



Delivering 5G Services with Oracle's Service and Network Orchestration

Oracle 5G Now enables service providers to co-create and orchestrate innovative, on-demand 5G service and network experiences tailored to the unique needs of specific industries

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INTRODUCTION

Service providers around the world are deploying 5G networks – either to address newly identified revenue opportunities in their core or new vertical markets or as a defensive measure against their service provider competitors and private 5G network providers.

Omdia, in their report “2020 Trends to Watch: Telecom Operations and IT (Dec 2019)” stated “*Reducing operations cost and complexity, as well as getting to grips with the systems required to manage and monetize 5G are expected to be the top two business challenges for 2020*”. They went on to state “*5G network investment and the imminent arrival of complex 5G service models is concentrating minds about the need to put new systems in place to support them*”.

This paper and [associated showcase video](#) outlines how [Oracle's Service and Network Orchestration \(SNO\) solution](#) helps service providers accelerate the delivery of 5G services – **Oracle 5G Now**. These could be to end consumers and enterprises over various pre-configured 5G network slices, or in a co-creation model with enterprises in which tailored network capability may be designed and instantiated on-demand to support network-intensive solution propositions into specific industries.

There are a number of such orchestration scenarios which are summarized below.

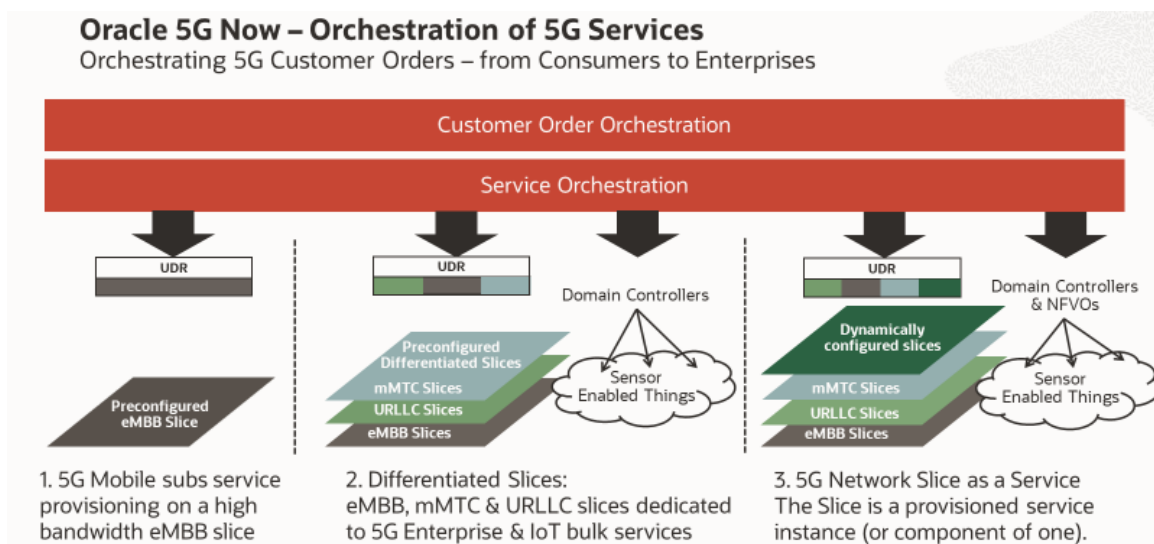
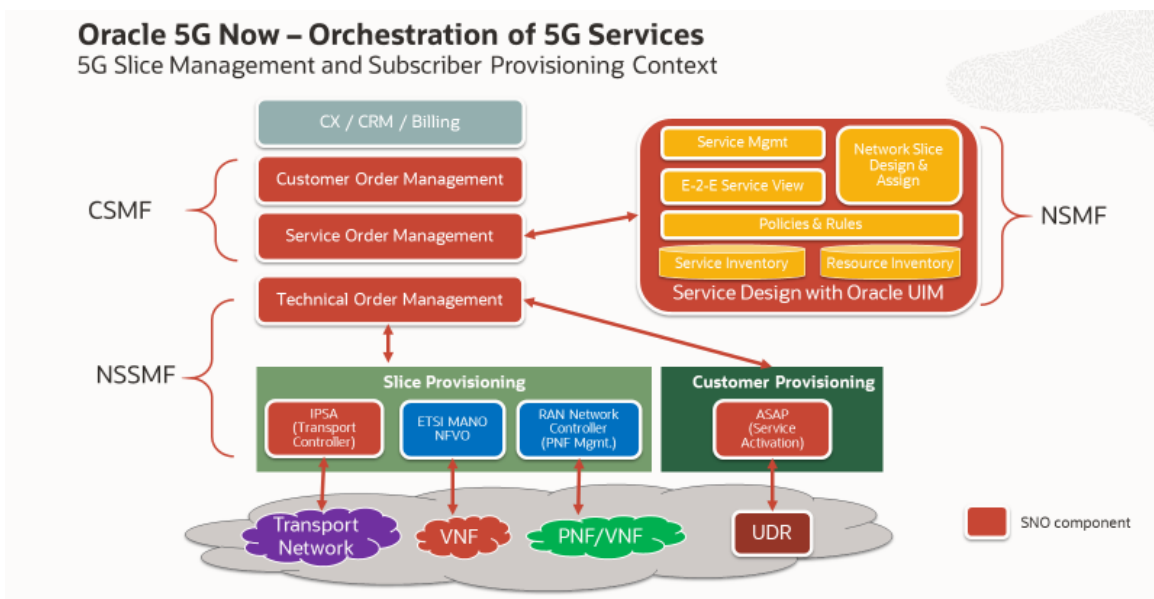


Image Caption 1. Customer order orchestration use cases.

