tsdsi India's Telecom SDO

celebrating 10 Years of developing ICT Standards

Inaugural Workshop on Standards Awareness

Achieving Leadership in Standards

Enabling Organisational Frameworks

in partnership with SAMSUNG

IIIT Bangalore

9th May 2024

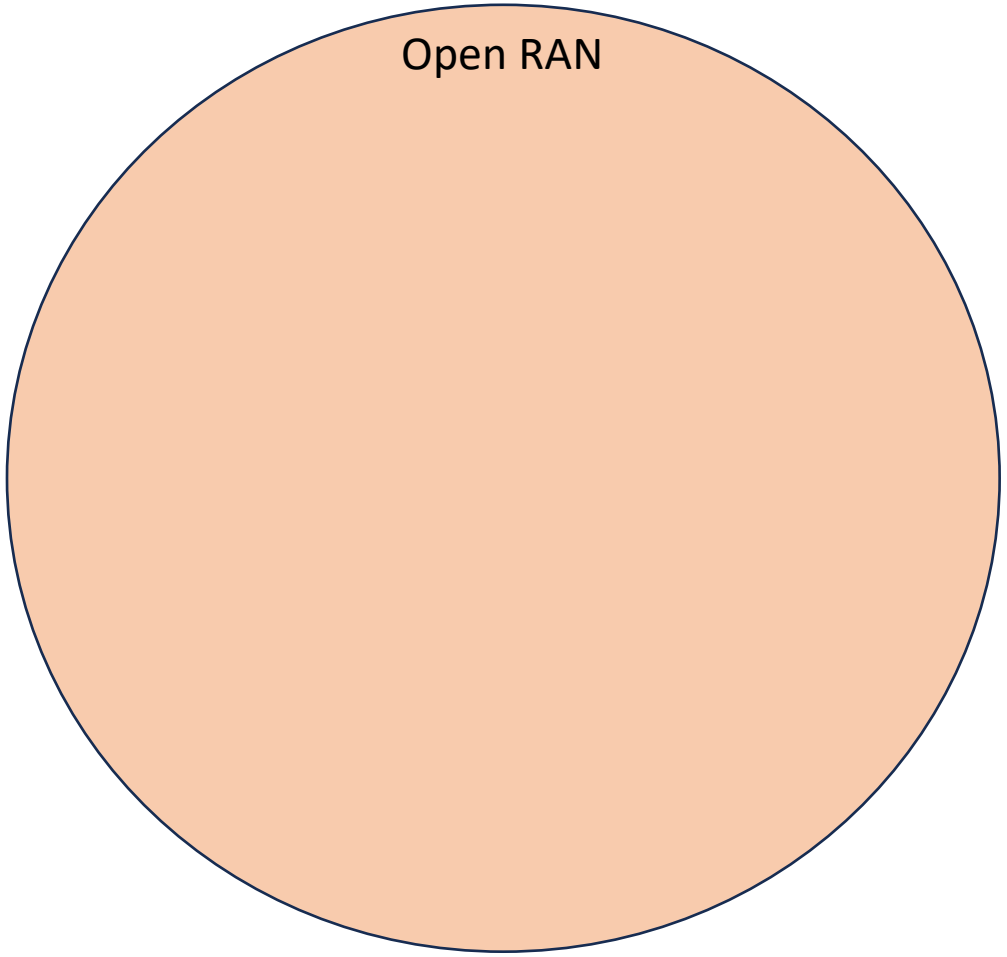
Technical Activities at O-RAN

