

Mobile Web Services Mediation Framework

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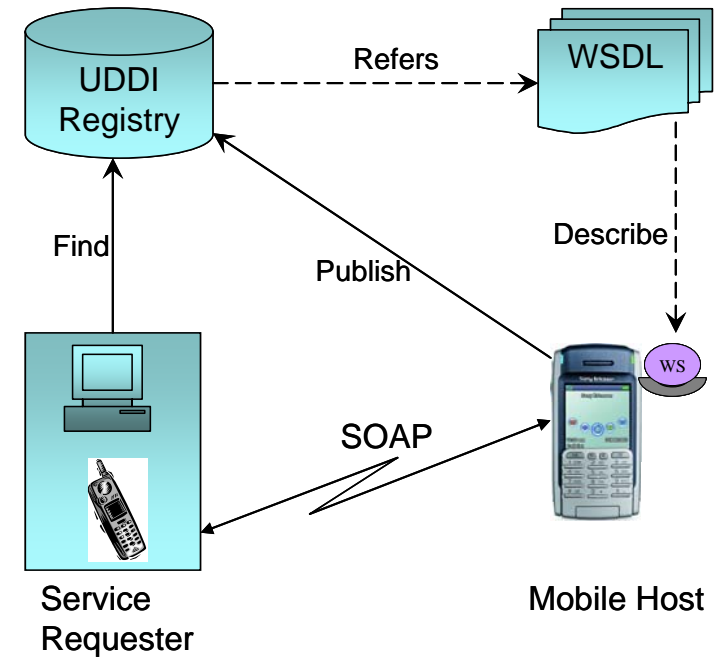


Outline

- Mobile Host
- Mobile Host: QoS extensions
- Mobile Host in P2P networks
- Mobile Web Services Mediation Framework
- Realization of MWSMF
- Conclusions and future research directions

Mobile Host

- Wireless developments
- Mobile web services [LA, OMA]
- Mobile web service provisioning
- Implementation details
 - Implemented in PersonalJava
 - Uses kSOAP2
 - SOAP over HTTP
 - Upgraded to J2ME
- Performance analysis
 - Acceptable performance levels for service delivery
 - The WS processing time at the Mobile Host (< 10%)
 - Directly proportional to achievable transmission rates
 - High data transmission rates with 3G & 4G



Mobile Host QoS extensions – Security issues

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- Security breaches
- End-to-end security
- Security Standards for web services
 - XML Encryption [W3C]
 - XML Signature [W3C]
 - WSSE (WS-Security Standard) [OASIS]
 - SAML (Security Assertion Markup Language) [OASIS]
- Adaptability of WSSE for mobile web services
- Bouncy Castle Lightweight cryptographic API



Security results

- Confidentiality & Integrity can be provided for reasonable message sizes of 2kb
- Extra time to the WS invocation cycle is ~ 2 sec with Confidentiality
- Integrity latency is 2 sec
- Signing on top of encryption ~3.5 sec
- Best scenario (Highly secured and better performance)
 - AES-256 Symmetric key encryption
 - RSA 1024 bit key exchange
 - RSAwithSHA1 signature
- Best scenario forces the need for a mediation framework

Mobile Host QoS extensions – Scalability issues

- Scalability aspects
 - To achieve less data to transmit
 - Significant for Mobile Host
 - Transmission time constitutes 90% of invocation cycle latency
 - Improves battery life

- Size of MWS message

$$B_{msg} = B_{tp} + B_{mtp} + B_{soap} + B_{app}$$

- Minimal encoding is not always the best option
- XML Compression

- XMill [Liefke and Suciu, 1999]
- Fast Infoset [Sandoz et al., 2004]
- Efficient XML [AgileDelta]