Oracle's SNO fulfills the 3GPP roles of CSMF, NSMF and aspects of NSSMF in conjunction with underlying orchestrators and controllers., This is depicted below.



ILLUSTRATIVE 5G SERVICE SCENARIO

To bring **Oracle 5G Now** to life, let's consider a scenario in which a service provider (Supremo) is looking to create and grow new revenue streams by partnering and co-creating new and differentiated 5G enabled services using 5G's unique capabilities, like network slicing. Here, Supremo partners with a football league (La League) to stream this season's games live in virtual reality using in-stadium 5G-connected VR cameras that deliver an immersive VR "in-stadium" experience to viewers at home or at locations outside the stadia. Supremo works with La League to design and instantiate a dedicated high speed, low latency 5G network slice for La League services together with the service bundles themselves. Using the La League VR app, Supremo and La League customers can subscribe to watch the game and enjoy a number of enhanced interactive options – from home in real time with a guaranteed 5G lag-free experience.

Let's first consider how an end customer would subscribe to this offering and how Oracle's SNO solution supports the configuration of their ordered services. Then we will take a look behind the covers at the co-creation aspects of the immersive VR "in-stadium" experience and how Oracle SNO helps Supremo rapidly design and instantiate 5G network slices to support this innovative service offering during its lifespan.

5G SERVICE ORCHESTRATION

The end customer selects this immersive VR "in-stadium" experience which is comprised of 3 products on their order:

- High speed mobile broadband service (which will be delivered on an existing 5G eMBB network slice)
- VR add-on service (which will be configured on the 5G URLLC network slice that was pre-provisioned explicitly for Supremo)
- VR headset (that may include an eSIM) to be shipped to the customer

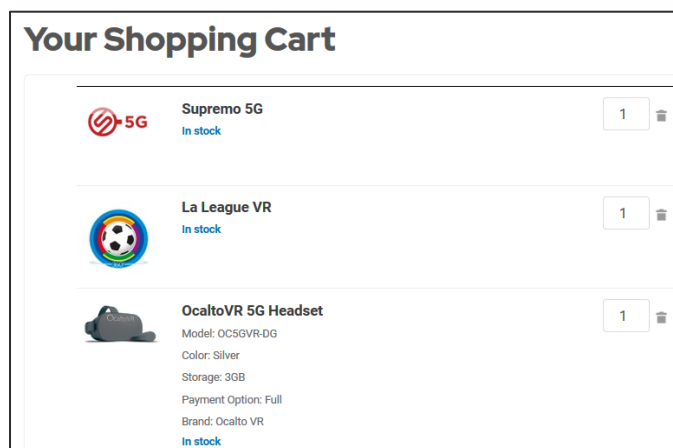


Image Caption 3. End customer shopping cart.

Customer Order Orchestration

Once the order is captured, the Oracle SNO order orchestration component (OSM) will examine the product line items on the order, determine the fulfillment dependencies and steps to be executed for each line item and then dynamically create and execute a customer order orchestration plan to fulfill the customer order – in this case it may:

- Create the customer account in the billing system for a new customer (and will also update the billing system as the customer order is fulfilled to turn on billing for specific services once they are successfully fulfilled – an important capability for longer lived orders (such as in B2B))
- Ship the VR headset to the customer
- For fulfillment of services against the network, calculate one or more service orders that contain customer facing services that have been derived from the product line items and actions on the order

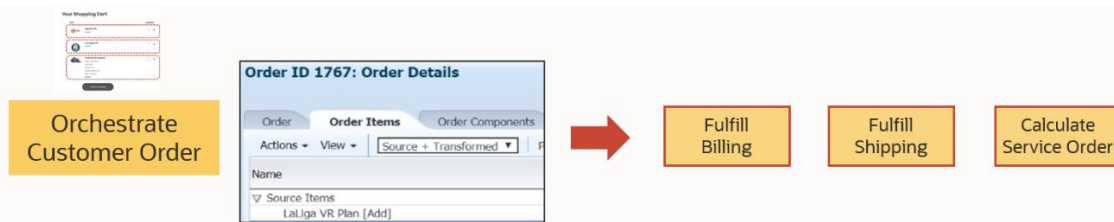


Image Caption 4. Customer order orchestration.

Service Order Orchestration and Intelligent, 5G-aware Service Design

The service order(s) containing customer facing services are then orchestrated. A key function within service order orchestration is the stateful design of the end customer services in the context of the customer's existing services – 5G-aware service design. This results in new or updated service assignments in the service and resource inventory.

