

Monitoring Cross-Site Processes Executed across Heterogeneous WS-BPEL Processors

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Background and Issue

Background

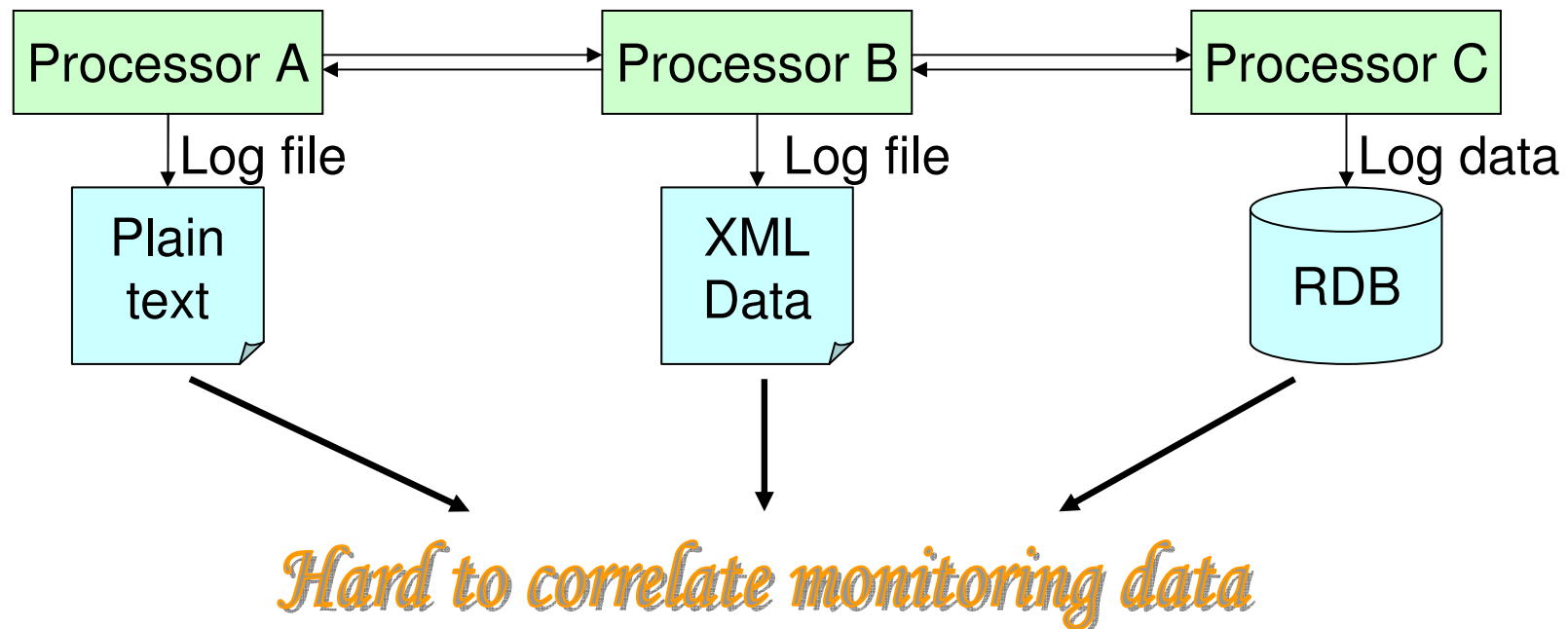
- Trend of Enterprise Systems
 - Integration of services and processes among distributed organizations and companies
 - Integration with Service Oriented Architecture (SOA) and Business Process Execution Language (WS-BPEL)



- Enterprise Systems become large-scale, heterogeneous, integrated process (Heterogeneous Cross-site process)
- Monitoring for Heterogeneous Cross-site process is important from viewpoint of Business Process Management

