

Mobile Internet Application Infrastructure: An Open Garden

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Abstract:

Based on good mobile Internet application infrastructure, the user access layer can provide users with quick and easy access to mobile Internet applications; the service provisioning layer can improve both access rate and Quality of Service (QoS), enforce the control of content resources, and reduce the cost for content storage as well as management overhead; and the service layer can reduce service development requirements and operation and maintenance cost, making it easier to launch services. This paper suggests that the Chinese Government should, based on the existing networks, make strategic efforts to push research work and industrialization process of the mobile Internet application infrastructure.

1 Opportunities and Challenges Facing Mobile Internet

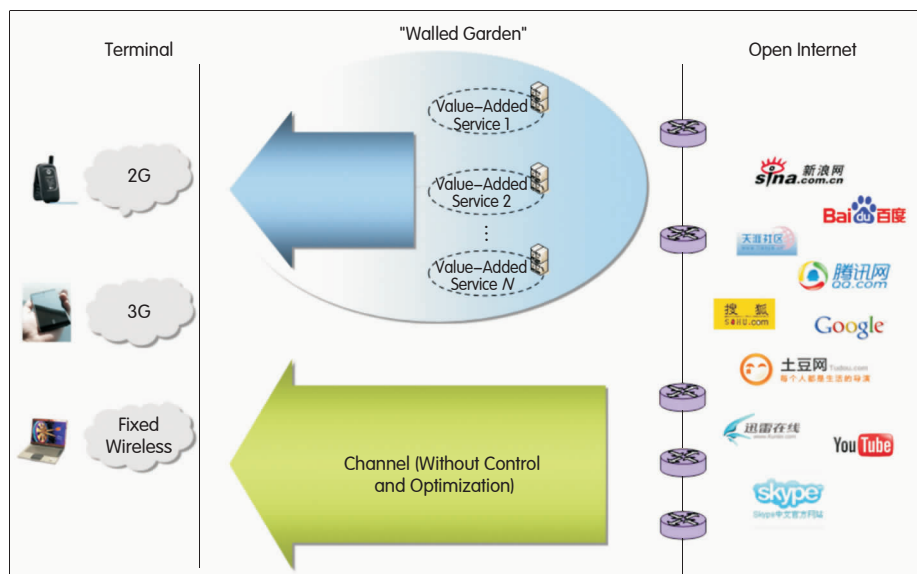
In the era of mobile Internet, the competition between businesses has upgraded from the level featuring independent services to the competition of platforms or even industry chains that take different organization forms. Emerging Internet enterprises are expecting to build advantageous platforms based on large-scale and popular applications, and only use operators as channels. The terminal manufacturers, however, hope to roll out their mobile Internet strategy with high terminal occupation rate and boosted customer loyalty. Operators, after all, also need to adapt to the new environment, energetically push their services and establish an operator-centric industry chain, so as not to be simply channelized.

As progresses are further made in transforming the telecom operators from telecommunication service providers to information service providers, mobile Internet services are playing an increasingly significant role in the overall strategy layout of enterprises. The grants of 3G licenses have led to wide

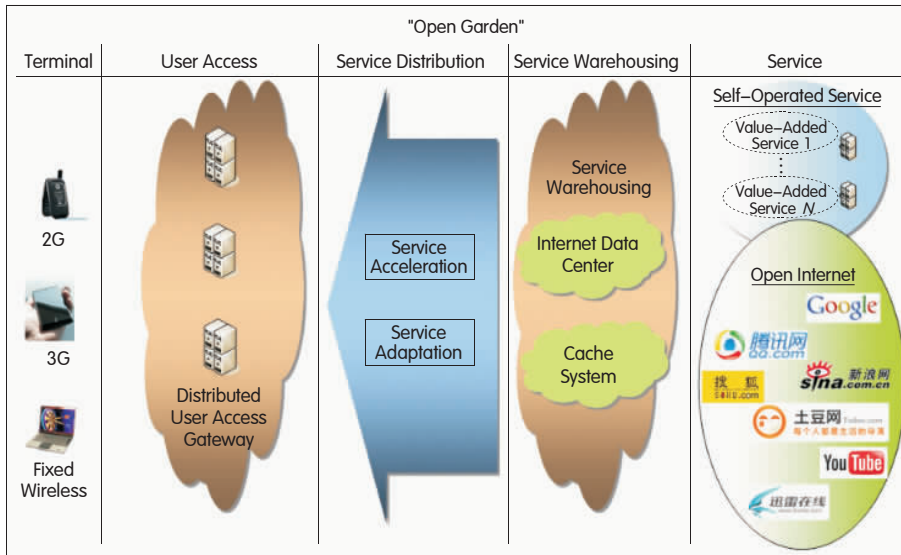
consensus on the new opportunities for service development and revenue growth that the mobile Internet has been bringing to the industry. The mobile Internet-based businesses and services are expanding all the time and have already covered areas of people's daily life. New potential market opportunities produced in this process also translate to big revenue sources for businesses.

