MRP++ Transport Protocol for Registration
MSP Transport Protocol for Reservation

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Scope of the project:
This amendment describes new protocols, procedures and managed objects for bridges and end stations, which are compatible with existing mechanisms, and provide:

- Support for more streams. The current worst case limit is less than 500 streams; there are use cases that require two orders of magnitude greater than this.

- Mechanisms that allow Stream Reservation class (SR class) parameters to be configured

- Inclusion of additional parameters and mechanisms in the stream reservation protocol that support additional applications, such as higher reliability, latency requirements, and latency changes due to network reconfiguration.

- Support for higher layer streaming sessions, such as Real-Time Protocol (RTP)-based sessions.

- Deterministic stream reservation convergence.

- User Network Interface (UNI) for routing and reservations.
It seems .1Qcc is focusing on “User Network Interface (UNI) for routing and reservations”

In principle three concepts are discussed within .1Qcc:
(for more details see the following slides)

1. Fully Distributed Model

2a. Centralized Network based on .1Qca / Distributed User Model
2b. NEW: Centralized Network based on .1Qca + Scheduling / Distributed User Model
2c. Centralized Network based on System Protocol / Distributed User Model

3a. Fully Centralized Model based on .1Qca
3aa. Alternative for fully Centralized Model based on .1Qca (see use case 2a)
3b. NEW: Fully Centralized Model based on .1Qca + Scheduling
3bb. Alternative for a fully Centralized Model based on .1Qca + Scheduling (see use case 2b)
3c. Fully Centralized Model based on System Protocol

⇒ The group has to make a decision on which models they want focusing!

Until now the TSN has support a distributed model (based on MRP) and a centralized model (based on ISIS-PCR). For these models TSN has specified interfaces which can be transferred in a YANG model. The new YANG model can be used by everyone.

See also slides 4,5,6 of presentation: http://www.ieee802.org/1/files/public/docs2014/cc-nfinn-control-flows-0414-v02.pdf
Decentralized controlled Network with Path Computation, Registration & Reservation

1. Fully Distributed Model

UNI Interface (ES <-> Edge-Bridge) is in scope of IEEE 802.1Qcc!

MRP++ and MSP (new version) are equivalent to MRP and its protocols (MVRP, MMRP, MSRP)

(The current version of MRP and its protocol (MVRP, MMRP, MSRP) will be supported also in future, but this is not shown in this figure)
Centralized controlled Network with Path Computation, Registration & Reservation

2a. Centralized Network based on 1Qca / Distributed User Model

Is PCEP for Layer 2 in scope of IEEE 802.1?
2b. **NEW:** Centralized Network based on 1Qca + **Scheduling** / Distributed User Model

**Question:**
- Is MSP for e2e signaling required? “YES”
- Is PCEP++ for Layer 2 in scope?
- Is the Scheduling protocol in scope?
Current Discussion in .1Qcc for Centralized controlled Network with Path Computation, Registration & Reservation

2c. Centralized Network based on System Protocol / Distributed User Model

Question: Is protocol D in scope of IEEE?

Out of scope of IEEE 802.1???
Applications in a fully centralized controlled Network with Path Computation, Registration & Reservation

3a. Fully Centralized Model based on 1Qca

Question: - Is simple PCEP in scope?
- Is protocol Z in scope?
Applications in a fully centralized controlled Network with Path Computation, Registration & Reservation

3aa. Alternative for fully Centralized Model based on 1Qca (see use case 2a)
Applications in a fully centralized controlled Network with Path Computation, Registration & Reservation

3b. **NEW: Fully Centralized Model** based on 1Qca + **Scheduling** (see use case 2b)

Question:  
- Is simple PCEP in scope?  
- Is protocol Z in scope?

![Diagram showing network components and protocols](image-url)
Applications in a fully centralized controlled Network with Path Computation, Registration & Reservation

3bb. Alternative for a fully Centralized Model based on 1Qca + Scheduling (see use case 2b)

Centralized User Configuration

Network Manager

Network Controller (PCE) based on IEEE 802-1Qca + Scheduling for TAS

Endstation

Bridge

Multiple-Signaling-Protocol
Multiple-Registration-Protocol
Intermediate-System-to-Intermediate-System with Path Computing and Registration

Listener propagation RxSpec (for receive)

User-only n Protocol

Netconf/YANG

Distribution of the Management Objects

Talker request for explicit path + TSpec propagation

MSP
MRP++
ISIS-PCR

Alternative Protocol A (e.g. only MSRP as UNI Interface) for ES—Edge-Bridge com.

