AGILITY, ACCELERATION, AND INNOVATION IN NETWORK ENGINEERING

NetPace is a comprehensive network engineering framework that provides organizations with better agility, speed, and innovation. Taken together, these three elements allow companies to launch products faster, lower costs, and provide a stellar customer experience.

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Communication networks are growing at a rapid pace, but it's not just the telecom companies that are profiting. Connected ecosystems are generating vast wealth in a broad range of industries. Despite a global recession, the market cap of electric carmaker Tesla increased by more than $500 billion in 2020, thanks in part to its bet on the future of autonomous and semiautonomous vehicles.[1] Qualcomm Inc., a maker of digital wireless communications products and services, saw its earnings per share grow by over 500% in the last quarter of 2020.[2] And esports, which requires the low latency and high throughput of next-generation networks, is now a growing segment of the $138 billion video game industry.[3]

To make the most of this transition, telecom providers and the partners they work with are rushing to update their networks 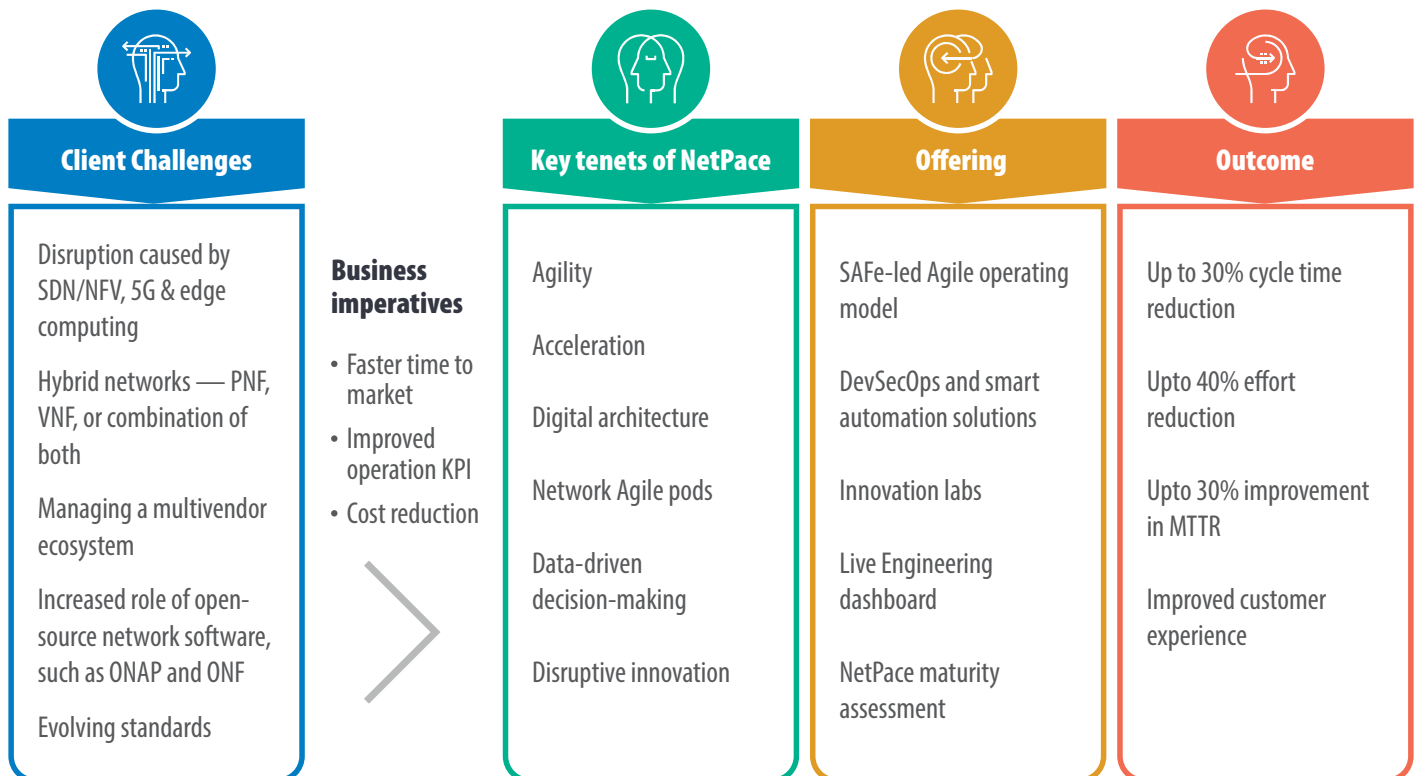with 5G hardware. However, the software is what's driving much of this growth as edge clouds and software-defined networking (SDN) become tech essentials. The telcos that will win in this new ecosystem are those that can deliver business and technology services with an eye on superior customer experience and operational excellence. Agile practices will allow these firms to increase network uptime (resilience), accelerate business outcomes, and develop and operate new applications at scale. Network vulnerabilities can be patched in real time, and new software releases can be deployed continuously through techniques such as DevSecOps.

