

Hype Cycle for Communications Service Provider Operations, 2020

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The 2020 Hype Cycle highlights market adoption and business impact of key technologies and capabilities for CSP operations. CSP product leaders should scrutinize the potential of these capabilities to enhance agility and efficiency in their operations and competitiveness of their offerings.

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Analysis

What You Need to Know

As communications service providers (CSPs) progress with digital transformation, they are facing many competitive pressures from inside and outside their industry. Unlike in past, the ongoing transformation is not merely for simplification or processes optimization or a new product launch or for better customer experience. It is all of such goals and enabling economic efficiency, new business models, diverse products and growth. These goals cannot be met without significant transformation of operations — particularly for network-based CSPs.

CSP operations and its transformation encompass scores of technologies and capabilities, many of which are continually evolving such as service operations, data monetization, technology sourcing and integration. These changes call for continued investments in technology and capabilities across infrastructure, service and commercial operations.

In this 2020 edition of Hype Cycle for Communications Service Provider Operations, we have made a number of changes and adjustment to help CSPs realign with future requirements. This Hype Cycle is for use by CSP technology and operations leaders. CSPs should also consult “Hype Cycle for the Future of CSP Wireless Networks Infrastructure, 2020” for infrastructure capabilities.

The Hype Cycle

CSPs, and in particular those with network assets, are undergoing significant changes. There are disruptive forces from new types of CSPs, as well as players from other industries. New cloud native CSPs are ambitious with their market, technology, service scope and operating model. In such a scenario, incumbent CSPs in particular need a structured approach to continue modernizing their operations. Delaying changes across commercial, service and infrastructure operations will prove to significantly limit competitiveness.

This year’s Hype Cycle has some key changes over last year (see “Hype Cycle for Communications Service Provider Operations, 2019”) to reflect the need to align investments and efforts in capabilities evolution. Key changes are:

- Inclusion of additional fundamental capabilities associated with operations of services and infrastructure, such as network disaggregation, cloud-native telco applications, open API integration, continuous intelligence, continuous delivery, DevOps and DigitalOps.
- Inclusion of certain capabilities in operations that are related to monetization. These include 5G charging, CSP data monetization, B2B2X business models and digital security.
- Enhancement or refinement of capabilities such as:

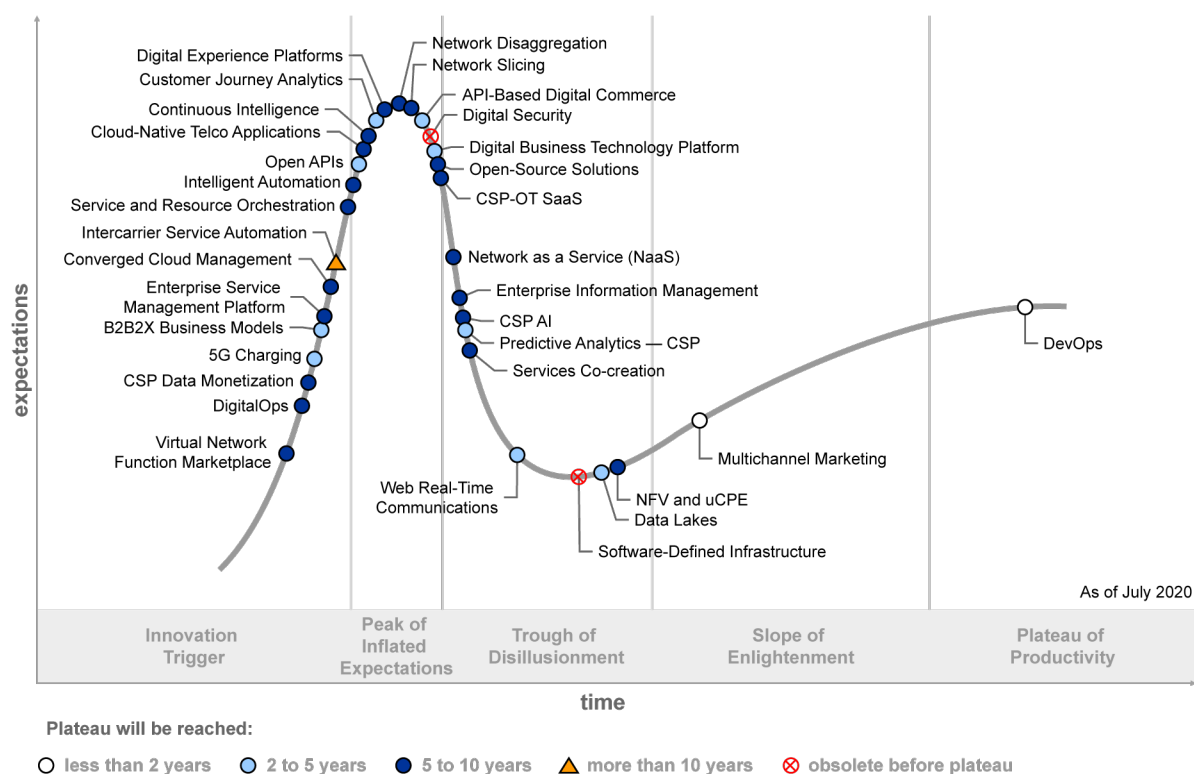
- Service life cycle management to service and resource orchestration
- Open-source adoption to open-source solutions
- Network function virtualization to NFV and uCPE

These changes contextualize the required capabilities in line with observed market trends.

Over last 12 months, there were no surprises due to unexpected technology movements. Some of the capabilities/technologies moved to the right at a faster pace than others due to their inherent high velocity. Examples include the capabilities associated with automation and intelligence.

No single technology on its own will help CSPs make the transition to being digital service providers, and they must explore technologies from outside of CSP operational technology (CSP-OT). Many technologies/capabilities on this Hype Cycle are not specific to CSPs but have different benefits and velocity as compared to other industries and are reflected here within the CSP context, bearing in mind telecom industry specific trends.

Figure 1. Hype Cycle for Communications Service Provider Operations, 2020



The Priority Matrix

The Priority Matrix indicates the need for strategic, long-term and sustained investments for capability improvement. Most capabilities will take more than two years for mainstream adoption, and in some cases, five years or more. Therefore, it is important for CSPs to carefully select

capabilities in line with their business strategy and invest early with the aim to effect operational changes.

For some of the elements shown in the Priority Matrix, technology and process capabilities will not suffice to deliver CSPs' intended outcomes. CSPs require an active strategic orientation toward culture and even structural changes. Many of these capabilities (such as network disaggregation, open-source solutions, services co-creation, converged cloud management, and B2B2X business models) will have significant impact over next three to five years, as they affect multiple dimensions of the organization.

One of the points to be noted is the need of dedicated and executive sponsorship for transformational capabilities such as intelligent automation, cloud-native telco applications, and digital business technology platform. Deploying/evolving these capabilities may require sourcing of specific skills from outside the organization. Similarly, investment prioritization in capabilities such as digital experience platforms, CSP-OT SaaS and digital security may be required to shape various transformation projects for customer experience and economic efficiency.

Figure 2. Priority Matrix for the Communications Service Provider Operations, 2020

Priority Matrix for Communications Service Provider Operations, 2020

benefit	years to mainstream adoption			
	less than two years	two to five years	five to 10 years	more than 10 years
transformational	DevOps	API-Based Digital Commerce B2B2X Business Models Digital Business Technology Platform Open APIs Web Real-Time Communications	Cloud-Native Telco Applications Continuous Intelligence Converged Cloud Management CSP AI DigitalOps Network Disaggregation Network Slicing Service and Resource Orchestration	
high		5G Charging Customer Journey Analytics Predictive Analytics — CSP	Digital Experience Platforms Enterprise Information Management Enterprise Service Management Platform Intelligent Automation Network as a Service (NaaS) Open-Source Solutions Services Co-creation	
moderate	Multichannel Marketing	Data Lakes	CSP Data Monetization CSP-OT SaaS NFV and uCPE Virtual Network Function Marketplace	Inter-carrier Service Automation
low				

As of July 2020

Source: Gartner
ID: 441609

Off the Hype Cycle

To provide readers with clearer, more focused research that supports their capability analysis and planning, we have made changes in innovation profiles to reflect strong linkage to the Hype Cycle

and its theme. In this process, many innovation profiles have been replaced with a more contextualized/nuanced one and some have been dropped.

- Managed SD-WAN, data and analytics services for enterprises, enterprise app stores, managed IoT connectivity services and multisourcing service integrator have been dropped as they relate more with CSP B2B products/offerings as compared to CSP operations.
- Recurring revenue management, dynamic discounting and integrated policy and charging control solutions have been replaced with capabilities that are better covering the market and technology trends. They are CSP data monetization and 5G charging.
- Software-defined networking, cloud center of excellence (CCOE) and cloud service brokerage have been dropped as the capabilities or technologies described in these are better covered through other innovation profiles.
- Bimodal IT operations have been dropped in line evolving operations models in CSPs. Innovation profiles such as DevOps, continuous delivery and DigitalOps cover the evolving practices in a better way.

On the Rise

Virtual Network Function Marketplace

Analysis By: Amresh Nandan

Definition: Virtual network function (VNF) marketplace refers to a platform-enabling commerce of VNFs, which allows developers/companies to offer VNFs for enterprises or SMBs to purchase/consume them. The marketplace is to request, procure, onboard, deploy VNFs, manage and provide support services in one or more commercial models. A communications service provider (CSP) VNF marketplace can enable CSPs to extend their enterprise network services to include offering VNFs, as well as service packages for multiple market segments.

Position and Adoption Speed Justification: VNF marketplace adoption is becoming one of the mainstream ways to commercialize and distribute VNFs. The idea has been implemented by certain leading CSPs like AT&T, Telstra and Verizon as well as by cloud service providers such as Amazon Web Services (AWS) and Microsoft Azure. Enterprise digital transformation and new business requirements present several opportunities for CSPs to commercialize VNFs through marketplaces. Network-based CSPs can target further revenue growth by augmenting their network as a service (NaaS) offerings with VNF marketplace. Among many opportunities in the form of IT, security, infrastructure and connectivity, is the opportunity to offer VNFs with flexible commercial and operational models. VNF marketplace enables enterprises to procure VNFs such as a router, switch and firewall to use with network function virtualization (NFV) points of presence (POPs) in a CSP's network or with universal customer premises equipment (uCPE).

Key modules of VNF marketplace platform include VNF catalog, license management, revenue management and self-service and support. Further, a VNF marketplace requires modules, tools and processes for partners to test, certify and onboard VNFs. Operationally, a comprehensive toolchain

and a uniform process of onboarding (and automating) as well as near-real-time support is essential. Commercially, the ability to offer standardized/pretested service chaining service packages priced according to the needs of various market segments, is crucial for developing a competitive offering. Some CSPs are also working on bring-your-own-VNF propositions.

User Advice: CSP's success with VNF marketplace depends on multiple factors, such as extent of ecosystem (partnerships for sourcing/developing/testing VNFs), agility and flexibility in VNF life cycle management and commercial contracts among VNF suppliers, CSPs and customers. Leading CSPs that have initiated efforts in developing a business via a VNF marketplace see the demand in a subscription model, which generates the requirement of sourcing VNFs in a pay-as-you-go model. Viability of VNF marketplace can be challenging unless the CSP targets a wide market segment, going beyond its national boundaries if the domestic market isn't large. CSPs should:

- Adopt a platform approach to enterprise services design, delivery and support — with a service factory model for operations.
- Craft a business strategy that allows leveraging the platform strategy for wider market segments, going beyond their national boundaries.
- Develop a blueprint of target services architecture and start developing/procuring specific modules as per the target architecture.

CSPs also need to pay attention to performance (connection quality and distance when the VNFs are hosted on CSP's network/uCPE suboptimized hardware or chipset for specific communication and security VNFs) and cost. Software license prices still pretty much as if they came with dedicated hardware. Cost of uCPE platforms should then be included. The approach is viable for end customers that have already decided to use three or more VNFs in the device. This limits ability to foster initial demand. For the other delivery model — network-based — there should be a dense-enough network of NFV POPs to satisfy performance requirements.

Business Impact: CSPs looking to expand their offerings for enterprises and SMBs can enhance their virtual customer premises equipment (vCPE) and WAN offerings through a VNF marketplace. Emergence of edge computing trends will further boost the demand for models like VNF marketplace, offering better exchange of values for both CSPs and customers. The platform can be integrated with a service (NaaS) management platform for easy bundling of VNFs and service packages. Such an approach can enable CSPs to target multiple market segments with VNFs sourced from multiple vendors — offering different price ranges and service packages. CSPs should develop and use a VNF marketplace platform offering for enterprises and SMBs when:

- They are open to developing a competitive positioning with VNF vendors, as this business model is disruptive for the traditional value chain.
- They have scaled their NFV implementation adequately with a robust VNF life cycle management process and tools.
- They have achieved a certain degree of automation in service design, service creation and service delivery across hybrid/virtual network.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cisco Systems; F5; Fortinet; Juniper Networks; OpenVPN; Palo Alto Networks

Recommended Reading: “2018 Strategic Roadmap for CSP NaaS and VNF Marketplace Platform Operations”

“Toolkit: 2018 Strategic Roadmap for CSP NaaS and VNF Marketplace Platform Operations”

DigitalOps

Analysis By: Derek Miers

Definition: DigitalOps enables rapid transformation and recomposition of operational models and components by directly linking them to business strategy and outcomes. It focuses on exploiting the automation aspects of BPM, including decision management and event processing, along with agile methodologies for continuous delivery of business improvement in applications to deliver a step-change improvement in business agility.

Position and Adoption Speed Justification: DigitalOps represents the “business” center of a digital business technology platform, coordinating and orchestrating systems and other resources that may sit outside the corporate firewall. Underpinning the orchestration and coordination, DigitalOps environments incorporate mechanisms for process modeling, sensing/analyzing (process mining, event detection and performance metrics) and responding (real-time operational decision models), and dynamic optimization (applying artificial intelligence and machine learning). A few vendors have some parts of the needed functionality:

- Most iPMS vendors have the core capabilities to enable DigitalOps, although they seldom have the event-driven mechanisms needed to scale.
- EBPA vendors have started to develop innovative ways of visualizing the operating model and linking that to performance reporting and continuous intelligence.
- APIs, multigrained services and RPA approaches have overcome most integration challenges.
- LCAP, process mining and machine learning algorithms have only a peripheral role today.

Like DevOps, DigitalOps is not a “system” to buy — it’s more of an approach or mindset. Most end-user organizations have yet to recognize the opportunity and benefits. For this reason, year-on-year adoption has stalled.

User Advice: EA and technology innovation leaders should:

- Sell the benefits of using business-centric models and technologies in a layered approach (business, IT, third party) to drive digital transformation in operations to their executive team. With broader understanding of these benefits, it becomes much easier to develop business product offerings that leverage automation.

- Shorten the time needed to implement and evolve business product offerings by reconsidering their organization's approach to business processes, decision models and associated tooling. Identify how these types of models can help to automate interactions at scale on the digital technology platform.
- Identify where automated decision management systems fit by exploring Decision Model and Notation (DMN) with a view toward radically simplifying processes. With all the variation captured in an executable decision model, a process that had 70 to 100 steps may reduce to less than 10 steps.
- Engage product development teams to co-create their future services together. Make reusability a priority by helping them translate customer journey maps into phased value streams, looking for shared capabilities within each phase and then developing more granular product descriptions for the common aspects of these business capabilities. Identifying the right level of granularity in these common business capabilities will enable reuse across a wide set of product scenarios.
- Integrate external processes and engines, as well as legacy data and applications where needed, by developing configurable interfaces based on multigrained services, APIs or (as a last resort) RPA tools. With careful attention to data design and configuration, the interfaces can then support multiple processes and products.
- Ensure careful governance of all the different elements (processes, decision models, common integration components, configurations) over time. They will often have different and distinct life cycles, as well as a diverse set of stakeholders.

Business Impact: DigitalOps provides the basis for an emergent approach to business operations. By applying a DigitalOps approach to better support execution within business operations, the organization can move from planning and definition of strategic goals to the clarification of that intent through to the orchestration of resources in the digital platform. Alternatively, the organization can focus on the industrialization of common components (complete with integrated engines and external services), which are then amenable to later configuration and extension to create new and innovative products for execution on the digital platform. DigitalOps:

- Enables the dynamic optimization and recombination of products and services through industrialized common process components, underpinning reuse of these elements and scaling new offerings in the market.
- Coordinates and balances customer expectations and corporate goals/objectives within each product offering, while driving the alignment of business operations.
- Ameliorates the first-mover advantages of digital disruptors by enabling a “fast-follower” business strategy, allowing both Mode 1 and Mode 2 operations to coexist and cross over.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Appian; Bizagi; IBM; Pegasystems

Recommended Reading: “DigitalOps Helps Connect Business Models to the Digital Business Platform”

“Use Co-Creation Workshop Techniques to Enable Innovation and Drive Transformation”

“How to Industrialize and Reuse Core Product Capabilities and Processes With DigitalOps Initiatives”

“Drive Knowledge Worker Productivity by Deconstructing Your Process Architecture With DigitalOps”

CSP Data Monetization

Analysis By: Amresh Nandan

Definition: CSP data monetization refers to a broad set of capabilities enabling revenue generation through products, business models, tools and techniques beyond standard connectivity products. Not limited to but it often involves big data, and capabilities range from identification of appropriate data to developing and marketing solutions of value to customers. Data monetization has been of interest to many industries including banking, finance, retail and offers even cross-industry collaboration opportunities to CSPs.

