Hotel Technology Infrastructure

Second Edition

A Technology Primer
Developed by the
American Hotel & Lodging Association's
Technology and E-Business Committee
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Editorial Review

Carol Beggs, Sonesta International Hotels

Disclaimer

This guide is intended only as a general guide concerning hotel computer systems infrastructure and does not purport to be, nor should it be used as, a complete description of hotel computer systems infrastructure problems or solutions. Companies should not rely upon this guide for other than general information and should consult their employees and attorneys before implementing any suggestions or procedure or using any forms contained in this guide. AH&LA does not warrant the accuracy of the guide, the accuracy or completeness of the procedures described in this guide, the effectiveness of such procedures, or the effect of any forms contained herein.
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1. OVERVIEW

Welcome to the AH&LA Technology Committee’s Hotel Technology Infrastructure Guidebook. The AH&LA Technology Committee is pleased to present this manual for specifying voice, video, and data cabling requirements in hotels. This Guidebook is one of a series designed by the AH&LA Technology Committee to familiarize hotel owners, operators, and developers with the fundamentals of technology in the hotel environment.

This Guidebook provides an overview of cabling infrastructure requirements for a broad range of property-level hotel technology applications. Some of these applications include voice, video, and data in guestrooms and public spaces as well as administrative voice, video, and data, including telephone (also known as Private Branch Exchange, or PBX), Property Management Systems (PMS), Point of Sale systems (POS), video (free-to-guest, pay-per-view, and interactive), locking systems, High-Speed Internet Access (HSIA), and more. The intended audience is hotel operators or developers with no particular technology or engineering background. Rather than being a treatise on cable plant engineering, the discussion is organized to answer such questions as, “What do I do in my guestrooms about voice communications?” Section 11 lists a variety of technical and nontechnical resources for more detailed information, if required.

The material in this Guidebook is presented in sufficient detail to provide the foundation of bid specifications for cabling contractors engaged by the hotel operator or developer in a new build or renovation scenario. If the property is installing a new system rather than undergoing renovation, then the principles described herein still apply and may be implemented on an as-needed basis.

The property owner or manager seeks four simple things from the cable plant:

- That it support the installed systems today, without failures.
- That it place all technology functions on a single platform.
- That it be a cost-effective installation.
- That it be maintainable and upgradeable with the life of the asset.

Most computer systems likely to be installed in a hotel today connect telephones, terminals, printers, and hosts via one of four types of communications protocol.1 Using the principles in this Guidebook and some planning, you will be able to support all of these devices through a single wall plate without rewiring for many years into the future.

The challenge for the hotelier is to define an infrastructure that supports all

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1 These four types of communications protocol include: analog voice, digital voice, TCP/IP over Ethernet, and RS-232 serial.
of these communications methods today and those that may come tomorrow, and to maintain the cable plant in the future. The most effective way to meet this challenge is to treat the cable plant as its own system, integral to the building and part of the real estate asset, much like plumbing or electricity.

Contrast this structured and systematic approach with the way businesses used to pull cable—dedicated home runs of radically different cable types, each with different termination pin-outs, with device relocations and replacement dependent on pulling a new cable from the host to the device every time.

This systems approach affords a long-term view (at least 10 years) of the cable plant asset. Many structured cable system installations are sold with 10-, 15-, and even 25-year warranties. Over this kind of lifecycle, the value of the maintainable and fully documented cable plant exceeds the initial cost many times over.

The foundation of this systems approach to building infrastructure is known as the Telecommunications Industry Association/Electronics Industry Alliance (TIA/EIA) 568 Commercial Building Telecommunications Cabling Standard. This is a voluntary standard maintained by the EIA and the TIA under the auspices of the American National Standards Institute (ANSI). Since these organizations published the initial standard in 1991, it has won broad acceptance and continues to evolve.

Other relevant standards include

- TIA/EIA 569—Cabling Pathways
- TIA/EIA 606—Administration
- TIA/EIA 607—Grounding & Bonding
- National Electric Codes (NEC)
- National Fire Protection Association Codes
- Construction Specification Institute—Divisions 25, 27, and 28
- Local building codes

Formal discussion of these other standards is generally beyond the scope of this Guidebook, but many of the concepts presented here are drawn from them.

In the succeeding sections of this Guidebook, we will provide concepts and recommendations for applying the TIA/EIA 568 standard in the hotel industry for key parts of the hotel, including guestrooms, administrative areas, and public space. Additional sections will provide detail on coaxial cable support for Master Antenna Television (MATV)/High-Definition

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2 Recognize that these warranties mean that the cable plant will perform in accordance with today’s TIA/EIA 568 standard for 25 years, not that the technology in place in 10 years may not need a different standard.
Television (HDTV) systems, and alternatives to TIA/EIA 568 for delivering high-speed Internet access (HSIA) into guestrooms. Then we will discuss how to source a qualified cable plant designer or installer and provide sources of additional information.

