

› **USE CASES FOR FTTR**

JOINT WORKSHOP ITU-T SG15, BBF, ETSI F5G, CCSA

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TEUN VAN DER VEEN AND TOON NORP

# › **USE CASES FOR FIBER TO THE ROOM** **RESIDENTIAL FIXED AND MOBILE 5G**

Content of this presentation:

- › Bringing Gigabit to the sofa
- › Use cases for FTTR with input from 3GPP
- › Some considerations

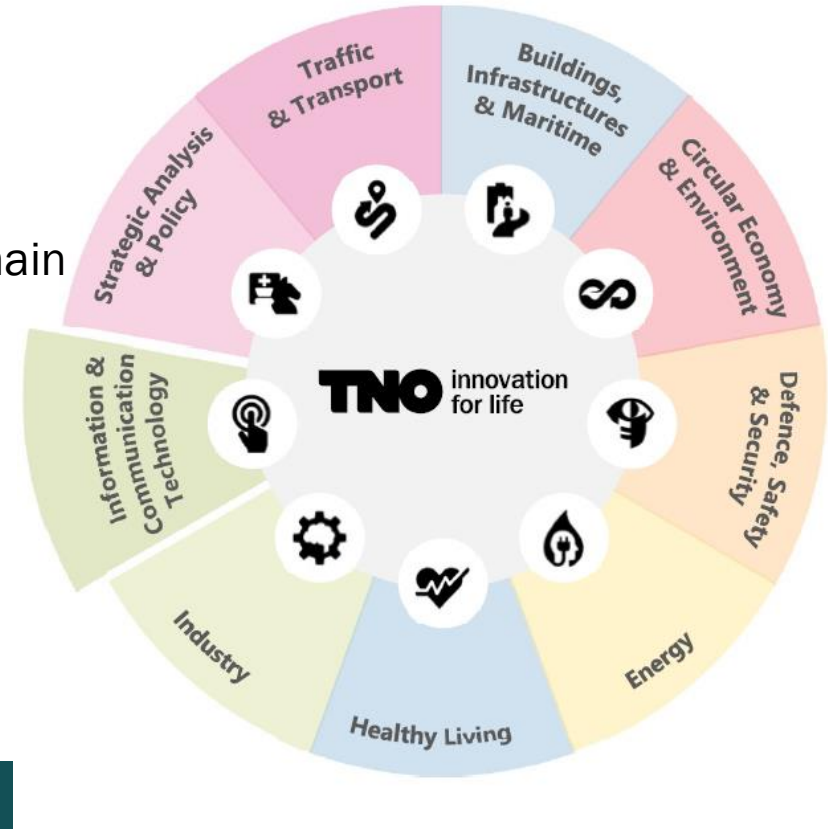


# INTRODUCTION TO TNO

**TNO CONNECTS PEOPLE AND KNOWLEDGE TO CREATE INNOVATIONS THAT BOOST THE COMPETITIVE STRENGTH OF INDUSTRY AND THE WELL-BEING OF SOCIETY IN A SUSTAINABLE WAY. THIS IS OUR MISSION AND IT IS WHAT DRIVES US, THE OVER 3,400 PROFESSIONALS AT TNO, IN OUR WORK EVERY DAY.**

