Further Reinforcing Competitiveness toward "Challenge 2010"

To achieve the medium-term target represented by "Challenge 2010", KDDI must aim to provide unparalleled customer satisfaction in every service. At the same time, it will be crucial to ensure sustainable growth through both "Quantitative Expansion" and "Qualitative Enhancement." KDDI will promote further convergence of mobile and fixed-line services to develop its businesses in its own unique way.

In the Consumer Business Sector and the Solution Business Sector, the respective general managers explain their thinking with regard to future business development.

Makoto Takahashi
Associate Senior Vice President,
General Manager, Consumer Business Sector
Member of the Board

Consumer Business

"au" is Central in our Efforts to Increase and Reinforce Touch Points With Customers to Provide Services That can Propose New Lifestyles.

Q. How do you evaluate the results of mobile number portability (MNP) following the system's introduction in October 2006?

A. I think the strong start under MNP comes down to the fact that customers recognized the comprehensive product power in au. If we look at surveys of uses that came to au through the MNP system, they gave us high marks in particular for our coverage. In addition to the superior call quality such as a good connection anytime and anywhere, I think that our efforts to provide pioneering data communications services were also crucial. KDDI led the industry in leveraging the capabilities of 3G infrastructure by the introduction of CDMA2000 1x EV-DO in November 2003. Clearly, choosing a mobile phone service depends on evaluating infrastructure, handsets, charges, and services as a complete package. That is why I think it is of the utmost importance that we continue to stay ahead of others on all counts.

Q. Has the progress of MNP so far differed from your initial expectations?

A. I thought mobility across the market would be stimulated by MNP and a little higher than it actually was. Once MNP got underway, however, KDDI's churn rate as well as conventional net additions without using MNP remains unchanged. The result was a substantial net gain in customers with the net addition due to MNP as add-on growth in subscribers. With regard to the current competitive environment, I think that simply cutting tariffs makes no sense—it is more important to boost competitiveness in other areas. Real differentiation in the market comes from raising the overall appeal of the product package including handsets, charges, and services, based on a strong infrastructure.

Q. How would you define the position of the Mobile Business within "Challenge 2010"?

A. Because consumer-oriented mobile operations are so important for KDDI, I feel a great deal of responsibility. First and foremost, we need to reach our long-sought target of 30% market share and 30 million subscribers within the fiscal year. Next, I think it is important that we increase our market share steadily, only by one percentage point each year by continuously achieving current net-add share of approximately 50%. Meanwhile, another key strategy to maximize sales is an enhanced business model: in addition to earning communications service fees, we will be focusing on expanding ARPU through content and other non-traffic revenues. In other words, our aim will be to maximize the KDDI services used by each customer. Going forward, we will also be expanding our business domain, for instance, by proactively working to offer mobile internet banking to make sure the most user-friendly internet bank for mobile phone users.

Q. What actions are planned for KDDI's Fixed-line Business?

A. We now expect "KDDI METAL PLUS" to move into the black in the fiscal year ending March 2008, its third year of operations. I think the reason this service is now on track is simply because we set distinct goals and everyone pitched in to make them work. The process of building on our achievements has given our people in fixed-line operations greater confidence. In the FTTH business, meanwhile, we established the "HIKARI-one" brand and integrated Tokyo Electric Power Company's FTTH business into our own. We now have an access network in metropolitan Tokyo and can develop the business independently. In April 2007, we united the sales divisions of mobile and fixed-line businesses, making it easier for us to cross-sell fixed-line services such as "KDDI METAL PLUS" and "HIKARI-one" to our approximately 30 million-strong au subscriber base. The significance of this event, I think, is that we are now starting to make real headway in Fixed Mobile Convergence (FMC). In our FTTH business, we are looking to establish a successful business model in the Tokyo metropolitan area, which has a high penetration rate for broadband services among households, and gain a 30% share in that service area. In the fiscal year ending March 2008, we are anticipating a return to profitability in all fixed-line categories except for FTTH, but by the fiscal year ending March 2011, we expect the Fixed-line Business as a whole to make a turnaround. On another front, we will make the JAPAN CABLENET (JCN) Group a KDDI subsidiary in July 2007, and I believe our ties with CATV will become increasingly important moving forward. In this age of conversion to IP networks, access networks will be essential, and KDDI cannot achieve total coverage with only "HIKARI-one". Therefore, we plan to build mutually beneficial relationships with CATV operators which have pay-TV subscribers. Our fundamental approach is to build up comprehensive capabilities in this way to compete with rival carriers.

