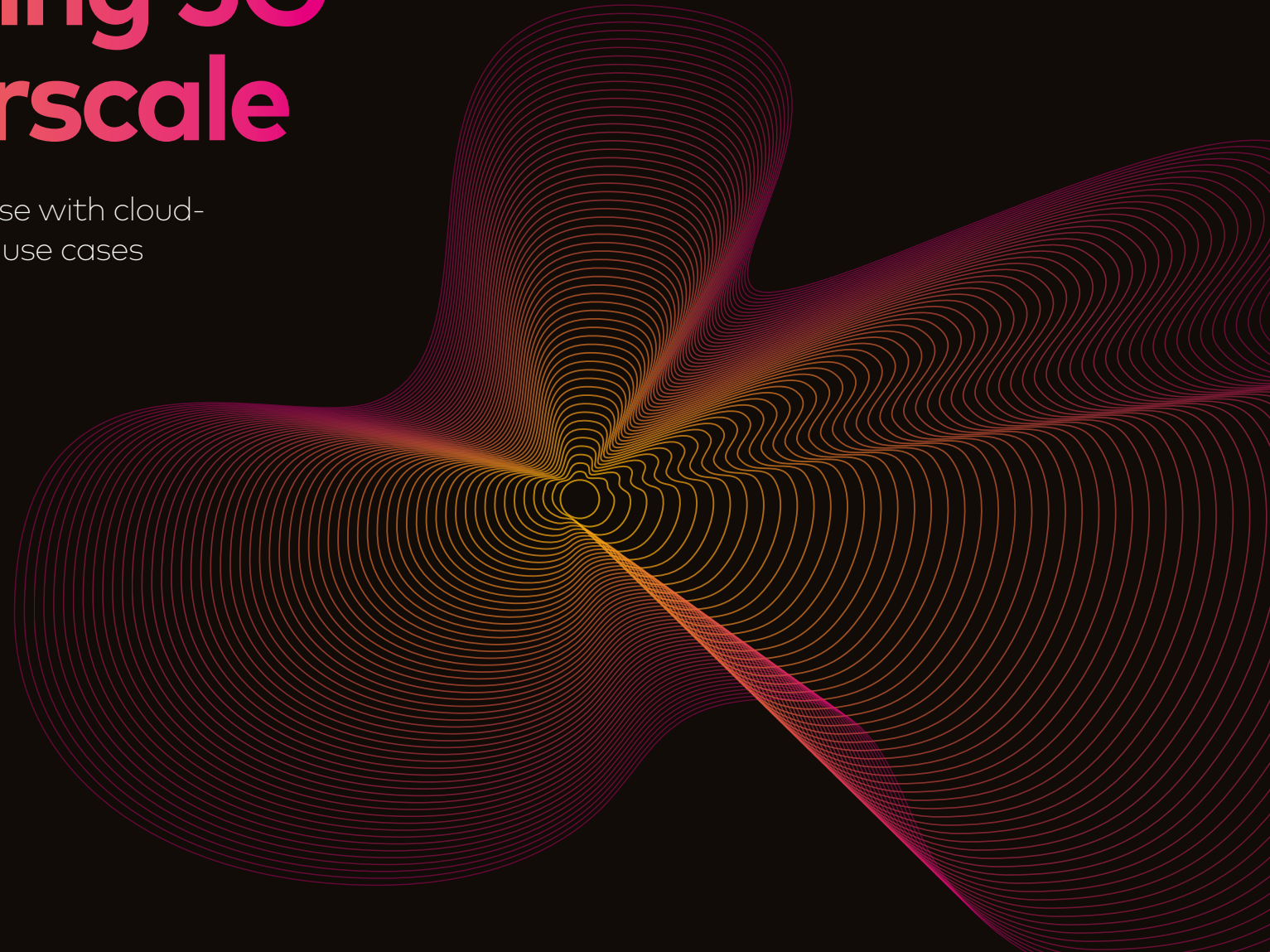


Monetizing 5G at Hyperscale

Delivering the 5G business case with cloud-driven flexibility and charging use cases



Introduction

The promise the “5G revolution” offers in terms of significant new revenues for operators is built on a combination of richer capabilities enabled by Cloud technology advances, automation, and programmability of the operator networks. These capabilities further leverage efficiencies of artificial intelligence (AI) and machine learning (ML), and evolved 5G radio technology. Cloud-based 5G has been talked about for some time largely because Cloud enables automated infrastructure scaling and network edge transaction processing. These scaling and edge capabilities are key to many of the new revenue models that the 5G revolution will enable.

