Network Sharing
Scenarios & Challenges

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Pandu Sinatriyo
Strategic & Business Development
PT Nokia Siemens Networks
Market trends and operator challenges

Market Trend

- Growth in mobile Users and traffic
- Flat data tariffs
- Operators face the costs of existing 2G and roll-out 3G networks
- In most markets there are multiple operators with overlapping coverage

Operator success factor

- Fast and easy Network rollout
- Increase operation efficiency
- join forces to consolidate the basic mobile coverage and focus on new technologies/services

Network Costs represent significant part of operators expenditures

(Source: Analysys, April 2007)
Network Sharing solution offers significant network CAPEX and OPEX savings for operators

- Depending on the different Network sharing methods, savings of up to 40% can be achieved.
- Additional cost savings assured through Managed Services by neutral 3rd party

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RA- Network CAPEX/ OPEX*

Separate BTS systems: 100%

Site sharing: 30%

Multiple Operator RAN sharing – maximal sharing: 40%

Multiple Operator RAN sharing – maximal sharing with managed service: Additional 10-15% OPEX savings

*) OPEX basing on 5 years period
SLA: Service Level Agreement
RA: Radio Access
Market outlook

“We estimate that savings on network build could be as much as 38% of overall CAPEX, the cost savings from network sharing could stimulate 3G roll-out throughout the industry”

Source: Analysys, April 2007

Nick Read, CEO of Vodafone UK, about Vodafone UK and Orange UK proposed radio access network share: 'This proposal is industry leading and will enable the two companies to remain vigorously competitive against each other and the market, while realizing the proven benefits of network sharing, notably faster roll out of high speed mobile services in the future and the earlier introduction of innovative products.‘

Source: Vodafone press release February 2007

“Mobile Operator Network outsourcing Leads to 20-25% Reduction in Cash costs…outsourcing has become a more acceptable approach to increasing profitability, as it offloads the cost burden to the partner firm.”

Source: Pyramid Research, June 2007

“The challenge is to optimally utilize available resources while ensuring competition and availability of services at affordable prices. The infrastructure sharing therefore is the crying need of the hour.”

Source: Telecom Regulatory Authority of India, April 2007
Building blocks of the network sharing solution

- End user Services (HSPA, MBMS)
- Routing functionality (MORAN, MOBSS, MOCN)
- Node B, BTS; RNC; BSC
- Antenna and Feeder

- MSC; VLR; SGSN;
- Service platform
- MOCN functionality (e.g. redirection for non-supporting UEs)

- Planning
- Consulting
- Implementation & Consolidation
- Operation & Maintenance
- Managed Services

- Integrated O&M for 2G/3G
- NetAct Regional Cluster
Network sharing scenarios

Sharing operators have different methods depending upon the operational environment

- Areas with high business potential
- Heavy competition between operators
- Service and performance differentiation needed
- Full control of own network assets

- Areas with moderate business potential
- Competition between operators
- Partial control of network assets

- Areas with low business potential
- Possibly regulatory coverage requirements

Site based sharing  RN controlled sharing  CN controlled sharing

RN: Radio Network
CN: Core Network
Increasing levels of sharing in mobile networks are supported by different technical solutions.

**Degree of sharing**

- **Site Sharing**
- **MORAN/MOBSS**
- **MOCN**
- **Shared RAN w/ Gateway Core**
- **Full Network Sharing**

**Degree of Network Control**

- **Site Based Sharing**
- **RN Controlled Sharing**
- **CN Controlled Sharing**

- **Service Platforms**
  - HLR
  - MSC/SGSN
  - BSC/RNC
  - BTS/NodeB

- **Shared frequency**
  - Dedicated frequencies

- **GMSC/VLR/SGSN**
  - BSC/RNC
  - BTS/NodeB
The key methods of network sharing

SITE BASED SHARING (Passive):
• Site Sharing

CORE NETWORK CONTROLLED SHARING:
• MVNO Shared Network Scenario
• National Roaming
• Shared RAN/BSS with Gateway Core

