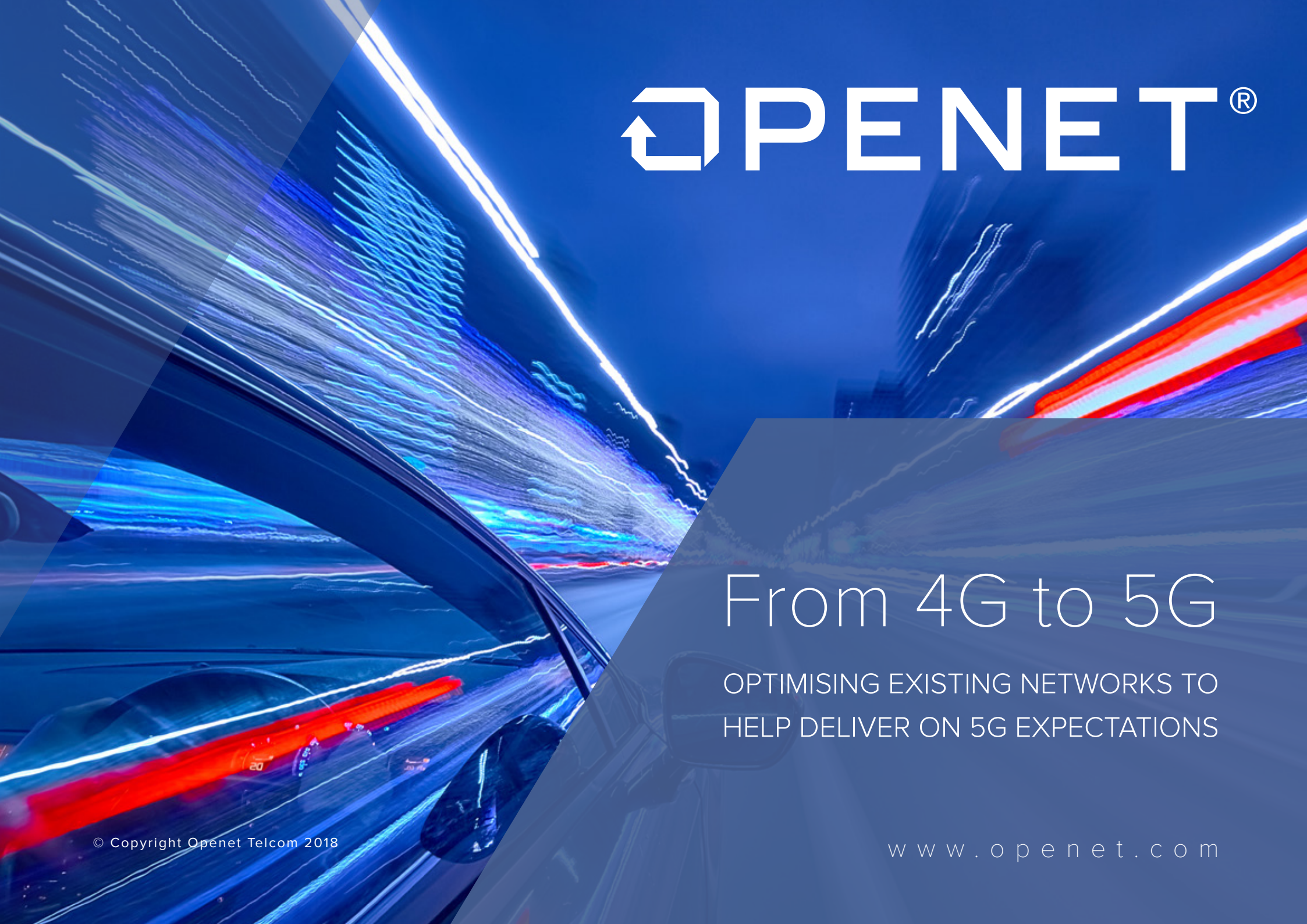

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From 4G to 5G

OPTIMISING EXISTING NETWORKS TO HELP DELIVER ON 5G EXPECTATIONS

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Abstract

5G is “not just another G” but will coexist with 3G and 4G for quite some time. Meantime, data traffic is still growing explosively on most networks. Improvements to the way existing cellular networks are accessed alongside new spectrum, and better optimisation of individual user experiences will deliver a more effective roll-out of 5G.