Challenges, however, are hardly

separable from opportunities. Operators used to build a "walled garden" (as shown in Figure 1) on the open Internet to meet their objective of manageable and operable data value-added service. Now with the wider network bandwidth for radio access and more advanced terminal technologies, functions of mobile terminals are becoming similar to those of PCs, so are the services and contents between self-operated business and



▲ Figure 1. "Walled garden" built by operators over open Internet.



▲ Figure 2. "Open garden" built by operators over open Internet.

open Internet business. Besides, disparities between channel charges are also shrinking. All these changes are intensely impacting the mode of "walled garden".

Due to the restrictions of current data service network architecture with the "walled garden" mode, specific research is often needed for the implementation scheme of some new services to be launched. Anyway, only make-shift or partial solutions can be worked out in this regard to meet a tight time-to-market schedule of these services. That is to say, the original service network mode is becoming more disorderly and presenting more limitations and thus bringing about serious difficulties for service deployment and operation that demand low-cost yet high efficiency.

The operators, therefore, need to consider more on how to effectively introduce Internet business and service, to enhance continuously user experience and manage Internet traffic in a more effectively way as well. This way, they are able to plan and deploy the orderly "open garden" (as shown in Figure 2) to meet requirements of the developing services and keep abreast with the growing mobile Internet.

The core of "open garden" is to eliminate boundaries between the "walled garden" and open Internet, and to provide all businesses with universal infrastructure service. By constructing an infrastructure for a variety of mobile

Internet applications, the user experience will hopefully be enhanced, the business and services be more adaptive to characteristics of mobile Internet, and the "open garden" develop in a more orderly way.

2 Importance of Mobile Internet Application Infrastructure for Operators

The coming years will see the competition focusing on services. Applications will be the trump-card weapon for retaining users. To make service development, operation and maintenance simpler, and to boost quality of service and user satisfaction, operators should build up the mobile Internet application infrastructure to the end that the "walled garden" could transit to "open garden" and the complete industry chain develop to a new level.

(1) Guarantee for the transformation of operators' services

To design reasonable mobile Internet application infrastructure so as to support service development is what can guarantee operators' telecom services transformed to information services. The reasonable application infrastructure is able to streamline the process of getting service online and developing service platform, slash cost in new service development and network operation and maintenance, and support effectively the new service expansion and rapid

reaction of customers. Traditional telecommunication network used to be designed for telecom service, which is typically featured by very simple category, high reliability, poor flexibility and long life cycle of a type of service. Even with the mode of "walled garden", the services are still too simple and the period for putting a service online is long, although the network has opened some capabilities for service invocation. Since the advent of the mobile Internet era, services have become diversified as in a long-tail distribution, and their life cycle significantly shortened as well. Meanwhile, in the process when the fresh market of information service grows, there is always a need for large quantities of "seed services" at a low cost. Only with the highly efficient application infrastructure, can operators adapt to the demand of service development during their transformation to information service provider.

(2) Guarantee for boost of user satisfaction

A high-quality mobile Internet application infrastructure is able to guarantee, on technological terms, the boost of user satisfaction and loyalty. The key to enterprise growth in market competitions is often to retain quality users. This is why operators should always make progresses for higher service quality, enhanced user experience and provisioning of well-tailored service to end users.

At the age of telecom services, customers use quite simple indexes for appraising operator service, for example, network quality, network coverage and call drop rate. Users' experience of data service, however, is becoming increasingly important due to the rapid development of data service. Current networks of operators are complicated, for instance, the interconnection modes between varying service platforms and the access control, management, operation, and charging systems are different. The reasonably planned application infrastructure is able to ensure that network elements in the network have clearly demarked functions, services in the network have well defined workflows, and then the quality of service launched onto the network can be promptly guaranteed.

