Web Service Reliability

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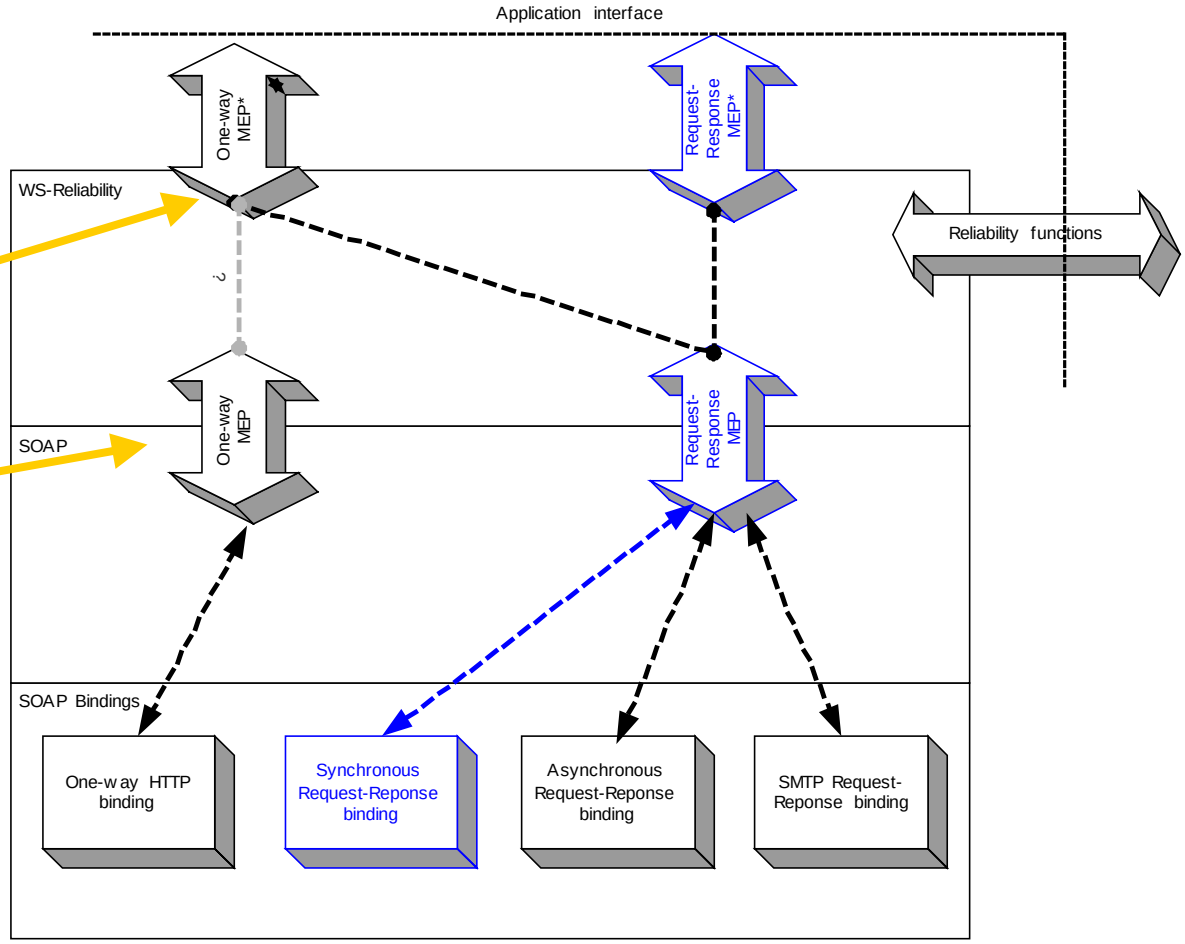
What is Web Service Reliability?

- Web Service Reliability is a **communication layer** in a Web Services protocol stack.

