

Introduction

Consumers live in an era of pervasive digital media that includes digital TV, TV shows recorded on a digital video recorder (DVR), digital photos or video captured by consumer cameras or mobile phones, digital music and movies on CDs and DVDs or downloaded from the Internet, and much more.

Consumers naturally want to be able to access this abundant content whether personal (their own content) or premium (content they paid for) anytime, anyplace, and on any device. This is especially true at home on TVs, stereos and PCs, or while traveling in their cars or on their mobile devices including notebooks, smart phones and personal multimedia players (PMPs).

The TV viewing experience has seen three major innovations in the last decade:

- DVR for time-shifting. The old saying, “I’ve got to get home to watch my show!” is a thing of the past.
- The shift from analog to digital has ushered in an explosion of new devices including PMPs like the Apple® iPod®, HDTVs and cell phones.
- High Definition TV has created a whole new ecosystem of devices and services.

These same innovations have added rich functionality and enjoyment to the home entertainment experience. They have also significantly complicated the TV installation and viewing experience. Today’s consumer is often overwhelmed and intimidated by the complexity of modern entertainment systems that include different types of audio and video cables and plugs, several remote controls, input selections, different aspect ratios, different resolutions, different digital TV technologies to choose from (Plasma, DLP, LCD, etc.) and more.

LiquidHD™ technology is the next innovation in the TV viewing experience that will tie the different audio/video sources and displays together into a consumer electronic network (CE network) that uses a single network cable (or even wireless) instead of the mass amount of cables required today. Adding devices to a CE network is as easy as using a single network plug and commodity home networking equipment. LiquidHD technology makes the modern TV viewing experience simple and easy while adding many exciting new capabilities.

LiquidHD is a device interoperability architecture and a set of protocols that enables this richer, simpler TV viewing experience including, robust A/V streaming, a remote user interface protocol, device control and a security/content protection subsystem.

This document discusses how consumers will experience LiquidHD technology and the channels they will use to obtain LiquidHD products. The set of essential use cases (or user scenarios) contained in this document showcases some of the features and capabilities of the LiquidHD architecture and specification.

Multi-Room DVR and Video On Demand

Nancy is in the process of remodeling and redecorating her home. Her entire family enjoys watching live TV throughout the home but is growing increasingly frustrated that they cannot watch a show recorded to the DVR on another TV. Also, there has been more than one occasion where a family member has purchased an on-demand movie on their personal TV and then been unable to watch it with others on the main living room TV. Nancy is also tired of the stacks of unsightly boxes and connections that are taking up space.

What Nancy needs

Nancy and her family want to be able to watch multiple live TV channels and/or multiple recorded shows (including on-demand movies) on any TV in the home. The ability to pause viewing and restart where they left off from any other TV is an added convenience, especially because they can do all of this using one remote control. Nancy is also looking for a way to reclaim some of the room taken up by entertainment centers, boxes and connections.

Solution

Nancy purchased four new LiquidHD-enabled TVs and called her pay TV service operator to subscribe to their new multi-room DVR package. The service operator's installer brought over a single LiquidHD-enabled DVR set-top box that contains four tuners. This single box replaces the family's current four set-top boxes (STBs). Nancy is delighted to learn that this new box can go anywhere in the home, such as inside a small armoire in an out of the way corner of her living room. The new DVR connects to all four TVs using the home's existing coax cabling that already runs to every room. Her new TVs can be hung on the wall and all cables can be hidden out of sight.

