5G FIXED WIRELESS

INCREASING MARKET POTENTIAL WITH SELF-INSTALL TECHNOLOGY

WHITE PAPER JAN 2019
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5G Fixed Wireless is generating a lot of interest as the main initial use case for operators deploying 5G technology. This is partly being driven by the fact that the higher frequencies being used for initial 5G services are well suited to delivering high-speed Fixed Wireless broadband.

However, although 5G Fixed Wireless holds plenty of potential promise, there are some challenges to overcome in order to provide the kind of high-quality service that can offer the same end-user experience already being delivered over xDSL, DOCSIS or Fibre.

5G Fixed Wireless will give operators the ability to deliver ultra-fast broadband services using the cellular network on a widescale basis, but doing so requires an activation solution that can be deployed at scale and yet still deliver a high-quality of service.

This Whitepaper outlines the challenges and benefits of delivering 5G Fixed Wireless services and outlines the huge value of being able to offer a self-installation solution that delivers a high-quality connection to as many end-users as possible to help make the 5G Fixed Wireless business case viable.

To this point Fixed Wireless deployments have seen a range of installation mechanisms used by operators, with some operators having to invest in a full professional install to deliver the requisite quality of service whilst others have chosen not to take this path.

As 5G deployments scale up we are likely to see this continue with technical and commercial considerations helping operators determine which route to take.

The nascent nature of the 5G market means there are still uncertainties ahead of what installation methods will be possible with different spectrum via different network topographies.

However, it is clear the more subscribers that operators can connect with a self-installation method – whilst continuing to ensure optimum service quality – then the better positioned they will be.

Whilst a professional installation gives the best possible performance and allows for large cell sizes, self-installation significantly reduces the cost, improves the business case and, most importantly of all, is very attractive for potential customers – making it a critical component.
Since the early days of mobile broadband, network operators have looked to see how they could potentially leverage their existing mobile spectrum and network infrastructure to deliver a fixed broadband style service to their subscribers to generate extra revenues.

This trend has been further fuelled by the technological advances in 4G technology that have delivered greater capability and will become even more pronounced as operators move towards large scale 5G deployments.

First generation mobile services were voice-centric and provided relatively limited area coverage meaning it wasn’t until second generation, or 2G, services arrived that consumer usage really picked up.

Although the subsequent arrival of 3G services in the early 2000s saw the arrival of the first ‘Mobile Internet’ services it wasn’t until the commercial deployment of the first 4G services in 2009 that the world really saw the arrival of high-speed mobile broadband.

<table>
<thead>
<tr>
<th>Year</th>
<th>Generation</th>
<th>Description</th>
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<tbody>
<tr>
<td>1980</td>
<td>1G</td>
<td>Basic voice services. 1st analog cellular systems.</td>
</tr>
<tr>
<td>1990</td>
<td>2G</td>
<td>Improved coverage. 1st digital cellular systems.</td>
</tr>
<tr>
<td>2010</td>
<td>4G/LTE</td>
<td>Designed for data+video transmission. True mobile broadband.</td>
</tr>
<tr>
<td>2016</td>
<td>4G/LTE Advanced</td>
<td>Designed for high rate data/video transmission.</td>
</tr>
<tr>
<td>2018</td>
<td>4.5G/LTE Advanced pro</td>
<td>Designed for ultrafast data/video transmission.</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Generation</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1G</td>
<td>2.4 kbps</td>
</tr>
<tr>
<td>1990</td>
<td>2G</td>
<td>50 kb/s to 1 Mbit/s</td>
</tr>
<tr>
<td>2000</td>
<td>3G</td>
<td>2 Mbit/s HSPA</td>
</tr>
<tr>
<td>2010</td>
<td>4G/LTE</td>
<td>50 Mbit/s LTE</td>
</tr>
<tr>
<td>2016</td>
<td>4G/LTE Advanced</td>
<td>300+ Mbits</td>
</tr>
<tr>
<td>2018</td>
<td>4.5G/LTE Advanced pro</td>
<td>Gigabit speed</td>
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The arrival of 4G capability, with its higher speeds and improved quality of service, gave mobile network operators the opportunity to deliver a fixed broadband style service to their subscriber base – particularly in areas that were not able to access high-speed fixed broadband.