Scalability analysis

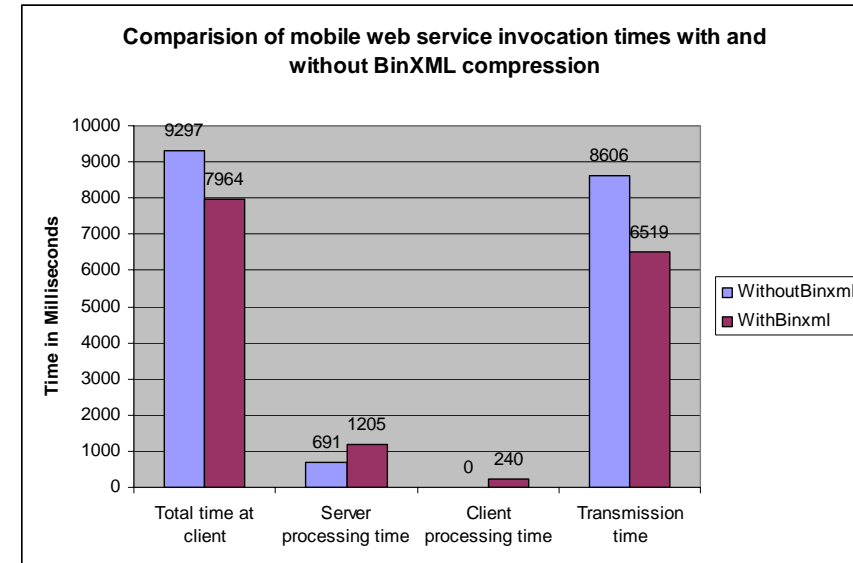
- **BinXML** [Ericsson and Levenshteyn, 2003]
 - XML tags replaced by Unique byte value
 - 6 reserved bytes (0x00-0x03, 0xFE, 0xFF)
 - Effective for SOAP messages

- **Analysis**

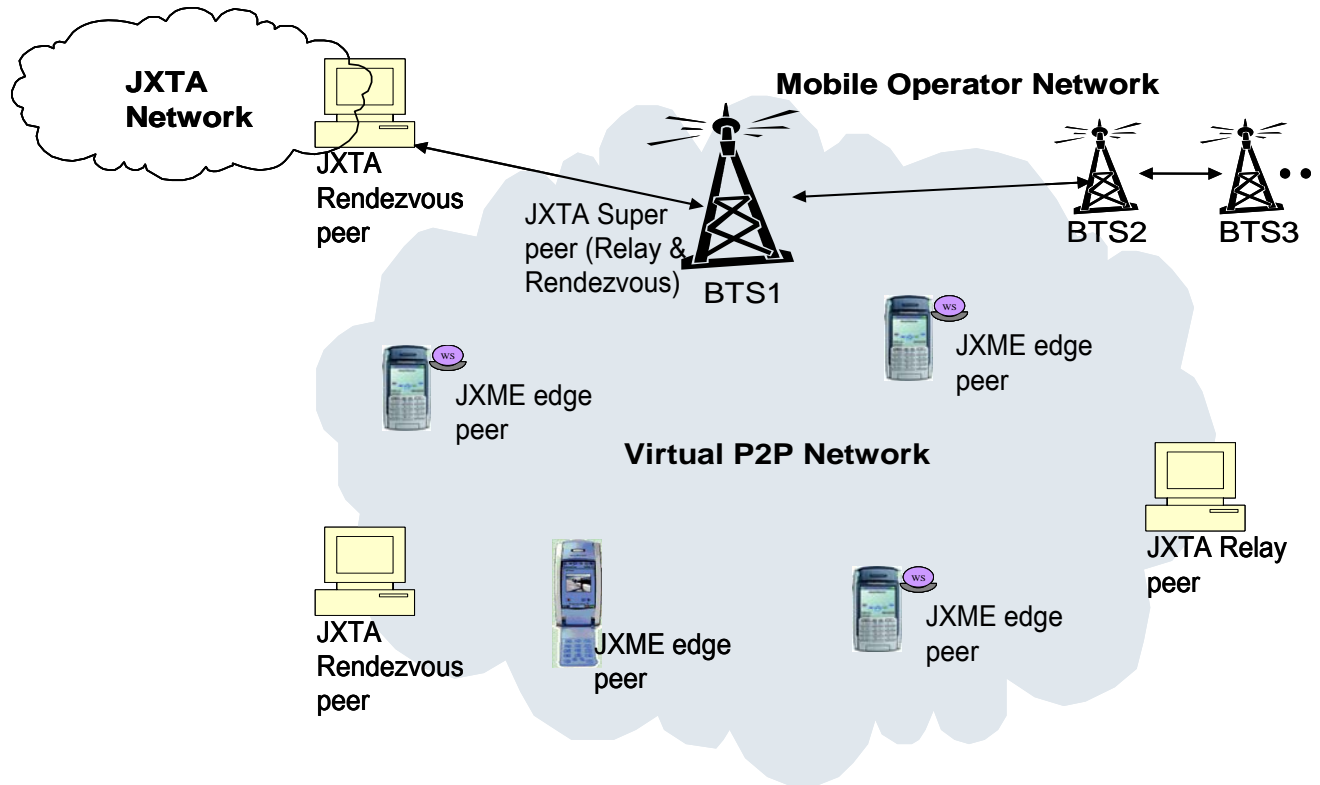
- BinXML enabled MH
- Message size 5 kb
- ~ 15% gain (1.3 sec)

