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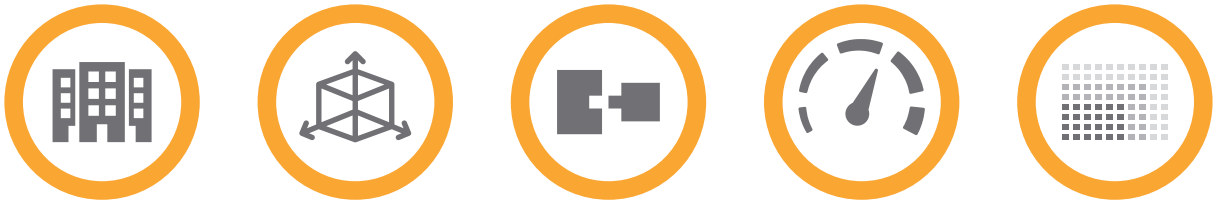
Five Key Attributes of Designing an AV System

A Videon Insight Paper



Five Key Attributes of Designing an AV System

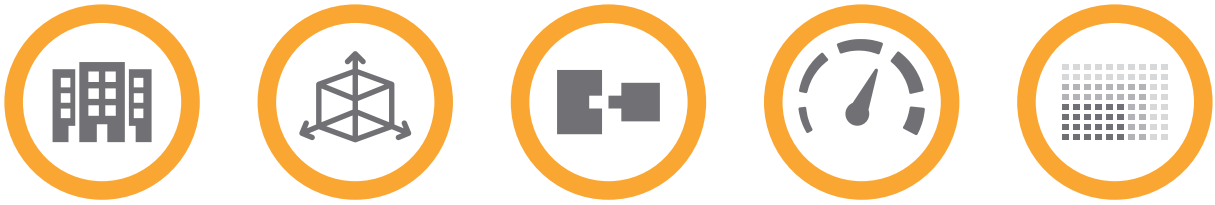
Installers face dozens of questions when designing AV systems. From camera to display, every component matters. But experienced installers know that one part of the system is more important than the rest. That part is the infrastructure. **It's the backbone that enables--or limits--the capabilities of the rest of the system.**

Just as AV installers focus on distribution methods, so should AV product designers. If your product is not compatible with a market's preferred distribution method, you will not be able to sell there. But unlike installers, you're not just making this choice for individual systems. You're committing to an entire product line.

So how do you decide which distribution methods your products should support? By understanding your customers better. With an understanding of the tradeoffs that AV installers face as they choose distribution methods, you'll be better positioned to create (and sell) products that fit their needs and help them create great systems.

AV installers focus on **five key attributes** as they design systems:

This piece will help you understand what your customers ask as they plan their systems and select components.



EXISTING INFRASTRUCTURE

SYSTEM SCALE

USAGE

TRANSMISSION FEATURES

FUTURE-PROOFING

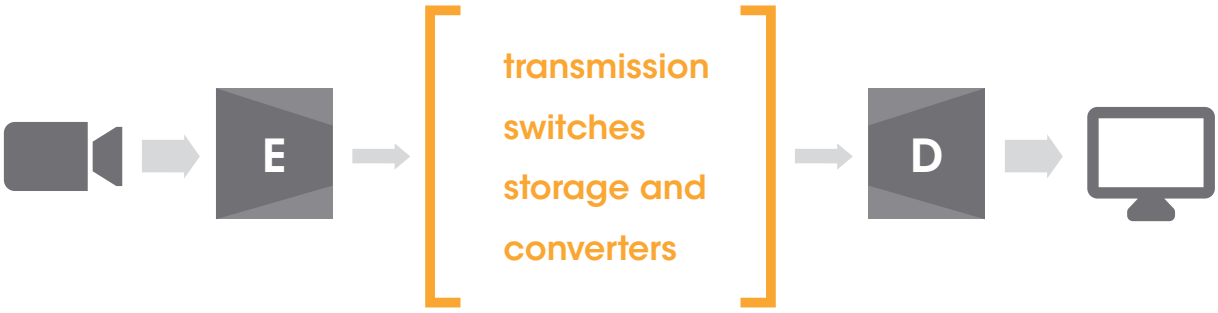
Existing Infrastructure

The difference between a greenfield installation and building on existing infrastructure is immense. When creating a completely new system, the installer has significant flexibility in all choices.

But most of your customers find themselves working with existing infrastructures. They're usually expanding, upgrading, redesigning, or otherwise repurposing a space that already has AV components. It's important for those customers to be able to take advantage of the existing infrastructure as much as possible.

How does this affect your choice of distribution method? Simple. If your product can fit into a pre-existing infrastructure, you have an immediate advantage. Few sites already have HDMI, fiber optic cable, or other dedicated AV backbones. For that reason, IP is often a useful and low-cost distribution method if you want to maximize your product's flexibility.

Are your customers creating greenfield installations or using existing infrastructure?



Most AV systems have some existing components: transmission technologies, switches, storage and/or converters.

