

Network Management It's Not Just Status Monitoring Any More

Raj K. Deshpande
IPNS Network Operation Solutions
Broadband Communication Sector
Motorola Inc.

presented at:
SCTE Chicago Chapter Seminar Series
September 21, 2000

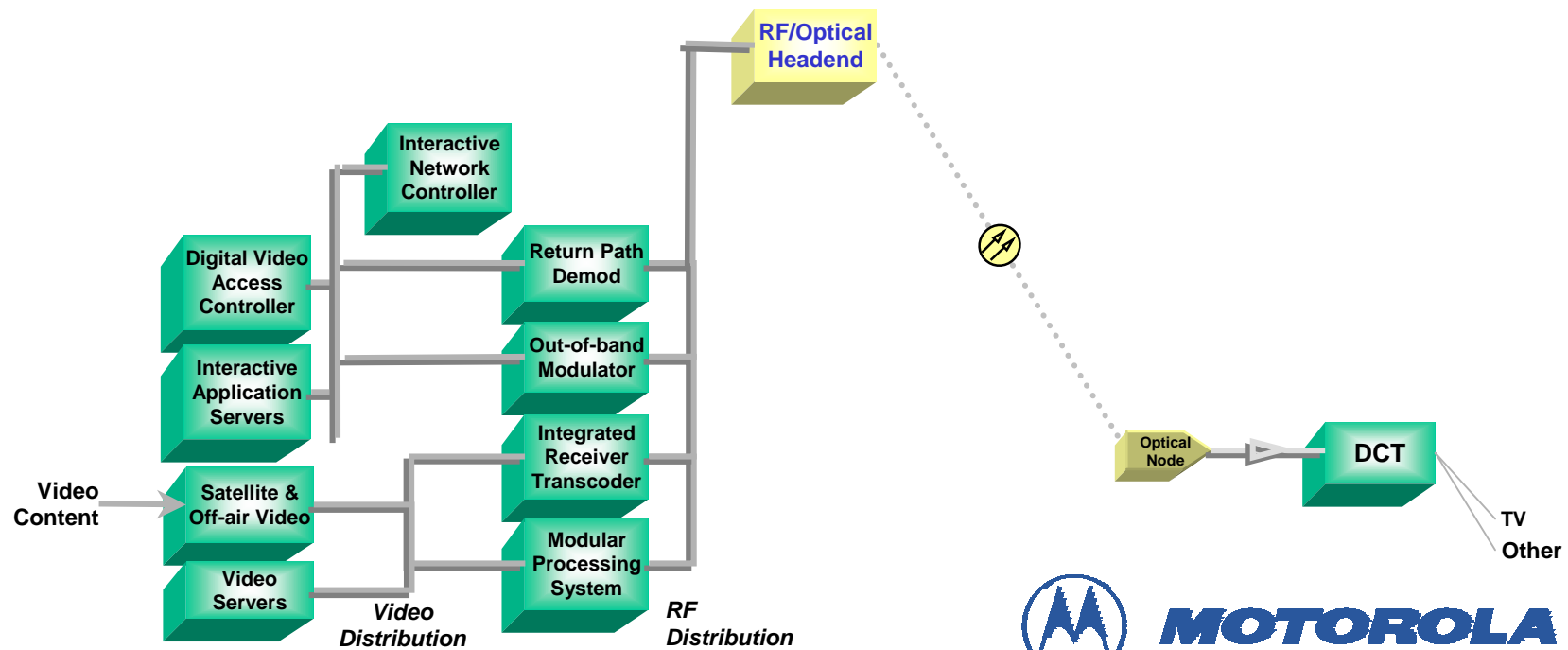


MSO Operations Challenges



The Cable Video Service

Home
Configurations

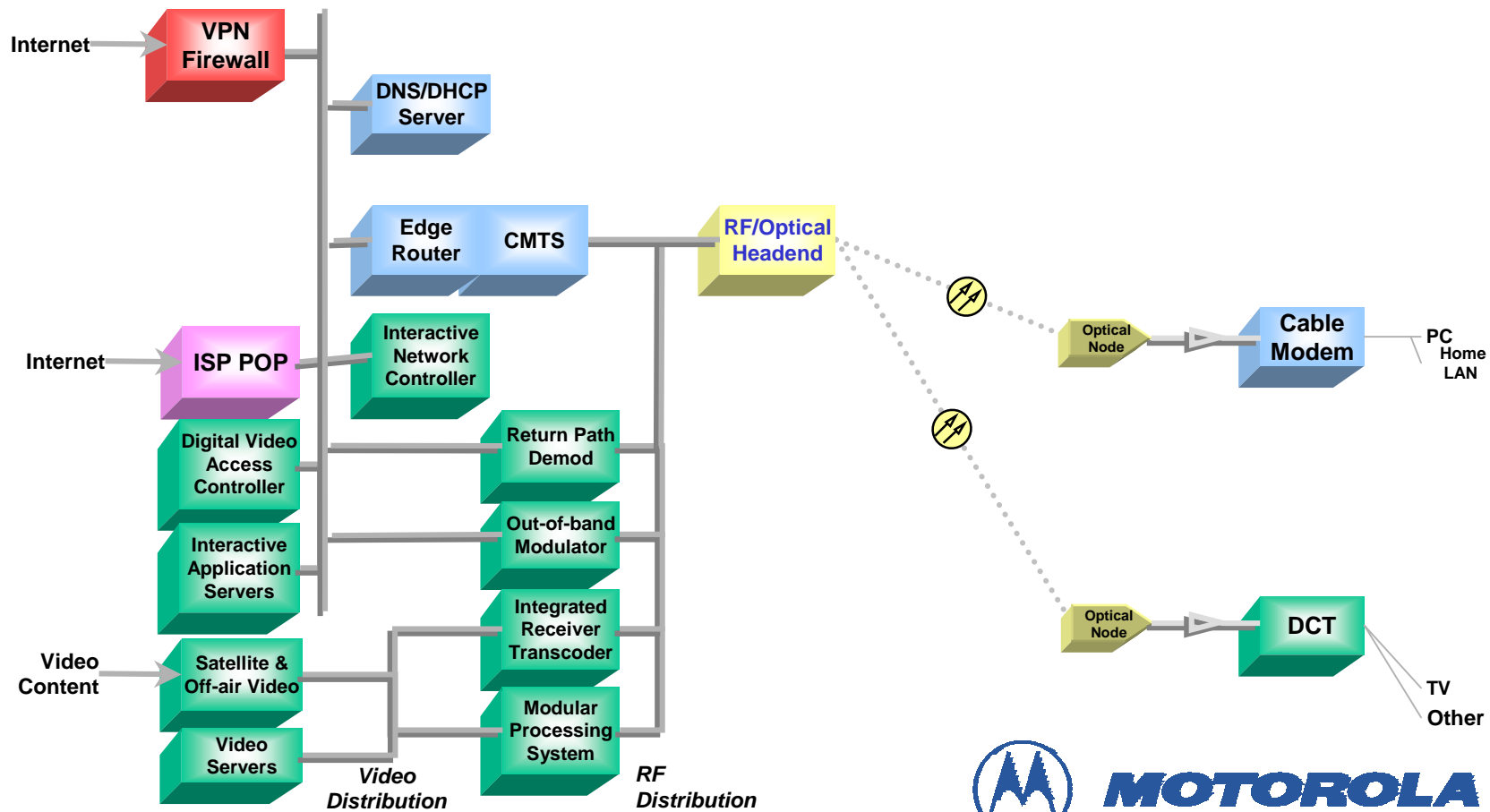


MOTOROLA

Broadband Communications Sector

The Cable Data Service

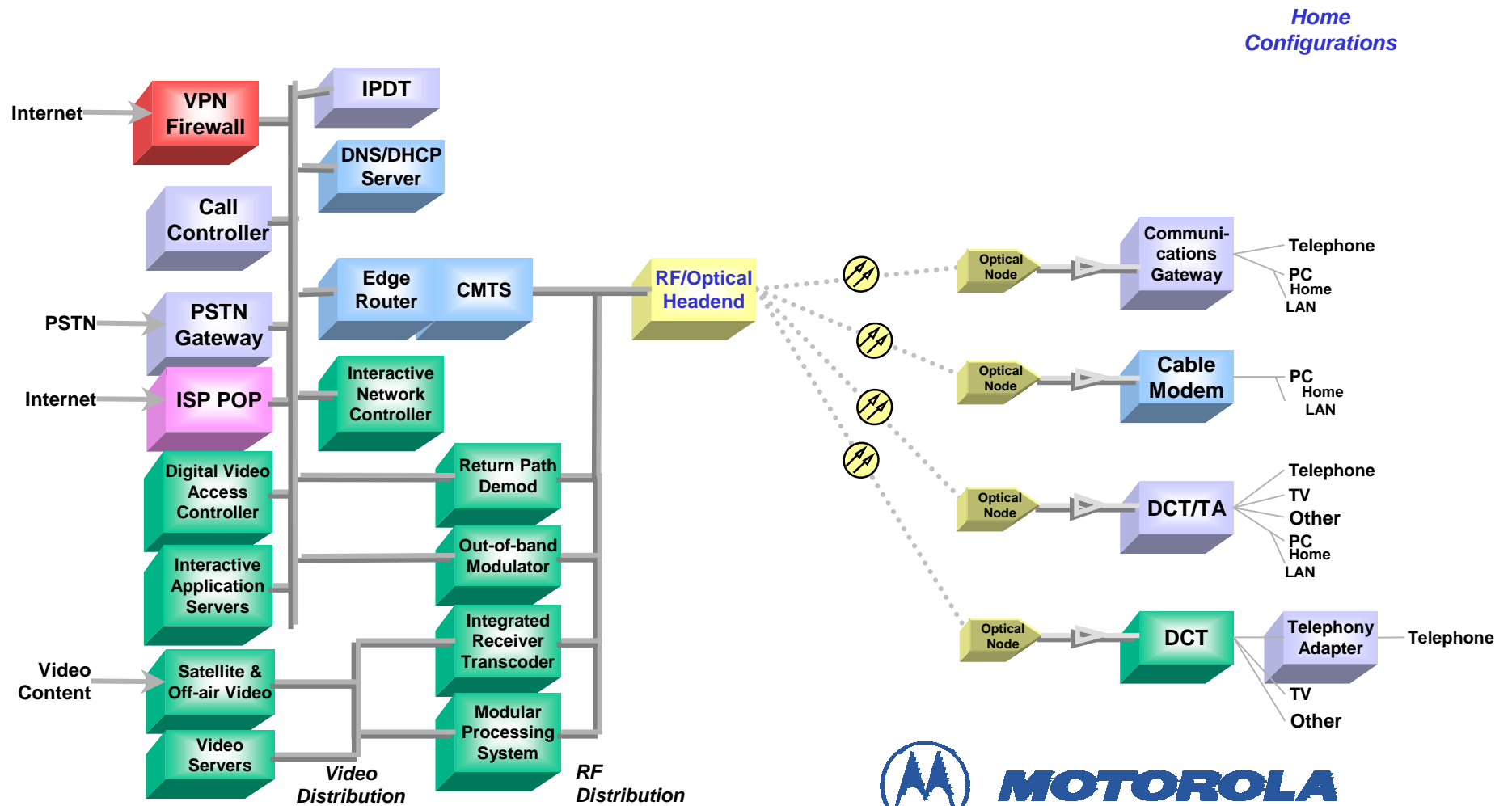
Home Configurations



MOTOROLA

Broadband Communications Sector

