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

- 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
  - RSA with SHA1 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:**
  
  \[ T_{mwsgc} = \delta T_{req} + \delta T_{rest} - T_{reqenc} - T_{reqdec} - T_{resenc} - T_{resdec} \]
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>
      . . .
    </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

WS Client

Internet

MWSMF

HttpReceiver

Broker

Binary Transformer

XSLT Transformer

P2PMapper

 normalized

Message Router

HttpInvoker

ContentBased Router

QoS Verifier

SAAJBinding

Context Engine

Mobile Host
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
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
Thank you