

# Amdocs Intelligent Networking suite

## Cross-Domain Service Orchestration

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## INTRODUCTION

This profile is one of many in a series that accompanies our research stream on [Cross-Domain Service Orchestration](#).

Two of the key strands of Appledore's research are the need for **innovation and automation** – and that there are right and wrong ways to approach each. Innovation is not only about technology, but also about of *commercial* innovation. Myriad new revenue opportunities, from IoT, to private 5G, to “digital services” depend on new business models and the ability to quickly and inexpensively combine communications capabilities with those of industrial and commercial verticals. For example, CSPs must be able to sell “as-a-Service” and also to increasingly consume external capabilities “as-a-Service”, based on business need. In our recent research on [Telco as a Platform](#), we looked at the opportunity from the disaggregation of telco, outlining how telco in the future will increasingly be built from ecosystems of platforms, each providing disaggregated components of the network.

**Cross Domain Service Orchestration** is the single process that will create these new, end-to-end services and unlock incremental revenues. To accomplish this, orchestration must facilitate the agile combination of pre-existing “services” from within a telco *and from many external partners*. In this way, pre-built, pre-tested and loosely coupled building blocks become the basis of rapid innovation. By way of example, we are already seeing this model generate market success in the **revitalized enterprise market**, with SD-WAN, public cloud, broadband “underlay”, private enterprise resources and on-demand cloud-based network functionality chained together, dynamically. While built from the same “building blocks”, each of these customers' environments are unique, and in fact change dynamically. The market for private 5G, “network slicing” and servicing IoT consortia all promise similar opportunity with similar operational needs.

The common thread across all of these is that we cannot anticipate future services. Corollary to that, there will be many combinations and permutations of services that must be created and managed. Much of this innovation may occur outside our industry's control – by innovative enterprises and System Integrators in healthcare, automotive, advanced manufacturing, etc. Operational platforms must prioritize easy, fast and cheap innovation.

Simultaneously, new network technologies promise flexibility and efficiency on the one hand, and vastly greater complexity on the other. Both demand automation to first rein in cost, and then to achieve the cost improvements possible through cloud native and configurable, smart technologies such as 5G, SDN, SD-WAN and others.

These concepts are becoming widespread, and endorsed by standards, although the face of each “standard” looks different. The MEF (Legato and Sonata), TMF (APIs, Open Digital Ecosystem), and 3GPP (network slicing) are all working on implementations that focus on re-usable components, customized services, and integration with components in the outside world. This is true progress, and like most progress, is slightly messy if you look too closely and take each too literally. Yet we observe clear direction.

The cross-domain orchestration market is embryonic, and like all new markets, many suppliers are competing, and following different playbooks. NEPs come from one perspective, traditional “OSS” ISVs from another, the IT heavyweights from a third, and finally, there are several new disruptive entrants with unique propositions. Over time the market will work out what works, and what is popular. The critical take-away is that understanding the market may be more about “what are your needs and abilities as a CSP?” than about “which vendor does it best and cheapest?”. Why? Because there is not one answer or one approach (so far) that fits the needs of all. We strongly encourage interested readers to read our major Market Outlook Report, which dives into this market and forms a foundation within which this and other profiles are best read.

In this profile we look at how **Amdocs**, with its *Intelligent Networking suite*, proposes to deliver these capabilities. Appledore will cover individual domains (e.g.: cloud native orchestration for datacenters and edge), SDN, and SD-WAN in related but separate research tracks.

