



THE FOUR PILLARS OF NETWORK TRANSFORMATION AND AUTOMATION

To move towards next-generation networking and successfully offer differentiated enterprise services at scale, operators must invest in a transformation journey across cloudification, data exploitation, automation and exposure. In this report, we detail the stages of maturity for operators in this journey, and how to prioritise investment to maximise their returns.



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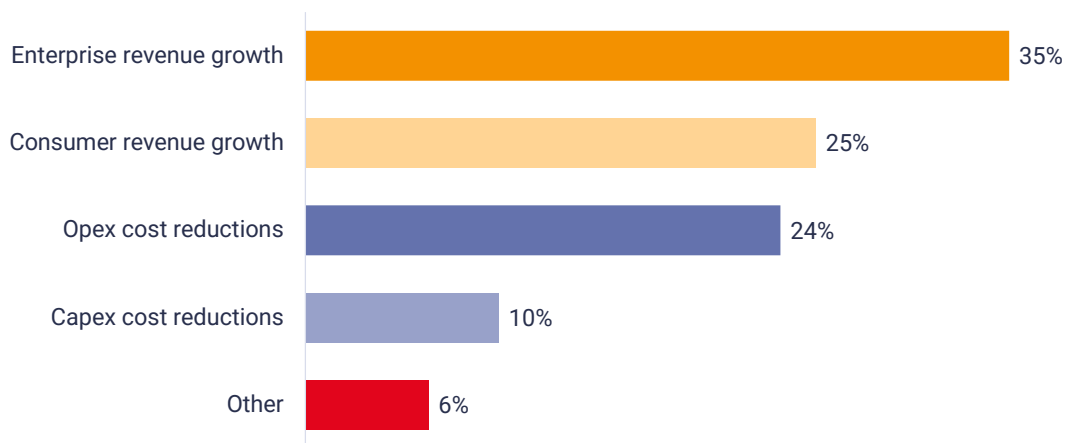
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Executive Summary

There is a broad and well-evidenced industry consensus that revenue growth, especially in the enterprise space, is a primary motivator for the implementation of next-generation networks – more so even than cost reduction drivers. This is reflected in STL Partners’ ongoing research and in the prominence given to topics like edge computing and private networks at industry events and in the trade media.

For telecoms operators in competitive markets worldwide, the key to sustaining success over their competition lies in creating service differentiation. In order to drive this differentiation telcos must invest in the network as a key enabler. As shown in Figure 1, 60% of operators identified increasing consumer or enterprise revenues as the key driver of network transformation initiatives.

