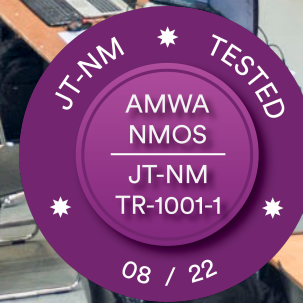


JT-NM TESTED AUGUST 2022

JT-NM Tested Board Report

IP Media Equipment Testing For Interoperable Future



CONTENT

- What is JT-NM Tested?
- What did we test and why?
- Test plans and tools
- Network and Infrastructure
- Findings and results
- Conclusions



JT-NM Tested Program – What is it?

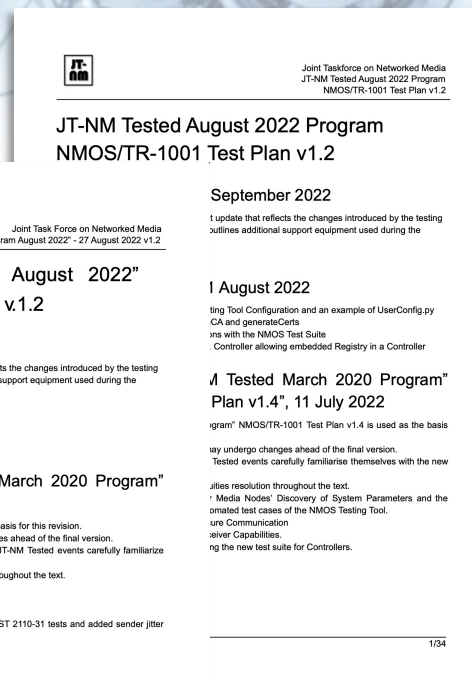
- The JT-NM Tested program offers documented insight into how vendor equipment conforms to specific SMPTE standards and AMWA NMOS specifications.
- Vendors who meet the testing criteria will have the opportunity to display badges and make public statements about their participation.
- The JT-NM Tested 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.

JT-NM Tested Program – What did we test?

- 3 main test tracks:
 - Data plane: Network access and SMPTE ST 2110 behaviour (curated by EBU and VRT)
 - Control plane: AMWA NMOS and JT-NM TR-1001-1 behavior, including NMOS registries and controllers (curated by EBU and CBC/Radio Canada)
 - Cybersecurity Vulnerability Assessment (curated by EBU and VRT)

JT-NM Tested Program – Test Plans & Tools

- Test Plans:
 - SMPTE ST 2110 Test plan
 - NMOS/TR-1001-1 Test plan
 - Cybersecurity Test Plan
- Main testing tools:
 - EBU LIST + multiple T&M devices
 - AMWA NMOS Testing Tool

