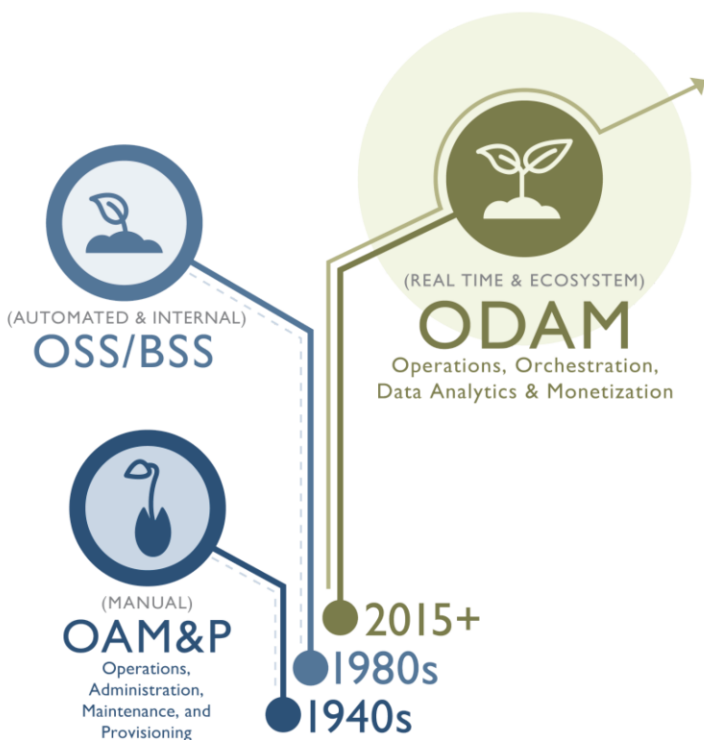


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Microservices: A Role Player in the Cloud-Native Architecture

Taking a parallel approach to digital transformation

Stratecast Analysis by
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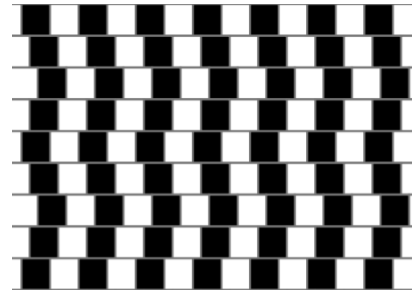
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Introduction¹

Many technologies operate in parallel as a matter of redundancy. Others operate in parallel to facilitate change management and cutover customers from an old version to a new version. It is now often said that the transformation from physical networks to virtual, software-controlled networks will be achieved running the two networks and their systems in parallel—for up to 10 years. This description is only partially true, and not useful when executing a transformation.

Virtual and physical networks supporting like-services may operate side-by-side, but they hardly work in parallel. They are not mirrored. They do not carry the same traffic. Instead, thousands of systems with hundreds of supporting processes operate at various levels of compatibility and capability, while sending and receiving data to and from completely different management and orchestration architectures.



At any one time, networks and their support systems operate at different stages along the digital transformation continuum. Yet, these systems must remain interoperable and maintain acceptable performance levels. Sure, physical and virtual networks appear to run in parallel, but the layers in the image above also run in parallel—or do they? Tiny offsets in alignment are enough to make these parallel tracks appear chaotic and unstable—two characteristics that networks cannot abide.

While network architectures are top of mind in the current transformations of Communications Services Providers (CSPs), operations and monetization software is undergoing its own architectural transformation—to a microservices architecture. Microservices will play an important role in how new services are created and fulfilled. And recently, Amdocs revealed its strategy for a new kind of parallel transformation that includes microservices. The company's vision is to move its CSP customers through parallel journeys rather than parallel networks. The three journeys transform infrastructure, applications, and people/processes on their way to becoming cloud native. Microservices are part of the applications journey; however, the technology relies upon and supports the other journeys. This interdependency is why each must move in parallel.

