

# Validating 5G ORAN Fronthaul O-RU Synchronization

*Alon Regev*

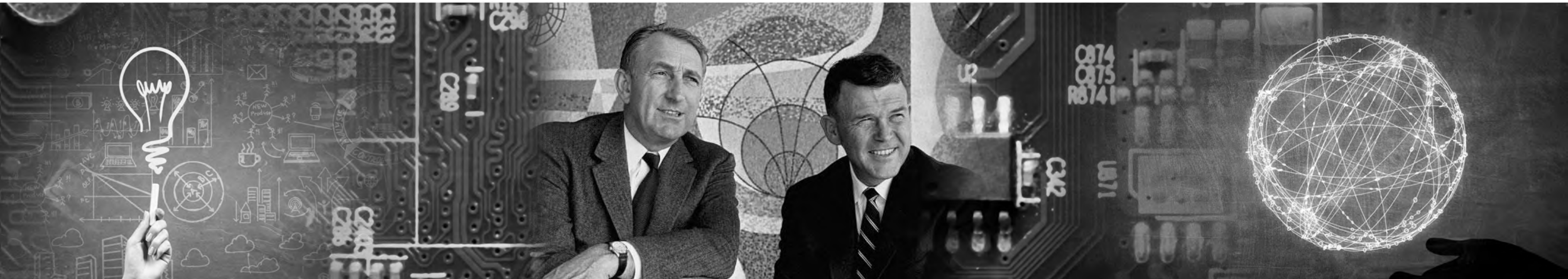
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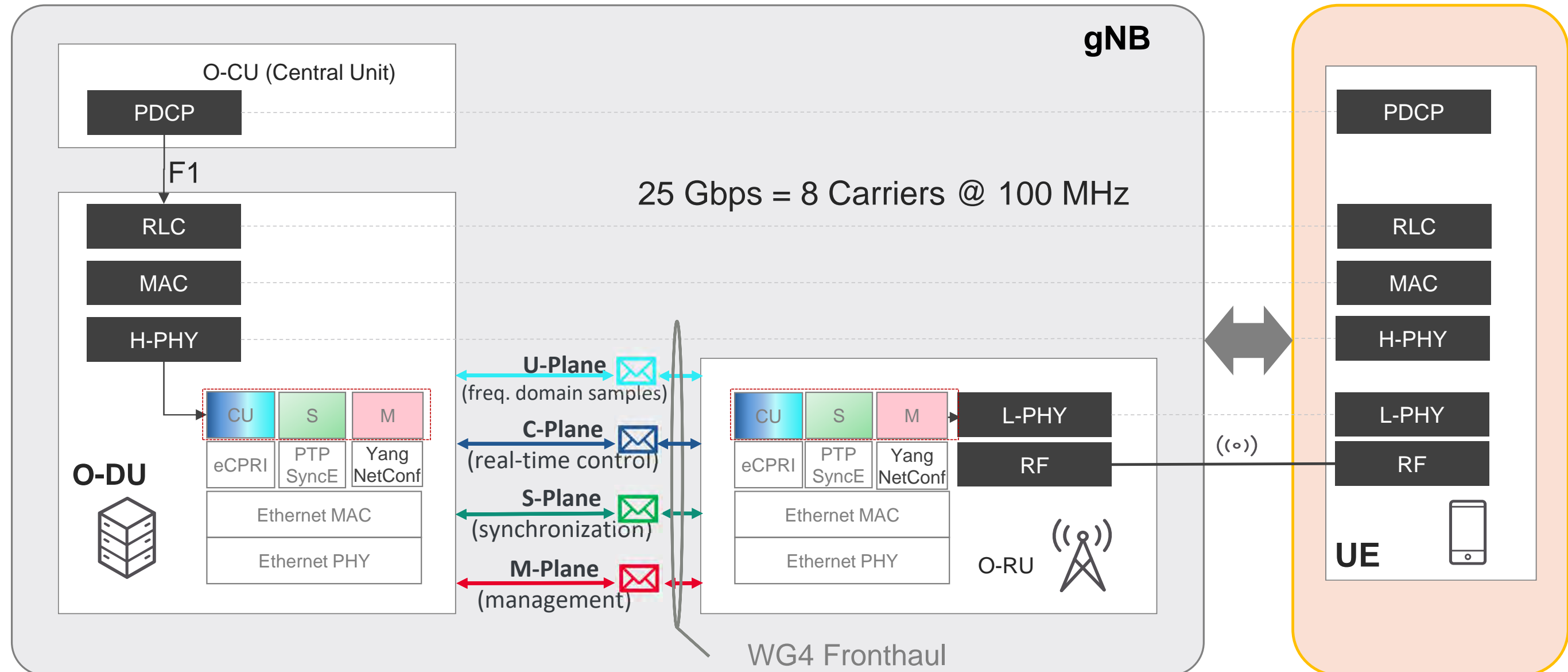
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# Introduction

