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The Future of Telcos and the Cloud: New Business Models and Paths to Growth for 2030

Table of Contents :

Table of Figures :

Summary

Catalyst: An industry in a grinding crisis

Touted revenue growth from the various “next generation networks” has largely failed to materialize.

What are the reasons behind this? Many point to regulatory constraints. Some highlight the need for telcos to adopt Agile, digital working cultures. Others, including Omdia, argue that traditional-based approaches to past and recent investments in network technology are another substantial factor. Historically, these investment approaches involved capital expenditure (capex)-intensive on-premises hardware deployment and required a concomitant investment in people to build and support this infrastructure. Various remedies have been proposed, from waves of re-organizations involving discrete digital teams to the divestment of what is considered legacy infrastructure. Very little has worked.

The industry’s expectation is that each generation of new network technology will lower the cost of delivering revenue and enable the rollout of new digital services. The reality so far is that each technology generation has enabled telcos to deliver more and better network services for less revenue, while operational expenditure (opex) grows. With few exceptions, average revenue per user (ARPU) has slid relentlessly, quarter on quarter, as consumers receive more for less.

Meanwhile, major consumer platform providers, such as Netflix, Amazon Prime, and others, are offering new digital services through ever faster and more widely available networks; they monetize increasing consumer demand by selling analytics that help businesses gain more insight into consumer behavior. Business networking services have not been spared: best-effort internet services and over-the-top voice have replaced more costly dedicated networks and voice services in some segments. Larger companies see the value in compute and application layers but view the network as a commodity. The telco, whose network and last mile deliver these services and help realize the digital economy, somehow misses out of most digital transactions.

Omdia’s view is that the industry must solve its opex and its capex challenge in order to leverage its network investments and drive profit. At the same time, it is a given that telcos must re-tool in order to offer better digital and managed services to consumers and enterprises. Could deep and transformative hyperscaler partnerships provide some of the answers? Or are the cloud players the ultimate threat?

This paper:

- Evaluates opex trends and considers the impact of further virtualization via the public cloud of network assets, functions, and their supporting systems.
- Maps out the future financial trajectory of the industry, given the potential impact of network cloudification.
- Identifies five new telco business models catalyzed by the cloud.
- Analyzes emerging ways of working with cloud providers to deliver new services and grow revenue.

For each way of working, we consider actual examples of the model in practice, deriving key lessons for telcos considering their next steps in the cloud.

Omdia view

The implications of this report are that telco-cloud working dynamics lead to significant, transformational consequences. Each service provider will adopt different motions at different times and with different business objectives. All communication service providers (CSPs) would do well to approach cloud as an opportunity to reimagine their roles in the technology ecosystem.

- **Shifting operations to cloud promises to reduce telco opex/revenue ratios by more than 10%**. Assuming a transformation horizon of a decade, by 2030, Omdia believes the typical brownfield operator could see opex as a percentage of revenue for network operations drop from 18.4% to 13.5%, and those associated with IT operations from 6.2% to 3.5%. For many telcos, especially those who choose a lean business model, this may be enough. These are significant declines for an industry necessarily characterized by complexity.
- **The current path will be hard to sustain because today's network continues to become more expensive to both build and run, with both capex and opex rising**. Our latest data shows that telco opex is growing at a faster pace than revenue. At the same time, 5G and fiber buildouts continue to sustain capex growth. Mobile infrastructure capex from the world's twenty largest operator groups increased from $177bn in 2Q21 to $190bn in 2Q22. Fixed network infrastructure capex from the same cohort increased from $172bn in 2Q21 to $174bn in 2Q22 (source: Omdia, *Communications Provider Revenue and Capex Highlights – 2Q22,* November 2022*)*.
- **Just one in 10 CSPs studied have reduced their opex over revenue in the last decade**. Omdia examined the financials for the last decade of 28 major operators. Only nine of them managed to reduce their opex. Of those nine, only three did so in an "efficient" manner by keeping their opex/revenue ratio below the 60% threshold, considered a sign of industry efficiency. We note that many of the CSPs surveyed in our recent telco cloud transformation research have not meaningfully migrated many of their IT and OT systems to the cloud. This implies there is room for more opex reduction and reduced infrastructure costs from cloud automation.
- **Profitability management will remain challenging against rising IT and network operations costs.** Network opex has grown significantly since the pandemic. Its share of opex has increased from 15.9% in 2009 to 17.4% in 2018 and 18.4% in 2022. IT operations costs are growing more slowly, but also steadily: from 2.9% of opex in 2009, to 5.9% in 2018, with a further increase to 6.2% in 2022. Telcos' necessary shifts toward software-centric networks and the delivery of new digital services are contributors to these rises in spend. So is the sheer complexity of maintaining and managing heterogenous infrastructure characterized by more next-gen radio and fiber access.
- **There are five possible telco-cloud business models.** Beyond cost control, we see evidence that partnering with cloud providers enables CSPs to conduct business in new ways. *Buy-from*—the direct sales model in which hyperscalers sell their services to telcos looking to migrate workloads to the cloud—is the predominant model today. The four newer models include *marketplaces* in which CSPs buy but also sell services, or even act as a channel and *sell-through*, in which CSPs resell hyperscaler services as well as those of the broader ecosystem. In the B2B segment, there are numerous cases of *side-by-side* sales of complementary hyperscaler and CSP services, as well as *co-investment* as the two build new services together to address the enterprise opportunity. These models let CSPs offer new network-based services in the control and management planes, with the telco building in local service delivery, managed, and support

services. Application delivery and analytics at the network edge will feature heavily. Omdia currently estimates that a typical national incumbent telco in a mid-sized country could derive hundreds of millions of dollars in additional connectivity revenue due to greater traffic flows and through premium features and services such as guaranteed latency, jitter, and remote hands at edge compute sites. Our latest survey on telco edge strategies (publication forthcoming) indicates that the most preferred sales approach for edge will be joint go-to-market with public cloud providers.

The case studies covered later in this report demonstrate that opex reduction or revenue growth through these new ways of working is possible today.

Recommendations

- **Focus on opex control through key cloud investments.** For many telcos, especially those that choose a lean operating model, focusing on reduction in spend may be enough. CSPs should set opex expectations with cloud partners and work with them to achieve these, demanding hard evidence of achieved results from existing CSP customers. Operational change will require retirement of legacy architectures, training, and cultural shifts in IT teams, some of which might be leveraged from hyperscalers' professional services teams.
- **The cloud is neither binary nor monolithic; consider your lean, light, and local futures**. Many, if not most, telcos will adopt a hybrid operating model. They will in parts be *lean* (best-in-class network with limited local CSP retail), in parts be *light* (use the cloud to achieve operational transformation and offer new products to consumers and enterprise), and in some cases be *local* (network functions sit in the cloud, with investment in a CSP's local retail services, marketing and delivery and support). Omdia believes one of the most compelling futures for the telco is local, delivered directly or via a partner ecosystem. Latency-sensitive applications and local service delivery have increased in value, and local is a core competency for CSPs.
- **Start with one or two of the five telco-cloud partner models.** Some CSPs, especially those in advanced markets, can afford to explore and invest in new cloud partner models. For the majority, we think that *buy from* and *sell through* provide the most readily available opportunities. Working *side-by-side* with cloud providers and *co-investment* may prove more challenging for CSPs in smaller geographies and markets. *Marketplaces* may prove a democratizing force, but they are not yet well developed in comparison to the buy-from and sell through business models.

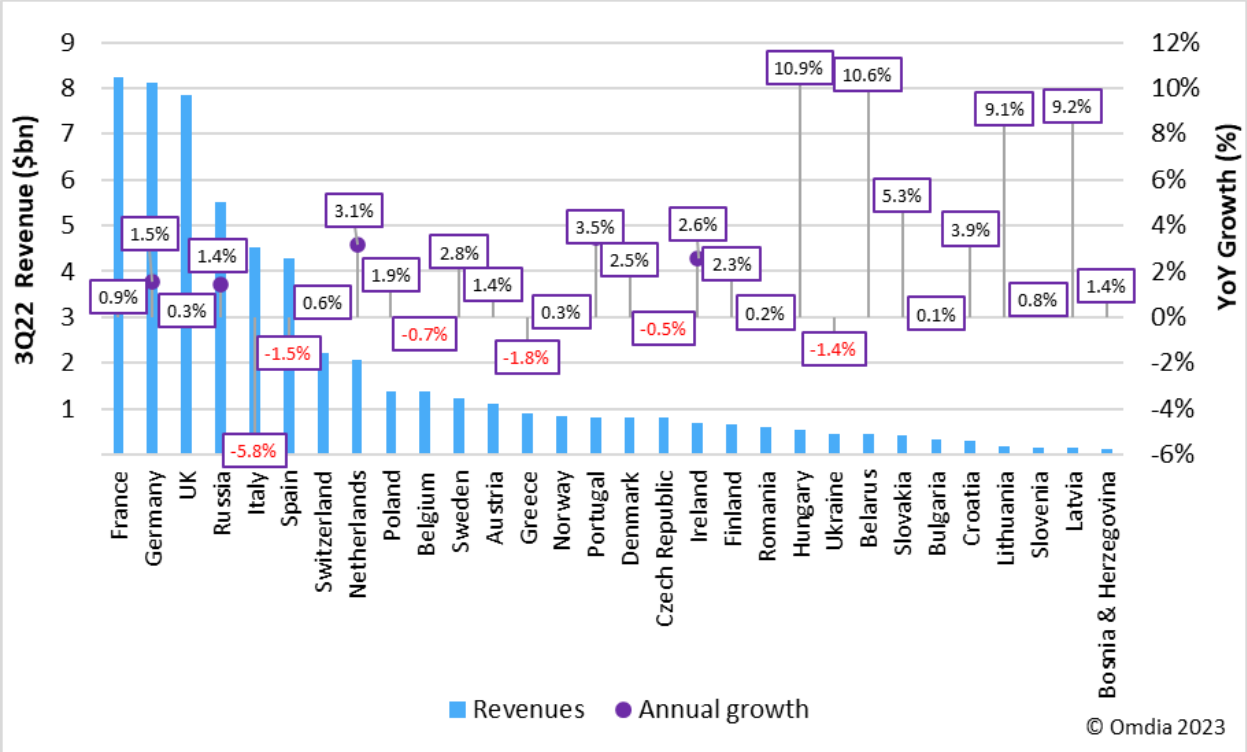
Network economics are failing to deliver growth

In the search for both revenue growth and cost savings, telcos have moved from one generation of network to the next. Yet, most often, as each new technology generation is rolled out, while bandwidth cost per bit falls, traffic volumes rise and revenue growth from new services fails to materialize. The industry has been caught in the cycle of delivering more data for less revenue.