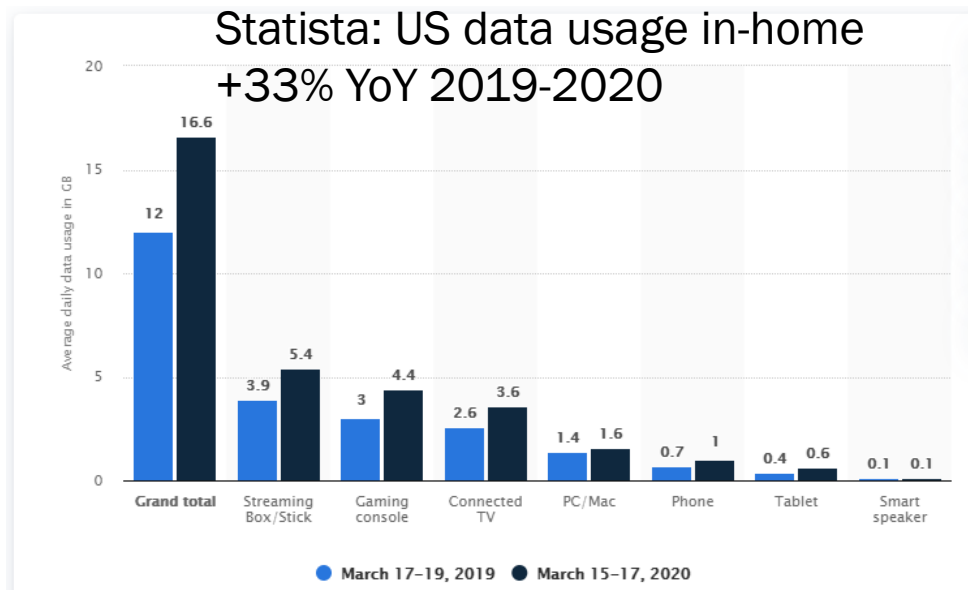
## TNO and SDGs in the context of broadband networks:

- › 3GPP : chair SA1, active in many groups
- › BBF: co-host UFBB-base, active in DSL/g.fast & in-home domain until few years back
- › ITU-T SG 15: active in the past, primarily on VDSL, G.fast
- › ETSI F5G: active member since end 2020



# › GROWTH OF FIXED DATA GIGABIT ACCESS TOWARDS “THE NEW NORMAL”

- › Growth in consumers data usage continues: Streaming, gaming, TV
- › Data rates supplied by increasing fixed broadband access speeds:
  - › Netherlands: two-thirds of homes is “gigabit-ready” (source: NLconnect)



Cisco:

*From 2018 to 2023:*

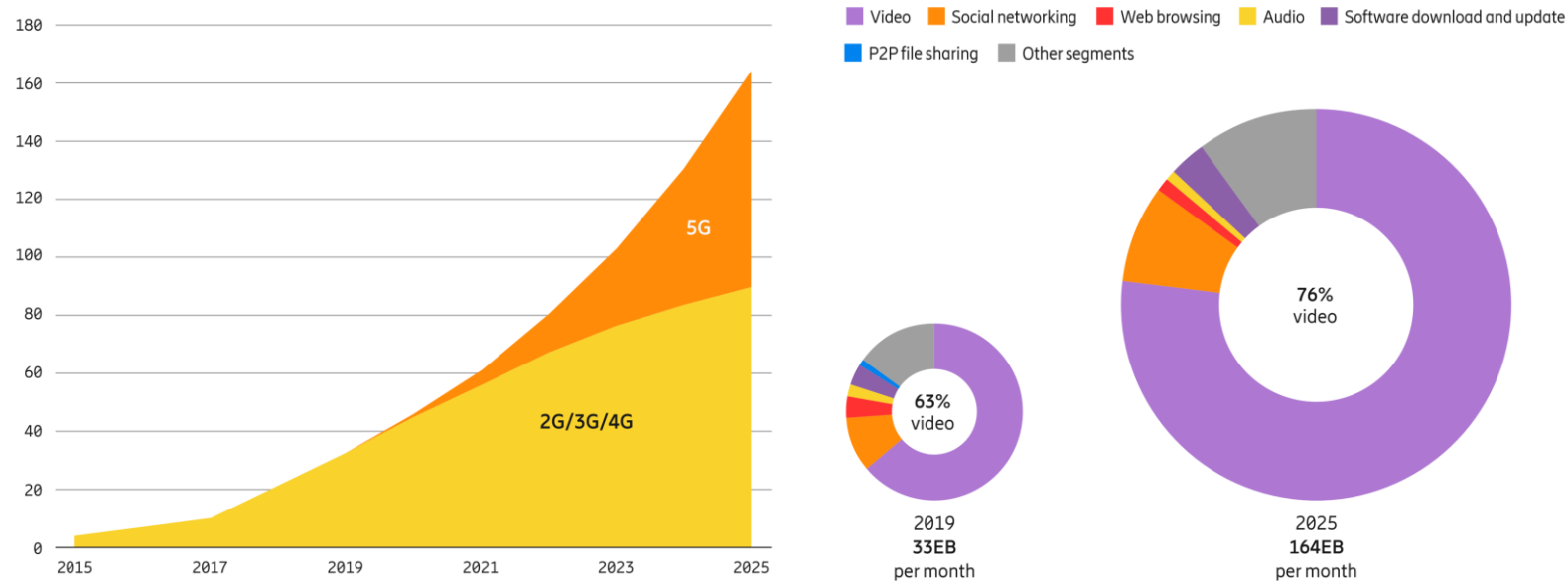
- *Fixed speeds double*
- *Wi-Fi speeds triple (from mobile devices)*