by

Makarand Kulkarni

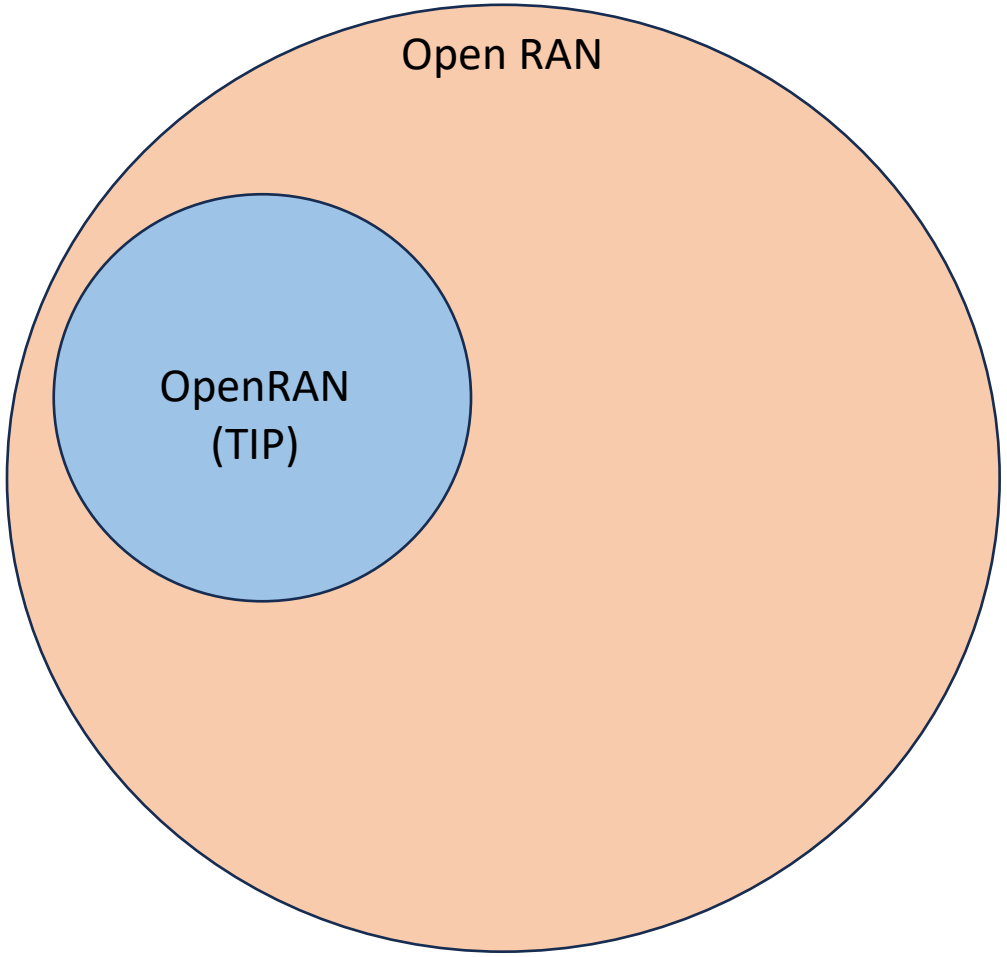
Saankhya labs/Tejas Networks

Origins*



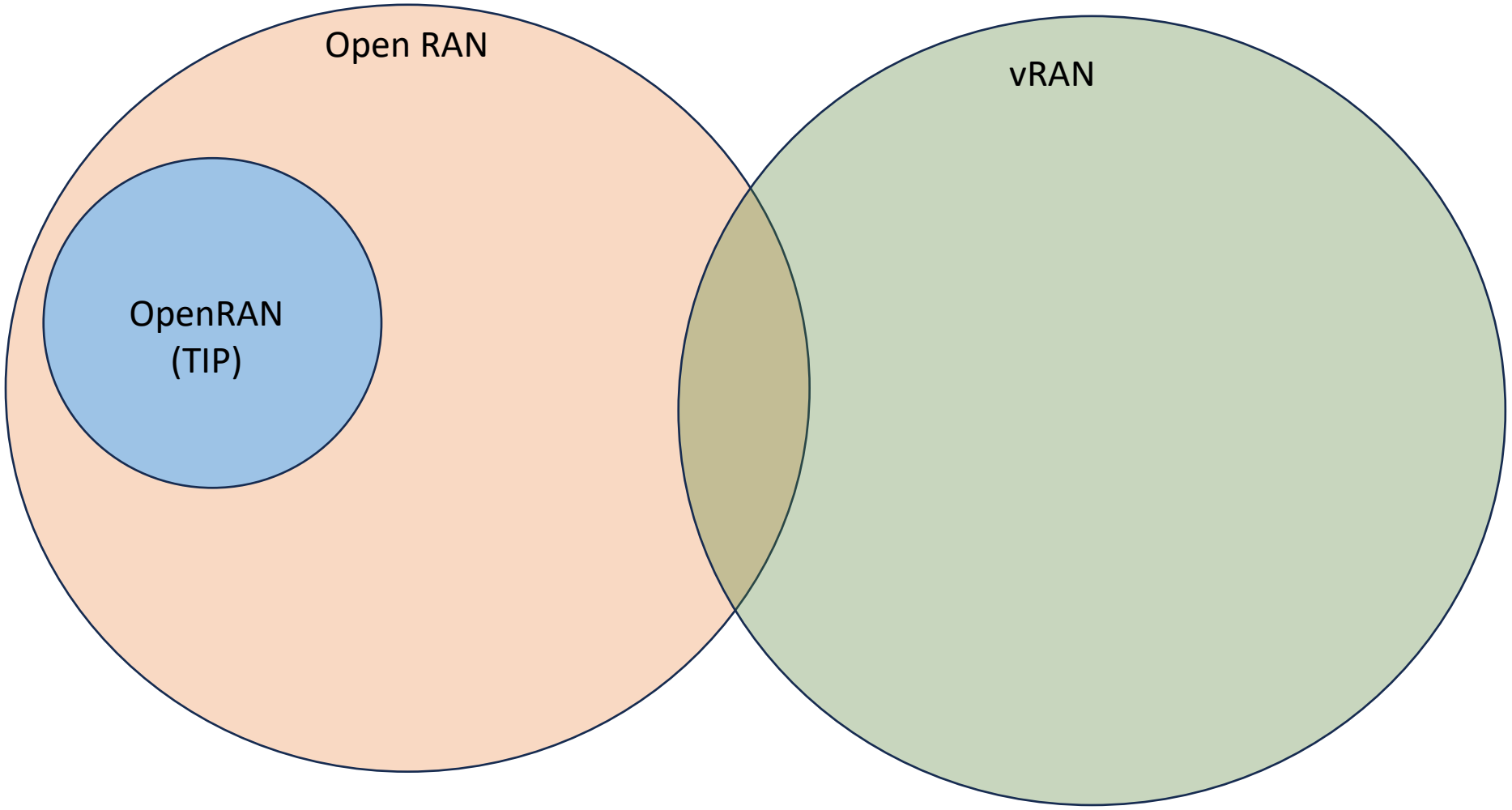
source: Fiber Cable Solution Technology Co.,Ltd.

Origins*



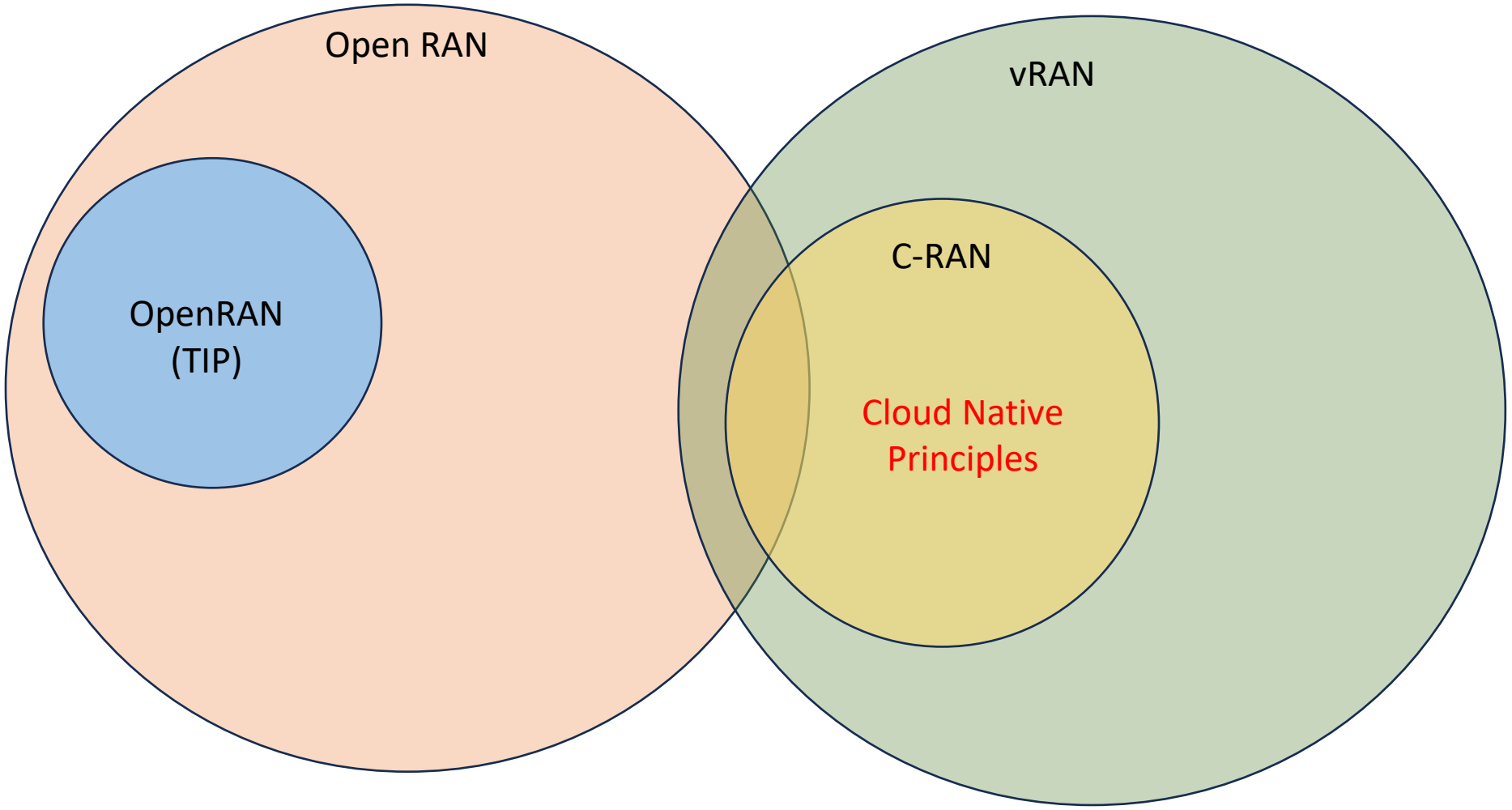
source: Fiber Cable Solution Technology Co.,Ltd.