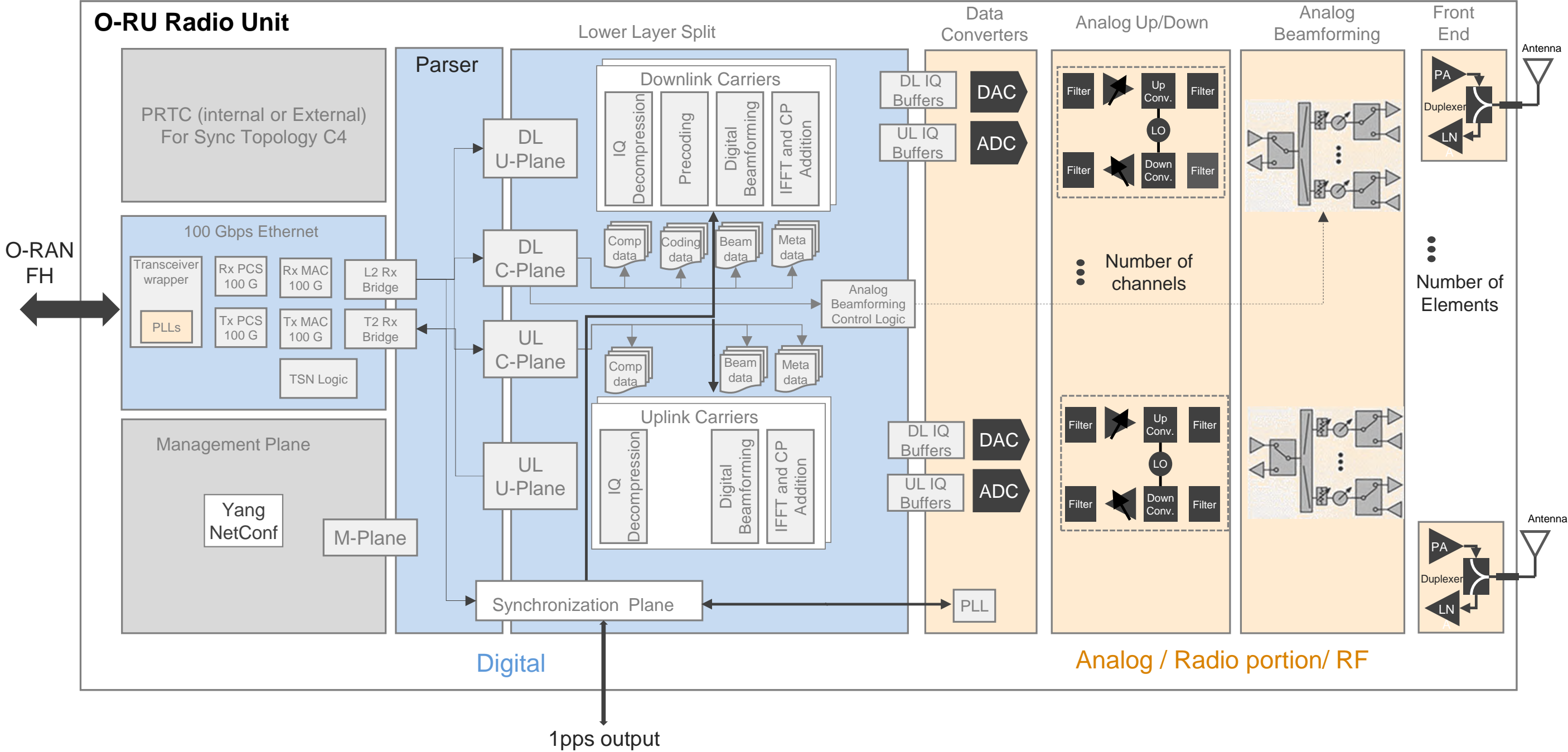
- In 5G, O-RAN (Open Radio Access Network) is enabling disaggregation of the eNodeB into separate components
- The O-RU (Open Radio Unit) is the component that includes the “Low PHY” and RF components.
- Testing timing / synchronization on the O-RU requires testing timing synchronization on both the Ethernet and the RF interfaces
- This presentation provides an overview of ORAN, the function and anatomy of an O-RU, the test requirements, test topology needed to run a sample test, and some of the analysis applied

