

New Era of ST 2110 Testing with PICS and RP 2110-25

Willem Vermost

wim.vermost@vrt.be

Pavlo Kondratenko

kondratenko@ebu.ch

 IP SHOWCASE™





IP Showcase

JT-NM TESTED PROGRAM

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IBC 2022 - IP SHOWCASE

Paola Kondratenko - Willem Vermeest

What JT-NM Tested?

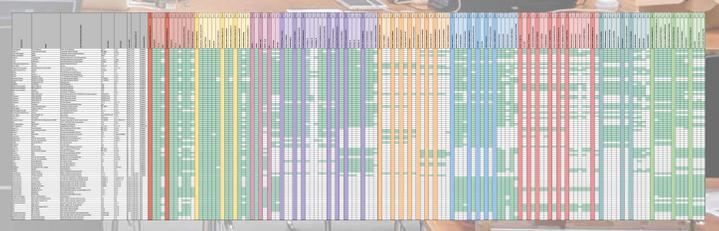


- The JT-NM Tested program offers documented insight into how vendor equipment conforms to specific SMPTE standards and AMWA NMOS specifications. Vendors who meet the testing criteria will have the opportunity to display badges and make public statements about their participation. The JT-NM Tested Catalog lists vendor results along with a detailed test plan. Anyone with the equipment listed in the test plan may execute the tests which were administered by the JT-NM test team, and you are encouraged to do so.
- It is important to note that the JT-NM Tested program is not a certification program; rather, it is a snapshot in time of how vendor equipment conforms to key parts of SMPTE standards and AMWA NMOS specifications.





AUGUST 2022 JT-NM TESTED PROGRAM



The road towards the tested event



- While drafting the standard, early T&M solutions came available
- Multiple “Dirty hands” events were held
 - to check the theory in real-life
- IP showcase: technology demonstrator
- IBC 2017: SMPTE ST 2110 officially published
- From “dirty hands” to JT-NM Tested event

- A tested event needs two major things:
 - Test & Measurement equipment
 - A set of tests to perform

What are the 2 problems?



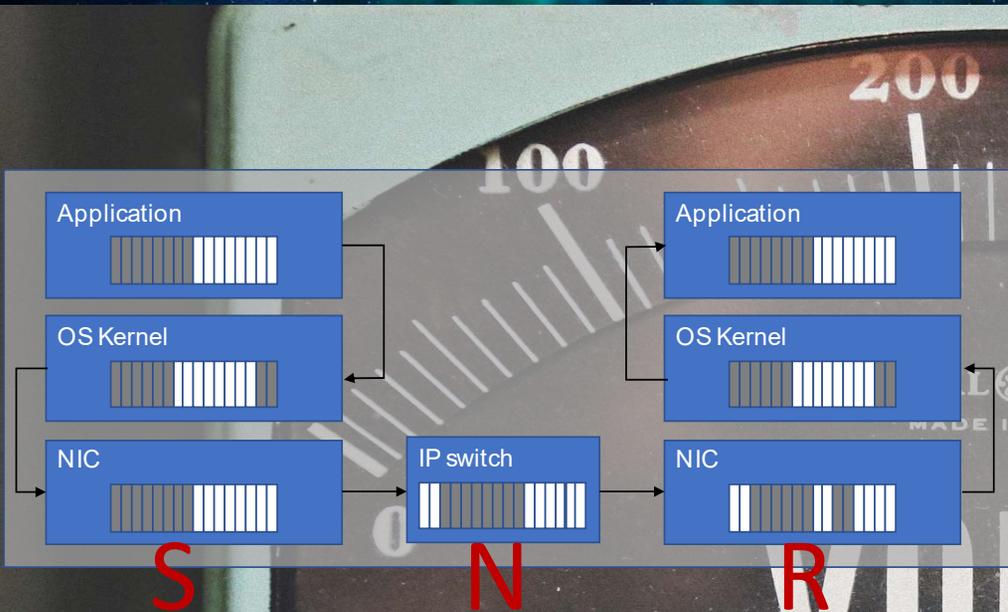
- Moving from creating the document to a published standard, measurement tools were already available. As a result, not using the same **nomenclature** for certain measurements and even not the same **formulas**. (SMPTE RP 2110-25)
- When creating the test document what tests are applicable? Sometimes it was hard to figure out, even amongst top experts, **what** specific part of the standard **is mandatory** and what's not? The PICS work brings a solution.