The entire Guidebook equips a hotel owner or developer to build out the cable plant as a value-added component of the hotel that will support the needs of the building’s users and owners for many years to come.
2. CABLE PLANT CONCEPTS AND PRINCIPLES

2.1 Systems Approach

The cable plant needs to be treated as a building infrastructure system of its own, much like the electrical, plumbing, or heating, venting, and air conditioning (HVAC) system. This infrastructure perspective means using a structured hierarchy of modular elements that are independent of the applications they support. You will use identical cable plants and often the same ones for analog voice communications, digital voice communications, and a broad range of data applications, including PMS, POS, MATV/HDTV, lock system terminals, and more.

Planning and configuring the cable plant needs to be an integral part of the design-build process. Designing the cable plant after construction has progressed beyond a certain point leads to costly rework if the conduit provisions prove inadequate. Design the cable plant before you pour concrete.

You may choose to use the modularity and flexibility of the systems approach to support a physical separation of computer system devices into independent local area networks (LANs). Conversely, you may treat them as terminals on a single LAN supporting all of the applications in the property. Larger properties with more devices and more applications will need more segmentation.

Architecturally, this approach to cabling is called a “star topology.” It is analogous to the airlines’ hub-and-spoke route maps, far more efficient than the old routes of point-to-point scheduling.

The elements of the cable plant include all of the components required to connect a telephone or a computer back to the appropriate host device in a hierarchical star topology, as shown in Figure 2-1.

**Main Cross-Connects:** Also known as main distribution frames, or MDFs. Generally a field of color-coded punchdown blocks (often referred to as “110” or “110-type” blocks) and often patch panels located on a plywood backboard in the primary data center or telecommunications room (TR). PBX and host computer ports are attached to the “host” side of these cross-connects.

**Backbone:** Also known as risers. May be either copper or fiber-optic cable. Generally run vertically to TRs on each or staggered floors of the building (one sometimes finds a TR on every third floor, supporting the floor above, the floor below, and the floor it is on), or horizontally to different buildings in a campus environment. The backbone connects the “house” side of the MDFs to the intermediate cross-connects located in the intermediate TRs.

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3 Backboards should be ¾-inch plywood, painted, and equipped with a grounding bushing.

4 Be sure to factor in “missing” 13th floors in assigning TRs under this scheme.
Figure 2-1 Schematic of Major Cable Plant Components Under TIA/EIA 568

Figure 2-2 Main Distribution Frame for Voice in a Telecommunications Room
Telecommunications Rooms: TRs should be secured, illuminated, free of dust, environmentally controlled (air conditioned with own thermostat, 50°–75°F), and have adequate 120V AC (120 volts of alternating current electrical service) power to support the installed load. TRs must have grounding points consistent with TIA/EIA 607 and the NEC.\textsuperscript{5} Do not use TRs as storage or work areas.

The main TR or data center is an “Equipment Room” under TIA/EIA 568, sharing the characteristics of TRs, but will hold PBXs, servers, and other equipment as well as wiring and hubs. Ideally, a hotel will have a single secured equipment room housing PBXs, servers, in-room entertainment racks, routers, and the MDF. Do not site the equipment room in a remote location. Rather, place it in a central location to avoid distance limitations.

Intermediate Cross-Connects: Also known as intermediate distribution frames, or IDFs. Connect the backbone on the “host” side of the cross-connect to horizontal distribution to telephones, computers, and terminals in work areas or guestrooms on the “house” side. Consolidation Points (CPs) are typically 110-type punchdown blocks used as part of the horizontal distribution to a given location such as a guestroom, which is in effect a satellite IDF. IDFs often require 120V AC power nearby for HSIA switches, MATV amplifiers, and so on.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure_2-3Intermediate_Distribution_Frame_Supporting_Both_Fiber-Optic_and_Copper_Cable.png}
\caption{Intermediate Distribution Frame Supporting Both Fiber-Optic and Copper Cable}
\end{figure}

\textsuperscript{5} Telecommunications grounding and bonding must be part of the building’s grounding infrastructure.
Cable: May be made of either copper or fiber optics in a variety of sizes and pair counts. Copper cable is usually rated by “category,” where the higher the number means higher throughput capacity. The 568 standard specifies Category 5e (Cat 5e) and Category 6 (Cat 6) for most voice and data applications. Category 7 (Cat 7) has also been ratified as a standard. Cat 7 (also called Class F) cable has the highest bandwidth capacity of any twisted pair standard and is almost impervious to external sources of electromagnetic interference. However, Cat 7 costs approximately three times as much as Cat 6 and is bulkier, requiring larger conduits and cores. Most new-build or renovation applications should choose Cat 6 or 7.

Horizontal Distribution: Usually four twisted pair Cat 6 or higher copper cables running from the IDFs to the telecommunications outlets at the work areas. May be bundled to service a satellite distribution frame or patch panel. Fiber is also used for horizontal distribution, especially for long or high-demand routes.