As services become much more varied and diverse in terms of value triggers than previous generations of telecom services, they will require the power of 5G Cloud-based charging in order to be optimally and efficiently monetised. In this paper, we describe how the promises of the 5G revolution are moving rapidly to implementation and are benefitting from optimised Cloud-driven scale. Returns from 5G are already being realised by the extreme service flexibility and hyperscale capabilities of Cloud.



Delivering the 5G business case with cloud-driven flexibility and charging use cases

1. The B2B opportunity for service providers – accelerated by 5G.

5G provides a rich tapestry of capabilities including improvements to latency, speed, coverage, capacity, security, and density. For consumers, speed is likely to be the most obvious and immediately visible improvement. Enterprises are perhaps more likely to benefit from the competitive advantages of other features in the near-term. These, along with more combinational benefits from 5G, such as network slicing, will provide competitive advantages in B2B environments before benefits are in turn passed on to consumers via B2B2C models in areas including gaming, entertainment, and other services. 5G is likely to provide such an expanse of industry vertical opportunities that specialist companies will almost certainly evolve to cater for 5G benefits available for verticals such as transport, government, manufacturing as well as others. Even within verticals, specialists will focus on segments and sub-segments. So, for example, within the transport vertical some specialists will cater for marine transport, others will cater for rail and still others for airlines.

Some analysts have gone as far as saying that 5G is only for enterprises, but we would not go that far. Benefits from 5G will also apply to consumer experiences of gaming, entertainment, vehicle-to-x (V2x) and more.

For enterprise customers, it is likely that the connectivity experiences they will want to procure will include more than just 5G radio capabilities, and include fiber networks, Wi-Fi networks and in some cases satellite network services also. Blending these underlying technologies into a seamless buyer experience is a complex engineering challenge – but allows for a very rich opportunity for monetisation by the operators.

What is certain is that the monetisation models for 5G services for different audiences and channels will be based on a much broader and diverse array of value triggers than has existed up to now – consumers want experiences and not megabytes, enterprises want outcomes and not simply rated transactions. This clearly has implications for service enablement and the requirement for hyper-automation

of new service creation. It also has implications for flexible billing and customer engagement in new ways, and most definitely on the underlying charging capabilities to support monetisation models. Put simply, the 5G revolution will require diverse methods for monetisation enablement that can be tailored to many different audiences, at huge scale and in an automated fashion.

2. Increasing digitisation of Enterprises and evolution to Industry 4.0 (automation, M2M communication, AI/ML driven processes).

Connectivity and communication services improvements enabled by 5G are converging with the on-demand expectations of consumers and industry, as well as the much fuller digitisation of industry verticals. Productivity improvement is a primary motivation for enterprises as they strive to stay ahead of also-digitised competitors. Within consumer markets there has barely been a sector, from insurance to transport to retail and education, that has not been impacted significantly by digitisation and the pace is set to accelerate. In many cases, the consumer uptake of tomorrow will be driven by faster testing and adaptation of enterprises today. IoT connectivity of all types is set to accelerate as more devices become directly connected. Availability and upgrade cycles for devices and services of all kinds will shorten as they become ever more Cloud- and software-driven. Those services will, however, only propagate in popularity and usefulness as much as they offer improved experiences and can self-optimize via machine-learned intelligence.

The drive to digitise business processes and customer engagement journeys is clearly driven by value – either in terms of efficiencies or enhanced, attractive, customer experiences. IoT and developments of metaverse type environments for business and consumers will be so varied that the digitization and automation of service creation and management is inevitable.

3. Maturing Cloud and edge technologies enabling cost-effective scale

Service providers have been active and effective in moving many existing functions and new 5G functions to the Cloud in various forms. For some, private Cloud is still important; for others, public or hybrid is optimal for their specific business needs. Whatever selection criteria are applied, the consensus is building that flexibility and cost savings allowed by Cloud (including edge processing) are more than sufficient to negate the earlier presumptions of business models related to “bare metal” infrastructure implementation. Launching services as needed and scaling up and back automatically is now more viable and economic for many service providers than could have been dreamt of in the early stages of 4G.

These aspirations and implementations are moving rapidly from labs to live test environments in ever shorter timeframes as confidence grows in the use of public Cloud services. Edge Cloud benefits are now available to provide for ever more diverse and potentially pervasive use cases including vehicle-to-x (V2x), robotics, mobile gaming, and virtual reality.

