White paper

Critical success factors for telco cloud transformation: key findings from the Nokia Telco Cloud index

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1 Introduction

Communications service providers (CSPs) want to become digital service providers (DSPs) to win business in the digital economy where webscale players are setting the agenda. DSPs need to sell digital services that are wrapped with a digital experience: communications services should be available on-demand through self-service portals and paid-per-use. Such a digital experience is best supported by the ‘telco cloud’ (TC), a programmable, ‘cloudified’ network which uses virtualisation technologies and software-driven operations to deliver new business value. CSPs recognise that they need to marry the business practices associated with webscale companies with cloud-based technologies to achieve DSP status.

This white paper offers a unique insight into the progress CSPs are making towards becoming DSPs. Its assessment of CSPs’ TC strategies and maturity is based on data collected from 35 operators around the globe in three phases of Nokia’s Telco Cloud index (TCi) study. The TCi framework was jointly developed by Nokia and Analysys Mason in 2014, and piloted and launched in 2015. Analysys Mason subsequently collected maturity-level data from CSPs each year, in 2015, 2016 and 2017, and analysed it independently to produce the Nokia TCi.

The key outcome of the TCi study is a TC maturity matrix in which CSPs occupy one of the nine positions: from the least mature quadrant in the matrix, “Traditionalist/follower”, to the most mature “Digital service provider” (DSP)1 quadrant. Figure 1 and Figure 2 show the results from the second and third phases of the TCi study, in which participating CSPs’ scores have been plotted on the maturity matrix. Advanced CSPs have reached the “Technology innovator” quadrant and a number are on the cusp of becoming DSPs. A detailed discussion of the methodology used in the TCi study and definitions of the nine quadrants in the maturity model can be found in Annex A.

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1 Please see the annex for more information on the TCi methodology and definitions.
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Successful TC transformation depends on simultaneous transformation of an operator’s business and network

The transformation of the network into a digital communications services platform is arguably the most difficult activity facing CSPs undergoing digital transformation. A key finding from the TCi study is that regardless of their size, regional presence and type, CSPs with a balanced approach to TC, which prioritises technology and business transformation equally, move fastest towards their DSP goal. This white paper explains why and describes the three critical factors that are propelling leading CSPs to TC success.

2 Successful TC transformation depends on simultaneous transformation of an operator’s business and network

To become DSPs, CSPs should balance the progress they make towards the adoption of TC technologies with the business transformations necessary to understand and leverage the power of the TC. Many operators struggle to maintain this balance. Cultural and organisational change are critical to the successful adoption of TC but are difficult to achieve. CSPs often invest first in technology transformation, as the easier path toward their goal, and only subsequently look for buy-in from the business. The lack of business support from the outset of a TC initiative can slow its overall progress and even risks business rejection of technology investment it does not understand.

2.1 CSPs are taking different paths towards the DSP destination; the ‘balanced’ route is shortest and least risky

CSPs are not yet universally following a balanced approach. In TCi Phase 2, we suggested that the optimal path towards becoming a DSP was a stepwise approach, travelling through technology-led, balanced adopter and technology innovator quadrants of the matrix. With more TCi data available in Phase 3, and having expanded...
the number of participants with the addition of several sophisticated TC adopters, we can see that CSPs are adopting individual routes through the TCi matrix which are compatible with their individual circumstances.

Figure 3 illustrates the five discrete routes that CSPs are taking across the TCi matrix: balanced path, stepwise path, slow start – fast finish (version 1), slow start – fast finish (version 2), and the powerful CTO path.

*Figure 3: CSPs are taking different paths towards the DSP destination [Source: Analysys Mason, 2017]*

**Balanced path**: CSPs that transform their businesses in parallel with TC technology transformation take a balanced path towards becoming DSPs. This path is typically taken by CSPs that have a disruptive business plan, the execution of which depends on leveraging TC technologies faster and more innovatively than their competition, or by fast-moving latecomers that are benefiting from a maturing technology market and the example (including how not to implement TC) of early adopters. *This is the shortest and least risky path through the matrix.*

**Stepwise path**: CSPs that first invest in technology and then use this to generate commercial results in alternate steps can be described as taking a stepwise path through the matrix. This is a typical traditional telco approach to the introduction of new technology and has been exhibited by early adopters, including B2B providers, which have wanted to prove out TC capabilities before finding a business case for implementing them.
Slow start – fast finish: Operators that are lagging behind their peers and face strong competitive pressure can skip steps in the TCi matrix and become DSPs in two years or less (although they will need a lot of vendor support with technology and/or business transformation tasks). Vendors provide ‘build, operate, transfer’ services to help CSPs which opt for this path to reach the DSP position at the end of the journey.