A crucial element in maintaining the rating of a Cat 5e/6/7 cable is keeping the twists in the pairs of conductors intact to within 1/2 inch of each termination and limiting the total length of all patch cables in the channel to less than 10 meters. The total length (including all patch cables) of a copper horizontal channel should be kept less than 100 meters, according to the standard, with fiber used for longer runs.

Figure 2-4 Properly Terminated RJ-45 Jack Showing Twists Maintained to 1/2 Inch of End
Fiber optic cable is usually used for backbone applications, and may be used for horizontal distribution as well. Typically, two-fiber multimode cable of either 62.5/125 μm⁶ or 50/125 μm may be used for either horizontal or backbone applications. Optical fiber can transmit at 4Gbps over a distance of 100 kilometers (63 miles) or at 140 Mbps over a distance of 220 kilometers (138 miles). Fiber optics offer significant advantages over conventional copper and coaxial cables in high performance, light weight, small physical size, and exceptional bandwidth capacity. However, fiber costs significantly more and requires highly skilled labor to terminate.

**Telecommunications Outlets:** Typically wall plates with one or more connectors built into them. Most cable channels terminate in a modular connector punched down to either the T568A or T568B configuration. RJ-45 is the most common connector type used, with the smaller RJ-11 connector form factor used for some analog voice terminations. MATV/HDTV telecommunications outlets terminate in an F-Type connector for coaxial cable.

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6 One μm equals one micron, a unit of measure also known as a micrometer.
The T568A termination assigns eight color-coded conductors to each of four pairs as follows:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pair</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>White/Green</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Green</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>White/Orange</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>White/Blue</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>Orange</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>White/Brown</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>Brown</td>
</tr>
</tbody>
</table>

The T568B termination uses the same pair and color assignments, switching the positions of pairs 2 and 3.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pair</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>White/Orange</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Orange</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>White/Green</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>White/Blue</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>Green</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>White/Brown</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>Brown</td>
</tr>
</tbody>
</table>

2.2 Applying the TIA/EIA 568 Standard in Hotels

TIA/EIA 568 does not define how to cable a hotel. It defines in great detail what the characteristics of the components defined above should be in any commercial building. We will present the application of the standard in terms of the following assumptions:

- There are at least two analog telephone lines per standard guestroom, with provisions for future use of digital telephone instruments.
- Data service is provided to the guestrooms, independent of the administrative network.
- Most hotel systems will be resources on a single LAN.
- The LAN may or may not be segmented by application.

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7 The U.S. federal government publication NCS, FTR 1090-1997 only recognizes T568A.
These assumptions may not hold for all properties in all market segments. Some brands require dedicated networks for their proprietary applications.

Most hotel companies today require or recommend true two-line service to guestrooms. Some observers debate the continued demand for this requirement as cell phones proliferate and call volumes drop, but we believe it remains a useful recommendation for most hotels. Note that a hotel wishing to use more advanced digital or VoIP (Voice over IP; using the Internet protocol to carry both voice and data to a terminal device) phones in guestrooms will still need to offer analog phone service in each room for modem users.

### 2.3 Key Principles

2.3.1 Document the cable plant. That means labeling both ends of every cable run, labeling each outlet cover, certifying all terminations with electronic test devices, and keeping a database of the runs. Require as-built documentation and maintain it.

2.3.2 Evaluate your cable plant every time you open the walls of your building. Take advantage of every opportunity to improve or upgrade the facility in renovations.

2.3.3 Identify a single product line of TIA/EIA products and use that line exclusively to ensure consistency. Manufacturers include Ortronics, Avaya, NordX, Siemon, and others.

2.3.4 Use 6 (or higher) for all copper applications. It does not cost much more than Cat 3 and offers more flexibility and performance. As Cat 7 was ratified in 2005, hotels with long planning horizons should consider Cat 7/Class F cable.

2.3.5 Use separate voice and data MDFs to enhance manageability.

2.3.6 Avoid lighting fixtures, elevator shafts, or other sources of electromagnetic radiation in cable routes. Anything with a motor can emit some amount of interference.

2.3.7 In general, use conduit, cable trays, or hangers for all cable runs. Local building codes will require conduit in many instances. Use plenum-rated cable for all non-conduit installations in any ceiling space used for air exchange. Do not allow cables to lie directly on suspended ceilings, even in a non-plenum space.

2.3.8 Assume growth. Use conduit sufficiently larger than the cable running through it to pull more in the future (40 percent fill maximum). The longer the run or the more bends in it, the larger the required conduit diameter relative to fill.

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8 Formerly Lucent Technologies, originally AT&T.
2.3.9 Ensure that installers use care in pulling cable, avoiding excessive bending, excessive pull tension (<25 pounds), chafing, or abrading.

2.3.10 Make extensive use of patch panels to facilitate changes and reduce the required skill levels for people making changes.

