



Perspective

NPaaS: operator strategies and implementation of 5G APIs

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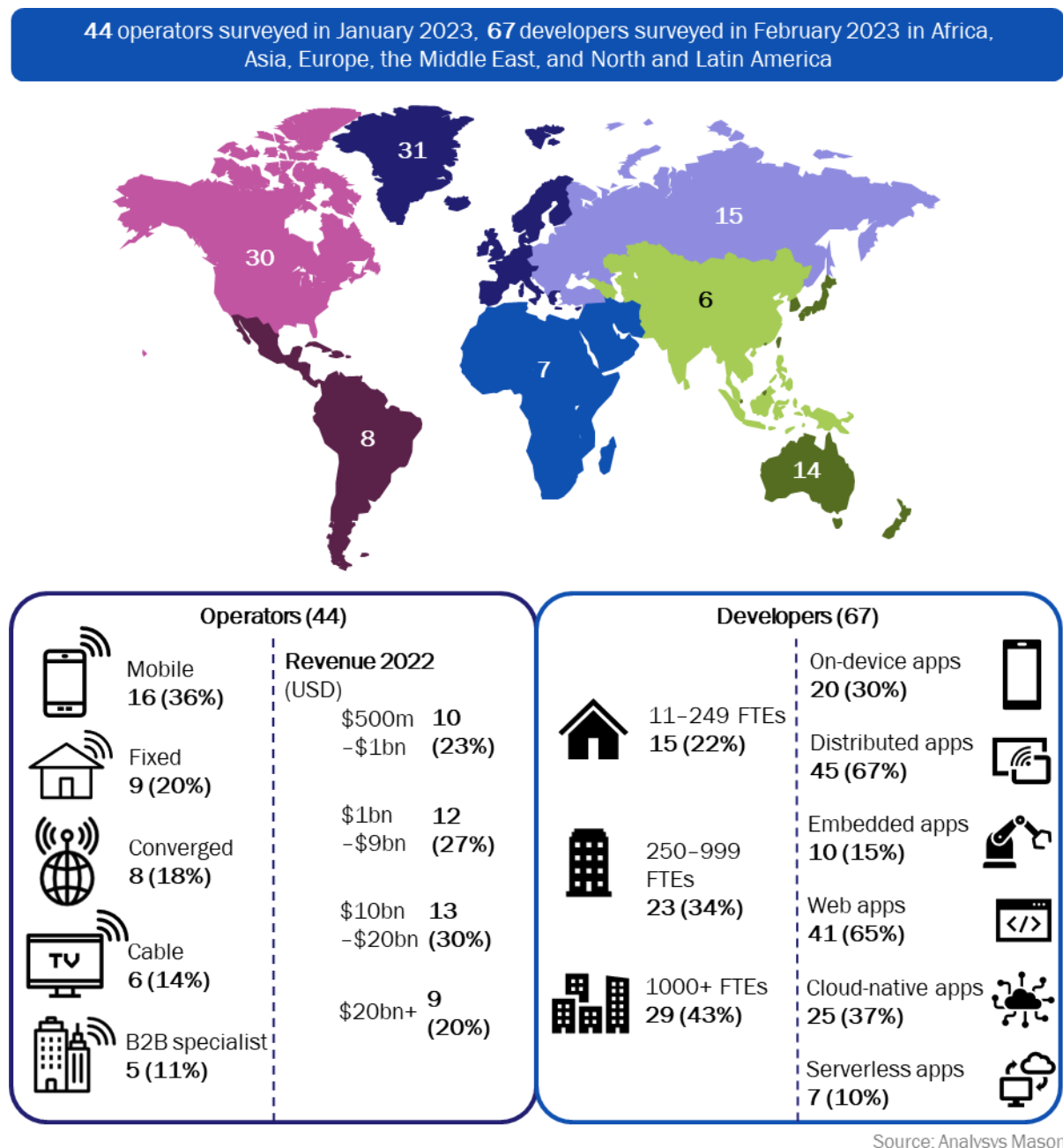
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1. Executive summary

At MWC 2023, the GSMA announced the Open Gateway initiative to identify and commercialise new APIs that can open up a wealth of capabilities in communications service providers' (CSPs') networks to developers. These network-as-a-service (NaaS) APIs will be defined and developed by the Linux Foundation's open-source Camara Project (CAMARA) but CSPs that participate in Open Gateway will determine the priority order for API development according to industry needs. The initiative is starting with the promotion of eight APIs that are already in the CAMARA GitHub repository, including SIM swap, quality on demand, device status, number verification, edge site selection and routing, number verification (SMS 2FA) and carrier billing, and more will be added during 2023.

Our previous paper [*Driving value from telecoms networks beyond CPaaS: the opportunity to revolutionize application delivery*](#), made the case for a network-platform-as-a-service (NPaaS) platform. An NPaaS platform comprises the set of technologies that will enable NaaS by managing the exposure of an extensive set of network capabilities. In this paper, we examine CSP attitudes to the NPaaS opportunity and their approaches to the NPaaS platform as revealed through a survey of 44 CSPs undertaken in early 2023. We have augmented the CSP view with the perspective of the developer community, gained through a survey carried out at the same time. These surveys determined the level of market interest in network APIs and probed CSP and developer strategies for providing and using them (Figure 1.1).

Figure 1.1: CSP and developer survey demographics



The reasons cited for the launch of Open Gateway align with the findings of our CSP survey. CSP respondents cited the need to generate new revenue from new sources as the main driver behind their interest in exposing a greater range of APIs than the IMS-based APIs that are currently available from CPaaS platforms. CSPs interviewed and surveyed by Analysys Mason agreed with the GSMA that such network capabilities will provide new value to developers by revolutionising the way the latter can deliver applications. While our research confirms that the exposure of network APIs is a strategic priority for CSPs, there is much to be done to establish a successful NPaaS that spans networks and attracts a large community of developers.

This paper addresses key findings of the survey, which are summarised as follows.

