Charging's Next Phase
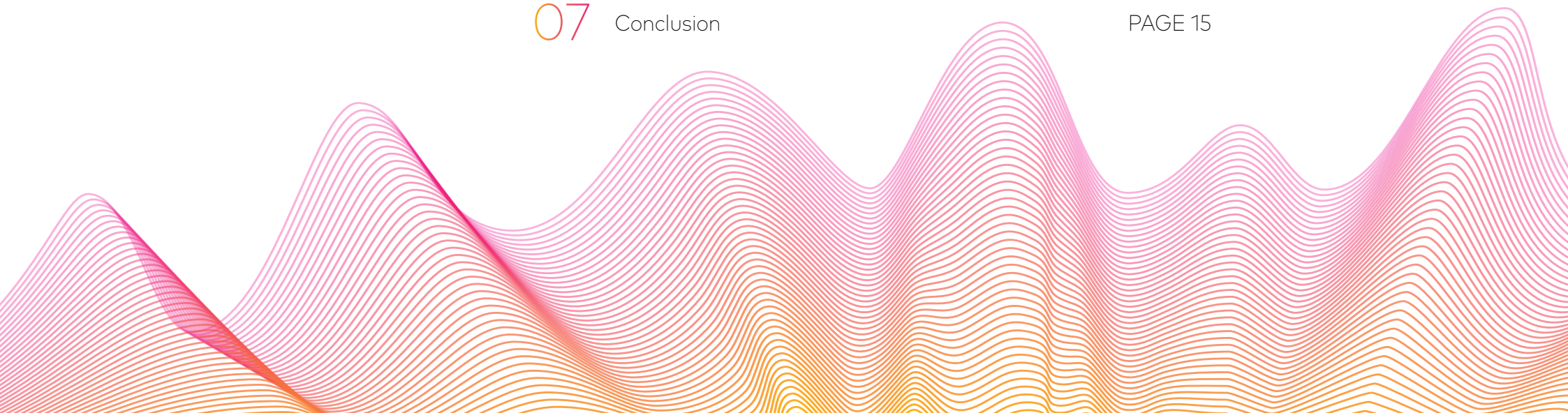
A different kind of charging is needed to optimize returns from 5G

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Introduction

As forward-looking service providers have come to find, the greatest challenge they face is overloaded and overly complex 3G and 4G monetization systems that are not up to par for an expansive 5G universe. Research analyst Omdia launched a publication titled Monetization in the Era of 5G in 2020 highlighting that a significant number of Operators had concocted a spaghetti of more than 50 revenue management systems in their stacks. Even prior to the ambitions of standalone (SA) 5G and all its potential, there were already huge challenges to transformation.

As 5G-driven services start to grow exponentially and diversify these already burdened 4G monetization environments are, in many cases, likely to break. Many are not Cloud-based and have limited scalability (both up and down) in ways that efficient automation of new services require.

Operators that previously thought in terms of millions of SIM cards are now planning for billions of connection points, driven by eSIMs and iSIMs, for everything from security cameras to vehicles to connected stadiums and lamp posts. With this level of scaling a fresh approach to service launch

is needed, and hence, cannot be from a bygone era as it also requires consolidation from previous systems (i.e. 4G and 3G). The total cost of ownership on a per-connection basis needs to be significantly more efficient at this scale. It also needs to be SaaS-based with updates seamlessly operating in the background.

For many organizations, beyond telcos, service diversity needs to be even more smartly managed by a range of business teams who demand the end-to-end service visibility on behalf of customers. All of this has organizational implications for most service providers as they rethink their structure and reorientate themselves for post pandemic expectations. For telcos it needs to encompass more user-friendly charging capabilities for diversified teams.

Monetization itself can also become a prime source of innovative value for service providers. Consider the ways in which new banking and payments companies have become disruptive to traditional finance, such as Revolut and Square and Checkout. com. Each provide an ever-expanding range of services such as insurance, investment products and lending beyond their core payments business. For example, one service they all aim to provide is "buy

now, pay later" – such innovations become easier if the building blocks that make these operations possible are not entirely constrained by outdated infrastructure, policies, and practices.

With the diversification opportunities as well as the focus on enterprise verticals that 5G charging can provide, there is an opportunity for service providers to consider the best method of evolving into arenas such as the digital economy. Tomorrow's focus and revenue (Figure 1) can be built upon today's experiments if the right focal points and building blocks are consolidated.

In this paper, we elaborate on some of the above topics with an emphasis on how charging can become a key focal point for service creation and the evolution of 5G.