Powerful CTO path: Operators that prioritise technology investments and deployments and start changing their businesses only in later stages of the transformation, typically take the “Powerful CTO” path. Although many operators have long been technology-led, this is a sub-optimal approach when applied to a transformation as large and disruptive as TC. Investing heavily in technology development before starting any programme to encourage business adoption can be a gamble.

2.2 The top-three critical success factors for TC transformation

The TCi study identifies three key success factors for a CSP to transform its business and network simultaneously. A CSP will need to address all three factors if it is to travel successfully along a balanced path.

► Success factor 1 – ALIGNMENT

- The most successful operators in TCi are those that take a balanced approach to business and technology transformation from the beginning of their TC transformations to maximise the benefits of their technology investment.
- Realising the benefits of TC technology investment is difficult without organisation-wide buy-in for TC transformation, since it touches every facet of the business.

► Success factor 2 – LEADERSHIP

- TC investment needs to be linked to strategic business goals to enjoy full organisation-wide support. This requires C-level/Board sponsorship to push forward the broad TC change agenda.
- TC transformation needs to be prioritised over most other CSP initiatives because of the level of investment required. This too can be achieved only with sponsorship at the highest levels.
- TCi shows us that without the strong support from the Board, changes in C-level leadership can paralyse or kill TC transformation.

► Success factor 3 – DIGITAL CULTURE

- CSPs must understand and nurture the set of digital behaviours that spell success in the digital economy.
- Buying new technology will not turn a CSP into a DSP. A DSP ‘controls its own destiny’ by investing in in-house software development capabilities, rather than depending on vendors with competing priorities and their own timescales to meet its needs.
- A DSP understands the importance of influencing TC technology evolution as a means of strengthening its market position. It invests in TC ecosystem development, actively contributes to the new type of ‘standards-making’ bodies – open-source organisations – and forms strategic partnerships with, or invests in, companies that support its TC technology leadership.
3 Success factor 1: Aligning business and network transformation enable CSPs to make faster progress towards DSP goals

The TCi scores CSP progress towards becoming a DSP across two interrelated trajectories:

- the level of engagement the wider business has with TC, including how far a CSP is socialising TC developments across the organisation.
- the maturity of a CSP’s TC technology roadmap and its level of investment in TC-related market activities that help to accelerate TC technology developments.

CSPs need to balance both business and technology trajectories if they want to be successful at introducing TC into their organisations. They are unlikely to achieve the anticipated payback from their investment in TC technology unless their businesses are transformed at the same time. Similarly, their businesses may have high aspirations to become more agile and responsive to the market which are unachievable without the implementation of TC technologies. The TCi shows that the most successful CSPs create a strategy for joint transformation early in the process.

3.1 Fast-moving TCi leaders follow a balanced path

The TCi study shows that the CSPs making the most rapid progress towards DSP goals ensure that their businesses not only know about and understand their TC initiatives but play a large part in driving them. When there is strong business backing for TC, based on a vision of what TC technology can do for a CSP’s business, the company is more likely to commit the technical resources required to ensure that immature TC technologies are developed for commercial deployment within a well-defined timeframe.

The CSP that has achieved the position of business leader in TCi is on the brink of becoming a DSP. It has pursued a balanced path from an early stage of its existence. This relatively small B2B operator’s TC vision is related to its business ambition to become a cloud provider that leverages network ownership in ways that are closed to public cloud providers. Years before Network Functions Virtualisation (NFV) got its name, this CSP was working on the business case for virtual customer premises equipment, creating a programmable network and building its own orchestration and converged telco/enterprise cloud platform to support this business goal. The company has undergone four large organisational changes in the past few years, to ensure that the way it is delivering technology remains aligned with its business strategy. It recognises that business agility depends on technology agility and works hard to keep both in step.

A further successful example of a CSP taking a balanced path is a Tier 1 operator that began its TC transformation just two years ago. Despite its size and the need to take multiple opcos on its TC journey, this CSP has ‘leapfrogged’ many earlier adopters to achieve an advanced balanced-adopter position in the matrix. It has already achieved a full-scale TC commercial launch, in part due to an enlightened decision to involve business and technology stakeholders together in the planning and execution of its TC strategy.

