



A short introduction to 5G and the BT/EE mobile network

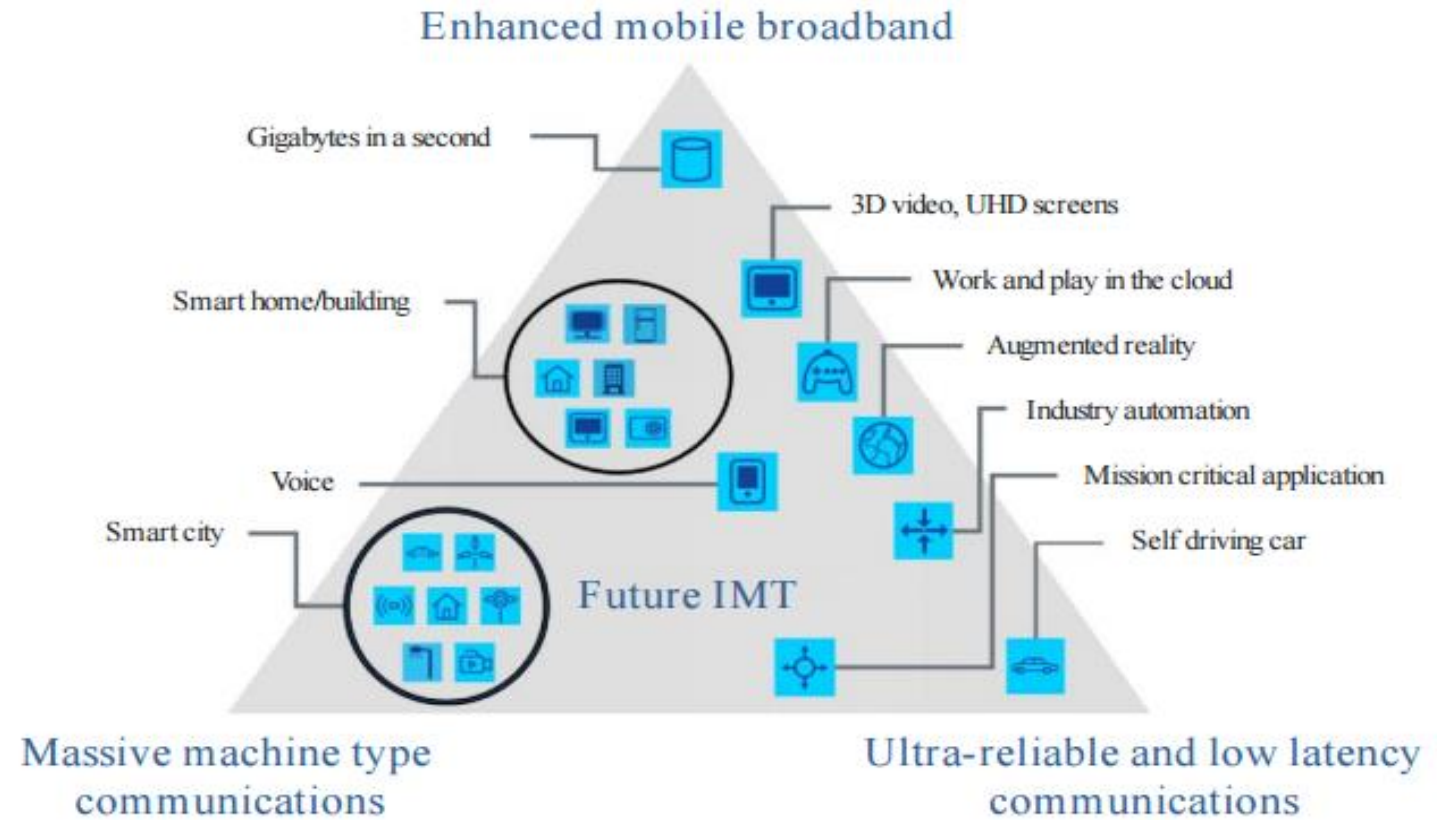
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October 2020

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- Usage scenarios of IMT for 2020 and beyond
- Some key 5G specifications and use cases
- EN-DC mode of operation - NSA
- BT/EE 5G network architecture
- 5G network architecture with NGC - SA
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Usage scenarios of IMT for 2020 and beyond



M.2083-02

Source: https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-!!!PDF-E.pdf

5G performance targets and use cases

The minimum requirements for eMBB peak data rate are as follows:

- Downlink peak data rate is 20Gbps
- Uplink peak data rate is 10Gbps

The target values for the user experienced data rate are as follows in the Dense Urban - eMBB test environment:

