July 16, 2014



# 3GPP system standards heading into the 5G era

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*An article for the Eurescom message, by Balazs Bertenyi, 3GPP TSG SA Chairman*

**3GPP standards have played a pivotal role in the success of LTE, making it the fastest growing cellular technology in history. Never before has a new radio technology made it to the market so quickly and widely after the finalization of the first version of the standards (3GPP Release 8 was finalized in December 2008).**

For the first time in history LTE has brought the entire mobile industry to a single technology footprint resulting in

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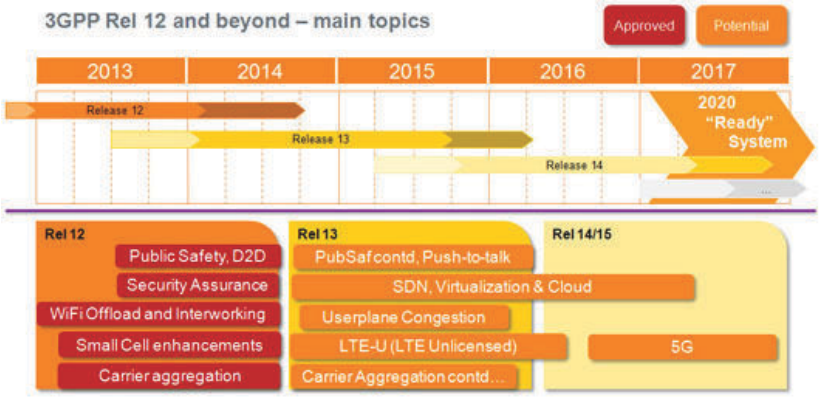
unprecedented economies of scale. After the initial LTE Release, work in 3GPP has been centered on the following strategic areas:

1. Enhancing LTE radio standards to further improve capacity and performance;
2. Enhancing system standards to make LTE and EPC available to new business segments;
3. Introducing improvements for system robustness, especially for handing exponential smart phone traffic growth.

This article focuses on the latter two aspects, and outlines the potential standards path towards the 5G era.

Here is a snapshot of the main features and their timelines 3GPP has been working on:




## Addressing new business segments

The converged footprint of LTE has made it an attractive technology baseline for several segments that had traditionally operated outside the commercial cellular domain.

In particular, the critical communication and public safety community has turned to LTE for developing their next generation broadband data system. 3GPP has embraced this initiative and committed to deliver the necessary standards enhancements to make the LTE/EPC system suitable for this purpose. Work has started in Release-12, and standards for the first batch of features will be completed by December this year.

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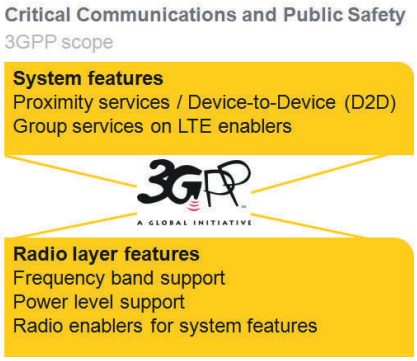
These features include enhancements for direct device to device (D2D) communications as well as group communication services, both of which are essential to achieve TETRA/P.25-like functionality for broadband data.




- D2D allows devices in close proximity to communicate directly with each other, thereby enabling authorities to communicate out-of-network-coverage or during network outages (e.g. in case of a natural disaster). There are also commercial benefits of D2D, with new applications building on the physical proximity of users being trialed by operators.
- Group communications allow authorities to create and dissolve groups on demand with resource efficient communications (e.g. multicast) within the group.

Work on further functions for critical communications will continue in Release 13, for example, in the area of enabling relays (relaying between in-coverage and out-of-coverage devices) and push-to-talk type functionality.

Machine-type Communications (e.g. smart meters) have been using the cellular networks for some time now, primarily over GSM and GPRS. Whilst 2G technologies provide cheap means for basic connectivity and data rate, there is growing demand for a more versatile M2M platform. The challenge in the industry (and in 3GPP standards) is the lack of convergence across the M2M providers with respect to traffic patterns and system needs. Hence, a holistic approach to an LTE-based M2M architecture design has not (yet) materialized. This has led to 3GPP standards work being focused on several different, smaller, enablers so far:

- Radio optimizations to allow for lower cost LTE chipsets;
- System level awareness of M2M devices, i.e. the system can identify such devices and apply selective handling as per operator configuration (e.g. selective disabling in case of overload);
- Device power consumption optimizations;
- Mechanisms for optimized handling of small amounts of data.

