An Extensible Architecture for Run-time Monitoring of Conversational Web Services

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Outline

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Monitoring Conversation Web Services

- Even if a Web service was fault-free during testing, it could deviate during run-time, since its context of execution is subject to continuous change.
- A service provider could modify a Web service without prior notifying all consumers, or a Web service could be substituted within a composite Web service.
- Monitoring is the primary trigger for adaptation in service-based applications.
- Conversational Web services introduce added complexity when it comes to monitoring (conversational protocol / state per consumer).

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Logical Classification of Monitors

- We have identified two approaches for constructing monitors:
  1. *Heavy-weight* monitor: A single monitor supports the monitoring of different aspects of a Web service.
  2. *Light-weight* monitor: A single monitor supports the monitoring of one aspect of a Web service. Several light-weight monitors can be used to monitor diversified aspects of a service.

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Monitoring Scalability

- We have identified two approaches for scaling monitoring capabilities:
  1. A single service acting as a message gateway for forwarding all requests/responses of the monitored services to specific monitors, which can be added and removed at run-time.
  2. A pool of different individual monitor services that are being attached to the monitored services at run-time.

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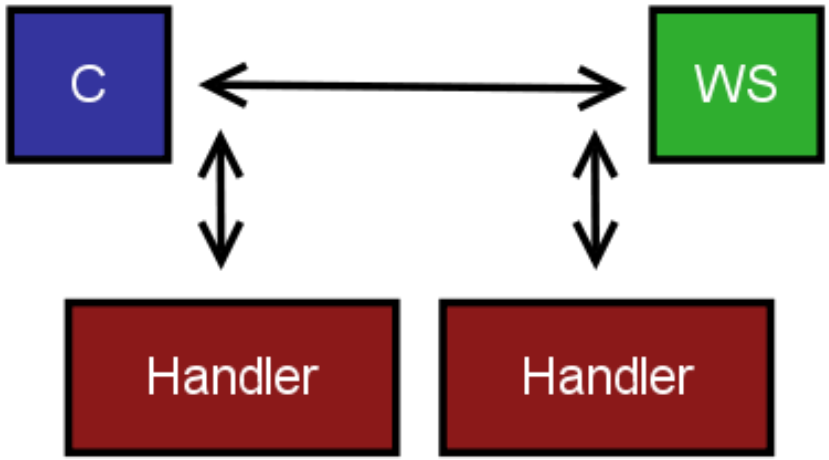
Message Interception Techniques

1. Handler-Based Interception
2. Wrapper-Based Interception
3. Proxy-Based Interception

Handler-Based Interception

- A handler is attached to the monitored service and/or to the consumer.
- The request/response messages are processed first by the handler.

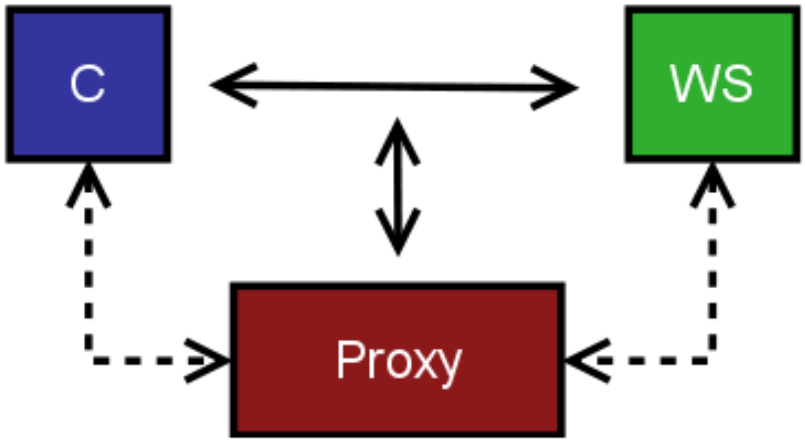


Wrapper-Based Interception

- The monitored service is wrapped within another service.
- The wrapper mediates between the service and the consumer.