- Downlink user experienced data rate is 100Mbps
- Uplink user experienced data rate is 50Mbps

The minimum requirements for 1-way user plane latency over the radio interface are:

- 4 ms for eMBB
- 1 ms for URLLC (3GPP target = 0.5ms)

The minimum requirement for mMTC connection density is 1,000,000 devices per km²

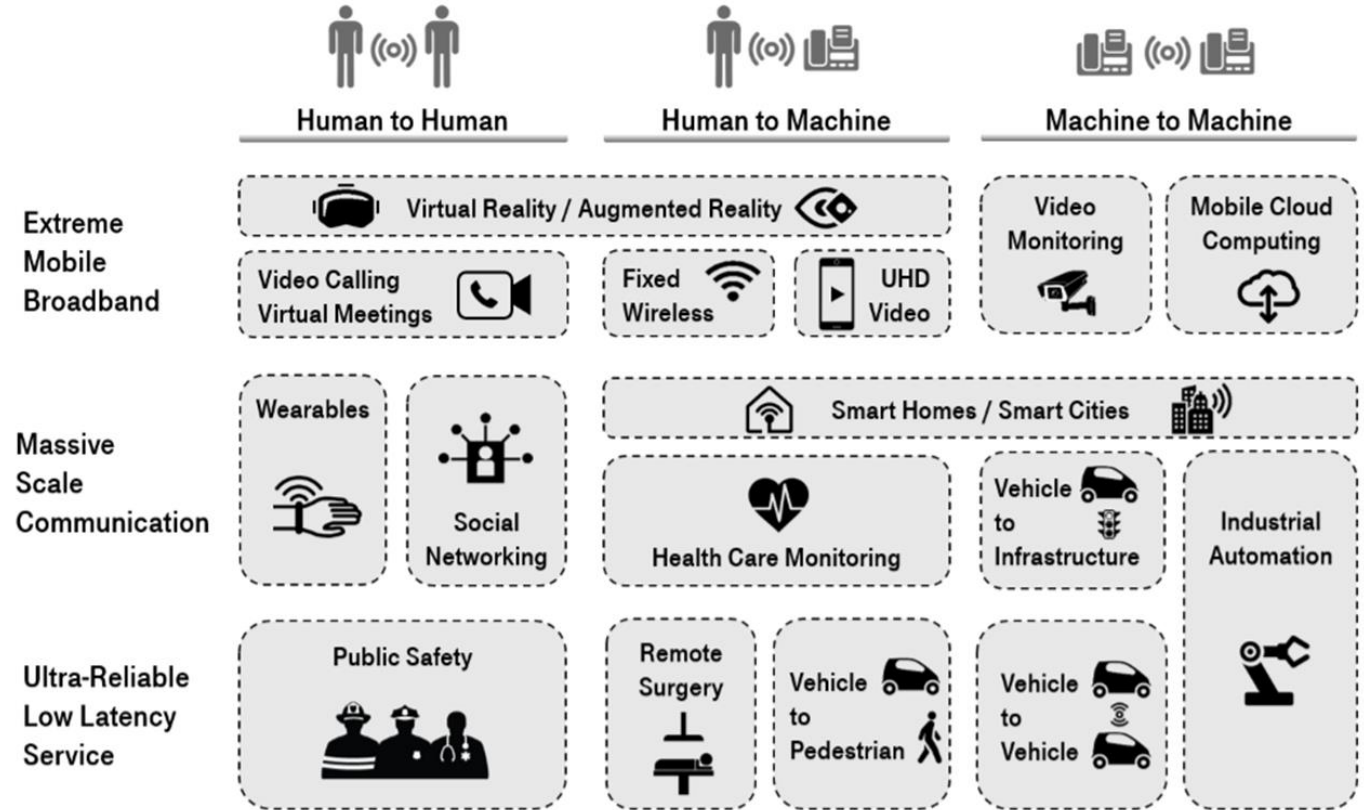
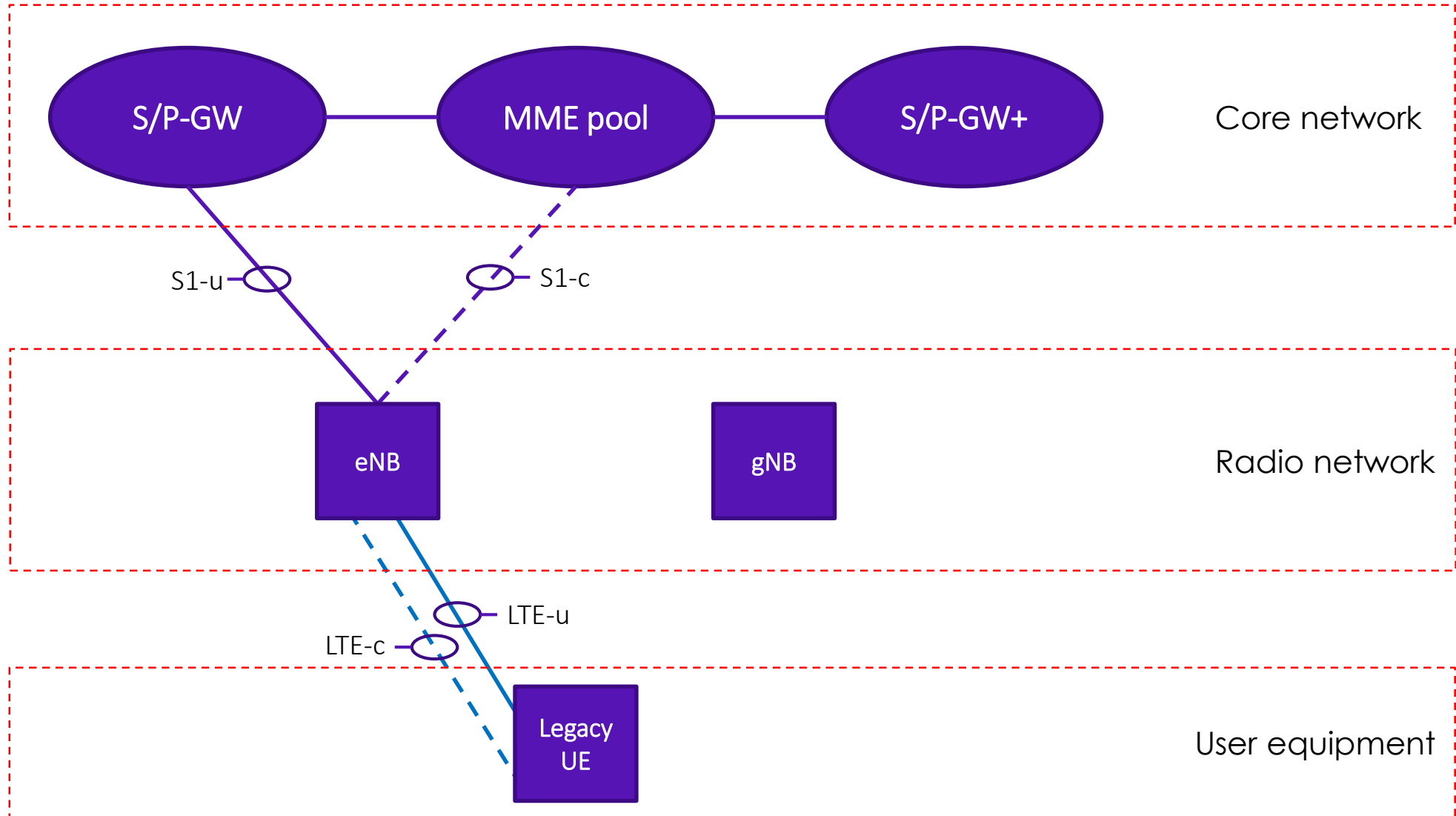