For example, over the last decade, Western European mobile ARPU has largely declined each quarter across the 3rd and 4th mobile generations. CSPs have been performing better since the pandemic. While they lost

4% of top-line revenue in 2Q20 vs 1Q20, they have recovered and, by 2Q2,1 more than made up this loss. However, growth is anemic, with total global CSP revenue entering 2022 only 3.4% higher than the start of 2020. Our most recent forecast shows telcos in developed markets poised to grow revenue only between 1% and 2% in 2022 (source: *World Telecoms Information Service (WTIS)).* The pandemic is not the excuse it used to be, and Omdia's data shows the concern about lack of growth among senior CSP leadership is well-founded. **Figure 1** demonstrates that in Europe's largest markets, growth remains anemic, and in almost all countries, it is below the rate of inflation.

Figure 1: European telecoms revenue and year-on-year (YoY) growth by country, 3Q22 ($bn)



Source: Omdia

These are poor returns for the industry given combined capex spend of $3.6trn in the last decade (source: *Communications Provider Revenue and Capex Tracker – 1Q22, Aug 2022*). Imagine spending $3.6trn, just shy of the entire size of the German economy, to grow at an average of between 1–2% per annum since 2012: CSPs have been investing heavily in order to tread water. While such capex has enabled the growth of other industries and economies overall, it has not put CSPs on their own growth paths.

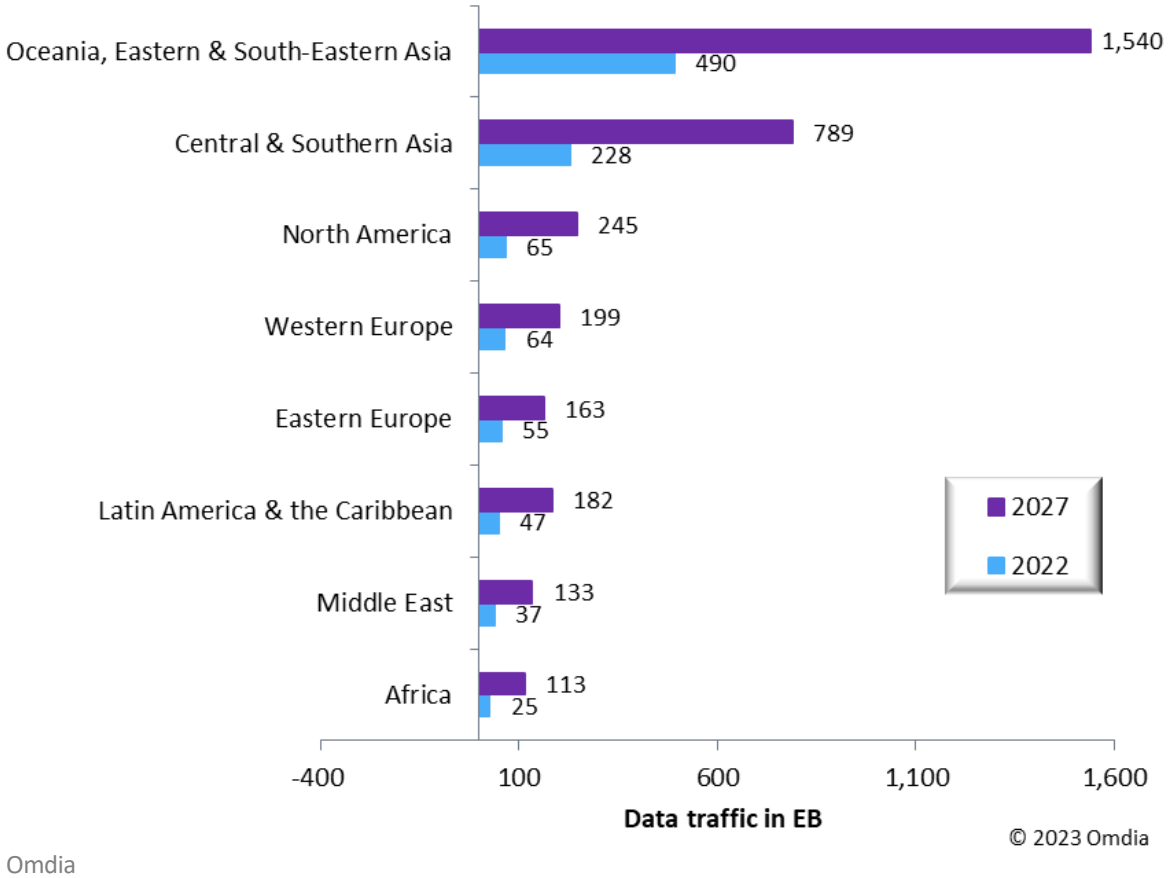
A changing traffic profile presents a further challenge

One of the key drivers against opex control is constant growth in network traffic. This insatiable demand shows little sign of abating. By 2026, Omdia expects another billion connections to be added to cellular networks globally, while the volume of network traffic will double in just over three years. Our media consumption habits continue to change. Consumers will not just watch more video: it is in higher definition, on more devices, and accessing more sources. Whether CSPs can learn from their misses in the 4G era and take a profitable cut of this is an open question.

What we know for sure is that tomorrow's network will be dominated by video, which Omdia forecasts will account for 80% share in traffic in 2024. Inevitably, bandwidth prices per GB fall in response to rising

demand. Omdia forecasts that by 2027, global revenue per GB of cellular data will be $0.25, a reduction of 66% from 2022 (source: *Cellular Data Traffic Forecast, July 2022*). Growth in traffic is simply going to outpace the ability of telcos to raise tariffs. Meanwhile, the average subscription will consume over 22GB/month of data by 2027, up from 8GB/month in 2022. Likewise for consumer fixed broadband, Omdia projects global revenue per GB will be $0.07 in 2024, down from $0.19 in 2019.

Figure 2: Regional cellular data traffic, 2022–27



Source: Omdia

Growth across all regions is very high, with Asia standing out in absolute terms, driven by high uptake of advanced devices and the pace of innovative service launches in advanced markets such as Korea, Japan, and China. However, in relative terms, developing markets in Africa, the Middle East, and Latin America will grow fastest, though from very low bases.

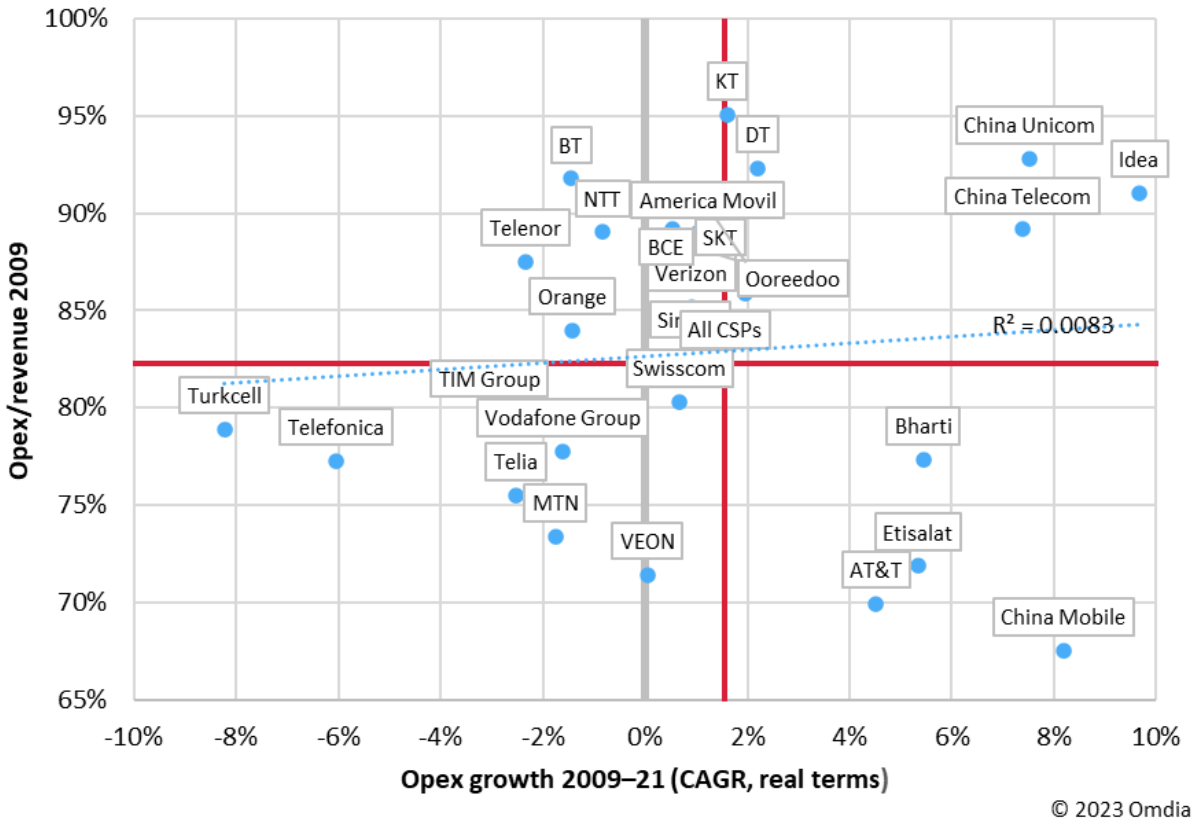
Opex is on the increase, placing telcos in a bind

While most telcos have been motivated to adopt each new generation of traditional-model network rollouts to reduce costs, the inefficiency of running multiple networks and the growing complexity of service delivery means that most telcos are accelerating rather than reducing opex. In particular, rising IT costs—to support automation and personalization—are driving up the cost of delivery.