Origins*



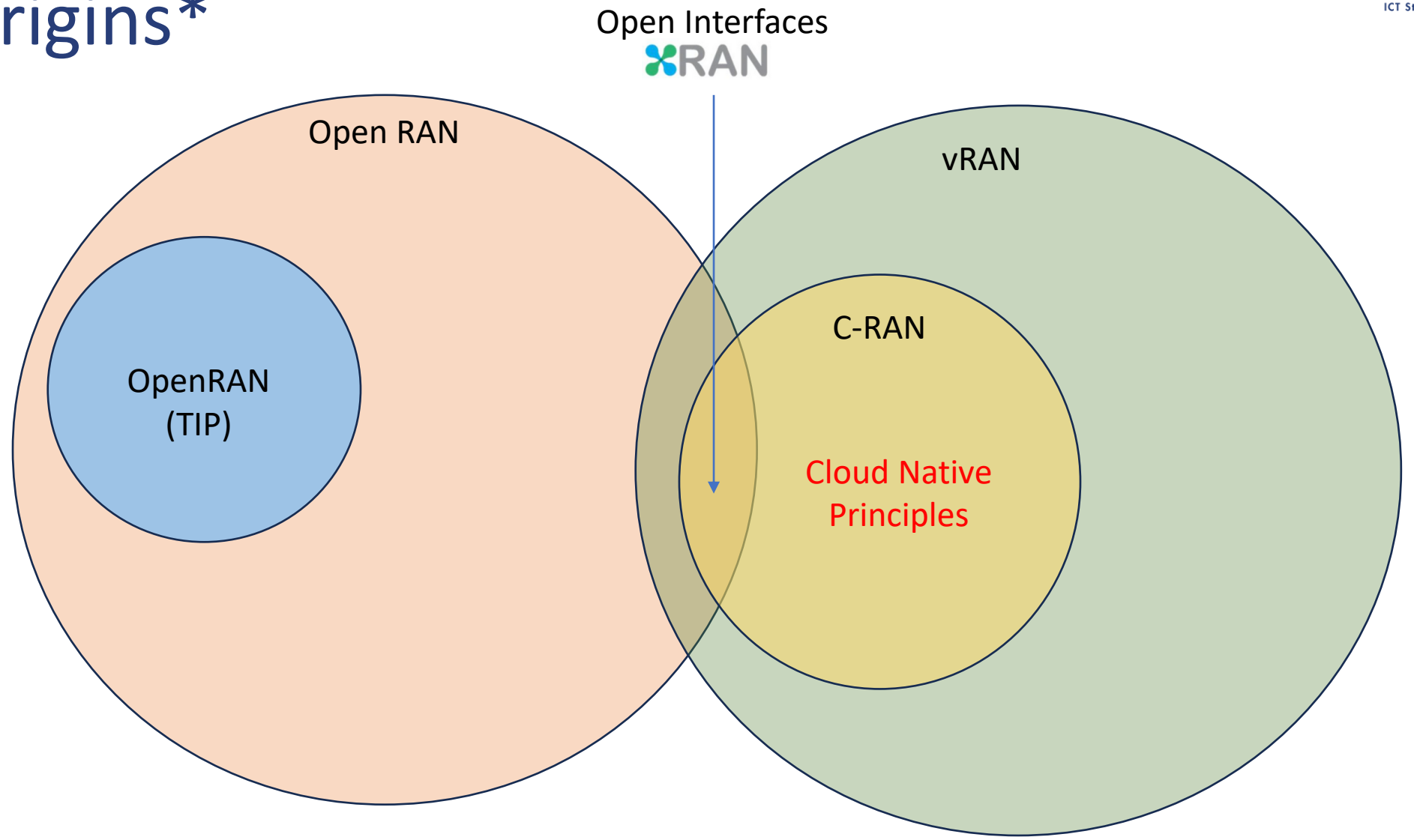
source: Fiber Cable Solution Technology Co.,Ltd.

Origins*



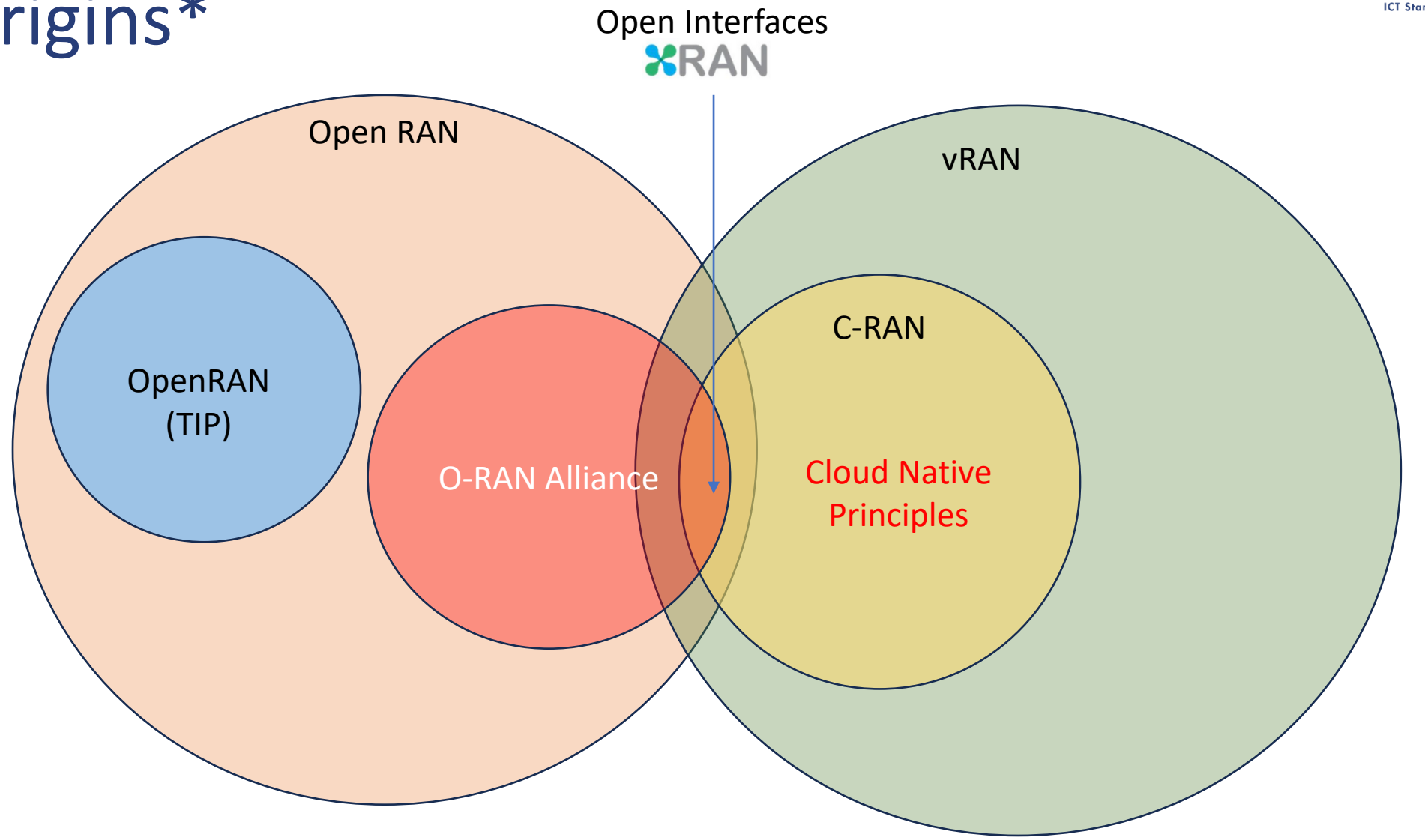
source: Fiber Cable Solution Technology Co.,Ltd.

