

# A P2P Based Distributed Services Network for Next Generation Mobile Internet Communications

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## ABSTRACT

In this poster, we present a novel P2P (Peer to Peer) based distributed services network (DSN), which is a next generation operable and manageable distributed core network architecture and functional structure, proposed by China Mobile for telecommunication services and wireless Internet. Our preliminary implementations of P2P VoIP (Voice over Internet Protocol) system over DSN platform demonstrate its effectiveness and promising future.

## Categories and Subject Descriptors

C.2.1 [Network Architecture and Design]: Distributed networks, Wireless communication

## General Terms

Management, Design, Economics, Standardization

## Keywords

Mobile communication, Distributed computing, P2P, DSN

## 1. INTRODUCTION

Nowadays, both the telecommunications network and Internet are facing some severe challenges respectively, and at the same time, they also have some advantages to draw on for each other. Therefore, to realize the convergence of the telecommunications network and Internet, it is necessary to design a new core network structure that can combine the advantages of them.

Distributed Services Network (DSN) is a next generation operable and manageable distributed core network architecture and functional structure proposed by China Mobile for telecommunication services and wireless Internet. To address the challenges that the current telecommunication networks and Internet are facing, in terms of service and operation we combine the advantages of the high speed, flexibility, lower cost and scalability of Internet and the operability and manageability of telecommunication network, which will be driven by emerging technologies (e.g. P2P and other distributed technologies).

DSN enables various functions that are originally provided by traditional telecommunication core network in P2P way. In addition, it is also required to provide continuous service delivery capability, self-adaptive load balancing capability, bandwidth convergence capability, distributed storage capability, dynamic resource scheduling to provide better support for wireless Internet and implement telecommunication services at lower cost.

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## 2. DSN ARCHITECTURE

### 2.1 Design Philosophy

DSN is a wireless Internet-oriented platform with carrier-level service capabilities, which is located in the core network between the service network and the bearer network. Based on distributed technologies, especially P2P, the DSN provides core network capabilities for wireless Internet services and necessary support for the operation of services [3].

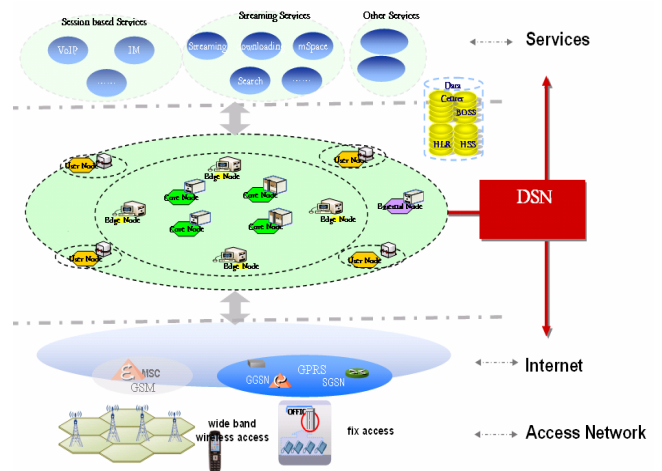


Figure 1. DSN architecture

The main points about the philosophy of the DSN design are as follows:

- deeply exploring the requirements of applications for network capabilities according to Internet services;
- introducing new services and realizing the desired network capabilities in combination with existing technologies;
- maintaining the operability and manageability of the telecommunications network;
- being oriented to mobile telecommunications customers, take the advantage of the network and highlight the service characteristic of wireless Internet services.

Much of the core functionality of the DSN can be realized through the application of software. With the componentization of software and the underlying layer screened by middleware, the DSN software can be deployed on hardware platforms with different functions and in different locations to realize distributed deployment.

### 2.2 DSN Architecture

As shown in Figure 1, DSN function is enabled by deploying Super Node in the core network, mainly providing the service

control capability. Furthermore, DSN function is gradually extended to access node, user node and external node to maximize the computing capability, storage capacity and bandwidth of access nodes and termination nodes. These nodes can provide network capability and service capability.

