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REPORT

Meeting expanded expectations

for network charging

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contents

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the**big**
picture

Network charging and convergent charging may not be buzzwords in the AI and 5G era, but they are critical in telco operations. Indeed, leading hyperscale cloud providers credit their revenue growth in AI to their cloud-metering capabilities – the cloud world's version of convergent charging.

As communications service providers (CSPs) strive to find new sources of growth in markets like IoT, B2B2X solutions, AI-based services and network APIs, it's time to rethink the role charging plays and how it's delivered. This encompasses not only monetization, but also the customer experience (CX) an operator delivers, which requires a relationship that goes well beyond a monthly bill.

3GPP has published 5G standalone (SA) specifications to evolve charging in wireless networks, but this will not be enough to support transformation for two reasons:

Charging is not limited to the 3GPP domain.
Hyperscalers have proven it is an end-to-end capability that should be inherent to the entire network and service platform.

Hyperscalers have normalized real-time CX
They deliver observability into configurations, events, usage and costs, plus the ability to simulate them all before deploying configurations. The 5G SA specification does not address CX directly.

These points reveal a key weakness for many CSPs currently: the inability to provide a single view of all usage and cost data – along with self-serve controls – to any user, for any service, and with differentiated levels of access and control permissions.

Beyond simple mobile charging
Telcos with mobile networks have tended to view charging as a standard network component that is upgraded generationally with their network stacks. But in the future, they need to view charging more strategically as a flexible capability to monetize the use of mobile network resources and functionalities. This necessarily should include the ability to monetize different network parameters and seamlessly integrate these into the user experience. But it also needs to cater for solutions that traverse both operators' and public-cloud networks such as IoT services, and networks where more than one supplier is involved.

> CSPs need to view charging more strategically as a flexible capability to monetize the use of mobile network resources and functionalities.

Rather than simply provisioning and authorizing accounts for prepaid access, for example, CSPs will need to charge for any sort of connectivity that might be integrated with a variety of devices and applications. These devices and applications produce data about their usage events and costs which customers want to monitor and which telcos must monetize.

Charging as a value enabler

In telcos' increasingly software-based and cloud-native networks, which span multiple domains – for example, 5G radio access and core, IP, and optical transport networks – scalable real-time charging solutions can enable CSPs to generate new value in the form of customer experiences and revenue, in more differentiated and granular ways, just as metering does for hyperscalers. A new approach to charging could be the key to deriving growth from ecosystem-based IoT and B2B2X services, for example.

Large-scale connected solutions that integrate components from 5G networks, hyperscale clouds and a range of APIs need distributed charging capabilities to scale and monetize their many different characteristics, configurations and on-demand events. CSPs need to understand this in order to monetize the self-healing autonomous networks they are deploying.

Read this report to learn:

- Why CSPs need to rethink network charging beyond 5G
- What charging needs to deliver for both monetization and CX
- How telcos can learn from hyperscalers' approaches to cloud metering
- How new AI opportunities may force a charging rethink.

> Scalable real-time charging solutions can enable CSPs to generate new value just as metering does for hyperscalers.

section 1

rethinking the role of charging in telecoms

Charging's roots lie in mobile networks, with functionality often comprising usage collection, metering, rating, billing and payment processing – plus reporting about each of these activities. But CSPs' growth opportunities in new and more complex markets like IoT and B2B2X ecosystems is causing them to rethink mobile-centric charging.

To discuss why and how charging needs to be modernized, it helps to understand the history of it in mobile networks. In addition to performing tasks like metering, rating and billing, charging systems are also important for authorizing or denying users access to the mobile network. This need, and the resulting functional split in charging technology between online and offline architectures, originated with the advent of prepaid mobile services.

Even through the 4G era, mobile charging standards specified an approach to managing the high volume of user authentications onto mobile networks that splits prepaid and postpaid. Only prepaid was concerned with checking in real time, or near real time, whether the customer had sufficient credit to permit access to the network and services (mainly voice, text and data).

In the 5G era, a compromise has been made. CSPs are rolling out 5G non-standalone (NSA) technology without requiring upgrades of their charging architectures to support 5G standalone (5G SA). Indeed, 5G SA charging was always intended to come last in the evolution to the new wireless technology.

As a result, it is extremely early yet in the adoption cycle for the 5G SA charging specification, with most operators still relying on their 4G-compliant charging stacks.

But a problem with relying on 5G SA is that increasingly telcos are offering their services and solutions in conjunction with partners' networks and clouds. This means that charging capabilities are needed to monetize services that will use both 5G SA and non-5G network resources.

Geoff Hollingworth, CMO at Rakuten Symphony, points out that even the term charging is a misnomer. "Counting how much somebody uses of something is metering and observability, not charging," he explains.

He adds that "linking charging evolution to standards evolution as the prime anchoring timer misses the point of the difference between commercial and technical" aspects of an operator's business. The need for more sophisticated monetization capabilities exist now but may remain unmet because of the 5G SA launch schedule.

> Capabilities are needed to monetize services that will use both 5G standalone and non-5G network resources.

Focus on flexibility

Another major challenge in standardizing an approach to charging is trying to define what you think the world is going to deliver as a sellable object years in advance. This concept does not make sense in the modern-day market because offerings and prices change continuously. In tech- and software-driven businesses, automated pipelines release updates regularly. What can be metered and charged for will undergo constant change as well.

The answer for many operators usually ties back to their legacy systems, including charging. "Traditional telcos, especially in regions like Africa where prepaid models dominate, have relied heavily on robust charging systems," says Luqman Shantal, CEO of Makman Consulting. "So, charging systems are fundamental to business operations. But as the industry shifts towards IoT and B2B2X digital ecosystems, evolving these charging systems is crucial."

Adopting TM Forum's Open Digital Architecture (ODA) is key to this evolution because of its ever-expanding Open API set and "robust digital ecosystem modeling", says Shantal. He adds that because ODA introduces and expands automated and intelligent network capabilities like anomaly detection and predictive performance analytics, it not only improves operational efficiency but can also support new and advanced (monetizable) usage scenarios and generate and deliver the type of granular data needed to enable real-time CX.

