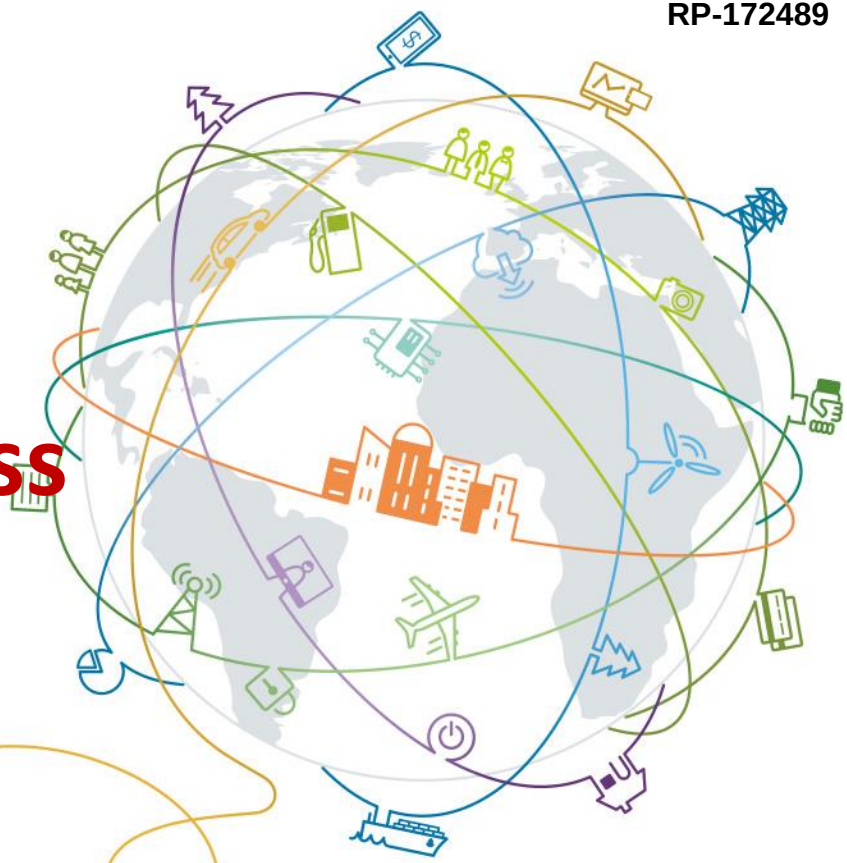
3GPP TSG RAN Meeting #78
Lisbon, Portugal, December 18 - 21, 2017

RP-172489

Document for: Discussion
Agenda Item: 9.1.2

Motivation for New SI

# Study of Home Access Architecture in NR



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# Justifications

- 80% traffic of MBB and IOT traffic happened indoor, yet in-building cellular system penetration is only 2%
- WTTx(FWA)  has emerged as one of the most predominant use cases
- Connected home is an emerging market for NR which requires to bring NR capabilities into buildings to support broadband, URLLC, mIOT, etc.
- 22.261 has service requirements of providing 5G coverage into home and office scenario with multiple access technologies

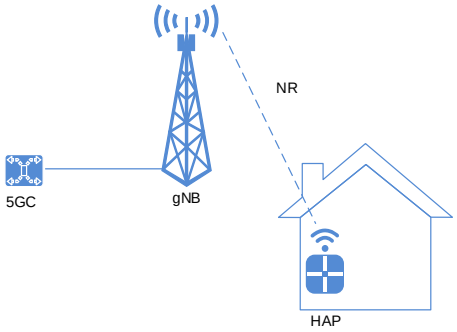
# What RAN should do?

