Eliminating Open Access Technology Barriers

Open access to Hybrid Fiber Coax (HFC) infrastructure is rapidly becoming a reality as technology barriers are being removed and next-generation infrastructure that allows multiple providers to deliver services and content over cable networks is being deployed. As local regulatory bodies and Internet Service Providers (ISPs) increasingly push for open access, broadband cable operators are recognizing the potential advantages of opening up cable infrastructure to other providers – and they are evaluating how to capitalize on these new revenue opportunities.

For example, AT&T Broadband has opened up its HFC network and allowed Earthlink to provide Internet access services. AOL Time Warner announced that cable subscribers would not be required to purchase AOL or RoadRunner services, and the Time Warner Cable system has already been opened up in some markets to allow multiple providers to offer services directly to consumers and corporate customers.

Diverse content and services delivered over cable infrastructure will drive more consumers and business customers to adopt cable as the preferred medium for broadband services. Open access – which was once looked at as a problem by operators – is increasingly viewed as an opportunity to accelerate subscriber growth, provide a richer and more complete set of value-added services and establish revenue-sharing agreements with third-party providers. Historically, technology obstacles imposed legitimate barriers to open access implementations, but next-generation broadband service platforms are eliminating these technology barriers and allowing the delivery of rich content and services across broadband HFC networks.

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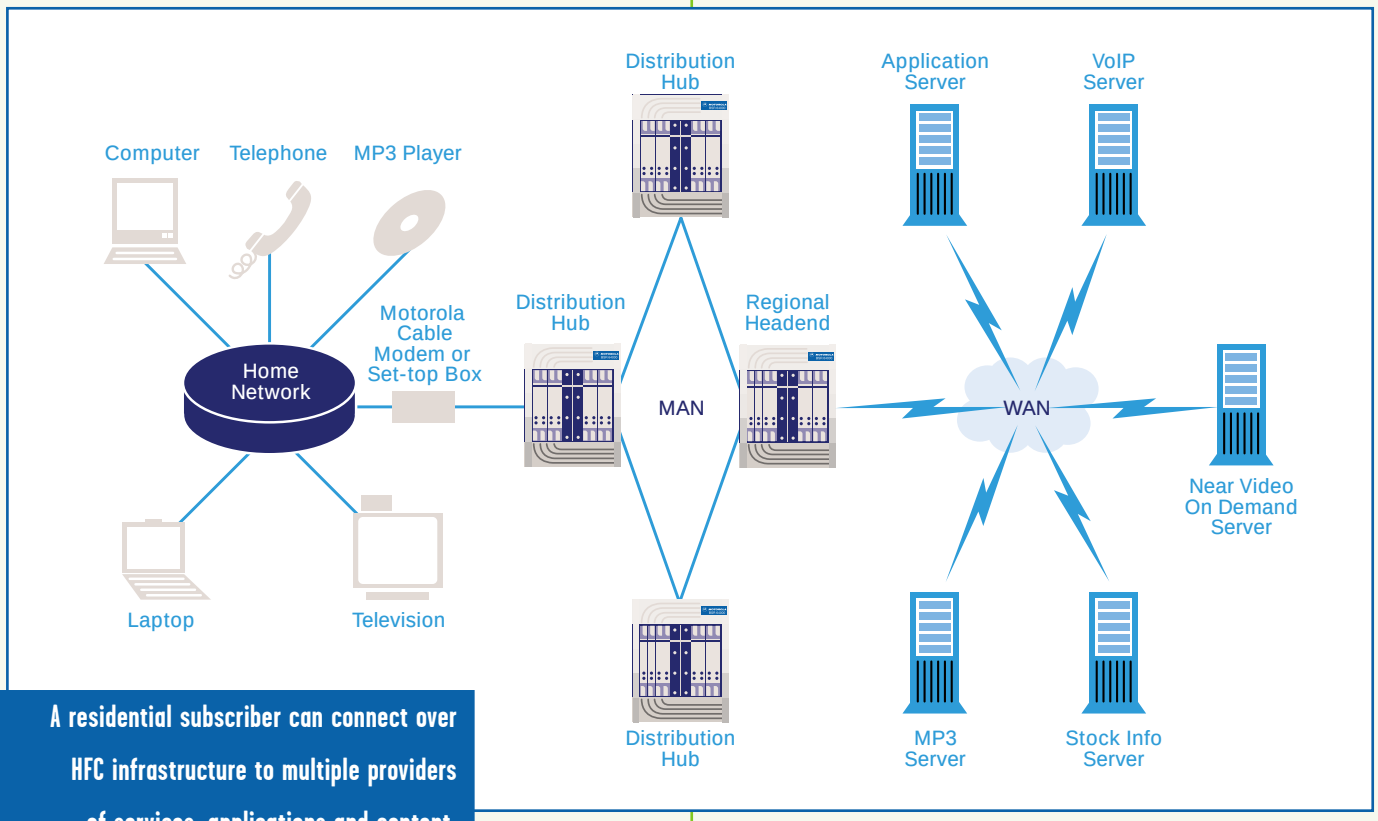