- The mobile broadband service is designed to be configured on an existing enhanced mobile broadband (eMBB) slice on the 5G network – denoted by a slice/service target of “1” with a slice differentiator of “175002”
- Similarly, the VR service add-on that promises a highly responsive experience is designed to be configured on an existing ultra reliable low latency communications (URLLC) slice on the 5G network – denoted by a slice/service target of “2” with a slice differentiator of “175001”
- The design process also identifies the 5G Unified Data Repository (UDR) in which the subscriber profile will be created and associated with session management policy and subscriber specific information – which is needed to activate the service in the 5G network

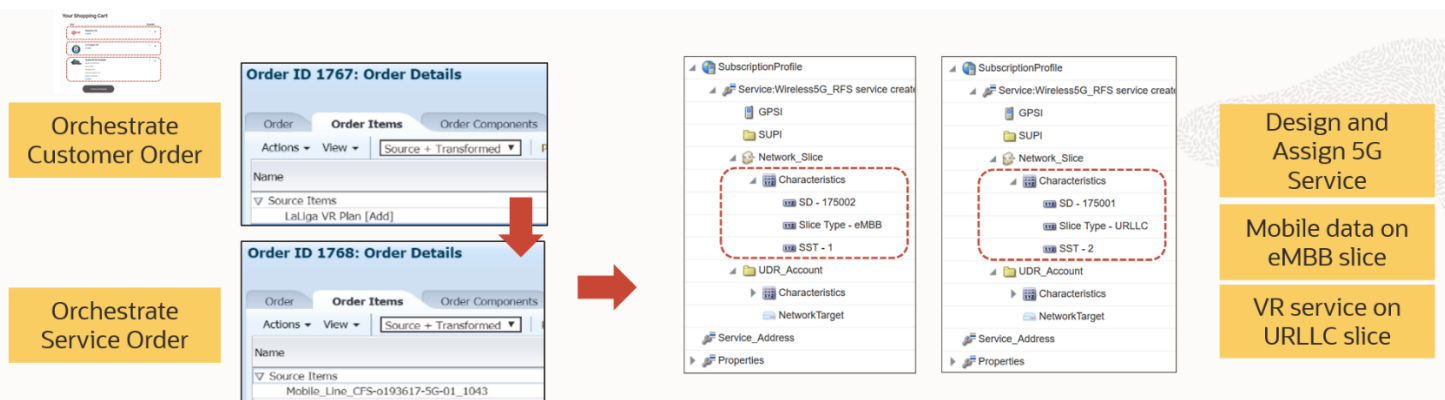


Image Caption 5. Service order orchestration and intelligent 5G-aware service design / assign.

Technical Order Orchestration and Service Activation

The results of these service and resource assignments enables the creation of one or more technical orders that contain all the fully assigned technical details including the GPSI (telephone number) and SUPI (subscriber id). These are then orchestrated in turn which triggers the SNO activation component, ASAP, to create the subscriber profile on the Oracle UDR, associating the session management policy information with this new profile before adding the subscriber information to complete the service orchestration of the high-speed mobile service as well as the immersive VR “in-stadium” experience.

