3GPP TSG RAN WG1 #105-e R1-21xxxxx

e-Meeting, May 10th – 27th, 2021

Source: Moderator (Qualcomm)

Title: [104b-e-NR-XR-01] Email discussion/approval on traffic model

Agenda Item: 8.14.1

Document for: Discussion and Decision

# Introduction

This contribution discusses traffic models based on the tdocs that have been submitted to RAN1#105e [1-18].

# PDB for UL AR

Below are RAN1 agreements on UL AR traffic model. As noted, PDB values in [ ] for Stream 2 in Option 1 and 3, and Option 2 are to be further discussed and potentially confirmed in RAN1#105-e, where other values can be also discussed if needed.

Agreements:

For evaluations of AR in UL:

* Option 1 (Baseline for power and capacity evaluations): Two streams as defined below
	+ Stream 1: pose/control
		- Traffic model and QoS parameters are same as for pose/control for UL CG/VR.
	+ Stream 2: A stream aggregating streams of scene, video, data, and audio.
		- Packet size: Truncated Gaussian distribution with the parameter values same as for DL
		- Periodicity: 60 fps
			* Jitter (optional): same model as for DL
		- Data rate: 10 Mbps (baseline), 20 Mbps (optional)
		- PDB: [60] ms (baseline), [10/15] ms (optional)
* Option 2 (Optional for power evaluation and baseline for capacity evaluation): Single stream as defined below
	+ Packet size: Truncated Gaussian distribution with the parameter values same as for DL
	+ Periodicity: 60 fps
		- Jitter (optional): same model as for DL
	+ Data rate: 10 Mbps (baseline), 20 Mbps (optional)
	+ PDB: [60] ms (baseline), [10/15] ms (optional)
* Option 3 (Optional): Three streams as defined below
	+ Stream 1: pose/control
		- Traffic model and QoS parameters are same as for pose/control for UL CG/VR.
	+ Stream 2: A stream aggregating streams of scene and video
		- Packet size: Truncated Gaussian distribution with the parameter values same as for DL
		- Periodicity: 60 fps
			* Jitter (optional): same model as for DL
		- Data rate: 10 Mbps (baseline), 20 Mbps (optional)
		- PDB: [60] ms (baseline), [10/15] ms (optional)
	+ Stream 3: A stream aggregating streams of audio and data
		- Periodicity: 10ms
		- Data rate: 0.756 Mbps/s or 1.12 Mbps
		- Packet size: determined by periodicity and data rate
		- PDB: 30 ms
* Option 4 (Optional): Three streams as defined below
	+ Stream 1: pose/control
		- Traffic model and QoS parameters are same as for pose/control for UL CG/VR.
	+ Stream 2: I-stream for video
	+ Stream 3: P-stream for video
	+ Note: For stream 2 and stream 3, the I/P-stream model for DL video can be reused for UL video.  Companies should report detailed assumptions in their simulations on packet size distribution for each stream, packet arrival interval (or fps) for each stream, PDB for each stream, PER requirement for each stream, criteria to be satisfied UE.
	+ Companies should strive to align the parameter values for the options chosen as much as possible
* Note: Above PDB values in [ ] for Stream 2 in Option 1 and 3, and Option 2 are to be further discussed and potentially confirmed in RAN1#105-e, where other values can be also discussed if needed.
* In case multiple steams are evaluated for UL AR, a UE is declared as satisfied only when each stream meets the requirement that X (%) of packets are successfully delivered within a given air interface PDB.
	+ X value for pose/control: follow X values for pose/control for CG/VR
	+ X value for other stream: follow X values for DL video stream.

SA4 studies on characters and requirements for AR2 are summarized in the following table.

Characters and requirements for AR2 in UL (S4aV200640)

|  |  |  |
| --- | --- | --- |
| **Media** | **Format and Model** | **E2E Latency requirement** |
| 3/6DOF Pose | Same as for split rendering | UL: 5-10 ms |
| Video + Depth | 1080p, Capped VBR 10/20 Mbit/s for UL | Conversational 100ms, 200ms |
| 2D Video is split rendering | 1080p or 4K (2 eyes)same model as split rendering | 60ms 100ms  |
| Front Facing Camera\* | 720p, CBR 3 Mbit/s for UL | Conversational 100ms, 200ms |
| Audio (MPEG-H) | 256/512 kbps for both UL/DL | Conversational 100ms, 200ms |
| Data Stream | 0.5 Mbps for both UL/DL | Conversational 100ms, 200ms |

**Companies’ views in tdocs [1-18] on PDB of the stream aggregating streams of scene, video, data, and audio**

* 60 ms (6 companies): FUTUREWEI, QCOM, Intel, Samsung, ZTE, Ericsson
* 10 ms (5 companies): CATT, Apple, LG, InterDigital, DCM
* 15 ms (4 companies): CATT, OPPO, LG, DCM

**Question 1. Please share your view on the PDB value of the stream in UL AR aggregating streams of scene, video, data, and audio, i.e., Stream 2 in Option 1 and 3, and Option 2. FL is planning to propose majority view as baseline.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | Referring to the modelling assumption in SA4 (S4-210614), the maximum latency for slice for AR2 UL is 60ms in 8.4.5, and 80ms in 9.2.1. As the maximum latency for slice in downlink is 60ms for VR2/AR2, and 80ms for CG, we think assuming the air PDB value for AR2 UL to be the same as that for either VR2/AR2 or CG should be a natural consequence. Therefore, we support 10/15 ms as baseline air PDB values, and 60 ms as optional. |
| Apple | Our preference is 10 ms, and LG’s observation is valid. As a compromise we are also fine with 15 ms. Hope other companies supporting 60 ms would be fine with 10 ms or 15 ms.  |

# Dual Eye Buffer for DL video stream

As indicated below, it is FFS whether and how to evaluate single eye and dual eye buffer.

|  |
| --- |
| RAN1 Agreement: Parameters of Truncated Gaussian distribution for packet size of DL video stream in case of single stream evaluation (note: these parameter values are those before the truncation):* [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size
* Other values that can be used for evaluation: [STD, Max, Min] = [4, 112, 88] % of Mean for single eye buffer, [3, 109, 91] % of Mean for dual eye buffer
* FFS: Whether and how to evaluate single eye and dual eye buffer
* Note: Companies report the values used in their simulation results.
* Note: There is no consensus that the [10.5, 150, 50]% of mean packet size is the best set of parameters
 |