# O-RAN Architecture

## BASE STATION DISAGGREGATION AND OPENNESS

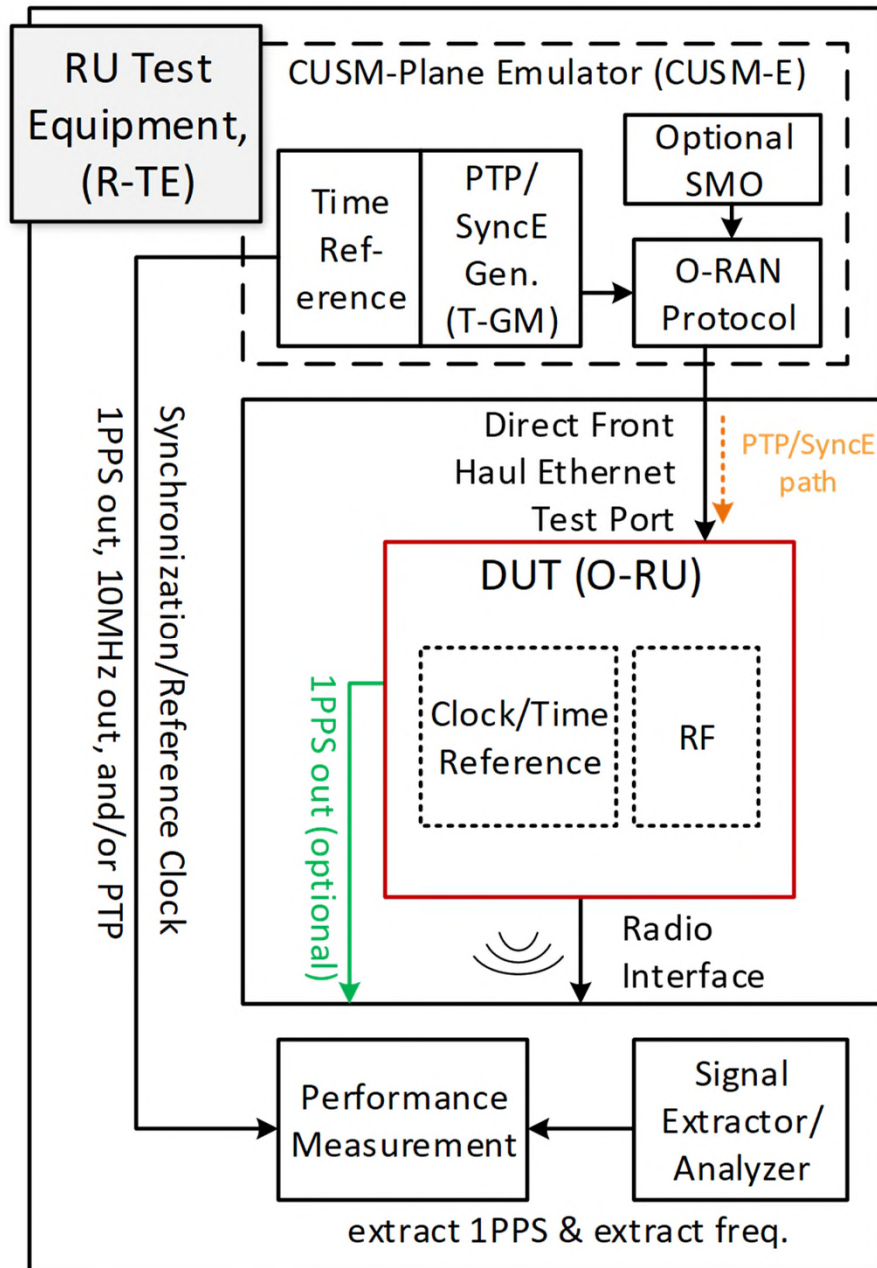


# Anatomy of a 5G Radio Unit (O-RU)





# O-RAN WG4 S-plane Device Tests: Section 3.3



## 3.3 Synchronization