This was particularly important in allowing network operators to deliver fixed broadband style services to rural areas where low population densities meant their spectrum assets were not being fully utilised. In addition, this also helped operators meet government targets to provide universal broadband availability.

That is not to say that the opportunities for 4G Fixed Wireless are limited to rural areas. Although spectrum availability is scarcer in urban markets the heavier population density also means operators have an opportunity to quickly and cost-effectively offer fixed broadband type services.

However, to this point in time 4G Fixed Wireless adoption has been limited in urban markets because of the scarcity of available spectrum. Operators have been careful not to compromise quality of service for mobile voice users by overloading their network with Fixed Wireless traffic and this has been a major barrier to the adoption of the Fixed Wireless use case in urban markets.
THE ARRIVAL OF 5G WILL CHANGE THE FIXED WIRELESS MARKET

Whilst there has been much hype around the capabilities of 5G there are several technical features that will be included in the standard that are already included in current 4G LTE technology.

However, there are also some new technological features in 5G technology that will enable new applications such as enhanced mobile broadband (eMBB), massive machine type and mission critical services.

New 5G features that will help deliver enhanced mobile broadband services include Massive MIMO (Multiple Input Multiple Output), beamforming, access to new available (higher) frequencies, New Radio (NR) and network slicing.

MASSIVE MIMO

Multiple Input Multiple Output (MIMO) is a technology that uses spatial diversity to increase the bandwidth between the base station and the end user equipment. With this technology multiple antennas using the same frequency are used to simultaneously send different data streams to the end-user, increasing the total amount of data sent and therefore increasing the bandwidth.

BEAMFORMING

Beamforming focuses the power transmitted by a base station antenna in a narrower beam allowing for a longer reach and more antennas to be used in the same segment. By focussing the power in a narrower angle, a higher RF performance for the user equipment can be achieved with less interference from other users. This improves the link quality and the bandwidth the end-user can get.

NEW FREQUENCIES

New frequency bands are being made available for 5G allowing for higher bandwidths and enhanced mobile broadband (eMBB). There will be 4 areas of improvement, each with their opportunities and challenges:

1. mmWave (FR2): There is a significant amount of spectrum available in the higher frequency bands (above 20GHz) that is currently not being used for mobile telephony. The more contiguous spectrum that can be used to transmit data, the higher the data rates that can be achieved. However, mmWave does have its challenges. Due to the nature of the signals, there are many materials that absorb them which makes it difficult to transmit signals through it. Glass for example is an attenuator (reducing the signal quality) which will make it difficult to use the devices inside the home. Torrential rain has an impact on the transmission and therefore the link quality as well.

2. New mid band spectrum (sub 6GHz - FR1): although frequently used by specialized applications, governments world-wide are looking to free up bands in this range. As these frequencies propagate better than mmWave, they will play a major role in 5G and the offering of new services.
3. New low band spectrum: these frequencies are better suited for longer distances and indoor coverage and provide a more reliable connection and can therefore be used to offload some of the mid and high bands allowing for a more reliable connection and giving more spectrum to other users. However, broadly speaking there isn’t a significant amount of spectrum available so these are not likely to be used for eMBB.

4. Spectrum Re-Farming: There are still many bands being used for 2G and 3G services. Discontinuing these older technologies will allow for more bandwidth over the spectrum already acquired as LTE/NR has an improved spectral efficiency versus GSM/3G. As per point 3 above however, the amount of spectrum from these refarmed bands is usually fairly small and therefore not well suited for eMBB.

NEW RADIO

New Radio (NR) is the new standard for the radio interface of 5G and is a new type of signalling allowing spectrum to be used more efficiently and therefore get more bandwidth. There are several new innovations that define NR, all focussing on getting the most out of the available spectrum over all the frequency bands.

