

Stock information dissemination using mobile web services

Stock information dissemination

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Abstract— Ubiquitous computing scenario makes mobile terminals as data providers and requestors. Mobile Web Service framework defines a network and terminal architecture with context-aware applications enabled in it. Context awareness enables a new class of applications in pervasive computing. These applications provide mobile clients with a customized and personalized behavior to better meet the needs of user's tasks. Ability to exploit context information is challenging task when considering limited resources of mobile devices and mobile communication systems. Context information is everything that could be used to influence the behavior of an application, like location, user preferences, environment, or properties of connectivity. We proposed a context aware application development process by the use of stock information dissemination application scenario. In this example, stock value with timestamp and its impact is considered. It provides means to build the application on a distributed environment containing different systems and terminals connected by various communication systems. The middleware abstracts the actual physical environment and provide a transparent and homogeneous API.

Keywords-mobile web service; topical information dissemination;publish subscribe system

I. INTRODUCTION

In a distributed environment, context data has to be disseminated from context data providers (CP) to context data requestors (CR). To reduce the communication effort and to increase the capacity, a Publish/Subscribe mechanism is used. The roles and high-level communication relations between them are shown in Figure 1.

The merit of using Publish/Subscribe lies in the asynchronous communication behavior. Requestors can access context data providers frequently. If the benefit of context data is dependent on the data value, then simple data polling is inefficient. So communication resources allocated even if the context value is not needed by the application leads to high performance degradation in mobile computing. An application

specific rule associated with a subscription is required to avoid performance degradation.

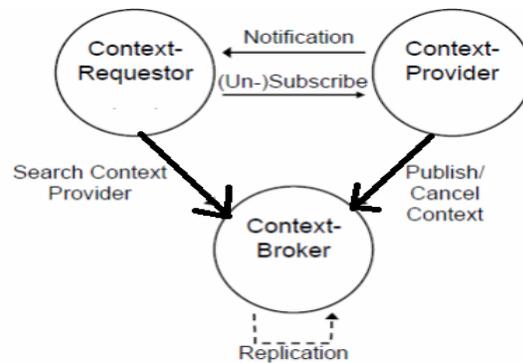


Figure 1. Context dissemination roles

The context dissemination system shown in Figure 1 has three roles as Context-Requestor, Context-Provider and Context-Broker are defined in the style of the roles used in the Service Oriented Architecture (SOA). Context-Provider publishes in a first step the context data definition to the Context-Broker. The broker collects all context data definitions in conjunction with source addresses and provides this data to Context-Requestors, which are able to find appropriate context parameters. Context-Requestor subscribes to the context information of his interest by transmitting a rule to the Context-Provider, which defines the condition for a notification. The notification includes all information that has been defined in the rule for cases that specified condition has been achieved. In order to exemplify the proposed context dissemination based on the Publish/Subscribe mechanism, stock information dissemination application is described in this paper.

II. RELATED WORKS

For the mobile industry, Web services offer at least three major application areas as mentioned in [1]. First, mobile terminals can be made to act as Web service clients, enabling many business and consumer scenarios. For example, applications that allow access from any location to backend

databases enable powerful customer relationship management, inventory management, and remote diagnostic applications. Second, mobile terminals can offer Web services to other service providers. For example, a mobile terminal can offer a service providing information stored in the terminal, such as contact, calendar, or other personal information. Third, service providers can leverage information provided by the mobile infrastructure. For example, a service provider can obtain the geographic location of a mobile terminal from a mobile infrastructure Web service. This can be used to provide customized information, such weather or restaurants in or near the terminal user's current geographic location. Other potential areas are related to billing and user presence in the mobile network.

A middleware for mobile context providers is proposed in [2] which enable publishing of context-data. This data can be remotely monitored by subscribing to a service of the context-provider and receiving notifications from the context provider. Automotive applications in common and especially the MYCAREVENT applications in [3] are one of the most challenging applications for mobile communication systems and mobile application designers. The mobility level varies from stationary to velocities of 100 km/h and more. Different mobile and wired communication system could be used, like e.g. an Ethernet connection in the workshop, GSM/GPRS, UMTS, or WLAN on the road, or many communication systems in parallel. Each of them has different devices. The car equipment ranges from cars without any computing device to cars with a diagnostic system, navigation system, and entertainment system. The roadside assistant may be equipped with one or more diagnostic tool, a laptop, or a Personal Digital Assistant (PDA). The driver may have a private PDA, a smart phone.

