Magma for 5G
Exploring future feature development and testing

LFN Developer and Testing Forum

10 January 2022

https://www.magmacore.org/
https://github.com/magma/magma

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Agenda

January 10, 2022

- How we test Magma 5G SA & Demo (from previous session)

- Features Under Development

- Magma and LFN

- 3GPP Standardization and Requirements

- TIP Private 5G Scenarios

- Magma Compliance to TIP FWA Requirements

- Requirement Validation for Network Slicing & Security Enhancements (Backup)

- Q&A

How we test Magma 5G SA

Magma Orchestrator in AWS

RF Chamber
gNB
UE
AGW
JumpHost
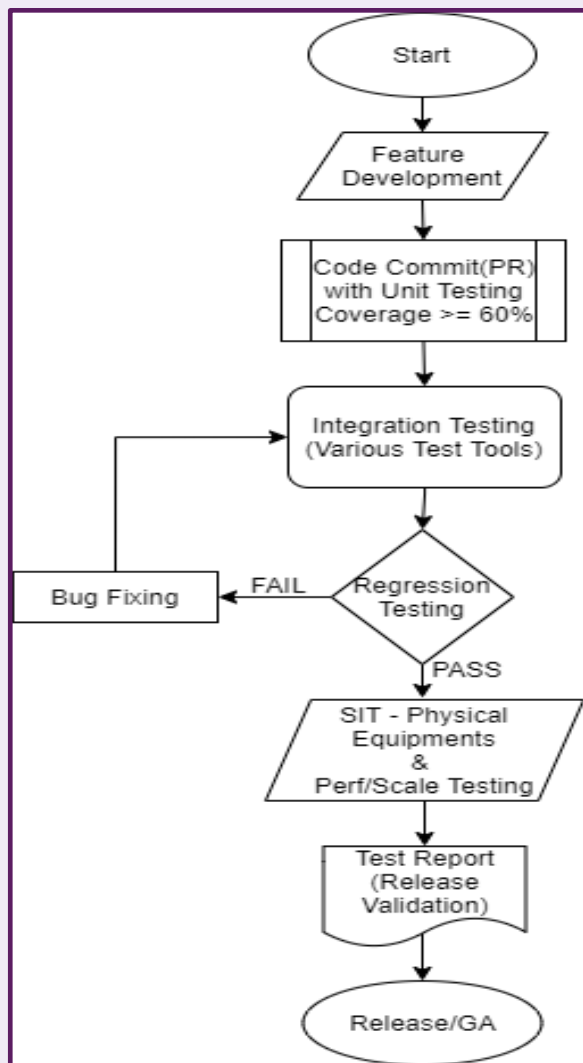
Automated CI Testing and Reporting

magma

magma-ci.web.app

Apps | New Tab | Build a Custom A… | nagiosgraph / Dis… | Getting Started | Imported From Fir… | Gmail | YouTube | Maps | Magma | DevOps | Reading List

« ‹ 1 2 3 4 … › » Rows per page 20

	Metadata				Builds					Workers				
Build ID	Time	Run	Branch	Actor	AGW	FEG	ORC8R	NMS	CWAG	FB Spirent	FB TVM	WL 5G	LTE INTEG	CWF INTEG
			filter	filter										
c1638c09	1/7/22, 10:03	1665872514	master	ardzoht	✓	✓	✓	✓	✓	○	!	✓	○	○

Report

about:blank

Wavelabs 5G SA test result report.

Magma build : 1.7.0-1641529342-c1638c09

Test Case Name	Test Run Result	Scenario			Steps			
		Failed	Passed	Total	Failed	Passed	Skipped	Total
5G_Registration_PDU_Session_Establishment.feature	passed	0	1	1	0	27	0	27
NG_Setup_Failure_Unknown_PLMN.feature	passed	0	1	1	0	12	0	12
NG_Setup_Request_Magma.feature	passed	0	1	1	0	12	0	12
5G_Registration_PDU_Session_Establishment_with_ping_data.feature	passed	0	1	1	0	28	0	28
5G_Initial_Registration.feature	passed	0	1	1	0	24	0	24

Demo – Let us see it running

Procedures / Features Available today

(1) Registration

(2) 5g specific Authentication

(3) PDU Session Establishment

(4) Idle mode and Paging

(5) Service Request

(6) UE initiated Session Release

(7) UE initiated De-registration

(8) Dynamic Policy support & 5G QOS

(9) Usage reporting & Charging
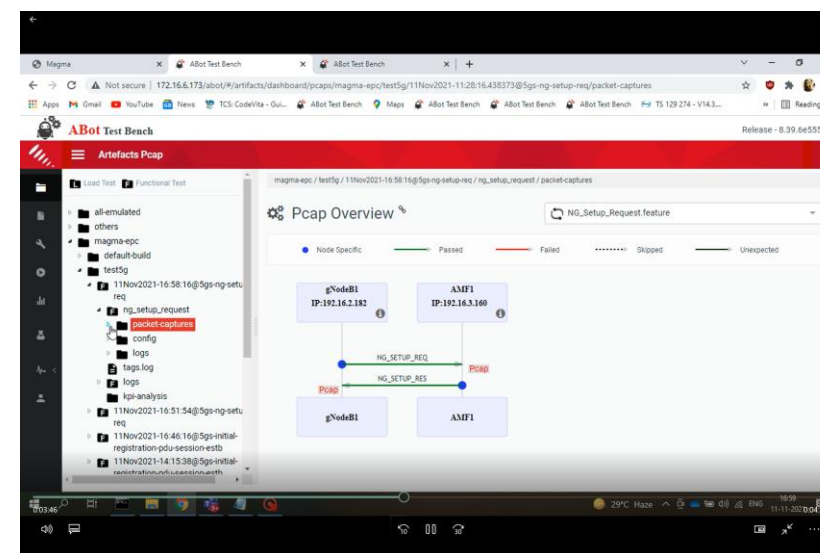
Features under Development & Testing

January & February 2022

(1) Stateless Network Function (Feature Parity)
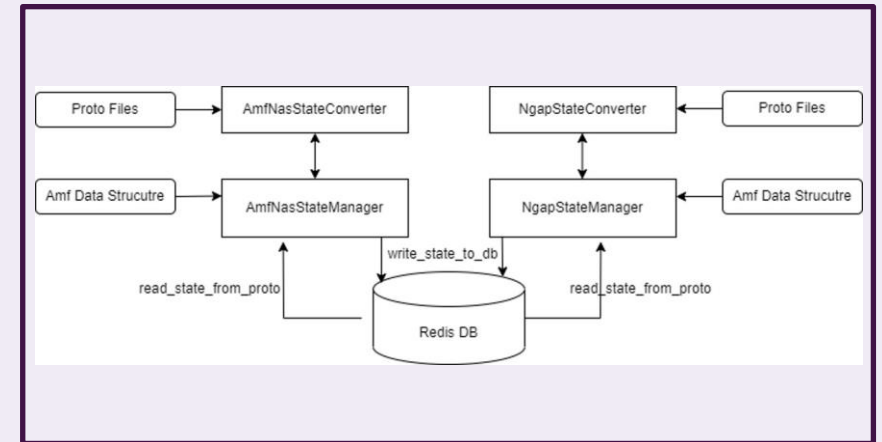
(2) Basic IPv6 Support

   - IPv4v6 sessions
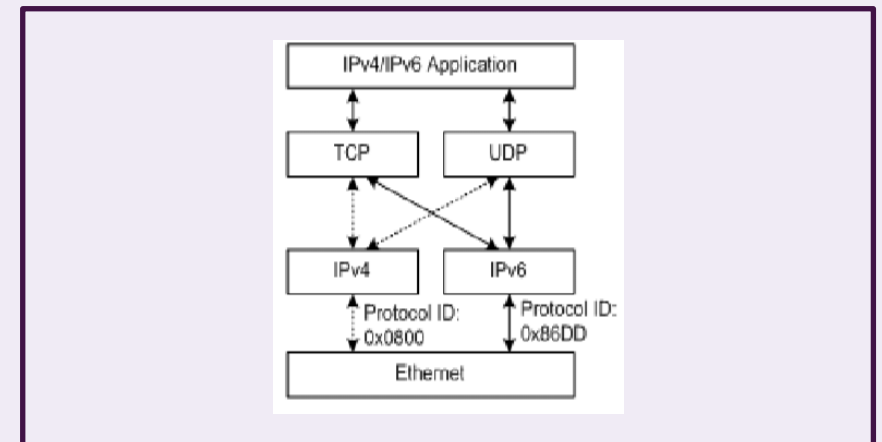
(3) Network Initiated Session modification