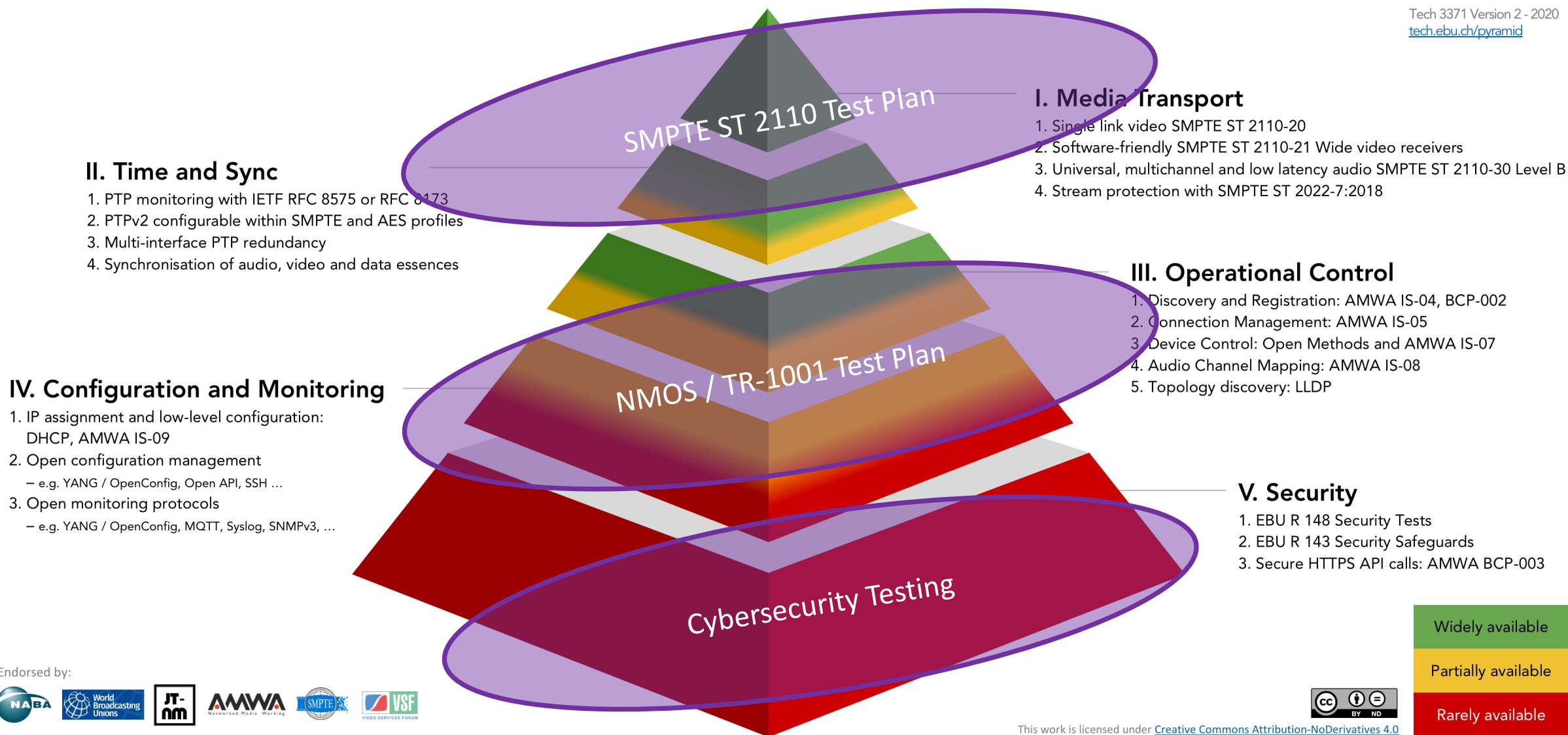


THE TECHNOLOGY PYRAMID FOR MEDIA NODES

Minimum User Requirements to Build and Manage an IP-Based Media Facility using Open Standards & Specifications.

EBU

Tech 3371 Version 2 - 2020
tech.ebu.ch/pyramid



Endorsed by:



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Widely available

Partially available

Rarely available

NETWORK AND INFRASTRUCTURE

JT-NM Tested Program – Network and infrastructure

Objectives:

- Provide a “real-world” scenario
- Highlight ST 2110 network design best practice
- Resilience and Reliability through design

Solution:

- Spine-leaf topology, Amber and Blue media networks
- Routed access
- BGP Dynamic routing
- Full multicast routing (IGMP / PIM)
- Multiple management VLANs for general use and NMOS testing
- Dual resilient PTP GMs
- Routable OOB network for switch management

JT-NM Tested Program – Network and infrastructure

- 16 switches in total:
 - 2x spine
 - 10x leaf
 - 4x OOB management
- Number of ports:
 - 48x 100G
 - 8x 40G
 - 116x 25G
 - 75x 10G
 - 215x 1G (Both media and management)
- **A strong move from 10G to 25G, and from 40G to 100G.**

JT-NM Tested Program – Network and infrastructure

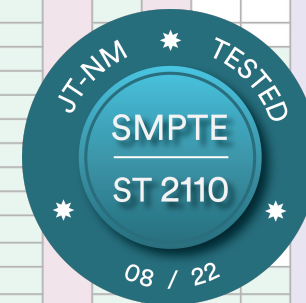
- PTP:
 - 2x grandmasters by Telestream
- DHCP:
 - 577x scopes
 - Over 5000x lines in the config file
- DNS:
 - DNS-SD for NMOS registry discovery
- NMOS registry:
 - Easy-NMOS by Richard Hastie



FINDINGS AND RESULTS

https://jt-nm.org/jt-nm_tested/

Data plane: Basic SMPTE 2110 behavior



SMPTE ST 2110 Test Plan (content by Willem Vermost, VRT)

Network Tests

SMPTE ST 2110-20

SMPTE ST 2110-22

SMPTE ST 2110-30

SMPTE ST 2110-31

SMPTE ST 2110-40

SMPTE ST 2022-7



Download results and test plan!