NetPace is built around the three tenets of agility at scale, network engineering acceleration and innovation

With such demands, telcos must ask themselves how mature they are in practicing Agile network methodologies. They must calculate how quickly they can launch new products that are compliant with ever-broadening network regulations. Companies need to understand how effectively they can create an innovative business culture that keeps them abreast of emerging technologies.

Infosys has used its "NetPace Agile" framework (Figure 1) to help telecom firms understand their current maturity (people, processes, and technology) and create a road map to fill in the missing gaps. Based on more than two decades of experience with telecom clients, this Agile framework is built with three tenets: agility at scale, acceleration, and innovation. By excelling in these areas, telco firms can increase talent density, foster agility, and help grow market share.

Figure 1. The NetPace solution solves client challenges through Agile-led network engineering

Client Challenges	Business imperatives	Key tenets of NetPace	Offering	Outcome
Disruption caused by SDN/NFV, 5G & edge computing	• Faster time to market	Agility	SAFe-led Agile operating model	Up to 30% cycle time reduction
Hybrid networks — PNF, VNF, or combination of both	• Improved operation KPI	Acceleration	DevSecOps and smart automation solutions	Upto 40% effort reduction
Managing a multivendor ecosystem	• Cost reduction	Digital architecture	Innovation labs	Upto 30% improvement in MTTR
Increased role of open-source network software, such as ONAP and ONF		Network Agile pods	Live Engineering dashboard	Improved customer experience
Evolving standards		Data-driven decision-making	NetPace maturity assessment	
		Disruptive innovation		

Source: Infosys

In fact, experience working with clients has shown that firms can reduce product development efforts by up to 40% and reduce end-to-end process times by as much as 30%, significantly reducing costs.

The top objectives of NetPace include:

- Ensuring delivery is in line with telco business and network imperatives.
- Scaling quickly.
- Maximizing savings.
- Future-proofing the enterprise by reducing technical debt.
- Transforming talent.
- Upskilling the software engineering practice for network engineering.

Three components of great network engineering

Like all other technology, networks are evolving. In the future, they will use open, flexible architecture; zero-touch provisioning; and improved orchestration and policy management. The best networks will be self-optimized, with automation, analytics, and artificial intelligence (AI) working across a multivendor cloud ecosystem.

As a result, network transformation programs will be very complicated and require multiple programs running in parallel. To ensure that programs don't drag on for years and eat into ever-tightening budgets, teams will need to work within the Agile methodology. NetPace, therefore, recommends that telcos focus their network engineering efforts on extreme agility at scale, acceleration through execution excellence, and strong thought leadership and innovation (Figure 2).

The overarching operating model should be based on the SAFe framework — an Agile development process that accelerates delivery — complemented by smart automation solutions, tools, and platforms.

1. Agility at scale

Agile development is a boon for next-generation networks. Telcos that have fully transitioned to Agile have reduced development costs by as much as 25% and significantly improved customer satisfaction scores.[4]

But Agile at scale isn't easy. SAFe-led network development is required, which combines Agile software development, lean product development, and systems thinking. Further, systems development should use the principles of live engineering — continuously evolving by learning from underlying data then adapting and improving. NetOps principles should also be used, stitching together network and software engineering to deliver faster and cheaper services.

