# Evolution of the 3GPP Network Architecture, (the Evolved Packet Core)

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# Air Interface Technology Evolution

OBAL INITIATIVE

OFDMA

Rel. 8 & 9
LTE

Peak Data Rate (bps)
DL/UL

WCDMA

Rel. 99
WCDMA

Rel. 4
TD-SCDMA

Rel. 5
HSDPA

Rel. 6
HSUPA

Rel. 7
HSPA+

Rel. 8
HSPA+

Rel. 9
HSPA+

2M/768K

2M/768K

14M/768K

14M/5.7M

28M/11.5M

42M/5.7M

84M/23M

300M/75M

'00

'02

'04

'06

'08

'10

'12


# Network Architecture Evolution

A GLOBAL INITIATIVE

Operator's IP Services (e.g., IMS, PSS etc)

PSTN

GGSN

MSC

SGSN

Circuit/GPRS Core Network

RNC

Node B

Operator's IP Services (e.g., IMS, PSS etc)

P-GW

MME

S-GW

eNode B

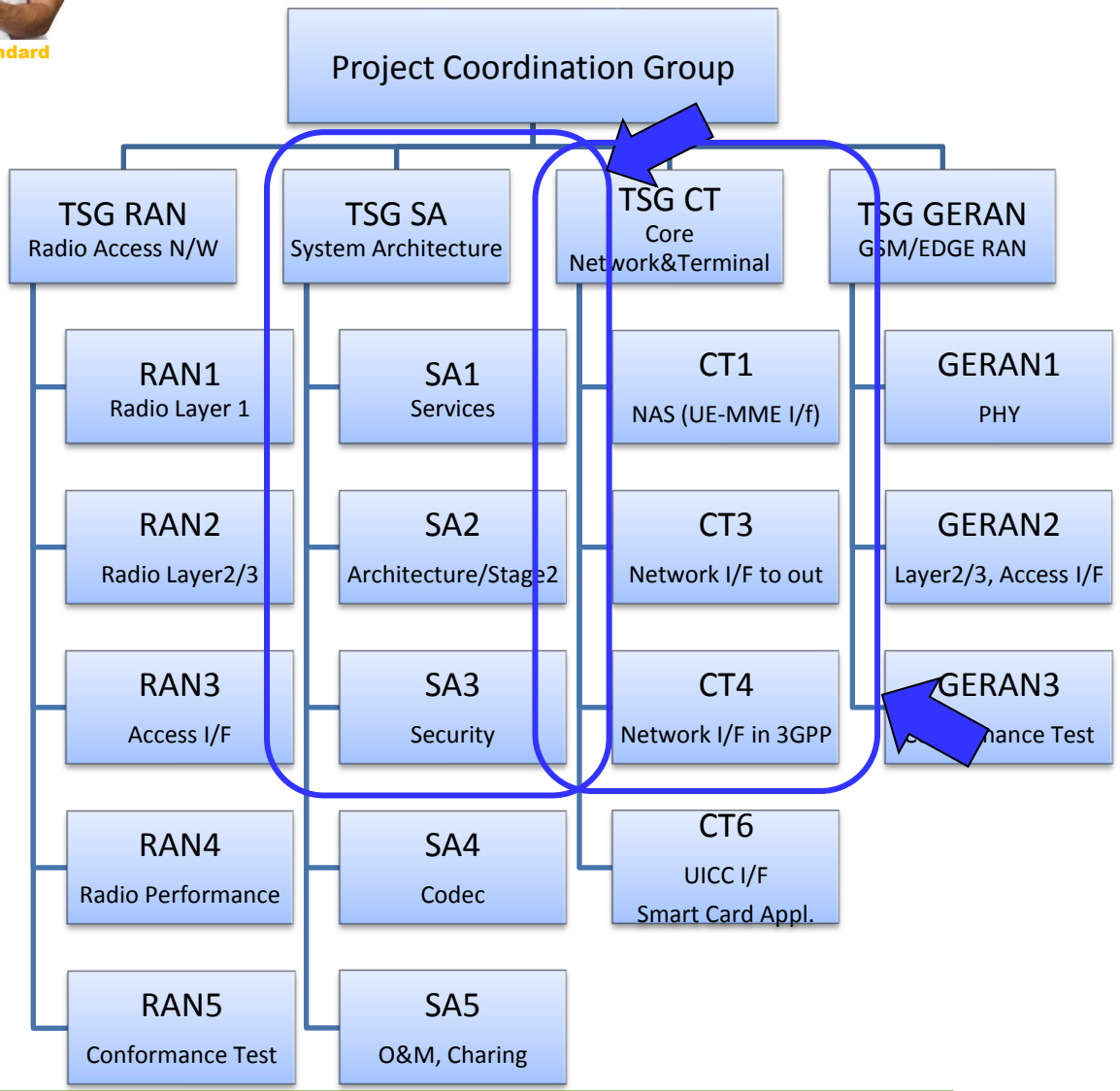