## System capacity and robustness

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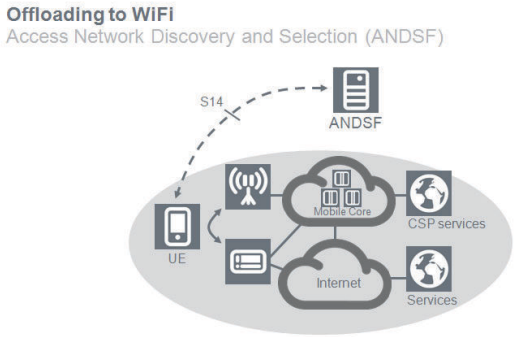
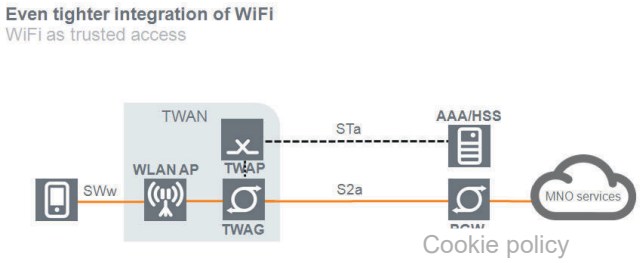
The exponential growth of smartphones and the traffic they generate have become a major challenge of the industry. Network investments are not able to keep pace with the growing data demand. A big portion of the work 3GPP has been undertaking, in recent years, was driven by alleviating this challenge.

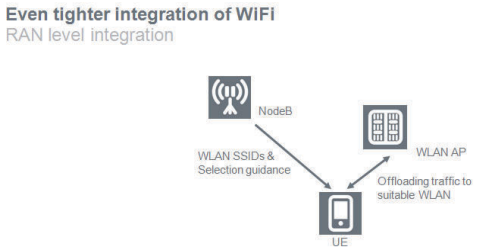
One key element to decrease data load of cellular networks is to *offload traffic to WiFi*, especially bulk traffic that does not require any special handling for service delivery or charging. The 3GPP-standard mechanism for this is built around a new functional element, the Access Network Discovery and Selection Function (ANDSF). The ANDSF conveys policies to the devices facilitating selection of either cellular or WiFi access for different kinds of traffic (e.g. based on IP flow designation):




Release-12 is enabling seamless mobility between WiFi and cellular accesses with multiple connections, see figure below (cf 3GPP TS 23.402):



Release-12 will also develop an even tighter integration of cellular and WiFi access through having the LTE RAN convey parameters and rules for offloading:




All in all, as traffic growth continues operators will need more and more innovative functionality in their network to cope with it. Unlicensed spectrum (via WiFi or with other technologies) will continue to play an important role in this quest.

Security certification of network elements is becoming an increasingly important issue in many regions. To ease deployments and avoid fragmentation it is critical for operators, and vendors alike, that certification of network products is harmonized as much as possible. To this end 3GPP initiated a new endeavor together with GSMA to converge security assurance of network elements around a single methodology. Release-12 specifications outline a method whereby 3GPP generates Security Assurance Specifications (SAS) for each functional element. GSMA takes responsibility for accreditation using the SAS documents, and also manages potential dispute processes.

## Moving towards the 5G era

The term ‘5G’ is rapidly coming into the limelight. Much of this early hype phenomenon is directly attributable to the (well-founded) bandwidth-thirst of the industry. Examining the potential technology trends behind this hype one can find the following likely pillars going forward:

**Extensive capacity need in dense areas;**

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LTE already has a Small Cell concept defined ... Release 12, that is optimized as much as technologically possible for the current bands. A potential enhancement being discussed for Release 13 is to make LTE suitable for unlicensed spectrum bands. Whilst the exact nature and focus of this work is still under discussion, it is clear that such an enhancement would provide further means to deal with the traffic load.
To further boost the capacity of dense areas it is expected that new licensed spectrum bands (in particular in higher frequency bands up to ~1 GHz carrier bandwidth) will also be needed. Initial research shows that such high frequency bands might require a new radio waveform, a new radio technology. It is yet unclear when/whether/where the standardization of such a new radio will be undertaken. Nonetheless, the earliest such work is expected to be potentially initiated in 3GPP is around the 2015-2016 timeframe.

**Ubiquitous coverage;**

For the currently available bands LTE is very close to reaching the technologically possible efficiency limits. Hence, it is expected that LTE will remain as the baseline technology for wide area broadband coverage also in the 5G era. 3GPP will continue working on enhancing LTE not only from the radio perspective, but also from service delivery perspective (e.g. making it more suitable for M2M). Consequently, interworking with LTE will remain to be a critical factor.

**Ever increasing cost pressure;**

Traditional telecommunications equipment has tied hardware and software close together. Advancements in hardware technology, as well as success of virtualization in the IT industry have brought the notion of virtualization into the mobile network space. Separation of user plane and control plane have long since been a key design element of mobile networks, making most of the mobile network architecture an ideal candidate for virtualized deployments. Industry activities and inception of specialized industry interest groups (e.g. ETSI NFV) all point towards the feasibility of this approach bringing the following main benefits:

- Enhancing the level of automation
- Decoupling software functions from the resources
- Allowing faster service introduction
- Providing service and network performance analysis and optimization

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3GPP standards work on virtualization is about to be started, ... Release 12. Initial focus will be turned towards O&M aspects, work on core network and radio architecture is expected to follow later.

History has shown that the mobile industry undergoes a major technology shift roughly once every 10 years. There are vast arrays of technology developments on the horizon and that demand for these is greater than ever. The global footprint, and the success, of 3GPP standards will continue to put pressure on the Project to get new specifications out in a timely manner. To achieve this, intensified industry collaboration becomes more important than ever before. As we add 5G discussions to the mix, we will have plenty to keep us busy in 3GPP for the foreseeable future.

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Source: The Spring 2014 edition of the Eurescom message.
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