

AirNotes: a Location-aware Application in SaaS Pattern

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Abstract

Software as a Service (SaaS), has been considered very attractive to business users, especially small and medium enterprises (SMEs). Most SaaS applications available are traditional enterprises applications. This paper studies a new type of application, location aware application, in SaaS pattern. Unlike business application, it involves a network of location tracking sensors. The paper reports on the development and demonstration of AirNotes, a typical location aware application that responds to users depending on their location with support of tracking devices. The AirNotes scenario, the challenges of being a SaaS, and some key issues in AirNotes development are discussed.

Key words: SaaS, location aware, application

1. Introduction

Software as a Service (SaaS), has been considered very attractive to business users, especially small and medium enterprises (SMEs) because they offer: (1) on-demand business flexibility, (2) low system development and maintaining cost, and (3) better resource management. Most SaaS applications in literature are enterprise applications that deal with enterprise information management. For example, Salesforce released several services for sales management, customer relation management, and collaboration management [1]. The Kingee published Youshang.com, which provide Online accounting, online SCM service for SMEs [2]. The UFIDA has WeCoo.com to provide online ERP service (weCoo) [3]. The 800APP provides SMEs with applications such as OA, SCM, DRP, HR, Call Center and so on [4].

This paper tries to explore a new type of application – location aware application, in SaaS pattern. It reports the development and demonstration of AirNotes, a typical location sensitive application. This paper describes the AirNotes scenario and discusses the challenges of enabling AirNotes a cloud service. The AirNotes architecture, the context modeling and reasoning method, and integration of AirNotes with IBM Web Delivered Service (WDS) platform are discussed.

2. The AirNotes scenario

The AirNotes is a typical location-based information customizing service. It captures the user's location information and request, and then either provides the location dependant message, e.g. electronic coupon to the user, or directs the user to a location related website, e.g. a particular commenting forum. The zone-based location tracking equipments, the Blip nodes [5], are used to track the location of individual users.

For most of available business applications in cloud, for example, the Salesforce, the whole business application is placed in cloud. The tenant only needs a web browser to access the service. Different from business application, location aware application involves a network of detection sensors or devices, such as Bluetooth, RFID, WIFI, GPS and so on. These devices have to be placed locally at the site. The context aware middleware that deal with the context acquisition, modeling and reasoning will be put in cloud as a service.

In order to make the context aware middleware as a service, the following issues should be addressed:

- **Distribution.** The sensors and the context aware middleware should be physically and logically distributed. The communication between them should be well maintained so that the context aware middleware can have fully control of the devices.
- **Configurability:** There are various flexibility degrees for a multi-tenant application that ranges from complex schema customization to simple field extension. For location sensitive application, it requires a context modeling and reasoning method that can support multi-tenant's context definition and reasoning configurability.
- **Data Isolation:** After being a cloud service, one AirNotes instance should be able to serve multiple tenants. Therefore it requires that the AirNotes be able to separate the resources allocation and usage among tenants.
- **Security:** The AirNotes should be able to prevent invalid resources access and potential malicious attack.

In this paper, the above challenges are solved by integrating AirNotes with IBM WDS platform. The AirNotes guarantees the distribution of the sensors and controlling components and provides configurability for multi-tenant. IBM WDS platform takes care of the data isolation and security.

3. The AirNotes Solutions

3.1 Architecture of the AirNotes

The AirNotes consists of two components, namely *AirNotes Adapter* and *Controller*. The *AirNotes Adapter* runs locally to control a number of blip nodes, which are used to capture users' location and exchange data with users via Bluetooth message. The *AirNotes Controller* runs in the cloud and provides context reasoning service. In order to cross the firewalls, both the *Adapter* and *Controller* are encapsulated as web services so that they can communicate with each other through HTTP protocol. Their interfaces are defined with standard *Web Service Definition Language* (WSDL).