Proxy-Based Interception

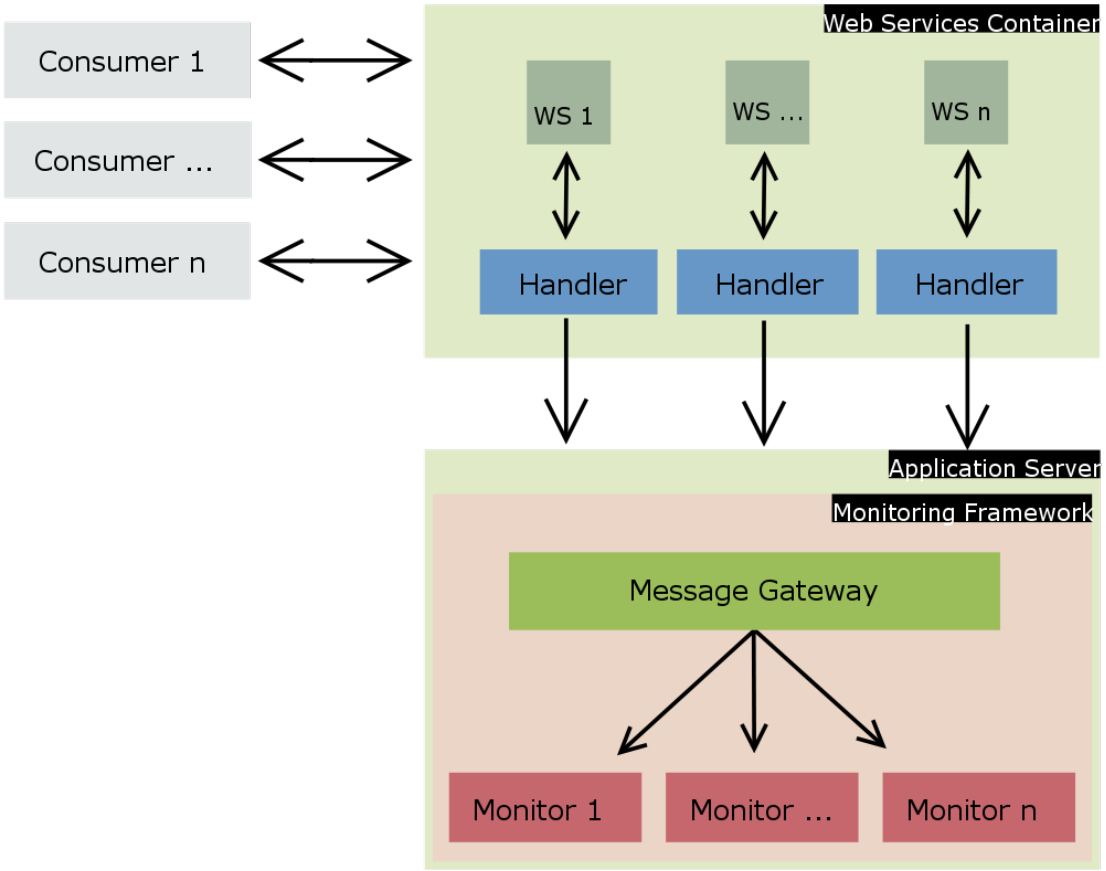
- An intermediate node acts as a network proxy.
- It transparently intercepts the messages.



Monitoring Session Handling

- For each instance of the monitored Web service, a new monitoring session is created.
- The monitoring session is uniquely identified by a monitoring session identifier (MSID).

The Monitoring Architecture



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Integration of a Behavioural Conformance Monitor

- JSXM is a model-based testing tool which uses the Stream X-Machine (SXM) formalism, in order to generate test cases and animate an SXM model.
- The functionality of JSXM was exposed through an API and it was integrated in the architecture as a monitor.
- The JSXM-based monitor is able to check the behavioural conformance of a Web service using an SXM model as an oracle.