*Still: Wi-Fi speed less than fixed speeds...*

**Fixed data keeps on growing. Access and home networks need to evolve to support this growth.**

# GROWTH OF MOBILE DATA

## 5G TO KEEP UP WITH MOBILE DATA GROWTH



Note: This graph does not include traffic generated by fixed wireless access (FWA) services

<sup>1</sup>Traffic from embedded video in web browsing and social media is included in the application category "Video"

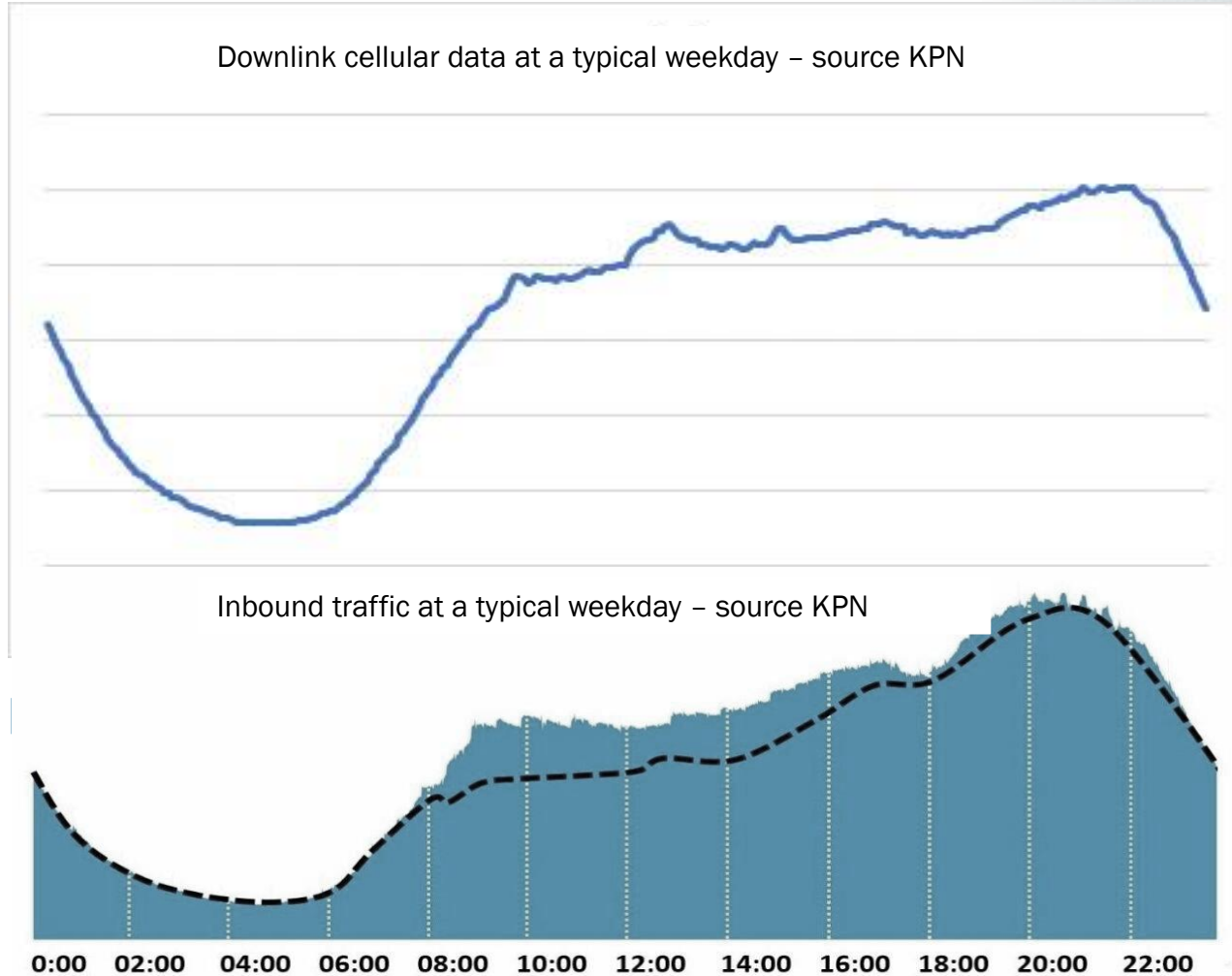
Source: Ericsson Mobility Report – June 2020

