

O-RAN WG1 활동현황

[Overview] What is O-RAN WG1?

WG1(Working Group 1) - Use Cases and Overall Architecture

- ❖ O-RAN의 overall architecture와 use cases에 대해 논의하고 관련 규격화 진행하는 WG
 - 사업자(China mobile, AT&T)에서 주도하여 chair 역할 수행 중, ATG와 UCTG 등 TG 단위는 제조사(Ericsson, Juniper)에서 chair 역할 수행 중
- ❖ Architecture를 main으로 논의하는 Architecture Task Group(ATG)와 use case를 main으로 논의하는 Use Case Task Group(UCTG)가 진행 중이며, WG1의 세부 scope는 크게 4가지로 분류됨

1) Architecture

2) Slicing

3) Use Cases

4) Decoupled SMO

[Overview] What is O-RAN WG1?

WG1 Charter

WG1 is responsible for:

Architecture:

- Specify the overall architecture of O-RAN.
- Provide high level description of the O-RAN functions and the associated interfaces that connect them.
- Illustrate relevant implementation options, as and when needed, to explain the O-RAN architecture.
- Facilitate and arbitrate the cross-WG architectural topics/discussions.

Slicing:

- Definition of O-RAN slicing use cases and requirements.
- Definition of O-RAN slicing, Service Orchestration, and Service Assurance.
- Alignment of WGs.

Use Cases:

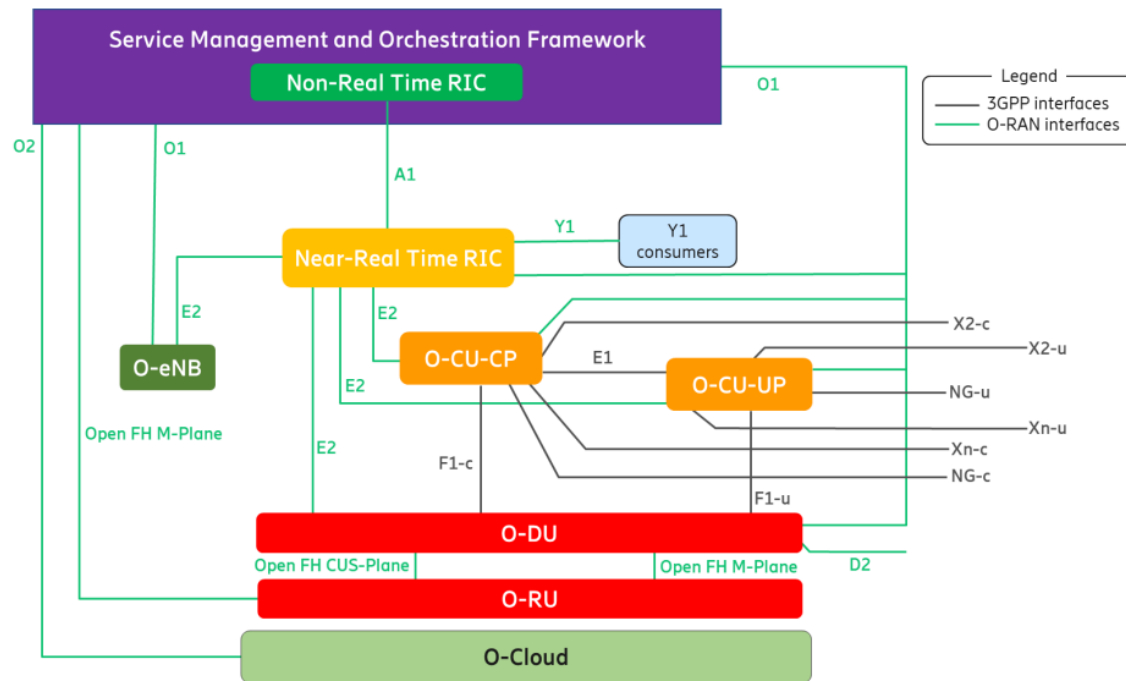
- Identification of potential use cases enabled by O-RAN.
- Definition of detailed top level use cases and inter-WG alignment.
- Clearly identify individual use case data requirements and their traceability.
- Dissemination of use cases.

Decoupled SMO:

- Specify Decoupled SMO Architecture.
- Definitions and Requirements for SMO Services.
- Set of specifications for specific SMO Service APIs and their interworking with other SMOSs as agreed.

