



# Cloud-Native 5G O-RAN at Scale

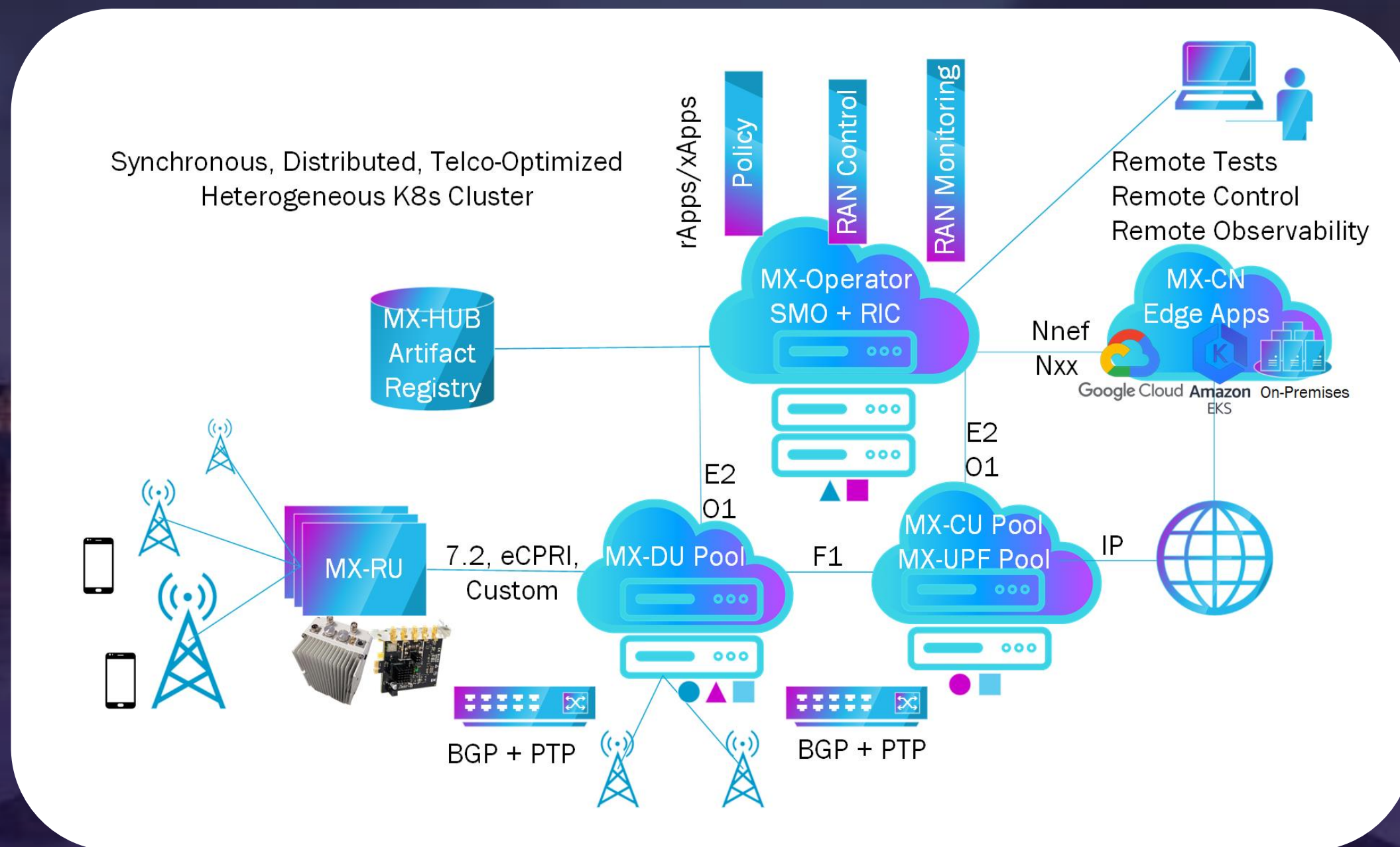
BubbleRAN (25/01/2024)

Leading provider of enterprise  
open source Telco Cloud  
solutions





# BubbleRAN



We are a software company dedicated to telecom and deliver a range of best-in-class cloud-native 4G/5G solutions empowered by O-RAN, Edge Computing, and Generative AI technologies for R&D and enterprise private 5G.

We help organization to deploy, operate, and automate a high-performance, reliable, and secure 4G/5G infrastructure at scale that is simple to use, customize and extend.

