3GPP Standards Development

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3GPP TSG-SA WG1 Chair

Contents

- Introduction to 3GPP
- Overview of 3GPP developments
  - System features
    - handling of traffic explosion
    - addressing new market segments
  - Radio features
    - improving network capacity and cell-edge performance
    - making more spectrum available at the terminal

A GLOBAL INITIATIVE

Introduction to 3GPP

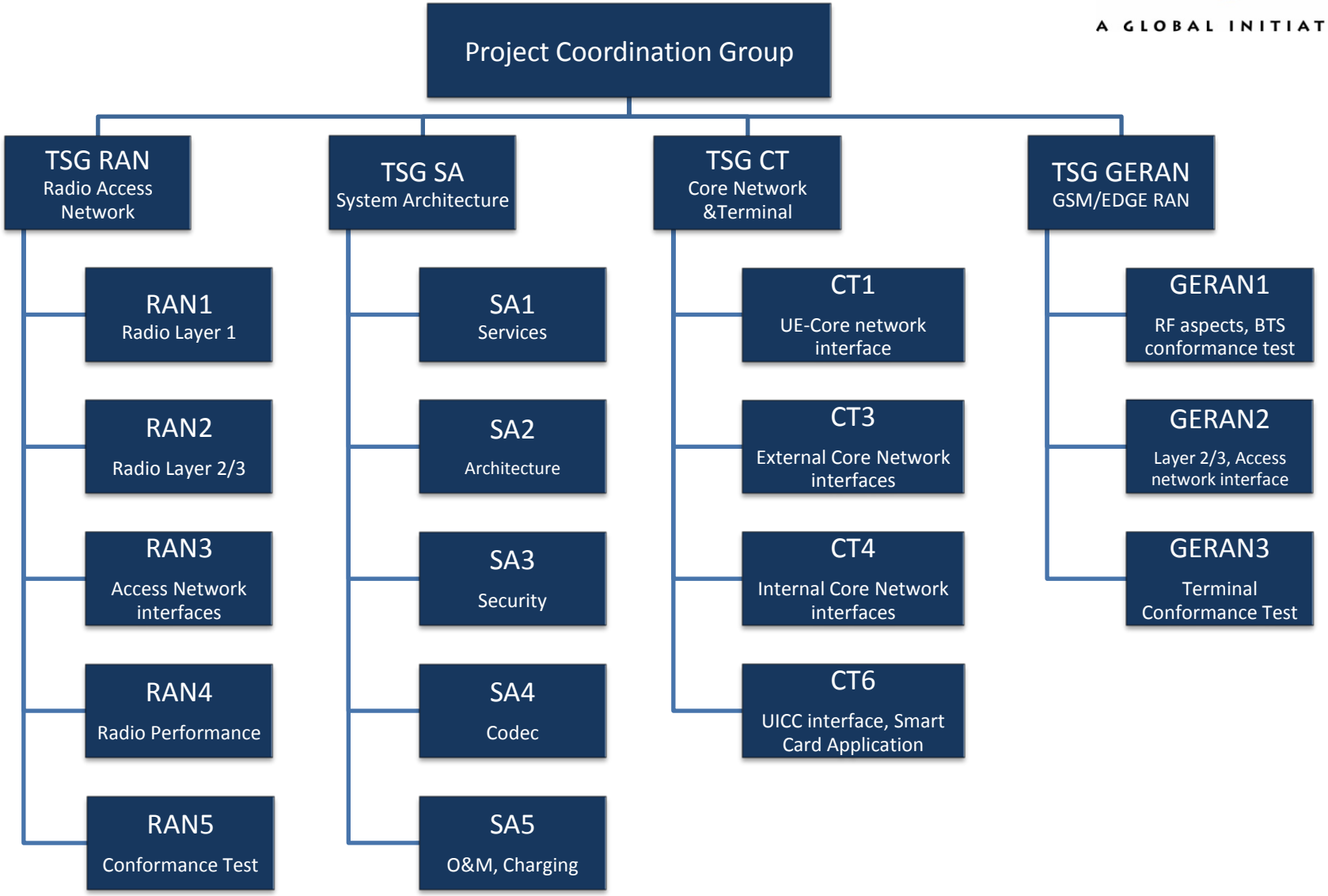
Role of 3GPP

- Evolution and maintenance of Radio and System Technologies

- Partnership consists of Regional standards

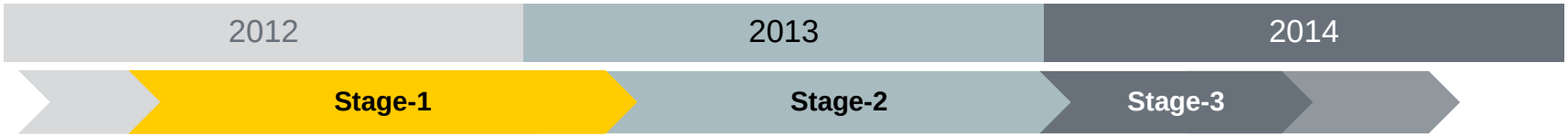
- Market partners representing the broader industry
  - GSMA, IPv6 Forum, UMTS Forum, 4G Americas, Small Cell Forum, NGMN Alliance, TCCA, etc.