Company views on the FFS point are summarized in the table.

|  |  |
| --- | --- |
| **Company** | **Proposals in tdocs** |
| vivo [3] | *Proposal 1: For dual-eye buffer, the dual-eye buffer traffic model in Table 1 can be optionally evaluated.* Table 1. Dual-eye buffer traffic model

|  |  |  |  |
| --- | --- | --- | --- |
| **Traffic model** | Single stream | Dual-eye buffer | Note |
| **Date rate (Mbps)** | 45 | 45 |  |
| **Packet size distribution** | Truncated Gaussian distribution |  |
| **Mean packet size (Bytes)** | 93750 | 46875 | Average data rate / FPS / 8 [bytes] |
| **STD of packet sizes (Bytes)** | 9844 | 4922 | 10.5% \* Mean packet size |
| **Maximum packet size (Bytes)** | 140625 | 70312 | 150% \* Mean packet size |
| **Minimum packet size (Bytes)** | 46875 | 23437 | 50% \* Mean packet size |
| **Packet arrival interval (ms)** | $$\frac{1000}{60}$$ | $$\frac{1000}{120}$$ |  |
| **Packet delay budget (ms)** | 10 |  |

 |
| CATT [4] | ***When single eye or dual eye buffer is modelled for evaluation, the total transmission data rate would be kept the same with the details of modelling reported by companies.*** |
| Samsung [11] | *The dual-eye buffer case is evaluated as single stream case by doubling the FPS and halving the packet size compared to the single-eye buffer case.* |
| LG [13] | *Proposal 1: Single and dual eye buffer can be modelled using the baseline single-stream DL traffic model with the agreed baseline and optional parameters.** *No further discussion on details is needed.*
 |
| Xiaomi [15] | **Proposal 1: For XR DL evaluation, interleaved eye buffer model can be optionally considered.** |
| ZTE [16] | [*Observation 1:* There is maximum 7% capacity gain for single eye traffic in high system load , compared to dual eye traffic in indoor house scenario, when bit rate is 45Mbps.](#_Toc15034)[*Proposal 1:* The simulation results based on traffic for dual eye buffer is enough to present the system capacity. And companies can provide the results based on traffic for single eye buffer optionally.](#_Toc9207) |

**Question 2. Based on the company inputs, the following is proposed. Please share your view in the below table.**

**FL proposal: For DL video stream, the dual-eye buffer case can be optionally evaluated, based on the single stream model by doubling the packet arrival rate and halving the packet size compared to sin-eye buffer, while all other parameters (e.g., jitter, PDB) are the same as for single stream. For companies who are evaluating the performance of dual-eye buffer in addition to single-eye buffer (baseline), the following scenarios in the table are recommended as a common baseline (so as to have more results in the same scenario). It is up to company to evaluate other scenarios.**



|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | Okay with the FL proposal. |
|  |  |

# DL: Two Stream Traffic Models: Option 1

Below is RAN1 agreement related to evaluation of two streams for DL.

|  |
| --- |
| RAN1 Agreement:In addition to single stream per UE in DL which is baseline, two streams can be optionally evaluated for DL* Option 1: I-frame + P-frame
	+ Option 1A: slice-based traffic model
	+ Option 1B: Group-Of-Picture (GOP) based traffic model
* Option 2: video + audio/data
* Option 3: FOV + omnidirectional stream
* Companies should report detailed assumptions in their simulations on packet size distribution for each stream, packet arrival interval (or fps) for each stream, PDB for each stream, PER requirement for each stream, criteria for being satisfied.
* Companies should strive to align the parameter values for the options chosen as much as possible
* FFS: Whether audio stream is separate or aggregated with the data stream in option 2 (Intention of option 2 is not to create a 3 stream option)
 |

Company inputs on the Option 1 are summarized below.

|  |  |
| --- | --- |
| **Company** | **Proposals in tdocs** |
| Huawei [2] | ***Proposal 1: For video of AR/VR/CG, adopt the traffic model in following Table 5 for “Option 1: I-frame + P-frame”.***Table 5. Option 1: I-frame + P-frame model for DL video

|  |  |  |
| --- | --- | --- |
| **Two data streams, i.e. M1 = 2** | **Option 1A: slice-based** | **Option 1B: GOP-based** |
| I-stream | P-stream | I-stream | P-stream |
| **Packet modelling** | Slice-level | Frame-level |
| **Traffic pattern** | Both streams are periodic with the same FPS.  | Follow the GOP structure, e.g. GOP size K = 8. |
| **Number of packets per stream at a time** | 1 | N-1 | 1 or 0 | 0 or 1 |
| * N is the number of slice per frame, e.g. N = 8.
 |
| **Average data rate per stream** | $$R\_{I}=R\*\frac{α}{N-1+α}$$ | $$R\_{P}=R\*\frac{N-1}{N-1+α}$$ | $R\_{I}=R\*\frac{α}{K-1+α}$  | $R\_{P}=R\*\frac{K-1}{K-1+α}$  |
| * R: average data rate of a single stream video
* $α$: average size ratio between one I-frame/slice and one P-frame/slice, e.g. $α$ = 1.5, 2
	+ Other values can be optionally evaluated.
 |
| **Packet size distribution** | truncated Gaussian distribution |
| Mean = $\frac{R\_{I}}{FPS}$ | Mean = $\frac{R\_{P}}{FPS\*(N-1)}$ | Mean = $R\_{I}\*\frac{K}{FPS}$ | Mean = $R\_{P}\*\frac{K}{FPS\*(K-1)}$ |
| * [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size
* FPS is the frame rate of the single stream video
 |

Note: the QoS requirement for each stream is separately discussed in the KPI part. |
| vivo [3] | *Proposal 2: Which traffic model to be chosen as the baseline of multi-stream evaluation needs to be further studied.**Proposal 3: For multi-stream modelling with I-frame and P-frame, the following traffic characteristics need to be further studied,* * *The packet size ratio of I-frame and P-frame.*
* *The length of GOP for GOP-based model and the number of slices per frame for Slice-based model.*
* *The jitter distribution.*