Results – SMPTE ST 2110 Test Plan (content by Willem Vermost, VRT)

- **35 vendors** published their results in the final catalog.
 - +1 compared to the previous event
- A few newcomers were welcomed
- **84 products** were tested against the ST 2110 test plan (142% compared to previous catalog)
- 63 Video devices
 - 44 devices were presented as a UHD capable
 - 39 Tx/Rx devices
 - 13 Rx devices
 - 11 Tx devices
- 17 Audio only devices
 - 13 Tx/Rx devices
- **11K tests executed in total!**

- **Network Interface Tests**

- 67% use DHCP on management network interface
- 61% use DHCP on Media network interface
- 99% respect the GM role when in “slave only”
- 96% properly react to PTP TLVs
- 57% warn or prohibit the use of the restricted multicast range (224.0.0.0-224.0.1.255)

- **ST 2110-10**

- 100% support and use IGMPv3 (*,G)
- ^{NEW} 67% support IGMPv3 SSM (S,G)

Lessons Learned – ST 2110 (content by Willem Vermost, VRT)

- **ST 2110-10**

- 67% expose and SDP
- 93% of exposed SDPs were valid

- **ST 2110-20**

- 94% produce a valid stream
- 94% produce a stream within the profile limits of N, NL or W
- 86% Produce a stream within the boundaries of the VRX limits.
- 92% can receive Wide streams

- **NEW ST 2110-22**

- 25% of the devices demonstrated the ST 2110-22 capabilities

Lessons Learned – ST 2110 (content by Willem Vermost, VRT)

- **ST 2110-30**

- 96% of the devices demonstrated capabilities for the ST 2110-30 tests
- **77%** have recommended DSCP values according to AES67

- **ST 2110-31**

- 39% of the devices demonstrated capabilities for the ST 2110-31 tests

- **ST 2110-40**

- 82% of the devices demonstrated capabilities for the 2110-40 tests

- **ST 2022-7**

- 88% of the devices demonstrated capabilities for 2022-7 tests
- **58%** had valid Seamless Protection Switching, critical for designing a resilient facility!

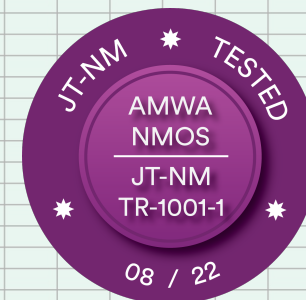
Results of NMOS/TR-1001-1 testing (content by Felix Poulin, CBC/Radio Canada)



JT-NM Tested August 2022
NMOS/TR-1001-1 Media Nodes,
Registries and Controllers
Results Catalog



Control plane: NMOS/TR-1001-1 behavior



NMOS/TR-1001-1 Test Plan (content by Felix Poulin, CBC/Radio Canada)

Startup Behaviour

**Secure Communication
(BCP-003-01)**

**Node API & Registration
Behavior (IS-04)**

**Connection Management
(IS-05)**

**Audio Channel Mapping
(IS-08)**

System Parameters (IS-09)

**Receiver Capabilities
(BCP-004-01)**

NMOS Registry Tests



Download results and test plan!



