**3GPP TSG-SA WG1 Meeting #91e S1-203361**

**Electronic Meeting, 24 - 28 Aug 2020** *(revision of S1-203076)*

Title: FS\_Resident Use case Base Station QoS

Agenda Item: 7.11.1

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*Abstract: This contribution proposes a use case for the FS\_Resident TR 22.858. The use case relates to providing a small indoor base station or Access point with QoS in the backhaul.*

===================Proposed Change==========================

## 5.x Use case QoS for small indoor base station connectivity

### 5.x.1 Description

In many cases, residential indoor coverage will require the deployment of indoor base stations or access points. Especially for multimedia services like UHD TV, or AR/VR gaming high bitrates are needed. This in turn requires the use of higher frequency bands (e.g. 3.5 GHz or 26/28 GHz for NR or 5 GHz, 6 GHz or 60 GHz for WiFi based radio access). At these frequencies, outdoor to indoor coverage from an outdoor PLMN is challenging. Also indoor penetration throughout a house is problematic, requiring multiple base stations or access points.

For 5G services that require specific QoS (e.g. guaranteed bitrate, latency) or e.g. that rely on edge applications, it is important that the 5G network can differentiate the related service data flows in order to treat them accordingly. This also applies in case an indoor base station is connected via a 5G Residential Gateway (5G-RG) and an indoor infrastructure. In the Wireline Wireless Convergence work between 3GPP and BBF, the 5G-RG is seen as an UE. That way the 5G-RG can request QoS for the fixed access network. Also on the radio interface between the UE and the indoor small basestation, QoS control can work as normal. An issue however is how QoS is provided on the backhaul between the indoor small basestation and the 5G-RG and in the 5G-RG. It is not guaranteed that this backhaul has sufficient QoS. Also prioritization of specific service data flows may be needed to provide the expected QoS. Finally, the 5G RG may have to request specific QoS for the fixed access network for specific service data flows.

Note: in the use case, we generally refer to indoor small base stations, but the similar requirements apply for e.g. a WiFi6 access point that is connected to the 5G core (non-3GPP access) via a 5G-RG.

### 5.x.2 Pre-conditions

The following pre-conditions and assumptions apply to this use case:

* An indoor small base station is deployed inside a residential home.
* The indoor small base station provides access to the 5G system (e.g not local IP access)
* UEs using the indoor small base station have individual subscriptions to access the 5G system.
* The indoor small base station is connected to a 5G-Residential Gateway (5G-RG)
* 5G RG is connected to the same 5G system (and has a subscription to the same 5G system) as the indoor small base station belongs to.

### 5.x.3 Service Flows

Teenagers Oliver and Scott are avid gamers. They get together in the games room in the basement of Scott's house and discuss the new game that has become available that day. Scott decides to download the new game on his laptop. The size of that game is over 100 Gbyte so even on 5G it will take a while. Good thing that Scott's parents had 5G indoor basestations installed in the house. 5G coverage would otherwise have been dismal in the basement and downloading would have taken forever.

While the game is downloading, Oliver and Scott decide to play their favorite multi-user AR/VR game. Each put on a VR headset, get a controller and start gaming. The AR/VR game they play is cloud based with rendering in an edge node. This way they can play the game wherever they want and still have optimal quality of experience. The low latency ensures they have no 'lag' when they move their head or when they try to shoot each other in the game. Good thing also that the 5G system makes sure that the AR/VR game is prioritized over downloading the game. That the download takes a bit more time is not a big issue, but without the usual settings for frames per second and resolution or with additional lag because of the download the game would be 'unplayable'.

### 5.x.4 Post-conditions

The game consoles have set up a 5G connection to the indoor small basestation. They have requested the same session with the same QoS, DNN, Slice, et cetera as they would have done with an outdoor basestation.

The 5G-RG ensures that prioritization within the 5G-RG and residential network takes requested QoS into account. This e.g. implies that the AR/VR game gets priority over the downloading of the game.

The 5G-RG also ensures that the 5G core network can differentiate the service data flows for the AR/VR games from general Internet access, to ensure that specific handling of these service data flows (e.g. routing to an edge node) is possible.

### 5.x.5 Existing features partly or fully covering the use case functionality

3GPP TS 22.220 "Service requirements for Home Node B (HNB) and Home eNode B (HeNB)" specifies requirements for indoor basestations in a 3G (HNB) or 4G (HeNB) context. It is not very clearly specified whether these requirements also apply for 5G. Requirements are included to request resources from the IP backhaul in the fixed broadband access. Note that TS 22.220 does not assume WWC convergence. There are no requirements for the provision of QoS within the residential network itself.

3GPP TS 22.261, clause 6.26.2.1 mentions indoor small basestations connected in the context of 5GLAN: "The 5G system shall enable the network operator to provide the same 5G LAN-type service to any 5G UE, regardless of whether it is connected via public base stations, indoor small base stations connected via fixed access, or via relay UEs connected to either of these two types of base stations."

3GPP TS 22.261, clause 6.3.2.4 discusses fixed broadband access. It does not really use WWC terminology (e.g. 5G-RG), but either assumes a residential gateway that functions as a relay UE, or a residential gateway that integrates an indoor base station. There is no mentioning of a basestation that is connected to the residential gateway. 3GPP TS 23.316 is the architecture specification for Wireline Wireless Convergence.

### 5.x.6 Potential New Requirements needed to support the use case

The 5G system shall enable the network operator to provide any 5G services to any 5G UE via an indoor small base station connected via a residential gateway.

Editor's Note: residential gateway to be defined

Editor's Note: indoor small base station to be defined and/or a shorter name or acronym to be found

NOTE1: The residential gateway may be connected via fixed access, via 5G Fixed Wireless Access, or hybrid access.

NOTE2: The indoor basestation may also be co-located with the residential gateway

The 5G system shall enable the residential gateway to provide backhaul with the required QoS for the services provided via an indoor small base station connected via the residential gateway.

NOTE3: Backhaul for the indoor small base station includes the residential network between indoor base station and residential gateway and the (fixed) access network between the residential gateway and the 5G core network.

Editor's Note: residential network to be defined as network infrastructure inside the house