Distributed Antenna Systems

Technology Update
**DAS Jargon**

- IBW – In-building Wireless
- NH/NHP - Neutral Host - Multi Carrier DAS
- Cellular Repeater - BDA = Bi-Directional Amplifier
- HetNet – Heterogeneous Network
- Small Cell
- BYOD – Bring Your Own Device
- Node
  - Cellular Enhancement
  - Cell Booster
  - Radio Frequency Repeater System

**DASs are used to enhance**

- Cellular (WSP) Voice and Data 2G/3G/4G
- First Responder & Operations Two Way Radios
- Wi-Fi
- Paging
- WMTS – Medical Telemetry
- RTLS – Location Systems
- Next Gen?

**Funding Models**

- Enterprise
- Carrier
- 3rd Party – Tower Co.

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*A distributed antenna system, or DAS, is a network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.*

~ Wikipedia
“Wireless broadband connectivity is becoming as important as heat and electricity in venues.”

Deployed DAS Nodes to Double Between 2013 and 2016

More than 50% of DAS Networks will include Small Cells and Wi-Fi by 2018.

The market for in-building wireless equipment will grow to $8 billion in 2019, up from a forecast $4.4 billion for 2014 - 14% compound annual growth rate (CAGR).

Sources:
2. DAS: Absorbing Small Cells and Wi-Fi – Mobile Experts
4. In-Building Wireless Market Reaches $8.5B in 2019 – ABI Research
Graph: In-Building Wireless Market Data Q1 2013 - ABI Research
DAS - What’s driving it?

1. Capacity - Data
2. Green Buildings
3. Safety
4. **Our Expectations!**
Data Tsunami

Source: Ericsson (2011)
# Green Buildings

<table>
<thead>
<tr>
<th>Clutter Type</th>
<th>800/900 MHz</th>
<th>1800/1900 MHz</th>
<th>2.4 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drywall</td>
<td>2</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>Plywood</td>
<td>1</td>
<td>2.5</td>
<td>4</td>
</tr>
<tr>
<td>Cubicles</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Glass (no shielding)</td>
<td>2</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td><strong>Low E Glass</strong></td>
<td><strong>17</strong></td>
<td><strong>19</strong></td>
<td><strong>29</strong></td>
</tr>
<tr>
<td>Concrete</td>
<td>18</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Lead</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

**Low-E Glass**

Low-E Glass reflects or absorbs IR light (heat energy) AND radio waves, causing major in-building wireless coverage problems.
DAS for Safety

• Your Safety = Government Duty = Enterprise Challenge
  ✓ NFPA 14.4.12 In-Building Emergency Radio Communication Systems
  ✓ 2009 IFC, Section 510 - Emergency Responder Radio Coverage (ERCC)

• Florida – Various Counties
• Memphis
• Las Vegas
• Washington, DC (soon)
• CA – Various Jurisdictions
• PA – Certain Counties
• NJ – Atlantic City
• AZ – Scottsdale, Tempe
• CO - Various counties
• Montgomery County, MD
• Alexandria, VA
• Richmond, VA
Your Expectations =

- **Enterprise** - 54% of office tenants would consider moving due to lack of coverage

- **Hospitality** - 57% hotel and resort guests would consider not returning to a facility with poor cellular service

- **Hospital/Medical** – 40% would not return to a hospital with poor wireless coverage

- **Conference** - 51% of meeting organizers indicated that they would consider not returning to conference facilities that lack a quality of cellular service.


- **Transit** - Airports, Subways, and Train Stations – NYC Subway, Chicago CTA, Washington DC WMATA, Boston MBTA, Nearly all Major Airports

- **Stadiums** - Most major league stadiums and most major college stadiums

- **Gov’t & K-12** - Public Safety and Cellular - Charlotte Mecklenburg BoE, Loudon Co. VA PS

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1. Source: OSP Magazine [WEB EXTRA: Bad Cell Phone Reception](#)
DAS Market in 2000

- Only 38% of the U.S. population used wireless
- Primarily limited to voice; no “wireless-only” households
- Very little data traffic carried on wireless networks
- In-building expectations were low among commercial customers; outdoor coverage was still patchy
- Coverage was a “carrier problem”
  - No Enterprise budget for DAS
- Customers looked to their primary carrier for coverage
- Customers accepted carrier terms in exchange for DAS
- Carriers were the main purchasers of DAS systems
DAS Market in 2014

- Wireless services driven by applications
  - Carrier capacity issues growing, not just a coverage issue
- Wireless Customers Demand Ubiquitous Coverage
- Businesses running operations on Smartphone, tablets and AirCard
- Enterprise customers need coverage for multiple carriers and neutral-host environments (Het Net)
  - Carriers are more challenged selling single-carrier DAS
- Enterprises are budgeting for DAS
- 4G/LTE Support is becoming a necessity due to poor in-building service
- Fire codes require in-building emergency radio coverage
WSP Market Share

2013 Q2 Market Share

Source: Fiercewireless.com Top US Wireless Carrier Metrics Q2 2013
Off Air – BDA/Repeater DAS

Legend
- In-Building Antennas
- Power Divider/Combiner
- Coaxial Cable
Active - Fiber DAS
Fiber to the Edge - DAS/Solution
Small Cells

• “If it’s not hanging from a tower, it’s a small cell.” ~ Iain Gillot, iGR
  – MicroCell
  – PicoCell
  – FemtoCell/eFemtoCell

• Shift in focus from cell towers to in-building and small cells
  – AT&T - 40,000 small cell 1,000 large antennas nationwide by the end of 2015
How long does it take?
How much is it?

What is most important to your organization?
- Cellular - Which WSPs?
- Public Safety – Which AHJs?
- Anything Else?
  - 802.11x
  - Paging
  - WMTS
- Any future Goals, Construction Plans and Considerations

Please describe the coverage area in detail?
- Building Construction
- Building Use – Location
- Pathways/Access
- Existing Infrastructure – Dark Fiber
- How many people are in your facility (phones?)
- Union Labor?

What do the carriers want?

Could another party pay?
Who will pay for the DAS?

<table>
<thead>
<tr>
<th>Model</th>
<th>Market Space</th>
<th>Pros to Venue</th>
<th>Cons to Venue</th>
</tr>
</thead>
</table>
| **Carrier – AT&T, VzW etc.** | Large Enterprise Customers, Public venue  | + Lower cost to venue  
+ No operational cost | - Least flexibility  
- Must provide space, access |
| **Neutral Host – 3rd Party Owned** | Shopping malls, Casinos, Higher Ed, Healthcare | + Lowest cost to venue  
+ No operational cost  
+ Income potential | - Not an option for most facilities  
- Requires most space, access |
| **Enterprise Owned**      | Hospitals, HigherEd, Hotels, Companies    | + Most flexibility, control                        | - Highest cost to venue (install, operation)           |
Questions?
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