NetPace ensures this agile-at-scale foundation is in place. If carried out effectively, telcos can transform from a communication service provider (CSP) to a digital service provider (DSP). The following principles provide direction.
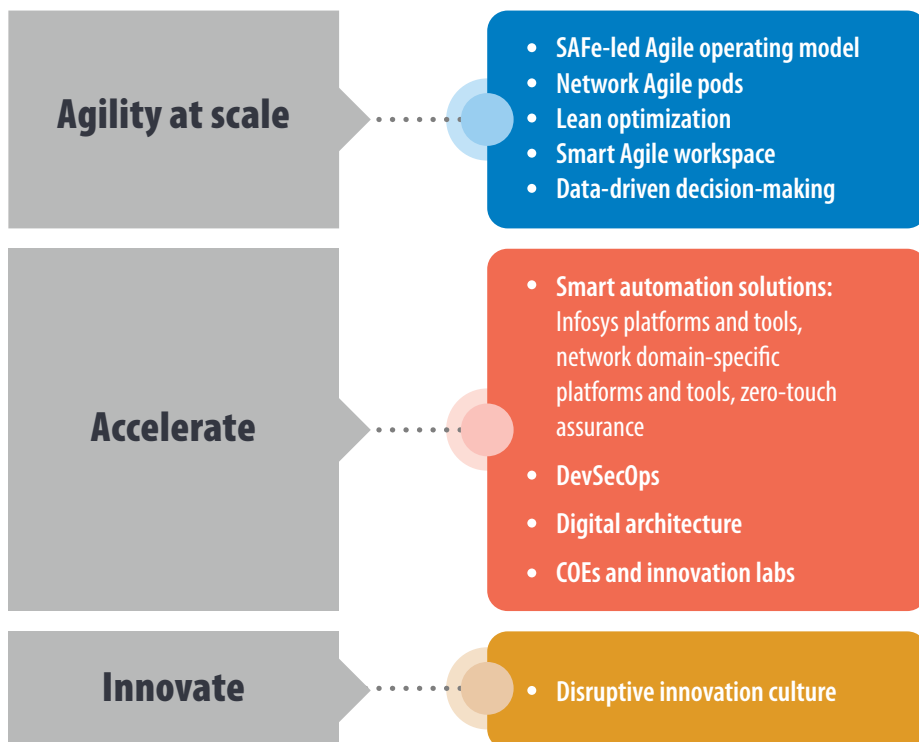
Process

The delivery model should be based on the SAFe construct, comprised of multiple Agile release trains (ARTs) that are themselves built on distributed Agile teams. Each ART is composed of scrum masters, product owners, Agile coaches, network engineers, network architects, developers, domain experts, solution architects, testers, and so on.

These Agile teams specialize across all network functions, including network planning and design, discovery, operations, fulfillment, orchestration, activation inventory, topology, fault and performance monitoring, and analytics-driven assurance, etc.

The ARTs are composed of multiple time-boxed program increments, delivering a specific network functionality or service. On its own, each ART delivers an increment of

Figure 2. The NetPace framework methodology

Agility at scale
- **SAFe-led Agile operating model**
- **Network Agile pods**
- **Lean optimization**
- **Smart Agile workspace**
- **Data-driven decision-making**

Accelerate
- **Smart automation solutions:** Infosys platforms and tools, network domain-specific platforms and tools, zero-touch assurance
- **DevSecOps**
- **Digital architecture**
- **COEs and innovation labs**

Innovate
- **Disruptive innovation culture**

Source: Infosys

service, so that taken together, it manages the full end-to-end life cycle.

For instance, implementing key initiatives such as 5G and edge network offerings involves multiple portfolios and ARTs. Business, network, and IT teams are closely aligned and provide tangible outcomes as often as every two weeks.