3.2 Context Modeling and Reasoning

The general principle to choose the context modeling and reasoning method for the AirNotes is that both the context definition and reasoning process can support multi-tenant configuration and data isolation. Since the structured data saved in database can be easily isolated via data isolation techniques, the key-value method and rule based reasoning method are adapted.

In this paper, the context C is defined as a set of keys, each key can have a set of values, as shown in (1), where K_i indicate the keys and V_{ij} indicates the possible values of K_i .

$$C = \{K_i | i=1, 2, \dots, n, n \in \mathbb{N}\}$$

$$K_i = \{(V_{ij}) | j=1, 2, \dots, m, m \in \mathbb{N}\} \quad (1)$$

In AirNotes, the keys are defined as follows in (2).

$$C_{AirNotes} = \{Group_ID, Zone_ID, Request_Type, Function_Type\} \quad (2)$$

The reasoning is going to find relations between the keys according to its values. Two types of context reasoning rules, namely conditional rule and logic rule, are defined. The conditional rule is defined as in (3), where i_1, i_2, \dots, i_n are the input keys and o_1, o_2, \dots, o_n are the output keys.

$$\text{if } (K_{i1} = V_{i1j} \dots \text{and } K_{in} = V_{inj})$$

$$\text{then } (K_{o1} = V_{o1j} \dots \text{and } K_{on} = V_{onj}) \quad (n \in \mathbb{N}) \quad (3)$$

The logic rules that are described by XML are used to define the reasoning path, in another word, to define the sequence of executing the relation rule.

3.3 Integration with IBM WDS platform

The AirNotes is integrated with IBM Web Delivered Service (WDS) platform to obtain support of security and multi-tenancy support. Particular, the Id Authorization and Security service and Multi Tenancy Data Tier service provided by WDS platform are integrated with AirNotes. Everyone who wants to access the application has to access platform portal and pass the Id authorization. When the AirNotes application read and write database, Multi Tenancy Data Tier service will change the operation and make it multi-tenant.

4. The demonstration and conclusions

The Airnotes prototype has been developed. It has been demonstrated in several occasions such as the workshop held in Danish Embassy in Beijing May 2010, IBM UR Annual Meeting held in Shanghai June 2010, and the Genie workshop held in IT University (ITU) of Copenhagen June 2010. In these demonstrations, Danish Embassy in China, IBM UR meeting, and ITU are considered as the tenants that subscribe to the AirNotes service. As shown in figure 1, the *AirNotes Controller* is deployed as a service on IBM WDS platform in IBM's Tianjin data center and is ready to serve all the tenants. The tenants need to place the Blip nodes at their sites and install the *AirNotes Adapter* on a machine that is in the same LAN with Blip Server and Blip Nodes.

The demonstration shows that the AirNotes in SaaS pattern benefits the tenants because they don't need to set up a server and install the whole AirNotes system anymore. They just need to subscribe and configure the service easily. The demonstration shows that the location aware application in SaaS pattern is not only possible but also helpful.

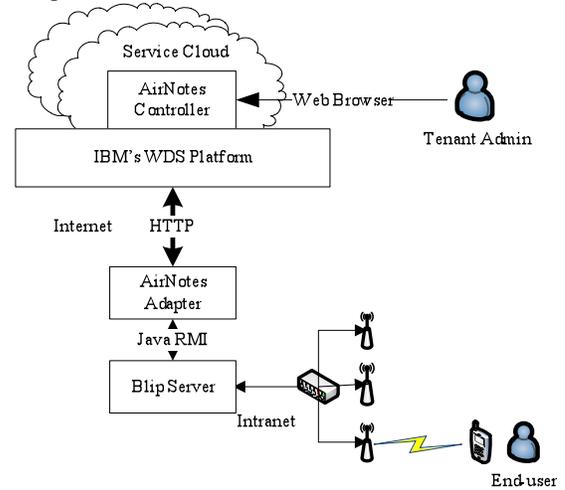


Figure 1. Deployment architecture of the AirNotes

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9. Reference

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