

# 5G CHALLENGE

## Scoring Guide and Metrics

### 5G Challenge Preliminary Event: RAN Subsystem Interoperability

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## Document History

| Version | Date     | Changes   |
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| 1.0     | 4/6/2022 | Initial Release   |
| 1.1     | 8/9/2022 | Stage Two prize qualification change; Stage Three contestant selection and prize changes in the case of critical contestant pairing limitations; Stage Two security evaluation change |
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## 1 Introduction

This document describes the 5G Challenge Preliminary Event: RAN Subsystem Interoperability scoring guide and metrics. The 5G Challenge Preliminary Event will use the following scales:

- **5-level:** numerical score of [1..5] where 5=excellent, 4=good, 3=fair, 2=poor, and 1=bad
- **Boolean:** [yes, no]
- **Number:** count the total number of observations
- **Text:** list or summarize relevant information from the application

## 2 Application Scoring and Selection Criteria

The 5G Challenge Preliminary Event applications will be scored using three steps.

**STEP 1:** The facts listed in Table 1 are recorded.

**STEP 2:** A panel of evaluators will review and rate the application SBOM (if submitted). These evaluators will review the SBOM using the scoring criteria shown in Table 2. The data fields to be evaluated correspond to the minimum elements defined in the Department of Commerce’s Minimum Elements for Software Bill of Materials, located here: [https://www.ntia.doc.gov/files/ntia/publications/sbom\\_minimum\\_elements\\_report.pdf](https://www.ntia.doc.gov/files/ntia/publications/sbom_minimum_elements_report.pdf). The overall score for the SBOM will be averaged across all evaluators and passed into the third step.

**STEP 3:** A panel of evaluators will judge the application using the scoring form shown in Table 3. **The application score will be computed as a weighted average across all categories and all panel members, using the weights and categories provided in Table 3.**

The overall SBOM score from Step Two will be used as the “SBOM Quality” score in Table 3. The maximum possible score for the SBOM is 5 points. However, the 5G Challenge will not penalize contestants who do not submit an initial SBOM or who have little experience writing SBOMs. Therefore, the “SBOM Quality” category will be given a default score of 2.5 if (1) an initial SBOM is not submitted with the application, or (2) the SBOM receives a score below 2.5.

**STEP 4, SELECTION:** Step 3 produces an overall score for each application that ranges from 1 (bad) to 5 (excellent). Applications with overall scores below 2.5 will be rejected; applications receiving a score of 2.5 and above will be considered for selection in the order of their application scores.

The 5G Challenge will select up to 12 contestant subsystems consisting of up to 6 CUs, 3 DUs, and 3 RUs. To select 12 contestants from the pool of qualified applicants, the 5G Challenge will first evaluate each subsystem category to determine and select contestants with the highest scoring subsystems in each category. These subsystems will be accepted into Stage Two.

The 5G challenge places a priority on choosing 12 different contestants. If contestants have more than one eligible RAN subsystem, the judges will designate a primary and a secondary RAN subsystem for that contestant. If all 12 slots have not been filled with eligible primary RAN subsystems, then the highest-ranking secondary RAN subsystems will be selected, allowing contestants to submit up to 2 different subsystems.

The “Host lab technology requirements,” “Baseline 5G system restrictions,” and “Previous integration partners” information from the Category column in Table 1 will only be used (1) for the Stage Two selection process, and (2) for scheduling Stage Three lab time assignments. The 5G Challenge is intended to accommodate all technological design strategies. The 5G Challenge Organizers reserve the right to reject any application whose subsystems cannot be evaluated with the available host lab equipment.

Table 1. Factual Application Information (not calculated in the overall score)

| Category                         | Scale   | Notes  |
|----------------------------------|---------|--|
| Proof of Eligibility             | Boolean | Whether the eligibility requirements have been met   |
| Subsystem(s)                     | Boolean | Mark presence or absence of each possible subsystem  |
| Host lab technology requirements | Text    | Technical approach specifications that may impact the host lab (e.g., computer hardware, operating system, and orchestration)  |
| Baseline 5G system restrictions  | Boolean | Mark whether the contestant’s products appear in the primary host lab system (for planning purposes only)  |
| Previous integration partners    | Text    | List of vendors and vendor subsystems that the applicant has interoperated with prior to the contest, including subsystems in the host lab system (Mavenir™, Accelleran™, Benetel™, Phluido™/EffNet™, open5Gs) |
| SBOM                             | Boolean | Initial SBOM included with the application   |

