

Intel and the Digital Home

Making Industry Standards the Foundation for the Digital Home

Building out the digital home

The digital home is a rapidly evolving reality all around us. Every day people use a wide variety of home devices that are digital—everything from HDTVs to laptops, smart phones and MP3 players. This list continues to grow as new digital devices and technologies for home and mobile use make their way into the market. Still, there is much more in store for the digital home. The vision of a home full of connected, interoperable devices that easily exchange and play content is only partially realized.

Recent developments, such as the convergence of television and Internet content converge into products like smart TV offer new opportunities for connectivity. What's more, the rate of innovation in consumer electronics continues to benefit just as computers do from [Moore's Law](#). For instance, the availability of powerful, inexpensive "System-on-a-Chip" (SoC) solutions (such as the Intel® Atom™ CE4200 processor) is transforming digital TVs, DVD players, and advanced set-top boxes. By integrating key components into a single integrated circuit, SoCs support rich Web applications in addition to high-definition (HD) audio-visual content. This allows more consumer devices to become net-connected for streaming content, applications, and other media, and enables TV manufacturers to inexpensively add more intuitive user interfaces and the ability to search and display Internet content.

In addition to these innovations, new industry alliances offer promise for improving life in the digital home. A good example is Google TV. Created through an alliance of Google, Intel, Sony, Logitech, Best Buy, DISH Network, and Adobe, this new platform enables consumers to access all their usual TV channels, as well as a world of Internet and cloud-based information and applications—all from the comfort of their own living room.

However, despite this progress, there are still challenges. Connectivity and ease of use remain issues in the digital home. It can be frustratingly difficult to navigate the Internet with a television-style remote control, or to try to add new devices to a home network to exchange content and services. Intel believes many of the shortcomings in today's technologies must be addressed in order for the digital home to achieve its full potential—and sees this as an effort well worth making. The combination of digital TV broadcast and broadband technologies, combined with advances in home networking, offer consumers the opportunity for unprecedented control over their media experiences, as well as new market opportunities for consumer electronic product manufacturers, content owners, application developers, and service providers.

A major part of the solution is industry standards. These are standards developed by organizations that are open to participation, provide public access to their standards, and support implementation by global stakeholders. As the world's leading manufacturer of microprocessors,¹ Intel has a strong interest in open industry standards that ensure the vision of the digital home both meets consumer expectations and enables manufacturers to innovate, compete and accelerate development of the next generation of interoperable digital home devices. This case study will discuss many of the trends leading to the need for these standards and Intel's work with various standards organizations on them.

Digital home trends

Consumer electronics is now at an evolutionary inflection point, driven by Internet availability in every room and outside the home. The Internet is evolving as well, providing much of the content people are used to enjoying on television, radio and DVD/CD players. This opens up new possibilities in content, conveniences and usage models for consumers.

Based on these developments, Intel sees three compelling trends for today's digital home.

1. **Making TV an Internet client.** People love television. TV sets are easy to operate and can access many channels of entertaining content. Add a DVR and you can record programs for later viewing. Add a game console and you can play hundreds of games. Television takes on yet another dimension when you connect it to the Internet. It becomes an even more versatile entertainment device, providing anytime access to an amazing wealth of online videos, including popular TV programs and movies. According to Global Industry Analysts, the worldwide market for Internet TV is forecast to reach US \$81.2 billion by the year 2017, driven by the virtually unlimited channels and entertainment options, among other factors.²
2. **Anytime, anywhere, any device access to media.** Along with the growing number of devices people own for playing media, people like the flexibility to enjoy digital content when and where (in and outside the home) they want it. To meet this expectation, the old model of separate islands of consumer electronic devices in different rooms is rapidly evolving to a home where all playing and recording devices are networked for the easy exchange, consumption and transportation of media.
3. **Home automation, smart appliances and smart grid.** Imagine being able to control every system and appliance in your home from your couch or even away from home in much the same way you channel surf. Broadband Internet access, home networks, smart appliances, in-vehicle infotainment systems, and more sophisticated computer and consumer electronic products are creating new convenient ways to simplify and improve control of home systems and vehicles. The growing interest in environment protection and smart energy usage is also creating interest in home automation systems, electric cars, and energy efficient products. In response, manufacturers are developing home energy management devices, in-home display units, and other digital devices to help customers manage energy consumption and control costs. Manufacturers such as Intel are even including sleep states in their products and platforms to automatically conserve energy when not in use, yet maintain important network functions while in standby mode.

