

# 5G - The Future of Communications

## An [@net mcr](#) evening talk

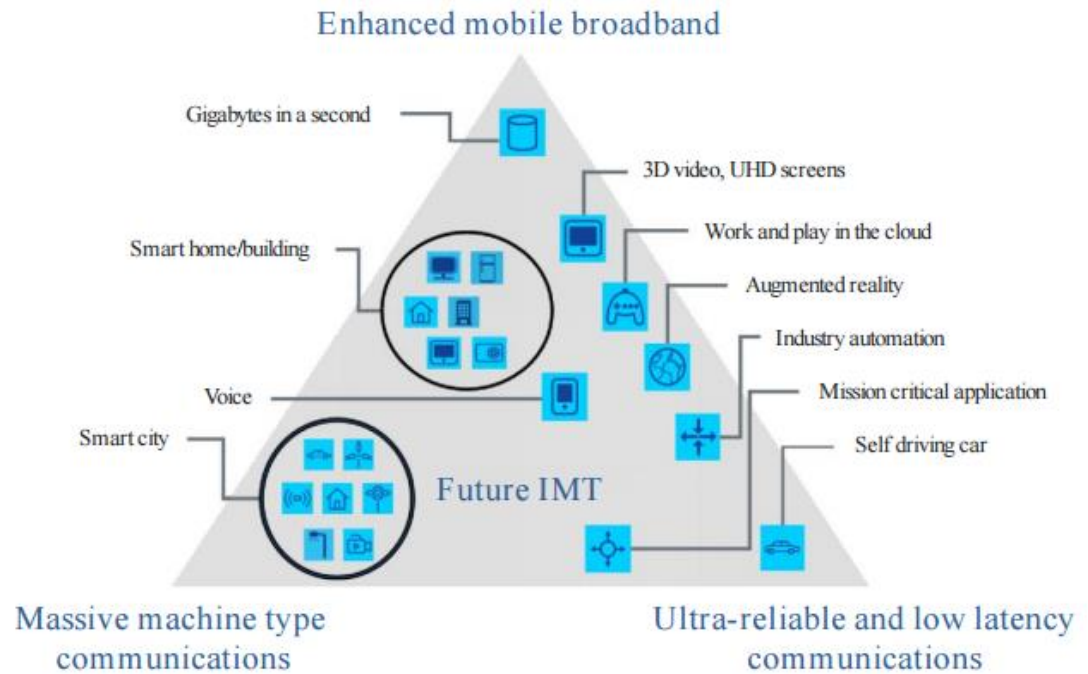
Andy Sutton  
14<sup>th</sup> April 2017