Table 2. SBOM Scoring

| Criteria                 | Scale   | Notes  |
|--------------------------|---------|--|
| SBOM format is valid     | Boolean | Use tool to check syntax validity (e.g., <a href="https://tools.spdx.org/app/validate/">https://tools.spdx.org/app/validate/</a> ) |
| Supplier name            | Boolean | Data field is present  |
| Component name           | Boolean | Data field is present  |
| Version of the component | Boolean | Data field is present  |
| Other unique identifiers | Boolean | Data field is present (may not be available)   |

| Criteria  | Scale   | Notes   |
|---|---------|---|
| Dependency relationship                             | Boolean | Data field is present   |
| Author of SBOM data                                 | Boolean | Data field is present   |
| Timestamp   | Boolean | Data field is present   |
| Known unknowns                                      | 5-level | Are the known unknowns specified?   |
| Number of levels of dependency surfaced in the SBOM | Number  | Walk through dependency trees (a low number does not necessarily imply a low score)   |
| Field intelligibility                               | 5-level | SBOM fields have meaningful values in formats   |
| Completeness  | 5-level | Gives evaluator high confidence in the integrity of the SBOM (e.g., thorough, exhibiting a high level of expertise in the area, covering all of the bases, and providing above-and-beyond information). |
| Overall assessment                                  | 5-level | Consider the above criteria and rate overall quality of the SBOM  |

Table 3. Qualitative Application Scoring

| Criteria                         | Scale   | Notes  | Weight |
|----------------------------------|---------|--|--------|
| Technical approach               | 5-level | Viability of the technical approach, including specification of 3GPP Release numbers, and ORAN Alliance versions, and reason why configurations were chosen where appropriate  | × 2    |
| Technical and business readiness | 5-level | Demonstrated functionality from prior tests (e.g., RAN test summary, independent testing, or plugfests). How close is the product to general availability (e.g., commercially available, some external interoperability testing, or internal testing only) | × 2    |
| Security plan                    | 5-level | Robustness of the security plan, including implementation of 3GPP security procedures, known critical software vulnerabilities, and mitigation plan.   | × 1    |
| Staffing / management            | 5-level | Sufficient staffing to support lab and design support. Sufficient experience in mobile telecommunications and 5G. Commitment to 5G Challenge (e.g., statement of organizational support, resume or history of related projects)                            | × 1    |

| Criteria  | Scale   | Notes  | Weight |
|---|---------|--|--------|
| SBOM quality (optional in Stage One, required in Stage Two) | 5-level | Overall assessment of the initial SBOM from Table 2. No contestant will receive a score below 2.5. | × 1    |

### 3 Qualification for Stage Two Emulated Integration Prize

#### 3.1 Emulated Integration Scoring

The emulated integration and functionality testing levels (using a wrap-around emulator for all levels) for Stage Two are:

- **LEVEL 0:** Integration into a test emulator
- **LEVEL 1:** Basic functionality and conformance tests
- **LEVEL 2:** Interoperability using interface emulation
- **LEVEL 3:** E2E (end-to-end) basic performance using emulation

The host lab will release testing procedures to Stage Two contestants at least one week prior to beginning their integration process. The testing procedures will identify the tests that will be run at levels 0, 1, 2, and 3. Each level may contain multiple tests. The subsystem's score will be the number of tests passed for all levels.

The final SBOM will be scored using the procedures and criteria from Section 2. The final SBOM will receive a passing score if it is scored 2.5 or above.

#### 3.2 Qualifying for Stage Two Emulated Integration Prizes and SBOM Prize

To qualify for an Emulated Integration Prize, one or more of a contestant's subsystems must receive a passing score for:

- Level 0
- The final SBOM (i.e., a score of 2.5 or above)

Of all subsystems that are awarded an Emulated Integration Prize, the subsystem with the highest rated SBOM will be awarded the SBOM Prize.

## 4 Selection of Stage Three Network Integration Contestants

### 4.1 Scoring For Admission to Stage Three

All subsystems that are awarded a Stage Two Emulated Integration Prize will qualify for selection into Stage Three. If a contestant submits multiple subsystems, each subsystem will be scored separately.

