Form A
Bidder Contact Sheet
Request for Proposal Number 5820 Z1

Form A should be completed and submitted with each response to this RFP. This is intended to provide the State with information on the bidder's name and address, and the specific person(s) who are responsible for preparation of the bidder's response.

Preparation of Response Contact Information	
Bidder Name:	MNC Software
Bidder Address:	1010 Turquoise St Suite 250 San Diego, CA 92109, USA
Contact Person & Title:	Mr. Joel Bredeson
E-mail Address:	jbredeson@mncsoftware.com
Telephone Number (Office):	(858) 771-4606
Telephone Number (Cellular):	
Fax Number:	(858) 771-4488

Each bidder should also designate a specific contact person who will be responsible for responding to the State if any clarifications of the bidder's response should become necessary. This will also be the person who the State contacts to set up a presentation/demonstration, if required.

Communication with the State Contact Information	
Bidder Name:	MNC Software
Bidder Address:	1010 Turquoise St Suite 250 San Diego, CA 92109, USA
Contact Person & Title:	Mr. James Bloomfield
E-mail Address:	jbloomfield@mncsoftware.com
Telephone Number (Office):	(858) 771-4601
Telephone Number (Cellular):	(858) 337-2742
Fax Number:	(858) 771-4488

REQUEST FOR PROPOSAL FOR CONTRACTUAL SERVICES FORM

By signing this Request for Proposal for Contractual Services form, the bidder guarantees compliance with the procedures stated in this Request for Proposal, and agrees to the terms and conditions unless otherwise indicated in writing and certifies that bidder maintains a drug free work place.

BIDDER MUST COMPLETE THE FOLLOWING

Per Nebraska's Transparency in Government Procurement Act, Neb. Rev Stat § 73-603 DAS is required to collect statistical information regarding the number of contracts awarded to Nebraska Contractors. This information is for statistical purposes only and will not be considered for contract award purposes.

_____ NEBRASKA CONTRACTOR AFFIDAVIT: Bidder hereby attests that bidder is a Nebraska Contractor. "Nebraska Contractor" shall mean any bidder who has maintained a bona fide place of business and at least one employee within this state for at least the six (6) months immediately preceding the posting date of this RFP.

_____I hereby certify that I am a Resident disabled veteran or business located in a designated enterprise zone in accordance with Neb. Rev. Stat. § 73-107 and wish to have preference, if applicable, considered in the award of this contract.

_____ I hereby certify that I am a blind person licensed by the Commission for the Blind & Visually Impaired in accordance with Neb. Rev. Stat. §71-8611 and wish to have preference considered in the award of this contract.

FORM MUST BE SIGNED USING AN INDELIBLE METHOD (NOT ELECTRONICALLY)

FIRM:	MNC Software
COMPLETE ADDRESS:	1010 Turquoise Street, Suite 250, San Diego, CA 92109
TELEPHONE NUMBER:	(858) 771-4600
FAX NUMBER:	(858) 771-4488
DATE:	5/30/2018
SIGNATURE:	Joel Bredeson
TYPED NAME & TITLE OF SIGNER:	Mr. Joel Bredeson Director of Software Engineering

NETC Nebraska Monitor and Control System (NMCS)

Proposal Response

RFP 5820 Z1

7th May 2018

ORIGINAL COPY

Table of Contents

1 Overview

MNC Software, Incorporated (MNC) is proud to provide the following proposal for the use of Mosaic as the foundation of NETC's Network Monitor and Control solution (NMCS). The full response is based on our industry-leading broadcast, satellite, and ground system experience and proven design and integration expertise. The proposed solution provides strong adherence to the NETC Monitor and Control System requirements, providing real-time operations centric displays for fast and accurate broadcast network issue identification, in addition to network status and information.

The solution proposed, of which, Mosaic is front and center, utilizes the latest modern technologies. Furthermore, each of the individual components continues to evolve guaranteeing the solution will not become obsolete.

1.1 Document Outline

Section 2 presents MNC's Executive Summary. This section serves as an introduction to the corporation.

Section 3 presents MNC's Management proposal. This section includes an overview of MNC's program management and engineering processes, a description of warranty and maintenance as well as specific program management details for the NETC Monitor and Control System program.

Section 4 presents MNC's Technical proposal. This section addresses technical aspects of the NETC Monitor and Control System requirements.

Attachment 1 presents MNC's Compliance to the NETC NMCS Requirements.

Attachment 2 presents MNC's Cost Proposal in the required format. Provided in separate binder per RFP requirements

Attachment 3 presents resumes for key members of MNC's project team, together with our installation partner JAK Broadcast Services.

Attachment 4 presents MNC's Silver and Gold support options

1.2 MNC Representatives

Questions concerning the information presented in this RFP response should be directed to any of the following individuals:

Mr. David Allen
1010 Turquoise St
Suite 250
San Diego, CA 92109, USA
(858) 771-4602
dallen@mncsoftware.com

Mr. James Bloomfield
1010 Turquoise St
Suite 250
San Diego, CA 92109, USA
(858) 771-4601
jbloomfield@mncsoftware.com

Mr. Joel Bredeson
1010 Turquoise St
Suite 250
San Diego, CA 92109, USA
(858) 771-4606
jbredeson@mncsoftware.com

2 Executive Summary

2.1 Company Overview

MNC Software is a forward-thinking and innovative company focused on supplying high-quality software and software services to the aerospace and broadcasting industries. Our engineering team has over 50 years of experience developing and integrating mission critical real-time monitor and control systems. We have worked on programs as diverse as multi-satellite mission control centers to broadcast network management. Our experience with these disparate monitor and control system requirements and operational philosophies has instilled in us the need for the following company-wide principles:

- Superior software architecture
- Highest quality standards
- Exceptional customer communication and support

These principles are evident in our core product, Mosaic, and the consistent high level of satisfaction of our customers around the world. Mosaic has been in use for 10 years and has been deployed in all broadcast operations environments, including:

- Radio and television broadcasts
- Traditional linear and OTT broadcast
- Satellite uplink facilities and terrestrial uplink antennas
- Cable HFC headend

At MNC Software, we are committed to providing broadcast and network operators with the tools and solutions to simplify the complex tasks required of them.

2.1.1 Corporate Details

MNC Software is a privately held corporation founded in July of 2008 in San Diego, California. The company has experienced continuous growth in the 10 years of existence and has no outside debtors. In addition to the main office in San Diego, the company has an office in the United Kingdom and services support in Asia. Currently, the company has active programs providing recurring revenue with numerous end customers across five continents. Additionally, we have multiple system integrators, hardware vendor partners, and resellers contributing to our expanding customer base.

MNC Software banks with Wells Fargo. Financial and banking reference information can be provided on request.

2.2 Product Highlights

Mosaic is a scalable, extensible framework providing organizations with the tools to manage large and complex service delivery infrastructures. Mosaic was designed to deliver clear and accurate information tailored to the needs of the end user. The core architecture is focused on issue detection and resolution, helping to keep channels on-air, minimizing downtime and maximizing revenue.

Mosaic was designed from the ground up to support several key goals:

Scalability

Mosaic supports a lightweight, optimized framework which can be easily distributed across multiple server hosts to handle the most demanding of network infrastructures. For a product to be easily scalable it must also be operationally maintainable, and to this end, Mosaic supports a centralized repository / distribution mechanism handling configuration, data items and automatic software upgrades, thereby significantly reducing overall system maintenance costs.

Robustness

A key feature of any monitor and control system is its ability to withstand the stresses of an operational environment. These stresses come from a number of sources including: anomalous inputs, erroneous driver code and hardware faults. Through the use of redundant server pairs, sophisticated failure detection and comprehensive error handling, Mosaic delivers a resilient architecture ensuring long-term operational continuity.

Flexibility

Mosaic provides a wealth of configuration and deployment options allowing the system to be easily tailored to meet customer requirements. The agile core architecture also supports numerous extension points allowing the system to adapt to concepts not readily supported out-of-the-box. As a vendor agnostic NMS product, this extends to the ability to integrate Mosaic with any hardware or software device.

Portability

Mosaic provides a cross-platform solution allowing it to interoperate with most modern operating systems and hardware platforms. Mosaic currently supports all versions of Windows and all common distributions of Linux, UNIX and Mac OS. The web client uses only standard technologies and so can be run on any modern browser without requiring any external plugins.

2.3 Past Performance

Mosaic has been successfully integrated into various programs to provide robust monitoring and control for a wide-ranging array of solutions including linear broadcast,

over-the-top broadcast, and satellite ground stations. Following are some examples that are most applicable to this program.

DIRECTV (USA, Venezuela, Brazil, Argentina, Mexico)

Mosaic was selected to replace the legacy MaxView monitoring systems that were in place throughout the DIRECTV broadcast network. The initial program focused on the baseband delivery network and during this phase, our role was that of a commercial software vendor. DIRECTV engineering staff was responsible for the integration of Mosaic into their operations. More recently, MNC Software was selected as the prime contractor to upgrade their over 80 satellite uplink antennas. Last year, we successfully deployed 5 new Ka-band antenna and upgraded 13 legacy Ka- and Ku-band antennas to Mosaic. These were all completed from installation to site acceptance within the less than 5-month timeframe provided by the customer.

In total, Mosaic is responsible for monitoring all equipment related to the acquisition and broadcast of over 4500 linear satellite and over-the-top channels. Mosaic monitors hundreds of thousands of pieces of hardware and software located at over 170 different sites while providing their operators with clear concise and consolidated information across their entire system. Included in those sites and devices are the 10 primary and 10 diverse uplink facilities.

On the RF side, in addition to monitoring the status of the equipment, Mosaic is responsible for maintaining signal strength through rain fade events using a combination of uplink power control and automated site diversity switching. This includes automatically increasing the attenuation of the uplink converters and the automatic switching to the diverse site if a maximum attenuation is reached.

Global Radio (UK)

Global Radio (recently rebranded as simply, Global) is the largest commercial radio group within the United Kingdom. MNC Software was originally selected as the prime contractor to integrate Mosaic to provide centralized monitoring of their off-air receivers via their 23 remote Davicom RTU-managed transmission sites. This initial phase was completed on time and provided their engineering staff near immediate visibility to the status of their broadcast.

Since this initial phase, the footprint of Mosaic monitoring has steadily grown to encompass all broadcast, IT and back office systems. The system contains a wide variety of standard broadcast equipment including: playout system, ad insertion, content delivery, OTT streaming systems. In addition to the broadcast equipment, Mosaic is increasingly responsible for monitoring, control, and configuration of studio equipment, call-in telephony, and branding and lighting. This continuing evolution from the initial purpose is indicative of the power of Mosaic and has been performed by a combination of MNC Software personnel and Global engineering staff.

Voice of Vietnam

Mosaic provides centralized monitor and control for roughly ninety remote terrestrial transmitter sites for Voice of Vietnam. The centralized system provides a full view of all site subsystems, which includes transmitters, audio switchers, fire suppression system, backup generators and three phase mains power. Due to varied infrastructure access, site connections are provided through a variety of links ranging for dedicated IP circuits, to secured VPN connections over public 3G. The central system provides shift-based SMS notifications to local site technicians, who have full local site control using a locally installed Davicom RTU unit.

For this program, MNC Software acted as a subcontractor to Radica Broadcast Systems. Radica maintained overall responsibility for the system, but MNC Software were responsible for all design and deployment of the monitoring facility.

General

The above programs are only 3 of many that highlight how MNC Software and Mosaic have successfully delivered solutions similar to the NETC Network Monitor and Control Solution. References for all can be provided along with more information about these or other programs upon request.

Whether it be a large deployment or a single one-off monitoring solution, MNC Software well understands the benefits of building and maintaining strong customer relationships. We also understand that a program's success is based heavily on our ability to understand and respond to our customer needs. Over the past ten years, MNC has worked tirelessly to develop positive and productive working relationships with all our customers. These relationships are built upon the following fundamental concepts:

- Open and honest channels of communication. This applies both internally within MNC and externally with the customer. Communication is the life blood of a program and without it there's little chance of success. Developing and maintain channels of communication is the primary focus of every member of the MNC team.
- Collaboration breeds success. Developing a collaborative approach through all phases of a program helps to ensure the end solution is fit for purpose and meets the needs and expectations of our customers. MNC works side-by-side with each and every customer to ensure a clear understanding of program requirements and operational intent.
- Demonstrate a willingness to go beyond contractual obligations to get the job done. Years of experience has shown that programs rarely go to plan. In most cases programs and requirements evolve as business needs become better understood. At MNC we go the extra mile to ensure all programs are successful.

2.4 Partner Corporate Experience

2.4.1 Comlab

Comlab's Davicom division has been developing, manufacturing and selling remote site management products for over 25 years. Broadcast, public safety and public utility organizations around the world rely on Davicom products to monitor and control their remote sites.

2.4.1.1 Davicom project

Wisconsin Educational Communications Board

April 2011: 50+ sites installed by customer. Very happy with the system and its operation.

Contact: Peter Ives,
Director of Broadcast IT,
Wisconsin Educational Communications Board,
Wisconsin Public Broadcasting.
Office # 608-264-9705 / Cell # 608-220-8561,
Peter.ives@ecb.org

2.4.1.2 Davicom project

North Dakota Department of Transportation

March to May 2015, customer installed 50+ sites and they are very happy with the system and Davicom's level of customer support.

Contact:
Robert J. Steckler
Telecommunications manager
North Dakota Department of Transportation
216 Airport Road, Bismarck, ND
701-328-6980
rsteckler@nd.gov

2.4.1.3 JAK Broadcast Services experience installing similar products over past 6 years.

2012 -- Installed a new Remote Control System on KJFA 101.3 FM replacing a Sine System Remote control

2013 -- Installed Remote Control System and Nautel NV 30 transmitter for KIOT 102.5 FM

2015 -- Moved KIOT 102.5 FM to a new site, replaced old Remote Control System with new generation Remote Control System and installed a Harris HT 20 transmitter as a full power backup transmitter.

2016 -- Installed Remote Control System on Auxiliary transmitter site for Univision Radio New Mexico (part of Univision Communications Inc.)

2.4.1.3.1 System switchover management

Where possible the new equipment will be paralleled with the old which should facilitate the installation and programming. At some point it will be necessary to remove the old equipment and wire the transmitters control logic directly into the Davicom equipment. The initial site survey will allow this process to be better defined.

3 Management Proposal

3.1 Program Management Process

3.1.1 Program Manager

The duties of the Program Manager start immediately following program award. The Program Manager has overarching responsibility for the program and together with key members of the project team is responsible for the planning, execution and ultimately, the successful completion of the project.

The Program Manager is a central figure within the team and is responsible for orchestrating the many activities which occur over the lifetime of the project. In order to ensure success, the Program Manager assumes responsibility for all aspects of the program, including schedule, quality, technical requirements fulfillment, change management, contractual adherence, financial performance, system integration and acceptance.

The Program Manager also maintains a Project Management Plan, the detailed program schedule, programmatic action item lists, and monitors financial performance throughout the life of the program.

3.1.2 Project Management Plan

In the initial phase of the program, the Program Manager is responsible for establishing a Project Management Plan (PMP). The purpose of the PMP is to document and communicate all important aspects and objectives of the program both internally and externally. The PMP captures relevant information about the program including schedule, budget, resources, and all technical, contractual, and risk issues. It provides detail on subjects such as configuration management, unique development requirements, test approach, system integration, acceptance and support plans.

The Project Management Plan is a living document and is updated and refined at all stages of the program.

3.1.3 Schedule and Resource Management

Schedule and Resource Management is a key element to the successful on-time completion of a program. To that end, MNC uses Microsoft® Project to track and plan all program activities and to ensure effective resource management over the lifetime of the project. Microsoft® Project also provides tools to identify and manage critical path activities.

The initial baseline schedule is constructed from the Statement of Work (SOW), contractual requirements, original proposal estimates, and any changes agreed upon during negotiations. The development of the schedule will also involve NETC to ensure milestones are in line with the overall program, and dependencies are well understood.

Once established, the schedule will be maintained under version control and reviewed on a regular basis to measure the overall performance of the program. Continual monitoring allows the Program Manager to quickly identify issues and ensure efficient and effective deployment of project resources. Any changes that would impact program milestones will be reviewed and agreed upon with NETC.

3.1.4 Risk Management

The Program Manager is responsible for maintaining and managing all identified risk items on the program. Once a risk to the program has been identified, it is the responsibility of the Program Manager to analyze, assess and prioritize the risk. Information on all identified risks is maintained within a risk register. The register compares the likelihood of the event occurring against the impact to the program should it occur. The register also contains any planned responses should an event occur and any actions taken or on-going to help mitigate a risk.

The risk register is a vital element to the success of the program and to the on-time delivery of project milestones. As a result, the register will be reviewed regularly and any changes will be communicated to NETC.

3.1.5 Customer Interfaces

The primary customer interface is the Program Manager, who ensures that all customer issues are appropriately addressed. Throughout the life of the program the customer will also interface with other MNC team members as appropriate and needed. For example, it is expected there will be regular contact between the two organization's technical departments as detailed system requirements and functionality are discussed, clarified, and implemented.

3.1.6 Change Management

MNC employs a formal change management process which often starts with an informal request made to the Program Manager. If after evaluation a request is deemed to be outside the scope of the contract, the following types of formal documentation will be used to initiate a contractual change to program technical requirements:

- Engineering Change Request (ECR). The formal request issued by the customer to MNC to explore impacts of a change in the requirements of the functional baseline. MNC will be obliged to evaluate and respond to an ECR.

- Engineering Change Proposal (ECP). The formal document generated by MNC either in response to an ECR or on its own initiative, to propose a change in the current approved program baseline.
- Request for Deviation (RFD). The formal document initiated by MNC to request a non-conformance against contractual documentation for a deliverable item and a particular delivery.
- Request for Waiver (RFW). The formal document initiated by MNC to request a non-conformance against contractual documentation for a deliverable throughout the program.

3.1.7 Issue Resolution

The Program Manager drives resolution of all programmatic issues. The Program Manager has the authority to make financial and programmatic decisions, yet will rely on the feedback and advice from both functional and technical experts. An important aspect of the Program Manager's responsibility is to assure that the customer's objectives and perspective are well understood, enabling decisions to be made in a context that best serves all parties involved in the program.

3.2 MNC Engineering Process

3.2.1 Product Assurance

MNC is committed to providing its customers with software and systems developed to the highest possible standard. MNC's quality processes start from receipt of an RFP through delivery and customer satisfaction. Quality is not just inspected in the final deliverable system but is a fundamental part of every stage in the program. Process artifacts and metric data are analyzed on a regular basis and provide a solid framework for low risk, on-schedule program deliveries.

3.2.2 Systems Engineering

To achieve 100% compliance on the NETC Monitor and Control program, MNC will work closely with NETC throughout the program to verify that requirements are understood and are representative of NETC overall expectations. Requirements analysis and management are the responsibility of Systems Engineering.

The Systems Engineer also plays a key role in the review of design materials and test documentation. In particular, the Systems Engineer will work closely with the Systems Architect to facilitate the smooth transition of the program from requirements analysis to preliminary design. The Systems Engineer will also verify that Acceptance Test procedures are developed with NETC operational concepts in mind such that MNC's test environment closely matches the target program environment.

3.2.3 Design and Implementation

MNC uses an iterative and incremental approach to design and implementation, whereby complex systems are disassembled into smaller more manageable components. These components are developed at different times or rates, and integrated as they are completed. As a component nears the end of the design and implementation phases, it undergoes a rigorous review to ensure that it is:

- Fit for purpose
- Satisfies customer requirements
- Compliant with the overall architecture
- Free from major defects
- Maintainable

The design and implementation activities associated with the NETC Monitor and Control program, if any, will be managed by the Systems Architect. The Systems Architect is responsible for ensuring that all development is in line with the requirements, that designs are consistent with the overall architectural approach, and that all critical components are identified and documented as risks within the PMP. In the initial phases of the program, the Systems Engineer and the Systems Architect work closely to generate the architectural and detailed designs for the program. If applicable, these designs are key inputs into the preliminary and critical design review milestones.

Throughout the engineering process, information pertinent to the customer will be captured in the Software Version Description (SVD) document, appropriate user manual, and system administration guide and training modules. As part of MNC's Systems Architecture activities, internal and external Interface Control Documents (ICDs) are also produced and circulated to all applicable team members.

3.2.4 Configuration Management

MNC uses a traditional software configuration management (SCM) process, which is looked upon as the best solution to handling changes in software projects. It identifies the functional and physical attributes of software at various points in time and performs systematic control of changes to the identified attributes for the purpose of maintaining software integrity and traceability throughout the software development life cycle.

MNC uses the software configuration management process to maintain all artifacts of the programs development. Items under configuration management control include:

- Contractual Documents
- Derived Requirements
- Architectural and detailed design documentation
- Source Code
- Test Plans and Test Procedures

A weekly Configuration Control Board (CCB) is held to review proposed changes to the existing configuration and will either authorize for advancement or reject. The CCB acts as a stop gate for those changes that are not complete or should not be implemented. Issues arising from integration and test will also be identified, analyzed and may result in a request for rework. The CM process uses the version control utility Subversion (SVN) to manage the documentation and source code repositories, and to build identified baselines. Baseline identification will be achieved by tagging each relevant file in the CM controlled repository.

MNC Software uses the JIRA issue tracking software by Atlassian to manage new development and defect reporting and resolution. The software allows MNC to map the software development process to issue workflow ensuring compliance.

3.2.5 Integration and Test

MNC places considerable emphasis on the independent testing of the products and systems that it develops. The first level of testing is comprehensive unit testing which is run automatically every night as part of the nightly build process. With each official build, new functionality will be integrated into the full system and added to an automated integration test suite. These tests not only validate that System and User requirements have been appropriately addressed but also ensure that the component's design and implementation are consistent with established standards and that the performance of the component meets expectations without impacting the rest of the system. MNC's test approach is systematic and all test activities are carefully planned.

The goal of MNC's internal test schedule is to perform testing as soon as functionality is included in a build and follows the Usage Model philosophy to integration testing. The basis behind this type of integration testing is to run user-like workloads in integrated user-like environments. In doing testing in this manner, the environment is proofed, while the individual components are proofed indirectly through their use.

Prior to Acceptance Testing, MNC will support a formal Test Readiness Review (TRR). This review will be held with the Program Manager and NETC. The review examines the test effort to date and MNC's readiness to proceed with formal Acceptance Testing.

Upon the conclusion of Acceptance Testing, a comprehensive Test Summary will be produced and copies of the as run log(s) prepared for distribution. As part of acceptance testing, MNC will support a Test Review Board (TRB). This review board will comprise of the Program Manager and NETC and its purpose will be to address the status of all actions and issues raised during testing.

3.3 Warranty and Maintenance

MNC's Standard Product Maintenance and Support program is designed to provide customers comprehensive and responsive support after product acceptance. This program is the mechanism by which end-customers can take advantage of MNC's

evolving products as well as the evolution of other products in the marketplace. When utilized, this program offers a cost effective approach for receiving professional technical support and for keeping a customer's system positioned to take advantage of the latest available capabilities and technology.

MNC's standard product maintenance and support begins after a customer's final on-site acceptance of the system. The following are just some of the services provided under maintenance:

- Provision of software media for product upgrades, enhancements and or fixes
- Provision of documentation updates
- Communication of upcoming product functionality and fixes
- Integration and testing of product upgrades in a customer's program environment (e.g. integration and test with a given program specific software/configuration)
- Telephone support to provide technical support and/or to capture and track customer support issues

3.3.1 Software Upgrades and Enhancements

MNC is committed to the on-going evolution and improvement of its core products to meet the changing needs of the marketplace and to ensure the latest advancements in technology are incorporated. MNC generally plans major releases every 18 months for its products, with minor releases every 3-6 months. It is recommended that customers take advantage of these upgrades on a regular basis in order to benefit from the latest available features and fixes.

3.3.2 Fixes for Software and/or Documentation Defects

MNC's standard product maintenance and support program addresses software or documentation defects found during the maintenance period. A software or documentation defect is any error that prevents a software system from behaving as intended. Defect resolution results in one of the following: a new software release, a software patch, a documentation update, or an acceptable workaround. In the event of a software release or patch, any necessary documentation, training, and installation support will also be provided.

Updates to software and documentation to address defects are generally scheduled to coincide with minor releases, incorporating fixes for the most critical defects in the first instance. However, should a critical defect arise which significantly degrades the performance or functionality of the software, MNC will expedite the process, providing a patch release to address the defect.

3.3.3 Customer Support

Throughout the maintenance period, MNC will provide Customer Support either by telephone or via electronic mail. This support will help the customer overcome any technical difficulties, investigate potential system problems, and formally document verified problems or defects. Defects covered under maintenance will have fixes scheduled based upon the criticality level via MNC's Change Control Process

Standard telephone support will be offered during MNC's normal business hours, which are 8:30 A.M. to 5:30 P.M. Monday through Friday (excluding all public holidays). Additional support outside of MNC's normal hours can be arranged if necessary and a price can be quoted separately for this.

Electronic Mail Support will also be available to customers via a dedicated customer e-mail address. Requests submitted via e-mail will be acknowledged within one working day of receipt.

See attachment 4 for details regarding our Silver and Gold support.

3.4 Proposed Management Plan

3.4.1 Resources

MNC Software will appoint a Program Manager to assume responsibility for the NETC Monitor and Control program. This single point of contact will provide NETC with continuity across all phases of the program.

The senior project team, which includes the Program Manager, will be constructed of subject experts in the field of real-time mission critical monitoring and control, each with a wealth of experience in all facets of the industry.

MNC intends to employ the resource and scheduling techniques described earlier to ensure efficient and effective resource utilization throughout the entire program.

3.4.2 Master Program Schedule

Figure 1 shows the initial high-level schedule for the NETC Monitor and Control System program. Since no schedule was made available as part of the RFP, dates and milestones represent an estimated timeline based on program requirements and may be subject to change.

Task Name	Duration	Start
EDC	0 days	Mon 10/1/18
Project Planning with NETC	7 days	Mon 10/1/18
Remote Trasmission	184 days	Wed 10/10/18
Central NOC	153 days	Tue 10/30/18
Installation	2 days	Tue 10/30/18
Development	30 days	Mon 11/12/18
Integraion	5 days	Wed 1/2/19
Site Acceptance	2 days	Wed 5/29/19
KUON	17 days	Wed 10/10/18
Installation	15 days	Wed 10/10/18
Integration	4 days	Fri 10/19/18
Site Acceptance	2 days	Wed 10/31/18
KHNE	17 days	Fri 11/2/18
KLNE	17 days	Tue 11/27/18
KMNE	17 days	Wed 1/9/19
KPNE	17 days	Fri 2/1/19
KRNE	17 days	Tue 2/26/19
KTNE	17 days	Thu 3/21/19
KXNE	17 days	Mon 4/15/19
KYNE	17 days	Wed 5/8/19
KUCV	17 days	Fri 5/31/19
Installation	15 days	Fri 5/31/19
Integration	4 days	Tue 6/11/19
Site Acceptance	2 days	Fri 6/21/19
Satellite Teleport	25 days	Mon 7/15/19
Installation	20 days	Mon 7/15/19
Integration	6 days	Wed 7/24/19

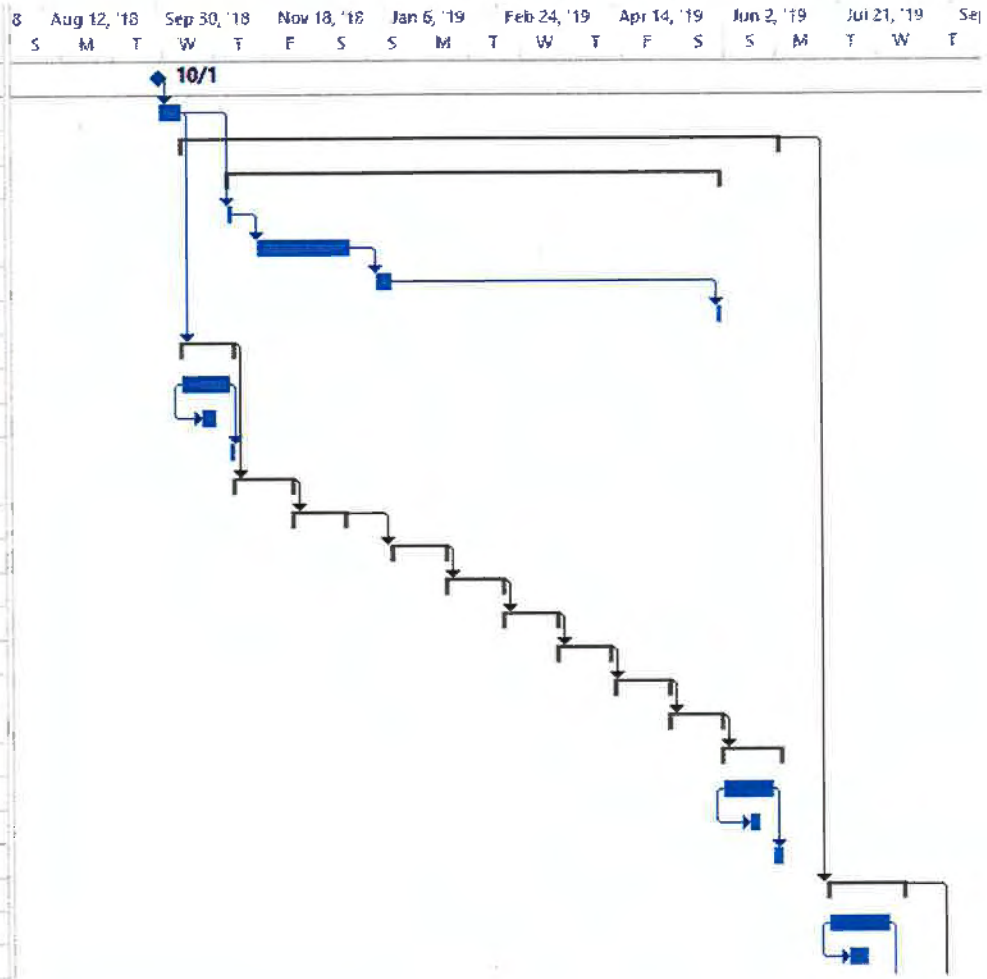


Figure 1 High-Level Program Schedule Part 1

Task Name	Duration	Start
Installation	20 days	Mon 7/15/19
Integration	6 days	Wed 7/24/19
Site Acceptance	5 days	Mon 8/12/19
Facilities	22 days	Fri 9/6/19
Installation	5 days	Fri 9/6/19
Development	10 days	Fri 9/13/19
Integraion	5 days	Fri 9/27/19
Site Acceptance	2 days	Fri 10/4/19
Terminal and Production Matrix Routing Switcher	27 days	Mon 10/28/19
Installation	5 days	Mon 10/28/19
Development	15 days	Mon 11/4/19
Integraion	5 days	Mon 11/25/19
Site Acceptance	2 days	Mon 12/2/19
Master Control and Studios	42 days	Tue 12/24/19
Installation	5 days	Tue 12/24/19
Development	30 days	Tue 12/31/19
Integraion	5 days	Tue 2/11/20
Site Acceptance	2 days	Tue 2/18/20
Web and IT Systems	22 days	Wed 3/11/20
Installation	5 days	Wed 3/11/20
Development	10 days	Wed 3/18/20
Integraion	5 days	Wed 4/1/20
Site Acceptance	2 days	Wed 4/8/20
Government Service and A/V	22 days	Thu 4/30/20

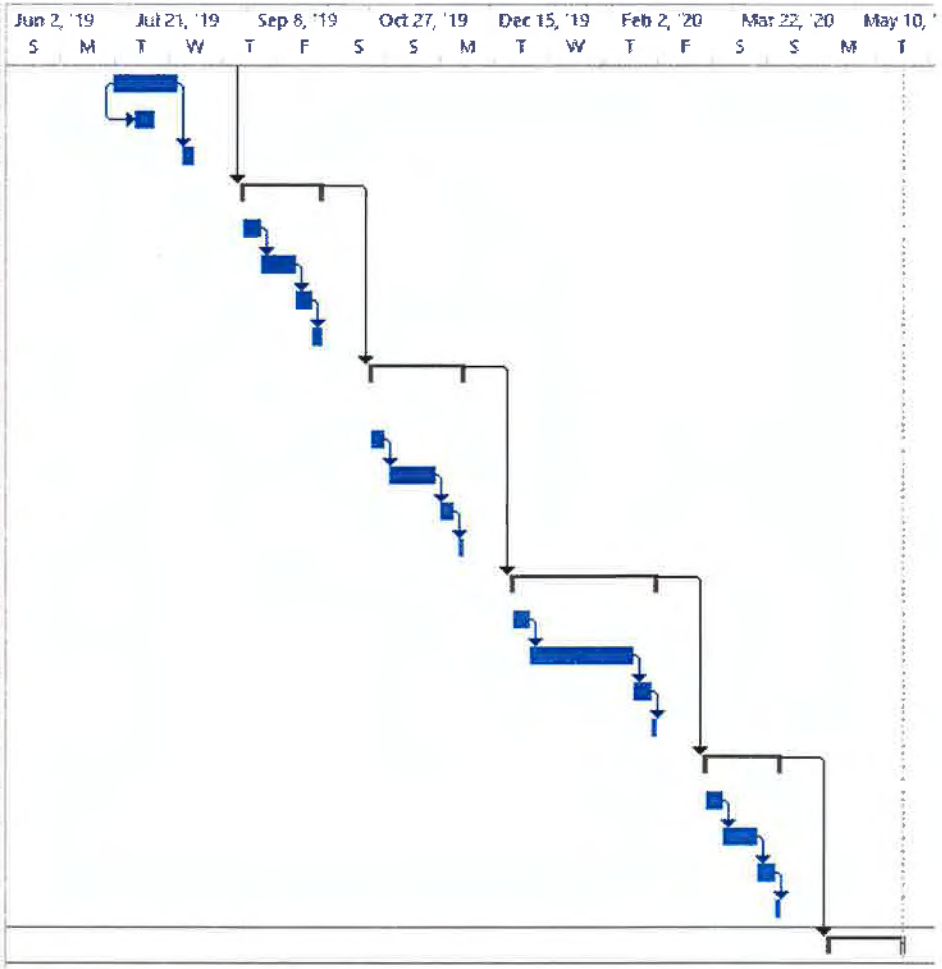


Figure 2 High-Level Schedule Part 2

3.4.3 Integration Schedule

MNC Software is proposing a phased deployment approach which allows for early integration of key components, thereby reducing the overall risk on the program. The following schedule highlights the integration opportunities currently identified. The schedule is an estimate based on the scope of the requirements and internal estimates and is expected to change after thorough review with NETC.

Anticipated development and integration phases include:

- Phase #1 – Remote Transmission System. Delivery of the core Mosaic Software Suite and all currently supported drivers. Installation of central Mosaic hardware and turning up of the servers. Cabling and hardware installation at each of the remote transmission sites. Integration of site devices into Mosaic and verification of systems. Early access to the core Mosaic software provides a platform for training and ensures key NETC personnel are familiarized with Mosaic and possess the necessary skills to support the program. Upon completion of phase #1, Mosaic will be controlling all remote transmission sites.
- Phase #2 – Satellite Teleport. This delivery includes the reconfiguration of Mosaic to support the Satellite Teleport. The installation of new hardware within the RF block house and any required cabling. Once complete each RF system will undergo a site acceptance test to verify all aspects of the installation.
- Phase #3 – Facilities and Production Matric Switchers. During this phase of the deployment, all the UPS devices and other facility equipment will be integrated into the core Mosaic software and their functions validated. In parallel, the existing Production Matrix Switchers will be fully integrated and verified.
- Phase #4 – Master Control and Production Studios. Mosaic will be integrated with existing Master Control functions within NETC and with the productions studios. New drivers and displays will be created to support the Master Control and Studio equipment and their functions will be modeled within Mosaic.
- Phase #5 – Web Services and IT Networking. Mosaic will be integrated into existing IT monitoring tools, acting as a Manager of Managers or overarching management system. In this mode, Mosaic will receive traps and alerts from systems including: Nagios Core, Nagios Network Analyzer, Solarwinds and Snort. In addition to generic displays related to the web service and IT networking components, network alarms which may impact the broadcast network will be mapped and correlation rules updated to provide more accurate root cause analysis.
- Phase #6 - Government Services Audio-Video Systems. This final phase covers the integration of AV systems and equipment into Mosaic. As this is also the final

phase of the deployment the overall system will be verified, to ensure readiness for handover to NETC. Given the system will have been operational since phase #1, this exercise will represent a gate check to ensure all project documentation is complete and available to NETC, all site drawings have been completed and all site acceptance tests have been completed and signed-off.

3.4.4 Software Deliverables

MNC has provided a Bill of Materials for the Monitor and Control System in Section 3.4.6. The Bill of Materials includes all software deliverables associated with the program.

3.4.5 Document Deliverables

MNC's proposal response accounts for the delivery of the documents listed below.

Item	Deliverable	Submission Date
1	Status Reports	Upon Request
2	Detailed Project Plan	EDC + 4 weeks
3	Initial Software	EDC + 4 week
4	Final System Design Package	EDC + 9 week
5	Acceptance Test Procedures	SAT – 2 weeks
6	Software User's Guide	With Software
7	Software Administrator's Guide	With Software
8	Software Developer's Guide	With Software
9	Training Materials	1 week prior

Table 1 CDRL Item List

3.4.6 Bill of Materials

Table 2 presents the bill of materials included in NETC proposal response.

Item	Description	Quantity

1	Mosaic Server Software Licenses	2
2	Mosaic Development/Test Software Licenses	1
3	Mosaic Desktop Client Licenses	10
4	Mosaic Web Client Licenses	10
5	Dell PowerEdge R640 Rack Server (2 CPU)	2
6	Dell PowerEdge R330 Rack Server	1
7	Davicom Cortex360 RTU	12
8	Davicom MEXM-1 Expansion Units	18
9	Comtrol DeviceMaster RTS 32 Port	2
10	Comtrol DeviceMaster RTS 16 Port	8
11	Comtrol DeviceMaster RTS 8 Port	5
12	TS-4085-O Outdoor Temperature Sensor (-40 to +85°C)	11
13	THS0080 Temperature and Humidity Sensor, 0-80°C, 0-100%RH	46
14	TS-4085-I Indoor Temperature Sensor (-40 to +85°C)	19

Table 2 Bill of Materials (Main NOC)

3.4.6.1 Bill of Materials (Davicom Cortex360, Expansion and Sensors)

						Spares			*Acc., wires & cables*
	TS-4085-O	**THS0080**	**TS-4085-I**	**Cortex 360**	***QTY MEXM-1***	***AI***	***DI***	***RO***	***(kit)***
Teleport	1	1	1	1	3	60	23	46	2
KUCV	1	3	2	1	1	32	40	32	1
KUON	1	3	0	1	1	24	22	32	1
KHNE	1	5	2	1	1	9	8	28	1
KLNE	1	4	2	1	2	44	20	44	1
KMNE	1	5	2	1	2	46	20	44	1
KPNE	1	5	2	1	2	46	20	44	1
KRNE	1	5	2	1	2	42	21	45	1
KTNE	1	5	2	1	2	42	22	45	1
KXNE	1	5	2	1	1	20	6	20	1
KYNE	1	5	2	1	1	32	27	32	1
Number of units	11	46	19	11	18				12

NET Nebraska Site Requirements Serial Devices				
	Devices	RTS Ports	Units	Spare Ports
Teleport	56	32	2	8
KUCV	4	8	1	4
KUON	8	16	1	8
KHNE	8	16	1	8
KLNE	8	16	1	8
KMNE	8	16	1	8
KPNE	6	8	1	2
KRNE	7	8	1	1
KTNE	7	8	1	1
KXNE	5	8	1	3
KYNE	0	0	0	0
Number of units			11	

3.4.7 Customer Furnished Equipment

This MNC proposal assumes that required documents, data, software, hardware, and other items are made available to MNC in order to successfully execute the contract. These items are referred to as Customer Furnished Equipment (CFE). MNC assumes that NETC shall furnish the complete list of CFE to MNC as outlined below:

Item	Description	Required Date
1	Monitored Device ICDs	EDC + 4 week
2	VPN / Site access to test equipment	SAT - 6 weeks

Table 3 Required CFE List

3.4.8 Assumptions Related to Management Proposal

The following assumptions are made by MNC:

- One Technical Interchange Meeting (TIM) and a Final System Design Reviews for the NETC Monitor and Control System program will be provided.
- The System Acceptance Tests (SAT) will be attended by a single MNC employee.
- Training is not included and is an optional add-on. The following training courses are available:
  - System Administrator training courses
  - Operator training courses
  - Developer training courses
  - Customized training courses
- All training will be provided at the primary NETC facilities.

