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Integrated Access and Backhaul in 5G NR

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5G New Radio (NR) will bring a new backhaul option known as Integrated Access and Backhaul (IAB), of high interest for the deployment of dense millimeter wave (mmWave), street-level radio nodes.

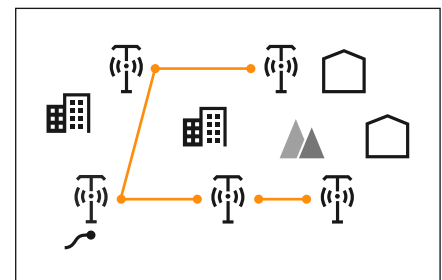
Historically, self-backhauling has had limited traction, since it consumes spectrum resources that are valuable for radio access. However, with mmWave 5G NR, large bandwidth and native beamforming create an opportunity to use IAB links. This will enable fast, flexible and very dense deployment of mmWave radio access sites at street level, without the need for a denser transport network (see Figure 9).

A study item on IAB is being concluded in 3GPP, followed by a work item in Release 16 that will be finalized at the end of 2019. The backhaul and access may be on the same or different frequency bands, known as in-band and out-of-band. In-band IAB is of higher interest since it could provide backhaul without any additional equipment. However, it is also more challenging and requires tight interworking between access and backhaul to avoid interference, both within the radio nodes as well as across the radio network. The IAB relays enhance access coverage and capacity, as users' devices connected to a nearby relay will experience far less path loss compared to a distant IAB donor (see Figure 10). The IAB link from the donor limits the total throughput of the connected relay nodes. The relay nodes will use a more symmetric downlink (DL) – uplink (UL) Time Division Duplex (TDD) ratio, when compared to typical DL-heavy radio nodes, as much user data is transiting the relay from receive to transmit side. The latency will also increase per IAB hop. The IAB network should be carefully planned to meet the targeted end-user experience at busy hours. Topologies with a limited number of aggregated relay nodes and few hops are expected to be most common.

Microwave backhaul and IAB are complementary alternatives to fiber with different advantages and uses. IAB is part of the 5G NR Radio Access Network,

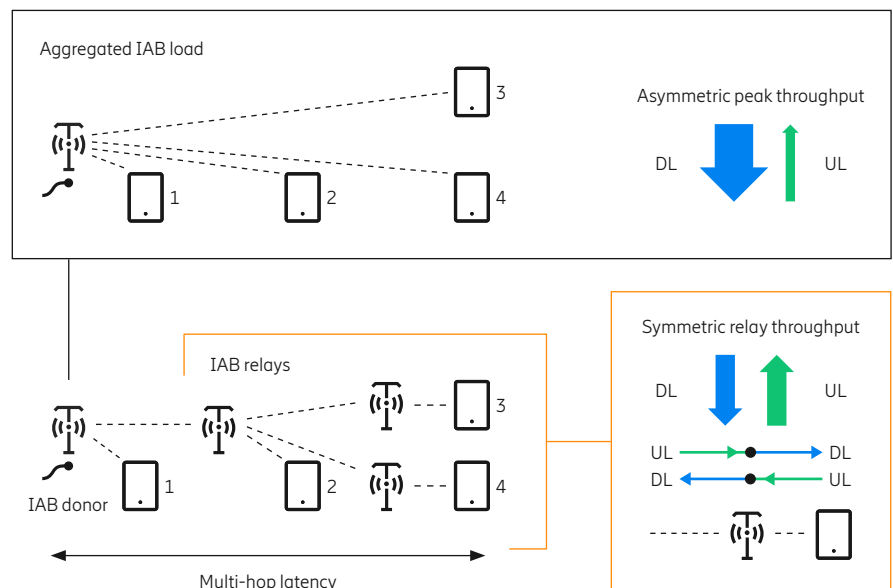
with several advantages: automatically established backhaul; no additional equipment needed, when the backhaul direction is within the access sector; and backhaul for limited line-of-sight path, but at a reduced distance. Microwave backhaul also has advantages: high capacity without using valuable access spectrum; a latency less than one-tenth of a single IAB hop; and a hop distance of more than five times that of IAB, with optional higher-gain antennas. Microwave backhaul has been the dominant backhaul media for over two decades, and will remain a very attractive alternative to fiber for traditional macro radio node deployments. IAB is expected to become an equally attractive alternative to fiber for the emerging dense street-level, mmWave 5G NR deployments.

Figure 9: IAB deployment scenario



Source: Ericsson (2018)

Figure 10: IAB characteristics to consider



Source: Ericsson (2018)

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