As a result, most telcos have seen opex growth since 2009. Omdia has measured operators' opex growth based on using opex measured as revenue—EBITDA—in order to normalize comparisons and eliminate accounting for depreciation and amortization as some operator groups have varied accounting practices as

they account for legacy infrastructure. Only 9 of the 28 major operators reduced their opex over the period, and of those, only three (or 11% of those under consideration), did so in an "efficient" manner—keeping their opex/revenue below the 60% threshold considered a sign of industry efficiency. As set out in **Figure 3**, these telcos were TIM, MTN, and Telefónica.

Figure 3: Opex reduction 2009–21 versus opex efficiency in 2009



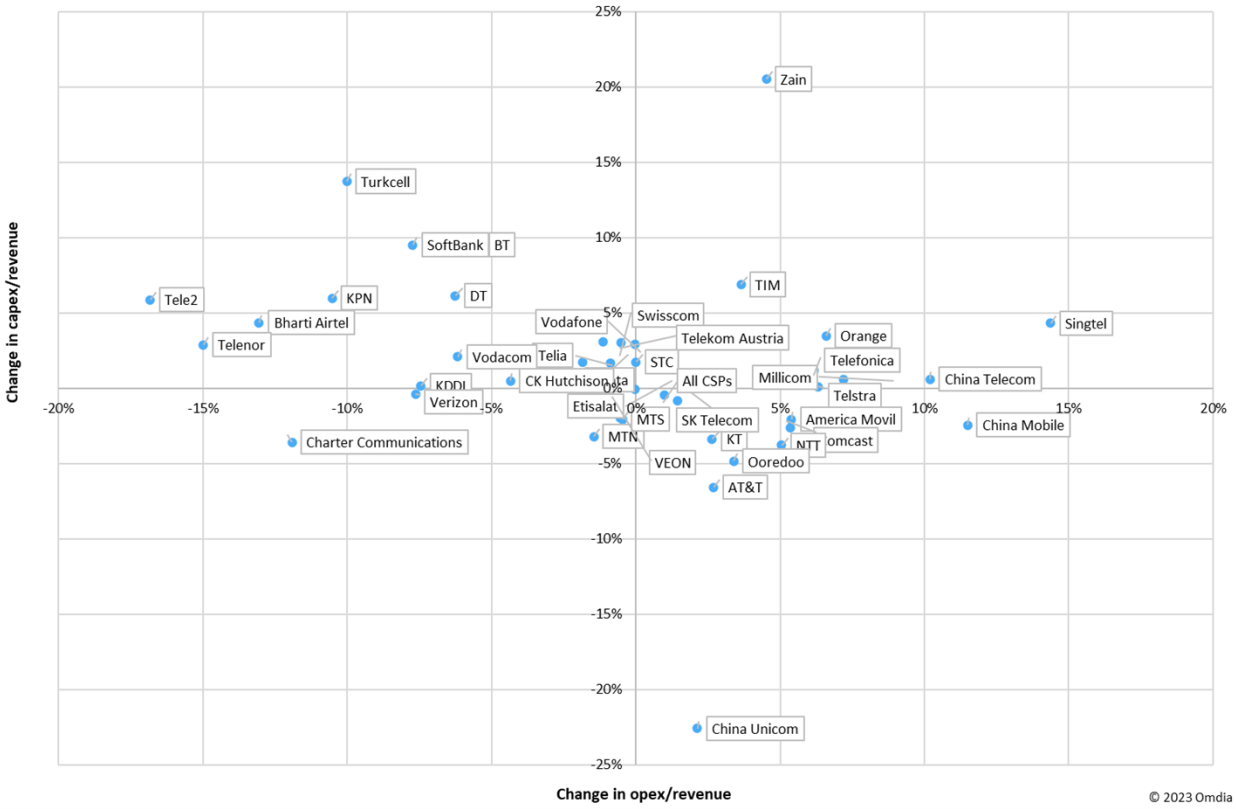
Source: Omdia

While the view above presents a picture of efficiency gains (or the lack thereof) via opex savings, it does not consider the overall telco capital investment scenario. The implicit promise is that increasing capex in new platforms and network technologies will lead to increased efficiency, which should be realized by a decreasing opex ratio. Failing that, capex investments will grow top-line revenue, thereby decreasing the opex-to-revenue ratio, if not within two to three years, then in the medium to long term. Has it?

- Over the entirety of the decade, there has not been a significant decrease in opex/revenue ratios. There has been an overall 1% increase. There are some outliers: Bharti, Charter, KPN, Tele2, Telenor, and Turkcell achieved opex/revenue ratio reductions of over 10%.
- In some high-growth markets, significant capex increases in absolute terms may be masked by the top-line revenue growth. Such is the case with China Unicom. Others who've increased their capital intensity include BT, SoftBank, and Turkcell, whose track records present a mixed picture. On average, and across all telcos under consideration, the capex/revenue ratio has not changed. With massive investment in next-generation access (both 5G and fixed) as well as internal transformation, we would not expect capex/revenue to fall. But such sustained capex should result in either top-line growth or improved opex/revenue.

Therefore, the answer is no: As an industry and as a whole, telcos have made no change to their opex and capex fundamentals in aggregate over the last decade. They may have transformed operationally, but it has not transformed their financial fundamentals.

Figure 4: Change in opex and capex, revenue ratios over time (2010–11/2020–21)



Source: Omdia

Cloud-led: Realizing opex efficiencies

If next-generation technologies are designed to be more efficient, what is it in the business of networking that makes most telco costs rise? The current opex picture is complex. The rising demand for data meets new technologies that make the cost per MB cheaper, and the cost efficiencies are neutralized. At the same time, in order to improve the management of the network through greater automation and personalization of services, IT spend is rapidly growing.

The demands on the industry to continuously invest in next-gen network technologies will not abate. But new technologies—at least as procured and deployed to date—are contributing to opex growth, not opex reduction. Telcos are caught in a bind. They must invest to enable next-generation services, but such investment comes at a cost which does not easily translate into operational savings. It would be easy to blame individual telcos for strategic or tactical errors, but the challenge seems to be structural in nature.

A new approach to network ownership, which is platform-led ("the network as the platform") and is executed in collaboration with hyperscalers, potentially improves CSP network economics for operators. When a telco adopts the public cloud, it aims to lower the cost of running infrastructure to power its

network and internal operations by transferring functions from hardware in its own data centers to software running in standardized hosted environments. But does it?

Table 1: Opex spend as a % of revenue has grown—the cloud-led approach would reverse this

Opex category	2009	2018	*2022 (f)*	*Cloud-led 2030 (f)*	Cloud-led drivers for opex reduction
Network operations	15.9%	17.4%	*18.4%*	*13.5%*	Sunsetting of legacy networks will partially mitigate network operations opex increases, but moving network functions into the cloud will accelerate this, allowing for a projected 50–75% reduction in headcount in network operations.
IT operations	2.9%	5.9%	*6.2%*	*3.5%*	As network footprints and services have grown, so too have costs for managing the IT that supports these. Cloud changes this dynamic. While enterprises show a 4% IT spend decrease (as a percent of revenue) when adopting public cloud, telcos are not projected to achieve quite these levels. However, increasing staff efficiency will enable a shift to a focus on dev and will decrease production release intervals. There will be a dramatic increase in VMs managed per head.
Content	0.6%	3.6%	*3.6%*	*3%*	Telcos will drive better content deals with hyperscalers as they deepen relationships.
Leased network	2.9%	3.4%	*3.9%*	*3.9%*	We expect an increasing reliance on neutral hosts and leased capacity.
Interconnection	7.1%	3.6%	*3.3%*	*3.3%*	No significant projected change.
Regulatory	1.9%	1.9%	*1.9%*	*1.9%*	No significant change.
Devices	8.8%	10.1%	*9%*	*8%*	Device costs will be driven down modestly through technology advances and economies of scale.
Marketing	2.5%	2.3%	*2.1%*	*2.1%*	No significant projected change in spend, though providers will be able to redirect resources to focus further on brand and outreach.
Operational sales	16.3%	11.8%	*9%*	*7%*	Using hyperscaler expertise in analytics and customer sentiment will improve sales

					efficiency.

Source: Omdia

The table above delineates opex as a percent of revenue in 2009 and 2018, with a forecast for 2022. We also project opex under a cloud-led operating model in 2030.

Telcos' IT operations costs climbed to over 6% of revenue in 2022, compared to about 3% of revenue in 2009, while network operations costs climbed from almost 16% in 2009 to over 18% of top-line revenue in 2022. In many industries, growing IT spend was met with higher top-line revenue growth from massive investment in enterprise digitalization. However, the telecoms industry saw growing IT spend in the face of flat revenue.

Omdia estimates that with a moderate adoption of hyperscaler cloud services, opex as a proportion of revenue would fall significantly. By moderate, we mean cloudification of BSS, including customer-facing systems, as well as key operational systems such as network management and analytics, and a partial cloudification of the 5G core.

In discussions with several hyperscalers and telcos, Omdia has determined that the benefits of public cloud adoption experienced by enterprises in other industries, such as retail, manufacturing, transport, and financial services, apply to operators, with some caveats. Typical benefits include IT operations cost saving, increased speed of innovation, and agility of business operations as some resource is diverted from traditional maintenance and upgrades to software-oriented DevOps-centric teams. CSPs are themselves highly complex technology providers, and are operating in a tightly regulated environment with universal service obligations, so we expect the impact of cloud transformation to be substantial, but slightly blunted when compared to the generic enterprise.