(4) 5G Testing, Scale and Hardening

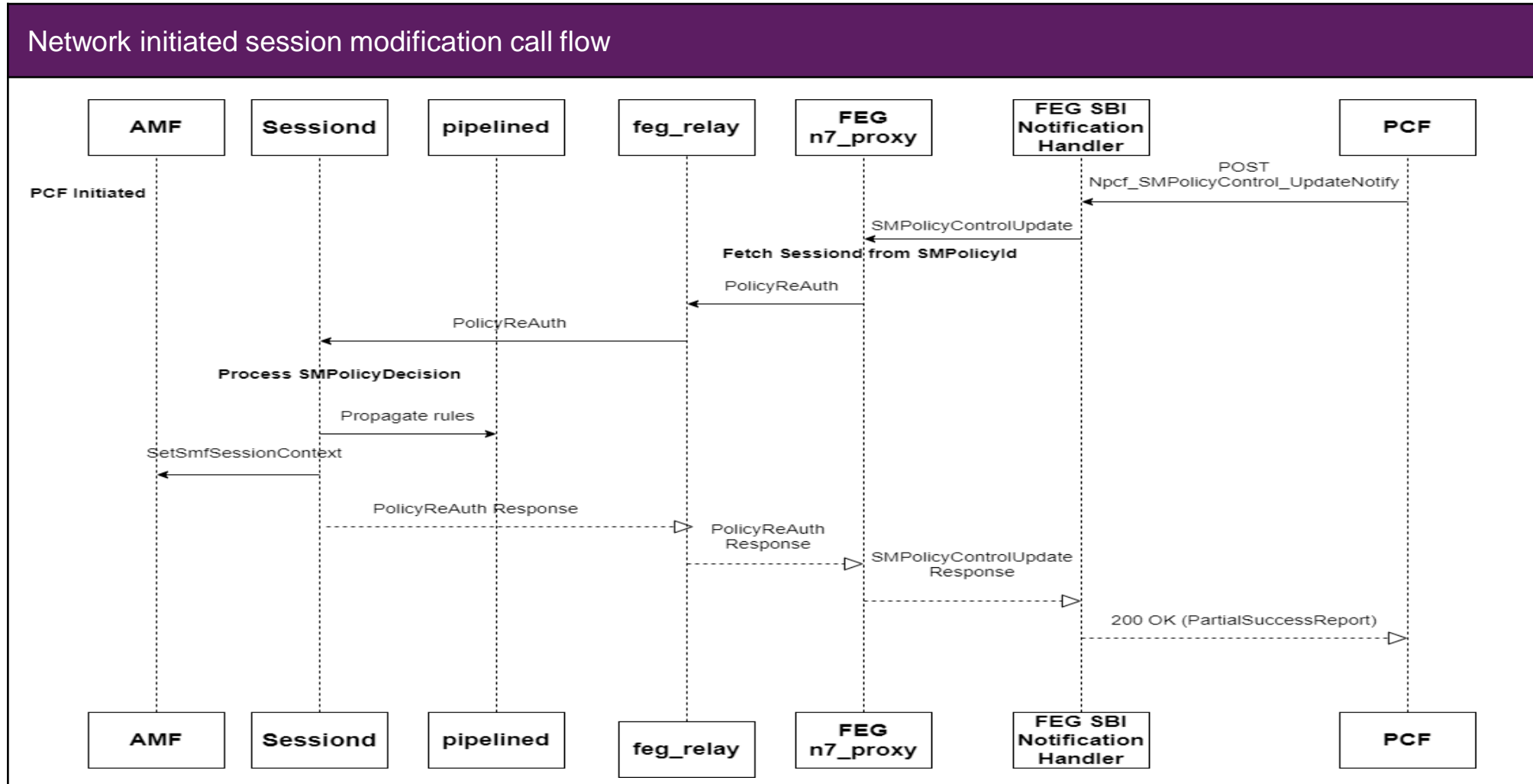   - 200 (up to 600 UE), 12gNB, 5 attaches/sec, 4 policies per UE & 4 sessions per UE

(1) Stateless Network Function (Feature Parity)

(2) Ipv6 Support

(3) Network Initiated Session modification

Network initiated session modification call flow

| AMF | Sessiond | pipelined | feg_relay | FEG n7_proxy | FEG SBI Notification Handler | PCF |