Rule based middleware is evaluated in respect of the application delay and the application communication costs in [4]. In the book [5], information access devices are pocket-size hand held organizers called Personal Digital Assistants (PDA). They carry around relevant information and are able to intermittently plug into intelligent networks. Their applications are comprised as Personal Information Management (PIM) and include calendar, address book, and email functionality. While today's usage is mostly restricted to schedule appointments and carry phone numbers around, PDA are evolving to powerful mobile network clients. They allow immediate access to corporate databases and can be used as an e-commerce platform.

While service-orientation may be a popular concept found in a broad variety of applications, in paper [6] a reference model focuses on the field of software architecture. The concepts and relationships described may apply to other "service" environments; however, this specification makes no attempt to completely account for use outside of the software domain. In the book [7] a mathematical model that accurately predicts system behavior is provided. Two basic problems

arise in mathematical modeling: the problem of identifying a system and the problem of applying a model to the system analysis. System identification consists of selecting a class of mathematical objects to describe fundamental properties of the system behavior.

The book [8] focuses specifically on the network-oriented functions of all digital wireless and mobile radio systems currently existing or planned for the near future. Particular attention is paid to the radio-related specifics required for establishment of a mobile communication system which is far more complex than a wired network. In the paper [9] mobile phones are hosting web servers, but HTTP access to them is currently impracticable in most operator IP networks. Demo system is designed to provide operator independent HTTP access to web servers running on mobile phones for anyone browsing the Internet.

In the paper [10], new architecture design and implementation is proposed as Handheld Flexible Representation (HHFR). The architecture provides alternative representations other than XML-based SOAP and fast communication transport options. The negotiation between two end-points using SOAP message sets up characteristics of following stream of messages. The verbosity of XML-based SOAP representation imposes possible overheads in mobile Web Service applications. So in the paper [11] separation of data content from the syntax is used for streaming message exchanges. The redundant or static message parts are stored in shared metadata space – the Context-store. The streamed messages are not self descriptive. But the combination of the message and the negotiation captured in the Context-store is self descriptive.

III. COMPONENTS IN STOCK DISSEMINATION SYSTEM

Six components are required to construct the context proposed dissemination system. These basic components and their relations are shown in Figure 2.

The following four components are used on context provider side:

1. Monitor Component collects the stock information from the stock exchange corporate database and covert to context object to store in context database.
2. Update Component reads context data from database and sends it to Notification Service when the data changes or when it is asked for current data.
3. Subscription Handler Component gets subscription messages from other mobile users and responds after authentication and authorization. Rules defined in the subscription message are read out by this Component.
4. Notification Component makes notification to the context requesters according to data coming from Update Component and according to rules defined

by different context requesters. This is main component since it sends notification through rule evaluations.

The following two components are useful on context requester side:

5. Subscriber Component is responsible for communication between subscription component of context provider and requester. It sends subscription messages and listens for acknowledgments.
6. Listener Component gets notification messages coming from context provider in order to forward them to needed component of requester in the required format.

Context Registrar collects addresses of the context providers and descriptions of context services offered by these context providers. The requesters should be able to find registered services and retrieve the addresses of desired context providers. Context registrar does not belong to the basic functional components because it does not have role in aggregation and dissemination of context information.

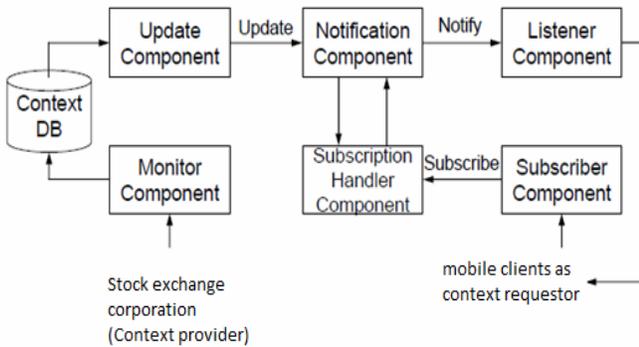


Figure 2. Components and their relations in Context dissemination

A context broker element enables filtering of context events and evaluation of context rules. The broker represents for one network or sub network as the central subscription and notification point.