Origins*



source: Fiber Cable Solution Technology Co.,Ltd.

Origins*



What's the difference between Open RAN and O-RAN ?

source: Fiber Cable Solution Technology Co.,Ltd.

Main Objectives

- Cloudification/Virtualization
  - Dynamic resource and service scaling
  - Sharing of resources
  - Use COTS hardware then purpose-built

Main Objectives

- Cloudification/Virtualization
- Disaggregation
  - Breaks monopolies in RAN market
  - Independent scaling of service planes
  - Promotes innovation from smaller players

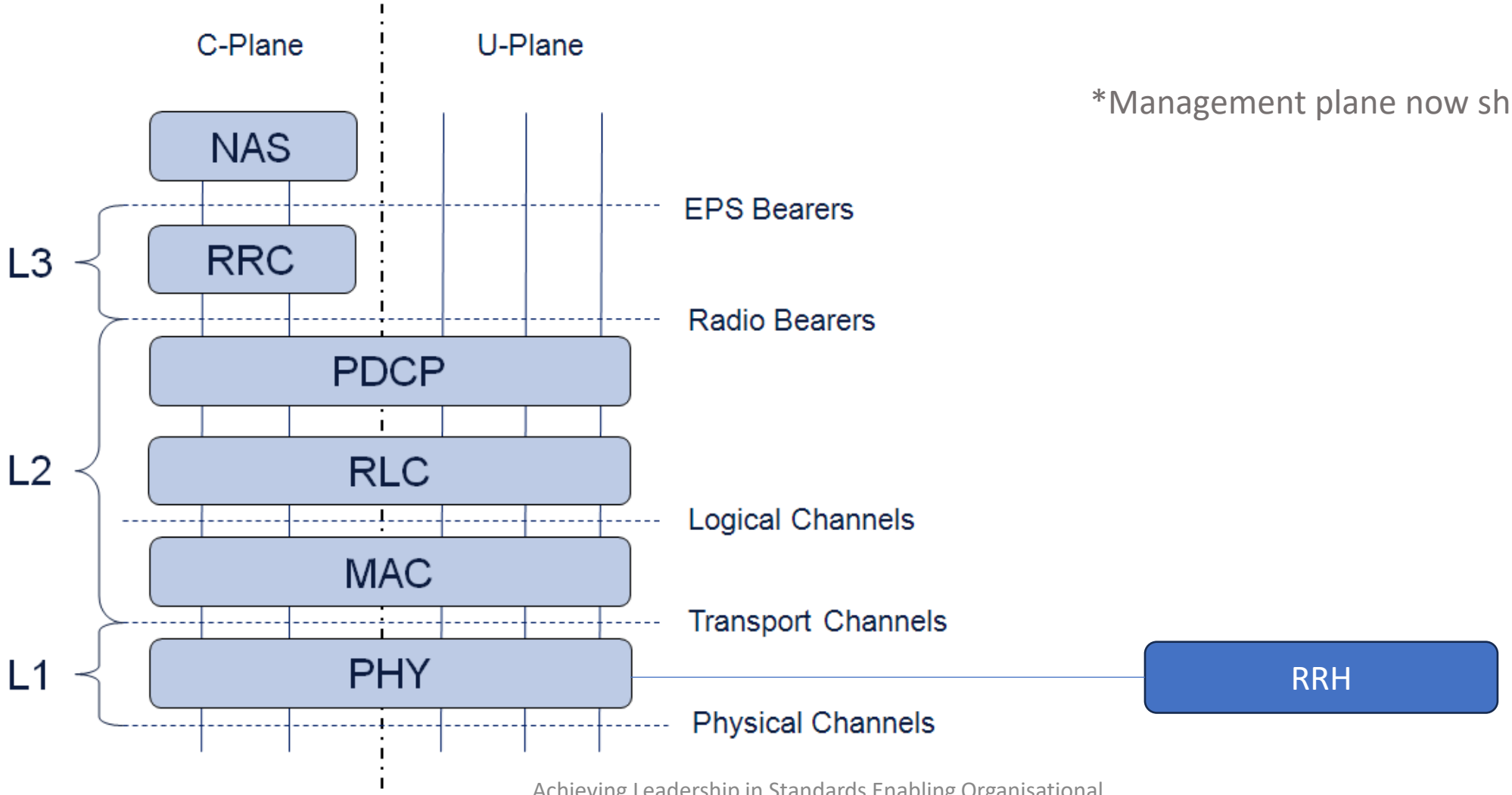
Main Objectives

- Cloudification/Virtualization
- Disaggregation
- Open Interfaces
  - Derives from disaggregation ☺ else interworking is a mess!

