AGENDA

› Ericsson and me
› Services we do
› Challenges we have
› Future we see
› Demands we have
NETWORK ROLLOUT

Consulting
Planning & Design
Build
Integration
Optimization
Operations & Support

Turnkey Network Rollout

IN COMBINATION WITH TECHNOLOGY LEADERSHIP
SMARTPHONES
BATTERY

› Typically dominating:
  – display, when user is active
  – 3G radio modem, when inactive
  – (CPU)

› Trend:
  – slow increase in battery capacity
  – faster increase in components peak power

› Low duty cycle key for battery lifetime

Battery lifetime is a challenge with smartphones
3G TRAFFIC LOAD COMPARISON

Signaling traffic

"9"

"3"

"1"

Feature phones

Smart Phones

Data traffic

"1"

"10"

"100"

Significant signaling
x
Many smartphones
= Impact on some networks

Signaling load increasingly important with smartphones

Data: IP packets to/from apps, services, Internet
Signaling: Mobile-specific messages for managing mobility and resources for the Data traffic
SMARTPHONE CHALLENGES - OVERVIEW

Trade-off between:
- Battery efficiency
- Radio resources
- Signaling & network resources
- User experience (latencies)

User experience

New usage patterns
Chatty traffic

Application behavior

Device behavior

Battery

Radio resources

Application server

Network behavior

Timeouts

Application behavior

Mobile Network

RAN

Proxy/ FW/NAT

CN

Internet

Memory, IP addresses

RAN = Radio Access Network
CN = Core Network
FW = Firewall
NAT = Network Address Translation

Application behavior

Signaling & network resources
Device-triggered fast dormancy

- Device trigger: data + display inactivity
- Problems: latency, signaling, shortcuts URA state

- Data rate
- Power

- HSPA “High”
- FACH “Low”
- URA “Standby”
- Idle

~ 3-5 s inactivity
Heterogeneous Networks
ENHANCING NETWORK PERFORMANCE
MOBILE BROADBAND GROWTH
TRAFFIC GROWTH IN 2011...

Source: Ericsson worldwide measurements
... AND LOOKING AHEAD

Source: Ericsson Strategic Forecast
WINNING STRATEGY

HIGH END & MASS MARKET DEVICES

SERVICE DIFFERENTIATION

NETWORK IS THE DIFFERENTIATOR

Coverage

Capacity

Speed & Latency

Subs

Price

Demand-based pricing / QoS
IT’S ABOUT END USER EXPERIENCE

Coverage

Coverage is taken for granted
But is bitrate dependent

Capacity

Data and voice volume capacity
to serve all subscribers

Speed and low latency

Cell edge performance
user experience

Always on

Signaling Capacity everywhere

An unsatisfied Smartphone user may become a subscriber lost!
EVO RAN
ONE NETWORK – ONE ASSET

- Everywhere Seamless Service
- Coordinated Multi Layer Cells
- Multi RAT RAN technology agnostic network

GSM
Mass market

HSPA
High end & Mass market

LTE
High end market

WiFi
Mass market spotty coverage
✓ Leverage proven macro functionality
✓ Advanced radio coordination
✓ Integration with Wi-Fi
End User Experience Challenges

1) Need for capacity, peak data rate, latency reduction
   Enhanced macros: advanced receiver structures, Multi Carrier aggregation, etc.

2) Need for higher cell edge data rates
   Site densification: more macro, or smaller base stations (main-remote/RRU´s and picos)

3) Need for indoor coverage
   Dedicated indoor solutions, Micro/Pico RBS & DAS combinations
PRINCIPLES FOR NETWORK EXPANSION

- Add indoor small cells
- Add outdoor small cells
- Improve and densify macro

WiFi complements good 3GPP coverage & capacity
Coordinated RRUs for the most challenging radio environments
Find the right mix For each part of the network and need
Key Areas

› Drivers For Change
› **The HetNet Toolbox**
› Integrating small cells
› Transport in HetNet
› Operations & Maintenance
HETEROGENEOUS NETWORKS

