



# OVER-THE-TOP ORCHESTRATION WITH THE TELCO CLOUD

Abstracting multi-vendor, multi-domain,  
multi-cloud complexity

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*CoSPs have to keep up with fast-moving hyper-scalers that are rapidly taking on high-value network-related services over-the-top of the telecom infrastructure.*

The transformation of telcos to Digital Service Providers has been underway for the better part of the last decade. Progress has been slow as change is hard, particularly for large organizations and old industries. Despite some progress, time is not an ally for Communication Service Providers (CoSPs). CoSPs must keep up with fast-moving hyper-scalers that are rapidly taking on high-value network-related services over-the-top of the telecom infrastructure. Ironically, as global communications advance with each new generation of telecommunications technology, cloud companies and cloud-based startups are often the first to monetize the higher-speeds with compelling consumer and business services. The developer eco-system indirectly leverages advances in the telecom network, but the benefits primarily go to the Cloud and application providers.

Perhaps the greatest advantage of cloud service providers is that they are digital-natives and launched with horizontally-architected infrastructure, which allowed them to take on any vertical industry use-cases that required scalable compute resources – Infrastructure-as-a-Service (IaaS). Horizontal architecture also enables them to rapidly adapt to changes in the underlying network and pass those benefits through to their customers without disruptive refactoring.

CoSPs have realized that they need to become cloud-native and service-based, but change is still difficult, time-consuming, and expensive. This is because CoSPs have pursued conflicting objectives. On the one hand, they have sweeping transformation agendas but on the other, they are guilty of reinforcing old notions of siloed domains and partitioned protocol layers. Legacy thinking from static, siloed, hierarchical, physical networks is an anchor that is holding back transformation initiatives. As the saying goes - culture eats strategy for lunch.

The shift to a decentralized, distributed network architecture will mean that all the elements of a network service at application, infrastructure or network layer will increasingly need to be accessed by APIs, which conceptually support horizontal representations. However, legacy thinking is still reflected in the software standards pursued by CoSPs. Despite the promotion of Open APIs, the siloed structures creep back in through implementations with concrete components and point-to-point integration.

Without a higher-level platform abstraction over-the-top of the APIs, CoSPs are simply trading tightly coupled physical infrastructure for tightly coupled virtualized infrastructure, which is why the promised automation and agility benefits have not been realized. In a recent blog post, we referred to this problem as the [Gordian Knot of telecom](#), which has manifested in many areas of the network and continues to frustrate the CoSP community.

*Instead of manually integrating CNFs on a static, one-off basis, a Telco cloud platform needs to include an abstraction that models OpenAPI and cloud provider API interfaces to support automation.*

While the CoSP community is building up Cloud expertise and container-based “cloud-native network functions” (CNFs), hybrid/multi-cloud and now edge deployments have compounded their headaches. There are no unifying models to help them work across silos and between layers, which constrains interoperability, end-to-end automation, and policy-based management. The industry is not going to break the knot by slowly untying it; they need an approach that swiftly cuts through all the complexity.

Incremental, conservative approaches are not sustainable as telcos face increasing economic and competitive pressure to monetize their 5G investments. A high-level platform abstraction would present a horizontal logical model, that conceptually flattens and unifies their networks while still supporting existing brown-field environments. It would give them a future-forward and backward compatible architecture so they, like Alexander the Great slicing through the Gordian knot, can creatively solve an otherwise intractable problem.

## **IN SEARCH OF THE TELCO CLOUD**

Telco cloud is not a product category, it is really a platform use-case. For the purposes of this paper, a telco cloud platform is a unified solution that addresses CoSP interoperability and automation pain points to facilitate the transformation to Digital Service Providers. The mission of a telco cloud platform is to enable a composable, catalog-driven, intent-based Telco.

The key to achieving the mission is abstraction. Instead of manually integrating CNFs on a static, one-off basis, a Telco cloud platform needs to include an abstraction that models OpenAPI and cloud provider API interfaces to support automation. A harmonized telco domain model would allow developers to declaratively compose services using standards, while the platform runtime automates the deployment on a target host and late-binds the elements as a background process. Abstraction for interoperability would eliminate tedious system integration work and accelerate service delivery.