For fixed and mobile alike: Video is approximately 70% of data traffic. AR/VR gaming is not even part of this mix and will create even more traffic

Mobile data keeps on growing. 5G is important to keep up with growth..



# HOME IS WHERE THE DATA DEMAND IS FOR BOTH FIXED FOR MOBILE



Internet traffic peaks when most people are ... at home

# › HOW TO BRING GIGABIT TO THE SOFA FIXED/MOBILE 5G EVERYWHERE IN THE HOUSE

## A TYPICAL SCENARIO IN 2025?

Family with two kids. The son has two friends visiting to play VR games. Daughter is watching UltraHD TV. Mother is on a VR conference for work and father is trying to create this presentation.

Max. UE data rate (DL)	Max. UE data rate (UL)	Per Home traffic capacity (DL)	Per Home traffic capacity (UL)	Per gNB traffic capacity (DL)	Per gNB traffic capacity (UL)
1 Gbit/s	500 Mbit/s	5 Gbit/s/home	2 Gbit/s/home	2.5 Gbit/s/gNB	1 Gbit/s/gNB

Assumption in this table:  
2 gNB in the home

Wireless challenge, assuming 5G:

- › High data rates and high capacity implies the use of higher frequencies:
  - › 5G frequency band at 3.5 GHz or 28 GHz
- › Outdoor to indoor 5G coverage is a challenge at higher frequencies
  - › How to get 5G into the house?
- › Even coverage with indoor solutions is a challenge
  - › How to distribute 5G throughout the house?



# › FTTR TO DISTRIBUTE GIGABIT IN-HOME FIXED/MOBILE 5G EVERYWHERE IN THE HOUSE

- › High data rates and high capacity implies a high capacity backbone
  - › FTTR could be this backbone and provide fixed outlets (e.g. workstation)
- › Radio signals at high frequencies blocked by inner walls
  - › Multiple wireless access points or basestations – connected to a fixed backbone
- › Enabling control & management of in home network
  - › Fixed backbone allows low latency control traffic

Let's look at some use cases for residential (5G) services





# CONVERGED SERVICES COMBINED SERVICE PARADIGM

## MOBILE SERVICE PARADIGM

Services are provided to individual devices. Each device is identified individually in the core network. Each device can get its own services.