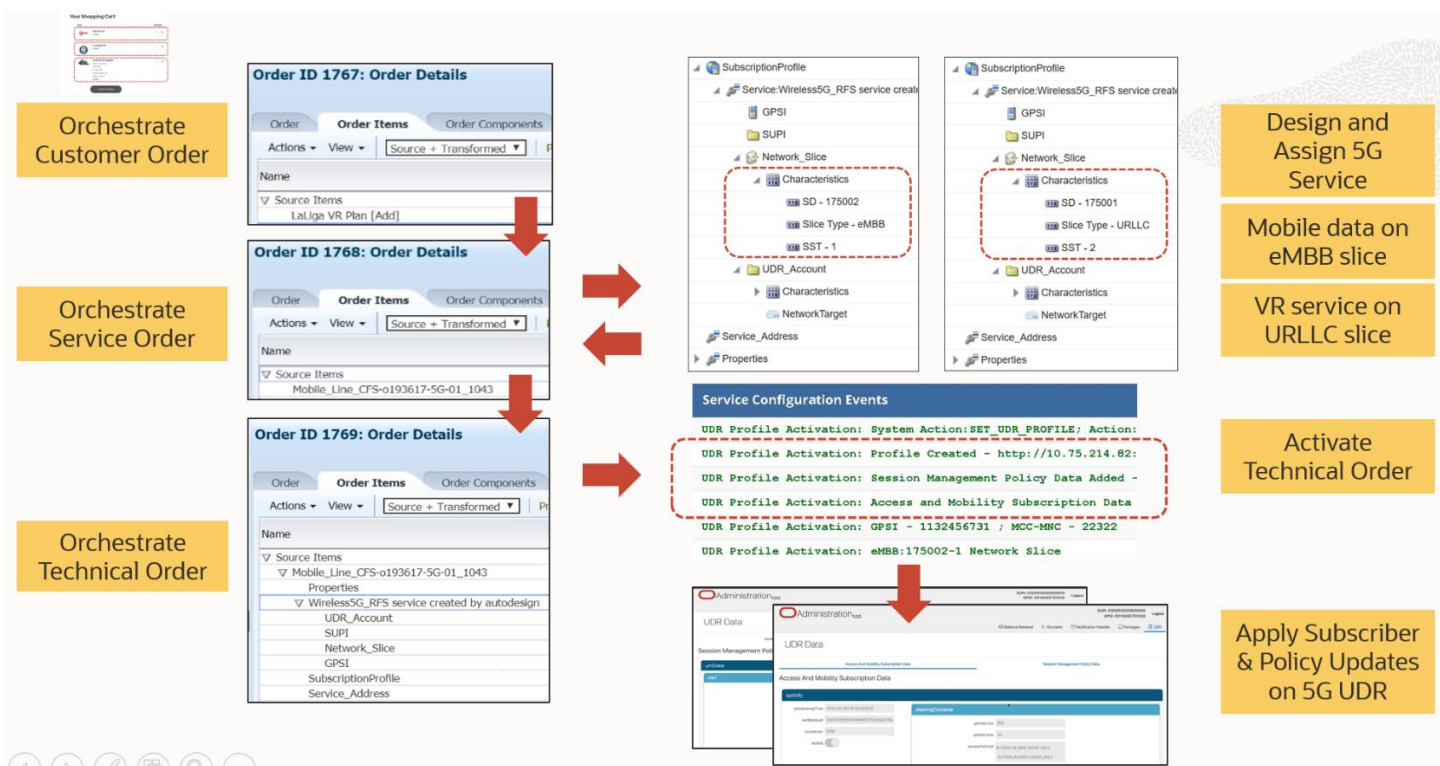


Image Caption 6. Technical order orchestration and profile, policy and subscriber configuration on the Oracle UDR.

5G NETWORK ORCHESTRATION

In order to support this end customer experience, Supremo and La League collaborate to co-create this immersive VR “in-stadium” experience for end customers. They decide to offer this service from football stadia in 4 cities and stream it to customers at home through a service subscription together with a VR headset. In terms of network requirements, the service requires a low latency network communication tailored to deliver the immediacy and interactivity of the desired customer experience. To achieve this, Supremo uses Oracle SNO to design, deploy and manage the lifecycle of a 5G URLLC network slice for this express purpose.

The 5G URLLC network slice gets designed within the SNO UIM component (UIM) – designing the end to end 5G RAN, Transport & 5G Core network across the identified 4 cities as depicted below. Once designed, the technical actions necessary are calculated and then one or more technical orders are orchestrated to implement the network changes through either direct automatic or manual network configuration or indirectly via domain orchestrators or controllers.

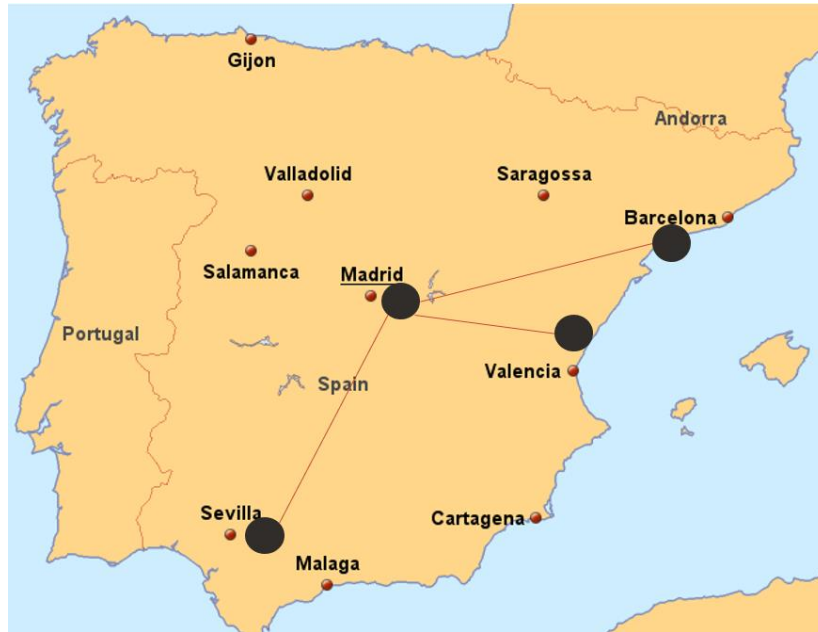


Image Caption 7. 5G URLLC slice geographic coverage.

URLLC Network Slice Design

The designed URLLC network slice comprises of the following elements:

- A Fully Virtualized Core Network Slice Subnet
 - The 5G user plane function (UPF) is moved to Edge Data Centers for URLLC to be as close as possible to each football stadium
- Partially Virtualized 5G RAN
 - The control units (CU-CP and CU-UP) are deployed as Virtual Functions
 - The next generation NodeB components (gNB-RRU and gNB-DU) are deployed as Physical Functions
- 4 Edge Network Slice Subnets (for each of the cities involved)
 - For the 5G RAN and the UPF portion of the 5G Core
- Transport Network Slice Subnet using L2 VPN to connect the core and edge subnets
 - Carrier Ethernet ELAN

URLLC Network Slice Topology

This topology of the deployed 5G URLLC slice, as viewed within UIM, is depicted below.