Both CSPs demonstrate that balancing business and technology transformation de-risks TC investment, since the latter is purposefully linked to business key performance indicators (KPIs). In fact, their businesses are pushing the CTO offices to achieve TC milestones faster in order to gain market leadership based on differentiated, TC-enabled capabilities.
3.2 Realising the benefits of technology investment is difficult without an early organisation-wide buy-in for TC transformation

The fast, diagonal path through the matrix towards the end goal of becoming a DSP cannot be achieved unless the CSP undertaking it enjoys organisation-wide support from an early stage. Indeed, the TCi study shows that a number of promising TC initiatives are stalling due to lack of business buy-in. This is often the case in culturally conservative markets (as seen in some countries in the Asia–Pacific). CSPs in these markets have developed excellent technology capabilities but are finding their businesses resistant to the cultural and organisational changes the CSPs need to make if they are to realise the full potential of those technologies as DSPs.

The TCi study finds that the level of involvement of marketing and sales teams in TC activities is a key KPI which can be used to measure how successfully a CSP’s business is engaged in TC transformation. Marketing and sales – the ‘commercial people’, as one CSP calls them – are typically evangelists for new products and features that can generate new revenue and differentiate their companies from the competition. As long as they remain unaware of the technical potential of TC, they are unable to translate it into ideas for services or build a compelling business case for TC launches. The majority of TCi participants do not yet see the need to involve their marketing and sales organisations, either at the planning or deployment phases of TC. This severely limits TC’s visibility both internally and externally, and jeopardises the launch of new products that are dependent on it. It is telling that CSPs that have already achieved full-scale commercial launches report a much higher level of involvement of their sales and marketing teams in TC initiatives than the CSPs that have less-mature TC strategies (see Figure 4). TCi CSPs that are not yet ready for commercial launch report even lower levels of sales and marketing involvement in TC transformation, suggesting that they are likely to make slow progress through the matrix.

Figure 4: The levels of involvement of CSPs’ sales and marketing teams in TC transformation² [Source: Analysys Mason, 2017]

The TCi monitors further KPIs that indicate the level of business involvement in TC transformation. For example, it looks at the level of company-wide training on TC concepts and related process changes that a CSP

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² Question: “What involvement have the following departments had in the TC initiative so far?” (scoring from 1 to 5, where 5 means very high involvement). Only answers that scored 4 or 5 are accounted for.
undertakes, to ensure that the new ways of working that TC enables are embedded across the organisation as a whole and are not simply confined to technology departments. The TCi also probes whether or not a CSP has a communications plan that keeps the business as a whole informed about TC and its impacts. A communications plan is an important means of increasing awareness, minimising uncertainty and encouraging positive views of change. Of the 18 CSPs in TCi that have limited or full-scale commercial TC launches, 12 have such communications plans. They are considered particularly important by the 6 CSPs that have achieved full-scale commercial launches (all but one of which have TC-related communications plans).

4 Success factor 2: TC transformation requires organisational and cultural change so C-level and Board leadership is critical

The sponsorship and involvement of the Board and all C-level executives is extremely important to the success of a TC transformation. To achieve company-wide buy-in for the transformation, as discussed in the previous section, any initiative must have the backing of the C-level leadership team and often the Board too. The Board/C-level executives are responsible for the strategic direction of the business and TC transformation needs to be aligned with those strategic business goals if it is to resonate across the company. It is similarly in the top leadership’s power to signal how important TC is to the company’s future – ideally by prioritising it over other technology initiatives – which will drive interest, investment and involvement in TC across the organisation. CSPs with strong C-level and Board support report positive employee responses to, and requests to be involved in, TC transformation.

4.1 TC transformation is successful when it is linked to strategic business goals and prioritised over most other CSP initiatives

TC transformations that are progressing fastest and most successfully are driven from the top of the company and are considered key enablers of strategic business goals such as:

- improved customer experience
- the creation of new sources of revenue
- breaking dependence on vendors.

There is a strong correlation between CSPs that have reached the stage of full commercial TC launch (the most mature) and those with C-level/Board involvement. 70% of CSPs that have reached full commercial launch stage report that Board and C-level executives have the highest levels of sponsorship. In contrast, among the ten CSPs that have made little progress in TC, only one claimed to have a CEO/Board that is highly involved in TC transformation.

