

Managing AV Signals for Telemedicine and Video Teleconferencing Services



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Introduction

Technology is making it possible for healthcare providers to administer care in ways that were previously unimaginable.

One of the most impactful and timely new technologies driving the need for upgrades or complete infrastructure expansions is telemedicine services, which enables physicians to provide care to patients and collaborate with other physicians in a virtual environment using high-speed video teleconferencing (VTC). In real-time, physicians can see and speak with patients and consult with fellow physicians for recommendations.

Telemedicine and video teleconferencing services provide many benefits to healthcare providers:

- Facilitates communication between physicians, patients, and other providers
- Can take on more patients without the need for additional physicians and auxiliary staff
- Drives new billing opportunities
- Reduces unnecessary office visits
- Reduces need for more office space and examination rooms
- Creates a cutting edge working environment that attracts top medical talent

Why are telemedicine and video teleconferencing services so important now?

With the arrival of the Patient Protection and Affordable Care Act (PPACA) in 2014, there'll be an influx of an estimated 32 million newly insured patients over the next ten years. Many of these new patients reside in rural areas. Their lack of proximity to healthcare facilities, along with other possible hindrances such as inclement weather, injuries and physical handicaps will greatly diminish their ability to keep office visits. Healthcare providers will have to rely on alternative methods - telemedicine and video teleconferencing services foremost among them - to service these new patients. Internet access, along with a tablet or home computer, will make virtual office visits possible, the doctor and patient communicating live via a VTC system. (See Figure 1.)

The challenge

As an IT professional responsible for the technology used in conference spaces, the challenge is to ensure your infrastructure can manage and distribute the AV signals telemedicine and video teleconferencing services require. This article provides solutions for the AV signal management and distribution challenges you'll face when implementing a telemedicine services solution in both wired and wireless environments.