Diagram source: http://www.5gamericas.org/files/3215/1190/8811/5G_Services_and_Use_Cases.pdf

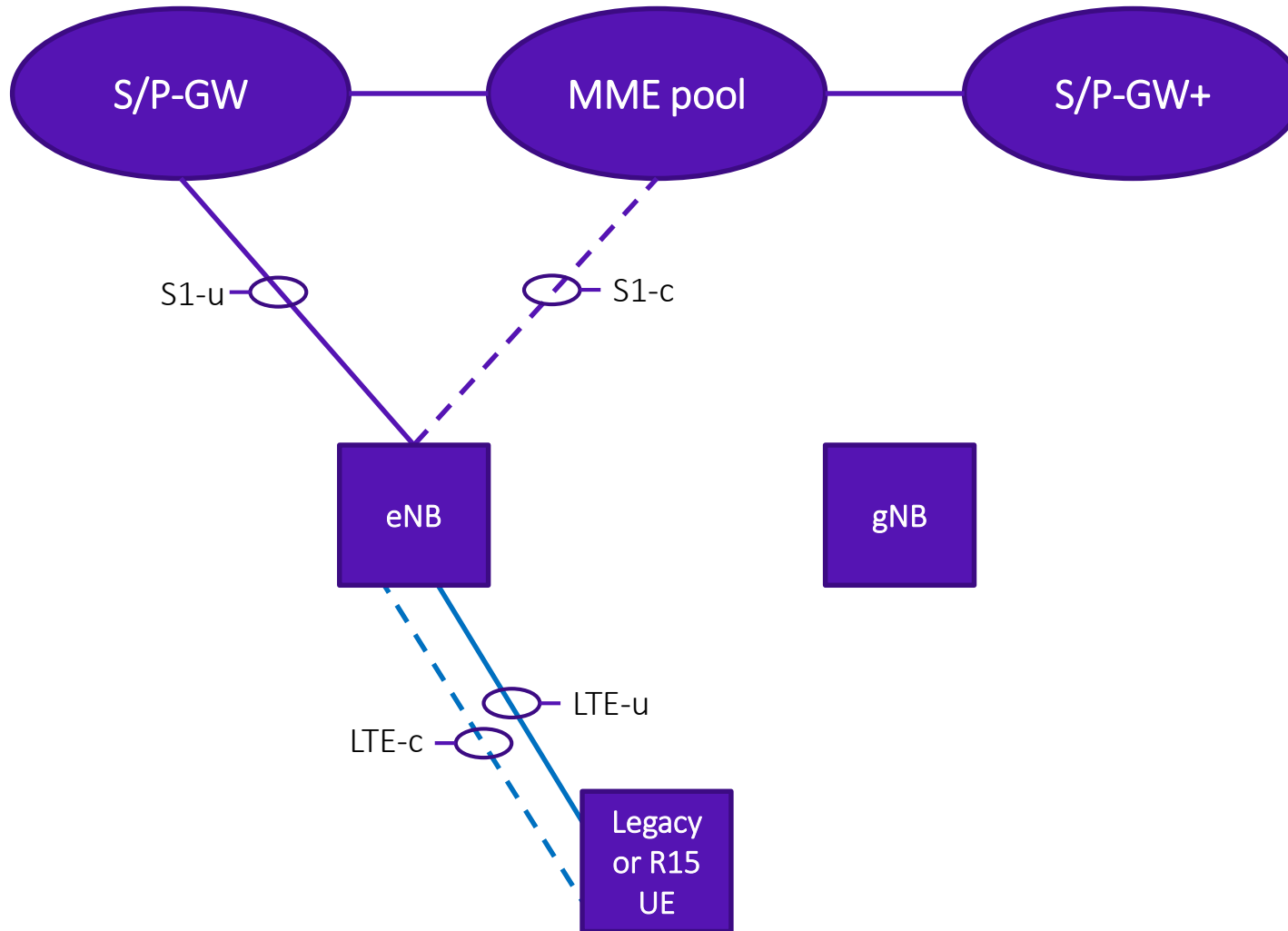
EN-DC network architecture supporting legacy terminals

Non-Standalone Architecture (NSA)