Q. Can you explain what form Fixed Mobile & Broadcast Convergence, or FMBC, will take?

A. Let's begin with FMC. As mentioned above, it stands for Fixed Mobile Convergence, an area in which we pride ourselves on having made considerable advances. Most notably, in our mobile phone operations we offer "LISMO" (au LISTEN MOBILE SERVICE), enabling users to save music downloaded by mobile phone onto their home PC. The service also enables users to do the opposite: they can transfer music downloaded from the Internet using their PC and listen to it on their mobile phone. If we extrapolate this idea a little further, it could become possible in future to connect a mobile phone to a television to watch video filmed using the phone while out, or to connect a phone to a car dashboard display for navigation. With this type of potential, I envisage FMC bringing changes that used to be in the realms of science fiction. In short, the mobile phone becomes your passport—your personal gateway—to a diverse variety of services.

FMBC, which also incorporates broadcasting, is what KDDI is proposing as the next step on from FMC. We envisage that FMBC will enable people to enjoy a wide range of content through broadcasts on their mobile phone, and are preparing for this through such services as Media-FLO. Development of FMBC, in terms of infrastructure, will be realized by "Ultra 3G" and the key here, I believe, will be an integration at the upper level—the content and media, prior to that in the networks.

Q. As General Manager of the Consumer Business Sector, which aspects of "Challenge 2010" have particularly inspired you?

A. Our main focus in this business is to use every available means to increase points of contact with customers. This includes au shops, customer service centers and the KDDI DESIGNING STUDIO, in addition to the screens of mobile phone and PCs and a huge diversity of content. By delivering a product or service that exceeds expectations at each interface, we will expand our customer base and the sales per subscriber. This will allow us to maximize sales on an ongoing basis which is, I believe, the ultimate goal of "Challenge 2010".

Takashi Tanaka
Associate Senior Vice President,
General Manager, Solution Business Sector
Member of the Board

Solution Business

KDDI Aims to be an All-round Player that can Provide One-stop ICT Solutions

Q. What are the strengths of KDDI's corporate business?

A. Clearly our greatest strength is being able to provide one-stop solutions that meet customer requirements. Generally we have dealt with the information systems departments of clients, but nowadays Information and Communication Technology (ICT) is being woven into corporations' business strategies, and playing a more central role. Whereas in the past, we only needed to respond in detail to a client's communication network requirements, now we are being asked to provide one-stop solutions covering not only the network, but also its peripheral areas. KDDI's strength as a one-stop solutions provider is to totally provide all network services—mobile, fixed-line, and even international fixed-line. Corporate clients can have all their communications requirements supplied by one company. Moreover, we can also provide for the peripheral areas. For some time, we have been offering System Integration (SI) services overseas and have developed highly proficient System Engineers (SE) worldwide who can offer solutions spanning both the fixed-line and mobile fields. These human resources are a substantial asset in terms of our ability to accurately meet customer needs.

Q. How has the corporate market reacted to MNP?

A. As in the consumer market, MNP has been good for our corporate business. I think there are three reasons for this. First, good mobile connections regardless of location are important to corporate clients, and au's superior network has earned high marks in this regard. Second, our corporate handsets themselves appeal to corporate clients, because we offer long battery life, durability, and other features companies are looking for. We have also recently enhanced our lineup of corporate handsets with models offering wireless LAN (Local Area Network) compatibility. Finally, we are able to propose effective solutions using these handsets to address business communication issues. As a result we can cater to corporations' needs throughout the process of promoting IT systems to handle administrative tasks, increasing efficiency, and strengthening information security.

Q. What specific actions do you take to help companies promote IT systems or increase their efficiency?

A. Partly because we were latecomers to the corporate mobile market, our marketing approach has centered on how to strengthen or improve our clients' business operations through mobile phone-based solutions, rather than focusing on person-to-person voice communications. In other words, we work to incorporate our customers' business activities into mobile phones by adding onboard administrative applications that effectively allow the phones to be used as IT terminals. In this sense, the BREW® platform used by au mobile phones has enabled us to achieve a diverse range of mobile solutions because of its superior high-speed processing and connectivity to other systems. For example, we designed a communications

solution for a major logistics company that uses Bluetooth® technology to create a low-cost, flexible information and communications system with mobile phone handsets as the hub. The system provides a personal gateway to printers and a range of other standard office equipment through the user's mobile phone. This solution model eliminates the risk of terminals or its functions becoming obsolete, which was the traditional problem faced when using specialized terminals. Not limited to the logistics business field, the system has been introduced by a variety of companies and is contributing to greater efficiency.

