ORAN Status Report

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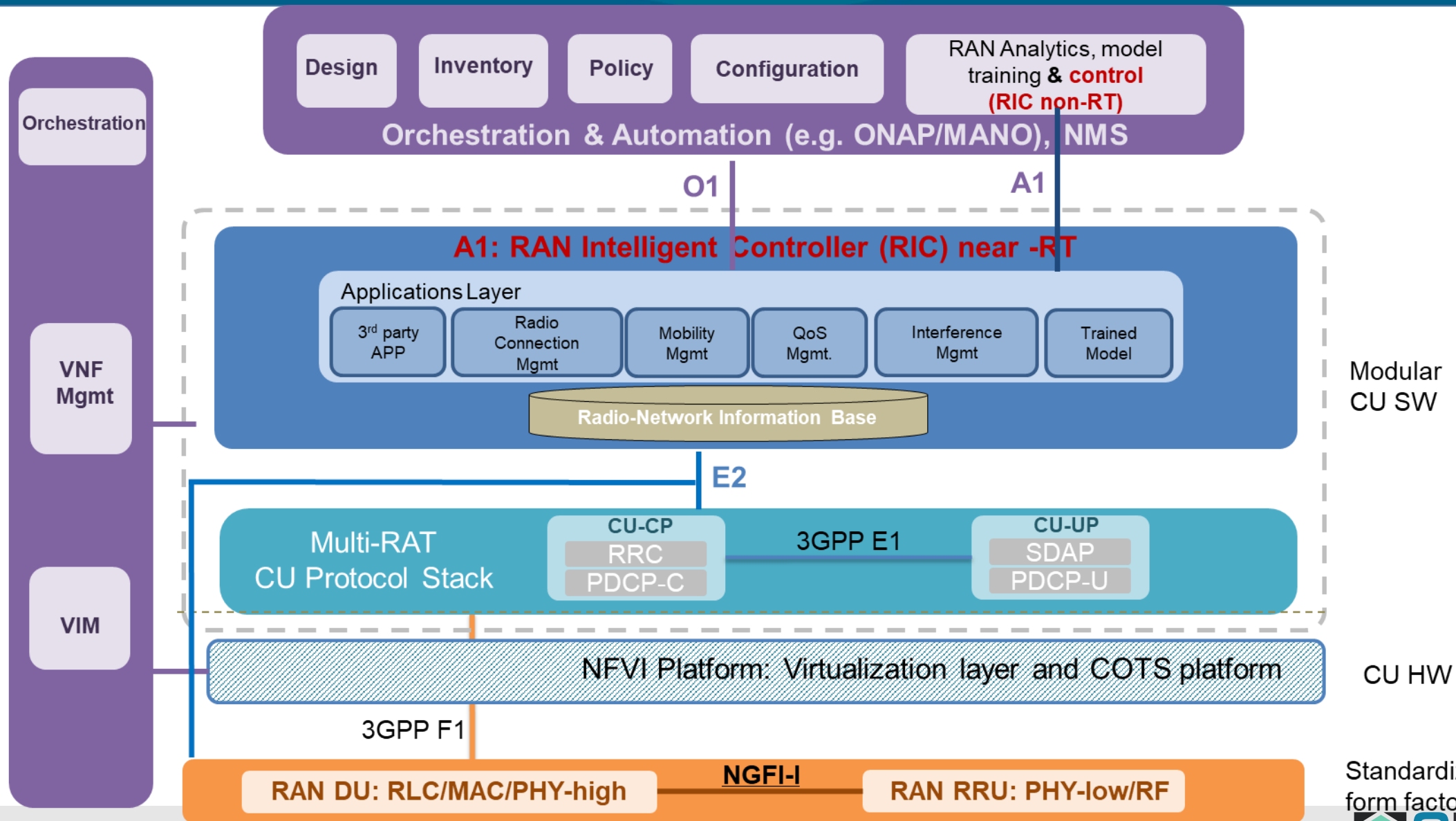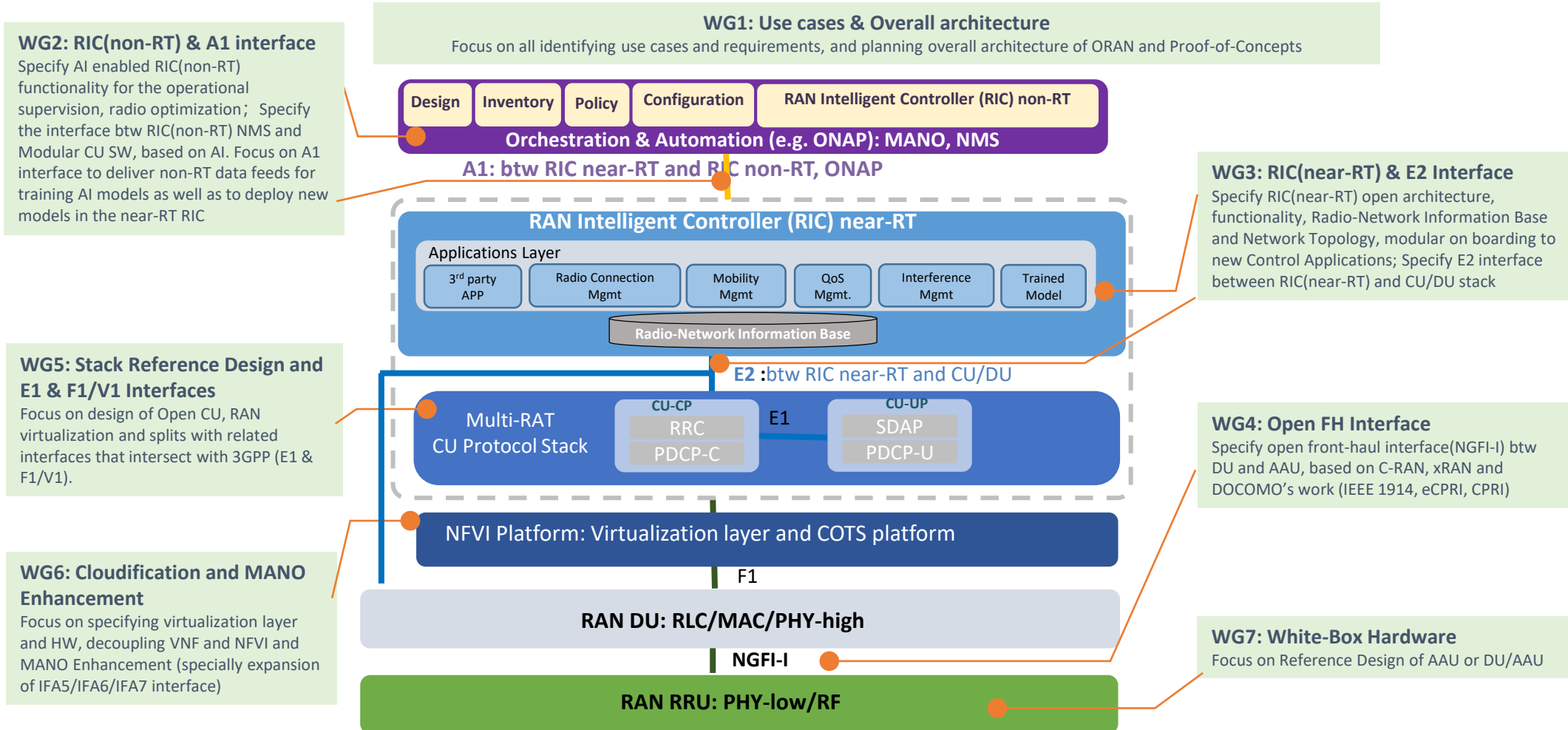
AT&T Labs