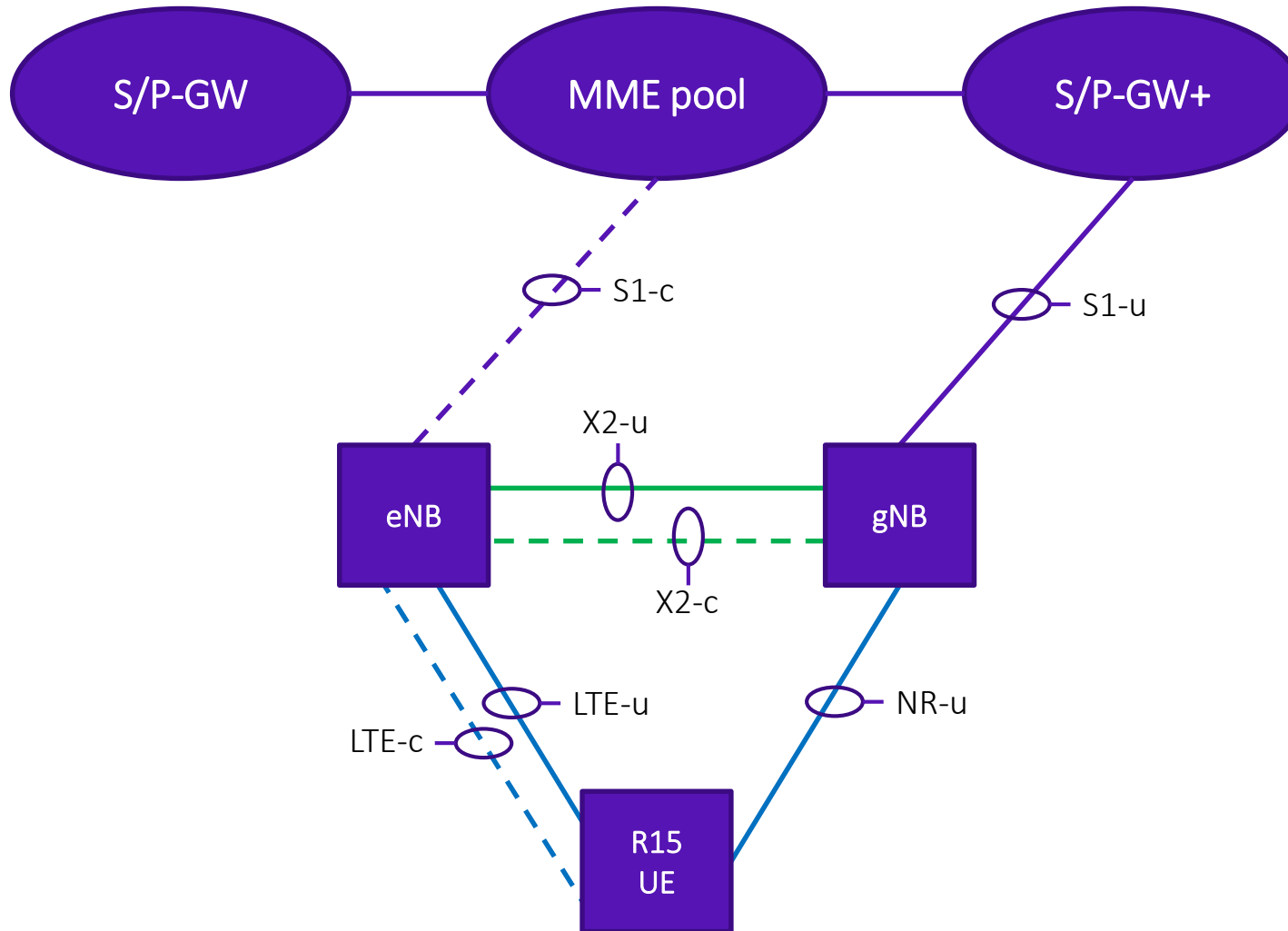
EN-DC network architecture supporting VoLTE

Non-Standalone Architecture (NSA)