This paper focuses primarily on Amdocs' approach to building (or unbuilding, to be more specific) microservices, and where the architecture fits along the transformation continuum. The report will also look at other changes CSPs must adopt for microservices to deliver on their potential, such as Continuous Integration/Continuous Delivery (CI/CD) and DevOps.²

¹ In preparing this report, Stratecast conducted interviews with:

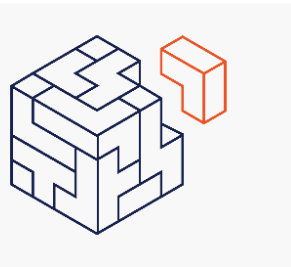
- Amdocs – Dayana Nevo, Product Marketing Digital Experience Unit
- Amdocs – Yifat Kafkafi, Product Marketing, Technology & New Offerings

Please note that the insights and opinions expressed in this assessment are those of Stratecast, and have been developed through the Stratecast research and analysis process. These expressed insights and opinions do not necessarily reflect the views of the company executives interviewed.

² DevOps is a new approach to traditional application lifecycle management (ALM) process. DevOps creates a fast and stable work flow through development and IT operations. The TM Forum describes it for telecom operations as the theory and practice of adopting continuous integration approaches.

Microservices: the Key to Complex Transformation

The microservices architecture, as it pertains to telecom operations and monetization, is comprised of small, composable blocks of functionality that are chained together as needed, and driven by the policies that are relevant to a given set of customers or a specific delivered service. Its function is to



enable a single application to operate as a suite of small services that can be managed and deployed independently as part of multiple applications for specific business purposes. In other words, microservices are disaggregated application components built to deliver specific functions to other applications.

Microservices by themselves have little impact. Theoretically, it is their operation within larger applications, functions, and architectures that renders them useful and effective. Microservices architectures have yet to

be fully vetted, because they have yet to be fully constructed for operations and monetization solutions pertaining to the communications industry.

Microservices technology is under development and in the roadmaps of all major ODAM³ suppliers. To date, the microservices concept has been tested in CSP networks around the world, following a variety of usage scenarios.⁴ CSPs expect that defining their business and operations needs through microservices will:

- Make networks and systems more open and conducive to collaboration
- Lower the cost of operations
- Boost the ability of business management, monetization, and operations systems to scale
- Help automate service creation, testing, fulfillment, assurance, optimization and maintenance
- Enable customization and personalization
- Improve data-driven business and operational intelligence
- Instill programmability

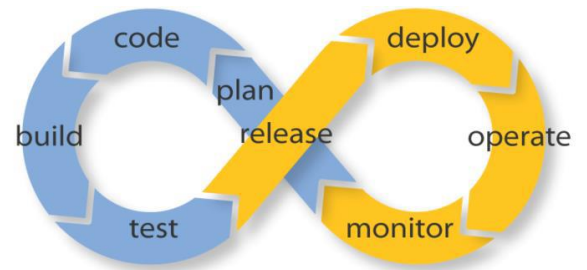
So far, progress has been deliberate in both adoption by CSPs and development by software providers. There are several legitimate barriers to moving quickly down the path of transformation:

- **Disaggregation: Where to start and how far to go.** Most leading suppliers have disaggregated some of the solutions in their existing portfolios, mostly those solutions serving monetization functions rather than operations and maintenance. But suppliers question just how granular they are willing to go in disaggregating existing, monolithic, bread-and-butter applications. The definition of “micro” appears to be subjective at this point in microservices development.

³ Stratecast views Operations, Orchestration, Data Analytics & Monetization (ODAM) as the next step in the evolution of business and operations support systems (BSS and OSS). For a graphical representation of this evolution, see the lower left corner of the report cover. For a description of ODAM, see the last page of this report.

⁴ For more analysis on Microservices in ODAM, see Stratecast report OSSCS 18-05, *Microservices: The Communication Industry's Next Little Big Thing – Why it is More Important to do Microservices Right than Fast*, July 2017.

