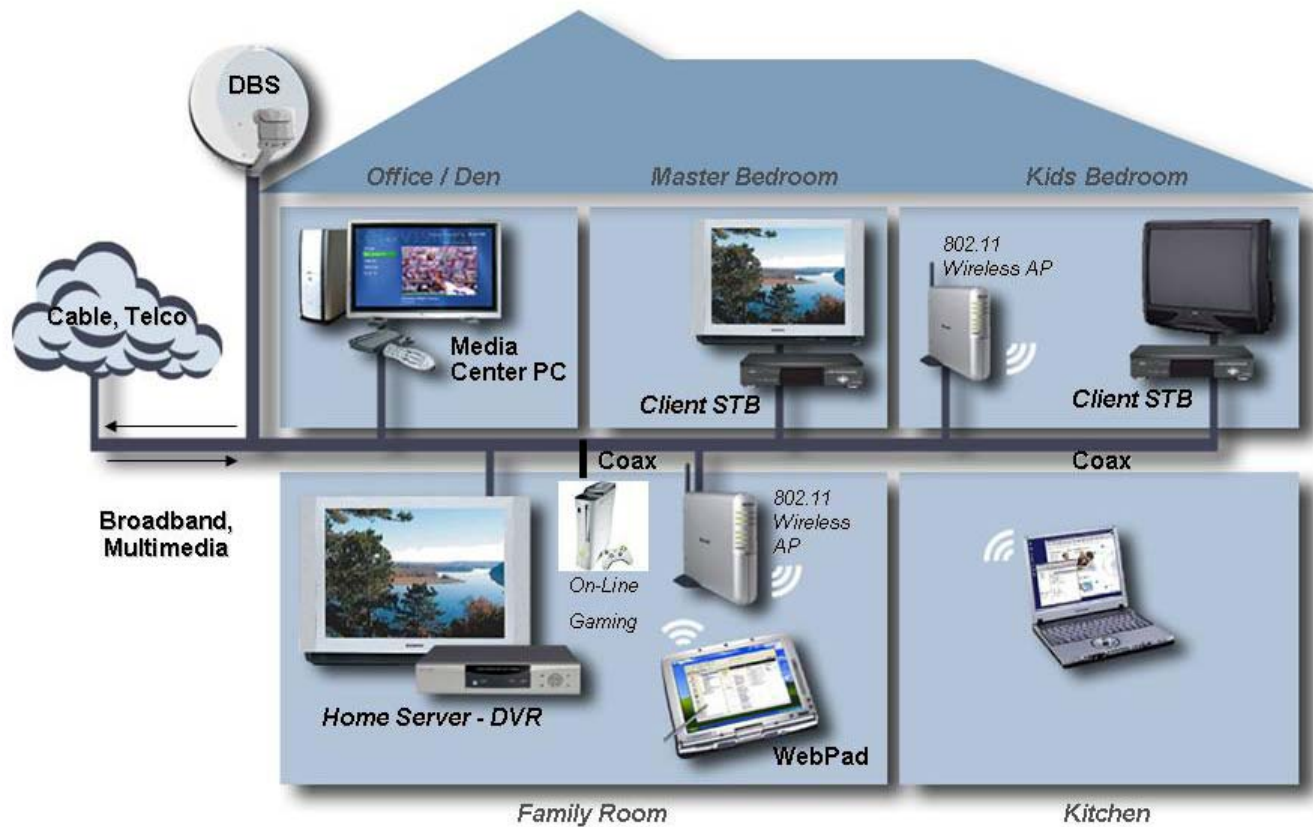**Robert C. Adams, CFA**
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Digital Media Technology
Wireless Technology

# The Battle Is On! Enabling the Digital Media Home Network

INVESTMENT SUMMARY

The battle for superiority in the next great digital media market opportunity—the digital multimedia home network—is on. And, like all great digital media markets, this one just makes good intuitive sense. Digital media consumers worldwide have a great appetite for digital content and they have a desire to move that content around the home. We believe that, necessitated by the continuing adoption of the digital video recorder (DVR) and other content storage technologies, accelerated by the rapid ramp of digital and high-definition television technologies, and enabled by the deep pockets of the telcos and cable operators, this market is poised for significant growth over the next several years and represents one of the largest-volume semiconductor opportunities in the digital media component space to date.

The digital media networked home—a function of recording...

The digital multimedia home network opportunity has been necessitated by the increasing ability of the consumer to record (or download) and display video content. Over the last several years consumers, especially in North America, have grown fond of recording content and storing it to hard drive solutions. Notable is the rise of the DVR (e.g., TiVo), which has seen rapid acceptance. Now consumers are able to record programs, saving them to the hard drive in the DVR device or to a DVR-enabled set-top box (STB), which enables them to watch these programs when they want to and save them for as long as they desire. As shown in Figure 1, the DVR and DVR-enabled STB market has grown quickly to date, totaling 19.5 million units in 2006 and poised to grow 23% annually to 43.4 million units in 2010.

**Figure 1: DVR and DVR-Enabled STB Market History and Forecast, 2003–2010 (in millions)**
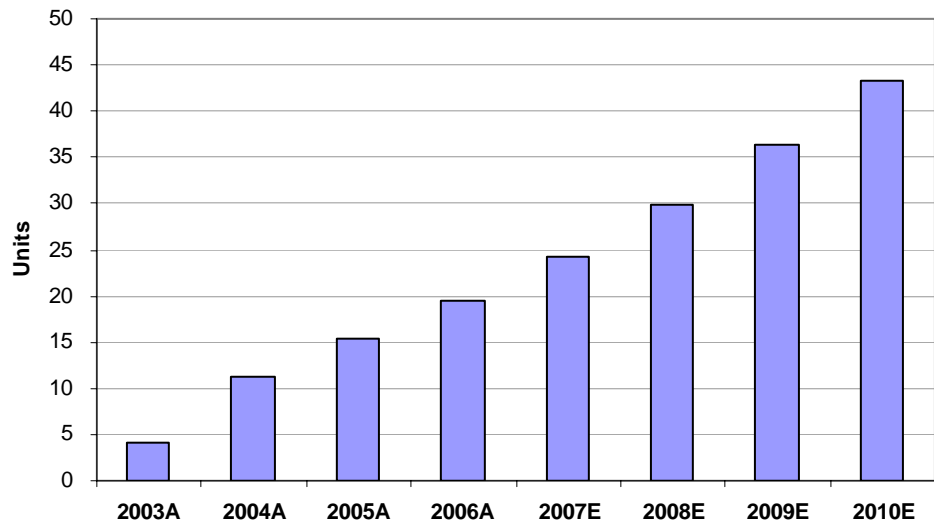
Source: IDC and Montgomery & Co.

...and playback...

While somewhat more tangential, the rise of digital television technologies has further spurred consumer interest in digital media home networking, in our view. While even standard-definition digital television transmission has allowed the delivery of crisper, clearer content, it has also allowed service providers to offer in aggregate more content to consumers as a result of the bandwidth saved via digital compression. Therefore, consumers now have not only a richer quality of content to watch, but more choices as to what they can watch as well. While high-definition digital content is a bandwidth hog, the consumer experience is so truly rewarding that we believe it will continue to spur the consumer's desire to record, store, and ultimately distribute such content. Figure 2, the digital television market history and forecast according to IDC, shows the rapid growth of the market to date. Add this to the worldwide installed base of one billion analog TVs and the scale of the networking opportunity can clearly be regarded as enormous.