2.3.11 Never use flat “silver satin” type patch cords. Use round twisted-pair cables labeled Cat 5e/6/7.

2.3.12 Do not use splices or bridge taps. Do not split pairs from a Cat 5e/6/7 channel to support multiple devices.

2.3.13 Ensure that all cable terminations maintain the twists in the cable to within 1/2 inch of the termination.

2.3.14 TIA/EIA 568 has two different specifications for terminating cables in plugs and jacks, known as T568A and T568B. Either will work, but pick one, use it exclusively, and know which one you use.

2.3.15 Note the following distance limitations for copper cable under TIA/EIA 568 for data applications:

2.3.15.1 90 meters (295 feet) maximum of backbone cable with no intermediate cross-connects.

2.3.15.2 90 meters (295 feet) maximum of horizontal cable.

2.3.15.3 10 meters (33 feet) maximum combination length of work area cables, patch cords, and equipment cable. This limitation includes patch cables in cross-connect fields.

2.3.15.4 Longer runs will require fiber.

2.3.15.5 Note that voice and video applications will operate over much longer channel lengths than data.

Figure 2-6 Patch Panel with Labels May Be Used by Housemen as Well as Engineers or IT Staff
3. TABLE OF RECOMMENDED AND MINIMUM TELECOMMUNICATIONS OUTLETS

A major decision in any cabling project is determining the number of cable terminations in telecommunications outlets in any given location. The table below is intended to facilitate that decision. Note that, in general, the more telecommunications outlets required in a given location, the more AC electrical power outlets required.

<table>
<thead>
<tr>
<th>Area</th>
<th>Assumptions</th>
<th>Recommended</th>
<th>Minimum</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Center</td>
<td>Dedicated data center housing PBX and most hotel systems.</td>
<td>Separate voice and data distribution frames. Data frame equipped with patch panels.</td>
<td>No dedicated data service to guestrooms, structured data to administrative locations.</td>
<td>Some locations may require hubs and switches distributed in TRs.</td>
</tr>
<tr>
<td>&quot;Equipment Room&quot; in 568 terms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guestrooms</td>
<td>Minimum of two analog voice circuits per guestroom.</td>
<td>25-pair Cat 6 horizontal cable terminated on a punchdown block in the guestroom with cross-connect to end points, typically bedside, desk and bathroom for voice, desk and possibly television for data.</td>
<td>Two Cat 3 horizontal cables bridged to voice end points.</td>
<td>CAUTION: Minimum configuration will not support digital or IP telephones if bridged. Rooms with cordless or digital phones should always have at least one line-powered phone in case of power failure.</td>
</tr>
<tr>
<td>Voice</td>
<td>If using digital or IP phones, provide an analog port for modems at desk area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Minimum of one data circuit.</td>
<td>As above, dedicated strands of Cat 6/7 terminated on a punchdown block with cross-connect to each end-point, possibly including TV and mini-bar as well as desk. Spare drop for future applications or printers. Pull two strands from desk area to TV to support future MATV or HSIA via coax applications.</td>
<td>Single dedicated Cat 5e strand to desk.</td>
<td>Allow additional data to support wireless access points in TRs or corridors. May choose Home Phone Network Alliance (HPNA) or similar in a retrofit.</td>
</tr>
<tr>
<td>Video</td>
<td>Coaxial cable required for in-room entertainment applications, including TV.</td>
<td>RG-11/U coax to each television.</td>
<td>RG-6/U coax to each television.</td>
<td>See Section 7 below for further discussion. Most hotels today use coaxial cable for MATV/ HDTV applications, but a new build or renovation should anticipate using Cat 6 in place of coax for some MATV/HDTV services in the future.</td>
</tr>
</tbody>
</table>
## Meeting Rooms and Public Space

<table>
<thead>
<tr>
<th><strong>Voice</strong></th>
<th>Both analog and digital voice required for house use, analog modem/fax, and resale.</th>
<th>Analog house phone in each meeting room and most corridors. Patch panels supporting both analog and voice ports on PBX servicing jacks in each meeting room for resale.</th>
<th>Analog house phone in each meeting room with controllable class of service to allow resale.</th>
<th>Voice and data resale in meeting rooms can be a major revenue area for hotels with any meeting space. Patch panels increase the margin considerably.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td>Resale of data access to the public Internet has become a baseline offering for most hotels with meeting space.</td>
<td>Patch panels supporting data outlets in each meeting room. Hubs may be placed in a meeting room to facilitate multiple devices. Large meeting room areas or exhibit halls should consider fiber for horizontal distribution.</td>
<td>Smaller properties with limited meeting space may choose to not offer access to the Internet, but should cable for it.</td>
<td>Resale of data services should be kept physically or logically isolated from administrative networks.</td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td>Both coaxial and twisted pair may be desired in public space for signage and reader board applications.</td>
<td>MATV/HDTV coax to appropriate locations for TV reader boards if appropriate. MATV/HDTV service to meeting rooms. Dedicated drops for signage if likely to install.</td>
<td>None.</td>
<td>House audio-visual services are beyond the scope of this Guidebook.</td>
</tr>
</tbody>
</table>