Compelling digital home usage models

What makes a thriving market for digital goods is a great user experience. This has to be the ultimate goal for technology advances, broadband infrastructure improvements, and new products hoping to take the digital home to the next level. Let's look at the emerging usage models for the three trends described above to see what will make them compelling to consumers.

Networked Smart Television Applications

Smart television is a veritable melting pot. It can blend broadcast content, Internet content, personal content, gaming and even social interaction and content sharing. Imagine being able to watch a program and, in another window on the screen, carry on a video phone conversation with a friend viewing the same program, perhaps even simultaneously sharing photos from a recent vacation stored on your TV or elsewhere in the home, all without pausing the program. Now imagine you're interrupted and need to pause that program and move on to a different task. Wouldn't it be great if you could resume it sometime in the future on a completely different device, such as a cell phone, and have that device recognize exactly where you left off and start the program off at that point? Back at the television, imagine having an interface that enables you with voice and gestures to easily search through countless video and other content choices. Then imagine choosing a sci-fi thriller and slipping on a pair of 3D glasses and enjoying a 3D theater experience in your home. Much of this sequence was demonstrated at an Intel Developer Forum.

Consumers are apparently more than ready for the rich, immersive experiences possible when digital, Internet-connected televisions become standard equipment. According to a 2010 report from In-Stat, by the year 2014, 57 million U.S. households will be watching full-length online content on their TVs and the revenue associated with that video will reach \$17 billion.³ The report predicts the number of installed web-enabled video devices will increase to 237 million units over the next five years.

Data from a 2011 AdWeek/Harris poll shows that 77 percent of Americans have watched a TV show on the Internet.⁴ A Parks Associates' 2011 study shows that 13 percent of broadband households in France, Italy and Spain already have a smart TV for watching online content.⁵ In China, a report revealed that 86.3 percent of the online videos viewed were either studio-created films or TV shows and 80 percent of young Chinese say the Web is their primary source of entertainment.⁶

The Internet's treasure chest of video content is attracting viewers worldwide and it's time for home TVs to connect and bring the Internet to the living room. People want to catch up on missed TV shows, rewatch episodes, and view movies. Other potentially popular usage models include being able to access up-to-date information like news, local weather, and personalized Web content through widgets that use a small amount of screen real estate to serve up information instantly.

Any device, anytime, anywhere access to media

People don't live in one room of the house or use just a single digital device in and outside the home. In fact, many people have multiple digital devices, including desktop and laptop computers, netbooks, televisions, DVD and Blu-ray players, and smart phones and other handhelds. Once people experience on-demand media streaming and downloads, their expectations rise for personalized media anytime, anywhere.

Imagine talking with a friend in the kitchen about your last vacation and wanting to show them pictures. Rather than having to move to another room to view the photos on a desktop computer, wouldn't it be nice to just flip on a digital TV in the kitchen or hand your guest a mobile Internet device (MID) and access the photos right then and there through an online photo gallery? In the usage model for TV above, we discussed the ability to watch a program on one device, stop it, and then continue where you left off with another device. Internet-connected home storage solutions and/or cloud computing may be the answer to enabling such an anytime, anywhere, any device model. Already people are storing media (music and videos) on the Internet and receiving digital rights to view media stored there. These services allow people to easily access their media away from home.