System Scale

Along with infrastructure, installers focus on the physical and financial scale of the system they're installing. Here's where detailed knowledge of your market is key.

Say your customers focus on small corporate installation, with a handful of co-located sources and displays. At that point most distribution methods are possible, even those like HDMI that cannot cover great distances. But as an installation scales up in either distance or number of endpoints, options grow limited.

Physically large installations are best served by methods that scale up well. Keep in mind that quality can degrade as cables near their recommended max length when delivering baseband video.

(continued)

Will your customer systems have few or many ins/outs?

AV systems can have few or many inputs—and some may need to scale for future growth.

System Scale (continued)

Check out this table of distribution methods and repeater costs to get a sense of the workable distance for various methods. Clearly, fiber optic cable is the gold standard for any long distance application but has unique challenges of its own.

Are your customers creating physically large systems?

	MAX LENGTH	COST/REPEATER
HDMI	15m for 1080p, longer for lower resolutions	$25-500
HDBaseT (Cat5/6)	100m	~$300-1000
IP (Cat5/6)	100m	$100-500
SDI (coax)	300m SD, 100m HD	~$300-1000
SDI (Fiber-optic)	80km (yes, km)	several thousand +

Scale is also important in relation to the number of sources and displays--and the size of the budget. In the small-scale corporate example, switches can be simple and inexpensive. Any switch can handle a small number of inputs and outputs, and for small installations switch cost is comparable across different distribution methods.

But for some distribution methods, switch cost increases dramatically as the number of ins and outs rises. A sixteen port Ethernet switch may cost $150. A same-size switch for HDBaseT will cost eight to ten times as much.

	SWITCH COSTS 4x4	SWITCH COSTS 8x8
SDI (Coax)	$1500	$2,000+
IP (Cat5/6) GigE	<$100	~$100
HDMI	~$500	$2,000+
HDBaseT (Cat 5/6)	~$1500	$4,000+

Usage

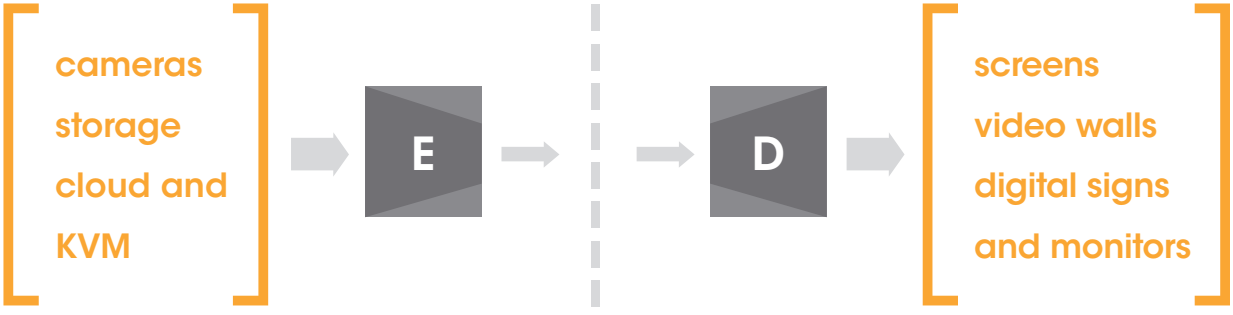
A system's application affects each component, including distribution method. Individual applications have different priority lists:

USAGE	PRIORITIES
KVM	1. Low Latency 2. Color Space (4:2:2 or 4:4:4) 3. Cost
Lecture Capture	1. Audio Performance and I/O 2. Cost 3. Bandwidth
Medical Capture	1. High Quality/Lossless 2. Low Latency 3. Redundancy

How will the product be used and what content needs to be delivered?

Customers will also be attentive to ease of system control and providing power to components. Distribution methods that incorporate web-based control and power (e.g. Power over Ethernet) without additional wires,like IP and HDBaseT, are particularly appealing for that reason.

Of course, resolution is the most obvious use case requirement to take into account. The standard for most applications has long been 1080p60, but that is rapidly being replaced by 4K. For distribution, this means that bandwidth is of crucial importance. More is better, and the numbers will continue increasing.



The system's usage determines necessary components and features.

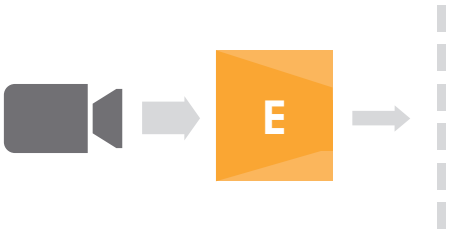
Transmission Features

Knowing where and when to introduce compression in an AV transmission system is incredibly important.

Compression is often a focus point for those who argue that certain products in pro AV need the best quality. Historically, it was true that compressed video compromised quality. That has improved every year with modern compression standards. But the association remains in pro-AV circles, despite the fact that many find it difficult to see the difference between raw video and H.264 compressed video. And now HEVC (H.265) provides similarly impressive video quality at half the bandwidth.