Ws-Reliability offers Reliable SOAP MEPs upwards, and uses Standard SOAP MEPs downwards



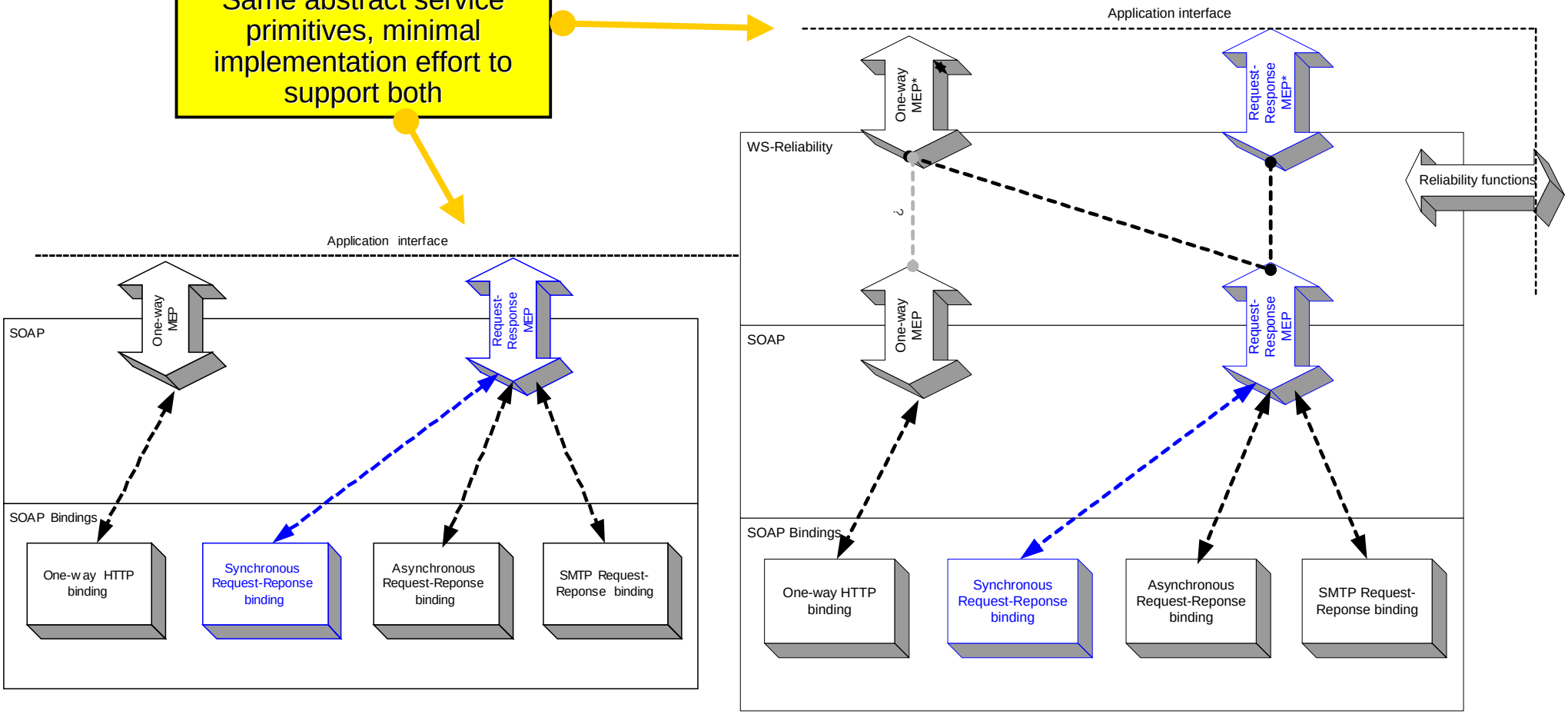
Blue = standard SOAP

Extension of existing SOAP

Standard SOAP

SOAP with WS-Reliability

Same abstract service primitives, minimal implementation effort to support both



Reliability aspects

- **Guaranteed delivery**: ensure that all information to be sent actually received by the destination or error reported.
- **Duplicate Elimination**: ensure that all duplicated information can be detected and filtered out.
- **Ordering**: communication between parties consist of several individual Message Exchanges. This aspect ensures that Message Exchanges are forwarded to the receiver application in the same order as the sender application issued.
- **Crash tolerance**: ensures that all information prescribed by the protocol is always available regardless of possible physical machine failure.
- **State synchronization:** If the MEP is cancelled for any reason then it is desirable for both nodes to set their state as if there were no communication between the parties.

