Research of Smart Home Service Platform Based on Mobile Cloud

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Abstract. With the development of smart city pilot projects of Housing Department, there has been a lot of smart city application products, meanwhile, smart home products emerge endlessly. To enjoy better service, people will choose a number of services provided by different suppliers, which causes a home need various service application terminals. Then, timely, quick and safe mobile remote access becomes very important. To solve this problem, the authors integrate service applications of affiliate service suppliers through standardized protocols, based on mobile cloud, and create smart home Platform. This providing customers a unified security service selection entry through customer settings.

Background

Mobile communication market is experiencing dramatic innovation and change. And smart phones with an open operating system are popular. With the addition of new features, active developers continue to develop a lot of new feature-rich applications. So that personalized phone applications become increasingly rich. More and more people use phone not only to make a telephone call or send a message but to achieve richer functionality. They want both personal applications and mobile office features with smoother operation⁴[1,2].

With the development of smart city pilot projects of Housing Department, there has been a lot of smart city applications. These applications use techniques of internet of things, cloud computing, mobile Internet, big data and automatic control. These technologies make our home life healthy, safe, comfortable, low-carbon and convenient, by integrating family intelligent control device, family environment perception, family health perception, home Safety Perception, information exchanging and consumption services⁴[1,2].

Due to limitations of mobile operating systems, mobile computing, storage, data processing capabilities, 3G bandwidth and flow rates, many service products need customer to personalize selecting and customizing. And it is very difficult to ensure optimal performance, maximum security and the most outstanding user experience on cross-platform development⁴[3].
In summary, it is very important to develop a smart home service platform, to adopt standard protocols, to integrate service applications of service providers and to provide customers a selectable unified security service entry by customer settings.

**Platform Architecture**

Smart home integrated services platform is a framework platform based on framework + plug-in technology. This platform can integrate many smart city systems to provide integrated home service system for customers, including smart education, agricultural product quality monitoring system, smart healthcare, intelligent PE, domestic service, smart community, family ordering system and so on. So this platform can provide customers integrated systems for home services.

Wisdom family services framework platform is based on framework + plug-in technology, including client framework (Northbridge) and its UI widget and server-side frameworks (Southbridge) and its service plug.

In support of the integrated service platform, people can order personalized UI interface provided by wisdom family services framework platform. And they can obtain many services such as housekeeping, healthcare, restaurant, family education, human services, community services, smart home and e-commerce. The client terminal is divided into web and mobile terminal (Android and IOS).

Southbridge provides event-driven and document guide’s processing modes well as distributed operation and management mechanism through Enterprise Service Bus (ESB). It supports content-based routing and filtering, has complex data transmission capability. And it offers a range of standard interfaces, sets according to the requirements of the protocol service of the residents, adapts the message sent by resident client. So that different application servers can operate coordinately and it enables communication and integration between different services. It is depicted in Fig.1.
Key Technology

**Framework Platform Technology.** Smart home integrated service platform uses software framework technology. It provides a full range of support for four-layer development and running of integrated services. The platform extracts the common basic components as the main family services applications framework part, and it defines standard interfaces to business components and sensing devices. So in the new application development process in the common part of the code does not need to write anew, they only need to make some adjustments and development on the basis of the frame. It will improve software quality, reduce costs, shorten development time and simplify the difficulty of software development, increasing the efficiency of software. The greatest benefit is the reusability of the platform; it is an important attribute of high-quality software. Software reuse means that the development of a post-ideological and code multiple times for multiple software, and this can improve the reliability, quality and efficiency of software development. Since the frame can reuse code, building applications from an existing component library becomes very easy. The platform provides a unified member-defined interface, allowing easy communication between members.

**Device-Driven Technology.** Device-driven application technology in the framework sensing device management, enables the interface program for sensing devices to transplant across hardware platforms and operating systems without any source code modifications.

In the things sensing device interface system, device interface developers have to concern both work and control of peripherals and the technical details of the operating system and
hardware platform. This will undoubtedly increase the burden on device driver development and maintenance, especially in the current condition of the coexisting variety of embedded operating systems and hardware platforms. The frame device interface layer uses the approach of Device Driver in the embedded environment. The device drivers developed in this way can across hardware platforms and operating system migration without any modifications to the source code. This development approach will no doubt be popular to IHV because this development approach can shorten development cycles of device interface and faster support multiple platforms. At the same time, this development approach allows device interface application developers to focus all attention on the functions and features of the device itself, thereby contributing to improve the quality of the device Interface Program.

**Framework + Plug-in Technology.** Sensing gateway architecture based on framework + plug-in technology makes heterogeneous sensing device can have a "plug" type of insert Southbridge, enabling dynamic access to the Internet of Things.