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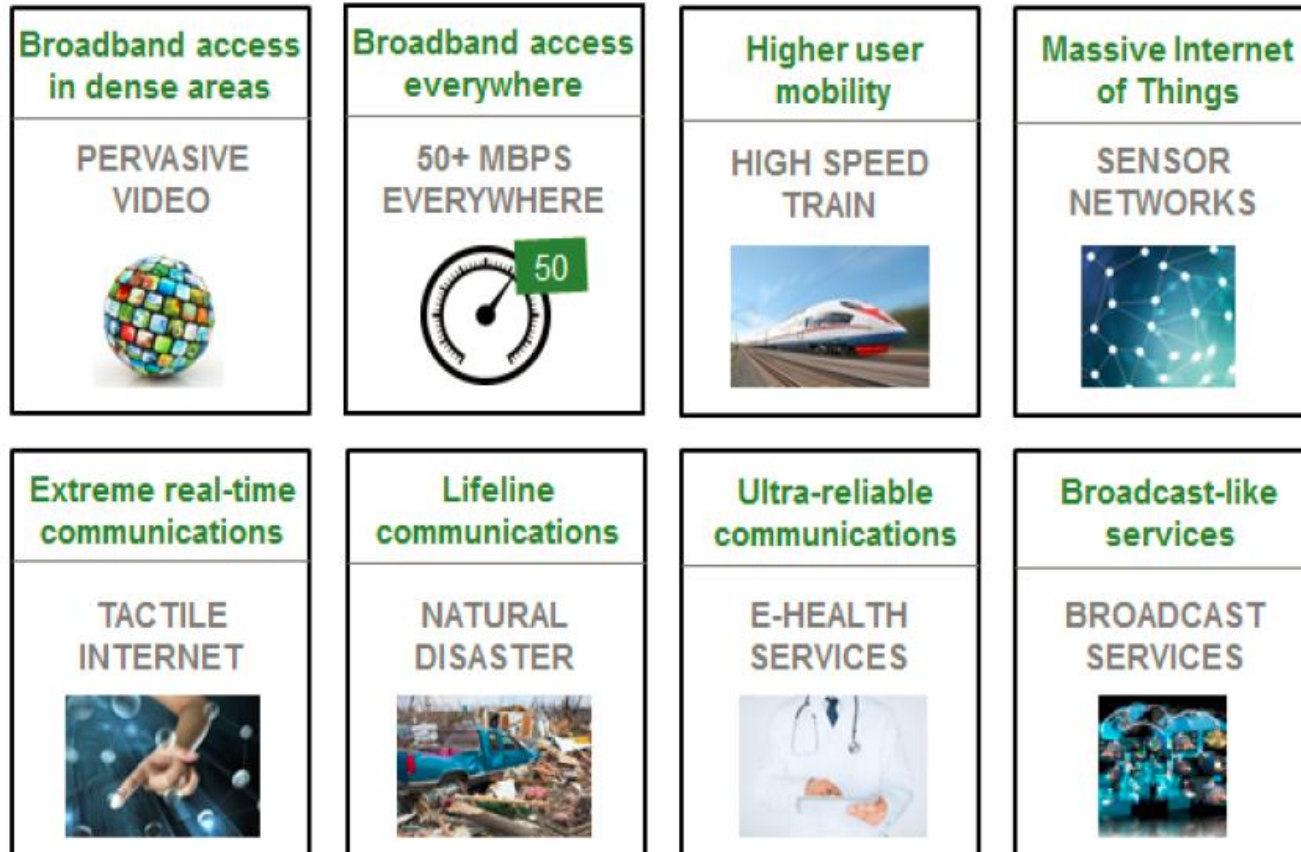
# Usage scenarios of IMT for 2020 and beyond



M.2083-02

Source: [https://www.itu.int/dms\\_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf)