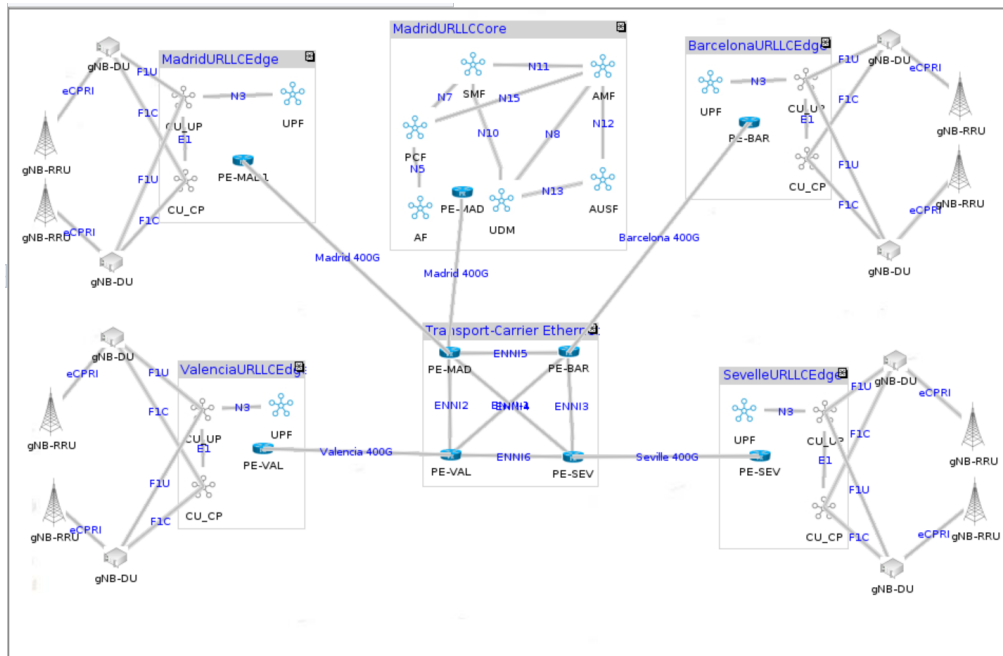


Image Caption 8. 5G URLLC slice topology.

Solution Architecture

As a general principle, Oracle SNO integrates with the network at the highest level of intelligence / abstraction it exposes. Some domains may expose high levels of intelligence and be somewhat self-managing in which case Oracle SNO will delegate control to such underlying intelligence. In others, Oracle SNO will more directly manage the network domain itself. Ultimately though, it is Oracle SNO that manages, either directly or indirectly via underlying orchestrators / controllers, the end-to-end lifecycles of service and network resources.

In this case, Oracle SNO is responsible for the end to end design and lifecycle management of the URLLC network slice.

For the Virtual Network Functions (VNFs) involved, Oracle SNO delegates their management to an NFVO component, in this scenario Open Source MANO. Oracle SNO integrates with Open Source MANO using the standard ETSI NFV-SOL005 RESTful APIs supporting

- Network Service Lifecycle Management
- Network Service Descriptor Management
- VNF Package Management

This relationship is outlined below.

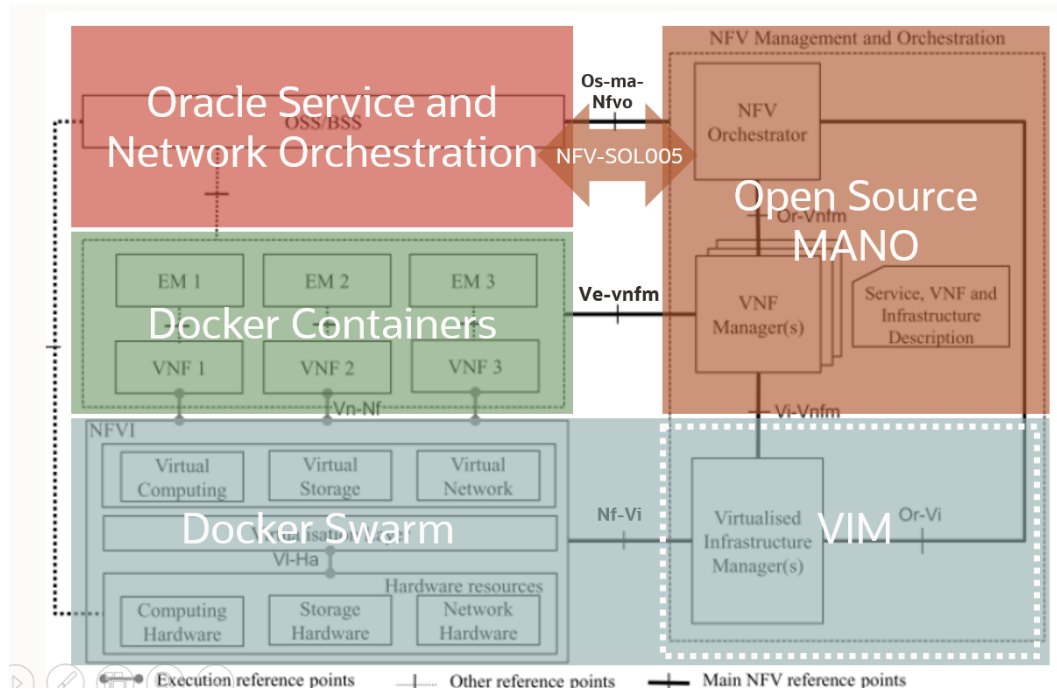


Image Caption 9. Oracle SNO and Open Source MANO Solution Architecture.

This solution synchronizes key configuration readiness data across UIM and Open Source MANO – such as for Data Centers, Network Slice Subnet Templates, VNF Descriptors etc. These are outlined in the following sections.

Managing 5G Data Centers

As a readiness activity, data center information is synchronized across UIM and Open Source MANO. In this scenario, we have data centers in 4 locations, each managed by a separate VIM. The data centers are modeled as inventory groups in UIM and contain the mappings of VNFs created in the data centers. These are used when SNO directs Open Source MANO to instantiate Network Slice Subnets in specific data centers.

