DOCSIS is not Just for Cable Anymore

What wireless operators have to know about the Cable Modem Termination System

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For the cable industry, data services have long been standardized. Thanks to the DOCSIS standard, cheap and reliable equipment is now available from multiple sources. Under the standard, the Cable Modem Termination System (CMTS) resides in the cable headend and communicates with cable modems that reside on the user premises to provide broadband access.

Thanks to low-cost CMTS, it became financially viable for the cable industry's Multiple System Operators (MSOs), municipalities, and Private Cable Operators (PCOs) to provide data services on coaxial cable – even to hotels, apartment buildings, and other multiple dwelling unit settings. With the next generation of CMTS products, the technology is being extended to support Wi-Fi and Fixed Wireless applications. This also allows for hybrid implementations, where a single CMTS can be used to support cable and Wi-Fi or Fixed Wireless applications *at the same time*. This article describes the use of CMTS on cable networks and in Wireless applications.

Flavors of CMTS

What type of system you choose depends on the size of the network, your budget and (most importantly) the revenue potential. CMTS comes in two flavors:

The CMTS performs a complex set of tasks, configuration and monitoring of IP as well as RF parameters. Simple and easy-to-use systems with stability tend to provide the lowest operational cost.

1. Those that have the CMTS and the management systems in one unit.
2. Those with an external management server designed to support several CMTS networks.

The second type is ideal for very large networks spanning a large city. The first type is more cost-effective for smaller networks, including smaller MSOs, small town municipal systems, PCOs, Multi-tenant units (MTUs) or Multiple-dwelling units (MDUs) and hospitality. In either case, you should choose a standards-based system solution for ease of replacement and lower overall cost.

Make no mistake. The CMTS performs a complex set of tasks, configuration and monitoring of IP as well as RF parameters. Simple and easy-to-use systems with stability tend to provide the lowest operational cost. For example, in a small network a CMTS with a Web-based interface is easier to install, configure and manage than those using a command-line interface. The monitoring data available in a Web/GUI interface is more meaningful and easier to comprehend. That, in turn, helps to more easily debug the network.

Management tools are also important. The systems that provide configuration, customer provisioning tools, IP monitoring tools, QoS configuration, RF management and RF monitoring tools from a Web browser window make it extremely simple to mange the network remotely. Such integrated tools reduce the total cost of equipment and maintenance. One of the most critical needs is the ability of the RF management tools to identify signal levels and noise levels at the CMTS and at the modems so the operator can monitor the RF health of the plant from his or her office rather than visit the customer site. Only a few of the more sophisticated CMTS offerings provide all of these features.

The MSO and MDU Environment

Cable operators, of course, want to increase their revenue base with ad-

ditional services like data and voice. Small- to medium-size cable operators with 200 to 10,000 subscribers on a given network can use a small CMTS to provide broadband access. The same applies to the PCOs or municipal networks.

With a drop in the price of CMTS and cable modems, MTU/MDUs offer lucrative opportunities for cable-based broadband access. There is an existing coaxial cable in almost every apartment or hotel room. It is lot more cost effective and convenient to use this coaxial cable for broadband access rather than rewiring for the following reasons:

1. It costs $150 to $200 per Cat5 cable drop (that is, per hotel room or dwelling unit).

2. New cable installation is disruptive to tenants in an MTU/MDU or hospitality business.

3. It is simple and easy to turn on and off the user service, by remotely activating or deactivating the cable modem.

In the hospitality space an operator can recover costs in four to nine months depending on the size of the property (number of rooms) and the amount charged per room. The typical rates in hospitality are $5 to $10 per day. In the case of MTU/MDUs and MSOs it typically takes nine to twelve months to recover the cost, on average. The price for Internet data service varies from $20 to $40 per month; some MSOs get even more. Overall this is a very attractive proposition for systems operators.

CMTS in Wi-Fi

As you can see, DOCSIS technology is wildly successful in cable space. Now it is being extended into the Wi-Fi and the Fixed Wireless space. A hybrid cable and 802.11 hotspot network can be a powerful combination. A WISP (Wireless ISP) can provide wireless Internet services with Wi-Fi hotspots. A WISP and cable operator can partner to install a CMTS plus Wi-Fi access points for a powerful business combination. Wi-Fi access points can be connected behind the cable modems to build a mixed network supporting wired and wireless access at the same time. Those users needing higher speeds or secure wired connections will use the cable modem service. The customers who need the convenience of mobility can use the Wi-Fi based service. It can all be managed at the same time by the same CMTS and the same personnel if desired.

One large Internet access connection at the cable headend can support all access points in a very large area, since Hybrid Fiber-Coax cable plant can span several tens of miles.