Tools and platforms

For agility at scale, the tools and platforms used to measure team productivity and software quality matter — a lot. Such tools should work at scale across large, distributed Agile teams assigned to each ART. Two such tools are:

- **Persona-based live engineering dashboards** — These dashboards show consolidated release plans and statuses; real-time intelligence for network and system portfolios; and business, operational, and engineering agility metrics using JIRA, Agile Central, and other popular DevOps custom tools. One example is the Infosys Live Engineering dashboard, which provides real-time metrics at scrum, ART, management, network domain, and portfolio levels. This improves speed and increases transparency, efficiency, and effectiveness by ensuring all stakeholders are on the same page and that decisions flow from meaningful insights.

- **Hyper-collaboration tools** — These include anytime, anywhere hyper-personalized "live enterprise" digital workplaces. These will help in conducting remote planning, collaborative designs, sprint demos, and knowledge management. In the post-COVID-19 era, such tools will be commonplace as more remote teams continue to collaborate.

People

NetPace recommends creating high-performing network Agile PODs — small, diverse, autonomous teams with buy-in from business — to nurture skills and train teams. The intent here is to reduce the skills gap between network engineering and IT teams through constant upskilling and cross-skilling. In addition to training on the network and system, the plan features other key elements such as:

- Domain engineering, including network management systems, wireline and wireless networks, and operations support systems, etc.

- Process instruction, including SAFe, distributed teams, and "smart working."

- Technology skills, including:
  1. Standard programming skills.
  2. Digital skills — Full stack development, cloud platforms, containerization, and DevSecOps.
  3. Niche skills — Radio frequency engineering, digital twins, robotic process automation, AI and machine learning, etc.

4. Emerging technologies — 5G, SDN, Open Network Automation Platform (ONAP), Open Networking Foundation (ONF) standards, and other reference platforms.

To enable upskilling, our clients have leveraged Infosys' LEX learning management system. The platform offers learning paths and tailored training content along with domain and technology certification programs.

2. Accelerating transformation

Once agile-at-scale software engineering is set up within PODs, network transformation can be accelerated through the right digital architecture, DevSecOps, and smart automation. This architectural design should be scalable, loosely coupled and cloud native — to form the backbone of the end product.

This evolution from legacy monolithic architecture to the next generation's open and digital architecture includes:

- An open-source-based technology stack featuring microservices and containerization along with the use of DevSecOps.

- Onboarding network functions seamlessly and directly in the CSP environment, funneling work through the original equipment manufacturer (OEM) product rollout DevOps pipeline for accelerated delivery.

Along with accelerating delivery through digital architecture, the teams themselves should be integrated using NetOps methodology. An example is bringing together network teams with IT DevOps teams, and using RPA to fix well-known problems of network design, data quality and inventory reconciliation, among other issues.

But implementing NetOps isn't easy. Silos must be broken between network and IT systems testing. To aid in this, NetPace recommends a shift

left, integrating network testing within the continuous integration-continuous deployment pipeline. This can be achieved by having a service-API layer so that networks' labs and their work can be booked through the DevOps layer directly, followed by triggering individual network domain test frameworks to perform end-to-end network and services testing.

Further, NetPace recommends carving out prioritized network transformation use cases through strategic intent-based ideation. This follows the Japanese school of thought wherein firms accelerate the pace of organizational learning and try to attain seemingly impossible goals by spreading the vision of global leadership.[5] To conduct these specific ideations, it is important to leverage best practices from peers, global forums, standards bodies, partner connect programs, and analysts.

Taken together, all these elements lead to faster execution through the use of:

- **Minimum viable products,** which are seed projects through new or ongoing ARTs.

- **Centers of excellence and innovation labs,** which develop and test proofs of concepts (POCs) and carry out pilots for new services and catalysts. These labs enable work on SDN, Networks Function Virtualization, and operations support systems, and generally use open-source components. Such assets can come from the ONF and other standards (e.g. OSM, ONAP, SEBA, P4, NOX, and vSwitch), along with standard SDN switching elements, traffic generators and tools, and Infosys IPs and accelerators.