3GPP Specification Group Structure



3GPP Release Timelines

Release 12 schedule



Release 13 tentative schedule

3GPP working procedures

- New work initiated by member companies via *Work Items* outlining scope and time plan
- *Work Items* prioritised if all estimated work cannot be done by the scheduled release deadline
- All 3GPP member companies contributes on equal terms on any *work item*
- 3GPP seeks consensus on for decision-making for all technical matters
- Release deadline respected, unfinished work deferred to a later release

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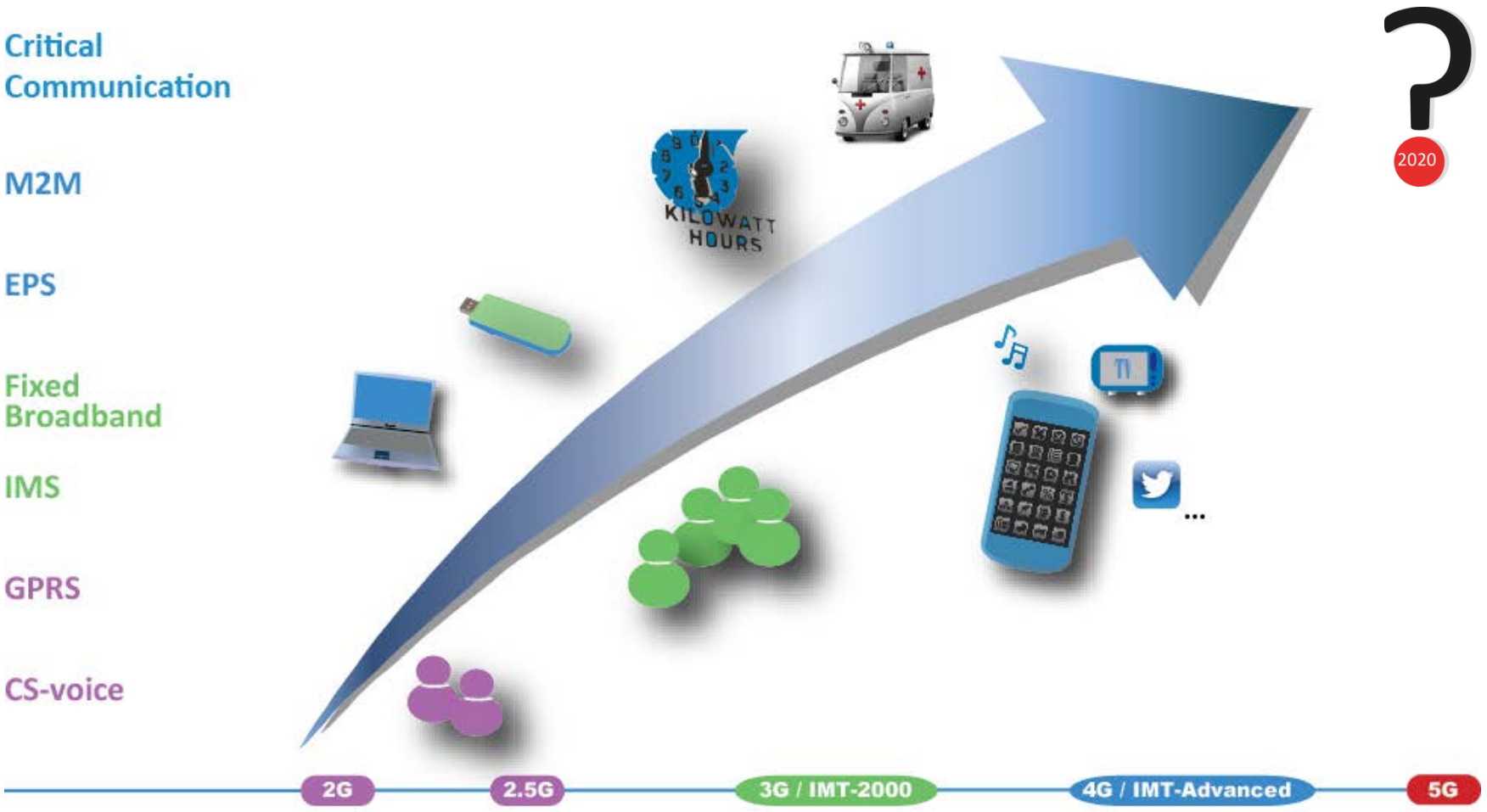
3GPP developments