- **Network APIs are strategically important to CSPs, and first-movers are forging ahead with early deployments.** 73% of CSPs surveyed described network API exposure as a top-five priority and conversations we have had with CSPs as part of our research for this paper show that several CSPs are already moving ahead with an NPaaS strategy. The desire for generating new revenue is the principal motivation for this strategy: three of the highest-ranked responses in our survey question about the motivation behind API exposure were directly related to the generation of new revenue.
- **CSPs can take advantage of developers' interest in network APIs that go beyond what is currently available from CPaaS providers.** 42% of developers in the survey are already using a CPaaS platform but APIs that allow developers to control quality of service, deploy applications according to network performance and customise connectivity and security features were rated important or very important by over 60% of developers. 55% of the group also ranked CSPs as their top preferred suppliers of network APIs.
- **CSPs need to decide on NPaaS platform strategies that maximise the exposure of their network capabilities to developer communities.** Nearly half of respondents plan to expose network APIs through one or more NPaaS providers. Just over a third of CSPs, however, have decided to build their own NPaaS platforms and risk fragmenting the developer market when it is clear that developers want to work with network aggregators.
- **CSPs and developers are broadly aligned on their assessment of the most important network APIs.** Three out of the four top-ranked APIs were given identical rankings by CSPs and developers: customised connectivity, network performance determining how and where to deploy applications and access to local cloud resource.
- **CSPs need to build strong relationships with external developers to drive new service revenue.** Our survey shows that many CSPs are inward-looking. 51% of CSPs want to build or control their own developer ecosystem while 69% of CSPs ranked 'in house' as their preferred source of network APIs, ahead of standards bodies, network equipment providers and public cloud providers.
- **CSPs regard their CSP peers as competitors.** 66% of CSPs see their peers as their primary competitor in the market for network APIs. This suggests that CSPs may be at risk of missing the NPaaS opportunity by rejecting open platforms and ecosystems in favour of controlling their own APIs. However, the level of collaboration and solidarity between CSPs as evidenced by the Open Gateway announcement suggests that many CSPs are aware of the dangers of fragmenting the nascent network API market.¹ The finding that CSPs consider each other as competitors can perhaps be interpreted as CSPs' understanding that network APIs will in time become widely adopted and thus commoditised; CSPs will therefore compete against each other, differentiating on orchestration, delivery and the quality of their overall solution as offered to enterprises.

¹ [GSMA Open Gateway](#).

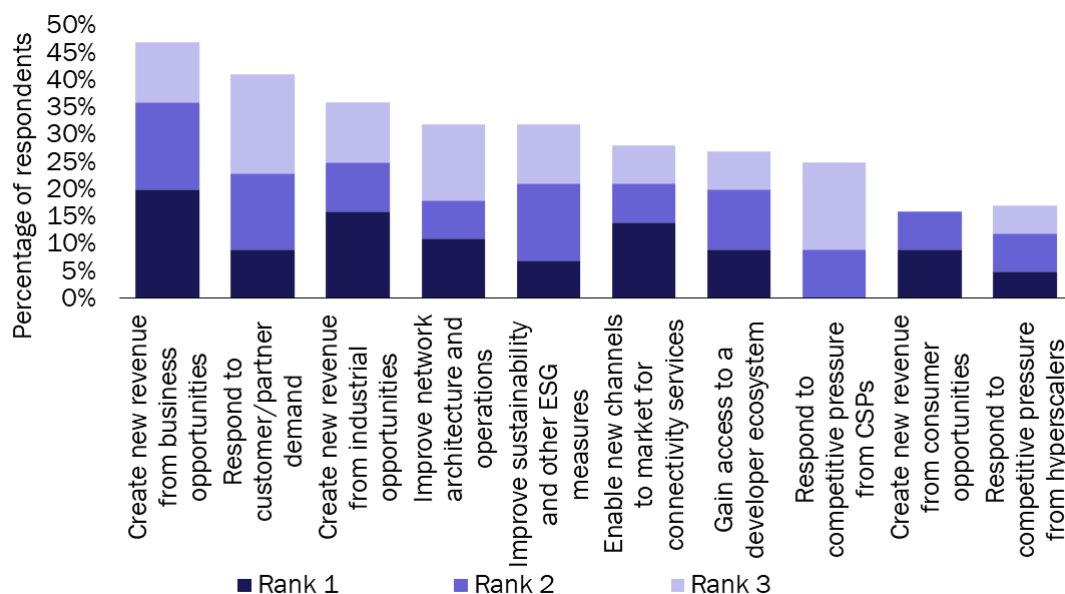
2. Key drivers for network APIs beyond communication APIs exposed by CPaaS providers

2.1 Revenue is the main driver for CSPs wanting to expose network APIs

Analysys Mason conducted a survey in 1Q 2023 of 44 CSPs from seven regions worldwide to examine issues such as operators' main drivers for exposing network APIs beyond the CPaaS APIs that many of them already support, their approaches to building an NPaaS to support broader API exposure to such a platform and the challenges they face in successfully monetising network APIs. We also surveyed 67 developers to gain their perspective on network APIs, their levels of awareness and interest, the features and APIs they would like to use and their preferences when it comes to providers of network APIs.

CSPs' desire for revenue growth is the dominant motivation for network API exposure. Three of the highest-ranked responses in our survey were directly related to the generation of new revenue: from business opportunities in retail financial and healthcare, from industrial opportunities in manufacturing and from new channels to market for connectivity services (Figure 2.1).

Figure 2.1: Question: "What are the top 3 drivers for exposing your network capabilities through APIs?"; n = 44 CSPs



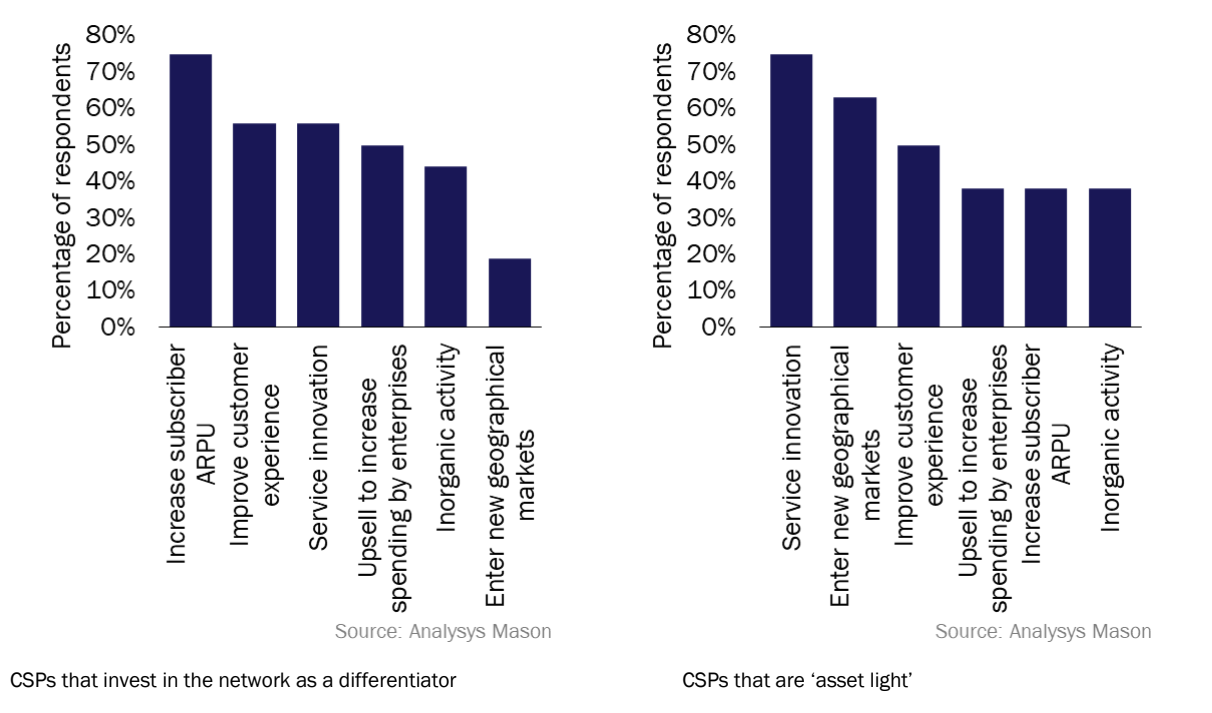
Source: Analysys Mason

CSPs ranked the revenue-generating opportunities from consumer-facing activities such as gaming and the metaverse lower than the opportunities from manufacturing and business. Our conversations with CSPs as part of our research for this project have also shown that manufacturing and retail are important target markets for CSPs.