What's the 1st problem?



- During the 2019 JT-NM Tested Event in Houston, the test team had access to a variety of test equipment, each with his or her specific specialty but also a fair amount of overlap of measurements. The overlapping measurements were conveniently used to ensure consistency of test and measurement equipment on the one hand, but also to simply have confirmation of the measurement on the other. It didn't take much time or the test team had to deal with a Babylonian confusion.
- Most of the test kit had been created in parallel with the writing of the SMPTE ST 2110 standard suite. Since nomenclature and formulas may be in flux until the document is published, or simply do not specify a practical test for a particular concept being introduced; not all test and measurement kits use exactly the same nomenclature or formulas that probably should do the same thing.

Avoiding Babylonian Confusion



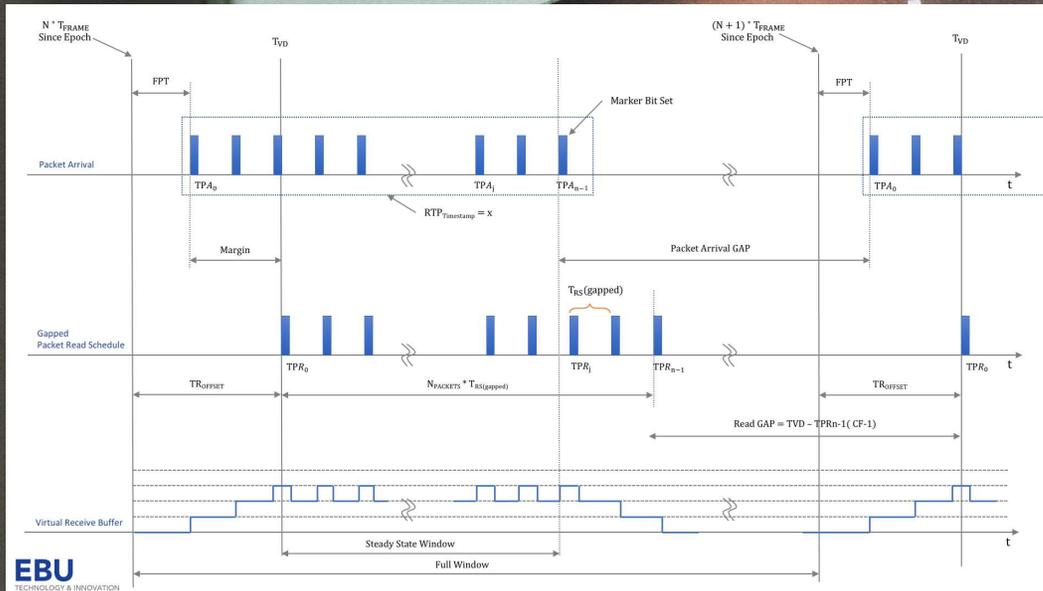
WHAT ARE WE FIXING?

Agree on a set of measurements

Agree on some naming conventions

Agree on the formulas

Avoiding Babylonian Confusion



EBU
TECHNOLOGY & INNOVATION

WHAT ARE WE FIXING?