- **MWS compression gain:**

$$T_{mwscg} = \delta T_{reqt} + \delta T_{rest} - T_{reqenc} - T_{reqdec} - T_{resenc} - T_{resdec}$$



Mobile Host in JXTA network



- Technical advantages to Mobile Host
 - Eliminating the need for Public IP
 - Better identification/access mechanisms (Peer ID)
 - Better service discovery

Mobile web service discovery issues

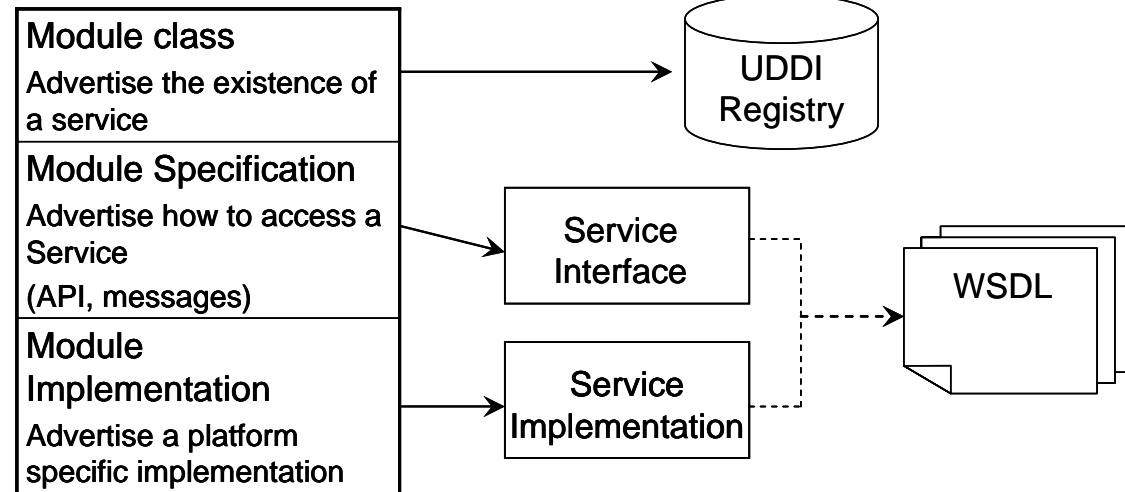
- Web service discovery
- Huge number of services are possible with Mobile Hosts
- Centralized UDDI not the best solution
 - Problems with bottlenecks
- Mobile nodes are dynamic
 - Binding information changes regularly
 - Services are to be published again and again
- Dynamic service discovery mechanisms
 - Announce listen model (e.g. Jini)
 - Distributed P2P WS registry (VISR) [Dustdar and Treiber, 2006]
 - Konark [Lee et al., 2003]
 - UPnP