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Business use cases for the same service (MMS)

- Advertisement company wants to send bulk MMS ads to its 15000 registered customers.
  - Duplicate Elimination is a nice-to-have (no disturbing multiple ads)
  - Guaranteed Delivery and Ordering not needed (cost-effectiveness is more important)
  - Crash tolerance not seen important
- Advertisement company wants to send customized ad MMS to one of its customers
  - Duplicate Elimination is a nice-to-have (no disturbing multiple ads)
  - Guaranteed Delivery needed (cost of customization should be guaranteed)
  - Ordering not needed
  - Crash tolerance is less important than price of service
- Mobile payment company sends payment receipt in MMS to customer
  - Duplicate Elimination is important
  - Guaranteed Delivery needed
  - Ordering not needed
  - Crash tolerance is important

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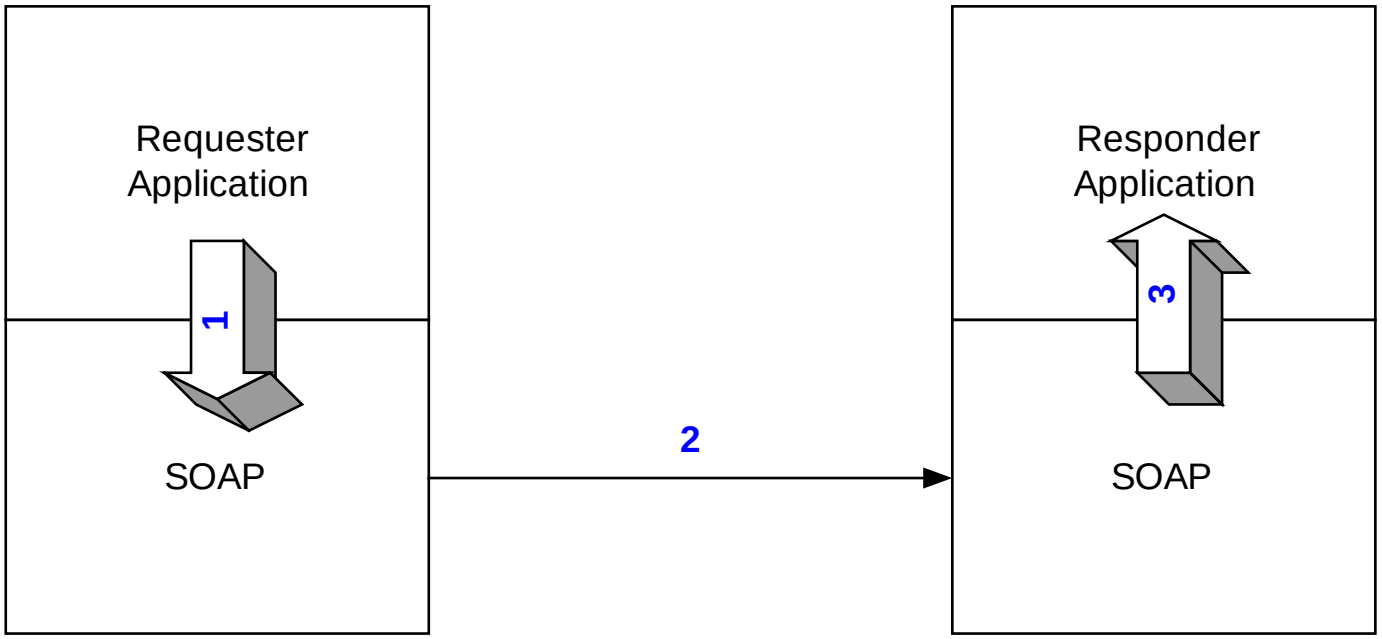
SOAP One-Way Message Exchange Pattern

- It is a new MEP, as it is not defined in SOAP specification.
- Must be defined to cover original Sun use cases.



