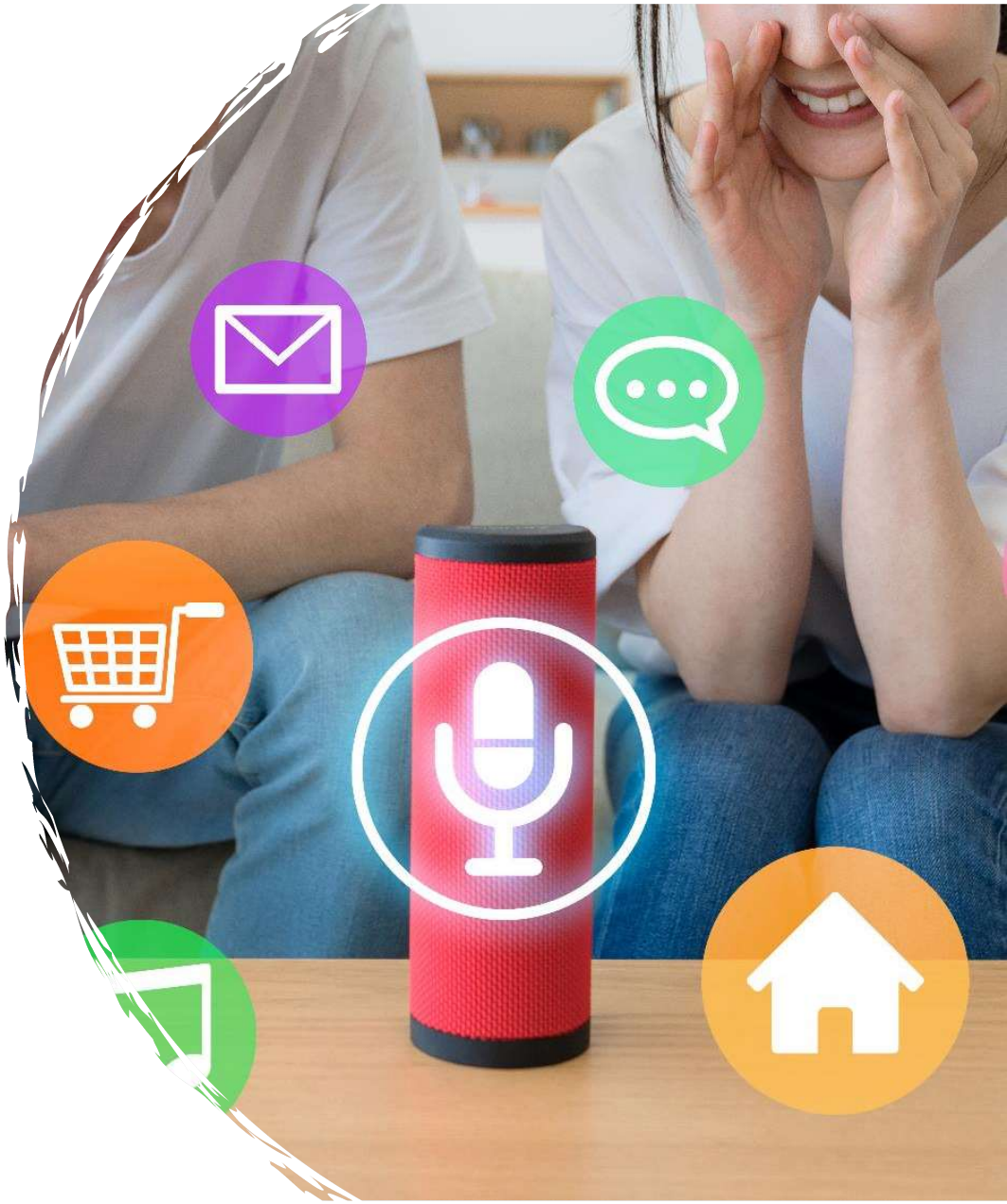
STQ Workshop

Utilizing Timeslice KPIs For AI/ML-Based Voice Service Automation

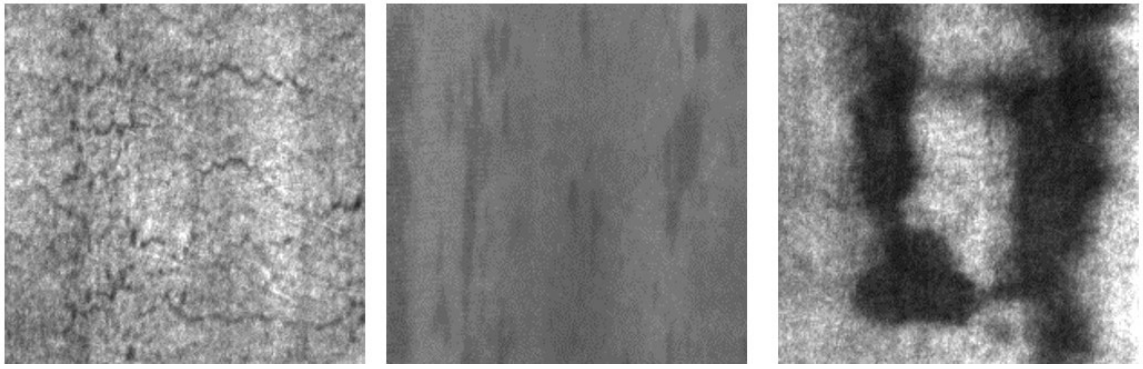
Dr. Michael Wallbaum



22/11/2022

30 years ago…

- My first job offer as student helper: QA at Parsytec
- Parsytec created systems for optical surface inspection using pattern recognition
- High-speed detection of defects on metal and paper surfaces during production



Source: ISRA Vision

- We'll get back to this… ☺