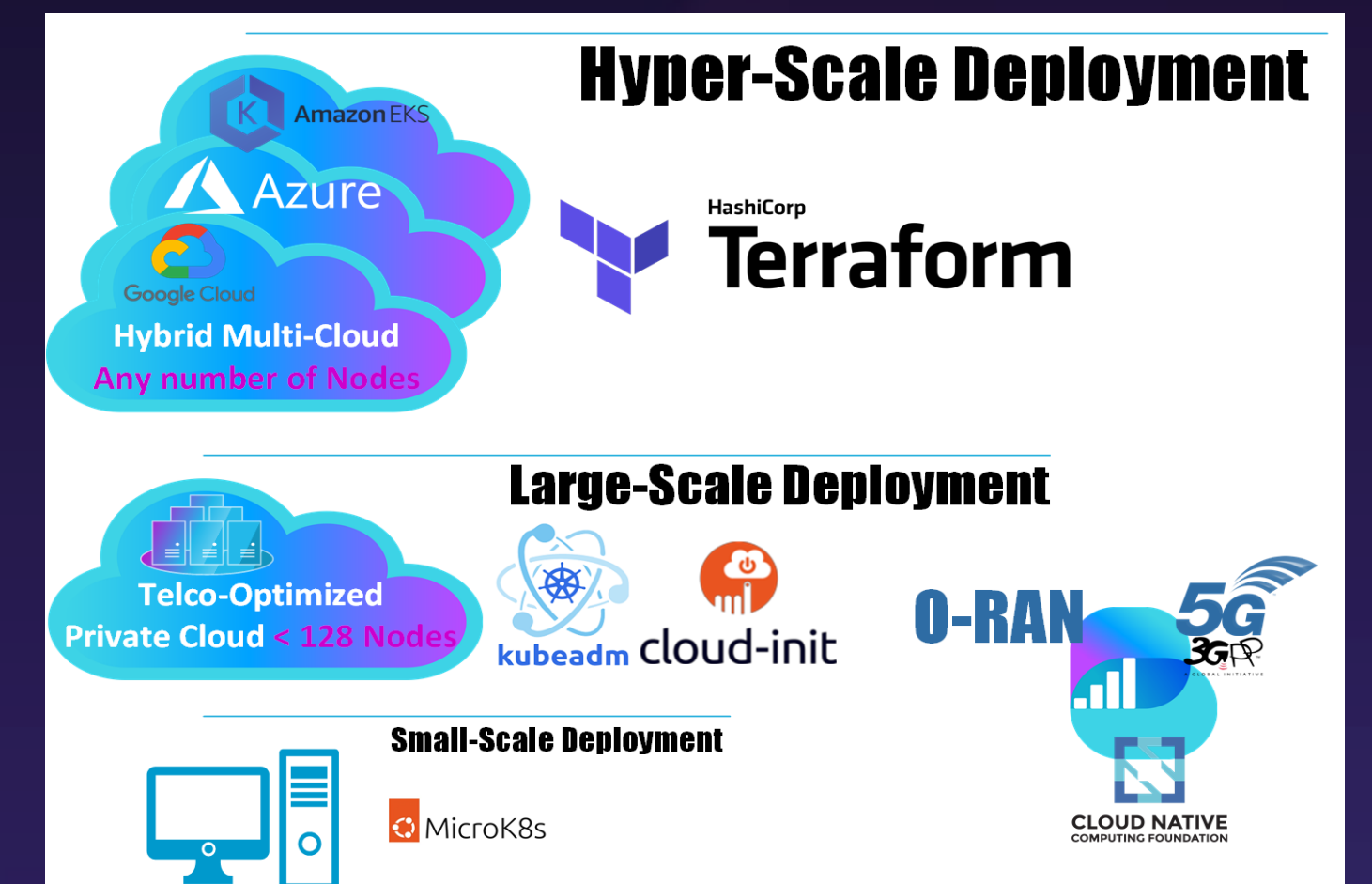
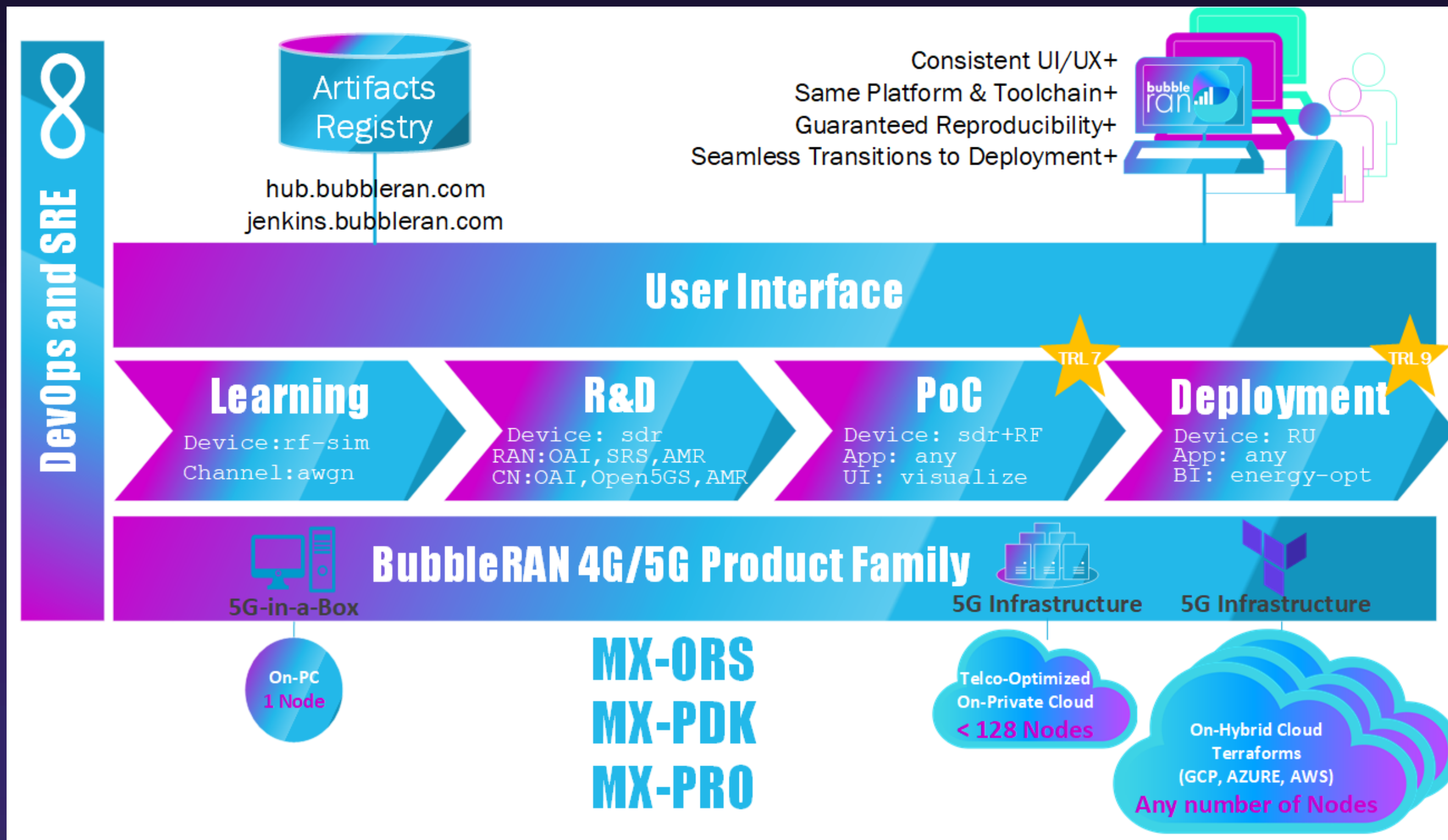
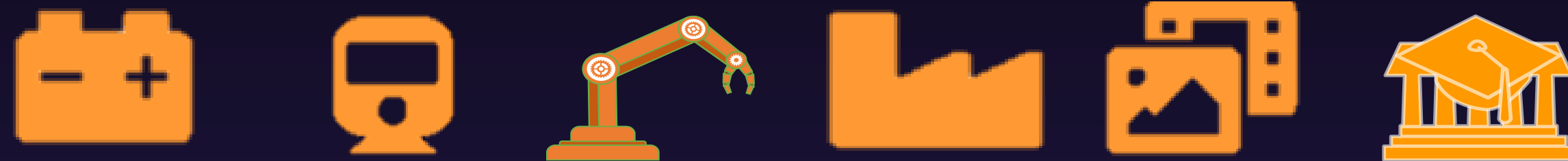


What are the dimensions of Multi-X ? Multi-vendor, Multi-version, Multi-RAT, Multi-Frequency, Multi-RF, Multi-cloud, Multi-OS, Multi-deployment.



# BubbleRAN Solution Portfolio

Seamless transition from R&D to PoC and to Deployment





# BubbleRAN Product Family

## From 5G-in-a-Box to 5G Infrastructure



### Hyper-Scale Deployment



### Large-Scale Deployment



### Small-Scale Deployment

- + Business Intelligence
- + DevOps to SRE Agility
- + Performance Guarantee
- + High Reliability & Security