WG1 주요 활동 - Architecture

- ❖ O-RAN 전반적인 architecture에 대해 정의, O-RAN 구성 요소와 interface에 대한 high level description
- 관련 주요 규격: O-RAN.WG1.TS.OAD
- ❖ WG1 혹은 타 WG에서 architecture 관련 논의 진행 시 조율 역할 진행



5	O-RAN architecture
5.1	Overall architecture of O-RAN
5.2	O-RAN control loops.....
5.3	Description of O-RAN architecture elements
5.3.1	Service Management and Orchestration (SMO)
5.3.2	Near-RT RIC
5.3.3	O-CU-CP.....
5.3.4	O-CU-UP.....
5.3.5	O-DU.....
5.3.6	O-RU.....
5.3.7	O-eNB
5.3.8	O-Cloud.....
5.4	Relevant interfaces in O-RAN architecture.....
5.4.1	Introduction to relevant interfaces in O-RAN architecture.....
5.4.2	A1 interface
5.4.3	O1 interface
5.4.4	O2 interface
5.4.5	E2 interface.....
5.4.6	O-Cloud Notification interface
5.4.7	Open Fronthaul interface.....

❖ O-RAN 기술이 실제 네트워크에서 어떻게 적용될 수 있는지에 대한 potential use case* 제시

* Ex. QoE Optimization, Traffic Steering, Massive MIMO beamforming optimization, Network Energy Saving

- WG1에서 제시된 Use Case를 활용하여 WG2, WG3 등에서 세부 시나리오 분석

: WG1.TS.Use-Cases-Detailed Specification 문서 내 network energy saving에 대한 background, goal, 필요 entity, solution, required data 등에 대해서 제시

This clause provides the motivations, descriptions, and proposed solutions for different energy efficiency and energy saving features (sub-use cases). While there are energy savings by improving base station hardware efficiency and by the evolution of radio access technologies, the EE/ES use case primarily addresses enhancements in software efficiency and optimized configuration/control of various elements and functions, which are often AI/ML based.

The RAN is responsible for a major part of the Energy Consumption (EC) of a mobile network, and the O-RU accounts for the largest part of the energy consumption of the RAN. The rarefication of fossil fuel-based energy resources and the urgent need to reduce CO₂ emissions make the EC a strategic topic for network operators, in addition of being a significant component of the operators' OPEX.

Editor's note: If possible, single common description for all sub-use cases.

1) Energy saving rApp:

- ### 4.21.3 Solutions

Editor's note: Sub-use case specific solutions with detailed descriptions in fully separate clauses.

Mobile networks often utilize multiple frequency layers (carriers) to cover the same service area. At low load, ES can be



WG1 주요 활동 - Use Cases

❖ Use case 별 요구사항이 불명확하거나 관련 규격과의 연관성 등에 대한 보완이 필요하다 판단되어, 관련 활동 진행 중 (Use Case Requirements and Traceability Improvements)

Use-Cases-Detailed-Specification-R004-v15.00 내 Required data

4.21.4 Required data

Input data

1) E2 node to SMO and Near-RT RIC (when Near-RT RIC serves as inference host)

- EE/EC measurement reports
- Load statistics per cell and per carrier, such as number of active users, average number of RRC connections, average number of scheduled active users per TTI, PRB utilization, DL/UL throughput
- UE mobility information including cell or beam level measurements (e.g., UE RSRP, RSRQ, SINR)
- Latency statistics per cell (if URLLC slices are involved, latency is used in the EE definition, 3GPP TS 28.554 [7] shall apply)

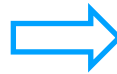
2) O-RU to E2 node (O-DU) or to SMO directly via open FH M-plane

- Power consumption metrics: Mean total/per carrier power consumption, mean total/per carrier transmit power (site/O-RU input power are needed for certain EE KPIs)

Output data

1) Non-RT RIC via SMO to E2 node or Near-RT RIC to E2 node (when Near-RT RIC serves as inference host)