Topology: Global Synchronized Data, path, registration

EDS signalling, reservation, diagnostics and monitoring

New: Scheduling Protocol

New: Scheduling Protocol

New: Scheduling Protocol

Distribution timing for TAS

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Current Discussion in .1Qcc for (one) application in a centralized controlled Network with Path Computation, Registration & Reservation

3c. Fully Centralized Model *based on System Protocol*

Question: Is this model and / or protocol E (User / Network) in scope?

![Diagram showing network model and protocols]
What about the other parts of IEEE 802.1Qcc PAR

- Support for more streams. The current worst case limit is less than 500 streams; there are use cases that require two orders of magnitude greater than this.

- Mechanisms that allow Stream Reservation class (SR class) parameters to be configured

- Inclusion of additional parameters and mechanisms in the stream reservation protocol that support additional applications, such as higher reliability, latency requirements, and latency changes due to network reconfiguration.

- Support for higher layer streaming sessions, such as Real-Time Protocol (RTP)-based sessions.

- Deterministic stream reservation convergence.

- User Network Interface (UNI) for routing and reservations.

=> See PAR proposals on the following slides!
## Motivation for V2 MRP (Multiple Registration Protocol) and V1 MSP (Multiple Signaling Protocol)

<table>
<thead>
<tr>
<th>Pro (also Supported by new Version)</th>
<th>Cons</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of network attributes over context</td>
<td>No fragmentation - limits the number of attributes. This problem is partly solved by spending one separate frame for each application or application instance. The disadvantage of the current solution that high computing power is required for serialization and deserialization.</td>
<td>+ Support Fragmentation</td>
</tr>
<tr>
<td>One basic mechanism for different applications (MVRP, MMRP, ...) Common architecture (application-instance-attribute)</td>
<td>Very complex and intransparent state machines -&gt; difficult to synchronize implementations from different vendors</td>
<td>+ Simplified state machine and synchronization mechanism</td>
</tr>
<tr>
<td>MSRP combines registration and reservation, the attribute size (advertise) is very large and extended the MAP mechanism and introduced four packed events exclusiv for MSRP</td>
<td>The pack mechanism for MRP is not practical (only for special use cases)</td>
<td>+ By introducing fragmentation the packed mechanism is no longer necessary</td>
</tr>
<tr>
<td>Support for more streams. The current worst case limit is less than 500 streams; there are use cases that require two orders of magnitude greater than this.</td>
<td>Support for higher layer streaming sessions, such as Real-Time Protocol (RTP)-based sessions</td>
<td>+ Extending existing applications (MVRP, MMRP, MSRP) to support redundancy and seamless redundancy on precalculated trees + If necessary add a new application like MRRP</td>
</tr>
<tr>
<td>MSRP combines registration and reservation, the attribute size (advertise) is very large and extended the MAP mechanism and introduced four packed events exclusiv for MSRP</td>
<td></td>
<td>+ Optional support for higher layers like IP (e.g. transport higher layer addresses, QoS specifier, ...) by e.g. using TLVs + Managed Objects + TLV's are used to specify the MRP attributes + The mechanism to synchronize the attribute list on a link is comparable to the synchronization mechanism used by ISIS (ISIS-like)</td>
</tr>
</tbody>
</table>

**MRP v1**

**MRP v2** "transport-protocol" for applications like MVRP, MMRP, MSRP, ...

**MSP** ("RSVP like")

("MSP is a separate transport-protocol" for e.g. stream reservation)

+ MSSP (Multiple Stream Signaling Protocol) is an application for MSP which is used for stream reservation, e2e signalling and diagnostic. The context, which is required for forwarding the signal / reservation, is either built by MRP or ISIS-PCR + Optional support for higher layers like IP (e.g. transport higher layer addresses, QoS specifier, ...) by e.g. using TLVs + Managed Objects
Proposals for new PARs (1)

Today:

- **MRP – Multiple Registration Protocol**
  (framework for all MPR applications (e.g. MVRP, MMRP, ... to register network attributes)