System/radio development overview



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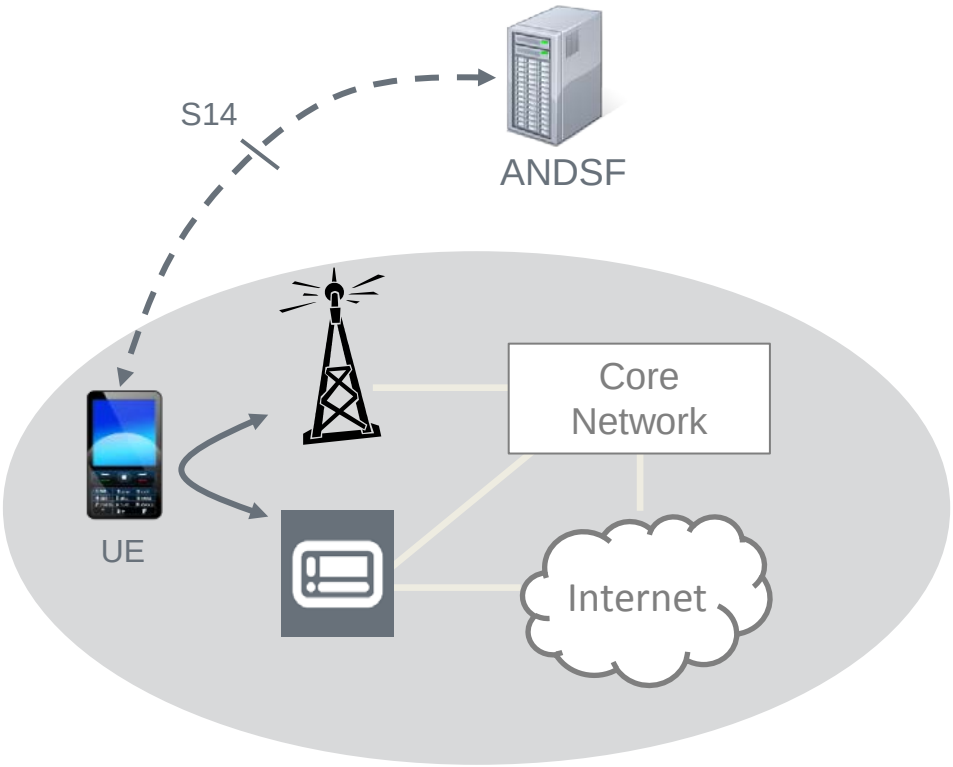
Overview of System developments

Technologies to improve handling of traffic explosion

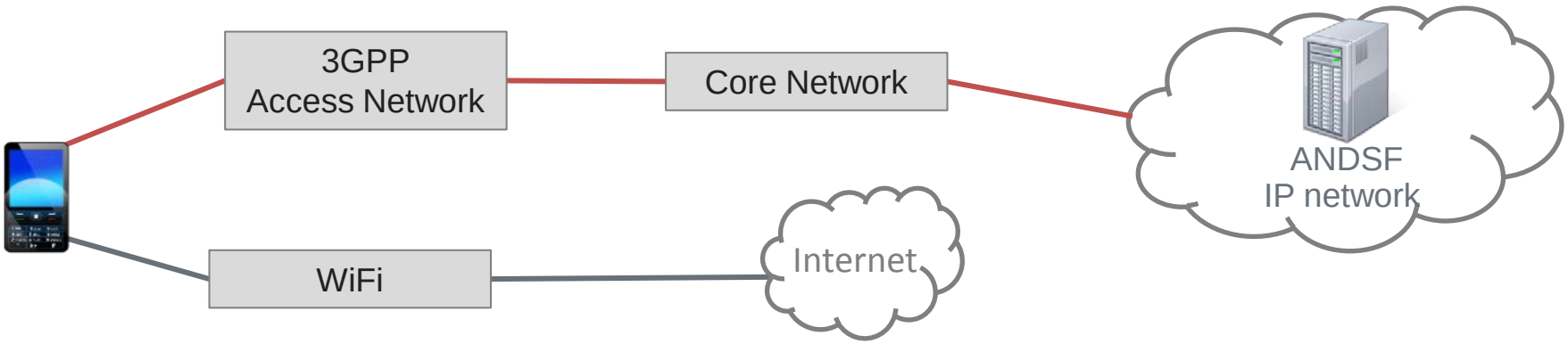
WiFi offload: Access Network Discovery and Selection (ANDSF)

- Enables operator to influence WiFi usage
- Provides network discovery information and access network selection policies to UE
- Device Management framework from OMA re-used for this purpose



