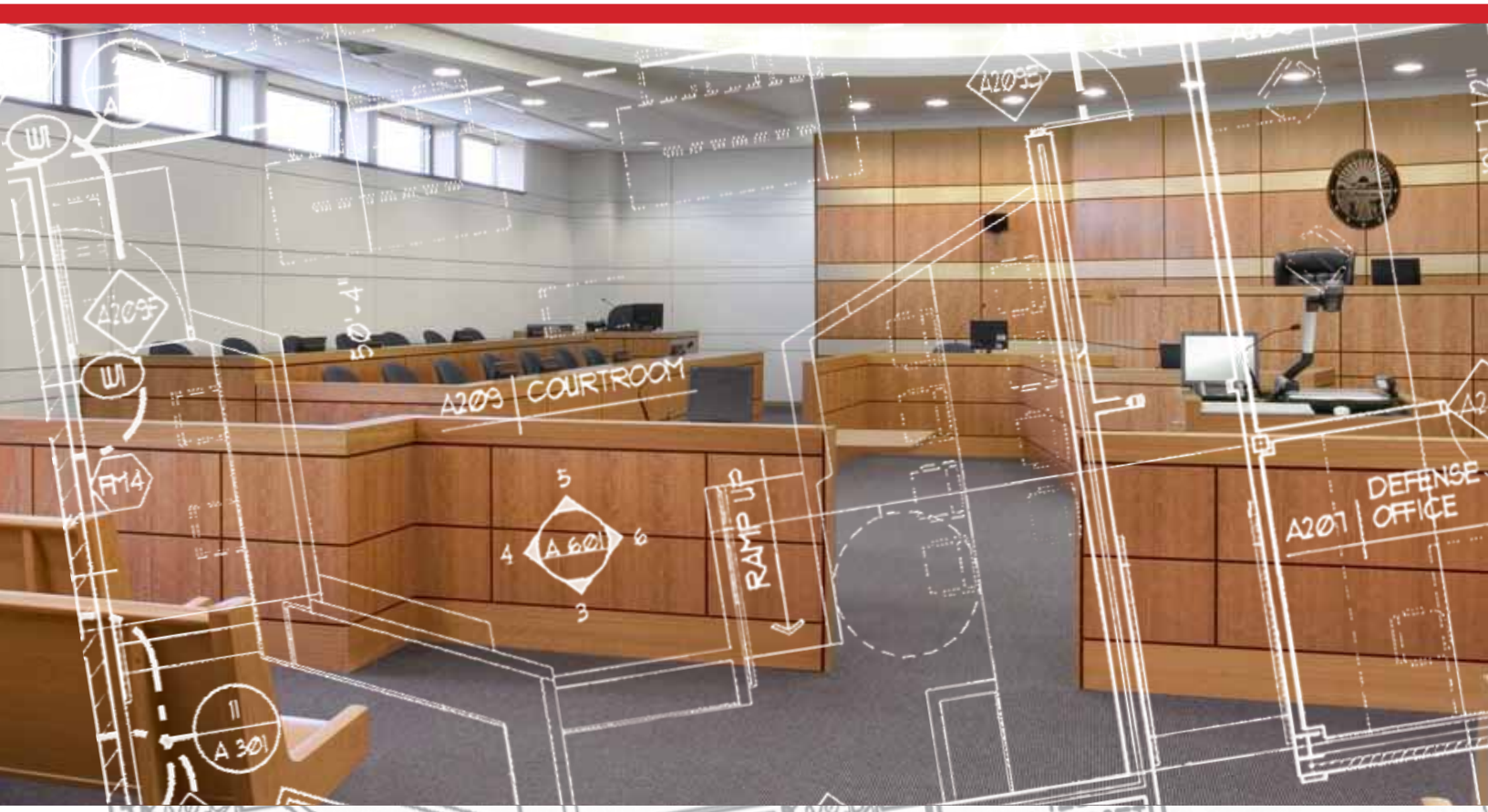
AV/IT Infrastructure Guidelines for Courts



THE AMERICAN INSTITUTE
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Academy of Architecture for Justice

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ON THE COVER: Lorain County Justice Center, Elyria, Ohio (photo courtesy of David Joseph).

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Preface

The age of personal Internet access and communications is bringing fundamental changes to how we interact with technology and in our expectations of the outcomes, including the justice system. Lawyers, for example, who wish to present their cases visually, who need to examine remote witnesses via videoconferencing, and who need to consult court transcripts during proceedings must be able to practice effectively in technology-enabled courtrooms.

Courthouses and courtrooms are increasingly dependent upon sophisticated technology. Whether it is described as "audiovisual", "AV," "audio/video," "media technology," or "AV/IT," low voltage information technology, and the amount of technology needed in courthouses will continue to increase. It is for these reasons that a courthouse is not just a building, and a courtroom isn't an ordinary room.

The law and legal environment culture controls and dictates acceptable technological solutions that may be very complex to implement. The best technical answer may be legally unacceptable. This fact makes it essential that judges, court administrators, courtroom technologists, and lawyers all be involved in the planning process from the beginning.

Everyone involved in the construction and renovation of courthouses needs to know what technologies are applicable. New technologies and design requirements demand increased knowledge of design principles. Architects, technologists, judges, and court administrators, as well as many specialists working in the field, should strive for an outcome that is both anticipated and measurable by the court.

Infrastructure comes in many forms and has had many definitions. Its effective implementation and design is critical to success. Planning a building and its spaces so that AV/IT infrastructure can be easily installed, maintained, expanded to meet growing needs, and accommodate required technologies are the most important features to take into account. If the infrastructure has been adequately implemented, technology can be installed inexpensively and properly when funds are available. If this is not, building and fiscal constraints may make that a major challenge. When facing limited budgets for technology, an investment in thinking toward future possibilities is never wasted!

The keys to successful technology implementation are careful planning, thoughtful design, and a detailed needs assessment. Other keys to success are regular expert involvement early in the project, and well thought out and frequent communications plans. This guide should assist all participants who play a part in each step.

Coordination among all the building professions, the technologists, and the court's judges and legal staff is essential to deliver a successful project that meets design specifications. Increasingly, we are seeing "convergence" between audiovisual and IT professionals, as well as other low-voltage technologies. IT experts working in this field must team with audiovisual experts, security, and building management professionals to ensure a successful solution.

Careful planning and coordination will yield a result that all can be proud of and will serve the public and court in providing continued access to justice and fairness during the life of the facility.

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Introduction

Architects, technologists, judges, court administrators, or any of the many specialists working to integrate technology into judicial facility design can benefit from this guide. It addresses common issues and situations that occur in the design phase of a project, with some direction offered regarding training, operations, and maintenance. Although there is concentration on courtroom environments, it also deals with courthouses and many of the other spaces as well as justice partner facilities.

A secondary goal of this guide is to provide guidance for the creation of aesthetically pleasing, functional facilities characterized by professional integration of technology with furniture and interior designs. Awareness of what is required, especially rigorous coordination between technologists (AV and IT professionals) and architects, is critical. The absence of such coordination typically results in additional cost, probable project delay, sacrifice of aesthetics, and loss of short- and long-term functionality as technologists improvise solutions.

A modern courtroom is part of a technologically sophisticated courthouse that must be designed to support numerous court functions often relying on technology. Courtrooms are increasingly different from the traditional forums seen in movies. They are likely to have many systems:

- Evidence presentation technology
- Technology-based court record system
- Remote appearance capabilities
- Sophisticated audio and video reinforcement capabilities (e.g., electronic dockets, remote self-help services, training)
- Assistive listening/language interpretation technology
- Electronic filing and case management
- Support for the federal Americans with Disabilities Act (ADA)

Court technology adoption poses complex challenges for architects, courtroom designers, and technology professionals. Similar challenges are also faced by judges, court administrators, and lawyers. All of whom are united in their interest in improving the administration of justice. Yet, technology is always changing, and there are no common solutions to repetitive problems. The situation is made more complicated because each court tends to be unique, whether viewed from the perspective of law, local culture, technology, or architectural environment. This guide can be a resource to help the reader address many of these important issues.

Overview of the Courts and Related Justice Agencies

Courts exist to administer justice and to house ancillary governmental services, such as maintenance of land deeds, probate of estates, and even applications for passports. These functions must be considered in the design phase of a project. Every court and every courthouse can be unique, and a careful and comprehensive needs assessment is a critical requirement for every courthouse construction or renovation project.

TYPES OF COURTS

Many different types of courts exist. In order to understand technology needs of the most common courts, let's distinguish between trial and appellate courts.

- Trial courts take evidence, such as hearing witness testimony, and determine verdicts. Trial courts may, but will not always, involve juries.
- Appellate courts review what happened at trial and consider if the trial and its result are legally correct.

Then, courts can be identified by their jurisdiction.

- State courts — In the United States, state courts are directly or indirectly responsible to a central state administration, which has rules affecting courthouse design. State courts are very likely to have a variety of civic functions other than the administration of justice, most notably maintenance of land records. The majority of courts in the U.S. are state courts.
- Federal courts are located within the states but are not responsible to them. For federal courts, the Administrative Office of the United States Courts and the General Services Administration play significant roles in courthouse design, construction, and renovation.
- Military courts are located on military installations and customarily consist of one courtroom in a building used for multiple purposes.
- International courts, such as the International Criminal Court or the International Court of Human Rights, are specialized courts with unique needs and procedures.
- Administrative tribunals hold proceedings in hearing rooms. The Social Security Administration, for example, holds about 650,000 disability hearings each year. Customarily, administrative tribunals are not housed in courthouses.

State trial courts can include:

- Courts of first instance, such as traffic court
- Juvenile courts
- Family courts
- Drug courts
- Veterans' courts
- Small claims courts
- Courts of general jurisdiction, civil and criminal

Courts of general jurisdiction are those courts that are legally able to hear the most serious cases. Some of these courts can hear both civil and criminal cases; others are limited to civil or criminal cases.

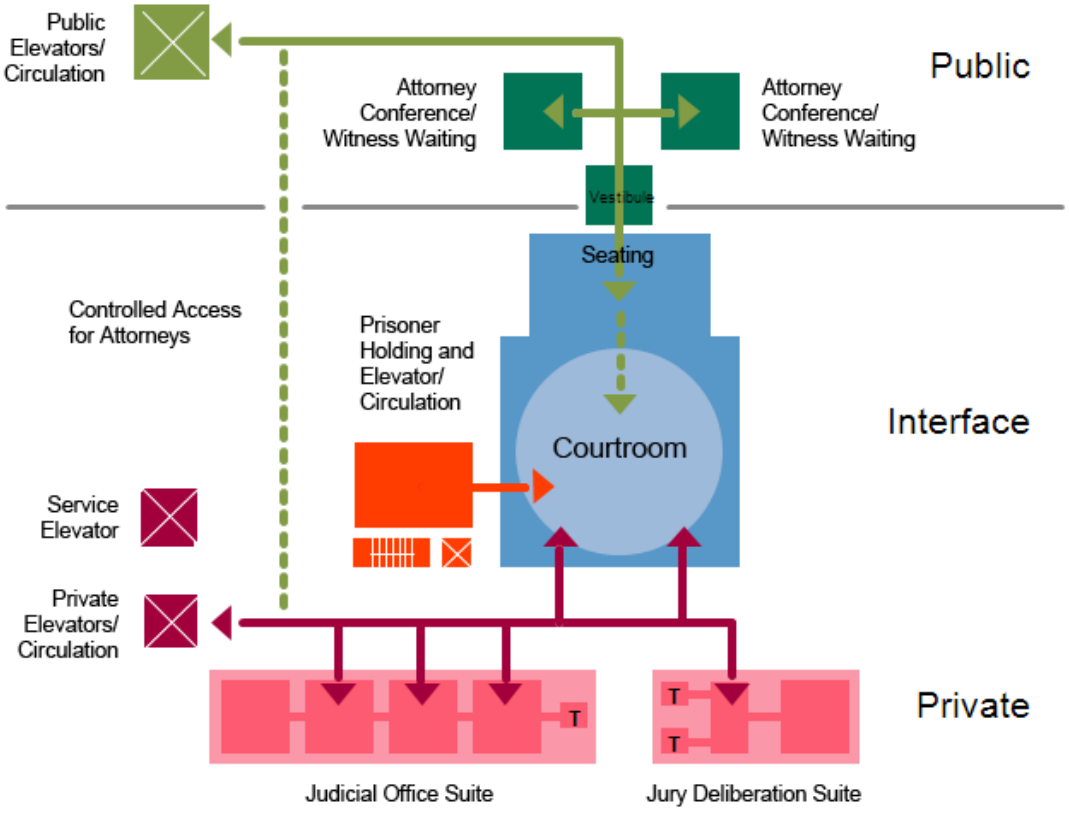
COURTHOUSE FACILITIES OTHER THAN COURTROOMS

Courthouses frequently have more functions than just adjudication of cases and these buildings contain spaces in addition to courtrooms – such as administration, customer service, self-help, jury assembly, prisoner detention, and courtroom support areas (including judicial chambers). Courthouse design requires careful consideration of these spaces and their needs.

Each court has a substantial administrative staff. Housing and accommodating the clerk of court, court administrator, and staff is a major part of courthouse design and construction. Key administrative staff members may need access to components of the court's courtroom technology and may require transcribing digital audio and video from the courtrooms. Increasingly, federal district courts have courtroom audio streaming over the court LAN for internal monitoring, or loudspeakers in various offices so that staff can monitor courtroom proceedings.

Customarily, each judge will have an office, or "chambers," in the courthouse. Besides needing the usual electrical and network connections, judges may require installation of video transmission/conferencing or other technology in chambers. Typically, this can be accomplished in the judicial conference room, which is a secure and fully operational room for all officers, and is a part of the judge's chambers.

Jury assembly rooms provide an initial location for potential jurors to wait until they are called for jury service. Courts are more often being asked to provide Internet access to those waiting elsewhere in the courthouse for potential jury service (jury assembly room) and/or for counsel in the courtroom and any surrounding conference room spaces. Because court technical staff is especially concerned with the security of their networks, they may require separate wired or wireless networks for this purpose even though security technology might be sufficient to supply these capabilities from a single network.



A floor layout illustrating common public and private courthouse rooms and spaces.

JUSTICE PARTNER FACILITIES

Courthouses are the primary focus of this guide; however, there are many partner facilities that support the judicial process and may need to be connected to the courthouse via AV/IT systems. Governmental facilities include pre-trial adult and juvenile detention centers, offices for the court clerk, prosecuting attorney, public defender, law enforcement, probation, parole and pretrial services, health and social service agencies, and other providers of alternative services. Videoconferencing connections may also be available to private attorneys, expert witnesses and translation providers working out of their own offices or through conferencing centers. Connections may also be required to hospitals, mental health facilities, and immigration and border patrol facilities. All of these locations are typically called "justice partner facilities." Some will be located in buildings other than the courthouse; some will be housed in the courthouse.

Videoconferencing has been especially important for remote first appearances and arraignments in criminal cases, permitting judges to appear remotely in detention facilities – while defendants simultaneously appear remotely in court – both by videoconferencing or a direct two-way connection. Expert witnesses from across the country, who could not travel, may appear by videoconference. Judges sitting in a state or provincial capital may preside over proceedings in a remote and isolated location by videoconference. The following paragraphs outline issues related to key justice partners. (For more information, download *Gateways to Justice: Design and operational guidelines for remote participation in court proceedings* by Emma Rowden.)

www.uws.edu.au/__data/assets/pdf_file/0019/471223/Gateways_to_Justice_Guidelines.pdf

PRE-TRIAL DETENTION CENTERS AND (POST-TRIAL) CORRECTIONAL FACILITIES

A detention center is a facility where adult or juvenile criminal defendants are initially brought for a short period of time. They are housed here while waiting for release or to be transferred to a different facility. Historically, detention facilities have been located adjacent to the criminal courts in such noted structures as the Doge's Palace in Venice, Italy, or the Alleghany County Courthouse in Pittsburgh, Pennsylvania. However, given increases in size, as well as cost of land and construction, many detention facilities are located more remotely in outlying areas of the county or other facilities around the state.

The quality of the space used in the detention facility for remote first appearances can affect the outcome of the proceedings. In order to provide for remote arraignments, courts may require that new courthouses include specially designed rooms with videoconference equipment (refer to the chapter on courtroom technologies for more information).

Detention facilities may utilize these rooms for remote visitation and interviews of inmates by justices and social service agencies. In addition, these rooms are referred to as "remote arraignment rooms." Social service personnel may also need to testify remotely from the detention facility as expert witnesses.

Correctional facilities are used for people who have been convicted and frequently remain for a long period of time serving a sentence. Prisoners in correctional facilities may need to testify remotely by videoconference as parties or witnesses in their own post-conviction proceedings or as witnesses in other cases.

A criminal defendant has a right after arrest to be advised by a judge or magistrate of the offense that he or she is charged with and the conditions, if any, for pretrial release. This is customarily called a "first appearance." Accordingly, as first appearances must be held quickly, and because transporting prisoners is difficult and expensive, many courts conduct at least first appearances by videoconference.

Buzz Westfall Justice Center, St. Louis County, Missouri.
A bridge ties the detention center to the courthouse.
Photo courtesy of Timothy Hursley

Courtroom Technologies

Law and local court and legal culture can have a huge influence on which technologies may be desirable in a given courtroom and how that technology will be used. Planning for potential courtroom technologies is critical for successful project delivery. Please refer to the chapter on needs assessment. For example, in some courtrooms lawyers present their cases from a central podium or lectern; in other courtrooms they do so from counsel tables. The lawyers may personally use evidence presentation technology or their staff assistants or vendor-employed staff may do so, perhaps from a different location in the courtroom.

Designers should balance the most technologically efficient solution with compliance with law and legal culture in each given jurisdiction. Also, some courtrooms are designed to host events, such as citizenship ceremonies and city or county government meetings, and therefore may have special technology needs. Some courtrooms may also be used for city or county government meetings. Below is a brief discussion of the technologies that might be used in a modern American trial courtroom.

DATA ACCESS

Most courtrooms have multiple computers for members of the court staff, including, at a minimum, the judge, courtroom clerk, and reporter. They require network connectivity to access court documents and a case management system. Data access is a normal minimum requirement in the courtroom. Accordingly, Category 5e and Category 6 network cabling for the bench and court staff millwork is essential.

AUDIO

The courtroom audio system is the most fundamental form of courtroom technology. In addition to providing sound reinforcement so that people in the courtroom can hear the participants, the audio system is critical to support other important courtroom technologies that may include court record, remote appearances, interpretation, and assistive listening technology. Good courtroom audio requires coordination between the architect and AV designers as well as attention to:

- Courtroom shape and size
- Surface finishes
- Ceiling height
- Furniture
- Millwork
- Casework

A basic audio system is likely to include components such as several types of microphones, audio processors, and loudspeaker placement considerations that are described below.

Microphones

A microphone is one of the most critical pieces of technology. It is central to allowing the other people in the courtroom to hear each participant's words. Microphones should have good sensitivity and should be able to be adjusted so that the speaker is not required to speak close to the microphone head. They must also be controlled, generally from the bench or clerk station (via a touchpanel), so that only the desired one is "on" at any given time – and, if inappropriate testimony is being given, the judge must be able to immediately switch them off.

Sidebar Microphones

These should be a very sensitive omni-directional boundary-type microphone. This is critical because it provides audio pick-up of bench conferences and allows the court reporter or the audio recorder to capture a record of the conversation at the bench. The output of this microphone should only be available to the court reporter and/or an electronic audio recording device. It should never be sent to the public address sound reinforcement system.

Wireless Microphones

Although wireless microphones can be effective in the courtroom environment, it is suggested that their use be constrained. Here are two good reasons: The lack of dedicated staff to maintain them (e.g., replacing batteries and trying to find the portable transmitter body packs), and the tendency of counsel to have private conversations that are unknowingly relayed through the courtroom loudspeakers. Many courts do not allow the use of RF-type wireless microphones as their signals may be received outside of the courtroom.

Audio Echo Cancellation (AEC) Devices and Microphone Isolation

It is important to use these technologies to ensure a quality audio experience, particularly as the use of remote technology for videoconferencing and remote arraignment grows.

The Loudspeaker System

The loudspeaker system is used for sound reinforcement in the courtroom, and is the only system that ensures that the spectators and others will be able to hear the proceedings and any audio elements of the evidence presentations. Signal amplification from audio amplifiers is required to feed the loudspeakers. The capability of the amplifier should be governed by how the loudspeakers are configured and connected.

A ceiling-mounted loudspeaker installed during construction.

A group of 10 wireless microphone receivers in an AV rack.

Gallery Loudspeakers

Gallery loudspeakers are normally ceiling-mounted and provide coverage of the spectator area. During a sidebar conference, white noise should be sent to these loudspeakers to mask the sounds from the conference.

The Jury Box

This area of the courtroom is traditionally covered by ceiling-mounted loudspeakers, but another method is to mount loudspeakers on the rails of the jury box. During a sidebar conference, white noise should be sent to these loudspeakers to prevent jurors from hearing the conversation.

Assistive Listening Systems (ALS)

These systems are used to accommodate people with hearing loss, and are required to comply with the Americans with Disabilities Act (ADA). An infrared hearing assistance system can be used to comply with the ADA. It is a standard package that includes:

- An infrared emitter panel
- A transmitter
- At least five headset receivers with rechargeable batteries
- A charger unit

Various forms of technology exist to address the needs for those with impairments to observe and participate in a trial. For the hearing impaired this includes infrared emitting devices, FM radio, or audio induction loops, as described above. These transmit a signal to various

forms of receivers to enhance the sound and can also be multi-track for transmitting translations. Many court reporters also utilize real-time translation that can be displayed on the bottom of monitors similar to closed captioning. Read these resources:

- Justice for All— Designing Accessible Courthouses, Courthouse Access Advisory Committee, U.S. Access Board.
- (http://www.access-board.gov/caac/report.htm)
- *Standards Engineering, The Journal of SES*, Nov/Dec 2010 (http://www.infocomm.org/cps/rde/xbcr/infocomm/SESNov2010.pdf)

There are many people with impairments or disabilities. It is imperative that assistive technology be considered in courtroom design. In addition to accommodating wheelchairs, including the possible use of wheelchair lifts, assistive hearing and vision devices should be carefully considered. Note that in addition to witnesses and jurors, judges, counsel, and court reporters may also have special needs.

