



# Network Management System Overview DIRECTV® MFH3™ Platform



## Introduction

This document provides an overview of the Network Management System (NMS) which provides NOC (Network Operation Center) monitoring and remediation support to DIRECTV system operators aka PCOs (Private Cable Operators) serving the MDU (Multi Dwelling Unit) market via DIRECTV's MFH3 platform.

Convergent Media Systems is a business unit of Thomson, Inc. with 24x7 NOC and Help Desk facilities located in Alpharetta, GA. Convergent supports an installed base of over (70) networks comprising more than 35,000 sites and over 400,000 viewing locations in support of video applications such as business television, interactive distance learning, networked digital signage, and digital cinema advertising.

DIRECTV and Thomson, Inc. have introduced an exciting new IP video distribution technology enabling delivery of all DIRECTV programming and services using existing in-building wiring, such as Fiber, Ethernet Cat5e, Cat3, and Coaxial cable plant. (See Figure 1)

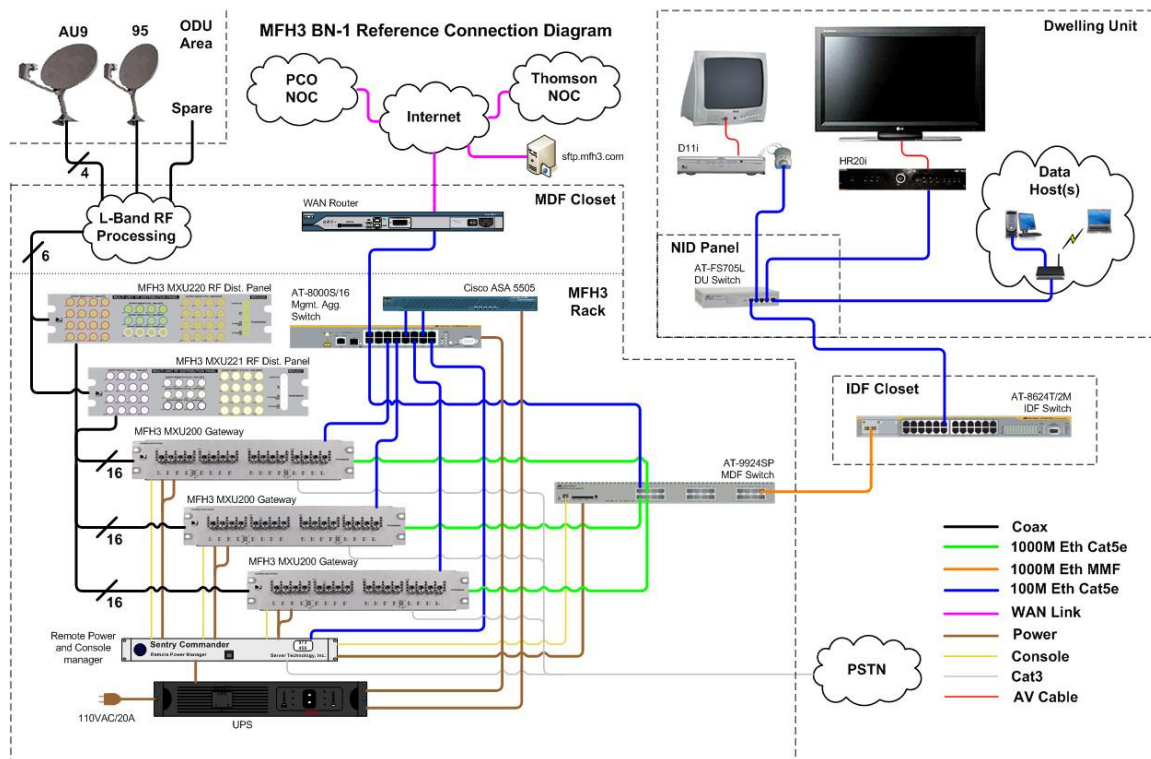


Figure 1: Fundamental Headend Design

## Comprehensive Services Offering

Thomson through its Convergent Media Systems (Convergent) business unit offers MDU and Commercial Operators a bundled services package to fully support the MFH3 IP Platform. From its state-of-the-art Network Operations Center, Convergent monitors the status of each network 24x7. All network-managed devices that reside at a property including IP Gateways, Layer 2, and Layer 3 Ethernet switches are continuously monitored over a secure VPN connection. If trouble occurs, alarms alert highly trained technicians who quickly investigate the matter.