October 28, 2019

Agenda

- ORAN Architecture, Working Groups & Their Progress
- ORAN OAM Specifications and ONAP Impact
- ORAN Software Community (OSC) and ONAP Alignment

ORAN Architecture:

Working Group Structure:

TSC Co-Chair

WG1: Use cases & Overall architecture
Focus on all identifying use cases and requirements, and planning overall architecture of ORAN and Proof-of-Concepts

WG2: RIC(non-RT) & A1 interface
Specify AI enabled RIC(non-RT) functionality for the operational supervision, radio optimization; Specify the interface btw RIC(non-RT) NMS and Modular CU SW, based on AI. Focus on A1 interface to deliver non-RT data feeds for training AI models as well as to deploy new models in the near-RT RIC

Design	Inventory	Policy	Configuration	RAN Intelligent Controller (RIC) non-RT

Orchestration & Automation (e.g. ONAP): MANO, NMS

A1: btw RIC near-RT and RIC non-RT, ONAP

WG3: RIC(near-RT) & E2 Interface
Specify RIC(near-RT) open architecture, functionality, Radio-Network Information Base and Network Topology, modular on boarding to new Control Applications; Specify E2 interface between RIC(near-RT) and CU/DU stack

RAN Intelligent Controller (RIC) near-RT

Applications Layer

3rd party APP	Radio Connection Mgmt	Mobility Mgmt	QoS Mgmt.	Interference Mgmt	Trained Model

Radio-Network Information Base

WG5: Stack Reference Design and E1 & F1/V1 Interfaces
Focus on design of Open CU, RAN virtualization and splits with related interfaces that intersect with 3GPP (E1 & F1/V1).