A residential subscriber can connect over HFC infrastructure to multiple providers of services, applications and content.

Requirements

Defining Open Access Requirements

Open access refers to the ability for multiple providers to deliver services, content or applications via a shared HFC access network. Operators provide the access and third-party providers can build value-added services on top of this HFC infrastructure. Subscribers can select services from multiple providers on either a subscription or pay-per-use basis. The following are some of the models for the delivery of multiple services from multiple providers that operators can implement using next-generation platforms:

- Delivery of IP network services only (transport, naming, routing, etc.) to enable a basic ISP service offering.
- Delivery of Internet services such as e-mail and Web hosting to subscribers.
- Delivery of content services via any selected ISP. For example, Application Service Providers (ASPs) can lease software programs and subscribers can access this content over the HFC infrastructure from any one of a number of ISPs.

Open access becomes increasingly challenging as operators allow multiple service and content providers access to HFC infrastructure.

- Delivery of enhanced services such as Voice over IP (VoIP) where interexchange or competitive local carriers deliver highly reliable, high-performance services over HFC networks.

Open access becomes increasingly challenging as operators allow multiple service and content providers access to HFC infrastructure. The solution is to deploy high-performance, next-generation platforms that remove the technology barriers inherent in legacy equipment and allow revenue-sharing partners to offer a diverse array of innovative services.

Legacy Equipment Constrains Open Access

Preconceived notions about technology limitations to open access are rationally based on the limitations of proprietary Cable Modem Termination System (CMTS) and first-generation Data Over Cable Service Interface Specification (DOCSIS) equipment. First-generation DOCSIS/EuroDOCSIS and legacy CMTS equipment was originally designed for closed environments where the cable operator was the sole provider of services over HFC networks. Since this equipment was not architected for the unique requirements of open access it offers limited ability to provide the sophisticated bandwidth management, routing, provisioning and traffic grooming services that are required to support multiple service providers.

Most of this legacy equipment does not support the service partitioning, Quality of Service (QoS) and carrier-class routing features required for open access, and it does not scale to meet increased subscriber demands. Some approaches require operators to create and maintain multiple RF channels to carry traffic for each provider, which requires duplicate CMTS systems and imposes network design limitations that constrain the growth of HFC infrastructure. Other approaches force operators to deploy additional subscriber management platforms to establish tunnels, but this method will also fail to scale to meet future requirements and will inhibit the DOCSIS/EuroDOCSIS 1.1 capability of assigning fine-grain QoS to application-specific flows.

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Operators need the ability to instantly recognize source traffic flows and match the traffic to the appropriate provider in real time, and they need advanced capabilities to police traffic flows and ensure that no provider consumes network resources that exceed agreed-upon specifications. Software-based routers lack the processing power to make the real-time routing decisions required to enable open access. Hardware-based packet-processing is required to rapidly classify traffic at the edge of the network for transmission across HFC infrastructure as well as across the core backbone of multiple providers.

Views of open access are often clouded by knowledge of the technical limitations of these legacy platforms, but next-generation technologies architected specifically to support open access can provide the functionality required by operators seeking to embrace new open access opportunities. The following are some of the technology obstacles that constrain legacy equipment, and each of these hurdles can be overcome by next-generation, multiservice platforms that allow operators to benefit from the many advantages of open access.

Service Provider Selection

A subscriber should be able to select from multiple providers based on the competitive nature of the providers' offerings, such as Internet access from a selection of ISPs, video service from the cable operator and voice service from Competitive Local Exchange Carriers (CLECs) or InterExchange Carriers (IXCs). Both residential and corporate customers should be able to select services either on a subscription or pay-per-use basis. This requires sophisticated, high-performance, carrier-class routing combined with flexible, open systems provisioning and management.