*Proposal 4: How to set the X value and air interface PDB requirements for multi-stream model need to be further studied.****Proposal 5: A UE with multi-stream is declared as a satisfied UE if each stream from the multi-stream has been satisfied, i.e. for each stream more than X (%) of packets are successfully transmitted within a given air interface PDB, where the X value and the given air interface PDB can be set per stream.*** |
| CATT [4] | ***Proposal 2: I-frame and P-frame would not be modelled differently as the baseline.******Proposal 3: The audio stream could be aggregated with the data stream in option 2 (video + audio/data) for two streams per UE in DL.*** |
| Apple [9] | **Proposal 1:** For DL traffic model Option 2, the audio/data flow is modeled with:* A stream aggregating streams of audio and data
	+ Periodicity: 10ms
	+ Data rate: 0.756 Mbps/s or 1.12 Mbps
	+ Packet size: determined by periodicity and data rate
	+ PDB: 30 ms
 |
| Sony [10] | **Proposal 3: Consider the entire video stream (I-frames, P-frames etc) to be transported on a bearer with a single associated QoS class.** |
| MediaTek[12] | ***Proposal 1: For the optionally evaluated two-stream DL traffic, prioritize the IDR Group-Of-Picture (GOP) based traffic model, Option 1B) evaluation.******Proposal 2: For the optionally evaluated two-stream DL traffic agreed in RAN1 #104-bis-e, further agree the baseline evaluation parameters about traffic model for Option 1 as in Table I.*****Table I**

|  |  |
| --- | --- |
| Application | AR/VR/CG |
| Two data streams, i.e. M1 = 2  | * Stream #1: I-stream
* Stream #2: P-stream
 |
| Option 1: slice-based | Option 2: frame-based |
| Packet modelling | Slice-level | Frame-level |
| Packet size distribution | Truncated Gaussian distribution for each stream. The STD/Max/Min of packet size follows the single stream assumption: [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size |
| Mean packet size | Derived from FPS and average data rate listed below |
| Traffic arrival pattern | Both streams are periodic with 60 FPS.  | Follow the GOP structure with GOP size K = 8, i.e., one I-frame is followed by seven P-frames. The overall FPS of I-frame plus P-frame is 60. |
| Number of packets per stream at a time | * Stream #1: 1
* Stream #2: N-1
* N is the number of slice per frame, use N = 8.
 | * Stream #1: 1 or 0
* Stream #2: 0 or 1
* At each time instant, there is either only one I-stream packet or only one P-stream packet
 |
| Average data rate | Stream #1: Stream #2 = $α$: (N-1)The aggregated data rate of I-stream plus P-stream should be the same as single stream assumptions | Stream #1: Stream #2 = $α$: (K-1)The aggregated data rate of I-stream plus P-stream should be the same as single stream assumptions |
| $α$ is average size ratio between one I-frame/slice and one P-frame/slice, use $α$ = 3* Other values can be optionally evaluated.
 |

***Proposal 3: Evaluate [PER\_I, PER\_P] = [1%, 1%] and [0.1%, 5%].******Proposal 4: Evaluate [PDB\_I, PDB\_P] = [10ms, 10ms] and [17ms, 9ms]. It is noted that for GOP size K=8 in Option 1B, [PDB\_I, PDB\_P] = [10ms, 10ms] and [17ms, 9ms] provide the same average PDB.******Proposal 5: RAN1 to coordinate and cooperate with SA4 to construct a video quality evaluation block (as shown in the red block in Figure 3 below) based on statistical models used in RAN1 to evaluate the different QoS requirements and the performance enhancement for various RAN1 proposals.*** ***Proposal 6: Discuss two possible options:*** 1. ***FoV vs. non-FoV***
2. ***FoV vs. low resolution Omnidirectional stream***
* ***FFS: Need for different QoS requirements for the two streams.***
* ***FFS: co-existence with the QoS requirements for I/P-frames.***
 |
| LG [13] | ***Proposal 4: For optional two-stream DL traffic models, audio stream is aggregated with the data stream in Option 2*** |
| Xiaomi [15] | **Proposal 2: Send LS to SA4 to ask (X, PDB) requirement and statistical models for packets associated to I-frames and P-frames** |
| ZTE [16] |  [*Proposal 3:* Further discussion in RAN1 the parameters of I/P stream modelling for DL video stream and parameters in table 7 can be regarded as starting point.](#_Toc26894)***Table 7 Summary of parameters for I/P stream modelling***

|  |  |
| --- | --- |
| ***Application*** | ***AR/VR/CG*** |
| ***Two stream data*** | ***Stream #1: I-frame******Stream #2: P-frame*** |
| ***Option 1 Sliced-based*** | ***Option 2: Frame-based (GoP)*** |
| ***Structure*** | ***A frame consists of:******Number of Stream #1: 1******Number of Stream #2: 7*** | ***A GoP consists of:******Number of Stream #1: 1******Number of Stream #2: 7*** |
| ***Frame per second*** | ***Stream #1: 60FPS******Stream #2: 60FPS*** | ***Stream #1 + Stream #2 = 60FPS*** |
| ***Average packet size ratio*** | ***Stream #1 : Stream #2 = 2:1*** | ***Stream #1 : Stream #2 = 2:1*** |
| ***(PSR, PDB)*** | ***AR/VR:******Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)******CG:Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)*** | ***Option 1:******Stream #1: (99%, 10ms)******Stream #2: (90%, 10ms)******Option 2:******Stream #1: (99%, 15ms)******Stream #2: (99%, 10ms)*** |

[*Proposal 4:* Further discussion in RAN1 the parameters of FoV and non-FoV stream modelling for DL 360°video stream and parameters in table 8 can be regarded as starting point.](#_Toc31285)***Table 8 Initial Parameters of FoV and non-FoV stream modelling***

|  |  |
| --- | --- |
| ***Application*** | ***VR1*** |
| ***Two Stream Data*** | ***Stream #1: FoV stream******Stream #2: Non-FoV stream*** |
| ***Option 1: sliced based traffic model*** | ***Option 2: Two separate streams*** |
| ***Structure*** | ***A frame consists of:******Stream #1: 1 (18 tiles)******Stream #2: 1*** | ***A Group of Tiles consist of:Stream #1: 18 tiles*** ***Stream #2: 1*** |
| ***Frame Per Second*** | ***Stream #1: 30FPS******Stream #2: 30FPS*** | ***Stream #1: 540 tiles per second******Stream #2: 30FPS*** |
| ***Data Rate*** | ***Stream #1: 12.78 Mbps******Stream #2: 8Mbps*** | ***Stream #1: 12.78Mbps (the aggregated data rate of the 18 tiles within a group of tiles)******Stream #2: 8Mbps*** |
| ***(PSR, PDB)*** | ***Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)*** | ***Stream #1: (99%, 10ms)******Stream #2: (90%, 10ms)*** |

 |
| DOCOMO [17] | **Proposal 2:*** *Audio stream is aggregated with data stream in option 2 for modeling of DL multiple streams.*
 |

