



ROAMING
Networks

OPEN RAN

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Lead Engineer for RAN development



Agenda

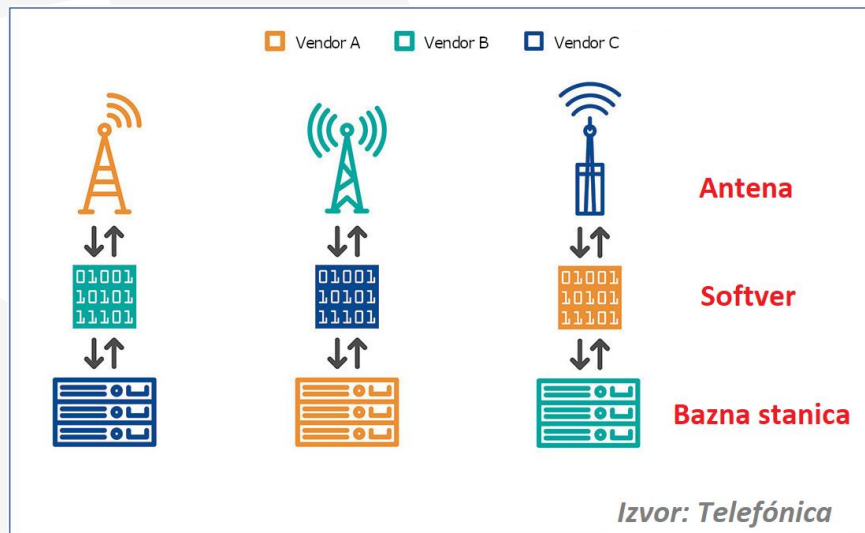
- ORAN definicija i terminologija
- ORAN razvoj
- TIP i O-RAN Alliance
- 7.2x funkcionalna podela
- ORAN arhitektura
- ORAN u praksi - mogućnosti i izazovi

ORAN definicija

- Disagregacija RAN hardvera i softvera korišćenjem otvorenih interfejsa.

Ključni pojmovi:

- **Disagregacija** = razdvajanje hardvera i softvera
- **Interoperabilnost** = otvoreni interfejsi
- **Diversifikacija** ≠ vendor lock-in
- **Inteligencija** = RIC
- **Performantnost** = Cloud + DevOps



ORAN terminologija

**Open RAN
ili
ORAN**

Predstavlja disagregaciju hardvera i softvera u radio pristupnim mrežama kreiranjem otvorenih interfejsa između njih

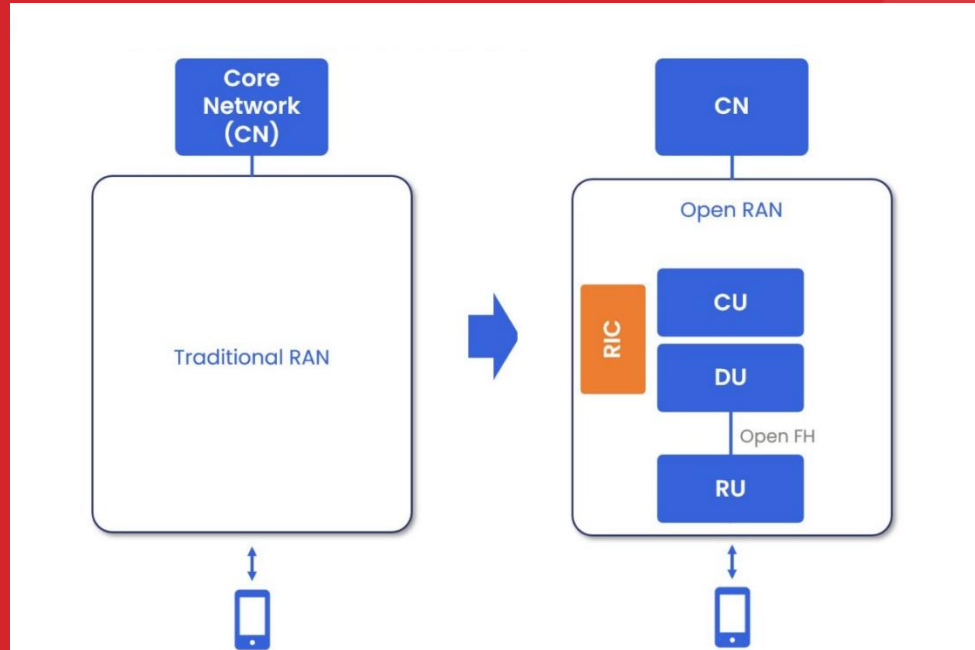
OpenRAN

Može se odnositi na razvojnu grupu u okviru TIP-a (Telecom Infra Project) ili koristiti kao hastag (#OpenRAN) na društvenim mrežama