Figure 1: Operators’ stated leading driver for network transformation

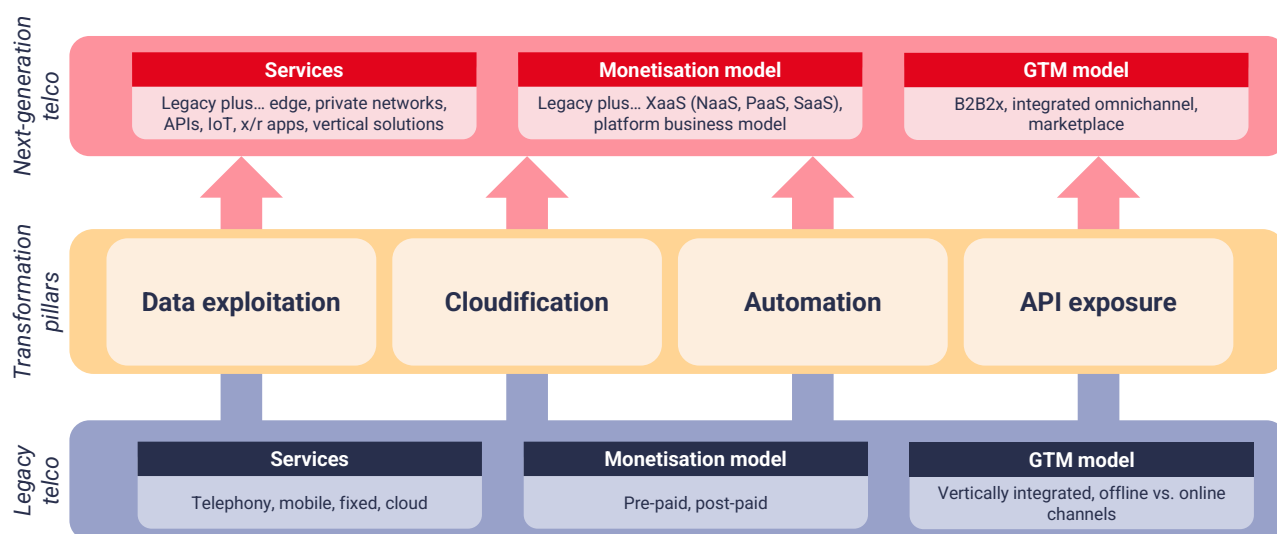


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Source: STL Partners, August 2023

However, what is less clear is the pathway to enabling this revenue growth. How can operators balance their network investment to ensure the right blend of transformation initiatives are being progressed to unlock value from their network?

To guide operators in this journey towards becoming a next-generation operator, we lay out a network transformation framework. Comprising four key pillars of network transformation and automation, each pillar is intertwined and interdependent on the others, which, when combined, can elevate a telco’s network to a key differentiator in the range of scale of differentiated services which it can offer. Our next-generation network maturity framework (see Figure 2) has been designed following interviews with 22 telco executives and a select group of vendors. It captures the key pillars of network transformation, as well as the transformation journey an operator must take to achieve maturity within each pillar.

Figure 2: The four pillars of network transformation and automation

Source: STL Partners' analysis of 22 interviews with telco executives in networks and IT

The four pillars aim to cover the fundamental infrastructure within the network and the network operations which underpin this infrastructure. The pillars are:

- **Data exploitation.** Viewing, analysing and generating advanced insights from data originated from heterogenous sources across an operator.
- **Cloudification.** Capturing the virtualisation and disaggregation of the network (and IT) stack, and beyond that the move towards a modular, microservices-based architecture hosted on a private (or public) cloud.
- **Automation.** Reducing or avoiding the number of human touchpoints within processes across an operator, through the introduction of simple, and later more intelligent, automation.
- **API exposure.** Exposing data and network services, enabling third parties to interact with the network in a simple and standardised manner. This applies to both internal and external customers, culminating in the ability to monetise this external exposure.

One key finding is that there are significant dependencies which sit within and between each of the four transformation pillars, mandating operators take a holistic approach to this transformation. It is not enough for operators to approach each pillar as its own siloed transformation programme. Dedicated resources, proactively architecting both the technology and associated business processes across these four pillars, is crucial to enabling a successful transformation.

This is particularly prevalent with respect to the role of laying strong foundations across cloud and data maturity in facilitating future revenue enablement. For example, the initial virtualisation and establishment of a common data model are key prerequisites to future transformation, such as the cross-domain automation and external API exposure required to deliver a cloud-like consumption model through a customer-friendly and scalable network-as-a-service (NaaS) offering. Operators who

are not actively investing in either of these areas should reprioritise investment to ensure lack of progress in these foundational pillars does not derail transformation initiatives within other pillars.

Operators navigating their network transformation and automation journeys must consider these additional points:

- True closed-loop, cross-domain automation is a key enabler of future transformation, but it has its own prerequisites.
- Monetising APIs at scale to enable mature NaaS offerings requires transformation across all four pillars. But the key remains translating technology maturity into business benefits for enterprises.
- Operators in the earlier stages of their network transformation journey should learn from the experiences of more mature operators and seek to leap across transformations steps where possible.

Different operators will have a range of unique circumstances which impact both their motivations and actions regarding their network transformation journey. However, by identifying the relative maturity of an operator across the four transformation pillars, the operator in question can understand both the tactical and strategic roadmap for investment in network transformation, to ensure business benefits can be unlocked as early as possible.

Using the framework, this report provides a tangible and comprehensive guide to the stages an operator must go through on their network transformation journey. It will ensure they understand not just the opportunities associated with a next-generation network, but the tangible steps to realising this vision.