## Administrative Locations

<table>
<thead>
<tr>
<th><strong>Voice</strong></th>
<th>Most administrative locations will require voice and data, with most voice applications using digital telephones.</th>
<th>A single digital voice telecommunications outlet supporting multiple voice lines for most administrative users with voice mail.</th>
<th>Analog voice service to administrative locations.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td>Most administrative applications today can reside on a single logical network, but some applications may require dedicated cabling. Some franchisors require an “airgap” between any device on their reservations network and any other network.</td>
<td>Two data terminations per administrative location.</td>
<td>One data termination per administrative location.</td>
<td>Administrative networks should be kept physically or logically separate from guest networks. Front desk locations typically require additional terminations due to the number of devices located there.</td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td>As required. Do not forget MATV/HDTV service from rooftop or other location of satellite reception dish or antennae. Best to penetrate roof during construction, before sealing and warranty.</td>
<td>As required.</td>
<td>Timeclocks, access control solenoids, cafeteria POS, cafeteria TV, and so on all require consideration.</td>
<td></td>
</tr>
</tbody>
</table>
4. SAMPLE GUESTROOM MARKUP

Figure 4-1 is an annotated markup of a fully-loaded voice and data communication configuration for an upper-upscale guestroom. This example assumes that the room will be equipped with two analog voice lines and MATV/HDTV via coaxial cable, but will be “future-proofed” with a cable plant that can support digital telephones and TV over Cat 6/7 in the future without pulling additional cable.

Figure 4-1 Sample Guestroom Markup
4.1 **Consolidation Point (CP):** Cat 6/7 110-type punchdown block behind an access panel in the guestroom. Host side runs 25-pair bundled cable to IDF in TR via horizontal distribution. House side runs to work areas as identified below.

4.2 **Bedside:** Two Cat 6/7 drops for analog voice applications mounted in a duplex faceplate. Quad 120V AC power.

4.3 **Desk Area:** Two Cat 6/7 drops for data applications, two for analog voice mounted in a quad faceplate above desk. Quad 120V AC power above desk.

4.4 **Television(s):** Both RG-11/U coax and Cat 6/7 drops mounted in either one duplex or two simplex faceplates. Duplex 120V AC power. Pull two strands from TV to desk, leave in wall with 1-meter service loop at each end.

4.5 **Mini-Bar:** Cat 6/7 drop mounted in simplex faceplate. Duplex 120V AC power.

4.6 **Bathroom:** One Cat 6/7 drop for voice applications, one for MATV/HDTV and RG-6/U coax.\(^9\) Duplex 120V AC power.

\(^9\) Omit unless a luxury hotel installing bathroom televisions. Bathrooms are not a good environment for either televisions or wiring due to moisture and temperature.
5. HIGH-SPEED INTERNET ACCESS TO GUESTROOMS

5.1 Overview
Travelers have come to expect High-Speed Internet Access (HSIA) in hotel guestrooms. The AH&LA Technology Committee recommends that new builds or major renovations implement Cat 6/7 or higher structured cabling systems supporting data to the guestrooms. Routers, switches, and hubs to support the guestroom broadband service can easily be added or changed by service providers or the hotel itself once the horizontal and backbone distribution is in place.

Some hotels felt competitive pressures to provide HSIA service without a major renovation facilitating installing Cat 7 horizontal distribution to guestrooms. Numerous vendors are in the marketplace with products that provide in-building distribution over existing Cat 3 cable, coexisting with analog voice traffic. There are multiple variations of how this is done, but most involve some form of Digital Subscriber Line (DSL) modem mounted in the wall behind the faceplate connected to a Digital Subscriber Line Access Multiplexer (DSLAM), which then is connected to a router on the public Internet. A property can reduce the total cost per room of these solutions by using port-sharing devices, reducing the number of DSLAM ports required. The most common variations found in the hotel marketplace are based on technology endorsed by an industry consortium called the Home Phone Networking Alliance (HomePNA or HPNA). Cable modems can be another option.

Most hotels can deliver HSIA services more effectively using wireless applications, generally called “Wi-Fi,” short for “Wireless Fidelity.” Please see Section 9 below for a specific discussion of Wi-Fi in hotels. Some organizations forbid their travelers to utilize wireless networks, so Wi-Fi-only solutions may not fit a hotel with a large proportion of guests from such security-conscious organizations.

5.2 Elements of an HSIA Solution
Any guestroom HSIA solution must address the following elements:

5.2.1 Connection point in the guestroom: Typically an RJ-45 receptacle in a wall-mounted faceplate. Sometimes found on a “puck” or “sled-like” device. Some devices support Universal Serial Bus (USB) interfaces as well as Ethernet from the guest’s laptop. Not required for Wi-Fi solutions.

