4th Utility Expectations
What Does it Mean for Building Network Design?

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Collaborative environments

Untethered workforce

Internet of Things (IoT)

Streaming content

5G

Augmented and virtual reality

Citizens Band Radio Service (CBRS)

Power over Ethernet (PoE) applications

BYO device

“WiFi-first” networks

Smart buildings

Shared workspaces
Connectivity has become the 4th utility
Global IP traffic is growing at an exponential rate

82% of IP traffic will be video by 2022

Today, 75% of worldwide video traffic is over mobile

By the year 2020, the IoT will comprise more than 30 billion connected devices

Source: Cisco, VNI, 2018; TIA Smart Buildings, 2019
Wi-Fi is the dominant access technology going forward

Higher
Speeds

More
Power
Global mobile population is **3.98B unique users** with **80% of all mobile usage** taking place **inside a building**

Monthly mobile data usage will surge to **98.34 GB/SIM** by 2025

<table>
<thead>
<tr>
<th>Year</th>
<th>Monthly Data Usage (GB/SIM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>13</td>
</tr>
<tr>
<td>2025</td>
<td>98.34</td>
</tr>
</tbody>
</table>

Source: TIA Smart Buildings, 2019
5G will drive network demands

Peak speed per user
- 6.5 Gbps Downlink
- 3.2 Gbps Uplink

Source: Cisco
It’s time to design the network differently!
Smart buildings start with smart network designs.
TIA defines a ‘smart building’ as one that uses an integrated set of technology, systems and infrastructure to optimize building performance and occupant experience.

Source: TIA Smart Buildings, 2019
SMART BUILDING INTEGRATED ECOSYSTEM

VALUE GENERATION
BUILDING AS A SERVICE

INTERCONNECTED SYSTEMS
& IOT CAPABILITIES

INNOVATION AND SERVICES ENABLEMENT

7

6

5

4

3

2

1

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Source: Telecommunications Industry Association, 2019
Foundation 2: Connectivity

Value Generation
Building as a Service

Interconnected Systems & IoT Capabilities

Connectivity and Communications
Basic Building Services Infrastructure

Wired, Wireless (Cellular & Other), WiFi, Public Safety, Internal/External

Source: Telecommunications Industry Association, 2019
Fiber Deep networking can enable smarter buildings

<table>
<thead>
<tr>
<th>Smart Building Foundations:</th>
<th>Fiber Deep...</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Innovation &amp; Services</td>
<td></td>
</tr>
<tr>
<td>6. Automation</td>
<td>Enable and centrally manage IP and RF applications that provide key end user experiences</td>
</tr>
<tr>
<td>5. Interoperable Processes</td>
<td></td>
</tr>
<tr>
<td>4. Information Management</td>
<td></td>
</tr>
<tr>
<td>3. Power &amp; Energy</td>
<td>Reclaim space, and reduce energy consumption</td>
</tr>
<tr>
<td>2. Connectivity &amp; Communications</td>
<td>Reduce ancillary networking components (racks, conduit, cable trays, etc.)</td>
</tr>
<tr>
<td>1. Basic Infrastructure</td>
<td>Reduce construction costs such as IDF closets</td>
</tr>
</tbody>
</table>
Traditional Switched Network Diagram
Fiber Deep Network Diagram
Comparing Architectures

Different

• Leverages a fiber- and power-deep network topology
• Centralized control and flexibility with moves, adds, and changes.

Same

• End devices/applications. Audio/Visual, Wi-Fi, phones, printers….
• Standard IEEE networking protocols and routers
Fiber clears bottleneck as aggregation point moves deeper into the network
Fiber clears bottleneck as aggregation point moves deeper into the network
Fiber deep in-building solutions converge multiple technologies over a single, simplified infrastructure.

- Up to 30% lower first-installed cost
- Save up to 50% on future upgrades
- Virtually unlimited bandwidth
- Optimized space utilization
- Low latency
- Scalable and intelligent
Commercial Office Building
- 170,000 square feet
- 800 employees
- 6 floors

Applications:
- Wi-Fi access points
- 4K TVs
- Café menu boards
- Scheduling panels
- Conferencing phones
- Video conferencing
- In-building cellular
- Printers, workstations
- Sound masking
- Security cameras
Fiber Deep Design:

- Reduced IDF count by 83%
- $50,000 saved per IDF buildout
- Reduced linear feet of cabling by 68%
- Eliminates long, bulky category cable runs
- Reduced cable tray size from 24” to 12”
- Reduces switching equipment expense
- Realized 29% CAPEX savings compared to traditional copper LAN design

<table>
<thead>
<tr>
<th></th>
<th>Fiber Deep</th>
<th>Traditional LAN</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>$730,170</td>
<td>$972,831</td>
<td>25%</td>
</tr>
<tr>
<td>Labor</td>
<td>$137,669</td>
<td>$242,209</td>
<td>43%</td>
</tr>
<tr>
<td>Total</td>
<td>$867,839</td>
<td>$1,215,040</td>
<td>29%</td>
</tr>
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</table>

*Comparison is based on network electronics and associated labor. Numbers do not include endpoints (WAPs, cellular radio nodes, printers, etc. which are the same in both cases).*
Significant savings by moving to a Fiber Deep architecture

<table>
<thead>
<tr>
<th></th>
<th>Small Office Building</th>
<th>Medium Office Building</th>
<th>Large Office Building</th>
<th>Campus</th>
<th>Outdoor Cameras</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Footprint (ft²/m²)</strong></td>
<td>3000/279</td>
<td>51000/4724</td>
<td>180000/16723</td>
<td>14 buildings 2000 drops</td>
<td>48 drops</td>
</tr>
<tr>
<td><strong>Employees</strong></td>
<td>15</td>
<td>65-70</td>
<td>800</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Applications</strong></td>
<td>• Wi-Fi, Security cameras, Voice, Data</td>
<td>• Wi-Fi, Sound Controllers, Security cameras, Voice, Cellular, Printer, Displays</td>
<td>• Wi-Fi, Sound masking, Security cameras, A/V, Cellular</td>
<td>• Wi-Fi, Voice, Data, A/V, Security cameras</td>
<td>• Outdoor Cameras</td>
</tr>
<tr>
<td><strong>Overall Savings</strong></td>
<td>17%</td>
<td>34%</td>
<td>29%</td>
<td>48%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Connectivity is the 4th Utility

Think about infrastructure early to optimize your building design & performance.