For CSPs, these savings include typically a single digit percent decrease in total IT spend as a percentage of revenue, with a more significant decrease (20%) in IT infrastructure spend as a percentage of total IT spend. Application development and management costs typically decline by up to one-third in the medium term. Enterprises as a whole report having achieved improved operational resilience, with a significant reduction in security incidents, a huge decrease in unplanned downtime and a near 25% increase in SLA adherence. Telcos differ from other more generic enterprises in their network and systems redundancy and resilience: Omdia expects telcos to also reap some benefits, but not at the level of the typical large enterprise.

Based on Omdia research, we have forecasted the reduction in opex spend as a percentage of revenue for the "average" brownfield operator by 2030, assuming a transformation horizon of nearly a decade, in a journey which begins in 2023. This forecast is in the cloud-led 2030 column in the table above.

In short, moderate cloud adoption across key telco domains will result on opex as a percent of revenue falling, with opex dropping from about 57% of revenue in 2022 to about 46% of revenue in 2030. Telcos believe in the savings potential: AWS alone has announced nine network-related deployments and 12 BSS/OSS implementations to date.

Telcos at a fork in the road

CSPs want to find operational savings and tap into faster routes to revenue growth. But they must do this in an environment where network investment—while necessary—is not translating into top-line growth.

Operators cannot sustain the current rise in their IT costs over the long term (Omdia forecasts that in the next three years, CSPs will spend over $300bn on IT). More and more of them are reaching the conclusion

that certain IT systems and operations will be cheaper when transformed, or just lifted and shifted, into a hyperscaler cloud.

Three broad responses

Omdia has delineated three possible strategic responses for telcos, divided between the data, control and management planes. In this model, telcos can choose from three operating strategies:

- **Lean.** Ever-leaner insourced operations, which are focused on the data plane and wholesaling services to other operators who serve retail customers (possibly even including the cloud providers as retailers).
- **Light.** Asset-light, cloud-heavy, and open network services. Supporting managed network services, including device management, technical support, analytics/security/edge, for consumers and enterprises in the control and management planes of the network.
- **Local.** Outsourced core network functions and third-party services where key network functions and systems are hosted by hyperscalers, with the telco focusing on local retail functions and service delivery from its own and partner ecosystems.

Most telcos will span the array. Some will decide in favor of a slimmed-down infrastructure that performs the workhorse tasks of shunting bandwidth-intensive traffic around its network; others will entrust more of their networks to the cloud; and still, others will target specific customer segments (for example, business customers) through an emphasis on local delivery and support. Within a single large telco, these approaches may co-exist.

Leaner-insourced traditional network operations

In order to manage their financial position, some large telcos are now disposing of low-return assets and operations (e.g., Telefónica its Latin America businesses, Verizon its media business). They are selling and leasing back passive infrastructure (e.g., Vodafone's spun-off tower assets, Telefónica's sold tower business). This trend of asset disposal may create future challenges for regional concentrations. For example, Cellnex will own 129,000 cell towers in Europe. Regardless, the model seems to be gaining in popularity. For more insight on this issue, you can read Light Reading's coverage in *A Cellnet Mutation Could Upend European Telecoms* (LightReading.com, 7 May 2021). Omdia's major report covers this topic in great depth in *Market Landscape: Neutral Infrastructure*.

Asset-light, cloud-heavy, and open-network economics

More telcos are looking to manage opex by moving from dedicated hardware and software to software-controlled networks and open hardware platforms. This shift from dedicated hardware to virtualized services means that moves/adds/changes (MACs) can be deployed with fewer truck rolls and lower operating costs. The China Unicom case study later in this report provides an example.

Some new service features allow CSPs to continuously monitor, automate, and upgrade their networks. The network is equipped to scale and shift network resources rapidly to better match the demand for revenue-generating services. One future example coming over the next five years might be dynamic traffic shaping through network slicing, by end-user session or context-of-use.

For the past three years, wireless services providers have shown an increasing appetite for open interfaces and RAN virtualization. Together with vendors, they have collaborated within organization, such as the O-RAN Alliance and the Telecom Infra Project (TIP), to define new specifications and to develop and test open, virtualized, and multivendor RANs.

New wireless service providers, namely DISH Wireless (US) and 1&1 (Germany), have committed to deploying nationwide networks using open vRAN. KDDI and NTT DOCOMO in Japan have also started deploying RAN with open interfaces and will adopt vRAN from 2022. In addition, DT in Germany and Vodafone in the UK opened their first Open vRAN sites in 2021, and Telefónica committed to doing the same in 2022.

Many obstacles remain, including the lack of maturity of the open vRAN vendor ecosystem. In 2022, Omdia forecasts that open vRAN spending will exceed $2bn: Several Tier 1 wireless service providers in North America, Europe, and Asia & Oceania are moving from small-scale pilots to sizeable commercial deployments. However, it is important to contextualize this number. Market coverage of open vRAN sometimes makes it sound like it has taken over the RAN market. But sales from open vRAN solutions only represent an estimated 7% of the total RAN market in 2022, growing to a projected 16% in 2026. Brownfield operators will likely face challenges integrating open vRAN networks with existing networks. Many operators facing the daunting prospect of nationwide 5G deployments may not want to introduce either new RAN technologies or vendors into their infrastructure in the near term. In short, the transition to asset-light, cloud-heavy, and open-wireless networks will be gradual for the majority of operators.

Outsourced core network functions and third-party services

In another effort to reduce costs and gain agility, telcos are outsourcing more of their network functions to hyperscalers. Examples include AT&T/Microsoft, Dish/Amazon, Bell Canada/Google, and SK Telecom/Amazon. Telcos seek cheaper operating models that let them focus development resources on other domains and initiatives.

Webscalers and telcos have been reluctant to state specific cost-saving targets that they hope to achieve. However, Omdia understands that Vodafone reportedly targets slashing the cost of running some systems by 20% to 40% through Google Cloud Platform. AT&T sold its Network Cloud business to Microsoft, transferring a few hundred staff with the expectation to “substantially reduce engineering and development costs.” Verizon's CFO called out the capital-easing benefits of the “intelligent edge” work it is undertaking, much of it with AWS. That project involves collapsing the transport, core, and other layers of Verizon's network into something that would be simpler and cheaper to manage. While Verizon’s CFO did not quantify the benefit, the aim is to reduce the operating expenses for Verizon's network significantly.

New revenue: the potential benefits of hyperscaler co-operation

Beyond cost savings and operational efficiency, the advent of cloud business models opens opportunities to forge new types of relationships with third parties, which are then managed locally by the telco in enterprise accounts and the consumer market. Such benefits include improved network capabilities, personalization, and new opportunities that arise at the network edge. The attributes of these potential benefits include:

- A shared risk model with the hyperscaler, easing the path for development of new functionality and the rollout of new network capability.
- A more dynamic software infrastructure that will facilitate operational simplification, service automation, and end user personalization.
- A new growth opportunity for edge services and private network managed services in B2B, with further potential application management opportunities.

CSPs need to target applications that require low latency, and that benefit from the future networks ability to meet the user's or machine's performance requirements. What will some of these applications look like and how will CSPs build them?

- **Analytics capabilities** will become standard as a way to deliver personalized services. For example, a business connectivity service may self-provision based on usage patterns and predictions of short-term bandwidth requirements. Other key functions for CSPs will be user authentication, location, and endpoint monitoring.
- New decentralized computing models will mean some CSPs will launch new edge service "factories," each of which is supported with an ecosystem of third-party applications via SDKs, speeding new service launches and product inventories. The telco potentially could provision and bill for these ecosystem services. Some telcos will develop these services in-house while others will rely on solutions provided by the cloud services providers.
- Local service provider B2B managed services will flourish in advanced markets, in partnership with the hyperscalers. There will be an expanded role for service providers to bind together cloud services, the network, and applications in a managed service model. However, these will only be profitable if highly targeted, "industrialized" and delivered through an ecosystem in which the CSP knows the limits of its capabilities. This opportunity is most relevant for established CSPs in advanced markets. Examples of such services follow in the case studies later in this report.

New ways of working: the five models

Table 2: The five telco-cloud business models

Model	Description	Examples
Buy-from	A cloud provider sells cloud services to the CSP, with the aim of moving workloads from premises-based and CSP-owned to the public cloud.	AWS and Dish; Microsoft Azure and AT&T
Marketplace	Cloud providers offer CSP connectivity services on their marketplaces. CSPs set up their own B2B cloud marketplace or draw on hyperscaler economies of scale as part of their B2B managed services propositions.	Rakuten; China Mobile mCloud
Sell through	A CSP resells a cloud provider's services, often with a focus on unified communications or office productivity suites.	O2 and Microsoft 0365; BT and Microsoft Teams
Side-by-side	Cloud providers and CSPs align and launch services jointly for enterprises that want their compute and connectivity suppliers to bundle relevant offers such as VPN and cloud.	T-Systems and Google for Sovereign Cloud; Orange and Microsoft for Cloud de Confiance; China Unicom and Huawei for One Telco Cloud for 5G PNI-NPN
Co-investment	Deep collaboration between CSPs and hyperscalers to co-develop and launch new unified services, the components of which would not be complete or able to stand alone without the others.	Verizon, AT&T, and Lumen with Microsoft Azure; AWS and Google for MEC