4. To monetize these trends effectively, service providers need flexible charging and billing systems

As enablers such as those mentioned above become available, their monetisation potential cannot always be predicted fully. For example, a robot on a factory floor may be monetised differently than one in a hospital or retail environment. As services move more rapidly from concepts to mainstream acceptance, the hyper-flexibility of monetisation engines will be key to optimising returns from 5G. Charging systems need the ability to mirror the Cloud-driven speed and diversity of services as they go to market and evolve rapidly. Monetisation itself is becoming part of the service offering. Rapidly growing alternative payments and finance providers offer a range of services that traditional banks would only have dreamt of some years ago. The same potential holds true of dynamic service providers. Their charging capabilities have the potential to be intrinsically linked to the diversity of service experiences that 5G now gives them the potential to provide.

These charging systems must handle the required processing for large enterprise accounts across different verticals such as automotive (connected car), security, ports, and their connected devices (including IoT). Such processing may sometimes be real time, or time sensitive, or may occur at the end of the customer's billing cycle, with strict time windows for generating invoices. As volume and service diversity increase, so does the challenge. For example, different pricing may be applied for the same service depending on demand, type of device enabled, priority of consumer requirements etc. Some real-world examples from other industries are

congestion pricing models for taxis, or premium pricing for real time content access on sports channels. Being capable of offering a breath of value triggers to the different enterprise audiences will be a significant competitive advantage to operators.

Not only is the diversity of services expanding rapidly in addition to the corresponding range of monetisation opportunities, volume requirements are increasing also. 5G standards describe one million devices per square kilometer. It may seem like a huge number of devices but imagine a large stadium or park with feasibly 100,000 spectators, each connected with a smartphone and a connected wearable. Then consider the need for that stadium or location to have perhaps thousands of devices, everything from high-definition cameras and sensors for fire and safety requirements. If the stadium or park is located in a busy city, that upper limit of one million seems less futuristic. Similarly, consider when cars are multi-connected with everything from rear-seat entertainment to engine sensors and driver assistance or automation. If those vehicles are in busy urban environments, such very high densities of connections are becoming entirely realistic.

5. The Next Wave of High-Volume Use Cases

Such high volumes of connectivity combined with meshed devices that require ultra-low latencies are having massive implications for revenue potential but also consumption expectations and automation requirements. Emerging segments and enterprise consumption require a newer, more flexible and reliable set of charging capabilities. Examples of enterprise-grade, high-volume, ultra-flexible cases that Amdocs has been working with inside and outside of lab environments include:

- Pooled price plans across multiple accounts for an enterprise customer, with flexible handling of overage usage for IoT as well as corporate consumers
- Allocation of usage to individual lines/devices within a shared enterprise (B2B2x) account with potentially many millions of connected devices relating to one enterprise
- Wholesale and multi-party pricing models to include partners and sponsored pricing models
- Time of day and device-type pricing for the plethora of devices to come
- Ultra-flexible tiered pricing models and segmentation handling for enterprise and government customers
- Flexible promotional capability
- And many more.

To handle such demanding requirements for large enterprise customers in a cost-effective way, operators are increasingly moving to Amdocs' Cloud-native Charging and Billing solutions. The flexibility of these solutions enables service providers to fully realise the benefits of Cloud platforms, with the ability to scale up to meet the demands of specific heavy workloads as needed for a diversity of use cases and to then release the resources once the required business processes are complete.

6. Addressing the Enterprise Challenge

As the leading global provider of telco industry solutions, Amdocs has been preparing our Cloud-native 5G Converged Charging System (CCS) to meet our Tier-0 and Tier-1 customers' needs for B2B and B2B2x Charging and Billing. In recent tests, Amdocs and Amazon Web Services (AWS) have demonstrated a scale capacity target of 12 billion complex charging transactions per day, which aligns with business support system (BSS) transformation needs for top-tier Service Providers.

A particularly challenging requirement relates to enterprise plans that are based on aggregate monthly service usage, and which require a significant proportion of that usage to be reprocessed (re-rated) as part of the month-end bill cycle. This reprocessing must be completed within a specific time window so that customer invoices can be generated and delivered on schedule. By way of a specific example, Amdocs and AWS have demonstrated this capability based on the following enterprise customer and service usage profile:

- An Enterprise Customer Account with 4 million lines (or subscribers)
- Usage for 4 million lines (with approx. 4 billion charging data records (CDRs)) must be reprocessed at bill cycle close
- The re-rating process must be completed within a 4-hour window.

