NETWORK CONSIDERATIONS FOR BEST-IN-CLASS EXPERIENCES FACILITY-WIDE

INFRASTRUCTURE OPTIONS FOR OPTIMIZED CONNECTIVITY, SECURITY, AND VISIBILITY
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPERIENCES CAN MAKE OR BREAK YOUR BUSINESS</td>
<td>3</td>
</tr>
<tr>
<td>ESCALATING EXPECTATIONS</td>
<td>3</td>
</tr>
<tr>
<td>TWO APPROACHES TO GAINING HIGHER BANDWIDTH</td>
<td>3</td>
</tr>
<tr>
<td>FIBER OPTICS: THE PATH FORWARD?</td>
<td>4</td>
</tr>
<tr>
<td>ASSESSING PON/GPON CHALLENGES</td>
<td>7</td>
</tr>
<tr>
<td>SMART RATE: THE INTELLIGENT CHOICE</td>
<td>7</td>
</tr>
<tr>
<td>AON + SMART RATE = BETTER TOGETHER</td>
<td>8</td>
</tr>
<tr>
<td>BEYOND 10GBPS</td>
<td>9</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>9</td>
</tr>
</tbody>
</table>
EXPERIENCES CAN MAKE OR BREAK YOUR BUSINESS

Consistency is the watchword of the hospitality industry. Just as exceptional home-like experiences strengthen guest loyalty, failure to honor your marketing promises is a recipe for disappointment, abandonment and damaging social media posts that can take years to unravel.

Transient opportunities to influence brand loyalty, sentiment and satisfaction, for better or for worse, happen throughout a guest’s journey. Taken together they form the overall guest experience, and the objective of the brand or property is to ensure it meet or exceed expectations of what that experience should be. Whether it is app-enabled property navigation, preferences-based dining suggestions, proximity-enabled housekeeping or lost child location services, skillfully blending digital capabilities and physical processes are critical for making or breaking the guest experience and affinity for your brand.

The need for consistent experiences also applies to facility operations, where they can affect productivity, profitability, safety, and staff enthusiasm. Examples include the ability to speedily locate luggage carts or dining trays, the provision of location-based panic buttons to improve personal safety and well-being, robust mobile voice options to smooth communications and uniform visibility across plant, equipment and networks for your security teams.

IP supports it all

Fundamental to delivering high-quality, consistent guest and staff experiences are your property’s IP-based WLAN and LAN networks.

Although disparate systems once carried data, television and telephony, today’s multimedia entertainment, comfort controls, door access, duress alarms, property navigation, voice telephony and video communications – along with their associated enabling technologies such as Wi-Fi 6 (also known as 802.11ax), IoT, cybersecurity and cloud-based productivity applications – have all converged to ride on IP networks.

With the right networking infrastructure supporting your common IP platform, you can roll out a broad range of new convenience, loyalty, safety, entertainment and marketing services quickly and easily. Where networks were once considered a cost center, now they can actually generate revenue via the marketing, loyalty, product placement, advertising and other services they host.

What’s the right type of infrastructure for supporting your IP networks? The balance of this paper will help you answer just that.

ESCALATING EXPECTATIONS

Advances in mobile technologies have completely transformed guest expectations. In less than a decade, the bar has risen from providing free Wi-Fi in common areas to supplying guests and staff members with the capability to control everything, everywhere from their personal smartphones or corporate-issued handheld devices. Now we’ve entered a transitional period where guests and employees alike are no longer satisfied with touch screens – ubiquitous voice-activation and streaming video communications are coming to the forefront.

From a networking infrastructure perspective, this means investing in solutions that can provide sufficient bandwidth to meet the accompanying performance escalations. Industry experts suggest 4K video streaming and conferencing, the most bandwidth-intensive application known today, will need 25Mbps of throughput for a single instance. Just 100 guest devices simultaneously streaming 4K video need 2.5Gbps.

Streaming video won’t be the only activity your infrastructure will be expected to support at any given time. There are also point of sale solutions, network printers, IoT systems for environmental and operational controls, connected physical security systems and typical workaday productivity applications. Each of these layers on further bandwidth requirements, ranging from 2Mbps to 20Mbps per device.

A network and application performance discussion shouldn’t just be about the minimum requirements for each type of guest, staff or operations activity. It should focus on planning for infrastructure that scales to higher throughput and more use cases than are typical today. The key is deploying a solution that provides a solid return on investment while also enabling your brand to achieve its growth, revenue and experience goals.

