Proposed RAP Extensions for the “Centralized network/distributed user model” & Scheduling

Based on LRP on TCP with proxies for controlled bridges

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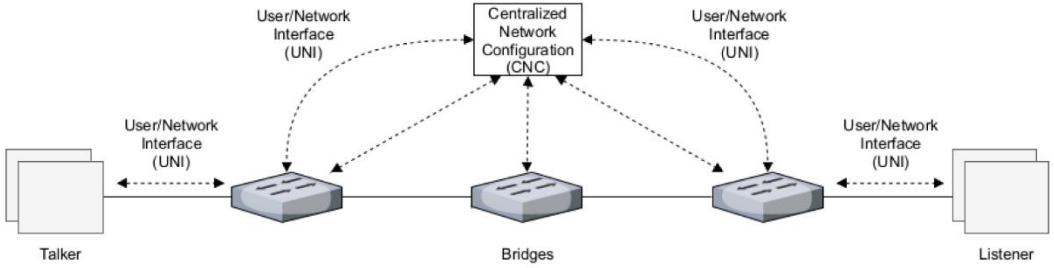
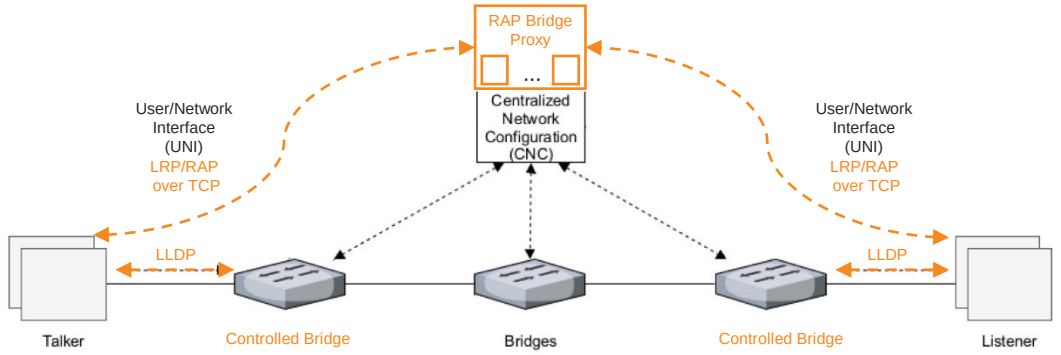
Content

- Configuration Model
- Scheduling within RAP
- Combining with Scheduling

From Qcc „Centralized network/distributed user model “ to LRP/RAP Proxies





Signaling

- End station:
  Signals stream properties using MSRPv1.
- Bridge:
  Forwards MSRPv1 stream properties to and from CNC.
- CNC:
  Takes admission control decision, computes and deploys configurations to bridges.

Signaling

- End station:
  Signals stream properties using the resource allocation protocol (RAP) which is part of the distributed UNI. The Talker or Listener does not know or care whether it is making a request to a Bridge or a Bridge Proxy/CNC.
- Controlled bridge:
  Exchanges address information of their RAP bridge proxy via LLDP.
- RAP Bridge Proxy (here: centralized):
  Signals stream properties to and from CNC.
- CNC:
  Takes admission control decision, computes and deploys configurations to bridges.

Advantage

- A common distributed User/Network Interface independently of the network’s stream configuration model.

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RAP Extensions for Scheduling

IEEE P802.1Qdd™/ D0.5 RAP currently describes path establishment and resource allocation on paths. For each stream, dedicated resources (e. g. queuing resources, bandwidth and latency per stream) are reserved to guarantee zero congestion loss and bounded latency.