Evolved Packet Core Network

Control Plane delay : 100ms
User Plane delay : 5ms

'99 '01 '03 '05 '07 '09 '11 '13


# 3GPP Organization structure

A GLOBAL INITIATIVE




# Key LTE/SAE Features

A GLOBAL INITIATIVE

| Rel.8 LTE (~09/03) | Rel.9 LTE (~10/03) |
|---|---|
| • 20MHz, OFDM New Air<br>• DL 4x4 MIMO<br>• SON, HeNB | • Enhanced Dual-Layer Tx<br>• SON/HeNB Enhancement |
| • **SAE For LTE Access**<br>• **CS Fallback in EPS**<br>• **Single Radio VCC** | • IMS Emergency Calls<br>• LCS for LTE and EPS<br>• MBMS support in EPS |
| • Peak: DL 300Mbps,<br>UL 75Mbps | • Peak: DL 300Mbps,<br>UL 75Mbps |

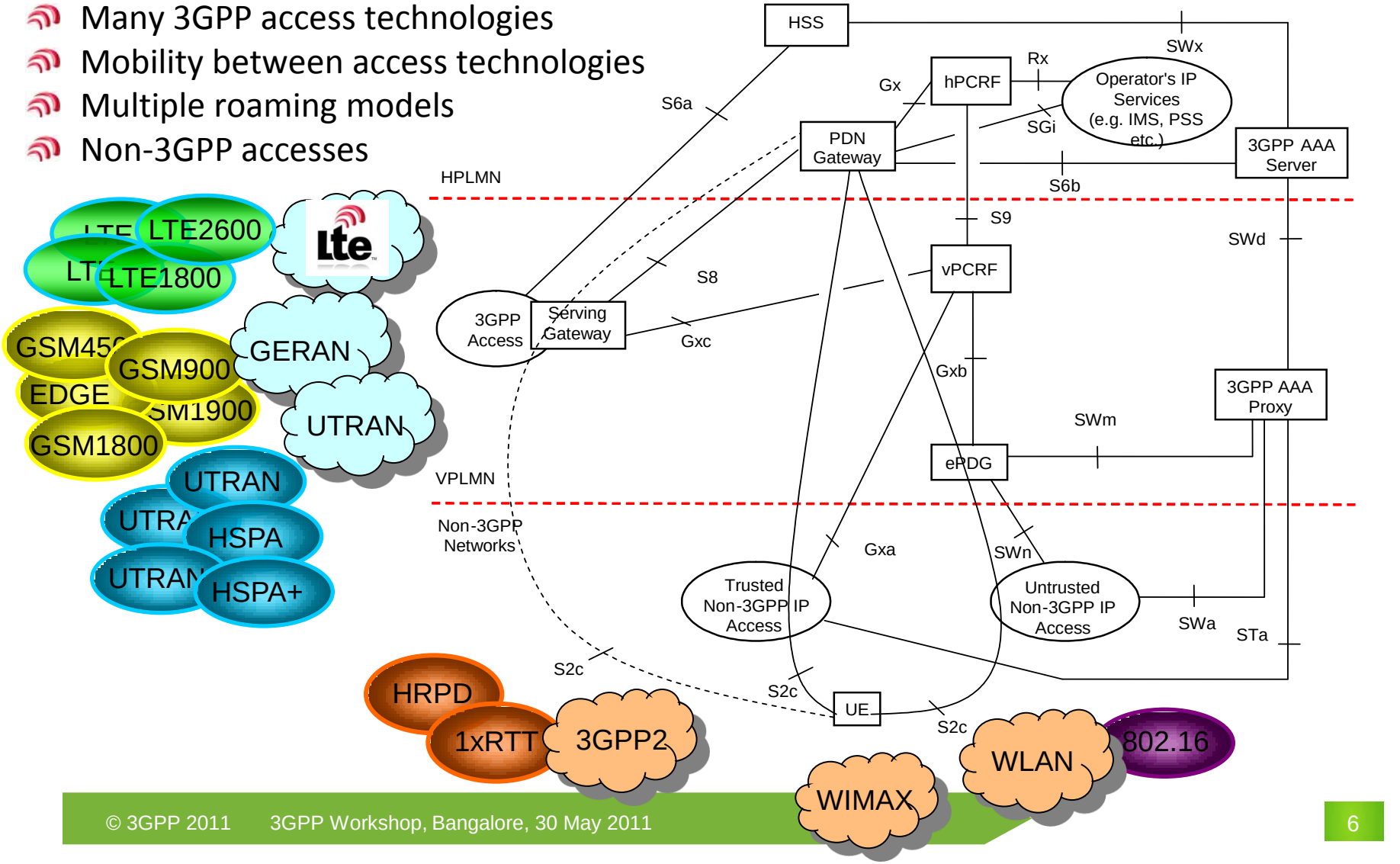
SON: Self Organizing Network, HeNB: Home eNB, SAE: System Architecture Evolution