Introduction

With all the industry talk of 5G it’s easy to forget just how much some operators have been doing to optimise their use of their existing 3G/4G assets and enable dramatic improvements in customer experience with relatively little effort. The industry may be at risk of repeating the hype of past “G’s” when it comes to 5G. After all, most users simply want better coverage or faster speeds in the most cost-effective and consistent way possible regardless of the “G”. Sure, 5G promises lots for future services and has lots of cachet but in itself may hold little value if the same or sufficient experience can be provided more consistently by alternative means. Nobody has said 5G will be easy to roll out of course however the focus has tended to be on the end result (5G everywhere) rather than inevitable phases in between. The value derived along the stepping stones towards it could be improved if the right foundational enablers are in place combined with optimal use of existing assets. The same enablers may even continue to be of use following 5G deployment.

1 5G: It's Not All or Nothing

Early motivators for operators to roll out 5G include: competitors rolling it out, fixed-wireless access (FWA) i.e. fixed line replacement, congestion in busy areas, predicted IoT requirements, bandwidth demands and low-latency use case predictions (such as for remote surgery). Operators already typically have a mix of 2G / Edge / 3G / HSDPA / HSPA+ / 4g / WiFi – not to mention fixed access, point-to-point solutions and various wholesale partner options, making up what they collectively describe as their "network" (singular). Most won't replace existing technologies as 5G comes along although 2G and perhaps 3G will be repurposed for IoT use by some operators. In many cases 5G will be a further addition.

In practice, operators often have a variety of (often under-used or cheaply extendible) existing network options in place and may never have full coverage with 5G. Many providers will roll out 5G gradually, depending on regulatory requirements. In many cases they will continue to rely especially on their existing 4G core networks for some time. The result for many will be a hybrid or "non-stand-alone" (NSA) network made up of old (relatively proven) elements and new (relatively unproven) aspects. This is reflected in forecasts of the global mix of technologies (Fig. 1).

If anything there will be a need for tighter controls of these interworking networks as the transition to 5G continues. This is in the context of increased demands from a larger number of devices (especially for IoT) and ever more intensive use of the hybrid network (especially for video as well as augmented and virtual reality services).

To add to the challenge, the upfront cost of 5G spectrum if anything further increases the incentive for ever more optimal use of existing 4G (and other) network assets including WiFi.

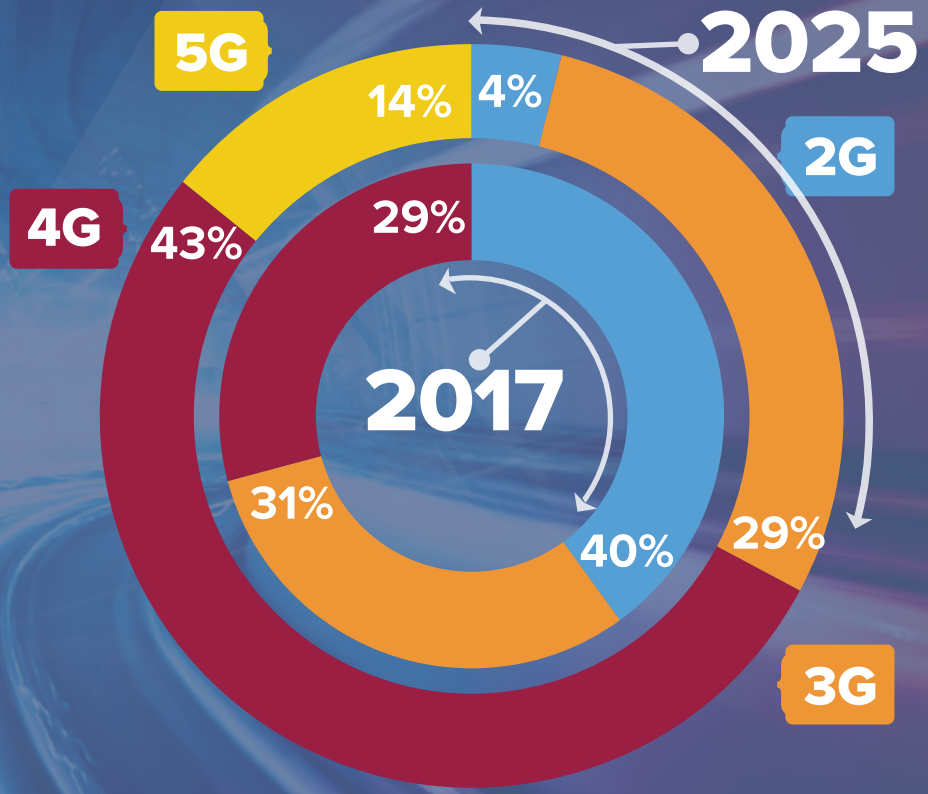

Fig. 1: Global Technology Mix Forecast, Source: GSMA Mobile Economy 2018

2 WiFi? Why Not?

Perhaps because of the ease of implementation of WiFi with unregulated spectrum it has become diluted in terms of quality in many markets. It has often been under-managed and for some consumers has become almost a dirty word in the face of “all you can eat” (albeit often capped) 4G bundles.