Next, we look at how network APIs, as well as the metering innovations of hyperscalers, could introduce telcos to a new world of cloud and connectivity metering and monetization.

5G SA charging benefits
3GPP's 5G SA charging specification introduces several useful concepts:

Eliminating the split between online and offline. This split originated with the need to support prepaid mobile yet offload postpaid metering, rating and billing from the real-time prepaid architecture. This makes sense because if you can charge and bill in real time, you can also bill at any other interval. But it is a complex step forward for charging architectures that's new to the entire telecoms industry.

Componentizing sub-functions. Rather than specifying that charging be run through one or more monolithic system(s) that deliver all charging needs in one box, the 5G SA specification componentizes functions and allows them to be deployed in a variety of models.

Permitting adaptable and scalable architectures. The 5G SA spec also allows for a variety of approaches to how components are deployed to form a complete charging architecture. This includes mirroring the centralized 4G model most mobile operators know and understand best, despite its limitations in supporting capabilities beyond voice, data and messaging charging and usage control.

section 2

telcos can learn from cloud metering

As CSPs aim to monetize new services like IoT, B2B2X and network APIs, they should consider the way hyperscalers charge and bill for their services. "Given that CSPs are putting their networks into the cloud and have this NaaS [network-as-a-service] vision of selling connectivity in the same way that hyperscalers sell compute, it seems completely logical that they should be exploring concepts such as cloud metering," says TM Forum Chief Analyst Mark Newman.

"The public cloud offers a valuable blueprint for the evolution of charging into a capability which enables CSPs to take a more diverse, agile approach to monetization," says Ron Porter, Head of 5G, Network & OSS Product Marketing, at Amdocs. "What began as simple storage services, charged based on number of megabytes, has transformed into a landscape where cloud providers leverage a variety of innovative monetization models to maximize revenue and cater to diverse customer needs."

These approaches include:

- usage-based pricing
- subscription models
- "freemium" tiers
- hybrid pricing strategies
- B2B2X models
- incentive-based pricing
- customized enterprise agreements
- reserved capacity pricing
- and spot pricing for flexible workloads.

Each model is designed to address different customer preferences and operational demands, offering both flexibility and transparency.

If CSPs are to move beyond the sale of connectivity, they must adopt similarly advanced pricing schemes to remain competitive and relevant, according to Porter. This means offering flexible and value-driven pricing that can quickly adapt to market conditions and customer expectations. "A new, flexible and dynamic approach to charging will also enable operators to experiment, fail fast and iterate not only on the offering themselves but also the monetization strategies," he says.

Network APIs are a good example of a service that could benefit from an approach similar to cloud metering. A new joint venture of 12 of the world's leading operators plans to sell network APIs globally, aiming to tap a market that IDC says will reach $6.7 billion by 2028. The venture aims to give customers and developers self-service, developer-level access to connectivity provisioning, quality of service (QoS) controls, security mechanisms, and user authentication within applications.

Network APIs are a good example of a service that could benefit from an approach similar to cloud metering.

This should enable developers to generate more pragmatic and deployable 5G use cases for businesses and consumers. The hope among the partners is that this innovation will lead to return on telcos' 5G investments, which so far has proven elusive.

But the joint venture is subject to regulatory approvals. Another potential issue for the group is that it is 5G centric, which risks missing the bigger market opportunity. But it could avoid this pitfall with a charging architecture similar to cloud metering which would meter solutions end to end and would not be limited to the 5G or 5G SA network domain alone.

What is cloud metering?
Hyperscalers view cloud metering as a driver of revenue growth. Not only does it enable them to monetize new services and differentiated workloads efficiently and immediately, like those made possible by new AI capabilities (see section 4), but it also powers the CX capabilities that have raised customers' expectations for observability across services, usage, events and costs.

In the simplest terms, cloud metering is how a cloud service provider measures, monetizes and reports live usage, event and cost data to users. In the strict sense, metering is measuring resource usage and events. Resources were once limited to elements like minutes, texts and kilobytes but now can span storage, compute, latency, QoS management and many other characteristics that might define an event or a differentiated sort of workload or usage.

"Cloud metering is charging," says Rick Lievano, CTO, Worldwide Telecommunications Industry, at Microsoft. "What are the resources? What do you consume? And how fast are you consuming it? Every Azure product has a specific meter with it that determines what you are measuring and what you charge for that."

In the hyperscale world, meters are defined to collect usage data for specific types of services. This data can then be rated and billed appropriately, but it's done in real time (or close to it) and shared through a live dashboard with the customer, rather than being provided monthly as a post-facto invoice.

Types of meters
All three major hyperscale cloud service providers – Amazon Web Services (AWS), Google Cloud and Microsoft Azure – use a range of compute, storage, and connection meters to measure and report in real time or near real time. As we illustrate in our graphics on the next page, these meters cover factors including utilization, usage volume, performance and events, any of which could be monetized from a granular usage basis to an all-you-can-eat subscription model.

Five simple examples of compute meters, in this case used in AWS, are shown on the next page.

> Hyperscalers view cloud metering as a driver of revenue growth, enabling them to monetize new services.

Compute hours measures the total hours of compute resources that are running, such as for AWS EC2 instances.

CPU utilization monitors the percentage of CPU resources compute instances consume.

I/O operations meters the number of input/output operations performed by storage volumes.

Data Transfer measures the amount of data transferred in and out of compute instances.

Memory usage tracks how much memory is consumed per duration.

Three common attributes among these different types of compute meters are that they measure resource consumption or availability, can support monetization of that resource consumption, and are about as granular as is practical to measure. As a result, however, they leave nothing on the bone – every resource or event in the cloud environment could be monetized.

Five simple examples of storage meters, in this case used in Google Cloud, include:

Storage bytes measures the total bytes of data stored.