Agree on a set of measurements

Agree on some naming conventions

Agree on the formulas

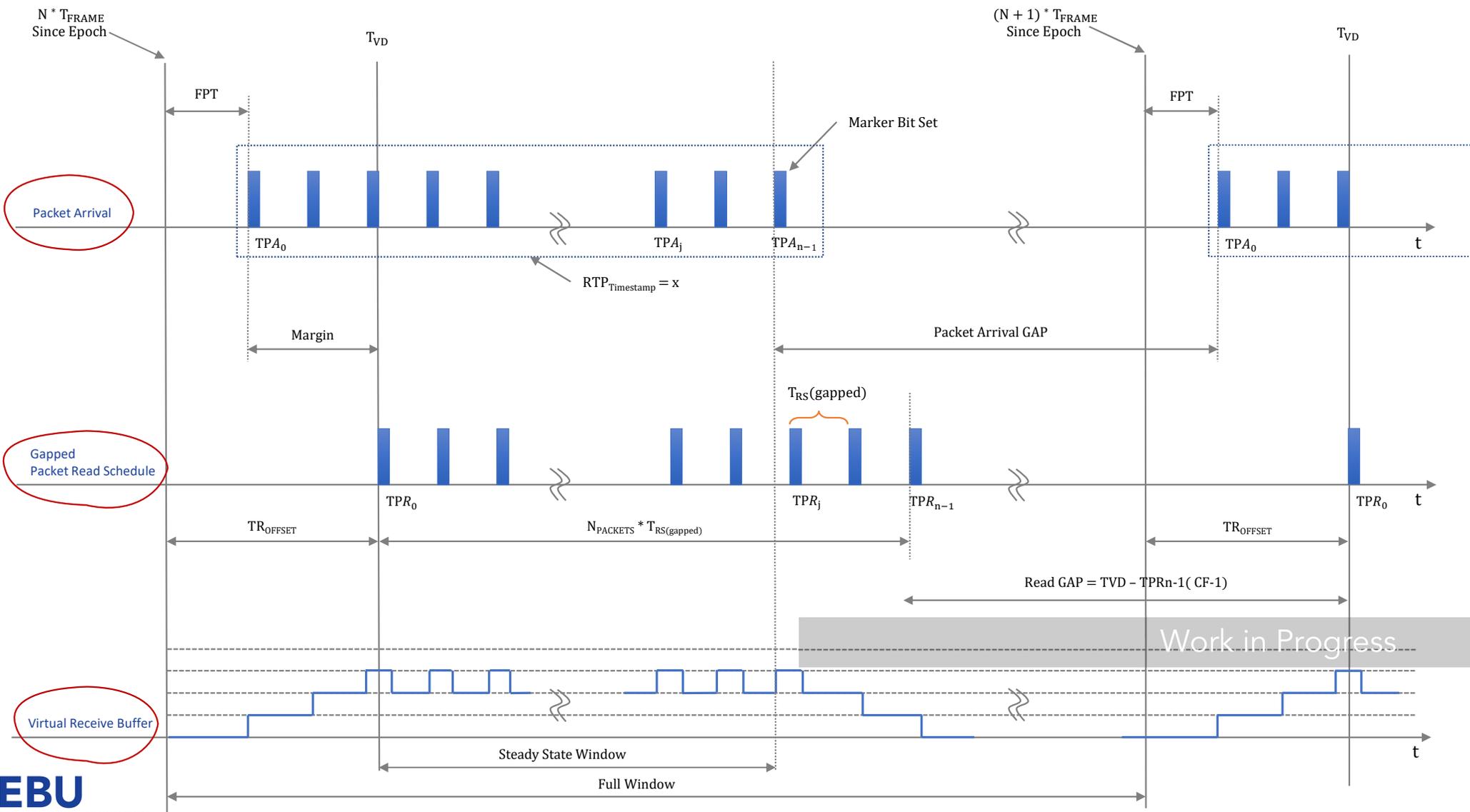
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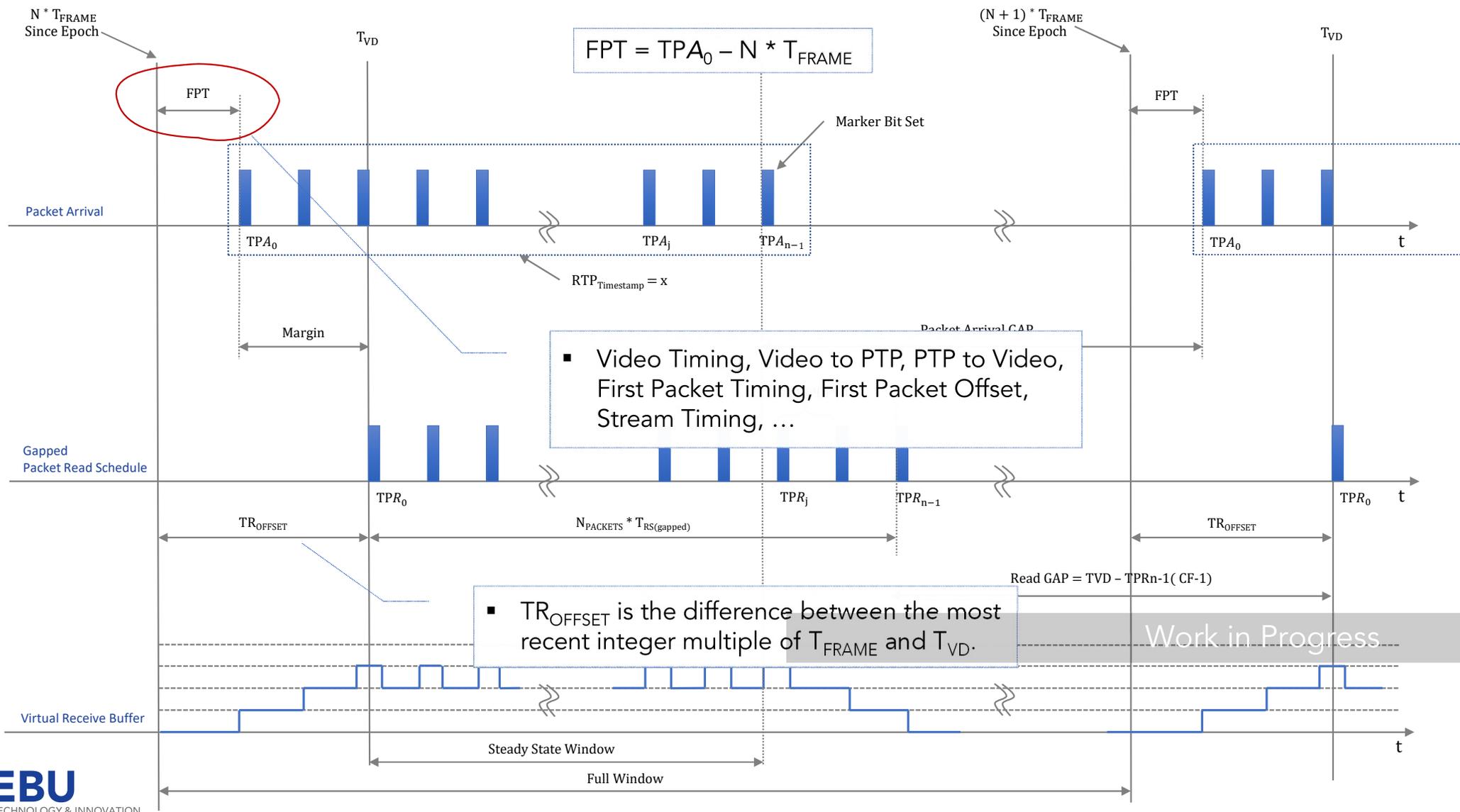