Q. The Mobile Solution Business Sector has been in operation now for three years. In what specific areas has it been successful?

A. Right from the start, our attitude has been to avoid price competition and compete on the basis of solution services. I feel that stance has steadily produced results. We have seen the successful implementation of many of our proposals that seek to improve clients' business operations by our suggestions that mobile phone use can contribute to sales growth or to cost reductions. And our activities have been appreciated by the business community with many prizes, including the Grand Prix, received by one of our clients at "Mobile Computing Promotion Consortium (MCPC) Award 2007". In our FMC business, it has been much the same story. Companies conduct their business both inside and outside their offices, but these activities are not mutually exclusive, both activities have to collaborate in order to be effective. In simple terms, if employees outside the office have mobile phones while employees in the office are using fixed-line phones, the only telecom carrier in Japan that can provide the clients with a one-stop solution is KDDI. The shift to Mobile Centrex Systems in clients' offices continues to gain ground in Japan and our "OFFICE WISE" and "OFFICE FREEDOM" services have been popular in this regard.

Q. What are the prospects for future growth in the corporate mobile phone market?

A. The corporate market only accounts for about 10% of the overall mobile phone market right now, but is expected to grow substantially. Considering that 30% of the total fixed-line market is for corporations, a rough estimate would suggest that the handset-based corporate market has the potential to reach the same level within the total mobile market. Moreover, there are other potential growth areas such as the communication module market, which is based on machine-to-machine communications, and is therefore not limited by the size of the population. For example, there are approximately 70 million automobiles in Japan today. Sooner or later, all of these cars are going to have a communication module in them. And there are a vast number of new applications for communication modules, such as in tooling machine maintenance, security systems or vending machines. I believe the communication module market offers infinite growth potential.

Q. As General Manager of the Solution Business Sector, which aspects of "Challenge 2010" have particularly inspired you?

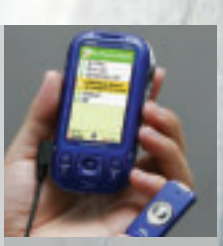
A. Until recently our Fixed-line Business targeting corporations offered little prospect of sales growth, providing only fixed-line services. However, there are related businesses targeting the corporate market that still offer ample opportunity for growth: potential lies not only in the burgeoning corporate mobile market, but also in FMC services and peripheral areas. Currently, our consumer-oriented mobile operations drive growth for the Group. However, as an all-round player that provides one-stop ICT solutions, we intend to transform our corporate services into an additional pillar of future growth. To meet the high demand for one-stop solutions, we looked carefully at our own capabilities and firmed up a detailed plan for supplementing our services in areas where we fall short. One such business area was the construction of LAN in buildings and ICT equipment management and other services for buildings. Through our business alliance with UNIADEX, Ltd.—which excels in this area—we can now provide appropriate one-stop solutions. Going forward, if there are services we cannot provide—in new or existing business areas—we will develop win-win relationships with specialist companies to provide them. Thus we can steadily build up our capacity to provide best-fit services promptly. And this in turn will enable us to expand our client base in both fixed and mobile communications, among large corporations as well as SMEs, in Japan and abroad. We will also strive to maximize sales by growing our operations in new domains, reaching beyond networks to include peripheral areas. I believe that to achieve future growth as an all-round player, the key is always to be able to respond to our clients' wishes, and that is a goal that inspires me.

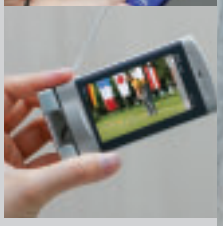
Mobile Business

Reliable call quality. Attractive handsets with a focus on design. A range of customer-oriented tariff plans. High value-added content and services. KDDI is refining the competitiveness of its overall package to raise levels of customer satisfaction further still.

au by KDDI

LISMO!





Music via mobile phone, "1 Seg" (TV broadcasts) digital radio, high-resolution camera capability. The possibilities offered by mobile phones are burgeoning along with the range of services.

