Business Case for Small Cell Deployment

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Berge Ayvazian, Senior Consultant, Heavy Reading

- Berge Ayvazian joined *Heavy Reading* as a Senior Consultant, following more than 20 years as a senior telecom industry analyst and strategy consultant with Yankee Group and CEO from 1999 through 2001.
- Extensive knowledge of communications service providers worldwide, networking technology and business strategies
- Ayvazian leads an integrated research and consulting practice helping mobile, broadband and communications service providers develop their 4G technology roadmaps and business plans
- This practice combines Heavy Reading technology roadmaps with Pyramid Research market data and Wireless 20/20 WiROI 4G Business Case Tool
Business Case for Small Cell Deployment

• Demand Drivers for Next-Generation RAN
• Small Cells Case Study
• Optimizing for Coverage and Capacity
• Benefits of Small Cell Deployment
• Create New Revenue Streams for Operators
RAN Evolution, Multimode & Small Cell Base Stations

• RAN architecture and infrastructure has remained the same for many years making it difficult for operators to address fast growing user demand and broadband traffic
• Radio architecture is now evolving to provide operators with enhanced flexibility, capacity, coverage and scalability
• The RAN vendor ecosystem is now gearing up to bridge the gap between legacy technologies and LTE by offering next-generation, multimode and small cell base stations
• This presentation will examine the Business Case for Small Cell Deployment, providing the insight mobile operators need to understand the options - and challenges - ahead
Demand Drivers for Next-Generation RAN

Key Challenges Facing Mobile Operators

- **High Penetration of Smartphones and “Apps” Drives Traffic Growth**

- **Coverage gaps**
  - High traffic hot spots

- **From Planned to Uncoordinated Deployment**

- **Limited or no spectrum available to enhance capacity**

- **Smooth capacity migration from 2G to 3G to 4G**

- **Backhaul challenges, Internet Offload, Energy savings**

- **CAPEX indigestion, OPEX Reduction, Where is ROI?**

**Enterprise**

**Public**

**Private**

**Neighborhood Microcell**

**Traffic Picocell**

**Multimode Macro BTS**
Deploying Small Cell Solutions for 4G & LTE Mobile Broadband Networks
Enabling the Next-Generation RAN Infrastructure Ecosystem

Major changes are happening in the RAN that signal major changes in the traditional approach to base stations, including:

• Multimode and multi-standard base stations and antenna
• Compact Base Stations - Microcells, Picocells & Femtocells
• Distributed, flexible approaches to radio access networks including cloud RAN infrastructure and baseband pooling
• Integrated radio (AIR) systems - compact, tower-mounted solutions for 3G and 4G macrocells
• Heterogeneous network management
• Active antenna systems
## 4G HetNet Deployment Strategies

### LTE Macrocell Networks for National/Rural Coverage

- Macrocell BTS in low bands 700/800 MHz for outdoor national & rural LTE coverage. Micro and Pico in urban.
- Telia Sonera in Scandanavia, AT&T in US and Vodafone and T-Mobile/DT in Germany

### Small Cell LTE Base Stations for High Traffic Urban areas

- Extend macrocell network coverage with micro/pico cells for high traffic urban areas
- Vodafone & Softbank use microcells in higher bands to significantly improve indoor coverage & capacity

### Hybrid HSPA+/LTE Network

- Use multimode macro-cell BTS supporting both HSPA+ and LTE
- Hybrid 3G/4G approach being used by M1 in Singapore and E-Plus in Europe

### LTE Added to CDMA/WiMAX

- Vz Wireless - LTE overlay CDMA
- Sprint LTE on multimode network
- Overlay LTE TDD as alternative to or in parallel with WiMAX
- Clearwire and Mobily
Small Cells Case Study

• Case Study to Determine the Tradeoffs of Small Cells vs. Macro Cells
• CapEx, OpEx and Capacity Assumptions
• WiROI™ 4G Model - Impact on the Business Case
• Sensitivity Analysis - Case Studies
WiROI Business Case for 4G HSPA+ and LTE Network Deployments
## Small Cell Case Cost Assumptions

<table>
<thead>
<tr>
<th></th>
<th>Small Cell</th>
<th>Macro Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of BTS</td>
<td>$3K-$6K</td>
<td>$30K - $60K</td>
</tr>
<tr>
<td>Average</td>
<td>$4,500</td>
<td>$45,000</td>
</tr>
<tr>
<td>Site Acquisition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collocation</td>
<td>$5,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>New Site</td>
<td>$15,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Microwave Backhaul</td>
<td>$4,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Monthly Site Rental</td>
<td>$200</td>
<td>$800</td>
</tr>
<tr>
<td>Site Maintenance /month</td>
<td>$50</td>
<td>$200</td>
</tr>
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</table>
# Technical Assumptions