TWO APPROACHES TO GAINING HIGHER BANDWIDTH

It’s likely you’ve already heard plenty of buzz about the potential options for supplying multi-gigabit bandwidths. Essentially, hospitality providers are considering two types of infrastructure. One is based on fiber optics and the other on Ethernet. Let’s take a closer look at each of them, along with the pros and cons you’ll need to evaluate.
FIBER OPTICS: THE WAY FORWARD?
For a variety of reasons, fiber optic networks have gained notice for offering high-bandwidth optical cabling to support IP networks, rather than using traditional copper Ethernet wires. Let’s start with the fundamentals.

Fiber ABCs: Cables & Connectors
Like traditional Ethernet, fiber optic networks are comprised of cables and connectors. However, there are significant differences among them in capabilities and long-term costs. In general, the type of fiber architecture you deploy will determine which components you’ll require. No matter what architecture is used, here’s a rundown of cables and connectors most commonly discussed in the hospitality industry.

Cables
Like Ethernet, fiber optics rely on cables to transmit signals. The two primary cable types are:

- Single Mode Fiber (SMF) cables have a smaller core size that permits single type of light mode (ray of light generated by a laser) to travel through the fiber’s core at a time. Due to the smaller core size, the quality of the light signal is higher. This makes SMF preferred for longer distance scenarios, including within a building, between multiple buildings or across a campus. SMF characteristics include:
  - Delivers 10Gbps over distances up to 10km (6.2 miles);
  - Enables standardizing on one type of cable for multiple uses;
  - Can support multiple network architectures and is therefore likely to have a much longer lifecycle than other fiber optic cable types. It may already form the backbone at some properties.

Multimode fiber (MMF) cables have higher data capacity than copper and use low cost vertical-cavity surface-emitting laser (VCSEL) optics but only over short distances, such as within a data center. MMF characteristics include:
  - Supplies 10Gbps over distances limited to 550 meters (600 yards);
  - Speeds drop markedly with distance, which tops out at 2km (1.2 miles);
  - Requires updating the cables and all related components whenever standards are updated, adding significantly to capital and operating costs over the life of a commercial building.

Connectors
Which connectors are appropriate depends upon what type of fiber optic architecture is deployed, passive or active, which we’ll discuss below. At a high level, connection types are:

- Optical Line Terminal (OLT) joins external communications connections (such as from a service provider) and internal data connections (such as enterprise servers and storage) in order to transmit data within a passive optical network (PON). Typical OLTs are layer 2 only. Regardless, all OLTs require an external power source to operate.

- Optical Splitter (Splitter) is a passive beam-splitting device that divides a single optical signal into multiple signals. It is required for PON.

- Optical Network Terminal (ONT) converts optical signals into formats usable by LAN and WLAN networks, televisions, VoIP telephony, IP surveillance cameras, and cable television. Modern ONTs exhibit a few characteristics of an Ethernet switch, but are vastly more limited in their capabilities. ONTs are required for both PONs and active optical networks (AONs).

Small form-factor pluggable (SFP) transceivers are used to connect an AON to a either LAN or WLAN. An SFP are the most common type of Ethernet transceiver and attach to a port on an Ethernet switch.
Fiber Optic Architecture #1: Passive Optical Network (PON)
A passive optical network (PON) is a one-to-many architecture with an individual SMF multi-fiber cable bundle running from a central location and then splitting into multiple feeds. All endpoint devices share the aggregate bandwidth of the originating cable. PON has been most attractive to service providers because a PON minimizes fiber runs from the service provider’s office to each customer’s premise – whether a home, apartment complex, commercial building or industrial facility (see Figure 1: Service Provider PON Architecture).

Fiber Optic Architecture #2: Gigabit Passive Optical Networks (GPON)
GPON is a high speed PON, and its main attraction is a reduction in the IDF closet footprint required to support a fiber optic network within a building since it doesn’t require a closet with Ethernet switches. GPON architecture is most commonly advocated by vendors for delivering what’s referred to as fiber-to-the-x (FTTX), which can be a home (FTTH), a room (FTTR) or a desktop (FTTD). (See Figure 2: Basic GPON architecture for FTTX)
Fiber Optic Architecture #3: Active Optical Network (AON)/Peer-to-Peer (P2P)

Just as PON is one-to-many, an Active Optical Network (AON) or Peer-to-Peer (P2P) is 1:1. Using this architecture, bandwidth from a central location runs to a single endpoint. In a hospitality setting, each fiber feed can run to an IDF and be plugged into an Ethernet network edge switch, which then transmits signals to multiple endpoints using a common IP protocol. To dissipate heat while minimizing power, fanless Ethernet switches can typically be used.