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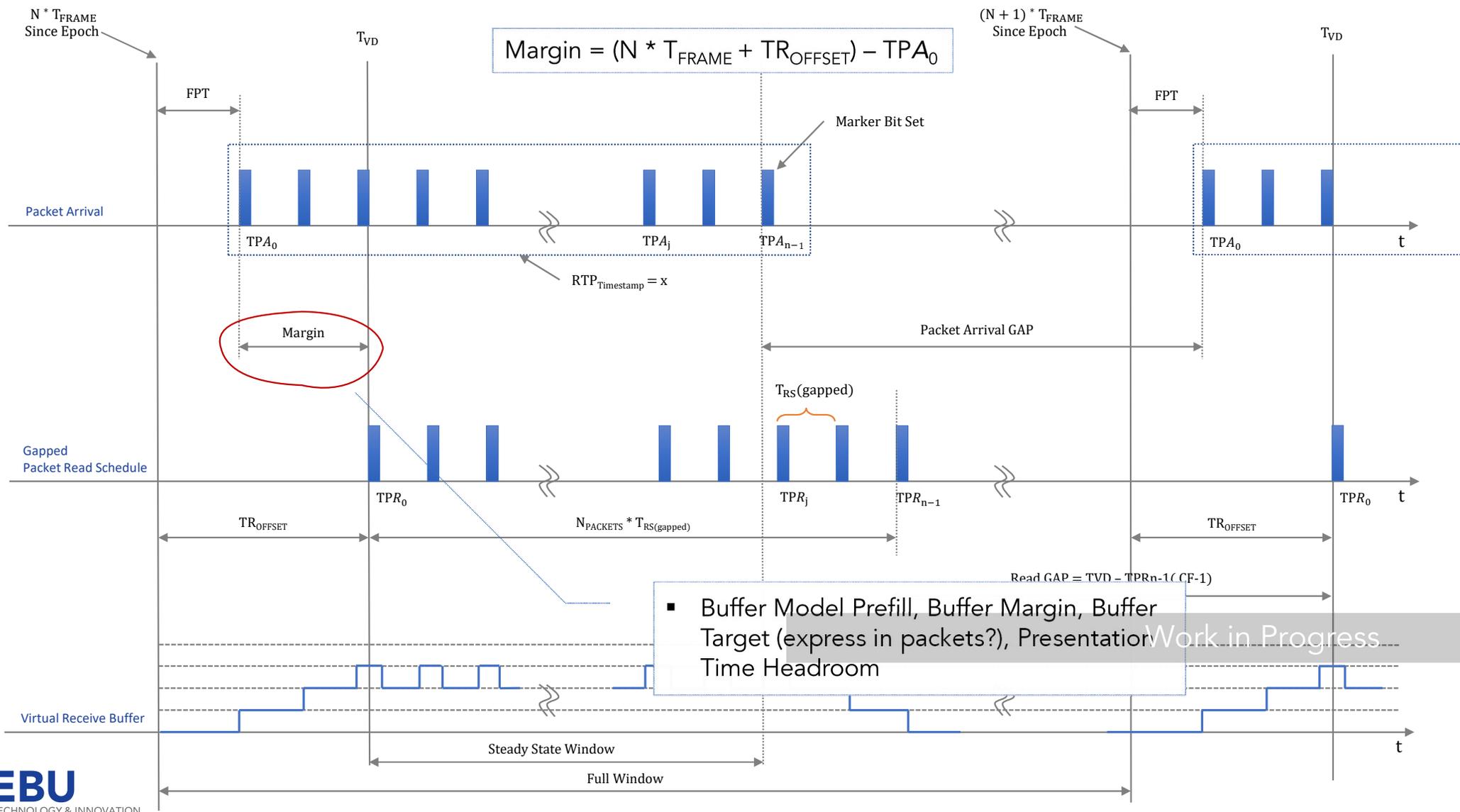
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VOLTS ON INST.
TERMINALS = ON SCALE
RESISTOR