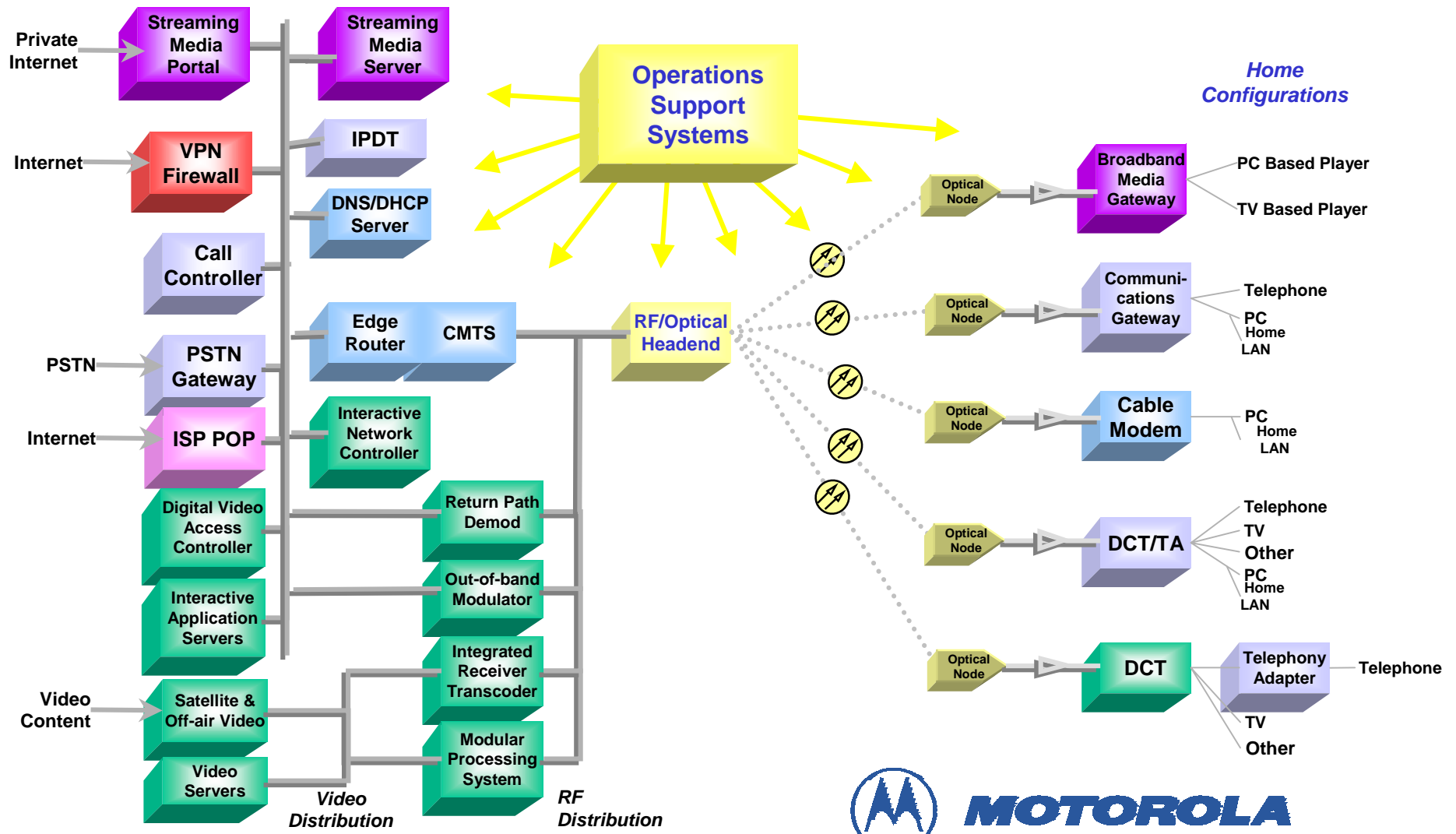
The Cable Telephone Service



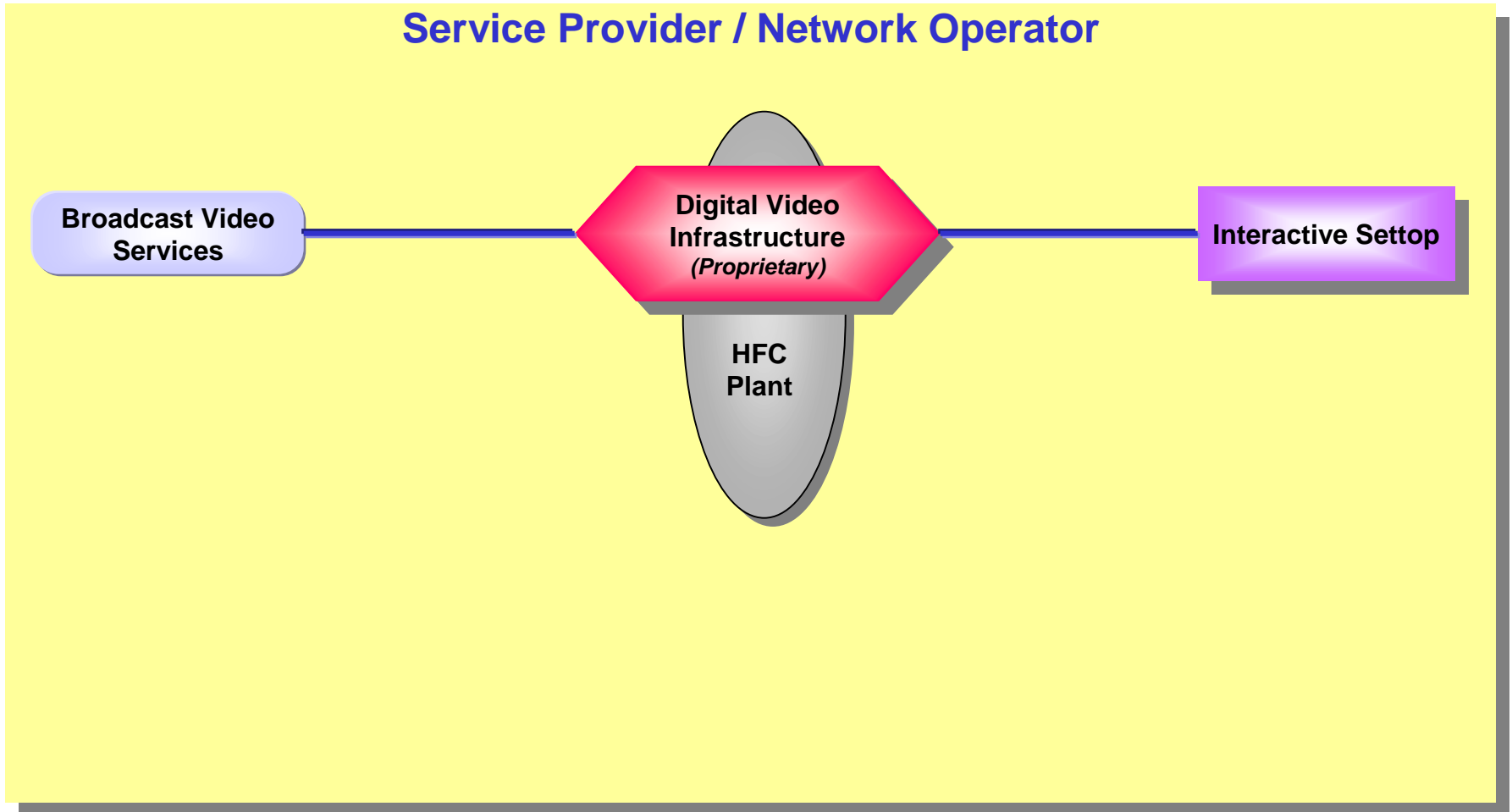
MOTOROLA

Broadband Communications Sector

The "Box" View



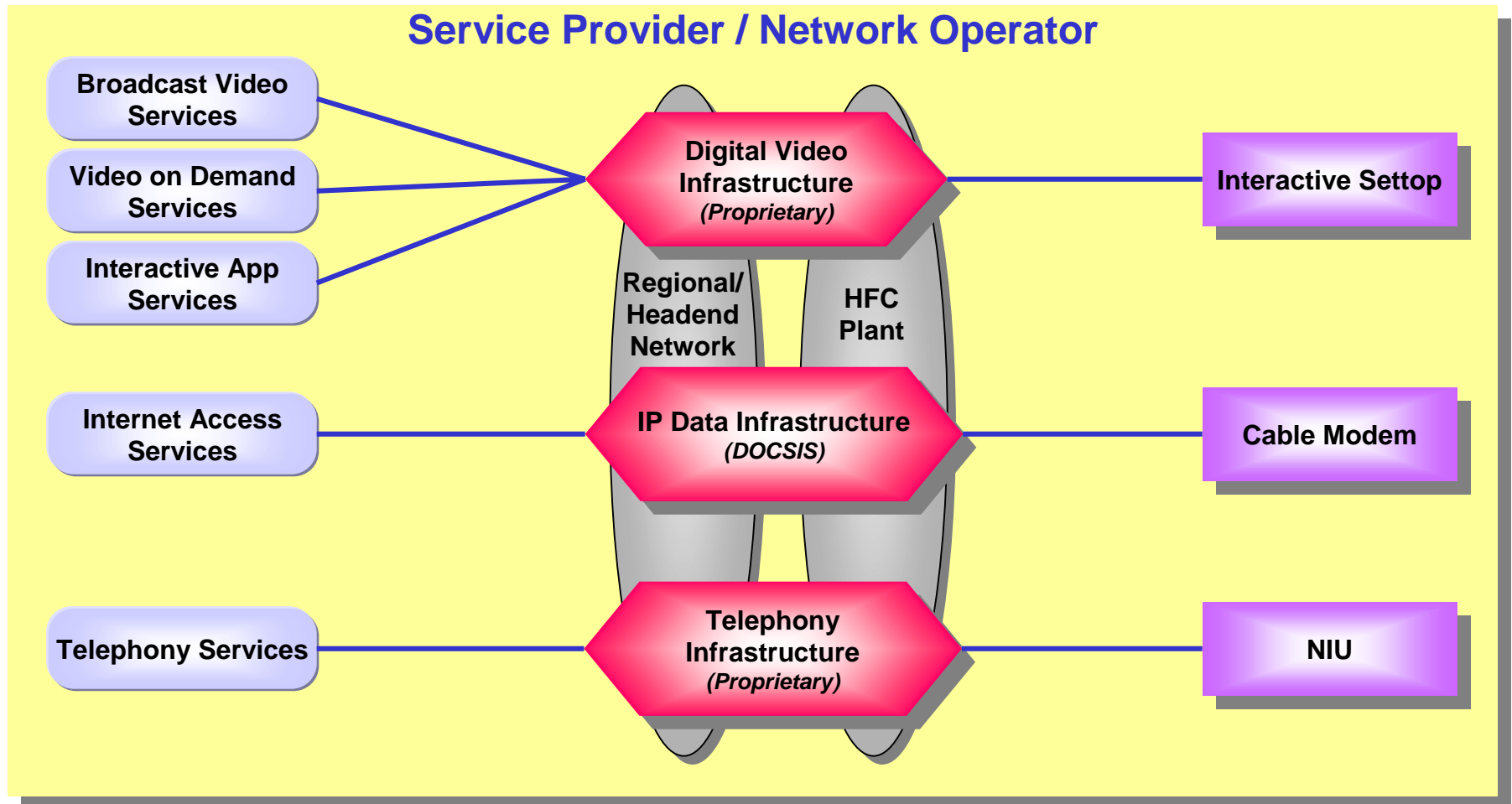
Yesterday's Management Challenge



MOTOROLA

Broadband Communications Sector

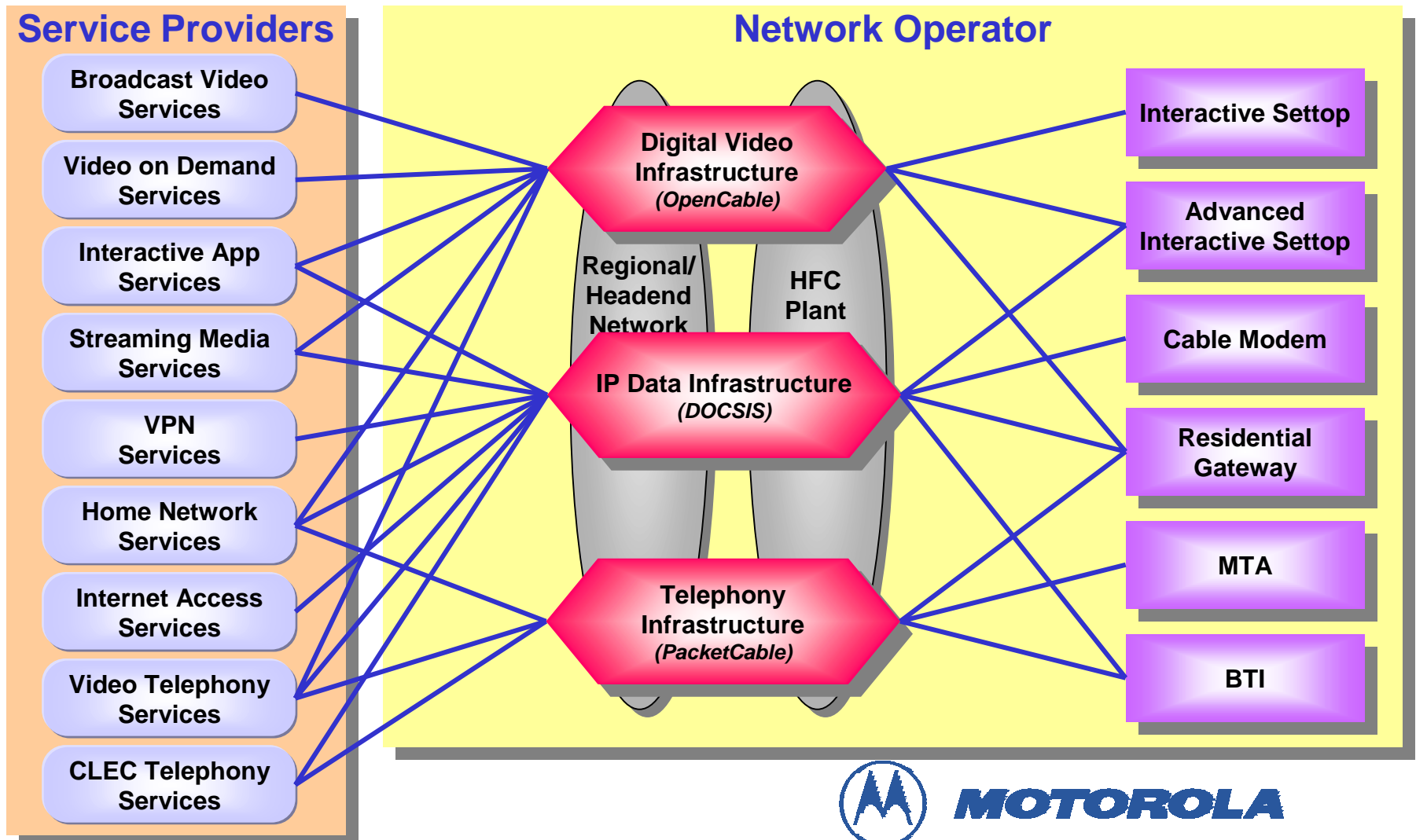
Today's Management Challenge



MOTOROLA

Broadband Communications Sector

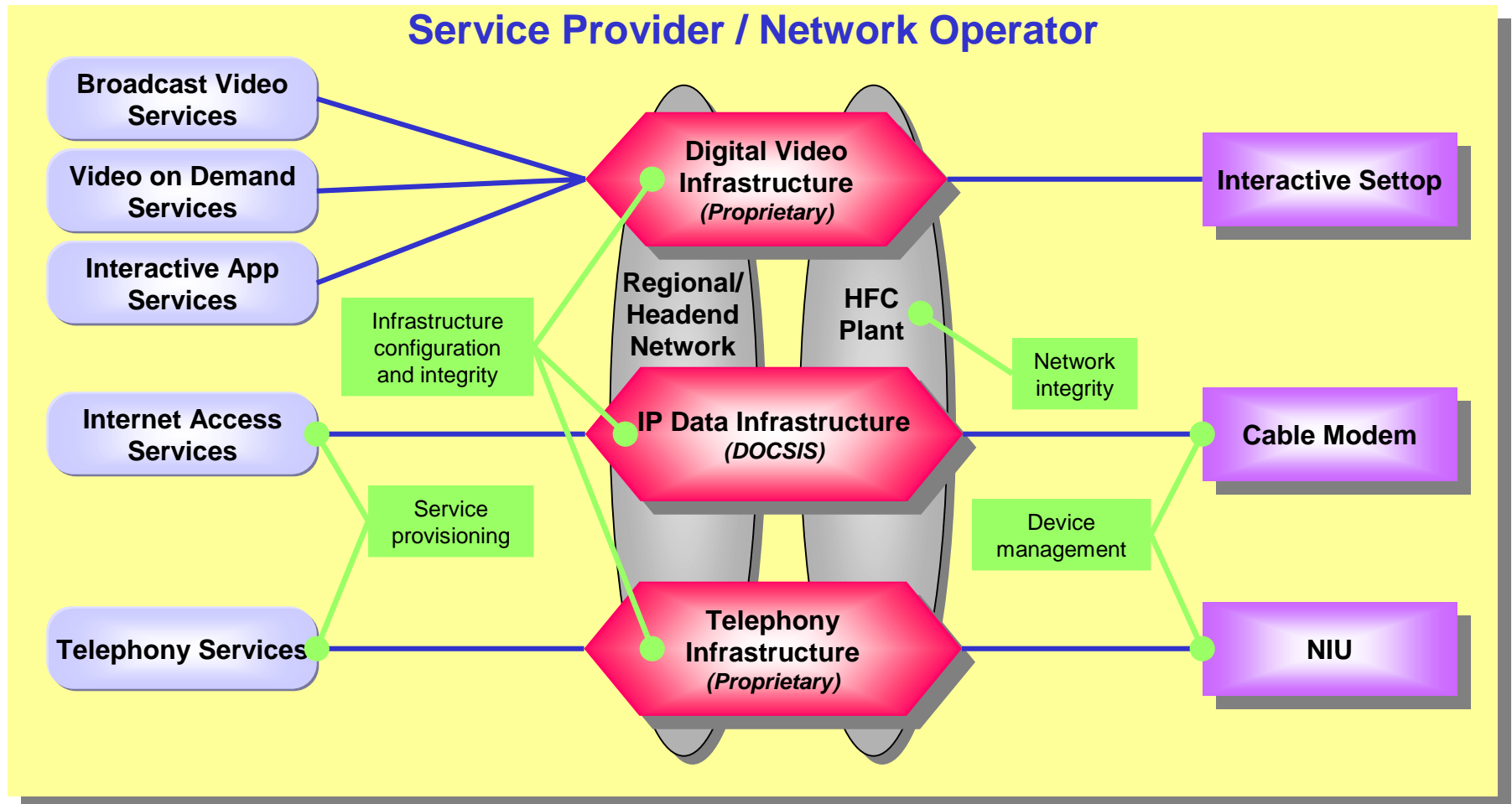
Tomorrow's Management Challenge



MOTOROLA

Broadband Communications Sector

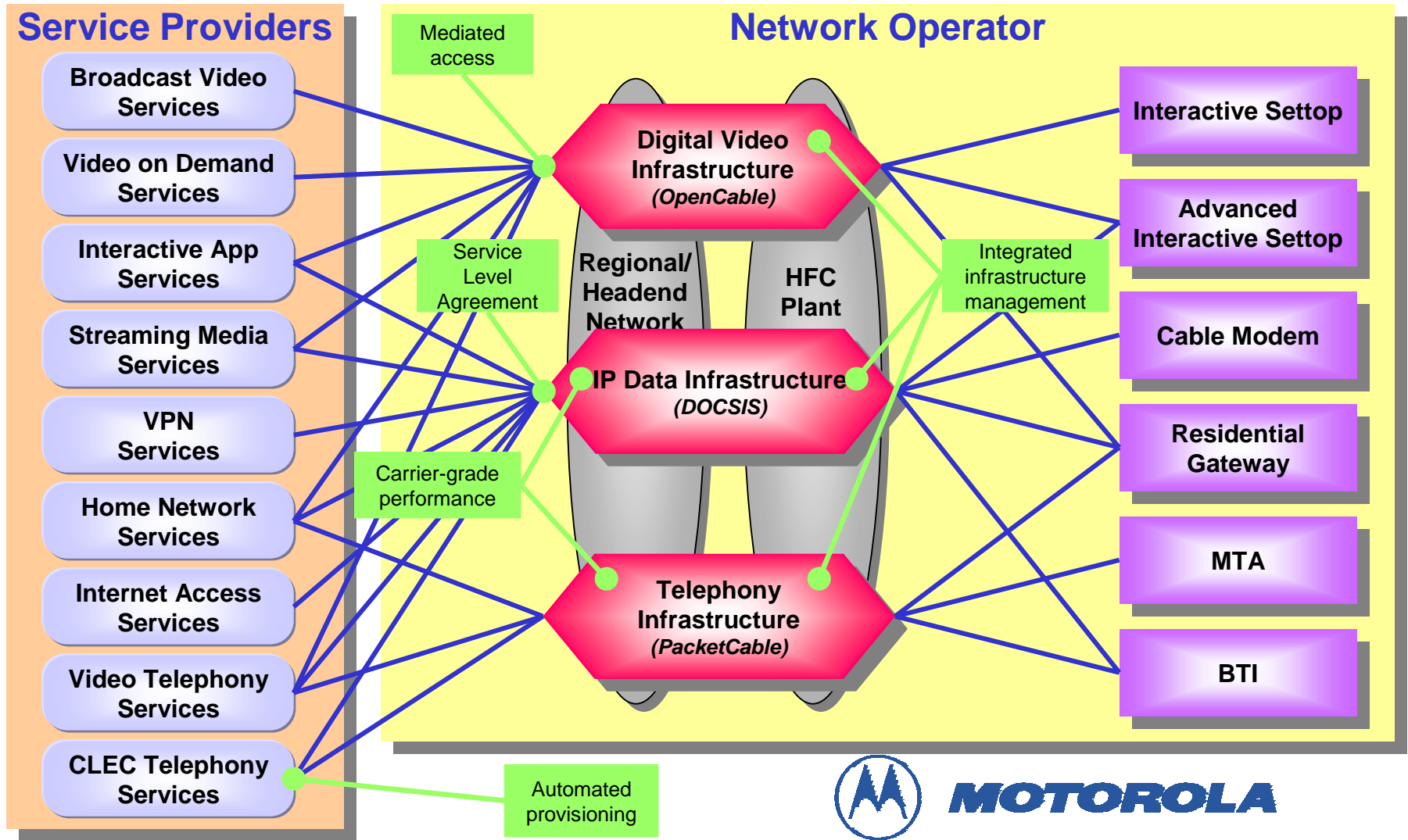
Addressing Today's Management Challenges