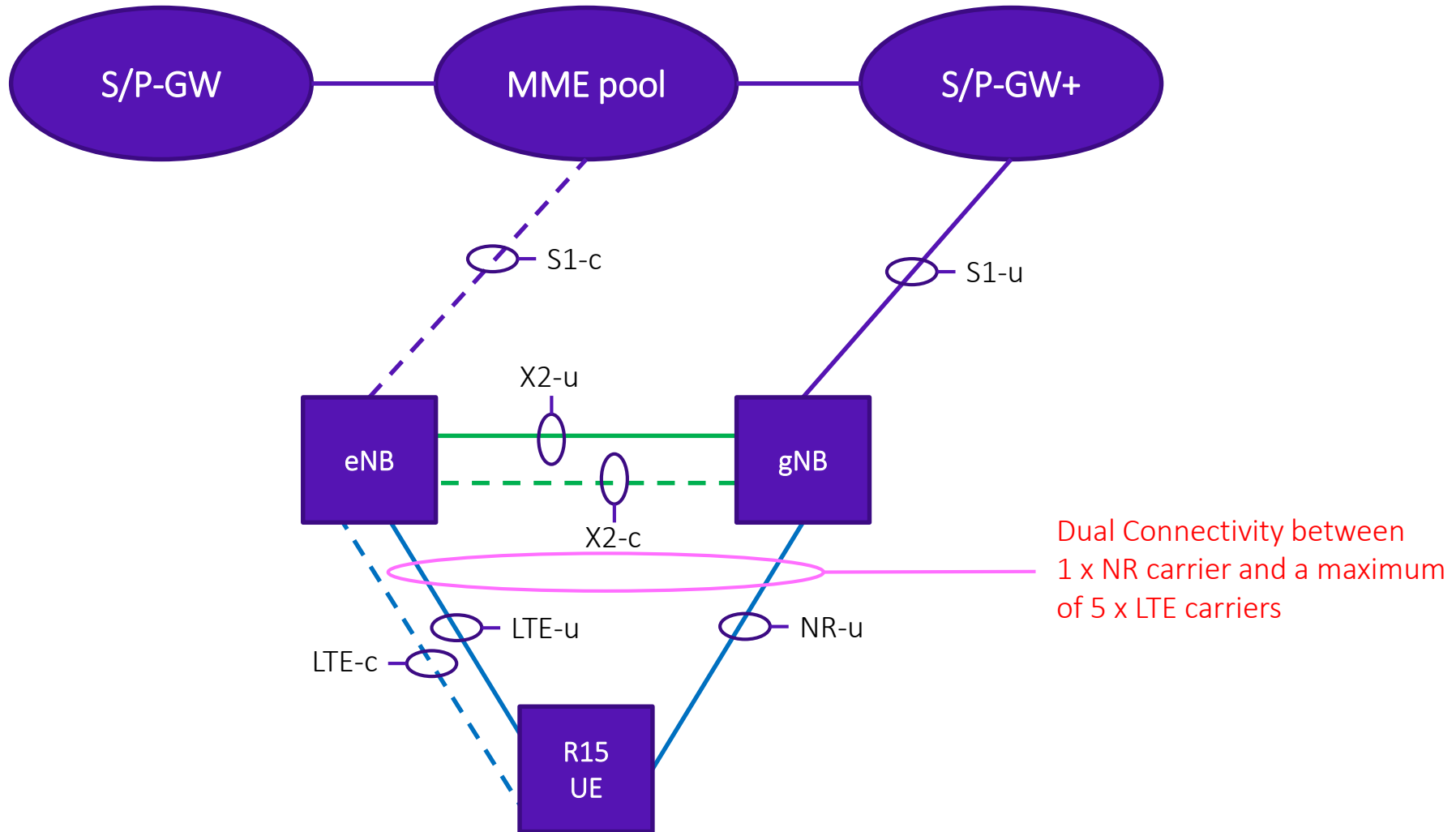
EN-DC network architecture supporting user data session