RADIO NETWORK CONTROLLED SHARING (Active):
• Multi-Operator Core Networks (MOCN)
• Nokia Siemens Networks Multi-Operator BSS (MOBSS); 2G
• Nokia Siemens Networks Multi-Operator RAN (MORAN); 3G
Network Sharing Solutions

SITE BASED SHARING (Passive)

CORE NETWORK CONTROLLED SHARING

RADIO NETWORK CONTROLLED SHARING (Active)
Site Sharing

Scenario

- Often limited to mast/tower and equipment room sharing for BTS/NodeB (co-location)
- Extension to sharing of power, antenna and RF
- Sharing the premises for BSC/RNC or even the core network is thinkable but not common
- Site costs constitute ~30% of 3G rollout CAPEX & OPEX

Characteristics

Site Based Sharing (Passive) - Alternatives

- Multi-Operator BSS Solution
- Shared antenna system by combining
- Shared power and backup
- Shared site space

Shared site either owned by
- Operator A
- Operator B
- JV
- 3rd party (eg Tower Company)
## Site Sharing

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Very minor effect on differentiation potential (other than geographical presence)</td>
<td>▪ Sharing partners need to coordinate site-related operational aspects</td>
</tr>
<tr>
<td>▪ Site rental costs reduced</td>
<td>▪ Limited space/room for expansion on certain sites</td>
</tr>
<tr>
<td>▪ Reduction in total number of sites</td>
<td>▪ Power loss in shared antenna systems requires additional amplification of output power</td>
</tr>
<tr>
<td>▪ Better utilization of scarce resources, i.e. sites, masts and shelters</td>
<td></td>
</tr>
<tr>
<td>▪ Significant reduction in site acquisition cost and build-out effort</td>
<td></td>
</tr>
<tr>
<td>▪ Harmonization of transmission costs</td>
<td></td>
</tr>
</tbody>
</table>
Network Sharing Solutions

SITE BASED SHARING (Passive)

CORE NETWORK CONTROLLED SHARING

RADIO NETWORK CONTROLLED SHARING (Active)
Mobile Virtual Network Operator (MVNO)

**Schematic**

- **Service Platforms**
- **HLR**
- **MSC/SGSN**
- **BSC/RNC**
- **BTS/NodeB**

- **Host Network owned by Host Operator**

**Characteristics**

- A MVNO is defined as an organization
  - operating a physical network infrastructure
  - having its own unique MNC with distinct number series (where applicable)
  - issuing its own branded SIM cards
  - but without a mobile radio access network (MVNO has no license!) and potentially without core network

- “Full MVNO”: comprising as a minimum a MSC, HLR and AuC
- Hosted operator has own HLR, billing system and service platforms
- By having their own network infrastructure Full MVNOs are able to offer enhanced services to their customers beyond those available on the host network

**Customer Projects**

- Multiple MVNO’s in some countries, eg Virgin Mobile, etc.
National Roaming

An operator relies on the network of a host operator to provide services to its customers in regions without an own network.

Example:
- Operator A builds a nationwide network
- Operator B only builds a network in urban and suburban areas
- In rural areas, Operator B customers access Operator A's network via roaming to get service coverage

Hosting operators use own PLMN-id's in their own network area. Possible to show operator's name in the phone display even when roaming in the host network (required SIM based solution)
Roaming Based Sharing Scenario: Shared RAN with Gateway Core

**Schematic**

- **Service Platforms**
  - HLR
  - MSC/SGSN
  - GMSC/VLR/SGSN
  - BSC/RNC
  - BTS/NodeB

- **Gateway Core**
  - BSS/RAN + GW Core
  - Shared frequency

**Characteristics**

- Operators have own core networks and service platforms
- RAN/BSS and gateway core are shared
- Shared carrier used
  - One PLMN-Id for the shared RAN/BSS
  - Possible to show Operator's name on phone display
  - Mostly applied for covering low to medium traffic areas (eg. rural & suburban coverage)
- Own RAN and core used in high-traffic areas
  - Second PLMN-Id for non-shared RAN
  - IMSI based handovers to select operator’s own RAN if more than one RAN is available
- Complies with 3GPP Rel. 99 specifications

**Customer Projects**

- 3GIS (Telenor & Hutchison) 3G Sweden

Special case for BSS with dedicated frequencies:

- Shared BSS, excluding dedicated radio resources (TRX)
- 'Multiple PLMN-id' (multiple BCCH) used in shared BSS.
- Operator’s own logo is also displayed in the shared area
### Roaming Based Sharing Scenario: Shared RAN with Gateway Core

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
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<tbody>
<tr>
<td>• Significant reduction in equipment volume (esp. during initial network rollout)</td>
<td>• Reduced independence in service development (Common feature set)</td>
</tr>
<tr>
<td>• Reduction in equipment cost and installation &amp; commissioning effort</td>
<td>• Highly limited technical differentiation potential</td>
</tr>
<tr>
<td>• Reduced network and site operating costs</td>
<td>• Additional costs for gateway Core</td>
</tr>
<tr>
<td>• In low traffic areas long term cost advantage</td>
<td>• Sharing partners need to coordinate</td>
</tr>
<tr>
<td>• Operator’s name visible on phone display</td>
<td>• all RAN-related operational aspects</td>
</tr>
<tr>
<td>• Follows 3GPP Rel. 99 specification</td>
<td>• RAN planning aspects</td>
</tr>
<tr>
<td></td>
<td>• equipment vendor selection and equipment decisions</td>
</tr>
<tr>
<td>(all items of site sharing)</td>
<td>• Cost of coordination</td>
</tr>
<tr>
<td></td>
<td>• Operator co-operation e.g. for charging is needed</td>
</tr>
<tr>
<td></td>
<td>• Own PLMN ID for shared RAN leads to roaming arrangements</td>
</tr>
<tr>
<td></td>
<td>• Handovers possible to other operator’s network within a shared RAN (if IMSI-based handover not implemented)</td>
</tr>
</tbody>
</table>
Network Sharing Solutions

SITE BASED SHARING (Passive)

CORE NETWORK MANAGED SHARING

RADIO NETWORK MANAGED SHARING (Active)
Active RAN Sharing
Scenario: 3G Multi Operator Core Network (3GPP MOCN)

### Characteristics

- Several core network operators can be connected to the same RNC sharing fully all RAN resources
- Operators can have shared RAN and own dedicated RAN networks
- Utilizes one or more shared carriers for multiple operators
- Common site and cell level parameters
- RNC routes the UE’s initial access to one of the available CN nodes
  - Rel-6 UEs are connected directly to own CN
  - For legacy UEs the RNC re-routing functionality is used to find the correct CN
- 3GPP Rel6 functionality
Active RAN Sharing  
Scenario: 3G Multi Operator Core Network (3GPP MOCN)

<table>
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</table>
| - Significant reduction in equipment volume (esp. during initial network rollout)  
- Reduction in equipment cost and installation & commissioning effort  
- Reduced network and site operating costs  
- In low traffic areas long term cost advantage  
- Follows 3GPP specification  
- *(all items of site sharing)* | - Due to the usage of same frequency, interference issues need to be addressed (additional RF CAPEX) which can lead to reduction of cell range  
- Increase in traffic for one operator can reduce throughput and cause congestion  
- Compared to MORAN for the same scenario cell range is smaller and data rate is lower at cell edges  
- Coordination effort for sharing partners  
- Service differentiation is not possible  
- End users will realize that the RAN is shared, because all Pre-Release 6 UEs will attach to the same PLMN ID  
- *(all items of site sharing)* |
## Active RAN Sharing
Scenario: Multi-Operator RAN/BSS (MORAN/MOBSS)

### Characteristics
- Sharing one or more physical BSC/RNC and BTS/NodeB between multiple operators
- Operators can have both shared RAN and own dedicated RAN networks simultaneously
- Dedicated carrier unit per operator in BTS/NodeB
  - Own PLMN-id’s and frequencies
  - Own cell level parameters
  - Common site level parameters
- Up to 4 operators with own
  - licensed frequencies
  - core networks
  - services
  - operator-dedicated RAN from any vendor in non-shared areas
- 2G MOBSS solution planned

### Customer Projects
- Vodafone & Optus 3G Australia

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### Schematic

![Schematic Diagram](image)

