

Technology Reports

Special Articles on Technology Supporting Large-capacity and High-efficiency Communication in the Flat-rate Era

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Flat-rate plans for communication services have not only reached fixed-line communication, but they have also extended to mobile communication. For users, a service that can be used for a fixed monthly fee is attractive in providing peace of mind. It allows them to communicate without caring about the time or the amount of use. The direction of services sought by NTT DOCOMO for creating new value in mobile phones is shown in **Figure 1**. We at NTT DOCOMO seek to strengthen services in three pillars. Flat-rate services make up one of the pillars.

Mobile phones, as the name suggests, started as telephone services, and fees were billed at a metered rate according to the amount of time they were used (for example, 10 yen for 1 minute of talk time). For data transmissions, such as e-mail, fee structures also started with metered rates based on the amount of packets sent. Recently, however, flat-rate services have been introduced and are now expanding. While metered rate services are being provided steadily, flat-rate businesses are expected to increasingly grow in the future.

Examples of flat-rate services are shown in **Figure 2**. Among the various flat-rate data services, i-mode's flat-rate plan (Pake-hodai), which began in 2004, has seen especially a rapid rise in the number of users. Including Pake-hodai Full, there are now already 12 million subscribers, making up 30% of total subscribers, and the number continues to grow. For voice services, the family plan, which allows free calls 24 hours a day between family members in Japan for a flat-rate, began in April 2008 and has been favorably received. Also, a flat-rate delivery service, providing for example news, is already being used by more than 15 million users in less than three years since its inception in September 2005.

To support the flat-rate system, the goals for technological developments are centered on increasing transmission speed, expanding transmission capacity, and lowering the cost of transmission. Increasing the speed of transmission expands the capacity at the same time, and is tied to the cut in transmission cost per bit. The rise in transmission speed for mobile communication is shown in **Figure 3** together with the

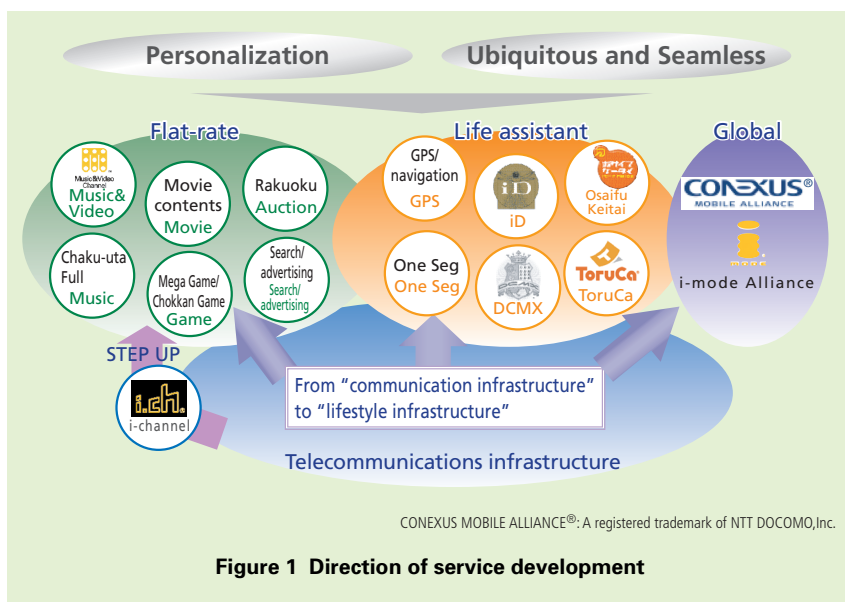
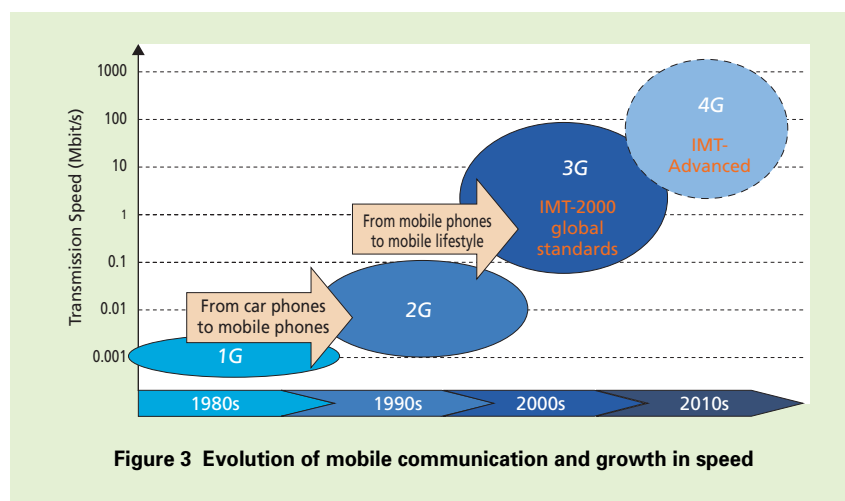
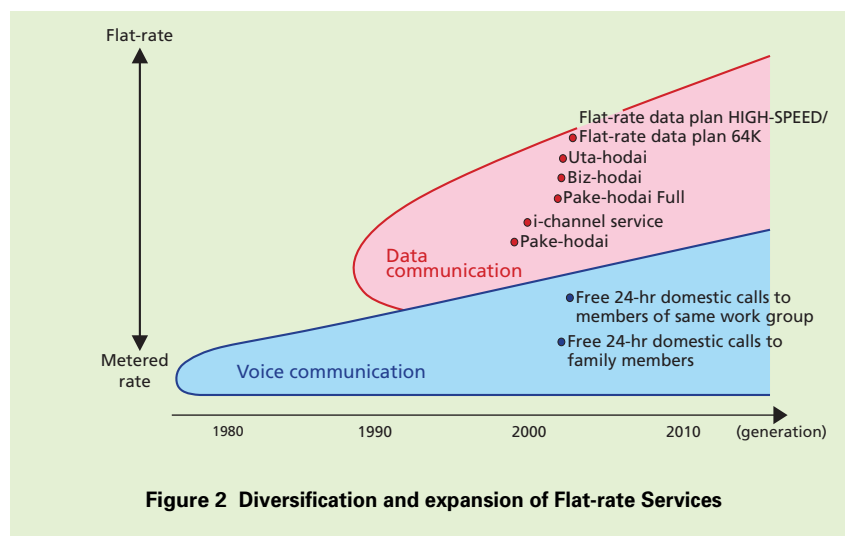


