Chapter 2

Optimizing Resource Consumption for Secure Messaging in Resource Constrained Networks

P. P. Abdul Haleem
National Institute of Technology, India

M. P. Sebastian
Indian Institute of Management, India

ABSTRACT

Conservation of resources such as bandwidth, energy and memory are of a concern in Resource Constrained Networks (RCNs). Wireless mobile devices, especially low cost devices are stifled by the limited resources such as battery power, screen size, input, memory and processors. The low cost wireless mobile devices penetrating the developing world market demand for a cost effective messaging format that fits within the constrained wireless environment. Reduction of verbosity is considered to be one of the most effective steps in controlling the resource consumption in RCNs. This chapter presents a method for optimizing resource consumption by the use of a new messaging format with less verbosity. The proposed format is based on YAML Ain't Markup Language (YAML), which is further enhanced with message level security specifications.

INTRODUCTION

The abundant growth of Internet services and the increased number of wireless mobile users resulted in the penetration of wireless mobile devices into the realm of wired networks. This penetration raised many issues related to wireless mobile networks and devices. Wireless mobile devices (with limited resources like battery power, memory, processing power, input and screen) together with wireless networks (with unreliable channels, low bandwidth, increased latency,

increased rate of retransmission of lost packets, and weak security features) impose a number of limitations. However, users expect to access much wider range of applications in wireless mobile devices than in the conventional devices.

A major constraint in the wireless mobile devices is power. Even with the latest processors and memory chips, the rechargeable battery attached to the mobile devices still tends to fall behind the expectations. The RF part of cellular engine, which is responsible for transmission and reception of messages, is the biggest consumer of energy in a mobile device (Michael, 2005). Security protocols also consume power – the number of packets transmitted or received and the size of the keys are two important factors to be taken care to conserve energy. Wireless networks are generally less reliable, less secure and with more message latency.

Verbosity reduction of messages is a major concern in the constrained wireless mobile environment (Kangasharju, Lindholm, & Tarkoma, 2008). Reducing the verbosity of messages may have an impact cutting across several layers of the wireless networking protocols. XML is the default protocol for messaging ("SOAP-Tutorial", 2007). However XML faces many problems when used in the wireless mobile environment (Kangasharju, 2005). The number of bytes required for data representation is huge in XML. Due to this verbosity, XML buffers need to be flushed more often at the time of input and output, leading to lesser throughput. Also, larger messages are vulnerable to retransmissions. The highly textual nature of XML makes the string parsing compulsory for further processing. XML documents are structured and this adherence of the document to the accompanying structure is to be verified by the parsers. XML has been one of the easy targets for hackers, due to its long term use and universality.

Distributed computing and systems have changed significantly with the introduction of wireless communication and mobile nodes. These differences are not only quantitative (in that the links and nodes have inferior performance), but also qualitative (in that the characteristics also differ from fixed links and stationary computers). In tune with the widespread use and popularity of wireless mobile devices, complex operations in distributed and collaboration technologies allow people to move across organizational boundaries and to collaborate among/in organizations and communities with mobile devices. As a result, user communities demand for increased flexibility, inter-connectivity, and autonomy of involved systems as well as new coordination and interaction styles for collaboration among people. Three emerging trends in this context are (i) support for virtual web communities, (ii) support for web recommender systems that are adaptive to the ubiquitous devices, and (iii) adaptive content generation and delivery. Present day popular applications like Web services and agent communications languages (ACLs) also make use of a data format.

In many of the above approaches, an XML based dynamic content creation mechanism is employed to create, maintain and provide multiple variants of the content depending upon the type of devices from which the request is originated. The device (the capacity of the device) and information (the principle of poly-representation based on the document surrogates and the data source characteristics) "contexts" play decisive roles in the modeling of effective contextual information retrieval systems (Tamine-Lechani, Boughanem, & Daoud, 2009). Clearly, an alternative scheme with the merits of XML and with less verbosity can be a catalyst in the performance gain of the data management and sharing services, which is one of the most important and challenging part of a middle-ware layer in a distributed storage system that allows group members to share the data in Collaborative Working Environments (CWEs).

Reduction of message size results in the reduction of number of transmissions, which in turn reduces the data transmission cost and storage

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