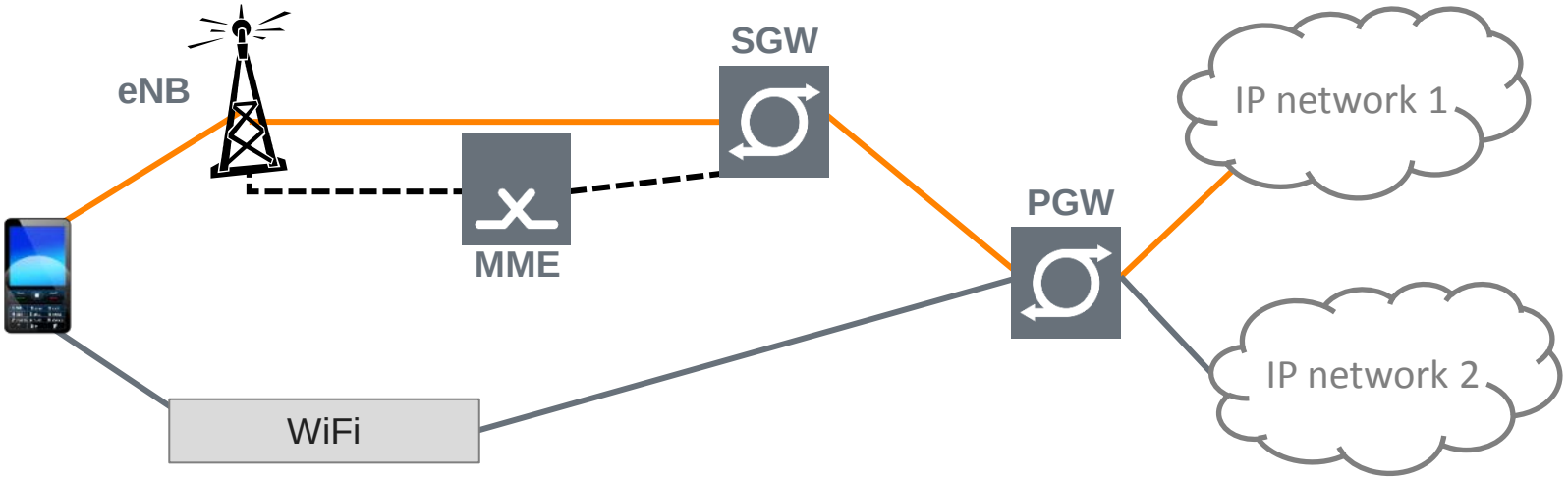
WiFi offload: Non-seamless offload

- Already used today, but ANDSF allows operator to decide what traffic to offload
- Offloaded traffic becomes normal IP traffic via WiFi
- Access network change means change in the IP address → non-seamless



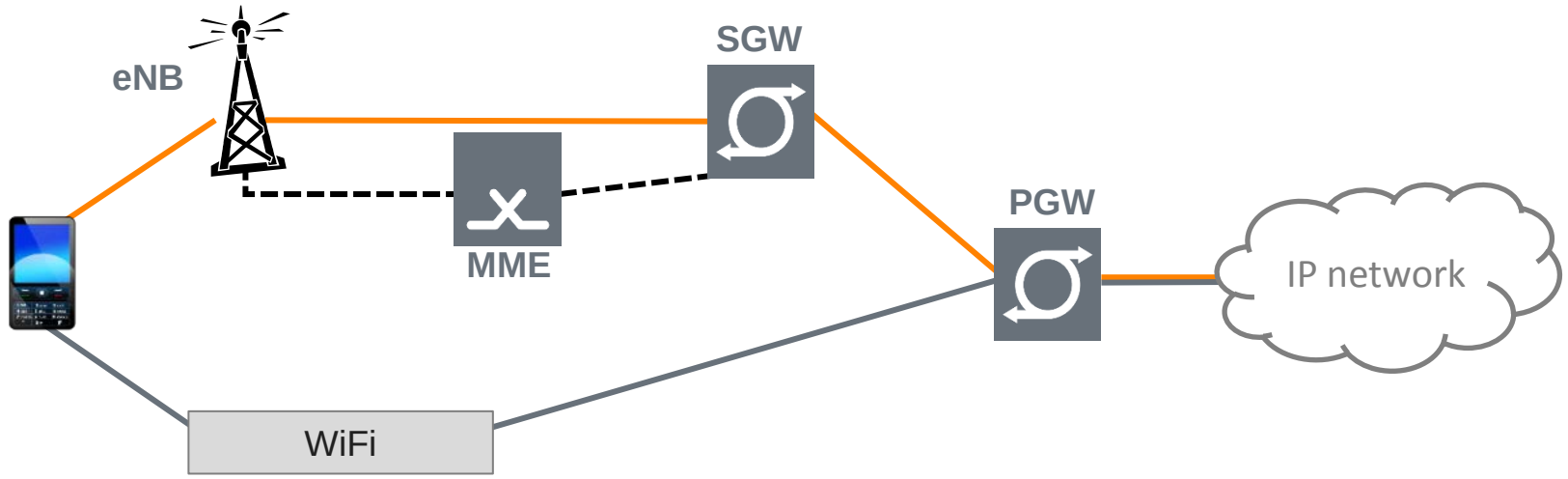
WiFi offload: PDN Connection level mobility