Early Lessons from 5G

As it turns out, 5G is slightly more complicated than anticipated by some in the industry. After all, there has always been a need to factor in the still evolving landscape of the previous 2G, 3G and 4G. There was no expectation that those "Gs" were going to be unplugged immediately or even any time soon, especially in the case of the latter. Inter-working considerations were top priority for service providers and will continue to be in the foreseeable future. Coverage is one factor – it is now common knowledge that 5G is unlikely to be pervasive. Equally important is that 5G frees up capacity for 4G and this will elate accountants with continued and perhaps increased returns from 4G assets. All of this has ramifications on the types of new services that can be launched and where they can be supported and monetized. 5G may be as much about managing expectations and delivering on them as it is about the next wave of yet-to-be imagined services. Either way, charging has an intensified role to play.

5G is indeed different, and not only in terms of the potential improvements to latency, speed, coverage capacity and density combinations that service providers can expect to offer. Functions, such as charging, are discoverable and "smarter" as they register themselves with the Network Repository Function (NRF). With the ability to communicate across the network

more autonomously, allocating and releasing resources as required, and realize commercial opportunities as never before. Charging will have to respond accordingly and seamlessly to such automation, with advances in real-time charging requirements to cater to more diverse service mixes and consumption models alike. Moving functions to the Cloud has brought its own set of challenges specific to the communication industry's evolving 5G functions and moving to cloud-based charging has been no exception. Merely porting existing functions and services as they were defined in 3G and 4G in the hope alone of upgrading to handle 5G expectations and opportunities will not suffice. Thus, a more cohesive approach is vital to its success.
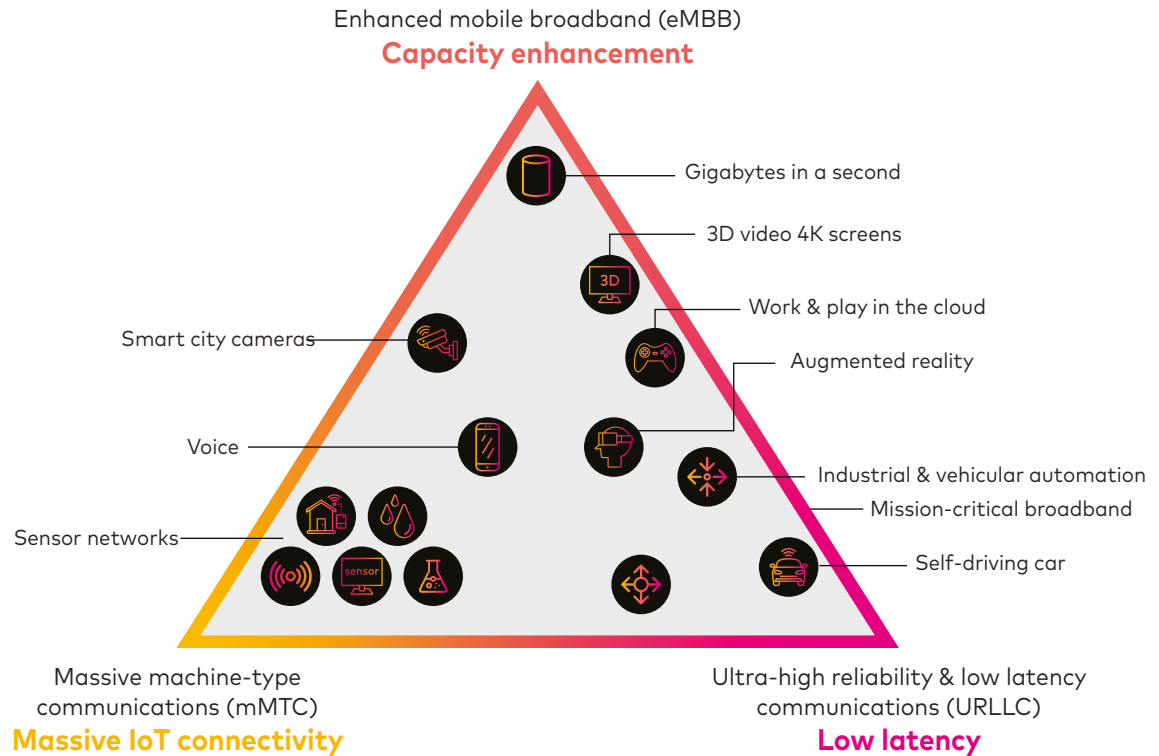