- Carrier(s) and cell(s) recommended to be switched off/on



Use-Cases-Detailed-Specification-R004-v18.00 내 Required data

4.21.4 Required data

4.21.4.1 Carrier and cell switch off/on

4.21.4.1.1 Solution 1: rApp-based solution

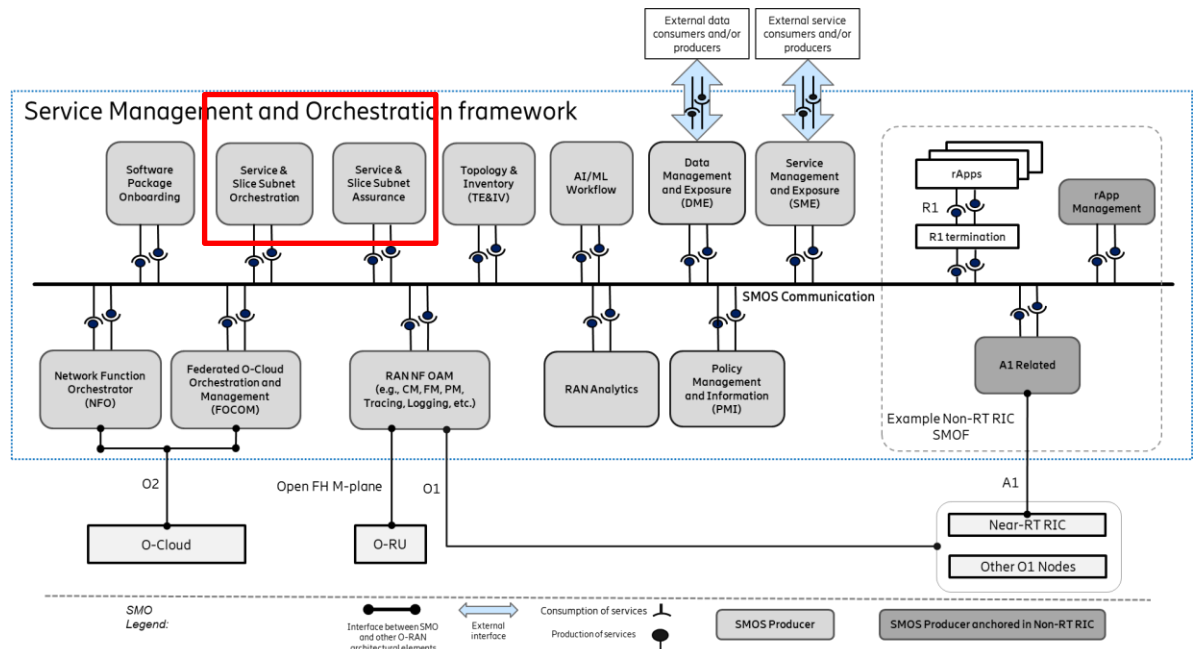
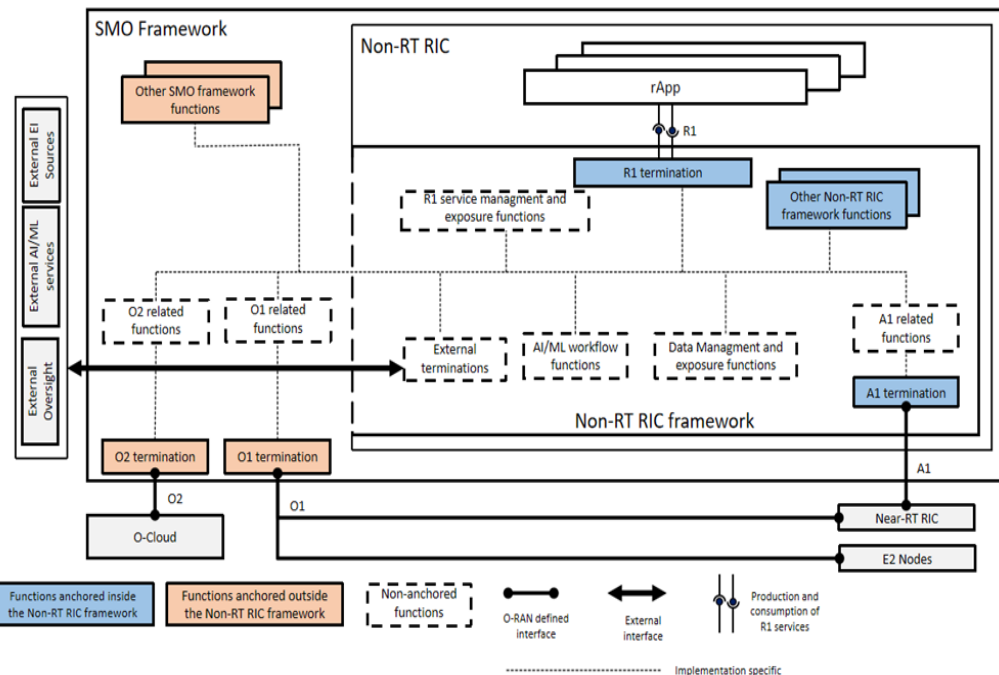
The data requirements for this solution are specified below. The input data specified in table 4.21.4.1.1-1 shall be supported by the associated interfaces specified in the table.

