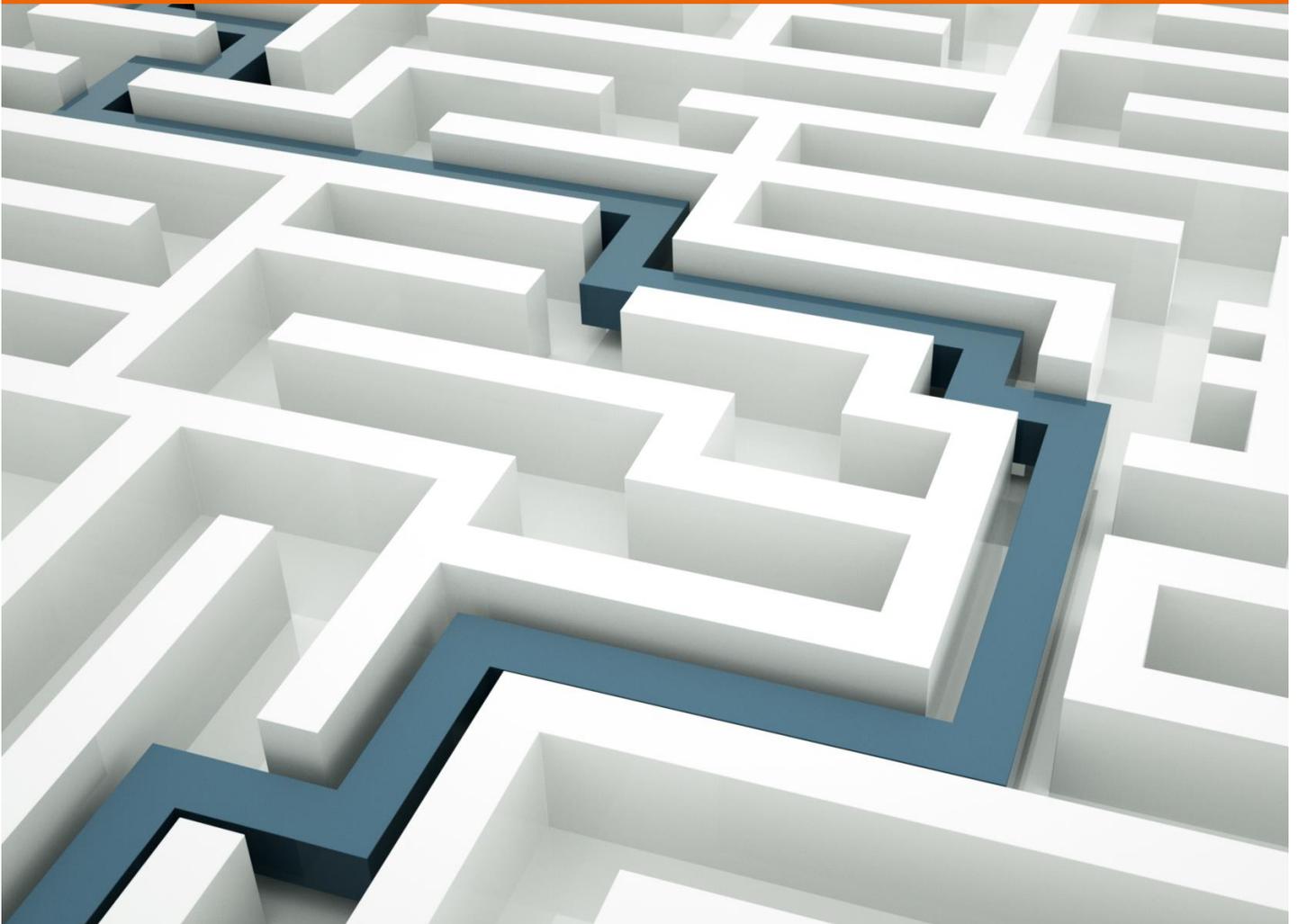February 2021

IBM Cloud Pak for Network Automation

Take a revolutionary path to 5G cloud native

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Why 5G and cloud demands automation

Intelligent automation is a pre-requisite for CSPs in their journey to remain profitable and relevant. Without it 5G will simply be more of the same.