- PDN connections can be moved between different access networks individually
- PDN GW is anchor point, so IP address is preserved
- ANDSF may be used to provide access network selection policies for a specific APN



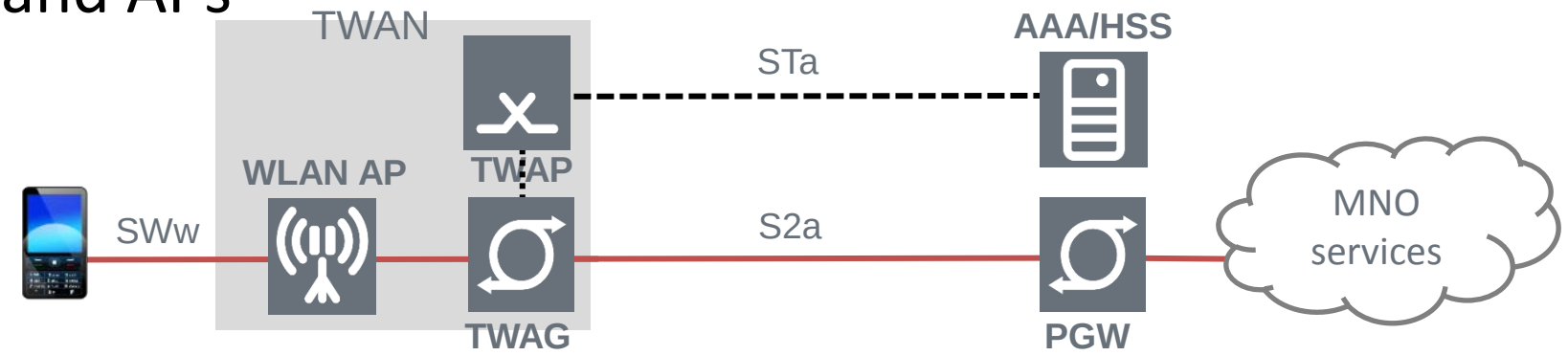
WiFi offload: IP-flow level mobility

- Single PDN connection but two simultaneous paths: one over a WiFi and another one over a 3GPP access
- IP Flows within a PDN connection can be moved between access networks at any time
- ANDSF used to guide UE's routing decisions per flow



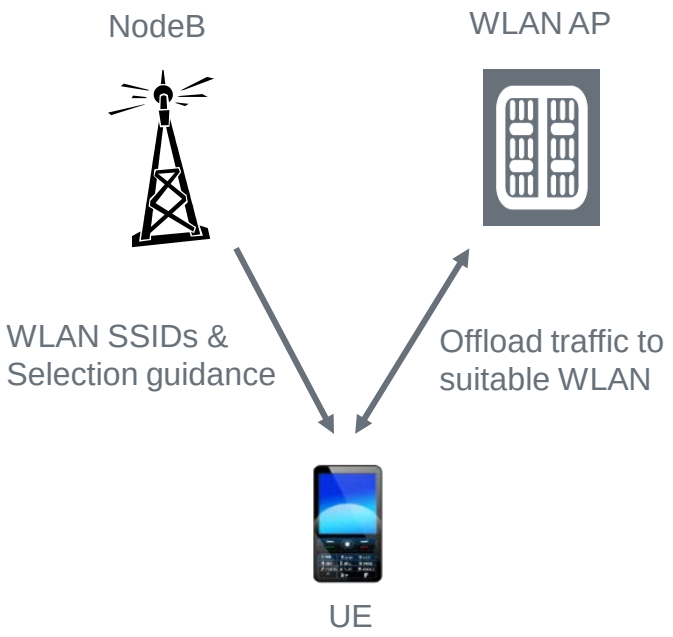
Tighter WiFi integration: Trusted access

- PDN connection to PDN GW created based on WiFi access authentication subscriber data
  - Done in a seamless manner, i.e. transparent to the UE
- Seamless mobility with 3GPP access and multiple connections are supported
- ANDSF policies used to select between WLAN NWs and APs



Tighter WiFi integration: WLAN - 3GPP Radio interworking

- RAN provides to UE:
  - Parameters about offloading priority (e.g. based on RAN load)
  - WLAN selection information
- Enhance ANDSF rules with RAN parameters
- Allows UE to decide when to go to WLAN and when to come back if QoS is poor



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Technologies to address new market segments

