Cell Service and Wireless Remedies for Reception & Coverage

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Why Is This Important?

MDU attach rate is approximately 17%

Table 1: Average Daily Mobile Device Usage by Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Hours per Typical Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your Home</td>
<td>2.5</td>
</tr>
<tr>
<td>Friend's Home</td>
<td>0.5</td>
</tr>
<tr>
<td>At Work at Normal Location</td>
<td>1.0</td>
</tr>
<tr>
<td>At Work but at Remote Location</td>
<td>0.5</td>
</tr>
<tr>
<td>Retail Locations**</td>
<td>0.5</td>
</tr>
<tr>
<td>Public Locations*</td>
<td>0.5</td>
</tr>
<tr>
<td>Travel Locations</td>
<td>0.5</td>
</tr>
<tr>
<td>On the Go</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Q33. In a typical day, for how long do you use your mobile devices in each of the following locations?

Source: Cisco IBSG, 2012

N=varies
* Public – e.g., stadiums, parks, schools
** Retail – e.g., stores, restaurants
When It Comes To In-building Coverage And Capacity  “There Is No Such Thing As Plug & Play”*

• To be effective, an in-building wireless solution needs to be architected specifically for the building it is covering including:

  – An exhaustive site survey that determines wireless coverage challenges and the wireless design that is needed to provide reliable signal throughout the building.

  – A coordinated approach to low voltage wiring to reduce cost while providing connectivity for the needed network components.

*Paula Doublin, AT&T AVP for Antenna Solutions speaking at the 2014 HetNet Expo.
FEMTOCELLS
Improved Wireless Coverage In Your Home

Benefits
• Acts as a personal base station/cell tower—5,000 sq./ft.
• Range from $100-$250 --can be purchased at carrier retail locations

What’s Required
• Require broadband 1.5 mbps connection & power outlet
• Manage approved devices via whitelist (can add up to 50)
• Supports up to 6 devices at a time
• Able to successfully make 911 calls
• Improves coverage and signal for 3G Voice/ Data

Potential Challenges
• Macro network handoff
• Whitelist management
• Potential for interference
SMALL CELL
Flexible Coverage Where You Need It

• Low power device that extends carrier (Voice) coverage, capacity, and wireless data access

• Small-scale antenna solution specific to carrier—seamless two way network handoff

• Combination of local equipment, network backbone equipment and IP Connectivity

• Differs from repeater solutions
  – Carrier owned call processing and spectrum

• Compatible with Wi-Fi & DAS

• Short Deployment timeline and non-intrusive install
SMALL CELL
System Design Overview
New FCC Rules on Signal Boosters

- Industrial Signal Boosters
- Consumer Signal Boosters
- Public Safety In-Building Signal Boosters
- Concatenation of Consumer Boosters permitted if configuration has been certificated and Network Protection Standard has been followed.
Concatenated Consumer Cell Booster Approach

- Cost of system is 1/3 to 1/5 of DAS.
- Requires adequate outdoor signal from carriers.
- Equipment must adhere to the new FCC Order Network Protection Standard and be FCC certificated.
- Can install a section at a time, so is pilot projectable.
- Is easily expandable to add building areas.
- Requires Registration with each carrier, but no carrier approval required.
- If interference is created, must conform to the FCC Report & Order.
Managed WiFi Service

• WiFi Calling on the horizon – seamless roaming with cellular
  – Apple and Android Support
  – T-Mobile and Sprint enabled
  – ATT and Verizon announced 2015 implementation

• Extremely Cost Effective – 1/5th the cost of DAS

• Remediates most interference and utilizes QOS to provide Voice service.

• Seamless service throughout community, including corridors, amenity areas, subterranean locations, etc.

• With new protocol (ac) will support multiple video streams in each apartment

• Requires NO carrier approval or cooperation other than support of WiFi Calling

• Supports OTT applications – Skype, WhatsApp, etc.
DAS System Implementation

• Comprehensive coverage in energy efficient buildings

• Increased data capacity with microcells

• Fully coordinated and designed with carriers

• Better service to all carrier subscribers in the building

• Managed network

• Ownership of equipment
  – Base Stations—options
Wireless Carrier Perspective
In-Building Coverage

Carrier In-building Wireless Solution Considerations
• Property owner Solution type
• Size, nature of property, and estimated number of users
• Integration with local macro cell network design
• Carrier closest Macro site, Macro capacity

Distributed Antenna Solutions
• All DAS designs are NOT created equal
• The RF signal source is crucial
• Suggest carrier engagement 1 year+ from when system is desired to be operational
• Get carrier specifications/requirements before you design the DAS

1) BDA (Bidirectional Amplifier RF Source)
• Takes existing carrier frequencies and amplifies them
• Does not resolve existing macro site problems or macro sites that are at maximum capacity.

Note—be familiar with FCC report that governs these in terms of carrier consent.

2) BTS (Base Transceiver Station RF Source)
• Dedicated capacity
CONCLUSIONS

Plan In Advance.

• A low voltage review, MDF/IDF design and cable pre-design plan is necessary to determine the most effective technology and cost effective solution for your property.
  • Timing is the issue – as close to Occupancy but far enough out to run cabling

• Prepare for a detailed radio frequency site survey once the walls are up and the windows are installed.

• Whichever coverage approach is selected, ensure it follows the rules (FCC Report & Order, CALEA Compliance, etc.)