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HIGH-DEFINITION AUDIO-VIDEO NETWORK ALLIANCE

Entertainment Networking For Consumers
A Reality Check

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Background

So you bought that cool new Plasma DTV, a 7.1 surround sound system, ordered the latest HD cable set-top-box and Digital Video Recorder, connected your DVD player and game system, and in just a few short hours of perusing 5 instruction manuals and on-line tutorials its working. Looks great, sounds great, and comes with a long list of really cool features like the ability to pause live TV while you call customer service to figure out why the surround sound system doesn't surround you, or the reality show you thought you recorded just entered the Twilight Zone. And best of all, now your family really appreciates you since no one else can get the system to work without you there to push all the right buttons. But hey – this is cutting edge stuff. No pain, no gain right?

HANA, the High Definition Audio Video Network Alliance doesn't believe that watching football on TV should be more painful than playing the game. Twenty-five years ago all you had to do was connect one wire, pick up one remote, and you could watch TV. HANA's goal is to go back to those good old 'one cable, one remote, anyone can do it' days, but with all of the latest products and features available – from any TV in your home.

HANA achieves this by using industry standards. In fact, HANA uses many of the same standards that the DLNA or Digital Living Network Alliance uses such as IPv4, xHTML, HTTP, DHCP, XML, DNS, and others. Additionally, HANA specifies the use of CEA-2027, DOM, CSS, AV/C, CEA-931B, and more. In fact, HANA is completely standards based including support its support for IPv4 over IEEE 1394 (RFC 2734).

So if both the DLNA and HANA are standards based, and use many of the same standards, why are both needed? It could be argued that since DLNA is addressing the complete range of networkable consumer electronic devices and services, nothing else is necessary. However, HANA's members believe that by attempting to address everything over a single network, and by coming at the problem from the perspective of the PC and the Internet, the complexity that pervades the PC world will be exported to the family room. Everything will indeed be connected. The real question is, will watching TV get easier or more complex than it is today?

HANA is focused on bringing simplicity back to the family room, starting with the connection – one per device; and control– one remote per room. We believe that if we can accomplish those two goals, 95% of the complaints consumers have with their A/V systems will be solved. That means fewer customer service calls, fewer returns, and happier customers.

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HANA and DLNA are both layer 3 (the IP layer) and above solutions meaning they do not explicitly specify physical and MAC layer networking protocols. However, they both have made some assumptions about the underlying network technology based on their needs and the world they evolved from. DLNA assumes that WiFi, Ethernet, and USB are used to carry both content and control information. HANA, recognizing that the network must be invisible to the user, has focused initially on IEEE 1394 or Firewire™.

Why 1394?

IEEE 1394 is both an isochronous and asynchronous network that was designed from the start to carry A/V content synchronously as well as transfer asynchronous data. It provides a number of services that are lacking from asynchronous networks such as Ethernet and WiFi. Those services include automatic device discovery, a system wide clock to synchronize audio and video content for lip-synching and multi-room audio applications, and guaranteed Quality of Service (QoS) using bandwidth reservation. Ethernet and WiFi have none of these and require additional protocol layers and therefore complexity to even begin to approach the capabilities inherent in 1394. That's fine when dealing with PCs and other devices that have enough memory to buffer content, have the resources to execute the complex software stacks required, and that can be periodically upgraded in the field. However, these are all features found in PCs, not in TVs, DVD players, surround sound systems, and all of the other entertainment products in the family room.

HANA's approach is simple. Any entertainment device should contain everything it will ever need the day it ships from the factory. It should be able to connect to newer products next year or in five years without software upgrades. And most importantly it must be reliable. Turn on the TV, choose a program, and watch the show – period. No hiccups, no blue screens, no rebooting.

HANA achieves this by letting every device send its user interface, control menus, play lists, etc. to the display. The TV does not need to know very much about what is connected to it. It simply displays the information that is sent to it and lets the user select what she wants to do. Want to watch a movie stored on your DVR? Simply select the DVR as the source and its play list is displayed. Select the program, hit Play, and you are watching it. Want to finish watching it in the bedroom? Simply pause the program, go to the bedroom, select the DVR, and hit play. It's that simple.

What is happening in the background is that when a 1394 device is plugged into the network, every connected device is immediately and automatically notified there is a new device. Included in that notification is information as to what it is, what type of commands it supports, etc. This all happens at the 1394 layer. Thereafter, the device gains an IP address using standard IP discovery. Once it has an IP address, IP protocols such as HTTP, xHTML, and others are used for command and control, and to establish and dissolve logical connections between devices. However, where DLNA specifies HTTP as the transport protocol, HANA uses isochronous transport as defined in IEEE 1394/61883, which guarantees low latency delivery of the content using bandwidth reservations.

