**Wireless SOAP: Optimizations for Mobile Wireless Web Services**

Naresh Apte
Keith Deutsch
Ravi Jain
DoCoMo USA Labs, USA
+1 (408) 573-1050 jain@docomolabs-usa.com

**Motivation:**
The authors point out that use of XML with its verbose and redundant nature and XML-based protocols is problematic. Some examples of XML inefficiencies are text-serialization of numbers, end tags, and namespaces. SOAP as a protocol built on top of XML suffers from the same issues, and adds a few on its own. For example, studies show that using SOAP uses 3x-10x more bandwidth than Java RMI. Techniques for compressing SOAP messages have thus been proposed in the literature. Thus the paper proposes a set of optimization techniques, collectively called Wireless SOAP (WSOAP).

**Assumption:**
The mobile device connects via a wireless link to a mobile gateway, which in turn connects via a wired network to the Web Service. WSOAP operates over the wireless link only.

**Features and notes:**
1. Wireless SOAP (WSOAP), which rests on two observations:
   a. Prior techniques to optimize SOAP attempts to encode or compress SOAP messages to allow recovery in exact form, this is not required, and recovery in an equivalent form suffices; authors call this approach, Name Space Equivalency (NPE).
   b. If the sender and receiver are aware of the underlying WSDL, substantial additional bandwidth savings can be obtained.

2. WSDL Aware Encoding (WAE): Paper proposes a simple synchronization protocol for use between the mobile device and gateway. It would need to be executed only once, and offline.

3. WSOAP can deliver significant bandwidth reduction compared to generic SOAP. Reduced message loss and communication energy, can also accrue.

4. Comparison of WSOAP to a generic text compression algorithm, namely Jzlib and SOAP optimization approaches such as plain WBXML:
   a. Generic text compression is oblivious to inherent structure in an XML document, and is typically compute-intensive, a drawback for mobile devices.
   b. WBXML is oblivious to SOAP message structure.
   c. Other XML-aware compression algorithms, typically use static, non-adaptive techniques and are guaranteed to be exact, unlike the NPE approach in WSOAP.
5. Differential Encoding technique (DiffEnc): is oriented specifically towards compressing SOAP messages by guessing the message structure at both the source and the sink, creating a skeleton based on that, and sending only the differences between the skeleton and the actual message.

6. Wireless SOAP Encoding:
   a. Basic principle:
      - Provide static encoding based on SOAP schema
      - Leverage WSDL service description to create adaptive encoding for Web Service interfaces
      - Require functional message equivalence rather than exact reproduction
      - Limit computational cost by favoring codification and lookup over computation wherever possible
      - Codify using a binary packaging scheme.

   b. Name Space Equivalency (NPE): The set of SOAP element tags can be codified as application-specific tags, as provided by WBXML. It exploits the fact that within any given document, the choice of a specific prefix string to denote association with a namespace is arbitrary. Example, within a document, the tags <soap:Envelope> and <s0:Envelope> are equivalent as long as the prefixes soap and s0 are associated with same namespace.

   c. WSDL Aware Encoding (WAE): If the gateway and the mobile client both have access to the WSDL for each Web Service interface used by the client application, the WSDL can be analyzed to create the requisite coding tables. We propose a protocol for synchronizing the WSDL coding tables in the gateway with the client.

**Conclusion:**
From the Experiments conducted by the authors and their results it can be concluded that:
1. WSOAP can reduce message size by 3x-12x compared to SOAP.
2. It outperforms DiffEnc and WBXML by large factors; in some cases DiffEnc in fact results in message size explosion.
3. WSOAP only outperforms Jzlib for messages that consist largely of structured XML.
4. For messages that consist largely of unstructured text data, Jzlib achieves 2x-3x better compression than WSOAP, however superior compression of Jzlib comes with significant increases in computation time.