CSPs also rank access to a developer ecosystem as a not particularly important driver for exposing network APIs. We will discuss the importance of a strong relationship between the developer community and CSPs in section 4.1, but this suggests a CSP attitude to building a developer ecosystem that is confirmed by findings elsewhere in the survey.

There are nuances to CSPs' attitudes to revenue growth and further investigation shows that these vary according to CSP network investment strategies. Segmenting the responses in shown Figure 2.1 by investment strategy shows (Figure 2.2) that three quarters of CSPs that invest heavily in their network and see it as a main differentiator, expect future revenue to come from upselling API-enabled services to existing customers to increase subscriber ARPU. On the other hand, 75% of CSPs that describe themselves as asset-light when it comes to network investment expect growth to come principally from new services. As we shall see later, this distinction influences CSPs' thinking on the types of use case that network APIs might enable, with those that invest heavily in the network focusing on exposing APIs for internal consumption rather than to third-party developer communities.

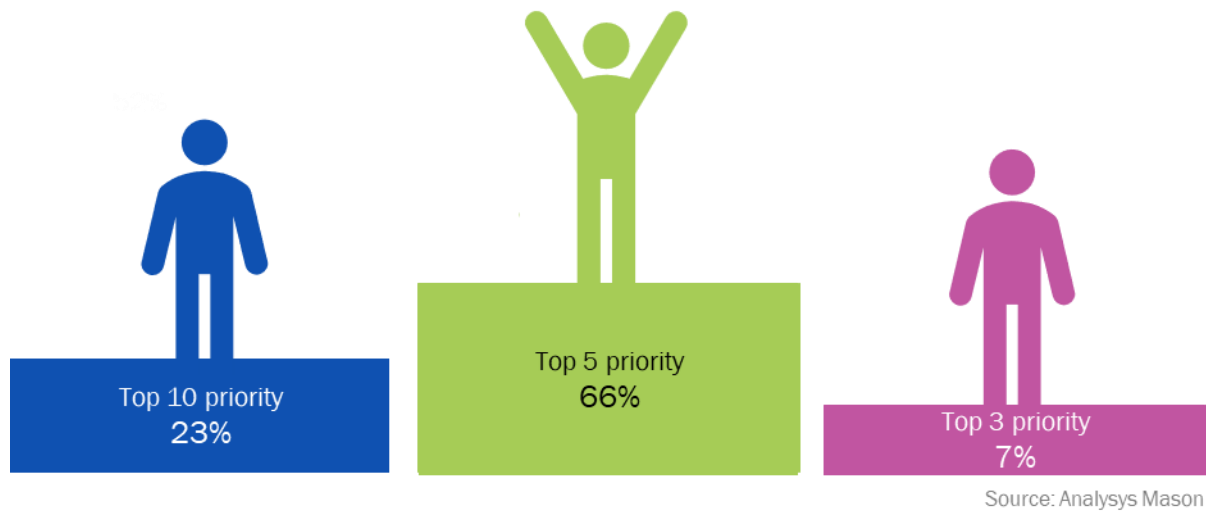
Figure 2.2: Question: "What are the top 3 drivers for exposing your network capabilities through APIs?; n = 16 and n = 8 CSPs



2.2 CSPs view the exposure of network APIs as a top strategic priority

The fact that 21 CSPs were involved with the launch of Open Gateway and that more are continuing to join the initiative underscores a further finding from our survey, which is that CSPs are placing a high level of strategic importance on the exposure of network APIs. A combined 73% of CSP respondents described network API exposure as a top-five priority for their companies. They are particularly concerned with the ability to exploit the features '73% of the 5G standalone (SA) cores in which they are investing and which they believe represent a major strategic opportunity. Analysys Mason tracks the implementation of 5G SA cores and finds that a third of CSPs expect to have a commercial deployment by 2024. This will put them in a strong position to leverage network APIs as they are produced by CAMARA under the auspices of Open Gateway. Our research finds that CSPs are familiar with the concept of API exposure; all the CSPs we surveyed already expose their communication capabilities through CPaaS platform APIs. However, they are keen to monetise new areas of the network to support Industry 4.0 applications and other areas of growth that will tap directly into their strengths associated with network ownership and operation.

Figure 2.3: Question: “Is the exposure of network capabilities through APIs a top 3/5/10 initiative for the company?” n = 44 CSPs



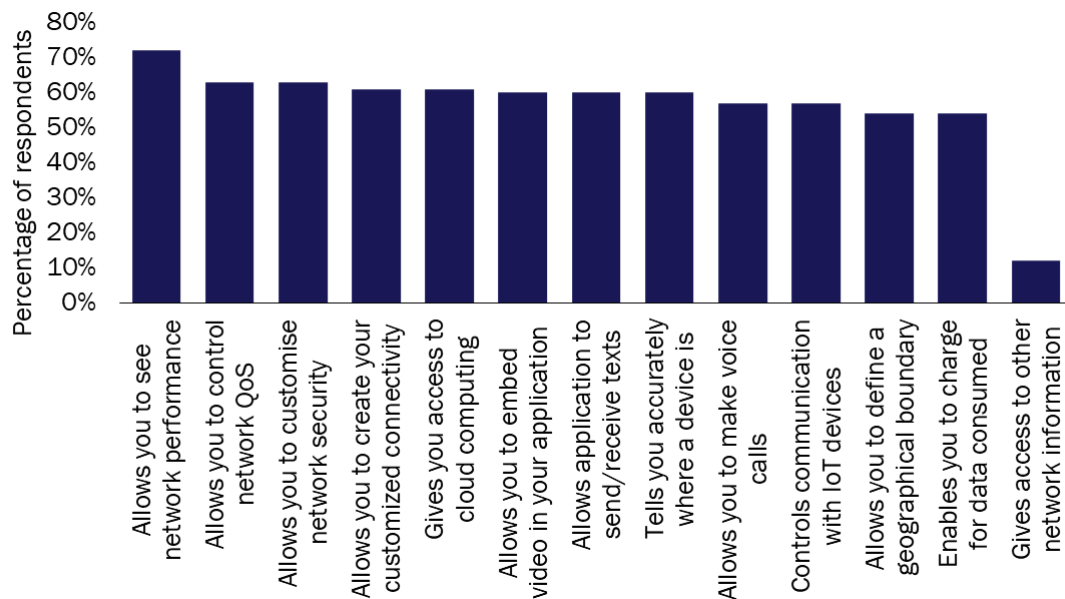
2.3 Developers are signalling that they need advanced network APIs and would prefer CSPs to provide them

As envisaged by Open Gateway and described in our previous paper *Driving value from telecoms networks beyond CPaaS: the opportunity to revolutionize application delivery*, CSPs need to put in place a platform that will enable developers to code to this new set of APIs and will enable CSPs to make a return on large investments in their 5G networks. CSPs invested USD103 billion in building 5G networks in 2022 and are expected to spend a further USD129 billion in 2023. We call this platform an NPaaS to emphasise that it will expose a more extensive set of network-based capabilities through APIs than are currently offered by CPaaS providers.