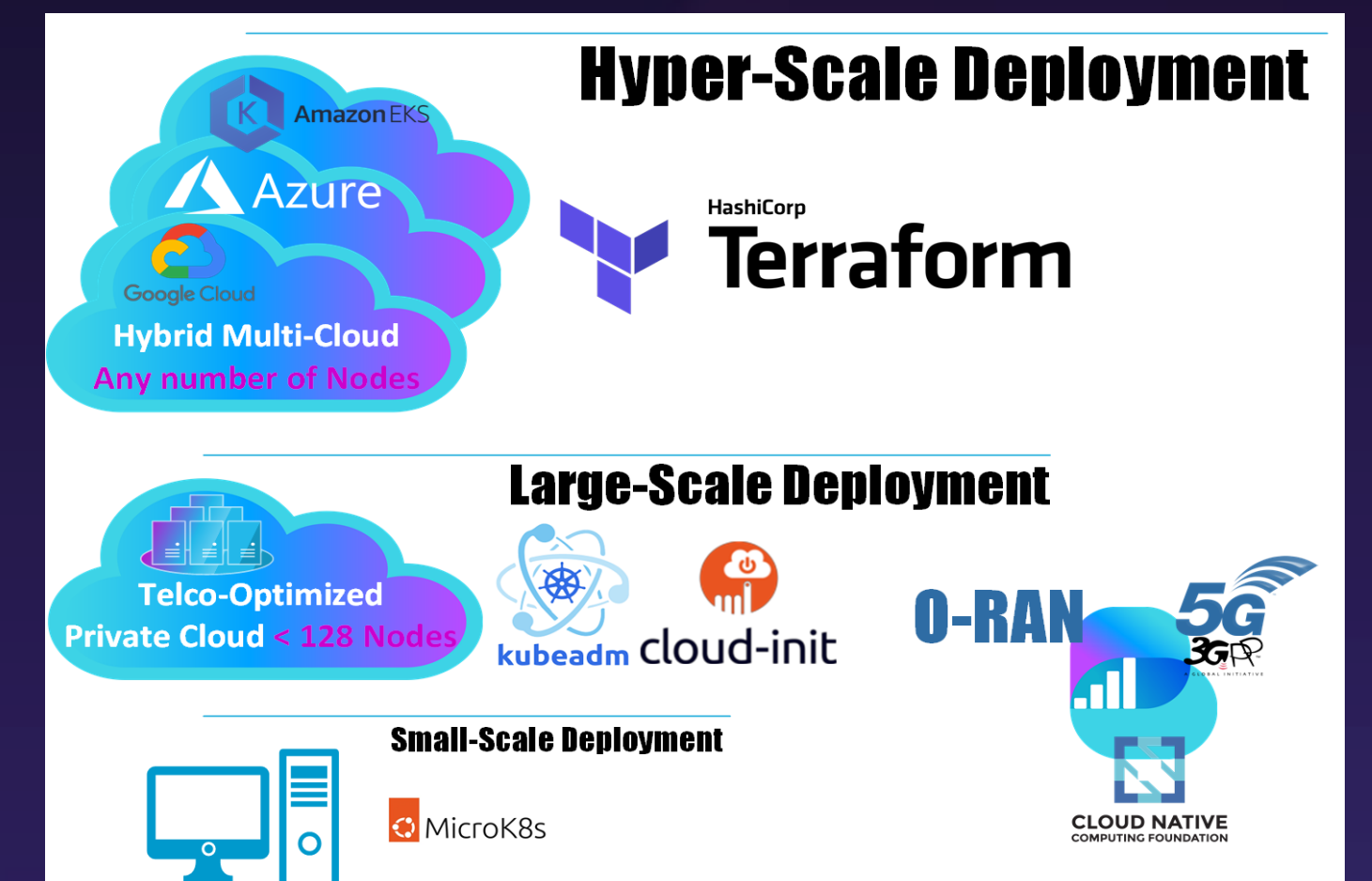
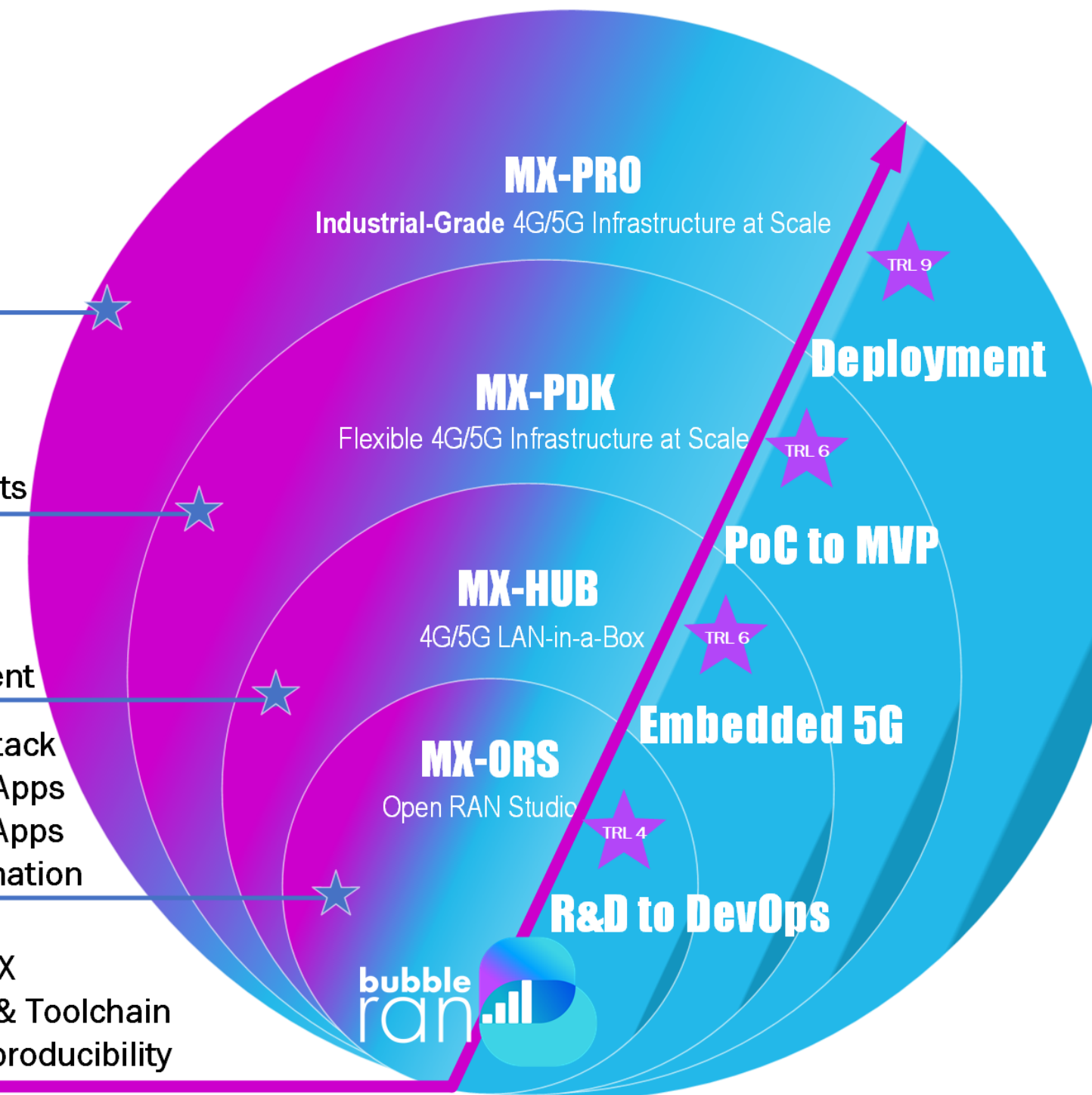
- + Full Automation & OAM
- + Observability Stack
- + Non-RT RIC and rApps
- + Large-scale Deployments

- + Edge Services
- + Multi-Bakchauling
- + Light & Low-power
- + Network Management





- + Multi-x 4G/5G stack
- + Near-RT RIC & xApps
- + Soft UE & Edge Apps
- + Manual & Automation

