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What should an upgrade cycle for audio/video (AV) equipment look like?

Why is this important?

As the role of audio and video (AV) technology becomes more critical to the effective implementation of business processes in court systems, it is increasingly necessary to implement appropriate policies pertaining to procedural, technical, and budgetary realities of AV applications and upgrades. Important questions related to upgrading AV technology are:

- What and how much must be done to upgrade the technology?
- When can (or must) the court carry out these AV upgrades?
- Is upgrading feasible within current court infrastructure?
- Can the court afford these upgrades?

Research

Determining a replacement cycle for court AV equipment may vary depending on (1) the type and complexity of equipment used, (2) how often the equipment is used, and (3) the cost of replacement.

The estimated lifespan of various AV system components averages at around seven years (see Table 1). However, the wide variation in lifespan of different pieces of equipment implies that, even if an AV system overhaul is performed every seven years, some equipment will need more frequent replacement. Further, AV equipment used for longer periods of time each day often experience reductions in lifespan simply from increased wear and tear.

Based on the results of surveying several state courts, the normal upgrade cycle for technology in state courts seems to range in length from five to ten years. In federal courts, on the other hand, court equipment is updated or renewed every fifteenth year. However, these routine cycles do not take into account drastic technology changes, such as conversions from analog to digital system designs or from proprietary matrix infrastructures to networked infrastructures, which usually require more immediate and complete implementation.

The primary issue for courts today centers on how they should keep their technology functioning properly with minimal, if any, breakdowns as, while some items (e.g., small monitors) can be easily replaced, other items require immense system programming changes that increase upgrade cost and complexity. This explains why IT departments normally operate as though equipment has a three- to five-year life cycle, even though the hardware may easily

function for longer. IT departments typically prefer to make incremental changes early over being caught behind the upgrade curve and being forced to make drastic changes all at once.

Some technologies require moderate to significant changes in infrastructure that can impact a court's upgrade cycle. As a result, coordination with other departments, such as IT and facilities departments, is imperative.

Recommendation

Courts should generally schedule complete AV system upgrades every five to eight years, with additional component upgrades for items such as displays and projectors that may require more frequent replacement (see Table 1).

Courts should retain copies of equipment control codes—or, better yet, one or more staff members who are trained in company programming—to make control code changes as equipment is replaced.

As part of an upgrade, additional training and support for use and maintenance of the new equipment should be provided depending on the extent of the enhancements and modifications and the impact of the upgrade on connected systems. Training should be performed before the upgrades are completed (see Sections 3-01 to 3-03).

Table 1: Estimated lifespan of typical AV equipment as reported by manufacturers

	Lifespan (years)				Years																			
	Minimum	Maximum	Spread	Mean	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Video players	3	5	2	4.0																				
Computers	3	5	2	4.0																				
Wireless connectivity	3	3	0	3.0																				
Small displays	4	6	2	5.0																				
Large displays	4	6	2	5.0																				
Projectors	4	5	1	4.5																				
Video conference codec	4	4	0	4.0																				
Video cameras	5	6	1	5.5																				
Audio Processors	6	10	4	8.0																				
Audio amplifiers	6	10	4	8.0																				
Video processors	6	10	4	8.0																				
Document cameras	6	6	0	6.0																				
Microphones	8	10	2	9.0																				
Speakers	10	15	5	12.5																				
LED displays	10	20	10	15.0																				
Screens	10	15	5	12.5																				
				7.1																				

How should courts budget for AV replacements?

Why is this important?

Budgeting for technology upgrades and replacements is an issue in all courts and is often tied to the proper proposal and management of budget requests. This becomes especially difficult with jurisdictional variation in funding sources (e.g., British Columbia P3, Private/Public Partnership) and those sources' often deficient understanding of courtroom technology as it pertains to trials and other court proceedings.

Research

AV technologists and their administrators often depend on their own resources to locate and apply for both internal and external funding (i.e., grants).

It may be possible to lease equipment instead of purchasing it (see Table 1), but this may yield procurement issues. Each court will have to examine whether leasing equipment is a viable option based on jurisdictional procurement policies.

Recommendation

Depending on the life cycles of the technology it uses, each courtroom will ideally budget for upgrades on a five- to eight-year cycle. Depending on the number of courtrooms a court contains, this may be accomplished by allotting a certain number of courtrooms to be upgraded every year so that all of its courtrooms have been upgraded by the end of the cycle term.

Alternatively, a court may divide the systems contained in its courtrooms collectively based on function (e.g., audio control, remote communications, video display) and upgrade its courtroom technology at intervals based on the life cycles of equipment within that functional category. However, with this approach, a single courtroom may be unusable (i.e., off-line) more often for upgrades than it would be if all of its equipment was overhauled at once.