# NGMN 5G use case families & related examples



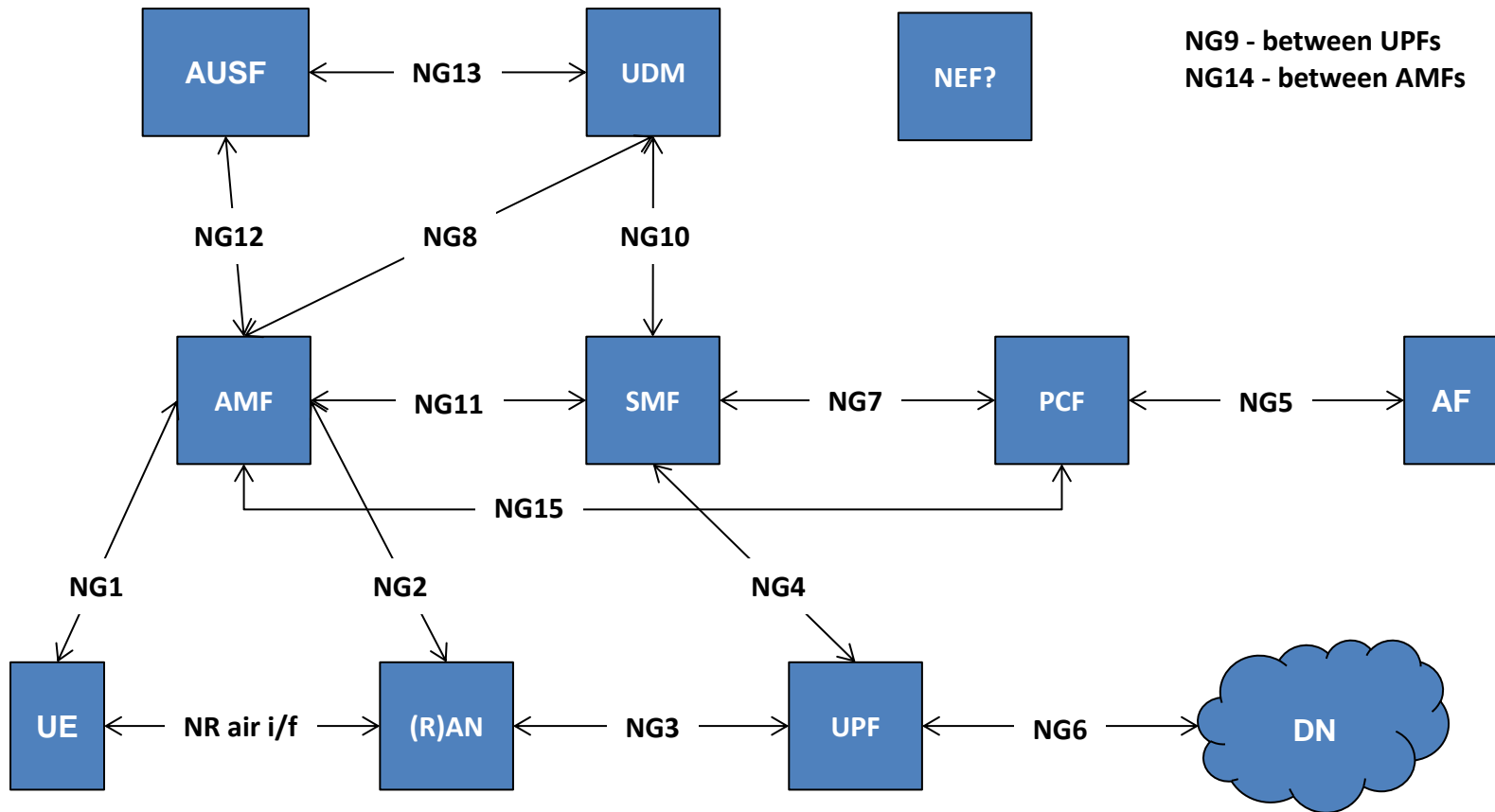
# Ofcom and RSPG (Radio Spectrum Policy Group) has identified three pioneer bands for 5G in Europe

## RSPG's pioneer bands:

- 700 MHz band – to provide a coverage layer
  - 2 x 30 MHz + 20 MHz centre gap – SDL – 2019/2020
- 3.4 – 3.8 GHz band – to provide a large amount of contiguous spectrum for high-data rate and low-latency services and a capacity solution in congested areas
  - 150 MHz in the 3.4 – 3.6 GHz band in 2017
- 26 GHz band – to provide “fibre-like” data rates and very low latencies at short distance, as a capacity solution in very congested hotspots
  - 24.25 – 27.5 GHz – date tbd, likely auction post WRC2019