NETWORK SLICING

With network slicing operators can virtually split up their network which will allow them to offer different services using the same physical equipment. This means operators can assign different Quality of Service (QoS) levels to different services, but also use different data flow paths resulting in the most optimal path for each service.

As fixed broadband users will have different expectations from mobile broadband users, this will allow the operator to make that distinction and cover both types of demand from the same network. Network Slicing is achieved through software; it limits the number of physical assets to be put in place to make the distinction allowing for a faster and more cost-effective implementation of network infrastructure.
Although mobile networks can deliver a fixed broadband type of service to end-users it is crucial to understand the different expectations that end-users will have when using mobile and fixed broadband services.

In terms of the kind of quality of service they expect end-users have different expectations from their fixed broadband service than what they have when accessing a mobile broadband service.

This means operators need to focus on three key areas to make sure that their Fixed Wireless service can deliver the kind of quality of service that end-users expect from their fixed broadband solution.

**RELIABILITY**

Mobile end-users usually understand that there are limitations to the network when it comes to broadband connectivity. Therefore, they accept that the performance of the network can be highly variable, ranging from very good at one moment in a certain location but then perform significantly poorer in another location.

Furthermore, mobile end-users have a different mindset in terms of their expectations over device management as they buy and manage their own mobile device, meaning they take personal responsibility for its optimal performance, they don’t expect the operator to do this on their behalf.

By contrast, fixed broadband subscribers have very different expectations, largely derived from the fact that their connection hardware is normally supplied by the operator – meaning the end-user expects the operator to take responsibility for ensuring its optimal performance.

In addition, fixed broadband subscribers expect their service to deliver a constant and stable connection to the network and find outages and fluctuations in speed and latency unacceptable. Even though service quality issues may indeed be on the customer side of the network, subscribers will typically attribute fault to the network operator when they occur.
SPEED

Network speed is one of the main selling points for fixed broadband services with operators advertising headline speeds and differentiating different products based on speed in a manner that doesn’t happen in the mobile market. This creates higher expectations on the speed offered and a sustainable minimum speed is therefore a must.

As a result, many fixed broadband end-users are heavily focused on making sure that they are getting the speeds that they have been sold and will regularly use the number of speed-test tools available to test their connection speed.

This subscriber desire to ‘get what I pay for’ is not unreasonable given that many end-users choose packages based on their actual bandwidth needs and will want to ensure, for example, that they have enough bandwidth to deliver multiple HD Netflix streams in the evening without suffering quality of service issues.

SUPPORT

In a mobile service, the end-user is responsible for their own mobile device and will therefore try to troubleshoot a potential problem themselves first or perhaps even contact the device manufacturer – they will not typically seek to engage their mobile network operator.

By contrast, in a fixed broadband service, the end-user will often contact their service provider for the smallest interruption in the service, even though problems are frequently located on the customer side of the network and are outside the immediate control of the operator.

This means that it is critically important for network operators delivering Fixed Wireless services to have the right tools to manage and diagnose a problem that is occurring in order to ensure the right level of customer experience and support.

The ability to properly diagnose and fix service problems is increasingly important given that regulators across the world are starting to implement requirements for network operators to be able to maintain certain Service Level Agreements (SLAs) with their customers or face financial penalties.

This means that a ‘best effort’ approach is simply not enough from an operator perspective when they are delivering Fixed Wireless services to end-users – they need to take active steps to ensure they can diagnose and fix problems involving in-home equipment.
In a traditional mobile network, the demarcation point and therefore the visibility and control of the operator is at the base station. To meet the requirements of a true fixed broadband service, operators need to go further and have control of the device installed at the end-user’s premises.

As the Fixed Wireless modem inside the home will generally be in a fixed position the network connection should be consistently reliable – but post-installation the operator needs to be able to have control over the device to run the latest software and troubleshoot if issues arise.

Although 4G networks have now been deployed worldwide every network deployment is different with operators needing to solve several challenges to deliver a quality connection – and the same will apply to 5G networks as they are deployed.

For example, with small cells being introduced for 5G the network topology will immediately be very different to what was deployed on 4G and, in turn, this means that depending on cell size and power output that the end-user device will need to have different characteristics.

