Technology and R&D activities supporting KDDI's business

Technical advantages of CDMA2000 1x EV-DO Revision A

Introduced in November 2003, CDMA 1X WIN services from au make use of a specialized high-speed packet-switched data communications protocol known as CDMA2000 1x EV-DO (Rev. 0). This facilitates maximum speeds of 2.4Mbps downloading and 154kbps uploading in the 1.25MHz frequency band.

Protocol standards for Revision A, the next-generation CDMA2000 1x EV-DO upgrade, were finalized in April 2004. KDDI is scheduled to enter commercial operation of the technology in 2006. Featuring improved downlink (3.1Mbps) and uplink (1.8Mbps) speeds, Revision A will support functional Quality of Service (QoS) improvements. The improved standard also employs quality assurance technology to allow maintenance of connection quality for specific users and minimal transmission delays, thus enabling the simple provision of two-way real-time communication services such as VoIP or IP television broadcasting.

Supporters of rival technology W-CDMA, beginning with NTT DoCoMo, are promoting the standardization of HSDPA (High Speed Downlink Packet Access) with an upgraded W-CDMA protocol. NTT DoCoMo has announced the mid-2006 launch of HSDPA services with initial maximum speeds of 3.6Mbps for downloading and 64-384kbps for uploading using the 5MHz frequency band.

The technology used in HSDPA services to maximize speed and volume of data transmission includes hybrid ARQ (Automatic Repeat Request), which improves error correction by triggering re-transmission using error codes, and modulation technology that varies speed depending on the strength of the connection and network status. In performance terms, the system used in HSDPA is arguably the equivalent of CDMA2000 1x EV-DO (Rev. 0), which means that CDMA2000 1x EV-DO (Rev. A) is effectively more advanced.

Mobile WiMAX[1] field trials

KDDI has positioned Mobile WiMAX as an access system for Ultra 3G, and is pushing ahead with field trials to test its viability as a wireless platform that will complement 3G mobile phone systems in urban areas.

KDDI received government approval in June 2005 to perform a phased program of field trials in the city of Osaka to test mobile WiMAX technology. The trials evaluated basic functionality and performance of the underlying OFDMA (Orthogonal Frequency Division Multiple Access) standard, followed by mobile applications, base station handover within a mobile WiMAX setting and seamless switching between media channels and 3G systems such as CDMA2000 1X EV-DO and WiFi[2].

KDDI also plans to evaluate WiMAX performance in multimedia applications such as image content and voice services and IP-based TV phones. Development work also continues to combine a mobile network with an IP-based multimedia platform to create a MultiMedia Domain (MMD) accessible to mobile devices using an IPv6 backbone. Tests conducted in early 2006 successfully connected the WiMAX system to an MMD application server. KDDI plans to develop these technologies to provide a new generation of mobile communication services.

To improve related infrastructure, KDDI is developing advanced technologies such as MIMO (multi-input multi-output[3]) and AAS (adaptive-array antenna system[4]) to facilitate a low-cost mobile WiMAX system.

Notes: 1. Standard for fixed wireless communications approved by the Institute of Electrical and Electronics Engineers (IEEE) in January 2003 (amendment to band frequency in IEEE 802.16 standard).
2. Brand name devised by the trade group WECA to increase awareness of IEEE 802.a/IEEE 802.11b, standards for wireless local area networks (WLAN).

Mobile WiMAX handset

3. A technique of wireless data transmission using multiple antennas to increase spectral efficiency. It has been applied to increase the speed of WLAN, for instance.
4. A system that enables dynamic directional control of antennas by applying an appropriate weight to each of the signals received at the antenna elements and combining them.

Uninterrupted IP multicasting technology

Going forward, video transmission will be characterized by broadband killer contents via FTTH. IP multicasting involves simultaneous transmission of video or other data to multiple users. KDDI has developed technology to prevent any interruption of transmission if there is a network failure.

IP networks automatically re-route if this occurs, but the resulting delay of up to 30 seconds typically cuts off the video signal during IP multicasting. KDDI has solved this problem by employing back-up servers installed in a gateway close to the user. If a network problem triggers re-routing, the gateway detects this within a few hundredths of a second and switches transmission to the back-up server to maintain an uninterrupted signal to users. This provides sufficient time for the network to find a problem-free route. Once re-routing has finished, the gateway switches back — without users noticing any program interruption.

Network and service security

The following are two examples of the initiatives undertaken by KDDI to boost network and service security.

1) High-speed encryption technology for mobile phones

Envisioning an environment where communications mixes seamlessly with broadcasting, KDDI has developed, an original high-speed encryption algorithm for mobile phones. It is 6-8 times faster than AES (Advanced Encryption Standard), a widely used encryption algorithm, and also supports real-time decoding of streamed video (such as One Seg) to mobile handsets — a feat that is beyond existing standards. As connectivity continues to improve, this algorithm promises to contribute to the development of emerging businesses involving real-time transmission of broadband content to mobile users.
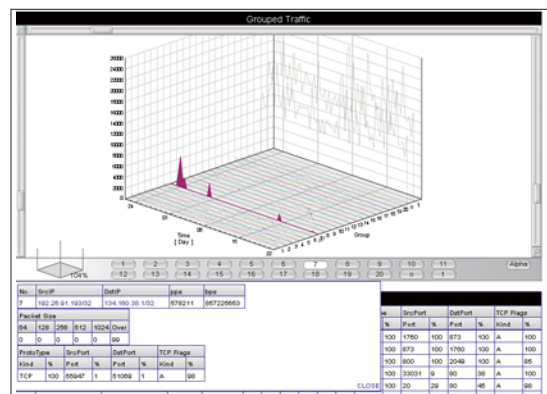
2) Combating network attacks

KDDI has installed on its network a system that automatically detects DoS (denial of service*) attacks. The system is capable of detecting such attacks by analyzing traffic samples in high-speed networks with connectivity of up to 10Gbps. Detection is based on analysis of traffic characteristics, and works irrespective of network features. Capable of detecting DoS or distributed DoS attacks on a network within just a few minutes, the system promises to raise the quality of KDDI's IP services.

Note: An attack on a network that causes a loss of service to users by overloading the system with high-volume data.

Testing IP multicasting

DoS analysis screen