Improve macro

Required Capacity

Current Capacity

Densify macro

Add small cells
COORDINATED SMALL CELLS

Full spectrum reuse
RAN integrated WiFi

Required Capacity
Current Capacity
AIR
– ANTENNA INTEGRATED RADIO

Main-remote with RRUS

Main-remote with AIR
CUSTOMER CHALLENGES

- Find hot spots, suitable sites and backhaul
- Deploy small cells efficiently
- Achieve target performance levels
- Optimize multi-layer radio performance
- Maintain small cells at low TCO
For small cell deployment 2/3 of cost are related to transport and site rental.

Building site where it is “easy” may be the best alternative even if a few more sites are needed because this will help to reduce OPEX.
Multi Operator In Building Solutions

› 70% of traffic generated indoors makes in building solutions a key part of HetNet for complex coverage areas!
   - Multi operators, multi technologies and many frequency bands
   - Property owners preferred one interface or is not allowing any mobile operators free access to building complex

› Up to now passive distributed antenna system (DAS) has in many cases been the preferred solution

Bahrain Financial Harbour
Manama, Bahrain

• Financial center complex including two 53 floor towers, a 10 storey building and a mall.
• Main Remote RBS solution connected to passive antenna systems
• Multi-band GSM 900/1800 and WCDMA solution combined with Wireless LAN

605 Antennas!
SMALL RBS & SMALL RRU

Use with built in antennas or combined small Distributed Antenna System DAS
CARRIER GRADE WIFI A VALUABLE COMPLEMENT - ESPECIALLY INDOORS

- Many mobile operators are already widely deploying WiFi for Hot Spot coverage
- High and growing penetration of 2G/3G/LTE Smartphones with WiFi capability
- Carrier Grade WiFi provides scalability and quality
- ...but many subscribers find it cumbersome and unsecure to connect to public WiFi

Source: Ericsson and market estimate

90% of Smartphones will have Wi-Fi by 2014
Up from 44% in 2009
ABI, Analyst Insider, August 2009

Up to now - Lack of 3GPP/WiFi network integration have limited usability
## POSITIONING OF WIFI

**WiFi Strengths**
- Very high performance in good radio conditions
- Low cost radio nodes
- No spectrum licensees needed reduces start up cost
- Terminals can automatically switch to WiFi when within range

**WiFi Limitations**
- Unpredictable radio conditions makes it a “best effort service”
- Very short range, many nodes needed
- Anybody can set up access points at hotspots - lower revenue
- Terminals will lock on also to poor WiFi reducing over all experience and draining batteries in terminals

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WiFi is **not** an alternative for providing everywhere always on access!

WiFi is a good complement to a mobile network with full coverage

WiFi is mainly useful for active subscribers turning on their WiFi when at home, in office or at a public hotspot
Key Areas

› Drivers For Change
› The HetNet Toolbox
› **Integrating small cells**
› Transport in HetNet
› Operations & Maintenance
INTER-LAYER
RAN MANAGEMENT

Inter-RAT
Load sharing & mobility

Inter-Frequency
Load sharing & mobility

Intra-Frequency
Mobility & Extended Pico Range

Interference Mitigation
Rx & distributed RRM

Multi-Cell coordination
Macro div & joint RRM

Inter-RAT
Load sharing & mobility
Cell Edge Users Consumes More Radio Resources

› Cause more interference
› Need higher transmit power for data and control channels
› Longer holding time due to lower achievable data rates
› More frequent handovers

Great capacity improvement by adding small cells at cell border – especially in traffic hot spots
Downlink/Uplink Imbalance
The HetNet handover dilemma

› For heterogeneous network deployments the transmit power of Micro can be much smaller than for macro ($P_{\text{pico}} \ll P_{\text{macro}}$)
› Uplink sensitivity is more similar between Macro and Micro
› The best uplink cell does not necessarily correspond to the best downlink cell...
  - Downlink: maximum CPICH Ec/No (or CPICH RSCP), RSRP
  - Uplink: minimum path loss