MOTOROLA

Broadband Communications Sector

Addressing Tomorrow's Management Challenges



MOTOROLA

Broadband Communications Sector

What is OSS for Cable Networks?



MOTOROLA

Broadband Communications Sector

Management Scope

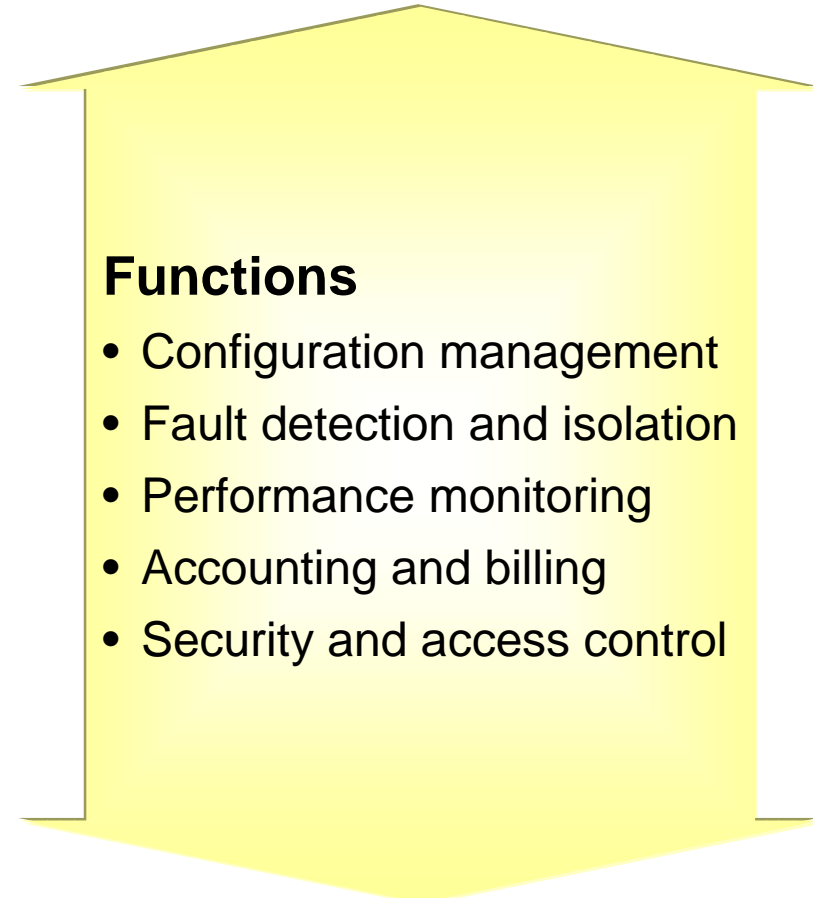
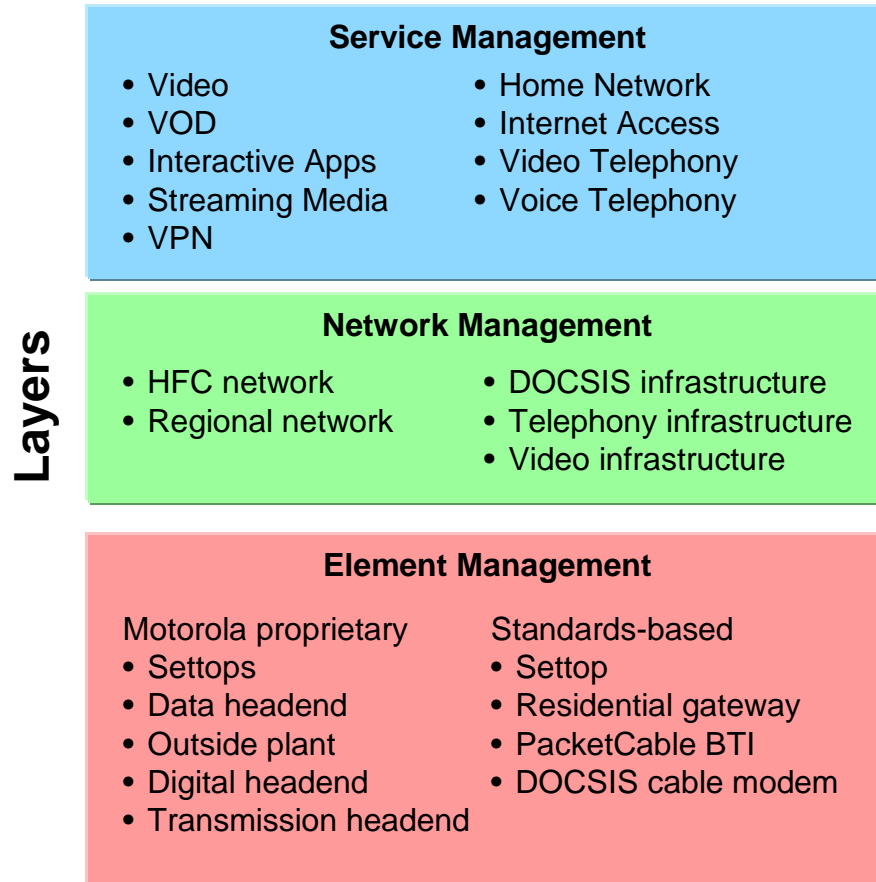
- **Network Management**
 - **Configure and Activate Network Elements**
 - **Monitor and perform pro-active maintenance of the Network Elements**
 - **Provide standard open interfaces for multi-vendor, multi-solution integrated network management.**
 - **Provide open interfaces to allow necessary instrumentation of Network Elements to enable end-customer service activation and modification**
 - **Provide applications that enable the customer to enhance the network by add/modify of Network Elements**
- **Service Management**
 - **Provide applications for service activation - integrate with customer work flow management solution**
 - **Provide applications for reliable billing - integrate with customer billing and service assurance applications.**
 - **Provide applications that enable simple, self, single-click service activation**