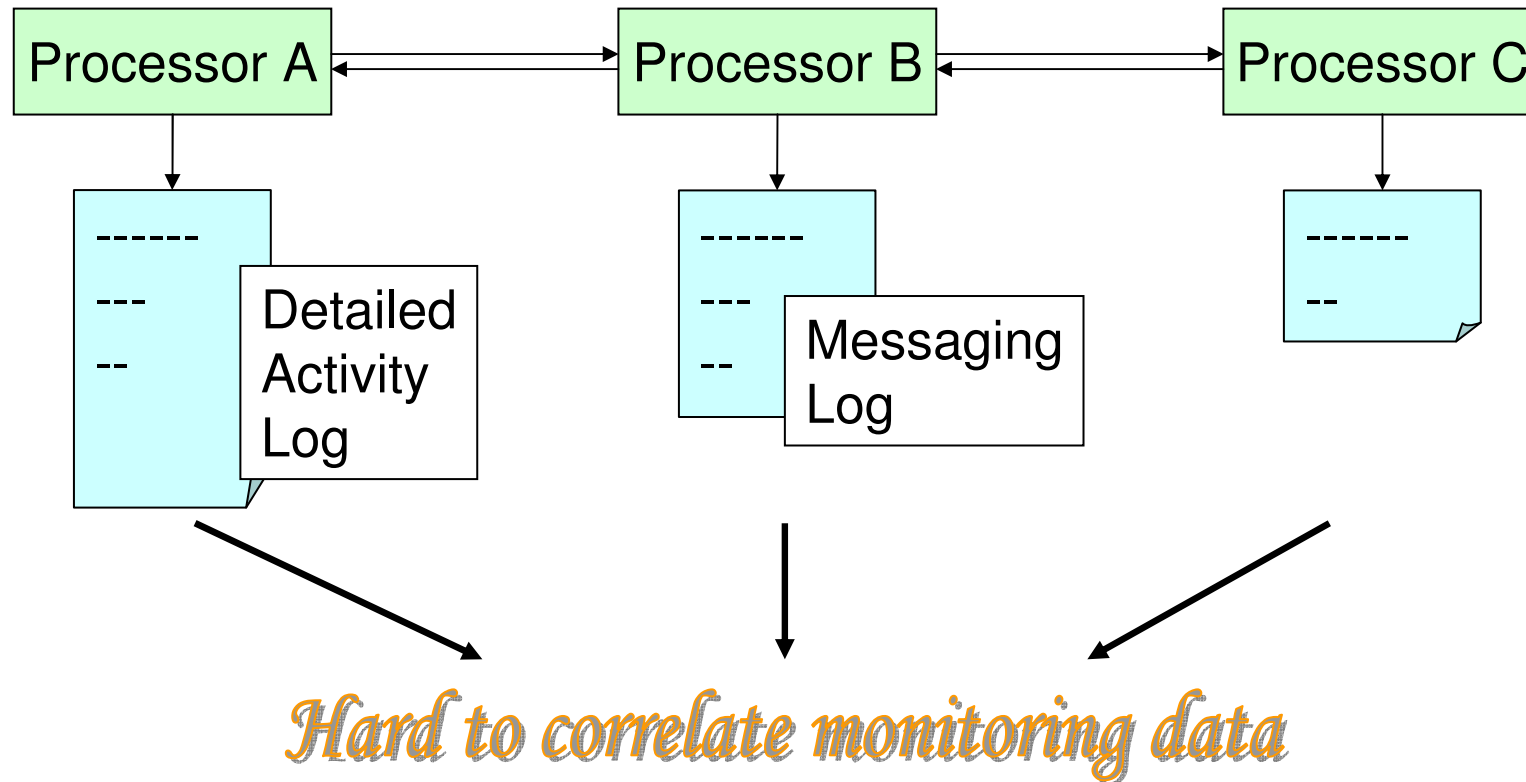
Issues for Monitoring Heterogeneous Cross-Site Process

- Difference of monitoring data format
 - Plain text log, XML, RDB data, etc.