Home automation, smart appliances and smart grid

You're at work and your home alarm goes off. You receive an alert on your MID and through IP video surveillance cameras in each room are able to determine it's just a false alarm. Using your MID, you then reset the security system remotely. You notice sun pouring into your home's south windows and check the thermostat and see it's rising. Fortunately, a temperature sensor will automatically activate a motor that closes your drapes on that side of the house to

Digital Home Standards at-a-Glance

Intel participates in many standards organizations and programs, including those below.

Access to the Home

Terrestrial

ATSC
DVB-T
ARIB (Association of Radio Industries and Businesses)

Cable

DVB-C

Satellite

DVB-S

Telecommunications

Broadband Forum*

Access to Content

High-Definition Disc

Blu-Ray

Codecs

MPEG

IPTV

CEA

DVB-IPTV

ITU

Open IPTV Forum (OIPF)

Society of Cable Television Engineers (SCTE)

Device Connectivity

Bluetooth

DisplayPort

Wireless Gigabit Alliance (WiGig)

ZigBee*

Ultra Wideband (WUSB)

WirelessHD

Network Connectivity

802.1AV

802.3

802.11x

ITU-G.hn

MoCA*

WiMAX*

Home Gateway Initiative (HGI)

WiFi Alliance*

Interoperability

CEA

DLNA

DVB-IPI and DVB-HN

UPnP

DECE

Platform

MeeGo Alliance

DVB-MHP (Multimedia Home Platform)

OpenCable* (OCAP)

W3C

Content Protection

DTCP and DTCP-IP

CPRM

HDCP

CMLA

DECE

reduce your air conditioning costs. Arriving home hours later, you wonder if it's a good time to recharge your electric car. An in-home display that monitors current usage on the electric grid tells you that if you wait until after midnight, you'll save USD 3.00, plus help the load balance in your power region.

Interest is growing in such power management and green technologies. A consumer survey reveals that 69 percent of consumers have "high interest" in displays providing users with real-time data on their current energy consumption, real-time costs, and potential savings in turning off or rescheduling the use of appliances.⁷ A study conducted for the European Union indicates that in-home demand response mechanisms could lead to annual savings of 25 billion Euro.⁸

Energy monitoring functionality can easily be integrated with consumer electronics through embedded applications to allow information and control from a networked TV or IP media phone. Smart grids that use information and communications technology (ICT) to enable consumers to monitor and control their energy use through computer dashboards, smart appliances, and personal energy asset networks are a major priority now in some countries. According to the U.S. Department of Energy, improving the efficiency of America's power grid by just 5 percent would equal the environmental benefits of taking 53 million cars off the road.⁹

The importance of standards in the digital home

Anytime, anywhere, any device access for most media types is still just a vision. Many challenges must be overcome to bring these and other compelling digital home usage models to daily life. Some of the biggest issues the industry faces have to do with the complexity of setup and operation of many digital home devices. After all, one reason consumers like TV so much is that it's simple and easy. But setup and operation on a smart TV quickly gets complicated when there are other devices to attach and complicated interfaces to navigate with button-filled remotes. Setting up and securing networks is also difficult for most consumers, particularly when it comes to getting wired and wireless devices of different generations to work together. Complications include different file formats, codecs, operating systems, content protection systems, and other factors that impede transfers and interoperability. Home networks also need to transition to Gigabit Ethernet to support multiple HD throughout the home without interruption and without dropping frames. Platforms need to improve how they talk to each other so consumers can just plug in devices and have them automatically work with existing devices in the home.

Solutions to many of these issues are available through industry standards and development of common formats and specifications. Such solutions help accelerate development of products that enable consumers to experience greater ease of use, choice and control in their digital media experiences.

Some key standards efforts

To help the industry move from promise to reality, Intel works with other industry leaders and organizations in a broad range of technical standards organizations and special interest groups (SIGs) in communications, computing, and consumer electronics. The goal is to create a full range of industry-supported standards that enable broadband access, data encoding/decoding, device connectivity, networking, and interoperability for new generations of consumer electronic platforms and services. The common objective is to develop and promote industry standards that will accelerate development at each link of the value chain and ensure tomorrow's digital home solutions meet the expectations of the community that matters most—the consumer.