test use cases, parameters and methodologies

3.3.2 Functional test of **O-RU** using ITU-T G.8275.1 PTP profile

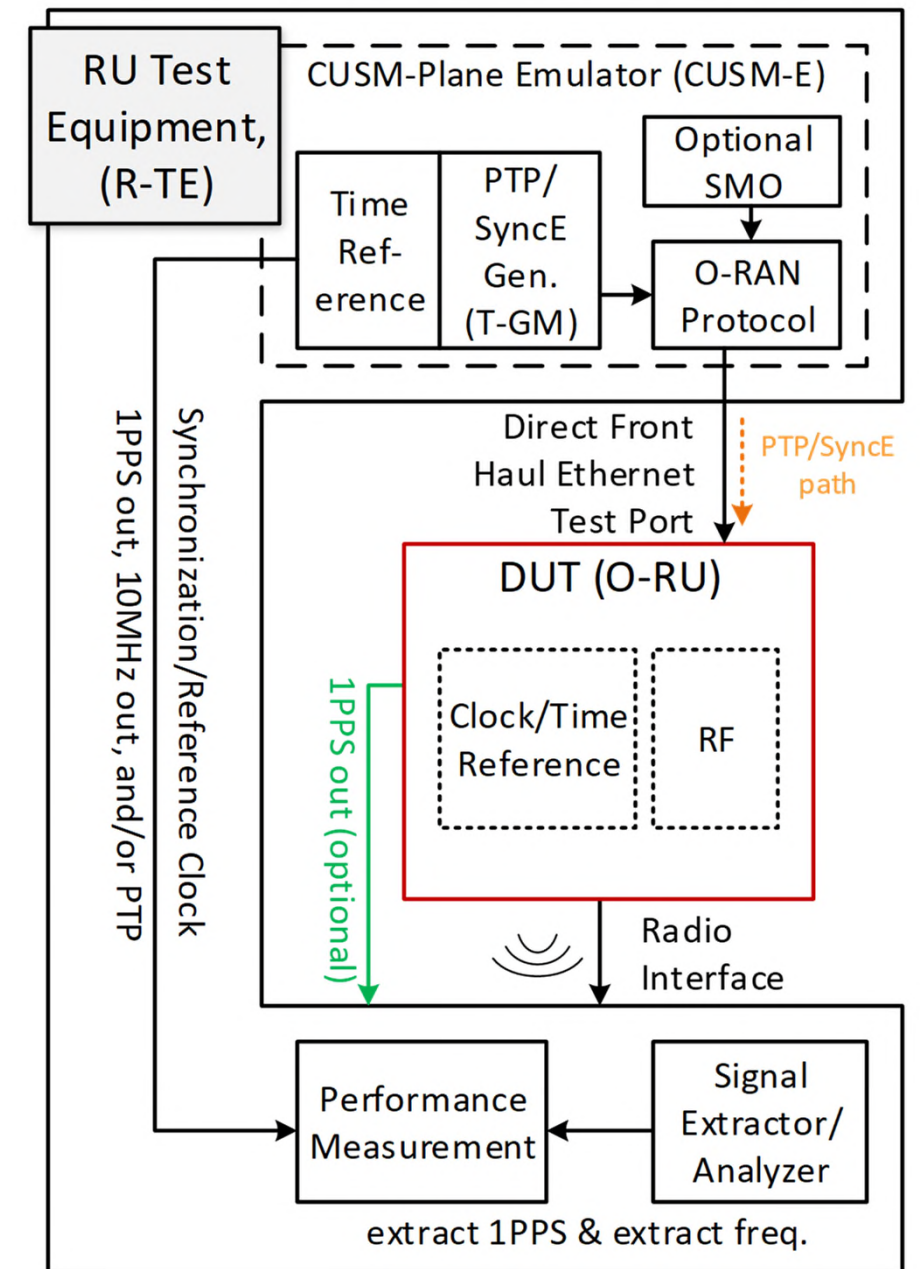
3.3.3 Performance test of **O-RU** using ITU-T G.8275.1 PTP profile