Object count records the number of files or objects that are stored.

Bandwidth meters how much data is transferred in and out of storage.

Download requests records the total number of download requests for stored objects.

Storage utilization monitors the amount of storage capacity used, by percentage.

Storage meters demonstrate how value is ascribed to resource consumption at any level and makes that consumption available for monetization, even if it's on a less granular basis, like per-GB pricing.

Compute meters can support monetization of resource consumption. Every resource in the cloud environment can be monetized.

Examples of connectivity meters, used in the Microsoft Azure cloud, are illustrated below.

Connection monitor measures end-to-end connections for Azure and hybrid cloud deployments.

Network performance monitor meters network performance factors like latency, jitter and packet loss across both Azure and on-premises networks.

ExpressRoute circuit meter measures data transfer and usage for private connections that link Azure data centers with customers' on-premises infrastructure.

VPN gateway meter measures data transfer and connections metrics for virtual private network (VPN) gateways that provide secure connectivity across premises.

Azure firewall meter measures traffic and security metrics for Azure firewall usage and events.

Load balancer meter measures load-balancing metrics like data processes and performance probe status.

Traffic manager meter measures endpoint health and performance of traffic routing.

Application gateway meter measures application gateway events and characteristics like requests, response time and throughput.

Azure front door meter measures request counts, data transfers and latency.

Virtual network gateway meter measures data transfers and connection status of virtual network gateways.

Metering is part of the CX

Though every metric a meter collects or monitors may not be chargeable, the ability to monitor and report usage live at a granular level is part and parcel of the hyperscaler's CX. A live dashboard shows customers what they are consuming in real time – or close enough – with the ability to drill down to granular detail.

Because of this granularity, hyperscalers are prepared to cater to customers at levels that exceed practical application – at least today. As a result, they are able to tap new monetization opportunities.

Modeling costs for customers

One CX feature that telcos typically lack is the ability to model, simulate and cost-optimize largescale solutions before – and certainly after – the customer has deployed them.

> A CX feature telcos typically lack is the ability to model, simulate and cost-optimize solutions before and after the customer has deployed them.

For example, before rolling out a secure, multi-site connectivity configuration that links a company's main office with its factories and transportation center, the company should be able to simulate exactly how much compute, storage and connectivity resources will be consumed under different load conditions – such as during business hours versus weekends, and busy holiday times versus the off-season. As a result, the company has a clear view of how much the multi-site solution will cost before launching it, while also simulating different configurations to find the best balance of cost and performance.

This type of simulation capability is also important for solutions like IoT, B2B2X, Industry 4.0 and network APIs. "Industry 4.0 goes beyond telco infrastructure," Lievano explains. It extends to partners and other parties that contribute solution components.

This means complexity at scale, but every usage type and event should be accounted for and potentially monetized. Lievano suggests that for any company that wants to sell more "high-value" solutions to enterprises, "it's going to be very hard to do without that cost modeling capability."

In the next section, we look at what a modern charging solution needs to deliver and how the telecoms charging and cloud metering worlds integrate through TM Forum's ODA.

> Industry 4.0 goes beyond telco infrastructure and extends to partners and solutions providers.

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section 3

what's in a modern telco charging platform?

At baseline, modern charging needs to provide live observability and metering coupled with rating and access control. In addition, any architecture must be able to span the environments that complex solutions can traverse, or from which they can consume a variety of resources, typically via APIs.

But remember that charging is a broad term that speaks to a variety of charging components, events and interactions among different parties in a transaction or involved in the delivery of a complete solution.

From a TM Forum Open Digital Architecture (ODA) perspective, a variety of Open APIs are relevant to charging's roles in monetization, metering and access control, and yet not all are charging functions themselves.

The breakout of API capabilities shown on the right demonstrates both the complexity involved in establishing charging processes, rules and procedures and the ability for Open APIs to organize them logically into manageable components. This is also where charging architectures of telecoms operators and hyperscalers' metering capabilities can come together seamlessly.

"From an ODA perspective, all I need to integrate what the hyperscalers do with cloud metering, even at a very granular level, is some information passed to the appropriate charging-related APIs about what parameters are being metered and how they are rated," explains TM Forum CTO George Glass.

Open APIs facilitate charging and metering

TMF635
Usage Management:
Provides a standardized mechanism for usage management such as creation, update, retrieval, import and export of a collection of usages. Manages rated and non-rated usage.

TMF651
Agreement:
API provides a standardized mechanism for managing agreements, especially in the context of partnerships between partners.

TMF654
Prepay Balance Management:
Includes model definition and all available operations for prepay balance management including multiple recharge channels and balance transfer across accounts.

TMF670
Payment Method Management:
Supports the frequently used payment methods for the customer to choose and pay the usage, including voucher card, coupon and money transfer.

TMF676
Payment Management:
Provides a standard client interface to payment systems for notifying about performed payments or refunds.

TMF677
Usage Consumption Management:
Provides real-time value of customer consumption within subscribed communication product buckets.

TMF685
Resource Pool Management:
Provides a resource reservation feature in the pre-order phase to reserve physical, logical and virtual products within a resource pool.

TMF688
Event Management:
Provides a standard interface to the enterprise event-management system to create, manage and receive service-related events and drive automation.

TMF723
Policy Management:
Uses the event-condition-action (ECA) definition where event triggers the invocation of the rule and condition is a logical test to trigger actions including updates or invocations on the local data.

TMF727
Service Usage Management:
Provides a standard mechanism for service usage management such as the creation, update, retrieval, import and export of a collection of service usages.

TMF735
CDR Transaction Management:
API goal is to manage CDR transactions that define how revenue share is calculated, billed and paid between an enterprise with one or more other parties.

TMF738 - Revenue Sharing Model Management:
API goal is to manage revenue-sharing models that define how revenue is shared by an enterprise with one or more other parties.

TMF771 - Resource Usage Management:
Provides a standard mechanism for resource usage management such as the creation, update, retrieval, import and export of a collection of usages.

