

A Coaxial-based Broadband Delivery Solution for the US Hospitality Industry

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INTRODUCTION

This paper discusses an alternate approach to the delivery of broadband services to the hospitality industry. This alternate approach has proven to be particularly effective in retrofit applications.

The hospitality industry has entered an era where the requirement for broadband data service within the guest rooms is a required amenity. In addition, this requirement is expanding to include wireless broadband delivery in the conference rooms, lobby and other common areas. The ability to lure travelers' back, particularly business travelers depends on the level of customer satisfaction regarding services and facilities. Hoteliers recognize broadband delivery as a differentiating service that will determine where travelers will stay.

Hotel owners are now being inundated with numerous broadband delivery solutions; the difficulty for the owner is determining what solution will be cost effective while ensuring that the necessary broadband services are being provided. While there are a multitude of companies offering solutions for the hospitality marketplace, there are three primary "core" technologies available for the distribution of broadband delivery. These are; (1) the use of the on-premises twisted pair wiring, (2) wireless deployment and (3) utilizing the on-premises TV coax. It is against the backdrop of these technology offerings that a decision must be made regarding the actual deployment. In the last year, a new deployment technology has been introduced which takes advantage of the existing coaxial wiring, provides broadband delivery and does not interfere with any of the existing coaxial services. This technology, "On-Premise Ethernet over Coax" from coaXmedia, provides a high-performance, robust and extremely cost-effective solution for broadband delivery using the existing coaxial infrastructure.

To expand on the discussion of the "core" available technologies; the hospitality industry typically has used twisted pair technologies, such as Ethernet switches, xDSL and long-range Ethernet. Earlier coaxial-based solutions have been deployed primarily into apartment complexes. While these technologies can

deliver the required bandwidth, the necessary hardware and installation often drive the cost beyond \$200 per door passed. coaXmedia's "Ethernet over Coax" solution, has driven the cost per door in the hospitality marketplace down to a level that allows a payback period of less than one year, generally considered to be an acceptable business model for deployment.

This paper summarizes a technology that is rapidly gathering momentum in this marketplace. Ethernet over Coax (E/c) is based on a server/client architecture and utilizes the existing coaxial wiring as the distribution medium for reaching end-users. This architecture provides, among other capabilities, software based feature enhancements, use of a variety of "backhaul" choices, and a price point that is both technology and marketplace driven.

HOSPITALITY OPPORTUNITY

Data provided from the "Smith Travel Research, PPR, Dodge" indicates that as of mid-2003 there are approximately 4.5 million hotel rooms available in the US. Based on accompanying data from this report, approximately 3.9 million of these rooms were built prior to 1998. These earlier constructed rooms generally have coax available but may not have either CAT3 or CAT5 wiring installed. If a twisted-pair solution is implemented for high-speed data delivery, these rooms often require extensive re-wiring to support this technology. Even rooms that have CAT5 available for the delivery of voice service may not be properly configured to support broadband data delivery, thus requiring some level of rewiring to support data delivery over the CAT 5 twisted pair wiring. On the other hand, these rooms have a coax infrastructure in place to support video delivery; this in-place infrastructure is an ideal delivery media for high-speed Internet/data service.

Note the following comments/data from various industry studies:

"More than 92 percent of business travelers base their hotel choice on the availability of fast and easy-to-use Internet access. A reported 25 million travelers today are demanding HSIA in hotels, a jump of 15 times what it was just five years ago." - Hotel News Resource 6/19/2003

"During a time of serious economic challenges to the hospitality industry, it pays to look at our operations to see where we can squeeze out some costs, or generate some incremental revenue. In the case of HSIA, an industry-wide take rate of 3 percent appears to provide a 97 percent chance for an opportunity to do just that." - Hospitality Tech Advisor 2/27/2003

Based on data from the Cahners In-Stat Group, the combined services and equipment market for multi-hospitality buildings in the United States will grow from \$137 million in 2000 to over approximately \$700 million in

2004. "This growth will benefit all three sides of the MHU broadband access triangle: the service provider, the equipment manufacturer and the property owner," stated Cahners.