![Southbridge Overall Architecture Diagram](image)

Figure 2. Southbridge Overall Architecture Diagram.

Principle of plug-in technology is through a unified programming interface to call different modules, and Implements different functions transfer, so that we can extend the main program features. Host program and plug-ins can only communicate by the interface promised. Southbridge frame of platform frame and sensing device plug constitute overall system environment of Things smart sensor terminal’s operation, monitoring, management and configuration. Southbridge overall architecture diagram is shown in Fig.2.

In this construction, Southbridge sensing device access using the "plug-in" form, and Southbridge master is a host program. Realization of this device plug-in is the use of dynamic link library component mode, and achieves a unified interface specification. Since the Southbridge master program and equipment plug use the same address space, Southbridge master program is extremely easy to access the function pointer list. When the master program getting a plug-in device interface pointer, the only intermediary that connects them is the interface of the binary structure. When the master program queries interface card, it is actually a memory request with a specific format. When the device plug-in returns an interface pointer, it tells the main program is actually this block of memory addresses. At the same time, the dynamic link library is in binary coding and it integrated software at the binary level, facilitate intellectual property protection, avoid the damage because of artificial modify file, achieve better code hidden.
For the preparation of the overall software relatively, develop a single plug-in device development effort is only a small part, and does not require all overall software recompile and publishing, it makes the development of equipment widget shortened cycle. It also can be based on different business needs to carry out division multiple devices plug parallel independent development, then we can improve development efficiency and product quality.

**SOA-based Enterprise Service Bus Technology.** Application Engine based on Enterprise Service Bus (ESB) technology provides Service development, operation and application integration support to smart home applications. App Engine is a service application support layer; it is the core of an integrated service platform, and it provides the support of development, operation and application integration of smart home service application. It implements the Enterprise Service Bus (ESB) functionality. Its function structure is shown in Fig.3.

![SOA-based Enterprise Service Bus Diagram](image)

**Figure 3. SOA-based Enterprise Service Bus Diagram.**

- **Service Access Proxy**
  Service access proxy mainly implements the client application is easy access to the bus system in a distributed SOA environment. It can initiate bus service requests or establish bus-based event-driven mechanism, so that service access proxy allows users to call each flexible service deployment in a distributed bus environment.

- **Service Bus**
  It is networking applications Enterprise Service Bus (ESB). ESB is a pillar technology of SOA architecture. As message broker architecture, it provides message queuing systems, uses standard techniques such as Http, Socket, SOAP or JMS. It is an open, standards-based messaging mechanism, and it completes the coarse-grained application (such as the service) and other components of interoperability between through simple standard adapters and interfaces.

- **Service Process Choreographer**
  The platform provides a service orchestration tool based on BPEL4WS (Business Process Execution Language for Web Services, BPEL). It assists service access proxy to satisfy the requirements of the service requester combination.

- **Service Resource Registry**
  Service resource registry is a service resources Register product adapted to distributed SOA and the actual needs of information integration. It is involved in all stages of business services across the SOA lifecycle, and provides enterprise SOA architecture design, development, deployment, operation full support.

- **Service monitoring center**
Service monitoring center provides visual bus monitoring platform for the enterprise service bus. It provides real-time, dynamic and flexible intelligent monitoring to business services distributed in different physical nodes bus. Service monitoring center show the bus service operating state data and the performance indicators to client vividly through rich graphical display interface.

● Service listener
Integration platform Provides HTTP, SOCHET, SOAP, JMS and FTPaisle to passing messages between business applications to support performance and security in a variety of environments to exchange information. Users can dynamically change the message channel by configuration. Platform engine provides a listener for each channel, receives client service request message.

● Service Adapter
Universal adapter’s main achievement is the seamless convergence of various data sources, information sources, and various application systems. It is an important component of government information exchange and information integration.

● Engine runtime
Engine runtime is the core component of platform engine. Its main function is responsible for the process of start and control platform.

● Message distributor
Message distributor is responsible for local services for messaging and distributes the message to local or remote server. It is mainly responsible for the distribution and routing messages under the distributed bus service. It implements a flexible message communication and interaction through static routing, dynamic routing, and routing rules. It supports multiple service providers simultaneously request.

● Service Bus Access
Access several components connected to the application service bus. It is mainly practiced in distributed SOA environment, the client application system easy access to the bus. It allows clients to call the service deployed in a distributed bus environment flexibly and easily.

Summary
The paper proposes a mobile-cloud-based smart home service platform technique. It has succeeded in integrating some application products from different suppliers, such as smart home, domestic service, food and beverage service, Community Shopping, community security and property service. The authors are planning to cooperate with several smart city operators and integrate urban public service, to provide more convenient government service for residents.

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References