Enhanced mobile broadband (eMBB)
Capacity enhancement

Gigabytes in a second
3D video 4K screens
Work & play in the cloud
Smart city cameras
Augmented reality
Voice
Industrial & vehicular automation
Mission-critical broadband
Sensor networks
Self-driving car

Massive machine-type communications (mMTC)
Massive IoT connectivity

Ultra-high reliability & low latency communications (URLLC)
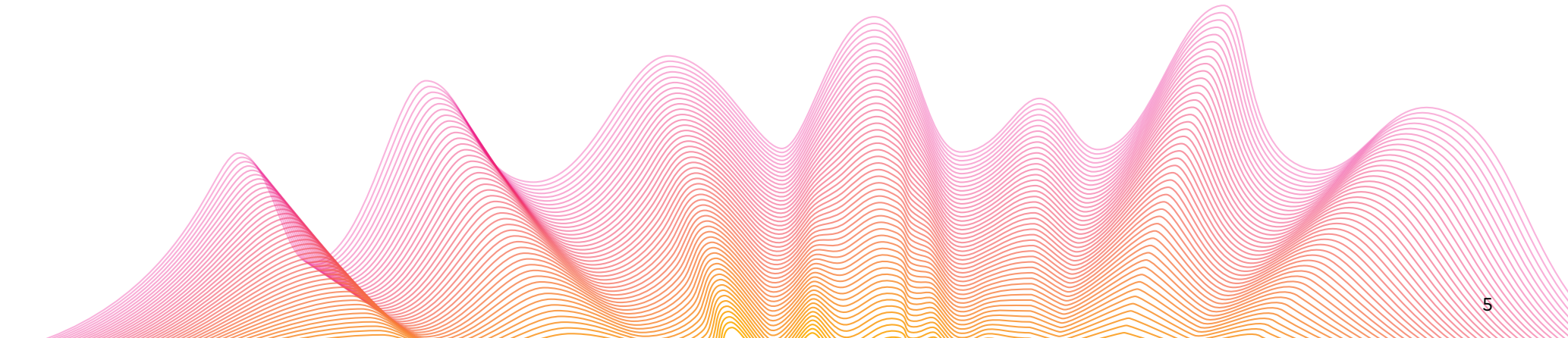**Low latency**

Fig.1, Much More Possible with Standalone 5G (source: TM Forum)

Cloud-Native Implications

5G has expanded the number of functions within the network, and many operators are pursuing strategies that involve a myriad of vendor solutions across the core network. Even though the standards are well defined, in scenarios where multiple vendors are responsible for the different network functions, alignment is crucial. There are also considerable implications for how and where these functions are deployed, particularly in a specific Cloud or across a hybrid Cloud. However, the potential still stands with arguably more severe implications given the rising number of 5G functions, for greater reliance or lock-in in scenarios where a single vendor is the supplier. By contrast if there are multiple vendors involved, an optimal level of interworking is necessary.

The most important 5G function for business success is charging, and hence, the reason for further discussions around Cloud choices. Given the relation of the cloud to charging possibilities it is imperative to assess and address early on and create a calculated ripple effect for the wider service provider business. The decisions pertaining to Cloud choices and function vendors are intertwined and can potentially have commercial resonance for decades to come. It is important

that these decisions are not constrained by partner ecosystems and supporting tools (particularly Cloud). So, agnostic frameworks as well as Cloud add-ons are better measured as early on as possible. More importantly, old (3G/4G) toolsets will not easily work in an evolving Cloud-based environment. For this reason, early investment in tooling and training will pay off enormous dividends and help minimize constraints further down the line.