**FL proposal: Based on the company inputs, the following is proposed.**

**For the optional two stream evaluation of I-frame and P-frame for DL video stream, parameters in the following table are used. For companies who are evaluating this option, the following is recommended (so as to have more results in the same scenario)**

* **Common baseline: AR/VR, 30Mbps (aggregated data rate), Dense Urban for FR1 and InH for FR2.**
* **Companies are also encouraged to evaluate at least, other baseline scenarios/configurations/parameters.**
* **In addition, evaluation of optional scenarios/configurations/parameters is up to company.**

|  |  |  |
| --- | --- | --- |
| **Two data streams, i.e. M1 = 2** | **Option 1A: slice-based** | **Option 1B: GOP-based** |
| I-stream | P-stream | I-stream | P-stream |
| **Packet modelling** | Slice-level | Frame-level |
| **Traffic pattern** | Both streams are periodic at 60 fps with the same jitter model as for single stream.  | Follow the GOP structure, where GOP size K = 8 with the same jitter model as for single stream. |
| **Number of packets per stream at a time** | 1 | N-1 | 1. frame: 1 or 0

P-frame: 0 or 1At each time instant, there is either only one I-stream packet or only one P-stream packet |
| * N = 8 is the number of slices per frame.
 |
| **Average data rate per stream** | $$R\_{I}=R\*\frac{α}{N-1+α}$$ | $$R\_{P}=R\*\frac{N-1}{N-1+α}$$ | $R\_{I}=R\*\frac{α}{K-1+α}$  | $R\_{P}=R\*\frac{K-1}{K-1+α}$  |
| * R: average data rate of a single stream video
* $α$: average size ratio between one I-frame/slice and one P-frame/slice, e.g. $α$ = 1.5, 2, 3
 |
| **Packet size distribution** | truncated Gaussian distribution |
| Mean = $\frac{R\_{I}}{FPS}$ | Mean = $\frac{R\_{P}}{FPS\*(N-1)}$ | Mean = $R\_{I}\*\frac{K}{FPS}$ | Mean = $R\_{P}\*\frac{K}{FPS\*(K-1)}$ |
| * [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size
* FPS is the frame rate of the single stream video
 |
| **PER, PDB** | [PER\_I, PER\_P] = [A %, B %][PDB\_I, PDB\_P] = [C ms, D ms] | [PER\_I, PER\_P] = [E %, F %][PDB\_I, PDB\_P] = [G ms, H ms] |

**Question 3. Please share your view on the above FL proposal. Please propose values of**$ α$**, A, B, C, D, E, F, G, H (if you are interested in multiple values for a parameter, e.g.**$, α$ = 1.5, 2, **please provide a single baseline value that can be simulated by more companies, e.g.,** $α$ = 1.5 (baseline), 2 (optional)**.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | Okay with the FL proposal. |
|  |  |

# DL: Two Stream Traffic Models: Option 2

Below is RAN1 agreement related to evaluation of two streams for DL.

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| --- |
| RAN1 Agreement:In addition to single stream per UE in DL which is baseline, two streams can be optionally evaluated for DL* Option 1: I-frame + P-frame
	+ Option 1A: slice-based traffic model
	+ Option 1B: Group-Of-Picture (GOP) based traffic model
* Option 2: video + audio/data
* Option 3: FOV + omnidirectional stream
* Companies should report detailed assumptions in their simulations on packet size distribution for each stream, packet arrival interval (or fps) for each stream, PDB for each stream, PER requirement for each stream, criteria for being satisfied.
* Companies should strive to align the parameter values for the options chosen as much as possible
* FFS: Whether audio stream is separate or aggregated with the data stream in option 2 (Intention of option 2 is not to create a 3 stream option)
 |

Company inputs on Option 2 are summarized below.

|  |  |
| --- | --- |
| **Company** | **Proposals in tdocs** |
| Apple | For DL traffic model Option 2, the audio/data flow is modeled with:* A stream aggregating streams of audio and data
	+ Periodicity: 10ms
	+ Data rate: 0.756 Mbps/s or 1.12 Mbps
	+ Packet size: determined by periodicity and data rate
	+ PDB: 30 ms
 |
| LG | For optional two-stream DL traffic models, audio stream is aggregated with the data stream in Option 2. |
| DCM | *Audio stream is aggregated with data stream in option 2 for modeling of DL multiple streams* |

**Question 4. Please share your view on the above proposals for Option 2 from companies.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | We are not very supportive of modelling Option 2 itself. In this case, we don’t have a P-trace from SA4 with which we can try to align our model. Anyway, for the FFS part above, our understanding is that audio stream is aggregated with the data stream in Option 2. For traffic modelling of the audio/data stream in Option 2, we are okay with the Apple’s suggestion with the understanding that the model is based on SA4 input. |
| Apple | We propose to agree with modeling details for traffic models, the details are essentially the same as for uplink’s for AR2 data/audio stream. |

# DL: Two Stream Traffic Models: Option 3

Below is RAN1 agreement related to evaluation of two streams for DL.

|  |
| --- |
| RAN1 Agreement:In addition to single stream per UE in DL which is baseline, two streams can be optionally evaluated for DL* Option 1: I-frame + P-frame
	+ Option 1A: slice-based traffic model
	+ Option 1B: Group-Of-Picture (GOP) based traffic model
* Option 2: video + audio/data
* Option 3: FOV + omnidirectional stream
* Companies should report detailed assumptions in their simulations on packet size distribution for each stream, packet arrival interval (or fps) for each stream, PDB for each stream, PER requirement for each stream, criteria for being satisfied.
* Companies should strive to align the parameter values for the options chosen as much as possible
* FFS: Whether audio stream is separate or aggregated with the data stream in option 2 (Intention of option 2 is not to create a 3 stream option)
 |

Company inputs on Option 3 are summarized below.

