



Video-over-IP is the state-of-the-art solution for an advanced OR



OR Integration

Top-of-the-line image quality and unmatched flexibility for a future-proof and integrated surgical environment



When patients' lives are at stake, surgeons can't wait for images to buffer. Routing and recording in ultra-high-definition supports first-class surgical performance in the OR. This provides surgeons with precisely what they need to better assess situations and perform procedures successfully.

The use of digital imaging and video in surgical practice is just one component of the modern OR. This highly complex environment needs a user-friendly system to seamlessly integrate a variety of technologies to minimize errors and enhance OR efficiency and ensure patient outcomes in the best possible way.

This paper will help you identify the important elements of a video technology that offers the highest image quality and lowest latency and corresponding management resource.

Understanding methods of video signal transmission

Video-over-IP is a technology used to transmit video signals between two or more locations over an IP network. In a video-over-IP system, standard video signals are encoded into network IP packages.

Transmission of video over an IP network

The encoded signals are transmitted and decoded back to standard video signals such as DVI (digital visual interface), VGA (video graphics array), for further processing, recording, and displaying.

There are many different ways to transmit video signals and transmitting video over an IP network has many different facets. It is common to share content live or on demand by compressing data and sending it as a network stream. For the purpose of this paper, we will focus on the transmission of video over an IP network. The important thing to know is that quality of the video can vary greatly depending on the technology used.

Protocols such as SIP or H.323 are used when audio and video are transmitted (e.g. MS Teams). Streaming Full HD videos is broadly done in H.264 standard (e.g. Netflix or Amazon). A video stream typically starts after a short buffering phase, a pre-loading period that aims for stutter-free video instead of real-time transmission that may contain image jitters.

However, these methods involve compression, which reduces the video quality. While some compression technologies claim to be “visually lossless,” they will never achieve pixel-perfect reconstruction of the raw signal.

The importance of uncompressed signals

Medical professionals have different requirements than we see in the examples above. Delivering best-in-class performance in the OR requires the highest image quality and fastest transmission. Therefore, uncompressed video-over-IP is the real-time solution for the OR.

Video-over-IP offers end-to-end transmission of video signals with ultra-low latency – less than 5 milliseconds of delay. Transmission of native video resolutions up to 4K (4096 x 2160 at 60 Hz) sets the current standard. This gives surgeons accurate, real-time information to support the successful assessment and treatment of the patient’s condition.

Already back in 2014, Getinge introduced the first video-over-IP featured Tegriss system. Since then the technology, scope and advantages have continuously improved. With the latest Tegriss platform, Getinge offers a fully video-over-IP based OR integration solution, aiming to deliver the best-in-class technology to our customers.

How video-over-IP systems work

There are four primary elements that build a hospital-grade video-over-IP system: Tegriss Base PC, the network, the IP encoder, and the IP decoder. Each plays a key role in the seamless transmission of video within the OR.

Central network

Video-over-IP systems require a central network – separate from the main hospital LAN – for high-bandwidth transmission of video and data.

A 10 GB switch is the core component of this network. Switches are available in different sizes with e.g. 10, 16, or 48 ports. Depending on the scope of the video routing setup, a switch can also be shared among two or three ORs.