- **MRRP – Multiple Relation Registration Protocol**
  (used to register relation ID’s and to nail down the path in combination with BLCE’s)

- **MVRP – Multiple VLAN Registration Protocol**
  (used to register VID’s – e.g. data plane for Streams)

- **MMRP – Multiple MAC Registration Protocol**
  (used to register MAC addresses or “Group Filtering Behavior”)

- **MSRP – Multiple Stream Reservation Protocol**
  (used to register streams and make the reservation)

**PAR Proposal for .1Qcc**

- **PAR 1: New definition of .1Qcc**
  - Maintenance for the existing MSRP protocol and creating YANG modules for Clause 12 specs and UNI interface for ES <> Edge-Bridge + ....

**PAR Proposals for MRP++ and MSP**

- **PAR 2: MRP++**
  - **MRRP – Multiple Relation Registration application**
    (used to register relation ID’s and to nail down the path in combination with BLCE’s)
  - **MVRP – Multiple VLAN Registration**
    application
  - **MMRP – Multiple MAC Registration application**
    (used to register “Group Filtering Behavior” or to register MAC addresses)
  - **MSRP – Multiple Stream Registration application**
    (used to register (no reservation) streams)

- **MRP++ – Multiple Registration Protocol**
  (Transport protocol for all MPR applications to register network attributes)

- **PAR 3: MSP**
  - **MSSP – Multiple Stream Signalling application**
    (used to Do stream reservation)

  - **MRSP – Multiple Rate Constrained Traffic Signalling application**
    (used for service reservation – also required for a converged network like TSN)

- **MSP – Multiple Signalling Protocol**
  (related to RSVP)

  (Transport protocol for all MSP applications to do reservations)
Data model for splitting the existing MSRP to MSRP on MRP++ and MSSP on MSP

<table>
<thead>
<tr>
<th>New Static Information</th>
<th>Dynamic Information</th>
</tr>
</thead>
</table>

### MSRP on MRP

<table>
<thead>
<tr>
<th><strong>Talker Advertise</strong></th>
<th><strong>Talker Failed</strong></th>
<th><strong>Listener</strong></th>
<th><strong>Domain</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>StreamID</td>
<td>StreamID</td>
<td>StreamID</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>Talker Sys-ID</td>
<td>Talker Sys-ID</td>
<td>Unique-ID</td>
<td>Unique-ID</td>
</tr>
<tr>
<td>Unique-ID</td>
<td>Unique-ID</td>
<td>StreamClassID</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>DataFrameParameters</td>
<td>Dest-Address</td>
<td>Dest-Address</td>
<td>Dest-Address</td>
</tr>
<tr>
<td>VID</td>
<td>MaxFrameSize</td>
<td>MaxFrameSize</td>
<td>MaxFrameSize</td>
</tr>
<tr>
<td>MaxInterval</td>
<td>Tspec</td>
<td>MaxInterval</td>
<td>MaxInterval</td>
</tr>
<tr>
<td>PriorityAndRank</td>
<td>DataFramePriority</td>
<td>PriorityAndRank</td>
<td>DataFramePriority</td>
</tr>
<tr>
<td>Rank</td>
<td>AccumulatedLatency</td>
<td>Rank</td>
<td>Rank</td>
</tr>
<tr>
<td>PortTxMaxLatency</td>
<td>FailureInformation</td>
<td>BridgID</td>
<td>FailureCode</td>
</tr>
</tbody>
</table>

### MSRPv2 on MRP++

<table>
<thead>
<tr>
<th><strong>Talker Advertise</strong></th>
<th><strong>Listener</strong></th>
<th><strong>Domain</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>StreamID</td>
<td>StreamID</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>Talker Sys-ID</td>
<td>Talker Sys-ID</td>
<td>Unique-ID</td>
</tr>
<tr>
<td>Unique-ID</td>
<td>Unique-ID</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>DataFrameParameters</td>
<td>Dest-Address</td>
<td>Dest-Address</td>
</tr>
<tr>
<td>VID</td>
<td>Rspec</td>
<td>MinRecvInterval</td>
</tr>
<tr>
<td>Tspec</td>
<td>Listener ID</td>
<td>Listener Sys-ID</td>
</tr>
<tr>
<td>MaxFrameSize</td>
<td>MaxInterval</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>MaxInterval</td>
<td></td>
<td>StreamClassID</td>
</tr>
<tr>
<td>PriorityAndRank</td>
<td>DataFramePriority</td>
<td>StreamClassID</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td>StreamClassID</td>
</tr>
</tbody>
</table>