THE Mobile Broadband Standard

# Evolved Packet System architecture

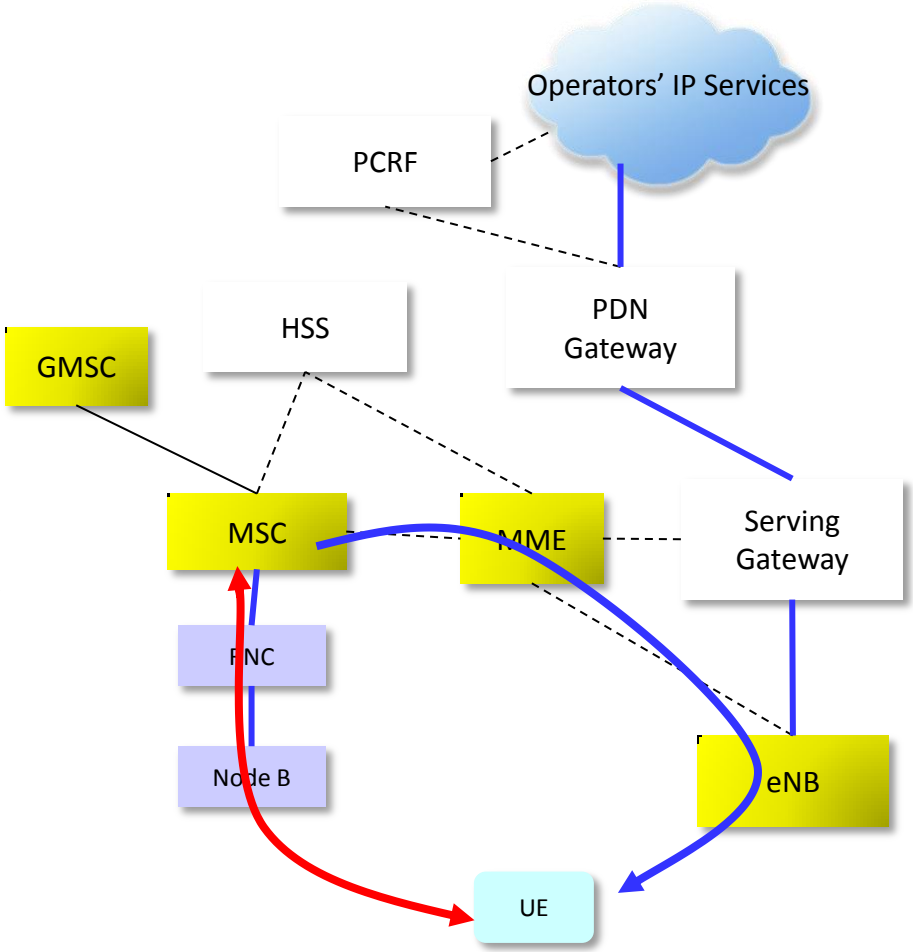
A GLOBAL INITIATIVE

- Many 3GPP access technologies
- Mobility between access technologies
- Multiple roaming models
- Non-3GPP accesses