Physical accommodations for disabled participants may also affect the technology infrastructure. Witness boxes, lecterns, jury and gallery seating, and the judge's bench may need to be specially equipped with technology that enhances the disability features.

Language Interpretation

Interpretation is an increasingly important component of the court as more languages are introduced into court proceedings. The same equipment can be used for ADA requirements as language interpretation. However, interpreter requirements need to be considered by the designer and architect.

Audio Processing Equipment

Processing equipment is mounted in an equipment rack and includes all devices that process, reproduce, and distribute audio. As a whole, these devices form the foundation of all the other systems in the courtroom. The audio processor receives the signals from the microphones and any audio playback devices, mixes them together, and routes them to the appropriate destinations. These mixers should provide:

- Programmable inputs
- Logic outputs
- A white-noise generator
- Control through a touchscreen interface
- Room equalization
- Feedback elimination to reduce audio feedback within the loudspeaker system with active filtering or other means
- Other features to adjust to changes in the room without operator assistance should also be included such as auto-mixing with gain-sharing.

State-of-the-art audio mixers allow control through the courthouse network and the Internet, eliminating in-courtroom repair calls for system adjustment.

Teleconference Systems

Teleconference systems are most effective when a telephone interface is used to connect the courtroom microphones and loudspeakers to the telephone lines. In effect, the system turns the entire courtroom into a "speakerphone."

Other elements of a courtroom audio system include:

- Connection to court record devices
- Audio feeds to remote conference devices
- Audio feeds to other locations, such as judge's chambers and overflow rooms

EVIDENCE PRESENTATION SYSTEMS

This type of system is one of the most basic forms of courtroom technology. An evidence presentation system consists of one or more sources of material and one or more displays to show the content to the courtroom. The defining element of a technology-enabled courtroom is the ability for counsel to visually display information to witnesses, the judge and, when present, jurors, and the gallery audience. Although these systems typically display documents, it can also include physical evidence and material related to pretrial and trial legal matters such as motions, opening statements, and closing arguments. Evidence presentation systems may also include audio and/or video material. Here are some common sources of material:

Evidence Cameras

A courtroom may have multiple evidence cameras. They may be located where counsel presents his or her case, at the witness stand, and/or the bench for the judge to display text materials to counsel.

Multi-Format Audio/Video Players

Although these players are slowly being replaced by use of laptops owned by counsel, many courts use multi-format audio/video players to play VCR tapes, CDs, DVDs, MP3s, and often various forms of media cards. These formats are now mostly transferred to a digital medium.

Audiotape Players

Audiotape players are largely obsolete, but some courts may need audiotape (e.g., audio cassette) players if law enforcement records intercepted conversations on tape.

Computers

Counsel-owned laptop computers are usually the source of choice for attorneys. Most courts prefer not to supply counsel with access to a court-owned computer because the court would be responsible for any computer-related difficulties as well as concern about computer viruses.

Handheld Tablets/Devices

Handheld tablet devices are computers but their small form factor makes them seem to be a different form of technology to many judges and lawyers. This is a rapidly evolving technology and new products are always being created for the marketplace. The challenge for the design team is finding a solution for connecting a wide variety of mobile devices with a range of screen resolutions. Explore the latest forms of portable computing and ensure that the courtroom technology will support them.

Annotation and Other Whiteboards

Touch-sensitive display monitors, graphical overlays, and whiteboards are frequently used in courtrooms not only as writing surfaces but also to permit lawyers to electronically display information such as documents or objects. In addition, court personnel can interact with the image by annotating the displayed image with electronic pens or fingers. Many whiteboards (which can be only an electronic capability added to large flat display panels) can be connected electronically to computers so that expert witnesses, for example, can run the computer remotely and display and annotate images. Courtrooms also often use touchscreen computer displays, especially at the witness stand, so that lawyers and/or witnesses can annotate images on the displays. Annotations may be recorded so that they become part of the court record if the judge allows it.

Other Sources

In our changing world it is impossible to predict what counsel might want to use to present information in court. As a result, most technology-enabled courtrooms strive for maximum flexibility. Digital cameras, for example, can often be connected directly to the courtroom display system. Fortunately, as long as personal computers (e.g., laptops, mobile devices) can be connected to the display system, many miscellaneous formats can be used. Various audio and/or video file types that have been placed on the computer's hard drive or a USB stick, etc., can then easily be shown and all must be considered in the future planning of courtrooms.

DISPLAYS

Visual images play an important part in courtroom presentations. In determining the number, location, size, and quality of displays to provide in the courtroom, one must take into account how they are to be used in the court proceedings. Some technology-enabled courtrooms may have either desktop-size flat panels for the judge, witness, court reporter and counsel, or one projection screen or larger flat panel that everyone views for evidence presentation (refer to Appendix A: Evidence and Videoconference Display Options, for further information on potential design options).

A courtroom with at least four small displays.
Photo courtesy of David Joseph

The judge should be able to see the same visual materials that the jurors see. Many court districts have a predefined requirement for the type of jury displays they use. If they do not have any requirements, then the designer must present options for each type of display style, and its cost/impact on the overall courtroom design.

CAPTURING COURT PROCEEDINGS

Courts make a verbatim record called "Courts of record," or transcript, of everything that happens during court proceedings. The purpose of the trial court record is for the appellant challenge review. These proceedings ordinarily include all courts of general jurisdiction (i.e., courts that try serious civil and/or criminal cases). There are different ways of making the court record:

Stenotype Machines

These machines allow for a rapid entry of shorthand writing called "stenography." The machine is used by a court reporter to create a text record of the proceedings.

Voicewriting or Stenomask Reporting

These technologies produce a digital vocal record prepared by a court reporter into an audio recorder via a mask or silencer that muffles the reporter's comments.

Digital Audio/Video Recording

Recordings can be done via a standalone recording device, or the technology can be set up to be part of the courthouse network. This permits judges to retrieve testimony in chambers or staff members to transcribe the recordings. The technology allows for audio recording, and is increasingly coupled with digital video recording. Digital recording can be paired with a court employee who prepares an index of events linked to a time stamp in the audio file for tracking key pieces of testimony on the recording.

Transcriptions Services

These services can be done remotely through connecting the court's teleconference system or through the Internet. This technology is entirely dependent on the adequacy and proper design of the courtroom audio system and any video cameras that may be used for identifying who is speaking at any one time.

APPLICATIONS OF VIDEOCONFERENCE TECHNOLOGY

Remote First Appearance and Arraignment

Arraignment occurs in criminal cases after a person is arrested. The person must be taken before a judge or magistrate to be advised of the right to counsel and any applicable conditions for release. It is an especially important stage in the criminal process, and one for which the defendant has the right to counsel.

This arraignment option is becoming more commonplace in criminal courts throughout the United States. The defendant may appear remotely from a detention facility usually located some distance from the courthouse or in another room in the same building. Design consideration should be given to the ability to provide a neutral environment remotely where defendants are located in a space that is reflective of the court's impartiality.

Courts increasingly use remote appearances by criminal defendants, counsel, interpreters, and even judges. Both audioconferencing and videoconferencing may be used but videoconferencing is growing in importance (For more information, download *Gateways to Justice: Design and operational guidelines for remote participation in court proceedings* by Emma Rowden).

www.uws.edu.au/__data/assets/pdf_file/0019/471223/Gateways_to_Justice_Guidelines.pdf

An example illustrating the video arraignment process is included in Appendix B: Needs Assessment for Remote First Appearance and Arraignment.

Remote first appearances in particular may require the exchange of documents between locations and may require judge and/or defendant to sign documents. Provisions for document review and approval should be included in these instances.

A PTZ camera mounted high on a wall.

Remote Witnesses and Parties

Remote testimony from witnesses is a developing practice in courts, especially in civil cases. Remote prosecution testimony raises significant Sixth Amendment confrontation clause issues. Sometimes, plaintiffs in civil suits may appear remotely from other nations and from prisons.

Occasionally in family law and juvenile dependency courts, sensitive witnesses, who may for example have been abused by a parent or spouse, prefer to appear remotely from within the courthouse. This is always at the discretion of the judicial officer.

Remote appearances involve fundamental legal and public policy questions with direct design consequences. This raises a big question: To what extent should a remote appearance be available to the public and if it should be available must it be available in a courtroom? Various forms of legal matters lawfully can be done in private (such as in chambers); some that can be done in private are often done in open courtrooms.

One technical issue within the courtroom is that designers should be very cautious and not assume that just because a procedure could be done via videoconference, for example, that it doesn't need to be routed to a large display.

Another issue in implementing remote witness technology is that court-based videoconferencing is migrating to a more unified communications network. However, the use of older ISDN technology is still a practice in the legal community. Connecting the two is increasingly problematic. Designers who specify IP technology should take care to ensure that adequate bandwidth, security and encryption, and quality of service are available.

Other Remote Applications

These are received by a few courts, like requests for protective orders from locations such as hospitals. Many courts permit law enforcement members to apply for remote search warrants via technology. Local practice may require the court in these cases to be able to sign a document submitted from a remote location.

LANGUAGE INTERPRETATION SUBSYSTEMS

Interpretation is a critical need in many cases, especially criminal prosecutions. This service overcomes a language barrier where a court participant cannot understand or effectively communicate in the common language used in the jurisdiction. Frequently, this service is live voice only and is done in person by a professional interpreter. However, telephone-based and two-way interpretation is now in use.

Most trials in the United States that use interpretation involve only one language. For multi-language interpretation, see the international tribunal discussion that follows. There is no question that the need for language interpretation is increasing.

TRANSLATION

Includes American Sign Language (ASL) interpretation. Interpretation is traditionally a visual service for the deaf and has been performed in person in the past. However, it can also be provided via videoconferencing.

CONTROL TECHNOLOGY

Most technology-augmented courtrooms use control panels to regulate the technology. At a minimum, this requires at least one control interface for each courtroom officer to decide who will control the courtroom technology, often a deputy clerk or similar staff member. In some cases, the judge will want to operate the equipment, and provisions should be made to all for the flexibility to decide and manage who will be responsible. At a minimum, the judge should have the ability to mute audio/video evidence and toggle on and off sidebar conversations.

Presentation lectern with monitor, small control touchpanel, evidence camera, and microphone.

Note that designers often ask whether courtroom technology can be operated by using wireless control devices. At times, this suggestion is rejected by judges or judicial conferences for two common reasons:

1. Evolving technology may well need more bandwidth than can reasonably be supplied in a wireless form.
2. Significant security concerns — even when there is no actual risk of other unauthorized persons intercepting transmitted conversations.

In new construction, it can be efficient to add low voltage connections to certain locations because so many devices will require AC power anyway.

MILLWORK

In a technology-enabled courtroom, the millwork must be considered as part of the technology infrastructure. Careful consideration and coordination needs to be planned for device and cable management that will integrate well, and be seamlessly fitted to be discrete and flexible. A judge's bench may have, for example, three display monitors, room for keyboards, and cable and power connections.

SECURITY

Courtroom technology also includes audio/video feeds to courthouse security and special controls for the judge's use in case of emergency. Although courtrooms may have multiple video cameras installed for court record or videoconferencing, security personnel prefer to use dedicated cameras and are unlikely to share them with systems intended for audiovisual use.

NEWS MEDIA ACCESS

Courts permit news media access to the courtroom when approved by the judge, either via media supplied equipment such as a pool video camera or by providing audio-video feeds to the media from locations outside the courtroom – or even outside the courthouse. Some courts will use such a media feed to provide overflow capabilities so that the public may view proceedings from another space, especially during high-profile cases. The physical connectivity that enables this is often referred to as a "press box."

The Needs Assessment Process

No construction or renovation project should proceed to the design stage until a clear understanding of exactly what is needed by the client is developed and approved. By its very nature, the needs assessment process involves education of both the planning consultant and the client. Completed properly, the process can help the clients to better understand their own needs. The process should, in fact, help them envision their short, mid-term, and long-term technological options, and the likely operational, financial, and facilities consequences of their possible decisions. This understanding grows directly out of what commonly is called "programming" in the facility planning and design context, and the AV/IT needs assessment, to be economical, should be conducted in parallel with or made part of the overall planning process. A timeline of three to six months or more is likely for a needs assessment to be completed — depending upon the scope of the project.

Because the future needs of any court space will change over time, the design team should use the opportunity to discuss long-term planning and explore many options. Every court has its own unique culture and the court's initial assessment may be based on a general understanding of what is possible or their past operations and what they may have seen elsewhere. However, just because one solution worked in, or was viewed as desirable by, a particular court doesn't mean it will meet the needs of the new project. Whatever the level of experience may be, all options should be explored thoroughly.

Aesthetics can also be an important consideration within courthouses. They must be stately and seen as embodying justice, while also being highly functional and flexible. There are differing opinions on how technology should look in the built environment. Some who value only a high aesthetic would choose to have no visible technology while others wish to either simply accept it or highlight it.

Differences in expectations must be managed early in the planning phases of court spaces, as the design decisions will greatly affect fundamental infrastructure. Often, the more hidden or integrated the technology, the more infrastructure will be needed to support it. For more information on project planning and coordination, refer to *ANSI/INFOCOMM 2M-2010 Audiovisual Systems Design and Coordination Processes*.

UNDERSTANDING THE COURT AND ITS FUNCTIONS

Since AV/IT technologies exist primarily to support court operations, it is essential that the needs assessment process begin with a review of the functions that may be impacted by technology. The needs assessment team should develop an understanding of the court's culture and practices as well as its near-term, mid-term, and long-term needs and goals. It may be necessary to research and observe various types of hearings and court sessions and to conduct wide-ranging interviews. Consider that actual practices may vary widely among members of the team, and questions on the use of spaces need to include all participants who utilize the courtroom on a daily basis.

During the exploration of the court's needs and goals, it is important for the team to challenge and voice any concerns about assumptions. The group must also consider potential solutions for the present, as well as those that are likely to exist when the technology will need to be acquired — functionality and cost can change substantially in the near term. Keeping detailed minutes of meetings can be very important given the likely absence of key members from some of the meetings, and the need to document options, analyses, and recommendations.

PREPARING A NEEDS ASSESSMENT

Preparing a needs assessment entails working with a significant number of people:

- Court planning consultant (architect or space programmer)
- Budget administrators
- Judicial officers
- Technologists
- Construction manager
- Court representatives
- Legal counsel (plaintiff and defense)
- Law enforcement officials
- Members of the public

ASSESSMENT PROCESS STEPS

Each meeting should be organized by a capable person so that the right people are at the correct meetings. To fully address the topics at each meeting, consider this process:

1. Describe the function – What does the court do now and why? What would the court ideally want or need to do in the new or renovated facility in the near-, mid-, and long-term?
2. Research – What options exist, procedurally and technologically, for this function – and what options might reasonably be anticipated in the future? For each option, what are the legal, economic, cultural, and practical requirements and implications, and to what extent are they subject to change? What operational requirements do the technologies imply?
3. Describe the technology that could or would be utilized.
4. Describe the spaces and infrastructure that will be needed for this function. Can the infrastructure and space be accommodated in the facility and does it allow for future growth?
5. Estimate the costs and savings associated with the changes – hardware, space, operations, technical support.
6. Assess the feasibility of implementation, taking into account all the information developed in steps 1 through 5. And, what technology can be implemented today that will allow for future growth, if budget restraints exist.

In addition to working with these individuals and establishing productive meetings, here are other considerations to address:

- What functions will be served by this facility?
- How much space is required to accommodate the technologies?
- Is there any cabling and power infrastructure that must be present?
- What kinds of equipment will be attached to the infrastructure?
- What ambient conditions will support the technology (temperature, lighting, and acoustics)?
- What are the operational and procedural changes that may be required?
- What training and maintenance may be necessitated by an implemented system?

THE AV/IT SYSTEM NEEDS ASSESSMENT

The AV/IT needs assessment addresses the following components and features:

- AV/IT infrastructure
- Space layouts
- Structural design
- Electrical power
- Cable raceways
- Casework design
- Millwork design
- Furniture design
- Operational protocols
- Maintenance

Judicial projects may include many types of specialized spaces. All spaces that are a part of the project should be included in the needs assessment. Here's a list of rooms that could be included in a judicial project:

- Entrance/in-processing information spaces
  - Courtrooms
  - Trial courtrooms with juries
  - Trial courtrooms without juries (bench trial-only courtrooms)
  - Appellate courtrooms
- Courtrooms with identified additional special proceedings such as arraignment courtrooms, ceremonial courtrooms, and the like.
- Other hearing rooms
- Technology rooms, equipment spaces, control spaces, etc.
- Grand jury rooms
- Attorney-client conference rooms
- Judge's chambers, including clerks' offices
- Jury assembly rooms
- Jury deliberation rooms
- Isolated witness rooms where two-way communications may take place
- Prisoner holding areas
- Self-help centers
- Conference rooms
- Training rooms
- Law library
- Court reporter or recorder offices and, where appropriate, central recording spaces
- Court security offices
- Other office areas
- Other public areas

Every project is constrained by budget, space, and other factors — and those responsible should provide decision-makers with several options: the ideal solution (what they would really like to do if they could), as well as the most likely solutions in light of constraints. Sometimes, if the ideal option is compelling enough, new funding resources can be found or money redirected. Those responsible for the needs assessment should not limit the designers by eliminating critical concepts just because they might yield potentially unfeasible design recommendations. The final design should emerge from much conversation, careful consideration, and informed evaluation (refer to Appendix C: Needs Assessment Documentation).

Design Details and Needs for Technology-Enabled Courtrooms

AV/IT equipment is often heavy or unsightly, and architectural considerations can help it to be both safe and aesthetically pleasing. Some of the following considerations are commonly included in courtrooms.

COMMON ROOM FEATURES FOR SUPPORTING AV/IT TECHNOLOGY

Walls and Other Bracing

Walls often need extra bracing or backboards behind the finished surface to help support monitors, electronic whiteboards, and other large and heavy devices. It is important that architects draw sections through these wall segments, detail the needed reinforcement, and consider the wall paneling and surface materials to match the decor.

Wall Niches

Niches may be desired for partially recessing large, flat-screen displays into a wall or concealing cameras. Deeper niches might be provided to recess an entire equipment rack into a wall, resulting in a much more aesthetically-pleasing appearance compared to having racks in the room. Recessing equipment is often a requirement to meet disabilities codes such as ADA. Care should be taken when equipment that is to be placed in these niches produce heat. Depending on the size of the niche and the heat levels produced, a passive solution such as open vents may be suitable. In other cases, a very quiet fan or even ducted air-conditioning may be needed. Niches may be designed oversized to allow for future devices of a different size to replace obsolete models.

Wall Cavities

Wall cavities differ from niches in that they are often covered with glass. Cameras are the most common candidate for cavity placement. Infrared emitters for assistive listening and language interpretation may also be candidates, though line of sight issues may prevent this. The glass helps mask any noise of a pan/tilt/zoom camera motor. The glazing needed for quality video can be clear float glass; optical quality glass is not required, and tinted glass is not suitable. It is very helpful for the cavities to be painted flat black inside to help the equipment be less visible. The amount of heat produced by equipment must be considered, particularly if the glass encloses or seals off the interior cavity space. Easy access to the equipment in the cavities is essential for equipment maintenance. Ventilation is mandatory and designers must determine whether active or passive techniques are more appropriate.

Typical wall niche to conceal a camera.

Finished Ceilings and Sensors

Several different technologies may affect the construction of finished ceilings in a courtroom or building, Recessed or built-in evidence cameras, additional infrared emitters, microphone antennas, wireless network antennas, and other devices are sometimes placed on, in, or above the ceilings.

The ceiling configuration will require a well-defined plan that coordinates among the involved disciplines, as well as various types of devices and sensors that may also be found in ceilings:

- Alarms
- Heat
- CO2
- Smoke detectors
- Occupancy sensors
- Mechanical diffusers
- Fire sprinklers
- Lighting

In the courtroom context, recessed or built-in evidence cameras, additional infrared emitters, microphone antennas, wireless network antennas, and other devices are sometimes placed on, in, or above the ceilings. To avoid conflicts with other elements, coordinate early to determine an appropriate location for each piece of equipment.

Finished Ceilings and Loudspeakers

There are a variety of audiovisual devices that may be installed in the ceiling:

- Loudspeakers
- Drop-down projection screens
- Flat panel displays
- Ceiling-mounted projectors
- Evidence cameras
- IR emitters and antennas

Multiple loudspeakers flush-mounted in finished ceilings are very common, and they may have a major effect on the ceiling. Loudspeakers can be challenging to fit in the available space above the finished ceiling, requiring considerable care and coordination. Also, ceilings and other design elements should be evaluated to avoid distracting acoustic noise and vibrations.

In the courtroom, loudspeakers are used for sound reinforcement, video- and audioconferencing, remote language interpretation, and sound playback of recorded media. Traditionally, the system is referred to colloquially as the "P.A." or public address system.

To provide appropriate sound coverage, loudspeakers must be spaced at the proper distance. *ANSI/INFOCOMM 1M-2009 Audio Coverage Uniformity in Enclosed Listener Areas* addresses the technical requirements to provide uniform audio coverage in the courtroom and all court spaces needing sound reinforcement.

An audiovisual designer may also choose a larger loudspeaker in order to improve the frequency response, as it can provide lower bass and higher treble frequencies. Generally, the greater the cubic volume of the room, the higher the sound pressure level (SPL) required at the loudspeaker to produce a reasonable level for the listener. While larger loudspeakers are not always needed for traditional speech reinforcement, it is during legal proceedings, when evidence in the form of audio recordings could require better sound. The recordings could be of any type and quality, but still need to be reproduced faithfully.

Even larger types of loudspeakers, sometimes called loudspeaker cabinets, require special structural support above the finished ceiling. They are often needed in large auditoria, which could include some jury assembly rooms and some ceremonial courtrooms.