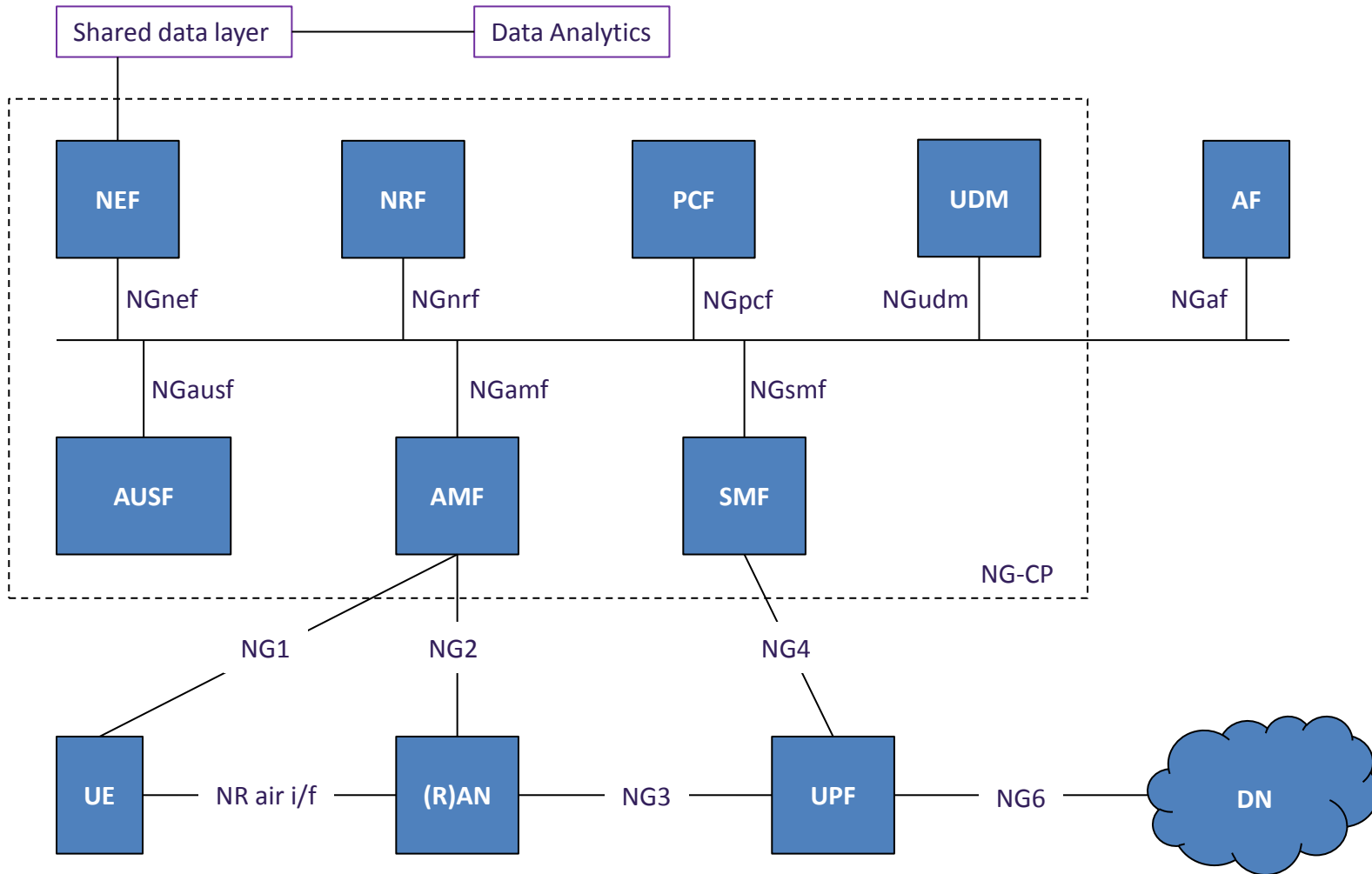
[Note: Existing bands could be refarmed and more bands are likely in the future...]