Consistent UI/UX  
Same Platform & Toolchain  
Guaranteed Reproducibility

### Seamless Transitions from R&D to Deployment

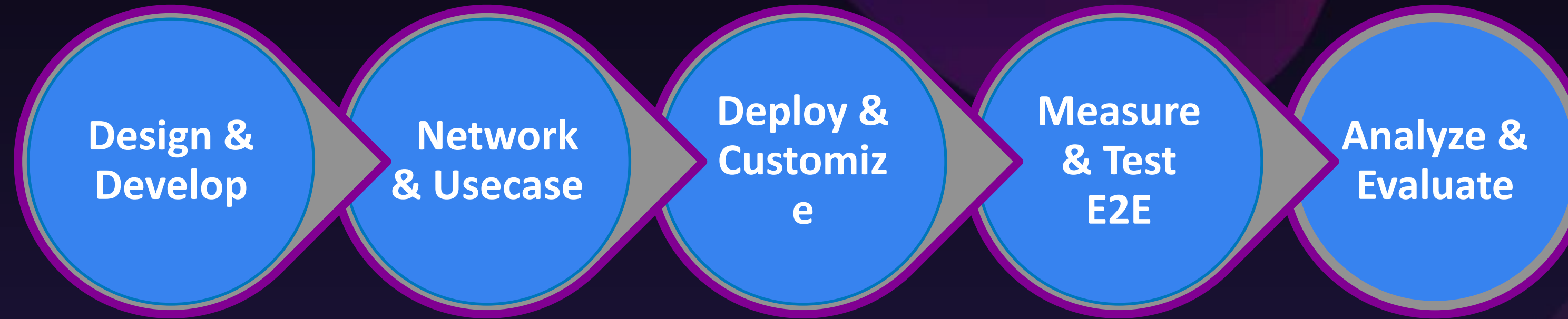


# BubbleRAN Product Comparison

Product	Noticeable Design Criteria	Target Customer Set
 <b>MX-ORS</b>	<ul style="list-style-type: none"> <li>* Data Verbosity</li> <li>* Open Documentation</li> <li>* Deployment Diversity</li> </ul>	<ul style="list-style-type: none"> <li>* Ease of Usage</li> <li>* Public Cloud Support</li> <li>* Reproducibility</li> <li>* Universities</li> <li>* Research Institutes</li> <li>* Training</li> </ul>
 <b>MX-HUB</b>	<ul style="list-style-type: none"> <li>* Minimal Cost</li> <li>* Lightweightness</li> </ul>	<ul style="list-style-type: none"> <li>* Sustainability</li> <li>* Security</li> <li>* Enterprises</li> <li>* Expeditions</li> </ul>
 <b>MX-PDK</b>	<ul style="list-style-type: none"> <li>* Versatility</li> <li>* Technology Novelty</li> <li>* Observability</li> </ul>	<ul style="list-style-type: none"> <li>* Reproducibility</li> <li>* Performance</li> <li>* Scalability</li> <li>* Research Institutes</li> <li>* Integrators</li> <li>* Operators</li> </ul>
 <b>MX-PRO</b>	<ul style="list-style-type: none"> <li>* Performance</li> <li>* Reliability</li> </ul>	<ul style="list-style-type: none"> <li>* Security</li> <li>* Business Intelligence</li> <li>* Factories</li> <li>* Campuses</li> </ul>

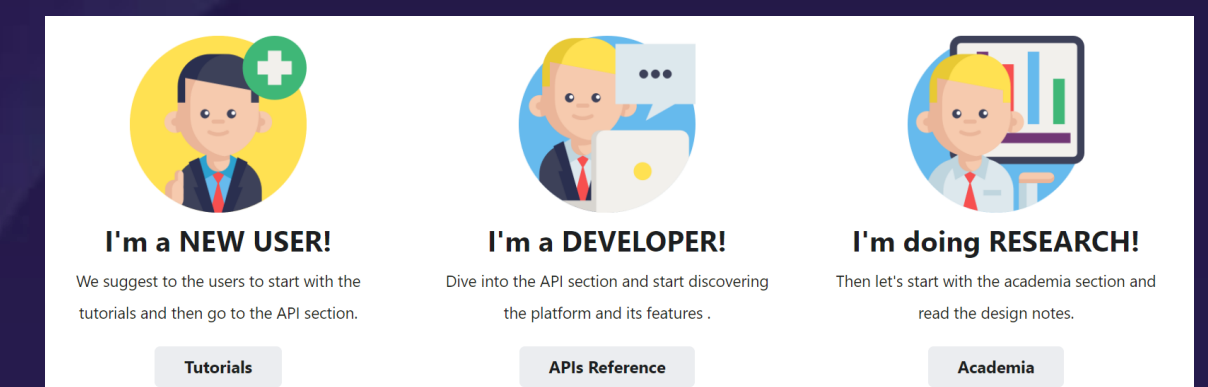


# Open RAN Studio Features (MX-ORS)



1. Develop NFs/xApps or extend the existing one and on-board them using the provided software development kit (SDK) and container-development kit (CDK)
2. Design an end-to-end 4G/5G Open RAN network blueprints, including UE, RAN, CORE, and EDGE elements, tailored to your use-case
3. Deploy and operate their blueprints at scale
4. Control and reconfigure RAN via xApps/rApps
5. Test and measure network performance
6. Collect datasets and analyze network control and user planes.
7. Online Open Documentation

<https://bubbleran.com/docs/>



Open RAN Studio is world-first production-grade cloud-native platform to seamlessly design, operate, experiment an emulated end-to-end 3GPP & O-RAN standard-compliant network with edge services, at scale.



# 5G O-RAN Platform at Scale

## With MX-PDK products

### Unique Features

☁ Fully cloud-native 5G O-RAN tested with a rich ecosystem

- reusable SMs (KPM and RC),
- xApps (e.g. RAN Slicing and HO),
- rApp (e.g. load balancing and user association) delivered in source code (C/C++, Python, and Go).

🔗 End-to-End 5G O-RAN network from

- “5G user applications to edge services”,
- “rApps and Intents down to RAN functions”.

🗄 Observability stack with a multi-source data lake aggregating metrics, alerts, resources, stats, and CO2 footprint.

♻ Sustainable product in terms of resource efficiency, infrastructure recycling, and long-term support.

#### O-RU

- 100MHz, 8x8 MIMO, R16 SA
- FR1: n77/n78/n79
- O-RAN 7.2 Fronthaul

#### Power Distribution Unit

#### Time-Aware Switching Fabric

#### • DevOps Node (x1)

- CDK
- SDK
- CI/CD/DevOps
- Source Code

#### Compute Node (x6)

- CU and DU Pool
- O-RAN 7.2 Fronthaul
- O-RU, SDR, RFSIM, soft UE

#### Master Node (x1)

- SMO/OAM & Observability Stack
- Non-RT & Near-RT RIC, xApps, rApps
- Business Intelligence
- 5GC