The lighting and loudspeaker locations should be coordinated early, and the other ceiling elements can then be designed around these elements. Building codes will dictate the structural support required to meet support and seismic safety standards.

Finished Ceilings and Ceiling-Mounted Projectors, Flat Panel Displays

Recessed video projectors and flat panel displays are lowered by mechanical lifts from the ceiling. Coffered ceilings and other design elements must also be evaluated in order to ensure they do not introduce acoustic noises and vibrations when the projector or display is used.

ACOUSTICS AND SOUND REINFORCEMENT IN THE COURTROOM

Attention to acoustics issues in a courtroom is paramount to creating a functional space. Often, aesthetic values create problems for room acoustics. The room shape and geometry, materials, and adjacencies must all be evaluated during design.

Acoustic Barrier Construction and Materials

Walls, floors, ceilings, doors, and windows that are used to separate one room from another have different acoustic properties. Room acoustics can be a very complex issue, but there are three basic factors to consider:

Noise isolation is the noise that makes it through the element to the other side; a thin hollow door, for example, will allow sound to travel through it much more efficiently

than a solid wood door with gasketing. The solid door has better "sound isolation" properties. The building industry has several ways of quantifying sound attenuation and knowing what is required for different types of spaces. In fact, many agency guidelines define a narrow range that certain elements, such as doors, must perform to be acceptable for the tenant. Surfaces within the courtroom must be a balance of sound reflection and absorption materials to produce the sound balance required.

Absorption is sound energy that is absorbed either in the air or absorbed by the materials in the space. When a space has hard surfaces such as tile or glass, sound is reflected efficiently, and the room has a very active or reverberant quality to it. As absorptive elements such as cloth panels, curtains, carpeting, and even people are added to a room, the room becomes more absorptive.

When amplified sound is introduced to very reverberant environments, it can be very difficult to understand what people are saying. You might be able to hear them well, but not be able to understand what they are saying. This is referred to as a measure of speech intelligibility. The goal of an audio system designer is obtain the perfect balance between absorption and diffusion (see below). Standards such as Noise Reduction Coefficient are used to measure the amount of sound absorption required to ensure privacy and confidentiality in the courtroom.

Reflection occurs when sound energy moves away from the source. Some of the sound will be reflected off of various sources and returned into the space. Those reflections can either be in a direct fashion or diffused (scattered). In both cases, the energy remains in the space. The materials and finish will define its acoustic properties. A white oak panel wall will reflect sound from it as it arrives on the flat surface, usually in one direction. If the same materials are used to build a wall with random surface variations, or if the wall is of a tambour style, diffusion occurs. While diffusion and absorption are very different, they often work together to produce a unique sound characteristic for any given surface.

Acoustical wall panel installation, Manatee County Courthouse.

The desired overall acoustic performance of a room is critical when developing acoustic performance criteria. The importance of the acoustic properties in spaces such as courtrooms cannot be overemphasized. Only the architect, the audio designer, and sometimes an acoustician together can provide a design that enables the character of the room sound to be known before the room is constructed. Modern analysis software can provide the acoustical expectations of a space, and assist in the prediction performance as part of an iterative design process. As all of these elements will affect construction details and project cost, they must be addressed in the earliest stages of the planning process.

ROOM HEIGHT-TO-DEPTH RATIO FOR GENERAL VIEWINGS AND VIDEO PROJECTION

Room dimensions affect technology requirements. The most common room proportion issues are front video projection design and determining the acoustic performance of a room. The audiovisual designer must calculate the height of the projection screen based on the distance of the nearest and farthest viewers by using formulas, to optimize the viewability of the images.

If the calculation dictates a screen that is taller than the planned ceiling height, the designer and architect should work together to formulate alternative solutions. For example, if the room has tiered seating, the height and slope can be adjusted. In some cases, part of the ceiling at the projection screen end of the room can be raised, leaving the lower ceiling height over the audience. Another technique is to add displays such as large monitors to the far side of the projection screen, which will shorten the viewing distance for participants on the outside walls, allowing the projection screen to be smaller. The structural height ("deck-to-deck") of the building itself is affected by this need. The audiovisual designer is trained to work with the balance of the design team on this issue very early in the design process. InfoComm International has published screen size calculations and also offers design courses that address the issues mentioned above.

HORIZONTAL CABLE DISTRIBUTION IN THE COURTROOM WELL

The center of the courtroom is called the "well," and contains the majority of the audiovisual equipment. Because of its central location in the courtroom, it can be a critical area for running cable to various locations in the courtroom. One benefit of using a mini-raised floor in the "well" is gaining the flexibility for pulling and changing cables. The well also makes it possible to connect any point with any other point. This can also be important for temporary changes such as the addition of network cables or audio cables to counsel tables. In the case of new construction, the structure can be planned early on to include a raised floor in the well by depressing that area relative to the surrounding floor (a split slab). This avoids unnecessary ramps between different finished floor levels. The cost-effectiveness of an installation of a raised floor system needs to be compared with other options, primarily the use of embedded conduit and floorboxes beneath the floor (refer to the chapter on courthouse infrastructure planning).

Another issue to consider is the possibility that elements within the well will be relocated. Some courtrooms such as appellate courtrooms, may support the same types of proceedings over their useful life. The same situation could be true for small hearing rooms, with restrictive sightlines, limited open space, and a single purpose. Over the lifespan on the space, if floorboxes are strategically located and permanently connected to correctly-sized conduits, this should provide adequate infrastructure.

Raised courtroom floors are typically covered by carpet or carpet tile. It is essential that roll-type carpeting not be installed over a modular raised floor as it defeats the purpose of providing access.

SPECIAL MILLWORK

Many courtrooms include built-in work surfaces for participants in the well, including judges, witnesses, clerks, court reporters, and others. Each participant's work area may need to accommodate technology; specific needs may require custom elements. A technology-enabled courtroom will have many cables around the bench, several cable pathways, and other types of millwork. Each of these infrastructure needs will require careful coordination among the architect, electrical engineer, and audiovisual designer. Properly designed millwork hides cables while leaving room for maintenance and growth. Architects must also consider:

- Locations for cable pathways in walls and millwork
- Where grommets need to be placed so that cables can pass through finished work surfaces
- Alternative locations for fixed or moveable technology
- If cable slots can run along the back of a countertop to allow users to customize the placement of the technology

Here are some additional considerations when designing millwork:

- It is critical to consider countertop heights and depths, along with cutouts for placing technology such as monitors or computer keyboards. Front rails and monitors must be evaluated for sightline interference.
- Sightlines from the judge's bench to the rest of the courtroom must be protected.
- Instead of providing a fixed cutout for monitors in the countertop, consider a long slot so the monitors can be slid to the location that best works for viewing angles and personal preferences. This also avoids the risk of a cutout being sized for a specific model or size monitor, which is certain to change.
- Common strategies for lowering monitors, such as laying them flat and especially placing them under glass, are likely to result in reflections of ceiling lights unless specific lighting designs have been taken into consideration. The glare can make the monitors unreadable.
- The Center for Legal and Court Technology (CLCT) recommends not placing monitors under glass. Users tend to cover the monitor glass with paper and books (refer to Appendix D: The Center for Legal and Court Technology).
- The construction of a full scale mockup can be used to avoid many problems in the design of a courtroom space.

It is common to find as many as four computers, several laptops and many peripheral devices at a busy courtroom bench area. Peripherals might include:

- Printers
- Scanners, barcode readers
- Computer keyboards
- Microphones
- Video monitors, control panels
- Stenograph machines, annotation devices
- Telephones, clocks

A good bench design will take all of this technology into account. The consequences of a poor design can make the front of the courtroom appear chaotic, which can affect the appearance of impartial deliberate justice. The architect should plan generic zones in or on benches and stands where certain types of technology are placed and managed. The AV designer can assist in this effort by employing his or her creativity and planning for unknown technologies. For example, computers at the bench area are increasingly being replaced with portable tablets keyboard, video, mouse (KVM) switches, or devices that allow the CPU processor to be placed in a nearby AV/IT room. This opens up more space at the bench, lowers the risk of equipment damage, and removes the fan noise from the courtroom.

PRESENTATION LECTERNS AND CARTS

Legal counsels are becoming more reliant on technology for presenting their cases. All of their equipment may be placed on a fixed lectern or a movable cart.

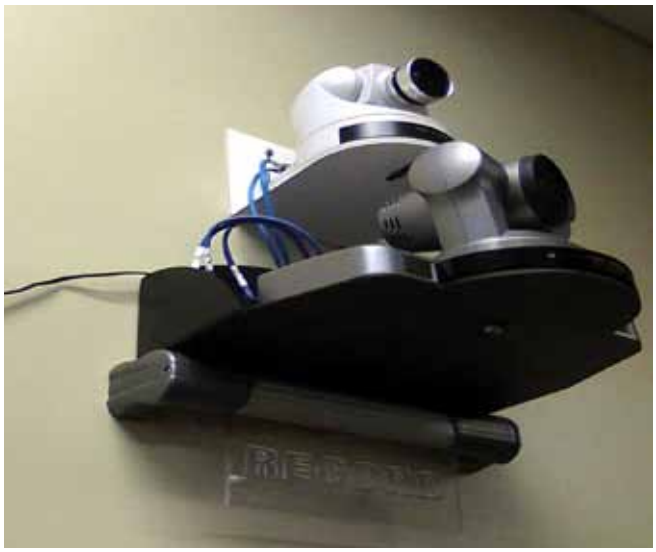
There are ready-made lecterns and evidence presentation furniture from the educational market that can be used where portable units are needed. However, they are not ideal for courtrooms where more decorum and higher finish levels are appropriate. A custom-designed lectern or podium that matches the finishes in the courtroom can cost the same as a ready-made unit. This is particularly true when multiple custom units are commissioned at the same time. In some cases, a lectern that rotates may be desirable.

Lectern-based technology can be easily upgraded or changed if enough space has been allowed for that purpose. Lecterns can incorporate one or two microphones, a reading light, a control panel, an argument timer display, a monitor that may have annotation capability, and an input for laptop presentations. Efforts to comply with ADA requirements is driving the adoption of lecterns that are usable by people with disabilities.

Because of the dimensions and layouts of some courtrooms, a fixed lectern may strike counsel as being too far away from the jury box for opening statements and closing arguments. In such courtrooms, counsel may ask the judge to have the court supply a small temporary lectern in front of the jury box or a fully portable one. Audiovisual designers should consider providing power and audiovisual connections near the front center of the jury box if conditions like those described above exist.

SMART TABLES

The term “smart table” is sometimes used to describe counsel tables fitted with a variety of technologies: microphones, data connections for laptops, video monitors with or without annotation capabilities, and real-time transcription connections. Many courtrooms have technologies that allow attorneys to deliver an audio or video presentation directly from their counsel table with their laptop or tablet. The tables should be designed to provide connection points that are accessible from the top of the table and can be hidden when they’re not being used. Unlike lecterns, there are few ready-made tables on the market that are configured for these needs, or are acceptable to courtroom aesthetics.



CAMERAS IN THE COURTROOM

This section describes some common applications of video cameras in judicial spaces, such as videoconferencing and security feeds. It is important to recognize that before any design begins, the application for each camera will define the type of camera, and where the camera(s) will be located.

For many people, the cameras connote studio cameras used for live television broadcasts or media events. They may also bring to mind photographic (still) cameras. These types of camera and their uses in judicial spaces are beyond the scope of this guide.

There are two types of cameras used in judicial spaces:

- Fixed cameras: These are installed to always show only one specific area. They are typically fixed in place on a single angle and will not need to move.
- Pan/Tilt/Zoom (PTZ) cameras: These are different from fixed cameras in that they can swivel left to right (pan), rotate up and down (tilt), and zoom in and out to capture a variety of situations.

And there are several common applications of video cameras:

- Evidence cameras are fixed above a surface to show hardcopy items or to illustrate an object.
- Security cameras are used to monitor a specific location to track or protect assets.
- News media feed cameras are used to show proceedings in the courtroom to journalists. These may or may not include a view of the jury.
- Overflow cameras are used to show proceedings to viewers in another room or remote location. The view may or may not include a view of the jury.
- Recording cameras are used for official court record.
- Private feeds come from cameras that show holding cells, isolated witnesses, or juveniles.
- Videoconferencing cameras allow for two or more groups of people in different locations to communicate and/or conduct business matters (refer to Appendix E: Common Courtroom Technologies in International Tribunals, for more information).

Security cameras, news feed cameras, overflow cameras, and cameras used for establishing views of the courtroom for video recordkeeping should be placed in hidden cavities with adequate space called “niches.” This is recommended for several reasons. The presence of exposed cameras — even ubiquitous security cameras — can intimidate people. Courtrooms and other judicial spaces can be very tense environments and people don’t always enjoy the feeling of being watched. If a camera is placed inside a niche or cavity, it improves the aesthetics of the space.

A security camera hidden in a wall niche.

Camera Placement

Camera placement and design of remote proceeding locations in courthouses are critical to maintain equal access to fairness and justice. The interpretation of the visual representation for both court personnel and remote participants is affected by camera locations within each space, and the primary outcome of the design is to impart neutrality on the proceedings and replicate a traditional face-to-face meeting with eye-to-eye contact.

When a camera is placed high in reference to the person being viewed, a feeling of inferiority is generated, as the audience on the far end sees the person being looked down upon. In contrast, when a camera is placed below

a person, the person appears larger and may come across as more dominating or commanding because the audience on the far end is looking up at him or her. The influence of camera placement affects the behavior and reactions for the people on both ends. This is why in many cases a remote first appearance, for example, can be achieved with a portable monitor and camera placed directly in front of the judge at eye level.

Many times, the camera(s) used for two-way applications in courtrooms are placed in niches or cavities. Typically, there are three to five cameras provided in the courtroom to capture the judge, witnesses, the lectern, and counsel tables. The complementary display that is showing the view from the other end should not be placed where the cameras are located because the eye-to-eye contact is lost.

Two-Way Systems

A two-way system is used so that one party in one location can see and hear another party in another location. An example of a two-way system in court applications could be remote testimony (e.g., the jury is viewing a report by a subject matter expert not in the building), or an isolated witness (e.g., a female victim who is giving testimony from a safe location to protect her from her alleged attacker who is in the courtroom).

To achieve an acceptable overall two-way experience, many courts have portable two-way systems, at least for the courtroom end. This way the mobile monitors and cameras can be placed near, and focused specifically on, the parties participating in the interaction. Additionally, given the portability of the equipment, it can be moved throughout the courthouse to serve multiple functions, including training and administrative meetings.

Telepresence

Telepresence is a term used for an enhanced version of videoconferencing and a two-way distant communication. The principle behind telepresence is to duplicate real-life experience via the design of the technology.

An important requirement of telepresence is the sense that the remote participants are actually with you in your room and that they appear life-size. This can be achieved by placing the camera as near to the display and at eye height as possible. When the equipment is set up this way, it creates a sense of eye-to-eye contact with the remote party.

Modern effort at telepresence in a conference room.

Providing Effective Lighting

It is important to provide effective lighting in all judicial spaces using AV/IT technologies. Careful consideration must be given to lighting in projects that are implementing sustainability initiatives, such as LEED or California Green. Often, natural daylighting is part of the courtroom design and the impact of this on light levels for cameras needs to be carefully reviewed. For example, lighting choices play a role in determining how participants appear in remote video proceedings. Likewise, the balance of natural and artificial light affects the viewability of displays.

Each participant should have his or her face lighted to appear as natural as possible. The face should not appear washed-out or over-exposed. Wall colors should be neutral and reflect the look and feel of the courtroom

or other space, especially in remote facilities where the architect and designers will hopefully have more flexibility with the room design.

In terms of wall surfaces:

- Use mid-to-light shades of gray or blue or similar color choices. This may be possible in the remote rooms where there is more control over the surroundings, but in a courtroom, the walls can be very dark or brown in nature.
- Reddish-colored wood should be avoided; lighter-colored wood is a better choice.
- None of the finishes should be reflective or glossy because lighting reflections can be a problem.
- At the very least, ensure that the walls do not have a slotted or rib-like design. These will cause the cameras to produce distorted images.

Here is more guidance on lighting:

- Measurements are typically made using foot-candles (fc) or lux as the unit of measure in front of the face or on walls.
- All measurements for subject are made with the light meter facing toward the camera.
- Each possible camera scene should be lit according to project specifications and technical legislative requirements, because the use of cameras in the courtroom and other areas is becoming commonplace.
- During the design of any room where cameras will be needed, avoid using any type of light dimming system.
- Lighting levels in the room should not be radically different between the subject and the background. For example, the subject should not be placed in front of an uncovered exterior window — especially during daylight hours. The camera imager will make the subject appear very dark and details in the face will be lost.
- A general recommendation is to use no greater than a 2:1 (subject to background) ratio. That is, if the light on the person is 80fc, the background should be no less than 40fc. Staying within a reasonable range and not exceeding a 1:1 ratio will yield good results.

Lighting System Color Temperature

Color temperature is a measurement of the visible light spectrum. Most people are familiar with the various types of light bulbs; warm white, cool white, daylight, etc. These are common terms for different color temperatures. These temperatures are measured in Kelvin (K). The incandescent lamp emits in the range of 2,900K, the “warm white” is about 3,000K, cool white is about 4,100K, and daylight is around 5,000K. The temperature of daylight varies quite a bit over the course of the day.

Cameras used for courtroom applications are calibrated to work best in the 3,500K range. This is why daylight must be blocked out of the room as much as possible in order to ensure color temperature stability.

Establishing 75 vertical foot-candles at each target, keeping the background lighting to one half of that and providing constant 3,500K lighting consistently throughout the space will go considerably far in producing good images for the cameras.

Architectural Design to Support Technology Infrastructure

This chapter provides an overview of the design process and touches on issues related to site selection and planning. Each government entity and jurisdiction may also have specific design, construction, and technology guidelines and requirements. In terms of planning and coordination, judicial spaces are complex building types that place a number of special demands on the design team.

Lorain County Justice Center, Elyria, Ohio
Photo courtesy of David Joseph

COURTHOUSE FEATURES AND FUNCTIONS

When considering courthouse design from a technology perspective, it is helpful to understand some of the unique functions and features of a courthouse:

The Courtroom

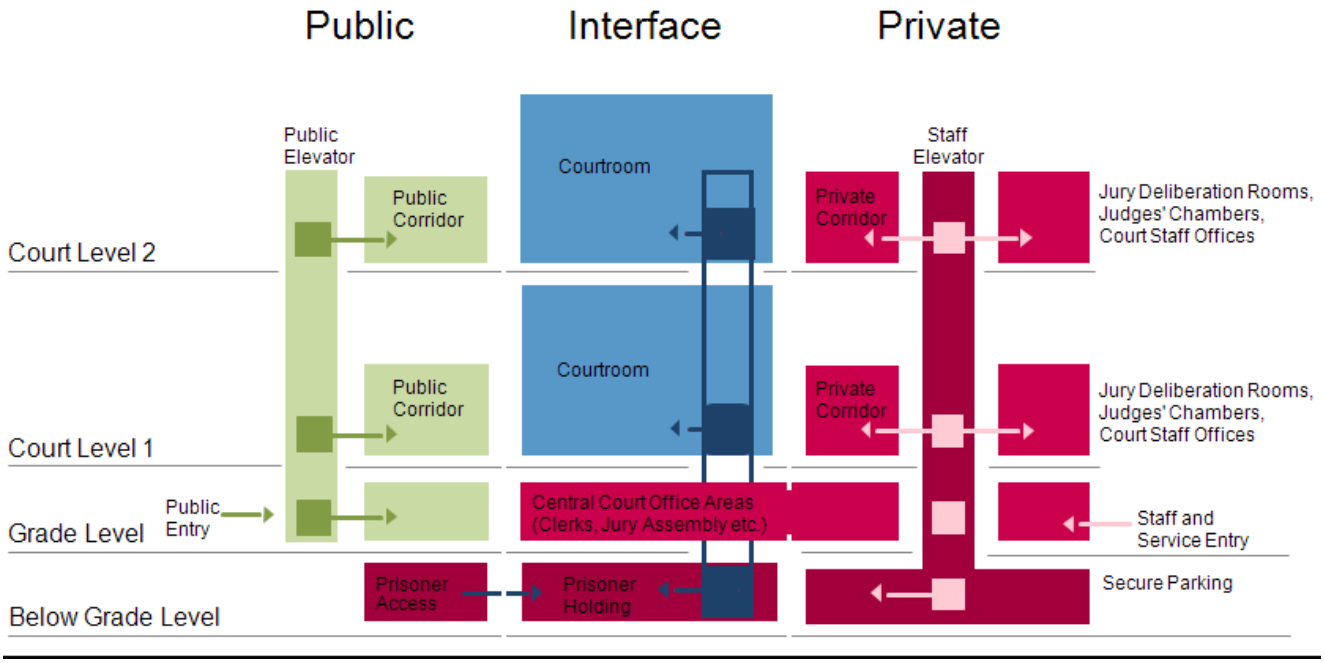
Ths courtroom is a single point where all parties to litigation come together. It must provide a polite and respectable environment that reinforces the judicial process. It is safe and secure, allows for good sightlines, acoustics, and lighting. It must support necessary building systems and technology. The need for a large, column-free space, as well as the appropriate height and proportions, make the courtroom the basic building block of the courthouse.

The Court Suite

Each courtroom is surrounded by a number of support spaces including judicial chambers, jury deliberation rooms, holding cells for in-custody defendants, and public waiting rooms. There are also a number of ancillary spaces such as attorney-client conference rooms, soundlock vestibules, closets for evidence storage, and court technology spaces. Together, these spaces are known as a “court suite” or “court set” (though the latter term may apply to pairs of courtrooms that share some of the ancillary spaces such as holding cells and perhaps jury deliberation rooms).

Safety and Security

The public, judges and their staff, and in-custody defendants may use separate circulation paths to meet together in the courtroom. This requirement necessitates great redundancy of building features, and complicates building planning, especially for large courthouses with multiple floors. To accommodate all the court suites, they almost always need to be "stacked" on different floors along with stairs, elevators, electrical rooms, and data risers.