Some Open APIs allow for the needed degree of granularity to measure, rate, control and monetize complex combinations of on-net and off-net resources, services and products. Others facilitate related interactions, like managing and reporting the revenue share among partners in a multi-component solution.

"ODA was designed to anticipate and adapt to change," explains Glass. He adds that although today's fast-growing AI market was not predicted specifically, ODA was designed with the expectation that new types of services, relationships and monetization models would emerge; that these would be very different from telcos' historic models; and that making them easy to componentize, integrate and monetize was necessary. This foresight could prove critical in CSPs' ability to capitalize on AI growth as hyperscalers have.

What should charging do?
As CSPs modernize support systems, charging architectures will continue to have core responsibilities that carry forward from previous generations and remain relevant to many CSPs' businesses. Some of these are outlined opposite.

While most of the functions listed are common to charging platforms, the advanced capabilities are different because they span the intent of the 5G SA charging specification and hyperscalers' metering capabilities.

Core charging

- Service monetization & access control
- Service bundling
- Prepaid and postpaid convergence
- Real-time balance updates
- Event-based charging
- Usage-based billing
- Subscription management
- Roaming charges

Customer-facing

- Customer notifications
- Customer self-service
- Real-time promotions
- Spending controls
- Fraud detection
- Credit control
- Real-time analytics

Advanced capabilities

- Network slicing
- Quality of Service (QoS) differentiation
- IoT usage and control
- API monetization
- Dynamic pricing

Dynamic pricing comes into play in two ways for telecoms service providers. Firstly, in the same way that companies like Amazon and Uber use demand-based pricing algorithms to raise and lower prices automatically based on live measurements of demand, those kinds of capabilities could be provided to a customer of an IoT, B2B2X or AI solution.

Secondly, take the example of multicomponent solutions that combine one or more virtual or physical device(s), mash up several API calls and traverse more than one operator's network. If those are to be assembled or instantiated automatically, or better yet autonomously, configurations would be priced dynamically – especially in the process of simulating and pre-approving the costs before deployment.

Speed and simplicity are key
But whichever way a CSP steers its charging architecture, one of the most crucial steps is to make it as usable as possible. One of the weaknesses legacy charging platforms can carry forward is how much time is required to make needed changes.

In the modern world, updates to rules or pricing information that impact charging functions are made for the purpose of impacting the marketplace competitively. This is why low code / no code approaches are favored for business functions like defining workflows and pricing tables. At once it helps to eliminate a bottleneck, a point of misinterpretation between IT and the business, and a delay in responding to marketplace changes.

This is also a common area for the application of AI and machine learning tools, because AI helps analysts to take on complex variables and suggest rule sets and changes based on interpreted intents. A next step in the charging future for AI may be to help overcome even greater degrees of multi-component solution complexity. As more solutions are automated and the development pipelines supporting their subcomponents are automated as well, it may become AI's job to define what any new component is, how to deliver and assure it, and therefore how to meter and monetize it.

Architecture and functionality lists aside, the big difference between how CSPs typically approach charging and the business model of hyperscalers is the customer experience. In an interview given on background for this report, a Fortune 100 C-level executive with responsibility for managing both hyperscaler and telecoms service provider relationships, revealed a major gap between the two experiences.

Hyperscale partners are involved directly in the business day to day, the executive said. They communicate that involvement through a live dashboard with detailed costs, usage metrics and related controls. Everything they meter can be surfaced, made observable, monetized and displayed live to the customer at any level of the organization.

By contrast, the telecoms connectivity provider sends a monthly bill. And someone in accounting pays it. The difference, ultimately, is in how they approach charging.

In the next section, we examine how AI may create revenue growth opportunities that hinge on CSPs' ability to perform hyperscale-type metering.

> One of the weaknesses legacy charging platforms can carry forward is how much time is required to make needed changes.

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section 4

monetizing AI through cloud-like charging

AI and generative AI (GenAI) will have a transformative impact both on the deployment of new charging systems and on the new products, services and value propositions that CSPs take to market. "AI has long been a driver of process automation and cost reduction, and GenAI amplifies this capability," says Porter at Amdocs. When it comes specifically to the charging function, GenAI allows for a more agile and business-driven configuration of new plans and pricing models.

For example, a CSP could use GenAI to help create customized service plans that are based on a customer's specific usage and requirements. It can do this by analyzing data from customers' usage patterns, preferences and behavior. It can also enable the CSP to introduce real-time dynamic pricing models that are based on the availability of, and demand for, network resources (for example, lower prices could be offered when network usage is low). Predictive algorithms could adjust pricing based on forecasts of network load, service demand or seasonal factors, leading to flexible, demand-driven pricing structures.

CSPs will also, increasingly, embed AI and GenAI within the products and services they offer their consumer and business customers. When these services generate incremental traffic there is the opportunity for CSPs with modern charging systems to charge for and monetize them.

As these technologies require significant compute resources often hosted in the cloud or at the network edge, connectivity becomes essential to their delivery – placing CSPs in a unique position to offer comprehensive,

AI-powered service bundles. The pricing models for these scenarios extend far beyond traditional prepaid and post-paid structures, opening up new monetization opportunities.

By integrating AI and GenAI, CSPs can not only reduce their operational costs but also generate new revenue streams, positioning themselves as leaders in the growing AI services market while delivering cutting-edge solutions to their customers. "We see charging as providing the critical lens through which value is captured from early service deployments, with AI capabilities enabling prediction and automation of new monetization opportunities," says Sarit Assaf, general manager of Amdocs Technology's New Tech business unit.

On the next page are five examples of AI-driven workloads that are predicted to generate traffic – and therefore present an opportunity to charge for and monetize them – on telco networks:

"

GenAI allows for a more agile and business-driven configuration of new charging plans and pricing models."
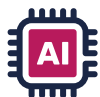
Using GenAI to streamline network operations.
Even with an initial focus on internal operations, AI workloads can generate traffic on a CSP's networks. AI models used for network optimization, which perform forecasts using predictive KPIs and automate fault detection and resolution, require data and real-time or near-real-time communications.