Figure 2: Digital Television Market History and Forecast, 2003–2009 (in millions)
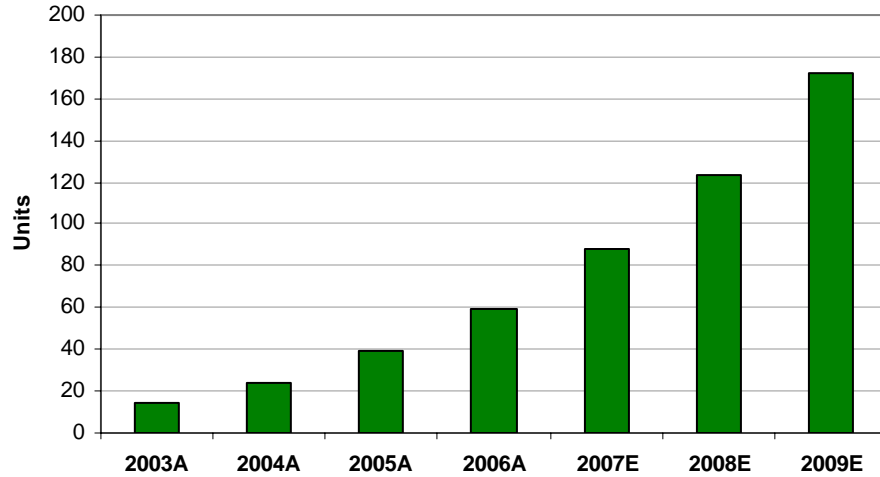
Source: IDC

...necessitating a network...

Consumers now have a growing need for media networking as a result of their ability to record richer digital content. To envision this, ask yourself, as a consumer, whether you have ever recorded content on one DVR or DVR-enabled STB in one room, only to realize later you would like to watch that same content on another TV in another room. The current solution to this problem is tedious to implement and redundant: you can make sure to have multiple DVRs in your home, all recording the same programs so that any program can be watched in whichever room you want. This solution is not optimal for the consumer, and it poses an issue for the service provider as well in that, to the extent that the service provider subsidizes the cost of the STB, the redundant storage capacity represents a financial burden.

...subsidized by someone else—a consumer's dream.

There is clearly a need today for a home media network, but in any digital media market at least three gating factors must always be considered: content, price, and standards. Looking at these three concerns in the context of the home media network, we note that content is increasingly available as a result of its digitization. Therefore, the availability of content certainly is not a gating factor. We note here that we are not, for the purposes of this report, covering any copyright issues in that we are discussing the networking or replay of content within the confines of the home.

Telcos versus cable: the battle for the home.

Price is a gating factor in any consumer-driven market. It does not take a lot of research to determine that the inflection point of most market ramps can be profoundly impacted by falling prices. In the case of video, examples are easily found in the DVD and digital television markets. However, in our view, the digital home network opportunity is a rare case where price should not be a materially gating factor in that much of the cost will be subsidized by telecommunications and cable service providers as they battle for consumer dollars. This "battle for the home" is the result of technology advances that allow either telco and cable service providers to offer products and services that compete with the other's legacy business. Cable companies now seek additional consumer dollars for phone and data services as they offer voice-over-IP (VoIP) and cable modems to consumers, targeting what used to be a telecom-only marketplace. Telcos, seeing their voice and DSL services encroached on, are now able to fight back by targeting the cable companies' television service in providing IPTV (Internet Protocol television) services. So, both telco and cable provider can provide a customer with telephone, high-speed modem, and television services. The result is a marketplace in which each offers its triple-play solutions at bundled prices that are attractive to consumers. In this battle, we expect telcos and cable providers to use home network capability as a differentiating factor in attracting customers.

Standards: the battle that remains.

Where there is honey, there are bees. The US is the ultimate battleground for ramping consumer electronics (CE) markets, and in looking at this geography alone, we note there are approximately 120 million homes with, on average, 3.5 televisions each. This is clearly an attractive, high-volume marketplace, so, in the battle for the high-volume home media network market, there are already a number of competitors. At its highest level, the battle can be viewed as wireline versus wireless, but a number of standards within each camp bear discussion, in our view. Importantly, our discussions are focused on technologies that require "no new wires." This is a catch phrase for the digital home

market and for good reason, as truck rolls to build networks within the home are fiscally unfeasible for any service provider. As such, a notable exclusion from our technology discussion is Ethernet technology, which, although it could easily facilitate home networking, is currently installed in less than 1% of US homes to date. Wired technology standards for delivery of video that we examine in this report are MoCA, HomePlug AV, and HomePNA. Wireless standards that we discuss herein are 802.11 (specifically 802.11n), ultra wideband (UWB), and wireless USB.

WIRELINE HOME NETWORKING TECHNOLOGIES

MoCA (Multimedia over Cable Alliance): Had It Right All Along

Technology Summary

Coaxial cable is clearly the medium of choice, as its use alleviates latency, throughput, and interference issues. While competing standards have scrambled to adopt coaxial functionality because of its performance advantages, the MoCA camp clearly had it figured out from the beginning. This technology is ideal for deployment in regions with high coax penetrations. North America clearly is one such region, as approximately 90% of homes have coax already installed. Another region of opportunity is Japan, which has coaxial support and impressive DVR attach rates. This protocol also supports copper phone line networking and industry watchers claim it actually outperforms HomePNA on its own turf. MoCA has a broad backing of cable companies in its alliance, but also notable is Verizon's decision to employ the technology in its FiOS rollout, in what ultimately will be an IPTV network. In this sense, MoCA technology is poised to benefit from the coming telco versus cable battle, as it is the one supplier that can truly sell bullets to either side. For more information, see the Multimedia over Coaxial Alliance website: www.mocalliance.org.

Performance

MoCA delivers the highest proven throughput of any of the three wired technologies we discuss in this report. Boasted PHY rates are in the 270Mbs range, but importantly, actual MAC rates are in the 135Mbps range. Actual field deployments prove rates above 100Mbps in more than 95% of homes where this technology has been installed. Latency performance, reported to be in the 5ms range, tops HomePNA's and HomePlug's 20–30ms. As this technology operates above the 850MHz spectrum, interference is a non-issue.

First Mover and Technology Leader

Entropic Communications
Entropic Communications is a fabless semiconductor company that provides chipsets and the associated software that allow consumers to easily share digital entertainment throughout the home via existing coax cable infrastructure. The core technology that enables communications backwards through cable splitters is called c.LINK and has been embraced by cable, telco, and satellite operators, STB OEMs, network equipment OEMs, and consumer electronics OEMs worldwide. The company's recent merger with Rf Magic brings solid silicon tuner technology on board, opening up complementary Rf opportunities in the satellite STB, digital video broadcast (DVB), and ATSC markets, with some long-term potential in the WiMAX customer premise equipment (CPE) arena.

Other MoCA-Targeted Suppliers

2Wire, Inc.

2Wire provides global telecom carriers with broadband services platforms that enable an integrated triple play of networked data, voice, and media services. 2Wire's products and services include residential gateways, broadband multimedia entertainment platforms, remote management systems, and call center customer support. 2Wire's customers include global DSL market leaders AT&T, Telmex, BellSouth, BT, Embarq, and SingTel.

Actiontec Electronics, Inc.

Actiontec Electronics is dedicated to providing a full range of broadband connectivity and broadband-powered solutions that support an all-digital lifestyle and enable broadband service providers to deliver a new communication and entertainment experience. The company's product offerings range from a broad selection of IPTV-capable broadband home gateways for bringing IP-based video services into the home, to products sold under the VoSKY brand that bring Skype-based Internet phone calls to traditional handsets, mobile phones, and business PBXs. The Actiontec product line also includes DSL modems, wireless networking devices, routers, and digital entertainment devices.

Advanced Digital Broadcast Holdings (ADB)

ADB is a member of ADB Group [listed on the Swiss stock exchange (SWX: ADBN)] and provides a diverse range of products to the worldwide digital television industry. ADB supplies digital STBs across all television transmission platforms: cable, IPTV, satellite, and terrestrial. Its customers include digital television operators, consumer electronics manufacturers, and distributors of digital STBs.

Alcatel-Lucent (NYSE: ALU)

Alcatel-Lucent provides solutions that enable service providers, enterprises, and governments to deliver voice, data, and video communications services to end-users. As a leading company in fixed, mobile, and converged broadband access, as well as carrier and enterprise IP technologies, applications, and services, Alcatel-Lucent offers the end-to-end solutions that enable compelling communications services. Alcatel-Lucent supports five business groups that are responsible for developing, delivering, and supporting end-to-end solutions targeted at key market growth segments including network transformation, 3G wireless, carrier IP, IMS, broadband access, video, optical, and next-generation applications and services.