To quickly get up to speed, clients can work with partners to take advantage of cloud-enabled SDN-NFV labs and 5G living labs. There, multiple tools, IPs, platforms, and accelerators are

developed for networks. These services include 5G slice management, AI- and ML-based closed-loop assurance solutions, network design automation, communications as a service, and platforms as a service for containerized network functions.

3. Disruptive innovation culture

Firms are under increasing pressure to innovate just to keep up with the competition. New network technologies are constantly emerging, and customers demand new products with high quality, delivered quickly and cheaply.

NetPace recommends:

- Tapping into TM Forum and other global forums to participate in catalysts that solve industry-wide challenges and problem statements.

- Working with standards bodies such as ONF and ONAP.

- Launching partner connect programs.

- And crucially, hiring people with rich industry experience.

> Insights from data platforms and developing POCs and prototypes in labs help accelerate the network transformation

Further, companies will benefit from building relationships with analysts, including those within iSG and other network advisory firms.

For continuous innovation, other practices such as client-centric idea-generation workshops (ideathons) help bring teams together. Finding insights from data platforms and developing POCs and prototypes in labs help with quick decision-making. That enables optimal use of resources, time, and effort — accelerating the network transformation agenda.

NetPace maturity assessment

A NetPace maturity assessment is recommended to ensure that key tenets are in place and implemented correctly. Firms are scored on 14 key attributes (Figure 3), giving them a bird's-eye view of where they are in their network engineering practice and how they can progress to full maturity.

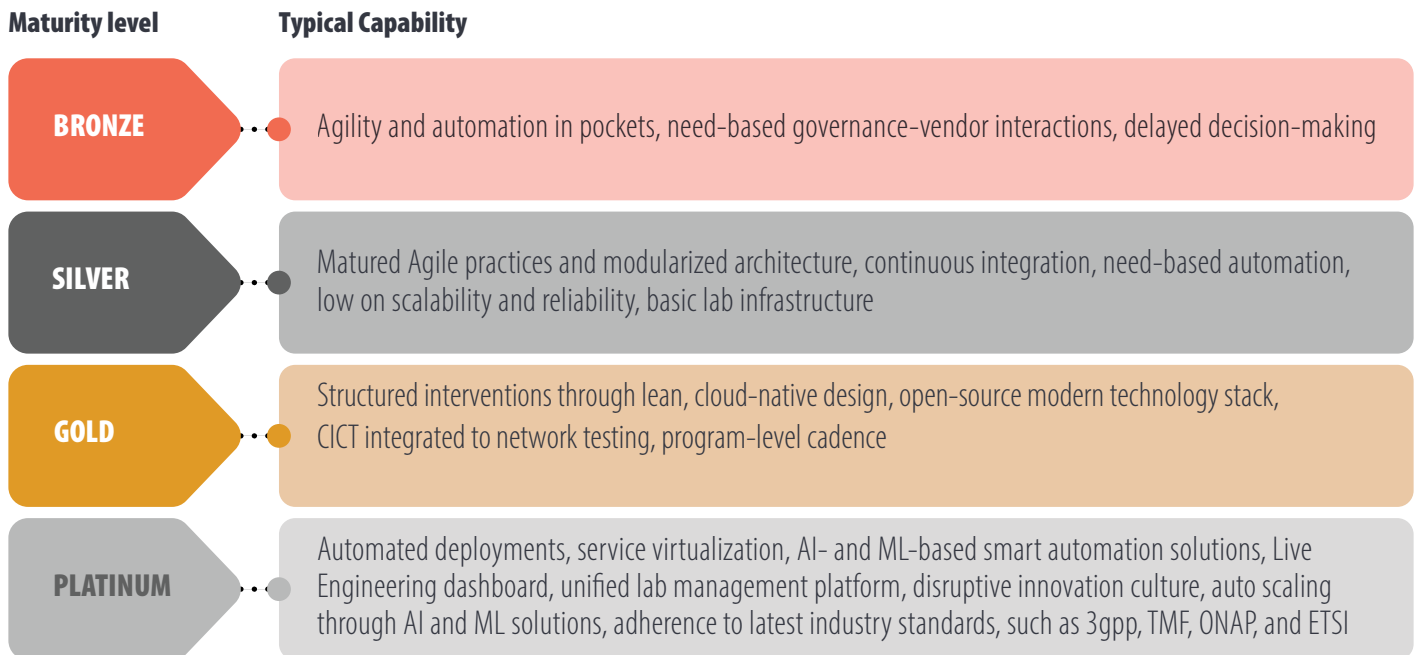The maturity level of the program is given in detail, with firms scored on a scale of bronze, silver, gold, or platinum. As firms move toward platinum, they are more likely to score high on important business outcomes such as customer experience, increased profit margins and efficiency metrics. Figure 4 outlines the typical nature of the network engineering practice in each tier.