Non-Standalone Architecture (NSA)



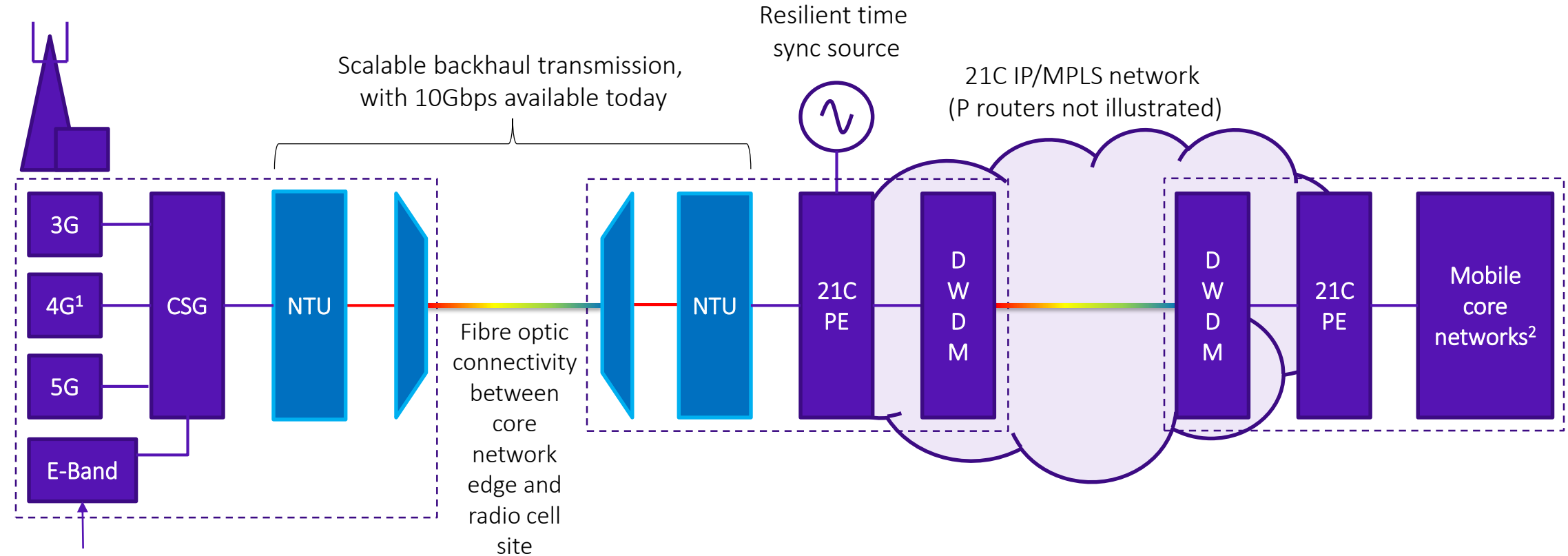
EN-DC network architecture supporting user data session