Work in Progress



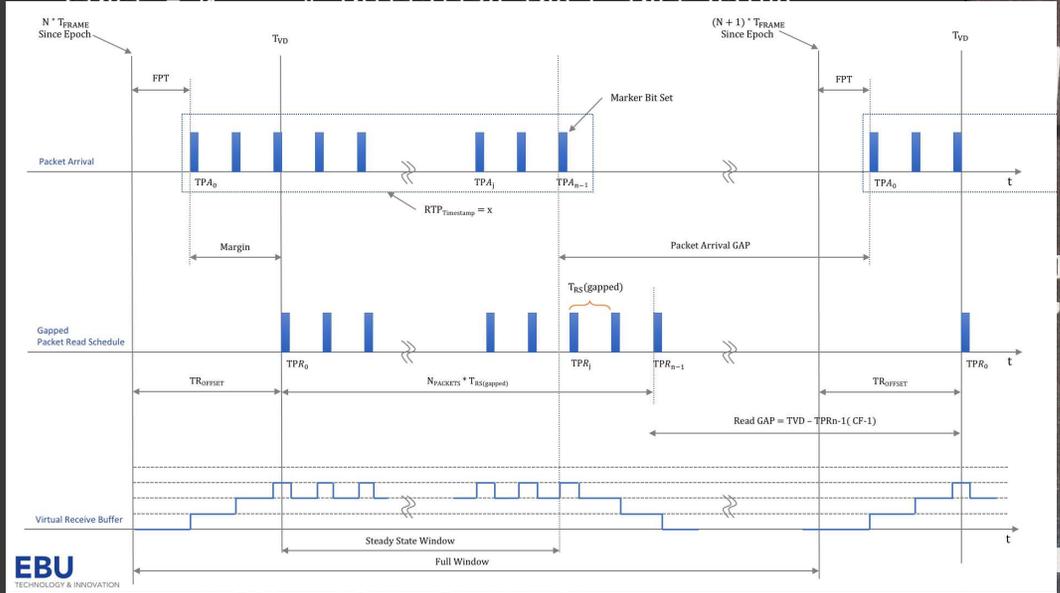


▪ Buffer Model Prefill, Buffer Margin, Buffer Target (express in packets?), Presentator Work in Progress Time Headroom

Avoiding Babylonian speech confusion (IP CASE™)

- Bursts and jitter could potentially lead to packet loss in the network. Therefore, jeopardizing the reliability of the solution. SMPTE ST 2110-21 introduced a leaky bucket with a maximum level (C_{MAX}) to prevent packet loss in the network.

```
def cfull_analysis(capture, tframe, npackets, B):
    cpeak = 0 # Initialize the C peak value
    cinst = 0 # Initialize the C inst value
```