MOTOROLA

Broadband Communications Sector

Key OSS Functions



MOTOROLA

Broadband Communications Sector

Management Functions

- **Configuration**
 - Service Activation
 - Network Provisioning
 - Resource Management
- **Fault**
 - Fault Reporting
 - Correlation/Summarization
- **Performance**
 - Service Level Agreements
 - Performance Monitoring
- **Security**
 - Network Security
 - Access Control
 - Key Management
- **Accounting**
 - Usage Monitoring
 - Transaction Records



MOTOROLA

Broadband Communications Sector

How do we approach the problem space ?

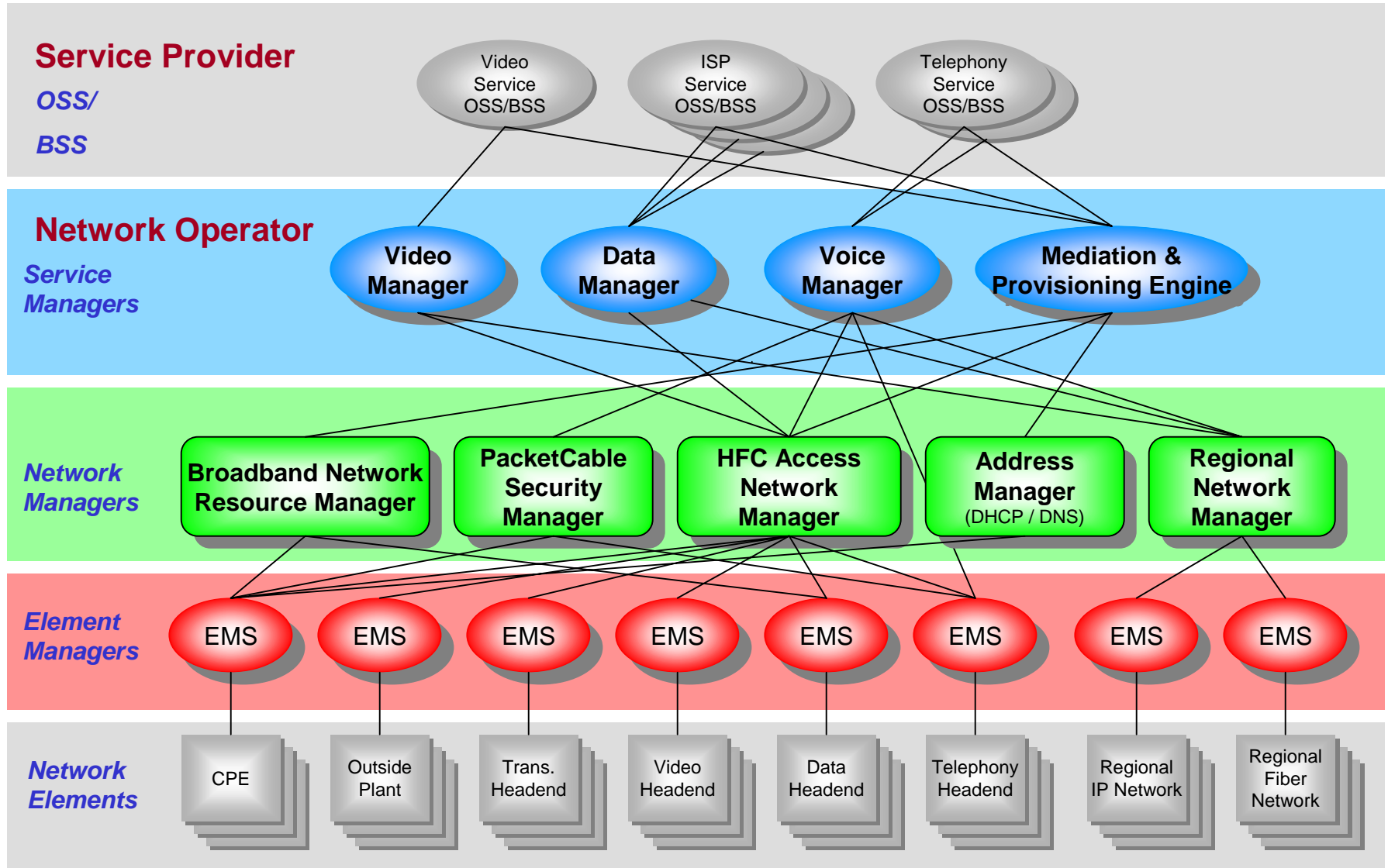
Example OSS solution



MOTOROLA

Broadband Communications Sector

OSS Reference Architecture



MOTOROLA

Broadband Communications Sector

Motorola Provisioning Solution

- **Supports Rapid Deployment**
 - Easily integrated into existing Higher Level OSS architectures
 - Web-based interface (either CSR or consumer)
- **Customer self provisioning**
 - Secure subscriber interface
 - Supports retail model
 - Self-service upgrades and addition of new services
 - Impulse and on-demand services
- **Fully scalable**
 - Supports multiple BTI EMSs, IPDTs, DHCP and TFTP servers
 - Supports DNS for naming individual BTIs



MOTOROLA

Broadband Communications Sector

HFC Access Network Manager

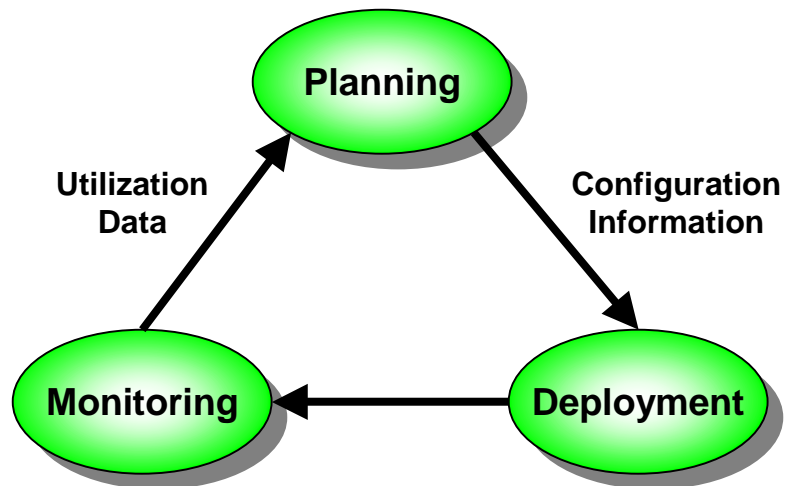
- **Configuration management**
 - Network element configuration tools
 - Interface with provisioning and inventory systems
- **Fault management**
 - Alarm management and correlation
- **Performance management**
 - Collect and process performance related statistics
 - Track performance versus SLA's and QoS business commitments
- **Accounting management**
 - Collect usage / transaction based statistics; forward to billing systems
- **Security management**
 - Ensure information is shared with the appropriate users/systems



MOTOROLA

Broadband Communications Sector

Network Resource Manager



- Resources
 - Hardware
 - Plant
 - Headend
 - Spectrum
 - Upstream
 - Downstream
 - Network segments
 - Channel bandwidth
 - DOCSIS
 - MPEG
 - Special purpose
 - IP addresses



MOTOROLA

Broadband Communications Sector

Network Resource Manager

- **Planning**
 - Plan from forecast or utilization data
 - Integrated planning of network layers
 - Master plan for all critical resources
 - Consistency checking across/among layers
- **Deployment**
 - Coordinated configuration parameters across network devices
- **Monitoring**
 - Utilization and performance statistic collection
 - Alarms
 - Reports



MOTOROLA

Broadband Communications Sector

Address Management Server

- **Rapidly design & deploy IP infrastructure**
 - Full featured GUI – easy management and troubleshooting
- **Create and manage large domains**
 - Diagnostic tools – including logging of all DHCP operations/events
 - Support address pools on multiple subnets
- **Standards based and extensible**
 - Compliant with relevant RFC's: 1542, 2131, 2132, 1034, 1035, 2136, 1995, 1996
 - Name Synchronization between DHCP and DNS
 - Supports Redundant DHCP servers
 - Extensibility – providing the ability to write custom define extensions to the DCHP process
 - Support of Custom DHCP options
 - Client class support to differentiate services to clients