Amedia Networks, Inc.

Amedia enables Ultra-broadband, via which every home, apartment, business, etc. can receive its own secured bandwidth connection over copper or fiber, ranging from 20Mbps to 100Mbps for voice, data, and video services with guaranteed levels of quality. Amedia offers service gateways, which are new devices that allow carriers to manage all types of services, and whereby each service can have different transmission requirements, over the same access point to the home or office.

Applied Micro Circuits Corporation (NASDAQ: AMCC)

Applied Micro Circuits is a global leader in network and embedded PowerPC processing, optical transport, and storage solutions, providing the essential building blocks for the processing, moving, and storing of information. Its products enable the development of converged IP-based networks offering high-speed secure data, high-definition video, and high-quality voice for carrier, metropolitan, access, and enterprise applications. The company provides networking equipment vendors with leading network and communications processing, Ethernet, SONET (synchronous optical networking), and switch fabric solutions. Applied Micro Circuits is also a leading vendor of SATA RAID controllers, which enable low-cost, high-performance, high-capacity storage.

AT&T, Inc. (NYSE: T)

The largest communications holding company in the US, AT&T is a leading worldwide provider of IP-based communications services to businesses and a leading US provider of wireless, high-speed Internet access, local and long distance voice, and directory publishing and advertising services. The company has a "three screen" integration strategy via which it is expanding video entertainment offerings to include next-generation television services such as AT&T U-verse TV. The merger of AT&T and BellSouth, along with the consolidation of Cingular Wireless, should enable AT&T to create new solutions for both consumers and businesses, in our view.

Bel Fuse, Inc.
Bel Fuse produces high-quality electronic components for the global market. The company designs, manufactures, and markets a range of products including DC/DC converters, transformer and connector modules, fuses, and delay lines. Its products are widely specified for use in network applications (LAN/WAN), telecommunications, high-speed data transmission, computer and power supply applications, and consumer electronics markets.

BroadLight, Inc.
BroadLight leads delivery of end-to-end (E2E) passive optical networks (PONs) technology through its comprehensive product solutions that consist of highly integrated semiconductor devices, embedded and application software, reference designs, and support tools. It delivers complete E2E BPON (broadband passive optical network) and GPON (Gigabit passive optical network) component solutions for the central office (CO) and customer premise equipment (CPE).

Comcast Corporation (NASDAQ: CMCSA)
Comcast is the largest US provider of cable services and one of the world's leading communications companies. Comcast is principally involved in the development, management, and operation of broadband cable, commerce, and content, delivering digital services, fast Internet, and clear broadband phone service. Comcast provides a wide variety of consumer products and services, including video (digital cable), online, voice, business services, and interactive media.

Conexant Systems, Inc. (NASDAQ: CNXT)
Conexant Systems designs, develops, and sells semiconductor system solutions that connect personal access products such as STBs, residential gateways, PCs, and game consoles to voice, video, and data processing services over broadband and dial-up connections. Conexant is a leader in semiconductor solutions for broadband communications for the digital home and offers a suite of networking components that includes applications based on HomePlug and HomePNA.

Cox Communications, Inc.
A multi-service broadband communications company, Cox Communications is the third-largest cable provider in the US, noted for its high-capacity, reliable broadband delivery network and customer care. Cox offers an array of advanced digital video, high-speed Internet, and telephony services over its own nationwide IP network. Cox Business Services is a full-service, facilities-based provider of communications solutions for commercial customers, providing high-speed Internet, voice, and long-distance services, as well as data and video transport services for small- to large-sized businesses. The Cox Media division offers national and local cable advertising in traditional spot and new media formats, along with promotional opportunities and production services.

EchoStar Communications Corporation (NASDAQ: DISH)
EchoStar Communications provides Direct Broadcast Satellite (DBS) television products and services through its DISH Network. EchoStar has been a leader in the satellite communications business for more than 26 years and is the operator of DISH Network, the second-largest direct-to-home satellite service in the US. DISH Network offers thousands of video and audio channels, interactive TV, HDTV, and sports and international programming, along with professional installation and 24-hour customer service.

Entrisphere, Inc. (an Ericsson company, NASDAQ: ERIC)
Entrisphere provides broadband access solutions to major telecom carriers in North America. Its flagship products are the BLM 1500 GPON system and the T-Series of Optical Network Terminals. Entrisphere is an access network equipment supplier and its multi-service access solutions have been designed from the ground up to simplify access networks, ease the migration to new services, and maximize carrier deployment and versatility throughout the process.

Infineon Technologies AG (NYSE: IFX)
Infineon is a leading innovator in the semiconductor industry, where it designs, develops, manufactures and markets a broad range of semiconductors and complete system solutions targeted at selected industries. Its products serve applications in the wireless and wireline communications, automotive, industrial, computer, security, and chip card markets. Infineon's product portfolio consists of both memory and logic products and includes digital, mixed-signal, and analog ICs as well as discrete semiconductor products and system solutions.

JDS Uniphase Corporation (NASDAQ: JDSU)

JDS Uniphase is a leading provider of broadband test and measurement solutions and optical products for communications, commercial, and consumer markets. The company offers test and measurement systems and services for telecommunications service providers, cable operators, and network equipment manufacturers. In addition, JDS offers components, modules, and subsystems for optical communication, display, security, medical/environmental instrumentation, decorative, aerospace, and defense applications. In 2006, JDS expanded its portfolio to include home networking test solutions by introducing a new home network installation meter, the IVT-600, and a new software management tool called Plan-Um AP (advanced planning).

Kawasaki Microelectronics America, Inc.

K-micro is a leader in high-end ASICs with extensive advanced IP, state-of-the art design and development competence, and close design support. K-micro supplies standard cell product series and advanced IP macros to suit customers' application requirements. These products are used by its customers in communications, image processing, office automation, and other applications.

Linksys (division of Cisco Systems, Inc., NASDAQ: CSCO)

Linksys is a leader in VoIP, wireless, and Ethernet networking solutions for home, SOHO, and small business users. Linksys specializes in products and solutions that provide effortless and economical sharing of broadband Internet connections, files, printers, digital music, videos, photos, and gaming over a wired or wireless network.

M/A-COM, Inc. (a Tyco Electronics company)

M/A-COM 's organizational structure is based on four business units: Integrated Semiconductors, Components, Aerospace & Defense, and Wireless Systems. M/A-COM Wireless Systems provides two-way mobile radio technology, products, and services to worldwide markets that include public safety, utility, industrial, commercial, and government organizations.

Maxim Integrated Products, Inc. (NASDAQ: MXIM)

Maxim is a leader in the design, development, and manufacture of analog, mixed-signal, high-frequency, and digital circuits. Maxim's products are used in a wide variety of microprocessor-based electronics equipment. Some of the applications for the company's circuits include consumer electronics, PCs and peripherals, handheld electronics, wireless and fiber communications, test equipment, instrumentation, video displays, and automotive applications.

Microtune, Inc. (NASDAQ: TUNE)

Microtune engages in the design and marketing of radio frequency (RF) ICs and subsystem module solutions for the cable, digital television, and automotive electronics markets and RF solutions for PC/TV multimedia. The company offers microtuner single-chip broadband tuners; silicon amplifiers, including upstream amplifiers, intermediate frequency amplifiers, and broadband antenna amplifiers; and its VideoCaster chipset and module for cable video-on-demand applications. As the inventor of the silicon tuner, Microtune is targeting its latest devices at the home multimedia networking makers, opening up new markets and potentially attracting new customers.