Figure 2: Normal Operator Traffic Split Between Wi-Fi and Cellular; Source: Openet

Attention has shifted significantly to 5G as an enabler of bandwidth but how fast will 5G really be? Where it becomes available it may not be quite as fast as predicted by some. Though theoretical speeds are around 1Gbit/s, if the core network is still 4G and there is limited coverage as well as limited numbers of 5G-dependent use cases in any event then a user may be just as well off with their (presumably lower cost) WiFi for some time. WiFi is still heavily relied upon (Fig.2). WiFi over reliable 4G could be reinvigorated as an offering in the near term to compliment 5G as it rolls out. In any event 5G is likely to be advertised as “where 5G coverage is available” but this is likely to manifest itself as mainly 4G (or potentially WiFi over 4G) in the early stages of 5G.

Meantime, smartphone consumption of video in North America makes up 56.6% of all video consumed there. Long form video (more than 20 minutes) now makes up almost 50% of that mobile video traffic*. Users are watching more video for longer on mobile. Video is expected to account for over 75% of all mobile traffic by 2020** and therefore on some networks it will be significantly higher.

But in parallel, users have become much more inclined to stream rather than download (think of Netflix, Spotify and so on). So the need to download huge files faster is less of a consideration. There are very few current, mainstream and near-future video or other bandwidth-hungry use cases that 5-10Mb/s over reliable WiFi won’t enable. High-definition (HD) video streaming generally requires 3-6Mb/s. Even if a user requires 25Mbit/s for Ultra HD virtual reality, Wi-Fi combined with a quality commitment doesn’t have to be a mere “fall-back” or best effort alternative.

*Ooyla Global Video Index, Q1 2018.

** BI Intelligence, Digital Media Briefing, June 2017

3 More G's, More Segment Opportunities

WiFi may even be a brand opportunity for some companies as others inevitably struggle with rollout of 5G. In addition to dramatic wholesale cost savings, evidence suggests that improvements of up to 30 points in Net Promoter Scoring (NPS) and 20% reduction in churn are achievable with effective WiFi offload using Network Selection Intelligence in congested areas*.

Although "free WiFi" as an offering everywhere from cafes to bus stations has become a bit jaded and less trusted in some markets than 4G, carrier-grade coverage and experience can be excellent when zero-touch WiFi empowered by the operator app on the handset is backed up with a reliable 4G network and sufficient control. Hotspots can be prioritised or blacklisted in real-time depending on how they are performing and individual users can be prioritised depending on their bundle. WiFi still represents service provider branding and premium service opportunities as Comcast and AT&T have generally enjoyed in the USA.

Meantime, amid concern that 5G requires ever more base stations, however discretely located, they could cause some consumer backlash. Alternatively, wherever 5G coverage is simply not quite as advertised that could also cause backlash. Simple time-to-market will also be a factor for 5G compared with long-established and well-understood WiFi. Where existing fixed line or mobile (4G) networks exist, WiFi supported by carrier-grade control can be deployed in days or even hours. The same simply cannot be said yet for 5G.

Devices need to be upgraded for 5G but users upgrading to top-end 4G devices in late 2018 or 2019 will expect good value for money in years to come. 5G could be something of limited virtue for many subscribers for years. Meantime traffic growth continues at pace. Even ignoring the next generation of WiFi (version 802.11ax due in 2018 promises theoretical speeds of up to 14Gbit/s), there is still plenty of WiFi opportunity, whether that is public or private or whether it is WiFi over: Fibre, cable or good old reliable 4G. WiFi options are still worth considering as part of efforts to improve the user experience, whether via a service provider's existing brand, a sub-brand, 2nd brand or entirely separate entity.