- Latency: A constant among engineering road blocks.** One thing all the promising new apps on the horizon share is the need for low latency. However, as suppliers move their apps and microservices to the cloud, they continue to struggle with this niggling issue as larger apps “dip” into cloud-based microservices containers⁵ on a regular basis through APIs. API management systems could potentially add to these expected increases in delay.
- Increased Complexity: It is not exponential, but it is troublesome.** Microservices are not inherently complex. In fact, in some cases their construct and functionality are simpler. However, operational support, including monitoring and service discovery, can become more complex. Business services also grow increasingly complex and difficult to support with precision. The open nature of microservices and use by many third-party applications also drives complexity. Although there are open platforms, standards around APIs, and common cloud infrastructure management for these third-party relationships, microservices-based components still require integration.
- DevOps and CI/CD: Bringing Microservices to market depends on these cultural and operational oddities.** DevOps (Development and Operations) incorporates principles from the methodology known as Agile Software Development. DevOps combines these principles with the continuous delivery model that has evolved for managing frequent software releases. In this model, CSPs and their development, operations, and quality assurance departments collaborate to deliver software in a continuous manner that enables the business to more quickly seize market opportunities. Unfortunately, DevOps concepts are foreign to most telecom operations departments, which require a significant shift in knowledge focus and operational practices. Continuous Integration/Continuous Delivery is also a foreign concept—one telcos have trouble adjusting to even though the benefits are clear. CI/CD is a long-awaited solution to long, expensive integration cycles, as well as system-wide and error-prone upgrades, testing, and delivery models.
- Progress: Keeping in sync requires knowing one’s place along the transformation continuum.** With so many components moving from legacy status to cloud-native, having a clear path ahead is important. Knowing the difference between cloud-enabled and cloud-native can help a CSP know when the time is right to adopt microservices. Infrastructure, applications, people, and processes all take their own journeys to the next generation network. Each component of the CSP business will proceed at its own pace. For example, systems and processes cannot be automated while still operating in silos; nor can applications become cloud native while running on and occupying individual virtual machines. Different levels of modernization among the components restrict the full and coordinated migration of networks. Microservices can be deployed today, but may not be fully leveraged until all components—infrastructure, applications, people, and processes—are brought to cloud-native status.



⁵ Containers encapsulate microservices but have no operating system like virtual machines. Connectivity to containers and the microservices within are made through application programming interfaces (APIs). Leading container suppliers include Docker and Kontena.

None of the barriers listed above are insurmountable. Some are not even engineering challenges. DevOps and CI/CD, for example, are primarily process and culture oriented; while the progress issue—keeping the transformation journeys in sync—is mainly a project management concern. This does not make them easier than engineering issues to solve, because they are all still complex; however, they are business problems that are not specific to telecom operations. Stratecast believes that overcoming these challenges quickly will demonstrate CSPs’ ability to operate outside their own boxes and in the broader Internet and cloud marketplaces.

Maturity Models

To gauge CSP progress on the digital transformation pathway, the TM Forum launched its Digital Maturity Model (DMM)⁶ in May 2017. The model calls for CSPs to transform traditional business and operating models, cultures, and infrastructures. More importantly, it tries to help CSPs develop a coherent view of where they are on that path, or where to start, and then develop a strategy to get there. The TM Forum is also developing a set of metrics to measure CSP digital transformation progress. The DMM considers maturity across five key dimensions, as shown in the box below. Each dimension contains a set of sub-dimensions (currently 28 combined).

The DMM helps all stakeholders across a CSP organization assess their own maturity in each of these dimensions. The model can be used as a planning tool to help CSPs identify where improvement is needed and what investment priorities should be. The DMM can also account for differences in stakeholder visions, strategies and business imperatives, and help develop a roadmap that suits the entire organization. The forum has even turned the DMM tool into an app that CSPs can now download.

Key Dimensions of Digital Maturity	
Customer	Provide an experience through which customers view the CSP as their digital partner using their preferred channels of interaction
Strategy	Plan for operating or transforming the business to increase competitive advantage through digital initiatives embedded within the overall business strategy
Technology	Support the effort to create, process, store, secure and exchange data to cost-effectively meet the needs of customers
Operations	Executing and evolving processes with digital technologies, drive strategic management and enhance business effectiveness
Culture, People and Organization	Define and develop an organizational culture with processes and governance to support progress and achieve the flexibility necessary to achieve growth and innovation

Although the TM Forum’s DMM is endorsed by more than a dozen industry-leading CSPs, consultants, and suppliers, including Amdocs, the model is based on CSP self-assessment. This characteristic sets the TMF’s DMM model apart from other models in the communications and networking industries. And, these industries are replete with maturity models from various industry forums and telecom software suppliers. Amdocs has its own maturity model, which is explained in the next section of this report, along with Amdocs’ take on how microservices will play a significant transformation role.

⁶ For more on the TM Forum Digital Maturity Model, click [here](#).