PCF Initiated

POST
Npcf_SMPolicyControl_UpdateNotify

SMPolicyControlUpdate

Fetch Sessiond from SMPolicyId

PolicyReAuth

PolicyReAuth

Process SMPolicyDecision

Propagate rules

SetSmfSessionContext

PolicyReAuth Response

PolicyReAuth Response

SMPolicyControlUpdate Response

200 OK (PartialSuccessReport)
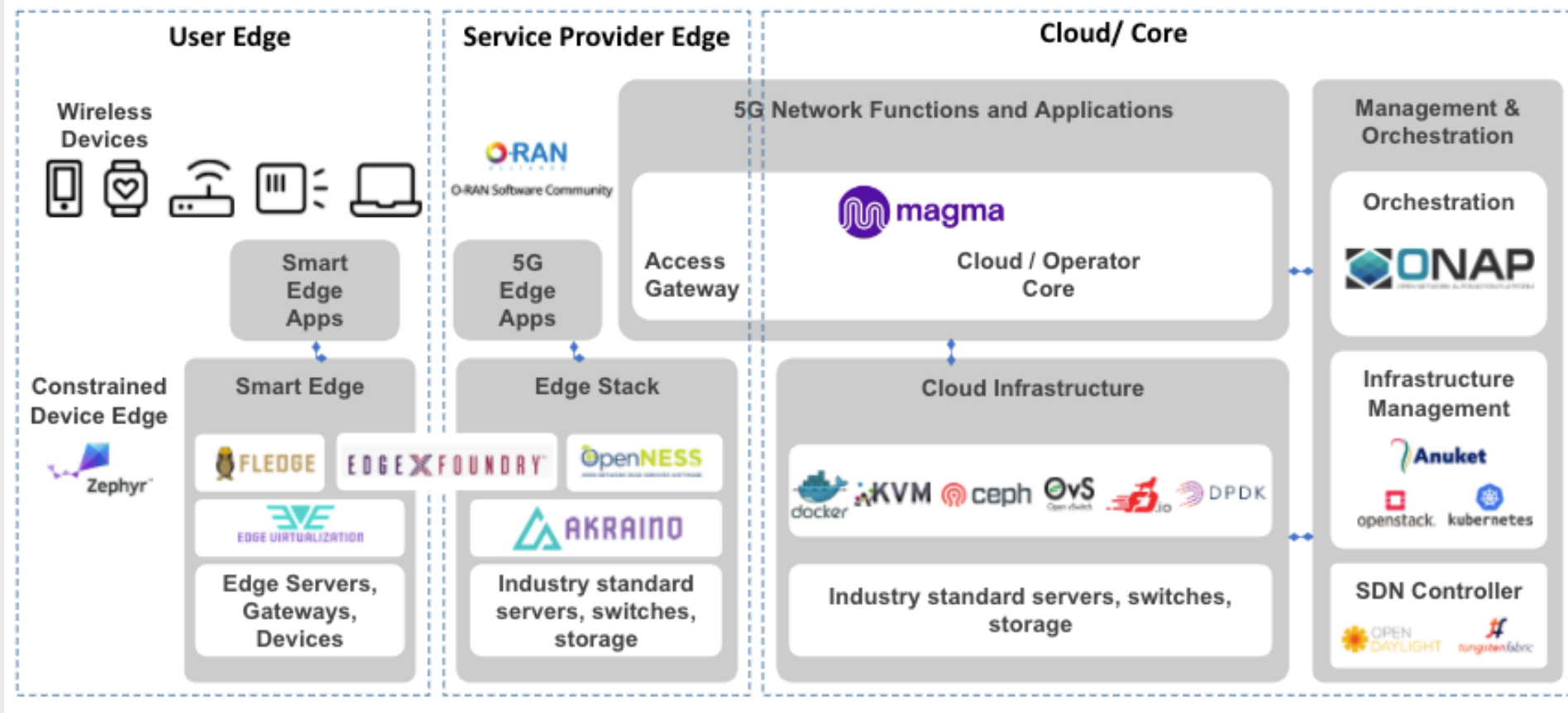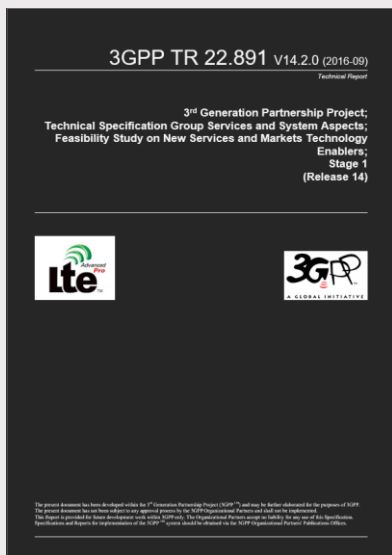
Rise in Adoption / Interest in Magma for 5G
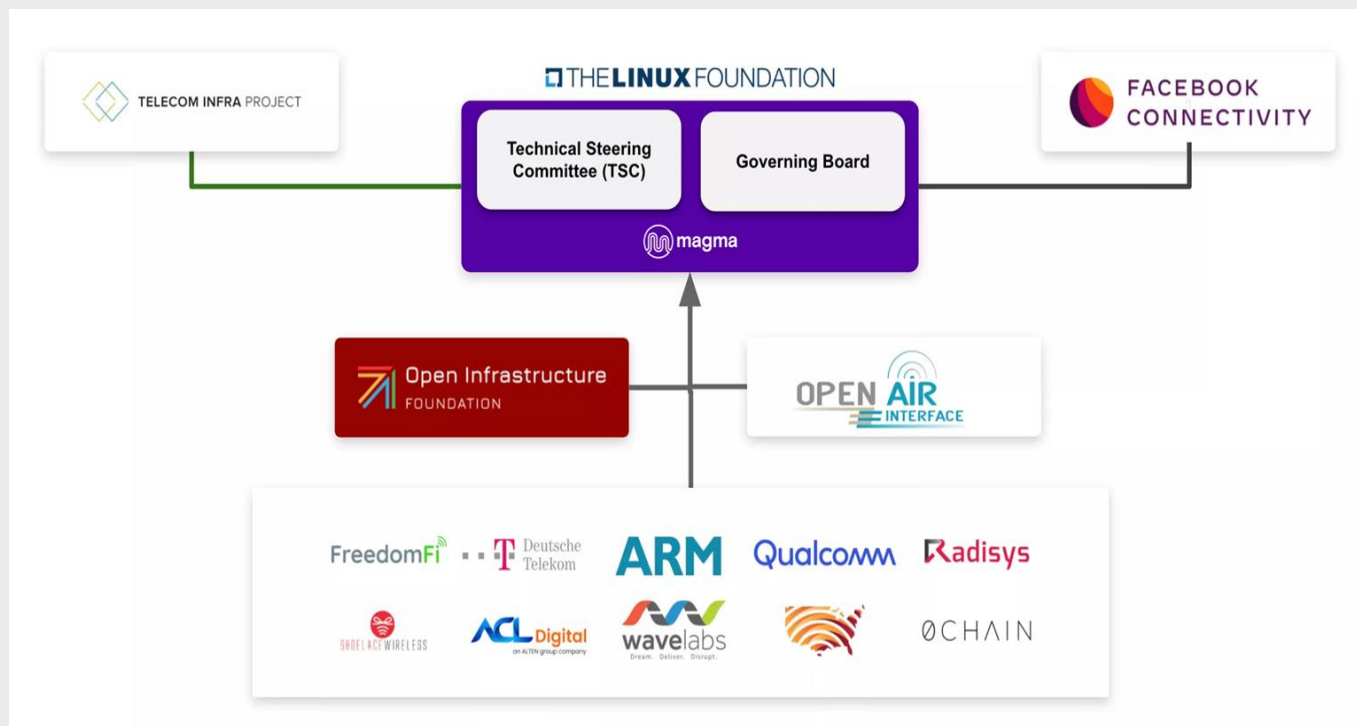
- Community projects using magma 5G
  (e.g.) LFN 5G Super Blueprint

- Commercial projects using magma 5G
  (e.g.) vendor, network operators, service providers

LFN End to End 5G Super Blueprint

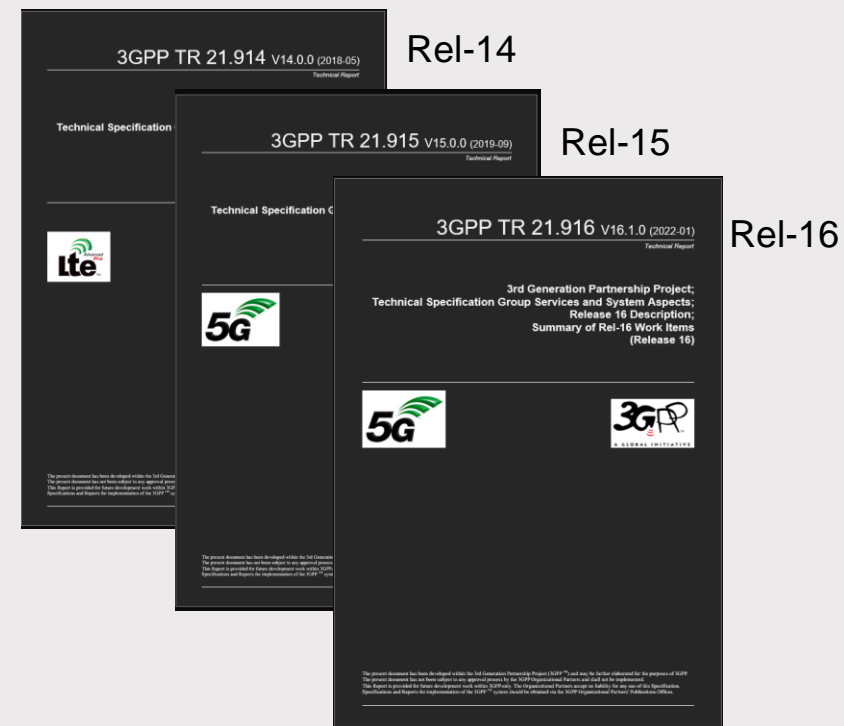# 3GPP Standards and Requirement (1 of 2)

Consolidated in to 4 major areas

eMBB, URLLC, mMTC, Network Operations

Rel-14

Rel-15

Rel-16

Started in 2015, consolidated into 74 use cases

Service requirements
- Basic capabilities
- Performance
- Security
- Additional verticals
- Additional service capabilities (V2X, IoT…)