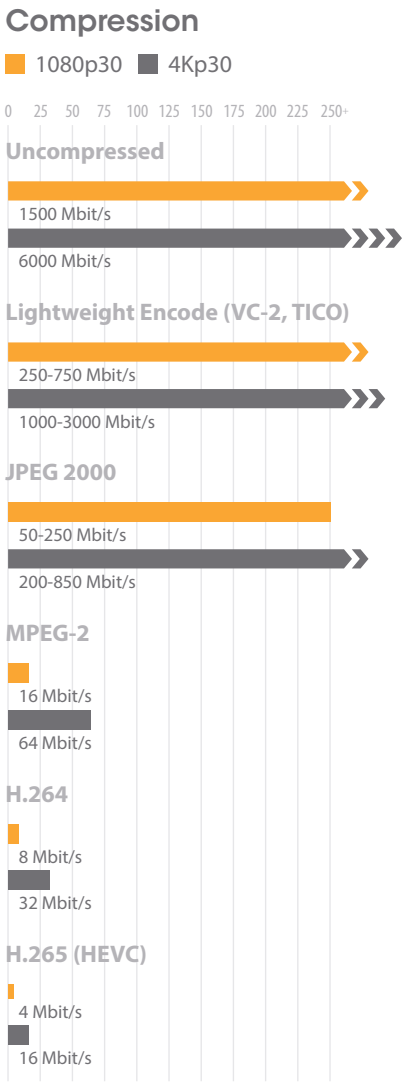
Bandwidth is the main limitation that many of your customers will face. More bandwidth means new cables, switches, and processing, which ultimately equals more money. And bandwidth requirements are only growing bigger. This is why we think compression is worth considering. It is becoming increasingly appealing to your customers; saving bandwidth is the same thing as saving money.

Of course, there are situations where compression isn't a viable option. For most applications, a few hundred milliseconds of latency will not matter one way or another, but other applications absolutely require a near zero-latency solution. Are your customers working with an application where milliseconds count? If so, you need an ultra-low latency solution, and specific compression technology.



Bandwidth is almost always a transmission constraint. Encoders help solve that problem.

Do your customers have enough bandwidth for uncompressed video at high resolutions?



Future-Proofing

Finally, all pro-AV installers will choose products with an eye to future proofing. Will the installation need to keep up with developing technologies and ever-increasing pixel counts? Will the system be upgraded regularly, or will it need to work as is for a long time? Again, bandwidth is a central concern.

Currently, your customers probably require enough bandwidth for 1080p60, and that can be met through a number of different distribution methods. 4K is the new standard, and systems that will need to last a while should already be planning for 8K. With baseband distribution methods, this means planning additional cabling and upgraded switches to gain bandwidth.

This is the area where IP can present the clearest savings. If installations can support a few hundred milliseconds of latency, compression will allow your customers to accommodate much higher resolutions. Even if they don't need the higher resolutions now, there's a very good chance that before too long, they will.

Would your customers rather upgrade infrastructure or add compression?

Accounting for bandwidth constraints and flexible infrastructure, AV over IP is a largely future-proof distribution method.

What should you take away from this?

In AV installation planning, there are always tradeoffs. Balancing quality, affordability and scalability is a full-time job. That's why your customers have such deep knowledge of AV distribution trends.

As the industry starts to trend towards compressed video and AV over IP, more and more of your customers will come to rely on compression to streamline their AV workflows. Get ready to accommodate demand for solutions that fit that distribution method.

Need a handy reference to help remember the AV tradeoffs we've discussed here? Check out the chart below.

	Infrastructure Backbone	Control	Maximum Length	Repeater Cost	Switching Cost	Latency	Maximum Bandwidth	PoE	Mobile Readiness
SDI	Coax	Separate cable (Ethernet, Serial, Cat 5)	100m	$300-1000	High	~0	3Gbit/s, (6 and 12 coming)	No	Converter needed
Copper IP	Cat 5, encoders and decoders	Over same cable (web server or direct interface)	100m	$100-500	Low	100ms-1sec	100 Mbit/s, 1 Gbit/s, 10 Gbit/s	Yes	Ready
HDMI	19 Conductor Cable	Separate cable (Ethernet, Serial)	15m	$25-500	Moderate	~0	10Gbit/s, 18Gbit/s	No	Converter needed
HDBaseT	Cat 5	Over same cable	100m	$300-500	Moderate	~0	10 Gbit/s	Yes	Converter needed
Optical IP -- compressed (IP Based)	Fiberoptic cable, encoders and decoders	Over same cable	80 kilometers	Many thousands	Moderate	100ms-1sec	10 Gbit/s	No	Converter needed
Optical uncompressed	Fiberoptic cable	Over same cable if IP-based	80 kilometers	Many thousands	High	~0	10 Gbit/s	No	Converter needed
Wireless	Tansmitters and receivers	Wireless	NA	$100-500	Low	100ms-1sec	300 Mbit/s	No	Ready

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