Enhancing CX with GenAI. An early focus for most retail and B2B businesses, including CSPs, has been using AI to improve and personalize CX, and specifically to deliver better automated chatbots. These interactions are becoming more sophisticated, adding more automation and enabling deeper conversations around more complex customer needs and troubleshooting. The movement of data to facilitate these AI-based interactions generates traffic for CSPs, more of which will become sensitive to latency factors given users' expectations for real-time responsiveness.

IoT device management. IoT is expanding market opportunities for CSPs and driving increases in traffic. IoT, utilizing AI, scales the capacity to gather and analyze substantially more data, such as in industrial-scale sensor networks. As a consequence, better connectivity is needed to deliver live device monitoring and support preventive maintenance with accurate predictions and forecasts for 24 x 7 production operations.

AI data centers. Connecting AI data centers is a baseline need for turning AI visions into reality. It is perhaps the lowest hanging fruit for CSPs in the AI market. To capitalize on it, however, Chris Penrose, Nvidia's Global VP of Business Development argues that telcos will need "AI-powered networks and APIs" to "enable the ecosystem to plug in".

Multicloud AI. A big next step in AI maturity for any enterprise is moving beyond AI product or vendor silos to multicloud fabrics. In this setting, an enterprise view of how the entire organization consumes cloud, AI, connectivity and other resources is needed. CSPs can be positioned to provide that view and monetize growing connectivity needs for multicloud services.

Nathan Bell, Partner in Kearney's digital practice, suggests that just as "some telcos were successful with cloud of clouds" business models, where they could aggregate the services of multiple clouds for their customers, CSPs similarly could present "different hyperscaler platforms' rates dynamically to customers combined with controls to manage compute resources, and costs, for AI use cases".

> An enterprise view of how the entire organization consumes cloud, AI, connectivity and other resources is needed.

Bell admits there are steps "to validate that an AI agent and underlying LLM could actually work on different cloud platforms" as well as a cultural change around metering. "Telcos can actually provide real-time tracking of utilization, but they don't because it would create a culture of how to minimize the traffic I consume each month, instead of highlighting how telcos could add value," Bell says.

Bell adds that CSPs may be concerned that they will face pushback in the market if or when they begin differentiating how they meter and bill for new types of connectivity usage. "Hyperscalers already charge for some aspects of cloud on a metering basis...hence in the culture of their business model, it's a known quantity," he argues. When hyperscalers roll out new services that are metered similarly to their other services, customers are not phased.

"[But] if telcos tried to do this," Bell argues, "there could be an uproar and a perception of gouging the market."

Monetization is the obvious and necessary next step CSPs must take in the AI market. They need to move beyond internal operations projects and position themselves to profit from the historic and explosive growth in AI and the connectivity AI solutions require. To meter, monetize and control access to – or charge for – connectivity supporting differentiated AI workloads, operators will need to adapt their charging infrastructures substantially.

The goal is to be able to meter and monetize a new range of consumed connectivity resources as well as related events and capabilities that underpin AI solutions and workloads. These could include guaranteed quality of service (QoS), autonomous self-healing events, ultra-low latency guarantees and security characteristics. Looking at charging in this way is not only substantially different than what was imagined for the 4G environment, but it also exceeds the market vision that resulted in the 5G SA charging specification.

Although the specification is a significant step beyond 4G in charging architecture and functionality, it was not originally designed to anticipate the novel developments rapidly emerging from the AI market. CSPs will need more from their monetization infrastructure, and more from charging, than what's included in the 5G SA specification to capitalize on growth opportunities.

In the final section we outline some steps CSPs can take towards meeting expanded expectations for network charging.

> CSPs may be concerned that they will face pushback in the market if they begin differentiating how they meter and bill for new types of connectivity usage.

section 5

make it happen – strategies for modernizing charging

Most CSPs still have charging solutions and architectures that were designed for 4G mobile networks. Given the rapid growth of services based in clouds, connected via APIs and powered with AI, it is time to rethink charging capabilities as part of a much-needed focus on monetization.

A major shift in telecoms charging strategies is necessary, given the digital disruption and emergence of AI in global telecoms markets. Makman Consulting's Luqman Shantal says that shift will often focus on a "transition from mobile-centric charging to a more integrated approach to drive growth in new markets".

Based on advice from experts interviewed for his report, here are several steps CSPs can take to rethink their charging architectures and the customer experiences they power.

Borrow from hyperscale metering concepts
"TM Forum is moving away from traditional OSS/BSS terms," says Shantal, and is adopting the language "to align with modern platform and e-commerce models". He encourages CSPs to embrace platform models so they can "offer modular and flexible services, similar to hyperscalers". He adds that "hyperscalers like Google and Microsoft have long invested in flexible metering infrastructures", and this is what enabled them "to swiftly adapt to AI-driven workloads". This kind of monetization flexibility is something "telecoms must emulate... to stay competitive", Shantal says.

Provide visibility and control
Future charging platforms need to provide more visibility and control over resource consumption and costs than telcos typically provide. The underlying technology needs to generate data that shows users in real time what is happening on a live dashboard. That will allow customers to manage performance, quality of service, and efficiency.

Let customers project their costs
Another major advantage hyperscale providers have normalized, and which combines CX and monetization, is modeling. They allow customers to simulate and optimize their deployments and predict what their costs will be and how they may change over time. "I have not seen in telcos where you can model your consumption beforehand and know what you're going to spend or use before you do it," says Microsoft's Lievano. In contrast, enterprises can use connectivity metering to measure and manage the cost of how much data they move in and out of hyperscalers' clouds.

> "
> Hyperscalers allow customers to simulate and optimize their deployments and predict what their costs will be and how they may change over time.