Summary of Work Items for completed releases

magma

Summary of Work Items for ongoing releases

Next milestones: Rel-17 St. 3: March 22. Rel-18: St.1: Dec. 21

|					
	0				Rel-18
	920035	5G system with satellite backhaul	5GSATB		Rel-18
27	940029	Charging Aspects of 5G LAN VN Group	5GLAN_CH	1	Rel-17
36	910052	Enhancement to the 5GC LoCation Services-Phase 2	5G_eLCS_ph2	1	Rel-17
69	890034	Integration of satellite components in the 5G architecture	5GSAT_ARCH	1	Rel-17
96	940044	Charging enhancements for 5G CIoT	5G_CIoT_CH	1	Rel-17
21	940009	Edge Extensions to 5GMS Stage 3	5GMS_EDGE_3	1	Rel-17
67	930040	Application Architecture for MSGin5G Service	5GMARCH	1	Rel-17
15	900030	Proximity based Services in 5GS	5G_ProSe	1	Rel-17
60	840019	5G System Enhancement for Advanced Interactive Services	5G_AIS	1	Rel-17
74	920009	Edge Extensions to the 5G Media Streaming Architecture	5GMS_EDGE	1	Rel-17
09	840028	IMS Charging in 5G System Architecture	5GSIMSCH	1	Rel-17
53	880019	Stage-3 5GS NAS protocol development 17	5GProtoc17	1	Rel-17
89	820035	Discovery of management services in 5G	5GDMS	1	Rel-17
87	830098	Enhancement of URLLC support in the 5G Core network	5G_URLLC	1	Rel-16
032	800006	LAN support in 5G	5GLAN	1	Rel-16
037	830043	Cellular IoT support and evolution for the 5G System	5G_CIoT	1	Rel-16
055	810050	5G message service	5GMSG	1	Rel-16
080	830078	5G V2X with NR sidelink	5G_V2X_NRSL	1	Rel-16
085	800013	5G positioning services	5G_HYPOS	1	Rel-16
088	830102	Enhancement to the 5GC LoCation Services	5G_eLCS	1	Rel-16
090	820002	Media streaming architecture	5GMSA	1	Rel-16
092	810040	Media Handling Extensions for 5G Conversational Services	5G_MEDIA_MTSI_ext	1	Rel-16
222	810031	Enhancement of performance assurance for 5G networks including network	5G_SLICE_ePA	1	Rel-16
256	810041	Single radio voice continuity from 5GS to 3G	5G_SRVCC	1	Rel-16
270	820045	Enhancements to the Service-Based 5G System Architecture	5G_eSBA	1	Rel-16
567	840001	5G Media Streaming stage 3	5GMS3	1	Rel-16
593	780055	5G Voice Service Continuity	5GVSC	1	Rel-16
614	820031	Charging Enhancement of 5GC interworking with EPC	5GIEPC_CH	1	Rel-16
616	820033	Network Exposure Charging in 5G System Architecture	5GS_Ph1_NEFCH	1	Rel-16
617	820034	Charging AMF in 5G System Architecture Phase 1	5GS_Ph1_AMFCH	1	Rel-16
624	820041	Stage-3 5GS NAS protocol development	5GProtoc16	1	Rel-16
631	840018	S6b Optional for ePDG connected to 5GS	5GS_S6b_Optional	1	Rel-16
638	850025	Network Slice Performance and Analytics Charging in 5G System	5GS_NSPACH	1	Rel-16
642	850033	Network Slice Management Charging in 5G System	5GS_NSMCH	1	Rel-16
648	880056	5GS Enhanced support of Over the air (OTA) mechanism for UICC configuration	5GS_OTAF	1	Rel-16
655	860021	Management of MDT in 5G	5GMDT	1	Rel-16
656	860023	5G management capabilities	5GMNC	1	Rel-16
706	740005	5G System - Phase 1	5GS_Ph1	1	Rel-15
759	760087	UE Conformance Test Aspects - 5G system with NR and LTE	5GS_NR_LTE-UEConTest	1	Rel-15
837	790021	Media Handling Aspects of 5G Conversational Services	5G_MTSI_Codecs	1	Rel-15

Work_plan_3gpp_220107 | Sheet1
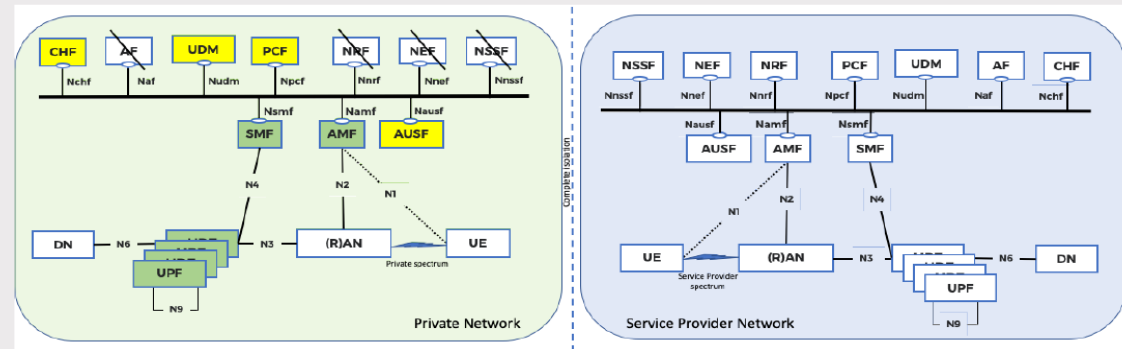
TIP Private 5G Scenarios and Use Cases
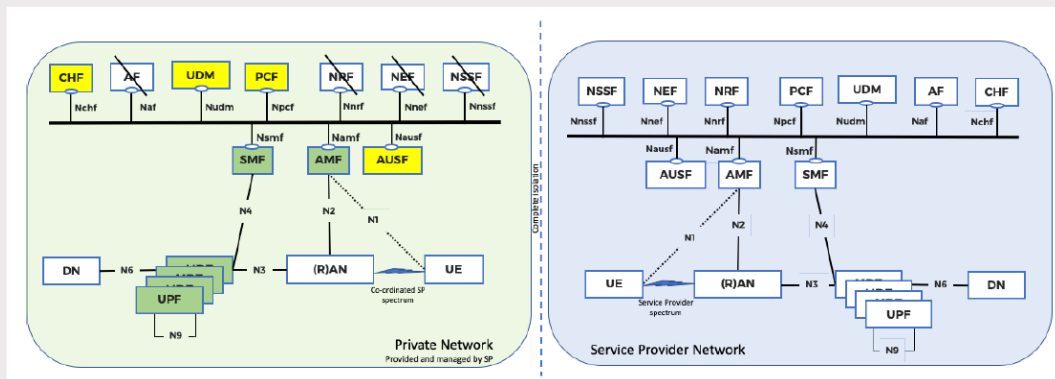
Service Provider Managed Private 5G
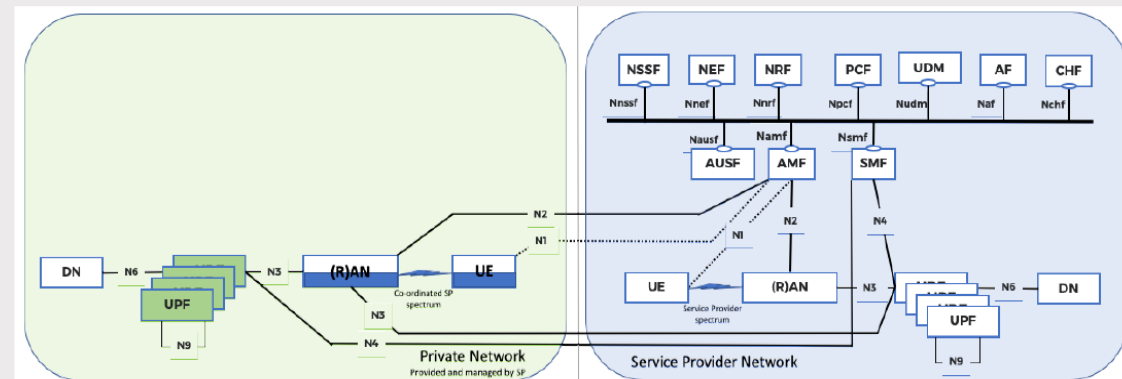
Private 5G with RAN and Control Plane Sharing
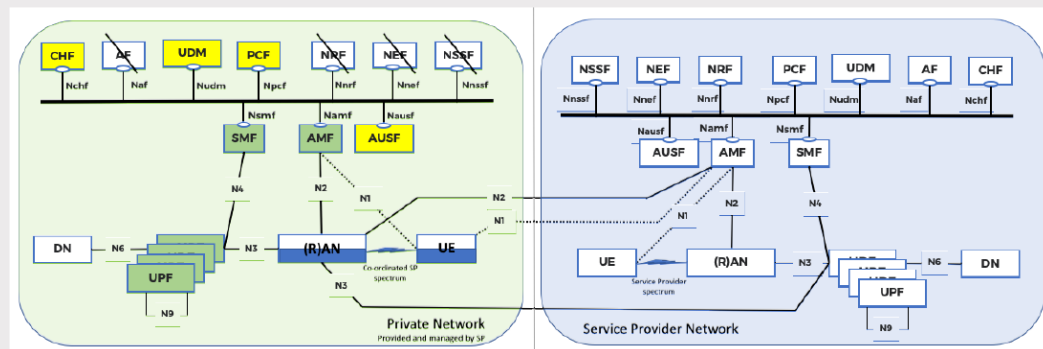
Private 5G with RAN Sharing

Neutral Host Private 5G

TIP Private 5G Scenarios and Use Cases

OCN	3GPP	ACIA
Scenario 1 SPM-P5N	SNPN	Standalone non-public networks
Scenario 2 P5N-RS	PNI-NPN, MOCN, MVNO.	Shared radio access network - Non-public network in conjunction with public networks
Scenario 3 P5N-RCS	PNI-NPN, Slicing, APN, DNN	Shared radio access network and control plane
Scenario 4 NP5N	SNPN	Standalone non-public networks