Each subsystem's score will be equal to the number of tests passed during the Integration and Functionality Testing (Level 0 to 3) during Stage Two.

Ties will be adjudicated on the basis of progress in this order: (1) performance in the integration testing, (2) reliability, and (3) resilience to stress. In the event that two or more contestants are tied after the above evaluation process, 5G Challenge judges will score each submission on a five-level scale based on these criteria.

### 4.2 Primary Selection Strategy for Stage Three

A maximum of six (6) subsystems will be invited to participate in Stage Three. Of the qualified subsystems, the two highest scores for each subsystem type (e.g., the two highest RUs, CUs, and DUs) will be invited to Stage Three.

If there are not two qualified contestants for each subsystem type, one subsystem will be selected for each subsystem type's contestant pool in turn, according to highest Stage Two score, in the following order of priority:

- 1) RU
- 2) DU
- 3) CU

If no contestant subsystems qualified for a subsystem type in Section 4.1, then that subsystem type will not be represented in Stage Three.

Subsystems will be selected from each subsystem type's contestant pool in turn, in the same order and according to highest Stage Two score. If no additional subsystems remain for one of the subsystem types, then it will be skipped. This selection process will be complete when six (6) subsystems are selected or no more qualified contestant subsystems under Section 4.1 are available.

Each contestant will be allowed a maximum of one subsystem in Stage Three. Once a contestant has one subsystem selected for Stage Three, other subsystems from that contestant (if any) shall be excluded from consideration. If under this selection criteria there are remaining Stage Three slots to be filled, the 5G Challenge organizers reserve the right to select a second subsystem from a contestant up to a maximum of six (6) subsystems for Stage Three.



### 4.3 Secondary Selection Strategy for Stage Three

After completing the above selection process, the judge panel will assess whether it is technically feasible to test this set of contestant subsystems in Stage Three, considering:

- Host lab system capabilities and limitations
- Number of each subsystem type (CU, DU, RU)
- Compatibility issues between FDD and TDD
- Need to avoid unfairness due to pairing a contestant's challenge submission with that same contestant's own product

If the testing is not feasible, the pool of contestants produced by Section 4.2 will be down-selected as follows:

- 1) Contestant subsystems found to be non-feasible for testing will be eliminated
- 2) All possible pairings of the remaining contestant subsystems and host lab systems will be identified, including combinations with three contestants per "pairing" (i.e., one CU, one DU, and one RU)
- 3) Contestant pairing(s) will be chosen to maximize the variety of vendors and subsystem types represented in Stage Three on a fair and equal basis, while ensuring each Stage Three contestant an equal opportunity to win a prize

If the above process produces only one possible contestant pairing, then the 5G Challenge Organizers reserve the right to alter the Stage Three scheduling accordingly (e.g., changing from two testing windows to one testing window).

## 5 Qualifying for Stage Three Prizes

### 5.1 Network Integration Scoring

The network integration and functionality testing levels (using an actual network for all levels) for Stage Three are:

- **LEVEL 0:** Integration of contestant RAN subsystems into an actual network
- **LEVEL 1:** Establish E2E connectivity between the UE emulator and 5G core packet data network (PDN)
- **LEVEL 2:** Demonstrate basic E2E performance to the UE emulator (basic data traffic, single UE connection, and single UE session)

- **LEVEL 3:** Demonstrate advanced E2E performance to the UE emulator (advanced data traffic, multiple UE connections, and multiple UE sessions)

The host lab will release testing procedures to Stage Three contestants at least one week prior to beginning their integration process. The testing procedures will identify the tests that will be run at levels 0, 1, 2, and 3. Each level may contain multiple tests. The subsystem's score will be the number of tests passed for all levels.

## 5.2 Qualifying for Stage Three Network Integration Prizes

Each contestant in the contestant pair with the highest score for each Test Window will qualify for the Network Integration Prize. Up to four (4) Network Integration prizes will be awarded during Stage Three.

Ties will be adjudicated on the basis of progress in this order: (1) performance in the integration testing, (2) reliability, and (3) resilience to stress.

If Section 4 produces only one contestant pairing, then all contestants who pass Level 1 Stage Three testing will qualify for a Network Integration Prize.