Position and Adoption Speed Justification: Data monetization in telecom industry has been of interest for several years. However, it reached its peak during 2016-17. In not-so-specialized ways, majority of telcos have found ways to monetize their data beyond standard connectivity products. And though it has been very limited for most, a small section of CSPs have been able to go beyond the specific use cases of personalized marketing and product bundling to developing a platform approach. Such CSPs have been targeting revenue from use cases such as advertisement, credit scoring and helping other industries with specific insights into population or location-specific insights and consumption patterns. Examples of such CSPs include Orange, Singtel, Telefónica and Verizon. Reliance Jio Infocomm is also moving in this direction through a number of applications’ bundling and now a partnership with Facebook. Data monetization is complex and its complexity is only increasing with further growth in CSPs’ goals and ambitions. We position this capability as sliding through the trough. With continued focus on data management and analytics, it will slide through the trough over next five years or so.

User Advice: Data monetization has been seen through a narrow lens of specific use cases associated with cross-sell and upsell to start with. Examples of such use cases include offers during roaming, content bundling based on device and data plan in use, and other OTT products. However, as CSPs go beyond specific use cases, there is a need of many capabilities associated with data handling and management, analytics, product life cycle management, near-real-time support services, automated security and assurance capabilities and partnerships with external entities. Therefore, CSPs must look at fundamental capabilities development in their operations and data management, to be able to scale monetization potential. Gartner recommends adapting data monetization initiatives to:

- Overall business strategy and market segments of interest
- Operational technology evolution and platform capabilities
- Ecosystem development
- Security, privacy and compliance requirements

This will enable two sets of initiatives — monetization of internally available data (e.g., location information) and opportunities through partners. As CSPs look at opportunities beyond their organization, security and privacy laws and compliance requirement become critical. Therefore, platform initiatives must include strong analytics and partnership capabilities besides product management, customer management and revenue management functionalities. Hence, BSS modernization (with diverse partnership models, flexibility in rating, charging and subscription management, loyalty and discounts management, and product bundling and life cycle management), along with analytics and automation tools integration, is critical.

Business Impact: Data monetization is a key revenue generation goal for CSPs. It has been a challenge for majority of CSPs owing to their legacy complexities and data governance/regulatory issues. As CSPs address their operational technology issues and adopt a structured approach beyond specific use cases, there lies potential for new business models and revenue. CSPs moving toward adjacent markets and adopting an ecosystem approach are better placed for externalizing data monetization capabilities.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Amdocs; Comarch; IBM; Oracle; Pegasystems; Salesforce; SAS; Thales (Guavus); Whale Cloud Technology

5G Charging

Analysis By: Amresh Nandan; Sylvain Fabre

Definition: 5G charging refers to implementation of 3GPP-specified new services-based charging and mediation capabilities. This includes one converged charging system (that can now cover 3G, 4G and 5G) with a new charging and billing architecture and corresponding functions and interfaces to address the new requirements associated with charging and billing, and the function's interaction with the network such as network slice charging and network-exposure-related functionalities.

Position and Adoption Speed Justification: Vendors initiated product upgrades with 3GPP releasing the first specification for 5G charging during 2018. Many vendors have already talked their readiness to help CSPs. However, 5G charging and billing (with a logical ubiquitous charging architecture, information flows and service-based interfaces) require planning on the part of CSPs. The product releases do not mean readiness with all kinds of scenarios however, as business requirements aren't fully clear for varied ambitions that CSPs have.

CSPs have been making 5G-related investments during 2019. Most of it has been on the infrastructure side. However, some leading CSPs have started planning or upgrading their BSS with 5G-related capabilities including charging. Early focus includes data connectivity charging, network slice charging and network-exposure-related functionalities.

User Advice: CSPs implementation of 5G charging and billing capabilities depend on a number of factors including:

- Readiness with 5G business plans and use cases prioritization — including various criteria for charging based on targeted business models
- Logical and technical architecture of their future BSS
- Capabilities associated with new products, partners management and settlement
- Strong data management capabilities with high elasticity and resilience

CSPs must avoid merely implementing 5G charging capabilities in their BSS if their readiness with other capabilities (as listed above) is low, unless they have created a specific layer for core capabilities in a cloud-native BSS architecture (see “Market Trends: Telecom BSS as a Set of Federated Capabilities”). Analytics and decision intelligence are critical supporting capabilities for enabling new business models and for generating value for various stakeholders in the ecosystem. As CSPs plan for implementing 5G charging, they must look at the broader analytics capabilities and upgrade it.

Business Impact: 5G charging implementation promises evolving a number of business model capabilities that CSPs are aspiring for, and commercializing value delivery to wide segments of enterprises, SMBs and consumers. However, payoffs depend on a number of factors (such as BSS and OSS architecture, creativity in partnerships and ecosystem management and business models). Therefore, 5G charging should be viewed as a base capability to enable other capabilities that CSPs are looking to add. 5G charging also allows billing for new enterprise services; for example, a hyperscaler could use open APIs to onboard and charge vertical users for access to services running on the CSP’s MEC (multiaccess edge computing). Another example is how from R16, 5G slices will contract defined QoS levels for vertical use cases, and 5G charging can adequately bill enterprises — or provide refunds where SLAs are not met.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Amdocs; CSG; Ericsson; Huawei; Netcracker; Oracle

Recommended Reading: “Market Trends: Fundamental Changes Awaits Telecom BSS Market”

“Market Trends: Telecom BSS as a Set of Federated Capabilities”

B2B2X Business Models

Analysis By: Jouni Forsman; Amresh Nandan

Definition: B2B2X business model combines communication service provider's and other provider-owned services and capabilities. It aims to deliver new or vastly improved and differentiated services to end users. Focus is typically on digital-technology-enabled dramatic experience improvement or a completely new experience that is only made possible by a combination of network (and device), IT, a user application and a specific context such as a car, a stadium, a sporting event, a game or an iconic product for example.

Position and Adoption Speed Justification: The communications industry has dreamt about B2B2X-based growth for many years. Previous attempts have for example included direct investments in intelligent cameras and AR/VR devices, ideating with third parties particularly in the field of sports as well as countless POCs particularly around IoT use cases. None of the approaches so far have worked to deliver repeatable profitable growth. Technology is less and less the impediment. Cloud, network virtualization, increasingly software-defined and controlled devices, portals, service assurance, orchestration and business support systems all have improved a lot. The problem is more about culture inside and across organizations including topics such as trust, defining roles including customer ownership, new ways of working together, measuring and recognizing value cross the business partners needed as well as making the required investments. Concrete efforts to realize B2B2X business models are starting now. 5G, private networks and edge computing proliferation are expected to create further interest in B2B2X models. Specifically considering multiple connectivity and IoT requirements of transportation/mobility industries, healthcare, energy and utilities industries; some CSPs have started targeting partnerships for such business models. Data monetization and multiservice aggregation in consumer space also offer opportunities for B2B2X models, where some CSPs have partnered with OTT solutions/service providers.

User Advice: Technology is fun but B2B2X has to be defined by the end-user benefit. Pick one starting area where you have existing assets that can differentiate. Build a clear facts-based and value-driven project that identifies value add for each value chain participant. Be transparent with all ecosystem participants and allow each entity to generate value instead of controlling the ecosystem. B2B2X business models require work on multiple areas:

- **Business strategy:** A clear understanding, intent and specific goals to pursue B2B2X business models.
- **Organization culture:** Intent and ability to partner with a varied set of companies such as technology providers, industry vertical companies, new/niche players, SMBs and different types of services partners.
- **Technology/systems readiness:** Ability to manage digital ecosystems through adequate platforms enabling resource utilization and value creation by partners.
- **Skills/talent:** Sales, partnership and technology skills to fulfill the above mentioned capabilities.

Business Impact: B2B2X business models will have a transformational impact on the communication service provider business if they take off. This is because they will unlock the

multiplier effect of ecosystem based growth. Communication service providers can benefit from their partners work not only of their own. B2B2X model only works when it is based on transparency and ensuing trust. This means faster decisions and less overhead and cost.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Cisco; Deutsche Telekom; Nokia; NTT; Orange

Enterprise Service Management Platform

Analysis By: Amresh Nandan

Definition: Enterprise service management platform refers to a set of integrated systems and capabilities, which are independent of underlying network and products and enable B2B customer journey, service design, service creation, provisioning, activation and assurance. The platform is extendible in both directions — supply (for partners to add to the CSP products) and customers (for empowering them with self-service capabilities).

Position and Adoption Speed Justification: Enterprise digital transformation and new business requirements present several opportunities for network-based communications service providers (CSPs) to target revenue growth. These opportunities in the form of IT, security cloud, infrastructure and connectivity, Internet of Things (IoT)-related services and managed services for various requirements are significantly diverse in comparison to traditional connectivity services. In addition, vertical-industry-specific requirements (such as for utilities, automotive, manufacturing and government) present further opportunities to be addressed. This is one of the key focus areas for CSPs and many CSPs are already investing in developing various capabilities for managing enterprise services through a platform approach.

Platform approach demands independent service management capabilities with features and functionalities to:

- Uniformly design and create various types of services.
- Provision and activate services in an automated manner.
- Assure services proactively through service impact analysis (by using techniques like advanced analytics)
- Enable exposure of APIs for partners to leverage underlying platform capabilities (including network/resource exposure) as well as to add to CSP offerings.
- Develop a well-crafted self-service and management portal for customers, partners and CSPs to manage customer journey and service life cycle.

A service management platform may need to be supplemented with professional services, depending on the products/services being offered. Complexities of legacy platform, operational practices and data management issues mean enterprise service management is still at an early stage with CSPs — yet to develop a full-fledged platform. However, with network function virtualization (NFV) or software-defined network (SDN) adoption for enterprise business segment and network as a service (NaaS) offerings evolution, CSPs are evolving their platform strategy for service management. We see the area still in adolescence stage, with about 6% to 8% of network-based CSPs using such approach and some more working toward it.

User Advice: Enterprise service management platforms will dramatically enhance a CSP's ability in multiple ways — which is important for differentiation among peer companies and competitiveness with cloud-based CSPs. This goes beyond product-specific service-oriented architecture (SOA) implementations, parlay gateway and operations support system through Java (OSS/J) implementations of the past. CSPs should develop and use a service management platform for enterprises, when:

- Targeted products and services go beyond traditional connectivity
- Service use cases necessitate simplification of processes and systems
- Utilization of partner ecosystem is vital for competitive offerings, such as IoT services

Success with platform opportunities is dependent on multiple factors such as infrastructure exposure, ability to link network and applications performance, processes for service fulfillment and assurance, and exposure of platform capabilities. However, the most critical success factors lie in:

- The ability to decouple service management with underlying infrastructure and products.
- The flexibility of configuring various business models.

Key recommendations for CSPs targeting to develop and use a platform approach to service management are:

- Develop capabilities to transition from product-specific systems and processes to a platform leading to operational efficiency
- Adopt uniformity in product design, service fulfillment and service assurance — affording scalability and efficiency in operations
- Enhance flexibility and efficiency in leveraging partners and their capabilities in augmenting CSPs' products and services through standardized/open APIs

Business Impact: Flexibility in commercial models (with pay-as-you-go services, usage of network equipment and ability to modify subscription) and operational models (through a customer's ability to make changes in products and services) necessitates the need for a service management platform. Among customers, traditional service development, fulfillment and assurance strategies are proving to be less than optimal (in both cost proposition and operational efficiency). Use of a service management platform has impact on multiple aspects of CSPs' operations including commercial models, partner engagement and service management processes. Advantages include:

- Better coverage of multiple market segments — such as large multinational corporation (MNC) enterprises, national companies, medium and small businesses.
- Flexibility in configuring products and service offerings based on multiple commercial propositions — operational efficiency through a service factory approach.
- Decoupling from underlying network, which provides the capability to develop different types of products and services — enabling scalability and business model change.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Amdocs; Ciena; Cisco Systems; Ericsson; Hewlett Packard Enterprise (HPE); Huawei; Juniper Networks; Nokia

Recommended Reading: “Toolkit: CSP B2B Customer Journey and Process Map Development”

Converged Cloud Management

Analysis By: To Chee Eng; Gaspar Valdivia

Definition: Converged cloud management integrates the automated provisioning, orchestration, and management of separate cloud infrastructure supporting network functions and IT applications. This enables communications service providers (CSPs) to simplify infrastructure management, optimize resource utilization, and accelerate service delivery. CSPs can gain efficiency and scale running network functions and IT applications over an integrated cloud infrastructure.

Position and Adoption Speed Justification: Major CSPs are implementing converged cloud management for their disparate telecom cloud and IT cloud platforms, with the goal of creating a unified cloud infrastructure. This will give them operational efficiency, scale of operations, as well as technical and business agility, crucial for future competitiveness. The first step is to consolidate their network function virtualization (NFV) implementations, currently running on their telco cloud, with their operations support system (OSS)/business support system (BSS), typically running on their general-purpose IT cloud. The intent is to expand the cloud infrastructure progressively to support other network and IT workloads, including mobile and IoT workloads.

It is important to note that converged cloud does not mean consolidated physical infrastructure. Physical infrastructure is likely to be based on a distributed architecture, including the centralized data centers, network edge cloud nodes and public cloud services. But the infrastructure will be managed in a uniform and centralized manner. A few vendors such as VMware, Ericsson and Huawei have started offering converged cloud management applications to CSPs. Adoption is starting to pass the emerging phase into the evaluation phase.

Early NFV implementations did not deliver the cost-efficiency expected because large virtual network function (VNF) vendors resisted CSPs’ requests to remove linkages to their proprietary

hardware. While they were supposed to decouple their hardware and software, there still built in some dependencies, and true portability could not be achieved. CSPs are now putting emphasis on open standards to enable multivendor interoperability and reduce their dependence on a few key vendors. They also want to embed their own intellectual property into the platform for competitive advantage.

For most CSPs, implementing converged cloud management is a big challenge. They lack sufficient software and integration skills to build such platforms. A few are outsourcing the development to large system integrators (SIs), which also lack experience, besides being costly. As such, many CSPs are observing the developments, and waiting for an opportune time to proceed. This will depend on when SIs can develop the expertise, and at an acceptable cost. SIs are beginning to build these capabilities, but it will take at least another two to three years before they have acquired sufficient experience.

User Advice: Converged cloud management is strategic for operational efficiency, service agility, and cost containment. While this approach is relatively new, CSPs must learn from successful implementations, develop an approach and roadmap, and identify technology partners to help them reach their goal. CSPs should:

- Develop an early reference architecture for a converged cloud, with considerations for different requirements for NFV and IT workloads, and different maturity levels of network and IT cloud platforms.
- Decouple the hardware and software as a standard approach to provide the flexibility of running a wide choice of VNFs and IT applications on general-purpose cloud platforms.
- Support open standards and open source where possible to provide multi-vendor interoperability and stimulate competition from supporting vendors.
- Harmonize and consolidate the separate network and IT cloud platforms progressively for ease of operations, efficiency and scalability.
- Ensure vendors' technology compliance with reference architecture to accelerate future architectural integration, and interoperability across legacy, physical and virtual infrastructure.

Business Impact: Most CSPs run their network and IT on separate systems or platforms, inflating their costs and adding complexity to their operations. With converged cloud management, CSPs can run an entire gamut of network services, network and communications apps, and IT apps across a unified cloud infrastructure. This will simplify infrastructure management, optimize utilization, as well as improve the agility of delivering current and future services.

The lower costs of ownership, operational efficiency, and flexibility are critical for CSPs' future competitiveness. The implementation requires a comprehensive and holistic approach toward operating network and IT, both converging on a common software-defined infrastructure. It applies across many CSP network and IT domains, including disaggregation of transport network, WAN edge virtualization, software-defined network, virtualized radio access network (vRAN), and 5G network slicing.

Other business benefits include:

- Ease of procurement and deployment of standardized hardware.
- Energy and space savings from a converged cloud platform.
- Improved economies of scale scalability through infrastructure sharing between network and IT.
- Ease of onboarding of new technology and vendors.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cisco; Ericsson; Huawei; Juniper Networks; Nokia; Red Hat; VMware

Recommended Reading: “Magic Quadrant for Cloud Management Platforms”

Intercarrier Service Automation

Analysis By: Amresh Nandan

Definition: Intercarrier service automation refers to infrastructure and service orchestration capabilities that are automated for life cycle management and operations across multiple service providers. These capabilities allow CSPs to build and offer advanced services, such as bandwidth on demand, IoT connectivity and cloud connect services across multiple partner networks.