Block diagram for planning vertical zoning or 'stacked' room layouts.

Long-Term Flexibility

A courthouse is expected to operate effectively for many decades and must accommodate future operational and technology changes such as hardware and cabling standards. In addition, budget restrictions may limit the amount and types of technology that can be installed initially so the facility must be constructed to support upgrades in the future.

Wayfinding

A typical person spends very little time in courthouses. Visits may be limited to payment of a traffic fine, jury duty, or some form of litigation. Architects incorporate information and wayfinding signage in complex courthouses to make it easier for visitors to find their destination. Digital displays showing the calendar of cases to be heard are often located in the lobby and outside each courtroom. More traditional forms of signage are also very common.

Ralph E. Arnason Courthouse, Pittsburg, California
Wayfinding signage in the lobby.
Photo courtesy of David Wakely

Natural Light

Natural light is often a desirable feature in courtrooms and other public spaces. An AV/IT consultant needs to understand how natural light is incorporated in the courtrooms and plan accordingly, which may require room-darkening window treatment to ensure that image displays are visible.

Accessibility

Most courthouses must be fully accessible to the disabled in order to comply with the ADA. Best practices for integrating accessibility into courthouses are available at: http://www.access-board.gov.

DESIGN PROCESS

The building design process is composed of distinct phases, each of which requires particular decisions about AV/IT systems. Given the complexity of courthouse design, it is essential that the owner representatives, the architectural design team, and the AV/IT design professionals be involved in each phase. Only by active engagement can they assure systems are appropriate for their intended function and are fully integrated into the building design.

The most critical decisions are made early in the planning process. That is when basic directions are taken that will affect building technology and infrastructure and either allow or constrain future change. The following presents a brief description of what happens in each phase. Note that this description applies directly to the "traditional" method of design-bid-build. Other building procurement methods, such as design-build, will proceed in a somewhat different fashion, but the decisions and concerns about AV/IT design and installation remain essentially the same as the project progresses from planning, through design, and into construction and operations. For a detailed description of this process, see InfoComm's publication, *AV Systems Design Implementation Handbook*.

Pre-Design

Before design can commence, many issues need to be explored and decisions need to be taken. As previously discussed, the needs assessment, together with the design program, should be developed during the pre-design phase. It provides the information needed to start the design process. Here, space programmers and technologists should be involved to assist the architect. The site should also be selected so the design team is ready to proceed with the design.

Schematic Design

This is the first phase of design and the beginning of the development of building concepts. The size, spatial relationships, and site have already been established in the pre-design. In this phase, it is important to determine technology locations, the size of dedicated equipment rooms, and the means of accommodating "vertical" and "horizontal" cable pathways. The impact of technology on heating, cooling, lighting, and acoustics must also be taken into account.

Design Development

The design development phase establishes the design of all building elements, including room finishes and aesthetics, together with complete diagrammatic layouts of the building systems. Ideally, the design team will construct a full-size courtroom mock-up and confirm with the court the proposed configuration, the design of all built-in fixtures, and the location of all technology.

Construction Documents

The documentation that will be used for bidding and construction is completed in this phase. This consists of drawings, specifications, and other written contractual elements. Audiovisual systems and other technology must be coordinated with all related aspects of the project to assure that they will function as intended and are supported by appropriate HVAC and electrical systems. It is critical that the design provide for future technology changes, and it is in this phase when that can be confirmed. Use of Building Information Modeling (BIM) or Smart Building principles may be very helpful. For more information on BIM, visit www.infocomm.org/industryinnovations.

Bidding

The design team assists the owner in obtaining competitive bids or proposals, answering questions, and confirming that bids are fully responsive to the requirements of the contract documents. Any proposed changes that affect AV/IT infrastructure or systems must be reviewed and approved by the design and technology team.

Construction Administration

The design team reviews contractor submittals including vendor qualifications, installation drawings, and proposed manufacturer specifications; responds to requests for information, conducts onsite visits to review the status of installation, and reviews the results of various tests. After the installation is complete the client should be provided with complete documentation including as-built documentation, software code, graphic and user operations and equipment manuals, and warranty information.

Post-Construction Services

Typically optional, post-construction services can include maintenance agreements, first-use monitoring and support, training, ongoing technology management services, and even full technology management outsourcing. It is desirable to conduct a post-occupancy evaluation after approximately six months to confirm that all systems and technology are operating as designed prior to expiration of warranties as well as to ascertain if any modifications are required.

LOCATION AND SITE SELECTION

Courthouses and related justice agencies are commonly located within downtown civic districts close to government centers and attorney offices, or campuses away from the city. They may be placed in proximity to pre-trial detention centers to facilitate the safe and secure transfer of in-custody defendants. The choice of building site should take into account its impact on technology.

The cost of the real estate to build a courthouse is always a factor and while the courthouse may need to be "downtown," the detention facility may not. The size and the shape of the site will affect the building's footprint and layout. This will drive where technology is located and how infrastructure is accommodated. Courthouse location can also have sound consequences. Sites should be avoided that are subject to very high levels of sound or vibration – such as below airport runway approaches or near heavily used rail lines. Buildings with extensive audiovisual systems should not be built near television or radio transmission towers due to possible interference with courthouse technology.

Carl B. Stokes Federal Courthouse in Cleveland, Ohio.

Courthouse Infrastructure Planning

Within the building and building technology industries, the word “infrastructure” means different things to different people. The lack of clarity has proven to be a problem in the growing world of facility technology integration. Audiovisual and IT functions used to be very separate and developed parallel cultures and terminology. However, these two technology disciplines are now crossing over. InfoComm International has used the term “convergence” to describe how the audiovisual and IT industries have merged.

The term “infrastructure” is used differently within every professional culture or trade involved in building design and construction, as if there were agreement on the definition. There isn’t — and the assumption of a shared understanding has led to errors, extra cost, delays, and client disappointment. This is why agreeing on a definition early in the stages of the project is so important.

For the purpose of this guide, “infrastructure” is defined as:

> *Those permanent elements of a building or facility that are provided prior to occupancy exclusively to incorporate, simplify and/or enhance installation and removal/updating of various technologies that are installed in the building or facility either during construction or after occupancy.*

Here are some additional considerations when discussing infrastructure:

- It is installed primarily by a general contractor, electrician, carpenter, or millwork fabricator.
- It is typically owned by the building owner or landlord. Tenants or end users do not get involved in infrastructure.
- It is specific to the physical space where it was originally installed. When a tenant moves out of a facility, the infrastructure typically remains.
- It is more difficult to add infrastructure after construction is completed. The cost to add infrastructure during design or construction might be less in comparison to adding it after construction has been completed.
- Adequate and properly designed infrastructure would eliminate the need to perform general construction renovations when technology is upgraded.
- When tenants install furniture, fixtures, and equipment, they use the infrastructure that has been provided.

IMPORTANT ROLES

It is also helpful to understand how other key players in the design and construction phases think about infrastructure:

Architects

Generally, architects think of infrastructure as permanent building components that are addressed during design. These would include electrical and telecommunications "closets," space allotment, and planning for stacking these type of rooms vertically in a multi-story building.

Audiovisual Professionals

The audiovisual community tends to define infrastructure as electrical closets and rooms, empty conduit and raceway for low voltage cables, adequate-sized J-boxes and floorboxes, as well as both standard power and specialized power at carefully designed locations. Infrastructure would also include adequate heating and cooling and specific designs for wall shapes, wall construction, placements, materials, and acoustic requirements. Because AV professionals do not expect to see pre-installed cable when they arrive on site, they do not tend to think of cabling as an "infrastructure," with the exception of structured cabling for networks.

The architect plays a key role in identifying both "vertical" and "horizontal" pathways for various technology interconnection elements, some of which would qualify as infrastructure. Architects coordinate design professionals — including the electrical and mechanical engineers.

Electrical Engineers

Electrical engineers typically view electrical infrastructure as the permanent "built-in" wires and their pathways within a building (i.e., any usage requiring more than 1000 volts) for many applications:

- Elevators
- HVAC
- Access control systems
- Empty wire trays
- Future cable pathways

About the term "low-voltage" wiring: In the U.S. building construction industry, "low-voltage" often implies internal building wiring under about 110 volts. This is a very common power outlet voltage. The highest voltage used in audio and video equipment external to the power supplies in the equipment is 70 volts. This voltage is used in distributed audio systems. Due to the lower voltage, this kind of cabling is frequently installed by specialty IT, telecommunications and AV installers, and not necessarily by the project's "electrician."

IT Professionals

There can be several IT roles in a judicial project. Two common roles are the Registered Communication Distribution Designer (RCDD®) and IT consultants. An RCDD is a design professional who focuses on the design and specification of the cabling and core/shell voice and data systems. These systems are sometimes referred to as the network "backbone." They may also be referred to as the "horizontal" cabling (i.e., cabling for the floors of buildings) and "vertical" cabling (i.e., cabling that runs between floors).

An IT consultant may be more concerned with active components in the data network such as data servers, network switches, routers, and PCs. This person may also be involved with system design at some point. Therefore, the IT professional tends to think of the passive cabling as infrastructure.

Because of their specific areas of responsibilities, each may have its own definition of infrastructure. In addition, there may be some overlap of responsibilities. As always, confirm the exact roles of all IT professionals in the project.

INFRASTRUCTURE CONSIDERATIONS

The IT industry has specific, standardized language for its infrastructure in the built environment. Much of this is based on the technical limitations of data signals, cabling, physical parameters, and materials that are fire-rated.

The Demarcation or Main Points of Entry (MPOE) Room

This location is where cables from a telecommunications service provider enter the building and are terminated. This critical physical junction is the boundary between any cabling inside the building and the cabling from the provider. These rooms should be located along the perimeter of the building, and oftentimes in the basement to receive cables entering below grade (below ground level). There should be an obvious, secured termination location between where the outside vendor and the internal network infrastructure hands off to the building responsibility.

A typical demarcation room. The optical fiber and cables coming out of the floor conduits are connected outside of the building.

In terms of disaster preparedness, protection from flooding is a critical design consideration because there is so much technology installed in these rooms. Any damage sustained in these rooms can disable or destroy critical building systems.

CABLE LENGTH LIMITATIONS

Voice and Data Equipment

Currently, Ethernet cables cannot be longer than 330 feet (100 m) without introduction of an active (powered) data switch, repeater, or some other active sender or amplifier. The overall configuration of the floor plan will determine the minimum spacing of these active technology distribution facilities. It is common to locate these types of rooms on major cable raceway pathways such as immediately adjacent to a major corridor. Engineers will look for centrally located rooms that allow a "hub and spoke" design to avoid the 330 feet (100 m) limitation as much as possible. The footprint of the building must take these relationships and distances into account. It is important to avoid locating these spaces near sources of potential water overflow such as bathrooms or maintenance/plumbing areas.

Audio Equipment

Ordinarily, cable distance is not a major factor when dealing with audio equipment that is not integrated into a data network. Some types of audio signals are more tolerant of cable length than are high bandwidth data and video. Distributed audio systems such as 70-volt loudspeaker systems can be installed where the loudspeakers are several hundred feet away from their originating source amplifier. However, low-voltage signals like microphones need to be within a reasonable distance. Many designers use the same 330 feet (100 m) distance limit rule for phantom powered microphones. These microphones require power through the cable they are connected to.

Where possible, the audio system equipment should be close to but not inside the room(s) it serves. This can provide better signal quality, easier troubleshooting, and lower cost.

Video Equipment

Video signals, particularly digital video signals, have cable length constraints. The maximum distance that DVI and HDMI can be run in their native format is about 50 feet (15 m). Any sufficiently sophisticated room fitted with audiovisual technologies likely will incorporate digital video.

An HDMI connector; a female DVI connector.

When a video signal must be sent over longer distances, such as when the main equipment rack is farther from the room it serves, special extenders must be employed. Twisted pair cable, coaxial cable, and optical fiber are used to extend the digital video with additional equipment along the cable path. This can add expense, so these options should be carefully considered.

A number of professional video manufacturers have developed extension systems for DVI and HDMI signals, as well. These function by adding two interfaces between the video source and the destination. The source such as a DVD player is connected to the transmitter interface with a standard HDMI or DVI cable within a short distance of 3.3 feet (1 m) or less. The transmitter converts the digital video signal into a transport format. The most common cable types for extended video signals are one or two Category 5e or 6 cables, although there are fiber optic, coaxial cable, and wireless types of extenders available, as well. HDBase-T is a common example of this technology. With HDBase-T, the destination device has a matching receiver interface that converts the signal back to HDMI or DVI for connection to the monitor. These extended systems currently have a limit of 330 feet (100 m) for a 1080p resolution. However, this distance requires shielded Category 6 cable. Currently, this cable is larger in diameter, more costly than Category 5e cables, and may require larger pathways. Fiber has a much greater distance capacity but the transmitters and receivers can be costly. However, the benefits are virtually unlimited bandwidth, and fiber-optic cabling "futureproofs" the building's communication needs.

The broadcasting industry uses a different high-definition format and connection standard: HD-SDI (High Definition Serial Digital Interface). This is a coax-based transport system that has significant intrinsic distribution advantages over the HDMI format. This should particularly be considered when reviewing the requirements for the news media feed in any courthouse.

CABLING DISTRIBUTION

Vertical Cabling Distribution

One of the key requirements of technology raceways in a building is the so called "vertical riser." This is the name given to conduit and/or pathways that allow large quantities of cable or fiber to extend vertically in a building between floors. These pathways often start at the demarcation room and move up from there. Electrical engineers and low-voltage specialists express a very strong preference for having demarcation rooms "stacked" or located above each other on each floor to make installation of the cable and fiber simpler and save on material costs. It also helps keep certain types of cables to the 330 feet (100 m) length limitation.

Horizontal and Vertical Cable Tray and Conduit

Perhaps the most important way to provide for future technology modifications is to have adequate cable management systems or raceways in the right places. As there is so much low voltage technology and only limited places where raceway can be installed, it is important that there be coordination during the design phase.

Post-construction labor costs to install new raceways, conduits, and to prevent heat buildup from wires inside the conduit may make later improvements financially impossible. The National Electrical Code (NEC) allows for a certain percentage of a conduit to be filled with cable. This is primarily to allow some cables to be removed and others installed without them jamming inside the conduit.

The horizontal infrastructure distributes cables and fiber to all points on a given building floor. The vertical risers are tied to the data room(s), and act as a junction to the horizontal riser. The method of the distribution is customized to the nature of the building construction. For example, in long hallways with lay-in ceiling tile, an open and accessible cable tray is the preferred method to hold the cable. The trays are typically about 12 inches (300 mm) to 18 inches (460 mm) wide and installed in accessible locations just above the lay-in tile. Open tray is easy to access for changing technology and can help organize different building system cables. For example, data cable could be on the left side of the tray, alarm cable on the right side, and audiovisual cable can be run down the middle.

With hard or inaccessible ceilings, the engineer may call for closed conduit to make the bridge between two open cable trays that are on either end of the solid ceiling. The capacity of the sealed pathway should exceed project requirements at either end to allow future flexibility.

Surface-mounted raceway is mounted to the outside of a wall in hidden locations and on top of walls where installation can be difficult, such as block or concrete walls. They should match the decor, color, and be coordinated with the architect to fit the design intent.

The advantage of raised floor systems is that the open space below the floor surface becomes the raceway. This offers the ultimate flexibility to add and move cables as needed. Raised access floors increase initial project costs but the benefit should be weighed against the long-term implementation costs.

Floor Cell-Duct

Cell-duct is commonly found in many courthouses. Although there are different varieties of cell-duct, their common feature is that they are rectangular metal raceways cast into the floor slab. Such raceways have access points and/or removable lids that allow for cable changes.

However, it is not recommended for future installations. The critical limitations of this system are that at the connection of the ducts and the floor junction boxes the shallow cavity only supports minimal voice, data, and power outlets. Also, audiovisual cables and connectors are too large for most types of cell-duct floorboxes. In the past, a common method for the horizontal distribution of power and telephone lines was the cell-duct.

Multi-Gang Junction Boxes

There are many types of junction boxes that are made of multi-purpose steel or plastic devices intended to accept electrical devices and interconnected wiring. The most common types are standardized boxes that come in various widths; 1-gang, 2-gang, 3-gang, etc. A single light switch on a wall would generally be placed in a 1-gang junction box. Data professionals primarily use 1-gang boxes and can terminate up to four cables in a single gang (1-gang) box. In a finished wall or ceiling, conduit cannot be left open. It must be attached to a box to allow the cables to transition to the next connection point.

Audiovisual professionals, however, prefer larger boxes as the connectors for audio and video signals tend to be larger than those for voice and data. Deeper boxes such as 1-1/2 inches (38 mm) allow for working room in the box and for adequate cable bends while still being able to close lids easily.

Poke-Through Floor Devices

A “poke-through” device is an electrical industry term for a conduit/faceplate solution that can be installed in a floor to provide limited technology connections from below the floor slab to the floor above it. Common connections are data, video, audio, or control. Where possible, the use of these types of connection solutions should be avoided.

A poke-through has two distinctive features that distinguish it from a floorbox:

- It is installed by drilling a round hole through the floor and is much easier to do than saw-cutting a rectangular recess. The connections to the jacks and outlets are on top of the poke-through. When nothing is connected to a poke-through, it is nearly flush to the finished floor (i.e., carpet level).
- It can present a tripping hazard if the connections are exposed in an open walk-path. Data connector heights are minimal, but audio and video connectors are notoriously tall and could present a serious hazard. Connectors can also fail after repeated abuse from vacuum cleaners and chair casters that regularly collide with the sides of the exposed connector housings.

Standard Floorboxes

Floorboxes come in a variety of shapes and sizes. Their purpose is to provide connectivity for cables routed through conduits from below the floorbox. There are special types for wooden, concrete, and raised floors. Like a poke-through, the connections could be routed through open ceiling space in the floor below, or placed in conduits buried in the floor slab.

Certain types of floorboxes are designed to mate only with under-floor cell-duct systems. These are uniquely designed to connect directly to specific duct sizes and shapes. They provide a transition point from the cell-duct immediately under the top of the floor slab so the users can connect their devices to the cables provided. This particular type of floorbox is often referred to as a cell-duct activation point.

A floorbox has three features:

- Instead of a round hole, a floorbox is rectangular. It is flush-mounted into the floor so nothing sticks up above the finished floor level and is fairly easily cut into wood and raised floor tiles. To accomplish this in concrete, the floorbox is ideally put in place when the structural floor is formed. Floorboxes can also

be installed after the slab is complete, but this requires saw-cutting the floor, which is costly and can introduce structural weakness in the floor system.

- All of the connections are made below its lid. While there will still be cables emerging from the top of the box when in use, tripping and damage hazard are greatly reduced.
- Another advantage of floorboxes is that they can be sized to fit many connectors and connector types while "poke-throughs" are generally limited to only a few small connectors.

CABLE DISTRIBUTION FACILITIES WITHIN ROOMS

Horizontal Distribution (raised floors)

Raised floor systems are a strategy for managing horizontal cable distribution, especially when there is a large quantity of cables to be installed. Or, if there is continual need for cable relocation or removal, in server rooms, open office scenarios, or courtroom wells. Raised floors can be designed via split slab or added on top of the basic floor. Split slab likely will be more satisfactory but can be expensive and must be planned for early in the design process. Generally, the more space needed under the floor, the more expensive the construction will be. A three-inch or more difference in slab height would be needed to provide about a two-inch clear pathway under the raised floor due to the thickness of the tile itself. Cost needs to be evaluated in light of the flexibility that is purchased.

Courthouse IT server facility on six-inch raised floor during installation.

Many advanced server rooms are designed with underfloor HVAC venting so cooling air can be pushed up through the bottom of the warm equipment racks and exhausted out of the rack tops. Here are some other benefits of placing equipment in server rooms:

- Mounting
- Flexibility
- Powering
- Cooling
- Maintenance
- Cable management

Additionally, the ADA dictates the need for ramps and/or steps to access raised floors that are six inches to one foot. Even a six-inch raised floor requires a six-foot long ramp up to it, plus a landing at each end. Over time, cavernous raised floors from 18 up to 24 inches (457 mm to 610 mm) have become less necessary, and this helps designers adapt to the ADA requirements.

Raised floors, even in a moderate-sized server room or other type of room, can be successful even where only small amounts of clear space under the floor can be provided. For example, a raised floor that is six-inches (152 mm) from the structural floor may provide up to 4-1/2 inches (114 mm) of clear cable space below. While this amount of space will be inadequate for HVAC ducts, it is normally adequate for most wiring applications as there is enough room to space cables laterally within the open spaces below the finished floor tiles. A six-inch (152 mm) overall height offset can be accommodated relatively easily in new construction.

In areas where technology is not as intense as server rooms, raised floors of modest heights are also considered by A/E/C design teams in new construction. These floors can be very low profile, as little as an inch or two, and still provide better flexibility than cellular duct or core-drilled poke-through floorboxes. These low-profile raised floors are very stable and it can be hard to tell if you are standing on one.

Split slab construction becomes much more practical when only a three-to-four-inch (76 to 102 mm) elevation change needs to be built into the building's structure. Courtrooms can benefit from raised floors given that later modifications to the courtroom technology should be anticipated.

Although implementing a raised floor during new construction can seem almost transparent to the end user, older construction implementation on an existing slab can also:

- Change how people travel from one area to another
- Create a need for a step-up or ramp
- Increase carpet maintenance
- Cause restricted ceiling heights
- Change door threshold offsets
- Modify wall finishes where the walls now meet the higher floor
- Require millwork adjustments

All of these factors need to be considered by a designer trying to implement the solution. From a cost standpoint, trenching may be much more cost effective if the integrity of the slab can be maintained. Note that installing a raised floor only in the courtroom well should be considered and reviewed. Recent project cost estimates have indicated that raised floor is more cost efficient than other approaches under certain circumstances. Use of floorboxes with raised floors allows extensive flexibility when new furniture configurations are needed.

TECHNOLOGY SUPPORT SPACES

Phone and PBX Rooms

The services that older phone systems provide are being absorbed into the data server rooms. Voice over IP (VoIP) phone technology continues to grow, and video transmission over the IP-data network is expanding. These rooms are often near the demarcation room for wire management reasons. Their requirements are similar to small server rooms or IDFs.