QoS Control

Best-effort service is adequate for standard Internet access offered by ISPs but is insufficient for most enhanced services because operators need the ability to offer different QoS levels for specific subscribers – and for specific services. Third-party providers must be able to establish Service Level Agreements (SLAs) with cable operators that document the resources required for each of many potential services. This requires the ability to create and enforce a hierarchy of nested QoS domains within the HFC infrastructure – which requires sophisticated, high-performance packet filtering and forwarding. It also requires the ability to support end-to-end QoS guarantees across both HFC and third-party networks using industry standards such as Multi-Protocol Label Switching (MPLS) and Diff-Serv.

Software-based routers lack the processing power to make the real-time routing decisions required to enable open access.

Operators need to support advanced SLA parameters such as maximum bandwidth allocation, minimum bandwidth guarantees, bounded delays and bounded jitter. They will need the ability to define QoS parameters both statically (e.g., Gold/Silver/Bronze services) and dynamically (e.g., for services such as voice call set-up). At a minimum, operators need the QoS capabilities of DOCSIS/EuroDOCSIS 1.1-based equipment, but they also need features beyond these standards to enable enhanced services over both HFC and service provider networks.

Intelligent Edge Routing

The ability to classify and treat traffic at the edge of the network is critical. This requires integrated edge router/CMTS platforms that provide sophisticated per-flow inspection to perform policy-based routing. Support for MPLS is essential so that operators can implement per-flow control across not only the access network but also the metro network and the core networks of multiple providers.

Isolation

To provide subscribers and third-party providers with predictable levels of service, it is essential that traffic flows be contained at each level of the QoS hierarchies. Overload or misbehavior within the HFC network by any given provider must be contained within the network resources committed to that specific service provider – and not be allowed to impact other providers sharing the network. The profitable delivery of open access requires advanced isolation functionality to prevent unscrupulous or naive providers from massively overselling their services to the detriment of all other providers on the HFC network.

Similarly, each service provider must be able to isolate each of its subscribers so that none of them can impact other subscribers sharing a common domain. In addition, any overload or misbehavior within a subscriber service should be isolated to that particular service. For example, a CLEC offering Internet access and voice services must be able to prevent a subscriber's Web traffic from impacting that same subscriber's voice calls.

Policing

Policing of traffic flows is required to provide the necessary isolation and enable SLA enforcement. Operators need to police traffic flows to make sure that each service provider is compliant with documented SLA parameters. The operators need flexibility to ensure that knowledgeable users do not take advantage of network QoS mechanisms to obtain services for which they have not paid. Traffic that exceeds SLAs should be handled according to SLA policies that determine whether excess flows should be dropped, assigned lower priority levels or routed at incremental costs.

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Operators must be able to efficiently scale HFC infrastructure to accommodate increased demands for new services and content.

Address Management

In the current Internet access model, a service provider manages IP addresses for subscribers and statically or dynamically allocates unique IP addresses that fall within that provider's address space. Traffic to the subscriber is then routed to the provider's network based on this IP address. Open access will involve having IP addresses assigned from multiple servers or having multiple address ranges assigned from a single server. Systems must be able to support these demands and deliver the ability to rapidly read and process the source address in real time.

Service Management

In the open access model, services are provided to subscribers from multiple sources. Each provider, therefore, must be able to ensure that its services are working correctly for all subscribers. This becomes increasingly complex since each service is based on QoS-enabled IP transport over a shared HFC infrastructure rather than over dedicated PSTN lines. Effective service management requires operators to develop sophisticated QoS and availability parameters and offer third-party providers the ability to test, quantify and troubleshoot delivery of multiple services to all of their subscribers – end-to-end, from the cable modem to the backbone network of each provider.

Subscriber Management

Provisioning becomes increasingly difficult in environments with multiple service providers because a single subscriber may select multiple services from any number of providers. Operators need the flexibility to enhance revenue by offering provisioning and billing services to revenue-sharing customers that isolate flows for each subscriber and for each provider. The advanced subscriber management features required for open access were not even considered when legacy equipment was originally designed so operators need next-generation platforms that enable highly tailored subscriber management and provisioning.

Partitioned Network Control

In an environment with multiple service providers, the CMTS is a shared resource that requires robust routing

capabilities to support open access applications. It must be capable of implementing filtering, QoS and routing policies for multiple service providers – all at the same time. Each service provider should be able to independently view its own services, subscribers and network resources.