► Strategic versus tactical drivers of TC transformation

Figure 5 shows that the more a TC transformation is driven by strategic goals, the more likely it is to have achieved a full commercial launch. This supports the finding above: the positive effect of Board/C-level sponsors, who both set such goals and recognise that TC is key way to achieve them. Such sponsors are more
likely to push TC transformations to produce results. Some of the most mature TCi participants report that C-level sponsors set ambitious timelines and KPIs for TC projects in line with strategic goals.

However, many CSPs in the TCi are pursuing TC transformations that enable short-term, tactical goals, such as cost-savings. These are often carried out ‘under the radar’ of the wider business, with limited C-level involvement. TCi participants with lower maturity see strategic drivers as less important than tactical drivers and only 25% of the CSPs that have not yet achieved a limited commercial launch cite strategic goals as drivers for their TC transformations.

**Figure 5: The percentage of CSPs that reported strategic drivers of TC transformation** [Source: Analysys Mason, 2017]

► **TC transformation as CSPs’ top priority initiative**

Given its scope and potential impact across a CSP’s entire organisation, TC transformation requires a major commitment from the business. To ensure their TC initiatives have the resources they need to be successful, the most mature CSPs prioritise them over other programmes. The responsibility for prioritising key company initiatives and communicating those priorities to the rest of the organisation lies with C-level executives and the Board. It is no surprise then that, as Figure 6 shows, there is strong correlation between those CSPs that report strong support from their CEO and Board for TC transformation and those that consider TC as a top-3 company initiative (6 out of 10 TCi CSPs). In TCi Phase 3, a higher number of companies said that TC transformation was a top-3 priority for them compared with TCi Phase 2, suggesting that TC transformation is moving up the business agenda.

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3 Question: “In order of priority, what are the drivers for this strategy?” (scoring from 1 to 5, where 5 is the most important).
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Figure 6: 60% of CSPs that reported strong Board and C-level leadership\(^4\) rank TC as a top-3 initiative [Source: Analysys Mason, 2017]

All TGi CSPs that have achieved a full-scale commercial launch regard TC transformation as a high-priority initiative: the majority say it is one of the three most important initiatives in the company (see Figure 7).

Figure 7: The percentage of CSPs at different stages of TC deployment that reported TC to be a top-3, -5 or -10 priority initiative for the business\(^5\) [Source: Analysys Mason, 2017]

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\(^4\) Question: “What involvement have the following departments had in the TC initiative so far?” (scoring from 1 to 5, where 5 means very high involvement). Figure 7 only accounts for CSPs that reported strong support (4 or 5) from their CEO and Board for their TC initiatives.

\(^5\) Question: “Is TC a top 3/5/10 initiative for the company?”
5 Success factor 3: Becoming a DSP depends on acquiring a set of digital behaviours that are unfamiliar to most CSPs

The most successful players in the digital economy – true DSPs – are the webscale companies. A DSP, by definition, shares the practices and commitment to digital technology-driven innovation of a webscale company. DSPs value in-house software development capabilities as a means of ‘controlling their own destiny’ in a digital...
world, cultivate an ecosystem of replaceable partners rather than relying on a handful of strategic suppliers, invest in innovation through participation in new open-source developments and sponsor and/or acquire companies with digital technology capabilities that are likely to become strategic in future.

The most mature operators in TCi already exhibit many of these behaviours. However, most TCi balanced adopters have yet to recognise the importance of these behaviours for their TC transformations. They are staying within the ‘comfort zone’ of familiar telco behaviours, for example, relying on vendors to build and customise the right products for them, remaining unenthusiastic about open source as they have no means of evaluating it, and engaging in a limited way, if at all, with Agile/DevOps methods. They therefore have a big chasm to cross to become DSPs. A CSP needs to recognise and to plan to adopt digital behaviours across the organisation at the outset of its TC transformation if it truly wishes to move into the DSP quadrant rather than hover at its margins.

5.1 Strong in-house development capabilities are propelling TCi leaders towards the DSP quadrant

Buying TC technology is not enough – a DSP cultivates in-house development capabilities instead of remaining dependent on vendors to meet its needs; this requires an enlightened attitude towards DevOps at an early stage in the transformation process.