Position and Adoption Speed Justification: Orchestration and automation of intercarrier services as a concept has been evolving through multiple CSPs’ partnerships as well as standardization efforts by telecom industry bodies such as TM Forum and MEF. With 5G deployment and advanced enterprise services in view, CSPs and technology vendors have been developing this capability in their solutions. Many POCs or trials have also been conducted by leading CSPs like AT&T, BCE, Colt Technology Services, NTT DATA, Orange Business Services and Vodafone. Hence, the prepeak positioning. However, the adoption of such features has been slow and it will take many years to witness significant commercial deployments. Several technology and business operational challenges need to be addressed before CSPs could deploy intercarrier automation at scale. Adoption of vendor-agnostic and standardized APIs will be significant for the success of intercarrier service automation.

User Advice: Intercarrier service automation capability will provide a major boost for CSPs because they will be able to build and operate network services across multiple partner networks in real time. As a first step, CSPs should focus on automating their service orchestration and network service operations within their footprint by deploying orchestration and automation systems. This automation drive needs to mature across multiple service providers in various geographical markets for intercarrier service automation to become mainstream.

CSP suppliers should focus on developing automation and orchestration solutions capable of supporting intercarrier service automation. They should also focus on integrating and/or

interoperating operating support systems (OSSs) and business support systems (BSSs) across multiple service providers to fully support the intercarrier service automation technology and business process requirements. Recent focus on API-based integration, end-to-end service orchestration and intent-based networks are steps in the right direction. CSPs should also explore blockchain technology for settlement across carriers.

CSPs and suppliers should start developing and trialing solutions based on initiatives led by TMF and MEF to further drive the capability toward becoming a reality. In addition, CSP suppliers should support other open interfaces that are required for real-time, closed-loop monitoring and service assurance across multiple service providers.

Business Impact: Intercarrier service automation will allow CSPs to build and offer advanced services such as bandwidth on-demand, IoT connectivity and other network services across multiple partner networks. Several managed network and security services can also be offered using this capability. This will be a major boost for CSP network service business. This capability will make life easy for enterprise customers availing such services because they won't have to deal with multiple service providers and can integrate various services on their own. They can also get services from a single CSP and thereby more agility and flexibility even with international network/connectivity services when connectivity requirements span multiple local connectivity partners.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amartus; Amdocs; AT&T; Ciena; Colt Technology Services; Fujitsu; Huawei; Orange Business Services; Verizon

Service and Resource Orchestration

Analysis By: To Chee Eng

Definition: Service and Resource Orchestration refers to the core functions in CSPs' operational support system (OSS). Service orchestration includes service catalog, configuration, service policy management, service provisioning and service assurance. Resources orchestration includes resource catalog and inventory, resource planning and design, resource policy management, resource fulfillment, and assurance. The emphasis is on automated operations for end-to-end service orchestration, using a platform-based approach.

Position and Adoption Speed Justification: OSS for CSPs has been dominated by traditional OSS vendors for a long time and it is extremely difficult to replace an existing OSS without causing disruption. For this reason and because CSPs are generally risk-averse, OSS solutions lagged in innovation and automation. Consequently, CSPs are facing challenges from over-the-top (OTT) providers offering a diverse range of new services and applications in an agile and fast to market way. To change the status quo, major CSPs have been taking steps to redesign and rebuild their infrastructure and operations by decoupling hardware and software layers, adopting virtualization,

and implementing automation. They are also placing emphasis on introducing open source into their environment to future-proof their flexibility, besides cutting their reliance on slow-moving vendors.

With the introduction of network functions virtualization (NFV) and software-defined networking (SDN), CSPs are also taking a new approach to service and resource orchestration to serve the needs of today's more dynamic and complex service provider environments. They are incorporating the Management and Orchestration (MANO) framework for coordinating network resources for cloud-based applications and the life cycle management of virtual network functions (VNFs), and integrating that as part of their bigger OSS implementation.

The results have been encouraging, especially for network function virtualization (NFV) services automation, with ability to service-chain multiple services, with minimal manual intervention. This improves the CSPs' efficiency, time to market, and cost base dramatically. For the CSPs, the end goal is to provide end-to-end service orchestration across different network services and systems, including for 5G and network slicing. Implementation has been difficult. While OSS vendors are taking steps to adapt their products for CSPs' requirements, progress had been slow and products incomplete. Also, most OSS vendors provide solutions for a discrete product or service, and lack broad understanding of CSPs' extensive product portfolio and complex environment, which do not position them well to lead CSPs' transformation.

The major CSPs are taking ownership of their own transformation, investing heavily in in-house R&D capabilities skills to rearchitect their environment and lead the implementation. A crucial part of their strategy is to align their future architecture with open standards and open source where possible, and using their market power to force vendors to comply with their requirements and specifications. Most CSPs worldwide lack the business size and enough technical skills to execute their own transformation. But their desire to emulate the major carriers have increased significantly in the past year, which will kick start the process for this overdue transformation, which when complete will transform the CSPs' capabilities to serve their customers dramatically.

User Advice: We recommend:

- Take control of the technology change and future architecture by developing the necessary in-house capabilities to define a best-of-breed platform, emphasizing open source for a multi-vendor environment.
- Build flexibility into your architecture so that it can evolve to support automated operations, 5G, and business model changes; develop a change management plan for operations to guide OSS transformation.
- Source OSS as "components," rather than a single vendor solution, giving preference to vendors that best align with your strategy through flexibility in engagement, solutions and multi-vendor support.

Business Impact: OSS transformation is crucial for CSPs to evolve their future operations to highly efficient and flexible model, key attributes needed to be agile and to keep operation costs low. Failure to modernize would mean that CSPs will remain an inflexible and high-cost connectivity provider, undermining their future viability. Successful implementations by major CSPs are providing

valuable lessons for other CSPs. Gartner expects more CSPs will rearchitect their OSS, change their procurement approach from relying on a single vendor solution to buying OSS functions as modules of a bigger integrated architecture, relying on open standards and open source for multi-vendor interoperability. Most OSS vendors recognize the trend and are overhauling their products to avoid being marginalized by more aggressive players. Some vendors are also putting their OSS on public clouds, offering it as a service, which will enable CSPs to align their costs and utilization better. When the vendors' products become more mature in the next two to three years, CSPs will be able to modernize their OSS in greater numbers, reaching mainstream adoption in five years. Vendors will also need to move beyond products to professional services, with ability to integrate third-party products for a best-of-breed solution, to lead the market.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Alibaba Group (Whale Cloud Technology); Amdocs; Ciena; Comarch; Ericsson; Hewlett Packard Enterprise; Huawei; IBM; Netcracker; Nokia

Recommended Reading: “Market Guide for CSP Operations Support System Solutions”

“Market Insight: How Do CSPs View OSS Products?”

“Is Your OSS Product Strategy Ready for CSPs' Future Operations?”

“Restructure Services Capabilities for a Strategic Role in CSP Operations Transformation”

“Prioritize OSS Product Capabilities for CSP Operations Transformation”

“OSS Solution Sourcing Criteria Changes for CSP Operations Transformation”

“Leverage ONAP to Expand Your Telecom Industry Footprint”

At the Peak

Intelligent Automation

Analysis By: Peter Liu

Definition: Intelligent automation is a broad category that describes any automation in a communications service provider (CSP) that goes beyond the simple execution of a set script to fulfill a simple task. The “intelligence” uses rule-based or AI to decide on the correct course of action and orchestrate these actions in one or more processes. Ultimately, intelligent automation needs to work across organizational silos for complex processes, thereby requiring significant change management process and people change — not just technology.

Position and Adoption Speed Justification: Automation is not new for CSPs. However, current self-organizing network (SON) or robotic process automation (RPA) for example, are mainly automations that do not include much “intelligence.” These automations are running predefined scripts that must be maintained and updated. In intelligent automation, the machine learning (ML) algorithm would identify this pattern independently and look for a resolution. Should it not find a solution, it requests the creation of a new script or designs a script of its own. Besides technological barriers that are worked on, broader CSP intelligent automation’s main issues are primarily cultural and organizational. A change management program is needed to ensure buy-in and to enable each part of the organization to understand and illustrate good quality processes that can then possibly be automated in an intelligent way. However, not everything should be automated, and with automation the risk profile of operations changes. These aspects require new skills, training, ways of working — even recognizing and rewarding value and performance. During the past year, leveraging the 5G deployment, we see more and more vendors starting to embed “automation intelligent” capability into their radio, network operation and management, BSS as well as CRM solution to address the complexity challenge. Therefore, we shift its Hype Cycle entry to pre-peak stage and forecast a two to five years’ time frame for a mass adoption.

User Advice: Support the development of a transformational mindset with respect to RPA and AI across the company. Make sure that the automation project has the requisite, enterprisewide support from the people who work for your company.

Identify and select the right business process for automation. Most of the unsuccessful intelligent automation projects are attributed to a poor choice of the initial business process automation.

When making a business case for early intelligent automation activities, first examine the IT roadmap to see what major new systems are coming into the business. Vendors can create a roadmap for including increasing amounts of intelligent automation into their product — or consider how internal capabilities can be developed that can create this automation.

Business Impact: Operational activities such as order fulfillment and trouble ticketing have early day opportunities. After this, areas that benefit from the improved ability to detect patterns and anomalies, that will also enact on the findings quickly, are potentially good candidates for intelligent automation. Examples of potentially good candidates include those in security, fraud management and campaign management. Customer-focused staff will also benefit from the automation of the systems that they use — which will reveal information as needed, troubleshoot proactively and generally reduce the time spent on data entry or opening/shutting screens.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Amdocs; Cisco; Ericsson; Huawei; IBM; Infosys; Nokia; Prodapt; SmartAction; Wipro

Recommended Reading: “Top 10 Trends for the Communications Service Provider Industry in 2020”

“Magic Quadrant for IT Services for Communications Service Providers, Worldwide”

“Market Insight: Unleash the Potential of AI in Telecom 5G Era”

“CSP CIOs Enable Business Outcomes Through AI Augmented Talent and Decision Making”

Open APIs

Analysis By: Amresh Nandan

Definition: Open APIs refer to application programming interfaces (APIs) that are publicly available, and developers can use them for programmatic access to a proprietary software. Such APIs are often developed by a commercial entity, industry body or industry standardization/specification organizations for the purpose of ease of integration, interoperability and utilization of data and functionalities by the wider community. Web companies took the lead in such APIs with YouTube APIs, Google Maps APIs, Yahoo’s open search API and others.

Position and Adoption Speed Justification: While web-based platform APIs have been used by the developer community for long, creation and adoption of open APIs by businesses is still emerging. Examples of such APIs are seen in networked industries such as telecom where integration requirements among several solutions have forced detailed specification and standardization by industry bodies such as 3GPP, ETSI and even TM Forum and MEF. Open APIs adoption in telecom industry is on the rise among several leading and Tier 1 telcos and many vendors.

One of the key reasons for end-user adoption of open APIs is the desire to achieve greater freedom in sourcing and integrating technologies. In addition, such APIs by industry bodies are often specified/developed in a collaborative manner leading to early identification of nuanced requirements and integration challenges.

User Advice: End-user companies wishing to develop platforms, control technology change, gain greater freedom in sourcing and integration should consider using open APIs. They should also encourage their technology vendors to adopt open APIs. However, effectiveness of such APIs comes through active participation in the collaborative development process. Therefore, it is advisable that end users dedicate some resources for participation in API development initiatives, trials and pilot programs. Examples of such initiatives include TM Forum’s Open APIs Catalyst programs (associated with telecom BSS, OSS and related areas), where many CSPs and vendors participate to address specific challenges/problems. This allows faster and collaborative development and integration while maintaining a degree of independence in technology change.

Business Impact: Theoretically, there is strong value in adopting open APIs. However, its success depends on level of adoption. As mentioned earlier, TM Forum reports greater adoption of their Open APIs by CSPs as compared to vendors and highlights it as an opportunity for vendors. With increase in adoption levels, the business impact is far-reaching. However, it requires active push by end users instead of waiting for vendors to adopt such APIs.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Cloud-Native Telco Applications

Analysis By: Amresh Nandan

Definition: Cloud-native telco applications refer to application of cloud-native and microservices architecture to CSP operational technology applications at various levels such as virtual network functions, network management applications, operational and business support systems. These applications could be running in private or public cloud or in some cases both (hybrid cloud infrastructure).

Position and Adoption Speed Justification: Even though discussed for many years now, cloud-native is a relatively new in adoption in the telecom domain. Adoption of cloud-native architecture and principles also vary across different layers of CSP architecture. It can be seen more in BSS as compared to network functions. Across industry, it is still in early stage and on the rise in terms of interest and adoption. Inadequate benefits from earlier adoption of NFV and complexities of BSS and OSS have motivated many CSPs to adopt cloud-native approach in their operational technology. While cloud-native approach offers a number of benefits such as flexibility, agility, scalability and improved products and feature velocity; it demands new skills and new way of working. That's why cloud-native adoption will take time.

User Advice: CSPs are advised to adopt cloud-native architecture and principles in phases — so that operational readiness in terms of DevOps, CI/CD, container orchestration and automation tool chain can be assured. BSS, OSS and NFV MANO applications are good candidates for cloud-native adoption before cloud-native VNFs are implemented. Network functions differ from IT applications as they process control plane and data plane in addition to other functional requirements, with often specific performance, capacity and latency requirements. These must be understood in detail. In addition, cloud-native application management is best in an open environment — with open APIs and open tool chain. CSPs moving to cloud-native approach also need a roadmap of balancing monolithic applications and decomposed microservices-based functionalities. Such decisions require careful selection and prioritization of operational technology functions. CSPs must work with suppliers in this change process to balance the complexity and benefits of moving to cloud-native approach.

It should be noted that cloud-native mean fundamental changes and impacts both — architecture as well as operating model. Therefore relevant tools, skills, adequate structure and new processes are prerequisite to gaining efficiency. As CSPs implement cloud-native across various layers of their technology stack, they should align it to their automation goals — zero touch provisioning, service creation and closed loop service management.

Business Impact: Cloud-native approach promises a transformational impact on operations and business — helping CSPs invest and scale as per market demand instead of preprovisioning of

capacity and capabilities. It can allow emulating web-scale operations as well as provide flexibility in sourcing and technology change management. A cloud-native approach can also address some of the legacy issues associated with infrastructure — network planning, design and deployment; by allowing platform as a service. Eventually CSPs can look at network infrastructure such as 5G core as a service from vendors. In operations, it can help develop a layered architecture separating core functionalities of BSS and OSS with capabilities needed for product changes and customer experience/journey management.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cisco; Ericsson; Huawei; Mavenir; Microsoft; Nokia; ZTE

Continuous Intelligence

Analysis By: Pieter den Hamer; W. Roy Schulte

Definition: Continuous intelligence is a design pattern in which real-time analytics are integrated into business operations, processing current and context data to prescribe actions in response to business moments and other events. It provides decision automation or decision support. Continuous intelligence leverages multiple technologies such as augmented analytics, event stream processing, optimization, business rule management and machine learning.

Position and Adoption Speed Justification: The current hype is focused on holistic, integrated continuous intelligence solutions that share real-time information from multiple sources with multiple departments and applications to support multiple business functions. Examples include real-time 360-degree views of customers, supply chain networks and enterprise nervous systems in airlines, railroads and other transportation operations. Simpler kinds of continuous intelligence are already common in point systems such as mobile device navigation, monitoring the health of machines, contact center monitoring, pop-up web ads, high frequency trading and package tracking. The hardware and software technologies for holistic, integrated continuous intelligence, including inexpensive sensors, publish-and-subscribe messaging systems such as Apache Kafka, event stream processing platforms and augmented analytics, are available and affordable. However, many companies lack the skills necessary to develop their own custom-built solutions so holistic continuous intelligence will take five to 10 years to achieve 50% penetration of the target audience.

User Advice: Data and analytics leaders should consider continuous intelligence for new business processes and when making significant changes to existing processes. It applies to situations in which real-time data from the last few seconds or minutes significantly improves business decisions. It is not relevant where equally good decisions can be made with data that is hours, days, weeks or older. It goes beyond real-time descriptive, diagnostic and predictive analytics by supplying prescriptive information about the best available action to be taken in response to the situation. The potential role of continuous intelligence should be discussed with business managers and subject matter experts early in the requirements-gathering process. If continuous intelligence is

implemented, it will fundamentally affect the design of business processes and their data and analytics. Companies can reduce the effort of achieving holistic continuous intelligence by subscribing to SaaS offerings, or acquiring packaged applications or devices that provide internal continuous intelligence on a point basis. However, holistic continuous intelligence will still entail custom design and integration with multiple applications, including independently owned and operated systems. This will require multidisciplinary collaboration among business domain experts, change managers, architects and developers. It may leverage messaging systems, event stream processing platforms, decision management tools, intelligent business process management suites (iBPMS), IoT platforms or other development, middleware and analytics products.

