

Motorola Connected Home Solutions Guide to Whole-Home Media Networking

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Motorola Connected Home Solutions is a global leader in creating smart broadband solutions that deliver personalized entertainment, information, and communications services to the home.

For more than 50 years, Motorola has been a trusted ally to home entertainment service providers. In the 1950s, Motorola helped to spark the growth of cable television by developing some of the first technologies for delivering broadcast TV into the home. In the 1960s and 70s, Motorola's content protection helped broadcasters send programming securely from the studio to the cable plant. In the 1980s, Motorola created the technologies that are the basis for video-on-demand (VOD). In the 1990s, Motorola pioneered digital television, helping to create the specifications for high-definition television and launching the first digital cable system. Today, Motorola is applying those decades of proven experience in connecting the home to help make Motorola's vision of seamless mobility a reality.

Motorola's content access and management solutions, such as state-of-the-art video set-tops and the exciting new iRadio® service, can record and store digital entertainment and seamlessly transport it throughout the home or out into the world.

Seamless Media Sharing in the Home

Building on Motorola's leadership in providing cable and telecommunications solutions, Motorola is investigating several technologies in the quest to deliver seamless mobility of information and

entertainment in the home. Following a brief overview of some of these networking technologies, we take a more in-depth look at MoCA, the new technology Motorola is using right now to connect advanced and digital set-tops, home computers, and voice, wireless, and mobile devices throughout the home.

The Promise of Whole-Home Networking

Time was, if you wanted to show visitors the digital pictures from your vacation, you had to walk them from the living room to the computer in your home office, or fetch the digital camera and a video patch cord to plug into the camcorder input on your living room TV. If you wanted to listen to your personalized music collection in any room in the house, you had to burn a CD of MP3s to play on your portable stereo. If you wanted to continue watching a DVD or cable TV movie in the bedroom, too bad—you were glued to the TV in the living room because the bedroom wasn't as fully equipped as the main entertainment center in the house.

Now, all that has changed. Using the coaxial cable already in the home, along with new software-driven set-top components, creating an all-purpose home media network is not only possible, it's simple and cost-effective—and Motorola Connected Home Solutions is leading the way.



Whole-Home Networking Technology

Motorola Connected Home Solutions (CHS) participates in a number of industry groups that are developing technological standards for delivering expanded media capabilities within the home. Motorola is a member of the boards of the Home Phoneline Networking Alliance (HomePNA), the HomePlug Powerline Alliance, and the Multimedia over Coax Alliance (MoCA), a voting member and group chair of the IEEE 802 alliance, and a member of the WiFi Alliance.

Motorola CHS uses the following criteria to determine which technologies will provide wins for us, our customers, and their consumers:

- Data rate: >80 Mbps (100 Mbps preferred) for IP-based multimedia services
- QoS: Must meet video requirements for jitter and latency
- Ease of installation: Must be easy for customers to install and troubleshoot
- Cost: Lowest cost is best; silicon implementation choices and volume drive cost
- Upgrade path: Since bandwidth requirements generally grow with time, future versions of the technology should offer additional bandwidth, better QoS, easier installation and maintenance, and lower costs

HomePNA over Coax

- Offers high speed and QoS
- Available now
- Might be requested by some telcos

HomePlug AV

- HomePlug AV offers high speed, QoS, and ubiquitous connectivity
- Production chips scheduled to be available in 2006
- More outlets; easier installation; more important for retail
- Wireless technologies, such as 802.11a/g, do not offer reliable whole-home coverage at entertainment data rates with entertainment QoS in this timeframe

802.11n

- Wireless offers the best of all worlds
- Technology still needs to be evaluated for coverage and QoS
- Standards-based silicon still a year away (anticipated 2007 and beyond)
- Motorola is developing extensions to create a whole-home wireless video network

Why are We Deploying with MoCA Today?

- Entropic's c.LINK™ chipsets have been selected as the baseline for the MoCA standard
- MoCA technology offers high speed, QoS, and state-of-the-art packet-level encryption over coax, and supports growth in system features and applications
- Production chips are available now

Motorola CHS may opt to stay with MoCA, transition to one of the above alternatives, or use multiple technologies. Other possibilities may come along in the next couple of years that aren't even on the horizon today.

“MoCA” is the name of both an industry alliance producing a specification for the transport of multimedia and data over in-home coaxial cable, and the network technology underlying the specification.