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- JSXM works as follows:
  1. JSXM transforms the actual Web service requests and responses to SXM inputs and outputs.
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Evaluation setup

- The evaluation involved a linearly increasing number of consumers accessing concurrently a monitored service.
  - 4 different interaction scenarios were used by the consumers.
- A conversational service was deployed in JBoss AS, in order to be the service under monitoring.
- The monitoring framework was deployed in the same server.
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  - 4GB Ram
  - openSUSE 11.2

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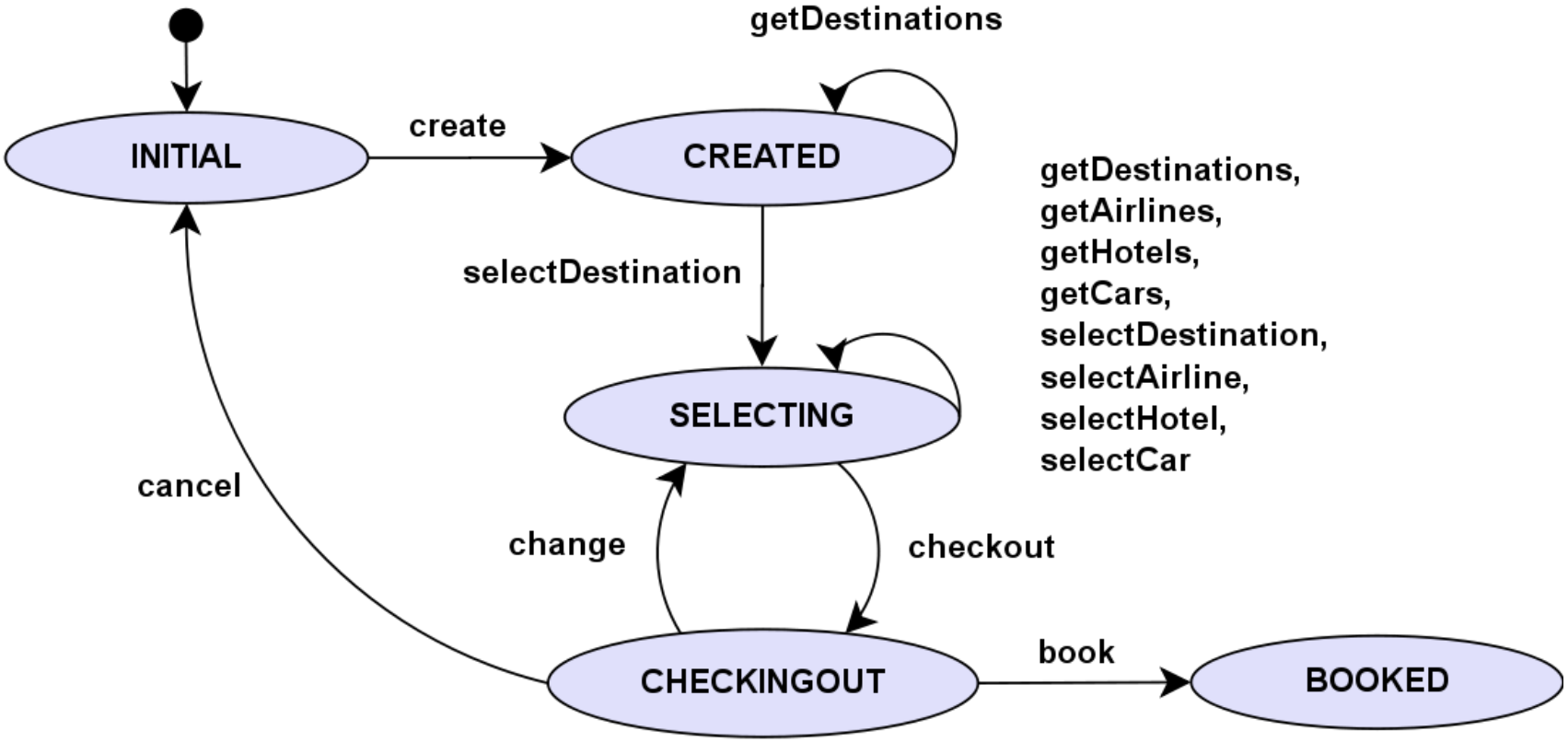
TravelAgency Web Service