Business Impact: Continuous intelligence plays a major role in digital business transformation and optimization projects. A key benefit is improved situation awareness and a common operating picture across business functions by providing real-time dashboards, alerts and best-next-action recommendations. Equally important is the capability to trigger automated responses by sending signals to machines or initiating business processes in cases where the decision on what to do can be automated. Systems with continuous intelligence leverage real-time context data to support decisions for customer interaction, manufacturing, fraud detection, supply chain management, or other areas. For example, to allocate resources in the most efficient manner possible. However, enterprises that want to build their own solutions and that do not already have staff expertise in messaging, stream analytics, machine learning and decision management disciplines may need to hire outside service providers or train their staff on the new disciplines.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Confluent; FICO; RedPoint Global; SAS; Software AG; TIBCO Software; Unscrambl; Vitria; XMPPro; ZineOne

Recommended Reading: “Innovation Insight for Continuous Intelligence in Supply Chain”

“Market Guide for Event Stream Processing”

“When to Automate or Augment Decision Making”

“How to Use Machine Learning, Business Rules and Optimization in Decision Management”

Customer Journey Analytics

Analysis By: Jason Daigler; Lizzy Foo Kune

Definition: Customer journey analytics (CJA) is the process to track and analyze the way customers and prospects use a combination of available channels to interact with an organization over time. It covers all channels the customer has used, including those with human interaction (such as a call center), those that are fully automated (a website), those that provide assisted help to the customer

(live chat and co-browsing), those that are operated in physical locations (a retail store) and those with a limited two-way interaction (advertising).

Position and Adoption Speed Justification: Customer journey analytics is a strategic priority for a variety of internal roles in several different industries, as application leaders and marketing leaders strive to gain a better understanding of customer acquisition, retention, satisfaction, advocacy and loyalty. In many cases, CJA initiatives begin as projects to create customer journey maps, which are snapshots of customer experiences for a given process. Often, organizations begin by manually mapping their perception of the customer journey without using data and analytics to track and measure journeys. For journey maps to become both more accurate and dynamic, organizations will ultimately need to power the journey maps with actual data. Without a clear strategy for capturing and linking the right data in each channel, organizations will lack a true understanding of the customer journey, beyond interactions wherein the customer is forced to reveal their identity.

CJA is accelerating in adoption as more applications begin to add elements of journey analysis into existing tools, such as customer data platforms, personalization engines, customer analytics applications, and multichannel marketing hubs.

User Advice: Customers hop from channel to channel over time, and as such organizations should not assume that continual investment in understanding customer behavior within a single channel will deliver more valuable insights than understanding the combination of channels they use. Similarly, organizations should be wary of key performance indicators (KPIs) that fail to consider the implications of customer activities in other channels, such as single-channel conversion rates. Starting with customer identification and journey mapping across only two to three channels, where data is both available and valuable, is an excellent way to start with CJA. The selected journey should also be one that is valuable to both the organization and the customer. Similarly, starting by manually mapping the internal perception of customer journeys is a reasonable starting point, as long as organizations intend to eventually validate the mapped journey with data and analytics. Organizations should also consider how they can orchestrate and automate journeys based on the insight gained from CJA; this will necessitate integrating CJA solutions, and specifically their outputs, into other internal systems.

As stated above, journey analysis functionality is becoming more frequently embedded into other systems, so organizations should evaluate their existing technology stack to see if they're already paying for an application with journey analysis capabilities.

Business Impact: Organizations can obtain the following benefits from CJA:

- Higher customer satisfaction from more seamless and personalized interactions across channels.
- Better understanding of the benefits that each interaction delivers to the overall journey, resulting in better allocation of investment to supporting the overall relationship.
- Improved understanding of the interrelationships between different parts of the journey, allowing organizations to, for example, evaluate the expectations that are set in the beginning of a journey with the outcomes toward the end of a journey.

- The ability to diagnose pain points in the customer journey across channels to aid business prioritization of CX projects.
- More accurate customer segments, based on data from multiple channels as well as real-time data and predictive modeling, thereby increasing the effectiveness of marketing campaigns.
- More successful personalization tactics — whether on commerce sites, communication channels or elsewhere in the customer experience — based on data that gives a more complete view of the customer’s activity in multiple channels instead of a single channel.
- More relevant and efficient customer service for customer-facing agents who have a more complete view of the customer’s activities and difficulties, based on data from multiple channels.
- More effective marketing, allowing media channels to be an extension of customer communications.
- Improved customer experience and reduced customer churn through real-time next best actions orchestrated by insight gleaned from customer activity.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Adobe; BryterCX; Cerebri AI; Kitewheel; Salesforce; Splunk; Teradata; Thunderhead; Usermind; [24]7.ai

Recommended Reading: “How to Run a Do-It-Yourself Customer Journey Mapping Workshop”

“Market Guide for Customer Journey Analytics”

“Technology Insight for Marketing Analytics”

Digital Experience Platforms

Analysis By: Irina Guseva; Gene Phifer

Definition: A digital experience platform (DXP) is an integrated and cohesive piece of technology designed to enable the composition, management, delivery and optimization of contextualized digital experiences across multiexperience customer journeys.

Position and Adoption Speed Justification: DXPs emerged because traditional approaches to creating, managing and delivering digital experiences across multiple channels were failing to meet escalating business and IT needs. The former WCM and portal vendors began delivering more comprehensive platforms for creating and managing digital experiences across multiple touchpoints of the customer journey. DXPs are now resonating with the buyers, and interest and awareness are

still increasing, as they're inching toward becoming a mainstream technology. As organizations embark on digital transformation programs, the interest for innovative DXPs will increase.

The most common deployment approach is to obtain the core platform from a single vendor, and then supplement it with best-of-breed technologies where functional gaps exist for addressing B2C, B2B and B2E use cases. An API-first approach, integration and interoperability are, therefore, key attributes. A DXP must be pluggable and extensible, and should easily integrate with adjacent technologies, such as digital commerce and CRM.

User Advice: Take the following steps:

- Identify the business outcomes you must achieve on the road to digital business success.
- Define the role of digital experience manager.
- Decide the capabilities and characteristics of your ideal DX platform.
- Make an inventory of the tools currently used for presentation management and presentation layer composition across all supported devices, channels and modalities.
- Identify overlaps and duplicate capabilities, as well as gaps.
- Pinpoint synergies where common vendors are identified.
- Demand that your vendors present their product roadmaps.
- Identify where and how integrations will occur.
- Explore the many vendor options available on the market, then draw up a roadmap to adopt a DXP during the next 12 to 36 months.

If you have already bought or built most of the components of a DXP, and are happy with them, fill in any gaps and pursue a do-it-yourself approach. If you are lacking major components, consider a DXP product as a source for the missing components. If you don't have much of a platform, or don't like most of the components you are using, consider buying a full product from a specialist vendor. For an agile, flexible DXP, look for extensive use of API models, cloud-native and incorporation of microservices architectures.

Business Impact: A poor digital experience results in a poor customer experience. DXPs help enterprises deliver compelling digital experiences for both internal customers (employees and citizens) and external customers (consumers and partners). Most enterprises deliver customer experience (CX) in silos, based on brand, product, or geography, which leads to poor CX. DXPs provide significant efficiencies in composition, management, delivery, contextualization and optimization of digital experiences across multiple touchpoints. The DXP addresses an enterprise's need for a consistent, integrated, versatile and optimized approach to CX across a wide range of engagement scenarios, audiences, channels, devices and modes. The integrated nature of a DXP can mean faster time to market and lower deployment costs, as well as higher levels of customer engagement and satisfaction.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Acquia; Adobe; Bloomreach; Episerver; Liferay; Microsoft; Oracle; Salesforce; Sitecore

Recommended Reading: “Magic Quadrant for Digital Experience Platforms”

“Critical Capabilities for Digital Experience Platforms”

“Defining the Digital Experience Platform”

Network Disaggregation

Analysis By: Peter Liu; Sylvain Fabre

Definition: Network disaggregation defines the evolution of network equipment from proprietary, closed hardware and software sourced from a single vendor, toward decoupled, open components. Employing commercial off the shelf (COTS) x86, ASIC or programmable merchant silicon, disaggregated devices are horizontally integrated, where the network operating system (NOS), Layer 2/Layer 3 networking protocols and the element management interfaces can be independently selected and easily integrated depending on each specific requirement.

Position and Adoption Speed Justification: Network disaggregation can mean different things in different part of networking. In CSP domain, There are many different network functions and network locations that are viable candidates for disaggregation. Types of network disaggregation include:

Chassis to fabric disaggregation: This type of network disaggregation replaces a single chassis device with multiple fixed-configuration devices.

Software and hardware disaggregation: In this type of disaggregation, CSPs can select the best combination individual hardware and software components while eliminating vendor lock-in.

Function from appliance disaggregation: This type of disaggregation takes some common appliances — particularly in the realm of security and information flow management, such as load balancing — and places them in software-only platform. Which means, the set of services traditionally provided by one appliance can be broken down into individual applications.

Control plane from appliance: The primary advantage of this kind of disaggregation is the reduction of individual network device complexity and the ability to centralize policy calculation and implementation.

The network functions that are the most likely candidates for disaggregation, are switches, routers, base stations and optical line systems. CSPs have a number of location options to for network disaggregation deployment include cell site, followed by aggregation nodes, core network, data center and lastly edge data center (such as in a MEC deployment).

CSPs are starting to explore network disaggregation, albeit with reservations. As an example, AT&T planned to install thousands of white box routers which are a combination of white box, standard hardware combined with routing software developed to run on merchant silicon. Interest also grows in optical domain as well as Radio Access Network (RAN) but are still in early stage.

When it comes to the challenges of network disaggregation, the concern is shifting from performance and scalability to the management and operation. How to deal with additional complexity in monitoring, configuration and management with a wider variety of vendors is the top concern. Followed by the orchestration of both physical and virtual network devices as well as lack of skill set in DevOps model.

User Advice: Network disaggregation represents a dramatic departure from the way these critical devices are designed and built. There are many supposed benefits of network disaggregation in CSPs domain but also with a lot of challenges and confusion. CSPs should:

- Working closely with open networking initiatives and vendors to start piloting and trial network disaggregation, we do see the technology is in early production especially in switch, router and CPE domain.
- Identify in which areas you want to adopt network disaggregation, Disaggregation is not one thing, but rather a group of ideas — each with its own positive and negative trade-offs. Separating and identifying each movement is useful in understanding the broader concept of network disaggregation and the business and technical drivers behind each type.
- Took a phased approach, starting with what's new and manageable. Pick a physical network function to replace with a cloud-native virtual network function which in line with your SDN/NFV overall strategy.
- Focus not only on the cost savings potential of disaggregation but also on the capabilities that will drive innovation, flexibility and new revenue.
- Deploy newer agile service delivery approaches for network disaggregation with service orchestration solutions, considering DevOps styles of development to allow newer services to be deployed on NFV frameworks with SDN control.

Business Impact: Network disaggregation provides the following key benefits in CSPs networking:

- **Reduced vendor lock-in:** By lowering the barriers to entry for both hardware and software vendors, disaggregation has the potential to significantly increase price competition.
- **More choice:** Disaggregation enables network operators to optimally mix and match the best hardware and software for a given use case.
- **Faster innovation:** Innovation is key to driving down capex and opex, scaling performance, and enabling new services. The disaggregated networking approach enables network operators to leverage the innovation capabilities of the entire ecosystem, selecting best-in-class vendors and upgrading based on the innovation cycle of each component of the disaggregated solution.
- **Cost-effective and flexible scaling:** With horizontal scaling, disaggregated networks and the separation of hardware and software based on standard networking white boxes offer the

economic benefits of hyperscale clouds, promoting higher scale at much lower capex and opex. The building block approach to hardware allows for a low initial spend for initial deployments with the ability to grow incrementally as traffic increases and more capacity is required.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Cisco; DriveNets; Ericsson; Huawei; Infinera; Juniper Networks; Mavenir; Nokia; Samsung; ZTE

Recommended Reading: “Changing CSPs’ NFV and SDN Budgets and Implications for Technology Suppliers”

“Competitive Landscape: NFV Management and Orchestration Solution Vendors”

Network Slicing

Analysis By: Peter Liu

Definition: Network slicing is a form of virtual network technology. It allows a network-based CSP to create multiple virtual networks in the form of a “network slice,” on top of a common shared physical infrastructure. Each slice can be customized to have its own network architecture, engineering mechanism, network provisioning methodology, configuration and service quality profile based on the requirements that it serves.

Position and Adoption Speed Justification: Network slicing emerges as an essential technique in 5G networks to accommodate different and possibly contrasting quality of service (QoS) requirement ([5G Network Slicing](#)). The realization of this service-oriented view of the network leverages on the concepts of software defined network (SDN) and network function virtualization (NFV) that allow the implementation of flexible and scalable network slices on top of a common Infrastructure.

From a [business model perspective](#), each network slice can be administrated by a mobile network operator (MNO), mobile virtual network operator (MVNO) or a solution provider. The infrastructure provider (the owner of the telecommunication infrastructure) can also leases its physical resources to the MVNOs that share the underlying physical network. According to the availability of the assigned resources, a MVNO can autonomously deploy multiple network slices that are customized to the various applications provided to its own users.

Key characteristics of network slicing include the following:

- Each network slice comprises an independent set of visualized network functions that support a particular use case.

- Each slice is completely isolated in operations so that no slice can interfere with the traffic in another slice.
- Each slice is configured with its own network topology, engineering mechanism and network provisioning. It normally contains a slice management function that may be controlled by the CSP or the customer, depending on the use case.

Network slicing always link with 5G and especially a stand alone (SA) 5G deployment as well as Edge computing. As the 5G commercial rollout has begun in various countries, network slicing has become a hot differentiating feature. More CSPs have started evaluations and trials of network slicing. They include BT, China Mobile, Deutsche Telekom (DT), SK Telecom (SKT) and Vodafone UK. CSPs in China will start deploying the stand-alone 5G and MEC in large scale in 2020, which we believe will accelerate the network slice maturity and enable more innovation opportunities.

Network slicing and related management activities are being trialed by some CSPs and their vendor partners. In the beginning of 5G SA deployment, commercial cases will mainly focus on the core network slicing. Full Dynamic network slicing and end-to-end slicing (including RAN) will take longer time.

User Advice:

- CSPs should focus now on infrastructure transformation, including NFV, SDN, cloud RAN, edge computing and cloudification initiatives, since those are the fundamental technologies that enable network slicing.
- Network slicing management requires certain new components in the technology stack. CSPs should identify the architectural changes well in advance, while adopting NFV technologies to facilitate network slicing even at a later stage.
- Network slicing is one of the key technologies in the 5G era, and CSPs should evaluate and trial network slicing by working closely with vendors.
- CSPs should be practical and plan static network slicing with a focus on core network and key vertical use cases, such as entertainment, manufacturing and connected car.

Business Impact: Network slicing offers a more efficient approach to building a mobile network, which is essential in creating multiple networks on a single common platform that potentially disrupts the traditional single network for all business models. CSPs can run multiple independent business operations or business models on a common physical infrastructure. This increases infrastructure utilization and economic efficiency, and it also helps generate new business models, especially for vertical industries.

With network slicing, business customers will be able to access highly customized network slices tailored to specific requirements in a cost-effective, timely and efficient way. It will also allow businesses to optimize their current services and create new offers that otherwise wouldn't have been possible.

Long-term, network slicing will create a new type of service provider that doesn't have a physical infrastructure, but purchases a virtual network slice from a single network-based CSP that has been optimized for the services it provides.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Ciena; Cisco; Ericsson; Huawei; Intel; Mavenir; Nokia; Samsung; ZTE

Recommended Reading: "CSP CIOs' Role in 5G Platforms as Accelerators for New Value Creation Across Industries"

"Market Guide for 5G New Radio Infrastructure"

"Innovation Opportunities Will Be Enabled as 5G Evolves Through 2025"

"3 Key Enterprise Networking Hype Cycle Innovations in CSPs' Roadmap for Manufacturing"

API-Based Digital Commerce

Analysis By: Mike Lowndes

Definition: API-based or, as more commonly used in the market, "headless" digital commerce is the provision of digital commerce functionality via APIs, to decouple presentation from business logic and to integrate commerce capabilities within any context where selling is required.