### MSSP on MSP

<table>
<thead>
<tr>
<th><strong>MSRPv2 on MRP++</strong></th>
<th><strong>Domain</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>StreamID</td>
<td>StreamID</td>
</tr>
<tr>
<td>Talker Sys-ID</td>
<td>Talker Sys-ID</td>
</tr>
<tr>
<td>Unique-ID</td>
<td>Unique-ID</td>
</tr>
<tr>
<td>PortTxMinLatency</td>
<td>PortRxMinLatency</td>
</tr>
<tr>
<td>PortTxMaxLatency</td>
<td>PortRxMaxLatency</td>
</tr>
<tr>
<td>State</td>
<td>Ready / ReadyFailed / Failed</td>
</tr>
<tr>
<td>AccumulatedLatency</td>
<td>AccumulatedRspec</td>
</tr>
<tr>
<td>(Calculated downstream)</td>
<td>AccMinRecvInterval</td>
</tr>
<tr>
<td>List&lt;FailureInformation&gt;</td>
<td>List&lt;FailureInformation&gt;</td>
</tr>
<tr>
<td>State</td>
<td>Ready / ReadyFailed / Failed</td>
</tr>
<tr>
<td>BridgID</td>
<td>FailureCode</td>
</tr>
<tr>
<td>FailureCode</td>
<td>BridgID</td>
</tr>
<tr>
<td>List&lt;FailureInformation&gt;</td>
<td>List&lt;FailureInformation&gt;</td>
</tr>
</tbody>
</table>
synchronizing Network Attributes (e.g. VLAN, MAC Address, Stream description, ...)

MRP++ Architecture
<table>
<thead>
<tr>
<th>State</th>
<th>R</th>
<th>D</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty</td>
<td>0</td>
<td>0</td>
<td>delete</td>
<td>No Attribute</td>
</tr>
<tr>
<td>Declared</td>
<td>0</td>
<td>1</td>
<td>---</td>
<td>Declare / announce a &quot;New Attribute&quot;</td>
</tr>
<tr>
<td>Registered</td>
<td>1</td>
<td>0</td>
<td></td>
<td>&quot;New Attribute&quot; registered</td>
</tr>
<tr>
<td>Established (Registered &amp;</td>
<td>1</td>
<td>1</td>
<td>ready</td>
<td>&quot;Attribute&quot; registered and declared</td>
</tr>
<tr>
<td>Declared)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MRP++ Frame Format

Frame:

- **Header**
  - **Version**
  - **Expected Length (in Bytes)**

- **Application List**
  - **Application**
    - **Application-ID**
    - **Length (in Bytes)**
  - **ApplicationInstance**
    - **Instance-ID**
    - **Length (in Bytes)**
  - **SortedAttributeList**
    - **List Count (Number of Elements in the List)**
    - **Attribute-Size (in Byte) + Status-Size (in Byte)**
    - **Checksum over Attribute Values**
      - **Attribute-Value**

Fragment:

- **Expected Length in Bytes (≠ Rest)**

REST OF FRAME
This presentation set is just a proposal to increase

- performance,
- supported number of streams,
- new features (like (seamless) redundancy, reduced latency, configurable traffic classes, …)
- performance of services (e.g. synchronization over redundant path),
- interoperability (to .1Qca, RSVP of IETF, implementations, …)

and to make more progress in the IEEE TSN project especially in .1Qcc project.

-> If there is no interest -> “Let it be!”
(Just for interest)
Proposals for other new PARs

Other PAR-Proposals

PAR 4: „device level“ YANG modules
- „This specifies YANG modules for 802.1Q Clause 12. This is the bottom level YANG (per bridge).“

PAR 5: „service level“ YANG modules
- This is high level YANG (topology-wide)
- There is an IETF I-D on this topic: https://datatracker.ietf.org/doc/draft-clemm-i2rs-yang-network-topo
  If we assume this I-D will proceed to RFC, 802.1’s role would be to specify an “augment” to this module for 802.1Q bridges. The augment should connect the top-level to the bottom-level.
Thank you for your attention!

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