Of course, there is no magic here. Actual complexity does not go away, it is merely hidden from view so developers can focus on the business. This new telco cloud abstraction layer would de-couple CoSP customers from implementation details so they can compose network services from functions in a catalog, identify a target host and set policies for its expected operations, without worrying about “how” that is to be achieved. When new orders come in, the telco cloud platform is responsible for fulfilling the service on Day 1 and enforcing the policies on Day 2 and beyond.

This separation-of-concerns insulates customers from network volatility and change. They declaratively describe “what” they want, not “how” it is done.

**A telco cloud must abstract across domains (RAN, Core and Transport) as well as layers of protocols (OSI 1-7) so that it can provide a single logical model of a CoSP's operations.**

Behind the scenes the operator now has newfound flexibility to implement the service with any combination of vendors and hosts as long as it satisfies the service level agreements. These decisions can be automated based on context of the service and internal policies. It gives CoSPs the freedom to evolve the network, onboard innovation and flexibly leverage Cloud partners so they can continuously optimize their operations.

To deliver on this objective the Telco cloud platform must meet the following criteria:

- It must expose a domain-neutral, infrastructure-independent, protocol-agnostic, and developer-friendly interface that supports any use-case over any environment. The platform would present a simplified interface to enable new capabilities and improve developer productivity to speed and ease service delivery.
- It needs to be lightweight, scalable, performant, and distributable so that Telcos can have a common technology to rationalize solution architecture, streamline new deployments, promote interoperability and provide a consistent developer experience across diverse environments (i.e., bare metal, virtual machines, and containers, as well as hybrid/multi-cloud and edge).

A telco cloud must abstract across domains (RAN, Core and Transport) as well as layers of protocols (OSI 1-7) so that it can provide a single logical model of a CoSP's operations. It would have to capture a general Telco information model (semantics) as well as the knowledge of systems environment (syntax) so that it can understand the "what" and handle the "how." It would provide the necessary metadata and relationships to support discovery, composition, automated deployments and intent-based network and service management. Importantly, it is the scope of the model that defines the scope of intent.

While it sounds daunting, every existing CoSP has an information model, which is usually a mix of standards-based concepts and internal concepts specific to its operations. The problem is that the models are often implemented in a rigid and hierarchical manner, and they generally do not model the OpenAPI or cloud host interfaces to enable automated interoperability. As a result, services are manually integrated in static, one-off, siloed solutions that are hard to change and extend.

## **NETDEVOPS AND THE TELCO CLOUD**

The telco cloud as an emerging theme runs parallel to the nascent world of NetDevOps, which is the application of DevOps principles and techniques to network operations. This is very relevant for telco service providers, who are increasingly moving towards designing intent-driven networks where network configurations are increasingly "automated" and aligned with business

*NetDevOps is very relevant to telco service providers, who are increasingly looking for unified solutions that help them realize end-to-end automation and intent-based network and service management.*

objectives. NetDevOps frameworks will require features like continuous integration/continuous delivery (CI/CD), automated workflows, programmable infrastructure (as a Code), automated workflow management, state awareness and more.

There are several players who are active in this new space. Major players, in a non-exhaustive list, include companies like Amdocs, Anuta Networks, Ciena Blue Planet, Gluware, Itential, Juniper, Netcracker and more.

These vendors all operate across multiple domains and layers to varying degrees. However, many of these products were specialized to work over a specific set of domain elements and protocols. This is evidenced by the evolution of these products themselves. They generally hard code domain-specific functionality, making it hard to weave in new concepts into their foundations, which inherently limits the scope of intent-based network and service management.

In addition, to offer a complete solution most of these products depend on other tools such as message queues, event-brokers, API gateways, integration tools, workflow engines, etc. (i.e., a middleware stack). While an integrated solution may be comprehensive, the approach might be tightly coupled and heavy weight. This means that some of these products will likely not be appropriate for the edge, which demands lightweight, low-latency, high-performance solutions.