Table 4.21.4.1.1-1: Required input data for energy saving use case

Requirement	Category	Parameters / Measurements	Source	Reference	Interface
Req-4.21.001	Network load and data performance	DL PDCP SDU data volume per interface (data volume in DL delivered from O-CU-UP to O-DU, per PLMN, per QoS level, per slice, per interface (F1-U, Xn-U, X2-U))	O-CU	3GPP TS 28.552 clause 5.1.3.6.2.3	O1
Req-4.21.002	Network load and data performance	UL PDCP SDU data volume per interface (data volume in UL delivered to O-CU-UP from O-DU, per PLMN, per QoS level, per slice, per interface (F1-U, Xn-U, X2-U))	O-CU	3GPP TS 28.552 clause 5.1.3.6.2.4	O1
Req-4.21.003	Network load and data performance	DL Total PRB Usage	O-DU	3GPP TS 28.552 clause 5.1.1.2.1	O1
Req-4.21.004	Network load and data performance	UL Total PRB Usage	O-DU	3GPP TS 28.552 clause 5.1.1.2.2	O1
Req-4.21.005	Network load and data performance	Mean number of Active UEs, per cell (and optionally per PLMN, per slice)	O-DU	3GPP TS 28.552 clause 5.1.1.23.5	O1

WG1 주요 활동 - Decoupled SMO

- ❖ 기존 규격에서는 SMO 내 여러 구조가 단일 구조로 정의되어 multi-vendor 상호운용성이 저하, 확장성과 유연성이 부족하다 판단
 - SMO를 SO SMOS, SA SMOS, OAM SMOS 등 여러 서브시스템으로 분리/규격화 추진 (Decoupled SMO)
 - Slice의 경우, 동작과 관련된 SMOS(Service Orchestration, Service Assurance)에 대해서도 WG1에서 논의 추진 중



WG1 내 진행 Work Item(WI)

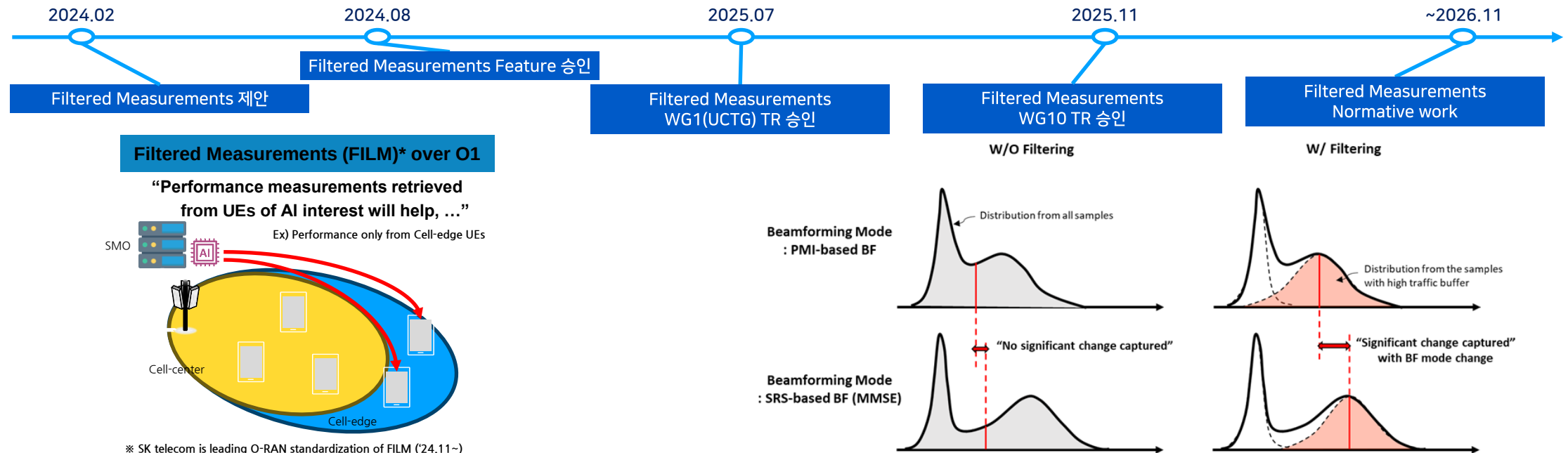
WID/FWID	TG	Name	Year Approved	관련 대표 문서
FWID	UCTG	Shared O-RU	2022	O-RAN-FWID-WG1-2022-01-Shared-O-RU-v2.01
FWID	UCTG	Network Energy Savings – Phase 2	2022	O-RAN-FWID-WG1-2022-02-Network-Energy-Savings.v01.01
WID	ATG, UCTG	SMO Intent	2022	O-RAN-FWID-WG1-2022-03-SMO-Intent-v05.01
WID	UCTG	Managed Spectrum Sharing	2024	O-RAN-FWID-WG1-2024-04-Managed-Spectrum-Sharing-v01.01
FWID	UCTG	RIC Enabling NTN Deployment	2024	O-RAN-FWID-WG1-2024-05-RIC-Enabling-NTN-Deployment-v01.02
FWID	ATG	Decoupled SMO	2024	O-RAN-FWID-WG1-2024-06-Decoupled-SMO-v01.02
WID	UCTG	Filtered Measurement	2024	O-RAN-FWID-WG1-2024-07-Filtered-Measurement-v01.01
WID	UCTG	Resiliency	2024	O-RAN-FWID-WG1-2024-08-Resiliency-v02.01
FWID	ATG, UCTG	Communication and Computing Integrated Network	2024	O-RAN-FWID-WG1-2024-09-Communication and Computing Integrated Network-v01.00
FWID	UCTG	TN Inclusion	2025	O-RAN-FWID-WG1-2025-10-TN-Inclusion-v01.01
WID	ATG	TN Inclusion	2025	O-RAN-FWID-WG1-2025-11-TN-Inclusion-v01.01