E2 :btw RIC near-RT and CU/DU

Multi-RAT CU Protocol Stack

CU-CP
RRC
PDCP-C

E1

CU-UP
SDAP
PDCP-U

WG4: Open FH Interface
Specify open front-haul interface(NGFI-I) btw DU and AAU, based on C-RAN, xRAN and DOCOMO's work (IEEE 1914, eCPRI, CPRI)

NFVI Platform: Virtualization layer and COTS platform

F1

WG6: Cloudification and MANO Enhancement
Focus on specifying virtualization layer and HW, decoupling VNF and NFVI and MANO Enhancement (specially expansion of IFA5/IFA6/IFA7 interface)

RAN DU: RLC/MAC/PHY-high

NGFI-I

WG7: White-Box Hardware
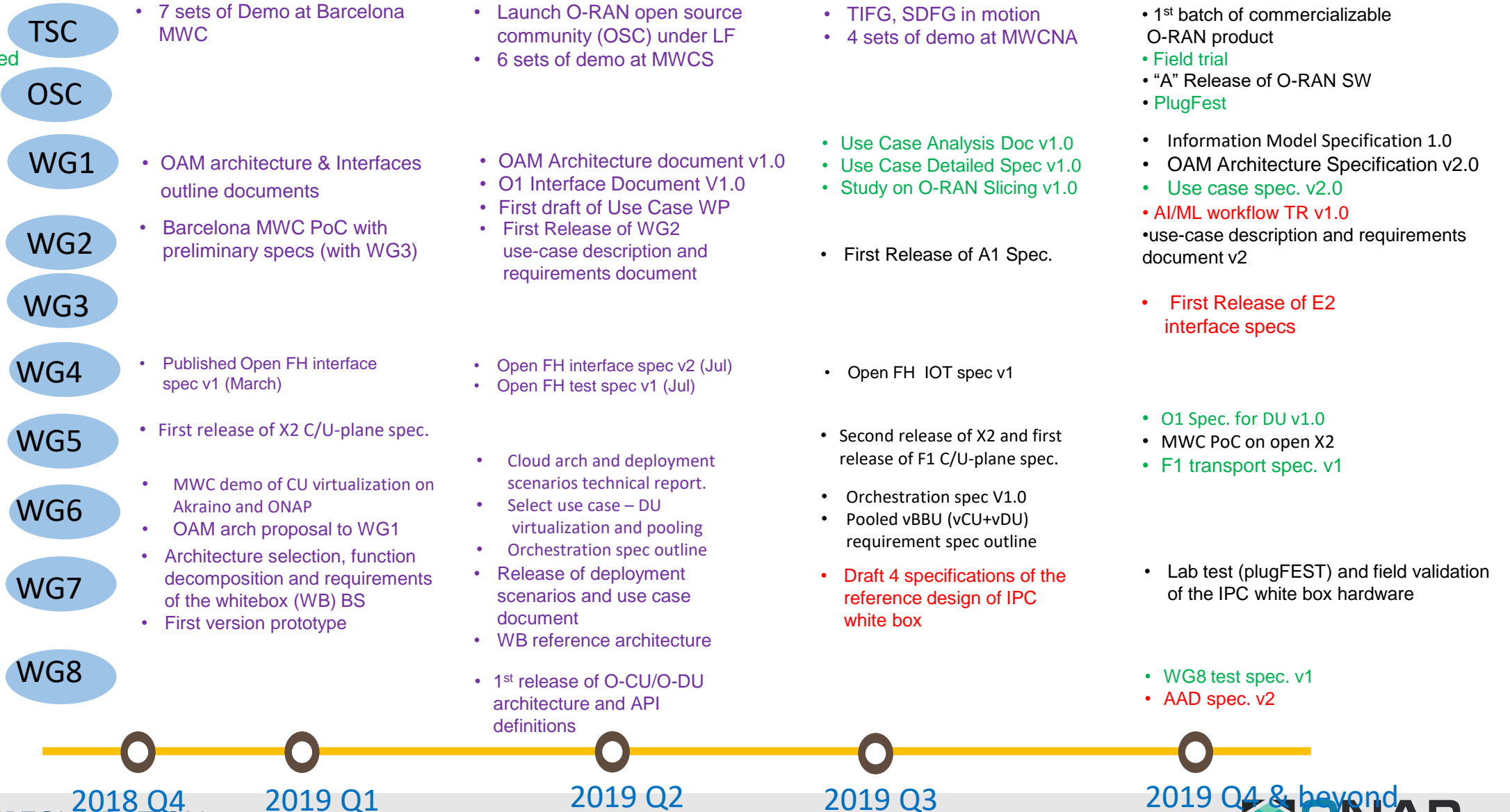Focus on Reference Design of AAU or DU/AAU