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The four pillars of network transformation and automation

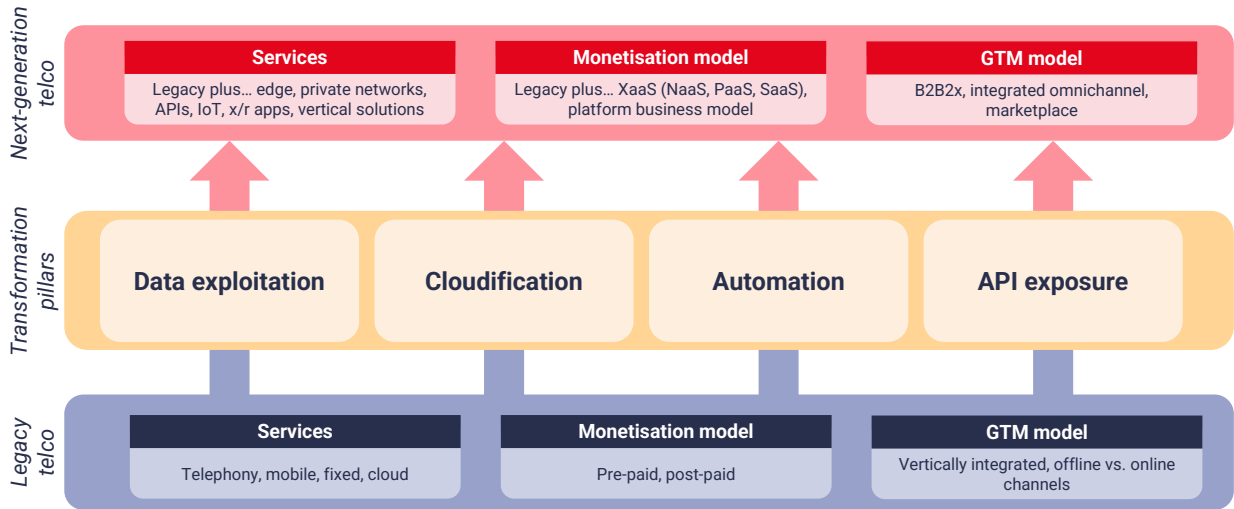
Operators globally are moving away from the legacy business models of a traditional telco. They are seeking to expand their range of services by introducing revenue diversification away from increasingly commoditised pure connectivity offerings and the reduced margins these represent.

Although operators have made some progress on the move towards these next-generation services (such as edge compute, private networks, network slicing [to an extent], and the use cases these technologies enable) they are still unable to **monetise these at scale**. A heterogeneous customer base, as well as relative immaturity of the technology and associated commercial model, means the industry is stuck in “proof of concept purgatory” and these services are not yet driving significant revenues. To drive more scalable solutions, **telcos must transform their networks, operations support systems (OSS) and IT** to enable more flexible and agile as-a-service models for next-generation solutions, and the delivery of these through a more diverse ecosystem of go-to-market avenues.

Attempting this transition requires sizable investment (with spectrum accounting for a significant portion of this) in additional technological capabilities, on top of the significant accompanying operational transformation across network and IT. There has been a lot of exploration of what this investment promises to return in terms of service differentiation. For example, hype around 5G network slicing as a service and the associated use cases in consumer and enterprise verticals. However, there has been limited coverage on the technological roadmap to achieving this end goal, the practical steps operators can take on the journey to next-generation operations, and the priority areas of investment across technological pillars.

In this report, we identify **four key pillars which underpin the transition to becoming a next-generation telco** and the service monetisation at scale this promises to bring (see Figure 3).