3.3.4 Performance test of **O-RU** using LLS-C4 [not yet defined]

# O-RAN WG9 S-plane System Test Use Cases: Section 9.1

## 9.1 Synchronization test use cases, parameters and methodologies

- 9.1.1 Network Time Synchronization-LLS-C1 (Option-A)
- 9.1.2 Network Time Synchronization-LLS-C1 (Option-B) config: Scenario-1
- 9.1.3 Network Time Synchronization-LLS-C1 (Option-B) config: Scenario-2.
- 9.1.4 Network Time Synchronization-LLS-C1 (Option-C)
- 9.1.5 Network Time Synchronization-LLS-C2 (Option-A)
- 9.1.6 Network Time Synchronization-LLS-C2 (Option-B) config: Scenario-1
- 9.1.7 Network Time Synchronization-LLS-C2 (Option-B) config: Scenario-2
- 9.1.8 Network Time Synchronization-LLS-C2 (Option-B) config: (Fail-over: Scenario-1)
- 9.1.9 Network Time Synchronization-LLS-C2 (Option-B) config: (Fail-over: Scenario-2)
- 9.1.10 Network Time Synchronization-LLS-C2 (Option-B) config (Fail-over: Scenario-3)
- 9.1.11 Network Time Synchronization-LLS-C2 (Option-B) config (Time Error with Traffic)
- 9.1.12 Network Time Synchronization-LLS-C2 (Option-B) config (SyncE network wander limit for chain of EEC and eEEEC clock)
- 9.1.13 Network Time Synchronization-LLS-C2 (Option-B) config: (1PPS TE on O-RU)
- 9.1.14 Network Time Synchronization-LLS-C3 (Option-A)
- 9.1.15 Network Time Synchronization-LLS-C3 (Option-B)
- 9.1.16 Network Time Synchronization-LLS-C3 (Option-B) config: (Time Error with Traffic)
- 9.1.17 Network Time Synchronization-LLS-C3 (Option-B) config: (PTP Holdover test)
- 9.1.18 Network Time Synchronization-LLS-C3 (Option-B) config: (PTP Fail-over/redundancy)
- 9.1.19 Network Time Synchronization-LLS-C3 (Option-C)



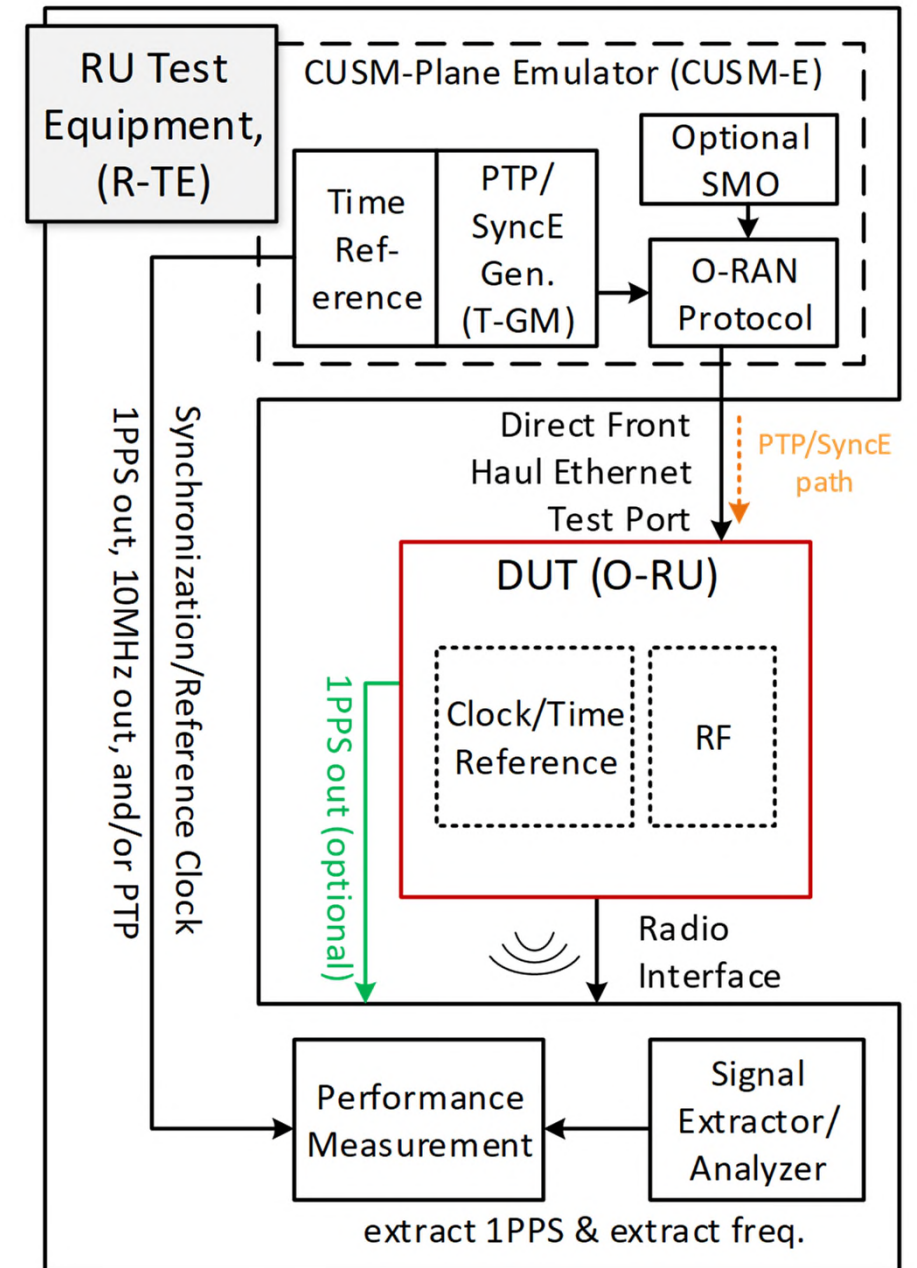
# O-RAN WG9 S-plane Test Use Cases: Sections 9.2 & 9.3