Fast forward to 2021: ETSI STQ filling the media KPI gap

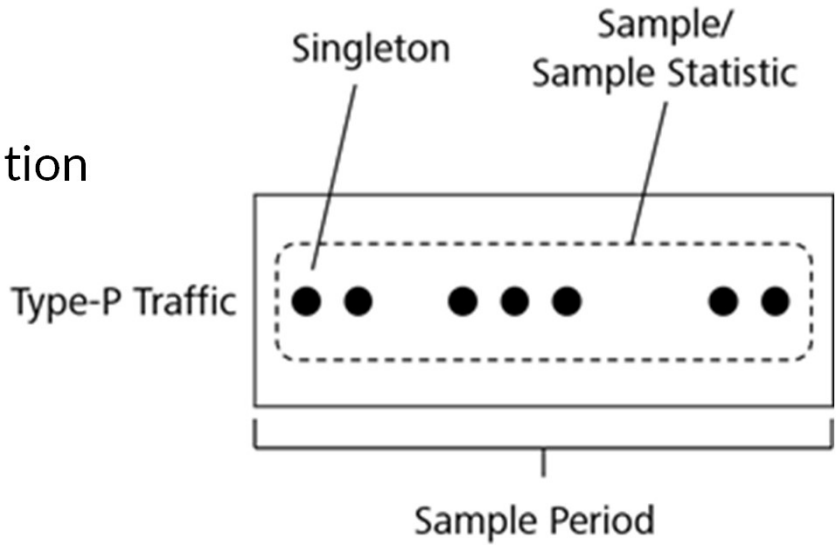
- Voice service performance monitoring traditionally focused on signaling
- IETF RFC 6076 is the de facto standard for VoIP signaling, defining e.g.
  - SEER – Session Establishment Effectiveness Ratio (comparable to NER)
  - SRD – Session Request Delay (comparable to Post-Dialing Delay, PDD)

- In 2018 ETSI STQ identified a gap in media KPIs and opened a new work item: "*Timeslicing KPIs for RTP based speech transmission*"