5.2.2 In-building distribution: As noted above, Cat 6/7 in a structured cabling system is the recommended vehicle, with coexistence over Cat 3 voice cable a second choice. Cat 6/7 solutions will require hubs and switches. Cat 3 coexistence solutions will require some form
of DSL/DSLAM or similar modem and multiplexer. For Wi-Fi, the cabling goes to the access points.

5.2.3 Subscriber Management Services (SMS): A server, probably located in the hotel, that controls user log-on, billing, PMS interface, and reporting. Usually also controls the home page that the guest first sees. A key function of an SMS application is to “spooﬁ” the user’s laptop into believing that it is attached to whatever network it expects to be attached to so that no changes are required to the guest’s laptop conﬁguration. The SMS products in the market vary widely in how effectively they handle this requirement.

5.2.4 Connection to the public Internet: Usually via a router supporting a T-1 or fractional T-1 circuit to the Internet. As a general rule, resale networks should be kept physically and logically isolated from administrative networks. Many franchisers require an “airgap” separation from their reservations networks.

5.2.5 End-user support: Who do guests call when they have a problem connecting? Very few guest service agents are skilled in trouble-shooting TCP/IP connections. Typically, the service provider will offer end-user support services via telephone, sometimes for a fee charged to the hotel.
6. CONNECTIONS TO EXTERNAL NETWORKS

As described above, most hotels have business reasons for connections to two or more data networks, typically the public Internet and a private network delivering reservations traffic. Some management companies may use another private network for accounting or other internal functions as well. There are also highly effective ways to make a public Internet connection function as a Virtual Private Network (VPN) with both the security of a private network and the cost-effectiveness of the Internet.

These external networks are connected to the hotels in a number of ways:

6.1 **T-1:** A T-1 circuit is a large-capacity digital circuit that can carry 1.5 megabits per second (Mbps) of data or up to 24 simultaneous voice conversations. A T-1 is a dedicated access connection that is always up, always connecting two points, typically the hotel and the carrier’s (Verizon, SBC, Sprint, etc.) nearest point-of-presence (POP). Many hotel companies use T-1 circuits in the hotels with a few channels of frame relay\(^\text{10}\) data network and the balance used for voice, so that the voice traffic subsidizes the cost of the reservations data network.

6.2 **Fractional T-1:** Uses only a portion of a full T-1 capacity for the data network at a lower cost. The remaining channels are simply not used. Often abbreviated as “frac T.”

6.3 **Integrated Services Digital Network (ISDN):** Many T-1 lines are provisioned as ISDN circuits, called Primary Rate Interfaces (PRI). Another type of ISDN service is called Basic Rate Interface (BRI), using two channels bearing traffic and a signaling channel. An ISDN connection to the public Internet will yield up to 128k of total bandwidth and may be either dial-up or dedicated. ISDN combines voice, video, and data over the same digital circuit from the telephony networks. Some mission-critical networks use dial-up ISDN circuits as automatic fallbacks in case the primary network (typically a dedicated T-1) fails.

6.4 **Digital Subscriber Line (DSL):** In addition to using DSL variants for in-building distribution, DSL has become a popular vehicle for cost-effective dedicated Internet connections for residential and small business applications. DSL services are available at various bandwidths, often with a higher download capacity than upload capacity (“asymmetric”).

6.5 **Cable Modem:** Cable modem operates over the ordinary cable-TV network and can provide broadband Internet connections.

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\(^{10}\) Frame relay is a very popular type of WAN for data applications, used by most hotel brands for reservations distribution.
6.6 **Analog Voice**¹¹ Trunks: The basic plain old telephone service (POTS) provided by two wires for every voice circuit, very similar to most residential telephone services. Analog POTS trunk service in hotels and other businesses is largely being pushed aside by more efficient digital services terminating on the PBX, but it still has a place both for fallback in case a T-1 fails and for analog voice lines independent of the hotel PBX.

A large hotel with extensive meeting space and Internet resale will want one or more T-1s for resale purposes only. Smaller properties might service their resale demand with “frac T” or DSL services.

The data component of any of these external network connections usually terminates on a router, which looks at each packet of information and determines where it needs to be routed to next. Switching, firewall, and Network Address Translation (NAT) functions are often provided by additional devices located at the router or built into a multifunction router device.

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¹¹ Don’t forget that modems and fax machines require analog service, not digital. Your digital PBX can present both digital and analog ports as required.
7. VOICE OVER INTERNET PROTOCOL

Voice over Internet Protocol (VoIP) is a technology that allows users to place telephone calls using Internet Protocol (IP) connections. This can take the form of a carrier technology, where the carrier converts the voice signal to IP, sends it out, and converts it back to voice at a switch near the recipient; or it can take the form of a Customer Premise Equipment (CPE) technology, where the telephones are terminals on the LAN in the hotel, connected to an IP PBX.

