

Fixed-wireless access: A path to 5G profitability

White paper

5G investments are accelerating around the world, bringing the promise of a revolutionary mobile experience. While operators figure out how to monetize 5G mobile services, there is an immediate opportunity to leverage 5G to deploy fixed wireless access broadband services. This can allow operators to extend existing or even create new business and residential broadband opportunities, simultaneously improving the ROI of their 5G network.

Contents

Introduction	3
Financial considerations	3
Technical considerations	4
CPE impact on the business case	5
Operator use cases	5
Conclusion	5
Abbreviations	5
About Nokia	5

Introduction

5G radio upgrades are accelerating around the world. There is a whole universe of use cases waiting for it, from connected vehicles, eHealth, cloud-based robotics, and so on. Mobile users, of course, are anticipating the arrival of Gigabit broadband wherever they go. Pending 5G revolutionizing people's mobile experience, it turns out that consumers are just as excited about the potential for their homes. Recent Nokia-commissioned research shows that fixed wireless access is a highly desirable 5G use case: 76% of consumers in their global survey like the idea of 5G FWA and 66% would happily subscribe to 5G FWA at the same price as their current broadband. Owners and operators of 5G networks can use this to their advantage to improve the return on investment of their networks.

Financial considerations

According to GSMA, Twenty 5G-ready smartphone models were launched in 1Q2020, about 40% of the total 5G handset market in a single quarter, with manufacturers and operators hoping to reverse the 2% drop in smartphone sales in 2019¹. Clearly, 5G service providers are also counting on 5G mobile subscriptions to provide an immediate boost to revenues. But the challenge is that consumers are currently reluctant to pay more for higher speeds. This is reflected in GSMA reports showing a 4-fold growth in mobile data use by 2025 but with only 1% annual revenue growth over the same period.

As operators figure out this conundrum, there's a new opportunity already available in the shape of fixed wireless access (FWA) that can generate immediate returns and improve the overall business case for 5G.

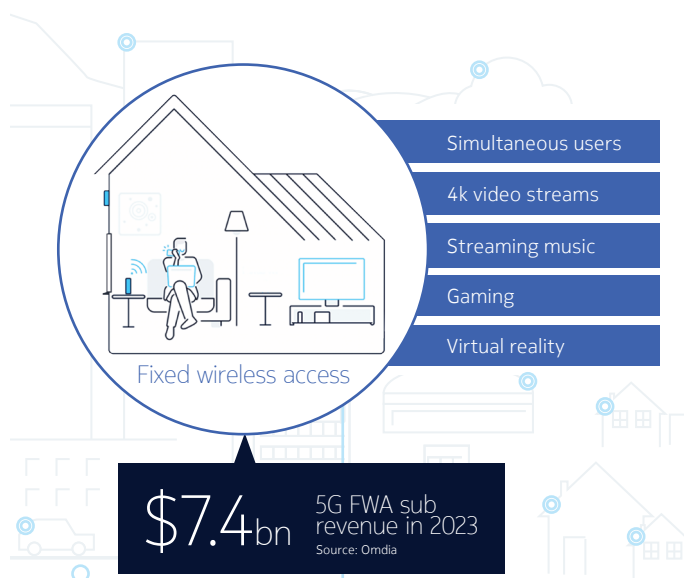
It's not just consumers believing in the potential of 5G FWA. Another recent survey, this time by Omdia, shows that 47% of service providers rate FWA as second only to enhanced mobile broadband (eMBB) as

the most important 5G use case. 5G, with its 10-25x increase in capacity over 4G, empowers FWA with speeds truly comparable with fixed broadband services.

5G fixed wireless access brings a multitude of services and revenue opportunities beyond commodity broadband pricing, in the same way we see today with mobile broadband. Omdia predicts that FWA will generate \$7.4 billion in subscriber revenue in 2023².