As an added benefit, the system operator has the ability to view the current state of all MFH3 systems deployed at their properties from anywhere via the Internet. If necessary, a Level 2 help desk session can be initiated providing direct access by the operator to live technical support. As well, detailed network management reports can be prepared for review by the operator providing valuable network performance data.

Other MFH3 Platform services include:

- Web portal access to property-specific system configurations, documentation, and equipment inventory data
- MFH3.com access to software maintenance releases and software patches
- Depot Level Support (optional) including the maintenance of an operator-specific spares pool with overnight shipment of spares and Repair & Replace service
- Field Maintenance Support (optional) including service technician dispatch according to an individualized Service Level Agreement *or* on a Time and Materials basis.
- Premium MFH3.com (optional) access to new software version release upgrades



## Equipment Redundancy

The system's standard equipment configuration includes some measure of redundancy such as:

- System Gateways designed with redundant power supplies
- 1500VA UPS

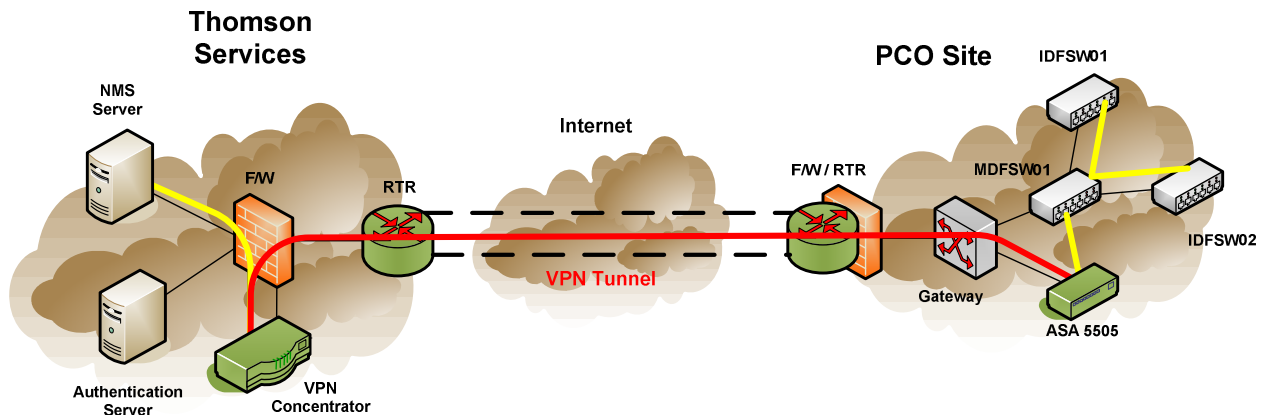
Optional equipment for increased redundancy and reliability includes:

- Video service redundancy is supported with the addition of a fourth gateway
- A redundant power supply for the MDF Layer 3 managed switch
- A Remote Console/Power Manager including the Sentry Commander PT-40 Remote Console/Power Manager, V.90 modem module, and 3-serial port adaptor
- Environmental monitoring equipment including ambient temperature, humidity, and airflow sensors

## Connectivity

Connectivity between the Convergent NOC and each MFH3 system is facilitated by a pre-configured Cisco ASA 5505 VPN device.

The individual IP-addressing characteristics at each property are considered when configuring the VPN connection. (See Figure 2)



**Figure 2: NOC/MFH3 Headend Connectivity Design**

## Theory of Operation

The NMS is designed according to industry best practices and approaches encompassed by the OSI model for network management, which is sometimes referred to as the FCAPS model. The five facets of network management included in the FCAPS model are:

- Fault management
- Configuration management
- Accounting management
- Performance management
- Security management

The NMS is designed to support two types of automated operations:

- Trap monitoring
- Periodic report collection

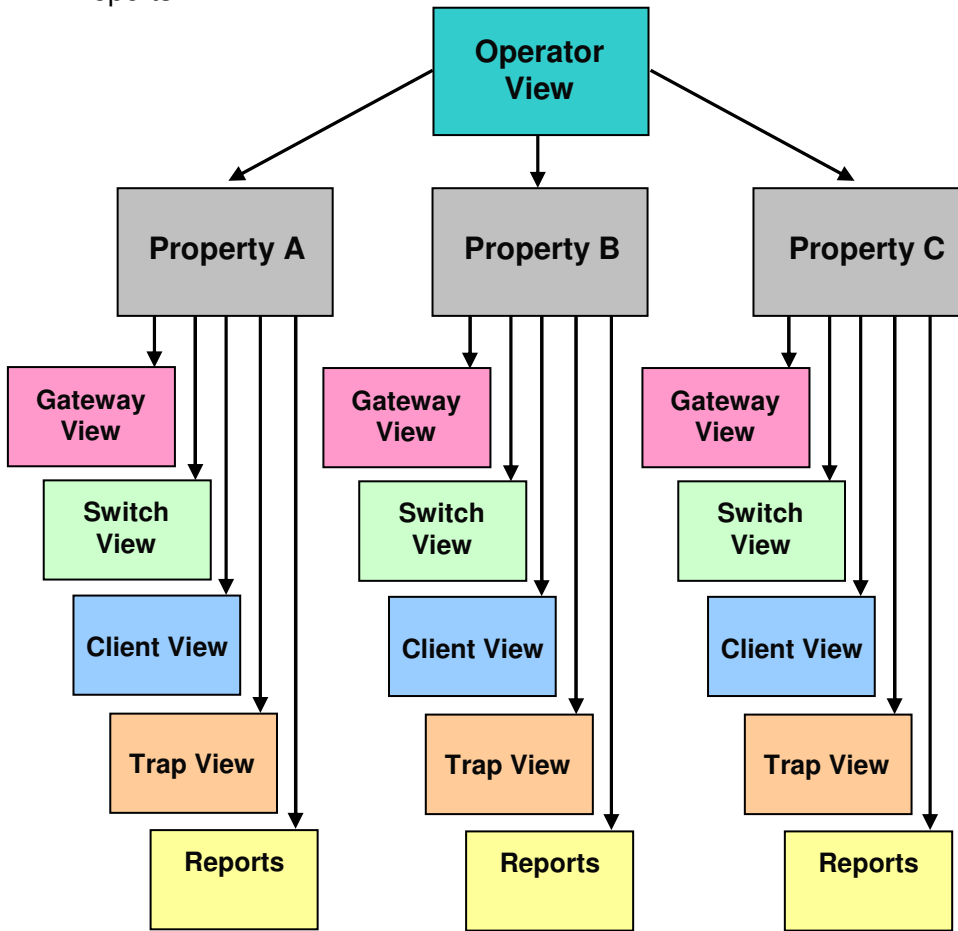
Both types of operations require small amounts of data to be stored. The amount of data expected to be collected per day is less than 500 bytes per system. Manual operations are initiated due to the following events:

- Response to a trap event
- Troubleshooting due to a failed report collection
- Validation of new software delivery to the MFH3 system
- Request from a system operator for information or reports

## System Operator NMS Access

The system operator will have access to the following information through the NMS:

- Real-time views of all operator's MFH3 properties (See Figures 3 & 4)
- Trap logs
- RF Statistics
- Tuner Statistics
- Client Statistics
- Reports