MOTOROLA

Broadband Communications Sector

PacketCable Security Manager

- Provides authentication and key management services to maintain integrity of PacketCable security mechanisms
- Kerberos Distribution Center (KDC) supporting public key initialization (PKINIT)
 - Authentication server (AS)
 - Validates identity of BTIs
 - Ticket granting server (TGS)
 - Provides *ticket* to BTIs for signaling with call agents/IPDTs
 - Interacts with provisioning servers and call agents
 - Initial distribution plus periodic renewal



MOTOROLA

Broadband Communications Sector

CPE Manager

- **Device Configuration**
 - MTA / CM downloadable configurations
- **Life-test polling**
 - 20k devices each 15 min.
- **Event Viewer (trap / Inform)**
- **Device Viewer / Editor**
- **Topology**
 - Device Discovery CMTS, BTI, CM
 - Node representation
- **Supports PacketCable MTA MIBs**
- **Web based Client**



MOTOROLA

Broadband Communications Sector

CMTS Manager

- **DCM EMS (Voice & Data)**
- **IFM EMS**
- **RFM EMS**
- **Functionality**
 - **Polling (configurable)**
 - **Data Collectors**
 - **Trap collection and filters**
 - **Device viewer / editor**
 - **Ping and Loop back tests**
 - **Web based clients**
 - **Trap forwarding to HFC ANM**



MOTOROLA

Broadband Communications Sector

HFC Plant Management with the Broadband Test Point



MOTOROLA

Broadband Communications Sector

Advanced Services and the HFC Network

- HFC networks were designed primarily to support the distribution of broadcast media, specifically video.
- HFC networks have several “interesting” characteristics, namely:
 - HFC network designs rely on a “Shared Network” with many single points of failure. A single failure could result in loss of service to “many” customers.
 - Historically the majority of the HFC network is NOT “managed”
 - HFC designs include a lot of return path “combining”. Potentially adverse condition relative to return path ingress.
- Comprehensive network management and modified plant designs can provide five nines of availability.

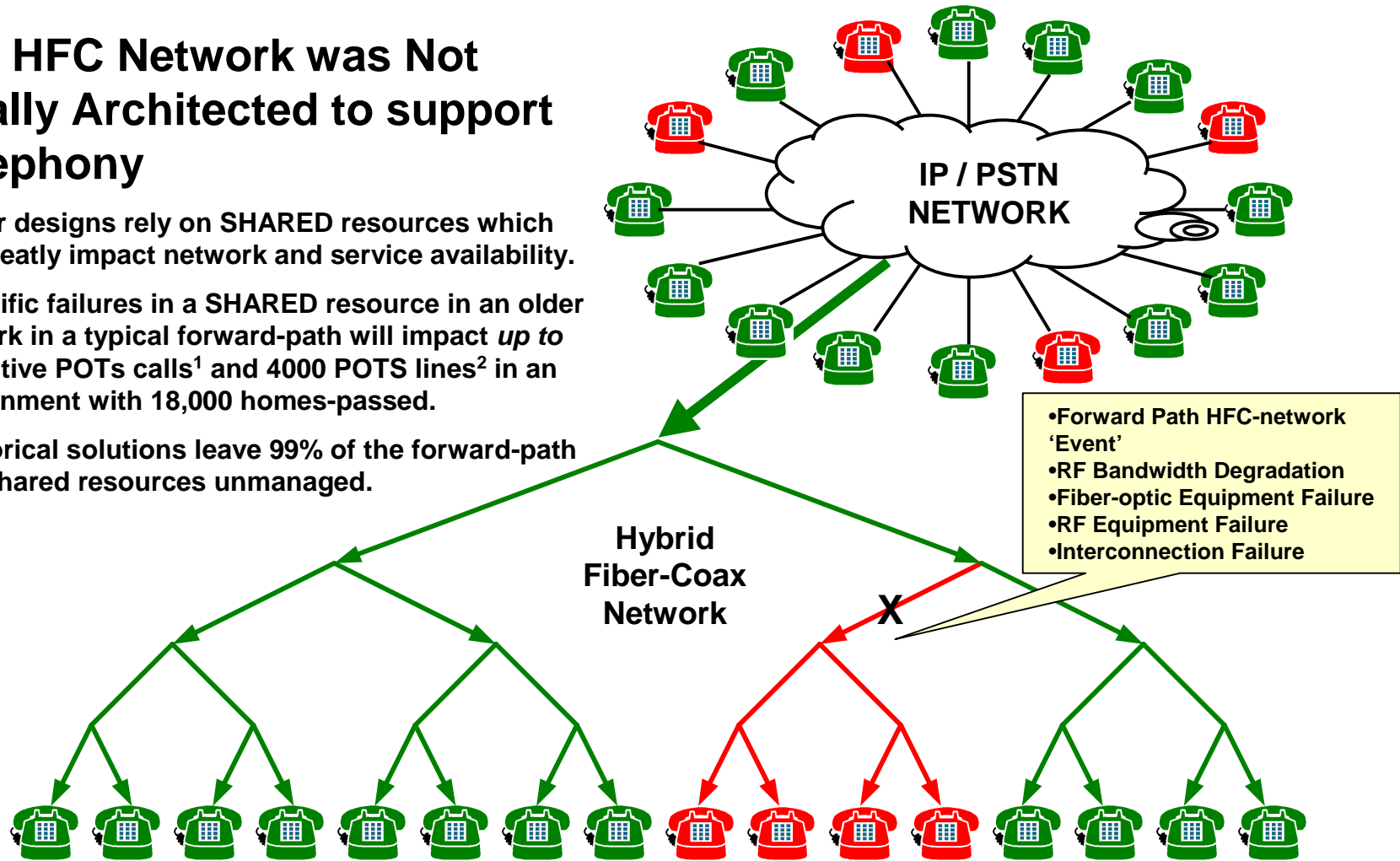


MOTOROLA

Broadband Communications Sector

The HFC Network was Not ideally Architected to support Telephony

- Older designs rely on SHARED resources which can greatly impact network and service availability.
- Specific failures in a SHARED resource in an older network in a typical forward-path will impact *up to* 500 active POTs calls¹ and 4000 POTS lines² in an environment with 18,000 homes-passed.
- Historical solutions leave 99% of the forward-path HFC shared resources unmanaged.



Note 1. High-Day Busy Hour = 14% active phones

Note 2: At 20% penetration rate

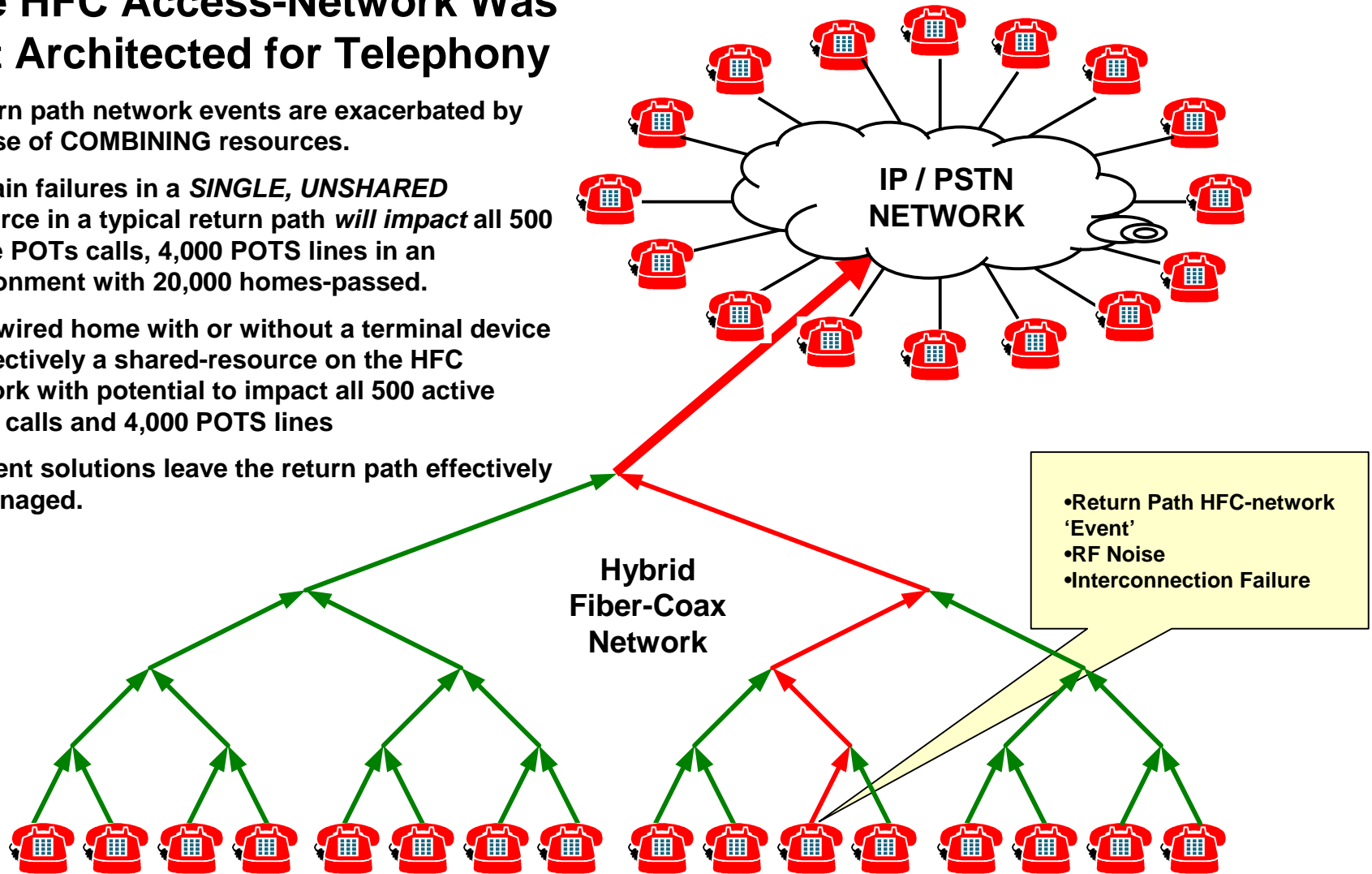


MOTOROLA

Broadband Communications Sector

The HFC Access-Network Was Not Architected for Telephony

- Return path network events are exacerbated by the use of **COMBINING** resources.
- Certain failures in a **SINGLE, UNSHARED** resource in a typical return path *will impact* all 500 active POTs calls, 4,000 POTS lines in an environment with 20,000 homes-passed.
- Any wired home with or without a terminal device is effectively a shared-resource on the HFC network with potential to impact all 500 active POTs calls and 4,000 POTS lines
- Current solutions leave the return path effectively unmanaged.