For many mobile operators it represents a new service generating new subscription revenues. Once subscribers are connected, operators have the opportunity to provide value-added services to increase ARPU, or create monetizing partnerships as distributors of streaming content.

Converged operators already have a keen understanding of consumer behavior in the home. They tend to have service offerings beyond basic



¹ GSMA, February 2017, "GSMA Intelligence: Smartphones now account for half the world's mobile connections"

² Omdia, November 2019, "Fixed Wireless Access Subscription Forecast: 2019-24".

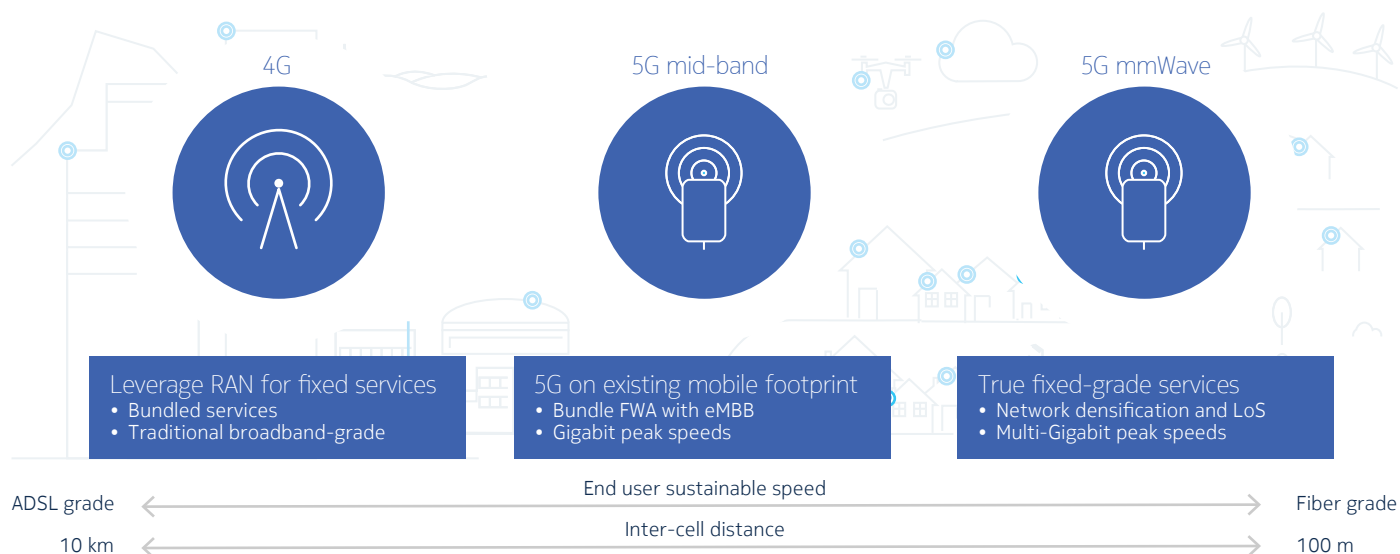
broadband, either in-house or through partnerships. For them, the advantage of FWA is in bringing connectivity to all subscribers in their service area quickly and at a lower cost. This is generally achieved through a mix of technologies such as fiber-to-the-home (FTTH) or fiber-to-the-x (FTTx), which runs fiber deep into the network while using existing copper or coax infrastructure to connect the final meters to the home. Fixed wireless access plays the same role, using Radio Access Networks (RAN) for the final connection to the subscriber.

Technical considerations

Mobile technologies are designed for mobile—i.e. on the move—users. In applying it to a fixed broadband service as FWA, there are some technical considerations for operators.

A typical smartphone user might consume 10-30 Gigabits a month. A fixed access connection to the home with multiple simultaneous users, video, gaming and Wi-Fi offload of mobile data can consume ten times that, or more. Figure 2 shows each RAN technology's ability to support this demand as a range from ADSL-grade to fiber-grade services.