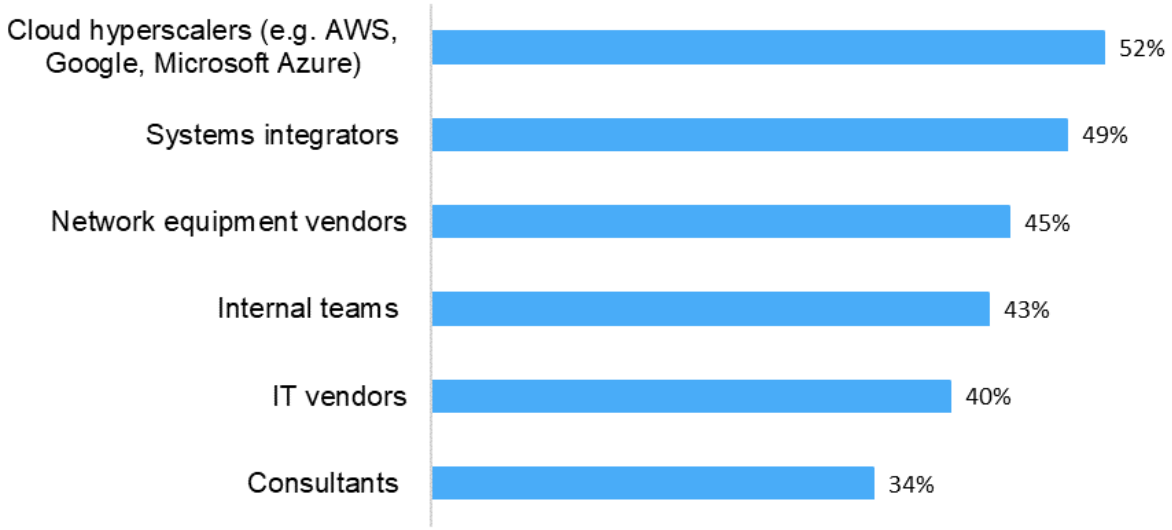
Source: Omdia

Model 1: Buy-from

The public cloud compute model in enterprise IT is founded on operationalizing IT infrastructure costs by moving workloads from in-house data centers to the hyperscaler's cloud. The benefits are well-understood by enterprises at large, as they shift towards an opex model in which usage, support, maintenance, and upgrades are bundled together in an over-arching services contract. Gone is the seven- to ten-year depreciation cycle for IT compute stacks, or applications, bought via traditional models.

More often than not, public cloud migration is central to the goal of overall enterprise digital transformation. Such a shift is associated with broader changes to business models as enterprises adopt agile, continuous application development. CSPs are large businesses: they, too, link public cloud and digital transformation. A recent Omdia report (*CSPs and the Public Cloud: Drivers and Challenges from a Technology and Business Perspective*) highlighted Omdia's CSP cloud survey. Omdia research shows that CSPs believe hyperscalers are their most important partners for executing their digital transformation plans.

Figure 5: CSPs' most important digital transformation partnerships



Note: Service Provider Digital Transformation and Cloud Strategies Survey – 2022
N=67

Source: Omdia

CSPs' two most important aims for their digital transformation initiatives are:

- Using cloud-based models to improve agility, scale, and efficiency. CSPs have historically faced long product development, enhancement, and rollout cycles due to the complexity of their multiple internal systems. They have often been limited in their ability to support service upgrades or new service launches across the entirety of their network estates.
- Aligning network and IT. For example, delivering a positive customer experience can also prove a challenge when network management and CRM systems are disjointed. CSPs have expressed a desire to increase the "programmability" of their network functions.

While telcos link agility and efficiency to cloud migration, cloudification of OSS/BSS and network domains has proven more complex than for IT domains. To date, most of the workloads shifted to the public cloud are more traditional IT applications (web services, Microsoft Office, and collaboration tools). Over the past year, more CSPs have begun to use public cloud to accelerate service delivery as they continue to explore and experiment with new applications. Some CSPs have moved select back-office operations and business support system (OSS and BSS) applications to the public cloud, as more OSS/BSS applications are offered in a software-as-a-service (SaaS) model. Some CSPs have trialed network functions on a public cloud. That said, of the hundreds of sizable telcos across the globe, relatively few have moved significant portions of their network functions into public cloud providers' infrastructure.

Most or all network functions will not necessarily move to the cloud (in any configuration). Most CSPs still need to become more educated about the benefits and risks, and they will need to prioritize and determine which network functions are most suitable from an architectural standpoint, as well as from operational and commercial angles.

Operators building infrastructure greenfield are more likely to explore full-scale cloud adoption. Multinational operators will take a more incremental approach. They can test new network function

development and delivery models in a discrete manner, letting one of their smaller OpCos, or a specific sub-region, test out new ideas. Omdia has seen this approach bear out as CSPs invest in 5G rollouts, and in particular 5G standalone (SA), where deploying network functions in the cloud makes both technical and commercial sense. The programmability and configurability of 5G SA is the essence of its value. CSPs can draw on network resources on-demand to deliver the right bandwidth at the right service levels for specific applications. 5G's promise of ultra-low latency supports the case for migration of network functions to the network edge, which implies central cloud-based function management.

Regardless of any individual CSP's path, there has been an acceleration of CSP workloads heading to the public cloud. The below case study on Dish and AWS showcases the public cloud as an enabler of new services, and a potential catalyst to develop services options for CSP customers.

Dish's goals

Omdia's sister publication, *Light Reading*, has covered Dish Network's 5G plans extensively. In short, as the US's fourth wireless carrier (thanks to the Sprint/T-Mobile merger of 2020), Dish committed to rolling out a core network and offer 5G services (initially focusing on fixed wireless access (FWA)) to at least a fifth of the population by 2022, with a commitment to extend 5G coverage to a majority of the US population in 2023. Since then, Dish has been an enthusiastic early champion of Open RAN (ORAN) and the public cloud, believing that these new architectures would enable it to bring new services to market faster and more cost-effectively than relying on single-stack vendor systems and traditional deployment models.

Table 3: Public Cloud—Dish Network's goals and outcomes

Goal	Description and outcomes
TCO reduction	Dish aimed for a significant cost savings over traditional deployment models for 5G core and other network and IT functions. The cloud deployment model will allow some zones to scale and others to sit idle according to relevant traffic and demand patterns, minimizing compute resource in use. Dish uses Graviton 2 instances where possible (for BSS, machine learning, video encoding, memory caching) and its code bases for core and RAN sit on Intel (AWS hosts these but achieves fewer advantages of scale compared to workloads running on Graviton 2). Further efficiencies are envisioned as code bases shift to Graviton, which AWS claims has a silicon architecture which allows for more efficient cycles, power, and overall less compute capacity for the same functional performance. In addition to Graviton driving TCO reduction, further reductions come from a rationalization of instance types, automation, and improved infrastructure elasticity.
Staff productivity gains	Account creation—for sandboxing applications for vendors all the way down to internal account creation for setting up virtual machines (VMs) for admins—used to take up to four months. This has now been reduced to a matter of hours. Dish and AWS also cite a substantial increase in VMs managed per admin, in infrastructure staff focused on strategic versus operational work, an increase in development staff focused on new features, as well as a decrease in the time gap between production releases.
Business agility	For Dish, agility means being able to get network functions and features to market significantly faster than competitors. While the network is still in its infancy, and few

	commercial services have yet to fully launch, the operator believes the public cloud and its open architecture approach will enable it to stand up and tear down hundreds and thousands of 5G network slices on demand. Cloud network functions (CNFs), which usually take months to deploy, should be launched in weeks, as tools like CI/CD, closed-loop automation, analytics, and predictive automation from the AWS public cloud are brought to bear. While it remains a challenge to place a specific value on agility, the vision is that the time-to-market for network applications is drastically reduced, and rollout (or roll-back) across network domains eased, enabling faster monetization. One proof point is that dish has gone from 0% to 20% coverage in 14 months (with 947 cloud network functions (CNFs) deployed).

Source: Omdia

Why AWS?

AWS and Dish cite the following reasons behind the CSP's decision to build its network on AWS's platform over that of competitors. These reasons are specific to Dish, and every CSP will need to carefully evaluate its own needs and its market context before deciding to move to public cloud, and then selecting the best cloud platform to achieve its goals.

- **Speed.** In evaluating the cloud providers, Dish felt that AWS was able to partner to move faster than its competitors, thereby enabling Dish to accelerate its network roll-out and monetization. For Dish, speed was paramount because it was making a "sitting start," launching a net-new national mobile network in a massive market that is highly mature. The FCC had also applied conditionality to its spectrum grants ,and Dish had committed to achieving significant population coverage in a short timeframe. Operators with large existing customer bases and other advantages of incumbency, as well as legacy telecoms tech stacks, may weight this criterion differently.
- **Presence.** Dish believes that AWS simply had more ubiquity of infrastructure, including local zones, outposts, and more cloud regions (as part of the project, AWS has delivered on more than 16 local zones, six availability zones, and three regions). This suited Dish's geographic requirements in the US market. Needless to say, CSPs are in the business of capillarity, and should ensure they are fully abreast of their hyperscaler partner's existing and planned presence in relevant end-customer locations.
- Ability to accommodate existing investments or other technology of choice. Dish also cited that the AWS hardware stack benefited them because less development effort was required for Dish's choice of hardware on AWS than in an Azure or GCP environment. Running an extremely lean development team, Dish was looking for ease of support for its hardware partners of choice. From its relatively greenfield context, Dish had a freedom of choice from which other CSPs may not benefit. CSPs should consider how public cloud partners can support dev on existing hardware stacks which the CSP has already invested in as they select a public cloud partner. There is also value in exploring the value of using the same cloud provider for network as for OSS/BSS.
- **Partnership.** Co-innovation is a highly subjective criterion, but Dish sees AWS as a partner for experimentation and innovation. This involves two types of co-investment. First, Dish felt AWS was willing to invest more to co-develop products to advance Dish's aims without asking for significant up-front investment from the CSP. Second, both parties invested in training up Dish team members to become more skilled on AWS.

The implication for CSPs considering a move to the public cloud is that they should ensure they see their provider as a partner and are comfortable with their culture of innovation, support for team development and their product roadmap. CSPs who go the public cloud route are entrusting their mission-critical infrastructure to their partner of choice. Culture counts, sometimes more than existing capabilities, if one of the CSP's goals is to use public cloud migration as an opportunity not just to cut opex, but to innovate with the realized savings.