Figure 3: The four pillars of network transformation and automation

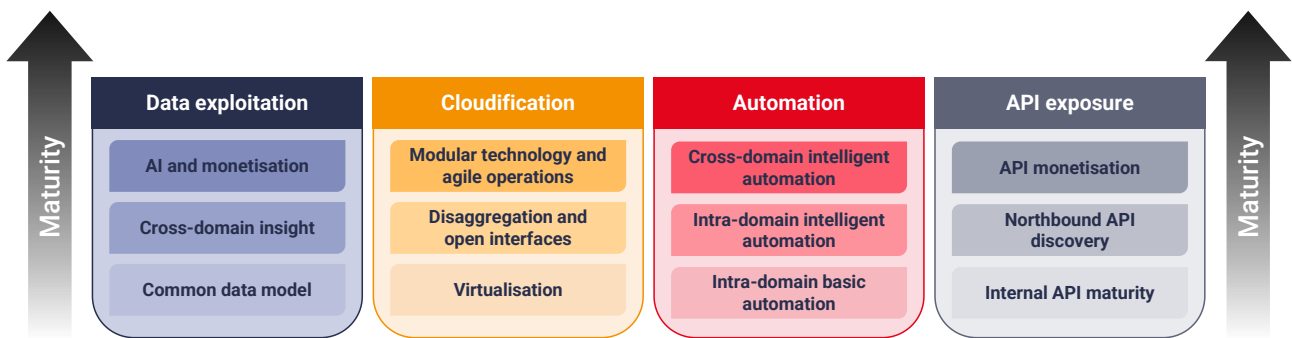


Source: STL Partners analysis of 22 interviews with telco execs in networks and IT

Although these pillars are inextricably intertwined, most operators are organised such that they have separate teams, initiatives and budget resource allocated to each. We therefore define them separately and think about progression on this framework within, as well as across, each pillar.

Each pillar has three stages of maturity. Each stage builds on the last to illustrate how operators might progress towards becoming a true next-generation operator. The sections below summarise our next-generation networks maturity framework (see Figure 4).

Figure 4: The next-generation networks maturity framework



Source: STL Partners analysis of 22 interviews with telco execs

As well as reflecting the relative increase in technological advancement, the stages of the maturity framework reflect to what extent the operator has enabled a cross-domain, organisation-wide approach versus implementation within siloes (single teams or domains). Understanding the role of cross-domain technology transformation in managing network and IT complexity is crucial for operators looking to offer an increasing number of enterprise services to an increasing pool of customers. Not only does cross-domain automation simplify workflows for operators, but it can also exponentially reduce reaction time to customer requests, improve customer experience and fundamentally alter the quality of service being offered. Similarly, generating right-time cross-domain

insights, facilitated by a common data layer and standardised data cataloguing, can help guide future product development and sales strategy.

The four pillars of transformation and their corresponding stages of maturity are detailed below.

Data exploitation

Data exploitation contains, at a base level, the establishment of a common data layer and accompanying data governance, all the way through to the integration of AI and machine learning as standard within business-as-usual processes.

Telcos have an abundance of rich first- and second-party data, both on their customers and about their networks, that they are searching for ways to monetise. Data sourced from business support systems, location, and network data from sources as diverse as assurance through to inventory, hold possible value for operators. However, they have faced numerous challenges in unlocking this potential.

This framework breaks the journey down into three stages of maturity:

1. **Common data model.** Data from sources across an operator is observable through one consistent “golden source” of data. Data governance maturity allows secure and timely access to relevant data, which sits under a common data model. Discrete teams are likely to be leveraging basic analytics to drive insights from data collected within their domain, although this is likely to not yet adhere to a standard data model.
2. **Cross-domain insight.** Cross-domain insights are available across teams, aggregated on accessible and automated dashboards. For those wanting to create their own visualisations or dig into data further, there is secure and real-time access to cross-domain raw data under a refined common data model.
3. **AI and monetisation.** Cross-domain insights remain available across teams, now leveraging advanced analytics such as AI and machine learning tools as standard. Data analysts and data scientists are integrated into cross-functional business teams as standard to ensure business units are maximising insights from data available to them. Data monetisation is a mature and revenue-generating offering, covering network APIs and aggregated customer data.

These stages describe a move to increase the breadth of adoption of simple data capabilities, before building on these to increase the maturity of both technology and accompanying organisational practices at a later date. The converse approach, to build complexity within individual domains and subsequently integrate these, is not recommended as it can lead to inconsistencies in data cataloguing and governance between domains. This results in significant integration challenges down the line.

"We have been focussed on creating a data layer, a common data model, that will enable us to build various kinds of APIs, digital channels, new services, etc."