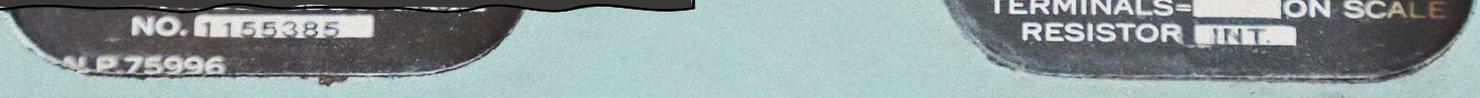
MEASURING 2110-21

C_{PEAK} shall not exceed C_{MAX}

VRX_{PEAK} shall not exceed VRX_{FULL}

No formulas, but algorithms. More fun!

```
    cpeak = math.ceil(cinst)
    return cpeak
```



Read schedule

Tro: 746.667 μ s
Trs: 10.997 μ s

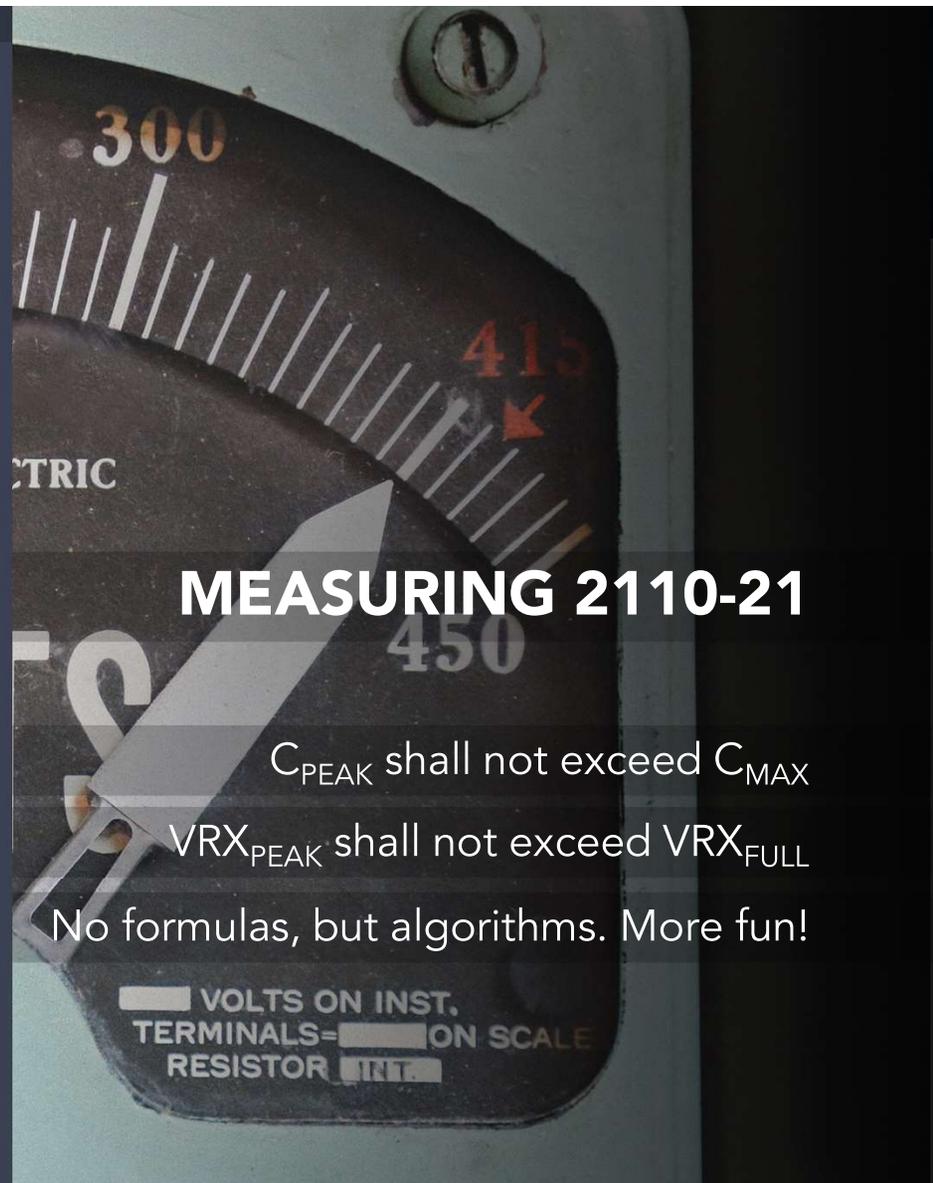
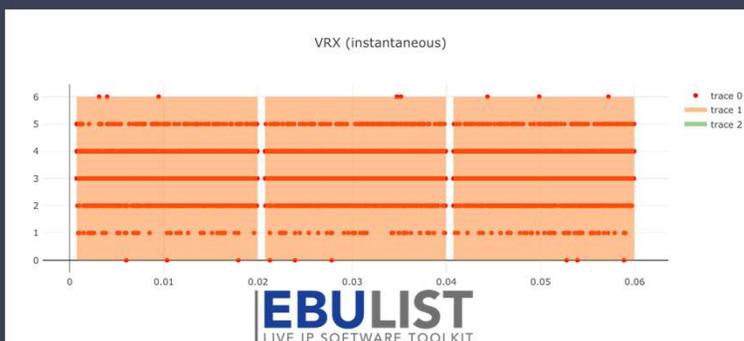
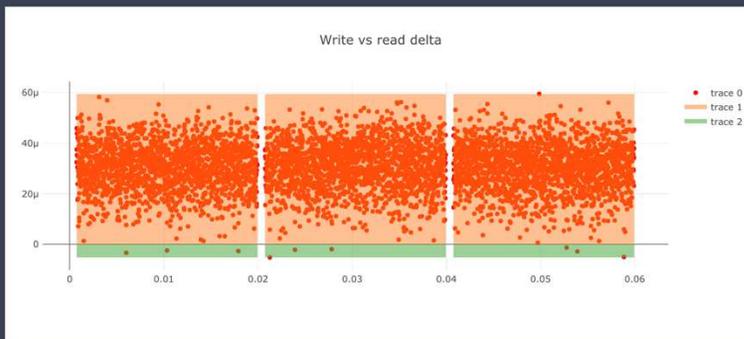
Sender