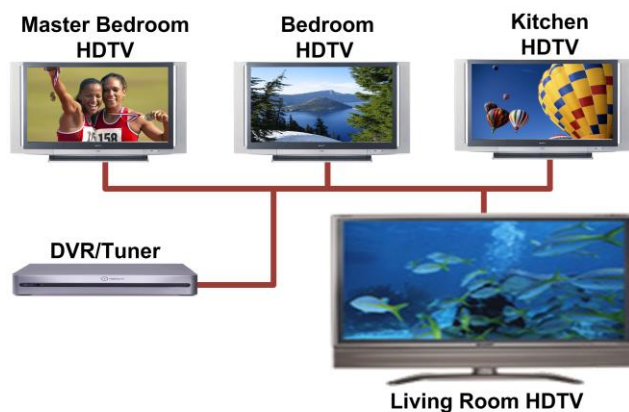


Figure 1: TVs sharing a DVR/Tuner

- Nancy and her family benefit by being able to watch any combination of live, recorded shows or on-demand movies on any TV in the home. They can even pause a show on one TV and resume watching it on another TV in the home.
- The retailer benefits by selling LiquidHD-enabled TVs and other LiquidHD-enabled CE devices.
- Consumer electronics OEMs benefit by creating devices with these valuable features that spurs increased demand for their TVs, STBs and DVRs.
- The service operator benefits both from their increased in-home reach to all TVs and from the reduced capital expenditures from only needing to provide one STB per home. Powerful LiquidHD functionality and ease of use boosts customer satisfaction and reduces churn.

How it works

Having a single LiquidHD-enabled DVR means that all recorded content is stored in a single convenient location and available for viewing on any LiquidHD-enabled TV in the home. This new DVR gives Nancy's family the flexibility to watch any combination of live and recorded content anytime, anywhere. Thanks to LiquidHD technology, Nancy can simply add new TVs to different locations around her home that provide her family with the same experience that they are used to on existing TVs.

1. Nancy calls her local cable, satellite or IPTV service provider. The service provider's technician arrives at the home with a LiquidHD-enabled high-definition DVR. The technician places the DVR in the living room armoire and connects it to the CE network using the home's existing coax cables. These coax cables already run to every TV in the home; connecting the TVs to the DVR is fast and simple.
2. When the LiquidHD-enabled DVR and LiquidHD-enabled TVs are turned on, they will automatically discover each other and a DVR icon will appear on the TVs. Nancy then selects the DVR icon and is connected to the DVR to begin watching TV shows.
3. LiquidHD technology includes the LiquidPixels remote user interface protocol. This allows the DVR to send its user interface over the CE network to the TV in a manner that is low latency, low bandwidth and pixel-accurate. Nancy will see the same exact user interface on every TV in the home.
4. Once Nancy selects a live or prerecorded show to watch, the LiquidMedia protocol streams a high quality compressed media stream from the DVR to the LiquidHD-enabled TV where it is decoded and displayed.
5. Combining LiquidHD technology and MoCA (multi-media over coax) physical layer networking allows service operators to reuse the home's existing coax wiring to provide multi-room DVR services. LiquidHD technology runs over commodity IP networks and can be deployed on coax, Ethernet, power line and Wi-Fi connections.

Sharing a Blu-ray player among multiple TVs

Nancy and her family love how LiquidHD technology in their DVR and TVs allows them to watch their shows in any room in the home. Nancy and her husband often like to start watching a movie in the living room after the children go to bed. After a while, they start to get tired and would like to pause the movie and continue watching in their bedroom without having to physically remove the Blu-ray disc, bring it to the bedroom and find where they left off. They wish they could just pause it and resume watching in the bedroom.

Nancy and her husband also enjoy using the BD-Live features that come with each disc. Many Blu-ray discs offer games and trailers that they can download from the Internet and play. Their Blu-ray player also includes the Netflix® service, which allows them to stream high-definition movies without having to go to the video rental store. Thanks to LiquidHD technology, they can enjoy all of these services on any TV in their home.

What Nancy needs

Nancy and her family need to be able to watch a Blu-ray disc on more than one TV. By now, she has come to expect that LiquidHD technology will deliver an easy, low-cost solution.

Solution

The solution is just as easy as Nancy has come to expect from LiquidHD technology. She purchases a LiquidHD-enabled Blu-ray player. She places the player in the same out-of-the-way location where the DVR is located and connects it to her CE network using a short length of coax cable. As always, a single remote control can access all source devices on the CE network.

- Nancy benefits by being able to access the same Blu-ray player from all TVs with minimal hassle and zero learning curve.
- The retailer benefits by selling a high-end LiquidHD-enabled Blu-ray player to a customer who already knows about LiquidHD technology, making this an easy—and highly profitable—sale.
- The manufacturer benefits by selling a new Blu-ray player.