**RAN should study home access architecture in Rel-16**

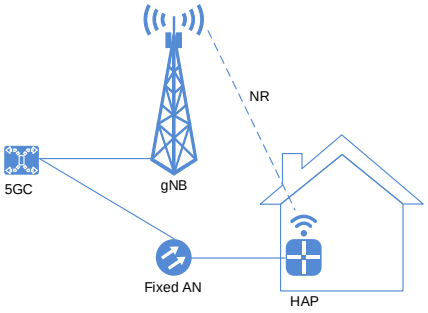
- To expand NR functionalities for use cases of home/business access;
- To provide access control mechanism for avoiding non-allowed UE to access NR Home Access Point (HAP)
- To support wireless and wireline convergence for WTTx deployment;
- To provide home UE served by HAP with 5GC/NR based connection setup, mobility control, and QoS management, etc.

# Deployment options

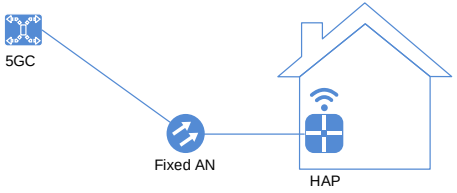
## HAP deployment options




A. HAP with NR backhauling

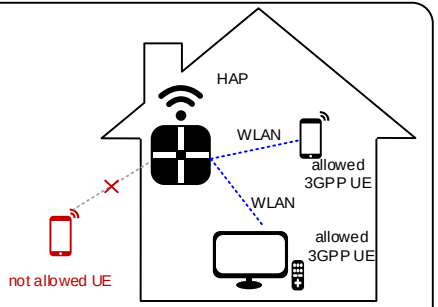



B. HAP with hybrid backhauling

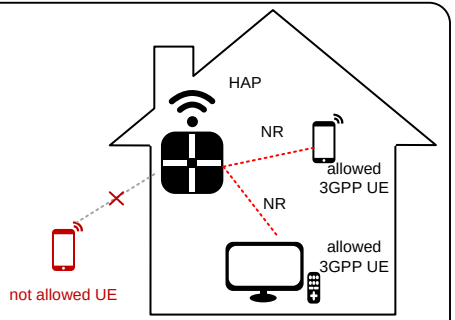



C. HAP with wireline backhauling

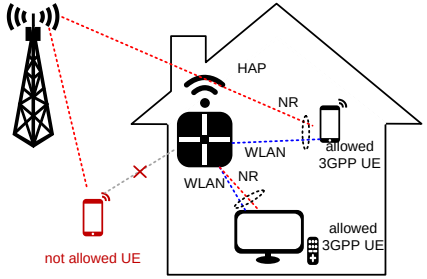
## Home UE deployment options




a. UE connects to HAP by WLAN




b. UE connects to HAP by NR




c. UE connects to HAP by NR-WLAN DC

# Related SA works

## SA1 agree to support multi-AT in home scenarios

### 22.261 Service requirements for the 5G system

#### 6.3 Multiple access technologies

##### 6.3.1 Description

The 5G system will support 3GPP access technologies, including one or more NR and E-UTRA as well as non-3GPP access technologies. Interoperability among the various access technologies will be imperative. For optimization and

##### 6.3.2.4 Fixed broadband access

The 5G system shall be able to efficiently support connectivity using fixed broadband access.

NOTE: The specification of fixed broadband access network is outside the scope of 3GPP.

The 5G system shall support use of a relay UE that supports multiple access types (e.g., 5G RAT, WLAN access, fixed broadband access).

The 5G system shall support use of a home base station that supports multiple access types (e.g., 5G RAT, WLAN access, fixed broadband access).