Non-Standalone Architecture (NSA)



5G within a multi-RAT network deployment

Mobile backhaul (transmission)



E-band millimetre wave radio system
- To sub-tended cell site

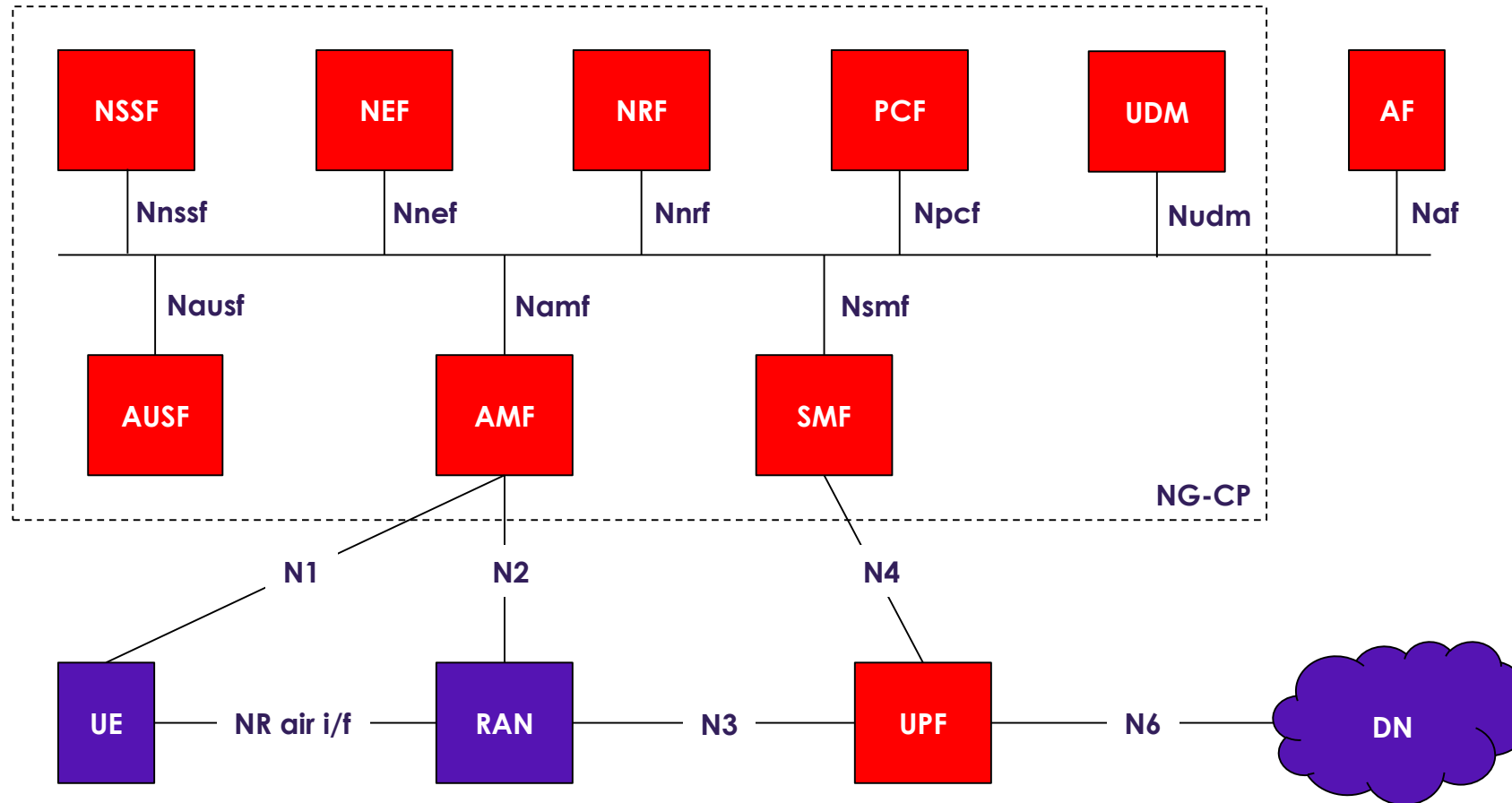
¹ - 2G is supported on the same base station as 4G (SRAN/Multi-RAT)