Main Objectives

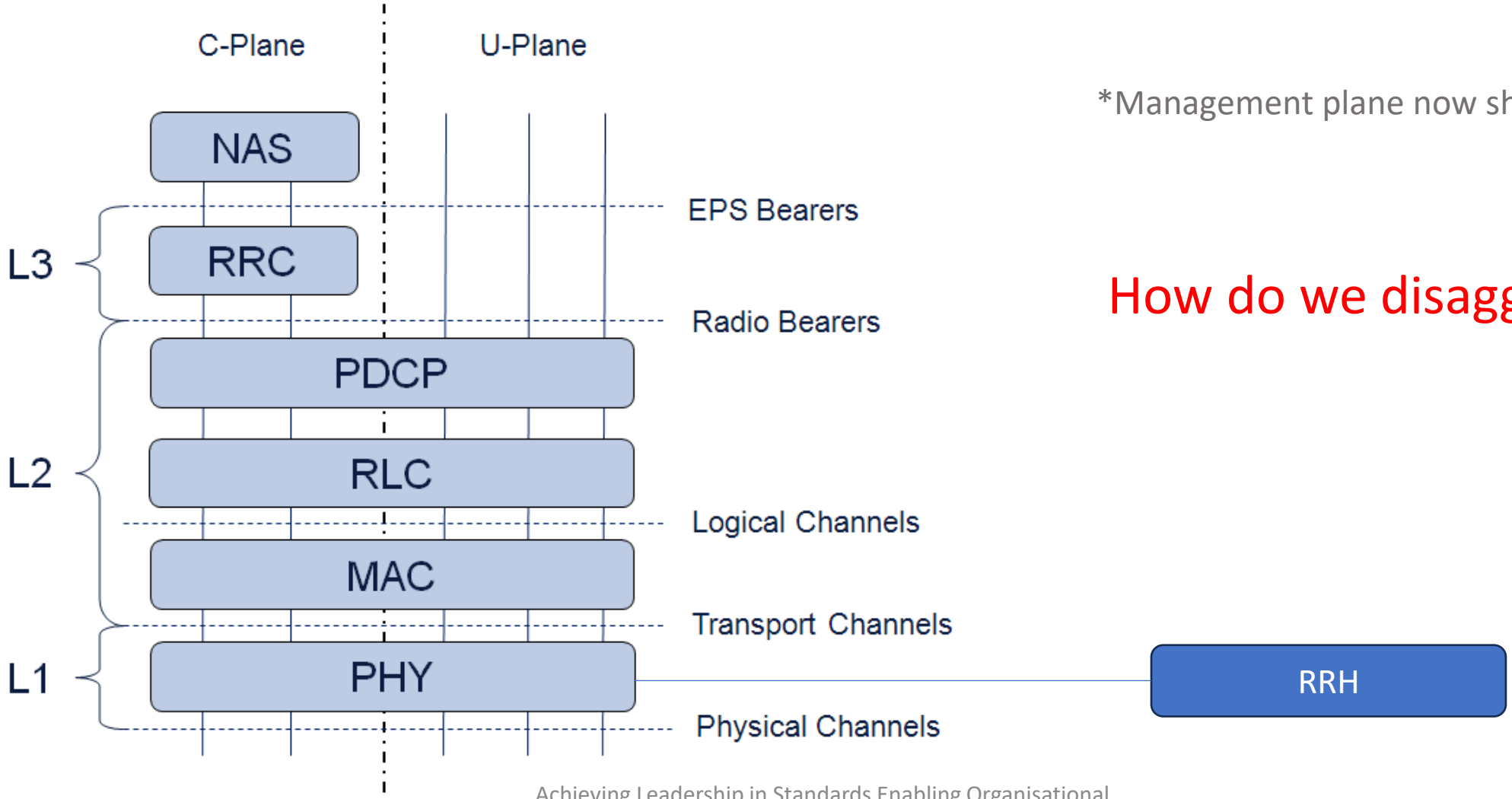
- Cloudification/Virtualization
- Disaggregation
- Open Interfaces
- Common Management and Orchestration
  - Effect of virtualization and multi-vendor ecosystem
  - ..like SON but vendor agnostic
  - Separation of infrastructure and actual functions

RAN Architecture



*Management plane now shown here

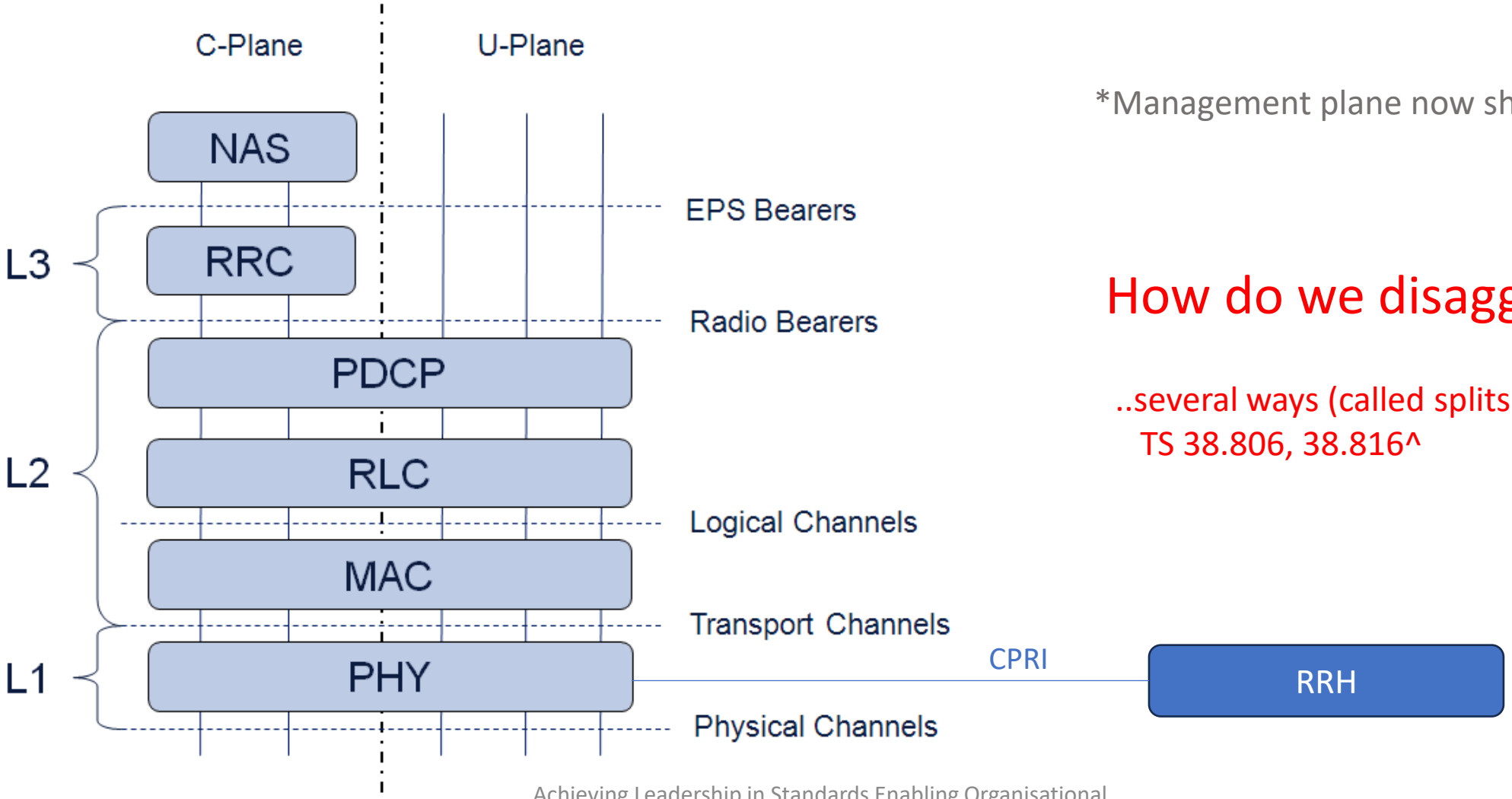
RAN Architecture



*Management plane now shown here

How do we disaggregate?