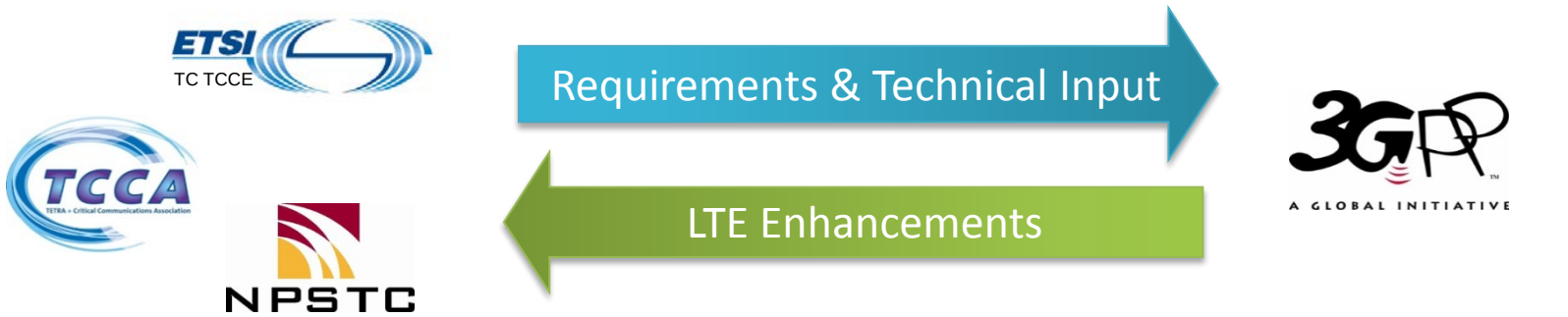
Machine-type communications

- 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
- Radio-level optimisations to enable implementation of low-cost LTE M2M devices
- Work moving towards generic solutions due to divergence of M2M traffic patterns
  - UE power consumption optimisation
  - Optimisation for small data transmission

Public Safety

- LTE chosen as next-generation nationwide public safety broadband network in the USA beyond the current P.25 system
- TCCA/TETRA community also settled on LTE as the next step beyond the current TETRA system

→ Opportunity to unify global public safety footprint



Public safety features

System Features

Proximity-based Services (ProSe)

Group Communication System Enablers for LTE (GCSE_LTE)

Radio Layer Features

Frequency band support

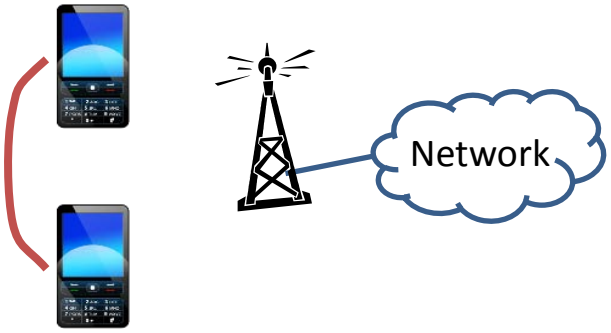
Power level support

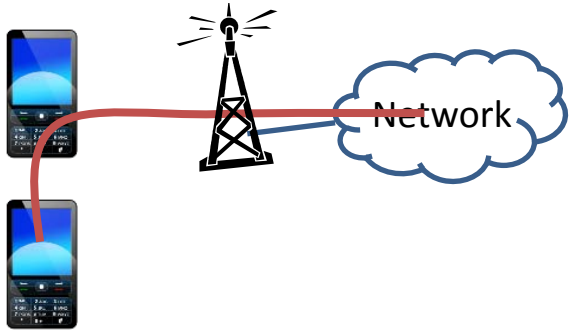
Radio enablers for system features

Proximity-based Services

- Enable devices in proximity to communicate directly
  - Reduce network load
  - Increase capacity in given bandwidth
  - Enable communication without network coverage
  - Relay communications at edge of network coverage