² - Includes BSC for 2G, RNC for 3G and IP Sec GW for 2G, 4G and 5G

3GPP 5G Service Based Architecture

Standalone Architecture (SA)

Next Generation Core network illustrated in red boxes
NGC during 2022 at geographically distributed
locations to enable lower latency services



Further reading:
https://www.academia.edu/36284890/5G_Network_Architecture (2017)



EE 5G - launched on 30th May 2019



DESIGN AND DEPLOYMENT OF THE EE 5G NETWORK

BT's mobile network EE launched the UK's first 5G mobile network on the 30 May 2019. 5G is very different to previous generations in terms of ambition and technical implementation; the first iteration of 5G relies on the existing 4G Long Term Evolution (LTE) network. Previous generations of mobile technologies have been stand-alone deployments, albeit since 2G, there has been mobility between the different generations of mobile networks. This reliance on 4G LTE results in a mode of operation known as EN-DC (Evolved UTRA (Universal Terrestrial Radio Access) New Radio - Dual Connectivity), we'll explore this later in this article. The ambition of 5G is to ultimately deliver a single mobile network technology which can support a broad range of use cases; from enhanced Mobile Broadband (eMBB) to Ultra Reliable and Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC), an evolution of the Internet of Things (IoT).

ANDY SUTTON
The future of wireless connectivity



Figure 1: EE 5G network rollout during 2019

Early rollout plans

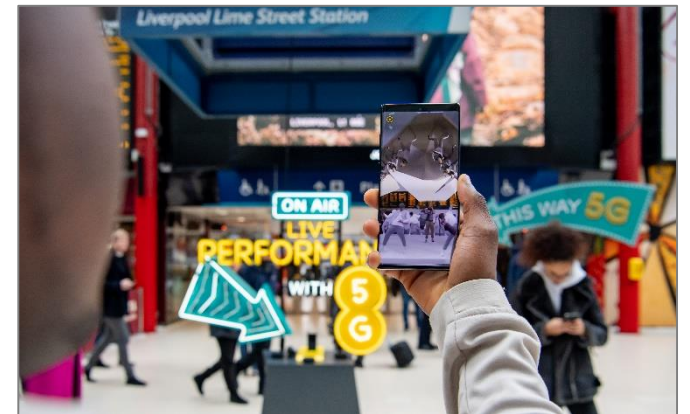
EE launched 5G in six cities; Belfast, Cardiff, Edinburgh, London, Birmingham and Manchester and has since rolled out service to a further ten cities, details in Figure 1. EE has focused first on the busiest parts of the busiest cities, a metric judged by data traffic; the first 1,500 cell sites

being upgraded to 5G only amount to approximately 8% of EE's national mobile network yet they carry 25% of its customers' data traffic. Upgrading these sites first will have the greatest impact on the highest number of customers, enhancing user experience despite significant data traffic growth. The growth



Summary

- 5G supports enhanced Mobile Broadband (eMBB) and Ultra Reliable and Low latency Communications (URLLC) along with massive Machine Type Communications (mMTC)
- 5G opens up new and exciting opportunities for industry verticals, including private/non-public networks - it's a lot more than just faster Internet to smartphones...
- 5G will be deployed across a wide range of frequency bands to address a variety of use cases and deployment scenarios
- Next Generation Core network will enable new services such as network slicing, low latency services and private/non-public network
- BT is working with academia, corporates, industry partners and international standardisation bodies to maximise the benefits of 5G for the UK...





Further reading:

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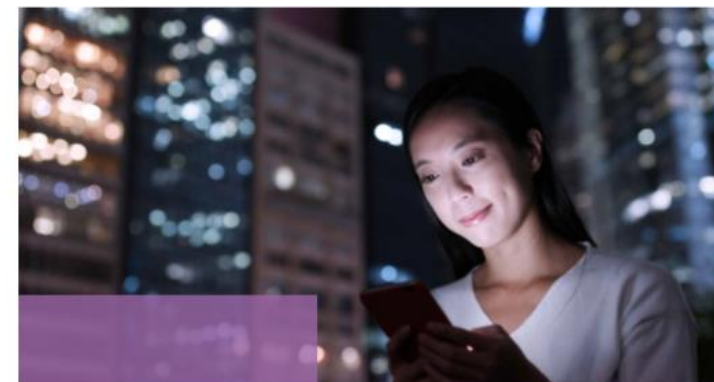
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Allaying health concerns regarding 5G and exposure to radio waves

An IET guide for policy makers and local planning authorities
2nd edition

theiet.org/5G-health