# CS Fallback in EPS

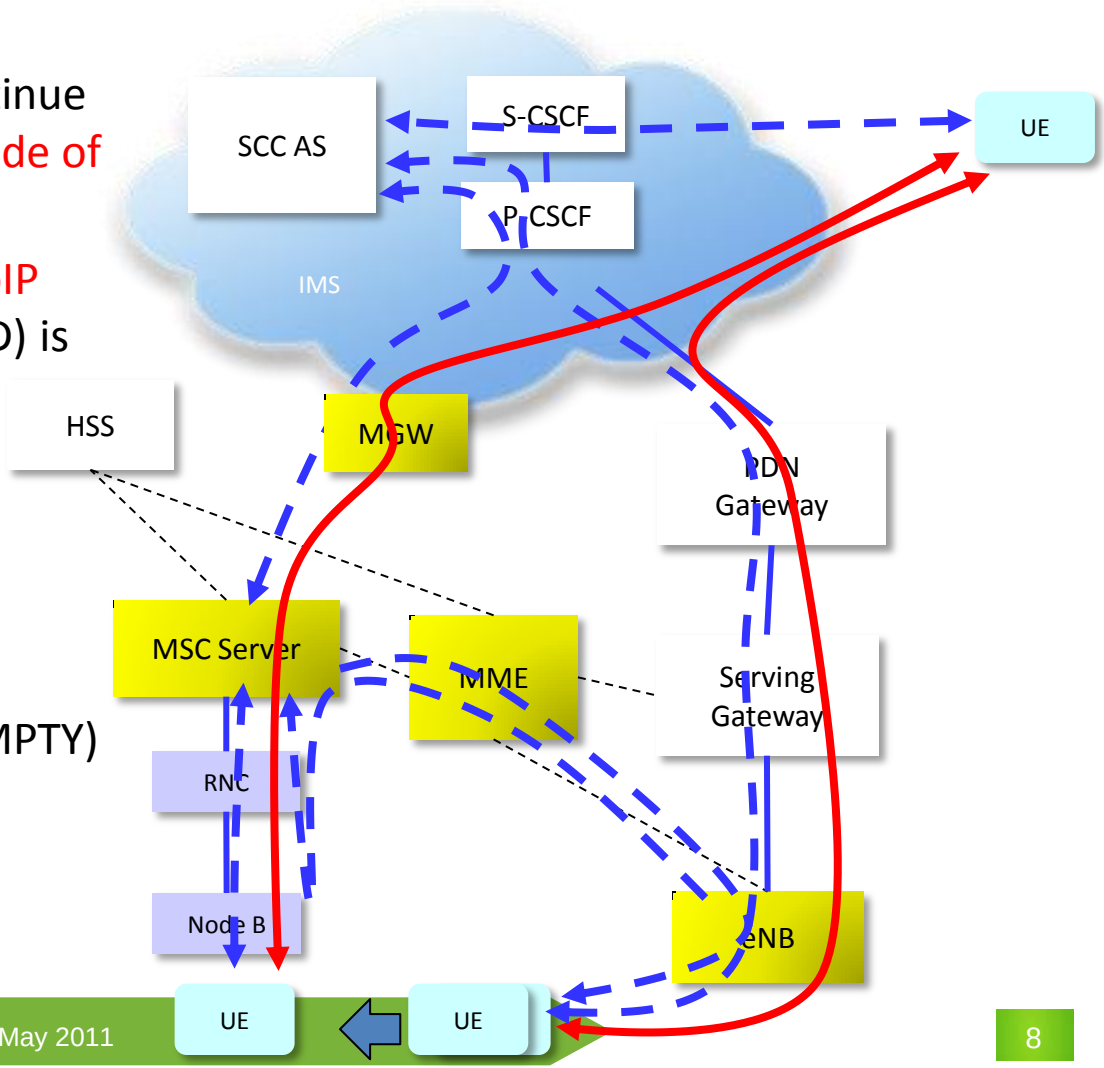
- Application of CSFB:
  - CS capable device camping on LTE cell can establish/receive CS services
  - Reuse of existing CS infrastructure for voice service until IMS VoIP is deployed
  - Provide voice roaming support with LTE
  - Can support emergency calls using existing CS infrastructure
- SMS can be delivered to the UE without redirecting to CS Domain




# Single Radio Voice Call Continuity

## SRVCC use case:

- IMS call initiated in LTE can continue in CS domain after moving outside of LTE coverage area
- SR-VCC is invoked if no other VoIP capable PS system (HSPA/eHRPD) is available for VoIP PS-PS HO
- Requires overlapping with GSM/WCDMA/1xRTT coverage




## SRVCC improvements:

- Mid-call services (like HOLD & MPTY)
- emergency calls
- video calls

# 3GPP Schedule

| | 2009 | 2010 | | | | 2011 | | | | 2012 | | | | 2013 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2H | 1Q | 2Q | 3Q | 4Q | 1Q | 2Q | 3Q | 4Q | 1Q | 2Q | 3Q | 4Q | 1Q | 2Q | 3Q | 4Q |
| Rel.8 | Rel.8 Commercialization | | | | | | | | | | | | | | | | |
| Rel.9 | ’09/12 | ’10/03 | | | | | | | | | | | | | | | |
| Rel.10 | | ’10/03 | | ’10/09 | | ’11/03 | | ’11/06 | | | | | | | | | |
| Rel.11 | | | | | | | | ’11/09 | | ’12/03 | | ’12/09 | | ’12/12 | | | |

First LTE launch (09/12)

Stage 3 | ASN.1 Freeze | Test spec

Stage 1 | Stage 2 | Stage 3 | ASN.1 Freeze | Test spec

Stage 1 | Stage 2 | Stage 3 | ASN.1 Freeze | Test spec

THE Mobile Broadband Standard

# Key Rel.10/Rel.11 Features

A GLOBAL INITIATIVE

## Rel.8 LTE (~09/03)

- 20MHz, OFDM New Air
- DL 4x4 MIMO/ UL 1x2 MIMO
- SON, HeNB
- SAE For LTE Access
- CS Fallback in EPS
- Single Radio VCC
- Peak: DL 300Mbps, UL 75Mbps

## Rel.9 LTE (~10/03)

- Enhanced Dual-Layer Tx
- SON/HeNB Enhancement
- IMS Emergency Calls
- LCS for LTE and EPS
- MBMS support in EPS
- Peak: DL 300Mbps, UL 75Mbps