Beyond these standard approaches, there are other possible, more "out-of-the-box" funding strategies that may be applied to large- and small-scale projects as necessary. Many of these approaches require additional administrative effort. Although in-depth descriptions of these strategies are beyond the scope of the current version of this document, examples of these strategies include the following:

- Outsourcing: long-term contracting with outside companies to manage, maintain, and upgrade court technology;

- SaaS: using newer "Software as a Service" (SaaS) programs to leverage cloud-based technology, distribute costs, and maintain current serviceability;
- Public-Private Partnerships (PPP, P3): acquiring funding and other resources from private organizations to develop court infrastructure and technology;
- Grants: acquiring funds from grant organizations, including the State Justice Institute, Bureau of Justice Assistance, and state grant programs (this is especially suitable for smaller, more focused projects); and
- GWAC: leveraging GSA pricing and Solutions for Enterprise-Wide Procurement (SEWP), a dedicated GWAC vehicle for commercial IT products and services, by federal courts.

Table 1 – Buying vs. Leasing AV Equipment

Advantages of Leasing	Disadvantages of Leasing
1. Keeps existing equipment up-to-date	1. More expensive in long run
2. Predictable monthly and yearly expenses	2. Obligates payment even if one no longer uses the equipment (through prepayment penalties)
3. Low initial costs	3. Maintenance of leased equipment may be controlled by leasing company
4. Flexibility to more easily acquire new technology	
Advantages of Buying	**Disadvantages of Buying**
1. Less complicated than leasing	1. Expensive initial outlays for essential equipment
2. Court controls maintenance schedule	2. Existing equipment may become out-of-date without ready replacement
	3. Capital expenditures can require extraordinary funding efforts

How do we "future-proof" a courtroom?

Why is this important?

There is no way to fully "future-proof" a courtroom; courts can only "future-accommodate." What can be guaranteed is that technology will change, video resolutions will develop, and the use of video displays will increase. The advent of new technology will inevitably bring a requirement for its availability in court.

Research

While it may be hard to plan for an uncertain future, when preparing to introduce new courtroom technology it is wise to put emphasis on the flexibility of infrastructure. One of the greatest costs during an upgrade is the removal of old infrastructure and replacement with new sets of cables and pathways. While a court may not currently require infrastructure that can handle 4K, or higher, video, it will likely need such infrastructure to accommodate the next technology upgrades. Infrastructure that was adequate a decade ago will not, in its current state, be able to handle the addition of newer equipment requiring additional cabling.

With networking playing a larger role in AV communications and court data management, the "fiber versus copper" discussion factors into upgrading and "future-accommodating" in the courtroom.

Recommendation

During infrastructure planning, courts should make sure there are conduits in place that are large enough to support cabling and allow wiring to reach every necessary location in a given courtroom. They should also ensure there is sufficient room for growth in inputs and outputs so that equipment does not have to be replaced to meet intermediate needs.

Courts should have a strong long-term cyclical replacement plan and be on the lookout for emerging technologies, trends, and best practices. Attendance at AV trade shows, conferences, and webinars is important to maintain a current understanding of existing and future AV technologies.

Today the AV industry is moving towards networked infrastructures. Currently, specifications call for 1 gigabit (Gb) network bandwidth, but most systems are now designed for 10 Gb requirements. This means that each courtroom will have huge bandwidth requirements to accommodate. Presently, the safest method of "future-accommodating" is to convert from copper cable to fiber optic cable. With fiber, the end pieces may change, but the court will not need to replace all the cabling every time there is an upgrade.

Is a service contract or hourly rate a better method of support? Or is in-house better?

Why is this important?

Protocols for servicing and supporting court AV equipment and associated infrastructure are going to depend on the individual court system, sometimes even an individual courtroom (e.g., "high tech" courtrooms). Installations of audio/video, infrastructure, networking, and fixtures, generally require more expertise and experience than is available for the courts.

Proper maintenance, rapid trouble-shooting, and recovery of dysfunctional infrastructure, equipment, and software require robust support protocols and skillful diagnostic capabilities. Lacking these capabilities leads to failure within the courtroom and the inability to provide justice in a timely and effective manner. The costs are not only in currency but in people's time and expense.

Research

In many courts, the IT staff is obligated to work with the AV systems and associated third-party support desks. Even with the ongoing integration of AV systems with IT systems, the skill sets are different. Further training through formal instruction, shared user experiences within a user group, or informally on a phone call is imperative to develop and maintain the needed AV skill sets.