Position and Adoption Speed Justification: API-based digital commerce is being rapidly adopted by midsize to large digitally mature organizations. Such adoption is driven by:

- Recognition of the quality of digital experience as a key differentiator across multiple touchpoints (e.g., native mobile apps, marketplaces, social platforms, in-store experiences, IoT and wearables, smart homes and vehicles).
- Emergence of the progressive web application (PWA) as the dominant "next generation" of client-side presentation.
- Emergence of digital experience platforms (DXPs) in supporting "experience-driven commerce."
- Commerce as an enabling part of a wider digital business technology platform.
- Pace of innovation in digital commerce requiring more flexible, modular architectures.
- Expense and complexity of some leading "monolithic" commerce platforms, when a subset of more agile capability is desired.

The proliferation of touchpoints requires a multiexperience approach to applications. This requires the decoupling of the presentation from logic and data that an API-based approach offers. Some

vendors (e.g., commercetools and Elastic Path) provide pure-play API-based commerce platforms, while others (e.g., Spryker) retain a native storefront but also provide full APIs for headless operation known as *head optional* or *hybrid headless*.

Most vendors' own native commerce platform storefronts are now shifting away from server-side "themes" or template engines toward being SPA or PWA. In this case, the platform customer may not use the API (or even know of its existence) but it nevertheless powers the native storefront. Interest in this approach is just over the Peak of Inflated Expectations as some of the complexity of this approach is being realized.

Commerce experiences built on API-based platforms can be more complex to manage than single-vendor "full stack" solutions. There is limited customer uptake in the SMB and lower midmarket commoditized digital commerce space. A key challenge when using commerce platforms completely "headless" is the integration with a fully decoupled storefront or other presentation layer. This adds complexity to implementations and can impact business user interfaces and usability of the overall system. Headless vendors are addressing this by providing reference storefronts via popular JavaScript frameworks, and ensuring business users retain control over the storefront.

User Advice: API-based commerce may fit your requirements if you:

- Want to retain granular control over multiexperiences, including deploying a SPA/PWA presentation tier.
- Already have or are looking to implement a DXP to provide a more consistent customer experience across commerce, brand and other digital properties.
- Have a large inflexible legacy monolithic, full-stack commerce application that cannot be replaced in a single step, and desire to migrate to a modular architecture.
- Are looking to support multiple digital and physical channels equally from the same business logic, and support cross-channel continuity of experience.
- Have a unique commerce business model that full-stack vendors cannot support without considerable customization.
- Need commerce integrations to support wider digital business strategies.

For more on the considerations around implementing an API-based platform, see "Innovation Insight for API-Based Digital Commerce."

Business Impact: API-based commerce is featured in the "2019 Strategic Roadmap for Digital Commerce" and will be critical for the future of "commerce to you (C2U)" (see "Industry Vision: Commerce to You"), whereby commerce functions occur in the customer's context wherever and using whatever channels are most convenient to them. Commerce journeys will become multiexperience and an API-based approach is a fundamental enabler for such experiences.

API-based commerce says nothing about the architecture underlying the API(s). Most digital commerce platform vendors are now providing robust APIs for "headless" use cases but are not all API-based. The API is often a "bolt on" to an existing traditional monolithic architecture. An API-based platform starts with the API as the primary interface and the commerce application is built to

support it. These platforms can be made available as a set of discrete capabilities that can be utilized independently. As such, these capabilities may no longer require a “whole platform” purchase or subscription. Some vendors approach this modular set of packaged business capabilities, while other vendors remain platform-focused. API-based commerce is therefore a step toward and an enabler of *composable commerce*.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: commercetools; Digital Goodie; Elastic Path; Skava; Spryker; Storm Commerce

Recommended Reading: “Apply the Principles Behind the Future of Applications to Digital Commerce”

“Magic Quadrant for Digital Commerce”

“Align Your Approach to the Emerging Digital Commerce Platform Landscape to Make Buy or Buy-and-Build Decisions”

“Harness the Core Capabilities of a Digital Commerce Platform”

“Innovation Insight for API-Based Digital Commerce”

“Industry Vision: Commerce to You”

Digital Security

Analysis By: Barika Pace

Definition: Digital security is the practice of governing, managing and operating the security systems of IoT, OT, physical and/or cyber-physical security systems. Digital security creates a state of trust, protection and safety for business assets: cyber assets (such as software and information) and physical assets managed by cyber assets (such as machines, buildings, etc.). As such, it plays a critical role in business focus to manage risks to the organization.

Position and Adoption Speed Justification: Digital security markets have evolved as digital transformation has evolved digital business. While other terms such as cybersecurity, cyber-physical system security, IoT security and others have been used in technology contexts for design and implementation purposes, digital security is the business view of those efforts. Unfortunately, precision of language remains a challenge in markets and with end users, and “digital security” as a term has grown increasingly synonymous with cybersecurity. The term has been clouded by the convergence of IT, IoT, OT, and cyber-physical systems, as more technology providers gravitate toward converged solutions and security and risk leaders look for high-levels of integration. It remains relevant to distinguish the physical context in security and its impact on business decisions. The convergence of IT, OT, IoT, and CPS into hyperconverged security platforms for ease

of integration continues to emerge over the last year, take with it the concept of digital security. The marketplace has seen signs of increased consolidation over the last year. As such, it has its own adoption by business and technology users. The position of digital security on the Hype Cycle reflects a peak period of recognition with the term and its impact on markets. A continuing evolution of next-generation capabilities (e.g., artificial intelligence, advanced cloud security services, robotic process automation) enhance capabilities for digital security. Risks across digital transformation initiatives increase due to the complexity of supported systems and functional requirements. Products claiming to offer digital security solutions are predominantly vertical-specific and have evolving capabilities. Movement on the Hype Cycle for 2020 reflects these changes and responses.

User Advice: Security and risk management leaders should:

- Assess digital transformation impacts occurring in the organization and harness digital security capabilities where needed.
- Establish proofs of concept to discover, classify and manage all connected devices to ascertain risk landscape, raise organizational awareness and create business value by onboarding visibility tools that can have dual purpose for operational teams.
- Plan your IT and functional alignment in the areas of architecture, governance, security, software management, infrastructure, support and software acquisition by teaming up cross-functional resources.
- Deploy skills training to incorporate unique digital security controls into mainstream security and risk management plans.
- Develop the same skills training for development and awareness to incorporate specific digital security controls into existing cybersecurity practice.
- Establish a list of new competencies required to support digital business initiatives and establish new roles as needed.
- Assign enterprise ownership for digital security capabilities that are not already claimed by a business unit and develop more effective techniques for selecting unique tools.
- Record all digital assets, from sensors to large industrial equipment, and create visibility into the organization's digital networks and think about digital security as part of a holistic ecosystem.
- Leverage cloud-based security programs to supplement scale and diversity of digital security requirements.
- Brace for increasing privacy regulations that impact digital security requirements and incorporate steps in privacy management to accommodate them.
- Drive alignment with environmental, health, safety, business and IT to address the cyber-physical realities over digital security only.

Business Impact: Business initiatives using advanced technologies continue to experiment with better methods of protecting assets in digital transformation initiatives (see “Managing the Digital Risks of Blockchain Initiatives”). Security and risk managers apply controls on behalf of the business as a single-system approach to effectively manage digital risks to the organization. Digital

security has moved from providing transformational benefits to mainstream benefits. This move is due to digital security components' ability to provide more practical advantages to organizations in deploying digital business technologies and services with mainstream providers, and with better testing, certification and technical standards for implementation.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: 802 Secure; Cisco; Darktrace; Dragos; Forescout Technologies; Radiflow; Tenable; Thales; Xage Security

Recommended Reading: “Develop a Pragmatic Vision and Strategy for Digital Business Security”

“Market Guide for Operational Technology Security”

“2020 Strategic Roadmap for IT/OT Alignment”

“Market Insight: Tech CEOs Must Act Before Convergence Kills Your Stand-Alone OT/IoT Product Solution”

“Emerging Technology Analysis: Cyber-Physical Systems Security Is an Opportunity for Security Product Managers”

Digital Business Technology Platform

Analysis By: Bill Swanton

Definition: A digital business technology platform is the combination of technologies that enables an organization to deliver digital business capabilities. It enables existing platforms for IT, customer engagement, data and analytics, ecosystem partners and the Internet of Things to sense business events, decide what to do, and implement a business response that creates value for those involved. Platforms share assets such as data, algorithms and transactions with business ecosystems to match, create and exchange services.

Position and Adoption Speed Justification: Companies use a variety of relatively new-to-market integration, API mediation, platform as a service (PaaS) and other cloud technologies to implement digital business technology platforms today (see “Survey Analysis: Building a Digital Business Technology Platform Requires New Technologies and Methods”). There is currently no specific market or vendor for an entire platform — companies need to assemble components and tools from generally available cloud frameworks and a cluttered market of Internet of Things (IoT) vendors. Some service providers are marketing their platforms, which are reusable assets inevitably sold in conjunction with significant services. While digital native organizations are adept at these technologies, traditional companies often struggle with new architectural approaches, such as microservices architecture, event-driven architecture, and programmable infrastructure that may be

required for large-scale implementations. Complicating matters is the rapid change in these technology markets, which may cause ongoing refactoring of the platform.

Despite these challenges, we believe digital business technology platforms are moving rapidly to the Plateau of Productivity in two to five years because:

- Organizations are being driven to digital business to mitigate disruption of their core businesses and the distancing rules of COVID-19.
- Digital business technology platforms enable platform business models, which can create rapid market growth and potentially dominate industries (see “Winning in the Platform Game, Part 1: Understand the Game and Determine Your Role”).
- Regulatory requirements in some regions are requiring organizations to share business services through digital platforms. For example, PSD2 requires banks in the European Union to provide mandatory access to customer accounts for regulated third parties.

User Advice:

- Work with business leaders to identify likely use cases (sense, decide, act) needed to implement your digital business based on the strategy (see “Use Gartner’s Digital Business Layers to Communicate Your Digital Intent”).
- Build out the digital business technology platform as needed to implement the initial digital use cases. The build out will take years and may require refactoring as the business scales and the technologies used mature. Given the limits most companies face on investment, the initial investment must be relatively small, with costs scaling with revenue, which precludes major upfront infrastructure and license costs (see “How to Build a Digital Business Technology Platform”). Treat the digital business technology platform as a continuously evolving product guided through its long life cycle by a product manager.
- Work with technology and service providers to determine what digital technologies are needed to implement the use cases in a way that will scale to the level the strategy envisions. Most organizations do not yet have the skills to implement this technology so skills transfer needs to be a part of any service contract.
- Understand what APIs you might need to consume or provide to interact with customers and/or ecosystem partners inside or outside of the enterprise.
- Keep existing platforms loosely coupled by using techniques such as API mediation so you can modernize those platforms without disrupting your digital business build-out. Managing an inherently hybrid IT infrastructure for all these parts will be a major challenge.

Business Impact: DBTP enables an enterprise to become a digital business and deliver digital products and services to customers. Without it, it will be much harder for an enterprise to gain the business benefits of digital business. They empower people, businesses and things to give, take or multiply value creation for the enterprise. Digital platforms will make it easier for new market entrants, startups, competitors and, eventually, smart machines to create and pursue new business opportunities. Traditional businesses will have to build a digital business technology platform to

compete and/or participate in these new markets. DBTPs provide an easier “funding/investment” target for business leaders to incorporate.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Sample Vendors: Amazon Web Services; Google Cloud Platform; Microsoft Azure; NXN; Red Hat OpenShift xPaaS; VANTIQ; VMware

Recommended Reading: “How to Build a Digital Business Technology Platform”

“Use Gartner’s Digital Business Layers to Communicate Your Digital Intent”

“Survey Analysis: Building a Digital Business Technology Platform Requires New Technologies and Methods”

“How to Govern a Digital Business Technology Platform”

Open-Source Solutions

Analysis By: Amresh Nandan

Definition: The adoption of open-source software continues to disrupt communications service providers’ (CSPs’) IT and network operations ecosystems. CIOs and CTOs are increasingly focused in deploying open-source software within their respective domains. CSP open-source adoption helps reduce vendor lock-in and provide greater control over technology change management.

Position and Adoption Speed Justification: CSPs are embracing open source in their network and IT operations. CIOs and CTOs are increasingly focused in deploying open-source software in their respective domains. While the CSP IT operations domain has been embracing open-source software over many years, the adoption of open source in the CSP network domain has picked-up among leading global CSPs. Gartner expects that it will further grow over the next few years. CSPs are in the process of virtualizing their network functions so that they can automate and orchestrate service delivery using open-source solutions. Open source in the network function virtualization (NFV) management and orchestration (MANO) component is growing rapidly. Examples include open-source solutions such as Open Network Automation Platform (ONAP), Open Source Management and Orchestration (OSM), open radio access network/physical access, among others. In addition, DevOps, CI/CD and cloud-native adoption has also fueled open-source tools adoption. This allows CSPs to leverage wider innovation, enhance vendor neutrality and gain better control over their technology change management. This trend of adopting and operationalizing open-source solutions is expected to continue for the next three to five years.

User Advice: CSPs should prioritize the adoption and operationalization of open-source IT and operational technology (OT) software solutions. Operations leaders should make it mandatory to

have open-source solutions in their roadmap. Open source presents the single biggest opportunity for CSPs to begin the transition from vendor-locked operations ecosystems to vendor-agnostic and open-source-powered operations ecosystems. In the past, internal research and development has proved to be expensive, time-consuming and inefficient, yielding only mediocre results. However, in the open-source world, CSPs aren't alone in developing a solution. In fact, open-source software solution development is driven largely by open-source communities (with active participation by large CSPs) that have hundreds of thousands of contributors around the world. To promote this advantage, all CSPs have to do is to participate and encourage this crowd innovation. There is an opportunity for CSPs to consider open-source innovation as the next "big thing" and reap the benefits of the trend:

- Prioritize the development of open-source software solutions focusing on reliability and support.
- Prioritize investments to generate high ROI and improve experience for customers.
- Eliminate or severely restrict the funding for vendor-locked proprietary solutions to force the development of open-source alternatives.
- Establish architecture, roadmap and timeline; methodically replacing various vendor-locked proprietary operational software elements with open-source alternatives.
- Promote innovation internally and in the CSP vendor landscape by taking advantage of the open-source ecosystem. Invest in programs to instill the culture of innovation.
- Hire new talent with core competencies to support open-source initiatives.

Business Impact: Open-source solutions provide CSPs with the following major benefits:

- Lower cost of acquisition
- Increased agility with faster time to market
- Accelerated innovation cycle
- More sourcing options
- Open-source solutions are generally simplified compared to proprietary solutions

Open-source solutions also have some disadvantages:

- There is a general lack of maturity and performance, which can be inconsistent occasionally
- Operational support for open source can prove challenging at times
- Development, engineering and operational resources can be hard to attain sometimes

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Kubernetes (Cloud Native Computing Foundation); O-RAN Alliance; ONAP; Open Compute Project (OCP); Open Networking Foundation (VOLTHA); Open Source MANO; OpenDaylight Foundation (ODL); OpenStack; Xen Project

Recommended Reading: “Best Practices in Implementing Open-Source Software in CSP Network Infrastructure”

“Best Practices in Cloud Transformation of CSP Network Infrastructure”

“What Innovation Leaders Must Know About Open-Source Software”

“Hype Cycle for Open-Source Software, 2019”

“Market Guide for CSP Operations Support System Solutions”

“OSS Solution Sourcing Criteria Changes for CSP Operations Transformation”

CSP-OT SaaS

Analysis By: Amresh Nandan

Definition: CSP-OT software as a service refers to operational technology applications (such as business support system [BSS], operations support system [OSS] and related software applications) for CSPs, delivered by third-party solution providers via the cloud in an as-a-service model. Instead of purchasing licenses, CSPs and mobile virtual network providers consume in a pay-as-you-grow model.

Position and Adoption Speed Justification: Communications service provider operational technology (CSP-OT) SaaS has the most traction among small and midsize CSPs and mobile virtual network operators (MVNOs) that prefer operating expenditure (opex)-based subscription models. These can be deployed as multitenancy applications in which the SaaS provider supports multiple CSPs using shared infrastructure (such as public cloud).

Large CSPs are slow to adopt CSP-OT SaaS for their core CSP-OT solutions, because of the challenges related to integrating it with existing solutions. Additionally, they prefer on-premises solutions to retain control over their networks and remain flexible to adapt to digital services. CSPs also perceive risks related to data security, quality of service, system uptime and privacy — thereby indicating a lack of maturity. At the same time, architectural changes in BSS and OSS as well as changes for 5G demotivate leading Tier 1 CSPs to adopt such a model across their business lines. Nonetheless, CSPs are considering the CSP-OT SaaS model for new digital capabilities. This motivates them to transform differently by examining each module in the future architecture.

Generally, CSPs are less likely to use the SaaS model for solutions close to the network. The strongest adoption has occurred in business support systems including customer management, billing, charging and partner settlement. CSP-OT SaaS deployed in a cloud-based multitenancy deployment model enables significant revenue streams in convergent digital partner ecosystems

and across multiple industry verticals. There are examples of CSPs extending certain BSS functions to their enterprise customers.