RAN Architecture



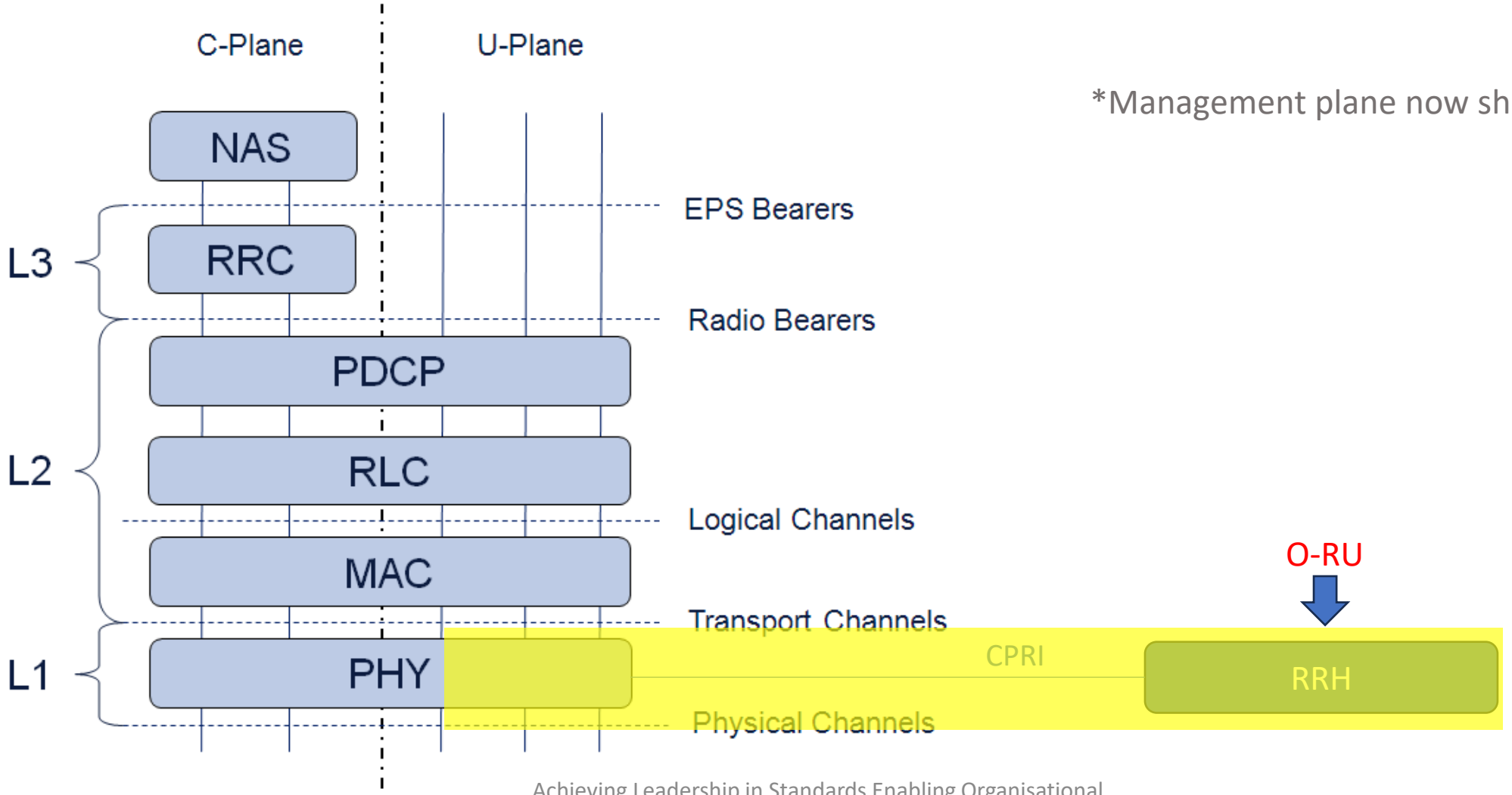
*Management plane now shown here

How do we disaggregate?