As technology changes, we may see the end of Plain Old Telephone Service (POTS) because POTS is being supplanted by Internet Service Providers (ISPs). The remaining advantage of the POTS system is remotely powered telephones. When the building's power is out, simple POTS phones that are separate from a building Private Branch Exchange (PBX) system will likely still be functional. But VoIP phones will stop working along with the building's power. At one time this was a critical feature, but with the expansion of wireless cellular telephone technology, it is becoming less so.

Much has been discussed about wireless technology and how so many mission critical devices will become wireless; therefore it is critical to consider this option for vital building systems.

Intermediate Distribution Frame Rooms (IDFs)

There are many unoccupied technology rooms in a typical building. These rooms usually have the following characteristics:

- They contain equipment such as patch bays, data switches, transport media converters, and many cable bundles. The equipment in these rooms serves to distribute cabling to many spaces on the same floor.
- Sometimes referred to as IDFs, per BICSI and TIA.
- They are often unfinished with exposed concrete block walls, sealed concrete floors, and no finished ceiling.

Computer and Server Rooms

The court's main data processing and communication equipment will be housed in a computer/server room or IDF. Many courtrooms have spaces that are not designed for technology. In order to properly support the installation, operation, and maintenance of the equipment, these types of rooms must be located, designed, and serviced in very particular ways:

- Installing server rooms below grade, against outside walls, or under water or waste service piping can be risky.
- Temperature and humidity control is essential. In some cases, a standalone air conditioning system is needed.
- If the room is not sealed properly then there can be negative air flow, allowing debris to be blown into the racks and potentially damage the equipment.

A moderate size IDF.

AV MASTER EQUIPMENT LOCATIONS AND ROOMS

Systems that require a large amount of audiovisual equipment may need a centralized space to house the items that the user typically does not need to access. The requirements for these spaces may include major power and cooling needs, and building designers must take these needs into account during planning and design.

There are usually three locations that may be used for the AV master equipment room:

Occupied Rooms

Occupied rooms have minimal amounts of audiovisual equipment, such as a computer and a single display, and do not require much master equipment. However, when additional features are needed, such as an audio-conferencing system, sound reinforcement system, or integrated control system, an equipment rack is needed. If the amount of equipment is small and doesn't generate much ambient noise (e.g., cooling fans and audible beeps), it is acceptable to install the equipment in a cabinet, a freestanding rack, or in a rack inserted into a cabinet.

Shared Technology Rack Room

New construction also offers the option of planning for a central room. If the scale of the building allows for it, the construction of rooms that serve multiple spaces may allow for combining services in one place. Such rooms are typically found on each floor, and accommodate the IDF functions together with audiovisual. If this strategy is used, it is critical that the rack room is centrally located so that the horizontal cables that connect to the occupied rooms are roughly the same length. As discussed above, placement must allow for cable lengths within TIA and NEC code requirements. If the room is located and sized properly, it can be used for low voltage lighting control, data services, audiovisual, master security equipment, and building management systems. Where local codes and policies allow, the room may also be used for branch power circuit panels.

Dedicated AV Rack Rooms

In new construction, it is common to dedicate small rooms for multiple audiovisual racks. This is preferred when the rooms they serve require a lot of technology. As an example, the equipment for a modern courtroom with all possible features installed would require:

- Two floor standing racks, each six-to-seven feet (1.8 m to 2 m) tall. This takes up 12 square feet (1.1 m^2) of floor area for the racks alone.
- Clear floor for access and wall space (for backboards and other accessories). The dimensions are an additional 3 square feet (0.3 m^2) on at least three, and preferably all sides.
- Following these minimum guidelines, this room would measure about 63 to 90 square feet (6 m^2 to 8 m^2), with access on all sides, without provision for other equipment, or door swings.
- The primary advantages of an equipment room located close to the room it serves:
  - Shorter cables will deliver much higher quality signals to the audiovisual equipment from the technology room.
  - A single, dedicated room allows access to be restricted to only those who absolutely must have it.
  - An adjacent audiovisual rack room makes installation and troubleshooting much easier, since these tasks require the technician to move back-and-forth between the two rooms.

Bringing services together into a single room can reduce construction costs. In addition, it better justifies a dedicated cooling system and/or access flooring where individual rooms could not. The challenge with shared spaces will be coordinating the needs of various technology designers so that everyone has their own correctly sized area of the room for their own equipment. This is very important because the equipment will be installed at different construction stages. For example, building management systems, and alarm or elevator control equipment will likely be installed near the mid-point of the construction project, while AV and IT equipment comes much later. The IT and AV integrators need to know that the space they have planned on is actually available when they arrive. Also, their power and cable raceway equipment should be onsite, labeled, and ready for the installation.

To ensure that technology professionals effectively coordinate their efforts, layout, and connectivity, the equipment in these rooms must be very carefully designed. It is highly recommended that:

- Each main technology room be laid out using a large scale such as 1/2 inch to one foot in elevation and floorplan views.
- The drawings should clearly illustrate the major equipment cabinets, components, and raceway paths in a way that clearly shows needed clearances and all code requirements.
- The area reserved for each type of technology should be shown and organized by function.
- Consideration must be given to providing needed separations of cabling and equipment categories to avoid electromagnetic and radio frequency interference (EMI and RFI).
- Accurately dimensioned elevations should be drawn of each wall showing the cabinets and controls that need to be mounted on them.

Using these guidelines, the overall room configuration will effectively meet the needs of the users, NEC requirements, and will likely be approved by building inspectors.

Building Systems Affected by AV/IT Technology

Audiovisual systems are interconnected with a variety of building systems. In addition, audiovisual systems have an affect on building systems. Coordination and awareness among the A/E/C team will ensure functionality and interoperability.

THERMAL LOADS

Electronic equipment generates heat. To avoid system failure, mechanical, electrical, and plumbing (MEP) design engineers need to take into account that AV/IT equipment produce heat all the time. The equipment's heating and cooling loads should be calculated into the overall HVAC design. Know that just because equipment is smaller in size doesn't mean it generates less heat. In fact, smaller units tend to concentrate heat in a smaller space, so increased air flow is often needed.

PLUMBING FEATURES

Plumbing can present challenges related to acoustics, condensation, and leaks.

When a courtroom is expected to perform at a consistent Noise Criterion (NC) of 25 or better, any sound of a running water pipe or waste line should be avoided to not compromise the needed quiet. It is important to avoid any type of water line running through – and particularly – a space that houses AV/IT technology. Auxiliary cooling when added to technology rooms, even small systems, should not have plumbing and/or drain lines installed close to the electrical equipment. In some cases, drip pans have been installed at these locations. The engineers must be diligent in consideration of what would happen if a moisture control device were to fail.

Audiovisual equipment racks full of equipment can generate a large volume of heat.

MECHANICAL SYSTEM NOISE

Noise Criterion (NC), or in Europe, Noise Rating (NR) curves, ratings generally indicate how quiet a space is when it is in its "resting" state. NC performance requirements for courtrooms and similar spaces are extremely important. Federal courts in the United States, for example, are required to achieve a total NC of 25 or lower. In contrast, typical classroom or corporate spaces are NC 30 or NC 35. Computing and audiovisual equipment can also contribute to the overall noise level. Due to these strict requirements, higher heat loads, and the total noise from all of the room's air terminals, correct calculations are very critical.

NON-STANDARD POWER LOCATIONS AND ELECTRICAL FEATURES

As previously noted, court audiovisual systems often require power connections at unusual places such as in the niches and cavities already described, or behind flat panel monitors. Designers should take care not to assume that standard design considerations apply. Electrical codes such as NFPA-70 provide direction on general building electrical requirements only.

AMPERAGE, GROUNDING, AND PHASE

Amperage is the amount of current needed at any given outlet. If equipment exceeds the rated amperage of the outlet, the outlet will overload and should trip a circuit breaker shutting off the connected equipment. Electrical grounds provide a safety "backbone" keeping errant voltage off of rack frames and balancing the levels between different locations of the system. In addition, it is important that all of your audiovisual systems (particularly audio) within a space be on the same phase at the power panel.

Types of Construction: New and Renovation

When planning technology-enabled courtrooms, the needs assessment process is generally the same regardless of the type of construction. The major difference among the types of construction is in implementation and any limitations that may arise based on the different types.

NEW CONSTRUCTION

New construction projects in general have few physical limitations on infrastructure implementation. Floorboxes, wallboxes, and pathways are identified and installed following normal construction protocols. Raised floors can be installed by recessing a section of the floor and this normally can only be provided practically in new construction. Electronic devices are designed at selected locations so that wall structure and millwork can be designed to accommodate them. All of this requires careful coordination with the other elements of construction.

A floorbox and conduit runs placed in a trenched concrete floor.

RENOVATION

The question for the architect and other professionals becomes, “How can we work in an existing environment to get the technology in place and meet the client’s needs?” There are unique criteria for a renovation construction project. Designers must pay careful attention to how the previous designers created or modified infrastructure. Many of the tasks that are easily completed in typical modern projects, such as running conduit, creating millwork, and implementing new technologies require special considerations. Given existing constraints, they often cost more than the same work during new construction when added. It is critical to set expectations that are appropriate for the given circumstances and constraints, as what may be easily possible in new construction may not be so easily accomplished in existing spaces.

Old City Hall in Toronto, Ontario.

Some common constraints are:

- Floorboxes are typically used for connecting devices to cabling, but existing floor structures might not allow such devices due to slab thickness or other construction issues.
- Any work on walls for mounting displays and fixtures may require special preparations. Hanging large displays may require blocking in the wall to support the weight. Existing walls may make this difficult or practically impossible and might require re-thinking or special engineering to carry the load.
- Building code issues and OSHA safety regulations (asbestos, lead, aluminum wiring) must carefully be considered. Common construction practices of the past are not only unacceptable, but can be dangerous by today's standards. The existing materials and methods have to be carefully evaluated prior to making any final installation plans. Some considerations when addressing environmental issues include the safety procedures that must be strictly followed for climate sensitive fabrics and materials. When demolition is called for, it could be impossible or require special permits and vendors for drilling, cutting through walls, attaching, sanding, and painting. A temporary occupancy permit may be required. As materials are removed, consideration must be given for waste and recycle management, as well as sanitation.
- The ADA accessibility requirements that are now common weren't in place before buildings designed prior to 1991. Here are three questions to consider:
  - How can the building be modified to allow easier access?
  - What technology can be used for those with special hearing or vision needs?
  - Can any pre-existing equipment be upgraded?
- Custom solutions may require very careful budget adjustments. It is unlikely that regularly available or packaged solutions will work in a facility that already has design constraints. Most installation work in renovations will cost more, since it takes longer to accomplish the same task. Cable installation can be difficult or may be impossible at critical locations.

Conservative use of small displays can help preserve the look and feel of historic courtrooms.

HISTORIC RENOVATION

Courthouses that are designated as historic bring additional concerns to the process. Typically, the original designers have not provided adequate infrastructure. They include all of the concerns found in renovation but add a dimension of their own. While this varies with location, the general rule is that the historic aesthetics and construction of the space must be maintained. This can create a major challenge to installing technology.

IDENTIFYING MATERIALS

The first step when designing technology into a historic space is to identify which spaces and materials are historic and which are not. Most historic buildings have been altered over time and the rules of historic protection may have changed over time. This may reveal opportunities. If the floor has been replaced, cutting floorboxes that blend into the floor finish may not be an issue, whereas if the floor finish is historic this may not be allowed. Some special considerations include:

- Changes to walls, floors, and windows may be restricted either due to physical constraints or in order to avoid altering historic materials. Mounting devices can create a challenge. For example, installation of videoconferencing cameras could be problematic. Simply securing a bracket to a wall may not be acceptable if the wall is designated as historic. In one historic courthouse, the cameras had to be mounted at the wall so as not to damage or put any holes in the rare wood.

- In many historic courthouses where displays or other simple devices are used, they are mounted on lifts or simply rolled in and out of the room so that they are not visible when not in use. The lifts add cost but help maintain the historic appearance of the room when the technology is not being used.
- Many surfaces are fragile or rare. Wood identified as historic is a particular challenge. Drilling, sanding, and demolition can require special preparation and permits, often with the need to receive approval from a historic preservation organization. In almost every case, installation methods must be altered to work with the existing materials and structures.

Preserving historic materials such as tile and wood require special considerations.

- Some textiles (e.g., fabrics, wallpapers, paints) are very sensitive to temperature and humidity changes. Heating and cooling to protect equipment may have adverse effects on them.
- Due to the age of many historic structures, the materials that were used in the original construction could be rare or now considered hazardous. Special protective procedures may be needed to remove or preserve materials.
- Historic witness desks and judge's benches were likely never designed to accommodate wheelchairs. As a result, installing lifts and ramps may be impossible or very expensive. A formal exemption from the requirement may be needed in order to proceed. An example of the extremes that can be faced can be found in a historic courthouse project where the courtroom was on a second floor and there was no possibility of installing an elevator. The compromise was to install a remote courtroom on the first floor that would accommodate people with physical needs. This was extreme but acceptable to the local and state historical societies.

A conservative approach to implementing technology can preserve the aesthetics of historic courtrooms.

Maintenance

Maintenance can be defined as the continuous process of keeping something in good working and physical condition. Although proper operation is essential to any technology – and a critical goal for the training addressed in the next chapter, maintenance is also important for any audiovisual system installation. Without maintenance, an audiovisual system installation cannot survive. Maintenance includes the correction or prevention of faults in hardware or equipment and the replacement of parts.

Maintenance is a daily responsibility and it includes verifying that technology is fully operational and ready for its original or designed capacity. To this end, the court ought to use an operational checklist to determine each morning before court whether each piece of technology is ready and, if it is not, to take immediate corrective action to include notifying the judge and clerk of any problems that cannot be remedied immediately.

When possible, full maintenance in a courtroom or other location requires that the associated space be free at the time from judicial and/or high profile activities so as to allow the audiovisual technical specialists to perform their job without any disturbance. Maintenance can be described in three main categories: preventive, corrective, and break-fix.

PREVENTIVE MAINTENANCE

Preventive maintenance is an equipment maintenance strategy based on inspection, replacement, dismantling, or remanufacturing an item at a fixed interval, regardless of its condition at the time. Traditionally, this occurs once a year. At a minimum, it should include:

- General hardware system checks (e.g., video cameras and lenses, pan/tilt heads, lens drive units, including checks of system performance
- Replacement of bad cables and connectors
- Cleaning of critical system hardware and video monitors — particularly in those pieces that use cooling fans
- Checking and adjusting power supplies

CORRECTIVE MAINTENANCE

Corrective maintenance is required to correct a failure that has occurred or is in the process of occurring. This may consist of repair, restoration, or replacement of faulty system components. Corrective maintenance can be performed at any time prior to equipment failure.

BREAK-FIX MAINTENANCE

Break-fix maintenance refers to a break in service due to hardware or software that would prevent stable conduct of business operation. If a failure occurs with a hardware or software component, the court should immediately be informed of the system(s) status and how failures are disrupting court operations. If possible, the appropriate technologist or administrator should request that the court recess for enough time for emergency repairs or equipment replacement.

Training

Courtroom technology training consists of two areas, technical and user training. The trainer not only needs to be familiar with the equipment involved, but needs to understand and be able to explain the intent of the audiovisual system design as well as any relevant judicial processes.

Technology is enjoyable to use when it is properly operated and maintained. To accomplish this, personnel must be trained so that court technology can be used reliably. In a practical way, instructors must understand the needs of each person to be trained.

Training users such as judges can be radically different than training technical staff for maintenance and troubleshooting. Judges are very busy professionals with rigid schedules. They need to see the benefits and the effects on their court operations that necessitate the need for their involvement in training.

OPERATIONAL TRAINING

Participants attending operational training are typically judges, court administrators such as deputy clerks, court reporters, court security, and attorneys. The instruction depends on what each user needs to know for the successful use of the technology. Successful training depends on the user's experiences with technology and how the user will actually use the technology. Some judges, for example, view courtroom technology as critical to the administration of justice, and they need to know every detail on how the system functions and how to control every component. Other judges will rely on court staff to manage the courtroom technology and will be far less interested. A survey should be conducted to gather information about perceived needs and topic interest from potential training attendees. Survey data can be used to help an instructor assess why training is important to attendees.

Technical training can be challenging in that users attending the training aren't necessarily technical in their professional work. The importance of conveying the value of prompt diagnostic and remedial action in the courtroom is critical to preventing major disruptions of court proceedings. Participants attending technical training are typically court technologists, including the AV and IT systems administrator responsible for the operations and maintenance of the equipment.

Technical training should provide a clear technical overview of how each type of system function is done. One good approach is to have two focus areas, one in the courtroom technology and one in the AV rack section. When dealing with courtroom technology, the trainer

should focus on control panel operations and clearly demonstrate to participants the functions of each "button." As an example, consider routing a video source input at the plaintiff table to the judge's display or device in the courtroom. Depending on the goal of the training, remember that there clearly is a major difference between a general overview lecture and "hands-on" training in the courtroom.

There are several models for user training to consider:

Combined User Groups (judges and their staff)

Some trainers prefer holding training events one judge's chamber at a time. This can be highly effective because each staff member can be provided with a concept of how everything fits together while they all use the technology. When using this model, the instructor must strike a balance to ensure that each staff member's individual needs are met while not boring the others.

Individual User Groups (courtroom clerks/ deputies)

Be aware that courtroom staff, often termed "deputy clerks" are typically the subject matter experts in the courtroom. The training needed for this group may be both technical and operational. While hands-on instruction may be important to all user groups, it is required with this group.

Judges Only

There can be many benefits to training judges at the same time. One benefit is that as a group, judges often have unique concerns, such as the legal impact of how attorneys will use technology and the courtroom implications of technology failure. Also, skeptical judges may be "transformed" by experiencing the enthusiasm of their peers.

When training judges, it is critical to explain the operation of the system as it pertains to the judge's role. If time permits, a mock trial, complete with difficult personalities, people who struggle with technology, and appropriate corrective measures may be useful.

Attorneys

Due to legal requirements, the court should only familiarize attorneys with the available evidence presentation technology and give them basic hands-on instruction of how to use any relevant equipment and controls. The need for caution here is to avoid giving an unfair advantage during courtroom presentations. This is not what the court lawfully can do. The 2011 CLCT Court Affiliates Protocols for Use by Lawyers of Courtroom Technology provides in Section 3-30.00 that:

> *The Court should make known to those lawyers who may appear as counsel in a trial or hearing before it the nature of any courtroom technology installed in its courtrooms and hearing rooms, and any technology owned or controlled by the Court that may be available for counsel's use. The Court should periodically provide counsel an opportunity to physically view and inspect the court's courtroom technology and should make available to counsel court staff able to answer reasonable non-case theory specific inquiries from counsel concerning use or operation of the courtroom technology. Court staff must not engage in what is customarily considered adversarial case theory specific litigation support advice.*

AUDIOVISUAL EQUIPMENT AND RECORD DRAWINGS REVIEW

Court technologists may be highly skilled audiovisual experts or selected IT specialists with little knowledge of audiovisual technologies. The main focus of skilled technologist training is to acquaint the technical support staff with any specific issues associated with the audiovisual systems. More basic training may be necessary for those less skilled. Training should include overviews of each functional system, such as the control system, audio system, and video system. The trainer for this portion of the technical training may be the technical project manager associated with the installation, who understands how to operate and troubleshoot each audiovisual system. During this element of the training it is important to provide hardcopy documents such as signal flow drawings, screenshots, and "cheat sheets" to create a comfort level for the users.

Appendix A: Evidence and Videoconference Display Options

One of the most important decisions affecting the design of the courtroom will be how most of the participants in the courtroom view video evidence and videoconferencing images. Note that the evidence presentation displays and the videoconferencing displays will each follow somewhat different design requirements as described below.

Be mindful that the primary evidence display options discussed below most often affect the jury and spectators. Ensuring that these displays are easy to look at, present clear images, and do not block sightlines is critical. Another very important consideration for a court is to be able to support both legacy and future screen resolutions for laptops.

In a traditionally configured courtroom, it can be nearly impossible to have a single large display in the well area with good sightlines for everyone in the courtroom. There are several reasons for this:

- The sightlines simply don't allow it. The best that can be expected is a minimum of two displays: one for the spectator/gallery seats farthest from the jury and the primary large well display for all others.
- The far side gallery's view of the single display will be up to 180 degrees from the plane of the main display. This makes the evidence impossible to view without a supplemental display.

More significantly, the judge and court staff will typically have their own small monitors. The judge may use the monitor for a shared PC display, preview, and/or annotation. The witness will commonly have a dedicated small monitor in the witness box for annotation if not for preview as well. It is also important to remember that evidence is presented electronically in the same procedural manner as physical evidence. In many courtrooms this means that the judge and attorneys — and sometimes the witness — review the evidence before the jury and spectators. Then, with the judge's permission, it is shown (or "published") to the witness and possibly to the jury and spectators as well. Courts that follow this procedure require dedicated small monitors for the judge, witness, and attorneys; leaving the following discussion only affecting viewing by the jury and gallery spectators.

Some seats, such as those where an attorney team members might have his or her back to a single primary display may require displays in the line of view. The designer needs to evaluate the special needs of each room participant and provide a suitable solution for every needed function.

EVIDENCE DISPLAYS

In some instances, court personnel or judges will have pre-determined the evidence display style based on district standards, personal bias, previous experience or local culture. It will be the job of the design team to implement any reasonable preference if at all possible. If the designers determine that the prescribed display style is unworkable in the physical space or outside the budget allotment, the design team will need to carefully explain to the client the reasons why it is not recommended and present an alternate solution that is suitable for everyone.

When the design team is wholly responsible to select the best solution for the courtroom given, they will need to review the many options during the design phase of the new or renovated courtroom. Existing courtrooms that are being retrofitted with displays may have limitations that will dictate the method for the displays that are ultimately chosen.