TELECOM INFRA PROJECT

Open Core Network Project Group
Applications and Services Subgroup

Private 5G Scenarios

Publish Date: November 3, 2021   Document version: v1.0

| Use Case #	Use Case	Lead Industry	Radio Owner	OCN
A1	Standalone Private Local Network	Manufacturing (Factories)	Enterprise Owns Radio	Scenario 1, 4
A2	Private Local Network + MNO Roaming	Hotel Chains, Retail Chains		Scenario 1, 4
A3	Full Neutral-Host Shared Network (MNO Pays)	CNO CBRS Network Operator (e.g.: MSO)		Scenario 1, 4
B1	Standalone Private Local Network	Mining	3rd Party Radio	Scenario 1, 4
C1	MNO RAN + Private Core	Local Gov., Education, Hospitals	MNO Runs Radio Network	Scenario 2
C2	MNO RAN + Macro Slice	Automotive (connected car)		Scenario 3
D1	Neutral host with MNO tenants	Tower Companies	Shared/Pooled/ Site Network	Scenario 1, 4
E1	APN, Managed Networks	Enterprises, Public Safety	National/WAN (MNO Radio /3rd Party Radio)	Scenario 3
E2	Specialist B2B Networks	National IoT, Regional Gov. (4)		Scenario 2, 3
E3	Private National Network	Rail, Utilities		Scenario 1, 2

OCN	Spectrum	RAN	Core	Applications	Management & Orchestration	Charging & Billing
Scenario 1 SPM-P5N	Private (Licensed/Unlicensed)	Private	Private	Private	Shared	Shared
	MNO	MNO	MNO	MNO	MNO	MNO
Scenario 2 P5N-RS	Shared with PLMN (Licensed)	Shared with PLMN	Private	Private	Shared	Shared
	MNO	MNO	MNO	MNO	MNO	MNO
Scenario 3 P5N-RCS	Shared with PLMN (Licensed)	Shared with PLMN	Shared with PLMN (e.g, slicing)	Private	Shared	Shared
	MNO	MNO	MNO	MNO	MNO	MNO
Scenario 4 NP5N	Private (Licensed/Unlicensed)	Private	Private	Private	Private	Private
	Enterprise/ third-party	Enterprise/ third-party	Enterprise/ third-party	Enterprise/ third-party	Enterprise/ third-party	Enterprise/ third-party

Magma Compliance to TIP FWA Requirements

Architectural Requirements (Total = 15 ; Magma Compliance = 8)

TIP OCN REQ ID	Requirement description	Magma compliance
REQ-ARC-03	Several 3GPP network functions may optionally be combined into an integrated OCN network function.	not compliant
REQ-ARC-04	When several network functions are combined and implemented as a combined OCN network function, the interfaces between network functions may be simplified/modified by the implementation. However, any interfaces outside the combined OCN network function must remain compliant with the relevant 3GPP and/or OCN specifications.	not compliant
REQ-ARC-05	Each Network Function of OCN shall be able to stand alone and operate as an independent Network Function	not compliant
REQ-ARC-06	Each Network Function of OCN shall be able to interoperate with Network Functions provided by other vendor's Network Functions using standard 3GPP reference point interfaces.	not compliant
REQ-ARC-11	OCN shall offer simple, templated onboarding with a bundled baseline schema	partially compliant
REQ-ARC-12	OCN shall be managed using automation and orchestration tools	partially compliant
REQ-ARC-13	It shall be possible to deploy OCN in a variety of configurations supporting differing user needs for capacity, reliability, scalability, and performance	partially compliant
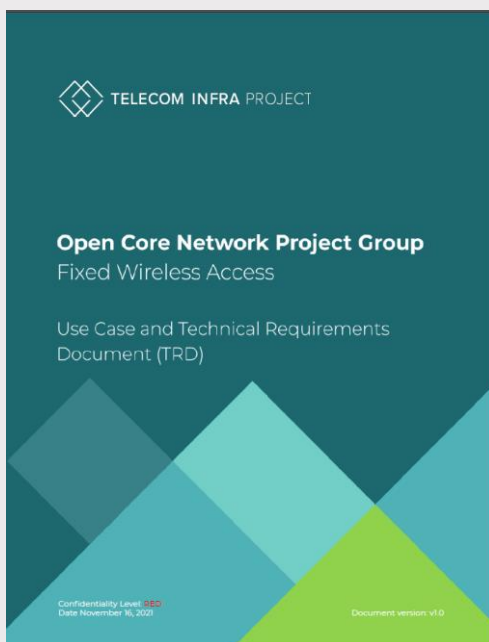
Software Implementation Requirements (Total = 10 ; Magma Compliance = 5)

TIP OCN REQ ID	Requirement description	Magma compliance
REQ-SW-02	Software components of OCN shall be constructed to scale horizontally (duplicating network functions)	not compliant
REQ-SW-06	Software components of OCN may support IO acceleration technologies	not compliant
REQ-SW-08	Software components of OCN shall provide open metrics and monitoring capabilities	partially compliant
REQ-SW-09	Software components of OCN shall publish metrics on a standard exporter endpoint(s) compliant with CNTT specifications	partially compliant
REQ-SW-10	Software components of OCN may publish metrics by other APIs or methods (event streams, SNMP, etc.)	Partially compliant

Magma Compliance to TIP FWA Requirements

Functional Requirements (Total = 19 ; Magma Compliance = 10)

TIP OCN REQ ID	Requirement description	Magma compliance
REQ-OCN-02	OCN shall support basic firewall functionality. If FW rules are global (not user specific) then may be handled outside UPF by FW appliance	not compliant
REQ-OCN-03	OCN shall support performance to handle typical fixed ISP bandwidth (speeds/feeds to be specified)	not compliant
REQ-OCN-04	Support of IPv4 user sessions is required, IPv6 support is highly desirable	not compliant
REQ-OCN-11	It is mandatory to support CDR (charging data records) creation, where CDR contains network usage information	partially compliant
REQ-OCN-13	It is desirable to support open API to integrate OCN on-line charging with service provider's customer care or billing system	not compliant.
REQ-OCN-14	It may be required to support CG-NAT (carrier grade NAT) as a large inventory of public IP is likely unavailable.	not compliant
REQ-OCN-17	It may be required to support LI (Lawful Intercept) functions, depending on regulatory requirements in the market/country of deployment	not compliant
REQ-OCN-18	It may be required to support simple DPI (deep packet inspection)/App Detection	not compliant
REQ-OCN-19	Application Function support for private services provided to customers (i.e., video services) is an option.	not compliant

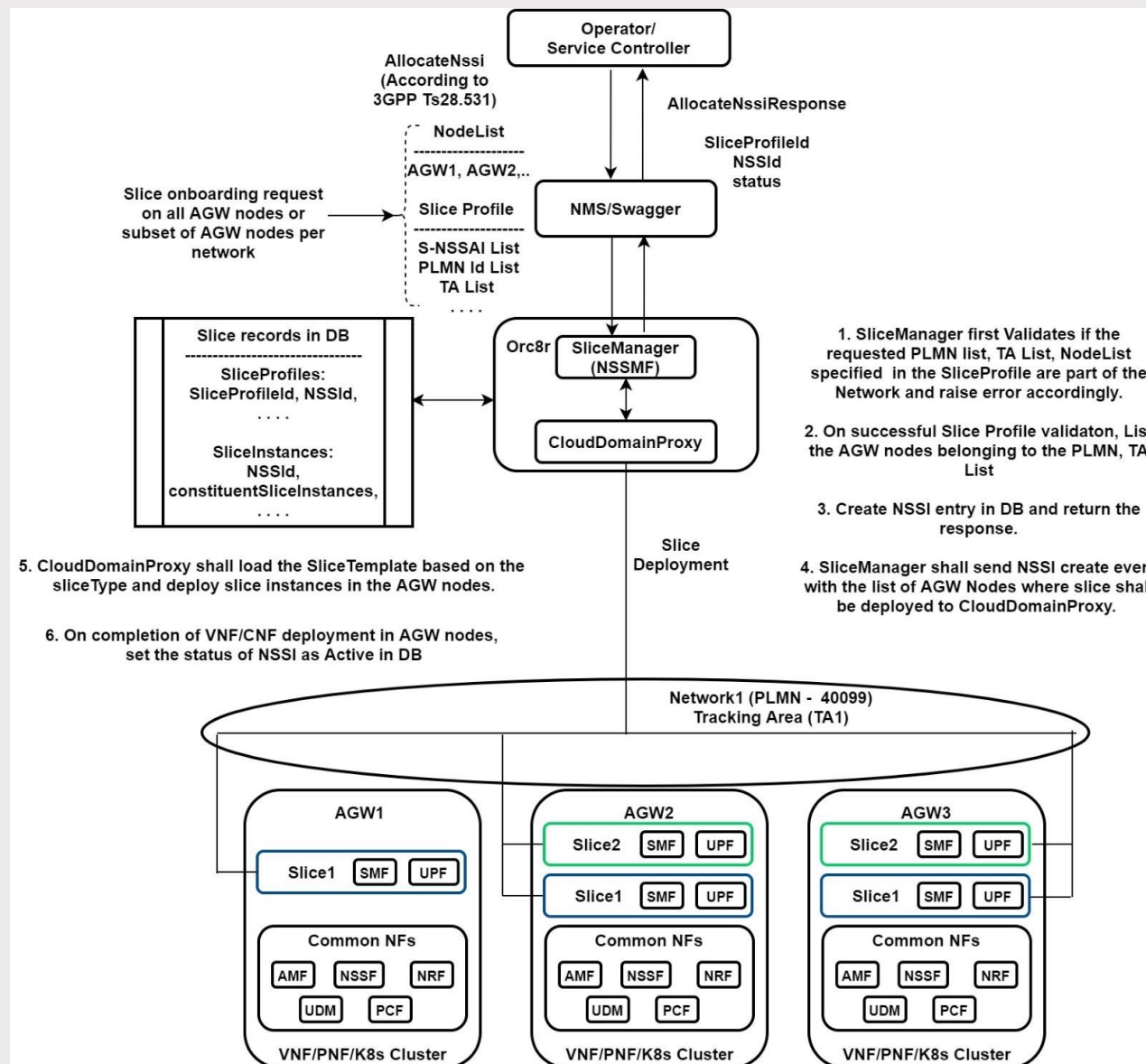## Non-Functional Requirements (Total = 10 ; Magma Compliance = 3)