The billing requirements for Hotel/Hospitality applications often include the ability to charge for service on a daily or even on an hourly basis. Authentication and accounting become an important part of the hospitality-based broadband solution.

The increased demand for broadband data delivery by hospitality customers ensures that this technology will become a revenue producing service for the cable providers, the telecom providers, the service provider and the owners of the hotel/resort complexes. It is important that the business traveler needs to be able to connect to broadband delivery in the most "hassle free" manner. The user may not have the technical background to reconfigure network settings on the PC, and indeed may not have the authorization to do so by his company. If he does reconfigure, he may have issues upon returning home to his company network. Features such as DHCP support, IP spoofing, and SMTP relay for email provide the client with full connectivity and functionality without the requirement to reconfigure the laptop.

Almost all the hotels/resorts have access to coax within their buildings since this is the preferred delivery system for video. Within the hotel/hospitality industry the adoption of broadband data is in its early stages, with the delivery system, to date, being based on twisted-pair technology. It is anticipated this adoption rate will increase dramatically in the next 12 to 24 months. As this occurs, there will be a significant increase in high-speed data deployment using either, or both, coax and wireless technologies. During the first half of 2003, a trend regarding the deployment strategy of high-speed data service has unfolded within the US hotel marketplace among several major hotel chains. These hotels have mandated that high-speed data service be provided to every room within their hotels. In support of this mandate, several of these hotels have issued "standards" that dictate what the performance and the functionality of the data deployments will be. A trend is unfolding in the US marketplace and that is for the hotels not to bill for high-speed data service to the guest rooms. This suggests that high-speed data is becoming an amenity within the guest rooms. These hotels, however, will continue to bill for the delivery of service to the conference and common areas. As a result, high-speed data service to the common areas continue to require an authentication and billing capability integrated into the high-speed data delivery system. An exception to the trend towards high-speed data as an amenity in the guest rooms are those hotels in close proximity to large convention centers who are continuing to charge on a per guest room basis.

ARCHITECTURE CONSIDERATIONS

For the distribution of high-speed data within hotel/hospitality applications, there are three primary technologies available: 1) on-premises twisted pair wiring, 2) wireless and 3) on-premises TV coax. The first technology, unmodified telephone twisted pair solutions for broadband delivery are sometimes difficult to achieve due to pair to pair crosstalk and electrical interference and do not have the generous bandwidth of TV coax wiring. While wireless solutions provide good flexibility, their ultimate sharing of limited spectrum and potential cross interference are challenges for the future. The existing "TV" coax can be used as the end-user distribution media by providing an Ethernet-over-coax system that can be cost effectively utilized to provide broadband services. These technologies are briefly summarized below:

1) Twisted Pair Solution

Perhaps the most cost effective solution available for new construction is a simple deployment of CAT5 twisted pair Ethernet. Guest units in relatively close proximity (<100 meters) will be best served by making wiring runs from each guest unit to the wiring closet (home runs) with inexpensive CAT5 cables. A simple managed switch in the wiring closet will provide connectivity for these units, the backhaul router and a subscriber management box. Unfortunately, 10BaseT and 100BaseT have operational distance limitations of 100 meters between an end point and the switch. Where the distance limit is exceeded, the use of xDSL modems or Long Range Ethernet solutions are much more costly. Also, if the hotel is not new construction, rewiring with CAT5 is difficult and cost prohibitive.

2) Wireless Solution

One of the most recent high-speed delivery solutions utilizes wireless technology minimizing the need to modify the existing wiring within the hospitality unit. It also offers flexibility in the placement of an end-users' computer with the assumption that the signal distribution is uniform and consistent throughout the building. Unfortunately, this is often not the case, especially in the larger hotels, due to overlap/coverage issues. All, or several of the following generally cause these coverage issues; poor placement of the wireless access points (WAPs), minimal transmission power, poor channel planning and coverage problems that are unique to the building structure. Because of these problems, wireless deployments for individual rooms can be labor intensive.