Aside from traditional support models, some technology companies can offer outsourced support and management of AV equipment beyond the traditional problem → phone call → resolution method. This could be up to the entire courtroom technology constellation.

Key factors that determine the source/extent of the support will be:

- In-house computer and AV expertise both in terms of knowledge, retention, and access;
- Effect of employment cycles on support resources;
- Cost of service/support contracts on a per room basis and budgetary constraints;
- Level of complexity/integration of the AV systems;
- Level of integration with traditional IT systems;
- Geographic distribution of courtrooms;
- Availability of in-house support desk management tools and protocols;

- Type of Support Level Agreements (SLAs) offered (e.g., response time for both on-site and remote, escalation response level, shipping);
- Experience and customer relationship management capabilities with a court system of the company offering support contracts;
- Need for inclusion of training on AV and associated infrastructure;
- Need for periodic maintenance as part of contract;
- Remote monitoring, access, and notification capabilities of the company offering support contracts;
- Inclusion of on-site equipment for replacement.

Recommendation

A blanket recommendation on types of support would be both difficult and quixotic. In general, leverage your in-house resources first, followed by third party resources (hourly or contract) that could encompass most or all of your AV systems.

Ideally, an AV support organization would direct resources based on relevant AV use case requirements provided by the customer. Clear definition of AV support scenarios, including impacted stakeholders, can provide the essential information for a support organization to provide the proper levels and commitments. Support that is both flexible and responsive is critical in courts and requires a higher level of oversight by trained court staff and management.

Support Level Agreements (SLAs) are essential in any support contract to clarify the roles and responsibilities of both the court and the support provider. All AV/IT court staff and management should have a clear understanding of the SLAs and be prepared to leverage them.

How should service calls be logged?

Why is this important?

Service logging is too often overlooked in courts. Logging is simply a method of keeping records of equipment service issues. The main benefit of logging is that it helps personnel identify recurring issues and their potential causes, thereby allowing in-house or off-site support personnel be better equipped to address such issues more efficiently. The data also is useful for vendors to consider when designing additional systems and integrations.

Research

A log entry should identify the issue, the date and time it occurred, what was done to correct it, the parties involved, the court's operational status, any error messages or dialog windows that appeared, how the issue was resolved, and the next step needed to prevent the issue from reoccurring. All issues, no matter how minor, should be recorded. Courts should have a central database that contains the service log inventory for each courtroom.

One concern regarding service call logs is that they are not designed for courts. To get proper and consistent usage, a service call log must be easy enough for clerical staff to use so they may enter information to generate quick reports and messages. It must also allow for easy sharing of summaries for review by management.

It may be worthwhile to keep paper copies of the log on the rack to help document system performance.

Recommendation

There are several help desk software packages, such as ServicePro, ZenDesk, Change Gear, and Team Support, that could be used to catalog calls. Microsoft Excel also provides the option to make a "home-grown" database. Should a court opt for the latter, it is imperative that several people know how to use and program the database to avoid, through staff turnover, generating an orphan system that cannot be modified or improved.

However it is accomplished, a service log and associated call reports should be periodically updated and reviewed.

Who should be responsible for wireless devices in the courtroom?

Why is this important?

The use of battery-powered devices, such as wireless microphones and hearing assistance headsets, in the courtroom is becoming increasingly prevalent and critical to courtroom function.

Research

Newer rechargeable battery technology allows a device to have a longer battery life (e.g., over six hours) at a mid-level charge, making rechargeable battery-powered devices more viable for long-term use than earlier battery-powered devices. With that said, to accommodate these rechargeable devices, certain court personnel must be assigned the tasks of docking the devices in their charging stations and performing other maintenance. The people assigned to such device management may vary from in-court personnel, to technical support staff, to clerical or administrative staff, and even to personnel not reporting within the judicial staff (e.g., bailiffs in some locations).

Recommendation

Someone specific on the court or judicial staff should be tasked with the daily maintenance of wireless technology. That staff member might vary from court to court based on personnel resources. Whoever is responsible for this duty should place the devices in their chargers after each court session or remove their rechargeable batteries.

An in-court user guide to managing the court's wireless assets should be available in both paper and electronic form and include support contact information to allow for training personnel in battery-powered wireless device management.

What documentation is needed for courtroom support?

Why is this important?

Complete, accurate, and consistent documentation is essential to supporting courtroom technology. It is unlikely that court technologists and personnel will know all of the features and functionalities of every available piece of court equipment. Access to thorough documentation of these features and functionalities facilitates more rapid and successful response efforts by technologists and personnel when significant equipment issues arise.