Some key standard groups Intel works with include the following.

- **Digital Living Network Alliance (DLNA).** This organization of leading companies from the consumer electronic, computing, and mobile device industries is working towards a world where connected, interoperable devices, including set-top boxes, PCs and handheld devices, work together over wired and wireless networks in the home. DLNA focuses on referencing existing standards and specifications, and defining specific

implementation details so that products from different vendors will interoperate. DLNA guidelines support underlying standards, including the Universal Plug and Play (UPnP) initiative of the UPnP* Forum. DLNA CERTIFIED* products are currently sold by leading manufacturers throughout the world. Since its formation in June of 2003, DLNA has grown rapidly and now includes more than 200 global member companies. Intel was a founding member and has a representative on the DLNA board of directors. Guidelines developed by the DLNA enable easy connections for sharing digital media content across consumer electronic devices. They also include specifications for link protection to allow secure transmission of copyright-protected commercial digital content.

- **UPnP Forum.** This critical standard defines how devices in the digital home interconnect and interoperate, including how one device discovers other devices and their capabilities, content, and content formats. It is a robust standard that allows for discovery and control between devices that may have different operating systems, program languages or physical network connections. UPnP technology can run on any network technology including Wi-Fi, coax, phone line, power line, Ethernet and 1394. The UPnP Forum, which drives UPnP, is an industry initiative group of more than 880 leading companies in computing, printing and networking; consumer electronics; home appliances, automation, control and security; and mobile products. The UPnP Forum Steering Committee is a group of up to 20 member companies including Intel that provide general leadership and business direction for the Forum. The Forum's goals are to simplify device connection and network implementation in home and corporate environments. Toward this end, UPnP Forum members work together to define and publish UPnP device control protocols built upon open, Internet Protocol-based communication standards. DLNA has made UPnP the primary media management and control standard for products built using DLNA guidelines. The UPnP specifications and DLNA guidelines have been adopted as formal international standards by ISO/IEC and IEC respectively.
- **Wi-Fi Alliance.** This global non-profit organization aims to drive adoption of a single worldwide standard for high-speed wireless local area networking. The Alliance also provides certification of wireless devices meeting its standards through its Wi-Fi CERTIFIED* program. Intel is a founding member and on the Board of Directors. One current effort of the Alliance is solving the difficulties consumers have in connecting wireless devices to each other and getting them to work together. Their solution, Wi-Fi Direct*, enables devices in a personal area network (PAN) to make secure, direct connections to one another quickly and conveniently to do things like print, sync and share content even when an access point or router is unavailable. The specification for Wi-Fi Direct was developed within the Wi-Fi Alliance by member companies and operates on 802.11 devices. The timing is excellent as Wi-Fi today is a must-have technology for not only laptops and netbooks, but also consumer electronic devices such as smart phones, portable media players, printers, projectors, smart TVs, game consoles, and many other devices. Intel helped lead the the effort in the Wi-Fi Alliance to develop the Wi-Fi Direct specification and has delivered the industry's first commercially available Wi-Fi PAN, Intel® My WiFi Technology, that incorporates this specification. Wi-Fi Direct will help transition Wi-Fi from a networking technology to a broad market connectivity solution that can easily connect devices together without requiring consumers to know anything about Wi-Fi networking and the various forms of wireless security.
- **HomeGrid/G.hn.** Network connectivity includes a range of wired, wireless and “no new wires” networking standards encompassing IEEE 802.3 and 802.11, ITU G.9960 and G.9961 (powerline, coax, and phoneline), HomePNA 3.0* (phone and coax), MoCA* (coax), WiMAX* (802.16 WirelessMAN) and WirelessHD*. Intel supports multiple standards, including those that work in combination to provide the optimum consumer experience. Intel believes the best solution is a unified technology standard for enabling connectivity over any wire, anywhere in the home. The goal is for consumers to be able to buy devices that can plug into any existing wiring (coaxial, phoneline or powerline) and