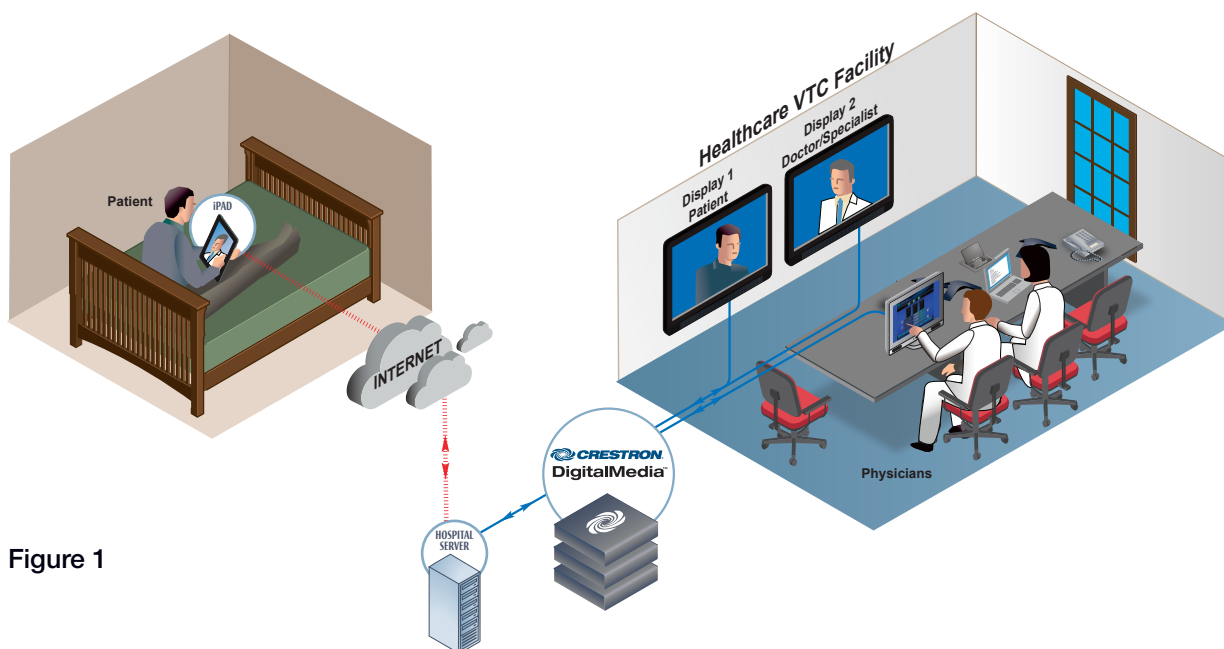


Figure 1

The solution

Crestron DigitalMedia™ (DM®) manages and distributes all AV signals long distance using an existing CAT5e/CAT6 infrastructure. It provides true, flawless 1080p HD content and HD video teleconferencing throughout your enterprise, integrating digital and analog AV signals on one platform. DM provides automatic management of resolutions for proper image display and easy connection with all the latest display standards including HDMI™, DVI, and DisplayPort™.

Integration of copper and fiber outputs on the same platform

With the analog-to-digital transition, healthcare facilities converted to digital displays that were dependent on HDMI, replacing traditional interfaces such as SDI, DVI, RGB and others. HDMI features increased pixel clocks, and greater bandwidth for higher resolutions and data rates. HDMI protocols govern content protection, resolution and even communication between devices.

However, HDMI cable is limited to signal distribution up to 30 ft. This proved highly problematic as video content regularly needs to be distributed to other departments, buildings, across campuses and to off-site specialists and research centers. But how do you do that? You need an infrastructure that can transmit and receive signals both long and short distances and manage them.

Chances are your facilities have standard CAT5e or CAT6 wiring installed today. New commercial construction already is utilizing fiber optic infrastructure. Certainly, fiber will become standard in the near future. Any digital AV solution should have the ability to incorporate both copper and fiber on the same platform to accommodate “hybrid” systems and any future upgrades and expansions.

A hybrid system is also critical when there's a need to distribute HD signals over longer distances, such as a large commercial building or between multiple buildings on a hospital or corporate campus. You would want to take advantage of the CAT5e/CAT6 wiring already in place locally – copper cables can transmit HD signals up to 330 feet – but use fiber for those longer runs.

Depending on how far the signals must travel, multi-mode or single mode fiber may be necessary. Multimode fiber can transmit uncompressed HD signals up to 1000 feet, while single mode fiber can transmit signals up to 7.5 miles. No matter which fiber solution you use, it should be seamlessly integrated with the copper and completely HDCP-compliant. Not all digital solutions integrate copper and fiber; not all solutions support multi-mode and single mode fiber; and not all fiber solutions manage HDCP. So, be careful; while others can do one or the other, only Crestron can manage them all on a single platform, providing an easier solution to manage.

Wire Type	Maximum Distribution
HDMI	30 ft
CAT5e/CAT6	330 ft
Multi-Mode Fiber	1000 ft
Single Mode Fiber	7.5 miles

DM is able to bring a signal carried by fiber from one building on campus, localize it, and then output it to CAT5e/CAT6 or even HDMI cable connected to a display. This flexibility makes DigitalMedia highly scalable. It can utilize existing CAT5e wiring plants in remodeling projects, thereby avoiding the cost of major construction and electrical work.

Managing HDCP

HDCP (High-bandwidth Digital Content Protection) is a Digital Rights Management (DRM) protocol built into the HDMI signal. It was developed by Intel® Corporation to prevent copying of AV signals as they travel across connections.

During a consult, for example, a physician might want to share HDCP content on his/her MacBook® with a colleague. So what happens when that MacBook is plugged into an HDCP-compatible device? The MacBook will attempt to communicate with the HDCP manager within the device and will receive a response. Now it knows that an HDCP session is possible, although it may not be required. The MacBook may choose whether or not to enable HDCP. In fact, real world results show that, in this case, the MacBook will always enable HDCP whenever the downstream device supports HDCP. This ensures a clean user experience, with no screen flashes. In a normal situation, where the MacBook is connected to a simple HDCP-compatible monitor, this is completely transparent to the user.

