# 3GPP TR 38.838 V0.0.1 (2020-11)

*Technical Report*

# 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on XR (Extended Reality) Evaluations for NR; (Release 17)

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# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# Introduction

In RAN #86 meeting, a new Rel-17 study item on XR Evaluation for NR was approved and the study item was further revised in RAN#88 and approved in [2]. The objective of this study item is to study and evaluate XR applications for specific scenarios for FR1 and FR2.

*(Editor's note: May be further updated depending on the SI progress)*

# 1 Scope

The present document captures the results and findings from the study item "Study on XR Evaluation for NR' [2].

The purpose of this TR is to document the findings related to the objectives of the study item

- Confirm XR and Cloud Gaming applications of interest
- Identify the traffic model for each application of interest taking outcome of SA WG4 work as input, including considering different upper layer assumptions, e.g. rendering latency, codec compression capability etc.
- Identify evaluation methodology to assess XR and CG performance along with identification of KPIs of interest for relevant deployment scenarios
- Once traffic model and evaluation methodologies are agreed, carry out performance evaluations towards characterization of identified KPIs

*(Editor's note: May be further updated)*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications"

[2] 3GPP RP-201145: "Revised SI on XR Evaluations for XR"

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

| | |
|---|---|
| ACK | Acknowledgement |
| BWP | Bandwidth Part |
| CSI | Channel State Information |
| DL | Downlink |
| DMRS | Dedicated Demodulation Reference Signals |
| FDD | Frequency Division Duplex |
| gNB | NR Node B |
| HARQ | Hybrid Automatic Repeat reQuest |
| iBLER | initial BLock Error Rate |
| MCS | Modulation and Coding Scheme |
| NACK | Negative Acknowledgement |
| OS | OFDM symbol |
| PDCCH | Physical Downlink Control Channel |
| PUCCH | Physical Uplink Control Channel |
| PUSCH | Physical Uplink Shared Channel |
| PDSCH | Physical Downlink Shared Channel |
| PRB | Physical Resource Block |
| rBLER | residual BLock Error Rate |
| SCS | Subcarrier Spacing |
| SR | Scheduling Request |
| TBS | Transport Block Size |
| TDD | Time Division Duplex |
| UCI | Uplink Control Information |
| UE | User Equipment |
| UL | Uplink |
| XR | Extended Reality |

# 4 XR applications

*(Editor's note: According to SID, "New SID on XR evaluations for NR" the following applications are to be considered as starting points. For instance,*

- VR1: "Viewport dependent streaming"
  - Tracking is processed in XR device and pose is sent to XR edge server.
  - XR media is delivered/requested based on XR viewport.

  - Reduced or viewport optimized scene is delivered (e.g., object not visible in viewport is not delivered).
  - Required rate (e.g., 25Mbps) is much lower than viewpoint independent streaming
- VR2: "Split Rendering: Viewport rendering with Time Warp in device"
  - XR server prerenders the XR scene based on pose information received from XR device.
  - XR device further processes the received pre-rendered scene based on pose information using ATW (asynchronous time warping) technique to reflect head motion made after the scene is rendered.
  - Viewport can be encoded in 2D or 3D format.
- AR1: "XR Distributed Computing"
  - Architecture is similar to split rendering.
  - XR device captures 2D streams from a camera and send the captured stream to XR edge server.
  - UL has higher rate due to uploaded scenes.
- AR2: "XR Conversational"
  - Conversational model where multiple XR users exchange XR traffic.
- CG: "Cloud Gaming"
  - Gaming based on rendering in network and user's control information feedback to network
  - Required rate: 5-35Mbps @ 60FpsNote: Use cases in quotes are from TR26.928.

*In either/both of Applications clause and/or Traffic Model clause, some aspects of system architecture relevant to the traffic model may be described.)*

# 5 Traffic model

# 6 Deployment scenarios

# 7 XR evaluations for NR

*(Editor's note: This clause captures evaluation methodology, KPIs, performance evaluation results towards characterization of identified KPIs. The relevant objectives of the SI are [2]:*

- Identify evaluation methodology to assess XR and CG performance along with identification of KPIs of interest for relevant deployment scenarios
- Once traffic model and evaluation methodologies are agreed, carry out performance evaluations towards characterization of identified KPIs

*Clauses may be added taking into account the four key aspects of XR evaluations for NR, power consumption, capacity, mobility, and coverage [2].)*

# 8 Conclusions

# Annex <A>: Simulation assumptions

## A.1 Simulation assumptions for FR1

This clause describes the system-level simulation assumptions for FR1.

**Table A.1-1: General parameters for FR1**

| Parameter | Value |
|---|---|
| | |
| | |
| | |
| | |

## A.2 Simulation assumptions for FR2

This clause describes the system-level simulation assumptions for FR2.

**Table A.2-1: General parameters for FR2**

| Parameter | Value |
|---|---|
| | |
| | |
| | |

# Annex <X> (informative): Change history

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2020-11 | RAN1#103e | R1-2009811 | | | | Skeleton TR | 0.0.1 |