Mobile web services discovery

- Publishing mobile web services in JXTA / JXME
 - JXTA Modules
 - Life time of advertisements

```

<jxta:MSA>
<MSID> ... </MSID>
...
<Parm>
    <WSDL>
    ...
    <WSDL>
</Parm>
...
</jxta:MSA>
    
```



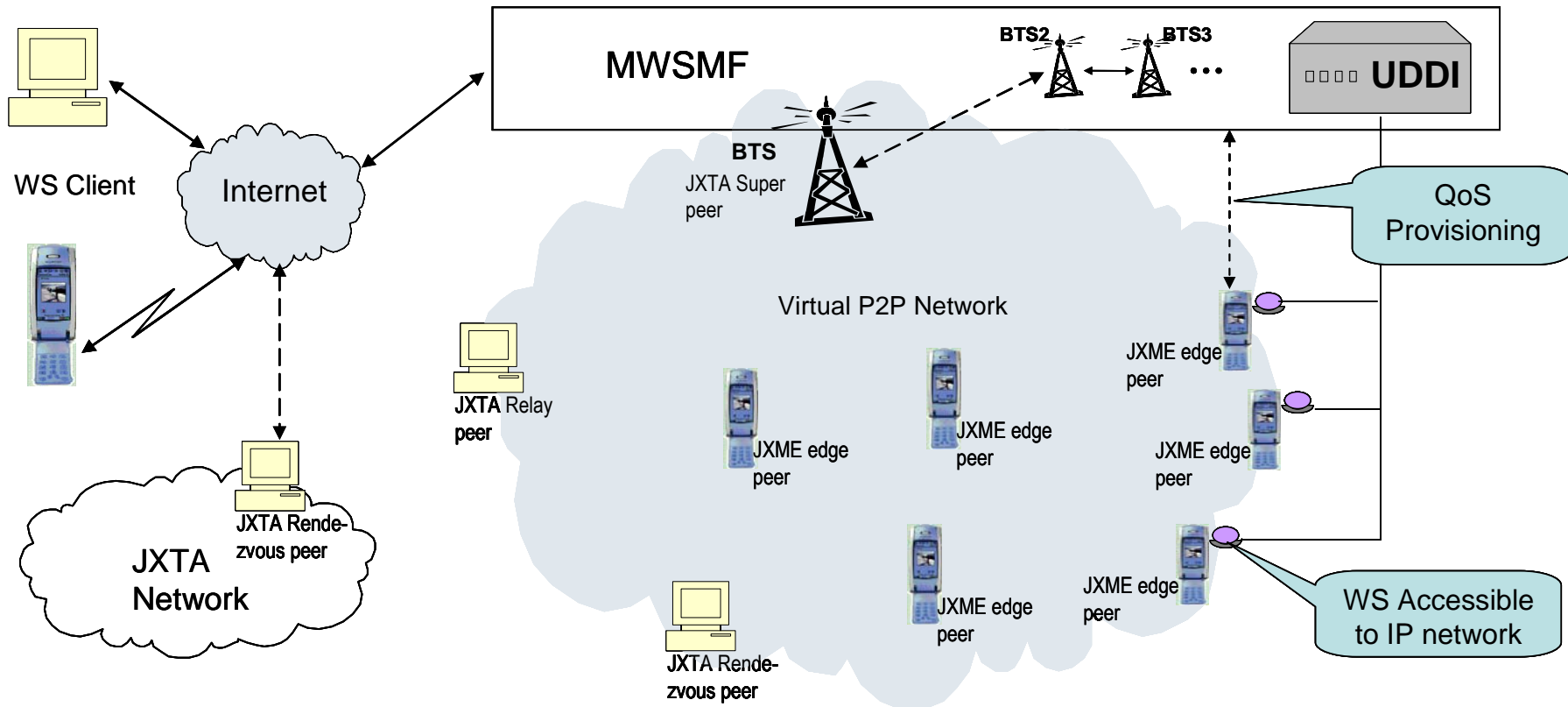
- MSAs advertise mobile web services
- Discovery of MSAs with name & description
 - Works, but not very precise

Advanced mobile web service discovery

- Categorization using MCA
- MCAs simulate Category bags & tModels in UDDI
- Peer Groups simulate business groups
- Post-filtering of mobile web services
 - Search can also extend to WSDL information
 - Search should be based on weight of keywords
 - Apache Lucene tool
 - Based on indexing
 - Advanced Matching of Services (AMS)
- Context-aware service discovery [WSTalk]
 - To achieve very precise results
 - Ontology based context engine

Mobile Web Services Mediation Framework

- How to integrate mobile web services and P2P domains taking care of QoS?