Direct Communication

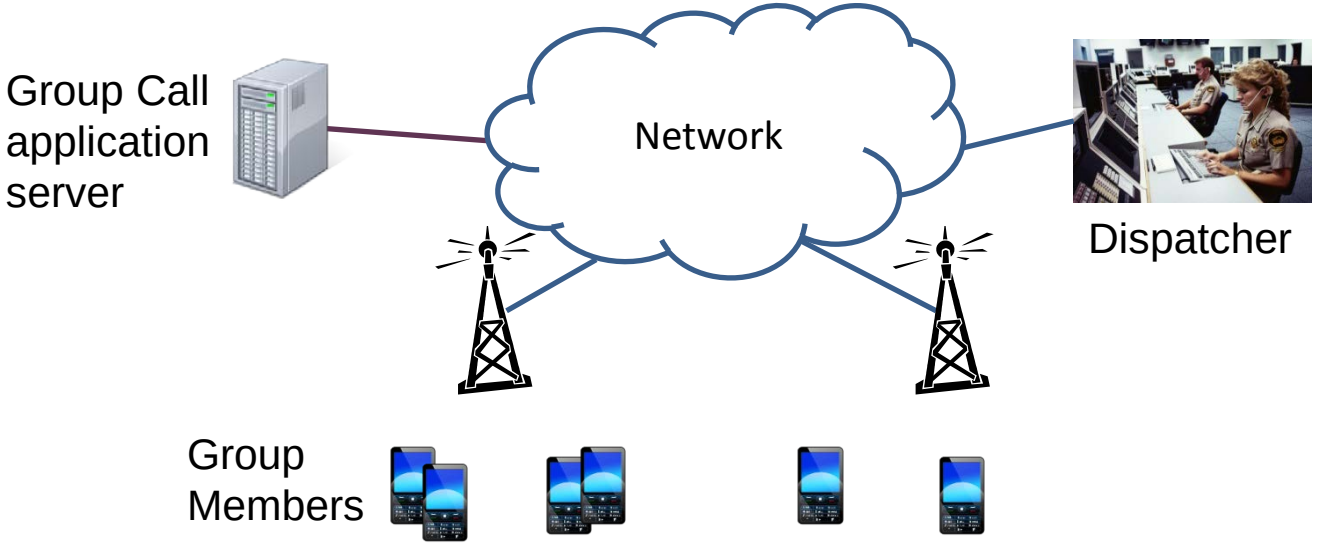




User Equipment to Network Relay

Group communication enablers

- Enable efficient group communication
  - Dynamic groups with mobile users and dispatchers
  - Support for large groups (perhaps up to 5000)
  - Service continuity for transitions between unicast and multicast bearers



Overview of Radio developments

Technologies to improve network capacity and cell-edge performance

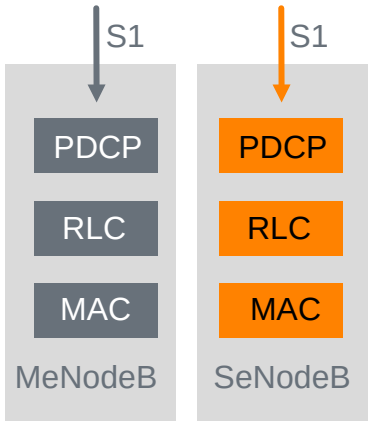
Small Cell enhancements

- Drivers
  - cost effective dense small cell deployments
  - improved mobility management in dense small cell deployments
- Key Release 12 features
  - Dual connectivity
  - small cell on/off
  - 256QAM

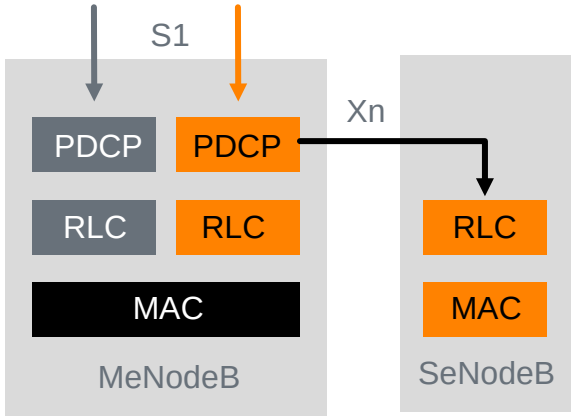
Dual Connectivity

Small Cells: User Plane

- Dual connectivity architecture options:
  - 1A: Small cell connected to core network via S1, bearer split option
  - 3C: Small cell connected to macro eNodeB via Xn-interface
    - PDCP layer located in macro eNodeB -> security handled by macro eNodeB



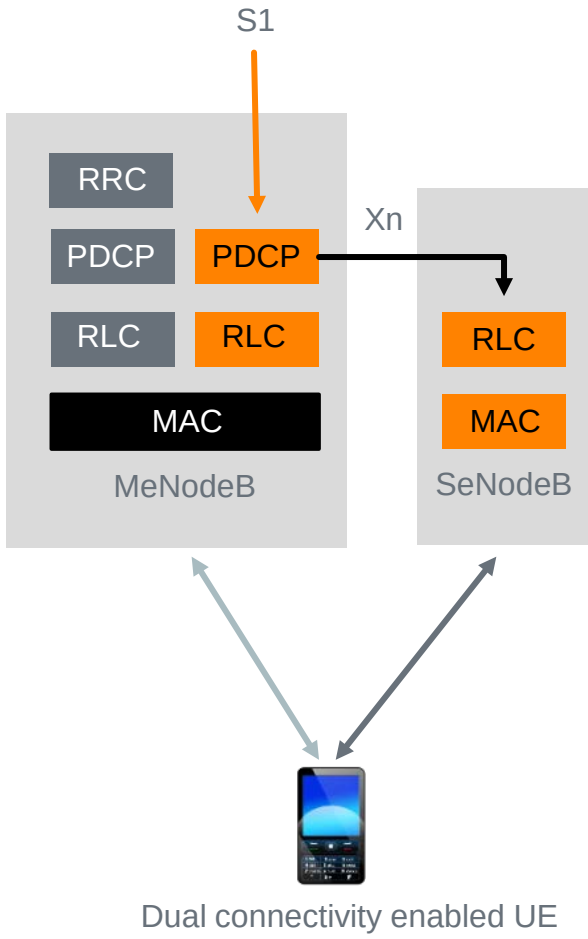
Alternative1A



Alternative 3C

Small Cells: Control Plane

- Dual connectivity:
  - RRC signaling is always in the macro eNodeB
  - Ensures connection reliability even if connection to small eNodeB is lost
  - Small eNodeB does not send own RRC messages to the UE