Guide clients and highlight telco value

Kearney's Bell suggests that, rather than dissuading usage, the simulation and cost projection process highlights the value a CSP can add and can enable it to "guide clients on how to maximize their telco services each month". He says that as we have seen with cloud providers offering portals to customers, this should translate into more connectivity resource consumption and more CSP revenue. In the longer term, portals could enable customers to see compute and storage consumption across different operators and connections, with recommendations on how to achieve greater efficiency.

Use ODA to connect telco charging with hyperscale metering

Shantal points out that TM Forum's ODA plays a critical role in merging telecoms and hyperscale concepts, like charging and metering, and in providing evolutionary paths for them, such as with Open APIs. "Enhancing charging systems with intelligent management functions [will prove] vital for supporting modern digital services," he says. He adds that charging should be seen as "a strategic asset that can unlock new revenue streams and business models for CSPs".

> Charging should be seen as a strategic asset that can unlock new revenue streams and business models for CSPs.

Amdocs Charging:
Confidence and Ingenuity

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Adaptation to Evolved Expectations

As services become more diverse and personalized, real-time visibility and seamless service activation are essential. For advanced experiences like industrial XR, gaming, entertainment or V2X, charging must be flawlessly integrated into the connectivity experience, operating smoothly in the background while providing clear pricing breakdowns and self-service options for adjusting service elements when needed.

Reliability, however, is non-negotiable. There can be no blind spots in terms of data visibility and system robustness. But reliability doesn't need to stifle innovation. The goal is to balance total reliability with extreme flexibility to meet diverse and evolving customer expectations. In other words, innovative charging models must be catered to.

By prioritizing both trustworthiness – which includes advanced security – as well as highly adaptable charging methods, businesses can confidently enhance customer satisfaction and stay ahead in the market.

Demands on realtime charging are much greater at an enterprise level

CSP-driven capabilities are only one side of the equation. As consumer expectations continue to evolve, enterprise requirements are also becoming increasingly demanding, pressing CSPs to adapt quickly. CSPs are therefore striving to define their roles in the enterprise space – for example which sectors such as healthcare or manufacturing to address – knowing that enterprises will continuously evaluate their choice of CSP.
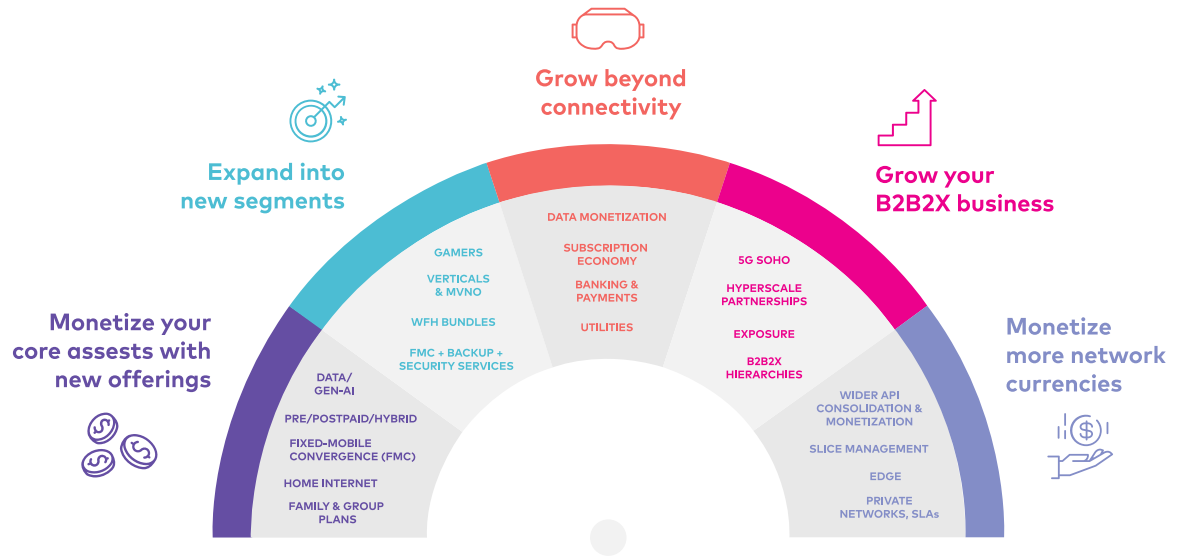

Fig. 1: Business requirements demanding network and charging flexibility

SLAs and real-time demands for industrial connectivity and applications can be a double-edged sword. While on one hand, they present CSPs with new revenue opportunities, on the other, they introduce challenges and consequences when expectations are not met. Multi-party services need to run precisely, enterprise hierarchies need to be made seamlessly controllable, and real-time, mid-cycle adjustments must be catered to as needed. Everything simply must work perfectly and securely for business users at any level. Enterprise and B2B2X services can be highly valuable but only when working flawlessly. The enormity of charging's role as an essential element of enterprise services cannot be underestimated.