Four models from au design project added to MoMA collection

INFOBAR (2003)
Naoto Fukasawa

talby (2004)
Marc Newson

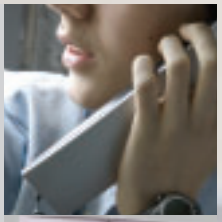
neon (2006)
Naoto Fukasawa

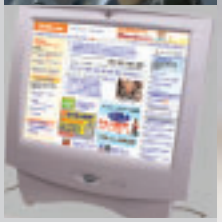
MEDIA SKIN concept (2005)
Tokujin Yoshioka

Note: ( ) refers to year when products were launched for sale except for MEDIA SKIN, which refers to the release of concept model.

Fixed-line Business

As it moves closer to full IP and broadband conversion with “KDDI METAL PLUS” and “HIKARI-one” (FTTH), KDDI is striving to develop and supply services offering outstanding convenience by leveraging the additional benefits of its mobile communications capabilities.





In addition to high-speed, high-capacity Internet connection services, KDDI offers high-quality, reliable, sophisticated phone services, compelling content via multi-channel television broadcasts and video on demand (VOD)—all with a single optical fiber.

Mobile Business

KDDI will Further Enhance Competitiveness in Handsets, Charges and Content Based on its Strength in Infrastructure.

Toward "Challenge 2010"

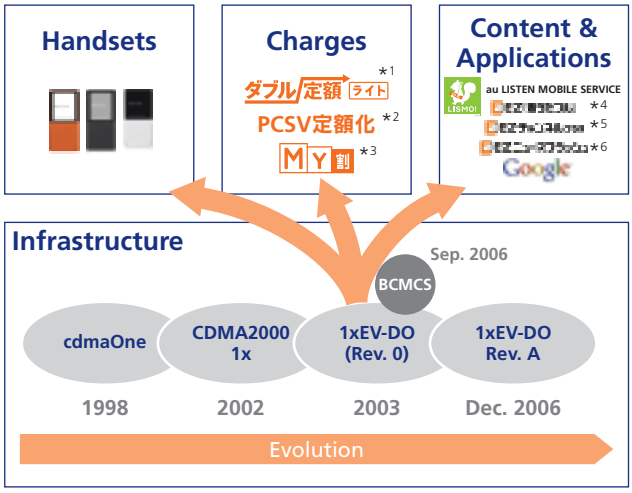
KDDI's Mobile Business currently accounts for three quarters of its consolidated operating revenues, and is the main driver for operating income as well. The business is expected to still be the central source of earnings in the final year of "Challenge 2010". KDDI has distinguished itself from its competitors by utilizing the strengths of the au 3G infrastructure (as shown in Figure 1), and the comprehensive product advantages it offers in terms of mobile handsets, charges, and content.

With "Challenge 2010" (Figure 2) as well, KDDI is working to further raise competitiveness in order to maintain the current increases in revenue and earnings in the Mobile Business. This section presents KDDI's plans and efforts for infrastructure and handsets, the strengths of KDDI's Mobile Business.

Infrastructure—Part 1: Maintaining and Enhancing the Competitive Advantage of the 3G System

Mobile Number Portability (MNP) in Japan went into effect in October 2006, with au the only service provider to achieve a net MNP increase. Surveys of customers who have chosen au reveal a high regard for KDDI's transmission quality and coverage area. Infrastructure means more than just the basics of being able to obtain a good connection anytime and anywhere. In Japan, where the use of 3G is spreading, a strong infrastructure leads to differentiation in terms of both data services and fee structures that take advantage of cost competitiveness. Also, since it takes two to three years and a huge investment in equipment to deploy a new system to cover all of Japan, it is not easy for other carriers to catch up with KDDI, which had a head start in deploying its 3G system.

Figure 1: All-round Product Attractiveness of Mobile Business



*1 Double-Teigaku-Light (Packet Flat-rate) plan
*2 PCSV Flat-rate plan
*3 My Plan Discount
*4 EZ Chaku-Uta-Full® (Music download service)
*5 EZ Channel-plus
*6 EZ NewsFlash

Figure 2: "Challenge 2010": Further Strengthening Competitiveness of Mobile Business

Handsets	● Reduce costs through KDDI Integrated Platform (KCP+) and expand Rev. A handsets
Charges/ service	● Underpin ARPU by adding new services ● Enhance global roaming ● Develop business models to address customer needs ● Reinforce settlement/authentication functions and FMBC service
Infrastructure	● Reorganize 800MHz band and enhance coverage ● Improve communications quality ● Commercial launch of the post-Rev. A system