4 Technical Approach

The proposed NETC Monitor and Control solution is based upon the MNC Software product, Mosaic. Mosaic is a scalable, extensible framework for use within broadcast industry and beyond. Through the combination of data driven design and planned extension points, Mosaic is adaptable for almost any monitor and control problem. This approach allows the various Mosaic applications to be easily configured into a system that meets NETC requirements.

For the NETC Monitor and Control program, various components of the Mosaic ecosystem will be used to provide a stable and configurable platform to present users with a consistent and reliable interface to all of the devices throughout the broadcast and non-broadcast realm. Monitoring downtime is virtually eliminated through the use of an integrated fault tolerant architecture and the use of configuration and dynamic change notification, which allows the system to evolve with little or no impact to operations.

A key component of the proposed solution is various automation capabilities to simplify operations for the user. This automation includes a script execution function, an execution schedule for planned operations, and an event correlation engine for reactive operations. These can be combined to handle routine operations so that the operations team can concentrate on anomaly resolution in order to keep the broadcast channels and services operational. The amount of system automation can be increased over time as confidence in the system grows so that the operational knowledge base is moved into the system, further simplifying operations.

4.1 Architecture

Mosaic is a native Java application and can be run on virtually any computer and operating system including most flavors of Windows, UNIX, Linux, and Mac OS. It is a client-server based architecture, providing near real-time device information, alarms and correlated events to the user interface. The user interface then provides the component required to visualize the processed data. Any computer with network access and relevant permission can be granted access to the Mosaic server or servers to monitor operational health and status.

The following diagram presents a functional breakdown of the Mosaic system. It is intended as a high level description of the architecture and not an indication of system deployment. The deployment along with various key components within the architecture are described in later sections.

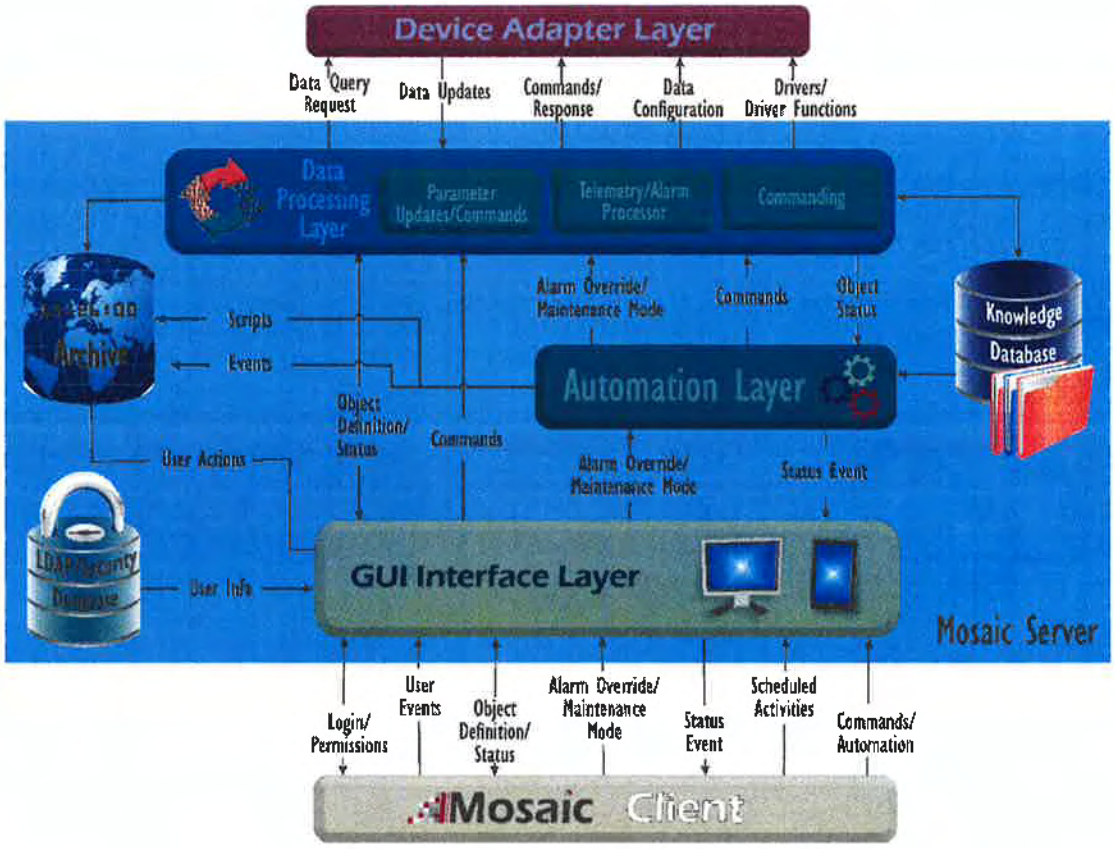


Figure 3 Mosaic Architecture

4.1.1 Device Adapter Layer

The device adapter layer or driver layer is responsible for providing the protocol adaption between the end device or software application and Mosaic. The device adapter layer supports the ability to distribute the processing across multiple hosts thereby providing load balancing in larger systems, together with the ability to overcome network restrictions, such as firewalls.

The device adapter layer is hardware agnostic, vendor agnostic and protocol agnostic and the drivers which execute within the device adapter layer are capable of supporting any end device regardless of the interface or API it may present. The following standard drivers are provided in the core software offering:

1. SNMP (v1, v2c and v3)
2. ASCII based IP protocols (TCP and UDP)
3. Binary based IP protocols (TCP and UDP)

4. All serial devices (via serial to IP converter)
5. REST or RESTful web services
6. SOAP web services

The standard drivers encompass support for most end devices and require simple XML based configuration to tailor the driver for a specific software application or hardware device. The current Mosaic driver database supports close to 1000 different devices across all of the protocols list above and is growing every day. In addition to the configuration or custom driver need to interact with the device the driver also includes displays specific to the device together with automation and other artifacts needed to fully control and monitoring. All drivers which are part of MNC Software's internal driver database are available free-of-charge to customers provided they're under an active maintenance agreement.

Mosaic offers the following types of drivers within its driver database:

Spectrum Analyzers	Power Meters	Variable Phase Combiners
Encoders	Multiplexers	Video Probes
Switches	IP Routers	Matrix Switch
Video Routers	Audio Routers	Line Drivers
Block Up Converters	Block Down Converts	High Powered Amplifiers (HPA)
GPS Receivers	Antenna Control Units (ACU)	Tracking Receivers
Discrete Logic Devices	Test Loop Translators	Frequency Controllers
Modulators	Transmitters	Video Monitors
Multiviewers	AD Converters	Playout Servers
Audio Codecs	DMX Controllers	Database Servers
Generic Server Hardware	Power Distribution Units (PDU)	Low Noise Amplifiers (LNA)

4.1.2 Data Processing Layer

The Data Processing Layer contains the internal Mosaic definitions of what can be monitored and controlled. It is different from the Device Adapter Layer because it has no knowledge of how data is acquired or how control directives are processed. Additionally, whereas the Adapter Layer can be developed and configured according to the full interface specification of the devices being monitored, the Data Processing Layer can be configured to limit the parameters and commands presented to operations. Similarly, the parameters and commands can be modified from the raw device format to make them more useful in an operations environment.

The main components of the Data Processing Layer are the Telemetry and Alarm Processor which is responsible for converting the raw updates received from the driver adapter layer into user friendly monitoring parameters and Commanding which is responsible for processing command requests from the Automation or GUI Interface Layers. Both the Telemetry / Alarm processor and Commanding are database driven and support online modifications without system downtime.

Additional functionality located in the Data Processing Layer is Data Archiving and Report Generation. These functions provide a historical view into the system, such as long-term trend analysis, anomaly investigation, live chart backfill and formatted reports detailing every aspect of the system.

4.1.3 Automation Layer

The automation layer provides a series of tools to automate all aspects of the Monitor and Control system. It combines operational experience with Mosaic's software intelligence, to inject business knowledge into the system to simplify routine tasks. The layer is broken down into three main areas - Scripting, the Event Correlation Engine, and Scheduling.

Mosaic Scripts are sequences of instructions which are designed to allow a subject expert to express a series of checks and actions to affect the overall state of the system. Examples include, triggering the system to poll a device, performing conditional logic based on the value of a device data point, sending commands to one or more devices and calling other procedures to promote reuse and modularization.

The Event Correlation Engine, which is a rules based inferencing engine, continuously examines all incoming data and based on a set of flexible and expressive rules, the engine identifies patterns in otherwise seemingly random events. This incredibly powerful and flexible component of Mosaic is used to trigger reactive automation based on real-time data, event correlation, root cause analysis, real-time analytics and more.

Scheduling provides the highest-level of automation, allowing routine, periodic and ad-hoc activities to be planned out well in advance. The Scheduling component will then initiate actions based on the required start times.

The level of automation is commonly built up over time as the engineering team becomes more familiar with both Mosaic and the devices it is monitoring. So, for

example, a common script that is created early in a program is to failover over a sequence of devices from the primary to backup path. Initially, this might be added to a display panel so that when an operator detects a failure in one of the devices, a button on the panel executes this failover script as a single user action. With more experience, the Event Correlation Engine can be utilized to predict that a device chain is failing and automatically execute the failover script before the station goes silent. Finally, if a temporal pattern is detected, such as a device that needs to be rebooted every 2 weeks, Scheduling can become involved to execute a maintenance script that includes failing over the execution path before and after the reboot is performed.

4.1.4 Interface Layer

Mosaic provides both a web and a rich desktop client, allowing users the flexibility of accessing Mosaic in whatever environment is best. Mosaic's web client is built with the latest technologies, utilizing HTM5, web sockets and CSS3 and can be run in all popular browsers. Mosaic desktop client is platform independent and can be run on virtually any modern operating system including Windows, Linux, and MacOS. The interface layer is responsible for brokering communication with both the Mosaic desktop client and the Mosaic Web. The Interface Layer provides authentication to ensure only authorized users are allowed access the NMCS. Authentication included access rights and restrictions which control what a user can and can't do within the system. The Interface Layer also provide access to near real-time monitoring data, control command, automation, event, alarms and all other aspects of the Mosaic server. The purpose of the Interface Layer to ensure efficient communication between all clients and the server. This includes filtering data transmission to only include items which are active within a given client, such as monitoring data within a display or events only when the event display is open.

4.2 System Deployment

The architecture for a monitor and control system must allow for flexible deployments in order to provide reliability, scalability, and maintainability. The Mosaic architecture allows clients and servers to be combined in multiple deployment scenarios to best meet the operational concepts and constraints of a given system. In addition, Mosaic server infrastructure fully support operating within a virtualized environment to further extend the deployment options. Virtualization can provide high availability for critical applications, such as Mosaic, and streamlines Mosaic deployment and migrations. Virtualization can also be used to respond to the growing demands placed on the Mosaic NMS, allowing computer resources to be easily scaled as more devices are added to the system.

The following section describes the proposed system deployment of Mosaic and ancillary hardware within the NETC NMCS infrastructure. It is not intended to be an exhaustive list of possible deployment scenarios. The proposed deployment represents MNC Software understanding of the size and scope of the system and may not fully account for NETCs operational concepts or constraints. If awarded, MNC Software will

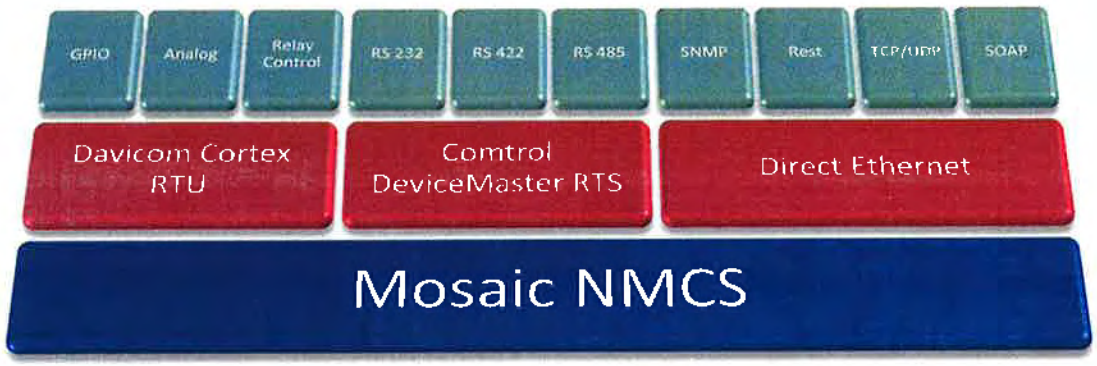
work with the NETC project team to refine the system deployment as further project goals become clear.

Finally, general expandability of the system and future potential deployment scenarios are discussed. This final section is intended to provide insight into how the system is capable of scaling as the NMCS project expands beyond the scope of the RFP.

A high-level summary of the proposed deployment is as follows:

1. A centralized Mosaic server pair, located at the main NETC facility in Lincoln, will form the core monitoring and control infrastructure. Whether virtualized or installed on physical hardware, the server will be capable of controlling all existing NOC, playout, content distribution, transmission, satellite teleport, UPS and PBS DR systems. An option is included to maintain the current system separation, but given the efficient processing and data throughput of the Mosaic server, system separation is not required. The Mosaic server pair provides system resilience. One acting as the primary monitoring and control server, while the other as a hot-backup should the primary become unavailable. The primary and backup servers should be connected via a crossover Ethernet cable, which is used to keep the servers synchronized. The crossover cable also eliminates other network equipment when determining the health and status of the primary server.
2. Each site will be upgraded to contain a Davicom Cortex remote telemetry unit (RTU) with MEXM expansion modules. The Cortex RTU will be responsible for handling all GPIO, analog and sensor communication. The device also provides local automation and control of the transmitter in the event of a loss of IP connectivity. In addition to SNMP and HTTP, the Cortex RTU also supports a POTS interface allowing direct communication with the unit. This feature acts as a failsafe backup path and allows control of the transmitter in the event of both primary and back connectivity loss. The Davicom Cortex RTU devices would replace the existing Burk RTU devices at each of the sites and would represent a significant step up in capability.
3. Comtrol DeviceMaster RTS devices at each site to handle all serial device communication. The Comtrol DeviceMaster RTS RJ45 is an 8/16/32 port device server designed for network-enabling serial communications. This device allows the centralized Mosaic server pair to communicate seamlessly via TCP or UDP with serial devices located at all the remote sites.
4. Networking and wiring will be updated at all sites to account for the additional hardware devices. All existing GPIO device and analog sensors will be cabled to interface with the Davicom Cortex RTU. All existing serial devices will be cabled to interface with the Comtrol DeviceMaster RTS instances, which will in turn be configured with the correct serial protocol and assigned a unique. All existing wiring outside the items listed above will be retained unless otherwise directed by NETC.

Through the use of the Davicom Cortex RTU and the Comtrol DeviceMaster RTS, the Mosaic NMCS can monitor and control virtually any device, whether it be legacy, current or future. The diagram below illustrates the protocols used to control current devices at the existing sites, together with the device or technology required to integrate the protocol within Mosaic.

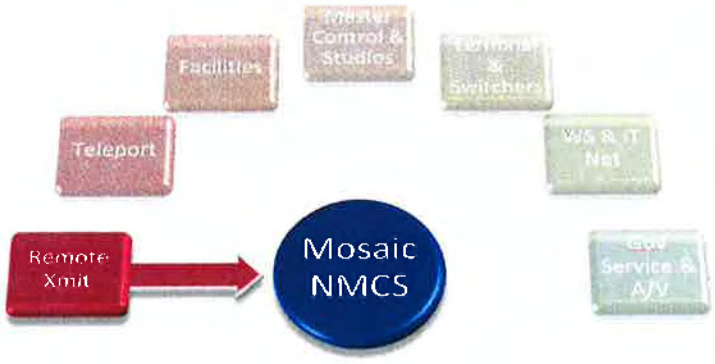


4.2.1 Phased Deployment

Given the size of the program and the constraints that an on-air system enforces, MNC software is proposing a phase deployment at each of the sites. The program manager will be responsible for coordinating the upgrade and deployment effort with NETC to ensure minimal interruption. Below are the proposed phases.

4.2.1.1 Phase 1

In phase 1, the additional server hardware will be installed to support Mosaic at NETCs NOC facility in Lincoln. This will include running power and network to the new servers, in addition to general commissioning of the central Mosaic system.



Once complete, each of the remote transmission sites will be upgraded in sequence. The priority of the sites will be discussed and agreed upon with NETC. Each site will first be upgraded to support the new Davicom RTU and DeviceMaster RTS hardware. Care will be taken to ensure there is no impact to on-air transmissions at any point. Once complete, each serial, GPIO and analog device will be integrated into the new hardware. Any device which would adverse impact NETCs ability to monitor and/or control the site will have new cables run, but not connected. The existing cabling will remain until an agreed cut over date has been scheduled. In parallel, the central Mosaic system will be configured with the addresses of the new site hardware and any panels, automation and drivers added ahead of the transition date. The panels and automation will be created with guidance and approval from NETC. Once approved, any remaining devices will be connected to the new cabling and each device will be fully verified to ensure correct communication within Mosaic. If any faults are found then the transition will be reverted and the faults will be corrected. Once all devices are transitioned successfully, then a site acceptance test (SAT) will be performed to formally accept the new installation. On successful completion of SAT, devices which were monitored by MaxView will be set into maintenance mode within the MaxView system. This will prevent MaxView from attempting to communicate with the devices and potentially interfering with Mosaic.

NOC operations will need to be conducted using both MaxView and Mosaic clients during the transition. To aid operations, the NOC consoles will be clearly marked, identifying which consoles are running MaxView and which are running Mosaic. In addition, the consoles will also identify which remotes sites are connected to MaxView and which have been migrated over to Mosaic.

As a parallel activity during phase 1, the NETC-UPS functions will be integrated into Mosaic. Initially, this will be limited to the UPS and HVAC systems which support SNMP. The generators, security camera system, HID security door system and Fire detection systems will be added during a later phase.

4.2.1.2 Phase 2

This phase will support the migration of the satellite teleport monitoring and control function into Mosaic. Again, given that the teleport is potentially carrying on-air traffic, care will be taken to ensure no unplanned interruption to service.

Similar to the remote transmission sites, the first planned activity will be to install, cable and commission the DeviceMaster RTS devices and the Davicom RTU. Once complete, each serial, GPIO and analog device will be integrated into the new hardware. Any device which would adversely impact NETCs ability to monitor and control the site will have new cables run, but not connected. The existing cabling will remain until an agreed cut over date has been scheduled. Also during this phase, the central Mosaic servers will be reconfigured to include all the devices at the teleport. In addition, standard Mosaic features such as Uplink Power Control (UPC), Uplink and Downlink Fade Monitoring and standard rack elevation views will be configured as needed.

In addition, the uplink and downlink paths will be mapped, together with any specific control logic required to control both the C band and Ku band systems. Finally, any specific device type displays, such as Antenna Control Unit (ACU), High-Powered Amplifiers (HPA), Block Up-Converter (BUC) and Down Converter (BDC) will be tailored to NETCs specific needs.

Since each C band and Ku band system can be considered a standalone system, once the installation and configuration is complete, it will undergo a site acceptance test. At a mutually agreed upon date, monitoring and control of a single system will be migrated over to Mosaic. The system will then undergo rigorous testing to verify all cabling is correct, all new hardware is functioning as expected and Mosaic is able to monitor and control each device in the uplink and downlink path. Once all systems have been ported over to Mosaic and all drawing and documentation has been delivered and signed off then the phase will be considered complete.

4.2.1.3 Phase 3

This phase will be a relatively short phase in which the remaining UPS, HVAC, generators, security camera system, HID security door system and Fire detection and suppression systems will be integrated into Mosaic.

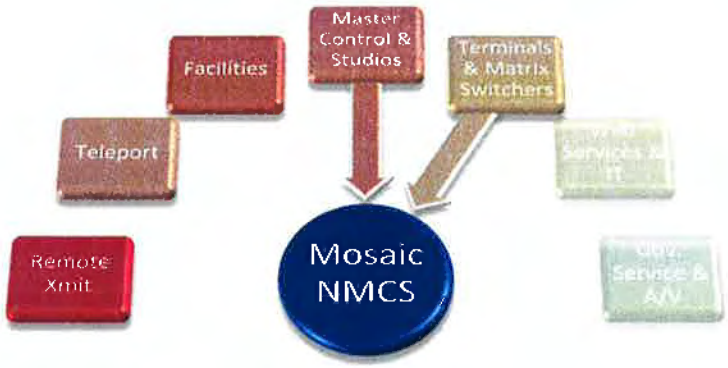
During this phase it is also proposed that we perform an operational review of the Phase 1 & 2 elements of the system. The review will provide a forum in which NETC and MNC are able to discuss the following:

1. The usability of the system in general,
2. New features which would enhance the capabilities of Mosaic
3. New displays or modification to existing displays
4. Performance on the program and planning for future deployments.

The completion of Phase 3 represents the successful transition from MaxView to Mosaic. All functions performed by MaxView will now be available via Mosaic. The MaxView servers and NOC clients will now be redundant and can be repurposed for other tasks. All day-to-day operations will be performed via Mosaic

4.2.1.4 Phase 4

Phase 4 will tackle the integration of Master Control, Production Studio equipment, Terminals and Production Matrix Switchers. All devices and workflows will be modelled within Mosaic. Since this phase expands the capabilities of the system into new areas we expect this phase to be collaborative with input from NETC regarding use cases and general workflows for the system.



4.2.1.5 Phase 5

This is the final proposed deployment phase of the Mosaic NMCS system. The phase will cover the integration of Web Services, IT Networking, Government Services, and Audio Video equipment. In addition, a final system review will be conducted to capture any desired updates to displays, layouts, automation logic, correlation rules, reports, drivers and other system elements. Once complete, the entire system will undergo a final set of Acceptance Tests. The purpose of these tests is to verify the end-to-end functionality of the entire system and to sign-off any remaining requirements. The system acceptance tests will also represent the completion of the contract and the start of the warranty and maintenance period.

4.2.2 Future Expansion

Mosaic provides multiple system configurations that allow for future expansion. When vertical scaling is no longer viable Mosaic provides multiple deployment strategies to support horizontal scaling and expansion of the system.

4.2.2.1 Clustering

Clustering allows for multiple individual servers to be clustered together to share data. Each server in a clustered setup provides full processing of all devices and software services it is in control of. The final processed values are passed to other servers in the cluster. This allows servers in the cluster to share data, but distributes processing. With the ability to continually add servers the system can scale horizontally.

Fault tolerance is also maintained with clustering since the clustered connections can swap to the current primary server. This provides a highly fault tolerant scalable solution.

4.2.2.2 Multi-System Clients

Mosaic provides the ability for clients to directly connect into multiple standalone servers at one time. In a Multi-System (multisite) environment the servers do not need to share any information, the client is responsible for connecting to all servers it is interested in and provide the combination of all data available. With this type of multisite deployment there is no need for server to server communication the only requirement is the client has IP access to each server. Multisite clients also provide the benefit of being able to join and leave sites as desired.

System expansion through Multi-System clients allows for horizontally scaling with full network isolation from server to server. Additional servers do not cause any additional load on currently installed servers since there is no communication required between them.

4.2.2.3 Distributed Driver Adapter Layer

Mosaic's driver adapter layer is responsible for maintaining drivers, maintaining device/server connections, automatic polling, data acquisition, and data decommutation. As the number of connected systems to Mosaic is increased so can the load on the driver adapter layer. For this reason Mosaic provides the ability for the driver adapter layer to be separated from the Mosaic server. Each Mosaic server can connect to any number of distributed driver adapter layers. Each layer can be responsible for any number of devices. Provisioning is done in configuration on the Mosaic server. This allows the system to distribute load and break out drivers with heavy processing. Combined with clustering or multi-system clients Mosaic allows for a truly expandable and configurable deployment structure.

One fear of distributing processing is configuration management of multiple processes. All driver adapter layers receive configuration for their primary Mosaic server and are updated automatically when the Mosaic server is updated. There is no need to individually update a distributed driver adapter layer, it will be updated automatically.

4.2.2.4 Server Distribution

System expansion is typically coupled with additional system complexity and management overhead. Horizontal scaling provides the ability to easily expand the system, but often also expands the number of systems to provision and configure. With Mosaic's distributed server configuration this becomes a non-issue. The distributed configuration provides a managed configuration repository built off of SVN allowing Mosaic systems to share configuration sets. An update to the central repository can trigger updates on all servers sharing the same configuration. All changes to configuration are tagged and recorded allowing for traceability. Individual servers maintain a copy of the current configuration so intermittent connectivity to the central repository does not cause any sort of failure.

4.3 Mosaic Graphical User Interface

The Mosaic UI can be broken down into two main frameworks, the desktop client UI and the web UI. The desktop client UI is a Java application which runs local to the client host, providing an immersive display environment through which a wealth of service and device status information can be delivered. Similarly, the web UI is a browser based interface using the latest web technologies. Both the web and desktop client allow individual views of the NETC system in a way that makes sense to operations, whether by dashboard view, geographical map view, service level view, or mimic panel views.

The following sections will describe the frameworks. In addition, a combination of data simulation utilities and information parsed from existing demo databases was used to demonstrate core Mosaic concepts. It is not intended to be an accurate representation of any device or device topology within the NETC broadcast environment. Finally, the desktop client UI supports a configurable and customizable "look and feel". This allows the UI to switch between a modern slate-gray, a more classic windows look and feel, or a custom skin. The screenshots taken throughout the sections predominantly use the slate-gray theme.

4.3.1 Mosaic Desktop Client UI

Figure 4 Dual Monitor Display Framework

The desktop client UI provides a series of intuitive displays allowing the user to gain an accurate picture of the health and status of either the entire system or a subset of the system which is tailored to meet the current user's specific monitoring objective.

The Mosaic desktop client supports the following high-level concepts:

- Hierarchical data access
- Audible and visual stimulus for critical issues
- Easily customizable display layouts
- Role centric display environment
- Intuitive user friendly displays

Unlike the Web UI, the desktop client natively supports multiple monitor environments. As a result it is more suited to a Network Operations Center, where client workstations typically have two or more monitors. The desktop client UI supports one or more display frames (typically one per monitor) which act as containers for display applications. Since the display frames are associated with the same underlying application they can coordinate and orchestrate the way multiple displays interact. For example, selecting a broadcast service within one display frame could update the service topology displayed within another.

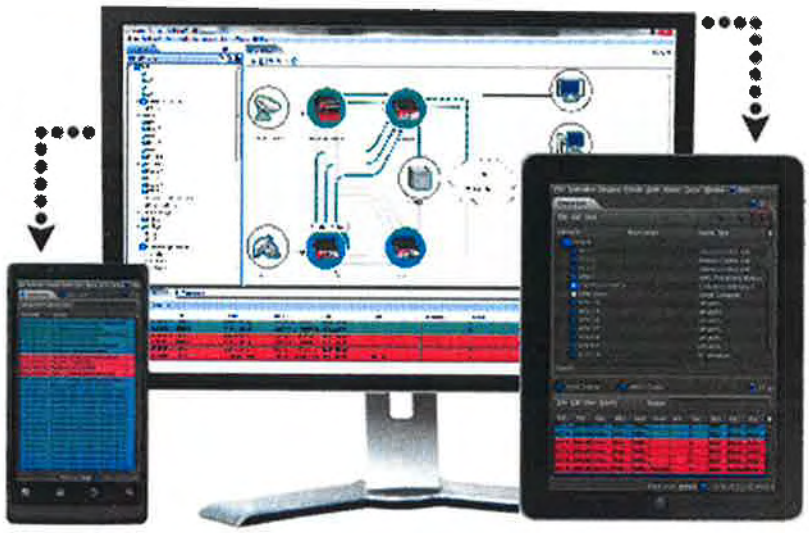
The Mosaic desktop client UI supports a docking framework, which allows display applications to docked anywhere on the display frame. Applications can then be dynamically moved, re-docked, and resized to allow for the most efficient use of screen real-estate. The resultant display layouts can then be saved and retrieved at a later date.

4.3.2 Mosaic Web Application

The Mosaic Web Application provides a web based display framework that behaves similar to the Mosaic desktop client UI. The Mosaic Web provides a convenient way to view the Mosaic UI displays to show the current health and status of the system on any device, whether it's a PC, tablet or smartphone.

The Mosaic Web Application makes use of much of the same configuration as the desktop client to provide a seamless transition between the two versions of Mosaic. This provides users with the flexibility to choose which interface is best for a given workflow, user, or location.

The Mosaic Web Application is built using the latest technologies, making use of HTML5 and CSS3. It is built with AngularJS and uses Twitter Bootstrap as the front-end framework. This combination of technologies allows the Mosaic Web Application to provide a performant display environment while being adaptive to the target end-user browser platform and device.



Example showing Mosaic on a range of devices

Browser instances connects to the Mosaic Web Server using an HTML5 Web Socket, this allows the Web Server to push updates to the browser in real-time, rather than the browser having to poll for changes. The result is a responsive near real-time experience which mirrors the Mosaic desktop client in performance.

In the browser window, there are two main areas for the different displays and widgets, the Summary Widget Dashboard and the Application View. The widgets and displays are designed to be resized and moved to allow the user to create the optimum layout based on screen size and workflow. As with the desktop client, the resultant display layouts can then be saved and retrieved at a later date, which can include layouts that are device-specific.

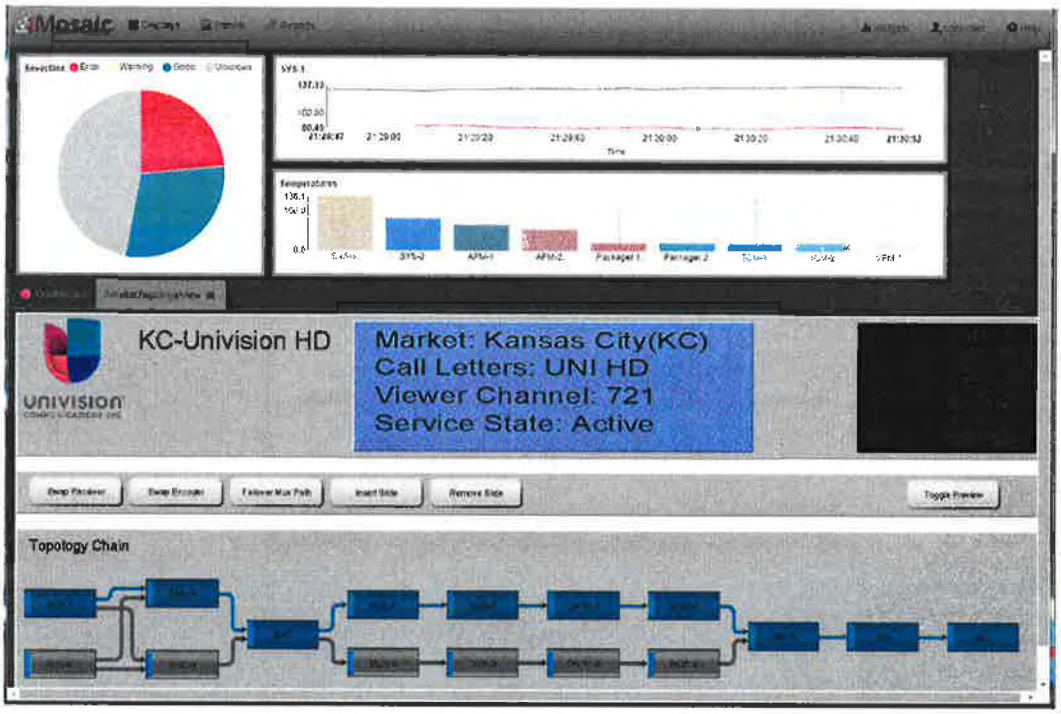


Figure 5 Mosaic Web Client

- Summary Widget Dashboard

The area that holds user configured dashboard widgets. Each widget is meant to show real-time data such as a specific parameter or parameters. The widget displays themselves can be dynamically moved or resized to allow for the most efficient use of screen real-estate and best viewing size of the widget. The summary dashboard can be hidden when more room is desired for the application view.

- Application View

This area contains all display applications in tabs with a grid layout. The application view can hold any number of tabs and each tab can hold any number of displays. Each tab has an editable name and displays the collective status of all displays within the tab. Each display within the application view can be dynamically resized to realize its most desirable size. When new displays are opened, the user has the ability to specify if the display should be opened in the currently selected tab or a new tab.

The framework is built to be responsive to provide an optimal work environment regardless of what size device a user is using and it is mobile friendly. Users can seamlessly switch from using a desktop device, tablet, or phone using any browser that supports the HTML5 standard.

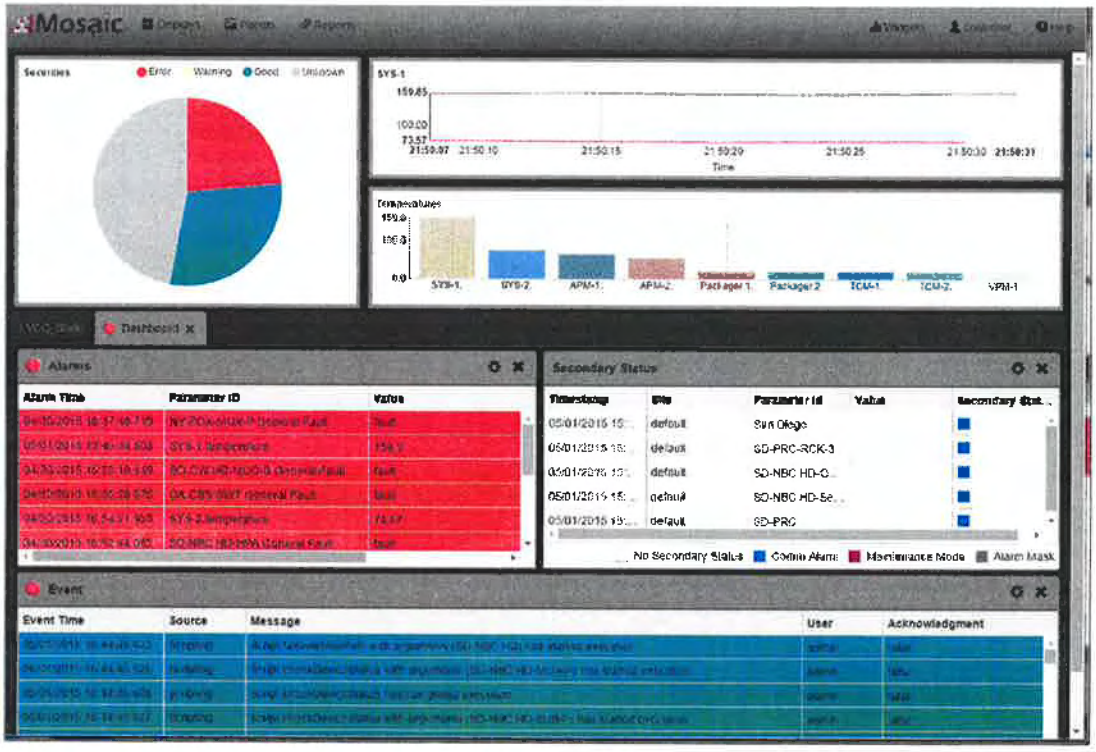


Figure 6 Mosaic Web Client Example

4.3.3 Remote Client Access

The Mosaic architecture allows clients and servers to be combined in multiple deployment scenarios to best meet the operational concepts and constraints of a given system. The Mosaic software supports two main mechanisms for remote access and control. Firstly, Mosaic supports a web-based access scheme via HTTP/HTTPS. Mosaic's web interface is not dependent on any 3rd party plugins, such as Adobe Flash and is fully HTML5 compliant. In addition, the web interface is fully responsive and will automatically adapt displays to the user's device, whether it be a browser on a desktop computer, a handheld tablet or a modern smartphone. If HTTP or HTTPS are unavailable, then Mosaic supports a desktop client which connects to the server instances via the open messaging protocol JMS.

Both client technologies work seamlessly across virtual private networks (VPNs). VPNs allow external remote users to tunnel into otherwise closed networks, as found in most broadcast centers. Alternatively, the Mosaic web server can be located on an edge node within the system and therefore bridge traffic from the closed broadcast network and a less secure corporate network. Finally, both the desktop and the web client utilize caching mechanisms to allow a responsive user experience even on low bandwidth / high latency connections.

4.3.4 Common Display Functionality

The following sections describe functionality that is common across display applications within both the Desktop Client UI and the Web UI.

4.3.4.1 Display Filtering

Many applications support the concept of specifying filter criteria either to limit what is shown in a display application or to support a search function for items in the application that match the filter criteria.

Filters are built from a collection of accumulators, attributes, operators, and values to form simple to complex filters. Filters can be stored for later use and the same filter definition can be used for different purposes (filtering and searching) and for different applications than the one for which it was created.

In addition, a number of displays support a Quick Filter mechanism. This allows commonly used filters to be applied or removed via a single mouse click.

4.3.4.2 Severities and Alarm Propagation

Mosaic utilizes a configurable severity hierarchy across all applications. Within this configuration are two types of severity, primary and secondary status. The primary severity is used to reflect the status of monitored parameters, messages, and the Mosaic application. Secondary status severity is used to provide peripheral status information about monitored parameters. Secondary status is optional and not all Mosaic installations will use it. In a device monitoring deployment, three common secondary status values are communication alarm, maintenance mode and alarm mask.

Primary severity is program configurable, but internally, Mosaic uses the following status levels (from most to least severe):

- Alarm
- Warning
- Event
- Debug

For example, within the NETC system the primary severities could be configured as follows: critical, serious, not serious, normal, etc. - where the seriousness decreases from left to right.

Within the configuration for the primary severity, the levels are defined in the hierarchical order from most to least severe. The following information can be specified:

- Text Label
- Foreground Color
- Background Color
- Icon
- Audible Alarm

Within the individual display applications, the exact textual descriptions and the applicable levels may vary. For instance, in a Panel Display, the Good status level is equivalent to a monitored device being free of any alarms. Similarly for the Event Display, the Good status level is equivalent to an Information level message. Regardless of the levels and textual descriptions used by the individual displays, they all follow the same hierarchy.

In addition to the consistent severity levels, many display applications support the concept of acknowledgement. At a configurable minimum severity level, messages and status updates require user acknowledgement. This provides a mechanism of alerting the user to changes to system state and also as a means to audit operations. When an update is received that requires acknowledgement, each display application marks the update in its own way. For example, tabular displays include a column that shows the messages or states that require acknowledgement, while Status Grid displays animate the status icon.

Most applications also report the status of the worst unacknowledged object to the display framework. This status is reflected in the title bar of the display applications and is also reported up to the application controller.

4.3.4.3 Printing and Exporting

Mosaic supports printing of an entire display frame, individual displays, and tables within the application. Each of the printing types support configurable options to control what is printed and how it is printed. Common configuration includes the ability to specify the scale, whether to print in color or monochrome, and the print layout to use. Print layouts provide the ability to define headers and footers that are included on the printouts. Any number of print layouts can be defined and selected at runtime.

Mosaic also supports the export of the contents of a display application to file. The contents to be exported depend upon the type of application. All applications support the export of a screen shot image. In addition to an image, tabular displays support the export of the data in the table to a Comma-Separated Value (CSV) file which can be easily accessed via an application such as Microsoft Excel.

4.3.4.4 Common Device Right-Click Menu

All display applications that contain parameter information, which includes the Resource View, Alarm Display, Event Display, and Device Panels, support a common right-click popup menu to allow common actions to be performed. The types of actions that will be available from the popup menu include:

- Open a Default Panel
- Send a Device Command
- Execute an Automation Script
- Mask a Parameter Alarm
- Generate a Report

- Edit Device Definitions
- Put a Device in Maintenance Mode
- Put a Device Driver in Debug Mode

The exact list of actions present on the right-click menu is end-user configurable and can change from program to program. Following is a representative example as accessed from the Resource View. For applications that already contain right-click menus, the Device Right-Click Menu will be in addition to the application-specific functions.