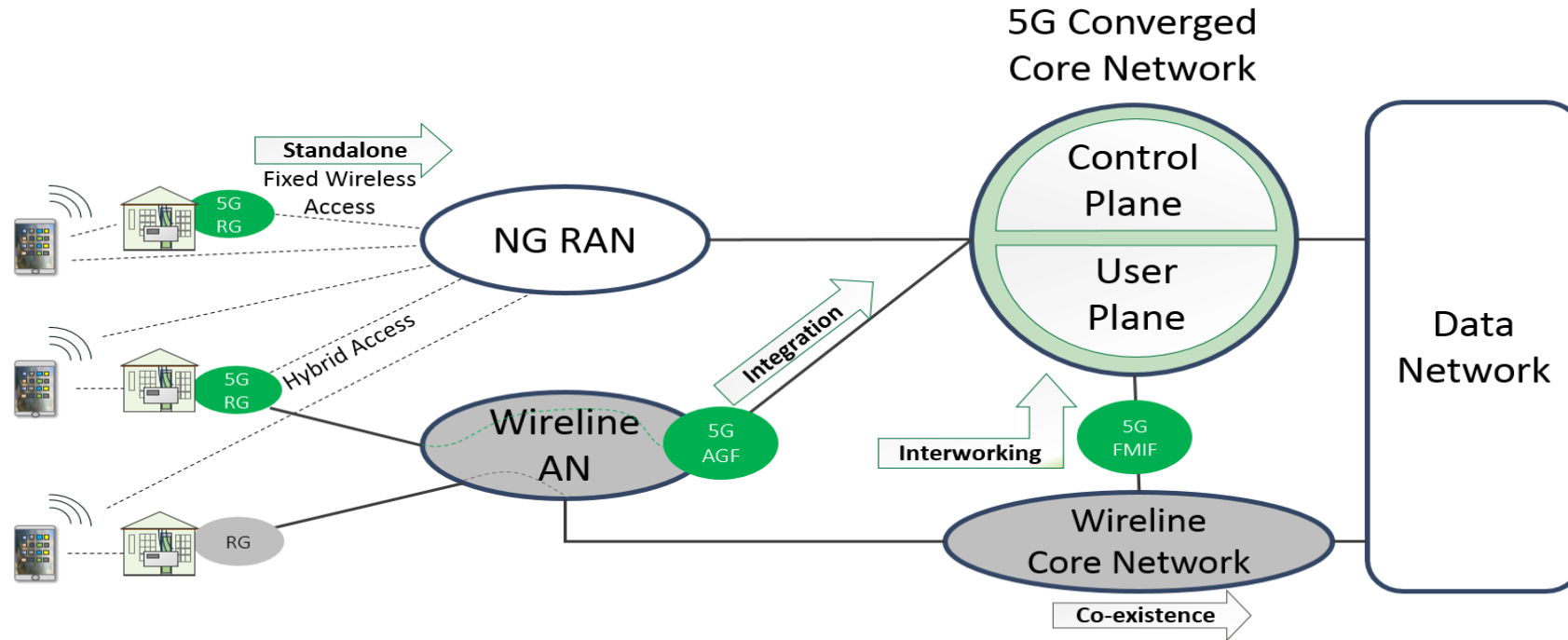
## FIXED SERVICE PARADIGM

Internet Access is provided to the residential gateway. Individual devices behind the residential gateway are not visible. Services (e.g. home automation, music streaming, printer service) are provided on the local area network.