Figure 2. FWA technology comparison



4G mobile networks commonly use macrocells serving many users over multiple kilometers—typically going to a maximum distance of 500 meters in dense urban environments and 10-15 km in rural areas. Maximum distance can be achieved with low bands, but the compromise is lower speeds. 4G LTE in the mid bands (up to 2.6 GHz) can deliver peak speeds in the hundreds of Mb/s but these speeds will degrade with distance. In addition, radio resources are shared, so actual sustained speeds would be far lower on a popular service, which is why 4G FWA can only really be compared to ADSL fixed broadband services (but with better peak rate). Nevertheless, 4G FWA is a good tool for increasing ARPU through bundled services and for providing broadband coverage in hard to reach areas, particularly rural and suburban.

Figure 3. Mid-band 5G fits the existing mobile footprint



5G at mid-bands brings much more capacity for FWA. With mid-band spectrum at 2.5 and 3.5 GHz, up to 100 MHz of channel bandwidth, and better spectral efficiency, 5G delivers 10-15 times more capacity than 4G LTE networks. A mid-band 5G base station with three sectors can provide more than 500 Terabytes of data per month, supporting hundreds of FWA users. With this capacity, operators can offer up to Gigabit peak speeds and sustained speeds up to 50 Mb/s range, depending on concurrent usage. This places 5G FWA in the mid-grade range when compared to traditional fixed networks.

The added advantages of 5G in the mid-bands are cost and time to market. Signal range at these frequencies is good, meaning network densification is not required; the existing mobile footprint can simply be upgraded from 4G to 5G to support both mobile broadband and fixed

wireless access. However, since the radio network is still shared with mobile broadband, care must be taken to ensure that FWA, with perhaps a take-rate of 10-20%, maintains residential sustained speeds without impacting mobile broadband services. This challenge can be overcome with capacity management tools to identify and control congestion points in the network, making it possible for operators to support service level agreements (SLA) with subscribers.

5G operating in the 24-39 GHz spectrum range (mmWave) makes as much as 800 MHz of spectrum available to operators. This ensures the bandwidth needed to support peak speeds in the multiples of Gigabits per second with sustained speeds that rival that of fiber. FWA using 5G mmWave, therefore, offers true fixed-grade services, but there is a downside. Firstly, signals can typically travel only short distances, meaning that network densification is required. Second, attenuation at these very high frequencies enforces line-of-sight or near line-of-sight planning. Despite the effects of densification and LoS on CAPEX and time to market, mmWave is still an attractive alternative for operators in specific regions where other spectrum options are limited or the cost to deploy FTTH is too great.

Some operators are looking at a combination of mmWave and sub-6 GHz 5G in a best-of-both-worlds scenario. Mid-band 5G can be deployed quickly on existing base stations to support a 10-20% FWA take rate. Millimeter-wave can be deployed later, on the very same base stations, to boost capacity for subscribers within range while freeing up sub-6 GHz capacity for homes and businesses that are beyond the reach of mmWave. With 5G multi-connectivity, operators can combine 4G, 5G sub-6 GHz and 5G mmWave to create a high capacity and reliable connection to end users.