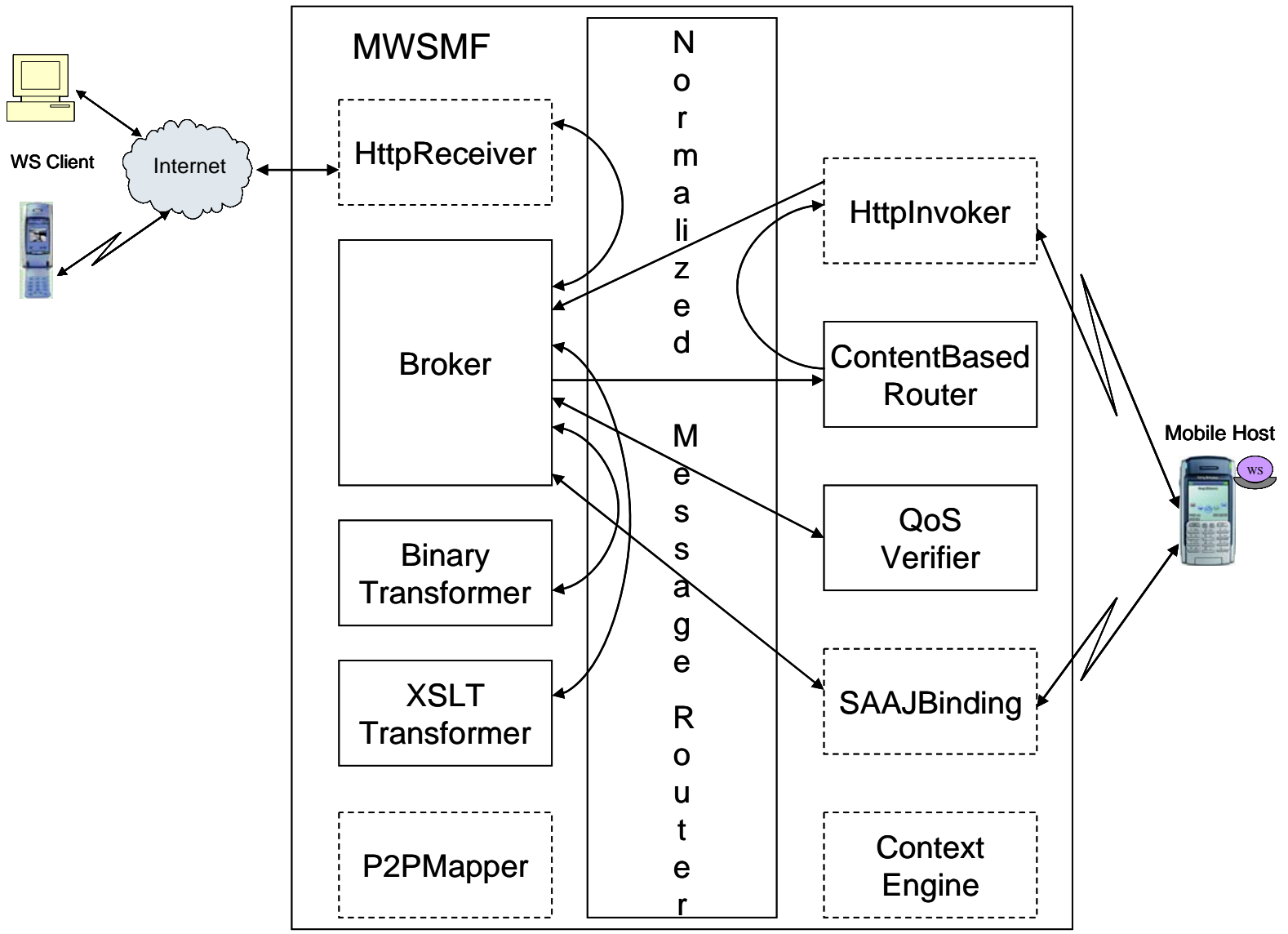
MWSMF realization

- Why Enterprise service Bus (ESB)?
 - Any SOA should be sufficient for the purpose
 - Web services are best means of realizing SOA
 - Latest developments in web services domain
- Enterprise service Bus (ESB)
 - “Enterprise Service Bus provides a set of infrastructure capabilities, implemented by middleware technology, that enable the integration of services in an SOA” [Gartner, Inc.]