DM switchers employ an innovative technology that manages HDCP, therefore enabling more content to be shown. (See Figure 2.) It recognizes and reconciles the incompatibility between certain source content and upstream devices, such as capture systems, enabling them to accept and display the content. Now the user’s content appears on the HDCP-enabled in-room display and on the VTC. They show up on the video capture stream without issue.

You can also receive and manage communication/signals from other healthcare facilities or specialists, in which case additional components, such as receivers, are required to get the third-party signal. Crestron can also integrate HD video capture solutions that record the patient and doctor exchange and then move the files into workflow once the conversation is complete.

DM can manage HDCP over fiber so you can distribute more content over greater distances. This is ideal for large healthcare facilities that have a central building and use breakout rooms across the campus. A person can present material in one building and have it distributed across campus, up to 7 miles, into additional rooms for viewing. This enables you to have a truly robust solution that integrates content from multiple sources and remote locations.

(For more on HDCP please download “HDCP management: the key to a fully-operational VTC or meeting room” at crestron.com/dmresources under the white paper section.)

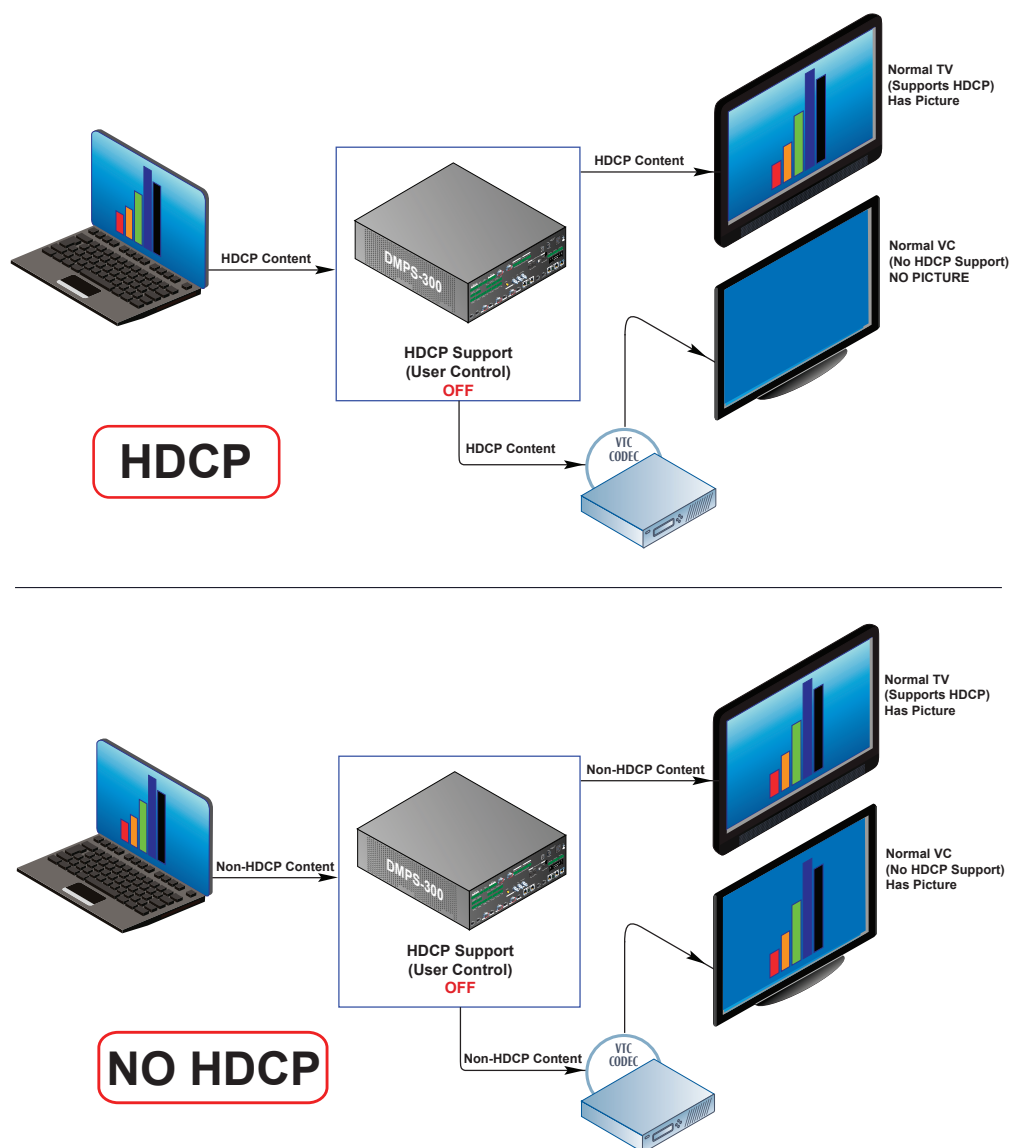


Figure 2

Managing EDID™

EDID is a standard data structure that contains basic information about a monitor and its capabilities, including vendor information, maximum image size, color characteristics, factory pre-set timings, frequency range limits, and character strings for the monitor name and serial number. When you have multiple sources and displays of varying types, most systems will send out the lowest common denominator resolution resulting in poor image quality. Crestron, however, manages EDID to deliver the optimal viewing experience.