Technology strategist, Tier 1, APAC

”

Cloudification and programmability

This pillar captures the growing shift towards cloud-native and the softwarisation of network functions, as well as the flexibility and network programmability this enables. Through the move to telco cloud, and eventually open interfaces and microservice-based architectures, operators can significantly reduce the barriers to entry within the vendor ecosystem. This stimulates innovation, as well as enabling greater network automation and orchestration, and agility in network and IT operations.

The three stages of maturity within this pillar are:

1. **Virtualisation.** A portion of network (likely excluding the radio access network [RAN] and user plane functions) and IT infrastructure is hosted on virtualised infrastructure. The majority of planned deployments involve virtualised network functions (VNFs), even if the long-term architecture calls for cloud-native network functions (CNFs).
2. **Disaggregation and open interfaces.** The majority of infrastructure across core, RAN and IT is software based, with workloads running on common, off-the-shelf hardware as standard. Disaggregation, the logical splitting of functions across geographies and/or vendors, is a consideration in new deployments. There is an ongoing convergence between network and IT business units, potentially under a common chief technology & information officer (CTIO) function, while an increasing number of network functions are deployed as CNFs.
3. **Modular technology and agile operations.** Network and IT applications are structured using a microservices-based approach, with CNFs deployed as standard. These can be flexibly pieced together across various product portfolios and multiple public and private cloud platforms.

"Our goal is to be cloudified across all domains by 2027. We have already achieved spending 60% less on CNFs than we did running functions in single vendor stacks."

**SVP Technology Innovation & Ecosystems,
Tier 1, EMEA**

”

Cloudification maturity tends to be built up in a specific domain, increasing knowledge of cloud architecture and development principles before this is rolled out to other business units across the organisation. The standard path for operators involves moving IT functionality to the cloud, before investigating opportunities arising from moving core network functions, and latterly access and transport capabilities, to the cloud.

Automation

Automation is key to ensuring the maximum benefits available through transformation of data and cloud capabilities are achieved. However, much like the two previous transformation pillars, there is both significant investment and transformation effort required to realise the sizable benefits which automation promises for operators.

The journey from basic, domain-specific, simple robotic process automation to cross-domain, closed-loop, intelligent automation, falls into three stages of maturity:

1. **Intra-domain basic automation.** Basic automation is used to solve specific pain points within specific domains, using simple decision-to-action algorithms to automate specific repetitive and traditionally manual tasks.
2. **Intra-domain intelligent automation.** Intelligent, analytics-based automation drives a shift towards more intelligent, zero-touch automations. Despite some organisation-wide initiatives existing, this is still primarily used to automate processes within specific domains.
3. **Cross-domain intelligent automation.** Advanced tools such as AI and machine learning are prevalent within the automation strategy, and are routinely exploited within cross-domain, end-to-end automations. This includes freely automating workflows which pull on both network and IT domains, such as automated billing based on quality of service delivered.

Much like the move towards cloud-based network architectures, we expect automation capabilities to first advance within a domain, with specific teams working on innovative automation use cases to drive efficiencies in their operations, before this intelligence is centralised and rolled out across other domains. Naturally, the significant dependency on underlying data capabilities required for cross-domain automation provides a natural blocker for such a cross-domain approach early on during an operator's overall network transformation journey. This also works to encourage development of intra-domain automation capabilities prior to this expanding to reach across domains.

"Automation is central to our transformation. We are trying to achieve total automation through a GitHub operating model."

VP Software Engineering, Tier 1, EMEA ”

API exposure

The last pillar of this network transformation framework illustrates the growing shift towards standardising interfaces used to expose networks, both internally between applications within an operator, and externally to vendors and customers alike. Operators are looking to begin by developing their internal API maturity, both to realise the benefits of standardised interfaces within their newly cloud-based network architecture as well as growing the capabilities required to develop APIs designed for third-party consumption (and eventually associated monetisation).

The three maturity stages of this pillar are:

1. **Internal API maturity.** Internal APIs are commonplace across the network and IT architecture, facilitating simple and standardised data transfer between discrete components or applications. Southbound APIs are beginning to be exposed to vendors, with the aim of facilitating component optimisation.
2. **Northbound API discovery.** A mature internal API strategy guides development within this area of network transformation. Centralised innovation teams are likely working on northbound exposure, leveraging industry standards to offer a handful of simple APIs, and exploring the monetisation of these using an aaS model.
3. **API monetisation.** A diverse portfolio of northbound API offerings is available through an aaS model, with API innovation decentralised to relevant network and IT product teams. Standards-based APIs are available as well as more bespoke offerings covering both vertical and customer-specific APIs.