Accounting and Metering

Allowing multiple service providers to operate over a shared access network requires robust features for reconciliation and billing. Detailed accounting information will need to be maintained on QoS usage to ensure that SLAs are enforced, and the sophistication and complexity of accounting can vary dramatically. In the simplest case, a provider could define an SLA and the cable operator could implement a policing mechanism to ensure that it is not exceeded. However, in most applications both the provider and operator will want to meter the SLA to ensure conformance. If subscribers have access to pay-per-use services such as long-distance phone calls or video conferences, then the operator needs to offer metering services that can support dynamic billing. Billing models based on both time-of-use and traffic volume are required with an event-driven mechanism used to initiate and terminate metering at wire-speed.

Scalability

Operators must be able to efficiently scale HFC infrastructure to accommodate increased demands for new services and content. This requires next-generation equipment with faster forwarding engines, increased port density and greater abilities to add network ports so operators can increase network capacity to support revenue streams from multiple service providers.

Density

As providers aggressively develop partnerships with ISPs and content providers demand for cable services will escalate. The ability to maximize use of scarce real estate at the distribution hub and regional headend requires next-generation platforms that provide higher-density RF termination and eliminate the need for external equipment such as up-converters and LAN switches.

Performance

Services such as VoIP require consistently high levels of performance, and wire-speed forwarding is required to support a vast array of enhanced services offered by third-party providers. Hardware-based packet filtering and forwarding is the only way to meet the performance demands of open access applications.

Interoperability and Manageability

Operators need equipment that supports the most widely used routing protocols, standards-based network management and IETF standards such as MPLS and Diff-Serv for handoffs from the HFC network to each provider's backbone network.

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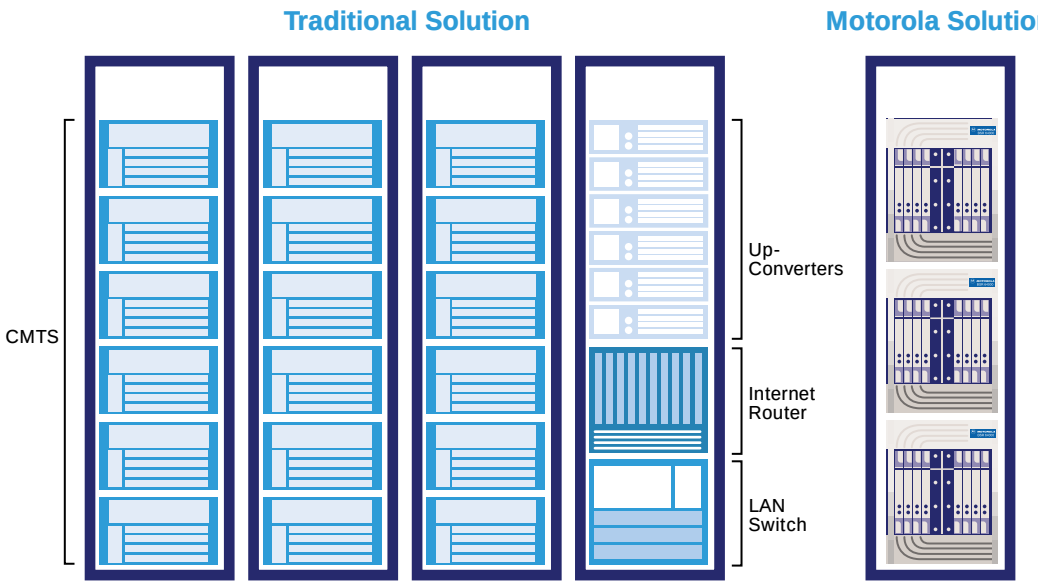


The BSR 64000 is a high-density platform that streamlines operations and management.

A Next-Generation, Multiservice Platform for Open Access

The Broadband Services Router 64000 (BSR 64000) from Motorola allows operators to efficiently – and profitably – support open access and develop sustainable revenue streams from multiple providers. Operators can sell services to CLEC, IXC and ISP revenue-sharing partners – as well as specialized content providers, such as ASPs or gaming and entertainment providers. The system includes flexible interfaces for SONET and Ethernet connectivity and it eliminates the need for discrete CMTS equipment, up-converters, aggregation switches and routers.