The most mature TCi CSPs intend their TC transformations to reduce and eventually to break their existing dependence on vendors. This enables the CSPs to introduce new technologies and adapt (‘pivot’) their businesses at a webscale pace. They recognise that they need to make profound changes to their existing technology procurement processes as well as to acquire and train people in the software skills necessary to achieve this goal.

TCi leaders have embedded DevOps across their organisations to foster in-house development capabilities and discourage reliance on vendors. They have expanded the reach of DevOps from their IT departments, its natural home, to network organisations and other teams, including security/sales and marketing/product management. All six of the CSPs that have achieved a full TC commercial launch are engaging with Agile/DevOps: three have adopted DevOps in both CIO and CTO organisations; one has adopted DevOps in its CIO organisation and is planning to introduce it to its CTO organisation and the remaining two CSPs are planning to use DevOps in their CIO organisations, with no current plans for the network organisation.

The current TCi business leader and technology leader have market-leading positions in DevOps and strong in-house development capabilities. The CTO of the TCi business leader remarked that unless his network engineers can also code, they are ‘useless’ to the CSP. Both the technology leader and the business leader have developed orchestration solutions in-house as existing vendor solutions were not mature enough to address their respective needs. The technology leader is also considering creating cloud-native virtual network functions (VNFs) to compensate for the lack of solutions in the market.

In-house development capabilities are seen as key to avoiding vendor delay and lock-in. A TCi balanced adopter realised this when endless haggling with an orchestration vendor disrupted its orchestration deployment schedule and overall TC progress.

“We haven’t yet launched orchestration. We keep going back and forth with our first choice orchestration vendor. This has caused delays” – Tier 1 operator, TCi balanced adopter

Nevertheless, the majority of TCi participants are challenged by the need to become more software capable and the organisational disruption and re-training investment it entails. Although they understand the advantages of
reducing their reliance on vendors, such a move threatens long-established habits and comfortable relationships. Leading operators embrace open source because they have the software skills to understand and use it. They value the ability to experiment with the potential of open-source software rather than being given ‘black box’ vendor code they are unable to explore or modify. Less-mature TCi participants, including some balanced adopters, do not possess the software skills that enable them to appreciate open source in the same way. Unless they change their behaviour, they will struggle to cross the DSP line.

5.2 A DSP drives the maturity of the entire ecosystem and invests in innovation through acquisitions and partnerships

A DSP actively contributes to TC standards bodies and industry open-source organisations and invests in innovation through acquisitions and partnerships.

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The importance of participating in TC technology evolution

TCi leaders are displaying a further key behaviour of DSPs: active participation in and contribution to standards and open-source bodies that are driving TC evolution. Such participation is a measure of a CSP’s commitment to being at the forefront of market innovation. Although the number of CSPs that contribute code to such bodies is still very small, the leaders are considering releasing in-house developments as open source and view open source as a market accelerant. They are also keen to influence the market and recognise the business value of being associated with market-leading innovation.

Almost 70% of the TCi CSPs that have achieved a full-scale commercial launch report involvement in three or more standards groups and industry initiatives (see Figure 9), since they have greater need for the innovation being developed in those initiatives in order to deploy TC. By contrast, the vast majority (70%) of operators that have not yet achieved even a limited commercial launch do not participate in any TC-related standards or industry bodies. Interestingly, the business leader in TCi lags behind other leading operators in this respect. Despite its great success to date, this operator is unlikely to become a true DSP until its leadership team recognises the importance of active participation in the TC ecosystem.

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6 Definition: A ‘black box’ is a complex system or device whose internal workings are hidden or not readily understood.
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Figure 9: CSPs with full scale commercial launches are involved in proportionately more standards group and industry initiatives since they have greater need for innovation7 [Source: Analysys Mason, 2017]

Figure 9: CSPs with full scale commercial launches are involved in proportionately more standards group and industry initiatives since they have greater need for innovation.

Influencing TC ecosystem through partnerships and acquisitions

TC transformation is not a one-off event in the life of an operator; it will require continuous and long-term investment given the speed of technology change and its importance to the business. CSPs that have made considerable progress in TC recognise the importance of investing strategically in start-up companies to foster cutting-edge innovation in their organisations. They are also maintaining and growing an ecosystem of vendor partners. They want to be able to source interchangeable solutions from this ecosystem which they can ‘plug’ into their internal reference architectures depending on their needs at any given time. One TCi leader talks of ‘pivoting’ every six months and replacing vendors that are no longer meeting its needs. Others claim ‘no vendor is safe’: they no longer have a ‘preferred supplier’ list with one or two vendors, but choose from an ecosystem of vendors that have all committed to support their APIs.