## 9.2 SyncE performance per G.8262.1 clock specifications

- 9.2.1 Pull-in/Hold-in/Pull-out Limits
- 9.2.2 Wander Generation Limit for eEEC Clock
- 9.2.3 Wander Tolerance Test for eEEC Clock
- 9.2.4 Frequency Holdover Limits as per G.8262 eEEC Clock
- 9.2.5 Short-term phase-transients

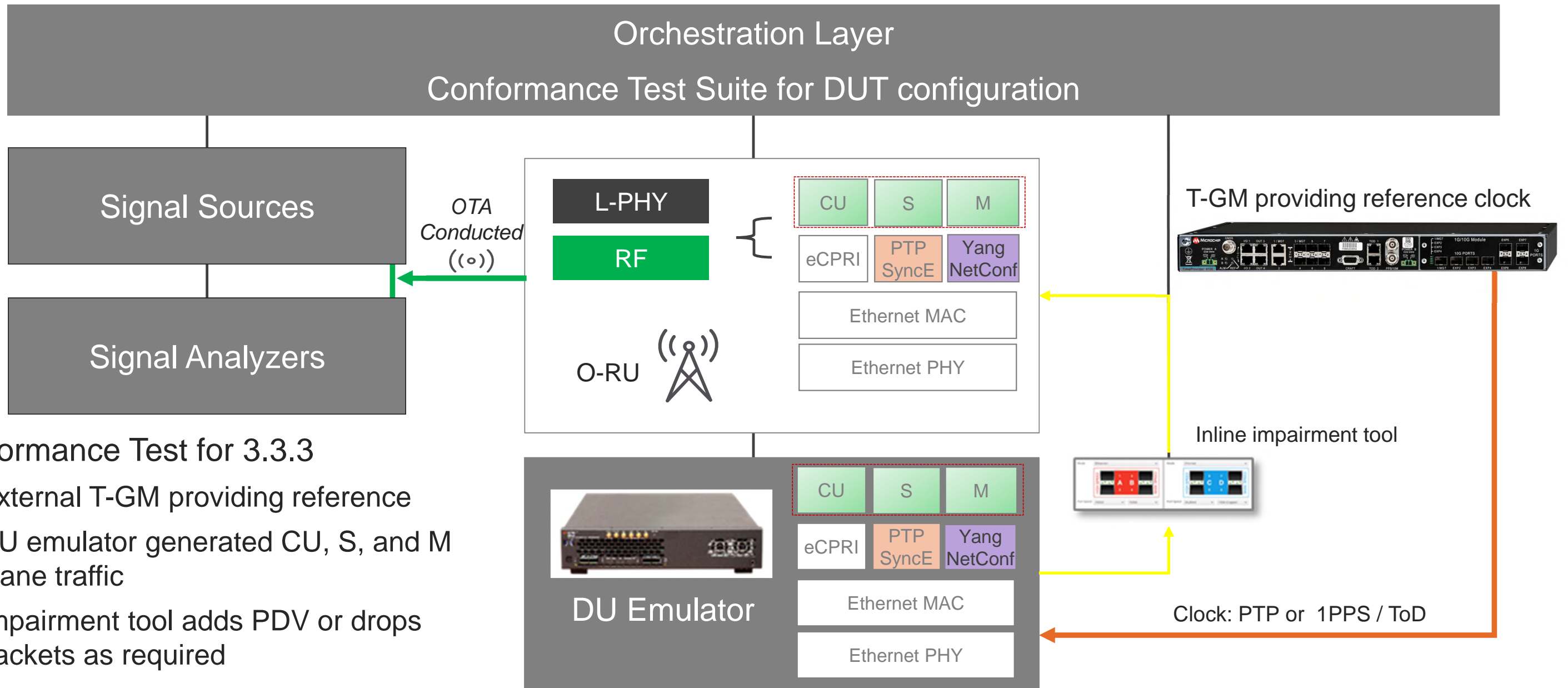
## 9.3 PTP performance as per G.8273.2 clock specifications