# 3GPP 5G network architecture



Note: Focus on mobile however Access Network (AN) could be fixed

# 3GPP 5G service based architecture



# Functional blocks within 5G network architecture

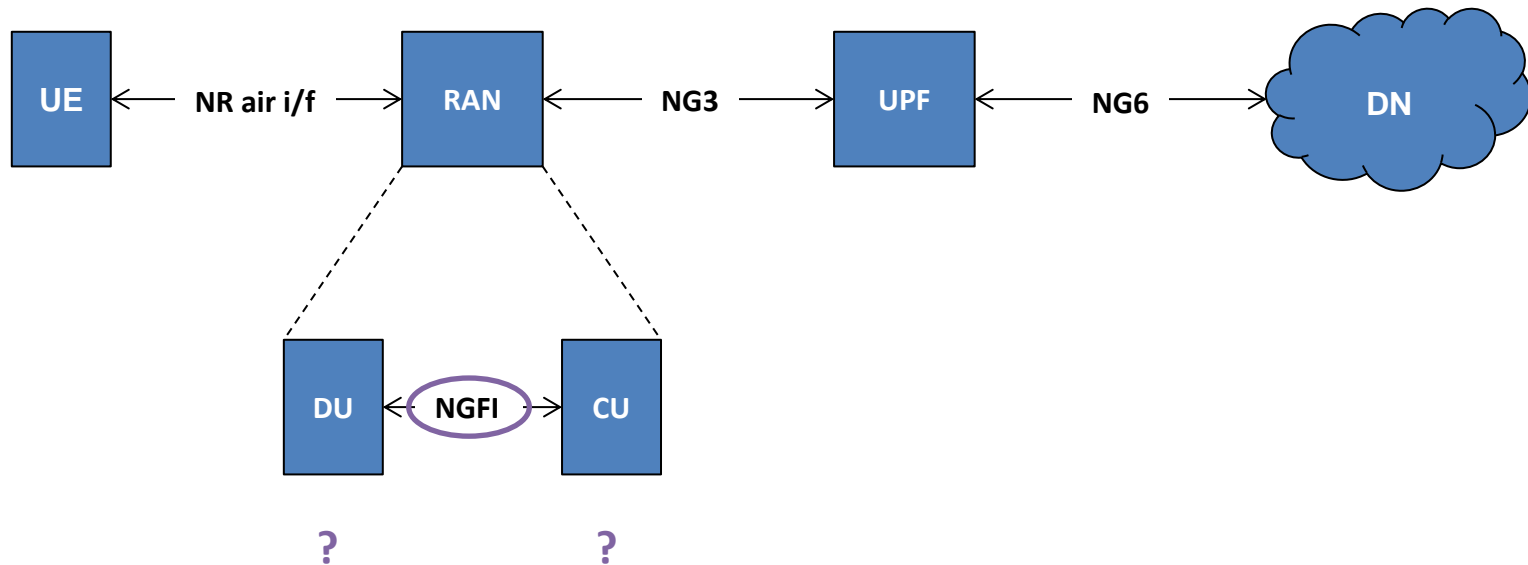
1. AUSF = Authentication Server Function
2. UDM = Unified Data Management
3. AMF = Core Access and Mobility Management Function
4. SMF = Session Management Function
5. PCF = Policy Control Function
6. AF = Application Function
7. UE = User Equipment
8. ((R)AN) = (Radio) Access Network
9. UPF = User Plane Function
10. DN = Data Network, e.g. operator services, Internet or 3rd party services