Motorola, Inc. (NYSE: MOT)

Motorola is a technology company known for innovation and leadership in the wireless and broadband communications sector. It focuses on three primary business: Connected Home Solutions, which provides integrated, end-to-end systems that deliver digital entertainment, information, and communications services over a variety of wired and wireless broadband network architectures; Mobile Devices, which designs, manufactures, markets, and services mobile devices; and Networks & Enterprise, which is a leading provider of end-to-end infrastructure, integrated voice and data communications, and information solutions.

Netopia (division of Motorola, NYSE: MOT)

Netopia is a leading provider of carrier-class broadband CPE, remote management software, and services to telecom operators worldwide. The company provides a full portfolio of products designed for DSL networks, including wired and wireless modems, routers, and gateways. Its products deliver voice, video, data, and other advanced services to residential and business customers. Motorola's acquisition of Netopia enables it to further address the global broadband DSL opportunity and extends Motorola's current solutions for the emerging IPTV opportunity. With a combined product portfolio, Motorola will now offer carriers a full suite of home CPE and remote management software, providing support for any connected device in the home, including media hubs, voice gateways, and IP set-tops.

Octalica, Inc. (acquired by Broadcom)

Recently acquired by Broadcom, Octalica was a privately held semiconductor company focused on developing leading-edge digital home entertainment networking products that allow consumers to enjoy an IP-based, high-definition TV experience anywhere throughout the home. To address this emerging market, Octalica has developed a solution that utilizes the existing coaxial infrastructure in the home and adheres to MoCA specifications. While Octalica is well behind industry leader Entropic Communications, its acquisition by Broadcom certainly validates the MoCA value proposition, in our view.

Panasonic (Matsushita Electric Industrial Co., Ltd.)

Panasonic provides a wide range of products, from audiovisual and information and/or communication equipment to home appliances and components, and is one of the largest electronics companies in the world. The main products in its AVC Networks segment include plasma, LCD, and CRT TVs, DVD players/recorders, VCRs, camcorders, digital cameras, compact disc (CD), mini disc (MD), and SD players, other personal and home equipment, AV and computer product devices, and many other consumer products.

PMC-Sierra, Inc. (NASDAQ: PMCS)

PMC-Sierra is a leading provider of broadband communications and storage semiconductors for metro, access, fiber to the home, wireless infrastructure, storage, laser printers, and customer premises equipment. PMC-Sierra is targeting the digital home with products such as its enhanced residential gateway platforms to ensure carrier-grade services, ADSL2 analog front-end devices for triple-play and IPTV-enabled broadband CPE, and ADSL2+AFE interfaces, providing a complete chipset for advanced residential gateways for the digital home.

Pulse Engineering, Inc.

Pulse Engineering is a leader in electronic component design and manufacturing. Its products are used in computers, wide and local area networks, wireless applications, telecommunications, broadband Internet, power conversion, defense, aerospace, and automotive and consumer electronics. Products that target the broadband/RF and wireless segment include RF magnetic components for use in RF and wireless applications (consumer, industrial, and medical), including cable television, hybrid fiber coaxial (HFC) equipment, STBs, and cable modems.

Samsung Electronics Co., Ltd.

Samsung is a global leader in semiconductor, telecommunication, digital media, and digital convergence technologies. The company consists of five main business units: Digital Media Business, LCD Business, Semiconductor Business, Telecommunication Network Business, and Digital Appliance Business. Samsung is a leader in the system logic, processors, and ASICs that are driving the next generation of products targeting the digital environment. In this area, Samsung focuses on the convergence of digital and wireless technologies in rapidly growing markets such as digital TVs, STBs, Smartphones, and wireless handheld PDAs.

Scientific Atlanta (a Cisco Systems company, NASDAQ: CSCO)

Scientific Atlanta is a leading supplier of transmission networks for broadband access to the home (set-tops and cable modems); digital interactive subscriber systems for video, high-speed Internet, and VoIP networks; systems integration expertise; and worldwide customer service and support. It is changing the way consumers receive, use, and enjoy a variety of entertainment, information, and communication experiences provided by cable, telecom, wireless, and satellite service providers.

Siemens AG (NYSE: SI)

Siemens is a global provider of electrical engineering and electronics products and services for a wide range of individual requirements. Siemens' Home and Office Communication Devices business segment has a full-solution portfolio of devices and services that service providers can use to create the "smart home." Siemens has a family of media devices that can be used to receive, store, and play back digital signals on multimedia devices and television sets. This family includes a wide range of models to support a broad subscriber base, offering models that support broadcast signals (DVB), broadband signals (IPTV), and both broadcast and broadband signals (hybrid).

Soontai Technology Company, Ltd.

Soontai specializes in the design and manufacture of high-quality TV/CATV/SMATV/MMDS filters and accessories. It offers a complete range of filters and CATV/cable network accessories

including solutions for cable Internet that target the distribution of digital video and entertainment throughout the home.

STMicroelectronics Corporation (NYSE: STM)

STMicroelectronics is a global leader in developing and delivering semiconductor solutions across the spectrum of microelectronics applications. It offers a combination of silicon and system expertise and system-on-chip (SoC) technology, and it provides products that help enable today's converging markets. STMicro dedicates considerable resources to its consumer segment, where it provides a wide portfolio of products, from discrete devices to complex ASSPs and full hardware-software system solutions, covering a very large variety of consumer applications, including audio, DVD, imaging and display, STBs, and TVs.

Tellabs, Inc. (NASDAQ: TLAB)

Tellabs designs, develops, deploys, and supports solutions for telecom service providers worldwide. Tellabs provides solutions for both wireline and mobile networks, including: an IntegratedMobile solution that transports new 3G services and streamlines mobile networks to lower "backhaul" costs; DynamicHome products that feature triple-play offerings of broadband voice, data, and video services with an end-to-end solution; and MultiservicePLuS and AssuredEthernet solutions that deliver business services with guaranteed reliability.

Texas Instruments, Inc. (NYSE: TXN)

Texas Instruments is a leading provider of digital signal processing and analog technologies. TI's consumer electronics solutions are designed for the entire signal chain. Its leading DSP-based digital signal processors, high-performance analog-to-logic processors, and extended portfolio of application software help TI deliver reliable, scalable, and power-efficient consumer electronic solutions for the marketplace.

Toshiba Corporation (OTC pink sheets: TOSBF)

Toshiba is a leading high-technology company and diversified manufacturer and marketer of advanced electronic and electrical products, spanning information and communications equipment and systems, Internet-based solutions and services, electronic components and materials, power systems, industrial and social infrastructure systems, and household appliances. Toshiba applies cutting-edge capabilities to the creation of digital products and solutions to meet diverse market needs in the era of digital convergence.

Trilithic, Inc.

Trilithic is a leading provider of telecommunications solutions for the broadband and RF/microwave markets, dedicated to providing quality products, services, and communications solutions for its end customers. Trilithic consists of three major divisions: Broadband Instruments and Systems, RF and Microwave Components, and Emergency Alert Systems (E.A.S.). The Instruments division offers test, analysis, and quality management solutions for the major cable television systems; the RF and Microwave division provides components and custom subsystems cellular, military, and other wireless applications; and the E.A.S. division is a supplier of government-mandated Emergency Alert Systems used by HFC service providers.

Verizon Communications, Inc. (NYSE: VZ)

Verizon is a leader in delivering broadband and other wireline and wireless communication innovations to mass-market, business, government, and wholesale customers. Verizon has three primary business segments: Verizon Wireless, Verizon Business, and Verizon Telecom. Verizon Wireless operates one of America's largest and most reliable wireless networks; Verizon Business delivers innovative and seamless business solutions to customers around the world; and Verizon Telecom brings customers the benefits of converged communications, information, and entertainment services over an advanced fiber-optic network.

Westell Technologies, Inc.

Westell Technologies designs and builds carrier-class equipment that delivers high-speed communications for telecommunications operators and Internet service providers throughout the world. Westell provides innovative solutions that make it easy for carriers and service providers to give their customers more content, more services, and more capabilities. Westell's products and services include residential gateways, broadband Smartphones, transport and termination devices, and conferencing services, targeting the triple play of networked data, voice, and media services. Westell operates three divisions: Broadband Home Networking, Transport and Termination, and Conference Plus, which offers voice, video, and IP data conferencing capabilities.