Configuring EDID from the source to display optimizes the display resolutions. It allows the source to send the highest quality resolution the display can handle. If you've ever experienced less than ideal image quality from an HD source, one of the many factors could be that the EDID was not optimized, resulting in the lower resolution. Crestron makes it easy to configure and get the most out of the display.

CEC device control

Consumer Electronics Control (CEC) is an HDMI feature that enables control of up to ten CEC-enabled devices by using only one of their remote controls. CEC-enabled devices can also communicate and control each other without user intervention. (See Figure 3.)

Think of your cable box connected to your TV. Turning one off turns them both off. A single command allows the two devices to communicate and perform the single function. This is useful in a VTC. As you turn the display on or off, the projector and all downstream devices follow the command. Unmanaged CEC, however, results in devices unexpectedly shutting down. When this happens you might mistakenly think the device is broken when, in fact, it's receiving a protocol to shut down.

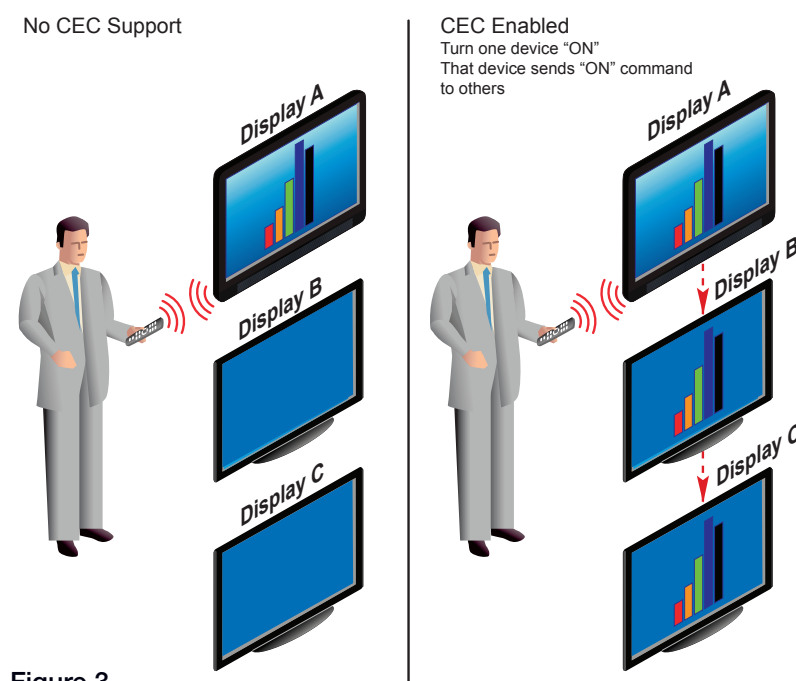


Figure 3

Since proper CEC management has eluded manufacturers – except for one - they simply disable it to avoid system disruption. As a control company, Crestron decided to manage and take advantage of the benefits of CEC protocols rather than disable and avoid them. With our advanced DigitalMedia digital AV distribution products, we give you the exclusive ability to use CEC or not. Using CEC provides many advantages to the systems integrator:

- Unified, reliable control of products from multiple brands for a seamless user experience
- Control more than one device at a time
- Replace most serial cables and IR remotes for cleaner system designs and easier installations
- Save on materials and labor

- Minimize key-presses required for global control of HDMI connected systems
- Save programming time (can swap displays/devices without reprogramming)
- Use consumer-grade displays rather than expensive commercial grade models
- Energy savings (devices not being left on)
- Provide users with a seamless, worry-free experience; they can trust everything will work
- Freedom of choice: you decide whether you want to use CEC or not

Through proper CEC signal management, DigitalMedia provides integrators with a decided competitive advantage over digital AV distribution solutions that disable CEC.

Switching speed

The interval between the transmission of a command to display a signal, and when that signal is actually displayed is called “switching speed.” Switching speed is very important to a satisfying user experience. Long delays or latency results in frustration and may lead to unnecessary technical support calls.

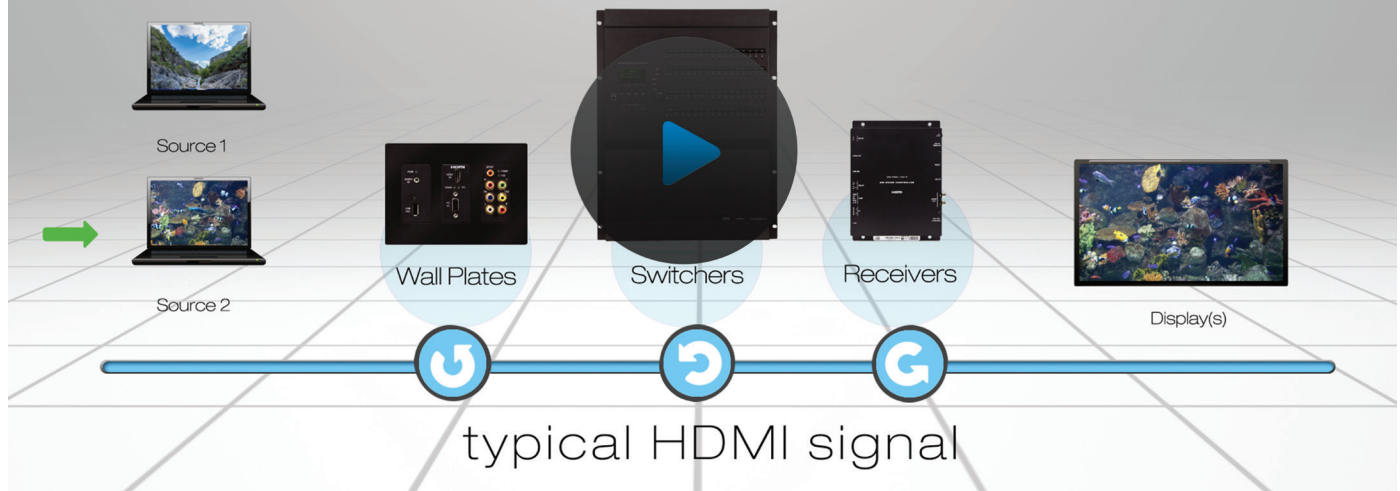
Switching time is a complex property of a multi-dimensional system, determined by how the system is designed and precisely which components are selected. Normally, the source generates a digital data stream that includes all the audio and video information. Each device or connection point must gather and process the data before locking onto the signal and passing it along, resulting in delays. (See Animation 1.)