# 5G interfaces (reference points)

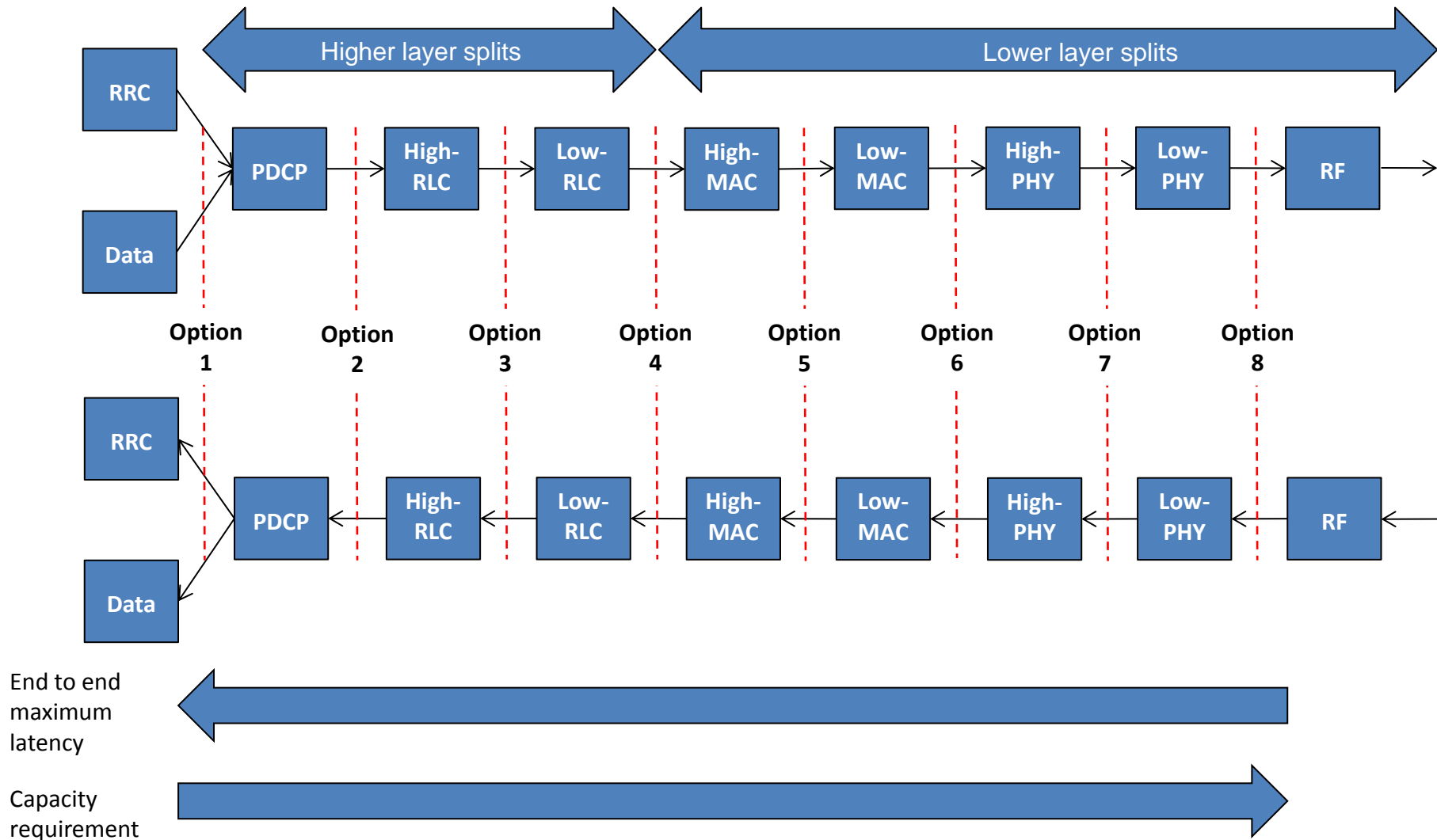
- NG1: Reference point between the UE and the Access and Mobility Management function.
- NG2: Reference point between the (R)AN and the Access and Mobility Management function.
- NG3: Reference point between the (R)AN and the User plane function (UPF).
- NG4: Reference point between the Session Management function (SMF) and the User plane function (UPF).
- NG5: Reference point between the Policy Function (PCF) and an Application Function (AF).
- NG6: Reference point between the UP function (UPF) and a Data Network (DN).
- NG7: Reference point between the Session Management function (SMF) and the Policy Control function (PCF).
- NG7r: Reference point between the vPCF and the hPCF.
- NG8: Reference point between Unified Data Management and AMF.
- NG9: Reference point between two Core User plane functions (UPFs).
- NG10: Reference point between UDM and SMF.
- NG11: Reference point between Access and Mobility Management function (AMF) and Session Management function (SMF).
- NG12: Reference point between Access and Mobility Management function (AMF) and Authentication Server function (AUSF).
- NG13: Reference point between UDM and Authentication Server function (AUSF).
- NG14: Reference point between 2 Access and Mobility Management function (AMF).
- NG15: Reference point between the PCF and the AMF in case of non-roaming scenario, V-PCF and AMF in case of roaming scenario.
- NG16: Reference point between two SMFs, (in roaming case between V-SMF and the H-SMF).