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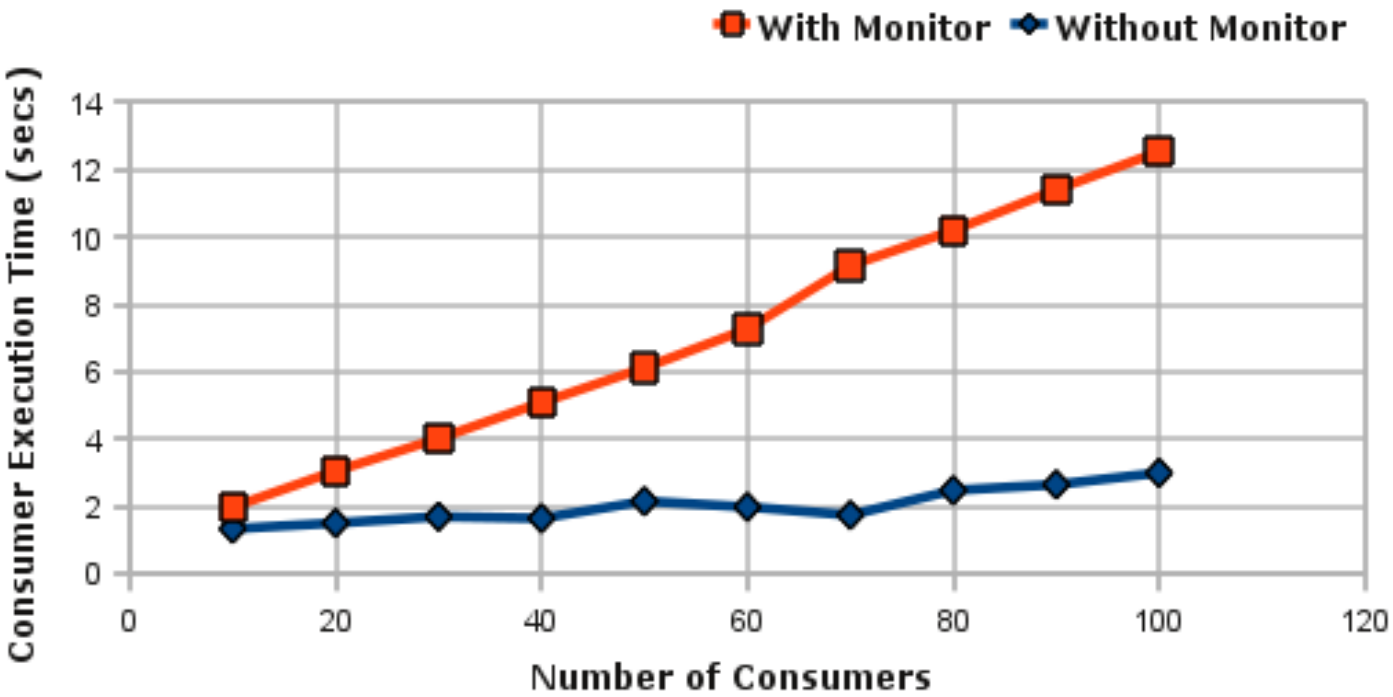
Evaluation Scenarios

Interaction scenarios containing different execution sequences.

Scenario	Effect	Execution
1	Booked	Succeeds
2	Booked with car	Succeeds
3	No hotel is selected	Fails
4	No checkout is done	Fails

Experimental Result



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Future directions

- Improve the implementation of the monitoring architecture to support monitoring of long-running (persistent) Web service interactions.
- Investigate extensions for supporting the integration of monitors for both non-functional and functional aspects of conversational as well as non-conversational Web services.
- Integrate existing monitoring tools from the literature to the monitoring architecture.
- Continue evaluating the monitoring architecture using more complex monitoring scenarios.

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Conclusions

- A primary objective of the implemented monitoring architecture was to provide a platform for integrating cross-layer monitoring approaches for Web services.
- Implementing a monitoring architecture for Web services involves issues such as message interception, session handling and concurrency.
- The presented monitoring architecture is agnostic to the interception mechanism used.
- Finally, the architecture is not bound to a specific vendor and thus it can be fully utilised within service-based applications.

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Thank you for your attention! ...Questions?

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