For their NPaaS strategies to be successful, CSPs will need to engage the developer community. Many CSPs have attempted to do this over the years but their track record is patchy. Other companies, including public cloud providers and CPaaS providers, have proven far more effective at engaging developers. Nevertheless, our developer survey gives grounds for optimism that developers and CSPs will engage over the NaaS opportunity.

- **Developers say they are already familiar with APIs that are associated with the network.** 42% of developers surveyed are already using a CPaaS platform, for example.
- **Developers identified a clear need for network APIs.** APIs that allow developers to control quality of service, deploy applications according to network performance and customise connectivity and security features were rated important or very important by over 60% of developers (Figure 2.4). These are more advanced and sophisticated network capabilities than the transactional APIs that are available today from CPaaS providers.

Figure 2.4: Question: “If you had or currently have access to the network APIs (from a CSP’s network), listed below, how important would or is each of them to the applications you are developing?”; percentage ranked 5 and 4, ‘very important and ‘important’; n = 67 developers



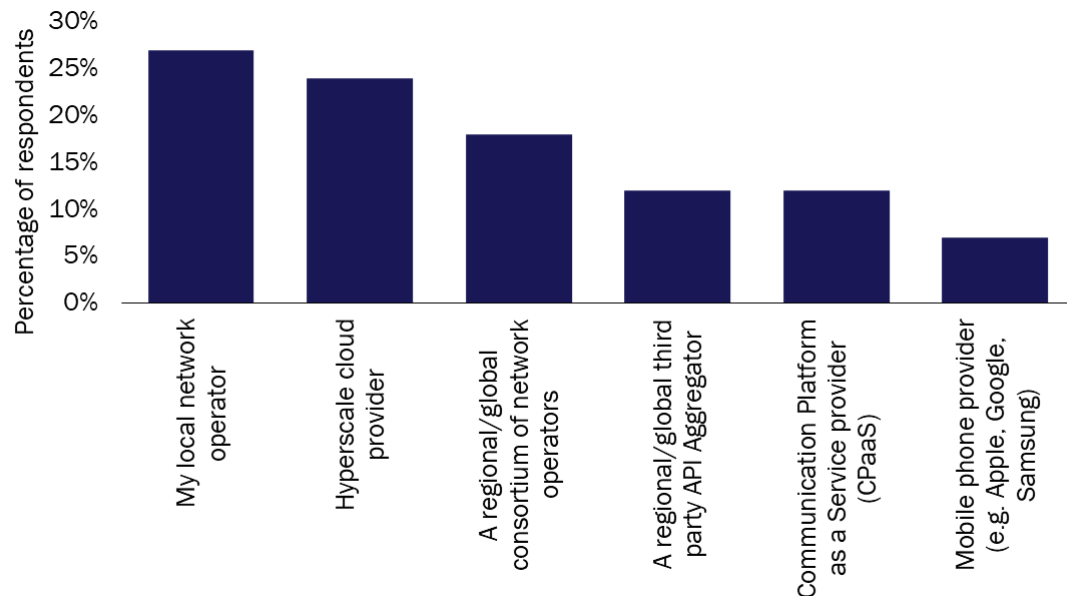
Source: Analysys Mason

Indications of the drivers behind the developer demand for Network APIs can be found by segmenting the answers to Figure 2.4 by vertical. Developers in manufacturing rank the ability to define a virtual geography second behind quality of service. The two APIs will play an important role in 5G Industry 4.0, supporting use cases such as hyper-accurate positioning and ultra-low latency. Access to other clouds was ranked ninth in importance by the same group, suggesting that compliance and security needs will frequently dictate on-premises processing of data.

Developers that work in media and gaming ranked first the ability to see how the network is performing (and then deploy workloads appropriately) and the API for quality of service ninth. Latency is important to this vertical but costs are too, perhaps explaining the lower ranking of QoS. Lastly, the ability to customise security features ranked highly for retail and finance developers; these industries process a wide range of data from highly sensitive payment and transaction data to low-level sensitivity sales and marketing collateral, and it is useful to be able to granularly control access.

- Developers are willing to work with CSPs.** 55% of developers ranked CSPs as their preferred supplier of network APIs. Nearly two thirds (61%) of developers show a preference for a local network operators while almost half (47%) are interested in network APIs being provided by a regional consortium of CSPs. Although developers say that public cloud providers are their main suppliers of APIs in general and many of them use CPaaS providers, they do not rank these types of company as highly when it comes to network APIs.

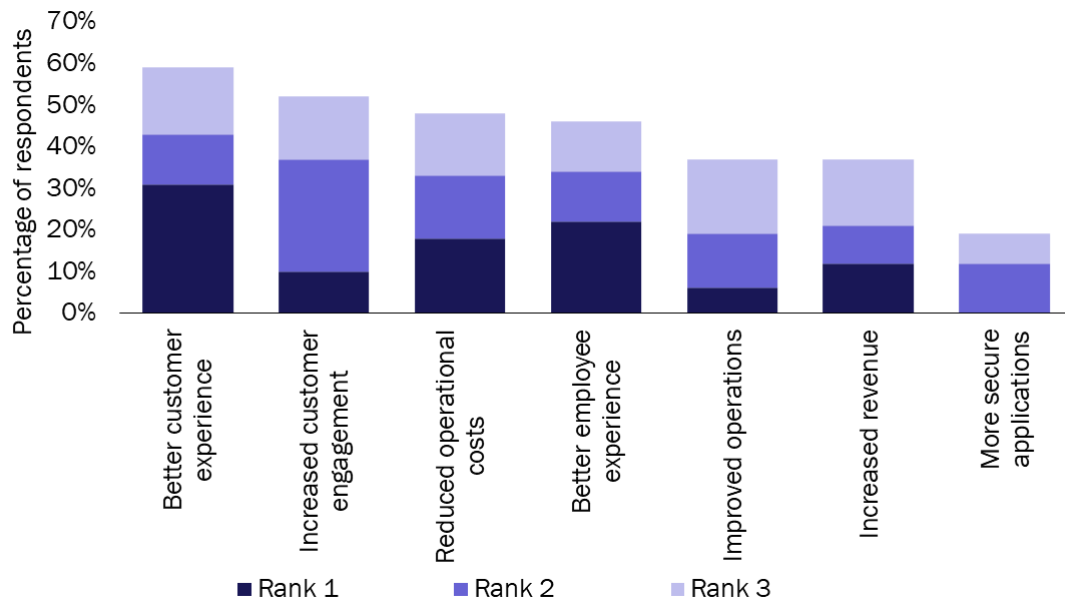
Figure 2.5: Question: “Which of the following types of platform provider for network APIs (Network Platform as a Service provider) are or would be your preferred suppliers of network APIs?”; n = 67 developers



Source: Analysys Mason

- Developers are motivated by a need to reduce operational cost and improve customer experience of their applications.** The need to improve customer experience is a priority for developers who ranked better customer experience and improved customer engagement as the top drivers for using network APIs. The types of network API that developers say they are most interested in, such as quality of service, are closely linked to improving customer experience of their applications. However, the developer survey also highlighted the importance of network APIs to internal efficiency. 48% of developers want to use network APIs to reduce operational costs, for example, of managing connectivity when they have limited visibility of and control over its performance, and 46% expect network APIs to improve employee experience of internal applications (Figure 2.6).