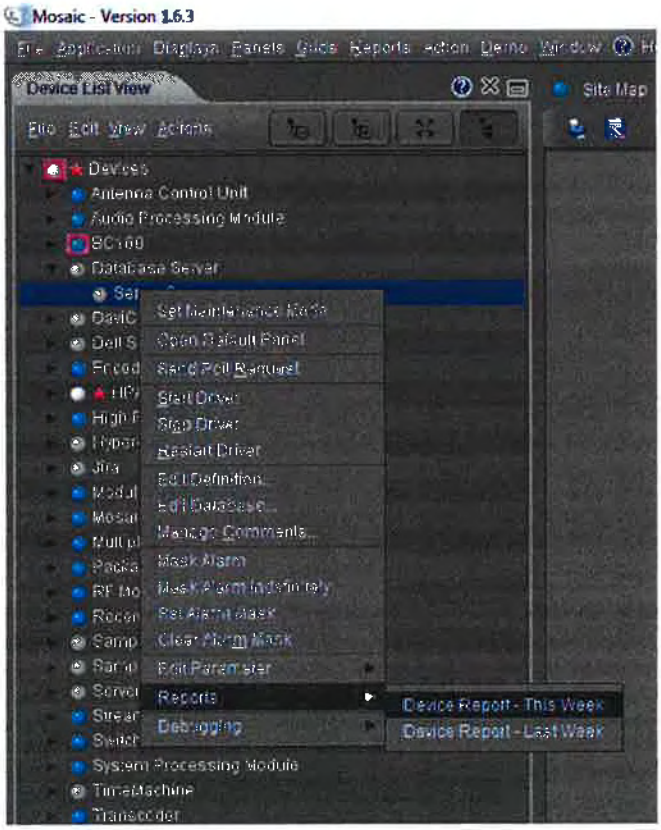


Figure 7 Device Right-Click Menu

4.3.5 Dashboard Displays

Both the desktop and web clients support the concept of a dashboard view to provide a quick look at the most important parameters in the system such as key performance indicators (KPIs) and summary status parameters.

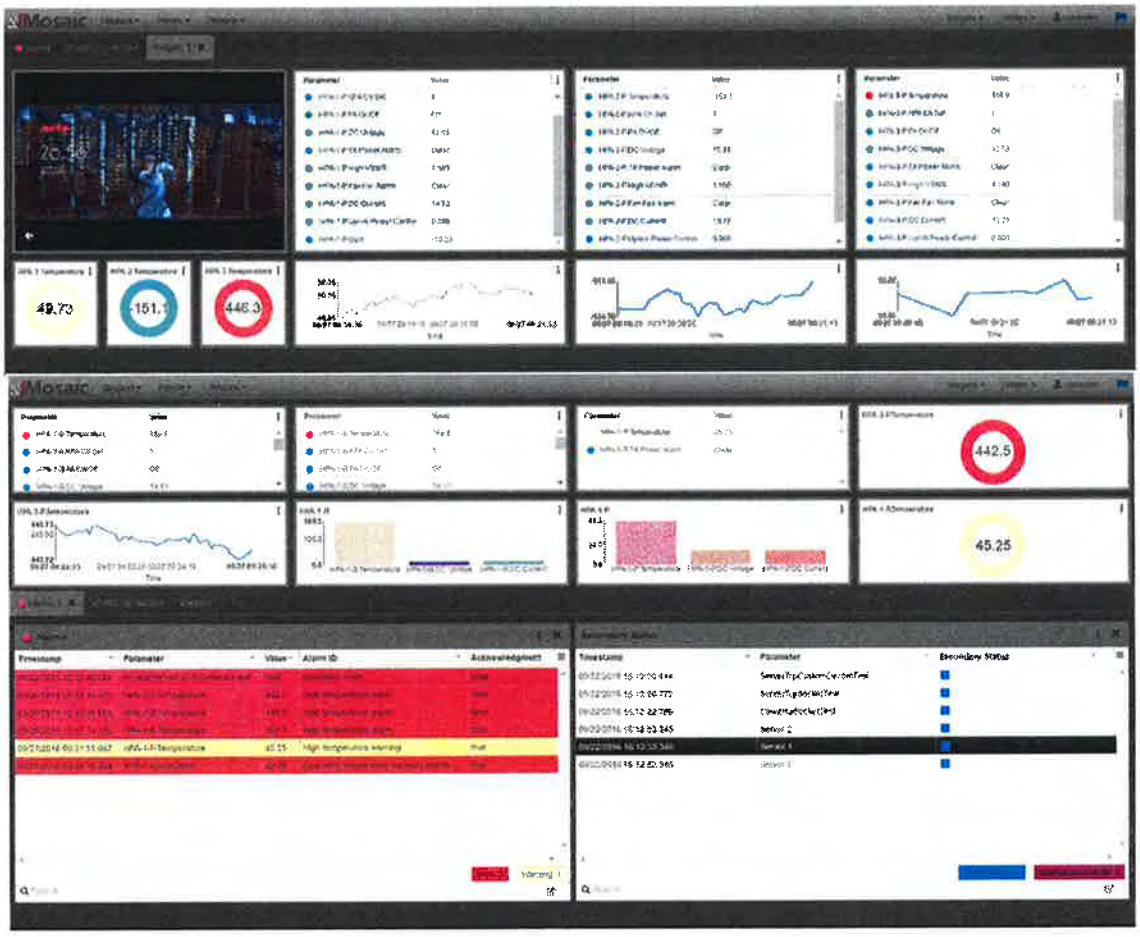
The following types of widgets are available within dashboards:

- Bar Chart
- Pie Chart
- Time Chart
- Gauge
- Dials

- Table Data
- Streaming Video

When a widget is created, it is associated with a parameter filter. This filter defines what monitoring points or parameters are bound to the widget for display purposes. The filter allows complex expressions and wildcard characters to allow fine-grained control over the data shown. In addition, the filter is stored within the dashboard definition and is re-evaluated whenever the underlying database changes. This allows the dashboard to keep track of changes within the Mosaic system and always display the latest monitoring information.

On the web client, widgets are added to either a dedicated tab within the view or to the summary dashboard area. Once added widgets can be easily resized, moved, edited, or deleted.



Example: Web Client Dashboards

4.3.6 Map Display

Both the desktop and web clients provide a Map Display capability which shows status for data points containing latitude and longitude geographical coordinates. Typically, this is used to show group roll-up status parameters reflecting the status of all devices at

a customer's sites such as uplink facility, broadcast center, or data collection facility. For the NETC program, the Map Display could provide a quick overview of all transmission and contribution paths within the NETC domain.

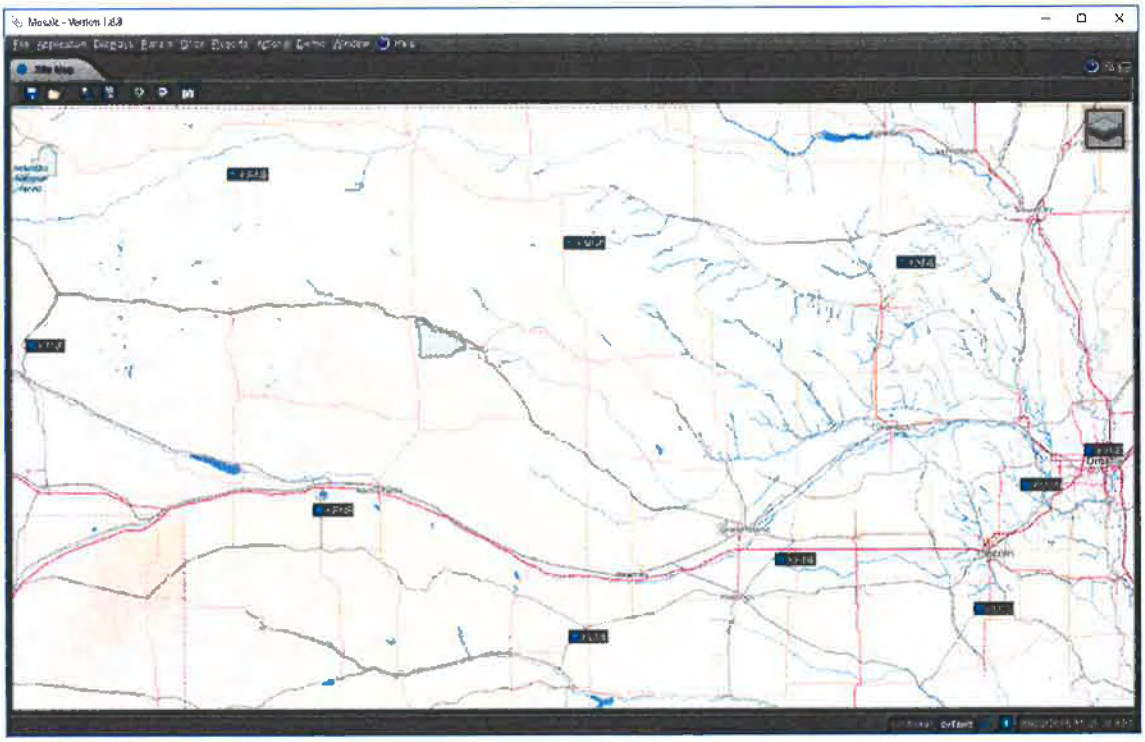


Figure 8 Desktop Client Map Display using OSM tile server

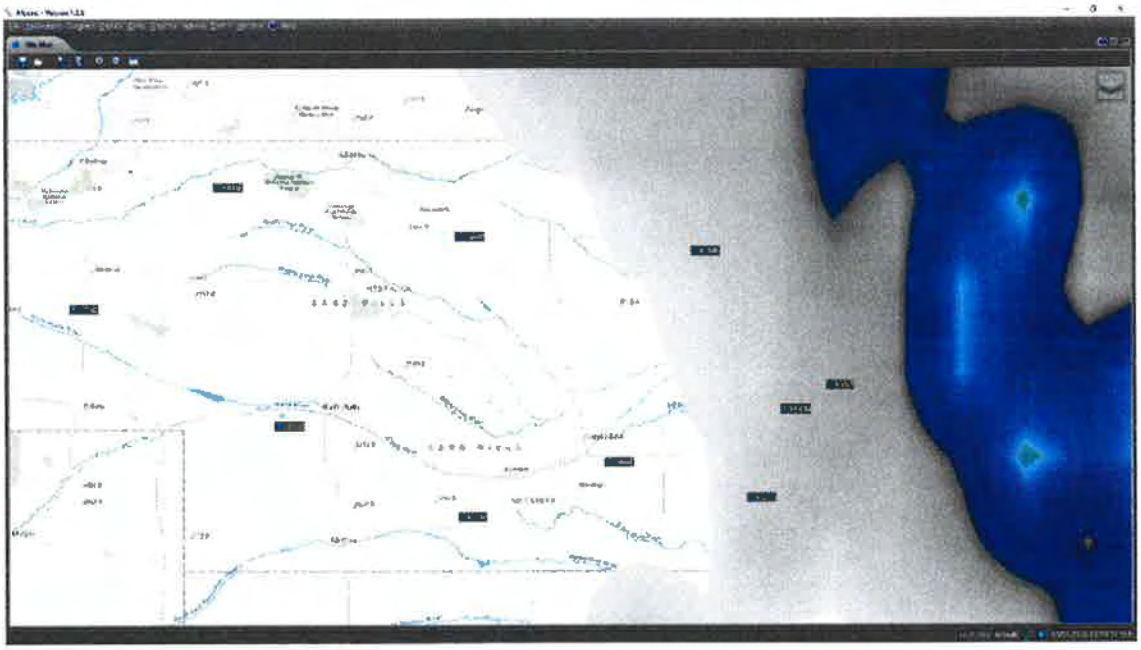


Figure 9 Client Map Display show live weather overlay

The Map Display itself is defined using configurable layouts which provide the ability to specify the parameters that should be shown on the map and also the default initial bounding box of the display, such as Nebraska.

The Map Display support a number of configurable element, such as the base map layer to use. In addition, any number of overlays can be configured and displayed. Map overlays provide a mechanism to augment the display to show additional information, such as live up-to-date weather information. This includes, but is not limited to:

1. Precipitation intensity
2. Wind Speed
3. Temperature
4. Lightning Strikes

Such information can be invaluable when coupled with the map display. It can be used to visualize weather information and the impacts it may have on broadcast services or ground assets. For example, the precipitation overlay provides insight into conditions which may impact fade levels at a satellite teleport, while the lightning overlay shows impending storms and lightning activity which may require a transmitter site to switch to generator power. Note, while extremely useful, most weather services require an active subscription to access live information.

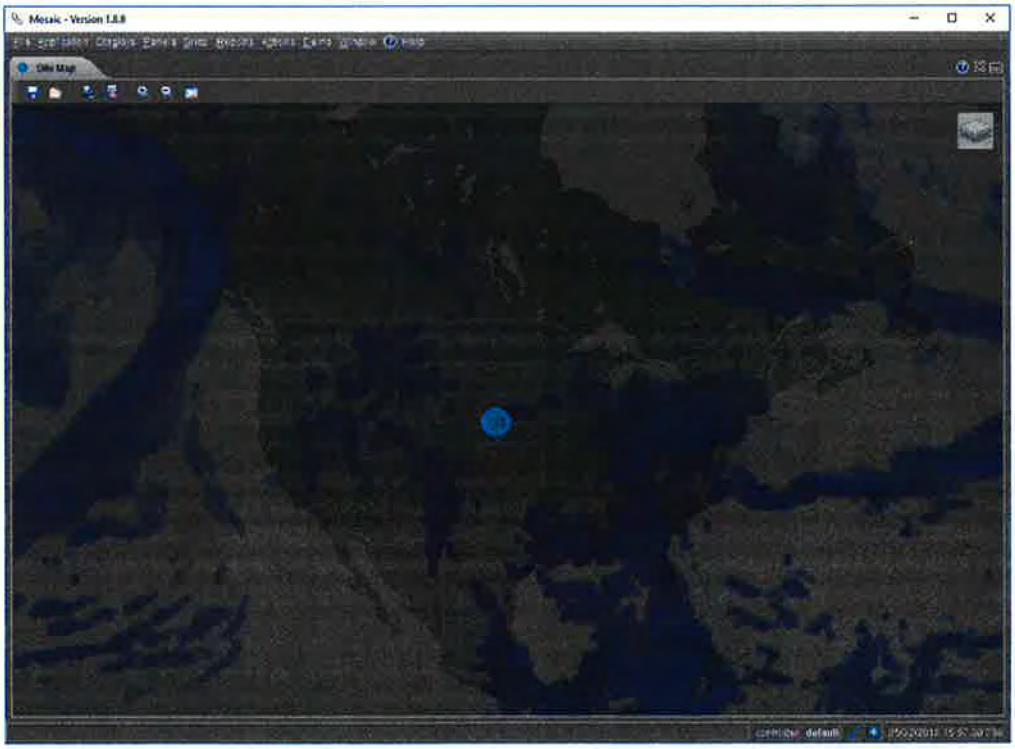
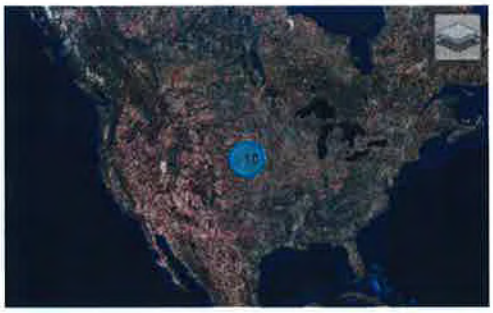


Figure 10 Map Display showing precipitation overlay

Base map layers supported by the Map Display include:

Open Street Maps (OSM)

World Topology (ESRI)



World Satellite Imagery

World Shaded Relief (ESRI)

Carto Light

Carto Dark

4.3.7 Resource View Display

The Resource View displays provide a high-level graphical representation of the health and status for objects monitored by Mosaic. The display is a simple tree, consisting of branches and leaf nodes. The exact structure and content of the tree are dependent upon the Mosaic installation and multiple Resource View models can be supported. In general, the leaves represent a top-level object monitored by Mosaic, such as a device or an external application to which Mosaic is connected. These leaf nodes can then be grouped under customizable branch headings to help organize them. All nodes within

the tree contain an associated status, which is displayed as an icon. For branch nodes the status is derived based on the status of its child nodes. When the status of a child node changes, its status is automatically propagated to the parent. The parent node will then recalculate its status based on the highest level status of any of its child nodes.

For the Monitor and Control System, the Resource View allows the layout to be specified dynamically so that devices can be grouped in various combinations based upon the information defined for a device. Examples of possible hierarchies include:

- Server Instance
- Device Location
- Device Group
- Device Types
- Device Model Number

The above list is just a representation and can be based upon any attribute specified for devices in the telemetry database. The following figure shows a Resource View generated using device types to group devices.

Figure 11 Resource View - Device Type Grouping

The Resource View also supports a detail view which allows additional device information to be displayed.

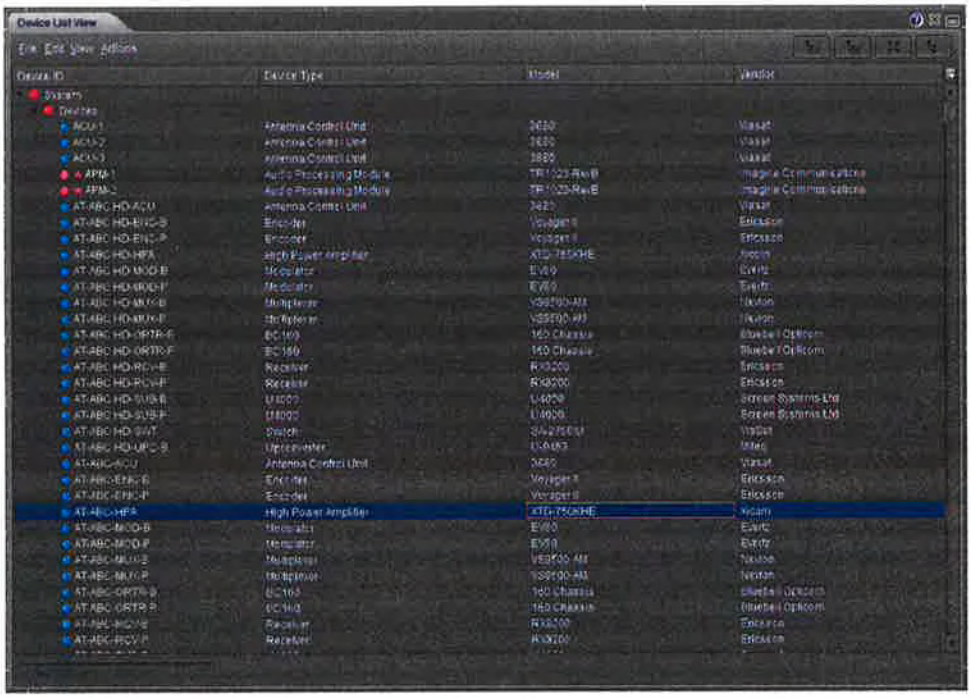


Figure 12 Resource View - Detail View

The resource view is currently only supported for the desktop client, but a web client implementation is on the road map for 2017.

4.3.8 Event Display

Status messages are generated from all applications within the Mosaic software system and received from external applications to which Mosaic interfaces. These messages provide detailed information regarding the status of the objects being monitored by Mosaic, internal status of the Mosaic system, and status and notifications from external applications.

The Event Display provides the user interface to view these messages. It maintains a local cache of messages received and generated by Mosaic and displays them in time order to the user. As new messages are received, the display updates in near real-time.

The columns available on the Event Display are largely dependent upon the Mosaic installation. It is adaptable to various customer specific display requirements. The following figures show a representative list of columns based upon the core Mosaic columns.

Figure 13 Desktop Client Event Display

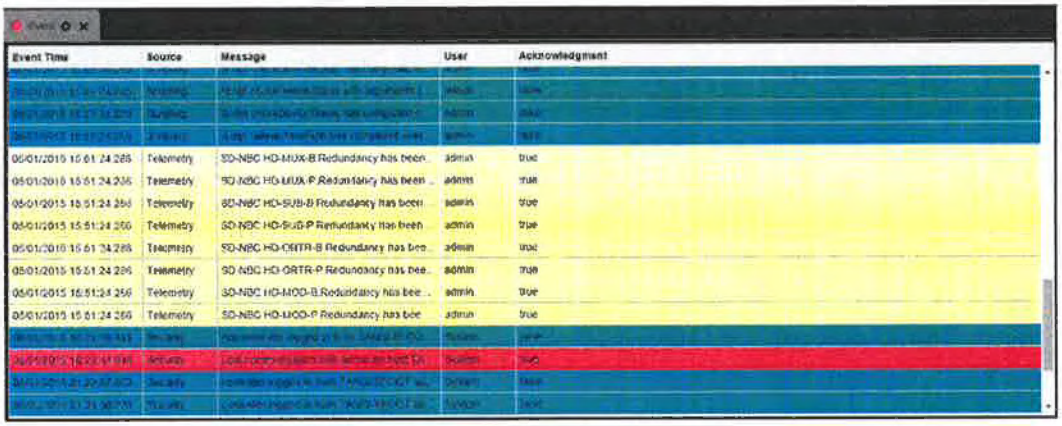


Figure 14 Web Client Event Display

Multiple instances of the Event Display can be active with individual filters applied. This makes it possible to create instances showing only commanding events or showing only device debugging events.

In addition to the standard display and tabular display capabilities, the Event Display provides some unique actions. These include the ability for a user to add a message to the system and for a user to annotate an existing message with additional information.

4.3.9 Alarm Display

The Alarm Display provides a summary of all of the alarms currently present on the system. The alarm messages provide detailed information regarding the source of the alarm, the impact on the system and the root cause.

The Alarm Display can be split into one or more regions, where each region contains a configurable alarm severity or list of alarm severities. Regions can be shown as individual resizable panes or within individual tabs. The separation aids the operations team in prioritizing a response and by ensuring severe alarms are not missed or lost due to a high volume of lower severity alarms. Within each region the entries are organized in time order with the most recent entry at the top. The status bar on the Alarm Display contains a summary alarm status displaying the counts of parameters in each severity level. Whenever a new alarm is detected or an existing alarm changes severity the Alarm Display is updated in near real-time.

As with the Event Display, the columns available on the Alarm Display are largely dependent upon the Mosaic installation. The following figures show a representative list of columns based upon the core Mosaic columns.

Figure 15 Desktop Client Alarm Display

Figure 16 Web Client Alarm Display

The following figure shows the Alarm Display reconfigured with two region, the first containing warnings and the second containing errors or critical alarms.

Figure 17 Partitioned Alarm Display

4.3.10 Mimic Display Panels

Mimic display panels provide the canvas on which data within the system can be represented in graphical form. Whether through graphic reproductions of a device, a conceptual subsystem, or a logical signal flow, mimic panels provide the tool to model any element of the system. Mimic displays also provide workflow tools which can be tailored and adapted to suit any customer and typically represent the primary control surfaces via which users interact with Mosaic.

Combined with the use of a built-in drill-down capability, Mimic display panels can provide an intuitive mechanism to display a large volume of data in a well-organized and easily digestible manner.

Examples of Mimic Panels below include:

- Visualization of overall system health
- Control surfaces for channel or service selection
- Visualization of subsystems and signal flows
- Facility or site monitoring and control
- Room and rack level representations
- RF Uplink Signal Flow

Figure 18 Desktop Client Service View Example

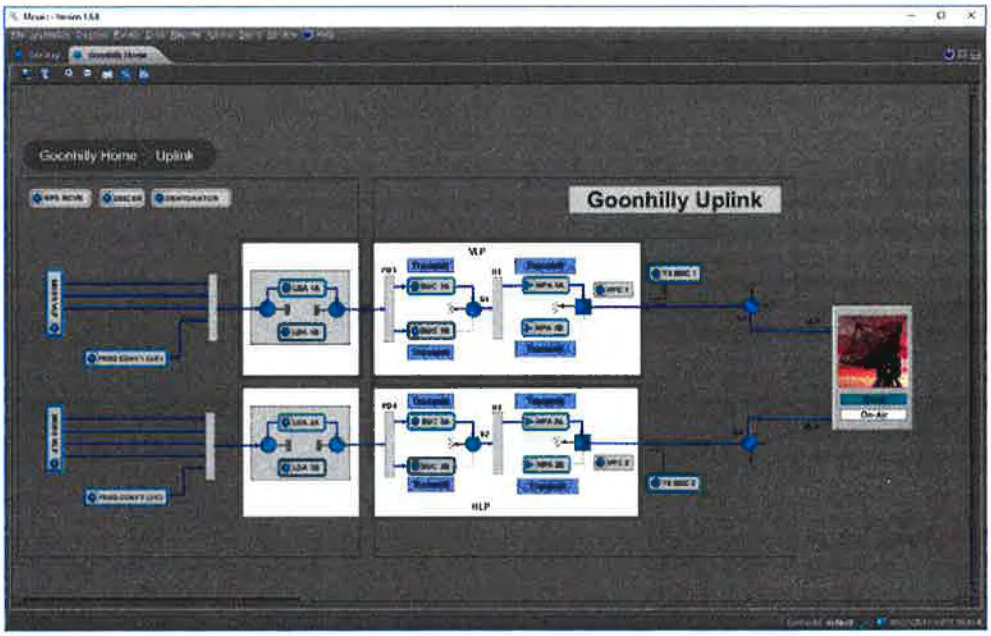


Figure 19 Satellite Uplink Example

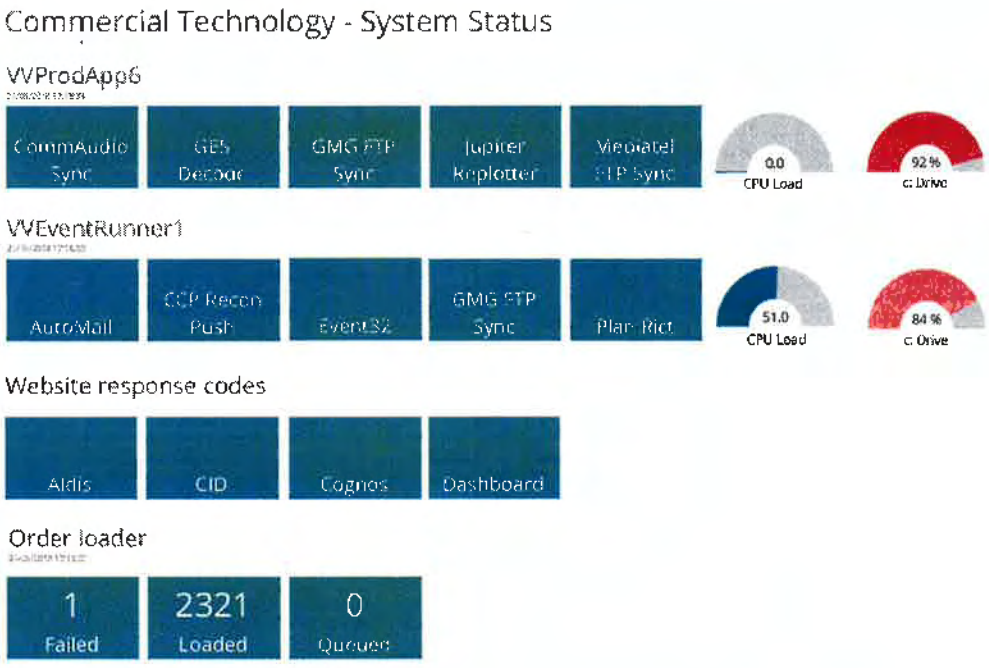


Figure 20 Commercial System Overview Example

Figure 21 Web Client Rack View Example

Figure 22 Transmission Site Overview

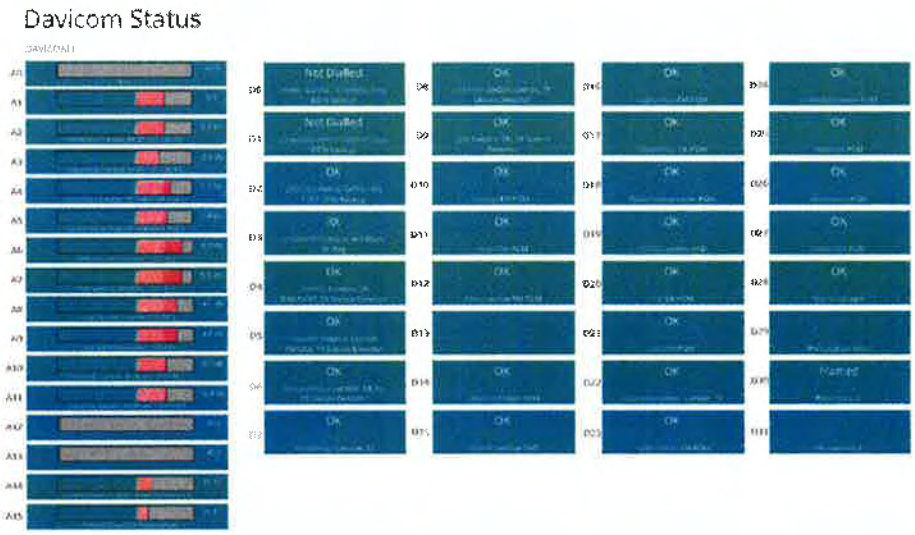


Figure 23 Davicom Device Status Panel

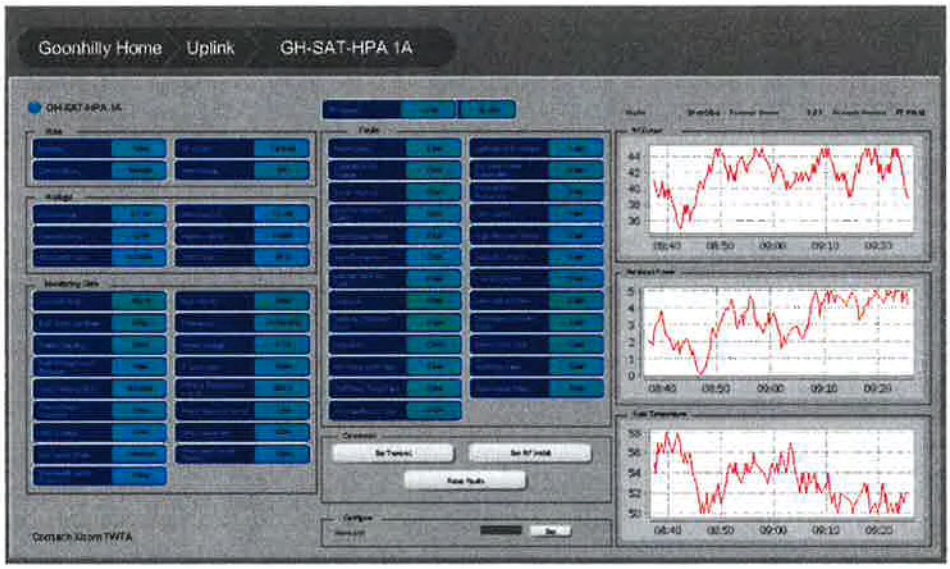


Figure 24 Device Type Panel (HPA)

4.3.10.1 Creating Mimic Panels

A Mosaic mimic panel consists of four main elements, these are:

1. The base drawing (static elements),
2. Symbols (animated elements),
3. Data bindings which connect the graphics to monitoring data,
4. Actions which trigger change within the system.

The Mosaic Desktop Client UI provides a full editing environment with which mimic display panels can be created, viewed or altered. In addition, the mimic editor also

supports importing of graphics from external sources, provided it supports the common interchange format Scalar Vector Graphics (SVG). For example, outputs of popular drawing packages such as Microsoft's Visio and AutoCAD can be easily imported.

Advanced users can also embed scripted elements within the mimic display panels. These scripted elements allow the panel to be built on-the-fly based on real-time data or static database inputs, for example a mimic panel representing a chassis. The cards within the chassis can be added dynamically based on data returned from the device. The use of scripted elements within panels supports and promotes the use of reusable templates, thereby reducing the maintenance cost associated with keeping panels up-to-date.

4.3.10.2 Mimic Panel Editor

The Mosaic Mimic Panel Editor is a graphical editing environment, which makes building complex panels quick and easy. The panel editor allows users to create, view, modify and delete panels within the system. The panel editor also supports a preview feature which has the ability to connect to a data source and animate the current panel with data. The preview feature can also be used to check the look and feel of a display before moving it to the development or production systems.

Mimic Panels are created by dragging and dropping graphical components onto the display. Once a component has been added it can be resized, moved and linked to other components. The editor also allows attributes such as color, font, text, visibility and tooltip text. In addition, device data can be mapped directly within the editor.

The editor contains tools to add a myriad of different graphical components, from simple shapes, free text and images to complex symbols, buttons, sliders and gauges. The Mimic Panel Editor allows domain experts to build rich, meaningful displays which can be tailored to their business needs.

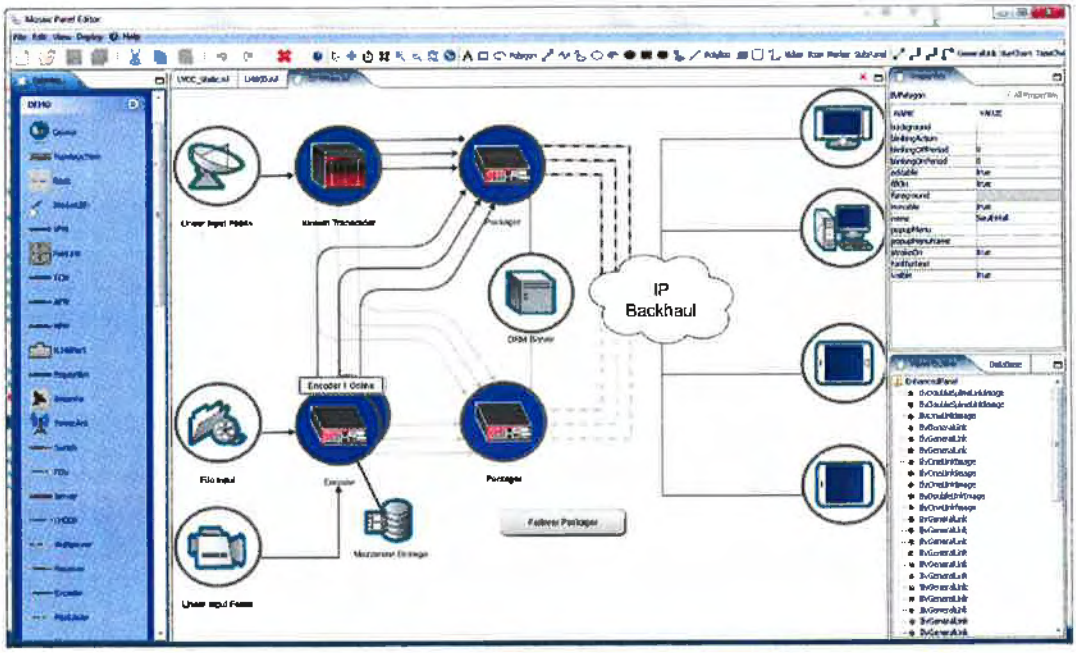


Figure 25 Mosaic Panel Editor

4.3.11 Status Grid Display

The status grid display provides a high level view into items, such as channels or services, which are monitored by the Mosaic system. Items modeled on the display are laid out in tabular grids and are represented using color coded primary and secondary status indications. There is no limitation to the number of status grid displays in the system or limitation to the number of displays that can be active on a client at any one time.

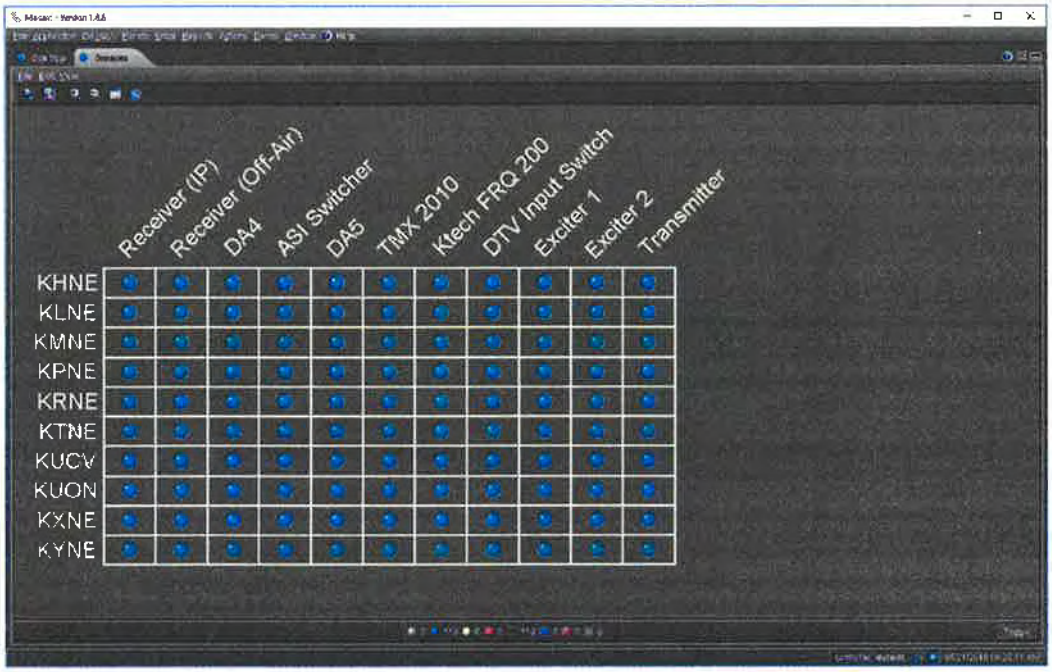


Figure 26 Example Status Grid Display

The status grid display is user-configurable and driven by real-time monitoring information. To create a new display, a simple grid editor is provided. The editor allows the user to choose the number of grids per display, the display items, the filter content for each grid, column and row header information, and column and row titles. Grid filters specify the row and column item criteria in order to determine what items are included on a grid. For example, in The status grid display provides a high level view into items, such as channels or services, which are monitored by the Mosaic system. Items modeled on the display are laid out in tabular grids and are represented using color coded primary and secondary status indications. There is no limitation to the number of status grid displays in the system or limitation to the number of displays that can be active on a client at any one time.

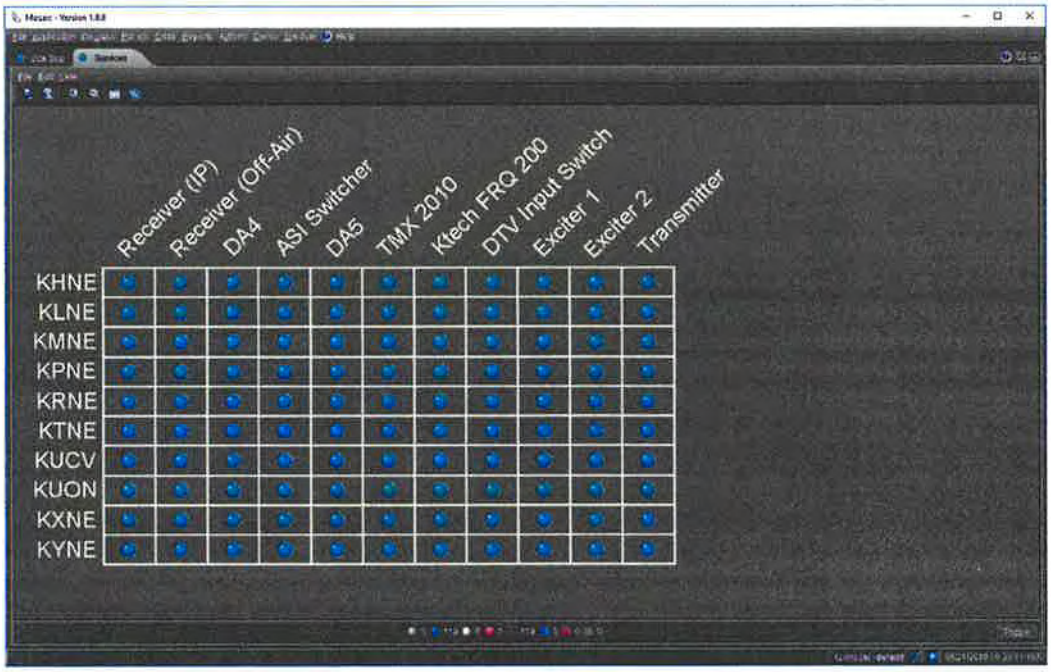


Figure 26 above, the column criteria is channel identifier and the row criteria is market identifier. The allowed criteria combinations match the standard filtering capabilities for any display. In addition, the editor adds the ability to manually specify the order of the resultant rows and columns. Once the display has been laid out to the user's requirements, it can be stored as a named grid display that can is available to all users.