MoCA

Creating the Multimedia Home Network

By tapping into the vast amount of unused bandwidth available on coaxial cables installed in more than 70% of American homes, MoCA easily and reliably shares digital video content (including multiple streams of high-definition TV), music, games, and images, through a managed and trusted home network that is invisible to the homeowner. MoCA offers a “plug and play” retail set-top box solution—no professional installation is required.

MoCA was developed from the ground up to address the key requirements for networking digital entertainment: high throughput, quality of service, security, and ease of use. It is a primary objective of MoCA technology to deliver high-definition and DVD-quality digital entertainment and high-speed data to consumers without glitches or freezes.

The Promise: The Multimedia Home

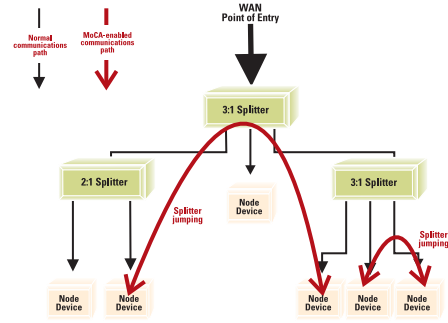
Research shows that once consumers get accustomed to the convenience of digital video recorders (DVRs), they will want access to all their stored entertainment in any room in the house, on demand. Just as the desire to share an Internet port and a printer among multiple PCs in the home led to the development and explosion in popularity of home networking, multi-room DVR functionality is expected to drive home networking of digital entertainment.

The multimedia home requires a high-speed digital backbone to provide adequate bandwidth for standard and HDTV video, music, photos, and data. Coax cable is an ideal medium. It is shielded, reliable, well understood and trusted by service providers and content providers, and already installed in nearly all American homes. Coax has superior communications and data rate capabilities compared to twisted-pair phone line, power line, and wireless, and, unlike CAT5 (Ethernet) wiring, requires no intrusive and expensive installation in existing homes. In-home coax has gigabits per second of data rate available above the frequencies used by cable television and cable modems.

The Problem: Coax is a One-way Communications Medium

Unfortunately, coax was not designed for arbitrary point-to-point networking. Cable splitters, or directional couplers that extend coax into the home from the wide-area network (WAN) point of entry, are specifically designed to allow communication from input to output and from output to input only. For room-to-room communication, however, data must be able to travel from output to output.

By enabling data to “jump” between splitter outputs, it becomes possible to transmit data from any coax outlet to any other coax outlet in the home. MoCA turns the coax into a high-speed pipe that is perfectly suited for secure, robust home networking.



The Solution: MoCA Talks Back

MoCA's revolutionary technology solves this problem. By enabling data to “jump” backwards through splitters from any coax outlet to any other coax outlet in the home, MoCA turns the coax into a high-speed pipe that is perfectly suited for secure, robust home networking. With the MoCA chipset built in, a set-top box with an integrated DVR or cable modem can communicate with PC media centers, thin clients, and other devices to become a whole-house network solution, extending high-definition DVR to all televisions in the house and broadband data to all PCs.

A large-scale field trial in several greater metropolitan areas proved the viability of the MoCA technology to deliver digital entertainment to nearly every coax outlet in the home. In its summary of the field trial, the Multimedia over Coax Alliance, a non-profit industry group developing the MoCA specifications, noted that MoCA is the only field-proven method capable of transporting multiple streams of HDTV. The trial demonstrated that even under field conditions, a MoCA-enabled network is significantly faster than speeds achieved by competing technologies under ideal conditions in the lab.

MoCA's Key Advantages

MoCA's coax-based technology has several key advantages over competing products in meeting the requirements for large-scale deployment of a home digital entertainment network.

No New Wiring Required

MoCA works in any home with coax cable, seamlessly linking consumer entertainment devices from room to room using the coax already installed in the house.

High Data Rates

MoCA's PHY data rate is 270 Mbps, five times faster than the typical Wi-Fi PHY data rate of 54 Mbps. More important is the net data rate, particularly as a function of the rate achieved in a percentage of homes. In the large-scale field trial mentioned earlier, MoCA achieved better than 100 Mbps in the vast majority of homes.

Reliability

Extensive laboratory and field testing helps to ensure that MoCA-enabled devices peacefully coexist with other televisions, cable modems, set-top boxes, PCs, and other consumer electronics products on the same coax cable. Nor can a neighbor's consumer electronics devices interfere with MoCA, which is a key issue with wireless technologies using an unlicensed spectrum.

MoCA's reliability is due not only to the use of coax cable as its transmission medium. It also uses frequency channelization (tuning to various 50 MHz-wide channels between 800 MHz and 1500 MHz), frequency scanning (automatically selecting an open channel), and power control (using only enough power to achieve the required data rate).

