

# The Adaptation of Mobile Learning System Based on Business Rules

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**Abstract**—In the mobile learning system, it is important to adapt to mobile devices. Most of mobile learning systems are not quickly suitable for mobile devices. In order to provide adaptive mobile services, the approach for adaptation is proposed in this paper. Firstly, context of mobile devices and its influence on mobile learning system are analyzed and business rules based on these analysis are presented. Then, using the approach, the mobile learning system is constructed. The example implies this approach can adapt the mobile service to the mobile devices flexibly.

**Keywords** —Mobile Learning System; Mobile Devices; Business Rules

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## 1 Introduction

The rapid adoption of mobile computing devices with Internet capabilities, such as computers, smart phones and handheld devices, makes us work or study at any time, at any place. And mobile learning will complement and add value to the existing learning models<sup>[1]</sup>.

It is important for mobile learners to get education information and service, which meet their needs in an adaptive manner. However, in the mobile learning system, different mobile devices have different CPU speeds, memory capacity and power. This means that a mobile learning system created needs to adapt to different mobile devices. Currently, some researches about device independence in mobile learning system have been proposed. Xinyou Zhao proposed a device-independent architecture for mobile learning, which is composed of device detector and adapted content model<sup>[2][3]</sup>. That system detects the features by using user agent and analyzing the head of request. Anastasios A. Economides presented a framework for adaptive mobile learning in order to stimulate and support providing service<sup>[4]</sup>. The adaption engine is the core of the adaptive mobile learning system. By employing the learner's state  $L(t)$ , the educational activity's state  $A(t)$ , the infrastructure's state  $I(t)$  and the environment's state  $E(t)$ , the system has the ability to detect the characteristics of device and learners. By employing the learning automata to reinforce a good decision and penalize a bad one, this system can

provide the most appropriate service. But all before-mentioned system frameworks are not extended easily, because the formal model of context and adaption is not presented. When more and more new-style devices are used to mobile learning system, this shortage will be obviously.

In this paper, business rule approach is proposed to construct mobile learning system. It can detect mobile devices' context and adapt the service to the device, by considering the influence of context on service parameters.

## 2 Business rule

### 2.1 Context and its influence

Mobile learning system is composed of one server and mobile devices which access the server via different types of networks, for example, GSM, 3G, internet, Wi-Fi, or other networks. Mobile devices maybe are PDA, computer, mobile phone, laptop, digital TV, or other devices which have the ability to access the network, play audio and video program, and access the system server using browser which support standard communication protocol.

Mobile devices communicate with the mobile learning system server interactively. The device sends the request of service to the server. Then the server provides the mobile service, such as video on demand, to the learners' devices. The learner's devices can communicate with others through the server. When providing the service, in order to adapt itself to several kinds of devices, the mobile learning system should adjust the parameters of information communication according to the context of devices. In this way, every user can obtain the mobile service automatically with the quality matching the ability of his device.

### 2.2 Business rule

Based on the analysis above, there are some rules in the mobile learning system. These rules have the same structure as 'IF conditions THEN adaption policy' in the codes. While the context match the condition, this rule will be triggered immediately, and the adaption policy will be implemented.

BR=(id; width, networktype; speed, size,color)

In this depiction,

BR is the symbol of an business rule.

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Id is the rule identity, which is exclusive.  
 Width is the width of the mobile device.  
 Networktype is networktype of the mobile device.  
 Speed is the transmission speed to the mobile device.  
 Size is the displaying size in the mobile device.  
 Colour is the displaying colour in the mobile device.  
 For example:  
 BR=(001; 0.6×2Mbps,0.4×ADSL;15f/s)

### 3 The approach

On the basis of the discussion above, we utilize business rules to implement the dynamic part in the mobile learning system. Figure 1 shows the mobile learning system architecture based on business rules.