Amdocs Charging:
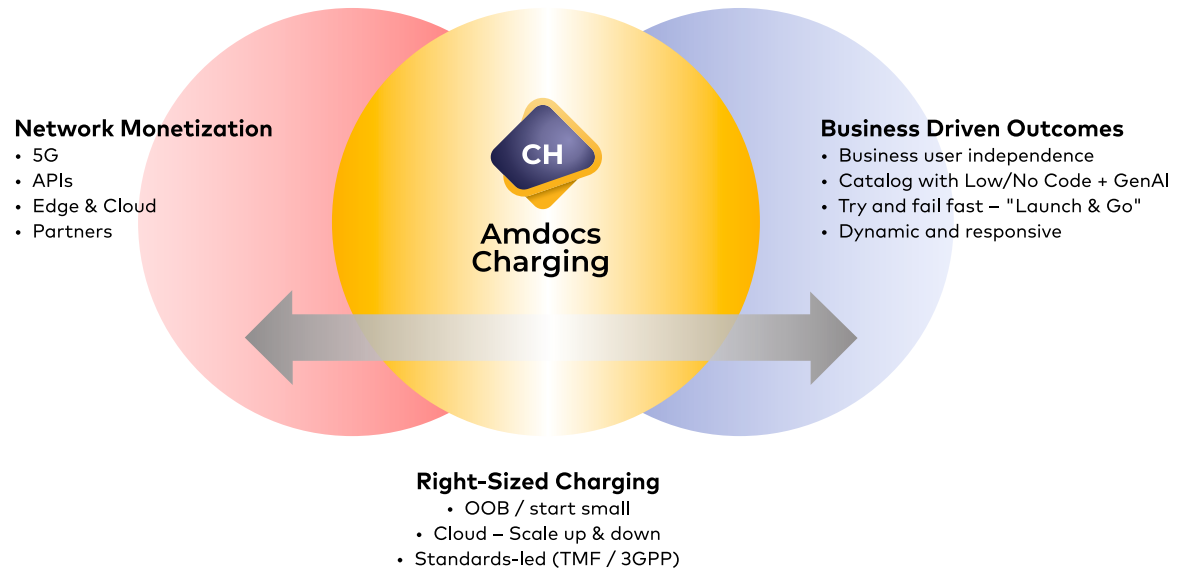# Confidence and Ingenuity

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The rapid evolution of GenAI and APIs underscores the critical need for responsive charging

As 5G technology advances, the pace of progress, though uneven, is expected to be explosive for certain services. The dynamic communications and media landscape (boosted by hyperscaler coopetition) presents significant opportunities for providers willing to shape and capitalize on emerging trends such as those in edge computing, IoT and satellite technologies – with recent advancements in GenAI and API exposure augmenting this.

Meanwhile, the competitive environment remains highly fluid and potentially disruptive. And while the opportunities for multi-party partnership continue to expand, for some CSPs it will be too complex. For these reasons, having an adaptable monetization strategy that facilitates experimentation in an increasingly complex environment is more important than ever. As the network diversifies, charging will remain critical, offering a strategic advantage to those who can navigate, influence and embed monetization strategies ahead of emerging trends.

Amdocs Charging: Balancing the three key requirements for effective monetization strategy

Growth is rarely driven by a single source or feature. Rather, it results from a combination of elements working together. Charging is no exception: to be truly effective, it needs to be adaptive, timely and well-supported.

Network Monetization
- 5G
- APIs
- Edge & Cloud
- Partners

CH

Amdocs Charging

Business Driven Outcomes
- Business user independence
- Catalog with Low/No Code + GenAI
- Try and fail fast – "Launch & Go"
- Dynamic and responsive

Right-Sized Charging
- OOB / start small
- Cloud – Scale up & down
- Standards-led (TMF / 3GPP)

Amdocs Charging focuses on three essential areas to ensure optimal monetization capabilities for CSPs, no matter where they are in their development journey.

1. Network monetization focus

Especially as 5G standalone (SA) matures, the newly monetizable elements of 5G, sometimes referred to as freshly available "currencies", continue to emerge. These elements, particularly improvements in latency, speed, coverage, capacity and density features, need to be managed, combined and tailored to monetize new devices and markets via API exposure. This goes far beyond traditional charging models and "all you can eat" plans of the past.

Fig. 2: Right-sized and adaptive charging for evolving business requirements & network capabilities

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Flexible monetization options that align with network capabilities are therefore more critical than ever. What was once an afterthought or just a checkbox for some CSPs has now become an essential driver of service success.

2. Versatility with right-sized charging

While the ability to reach and respond to network capabilities as they become available is essential, it alone is insufficient. And while CSPs need additional flexibility such as cloud elasticity to spin up (and back down) as needed for specific services, those services need to be personalized – potentially in real-time. This service-focus needs to be both lightweight enough for specialized MVNO competitiveness, as well as scalable to manage millions and perhaps hundreds of millions of users or endpoints.

Of course, in addition to deployment and adaptive scaling, charging has to provide continuous rating and monetization innovation after the initial setup. This means acting as a responsive value engine for every opportunity, from online gamers to industrial manufacturers, while catering to complex B2B hierarchies and B2B2X value chains. Increasingly, this will involve closer integration and interworking with data and AI to revolve silos and enhance existing services, as well as the need to define and develop yet-to-be-imagined services with optimal charging options.

3. Business outcome focus

In the context of ever-accelerating change and rising expectations, trialling more services increasingly seems like an obvious move. CSP business teams still dream of being able to test and adapt services rapidly without being hindered by outdated technology or complex systems. But they also need the confidence that comes with always having the latest toolsets – those that offer robustness, and are updated in the background without disrupting customers.

Meanwhile, interfaces need to be intuitive, based on low-code or no-code with rapidly available and easily accessible pre-integrated use case libraries. Configuration should take priority over customization, with telco-specific GenAI offering valuable support – even anticipating what is needed.

Unblocking the opportunities

So where does this leave CSPs now? There's no question that demands on these players are constantly changing and for many, they are more urgent than ever. To meet these challenges, CSPs must respond accordingly. Strong change agents are essential – particularly those who can efficiently support monetization and charging.

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Yet not all CSPs have managed this transition effectively. It's unsurprising that some CSPs have become frozen by bureaucratic and monolithic 3G or 4G-era vendor decisions. Others have become frustrated, having opted for unsupportive, startup-style providers with limited wider BSS and network experience in an over-focus on siloed services and cost-cutting. Both miscalculations have resulted in missed opportunities and under-delivery.

As a critical lens and driver of service lifecycle management, especially in the context of increasingly diverse and complex enterprise opportunities, Amdocs Charging continues to demonstrate its greater adaptability for CSPs of all sizes. By combining essential reliability with future-proof flexibility – supported by its focus on network orientation, versatility and business – the solution sets new standards in our industry for monetization success.

Amdocs and APIs

Amdocs believes in API-led opportunities and ecosystems for effective monetization. In today's digital landscape, seamless software integration is crucial for success. The TM Forum Open API program is paving the way for an "API-first" vision, making software in the communications industry work together seamlessly.