- Java Business Integration (JBI)
- ServiceMix

MWSMF - Components

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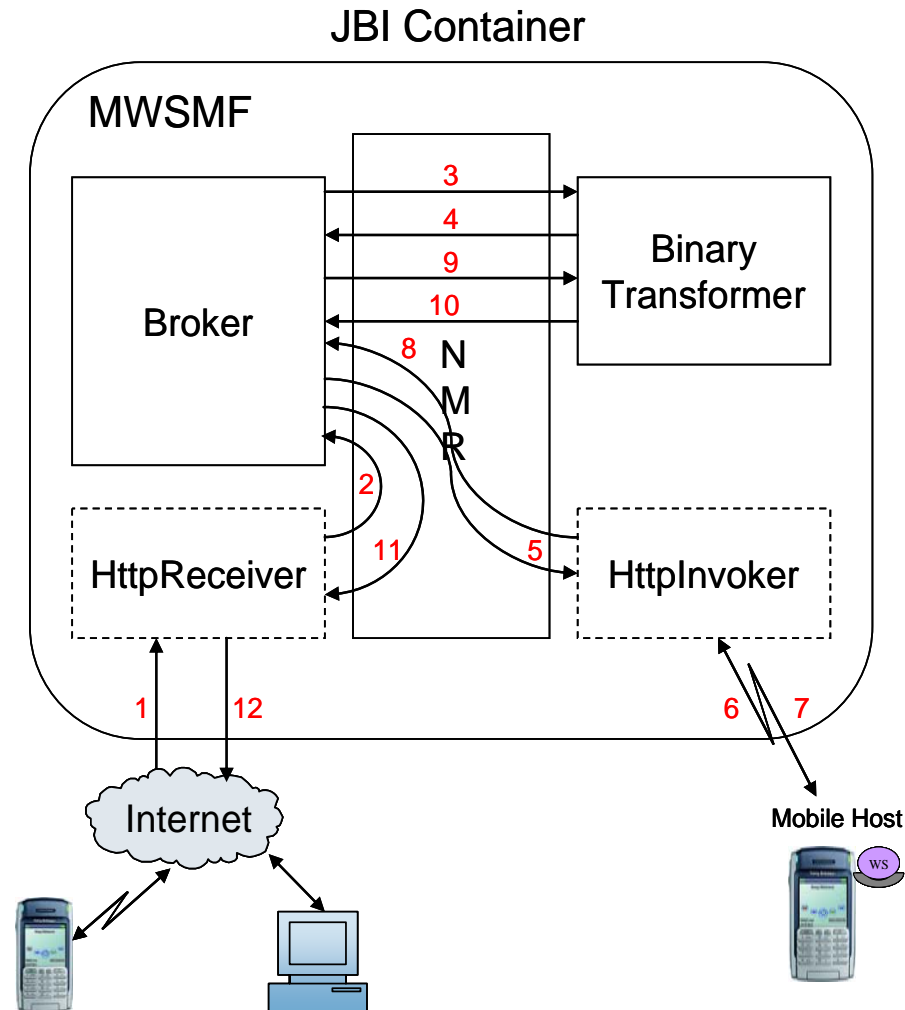
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Message flows in MWSMF

- Mobile web service message optimization scenario

- Supplementary features of MWSMF
 - Hosts a UDDI registry
 - Supports automatic startup of Mobile Hosts
 - PushRegistry feature of WMA