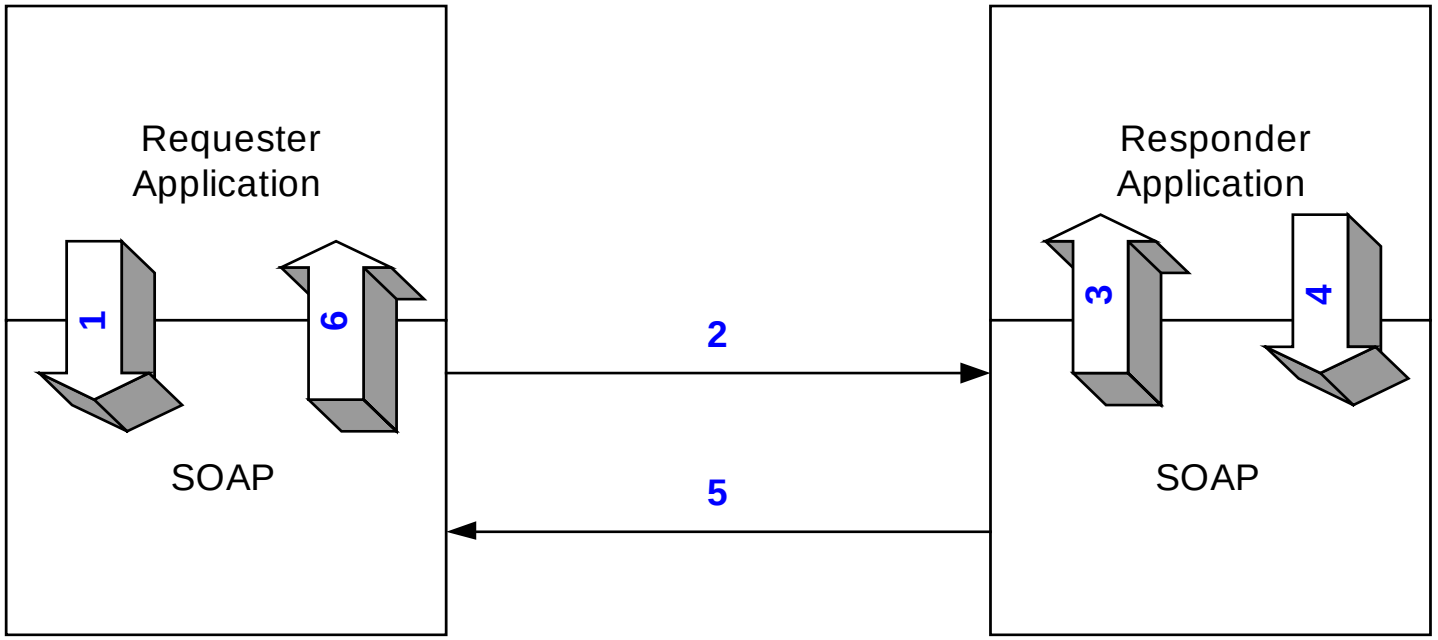
1: SOAP message initiated trough the API
2: SOAP message sent on-the-wire using the actual transport binding
3: Responder Application notified about the incoming message

Guaranteed delivery for One-Way MEP

- Must be solved if SOAP Transport **binding** is not guaranteeing delivery

- From Requester point of view
  After step 1 either
  - Message delivered or
  - Error reported

SOAP Request-Response Message Exchange Pattern



1: SOAP request initiated trough the API
2: SOAP request sent on-the-wire using the actual transport binding
3: Responder Application notified about the incoming request
4: Responder application answers
5: SOAP response sent on-the-wire using the actual transport binding
6: Requester application notified about the answer

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Guaranteed delivery for Request-Response MEP

- Must be solved if SOAP Transport **binding** is not guaranteeing delivery (This is the case with the standard HTTP binding)
- From Requester point of view
  After step 1 either
  - Step 6 will occur at some time (Message Exchange closed) or
  - Error reported
- From Responder point of view
  After step 4 either
  - Step 6 will occur at some time (Message Exchange closed) or
  - Error reported

- Both must be satisfied
- Because Responder depends on Step 6, MEP must be extended for delivering information to Responder after step 4.