RAN RRU: PHY-low/RF

Working Group Progress Summary:

- WG1:
  - Published OAM Architecture
  - Completed Draft Information Model
  - Published O1 Specification Covering Fault, Performance, software upgrade
- WG2:
  - A1 Interface Definition Completed and is under TSC review for approval
- WG3:
  - E2 Specification in Progress
- WG4:
  - Published Front Haul Specification
  - Completed Front Haul Inter-operability test specification and under review, waiting for approval
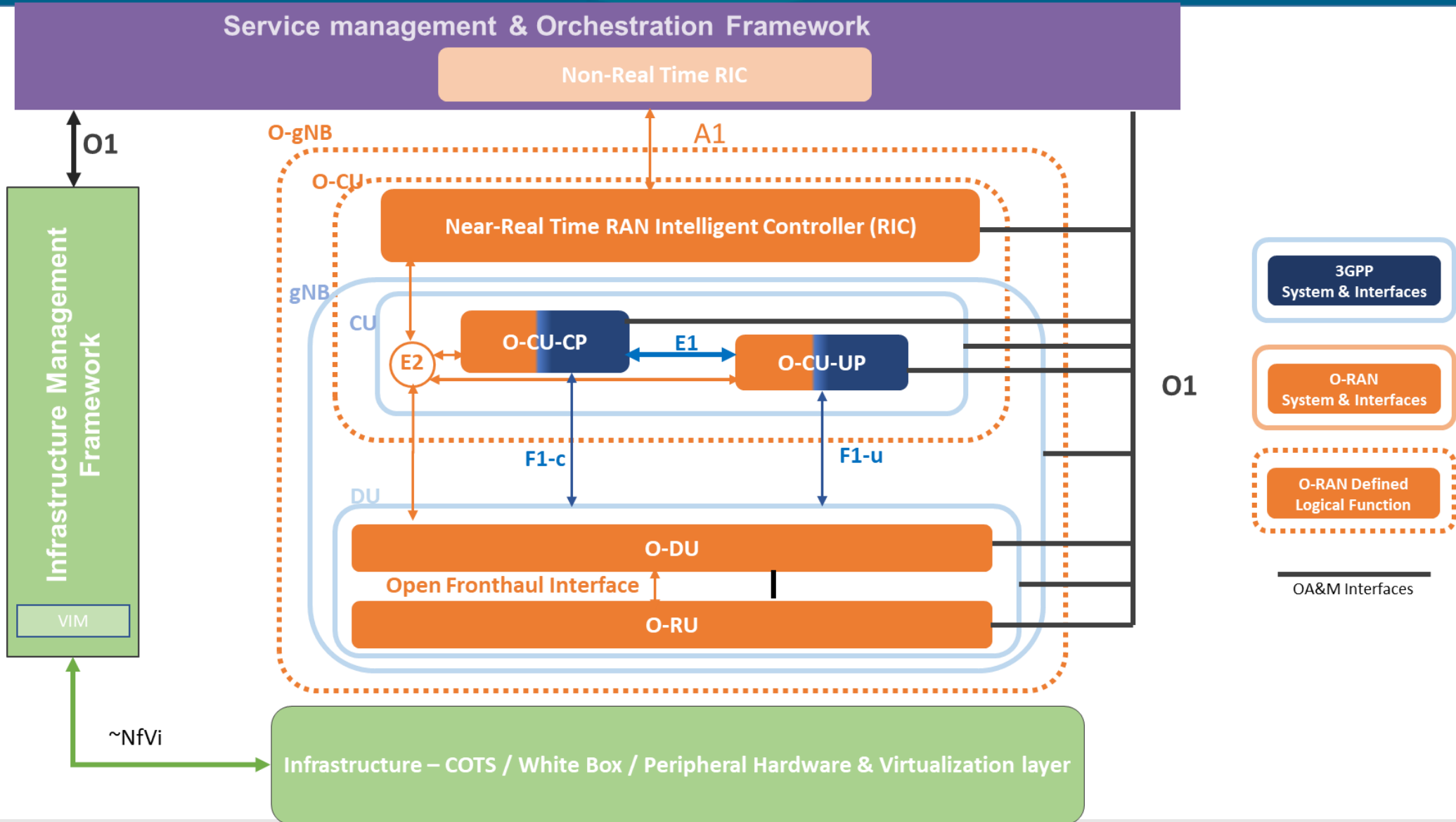
O-RAN TSC Update – Key milestones for 2019