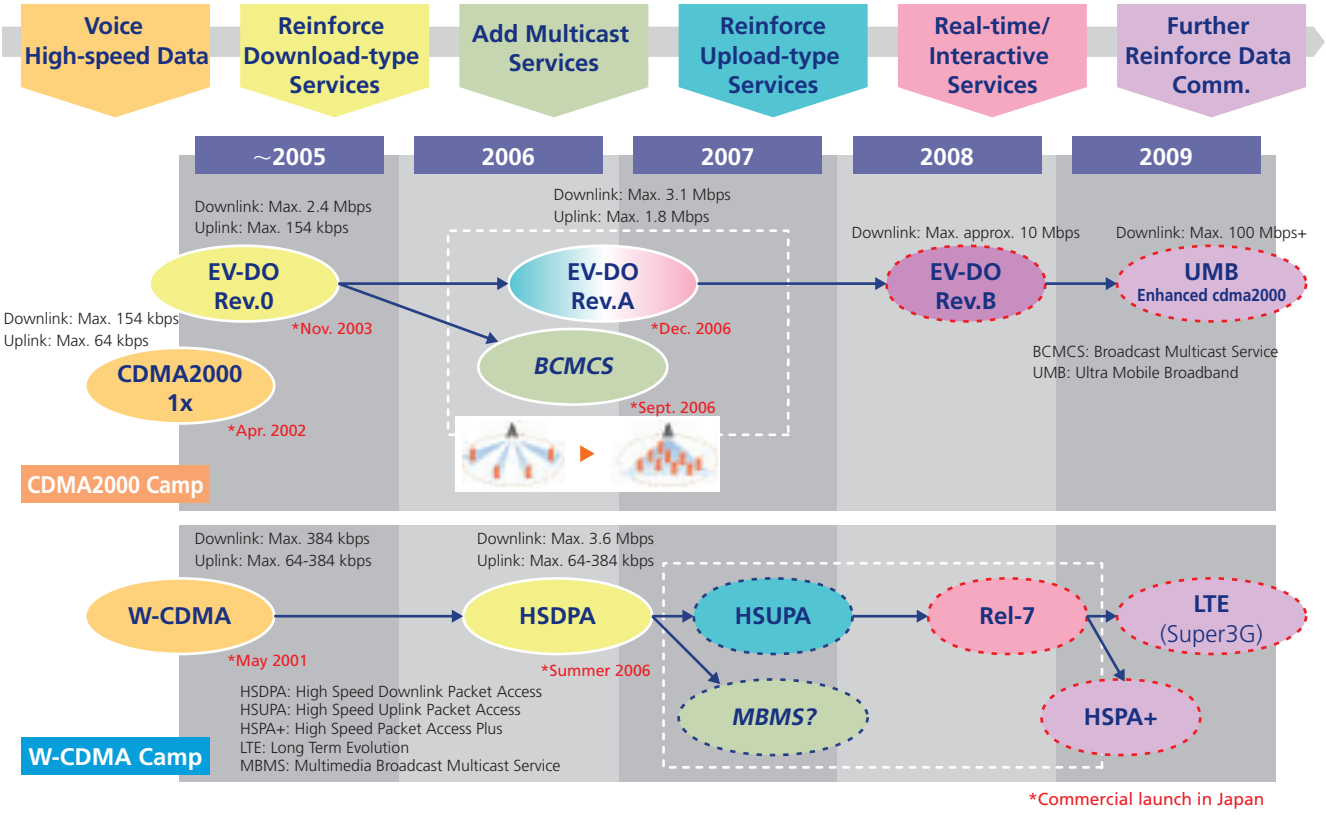
Figure 3 shows the evolution of the 3G CDMA2000 system adopted by the au brand alongside the W-CDMA system, with the same colors representing comparable functions. In terms of infrastructure, although rival carriers introduced HSDPA (High Speed Downlink Packet Access) from the summer of 2006 (the yellow circle), this simply enabled them to catch up with the EV-DO service introduced for au in November 2003. KDDI has remained one step ahead of the competition, introducing BCMCS (Broadcast Multicast Service) in September 2006, and an upgraded version of EV-DO, EV-DO Rev. A, in December 2006. The successor system to EV-DO Rev. A has not yet been determined, but KDDI will continue to maintain and enhance its competitive advantage in infrastructure.