Jitter sigma: x Trs

Tvd offset: x Trs

Packet spacing increment: x Trs

TPROffset factor: x Trs



MEASURING 2110-21

C_{PEAK} shall not exceed C_{MAX}

VRX_{PEAK} shall not exceed VRX_{FULL}

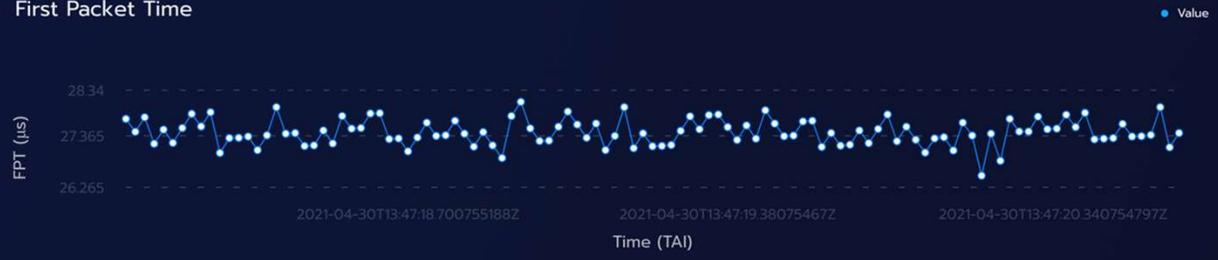
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VOLTS ON INST.
TERMINALS= ON SCALE
RESISTOR