* Source: Openet results using 3GPP ANDSF Network Selection Intelligence

4 Congestion Control: Same Juice, More Flavour

With data traffic growing by over 60%* on many supposedly mature 4G networks, operators will need to consider available options in advance of having end-to-end 5G. Many if not most networks will not be end-to-end 5G standard for some time. Multi-purpose, 5G standards-based functions such as NWDAF (Network Data Analytics Function) may not be easily integrated into an existing ecosystem and when they are, they may only speak to the 5G side of the network. But a "data crunch" is already happening on many networks. What may have been seen as "all you can eat" 15Gbit bundles a couple of years ago can now seem constraining to Netflix boxset addicts. What should operators do right now? Simply giving away more Gbits in the interest of "all you can eat" in the hope that 5G provides sufficient capacity later may not be sufficient and has network capacity implications.

One option is to re-explore the seamless network selection options relating to WiFi mentioned above in order to restore users' experiences. Where WiFi is simply not available or congestion cannot be predicted, another option is congestion management at the RAN side on the 4G network using a 3GPP-supported RAN Congestion Awareness Function (RCAF). Operators such as Sprint have been leaders in fine-tuning such RCAF implementations. If a cell becomes busy, real-time determination of application usage can potentially trigger finely-tuned individual user experiences that more precisely adapt to the available capacity in a cell. In other words, why treat a person only using email the same as one using Netflix with the result that everyone receives Netflix-capable bandwidth? The result is gross inefficiency in the network.

Going further and handling users a little differently based on their specific device capability can provide further efficiencies e.g. if they have a small screen and are only watching daily news videos or weather forecasts why provide them with HD video quality if it is not expected or required? Or, depending on the conditions of the network and current individual usage, apps working in the background could be temporarily deprioritised.

Such use cases can be fine-tuned even further based on geography or time-of-day expectations e.g. typically congested urban areas or transport links can be prioritised for control during rush hours or such controls can be activated if there is a non-normal traffic event (such as an unexpected traffic accident or arrival of a flashmob or conference group at a location even during off-peak hours). Or there can be de-prioritisation if surges in use look like network attacks. Further, in advance of end-to-end network slicing and prioritisation that 5G promises, congestion control could provide confidence to specific content (e.g. video) partners that congestion can be more tightly controlled.

The inconsistent availability of 5G as it rolls out and the potential it provides to are all the more reason to consider enablers that smoothen the personal experience at an individual application level before it arrives. Without a smooth transition to 5G, users are as likely to be as cynical as they remember they were during their transitions to 3G and 4G.

* BBC podcast: "Will 5G Revolutionise Our Lives?", 2nd June 2018

5 Data Cocktail

WiFi and RAN congestion control tools have been around for a while. So what's different now?

WiFi has been through a few phases but its easy availability has perhaps diluted its brand. That in itself should be easily fixable as described above. The same holds true for 4G RAN controls of course. RAN efficiency tools have been around for some time but can be quite isolated from other elements of the network or other access points such as WiFi. Again, that can now be more powerfully implemented as a point solution as described above.

What has evolved is the more combined experience of seamless WiFi access with RAN controls that may be the basis of a secret sauce for operators. These enablers have been fine tuned to become more serviceable in combination. So for example if a user is in a congested area but is not mobile for a period of time they are seamlessly enabled on WiFi if its quality (signal strength) is above a prescribed level on trusted access points. Less stationary users in the same area are handled in real-time via a carefully managed but powerful set of RAN (RCAF) controls at an application-specific level. The combined effect on user experience and network costs can be dramatic.