Infrastructure—Part 2: Reorganization of the 800MHz Band and Expanding Capacity for the 2GHz Band

KDDI is currently increasing its capacity in the 2GHz band in view of the increase in subscriber numbers and the reorganization of the 800MHz band. At the present time, the frequency directions for this band are opposite to overseas. Its reorganization, to be completed by July 2012, involves switching round the current directions for uplink (handset to base station) and downlink (base station to handset) services, and re-allocating frequencies to replace the current narrow allocations with blocks.

The 2GHz band requires more careful efforts when expanding area coverage due to characteristics including the direct

Figure 3: Evolution of 3G Systems



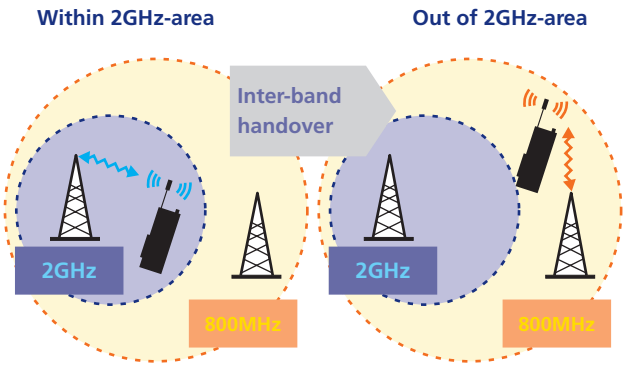
propagation of radio waves. KDDI, however, has begun offering dual-band handsets that can access the current 800MHz band frequencies in addition to the 2GHz band. In addition, the company is offering triple-band models that will be able to access the newly allocated 800MHz band to ensure convenience for its customers. There were a total of approximately seven million such handsets in use as of the end of March 2007, accounting for a quarter of all au-branded models, and the number is expected to increase in the future. As shown in Figure 4, the dual-band handsets will mainly use the 2GHz band, and when outside the 2GHz coverage area, they will use the 800MHz band. KDDI believes that it can raise the quality of its infrastructure still further by expanding the 2GHz coverage area.

Handsets: "KCP+" Lowers Handset Procurement Costs

Along with infrastructure, another significant strength for KDDI is in declined procurement costs of au handsets amid further enhancements to the handset lineup, additional functions and a rising proportion of WIN handset sales. With handsets becoming more sophisticated and complex, manufacturers are facing greater difficulties in terms of product development and testing. KDDI has been able to lighten their burden through the use of "KCP" (KDDI Common Platform), a shared software platform currently based on the BREW® system.

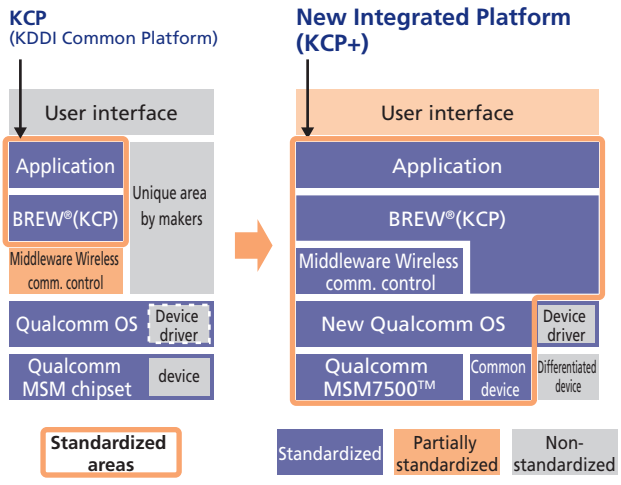
Going forward, as shown in Figure 5, the scope of standardization will be expanded with "KCP+" (KDDI Integrated Platform) planned for development within 2007. "KCP+" will allow handset manufacturers to focus on differentiating themselves in terms of the user interface, design, and the device areas in which they are strongest (cameras, LCDs, etc.). KDDI expects that the adoption of "KCP+" will further enhance the attractiveness of its handsets in response to continually increasing diversity and individuality in customer needs, as well as raise cost competitiveness by bringing greater efficiency to handset development.

Figure 4: 800MHz/2GHz-Dual-band Compatibility



Note: 2GHz-area expansion is in progress.