- Purple: finished
- Green: newly planned
- Red: changed

TSC
- 7 sets of Demo at Barcelona MWC

OSC

WG1
- OAM architecture & Interfaces outline documents

WG2
- Barcelona MWC PoC with preliminary specs (with WG3)

WG3

WG4
- Published Open FH interface spec v1 (March)

WG5
- First release of X2 C/U-plane spec.

WG6
- MWC demo of CU virtualization on Akraino and ONAP
- OAM arch proposal to WG1

WG7
- Architecture selection, function decomposition and requirements of the whitebox (WB) BS
- First version prototype

WG8

TSC
- Launch O-RAN open source community (OSC) under LF
- 6 sets of demo at MWCS

WG1
- OAM Architecture document v1.0
- O1 Interface Document V1.0
- First draft of Use Case WP
- First Release of WG2 use-case description and requirements document

WG4
- Open FH interface spec v2 (Jul)
- Open FH test spec v1 (Jul)

WG6
- Cloud arch and deployment scenarios technical report.
- Select use case – DU virtualization and pooling
- Orchestration spec outline

WG7
- Release of deployment scenarios and use case document
- WB reference architecture

WG8
- 1st release of O-CU/O-DU architecture and API definitions

TSC
- TIFG, SDFG in motion
- 4 sets of demo at MWCNA

WG1
- Use Case Analysis Doc v1.0
- Use Case Detailed Spec v1.0
- Study on O-RAN Slicing v1.0

- First Release of A1 Spec.

WG4
- Open FH IOT spec v1

WG5
- Second release of X2 and first release of F1 C/U-plane spec.
- Orchestration spec V1.0
- Pooled vBBU (vCU+vDU) requirement spec outline

WG7
- Draft 4 specifications of the reference design of IPC white box

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TSC
- 1st batch of commercializable O-RAN product
- Field trial
- "A" Release of O-RAN SW
- PlugFest

WG1
- Information Model Specification 1.0
- OAM Architecture Specification v2.0
- Use case spec. v2.0
- AI/ML workflow TR v1.0
- use-case description and requirements document v2

- First Release of E2 interface specs

WG5
- O1 Spec. for DU v1.0
- MWC PoC on open X2
- F1 transport spec. v1

WG7
- Lab test (plugFEST) and field validation of the IPC white box hardware

WG8
- WG8 test spec. v1
- AAD spec. v2

2018 Q4 | **2019 Q1** | **2019 Q2** | **2019 Q3** | **2019 Q4 & beyond**

ONAP
OPEN NETWORK AUTOMATION PLATFORM

ORAN OAM Architecture and Specifications

OA&M Architecture for Disaggregated RAN

O-RAN O1 & A1 Specifications:

- O-RAN Alliance has defined OA&M specifications (called O1) for disaggregated Radio Access Network.
  - It leverages 3GPP as much as possible
  - Specifications are management frame neutral
  - It covers FCAP functions (Fault, Configuration, Performance, etc.)
  - O1 specifications also cover software upgrade
- O-RAN also introduce a new interface called A1.
  - A1 interface is an open logical interface between non-RT RIC functionality in the Orchestration/management platform and near-RT RIC functionality in RAN of O-RAN architecture.
  - A1 interface should enable a multi-vendor environment, and is independent of specific implementation of the Orchestration/management platform, non-RT RIC, and near-RT RIC.
  - A1 interface should enable policy-based guidance of radio resource management and control functions or applications that are internal to the near-RT RIC.