#### 7.1 High data rates and traffic densities

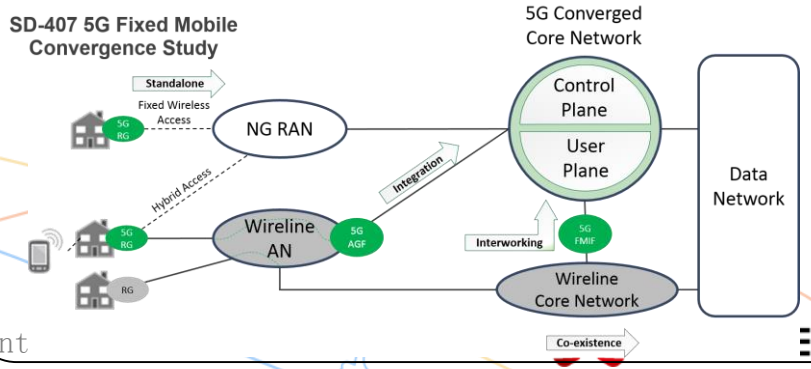
Several scenarios require the support of very high data rates or traffic densities of the 5G system. The scenarios address different service areas: urban and rural areas, office and home, and special deployments (e.g., massive gatherings, broadcast, residential, and high-speed vehicles). The scenarios and their performance requirements can be found in table 7.1-1.

## SA2 and BBF start studies on wireless and wireline convergence

- Study on how to support CPE/Residential Gateway capable of connecting via wireline / wireless access to the 5G CN as a 3GPP UE;
- Study on how to support end user devices, with or without UICC, connected to the convergent 5G CN from behind a CPE/Residential Gateway
- Identification of the the impacts on mobility, session management and interaction with Access Traffic Steering, Switching and Splitting for UEs accessing the 5G convergent network and investigation on whether enhancements are needed;

2: The study of Access Traffic Steering, Switching and Splitting is not in the scope of this SID

- Study on how to support CPE/Residential Gateway capable of connecting simultaneously via both 5G RAN and wireline access to 5G CN;

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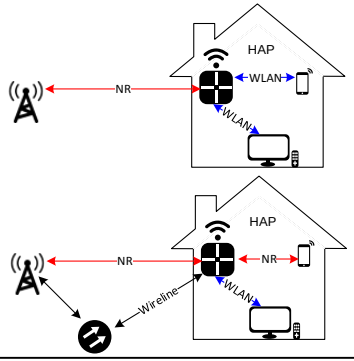
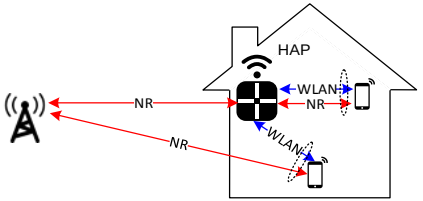
# Issues to be addressed in RAN

## Wireless/wireline convergence at HAP



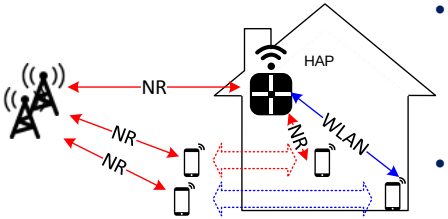

- 3GPP UE served by HAP connected to gNB via WLAN
- To support HAP backhauled by NR and wireline simultaneously

## NR-WLAN DC operation



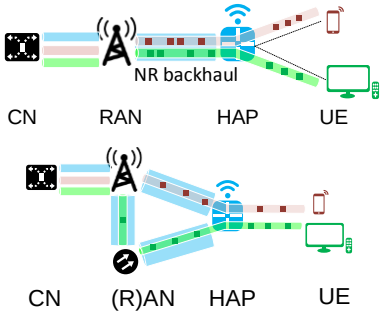

- UE connects to HAP by NR-WLAN DC
- UE connects to both gNB and HAP by NR-WLAN DC

## Indoor-outdoor service continuity




- To enable seamless NR-NR mobility between indoor HAP and outdoor gNB
- To enable seamless NR-WLAN mobility between indoor HAP and outdoor gNB

## Support of 5G QoS management for home




- To enable flow-based QoS management between 5GC and UE served by HAP
- To enable traffic steer/split between wireless and wireline backhaul for UE served by HAP

# Potential SI objectives

To study home access architecture based on NR RAN with the following functions:

- To support connecting UE to NR backhauled and/or wireline backhauled HAP
  - *[Note: built on SA2 WWC study and RAN2 IAB study]*
- To support NR-WLAN DC from HAP only or from HAP and gNB
- To enable seamless NR-NR and NR-WLAN mobility between indoor-outdoor connections
- To enable flow-based QoS management between 5GC and HAP served UE

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# THANK YOU

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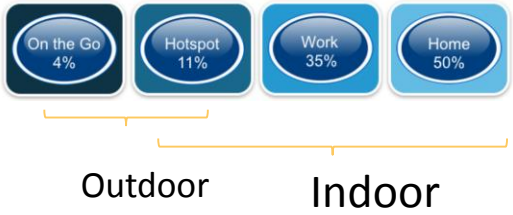
# Backup

## Most MBB and IOT traffic happened indoor

Figure 1. Cisco VNI 2020 Estimates of Mobile Data Consumption




### DRIVERS FOR INDOOR WIRELESS

- 80% of mobile traffic originates from indoors (Ref: CommScope).
- Almost all vertical industries addressed by 5G rely on high coverage/capacity indoors.
  - Smart factories, Smart homes, Offices, e-Health, mission critical services.
- In-building wireless market predicted to be worth $16.71 billion in 2020 (Ref: marketsandmarkets.com).
- However, only 2% of buildings right now have dedicated in-building cellular systems (Ref: CommScope).

## WTTx(FWA) has emerged one of most predominant use cases for 5G

5G fixed wireless a $1 billion market by 2019, SNS Research says

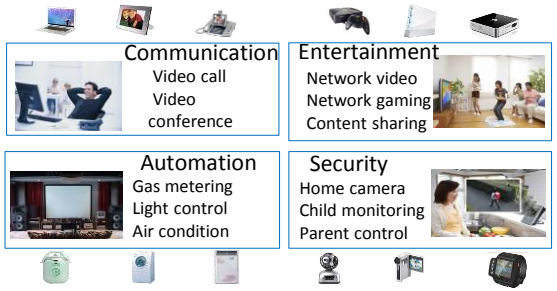
By Sean Kinney, Managing Editor on AUGUST 28, 2017 — 5G, Business, Network Infrastructure

**5G fixed wireless access growth as a wireless alternative to last mile fiber**

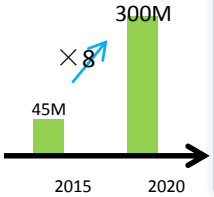
**Key Findings:**
The report has the following key findings:

- 5G-based FWA subscriptions are expected to account for $1 Billion in service revenue by the end of 2019 alone. The market is further expected to grow at a CAGR of approximately 84% between 2019 and 2025, eventually accounting for more than $40 Billion.
- SNS Research estimates that 5G-based FWA can reduce the initial cost of establishing last-mile connectivity by as much as 40% – in comparison to FTTP (Fiber-to-the-Premises). In addition, 5G can significantly accelerate rollout times by eliminating the need to lay cables as required for FTTP rollouts.
- The 28 GHz frequency band is widely preferred for early 5G-based FWA deployments, as many vendors have already developed 28 GHz-capable equipment – driven by demands for early field trials in multiple markets including the United States and South Korea.
- Millimeter wave wireless connectivity specialists are well-positioned to capitalize on the growing demand for 5G-based FWA. However, in order to compete effectively against existing mobile infrastructure giants, they will need to closely align their multi-gigabit capacity FWA solutions with 3GPP specifications.

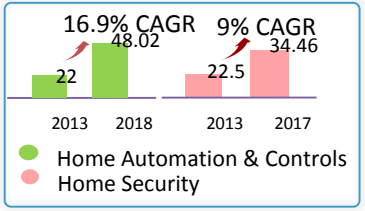
## Connected Home is an emerging market for 5G




**Smart Home users will be 300M @ 2020**




Home Market Forecast($ billion)




- 15% household market

Source: MarketsandMarkets