Issues for Monitoring Heterogeneous Cross-Site Process

- Difference of monitored items



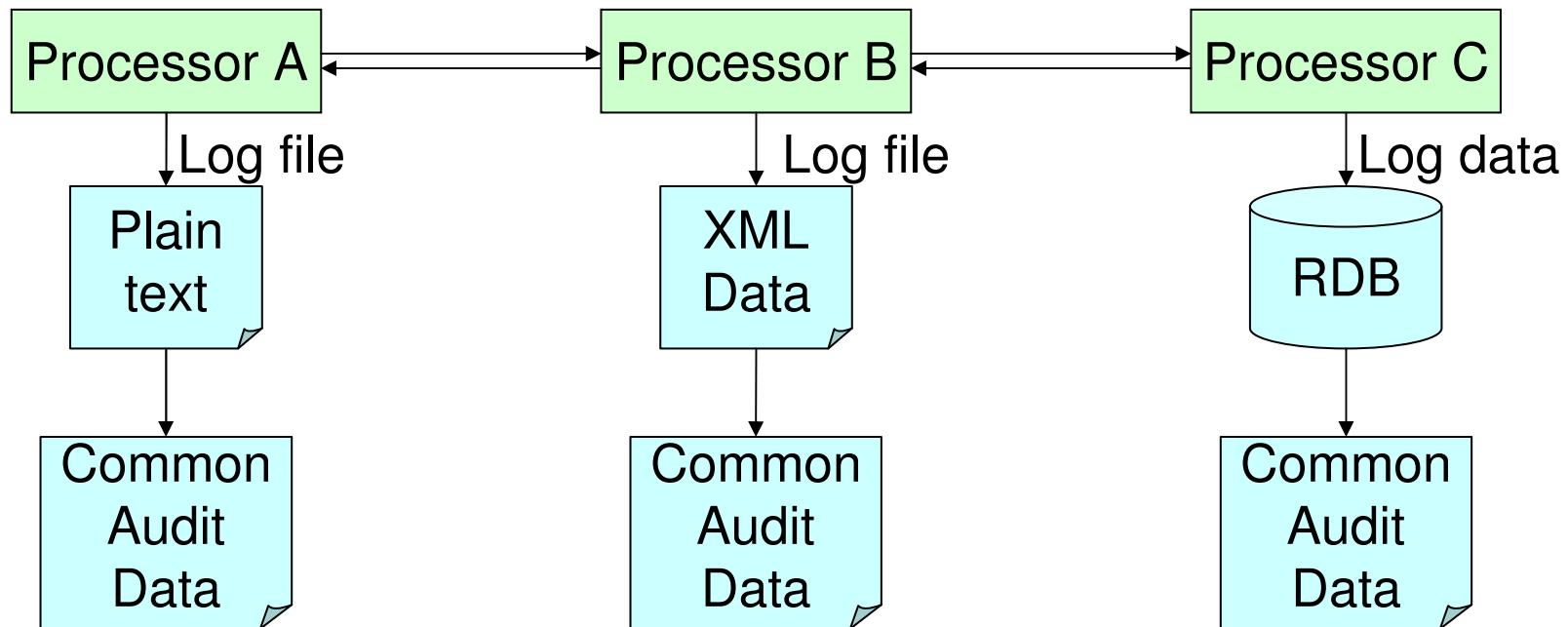
The reason why monitoring items differ

- Difference of WS-BPEL processor implementation
 - Optimization
 - sequence, scope -> omitted
 - assign -> put together
 - Translation
 - WS-BPEL -> Java
 - WS-BPEL -> XPDL
- Difference of Reporting (Logging) Function
 - Granularity of log data is different
 - Not all activities are logged

Solution

Issue: Difference of Monitoring Data Format

Solution: Define Common Audit Data Format to unify Monitoring Data Format

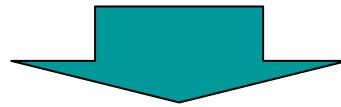


Can be correlated

Issue: Difference of Monitoring Items

Solution:

Define common monitoring items which satisfy appropriate monitoring level

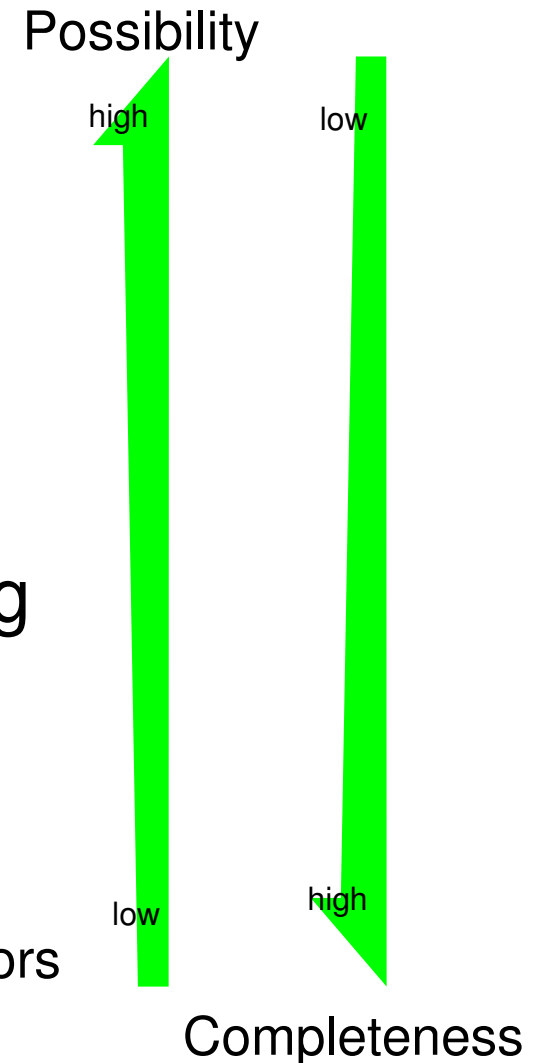


What is “appropriate monitoring level”?

- Monitorable from usual WS-BPEL processors
 - If not, some processors of heterogeneous process cannot be monitored
- Sufficient for monitoring cross-site process
 - If not, each processors can be monitored, their result is not meaningful for cross-site process monitoring

Monitoring Level

1. **Site-level monitoring**
 - Messaging between sites are monitored
2. **Process-level monitoring**
 - Messaging between process instances are monitored
3. **Messaging-activity-level monitoring**
 - Messaging among WS-BPEL activities are monitored
4. **Activity-level monitoring**
 - All Messaging and WS-BPEL activity behaviors are monitored



Appropriate Monitoring level

- Monitoring all WS-BPEL activities is not possible
 - Not all activities are logged
 - Some activities are optimized

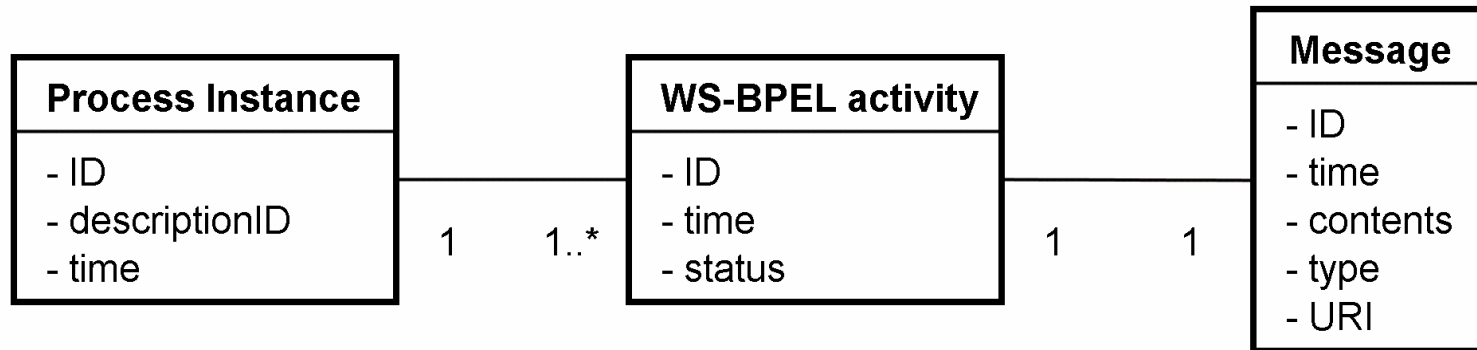
Activity level monitoring is not feasible

- Messaging activities must be executed as defined in WS-BPEL
 - Messaging must not be omitted
 - Messages must be sent or received as described in WS-BPEL
- Messaging are important for designers and operators
 - Messaging should be monitored