The display style employed can influence:

- Equipment selection
- Size of the jury box
- Well size
- Ceiling heights
- Natural daylight allowed into the room
- Lighting
- Wall structures, infrastructure
- Cost
- Basic footprint of the courtroom
- Structural grid design

It is important for the design team and the court to understand that this is not a 'one size fits all' situation. The client and the design team should abandon preconceived biases and base their recommendations on the space where the system will actually be functioning. This is particularly true where video evidence displays are being retrofitted into an existing courtroom.

Essentially, the reasons there are different options for the evidence display styles are:

- The philosophy of how visual evidence should be viewed
- How clear sightlines can be achieved between all parties and the displays they each need to see
- What the physical space can bear without substantial additional cost
- The physics of technology, light and the human eye's abilities

PHILOSOPHY

Many believe that it is most important to have a central location in the courtroom well area with a single display (whether the display is front or rear screen projection or a large flat panel monitor) where the jury and other trial participants can more easily focus on the activity in the well and still easily view materials during the visual evidence presentation. As when the attention of the jury is all focused on the single presenter in the courtroom, so should a single display be utilized to garner the same single point of focus. This also reduces eye fatigue since the viewers' focus is between two or three items in the same direction in nearly the same focal plane. This philosophy is summarized by the thought that the presentation itself – and keeping the focus and attention constant — is more valuable than the viewing quality of the evidence itself.

Some feel the above argument is overrated and that the jury and others will always have to look at various locations in the courtroom anyway and did so prior to the introduction of video evidence. They feel that it is very common and natural that the jury and others will look up and down and side to side even while there is a single point of presentation being made. They cite times when a small evidence object is passed from juror to juror. While a juror is looking down at the object, he or she is not focusing toward the well or witness. This philosophy usually results in more distributed monitors so that each participant is provided a more personalized view of the evidence. This philosophy is summarized by the thought that the viewing quality of the evidence trumps having a single point of focus in the well area.

There are variations of the two above philosophies, and certainly there are always supplemental monitors used in the same courtroom for one reason or another, but the decision between these two particular approaches described above will hugely impact the design approach.

SIGHTLINES

A good sightline to a display is one where no portion of the screen is blocked from view at any time by a person or architectural element. A 100 percent view of a display is not required when watching general materials such as a TV program or a movie. Movie directors do not place important image elements in the corners or on the side of the frame — the important visuals in general viewing conditions will be near the center of the display area.

In evidentiary presentations, however, the attorney may wish the trial participant to see a signature at the bottom of a letter, for example, and still show the entire letter (without zooming in). The signature may be in the extreme lower right of the frame. If that portion of the display is blocked to the viewer from something or some person, they have a poor sightline. This results in a poor design and a very frustrated viewer.

While determining the sightlines, the designers must be mindful of the display placement and place them where they are ergonomically comfortable. Often monitors in jury boxes have been installed too low, so that no portion of them is seen above the rail from the well perspective. This causes the jurors to lower their heads too far, which is not only uncomfortable but also causes the attorney to see only the top of the jurors' heads. Proper installation should allow the juror to comfortably see the monitor, the witness, and the attorney with minimal head movement.

PHYSICAL SPACE

In the example used above for sightlines, imagine a large projection screen in the well of the courtroom. In order for the jury to have acceptable sightlines, the bottom of the image would need to be at least 52 inches (1.3 m) from the floor. If the image is 6 feet (1.8 m) tall, the ceiling height needed would be nearly 11 feet (3.4 m). Many courtrooms do not have a ceiling this high. Conversely, if the ceiling height is 15 to 20 feet (4.6 m to 6 m), which is common in older courtrooms, the large open space between the top of the image at 11 feet (3.4 m) and the ceiling height must be dealt with. Raising the entire screen image toward the ceiling to make up some of the distance may by completely acceptable or result in an image that is too high for comfortable viewing.

Another scenario is adding small monitors (16:9 aspect ratio, 22-inch diagonal flat panels) within the jury box. Many jury boxes were simply not designed to have this additional equipment; the space between rows, the space between seats, etc., may not allow for practical application of these monitors. If the jury box is deepened to make more space for the displays, the position of the front rail may intrude into minimum clearances for walkways or exits.

Each space will have its own conditions that need to be accessed before the best approach can be determined.

ERGONOMICS

The Human Eye

The human eye has limitations. Technology always has limitations. It is not possible to install a single 22-inch monitor across the expanse of an entire courtroom and be able to read a spreadsheet that is being displayed. Nor can a super-high resolution display be manufactured that would allow this.

InfoComm International® and many other agencies, universities, committees, ophthalmologists, and manufacturers have studied the human eye's abilities and its limitations. Many volumes have been written on this and most are extremely technical. So many variables enter into accurate calculations when done correctly (e.g., distance to the display, resolution of the display, ambient room light and glare, viewing angles, display contrast, and brightness) that we could not possibly begin to discuss them here. However, there are handy tips that can assist the design team to see if the design approach is even feasible.

VIEWING CRITERIA

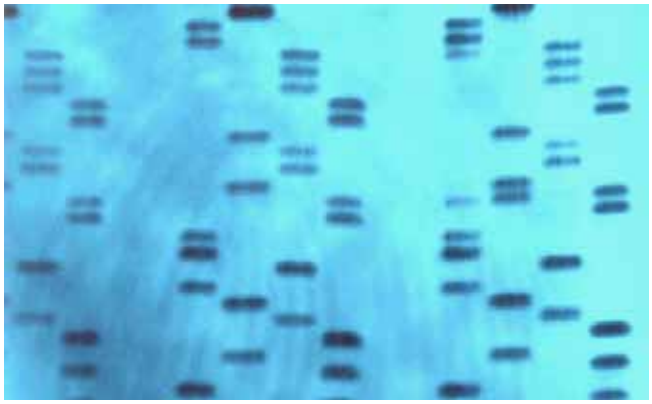
The most important calculation to use is the viewer-to-display distance requirement. Of course this depends on the size of the display, but it is also important to understand the material that will be viewed. There are basically three types of viewing criteria recognized by InfoComm at this time:

Passive Viewing

The viewer is able to recognize what the images are on a screen and can separate the text or the main image from the background under typical lighting for the viewing environment. There is passive engagement with the content.

The formula for this quality level is screen height multiplied by a factor of 8, so if the screen height is 3 feet (1 m), the viewer should not be much farther than 24 feet (7 m) away.

Observing a video deposition is a typical passive viewing task.



DNA information from a fingerprint that requires explanation is typical of basic decision-making tasks.

Basic Decision Making

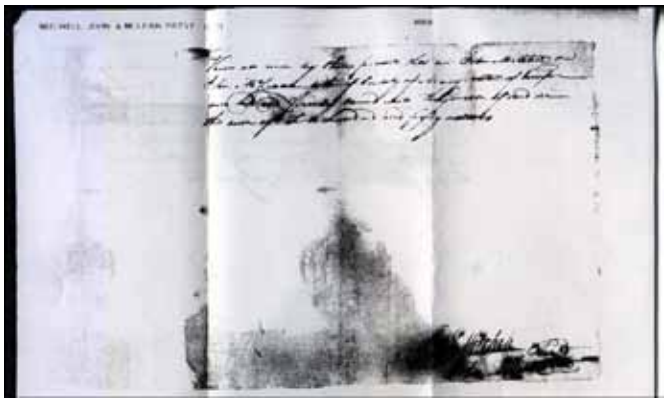
The viewer can make basic decisions from the displayed image, and is actively engaged with the content. Graphic images and text are legible to the extent that the viewer can make basic decisions on the basis of what is being seen.

The formula for this quality level is screen height multiplied by a factor of 6, so if the screen height is 2 feet (0.5 m), the viewer should not be much farther than 12 feet (3.5 m) away.

Analytical Decision Making

The viewer is fully engaged with minute detail present in the content and needs to be able to resolve every element of the image. Professional assessments should be possible, such as forensic evidence schematics, or photographic image inspection.

The formula for this quality level is screen height multiplied by a factor of 4, so if the screen height is 6 feet (2 m), the viewer should not be much farther than 24 feet (7 m) away.



A low quality manuscript requiring analysis is a typical analytical decision-making task.

The designers will quickly find that trying to place a display at all three possible distances becomes impractical. The result is to use the 'worst case scenario' and design viewing distances for 4 times the screen height. In practice, the designer will measure the distance to planned display locations and size it appropriately, if possible.

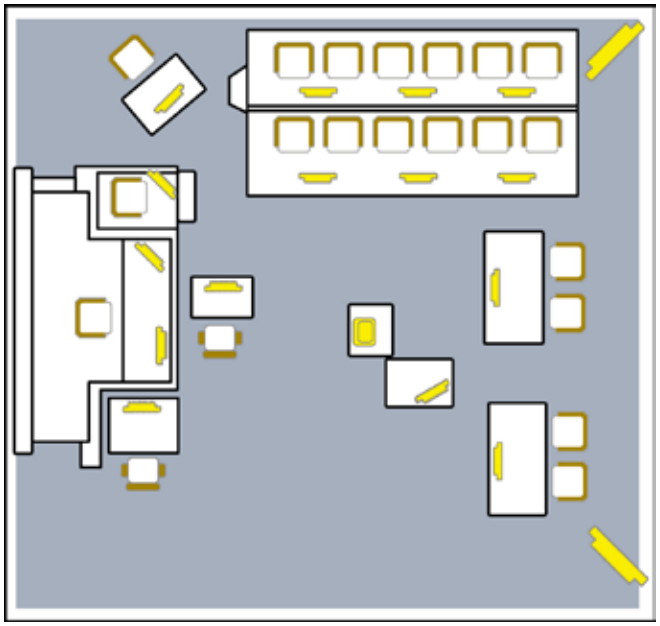
Distance and image size experiment using five displays.

Example of a sightline mockup test for jurors. View is looking toward the witness from the third row of the jury box. Note the very poor view of the "A" monitor.

VIDEO EVIDENCE DISPLAY SOLUTIONS

There are three basic types of video evidence display solutions, small monitor, medium display, and large display. Each type has several variables that will come into play when the project-specific requirements arise later in the detailing of the design phase. With the viewing criteria formulas taken into account, some of the following approaches may be able to achieve the goal in one courtroom, but not in another. A list of the benefits and drawbacks for each style should be provided for discussion by the design team and the court.

Small Monitor Style



Display locations (yellow).

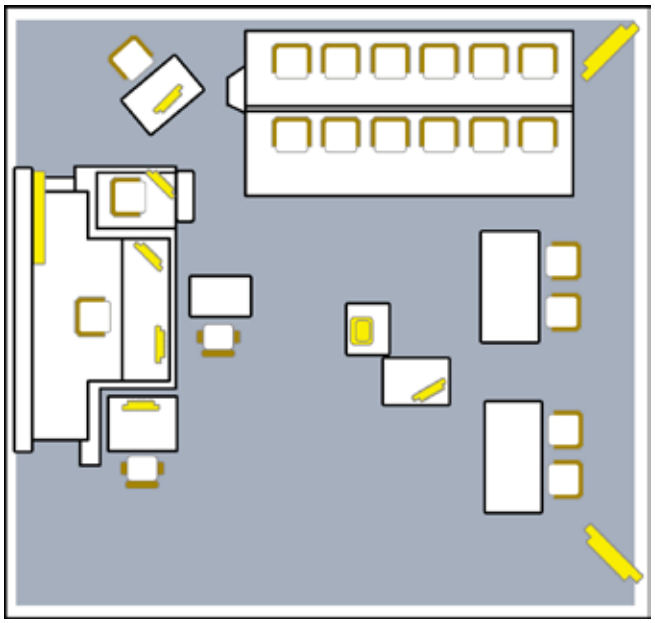
Successful retrofit of small monitors in jury box of an existing courtroom.

- 1 per 2 jurors
- 1 or 2 at attorney table
- 1 at witness location
- 1 at courtroom deputy
- 1 at courtroom reporter
- 1 at judge's bench

A small monitor could be a 22-inch diagonal image size with a 16:9 aspect ratio. This style may require more infrastructure work — and therefore cost — than other approaches, depending on the courtroom. The monitors positioned at the courtroom deputy and at the court reporter locations can be used both as display monitors and as local computer monitors by utilizing a switch. A second or third monitor can be added for use with the deputy's and judge's computer, if desired.

Benefits	Drawbacks
Easy for all participants to see. Best size to distance ratio (approximately 3:1 in jury box)	Jury might not focus on witness or attorney (depending on location)
Allows for private preview for attorneys and/or witness before displaying to the jury and public in gallery	Participants looking in different directions — jury looking at displayed evidence on their monitors
Numerous mounting and stand options	At least 15 monitors required per courtroom; oversize monitors on mounts with too many adjustments may result in an unsuccessful installation
Very little impact on well space	Impact on jury box space and clearances
Backup monitors are easy to come by locally	Adds some clutter and requires space on tables
Avoids single point of failure — court would be able to continue with a monitor not functioning in most cases	Table monitors in particular can obstruct good sightlines

Medium Display at the Side of the Witness



Display locations (yellow).

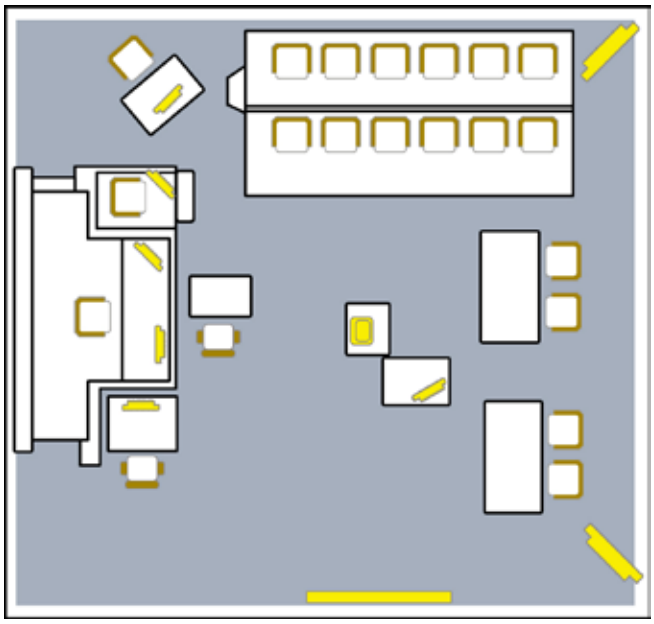
One medium display at witness stand.

This style uses a larger size flat panel display monitor or a smaller video projection system to produce an image in the 55-inch to 100-inch diagonal range. This scenario assumes the witness is adjacent to the judge's bench-between the judge and jury. As one may imagine, placement at this location must be planned in advance in new construction. In existing renovations, the area for the display must be clear and large enough to implement this style and ensuring the sightlines to the display from the jury box are not blocked by the witness or jurors who are sitting closer to the witness. The location of the display at the witness may not suit all viewers; those on the opposite side of the courtroom may not have the sightlines to the display and may require supplemental displays at their tables.

A successful addition of a display at witness stand with good sightlines.

Benefits	Drawbacks
Jurors and most others in the well area are able to look at witness while viewing the display immediately adjacent to or behind witness	All of the courtroom users will not be able to see the display on the far side of the courtroom, the judge and court staff will need small monitors
No modification to the jury box required	Aesthetic concerns about the front wall may disqualify this design as an option
The display can double as a remote witness via video-conferencing	Projection screen style is challenging by limited options on projector placement and shadows on the screen from the witness
Lesser number of small monitors needed overall	Jurors in back row may have difficulty seeing the display and some jurors have better/closer/clearer views than others
Display size is closest to 'life size' images	The witness will still need a monitor in front of him or her

Large Display in the Well



Display locations (yellow).

One large display or projection screen directly across from jury or other location in the well that all jurors can easily see.

This style uses a large size flat panel display monitor or a moderate size video projection system to produce an image of 60-inch to over a 200-inch diagonal range. This position for the display is good when the court feels that the arguing attorney should be very near — and in the same view plane — as displayed images. This, of course, is similar to (and may be rooted in) the traditional method where flipcharts and posterboards are used to show evidence. These require physical handling by the attorney. As a result, the jury and other audience members spend more time focusing in the direction of the well than they might with other display style options.

Benefits	Drawbacks
Sightlines to the evidence display and to well activity at the same angle and in same viewing plane	Due to space, ceiling height, and/or distance restrictions, it may not be possible to achieve the display size determined by the size/distance formula results
Works better if the witness box is also across from the jury near the large display	Placement of the display or screen in the well cannot impede movement or block important room doors.
All participants who can see the large display will be looking at exactly the same place	Projection screen style is limited by options on projector placement and objectionable projector fan noise near the jury box
Typically, the cost of infrastructure is less for a single display than with other options	Ambient lighting will affect the quality of a front projection image. Light dimming or shades may hinder the quality of videoconference cameras.
No modification to the jury box required	Single point of failure risk
The witness will still need a monitor in front of him/her.	Additional small monitors will still be needed for those with their backs to the large display
Lesser number of small monitors needed overall	Displayed images seem “larger than life”

Other Examples of Large Display Implementations

Successful implementation of a projector into a courtroom. The projector is installed over the jury using pre-designed infrastructure. It is shown pulled out to the maintenance position.

Proper placement and size of display for this courtroom. Of added benefit here is that witness is directly across from the jury.

VIDEOCONFERENCING DISPLAYS

There are two types of visual images required for videoconference systems.

The first image is that of the people at the far end, or the "People" view. All of the concerns with the proper video display solutions as they apply to evidence do not apply to views of remote people. The view of the person coming in from a remote location should emulate the same appearance as if they were seated in the witness stand, standing at the attorney's lectern, or seated in the judge's seat depending on who the remote person may be. This method has been shown to not create any negative impact on testimony or the outcome of the trial, as opposed to a "talking head" image of any size with no body language. Remote people should be presented at normal human scale; an adult head and upper torso measures approximately 2 feet high. This is a very common camera framing of a person seated at a table. They should therefore be framed by the camera at the remote site as 2 feet high, reproduced in the court as 2 feet high.

The second image that videoconferencing can use is "Content." In the case of judicial proceedings, this is usually evidence. Due to the implementation of ITU's H.239 standard, modern codecs are able to send the "people" image and the "evidence" image at the same time to separate displays. The evidence being sent to the courtroom from another location should be treated no differently than evidence being display within the courtroom. Therefore, the guidelines described above for video evidence display apply to video evidence with regard to size and distance regardless of where the evidence originates.

Appendix B: Needs Assessment for Remote First Appearance and Arraignment

Remote first appearance and remote arraignment are important court functions that are entirely dependent upon technology. They provide a good example of how the needs assessment process should be used to deal with court technologies.

Many people are involved in first appearance and arraignment proceedings. Due to the complexities involved in these kinds of proceedings, all stakeholders should be invited to workshops to discuss what is needed. In addition to representatives of the court, prosecution, and defense, the agencies (e.g., the sheriff and/or police) should be invited that manage detention facilities where in-custody defendants might be located. Follow these suggested steps to assess the feasibility of remote first appearance and arraignment:

1. Research current legal requirements and constraints for remote first appearance and arraignment. Look for successful (and unsuccessful) examples in the area that you might be able to visit and observe. Both examples can be instructive. If none exist locally, review articles and papers on the subject or consider a field trip to a facility. Collect all the information and summarize findings for the group.

2. Describe the function/process of first appearance and arraignment as it takes place now in the jurisdiction and then project how it could be accomplished if remote videoconferencing technology were implemented. Here are some questions to begin the dialogue:

   - Who should be involved in arraignments?
   - How many people should be involved?
   - Where should the participants be located?
   - When should each function occur?
   - How often should it take place?
   - How much time should each function take?
   - What types of communications must take place?
   - In what form should those communications be? With what record?
   - How will the case files and the record of the proceedings be handled?
   - Will papers need to be signed remotely?
   - Will hard copies of any documents need to be transmitted between locations?

3. Describe the technology that will be needed at both ends. Using the help of appropriate audiovisual experts and other experts, determine:

   - What number and types of cameras will be needed?
   - Where should the cameras be located?
   - What types of lighting, acoustics, and quiet HVAC are necessary?
   - What audio system features are necessary?
   - If defense counsel will not be at the detention facility with the defendant, what type of secure communications will permit private attorney-client communications?
   - What type of control system, cabling, and power will be needed?
   - Are there data security concerns?
   - Can the technology be secured so that it can neither be harmed nor used as a weapon by inmates?

4. Describe the spaces that will be needed.

   - While the judges and, possibly, the prosecutor might be in a technology-enabled courtroom, where will the in-custody defendants be located?
   - What type of secure space will be necessary for the defendant?

- What type of secure space will be necessary for videoconferencing equipment?
- What type of secure space will be needed for possible defense counsel, and security staff?
- If defense counsel will be at the detention facility, what type of attorney-client conference space will be needed?
- What type of entry/pathway is necessary to access the videoconferencing space?

5. Estimate the costs and savings to implement the changes. All costs and savings need to be taken into account. This includes the purchase, installation, and operation costs of the equipment and related architectural improvements. Also consider:

   - The effect of work rule changes such as police who do not have to work overtime to escort prisoners to the courthouse.
   - Any possible savings for the acquisition of land if the courthouse can be located on a cheaper site away from the detention facility.
   - The construction savings if courthouse holding cells can be reduced.
   - Law and proposed procedures. If defendants are given a choice as to whether to appear remotely, for example, cost savings will be smaller than if everyone appears remotely.

     Note that cost savings analysis can be complicated by budget bureaucracy.

   - Who will pay the cost of remote first appearances or arraignments?
   - Who pays police or sheriff's deputy salaries or overtime?
   - Will police or sheriff's deputies lose valued overtime pay?
   - Who may be unwilling to bear the expense? Although a net budget savings may be effected, it may be at the cost of increasing capital or operations costs of one or more justice partners.

6. Assess the feasibility of implementation. Given the complexity of the issues involved, an implementation decision might require many meetings.

Appendix C: Needs Assessment Documentation

These examples are not intended to be used as templates for actual projects as complete documentation; every project has unique characteristics and every project team must complete their own documentation after the overall goals are defined.

Needs Assessment Interview Questions

These questions can be asked directly to the client or worked into a conversation.