## Rel.10 LTE-Adv (~11/06)

- DL 8x8 MIMO, UL 4x4 MIMO
- Carrier Aggregation
- HetNet, MDT
- **HeNB Local IP Access**
- **Wifi offloading**
- **Machine Type Communication**
- Peak: DL 1Gbps, UL 500 Mbps

## Rel.11 (~12/12)

- CoMP
- Enhancement of Rel.10 features
- System Improvement of MTC
- Service Awareness and Privacy Policies
- IW MNO and Application Provider
- Data Application Impacts


# Local IP Access (LIPA)

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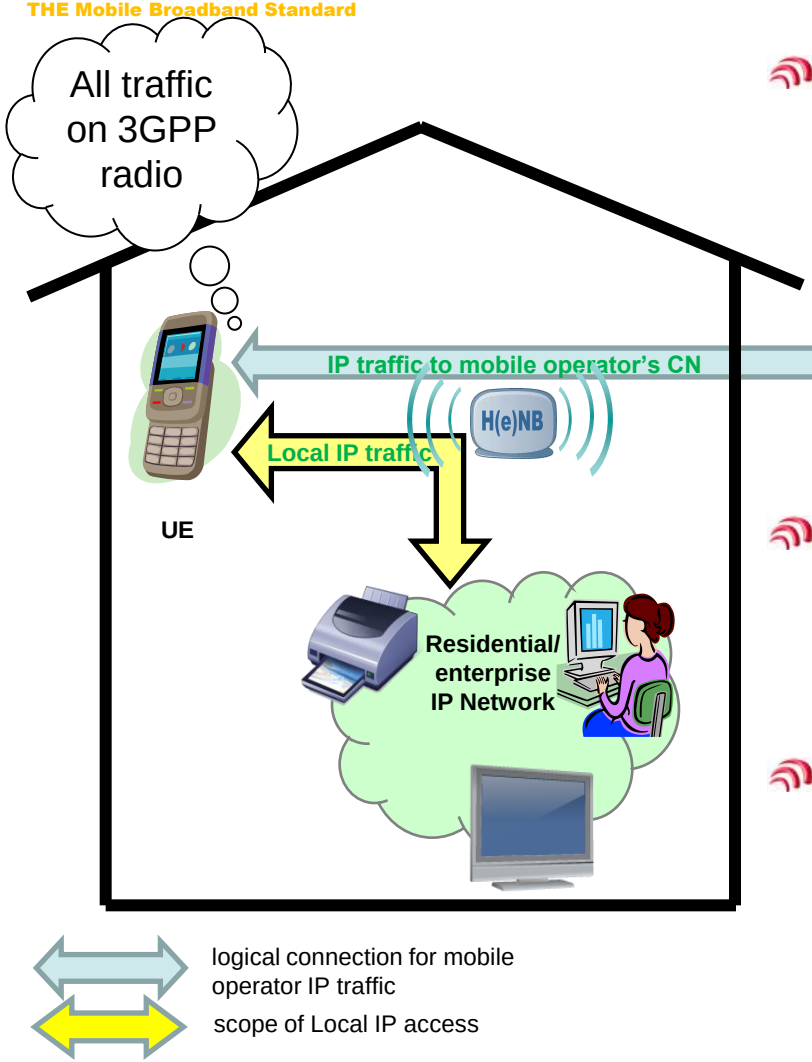
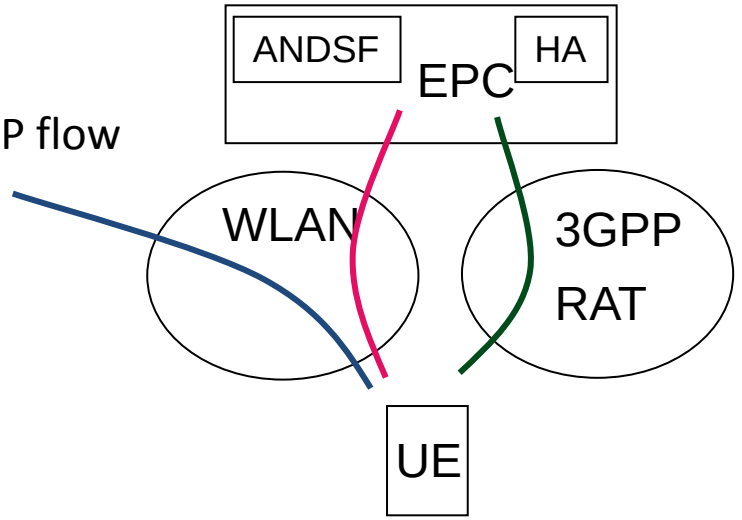



- LIPA is primarily for end user's benefit, to allow access to local residential or corporate network through a 3GPP device
- LIPA provides access for IP capable UEs that are connected via a H(e)NB subsystem to other IP capable entities in the same residential/ enterprise IP network.
- Simultaneous access from a UE to the mobile operator's core network and Local IP Access to a residential/enterprise IP network will be supported.