With many vendors like Amdocs, MATRIX Software, Microsoft, and Netcracker developing capabilities, CSPs will have greater options in future. Adoption is likely to spike in the coming years, since most large CSP-OT vendors recently launched SaaS solutions with phased migration paths to transition from on-premises to the cloud.

User Advice: CSPs should:

- Invest in CSP-OT SaaS (preferably from a public cloud) as a means to reduce upfront investment and tap into new digital business models, particularly multitenancy-enterprise-enabled B2C as well as business-to-business-to-consumer (B2B2C).
- Use CSP-OT SaaS in discrete areas that require strong operational management expertise — yet ensure adequate support to the business strategy, products and services in the SaaS model.
- Ask their strategic CSP-OT vendor for a viable migration path from on-premises OSS/BSS to cloud-based OSS/BSS SaaS solutions that help drive operational scale in terms of efficiency gains, as well as deliver the desired agility and business outcome.

Considering the economic situation and disruption caused by COVID-19 pandemic, CSP-OT SaaS is an option for all kinds of CSPs to transform their operations faster through opex-based model.

Business Impact: CSPs leverage OT SaaS delivery models to gain cost-efficient and easy access to certain CSP-OT functions and to embrace digital capabilities. Midsize and large CSPs typically leverage CSP-OT SaaS in discrete areas linked to a business case. For example, to gain competitive advantage for emerging services like Internet of Things (IoT) and machine-to-machine (M2M) or composite services for enterprise customers.

MVNOs often take advantage of CSP-OT SaaS provided by mobile virtual network enablers to reduce upfront costs and mitigate the risks associated with migrating to new communications technologies, as well as managing internal infrastructure. Marketing functions can leverage cloud-based CSP-OT SaaS to quickly drive new revenue streams, independent of sometimes long-wired technical approval processes and dependence on IT constituents.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Amdocs; Ericsson; Hewlett Packard Enterprise (HPE); Huawei; Nokia; Oracle

Recommended Reading: “Market Trends: Fundamental Changes Await the Telecom BSS Market”

“Market Trends: Telecom BSS Evolving as a Set of Federated Capabilities”

“Market Guide for CSP Operations Support System Solutions”

“Magic Quadrant for Operations Support Systems”

“CSP Platform Business Signals an End to BSS and OSS as We Know It”

Sliding Into the Trough

Network as a Service (NaaS)

Analysis By: Gaspar Valdivia; To Chee Eng

Definition: Network as a service (NaaS) is a standardized, highly automated offering, where network products, services and operations are consumed by enterprises as a service. NaaS can be offered across the LAN, WAN and/or data center by communication service providers that may own or not the network. NaaS offers often leverage SDN and network automation and are combined with VNF marketplaces enlarging value to enterprise customers. Provider’s web portal is used by customers to self-provision the NaaS components, often charged on a pay per usage basis.

Position and Adoption Speed Justification: A growing number of global communications service providers (CSPs) are investing in NaaS and virtual network function (VNF) marketplaces. These CSPs are evolving to a platform approach for service management for their NaaS offers and have adopted software-defined network (SDN) and network function virtualization (NFV) to decouple data plane for control plane and network hardware from software.

TM Forum and Metro Ethernet Forum (MEF) have carried out initiatives joined by carriers and technology vendors to define a common framework on how telecom service providers build and deliver NaaS. They assess what elements needs to be homogenized in the industry and provide definitions on elements such as service metrics and service orchestration and standardize service information models and application programming interfaces (APIs) to enable interconnection of services across networks. However, intercarrier connections are still mostly pending.

Today, most CSPs still lack a comprehensive NaaS platform. They have limited offers in their VNF marketplaces in breadth (just some network functions), depth (limited pretested services chains) or geographic reach (offering bandwidth on demand [BoD] but only for some connectivity services in selected countries). Legacy and complex systems (BSS and OSS) and processes, siloed organizational structures, lack of appropriate skills are among the most common barriers.

Enterprise’s uptake of CSP’s NaaS offering is still rather limited. Over time, as CSP’s capabilities develop aligned with standards and enable end-to-end service orchestration across networks and technologies, and service catalogs get populated, Gartner expects NaaS will gain further market traction.

User Advice: Deploying NaaS requires end-to-end automation of service orchestration and life cycle management across cloud-based and hybrid infrastructure, both in IT and network domains. NaaS includes processes such as endpoint authentication and authorization, service provisioning and QoS management. A master service catalog together with a common information model

framework across domains and standards-based APIs are key components of a CSP's NaaS implementation.

For CSPs, operational success of NaaS, VNF as a service (VNFaaS), and increasingly containerized network functions (CNF), will require the adoption of a digital business technology platform approachable to meet internal and external requirements from customers and ecosystem partners. As CSPs evolve their NaaS portfolios, they must provide partners with modules, tools and processes to test, certify and onboard VNFs. If not yet deployed, CSPs should build NaaS platform capabilities to enable on-demand enterprise service delivery and consumption-based commercial models for network services. Typically starting with bandwidth on demand on MPLS, Ethernet and/or internet services and cloud connects. CSPs should:

- Adopt NaaS using a platform approach for enterprise services design, deliver and support a service factory model for operations. Begin by developing a blueprint of target services architecture and deploying specific modules to that target architecture.
- Expose network APIs for partners and developers so they can leverage underlying platform capabilities to add to your offerings or build their own services.
- Combine NaaS platform capabilities with a VNF marketplace for enterprise network services that customers can consume on as-a-service commercial model either directly from the NFV network POPs or onboarded on on-premises universal CPEs.
- NaaS and VNF marketplace platforms should include service/VNF catalogs, license management, revenue management, self-service and support and robust life cycle management process and tools.

Business Impact: Deploying NaaS requires from CSPs upfront investments in network and operation transformation for increased agility, automation and cost-efficiency in service delivery. CSPs can use NaaS to offer more flexible, consumption-based commercial models such as bandwidth on demand on WAN connections as well as to enhance the user experience they offer to their enterprise customers. Flexible and scalable services, real-time configuration, ease of management through service web portals and full-service automation become key service attributes. The combination with VNF marketplaces allows for easy consumption of value-added services such as security, WAN optimization or SD-WAN services.

Advanced analytics, cloud, virtualization, microservices, open source will also bring opportunities for CSPs to untap new revenue streams with NaaS. An example could be mobile private networks including NaaS orchestration of service life cycle for 5G network slicing capability. Usage of AI in network operation and maintenance, and self-optimization, self-healing capabilities will also build into the NaaS-enhanced services.

CSP's exposure of network APIs can allow partners and developers to add to CSP's offering as well as to leverage and combine underlying platform capabilities with others from third-party providers (such as Amazon or The Walt Disney Co.) to build their own services. That would create new revenue streams for CSPs.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Arista Networks; Arista Networks (Big Switch Networks); Cisco; Dell; Ericsson; Hewlett Packard Enterprise (HPE); Huawei; Juniper Networks; Nokia; VMware

Recommended Reading: “2019 Strategic Roadmap for Networking”

“Market Guide for CSP Operations Support System Solutions”

“Market Opportunity Map: Enterprise Network Services, Worldwide”

“Magic Quadrant for Network Services, Global”

“Debunk the Misperceptions About Network as a Service”

Enterprise Information Management

Analysis By: Andrew White; Ted Friedman

Definition: Enterprise information management (EIM) is an integrative discipline for describing, organizing, sharing, governing and implementing data and analytics in order to maximize business outcomes.

Position and Adoption Speed Justification: The enablement and improvement of business outcomes, process integrity and decision effectiveness is critical in this COVID-19 reset. A structured, repeatable, scalable approach that usually starts small, but can scale to enterprise class, is required. EIM is often a formalized effort that manifests the discipline across all data and analytics initiatives, and is led by data and analytics leaders such as the chief data officer. (See Gartner’s Data and Analytics Strategy and Operating Model [DASOM] in “How to Craft a Modern, Actionable Data and Analytics Strategy That Delivers Business Outcomes.”)

Increasingly, data that is critical to decision making comes from outside the organization and analytics insight is being created in silos. Various market factors are increasingly converging to create greater demand for EIM. These include regulatory and legal requirements (e.g., General Data Protection Regulation [GDPR]) to share data, the need for new data to train machine learning engines, cost optimization initiatives, movement of data and applications to the cloud, and streaming data for new continuous intelligence programs. Efforts related to data literacy help CDOs to craft a more business-relevant story for how EIM can be valuable to the organization.

In 2020, the economic impact of COVID-19 is urging organizations to be more effective in order to make smarter, faster decisions. DataOps and other cross-discipline agile delivery models are fast-becoming the standard approach to organize cross-disciplined teams to delivery EIM programs spanning all data and analytics. As organizations seek to reengineer how they make decisions, a more focused effort to exploit data, to impact the business more productively, is critical. Managing metadata across silos is a critical enabler for EIM. The new hype around “data fabric” is driving

more interest in EIM as machine learning can augment the development of dynamic, semantic models. As the hype around EIM has actually increased, its descent toward the trough has been reversed slightly this year.

User Advice: Data and analytics leaders, such as CDOs, must find a way to achieve measurable and precise business goals, and communicate these in a language that is familiar to business leaders. Organizations should plan to implement each data and analytics initiative with the same operating model that spans scope, governance, organization, processes, technology and so on. They should plan to implement data and analytics in stages. No organization has time, money or can justify the time needed to develop a roadmap that spans several years given it will all likely change in hours. Where there is added business value, share semantic data across siloed projects to drive productivity and increased value. Over time, your small/siloed programs will connect into a broader effort, where each step is driven by improved outcomes. Organize and resource EIM to ensure that you can support lean, agile, cross-disciplinary product delivery teams (e.g., DataOps) for each program as necessary.

Business Impact: The business benefits of EIM are huge. These include greater productivity, increased efficiency, better risk mitigation and new value creation (new products and business models, for example). As a discipline, EIM demands organizations to identify when data management must be deliberate and highly formalized or when it can be relaxed and more reactive. Stringent data governance rules require equally responsive data management approaches, and a strategic use of EIM will include an overall process for identifying such cases. Similarly, data assets that are less restrictive in terms of allowed processes, management and utilization can be identified and broader guidance provided. The effect is manifold in that application designers/developers will accelerate delivery by reducing the cycle of continuously rediscovering data governance and management requirements that are now held in trust by the EIM strategy. Analytics teams will be able to identify authoritative sources as well as alternative sources more quickly. All data users will be informed regarding the use of external data and how to qualify such data for use. By formalizing the information management structure, the enterprise will also facilitate transparent external reporting and use of its own data.

EIM can support run, grow and transform business priorities. For example, data and analytics governance, data quality and intelligent process-monitoring efforts can support “run the business” initiatives, which seek to reduce risks, eliminate inefficiency and improve responsiveness. Pervasive business intelligence, data-as-an-asset strategies, single versions of customer or product, and performance management efforts support “grow the business” initiatives, thus yielding improvements across the entire value chain. Collaborative or continuous intelligence, information ecosystems, content in context and universal data exchanges support “transform the business” initiatives, which seek to reach new horizons, new markets and new models.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Recommended Reading: “How to Craft a Modern, Actionable Data and Analytics Strategy That Delivers Business Outcomes”

“Tool: A Living Library of Real-World Data and Analytics Use Cases”

“IT Score for Data & Analytics”

CSP AI

Analysis By: Peter Liu

Definition: Artificial intelligence (AI) applies advanced analysis and logic-based techniques, including machine learning, to interpret events, support and automate decisions, and take actions. “CSP AI” refers to how communications service providers (CSPs) leverage AI and machine learning technology to improve customer experience, reduce costs, generate new revenue opportunities, and optimize their IT and infrastructure operations.

Position and Adoption Speed Justification: AI promises to be one of the most disruptive and innovative classes of technologies in the next 10 years and has been identified as top game-changer technology by CSP CIOs (refer to “2019 CIO Agenda: A CSP Perspective”). Further, 40% of the CSP CIO respondents are already implementing or plan to implement AI within 12 months. The disruptive nature of AI is a result of the increasing demand for vendors to create insights and outcomes from advances in emerging AI technologies and techniques.

The early promise and function of the AI technology in telecom industry are mostly focused on improving existing operations, enhanced audience analysis and segmentation.

CSPs have been using virtual assistant (VA), analytics and machine-learning-related technologies for years, mostly focused on improving existing operations, and enhancing audience analysis and segmentation. Major CSPs in developed markets have, to some extent, been leveraging advanced analytics, artificial intelligence and automation (AAA)-related technologies, aiming to empower and enable various capabilities, process and technologies such as network optimization, self-organizing network (SON), and customer engagement.

An increasing number of CSPs are exploring use cases for AI, and many are already in the initial phases of a pilot or proof of concept. Leading CSPs, such as AT&T, Orange, Telefonica and Vodafone, are combining data analytics capabilities with AI and automation to differentiate themselves further.

However, the legitimate excitement about the transformative power of AI leads to unrealistic expectations within the CSPs (further buttressed through hype by solution providers) and the loose link between theoretical/conceptual frameworks and their business value fuels a deepening skepticism. Therefore, very few of the AI projects make it to live deployment. The industry is at risk of getting stuck in “proof-of-concept purgatory” — a limbo state where AI stalls and never reaches its full potential. Subsequently these lead to lack of leadership support for AI initiatives and competing priorities for investment.

We do, however, forecast that CSP AI and machine learning technologies will take a relatively long time to reach the Plateau of Productivity. Barriers include the nascent and expensive nature of the technology and the execution strategy. CSP AI also requires specific expertise and rare skill sets, which most CSPs lack. Other challenges include a lack of good-quality data for training sets and process changes to enable new automations.

User Advice: Expect effective adoption of AI to be a learning journey. Don't be afraid to start small with modest, straightforward projects, such as simple algorithms in network planning and next-best offers or including automation in areas with a lot of manual, repetitive work. At the same time, think big. Plan for an architecture that supports AI across all business functions in the organization, and use early projects as learning platforms for more-complex midterm projects.

Obtain senior management and business support for projects needed to underpin AI and machine learning, since there will be many personnel hours needed to complete data cleansing, system integration and process fixes.

Invite sourcing to participate in business outcome meetings. This can help ensure that supplier RFPs minimize the chance of vendor lock-in by including questions that uncover the supplier's attitude to risk sharing and co-creation on projects that include nascent technologies.

Business Impact: The benefit of AI is very wide, and almost all CSP functions can benefit from it.

AI drives improvements and new solutions to business problems across a vast array of business, consumer and operation areas. Key applications include:

- **Intelligent network operations.** AI makes it possible to derive value from this network data and to shift network operations from being reactive to being data-driven, predictive and proactive operations. This results in higher efficiency and lower operating expenditure.
- **Process automation.** Larger CSPs already have multiple small robotic process automation initiatives, but the delivery of truly "intelligent" automation of major processes is still some years away. CSPs are evaluating early products that provide machine learning to find the root cause of issues and to determine the simple next best action in individual parts of a process.
- **Virtual customer assistant (VCA) and augmented cognition.** Leading CSPs have already implemented VCAs to help them improve their customer engagement. By using AI algorithms that analyze vast amounts of customer data and through natural language processing, intelligent chatbots can gain a better understanding of the customer. They can also combine historic and behavioral patterns with ongoing real-time engagement data to determine the best action at the best moment of the customer journey.
- **Personalization service design.** New pattern detection techniques can improve adoption of campaigns and enhance the ability to understand and respond to customer experience needs.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Aria Networks; Ericsson; Guavus; Huawei; IBM; Mavenir; Nokia; Nuance Communications; Oracle; P.I. Works

Recommended Reading: “Market Insight: Unleash the Potential of AI in Telecom 5G Era”

“Top 10 Trends for the Communications Service Provider Industry in 2020”

“CSP CIOs Enable Business Outcomes Through AI Augmented Talent and Decision Making”

Predictive Analytics — CSP

Analysis By: Peter Liu

Definition: Predictive analytics is a technique to analyze internal and external data, identify patterns and anticipate future events. It is characterized by techniques such as regression analysis, multivariate statistics, pattern matching, predictive modeling and forecasting.

Position and Adoption Speed Justification: 5G brings more complex network setup and diversified business cases; therefore, predictive analytics continues to drive more interest and adoption in CSP domain. However, this technology is unlikely to spend significant time in the Trough of Disillusionment as the rate of evolution and underlying value of predictive analytics drives the technology rapidly toward the Plateau of Productivity in the near future. For CSPs, from those just getting started with predictive analytics, to those with mature data scientists, CSPs are increasingly convinced of the value and potential impact of predictive models. The market is demonstrating some practical readiness as more CSPs move from talking about predictive analytics to adopting. This pushed more application providers and network equipment providers embedding predictive analytics features into their products. Interest is also driven by improved availability of data, low-cost compute processing and real-world proven use cases. However, due to the silo of the data and lack of the collaboration between data owners, CSPs are still struggling to realize the expected business value from predictive analytics.