At their heart, AONs are the opposite of PONs. Instead of providing oversubscribed bandwidth, AONs supply bandwidth specific to the services, applications, and devices in use. Further, AONs dispense with OLTs, eliminating the costs and complexity of OLT/ONT pairing, and related requirements, in PON/GPON architectures. (See Figure 3: Hospitality property AON architecture.)

Additional Fiber Optic Technologies

Conversations around fiber optic architecture frequently include two other technologies worth noting, one that is currently available and the other still under development.

**Powered Fiber**

In situations where new cable pulls are cost-effective, an AON-related option that can be used is called “powered fiber.” It combines a fiber optic cable and two copper conductors in one common sheath. The thickness of the copper conductors supports higher wattages and the fiber optic link supports runs up to 3 kilometers, making it an attractive option for outdoor applications in areas where lighting is desired, or wherever a very long cable run is needed.

However, the high cost of the transmitter and receiver required by powered fiber solutions price them out of the game for broader use in guest rooms.

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**Figure 3: Hospitality property AON architecture**
**Digital Electricity**

A technology on the horizon with the potential to distribute power in brownfield situations is called “digital electricity.” This technology uses specialized signaling cables, transmitters and receivers to provide up to 2,000 Watts over a maximum of 2,000 meters. However, there is a tradeoff between power and distance.

Digital electricity doesn't distribute data, necessitating installation of a separate Ethernet data cable or fiber. Justifying the deployment of two cables – one for power and one for data – hinges on achieving significant savings from such a novel power distribution format. Proof of this remains to be seen.

**ASSESSING PON/GPON CHALLENGES**

Despite well-known bandwidth and performance benefits, it is prudent to understand the broader implications of PON/GPON networks before deciding if it's appropriate for your application.

Local power is required at every fiber termination point and for every device that otherwise would have been PoE-powered using a traditional Ethernet architecture. At any given hospitality property, this potentially means thousands of power supplies connected to AC outlets. Each supply will require battery backup or a UPS to provide service reliability comparable to a UPS-backed PoE network, adding appreciably to deployment and management costs.

Fixed bandwidth capacity per OLT port gets split between as many as 128 endpoints, based on the capabilities of the splitter. Endpoint examples include Wi-Fi access points, IoT devices and streaming video devices. The total capacity of each OLT is about 2.5Gbps downstream and about 1.25Gbps upstream, translating to 20Mbps downstream and 10Mbps upstream, if 128 endpoints share a single OLT.

OLTs must be paired with ONTs, meaning an attempt to reduce the number of endpoints, in an effort to gain bandwidth, increases the number of both OLTs and ONTs that must be purchased.

OLTs and ONTs typically proprietary, coming from the same manufacturer and be paired according to the manufacturer’s specifications. This runs contrary to the IT industry trend toward open, interchangeable solutions that reduce vendor lock-in.

Powered ONTs only deliver a maximum of 30 watts of PoE – equivalent to 802.3at. This is insufficient to power all of the connected and IoT devices you’re likely to deploy, like Wi-Fi 6 access points, LED lighting, physical access systems, video solutions, voice telephony and a range of others. Although newer models offering 100 watts are on the horizon, options are currently limited and higher power ONTs may require installation by a licensed electrician.

The GPON communication protocol is unique, creating significant challenges for converging management and security across fiber and LAN/WAN networks. Specialized integration work is required to unify management, reduce complexity and deliver uniform security across media and systems.

To recap: PON/GPON architectures fail to provide the power you'll need for connected devices, ranging from Wi-Fi access points to IoT solutions and security systems. Further, PON/GPON solutions typically exhibit proprietary component, protocol and management requirements, adding to costs and complexity over the short and long term.

**SMART RATE: THE INTELLIGENT CHOICE**

Although fiber can be attractive, Ethernet has a proven and successful track record as an open-standards solution for reliably and resiliently providing data transmission and centralized PoE power. Now, it can also deliver the higher bandwidths needed for your converged data, video and voice network.

In the past, the concern for hospitality property owners was Ethernet's limitation for supplying no more than 1Gbps speeds and 30 Watts of power. All of that changed with the introduction of the IEEE's 802.3bz multi-gigabit Ethernet standard, which enables delivering higher bandwidths and the introduction of IEEE 802.3bt PoE standard for high power PoE.