## AMDOCS INTELLIGENT NETWORKING SUITE

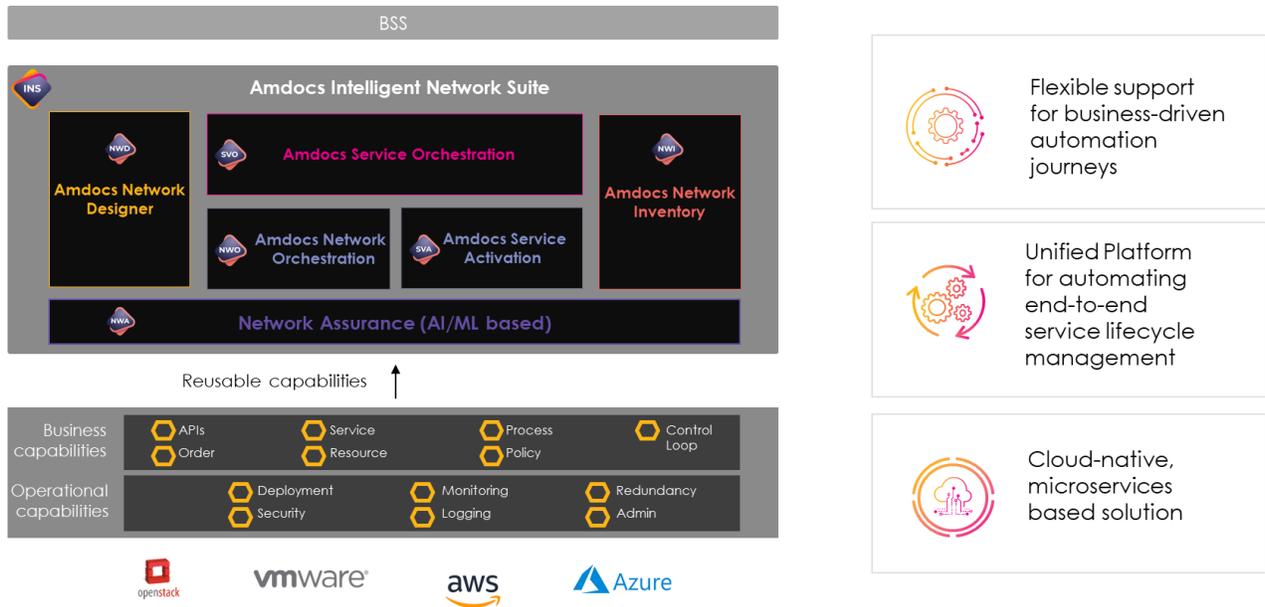
### Overview

Amdocs’ entry into the End-to-End (E2E) Service & Network Orchestration space is the **Amdocs Intelligent Networking Suite** (herein sometimes abbreviated “INS”), which provides lifecycle management of services that span multiple domains, technologies and clouds. The Intelligent Networking Suite comprises the following functional modules:

- Service Orchestration
- Network Orchestration
- Network Design
- Network Inventory
- Network Assurance
- Service Activation

Amdocs’ INS capabilities work closely with Amdocs’ BSS, including the product catalog, and their [Microservices360 environment](#).

Figure 1: Amdocs Intelligent Networking Suite



Source: Amdocs

Amdocs’ offering incorporates concepts that we regard as essential in a modern, next-gen, intent-based, cross-domain service orchestration, including ML-driven, closed loop automation (although it is a feature of this market that CSPs remain cautious about enabling this level of automation). Service design and creation is a strong point, as might be expected, with Amdocs reaping returns from its investment in ONAP.

In this emerging market of cross-domain service orchestration, Amdocs is playing to its traditional strengths, updated to tomorrow’s management environment – delivering a combination of service design, catalog, orchestration, charging and other functions, on an “a la carte” basis, wrapped in Amdocs’ traditional business model – a strong services and integration play.

## Positioning and Strategy

Coming from roots in BSS and OSS projects ranging from service fulfilment to inventory and activation, Amdocs has made dramatic changes to its forward-looking product line, branded Amdocs Intelligent Networking Suite. The first big change in Amdocs Open Network Division’s focus came when it positioned itself as the leading integrator for ONAP, where it already had significant experience working with its lead customer, AT&T. While ONAP has not taken the CSP world by storm, Amdocs has, from its ONAP journey, built a new set of hardened, supported modules that occupy much of the same space. As always, some modules seem to shine brighter than others, and Amdocs’ shows particular emphasis on its service design and creation product (Amdocs Network Design), which also supports deployments in conjunction with 3<sup>rd</sup> party service and network orchestrators.