Amid this additional complexity and potential is the rapidly evolving and draw up considerable questions around security. Service providers are quickly realizing the need to prioritize the "4 Cs": Cloud, Cluster, Container and Code. In other words, the choice of Cloud is one thing, but ways in which applications are securely deployed and made robustly future proof are further considerations. As the ambition to expose 5G at scale remains and evolves into actual partnerships, the prospects of securely exposing functions, including charging, with all the vulnerability that entails is now firmly at the top of many priority lists.
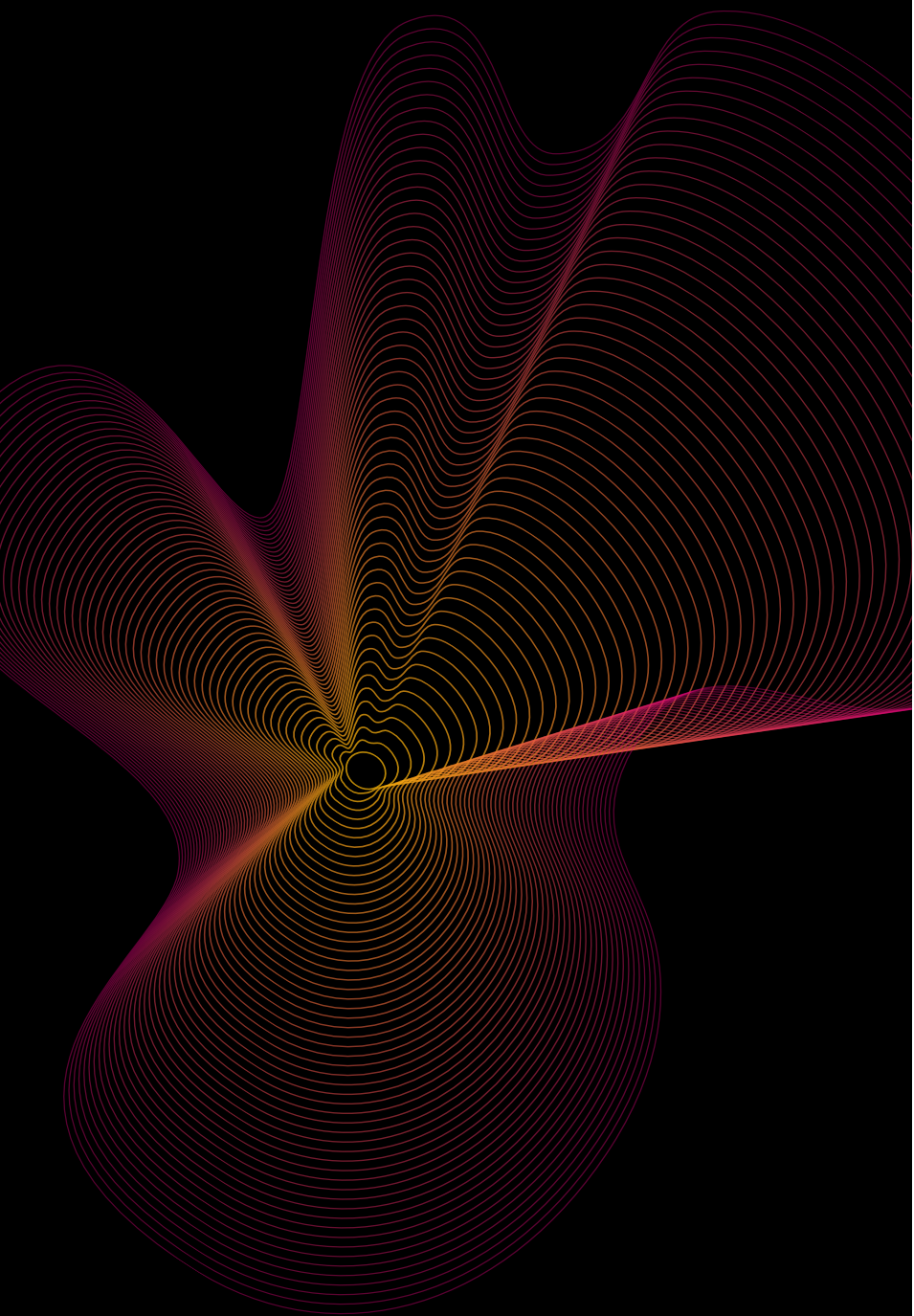
- **Cloud**

  Different Cloud providers have specific recommendations for security in their Cloud environment so recommendations will differ based on provider.

- **Cluster**

  Two areas of concern for securing Kubernetes:

  - Securing the cluster components that are configurable

  - Securing the applications which run in the cluster

- **Container**

  This layer focuses on steps that can be taken to increase security at the container layer, this includes things like vulnerability scanning, OS dependency vulnerabilities, image signing, user privilege and container runtime isolation.

- **Code**

  Application code is one of the primary attack surfaces over which service providers have the most control. There are a range steps you can take to increase the security of your code.

The underlying array of 5G function choices available, service providers are also choosing between both public and private Cloud in addition to hybrid options and making decisions with 3–5-year implications. For instance, some are choosing VMWare and OpenShift instead of direct to public-Cloud hyperscaler options i.e., AWS\Azure\Google.