TIP OCN REQ ID	Requirement description	Magma compliance
REQ-NFUN-01	OCN shall target service availability of 99.999%	not compliant.
REQ-NFUN-02	Network Functions shall support horizontal scaling (i.e., scaling by adding replicas)	not compliant.
REQ-NFUN-03	Each Network Function shall scale independently from other functions (i.e., scaling one network function does not lead to or require scaling of any other network functions)	not compliant
REQ-NFUN-04	Network Functions may be vertically scalable (e.g., increasing CPU, RAM resources.) Note: vertical scale may be increased by horizontal scaling of the microservices that make up the Network Function	not compliant.
REQ-NFUN-08	Network Functions shall be independently re-startable without impact to other functions	Not compliant
REQ-NFUN-09	Network Functions shall be upgradeable independently	Not compliant
REQ-NFUN-10	OCN interfaces shall be versioned allowing forward and backward compatibility	not compliant

TELECOM INFRA PROJECT

Open Core Network Project Group
Fixed Wireless Access

Use Case and Technical Requirements Document (TRD)

Confidentiality Level:
Date November 16, 2021   Document version: v1.0

Requirement Validation for Network Slicing

Backup

Slice Instance Onboarding

Network Slice Selection Function

Overall representation of RAN, TN, CN block elements for integration testing
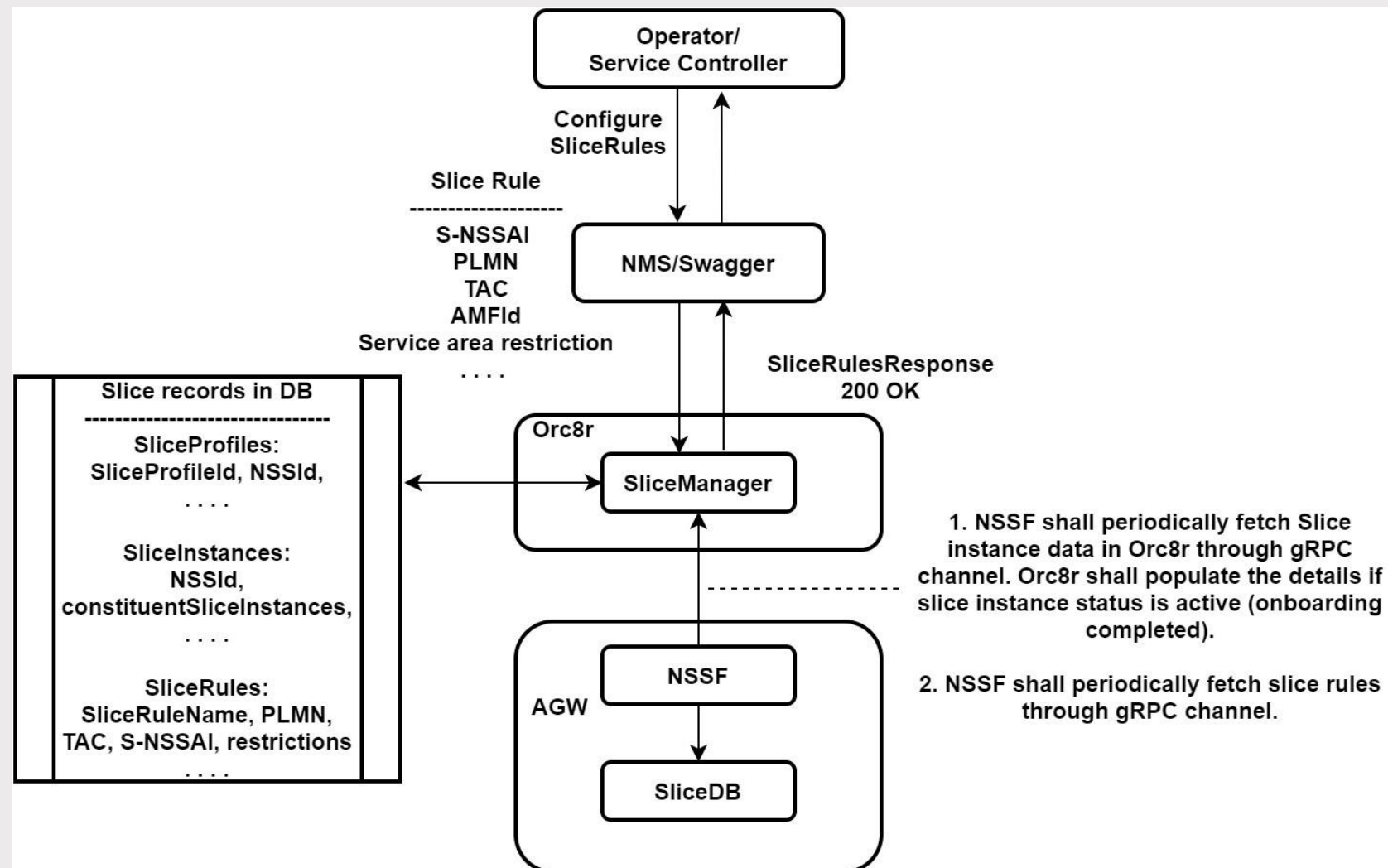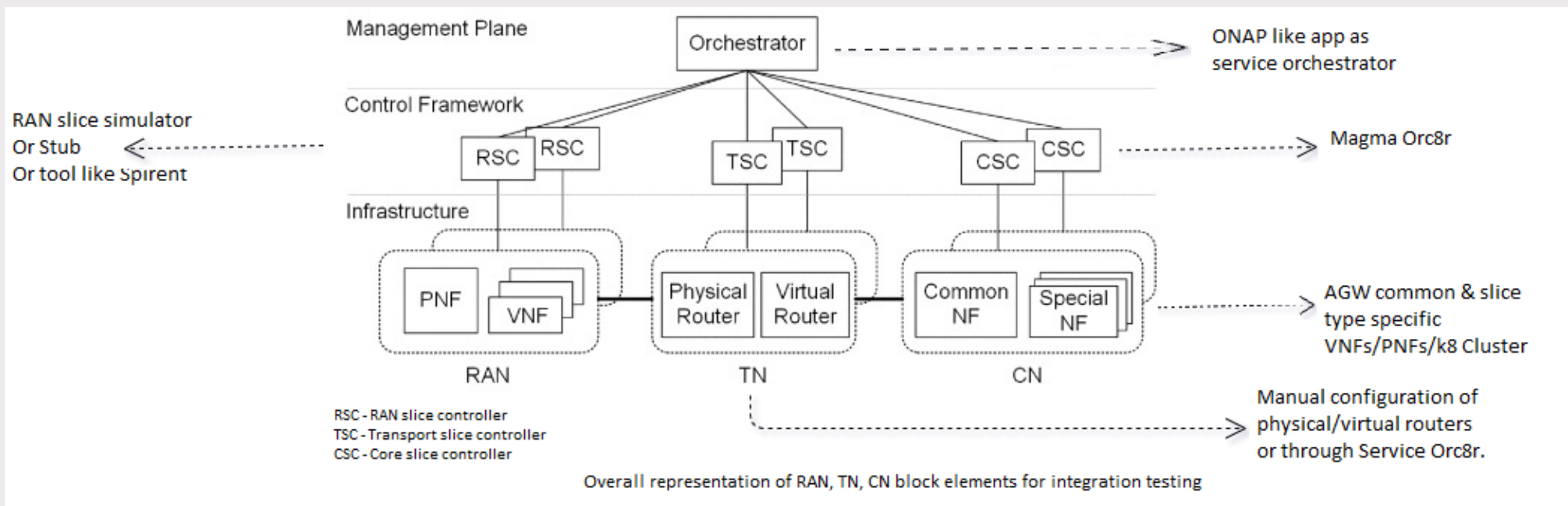
NSS Feature E2E testing