Messaging-activity-level monitoring is feasible

Common Audit Data Format

- Structure

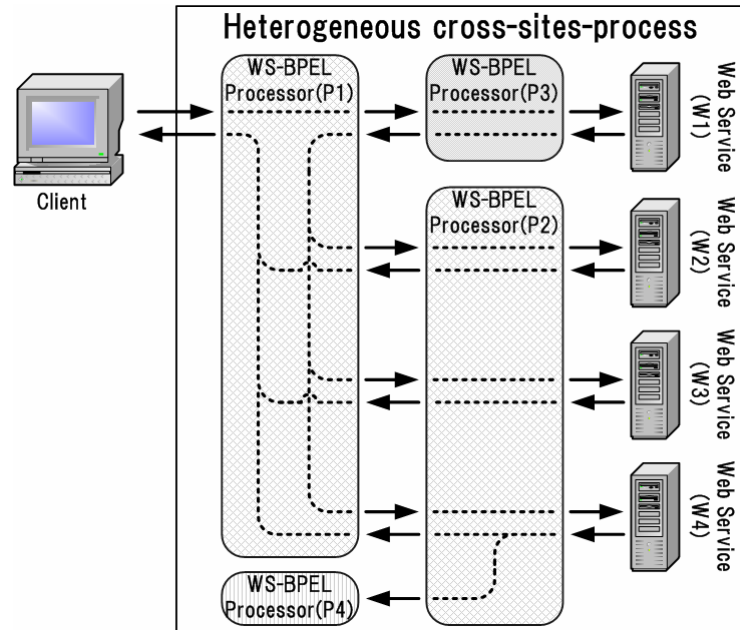


Example

```
<soapenv:Envelope ...>
  <soapenv:Header>
  :
</soapenv:Header>
  <soapenv:Body>
    <aq:BPMAudit>
      <aq:processInstance>
        <aq:sequenceNo>2995</aq:sequenceNo>
        <aq:processInstanceId>1198739206031_1987___urn:uuid:a-bpm1</aq:processInstanceId>
        <aq:status>running</aq:status>
        <aq:processDefId>lgAbp</aq:processDefId>
        <aq:activity>
          <aq:date>2007-12-27T10:50:51.437Z</aq:date>
          <aq:activityId>/bpel:process[1]/bpel:sequence[1]/bpel:switch[1]/bpel:case[1]/bpel:sequence[1]/bpel:flow[1]/
            bpel:sequence[1]/bpel:switch[1]/bpel:case[1]/bpel:scope[1]/bpel:sequence[1]/receive[1]</aq:activityId>
          <aq:status>end</aq:status>
          <aq:message>
            <aq:messageId>01216867N</aq:messageId>
            <aq:messageContents> ... </aq:messageContents>
            <aq:type>incoming</aq:type>
            <aq:processedDate>2007-12-27T10:50:51.437Z</aq:processedDate>
          </aq:message>
        </aq:activity>
      :
    </aq:processInstance>
    :
  </aq:BPMAudit>
</soapenv:Body>
</soapenv:Envelope>
```