CPE impact on the business case

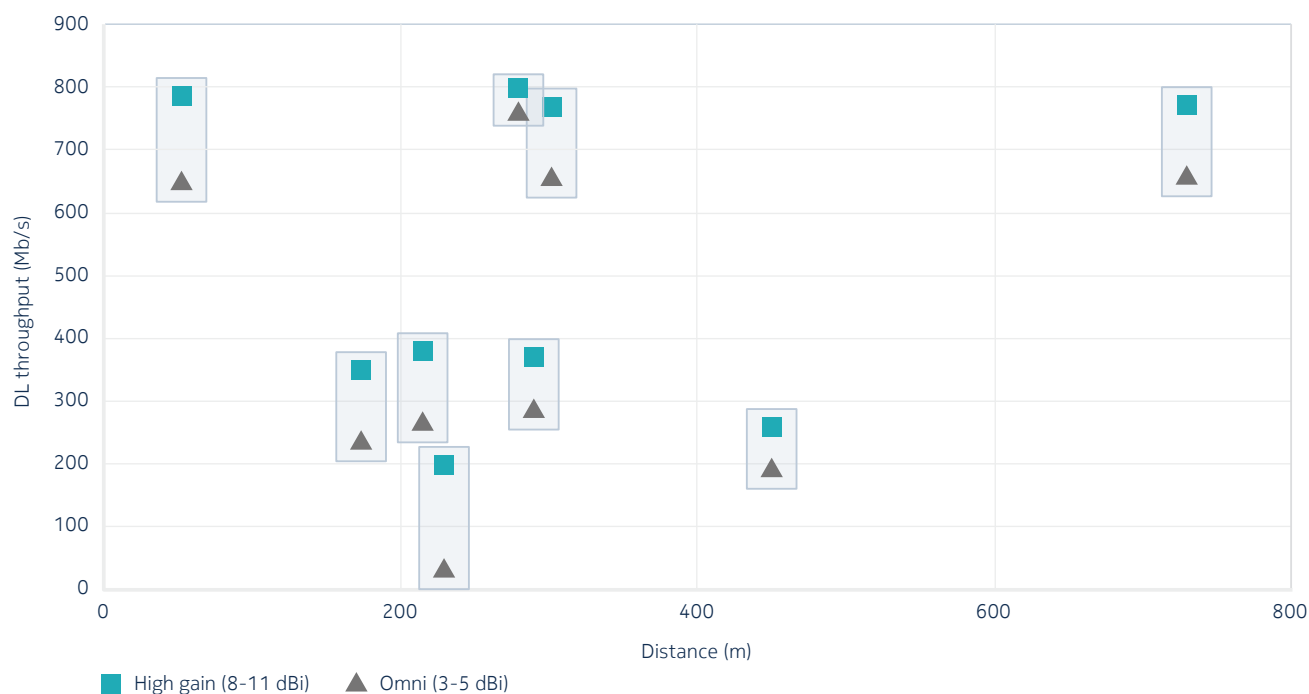
FWA serves stationary subscribers with stationary CPE. Consumers today have many choices when it comes to connecting to mobile broadband at home.

Smart phone tethering and data dongles (Mi-Fi) are commonly used but they are designed for mobile convenience, not home broadband. They tend to waste radio resources while providing limited ARPU opportunities.

Fixed wireless access CPE are designed for use in homes and businesses. They tend to be higher category devices, with higher gain antennas driving higher speeds while using radio resources more efficiently. It's this efficiency which can boost the business case for FWA.

Nokia field data from customer trials show that high gain 11 dBi antennas can consistently boost peak rates at a given location by up to 180 Mb/s when compared to omni antenna designs with 3-5 dBi gain. This added performance pays significant dividends in ARPU and customer satisfaction. When serving subscribers at the cell edge, high gain antennas offer similar increases in speed and in some cases connect with 5G services where others connect on 4G only.

Figure 4. Impact of CPE antenna quality



The impact on the radio network CAPEX and cashflow can be significant. Nokia studies with operators show that high gain antennas can result in an increase of up to 20% in base station coverage, generating 43% CAPEX savings. The use of high category devices improves spectral efficiency which can result in being able to connect up to 25% more FWA subscribers to a given base station.

Operator use cases

The arrival of 5G finally allows fixed wireless access to live up to its promise, providing solutions for different operators based on their unique needs.