Results – NMOS / TR-1001-1 Test Plan (content by Felix Poulin, CBC/Radio Canada)

- **17K tests executed - 92% automated!**

- **Nodes**

- 74 Media Nodes **+118% from 2020**
- from 35 vendors **+ 75% from 2020**
- **87%** of ST 2110 Devices tested for NMOS
- **Growing adoption!**

Capabilities

- **90%** tests passed IS-04 Reg. and Discovery
- 65% do Natural Grouping (BCP-002-01)
- **NEW** 8% do Receiver Capabilities (BCP-004-01)
- **91%** tests passed IS-05 Connection Management
- **Maturity of most of IS-04 and IS-05 implementations!**

Results – NMOS / TR-1001-1 Test Plan (content by Felix Poulin, CBC/Radio Canada)

- **NEW** 12% do basic or full Secure Communication (BCP-003-01)
 - A beginning, but long way to go!
- 59% do System Parameters (IS-09)
- 19% do Audio Channel Mapping (IS-08)
- 76% do LLDP

Controllers and Registries

- 9 Controllers and Registries +29% from 2020

Capabilities

- 94% of Controller tests passed
- **NEW** 66% of Registries partially supporting secured communication (BCP-003-01)
- 79% Registry tests passed (IS-04)



CYBERSECURITY ASSESSMENT FINDINGS AND RESULTS

http://jt-nm.org/jt-nm_tested/

Cyber Security – Initial Results (see detailed presentation from Gerben Dierick, VRT)

- 145 IP addresses scanned (93 unique devices)
 - 71 scans on media network
 - 74 scans on management network
- 52 devices on media and management network
- 22 devices only on management network
- 19 devices only on media network

Cyber Security – Automated Scanning Results (see detailed presentation from Gerben Dierick, VRT)

7841 findings

Severity > 0?

2145 Potential vulnerabilities

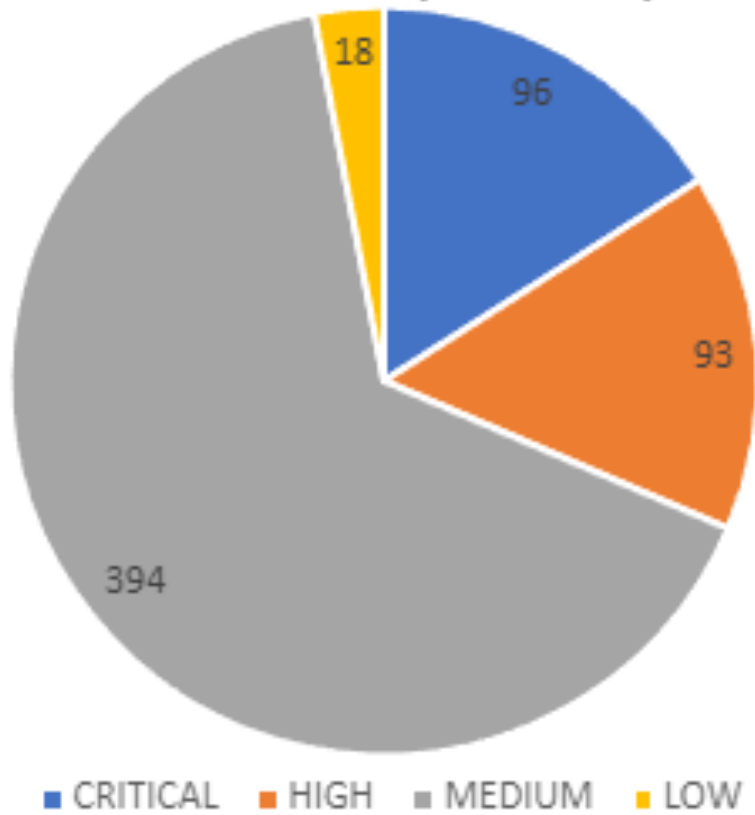
Quality of Detection > 30?

777 Potential vulnerabilities

Not a duplicate?