**Figure 3: Operator View - Conceptual**

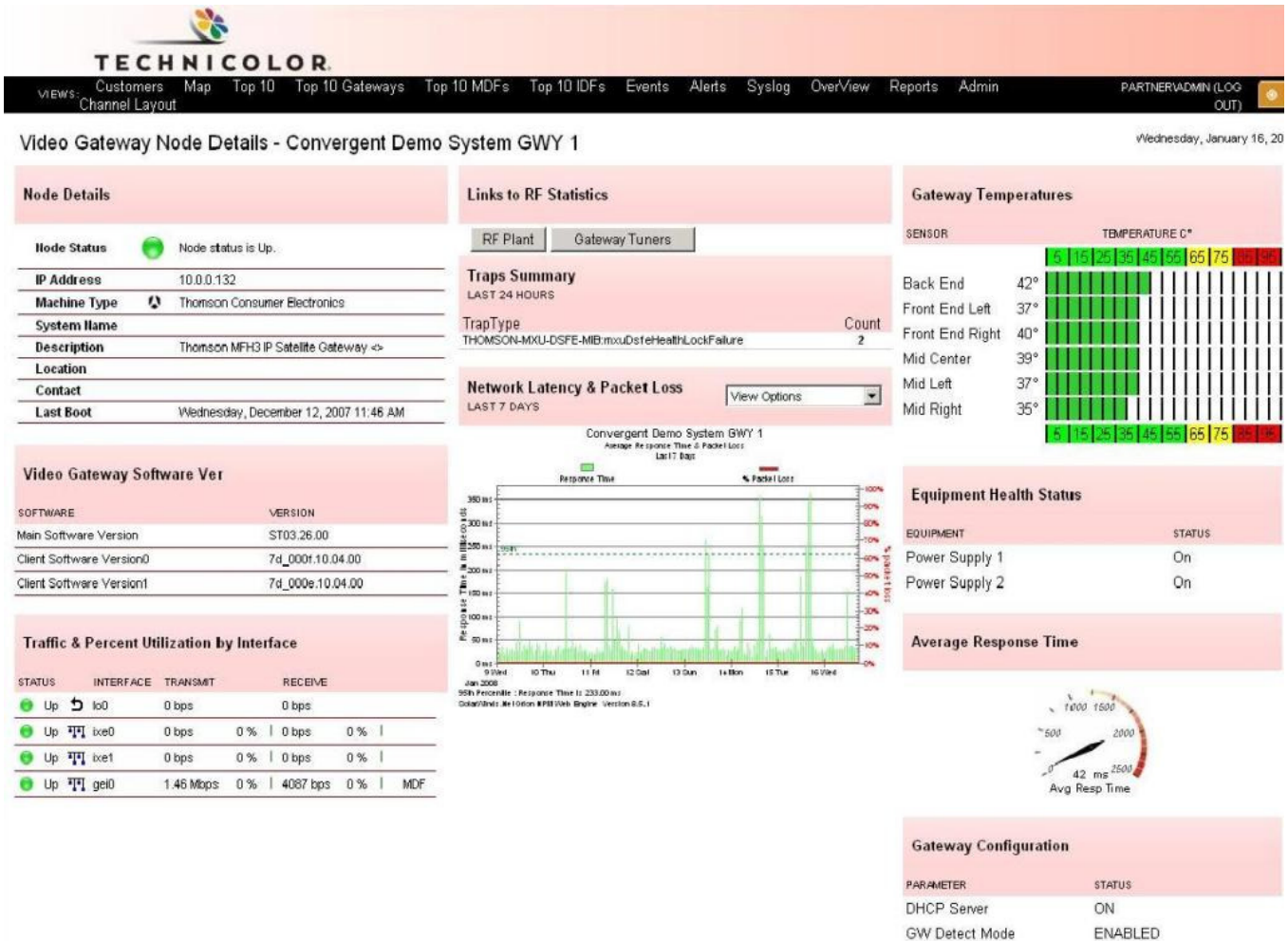


Figure 4: Sample Operator NMS Screen View

## Statistical Tracking

The Accounting and Performance management aspects of the NMS provide for the collection of large amounts of data by the gateways and can be used to create customized reports. Examples of data collected include:

- All alarm notifications
- Number of IRDs in the system
- Data errors reported by IRDs:
- Channel changes per IRD
- Packet loss sequential errors at the IRD
- Number of IRD resets
- Satellite signal quality: (Signal Strength, AGC, Carrier/Noise Ratio, etc.)
- Network utilization of each segment
- Data errors reported by the switches
- Up-time of each monitored device at the property

## Alarms

The Gateways have the ability to generate traps due to several events that might indicate a system failure. These traps are generally in the areas of security and equipment failure. Each trap event has been assigned a priority and a specific action procedure to follow when the trap occurs. The following are events that can generate a trap and a subsequent alarm:

- Equipment is not responding i.e.; communications with the gateway is lost
- High temperature conditions occur either inside of equipment or within headend
- High ambient humidity is detected
- Power supply is lost (redundant supply takes over)
- A fan is lost
- A satellite signal fails to lock (there are 32 tuners to monitor in each video gateway)
- A video gateway cannot allocate a tuner for an RTSP setup request
- A video gateway cannot allocate a multicast address
- A video gateway terminates an RTSP session
- A video gateway detects that another gateway has failed
- A video gateway detects that another gateway has been added
- A video gateway receives and verifies new software image
- A video gateway detects an unauthorized IRD
- A video gateway detects connection rate exceeds threshold
- A video gateway detects message rate exceeds threshold
- A video gateway detects a change in switch topology
- A video gateway detects a network switch failure
- High data loss is occurring in the network
- Ethernet port links are established or removed
- Denial of service attack is detected
- A video gateway experiences high modem connection failures