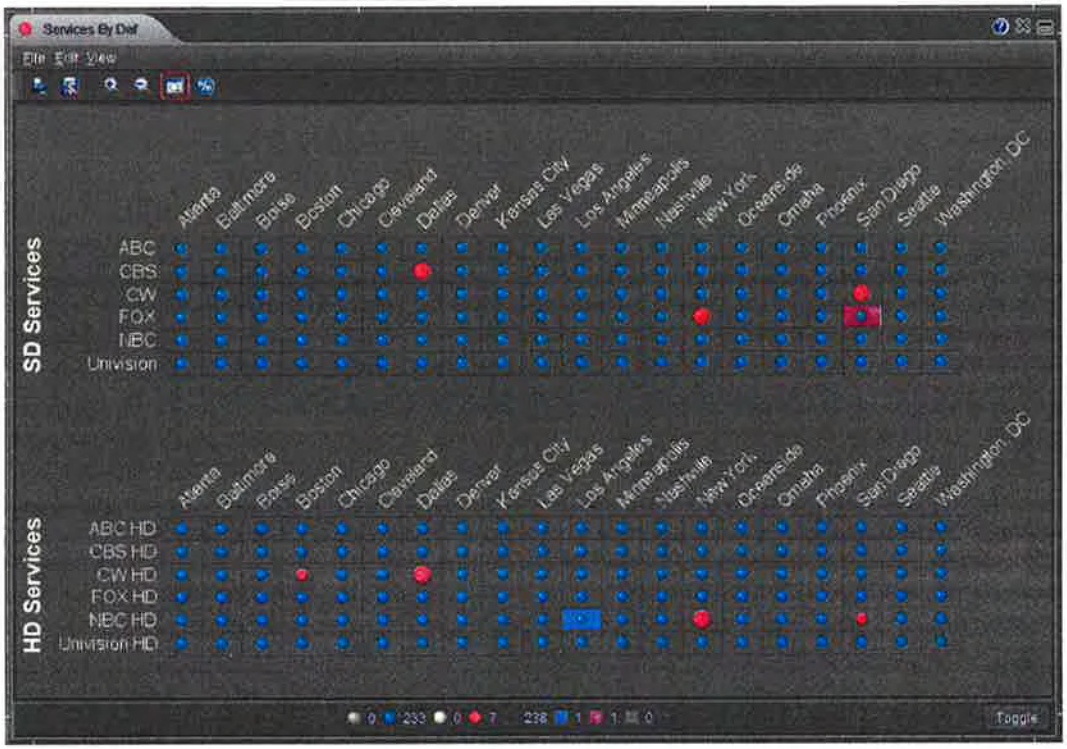


Figure 27 Status Grid Display with Multiple Grids

In addition to being able to configure the layout of the grid displays, a user can modify the status grid display at runtime by clicking on the color representations of the primary and secondary statuses and by applying a filter on the display. As an extension to the common mechanism to apply a filter to a display, the status grid display offers one-touch filtering on primary and secondary status.

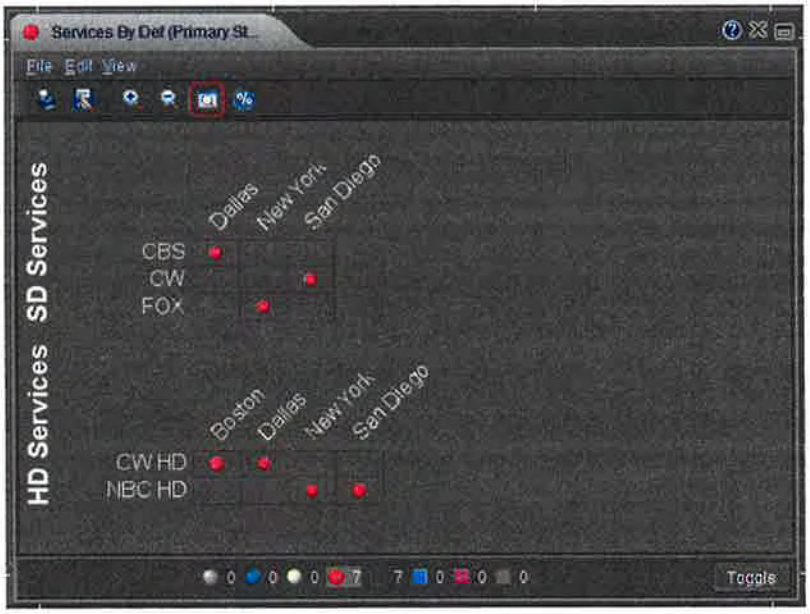


Figure 28 Status Grid Display with Primary Status Filter

The status grid display listens to changes to both the status of the items on the grid and to changes that would affect the structure of the grid. For example, if new services are added or removed the grid will automatically rebuild itself to include or remove the affected services. In addition, when a filter is applied to the grid the items contained within the unfiltered grid are retested on change to determine whether they meet the filter criteria currently applied. This feature allows the grid to grow or shrink dynamically based on the real-time status of the system.

Similar to filtering, the status grid display provides a search capability to find the items on the display that match a filter criterion. The following figure shows the search capability being used to find all items that come from a certain market.

Figure 29 Status Grid Display with Search

The search dialog allows the user to navigate through each of the items in the display and highlights each instance. It also has the capability to search the entire library of status grid displays to show the list of displays that contain at least one instance of an item that matches the filter.

The status grid is currently only available on the desktop client.

4.3.12 Command Display

Although devices are typically commanded via scripts, panels or other more user-friendly mechanisms, from time-to-time a user may need to send one or more commands directly to a device. The command display provides the user interface from which commands can be manually sent.

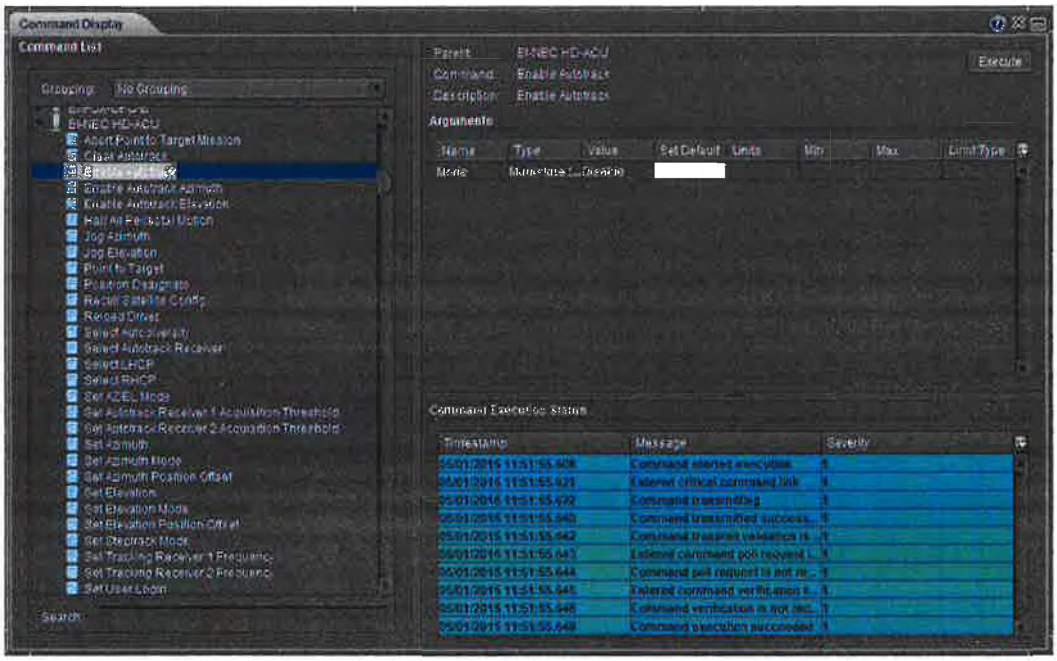


Figure 30 Command Execution Display

From the display, the user is required to enter any command arguments that do not have default values. Any user entries in the argument editor are validated against the argument type defined in the commanding database. When a command is executed, the Command Execution Display tracks the intermediate steps as the command goes through the execution chain. Once a command has completed, it can be re-executed with or without changing the command arguments.

Command execution can be initiated from multiple GUI mechanisms, including buttons configured on mimic display panels, the device right-click menu or the main menu. When executing from the device right-click menu, the user can start the Command Execution Display in two modes, with or without a command selection menu.

Figure 31 Execute Command Right-Click Menu

The command display is currently only available on the desktop client.

4.3.13 Schedule Display

The schedule display provides a view into the actions that have been added to the automated schedule, described later. The number of actions shown is based upon a sliding time window where the size of both the window and the historical window are user configurable.

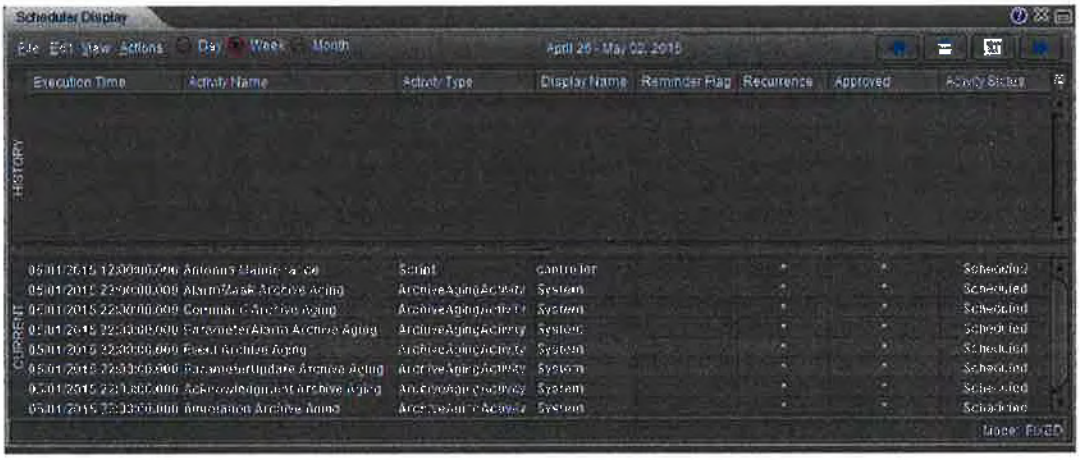


Figure 32 Schedule Display

From the schedule display, users with appropriate permission can edit or delete scheduled actions.

The schedule display is currently only available on the desktop client.

4.3.14 Script Display

The Script Display shows the list of active scripts together with a configurable history buffer. The figure below shows a listing of all active scripts and a 3 hour history of completed scripts. The display also provides an indication of the success or failure status of any completed script.

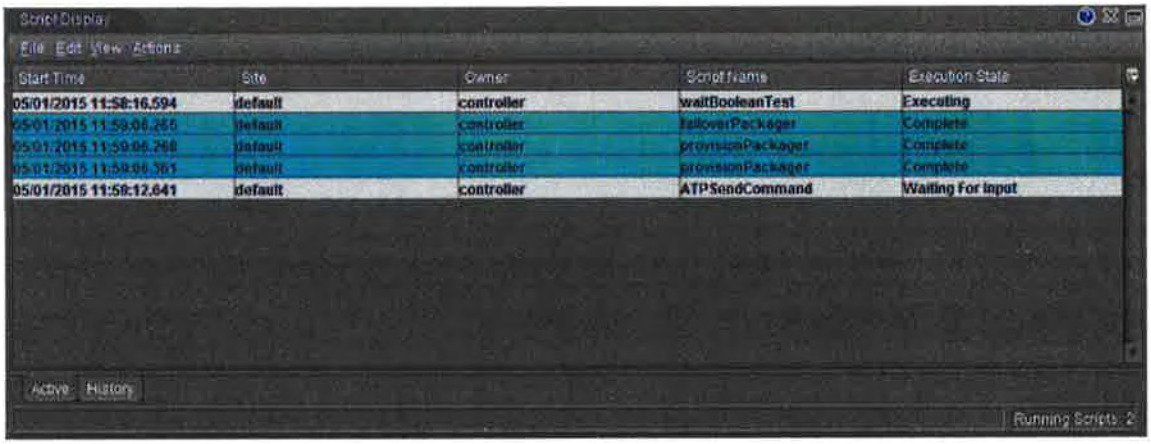


Figure 33 Script Display

The script display is currently only available on the desktop client.

4.3.15 Fault Tolerance Display

The Fault Tolerance Display provides a view of the cooperating servers in a distributed Mosaic deployment. The display provides visibility into the current connection status of the servers, whether the servers are acting as primary or backup, and the data synchronization occurring between the servers. Additionally, it provides the ability for a user with the proper permissions to control the fault tolerance operations, such as failing over to a new server and setting the primary server for a backup server.

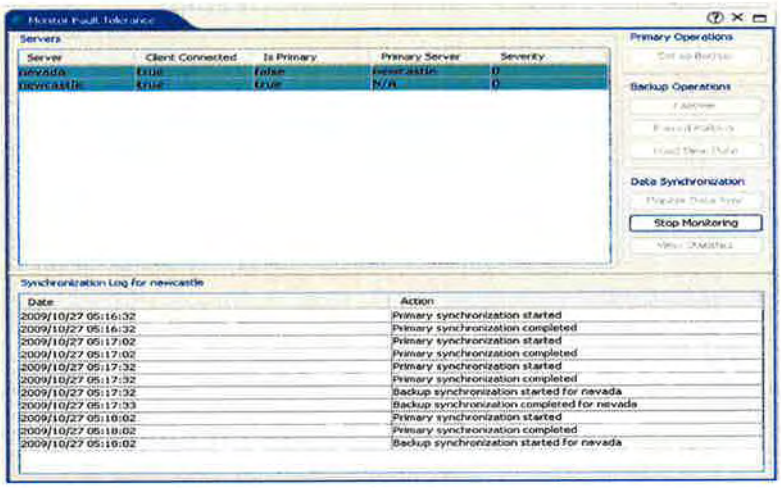


Figure 34 Fault Tolerance Display

The fault tolerance display is currently only available on the desktop client.

4.4 Automation Layer

The automation layer provides a series of tools to automate all aspects of the Monitor and Control system. It combines operational experience with Mosaic's software intelligence, to inject business knowledge into the system to simplify routine tasks. The layer is broken down into three main areas - Scripting, the Event Correlation Engine, and Scheduling.

Mosaic Scripts are sequences of instructions which are designed to allow a subject expert to express a series of checks and actions to affect the overall state of the system. Examples include, triggering the system to poll a device, performing conditional logic based on the value of a device data point, sending commands to one or more devices and calling other procedures to promote reuse and modularization.

The Event Correlation Engine continuously examines all incoming events and based on a set of flexible and expressive rules, the engine identifies patterns in otherwise seemingly random events.

Scheduling provides a high-level of automation, allowing routine, periodic and ad-hoc activities to be planned out in advance. The Scheduling component will then initiate actions based on the required start times.

The level of automation is commonly built up over time as the engineering team becomes more familiar with both Mosaic and the devices it is monitoring. So, for example, a common script that is created early in a program is to failover over a sequence of devices from the primary to backup path. Initially, this might be added to a display panel so that when an operator detects a failure in one of the devices, a button on the panel executes this failover script as a single user action. With more experience, the Event Correlation Engine can be put in use to predict that a device chain is failing and automatically execute the failover script before the station goes silent. Finally, if a

temporal pattern is detected, such as a device that needs to be rebooted every 2 weeks, Scheduling can become involved to execute a maintenance script that includes failing over the execution path before and after the reboot is performed.

4.4.1 Scripting

Mosaic scripts are designed to perform a series of actions. The scripts are ASCII files which may contain any combination of conditional logic, loop constructs, and control statements, such as sending commands and configuration statements. Configuration statements are primarily used to check or set device configuration. In essence, a Mosaic script can interact with virtually all elements of the system and can perform all common functions performed by a user. This level of integration makes the Mosaic Script Engine a powerful addition to the overall system.

4.4.1.1 Script Development

Since Mosaic scripts are ASCII files, they can be modified using any text editor, however Mosaic provides a fully featured integrated development environment which supports the entire Mosaic scripting language. The development environment is built upon the Eclipse development framework. The Mosaic scripting language is derived from the Groovy language with domain-specific extensions added.

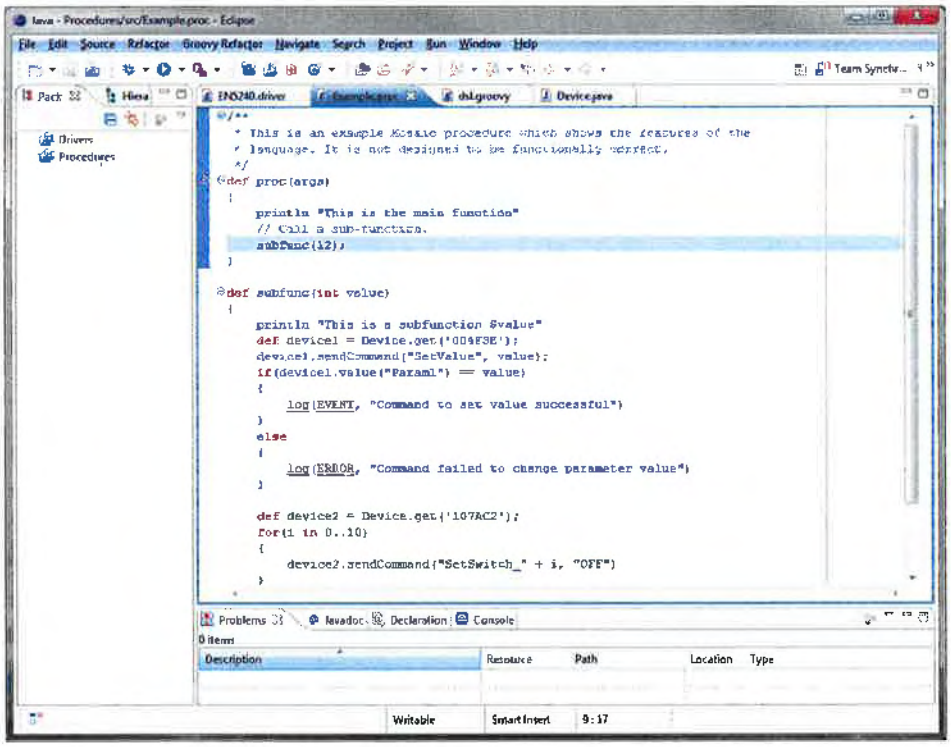


Figure 35 Mosaic Script Development

The development environment supports all of the same features as the driver development environment described in a later section.

4.4.1.2 Script Execution

The Mosaic Script Engine is responsible for accepting execution requests from a number of sources. These sources include the Mosaic client display, the scheduling function, the event correlation engine and the external API. The execution request specifies the name of the script to execute, any arguments the script may require and a reference to an active user. The user is essential not only for informational purposes, but also to provide an audit log and to enforce any security constraints which may have been applied to the system. The script execution engine is capable of executing multiple scripts concurrently. The limit to the number of concurrent scripts is driven by the resources allocated to the script execution engine and not by an artificial threshold.

4.4.2 Event Correlation

The event processing layer combines both event stream processing (ESP) and complex event processing (CEP) to ingest events from the Mosaic system and to perform complex analysis. The event processing engine aggregates information from distributed systems in real time and applies rules to discern patterns and trends that would otherwise go unnoticed.

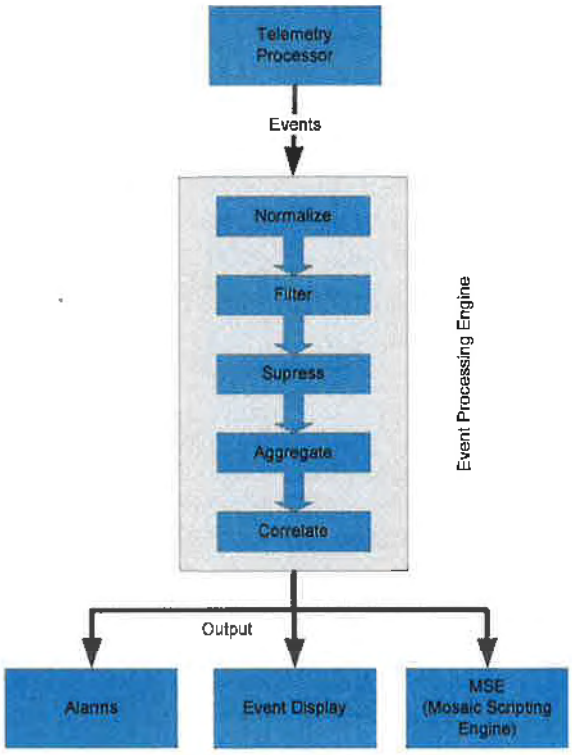


Figure 36 Event Processing Engine

As a general rule the event processing engine can be broken down into the following tasks:

- Event Normalization

  Normalization takes events from disparate sources and extracts common attributes, thereby creating a standardized event stream. Although not strictly required, event normalization makes downstream processing more efficient and allows for a more generic set of collation rules.

- Event Filtering

  Filtering is responsible for discarding events that are deemed to be irrelevant by the correlation rules. Event Filtering is designed to thin the incoming data generating a more manageable set of important events.

- Event Suppression

  Suppression (also known as Event Masking) consists of ignoring events pertaining to devices that are downstream of a failed component. For example, devices that are downstream of a crashed router will fail availability polling. Masking also allows the suppression of events based on the state of a device, for example if a device is put into maintenance mode, Masking can selectively ignore events from the device until it is returned to an online state.

- Event Aggregation

  Aggregation is often used to describe the act of taking a number of similar or repeat alarms or events and compressing them into a single event. The aggregated event tends to include additional data, such as the first and last event times and the repeat count. Aggregation is also known as Event Deduplication.

- Event Correlation

  Correlation is the last and most complex step of the event processing engine. Correlation identifies patterns and relationships between events. Patterns can be as simple as either A or B or more complex: A followed by either B or C within 5 seconds of A. Correlation can also be used to identify causality, which is often referred to as Root Cause Analysis. With the right set of correlation rules, the event processing engine can make fast, accurate, and intelligent determinations from a seemingly unordered, unrelated set of events.

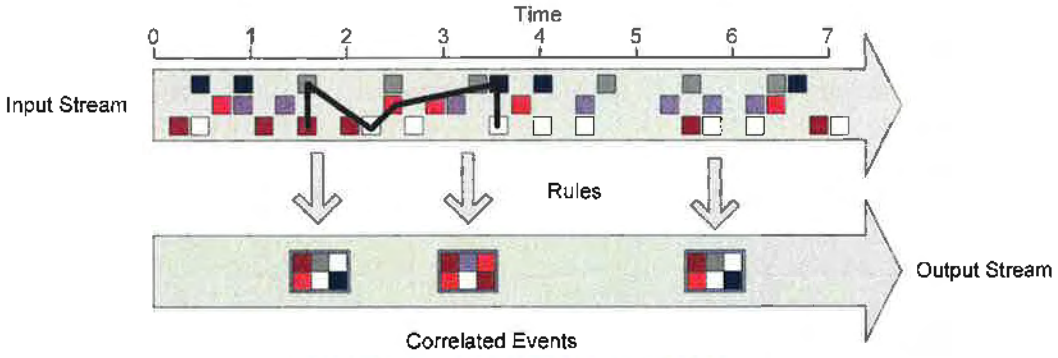


Figure 37 Illustration of Event Correlation

The figure above illustrates a single input stream together with a set of correlation rules generating a single output stream. In reality, the event processing engine supports an arbitrary number of input streams, together with an arbitrary number of output streams. The event correlation engine also generates a number of internal streams, which are then used as inputs to further correlation rules. Some real-world examples of streams might include:

- Internal Streams

  A filtered stream where all events deemed to be irrelevant by the correlation rules have been removed. The filtered stream may then feed a second tier of correlation rules designed to remove events from suppressed devices, such as those currently in maintenance mode.

- Output Streams

  In addition to the status and alarm output stream, which is important for driving displays and performing impact analysis, the event correlation engine can be configured to calculate statistical output. A statistical output stream may contain information such as the mean time between failures (MTBF) or the mean time to recovery (MTTR) of all devices within the NETC broadcast system.

After correlation, events are forwarded to interested listeners that can perform functionality based on the type of event passed through. The Mosaic system currently supports the following actions that can be triggered by these events:

- Generate a new event message in the event display
- Execute a script
- Create a new parameter update or modify the parameter being processed
- Suppress an alarm using an alarm mask
- Send an e-mail to a list of users or to a predefined e-mail group

4.4.3 Scheduler

The Mosaic Scheduler allows actions to be scheduled for later execution. Activities can be scheduled for single or recurring execution. The following actions are currently supported by the scheduler:

- Send a notification to one or more users
- Mark a significant event, such as a station going off-air
- Execute a script
- Put a device into maintenance mode
- Generate a report

The script execution and maintenance mode activities support the concept of a counterpart activity. For example, it is possible to simultaneously schedule a script that sets up one or more devices for a function and to schedule its counterpart that returns the devices to their normal state.

When an action is scheduled, the following information is specified:

- Time the action is to be executed
- Type of action to be executed
- Optional description to provide an explanation as to why the action is being scheduled
- Optional execution duration
- Optional recurrence schedule

In addition to the common fields above, actions themselves have configuration information that is required. For example, executing a script requires the name of the script to be executed and, if the script has any parameters, the values for those parameters.

4.5 Data Processing Layer

The Data Processing Layer contains the internal Mosaic definitions of what can be monitored and controlled. It is different from the Driver Adapter Layer because it has no knowledge of how data is acquired or how control directives are processed. Additionally, whereas the Adapter Layer can be developed and configured according to the full interface specification of the devices being monitored, the Data Processing Layer can be configured to limit the parameters and commands presented to operations. Similarly, the parameters and commands can be modified from the raw device format to make them more useful in an operations environment.

The main components of the Data Processing Layer are the Telemetry and Alarm Processor which is responsible for converting the raw updates received from the driver adapter layer into user friendly monitoring parameters and Commanding which is responsible for processing command requests from the Automation or GUI Interface

Layers. Both applications are database driven and support online modifications without system downtime.

Additional functionality located in the Data Processing Layer is Data Archiving and Report Generation. These functions provide a historical view into the system.

4.5.1 Telemetry Processor

The telemetry processor is responsible for receiving parameter updates from both external and internal sources, performing any processing on the updates, and then providing those updates to the rest of the Mosaic system. What constitutes a parameter is dependent upon the Mosaic application instance and for the NETC Monitor and Control system will include device monitoring parameters, devices, software applications, and groupings of devices. Mosaic supports hierarchical parameter definitions such that the status of lower level entities can drive the status of higher level entities. In this way, a device status is driven by its individual parameters and a device group status is driven by its devices.

Because Mosaic makes no assumptions of what constitutes a parameter it is possible to add parameters that are not related to a device, augment the device with parameters that are not part of its specification, and to create pseudo-devices that contain any combination of parameters. Parameter values can be set by device drivers, by a user with appropriate permission, by commands, and by the automation layer.

4.5.1.1 Telemetry Database

The Telemetry Database uses XML to define the list of parameters in the system and how these parameters are to be processed. Contained within the database are data templates, parameter definitions, alarm definitions, and parameter groups.

The first step to creating the telemetry database is to define the alarms that are available to the system. In order to allow a consistent presentation to the user, alarms are defined by reference and so multiple parameters and devices can share the same alarm definition regardless of how the devices themselves report status. This provides a convenient mechanism to convert from manufacturer-specific semantics to NETC-general operations semantics. Because there is no limitation to the number of alarms that can be defined, any combination of specific and generic alarms can be created. The information that can be defined for an alarm includes a name for the alarm, the severity level for the alarm, and optional descriptive text for the alarm.

The next step in database creation is developing the data templates, which for the NETC Monitor and Control System, amounts to defining the device types. A device type template provides a single place to define the monitoring parameters that are available as indicated in the device manufacturer's specification. For that reason, it is advisable to create a device template for each unique specification. If different versions of a device have different specifications, it would likely be beneficial to create a device type template for each.

Once the device templates have been defined, the individual devices to be monitored are defined. If a device is configured with a device template, it automatically inherits parameters and configuration information from the template. This list can be added to or modified for an individual device. For example, if a device is being used in such a way that certain parameters defined at the device type are not required, they can be disabled for the device. Similarly, additional parameters can be added if they are needed for use in automation or aggregation.

The following information can be defined at both the device type and device levels:

- Parameter Type
  Mosaic supports various parameter data types including numeric, discrete states, and strings.
- Parameter Alarm Limits
  Parameters can have alarms associated with their values including threshold limits and discrete limits. Limit checking and alarm processing is discussed in detail in the next section.
- Parameter Archiving Configuration
  Parameter archiving information can be specified for individual parameters to override default settings to indicate how often parameter updates are written to the archive.
- Device Configuration Information
  Configuration information is program specific metadata and typically includes information such as the device driver to use, device connection information, and physical location.

As mentioned previously, there is no limitation within Mosaic that a parameter be contained within a device. The database can contain any number of standalone parameters that have the same definable attributes as mentioned above.

A final optional step for creating the telemetry database allows devices to be added to groups to represent logical collections. Certain displays and certain configuration actions can be applied to these groups. Typical device groups include geographical collections, such as all devices at a site, and service-level collections, such as all devices required to broadcast a single channel.

4.5.1.2 Parameter Limit Checking and Alarms

Within Mosaic, limit checking and alarms are processed using a common mechanism that is independent of the parameter raw format or data type. In this way, device fault conditions are treated no differently from numeric parameters. In all cases, the value of the parameter is evaluated against the database to determine if the value is considered out-of-limits. If the value is considered out-of-limits, the parameter's status is set to the database assigned alarm level.

This generic processing of limits and alarms frees the drivers from making the determination as to the severity of a device parameter. This decision is made at a higher

level which more readily supports user limit overrides either temporarily or permanently. Limit violations are then be passed to the Complex Event Processor (CEP), described in section 4.5.2, to further process the alarms.

4.5.1.2.1 Discrete Limits

Discrete limits are used to set alarms on state or status values. For example, a device fault code can be used to report multiple device states. As an example, a temperature sensor might report device faults on the following conditions:

- Severe Low Temperature
- Low Temperature
- High Temperature
- Severe High Temperature
- Thermocouple Error

Within the telemetry database, it is possible to assign each of those fault codes its own alarm level, allowing the severity and alarm text to be tailored to the fault.

For device parameters that report only whether the alarm has been triggered or not, the same mechanism can be used, but with two states - On and Off.

Discrete limits can be used with any of the supported parameter data types.

4.5.1.2.2 Threshold Limits

Threshold limits allow a range of values to be considered out-of-limits. For any parameter, any number of threshold limit ranges can be defined. Using the same device as in the Discrete Limits example, but in this case, only the temperature value is reported, the device manual may list operational temperature constraints:

- Do not operate at under 45 or above 85 degrees
- Recommended operating temperature between 65 and 75 degrees

In this case, although the device does not report faults corresponding to those temperatures, it is possible to define four alarm levels that correspond to:

- Severe Low Temperature: value < 45
- Low Temperature: 45 <= value < 65
- High Temperature: 75 < value <= 85
- Severe High Temperature: value > 85

As with Discrete Limits, each of the limit violation levels can be assigned its own alarm.

Threshold limits can only be used with numeric parameter data types.

4.5.1.2.3 Conditional Limits

One additional feature of Mosaic's parameter limit checking is conditional limit processing. Conditional limits allow multiple limit sets to be assigned to a parameter where the active limit set is dependent upon the value of a different parameter. One of

the benefits of conditional limits is that alarm severities can be downgraded automatically when the device enters a certain state.

As an example of the use of conditional limits, consider a station that is known to go off-air for a number of hours. Audio silence alarms during that time period are meaningless because it is the temporary expected state. Using conditional limits, audio level alarms can be disabled depending on the on-air status of the station.

4.5.2 Fault Detection and Management

Mosaic continually monitors all the devices configured within the network and is able to detect, isolate and notify users when fault conditions occur. Mosaic is designed to accurately detect faults or alarms within the network, log the occurrence of the alarm and notify users either via internal displays or via email / SMS. Fault Detection within Mosaic can be broken down into three key mechanisms:

1. Device fault conditions directly reported by the underlying device. Most devices report internal faults or fault codes to alert the user when a problem occurs with its internal function. The Mosaic software detects these faults and converts them into alarms within the system.
2. Parameter Limit Checking and Alarms. A parameter within Mosaic is simply a piece of data, whether it be directly monitored from a device, derived based on one or more inputs, managed via automation or via a user. Within Mosaic, limit checking and alarms are processed using a common mechanism that is independent of the parameter raw format or data type. In this way, device fault conditions are treated no differently from numeric parameters. In all cases, the value of the parameter is evaluated against the database to determine if the value is considered out-of-limits. If the value is considered out-of-limits, the parameter's status is set to the database assigned alarm level and an alarm is triggered within the system.
3. Rules Based Alarming. In addition to the mechanisms listed above, the rules engine can be configured to generate alarms within the system. The rules may be configured to detect future or potential faults which have not yet occurred. They can also be used to alter the severity of an alarm based on additional inputs or conditions within the system. Finally, through the use of root cause analysis and correlation rules, multiple related device alarms can be suppressed and a more general alarm created which more accurately reflects the true fault within the network.

4.5.3 Notification Capability

Mosaic supports a comprehensive notification and escalation mechanism. Whether responding to a fault / alarm within the system or periodically generating complex reports. Mosaic allows notifications to be tailored to the end-user's needs. Typically notifications are sent via email, but with the use of an optional 3G modem Mosaic is also able to generate true SMS based notifications. All notifications are generated based on

templates, which allow the content and structure of the notifications to be controlled by the customer.

In addition, Mosaic supports the ability to escalate notifications to different user groups if the original fault persists or if the severity of the fault increases. This escalation process ensures that critical system issues are highlighted to the correct individuals or groups. Coupled to the escalation process is the ability to apply rules to the notification mechanism. This allows for features such as alarm delays, which only trigger notifications if the device is in fault for a given period of time. These rules can help reduce the noise and ensure notifications are sent only when a real issue is detected.

The rules engine within Mosaic is not only used to handle notifications and escalations. It is also capable of performing far more complex tasks, such as predictive analysis, automated fault responses and event correlation. Predictive analysis is used to look for trends within the underlying device data that may be indicative of a future fault or conditions. This allows Mosaic to detect and avert potential on-air affecting issues before they happen.

4.5.4 Commanding

Commanding is responsible for receiving requests to send commands and directives from various internal and external sources, processing them, and sending them on to the appropriate device drivers. The design of commanding is flexible to allow program specific functionality to drive the format of a command and how it is processed by the system. Mosaic does provide certain inherent capability such as the ability to check that the command arguments are valid and to perform checks on telemetry to verify that the command performed the expected behavior. In this way, most of the commanding functionality can be provided at a higher layer and only the translation of a command to the device protocol needs to be done at the driver level.

4.5.4.1 Command Database

The structure of the command database is similar to the telemetry database. It is defined in XML to make it easily accessible. It allows commands to be defined for both a device type template and for a device.

Commands defined in the database include any arguments for the commands and any pre-execution or post-execution instructions. Mosaic supports various types of command arguments including numeric values, discrete state selection values, and string values. Optional default values can be specified for any or all of the command parameters.

The pre-execution and post-execution instructions are dependent upon the program-specific command processing steps described in the next section. The types of information that are typically defined include:

- Indication that user confirmation is required and the prompt text to be issued
- User role restrictions for accessing the command

- State restrictions for executing the command
- Command execution validation configuration
- Command execution verification configuration

4.5.4.2 Command Processing

When a command is executed it is passed through multiple links in a program-configurable chain. The responsibilities of these links can include pre-execution processing, command execution, and post-execution processing. Many of the links determine the current status of the executing command and if a failure is encountered prevent the command from moving on to the next link. The links that are executed are dependent upon current program configuration and the information defined in the commanding database. It is possible to enable and disable most of the links at runtime.

The following diagram shows the typical commanding links used in a broadcast Monitor and Control System.

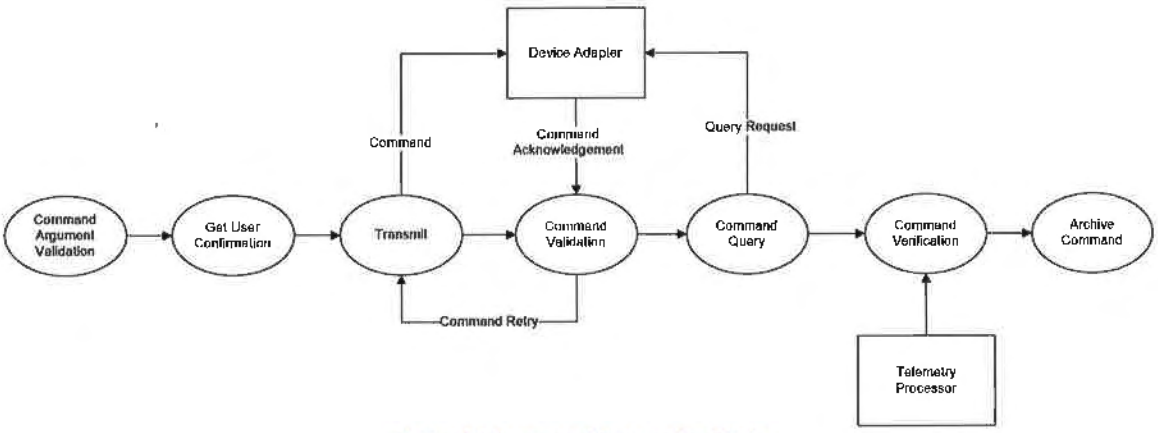


Figure 38 Command Processing Chain

1. When a command execution request is received, the first step is to validate the supplied command arguments to assure that all of the required arguments have been populated or have default values in the database. Additionally, the values are compared against the database to verify that they match the specified data type and do not violate any specified restrictions.
2. If the command request is valid, and the command requires user confirmation, the user is prompted to confirm execution.
3. Once the command has been confirmed to execute, it is sent to the device adapter for transmission to the device.
4. The next link waits for the device to acknowledge that it has received the command and that it was valid for execution. A configurable validation timer is used to determine if the device is non-responsive. If the command has been put on a queue within the device adapter, the link is notified and waits to start the

timer. If the device fails to respond to the execution request in the specified time, the command can be retransmitted up to a configurable number of times before commanding declares the command has failed.

5. The next link, Command Query, is used in conjunction with command verification. It is responsible for forcing a poll query on a device so that the verification parameters are retrieved faster than the normal poll rate for the parameters.
6. The final execution link is the verification link which compares the expected results of the command to the actual results. For example, if a command is intended to set a switch to off, this link would verify that the value did switch to the off state.
7. After execution, regardless of the end result of the command, the command is sent to the archiver where it is processed according to the current archiver settings.

4.5.5 Database Translation

In a complex system, such as the NETC broadcast topology, the inputs for the telemetry and command databases can come from multiple sources. Typically, the device templates and command database are generated from the device manufacturer's documentation. For example, if the device supports the SNMP protocol, the device's MIB provides the list of monitor and set points provided and the Mosaic SNMP compiler can be used to easily generate the shared device template. Similarly, for REST, SOAP, or other XML-based protocols, the XML Schema will specify the available parameters and commands.

Device instance information such as physical location, connection information, and the device's role in the broadcast topology is usually provided by the customer in the form of a Configuration Management Database (CMDB) or via spreadsheets such as .csv files. Mosaic does have the capability to perform device discovery, but it is usually not used as the source of record because device discovery does not provide contextual information.