As far as the user experience of mobile Internet service is concerned, the difference between mobile terminal and PC will remain for some time, it is prone to be phased out though. Limitations exist when the mobile terminal is used to access the Internet, for instance, the screen size, application protocol and access speed. Worse still, the large diversity of mobile terminals is easily ignorable by the application design of open Internet. Operators may, with the established application infrastructure, realize interoperation and interconnection of services among heterogeneous networks, and provide services such as protocol adaptation and application acceleration, to the end of boosted user experience.

The application infrastructure offers primary data to intensive service operation and functions as the foundation for the provisioning of more sophisticated service. In the era of mobile Internet, the core competitiveness of operators is best represented by the capability of, as oriented to the customer resource, continuously subdividing customers and then integrating data service resources so as to provide customers with customized and personalized service. Anyone who is able to catch and meet future demands of users can stand out in future competition. The application infrastructure, by tracing, collecting and sorting out user activities, is there to technologically support operators in shaping up overall and precise schemes for rolling out marketing activities, service and business activities, thus laying the foundation for enterprise growth in the times of mobile Internet.

(3) Guarantee for commanding heights in future competition

In the era of mobile Internet, roles along the industry chain, the high-ranking terminal manufacturers and Service Providers (SPs) for instance, are trying to set up a chain that emphasizes their core advantages. This means there are diversified competitors to be faced by operators, and the focus of future competition has changed, as well, from a certain telecom product to the whole information service, from service to integration capabilities, and from between enterprises to industry chains that take different organizational patterns.

By building up the application infrastructure, operators can, while steering clear of being channelized, stand in a better position in settling on an industry chain that is favorable to themselves.

Estimation shows that in 2012, the revenue of telecom operators from Internet will rise to 20% in terms of occupation ratio. Data of AT&T, a US operator, also indicate that new applications requiring more and more bandwidth are springing up, and that the broadband data service is growing at a 50% rate each year. It's now a very important issue for operators to consider as how the growth in data service can bring about more revenues. Operators used to make a profit through access service, in this mobile Internet era, however, when eyeball economy and user experience are what it is all about, operators should definitely take into account the approaches to increasing network value, providing differentiated service and staying away from being channelized. The building of mobile Internet application infrastructure can help strengthen up the operation and management of content and application, and research of user needs, so that operators are able to provide network-based infrastructure value-added service and engage in the Internet service from various aspects.

Furthermore, the mobile Internet application infrastructure can help facilitate the subdivision and development of the industry chain and accelerate the development of the mobile Internet industry. By building the application infrastructure, operators are able to streamline the service development process and provide network functions such as capability invocation and service acceleration, which are advantages of a network platform after all. By combining the advantages of network and user quantity, operators are able to provide diversified service with high added-value to partners and stimulate continuous innovation out of partners, to the end that partners' service and terminals can be combined to the greatest extent with the operators' network platform and richer services can be launched for end users. As a result, an eco-environment