A wireless application, which has achieved wide acceptance, is the deployment of "hot-spot" wireless access points. In the case of a hotel/hospitality application this would provide broadband connectivity to the common areas, such as the meeting rooms, lobby and recreational areas.

The deployment of hot-spots is generally much more straightforward than deployment into the hotel's individual rooms.

While wireless solutions provide good flexibility, their ultimate sharing of limited spectrum and the potential cross interference, particularly within the entire hotel, will limit this technology to being a complementary technology with its wired counterpart for hotel/hospitality applications.

3) Coaxial Solution

Coaxial cable has the ability to support a frequency range from DC to over 3 GHz, while providing a relatively low loss budget within a closed or shielded environment. This shielded environment allows the use of all the frequency capability within the coax without the concern of interference with the over-the-air signals in the same frequency domain. With this understanding, the advantage of coax as a distribution mechanism becomes apparent since only fiber can deliver higher bandwidth within a closed environment. From an available bandwidth perspective, there is no comparison between twisted pair and coax.

The coaXmedia "Ethernet over Coax" product offering takes advantage of the tremendous bandwidth available within the coaxial network that is used to distribute video within the Hospitality location to provide broadband services. The coaXmedia ® E/c system consists of two hardware elements – the server (Broadband Gateway) and the client (Access Appliance or AA). The Broadband Gateway resides in a wiring closet or office on a property and is connected to any available wide area network (WAN) backhaul via a 10/100BT Ethernet connection. Examples of these WAN service connection types include T1, DSL, cable modem, fiber, power line connection or fixed wireless. Once the Broadband Gateway is deployed, every coax outlet connected to the coaxial infrastructure is enabled to provide data service. The Access Appliance (AA) can be easily installed, with the transmit levels and registering of the AA on the network occurring automatically. **It is important to note that there is no interference between the coaXmedia system and any of the existing video services currently being provided on the in-building coax.** Note the following figure (Figure 1) to describe the topology of an installed system:

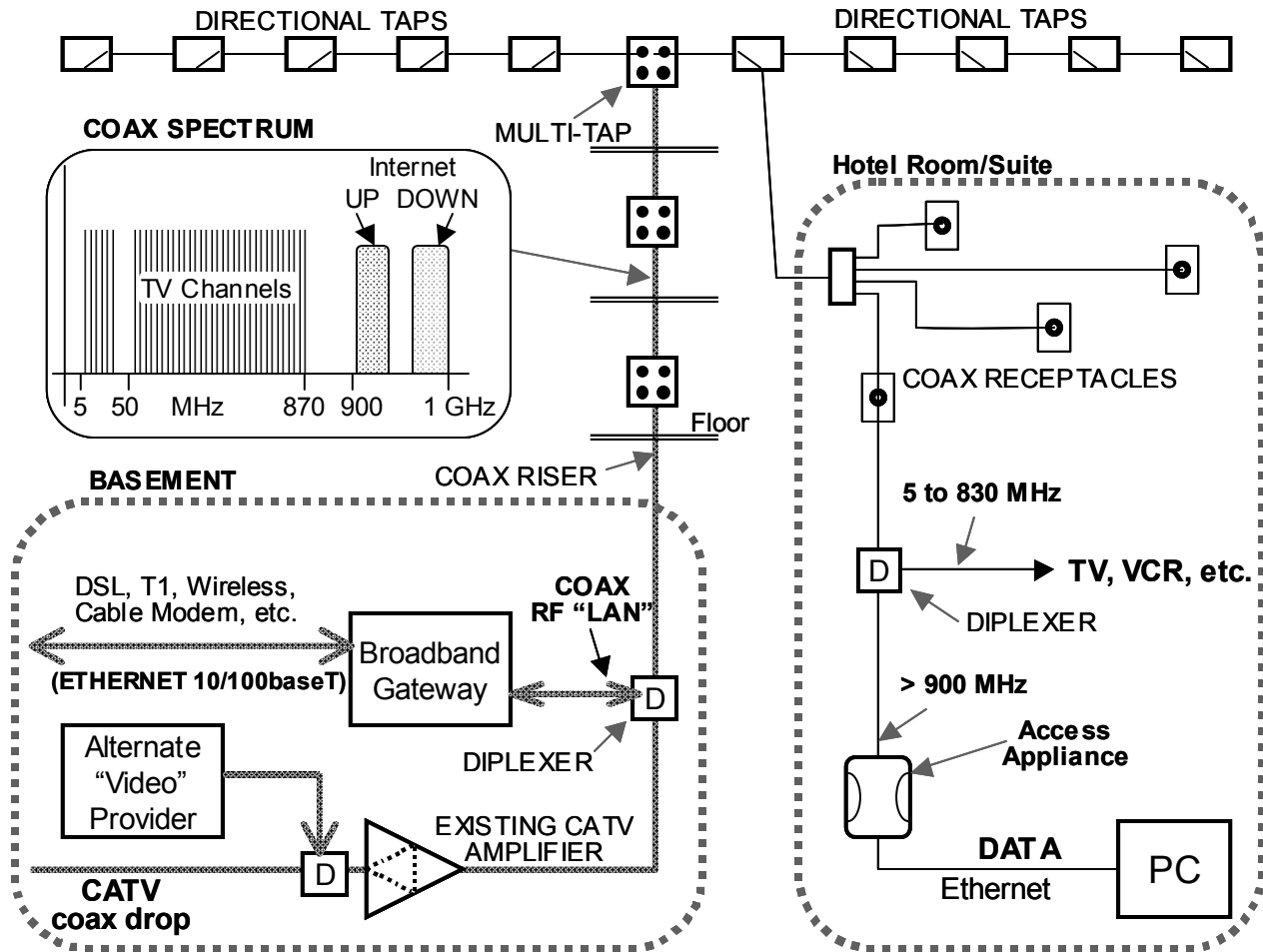


FIGURE 1: Example Deployment Topology

Each Gateway can manage up to 256 Access Appliances, provide a variety of functions commonly associated with a standard IP-based router and network access gateway, as well as specialized features for the hotel/hospitality marketplace. The Broadband Gateway has three basic operating modes; specifically, Bridge mode, Router Mode or Network Address Translation (NAT) mode. Table 1 shows the feature set capability as a function of the operating mode of the Gateway:

Function/Feature	NAT Mode	Router Mode	Bridge Mode
T&C Acceptance Page	Y	Y	NA
URL Redirect	Y	Y	NA
DHCP Server	Y	Y	NA
DHCP Client	Y	Y	Y
VPN Support	Y	Y	NA
IP Spoofing	Y	Y	NA
MAC Masquerading (1)	NA	NA	Y
QoS / Bandwidth Shaping	Y	Y	Y
SMTP Relay	Y	NA	NA
LAN Sharing (VLAN)	Y	Y	NA
TCP Port Mapping	Y	NA	NA
Multicast	Y	Y	Y
Log to server	Y	Y	Y
SNMP ver. 1.1	Y	Y	Y
Telnet support	Y	Y	Y
Interface to Property Mgmt. System	NA	NA	Y (Note 2)
Interface to Authentication Server	NA	NA	Y (Note 2)

Note 1 - Selectable on an individual Access Appliance basis.

Note 2 - Bridge mode is used in conjunction with a third party platform for PMS and Authentication

TABLE 1: Gateway Functional Matrix

Each Broadband Gateway provides up to 36 Mb/s downstream and 12Mb/s or 24 Mb/s upstream service. This bandwidth is shared among the Access Appliances connected to the Gateway, thus providing more than enough bandwidth for the typical hotel/hospitality application. Each Access Appliance is capable of fully utilizing the bandwidth supplied to the Broadband Gateway, or up to the designated subscriber limit configured by the system operator (independently configured per Access Appliance). Users simply connect the Access Appliance to their PC's network card, allowing Ethernet traffic to be passed between their PC and Broadband Gateway quickly and securely.