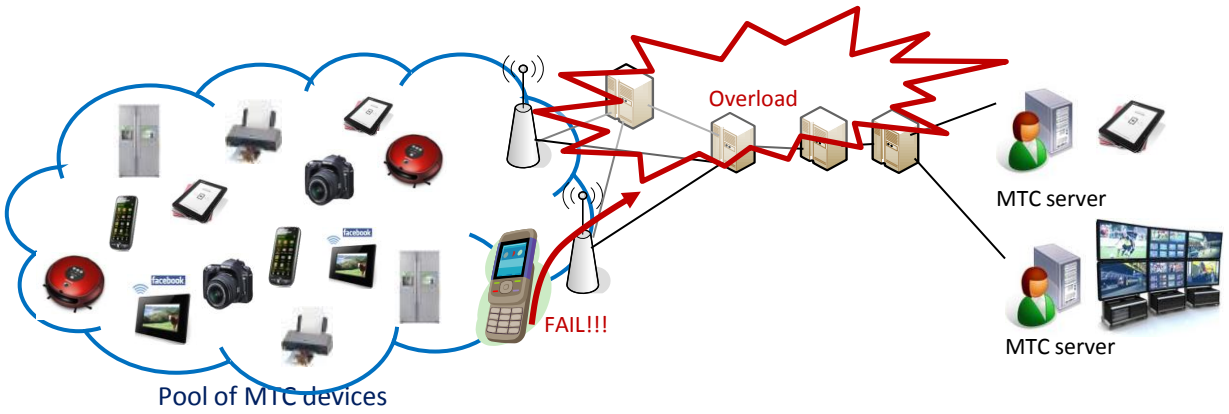

# WLAN Offloading

- WLAN offloading refers to the dual radio scenario where part of the traffic is routed via WLAN access and part via 3GPP access
- WLAN offloading covers both the scenario where the traffic via WLAN radio is anchored in the EPC (i.e., seamless offloading) and the scenario where it is not anchored (i.e., non-seamless offloading)
- Access Network Discovery and Selection Function (ANDSF) is there to provide the UE with the access network discovery information and the policy on how to use the available access networks
  - Available access networks
  - Preferred routing of the traffic per APN, per IP flow




# Machine Type Communication

- M2M is recognized as a key segment in future packet networks
- Initial 3GPP efforts have focused on the ability to differentiate machine-type devices
  - This allows the operator to selectively handle such devices in overload situations
    - Low priority indicator has been added to the relevant UE-network procedures
    - Overload and Congestion control is done on both core network and radio access network based on this indicator