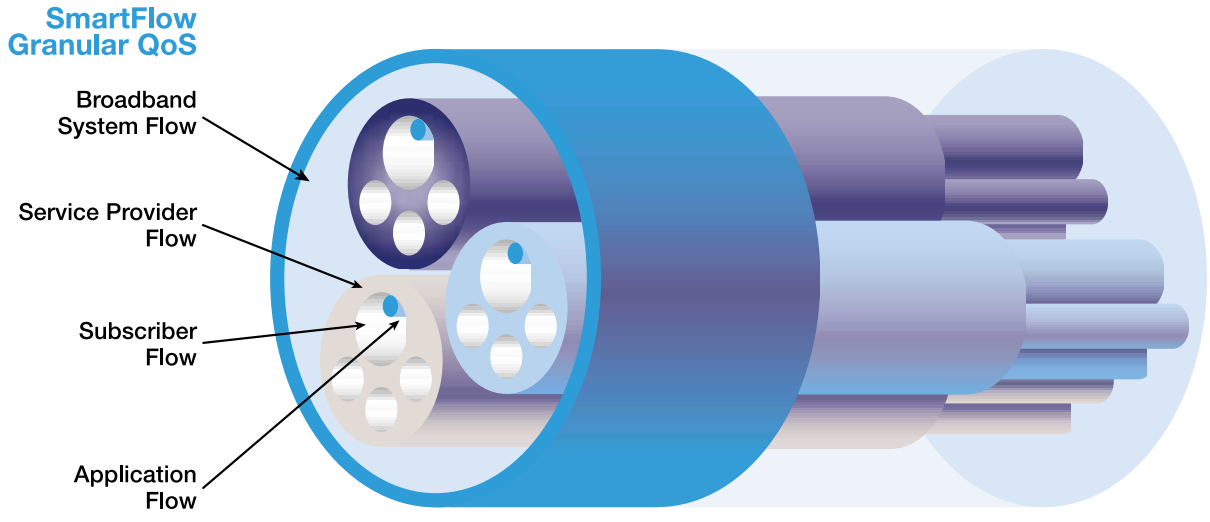
The BSR 64000 offers unified management of routing, QoS and CMTS functions and scales economically to meet ever-increasing subscriber demands and the introduction of new services. It can be deployed in the distribution hub to provide an interchange point between the regional fiber network and the cable plant and in a regional headend to interconnect the regional network with a backbone network to allow connectivity to local content servers and management systems. The BSR 64000 is based on the DOCSIS/EuroDOCSIS 1.0, DOCSIS/EuroDOCSIS 1.1 and PacketCable 1.0 standards. It offers full-featured support for policy-based routing and MPLS so operators can profitably support third-party providers.

SmartFlow™ – The Key to Open Access

The SmartFlow features of the BSR 64000 perform content-aware packet classification through Layer 4 to provide unprecedented QoS flexibility. Since all the processing-intense filtering, forwarding, accounting and QoS/SLA functions are performed in hardware at wire-speed, the BSR 64000 reduces latency to a fraction of that commonly found in mainstream, software-based routers.

SmartFlow features of the BSR 64000 offer the QoS, isolation and policing capabilities that allow operators to deliver flexible, measurable and enforceable SLAs to both providers and subscribers and allow the delivery of real-time services over the HFC network from multiple sources. Operators establish and enforce network policies for admission control and rate limitations to ensure that all SLAs can be met while optimizing revenue from available network capacity. SmartFlow enables the isolation, policing and address management needed to implement measurable SLAs.

SmartFlow provides the wire-speed flow classification and forwarding required to deliver highly-granular QoS levels for multiple applications and multiple services.



The BSR 64000 offers several options for management, control and administration.

Guaranteed End-to-End Service Delivery

A carrier-class implementation of MPLS allows operators to create Label Switched Paths (LSPs) from the edge of the network through the core network of multiple providers. The BSR 64000 is an MPLS Label Edge Router (LER) that inspects traffic flows in hardware to enable real-time flow classification and forwarding at the edge of the network.