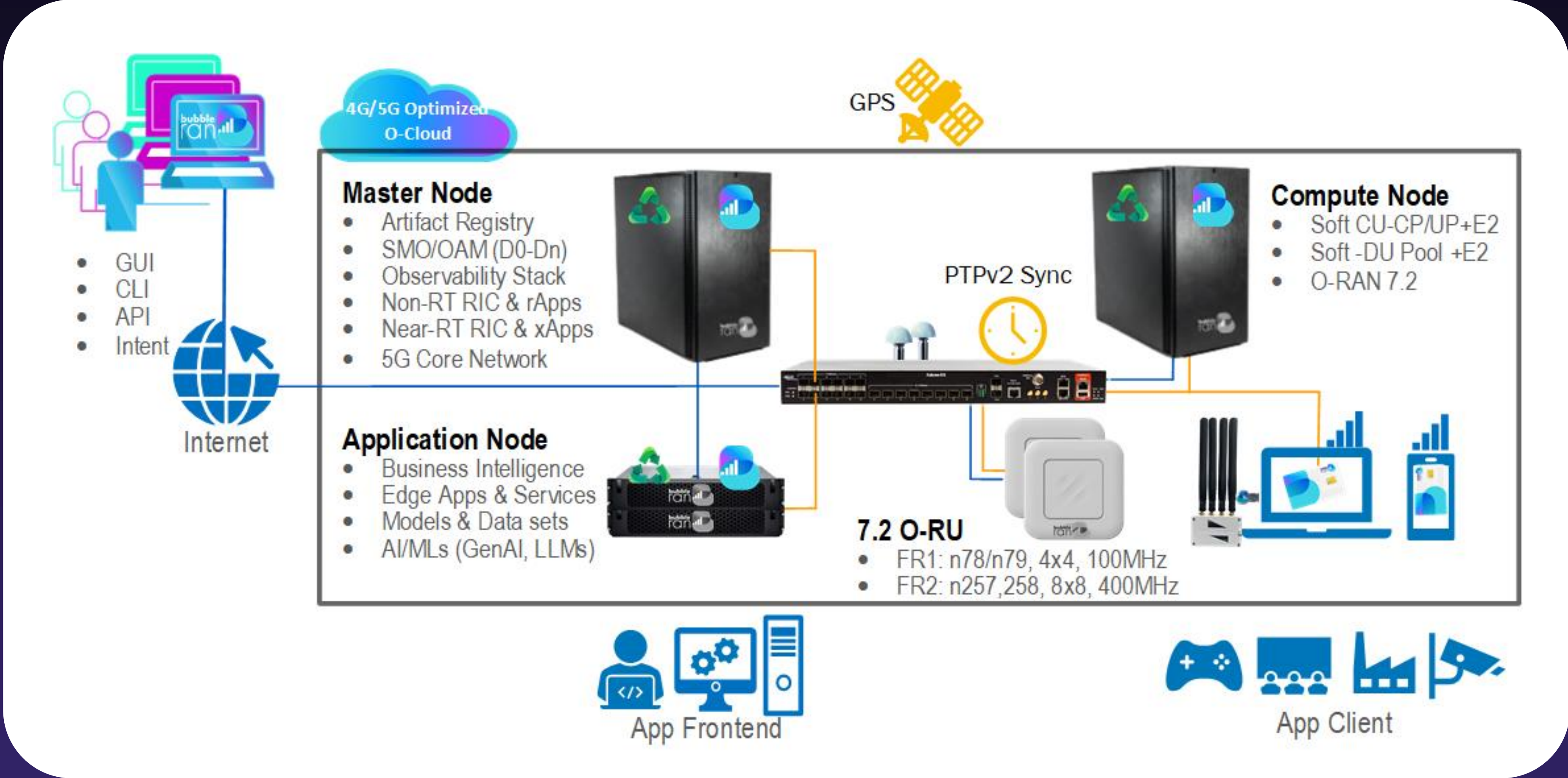


Let us help you build a fully-fledged cloud-native 5G O-RAN testbed with your desired choice of vendors, radios, and clouds scaled to your requirements and budget.