Some varied examples that Amdocs Charging teams are working with are:

- European group operator on VMWare Telco Cloud Platform (TCP)

- European group on existing CaaS solution but considering Rancher or OpenShift

- North American Tier 1 service provider on Rancher and moving to Azure as their target environment

- North American Tier 1 on VMWare Telco Cloud Platform (TCP)

- North American Tier 1 testing on Google Cloud Platform (GCP)

- Asian alternative service provider on Azure

- European group IoT on AWS but using Giant Swarm for Kubernetes

More enduring and partner-oriented vendors will not call all the shots on the choice of containers-as- a-service (CaaS) infrastructure. It is imperative that the preference leans towards a more agnostic approach. Remaining agnostic means ensuring a common level of support for all CaaS environments. To attain enduring agnostic value, service providers will need to take into consideration whether to take advantage of the short-term savings using tools and tech provided by a particular hyperscaler, or otherwise bring components including databases, that will deploy into all CaaS environments in the same way and obfuscate over-commitment to one environment. Partners understand the long-term benefits of not over-committing to monoliths. Amdocs is a vendor with such understanding.

Organizational Impacts (What Needs Fixing to Take Advantage of 5G Charging)

The adage *"if it cannot be charged for it's not worth doing"* does not apply as simply in relation to new business models such as "try before you buy" or "order now, pay later". In the era of such newer payment models charging has an even more critical and perhaps more nuanced role for service providers.

Whatever Cloud or hybrid Cloud options are selected, this will have significant influence on how businesses operate in the future. Once cost-benefits from Cloud choices become visible, the revenue side will regain better definition. As such, a new way of working is necessary – with faster and more diverse routes to market that will be reflected in terms of how 5G functions (including charging) are managed. This will involve a larger number of teams and partnership models working in parallel to achieve the desired success. Various business teams will need to test a wider range of services in live environments. At that, very few service providers can achieve this beyond the scope of their ambition or range of opportunities that 5G can provide – especially for enterprise verticals.

Telcos now acknowledge the need to become more invested in preparing their staff and training in the new technologies

that Cloud-native introduces. Some service providers have seen a move from an all-encompassing product GUI and an Oracle database to a solution that requires them to understand Kubernetes, Containers, CI:CD Pipelines and tooling that is more familiar to developers. This kind of solution makeup is based on the industry concept of a DevOps platform. A solid DevOps platform needs a steadfast DevOps team structure to achieve maximum efficiency; finding the right balance in one's DevOps team is not a one-size-fits-all proposition.

Several factors are at play when it comes to team structure:

- Existing silos: are there product sets/teams that work independently?

- Technical leadership: are group managers set up to achieve DevOps goals?

- Changing roles: Ops tasks have bled into Dev roles, security teams are working with everyone, and technology is changing. Expect to regularly re-evaluate everything.

- Continuous improvement: a DevOps team will never be a "one and done". Iteration will be required.

Service providers must evolve to take advantage of the tech, and as some analysts have postulated, become "techcos" instead of simply "telcos".

To take advantage of the technology, telcos need to embrace it. This means embracing a level of continuous change, in areas such as:

- Understanding networking

- Understanding deployment patterns: Kubernetes, Helm etc.

- Understand scaling practices etc.

Operations and delivery teams need to be more in sync with their approach in designing, developing, and delivering solutions together alongside business colleagues. A collaborative effort that needs to continue after the launch, in an age when development cycles have shortened lifespans. Agility and continuous change drive production evolutions more frequently, especially with the rise of DevOps practices.

5G-Driven Services Need 5G Monetization Capability

Service providers with millions of subscribers are often reminded of the 5G capability of managing a theoretical volume of approximately one million connected and diverse device types in the network per square kilometer. This may seem like a lot, but it is easy to envisage over a hundred thousand consumers at a busy sports stadium or concert within a city. Each person might carry a smartphone and one or two additional connected devices. If the venue is in a city with thousands of connected vehicles, and near to shopping malls or theaters or universities then the idea of a million of devices including sensors really is not that far-fetched of a concept.

Such service providers are already considering the need to move from handling millions of smartphones to billions of diverse devices. Usage, partnership and thus charging expectations have changed and proliferated greatly. The supply-side must evolve accordingly and become more SaaS-oriented and tailored to the value of the service. It has never made much sense to most consumers to be charged by the megabyte or gigabit in any event. The value of a light switch or sensor in a lab or

datacenter is much different to the same sensor in someone's shed. Should they be charged the same way? We are more than inclined to say no.