|  |  |
| --- | --- |
| **Company** | **Proposals in tdocs** |
| MTK | ***Proposal 6: Discuss two possible options:*** 1. ***FoV vs. non-FoV***
2. ***FoV vs. low resolution Omnidirectional stream***
* ***FFS: Need for different QoS requirements for the two streams.***

***FFS: co-existence with the QoS requirements for I/P-frames.*** |
| ZTE |  ***Further discussion in RAN1 the parameters of FoV and non-FoV stream modelling for DL 360°video stream and parameters in table 8 can be regarded as starting point******Table 8 Initial Parameters of FoV and non-FoV stream modelling***

|  |  |
| --- | --- |
| ***Application*** | ***VR1*** |
| ***Two Stream Data*** | ***Stream #1: FoV stream******Stream #2: Non-FoV stream*** |
| ***Option 1: sliced based traffic model*** | ***Option 2: Two separate streams*** |
| ***Structure*** | ***A frame consists of:******Stream #1: 1 (18 tiles)******Stream #2: 1*** | ***A Group of Tiles consist of:Stream #1: 18 tiles*** ***Stream #2: 1*** |
| ***Frame Per Second*** | ***Stream #1: 30FPS******Stream #2: 30FPS*** | ***Stream #1: 540 tiles per second******Stream #2: 30FPS*** |

 |

**Question 5. Please share your view on the above proposals for Option 3 from companies.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | Similar comment as above. For Option 3, we also don’t have a P-trace from SA4 with which we can try to align our model. We prefer not to spend time on discussing details of parameter values until we have a clear guidance from SA4. |
|  |  |

# Common baseline

Given that there are a number of simulation scenarios, i.e., combinations of applications, data rates, PDB, etc., it is challenging to compare simulation results among companies. In this regard, the following scenarios are proposed in [18] as a common baseline.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Data rate [Mbps] | Frame rate [FPS] | PDB [ms] | Jitter? | Random frame size? |
| DL | CG | 8 | 60 | 15 | Yes | Yes |
|  | AR/VR | 30 | 60 | 10 | Yes | Yes |
| UL | Pose | 0.2 | 250 | 10 | No | No |
|  | Scene | 10 | 60 | 60 | No | Yes |

Table 1 The traffic parameters of the common baseline

* RAN1 should use the traffic model settings in Table 1 as a common baseline.
* In the common baseline, 99% of the frames should arrive within the PDB
* For the capacity simulations in the common baseline, only one stream at a time is simulated.

**Question 6. Please share your view on the above proposal, i.e., defining those scenarios/parameters as the common baseline. It is clarified that the potential definition of such a common baseline set is not intended for prioritization of simulation scenarios but is purely intended to facilitate comparison of results among companies by ensuring that we have more results from more companies for the reduced set of scenarios. With a potential agreement on the common baseline, companies are generally encouraged to submit results for other baseline and optional scenarios/configurations as many as they can.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| LG | We are supportive of the intention of setting a common baseline in principle. We are open to discuss details. |
| Apple | The intention from Ericsson [18] is very good, but it may actually add to the load of evaluation. Note for calibration, we are open to very simple setup to check alignment among companies. But the discussion on calibration and capacity evaluation should be separated. |

# Summary of Proposals in Tdocs [1-18]

|  |  |
| --- | --- |
| **Company** | **Proposals in tdocs** |
| FUTUREWEI [1] | ***For remaining parameters in [] for Stream 2 in Option 1 and 3 and [] for the stream in Option 2, suggest that the 60msec is taken as baseline and remove the []. For optional PDB, suggest down-selection between 10 msec or 15 msec*** |
| Huawei [2] | ***Proposal 1: For video of AR/VR/CG, adopt the traffic model in following Table 5 for “Option 1: I-frame + P-frame”.***Table 5. Option 1: I-frame + P-frame model for DL video

|  |  |  |
| --- | --- | --- |
| **Two data streams, i.e. M1 = 2** | **Option 1A: slice-based** | **Option 1B: GOP-based** |
| I-stream | P-stream | I-stream | P-stream |
| **Packet modelling** | Slice-level | Frame-level |
| **Traffic pattern** | Both streams are periodic with the same FPS.  | Follow the GOP structure, e.g. GOP size K = 8. |
| **Number of packets per stream at a time** | 1 | N-1 | 1 or 0 | 0 or 1 |
| * N is the number of slice per frame, e.g. N = 8.
 |
| **Average data rate per stream** | $$R\_{I}=R\*\frac{α}{N-1+α}$$ | $$R\_{P}=R\*\frac{N-1}{N-1+α}$$ | $R\_{I}=R\*\frac{α}{K-1+α}$  | $R\_{P}=R\*\frac{K-1}{K-1+α}$  |
| * R: average data rate of a single stream video
* $α$: average size ratio between one I-frame/slice and one P-frame/slice, e.g. $α$ = 1.5, 2
	+ Other values can be optionally evaluated.
 |
| **Packet size distribution** | truncated Gaussian distribution |
| Mean = $\frac{R\_{I}}{FPS}$ | Mean = $\frac{R\_{P}}{FPS\*(N-1)}$ | Mean = $R\_{I}\*\frac{K}{FPS}$ | Mean = $R\_{P}\*\frac{K}{FPS\*(K-1)}$ |
| * [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size
* FPS is the frame rate of the single stream video
 |

Note: the QoS requirement for each stream is separately discussed in the KPI part. |
| vivo [3] | *Proposal 1: For dual-eye buffer, the dual-eye buffer traffic model in Table 1 can be optionally evaluated.* *Proposal 2: Which traffic model to be chosen as the baseline of multi-stream evaluation needs to be further studied.**Proposal 3: For multi-stream modelling with I-frame and P-frame, the following traffic characteristics need to be further studied,* * *The packet size ratio of I-frame and P-frame.*
* *The length of GOP for GOP-based model and the number of slices per frame for Slice-based model.*
* *The jitter distribution.*