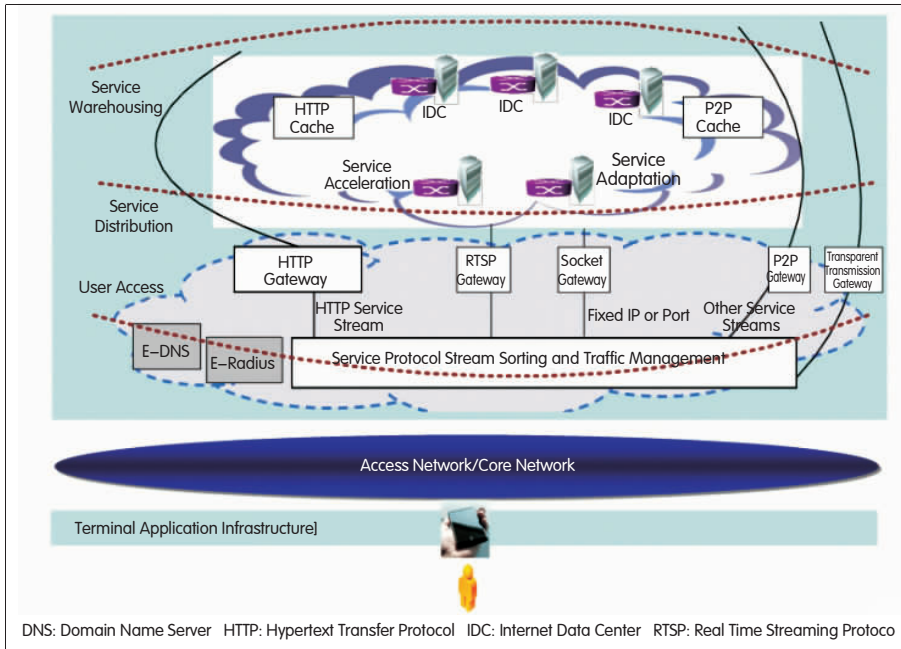


centered on operators will come into being and an industry chain of contents, applications and terminals be shaped up that is bound with the infrastructure, hence enterprises can get the upper hand in future competition.

3 Development Vision of Mobile Internet Application Infrastructure

The mobile Internet application infrastructure is an organic set of services, terminals, network and components of resource capabilities that is deployed over the IP bearer network. It provides users and SPs with a quick channel for accessing the mobile Internet applications, improves users' access rate and service experience, cuts down storage cost and management overhead, and makes services easier to develop and quicker to launch online. The infrastructure constructed with the help of cloud computing and Peer-to-Peer (P2P) technology provides, through virtualized distribution of IT resources such as computation and storage, the new-model IT service in such modes as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS).

The vision for the mobile Internet application infrastructure is to construct the open and orderly eco-environment of mobile Internet. The application infrastructure, as it is based on a general and unified plan, provides easy access for self-operated business and open Internet services, to encourage the open Internet contents and services to be used in the interests of operators. The foundation for this eco-environment is



▲ Figure 3. Vision of mobile Internet application infrastructure.

the application infrastructure that is planned and designed on a unified basis and made up of two components. One is to provide with unified solution for users to access the self-operated business and open Internet. That is, to make easier access to service applications through the user access gateway which is based on the distributed architecture. The other is to provide universal infrastructure services for the self-operated business and open Internet applications. Such universal services include service warehousing, service distribution acceleration, and adaptation of Internet contents and application, for the purposes of higher efficiency of service application distribution, no more repetitive investment, better user experience of Internet access, and avoidance of traffic impact on Internet as well.

Figure 3 depicts the vision of mobile Internet application infrastructure.

The mobile Internet application infrastructure consists of the following parts:

(1) User access—distributed user access gateway

The distributed user access gateway is able to provide users with a uniform and easy access to self-operated business and open Internet. With the traditional "walled garden" business

mode, the channels to self-operated business and open Internet provided by mobile service operators are not really smooth. The "distributed user access gateway" system in the target vision, therefore, will focus on smoothing up the channels, that is, to direct the service streams by different protocols to different protocol gateways for further processing. The function of protocol gateway is to optimize protocols, insert effective information and adapt contents. The processing by protocol gateway will accelerate user access, improve user experience of Internet contents, and also provide effective user information to partner SPs of operators. The access channel to open mobile Internet built for the sake of distributed user access gateway offers the foundation that guarantees the win-win co-operation between operators and Internet SPs.

(2) Service warehousing—Internet Data Center (IDC) and cache system

The service warehousing facilities refer to the IDC and a variety of cache systems. The IDC belongs to this part of the application infrastructure built to meet the needs of Internet businesses and enterprises/agencies for information. Based on its abundant computation, storage, network and application resources and through its high-speed connection with the Internet, the IDC

provides SPs, Content Providers (CPs) and group clients with large-scale, high-quality and reliable services, for example, managed host service, host leasing, network bandwidth leasing and content distribution.

The varied cache systems include Hypertext Transfer Protocol (HTTP) and P2P cache systems. The HTTP cache system is able to cache the open Internet websites into the network and provide page adaptation and protocol optimization functions to suit different terminals. The P2P cache system is able to effectively cache the P2P content of open Internet within the network, reduce the inter-network P2P traffic and provide high-quality P2P service to users.

(3) Service distribution—distributed business networks, for instance, application distribution network, content distribution network and P2P Session Initiation Protocol (SIP) network.

The objectives of developing Internet business are differentiation and competitiveness, and understandably capabilities require appropriate aggregation. A large and full-purpose network may just turn out to be unrewarding and thankless with its services much less individualized, diversified and flexible. If public units are adopted for all general-purpose functions, the public units will then need upgrading over and over again. This explains why both intelligent network and IP Multimedia Subsystem (IMS) have failed to carry all services.