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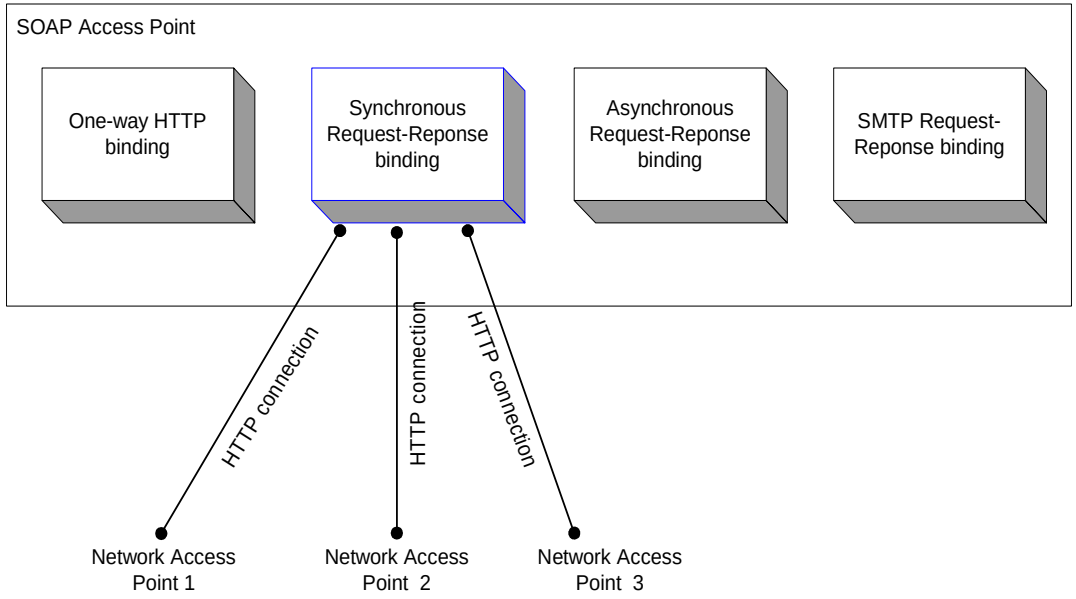
Duplicate elimination (for all MEPs)

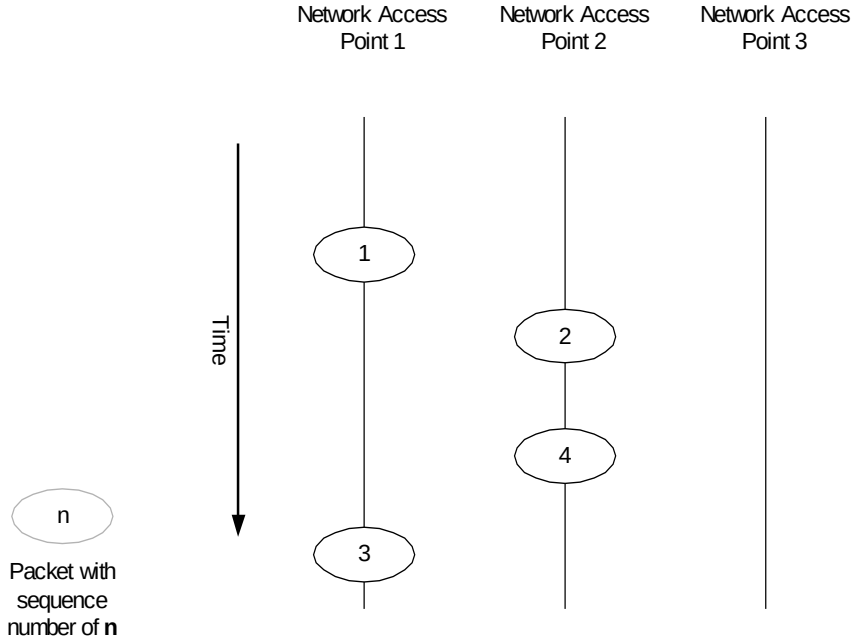
- Must be solved if transport binding doesn’t offer duplicate elimination
- Duplicated messages must not be received by the application

Ordering (for all MEPs)

- Ordering of Message Exchange Patters must be solved if
  - Transport binding doesn't ensure ordering of messages

    or
  - Multiple network access points are used between two communication parties (see figures below)
- Be aware, that using Ordering means a kind of session !