How it works

Nancy buys the LiquidHD Blu-ray player at her local electronics retailer. She takes it home, unpacks it and connects it to the home's coax network. She powers up the Blu-ray player, then goes to the master bedroom where an icon for the Blu-ray player appears on her TV. She clicks

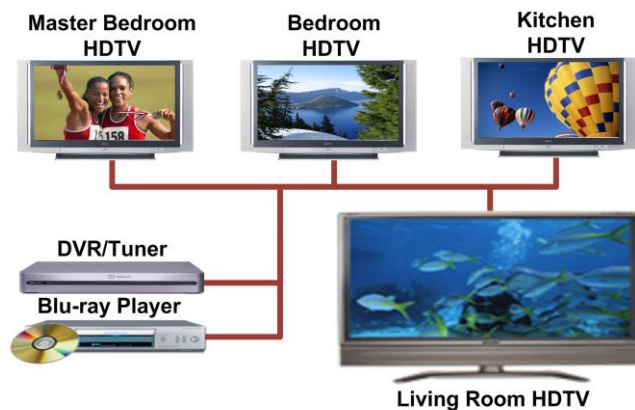


Figure 2: TVs sharing a Blu-ray player

on that icon and is now connected. The entire family can enjoy Blu-ray movies, BD-Live content and Netflix throughout the home.

Whole Home Gaming

Nancy's children love playing video games but they have an older game console and keep asking Nancy to buy the newest game system. On many evenings, the children start playing games right when Nancy and her husband want to watch TV in the living room. Nancy is looking for a game console that lets the children play games in any room in the home without physically moving the game system. The family has also heard about media features in new game consoles that offer both online TV shows and movies for download and storage of digital photos to play on the TV. They wondered whether a LiquidHD-enabled game console would solve this dilemma.

What Nancy needs

Nancy's children need to be able to access their game console from any TV in the home, thus eliminating disputes over playing games versus watching TV shows and video stored on the game system.

Solution

Nancy visits her local electronics store again and purchases a new LiquidHD-enabled game console. She installs the game system in the living room so the whole family can enjoy gaming and downloaded videos on the big HDTV. She connects the game console to the coax wiring and goes into the bedroom where she sees the game console icon on her TV. She clicks the icon, gets connected to the game system and can begin playing games immediately.

- Nancy's children benefit by accessing their game console from any TV. Nancy and her husband benefit because they can watch TV without arguing with the children.
- The retailer benefits by selling a new LiquidHD-enabled game console and from increased game sales.
- The manufacturer benefits by making a sale and increasing their reach into the home.

How it works

The game console is LiquidHD-enabled with a coax network connection.

1. Nancy connected the game console to the CE network using a coax cable in her living room.
2. Upon power-up, the game console self-configures and is automatically discovered by all current LiquidHD-enabled TVs on the CE network.

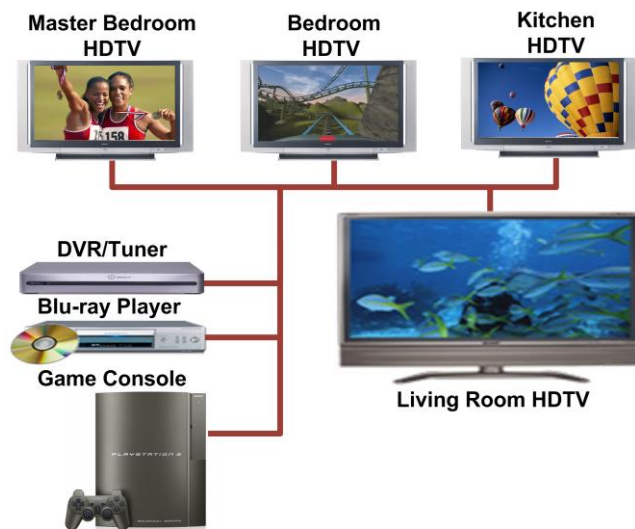


Figure 3: TVs sharing a game console

3. The children see the game console as a source device on their TVs. Selecting it brings up the game console interface, which they then navigate to select the game they want to play, video they want to watch or photo they want to view.