WG1 내 진행 Work Item(WI) – FILM

- ❖ 통신망과 AI 기술과 결합하여 진화하는 '네트워크(Network) AI' 실현을 위해 고품질·정규화 데이터 확보 필수적
→ AI 기반 네트워크 지능화를 위해, 장비 종속성 없이 PM, MDT 등 여러 종류의 measurements를 목적에 맞게 filtering하여 수집하는 방안 연구 및 규격화 추진 (Filtered Measurements, FILM)

❖ FILM 진행 현황

SKT에서 제안 및 Leading. KDDI, Verizon, Vodafone, Nokia, Samsung 등 주요 사업자/제조사 포함 11 개사 Supporting 중이며, 현재 WG10 내 FILM 관련 활동 중



최근 WG1 주요 진행현황

- 1) Computing and Communication Integrated Network(CCIN)에 대한 TR Release 이후 관련 시나리오 및 Use Case에 대한 연구 및 규격화 추진 중
- 2) SO and SA SMOSs 관련 논의가 8월부터 weekly meeting으로 논의 시작, 규격화 추진 중
- 3) UCTG에서 3개의 TR(Technical Report), ATG에서 1개의 TS(Technical Specification)가 승인되어 IPR 심사 중

✓ UCTG

A. Filtered Measurements TR

- O-RAN에서 방대한 측정 데이터를 목적에 맞게 필터링하여 수집/활용하는 방안, 구현 솔루션 등에 대한 TR

B. O-RAN Resiliency TR

- 네트워크 장애, 장애 복구, 장애 예방, 자동화된 회복, 장애 시 서비스 연속성 보장 등에 대한 TR

C. RIC Enabling NTN TR

- 5G Non-Terrestrial Networks에서 O-RAN RIC의 적용 가능성, 최적화 use case 등에 대한 TR

✓ ATG

SMO Architecture TS

- Decoupled SMO Feature 활동의 결과로, Service-based SMO architecture와 SMO Service에 대한 규격 문서

[참고] WG1 주요 규격문서

- ❖ O-RAN Architecture Description
- ❖ O-RAN Slicing Architecture
- ❖ O-RAN Use Cases Analysis Report
- ❖ O-RAN Use Cases Detailed Specification
- ❖ O-RAN Decoupled SMO Architecture
- ❖ O-RAN Communication and Computing Integrated Networks

<https://specifications.o-ran.org/specifications>

Thank You