Distributed Antenna Systems (DAS)

Requirements, Approach, and Current Market Trends

Thinkbox Technology Group
Ahmed Al Taie, RCDD, PMP
Agenda

- Introduction
- Emerging Technology
- Planning for a DAS Implementation
- Building the Business Case
- Conclusions
What is DAS?

• Distributed Antenna System
• Distribute Cellular Wireless Signals Through Large Structures
  — Enhance Signal Coverage
  — Increase Capacity
  — Regulatory Compliance
• Passive vs. Active DAS
• Single Carrier vs. Neutral Host
Drivers For Implementation

• Technological Innovation

• User Experience
  – Increase Productivity and Convenience
    • Voice Calls
    • Video Calls
    • Data Usage

• Regulatory Compliance
  – Codes, Regulations, and Ordinances
  – E911 – Location Accuracy
Building Types

- Residential
- Offices
- Healthcare
- Higher Education
- Hospitality (Hotels & Casinos)
- Commercial (Retail/Malls, Warehouses)
- Public Venues (Stadiums, Conference Centers)
Other Applications/Benefits

- Utilizing services offered by carriers (Push To Talk)
  - Security Benefits
  - Facilities & Maintenance Teams
- Phase out hardwire phones in some areas
  - less PBX hardware
  - less cables (for new installs)
# Major US Carriers/Frequency Bands

<table>
<thead>
<tr>
<th>Services</th>
<th>Two-Way (450)</th>
<th>PS (700)</th>
<th>PS (800)</th>
<th>iDEN (800)</th>
<th>SMR (900)</th>
<th>Cell (850)</th>
<th>PCS (1900)</th>
<th>LTE (700)</th>
<th>AWS (2100)</th>
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<tbody>
<tr>
<td>Verizon Wireless</td>
<td></td>
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<tr>
<td>AT&amp;T Wireless</td>
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<td></td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td></td>
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<tr>
<td>T-Mobile</td>
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<td></td>
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<td></td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Sprint</td>
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<td>X</td>
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<tr>
<td>Nextel</td>
<td></td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Public Safety</td>
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<tr>
<td>UHF</td>
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</tr>
</tbody>
</table>
Mobile Data Projections 2011

- Utilizing Mobile Data Traffic from 2010*
  - A Smartphone generated 79MB/Mo
  - A Tablet generated 400MB/Mo

*Source: Cisco VNI Report – Feb 2011
Mobile Data Projections 2012

• Utilizing Mobile Data Traffic from 2011*
  – A Smartphone generated 150MB/Mo
  – A Tablet generated 517MB/Mo

*Source: Cisco VNI Report – Feb 2012
### Traffic Projection / Device Type

- **Average Traffic Used per Device (MB/Mo)**

<table>
<thead>
<tr>
<th>Device Type</th>
<th>2010</th>
<th>2011</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Smartphone</td>
<td>1.9</td>
<td>4.3</td>
<td>108</td>
</tr>
<tr>
<td>E-reader</td>
<td>.5</td>
<td>.73</td>
<td>2.8</td>
</tr>
<tr>
<td>Smartphone</td>
<td>55</td>
<td>150</td>
<td>2,576</td>
</tr>
<tr>
<td>Portable Gaming Console</td>
<td>244</td>
<td>317</td>
<td>1,056</td>
</tr>
<tr>
<td>Tablet</td>
<td>405</td>
<td>517</td>
<td>4,223</td>
</tr>
<tr>
<td>Laptop and Netbook</td>
<td>1,460</td>
<td>2,131</td>
<td>6,942</td>
</tr>
<tr>
<td>M2M Module</td>
<td>35</td>
<td>71</td>
<td>266</td>
</tr>
</tbody>
</table>

*Source: Cisco VNI Report – Feb 2012*
Example of Projected Traffic

- Approximate Campus Size 2M sq. ft.
- 20 buildings (100k sq. ft. each)
- 110 users / building (2,200 Total Users)
  - Distribution between major carriers:

<table>
<thead>
<tr>
<th>Major Carrier 1</th>
<th>Major Carrier 2</th>
<th>Major Carrier 3</th>
<th>All Carriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>35%</td>
<td>25%</td>
<td>40%</td>
</tr>
<tr>
<td>TB/Mo</td>
<td>2.2</td>
<td>2.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Distribution:
- Major Carrier 1: 40% (2.2 TB/Mo)
- Major Carrier 2: 35% (2.0 TB/Mo)
- Major Carrier 3: 25% (1.4 TB/Mo)
- All Carriers: 100% (5.6 TB/Mo)
Cost Estimates / Distribution