Amdocs Microservices: One Step on the Transformation Journey, But Not the First Step

In developing a CSP solution strategy, no supplier relies on a CSP's self-assessment of where it is on the transformation trail. Assessing needs is what consulting and professional services teams are all about. The needs and capabilities of the CSP must be mutually agreed upon before a path to transformation can be set. And so, Amdocs starts with its CSP Cloud Maturity Model, which describes, as mentioned in the introduction to this report, the three journeys of infrastructure, applications, and people/processes. Amdocs then defines the path from physical, siloed operations to a virtual, fully-automated, cloud-native digital business.

To create, apply and manage its maturity model, Amdocs leverages its Cloud Center of Excellence (CCoE), which was created to assist CSPs in building their cloud and microservices roadmaps. The CCoE relies on collaborative teams across architecture, development, engineering, security and governance groups who gather and assess cloud capabilities and readiness. They also conduct testing and requirements gathering in relationship to business goals and objectives.

Amdocs used this methodology internally to employ its own cloud environment before taking on the solution consulting role with its CSP clients. The CCE helps determine factors such as:

- Where public or private cloud environments are the best fit for Amdocs' CSP customers
- Where automation can be implemented most easily and reliably
- Security concerns associated with cloud-based solutions and services
- What processes need to change and how
- How to protect revenue streams and ensure billing and charging are not adversely affected

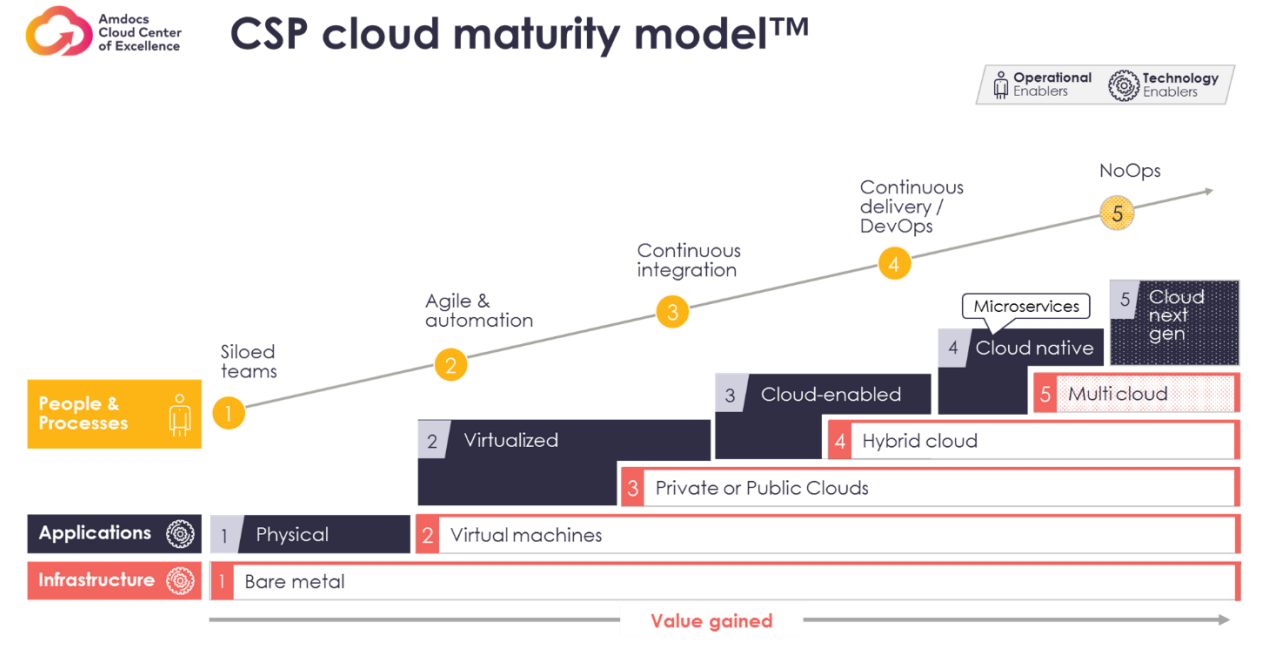
The maturity model takes analysis from the CCE teams to determine, at any given time, where CSPs are in relationship to each of the three journeys, and what part of what journey needs to move forward next. **At first glance, the cloud maturity model may appear as a mere needs assessment analysis. However, the application goes much deeper in that it compares the needs of each journey, prioritizes them, and determines, from a technology and compatibility standpoint, which capability must come first to enable the next step. Stratecast believes this model aligns with the higher level of complexity in transforming to virtual, software-driven, cloud-native autonomous networks.**