Figure 5: Create New Integrated Platform



Content and Media Business

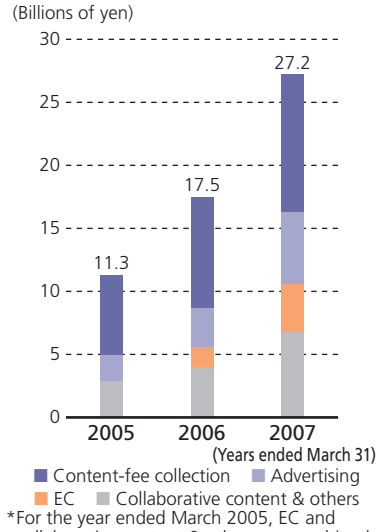
Increase and Reinforce Touch Points—Points of Contact with the Customer—to Expand Customer Reach

Toward "Challenge 2010"

au brings excitement to customers' lives by adding value to its mobile services in novel ways. The spirit of innovation that characterizes au is in large part thanks to the Content and Media Business. With au, KDDI has focused particularly on improving music services, to the extent that the au brand name is now synonymous with music via mobile phone. This is thanks to KDDI's efforts in leveraging its infrastructure advantages to develop a range of pioneering services. Examples include innovative music download services such as "EZ Chaku-Uta®", "EZ Chaku-Uta-Full®", and "au LISTEN MOBILE SERVICE (LISMO)", which have helped to establish win-win relationships with the music industry.

KDDI believes that to ensure future growth it will need to develop other earnings streams in addition to traffic revenues by expanding its operational reach. KDDI's Content and Media Business is already steadily producing results; sales growth was strong in the fiscal year ended March 2007, resulting in net sales of ¥27.2 billion, 1.5 times higher than in the previous year. KDDI intends to continue expanding the business into new domains as well as increase its involvement in existing service areas such as fee collection for content providers, advertising, e-commerce and providing collaborative contents. Through these efforts KDDI is targeting net sales in the fiscal year ending March 2011 of 2.5 times current net sales. This section explains plans for the future direction of KDDI's Content and Media Business.

Figure 1: Sales of Content/Media Business



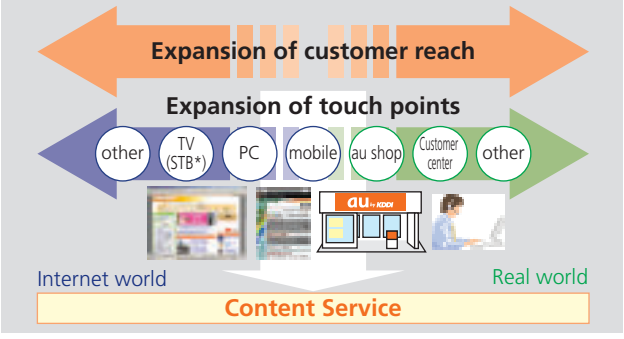
*For the year ended March 2005, EC and collaborative content & others are combined.

Mobile Phones to Play Pivotal Role and Propose New Lifestyles for Customers

Looking ahead, the priority for KDDI is to increase the number of touch points (points of contact with customers) to appeal broadly to customer categories and age groups that the company has so far been unable to reach. To this end, the Content and Media Business will target all customers in the KDDI group. In the au service, KDDI is already working to upgrade its entertainment-oriented content, including video to complement the music content in which the service has already excelled. Meanwhile, in the banking and broadcasting fields, KDDI is pushing ahead with preparations for the launch of new services such as mobile phone-based Internet banking and Media-FLO. KDDI will continue to take proactive measures to expand its operational domain into new areas by working with leading players in other industries. Through these initiatives, KDDI aims to increase the total amount of transactions via its business platforms, from digital content (virtual) to tangible commodities (real).

Mobile phones have become essential tools for customers in Japan; in fact, many would struggle to get through their day if they left their mobile phone at home in the morning. KDDI wants to make the most of the indispensability of mobile phones, while at the same time transcending the limitations of the existing products and services of mobile phones to offer customers a comprehensive range of them that suit their lifestyles. To maximize earnings KDDI will extend its customer reach to increase the number of people using KDDI content, while pursuing earnings opportunities outside the conventional boundaries of telecommunications business.