As shown in Figure 10, well over half of CSPs that have achieved commercial launches or are working towards a full-scale commercial launch either already have or plan to create an ecosystem of partners or alliances to address their evolving TC requirements.

7 Question: “What participation does your organisation have in standards group/working councils or specific vendor or industry-led initiatives?”

© Analysys Mason Limited 2017 5: Success factor 3: Becoming a DSP depends on acquiring a set of digital behaviours that are unfamiliar to most CSPs
Success factor 3: Becoming a DSP depends on acquiring a set of digital behaviours that are unfamiliar to most CSPs.

CSPs that have made considerable progress in TC are also more inclined to make strategic investment in TC-related companies (see Figure 11). None of the less-mature TCi participants have made any such strategic investments and 80% stated that they do not plan to do so. Building partner ecosystems and fostering innovative start-ups through incubation and acquisition are still alien behaviours for CSPs, whereas they are natural activities for webscale DSPs. Again, a chasm is opening between CSPs on a DSP trajectory which are committed to making strategic investments and those how have yet to make any or to plan to do so.

Figure 11: Percentage of CSPs that have or plan to make strategic investment in TC companies [Source: Analysys Mason, 2017]

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8 Question: “Do you have plans to create or have you created an ecosystem of partners and/or alliances to address your TC requirements?”

9 Question: “Have you made or do you plan to make strategic investments in TC companies?”
Finally, CSPs that have already made strategic investments in TC companies are also the most likely to maintain and grow TC partnerships, as shown in Figure 12.

![Figure 12: Percentage of TCI CSPs that are open to TC partnerships among those that have invested in TC companies](Source: Analysys Mason, 2017)

### 6 Conclusion and recommendations

#### 6.1 Conclusion

CSPs need to work with their unique sets of organisational constraints, histories and internal capabilities to transform themselves into DSPs. Nevertheless, the TCI study clearly shows that the most successful operators are those that balance business and technology objectives from the beginning of their TC transformations. This alignment requires organisational and cultural change that can only be implemented if it enjoys the strong support of all C-level executives and the Board. Cultural change is strongly linked to the adoption of the digital behaviours displayed by webscale companies, including acquiring in-house software development capabilities, investing in TC ecosystem evolution and fostering innovation in multiple ways. The acquisition of digital behaviours is difficult to achieve and is the area in which most CSPs in the TCI are currently falling short. CSPs therefore need to prioritise the acquisition of these digital behaviours and ensure they are engrained across the business early on if they are to cross the threshold to becoming DSPs.

Although the balanced path is the fastest and least risky, not every CSP is currently equipped to travel it. Not all CSPs are truly aware of what it takes to become a DSP: they claim to want to reach this goal but are resisting the disruption to long-standing internal practices that it entails. CSPs that lack technology and/or business change

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10 Question: “Have you made or do you plan to make strategic investments in TC companies?”

11 Question: “Do you have plans to create or have you created an ecosystem of partners and/or alliances to address your TC requirements?”
capabilities may need to seek external help to address these shortcomings if they wish to accelerate their route to TC maturity.

### 6.2 Recommendations for operators

**Recommendation for TC leaders**
- TC leaders should continue to promote TC vigorously to the business and external stakeholders to ensure buy-in for DSP-style organisational and cultural change.
- TC leaders should emphasise their DSP software credentials by creating and publicising open-source contributions, enriching the TC ecosystem with in-house innovation, encouraging third-party developer engagement and adopting leading-edge technology capabilities.
- To accelerate TC transformation at scale, TC leaders need to push new skills more extensively into their operational teams. The most successful TC leaders are engaging their operations teams earlier in the TC transformation process and are moving fast to ensure that they are equipped with the right software skills.

**Recommendations for balanced adopters**
- Balanced adopters should ensure that the Board/C-level executives prioritise TC as a top-three initiative; this will help the operators to accelerate TC activities and ensure they keep moving along a balanced path.
- Balanced adopters should work on the development of the set of digital behaviours (in-house software development capabilities, open-source participation, DevOps-driven extreme automation) that will help them reach full DSP status.
- This group of CSPs should consider building vendor ecosystems and investing in/incubating start-ups that will bring them interesting capabilities in key areas such as 5G, security, cloud-native technologies, including cloud-native VNFs, and machine learning.
- Those balanced adopters that have not yet achieved full commercial launches should prioritise this objective. CSPs that execute a commercial TC launch find it an excellent way of bringing together stakeholders across the business, including senior business executives, sales and marketing, and technology/operations departments. A successful commercial launch generates internal company and broader market interest which helps drive further TC transformation.