*Proposal 4: How to set the X value and air interface PDB requirements for multi-stream model need to be further studied.****Proposal 5: A UE with multi-stream is declared as a satisfied UE if each stream from the multi-stream has been satisfied, i.e. for each stream more than X (%) of packets are successfully transmitted within a given air interface PDB, where the X value and the given air interface PDB can be set per stream.*** |
| CATT [4] | ***Proposal 1: When single eye or dual eye buffer is modelled for evaluation, the total transmission data rate would be kept the same with the details of modelling reported by companies.******Proposal 2: I-frame and P-frame would not be modelled differently as the baseline.******Proposal 3: The audio stream could be aggregated with the data stream in option 2 (video + audio/data) for two streams per UE in DL.******Proposal 4: The PDB for a stream aggregating streams of scene, video, data, and audio would be either 10ms or 15ms.*** |
| Nokia [5] | **Observation 1:** *Table 1, 2, and 3 are the summary of the main parameters agreed for the DL and UL baseline traffic models and employed for the evaluation purposes.***Observation 2:** *Table 4 is the summary of the mandatory streams to be used for evaluation of VR, AR, and CG. Table 5 shows the optional streams that can be also modelled when evaluating VR, AR, and CG applications.* |
| Qualcomm [6] | ***Proposal: For UL AR traffic model, conform PDB values in [ ] for Stream 2 in Option 1 and 3, and Option 2, i.e., 60 ms PDB for the stream representing streams of video, camera feed, audio, and data*** |
| OPPO [7] | ***For evaluations of AR in UL:**** ***Option 1 (Baseline for power and capacity evaluations): Two streams as defined below***
	+ ***Stream 1: pose/control***
		- ***Traffic model and QoS parameters are same as for pose/control for UL CG/VR.***
	+ ***Stream 2: A stream aggregating streams of scene, video, data, and audio.***
		- ***Packet size: Truncated Gaussian distribution with the parameter values same as for DL***
		- ***Periodicity: 60 fps***
			* ***Jitter (optional): same model as for DL***
		- ***Data rate: 10 Mbps (baseline), 20 Mbps (optional)***
		- ***PDB: ~~[~~15~~60]~~ ms (baseline), ~~[~~10~~/15]~~ ms (optional)***
* ***Option 2 (Optional for power evaluation and baseline for capacity evaluation): Single stream as defined below***
	+ ***Packet size: Truncated Gaussian distribution with the parameter values same as for DL***
	+ ***Periodicity: 60 fps***
		- ***Jitter (optional): same model as for DL***
	+ ***Data rate: 10 Mbps (baseline), 20 Mbps (optional)***
	+ ***PDB: ~~[~~15~~60]~~ ms (baseline), ~~[~~10~~/15]~~ ms (optional)***
* ***Option 3 (Optional): Three streams as defined below***
	+ ***Stream 1: pose/control***
		- ***Traffic model and QoS parameters are same as for pose/control for UL CG/VR.***
	+ ***Stream 2: A stream aggregating streams of scene and video***
		- ***Packet size: Truncated Gaussian distribution with the parameter values same as for DL***
		- ***Periodicity: 60 fps***
			* ***Jitter (optional): same model as for DL***
		- ***Data rate: 10 Mbps (baseline), 20 Mbps (optional)***
		- ***PDB: ~~[~~15~~60]~~ ms (baseline), ~~[~~10~~/15]~~ ms (optional)***
	+ ***Stream 3: A stream aggregating streams of audio and data***
		- ***Periodicity: 10ms***
		- ***Data rate: 0.756 Mbps/s or 1.12 Mbps***
		- ***Packet size: determined by periodicity and data rate***
		- ***PDB: 30 ms***

Proposal 2: Modify the following RAN1 agreement of RAN#104bis-e as below (changes are highlighted by RED)***On UL Traffic model and QoS parameters**** ***CG/VR: single stream (pose/control)***
* ***Traffic model for Pose/control***
	+ ***Periodic: 4ms (no jitter)***
		- ***Other values can be optionally evaluated.***
	+ ***Fixed: 100 bytes***
		- ***PDB: 4ms (baseline), 10 ms (Optional).***
	+ ***A UE is declared a satisfied UE if more than X (%) of packets are successfully delivered within the given air interface PDB.***
		- ***The baseline X value is 99.***
		- ***Other X values can be optionally evaluated are 90 and 95.***

Proposal 3: For air interface PDB for DL video stream, no more mandatory value is needed. |
| Intel [8] | ***Based on SA4 discussions for XR conversational, 60 ms uplink PDB seems reasonable (for a E2E latency budget of 100ms - 200ms)*** |
| Apple [9] | **Proposal 1:** For DL traffic model Option 2, the audio/data flow is modeled with:* A stream aggregating streams of audio and data
	+ Periodicity: 10ms
	+ Data rate: 0.756 Mbps/s or 1.12 Mbps
	+ Packet size: determined by periodicity and data rate
	+ PDB: 30 ms

**Proposal 2**: The Packet delay budget for the video stream in UL traffic models Option 1/2/3 is 10 ms. |
| Sony [10] | **Proposal 1: Reuse the media characteristics / simulation configurations that SA4 already defined in LS - R1-2101765 [4].** **Proposal 2: RAN1 strives to define one or more scenarios that can be used for simulation calibration purposes.****Proposal 3: Consider the entire video stream (I-frames, P-frames etc) to be transported on a bearer with a single associated QoS class.****Proposal 4: RAN1 to study layer-1 aspects of large packet transmission with better reliability than eMBB and/or with low packet delay** |
| Samsung [11] | **Proposal 1***The dual-eye buffer case is evaluated as single stream case by doubling the FPS and halving the packet size compared to the single-eye buffer case.***Proposal 2***PDB 60 ms (baseline), 10/15 ms (optional) for Option 1 & 3 Stream 2 and for Option 2* |
| MediaTek[12] | ***Proposal 1: For the optionally evaluated two-stream DL traffic, prioritize the IDR Group-Of-Picture (GOP) based traffic model, Option 1B) evaluation.******Proposal 2: For the optionally evaluated two-stream DL traffic agreed in RAN1 #104-bis-e, further agree the baseline evaluation parameters about traffic model for Option 1 as in Table I.*****Table I**