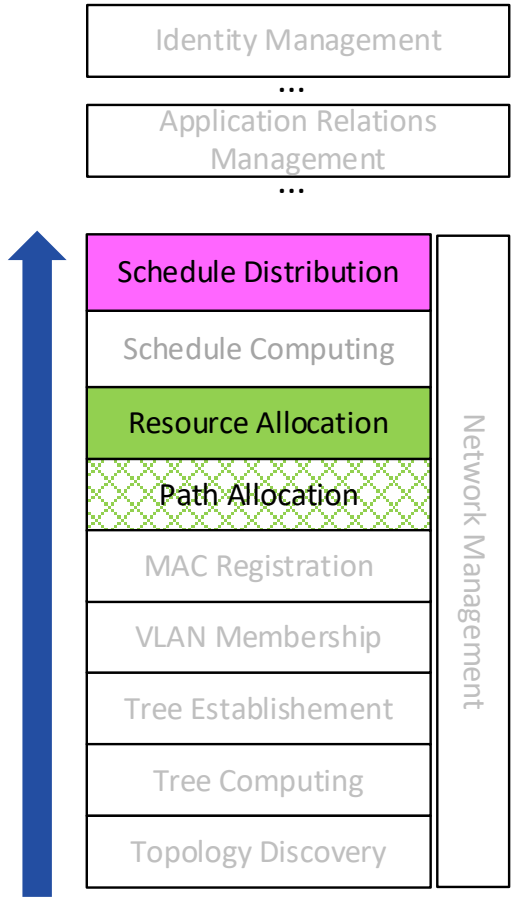
The number of reservable streams is limited by the available resources.
In case of streams with low bandwidth, usage especially of the queuing resources is inefficient.

To improve resource utilization in such a case, the streams of a group of talkers can share the same resource at different times given:

- The group of talkers is synchronized,
- Each talker transmits its frames of a stream according to a schedule.

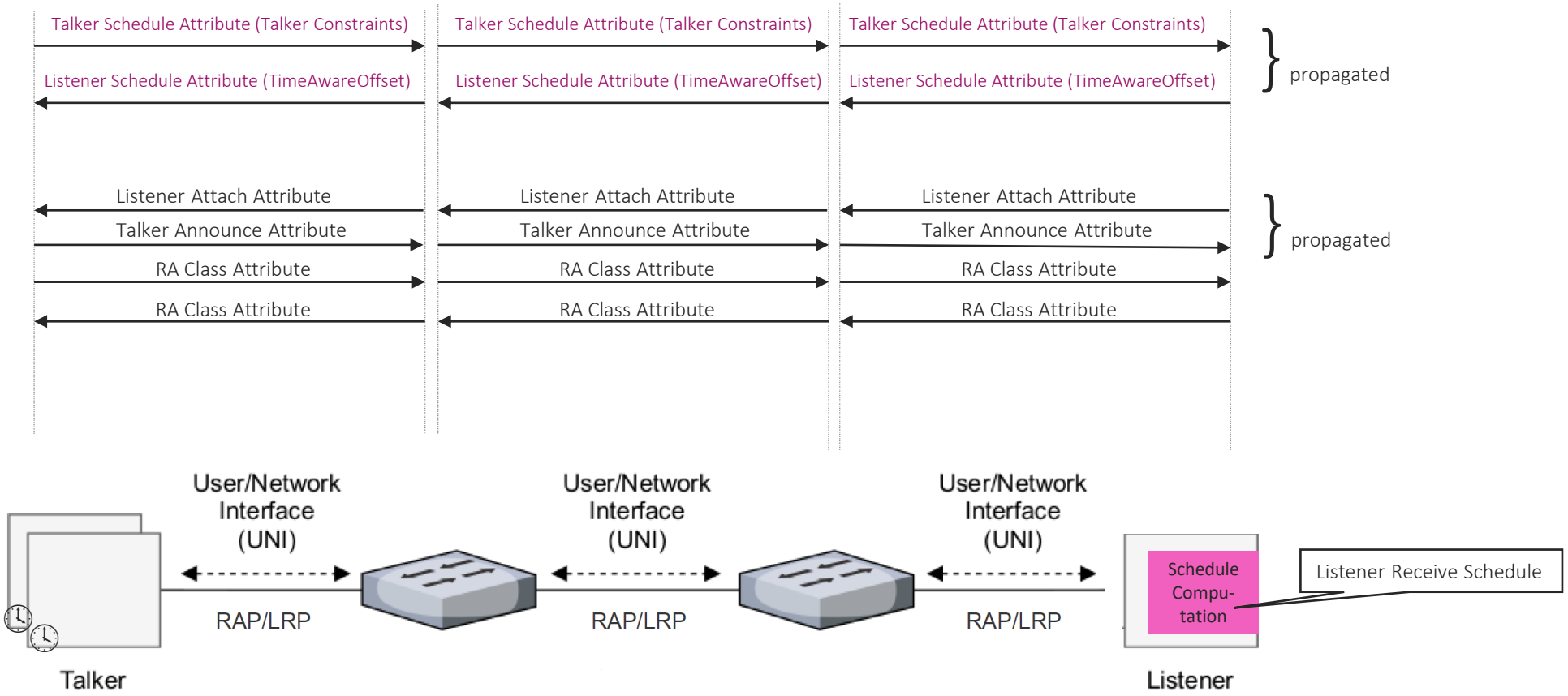
This can be achieved by an optional RAP extension to distribute the results of schedule computing.