Requirement Validation for Security Enhancements

Backup

Hard coded user roles propagation to Magma Orc8r

NMS UI

Organization portal
(<org_name>.nms.<domain_name>)
- admin page (/admin)
- NMS page (/nms/*)

Master Portal
(master.nms.<domain_name>)
- master page(/master)
- admin page

nms-nginx

Magmalte
- organizationMiddleware
- appMiddleware
- sessionMiddleware
- csrfMiddleware
- userMiddleware
- masterMiddleware

Sequelize ORM

insecure

Grafana
/grafana

DataSource

admin cert

admin_cert

Orc8r
/nms/apicontroller

NMS DB

Contains
- users
- organizations
- featureFlags
- auditLog entries

Prometheus

AlertManager

Magma NMS Improvement areas

Magma NMS Improvement areas Solution

Hard coded user roles propagation to Magma Orc8r

Security Enhancement Requirement (3 of 4)

Orc8r is not exposed to the tenant user. Tenants will not have granular control over the REST API endpoints and attributes of the Orc8r.
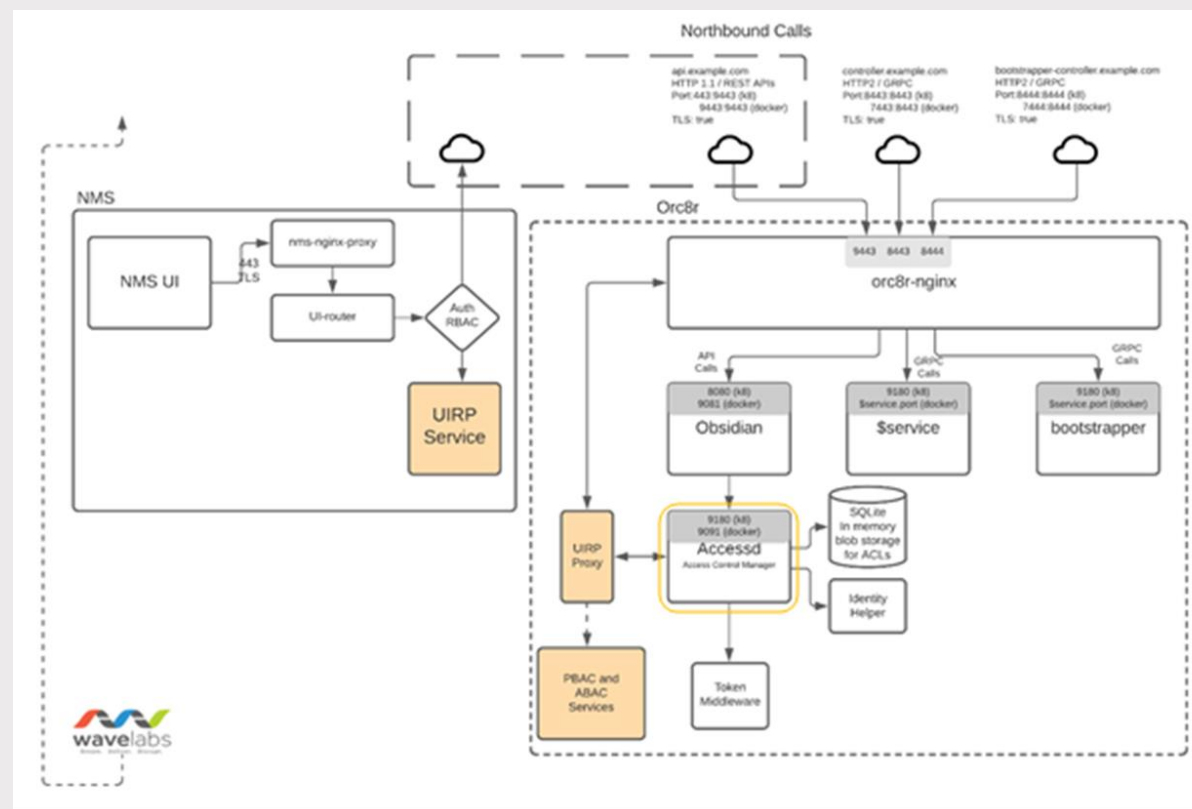

Magma Orc8r Improvement areas

Magma Orc8r Improvement areas Solution

Orc8r is not exposed to the tenant user. Tenants will not have granular control over the REST API endpoints and attributes of the Orc8r.
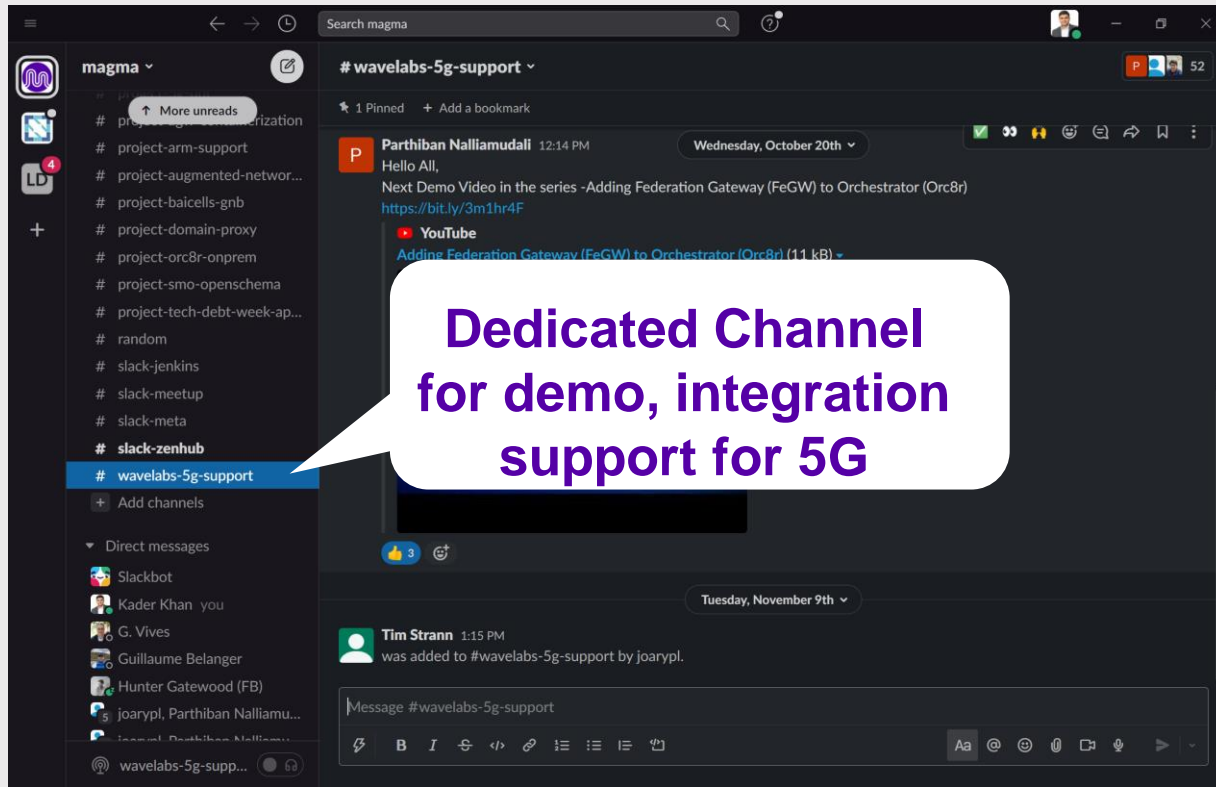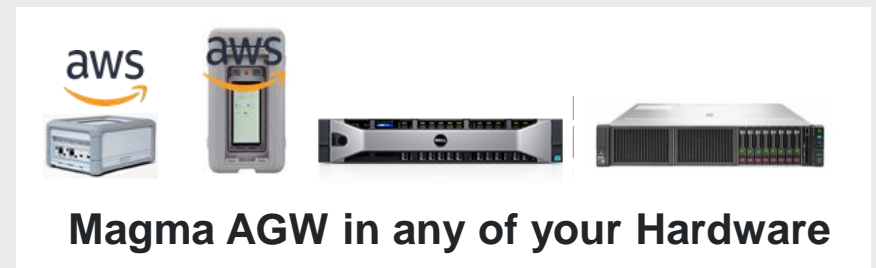
MAGMA 5G SA SUPPORT

Dedicated Channel for demo, integration support for 5G

Try it ! We are Ready to Support it !