|  |  |
| --- | --- |
| Application | AR/VR/CG |
| Two data streams, i.e. M1 = 2  | * Stream #1: I-stream
* Stream #2: P-stream
 |
| Option 1: slice-based | Option 2: frame-based |
| Packet modelling | Slice-level | Frame-level |
| Packet size distribution | Truncated Gaussian distribution for each stream. The STD/Max/Min of packet size follows the single stream assumption: [STD, Max, Min]: [10.5, 150, 50]% of Mean packet size |
| Mean packet size | Derived from FPS and average data rate listed below |
| Traffic arrival pattern | Both streams are periodic with 60 FPS.  | Follow the GOP structure with GOP size K = 8, i.e., one I-frame is followed by seven P-frames. The overall FPS of I-frame plus P-frame is 60. |
| Number of packets per stream at a time | * Stream #1: 1
* Stream #2: N-1
* N is the number of slice per frame, use N = 8.
 | * Stream #1: 1 or 0
* Stream #2: 0 or 1
* At each time instant, there is either only one I-stream packet or only one P-stream packet
 |
| Average data rate | Stream #1: Stream #2 = $α$: (N-1)The aggregated data rate of I-stream plus P-stream should be the same as single stream assumptions | Stream #1: Stream #2 = $α$: (K-1)The aggregated data rate of I-stream plus P-stream should be the same as single stream assumptions |
| $α$ is average size ratio between one I-frame/slice and one P-frame/slice, use $α$ = 3* Other values can be optionally evaluated.
 |

***Proposal 3: Evaluate [PER\_I, PER\_P] = [1%, 1%] and [0.1%, 5%].******Proposal 4: Evaluate [PDB\_I, PDB\_P] = [10ms, 10ms] and [17ms, 9ms]. It is noted that for GOP size K=8 in Option 1B, [PDB\_I, PDB\_P] = [10ms, 10ms] and [17ms, 9ms] provide the same average PDB.******Proposal 5: RAN1 to coordinate and cooperate with SA4 to construct a video quality evaluation block (as shown in the red block in Figure 3 below) based on statistical models used in RAN1 to evaluate the different QoS requirements and the performance enhancement for various RAN1 proposals.*** ***Proposal 6: Discuss two possible options:*** 1. ***FoV vs. non-FoV***
2. ***FoV vs. low resolution Omnidirectional stream***
* ***FFS: Need for different QoS requirements for the two streams.***
* ***FFS: co-existence with the QoS requirements for I/P-frames.***
 |
| LG [13] | *Proposal 1: Single and dual eye buffer can be modelled using the baseline single-stream DL traffic model with the agreed baseline and optional parameters.** *No further discussion on details is needed.*

***Proposal 2: Companies to report the X value used for per UE KPI including multiple X values if they used.**** *No further discussion on the X values is needed.*

***Proposal 3: For evaluations of AR in UL, assume the following PDB values for Stream 2 in Option 1 and 3, and Option 2**** ***PDB: 10/15 ms (baseline), 60 ms (optional)***

***Proposal 4: For optional two-stream DL traffic models, audio stream is aggregated with the data stream in Option 2*** |
| InterDigital [14] | **Observation 1:** For CG, the UL traffic can be represented by 2 different traffic streams delivering the following data: * User actions (e.g. gamepad controller, HMD): traffic volume (pkts/s) follows user actions and stops when there is no activity
* Control data (e.g. protocol flow control, keep-alive messages):
	+ Reports: traffic volume is correlated to DL traffic and is independent of the user activity
	+ Lifecycle status: traffic volume is constant and periodic (e.g. keep-alive every 500ms)

**Observation 2:** For CG, the chacteristics of the UL traffic streams are as follows: * User Actions
	+ Packet arrival is aperiodic and correlated with user activity. Inter-packet arrival follows exponential distribution
	+ Packet size can vary depending on the CG platform (i.e. typically Gaussian distribution)
* Control Data
	+ Packet arrival can be periodic (e.g. 1/100Hz, 1/10Hz) or correlated with user activity depending on the CG platform. Dedicated periodic flows may exist for indicating lifecycle status.
	+ Packet size can vary depending on the CG platform (i.e. typically Gaussian distribution)

**Observation 3:** For CG, the different UL traffic streams (e.g. user actions, control data) are delivered using different transport protocols**Observation 4:** For a given application, using multiple traffic streams with different characteristics can result in impacting both capacity and power consumption performance**Observation 5:** The sensitivity of QoE to change in QoS is significantly different between the 2 traffic streams belonging to the same CG application **Observation 6:** The traffic models applied for AR/VR use case (TR 38.824) and UL pose/control traffic can be used to model the 2 UL traffic streams related to CG (i.e. user action and control data streams)**Observation 7:** Similar to CG, VR uses 2 traffic streams in UL with similar traffic characteristics**Observation 8:** For AR, the UL traffic characteristics of aggregated video/media stream is significantly different than the pose/control stream**Observation 9:** For AR, due to the per-UE KPI requiring equal importance for all streams for meeting the X% and PDB and pairing of 2 streams with significant differences, the pose/control stream can have major impact on the capacity achievable Based on these observations, the following conclusions were made:**Proposal 1:** RAN1 uses 2 traffic streams in UL (i.e. user actions and control data) for CG as baseline for capacity and power consumption evaluations**Proposal 2:** RAN1 uses the following traffic models in UL for evaluating 2 streams for CG* Stream 1: User actions
	+ - Periodic with different (inter-packet) arrival time: 10ms (average)
		- Fixed: 200 bytes
		- PDB: 4 ms
* Stream 2: Control data
	+ - Periodic: 4ms (no jitter)
		- Fixed: 100 bytes
		- PDB: 10 ms

**Proposal 3:** RAN1 uses 2 traffic streams in UL (i.e. user actions and pose/control data) for VR as baseline for capacity and power consumption evaluations**Proposal 4:** VR evaluations in UL use the same traffic models used for CG for the 2 traffic streams (i.e. user actions and pose/control data) **Proposal 5:** RAN1 uses the 2 traffic streams in UL (i.e. pose/control and aggregated video/media) for AR as baseline for capacity evaluations**Proposal 6:** RAN1 uses the following traffic model in UL as baseline for evaluating the aggregated traffic stream (i.e. consisting of scene, video, data, and audio) for non-conversationalAR:* + - Packet size: Truncated Gaussian distribution with the parameter values same as for DL
		- Periodicity: 60 fps
			* Jitter (optional): same model as for DL
		- Data rate: 10 Mbps (baseline), 20 Mbps (optional)
		- PDB: [10] ms (baseline)
 |
| Xiaomi [15] | **Proposal 1: For XR DL evaluation, interleaved eye buffer model can be optionally considered.****Proposal 2: Send LS to SA4 to ask (X, PDB) requirement and statistical models for packets associated to I-frames and P-frames** |
| ZTE [16] | [*Observation 1:* There is maximum 7% capacity gain for single eye traffic in high system load , compared to dual eye traffic in indoor house scenario, when bit rate is 45Mbps.](#_Toc15034)[*Proposal 1:* The simulation results based on traffic for dual eye buffer is enough to present the system capacity. And companies can provide the results based on traffic for single eye buffer optionally.](#_Toc9207)[*Proposal 2:* Confirm the note on 60ms as baseline for the PDB of stream including video. Other reasonable PDB values can be evaluated optionally.](#_Toc22903)[*Proposal 3:* Further discussion in RAN1 the parameters of I/P stream modelling for DL video stream and parameters in table 7 can be regarded as starting point.](#_Toc26894)***Table 7 Summary of parameters for I/P stream modelling***