For the NETC program, MNC Software is assuming that topology information will be provided as .csv files. Mosaic has an extensible .csv translation capability that allows dynamic interpretation of the contents of the input files to generate the telemetry and command databases. With online definitional change, modifications to either the .csv inputs or the interpretation scripts results in automatic translation and loading of the new database.

4.5.6 Archiving

Mosaic provides multiple types of archiving to provide access to historical data, including events, telemetry parameters, and commands. The archive itself is stored in an SQL-compatible database. Mosaic is regularly tested with MySQL, Microsoft's SQL

Server, Oracle and Derby, but is flexible to work with any database provider that supports a JDBC connection.

The following archive types are provided with Mosaic:

Type	Description
Event Messages	This archive contains a record for every event message generated by the system. Via configuration, it is possible to disable archiving for specific event messages.
Parameter Alarms	This archive records when a parameter violates its database defined limit and when the limit violation is cleared.
Event/Alarm Acknowledgement	This archive records the user that acknowledged an event or a parameter alarm.
Event/Alarm Annotation	This archive records any annotations that a user has added to an event or a parameter alarm.
Parameter Update	This is the normal parameter archive which stores sequential parameter updates. Database configuration is used to control how often a parameter update is archived and is described below.
Parameter Current Value	This archive is continuously updated with the last received value of a parameter
Parameter Statistics	This archive contains periodic statistics information for a parameter including, minimum, maximum, and average values, number of samples over the interval, and the standard deviation. Mosaic supports hourly, daily, and monthly statistic periods.
Alarm Mask	This archive records when an alarm mask (usually used to manually downgrade a parameter alarm) is applied to a parameter and by whom.
Command	This archive records every command that was sent to the devices monitored by Mosaic, whether the command completed successfully or not.

As mentioned above, the telemetry database controls the frequency at which Parameter Update records are created in the archive. This allows the data to be thinned which can be especially useful for analog parameters that are continuously changing by an

insignificant amount. Mosaic supports the following types of Parameter Update archive filters:

Type	Description
All Samples	Every received update will be archived
Change Only	Parameter will be archived if one of the following changes - value, severity, secondary status, or dynamic attributes
Change with Delta	Similar to Change, but a value change must be by more than a defined amount
Interval	Parameter will be archived at a configurable periodic rate. One sample will be archived each interval with the current value at that time no matter the number of received samples during that interval.
Change with Interval	Combines the Change with Delta and Interval definitions so that a parameter will be archived if it changes and also at an interval.
Sample	Every Nth sample is archived, where N is configured in the database.

4.5.7 Reporting

Mosaic provides a comprehensive reporting capability that can extract data from any of the archives mentioned above into extensible, formatted reports. Reports can be generated into many different output types, including PDF, Word, and HTML. They can be created manually by a user or scheduled as part of a recurring task. When created by the Mosaic scheduler, reporting can be used to generate shared access reports, such as weekly service outage reports. The report could be generated in HTML and written to a web accessible location or it could be generated as PDF and sent to an applicable e-mail group.

Reports themselves are generated from report templates that specify what data to extract and how to lay the data out. Typically reports contain a combination of charts, graphs, and tabular data; however it is also possible to combine these functions with analytic logic to create much more complex reports, such as the service outage report which uses the Parameter Alarm archive to determine service availability over the report timeline.

Mosaic is delivered with various report templates that can be used out of the box. These can be easily extended or new ones created to generate templates more suited to a customer's preferences.

4.5.8 Security

Security within Mosaic is handled through the use of logins, roles, and permissions. When a user attempts to log into Mosaic, he is required to enter a username and password. This information, along with the host from which he is logging in, is encrypted and passed to the GUI interface layer. If the username and password are valid, the user is granted access to the system according to the permissions defined for the user.

Permissions are simple text representations for actions that a user may take. These include things such as acknowledging an alarm, putting a device into maintenance mode, and setting the default system GUI layout that is started when a user logs in. The entire list is made up of the core functional areas and any custom applications and will be provided to NETC during the program.

Permissions themselves are granted by grouping them under named user roles. Typically, user roles are organized according to the job description in the operations center, but there is no limitation inherent in the system as to how roles are defined. Any number of roles can be defined with any combination of permissions, including overlapping permission lists. Once the roles are defined, users can be assigned to the roles. A user can be assigned to any number of roles and is granted the union of permissions assigned to those roles. The following table shows some potential roles that might be used in the system:

User Role	Description
System Administrator	Responsible for maintaining the Mosaic system including the security database. May not have permissions to start the Mosaic GUI.
Operations Controller	Lead engineer in the operations center. Has all of the permissions of an operator and the ability to specify system defaults.
Operator	Able to start the Mosaic GUI and has primary responsibility for monitoring and controlling devices. Has ability to put a device in maintenance mode, send commands, and override alarm severities.
Trainee	Able to start the Mosaic GUI in view only mode.

Developer	Creates standard Mosaic display panels. Responsible for setting up the events and rules for event correlation.

Table 4 Example User Roles

Security can utilize its own internal security database, connect to an existing LDAP or ActiveDirectory database, or use a combination of the two. It can be configured such that if the LDAP/Active Directory database is not accessible that it will use its own security database as a fallback option so that operations can continue.

4.5.9 Fault Tolerance and Failure Recovery

To support high availability of the Mosaic system, fault tolerance and failure recovery is built into the architecture. In a fault tolerant deployment, two or more server machines cooperate to provide system redundancy in the event of a software or hardware failure. In this configuration, one of the servers is acting as the primary server and the others are acting as backup servers. As configuration changes are made on the primary server, this information is either written to the persisted store, or, for temporary changes such as an alarm override, written to a checkpoint data store. Based upon configuration both the permanent and checkpoint data is automatically synchronized to the backup servers so that the backup servers are ready to take over operations if the primary server fails.

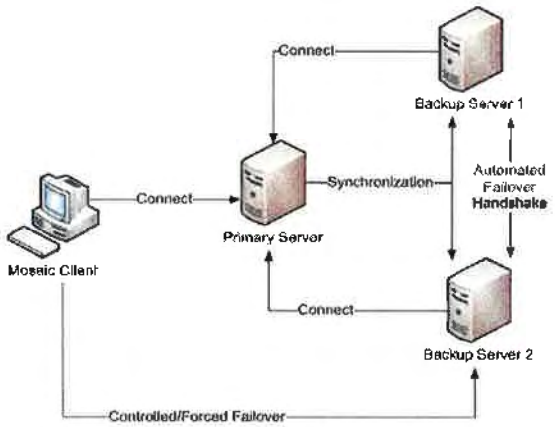


Figure 39 Redundancy Configuration

If the primary server fails, recovery can be automatic or manual. In automatic recovery mode, the backup server determines that it can no longer reach the primary server and automatically assumes primary operations. In manual recovery mode, a user is required to initiate the failover either from the O/S command line or from the Fault Tolerance Display. During manual recovery mode, the user is provided with the option of performing a controlled failover or a forced failover. A controlled failover is a planned transition of operations and once complete, the original primary server becomes a

backup server. A forced failover is similar to the automatic failover and is used when the primary server is no longer accessible and the backup server immediately takes over primary operations.

Automatic failover is a configurable option on the servers and can be configured independently for each server. This provides the ability to automate failover in one direction, from the NETC nominated primary server machine to backup, but require a user to manually initiate the failover back to the nominal server configuration.

When a failover occurs, all clients that were connected to the original primary server automatically follow the change to the new primary server. Similarly, a federated server will automatically connect to the new primary server for the local monitoring station.

4.6 Driver Adapter Layer

4.6.1 Overview

Mosaic is a vendor agonistic Monitoring and Control solution. As such, Mosaic has previously been integrated with a wide range of different devices types and many different protocols. Integration with new device types is simple and straightforward and is not dependent on a new release of the Mosaic core software.

Mosaic is adapted to work with new device types by way of drivers and the driver adapter layer. The Driver Adapter Layer is responsible for the connection, monitoring, and commanding of external logical devices. Whether the logical device is a physical or software device does not change the behavior of the system, simply the implementation of the driver. The Driver Adapter Layer allows for pluggable device drivers, each driver being responsible for the connection and communication between the adapter layer and a logical device or set of logical devices. The Mosaic server can contain a single embedded driver adapter layer or can connect to multiple external adapters to help distribute the load of high volume systems. Each external adapter that is loaded is configured with the set of commands, device configuration and polling configuration needed by the attached drivers. The general architecture is as follows:

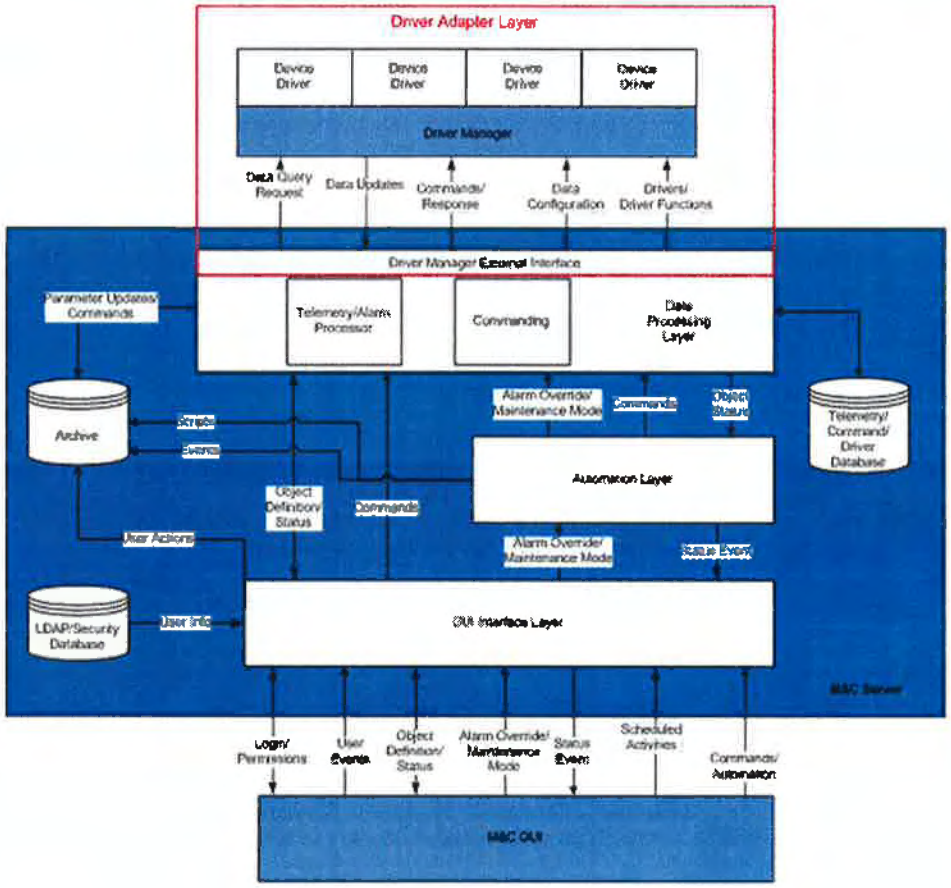


Figure 40 The Driver Adapter Layer

4.6.2 Driver Manager External Interface

The Driver Manager External Interface is the bridge between the rest of the Mosaic server and the Device Adapter Layer and provides a consistent view into the adapter and all associated drivers. The runtime functionality provided is as follows:

- Dynamic addition of data listeners
  - Mosaic servers act as data listeners and can be dynamically connected and disconnected.
- Manual poll requests
- Command execution
- Dynamic system configuration updates
- Dynamic switching between standard and debug mode

4.6.3 Polling Manager

The polling manger is responsible for providing a general polling mechanism that can be used to automatically query information from drivers at a configurable rate. Configurable polling strategies are used to define how the data is acquired. All poll

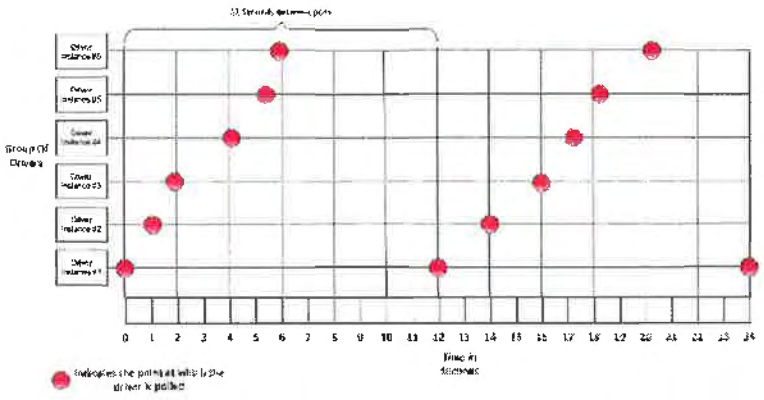
strategies include the parameters and groups to poll as well as the driver or drivers that the poll requests are for.

All polling strategies allow for the setting of a poll timeout and a number of retries. If a poll has not been successfully executed in the timeout period the poll is considered to have failed. The poll will be executed again until execution is successful or the total number of retries has been reached.

The delivered set of polling strategies include:

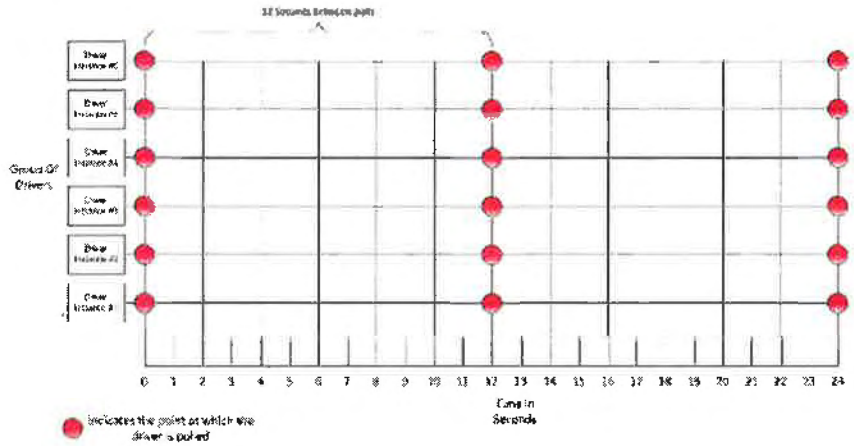
- Synchronous Execution

  The Synchronous Execution strategy allows a group of drivers to be polled over a specific time period. Each parameter and group is processed individually before moving on to the next. For example, with a fixed polling rate of 12 seconds and 6 driver instances, the first driver will be polled at time 0 and when it completes the next will start until all have completed. After 12 seconds, the poll cycle will start again. If the poll cycle did not complete within the poll rate, it will start again immediately after the last poll completes. See the diagram below for clarification:



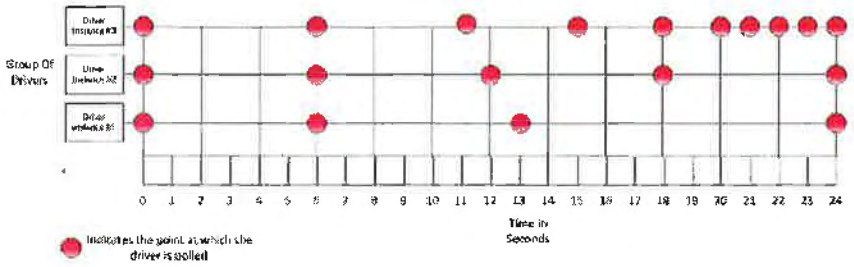
- Asynchronous Execution

  The Asynchronous Execution strategy allows a group of drivers to be polled at the same time at a given rate. Unlike the Synchronous Execution strategy all parameters and groups are processed at the same time up to the maximum configured number of concurrent threads. For example if the polling interval is 12 seconds with 6 driver instances, all 6 will be polled at time 0 and then again at time 12 (12 seconds apart). See the diagram below for clarification.



- Adaptive Execution

  The Adaptive Execution strategy allows the polling of a driver to be done at a modifiable rate. An initial rate is used at the start of the polling and is subsequently changed based on whether data changes were gathered from the poll or not. If the last poll resulted in a data changes then the poll rate is increased, otherwise if the last poll resulted in no data changes then the poll rate is decreased. The rate at which the polling interval is increased or decreased is configurable as a fixed rate or percentage rate. The Variable Rate Execution strategy also provides the ability to set a minimum and maximum rate to allow bounding of the polling rate. See example below for further clarification.



As show in the diagram above, Driver Instance #3 has a fast change rate and gets polled more frequently as time goes on. Driver Instance #2 illustrates a fixed pull rate and Driver Instance #1 illustrates a slow change rate and subsequently gets polled less frequently as time goes on.

4.6.3.1 Conditional Polling

Conditional polling allows automatic polling to be enabled or disabled based on the value of one or more parameters. The most common use of this is when modeling dynamic devices such as a chassis that can have a dynamic set of cards. Assuming the chassis identifies the presence of the cards, conditional polling can be used to automatically poll the cards that were detected. Another potential use is in cases where Mosaic is monitoring remote devices across a limited bandwidth network. To reduce the amount of data, conditional polling can be used to poll only the highest level status

information by default. When a potential error is detected, additional detail information can then be polled for as long as the error is present.

4.6.4 Driver Manager

The Driver Manager is the core of the device adapter's management layer and provides a large portion of the control logic. The Driver Manager's core responsibilities are as follows:

- Initialize all subsystems including the Polling Manager, the Global Driver Functions, the Driver Controller and all configured drivers.
- Route external interface requests to the corresponding responsible entity.
- Handle all dynamic loading and unloading of drivers
- Handle the threading strategy for the Driver Controller
- Route all polling requests from the Polling Manager to the corresponding driver
- Handle registration and updates of data listeners.

Of the Driver Managers core responsibilities, the most active is the management and communication with the Driver Controller. All requests to a particular device are routed to the driver manager, who is then responsible for passing the request to the correct driver.

4.6.5 Global Driver Functions

Global Driver Functions represent a set of common driver functionality that is available to all the loaded drivers. Mosaic provides a large set of built in features that can be used to create custom driver functionality. This set includes, but is not limited to:

- TCP/UDP connection management, packet encoding and packet decoding
- SNMP connection management, sets, gets, and MIB navigation
- SOAP connection management, message building and message decoding
- Telemetry database access
- Creation of telemetry updates
- Sending events
- Debug logging
- Global variable creation and access
- Driver configuration and parameter mapping access
- Synchronous and Asynchronous control of command execution status
- Service lifecycle management (custom and internal services)
- Mapping, String, Object and Binary configuration based decommutation

Additionally custom driver features can be added through the addition of custom services, libraries or helper scripts. Services can be custom created in the same language as drivers and made accessible to any driver. Libraries (.jar files) can be added to the system and loaded for one or more drivers. Helper scripts written in the same language as drivers can also be created and imported into drivers as needed.

4.6.6 Driver Controller

The Driver Controller is a lightweight component located between the drivers and the device adapter. All interactions to the driver are passed through the driver's controller allowing for a consistent interface between the custom driver code and the adapter layer. The Driver Controller also controls default driver threading as well as command throttling, queuing and priority order. All of these features are configurable and are designed to make driver implementation as simple as possible.

4.6.7 Device Drivers

The Mosaic product supports a default driver language which has been tailored to best support the development of device drivers. This Domain-Specific Language is built upon Groovy, which is an interpreted, dynamic language similar in syntax to Java.

4.6.8 Driver Development Platform

The driver development platform in Mosaic is built upon the Eclipse Integrated Development Environment (IDE). Eclipse is a proven, reliable, scalable technology providing a rich editing, execution and debugging environment. Eclipse consists of a small lightweight execution engine to which language tool support is added via the use of plug-ins. The Eclipse framework is built upon the Java programming language making it platform-independent and is currently supported on variety of platforms including Windows, Linux and Mac OSX.

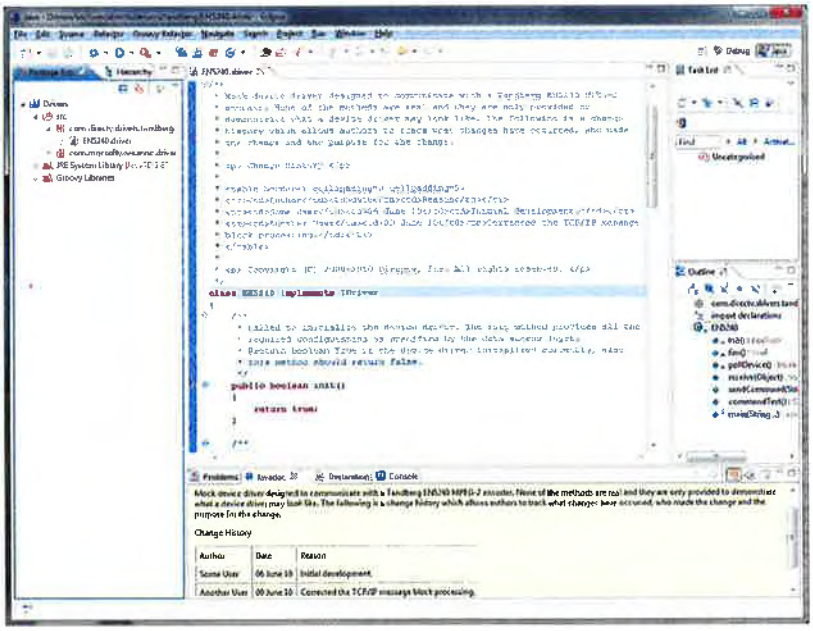


Figure 41 Driver Development Platform

The driver development platform is provided as an Eclipse plug-in and supports many of the advance editing features, including:

- Syntax highlighting
- Edit time syntax checking
- In-editor driver execution
- Source line debugging
- Auto-complete / Code Assist
- Integrated Version Control

4.6.8.1 Syntax highlighting

The driver development platform supports color based syntax highlighting. This feature improves the readability of the device driver code and helps reinforce the structure of the language. Syntax highlighting also aids in the identification of coding problems. For example, the highlighting engine marks string literals in a unique color. Therefore if the literal is missing an end quote it is immediately visible through the syntax highlighting.

4.6.8.2 Edit time syntax checking

The driver development environment supports edit time syntax checking. The syntax checking engine is active whenever a file is open for editing. All errors and warnings identified within the current driver file are highlighted within the editor. In addition, all problems found across all drivers within a project are highlighted on the Problems tab in the lower section of the display. All errors and warnings displayed within the Problems tab are hyperlinked to the exact line within the file containing the problem. The Problems tab allows easy navigation to the source, including opening the file into the editor if not already open.

4.6.8.3 Source line debugging

The driver development platform's ability to run driver code interactively is one of its most powerful features. By using the debugger feature, driver code can be executed line by line and the value of variables examined at different points in the code. This process can be invaluable in locating problems early in the development of a driver and could save countless hours debug problems in the field.

The driver development platform supports a powerful runtime debugger which allows the user to set breakpoints anywhere in the driver code. When running in debug mode the system will halt whenever a breakpoint is encountered and allow the user to interact with the running driver. On first encountering a breakpoint the editor framework will switch from editing mode to debugging mode, these modes are called perspectives. The debug perspective includes several new views which are, not surprisingly, especially useful while debugging driver code. The new views provide insight into all aspects of the executing script. The Debug view provides a comprehensive call stack allowing the user to trace how the script arrived at the current breakpoint. The Debug view also provides standard controls to interact with the executing driver script. These controls allow the user to step into a function, step over a function or step out of the current

function. The controls also allow the user to terminate, pause or continue execution until the next breakpoint.

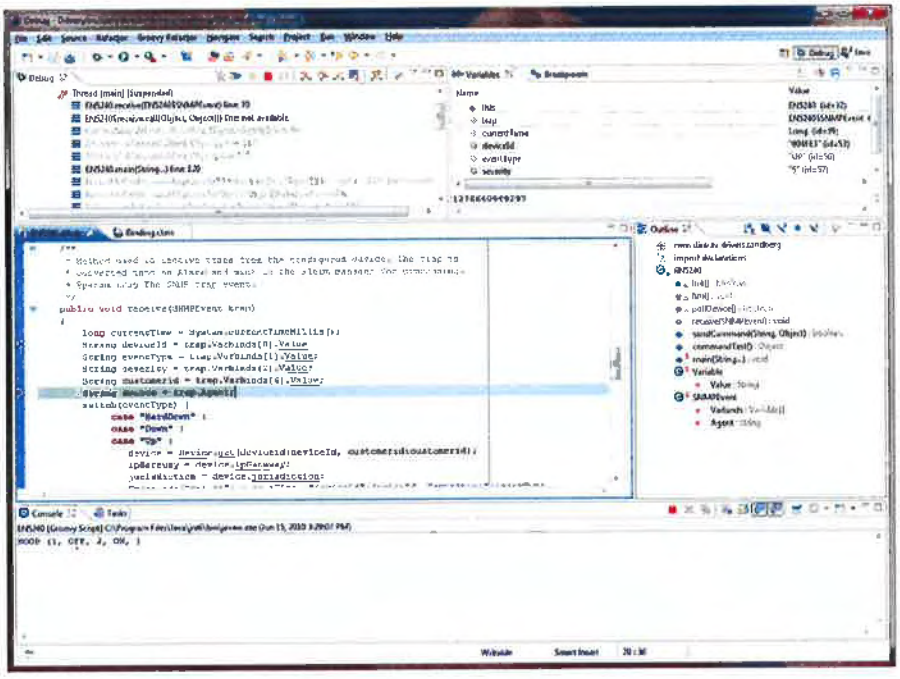


Figure 42 Debugging Mode

The debugging environment also supports a variable inspection tool. This tool is available whenever the execution of the driver is paused. The inspection tool lists all variables currently visible based on the active line within the script. The inspection tool also supports the ability to change the value of any variable currently in scope. Once changed, the new value takes immediate effect.

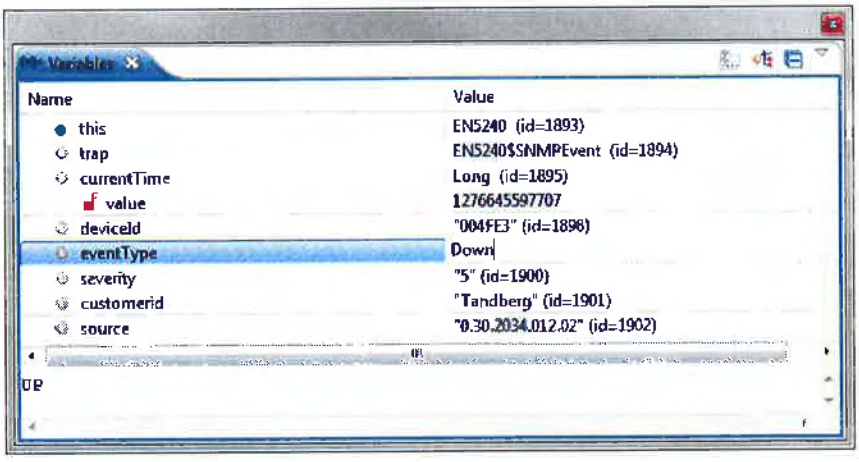


Figure 43 Debug Variables

4.6.8.4 Auto-complete / Code Assist

To ease the development of new device drivers, the development platform supports a feature known as auto-complete or code assist. This feature examines code fragments as they are entered by the user and provides proposals based on the current fragment. The list of proposals is provided as a popup window just below the current cursor position. The user can then either select from the list to auto-complete the current statement or simply continue to type.

This feature greatly simplifies the task of writing new driver code and provides helpful insight into the language for users with limited experience. The feature can be ignored by more experience users, allowing the statement to be completed without any assistance from the auto-complete feature.

4.6.8.5 Integrated Version Control

When maintaining a large set of device drivers, controlling change is usually a very important and complex activity. Tracking changes through the use of comments is easy and effective, but relies heavily on the discipline of the user making the changes. In addition, a comment may only identify the line where a change occurred, but it usually does not identify what was physically changed.

The development platform supports direct integration with a number of 3rd party version control tools. These tools offer an efficient way to track and manage changes in everything from a single file to a large set of device drivers. Out-of-the-box, the development platform supports both Subversion and CVS, which are free open-source version control tools. Both tools support the ability to track changes in any file and visually view differences between revisions of a driver. They also support the ability to tag sets of files, which can be useful when establishing a formal baseline.

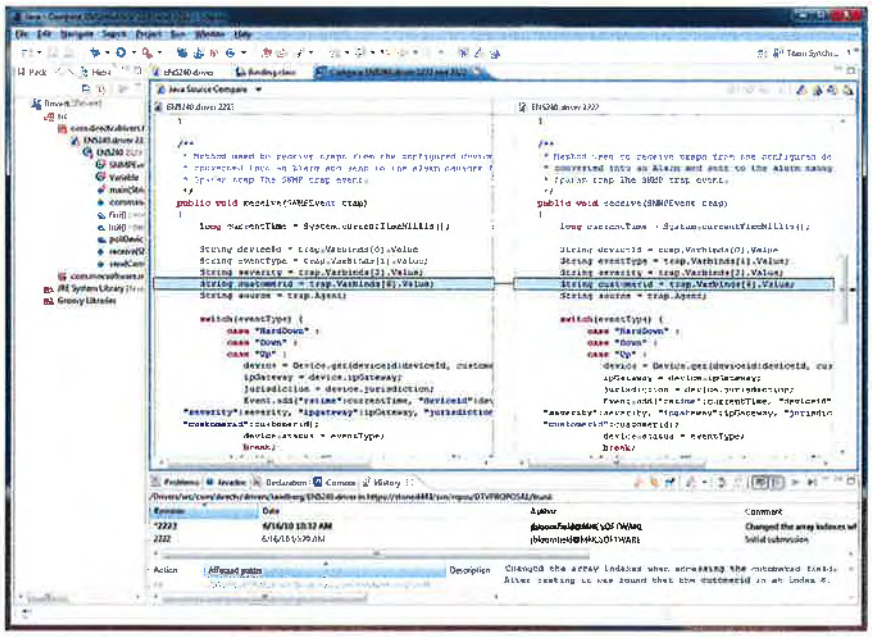


Figure 44 Version Control

4.6.9 Built-in Drivers

As part of the default installation, Mosaic provides a set of drivers that can be used without the need of custom coding. These drivers are built using the Mosaic driver API and can be configured directly for use or modified as needed. With simple XML configuration, each driver can be customized to work with a specific device or device type. When properly configured, the system will automatically load a new instance of the built-in driver customized for a specific device. The set of built-in drivers and some of their features is as follows:

- SNMP
  - Provides SNMP support with configurable host, port, protocol, community, SNMP version, authentication, individual OIDs, tables, heartbeat, set commands and much more.
- Socket
  - Can be configured as a client or sever, TCP or UDP socket.
  - Provides configurable binary command building and data decommutation.
  - Provides ability for auto reconnect and redundant socket connections.
- REST
  - Provides ability for HTTP gets and posts as well as decommutation of XML or JSON data.
- SOAP
  - Provides ability to encode and decode SOAP messages
  - Provides configurable decommutation

4.6.9.1 SNMP Device Compiler

In order to make configuring the built-in drivers as simple as possible, Mosaic is delivered with helper applications that can auto generate the required configuration. For example, he SNMP compiler provides a graphical interface for MIB files that allows a user to select the desired monitoring points from a MIB.

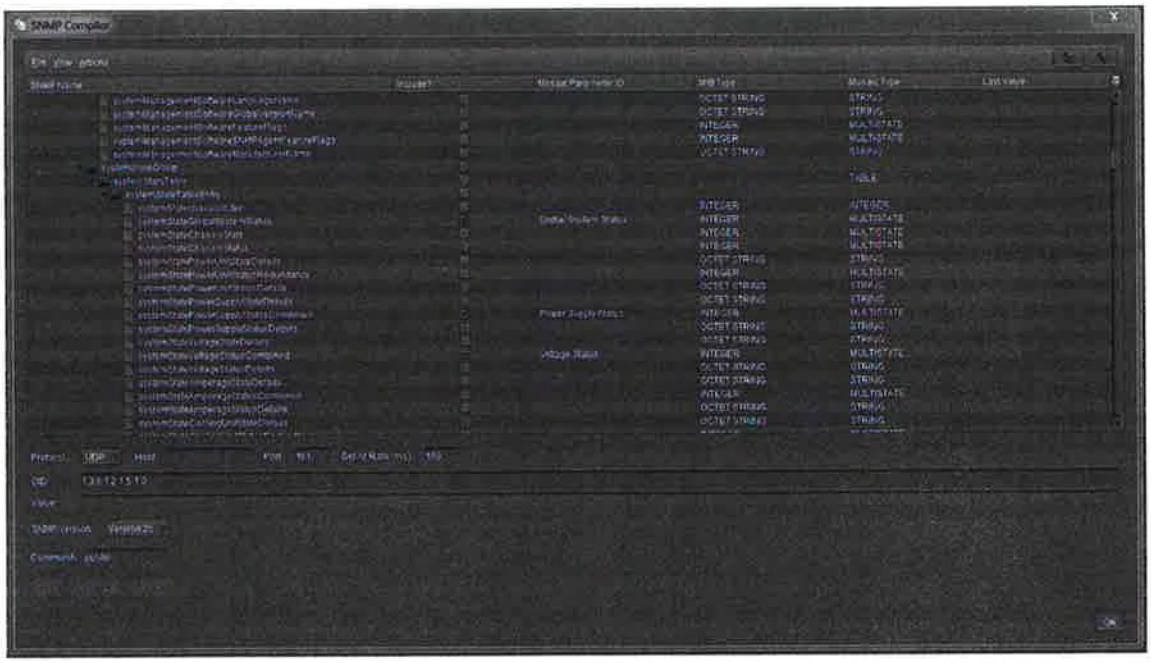


Figure 45 SNMP MIB Compiler

After the data points of interest are selected the Protocol, Community and SNMP Version are set and the configuration can be generated. Templates for the device type that the MIB represents can be automatically created and deployed. Instances of the device can also be auto discovered using the auto discovery tool.

Figure 46 SNMP MIB Compiler Deployment

The final generated output is the entire configuration needed to add a new device type and devices instances into the system.

NETC Nebraska Monitor and Control System (NMCS)

Attachment 3 Resumes

RFP 5820 Z1

7th May 2018

ORIGINAL COPY

1 MNC

1.1 Andrew James Bloomfield

Andrew James Bloomfield

Address:	1175 Diamond St, San Diego, CA, 92109	Date of birth:	20th August 1974
		Telephone:	858-337-2742

Profile

Successful business owner with a proven track record of leadership. Instrumental in developing strong customer relations with a focus on technical excellence. 20 years of experience in the satellite and broadcast industries.

Skills

Satellite and Broadcast Engineering, Project Management, Software Systems Design, Implementation and Deployment, Distributed Systems, Systems Engineering and Requirements capture and analysis.

Professional Experience

2008–Present | MNC Software | San Diego, CA, USA

President

Responsible for managing all aspects of the business, including the project management of several major programs for the company. Worked closely with customers to develop and manage project schedules, managed the risk register and ensure a timely delivery.

- Managed the development and delivery of a manager-of-manager to sit on top of DirecTV's disparate element monitoring systems. The system aggregated data from multiple sources and provided a channel centric view of their linear broadcast networks.
- Managed the replacement of MaxView with MNC's flagship network management platform Mosaic. Worked closely with the customer to develop a transition plan and worked within operational constraints.
- Successfully deployed Mosaic into numerous Radio, Television and satellite uplink facilities.

2005–2008	L3 Telemetry West	San Diego, CA, USA

Software Architect

Manage a group of software engineers responsible for the development and enhancement of L-3's flag ship satellite and ground monitoring and control software InControl. Assisted in the drafting of bids and proposals for numerous large satellite programs. Provided technical support to sales and business development helping secure new programs. Performed program management tasks including the development of schedules, tracking of performance and completion of ETCs.

- Senior Architect for the Thor 6 program for Telenor. The program required the integration of a Thales SB4000 high-powered communication satellite into the Telenor fleet. The existing fleet consists of an Orbital Star-2 and two BS376 satellites.

- Senior Architect for the JHU/APL RBSP program. A scientific mission to explore the earth's radiation belt. Provided extensive on-site pre-sales support for the JHU/APL RBSP program, which resulted in the selection of InControl.

- Designed and implemented support for multiple satellite scripting languages, include CECIL, ITOS STOL, Maestro STOL and Astrium's PIL.

2000–2005	L3 Storm Control Systems	Basingstoke, UK

Principle Software Engineer

Responsible for technical and architectural oversight of European programs, design, implementation and integration of core components within InControl. Supervision of the UK development team, providing both technical and design direction. Supporting Systems Engineering with capture and analysis of customer requirements. Supporting business development, providing targeted product demonstrations.

Key contributions:

- Architected Inmarsat's I4 program, a new generation of high-powered global communications satellites. This program included harmonizing operations across Inmarsat's existing I2 and I3 satellites, thereby reducing

operations costs.

- Architected the Skynet program, a fleet of new high-powered secure communications satellites to support the UK MOD and NATO.

- Lead a team of engineers responsible for the redesign and implementation of a key software component supporting the automation of satellite and ground operations. The redesign eliminating a costly 3rd party product, increasing the competitiveness of InControl.

- Designed and implemented components to support the integration of InControl within customer programs, as well as custom applications in support of end-user requirements.

- Providing both on-site and telephone support to Inmarsat, during transition to live operations.

- Compiled and presented training courses for the administration of InControl

Training

- Technical Leadership
- Object Oriented Analysis and Design
- C++ Programming
- Windows programming using MFC
- Advanced Java Programming

Education

1993–1997 Bristol University Bristol, UK

- M.Sc., Computer Science.
- B.Sc. (hons), Chemistry

1.2 David Allen

DAVID ALLEN

San Diego, CA 858-774-5618
dallen@mncsoftware.com

QUALIFICATIONS SUMMARY

- 25 years of software development and integration experience in the broadcast and aerospace industries
- Accountable for all phases of software development from initial proposal phase through final acceptance test
- Successfully deployed and integrated software solutions into diverse customer environments
- Extensive software architecture and design experience

EXPERIENCE

JUNE 2008 – PRESENT

CEO, MNC SOFTWARE, INCORPORATED – SAN DIEGO, CA

Company founder and developer of the Mosaic network monitoring and control solution.

- Architected and implemented the core software product offering
- Integrated Mosaic with varied hardware and software devices encompassing all communication protocols including SNMP, REST, SOAP, and proprietary
- Successfully deployed Mosaic for customers across the broadcast industry including content processing, satellite uplink, terrestrial transmission, OTT, and cable headend
- Provided technical support for all Mosaic customers

JUNE 2007 – JUNE 2008

PRINCIPAL SOFTWARE ARCHITECT, DATAPATH, INCORPORATED – POWAY, CA

Lead architect for the MaxView network monitor and control suite.

- Led a team of architects to improve the core software
- Responsible for the development of the product roadmap
- Primary liaison for largest customer
- Identify and plan remediation effort to achieve EAL-4 Common Criteria Certification

AUGUST 1998 – JUNE 2007

SOFTWARE ARCHITECT, L-3 COMMUNICATIONS – SAN DIEGO, CA

Lead software developer for the InControl Next Generation satellite command and control software

- Responsible for all design of the core software to provide a flexible and extensible platform that

could be easily adapted for any customer and spacecraft specific requirements
- Led the deployment of the software for varied commercial, civil, and military space programs
- Worked directly with the systems engineering team to convert requirements to functional design specifications
- Provided sales engineering support to business development via product demonstrations and proposal inputs

DECEMBER 1996 – AUGUST 1998

SOFTWARE ARCHITECT, INTERFACE AND CONTROL SYSTEMS, INC – COLUMBIA, MD

Lead the design and development for the NASA FUSE satellite control center

- Led a team of 8 developers through critical design review to implementation
- Primary representative for all technical discussions with the customer and end-user
- Integrated ICS' embedded software expert system into a distributed control center
- Modified the core software to support other customer requirements

JUNE 1994 – DECEMBER 1996

AEROSPACE ENGINEER, LOCKHEED MARTIN, INC – SEABROOK, MD

Developed mission analysis software for various NOAA satellite control centers

- Upgraded satellite control center from a single computer to distributed network
- Ported legacy software for orbit and attitude and maneuver planning
- Developed engineering analysis tools
- Provided onsite support for integration testing and verification
- Assisted preparation for critical design review

EDUCATION

MARCH 1993

B.S. AEROSPACE ENGINEERING, FLORIDA INSTITUTE OF TECHNOLOGY

Academic Honors: President's List, Dean's List

SKILLS

- Software Architecture
- Software Development
- Requirements Analysis
- Software Integration
- Device Integration
- Distributed Computing

1.3 Joel Bredeson

Joel Bredeson

Address: 1010 Turquoise Street, Suite 250, San Diego, CA, 92109 Telephone: 858-771-4606

Profile

Software development expert with 11 years of experience creating real-time monitoring and control solutions. Focused development of broadcast and satellite software systems.