Cloud Scaling for Emerging Use Case Monetisation

In our AWS tests, the required re-rating was completed in 3 hours and 50 minutes, which is comfortably within the target 4-hour window, and with average processing rates of 145 subscribers/second and 148.4 Charging Data Records (CDRs)/second.

The following are some key aspects of the system scaling to support the required business process:

- The number of pods for the re-rate service scales up from four to 70 when the 4 billion CDR workload is triggered and system processing loads start to increase, and then scales back down to four pods after the processing is complete.
- The Kubernetes HorizontalPodAutoscaler (HPA) automatically adds additional pods until the demand of the workload is met; see Fig. 1 below:

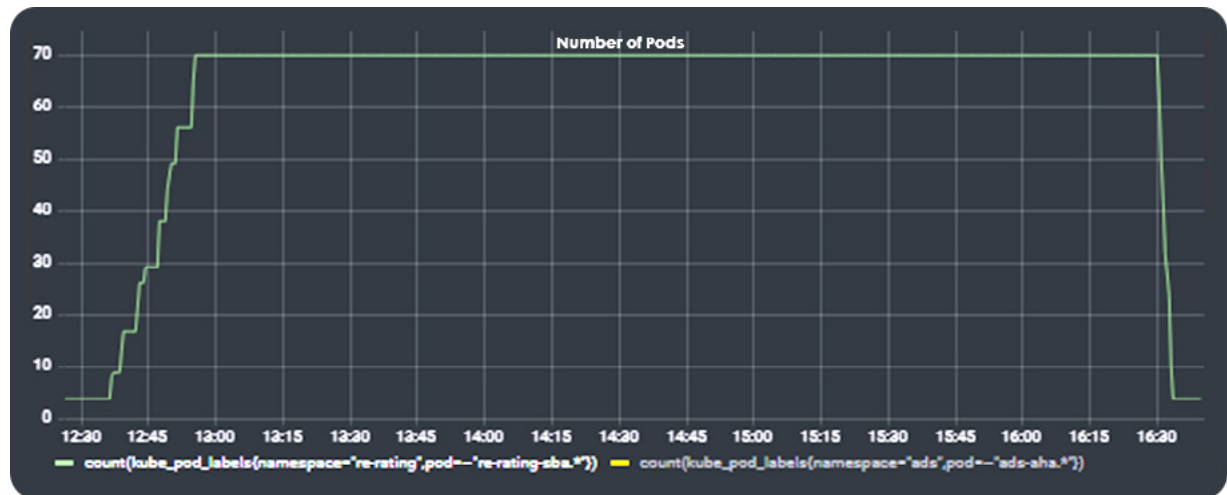


Fig. 1 Pod Scaling for Amdocs CCS Re-Rate Service

- The AWS EKS cluster scales up from 13 to 23 nodes as processing demands start to increase, and then scales back down to 13 nodes once processing for that account is complete.
- The AWS EKS cluster adds additional nodes (VMs) to the cluster on-demand, to support the newly created Re-Rate pod workloads; see Fig. 2 below:

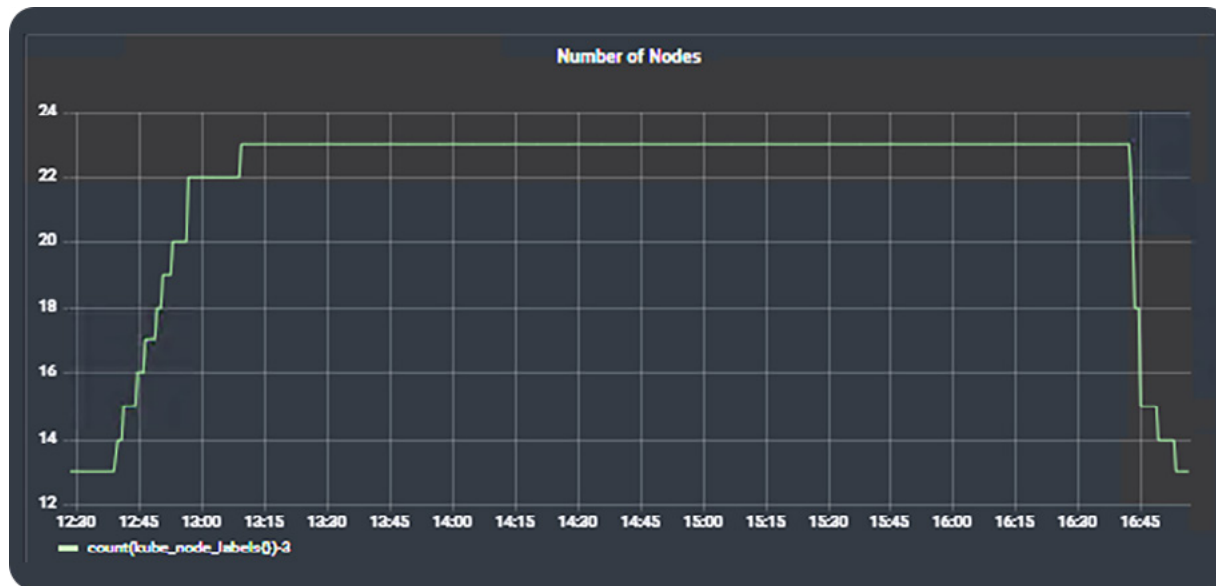
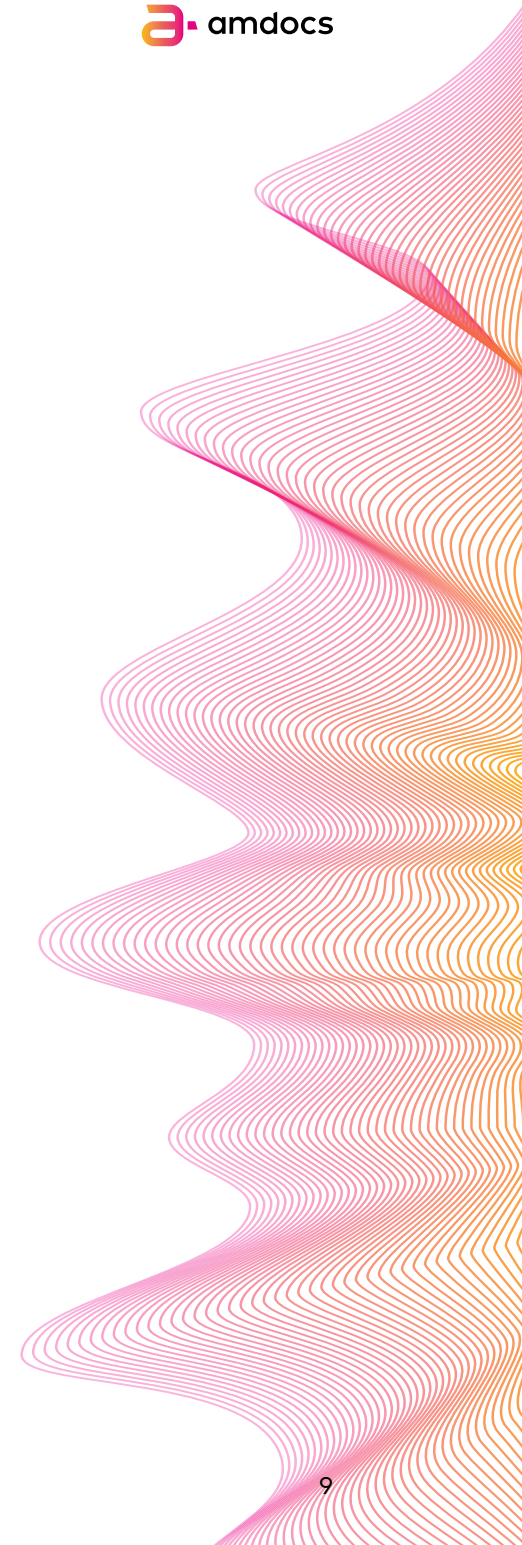