..several ways (called splits) described in TS 38.806, 38.816^

^These are not normative specifications

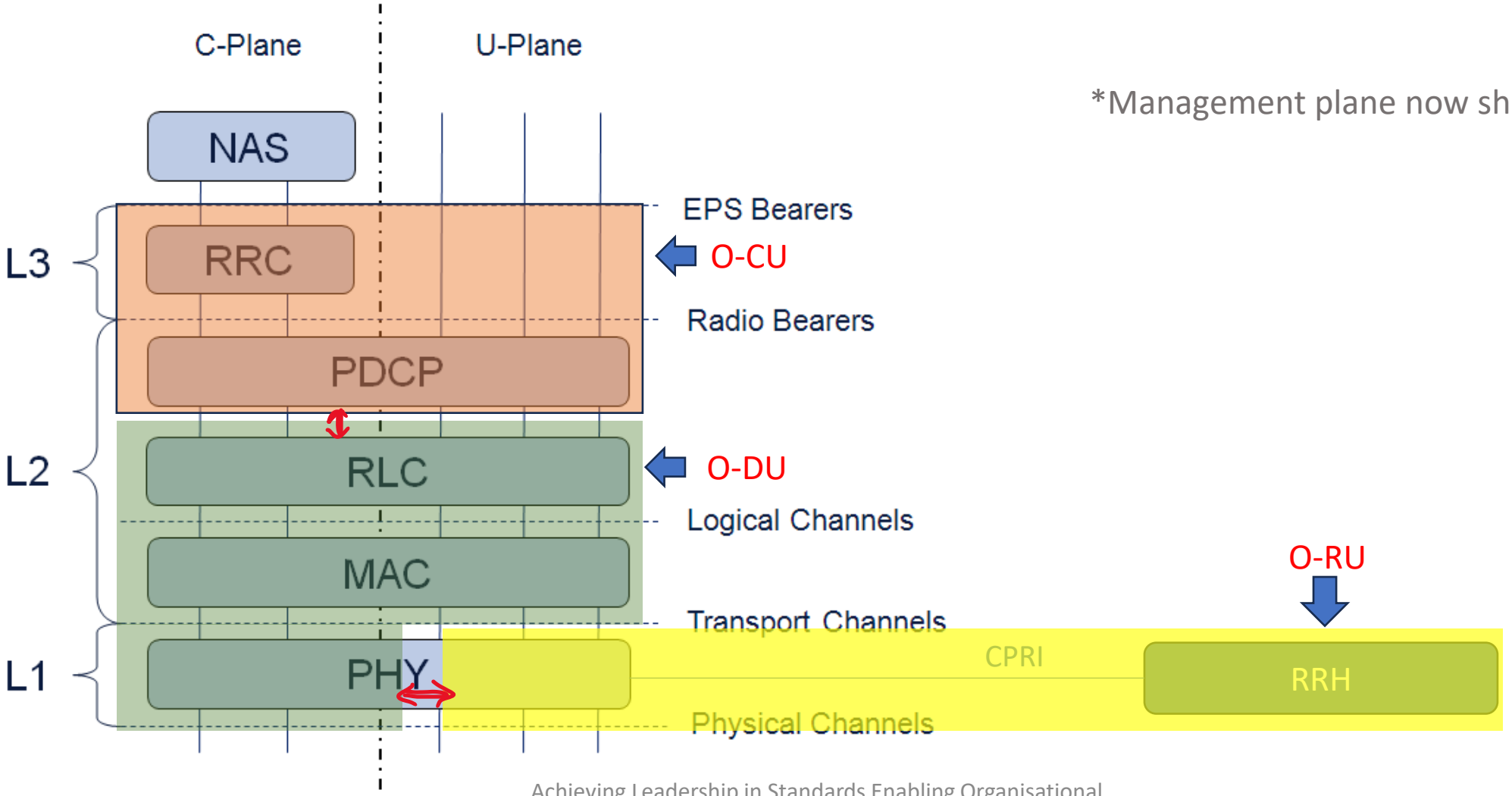
O-RAN Architecture



*Management plane now shown here

^These are not normative specifications

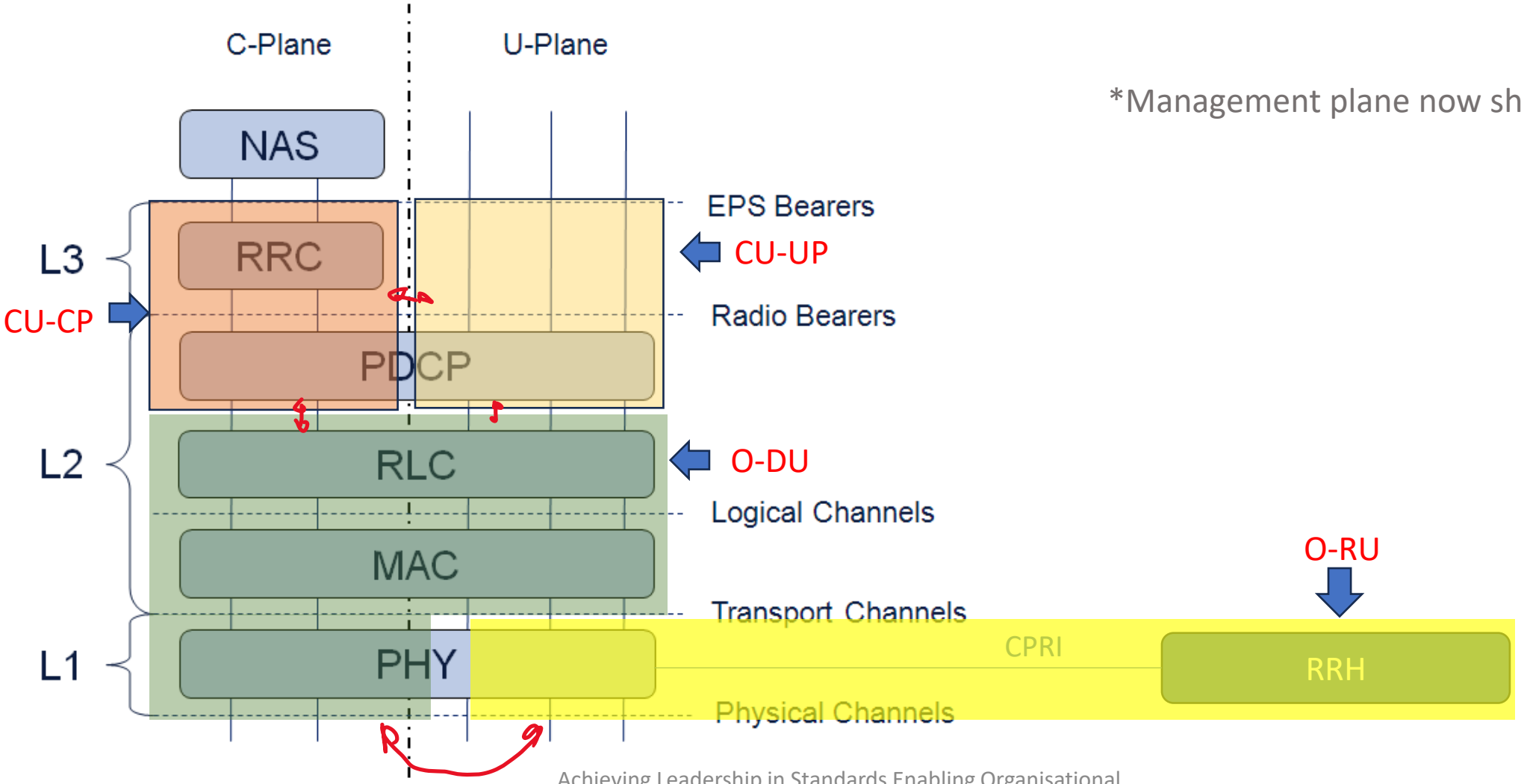
O-RAN Architecture



*Management plane now shown here

^These are not normative specifications

O-RAN Architecture



*Management plane now shown here

^These are not normative specifications

And throw a dash of Intelligent Management ☺

And throw a dash of Intelligent Management ☺

RAN Intelligent Controllers aka RIC

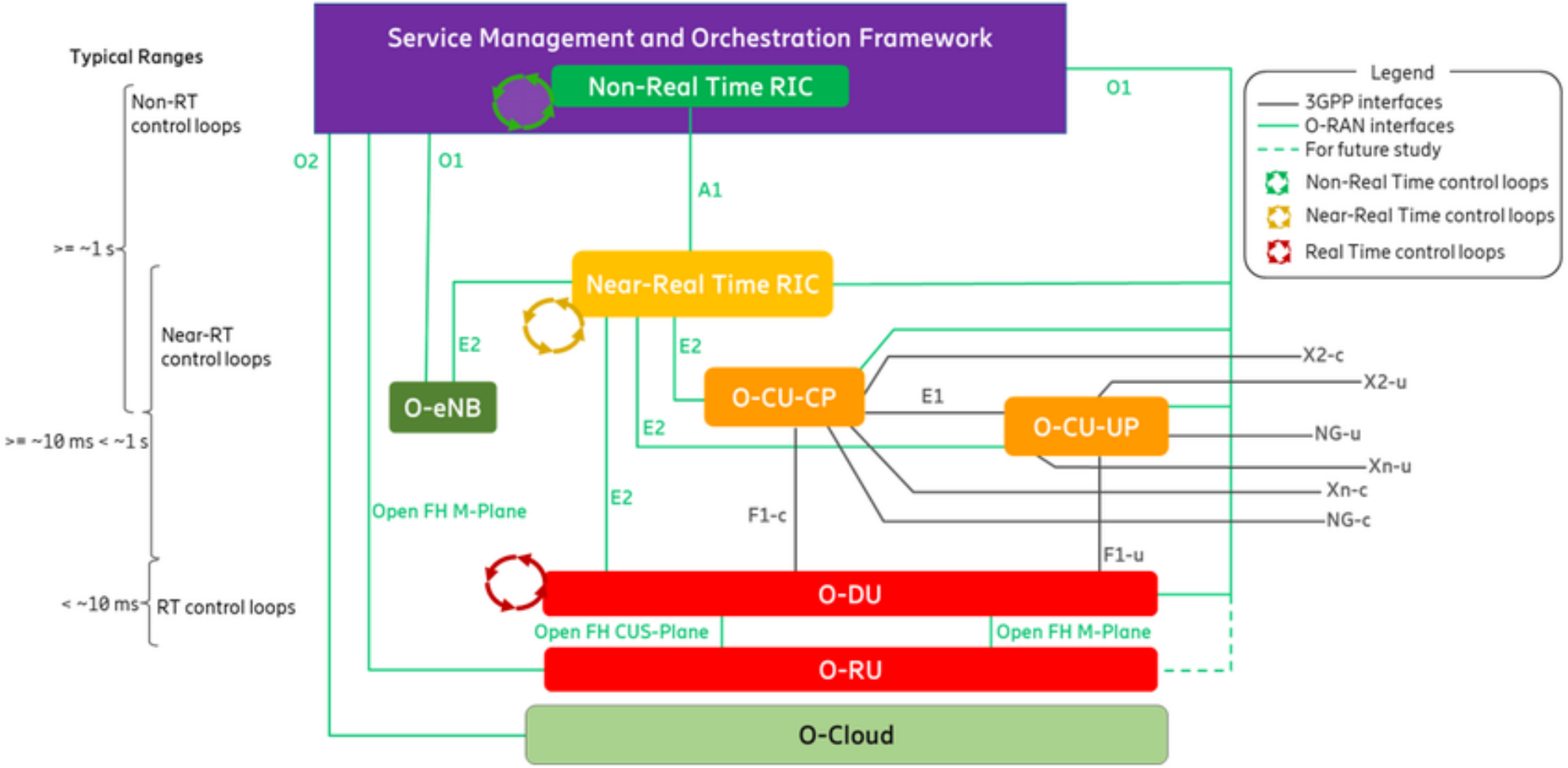
RAN Intelligent Controller

- Primary Objectives
  - Provide (common and standardized) framework for
    - RAN resource management
    - Higher layer procedure optimization
    - Policy optimization
  - AI/ML techniques
  - Uses feedback loops

However ..