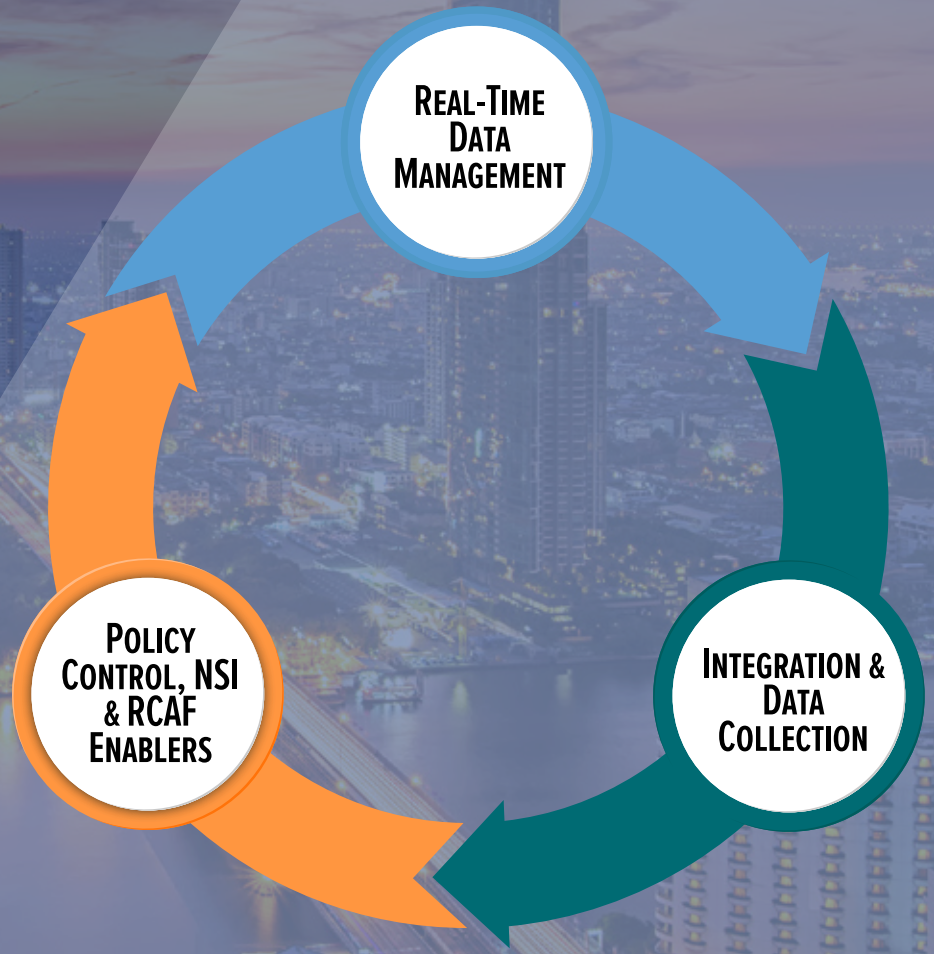

Fig. 3, Virtuous Circle of Key Enablers

5

What has evolved significantly further however (Fig. 3 previous page) is more powerful, real-time use of data. Improvements in real time data visibility (Fig. 4) and integration into a single, more manageable fabric that is more efficiently able to prioritise and activate what is most relevant is now truly feasible. More proven and efficient use of analytics and artificial intelligence provide further incentives to drive efficiencies long talked about in the telecom space but rarely cohesively implemented in practice. Open-source and easy to deploy data-handling software like Hadoop have provided a much-need boost to existing enablers. This is regardless of but complementary to the availability of 5G.

What were previously delivered as point solutions and best-effort control of silos of disparate technology are now possible to more powerfully and cohesively control with the injection of real-time data. Thus for example a single user could make use of 4G but when using Netflix in a busy area they move to WiFi while they are stationary. That user might move seamlessly back to 4G or even 3G as soon as they are on the move again. All with the benefits for the service provider of more effective network utilisation whilst accounting for the individual's preferences. It is a more dynamic set of controls, interweaving access technologies with real-time data relating to network conditions as well as individual subscriber preferences. It becomes more powerful still and perhaps more essential in the 5G environment, when a greater number of services are enabled.