"We have an aim to be an API-driven organisation. We already have 600+ internal APIs and expose APIs to vendors through our API gateway/marketplace."

CTO, Tier 1, North America ”

The development of APIs has followed a two-pronged approach in recent years, with internal API development mostly driven by teams across the organisation, whereas external exposure has emerged as a top-down strategic initiative. The challenge of external API exposure has been driven by concentrated resources within a small number of discrete teams, with the aim of simplifying the plethora of internal APIs, which will have limited meaning for an

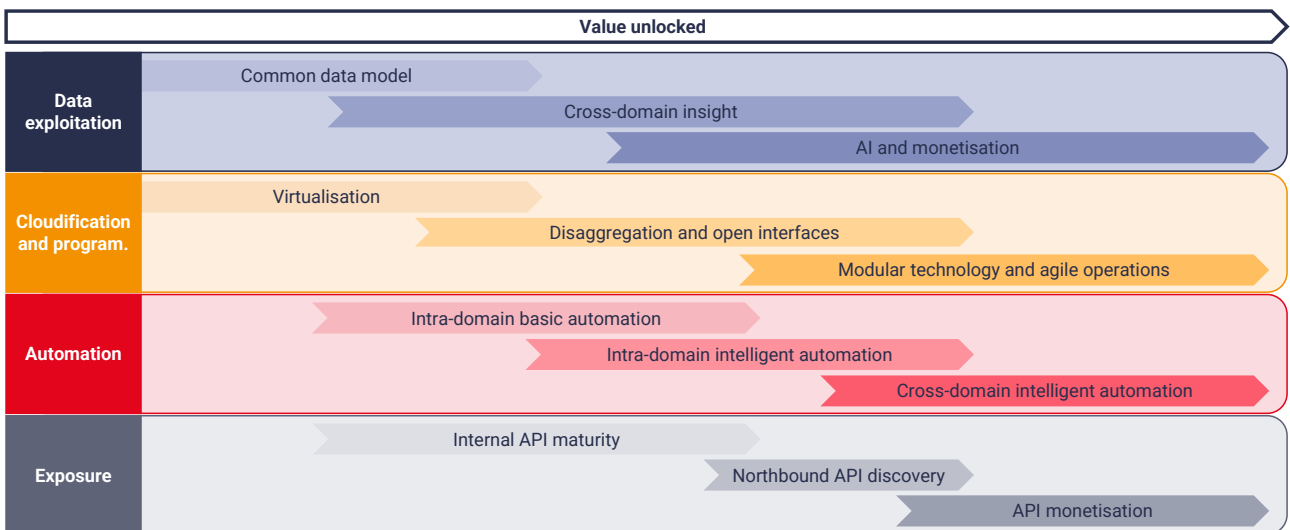
external developer, for external consumption. This dual approach allows APIs to be tailored to specific customer requirements, whether those are internal and well documented or external and largely unknown. Also, the development of APIs which synthesise data from multiple sources from across an operator into one packaged offering are expected to be developed, after those which solely require data from one domain.

Unlocking value through cross-domain transformation

Operators cannot expect to realise significant value through transforming in just one of these four pillars. Each pillar has significant dependencies and overlaps with other pillars, and the points at which value is unlocked for operators relies upon milestones being reached across multiple pillars.

There are four technology milestones across the four pillars which unlock significant incremental value for operators. This is not to say that value is only realised for operators once they have achieved all of the associated milestones within pillars, however operators cannot expect to jump to later stages within each pillar without regard for the earlier stages. For example, efficient and flexible cross-domain automation is contingent on a certain level of disaggregation, as well as a common data model, internal API maturity and intelligent automation having previously been pioneered within a single domain. See Figure 5.