Figure 2.6: Question: “What outcomes would you achieve or are you already achieving for your customers with access to these network APIs?”; (rank top 3 outcomes); n = 67 developers



Source: Analysys Mason

3. CSP strategies for monetising network APIs through an NPaaS platform

3.1 CSPs are weighing up whether to become network API aggregators or whether to bring their network APIs to market through a third party

CSPs can take different approaches to bringing network APIs to market and there is little consensus on what that strategy should look like at this early stage of the market. Although CSP approaches are currently fragmented, they can be divided into the following two groups.

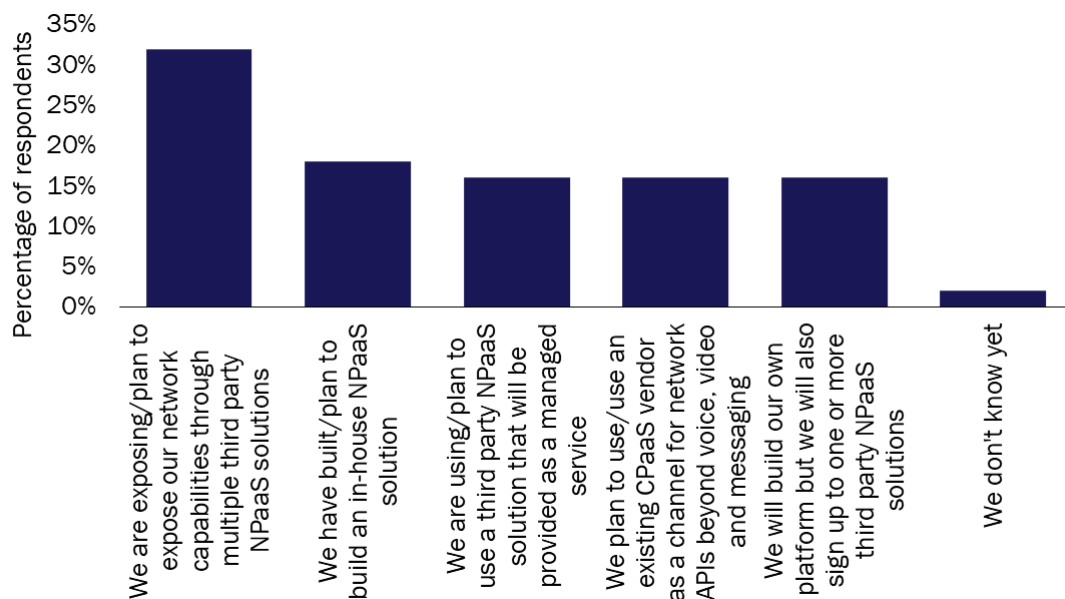
- Some CSPs expect to become NPaaS providers themselves, in which case they will need to build or buy their own NPaaS platforms.
- Others expect to work with third-party NPaaS providers, exposing their network APIs through third-party NPaaS platforms in a wholesale model. The NPaaS platforms in this case may be provided by network equipment providers, CPaaS providers moving up the value chain or potentially a new entrant to the market such as a public cloud provider.

Our survey shows that the most popular route to market for CSPs is through a third party NPaaS provider that aggregates network APIs from multiple operators (Figure 3.1). Nearly half of respondents plan to expose network APIs through one or more NPaaS providers. Just over a third of CSPs, however, have decided to build their own NPaaS platforms. About half of this self-building group understand the importance of aggregating APIs across their own and others' networks and are also planning to sign up to other NPaaS platforms on a

wholesale basis. The most sophisticated respondents recognise that they may need multiple strategies to reach the largest number of developers. CSP respondents that were interviewed in-depth about their strategies pointed out that the market needs help to understand how best to maximise the reach of network capabilities to multiple developer communities worldwide.

The challenging relationship that CSPs have with CPaaS providers (detailed in our earlier paper *Driving value from telecoms networks beyond CPaaS: the opportunity to revolutionize application delivery*) has led to CSPs having little appetite to work with CPaaS providers on network APIs, despite the fact that many of the CSP respondents have an existing relationship with them for communications APIs.

Figure 3.1: Question: “How are you making/do you plan to make your exposed network capabilities exposed to the market?”; n = 44 CSPs

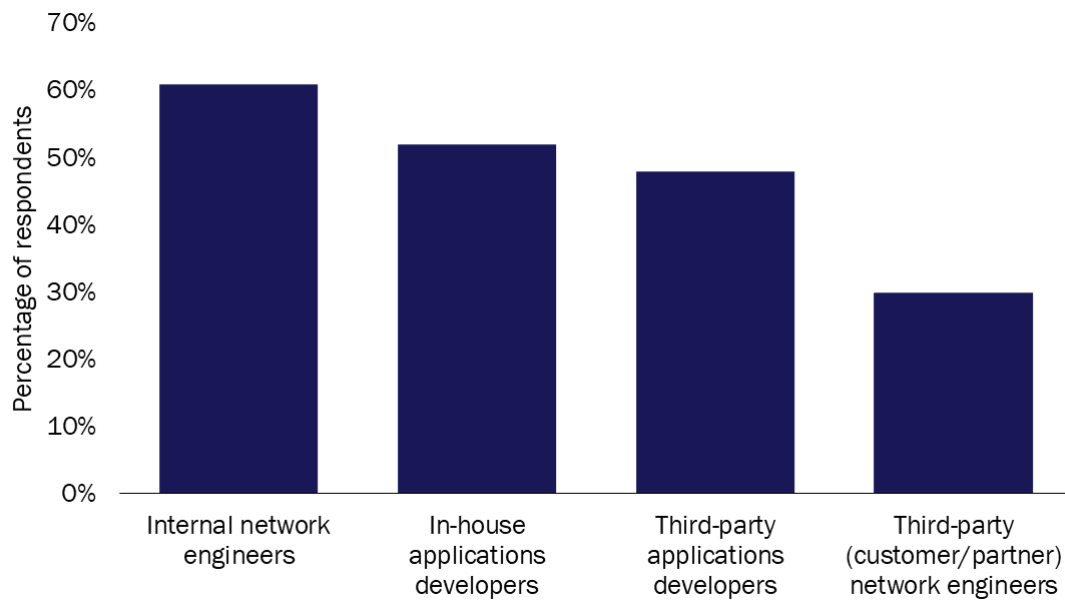


Source: Analysys Mason

3.2 CSPs appear to be most interested in using network APIs to improve internal processes

Analysis of developer demand for network APIs in section 2.3 showed that internal efficiencies are a key objective. This view is shared by CSPs but to an even greater extent. CSP respondents expect network APIs to be used primarily by their own network engineers and application developers, for example, to support key operational processes and to build differentiated services themselves. Just under half of CSPs expect third-party developers to use their network APIs.