As a result, given the different types of 5G networks that will be deployed, both in terms of topology and radio spectrum being used, there is no one-size fits all solution for Fixed Wireless deployments with a range of options being required.
5G FIXED WIRELESS SOLUTIONS

In order to successfully deploy 5G Fixed Wireless at scale network operators need to be able to offer a self-installation option – delivering the best possible quality of service – to the largest number of end-users possible.

However, although testing of 5G in the higher frequency ranges is still in its relative infancy, there is a consensus emerging that 5G Fixed Wireless self-installation will not be possible in these higher frequencies meaning that a costly professional installation will be required.

Although a professional installation would deliver the requisite level of service quality the cost of delivering it has a major impact on the 5G Fixed Wireless business case with costs potentially reaching several hundred dollars per subscriber connection.

Even if professional installation costs can be reduced then the end-user connection experience is still negatively impacted because the subscriber will need to wait for an engineer to visit their premises before their service can be activated – and will often need to take an absence from work to do so.

By using the experience gained over ten years with professional installation of a Fixed Wireless modem, NetComm has developed a solution that can easily be used by the end-user to deliver the best possible 5G Fixed Wireless network connection both in the sub 6GHz range as well as in the higher spectrum ranges.

The platform enables self-installation to more end-users and therefore increases the opportunities that operators can leverage from 5G Fixed Wireless.

The solution consists of two major components:

1. Ground-breaking Self-Install technology
2. Extensive device portfolio to suit different installation requirements

SELF-INSTALL TECHNOLOGY

Operators looking at providing 5G Fixed Wireless services must focus on how they can deliver a true plug and play installation and activation experience without impacting the quality of service.

With 5G’s higher frequencies, the position of the 5G modem to the base station becomes more crucial to ensure the end-user is maximising their network connection.

mmWave products require directionality and therefore require an even more accurate placement of the CPE within the premises. The Self-Install technology helps the end-user to position the CPE in the optimal place to get the best possible experience.

With an easy to use, end-user friendly step-by-step guide, optimal connectivity can be assured while offering a convenient plug and play solution. The Self-Install technology indicates connectivity strength, not only by LEDs on the device, but also through a mobile application usable by the end-user.

The mobile application is designed to help the end-user locate the closest base station as well as find the best room in the house to install the device. By allowing the end-user to link the network information with the signal strength, significant costs can be saved.

Through extensive research, user experience (UX) testing and validation, NetComm has innovated this technology which will revolutionise the installation and provisioning process for the operator and the end user.
EXTENSIVE DEVICE PORTFOLIO

Every network is different, every operator will face different challenges. Differences will be encountered in frequency bands used and cell density will depend on the type of 5G base stations. To support all network topologies, a certain level of customization will be needed. There are 4 key locations where the device can be installed:

1. **Indoor desk mount**: uses a 5G Indoor Gateway, which is a fully integrated WiFi and Ethernet gateway that features powerful internal antennas and should be set up in a location with the strongest signal strength.

2. **Indoor window mount**: uses a 5G Indoor WiFi Modem which can be mounted on the window to maximise overall 5G connectivity or mounted on a desk in an optimal location within the premises.

3. **Outdoor wall mount**:
   - a. **Self-Install 5G Outdoor CPE** is mounted by the end user on the outside of the premises in a direction facing the closest 5G base station to optimise connectivity. Ideal for mid to high density locations.
   - b. **5G Outdoor Mid-Gain CPE** is ideally installed on the outside of a premises by a technician in a location that delivers the strongest signal strength. As a mid-gain solution, this device is ideal for mid-density suburban style deployments.

4. **Outdoor roof mount**: uses a 5G Outdoor High-Gain CPE integrates powerful high-gain antennas and is installed by a technician who will install the CPE either on the roof, or under the eaves to optimise the line of sight connectivity to the base station.

All these devices support both sub 6GHz bands as well as mmWave. The mid-bands always provide a reliable connection while the mmWave bands are used to offer higher speeds on top of the basic service.