HomePlug AV: Supplier of Choice for Non-Coax Regions

Technology Summary

The HomePlug AV standard targets using a home's existing electrical system as the wiring for the home network. This technology is clearly compelling in that it meets the "no new wires" requisite given that every electronic device such as an STB or television already plugs into a wall outlet. As such, there is almost no limit as to where a networked device could reside given the plethora of electrical outlets in every home. Latency can be an issue and, along with typical application speeds over the powerline, has forced the HomePlug protocol to work over coaxial cable. This usage is truly necessary to support video streams, especially multiple or high-definition streams. We see this as an excellent technology for "no new wires" rollouts in regions where coaxial cable is not prevalent and high-definition video is not a high-priority mandate, specifically much of Europe, especially southern Europe. For more information, see the HomePlug Powerline Alliance website: www.homeplug.org.

Performance

Theoretical speeds are encouraging, with boasted PHY rates of 200Mbps, but as is always the case, these sorts of statistics are subject to much discussion and doubt. The HomePlug Powerline Alliance states that actual throughput over powerlines is only at 50–55Mbps. Assuming that a high-definition video stream requires at least 20Mbps, we expect this will not be sufficient for regions requiring multiple networked nodes and high-definition content, notably the US. However, the technology does promise 100Mbps over coaxial cable.

First Mover and Technology Leader

Intellon Corporation
Intellon designs and sells ICs for powerline communications, providing HomePlug-compliant and other powerline ICs for home networking, networked entertainment, commercial, and broadband over powerline (BPL) applications. We believe the company is well positioned to capitalize on the significant growth in home networking, AV connectivity, and the convergence of PC and CE environments. Intellon created and patented the baseline technology for the HomePlug 1.0 standard and introduced the world's first HomePlug 1.0-based IC in June 2001. Intellon ICs are used to create instant networks, enabling PCs, broadband modems, STBs, gaming consoles, and audio/video devices to communicate instantly over existing power lines in the home.

Other HomePlug-Targeted Suppliers

Arkados, Inc. (subsidiary of Arkados Group, Inc., OTC BB: AKDS)
Arkados is a fabless semiconductor company that designs, develops, markets, and sells technology and solutions enabling broadband communications over standard electricity lines; it has developed a re-configurable hardware and software platform for high-speed transmission of converged multimedia, voice, and data traffic over AC electrical wires. Arkados is an active contributor to the HomePlug Powerline Alliance.

Gigle Semiconductor, Inc.
Gigle Semiconductor offers a solution for the digital home that allows for CE integration and mass-market deployment; its ICs are fully compliant with the HomePlug AV worldwide standards. Gigle's mediaxtream technology can provide physical throughput rates of up to 1Gbps, eliminating the limitations of current technologies for the CE and communications market, which is becoming increasingly important as IPTV and storage and sharing of digital content around the home begin to proliferate.

Huawei Technologies Co., Ltd.
Huawei Technologies is a leader in providing next-generation telecommunications networks, serving 31 of the world's top 50 operators. The company provides innovative and customized products, services, and solutions to its customers. Huawei's products and solutions encompass wireless products (HSDPA/WCDMA/EDGE/GPRS/GSM, CDMA2000 1x EV-DO/CDMA2000 1x, TD-SCDMA, WiMAX), core network products (IMS, Mobile Softswitch, NGN), network products (FTTx, xDSL, optical, routers, LAN switch), applications and software (IN, mobile data service, BOSS), and terminals (UMTS/CDMA).

Intel Corporation (NASDAQ: INTC)
Intel engages in the manufacture and sale of semiconductor chips, as well as in the development of advanced integrated digital technology platforms for the computing and communications industries worldwide. It offers microprocessor products, including dual-core, quad-core, 32-bit architecture, and 64-bit architecture microprocessors used in computer systems. Its wired and wireless connectivity products are used to translate and transmit data in packets across networks for the traditional LAN, wireless LAN, metropolitan area network, and networked storage market segments, as well as for mobile and fixed networks.

LG Electronics, Inc.
LG Electronics is a global leader and technology innovator in consumer electronics, home appliances, and mobile communications. LG comprises four business units: Mobile Communications, Digital Appliance, Digital Display, and Digital Media. LG is the world's largest producer of CDMA handsets, residential air conditioners, plasma panels, optical storage products, DVD players, and home theater systems.

SPiDCOM Technologies, Inc.
SPiDCOM Technologies is a fabless semiconductor company specializing in integrated ICs and Linux-based software bundles for high-speed communication over electrical powerlines and coaxial cables. SPiDCOM provides ICs, reference designs, development kits, and software to its OEM/ODM partners. Its solutions support a wide variety of broadband applications, such as Internet, VoIP, Video on Demand, digital audio, HDTV streaming, basic LAN connections, and online games.

TCL Corporation
TCL Corporation is one of the largest consumer electronics enterprises in China and has global operations. There are three listed companies under the TCL umbrella: TCL Corporation, TCL Multimedia Technology, and TCL Communication Technology. It has distributors and agents selling televisions under the TCL, Thomson, and RCA brands, as well as mobile handsets under the TCL and Alcatel brands. TCL is an integrated enterprise that engages in three core businesses: multimedia electronics, mobile communications, and digital electronics.

HomePNA: On Its Way Out?

Technology Summary

HomePNA's initial strategy was to use existing copper telephone lines as the home networking medium. This obviously satisfies a "no new wires" mandate, and phone jacks, much like coaxial outlets, are usually widely available in the average home, certainly in North America, although not always where one wants a television to sit. This technology operates at a higher frequency band than data (DSL) line, so interference is not an issue. We think that of the three wireline technologies we discuss in this report, HomePNA's future is the most uncertain, as its use of POTS lines has resulted in high latency rates of 20–30ms, which make it unacceptable for video applications. Much like HomePlug, this technology has been forced, via its late specification, HomePNA 3.0, to adopt the coaxial cable medium in order to enable the triple-play initiatives of telcos and cable providers. After a fast start, garnering AT&T's initial support for its IPTV U-Verse

rollout, the technology has not seen any volume rollout, as there have been rumors that its coaxial performance has interference issues. Most industry observers expect that AT&T will soon walk away from the technology for uses other than DSL modems. For more information, see the HomePNA Networking Alliance website: www.hpna.org.

Performance

The standard targets data rates of up to 340Mbps, but typical application speeds are more likely to be in the 80–100Mbps range over coaxial cable. As mentioned above, latency issues make the phone line aspect of the networking technology doubtful, and there has been some industry concern regarding interference issues when the protocol is deployed over coaxial implementations.

HomePNA-Targeted Suppliers

AFL Telecommunications LLC (a subsidiary of America Fujikura Ltd.)
AFL Telecommunications is a leading provider of fiber-optic products, VDSL2 RF filter components manufacturing, engineering expertise, and integrated services to the telecommunications industry. AFL manufacturers, engineers, and installs fiber optic products and equipment that communications providers need to provide high-speed voice, video, and data services to their customers.

Allied Telesis, Inc.
Allied Telesis offers a broad range of access, aggregation, and core transport systems. The company builds products such as Layer 3 Ethernet switches and multiservice access platforms for network interface controllers (NICs), media converters, and wireless access points. It primarily focuses on delivering end-to-end, purpose-built applications, and it rigorously tests systems in its design and support centers, where it creates solutions for the access edge.

Amino Technologies plc
Amino Technologies delivers products and services through three operating divisions. (1) Amino Communications supplies its AmiNET series of high-performance IPTV STBs and gateways for deployment in the telecommunications, broadcast, and hospitality markets. (2) With its IntAct brand name, Amino licenses hardware designs together with the IntAct IPTV software stack to OEMs, enabling them to supply IPTV STBs and gateways into specific markets. (3) Finally, Modelo provides systems consultancy services to service operators in the telecommunications and broadcast markets.