- Samples for cost estimates

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Option 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Equipment</td>
<td>$380,000</td>
</tr>
<tr>
<td>Electronic Equipment</td>
<td>$1,250,000</td>
</tr>
<tr>
<td>Professional Services</td>
<td>$400,000</td>
</tr>
<tr>
<td>Installation Services</td>
<td>$620,000</td>
</tr>
<tr>
<td>Project Management</td>
<td>$400,000</td>
</tr>
<tr>
<td>Conduits</td>
<td>$150,000</td>
</tr>
<tr>
<td>Security Escorts</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3,250,000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of Installation (CAPEX)</th>
<th>Managed Services (OPEX)</th>
<th>Regular Maintenance (OPEX)</th>
<th>Running Cost (Power) (OPEX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$3,250,000</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>2</td>
<td>$0</td>
<td>$0</td>
<td>$40,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>3</td>
<td>$0</td>
<td>$40,000</td>
<td>$0</td>
<td>$10,000</td>
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<tr>
<td>4</td>
<td>$0</td>
<td>$40,000</td>
<td>$0</td>
<td>$11,000</td>
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<tr>
<td>5</td>
<td>$0</td>
<td>$50,000</td>
<td>$0</td>
<td>$13,000</td>
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<td>6</td>
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<td>7</td>
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<td>$50,000</td>
<td>$0</td>
<td>$17,000</td>
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<tr>
<td><strong>7 Yr TCO</strong></td>
<td><strong>$3,570,000</strong></td>
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<td></td>
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</tbody>
</table>

Old Days Estimates = $0.75 / sq. ft.
Cost Estimates / Distribution

- Samples for cost estimates

![Pie chart showing distribution of costs]

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<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Total</th>
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<tbody>
<tr>
<td>$3,250,000</td>
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<td>$40,000</td>
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<td>$50,000</td>
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<td>0</td>
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<td>$11,000</td>
<td>$13,000</td>
<td>$15,000</td>
<td>$17,000</td>
<td>$71,000</td>
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</table>

7 Yr TCO: $3,570,000

**MYTH**

Old Days estimates = $0.75 / sq. ft.

$/sq. ft. = $3.25M / 2M sq. ft. = $1.70 / sq. ft.
Requirements Gathering

- Why do we need DAS?
- What services?
- Which Carrier(s)?
- What frequency bands?
- Where? (Coverage Areas)
- When? (Time frame for implementation)
Selecting a System

- Cost (CAPEX & OPEX)
- Scalability
- Manageability
- Infrastructure Requirements
- Ease of Installation
- Support All/Most of Major Carriers
- Maintenance
Infrastructure Requirements

• Fiber Optic Cables (New/Existing Network)
  – 1 to 2 strands for each building
• Coax Cables
  – New Install Required
  – Re-use of Existing Coax
• Power
• HVAC
• Space
Implementation Challenges

• Campus Terrain/Building Construction
  – Requires Detailed Survey & Design

• Scheduling Challenges
  – Avoid Operation Interruptions (live buildings)

• Wireless Carriers’ Coordination
  – RF Signal Sources, Macro Cell integration

• City/County Requirements
  – Approval Process For BTS (Base Transmission Station) Installations
Carrier Coordination

- Main Selected Carrier
- Other Carrier(s)
- Design Parameters
- Design Review and Approval
- Signal Sources
- Macro Cells Integration
Implementation Strategy

• Implementation in phases
  – Initial Phase:
    • Pilot install
    • Test for 3 months
    • Confirm requirements are met
    • Adjust design/approach (If needed)
  – Subsequent Phases:
    • Plan for remaining buildings/areas
    • Implement the remaining areas (based on priorities / expansion plans)
Building a Business Case

- Requirements
- Mobility Strategy
- Projections and Capacity
- Risks and Benefits
- Time Line For Implementation
- Challenges
- Options Available
- Cost Estimates and Comparisons (CAPEX, OPEX, TCO, Depreciations)
Conclusions / Questions

• Conclusions
  – What is DAS and Why it’s required
  – Design and Implementation Cost
  – Implementation Strategy and Challenges
  – Building a Business Case

Questions?

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