Carrier-Class Availability

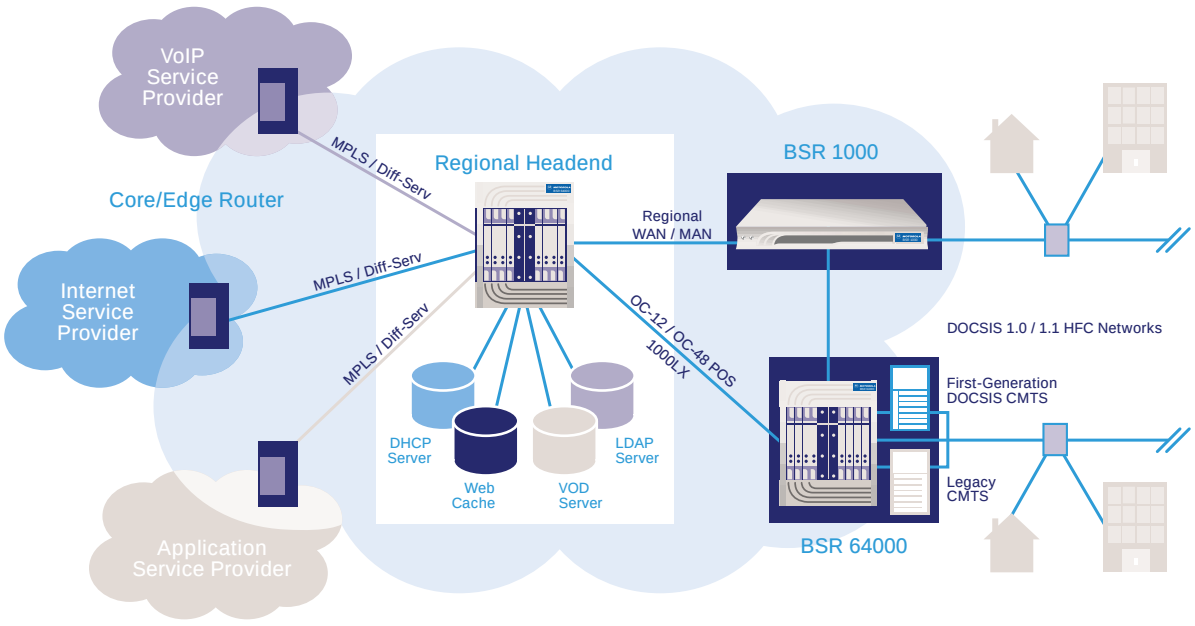
The BSR 64000 is architected for 99.999 percent availability and provides the fault detection and switchover required for high-availability services. The carrier-class BSR 64000 supports all of the traditional Central Office (CO) operational requirements – such as minimal disruptive software upgrades in redundant pairs, live insertion, version roll-back, integration into the alarm scheme and full NEBS compliance. Extensive fault detection and reporting features let operators optimize system performance and deliver primary-line IP telephony reliability.

Automated Subscriber Management

The Advanced Provisioning System is a powerful element management and service creation and provisioning system aimed at operators seeking rapid definition and deployment of highly customized IP services to millions of subscribers. Operators can allow partners to create QoS policies and service profiles that can be applied to a subscriber or group of subscribers. Flexible metering services can be provided to allow various billing methods, and operators can carefully track utilization and accurately generate invoices to maximize revenue from both retail subscribers and revenue-sharing partners. They can create profiles for each user and even allow them to self-provision services through a Web-based interface.

Partitioned Management Views

The BSR 64000 offers several options for management, control and administration. In headend locations with limited availability of trained staff, troubleshooting on the BSR 64000 is simple – with easy-to-read diagnostic LEDs as well as remote management capabilities to



MPLS and Diff-Serv allow operators to classify and treat traffic to enable end-to-end service guarantees across the core networks of multiple providers.

support provisioning, configuration and problem identification. The BSR 64000 supports Simple Network Management Protocol (SNMP) v1 and v3 and offers a Cisco-compatible Command Line Interface (CLI) for ease-of-use and interoperability with legacy infrastructure. Partitioned management features on the Advanced Provisioning Manager allow each provider to view its own network management environment and its committed resources on the HFC network.

The BSR 64000 Eliminates Technology Barriers to Open Access

Cable operators can aggressively shift their business models to create new revenue streams from open access opportunities. They can overcome the technical limitations of legacy CMTS and routing equipment to expand market share, increase subscriber penetration and generate additional profits.

Operators can deploy a single integrated solution with full-featured routing and a high-density CMTS, and they can leverage investments in legacy CMTS equipment while enabling open access. The BSR 64000 is architected for 99.999 percent reliability so operators can generate revenue from revenue-sharing partners by allowing them to offer enhanced services such as IP telephony or video conferencing. SmartFlow sophisticated-flow classification and QoS treatment delivers the intelligence needed to offer the guaranteed SLAs required by partners. The tight integration of routing and CMTS features allows operators to maximize the use of headend space and simplify management and operations while delivering robust new services.

The BSR 64000 removes the technology barriers to open access and allows broadband cable operators to scale their infrastructure to support new revenues and services. Finally the promise of open access can be realized and MSOs can embrace open access as a welcome new revenue source that creates increased subscriber loyalty to the cable network.

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101 Tournament Drive, Horsham, PA 19044
800.523.6678 www.motorola.com/broadband
5392-1001-5K