Ease of Installation

MoCA technology transforms the humble set-top box into the hub of the digital home. Anyone who has hooked up a VCR, DVD player, or TV can create a digital entertainment

network within the home using a MoCA-enabled set-top box—just attach the coax cable. In the small percentage of homes where MoCA does not meet the required data rate, the homeowner or service provider can usually remediate with a simple, low-cost solution such as replacing one or more passive devices or installing an in-line filter that costs about a dollar. MoCA signals cannot pass through in-line amplifiers, so home networks with amplifiers require more complex remediation.

Full Quality of Service

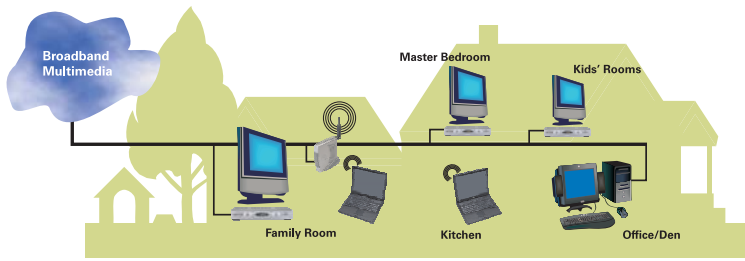
The immediate answer to QoS requirements is to provide lots of bandwidth. MoCA operates at a net throughput of more than 100 Mbps in a very high percentage of homes.

In addition, 802.1P is available today. Since MoCA is a fully scheduled MAC, a higher layer of QoS can be added in the future to eliminate collisions, minimize network congestion, latency, and jitter, enable prioritization of network traffic, and support dedicated bandwidth for critical users and applications.

Security

MoCA uses DES encryption, similar to a cable modem, to provide basic privacy for a homeowner's personal content. Nearly all broadcast content uses some form of encryption and Digital Rights Management (DRM). MoCA operates at the link layer, where DRM is not applicable. However, it does support forms of DRM, including a variety of conditional access systems, that are included by service providers and content providers in the network layers above MoCA, independent of the communications link.

Even under field conditions, a MoCA-enabled network is significantly faster than speeds achieved by competing technologies under ideal conditions in the lab.



What Can You Do with a MoCA Multimedia Home Network?

By connecting digital entertainment devices throughout the home over existing coax cable, MoCA allows consumers to enjoy:

Whole-Home HDTV DVR

Watch a different HDTV broadcast, or record and share digital programming, simultaneously in every room in the home, from a single set-top box.

Whole-Home gaming

Run games from anywhere in the home. Play with others in the home or across the country simultaneously, with “you are there” response times.

PC-to-TV content

Merge data and digital entertainment networks to share PC, TV, and home stereo content throughout the home.

Extended Wi-Fi coverage

Extend the coverage of home wireless networks to use laptop computers in more rooms.

Other Advantages

MoCA technology also fulfills other key requirements of the high-volume consumer electronics market: (1) it meets industry needs and has wide acceptance, (2) its price point is consumer-friendly, and (3) it is commercially available and can be quickly ramped to high volume.

Accepted by Industry—The Multimedia over Coax Alliance

MoCA meets the industry’s need for coax networking in a manner which is compatible with standard industry practices. MoCA’s core technology has been embraced by cable, telco, and satellite operators, set-top box OEMs, network equipment OEMs, and consumer electronics OEMs worldwide.

Entropic, developer of the MoCA technology, is a founding member of the Multimedia over Coax Alliance. Other MoCA members include Cisco, Comcast, Cox, EchoStar, Panasonic, Motorola, Radio Shack, Toshiba, and Verizon—a “who’s who” list of industry leaders in consumer electronics.

Price

Two key elements of cost in a networking technology are cost of deployment and solution cost. The cost of deploying MoCA in the home is minimal, since no professional installation, or “truck-roll,” is required.

With respect to solution cost, the MoCA chipset is competitively priced at high-volume quantities. As with any semiconductor technology, these prices will decline over time as the market size increases.

Production Availability

MoCA is in production and available now. Both of the chips in the two-chip set are manufactured using standard CMOS process technology at multiple foundries.

Summary

MoCA technology enables seamless networking of digital multimedia over existing in-home coaxial cable infrastructure at speeds as high as 270 Mbps. MoCA meets all of the stringent consumer requirements for whole-home networking of digital entertainment, including no new wires, high data rate, reliability, ease of installation, full quality of service, and security. MoCA is in production and available now.



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