Figure 3.2: Question: “Who do you foresee using your network capabilities exposed through APIs?”; n = 44 CSPs



Source: Analysys Mason

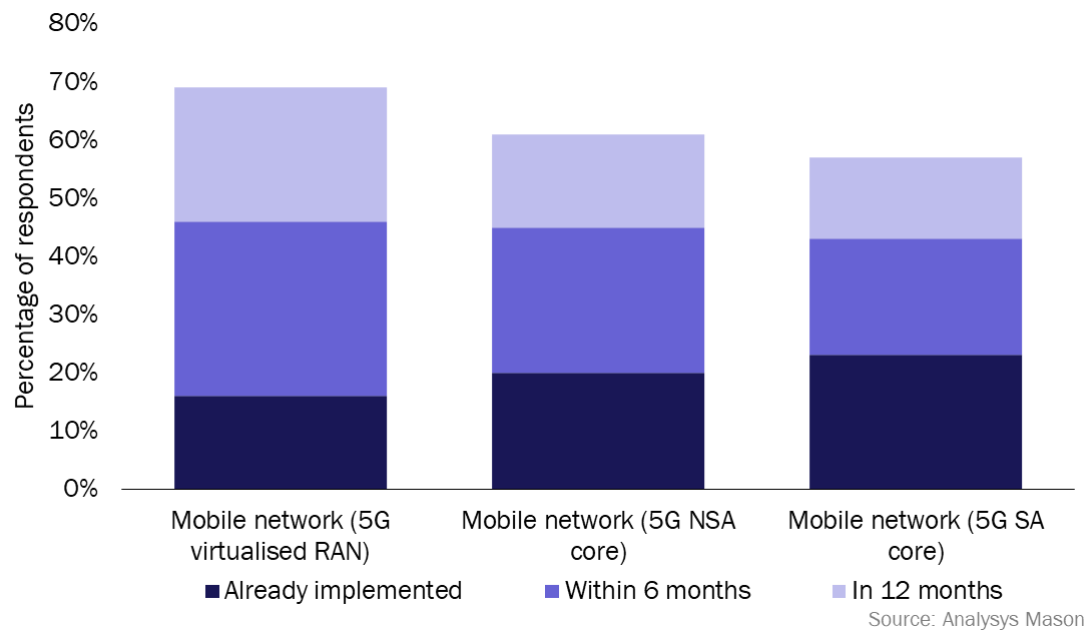
The bias towards internal consumption of network APIs varies according to the type of CSP that is exposing them. In section 2.2 we drew attention to the differing approaches that CSPs are taking to network APIs depending on their ‘asset light’ or heavy network investment strategies. CSPs that focus on their network as a differentiator and that want to boost subscriber ARPU view internal network engineers as the main users of network APIs. In contrast, the ‘asset light’ group of CSPs unsurprisingly expect third-party application and in-house application developers to be the primary consumers of network APIs. This suggests that CSPs in the network-focused category need a better understanding of the revenue-generating potential of exposing their network capabilities through APIs.

3.3 CSPs will expose 5G SA cores first and transport networks later

CSPs are confident that they will provide APIs across network domains but there is little consensus yet about the timing of their exposure of different network domains. 23% of CSPs in our survey say they have already exposed features within their 5G SA cores and another 34% expect to do so within 12 months. Respondents are slightly more advanced at exposing the capabilities of the 5G SA core than those in other network domains since this function has been designed with exposure in mind. The 5G Network Exposure Function (NEF) allows third parties to make API calls direct to an SA core whereas no other network domain can yet expose capabilities natively through APIs.

Nevertheless, CSPs say they have ambitious plans for APIs that expose capabilities within the broadband access network and the transport network, with more than half of respondents saying that network capabilities will be exposed in these domains within a year. These figures should perhaps be taken as a statement of intent to start this process rather than as a concrete delivery schedule: just under 10% of the sample believes it will take 5 years to open up their transport networks.

Figure 3.3: Question: "In which of the following network domain(s) are you exposing/do you plan to expose network capabilities and in which timeline?"; n = 33 CSPs



CSPs and developers are aligned in their assessment of the most important network APIs

CSPs and developers broadly agree over the network APIs that should be prioritised for exposure. Respondents from both surveys have come to similar conclusions on the importance of specific network APIs. Three out of the four top-ranked APIs were given identical rankings by CSPs and developers.

Figure 3.4: A comparison of developer and CSP ranking of network APIs

Ranking	APIs viewed as very important by developers	APIs prioritised for near term (6 month) release by CSPs
1	Quality of service	Define virtual boundary and trigger response when device leaves area
2	Customised connectivity	Customised connectivity
3	Network performance determining how and where to deploy applications	Network performance determining how and where to deploy applications
4	Access to local cloud resources	Access to local cloud resources
5	Embedded video	Customise security
6	Ability to make voice calls	Quality of service
7	Define virtual boundary and trigger response when device leaves area	Ability to charge for data that the application consumes
8	Customise security	Controls and manages communications with IoT devices
9	Allows application to send/receive text messages	Application detection to a very high degree of accuracy

Source: Analysys Mason

The highest-ranked API does not match: CSPs are prioritising device location, potentially because this feature is closely linked to the industrial use cases that CSPs are currently working on. Developers meanwhile rank quality of service first. As we shall see later when discussing barriers to network API adoption, developers currently find network connectivity challenging; nearly half of respondents citing poor application performance as a reason for wanting to use network APIs and 52% of developers saying they need more visibility of latency and congestion. Developers and CSPs also say that they plan to make greater use of cloud-based and internal platform APIs in the future. Growth in API calls to an increasing number of internal services (such as OSS/BSS) and external services (such as public cloud and SaaS) will make the issue of connectivity even more pressing.

Developers are less concerned about security APIs than CSPs, possibly because security has long been a core competence and focus for CSPs which they are keen to monetise. CSPs also rank quality of service as a lower priority than developers, although 61% of CSPs surveyed say they are planning to expose QoS within a year.

The high level of agreement between CSPs and developers about highly-ranked APIs supports the opinion of a Tier-1 CSP that was interviewed for this research. The CSP expects that 70% of its API exposure revenues will come from just four network APIs: QoS, deterministic connectivity, discovery and network data collection.