- 9.3.1 Time Noise Generation Performance
- 9.3.2 Time Noise Tolerance Performance Test
- 9.3.3 Time Holdover Performance Test





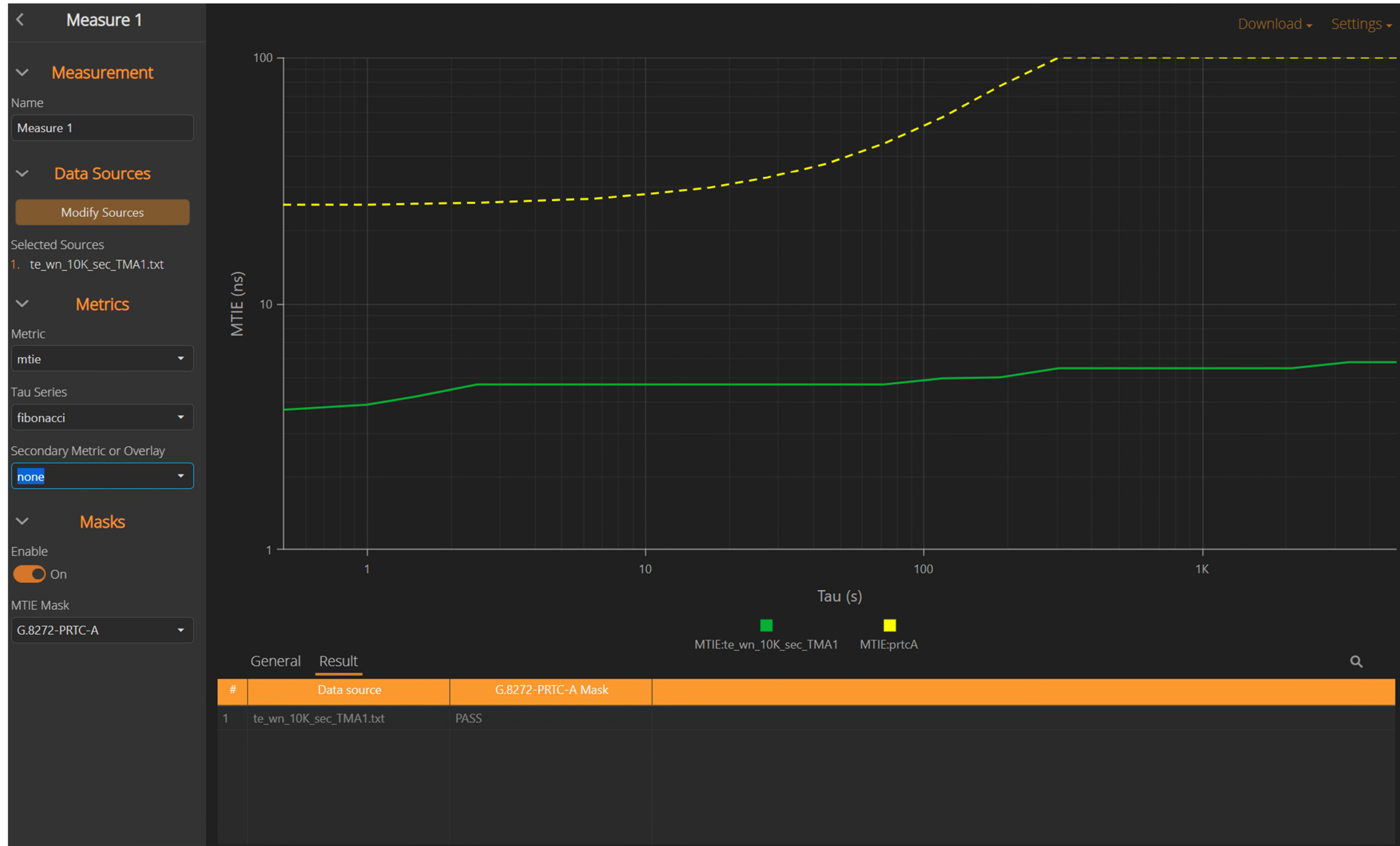
# O-RU S-plane Performance Test Topology