Last 125 Events w/o Port Up/Down	
TODAY	
1/17/2008 10:22 AM	+ Added Convergent L'ville IDF 2-Allied Telesyn Ethernet Switch AT-8524M · Module 0 Port 19
1/17/2008 10:22 AM	+ Added Convergent L'ville MGNT 1-Allied Telesyn Ethernet Switch AT-8524M · Module 0 Port 16
1/17/2008 10:22 AM	+ Added Convergent L'ville IDF 1-Allied Telesyn Ethernet Switch AT-8524M · Module 0 Port 16
1/17/2008 10:22 AM	+ Added Convergent L'ville IDF 1-Allied Telesyn Ethernet Switch AT-8524M · Module 0 Port 15
1/17/2008 10:07 AM	↻ YRT2 Mill Creek GWY 2 rebooted at 1/17/2008 10:06
1/17/2008 10:07 AM	↻ YRT2 Mill Creek GWY 3 rebooted at 1/17/2008 10:06
1/17/2008 10:07 AM	↻ YRT2 Mill Creek2 GW2_3 rebooted at 1/17/2008 10:06
1/17/2008 10:06 AM	↻ YRT2 Mill Creek GWY 1 rebooted at 1/17/2008 10:06
1/17/2008 10:06 AM	↻ YRT2 Mill Creek2 GW2_1 rebooted at 1/17/2008 10:06
1/17/2008 10:06 AM	↻ YRT2 Mill Creek2 GW2_2 rebooted at 1/17/2008 10:06

**Figure 5: Sample Operator NMS Screen View of Trap Events**

## Remote Management

The following are some of the remedial actions that can be initiated remotely by Convergent.

- Reset video gateways
- Reset a tuner (32 tuners per gateway)
- Reset an IRD (not yet enabled)
- Bring up a standby video gateway when a production gateway fails
- Set polling policies
- Force video gateway software upgrade
- Force set-top box client software upgrade
- Place a video gateway in standby mode (not yet enabled)
- Clear monitor tables
- Set temperature thresholds
- Adjust tuner parameters (19 parameters per tuner)
- Convergent can designate operators that can monitor MFH3 SNMP equipment & interfaces at all of their properties.
- Convergent can designate operators (such as a property owner) that can monitor MFH3 SNMP equipment or interfaces related to a specific property.
- Operators will be able to remotely monitor their MFH3 equipment via the Internet using a web browser.
- Alarm notifications and polled MIBs for current or new SNMP clients (new equipment) can be easily added.
- RFC 1213 is fully supported.
- SNMP v1 and v2c are both supported.
- Sounds can be used to alert technicians of various conditions.