IP encoder

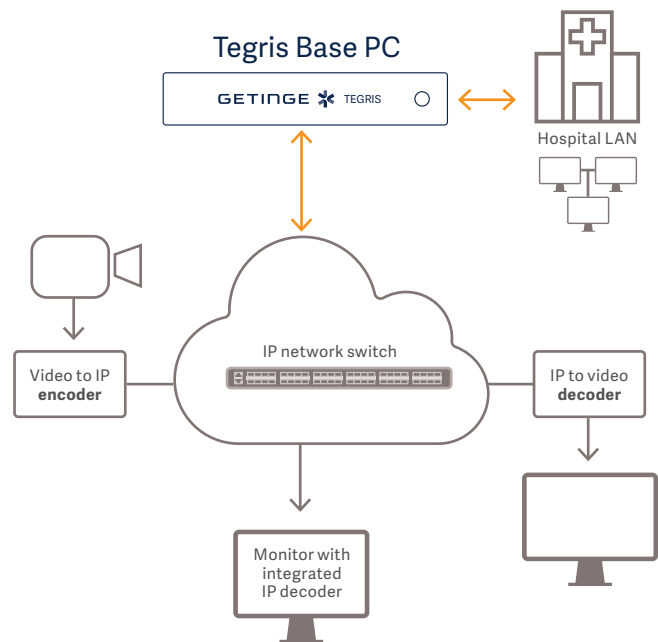
Cameras, computers and other video sources offer standardized video interfaces. These include VGA, SDI, DVI, HDMI and others. Each of these interfaces is typically based on copper wiring. IP encoders convert these video signals into IP packets, and feed the information to the IP network.

Encoders are available in single (1x Full HD), dual (2x Full HD) and quad (1x 4K) models and in different version to support the various standard video signals.

IP decoder

IP decoders are linked to the central network. They convert the received IP packets back to standard video signals, which are then displayed on a network-connected monitor. Decoders are available in dual (2x Full HD) and quad (1x 4K) models.

Some monitors are available with integrated IP decoders. These monitors help streamline the planning, cabling, and implementation of the video-over-IP system.



Tegriss Base PC

In such a setup, the Tegriss Base PC manages the network and the distribution of all routes between connected IP encoders and decoders or monitors. In addition, Tegriss remains the central component for other integration functions such as recording, device control, and IT integration. The number of inputs and outputs for video routing is limited only by the number of available ports on the network switch.

Having set the scene, the video-over-IP based Tegriss solution can be flexibly configured and sized to match individual customer requirements. Decoders and encoders can be added at any time. Videos and snapshots can be recorded by adding a transcoder device to the network, which transforms video-over-IP signals into standardized MPEG or H.264 videos. In a first step, these media items are stored on Tegriss and can then be exported to external targets like USB, LAN or PACS archives.

Additional important elements in a video-over-IP system

A variety of complementary technologies play a significant role in the successful implementation of a video-over-IP system.

Video transmission and fiber-optic cabling

One uncompressed Full HD video signal requires 3.7 Gbps bandwidth, as calculated here:
 $1920 \times 1200 \text{ pixels} \times 60 \text{ Hz} \times 24 \text{ bit} \times 1.11 \text{ header} = 3.7 \text{ Gbps}$

Copper cabling has limitations in speed and distance, and would require a more complex and expensive cable installation. Therefore, video-over-IP networks are built on fiber-optic cabling. Fiber-optic cabling ensures fast transmission at high data rates across long distances. It is immune to electromagnetic influences; optical isolation avoids any leakage current between medical and non-medical devices.

As an added benefit, all connections are based on the same interface type which allows the use of universal connectors. This eliminates the need to think about signal types, cables, plugs, and sockets, and allows quicker and easier installation for fixed devices in the OR. Mobile equipment, like endoscopy or microscope carts, can be equipped with solid optical fiber connection cables. With IP sockets placed at different locations in the OR, the mobile devices can easily be plugged in and will automatically connect to the Tegrís system.



The common specification for fiber-optic cabling is 50/125 μm (diameter), multimode (fiber type), 850 nm (wavelength), OM3 (quality class), LC (connector type), duplex or quad (number of fibers).

Tegris IP assets: encoders, decoders, and monitors

The Tegriss portfolio includes different types of encoders and decoders that serve different signals and situations. In general, every device is delivered along with the necessary SFP+ network interface modules, based on optical fiber.

IP encoders

Encoders convert conventional video signals such as SDI, DVI, HDMI or DisplayPort into digital streams that are transmitted over the IP-based network. For best use of the technology's benefits, it is recommended to place the IP encoders close to the cameras and sources.

Single encoders

- Can encode a Full HD video signal and feed it into the network
- Require one free port on the central network switch

Dual encoders

- Can encode two independent Full HD video signals and feed them into the network
- Require one free port on the central network switch

Quad encoders

- Can encode a 4K-UHD video signal and feed it into the network
- Require two free ports on the central network switch

IP decoders

Decoders take the encoded data from the IP stream and convert them for display on a monitor.