HOTEL/HOSPITALITY APPLICATION EXAMPLE

Many hardware/software vendors provide specific solutions for the differing sectors within the hotel/hospitality and MDU marketplace. Unfortunately, all too frequently a collection of various vendor's hardware and software is required to implement a specific solution. Note figure 2 below showing a potential twisted pair (CAT3/CAT5) solution as it might be deployed for hotel/hospitality application:

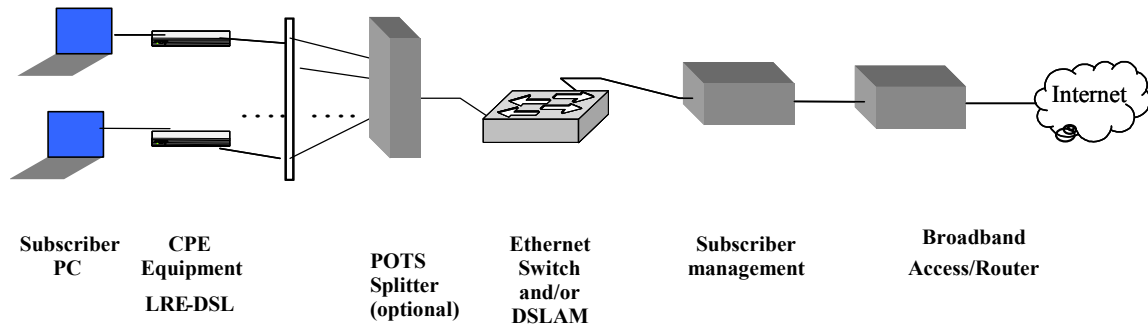


FIGURE 2: Block Diagram for a Twisted-Pair Solution (Hotel/Hospitality)

By using a server/client architecture with an intelligent server that can be configured to emulate the set of desired applications, the eclectic collection of hardware and software can be cost effectively implemented in a single unit.

Figure 3 shows the potential reduction in the number of external “boxes” by combining much of the functionality of the Subscriber Management System into the Broadband Gateway. It also shows that the use of the coax as a shared media removes the requirement for the POTS splitting function and the Ethernet switch.

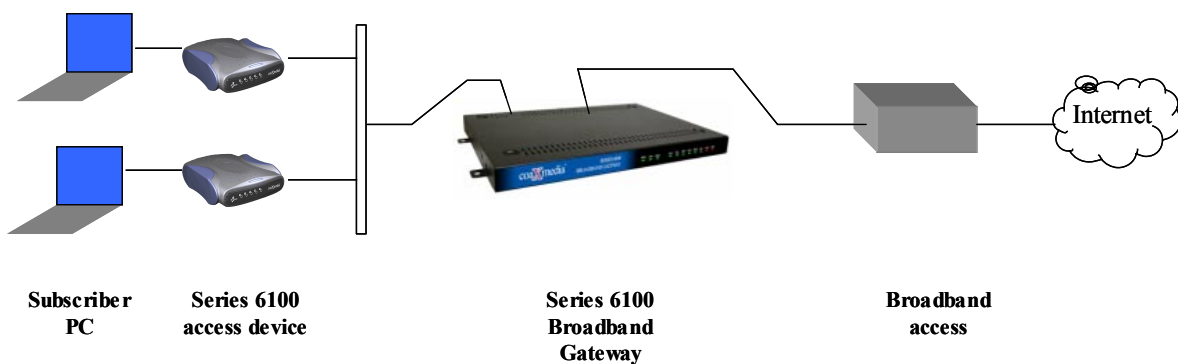


FIGURE 3: Block Diagram for a Coax-based Solution (Hotel/Hospitality)

MANAGEMENT SYSTEM

coaXmedia's Network Management Software (NMS) is distributed as a standalone Web server and a collection of HTML (Web) pages. Acting together, this software can control every aspect of a coaXmedia network including the Broadband Gateway and the individual Access Appliances. This section briefly describes the coZmo Network Management System.