You can see how switching time can become significant. It also creates potential for any location to misidentify the signal format. Misidentification can cause image distortion and even “green screen”. Other manufacturers are trying many things to speed up this process. Most involve guessing at video formats or restricting resolutions. Therefore, in an effort to improve switching speed sometimes image quality is compromised.

DigitalMedia resolves these issues utilizing exclusive auto-locking technology. DigitalMedia sends the data ahead of the AV signal so there’s no delay. As a result, fast switching speed is maintained without sacrificing image quality. (See Animation 2.)

(For more on scaling and switching times please download “The Myths of Fast Switching” at crestron.com/dmresources under the white paper section.)

Exclusive auto-locking technology for faster switching



Animation 1 | Data processing causes video switching delays

crestron.com/hdmiswitch

Exclusive auto-locking technology for faster switching



Animation 2 | Crestron "Auto-Lock" technology pre-processes data to eliminate switching delays

crestron.com/auto-lock

Content capture

With its advanced HDCP management technology, Crestron DigitalMedia has the ability to seamlessly integrate a full-motion HD video capture and annotation solution such as Crestron CaptureLiveHD™. This is especially valuable for medical institutions that need to share captured content across multiple facilities for communication and education purposes. (See Figure 4.)

Engineered with the physician in mind, CaptureLiveHD enables them to easily record and stream content, such as meetings, grand rounds, training sessions, and refreshers. Once the video is approved it can automatically be uploaded to your existing network for online delivery. It's a simple, intuitive solution that walks the physician through the experience so they can focus on their meeting, not technology. Colleagues and other service providers can then view it anytime and anywhere they have online access.

With an intuitive interface running on a touch screen or smart device for control, the physician can easily begin the session, set audio levels, and use the confidence monitor to see what's being recorded. CaptureLiveHD simultaneously records a live camera image of the presenter in full-motion HD video along with content from a computer or other source. The two images may be composited on screen side-by-side or picture-in-picture (PIP). The camera PIP window can be sized and positioned in any corner of the screen over the presentation content. Either image may be captured full screen as well. The physician can toggle between these views for added emphasis, based on the content.

CaptureLiveHD is equally simple for the IT Department. It requires no scheduling, recording, encoding or uploading of content to the network. It's a total workflow engine for moving recorded content seamlessly through the entire process, from capture to consumption, with minimal intervention.