Figure 5: The transformation milestones to value creation



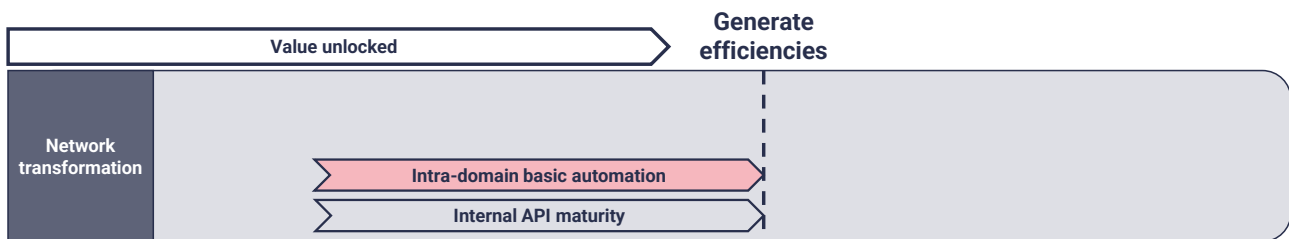
Source: STL Partners

Milestone 1: Lay the foundations



The first significant point on an operator’s transformation journey at which value is unlocked comes when they have both moved a significant proportion of their network and IT workloads to virtualised infrastructure and have combined this with a common data model across an operator’s business units. Operators should not invest in tactical transformation of legacy systems which will soon become superseded. Instead they should seek to unlock incremental value for their current enterprise services by laying the foundations of a modernised infrastructure for the future. In addition to enabling future transformation, operators can improve the speed, scalability and resilience of core enterprise connectivity services at this point.

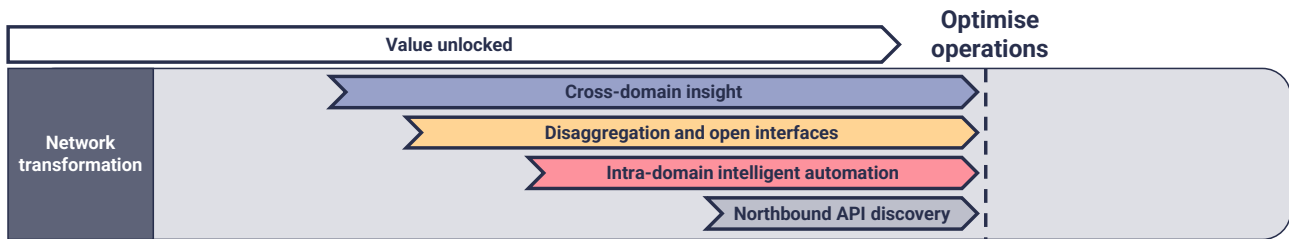
Milestone 2: Generate efficiencies



These foundations allow an operator to build on its initial groundworks across virtualisation and a common data model, leveraging basic automation and internal APIs to improve organisational efficiency and flexibility. Basic intra-domain automation of repetitive, manual tasks can, if implemented correctly, facilitate cost reductions and reduce the possibility of human error. In addition, the likely improvement in the speed of processes which have been automated can enable certain internal processes to scale up and down more easily. If coupled with consumption-based procurement models this can lead to further cost efficiencies on top of the flexibility benefits.

Similarly, the shift towards an API-based architecture can facilitate improved cross-organisation collaboration, as well as supporting early attempts to automate across domains. As the heterogeneity across domain-specific technologies and resulting data is beginning to be mitigated (through standardised and appropriately documented APIs), greater cross-domain insight and optimisation is enabled, as well as building internal API competency, in addition to overall data capabilities which will allow later API exposure both to partners and customers alike.