# 5G O-RAN Minimal Testbed: R&D

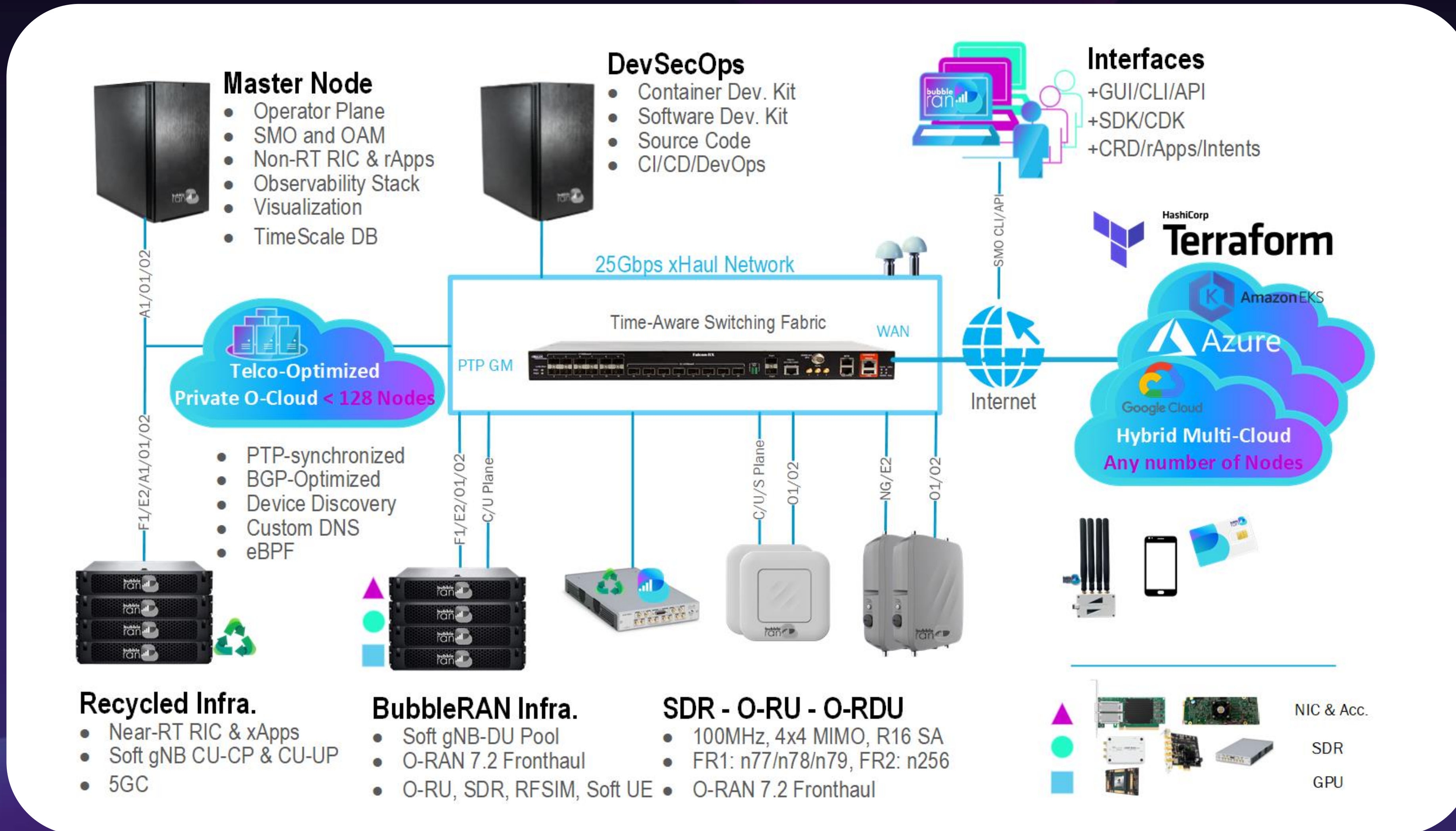
With MX-PDK products





# 5G O-RAN Scalable Infrastructure: R&D to DevOps

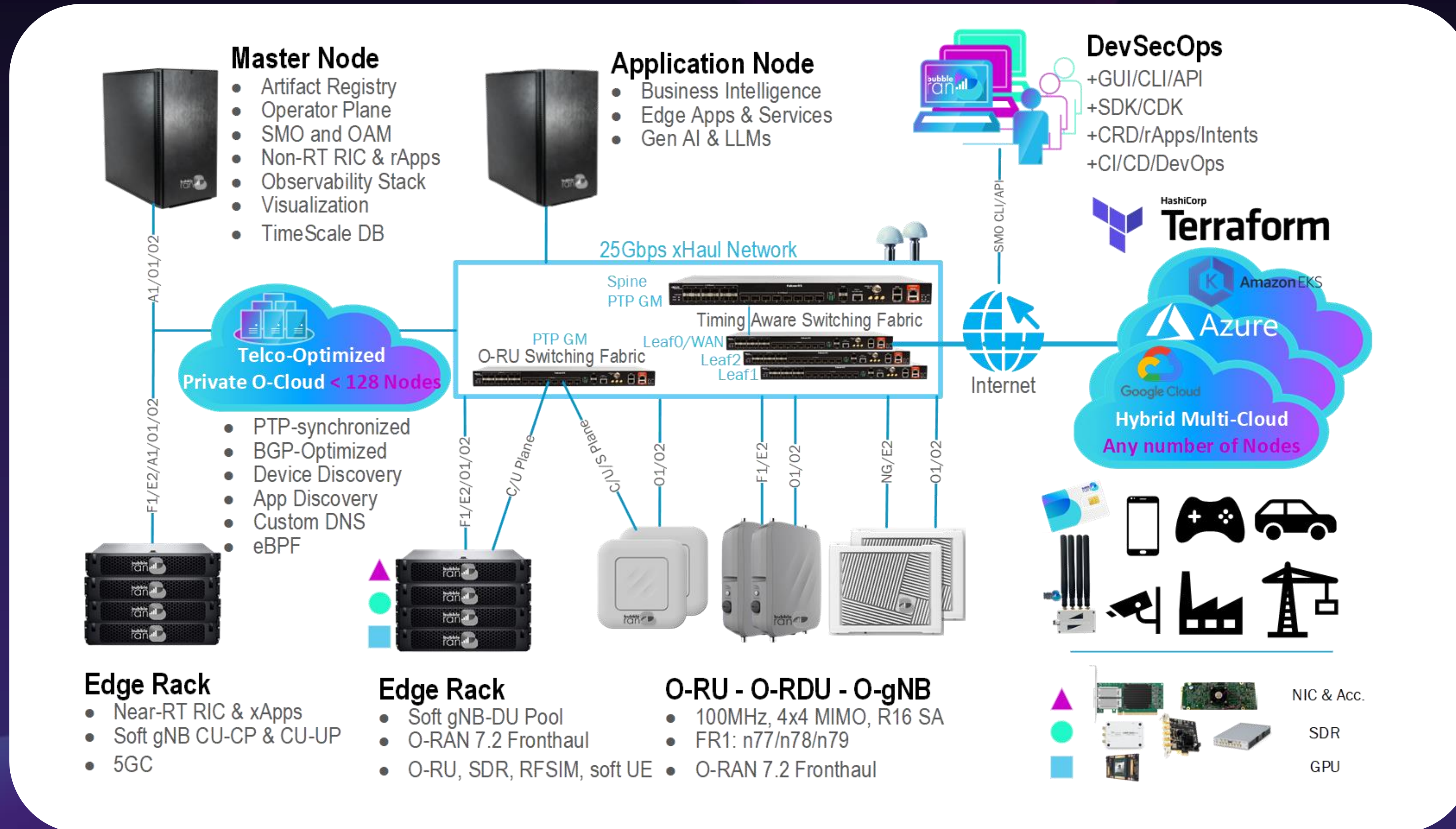
## With MX-PDK products





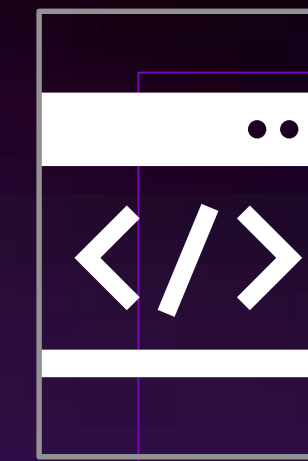
# Private 5G Infrastructure Featuring O-RAN: Campus

## With MX-PRO products





# How does Cloud-Native 5G Open RAN performance look like?



1000 times faster  
commit-to-deploy lead time



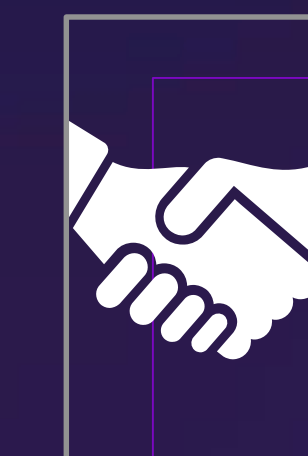
100 times faster  
TtM 3 features/week/developer



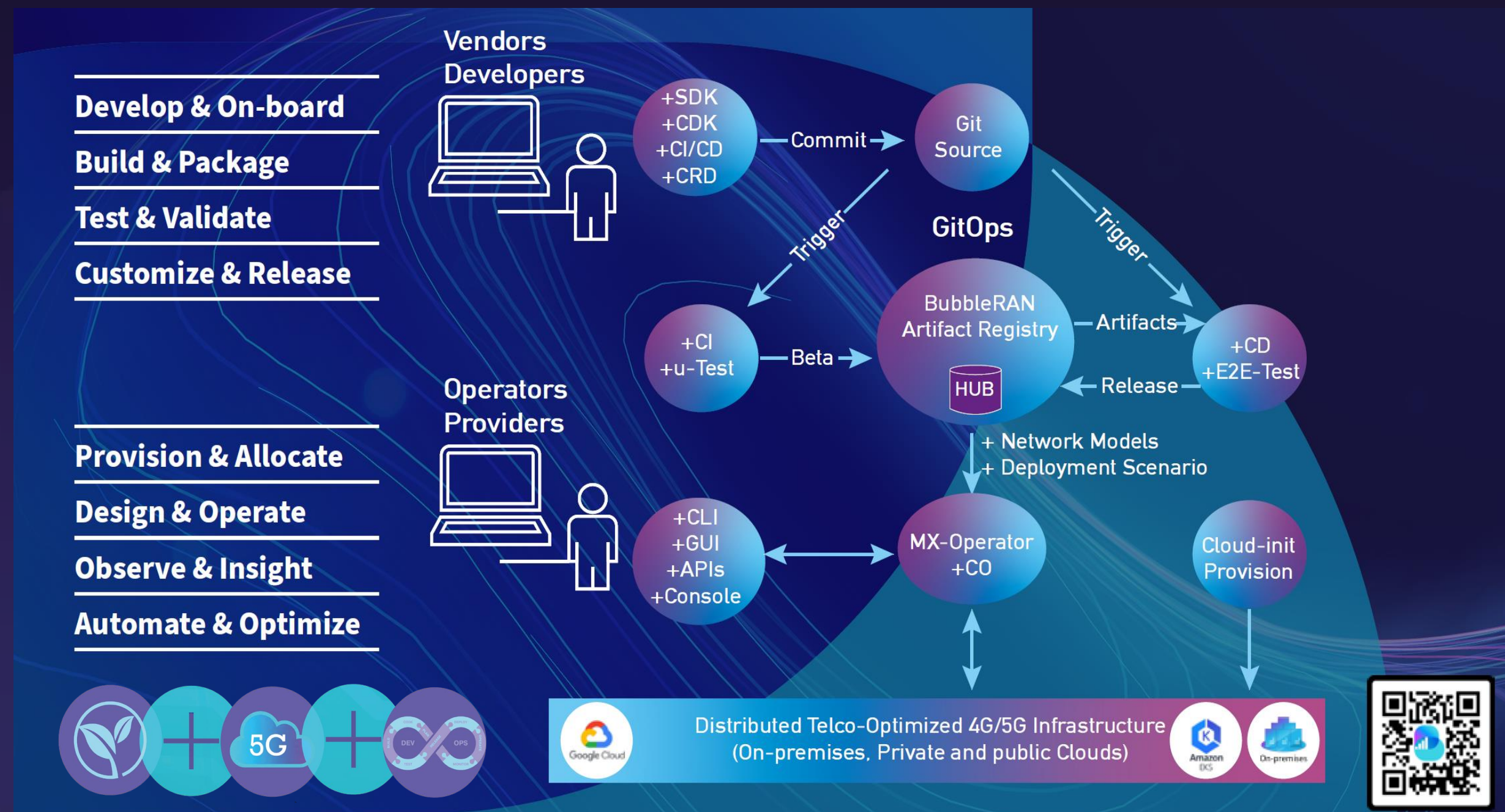
100 times faster  
failure recovery & infra scaling