- The resulting technical report TR 103 639 was published in March 2021

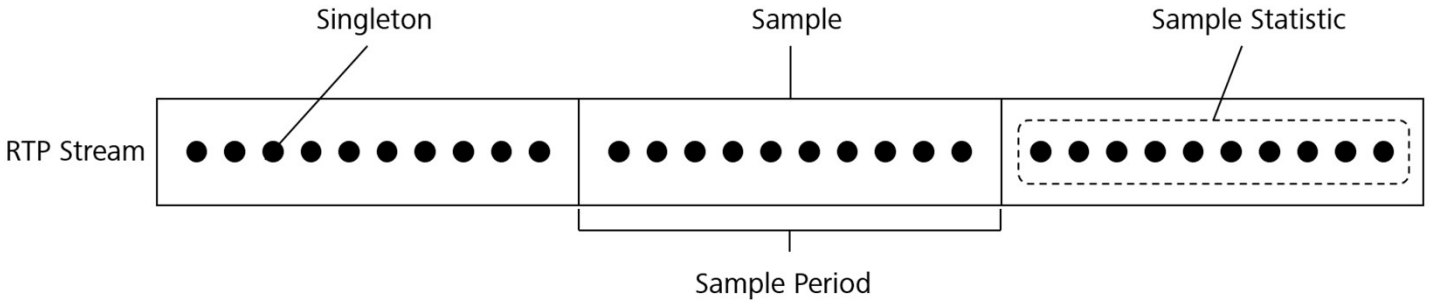
ETSI TR 103639 Basics

- TR 103639 provides a framework for defining timeslice media metrics and KPIs
- Uses concepts from the well-known IPPM (IP Performance Measurement) working group of the IETF
- IPPM Terminology
  - Type-P traffic: type of observed packets
  - Singleton metric: corresponds to single observation
  - Sample: collection of singleton measurements
  - Sample statistic: an aggregation of singleton measurements over a sample period

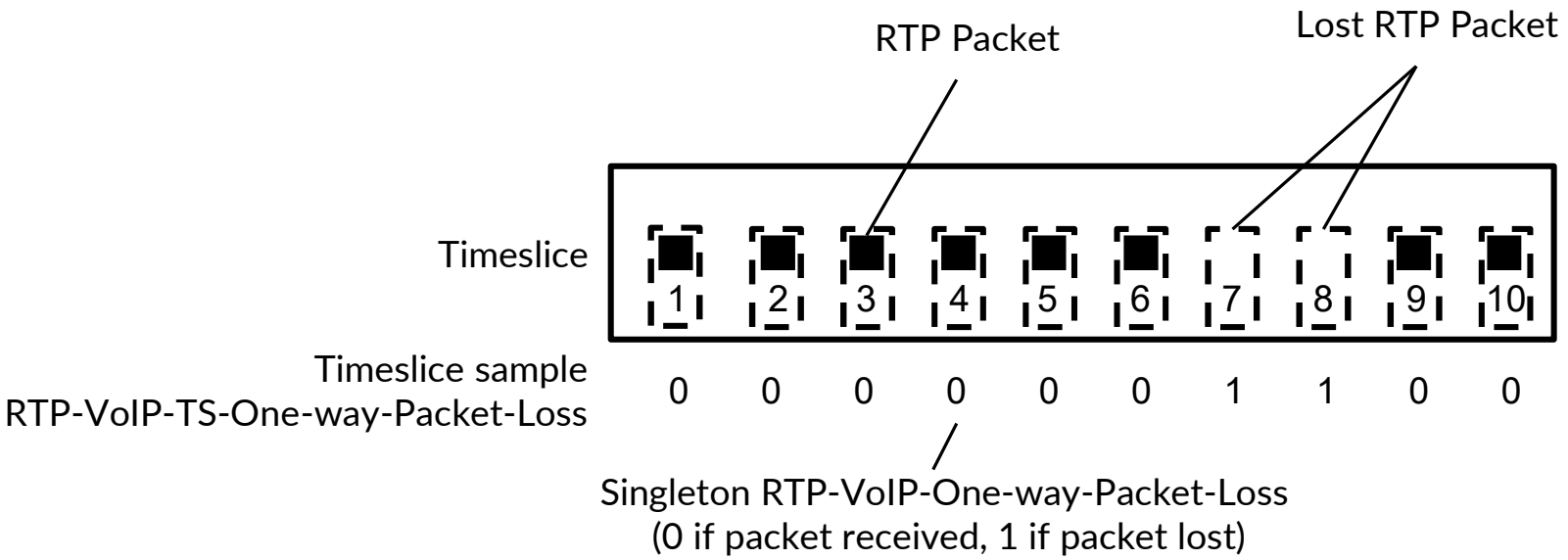


ETSI TR 103639 Terminology

- ETSI TR 103639 applies IPPM concepts with the following provisions:
  - Singleton metrics are of type "RTP-VoIP", i.e. they refer to packet streams transporting speech using RTP over UDP
  - Sample periods (timeslices) are of fixed duration and shorter than a typical call
  - All RTP packets in a sample period contribute to singleton metrics to fully characterize the timeslice
  - Samples are consecutive and continuous for the duration of each RTP stream