With this approach, an application agnostic UNI between end stations and network based on LRP/RAP can be provided.



RAP Extensions for distributed Scheduling

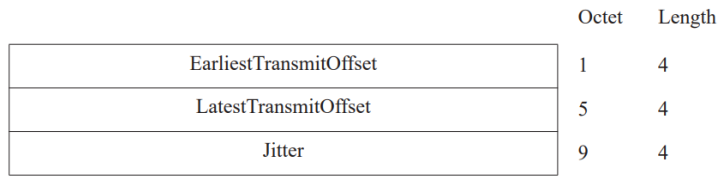
Enhancement of https://www.ieee802.org/1/files/public/docs2019/dd-chen-flow-aggregation-0119-v03.pdf



RAP Extensions for centralized Scheduling

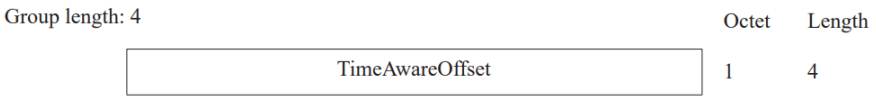
Optional Schedule Attributes from IEEE 802.1Qcc™-2018

- Talker to CNC:
  EarliestTransmitOffset specifies the earliest offset within the Interval at which the Talker is capable of starting transmit of its frames.
  LatestTransmitOffset specifies the latest offset within the Interval at which the Talker is capable of starting transmit of its frames.
  Jitter specifies the maximum difference in time between the Talker's transmit offsets, and the ideal synchronized network time (e.g. IEEE Std 802.1AS time).
- CNC to Talker:
  TimeAwareOffset specifies the offset that the Talker shall use for transmit. The network returns a value between EarliestTransmitOffset and LatestTransmitOffset of the Talker's TrafficSpecification.



	Octet	Length
EarliestTransmitOffset	1	4
LatestTransmitOffset	5	4
Jitter	9	4

Figure 35-12 — Value of TSpecTimeAware TLV



Group length: 4

	Octet	Length
TimeAwareOffset	1	4

Figure 35-17 — Value of TimeAwareOffset TLV

RAP Extensions for Scheduling

New RAP Values

Proposal: Define new RAP attributes including below values which are declared by Talkers and by Schedule Computing Entities which includes, e.g.:

- Referenced sync DomainID used for synchronization.
- Jitter specifies the maximum difference in time between the Talker's transmit offsets, and the referenced synchronization domain.
- EarliestTransmitOffset specifies the earliest offset within the Interval at which the Talker is capable of / allowed to start transmitting its frames.
- LatestTransmitOffset specifies the latest offset within the Interval at which the Talker is capable of / allowed to start transmitting its frames.
- TimeAwareOffset specifies the offset that the Talker shall use for transmit.