Dual decoders

- Can decode two independent IP streams and output them as DVI or HDMI video signals
- Require one free port on the central network switch

Quad decoders

- Can decode a 4K-UHD IP stream and output it as HDMI, DisplayPort or Dual Link DVI video signal
- Require two free ports on the central network switch

IP monitors

Surgical monitors with integrated IP decoders are available in different sizes.

IP monitors

- Can decode a Full HD or 4K-UHD IP stream
- Require one (Full HD) or two (4K-UHD) free ports on the network switch

Accessories

The portfolio is rounded off by accessories like power extension cables and housing kits to mount encoders on mobile carts.



Accessories: IP network switch

IP network switches are available in different sizes and with different capabilities. The switch model that fits best depends on the project scenario and requirements.

Every video-over-IP OR setup will be configured to run in a separate VLAN (virtual local area network). A VLAN separates physical networks into logical subnets and avoids any data exchange between different VLANs. An IP network switch can host several VLANs and so be shared among several ORs. This can help to reduce costs or save space in technical areas.

SFP+ modules are required to equip the ports of a switch and must be ordered separately depending on the size and type of the OR setup. Any IP encoder and decoder connection requires an optical fiber SFP+ module per port. Each port can be flexibly used with either IP encoders or decoders.

Note that each OR requires one port equipped with an RJ45 SFP+ module to connect Getinge Tegrís and the switch.

Model	Optional power supply	Switch stacking	Share among ORs	Comment
10 port switch (1703.58A0)	—	—	○	The smallest model in the portfolio. This switch can easily serve small and medium OR setups in conjunction with dual encoders and decoders. Sharing among multiple ORs is impractical due to the limited number of ports.
16 port switch (1703.58B0)	●	—	●	This medium size switch may fit a scenario with many connected assets per OR. For smaller OR setups, it can also be shared between two rooms, with 8 available ports per OR.
48 port switch (1703.53A0)	●	●	●	This large switch is typically shared among 2, 3 or 4 ORs. This model is required for room-to-room communication.
48 port switch 40G (1703.53B1)	●	●	●	This large switch is typically shared among 2,3 or even 4 ORs. With 40G uplink it serves room-to-room communication with up to 4K-UHD video.
32 port star switch 40G (1703.65A0)	●	—	○	This 40G switch is used as a backbone in a star network topology to support room-to-room communication with up to 4K-UHD video between several 48port switches.

- available
- limited available
- not available



Advantages of investing in a Tegrís OR integration solution with video-over-IP system

With Tegrís, we offer you a flexible, cutting-edge technology that enables you to grow with your facility's requirements.

IP network

The video-over-IP based system will provide you with a separate secured and encrypted network, dedicated solely to video and data transmission in the OR. That system is centrally managed for ease-of-use and flexible growth. Video-over-IP systems benefit from IP network features that automatically detect connected devices. This is particularly beneficial with mobile devices, such as endoscopy trolleys, that are used among several ORs.

Latency

Transmission latency is nearly zero while uncompressed. Undoubtedly the highest possible image quality and real-time availability contribute to successful surgical outcomes.

Usability

Technology moves into the background. The best possible resolution will always be automatically shown on monitors. Unified connectors, live previews and comprehensive UI naming support intuitive use of the solution.

Plug-and-play

The harmonization of signals supports plug and play connectivity. Offering one type of connector improves daily workflows and reduces the burden of new technology adoption for OR staff.

Cabling

The variety of required cables is narrowed down. Optical fiber also benefits from being resistant against electromagnetic influence and separates medical and non-medical devices by nature. It also allows for increased cable length across greater distances, without loss of signal quality.

Future-proof growth

Adding new devices to the existing video-over-IP setup is effortless, even as video quality has been multiplied by a factor of four from Full HD resolution to 4K resolution. The IP network roots, paired with optical fiber transmission is key for future upgrades, ensuring that advanced devices and improved workflows are easily integrated.