- **Service Platforms**
- **HLR**
- **MSC/SGSN**
- **BSC/RNC**
- **BTS/NodeB**

- RAN owned either by
  - Operator A
  - Operator B
  - JV
  - 3rd party (Network Provider)

- Dedicated frequencies

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<table>
<thead>
<tr>
<th>Operator A</th>
<th>Operator B</th>
</tr>
</thead>
</table>

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Network Sharing CP/ A. Gerber / August 2007
Active RAN Sharing
Scenario: Multi-Operator RAN/BSS (MORAN/MOBSS)

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<tr>
<td>▪ Reduction in equipment cost and installation &amp; commissioning effort</td>
<td>▪ Coordination effort for sharing partners</td>
</tr>
<tr>
<td>▪ Minimize OPEX</td>
<td>▪ Risk of delayed decisions or implementation</td>
</tr>
<tr>
<td>▪ In low traffic areas long term cost advantage</td>
<td>▪ Reduces technical differentiation potential</td>
</tr>
<tr>
<td>▪ Operators maintain control of their own network traffic (quality &amp; capacity)</td>
<td>(radio QoS and features)</td>
</tr>
<tr>
<td>▪ Independence in roaming agreements</td>
<td>▪ (all items of site sharing)</td>
</tr>
<tr>
<td>▪ (all items of site sharing)</td>
<td></td>
</tr>
<tr>
<td>▪ Compatible with any core network</td>
<td></td>
</tr>
<tr>
<td>▪ Exit path to own dedicated NodeBs when traffic grows or if operator changes sharing policies</td>
<td></td>
</tr>
<tr>
<td>▪ 3GPP Rel 99 compatible / all terminals supported</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Summary table of different methods of Network sharing

<table>
<thead>
<tr>
<th>Sharing methods</th>
<th>Own frequency in use in shared area</th>
<th>End-user services can be provided in shared area?</th>
<th>Operator logo can be shown in the shared RAN area</th>
<th>Impact on Core Network (special SW in CN needed)</th>
<th>Individual cell level parameters in shared area</th>
<th>Terminal base line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site sharing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>3GPP R99</td>
</tr>
<tr>
<td>Mobile virtual network operator (MVNO)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>3GPP R99</td>
</tr>
<tr>
<td>Geographical sharing/National roaming</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>3GPP R99</td>
</tr>
<tr>
<td>Shared RAN with Gateway Core</td>
<td>No</td>
<td>Yes*)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>3GPP R99</td>
</tr>
<tr>
<td>Shared BSS with Gateway Core</td>
<td>Yes</td>
<td>Yes*)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>3GPP R99</td>
</tr>
<tr>
<td>Multi-Operator Core Networks, 3GPP MOCN</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>3GPP Rel-6 **</td>
</tr>
<tr>
<td>NSN Multi-Operator BSS, MOBSS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>3GPP R99</td>
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<td>NSN Multi-Operator RAN, MORAN</td>
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<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>3GPP R99</td>
</tr>
</tbody>
</table>

*)GW Core has to provide services of all parties  
**) Pre Rel-6 terminals supported through Iu-interface connection re-routing procedure
OSS Management Solution for the Shared Network

- **Indirect Management:** Common network domain managed by separate OSS

- **Operational responsibility** must be agreed between operators
  - Joint venture
  - One of the sharing operators
  - Neutral 3rd party Managed Services solution

- **Sharing operators** do not have direct access to the shared network

- Information sharing between the shared network operator & the sharing operators depends upon the solution, e.g.
  - On-line automatic data forwarding
  - Off-line regular reporting upon a request
  - According to mutually agreed processes

- **“Chinese Walls”** by 3rd party Managed Services to meet regulatory requirements
Operators facing the costs of existing 2G and roll-out of 3G networks, need to increase operation efficiency.

Nokia Siemens Networks is the market leader in Network Sharing solutions.

MORAN for RN controlled sharing is a unique and proven method.

Nokia Siemens Networks can offer all different network sharing methods for 2G and 3G – from simple site sharing to the fully managed network.

Our Network Sharing solution offers significant network CAPEX and OPEX savings for operators.