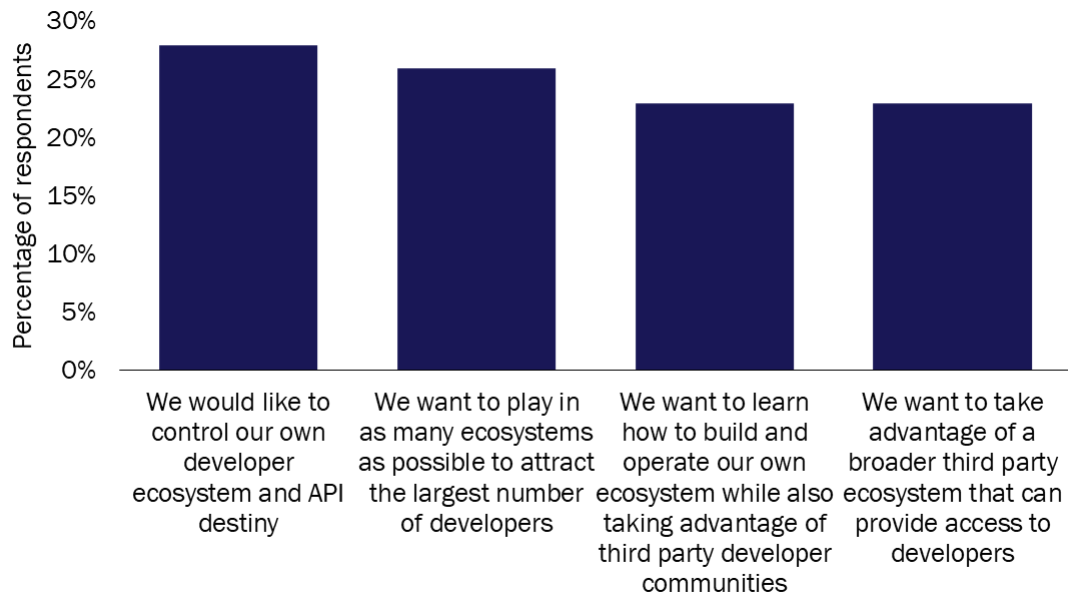
4. CSPs need to overcome several challenges to build a successful NPaaS strategy

4.1 CSPs need to build strong relationships with developer communities

CSPs' relationships with developers are fundamental to the success of network API exposure and to CSPs' plans for taking network APIs to market. CSPs will need strong relationships with developer communities but they do not currently have good strategies for engaging with them. This is despite developers showing willingness to work with CSPs.

- **CSPs need to join ecosystems that have strong developer communities.** Our survey shows 51% of CSPs want to build or control their own developer ecosystem (Figure 4.1). 69% of CSPs ranked 'in house' as their preferred source of network APIs, ahead of standards bodies, network equipment providers and public clouds. This was the thinking CSPs followed a decade ago when they released communication APIs, and the consequent fragmentation enabled over-the-top platform providers to emerge and dominate the market. Instead CSPs need to partner with third party ecosystems that have existing developer communities to take advantage of developers' current interest in working with network APIs.

Figure 4.1: Question: “How do you plan to expose your network APIs to the market?”; n = 43 CSPs



Source: Analysys Mason

- **CSPs can engage the developer community with a targeted outreach.** There are well-worn paths to gaining traction with the developer community such as hackathons and offering prizes for the development of innovative services. CSPs can organise roadshows that encourage developers and start-ups to build Industry 4.0 type applications using their network APIs. Some of these techniques are already in use today as early-mover CSPs begin to persuade start-ups (often funded by the CSP itself) onto early iterations of their emerging NPaaS platforms.
- **CSPs need to start reaching out to the developer community now.** There is a window of opportunity but it will only be open for a short time as there will be strong competition in the NPaaS market from established CPaaS providers and potential new entrants to the market such as public cloud providers.

4.2 CSPs must decide whether public cloud providers and CSPs are competitors or allies

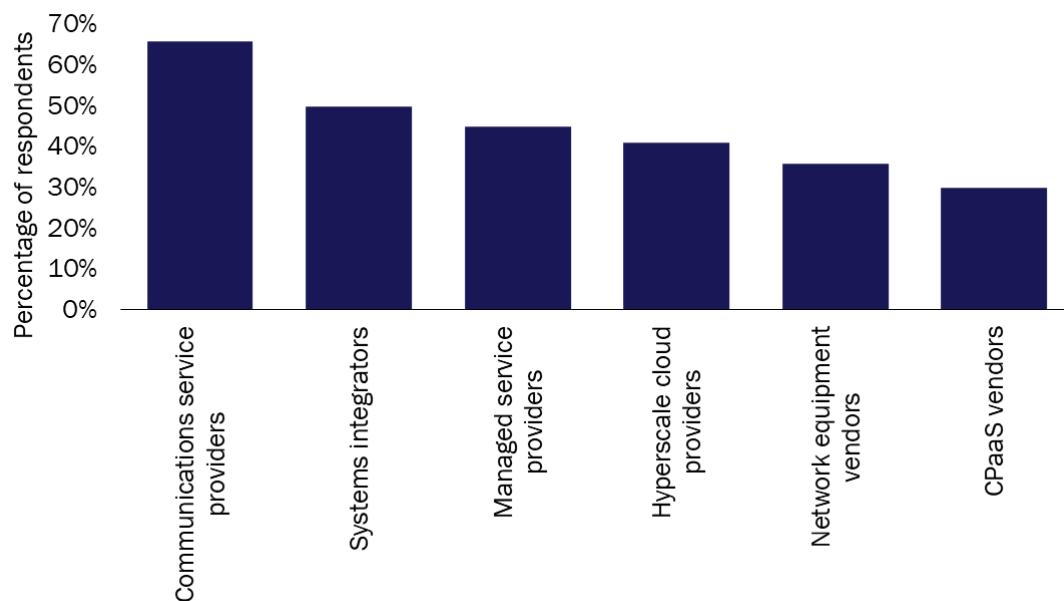
CSPs face difficult choices when it comes to their relationships with public cloud providers and other CSPs. They view both as competitors in the market (Figure 4.2). However, the CSP survey also revealed that 54% are already working with public cloud providers as a source of APIs for exposing their networks and a further 41% plan to work with a public cloud provider. Public cloud providers are attractive to developers and have large developer communities but the picture is nuanced with our survey showing public cloud as the most popular platform for application hosting today, but coming in second place to SaaS platforms like Salesforce for future service platforms.

It is also difficult to see how a CSP can become an NPaaS provider itself without aggregating the APIs of multiple other networks and allowing other CSPs to do the same with its APIs. CSPs that serve multinational enterprise customers such as car manufacturers or logistics companies will need access to the same network capabilities in network footprints beyond their own. A Tier-1 North American CSP interviewed for this research commented that the network API market will only succeed if CSPs are prepared to embrace its wholesale aspects and to align their commercial models as well as software development toolkits and APIs.

In light of this, it could be considered alarming that 66% of CSPs see their peers as their primary competitor in the market for network APIs. It was this kind of thinking that led CSPs to miss the CPaaS opportunity, rejecting open platforms and ecosystems in favour of control over their own APIs and creating fragmented developer communities. It is clear that developers want the same APIs to work across networks, with 45% ranking the ability for the API to work well across multiple networks as a top-three feature. 40% of developers also ranked ease of use as a top three NPaaS feature: if network APIs are implemented differently by different platforms, making their use difficult, momentum in this emerging market may be lost.