This white paper explores another NetDevOps product that took a clean-slate approach with its platform design that makes it stand out as a candidate for telco cloud.

## **ENTERPRISEWEB'S CLOUDNFV PLATFORM OFFERS A UNIQUE APPROACH**

EnterpriseWeb is a New York based software company. It was founded in 2009 specifically to address challenges of complex, distributed systems. This is well before microservices were trendy, before Kubernetes was publicly released, and before the cloud took off. The founders anticipated the need to work flexibly across domains and layers. They intentionally de-coupled functions from domain logic, so they could be dynamically configured for purpose, based on interaction context. The company built the solution from the ground up to ensure a holistic approach. They implemented the domain as a graph knowledge base and the middleware capabilities as event-driven functions-as-a-service before either of these technologies were widely understood.

*EnterpriseWeb can be deployed in each domain/layer as part of a modular, standards-based architecture, it can also act as an orchestrator-of-orchestrators and manager-of-managers*

## SOLUTION DESCRIPTION

EnterpriseWeb offers an industrial grade, no-code platform that supports complex distributed systems and event-driven processes. It enables end-to-end automation and agile business operations. The company has been a pioneer in telecom virtualization and automation initiatives. It led ETSI NFV proof-of-concept #1, "CloudNFV", which was the first solution to bridge IT and networking. It subsequently ran the first ETSI Zero-touch network and service management proof-of-concept. Now, it is leading an award-winning Intel 5G RAN testbed with Red Hat, Fortinet, Keysight, KX and Tech Mahindra, which was showcased at Mobile World Congress 2023, in Barcelona, Spain.

The company's CloudNFV solution is centered around the following key features:

- A graph knowledge base, which provides domain semantics and metadata for streamlined onboarding, declarative composition of intent-based services, automated deployments, and zero-touch management. The graph knowledge base provides a consistency layer enable unified discovery, interoperability and policy management across heterogeneous solution elements and diverse environments.
- The platform runtime is based on event-driven, stateless functions. These platform services represent a comprehensive set of middleware patterns for connection, integration, transformation, orchestration, configuration, and workflow automation (including human process). No third-party middleware is required (no queues, gateways, brokers, integration tools, orchestrators, workflow engines, etc.). The approach to handling middleware Functions-as-a-Service (FaaS) is inherently lean.
- The graph efficiently hydrates context for the functions, which are dynamically dispatched, configured and coordinate by the platform as background services. The domain abstraction drives the fulfilment, assurance, and operations of services for Day 0, 1 and 2 operations. The breadth and depth of the domain model supports the first intent-based system to cover a full-scope of NetDevOps. Without that, CoSPs are back into one-off silos.
- EnterpriseWeb's runtime abstracts implementation complexity so developers can focus on the business. Service designers only need to compose the service topology, declare service-chain and service level agreement policies, along with high-level preferences for latency, energy efficiency, etc. and the runtime takes responsibility to deploy and operate the service according to those policies.
- EnterpriseWeb replaces static, tightly coupled, vertically integrated automation stacks with a dynamic, loosely coupled, horizontally architected platform that is 100% configured by metadata. The most dramatic aspect of the CloudNFV platform is that it is lightweight (a mere 50MB), highly scalable and performant.

EnterpriseWeb offers an industrial grade, no-code platform that supports complex distributed systems and event-driven processes. It enables end-to-end automation and agile business operations.

The EnterpriseWeb platform’s capabilities are generic and applicable to many business verticals, it is the graph knowledge base that captures the domain logic. For its Telco solution CloudNFV, the graph knowledge base represents a ready-to-use, harmonized, standards-based Telco operational model. It includes concepts from 3GPP 5G and NEF, MEF LSO, LF CAMARA, O-RAN Alliance, TMF OpenAPIs, ETSI NFV, etc. EnterpriseWeb uses abstraction to enable interoperability. For vendors, which often have partially conformant or non-conformant interfaces, EnterpriseWeb maps them to the model. This enables CoSPs to design and manage using standards-based interfaces, without having to code the gaps, which is what causes all their system integration challenges.