Unlike NEPs, who traditionally approach operations from the network up, Amdocs approaches it, as always, from the “top-down” where the “top” is defined by orders (capture, management), and the

realization of customer's end-to-end needs, i.e., services. This falls squarely on in the cross-domain, service orchestration space, our focus for this series. Like others, Amdocs is following CSP's commercial needs, initially building out their solution in support of "SD-WAN+", where the "plus" involved myriad other domains from transport underlay to security/firewall, etc. Readers can learn more about Amdocs' specific approach to enterprise networking [here](#). They are also targeting emerging opportunities in the private networking and 5G network slicing spaces. Amdocs claims strong support for leading industry interface/API standards, and "ready" integration to leading 5G and transport vendors, including SD-WAN.

Since Amdocs understands that no solution is an island, and few are greenfields, they utilize their [Microservices360](#) platform to allow a modular approach to deployment, to building integration, and to adding "services" as needed. Amdocs also surrounds new service orchestration deployments, as needed, with modern charging and billing functions, traditionally another strong domain for Amdocs.

### Architecture and Capabilities

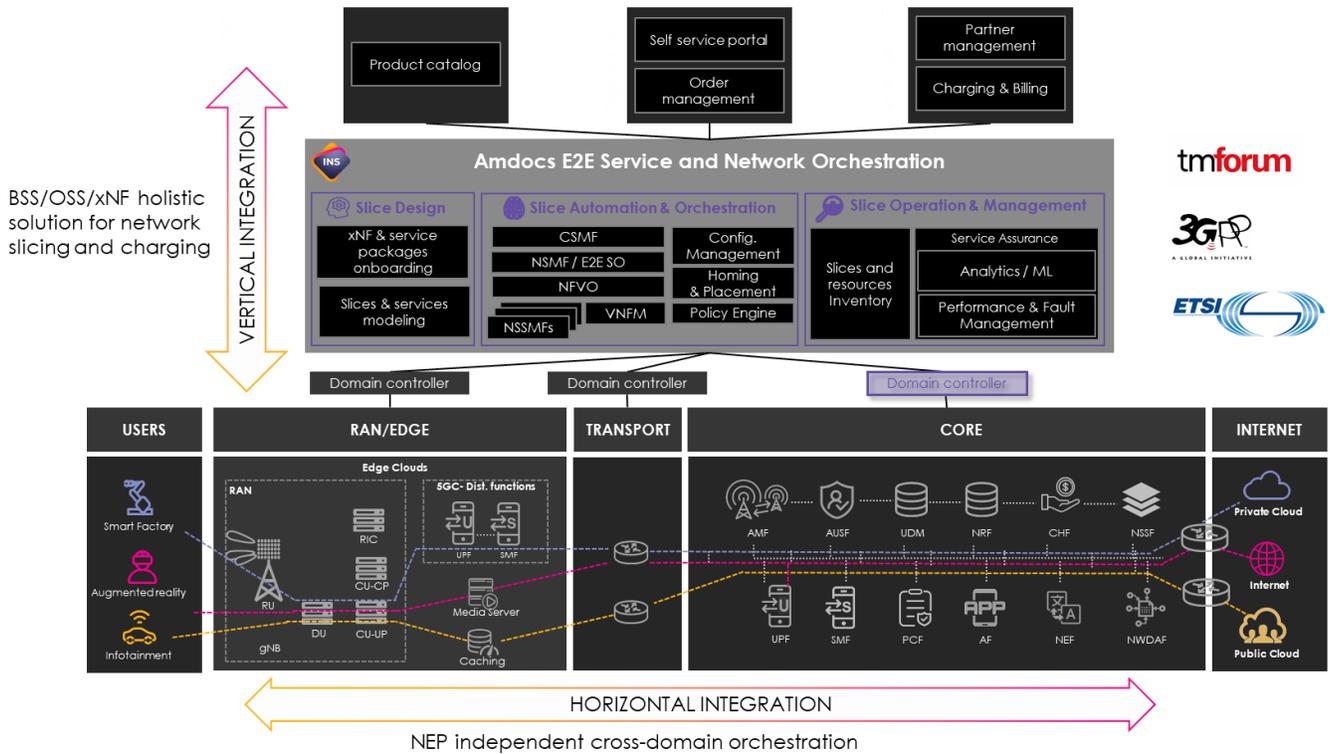
The packaging of Amdocs Intelligent Networking suite is relatively new as it stands, and yet the direction has been underway at Amdocs for years. (In fact, I recall discussions with one senior technical expert, who came to Amdocs through an acquisition, where he laid out their radical re-thinking: it was a dynamic, closed loop; this conversation was in 2015.)