601 Potential vulnerabilities

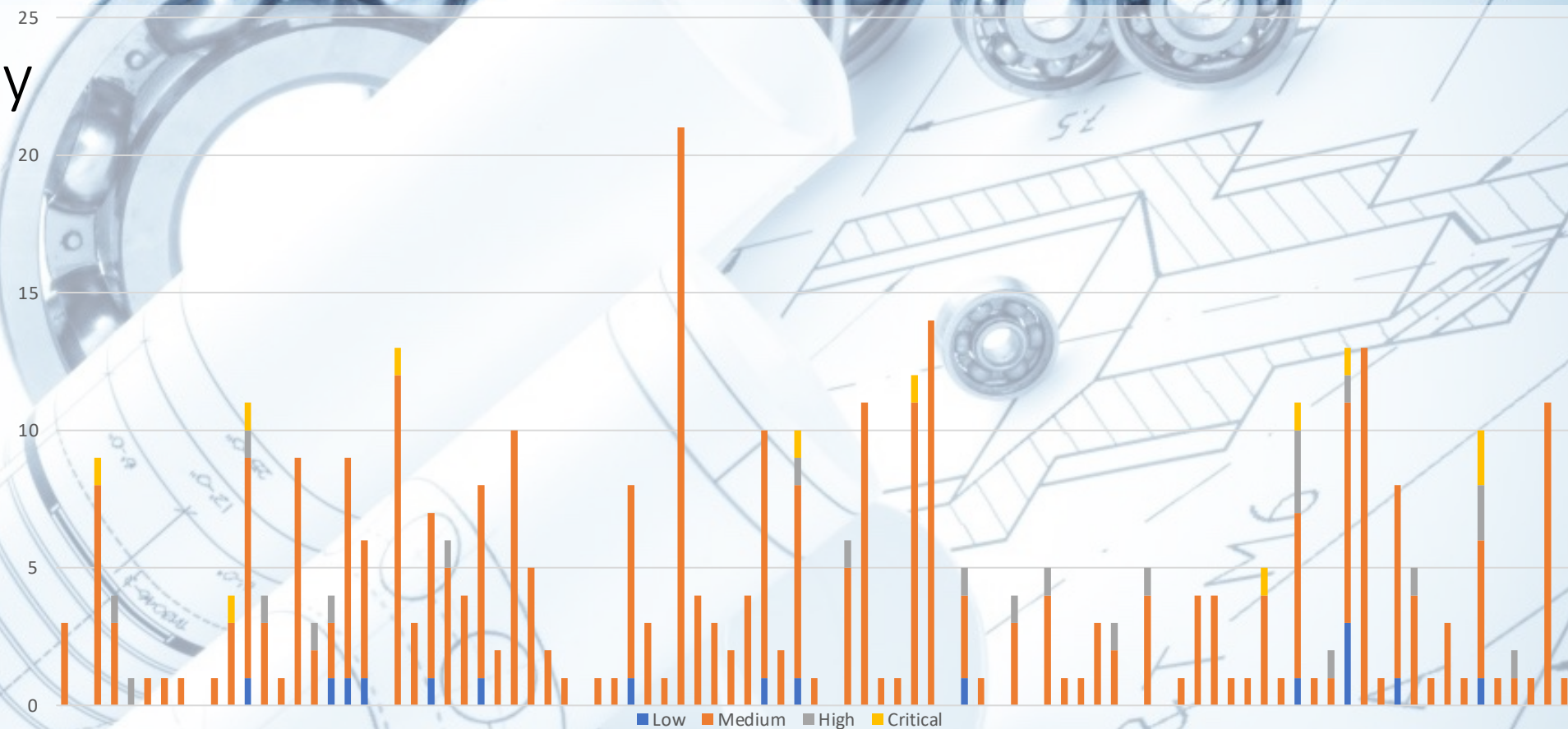
Vulnerability Severity



Cyber Security – Uneven issues distribution (see detailed presentation from Gerben Dierick, VRT)