Leveraging the different charging trigger functions in 5G will see dramatic shifts from charging based on usage, to adopting charging and monetization based on a much wider range of criteria driven by new and adjacent functions such as Policy (PCF), Network Data Analytics (NWDAF) and Network Exposure (NEF). New charging methods will include, but not limited to, charging based on access or quality of service and various combinations along those lines. 5G Policy needs to be easily accessed by charging and allow service access as well as quota for a much wider range of devices and services.

Moreover, take into consideration events from the Access and Mobility Management Function (AMF) being used to count active devices per day, with little or no resource overhead in the charging infrastructure for low cost but high density IoT devices that talk over the network infrequently. The key factor is that 5G charging can be the prioritized focal point for consideration of
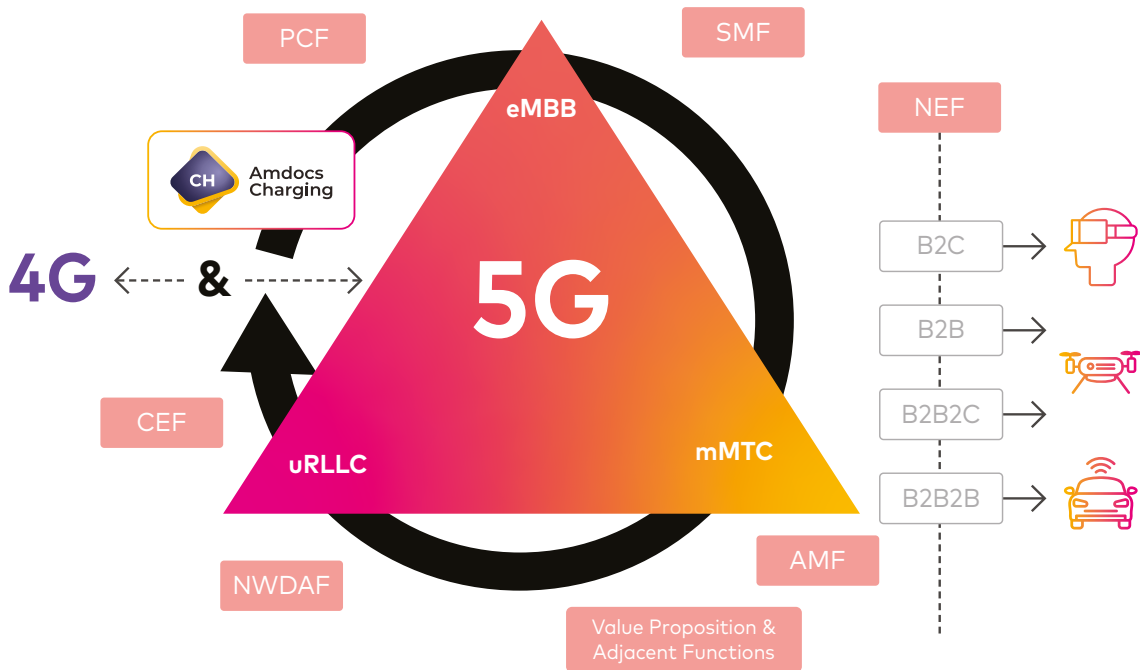
Fig. 2, 5G Viewed with 5G Charging as Focal Point*

Abbreviations: PCF: Policy Control Function, CEF: Charging Enablement Function, NEF: Network Exposure Function, NWDAF: Network Data Analytics Function, SMF: Session Management Function, AMF: Access & Mobility Management Function

how various functions are coordinated and charged accordingly, without limitations on the possibilities in the new 5G environment (Figure 2).