As a carrier technology, VoIP can reduce the cost of long-distance tolls somewhat, especially for organizations with a large proportion of on-network traffic (military bases, for example). As a CPE technology, VoIP today costs significantly more than analog or digital telephony. Note also that few VoIP devices are line-powered, thus they will not work during power outages.

We anticipate that the price differential will come down over time, and that IP PBXs will become a dominant format.
8. MASTER ANTENNA TELEVISION/ HIGH-DEFINITION TELEVISION REQUIREMENTS

Master Antenna Television (MATV) services are required to deliver broadcast, cable, pay-per-view, and various interactive services to guestrooms. Traditionally, MATV has been delivered by RG-6/U coaxial cable (very similar to the cable TV coax service in your home). Some free-to-guest (FTG) providers (Comcast, for one) are now recommending RG-11/U for in-building distribution to support HDTV signals. More recently, in-room service providers have entered the market delivering pay-per-view, interactive, and Internet services over Cat 5e (or higher) rather than coax. Typically, these providers will still require coax to distribute free-to-guest programming.

Today, developers should install both coax and Cat 6 for MATV support in a new build or major renovation as a form of future-proofing. Installing coax only to support MATV risks limiting future choices for in-room services.

Use your in-room services vendor for final design and specifications of your MATV system, particularly for the selection and installation of amplifiers, mixers, and filters. The AH&LA Technology Committee cautions developers against allowing the provider to install and own the cable plant, however. While it is often attractive to push the cabling cost back to the vendor, a poorly structured agreement can greatly limit the hotel’s future choices and subject the cable plant asset to mechanic’s liens or other encumbrances in the event that the provider does not fulfill its obligations. Better to own the MATV cable plants yourself as an asset, built to the specifications of the provider.

Coaxial cable plants share many similarities to the structured Cat 6 systems defined in TIA/EIA 568, with backbone and horizontal distribution. Loop-through designs are not recommended. Riser or backbone distribution generally calls for RG-11/U coaxial cable. Long runs (more than 500 feet) require .500 (or larger) hardline backbone. Horizontal distribution to the guestrooms will generally utilize RG-6/U cable, or, as noted above, RG-11 for future support of HDTV. Use conduit according to local building codes.

Provide dedicated riser cabling, with spare capacity, from the data center to the rooftop to support satellite dishes and antennae. This riser should terminate in a 4-inch weather-capped conduit in a rooftop location with an unobstructed view of the southern sky.12 It is also wise to install a 3-inch antenna mast during construction.

12 Geosynchronous satellites are over the equator, so Northern Hemisphere locations need a southern line-of-sight to “see” the satellite.
9. WIRELESS

Wireless data communications ("Wi-Fi") have largely obviated the need for “shared-pair” HSIA solutions that coexist with analog voice. They also attract attention for being perceived as insecure. The most widely-used wireless networking standard at this time is IEEE 802.11b, with 802.11g (faster) coming on strong. Currently, most service providers install APs that support both 802.11b and 802.11g.

Wi-Fi technology establishes a Wireless Local Area Network (WLAN) where each transmitter can service computers up to 300 feet away. These transmitters (usually called Access Points, or APs) are connected by Cat 5e/6/7 cable in a LAN. They are typically placed in a ceiling or Telecommunication Room (TR), which is then wired back to a router in the equipment room.

Therefore, a wireless network still requires a structured cabling system, but less horizontal cable. This can be a real advantage in guestrooms, but it requires that guests have Wi-Fi capabilities in their laptops, 13 know how to use them, and accept the perceived security risks.

A successful wireless data installation depends on properly positioning and tuning the access points. Proper positioning requires a formal engineering survey using test equipment. Place the access points properly and run horizontal cable to them, rather than placing access points where the cable happens to be. Access points generally require 120V AC power, or they can receive power over the data cable (Power Over Ethernet, POE) by adding an inexpensive injector device.

Other useful wireless data applications in the hotel environment include:

- Pool and beach bar areas to support handheld POS applications.
- Resale for special events in locations that are not normally cabled (golf courses, parking lots, etc.).
- Temporary use during renovations or administrative office relocations.

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13 Most commercial laptops today ship with the Intel Centrino chipset which includes Wi-Fi capability.
10. SOURCING CABELING CONTRACTORS

10.1 Overview

Most telecom and electrical vendors are familiar with TIA/EIA 568. Their skill levels in implementing it will vary widely. If you use a full-service PBX service vendor, you will find that it can provide most cabling services, it already knows your facility, and it has a business relationship with you. Likewise, your in-room service provider should have comparable skills and knowledge, and already has a business relationship with you. Your responsibility is to ask vendors for an installation compliant with this Guidebook and TIA/EIA 568, and ensure that the installation is tested and documented. Ask them about professional or vendor certifications.