Example timeslice metric: one-way packet loss

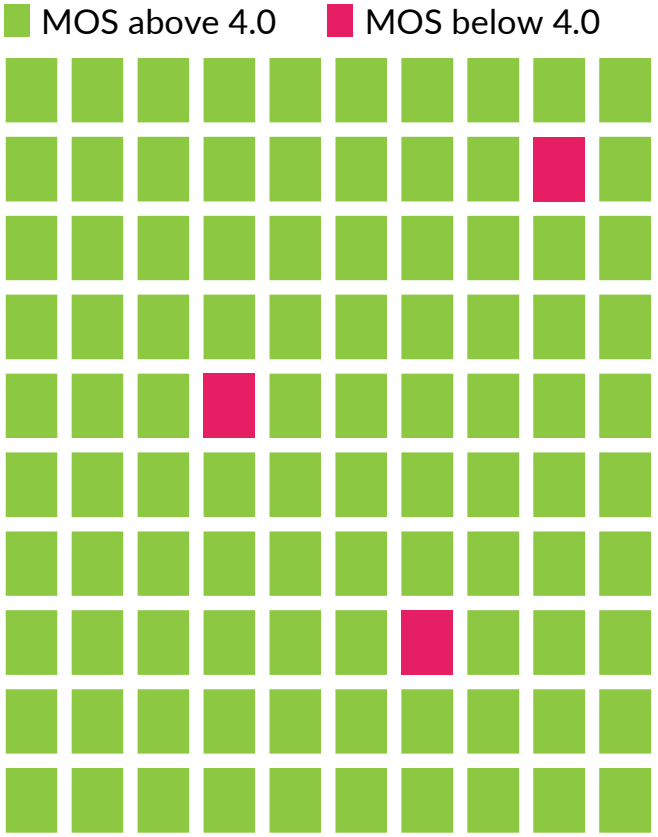


- Example timeslice statistics based on this sample definition:
  - RTP-VoIP-One-way-Packet-Loss-Count
  - RTP-VoIP-One-way-Packet-Loss-Ratio
  - RTP-VoIP-One-way-Burst-Loss-Event-N

Annex A KPI example: Good Minute Ratio

- A 'good minute' is a set of timeslices representing one minute, where all time slices have MOS > 4.0.
- GMR = # good minutes / total number of minutes
- The set of time slices can be based on any group of media streams, e.g.
  - One direction of a call
  - All calls in the past 15 min to Bratislava
  - Incoming RTP on interconnection in the past year

- Example calculation: GMR = 97/100 = 97%



Using timeslice KPIs for machine learning

- Prediction of time-series data is rather straight-forward
  - Timeslice KPIs can be provided periodically, e.g. for 5-, 10-, 15-minute intervals
  - Technically there is no difference to other time-series data
  - Prediction techniques are well-known
- Need to focus on standardisation/productization:
  - Define/select timeslice KPIs of interest, e.g. based on TR 103639 Annex A
  - Standardize data feed interfaces, e.g. as data source for NWDAF (3GPP TS 29.520) or comparable functions in other network segments
  - Develop respective ML-models making use of timeslice KPIs