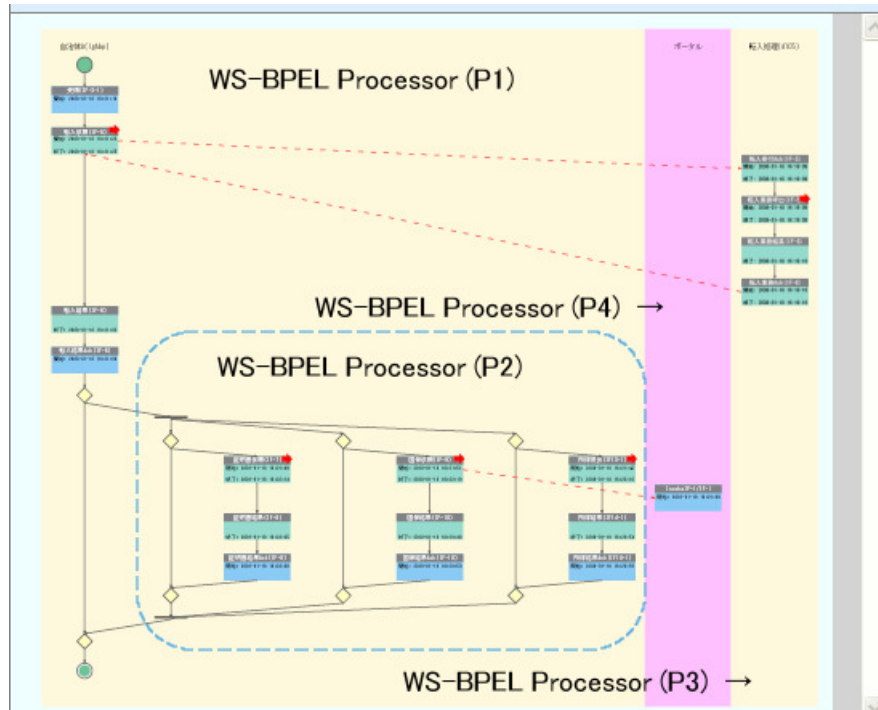
Implementation and Experiment

Experiment Environment



- 3 types of WS-BPEL processors
- Monitoring modules for each type of WS-BPEL processor
- 4 Web services
- 2 types of monitoring applications

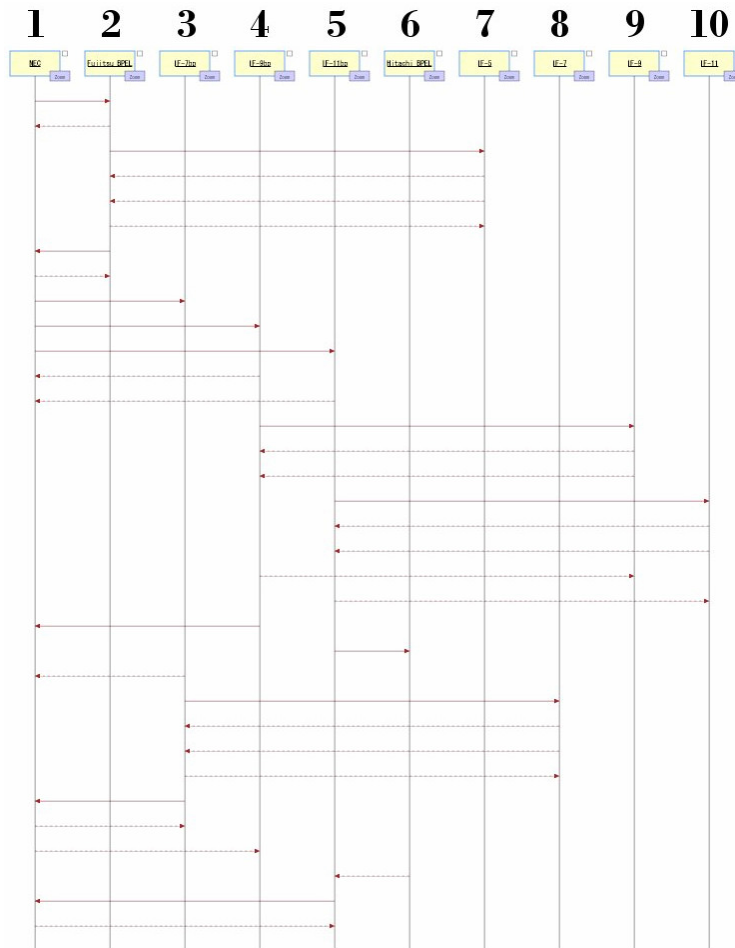
Result of Monitoring (1)



Monitoring result of Fujitsu monitoring application

- Common audit data of 3 WS-BPEL processors can be uniformly monitored
- Messaging between activities can be monitored by this monitoring application

Result of Monitoring (2)



- Common audit data of 3 WS-BPEL processors can be uniformly monitored
- Messaging between activities can be monitored by this monitoring application

Monitoring result of NEC monitoring application

Conclusion and Future work

Conclusion

- Common audit data could be implemented in 3 independently developed processors
 - Possibility of messaging-activity-level monitoring is confirmed
- Heterogeneous cross-site processes could be monitored using the common audit-data
 - Messaging-activity-level monitoring is suitable for heterogeneous cross-site process monitoring

Future work

- Support all WS-BPEL descriptions
 - Compensation
 - Fault handlers
- Support other business-process languages
 - XPDL
- Solve remaining issues
 - Security
 - Support much more processors
 - Standardization

Empowered by Innovation

NEC