Analog Devices, Inc. (NYSE: ADI)
ADI provides analog, mixed-signal, and digital signal processing (DSP) ICs that play a fundamental role in converting, conditioning, and processing light, sound, temperature, motion, and pressure into electrical signals to be used in a wide array of electronic equipment. As the digital revolution continues to advance, ADI products are used in the following: automobiles, digital still cameras, LCD and plasma televisions, cellular handsets, medical imaging devices, and factory automation equipment.

Calix, Inc.
Calix powers access networks with its leading solutions that enable the delivery of a wide variety of business and residential services over fiber- and copper-based access networks. In addition to the delivery of basic voice services, its packet-based Calix C-Series platforms can be applied to deliver advanced business Ethernet services, and its F-Series purpose-built GPON access systems provide a high-speed FTTP solution that is capable of delivering very-high-speed Internet access along with IPTV and RF video services.

Cameo Communications, Inc.
Cameo Communications is an international networking products supplier specializing in Layer 2 management Ethernet switches, wireless client adapters, wireless LAN AP/routers, small-office and home-office (SOHO) routers, Ethernet switches, media converters, USB-to-Ethernet converters, Web-Smart switches, and Ethernet NICs. The company is beginning to increase its market share in the data communications field through innovative product design and marketing.

CopperGate Communications, Inc.
CopperGate is a leading provider of standards-based home networking chipsets for networking and distribution of multimedia entertainment content throughout the home over both coaxial cables and

phone lines. CopperGate products are integrated into gateways, optical network terminals, and STBs, and they are key components for enabling the deployment of IPTV services by several major service providers. The CopperStream chipset family offers a complete solution for a variety of home networking and MDU/MTU access applications.

CyberTAN Technology, Inc.
CyberTAN Technology is a leading manufacturer of broadband and wireless networking equipment. CyberTAN has also invested in R&D resources to provide professional OEM/ODM services for the home networking and communications market and has expanded its development efforts to the broadband and wireless fields, concentrating on broadband communications and wireless networking products for the SOHO market.

Fluke Networks (operating unit of Danaher Corporation, NYSE: DHR)
Fluke Networks provides innovative solutions for the testing, monitoring, and analysis of enterprise and telecommunications networks and the installation and certification of the fiber and copper foundation of those networks. The company's lines of Network SuperVision solutions provide network installers, owners, and maintainers with speed, accuracy, and ease of use for optimizing network performance.

IneoQuest Technologies, Inc.
IneoQuest Technologies is a private company that provides solutions in areas such as packet-based technology, developing new video and networking standards, video engineering and processing, and Ethernet networking technology. IneoQuest specializes in IPTV/IP video quality assurance technology, enabling it to design, manufacture, and market a growing portfolio of advanced solutions that enable real-time remote troubleshooting, including simultaneous monitoring of hundreds of live video streams.

Janifast, Ltd.
Janifast provides low-cost manufacturing operations for a joint contract with AT&T and provides manufacturing and sourcing services for numerous types of products including printed circuit board assemblies, RF components, injection molding, casting, sheet metal fabrication, fiber-optic assemblies, and electronic components.

MCR Group, Inc.
MCR is a private OEM manufacturing company whose products include HomePNA 3.0 passive balun/bridges, VDSL MoCa filter/baluns, coaxial passives and actives, and 1–3GHz passives.

Occam Networks Inc.
Occam Networks develops and markets solutions that help local telecommunications carriers meet the challenge of delivering high-speed broadband services, such as data and video, as well as lifeline voice services to residential and business subscribers. Through the use of IP and Ethernet technologies, Occam BLC products enable carriers to add the bandwidth they need to provide new, revenue-generating broadband services while also lowering capital expenditures and operating expenses.

ReadyLinks Inc.
ReadyLinks is focused on applying the latest communication technology to provide an economical solution for broadband integration and communication. ReadyLinks utilizes industry standards to develop products with low acquisition and support costs. Specific technical experience includes DOCSIS standards definition and development, DOCSIS modem and CMTS development, OFDM over cable infrastructure, 802.11 chipset development, and in-building cellular coverage equipment.

SendTek Corporation
SendTek provides customers with products such as ISDN terminal adapters and HomePNA CPE/MTU devices. SendTek dedicates its resources to the development of telecom and broadband Internet solutions including its HomePNA 3.1 Home Networking Solution, which serves the wiring needs of the digital home, IPTV, and triple play over existing phone line or coax cable.

SMC Networks, Inc.
SMC Networks is a leading provider of networking solutions for the small- and mid-sized business and the home. Its new SMC8414WG EZ Connect Embedded Multimedia Terminal Adapter (E-MTA) broadband telephony modem integrates both an Ethernet port and a USB port for data traffic,

and two PacketCable VoIP ports. This new SMC EZ Connect E-MTA is certified for interoperability with PacketCable and DOCSIS cable networks to deliver data as well as multimedia services.

Sunrise Telecom, Inc. (OTC pink sheets: SRTI)
Sunrise Telecom is a leading provider of testing and monitoring solutions for digital multimedia, metro Ethernet, and VoIP networks. By means of past acquisitions, the company has positioned itself to guide its customers through the convergence of voice, video, and data applications.

Tatung Company
Tatung is a worldwide leader in the design and manufacturing of a vast array of digital consumer products including LCD TVs and plasma display panels (PDPs), network-connected devices, storage-based media players, and home appliances. Tatung also delivers advanced products for business computing, such as tablet PCs, WebPAD, and blade servers. Tatung focuses particularly on the development of advanced technologies and global networking of operations.

TII Network Technologies, Inc.
TII is a leading technology provider specializing in the communications industry with innovative network protection and management products that include station protectors; network interface devices; DSL protectors; filters and splitters; power, data-line, and home networking protectors; a multi-service residential gateway; and custom design solutions.

UTStarcom, Inc. (NASDAQ: UTSI)
UTStarcom is a global leader in the manufacture, integration, and support of IP-based, end-to-end networking and telecommunications solutions. The company sells converged broadband wireless and wireline products, an integrated IPTV solution, and a comprehensive line of handset and customer premise equipment to operators in both emerging and established telecommunications markets worldwide.

Zhone Technologies, Inc. (NASDAQ: ZHNE)
Zhone Technologies is a global provider of advanced communications equipment and a leader in VoIP, IPTV, and Ethernet over both copper and fiber access lines in both emerging and established markets. The company's products address a broad range of applications including residential and business broadband, VoIP, IPTV, and Ethernet over both copper and fiber access lines.

WIRELESS HOME NETWORKING TECHNOLOGIES

How Will Wireless Adapt As the Home Network Moves Beyond Just Data?

While wireless networks to date have done a good job of distributing data connectivity throughout the home, the emergence of HD content and digital music will tax existing standards beyond their capabilities. New standards and technologies that integrate quality of service (QoS) and have significantly higher bandwidths are being developed to address this issue. From local-area networks such as 802.11n to higher-speed personal-area networks such as UWB, the digital media and wireless industries are gearing up to help alleviate the bandwidth bottlenecks within the home.

As shown in Figure 3, PC home networks have historically dominated home networking needs. But beginning in 2006, the emergence of multimedia and entertainment networks is expected to outpace the growth of the PC home network. By 2010, multimedia and entertainment networks are expected to dominate the home networking market. Given the increasing amount of digital content ranging from music to video and pictures, the distribution and access of this content is the key driving point for home networking. We believe the PC OEMs will be the first adopters of new wireless networking technologies, followed quickly by consumer electronics vendors of applications such as wireless USB and UWB. With UWB providing more than ample bandwidth for applications such as wireless connectivity between a digital TV and a DVD player, we view these initial applications as seeding the market for a widely networked and multimedia-distributed home.