Further, consistently updated procedures help alleviate confusion, address simple questions quickly, and present technologists and personnel with a baseline for performance expectations. These procedures help technologists and personnel more efficiently return the court to equilibrium when an issue arises.

Research

Support documentation can exist in many formats and are usually divided into three categories according to the material they cover: procedure, references, and diagnostics (troubleshooting). In Table 1, we have provided multiple examples of each, not all of which will be relevant to all jurisdictions or courts. Certain examples should only be used by qualified support personnel.

Recommendation

Basic documentation should include manufacturer's manuals, as-built documents and drawings, copies of un-compiled control programs, and step-by-step operator instructions or quick reference guides. Documentation can be in either hard or electronic form, though having at least one of each for any given court would be preferable. Electronic documentation can be made available through networked servers or stored in a cloud.

Each courtroom should have two copies of basic documentation per courtroom. One should be held in the rack room, and the other in the central support office. The second copy will serve as a backup should the first copy be lost.

Support logs should be maintained for historical and diagnostic purposes, as well as for review by later equipment manufacturers and support evaluations.

AV system training should be offered to court technologists and personnel during the installation of the equipment and periodically (at least once a year) depending on frequency of equipment updates and staff turnover. Information from training sessions should be used to update relevant documentation.

Documentation in the courtroom should be reviewed at least twice per year to ensure it reflects current court technology, training, and processes.

Table 1: Types of Support Documentation

Category	Document Type	Use
Procedure	Quick Reference Card	Allows end-users and support personnel to quickly find and identify elements of the software or system in use.
	Process Script	Provides step-by-step instructions for common and uncommon procedures.
	Contact Information Card	Provides contact information for technical and operational support, including external vendors.
	"Start Troubleshooting" Guide	Provides necessary information to acquire before contacting outside support personnel.
Reference	User Guide	Provides complete information on how equipment and software is used in the court. It can be in an e-format on a courtroom PC, on the court network, or in a secure cloud storage area.
	Manual	Provides complete information on equipment features, functions, specifications, installation processes, schematic diagrams, and basic troubleshooting. It often overlaps with User Guides but is kept within the support library instead of the court.
	As-Built Document and Drawing	Provides a reference to current AV/technology systems that are installed in a specific courtroom. Each courtroom should have its own As-Built documents, which should include all technology and infrastructure.
Diagnostics	Diagnostic Guide	Often provided by the manufacturer or developed internally in response to common issues.
	Diagnostic Script	Most commonly developed internally to provide newer personnel with standard processes for troubleshooting issues in the courtroom.
	Support Log	Created and maintained by the court support team to provide details on an issue for the manufacturer's

		support team, document ongoing issues for review, justify procurement, remedy recurring issues, and track efforts in diagnosing and resolving support issues.
	Manufacturer Contact Log	Often a subset of a Support Log, but reserved for documenting direct contact with manufacturers, their responses, and ongoing resolution efforts. This is used to document internal court activity with the manufacturer and problems with manufacturer support issue resolution.

How should courts handle the various video formats that need to be displayed in the courtroom?

Why is this important?

The court record is no longer a file folder containing a mass of paper documents. The proliferation of digital devices in the courts has created an explosion of video, audio, and interactive media formats. The problem for courts is that every AV manufacturer can have its own (possibly proprietary) media format(s).

Attorneys, expert witnesses, and court personnel often need to leverage video technology for evidence presentation and to provide visual support for concepts and testimony.

Research

According to Wikipedia, over 38 video file formats are available. In addition, there are 10 biomedical imaging formats, 20 presentation file formats, 76 3D graphics file formats, 29 vector graphics file formats, and 39 raster graphics file formats. This does not include the 41 existing audio file formats.

Realistically, only a small percentage of these 212 video or graphics formats and 41 audio file formats would ever be presented to a court system in their native states. It would still be a herculean task to expect courts to provide and maintain the audio and video codecs and necessary playback devices to account for every contingency.

There are so many video formats that the court simply cannot provide players for them all in all courtrooms. In addition, providing technical support for an attorney seeking to play a proprietary video format would open trap doors that court technical staff should avoid (see Section 2: Attorney Support).

Judges and hearing officers are often not familiar with the nuances of video formats and format conversion and will rely on court technologists to provide guidance and support.

Recommendation

A court should provide standard analog and digital video hardware connections (e.g., HDMI, Displayport, VGA) with some basic adapters and require attorneys to provide compatible playing devices (e.g., laptop computers). Converting file formats would be the responsibility of the attorneys, as would any communication with opposing parties regarding such conversion.