Section 1: Audio System Questions

1. What do you think the sound system of the future will be like?
2. If you had to invent the perfect courtroom, what would it be like?
3. How do you think your job will be different in 15 years?
4. In the past, have you been able to hear other people acceptably in the courtroom? **YES** **NO**
   4.1. If no, explain_____
5. What do you feel is imperative to fix or add to the sound system?
6. Are there locations in the room where you consistently cannot hear talkers?
7. Are *wireless* microphones needed, even though there may be privacy and battery issues? **YES** **NO**
8. Do attorneys ever say anything, even if very briefly, from the attorney tables that should be on the record? **YES** **NO**
9. Do you think microphones are needed in places in the courtroom where they have not been placed before? **YES** **NO**
10. Do people in chambers need to hear the bench conference/sidebar discussion? **YES** **NO**
11. If a disruptive defendant is removed from a proceeding and placed in custody, what rights does he/she have?
12. If a defendant is removed from a hearing and placed in custody, how does he/she participate?
13. Must a defendant be able to privately talk to counsel? **YES** **NO**
14. If audio recordings are made, can people be clearly heard (good quality)? **YES** **NO**
    14.1. If the recording system doesn't work effectively, what is the problem?
15. Describe the challenges you have had with language interpretation and/or translators.

Source: Electronic Interiors, Inc.

16. When interpreters are used, which methods in the table below are employed?

Method	Used Frequently	Used Occasionally	Used Rarely
In-room interpreter sitting at defense table			
In-room interpreter sitting at witness area			
Remote interpreter with defendant who cannot talk privately back to interpreter			
Remote interpreter with defendant who can talk privately back to interpreter ("TIP")			
Need for more than one foreign language at a time			

Other thoughts, comments and ideas about AUDIO SYSTEMS:

_____

_____

_____

_____

_____

_____

Section 2: Video Evidence Presentation System Questions

1. Connections for video evidence shown from laptops should be provided at:

Location/Presenter	Needed	Not Needed
Primary prosecution/plaintiff table		
Secondary prosecution/plaintiff table		
Primary defense table		
Secondary defense table		
Probation table or location		
Witness box		
Judge (for jury instruction or law reference presentation)		
Courtroom deputy (for jury instruction or law reference presentation)		

Source: Electronic Interiors, Inc.

2. What type of display options do you feel are appropriate for the jury to see evidence?

Example	Description	Appropriate	Inappropriate
	Video projection behind witness box. Large drop-down screen (~120” to 144”)		
	Video projection directly opposite jury box. Large drop-down screen (~120” to 144”)		
	Flat panel display near witness or in well area. Medium flat panel (~46” to 70”)		
	Flat panel displays at jury seats. Equal sized panels at the judge, attorney, and witness locations. Small flat panels (~17” to 21”)		

Other thoughts, comments and ideas about VIDEO EVIDENCE and VIDEO DISPLAYS:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Source: Electronic Interiors, Inc.

Section 3: Videoconferencing System Questions

1. How often is it really necessary to hold a videoconference in the courtroom?

Frequency of use	Agree
Once a week	
Once a month	
Six times a year	
Two times a year	
One time a year	
Will never hold them	

2. How often would you like to hold a videoconference in the courtroom if the equipment was available and worked acceptably?

Frequency of use	Agree
Once a week	
Once a month	
Six times a year	
Two times a year	
One time a year	
Will never hold them	

3. Do you feel strongly about the system being built-in or portable?

Videoconference System	Agree
Must be built-in	
Must be portable	
Don't care as long as it can be setup within a couple of hours	

Other thoughts, comments and ideas about VIDEOCONFERENCING SYSTEMS:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Source: Electronic Interiors, Inc.

Santa Clara Family Justice Center
Audiovisual Room Matrix

Family Justice Center
100% Schematic Design
Audiovisual System Standards Coordination

LEVEL	SCFC AREAS	AOC STANDARDS AREAS	Assisted Listening Device	Speech Reinforcement	Program Audio Reinforcement	Audio Teleconferencing	Digital Signage / Customer Flow Management	Video Presentation	Evidence Presentation	Language Interpretation	MATV/CATV	AOC Satellite Television	Video Display	Real-Time Transcription	Sound Masking System	Control System	Audiovisual Distribution System	Videoconferencing	Audio Video Recording
			AUDIOVISUAL SYSTEM COMPONENTS																
1	Public Lobby	Public Lobby	I				X						I			I	I		
1	Workshop/Orientation Room	Self-Help Center Workshop	X	X	X		X			X	I	I	X			X		X	
1	Self-Help Center Lobby	Public Lobby	I				I						I				I		
1	Children's Play Area	Children's Play Area			X			X			I		X						
2	MH / Drug Treatment Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
2	DC Service Counter Queue	Public Lobby	I				I						I				I		
3	Drug Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
4	Family Law Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
4	Juvenile Dependency Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
5	Child Support Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
5	Conference / Meeting Room	Large Conference Room	X	X	X	I		X			I	I	X			X	X	X	
5	Mediation Conference Rooms	Small Conference Room						I					I				I		
6	Family Law Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
6	Conference / Meeting / Future Jury Deliberation Rooms	Large Conference Room Jury Deliberation Room	X	X	X	I		X		I	I	I	X			X	X		
7	Family Law Courtroom Set	Standard Courtroom	X	X	X	X	I	X	I	X			X	X	X	X	X	I	I
7	Conference / Meeting / Future Jury Deliberation Rooms	Large Conference Room Jury Deliberation Room	X	X	X	I		X		I	I	I	X			X	X		
8	Small Conference Room	Small Conference Room						I					I				I		
8	Executive Conference Room	Large Conference Room	X	X	X	I		X			I	I	X			X	X	X	
8	Large Training Room / Judicial Conference Room	Training Room	X	X	X	X		X			I	X	X			X	X	X	I

(X) Equipment and Infrastructure Provided
(I) Infrastructure Only (conduit, j-boxes, blank coverplates)
(1) Items requiring further discussion with the AOC and Local Court
Deviation from Standards

Source: Shen Milsom & Wilke, LLC

Digital Annotation	Skype Capable Video Conferencing	NOTES	COMMENTS
		Court requested digital signage and customer flow management	VTC REMOVED ON 06/20 - ADD TO LOG
		Local Court Requested Digital Signage and Costumer Flow Management in Self Help Center Lobby	ADD TO LOG
			BUILT IN SPEAKERS
I			
		Requested that Infrastructure be placed for future queuing systems	
I			
I	X	Court requested that these courtrooms be equipped with Video Teleconferencing via Skype	
I	X	Court requested that these courtrooms be equipped with Video Teleconferencing via Skype	
I			
		Court requested Conference / Meeting Room be equipped with VTC on Day One	OUTFITTED AS MEDIUM CONFERENCE ROOM PER REVIEW ON 6/20 - ADD TO LOG
		Requested that Mediation Conference Room be design as per Small Conference Room Standards	REMOVED FROM PROGRAM ON 6/20 - ADD TO LOG
I	X	Requested that Family Law Courtrooms on Level 6 and 7 should be outfitted to convert to criminal proceedings in the future. Court requested that these courtrooms be equipped with Video Teleconferencing via Skype	
		Requested that Level 6 and 7 Conference Meeting Rooms located between court sets be equipped to convert to Jury Deliberation Rooms in the future	
I	X	Requested that Family Law Courtrooms on Level 6 and 7 should be outfitted to convert to criminal proceedings in the future. Court requested that these courtrooms be equipped with Video Teleconferencing via Skype	
		Requested that Level 6 and 7 Conference Meeting Rooms located between court sets be equipped to convert to Jury Deliberation Rooms in the future	
			REMOVED FROM PROGRAM ON 6/20 - ADD TO LOG
		Local Court Requested Executive Conference Room be equipped with VTC on Day One	
			ADDED FULL FUNCTIONALITY FOR EACH PARTITION ON 6/20 - ADD TO LOG

Source: Shen Milsom & Wilke, LLC

Appendix D: The Center for Legal and Court Technology

Remote witness testifies while jurors review documentary evidence in the 2010 CLCT Laboratory Trial.

Founded as the Courtroom 21 Project, the Center for Legal and Court Technology (CLCT) is the world center for courtroom and related technology. CLCT is a joint initiative of William & Mary Law School, the nation's oldest law school, and the National Center for State Courts. CLCT conducts legal and empirical research into courtroom and related technologies and their interaction with the law, members of the legal professions, trial and hearing participants, and the public. It also provides consulting and design services throughout the world, assisting federal and state courts, the Department of Defense and State Department and federal administrative agencies such as the Social Security Administration and the Office of Medicare Hearings and Appeals. It now serves as the legal technology consultant to the Administrative Conference of the United States and is assisting in the modernization of the Supreme Court of Nigeria.

CLCT includes William & Mary Law School's McGlothlin Courtroom — the world's most technologically advanced trial and appellate courtroom. This legal space is frequently upgraded, and it offers an ever-improving courtroom technology laboratory that provides a platform for both controlled scientific and ad hoc empirical experimental work. The following conclusions from their research may be of interest to the reader:

REMOTE WITNESS TESTIMONY

Two controlled scientific studies of remote testimony were supervised by Professor Kelly Shaver, then of the William & Mary Psychology Department. The results showed that in civil cases with conceded liability but highly controversial damages, there was no statistically significant difference in verdict regardless of whether expert witnesses testifying to damages were in the courtroom or appeared live remotely via videoconferencing when the witnesses appeared life-size on a flat panel located behind the witness stand.

INFORMATION DISPLAY

Although CLCT has a permanently installed annotatable whiteboard with a short-throw projector and a drop down screen, evidence and other visual material are primarily displayed on flat panel monitors. There are some courts that use small monitors for jurors, ordinarily using one monitor for every two jurors.

However, CLCT uses one monitor per juror. Each monitor is installed in specially designed millwork that allows for easy legibility and provides excellent sightlines. CLCT research suggests that individual monitors provide a better viewing experience than most projection screens when large amounts of text are involved — especially for jurors and other trial participants with vision constraints. This assists in compliance with the requirements of the ADA and the Rehabilitation Act and poses no due process or other legal issues in the normal case.

ASSISTIVE TECHNOLOGY

Due to an aging demographic, trial participants and members of the public are in more need of assistance with their vision, hearing, and mobility. CLCT agrees with the views of organizations supporting the reasoning that persons with disabilities should not be singled out via special accommodation if the need for that accommodation can be avoided. When not, devices such as assistive listening systems, in-court or remote American Sign Language interpretation, vision enhancement equipment, and the like will be necessary, and AV designers should take such equipment into consideration in planning and design.

COURT AND LAWYER RESPONSIBILITIES

As these materials emphasize, it is not enough to specify and install proper equipment. Users must be trained in its appropriate operation. Courts are constrained in the nature of that training as it is improper for courts to help lawyers win their cases, and clear lines must exist between technology familiarization and case assistance. Readers are encouraged to review the 2011 CLCT Court Affiliates Protocols for Use by Lawyers of Courtroom Technology, best practices prepared with the help of CLCT's affiliated federal and state courts.

Appendix E: Common Courtroom Technologies in International Tribunals

International tribunals, especially those with criminal jurisdiction, often have special technology needs that are distinct from those of traditional courts in the United States. The technology considerations of international tribunal courts can be useful, especially when a designer in the United States encounters special needs ordinarily not associated with a domestic court.

TECHNOLOGIES

The technologies described below are essential in the day-to-day activities of courtroom operations from an international tribunal.

Audio Technology (multiple simultaneous language interpretation system)

Audio technology is considered the core and most critical and essential requirement for an international courtroom. Therefore, audiovisual designers and installers must ensure the most reliable, intelligible, professional, and high quality audio system possible and affordable. For an international tribunal, multiple and simultaneous language interpretation is necessary. To accomplish this, designers may decide to use a Digital Congress Network (DCN) system that is capable of providing multiple and simultaneous language interpretation. This DCN package is mostly comprised of delegate microphones, interpreter-desks (IDESK), a chairman's microphone, a Central Control Unit (CCU), audio expander unit, Infrared transmitter, extension power supply (EPS) trunk unit, radiator, and IR receivers that provide for multiple language interpretation in the public area.

Thomas F. Eagleton United States Courthouse, St. Louis, Missouri
Photo courtesy of Robert Pettus

Designers are encouraged to adhere to the technical and physical requirements of ISO 2603:1998 — Booths for simultaneous interpretation. These requirements provide for the acoustical, comfort, and concentration needs of professional interpreters:

- Acoustic separation between different languages spoken simultaneously, without mutual interference between languages interpreted or with the speaker in the hall
- Efficient two-way communication between the booths and the conference hall
- A comfortable working environment enabling interpreters to maintain the intense effort of concentration required by their work

The chairman's microphone, used by a conference chair or presiding judge, has a built-in microphone on/off button and an override function button that allows the chair or presiding judge to mute participants in case of confrontation during a meeting or court proceeding. Both the chairman's and delegate microphones have options for headphones, volume control, and channel selection to enable participants to follow the proceedings in their language of choice. At a minimum, two channels should be provided, one for language interpretation and another for ADA requirements. Further assessment of the number of channels should be performed in locations and areas where multiple languages are required to meet the needs of daily court proceedings.

Courtroom Video

As a result of the increase in the number of participants in tribunal proceedings and in order to obtain full video coverage in courtrooms and remote witness rooms, most tribunals have employed the use of multiple (usually four to six) robotic remote-controlled video camera systems. The camera in the remote witness room and the witness camera inside the courtroom are considered the most important.

These cameras are mostly attached to a Pan/Tilt/Zoom (PTZ) unit usually mounted on the wall or ceiling and sometimes on high-end tripods. Video cameras with stationary shunts are also installed in the public galleries and remote witness room.

The remote witness room is usually equipped with a camera, a set of DCN delegate microphones, a video monitor, headsets, and a channel selector to enable witnesses to follow the proceedings in their language of choice.

Videoconference Systems

Court videoconferencing is a typical requirement for tribunals. Videoconferencing technology reduces staff traveling costs, enables witnesses to testify remotely, and permits testimony in high-security situations with high-security risks. It can also be used for administrative and staff purposes.

Tribunals employ video codecs that support the H.264 protocol using either ISDN or IP protocols with full encryption security, mostly AES 128 bits or CCMP. The remote participants can follow the proceedings not only via audio and video but also with simultaneous language interpretation from the courtroom. Adequate bandwidth is essential to ensure that the data is transported to all the sites involved.

Video/Audio Streaming

Streaming technology permits the broadcast of court proceedings. The court's streaming technology that is mostly multiple audio channels and a single video signal, can be configured for internal or external streaming. Internal streaming allows court staff to follow the proceedings on their computers, while external streaming allows general public access, including news media access.

Phone Hybrid Systems

Phone hybrid technology is used to allow remote participants to follow the proceedings in their language of choice. This technology can be very useful during a videoconference when the language in the call is not in the preferred language. This system is SIP-based and allows for AES or CCMP encryption security.

Facial and Voice Distortion

Witnesses who fear retribution can be protected by electronic face and voice distortion when ordered by the judge. Voice distortion is only used for protected witnesses. This software-based solution can be applied to witnesses appearing in the courtroom, remote witness room, and remote participants via videoconferencing. The distorted or scrambled voice of protected witnesses can only be heard by the public sitting in the public gallery and elsewhere. Court participants listen to the actual voice of the protected witnesses as do the interpreters.

Delayed Broadcast Systems

Given the high sensitivity of some international court proceedings and the need to protect witnesses when the proceedings are broadcast, an electronic delay is employed to allow for the obscuring in real-time of both audio and video signals. The amount of delay can be programmed as desired.

Evidence Display, Playback Systems

This type of technology is employed within a courtroom audiovisual system setup to enable courtroom participants to present judicial evidence in a court proceeding via a desktop PC, MacBook, and laptop from where they are positioned. The audio and video output feeds the distribution system that then distributes the material to the rest of the courtroom participants and the public areas. Counsel also has access to evidence cameras and interactive touchscreen devices.

Each courtroom participant has a display monitor that allows for viewing the proceeding, counsel's presentation, real-time transcript, or the participant's computer. The participant chooses the desired content via a control system button.

Court Recording

Capturing dialogue during tribunals is a very complex process. Tribunals typically employ court reporters who use realtime technology to convert stenographic notes into English text. At the same time, digital audio/video recording equipment is used to capture the same content. The two-to-eight audio channels and digital video are used to assist the court reporters in identifying presenters, and in editing the final transcript.

A raised floor server room for recording court proceedings.

Microphone Management

The synoptic microphone control software provides a layout of the microphones deployed in the courtroom. Each microphone is assigned a seat number with an LED to indicate an active microphone. This software allows the audiovisual support staff to monitor and control (mostly switching off) unused microphones. With this software, only four microphones can be active at a time.

Control Systems

Control software is critical for using courtroom technology. The software is used for audiovisual system startup and shutdown, witness signal routing, distribution of audiovisual signals to in-court participants and public areas, control of videoconferencing, and numerous other important aspects.

Appendix F: Glossary

A

Acoustic treatments There are only three physical tools available for the acoustician to treat a room: absorbers, reflectors, and diffusers. These tools change the temporal, spectra, and spatial quality of the sound. Absorbers attenuate sound, reflectors redirect sound, and diffusers uniformly distribute sound.

ADA (Americans with Disabilities Act) The ADA prohibits discrimination on the basis of disability in employment, programs, and services provided by state and local governments, goods, and services provided by private companies, and in commercial facilities. The ADA was signed into law on July 26, 1990, and has been significantly expanded since. It contains requirements for new construction, for alterations or renovations to buildings and facilities, and for improving access to existing facilities of private companies providing goods or services to the public.

AE (Audio Expander) An audio processor that comes in two types – a downward expander and a part of a compander.

AES (Advanced Encryption Standard) A specification for encrypting and decrypting electronic data by using algorithms.

ALD (Assistive Listening Device) An audio amplification device used for the purpose of helping a person hear audio content. Assistive listening systems are required by the ADA in many types of assembly areas.

Amplifier An electronic device used for increasing the strength of electronic signals.

Analog A method of transmitting information by a continuous but varying signal.

ANSI (American National Standards Institute) The national coordinator of voluntary standards development and the clearinghouse in the United States for information on national and international standards.

AOC (Administrative Office of Courts) Used by many state and county agencies that manage their court facilities.

AOUSC (Administrative Office of the United States Courts) The management agency for the federal courts.

Architect Licensed professional responsible for the design and specification of the building facilities and systems. Design firm under contract to the court, political entity, General Services Administration (GSA), or other body responsible for capital projects.

Aspect ratio Aspect ratio is the ratio of image width to image height.

Audioconference Also known as a teleconference, allows multiple groups to communicate by audio over long distances. An audioconference is often used in conjunction with a videoconference. Audioconference data may travel over ISDN, IP, or POTS.

AV system A set of specified individual audio and video components designed and configured to operate as one comprehensive system for the purpose of communicating content to an audience.

AWG (American Wire Gauge) A standard specifying the diameter of a wire; the larger the gauge number, the smaller the wire diameter.

B

Bandwidth A measure of the amount of data or signal that can pass through a system during a given time interval.

Bidder An individual or organization submitting a proposal in response to specifications provided from an issuer.

BICSI An international professional association supporting the information technology systems (ITS) industry.

Bit (Binary Digit) The smallest unit of digital information symbolized by 1s and 0s.

BNC connector The most common and most professional coaxial cable connector due to its reliability and ruggedness. It is used to transport many signal types.

Boundary microphone A type of microphone that relies on reflected sound from a surrounding surface. It sits directly on a table or surface. Sometimes referred to as "surface mount" microphones.

BPS (Bits Per Second) A measurement of the quantity of information over time in a digital signal stream. The higher the bit rate, the better the signal quality will be.

BRI (Basic Rate Interface) An ISDN service referred to as "2B+D," BRI provides two 64-kbps, bearer digital channels, plus a 16-kbps delta channel.

Bridge 1) Connects two different types of networks together. It translates one network protocol to another protocol. An example of a bridge is a computer modem. A cable modem converts, or bridges, the Ethernet protocol to a cable TV protocol. 2) In a videoconference, a device that may be part of the videoconference unit that connects two or more calls for transmission to another unit.

Byte An 8-bit word is called a byte. "B" is the abbreviation for byte.

C

Cable An assembly of more than one conductor (wire).

CAD (Computer Aided Design) operator A technical professional who uses software programs to create computer models or drawings of the designs to show how they fit into the building.

Category 5 cable The designation for 100-ohm unshielded twisted-pair cables and associated connecting hardware whose characteristics are specified for data transmission up to 100 Mb/s. (Part of the EIA/TIA 568A standard.) Sometimes referred to as, "CAT 5" cable.

Category 5e cable An enhanced version of the CAT 5 cable standard that adds specifications for far-end crosstalk (part of the EIA/TIA 568A standard). Sometimes referred to as, "CAT 5e" cable.

Category 6 cable A cable standard for Gigabit Ethernet and other interconnections that is backward compatible with Category 5 cable. Sometimes referred to as, "CAT 6" cable.

CCD (Charge-Coupled Device) A semiconductor image-sensing device, commonly used in video and digital cameras, that converts optical images into electronic signals.

CCITT (The International Telephone and Telegraph Committee) A former international group that set worldwide communications standards, e.g., H.261. Now known as the ITU-T.

CCMP (Counter Cipher Mode Protocol) A data encryption protocol created for wireless environments to address weaknesses in other older protocols such as WEP and WPA. A major feature is increased data confidentiality.

CCU (Central Control Unit) The central control unit forms the heart of the digital congress network conference management system. It can operate standalone to provide automatic conference control, or be accessed by an operator via a PC when more extensive management is required.

Centrex A type of telephone service offered by local telephone companies. The telephone equipment is located on the telephone company premise requiring no support operation by the user. There is no usage charge for monthly calls between numbers on the same Centrex system.

CFE (Client Furnished Equipment) New or existing equipment that is to be used or reused by the contractor for installation into the system. The CFE is typically not provided with a warranty by the installer. Also see OFE.

Chrominance Chrominance is the color portion of a composite or S-video signal.