On the other hand, the level of collaboration and solidarity between CSPs as evidenced by the Open Gateway announcement is encouraging. This suggests that many CSPs are aware of the dangers of fragmenting the nascent network API market. One way of interpreting the finding that they regard each other as competitors is that many plan to combine standard CAMARA network APIs in their NPaaS platforms with professional and other value-added services to deliver high-value business outcomes to enterprise customers. Many of the network APIs themselves will be commoditised but the way a CSP orchestrates and delivers them as part of an end-to-end business solution will be differentiated and will allow the CSP to compete against its peers in a local, national or regional market.

Figure 4.2: Question: “What type(s) of organisations do you consider as current or potentially competitive providers of network APIs?”; n = 44 CSPs



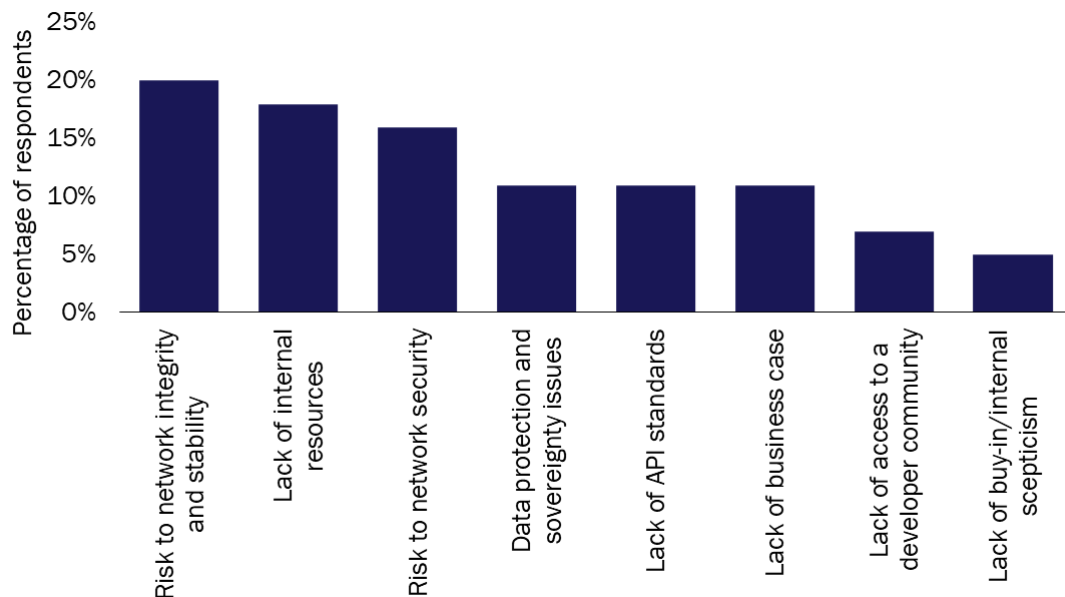
Source: Analysys Mason

4.3 Security, network integrity and lack of internal resources are the biggest barriers to the adoption of NPaaS

Three related technical factors are the largest barriers to network API exposure. Understandably, CSPs see risks from opening up their network in terms of traffic management (network integrity), malicious activity (security) and internal resources (support). Loss of integrity was the highest-ranked issue, underlining the uncertainty that comes with opening a network to third-party developers. These are ahead of external risks such as lack of API standards, the lack of access to a developer community and data sovereignty issues. There is also a small but sizeable minority of CSPs that perceive a lack of a business case and need to be convinced of the value of the opportunity or feel there is too much internal scepticism for an initiative to prosper. Such scepticism currently

extends to the Open Gateway initiative and CAMARA project: the CSPs and vendors that are leading these efforts will need to prove early successes to win the hearts and minds of the CSP market overall.

Figure 4.3: Question: “Which of the following challenges to exposing network capabilities through APIs do you consider to be the biggest barriers?”; n = 44 CSPs



Source: Analysys Mason

Our conversations with CSPs have underlined the importance of internal co-ordination. It will be difficult for CSPs to co-ordinate internal teams such as operations, compliance, and security with externally facing functions such as sales and marketing. Without such cross-organisation co-ordination it will be difficult to build a commercially successful NPaaS platform, and for many CSPs this will be a daunting undertaking.

5. Conclusions and recommendations

The opportunity to become a NaaS provider promises to deliver new revenue, a higher return on investments in 5G networks, a reduction in operational costs and improvements in network efficiency. However, this opportunity requires a larger ecosystem to be successful – one that brings together CSPs that expose their network assets through an NPaaS platform, developers that build applications that use NPaaS APIs and enterprises that buy the applications that support their operational technology use cases of the future.

To execute a successful NPaaS strategy, CSPs need to overcome any reluctance they might have to engage with an external developer community. Fortunately, developers are open and willing to use CSPs’ NPaaS platforms, but they will lose interest if these platforms are not federated and do not aggregate APIs across networks. CSPs also need to bring an offering to market rapidly, as there will be intense competition, not just from well-established CPaaS vendors but also from potential new entrants into the market such as public cloud providers.

Based on the survey results discussed in this paper, we recommend the following.

- **CSPs should start planning to take advantage of the NPaaS opportunity as soon as possible.** At a time when CSPs are facing revenue pressures from many sides, a strategy for NaaS/NPaaS has the potential to generate incremental revenue, some of which could prove to be high margin. The strength of the Open Gateway initiative and the fact that the CAMARA project has existed for more than a year and is already yielding open-source APIs should reassure CSPs that there is a strong industry opportunity here and warn others that they may lose out if they ignore it.
- **CSPs should strongly consider buying in and/or contributing their APIs to a third-party NPaaS platform.** CSPs can build their own NPaaS platforms but the technical challenges involved and more importantly the need to bring an offering to market as soon as possible point towards a third-party NPaaS platform as the better route.
- **CSPs need a better understanding of, and engagement with, developers.** The developer community is open to working with local and national operators. In contrast, a significant proportion of CSPs want to retain control of their developer ecosystem, use their API platforms for internal use and want to retain control of their developer ecosystem. There is a need for thought leadership and an education exercise to win over this group of CSPs.
- **CSPs need to build an ecosystem that includes other CSPs.** NPaaS platforms need to enable developers to deploy their applications seamlessly across multiple networks and therefore CSPs need to engage with their peers and build a wholesale channel that will aggregate each other's enhanced network API sets. Despite initiatives such as Open Gateway, it seems that CSPs are in danger of creating a level of fragmentation that could have a severe impact on the viability of the NaaS opportunity.

6. About the author



Daniel Beazer (Senior Analyst) leads Analysys Mason's *Edge and Media Platforms* research programme. His research focuses on the key building block technologies and architecture of the edge computing infrastructure that is emerging to support the delivery of applications and services for 5G, media, entertainment and other industries. Before joining Analysys Mason, he led Structure Research's Edge, 5G and Cloud practice. Daniel has worked extensively in the internet infrastructure industry in management and strategy roles and has several years'

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