Skills

Software System Design, Software Development and Deployment, Project Management, Satellite and Broadcast Engineering, Systems Engineering and Requirements Analysis.

Professional Experience

2015–Present MNC Software San Diego, CA, USA

Director Of Software Engineering

Responsible for determining the direction of the Mosaic product. Focused on providing customer value, best in class features and modern forward thinking technology stack.

- Managed development and delivery of multiple product offerings ranging from radio, satellite and OTT broadcast.
- Managed creation of the Mosaic web GUI using all modern technologies and best practices.
- Managed R&D efforts for new technology stacks and product offerings.

2009–2015 MNC Software San Diego, CA, USA

Senior Software Engineer

Responsible for design and development of major subsystems for the DBOSS, DMACS and Mosaic products. Supported and mentored junior developers in the creation of the Mosaic product.

- Architected and development major subsystems of the Mosaic product including the communication layer and driver adapter layer.
- Worked to produce development standards for desktop and web

development
- Developed and integrated multiple customer solutions for broadcast at DTV

2007–2009 L3 Telemetry West San Diego, CA, USA
Software Engineer

Responsible for product development, integration and training for L-3's flag ship satellite and ground monitoring and control software InControl.

Key contributions:

- Performed onsite SAT and thermal vacuum testing for the Thor6 SB4000 satellite
- Created and executed training program for users and administrators for the Thor6 program
- Developed new features and bug fixes for the InControl product.

Training

- Advanced Java Programing
- Object Oriented Analysis and Design
- Data Structures and Algorithms
- Operating System Structure and Design
- Digital Circuit Analysis and Design

Education

2002–2007 University of California San Diego San Diego, CA
- B.Sc., Computer Engineering

2 JAK Broadcast Services

2.1 Andrew C. Kiska

2717 Chessman Dr. NE
Rio Rancho, NM 87124

Phone 505-254-7180
Fax 505-254-7186
E-mail
akiska@univisionradio.com

Andrew C. Kiska

Summary of Work History

[September 2017 to November 2017] American General Media

[1997 to August 2017] Univision Communications dba: Univision Radio
New Mexico/ Texas Albuquerque / Tichenor Media / HBC

Engineering Manager

- Design, build and maintain studio and transmission facilities for Univision Radio (formerly Tichenor Media & Hispanic Broadcasting Co.)
- Oversee Engineering Operations for the Albuquerque and El Paso Facilities

[1995 to Present] JAK Broadcast Services

Owner

- Design, Maintenance and Consulting services for Television and Radio Broadcast and Editing facilities
- Designed a facility for the Native Broadcasting Enterprise in Window Rock AZ for Radio, Television and Video & Audio Editing working with a Native American architect (2007 to 2009)

Education

[1977 to 1985] University of Texas at El Paso El Paso, TX

- **Bachelors in Psychology/Biology**

[1981 to 1985] El Paso Community College El Paso, TX

- **Electronics Associates Certificate**

[1996] Ennis Foundation Las Vegas, NV

- **Advance Technology for Television**

[1997] National Association of Broadcasters Las Vegas, NV

- **HDTV Forum**

[1998] National Association of Broadcasters Seattle, WA

- **AM Directional Antenna Workshop**

Broadcast Electronics Quincy, IL

- **Audio Vault University**

[1999] National Association of Broadcasters Las Vegas, NV

- **Facilities Design Workshop**

[2000] National Association of Broadcasters Las Vegas, NV

- **Nautel Transmitter Workshop**

Texas Association of Broadcasters Convention
National Association of Broadcasters Radio Show

[2001] National Association of Broadcasters Las Vegas, NV

- **IT in Broadcasting Workshop**

[2002] National Association of Broadcasters Las Vegas, NV

- **Audio and IT Infrastructure**

National Association of Broadcasters Radio Show

[2003] National Association of Broadcasters Las Vegas, NV

- **RF Safety Course**
- **Fundamentals of 8VSB**

[2004] National Association of Broadcasters Las Vegas, NV
National Association of Broadcasters San Diego, CA

- **H D Radio Workshop**

Texas Association of Broadcasters Convention

[2005] National Association of Broadcasters Las Vegas, NV

National Association of Broadcasters Philadelphia, PA

- **Radio Technical Workshop**

Univision Communications Inc.

- **Management Training Seminar**

Society of Broadcast Engineers, Albuquerque, NM

- **Audio over IP Techniques and Equipment**

Texas Association of Broadcasters Convention

[2006] National Association of Broadcasters Las Vegas, NV

National Association of Broadcasters Dallas, TX

- **Radio Technical Workshop**

Panasonic Seminar Albuquerque, NM

- **New Choices for HDTV**

New Mexico Broadcasters Association Convention

[2007] National Association of Broadcasters Charlotte, NC

- **SBE Radio Engineering Forum NAB Radio Show Technical Workshop**
- **AM/FM Transmitter Workshop**
- **Radio World Workshop on AM**
- **Directional Arrays**

New Mexico Broadcasters Association Convention
Data Center Design and Workflow

[2008] Radio World Seminar

- **Audio Over IP**

Citrix Online Seminars

- **Digital Signage**

ATSC 8 VSB Transmission System Seminar

- **Gary Sgrignoli 2 day seminar**

[2010] Ennes Workshop El Paso, Tx
SBE Webinar "The 'New" EAS
SBE Webinar "Computer Networking for Engineers

[2011 – 2012] SBE Webinars
Networking Technology Parts 1-4
KREX- The Real World pf Disaster Recovery
Broadcast Audio Processing

[2013] Tektronics Workshop on Video Monitor Color Balance
SBE Webinars
Networking Technology Parts 5 & 6

Professional experience

[1981 to 1990] El Paso Public Television Foundation, KCOS-TV
El Paso, Texas

Engineering Technician

Performed transmitter and studio equipment maintenance

Record and playback of on air programs
On Air Switching
Designed and built on air studio for video tele-courses

[1990 to 1992] KTSM AM, FM & TV (NBC Affiliate)

Master Control Supervisor

Record and playback of on air programs
Supervised all master control operators
On Air Switching

[1992 to 1997] KTSM AM, FM & TV (NBC Affiliate)

Engineering Technician

Maintained and repaired television and radio studio and transmitter facilities
Maintained and repaired television remote vehicles
Worked on design of new radio studios and television News and Weather Set

[1997 to 2005] Tichenor Media/ Hispanic Broadcasting Co./ Univision Communications El Paso, TX

Chief Engineer

- Maintained Studio Facilities
- Maintained Transmitter Facilities (2 Directional AMs and FM)
- Designed and built current studio facilities

[1994 to 1997] El Paso Playhouse, Inc.

President (CEO)

- Managed Operations for a local Community Theater
- Chairman of the Board of Directors
- Member of the Board of Directors from 1983 to 1997 serving in various positions (Secretary, Treasurer and Vice President)

Professional memberships

Member of the Society of Broadcast Engineers since 1992

Member of the Texas Association of Broadcasters

- Texas State EAS Development and Implementation Committee

[2002 to 2004] developed new state standards

Accreditations

Certified Broadcast Engineer for Television (SBE)

Certified Broadcast Engineer for Radio (SBE)

Certified Broadcast Network Technologist (SBE)

NETC Nebraska Monitor and Control System (NMCS)

Attachment 4 MNC Support

RFP 5820 Z1

7th May 2018

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Silver Level Maintenance and Support

MNC's Standard Product Maintenance and Support program is designed to provide customers comprehensive and responsive support after product acceptance. This program is the mechanism by which end-customers can take advantage of MNC's evolving products as well as the evolution of other products in the marketplace. When utilized, this program offers a cost effective approach for receiving professional technical support and for keeping a customer's system positioned to take advantage of the latest available capabilities and technology.

The following are just some of the services provided under maintenance:

- Access to product upgrades, enhancements and or fixes
- Access to all device drivers available within MNC Software's driver database
- Communication of upcoming product functionality and fixes
- Telephone support to provide technical support and/or to capture and track customer support issues

Software Upgrades and Enhancements

MNC is committed to the on-going evolution and improvement of its core products to meet the changing needs of the marketplace and to ensure the latest advancements in technology are incorporated. MNC generally plans major releases every 18 months for its products, with minor releases every 3-6 months. It is recommended that customers take advantage of these upgrades on a regular basis in order to benefit from the latest available features and fixes.

Fixes for Software and/or Documentation Defects

MNC's standard product maintenance and support program addresses software or documentation defects found during the maintenance period. A software or documentation defect is any error that prevents a software system from behaving as intended. Defect resolution results in one of the following: a new software release, a software patch, a documentation update, or an acceptable workaround. In the event of a software release or patch, any necessary documentation, training, and installation support will also be provided.

Updates to software and documentation to address defects are generally scheduled to coincide with minor releases, incorporating fixes for the most critical defects in the first instance. However, should a critical defect arise which significantly degrades the performance or functionality of the software, MNC will expedite the process, providing a patch release to address the defect.

Customer Support

Throughout the maintenance period, MNC will provide Customer Support either by telephone or via electronic mail. This support will help the customer overcome any technical difficulties, investigate potential system problems, and formally document verified problems or defects. Standard telephone support will be offered during MNC's normal business hours, which are 8:30 A.M. to 5:30 P.M. Monday through Friday (excluding all public holidays).

Electronic Mail Support will also be available to customers via a dedicated customer e-mail address. Requests submitted via e-mail will be acknowledged within one working day of receipt.

Gold Level Support

MNC's Gold Support program is designed to provide customers with 24x7 comprehensive and complete technical support. Gold support is an extension to standard Silver Support, with the benefit of direct access to qualified engineers with in-depth knowledge of MNC's products around-the-clock, 365 days a year. Gold support provides time-sensitive, critical support to broadcast and network operations to resolve any mission critical issues. Gold support includes the following:

- 24 hour access, 365 days a year.
- Immediate telephone and remote assistance.
- A dedicated phone number.
- Direct access to a dedicated support engineer.
- Guaranteed response times / SLA.

Gold support does not provide on-site support, but rather remote support. As a result our engineers must have remote access to the customers system via either VPN or a 3rd party application such as TeamViewer. Workaround and service restoration times are only guaranteed when timely remote access is provided.

Gold support provides the following response times and SLAs:

	Severity 1	Severity 2	Severity 3	Severity 4
Response Time	2 hours	4 hours	24 hours	4 Business Days
Workaround	4 hours	24 hours	5 Business Days	-
Restore	5 Business Days	7 Business Days	30 Business Days	-

The exact definition of each severity level will be negotiated with each customer to ensure that MNC Software remains responsive to our customers' needs as each operational environment is unique.

NETC Nebraska Monitor and Control System (NMCS)

Sections II - IV

RFP 5820 Z1

7th May 2018

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II. TERMS AND CONDITIONS

Bidders should complete Sections II through VI as part of their proposal. Bidder is expected to read the Terms and Conditions and should initial either accept, reject, or reject and provide alternative language for each clause. The bidder should also provide an explanation of why the bidder rejected the clause or rejected the clause and provided alternate language. By signing the RFP, bidder is agreeing to be legally bound by all the accepted terms and conditions, and any proposed alternative terms and conditions submitted with the proposal. The State reserves the right to negotiate rejected or proposed alternative language. If the State and bidder fail to agree on the final Terms and Conditions, the State reserves the right to reject the proposal. The State of Nebraska is soliciting proposals in response to this RFP. The State of Nebraska reserves the right to reject proposals that attempt to substitute the bidder's commercial contracts and/or documents for this RFP.

The State will not consider incorporation of any document not submitted with the bidder's proposal as the document will not have been included in the evaluation process. These documents shall be subject to negotiation and will be incorporated as addendums if agreed to by the Parties.

If a conflict or ambiguity arises after the Addendum to Contract Award have been negotiated and agreed to, the Addendum to Contract Award shall be interpreted as follows:

1. If only one Party has a particular clause then that clause shall control;
2. If both Parties have a similar clause, but the clauses do not conflict, the clauses shall be read together;
3. If both Parties have a similar clause, but the clauses conflict, the State's clause shall control.

F. GENERAL

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

The contract resulting from this RFP shall incorporate the following documents:

4. Request for Proposal and Addenda;
5. Amendments to the RFP;
6. Questions and Answers;
7. Contractor's proposal (RFP and properly submitted documents);
8. The executed Contract and Addendum One to Contract, if applicable ; and,
9. Amendments/Addendums to the Contract.

These documents constitute the entirety of the contract.

Unless otherwise specifically stated in a future contract amendment, in case of any conflict between the incorporated documents, the documents shall govern in the following order of preference with number one (1) receiving preference over all other documents and with each lower numbered document having preference over any higher numbered document: 1) Amendment to the executed Contract with the most recent dated amendment having the highest priority, 2) executed Contract and any attached Addenda, 3) Amendments to RFP and any Questions and Answers, 4) the original RFP document and any Addenda, and 5) the Contractor's submitted Proposal.

Any ambiguity or conflict in the contract discovered after its execution, not otherwise addressed herein, shall be resolved in accordance with the rules of contract interpretation as established in the State of Nebraska.

B. NOTIFICATION

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

Contractor and State shall identify the contract manager who shall serve as the point of contact for the executed contract.

Communications regarding the executed contract shall be in writing and shall be deemed to have been given if delivered personally or mailed, by U.S. Mail, postage prepaid, return receipt requested, to the parties at their respective addresses set forth below, or at such other addresses as may be specified in writing by either of the parties. All notices, requests, or communications shall be deemed effective upon personal delivery or three (3) calendar days following deposit in the mail.

Vendor Contract Manager	James Bloomfield
Vendor	MNC Software
Vendor Street Address	1010 Turquoise St, Suite 250
Vendor City, State, Zip	San Diego, CA, 92109

C. GOVERNING LAW (Statutory)

Notwithstanding any other provision of this contract, or any amendment or addendum(s) entered into contemporaneously or at a later time, the parties understand and agree that, (1) the State of Nebraska is a sovereign state and its authority to contract is therefore subject to limitation by the State's Constitution, statutes, common law, and regulation; (2) this contract will be interpreted and enforced under the laws of the State of Nebraska; (3) any action to enforce the provisions of this agreement must be brought in the State of Nebraska per state law; (4) the person signing this contract on behalf of the State of Nebraska does not have the authority to waive the State's sovereign immunity, statutes, common law, or regulations; (5) the indemnity, limitation of liability, remedy, and other similar provisions of the final contract, if any, are entered into subject to the State's Constitution, statutes, common law, regulations, and sovereign immunity; and, (6) all terms and conditions of the final contract, including but not limited to the clauses concerning third party use, licenses, warranties, limitations of liability, governing law and venue, usage verification, indemnity, liability, remedy or other similar provisions of the final contract are entered into specifically subject to the State's Constitution, statutes, common law, regulations, and sovereign immunity.

The Parties must comply with all applicable local, state and federal laws, ordinances, rules, orders, and regulations.

D. BEGINNING OF WORK

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

The bidder shall not commence any billable work until a valid contract has been fully executed by the State and the successful Contractor. The Contractor will be notified in writing when work may begin.

E. CHANGE ORDERS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The State and the Contractor, upon the written agreement, may make changes to the contract within the general scope of the RFP. Changes may involve specifications, the quantity of work, or such other items as the State may find necessary or desirable. Corrections of any deliverable, service, or work required pursuant to the contract shall not be deemed a change. The Contractor may not claim forfeiture of the contract by reasons of such changes.

The Contractor shall prepare a written description of the work required due to the change and an itemized cost sheet for the change. Changes in work and the amount of compensation to be paid to the Contractor shall be determined in accordance with applicable unit prices if any, a pro-rated value, or through negotiations. The State shall not incur a price increase for changes that should have been included in the Contractor's proposal, were foreseeable, or result from difficulties with or failure of the Contractor's proposal or performance.

No change shall be implemented by the Contractor until approved by the State, and the Contract is amended to reflect the change and associated costs, if any. If there is a dispute regarding the cost, but both parties agree that immediate implementation is necessary, the change may be implemented, and cost negotiations may continue with both Parties retaining all remedies under the contract and law.

F. NOTICE OF POTENTIAL CONTRACTOR BREACH

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

If Contractor breaches the contract or anticipates breaching the contract, the Contractor shall immediately give written notice to the State. The notice shall explain the breach or potential breach, a proposed cure, and may include a request for a waiver of the breach if so desired. The State may, in its discretion, temporarily or permanently waive the breach. By granting a waiver, the State does not forfeit any rights or remedies to which the State is entitled by law or equity, or pursuant to the provisions of the contract. Failure to give immediate notice, however, may be grounds for denial of any request for a waiver of a breach.

G. BREACH

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Either Party may terminate the contract, in whole or in part, if the other Party breaches its duty to perform its obligations under the contract in a timely and proper manner. Termination requires written notice of default and a thirty (30) calendar day (or longer at the non-breaching Party's discretion considering the gravity and nature of the default) cure period. Said notice shall be delivered by Certified Mail, Return Receipt Requested, or in person with proof of delivery. Allowing time to cure a failure or breach of contract does not waive the right to immediately terminate the contract for the same or different contract breach which may occur at a different time. In case of default of the Contractor, the State may contract the service from other sources and hold the Contractor responsible for any excess cost occasioned thereby.

The State's failure to make payment shall not be a breach, and the Contractor shall retain all available statutory remedies and protections.

H. NON-WAIVER OF BREACH

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The acceptance of late performance with or without objection or reservation by a Party shall not waive any rights of the Party nor constitute a waiver of the requirement of timely performance of any obligations remaining to be performed.

I. SEVERABILITY

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

If any term or condition of the contract is declared by a court of competent jurisdiction to be illegal or in conflict with any law, the validity of the remaining terms and conditions shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if the contract did not contain the provision held to be invalid or illegal.

J. INDEMNIFICATION

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

1. GENERAL

The Contractor agrees to defend, indemnify, and hold harmless the State and its employees, volunteers, agents, and its elected and appointed officials ("the indemnified parties") from and against any and all third party claims, liens, demands, damages, liability, actions, causes of action, losses, judgments, costs, and expenses of every nature, including investigation costs and expenses, settlement costs, and attorney fees and expenses ("the claims"), sustained or asserted against the State for personal injury, death, or property loss or damage, arising out of, resulting from, or attributable to the willful misconduct, negligence, error, or omission of the Contractor, its employees, Subcontractors, consultants, representatives, and agents, resulting from this contract, except to the extent such Contractor liability is attenuated by any action of the State which directly and proximately contributed to the claims.

2. INTELLECTUAL PROPERTY

The Contractor agrees it will, at its sole cost and expense, defend, indemnify, and hold harmless the indemnified parties from and against any and all claims, to the extent such claims arise out of, result from, or are attributable to, the actual or alleged infringement or misappropriation of any patent, copyright, trade secret, trademark, or confidential information of any third party by the Contractor or its employees, Subcontractors, consultants, representatives, and agents; provided, however, the State gives the Contractor prompt notice in writing of the claim. The Contractor may not settle any infringement claim that will affect

the State's use of the Licensed Software without the State's prior written consent, which consent may be withheld for any reason.
If a judgment or settlement is obtained or reasonably anticipated against the State's use of any intellectual property for which the Contractor has indemnified the State, the Contractor shall, at the Contractor's sole cost and expense, promptly modify the item or items which were determined to be infringing, acquire a license or licenses on the State's behalf to provide the necessary rights to the State to eliminate the infringement, or provide the State with a non-infringing substitute that provides the State the same functionality. At the State's election, the actual or anticipated judgment may be treated as a breach of warranty by the Contractor, and the State may receive the remedies provided under this RFP.

3. **PERSONNEL**
The Contractor shall, at its expense, indemnify and hold harmless the indemnified parties from and against any claim with respect to withholding taxes, worker's compensation, employee benefits, or any other claim, demand, liability, damage, or loss of any nature relating to any of the personnel, including subcontractor's and their employees, provided by the Contractor.

4. **SELF-INSURANCE**
The State of Nebraska is self-insured for any loss and purchases excess insurance coverage pursuant to Neb. Rev. Stat. § 81-8,239.01 (Reissue 2008). If there is a presumed loss under the provisions of this agreement, Contractor may file a claim with the Office of Risk Management pursuant to Neb. Rev. Stat. §§ 81-8,829 – 81-8,306 for review by the State Claims Board. The State retains all rights and immunities under the State Miscellaneous (Section 81-8,294), Tort (Section 81-8,209), and Contract Claim Acts (Section 81-8,302), as outlined in Neb. Rev. Stat. § 81-8,209 et seq. and under any other provisions of law and accepts liability under this agreement to the extent provided by law.

5. The Parties acknowledge that Attorney General for the State of Nebraska is required by statute to represent the legal interests of the State, and that any provision of this indemnity clause is subject to the statutory authority of the Attorney General.

K. ATTORNEY'S FEES

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

In the event of any litigation, appeal, or other legal action to enforce any provision of the contract, the Parties agree to pay all expenses of such action, as permitted by law and if order by the court, including attorney's fees and costs, if the other Party prevails.

L. RETAINAGE

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The State will withhold ten percent (10%) of each payment due as retainage. The entire retainage amount will be payable upon successful completion of the project phase. Upon completion of the project, the Contractor will invoice the State for any outstanding work and for the retainage. The State may reject the final invoice by identifying the specific reasons for such rejection in writing to the Contractor within forty-five (45) calendar days of receipt of the final invoice. Otherwise, the project will be deemed accepted and the State will release the final payment and retainage in accordance with the contract payment terms.

M. ASSIGNMENT, SALE, OR MERGER

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Either Party may assign the contract upon mutual written agreement of the other Party. Such agreement shall not be unreasonably withheld.

The Contractor retains the right to enter into a sale, merger, acquisition, internal reorganization, or similar transaction involving Contractor's business. Contractor agrees to cooperate with the State in executing amendments to the contract to allow for the transaction. If a third party or entity is involved in the transaction, the Contractor will remain responsible for performance of the contract until such time as the person or entity involved in the transaction agrees in writing to be contractually bound by this contract and perform all obligations of the contract.

N. CONTRACTING WITH OTHER NEBRASKA POLITICAL SUB-DIVISIONS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor may, but shall not be required to, allow agencies, as defined in Neb. Rev. Stat. §81-145, to use this contract. The terms and conditions, including price, of the contract may not be amended. The State shall not be contractually obligated or liable for any contract entered into pursuant to this clause. A listing of Nebraska political subdivisions may be found at the website of the Nebraska Auditor of Public Accounts.

O. FORCE MAJEURE

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Neither Party shall be liable for any costs or damages, or for default resulting from its inability to perform any of its obligations under the contract due to a natural or manmade event outside the control and not the fault of the affected Party ("Force Majeure Event"). The Party so affected shall immediately make a written request for relief to the other Party, and shall have the burden of proof to justify the request. The other Party may grant the relief requested; relief may not be unreasonably withheld. Labor disputes with the impacted Party's own employees will not be considered a Force Majeure Event.

P. CONFIDENTIALITY

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

All materials and information provided by the Parties or acquired by a Party on behalf of the other Party shall be regarded as confidential information. All materials and information provided or acquired shall be handled in accordance with federal and state law, and ethical standards. Should said confidentiality be breached by a Party, the Party shall notify the other Party immediately of said breach and take immediate corrective action.

It is incumbent upon the Parties to inform their officers and employees of the penalties for improper disclosure imposed by the Privacy Act of 1974, 5 U.S.C. 552a. Specifically, 5 U.S.C. 552a (i)(1), which is made applicable by 5 U.S.C. 552a (m)(1), provides that any officer or employee, who by virtue of his/her employment or official position has possession of or access to agency records which contain individually identifiable information, the disclosure of which is prohibited by the Privacy Act or regulations established thereunder, and who knowing that disclosure of the specific material is prohibited, willfully discloses the material in any manner to any person or agency not entitled to receive it, shall be guilty of a misdemeanor and fined not more than $5,000.

Q. EARLY TERMINATION

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The contract may be terminated as follows:

1. The State and the Contractor, by mutual written agreement, may terminate the contract at any time.
2. The State, in its sole discretion, may terminate the contract for any reason upon thirty (30) calendar day's written notice to the Contractor. Such termination shall not relieve the Contractor of warranty or other service obligations incurred under the terms of the contract. In the event of termination the Contractor shall be entitled to payment, determined on a pro rata basis, for products or services satisfactorily performed or provided.
3. The State may terminate the contract immediately for the following reasons:
   - **a.** if directed to do so by statute;
   - **b.** Contractor has made an assignment for the benefit of creditors, has admitted in writing its inability to pay debts as they mature, or has ceased operating in the normal course of business;
   - **c.** a trustee or receiver of the Contractor or of any substantial part of the Contractor's assets has been appointed by a court;
   - **d.** fraud, misappropriation, embezzlement, malfeasance, misfeasance, or illegal conduct pertaining to performance under the contract by its Contractor, its employees, officers, directors, or shareholders;
   - **e.** an involuntary proceeding has been commenced by any Party against the Contractor under any one of the chapters of Title 11 of the United States Code and (i) the proceeding has been pending for at least sixty (60) calendar days; or (ii) the Contractor has consented, either expressly or by operation of law, to the entry of an order for relief; or (iii) the Contractor has been decreed or adjudged a debtor;
   - **f.** a voluntary petition has been filed by the Contractor under any of the chapters of Title 11 of the United States Code;
   - **g.** Contractor intentionally discloses confidential information;
   - **h.** Contractor has or announces it will discontinue support of the deliverable; and,
   - **i.** In the event funding is no longer available.

R. CONTRACT CLOSEOUT

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Upon contract closeout for any reason the Contractor shall within 30 days, unless stated otherwise herein:

1. Transfer all completed or partially completed deliverables to the State;
2. Transfer ownership and title to all completed or partially completed deliverables to the State;
3. Return to the State all information and data, unless the Contractor is permitted to keep the information or data by contract or rule of law. Contractor may retain one copy of any information or data as required to comply with applicable work product documentation standards or as are automatically retained in the course of Contractor's routine back up procedures;
4. Cooperate with any successor Contactor, person or entity in the assumption of any or all of the obligations of this contract;
5. Cooperate with any successor Contactor, person or entity with the transfer of information or data related to this contract;
6. Return or vacate any state owned real or personal property; and,
7. Return all data in a mutually acceptable format and manner.

Nothing in this Section should be construed to require the Contractor to surrender intellectual property, real or personal property, or information or data owned by the Contractor for which the State has no legal claim.

III. CONTRACTOR DUTIES

A. INDEPENDENT CONTRACTOR / OBLIGATIONS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

It is agreed that the Contractor is an independent contractor and that nothing contained herein is intended or should be construed as creating or establishing a relationship of employment, agency, or a partnership.

The Contractor is solely responsible for fulfilling the contract. The Contractor or the Contractor's representative shall be the sole point of contact regarding all contractual matters.

The Contractor shall secure, at its own expense, all personnel required to perform the services under the contract. The personnel the Contractor uses to fulfill the contract shall have no contractual or other legal relationship with the State; they shall not be considered employees of the State and shall not be entitled to any compensation, rights or benefits from the State, including but not limited to, tenure rights, medical and hospital care, sick and vacation leave, severance pay, or retirement benefits.

By-name personnel commitments made in the Contractor's proposal shall not be changed without the prior written approval of the State. Replacement of these personnel, if approved by the State, shall be with personnel of equal or greater ability and qualifications.

All personnel assigned by the Contractor to the contract shall be employees of the Contractor or a subcontractor, and shall be fully qualified to perform the work required herein. Personnel employed by the Contractor or a subcontractor to fulfill the terms of the contract shall remain under the sole direction and control of the Contractor or the subcontractor respectively.

With respect to its employees, the Contractor agrees to be solely responsible for the following:

1. Any and all pay, benefits, and employment taxes and/or other payroll withholding;
2. Any and all vehicles used by the Contractor's employees, including all insurance required by state law;
3. Damages incurred by Contractor's employees within the scope of their duties under the contract;
4. Maintaining Workers' Compensation and health insurance that complies with state and federal law and submitting any reports on such insurance to the extent required by governing law; and
5. Determining the hours to be worked and the duties to be performed by the Contractor's employees.
6. All claims on behalf of any person arising out of employment or alleged employment (including without limit claims of discrimination alleged against the Contractor, its officers, agents, or subcontractors or subcontractor's employees)

If the Contractor intends to utilize any subcontractor, the subcontractor's level of effort, tasks, and time allocation should be clearly defined in the bidder's proposal. The Contractor shall agree that it will not utilize any subcontractors not specifically included in its proposal in the performance of the contract without the prior written authorization of the State.

The State reserves the right to require the Contractor to reassign or remove from the project any Contractor or subcontractor employee.

Contractor shall insure that the terms and conditions contained in any contract with a subcontractor does not conflict with the terms and conditions of this contract.

The Contractor shall include a similar provision, for the protection of the State, in the contract with any Subcontractor engaged to perform work on this contract.

B. EMPLOYEE WORK ELIGIBILITY STATUS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor is required and hereby agrees to use a federal immigration verification system to determine the work eligibility status of employees physically performing services within the State of Nebraska. A federal immigration verification system means the electronic verification of the work authorization program authorized by the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, 8 U.S.C. 1324a, known as the E-Verify Program, or an equivalent federal program designated by the United States Department of Homeland Security or other federal agency authorized to verify the work eligibility status of an employee.

If the Contractor is an individual or sole proprietorship, the following applies:

1. The Contractor must complete the United States Citizenship Attestation Form, available on the Department of Administrative Services website at http://das.nebraska.gov/materiel/purchasing.html

   The completed United States Attestation Form should be submitted with the RFP response.

2. If the Contractor indicates on such attestation form that he or she is a qualified alien, the Contractor agrees to provide the US Citizenship and Immigration Services documentation required to verify the Contractor's lawful presence in the United States using the Systematic Alien Verification for Entitlements (SAVE) Program.

3. The Contractor understands and agrees that lawful presence in the United States is required and the Contractor may be disqualified or the contract terminated if such lawful presence cannot be verified as required by Neb. Rev. Stat. §4-108.

C. COMPLIANCE WITH CIVIL RIGHTS LAWS AND EQUAL OPPORTUNITY EMPLOYMENT / NONDISCRIMINATION (Statutory)

The Contractor shall comply with all applicable local, state, and federal statutes and regulations regarding civil rights laws and equal opportunity employment. The Nebraska Fair Employment Practice Act prohibits Contractors of the State of Nebraska, and their Subcontractors, from discriminating against any employee or applicant for employment, with respect to hire, tenure, terms, conditions, compensation, or privileges of employment because of race, color, religion, sex, disability, marital status, or national origin (Neb. Rev. Stat. §48-1101 to 48-1125). The Contractor guarantees compliance with the Nebraska Fair Employment Practice Act, and breach of this provision shall be regarded as a material breach of contract. The Contractor shall insert a similar provision in all Subcontracts for services to be covered by any contract resulting from this RFP.

D. COOPERATION WITH OTHER CONTRACTORS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Contractor may be required to work with or in close proximity to other contractors or individuals that may be working on same or different projects. The Contractor shall agree to cooperate with such other contractors or individuals, and shall not commit or permit any act which may interfere with the performance of work by any other contractor or individual. Contractor is not required to compromise Contractor's intellectual property or proprietary information unless expressly required to do so by this contract.

E. PERMITS, REGULATIONS, LAWS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The contract price shall include the cost of all royalties, licenses, permits, and approvals, whether arising from patents, trademarks, copyrights or otherwise, that are in any way involved in the contract. The Contractor shall obtain and pay for all royalties, licenses, and permits, and approvals necessary for the execution of the contract. The Contractor must guarantee that it has the full legal right to the materials, supplies, equipment, software, and other items used to execute this contract.

F. OWNERSHIP OF INFORMATION AND DATA / DELIVERABLES

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The State shall have the unlimited right to publish, duplicate, use, and disclose all information and data developed or obtained by the Contractor on behalf of the State pursuant to this contract.

The State shall own and hold exclusive title to any deliverable developed as a result of this contract. Contractor shall have no ownership interest or title, and shall not patent, license, or copyright, duplicate, transfer, sell, or exchange, the design, specifications, concept, or deliverable.

G. INSURANCE REQUIREMENTS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor shall throughout the term of the contract maintain insurance as specified herein and provide the State a current Certificate of Insurance/Acord Form (COI) verifying the coverage. The Contractor shall not commence work on the contract until the insurance is in place. If Contractor subcontracts any portion of the Contract the Contractor must, throughout the term of the contract, either:

1. Provide equivalent insurance for each subcontractor and provide a COI verifying the coverage for the subcontractor;
2. Require each subcontractor to have equivalent insurance and provide written notice to the State that the Contractor has verified that each subcontractor has the required coverage; or,
3. Provide the State with copies of each subcontractor's Certificate of Insurance evidencing the required coverage.

The Contractor shall not allow any Subcontractor to commence work until the Subcontractor has equivalent insurance. The failure of the State to require a COI, or the failure of the Contractor to provide a COI or require subcontractor insurance shall not limit, relieve, or decrease the liability of the Contractor hereunder.

In the event that any policy written on a claims-made basis terminates or is canceled during the term of the contract or within one (1) year of termination or expiration of the contract, the contractor shall obtain an extended discovery

or reporting period, or a new insurance policy, providing coverage required by this contract for the term of the contract and one (1) year following termination or expiration of the contract.

If by the terms of any insurance a mandatory deductible is required, or if the Contractor elects to increase the mandatory deductible amount, the Contractor shall be responsible for payment of the amount of the deductible in the event of a paid claim.

Notwithstanding any other clause in this Contract, the State may recover up to the liability limits of the insurance policies required herein.

1. **WORKERS' COMPENSATION INSURANCE**

The Contractor shall take out and maintain during the life of this contract the statutory Workers' Compensation and Employer's Liability Insurance for all of the contactors' employees to be engaged in work on the project under this contract and, in case any such work is sublet, the Contractor shall require the Subcontractor similarly to provide Worker's Compensation and Employer's Liability Insurance for all of the Subcontractor's employees to be engaged in such work. This policy shall be written to meet the statutory requirements for the state in which the work is to be performed, including Occupational Disease. **The policy shall include a waiver of subrogation in favor of the State. The COI shall contain the mandatory COI subrogation waiver language found hereinafter**. The amounts of such insurance shall not be less than the limits stated hereinafter. For employees working in the State of Nebraska, the policy must be written by an entity authorized by the State of Nebraska Department of Insurance to write Workers' Compensation and Employer's Liability Insurance for Nebraska employees.

4. **COMMERCIAL GENERAL LIABILITY INSURANCE AND COMMERCIAL AUTOMOBILE LIABILITY INSURANCE**

The Contractor shall take out and maintain during the life of this contract such Commercial General Liability Insurance and Commercial Automobile Liability Insurance as shall protect Contractor and any Subcontractor performing work covered by this contract from claims for damages for bodily injury, including death, as well as from claims for property damage, which may arise from operations under this contract, whether such operation be by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by either of them, and the amounts of such insurance shall not be less than limits stated hereinafter.

The Commercial General Liability Insurance shall be written on an **occurrence basis**, and provide Premises/Operations, Products/Completed Operations, Independent Contractors, Personal Injury, and Contractual Liability coverage. **The policy shall include the State, and others as required by the contract documents, as Additional Insured(s). This policy shall be primary, and any insurance or self-insurance carried by the State shall be considered secondary and non-contributory**. **The COI shall contain the mandatory COI liability waiver language found hereinafter.** The Commercial Automobile Liability Insurance shall be written to cover all Owned, Non-owned, and Hired vehicles.

REQUIRED INSURANCE COVERAGE	
COMMERCIAL GENERAL LIABILITY	
General Aggregate	$2,000,000
Products/Completed Operations Aggregate	$2,000,000
Personal/Advertising Injury	$1,000,000 per occurrence
Bodily Injury/Property Damage	$1,000,000 per occurrence
Medical Payments	$10,000 any one person
Damage to Rented Premises (Fire)	$300,000 each occurrence
Contractual	Included
XCU Liability (Explosion, Collapse, and Underground Damage)	Included
Independent Contractors	Included
Abuse & Molestation	Included
If higher limits are required, the Umbrella/Excess Liability limits are allowed to satisfy the higher limit.	
WORKER'S COMPENSATION	
Employers Liability Limits	$500K/$500K/$500K
Statutory Limits- All States	Statutory - State of Nebraska
USL&H Endorsement	Statutory
Voluntary Compensation	Statutory
COMMERCIAL AUTOMOBILE LIABILITY	
Bodily Injury/Property Damage	$1,000,000 combined single limit
Include All Owned, Hired & Non-Owned Automobile liability	Included
Motor Carrier Act Endorsement	Where Applicable
UMBRELLA/EXCESS LIABILITY	
Over Primary Insurance	$5,000,000 per occurrence
PROFESSIONAL LIABILITY	
All Other Professional Liability (Errors & Omissions)	$1,000,000 Per Claim / Aggregate
COMMERCIAL CRIME	
Crime/Employee Dishonesty Including 3rd Party Fidelity	$1,000,000
CYBER LIABILITY	
Breach of Privacy, Security Breach, Denial of Service, Remediation, Fines and Penalties	$10,000,000
MANDATORY COI SUBROGATION WAIVER LANGUAGE	
"Workers' Compensation policy shall include a waiver of subrogation in favor of the State of Nebraska."	
MANDATORY COI LIABILITY WAIVER LANGUAGE	
"Commercial General Liability & Commercial Automobile Liability policies shall name the State of Nebraska as an Additional Insured and the policies shall be primary and any insurance or self-insurance carried by the State shall be considered secondary and non-contributory as additionally insured."	

If the mandatory COI subrogation waiver language or mandatory COI liability waiver language on the COI states that the waiver is subject to, condition upon, or otherwise limit by the insurance policy, a copy of the relevant sections of the policy must be submitted with the COI so the State can review the limitations imposed by the insurance policy.

5. **EVIDENCE OF COVERAGE**

The Contractor shall furnish the Contract Manager, with a certificate of insurance coverage complying with the above requirements prior to beginning work at:

Nebraska Educational Telecommunications
Attn: Contract Manager
1800 N. 33rd Street
Lincoln, NE, 68503

These certificates or the cover sheet shall reference the RFP number, and the certificates shall include the name of the company, policy numbers, effective dates, dates of expiration, and amounts and types of coverage afforded. If the State is damaged by the failure of the Contractor to maintain such insurance, then the Contractor shall be responsible for all reasonable costs properly attributable thereto.

Reasonable notice of cancellation of any required insurance policy must be submitted to the contract manager as listed above when issued and a new coverage binder shall be submitted immediately to ensure no break in coverage.

6. **DEVIATIONS**

The insurance requirements are subject to limited negotiation. Negotiation typically includes, but is not necessarily limited to, the correct type of coverage, necessity for Workers' Compensation, and the type of automobile coverage carried by the Contractor.

H. ANTITRUST

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor hereby assigns to the State any and all claims for overcharges as to goods and/or services provided in connection with this contract resulting from antitrust violations which arise under antitrust laws of the United States and the antitrust laws of the State.

I. CONFLICT OF INTEREST

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

By submitting a proposal, bidder certifies that there does not now exist a relationship between the bidder and any person or entity which is or gives the appearance of a conflict of interest related to this RFP or project.

The bidder certifies that it shall not take any action or acquire any interest, either directly or indirectly, which will conflict in any manner or degree with the performance of its services hereunder or which creates an actual or an appearance of conflict of interest.

The bidder certifies that it will not knowingly employ any individual known by bidder to have a conflict of interest.

The Parties shall not knowingly, for a period of two years after execution of the contract, recruit or employ any employee or agent of the other Party who has worked on the RFP or project, or who had any influence on decisions affecting the RFP or project.