Today much has progressed, driven by productization, intake of foundational open-source software from ONAP, and driven by the relentless guidance of customer need. The result is a modular solution comprised of a set of cloud-native products that may be deployed together or individually; in an Amdocs ecosystem or supporting third party software.

Focusing in on the operations that we queried each vendor on in our written survey and briefings, Amdocs documented support for all our best practices. These include automatic closed loop operation, declarative models and intent-based orchestration, model-driven operation, loose coupling to domains, and extensive adherence to industry standards. Some supporting information and diagrams are below.

The diagram immediately below illustrates Amdocs' intelligent Networking suite in context. We chose their 5G slicing diagram since it is the most generic and includes the most domains. It illustrates where Amdocs E2E Service and Network Orchestration solution resides and to what it interfaces, north, south, east and west.

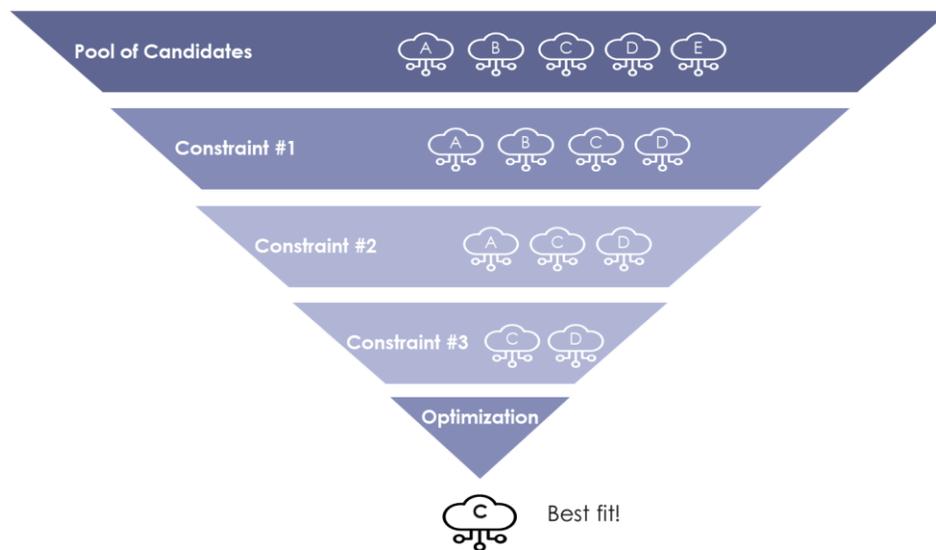
Figure 2: Amdocs E2E Service and Network Orchestration for 5G network slicing



Courtesy: Amdocs

Amdocs supports declarative operations in their solution, starting from its model-driven approach. Per the diagram below, Amdocs has algorithms (mostly rule-trees, per Amdocs, a solid solution) that find all or a significant number of valid solutions, and then find the best fit based on trade-off weights (e.g.: latency vs cost vs inventory scarcity). This is crucial to a solution that doesn't merely "find one solution" but considers that it may be charged with finding 1000s of instances and must use resources wisely.