EnterpriseWeb has built a solid ecosystem of partners like Intel, Red Hat, Fortinet, KX and Tech Mahindra. In fact, Tech Mahindra has OEM’ed CloudNFV as the orchestrator for their NetOps.ai solution. In terms of commercial adoption, EnterpriseWeb’s CloudNFV solution has been running in production in a leading Tier-1 operator for several years.

Telco Cloud Platform Competitive Landscape			
<b>Layer 7</b> Application layer	<ul style="list-style-type: none"> <li>EnterpriseWeb</li> </ul>	<ul style="list-style-type: none"> <li>EnterpriseWeb</li> </ul>	<ul style="list-style-type: none"> <li>EnterpriseWeb</li> </ul>
<b>Layer 5-6</b> Cloud infrastructure "above the cluster"	<ul style="list-style-type: none"> <li>Amdocs</li> <li>EnterpriseWeb</li> <li>Gluware</li> <li>Itential</li> <li>Juniper</li> </ul>	<ul style="list-style-type: none"> <li>Amdocs</li> <li>EnterpriseWeb</li> <li>Itential</li> <li>Juniper</li> </ul>	<ul style="list-style-type: none"> <li>Amdocs</li> <li>EnterpriseWeb</li> <li>Itential</li> <li>Juniper</li> </ul>
<b>Layer 1-4</b> Network infrastructure "below the cluster"	<ul style="list-style-type: none"> <li>Amdocs</li> <li>Anuta</li> <li>Ciena</li> <li>EnterpriseWeb</li> <li>Gluware</li> <li>Itential</li> <li>Juniper</li> <li>Netcracker</li> </ul>	<ul style="list-style-type: none"> <li>Amdocs</li> <li>Anuta</li> <li>Ciena</li> <li>EnterpriseWeb</li> <li>Gluware</li> <li>Itential</li> <li>Juniper</li> <li>Netcracker</li> </ul>	<ul style="list-style-type: none"> <li>Amdocs</li> <li>Anuta</li> <li>Ciena</li> <li>EnterpriseWeb</li> <li>Juniper</li> <li>Netcracker</li> </ul>
	<b>RAN</b>	<b>Core</b>	<b>Transport</b>

SOURCE: MANDALA INSIGHTS, VENDOR WEBSITES AND PROFILES

**In a telecom network, the ability to have a unified control plane to orchestrate services through a common technology platform can lead to significant OPEX and even CAPEX savings.**

While EnterpriseWeb can be deployed in each domain/layer as part of a modular, standards-based architecture, it can also act as an orchestrator-of-orchestrators and manager-of-managers, connecting all the domains and layers under a unified interface. EnterpriseWeb can also work in a federated manner, integrating with third party orchestrators and controllers in any combination. In this way, EnterpriseWeb can fill gaps in an existing brownfield solution.

## **ENTERPRISEWEB OFFERS INNOVATION THAT CUTS THROUGH THE GORDIAN KNOT OF TELCO COMPLEXITY**

EnterpriseWeb's CloudNFV aligns closely with the requirements and mission of a telco cloud platform. It offers high-level abstractions and common tools across environments to support a composable, catalog-driven, intent-based telco. It should be particularly compelling to the telecom industry. The company's focus on a cross-domain, cross-layer integration and automation will help telcos to abstract away the complexity and deliver true end-to-end services.

In a telecom network, the ability to have a unified control plane to orchestrate services through a common technology platform can lead to significant OPEX and even CAPEX savings. OPEX savings will come from automated cross-domain orchestration, while CAPEX savings will come from rationalized solution architecture.

This unique and potentially disruptive approach can be an enabling technology for telcos who are deploying 5G networks. For example, one of the core promises of 5G was the concept of network slicing, through which an operator could quickly create slices of their network customized and optimized for different customer segments. As of today, network slicing has made limited progress due to the problems we have outlined in this paper. However, a Supercloud approach with middleware as a service will go a long way to breaking through the current bottlenecks in the modern telecom network.



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## ABOUT MANDALA INSIGHTS

Mandala Insights is an independent analyst firm that offers insights, opinions and research on the network technologies that will drive the next billion digital opportunities in Asia.

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