Figure 3: Worldwide Installed Base of Home Networks by Type, 2005–2010 (in millions)
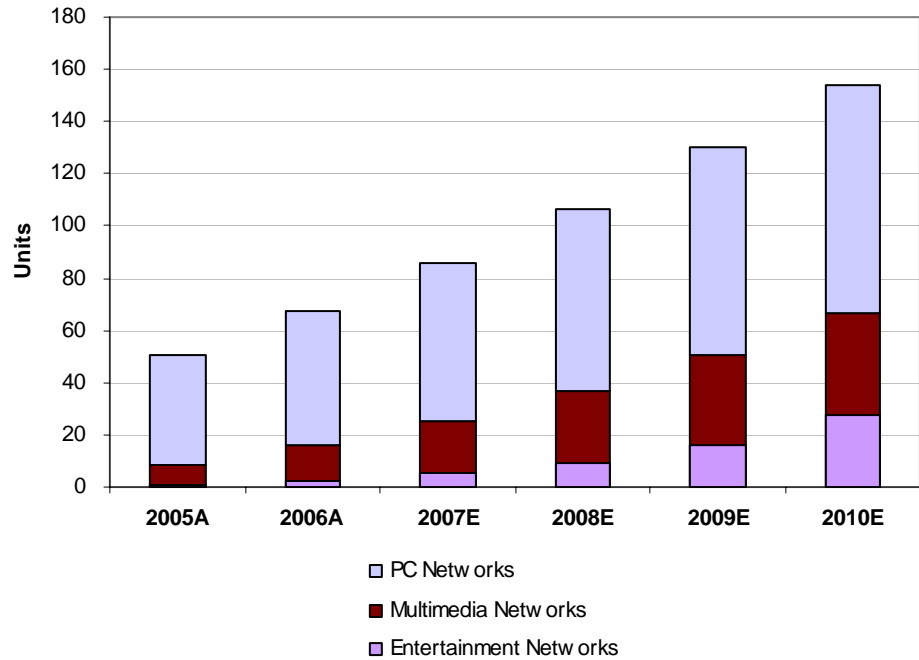
Source: IDC

Multimedia and entertainment home networks are going to be dedicated to distributing digital content throughout the home, in our view. Whereas PC networks have been focused on distributing data throughout the home, the multimedia and entertainment network would integrate multiple media and entertainment formats and deliver the content through various technologies and protocols to multiple devices for consumer consumption.

Multimedia networks would integrate the PC as a content hub and distribute the content to a variety of different devices including web terminals, DVD players, gaming consoles, STBs, receivers, and media adapters. A multimedia network would be set up to not only share bandwidth, but also to share content within the network. A multimedia network would enable the streaming of content from the PC to the audio receiver or from the DVD player to the media adapter in another room.

Entertainment networks would enable dedicated communication between devices. These networks would be independent of the PC and multimedia networks and most likely would run off a proprietary platform. They would enable two devices (most likely from the same manufacturer) to communicate and share data between them. While we believe the market for these entertainment networks would remain the smallest compared to PC and multimedia networks, they should help to alleviate the bandwidth burden on other networks.

New Technologies, New Capabilities

Wireless LAN networks began to take hold in 2001, with 802.11b networks dominating in an early standards battle. Since then, .11b networks have evolved to offer higher bandwidth and range but are soon expected to be complemented by other wireless technologies such as UWB and Bluetooth.

As shown in Figure 4, the evolution of 802.11 networks from data-only protocols such as .11b to more robust and multimedia-centric protocols such as .11n should help deliver multimedia throughout the home. While the theoretical throughput for .11n is expected to be 270Mbps, the actual throughput likely will be only about half that. Given that HD signals typically utilize 20–40Mbps, we believe that wireless networking will be only part of the solution. What happens when a household wants to stream multiple HD content to multiple sets? What happens when you layer in data usage for Internet surfing and music streaming? While .11n with its 270Mbps seems like it has plenty of headroom for all of these applications, we believe a true multimedia household will quickly

run out of bandwidth. In our view, multimedia connectivity within a home will be derived from multiple technologies using multiple interfaces, making for a truly complex environment.

Figure 4: Overview of Wireless Standards

Protocol	Release Date	Operating Frequency	Data Rate (Max)	Range
802.11a	1999	~5 GHz	54 Mbps	~30-100 meters
802.11b	1999	2.4-2.5 GHz	11Mbps	~35-110 meters
802.11g	2003	2.4-2.5 GHz	54 Mbps	~35-110 meters
802.11n	2006	2.4 GHz	270 Mbps	~50-126 meters
Bluetooth v. 2.0+ EDR	2004	2.4 GHz	3 Mbps	~1-100 meters
Ultra-Wideband (UWB)	2002	3.1-10.6 GHz	0-500 Mbps	~2-10 meters
Wireless USB	2004	3.1-10.6 GHz	0-480 Mbps	~2-10 meters

Source: IDC

UWB and wireless USB networks will help bridge the personal area network for consumer and multimedia devices. While the range for these devices is only about 10 feet, the bandwidth capabilities are significantly higher than those of the wireless LAN technologies. These solutions are ideal for delivering picture and video from a set-top box to a TV. Consumer electronics products such as camcorders will integrate this technology to allow wireless transfer of content and video straight from the camcorder to a TV or a PC.

We believe it would be easiest and most logical for PCs to be the first to integrate expanded wireless connectivity solutions such as UWB and wireless USB. UWB is expected to come to market in 2008 and rapidly increase to more than 10% of the total PC market by 2010 (see Figure 5). During this period, we believe that consumer electronics devices including DTV, DVD, digital cameras, camcorders, and mobile phones will also start delving into this market and integrating UWB and wireless USB capabilities.

Figure 5: Worldwide UWB and Bluetooth Penetration in PCs, 2005–2010
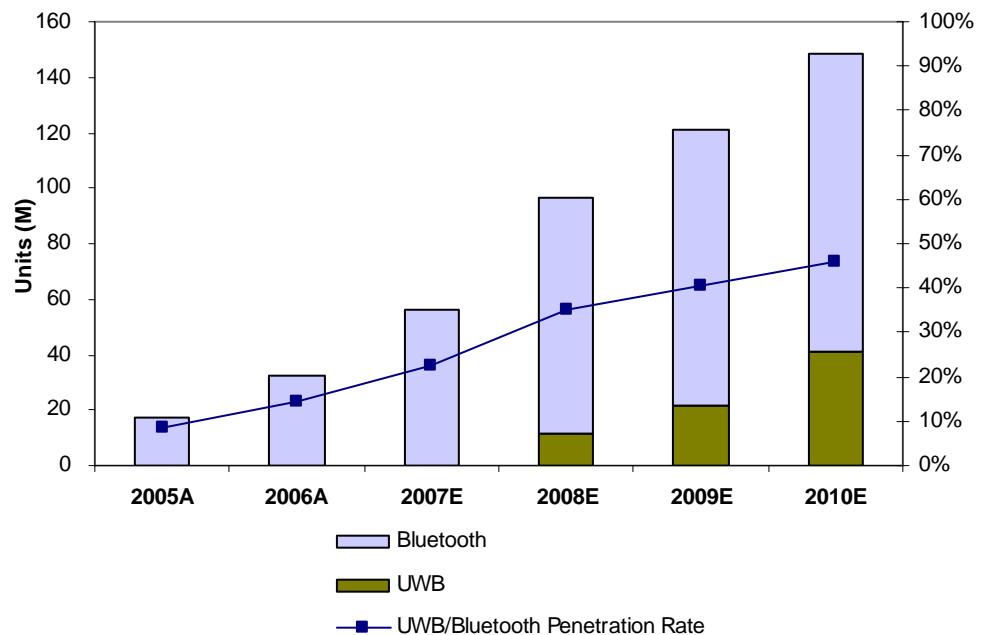
Source: IDC

We believe the integration of UWB and wireless USB technologies beyond the PC will occur in 2008. We have already had extensive discussions with consumer electronics vendors that are testing these solutions today and expecting to bring these products to market in 2008. While we expect the initial rollout to be slow, we believe that by 2010 the majority of consumer devices will be wirelessly enabled through UWB and/or wireless USB technologies. In addition, while the initial drive will be to remove cable clutter, we believe that the overall improvement in user experience will drive continued growth and adoption of these wireless multimedia technologies so that they become an integral portion of the home multimedia network.