**Figure 3: Declarative, Intent-based operations: finding multiple options and selecting the best fit**



Courtesy: Amdocs

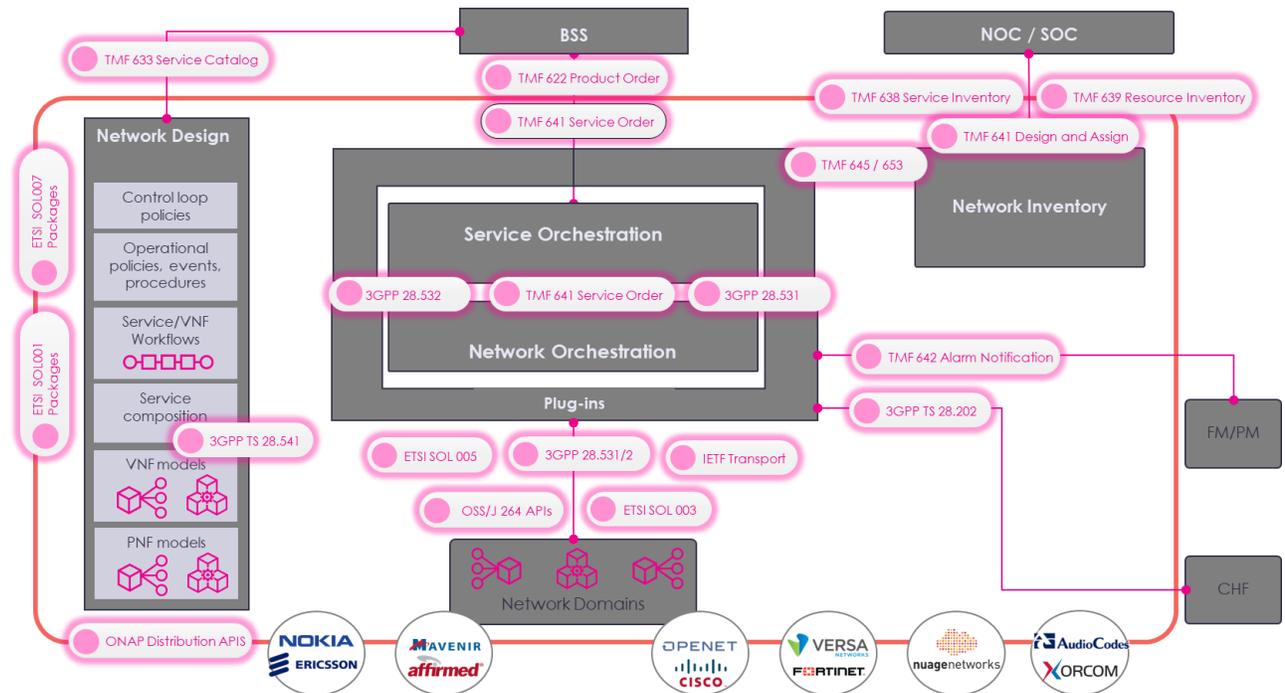
By definition, a Cross-Domain Service Orchestrator must interface to two or more, often many more, domains. Given that integration and re-integration has been the bane of our industry for decades, it is critical that a practical, low code, low risk solution adhere to industry interfaces (APIs) and build a library of pre-integrated partners. Amdocs supports the following list of standards and partners:

### Existing Standards, APIs and Integrations

- *Industry Standard APIs :*
  - TMF : 641, 642, 633, 638, 639
  - ETSI : SOL001, SOL003, SOL005, SOL007
  - 3GPP: 28.531/532/541, 28.552/554, 28.202/201
- *Pre-built integrations:*
  - vCPE/uCPE: RAD
  - SD-WAN: Nuage, Versa
  - Firewall: Fortinet, Palo-Alto
  - Mobile: Ericsson, Nokia, Mavenir, Affirmed, HyperBlox, Huawei
  - Network controllers: Cisco NSO, Juniper, RAD
- *Infrastructure as a Service:*
  - AWS, Azure, Google Cloud, RedHat, VMWare

It is worth noting that many interfaces from TMF are essentially a vessel only, and still demand the semantics for any request (e.g.: network service).

Figure 4: Modular, open suite that leverages standards



Courtesy: Amdocs

Overall, we see Amdocs evolving with the major industry trends of greater adherence to open standards, loose coupling via APIs, intent-based and closed-loop operations. Along with it comes many of the key design choices necessary to achieve those goals.

## The Broader Package: Traditional Amdocs Strengths & "Microservices360"

Amdocs has long been known for its projects to integrate its products into the large, heterogeneous, often unique environments of its customers. While the Intelligent Networking Suite moves to a much more standardized-product approach (a good thing), complex environments, legacy systems, and unique needs persist throughout CSPs' OSS/BSS environments. Moreover, Amdocs is a strong BSS player, with a large portfolio of billing, charging and order management software – all of which is at least impacted, at most crucial, to implementing new business models.