J. STATE PROPERTY

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor shall be responsible for the proper care and custody of any State-owned property which is furnished for the Contractor's use during the performance of the contract. The Contractor shall reimburse the State for any loss or damage of such property; normal wear and tear is expected.

K. SITE RULES AND REGULATIONS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor shall use its best efforts to ensure that its employees, agents, and Subcontractors comply with site rules and regulations while on State premises. If the Contractor must perform on-site work outside of the daily operational hours set forth by the State, it must make arrangements with the State to ensure access to the facility and the equipment has been arranged. No additional payment will be made by the State on the basis of lack of access, unless the State fails to provide access as agreed to in writing between the State and the Contractor.

L. ADVERTISING

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor agrees not to refer to the contract award in advertising in such a manner as to state or imply that the company or its services are endorsed or preferred by the State. Any publicity releases pertaining to the project shall not be issued without prior written approval from the State.

M. NEBRASKA TECHNOLOGY ACCESS STANDARDS (Statutory)

Contractor shall review the Nebraska Technology Access Standards, found at http://nitc.nebraska.gov/standards/2-201.html and ensure that products and/or services provided under the contract are in compliance or will comply with the applicable standards to the greatest degree possible. In the event such standards change during the Contractor's performance, the State may create an amendment to the contract to request the contract comply with the changed standard at a cost mutually acceptable to the parties.

N. DISASTER RECOVERY/BACK UP PLAN

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

The Contractor shall have a disaster recovery and back-up plan, of which a copy should be provided upon request to the State, which includes, but is not limited to equipment, personnel, facilities, and transportation, in order to continue services as specified under the specifications in the contract in the event of a disaster.

O. DRUG POLICY

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Contractor certifies it maintains a drug free work place environment to ensure worker safety and workplace integrity. Contractor agrees to provide a copy of its drug free workplace policy at any time upon request by the State.

IV. PAYMENT

A. PROHIBITION AGAINST ADVANCE PAYMENT (Statutory)

Payments shall not be made until contractual deliverable(s) are received and accepted by the State.

B. TAXES (Statutory)

The State is not required to pay taxes and assumes no such liability as a result of this solicitation. Any property tax payable on the Contractor's equipment which may be installed in a state-owned facility is the responsibility of the Contractor.

B. INVOICES

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Invoices for payments must be submitted by the Contractor to the agency requesting the services with sufficient detail to support payment. Invoices for payment shall be submitted to Nebraska Educational Telecommunications 1800 N. 33rrd Street, Lincoln, Nebraska, 68503. The terms and conditions included in the Contractor's invoice shall be deemed to be solely for the convenience of the parties. No terms or conditions of any such invoice shall be binding upon the State, and no action by the State, including without limitation the payment of any such invoice in whole or in part, shall be construed as binding or estopping the State with respect to any such term or condition, unless the invoice term or condition has been previously agreed to by the State as an amendment to the contract.

C. INSPECTION AND APPROVAL

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

Final inspection and approval of all work required under the contract shall be performed by the designated State officials.

The State and/or its authorized representatives shall have the right to enter any premises where the Contractor or Subcontractor duties under the contract are being performed, and to inspect, monitor or otherwise evaluate the work being performed. All inspections and evaluations shall be at reasonable times and in a manner that will not unreasonably delay work.

D. PAYMENT

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:

State will render payment to Contractor when the terms and conditions of the contract and specifications have been satisfactorily completed on the part of the Contractor as solely determined by the State. (Neb. Rev. Stat. Section 73-506(1)) Payment will be made by the responsible agency in compliance with the State of Nebraska Prompt Payment

Act (See Neb. Rev. Stat. §81-2401 through 81-2408). The State may require the Contractor to accept payment by electronic means such as ACH deposit. In no event shall the State be responsible or liable to pay for any services provided by the Contractor prior to the Effective Date of the contract, and the Contractor hereby waives any claim or cause of action for any such services. No payment shall be made prior to the delivery of any hardware or software; all shipments will be FOB destination.

E. LATE PAYMENT (Statutory)

The Contractor may charge the responsible agency interest for late payment in compliance with the State of Nebraska Prompt Payment Act (See Neb. Rev. Stat. §81-2401 through 81-2408).

F. SUBJECT TO FUNDING / FUNDING OUT CLAUSE FOR LOSS OF APPROPRIATIONS

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

The State's obligation to pay amounts due on the Contract for a fiscal years following the current fiscal year is contingent upon legislative appropriation of funds. Should said funds not be appropriated, the State may terminate the contract with respect to those payments for the fiscal year(s) for which such funds are not appropriated. The State will give the Contractor written notice thirty (30) calendar days prior to the effective date of termination. All obligations of the State to make payments after the termination date will cease. The Contractor shall be entitled to receive just and equitable compensation for any authorized work which has been satisfactorily completed as of the termination date. In no event shall the Contractor be paid for a loss of anticipated profit.

G. RIGHT TO AUDIT (First Paragraph is Statutory)

Accept (Initial)	Reject (Initial)	Reject & Provide Alternative within RFP Response (Initial)	NOTES/COMMENTS:
JB			

The State shall have the right to audit the Contractor's performance of this contract upon a 30 days' written notice. Contractor shall utilize generally accepted accounting principles, and shall maintain the accounting records, and other records and information relevant to the contract (information) to enable the State to audit the contract. The State may audit and the Contractor shall maintain, the Information during the term of the contract and for a period of five (5) years after the completion of this contract or until all issues or litigation are resolved, whichever is later. The Contractor shall make the Information available to the State at Contractor's place of business or a location acceptable to both Parties during normal business hours. If this is not practical or the Contractor so elects, the Contractor may provide electronic or paper copies of the Information. The State reserves the right to examine, make copies of, and take notes on any Information relevant to this contract, regardless of the form or the Information, how it is stored, or who possesses the Information. Under no circumstance will the Contractor be required to create or maintain documents not kept in the ordinary course of contractor's business operations, nor will contractor be required to disclose any information, including but not limited to product cost data, which is confidential or proprietary to contractor.

The Parties shall pay their own costs of the audit unless the audit finds a previously undisclosed overpayment by the State. If a previously undisclosed overpayment exceeds one percent (.1% of the total contract billings, or if fraud, material misrepresentations, or non-performance is discovered on the part of the Contractor, the Contractor shall reimburse the State for the total costs of the audit. Overpayments and audit costs owed to the State shall be paid within ninety days of written notice of the claim. The Contractor agrees to correct any material weaknesses or condition found as a result of the audit.

NETC Nebraska Monitor and Control System (NMCS)

Attachment One: Requirements Traceability Matrix

RFP 5820 Z1

7th May 2018

ORIGINAL COPY

Attachment One
RFP # 5820 Z1
Requirements Traceability Matrix
Network Management Control System (NMCS)

Bidders shall complete a Traceability Matrix to provide Network Management Control System. Bidders are required to describe in detail how their proposed solution meets the specifications outlined within each Requirement.

The Traceability Matrix is used to document and track the project requirements from the proposal through testing to verify that the requirement has been completely fulfilled. The contractor will be responsible for maintaining the contract set of Baseline Requirements. The Traceability Matrix will form one of the key artifacts required for testing and validation that each requirement has been complied with (i.e., 100% fulfilled).

The Traceability Matrix must indicate how the bidder intends to comply with the requirement and the effort required to achieve that compliance. It is not sufficient for the bidder to simply state that it intends to meet the requirements of the RFP. The State will consider any such response to the requirements in this RFP to be non-responsive. The narrative should provide the State with sufficient information to differentiate the bidder's technical solution from other bidders' solutions.

The bidder must ensure that the original requirement identifier and requirement description are maintained in the Traceability Matrix as provided by the State

How to complete the traceability matrix:

Column Description	Bidder Responsibility
Req #	The unique identifier for the requirement as assigned by the State, followed by the specific requirement number. This column is dictated by this RFP and must not be modified by the bidder.
Requirement	The statement of the requirement to which the bidder must respond. This column is dictated by the RFP and must not be modified by the bidder.

Req #	Project Requirements	Existing Capabilities	In Development	Customized for NETC
PRM #1	The NMCS bid shall provide the ability to control and monitor the NETC NMCS systems via Virtual Private Network (VPN) using Standard Ethernet Internet Protocols, and a mechanism for backup monitor and control capabilities over dial up telephone when terrestrial IP connectivity is not available The NMCS shall provide monitor and control capabilities whether that be alternate connectivity or a desperate system.	✓		
Bidder Response: Mosaic has been deployed in environments which utilized VPNs to tunnel from remote sites back to a central server location and is fully compatible with dial up modem connections, provide the dialup establishes an IP link to the remote site. Note Mosaic in-build conditional polling can be used to reduce or throttle polling of external devices when on a dialup link to reduce the overall bandwidth requirements.				
PRM #2	The NMCS bid shall provide the ability to communicate with remote devices over dial up telephone modems, direct connection and Ethernet IP.	✓		
Bidder Response: Again Mosaic is capable of adapting to low bandwidth connections such as dial up modems. The use of conditional polling can ensure optimal bandwidth usage regardless of the connection method. In addition, the proposed Davicom Cortex 360 units support a direct dial up connection, providing the ability to monitor and control the transmitter independent of the IP network.				
PRM #3	The NMCS bid shall provide the ability for simultaneous control and monitoring from all or multiple workstations, by single and multiple operators connecting to similar or divergent NMCS systems	✓		
Bidder Response: The Mosaic architecture is based on a Client / Server model, where any number of clients can connect at any given time. Each client has full simultaneous access to monitoring data and given the correct permissions control of the underlying hardware. In addition, the Mosaic server can be distributed to provide system resilience and to provide load balancing on larger deployments. In this scenario, the clients are able to connect to one or all of the servers to provide an aggregated view of the overall system.				
PRM #4	The NMCS components bid shall provide the ability to be addressable using standard IPV4 addressing, and have the ability to be run locally and remotely.	✓		
Bidder Response: Mosaic is designed to run on a Layer 3 network using standard IP based communications. It works equally well on an IPV4 addressing scheme as IPV6. Provided there is IP connectivity between nodes, Mosaic can be distributed throughout the network or collocated on the same physical host, thereby allowing components of the system to run both locally and remotely.				
PRM #5	The NMCS bid shall provide the ability of executing simultaneous commands or instructions to multiple remote devices at multiple diverse sites.	✓		
Bidder Response: The Mosaic command engine allows up to 1000 commands to be executed simultaneously. The 1000 active command limit is configurable and can be tailored as required. Commands to a single device instance can be restricted to ensure only one command is pending at any given time. This is to ensure compliance with the capabilities of the hardware. In addition, commands can be paced to ensure commands are not sent too quickly. Some hardware devices cannot handle commands sent fast than a given rate				

and therefore pacing is used to throttle commands sent to the device. More in-depth technical information is provided in the technical proposal under the commanding section.				
PRM #6	The NMCS bid shall provide the ability to execute preprogrammed events at specified times and/or in response to external triggers which may or may not be tied to automation events using synchronized time clock and/or GPI/GPO, serial, or ethernet interfaces.	✓		
Bidder Response: Mosaic fully supports this requirement with a few mechanisms coming into play. Firstly Mosaic supports a scheduling engine which allows ad-hoc and periodic tasks to be scheduled well in advance. Each activity is attributed a start date and time, together with configuration of the task to perform. The scheduler will then execute the activity at the desired time and track the success / failure status of the activity. Note the schedule also supports the definition of a repeat period for an activity, allowing common tasks to be easily defined within the schedule. For example, generate a transmitter power report every Monday at 9 am. The second mechanism supports the ability to trigger responses based on incoming monitoring data or patterns within the data. The complex event processor is a rules based inferencing engine which can react to external triggers and initiate a system response. The response could be many things, but a common action is to start an automation script, which can in turn contain control logic and commands.				
PRM #7	The NMCS bid should have an open architecture protocol to allow for integration with existing and future third party systems.	✓		
Bidder Response: Mosaic provides a number of extension points via which it can integrate with 3rd party systems. All extension points are scriptable using the Groovy scripting language and well documented via the Mosaic developers guide. A common extension point is via the Mosaic Driver Platform. Drivers are classes written within Groovy which handle integrate and adoption of a device or external system. All standard Mosaic drivers are provided for reference and can be freely extended or altered to suit the needs of a customer.				
PRM #8	The NMCS bid shall be capable of generating reports showing all commands issued, alarm and fault status, and system configurations. Reporting mechanism shall be capable of logging and reporting of system, service level, and device specific events.	✓		
Bidder Response: Mosaic provides a comprehensive reporting mechanism. Reporting allows both raw and formatted reports to be generated based archive data available within the Mosaic system. All archive and live data is available to reporting, this includes commands issued, alarms and faults (active and historic), events, system configuration, historical monitoring data, statistical data and current monitoring data. Reports can be scoped to access all data (system), data related to a given service, data related to a given device or any variation thereof.				
PRM #9	The NMCS bid shall have provisions for redundancy, for both hardware and software systems.	✓		
Bidder Response: The core Mosaic architecture supports redundancy, both of its internal systems within Mosaic and external software and hardware. The Mosaic system is inherently fault-tolerant, supporting an NxM redundancy scheme. Typically a primary / backup server pair it utilized, with the primary and backup connected via a crossover cable. The primary server is then responsible for synchronizing the most up-to-date system state information with the backup and the backup is responsible for monitoring the primary. Should the primary server become unresponsive the backup server will promote itself to primary and assume control. Note clients within the system automatically follow and it is mostly transparent to the user that the backup took over. See the fault tolerance section of the technical proposal for more details.				

PRM #10	The NMCS bid shall specify operating system software and versions for all software including third party software. Any server, terminal, workstation, or peripheral software required bur not included shall be specified.	✓		

Bidder Response:
Mosaic is most operating system agnostic and will run on all modern versions of Windows, Linux and even MacOS. That said, Mosaic is regularly tested on the following operating systems to ensure compatibility:

- Windows 7, 10, Server 2012, Server 2012 R2, Server 2016
- Ubuntu 16.04 & 18.04 LTS
- RedHat RHEL versions 5.6 and 6.7
- MacOS El Capitan and Sierra

PRM #11	The NMCS bid should state any special "value added" features such as self-diagnostics, virtualization, accessibility, etc....	✓		

Bidder Response:
See the technical proposal for more details, but some highlights are:

- Virtualization and cloud support
- Real-time analytics
- HTML5 with web sockets for web clients. No obsolete plugins such as Flash or Silverlight
- Uplink Power Control and Site Diversity Switching (although the latter may not be useful for NET)
- System health reporting and visualization
- End-user tools for device integrations, such as the SNMP MIB translator which build a fully fledge driver based on simply MIB item selection.

PRM #12	The NMCS bid should be capable of interoperability with other systems. These systems should be specified, e.g. automation, machine control, GPI/GPO, matrix routers, tally, etc...	✓		

Bidder Response:
Mosaic is manufacturer, hardware and protocol agnostic. As such, Mosaic integrates with a wide range of different devices and applications. If a device or system presents an interface then Mosaic can be configured to integrate with it. Even devices which don't provide a dedicated interface can be successfully integrated into Mosaic, provided they allow some access, such as via a web page or log file.

PRM #13	The levels of technical and operational support shall be specified for the NMCS bid.	✓		

Bidder Response:
A list of available support options is provided with the proposal, by default MNC Software offers its silver support with Mosaic. Just some of the services provided under silver support are:

- Access to product upgrades, enhancements and or fixes
- Access to all device drivers available within MNC Software's driver database
- Communication of upcoming product functionality and fixes
- Telephone support to provide technical support and/or to capture and track customer support issues

In addition, MNC Software provides an option for Gold support, which provides 24/7 support for both technical and operational issues. Gold support can be quoted upon request.				
PRM #14	The NMCS bid shall have all system single-points-of-failure clearly indicated in the bid response.	✓		
Bidder Response: Mosaic does not have an identified single point of failure, but can be placed in a network path that is a single point of failure. If both primary and backup servers are connected through a single switch or switch path then access to the Mosaic server through this switch can be a single point of failure. The Davicom and DeviceMaster units can be considered single points of failure for the devices they are connected to.				
PRM #15	A clearly defined list of proprietary and off-the-shelf technology for the NMCS bid shall be submitted for all hardware and software.	✓		
Bidder Response: Mosaic uses the following software technologies: Java, ActiveMQ, MySQL, HTML 5, Web Sockets. The bid includes the following hardware: Dell Servers, The Davicom Cortex 360 and Comtrol DeviceMaster RTS				
PRM #16	The NMCS bid shall have provisions for secure access, and customizable rights and permissions for all users of the system, and be capable of supporting single sign-on through authentication.	✓		
Bidder Response: Mosaic security provides the authentication and authorization mechanism via which users gain access to the system. The security system supports a configurable password authentication module, which can be configured to use an internal security database or access external systems such as Active Directory / LDAP. Authenticated users are assigned one or more roles within Mosaic. A user's roles will govern what the user can and cannot do within the application. See the security section within the technical proposal for more information.				
PRM #17	The NMCS bid shall be scalable, capable of being upgraded and expanded due to improvements and/or enhancements to the infrastructure of the NETC system and/or systems capabilities	✓		
Bidder Response: Mosaic supports a number of mechanisms which provide scalability and expansion. Our biggest customer is DirecTV where we monitor >4000 broadcast streams within both the Linear and OTT domains. We are also in the process of migrating all of their RF systems from MaxView to Mosaic, giving a total monitored device count well in excess of 200k devices. Mosaic provides such scalability through clustered servers, distributed processing and system separation. In the latter case, clients are able to automatically connect to multiple systems and provide the user with an aggregated view of the system as a whole. More information is provided in the technical proposal.				
PRM #18	The NMCS bid shall be capable of executing automated workflows related to equipment failovers, conditional variables, and backup solutions.	✓		
Bidder Response: Mosaic supports an extensive automation capability within the software. Automated workflows are handled via both the Mosaic Script engine and the complex event processor. Mosaic Scripts are sequences of instructions which are designed to allow a subject expert to express a series of checks and actions to affect the overall state of the system. Examples include, triggering the system to poll a device, performing conditional logic based on the value of a device data point, sending commands to one or more devices and calling other procedures to promote reuse and modularization.				

Triggering of a Mosaic Script in response to an event is handled via the complex event processor. The rules engine can be configured to detect conditions within the underlying system and trigger a Mosaic Script to handle the response. More information about both these features is presented in the technical proposal.				
PRM #19	The NMCS bid shall be capable of issuing alarms relative to equipment and environment status viewable by all users, and have the capabilities for multiple alarm monitoring and masking options. Alarms must be able to be propagated to the top most level.	✓		
Bidder Response: Within Mosaic, limit checking and alarms are processed using a common mechanism that is independent of the parameter raw format or data type. In this way, device fault conditions are treated no differently from numeric parameters. In all cases, the value of the parameter is evaluated against the database to determine if the value is considered out-of-limits. If the value is considered out-of-limits, the parameter's status is set to the database assigned alarm level. All alarms within the system are viewable from any client, whether it be the native desktop client or the web client. Alarm masking is also provided as a core capability of Mosaic. A number of masking options are provided, including mask indefinitely, and temporary mask, which masks the alarm until the parameter returns within limits. The alarm severity can also be modified using the alarm masking feature allowing the criticality of an alarm to be increased or decreased accordingly. Finally, by default, all alarms propagate upwards through the telemetry database structure, so that if a device's monitoring point goes into alarm, so too does the device and the service to which the device is grouped and the rack in which the device is contained and the room containing the rack and the facility containing the room. Alarm propagation allows the flow up of status information and is used to drive many displays within Mosaic, such as the Map Display.				
PRM #20	The NMCS bid shall be capable of monitoring and controlling external or internal tally systems viewable within the system and on connected multiviewers, including the support for under monitor displays (UMD).	✓		
Bidder Response: Mosaic supports a vender agnostic driver adapter platform that provides the ability to monitor and control any external system that provides an interface. In the case of systems requiring GPIO the Davicom Cortext 360 is deployed and provides input and output triggers to Mosaic. This combination of Mosaic software drivers and Davicom hardware Mosaic can control tally and UMDs through their controllers or directly through their GPIO connections, depending on the model.				
PRM #21	The NMCS bid shall be capable and compatible with common network security protocols to protect connections to the system that involve multiple VLANs in accordance with NETC Information Security Policies, Standards and Procedures.	✓		
Bidder Response: Having reviewed the NETC Information Security Policies, Standards and Procedures, Mosaic is 100% compliant.				
PRM #22	The NMCS bid shall be capable of monitoring by exception with industry and user defined parameters, and user-defined graphic views/dashboards and pop-up alerts.	✓		
Bidder Response: Mosaic fully supports the concept of monitoring by exception. All displays within Mosaic can be filtered to only show systems, services and devices which are in an off nominal state. This allows the operators to focus on what's truly important without being distracted by healthy devices. Pop-up alerts are also supported through our prompting framework allowing automation to prompt users as needed. For some of our larger customers this is the defacto mode of operation.				
PRM #23	The NMCS bid shall have the capability to filter and notify multiple users or groups via email and SMS or MMS messaging of any alarm conditions at any of the locations. The ability to activate external audio and or visual alarms via GPI or other protocol should also be part of the system.	✓		
Bidder Response: Mosaic supports any number of users, groups and escalation groups for notifications, whether they be via email, e2v services or SMS. SMS notifications can be supported via either an SMS gateway or via a 3G/4G modem which supports standard AT commands. Note a 3G/4G modem is not included in the proposal. GPI is supported through the Davicom unit and can feed triggers to Mosaic to support notifications.				

PRM #24	All device drivers that are **not** fully pointed drivers, allowing for all parameters as designed by the manufacturer, shall be indicated.	✓		
Bidder Response: While Mosaic is not typically configured to pull every single parameter from a device, all drivers are capable of being fully pointed. Fully pointed devices are often impractical if all parameters are active and represent an unnecessary load on the system and network. Device drivers provided Mosaic are configured to pull the most commonly used parameters for a device, but can easily be reconfigured to access any additional parameters without the need for development.				
PRM #25	The NMCS bid shall have the ability to create custom panels, layouts and views made up from any and all elements within the system.	✓		
Bidder Response: Mosaic is delivered with a full editing environment which allows for the creation of drivers, automation scripts and panels. In addition, the client allows the creating and management of both layouts and views. More information is provided in the UI section of the technical proposal.				
PRM #26	All cabling shall conform to NETC cable specifications* and industry standard best practices. (See Exhibit A)	✓		
Bidder Response: All installation and cabling will be done per the NETC cable specification and will conform to industry standard best practices. See the experience section of the commercial proposal.				
PRM #27	The NMCS bid shall provide detailed approaches addressing cyber security concerns including but not limited to architecture design, prevention, detection and response, and security audit.	✓		
Bidder Response: Mosaic typically runs with the secure environment of the broadcast network, but irrespective of that fact it also supports the following security features: 1. All Mosaic communication conducted via two ports, therefore Mosaic is very simply to secure behind a corporate firewall. 2. Mosaic can be run within a secure environment such as VPN 3. Mosaic can be configured to use SSL if internal encrypted connections are needed 4. Web access can be configured to use HTTPS to secure all web based connections. 5. User authentication is against customer supplied authentication system 6. All successful and failed logins are logged				
PRM #28	The NMCS bid should be capable to recall system settings such as equipment setup, signal routes, router mnemonics and UMD settings for quick and easy deployments of applicable systems and/or equipment.	✓		
Bidder Response: Mosaic supports the ability to model device settings either directly from the device or via a virtual device. Such settings can then be stored to and loaded from file within Mosaic to provide a quick and simply mechanism to configure or reconfigure equipment.				

BRM #	Business Requirements	Existing Capabilities	In Development	Customized for NETC
BRM #1	The NMCS bid shall specify any and all equipment required but not included in the RFP response. Projected cost for specified hardware, software, licenses, drivers, and any other equipment needed for the NMCS shall be specified in detail.	✓		
Bidder Response: All equipment, including hardware, software, licenses and drivers are detailed in the cost proposal. There is no additional hardware required as part of the bid. All hardware included in the cost proposal is standard hardware and commercially available. As such it may be purchased by NETC directly or via the NETC contract.				
BRM #2	The NMCS bid shall have provisions for future expandability. Projected cost for system expandability concerning hardware, software, licenses, device drivers, and any other equipment needed for expansion shall be specified in detail including required steps.	✓		
Bidder Response: The cost proposal in most cases accounts for some future expandability. Additional expandability is detailed in the optional sections of the cost proposal.				
BRM #3	The NMCS bid shall have provisions for a tiered support contract. Technical support shall be in the form of documentation, on-line, telephone, and/or in person on-site. Levels of support shall be specified in detail including limitations and liabilities.	✓		
Bidder Response: MNC Software has provided details of the support tiers within the cost proposal. In addition to our standard Gold and Silver support, which provides on-line and telephone support, the cost proposal contains hourly rates for professional services both onsite and remote.				
BRM #4	The NMCS bid shall have provisions for system training at all levels. Training options shall include price per person, including all associated expenses for factory and/or on-site training. Training options should remain in effect during the entire time that the NMCS is under a support contract.	✓		
Bidder Response: MNC Software has provided training options per this requirement in the cost proposal. Standard Mosaic training courses include, User, System Administration and Developer. Additional courses and tailored course are also available, although not included in the cost proposal.				
BRM #5	The NMCS bid shall have provisions for warranty coverage of all hardware supplied with the system including third party hardware, with provisions for extending warranty coverage.	✓		
Bidder Response: All Dell provided hardware is costed to include 5 years of Dell ProSupport. Additional warranty coverage is available upon request. The Davicom Cortex 360 and Comtrol DeviceMaster RTS both come with a standard 2 year warranty, with extended warranties costed in the appropriate section of the cost proposal.				
BRM #6	All items requested in this RFP shall be supplied by a single vendor or reseller. It is up to the bidder to make sure that all items integrate into a complete NMCS.	✓		

Bidder Response:

MNC Software will act as the sole vendor on the project and will be responsible for managing the purchasing of all required hardware, software, licenses, etc in order to perform on the contract. In addition, MNC Software will manage all sub-contractors per NETC requirements.

BRM #7	The bidder awarded the NMCS shall coordinate and work with the NETC NMCS Project Manager to establish a workable timeline for planning, installation, implementation, integration, configuration, and testing of the system or systems in all sections of this RFP prior to deployment.	✓		

Bidder Response:

Agreed. MNC Software will work closely with NETC immediately following contract award to agree and establish workable timelines for all future project activities. MNC Software will also provide NETC regular project status updates and communicate project risks and issues via the appropriate channels.

BRM #8	NET intends to replace the existing NMCS with the NMCS bid and further extend the NMCS bid to other listed technical functional areas. The NMCS bid shall monitor and control all devices listed in this RFP, and support technology advancement and industry standards change.	✓		

Bidder Response:

Mosaic is a fully customizable and configurable platform and is in continual development to enhance the product. Current and future devices can be easily integrated through our driver development platform with no need for software releases or down time. New releases of Mosaic are guaranteed to support backwards capability and provide new advanced features.

BRM #9	The NMCS bid shall be integrated with NETC's Network Nebraska's terrestrial delivery network, University of Nebraska-Lincoln regional networks, NETC's virtual systems and multiple LAN environments in accordance with NETC Information Security Policies, Standards and Procedures.	✓		

Bidder Response:

Mosaic is designed to operate on any standard layer-3, provided the Mosaic server has access to all relevant LAN segments then it will be fully capable of monitoring and controlling devices within those segments.

BRM #10	The NMCS bid shall have high availability, be able to automatically reconnect all devices, retain latest captured status and regain control functions after power and /or network outages.	✓		

Bidder Response:

Mosaic was designed to be fault tolerant from day one. It does not rely on external tools such as Linux HA or other high availability libraries, but rather uses an internal mechanism which allows Mosaic to control the synchronization of data between the participating servers. The data synchronized, includes but it not limited to parameter status, database changes, automation scripts, schedules and event correlation rules. More in-depth information is provided in the fault-tolerance section of the technical proposal.

BRM #11	The NMCS bid shall be media and hardware agnostic.	✓		

Bidder Response:

Mosaic is both hardware and media agnostic by design. It is not limited to specific manufactures or protocols and can interoperate with any device which publishes an interface via which to interact.

TRM #	TECHNICAL REQUIREMENTS	Existing Capabilities	In Development	Customized for NETC
TRM #1.1.0	The NMCS specified shall provide the ability to control and monitor the NETC Television and Radio Broadcast Transmission Sites (Exhibit B). The NMCS should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Sites (Exhibit C).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.1	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KUON - Mead (Exhibit D).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.2	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KHNE - Giltner (Exhibit E).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.3	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KLNE - Atlanta (Exhibit F).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				

TRM #1.1.4	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KMNE - Bassett (Exhibit G)			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.5	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KPNE - Sutherland (Exhibit H).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.6	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KRNE - Merriman (Exhibit J).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.7	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KTNE - Angora (Exhibit K).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.8	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KXNE - Carol (Exhibit L).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				

TRM #1.1.9	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KYNE - Omaha (Exhibit M).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.1.10	The NMCS bid should be able to control and monitor all existing and future equipment for the NETC Television and Radio Broadcast Transmission Site KUCV - Hallam (Exhibit N).			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required. Customization is done through the driver adapter layer and does not require software updates. See device adapter layer section within the technical approach for additional details.				
TRM #1.2.0	The NMCS bid shall have the ability to communicate with transmission equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial Communications will be established, administered, maintained, and operated.	✓		
Bidder Response: All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.				
TRM #1.3.0	The NMCS bid shall have the ability to communicate with transmission equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		
Bidder Response: Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.				
TRM #1.4.0	The NMCS bid shall have the ability to communicate with transmission equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		
Bidder Response: Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support				

the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.

TRM #1.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to transmission equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		

Bidder Response:

Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;
- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM #1.6.0	The NMCS bid shall be able to communicate with the Harris Platinum ATSC high power television transmitter via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		

Bidder Response:

Harris Platinum ATSC transmitter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. For all devices that support direct browser access we also provide direct access in out graphical displays. See system deployment section within the technical approach document for additional information.

TRM #1.7.0	The NMCS bid shall be able to communicate with the Harris Sigma CD ATSC high power television transmitter via discrete parallel connections, providing direct monitor and control via GPI, GPO, and analog interfaces.	✓		

Bidder Response:

The Harris Sigma CD ATSC transmitter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.

TRM #1.8.0	The NMCS bid shall be able to communicate with the Thales DCX Millennium ATSC high power television transmitter via multiple serial connections, providing direct monitor and control.	✓		
Bidder Response: Thales DCX Millennium ATSC transmitter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.				
TRM #1.8.1	The NMCS bid shall be able to communicate with the Thales ADAPT DTV Exciter via RS232 serial connections, providing direct monitor and control.	✓		
Bidder Response: Thales ADAPT DTV Exciter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.				
TRM #1.8.2	The NMCS bid shall be able to communicate with the Comark Exact-ATSC Exciter via ethernet connections, providing direct SNMP monitor and control.	✓		
Bidder Response: Comark Exact-ATSC Exciter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.				
TRM #1.9.0	The NMCS bid shall be able to communicate with the GatesAir Maxiva ATSC high power television transmitter via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: GatesAir Maxiva ATSC high power television transmitter is supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.				
TRM #1.10.0	The NMCS bid shall be able to communicate with the Nautel NV5, NV20, and NC30 high power FM radio transmitter via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: Nautel NV5, NV20, and NC30 high power FM radio transmitters are supported through a locally installed Davicom. Mosaic has a full integration with the Davicom unit allowing monitor and control of all devices connected to the Davicom. See system deployment section within the technical approach document for additional information.				

TRM #1.11.0	The NMCS bid should be able to communicate with the Belar FMHD-1, FM modulation monitor via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with Belar FMHD-1, FM Modulation monitor. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device. If SNMP is not currently available the FMHD-1 also supports an RS232 interface that can be supported.				
TRM #1.12.0	The NMCS bid should be able to communicate with the K-Tech DVM-150E DTV Demodulator/Decoder via SNMP and proprietary ethernet, providing direct monitor and control via SNMP and the Ktech proprietary GUI.			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with the K-Tech DVM-150E DTV Demodulator/Decoder. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.13.0	The NMCS bid should be able to communicate with the K-Tech DCC-150E 8VSB DTV digital processor via SNMP and proprietary ethernet, providing direct monitor and control via SNMP and the Ktech proprietary GUI.			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with the K-Tech DCC-150E 8VSB DTV digital processor. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.14.0	The NMCS bid should be able to communicate with the K-Tech FRQ-200 ASI-to-310 converter via SNMP and proprietary ethernet, providing direct monitor and control via SNMP and the Ktech proprietary GUI.			✓
Bidder Respone: According to the manufacture no SNMP is available for this device. If SNMP is available we will integrate directly with the SNMP interface. In the case no SNMP is available we will integrate directly with the email alerting feature to provide alarms via email in our system. We will also integrate with the web interface to provide direct access to configuration.				
TRM #1.15.0	The NMCS bid should be able to communicate with the Evertz 7880IP ASI-to-IP converter via SNMP and proprietary Evertz VistaLink ethernet, providing direct monitor and control via SNMP and the Evertz VistaLink proprietary GUI.			✓
Bidder Response:				

MNC Software will generate a configuration for communicating through SNMP with the Evertz 7880IP ASI-to-IP converter. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.16.0	The NMCS bid shall be able to communicate with the Motorola DSR4410 Integrated Receiver Decoder via SNMP, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with the Motorola DSR4410 Integrated Receiver Decoder. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.17.0	The NMCS bid shall be able to communicate with the Sencore 3187A Modular Receiver Decoder via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: MNC Software is currently integrated with the Sencore MRD 3187A via SNMP.				
TRM #1.18.0	The NMCS bid shall be able to communicate with the Sencore 3187B Modular Receiver Decoder via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: MNC Software is currently integrated with the Sencore MRD 3187B via SNMP.				
TRM #1.19.0	The NMCS bid shall be able to communicate with the Sencore MRD4400 Modular Receiver Decoder via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: MNC Software is currently integrated with the Sencore MRD 4400 via SNMP.				
TRM #1.20.0	The NMCS bid shall be able to communicate with the Evertz X9504 digital baseband routing switcher via GVG TenXL RS232 and RS422 serial protocols, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver for use with the GVG TenXL protocol. With the generation of the driver all device type displays will be provided. All serial communication will be made through the DeviceMaster.				
TRM #1.21.0	The NMCS bid shall be able to communicate with the Videotek RS12A analog audio/video baseband routing switcher via GVG Performer ASCII RS232 and RS422 serial protocol, providing direct monitor and control.			✓

Bidder Response: MNC Software will generate a driver for use with the GVG Performer ASCII protocol. With the generation of the driver all device type displays will be provided. All serial communication will be made through the DeviceMaster				
TRM #1.22.0	The NMCS bid shall be able to communicate with the Videotek RS-12 MPEG digital baseband routing switcher via GVG Performer ASCII RS232 and RS422 serial protocols, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver for use with the GVG Performer ASCII protocol. With the generation of the driver all device type displays will be provided. All serial communication will be made through the DeviceMaster				
TRM #1.23.0	The NMCS bid should be able to communicate with the Sage Digital Endec EAS Encoder/Decoder Model 3644 via 10/100 Base-T LAN protocol, providing direct monitor and control and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a driver to work directly with the web browser interface of the Sage Digital Endec 4644. Direct GPIO integration will be made through a Davicom unit. With the generation of the driver all device type displays will be provided.				
TRM #1.24.0	The NMCS bid shall be able to communicate with the Best Power Axxium 2000 UPS's via SNMP and HTTP protocol, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with the Best Power Axxium 2000 UPS. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.25.0	The NMCS bid shall be able to communicate with the APC 2000 UPS's via SNMP and HTTP protocol, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a configuration for communicating through SNMP with the Best Power Axxium 2000 UPS. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.26.0	The NMCS bid should be able to communicate with the Xytronix Research & Design Control by Web X310 and X332 products via SNMP and HTTL protocol, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.			✓

Bidder Response: All current devices connected to the X310 and X332 will be migrated to the Davicom. See system deployment section within the technical approach document for additional information. If the future use of current X310 and X332 devices are desired an SNMP integration will be provided. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #1.27.0	The NMCS bid should be able to communicate with the EECI (Electronic Energy Control, Inc.) ADC-16 analog to digital converter via serial protocol, providing direct monitor and control	✓		
Bidder Response: All current devices connected the ADC-16 will be migrated to the Davicom. See system deployment section within the technical approach document for additional information.				
TRM #1.28.0	The NMCS bid should be able to communicate with the HVAC systems in place at the remote transmission sites, providing monitoring and limited control where applicable	✓		
Bidder Response: Monitor and control of HVAC systems will be provided through the Davicom system. Any devices use a serial protocol will be communicated with through the DeviceMaster.				
TRM #1.29.0	The NMCS bid should be able to communicate with the electrical generator systems in place at the remote transmission sites, providing direct monitoring	✓		
Bidder Response: Monitor and control of electrical generators will be provided through the Davicom system.				
TRM #30.0	The NMCS bid should be able to communicate with the tower lighting systems in place at the remote transmission sites, providing direct monitoring	✓		
Bidder Response: Monitor and control of tower lighting systems will be provided through the Davicom system.				

TRM #2.0	Provide NMCS as Specified for NETC Satellite Teleport Systems.	Existing Capabilities	In Development	Customized for NETC
TRM #2.1.0	The NMCS bid shall provide the ability to control and monitor the NETC Ku-Band and C-band Satellite Teleport Systems. The NMCS should be able to control and monitor all existing and future equipment for the NETC Ku-Band and C-band Satellite Teleport Systems.			✓
Bidder Response: While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required.				

TRM #2.2.0	The NMCS bid shall have the ability to communicate with teleport equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		

Bidder Response:

All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.

TRM #2.3.0	The NMCS bid shall have the ability to communicate with teleport equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		

Bidder Response:

Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.

TRM #2.4.0	The NMCS bid shall have the ability to communicate with teleport equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		

Bidder Response:

Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.

TRM #2.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to teleport equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		

Bidder Response:

Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;

- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM #2.6.0	The NMCS bid should be able to communicate with the Vertex 7134 Antenna Controller via serial protocol, providing direct monitor and control.			✓

Bidder Response:

MNC Software will provide a driver to communicate with the Vertex ACU 7134 via serial protocol. All serial communication will be done through the DeviceMaster. MNC Software has previously integrated with VertexRSI ACU's including the 133 and 900 series. As part of the integration device specific control panel will be provided.

TRM #2.7.0	The NMCS bid shall be able to communicate with the Andrew APC100 Antenna Controller via serial protocol, providing direct monitor and control.	✓		

Bidder Response:

MNC Software is currently integrated with the APC100 Antenna Controller. This driver will be provided as part of the base install. All serial communication will be provided through the DeviceMaster

TRM #2.8.0	The NMCS bid shall be able to communicate with the Research Concepts RC1000 Antenna Controller via serial protocol, providing direct monitor and control.			✓

Bidder Response:

MNC Software will generate a driver that communicates with the Research Concepts RC1000 Antenna Controller through the serial protocol. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.

TRM #2.9.0	The NMCS bid shall be able to communicate with the Research Concepts RC2000 Antenna Controller via serial protocol, providing direct monitor and control			✓

Bidder Response:

MNC Software will generate a driver that communicates with the Research Concepts RC2000 Antenna Controller through the serial protocol. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.

TRM #2.10.0	The NMCS bid shall be able to communicate with the Miteq/MCL MT3200 Ku-Band High Power Amplifier via serial protocol, providing direct monitor and control.			✓

Bidder Response:

MNC Software will generate a driver to communicate with the Miteq/MCL MT3200 Ku-Band HPA. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.

