Femtocell

(What, Why, Where & When )

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Overview

- Paradigm Shift
- In-building Options
- Introduction to Femto Cells
- Business Case – Value proposition
- Opportunities & Challenges
- Femto Forum
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A compelling and urgent need

- Substantial growth in mobile broadband data revenues
- But much faster growth in data volumes
- Must find ways to dramatically reduce cost-per-bit
- Paradigm shift from Macro cellular coverage to inbuilding coverage

Figure 1.4: Global mobile data revenues and traffic, 2007-2012

Source: Informa, 2008
In-Building Segment - Alternatives

CDMA Network

Internet

PSTN

VoWiFi Home

- Leverage existing WiFi unit
- Requires new dual-mode handset

Femto Home

- Femto works with existing 1x handset
- Requires new Access Point at home

CDM

Femto RAN

1x/DO Handset

• Dual-mode Handset
• WiFi Router

SIP/WiFi

IEEE Globecom 2008
What are femtocells?

- Low-power domestic access points...
  - using mature mobile technology
  - in licensed spectrum
  - generating coverage and capacity
  - over internet-grade backhaul
  - at low prices
  - with full operator management

Generic Femto Network Architecture

Technology that works with Legacy Handsets

Source: Femto Forum
## Where does it Fit?

<table>
<thead>
<tr>
<th><strong>Macro (18W)</strong></th>
<th><strong>Micro (5W)</strong></th>
<th><strong>Enterprise (&lt;1W)</strong></th>
<th><strong>Consumer (&lt;50mW)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro cellular coverage</td>
<td>Coverage fill; Repeater replacement</td>
<td>Large, Medium &amp; Small Businesses, Repeater/DAS replacement</td>
<td>Residential coverage</td>
</tr>
</tbody>
</table>

- **Macro Cell Indoor**
- **Compact Metro Cell Outdoor**
- **BTS 3011**
- **BTS 3030/3031**
- **picocell**
- **femtocell**

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*IEEE Globecom 2008*
Why femtocell?

- **Subscriber Benefits**
  - signal quality
  - voice quality & data speed
  - longer battery life
  - cheaper minutes (operator offers will vary)
    - subscriber’s mobile “1 phone, 1 number”
      - no worries over minutes
    - eliminate 2nd line
    - family calling plans
- **Operator Benefits**
  - Improve residential coverage at low cost
    - reduce churn due to coverage issues
    - improve CSAT
    - increase overall use
    - low impact to macro BTS capacity or backhaul
- **Reduced opex and capex**
  - subscriber provides femto backhaul
  - does not consume macro RF
  - lower costs enable special femto rate plans
  - increase “stickiness” of cellular services
  - defense from VoIP competition

IEEE Globecom 2008
Femtocell: Carrier expectations

- Must work with existing (already sold) devices
- Easy to deploy – No truck roll, consumer device like
- Don’t want femtocells, want an end-to-end solution
- Quality/reliability comparable to macro systems
  - No impact to Macro KPI’s
- Much more feature-rich
- Cost/subscriber comparable to that in macro network

Source: Airvana
Femtocells: End-user expectations

- Easy to set up
- Fits into home network easily
- Works out of the box
- Improved cellular experience in the house
  - Better coverage, good voice quality, faster downloads
- Looks good
- Physically unobtrusive
- Low box cost
- Reduced monthly bills
- Security

Source: Airvana
Femtocells: Vendor requirements

- Ease of manufacturing, provisioning, shipping
- Ability to support multiple operators with minimal (no) hardware changes
- Minimize the number of supported software loads
- Keep proprietary features segregated between customers
- Easy upgradeability
- Show me the money baby!

Source: Airvana
Opportunities & Challenges

Challenges
- Interference
- System selection
- Idle mode ping pong
- Backhaul QoS
- Femto Access Control
- Handoff
- Femto cost
- Subscriber value prop

Opportunities
- Better indoor coverage
- Churn reduction
- Existing handsets
- Bundled pkg @ lower rates
- Increased capacity
- Reduce Capex & OpEx
- Increased ARPU
- One phone One Number
Roadmap to success

**Subscriber Pull**
- Low cost Device
- Integrated, multi-function Device
- 1 #, 1 Phone
- Home zone rates
- Value added applications

**Operator Push**
- Low cost device
- Low CapEx & OpEx
- Reduced Churn
- QoS – ability to maintain user experience
- Flexibility

\[ \text{Subscriber Pull} + \text{Operator Push} = \text{Widespread Deployment} \]