Other Technology Companies

Alereon, Inc.
Alereon is a fabless semiconductor company that develops UWB wireless chipsets. Its technology helps simplify networking by removing cables, allowing effortless connections among PCs, consumer electronics, PC peripherals, and mobile devices. Alereon assembled a team that demonstrated the first complete, fully functional 480Mbps solution in early 2005 and introduced production silicon for delivery in early 2006.

AMIMON, Inc.
AMIMON is a fabless semiconductor company focused on wireless uncompressed high-definition video for universal connectivity among CE video devices. Its uncompressed Wireless High-Definition Interface (WHDI) allows flat-panel televisions and multimedia projectors to wirelessly interface with all HDTV video sources, at a quality equivalent to that achieved with wired interfaces such as component video, digital visual interface (DVI), and high-definition multimedia interface (HDMI).

Atheros Communications, Inc. (NASDAQ: ATHR)
Atheros develops semiconductor system solutions for communications products. It offers reference designs that can be used to design various systems, including networking cards and access points, mobile devices, and handsets. The company also provides a portfolio of multi-chip and single-chip products, including entry-level wireless networking products for the home and small office markets; and wireless infrastructure systems-on-chip with network management capabilities for the enterprise market.

Cambridge Silicon Radio, Ltd.
Cambridge Silicon Radio (CSR) designs single-chip wireless devices. It started with a focus on solutions for the 2.4GHz Bluetooth personal area networking standard and has since entered the IEEE 802.11 marketplace with devices capable of operation in both the 2.4GHz and the 5GHz frequency bands. CSR offers developed hardware/software solutions for Bluetooth based around its BlueCore product, a fully integrated 2.4GHz radio, baseband, and microcontroller.

Focus Enhancements, Inc.
Focus Enhancements designs and manufactures state-of-the-art PC-to-video semiconductor chips, video scan converters, and TALARIA Ultra Wideband wireless technology for video, media, and mass storage solutions. Its semiconductor chips are used to enable the convergence of digital media with home entertainment and have been integrated into professional and consumer products.

Pulse~LINK, Inc.
Pulse~LINK's CWave Whole-Home Interactive HD solution claims to facilitate room-to-room distribution of multiple HDTV streams and multimedia content over both coax and wireless connections simultaneously from the same chipset. Devices enabled with the CWave UWB PL3100 chipset allow HD/multimedia content located anywhere in the home to be shared across the existing coax backbone with wireless networking connections in each room for STBs, HDTVs, DVRs, DVD players, media center PCs, and other multimedia equipment.

Ruckus Wireless, Inc.
Ruckus Wireless is a wireless equipment supplier focused on the next generation of home networking. The company developed one of the first in-home wireless multimedia systems, MediaFlex, which was introduced in October 2005. Its business includes system products that it sells directly to broadband providers and embedded technology that it licenses to third-party equipment manufacturers. For example, NETGEAR is licensing and has incorporated Ruckus technology into its RangeMax wireless router line.

Sigma Designs, Inc. (NASDAQ: SIGM)

Sigma Designs offers silicon-based digital media processors primarily for IP video technology, connected media players, high-definition televisions, and personal computer add-in and other markets. The company's Windeo Chipset (its Blue7 Communications subsidiary) is based on the WiMedia Alliance Multi-band technology and adds high-speed wireless access to the next generation of consumer electronics products including IPTV STBs, Blu-ray and HD-DVD players, HDTVs, digital media adapters, and portable media players for high-quality, uninterrupted audio and video streaming over extended ranges.

Staccato Communications, Inc.

Staccato Communications is a UWB technology company with applications expertise in certified wireless USB, Bluetooth, and IP connectivity. Staccato's Ripcord product family offers low-cost, low-power and blazing high-speed wireless connectivity in the smallest, most integrated form-factors.

CONCLUSIONS

We view wireline solutions as doing the heavy lifting... In focusing on a technology's ability to deliver video (and increasingly high-definition video) content, we conclude that currently only wireline networking solutions can deliver the throughput and QoS necessary to distribute challenging video feeds throughout the average home. When considering the growing demand for high-definition content, we believe this choice only becomes clearer.

...and coaxial cable as clearly the medium of choice... While one technology (MoCA) is clearly built on using coaxial cable as the delivery medium, we find it interesting that rival technologies currently seek to integrate coax functionality. The reasoning seems obvious: no other medium delivers the throughput of coax without low-frequency interference issues. Already installed in roughly 90% of US homes, and therefore offering "no new wires" installation, coax is the clear winner as a digital media network medium for emerging home networks.

...with wireless technologies offering near-term complementary functionality and long-term competitiveness, theoretically. Wireless technologies have their place in the home network, one that we expect will grow over time. While we conclude that video streams today can be delivered over distance with acceptable throughput, QoS, and latency specs only by wireline technologies, we think the emerging 802.11n standard (targeted for mid-2008) may challenge that belief. Furthermore, in our view there is much near-term opportunity in wireless USB and UWB for patch cord replacement and other short-distance applications, as they would remove cable clutter and extend the reach of the home network beyond that of a wired solution, for example to send the signal to another spot in a room where a coaxial cable did not already exist. While all of this may seem complex, we believe that the implementation of these technologies will in fact simplify and enrich the user experience. And in targeting consumer dollars, that is clearly the goal.

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Publicly Traded Companies Mentioned in This Report:

Analog Devices Inc. (ADI, $39.13, Not Rated)

Arkados Group, Inc. (AKDS, $0.44, Not Rated)

Alcatel-Lucent ADS (ALU, $13.40, Not Rated)

Applied Micro Circuits Corporation (AMCC, $2.96, Not Rated)

Atheros Communications, Inc. (ATHR, $27.40, Not Rated)

Broadcom Corp. (BRCM, $32.08, Not Rated)

BT Group plc (BT, $63.28, Not Rated)

Comcast Corporation (CMCSA, $26.59, Not Rated)

Conexant Systems Inc. (CNXT, $1.41, Not Rated)

Cisco Systems, Inc. (CSCO, $26.13, Not Rated)

Danaher Corporation (DHR, $70.69, Not Rated)

EchoStar Communications Corporation (DISH, $47.74, Not Rated)

L.M. Ericsson Telephone Co. ADS (ERIC, $38.11, Not Rated)

Infineon Technologies AG ADS (IFX, $15.19, Not Rated)

Intel Corp. (INTC, $22.01, Not Rated)

JDS Uniphase Corp. (JDSU, $13.33, Not Rated)

Motorola Inc. (MOT, $17.92, Not Rated)

Maxim Integrated Products, Inc. (MXIM, $31.64, Not Rated)

NETGEAR, Inc. (NTGR, $33.75, Not Rated)

PMC-Sierra, Inc. (PMCS, $7.49, Not Rated)

Sprint Nextel Corp. (S, $20.07, Not Rated)

Siemens AG ADS (SI, $118.42, Not Rated)

Sigma Designs, Inc. (SIGM, $27.86, BUY)

Sony Corp. ADS (SNE, $52.70, Not Rated)

Sunrise Telecom Inc. (SRTI, $2.93, Not Rated)

STMicroelectronics Corporation (STM, $19.68, Not Rated)

AT&T Inc. (T, $40.39, Not Rated)

Tellabs, Inc. (TLAB, $10.74, Not Rated)

Toshiba Corp. (TOSBF, $7.70, Not Rated)

Microtune, Inc. (TUNE, $4.55, BUY)

Texas Instruments Inc. (TXN, $36.67, Not Rated)

UTStarcom, Inc. (UTSI, $7.00, Not Rated)

Verizon Communications Inc. (VZ, $32.61, Not Rated)

Zhone Technologies, Inc. (ZHNE, $1.29, Not Rated)

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