Billions of devices will soon emerge with form factors way beyond smartphones and connectivity. Thus, creating an even greater need for connecting everything from security cameras to vehicles along with arenas and lamp posts. New entertainment, lifestyle and industrial platforms are also emerging with the metaverse as one suggested platform (or set of platforms in some cases). Service providers will need to be reactive to these changes and cannot rely solely on their older capabilities (or modes of charging) from an earlier era to be lifted into Cloud. Even if it were to provide some initial efficiency, this will undoubtedly limit functionality further down the line. The total cost of ownership on a per-connection basis needs to be significantly more efficient at the scale planned for 5G. The diversity of scale opportunities also needs early consideration. (Figure 3 & Figure 4).
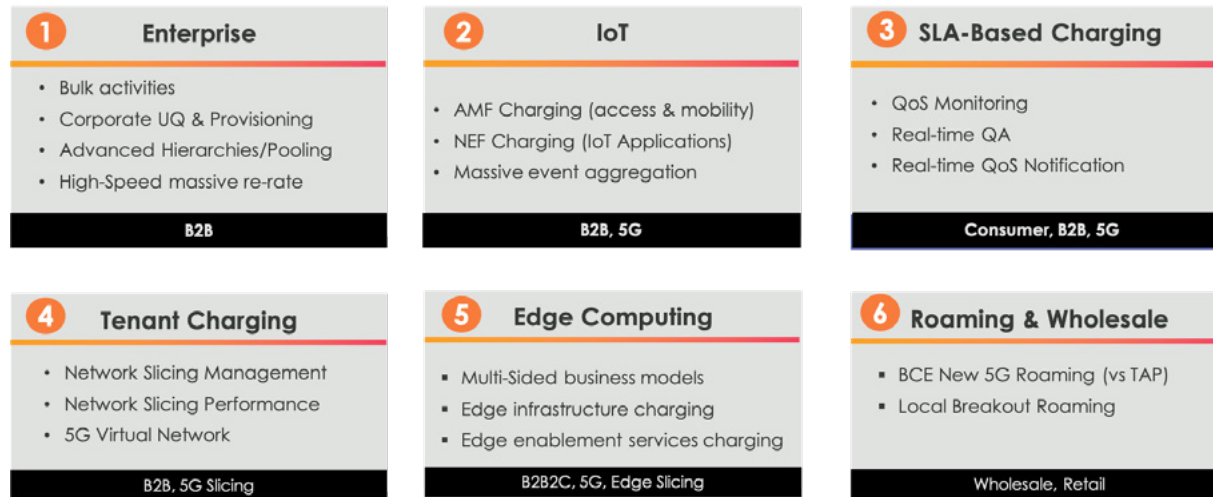
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1 Enterprise	**2 IoT**	**3 SLA-Based Charging**
• Bulk activities • Corporate UQ & Provisioning • Advanced Hierarchies/Pooling • High-Speed massive re-rate	• AMF Charging (access & mobility) • NEF Charging (IoT Applications) • Massive event aggregation	• QoS Monitoring • Real-time QA • Real-time QoS Notification
B2B	**B2B, 5G**	**Consumer, B2B, 5G**
4 Tenant Charging	**5 Edge Computing**	**6 Roaming & Wholesale**
• Network Slicing Management • Network Slicing Performance • 5G Virtual Network	▪ Multi-Sided business models ▪ Edge infrastructure charging ▪ Edge enablement services charging	▪ BCE New 5G Roaming (vs TAP) ▪ Local Breakout Roaming
B2B, 5G Slicing	**B2B2C, 5G, Edge Slicing**	**Wholesale, Retail**

Fig. 3, Charging Needs to Respond to Emerging Use Cases

Prepared for Whatever the Future Holds

5G monetization is not necessarily all about disruptive new services and platforms such as the metaverse. Plenty of value will be driven by the adaptive building blocks for whatever service requirements are to come. In addition to this, the efficiencies that can be derived from the adoption of the new technologies and tools, especially those that are Cloud-based are endless. The business benefits that ensue will illuminate the path to 5G success addressing far more than a functional core network evolution.

The potential complexity and diversity of services points to a real need for a more consolidated view of 5G that focuses on both standards and functions. Keeping in mind that the consolidation ought to include 4G, and where applicable, 3G and 2G efficiently. This might also include other non-3GPP capabilities in conjunction with 5G and 4G such as Wi-Fi, LoRA and satellite communications.

For many, charging can potentially become the focal point of consolidation and convergence along with the realization of the early promises of 5G including service diversity, data-led innovation, and enterprise customer satisfaction. The other key functions of the 5G "Value Plane" that represent a priority for value focus within 5G can be monetized efficiently and adapt rapidly to requirements of new services. However, this requires more than a functional approach.

Charging (or the CHF as it is described in 5G) provides a single lens as well as the means for a more effective consolidation and growth. It is not sufficient to merely deploy it as a functional requirement to enable standalone (SA) 5G. Charging is only fully optimized so long as it is allowed to consolidate existing, disparate, monetization add-ons available in most networks. These disjointed add-ons in networks are typically due to ad-hoc and siloed evolution of post-paid, prepaid, enterprise, voice, data, and other strands of business including use cases from 3G and 4G eras that have continued to exist as is. Thus, this will require new ways of working and a more flexibly capable way to create new services.