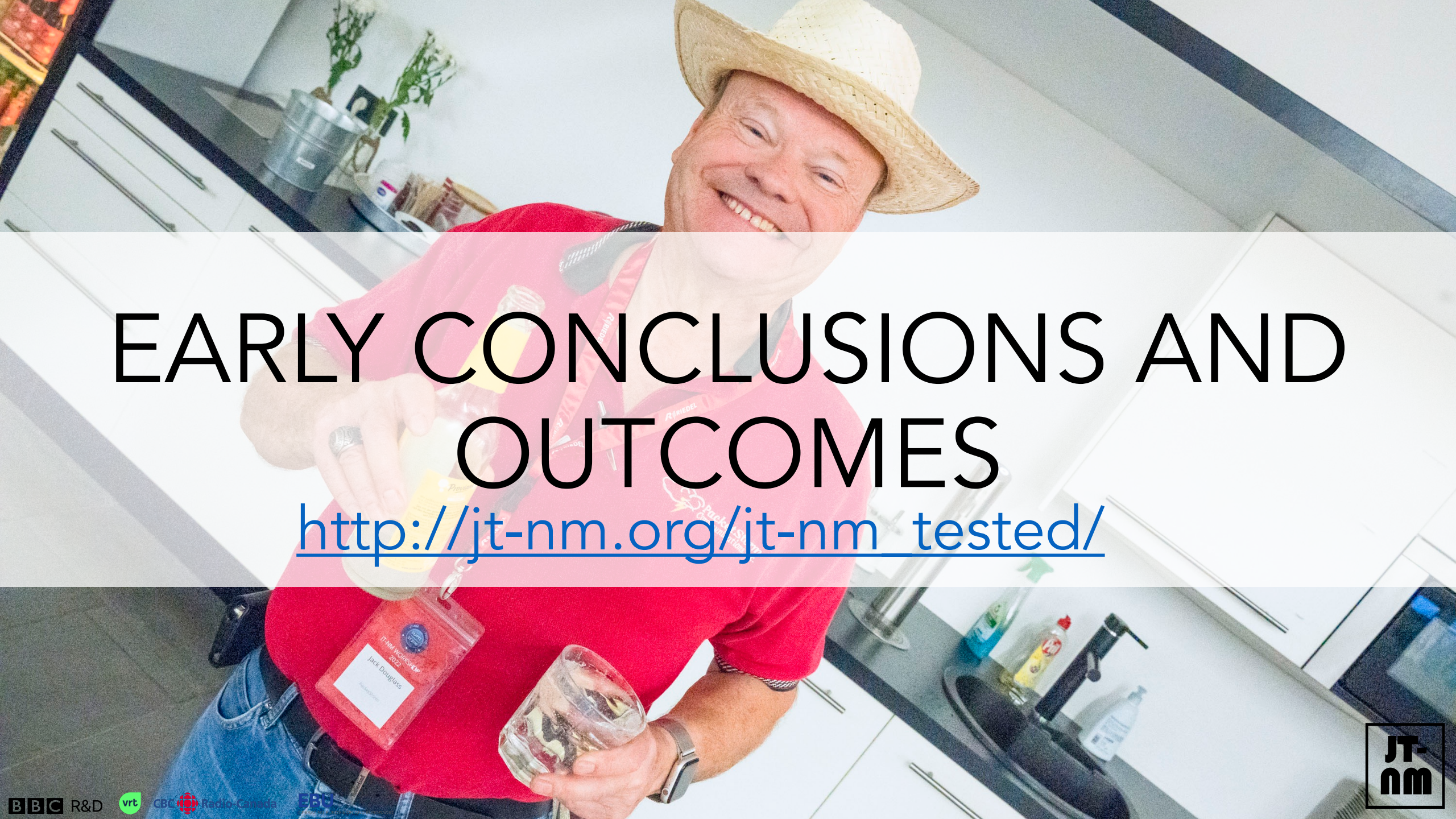
Issues not equally distributed over DuTs...

of Vulnerabilities per category per device (no outliers)



Cyber Security – Categories of vulnerabilities (see detailed presentation from Gerben Dierick, VRT)

- Almost all vulnerabilities can be put in these categories
 - Unpatched software
 - Unsupported software
 - Encryption misconfiguration
 - Unnecessary features
 - Web interface weaknesses
 - Default credentials
 - Unauthenticated remote access