# 5G RAN and functional decomposition...

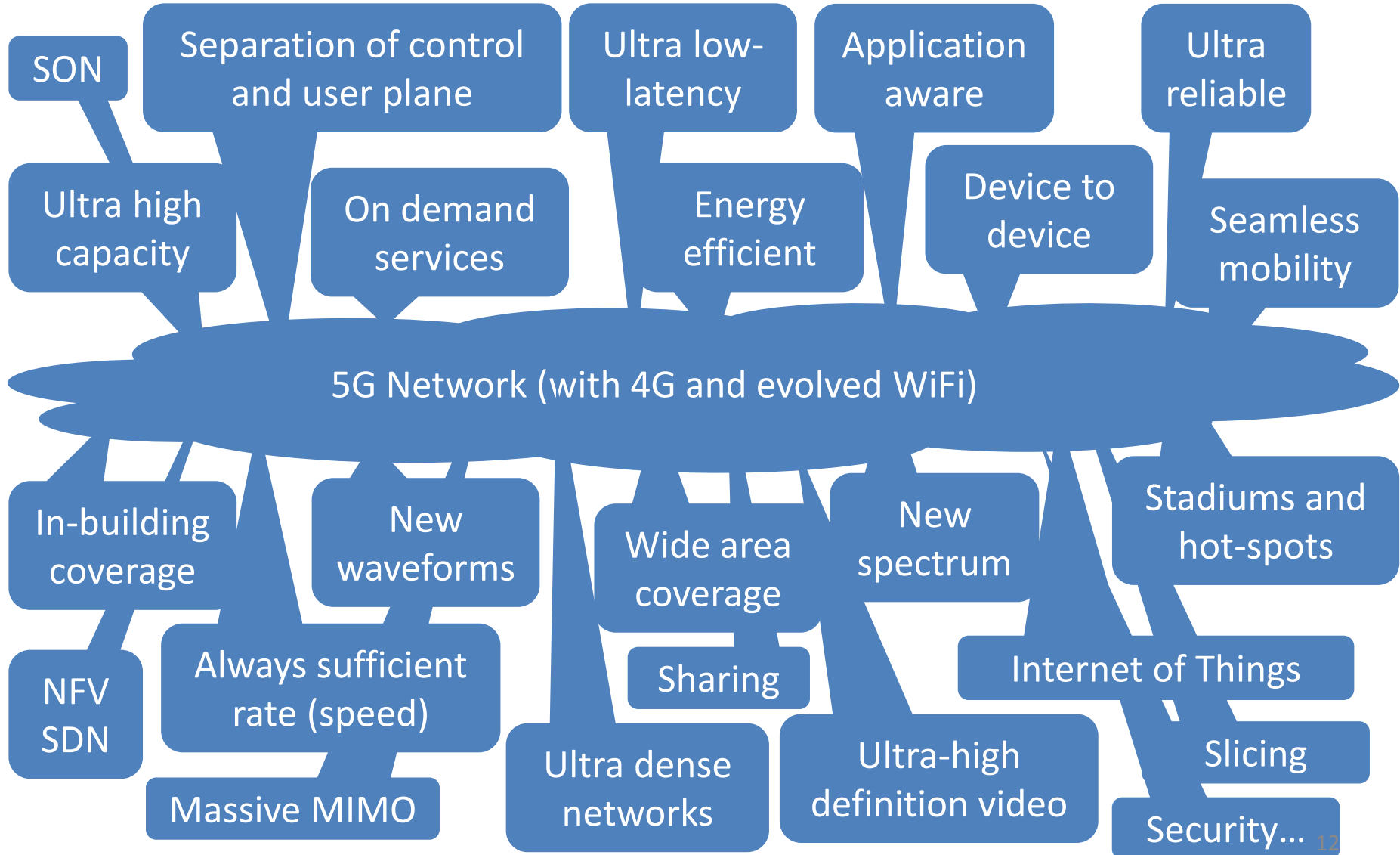


CU = Centralised Unit  
DU = Distributed Unit  
NGFI = Next Generation Fronthaul Interface