Model 2: Marketplace

A compelling aspect of CSPs working with major cloud providers is the potential to exploit their marketplaces. Large cloud providers reach millions of businesses and tens of millions of consumers, and are a new channel to market for consumer and business services. This can work both ways. Hyperscalers offer connectivity services on their marketplaces in partnership with CSPs, who provide local access and value-added services such as integration and support. Examples include AWS Cloud WAN and Direct Connect, as well as Microsoft Azure ExpressRoute or BT Operator Connect for Microsoft Teams. Omdia is aware of partnerships in the works that will enable telcos in one geography to market jointly developed consumer services globally through a hyperscaler marketplace. In another type of marketplace model, a start-up offers its mobile core on the hyperscaler's cloud.

We expect this model to mature and grow in popularity. It holds the promise that CSPs can distribute their platforms far and wide for a relatively low cost, and with the ability to scale as they generate demand. The marketplace owner, of course, also stands to profit.

Two current examples stand out.

China Mobile mCloud

mCloud: from procurement to management

China Mobile's International mCloud portal provides enterprises with a marketplace platform which provisions services ranging from connectivity through to cloud compute and security, as well as other enterprise products such as collaboration and conferencing software.

China Mobile International clients can subscribe, manage, and monitor their services from the platform.

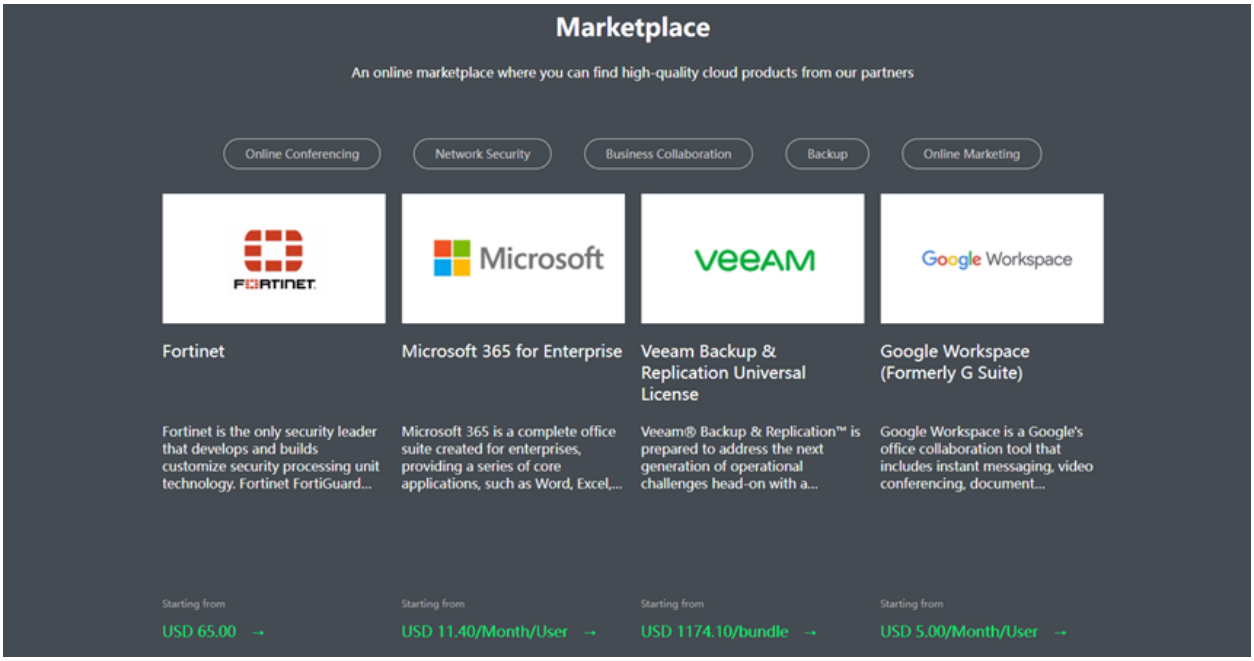
All services are purchased online. mCloud includes the following services:

- **Cloud Connect:** for connecting to and mirroring cloud services.
- **Multicloud:** for creating, deploying, and managing multicloud services from one integrated service management solution. Customers have the option to select cloud services from Google, Microsoft, or AWS.
- SD-WAN nodes managed through one single interface with CPEs installed and managed at local branches.
- **Application Acceleration:** software services to accelerate and cache key services across the enterprise network.
- An A2P platform for the delivery of SMS to customers.
- **A CDN service:** for the distribution of content through managed points of presence (PoPs).

In addition, clients have the option of purchasing China Mobile's marketplace platform itself, over which the customer can strike other third-party relationships which it can then go on to sell to its enterprise customers. The subscription process for these services appears to be straightforward—all prospective customers need do is to sign up to the mCloud portal, select a payment method and provide a business license.

Beyond cloud and connectivity, there are a number of other third-party application services available, including network security (Fortinet, starting from $65/month), conferencing (ARB Wemeet), cloud back-up (Veeam, starting from $1,174/month), Collaboration (Google Workspace, starting from $4.98/user/month) and marketing solutions (Dayta Cyclops starting from $42/month and Cloudbreakr at $424/month).

Figure 6: CMI mCloud, select offers (December 2022)



Source: China Mobile International, Omdia

Rakuten Symworld

Rakuten is widely known within the industry for building a greenfield wireless network in a highly mature mobile market (Japan), and doing so at break-neck speed, moving from initial build to commercial launch in under two years. Its approach was to self-build, acting as its own integrator. Committed to OpenRAN and cloud-native, Rakuten owns the software it uses to run its network. While Rakuten owns a scant share of the Japanese market just over two years post network launch, and is running at a loss, it claims a very significant $3.1bn in bookings for its private cloud "MNO as a service" vendor, Symphony, which was itself born out of the launch of Rakuten Mobile. (Source: *Iain Morris, Light Reading, "Rakuten Mobile turnaround cannot happen fast enough,"* November 11, 2022*)*.

Symphony describes Symworld as a platform that provides solutions for mobile network operators (MNOs) to manage their networks end-to-end, based on the latest functionality and insights offered by Rakuten's own investments in AI, machine language, and big data technologies. This includes the ability to provide insight in core operational domains, such as how to serve customers and manage a supply chain, through to the technicalities of IP address management. A private cloud built by Rakuten, Symworld contains the

following modules, each with its own set of network software applications available on the Symworld marketplace.

- Symplan: includes mobile network visualization and performance analysis.
- Symbuild: build, manage and maintain network sites.
- Symops: automation of operations and incident resolution.
- Symmanagement.
- Open RAN: disaggregated 4G and 5G stacks, plus an edge appliance for network densification.
- Cloud: containerized compute for network functions, including storage and orchestration.

Rakuten Mobile has monetized the expertise and ecosystem it built as it rolled out its own network and has, through Symphony, become a cloud-native vendor itself, offering its solutions on a marketplace and inviting other vendors to do the same: in March of 2022 Nokia become the sole Symworld vendor for specific mobile core products such as IP Multimedia Subsystem (IMS), Shared Data Layer (SDL) and its Internet of Things (IoT) platform.

A management and monetization option for the B2B segment, whether enterprises or other telcos

Many CSPs have struggled to respond to the requirement for digital-enabled sales interactions as their customers move online and increasingly embrace self-service customer care.

Large CSPs tend to sell their enterprise services in two ways: through sales reps employed by the carriers (the direct channel) and by telecom agents (the indirect channel). Managed services are usually procured through an RFP process that results in an extensible contract award valid for three years.

The China Mobile mCloud portal is one of only a few examples of a CSP provisioning services in near real-time, clearly responding to the threat of the hyperscalers whose cloud services are available on demand. And while there will no doubt be a delay of weeks as local hardware is configured in branch offices, the speed of deployment will be weeks rather than the months typically required in traditional connectivity managed services. Pricing is similarly dynamic, with promotional offers available for the first month or the option for custom pricing.

Rakuten Symphony's Symworld provides another type of marketplace, one focused on CSPs as the customer in an attempt to monetize its own experience and expertise. Rakuten claims very healthy bookings for Symphony, though it is still too early to declare it a success. At the same time, Rakuten stresses that in its home market, it is itself the leading eCommerce marketplace, in which connectivity services are just part of a host of services offered to consumers and businesses. In this way Rakuten can monetize customer relations across a host of consumer and business products, with connectivity being merely one of a panoply of services. Few incumbents will have such an option, but we see others, notably, Rakuten's own customer, 1&1 (now known as IONOS), launching mobile services and associated marketplaces, in select markets.

With their legacy systems and typical sales cycles lasting months, CSPs are aiming for more agility. The promise of cloud marketplaces is that they offer telcos a platform to procure but also to re-sell cloud services, whether a strict resale with access, management and support, or a complete new service developed within the CSP or through collaboration with the ecosystem.

Model 3: Sell through

Sell through is one of the most established and mature cloud business models. It is a common practice for CSPs to act as a channel to market for business SaaS, and they often bundle connectivity services plus billing and support. There are also examples in the consumer segment, such as content aggregation for streaming video services. In the B2B segment, the most common types of third-party cloud applications sold by CSPs include workforce productivity suites (unified communications and office suites such as Google Workspace and Microsoft Teams). Examples include:

- TIM and Google Workspace, wherein TIM resells Workspace to Italy's small and medium-sized businesses.
- Vodafone and Google Workspace, in which Vodafone manages enterprise subscriptions as well as support.
- O2 UK and Microsoft Office 365, whereby O2 offers set up and management, user training, uptake analysis, and cloud security, often bundled with other small business services such as its customer loyalty program.
- Lumen and Zoom, with the CSP monitoring service availability, providing support and working with enterprises to increase Zoom adoption within the business.

Some CSPs offer skill sets and capabilities to help enterprises adopt cloud-based enterprise resource planning (ERP) suites. Lumen has a well-established SAP practice specializing in migration to SAP S4/HANA, the software vendor's cloud enterprise resource planning (ERP) suite. This is then paired with Lumen's managed services for a comprehensive business offer. The following case study focuses on Telefónica Tech and its expertise in Microsoft Dynamics 365 via its BE-terna arm.