**Smart Rate delivers multi-gigabit speeds and more**

A leading solution using the enhanced 802.3bz multi-gigabit Ethernet standard is called HPE Smart Rate. It permits Wi-Fi 5 (802.11ac) and Wi-Fi 6 access points, as well as IoT devices and other connected systems, to obtain up to 10Gbps speeds and with IEEE 802.3bt switches 60W PoE over existing CAT5e and CAT6 Ethernet cabling.
To put it another way, Smart Rate enables property owners with existing Ethernet architectures to make a wholesale performance upgrades for answering the escalating performance expectations without pulling new cable. This yields meaningful cost and time savings, and lowers complexity compared with replacing Ethernet copper cabling with fiber.

In situations where re-cabling is a cost-effective option, installing CAT6a cable cost-effectively increases the flexibility of Smart Rate for supplying ever-greater bandwidth, and higher PoE, as Ethernet standards continue to evolve.

**Technology You Can Support**

From a management perspective, Ethernet switching solutions with Smart Rate offer known ease of integration and management for your IT staff, unlike the specialized expertise required for PON/GPON.

Leading Smart Rate multi-gigabit Ethernet solutions go a step farther by providing a wealth of intuitive new tools, centralized dashboards and AI-powered analytics for unifying and automating LAN and WLAN operations. With thousands of devices soon to connect to your network, eliminating manual tasks is key to minimizing IT overhead. These tools enable IT teams to transition from break/fix to predictive mitigation by uncovering potential issues before they affect staff or guest experiences.

**AON + SMART RATE = BETTER TOGETHER**

If you’re constructing a new property, or remodeling an existing one, another future-readiness option is combining an AON with a Smart Rate multi-gigabit Ethernet solution. This strategy gives you the flexibility to upgrade as new AON and Ethernet capabilities are introduced, at significantly more economical price points than proprietary PON/GPON solutions.

Further, an AON/Ethernet hybrid can also converge once-disparate services since it doesn’t require OLTs and Ethernet switches are very versatile. For example, SFP/SFP+ transceivers can be easily upgraded from 1 to 10Gbps by replacing the SFPs without replacing the switches. Also, switches don’t require special pairing and can be procured from any vendor, unlike OLTs and ONTs. Finally, switches provide unified network management, which can reduce both complexity and ongoing operational costs. (See Figure 4: AON and Smart Rate Ethernet architecture)
BEYOND 10GBPS

One question you’re certain to consider is how much bandwidth your properties really need. Although such inquiries often generate some debate, in this case the answer is fairly clear. Estimates by leading industry experts suggest 10Gbps will meet the needs of every current and foreseeable application.

Beyond foreseeable bandwidth needs are the inevitable Ethernet technological advances. With development already well underway for terabit speeds, new IEEE standards will deliver ever-higher throughputs by the time greater speeds across hospitality properties are required.

SUMMARY

Whether you’re planning a network upgrade or designing a new building, successfully delivering guest experiences depends upon laying the right networking foundation. As you’re weighing the benefits of open-standards, vendor-agnostic solutions like Smart Rate multi-gigabit Ethernet against proprietary fiber options, it’s critical to go beyond comparing short-term purchasing costs. To get the best option for your brand, be certain to calculate long-term capital and operating expenses that will impact your overall return on investment.

From a performance perspective, GPON is typically presented as the closest contender to Ethernet. However, important considerations like power distribution costs and vendor lock-in expenses can tip the scales. Consideration has to be given to the ease and cost with which the network infrastructure can elevate or hinder the guest experience. With properties now adding Wi-Fi access points to every guest room to handle everything from multimedia conferencing to door access controls and location-based site navigation, you have to consider which technology is best suited to meet those needs.

Given the synergies between copper and fiber, many property owners will pursue a hybrid approach, where an AON is used in the data center, and for risers, with Smart Rate multi-gigabit Ethernet supplying connectivity everywhere else – guest rooms, conference facilities, operations centers, HVAC rooms and back offices. This approach is well proven to address all current needs and flexible enough to future-proof investments.

The Bottom Line

Embracing latest networking hype doesn’t ensure a cost-effective future-ready network, while overlooking a solid technology, like PoE, can lead to headaches for years to come. No matter which infrastructure you ultimately choose, only a thorough evaluation of advantages and tradeoffs will yield a solution that delivers the experiences on which you and your guests can count.