CLCT (Center for Legal and Court Technology) Formerly the "Courtroom 21 Project," this entrepreneurial public service project is a joint initiative of William & Mary Law School and the National Center for State Courts.

Coaxial cable A cable consisting of a center conductor surrounded by insulating material, concentric outer conductor, and optional protective covering, all of circular cross-section. Abbreviated "coax."

CODEC An abbreviation for coder/decoder. An electronic device that converts analog signals, such as video and audio signals, into digital form and compresses them to conserve bandwidth on a transmission path.

Color temperature The color of light sources, as rated in a numerical color temperature. Low color temperatures (2000K) cause a warm (red) look while high color temperatures (6000K) cause a colder (blue) look.

Component video A color video in which the brightness (luminance) and color hue and saturation (chrominance) are handled independently. The red, green, and blue or, more commonly, the Y, R-Y, B-Y signals are encoded onto three wires. Because these signals are independent, processing such as chroma keying is facilitated.

Composite video A signal that represents complete color picture information and all synchronization signals, including blanking and the deflection synchronization signals to which the color synchronization signal is added in the appropriate time relationship.

Consultant Individual or firm under contract to the architect, court, or building construction/renovation "owner" to supply specialized advice or services.

Contractor Individual or organizations awarded the contract to perform the work as proposed.

Courtroom 21 Refers to the "Courtroom 21 Project," the former name of the Center for Legal and Court Technology at William & Mary Law School. Sometimes incorrectly used as a term for a high-technology courtroom as in, "This is our 'Courtroom 21.'"

CPU (Central Processing Unit) The "thinking" part of a computer system that reads and executes commands.

CRT (Cathode Ray Tube) The video display tube used in monitors and receivers, radar displays, and video computer displays. The CRT is a high-vacuum tube containing an electron gun to produce the images seen on the face of the tube.

D

dB (Decibel) A comparison of two measurements or values. Abbreviated dB, it is one-tenth of a Bel (a unit of measurement named for Alexander Graham Bell).

DCE (Data Communications Equipment) Devices that provide the functions required to establish, maintain, and terminate a data-transmission connection. For example, a modem.

DCN (District Court Network) The courts' United States private data network.

DCN (Digital Congress Network) A conference system with the ability to enable simultaneous language interpretation in a conference and/or judicial proceedings.

Decoding The process in which a composite video signal is separated back out into its component parts: red, green, blue, horizontal sync, and vertical sync, or RGBHV.

Deliverable Contracting term for formal documents or key events to which the consultant's or contractor's payment is tied. The deliverables are determined according to specific contract agreements.

Digital A method of transmitting information by discrete, non-continuous impulses.

Distribution amplifier An active device used to split one input into multiple outputs, while keeping each output isolated, and the signal level constant.

DVD (Digital Video Disc/Digital Versatile Disk) An optical storage medium for data or video.

DVI (Digital Visual Interface) A connection method from a source (typically a computer) and a display device that can allow for direct digital transfer of data. The digital signal is limited to 5 meters.

Dynamic range The difference between the loudest and quietest levels of an audio signal.

E

ECRO (Electronic Court Reporting Operator) Used as a term for many multi-track recording technologies.

EIA (Electronic Industries Alliance) This alliance, which no longer exists, determined recommended audio and video standards in the United States until 2011.

Eight Position Eight Conductor (8P8C) A modular Ethernet connector. It is attached, or terminated, to the cabling. Incorrectly referred to as RJ-45, which is a different connector.

EMI (Electromagnetic Interference) The improper operation of a circuit due to the effects of interference from electric and/or magnetic fields.

Emitter A type of transmitter, such as an infrared transmitter sending modulated audio or control information on the light frequencies typically used for assistive listening equipment.

EPS (Evidence Presentation System) Electronic technology used in a courtroom by counsel to show visual images to the judge and jurors. Typical technology includes an evidence camera, DVD/MP3 players, and PC inputs for laptop or other computing devices. EPS often has the capability for remote testimony via a videoconference.

EPS (Extension Power Supply) Used in combination with a central control unit to supply extra power to a digital congress network (DCN).

Equipment rack An equipment rack is a centralized housing unit that protects and organizes electronic equipment. Sometimes referred to by IT professionals as a cabinet.

Evidence camera In a legal environment, an imaging device used to create a video image of printed documents or three-dimensional objects. In the corporate environment, this is referred to as a document camera.

F

FD (Facial Distortion) Facial distortion is used as part of the witness protection system in tribunals in order to help disguise the face of protected witnesses with the use of mosaic effects.

F connector Typically carries audio and composite video signals and is commonly used in VCRs, antennas, and televisions.

FCC (Federal Communications Commission) A U.S. federal government agency that regulates and monitors the domestic use of the electromagnetic spectrum for communications.

FF&E (Furniture, Fixtures, and Equipment) An architectural term for removable items that are typically added to a building by a tenant. Even though furniture may be custom designed for a particular building, movable furniture is still considered FF&E.

FIPS 175 (Federal Information Processing Standards) Specifies minimum requirements for the design and construction of rooms, areas, and pathways into which and through which telecommunications equipment and media are to be installed within a building and between buildings in a campus environment.

FIPS 176 (Federal Information Processing Standards) Specifies minimum requirements for telecommunications wiring for connecting one to four exchange access lines to various types of customer premises equipment in small buildings.

Firewall Any technology, hardware, or software that protects a network by preventing intrusion by unauthorized users and/or regulating traffic permitted to enter or exit the network. A firewall controls what traffic may pass through a router connecting one network to another. Firewalls control access across any network boundaries, including between an enterprise network and the Internet, or between LANs within an enterprise.

Footcandle Abbreviated "fc," is an English unit of measure expressing the intensity of light illuminating an object. The illumination from one candle falling on a surface of 1 square foot at a distance of 1 foot.

Frame An individual segment of film. Film is a complete video picture or image of odd and even fields; two fields equal one frame.

Frequency The number of complete cycles in a specified period of time. Formerly expressed as cycles-per-second (cps), now specified as hertz (Hz).

G

Ground loop An electrically conductive loop that has two or more ground reference connections. They can be detrimental when the reference connections are at different potentials causing current flow within the loop.

GSA (General Services Administration) The GSA is one of the three central management agencies in the federal government. The GSA provides expertly managed space, supplies, services, and solutions to enable federal employees to accomplish their missions.

GUI (Graphical User Interface) In iconographic representation, commands within a GUI system are represented by icons instead of text, allowing people to interact with computers by manipulating a mouse or a finger on a touch screen.

H

H.239 A protocol for allowing simultaneous multimedia communications (i.e., sharing video or audio content while still watching other remote participants) over various networks.

H.261 A standard for digital video compression in a videoconference.

H.264 A standard for video compression, allowing faster exchange of moving images over networks but using less transmission bandwidth.

H.320 A standard that allows videoconference codecs (equipment) to communicate over ISDN-based networks.

H.323 A standard that allows videoconference codecs (equipment) to communicate over IP-based (packet-switched) networks.

HD-15 A 15-pin connector used to transmit an image from a computer to a projector or monitor.

HDTV (High Definition Television) Refers to displayed images with audio that are broadcast in a digital 16:9 format, and in two resolutions: 1920x1080, and 1280x720.

HDMI (High Definition Multimedia Interface) A point-to-point connection between video devices, and becoming the standard for high quality all-digital video and audio in the consumer marketplace. HDMI signals include audio, control, and digital asset rights management information. It is a "plug-and-play" standard that is fully compatible with DVI.

HD-SDI (High Definition Serial Digital Interface) A standard developed for the transmission of uncompressed digital video and timecode within television studios or other broadcasting facilities.

Head end The equipment located at the start of a cable distribution system where the signals are processed and combined prior to distribution.

Heat load The heat that is generated and released by a piece of electronic equipment. It is measured in British Thermal Units (Btu).

HVAC (Heating, Ventilation, Air Conditioning) Refers to air handling systems for occupant comfort within a building.

I

IEEE (Institute of Electrical and Electronics Engineers) An international professional society that issues its own standards and is a member of ANSI and ISO.

IGE (Independent Government Estimate) An estimate from a third party of the likely project cost to a government entity prior to receiving bids or quotes. Also see OOPC.

Infrastructure The permanent elements of a building or facility that are provided prior to occupancy exclusively to incorporate, simplify, and/or enhance installation and removal/updating of various technologies that are installed in the building or facility either during construction or after occupancy.

Interface A shared boundary defined by common physical interconnection characteristics, signal characteristics, and meanings of interchanged signals.

IP (Internet Protocol) A standard networking protocol, or method, that enables data to be sent from one computer or device to another over the Internet.

ISDN (Integrated Services Digital Network) A communications standard for transmitting voice, video and data over digital phone lines or the traditional telephone network. Common applications of ISDN include telecommuting, Internet access, videoconferences, and data networking.

ISO (International Standards Organization) Responsible for many audio, video, and telecommunications standards.

ITU-TSS (International Telegraphic Union Telecommunications Standards Sector) The replacement organization for the CCITT.

J

JERS (Jury Evidence Recording System) A type of technology that captures exhibits as they are presented in a court proceeding and then makes them easily accessible to jurors as they deliberate. The system was created by Judge Robert J. Conrad, Western District of North Carolina.

K

Kelvin A unit of measure for the temperature of visible light colors. Colors are typically described in Kelvin as 'cool' or 'warm' but aren't physically cool or warm as in surface temperatures.

L

LAN (Local Area Network) A local area network (LAN) uses physical addresses to send data between networked devices. Devices on a LAN must be directly, physically connected either by cables or RF signals. LANs are generally owned and/or operated by the end user.

LCD (Liquid Crystal Display) A video display that uses liquid crystals to produce an image. These devices do not emit light directly.

Leased line A telephone line reserved for the exclusive use of leasing customers without interexchange switching arrangements. Also called a private line.

Lectern A piece of furniture or designated area where a presenter would stand to make a presentation. Lecterns often have a desk-like area and many now incorporate technology. The term "podium" is not a synonym for a lectern.

Lecternette A small piece of furniture placed typically on top of a 30-inch (0.8 m) high table to provide a higher and angled surface that simulates a free-standing lectern.

LED (Light Emitting Diode) Low-power lights used as indicator lights, within infrared lamps, or to illuminate signs, walkways, or displays. LEDs have a long lamp life (>100,000 hours).

Line driver Used for gain and peaking in order to compensate for signal attenuation created by cable resistance for longer cable runs.

Litigator's lectern A term originating from the Center for Legal and Court Technology that describes a fixed lectern for trial lawyers. It contains all of the technology necessary for case presentation, usually with left and right wings for an evidence camera and one or more notebook computers.

Lumen A unit of light energy equal to the light emitted by a uniform light source onto a small area of a sphere.

Luminance Part of a bandwidth limited video signal. It combines sync and brightness information. It is also called "luma," and "Y" is its abbreviation.

Lux A contraction of the words 'luminance' and 'flux'. 10.7 lux is equal to 1 footcandle.

M

MHz (Megahertz) A unit of measure equal to 1 million cycles per second.

Millwork Primarily built-in furniture that is part of a building. Millwork may include a kitchen cabinet, judge's bench, or a jury box. Millwork is provided by the building contractor and is not considered part of removable items that are typically added to a building by a tenant.

Mix-minus A mix-minus system is a type of speech reinforcement system that allows both meeting presenters and participants to be heard. Each loudspeaker is given a separate subsystem, which mixes the microphone signals, minus the closest microphone.

Modem (Modulator-Demodulator) Combined into one device, a modem converts composite or S-video signals, along with corresponding audio signals, into modulated signals on a carrier channel, and removes information from a modulated signal.

Monitor A television that receives and displays baseband information only (i.e., direct feed from a source). In customary language, any electronic display of visual information.

Multimedia The merging of different media, e.g., text, graphics, still images, sound, animation, and video on a desktop computer, thus creating a multisensory experience for the participant.

Multiplexing Multiplexing is the process used by the combiner to put together a number of modulated signals.

Multipoint line A single communications line or circuit interconnecting several stations; usually requires some kind of polling mechanism to address each connected terminal with a unique address code.

N

NCSC (The National Center for State Courts) An independent, nonprofit court improvement organization that functions as a clearinghouse for research information and comparative data to support improvement in judicial administration in state courts.

NEC (National Electrical Code) A guide book for electric installation standards. It provides rules, formulas, and diagrams to create a comprehensive description of electric installation standards.

Network A network consists of two or more nodes interconnected so that they can share meaningful data.

Network topology The physical connection that aids in the communication between devices in an area network.

NiCad (nickel cadmium) Common rechargeable battery type.

NSID (Name Space Identifier) A key used for encryption, decryption, and authentication.

NT1 (Network Terminator) A device that terminates an ISDN line at the customer's premises.

NTSC (National Television Standards Committee) The standard for analog video transmission in North America.

O

OFE (Owner Furnished Equipment) New or existing equipment that is to be used or reused for installation into the system.

OOPC (Opinion of Probable Cost) An estimate from a third party of the likely project cost prior to receiving bids or quotes. Also see IGE.

OSI (Open System Interconnection) A seven-layer reference model developed by ISO in 1984, as a conceptual framework of standards for communication in the network across different equipment and applications by different vendors.

P

Patch panel A matrix of sockets that can be interconnected manually by means of patchcords (i.e., short cables with plugs on both ends).

PTZ (Pan/Tilt/Zoom) Camera movements enabling a wider viewing area or better focus on a video coverage. PTZ cameras can change angles to look at objects both above and below the camera and zoom in to give objects greater detail. These movements can be used for any type of camera from professional video camera down to web or security cameras.

PBX (Private Branch Exchange) A piece of equipment that manages and controls phones via a software connection. The term Private Branch Exchange describes an exchange that the local user controls. A private automatic branch telephone exchange system is used by individual businesses or governmental agencies.

Phase The position of a point in time (instant) on a waveform cycle. It is measured in degrees, with 0 degrees to 360 degrees defining a complete cycle.

Pixel (Picture Element) The smallest element used to build a digital image.

Picture tube A vacuum tube containing the elements necessary to convert transmitted electronic signals into visual images.

Podium A platform on which the presenter and lectern stand. A podium is synonymous with a rostrum.

POP (Point of Presence) The place where a line from a long-distance carrier (IXC) connects to the line of the local telephone company or to the user if the local company is not involved.

POTS (Plain Old Telephone Service) The basic analog service provided by the public telephone network, without any added facilities.

Protocols Conventions governing the transmission of data; a set of rules or standards designed to enable computers to connect with one another and to exchange information with as little error as possible.

Provide To supply, install, and connect complete and ready for safe and regular operation of particular work referred to unless specifically noted.

Provisions Features of architectural spaces and details as well as electrical accommodations that allow for installation of future equipment or other devices.

Public carrier phone Telephone source provider.

Public Switched Telephone Network (PSTN) Any switching communications system that provides circuit switching to many customers. Some examples are Telex, TWX, or public telephone networks.

PVC (Polyvinyl Chloride) The material most commonly used for the insulation and jacketing of cable.

R

RAM (Random Access Memory) The most common computer memory used by programs to perform necessary tasks while the computer is on; an integrated circuit memory chip allows information to be stored or accessed in any order and all storage locations are equally accessible.

Receiver The person or device to which information is sent over a communication link.

Radio Frequency (RF) The portion of the electromagnetic spectrum that is suitable for radio communications. Generally, this is considered to be from 10 kHz up to 300 MHz. This range extends to 300 GHz if the microwave portion of the spectrum is included.

Radio Frequency Interference (RFI) Electromagnetic energy that interferes with or disturbs an electrical circuit.

RGB Abbreviation for the primary colors of light: red, green, and blue.

RGBHV (Red, Green, Blue, Horizontal sync, Vertical sync) refers to a high bandwidth video signal with separate conductors for the three color signals and the two sync signals.

RJ-45 A modular connector with eight pins and two conductors (8P2C). Often mistaken for the connector with eight pins and eight conductors (8P8C) connector that is commonly used for Ethernet connections.

RS-232 The interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange. It supports a single-ended mode of operation with one driver and one receiver. It supports a maximum cable length of 50 feet (15 m) with a data rate of 20 kb/s.

RS-422 Provides the electrical characteristics of balanced voltage digital interface circuits. It is a balanced signal with one driver and 10 receivers with multi-drop capability. The maximum cable length for RS-422 is 4,000 feet (1,220 m) with a data rate of 10 Mbps.

RT60 The reverberation time of a space in the number of seconds it takes for it to decay to one thousandth of its original level, or 60 dB.

RTT (Realtime Transcript) A transcript of live court proceedings that is available almost instantly. Sometimes referred to as “Computer Aided Transcription” (CAT).

S

Satellite communication systems A remote communication technique using a satellite in orbit to receive signals from one location, and retransmit that information to another location.

Scan line One pass of an electron beam across the face or target of a television picture tube or camera.

Scan pattern The part of an electron beam that converts an image into electronic signals.

Serial data The transfer of data over a single wire in a sequential pattern.

Signal converter A communications circuit that converts one form of information signal input into another form of signal output, such as an analog to digital converter.

Simultaneous interpretation The interpreter renders the message in the target-language as quickly as he or she can formulate it from the source language, while the source-language speaker continuously speaks. As opposed to "consecutive interpretation."

SIP (Session Initiation Protocol) An Internet protocol used to start or end live video or voice data sessions online. Session Initiation Protocol connections can transmit voice and video data from one user to another. SIP connections are commonly used by VoIP services as a way of allowing people to have a telephone conversation over the Internet.

SMART Table Often a custom attorney table with a covered trench built into the table top. The trench houses various audio, video, and sometimes power connections/connectors. The legs of the smart table are typically hollow to provide cable an enclosed route for the cable from the connectors in the trench to the floorbox beneath the table.

Sound Spectrum The range of frequencies in the electromagnetic spectrum that can be heard by the human ear. Usually from about 20 Hz to 20,000 Hz.

SPID (Service Profile Identifier) A number assigned to an ISDN line by the ISDN service provider that identifies certain characteristics of the line.

Supply To purchase, procure, acquire, and deliver complete with related accessories.

SVGA (Super Video Graphics Array) A set of graphics standards designed to offer greater resolution than VGA. All SVGA standards support a palette of 16 million colors, but the number of colors that can be displayed simultaneously is limited by the amount of video memory installed in a system. The SVGA standards are developed by a consortium of monitor and graphics manufacturers called VESA.

SVHS (Super-VHS) A higher quality version of the VHS videotape format. Separates luminance and chrominance (Y/C) information to produce a sharper picture than regular VHS videotape.

S-video (Y/C video) A video signal, also known as Y/C. Y is the luminance and C is the chrominance. Y and C are transmitted on separate conductors.

Switched line A communications link for which the physical path may vary with each usage, such as the public telephone network.

Sync Abbreviation of synchronization. In analog signals, sync preserves the time relationship between video frames and correctly positions the image horizontally and vertically.

T

Tap Taps are connections to the transformer windings allowing you to select different power levels from the transformer.

TCO (the Swedish Confederation of Professional Employees) A standard that limits monitor emissions, energy consumption, screen flicker, luminance, and keyboard use.

TIA-568 The Telecommunications Wiring and Cabling for Customer Premises standard, that defines "pinouts" or what signal is on each numbered pin.

TIP (Telephone Interpreting Program) A federal court program available nationwide since 2002. TIP allows an interpreter at a remote location to deliver simultaneous interpretation of court proceedings for defendants and consecutive interpreting for the court record by means of a two-line telephone system.

Twisted Pair Any number of wires that are paired together and twisted around each other. They can be shielded or unshielded.

U

UHF (Ultra-High Frequency) The portion of the electromagnetic spectrum from 300 MHz to 3 GHz.

UPS (Uninterruptable Power Supply) A UPS maintains power flow to devices for short periods of time via charged internal batteries. It also protects electronic devices against potentially damaging electrical events such as power surges and voltage drops. Different models offer different levels of protection and up time.

USCDG (United States Court Design Guide) The official document produced by the AOUSC that defines the design standards to which the GSA adheres during the design and construction process. Media technology is addressed to a limited degree and is supplemented by the CTM.

UTP (Unshielded Twisted Pair) Typically used for data transfer, contains mutiple two-conductor pairs twisted at regular intervals, employing no external shielding.

V

Videoconference Live communication between two or more parties via video and audio.

VD (Voice Distortion) A witness protection system used in tribunals in order to electronically disguise the voice of protected witnesses.

VEPS (Video Evidence Presentation System) A generalized term describing the basic use of media technology to show evidentiary material in a courtroom. VEPS does not include videoconferences unless evidence is being sent from the far end of the call (see H.239). VEPS is very similar to any other multimedia presentation although there can be many more display locations and the actual content displayed is carefully controlled.

VESA (Video Electronics Standards Association) A consortium of video adapter and monitor manufacturers whose goal is to standardize video protocols. VESA is a family of video standards that offers greater resolution and more colors than VGA. These standards are known collectively as Super VGA (SVGA).

Video signal Electronically captured, transported, and displayed images.

VOD (Video on demand) In commercial and government applications, these are typically PC-type servers on the network tailored to stream audio and video content from a stored location.

Voir dire In legal terms, voir dire means “to speak the truth.” The voir dire refers to the process by which judges and lawyers ask questions of prospective jurors about their background, attitudes, and other information. Its purpose is to assure that each member of the jury, including alternates, is both willing and able to consider the issues impartially in a particular case.

W

WAN (Wide Area Network) Connects several LANs (local area networks) via leased line, packet switching, virtual private network (VPN), or other means. LANs are connected to a WAN through use of a router.

Well The region of the courtroom from the end of the spectator seating forward to the judge’s bench, including the area where tables are provided for counsel. Typically, this area is a raised floor.

Your Guide to Designing AV/IT Infrastructure for Courts

"This guide represents the result of true collaboration at work, with expert input from a diverse group of specialists spanning across the spectrum – design professionals, technical analysts, technologists, law professors, court administrators, and researchers."

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Courthouses are highly specialized environments where the integration of technology and architectural design must enable people to administer justice. This guide provides expert insight for common implementation issues:

- The unique challenges of courtroom design
- Infrastructure considerations
- Integrating courtroom technologies
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