automatically network with other devices adhering to the standard. The G.hn (next generation home wired network technology) workgroup within the International Telecommunication Union (ITU-T) has finalized a unified standard for a single Physical Layer/Media Access Control (PHY/MAC) technology that works on coax, phonelines and powerlines. To meet the needs of modern home networking, the technology needs to deliver reliable signals capable of handling multiple HD broadcasts—something today's wireline technologies cannot do. The G.hn workgroup has about 35 members, including Intel, and includes service providers, consumer electronic companies, personal computing companies, IP licensing companies, and silicon suppliers. Significantly, its members include all the silicon suppliers for the existing powerline, phoneline and coax networking technologies. Intel is also a participant in The HomeGrid Forum, an industry group formed to certify compliance with G.hn specifications, ensure interoperability of G.hn products, and help market G.hn technologies to the industry and consumers. The goal of G.hn is to empower service providers to deploy new offerings, including Internet TV, more cost effectively; allow consumer electronic manufacturers to network all types of entertainment, home automation, and security products throughout the house; and greatly simplify consumers purchasing and installation processes. What makes G.hn especially intelligent is that it gives new use to the cabling many people already have in their homes.

- **OpenIPTV.** The technology behind IPTV is standardized, but those standards come from a variety of different bodies covering different parts of the transmission path. IPTV systems use technologies standardized by 3GPP, TISPAN, ATIS IIF, OMA, DBV, DNLA, HGI, and ITU-T. Getting them all to seamlessly together is a major undertaking. Current set-top boxes must be tuned to work with specific IPTV implementations, but the industry forum OpenIPTV hopes to change that, enabling a "plug and play" experience for consumers by enabling devices to work seamlessly with multiple service providers. The Open IPTV Forum is acting as a sort of meta-standardization body working to make all the current standards work smoothly from end to end. Members include Intel and a wide range of companies in the communications and entertainment industries.

Protecting content rights in the digital home

There is substantial recognition in the information technology (IT) and consumer electronic industries that improving the interoperability and ease of content transfer among devices is vital to improving the user experience and maintaining a healthy market for both content and devices. Consumers have an expectation that, when they buy a song or a video, it should be theirs to play on any device they own. Content providers, on the other hand, understandably want to be paid fairly for their product and ensure it is not pirated and shared or sold to unauthorized users.

Intel, as a manufacturer of the silicon in many of the devices used for playing, exchanging and recording media, wants to facilitate use of content protection on and among Intel-based platforms to help all parties achieve their goals. Consequently, for more than a decade and a half, Intel has taken a leadership role in content protection, helping drive many key developments. A major effort today is to keep digital rights management (DRM) and content protection invisible and nonintrusive to consumers. It shouldn't be yet another confusing feature to consider when choosing content or shopping for a device or a way for content service providers and services to compete. Yet most DRMs available today are proprietary, vertical solutions for license only on specific platforms (based on an operating system, device category, etc.), and/or designed to benefit specific service providers.

Intel focuses its efforts on cost-effective end-to-end solutions and content protection systems where device and service interoperability are the foundation of the technologies. This means developing technologies that can be implemented by anyone and which protect content and interoperability through product design and product robustness as defined by content protection license agreements.

One of Intel's most successful efforts was its work on High-bandwidth Digital Content Protection (HDCP) technology. This specification which protects digital entertainment across High-Definition Multimedia Interface (HDMI) connections is so successful that today it would be hard to go to an electronics store and find a device with digital outputs that doesn't include it. The HDCP specification provides a robust, cost-effective and transparent method for transmitting and receiving digital entertainment content to HDMI-compliant digital displays. HDCP technologies protect high-value digital motion pictures, television programs and audio against unauthorized interception and copying between a digital set-top box or digital video recorder and a digital TV or PC. Today this specification is evolving to allow people to conveniently connect displays, devices, and home-theater systems via standard protocols and interfaces like TCP/IP, Wi-Fi and USB.