Context requestors and providers routes their subscriptions or notifications to their counterparts. Broker element in between them filter and forward message. This framework is useful if many users are subscribing to same context data with congruent rules.

IV. DEPLOYMENT OF DISSEMINATION SYSTEM

The context dissemination middleware is based on Mobile Web Services framework. All software components on terminal are shown in Figure 3 is communicating by means of

Mobile Web Services protocols. So SOAP bindings, mobility management and Mob-WS sessions can be utilized. Monitoring Services component and notification component are based on WS-Eventing. Monitoring Service has methods Subscribe(), Unsubscribe(), GetStatus() and Renew(). The Notification Service provides a method AcceptNotification() to receive incoming notification messages.

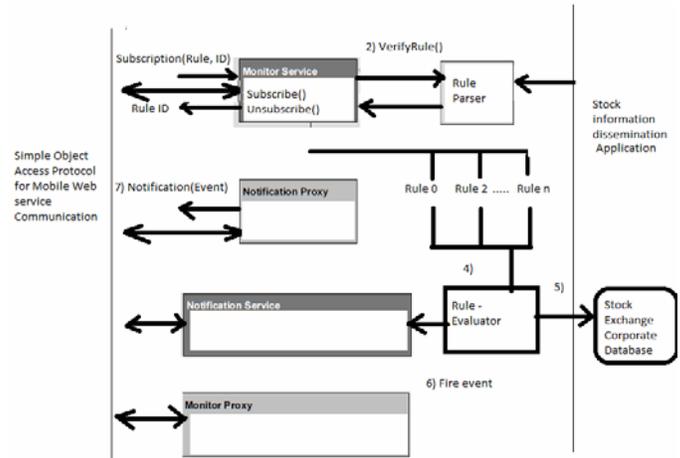


Figure 3. Context dissemination terminal Components

The counterparts of Web Services are the respective Proxy components and a rule evaluator. First, stock information from corporate database is collected in a local database of the application. Then application publishes the context information to broker and registers it to rule parser. If subscription arrives (1), rule is extracted and verified (2). If rule is correct, a rule ID is sent back to subscriber and rule tree object is placed in the rule buffer (3). All rules in buffer are sequentially evaluated (4) depending on actual context database (5). If rule applies, then a notification is initiated by Notification Proxy (7).

The standard Rule Markup Language has been used to represent a rule in XML format. This is simple and apt to use in resource limited mobile devices. Using standard approach of XML Schemas, a rule language has been designed to facilitate clients for easy generation of subscription rule.

An example of a rule according to the above definition:

```
<rule id='1'
  xmlns:xsi=http://www.stock-
exchange/XMLSchema/ContextRule>
<action>
  <wMsg>Microsoft stock quote</wMsg>
  <priority>high</priority>
<send>
  <contextData name=" time">
<temporal type="date ">22:08:2015 @3.00am</temporal>
  </contextData>
  <contextData name="stock value">
```

```
<temporal type="numbers">60</temporal>
</contextData>
</send>
</action>
<condbase>
<and>
<or>
<cond>
<opr>greater</opr>
<oprnd1 type="object">stock value</oprnd1>
<oprnd2>120</oprnd2>
</cond>
<cond>
<opr>lower</opr>
<oprnd1 type="object"> stock value </oprnd1>
<oprnd2>40</oprnd2>
</cond>
</or>
</and>
</condbase>
</rule>
```

A stock information dissemination application is subscribed by mobile clients with rules that are adjusted to the stock's critical high and low values. So the subscribed mobile clients are notified if their rule generates an event notification.

The threshold for a critical value is dependent on the submitted rule. These are examples only, but the rules could be more complex including various combinations of these context data. The mobile clients can un-subscribe or re-subscribe with new rules depending on the changed economic status of stock exchange.

V. CONCLUSIONS

In this context information dissemination for stock exchange data uses rule language, which contains two main child elements Action and Condition. Rules can be evaluated based on their priority. This requirement is vital for critical applications. Element in rule language has action, which takes

place when some condition is satisfied. It is defined as a complex type in rule language XML Schema.

This application enables mobile clients to get alert upon major changes in their subscribed corporate stock value. WLAN terminal acts as database and communication gateway for the corporate stock exchange data and provides the logic and services to monitor the context data according subscribed rules. It is taken into account that not only the context values are important for the application, but also meta-database which has to be encountered in the future work.

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