### 2.3 Application Scenarios

DSN enables the core architecture of wireless Internet with the combination of P2P technology and other distributed technologies. With DSN, carriers are able to build scalable telecommunication network platform that deliver multimedia applications and content applications. In DSN application system, the following services are enabled:

- (1) **MMTel Scenario:** With DSN, carriers can build a large-scale cost-effective operable distributed MMTel service system.
- (2) **Content storage and delivery:** DSN enables very large data storage with the help of DSN, and in turn content delivery. In P2P-enabled system, network resources are distributed across peer nodes in the system.
- (3) **Streaming:** In P2P-based streaming system, each node provides uplink bandwidth while obtaining data from other nodes, and uploads data to other nodes. Data is transmitted in segmented manner. In P2P-based streaming architecture, system capability is improved along with the addition of nodes, this also solves the scalability problem. For system provider, the load of server will be reduced with the increase of users. For users, then are faster to access the resources and the media is played more fluently.
- (4) **Large-scale High Bandwidth Multi-media Service Scenarios:** Bandwidth exhausting multimedia service in the future may become the killer application of carriers. However, it has higher requirements on the network bandwidth and processing capability. These applications have very high requirements on the carrier network: Presence system requires 3-10M network bandwidth, less than 100ms delay, and 10ms jitter, and also have high requirement on route setup process and QoS. DSN intelligent routing mechanism provides routing function for the system, and provides QoS guarantee for large capacity multimedia service on the basis of P2P bandwidth aggregation capability.
- (5) **Other Service Scenarios:** Since the functionality of the DSN can be realized in the form of various software components, it can flexibly support all kinds of wireless Internet service scenarios in the future, such as IM, web2.0, and online games, etc.

### 2.4 Main Characteristics

- (1) **Distributed:** DSN uses P2P technology and distributed computing technology to distribute the system load across the service nodes in the system in balanced manner, which not only ensures the service availability and stability, but also reduce the cost.
- (2) **Homogenous:** Using the distributed technology like P2P, DSN provides homogenous treatment to the system service nodes, which improves the scalability and reliability of DSN and effectively reduces the expansion cost of DSN.

- (3) **Robustness:** Distributed network architecture in nature features high error tolerance. Since service is distributed across nodes, when part of nodes or network are damaged, it will have minimal impact on other parts of the network.
- (4) **Self-organized:** With distributed technology, DSN provides self-organization feature. In distributed architecture, DSN nodes collaborate with each other with specific algorithm.
- (5) **Distributed Network Control Capability:** In DSN, QoS on application layer, P2P mobility management, P2P interconnection, network traffic control and exception discovery can be enabled by building a P2P-based network control management layer to improve the control and management capability of Internet.

### 3. PRELIMINARY IMPLEMENTATIONS

Up to now, we have deployed hundreds of super nodes in our China Mobile IP Private Network and implemented an effective P2P based VoIP applications using well-known P2P SIP protocols, which provided the mobile users with high quality and cheap voice services. In this application, we provided an effective strategy to find relay nodes for VoIP communication nodes with low delay, thus optimize the connecting link. The P2P VoIP architecture is depicted in Figure 2 [1, 2, 4].

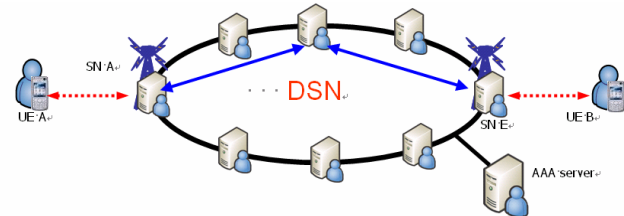


Figure 2. Architecture of P2P VoIP application

### 4. CONCLUSIONS

DSN is an open and promising mobile Internet network architecture towards next generation mobile network, which effectively adopts P2P based distributed computing technology for cost effective and high quality services.

Based on the current preliminary results both in research and practice, we would like to further study on how to realize P2P streaming services such as IPTV in our DSN platform.

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