5G presents a revolutionary time for Communications Service Providers (CSPs) to increase earnings, accelerate service innovation and reduce operational costs. However, many years into the software network "revolution" (NFV, SDN and Telco Cloud), CSPs have yet to truly achieve this potential. This report looks at what we need to make 5G a real success for CSPs, and how we can avoid 5G becoming yet one more over hyped technology.

Central to success is the need to adopt process automation throughout the lifecycle of a service. Process automation is central to the maximization of service innovation and the minimization of operational cost. Process automation is not new to CSPs, but it has tended to be focused at a slowly evolving network and network services. Automation combines continuous data inputs and orchestrated intent to meet business outcomes.

The whitepaper looks at the potential for IBM Cloud Pak for Network Automation, underpinned by Red Hat open source solutions, to revolutionize the way services are designed and delivered; how this can support CSPs in maximizing their opportunity with 5G.

Appledore believes CSPs face a choice in their journey to 5G: A revolutionary approach, which allows the CSP to move to a cloud native converged IT/Network or an evolutionary approach, favored by many network equipment providers (NEPs), that will potentially tie the CSP to be a network provider. We believe that IBM can enable CSPs to safely adopt this revolutionary approach to software-based network management. This will allow CSPs to benefit from the already demonstrated benefits of cloud native from other industries of higher innovation rate and lower operational costs.

The whitepaper is aimed at senior decision makers within a CSP.

Intelligent automation

"Any organization that designs a system will produce a design whose structure is a copy of the organization's communication structure." — Conway's law

In an observation that dates back to the 70s, Melvin E. Conway noted that system design tends to reflect existing organizational structure. In the move to networks that have software at their heart, deployed on the cloud, there is a danger that existing organizational ways of working, based on hardware, may prevent CSPs from truly achieving the benefits of software enabled networks like 5G.

The danger in many of the current evolutionary approaches to software enabled networks is that they bring with them the operational and organizational structures of existing physical networks. Particularly where many of today's virtual network functions (VNFs) continue to

resemble the monolithic physical network functions that they replace and where current limitations require these functions to be closely coupled to virtual machines (VM) and even to specific hardware. Even newer architectures, like ETSI MANO, to some extent bring with them existing operational methods: separation of infrastructure and function management layers, separation of fulfilment and assurance processes.

You can't simply try to automate the existing legacy processes.

AI-powered automation requires CSPs to understand the need to adopt a software development and management model and organization. You can't simply try to automate the existing legacy processes. Processes that were designed for networks that were based on hardware, where change in configuration and hardware is slow and often has to be manual. Where network upgrades are measured in months and years.

Cloud is moving at an order of magnitude more speed

For a sense of the disjoint between CSP network processes and IT processes it is useful to look at some numbers. Sysdig Monitor[1], which monitors container usage worldwide, estimates the majority of containers are alive for less than a week, with 49% of these containers living less than five minutes, and 21% of them living less than 10 seconds. This is not natural for hard iron networks that are installed and capitalized over years, with network upgrade lifecycles measured in months and quarters.

Investing in the factory

Traditionally, it has been very difficult for CSPs to innovate rapidly. For this reason, they have often found it easier to evolve existing systems for specific network technologies rather than invest in new platforms for rapid innovation (see figure 1). Systems that have often evolved in tandem with a particular technology and service continued to be used well past their sell by date. This will not hack it in the world of 5G and cloud.