UIM receives the data center information from the respective NFVIs. The VIMs tend to be bundled by the NFVI provider and registered with Open Source MANO.

The screenshots below illustrate how the Open Source MANO VIM identifier is mapped in UIM, and the virtual functions managed in that corresponding data center, in this case the Madrid one.

Registered VIM

Show 10 entries

Name	Identifier
barcelona-vim	8d8e020a-d3bb-4ccb-b2ce-d57caa7d4a1b
madrid-vim	611f55bd-77ec-4470-b9e1-695b9203acd4
seville-vim	3a19a7d2-5007-462b-a933-5167167fb51b
valencia-vim	7a0dfb13-39c4-4f8b-9650-a0db79251644

ORACLE Communications Unified Inventory Management

Inventory Group Summary - Madrid DC 01

Inventory Group Information

Specification	Data_Center
Name	Madrid DC 01
Description	611f55bd-77ec-4470-b9e1-695b9203acd4
Mano Identifier	611f55bd-77ec-4470-b9e1-695b9203acd4

Items

ID	Name
16275020	SMF
16275021	PCF
16275022	AMF
16275023	AF
16275024	AUSF
16275025	UDM
16275028	PE-MADI
16275035	CU_CP
16275036	CU_UP
16275037	UPF

Image Caption 10. Managing data centers.

Managing 5G Network Functions

The 5G Core and RAN components are modeled based on 3GPP TS 23.501

- The 5G RAN components are modeled in UIM as Logical Device Specs
- The interfaces exposed by the Core and 5G network functions are modeled based on 3GPP standards
 - PCF exposes N5, N7 and N15 interfaces
 - SMF exposes N7 and N4 interfaces
- Fully Virtualized Core and Partially Virtualized RAN Network
 - UIM manages both PNFs and VNFs
 - Open Source MANO manages just the VNFs
- UIM-MANO Integration enables the sync of VNF Descriptors

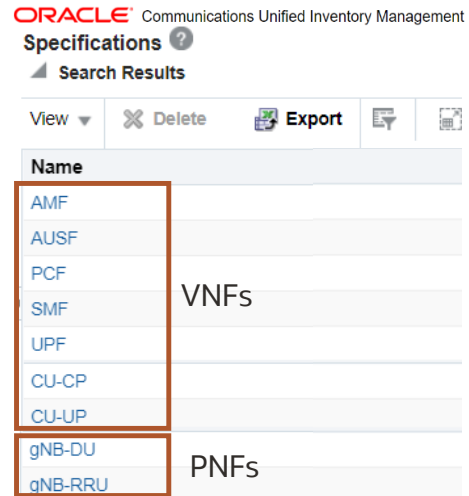


Image Caption 11. Managing 5G network functions.

Managing Network Slice Subnet Templates

The Core and Edge Network Slice Subnet Templates for the eMBB and URLLC network slices are used to create Network Slice Subnets across multiple data centers.

UIM is the master for managing the Lifecycle of Network Slice Subnet Templates. The Network Designer in UIM designs the Network Slice Subnet Templates.

SNO-MANO Integration synchronizes the Network Slice Subnets using the NFV-SOL005 interface. Network Slice Subnet Templates are created in UIM and may be synced to Open Source MANO. Network Slice Subnet Templates may also be imported into UIM from Open Source MANO.

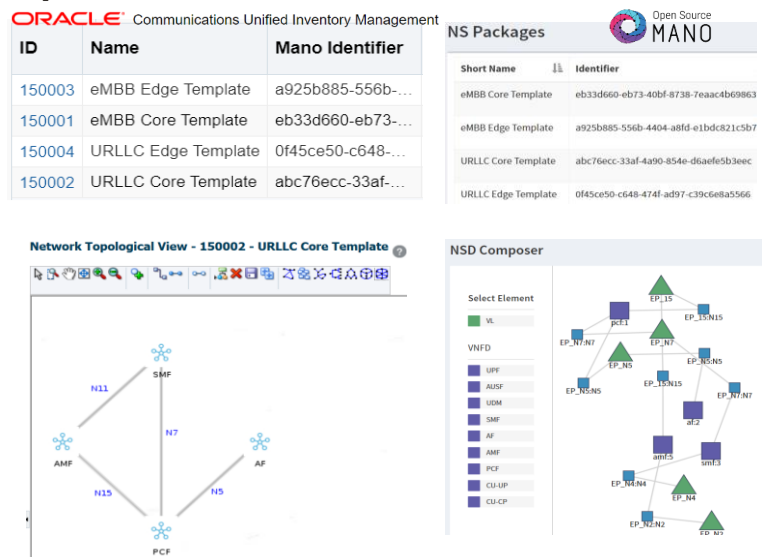


Image Caption 12. Managing network slice subnet templates.

Managing Network Slices and Network Slice Subnets

When the 5G URLLC slice is designed and the engineering order is issued within UIM, Oracle SNO directs Open Source MANO to instantiate the virtual components of the 5G slice.