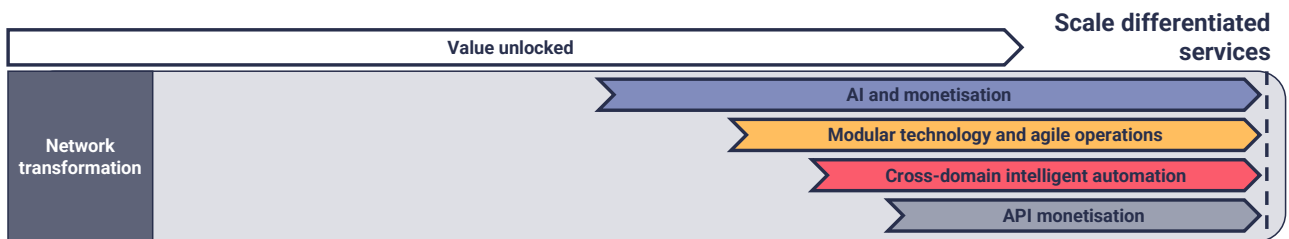
Milestone 3: Optimise operations



The third significant milestone at which value is unlocked is achieved when operators realise the benefits of a disaggregated cloud-based architecture across both network and IT, while incorporating increasingly intelligent automation. Disaggregation of the virtualised network architecture lays the groundworks for future composability and allows some reconfiguration and flexibility to optimise for an attribute within a specific deployment, such as baseband unit pooling to reduce overall RAN costs.

Intelligent automation, albeit within specific domains, and initial northbound API use for component optimisation, have allowed specific sub-domains within the network to largely be optimised and automated, bringing a certain level of cost savings to the operator, as well as beginning to mitigate against growing technical complexity. Insights are beginning to be shared more freely across domains, although this has not yet extended to automating cross-domain processes.

Milestone 4: Scale differentiated services



However, operators must achieve maturity against each of the four pillars to unlock a truly customisable, monetisable and efficient network. A microservices-based architecture facilitates new levels of enterprise service flexibility, as this composability, coupled with open interfaces, work to stimulate comparatively simple product customisation, as well as reducing the marginal cost to innovate and an operator’s time to market with new services.

Cross-domain automation is also key here, underpinned by advanced analytics such as AI, facilitating the levels of operational simplicity required to offer a full range of off-the-shelf and customised enterprise services. Enterprises can select outcome-based services and rely on a self-optimising suite of services, covering network APIs, slicing, private networks and edge compute, to deliver best-in-class offerings. These are designed to optimise around a set of outcome-based selections which an enterprise can change in real time (for example, minimising cost or maximising performance), underpinned by a largely autonomous network.

Conclusion

Telcos are focused on how to transform their networks to become a next-generation operator. However, it is not enough to just narrow in on and understand the “end state” of the operator and what this entails. Operators must understand the journey to this final destination and the portfolio of network transformation, backed up by cross-domain automation, which will eventually enable scalable future revenue opportunities.

Through transformation across data exploitation, cloudification, automation and API exposure, telcos can transform their technology and operations from the current standard of siloed, proprietary systems to an agile and flexible architecture of interoperable components, enabled by true closed-loop, cross-domain automation and autonomy. However, operators must prioritise and time where and when they invest.

Recommendations for operators looking to maximise the value created by their network transformation and automation:

- **Take a holistic view to transformation.** Do not rely on a technology-focused approach with separate, siloed transformation programmes for each pillar. Instead, view these as horizontal enablers of a product-based programme. Such a matrix-based organisational structure is yet to become commonplace within the industry. However, they can have real impact in ensuring alignment in solution design and development, ensuring technology expertise can be leveraged while the focus remains on generating value for the customer.
- **Evaluate the prerequisites to end-to-end, zero-touch automation.** Do not expect to skip to enabling cross-domain autonomy at scale without the necessary groundworks being laid across cloudification and data maturity. This in turn has implications for the ability to scale on-demand enterprise services (like dynamic network slicing) which rely on such cross-domain automation.
- **Invest in a foundational transformation project before rushing to API monetisation.** Monetising APIs at scale to enable mature NaaS offerings requires transformation across all four pillars, but the key remains translating technology maturity into business benefits for enterprises. In terms of the network transformation journey to achieve this, strong maturity across data, cloud and automation is crucial. However, the value comes in rolling up the plethora of data and services the operator possesses into a small number of APIs which are accessible to developers, and which can be enabled in real time at scale thanks to mature cross-domain automation.
- **Learn from the successes (and failures) of others.** Operators earlier on in their network transformation journey should learn from the experiences of more mature operators and seek to leap across transformation steps where possible. For example, operators that have not prioritised investment in virtualisation can capitalise in advancements in cloud-native networking to skip legacy VNF investment and rearchitect functions directly from proprietary components towards CNFs.

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