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[1] https://sysdig.com/blog/sysdig-2021-container-security-usage/

Figure 1: Cost vs services innovated comparing traditional and re-use-based methods
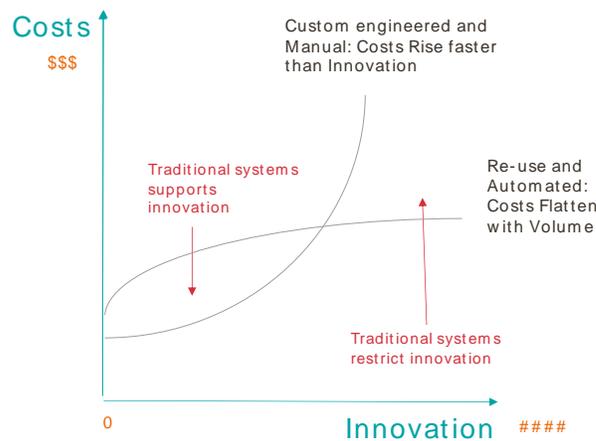
Source: Appledore Research "Cloud Native: A Revolution Postponed, 2019"

CSPs require an enabling technology to move from incremental automation on a semi-static number of products to a factory based approach where new services can be readily created from pre-defined components; and where new technologies and 3rd party components can be readily added as components, with each component enabling maximum automation encapsulated in the service.

Cloud Native is the road to 5G

"Ultimately 5G is about the move to software at the center of the network"

After a 40-year decline, CSPs are at a crossroads. 5G and network cloud technologies have the potential to change this. The combination of distributed workplaces, cloud-resident applications and data, self-managing technologies like SD-WAN and dynamic, "on-demand" capacity offers CSPs a credible opportunity to stem this slide.

However, this all comes at the cost of increased operational complexity and a rapidly changing dynamic network. By leaving things as they are, CSPs are faced with either an exponentially rising operational cost as more services are introduced or instead will be forced to limit service innovation to allow existing operational processes to continue working; effectively "nailing down" the new technology.

The reality of most 5G deployments today is that they remain 4G+, with increased RAN capacity enhancement tied to an existing 4G EPC. However, this will change in the future with the introduction of cloud native 5G standalone core and the disaggregation of the RAN with vRAN, and ultimately Open RAN. This will require the move to a truly cloud native software defined network. Current 5G can still feel like a traditional physical network and this favors the continued use of traditional network architecture practice. The future of 5G requires the move to cloud native software architecture practice.

Ultimately 5G is about the move to software at the center of the network. The only way CSPs can truly achieve both the innovation gains promised by 5G and maintain operational costs is by adopting a cloud software culture. Starting with software management approaches and adapting them for the telco. Not the other way around.

Central to this new thinking are:

- **AI-powered automation.** CSPs will need to move from implementing automation through fixed monolithic workflow to one where automation is achieved through the intelligent combination of encapsulated services.

- **Intent based automation**. CSPs with 5G need to focus on exposing and delivering "what" a consumer wants, not exposing the technological "how" it is delivered.

- **Operational changes**. CSPs with 5G will need to adopt new processes and approaches. Automating the wrong process goes nowhere and will block benefits.

CSPs are still very much in the early stages of cloud native thinking. Some of this is about inertia, but some is tied to the very real and distinct needs of networks. Today, most VNFs are still heavily tied to the underlying software infrastructure stack and even hardware. This is to address critical IO or throughput needs that still cannot be decoupled from software infrastructure or require direct access to hardware. These distinct needs can make it very easy to fall back on existing physical network operational approaches. However, this can also very easily mean that these physical operational approaches lock new technologies, like 5G, into the processes of the past.

IBM Cloud Pak for Network Automation

IBM is taking a different software-based path to 5G cloud native to enable the revolution.

IBM's approach to intent based service orchestration is built from an IT perspective and not from a traditional physical network perspective. It has been designed for IT cloud and CI/CD; not on the basis of an evolution of existing network practice. IBM Cloud Pak for Network Automation is an open, cloud native, technology/vendor agnostic solution. This means it is applicable, to a wide range of applications, technologies old and new, and across industries. Adopting the IBM approach means a CSP can be supported in moving to cloud native networks. However, more importantly it means that the ultimate business benefits of cloud native in terms of innovation and reduced operational cost can be fully realized.