ONAP
OPEN NETWORK AUTOMATION PLATFORM

ONAP/3GPP & O-RAN Alignment Work

- Provisioning Management
  - Three New CM VES notifications notifyMOICreation, notifyMOIDeletion, notifyMOIAttributeValueChange.

- Fault Supervision
  - Align existing VES fault event or create new VES fault3gpp event to support harmonization work in TS 28.532.

- Performance Assurance/File Management
  - Modify the changeIdentifier field name of the fileReady event to filetype indicating the type of file that is ready for upload (call trace, log, certificate, beamforming etc.) or add a new field fileType for this purpose

- PNF Registration
  - ONAP modifications to support the addressing of MEs behind a NAT
  - Potential modification of pnfRegistration event when 3GPP completes harmonization activity.

- PNF SW Management
  - Ensure O-RAN PNF Software Management can be supported in ONAP
    - O1 PNF Software Management specifies the order, behavior, input and output for each step.
    - O-RAN needs ONAP to support workflow order, events, and steps specified in the O1.
      - Order and behavior of steps is different in ONAP proposals in Frankfurt; e.g. pre-check, update AAI, post-check.
  - Definition of additional Notifications (VES events)
    - resetReason Notification
    - softwareActivate Notification
    - downloadFile Notification

- A1 Interface introduction
  - A1 interface between Non-Real Time RIC and the Near Real Time RIC to transmit Policy and optimization information to the Near Real Time RIC and carry responses (e.g. policy applied, couldn't be applied etc.)
  - A1 interface has been published by WG2, waiting ORAN TSC Approval

OSC & ONAP Alignment

OSC & ONAP Mission Statements

- **ONAP:** ONAP is service, resource, and vendor agnostic automation platform. ONAP *does not* produce finished goods, except for few illustrative examples to demonstrate its capabilities.

- **O-RAN Alliance:** O-RAN Alliance objective is to define architecture for disaggregated 5G radio network to support inter-operability, white boxing and open-source implementation for various RAN elements to achieve service agility and cost reduction. O-RAN alliance is management framework agnostic. Key focus areas are:
    - Leading the industry towards open, interoperable interfaces, RAN virtualization, and big data enabled RAN intelligence
    - Maximizing the use of common-off-the-shelf hardware and merchant silicon and minimizing proprietary hardware.
    - Specifying APIs and interfaces, driving standards to adopt them as appropriate, and exploring open source where appropriate

- **O-RAN Software Community:** OSC is a collaboration between the O-RAN Alliance and Linux Foundation with the mission to support the creation of software for the Radio Access Network (RAN). Provide opensource implementation of O-RAN defined architecture / specifications, including Near-Real Time RAN Intelligent Controller, white box DU, etc.

OSC Non-Real Time RIC Implementation Approach

- **Objective:** Implement / Create Finish Goods for Non-Real Time RAN Optimization Functions (use cases to be identified)

- **Using ONAP Platform for Non-Real Time RIC Implementation:**
  - Use the latest ONAP Release for Non-RT RIC implementation (Dublin for the first release)
  - Could use a sub-set of the components needed for Non-RT RIC
  - Focus will to implement finished good services to develop Non-RT RIC. This could require following components:
    - Additional Data Collection Micro-Services (not supported by ONAP base platform)
    - Analytic Micro-Services to run on DCAE to detect anomalous conditions
    - Policy Rules to select best possible action to address the anomaly
    - Configuration change flows (e.g. DG or BPMN) to execute actions identified by the policy rules

- **ONAP Platform Enhancements:**
  - Use the latest ONAP release for any Non-RT RIC implementation (e.g. Dublin for the first release)
  - Any platform level code changes / enhancement needed:
    - Include needed enhancements in the upcoming ONAP release (e.g. O1 / A1 alignment planned for Frankfurt release)
    - Or Can be implemented as PoC in ONAP or locally and then committed to the next release of ONAP
    - Or Plan for the next release of ONAP and develop as part of ONAP development, if we can wait

- **Finished Good Packaging:**
  - Non-RT RIC specific artifacts, including associated helm charts, etc. can be packaged as add-on to ONAP platform
  - This will allow end user to take finished good package(s) only and onboard onto their ONAP implementation (e.g. AT&T's ECOMP)
  - Finished good code and packaging will remain with the OSC
  - OSC can create a catalogue of finished good packages for various management platforms (e.g. ONAP, OSM, etc.)