# PROVIDING 5G CONNECTIVITY TO THE HOME

## INTEGRATION OF FIXED AND MOBILE ACCESS



### 3GPP AND BBF COLLABORATION ON WIRELINE WIRELESS CONVERGENCE

Wireline access, fixed wireless access, and hybrid access all controlled from the same 5G core network (3GPP Release 16)

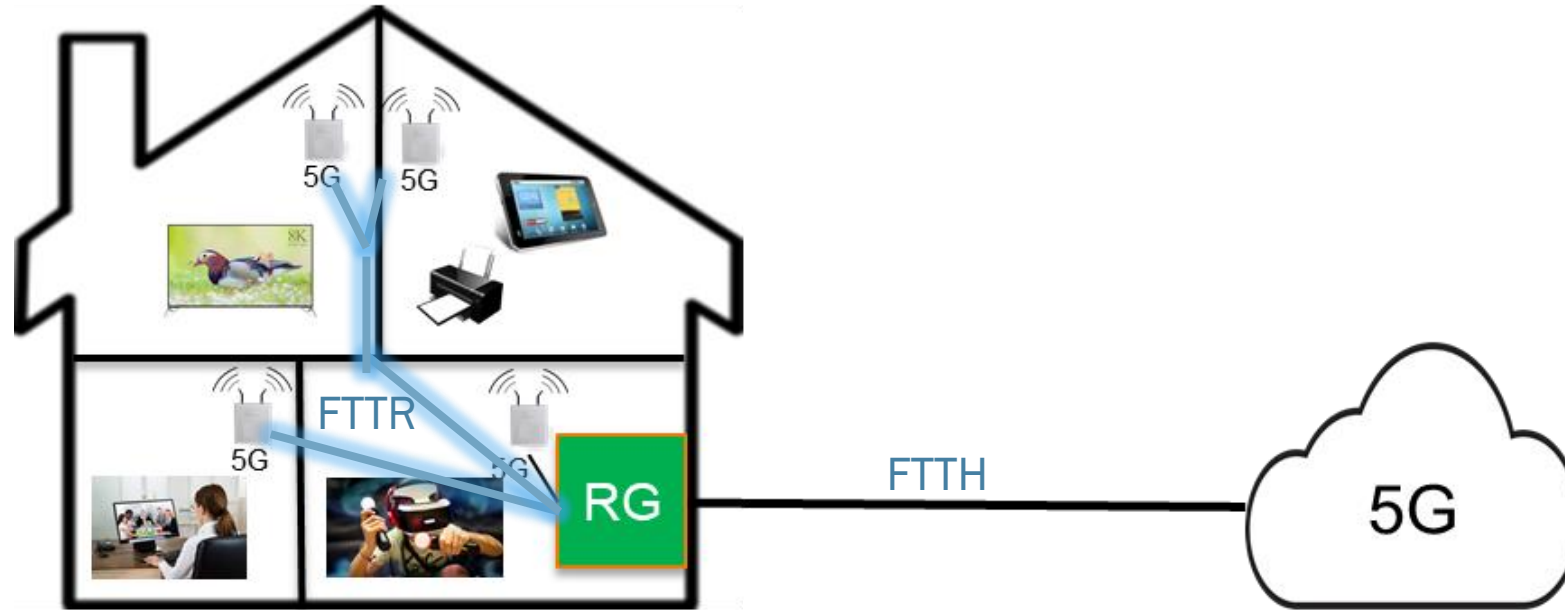
5G Residential Gateway is seen as a User Equipment, QoS control in the 5G Core

High data rates needed for a house with multiple 5G UEs – somewhere between 2 and 10 Gbits/s

Next step: E2E QoS control and residential base stations. Part of 3GPP study item residential 5G (TR 22.858)