"Closing the loop, between fulfilment and assurance, is critical for automation"

IBM has combined its existing assets and packaged them into an integrated, product; this includes their proven ML/AI technology and their Accanto Systems acquisition[2]. The new product can be applied to any domain or layer in a CSP network cloud. It can act as an end to end service orchestrator; as a lower layer generic-VNF/CNF manager, as a VNF/CNF Infrastructure manager or all of these. in many ways the hard distinctions between these layers collapses as you move to a truly cloud native software-based approach. Gone are the hard distinctions between infrastructure, network functions and end to end services; instead replaced by a flexible hierarchy of interconnected software services.
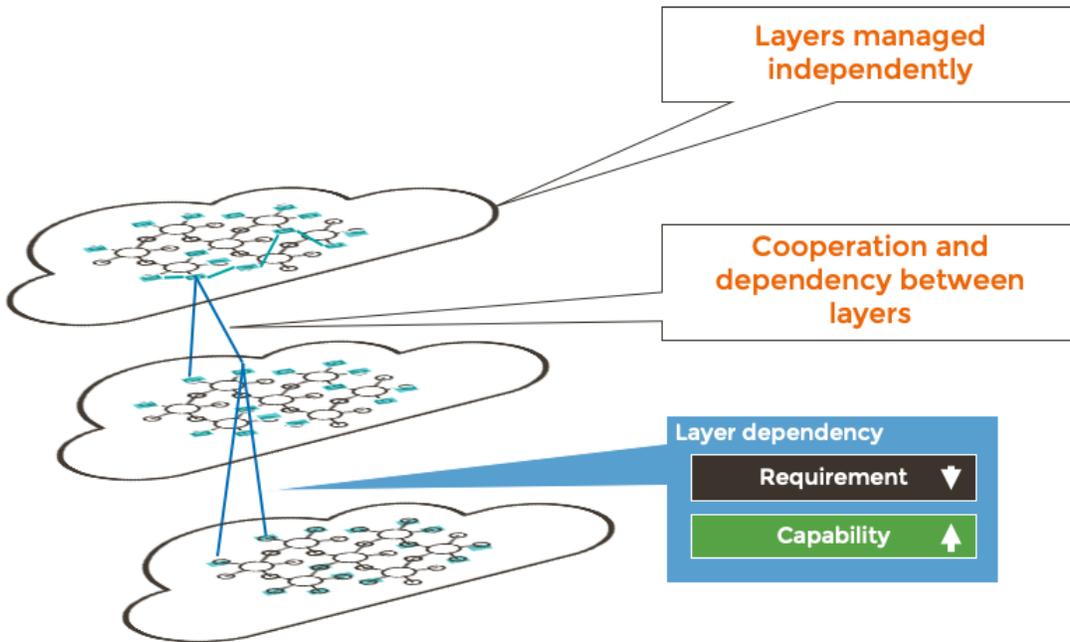
IBM understands that closing the loop, between fulfilment and assurance, is critical for automation. They have recognized the need for both assurance and fulfilment to share the same orchestration functionality. This means that there is a single process to develop, instantiate, scale, heal and eventually, tear down from the simplest VNF/CNF to the most complex service assembly. This approach allows re-use of "building blocks" (services) reducing complexity and cost over the long haul.

IBM Cloud Pak for Network Automation implements strict layering, and exposure of each layer to the next higher one as an abstracted service (see figure 2). Service capabilities are exposed upwards with change/need requirements exposed downwards.