The world of content protection is extremely complex. Many efforts have formed to address content protection and DRM. These include the formation of the Content Management Licensing Authority (CMLA) in 2004, a trust authority for the Open Mobile Alliance (OMA) DRM. Also in the works is a promising solution from a large group of industry players, the Digital Entertainment Content Ecosystem (DECE).

- **CMLA.** Formed by Intel, device manufacturers, service providers, and content providers, CMLA provides commercial licenses to companies wishing to use the CMLA trust model and implement the CMLA Technical Specification. CLMA also acts as a broker, providing trust model services (key generation and certificate signing services) for licensees (client vendors, service providers and developers) implementing OMA DRM, or OMA and Digital Video Broadcasting-Handheld (DVB-H) in CMLA-licensed products and services. CMLA makes its licenses and cryptographic certificates/keys available to any service provider, device maker, and content provider that desires to participate in the horizontal interoperable markets enabled by CMLA/OMA DRM.
- **DECE.** This consortium of content providers, consumer electronic companies, and Internet service providers supports UltraViolet*, a new framework for a consumer-friendly open market for digital content distribution. UltraViolet enables consumers to purchase digital content and watch it wherever, whenever. Consumers who purchase UltraViolet entertainment enjoy an easy and consistent way to watch film and television content across multiple branded platforms, such as computers, connected TVs, game consoles, smartphones and tablets. The UltraViolet name and logo help identify content, devices and services from a spectrum of familiar entities—including studios, retailers, consumer electronics manufacturers, cable companies, ISPs and other service providers—that will work together. Through the UltraViolet Account system, each household can create an account for up to six members who access the household's UltraViolet movies, TV and other entertainment via participating retailers, streaming providers and devices. Consumers can also register up to 12 devices so UltraViolet content can be easily downloaded to those devices, or shared among them. In addition to these UltraViolet devices, UltraViolet streaming access enables consumers to access their collections via set-top boxes and most places they can access the web. Also, the UltraViolet Account enables retailers to provide consumers with a copy to use on DVD players or other physical media, such as portable flash memory.
- **DTLA.** Formed by Intel, Hitachi, Panasonic, Sony and Toshiba, the Digital Transmission Licensing Administrator (DTLA) licenses a content protection technology that ensures a consumer's reasonable and customary right to make personal use copies of protected content and digitally network it throughout the home. Digital Transmission Content Protection ("DTCP") has been widely adopted across the globe in consumer electronics products from set-top boxes and digital TVs to Blu-Ray and DVD recorders; in voluntary standards groups; by a spectrum of cable, satellite, and media services; and over a variety of wireless and wired interfaces. One of the most important extensions of DTCP technology is DTCP-IP which supports IP-based networks. As IP networks spring up in the home and people move to new broadband content sources, companies that offer

digital content over the Internet are growing quickly in popularity. In the digital home, DTCP-IP makes the perfect common denominator for protecting content as it is exchanged from one device to another, such as from a desktop PC to a DVR connected to a TV.

Signs of progress

The digital home is constantly undergoing its own "home improvement" through many of the organizations and efforts we've described. For example, DLNA reports that, by the middle of 2011, the Alliance had certified more than 11,000 different TVs, PCs, mobile phones, printers and other products for interoperability. Industry analyst Strategy Analytics forecasts that the number of DLNA Certified* device models will rise to nearly one billion products sold in 2014.¹⁰ Windows 7 is playing a key role in DLNA popularization. Its version of Windows Media Player features a "Play to" command that makes it simple for consumers to play files to DLNA-certified devices throughout the home.