# MTC – basic architecture

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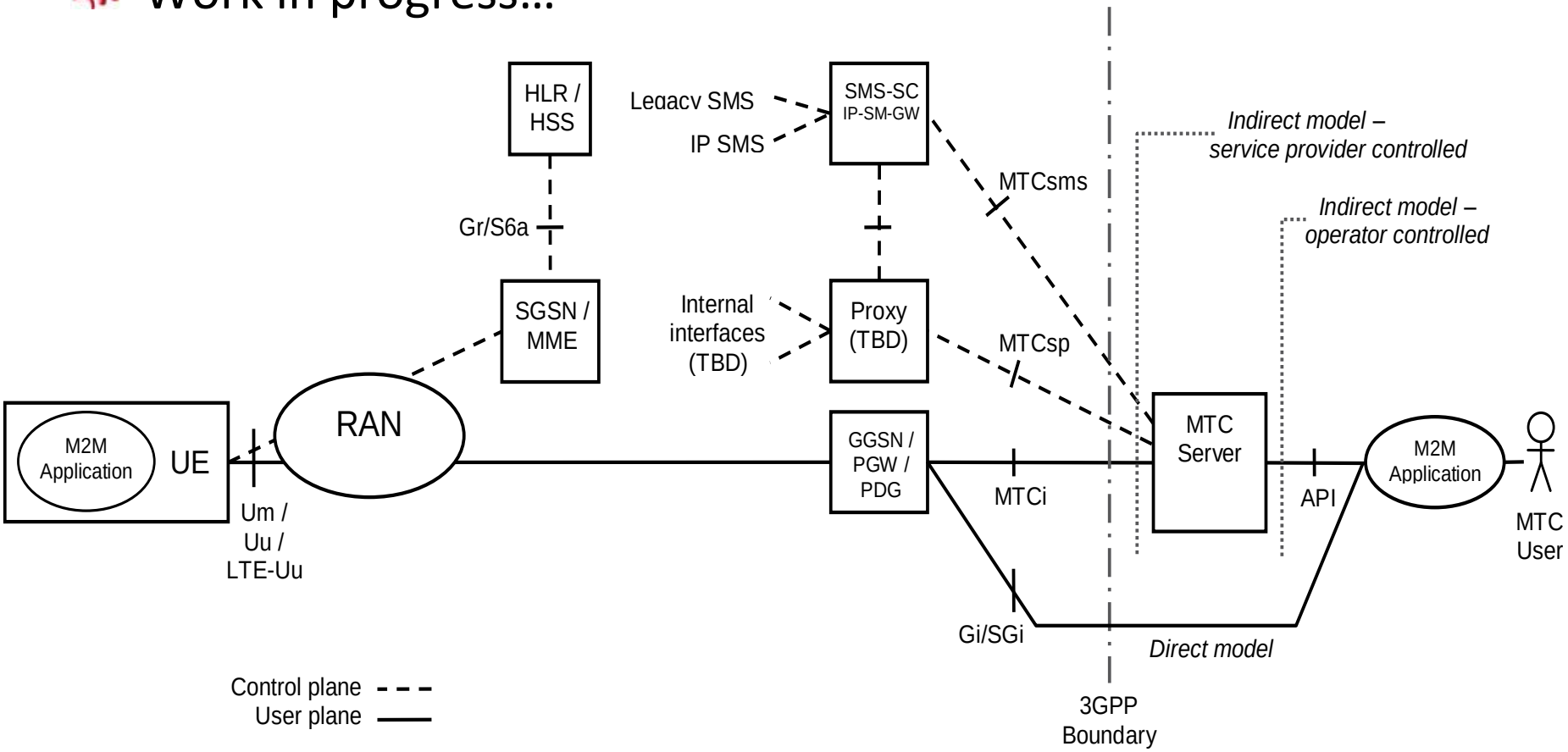
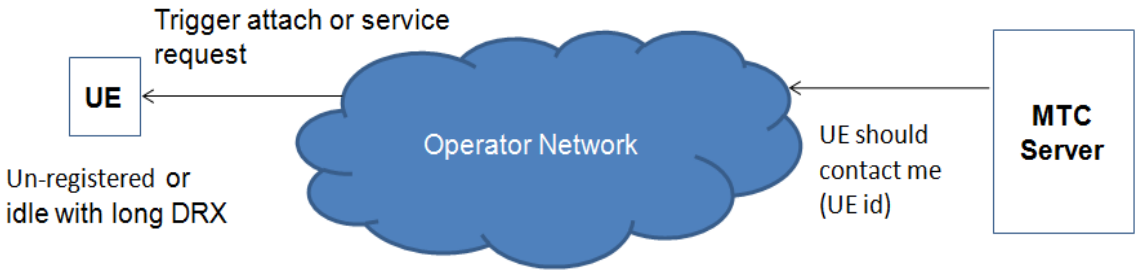
- Work in progress…




# Evolution of MTC

- Further functionality being added to 3GPP standards in the following areas
  - Reachability Aspects, MTC Feature control, Device Triggering
  - Addressing, Identifiers - especially removal of MSISDN dependencies in the architecture
  - Signaling Optimizations, Small Data Transmissions, MTC Monitoring




- MTC is a substantial technical area, full completion will span across multiple future Releases