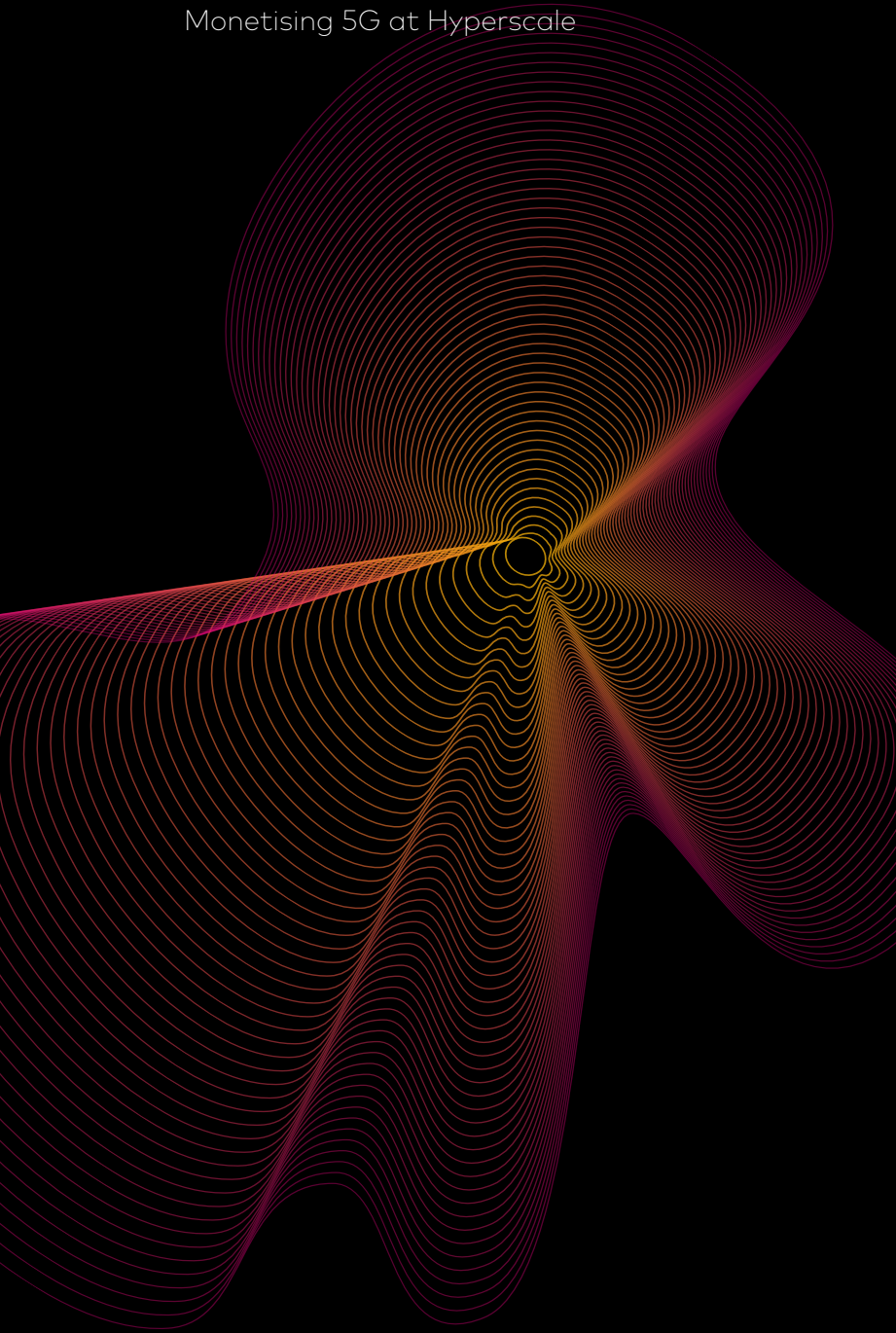