At a high level, each source device includes a Web server, and each display device includes a browser. When a consumer selects a device, a DVR for example, the DTV/browser reads a

predefined URL in that device and its top-level menu is served to the DTV for display. The consumer simply selects the function or feature of interest from the menu using the TV's remote control, and that selection is sent to the DVR, which executes it. The TV does not need to know what the action is. For example, if the action is to play a movie, the DVR will simply establish the isochronous connection with the TV and start to stream the movie. If multiple devices are involved in an action, for example record a given channel at a specific time on a DVR, one of the devices (defined in the HANA Design Guidelines) will act as the coordinator and orchestrate the activity.

The simplicity comes from the fact that each device knows its capabilities, and provides its own interface to the DTV while 1394 provides the reliable connections without the need for complex protocol stacks. There is no central intelligence to maintain the state of the network or the devices. The devices involved maintain reservations for future actions. Tuners and DVRs each know that they have been reserved to record a program at a specific time and what to do at that time.

Of course not all devices are or will be HANA devices. To support those devices, whether they are legacy 1394 devices, or DLNA devices sitting on the other side of a bridge, HANA defines the necessary proxies to allow them to seamlessly participate on the HANA network. For legacy 1394 devices that proxy might include a generic user interface. For example, when a legacy 1394 camcorder is plugged into a HANA network, the DTV knows that camcorders can record, play, stop, pause, fast forward, etc. and therefore it will display a generic UI to provide those functions to the user just as if the camcorder had generated it.

Devices on a DLNA network may contain more information and rich content, both personal and commercial, all of which can be made available to the HANA network. A HANA-DLNA gateway will provide the necessary proxy between UPnP (used by DLNA) and HANA enabling a rich interaction between the devices. The gateway also isolates traffic that does not need to, or should not be shared between the two networks. This is important not just because the QoS capabilities of 1394 far exceed those of asynchronous networks, but because there are security issues associated with commercial content that may require it.

1394 has long been considered a secure network for commercial content thanks to DTCP or "5C". Ethernet and PCs on the other hand have traditionally been seen as unsecured. While this is changing with the adoption of DTCP-IP, not all content owners and service providers recognize Ethernet or the PC as a trusted environment. The gateway or bridge between 1394 and other networks allows free flow of protected content to and within the HANA network, while blocking content from passing back through the bridge unless it is legally allowed to. This is an important feature because it allows service providers and content owners to wrap their content with their own copy protections (e.g. conditional access for a cable service provider) and download it through an untrusted network and onto the HANA network. Once there, they can either maintain their own security or allow it to be stripped away and re-wrapped with DTCP and/or other HANA approved protections, confident that it will never leave the network unless they allow it to.

Another reason for choosing 1394 as the network of choice for HANA's introduction is the fact that all high-definition cable set top boxes must include a 1394 port due to an FCC mandate. To date, this port has not received much support from the cable MSO community due to 2 main issues. First, cable companies provide a rich graphical user interface (GUI) that is rendered in the STB, and sent uncompressed to the DTV over DVI, HDMI, or as an analog signal. No existing home network technology, including Gigabit Ethernet, can cost effectively support uncompressed HD signals. The second reason is that cable companies do not install CAT5 or CAT6 UTP wire. They pull coax. Faced with a choice of training thousands of installers to install thousands of miles of UTP in homes, or place a STB at each DTV, they have opted for the STB solution.

Both of these issues are being addressed today. HANA is working with member companies, and cable companies to enable an OCAP GUI to be networked over 1394. And the 1394 TA, in partnership with HANA member companies, is developing 1394 over coax at 400 Mbps. Thus cable companies will finally be able to use all of those 1394 ports.

Conclusion

HANA sees the work being done by the DLNA and UPnP Forum as crucial if we are to get to a point where everything is connected to everything else in and beyond the home. However, HANA members, and many others believe that at least initially, it is more important to simplify the entertainment experience than it is to connect more things to the entertainment system. Once that is accomplished, we can turn our attention to attaching everything else.

HANA is not about networking, 1394 or otherwise, nor is it about CAT5, coax, or any other physical medium. It is about letting everyone enjoy high definition entertainment, anywhere in the home, anytime they want to without having to read instruction manuals or employ their own IT department. The network is simply a means to an end. And if Ethernet, WiFi, USB, HomePlug, HomePNA, MoCA, or some other technology can provide the connections with the necessary reliability and simplicity, HANA will embrace them as solutions as well.