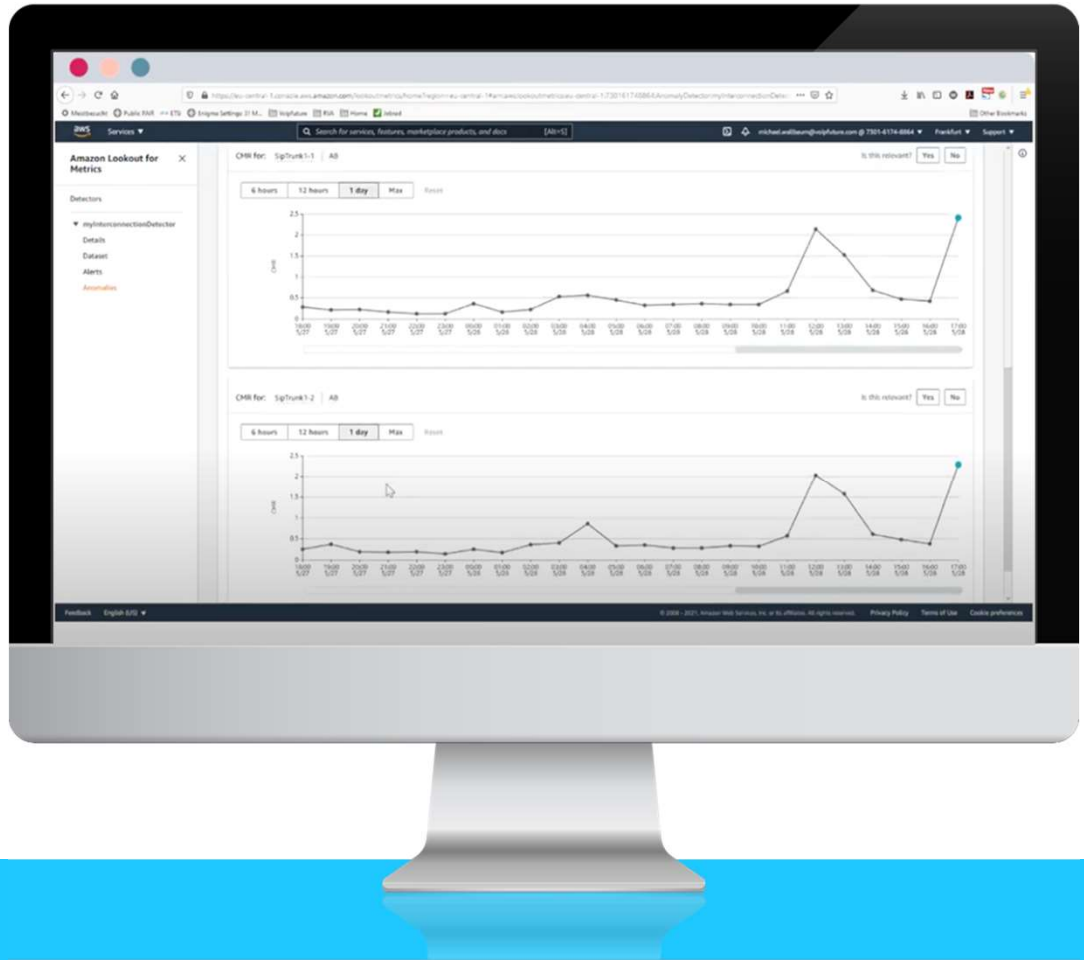
Anomaly detection

Fed AWS Lookout for Metrics with signaling & timeslice media KPIs for a large set of SIP trunks

Lookout automatically detected anomalies in CMR (Annex A)

Lookout identified the affected trunks and media direction

Integrate to raise adaptive alarms



Adaptive alarming

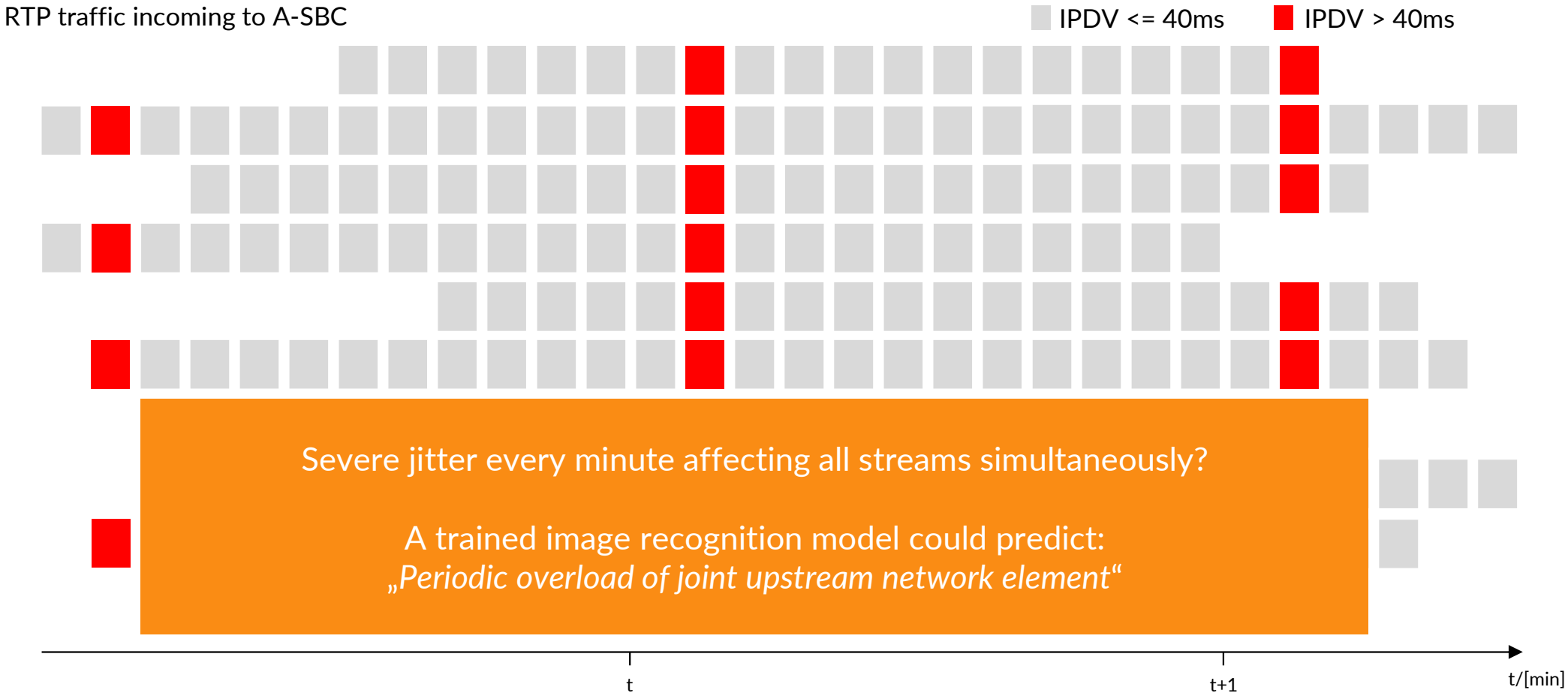
- NOC dashboard created for a Voipfuture customer
- Selected KPIs used for anomaly detection
  - SER/NER
  - ACD
  - Proprietary signaling KPI
  - GMR (Annex A)