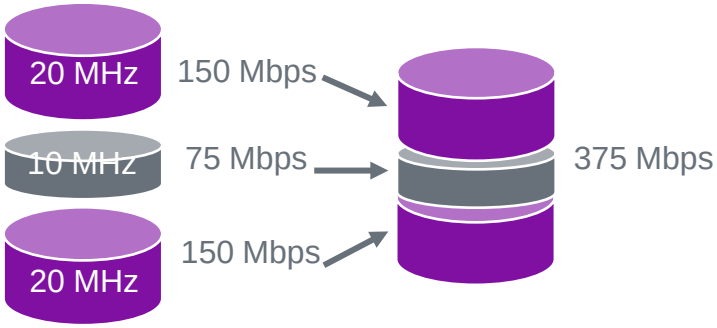
Multi-antenna technology: 3D beamforming

- 3GPP finalising enabler for 3D channel model
- Allows evaluation of features such as:
  - UE-specific elevation beamforming
  - vertical sectorisation
  - full-dimension MIMO with large number of antennas

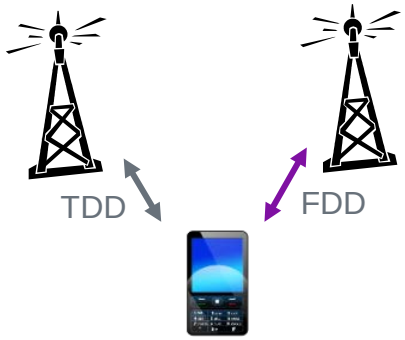
Technologies to make more spectrum available at the terminal

LTE Carrier Aggregation

Higher peak data rate



FDD/TDD Aggregation



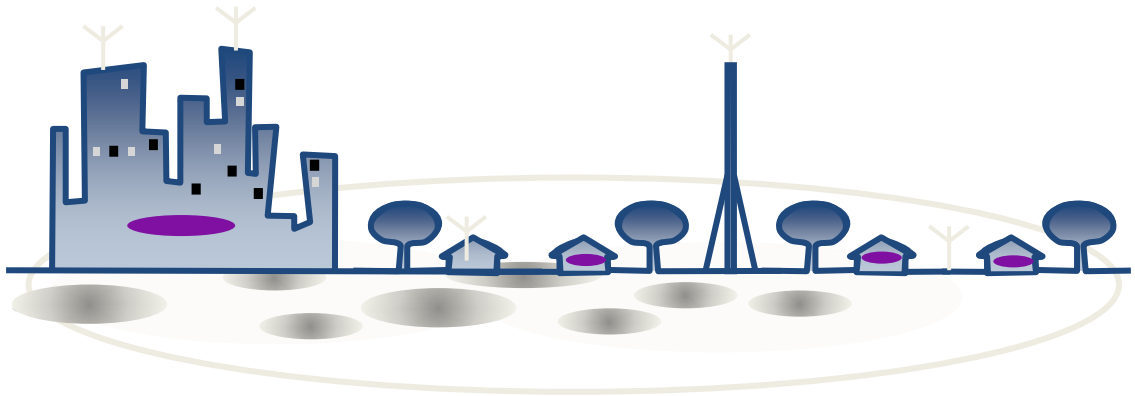
- Higher peak data rates
- Mitigates challenge of fragmented spectrum
- Release 12 defines up to 3-carrier downlink band combinations
- Aggregation between FDD and TDD bands
- With 3 carriers, the maximum amount of spectrum to be aggregated is 60 MHz

MTC low-cost and long-range

- Aim to reduce modem cost and improve range for low data rate, delay tolerant usage
- Low cost enablers
  - New low data rate UE category (~1Mbps max throughput)
  - 1 RX antenna operation
  - Narrowband data channel operation
  - Half-duplex operation
- Coverage enhancements
  - Receiver, repetition and bundling techniques to extend coverage of control and data channel

LTE-Unlicensed (LTE-U)

- Outdoor and indoor public small cells
- Focus on public /corporate environment
- Focus on 5.8 GHz band: widely available globally
- Home solution to rely on WiFi -> LTE-U intended always to be used together with licensed band operation



Acknowledgements

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- Atle Monrad, 3GPP TSG CT Chair

Thank You !

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More Information about 3GPP:

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