3 times lower  
failure rate



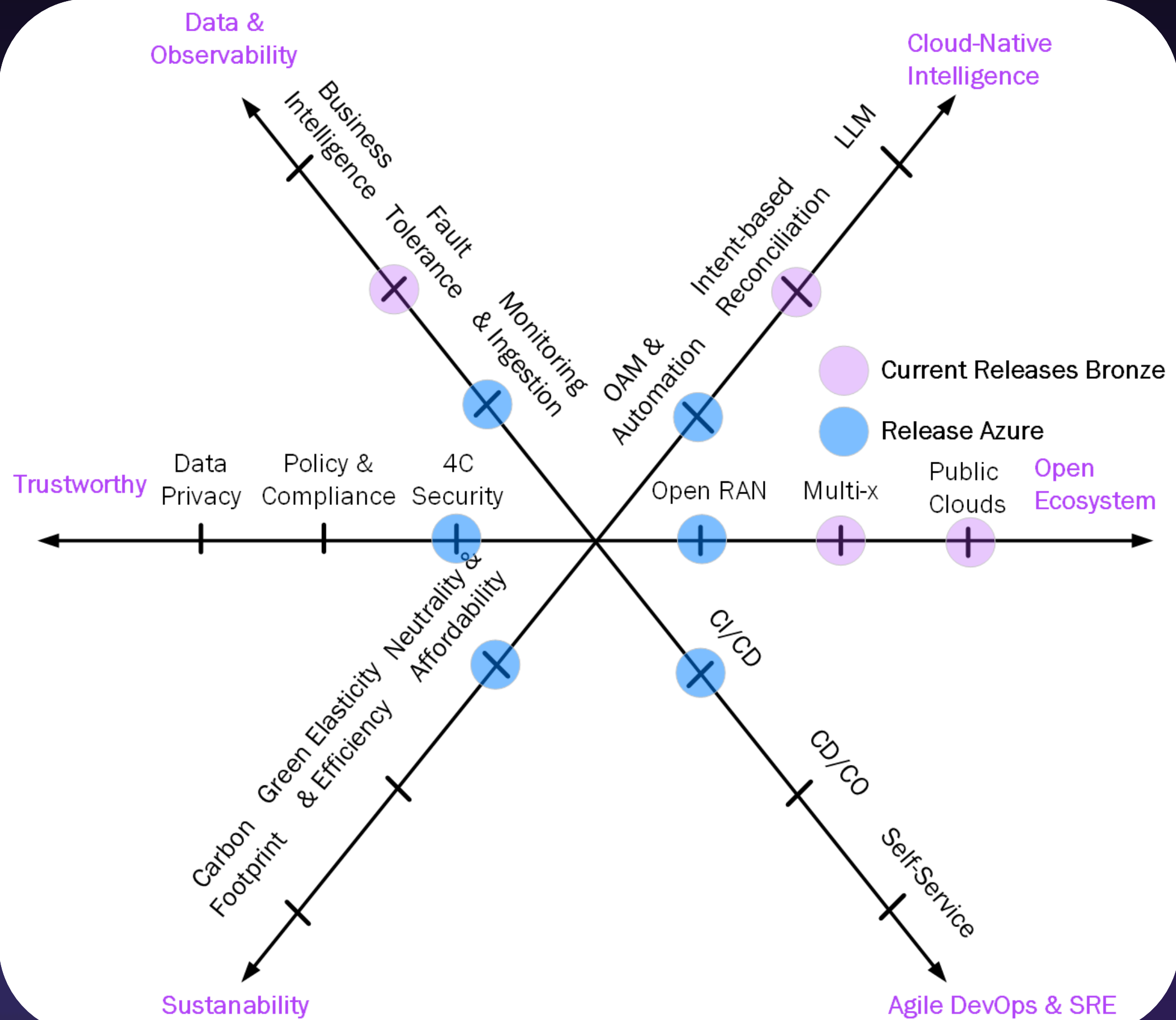
1.8 times better  
business outcomes



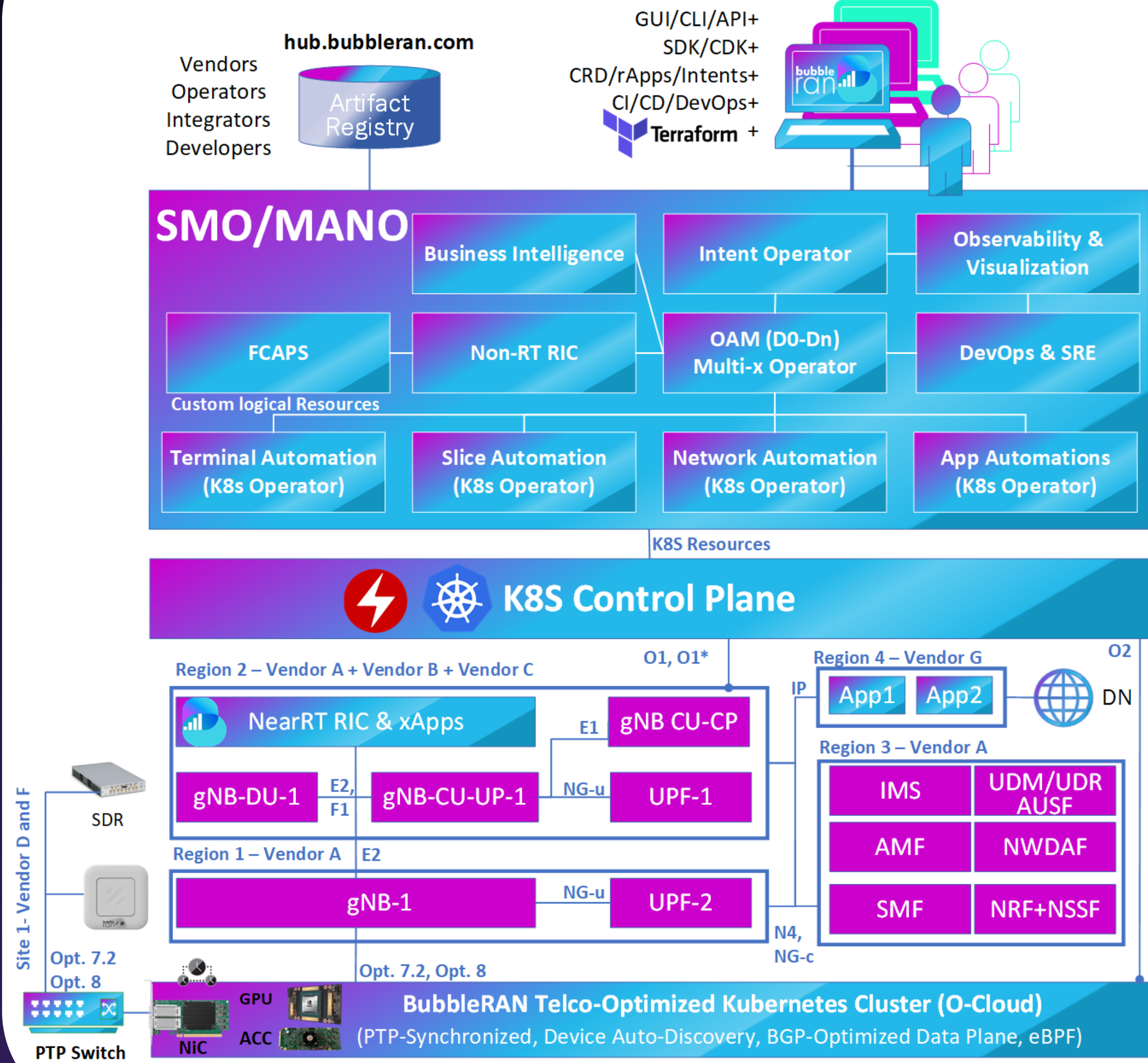


# BubbleRAN Multi-X Cloud-Native 5G Open RAN Technology

## Releases and Functionalities



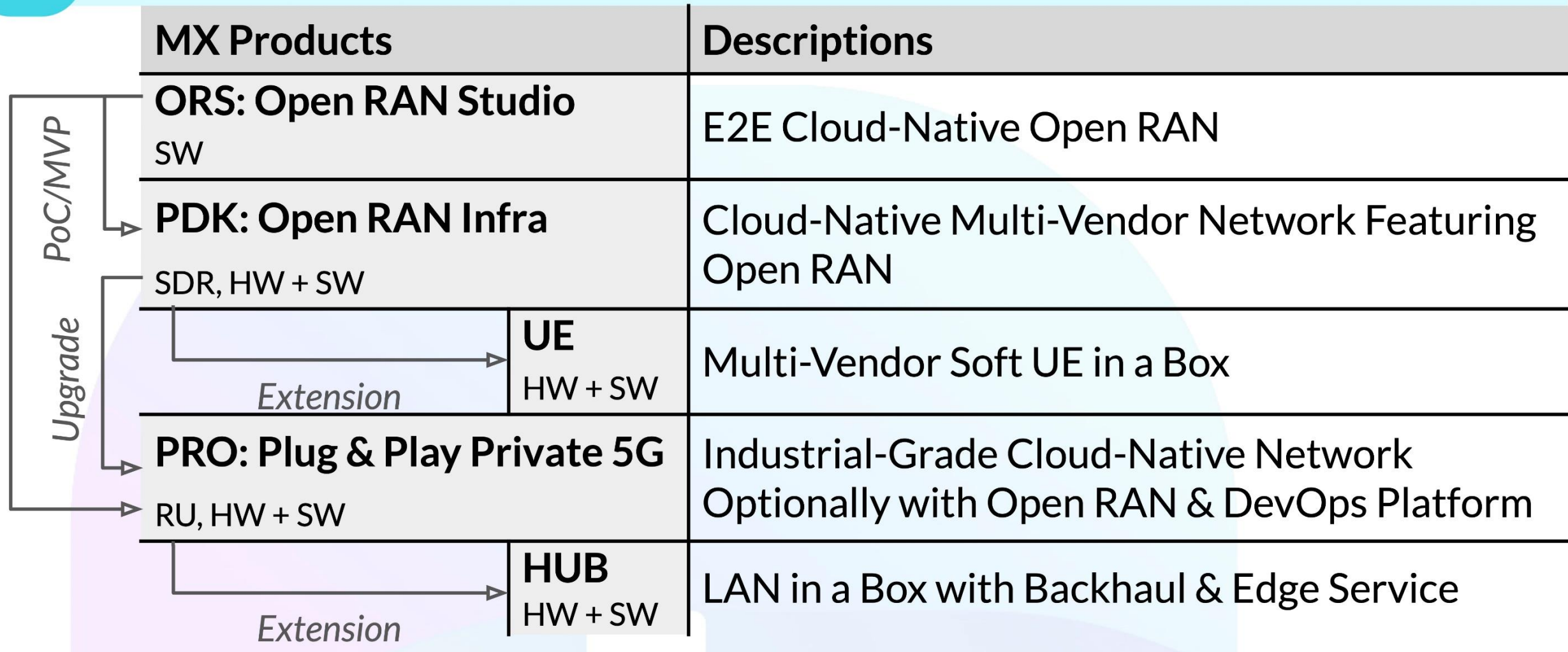
## Cloud-Native 5G O-RAN Blueprint





# BubbleRAN Open RAN Landscape

Deployment & Optimization



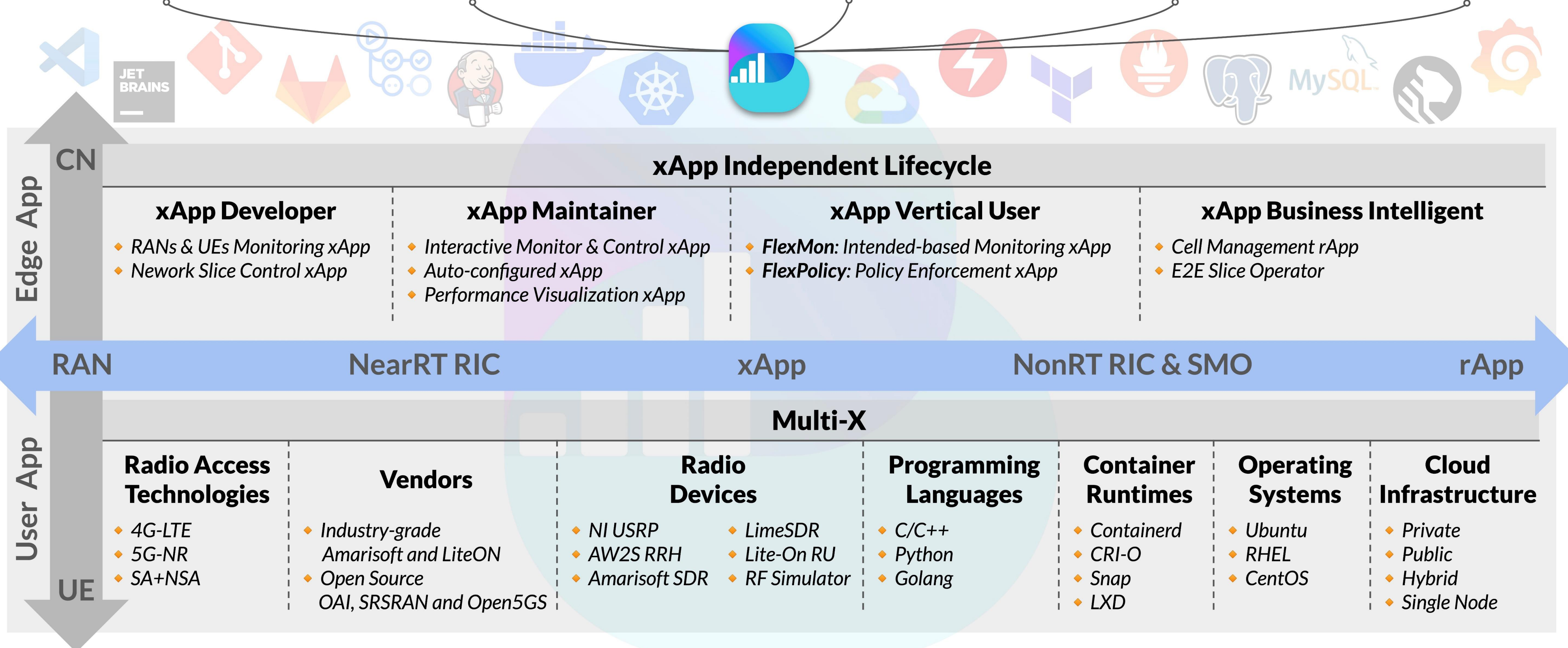
# xApp Features

Language	O-RAN SMs			Customized SMs					
	KPM		RC	MAC	RLC	PDCP	GTP	SLICE	TC
	v2	v3	v1						
<b>C</b>	v	v	v	v	v	v	v	v	v
<b>Python</b>	v	v	24'Q2	v	v	v	v	v	TBD
<b>Go</b>	v	v	24'Q2	v	v	v	v	v	TBD
Database									
<b>SQLite3</b>	v	v	24'Q2	v	v	v	v	v	N/A
<b>MySQL</b>	v	v	24'Q2	v	v	v	v	v	N/A
<b>TimescaleDB</b>	v	v	TBD	v	v	v	TBD	TBD	N/A

# BR-T9S Command Line Interface

Commands	Descriptions	
<b>observe</b>	Open up the observation toolbox	
<b>cic</b>	CLI in CLI	
<b>install</b>	Install a component on Trirematics	
	Ex: <code>cli install operator/model/network</code>	
<b>extract</b>	Extract contents from the containers	
	<b>config</b>	Get decoded configurations out of an Element
	<b>logs</b>	Get logs from a specific Element
	<b>graph</b>	Get the network graph
	<b>pcap</b>	Get PCAP from the network interfaces of the Workload
	<b>infra</b>	Get infrastructure data
<b>test</b>	<b>port</b>	Get particular port number and IP address from a specific Element
	Perform an evaluation	
	<b>rtt</b>	Measure the round-trip time
<b>remove</b>	<b>throughput</b>	Measure the network throughput
	Remove a component on Trirematics	
<b>completion</b>	Ex: <code>cli remove operator/model/network</code>	
	Generate the auto-completion script for the specified shell	
<b>login</b>	Ex: <code>cli completion bash/powershell/fish/zsh</code>	
	Authenticate to Harbor for the current namespace	
<b>list</b>	List all the operators, models, or networks	
<b>diag</b>	Perform diagnostics against the cluster	
<b>help</b>	Help about any command	
<b>run</b>	Run an arbitrary command list	








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## Our Technology, Your Network



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