Note 1: At 20% penetration rate

Note 2. High-Day Busy Hour = 14% active phones

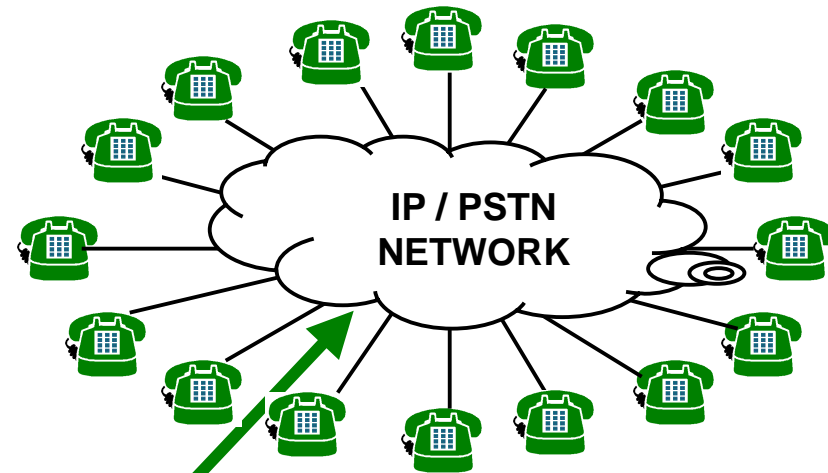


MOTOROLA

Broadband Communications Sector

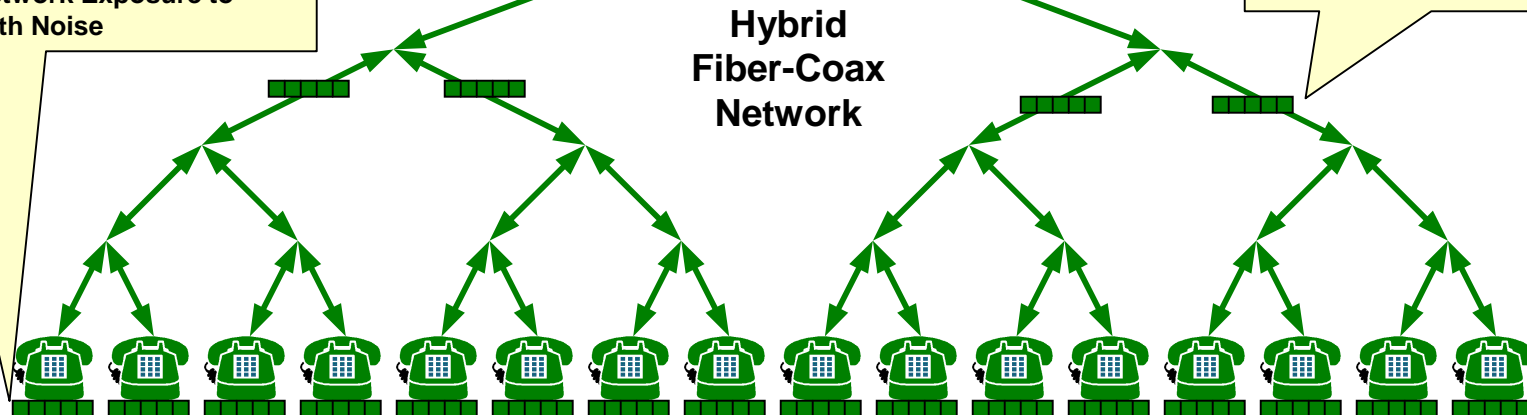
Proposed Step-Function Improvement in HFC Network Management

- Comprehensive management of the HFC forward-path via intelligent end-terminal devices.
- Comprehensive management of the HFC return-path via intelligent network test points.



- Intelligent End-Terminal Devices
- Detects Forward-Path Problems
- Sectionalizes Problems
- Provides Actionable Alerts
- Limits Network Exposure to Return Path Noise

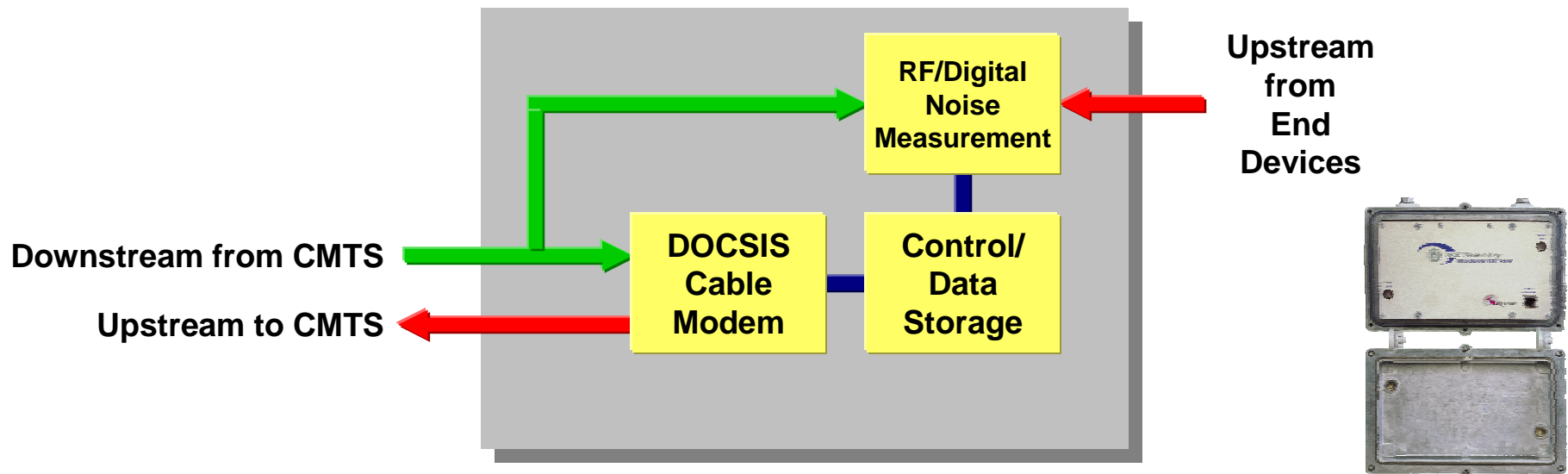
- In-Line Digital Instrumentation
- Detects Return-Path Problems
- Sectionalizes Problems
- Provides Actionable Alerts
- Limits Network Exposure to Return Path Noise



MOTOROLA

Broadband Communications Sector

Broadband Test Point



- Resides on strands or in nodes
- Correlates DOCSIS MAC and end device responses to identify downstream devices for topology discovery
- Measures upstream and downstream digital performance
- Measures upstream “quiet” noise conditions



MOTOROLA

Broadband Communications Sector

Broadband Test Point

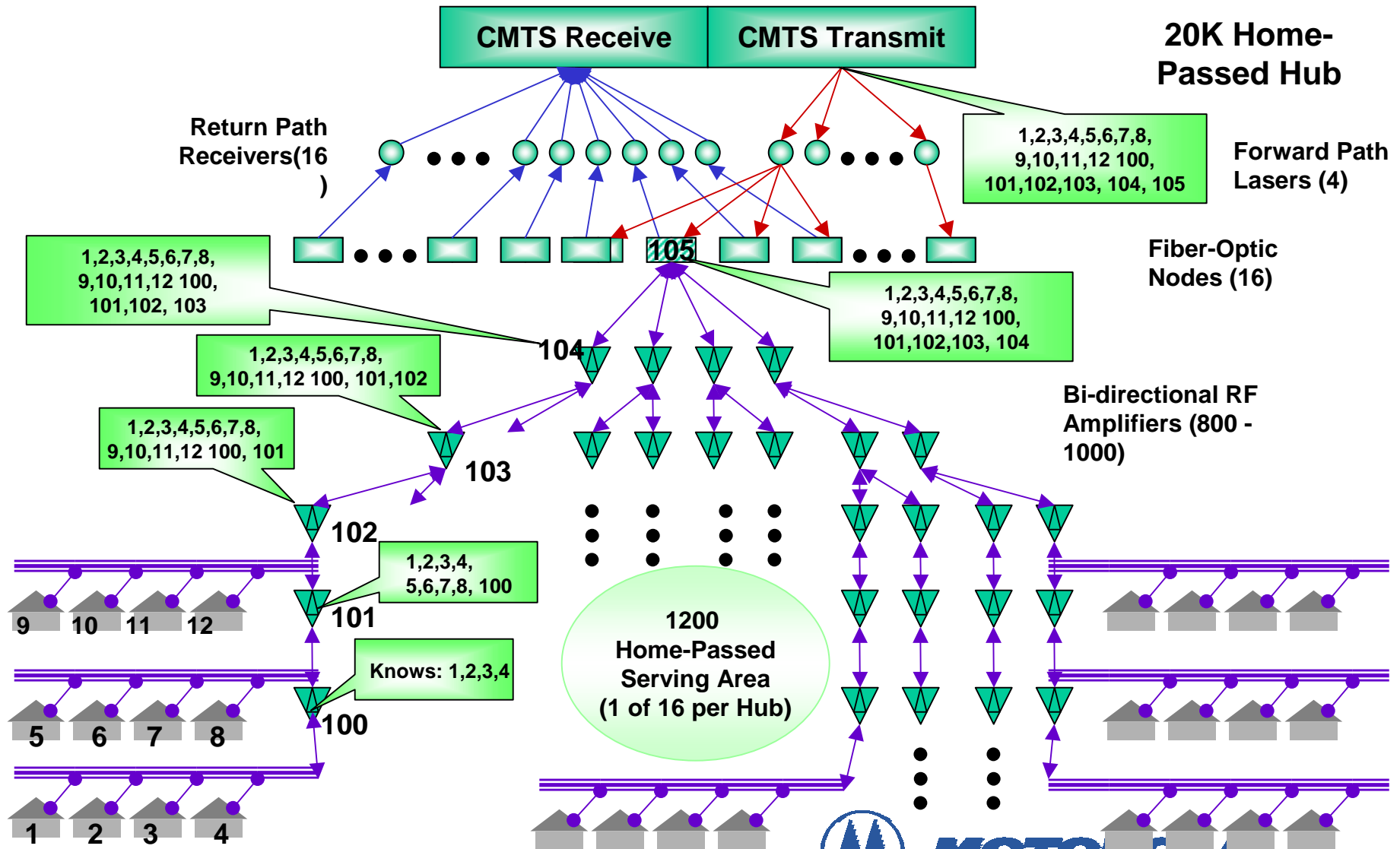
- **Automatically discovers and locates all DOCSIS devices (CM, BTI, DCT5000s and other BTPs)**
 - Enables segmentation of network via autodiscovery
 - Supports mass deployments of DOCSIS and PacketCable devices
- **Proactive ingress management**
 - Find ingress source before it affects service levels
 - Integral part of Motorola's bandwidth management solution
- **Data reduction**
 - Automates evaluation of spectrum analysis plots
 - Actionable alarms: alarms are limited to high confidence events, declared events are linked to a physical location
- **May be used with any plant design, not just "Motorola" plants**