To be coordinated with Qdj

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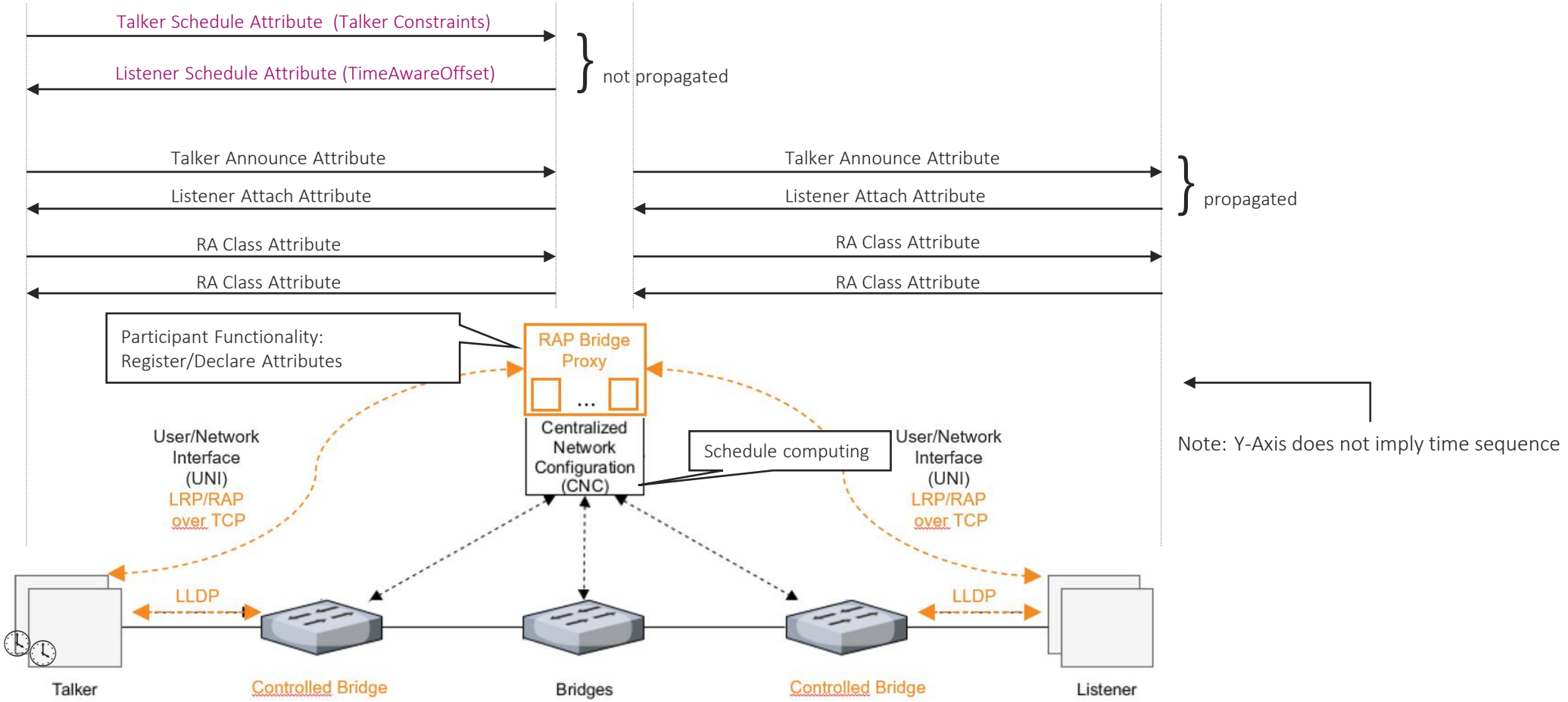
RAP Extensions for Centralized Scheduling

RAP signals resource and schedule attributes



Summary

- RAP provides an application agnostic (distributed) UNI, ensuring that different applications can share guaranteed QoS in a centrally or distributed controlled network.
- With proposed RAP extensions it will support the distribution of distributed and centralized schedules, too.
- Multiple use cases can be supported, from lowest latency „frame isolation“ scheduling to efficient network resource utilization for a huge number of low bandwidth streams.

Thank You

References

- **L. Osswald**, S. Lindner, L. Wuesteney, and M. Menth: RAP Extensions for the Hybrid Configuration Model

  https://atlas.informatik.uni-tuebingen.de/~menth/papers/Menth21d.pdf