The coZmo Server, which is running on a local or remotely located PC, can communicate with Broadband Gateways using either the serial port or through a TCP/IP network. Connecting the coZmo Server computer to a Broadband Gateway via a serial (RS-232) port requires only a DB9 female to DB9 female null modem serial cable. When using a TCP/IP connection the connection is very straightforward, connect the network cable from the coZmo Server computer to a hub, switch, or router, which can communicate with the Broadband Gateway. This allows remote control and monitoring of a single or multiple Broadband Gateways.

Overview

coZmo allows operators to monitor and manage numerous coaXmedia Broadband Gateways and the Access Appliances attached to them from a single, centralized console. coZmo does this by acting as a specialized Web Server that allows operators to use a Web browser such as Internet Explorer to view and manipulate the managed devices.

coZmo structures its view of the devices in the network hierarchically. At the top of the hierarchy are *Sites*, which identify a specific geographic location. For example, a site might be a single hotel ("Hampton Inn - Atlanta") or a hotel complex ("Sugarloaf Resort").

Each site has associated with it one or more Broadband Gateways. For example, the site "Sugarloaf Resort" might contain Broadband Gateways named "Building 1" through "Building 10".

Finally, each Broadband Gateway is associated with the Access Appliances for which it provides network services. For example, the "Building 1" Broadband Gateway of the "Sugarloaf Resort" site might contain Access Appliances "Room 1-A" through "Room 1-L" if each building contains twelve guest units.

Figure 3 is a screen shot that shows this functionality; note that the screen on the left shows the hierarchal structure, whereas the screen on the right shows specific information regarding the status of Broadband Gateway(s).