CSPs adopt predictive analytics to mainly focus in:

- **Proactive Customer Care:** It relates to the use of data/analytics to identify issues that may impact customers' behavior and satisfaction, and implement a “proactive” resolution accordingly.
- **Proactive Network Maintenance:** Leverage predictive analytics to predict future network issues having high variety (thousands of variables type of variables which could impact performance).
- **Fraud Management:** It related to leverage predictive analytics to detect potential anomalies in the behavior of users or look for associations and pattern in the data from network that related to fraud.
- **Business Performance:** It related to predict campaign results and return on investment, harnessing that data to ensure that the right offers are delivered to customer at the right time

and to predict what buyers will response to next. For example, to predict impact/outcome of price changes or introduction of new bundles.

Other use cases, like predict customer behavior, dynamic pricing, churn management, demand prediction, etc., have also been evaluated by CSPs. In the next few years, CSPs will increasingly leverage predictive analytics in zero-touch orchestration, end-to-end service orchestration and closed-loop scenarios.

User Advice: For CSPs Business Unit Leaders and CTIOs:

Predictive analytics can be quite easy to use if delivered via a packaged application. However, packaged applications do not exist for every analytics use case. Packaged applications may also often not provide enough agility, customization or competitive differentiation. In these situations, CSPs are advised to build solutions either through an external service provider or with typically highly skilled in-house staff using a data science platform. Many CSPs increasingly use a combination of these tactics (build, buy, outsource) and some vendors have hybrid offerings.

In addition, predictive analytics success is dependent on the quality of the data, most of the CSPs are facing data silo challenges which weakens the impact of the predictive analytics. Breaking the data silo and building data aggregation platform is crucial.

Finally, to secure the success of predictive analytics projects, it is important to focus on an operationalization methodology to deploy these predictive assets.

Business Impact: By understanding likely future outcomes, organizations are able to make better decisions and anticipate threats and opportunities, being proactive rather than reactive (for example, predictive maintenance of equipment, demand prediction, fraud detection, and dynamic pricing). Interest continues to grow in both new use cases and more traditional applications of predictive analytics (for example, churn management, cross-selling, propensity to purchase, database marketing, and sales and financial forecasting).

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Amdocs; Cisco; Cloudera; Ericsson; Huawei; IBM; Juniper Networks; Microsoft; Nokia

Recommended Reading: “Enable Predictive Analytics to Improve Program and Portfolio Outcomes”

“Increasing Trust in Predictive Analysis in Times of Uncertainty”

“Hype Cycle for Analytics and Business Intelligence, 2019”

“Market Guide for CSP Operations Support System Solutions”

Services Co-creation

Analysis By: Amresh Nandan

Definition: Services co-creation is an initiative where the communications service provider (CSP) and external parties jointly commit resources to develop new services or solutions aimed at solving business problems that cannot be addressed by existing services. The external parties are usually enterprise customers, but they can also encompass network equipment providers and/or system integrator partners. Specific timelines, responsibilities and objectives are attached to service co-creation initiatives.

Position and Adoption Speed Justification: Services co-creation is attractive to large CSPs with extensive enterprise customer bases. As enterprises pursue digital business transformation and competition from cloud-based CSPs intensifies, we expect more large CSPs to embrace services co-creation to develop inventive, new services. In the next five years, we expect these CSPs to quickly acquire external talent and resources to strengthen their competencies. Examples of services co-creation can be seen among leading global CSPs working with automotive, manufacturing, logistics and public-sector organizations. Other examples include CSPs working with technology and services supplier partners.

However, these CSPs are still challenged by the lack of internal competencies and skill sets, resource allocation conflicts, and the required shifts in organizational mindset/culture. While they have implemented new processes (for example, design thinking, lean startup, rapid prototyping, minimum viable products), technologies and performance measurement tools, they have yet to achieve sufficient scale. They also continue to face difficulties in demonstrating returns on investment and improving success rates. Sustained management commitment is required.

User Advice: CSPs should:

- Appoint leaders that have the passion and ability to ignite enthusiasm for services co-creation. They must be able to sustain high levels of engagement within the organization.
- Implement incentives and performance metrics that are aimed at encouraging the right behavior and inculcating the required culture/mindset. Performance metrics must support risk taking — for example, do not set success rates too high because it will discourage risk taking. Ensure that failures are culturally acceptable.
- Build a reputation for equitable risk and reward so that enterprises and third parties are attracted to partnering with you. Risk and reward should be fair and proportional to each participant's contribution/engagement.
- Establish a dedicated space for services co-creation initiatives. This releases co-creation participants from being encumbered by traditional telecom practices and mindsets.
- Obtain top management support to resolve resource prioritization conflicts, particularly in the early stages until the services co-creation initiatives are on a more solid footing internally.
- Learn and adopt relevant best practices from system integrators and consulting firms that have more mature and established co-creation practices.

Effective implementation of services co-creation initiatives will require CSPs to ensure proper coordination and collaboration among multiple functional teams within the organization. A multifunctional team comprising IT, design, technology, product development and legal is needed. Potential customers must be properly qualified by sales for the services co-creation initiative. This is to ensure optimal and effective utilization of the CSPs' human resources such as expensive solutions specialists and technical consultants. The IT department must be ready to provide the necessary IT tools and processes to facilitate the services co-creation process. Legal representation is necessary to ensure that intellectual property aspects (such as ownership and patent applications) are adequately addressed.

Business Impact: CSPs pursue services co-creation to strengthen customer relationships and generate new sources of revenue. Today, CSPs are challenged by their peers and nontraditional competitors. Services co-creation can help CSPs deliver differentiated value propositions to enterprise customers and change the perception these customers have of them. CSPs can better position themselves as trusted, strategic partners and forge closer ties. This, in turn, can lead to improved customer lifetime value and new, incremental revenue for the CSPs. This is important as enterprises seek credible and committed partners that can help them with their business challenges.

Some areas where services co-creation can be applied are 5G, network slicing, IoT use cases. Many CSPs are still struggling to uncover viable business cases for the technology. Here, CSPs can leverage services co-creation together with industry partners to develop novel and innovative applications.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AT&T; BT; China Mobile; Orange Business Services; Telstra; Verizon; Vodafone Global Enterprise

Recommended Reading: "TSPs Can Leverage Co-creation to Grow Mind Share and Revenue as Part of Their Industry-Vertical Strategies"

"A Maturity Model for Innovation Management"

"Use 16 Innovation Catalysts to Widen Your Innovation Aperture"

"Executing on Innovation: Design the Process From Idea to Value"

Web Real-Time Communications

Analysis By: Rafael Benitez

Definition: Web Real-Time Communications (WebRTC) is an open-source project that delivers voice, video and data communications directly to a browser and to mobile applications using

JavaScript APIs. The WebRTC project was initially launched in 2011, following Google's open sourcing of much of the code they got from the acquisition of San Francisco based Global IP Solutions in 2010.

Position and Adoption Speed Justification: The goal of the WebRTC standard is to enable real-time communications, such as voice and video, to be delivered through web browsers, mobile applications, and IoT devices without additional software being necessary (e.g., plug-ins or extensions). WebRTC standardization groups in the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C) have defined a set of protocols and JavaScript APIs that enable voice, video and data communications services in web browsers, mobile apps and IoT devices. These protocols and APIs can be used to develop: web applications that require voice and video, UCC, contact center services, and meeting solutions. Google Chrome, Mozilla Firefox and Opera browsers have implemented WebRTC. Microsoft's decision to use Chromium in its Edge browser has given Edge similar levels of WebRTC compatibility as Google's Chrome browser. Apple's Safari 11 was the first Safari version to support WebRTC. Safari 13.1 for both iOS and macOS, supports the H.264 and VP8 video codecs, video simulcast and the "Unified Plan Session Description Protocol (SDP)," which is an [IETF draft proposal](#) for signaling [multiple media sources in SDP](#).

The migration to WebRTC will continue to evolve over the next years. Chromium-based browsers and platforms are best placed to leverage new WebRTC applications. Many unified communications and collaboration (UCC), contact center and cloud-based meeting service providers have leveraged WebRTC in their web clients, including Microsoft with Teams, Cisco with Webex Teams, RingCentral, Genesys with PureCloud WebRTC phones, and Google with Hangouts. Additionally, mobile app developers have leveraged WebRTC, using it to speed the development of business communications apps that require VoIP and video. IoT and connected devices, such as baby monitors, video doorbells, and surveillance cameras also leverage WebRTC. Currently, enterprise adoption is highest in meeting services and contact center solutions from providers that support web clients.

User Advice: Contact center offerings that adopt the ability to engage customers with voice, video and chat through the browser will have a competitive advantage over those that require the customer to place a call from a phone. It is because the latter lacks insight into the customer's valuable browsing history. This is especially true in a post-COVID-19 world, where technology that easily supports remote work is becoming a critical capability. Enterprises that use audio-, video- and web-conferencing services regularly should evaluate use of WebRTC-enabled meeting solutions, as they allow attendees to join meetings without having to download and install desktop clients or browser plug-ins on their PCs and mobile devices. Real-time communication services (audio/video/messaging) in web clients are currently not as feature-rich as comparable desktop clients. However, the convenience factor improves the ease of deployment for IT operations' teams and makes it easier for users to securely consume these services. This is especially applicable for new hires that require communications services on day one, even before they receive a physical personal communication device. Further, many gaps that existed previously have been closed, and parity with desktop clients is expected in offerings from leading vendors within one to two years. The codecs that WebRTC currently designates as "mandatory to implement" are G.711 and Opus for audio, and H.264 and VP8 for video. Optional codecs currently supported include G.722, iSAC and iLBC for audio, and VP9 (with SVC) for video. The wideband and adaptive codecs are designed

to provide a high-quality user experience even over best-effort networks, where end-to-end quality of service (QoS) cannot be guaranteed.

Business Impact: The benefit for enterprises of WebRTC is that voice and video interactions can occur within an application's context and its web client, as opposed to users having to use a desktop client or a separate personal device like a desk phone. With embedded voice, video and data channel, an application's web client can add contextual information on the same browser, delivering a richer web application experience. WebRTC will allow click-to-call applications to shift away from proprietary methods, allowing customers that start on a company's website to stay on the website for voice and video interactions. Within contact center operations or communications-enabled business processes (CEBPs), WebRTC can surface voice, video and messaging objects in webpages where workflows, e-commerce and business process applications could be enriched or optimized. WebRTC will potentially transform the communications industry, since no desktop client or plug-in software is installed to access communications. Traditional software vendors are utilizing WebRTC as a low-cost way of entering the real-time voice and video communications market. As WebRTC matures, the expectation is for high-quality voice and video to be tightly integrated with business applications that can be consumed by any smart device.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Apple; Cisco; Google; Microsoft; Mozilla; NICE inContact; Oracle; RingCentral; Twilio

Recommended Reading: "Magic Quadrant for Meeting Solutions"

"Market Guide for Communications Platform as a Service"

"Magic Quadrant for Unified Communications as a Service, Worldwide"

"Delivering Customer Service During COVID-19: 3 Steps to Implement Business Continuity in the Contact Center"

"3 Hype Cycle Innovations That Should Be on Your Unified Communications Product Roadmap"

Software-Defined Infrastructure

Analysis By: Philip Dawson

Definition: Software-defined infrastructure (SDI) includes the broad set of software-defined anything (SDx) infrastructure components and the software-defined data center (SDDC). SDI also includes non-data-center infrastructure deployed in Internet of Things (IoT) applications and an SD edge of edge-based adapters, monitoring devices, gateways, appliances and machines.

Position and Adoption Speed Justification: Data center infrastructure is well-covered with compute (SDC), network (SDN) and storage (SDS), but SDI also extends to non-data-center infrastructure with the use of monitoring devices or machines that are software-defined. This is enabled through the use of sensors and adapters that are abstracted through software, becoming SDI in edge, IoT and operational technology (e.g., retail POS), rather than traditional, IT-driven SDI through data center or cloud. In 2020, we are seeing SDI move to vendor-specific silo technology (not heterogeneous service drive) and, hence, obsolete as multivendor interoperable standards.

User Advice: As SDI initiatives roll out, consider the integration and measurement of non-data-center edge infrastructure. Focus on core IT SDI for compute, network, storage and facilities, but consider the impact of SDI on IoT, edge computing, remote office/branch office (ROBO) and other operational technologies. Key verticals operating in multiple, geographically distributed locations (such as retail, manufacturing, retail banking, distribution and utilities) are extending IoT and non-data-center SDI initiatives for new IT operations and functions. Expect SDI to be tied to a specific vendor or technology silo.

Business Impact: With the increase of IoT touching edge-based operational technology, SDI reaches beyond and between SDDCs, and leverages SDI benefits and features for new multimode applications and edge IoT endpoints. However, SDI is now tied to vendor technology not interoperability.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Obsolete

Sample Vendors: IBM; Intel; Microsoft; Red Hat; VMware; Wipro

Recommended Reading: “Simplify Intelligent Infrastructure by Using Workload Architectures”

“Drive Administration, Application and Automation Capabilities of Infrastructure-Led Disruption”

Data Lakes

Analysis By: Nick Heudecker; Henry Cook

Definition: A data lake is a concept constituting a collection of storage instances of various data assets combined with one or more processing capabilities. Data assets are stored in a near-exact, or even exact, copy of the source format and in addition to the originating data stores.

Position and Adoption Speed Justification: Though data lakes have started emerging from the Trough of Disillusionment, a majority of the market still exhibits significant confusion over the data lake concept, how it compares to concepts like data warehouses and data hubs, and how it supports different user groups and service-level agreements. Another portion of the market is embracing packaged data lake offerings from cloud providers and other vendors. These packaged offerings help enterprises conceptualize both what a data lake is and where the data lake fits into

their data estate. Adoption of these products has pushed data lakes through the Trough of Disillusionment and toward the Slope of Enlightenment.

This progression has come at a cost. Data lakes have already run their course for many organizations. Some companies struggled to determine the return on investment for their data lake projects, failing to uncover a single meaningful outcome that originated from their lake. Others found some success in their experiments but struggled to evolve those experiments into production for a variety of reasons. Many of these organizations gave up on their data lakes, preferring to use infrastructure that accommodated diverse analytics consumers, rather than solely accommodating data scientists.

Despite progression along the Hype Cycle, data lake success is far from guaranteed. Infrastructure is only one part of the data lake equation. Data and analytics leaders must design and implement a pipeline to move projects into production, ensure high quality, reproducible outcomes, and develop highly skilled individuals that can derive value from datasets with varying levels of context, quality and format.

User Advice:

- The fundamental assumption behind the data lake concept is that everyone accessing a data lake is moderately to highly skilled at data manipulation and analysis. Before implementing a data lake, ensure you have either the necessary skills, such as data science or engineering, or a plan to develop them.
- Recognize that results will likely be difficult to reproduce between analysts. By definition, data stored in data lakes lacks semantic consistency and data governance of any kind. This makes data analysis highly individualized (a consumerization of IT goal) at the expense of an easy comparison or contrast of analytic findings (also indicative of consumerization of IT).
- There are certain SLA expectations that can be served by data lakes. However, most end-user SLAs for analytics rely on repeatability, semantic consistency and optimized delivery. Once data lake efforts confront these SLAs, it is time to explore alternative information management architectures, such as the logical data warehouse, to rationalize how information is stored with how it is used.
- Evaluate a variety of implementation options. Cloud-based data lake offerings are increasingly popular choices and provide a simple pattern for data ingestion and consumption, but no two data lakes are the same. Your users' needs may require a radically different implementation than prepackaged services. Expect your data lake to be a portfolio of processing capabilities.
- Many organizations think of a data lake to share data within the organization, roughly equivalent to data as a service. This frequently results in multiple copies and lineages of data — exactly what many data lake advocates said wouldn't happen. Alternative architectures, like data hubs, are often better fits for such use cases (see “Use a Data Hub Strategy to Meet Your Data and Analytics Governance and Sharing Requirements”).

Business Impact: The data lake concept has the potential to have a high impact on organizations, but its effect is only moderate at present. To get full value from a data lake, its users must possess all the skills of a system analyst, data analyst *and* programmer. They should also have significant

mathematical and business process engineering skills — otherwise it will still have a significant impact, but a highly undesirable one.

Depending on the method of implementation, a data lake can be a low-cost option for massive data storage and processing. Processed results can be moved to an optimized data storage and access platform, based on business requirements and tool availability. However, the potentially high impact of this will be diluted by vendors seeking to use the term “data lake” merely as a means of gaining entry to the highly mature analytics and data management markets. This presents the potential for some very real lost opportunities and large sunk costs, as a balanced warehouse/services/lake architectural approach would be the better solution.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Amazon Web Services; Cambridge Semantics; Cazena; Google Cloud Platform; IBM; Informatica; Microsoft; Oracle; Zaloni

Recommended Reading: “How to Avoid Data Lake Failures”

“Solve Your Data Challenges With the Data Management Infrastructure Model”

“Efficiently Evolving Data From the Data Lake to the Data Warehouse”

“Data Hubs, Data Lakes and Data Warehouses: How They Are Different and Why They Are Better Together”

“Building Data Lakes Successfully”

“Metadata Is the Fish Finder in Data Lakes”

NFV and uCPE

Analysis By: Bjarne Munch; Mike Toussaint

Definition: Universal customer premises equipment and network function virtualizations entail the virtual instantiation of network functions such as firewall, WAN optimization, SD-WAN, routing, etc. running on uCPE hosts which use standard CPUs (such as x86). NFV is not specific to the WAN, and can entail virtualization of any network function. However, NFV in conjunction with uCPE is specific to WAN deployments.