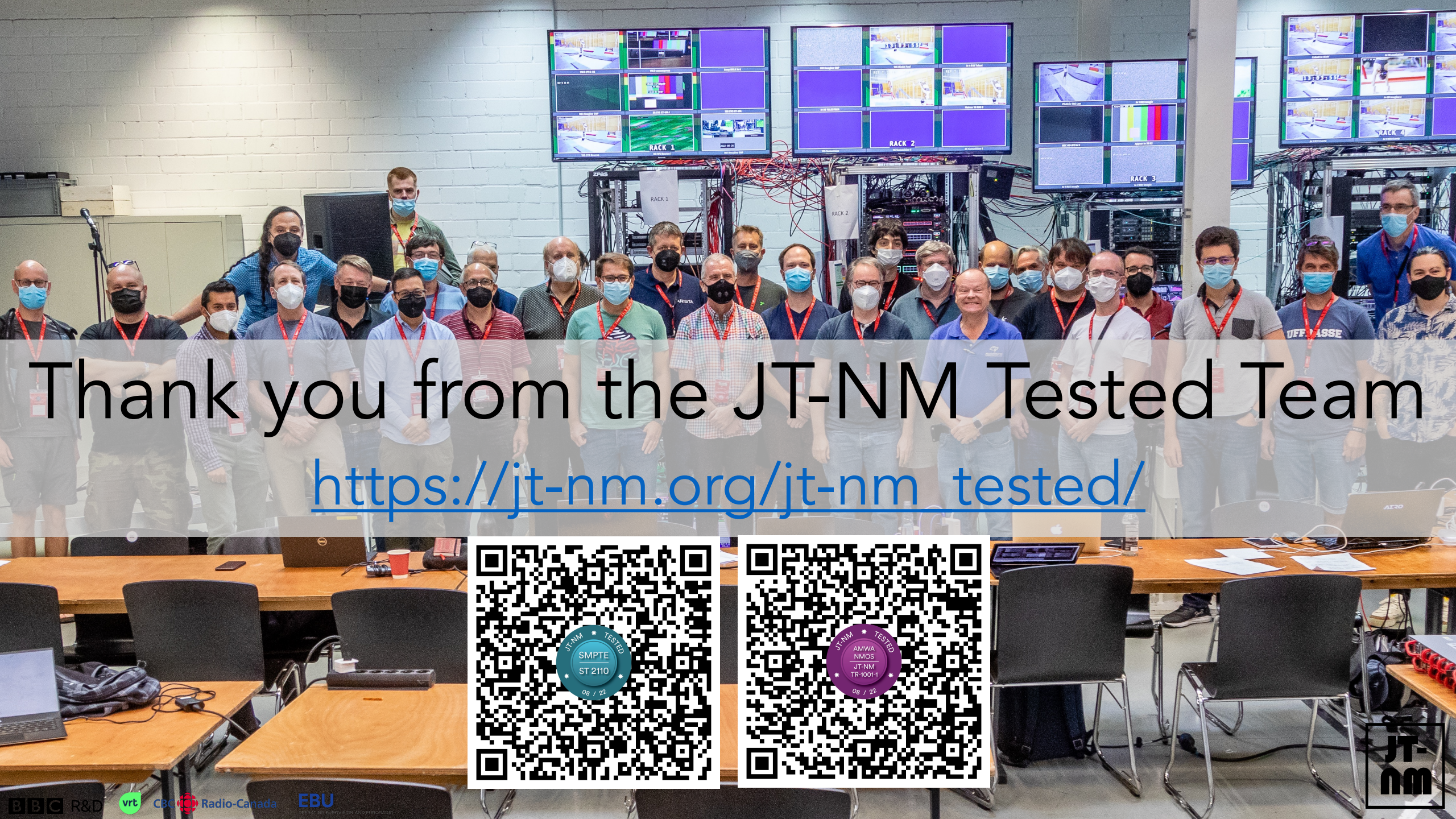
A man wearing a straw hat and a red t-shirt is smiling and pouring juice from a bottle into a glass. He is in a kitchen setting. A semi-transparent white banner is overlaid on the image, containing the title and a URL.

EARLY CONCLUSIONS AND OUTCOMES

http://jt-nm.org/jt-nm_tested/

Early conclusion and outcomes

- It's time for the EBU Pyramid revision.
- JT-NM will look for a way to make the testing more automated and sustainable.
- Extensive NMOS support is essential for future automatable testing. The value of the Badge must be revised and increased.
- The cybersecurity situation hasn't improved a lot – needs additional attention.
- Another round of testing may take place in the Summer of 2023, with preparatory exercises to start soon.



Thank you from the JT-NM Tested Team

https://jt-nm.org/jt-nm_tested/