At any time during play, the children can pause the game and pick up where they left off from any TV in the house.

Watching Content from My Phone on My TV

Nancy's daughter Jennifer loves her new smart phone. She takes photos and videos of her family, friends and pets. She downloads music, movies and TV shows to watch on the go. One day, Jennifer had started watching one of her TV shows when Nancy came to pick her up. She paused the show but wanted to continue watching it in the living room when she got back home.

What Jennifer needs

Jennifer needs to be able to watch the movie she downloaded to her phone on the living room TV.

Solution

Jennifer's phone is LiquidHD-enabled. Connecting her phone to the home's Wi-Fi network makes it part of the LiquidHD CE network. Jennifer can simply turn on her TV, select her phone as an input source and resume watching her TV show. Afterward, she can purchase and download additional episodes to watch the rest of the week. On the TV, she brings up the media service from her phone company using her phone's interface projected onto the TV where it's easier to see and navigate. From there, she selects some shows to purchase and download.

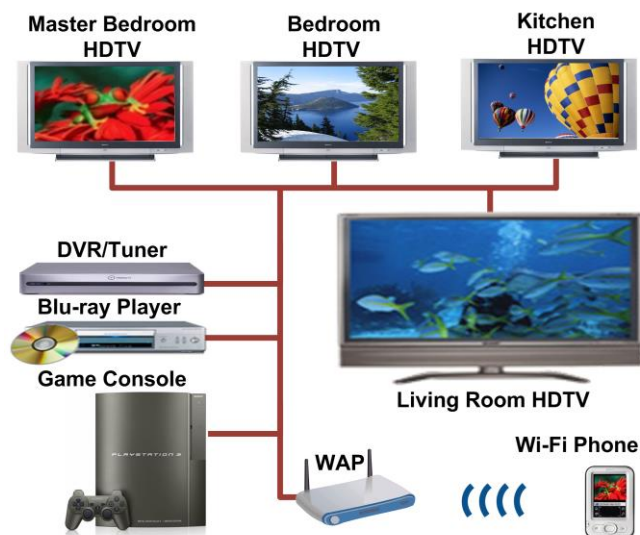


Figure 4: Using a Wi-Fi Phone

- Jennifer benefits from a seamless entertainment experience whether she is at home or on the road.
- The family's cellular carrier benefits because LiquidHD technology drives new phone sales and upgrades. The carrier is able to display their user interface and store on the TV, which makes it easier for consumers to browse and purchase content, which also benefits the carrier.

How it works

The phone is LiquidHD-enabled with a Wi-Fi connection.

1. Jennifer pauses the movie on her phone when she arrives home.
2. AT home, multiple TV icons appear on her phone. She selects the living room TV icon and then resumes playing the program, which appears on the TV.
3. She then plugs in her phone to charge and also pauses the movie in the living room to eat dinner with her family. She leaves the phone plugged in and resting in the living room and goes to her bedroom where she clicks on her phone icon and resumes playing the TV show.

4. After watching the TV show, the phone's branded user interface appears on the TV. Jennifer selects the store option to purchase additional episodes from that TV series. With one click, she buys the shows and begins download them to her phone from the convenience of her big TV and its remote control.

TV to Go

Jennifer likes to record a number of TV shows on the family's DVR but her active lifestyle leaves her little time to watch them at home. She would like to load those shows onto her phone and laptop to watch whenever she has some spare time.

What Jennifer needs

Jennifer needs to be able to download content from the family DVR to her phone and laptop to watch while away from home.

Solution

Jennifer's phone is LiquidHD-enabled. Connecting her phone or laptop to the home's Wi-Fi network makes it part of the LiquidHD CE network. Jennifer can simply select the DVR as an input source on her phone, navigate to the show or movie she wants to watch and download it to the phone for later viewing.

- Jennifer benefits from a seamless entertainment experience whether she is at home or on the road.
- The cable, satellite or IPTV service operator benefits by increased customer satisfaction and luring new subscribers to their service because of support for additional consumer electronics devices.