<table>
<thead>
<tr>
<th></th>
<th>Small Cell</th>
<th>Macro Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link Budget</td>
<td>112dB</td>
<td>137dB</td>
</tr>
<tr>
<td>BTS Antenna Height</td>
<td>15 Meter</td>
<td>30 Meter</td>
</tr>
<tr>
<td>Spectrum</td>
<td>2.5GHz</td>
<td>2.5Ghz</td>
</tr>
<tr>
<td>Cell Radius</td>
<td>250 Meter</td>
<td>1,000 Meter</td>
</tr>
<tr>
<td>Technology</td>
<td>LTE-FDD</td>
<td>LTE-FDD</td>
</tr>
<tr>
<td>Spectral Efficiency</td>
<td>2.4bps/Hz</td>
<td>2.1bps/Hz</td>
</tr>
<tr>
<td>Weight</td>
<td>10Kg</td>
<td>80Kg</td>
</tr>
</tbody>
</table>
Small Cell Model Findings
Coverage and Capacity Results for London

- **London Case Study**
  - 320 Sq Km Urban
  - 1,280 Sq Km Suburban
  - 8,200,000 Population
  - 3,660,000 Households

- **Sites for London**
  - 1,257 for Macro
  - 5,831 for Small Cells
  - Small Cells (5,831 Coverage, 0 Capacity)
  - Macro (592 Coverage, 665 Capacity)
# Small Cell CapEx Differences

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<tr>
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<th>Macro Cell</th>
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</thead>
<tbody>
<tr>
<td>BTS CapEx</td>
<td>$25M</td>
<td>$48M</td>
</tr>
<tr>
<td>Backhaul CapEx</td>
<td>$20M</td>
<td>$4M</td>
</tr>
<tr>
<td>Core CapEx</td>
<td>$18M</td>
<td>$8M</td>
</tr>
<tr>
<td>Site Development</td>
<td>$43M</td>
<td>$93M</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$51M</td>
<td>$54M</td>
</tr>
<tr>
<td><strong>Total CapEx</strong></td>
<td><strong>$158M</strong></td>
<td><strong>$209M</strong></td>
</tr>
</tbody>
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Small Cell OpEx Differences

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<tr>
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</thead>
<tbody>
<tr>
<td>Site Rental OpEx</td>
<td>$165M</td>
<td>$92M</td>
</tr>
<tr>
<td>Backhaul OpEx</td>
<td>$142M</td>
<td>$36M</td>
</tr>
<tr>
<td>Other OpEx</td>
<td>$791M</td>
<td>$759M</td>
</tr>
<tr>
<td>Total OpEx</td>
<td>$1,098M</td>
<td>$887M</td>
</tr>
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Small Cell TCO Results

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<tr>
<td>Total OpEx</td>
<td>$1,098M</td>
<td>$887M</td>
</tr>
<tr>
<td>TCO</td>
<td>$1,256M</td>
<td>$1096M</td>
</tr>
</tbody>
</table>
Optimizing for Coverage and Capacity

- **Small Cells**
  - Lower CapEx
  - Higher OpEx

- **Macro Cells**
  - Higher CapEx
  - Lower OpEx

- **HetNets**
  - Use Macro Cells for Coverage
  - Use Small Cells for Capacity where needed
Optimizing for Coverage and Capacity
HetNet Benefits

**Total CapEx**
- **Small Cell**: $158M
- **Macro Cell**: $209M
- **HetNet**: $191M

**Total OpEx**
- **Small Cell**: $1,098M
- **Macro Cell**: $887M
- **HetNet**: $835M

**TCO**
- **Small Cell**: $1,256M
- **Macro Cell**: $1,096M
- **HetNet**: $1,026M
## Key Financial Results

<table>
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<th>HetNet</th>
</tr>
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<tbody>
<tr>
<td><strong>Maximum Borrowing</strong></td>
<td>$197M</td>
<td>$86M</td>
<td>$96M</td>
</tr>
<tr>
<td><strong>IRR</strong></td>
<td>45%</td>
<td>65%</td>
<td>70%</td>
</tr>
<tr>
<td><strong>Cum Free Cash Flow</strong></td>
<td>$637M</td>
<td>$835M</td>
<td>$990M</td>
</tr>
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</table>
Benefits of Small Cell Deployment
Business Case Conclusions

• Small Cells Create Opportunities & Face Challenges
• Interference, Backhaul, Site Rental OpEx
• Small Cells Can Impact CapEx and OpEx
• Improve the cost-per-bit economics to deliver 4G when combined with other technology improvements
• Create New Revenue Streams for Operators
  • Residential and Mobile Offerings Minimize Churn
  • Fixed/Mobile Convergence for Enterprise
• Each Business Case is Unique
• Simulation Model can Optimize a 4G Business Case
New Revenue Streams for Operators
Residential and Mobile Offerings Minimize Churn

Mobile Broadband
Internet, VoIP and VAS

MultiPlayer &
Mobile Gaming

Mobile Video
Live – On Demand
P2P Video Coms

User Content
Social Networks

Live – On
Demand
Create New Revenue Streams for Operators
Fixed/Mobile Convergence for Enterprise

Fixed and mobile workers have equivalent access and experience to a broad range of applications without performance penalty.

**Unified Communications**
- **Desktop Virtualization**
- **Video Applications**

**FIXED NETWORK SERVICES**

**4G LTE**

- **Speeds**: 5–12 Mbps download, 2–5 Mbps upload
- **Latency**: 30 ms, 120 ms
Questions?

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Part of the Light Reading Communications Network