Telefónica Tech and BE-terna for Microsoft Dynamics 365

BE-terna, a division of Telefónica Tech, provides consulting, implementation, and support for both Microsoft Dynamics 365 and Infor, two enterprise resource planning platforms which compete with SAP in the manufacturing, retail, and services industries. BE-terna is based in Germany, and the majority of its clients are in central Europe. Its Microsoft D365 practice enhances Telefónica Tech's other acquired and organic Microsoft capabilities, including the Azure practice of its BMI division and its operating companies' established O365 businesses.

Customers span the breadth of industries and include:

- Jako, where Telefónica Tech's BE-terna implemented a comprehensive Dynamics solution to support and automate production, warehouse management, and logistics for the fashion manufacturer.
- Nordiska Kompaniet, for which BE-terna implemented D365 across the head office and its branch department stores, allowing for a single and unified view of logistics, customer service, and payments.
- Masterflex Group, a manufacturer of hose systems. In this case, BE-terna migrated the firm off its old ERP system and onto Dynamics, while it improved manufacturing processes, communication between warehouses and logistics, and reduced paperwork.

Seasoned analysts and members of the enterprise IT industry might note that ERP migration (or, indeed, unified communications), is hardly at the leading edge of digital transformation, as most CSPs and their

marketing teams are focused on emerging domains such as multicloud, computer vision, edge, and 5G private networks. This risks undervaluing the fact that a large number of enterprises have yet to transition core workloads to the cloud, and that this presents an opportunity for CSPs with the right B2B capabilities and ambitions.

Furthermore, it promises to provide another way for CSPs to start a discussion about next-generation access services and secure network connections to the cloud (SASE), along with the need to modernize the wide area network (WAN). While conversations like this are at very early stages at Telefónica Tech as it works to onboard its newly acquired capabilities, it is clearly on the mind of senior executives that there is a natural alignment between enterprise workload cloud migrate and monetization of core telco network services.

Model 4: Side-by-side

As hyperscalers and telcos deepen their relationships, their enterprise customers have made it clear that they expect closer coordination and collaboration between parties to solve business challenges. The most sophisticated and demanding enterprise customers want their compute and connectivity suppliers to jointly address their requirements. Hyperscalers and telcos are keen to co-develop and launch solutions to meet prospective customer needs.

Such side-by-side product and service launches are accelerating, particularly to develop and monetize cloud services at the network edge. Telcos are in search of new business applications (B2B or B2B2C) that can be enabled by placing compute stacks and application delivery at the network edge. They need to understand which industry use cases will drive uptake, and what the role of the telco vs the hyperscaler (and integrator) will be in these scenarios. The increasing pace of side-by-side launches, and increasing business case studies, will bring successes and failures to light in the coming years.

Recent partnerships of note include secure public cloud access. The focus of these offers is to enable European businesses to access public cloud services while ensuring that data stays in Europe, subject to national and EU-level privacy and other regulatory controls.

- The Sovereign Cloud from Google and T-Systems allows enterprises to host sensitive workloads within Germany.
- Similarly, Orange is working with Capgemini and Microsoft to create a French cloud service provider, Bleu, aimed at critical national public services, the French state and essential infrastructure providers under the *Cloud de Confiance* (Trusted Cloud) moniker.

The net goal of both of these sets of partnerships, aside from ensuring traffic traverses relevant Deutsche Telekom and Orange networks, is to allow risk-averse organizations to benefit from public cloud. The CSP gets a share of the integration and service management opportunity.

How successful have these early endeavors been? The jury is out, but the volume and depth of such partnerships indicates that whatever the eventual financial benefit, the partnerships are opening up new opportunities for telcos to enter strategic IT sourcing discussions.

A variation on this theme is developing in China, where authorities have fostered vendor and telco cloud service development in an effort to balance the power of their own native hyperscalers. Huawei's partnership with China Unicom, for example, is notable for the extent of its reach, its depth, and the degree of technical innovation.

China Unicom and Huawei: One Telco Cloud for 5G PNI-NPN

China Unicom and Huawei have worked closely together to address the enterprise requirement for mobility in China. China Unicom, through its China Unicom Digital Tech organization, claims to have delivered more than 2,000 5G virtual private network projects across multiple industries, including metals, mining, education, culture, healthcare, and tourism.

The cloud platforms run on Unicom's 5G core network, with control planes centralized; the user plane functions (UPFs) are distributed, enabling the cloud-based coordination of network nodes for service creation and management across all network domains. Huawei worked with China Unicom to improve efficiency of delivery and reduce deployment costs.

- Edge-integrated cabinets simplify the interconnect between network functions, with most private network deployments now requiring one cabinet and one engineer as opposed to specialists in RAN, core, and datacom. Central, remote configuration further simplifies provisioning.
- Unicom "pre-installs" (pre-configures) hardware on its own site before delivery to the enterprise campus, shortening the on-site time required and increasing economies of scale. Unicom and Huawei claim that excluding radios, installation time can be shortened from seven to one day.

Developments are not just at the level of network hardware and software. China Unicom has the ambition to continue to grow its 5G Application Innovation Alliance to build applications which will foster further P5G market development. The operator runs labs in Guangdong, Beijing, and Shandong, and claims to have incubated 15 applications, including 5G convergent positioning, edge AI, and edge DMP. Furthermore it claims to have transitioned from a lab use case to live in-industry services, having implemented more than 20 5G applications-oriented commercial projects.

In addition, China Unicom has upgraded the 5G application store and 5G private network operations platform, automating the orchestration of the wireless network, transport network, and core network in China, and it has also invested in streamlining BSS/OSS processes. It has furthermore developed a consulting capability to analyze enterprise challenges and recommend appropriate 5G solutions.

One Telco Cloud for 5G PNI-NPN: functionality and use cases

One Telco Cloud for 5G, built by Unicom and Huawei, supports the following features:

- Fast slice provisioning: one day provisioning of a private line based on a 5G core slice.
- Rapid stand-up: availability in eight regions in China, with both Unicom and Huawei claiming that the services were built within five months, and all are serving live commercial instances across multiple industries.
- High degree of automation: continuous delivery and testing (CDCT) enabling automated upgrades of commercial network functions.
- Integration with the public network: by placing MEC nodes in regional areas or enterprise campuses, service continuity can be ensured since the private nodes can be managed via the public network.
- 5G VPN: enabling customers to access enterprise private networks in different regions (because the user plane function is deployed in the public network), reducing the need for conventional VPNs which detour through the internet.

Table 4: Huawei—Unicom One Telco Cloud customer case studies

Customer	Description and outcomes
Chongqing Changan Automobile	A 5G private LAN solution. CCA built a 5G full-connection factory, speeding up its digital transformation. In this project, China Unicom's 5GCtoB One Cloud provides the 5GC control plane functions; and MEC is deployed at Changan Automobile campuses. Through 5G LAN-based Layer 2 networking, the industrial cameras and servers in multiple campuses can be centrally managed, reducing the operations and maintenance burden. 5G LAN has enabled industrial cameras to connect to the industrial camera server through the 5G network so that Changan can collect product image data. The average latency between the cameras and the server reaches 15.42ms. Changan is now exploring the possibility of other edge interworking scenarios.
Midea Group	Midea engaged China Unicom and Huawei to build out a "5G+MEC+Slicing+Intelligent Applications" solution based on the 5GCtoB One Cloud. Midea deployed four platforms—converged positioning, 5G private network self-service, slice management, and intelligent analysis—for its factory to ensure connections and process services for over 300 access points in 16 scenarios. The solution uses outdoor and indoor micro base stations to ensure full 5G coverage, and uses the UPF deployed in the campus to process service data locally. China Unicom and Huawei highlight that the analytics capabilities alone have led to significant savings based on predictive maintenance: robot fault duration has decreased by about 40%, and losses caused by production suspension have been reduced by about $88,000 per product line each year.
Ferrotec	Ferrotec (China) is a supplier of semiconductors. It has a total of 30 campuses in China scattered across the mainland. These campuses need to be interconnected to work together, the networks need to be managed in a unified manner, and it needs to self-serve, with cross-region service replication. China Unicom, Ferrotec, and Huawei jointly built the industry's first 5G+MEC private network that covers multiple campuses locatd in different regions. This project connects cross-region campuses to a unified operations platform through Unicom's 5GCtoB One Cloud, enabling efficient service deployment on edge MEC nodes and facilitating centralized operations.
Zhuhai Gree Electric	Gree manufactures household air conditioners, central air conditioners, intelligent devices, household appliances, air water heaters, mobile phones, refrigerators, and other products. Gree has nearly 90,000 employees in 15 production bases and six renewable resource bases. In this scenario, Unicom deployed a dedicated MEC edge cloud close to users to physically isolate enterprise services from public user services, ensuring that enterprise data is not transmitted out of the campus and safeguarding production data. E2E 5G hard slicing based on service scenarios segments traffic accordingly. Gree claims that the smart factory model improves management efficiency by over 10% and operations accuracy by 30%, reducing the response time of the control and scheduling system by 50% and annual production costs by over CNY15m ($2.2m). What's more, 5G Al technologies monitor and help standardize

	manufacturing operations in real-time.

Source: Omdia

The enterprise implementations demonstrate the effectiveness of a joint approach between a vendor (acting in this case as both technology platform and cloud enabler) and a service provider to meet enterprise requirements. China Unicom's commitment to develop the application layer and its own professional services capabilities speak to its ongoing plans to further verticalize One Telco Cloud for 5G.

Model 5: Co-investment

As CSPs and hyperscalers work together more closely, they increasingly identify market opportunities that they can address most effectively if they collaborate deeply to build and launch new services. This is nothing new: for nearly a decade, telcos have been selling connectivity services to the public cloud; for even longer, CSPs have re-sold cloud unified communications, team working services, and office productivity suites. CSPs add value by providing a local sales channel and support, billing, bundling or managed services. They also can add unique procurement options and reporting solutions. However, the CSP is building a service wrapped around another service. The customer-facing name brand on the application reflects that reality.