Position and Adoption Speed Justification: Universal customer premises equipment (uCPE) and network function virtualization (NFV) have grown out of the requirement to support and consolidate multiple network functions at the WAN edge, while increasing flexibility and agility of deploying these functions for both network providers and end users alike. uCPE and NFV technologies address this requirement by enabling multiple dedicated network functions, from multiple vendors,

to run concurrently on a single server platform. Thus, it enables increased deployment agility, additional service chaining capabilities, automation of device provisioning and orchestration, and reduced power requirements at branch sites.

While there are advantages to deploying uCPE with NFV technologies, obstacles to adoption are moderate to high. For instance, we have observed that while carriers have favored uCPE and NFV form factors, adopters have found performance issues have arisen with one or more NFVs running on a single uCPE platform. Additionally, the premise of “any” NFV running on uCPE platforms has become problematic due to integration and heterogeneity, thereby causing vendors to certify functionality on a small subset of uCPEs — which patently negates the very concept of a universally supported host infrastructure. We have also observed challenges with support for network interface modules in uCPE platforms because they are vendor-specific. Therefore, adding network interface modules to the uCPE from different vendors is not supported.

We commonly observe clients deploying at least two of the following NFVs at branch locations, including SD-WAN, and firewalls. Several network service providers (NSPs) with NFVs running on uCPEs, which they provide.

While end-user-managed uCPE-based NFV services are still nascent, and still facing substantive challenges, there is growing adoption of managed network-based NFV services. This is especially true of network service providers deploying network nodes across the geographies which they cover because uCPE and NFV technologies enable a broadening set of functions and vendors, combined with increased availability of web-based customer portals for self-service and service-chaining capabilities.

This Hype Cycle covers uCPE and NFV together, as it relates to WAN and branch scenarios. NFV has broader applicability outside of WAN which is not included in this analysis.

User Advice: When refreshing WAN edge equipment from a managed network service provider, prefer uCPE to custom-built appliances, but recognize that, as of early 2020, the technology is still nascent and consequently may present price/performance/compatibility obstacles that offset the agility advantages.

Ensure that any proof of concept or pilot is performed with all functionality required on the uCPE to ensure these functions operate acceptably together on the chosen hardware.

For network-based NFV, ensure that virtual functionality is located close to the enterprise locations (ideally not more than a 10 ms to 20 ms round-trip delay between the site and the point of presence, typically a distance of a few hundred miles).

When managed services are a preference, choose providers that support the range of functions required by the enterprise and, if applicable, any preferred vendors, and conduct a pilot before signing any contract to ensure that the provider can deliver and manage the service as promised.

Conduct a thorough total cost of ownership analysis to validate that the promised agility justifies the additional expense.

Business Impact: For the enterprise, there are three main value propositions of NFV:

- Network-based NFV can improve enterprise network agility because it enables enterprises to rapidly deploy new functionality where needed.
- Network-based NFV can facilitate the deployment of network functionality in several locations where it can offer an optimized architecture, such as an SD-WAN endpoint close to cloud services or a virtual firewall deployed in providers' facilities instead of a large number of small branch offices.
- For branch office uCPE-based NFV, business impacts are mainly from the ability to consolidate more functionality on fewer appliances, as there is still limited enhanced agility availability.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AT&T; NTT Communications; Orange Business Services; Versa Networks; VMware

Recommended Reading: "Pump the Brakes on Network Function Virtualization Services"

"NFV/uCPE Is a Deployment Option — Shift Focus and Resources to SASE and Edge Computing Opportunities"

"Magic Quadrant for Network Services, Global"

"Critical Capabilities for Network Services, Global"

"5 Options to Secure SD-WAN-Based Internet Access"

Climbing the Slope

Multichannel Marketing

Analysis By: Jouni Forsman

Definition: Multichannel marketing orchestrates contextualized engagement to customers and partners across channels such as websites and stores. Using this technology, marketers build profitable relationships with customers and partners. Seamless multichannel marketing mimics an ongoing conversation with purpose, context and an understanding of previous and potential interactions. We note focus on customer analytics, automation, prediction, measurement and visualization of campaign effectiveness.

Position and Adoption Speed Justification: Communications service providers (CSPs) have been building real-time campaign management capabilities to create offers across multiple channels for many years. Vendors have improved capabilities to deliver multichannel marketing which is more "conversational" — these solutions offer new opportunities in the postpaid market where customers

often have all-you-can-eat subscription services and it proves more difficult to identify moments of need/choice. These conversational capabilities were first delivered by defining a typical customer journey for different types of customers and creating preconfigured campaigns at key points in that journey. However, this approach did not provide significant uplift in revenue due to the complexity and nuance of individual customer journeys. Vendors have been expanding their microsegmentation capabilities by incorporating machine learning to mimic the customer journey by identifying moments of likely need/choice for a single customer.

Marketers are building increasingly complex customer journeys that require careful planning, design and timing of engagement. Collecting and resolving data — often in real time — from multiple sources and touchpoints into a single individual profile to drive triggered messages is central to this capability. Customer profiles identify digital users and behaviors across channels to improve targeting and automate campaign execution in the right channels. Required customer data resides in a maze of business and marketing systems, creating persisting data collection and profile unification challenges. Artificial intelligence (AI) or machine learning (ML) capabilities are playing a bigger role in solutions to increase speed, lower the cost and improve the quality of data and insights. Marketing analytics are increasing in importance as are marketing effectiveness measurement capabilities and visualization.

We place multichannel marketing past the bottom of the Hype Cycle for CSPs because most CSPs have at least some capabilities in place. The COVID-19 pandemic has lifted mobile and digital over physical channels in 1H20.

User Advice: Focus on the following areas during deployments:

- Continue to invest in data and start looking at opportunities across the whole company consumer and SMB maybe even enterprise.
- Vendors are very cost focused. Assure that your supplier has sufficient support service capabilities and ability to weather the COVID-19 disruption.
- Invest more in multichannel customer journey analytics, which cover all touchpoints with the company while customers go through the explore-evaluate-engage process in the buying cycle.
- AI and ML messages from vendors are at the top. Assure pragmatic value from intelligence-related promises such as predictive decision making, improved segmentation or recommendations.

Business Impact: Contextualized and personalized marketing for consumers have become a defacto expectation in most markets in 2020. SMB and enterprise markets are still trailing in experience.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amdocs; Flytxt; IBM; Oracle; Pegasystems; SAP Hybris

Recommended Reading: “Magic Quadrant for Multichannel Marketing Hubs”

“Multichannel Marketing Survey 2019: Marketers Reorient Programs Around Customer Insights”

“Cool Vendors in Multichannel Marketing”

Entering the Plateau

DevOps

Analysis By: George Spafford; Joachim Herschmann

Definition: DevOps is a customer-value-driven approach to deliver solutions using agile methods, collaboration and automation. DevOps emphasizes people and culture to improve collaboration between development, operations and other stakeholders to navigate uncertainty, and accelerate the delivery of customer value. DevOps implementations use architecture and tools to improve the flow of work.

Position and Adoption Speed Justification: DevOps doesn’t have a concrete set of mandates or standards, or a known framework (such as ITIL); thus, it is subject to a more liberal interpretation. In general, it is about cross-functional teams collaborating to deliver business value faster. DevOps is associated with processes, tools and organizational styles intended to optimize the flow of work across the application life cycle, from development to production. DevOps concepts have become widely adopted for initiatives with a style of work that is focused on exploration and agility, including digital business, machine learning, mobile apps, IoT. Also, there is potential for use in more traditional enterprise environments; however, every implementation is unique. Good practices are emerging, the sharing of lessons learned is vibrant among practitioners. Vendors are developing and delivering supporting tools and professional services. While some new adopters are having challenges clients report that DevOps does deliver value.

User Advice: DevOps initiatives must be iterative, focused on business value and have executive sponsorship, with the understanding that new team(s) will have to make an often-difficult organizational philosophy shift toward the development of agile capabilities. DevOps hype remains elevated among tool and service vendors, with the term applied aggressively and claims outrunning demonstrated capabilities. Many tool vendors are adapting their portfolios and branding their offerings as DevOps-related to gain attention. Some vendors are acquiring smaller point solutions specifically developed for DevOps to boost their portfolios. Clients are recommended to clearly tie investments to business outcomes to help improve internal adoption.

IT organizations must establish key criteria that will differentiate DevOps tooling traits (strong toolchain integration, workflow, automation, etc.) from traditional management tools. Both development and operations should look to tools to replace custom scripting with improving deployment success and cycle times through more predictable configurations and seek to continually improve the flow of work via refactoring.

IT organizations should approach DevOps as a set of flexible guiding principles. Start small and focused — don't try a “big bang” approach. Select a product that is politically friendly, and offers acceptable value and risk involving development, operations and other critical stakeholders, such as information security and architecture. Stakeholders need to work together to accomplish the business objective, while learning how to organize and determining what methods and tools to use. At a minimum, seek to continually improve the flow of work from developer through to the new or changed application being in production and the customer receiving the promised value. These stakeholders must also collaborate to scale efforts.

Business Impact: DevOps is focused on delivering customer value and enables hypothesis-driven development and the aggregation of data to make decisions about future functionality. Release cadence can be varied to meet demands for organizational learning and change absorption. DevOps approaches are made possible by the adoption of continuous learning, improvement and incremental release principles adopted from agile methodologies. Smaller, more frequent updates to production can work to improve organizational learning and overall quality, including both stability and control, thus reducing risk. A successful DevOps implementation will improve the delivery of customer value. This delivery of value justifies the scaling and expansion of DevOps using an iterative approach.

Benefit Rating: Transformational

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Recommended Reading: “Adopt an Iterative Approach to Drive DevOps Success in Large Organizations”

“DevOps — Eight Simple Steps to Get It Right”

“DevOps Primer for 2019”

“Three Ways Midsize Enterprises Can Maximize Value From DevOps”

“Four Steps to Adopt Open-Source Software as Part of the DevOps Toolchain”

“DevOps Success Requires Shift-Right Testing in Production”

“Avoid Failure by Developing a Toolchain That Enables DevOps”

“Top 5 Causes of DevOps Failure and How to Avoid Them”

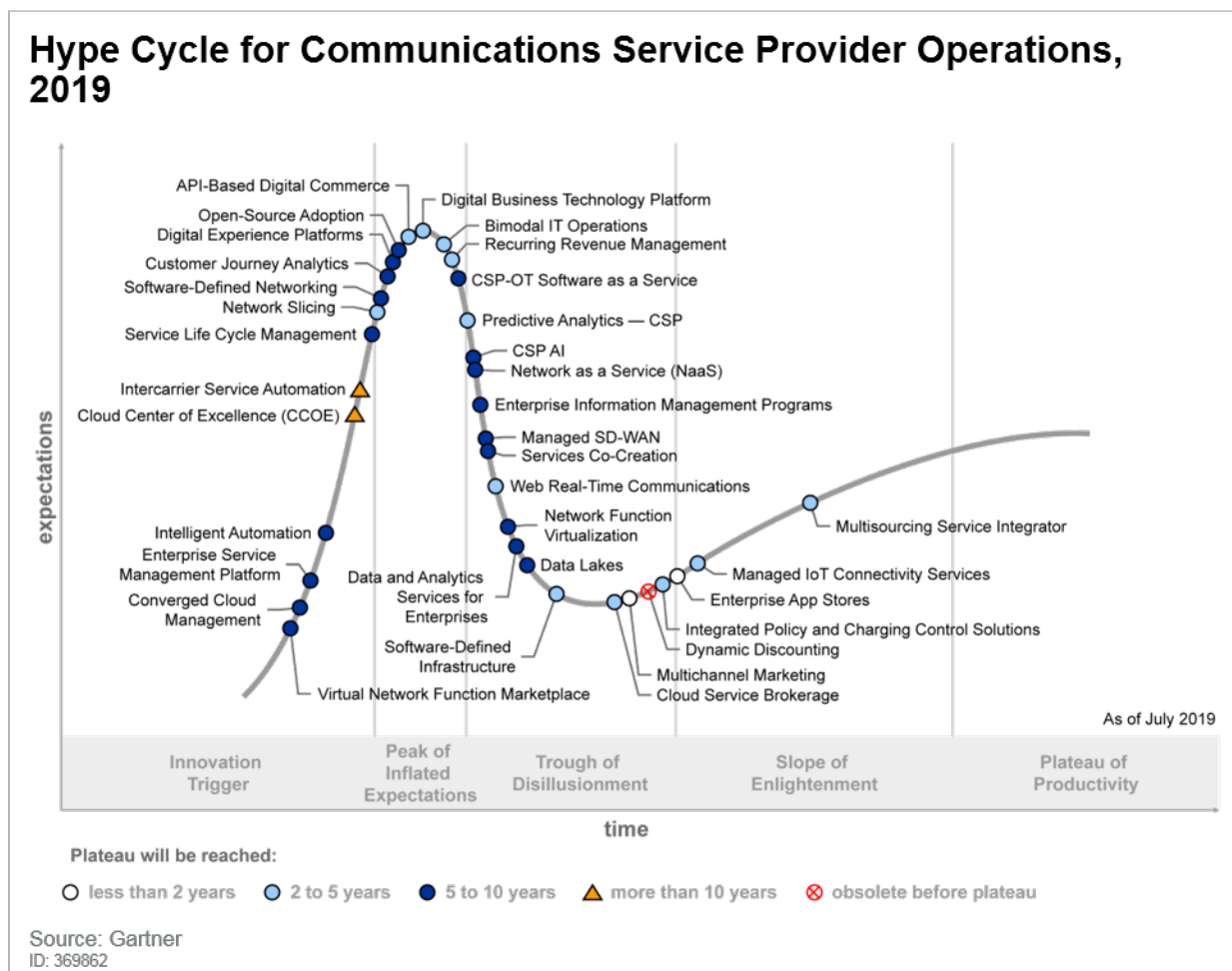
“How to Avoid Compliance and Audit Concerns When Using DevOps”

“How to Scale DevOps by Building Platform Teams”

“Top SRE Practices Needed by Teams Scaling DevOps”

Appendixes

Figure 3. Hype Cycle for Communication Service Provider Operations, 2019



Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
<i>Innovation Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
<i>Peak of Inflated Expectations</i>	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
<i>Trough of Disillusionment</i>	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
<i>Slope of Enlightenment</i>	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
<i>Plateau of Productivity</i>	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
<i>Years to Mainstream Adoption</i>	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2020)

Table 2. Benefit Ratings

Benefit Rating	Definition
<i>Transformational</i>	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
<i>High</i>	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
<i>Moderate</i>	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
<i>Low</i>	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2020)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
<i>Embryonic</i>	<ul style="list-style-type: none"> In labs 	<ul style="list-style-type: none"> None
<i>Emerging</i>	<ul style="list-style-type: none"> Commercialization by vendors Pilots and deployments by industry leaders 	<ul style="list-style-type: none"> First generation High price Much customization
<i>Adolescent</i>	<ul style="list-style-type: none"> Maturing technology capabilities and process understanding Uptake beyond early adopters 	<ul style="list-style-type: none"> Second generation Less customization
<i>Early mainstream</i>	<ul style="list-style-type: none"> Proven technology Vendors, technology and adoption rapidly evolving 	<ul style="list-style-type: none"> Third generation More out-of-box methodologies
<i>Mature mainstream</i>	<ul style="list-style-type: none"> Robust technology Not much evolution in vendors or technology 	<ul style="list-style-type: none"> Several dominant vendors
<i>Legacy</i>	<ul style="list-style-type: none"> Not appropriate for new developments Cost of migration constrains replacement 	<ul style="list-style-type: none"> Maintenance revenue focus
<i>Obsolete</i>	<ul style="list-style-type: none"> Rarely used 	<ul style="list-style-type: none"> Used/resale market only

Source: Gartner (July 2020)

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

Understanding Gartner's Hype Cycles

Predicts 2020: 5 Key Trends for CSPs' Digital Growth

Cool Vendors in Communications Service Provider Network Operations

Toolkit: CSP B2B Customer Journey and Process Map Development

Market Trends: CSPs Must Accelerate Direct Connections to Cloud

Market Insight: Unleash the Potential of AI in Telecom 5G Era

Lessons Learned From Rakuten's Fully Virtualized and Cloud-Native 4G Network

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