Crash tolerance (for all MEPs)

- Crash tolerance should be an optional feature with more levels

- No persistent storage
  - lost message content without specific indication of crash
  - possible replay
- Persistent storage of MEP metadata
  - lost message content, but specific indication of crash
  - MEP replay is not possible
- Persistent storage of MEP metadata and content
  - No lost content
  - No replay

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State synchronization (for all MEPs)

- There are cases when MEP is broken despite of any effort (for example network cable is cut)

- The problem can be solved by persistent storage of message contents for unlimited time
- If this is not possible then consistent states on both ends can be ensured by rollback on the Responder side
  - If Rollback is available, then in case of broken MEP, the state of Responder must be set back to pre-MEP state.
- If not possible then application level action is needed to synchronize states on both ends (!)

Requirements

- Maximal reuse of existing implementations
  - Interoperability with SOAP nodes not supporting the reliability feature
    - » Fallback to non-supporting mode
    - » Indication by the source if fallback is acceptable
  - API offered by Reliable SOAP should be an extension of what classic SOAP offers
  - SOAP Message Exchange Patterns should be supported
  - SOAP Transport bindings should be supported
- Persistent storage must not be mandated
  - It must not be indicated as a mandatory feature in the specification to store messages in a persistent storage.
- Levels of reliability should be defined
  - Choose **duplicate elimination** or **reliable message delivery** as possible functionalities. **Message ordering** is not a high priority for us, it should be optional. Strict s**tate synchronization** should be optional.
  - Minimal levels of **persistent storage** usage:
    - » Persistent storage of all message content
    - » Persistent storage of MEP metadata
    - » No persistent storage of any data
- SOAP **intermediaries** should be supported

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Solution

- Definitions:
  - *Standard Request-Response MEP* is the MEP defined by SOAP 1.2 Part 2 that is equivalent with the SOAP 1.1 HTTP binding.
  - Here we denote the content of the Standard Request-Response MEP as a *Standard Request* and a *Standard Response*.

- Solution proposal:

Only for consistency

  - Define a (very simple) state machine for the One-Way MEP (according to SOAP 1.2 Part 2 Section 6)
  - The HTTP binding for One-Way MEP is already defined in WS-I Basic Profile
  - Define two **state-machines:**
    - Reliable One-way MEP using Standard Request-Response MEP
    - Reliable Request-Response using Standard Request-Response MEP

(All details are not covered here)

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Reliable One-way MEP

- Consist of a Reliable Message abstract service primitive

- Needs two transport-level, logical messages:
  - **Req:** A message conveying the content of the Reliable Message. (Requester -> Responder)
  - **Ack:** A message containing an acknowledgement (Responder -> Requester)

- The logical messages are bound to the Standard Request-Response MEP the following way:
  - **Req** is conveyed in the Standard SOAP Request
    - There is a mandatory SOAP header indicating that this is a Reliable One-Way MEP
  - **Ack** is conveyed in the Standard SOAP Response
    - <SOAP:Body> is empty, <Ack> header entry added.

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Reliable Request-Response MEP

- Consists of a *Reliable Request* and a *Reliable Response,* otherwise the state machine is equivalent with Standard Request-Response MEP's state machine
- Needs three transport-level logical messages:
  - **Req** (Requester -> Responder) containing the Reliable Request
  - **Rsp** (Responder -> Requester) containing the Reliable Response and means implicit acknowledgement of **Req**
  - **Ack** (Requester -> Responder) is the explicit acknowledgement of **Rsp** and closure of MEP
- The logical messages are bound to the Standard Request-Response MEP the following way:
  - **Req** is conveyed in the Standard SOAP Request
    - There is a mandatory SOAP header indicating that this is a Reliable Request-Response MEP
  - **Rsp** is conveyed in the Standard SOAP Response
    - There is an optional SOAP header indicating that reliable messaging is accepted.
  - **Ack** can be conveyed in
    - In an optional <Ack> header entry of a subsequent MEP's **Req**
    - In an <Ack> header of a Standard SOAP Request with empty <SOAP:Body>

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