Hierarchical Network Requires System Integration Between Layers
Uncoordinated microcells will shrink in size
Key Areas

› Drivers For Change
› The HetNet Toolbox
› Integrating small cells
› Transport in HetNet
› Operations & Maintenance
MOBILE TRANSPORT TRENDS

› Shift in backhaul solutions the last and coming years for Macro Networks
› Packet Microwave and optical fiber pre-dominant
› Drivers
  – Capacity
  – Characteristics

Does this trend apply for small cell networks?

No, it does not!
SMALL CELL BACKHAUL STRATEGY OVERVIEW

› Highest possible **Deployment flexibility**
  – Common transport for 3G, 4G and WiFi
  – Complementing backhaul aggregation portfolio
  – Flexible transport requirements

› **Fixed** Backhaul
  – For both **indoor** and **outdoor** deployments
  – Traditional telecom infrastructure: Copper & Fiber
  – Tactical Reuse: Cat5/6, POTS UTP, DOCSIS, DAS, Powerline etc

› **Wireless** Backhaul
  – For **outdoor** deployments
  – Both licensed and unlicensed spectrum, Line of Sight and Non/Near-LOS
Key Areas

› Drivers For Change
› The HetNet Toolbox
› Integrating small cells
› Transport in HetNet
› Operations & Maintenance
SMART SIMPLICITY - SON

Deployment
- Automated planning
- Automated Preparation
- Automated Integration

Maintenance
- Automated monitoring
- Automated failure handling
- Automated administration

Optimization
- Coverage
- Capacity
- Performance
- Energy Efficiency

SMART SIMPLICITY

ADDITIONAL SMART SIMPLICITY BENEFITS
AUTOMATIC NEIGHBOR RELATIONS

› Creates neighbor cell relations
  - In real time
  - In time for handover
  - Automatic clean-up

› Operator in control
  - Policies
  - Visualization
  - Observation mode

› Related to
  - PCI (re)assignment in OSS

Comparison between manual planning and ANR
Showing neighbor cell relation matrices
HetNet Summary

Densification often driven by bitrate demand - not data volume

One Network 2G/3G/LTE/WiFi

WiFi as a complement to 3GPP access – no coverage solution

Site, Transport and O&M new areas for innovation
NETWORK ENGINEER

› Participation in customer projects
› Collection and analysis of customer requirements
› Acquisition of network data and information
› Perform Network Planning and Design
› Perform Initial Tuning
› Perform Network and/or Node Reviews/Audits
› Perform Network Optimization including investigating network performance and issuing, discussing and/or implementing recommendations for network improvement
› Share knowledge from service deliveries in applicable forums
Radio Network Design

- Radio Propagation
- Advanced/Special Radio Network Deployment
- Antennas & ANP
- N&TC Service Product Area
- GSM/WCDMA/LTE Radio Network Traffic/Capacity
- Mapping Tools and Data Formats
- Network Perf (KPI) based on Field Measurements
- Network Perf (KPI) based on System Measurements
- Network Traffic Modelling
- Radio Functionality and cell parameters
- Radio Network Design & Tuning Tools
- Radio Network Design Processes & Methods
- Radio Network Dimensioning/Coverage Design
- Radio Network Initial Tuning Processes
RADIO NETWORK PERFORMANCE OPTIMIZATION

› Antennas & ANP
› N&TC Service Product Area
› Radio Network Performance Improvement
› Enhanced Capacity and Tight Spectrum Methods
› GSM/WCDMA/LTE Radio Network Traffic/Capacity
› MultiLayer (carrier) management
› Network Perf (KPI) based on Field Measurements
› Network Perf (KPI) based on System Measurements
› Optimisation and Post processing tools
› Radio Functionality and parameters
› Service Quality for Radio Networks
› Wireless End-to-end Performance
THANK YOU!