## › INDOOR COVERAGE

### INDOOR BASE STATIONS

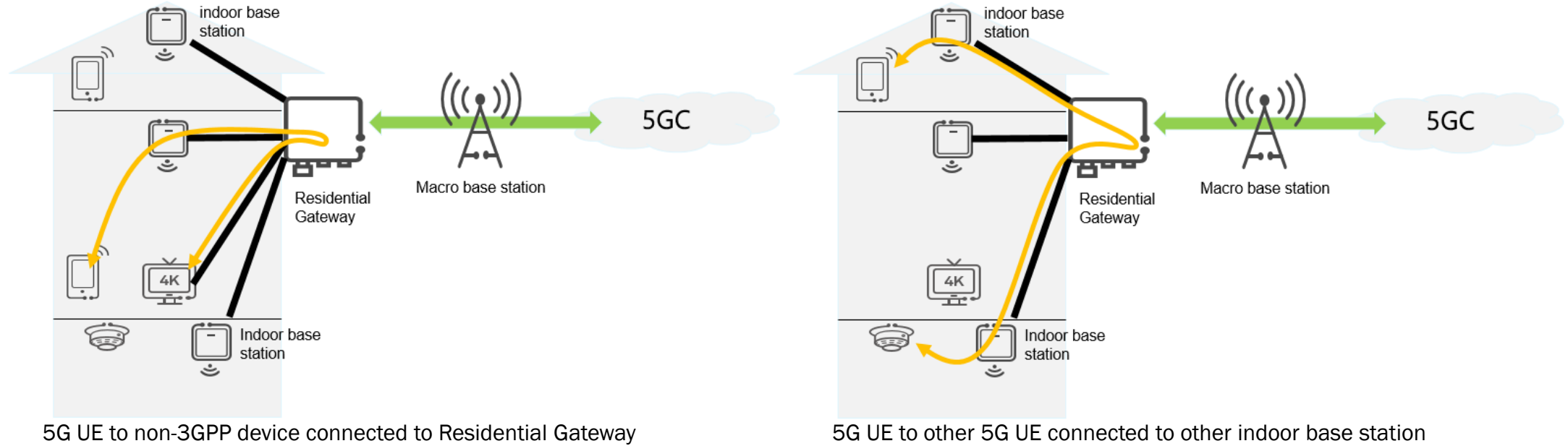


Small indoor base stations can be deployed within the house. These can be connected with e.g. passive optical cabling to the Residential Gateway (RG). Note similar can be done with WiFi6 access points.

- › Backhaul with data rates of approximately 2 - 10 Gbps (DL)
- › End-to-end QoS from base station to 5G core – including within the residential network
- › Visitor access – allowing (controlled) access to visitors, providing secure connectivity and charging records for visitors

# › IN HOME ROUTING

## ROUTING VIA INDOOR BASE STATION AND RESIDENTIAL GATEWAY



- › Communication between 5G UE and other devices within the home should be routed via the residential gateway not via the 5G Core network
  - › Efficiency
  - › Data privacy for end-users

## › SEAMLESS MOBILITY

### MOVING IN AND OUT OF THE HOME

- › When a consumer steps into the garden with his laptop, he should have a consistent and good experience. He should be unaware of:
  - › Switching from an indoor base station to a macro cell
  - › Switching from one indoor base station to another
  - › Switching from different types of wireless connections (WiFi, 5G)
  - › Switching from one radio channel to another



## › **CONSIDERATIONS** **MAKING FTTR WORK**

- › Responsibility for the network:
  - › Home owners, building owners , operators
- › Regulation:
  - › Self install will be key requirement in Europe
- › Practical
  - › How to deal with home reconstruction?
- › Installation
  - › Fiber handling characteristics
- › Strategy
  - › Greenfield vs existing houses



# › CONCLUSIONS

## TOWARDS 5G RESIDENTIAL SERVICES

### FTTR CAN HELP TO REALISE 5G RESIDENTIAL SERVICES

5G residential is addressed in 3GPP and BBF standardisation. Also ETSI F5G is working in this space.

The work on specifications is not yet done, more is needed. Moreover, implementation and trials will be needed to make the specifications a success.

- › 3GPP and BBF have specified Wireline Wireless Convergence (3GPP Release 16)
- › 3GPP SA1 is specifying service requirements for 5G Residential and Personal IoT Networks (Release 18)
- › ETSI F5G is working on its vision of “fibre-to-the-device”
- › ITU started working on FTTR

TNO is happy to help with use cases, standardisation and proof of concept trials





› **THANK YOU FOR  
YOUR TIME**

**TNO** innovation  
for life

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