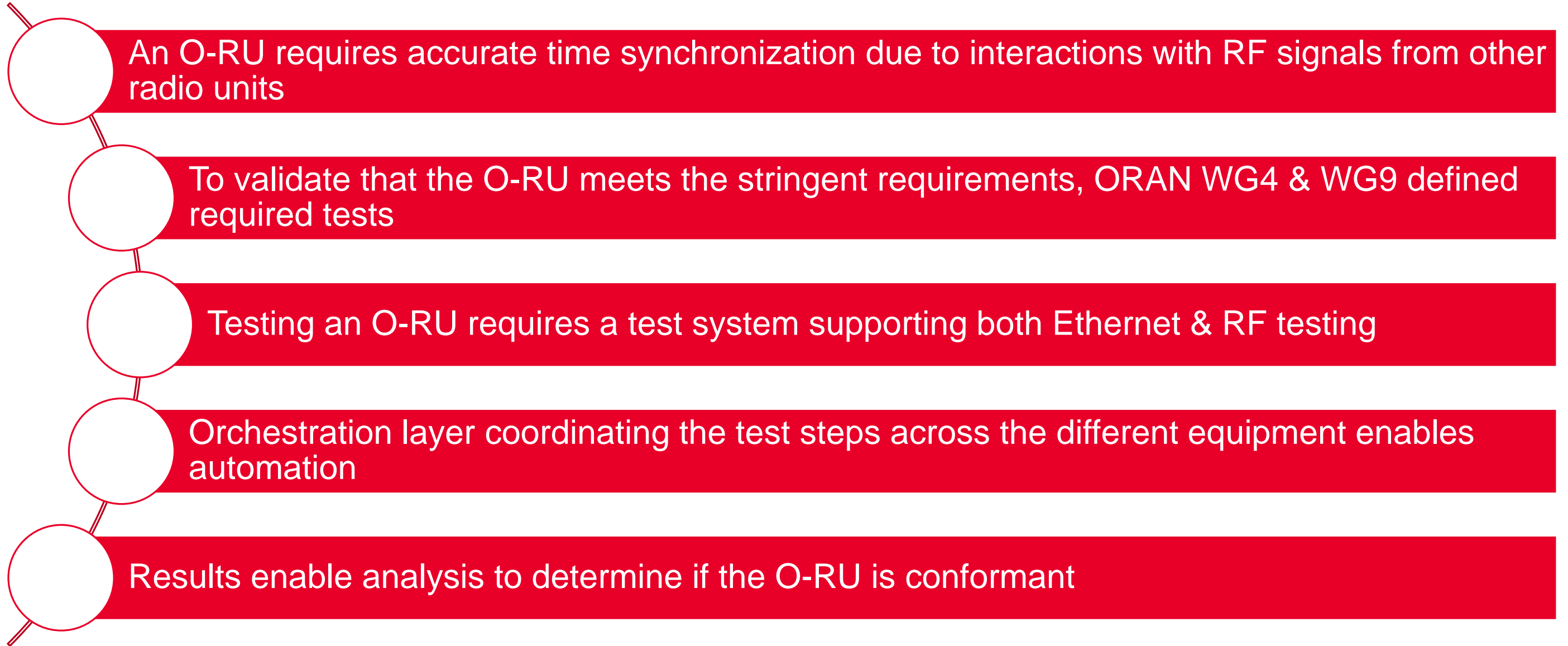
## Performance Test for 3.3.3

- External T-GM providing reference
- DU emulator generated CU, S, and M plane traffic
- Impairment tool adds PDV or drops packets as required
- Signal Analyzers & Sources enable evaluation of RF timing

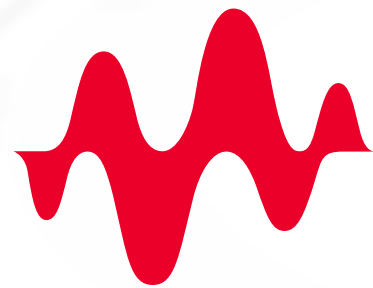
# Clock Quality Analytics



# Conclusion



*Questions or comments: email [Alon.Regev@keysight.com](mailto:Alon.Regev@keysight.com)*



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