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[2] http://www.accantosystems.com/accanto-transitions-their-stratoss-lifecycle-manager-business-to-ibm/

Figure 2: Complex dependencies abstracted across multiple cloud technology layers

Source: Appledore Research

A modular solution designed for IT cloud and CI/CD

IBM Cloud Pak for Network Automation provides a strong structured development environment. This provides tools to model workloads and services and to combine them into "assemblies.". Dependencies between services are defined declaratively with well-defined inputs, outputs and models. Services can be easily integrated into assemblies, with tools that select, configure and orchestrate resources, resolving conflicts in service dependencies.

Figure 3: IBM declarative modelling of service assemblies
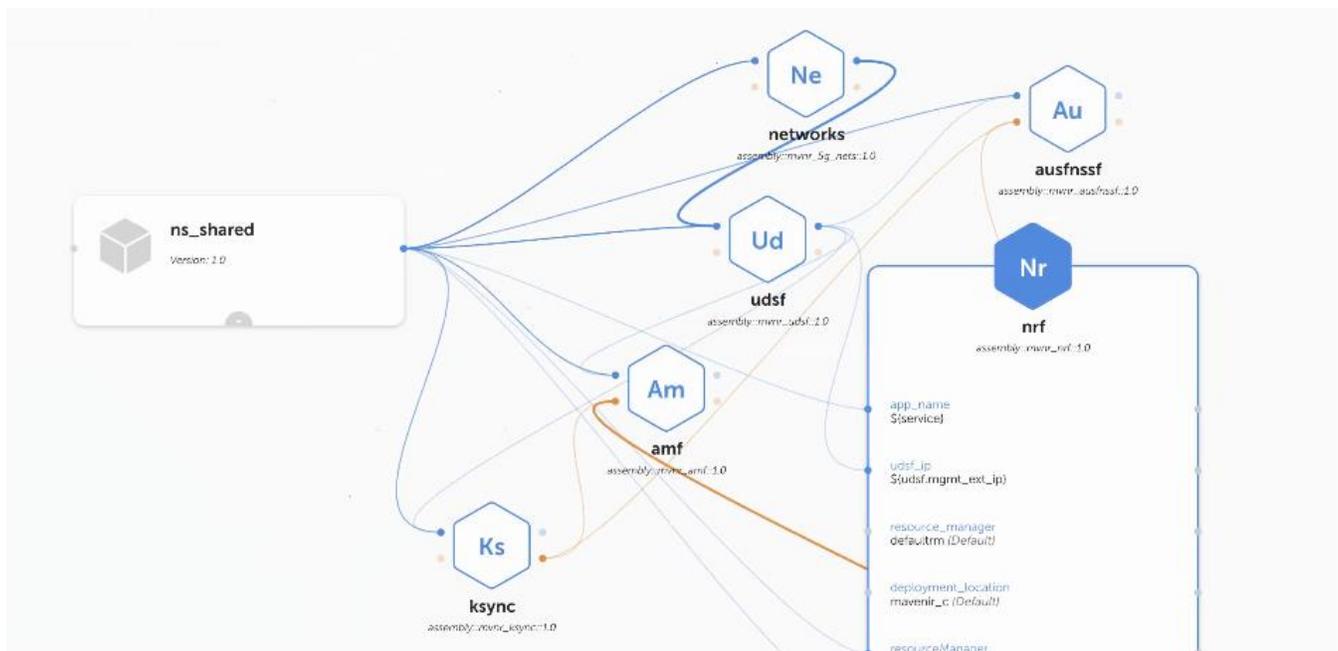
Source: IBM

The lack of a structured development environment has been a weakness in most CSP "OSS" developments for decades. IBM's solution ends this with a cloud native approach that encourages re-use, and which demands intent-based definitions that let "the machine" handle the specifics. Once defined/declared self-management is automatic with underlying complexity abstracted. It means that we can let go of specifics in other domains or layers and accept that they will meet an SLA for a service, not return a specific configuration that we demand.

Intent based modeling, in high level terms, results in models that provide latitude for the *other half* of the intent engine to choose the best solution from a wide range of instantiation options (for example, places and resource choices). IBM Cloud Pak for Network Automation decomposes a service assembly, configures all the dependencies needed to make it work, finds specific solutions, and orchestrates the instantiation. It also manages service healing and scaling in the same way.