The context management module in the architecture employs the approach proposed by Henricksen in [5]. The context repository management module is responsible for collecting context, maintaining a set of context models and their instantiations. This module additionally provides the reasoning capacity between the low-level and high-level context and implements the query interface. The other modules in the architecture are our own work and will be discussed as follows. At present, the reasoning procedure has not been included in the business rules.

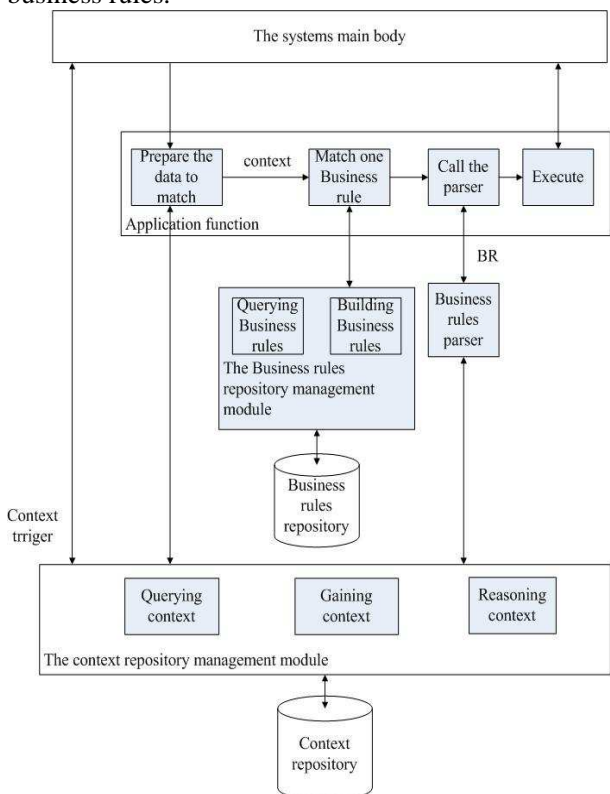


Figure 1 the mobile learning system architecture based on business rules

The traditional mobile learning system architecture consists of the system's main body and the context repository management module. The dynamic elements of the system's main body are

encoded in the traditional architecture. In the new architecture shown in Fig.1, the system consists of the main body, the context repository management module and the implementation module for the dynamic element separated from the program code. When the system executes the dynamic element, a function is invoked and implemented. Moreover, the variables of the invoked function are the parameters, their values easily being modified to suit the changing situation.

### 4 Example

In the mobile learning system, learners can get the video courseware resource by VOD service provided by this mobile learning system. They can get these video resources by many kinds of device, such as PDA, mobile phone, laptop and computer. The mobile learning system must perceive the context of terminal device, and adjust the transmission policy to the different context.

In this example, the bandwidth, type of link, the vendor and model of terminal, the size of screen are considered as the context of device.

- Business rules are show in follow:
- BR=(001; 0.6×2Mbps,0.4×ADSL;15f/s)
- BR=(002; 0.6×1Mbps,0.4×ADSL;10f/s)
- BR=(003; 0.6×10Mbps,0.4×LAN;25f/s)
- BR=(004; 0.6×20Kbps,0.4×GPRS;5f/s)
- BR=(005; 0.6×120Kbps,0.4×HSDP;7f/s)

The contexts of mobile device are detected by the context information server, and then according to the business rules above, some information transmission policy is carried out to ensure the quality of mobile learning. Moreover, when more and more new-style devices are used to mobile learning system, we only add some business rules instead of modifying the codes.

### 5 Conclusion and expectation

In mobile learning environment, system should detect the context of mobile devices, and then adapt the service parameters to the context. In order to construct the mobile learning system that can adapt to mobile devices, business rule approach is presented. Using the approach, the mobile learning system is constructed. The example implies this approach can detect the contextual environment of mobile computing and adapt the mobile service to the mobile devices flexibly.

In future, the business rules repository will be researched and optimized, employing the method and theory of artificial intelligence.

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