How does it get built? The cable operator can decide to provide Wi-Fi service or hotspots along the cable network. This can be achieved by installing outdoor cable modem plus 802.11 access point combinations on poles or attached to the cable itself. The modems and access point combinations can also be located inside local business along the cable plant, such as in Internet cafes, coffee shops, shopping malls, restaurants, apartments and hotels. This network architecture allows for the following business models:

1. The cable operator can enter into the hotspot business providing Wi-Fi service wherever there is cable.

2. A WISP partners with a cable operator and provides data service to hotspots, using the cable as a backhaul.

3. A WISP can rent or purchase a 6MHz TV channel from a cable operator and use it as a backhaul for interconnecting the hotspots spread out over a large city.

4. In an apartment/MTU/MDU or hospitality application the Wired Cable Modem based Internet access and Wi-Fi access can be provided at the same time using the same CMTS equipment.

In business model #1 the cable operator provides the Wi-Fi support and user billing and in models #2 and #3 the WISP can provide those services. The CMTS used for this application can be a separate unit and different from the one traditionally used to provide cable modem-based Internet services by cable operators. This enables the Wi-Fi hotspots to be controlled and operated as a different entity from the rest of the traditional cable modem users.

Using cable as a backhaul for the hotspots makes for a powerful business model. If a WISP wants to provide Internet service in a downtown area it will have to install access points at different locations and bring in T1 con-

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Wi-Fi access points can be connected behind the cable modems to build a mixed network supporting wired and wireless access at the same time.

nections to each location, especially if these access points are far apart. Due to the nature of the cable plant literally one large Internet access connection at the cable headend can support all access points in a very large area, since Hybrid Fiber-Coax (HFC) cable plant can span several tens of miles.

In a hospitality application, the guests could have wired or Wi-Fi access in their hotel rooms and jump on to a Wi-Fi access point in the lobby or conference room where wired access is not possible.

Fixed Wireless

The Fixed Wireless network consists of a wireless base station with a wireless transceiver (transmitter and receiver) and antenna at the headend. There can be several customer sites within the headend transceiver range. A wireless transceiver and antenna, typically integrated into a single unit, is required at the customer site. This customer site transceiver is connected to a cable modem. In short, the DOCSIS based CMTS, which is a point to multipoint technology, is overlaid on top of a point to multipoint wireless physical layer technology.

Why is it so easy? Simple. The cable between the CMTS at the headend and the cable modems at the customer sites is merely being replaced by the wireless link. This technology is also referred to as "DOCSIS over Air." Similar architecture is used in other standards-based fixed wireless technologies like MMDS/LMDS and in other proprietary fixed wireless technologies. With ever-increasing acceptance of the DOCSIS technology and the increasing traffic volumes it is easier to use a modified and enhanced DOCSIS based CMTS than a proprietary solution as a base station in either licensed or unlicensed frequency bands.

If this architecture is compared to the traditional cable system based on coaxial or HFC cable, the following differences are obvious:

1. The point (CMTS) to multipoint (cable modems) communication "over cable" in a traditional CMTS network is now replaced by "a wireless point to multipoint link". Architecturally the CMTS and the cable modem will not see any differences.

2. The CMTS and the cable modem are now replaced by an enhanced CMTS-cable modem combination. The enhanced combination will have all the features of the traditional CMTS-cable modem, plus other features to handle the different characteristics of the wireless link.

Different Characteristics

It is not quite that simple, of course. The transmission path in a wired cable connection provides a controlled environment. In wireless the transmission path and its characteristics depend on structures along the way, weather, birds and other issues, which are not in the operator's control. Also, in unlicensed bandwidth space, there are other users in the same spectrum causing interference. In licensed, LMDS/MMDS space, the spectrum is reserved for the operator and hence it is not so much an issue except for the high cost of the rights to use the spectrum. An alternative in some cases, of course, is to use infrared beams or the newly approved E-band. But these are restricted to fairly short distances (less than a mile or so) for adequate reliability.

The wireless environment provides convenience and flexibility but has a higher noise and other limitations as described above. To handle these issues the CMTS is modified to run at lower modulation schemes and with changes specific to wireless technology. This enables the technology to provide robust service over a range of 16 to 25 kilometers (10-15 miles) or greater with an adequate signal to noise ratio.

Conclusion

It is expensive to lay new HFC or cable and hence in such cases it is wise to consider Fixed Wireless as an option. Thinly populated areas, or housing communities far from the major cities or separated by geographic obstructions like a river, can be connected through Fixed Wireless. Make no mistake. The Fixed Wireless solution is more expensive than the average wired solution on a per-subscriber basis, but cheaper in these non-average conditions. ◆

About the Author

Srini Kola is the founder and CEO of C9 Networks. He has over 15 years experience mostly in data communications and Broadband access. C9 Networks provides cost effective CMTS solutions to small and medium MSOs and to the MTU/MDU and hospitality business. C9 Networks' is an innovation leader in cable broadband space with the industries most user friendly CMTS products. C9 Networks' next generation CMTS products support broadband access on Cable, Wi-Fi and Fixed Wireless solutions. See www.c9networks.com. Srini can also be reached at info@c9networks.com, or at 408-746-0400.