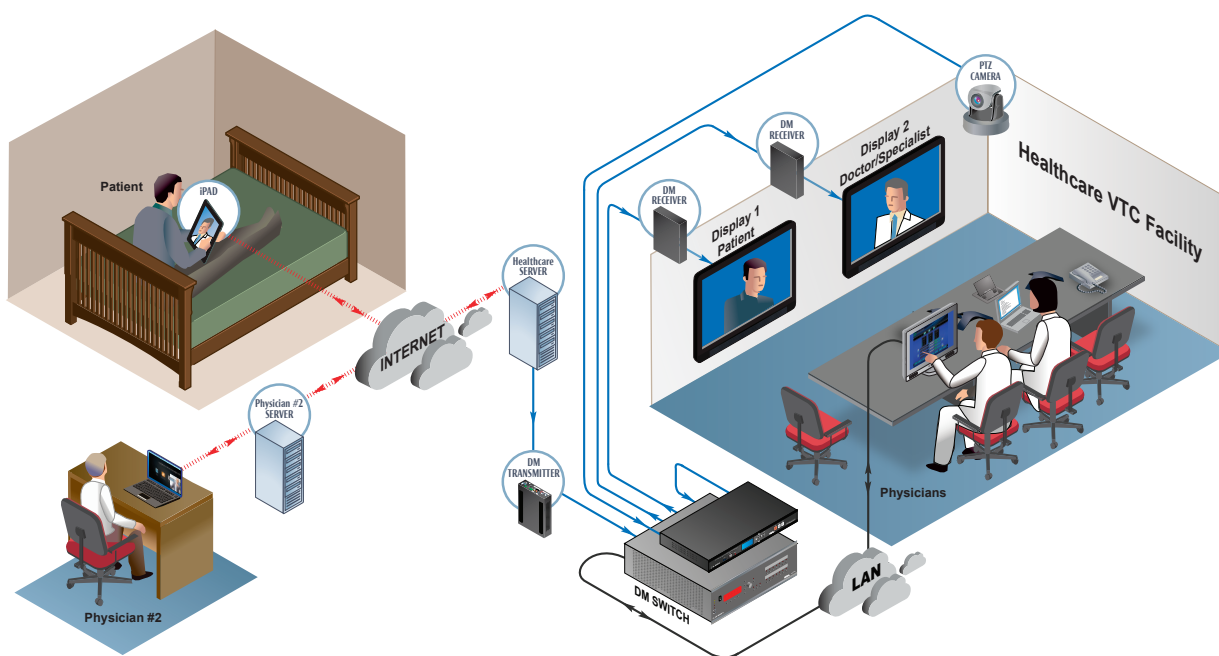


Figure 4

Go with a proven, complete digital solution

As a healthcare provider, fast and reliable communication with other providers and patients is critical.

Crestron has been setting the standard in digital AV distribution since 2007, representing almost a million connections between digital devices and displays, ensuring seamless connectivity, and dependable switching and signal distribution. (See Figure 5.)

Tested and proven, the most demanding clients in the world, including leading healthcare providers such as United Health Care Group and St. Jude Medical trust and rely on Crestron DigitalMedia.