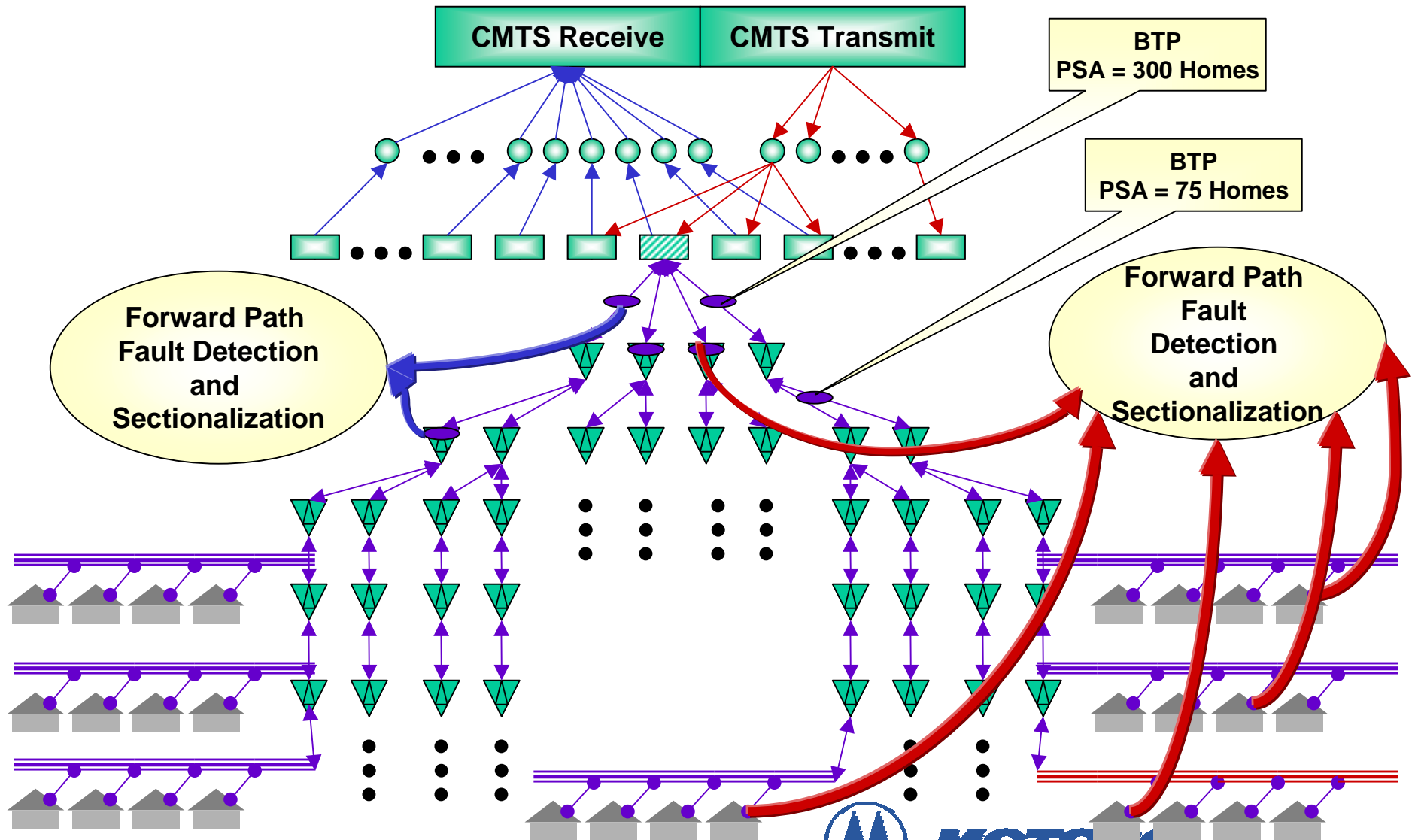
MOTOROLA

Broadband Communications Sector

Topology Discovery



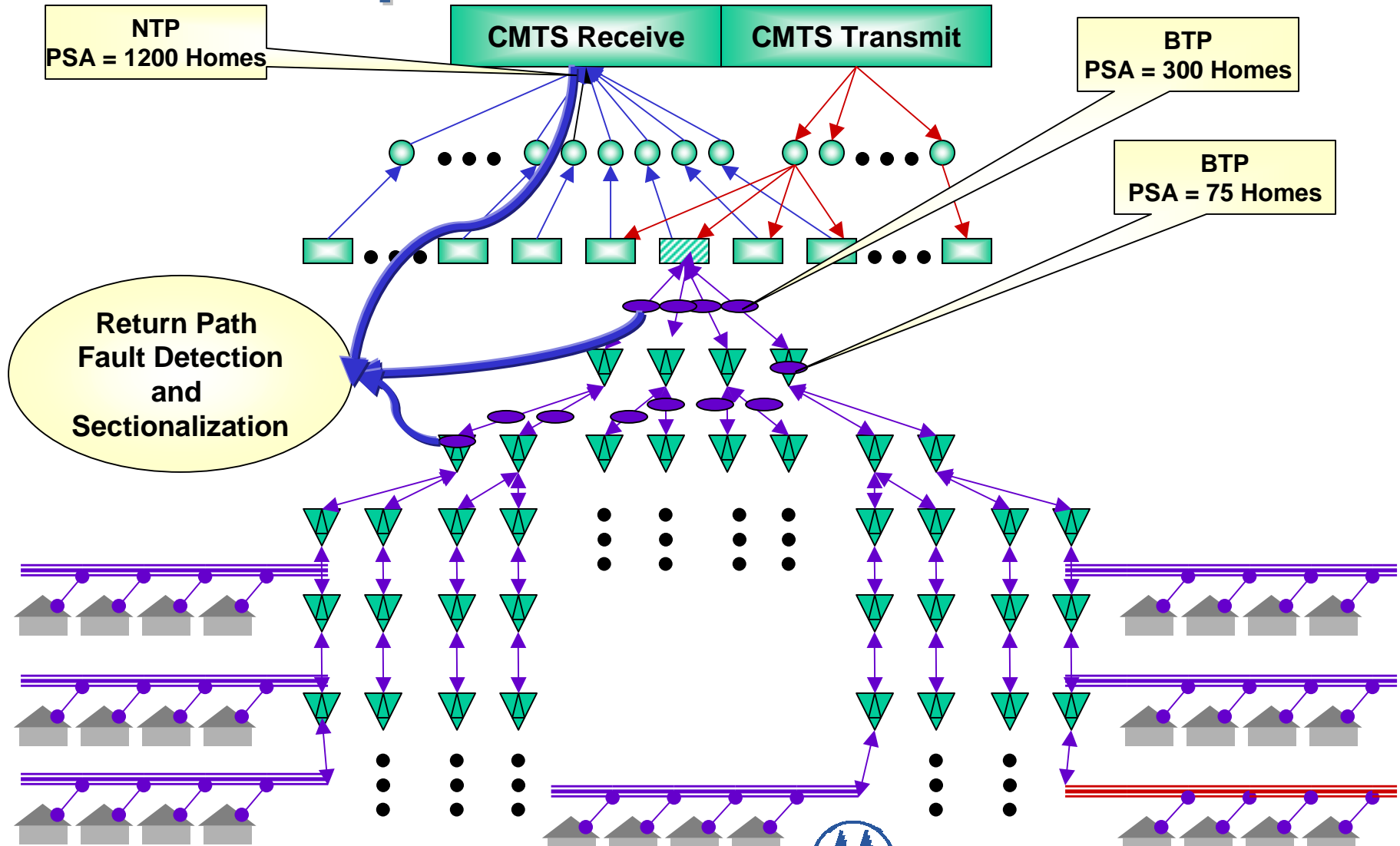
HFC Downstream Network Health



MOTOROLA

Broadband Communications Sector

HFC Upstream Network Health



MOTOROLA

Broadband Communications Sector

Thank You



MOTOROLA

Broadband Communications Sector