Internet firms are usually top professionals and this makes us wonder whether those big names, such as Google, Youtube, Skype, BT and PPLive, will be able to integrate their services on a common network. We expect dedicated and differentiated services and capabilities on the network to make the integration possible.

As the telecom network is concerned, the 3GPP is also dividing services into four types with much different service patterns in between, namely, the session type, the stream type, the interaction type and the background type.

The P2P SIP network is a distributed service network targeted at the integration of traditional telecom network and Internet. It is designed for the session type of service, for example,

voice, video telephone, and video conferencing.

The P2P Content Delivery Network (CDN) is designed for the live play, play-on-demand, download and static webpage browse of multimedia content. It is the application infrastructure for content acceleration and is able to cut down effectively the consumption of backbone bandwidth, decrease service platform's load and improve the quality of access to various service platforms as well.

The Application Distribution Network (AND) is targeted at real-time interactions of web games, e-commerce and dynamic webpage browse.

Other service networks emerging as new favorite include those for intelligent search and junk mail processing that requires bulk computations and mass data treatment.

(4) Terminal application infrastructure

As a wide variety of mobile terminals (such as cell phones) equipped with the multimedia capabilities are flooding to the market, there comes a necessity to screen off the operating system disparities for the sake of an open, open-source and uniform mobile terminal environment. The recent years have seen significant progress made in hardware processing capability and intelligent software of handsets, the open operating system has provided terminals with a platform for plenty applications as well. But because of the lack of a uniform Application Programming Interface (API) between these operating systems, third parties need to develop applications to suit these different systems. Service adaptation between different systems and terminals is also quite complex, making it harder to launch a new service. The terminal application infrastructure will bring about quite favorable mobile terminal environment with uniform API for terminal application and improved terminal adaptability for various services, making it easier to develop third party applications and popularize new services.

4 Problems of Mobile Internet Application Infrastructure

In the process of building the mobile

Internet application infrastructure, problems deserving special attention are: user access, service warehousing and service distribution.

(1) User access

A common problem of user access is the lack of an easy channel to mobile Internet applications. There are two mainstream access channels that both have their own drawbacks. One is the Wireless Application Protocol (WAP) gateway featured by "blocking", that is, the "walled garden" service system constructed on a single protocol gateway can hardly meet the requirements for new service deployment. The other is the "let go" pure channel that set no blocks in the way for Internet access. Without any restriction or management, users are free to access Internet applications and contents. However, special applications of Internet, such as P2P, will cause serious impact on the mobile network system and quality of service that are set up in a closed system.

(2) Service warehousing and service distribution

Operators may build the service warehousing and service distribution infrastructure to solve three problems. Firstly, operators should further control the content resource so that they can beat the competition of information service, and converge content through the IDC so as to set themselves free of the inter-network channel bandwidth limitations, hence the improved user access speed and quality. Secondly, thanks to the booming data service especially broadband multimedia service, service contents are richer and user access and bandwidth increase, all these are setting higher requirements on quality of service, service platform and data service bearer network of operators. Cases are that the backbone network bandwidth slows down the development of content operation, and single point service server suffers from heavy load. Meanwhile, content storage cost and management overhead increase all the time. With the content distribution network, service access quality and user experience will be greatly enhanced, hence the much higher rate of return on investment. Thirdly, the progresses made in P2P have led to increasing proportion of P2P traffic (including inter-network

P2P traffic). The P2P cache system will provide users of a network with high quality P2P service and reduce inter-network P2P traffic.

5 Conclusions

The coming three to five years will see rapid growth of mobile Internet as well as the transform of telecom businesses. The mobile Internet service will play a critical role in the revenue breakthrough of operators^[1-3]. Faced with problems in service development and transform, operators have to accelerate the technical research and industrialization process of infrastructure for service network and mobile Internet, to turn the "walled garden" into an orderly "open garden", promote service innovations centered on user experience and explore the future of mobile Internet for themselves.

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Biographies

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Yang Zhiqiang is a senior engineer and the vice president of the China Mobile Research Institute. She has long been engaged in the research of communication engineering design, technological management and product R&D, and led her team to successfully launch China Mobile Digital Service Management Platform (DSMP), Mobile Broadcast Business Management System (MBBMS) management platform, and end-to-end service system for mobile phone payment. She obtained a specialist allowance granted by the government, and has published 60 research papers.

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