On the plug-and-play front, UPnP certification is making it increasingly easy way for retailers and consumers to recognize products that have been developed and tested to comply with the UPnP device standards. Thousands of devices are now UPnP-certified. UPnP technology is being used in devices designed to:

- Remotely control devices
- Move digital data in the form of audio, video and still images between devices
- Share information among devices and with the World Wide Web
- Exchange structured and secure digital data to support electronic commerce

As for efforts in HomeGrid/G.hn, in June 2010, ITU-T approved all sections of the G.hn specification at its meeting held at the United Nations in Geneva. As a result of this agreement, ITU-T has published an Approved G.hn Recommendation for the Physical Layer (PHY) and architecture (G.9960), the Data Link Layer (DLL) (G.9961), and the coexistence portion (G.9972) of the specification. G.9972 will allow coexistence between G.hn products and other wireline networking standards. The outcome of this meeting marks another step in the steady adoption of G.hn and reaffirms the desire to unite a fragmented industry which currently uses a variety of incompatible technologies that typically address only single types of household wiring options—coax, phone line, or power line.

The challenges ahead

Consumers want electronics products for entertainment that are easy to shop for, convenient to use, and allow them to easily access desired services and content on whenever and wherever they want. While we are seeing significant progress in many of these areas, important challenges remain. One area that especially needs more work—and is a focus of the Open IPTV Forum—is the development of industry standards for connecting digital TVs to the Internet in ways that maximize bandwidth, ensure quality of service, and protect premium content without compromising user experiences.

The consumer electronic industry is clearly working to make devices smarter, provide more features, and play more content. The industry is also continuing to create new usage models and applications. While the industry works on all this, it must be careful to preserve the enjoyment of consumer electronic experiences. To do this, Intel believes the industry and standards organizations need to continue their work on:

- Developing solutions for enabling better use of Internet features, content, and content protection in smart TV sets.
- Creating genuine plug-and-play for all CE devices, especially those that connect to the TV. Connecting devices should be as easy as plugging in a jack.

October 2011

- Eliminating the tangle and clutter of wires, cables and plugs that plague anyone who cares about the aesthetics and style of their principal social spaces.
- Making tomorrow's TV experience smart enough to be simple with interfaces and remote controls that are less complicated, more intuitive, and make all content (broadcast, Internet, and personal) easier to find. The industry needs to develop more human-like interactions, such as voice and gesture, rather than machine interactions.
- Creating more intelligence in devices so that they recognize their owner's media and content rights no matter which device is being used, while at the same time providing better security, all without involving the user.
- Incorporating more energy-efficiency and smart grid features in all consumer electronics and appliances to lower their carbon footprint, annual energy costs, and impact on the power grid, particularly in peak power periods.

Learn More

- [Intel Consumer Electronics Web site](http://intelconsumerelectronics.com/) (<http://intelconsumerelectronics.com/>)
- [Open Standards: Foundation for Progress in the Digital Home](http://www.intelconsumerelectronics.com/Archive/Open-Standards.aspx) (<http://www.intelconsumerelectronics.com/Archive/Open-Standards.aspx>)
- [Intel and Content Protection](http://download.intel.com/standards/Content_Protection_Case_Study.pdf) (http://download.intel.com/standards/Content_Protection_Case_Study.pdf)

*Other names and brands may be claimed as the property of others.

¹ 2010 iSuppli rankings of top 25 semiconductor suppliers by worldwide revenue.

² "Internet TV: A Global Strategic Business Report," Global Industry Analysts, 2011.

³ "Web-to-TV Gaining Momentum in the US," In-Stat, October 2010.

⁴ "Poll: More Americans Are Watching TV Online, But Few Ready to Cut Cable Cord," Sports Business Daily, June 21, 2011.

⁵ "Online Video and Internet TV Services: Global Outlook," Parks Associates, 2011.

⁶ Walsh, Mike, "FutureTube – Online Video in Asia," quoting statistics from his research report for Cable & Satellite Broadcasting Association of Asia.

⁷ In-Home Displays Spike Interest in Energy Usage and Efficiency, Energy Insights, IDC.

⁸ Plenary Session Metering Europe Conference, Amsterdam, Capgemini Worldwide, September 2008.

⁹ "The Smarter Grid: An Introduction;" U.S. Department of Energy, pg. 7.

¹⁰ "DLNA Drives Connected Consumer Experience in 2011," DLNA press release at International CES, January 6, 2011.