Having said that, this does not need to be a painful process or procedure, nor does it have to be a high-risk transformation. In fact, it can be seen and planned as a more organic development of 5G monetization that will also onboard earlier 4G requirements (voice, data, SMS and so on from the mainly smartphone era) in due course.
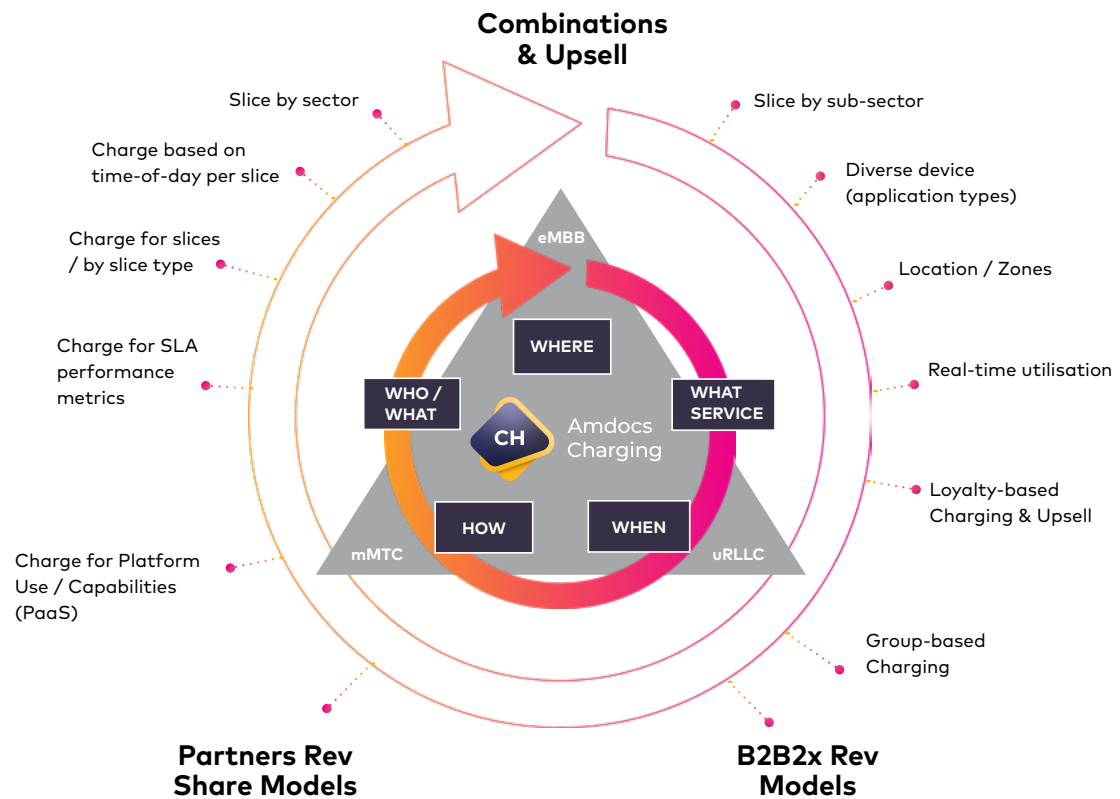

Fig. 4, 5G Charging: Focal Point for Consolidation & Expanded Services

Conclusion

5G has already provided an enormous learning curve to leading service providers pushing towards standalone (SA) 5G. Moving functions to hybrid and public Clouds is already providing a range of scaling and efficiency advantages, with more to come. Charging needs to reciprocate the flexibility and service diversity that will be possible both in terms of the ability to be deployable in the Cloud and in terms of its own functional flexibility, usability, and automation potential.

5G is also a driver of consolidation of earlier "G's" so the convergence of adjacent technologies and charging has the potential to ensure that monetization remains a focal point of successful modernization. It can serve powerfully as an essential point of prioritization for 5G success, a critical building block and a single lens through which these objectives can be met.

Perhaps the most important factor continues to be the promise of enormous revenue potential. This will emerge via the increased usability, efficiency and service diversity that will be made available through the choice of proven partners as well as the flexibility of the tools they support. These partners will enable the unlocking of a long line of partners and services to come.

Amdocs Charging

Amdocs Charging – built as a Cloud-native solution on a service-based architecture – supports an ever-expanding range of service provider requirements for B2C, B2B and B2B2x charging, including expanding service diversity and scale. Having been built on microservices, it provides a critical focal point and set of building blocks for yet-to-be-imagined scale and scope.

For more information, please **contact us.**

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