- RAN exhibits multiple feedback loops!
  - Real-Time (RT)
  - Near-RT
  - Non-RT
- So multiple flavors of RICs operating at various granularity

O-RAN Architecture



Who and How decides Splits and Interfaces?

Who and How decides Splits and Interfaces?

O-RAN Working Groups and Focus Groups

WG1

WG2

WG3

WG4

…

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG1 – Use cases and Overall Architecture	Identification of key O-RAN use cases, deployment scenarios and development of the overall O-RAN architecture	ATG NSTG UCTG
WG2 – NonRT RIC/A1 Interface	Use cases, Architecture of NonRT RIC, A1 definition, R1 interface definition	
WG3 – NearRT RIC/E2 Interface	Use cases, Architecture of NearRT RIC, E2 definition, Y1 interface definition	
WG4 – Open FH Interface	Open Fronthaul (7.2X splits) between O-DU and O-RU, Management interface (SMO), co-operative transport and test specifications	
WG5 – Open Interfaces	Open F1, W1, E1, X2, Xn etc.	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG1 – Use cases and Overall Architecture	Identification of key O-RAN use cases, deployment scenarios and development of the overall O-RAN architecture	ATG NSTG UCTG
WG2 – NonRT RIC/A1 Interface	Use cases, Architecture of NonRT RIC, A1 definition, R1 interface definition	
WG3 – NearRT RIC/E2 Interface	Use cases, Architecture of NearRT RIC, E2 definition, Y1 interface definition	
WG4 – Open FH Interface	Open Fronthaul (7.2X splits) between O-DU and O-RU, Management interface (SMO), co-operative transport and test specifications	
WG5 – Open Interfaces	Open F1, W1, E1, X2, Xn etc.	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG1 – Use cases and Overall Architecture	Identification of key O-RAN use cases, deployment scenarios and development of the overall O-RAN architecture	ATG NSTG UCTG
WG2 – NonRT RIC/A1 Interface	Use cases, Architecture of NonRT RIC, A1 definition, R1 interface definition	
WG3 – NearRT RIC/E2 Interface	Use cases, Architecture of NearRT RIC, E2 definition, Y1 interface definition	
WG4 – Open FH Interface	Open Fronthaul (7.2X splits) between O-DU and O-RU, Management interface (SMO), co-operative transport and test specifications	
WG5 – Open Interfaces	Open F1, W1, E1, X2, Xn etc.	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG1 – Use cases and Overall Architecture	Identification of key O-RAN use cases, deployment scenarios and development of the overall O-RAN architecture	ATG NSTG UCTG
WG2 – NonRT RIC/A1 Interface	Use cases, Architecture of NonRT RIC, A1 definition, R1 interface definition	
WG3 – NearRT RIC/E2 Interface	Use cases, Architecture of NearRT RIC, E2 definition, Y1 interface definition	
WG4 – Open FH Interface	Open Fronthaul (7.2X splits) between O-DU and O-RU, Management interface (SMO), co-operative transport and test specifications	
WG5 – Open Interfaces	Open F1, W1, E1, X2, Xn etc.	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG1 – Use cases and Overall Architecture	Identification of key O-RAN use cases, deployment scenarios and development of the overall O-RAN architecture	ATG NSTG UCTG
WG2 – NonRT RIC/A1 Interface	Use cases, Architecture of NonRT RIC, A1 definition, R1 interface definition	
WG3 – NearRT RIC/E2 Interface	Use cases, Architecture of NearRT RIC, E2 definition, Y1 interface definition	
WG4 – Open FH Interface	Open Fronthaul (7.2X splits) between O-DU and O-RU, Management interface (SMO), co-operative transport and test spefcifications	
WG5 – Open Interfaces	Open F1, W1, E1, X2, Xn etc	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG6 – Cloudification and orchestration	O-Cloud architecture, deployment and infrastructure management, Accelerator Adaptation layer (HW slicing and dicing) Energy saving through efficient deployment Network slicing aspects in cloud deployments	O2 AAL Energy saving NW slicng
WG7 – White Box HW workgroup	Hardware reference designs of high performance, spectral and energy efficient white box base station (O-RU, O-DU, FH-GW)	
WG8 – stack reference design		
WH9 – Open X-haul transport	Packet swichted transport networks for FH, MH and backhaul. QoS, slicing and routing aspects	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG6 – Cloudification and orchestration	O-Cloud architecture, deployment and infrastructure management, Accelerator Adaptation layer (HW slicing and dicing) Energy saving through efficient deployment Network slicing aspects in cloud deployments	O2 AAL Energy saving NW slicng
WG7 – White Box HW workgroup	Hardware reference designs of high performance, spectral and energy efficient white box base station (O-RU, O-DU, FH-GW)	
WG8 – stack reference design		
WH9 – Open X-haul transport	Packet swichted transport networks for FH, MH and backhaul. QoS, slicing and routing aspects	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG6 – Cloudification and orchestration	O-Cloud architecture, deployment and infrastructure management, Accelerator Adaptation layer (HW slicing and dicing) Energy saving through efficient deployment Network slicing aspects in cloud deployments	O2 AAL Energy saving NW slicng
WG7 – White Box HW workgroup	Hardware reference designs of high performance, spectral and energy efficient white box base station (O-RU, O-DU, FH-GW)	
WG8 – stack reference design		
WH9 – Open X-haul transport	Packet swichted transport networks for FH, MH and backhaul. QoS, slicing and routing aspects	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG6 – Cloudification and orchestration	O-Cloud architecture, deployment and infrastructure management, Accelerator Adaptation layer (HW slicing and dicing) Energy saving through efficient deployment Network slicing aspects in cloud deployments	O2 AAL Energy saving NW slicng
WG7 – White Box HW workgroup	Hardware reference designs of high performance, spectral and energy efficient white box base station (O-RU, O-DU, FH-GW)	
WG8 – stack reference design		
WH9 – Open X-haul transport	Packet switched transport networks for FH, MH and backhaul. QoS, slicing and routing aspects	

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG10 – OAM for O-RAN	OAM architecture, O1 interface definition and data models for various network elements.. Define role of O1 in control and management loops	
WG11 - Security		

Various O-RAN Working Groups

Work Group	Charter	Sub-groups
WG10 – OAM for O-RAN	OAM architecture, O1 interface definition and data models for various network elements.. Define role of O1 in control and management loops	
WG11 - Security		

How do I contribute

- Organizational membership
  - Company, academic, research institute
- Participate in weekly meetings through contributions, CRs etc.
- o-ran-sc
  - Reference implementations of components, bug-fixes, proposals etc

Thank You

< Makarand.Kulkarni[at]saankhyalabs.com>