# Rel.11: Service Awareness and Privacy Policies

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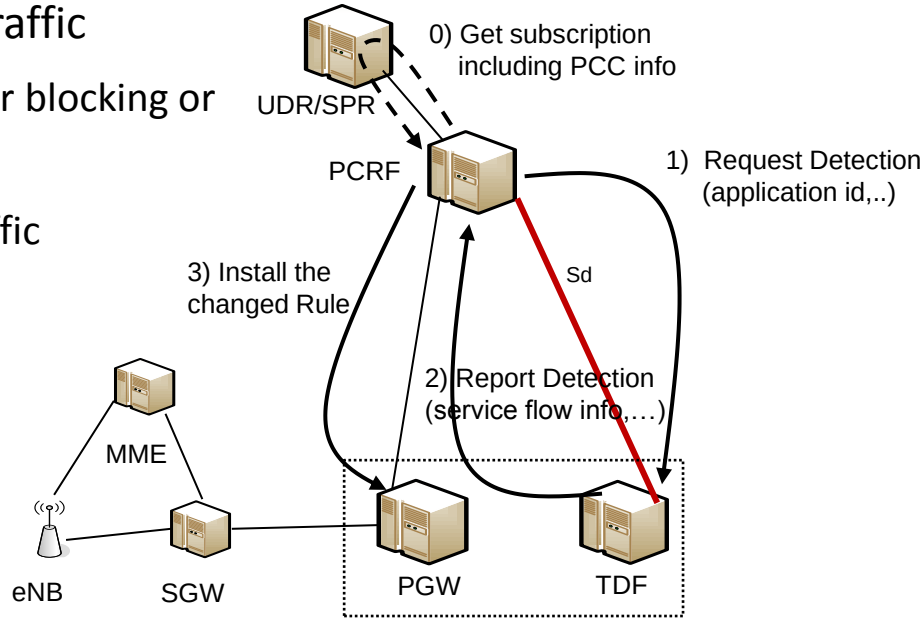
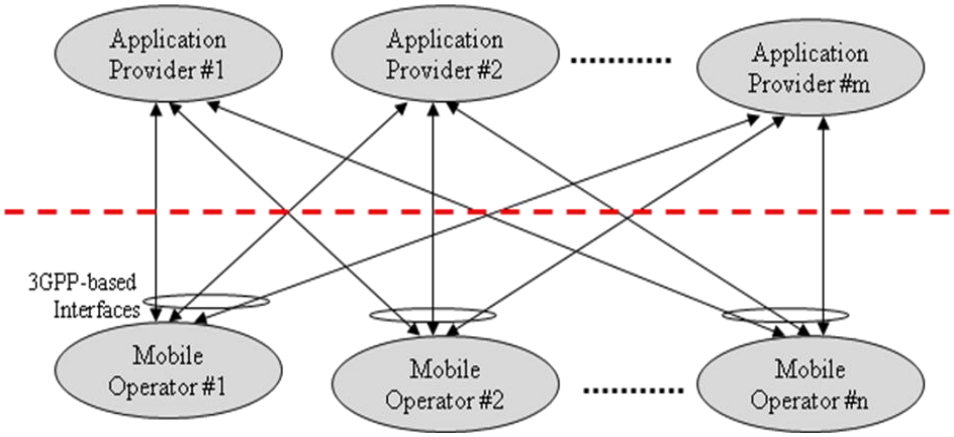
- Analyzing traffic, standardization of detecting the service traffic and applying the policy
  - Traffic Detection Function newly defined
  - Performs the following for the Detected traffic
    - Gating of the detected service traffic either blocking or permitting unrestricted
    - Traffic Shaping of the detected service traffic
    - Redirecting of detected service traffic




TDF: Traffic Detection Function


# Rel.11: IW MNO and Data Application Provider

- Interface will be provided toward 3rd Party Data Application Provider
  - The following services will be proved over the newly defined interface
    - Customised billing/charging, Promotion services, Group addressing capabilities, identity services, statistics etc




# Study on Non-MTC Mobile Data Application Impacts

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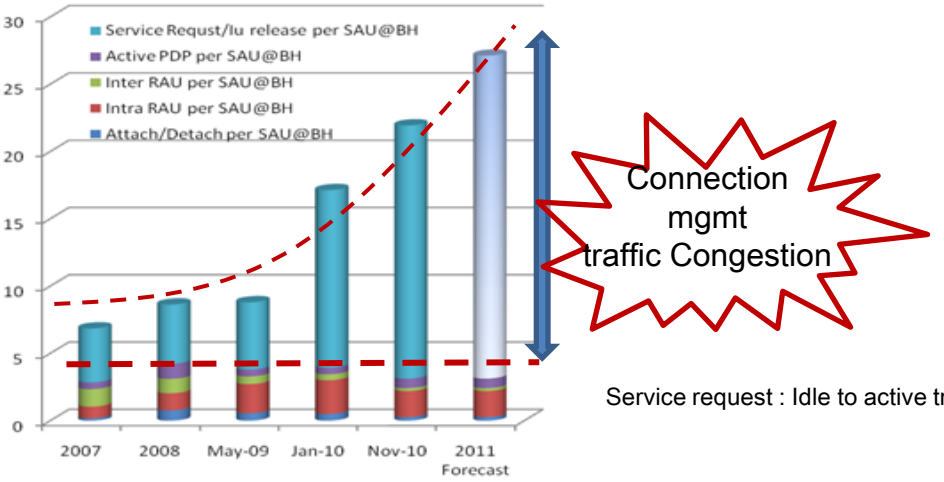
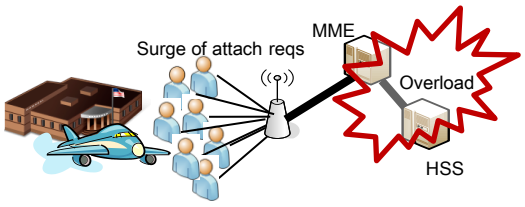
- Study on Service Scenario and Use case on Mobile data application
- Study on Network inefficiency from Mobile data application

(Problem 1)




(Problem 2)

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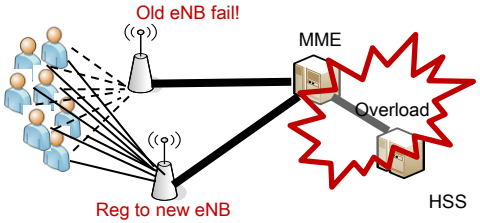


<Failure/restart of nodes>


# Thank You

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