Co-investment, or co-development, of solutions to meet emerging customer requirements is a newer phenomenon. Marketing teams often call this "co-innovation." Whatever the preferred word, such instances are characterized by:

- Identification of a new market requirement, usually in the B2B segment.
- A reliance on new architectures that extend the notion of cloud from the data center to the edge (in the network or on the customer's premises).
- Hyperscaler and CSP marketing and product teams that have identified joint prospects and work closely together to create a new product specification and fund its development.
- Coordinated sales, but also a recognition of the heterogeneous nature of the commercial opportunity.
- An understanding that customers want choices, and that a monolithic approach tied to specific vendors will not fly.

Many market stakeholders speak of the importance of this "ecosystem' approach: the coming together of vendors with different strengths to relieve customer headaches and enable them to unlock new opportunities. However, customers don't necessarily want to deal with individual ecosystem players for evaluation, procurement, implementation, and maintenance. This is why one party—CSP, or possibly a value-added reseller (VAR), systems integrator (SI), or managed services specialist—fronts the solution.

Examples of co-investment in building new services are prevalent at the edge. AT&T and Google have an established partnership and joint services that combine Google Cloud with AT&T multi-access edge compute (MEC) for businesses. The partnership deploys applications on Google's edge points of presence (POPs) for low-latency compute and storage. Lumen has a similar relationship with Google, as well as private cloud options based on VMware and AWS. Lumen also has a partnership with Microsoft that deploys the Azure edge stack on Lumen's network edge, to pursue joint enterprise opportunities.

The below case study looks more deeply into Verizon's strategy to work closely with major hyperscalers to advance its edge strategy and services through joint service development.

Verizon's multi-pronged approach to 5G Edge

The market has increased its focus on the enablement and monetization of the network edge, as enterprises adopt more nuanced cloud strategies: some workloads may stay on premises, others will migrate to a central data center-based public cloud, and still others will be re-architected but sit on more local cloud stacks, either on site or at the edge of the network. The key is understanding which applications and workloads will benefit from proximity to end users and smart devices due to latency requirements.

What role does a telco have in this? Verizon is betting on a significant one, and ties its edge strategy to its national 5G network rollout, which has always been as driven by the B2B opportunity as it has been by the consumer segment.

With an understanding that enterprises do not rely on one cloud provider, and that tapping into the full opportunity requires working closely with the three leading US hyperscalers, Verizon has invested with Microsoft, AWS, and Google to co-develop new edge services which play to each party's advantages.

Verizon positions its 5G Edge as a hybrid cloud solution for balancing application workload from on-premises to distributed cloud nodes. The solution's goal is to provide enterprises with:

- The right resource at the right time in real time with an optimized workload performance.
- Data sovereignty for critical IT and OT data elements, while maintaining the use of remote tooling and modeling assets.
- Customizable security for specific workloads.
- Optimized least cost routing models to meet geographic constraints.
- Developer innovation channels with newly introduced network APIs and data sets.
- Access to AI, ML, and quantum computing foundations.

Verizon and Azure: private mobile networks in warehousing

Verizon's private network offers (both LTE and 5G) are well-developed and Omdia has tracked numerous deals with enterprises. In this collaboration, which is focused on warehouses and other distribution centers, the two providers integrated Verizon's private network platform with Azure Stack Edge, which facilitates optimal data storage so that enterprises have immediate access to the right data in the local cache—essentially enabling low-latency data access, processing, and analytics.

The aim of the service is to enable AI vision to guide stock picking and product packing. This increases warehouse efficiency and may also reduce packing errors. In the future, the service will be enhanced to assess and analyze costs associated with specific product lines, accounts, and activities, pointing a possible way toward future efficiency gains and cost savings.

Verizon and AWS: exploring and exploiting the connected car opportunity

Leading US operators consider the connected car market to be one of the, if not the, primary opportunities as the next large directly addressable segment for 5G mobile services. This market opportunity has factored greatly into network planning and rollouts. The bandwidth and latency requirements to support connected vehicles the length and breadth of the nation's highways are immense.

Verizon and AWS offer both private (AWS Outposts) and public (AWS Wavelength) edge compute and network options. While cross-industry, there is a particular focus on the vehicle-to-everything (V2X) opportunity. V2X includes vehicle-to-vehicle communication, but also communications with other

infrastructure such as poles, smart lanes, traffic lights and even pedestrians with cellular devices. Verizon has made many announcements in the auto/OEM space, including its most recent with Audi to embed 5G ultra-wideband connectivity into Audi vehicles and provide the speed and telecommunication architecture necessary for personalized and augmented mobile services, new driver-assistance features, and to support connectivity-enabled innovations as driving becomes more automated. In another trial, Verizon is working with AWS and LG Electronics to develop its V2X services, which it will sell onward into the auto sector. A further automotive industry player co-developing with Verizon and AWS is Nissan.

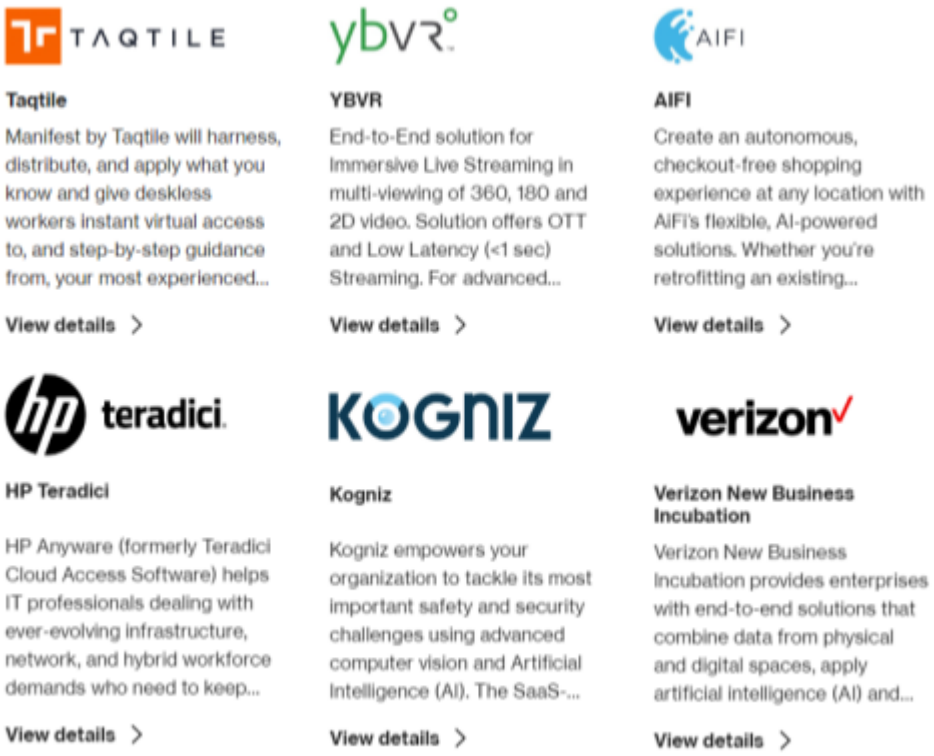
Verizon and Google Cloud: the smart factory in their sights

Verizon's partnership with Google is newer, but it announced plans late last year to work with Google to launch services based on Google's Distributed Cloud Edge. A cross-industry initiative, the initial focus is on the smart factory, with Ericsson joining in to co-develop a proof of concept for its own 5G Smart Factory located in the Dallas metro area. In combination with Verizon's Sensor Intelligence service, a video-enabled autonomous robot will scan packages and maintain inventory in the factory's warehouse. Computer vision will be used to improve logistics.

Early, but also open

The co-investment model for telco cloud is in its very early days. 5G for business is also still being developed and is not yet mature. Mobile edge compute, and edge in general, are emerging architectural models. In such a nascent ecosystem, recognition of the value of experimentation, partnership, and agility, especially when it comes to meeting the requirements of enterprises, are critical factors. The need in this market is multi-vendor and multi-partner, which is familiar territory for CSPs. As one of a growing list of examples, Verizon is working to build a partner ecosystem focused primarily on 5G edge.

Figure 7: Verizon's 5G Edge Partner



Source: Verizon, Omdia

The potential upsides are clear for the CSP. These include:

- The prospect of building deeper enterprise customer relationships by meeting emerging customer requirements.
- Positioning themselves as tech innovators and integrators who remove complexity by combining network, cloud, compute, and analytics for better business outcomes.
- Being major players in an open ecosystem driven by enterprise choice.
- Monetizing their investments in 5G networks (as well as fiber access) by baking connectivity into enterprise transformation.

Of course, hyperscalers are more than happy to gain yet another channel to market, and to cement themselves in the compute "value chain" as it evolves. However, just because leading cloud compute providers have recently benefited from exponential growth, edge poses a threat to them.

Hyperscaler business models were originally built on centralization at scale. They were able to realize high margins (and efficient growth) due to the benefits of building massive compute capacity in carefully chosen and 100% controlled environments. What happens if or when compute workloads shift closer to the customer? Hyperscalers will need CSPs, the purveyors of local access, more than ever. While all the telco-cloud operating models hold promise, when it comes to the edge, the co-investment model particularly aims to bring benefits to both sides.

Appendix

Methodology

Omdia conducted more than 10 discussions and briefings with major cloud provider and service provider senior executives over the course of 2022 to inform this report and help formulate the business model framework. Data is based on numerous sources, including primary research surveys of over 100 telcos globally, focused on cloud and edge priorities and ambitions. Omdia tracks more than 800 service providers in over 160 national markets quarterly. Omdia's revenue analysis, forecasts, operational expenditure, and capital expenditure data is extracted from these dedicated data products for tracking and forecasting.

Further reading

CSPs and the Public Cloud: Drivers and Challenges from a Technology and Business Perspective (June 2022)

Telco Cloud Evolution Survey – 2022 (September 2022)

Telco Edge Cloud Survey – 2022 (September 2022)

Hyperscaler Telco-Workload Tracker – 2022 (November 2022)

2023 Trends to Watch: Telco Cloud and Network Automation (December 2022)

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