Models are one thing, implementation is another. Recently, Amdocs made a move to improve its ability to implement in new complex environments. Anticipating the specific skills required to help CSPs transition to a microservices architecture and beyond, Amdocs quietly acquired a company called Kenzan in 2014. Kenzan specialized in ideation, architecture, development, DevOps and implementation. The company's specialty is in development testing, project management, and accelerating software delivery.

Kenzan recently worked with a global media company on building and implementing a new social media platform to maintain and engage its audience. Kenzan built a new cloud platform for enabling applications to be more scalable than in the CSP's current physical data center. Using microservices, Kenzan built the architecture for a front-end portal, and implemented a platform for development teams to deploy applications continuously. **Kenzan provided platform architecture, front-end development, platform development, and project management. More importantly, Stratecast**

believes the company delivered the kind of project management and development skills Amdocs will need going forward as the company applies the three-journey process in its cloud maturity model. A high-level view of this model is outlined in Figure 1.

Figure 1: Amdocs CSP Cloud Maturity Model (High-Level View)



Source: Amdocs

As Figure 1 indicates, microservices come into play primarily after a CSP is cloud-enabled and is well on the pathway toward becoming cloud-native. Apps are disaggregated into microservices to support their requirements for agility. Amdocs sees three main drivers of agility for CSPs:

- The speed of business
- The ability to quickly make changes and develop new capabilities with a fast code-to-production cycle
- Total cost-of-ownership reduction and elasticity

The first applications that Amdocs disaggregated into microservices, based on these criteria, were Customer Relationship Management, Order Capture, and Catalog—three applications in desperate need of increased agility across the industry. Other applications of equivalent need, but much more complex, are in the monetization realm.

Taking its Own Journey

Mirroring the journey Amdocs is taking with its customers, Amdocs began its move to cloud-native and microservices architectures with the CES 9 release of its software platform in 2013. CES 9 focused on virtualization, as Amdocs became one of the first OSS/BSS suppliers certified on VMware. Amdocs also claims to have delivered the first virtualized real-time charging platform on

the VMware platform.⁷ Today, Amdocs continues to support hundreds of millions of subscribers with virtualized workloads.

In its next release, CES 10 in early 2016, Amdocs introduced a more cloud-enabled platform, which included the use of more granular virtual machines, more automation, more modular solutions and a full embrace of open source software. Amdocs had already embarked on its cloud-native journey with the launch of its Network Cloud Service Orchestrator (NCSO.) The NCSO is an open, catalog-driven solution for CSPs transitioning from physical networks to dynamic network-clouds. The orchestrator continuously designs, fulfills, and assures network services from any virtual network functions (VNF) supplier.

Amdocs' cloud-native journey continued with its microservices-based Digital Enablement Platform and catalog.

In 2013, the road leading through the lands of virtualization and software-defined networking was unclear. Microservices got barely a mention. Still, suppliers knew they would finish in the cloud, and began working on that assumption. All development work, until recently, served as a preamble, as more certain strategies began to coalesce in 2017.

Ready for Microservices

With the right platforms in place, Amdocs readied its microservices portfolio by setting some design principles. The company specified that microservices should:

- Be modular, reusable and organized around specific business/technical capabilities
- Standardize on technologies that accelerate adoption, improve quality and foster reusability
- Not include superfluous capabilities or unnecessary memory in order to retain simplicity
- Stay independent by being manageable and serviceable without impacting other microservices or affecting their performance
- Deploy, provision, operate, scale in, and scale out automatically

Amdocs' Digital Enablement Platform is the delivery vehicle for its omni-channel experience, and contextual and personalized engagements. The platform is open, modular, cloud-native, and microservices based. The platform also supports service & partner enablement, omni-channel engagement, and digital versions of catalog, care, and commerce.