**O-RAN
ili
oRAN**

Podrazumeva O-RAN alijansu, jednu od dve vodeće organizacije za razvoj i promociju ORAN-a

ORAN razvoj



vRAN vs ORAN

Komponenta	vRAN	ORAN
Hardver	Proprietary /COTS	COTS
Softver	VNF/CNF	VNF/CNF
Interfejsi	Zatvoreni	Otvoreni



Telecom Infra Project

TIP Project Groups		
Access Projects	Transport Projects	Core & Services Projects
CrowdCell	Millimeter Wave (mmWave) Networks	Edge Application Developer
OpenCellular	Non-Terrestrial Connectivity Solutions	End-to-End Network Slicing (E2E-NS)
OpenRAN	Open Box Microwave	
OpenRAN 5G NR	Open Optical Packet Transport	
vRAN Fronthaul		
Solutions Integration		
Wi-Fi		
Startups – TEAC		
TIP Community Labs		
PlugFest		
Graduated Projects		

ORAN Alliance

XRAN FORUM + C-RAN ALLIANCE = O-RAN ALLIANCE

China Mobile &
mainly other
Chinese vendors

C-RAN Alliance

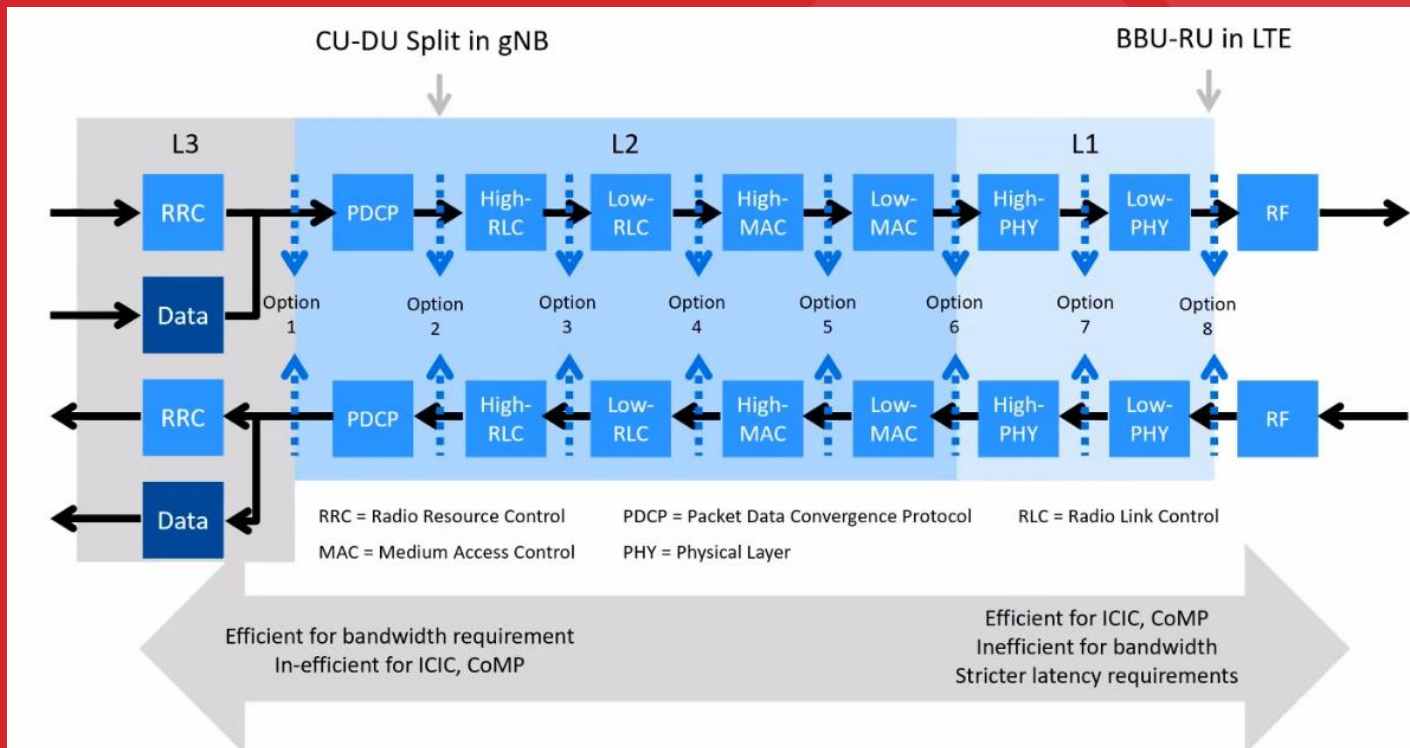
NTT Docomo &
other mainly
American vendors