Coming back to detection of surface defects

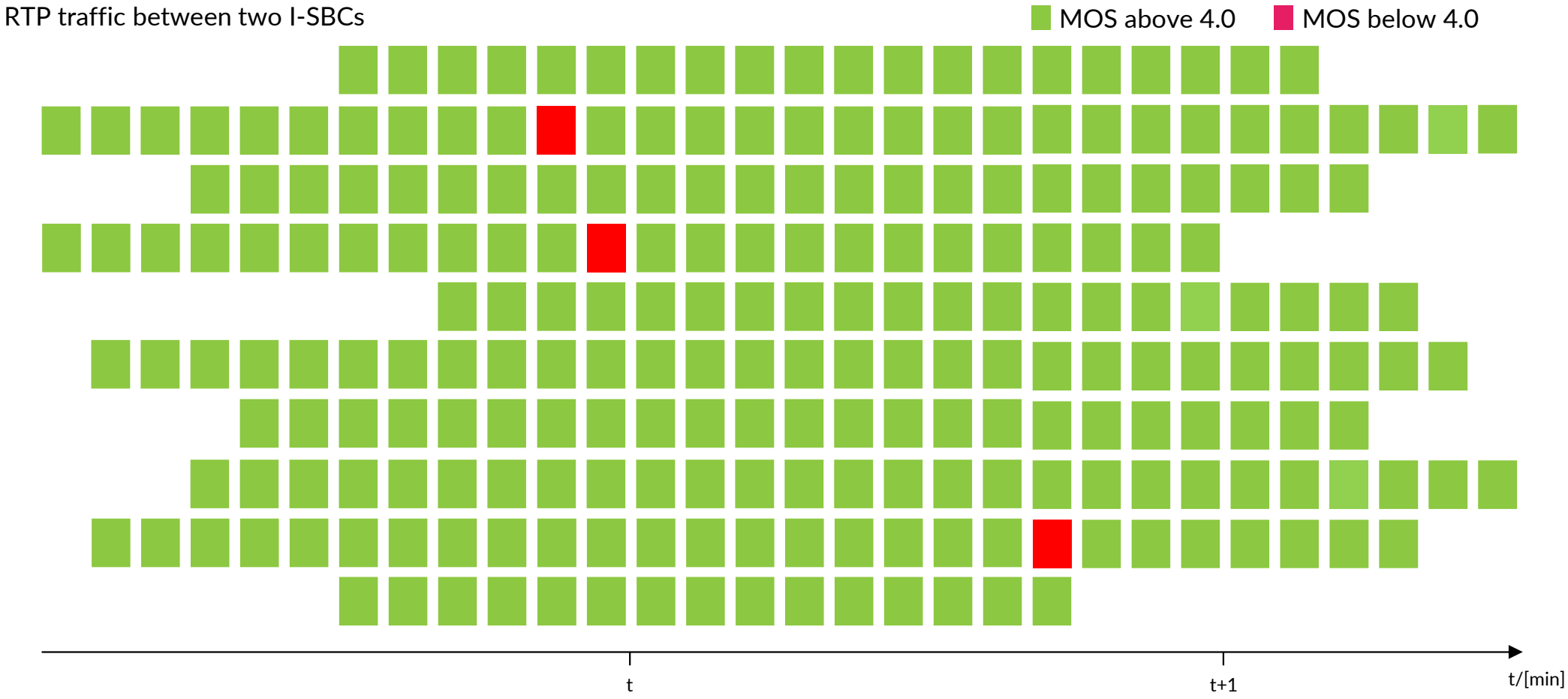
- Passively monitoring live VoIP traffic in an operator‘s network generates millions and billions of timeslices
  - Now interpret each timeslice as the pixel of an image
  - Now assume timeslice metrics define the „color space“
- Get the picture? Idea is to apply image classification techniques from machine learning to detect impairment patterns affecting the RTP traffic