|  |  |
| --- | --- |
| ***Application*** | ***AR/VR/CG*** |
| ***Two stream data*** | ***Stream #1: I-frame******Stream #2: P-frame*** |
| ***Option 1 Sliced-based*** | ***Option 2: Frame-based (GoP)*** |
| ***Structure*** | ***A frame consists of:******Number of Stream #1: 1******Number of Stream #2: 7*** | ***A GoP consists of:******Number of Stream #1: 1******Number of Stream #2: 7*** |
| ***Frame per second*** | ***Stream #1: 60FPS******Stream #2: 60FPS*** | ***Stream #1 + Stream #2 = 60FPS*** |
| ***Average packet size ratio*** | ***Stream #1 : Stream #2 = 2:1*** | ***Stream #1 : Stream #2 = 2:1*** |
| ***(PSR, PDB)*** | ***AR/VR:******Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)******CG:Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)*** | ***Option 1:******Stream #1: (99%, 10ms)******Stream #2: (90%, 10ms)******Option 2:******Stream #1: (99%, 15ms)******Stream #2: (99%, 10ms)*** |

[*Proposal 4:* Further discussion in RAN1 the parameters of FoV and non-FoV stream modelling for DL 360°video stream and parameters in table 8 can be regarded as starting point.](#_Toc31285)***Table 8 Initial Parameters of FoV and non-FoV stream modelling***

|  |  |
| --- | --- |
| ***Application*** | ***VR1*** |
| ***Two Stream Data*** | ***Stream #1: FoV stream******Stream #2: Non-FoV stream*** |
| ***Option 1: sliced based traffic model*** | ***Option 2: Two separate streams*** |
| ***Structure*** | ***A frame consists of:******Stream #1: 1 (18 tiles)******Stream #2: 1*** | ***A Group of Tiles consist of:Stream #1: 18 tiles*** ***Stream #2: 1*** |
| ***Frame Per Second*** | ***Stream #1: 30FPS******Stream #2: 30FPS*** | ***Stream #1: 540 tiles per second******Stream #2: 30FPS*** |
| ***Data Rate*** | ***Stream #1: 12.78 Mbps******Stream #2: 8Mbps*** | ***Stream #1: 12.78Mbps (the aggregated data rate of the 18 tiles within a group of tiles)******Stream #2: 8Mbps*** |
| ***(PSR, PDB)*** | ***Stream #1: (99%, 20ms)******Stream #2: (90%, 20ms)*** | ***Stream #1: (99%, 10ms)******Stream #2: (90%, 10ms)*** |

 |
| DOCOMO [17] | **Proposal 1:*** *Consider to study XR conference as optional.*

**Proposal 2:*** *Audio stream is aggregated with data stream in option 2 for modeling of DL multiple streams.*

**Proposal 3:*** *10 or 15 ms should be baseline for PDB of AR in UL.*
 |
| Ericsson [18] | [Observation 1 Multiple options even for baseline cases have been agreed and complexity of evaluations has increased](#_Toc71642547)[Observation 2 Many options and high complexity of simulation settings might be problematic for comparing and understanding results between companies](#_Toc71642548)[Observation 3 Understanding base settings is of high importance to reach the goal of the XR SI](#_Toc71642549)[Observation 4 Parameters to decide on consists of, UL/DL traffic types, data rates, frame rates, PDB, percentile of packets to meet PDB, number of simultaneous streams and jitter](#_Toc71642550)[Proposal 1 Define a common baseline for all companies to use in their evaluations](#_Toc71642551)[Proposal 2 RAN1 should use the traffic model settings in Table 1 as a common baseline.](#_Toc71642552)[Proposal 3 In the common baseline, 99% of the frames should arrive within the PDB](#_Toc71642553)[Proposal 4 For the capacity simulations in the common baseline, only one stream at a time is simulated](#_Toc71642554) |

# List of contributions in RAN1 #105-e

1. [R1-2104207](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104207.zip) XR traffic model FUTUREWEI
2. [R1-2104238](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104238.zip) Traffic model for XR and Cloud Gaming Huawei, HiSilicon
3. [R1-2104395](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104395.zip) Remaining issues on traffic models of XR vivo
4. [R1-2104502](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104502.zip) XR traffic model CATT
5. [R1-2104555](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104555.zip) On Traffic Model for XR study Nokia, Nokia Shanghai Bell
6. [R1-2104701](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104701.zip) Remaining Issues on XR Traffic Models Qualcomm Incorporated
7. [R1-2104745](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104745.zip) Discussion on the XR traffic models for evaluation OPPO
8. [R1-2104934](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104934.zip) Traffic Model for XR Intel Corporation
9. [R1-2105134](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105134.zip) Considerartions on XR traffic model Apple
10. [R1-2105181](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105181.zip) Considerations on XR traffic model Sony
11. [R1-2105342](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105342.zip) Traffic Models for XR Samsung
12. [R1-2105376](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105376.zip) Traffic Model for XR and CG MediaTek Inc.
13. [R1-2105443](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105443.zip) Discussion on traffic models for XR evaluation LG Electronics
14. [R1-2105499](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105499.zip) Discussion on UL traffic models InterDigital, Inc.
15. [R1-2105547](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105547.zip) Discussion on remaining issues of traffic Model for XR services Xiaomi
16. [R1-2105603](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105603.zip) Remaining Issues of XR Traffic Model ZTE, Sanechips
17. [R1-2105726](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105726.zip) Discussion on traffic model for XR NTT DOCOMO, INC.
18. [R1-2105829](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2105829.zip) Traffic model for XR Ericsson