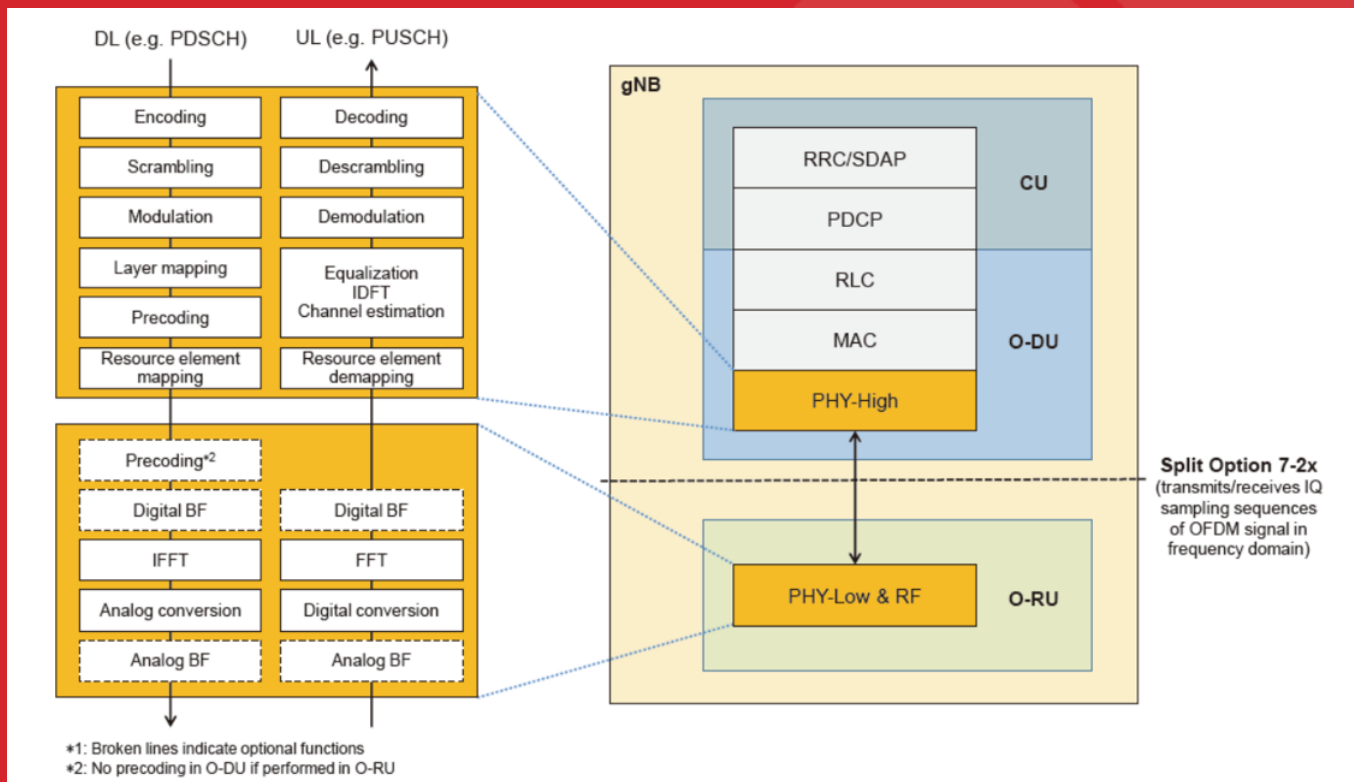
Founding Operators
AT&T, China Mobile,
DT, NTT Docomo,
Orange

Work Group 1	• Focuses on studying use cases and overall architecture.
Work Group 2	• Focus on optimization and automation of the RAN Radio Resource Management, or RRM, using the RAN Intelligent Controller, or RIC.
Work Group 3	
Work Group 4	• Focus on open interfaces for achieving interoperability between different RAN hardware and software vendors.
Work Group 5	
Work Group 6	• Focus on commoditization, virtualization and modularization of RAN hardware and software.
Work Group 7	
Work Group 8	
Work Group 9	• Focuses on the new open transport network based on new architectures and end-user service requirements for fronthaul, midhaul and backhaul, collectively known as X-haul.