**Recommendations for TC traditionalists/followers**
- Traditionalist/follower CSPs should increase cross-organisational interest in and support for TC with the aim of making it a top-three initiative. It should involve the COO/CIO alongside the CTO in operational transformation and ensure that the team responsible for TC transformation has a dedicated budget to accelerate deployment.
- Traditionalists should accelerate their understanding of and experience with cloud. They could start by ensuring that as high a percentage of ‘easier’ IT and network IT (B/OSS) applications as possible are virtualised/running in the cloud. IT cloud knowledge and skills will be critical to advanced phases of NFV.
- Traditionalist/follower CSPs should develop communication and education plans so that the rest of their organisations are aware of TC and understand the potential benefits that being a TC-enabled company will bring to their individual departments.
Annex A  TCi methodology

The TCi benchmarking process consists of four steps:

- questionnaire development
- interviews
- scoring answers
- TCi position plotting.

The following sections explain in detail what each step entails.

**Questionnaire development**

In collaboration with Nokia, Analysys Mason developed a questionnaire on TC of around 60 questions. These questions are organised into three main categories: overall strategy, technology maturity and business maturity. The questionnaire contains both single-choice and multiple-choice questions. Each question has a number of options to choose from. A small number of questions and options were updated with each phase of TCi to reflect industry progress in TC.

**Interviews**

Senior staff of Analysys Mason, such as Principal Analysts or Senior Analysts, interviewed CSP staff in senior positions relevant to TC, such as Head of Network Virtualisation, VP of Network Strategies and CTIO. The interviews either took place face-to-face or over the telephone and lasted for 60 to 90 minutes. For some CSPs, Analysys Mason interviewed more than one staff member to gather detailed views from departments focused on the business aspect and on the technology aspect. As well as noting down and discussing the answer to each question, the interviewer also captured the underlying rationale.

Nearly 80% of interviewees were senior executives of CSPs (VP and C-level) and 60% of CSPs were Tier 1 and Tier 2 CSPs. The profiles of interviewees and CSPs can be seen in Figure A.1 and Figure A.2.
Scoring

Analysys Mason developed a scoring model that translates the answers of the questionnaire into a business and technology maturity score. The business and technology maturity score of a given option may not necessarily be equal as such an option might indicate that the CSP is more focused on one aspect of TC over the other. For instance, it makes a huge difference if the CEO is the budget holder of TC rather than the CTO.

Occasionally, the option chosen by the interviewee needed to be revised to take into consideration the qualitative information provided the operator which qualified its original response. Not all questions in the questionnaire are scored. For instance, the questionnaire asks the interviewees for their perceived position in the TCi at the time of interview, in 12 and 24 months’ time. This question is used to show participating CSPs how
their internal assessment of their positions compares with TCi and to highlight which business or technology issues they need to address to reach their aspired positions.

**TCi positioning plotting**

The TCi is a $3 \times 3$ matrix of two axes, with business maturity on the x-axis and technology maturity on the y-axis. Figure A.3 provides a definition of the nine maturity levels. Each participating CSP receives a customised TCi report containing its own position alongside those of other CSPs, all anonymised.