In those complex environments, Amdocs retains its ability to manage and deliver customer solutions on-site, and to surround their E2E Service and Network Orchestration solution with requisite charging and order management software.

One example from Amdocs: *"In a cross-domain service orchestration project for a major US Tier1, Amdocs is also acting as a lead delivery engineering and SI partner on the project, delivering the*

*real-time “charging trigger function – bringing in yet another historic Amdocs strength – billing and charging.”*

One interesting twist is Amdocs’ Microservices360 environment (linked above). Using Microservices360, Amdocs can deliver integration code, charging code, etc. as small, loosely coupled and re-usable modules. While we have performed a detailed study of their deployments, we expect that this allows Amdocs to write relatively small “services” that tie new processes to old, or add incremental functionality, without diving into the existing spaghetti.

## **Competition and Market**

Amdocs Intelligent Networking suite competes with a wide range of competitors, large and small. These range from the major NEPs (**Ericsson, Nokia, Cisco, Huawei** ...), to large IT firms (**HPE, IBM, Oracle, ...**) to other telecom ISVs (**Netcracker\***, ...) to the many specialists and innovators that are not only challenging, but in some cases establishing significant beachheads (**Itential, Inmanta, ...**).

As we discuss at length in our recent Market Outlook Report on the Cross-domain Service Orchestration market, we are seeing significant segmentation with players that offer different combinations of product strengths and delivery/services strengths, such that choice is often a matching of a supplier’s packaging and emphasis to a CSP’s unique needs and aspirations.

## **MARKET IMPACT**

### **Cross Domain Orchestration: An embryonic market in transition**

The cross-domain service orchestration market is embryonic but forecast to grow rapidly over the next 5 years. This is in part explained by the innate conservatism of CSPs, combined with the very real complexity of their network and operational environments. This creates an apparent paradox for those who scrutinize this market. On one hand, the vast majority of suppliers claim very advanced technology and capabilities that support automation, and the quality of responses over the past 2+ years has risen dramatically – from primarily workflow-based solutions to true, intent-based, closed-loop capable, solutions. Yet, on the other hand, the reality of commercial deployments does not yet demonstrate these levels of sophistication. We are clearly on a journey, and operators are proceeding cautiously. To be fair, such radical change is not only complex, but also labor-intensive, so this ought not be entirely surprising.

From the examples we have seen across all suppliers, many operators are testing technology before they turn on full automation and, so far, are orchestrating across only a limited set of domains. As further evidence, back in 2018 we noted that while many leading CSPs had big plans to transform their SDWAN businesses into dynamic, multi-service, on-domain powerhouses, in reality they initially had no automated cross-layer assurance, nor automated healing – to say nothing of proactive healing! The good news is that by the time we revisited in 2020, many of these omissions were implemented or in the process of being implemented. The bottom line is that we must treat these evolutions as works-in-progress and anticipate course and speed with confidence that the industry will in fact continue to progress.

The table below provides evidence for Amdocs' progress in the CDSO market, specifically those deployments that meet Appledore's criteria for modern, next-generation and *cross-domain* service orchestration. According to Amdocs, these deployments, selected from their larger universe of customer engagements, best reflect their market success in true, cross-domain orchestration employing modern automation methods. Note that the scope of our report and this list omits in-domain orchestration (for example, those entirely in the IP, transport or cloud/datacenter domains).