Magma Orchestrator in AWS

Magma AGW in any of your Hardware

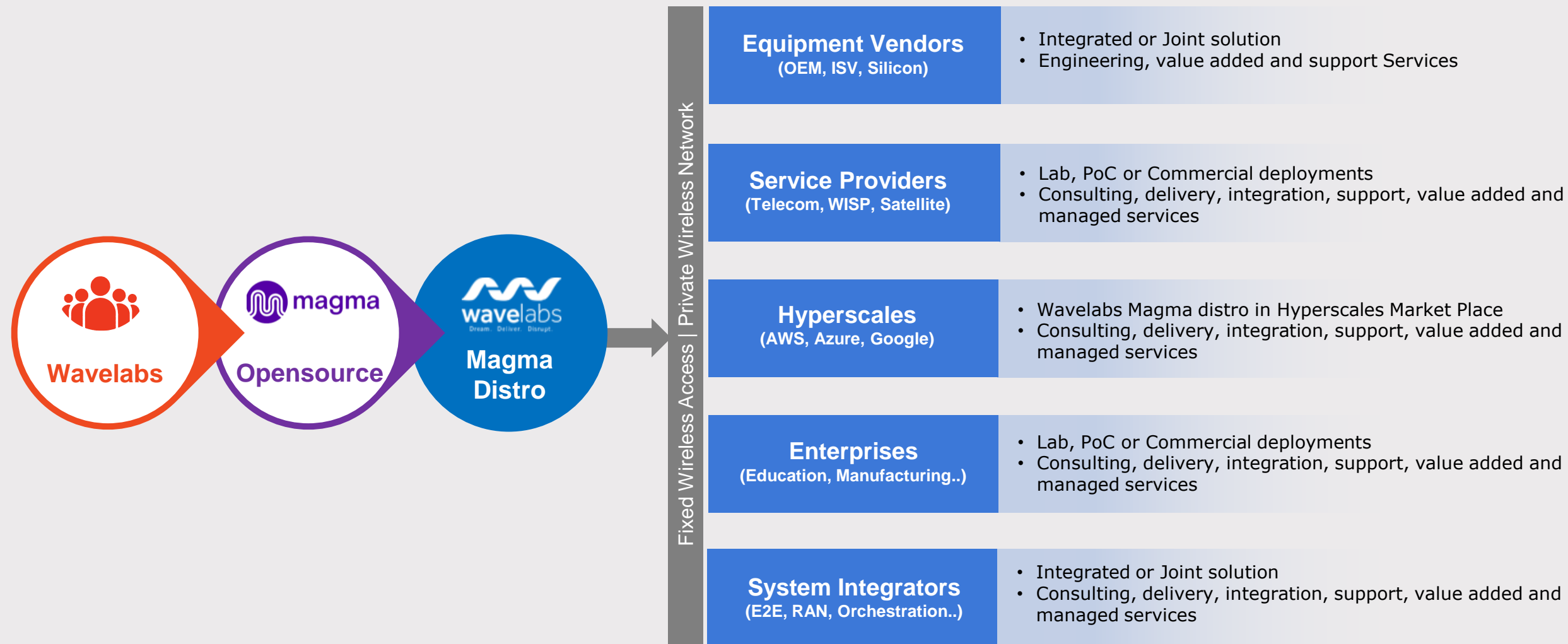# Wavelabs Commitment to Magma 5G SA Open Source

EMBRACE 'OPEN X' NETWORK VISION WITH WAVELABS
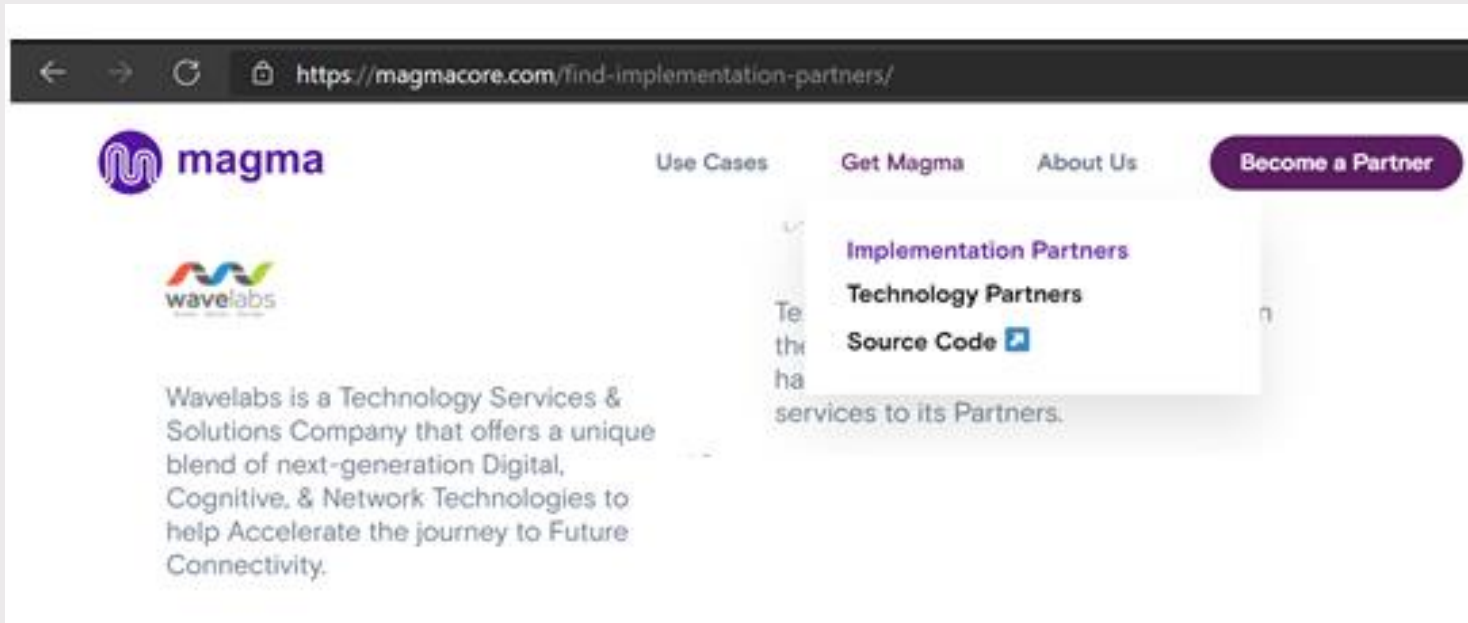
Wavelabs is an ardent proponent of 'OPEN X' network vision that enables unprecedented innovation, agility, choice, cost efficiency, and speed to market.

We help our clients to overcome challenges and realize the vision of the open and disaggregated 'White Box' connectivity products and solutions a reality.

Enabling engagement, collaboration, and adoption of Magma for 5G

Wavelabs → **Opensource** → **Magma Distro**

Fixed Wireless Access | Private Wireless Network

Equipment Vendors
(OEM, ISV, Silicon)
- Integrated or Joint solution
- Engineering, value added and support Services

Service Providers
(Telecom, WISP, Satellite)
- Lab, PoC or Commercial deployments
- Consulting, delivery, integration, support, value added and managed services

Hyperscales
(AWS, Azure, Google)
- Wavelabs Magma distro in Hyperscales Market Place
- Consulting, delivery, integration, support, value added and managed services

Enterprises
(Education, Manufacturing..)
- Lab, PoC or Commercial deployments
- Consulting, delivery, integration, support, value added and managed services

System Integrators
(E2E, RAN, Orchestration..)
- Integrated or Joint solution
- Consulting, delivery, integration, support, value added and managed services

Q & A

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Thank You!

https://www.magmacore.org/
https://github.com/magma/magma