- Next examples assume passive monitoring system with 5s timeslice duration

First example image

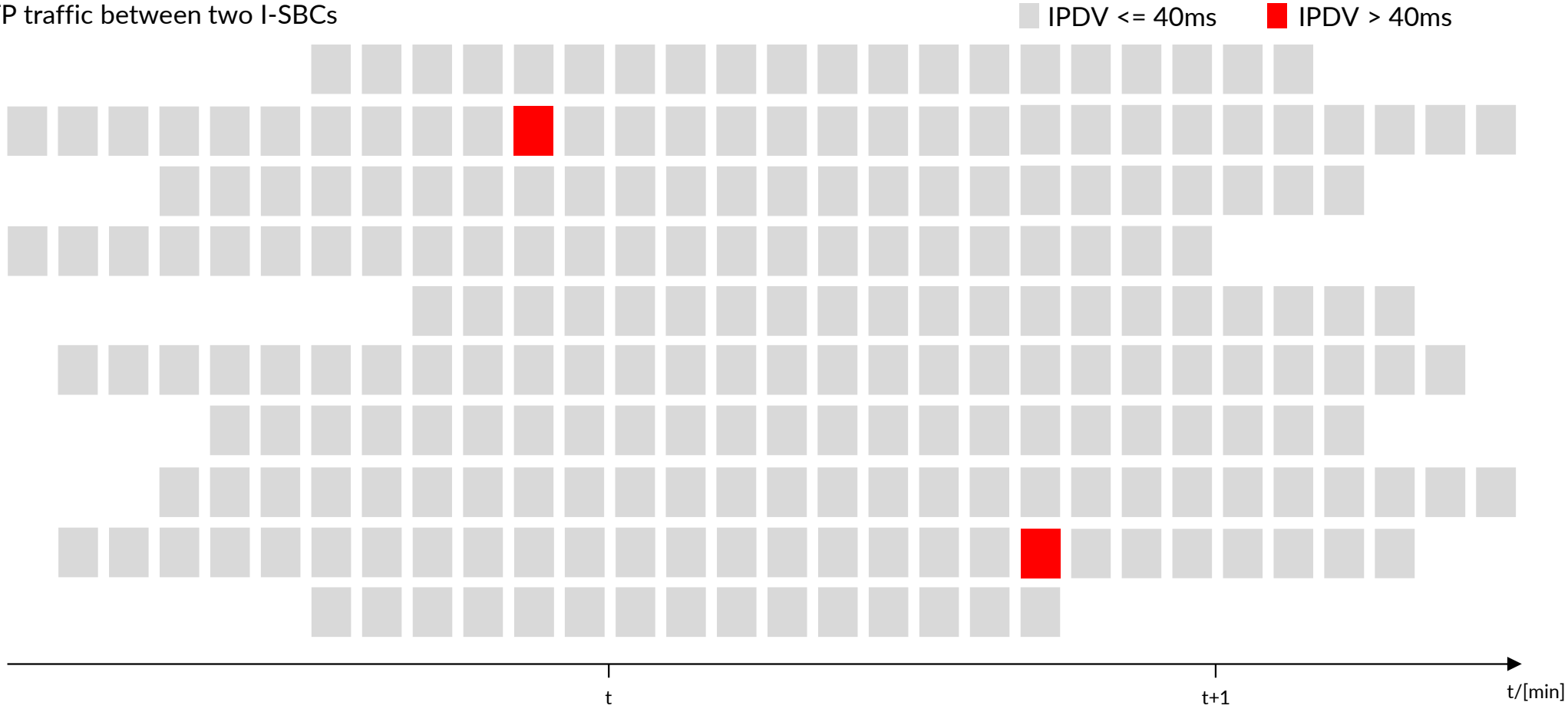


Second example: overall „image“ in terms of user experience

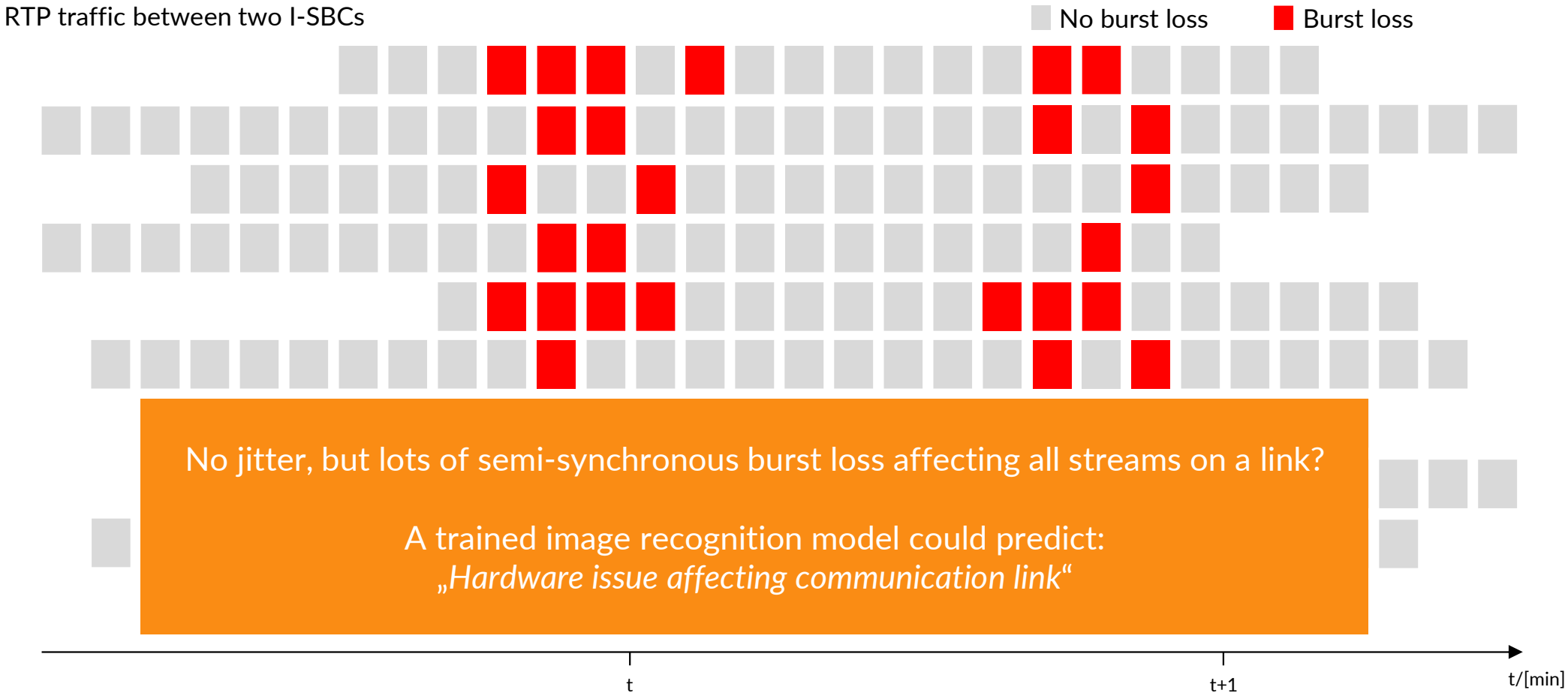


Jitter „color layer“

RTP traffic between two I-SBCs



Burst loss „color layer“



Summary and outlook

- ETSI TR 103639 timeslice KPIs provide a data foundation for AI/ML-based prediction of media traffic
- Specifically Annex A KPIs are actively being used in the industry, incl. for AI/ML-based anomaly detection and adaptive alarming

- Application of image analysis techniques to timeslices
  - More complex than use of timeslice KPIs, however approach retains temporal detail
  - Potential for faster and more accurate/detailed predictions regarding root causes
  - More research needed…

Thank you!