**Figure 5: Amdocs CDSO Market Deployments, (no legacy), as of Q4 2021**

<u>Operator</u>	<u>Amdocs deployment summary</u>
<b>Asia-Pac Tier 1 (NDA)</b>	Consolidation of multiple siloed B2B services OSSes into a single unified CDSO solution that orchestrate Enterprise 4G/5G mobile services, collaboration/UC, fiber / internet access services, IoT services, and SD-WAN, Network as a Service (NaaS).
<b>Globe Telecom</b>	Automate and simplify virtual network services and enable expansion beyond large enterprises to SMBs. CDSO solution an agile, multi-vendor system that includes SD-WAN, security (vFW), VoIP and anti-DDoS functions. Various functions and services are deployed in disparate environments, but unified by Amdocs E2E Service and Network Orchestration.
<b>SES (GEO/MEO satellite + terrestrial transport)</b>	Automates highly available network, security and other virtual value-added services. Single end-to-end service and network orchestration solution spanning multiple domains and technologies, and imbeds 5G capabilities within satellites in compliance with 3GPP. Amdocs E2E Service and Network Orchestration solution is deployed on Microsoft Azure.
<b>European OpCo</b>	CDSO of their enterprise network, communication and value-added services network and service operations. Integrated with Ericsson, AudioCodes, Versa, RedHat and Cisco domain controllers.
<b>USA Tier-1 (NDA)</b>	Amdocs Network Design product is deployed – in conjunction with 3 <sup>rd</sup> party orchestration - for this client's 5G service orchestration platform. Amdocs Network Design is used to onboard all PNFs/VNFs/CNFs using standard structures and information models. This suggests a designer module CSPs seek out independent of other orchestration choices.
<b>&gt;10 5G service and slicing PoCs (various, most under NDA)</b>	Amdocs E2E Service and Network Orchestration is, across these PoCs, integrated with 5G Core domain managers from Nokia, Ericsson, Affirmed Networks and Huawei, as well as with 5G RAN systems from Nokia, Airspan and Ericsson. These PoCs cover design, instantiation and LCM and operation of eMBB and URLLC Network Slices for various use cases including: Cloud Gaming, V2X, Smart Manufacturing, IoT, AR/VR and others.

Source: Appledore Research, Amdocs

The evidence above covers a wide range of scenarios and, technologies aside, illustrates a trend toward consistent methods and environments for all services and vendors. Without this, true innovation, e.g.: APIs exposing NaaS capabilities into digital services environments, is not feasible.

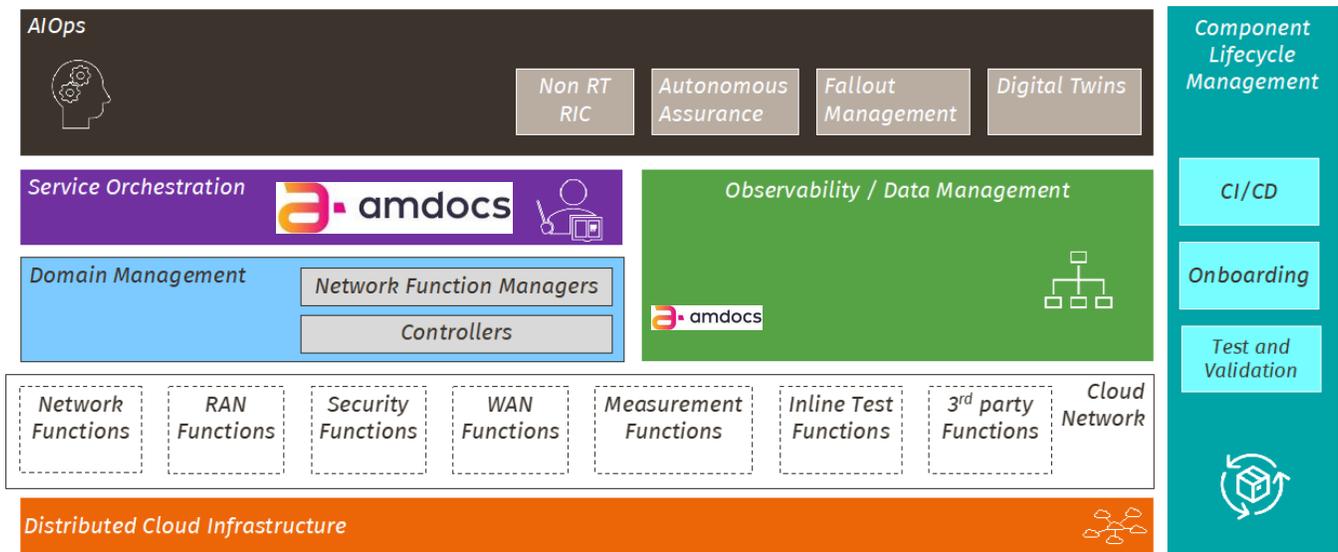
We note coverage of 5G, 5G network slicing, SDWAN+ and diverse transport technology unification as evidence of progress.