The screenshots below illustrate how UIM:

1. Directly controls the lifecycle of the network slices and indirectly, via Open Source MANO, the network slice subnets – showing the relationship of the network slice CFS to its RFS subnets, the network slice subnet templates and data center for each
2. Integrates with Open Source MANO to instantiate the network slice subnets to synchronize their operational status enabling UIM to manage the end to end lifecycle of the network slice

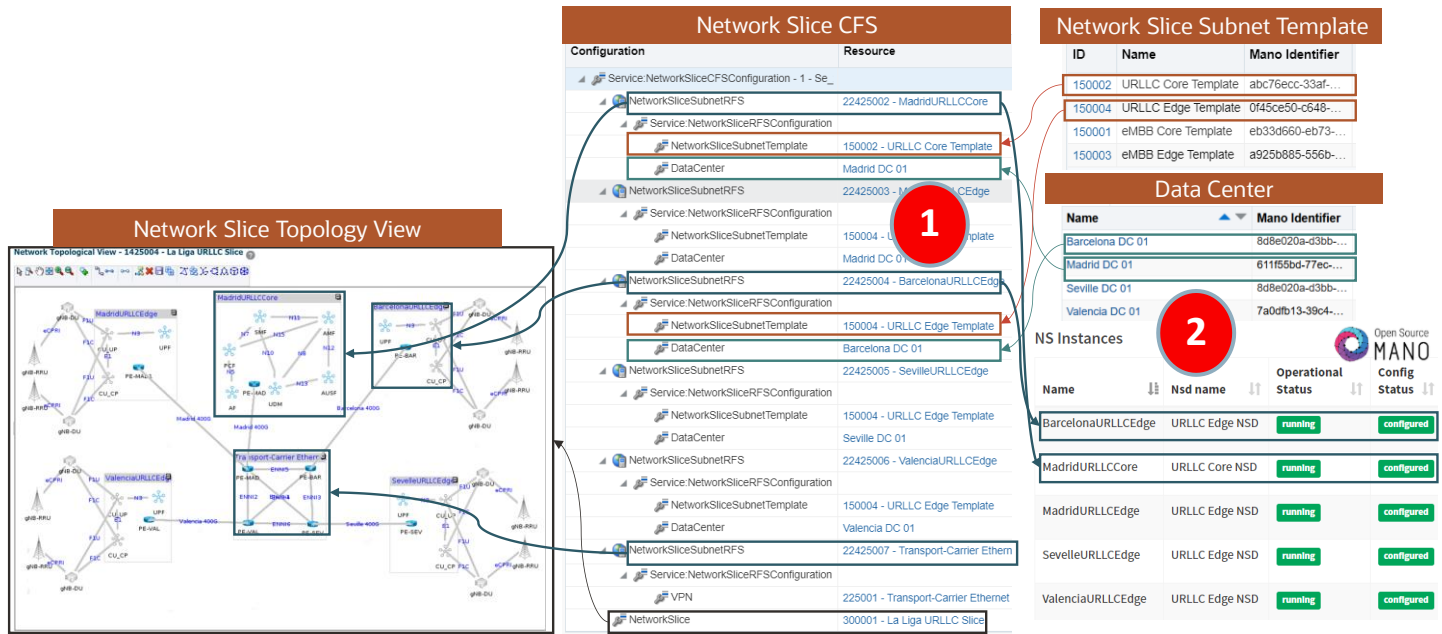


Image Caption 13. Integrated SNO / Open Source MANO lifecycle management of network slices and network slice subnets.

Finally, the screen shots below outline the mapping of network slice subnets in UIM (for Barcelona and Madrid as examples) to the associated network services and constituent VNF instances and operational status running in each network slice subnet.