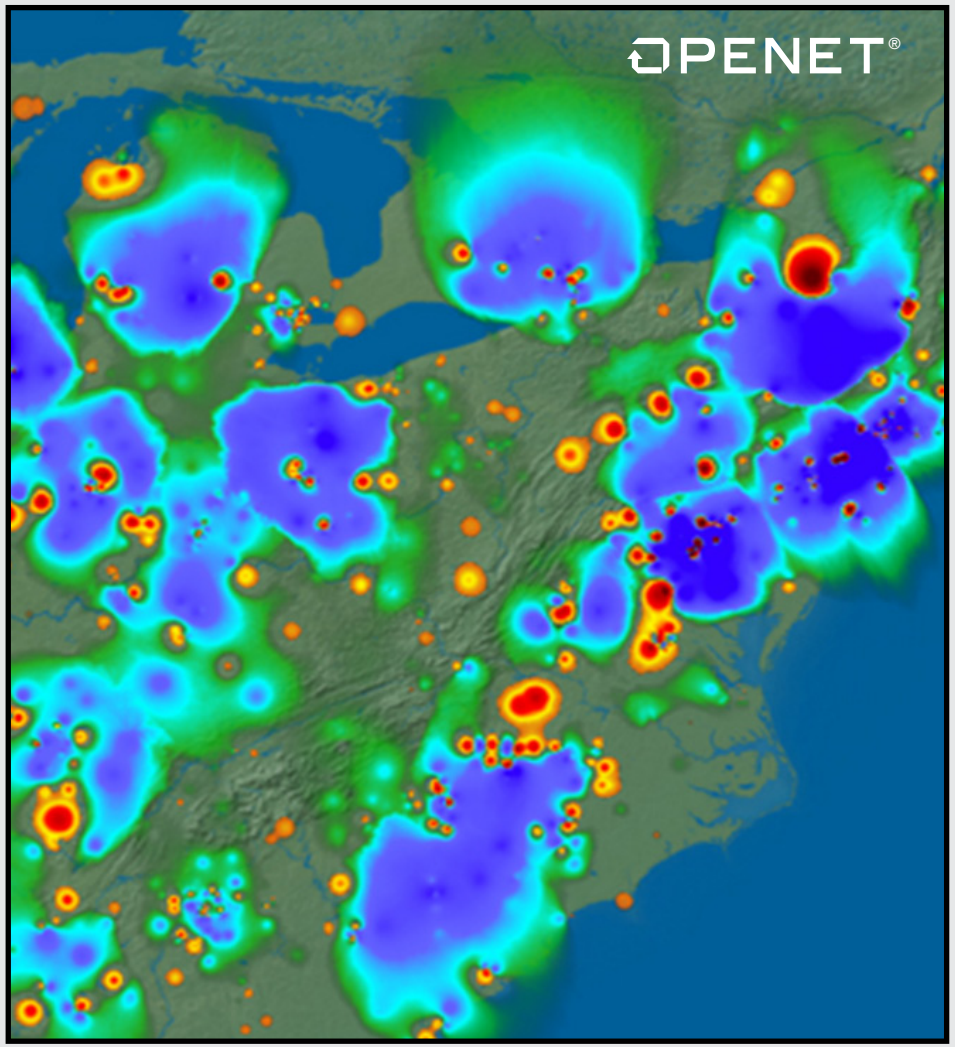

Fig. 4: Traffic Heatmaps; Source: Openet

6 Conclusion: Dream On, Stay Grounded

Fine-tuning existing solutions can provide many operators with astounding opportunity for cost savings as well as user-experience improvements. Even assuming 5G is all that it is cracked up to be, it is just one additional enabler in a combined suite of assets for most providers. It too will need fine-tuning with tools, such as the ones mentioned here, to insure best use of resources in the context of all that has gone before it. 5G won't happen overnight but having the right visibility and "cement", in the form of enablers and data management, between what can be disparate networks that disrupt rather than enhance the user experience might be the source of competitiveness for years to come.

Being able to robustly promote a reliable and clearly understood 4G-based service in the absence of a consistent and pervasive 5G is an extremely valid offering that still has opportunity in the medium term. For example, many IoT services can be catered for and are already being catered for on 4G. This is not to say that 5G doesn't hold enormous potential but some competitors may roll it out in a rather lumpy way. The competitive battle may be fought and won in the middle ground of 4G and enablers that can be deployed in weeks rather than in the end-to-end rollout of 5G for services that may yet be several years away for mainstream consumption in many markets.

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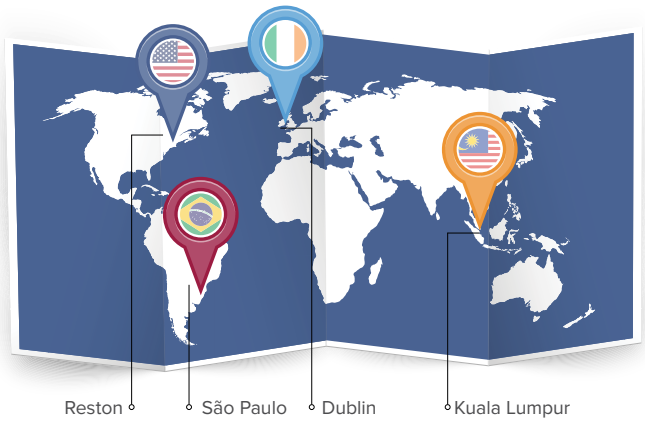

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We passionately believe that the most adaptable businesses are those that prosper best. We help our customers transform their businesses and access new revenues and profits by using the latest technologies and methods – in ways ranging from augmenting existing architectures or replacement with more agile and cost-effective end to end platforms.