Red Hat open source technology underpins everything

IBM with Red Hat provide a complete solution for telco network cloud. Red Hat provides an infrastructure capability both for VNFs on VMs and containers (CNFs). IBM believes that OpenShift® containers, under Kubernetes, is a strong enabler for CSPs making the transition from VNFs on VMs to containers. IBMs solution has been built and optimized for both Red Hat OpenStack and OpenShift. However, the solution is NFVI agnostic, supporting any required NFVI/VIM and the VNFs that depend on them. This is important because most VNFs today are still heavily tied to stack and even hardware. IBM Cloud Pak for Network Automation is designed

to work with PNFs, VNFs and CNFs, reflecting the ongoing journey to cloud native and the heterogeneous and legacy nature of networks.

IBM Cloud Pak for Network Automation is itself a fully container-based solution.

Putting it into practice

CEOs are now talking to IBM about business outcomes; a software approach to cloud native networks is getting attention upstairs

As a new product it is still early days but there is already significant success from the IBM approach.

IBM did an internal TCO exercise to compare their platform to an open source industry platform (OpenBaton). The results of this assessment, which were consistent with actual customer results, showed an 82% reduction in initial cost of onboarding new network services. Even larger savings were obtained maintaining those network services through normal lifecycle functions.

IBM and Red Hat have announced significant hybrid cloud deals with Indian operators Vodafone Idea[3] and Bharti Airtel[4]. In India, as elsewhere, data usage continues to grow rapidly but revenue and ARPU remains flat. By adopting a modern hybrid cloud architecture, based on Red Hat, both operators hope to be able to reduce operational cost and capital costs to meet this challenge. In addition, they hope to enable new valued services with a quick time to market through rapid on-boarding and integration of third-party services including gaming, remote media production and enterprise services.

Open source is proving itself as a key foundation for CSP flexibility. It promotes the ability to use any cloud infrastructure; Red Hat OpenStack for all network workloads and Red Hat OpenShift for newer containerized workloads. Open source is also enabling workloads to be deployed flexibly all the way to the network edge; allowing new services at the right network location and tier.

IBM is also allowing CSPs to redefine their relationship with NEPs. An Asian CSP has been able to transition to an environment where the only role for the traditional NEPs is to supply VNFs. Using IBM's solution, the operator has been able to completely disaggregate its network software stack.

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[3] https://newsroom.ibm.com/2020-05-11-Vodafone-Idea-Limited-Achieves-Major-Production-Milestone-with-IBM-and-Red-Hat-for-its-Open-Universal-Hybrid-Cloud-for-Network-and-IT-workloadsFor

[4] https://newsroom.ibm.com/2020-05-11-Airtel-Selects-IBM-and-Red-Hat-to-build-Open-Hybrid-Cloud-Network

"We were surprised and pleased that IBM were the only vendor to talk about orchestration without starting with ONAP or MANO"

IBM's solution is also enabling a US CSP to move beyond the strict frameworks imposed by ETSI MANO and ONAP. Blurring the boundaries, between what constitutes infrastructure orchestration and function orchestration, is enabling the flexible transitioning of network functions from VMs to containers as this becomes possible.

Conclusion

5G beyond access augmentation can only be a success if telecommunications adopt revolutionary cloud native processes and a management approach. Building and evolving existing physical network processes and OSS management approaches can only take us so far.

Without change telecommunications will remain a slow-moving industry that is increasingly a provider of dumb pipe connectivity. However, now CSPs have the opportunity to transform their processes to become efficient and agile.

IBM Cloud Pak for Network Automation is a strong solution that can enable CSPs to grasp the full benefits of 5G, underpinned by automation at scale.

For further information on IBM Cloud Pak for Network Automation visit ibm.com/cloud/cloud-pak-for-network-automation

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