Fig. 2 Node Scaling for Amdocs CCS

It is worth noting that the ramp-up of resources – pods and nodes – between approximately 12:40 and 13:10 in Fig. 1 and Fig. 2 above is a one-time occurrence. This means that in a production billing cycle, with multiple enterprise accounts to be processed, the elevated resource allocation levels would be sustained for the subsequent accounts resulting in greater throughput and more efficient overall processing because all necessary resources are already allocated and operational for the rest of the cycle.





Next, we present a summary of some key re-rate metrics from the Amdocs CCS tests based on the parameters described above. Fig. 3 shows CPU utilisation as Amdocs CCS scaled up and back down to handle the required workloads. As in the previous charts showing scaling of pods and nodes, here too we see a ramp-up in CPU resources as processing demands increase and observe that this then tails off once processing is complete.

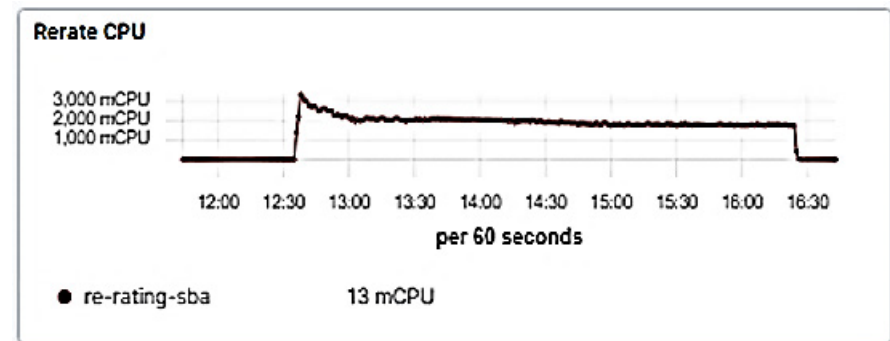


Fig. 3 Re-Rate Service CPUs Used

In Fig. 4 we see an initial spike in calls to the system's Profile and Balance Manager to create the required new balances for each of subscriber lines that expect to receive balance updates during the re-rating process.

These balance amounts are not updated for each CDR, but rather at the end of the reprocessing of all usage for each line, hence the initial peak in calls/sec after which the updates are made at a lower rate.

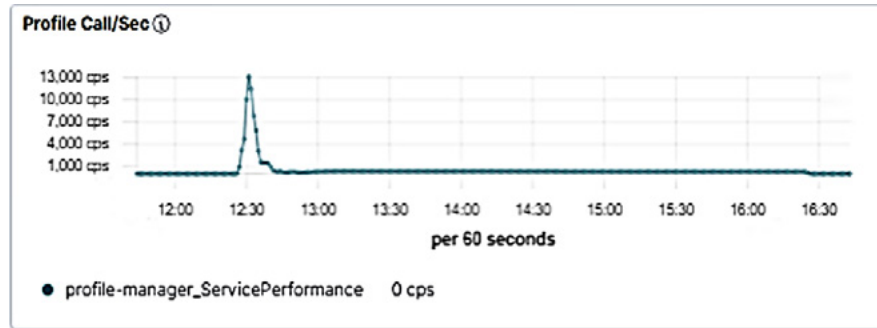


Fig. 4 Profile and Balance Manager Calls

Fig. 5 presents a view of the system dashboards used to execute and monitor the tests described above. This type of consolidated “single pane of glass” view is another key requirement for the types and scale of enterprise level processing described above.

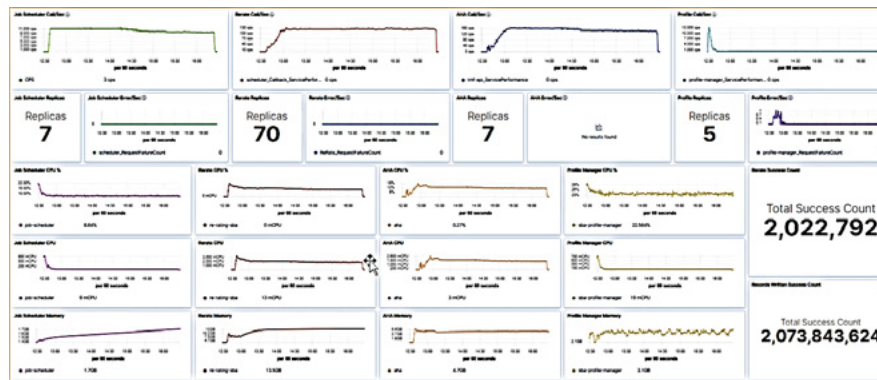


Fig. 5 Amdocs CCS Monitoring Dashboard

Conclusion

As post-pandemic expectations continue to expand, service providers will need to plan for the next wave of use case diversity with advanced levels of flexibility to ensure competitiveness. This will require advanced scaling flexibility in multi-cloud environments. As the number of connections on a typical network move from hundreds of millions to billions, it will require changes to automatically occur on the network as required and with automation as the network is increasingly exposed to ambitious partners. It will require a responsive and seamless monetisation capability that can react accordingly, cater for multiple levels of differentiation and partnership, serve as a critical focal point and foundational building block for these as well as future, yet-to-be-determined 5G challenges. Testing in live environments is proving that Amdocs has been and continues to be up to these expanding challenges.



Amdocs Charging – built as a Cloud-native solution on a service-based architecture – supports these and an ever-expanding range of service provider requirements for B2B and B2B2x charging, including handling the end of billing cycle processing at 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](#).