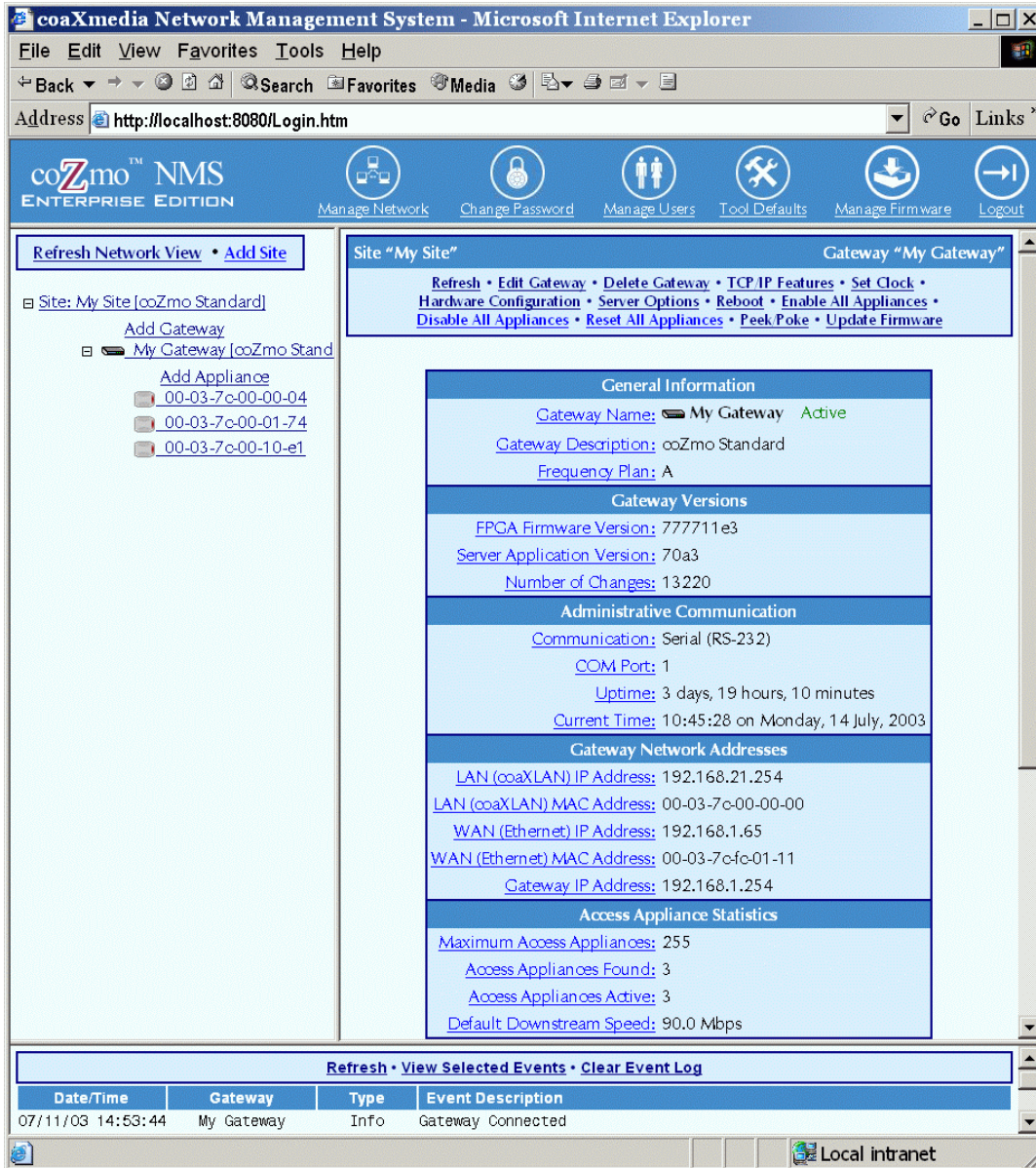


FIGURE 3: Screen Shot of coZmo’s Gateway Information/Management Page

coaXmedia’s network management system allows the administrator to manage and monitor guest connections. This capability includes the ability to view individual Access Appliances when they are connected to the Broadband

Gateway and to see when a user is connected to a given Appliance. When the user is connected, his or her assigned IP address will appear associated with the Appliance. When no user is connected to the Appliance, the IP address will appear as 0.0.0.0. coZmo also indicates when the Appliance is enabled and discovered, which means that it is ready for connection to a client.

The following (Figure 3) is a screen shot that shows the control and status information of the individual Access Appliances in the various guest rooms. Note that the screen on the left shows the Appliance with its unique MAC address, this address can be tied uniquely to an individual guest room by typing a room number into the "Description" field on the right-hand portion of the screen shot. Each Appliance can be enabled, disabled, reset and the data rate can be controlled in 0.1 Mbps increments from 0.1 Mbps to 20 Mbps.