End-to-End 5G Network Slice across Oracle SNO and Open Source MANO

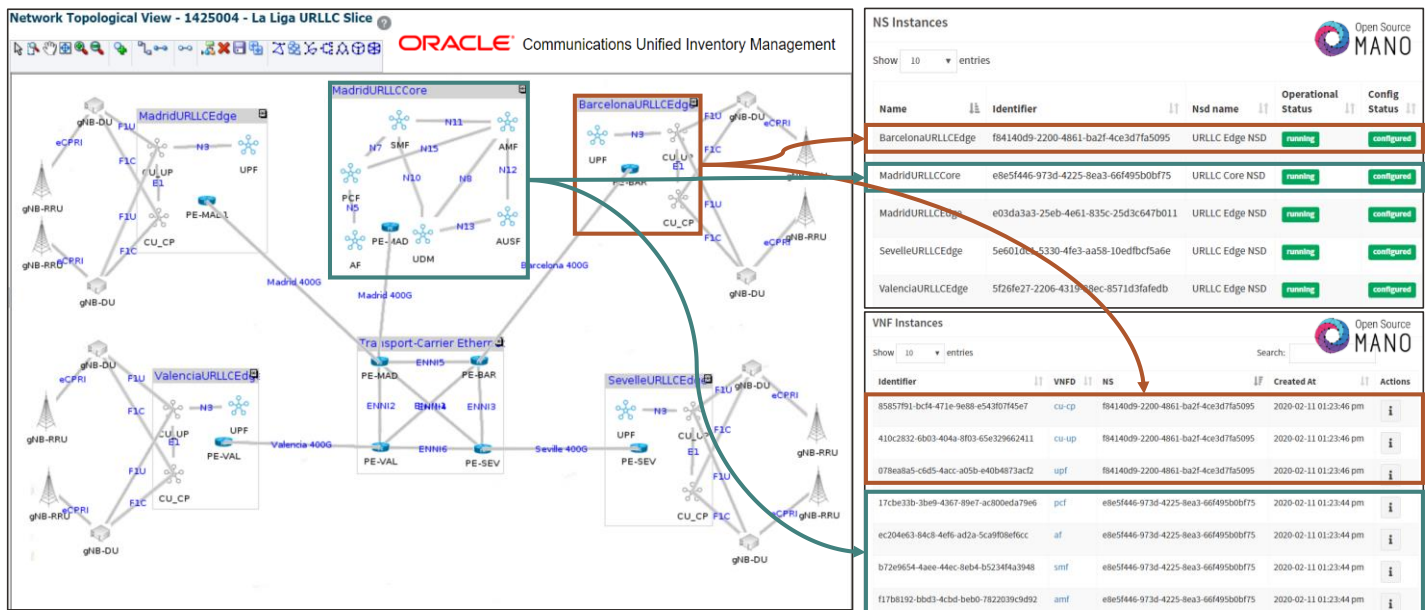


Image Caption 14. End-to-end 5G network slice across Oracle SNO and Open Source MANO.

SUMMARY

This white paper outlines how Oracle's SNO solution enables service providers to deliver 5G services with **Oracle 5G Now**.

It illustrates how Oracle's SNO solution, and UIM component in particular, supports the 5G network plan and build process as well as spinning up (and down) 5G network slices on an on-demand basis as illustrated above. In each of these situations, UIM controls the end to end lifecycle of the 5G network and delegates control for portions of the network to one or more underlying orchestrator(s) (such as Open Source MANO in this example) to manage the virtual network functions while also directly controlling the physical network functions.

The paper also articulates how customer orders containing services requiring different network characteristics, may be orchestrated end to end, intelligently designed and automatically fulfilled on appropriate 5G network slices through full integration with the 5G network elements inc. the Oracle UDR. This enables service providers to innovate, offer, fulfill and monetize compelling end customer propositions such as the immersive VR "in-stadium" experience made possible by 5G network deployment.

APPENDIX: ORACLE SERVICE AND NETWORK ORCHESTRATION

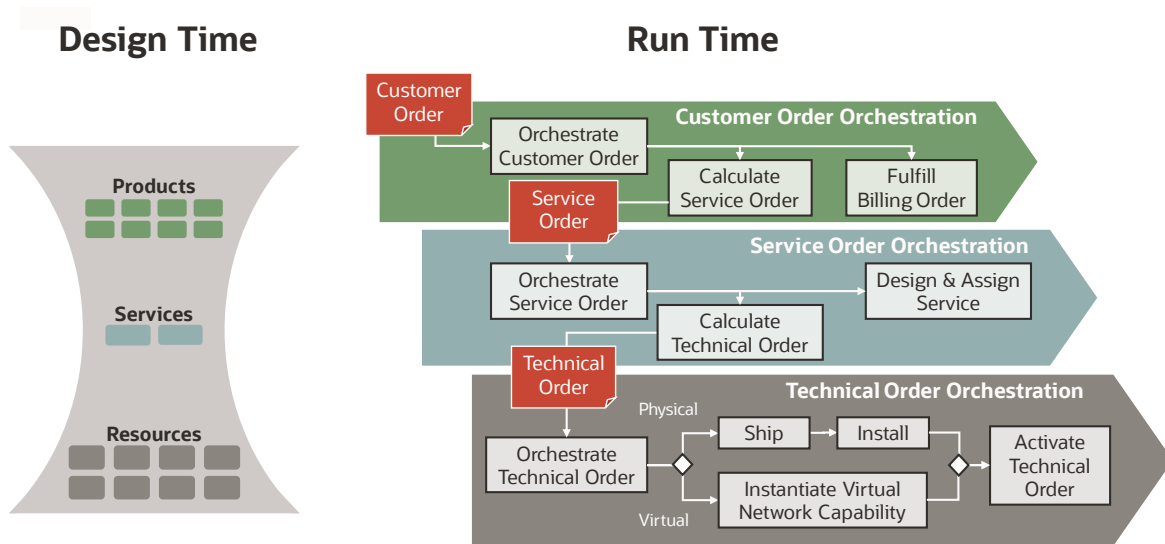


Image Caption 15. Oracle SNO design time and run time architectural blueprint.

Oracle's Service and Network Orchestration solution is a modern model-driven orchestration platform providing:

- **Multi-service, Multi-domain Orchestration** for Consumer and Enterprise services across virtual, software defined, cloud and traditional networks
- **Multi-layer Orchestration** that decouples orchestration of commercial activities from the technical implementation and decouples the technical service design from details of delivery
- **Modular Decoupled Run-time architecture** for agile incremental solution development through decoupling of concerns and strongly encapsulated metadata
- **Model Driven Solution Design** based on a "Product-Service-Resource" information model to drive a coherent set of modular configurations that define each domain's behavior of the platform
- **Certified TM Forum Open APIs** to accelerate solution development with lower risk and cost
- A **proven, referenceable at scale and globally deployed** solution

For further information, see:

[Service and Network Orchestration Overview](#)



[The Oracle Orchestration Learning Library](#)



*"Oracle is further demonstrating the industry value of **adopting extensible open APIs** to expose and consume a catalog of capabilities to drive innovation and monetization of new products and services," said George Glass, vice president architecture & APIs, TM Forum.*

"The adoption of these APIs enables companies like Oracle to execute at digital speeds and capitalize on the opportunities presented by an increasingly connected world."

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