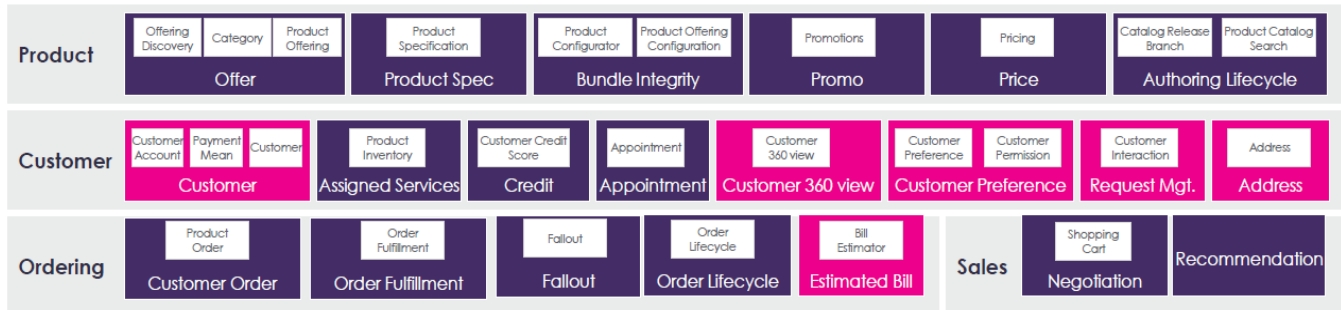
A key capability for the digital experience platform is providing care and commerce on every channel. This is where the decomposition into microservices begins. Stratecast believes Amdocs has the most well-articulated microservices stories so far within the CSP operational domain. One example of this decomposition is Amdocs' Commerce & Care

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⁷ For more on Amdocs' virtualized Real-Time Charging solution, click [here](#).

business domain, which is decomposed into nine granular, value-based business capabilities for agile, scalable, always-on and standardized processes called domains. These domains are: product, customer, ordering, sales, billing, engaged party, resource, service, and common domains. Domains are further segmented into sub-domains, and microservices. Connectivity to and from microservices is accomplished through open APIs, as shown in Figure 2.

Figure 2: Domains & Microservices: A Portion of the Care & Commerce Domain Map



Source: Amdocs

In the Product domain above, for example, the Offer sub-domain includes three microservices (so far): Offering Discovery, Category, and Product Offering. The decomposition process is fluid, as domains and sub-domains continue to be sub-divided. Each microservice can stand alone and be used with existing BSS, and for multiple service offerings. Amdocs’ Digital Enablement Platform ties the microservices layer and the integration and digital experience layers together to make them available to any BSS or channel application through open APIs. **Stratecast believes this level of integration and open APIs will help CSPs overcome their biggest obstacle to becoming the most essential component in the platform-based digital economy: being easy to do business with.**

Microservices in Action

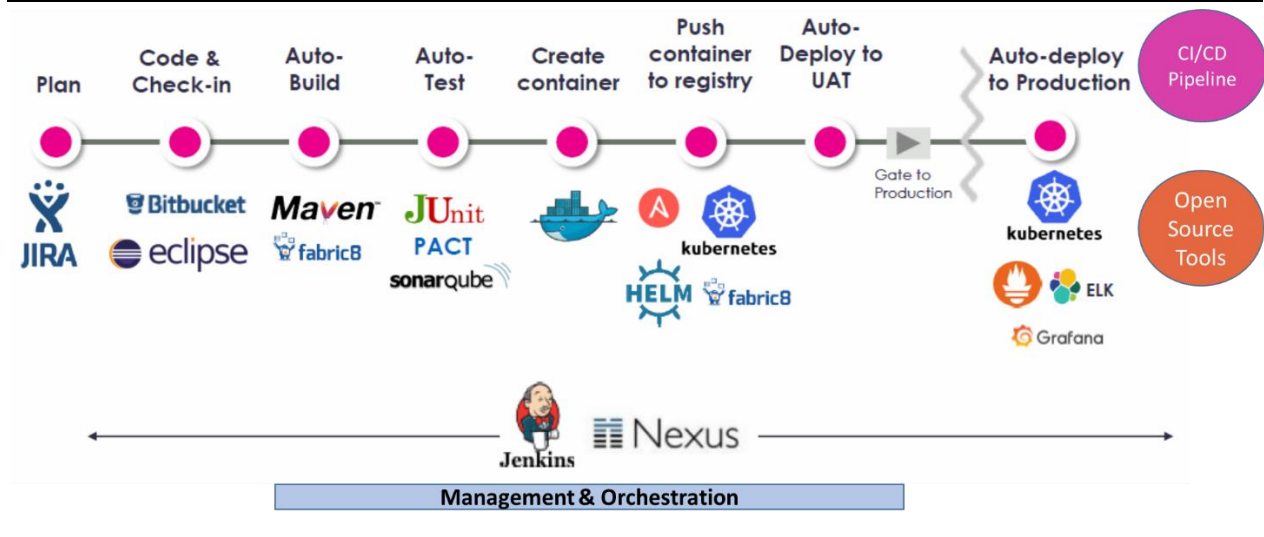
Amdocs has employed microservices in live service delivery. One example comes from a North American CSP—a mobile operator providing mobile device activation for a customer purchasing a SIM card. The solution relies on the domain-driven microservices design described above, and leverages nine microservices, including: Shopping Cart, Catalog Management, and Device Identification. The solution also leverages tools from open-source developers to create a fully-automated CI/CD pipeline, as well as the Amdocs Microservices360 framework for managing and orchestrating microservices. For CSPs using this approach, the expected benefits include:

Fewer call center inquiries

- An improved customer experience from a faster, automated process
- Increased agility and responsiveness
- Cloud-native capabilities

Figure 3, below, shows both the CI/CD pipeline and the open source tools used in scenarios such as the CSP example above, as well as from other service delivery requests. It also references Jenkins, which is used as a CI/CD orchestrator and manager.

Figure 3: The CI/CD Pipeline Using Open Source Tools



Source: Amdocs/Stratecast

Given Amdocs’ microservices architecture and deployment, its cloud maturity model, and full embrace of open source software and new best practices such as DevOps and CI/CD, the company has shown a navigable path to the future. The ideal of a cloud-native, virtual architecture supporting digital services with automation and agility appears attainable. The path is not yet paved, and likely never will be as unforeseen challenges are part of every complex transformation. And the number of paths that will ultimately be cleared will depend in part on aggressive strategies such as the one Amdocs has initiated.

Stratecast The Last Word

The microservices architecture presents an unnerving scenario for suppliers of operations and monetization software—similar to the one that network equipment manufacturers faced when the prospect of virtualization became a business reality for them. Software suppliers are now asked to disaggregate the systems that are the backbone of their business. The greatest concern in this endeavor, should they choose to accept it, is how to do so without sacrificing differentiation and adversely affecting their revenue.

Becoming integral to the processes and practices of CI/CD and DevOps can go a long way toward protecting the value of each microservice, sub-domain, domain, and the overall business domain. These practices are making suppliers such as Amdocs more valuable than ever before. The agility that microservices instill is too precious for CSPs not to push their suppliers to adopt this approach; so, it is best for suppliers to find the silver lining and go with this transition.

Stratecast believes Amdocs has one of the more fully-fleshed microservices strategies among its peers. Amdocs also appears to have fully embraced the open source community. For CSP operations departments, Amdocs has helped place microservices in its proper place within the transition to next-generation networks. There is much work still to be done in all three layers of the journey that the microservices architecture depends on in order to achieve its promise. Becoming cloud native is the most important example, so far—one step below the fully autonomous network. With the complexity of digital, virtual, and cloud transformation, it is important to know in what order to adopt new technologies. Amdocs' maturity model paints a good picture of this process.

Despite the attention that microservices have received over the last two years in the telecom industry, the technology is still in its early stages. This gives CSPs a little time to begin the hard work of cultural change in the meantime.

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About ODAM

The processes and tools that communications service providers (CSPs) have utilized to run their businesses have changed over time. More than a half-century ago, CSP network and business management processes were manual (OAM&P). As CSPs evolved over the years, so did the operations support systems (OSS) and business support systems (BSS) that address CSP business and network management needs. In recent years, the lines between OSS and BSS have become less clear, with much overlap. In addition, the roles in which OSS and BSS operate have expanded beyond traditional boundaries. As such, Stratecast now uses the term Operations, Orchestration, Data Analytics & Monetization (ODAM) to encompass both the traditional OSS and BSS functions and the new areas in which business and operations management must now work together, including virtualized networks and telecom data analysis.

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