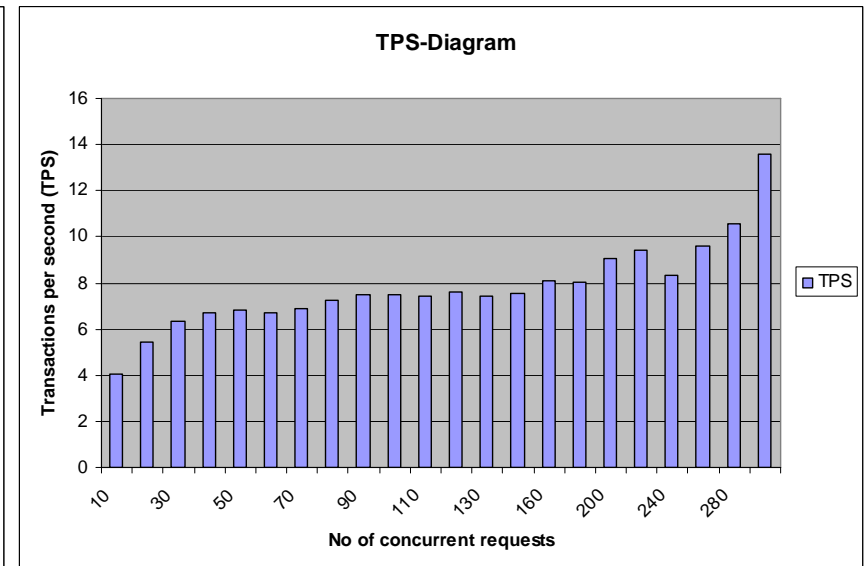
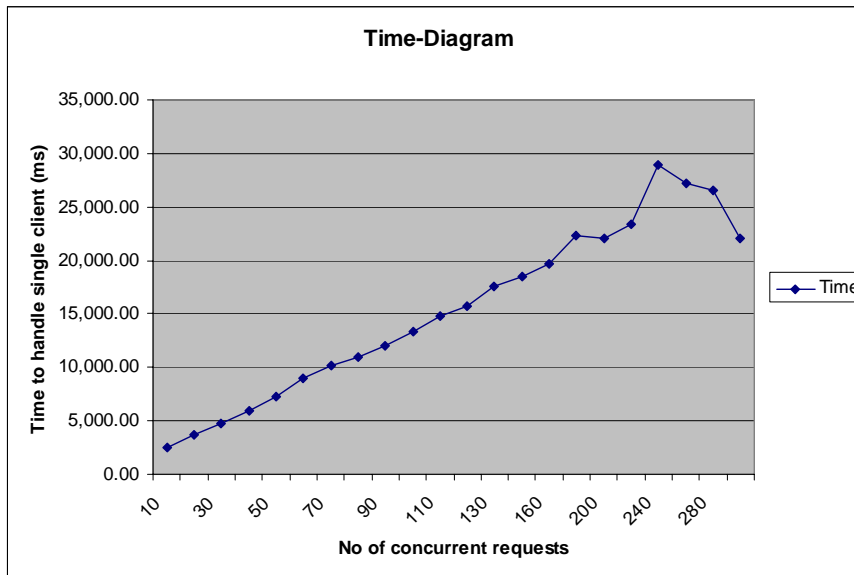


Performance evaluation of MWSMF

- ApacheBench load generator
- Established on a laptop
- Successful in handling 110 concurrent requests
- Mean value of handling a client ~ 130 ms
- Evaluation proved that MWSMF can handle large number of concurrent clients

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Conclusions

- QoS aspects for MWS are discussed
- Alternatives for mobile web services discovery are identified
- Architecture, features and realization details of MWSMF are identified
- Discussed mobile web service message optimization scenario
- Evaluation proved MWSMF deployment scenario is feasible
- Remaining components of the MWSMF are to be realized
 - P2P Mapper
 - ContextEngine
- Further scenarios can be envisioned

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Thank you