TRM #2.11.0	The NMCS bid shall be able to communicate with the Miteq/MCL MT4000 Ku-Band High Power Amplifier via serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL MT4000 Ku-Band HPA. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.11.1	The NMCS bid shall be able to communicate with the Miteq/MCL PSU 1:4 HPA protection Switch via serial and HTTP protocol, providing direct monitor and control via serial communications, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a driver to communicate with the the Miteq/MCL PSU 1:4 HPA protection Switch. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided. Integrated browser access will be provided on the control surface.				
TRM #2.12.0	The NMCS bid shall be able to communicate with the Miteq/MCL MT4000 C-Band High Power Amplifier via serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL MT4000 C-Band HPA. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.12.1	The NMCS bid shall be able to communicate with the Miteq/MCL MXC-VPC Variable Phase Combiner via serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL MXC-VPC. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.13.0	The NMCS bid shall be able to communicate with the CPI VZU-6994AD Ku-Band High Power Amplifier via serial protocol, providing direct monitor and control.	✓		
Bidder Response: MNC Software is currently integrated with the CPI VZU-6994AD Ku-Band HPA. This driver will be provided as part of the base install. All serial communication will be provided through the DeviceMaster				
TRM #2.13.1	The NMCS bid shall be able to communicate with the CPI VZU-CMPA 1:1 Redundancy Switch via serial protocol, providing direct monitor and control.	✓		

Bidder Response: MNC Software is currently integrated with the CPI VZU-CMPA 1:1 Redundancy Switch. This driver will be provided as part of the base install. All serial communication will be provided through the DeviceMaster				
TRM #2.14.0	The NMCS bid shall be able to communicate with the Miteq/MCL U-9653-3 C-Band Upconverter via serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL U-9653-3 C-Band Upconverter. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.15.0	The NMCS bid shall be able to communicate with the Miteq/MCL U-9696 Ku-Band Upconverter via serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL U-9696 Ku-Band Upconverter. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.16.0	The NMCS bid shall be able to communicate with the Miteq/MCL U-9656-6-1K Ku-Band Upconverter via Serial, and SNMP protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL U-9656-6-1K Ku-Band Upconverter. Communication to the Upconverter will be through SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #2.16.1	The NMCS bid shall be able to communicate with the Miteq/MCL NSU 1:4 Redundancy Switch via Serial and SNMP protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Miteq/MCL NSU 1:4 Redundancy Switch. Communication to the redundancy switch will be through SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #2.17.0	The NMCS bid shall be able to communicate with the Radyne SFC-1450 Ku-Band Upconverter via Serial protocol, providing direct monitor and control.			✓
Bidder Response:				

MNC Software will generate a driver to communicate with the Radyne SFC-1450 Ku-Band Upconverter. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.18.0	The NMCS bid shall be able to communicate with the Newtec M6100 DVBS Modulator via SNMP and HTTP protocol, providing direct monitor and control via SNMP communications, and access to the integrated browser interface via http.	✓		
Bidder Response: MNC Software is currently integrated with the Newtech M6100 Modulator via SNMP. Integrated browser access will be provided on the control surface.				
TRM #2.18.1	The NMCS bid shall be able to communicate with the Newtec AZ202 1:7 Protection Switch via SNMP and HTTP protocol, providing direct monitor and control via SNMP communications, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Newtec AZ202 1:7 Protection Switch. Communication to the switch will be through SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device. Integrated browser access will be provided on the control surface.				
TRM #2.19.0	The NMCS bid shall be able to communicate with the Miteq DVM100 DVBS Modulator via Serial, SNMP and HTTP protocols, providing direct monitor and control via Serial or SNMP communications, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a driver to communicate with Miteq DVM100 DVBS Modulator. Communication to the modulator will be through SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device. Integrated browser access will be provided on the control surface.				
TRM #2.20.0	The NMCS bid shall be able to communicate with the Radyne DM240 DVBS Modulator via Serial protocol, providing direct monitor and control.	✓		
Bidder Response: MNC Software is currently integrated with the Radyne DM240 DVBS Modulator via the serial interface. All serial communication is provided through the DeviceMaster.				
TRM #2.20.1	The NMCS bid shall be able to communicate with the Radyne DM240 1:1 Redundancy Switch via Serial protocol, providing direct monitor and control.	✓		
Bidder Response: MNC Software is currently integrated with the Radyne DM240 1:1 Redundancy Switch via the serial interface. All serial communication is provided through the DeviceMaster.				
TRM #2.21.0	The NMCS bid shall be able to communicate with the Miteq RSU 1:1 Redundancy Switch via serial protocol, providing direct monitor and control.			✓

Bidder Response: MNC Software will generate a driver to communicate with the Miteq RSU 1:1 Redundancy Switch. All serial communication will be provided through the DeviceMaster. As part of the integration device specific display panels will be provided.				
TRM #2.22.0	The NMCS bid should provide the ability to control and monitor the Adtec Digital EN210 Multi-codec Encoder via GPIO, serial, IP and/or other means as allowed by the manufacturer.			✓
Bidder Response: MNC Software will generate a driver to communicate with the Adtech Digital EN210 Multi-codec Encoder via SNMP. The manufacture provides an SNMP interface for this encoder. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device. Integrated browser access will be provided on the control surface.				
TRM #2.23.0	The NMCS bid should be able to communicate with the Agilent E-Series Spectrum Analyzer via GPIB protocol, providing direct monitor and control.	✓		
Bidder Response: MNC Software is currently integrated with the Agilent E-Series Spectrum Analyzer using a serial protocol. All serial communication is provided through the DeviceMaster.				
TRM #2.24.0	The NMCS bid shall be able to communicate with the Hewlett Packard 8595E Spectrum Analyzer via Serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver configuration to communicate with the Hewlett Packard 8595E Spectrum Analyzer via the serial protocol. All serial communication is provided through the DeviceMaster.				
TRM #2.25.0	The NMCS bid shall be able to communicate with the Hewlett Packard 8590L Spectrum Analyzer via Serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver configuration to communicate with the Hewlett Packard 8590L Spectrum Analyzer via the serial protocol. All serial communication is provided through the DeviceMaster.				
TRM #2.26.0	The NMCS bid shall be able to communicate with the Quintech SRR-2150 16x1 L-Band Routing Switcher via SNMP protocol, providing direct monitor and control.	✓		
Bidder Response: MNC Software is currently integrated with the Quintech SRR-2160 16x1 L-Band router via SNMP.				

TRM #2.27.0	The NMCS bid shall be able to communicate with the Standard Communications MT-930 Satellite Receiver via Serial protocol, providing direct monitor and control.			✓
Bidder Response: MNC Software will generate a driver to communicate with the MT-930 Satellite Receiver via the serial protocol. All Serial communication is provided through the DeviceMaster				
TRM #2.28.0	The NMCS bid shall be able to communicate with the Sencore 3187A Modular Receiver Decoder via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.	✓		
Bidder Response: MNC Software is currently integrated with the Sencore MRD 3187A via SNMP.				
TRM #2.29.0	The NMCS bid shall be able to communicate with the Sencore 3187B Modular Receiver Decoder via SNMP and HTTP protocols, providing direct monitor and control via SNMP, and access to the integrated browser interface via http	✓		
Bidder Response: MNC Software is currently integrated with the Sencore MRD 3187B via SNMP.				
TRM #2.30.0	The NMCS bid should be able to communicate with the Xytronix Research & Design Control by Web X310 and X332 products via SNMP and HTTL protocol, providing direct monitor and control via SNMP, and access to the integrated browser interface via http.			✓
Bidder Response: All current devices connected to the X310 and X332 will be migrated to the Davicom. See system deployment section within the technical approach document for additional information. If the future use of current X310 and X332 devices are desired an SNMP integration will be provided. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #2.31.0	The NMCS bid should be able to communicate with the EECI (Electronic Energy Control, Inc.) ADC-16 analog to digital converter via serial protocol, providing direct monitor and control.	✓		
Bidder Response: All current devices connected the ADC-16 will be migrated to the Davicom. See system deployment section within the technical approach document for additional information.				

TRM #3.0	**Provide NMCS as Specified for NETC Television and Radio Facilities.**	**Existing Capabilities**	**In Development**	**Customized for NETC**
TRM #3.1.0	The NMCS bid shall provide the ability to control and monitor the NETC Television and Radio Facilities.			✓
Bidder Response:				

While Mosaic supports a good number of the interfaces required to monitor and control all the equipment out-of-the-box, some customization is required.				
TRM #3.2.0	The NMCS bid shall have the ability to communicate with facilities equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		
Bidder Response: All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.				
TRM #3.3.0	The NMCS bid shall have the ability to communicate with facilities equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		
Bidder Response: Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.				
TRM #3.4.0	The NMCS bid shall have the ability to communicate with facilities equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		
Bidder Response: Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.				
TRM #3.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to facilities equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		
Bidder Response: Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:				

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;
- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM #3.6.0	The NMCS bid should be able to communicate with the Lieberts HVAC systems via SNMP protocol, providing direct monitor and control.	✓		

Bidder Response:

Monitor and control of HVAC systems will be provided through the Davicom Cortex system.

TRM #3.7.0	The NMCS bid should be able to communicate with the Cummins/Onan generators, providing direct monitoring.	✓		

Bidder Response:

Monitor and control of Cummins/Onan generators will be provided through the Davicom Cortex system.

TRM #3.8.0	The NMCS bid shall be able to communicate with various models of APC UPS systems via SNMP protocol, providing direct monitor and control, and access to the integrated browser interface via http.	✓		

Bidder Response:

MNC Software is currently integrated with the APC UPS systems via SNMP. Integrated browser access will be provided on the control surface

TRM #3.9.0	The NMCS bid shall be able to communicate with various models of Best Power UPS systems via SNMP protocol, providing direct monitor and control, and access to the integrated browser interface via http.	✓		

Bidder Response:

MNC Software is currently integrated with the Best Power UPS systems via SNMP. Integrated browser access will be provided on the control surface

TRM #3.10.0	The NMCS bid shall be able to communicate with various models of Powerware UPS systems via SNMP protocol, providing direct monitor and control, and access to the integrated browser interface via http.	✓		

Bidder Response:

MNC Software is currently integrated with the Powerware UPS systems via SNMP. Integrated browser access will be provided on the control surface

TRM #3.11.0	The NMCS bid should be able to communicate with the Pelco DX4800 security camera systems, providing direct monitor and control. NET is looking to modernize its existing outdated analog security camera system, bidder should provide a list of specified solution currently supported security camera systems.			✓

Bidder Response:

MNC Software can provide direct monitoring of the Pelco DX4800 through the web interface. Mosaic has also supported multiple IP security cameras that generate H264 and Motion JPEG. PTZ cameras have also been supported through the Davicom. We do not directly recommend any specific camera systems, but can integrate with the camera system of NET's choice.

TRM #3.12.0	The NMCS bid should be able to communicate with the HID security door system, providing direct monitor and control.			✓

Bidder Response:

MNC Software has had no prior experience integrating with the HID security system. MNC Software has contacted the manufacturer to identify possible integration with the system. MNC Software will work with HID and NET to identify monitor and control requirements and facilitate integration. Please see the device adapter layer portion of the technical approach for details on our flexible driver platform.

TRM #3.13.0	The NMCS bid should be able to communicate with the Vesda Fire detection systems, providing direct monitoring.			✓

Bidder Response:

MNC Software will provide integration with Vesda Fire detection system via their web server. Utilizing Vesda Connect, alerts will be sent to Mosaic via standard email protocol.

TRM #4.0	Provide NMCS as Specified for NETC Television and Radio Terminal Equipment and Production Matrix Routing Switcher Systems	Existing Capabilities	In Development	Customized for NETC
TRM #4.1.0	The NMCS bid should have provisions for future expandability to provide control and monitoring of the NETC Television and Radio Terminal Equipment and Production Matrix Routing Switcher Systems. The future expandability provision should allow for control and monitoring of existing and future equipment for the NETC Television and Radio Terminal Equipment and Production Matrix Routing Switcher Systems.	✓		

Bidder Response:

Mosaic provides an open system that allows expandability through configuration on the graphical workflow as well as in device integration. MNC Software delivers base set of configurable protocols that can be utilized for current and future equipment. New protocols and standards are implemented and provided as they are adopted. Any new integration is provided as part of maintenance. The open platform also provides the ability for custom integration and behavior to be created outside of adoption of new standards. New workflows and custom panel displays can be created to support any desired control and monitoring situation.

TRM #4.2.0	The NMCS bid shall have the ability to communicate with terminal and routing switcher equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		
Bidder Response: All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.				
TRM #4.3.0	The NMCS bid shall have the ability to communicate with terminal and routing switcher equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		
Bidder Response: Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.				
TRM #4.4.0	The NMCS bid shall have the ability to communicate with terminal and routing switcher equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		
Bidder Response: Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.				

TRM #4.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to terminal and routing switcher equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		
Bidder Response: Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:				

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;
- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM #4.6.0	The NMCS bid should be able to communicate with Evertz 7700FR and 7800FR Frames via SNMP and GPI/GPO communications, providing monitor and control of frame and module status.		✓	

Bidder Response:

MNC Software is integrated with the Evertz 7700FR Frame via SNMP. Integration with the Evertz 7800FR frame is in progress with another customer including multiple cards.

TRM #4.7.0	The NMCS bid should be able to communicate with various Evertz 7700 and 7800 modules via ethernet communications, providing monitor and control utilizing SNMP, or access via Evertz Vistalink proprietary NMS.		✓	

Bidder Response:

MNC Software is already integrated with multiple Evertz modules via SNMP. Additional cards are currently be added and will also be added for this system if not already present. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.

TRM #4.8.0	The NMCS bid should be able to communicate with the Utah Scientific UTAH-300 analog matrix routing switcher.			✓

Bidder Response:

MNC Software will provide a driver for communicating with the UTAH-300 binary protocol. This assumes that the SC-3 or SC-4 control system is installed. In the case the SC-3 system is installed RS232 connection will be made through the DeviceMaster. The SC-4 supports direct ethernet connections, which would be used if installed. Both support the same protocol and will require no additional work to support one or both.

TRM #4.9.0	The NMCS bid should be able to communicate with the Grass Valley Venus Wideband digital matrix routing switcher.			✓

Bidder Response:

MNC Software will generate a driver for the Grass Valley native protocol used by the Venus digital matrix routing switcher.

TRM #4.10.0	The NMCS bid should be able to communicate with the Imagine Communications Platinum VX 3G Digital matrix routing switcher.			✓
Bidder Response: MNC Software will generate a driver for the LRC TCP protocol used by the Platinum VX matrix routing switcher.				
TRM #4.11.0	The NMCS bid should be hardware and media agnostic, that is able to provide routing switcher control for the routing switchers referred to in section 4.8, 4.9, and 4.10. As well as IP based layer 2 and layer 3 ethernet switches which comply with Professional Media Over Managed IP Networks suite of standards such as SMPTE ST2022, and ST2110.	✓		
Bidder Response: Mosaic is fully hardware and media agnostic. Mosaic's open development platform provides the ability to integrate with any number of devices indirectly through controllers or directly through device APIs. Mosaic will interface with all present switchers through their controller or directly to provide the needed switching ability				
TRM #4.11.1	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the routing switchers through a series of mapping tables in order to create a "Hybrid" routing switcher made up of gateways, processors, and converters providing logical signal flow between systems and end-to-end service level events.	✓		
Bidder Response Mosaic's open development platform provides the ability to create completely custom workflows and display panels to provide the switching control interface required. Custom mapping tables or meta routing data can be stored and utilized by the display panels and automation scripts to provide the required context for complex routing actions. There are multiple locations held within the Mosaic system that the mapping data can be stored and would be chosen depending on how and how often the mapping tables are updated. Mosaic also provides a separate topology configuration that allows the system to map out the flow of devices in the system separate from their individual implementation.				
TRM #4.11.2	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the routing switchers through both software and hardware panels. Panels should be capable of full X-Y switching, limited X-Y switching, and button-per-source switching.	✓		
Bidder Response; Through Mosaic's open display panel system, software panels for router switching are fully available. Through the integration with hardware switching panel controllers or direct GPIO through the Davicom, Mosaic can control and be controlled. Mosaic's automation layer and complex event process engine can be used to trigger automatic actions based on button selection.				
TRM #4.11.3	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the existing Grass Valley CP300 and CP328 hardware panels. Panels should be capable of full X-Y switching, limited X-Y switching, and button-per-source switching where applicable.			✓
Bidder Response: MNC Software will provide a driver for the VM3000 and SI3000 controllers. Through these controllers Mosaic will be able to control the Grass Valley CP300 and CP328. Switching panels, made with our panel editor system, will be provided to cover the desired displays.				
TRM #5.0	**Provide NMCS as Specified for NETC Television and Radio Master Control, Production Studios and Remote Systems.**	**Existing Capabilities**	**In Development**	**Customized for NETC**

TRM #5.1.0	The NMCS bid should have provisions for future expandability to provide control and monitoring of the NETC Television and Radio Master Control, Production Studios and Remote Systems. The future expandability provision should allow for control and monitoring of existing and future equipment for the NETC Television and Radio Remote Systems.	✓		

Bidder Response:

Mosaic provides an open system that allows expandability through configuration on the graphical workflow as well as in device integration. MNC Software delivers base set of configurable protocols that can be utilized for current and future equipment. New protocols and standards are implemented and provided as they are adopted. Any new integration is provided as part of maintenance. The open platform also provides the ability for custom integration and behavior to be created outside of adoption of new standards. New workflows and custom panel displays can be created to support any desired control and monitoring situation.

TRM #5.2.0	The NMCS bid shall have the ability to communicate with Master Control, Production Studios and Remote Systems equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		

Bidder Response:

All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.

TRM #5.3.0	The NMCS bid shall have the ability to communicate with Master Control, Production Studios and Remote Systems equipment via IP, TCP, UDP, HTTP, SNMP, FTP, and Telnet protocols using ethernet communications. Bidder should specify exactly how ethernet communications and IP protocols will be established, administered, maintained, and operated.	✓		

Bidder Response:

Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.

TRM #5.4.0	The NMCS bid shall have the ability to communicate with Master Control, Production Studios and Remote Systems equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		

Bidder Response:

Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.

TRM #5.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to Master Control, Production Studios and Remote Systems equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		

Bidder Response:

Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;
- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM # 5.6.0	The NMCS bid should have the ability to respond to SNMP traps sent from the Imagine Communications Version Integrated Video Server (Channel-in-a-box).			✓

Bidder Response:

MNC Software will provide configuration for the processing traps from the Imagine Communication Versio Video Server.

TRM #5.7.0	The NMCS bid should be able to communicate with the Sage Digital Endec EAS Encoder/Decoder Model 3644 via 10/100 Base-T LAN protocol, providing monitor and control and access to the integrated browser interface via http.			✓

Bidder response:

MNC Software will generate a driver to work directly with the web browser interface of the Sage Digital Endec 4644. Direct GPIO integration will be made through a Davicom unit. With the generation of the driver all device type displays will be provided.

TRM #5.8.0	The NMCS bid should be able to communicate with the Euphonix System 5 Audio Mixing Console via EuCon/SNMP protocol, providing monitor and control.			✓

Bidder Response:

MNC Software will provide a configuration for communicating with the Euphonix System 5 Audio Mixing Console via SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.

TRM # 5.9.0	The NMCS bid should be able to communicate with the Grass Valley Kayak HD and Karrera/K-Frame Vision Mixer, providing monitor and control.			✓
Bidder Response: MNC Software will provide two options for connecting to the Kayak HD and Karrera/K-Frame Vision Mixer. A driver will be provided to communicate directly with the devices over Serial using the AMP protocol. Both devices also support connecting to a Grass Valley Jupiter control system, which is already supported in the previous requirement. Either connection type can be used depending on desired deployment.				
TRM #5.10.0	The NMCS bid should be able to communicate with the Vizrt Treo Graphics System via SNMP protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration for communicating with the Vizrt Treo Graphics System via SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.11.0	The NMCS bid should be able to communicate with the AVID Thunder Video Server System, providing monitor and control.			✓
Bidder Response: MNC Software will control the AVID Thunder Video Server System through the current switcher setup. General health and status will be provided via Mosaics standard software system monitoring. Desired file transfer automation will be handled through Mosaics built-in file transfer protocol drivers. With any standard use of Mosiacs file transfer protocol drivers additional status will be provided on success and failures of transfers.				
TRM #5.12.0	The NMCS bid should be able to communicate with the Grass Valley Summit K2 Video Server System, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration for monitoring and controlling the Summit K2 Video Server over SNMP. In addition to SNMP a file transfer configuration will be provided to allow automation to be created for transferring files to and from the Summit K2 Video server. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.13.0	The NMCS bid should be able to communicate with the EVS XT3 System via Truck Manager proprietary EVS protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver for the EVS protocol to communicate with the XT3 System.				

TRM #5.14.0	The NMCS bid should I be able to communicate with the Harris Predator Multiviewer System via SNMP protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration for monitoring and controlling the Harris Predator Multiviewer System via SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.15.0	The NMCS bid should be able to communicate with the Grass Valley Trinix NXT Multiviewer, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration for monitoring and controlling the Grass Valley Trinix NXT Multiviewer via SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.16.0	The NMCS bid should be able to communicate with the Bosch (RTS / Telex) Intercom System, providing monitor and control.			✓
Bidder Response: MNC Software has had no prior experience integrating with the Bosch (RTS / Telex) Intercom Systems. MNC Software will work with NET and the manufacturer to identify monitor and control requirements and integration availability.				
TRM #5.17.0	The NMCS bid should be able to communicate with the Grass Valley LDK3000 Camera System, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver to communicate with Grass Valley C2IP supported Camera Systems through a Grass Valley LDK gateway. Depending on the setup Mosaic can also provide camera control through the Kayak HD / Karrera systems.				
TRM #5.18.0	The NMCS bid should be able to communicate with the Grass Valley LDK80 and LDX86N Camera System, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver to communicate with Grass Valley C2IP supported Camera Systems through a Grass Valley LDK gateway. Depending on the setup Mosaic can also provide camera control through the Kayak HD / Karrera systems.				
TRM #5.19.0	The NMCS bid should be able to communicate with the AJA FS2 Frame Synchronizer System, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver to communicate with the AJA FS2 Frame Synchronizer System through its embedded web server.				

TRM #5.20.0	The NMCS bid should be able to communicate with the For-A FA-9500, 9520, and 505 Frame Synchronizer Systems, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration to communicate with the For-A FA-9500, 9520, and 505 through SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.21.0	The NMCS bid should be able to communicate with the For-A FVW5-00HS Telestrator via SNMP protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration to communicate with the For-A FVW5-00HS Telestrator using SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.22.0	The NMCS bid should be able to communicate with the Atomos Shogun Studio via serial RS422 and ethernet connection for using AMP protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver for communicate with the Atomos Shogun Studio via the AMP protocol. All serial connections will be made through the DeviceMaster.				
TRM #5.23.0	The NMCS bid should be able to communicate with the ETC Express 48/96 Lighting Board System via DMX protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a DMX protocol driver to communicate with the ETC Express 48/96 Lighting Board.				
TRM #5.24.0	The NMCS bid should be able to communicate with the Newtec Tricaster Model 460 and Model 8000 Vision Mixer via serial protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a driver to communicate with the Newtec Tricaster 460 and 8000 over serial. All serial connections will be made through the DeviceMaster				

TRM #5.25.0	The NMCS bid should be able to communicate with the Broadcast Pix Slate-HD Vision Mixer System via VDCP protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a VDCP protocol driver to communicate with the Broadcast Pix Slate-HD Vision Mixer.				

TRM #5.26.0	The NMCS bid should be able to communicate with the Yamaha 02V96 Audio Mixing Console via MIDI protocol, providing monitor and control.			✓
Bidder Response: MNC Software will provide a MIDI protocol driver to communicate with the Yamaha 02V96 Audio Mixing Console. MIDI support can be provided natively through the Mosaic system, but requires a serial or ethernet conversion device to provide the proper format.				
TRM #5.27.0	The NMCS bid should be able to communicate with the Image Video TSI3000 Tally System, providing monitor and control.			✓
Bidder Response; MNC Software will create a driver to communicate to the TSI-3000 Tally System over TCP using the TSL v3.1 protocol.				
TRM #5.28.0	The NMCS bid should be able to communicate with the Tektronix SPG8000 Master Clock/Sync System, providing monitor and control.			✓
Bidder Response: MNC Software will provide a configuration to communicate with the Tektronix SPG8000 using SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.29.0	The NMCS bid should be able to communicate with the Grass Valley Trinix Wideband digital matrix routing switcher.			✓
Bidder Response: MNC Software will provide a configuration to communicate with the Grass Valley Trinix Wideband digital matrix routing switcher using SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.29.1	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the routing switchers through a series of mapping tables in order to create a "Hybrid" routing switcher made up of gateways, processors, and converters providing logical signal flow between systems and end-to-end service level events.	✓		

Bidder Response: Mosaic's open development platform provides the ability to create completely custom workflows and display panels to provide the switching control interface required. Custom mapping tables or meta routing data can be stored and utilized by the display panels and automation scripts to provide the required context for complex routing actions. There are multiple locations held within the Mosaic system that the mapping data can be stored and would be chosen depending on how and how often the mapping tables are updated. Mosaic also provides a separate topology configuration that allows the system to map out the flow of devices in the system separate from their individual implementation.				
TRM #5.29.2	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the routing switchers through both software and hardware panels. Panels should be capable of full X-Y switching, limited X-Y switching, and button-per-source switching.	✓		
Bidder Response; Through Mosaic's open display panel system, software panels for router switching are fully available. Through the integration with hardware switching panel controllers or direct GPIO through the Davicom, Mosaic can control and be controlled. Mosaic's automation layer and complex event process engine can be used to trigger automatic actions based on button selection.				
TRM #5.29.3	The NMCS bid should be able to provide a routing switcher control system which should be capable of controlling the existing and additional Grass Valley CP300, CP330, CP328 and SXY hardware panels. Panels should be capable of full X-Y switching, limited X-Y switching, and button-per-source switching where applicable.			✓
Bidder Response: MNC Software will provide a driver for the VM3000 and SI3000 controllers. Through these controllers Mosaic will be able to control the Grass Valley CP300, CP330, CP328, and SXY. Switching panels, made with our panel editor system, will be provided to cover the desired displays.				
TRM #5.30.0	The NMCS bid should provide the ability to control and monitor the Broadcast Electronics' AudioVAULT system via GPIO, serial data (where applicable) and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response; AudioVAULT provides various features using different communication mechanism all of which are supported by Mosaics driver system. MNC Software will provide driver configuration for communicating with the AudioVAULT via Email and RS232 as well as GPIO through the Davicom.				
TRM #5.31.0	The NMCS bid should provide the ability to control and monitor the Broadcast Electronics' AVFlex automation and playout system via GPIO, serial data (where applicable) and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: AVFlex provides various features using different communication mechanism all of which are supported by Mosaics driver system. MNC Software will provide driver configuration for communicating with AVFlex via Email and RS232 as well as GPIO through the Davicom.				

TRM #5.32.0	The NMCS bid should provide the ability to control and monitor the Broadcast Tools Streaming Sentinel 4 via GPIO, SNMP, and access to the integrated browser interface via http, and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response; MNC Software will provide a driver configuration for communicating with the Sentinel 4 via SNMP. If additional communication types are required configuration can be provide to access the web interface or communication via GPIO through the Davicom. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.33.0	The NMCS bid should provide the ability to control and monitor the Broadcast Tools WVRC-8 Dial-up Remote Control System via GPIO, SNMP, and access to the integrated browser interface via http, and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software will provide a driver configuration for communicating with the WVRC-8 Recmote Control System via SNMP. If additional communication types are required configuration can be provide to access the web interface or communication via GPIO through the Davicom. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				
TRM #5.34.0	The NMCS bid should provide the ability to control and monitor the International Datacasting Pro Audio EXP Satellite Receiver via GPIO, SNMP, and access to the integrated browser interface via http, and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software will provide a driver to communicate to the Audio EXP Satellite Receiver via the manufactures RS232 ASCII interface. If an SNMP MIB configuration is provided MNC Software will provide SNMP access to the satellite receiver. All serial connections will be made through the DeviceMaster.				
TRM #5.35.0	The NMCS bid should provide the ability to control and monitor the International Datacasting SR2000 Pro Satellite Receiver via GPIO, SNMP, and access to the integrated browser interface via http, and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software will provide a driver to communicate to the SR2000 Pro Satellite Receiver via the manufactures RS232 ASCII interface. If an SNMP MIB configuration is provided MNC Software will provide SNMP access to the satellite receiver. All serial connections will be made through the DeviceMaster.				

TRM #5.36.0	The NMCS bid should provide the ability to control and monitor the Nautel HD Radio Importer Plus via GPIO, SNMP and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software has not previously integrated with the Nautel HD Radio Importer Plus, but has a working relationship with Nautel. MNC Software will work with Nautel and NET to identify the best integration interface available and provide the desired control and monitor capability.				
TRM #5.37.0	The NMCS bid should provide the ability to control and monitor the Nautel HD Radio Exporter Plus via GPIO, SNMP and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software has not previously integrated with the Nautel HD Radio Exporter Plus, but has a working relationship with Nautel. MNC Software will work with Nautel and NET to identify the best integration interface available and provide the desired control and monitor capability.				
TRM #5.38.0	The NMCS bid should be able to communicate with the Sage Digital Endec EAS Encoder/Decoder Model 3644 via 10/100 Base-T LAN protocol, providing monitor and control, and access to the integrated browser interface via http.			✓
Bidder Response: MNC Software will generate a driver to work directly with the web browser interface of the Sage Digital Endec 4644. Direct GPIO integration will be made through a Davicom unit. With the generation of the driver all device type displays will be provided.				

TRM #5.39.0	The NMCS bid should provide the ability to control and monitor the Telos Pathfinder Routing Control Software Suite via GPIO, serial and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software will provide a driver to communicate with the Telos Pathfinder Routing Control Software Suite using the manufactures email alerts and GPIO triggers. All GPIO will be handled thought the Davicom. See device adapter layer section of the technical approach for further information on how communication is handled for drivers.				
RM #5.40.0	The NMCS bid should provide the ability to control and monitor the Telos ZIP/One IP Audio Link via GPIO, HTTP and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response:				

MNC Software will provide a driver to communicate with the Telos ZIP/One IP Audio Link through their web interface (HTTP). See device adapter layer section of the technical approach for further information on how communication is handled for drivers.				
TRM #5.41.0	The NMCS bid should provide the ability to control and monitor the Moseley Startlink 9003Q Microwave STL via GPIO, serial and/or other means allowed by manufacturer. Bid response should specify exactly how communications will be established, administered, maintained, and operated.			✓
Bidder Response: MNC Software will provide a driver to communicate with the Moseley Starlink 9003Q through the manufactures RS232 interface. All serial connections will be made through the DeviceMaster. See device adapter layer section of the technical approach for further information on how communication is handled for drivers.				

TRM #6.0	Provide NMCS as Specified for NETC Television and Radio Web Services and IT Networking Systems	Existing Capabilities	In Development	Customized for NETC
TRM #6.1.0	The NMCS bid should have provisions for future expandability to provide control and monitoring of the NETC Television and Radio Web Services and IT Networking Systems. The future expandability provision should allow for control and monitoring of existing and future equipment for the NETC Television and Radio Web Services and IT Networking Systems.	✓		
Bidder Response: Mosaic provides an open system that allows expandability through configuration on the graphical workflow as well as in device integration. MNC Software delivers base set of configurable protocols that can be utilized for current and future equipment. New protocols and standards are implemented and provided as they are adopted. Any new integration is provided as part of maintenance. The open platform also provides the ability for custom integration and behavior to be created outside of adoption of new standards. New workflows and custom panel displays can be created to support any desired control and monitoring situation.				
TRM #6.2.0	The NMCS bid shall have the ability to communicate with NETC Web Services and IT Networking Systems equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		
Bid Response: All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.				
TRM #6.3.0	The NMCS bid shall have the ability to communicate with NETC Web Services and IT Networking Systems equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		
Bidder Response; Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages				

ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.				
TRM #6.4.0	The NMCS bid shall have the ability to communicate with NETC Web Services and IT Networking Systems equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		
Bidder Response; Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.				
TRM #6.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to NETC Web Services and IT Networking Systems equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.	✓		
Bidder Response: Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features: • Resolution: 12 bits; • Bipolar/Differential; • Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC; • 4-20mA input mode jumper selectable; • Impedance = 1 MΩ; • Audio Rectifier: software selectable. Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.				
TRM #6.6.0	The NMCS bid should be able to communicate with the Imagine Communications (Digital Rapids) Broadcast Manager Streaming Scheduler, providing monitor and control, and access to the integrated browser interface via http.			✓
Bidder Response; MNC Software will provide a driver to communicate with the Broadcast Manager through the web interface (HTTP).				
TRM #6.6.1	The NMCS bid should be able to communicate with the Imagine Communications (Digital Rapids) SelinoFlex Live and StreamZ Streaming Encoders, providing monitor and control, and access to the integrated browser interface via http.			✓
Bidder Response:				

MNC Software will provide a driver to communication with the SelinoFlex Live and StreamZ Streaming Encoders through the http interface.				
TRM #6.7.0	The NMCS bid should be able to communicate with the NETC Nagios Core and Nagios Network Analyzer software systems, providing monitor and control for network infrastructure and alerting for servers, switches, applications and services.			✓
Bidder Response: MNC Software will provide a driver to communicate with Nagios Core and Network Analyzer through SNMP and Web CGI. Nagios Core uses web CGI as its general interface, but many plugins including the Network Analyzer provide SNMP support. Both will be provided to support the full set of features needed for the project.				
TRM #6.8.0	The NMCS bid should be able to communicate with the NETC Solarwinds Network Analyzer software systems, providing monitor and control for network infrastructure.			✓
Bidder Response: MNC Software will provide a driver to communicate with Solarwinds via HTTP and SNMP.				
TRM #6.9.0	The NMCS bid should be able to communicate with the NETC KACE enterprise systems inventory, ticketing system, providing intractability between the NMCS and the KACE system.			✓
Bidder Response: MNC Software will create an integration with the KACE enterprise ticketing system. Mosaic contains a pluggable ticketing system that allows the system to create, update and view tickets automatically or manually. Currently the ticketing system has a plugin and configuration for the Remedy ticketing system. A new plugin and configuration will be created to work with the KACE enterprise ticketing system.				
TRM #6.10.0	The NMCS bid should be able to communicate with the NETC Snort IPS (intrusion prevention system), providing intractability between the NMCS and the Snort system.			✓
Bidder Response: MNC Software will provide a driver configuration to communicate with the Snort IPS system via SNMP. Snort provides multiple plugins that allow various sets of communication protocols. SNMP is seen as simplest integration type, but with Mosaic open driver architecture various other types of integrations can be provided as needed.				

TRM #7.0	**Provide NMCS as Specified for NETC Government Services Audio-Video Systems.**	**Existing Capabilities**	**In Development**	**Customized for NETC**
Bidder Response:				

TRM #7.1.0	The NMCS bid should have provisions for future expandability to provide control and monitoring of the NETC Government Services Audio-Video Systems. The future expandability provision should allow for control and monitoring of existing and future equipment for the NETC Government Services Audio-Video Systems.	✓		
Bidder Response: Mosaic provides an open system that allows expandability through configuration on the graphical workflow as well as in device integration. MNC Software delivers base set of configurable protocols that can be utilized for current and future equipment. New protocols and standards are implemented and provided as they are adopted. Any new integration is provided as part of maintenance. The open platform also provides the ability for custom integration and behavior to be created outside of adoption of new standards. New workflows and custom panel displays can be created to support any desired control and monitoring situation.				
TRM #7.2.0	The NMCS bid shall have the ability to communicate with NETC Government Services Audio-Video Systems equipment via serial RS232, RS422, and RS485 protocol. Bidder should specify exactly how serial communications will be established, administered, maintained, and operated.	✓		
Bidder Response: All RS232, RS422, and RS485 devices will be connected to a Comtrol DeviceMaster. This device provides software selectable RS232/RS422/RS485 ports that allow communication over a standard IPV4 or IPV6 network. Mosaic will communicate through the DeviceMaster using TCP connections. Any new equipment requiring use of serial communication can be plugged into the DeviceMaster, configured via a web interface and then accessed directly from Mosaic. See system deployment section within the technical approach document for additional information.				
TRM #7.3.0	The NMCS bid shall have the ability to communicate with NETC Government Services Audio-Video Systems equipment via IP, TCP, UDP, HTTP, SNMP, FTP, Telnet and Networked Media Open Specifications protocols. Bidder should specify exactly how ethernet communications will be established, administered, maintained, and operated.	✓		
Bidder Response: Mosaic out of the box provides configurable drivers to support IP based communication including TCP, UPD, HTTP, SNMP, SOAP, REST, FTP, Telnet and multiple proprietary protocols. Mosaic's open driver architecture allows the creation and installation of new drivers with no downtime to the system. The system typically auto manages ethernet based communication and can also be manually managed through our GUI. See device adapter layer section within the technical approach for additional details.				
TRM #7.4.0	The NMCS bid shall have the ability to communicate with NETC Government Services Audio-Video Systems equipment GPI and GPO interfaces. Bidder should specify exactly how parallel discrete GPI and GPO communications will be established, administered, maintained, and operated. The proposed system shall be able to support single and multiple bit drivers for alarm, status, and command functions as provided by discrete connections.	✓		
Bidder Response; Mosaic has drivers for a number of discrete IO devices. For the NETC proposal MNC Software intends to replace the existing IOLink hardware with Davicom Cortex 360 units. For sites requiring > 16 GPIOs additional MEXM units will be provided to cover the required number of discrete connections. Both Mosaic and the Cortex 360 support the ability to combine 1 or more inputs and outputs to drive alarms, status and commands. Mosaic utilizes conditional alarming and derived expressions to calculate multi-bit alarms and status, while commanding can drive multiple outputs in a single command. Likewise the Cortex uses virtual logic gates to combine inputs and drive multiple outputs to achieve the same functionality.				
TRM #7.5.0	The NMCS bid shall have the ability to display analog measurements from direct connection to NETC Government Services Audio-Video Systems equipment providing analog contacts. Bidder should specify exactly how analog measurements will be established, administered, maintained, and operated. The proposed system should be able to support drivers for analog measurements	✓		

	of percentage, amps, milliamps, micro amps, degrees-Fahrenheit, volts, kilovolts, psi, ratio, threshold, and watts as provided by discrete analog connections.			

Bidder Response:

Mosaic accesses and displays analog measurements directly from the Cortex 360 which provides the reading via SNMP. The Cortex provides the following analog measurements features:

- Resolution: 12 bits;
- Bipolar/Differential;
- Selectable ranges: 0.5, 2.5, 5, 10, 20, 40 & 80 VDC;
- 4-20mA input mode jumper selectable;
- Impedance = 1 MΩ;
- Audio Rectifier: software selectable.

Analog measurements support a transform function within the cortex unit to convert the raw measured value into an engineering value. In additional, units can be applied to the value to convey scale. Finally all values received by Mosaic support a similar conversion process allowing the raw input values to be calibrated based on a user defined expression.

TRM #7.6.0	The NMCS bid should be able to communicate with the Crestron Pro2 Controller via SNMP, providing monitor and control.			✓

Bidder Response:

MNC Software will provide a configuration to communicate with the Crestron Pro2 Controller via SNMP. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.

TRM #7.7.0	The NMCS bid should be able to communicate with the Yamaha DME 64/24 Audio Processor via ethernet and/or serial protocol, providing monitor and control.			✓

Bidder Response:

MNC Software will provide a driver to communicate with the Yamaha DME 64/24 Audio Processor via serial. All serial connections will be made through the DeviceMaster.

TRM #7.8.0	The NMCS bid should be able to communicate with Evertz 7700FR and 7800FR Frames via SNMP and GPI/GPO communications, providing monitor and control of frame and module status.		✓	

Bidder Response:

MNC Software is integrated with the Evertz 7700FR Frame via SNMP. Integration with the Evertz 7800FR frame is in progress with another customer including multiple cards.

TRM #7.9.0	The NMCS bid should be able to communicate with various Evertz 7700 and 7800 modules via ethernet communications, providing monitor and control utilizing SNMP, or access via Evertz Vistalink proprietary NMS.		✓	

Bidder Response: MNC Software is already integrated with multiple Evertz modules via SNMP. Additional cards are currently be added and will also be added for this system is not already present. Mosaic is shipped with a configurable SNMP driver and a SNMP graphical MIB generator. Communication with any SNMP device is a simple task of using the MIB generator to create a configuration that will communicate with the device.				