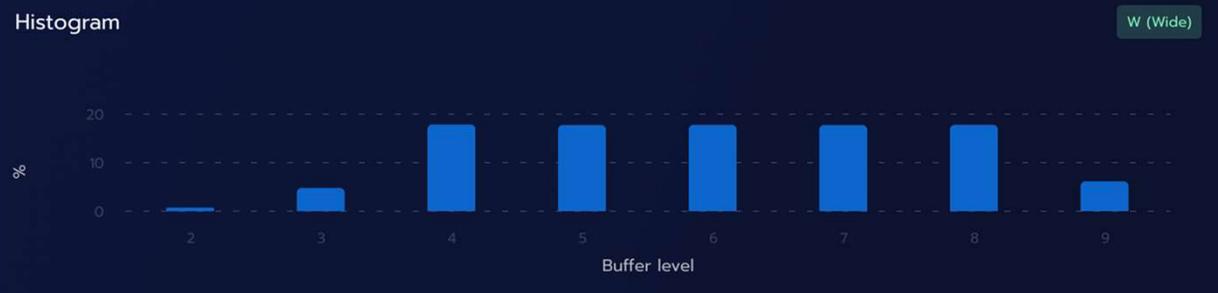
EBULIST

2.2

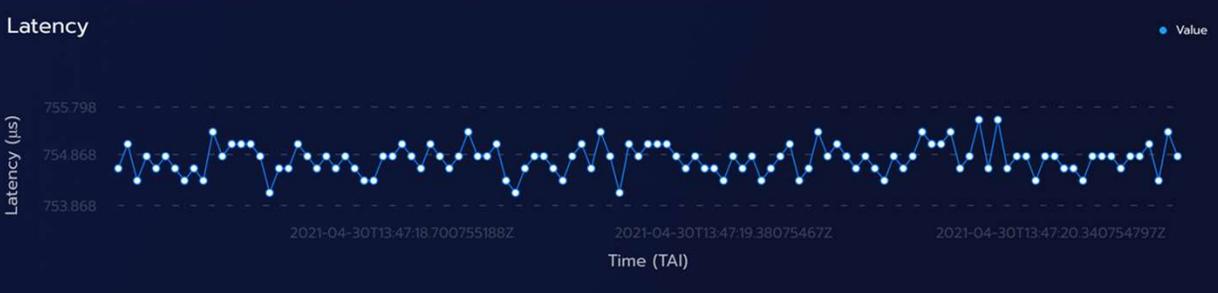
First Packet Time



Histogram



Latency



What is a PICS?



- A Protocol Implementation Conformance Statement (**PICS**) is a structured document which asserts which specific requirements are met by a given implementation of a protocol standard.
- AES67-2018 was the first revision of the AES67 standard to include PICS for this standard. We used it as an example.

PICS Benefits



- Helps implementers by providing a checklist of requirements
- Helps implementers by providing additional clarifications to some of the requirements
- Helps users by listing all the requirements and exact options that were implemented
- Helps users ensure interoperation between two implementations

PICS Benefits



- Helps in procurement - might be utilized for tender procedures
- Helps in testing – provides a basis for preparing tests to be used to determine conformance of an implementation to the standard. Will be used in JTNM-Tested.

SMPTE ST 2110 PICS



- Format:
 - Separate document – Recommended Practice
- Naming:
 - Number of the original document plus 100:
Pics for ST 2110-10 is in RP 2110-110

SMPTE ST 2110 PICS



- Structure:
 - Follows the original document, statement by statement, each statement is numbered
 - Each requirement level is color-coded and numbered

Requirement Level	Requirement Language
1	Shall (requirement), when applicable to all implementations
1	Shall (requirement), when applicable to a subset of implementations
2	Should (strong suggestion)
3	May (permission)
4	Informative or no test needed

SMPTE ST 2110 PICS



- The core of the proforma:
 - The statement number
 - The statement from the ST2110 document
 - Requirement level
 - “Notes” column with criteria for making the decision. Eventually comments or further clarifications of original document’s statement are also provided here
 - “Supported” column with the decision in “Yes/No” format

Statement Number	Feature	Requirement Level	Notes	Supported
6.1-1	The network interfaces of Devices specified in this standard shall support IPv4, wherein streams are transported using IP version 4 as specified in IETF RFC 791.	1	Mark as supported if the device supports IPv4.	Yes <input type="checkbox"/> No <input type="checkbox"/>
6.1-2	Devices should support IPv6 as specified in IETF RFC 2460	2	Mark as supported if the device supports IPv6.	Yes <input type="checkbox"/> No <input type="checkbox"/>

SMPTE ST 2110 PICS



- Statements applicable only to a subset of implementations:
 - The additional question that strictly defines if the statement is applicable to the implementation
 - A special color for the requirement level to differentiate between the strongest “shall” statements that apply to all implementations and those that apply only to a subset of implementations

6.3-4	Senders shall ensure that there are no fragmented IP packets in the egress interface of the Sender, notwithstanding the provisions of IETF RFC 791 which might allow them.	1	Does the device contain one or more senders?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
			Mark as supported if senders ensure that there are no fragmented IP packets in the egress interface of the Sender, notwithstanding the provisions of IETF RFC 791 which might allow them.	Yes <input type="checkbox"/> No <input type="checkbox"/>

Conclusions



- Number of practical problems have emerged
- Addressed with
 - JT-NM Tested
 - SMPTE PICS
 - ST 2110-25

Any Questions?

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