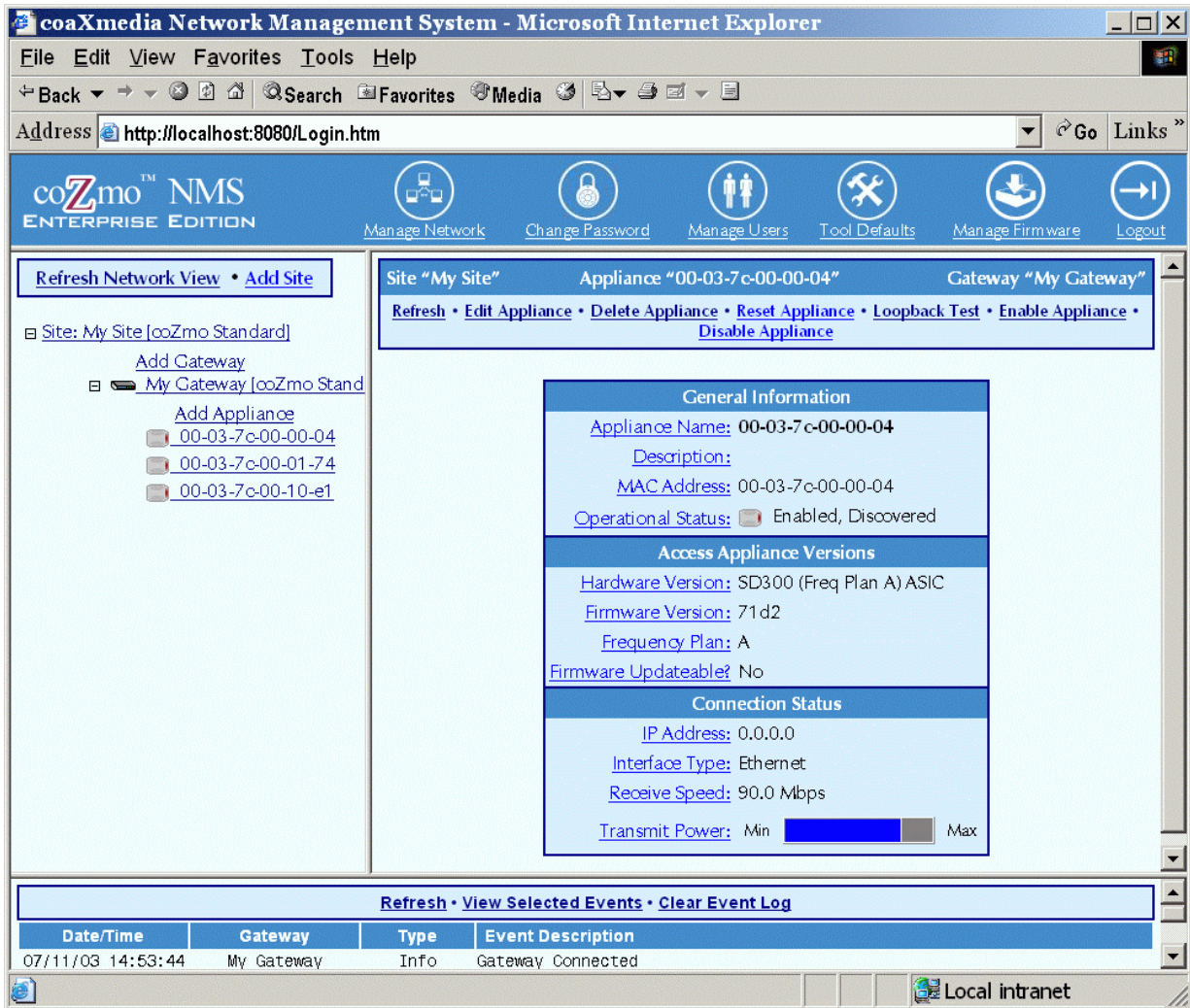


FIGURE 3: Screen Shot of coZmo’s Access Appliance Information/Management Page

For an application where an interface into a hotel's Property Management System (PMS) is required, the Gateway is configured in Bridge mode and a PMS interface is provided between the Gateway and the Internet.

CONCLUSION

A wide selection of technologies is available for delivery of broadband access to the hotel/hospitality marketplace. The importance of developing a business model that reflects the cost of the hardware/software, installation, marketing, support and backhaul to the Internet cannot be overemphasized.

With the multiple technologies available, a viable solution often combines more than one technology. As an example, the use of a wireless system for the delivery of the "backhaul connection" to the Internet can be used in combination with coax or twisted pair for the delivery of data services to the subscriber within the hospitality application. Additional backhaul connections can include such media as T1/E1, cable modems, wireless, power line connection, fiber, etc. Within the hotel/hospitality complex, a hybrid combination of a wireless hotspot technology for the common areas and a wired solution for the guest rooms can be both a cost and performance effective solution. In summary, the final solution often combines the lowest cost and highest performance components from a collection of available technologies, to architect the proper combination of these components is not always a straightforward decision.

The Ethernet over Coax solution, using the server/client architecture provides a highly cost effective solution. This solution takes advantage of the existing coaxial infrastructure and can provide data services without having to upgrade the coax to support DOCSIS compliant services. Having the necessary "hooks" designed into the core product offering permits the use of complementary technologies in support of coaXmedia deployments. This approach permits the addition of advanced features within the server to support multiple services. These additional services could include such capabilities as; video delivery, both VOIP and circuit switched telephony as well as incorporating the necessary controls to allow a combination of wired and wireless devices over the same coaxial network.