To tailor for a specific mobile network, NetComm works together with its customers to fine-tune these standard solutions to allow for the most optimal solution.
Operators around the world will face different challenges when deploying their 5G Fixed Wireless networks – no two networks will ever be the same.

This means operators must be able to find a tailored solution that will meet their unique needs in terms of the spectrum they are using and the type of 5G Fixed Wireless network they are building.

In most cases, operators will need different solutions depending whether the customer device can be installed indoor or outdoor and whether a technician is available or not to conduct an install.

However, to avoid multiple qualification cycles, a uniform base station interaction between the indoor and outdoor version is important.

NetComm offers a wide suite of products and years of experience in the Fixed Wireless industry to guide operators in their journey to add Fixed Wireless to their product offering.

NetComm has over a decade of experience in building Fixed Wireless devices – we built our first devices all the way back in 2006 – and we have evolved our solution to a point where it can be deployed as a true alternative for fixed broadband services.

NetComm’s devices are designed to cater for broadband growth and with robustness to assure a long lifecycle to reduce the number of truck rolls over the years – therefore making opex savings and increasing profitability.

Additional features such as compass and GPS as well as optimized tools to improve the installation process help to maximise first time right performance and remote SLA monitoring.

To get the most efficiency out of the network and guarantee the highest bandwidth, the RF link budget plays a major role. The optimized antenna design and installation process allows for the best performance.

Our experience as a pioneer in the Fixed Wireless space over the last decade has taught us that the right installation – either by a professional installer or via self-install – will minimise future truck rolls and calls to operator help desks from disgruntled end-users.

In short, getting the installation and activation process right means more profitable Fixed Wireless services for operators and, just as importantly, happier end-users.
The arrival of 5G technology will make Fixed Wireless services an even more valuable tool for operators to expand their service options by offering a fixed broadband service to their subscribers. With the new additions to the new 3GPP standard more bandwidth is available, and more subscribers can be served in the same segment, allowing for better quality of service to be delivered.

In particular, the arrival of 5G Fixed Wireless opens huge opportunities for operators that are currently offering only mobile services and have not yet moved into the fixed-broadband space - because 5G Fixed Wireless will allow them to offer fixed broadband services in areas where they couldn’t before.

However, although the opportunities are there for mobile-only network operators to use their existing networks and spectrum to expand their customer base and increase revenues from 5G Fixed Wireless they need to understand that customer requirements are different.

A fixed broadband customer has different requirements than a customer that is only receiving mobile services – the former expects a higher quality of service.

This means that 5G Fixed Wireless operators need to extend the trusted zone and have visibility of the end-user device to deliver the reliability, speed and support that fixed-broadband customers expect.

The final piece of the jigsaw for 5G Fixed Wireless is ensuring that as many customers as possible can self-install the service.

Not only does self-installation potentially save hundreds of dollars on engineer truck rolls to connect subscribers but it also provides end-users with an immediate connection to ultra-fast broadband without having to wait lengthy periods for their service to be activated.

A self-installation option that still delivers the optimal connection to the 5G Fixed Wireless network will deliver operators a great opportunity for successful and profitable 5G Fixed Wireless services.

As a pioneer in delivering solutions to Tier-1 Fixed Wireless operators all over the world over the last decade, NetComm is the partner of choice to build bespoke solutions that fit the needs of each network perfectly.

All 5G Fixed Wireless networks will be built differently meaning that all customer devices will also have a range of different requirements - with our unique expertise NetComm can tailor an optimal solution for each of them.
NetComm is a global developer of solutions that bridge the gap between fibre and the end-user. In a world where everyone’s connected life matters – no home, device or machine is too hard to connect. Fibre networks create new revenue streams while delivering the minimum bandwidth needed by all today, but the final connection of fibre to end-user equipment has proven to be challenging. New technologies such as VDSL, Gfast, 4G and 5G are therefore used to speed up deployment and reduce costs. At NetComm we understand that no one-solution fits all. Every operator is different, so we build the right technology, enclosure and size, to meet specific network, market and geographic conditions worldwide.

netcommwireless.com