*Figure A.3: TCi CSP profiles and definitions [Source: Analysys Mason, 2017]*

<table>
<thead>
<tr>
<th>CSP profile</th>
<th>Definition</th>
<th>Position in TCi</th>
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<tbody>
<tr>
<td>Traditionalist/follower</td>
<td>A traditionalist/follower is cautious, risk-averse and is not an early adopter of technology or new business strategies because of tactical business needs such as cost reduction, low ARPU, high churn, hyper-competitive market. As such it will wait and adopt proven TC technology and business improvements from vendors with proven capability and track record. Possibly, late adoption may allow them to ‘leapfrog’ some steps.</td>
<td></td>
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<tr>
<td>Technology-led</td>
<td>A technology-led CSP has started investing in Proofs of Concept and trials with the aim of migrating from a physical to a virtualised network infrastructure platform layer. It will also begin preparing its systems for hybrid management and orchestration of PNFs and VNFs, OSS automation, near real-time analytics and security, using a phased approach.</td>
<td></td>
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<tr>
<td>Technology specialist</td>
<td>A technology specialist has implemented and operates a converged TC environment. It invests in the new network technology to stay ahead of the competition. It ensures the organisation is very lean and highly skilled in new technologies. It sees technology as a means to continuously optimise opex over capex.</td>
<td></td>
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<tr>
<td>Technology innovator</td>
<td>In addition to having the best TC technology, a technology innovator CSP is also aware of changing market needs. It develops and uses technology innovations to address these changing needs, and improves and ensures its associated organisational transformation (people and processes). It will adopt new business models that align their technology investments to stay competitive.</td>
<td></td>
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<tr>
<td>Business-led</td>
<td>A business-led CSP continuously optimises key operational processes using existing technology and organisational restructuring. It also focuses on sales, marketing and branding activities using customer segmentation and campaign management from BSS systems and external market research data. It targets improving revenue, reducing churning, increasing operational efficiency. Typically, it will launch new innovative services with partners and on existing technology.</td>
<td></td>
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### CSP Profile

<table>
<thead>
<tr>
<th>CSP Profile</th>
<th>Definition</th>
<th>Position in TCI</th>
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<tbody>
<tr>
<td>Business specialist</td>
<td>A business specialist fully optimises business processes, organisation and systems consolidation so that they are fit for purpose, and as automated as its non-TC technology will allow. It invests in partnerships for technology gaps and highly outsourced operations as the main focus is on launching and/or reselling new branded digital services with minimal technology investments. It can be slow to market because of external dependencies.</td>
<td>Business maturity</td>
</tr>
<tr>
<td>Business innovator</td>
<td>In addition to the characteristics of a business specialist, a business innovator also invests in required proven technology to ensure it can deliver new innovative services quickly while also optimising operational costs. Technology operations are largely outsourced, except in service innovation areas as it is a differentiator. It uses a DevOps organisational structure and culture. Partnerships are still needed.</td>
<td>Business maturity</td>
</tr>
<tr>
<td>Balanced adopter</td>
<td>A balanced adopter incrementally invests in new technology, process and organisational transformations such that it aligns with market demands and overall business strategy. It has an effective, executive-led, long-term, cross-functional programme management function that continuously and incrementally implements company-wide business and technology projects to meet market needs, realise new business models and optimise operations.</td>
<td>Business maturity</td>
</tr>
<tr>
<td>Digital service provider</td>
<td>A digital service provider invests in leading-edge converged telecoms and IT technologies to increase service agility and innovation, while optimising cost efficiencies with automation, real-time analytics and proactive customer care. It focuses on customer empowerment and aims to be a disrupter by providing leading-edge services with new secure self-service cloud-based delivery models. It competes with any provider of digital services, not only other telcos, such as OTTs, content providers, application developers, aggregators and resellers. It may own most of the technology but will still use partnerships and APIs to ensure the best-in-class service innovation.</td>
<td>Business maturity</td>
</tr>
</tbody>
</table>

The second step in the TCi benchmarking process is not applicable to every participating CSP. Instead of being interviewed, CSPs that joined the TCi from previous phases received and completed the updated questionnaire, with a follow-up telephone call or email correspondence for clarification.
About the authors

Caroline Chappell (Principal Analyst) is the lead analyst for Analysys Mason’s Software-Controlled Networking research programme. Her research focuses on service provider adoption of cloud and the application of cloud technologies to fixed and mobile networks. She is a leading exponent of SDN and NFV and the potential that these technologies have to enhance business agility and enable new revenue opportunities for service providers. Caroline investigates key cloud and network virtualisation challenges, and helps telecoms customers to devise strategies that mitigate the disruptive effects of cloud and support a smooth transition to the era of software-controlled networks. Caroline has over 25 years’ experience as a telecoms analyst and consultant.

Stela Bokun (Manager and Head of Custom Research) heads Analysys Mason’s custom research team and contributes to a range of published research within the Telecoms Software research team. Her recent projects and research publications include: an analysis of the impact of telco cloud transformation and hybrid network management on CSPs’ operations; a study on CSPs’ digital service enablement platforms and digital operating models; an analysis on the impact of NFV/SDN on network planning and design; an analysis on the importance of digitalisation for CSPs’ B2B customer engagement, and an analysis on the impact of NFV/SDN on managed services, among others.

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