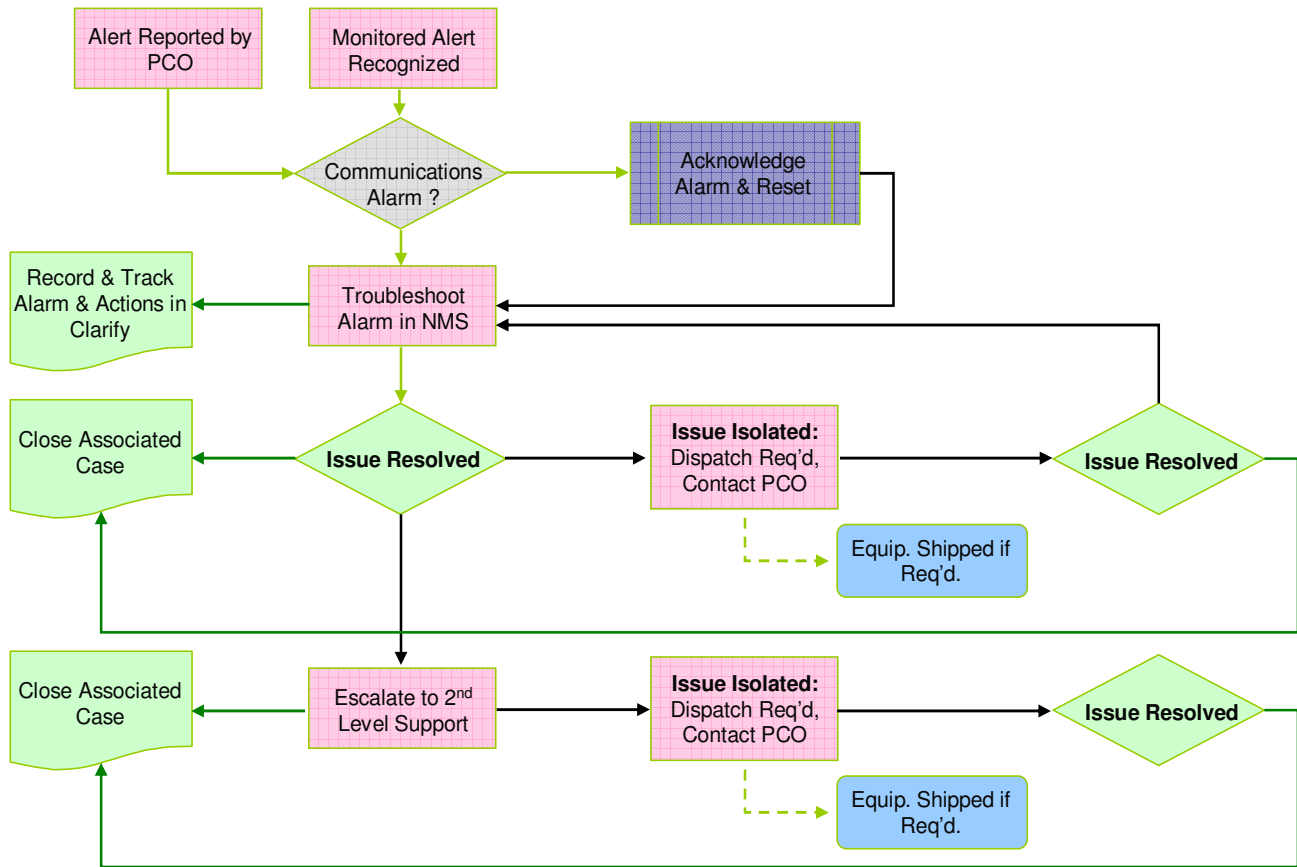
## Level 2 Help Desk Service

A critical component of the MFH3 Platform services offering is the Level 2 Help Desk Service. In addition to 24x7 monitoring of all deployed MFH3 systems at the Convergent NOC, highly-trained technical support personnel are available to consult by phone with a system operator's technical staff.

The levels of support provided to the system operator are as follows:

- First Level Trouble Resolution will be available 24 hours per day, 7 days per week. If there is a technical problem with the MFH3 Equipment at a property, a Network Services Technician will:
  - create a record of a technical problem (a "Trouble Ticket")
  - troubleshoot the problem by stepping through a predetermined set of troubleshooting procedures, including, if appropriate, contacting the MFH3 System Operator to troubleshoot the problem and...
  - if the MFH3 System Operator is on site at the property, talking the MFH3 System Operator through a series of questions and responses designed to confirm and/or resolve the MFH3 Equipment problem.

- If Convergent is unable to contact the MFH3 System Operator within one hour of recognition of the need to do so, and Convergent can remotely correct the problem by resetting the MFH3 Equipment, Convergent will take appropriate action to correct the problem.
- Second-Level Trouble Resolution. If the Convergent Network Services Technician cannot isolate a problem, it is escalated to a Convergent Network Engineer who will work with the MFH3 System Operator to resolve or identify the MFH3 Equipment problem.
- Third-Level Trouble Resolution. If Convergent is unable to resolve a problem with the MFH3 Equipment at a MDU using the First or Second-Level Trouble Resolution efforts described above, then Convergent will offer to initiate the Return Authorization Process. Any and all MFH3 Equipment replacement, service or on-site support provided by TNS is done so at the rates set forth in the MFH3 Master Purchase and Installation Services Agreement.
- The Convergent process by which Network Monitoring and Technical Support Services are provided is further illustrated in the following diagram (See Figure 6)



**Figure 6: Process Flow for Network Monitoring and Technical Support Services**

## **Summary**

The advent of Next-Generation IP-based network infrastructures configured for the delivery of video as well as data and voice allows the service provider to take advantage of the power and flexibility of industry-standard IP-network management and monitoring.

The intent of the services package offered in support of the MFH3 IP Platform is to reduce service interruption by quickly identifying the source of a system outage. In combination, the NMS, NOC monitoring technicians, and the Level 2 Help Desk offer the system operator a valuable array of support resources that will help reduce service interruption and the total cost of ownership which is a win/win for system operators and the customers that they serve.

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