# RAN functional splits and impact on backhaul



# Research topics include:

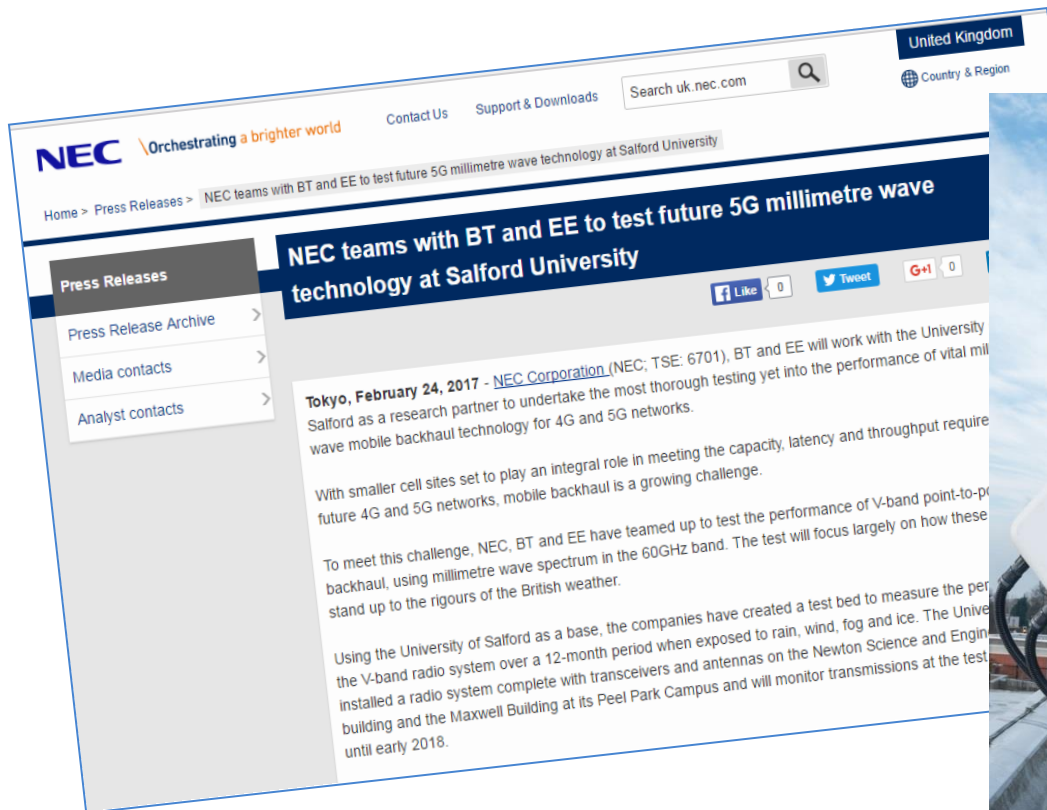


# BT, EE, NEC and University of Salford V-band radio (60GHz)

NEC teams with BT and EE to test future 5G technology at Salford University

Thursday 23 February 2017

NEC Corporation, BT and EE will work with the University of Salford as a research partner to undertake the most thorough testing yet into the performance of vital mobile technology for 4G and 5G networks.



**BT steps up its 5G preparation work as UK gets a new mmW test centre**

# Summary

- 5G standards are still under development within 3GPP
- Final technical contributions for the initial 5G standards are being discussed (Release 15)
- 5G will support enhanced Mobile Broadband (eMBB), Ultra-Reliable and Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC)
- 5G will introduce new radio concepts in new spectrum
- Some aspects of core network evolution to NGCN will be based on NFV
- Spectrum >24GHz will significantly increase area capacity density...
- Expect to see commercial 5G services in or around 2020