Balanced “Pull” & “Push” factors = widespread acceptance
Overview

- Introduction to Femto Forum
- Femto Forum and standards
- What have we achieved?
- What are we working on?
- What lies ahead?
The Femto Forum

• A not-for-profit membership organisation founded in 2007 to promote femtocell deployment worldwide
• Independent - Technology agnostic
• Inclusive
  • operators (mobile and fixed)
  • hardware, software & silicon vendors
• International
• A portal for public information, press briefings, white papers, technical studies, market data
• Four working groups established to address the key enabling factors

“The introduction of open standards will be critical in enabling an economy of scale that will better enable the OEM and semiconductor communities to meet very aggressive price points and stimulate the market. The Femto Forum provides the ideal vehicle for driving this process.”

Stuart Carlaw, Principal Analyst, ABI Research,
Femto Forum Aims

**Aims**

- **Ecosystem Development**
  - Large number of members
  - Geographical and technological spread

- **Market Education**
  - Spreading awareness
  - Increasing informed coverage

- **Driving open standards**
  - Not a standards-setting body
  - Building voluntary consensus
  - Close interactions with standards bodies
Femto Forum Members

57 providers of femtocell technology
Femto Forum Members
34 operators covering 865 million subscribers

Board members
Welcome to 11 new members since June
Femtocells and Standards

• Need the right standards at the right time, reflecting experience, encourage innovation
• Accelerate via voluntary consensus amongst operators and vendors
• Many standard contributions already produced and in preparation
• Femto Forum is supporting and encouraging the standards development process
  • Worldwide femtocell expertise in one place
  • Addressing the issues ahead of time to provide mature contributions quickly
Challenges

**Market – WG1**
- Public awareness and concerns
- Business cases

**Radio – WG2**
- Interference management between femto and macrocells
- Handover management

**Network – WG3**
- Architectures and interfaces
- Management and provisioning

**Regulatory – WG4**
- Understanding Benefits
- Spectrum issues
- Service issues
WG1 - Market and Promotion: Achievements

• Specifying detailed use cases for application in other groups, including wide range of potential customer propositions
• Providing information of general interest (e.g. ‘Femtocells and Health’ brochure)
• Setting a programme of promotional activities to broaden knowledge of femtocells and of the Forum’s progress
• Identifying key market challenges and proactively addressing these ahead of time
WG1 – Market & Promotion: Ongoing Activities

- Business modelling
- Femtozone services
- Environmental issues
- Consumer research
- Market evolution
- Femtocells for fixed-line operators
- Femtocells beyond the home
WG2 – Radio & Physical - Ongoing activities

Interference management
- WCDMA
- OFDMA (LTE and WiMAX)
- CDMA

Standard performance tests

Internal Physical Interfaces
- Radio-baseband-modem

Network monitoring receiver performance

Mobile standby time

Radio co-existence tests

Network configuration guidelines
WG3 Network & Interop Activities

- Network Requirements
- OSS/BSS Requirements & Evolution
- Interoperability Testing
- E2E Security
- Architecture Evolution
- Device Management

**Reference Functional Femto Architecture**

**Hot Topics:**
- Mobility
- End-to-end Security
- Quality of Service management
- Home indication
- Emergency calls
- Location retrieval/locking
- Cell-ID management
- ...

... driving voluntary consensus
WG3 – Network & Interoperability
ongoing activities

Operation and management requirements and procedures

Network architectures
- Including IMS-based

End-to-end interoperability
Looking Ahead…

<table>
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<th>Description</th>
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<tr>
<td>Next-generation Femtocells</td>
<td>- The role of femtocells beyond 3G</td>
</tr>
<tr>
<td>Radio Management</td>
<td>- Managing macrocells and femtocells together to maximise system capacity and performance</td>
</tr>
<tr>
<td>Operation &amp; Management</td>
<td>- Consistent, scalable methods for looking after millions of femtocells</td>
</tr>
<tr>
<td>Femtocell Economics</td>
<td>- Support for a wide range of business cases</td>
</tr>
<tr>
<td>Interoperable Femtocells</td>
<td>- How to assure full interoperation</td>
</tr>
<tr>
<td>Femtozone Services</td>
<td>- Applications and femtocells</td>
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Conclusions

• Interest in femtocells has continued to grow rapidly
• Femto Forum is leading the way, supported by membership which is:
  • Large and growing
  • Representative of the whole ecosystem
• We have succeeded with our aims to date and have a clear set of priorities for the future
• We are delighted to see
  • Increase in market visibility
  • Real standards progress
  • First commercial steps
femtoforum

driving convergence worldwide