Video, data and more

The video-over-IP setup not only serves for video transmission. Audio signals, USB or input/output commands can be sent on the same lines. As an example, KVM (keyboard, video, mouse) transmission opens up new possibilities within ORs using Tegrís.



Tegris OR integration

Experience the difference of an integrated operating room

Video-over-IP is just one of the building blocks of the comprehensive Tegris OR integration system.

In partnership with Barco, we offer video-over-IP technology within our Tegris system setup. Thereby, we benefit from broad experience within the medical field and standard technology. Our partnership with Barco is not exclusive. With plug and play, we can also support a variety of compatible video-over-IP interface integrations.

Deciding for a local competing system, even with Barco's technology embedded, may cause uncertainties and unnecessary challenges. Let us help you build a system setup that meet your requirements. Please contact your local Getinge representative.

We offer a modular Tegris OR integration solution with unique features like:

- live previews
- monitor overlays
- 4K recording
- room-to-room communication or
- central IP asset management.

Please visit our website: <https://www.getinge.com/> to learn more about Tegris and how to maximize the utilization of your operating room.



Complete range of service and support

Any OR integration project requires detailed preparation and cooperation across multiple hospital departments. It is important to involve all relevant parties from the start: surgeons, nurses, biomed, and the IT department. We provide project management and implementation support, guiding you through the process.

Our specialists have detailed knowledge and best practice experience to support you from planning to installation and implementation.

Getinge product training

During implementation, it is important that users are trained to work with Tegrís so that they can use this solution in their daily workflows with confidence. To ensure the most realistic workflow, user training and on-site briefings are conducted so that healthcare professionals learn to use and work with the system in their own work environment.

Please contact your local Getinge representative for more information about the Tegrís OR integration solution.



FAQ

Is the video-over-IP network linked to the hospital network?

No. The video-over-IP network is a completely separated network, dedicated to video transmission in the OR, and is managed by Getinge Tegrís only.

How secure is the video-over-IP network?

The communication is AES128 encrypted. As the network is physically separated from other TCP/IP networks, it is almost invulnerable.

Is there a on-site Tegrís support?

Getinge offers a variety of service level agreements that best fits your needs. If an issue cannot be solved remotely, you are guaranteed on-site support of your Tegrís solution. Please contact your local Getinge representative for more information about our service level agreements.

Which Base System is needed for a video-over-IP based Tegrís solution?

With the first Tegrís generation hardware, the choice of the model was dependent of the configuration. For the latest generation Tegrís platform, the Tegrís Base PC is the main item required for each OR setup.

Is it possible to use other monitors than Barco? Can Tegrís with video-over-IP be used anyway?

Yes. In this case non-compatible monitors need to be fed via an external IP decoder. Make sure that the monitor is compatible with DVI or HDMI.

Is there a way to upgrade older Tegrís versions to video-over-IP at a later stage?

This is technically still possible. However, when upgrading already installed Tegrís systems, we recommend to combine the upgrade with the latest Tegrís platform hardware. Please contact your local Getinge representative for more information about special upgrade offerings.

Where should the equipment be placed?

Technical equipment should be placed outside the OR wherever possible. The Tegrís Base PC and the IP network switch may be installed in a technical room. Encoders should be installed close to the source.

Are there any devices that offer a compatible video-over-IP interface?

It is recommended to use Barco monitors with integrated video-over-IP interfaces for seamless integration. Arthrex offers the first 4K-UHD endoscopy camera (Synergy UHD4™) that has an integrated video-over-IP interface based on Barco's technology. The signal is fully compatible with Getinge Tegrís IP.



With a firm belief that every person and community should have access to the best possible care, Getinge provides hospitals and life science institutions with products and solutions aiming to improve clinical results and optimize workflows. The offering includes products and solutions for intensive care, cardiovascular procedures, operating rooms, sterile reprocessing and life science. Getinge employs over 10,000 people worldwide and the products are sold in more than 135 countries.

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