Figure 1 Direction of service development

evolution in communication systems. Compared to the first digital mobile phone services, today's services provide a transmission rate 100 times faster. Furthermore, the Fourth-Generation (IMT-Advanced) system promises to deliver mobile services at a rate of 1 Gbit/s in the near future.

For mobile communications, which share the use of a limited frequency spectrum, improving the spectral efficiency is an essential element of increasing speed, expanding capacity, and lowering costs. Compared to the initial Third-Generation technologies in 2001, HSDPA, which began service last year, has three to four times greater spectral efficiency. Furthermore, Super 3G (Long Term Evolution (LTE)), which is currently under development, is expected to increase this efficiency by several factors.

In this special articles, we introduce technologies that support flat-rate mobile communication from a variety of directions, such as wireless access technologies that include improving spectral efficiency, networking technologies, and terminal technologies. We also introduce technologies that support and promote the growth of flat-rate mobile communication. First, we describe Super 3G (LTE). While providing a look at the history of the development of wireless access technologies and the generational shifts, we survey the standardization of Super 3G and the worldwide trend concerning its commercialization. We also describe its latest technological developments for improving speed and increasing spectral efficiency. To lower bit costs in



order to support the demands of flat-rate communication services, it is especially becoming vital to maintain competitive strength in the marketplace. We next introduce our efforts to make the FOMA voice network All-IP network (AIPN technology) in order to advance services and economize the network so as to support the flat-rate business market. Furthermore, we provide a look at latest trends in high-speed data communication terminals that meet the mobile needs of users not only in the home or office. Finally, we introduce fundamental technologies for indispensable wireless access using high frequency and

wide bandwidth, such as the Fourth-Generation (IMT-Advanced) system. We also present the newest technologies in batteries and power sources that will contribute to the miniaturization and power saving of mobile terminals.

Flat-rate services for mobile communication are expected to further grow and diversify from now on. We will continue R&D on technologies such as wireless access, networking, and mobile terminals in a comprehensive, integrated manner to make use of these services even more convenient and comfortable.