Amdocs is a top downloader of OpenAPI assets and is actively involved in designing new APIs. This commitment to open standards allows efficiency and ultimately, delivery of better services and experiences for CSPs. From its early support of the Open API manifesto to its leadership in designing new APIs, Amdocs is dedicated to driving the industry forward.

www.amdocs.com/products-services/charging
www.amdocs.com/news-press

About Amdocs

Amdocs helps those who build the future to make it amazing. With our market-leading portfolio of software products and services, we unlock our customers' innovative potential, empowering them to provide next-generation communication and media experiences for both the individual end user and large enterprise customers. Our approximately 29,000 employees around the globe are here to accelerate service providers' migration to the cloud, enable them to differentiate in the 5G era, and digitalize and automate their operations.

Listed on the NASDAQ Global Select Market, Amdocs had revenue of $4.89 billion in fiscal 2023.

For more information, visit Amdocs at **www.amdocs.com.**

tm forum
open digital architecture

TM Forum Open Digital Architecture - A blueprint for intelligent operations

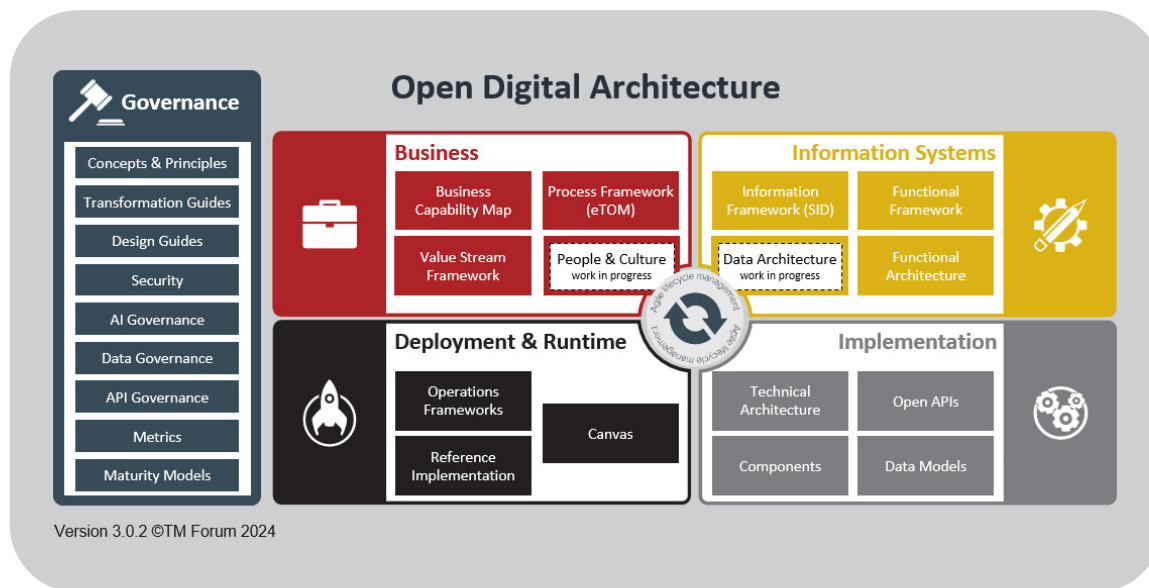The TM Forum Open Digital Architecture (ODA) provides a migration path from legacy IT systems and processes to modular, cloud-native software orchestrated using AI.

ODA comprises tools, code, knowledge and standards (machine-readable assets, not just documents). It is delivering business value for TM Forum members today, accelerating concept-to-cash, eliminating IT & network costs, and enhancing digital customer experience.

Developed by TM Forum member organizations through our Collaboration Community and Catalyst proofs of concept, ODA is being used by leading service providers and software companies worldwide.

ODA includes:

- An architecture framework, common language, and design principles
- Open APIs exposing business services
- Standardized software components
- A reference implementation
- Guides to navigate digital transformation
- Tools to support the migration from legacy architecture to ODA
- Maturity models and readiness checks to baseline digital capabilities.

Open Digital Architecture

Governance
- Concepts & Principles
- Transformation Guides
- Design Guides
- Security
- AI Governance
- Data Governance
- API Governance
- Metrics
- Maturity Models

Business
- Business Capability Map
- Process Framework (eTOM)
- Value Stream Framework
- People & Culture *work in progress*

Information Systems
- Information Framework (SID)
- Functional Framework
- Data Architecture *work in progress*
- Functional Architecture

Deployment & Runtime
- Operations Frameworks
- Canvas
- Reference Implementation

Implementation
- Technical Architecture
- Open APIs
- Components
- Data Models

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Goals of the Open Digital Architecture
The aim is to transform business agility (accelerating concept-to-cash), enable simpler IT solutions that are easier and cheaper to deploy, integrate and upgrade, and to establish a standardized software model and market which benefits all parties (service providers, their suppliers and systems integrators).

Learn more about collaboration

If you would like to learn more about the project or how to get involved in the TM Forum Collaboration Community, please contact George Glass.

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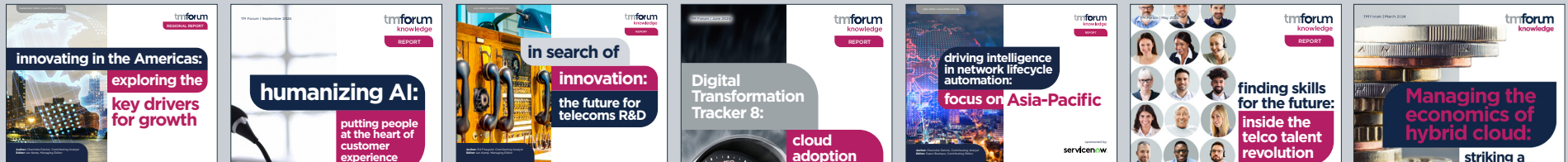
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