Figure 3. 14 key attributes of the NetPace maturity assessment

Tenets of NetPace	Attribute	Description
Agility at Scale	Delivery model	Maturity of Agile delivery model in terms of adoption and effectiveness, digital collaboration among distributed teams, culture and behavior
	Lean optimization	Structured intervention for optimization through techniques such as value stream mapping, demand capacity analysis and individual productivity analysis
	Vendor governance	Onboarding and collaboration with vendor teams
	Data-driven decision-making	Informed decision making at the right time by the right people, leveraging inputs from AI/ML, data sensors
	Business-driven metrics	Personalized Live Engineering dashboard-driven improvements on key business metrics
	Learning and development	Continuous cross-skilling and upskilling of teams on domain and digital skills through talent transformation platform
Accelerate	Architecture and modern technology stack	Monolithic vs microservices-based, cloud-native design and use of open-source, modern technology stack
	Standards compliance and openness	Adherence to latest industry standards: 3gpp, TMF, ONAP and ETSI
	DevSecOps pipeline	E2E automated DevSecOps pipeline with network testing integrated in the continuous integration and deployment pipeline
	Test automation	Service virtualization integrated with CICD pipeline
	Life cycle automation	Identification of automation opportunities, and AI, RPA, AR-VR utilized for E2E automation
	Application reliability and scalability	Continuously sense, correlate and auto scale based on AI and ML solutions
	Lab infrastructure	Unified lab management, fully automated, integrated to CICD stack, with network simulators along with dashboard depicting incidents, availability
Innovate	Innovation culture	Disruptive innovation culture leading to break though improvements for the client

Source: Infosys

Figure 4. Capabilities of the NetPace maturity levels

Maturity level	Typical Capability
BRONZE	Agility and automation in pockets, need-based governance-vendor interactions, delayed decision-making
SILVER	Matured Agile practices and modularized architecture, continuous integration, need-based automation, low on scalability and reliability, basic lab infrastructure
GOLD	Structured interventions through lean, cloud-native design, open-source modern technology stack, CICT integrated to network testing, program-level cadence
PLATINUM	Automated deployments, service virtualization, AI- and ML-based smart automation solutions, Live Engineering dashboard, unified lab management platform, disruptive innovation culture, auto scaling through AI and ML solutions, adherence to latest industry standards, such as 3gpp, TMF, ONAP, and ETSI

Source: Infosys

Communications has always been a mission-critical service. High-bandwidth networks with built-in resilience are crucial in an age where billions of devices are online, connected, and require real-time data; where digital and physical worlds are converging; and where autonomous technologies, immersive technologies, and increased use of video are expected.

The CSP of the future will be one that can innovate and change strategic direction quickly and at scale. Agile will be a big part of this. Telcos must exhibit the core tenets of the Agile philosophy, with success tied to business outcomes such as improved customer retention, and ensuring dispersed teams can do their best work in fast release cycles. DevSecOps, automation, niche collaboration tools, auto-scaling through AI, and dashboards will play a big role. So too will a culture of accountability and responsibility, with product team leads taking a servant leadership role.

The CSP of the future will also be one that takes the tools, practices, and principles of NetPace beyond the engineering domain. Business outcomes will only be achieved with the firm acting in a predictive and responsive manner, a live enterprise that senses business opportunity and rallies all employees and partners to deliver the right products, at the right time, quickly and at scale.

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