Many mobile operators face the very present challenge of eroding mobile broadband revenue. In some European markets, for example, mobile broadband pricing has dropped to as little as 7 Euro for 50 Gigabits of data per month. There's little opportunity for differentiation, and the result is high churn for what has become a commodity service with small profit margins. FWA provides an opportunity to create more ARPU and reduce churn with a sticky bundle of home and mobile 5G services. FWA CPE can also serve to reduce the load on the network since they deliver better radio efficiency with better antennas than mobile

handsets. These higher category devices make better use of precious radio spectrum, wasting less and, therefore, connecting more users with faster speeds.

Converged operators with legacy DSL networks that struggle to compete or to meet regulators' requirements are looking at 5G FWA as a way to boost speeds without having to invest in new physical infrastructure. Subscribers get improved services and operators are able to reduce costs by retiring legacy DSL networks. This is especially helpful in regions with national broadband plans driving a need for rapid deployment of faster speeds. In these situations, 4G FWA can make an immediate impact.

Another compelling use case is for fixed broadband operators deploying FTTH. A regular challenge in FTTH deployments is providing 100% coverage: many physical and financial reasons can make it too costly, complex, or time-consuming to deploy fiber all the way to every home. Since 5G FWA can be deployed quickly, it is a good tool for connecting these harder to reach homes. Subscribers can be switched to fiber later when it becomes available, liberating 5G spectrum for other uses. In cases where operators have nationwide RAN networks and regionalized fiber networks, FWA can be considered as a tool to compete out of region.

5G FWA also has the potential to meet required SLAs for broadband services demanded by small and medium businesses, adding yet more revenue. For larger enterprises, it can be used to connect remote buildings or to provide a backup connection in case of a failure of their fixed connection.

Whichever business case is pursued, one of the key advantages of 5G FWA is agility as services can be deployed quickly and easily to subscribers. With Nokia's Fastmile FWA solution, a significant benefit is its ease of installation: a mobile app helps field technicians or self-install customers quickly and simply set up the outdoor antennas, reducing deployment costs and lead times. Another app gives salespeople insight into network capacity in a subscriber's location so a guaranteed level of service can be sold every time.

Conclusion

For several years, operators have faced rising demand for residential broadband. Since the COVID-19 pandemic, demand has sky-rocketed. Network operators are now challenged with adapting to a "new normal" in digital behavior and a recognition from governments that fixed broadband connectivity is essential for protecting economies and citizens. FWA can play a role in connecting the unserved (those with no fixed broadband) and the underserved (those with broadband connections inadequate for lockdown living). FWA offers an efficient way to use precious radio spectrum and a very rapid deployment model that can connect homes and businesses anywhere that a RAN exists.

Whether it's used as part of a mobile bundle to increase ARPU, connect homes that can't be reached with fiber, compete out of region, or connect businesses, 5G FWA offers operators many ways to improve the ROI of their 5G investments.

Abbreviations

5G	Fifth generation mobile
ARPU	Average revenue per user
CAPEX	Capital expenditure
CPE	Customer premises equipment
eMBB	Enhanced mobile broadband
FTTH	Fiber-to-the-home
FTTx	Fiber-to-the-x
FWA	Fixed wireless access
Gb/s	Gigabit(s) per second
LoS	Line-of-sight
Mb/s	Megabit(s) per second
mmWave	millimeter wave
SLA	Service level agreements
RAN	Radio access network
ROI	Return on investment

About Nokia

We create the technology to connect the world. Only Nokia offers a comprehensive portfolio of network equipment, software, services and licensing opportunities across the globe. With our commitment to innovation, driven by the award-winning Nokia Bell Labs, we are a leader in the development and deployment of 5G networks.

Our communications service provider customers support more than 6.4 billion subscriptions with our radio networks, and our enterprise customers have deployed over 1,300 industrial networks worldwide. Adhering to the highest ethical standards, we transform how people live, work and communicate. For our latest updates, please visit us online www.nokia.com and follow us on Twitter @nokia.

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering the future where networks meet cloud to realize the full potential of digital in every industry.

Through networks that sense, think and act, we work with our customers and partners to create the digital services and applications of the future.

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