The court should not be involved with any format changes, as they could contribute to possible data loss. The court will also need to manage the inventory and distribution of basic adapters.

Accompanying the concern with how to handle video files is that of how to capture these video files for the record and jury deliberation. The obvious response to this concern is that the attorneys presenting the videos must provide copies to the court. For jury deliberation, courts should follow the federal PACER model and capture what is shown to juries in court through their AV systems, which can be done in several ways. Doing so would provide juries with "courtesy copies" of the videos, not the originals.

Judges should be prepared by court technologists regarding any unusual or difficult playback of video and its impact on courtroom technology. This preparation should include discussion of the nuances and consequences of video format conversion.

How should courts handle the future demand for and volume of police videos?

Why is this important?

Police video and audio recordings via car-based or body cameras are becoming more widely used. From a law enforcement officer's perspective, they are beneficial because they can reduce the amount of time spent attending court, improve officer training, and reduce the frequency of filed complaints and lawsuits against officers and departments.

In court, these videos generally become evidence and must be secured and displayed as needed.

Research

Thirty-four states and the District of Columbia have laws for the use of LE body cameras (see (1) below). Body camera technology is undergoing intense review by community, government, and judicial entities trying to address their role in police interactions with communities. As these cameras become more widely available, questions regarding videos' evidentiary value, issues of privacy, and the need for disclosure of sensitive content will fall into the courts' purview.

Recommendation

How do we handle the exploding volume of video? Will the current escalation in video availability eventually plateau, or will it steadily increase as people use it more often in an evidentiary capacity? The only choice for courts currently is to plan for elevated demand for video playback and management of video evidence.

One administrative solution to handling the growing volume of video is to establish court rules regarding its use. For example, one might require an attorney presenting video evidence to use a form explaining why it is necessary. The United States District Court for the Southern District of Indiana uses this model and requires that the form be signed by the Deputy Clerk one week before trial so the court can anticipate and control the volume of video it will need to accommodate.

From a technical point of view, every courtroom should be prepared for high definition video presentation and be able to capture what is presented through its AV system. However, because police videos are frequently stored in the cloud, the technology used to play the video should be published and clearly understood by all parties. Any video format conversions should be performed by the interested parties, not the courts, and the converted file should be in a common format that the court can easily play for the court and jurors as needed.

Figures, Tables, and Addendums

(1) http://www. ncsl.org/research/civil-and-criminal-justice/body-worn-cameras-interactive-graphic.aspx
(2) Bureau of Justice Assistance. 2015. Body-Worn Camera: Frequently Asked Questions. https://www.bja.gov/bwc/pdfs/BWC_FAQs.pdf
(3) https://statescoop.com/storage-management-a-big-concern-for-body-camera-users/

How can we best support wireless courtroom devices?

Why is this important?

As battery-powered wireless devices become critically important to courtroom functions, their management becomes a topic of concern for many reasons. Among these reasons are the facts that court staff often do not know when or how to change the devices' batteries and that these devices, due to their mobility, are significantly more susceptible to damage and misplacement by court personnel and other end-users.

Research

Newer rechargeable battery technology allows for a device to have a longer battery life (e.g., over six hours) at a mid-level charge, making rechargeable battery devices more viable for long-term use than earlier battery-powered devices. Devices that use standard batteries may be affected by the type of battery inserted.

Ideally, any battery-powered device should have a docking or charging station. When not in use, these devices can be placed in their stations to charge, which alleviates the need to check and replace their batteries. However, this would require staff to place the devices on the appropriate charging bases daily. Because some devices require individual proprietary docking stations, this may add to the burden of managing these devices.

The people assigned to battery-powered device management may vary from in-court personnel, to technical support staff, to clerical or administrative staff, and even to personnel not reporting within judicial staff (e.g., bailiffs in some locations).

Recommendation

Someone specific on the court or judicial staff should be tasked with the daily maintenance of wireless technology. That staff member might vary from court to court based on personnel resources. Whoever is responsible for this duty should place such devices in chargers after each court session or remove their rechargeable batteries.

Courts may consider adopting the approach of professional presentation venues, such as theaters and sound stages, which often retain about twenty-five percent more devices and batteries than they need to ensure that fully-charged devices are readily available if someone accidentally forgets to place a device into a charging station in a timely manner.

Each device (and charging station, if applicable) should be labeled with either a court system asset tag or a support help desk asset tag to track incidents involving individual units. The asset tag should include a contact phone number in case the device is misplaced.

An in-court user guide to managing the court's wireless assets should be available in both paper and electronic form and include support contact information.

A summary of available batteries and their associated battery lives and charging requirements can be found at the Shure website.