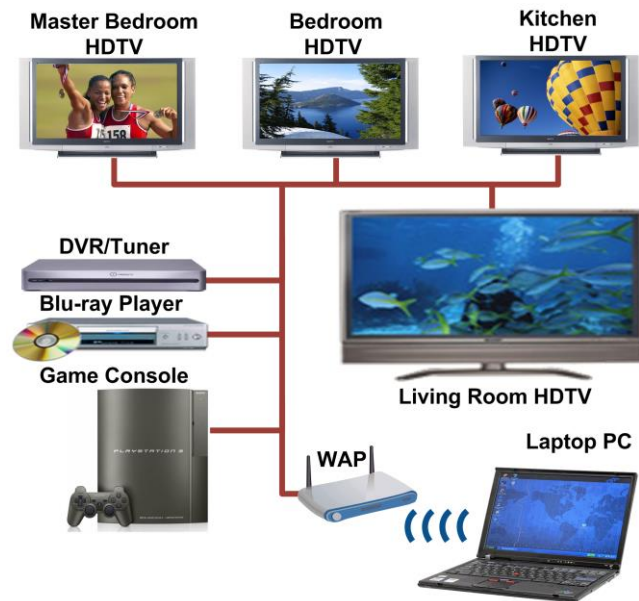


Figure 5: Using a personal computer

How it works

The phone is LiquidHD-enabled with a Wi-Fi connection and the laptop is LiquidHD enabled and it too connects to the WiFi consumer electronics network.

1. On the phone or laptop, an icon appears for the DVR. Jennifer clicks on the icon and sees the user interface from the DVR. She navigates the user interface to locate the content she recorded and then downloads it to her phone.
2. The content is securely stored on her phone or laptop to watch at her convenience.

Internet Services All TVs

Nancy visited a friend and saw their family exploring Google Earth and watching YouTube videos on their new HDTV. She became excited about the learning and entertainment capabilities of having Internet services on her big screen TV. She would also like to make those same services available on all of the TVs in her home so her entire family can have this experience.

What Nancy needs

Nancy needs to be able to access Internet services from any TV in the home.

Solution

Nancy upgrades her living room TV to a new LiquidHD-enabled model with built-in Internet access services. She already knows that LiquidHD technology will let her access those same services from all TVs in the home. With just a remote control, Nancy and her family can view Google Earth, watch videos from Hulu or YouTube, get information on stocks, sports and weather, stream movies from Netflix and enjoy many more educational and entertainment experiences.

How it works

Nancy unpacks her new TV, connects the coax cable and powers on the TV. Her new TV is now part of her CE network and all TVs in the home can access the Internet services. An icon appears on all TVs. Clicking this icon brings up the Internet services. The LiquidHD-enabled Internet TV uses the LiquidPixels remote user interface technology to project the Internet services to any TV in the home.

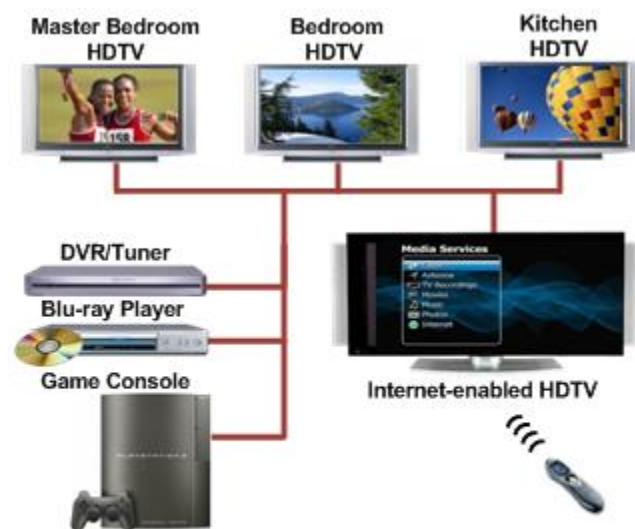


Figure 6: Adding an Internet-enabled TV