To ensure a fully-compliant cable plant for large or sophisticated installations, especially new builds, look for the Registered Communications Distribution Designer (RCDD) certification. A RCDD certificate indicates that the holder has demonstrated a broad range of expertise in the detailed design and implementation of cable plants. The RCDD professional designation requires passing a formal exam, proof of several years of design experience, and regular recertification. The RCDD designation is awarded by the Building Industry Consulting Service International (BICSI) professional association. BICSI also has a certification program for installers and offers a variety of educational opportunities for those pursuing these designations.

Vendors are another source of certification. Most of the manufacturers of integrated Cat 6/7 cable, connectors, and so on offer certification in using their product lines. If a vendor proposes using a given product line, ask whether it is certified in it. Manufacturers’ warranties are typically valid only if sold and installed by a certified distributor. Many of the manufacturers’ Web sites allow you to search for their distributors by location. See Section 11 below.

However you source cabling contractors, demand testing and certification in addition to as-built documentation of the cable plant. Although testing may seem expensive, it is nothing compared to going back later to do the job over.

10.2 Components of a Cable Plant Request for Proposal

When you are buying cable plant infrastructure sourcing and installation in a new-build or renovation scenario, the developer, project manager, or general contractor should use a structured bidding process. You should include the following elements in a Request for Proposal (RFP):

10.2.1 Provide an overall description of the project and the project management.

10.2.2 Provide marked-up samples of the most current available drawings with accompanying narrative describing requirements at
the telecommunications outlet level in detail. See Section 4 of this Guidebook for an example.

Require the following components in the response document:

10.2.3 A statement of qualifications, including RCDD certification of lead designer (identified by name). You may verify an individual’s RCDD status at the BICSI Web site, www.bicsi.org/index.htm.

10.2.4 Identification of which manufacturer’s components will be used and a statement of certification on that product line.

10.2.5 A statement of experience with projects similar in scope and nature, particularly hotels.

10.2.6 A statement of full compliance with TIA/EIA 568, 569, 606, and 607 and all local and national codes that apply (see Section 1 of this Guidebook).

10.2.7 A narrative describing the backbone media and horizontal distribution proposed to satisfy the telecommunications outlet requirements for guestrooms, administrative locations, and public areas.

10.2.8 Estimated conduit sizes and counts required for riser applications.

10.2.9 Certificates of liability and workmen’s compensation insurance coverage in amounts proportional to the scale of the project.

10.2.10 Compliance with union membership requirements as per the overall project or local custom.

In the Scope of Work section of the RFP, include the following:

10.2.11 Complete turn-key services, including design, build, source, install, cross-connect, test, certify, and document.

10.2.12 Delivery of as-designed plans to project management before work begins.

10.2.13 Labeling of all cables at both ends according to a documented and consistent labeling nomenclature. Labeling of all telecommunications outlet faceplates, patch panels, and distribution frames.

10.2.14 Wire-map and swept frequency testing and certification of the installed plant as compliant with the electrical characteristic requirements of TIA/EIA 568.

10.2.15 Delivery of as-built plans to project management with the test and certification results.
11. ADDITIONAL RESOURCES

11.1 General Information on Cabling

11.1.1. www.lodgenet.com
Detailed MATV/CATV specifications available for download.

11.1.2. www.cableu.net
Absolutely outstanding source for information on copper and fiber cabling in general and TIA/EIA 568. Offers training programs online or for sale, as well as testing products and tools.

11.1.3. www.smartwire.com/techcontents.htm
Very good site with overview and detail on both TIA/EIA 568 and MATV cabling. Sponsored by a cable distributor.

11.1.4. www.global.ihs.com
Purchase the actual standards documents (via download of PDF).

11.1.5. www.connectworld.net
Large technical library; “virtual mall” of distributors.

11.1.6. www.omedacom/cim
Site to subscribe to e-mail newsletter Cabling World.

11.2 Trade and Professional Associations

11.2.1. www.bicsi.org
Home page for BICSI, with information on the RCDD professional designation, variations on it, and the Installers certification program.

11.2.2. www.tiaonline.org
Home page for the Telecommunications Industry Association, a sponsor of the 568 and other standards; markets various trade shows and educational offerings.

11.2.3. www.eia.org
The Electronics Industry Alliance, the co-sponsor of 568.

11.2.4. www.ieee.org
The Institute of Electrical and Electronics Engineers, Inc., the leading authority in the electrical and electronics fields.

11.3 Manufacturer and Distributor Sites

11.3.1. www.anixter.com
Full-line distributor.

11.3.2. www.avaya.com
Formerly Lucent Technologies; markets the “Systemax” product line.
11.3.3. www.cables-unlimited.com/index.html
Multiline distributor.

11.3.4. www.nordx.com/public/htmen/0_0.asp
Markets the IBDN product line. Spun off from Nortel Networks.

11.3.5. www.ortronics.com
Markets comprehensive structured cabling product line and systems, with a strong certification program.

11.3.6. www.panduit.com
Full-line manufacturer.

11.3.7. www.siemon.com
Full-line manufacturer with strong certification program and educational offerings.