## APPLEDORE ANALYSIS

In the Appledore Network Automation Software Taxonomy diagram below, Amdocs' Intelligent Networking Suite occupies the service orchestration box. Yet, as noted above, this is really a suite of products, both closely associated (such as a dependency graph/unified inventory, and service design environment) and more distant (such as charging and order management capabilities that may surround CDSO. Some of those fall outside our network automation taxonomy.

Amdocs documented support for many of our “best practices” such as proper closed loop design, declarative operations, declarative model-driven service definitions, loose coupling and domain driven design. These should go a long way to supporting agility, innovation, and integration with 3<sup>rd</sup> parties which is increasingly both a practical necessity for CSPs and an opportunity for revenue growth.

**Figure 6: Amdocs Intelligent Network Suite in the context of the Appledore NAS Taxonomy**



Source: Appledore Research

## SWOT

### Strengths

- Strong on service lifecycle aspects.
- Integrated suite, using TMF, 3GPP, ETSI standards.
- Breadth and depth of resources for complex projects.
- Microservices system and approach.
- Standards and opensource credentials (from ONAP).
- Tier 1 name recognition.

- Strong service design module.
- Good references on modern service-chain (multi-cloud) type services and 5G slicing
- NEP-independence.
- Intent-based orchestration driving automatic closed-loop operations

### Weaknesses

- Fewer strong references than rivals specifically in cross-domain service orchestration; specifically, fewer Tier1s.

### Opportunities

- Become the leader in cross-cloud service chain type services, especially with 3rd party cloud components.
- Exploit service design and essentially monetization assets to position Amdocs as the “commercial service implementation firm” – jumping over technical aspirations.
- Significant installed base of related products to expand from – and from commercial/service layer down or OSS up.

### Threats

- Competition for tier1 business is intense with competition from innovators, IT giants, newly and modernized NEPs.
- The open, loosely coupled world loosens Amdocs’ traditional incumbencies.

## SUMMARY

With its CDSO suite, Amdocs has endeavoured to embrace closed loops, declarative operations, standardized interfaces, and a much more standardized-product approach – all of which contribute to far more efficient operations and reduce maintenance/re-integration. In its position as an ISV, Amdocs emphasizes its ability to work across vendors. While most vendors today claim a similar capability, and in product demonstrate open interfaces, the politics of competition and confidential features will always make collaboration between two competing NEPs difficult. This positions Amdocs well in those places where myriad suppliers/NEPs must be accommodated – such as CDSO and, for another example, dynamic, AI-driven C-SON.

In terms of market evidence, Amdocs’ deployments tell a more incremental story. This is not uncommon – and was seen in many vendors, driven in part by the early stage of the market, and also by the innate conservatism of many CSPs’ deployments – which are moving cautiously to hands-off automation, and talking domain integration essentially on an “as needed” basis. We will be watching to see how these play out.

We expect that while CDSO is not Amdocs’ largest business, it may in fact be a crucial entry-point for Amdocs to begin new transformative processes that will pull in its other software portfolio products, as well as its deployment and integration services. In this way, it is a strategic play for Amdocs, and CSPs may consider this broader portfolio as part of their partner evaluation.

Amdocs' approach to the market is practical, like many others, driven by CSPs' commercial priorities. Where there is money, and a need for automation, there lies a need to be satisfied. Amdocs' early deployments supported the SDWAN-led portfolios that we have covered extensively elsewhere. We now see them gearing up for what is anticipated to be the complexity and financial opportunity of 5G network slicing.

In the end, Amdocs E2E Service and Network Orchestration solution is a strong CDSO offering, especially for modern multi-cloud-based services, though in an increasingly crowded and competitive market. We believe that more and more, success will be determined by the broader package and how well suppliers reduce the cost of deployment, the risks associated and the end-to-end automation – which goes beyond the network. In that event, Amdocs wider capabilities and experience should be an important differentiator.



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