Femtocells + Wireless backhaul = AdHoc Network for Disaster recovery

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The Applications and Situation of Femtocells with Satellite Backhaul in Thailand

3 Roles of FemtoCell

As a part of 3G Business
Extension of ADSL product
Emergency Network

How to deploy?

• Femtocell and the public pay phone booth
• Femtocell with wireless backhaul
  • Satellite backhaul
  • Wireless Mesh backhaul
FemtoCell as a part of 3G Business

**Evolution Path**

**2G**
- GSM
  - 900MHz: AIS
  - 1800MHz: DTAC/True Move /DPC
  - 1900MHz: Thai Mobile (TOT+CAT)
- 800MHz: CDMA 2000
  - Hutch CAT

**3G – 3.75G**
- WCDMA
  - 900MHz: AIS
  - 2100MHz: TOT
  - 800 MHz: DTAC (TAC)**
- HSPA
  - 800MHz
- HSPA+
  - 800MHz
  - Real Move (TrueMove)

- CAT decide to change the Tech. Path to HSPA
- DTAC use the AMP800 band for jumping to HSPA
As a part of 3G Business

533 Sites in Bangkok and Vicinity area

Sites
- Co-sites (AIS, CAT) 3,040 (57%)
- TOT sites 1,562 (29%)
- New sites 718 (14%)

16.6 Billion Bath Project

* For illustration only
As a part of 3G Business

<table>
<thead>
<tr>
<th>Area</th>
<th>Pop. (Mil)</th>
<th>Density -per KM²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Country</td>
<td>513,120</td>
<td>60.6</td>
</tr>
<tr>
<td>Municipality+Bkk+Pattaya</td>
<td>16,159 (3.15%)</td>
<td>18.6(23.7%)</td>
</tr>
<tr>
<td>Bangkok</td>
<td>1,569 (0.3%)</td>
<td>5.78(10%)</td>
</tr>
</tbody>
</table>

Femto Cell

- Interim Solution for the targeted Area
- QuickWin Solution for the non-targeted Area

Extension of Coverage Area
TOT BroadBand Situation

Tend of BB is continuous growth

- Broadband Internet Market share
  2005-2009 TOT 69%  3BB 79% and True 23%
- End of 2009 TOT 42 %  TRUE internet and 3BB 30% and 24% respectively
- ARPU 600 -700 Bahts
- Revenue Growth  11%

Internet Subscriber(Ports)

Revenue and Forecast (Million Bahts)

Market Share -ADSL @ End of 2009

Others = ISPs
Price War
Emergency Network

Virtual Overlay Network

- IPSTAR Radius Server
- Telco’s ADSL Radius Server

Internet

Outdoor Femtocell coverage
How To Deploy Femtocell over the Public Pay Phone Booth

Situation Analysis

- Fixed Line Dominated period
- Mobile Dominated period

Customer Behavior
- Phone via Mobile >>> Phone via Public PayPhone
  (more convenience, more privacy)

- #minutes of Traffic in public Area
- Waste of CAPEX and OPEX
- Waste of Manpower
- ARPU
How To Deploy Femtocell over the Public Pay Phone Booth

POC Step

- Electric Power
- xDSL backhaul
- Height of installation
- Backhaul

Confidential
How To Deploy Femtocell over the Public Pay Phone Booth

**POC Step**

- **Dropwire Line**
- **xDSL Modem**
- **Electric line for fluorescent inside the booth**
- **Ground System**
Femtocell with wireless backhaul: Satellite Backhaul

Case Study: Surat Thani & HatYai Flood (Southern Part Thailand)

3-9 Nov & 15-19 Nov 2010

Courtesy of Thaicom co.ltd.,

Confidential
Surat Thani

Route 41

Courtesy of Thaicom co.ltd.,
Emergency solution

Femtocell over MVV via IPStar Backhaul

Courtesy of Thaicom co.ltd.,
Hatyai Songkla
Service over MVV
- VoIP
- FemtoCell Backhaul
- AIS service due to blackout period so, more than 50% (400 Units) of BTSs down in Kim young Market, CBD of HatYai

Courtesy of Thaicom co.ltd.,
Songkla
Songkla

Value Added Service: Mobile charging Service

BTS Damage
Femtocell with wireless backhaul Wireless Mess Backhaul

- Macro site
  - Star Topology
  - Single Hop

- Femto site with Mesh Backhaul
  - Mesh Topology
  - Multihop

Geographical Coverage

Fast and Easy to Deploy
Femtocell with wireless backhaul

Femtosite with Mesh Backhaul
- Mesh Topology
- Multihop

Macro site
- Star Topology
- Single Hop

Femtosite with Mesh Backhaul
- Mesh Topology
- Multihop

Resiliency for Better Service Reliability (No Single Point failure)

Macro-cell architecture

- Prone to obstructions by terrain and buildings
  - Tough to deploy due to LOS requirements
  - No flexibility - City environment always changing

Line of Sight

Street Level – Follow Natural Urban Canyons
Femtocell with wireless backhaul - Wireless Mesh Backhaul

- Macro site
  - Star Topology
  - Single Hop

- Femtosite with Mesh Backhaul
  - Mesh Topology
  - Multihop

Come from
The center only

Bandwidth
Come from
Many directions

Add new Egress point

Add new Carrier and make more Sector

Add new Egress point
Femtocell with wireless backhaul Wireless Mess Backhaul
Using “Spine and Rib” design for minimizing the # of hop effect

Critical Point:
Max 5 hops to egress

5 GHz Backhaul Link (802.11A Multipoint, effective BW 22Mbps)

2.4 GHz BackhaulLink (802.11G 10Mbps, effective BW 10Mbps)
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