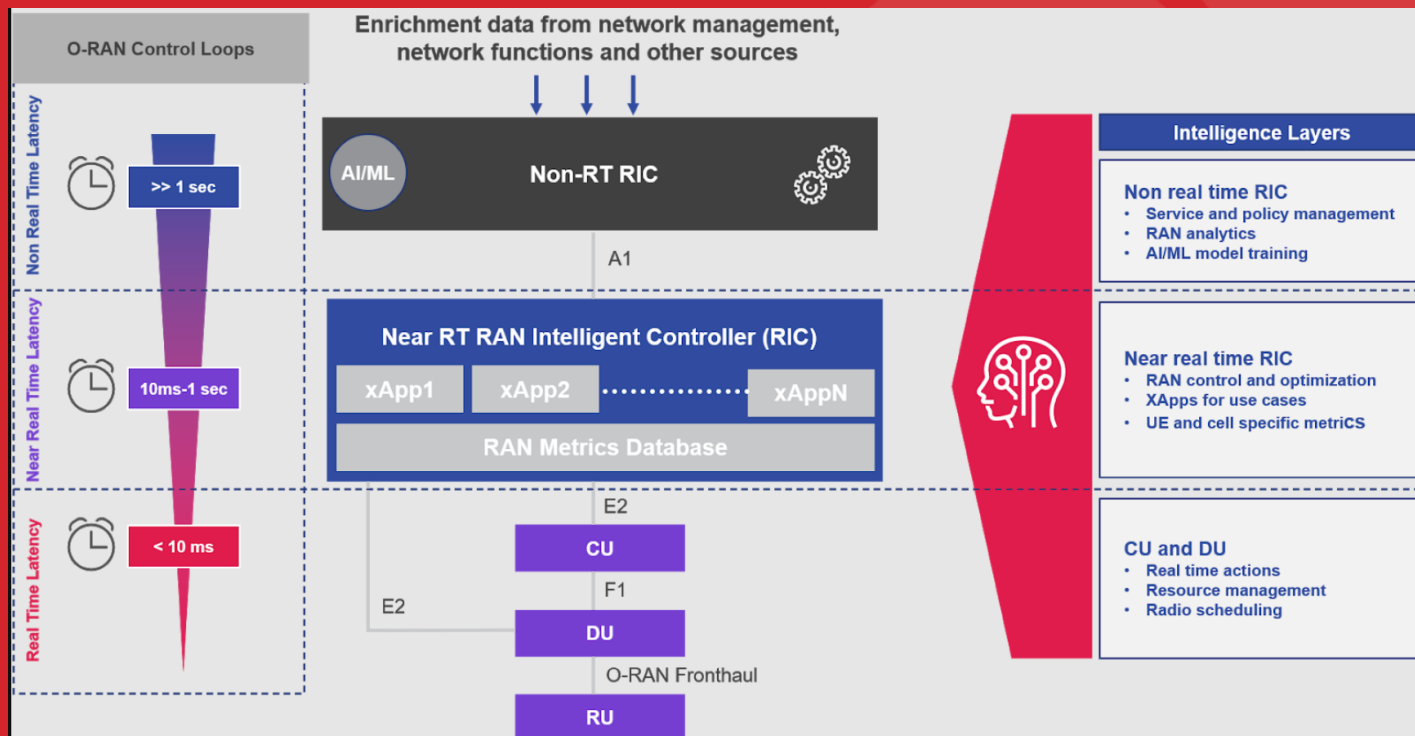
5G funkcionalna podela prema 3GPP



7.2x funkcionalna podela u ORAN-u



ORAN arhitektura





ORAN u praksi

Servis provajder	Hardverske i softverske kompanije
Rakuten Mobile	Nokia, AirSpan, NEC, MTI, Altiosstar, Cisco, Intel, OpenStack
Dish Network	Mavenir, Altiosstar, MTI, Fujitsu, Dell, Intel, Cisco, AWS
1&1	Rakuten Symphony, NEC, Mavenir, Cisco, Sercomm
IpT (Telefónica, Facebook, IDB Invest i CAF)	PW, Mavenir, Altiosstar, Intel, SuperMicro, Xilinx, Gigatera, AWS
NTT DoCoMo	Fujitsu, NEC, Samsung, Nokia
Vodafone	Parallel Wireless, SuperMicro, Vmware, HP, Comba Telecom
Deutsche Telekom	Mavenir, Dell, NEC, Fujitsu, Samsung

ORAN izazovi i mogućnosti



O&M KPIs Bezbednost

Integracija Testiranje

Troubleshooting

Capex/Opex Skalabilnost

Fleksibilnost Diversifikacija

Vendor lock-in Future-proof



ROAMING
Networks

HVALA NA PAŽNJI!