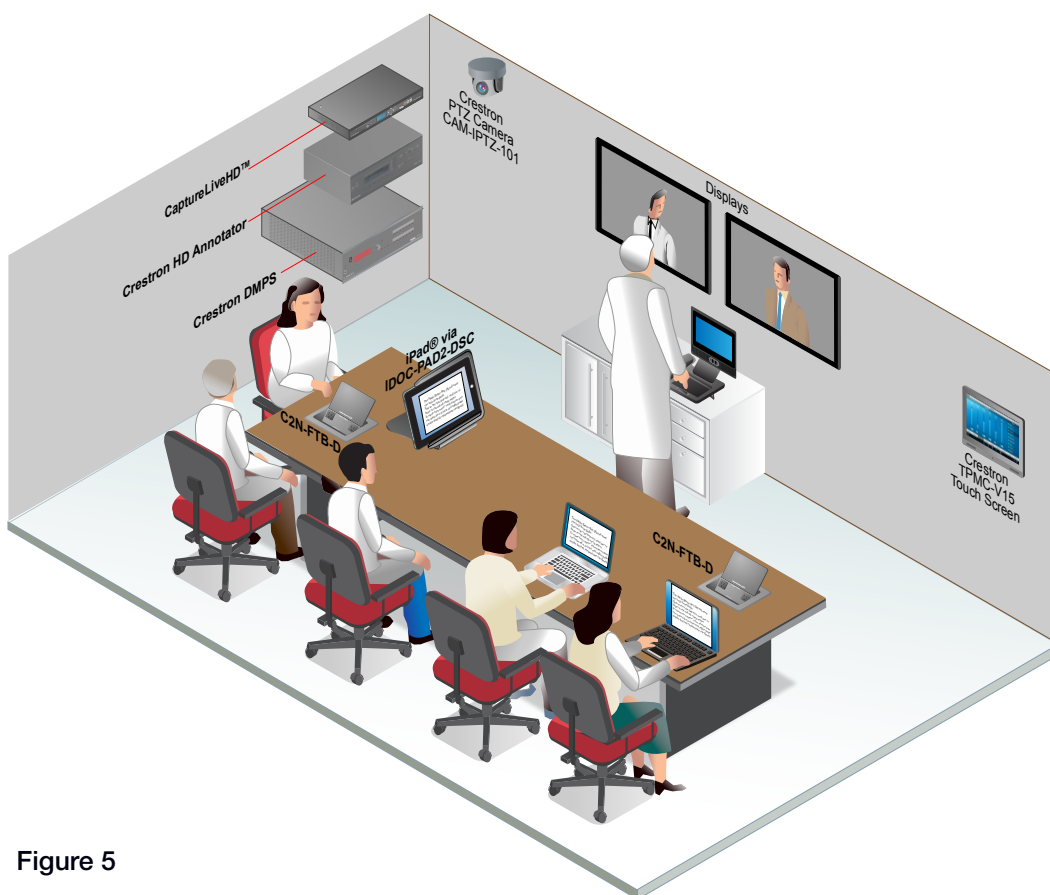


Figure 5

DigitalMedia incorporates the most advanced technologies, ensuring your investment won't be obsolete:

- Supports 4K display resolutions, also known as Ultra HD. 4K is the newest and highest resolution (3840 x 2160) providing the best image clarity for diagnosis. The YouTube® player already supports 4k resolution.
- HDBaseT™ connectivity for seamless connection to all sources and displays without the need for additional adapters. HDBaseT is a connectivity technology for long-distance transmission of uncompressed high-definition video, audio, 100BaseT Ethernet over standard CAT5e and CAT6. It enables devices to speak to one another. DM enables communication between HDBaseT and non-HDBaseT devices on the same platform.
- SNMP support for seamless integration with your existing IT management tools
- Wireless connection from any laptop or tablet for presentation of material, using a single IP address
- Uncompressed HD audio and video over a single, unshielded twisted pair. DM can combine any audio input with any video input, and routes any combination to any output.

Conclusion

With the imminent arrival of the Affordable Care Act and the 30 million+ new patients it will bring into the healthcare system, demand for telemedicine and video teleconferencing services is set to explode. More than ever, healthcare providers will need to rely on technology to manage the changes this will bring.

VTC technology will enable healthcare providers to manage the huge influx of new patients located in rural locations and consult with other physicians in a virtual environment. Telemedicine services can increase revenues by giving healthcare providers the ability to accept more patients while eliminating the need for additional personnel, office space and infrastructure.

As an IT professional it's important to ensure that your infrastructure can manage and distribute the AV signals telemedicine services requires, both in wired and wireless environments. It requires seamless integration of many components:

- AV Switchers, receivers, scalers, transmitters, wall pates
- Multi-window digital video processors
- Touch screens
- Management software
- Wireless conference room solutions
- Cabling, both analog/legacy and digital equipment

DigitalMedia makes it equally simple to control a single room PC and projector or a centralized server connected to hundreds of rooms across a campus. DigitalMedia extends 10/100 Ethernet out to each display and source, providing high-speed connectivity for any LAN-connected room device. Built-in USB-HID (USB Interface Device Class) signal routing allows you to conveniently connect all USB-HID compatible input devices (wireless mouse/keyboard) at any display location, whether it's across the room, across the building, or across campus.

Crestron pioneered digital AV signal distribution more than seven years ago. Along the way, we've encountered and resolved all the issues that prevented proper signal distribution for healthcare environments. Crestron DigitalMedia delivers true, flawless 1080p HD content and HD video teleconferencing throughout your healthcare facilities and integration of digital and analog AV signals on one platform.

DigitalMedia makes telemedicine and video teleconferencing services simple. It delivers fingertip control from easy-to-use touch screens, iPad®, iPhone®, Android™ devices, laptops, keypads and remotes so healthcare professionals can focus on patients and medicine, not technology.

About Crestron

Crestron technology is making it possible for healthcare providers, researchers, and educators to administer care, teach, and collaborate in ways that were previously unimaginable.

Crestron integrates all of your disparate systems and devices on a single open platform so they can communicate and work together intelligently and seamlessly. This enables you to easily monitor, manage and control everything from one convenient interface, anywhere, anytime, using touch screens, remotes, keypads, and smart devices.

Crestron gives you total visibility and control of all your technology, from AV and lecture capture to security, voice & data, BMS, HVAC, room scheduling and lighting.

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