Figure 2: Expansion and Enhancement of Touch Points



*Set Top Box

Fixed-line Business

Targeting Subscriber Base Expansion and Profitability Recovery through Broadband Businesses

Toward Challenge 2010

Japan's fixed-line market is at a turning point, with its legacy services being transformed to direct-access, IP, and broadband services. At KDDI, we are also moving in this direction, working toward the next growth phase in the business through the development of our new services "KDDI METAL PLUS" and "HIKARI-one". Because of the front-loading of subscriber acquisition and other costs during the start-up period for these new services, the Fixed-line Business is currently in the red. However, we intend to recover profitability not by downsizing, but by increasing sales based on subscriber base expansion.

As can be seen in Figure 1, "Challenge 2010," we are aiming to bring the Fixed-line Business back into the black along with the expansion of our FTTH and other broadband businesses based on our expansive and diverse access network. In this section, we introduce the initiatives being implemented by our Fixed-line Business for the future.

"KDDI METAL PLUS" Enters Profit Contribution Phase

"KDDI METAL PLUS" is a direct-access, IP-based service. Due to direct customer access, this service earns a basic monthly charge and has contributed to an upswing in KDDI's previously declining voice telephony revenues. At the end of March 2007, "KDDI METAL PLUS" had a total of 2.81 million subscribers, and is forecast to increase this figure, maintaining it at over 3 million in the medium to long term. In line with the original plan, the service is expected to record profits in the fiscal year ending March 2008, its third year of operations, and enter a stable profit contribution phase.

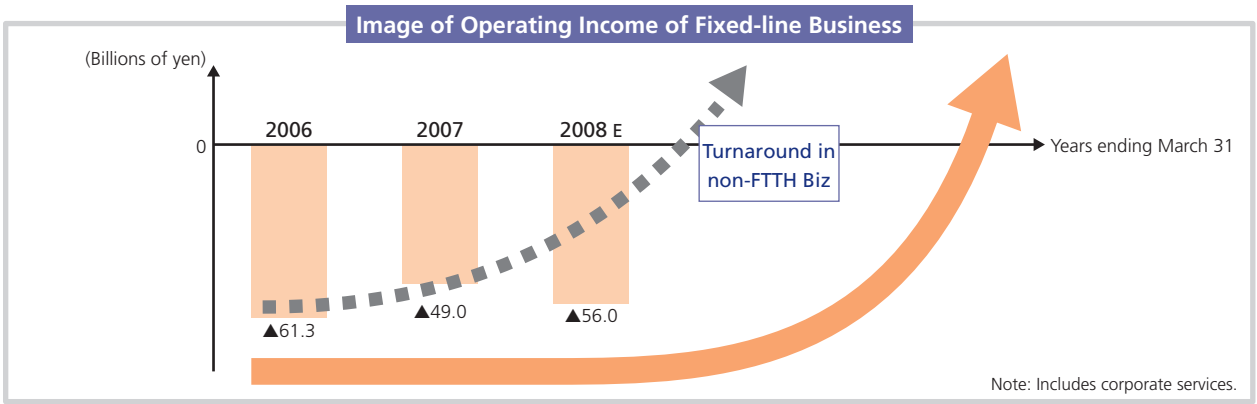
Targeting a 30% Share of FTTH Market in Tokyo Metropolitan Service Area

In January 2007, we integrated the FTTH business of Tokyo Electric Power Company (TEPCO) with our own FTTH business. Because we can now set up our own lines in the Tokyo met-

Figure 1: "Challenge 2010" Fixed-lined Business Initiatives

Promote broadband such as FTTH business, etc., by utilizing various access lines and make a turnaround in Fixed-line Business.

- As for FTTH, access network of our own, aim for a 30% share in Tokyo-metropolitan service area over the mid-long terms.
- Enhance video ARPU by promoting broadband.
- As for KDDI METAL PLUS, bolster profitability by maintaining a customer base of more than 3M over the mid-long terms.



ropolitan area, whereas before we had to lease them from NTT, it has become possible to flexibly expand the business in accordance with individual area demand. Currently, we are endeavoring to expand our FTTH service "HIKARI-one", which offers subscribers the "triple play" of IP phone, high-speed Internet, and video distribution services.

As can be seen in Figure 2, which shows KDDI's FTTH network, we have a content delivery network (CDN) as its backbone, while based on the business integration with TEPCO's FTTH business, we already have access to approximately 10 million households in the Tokyo metropolitan area. Therefore, in terms of capital investment, we will only need to shoulder the last-one-mile costs to install drop cables, which will increase in proportion with new subscribers.

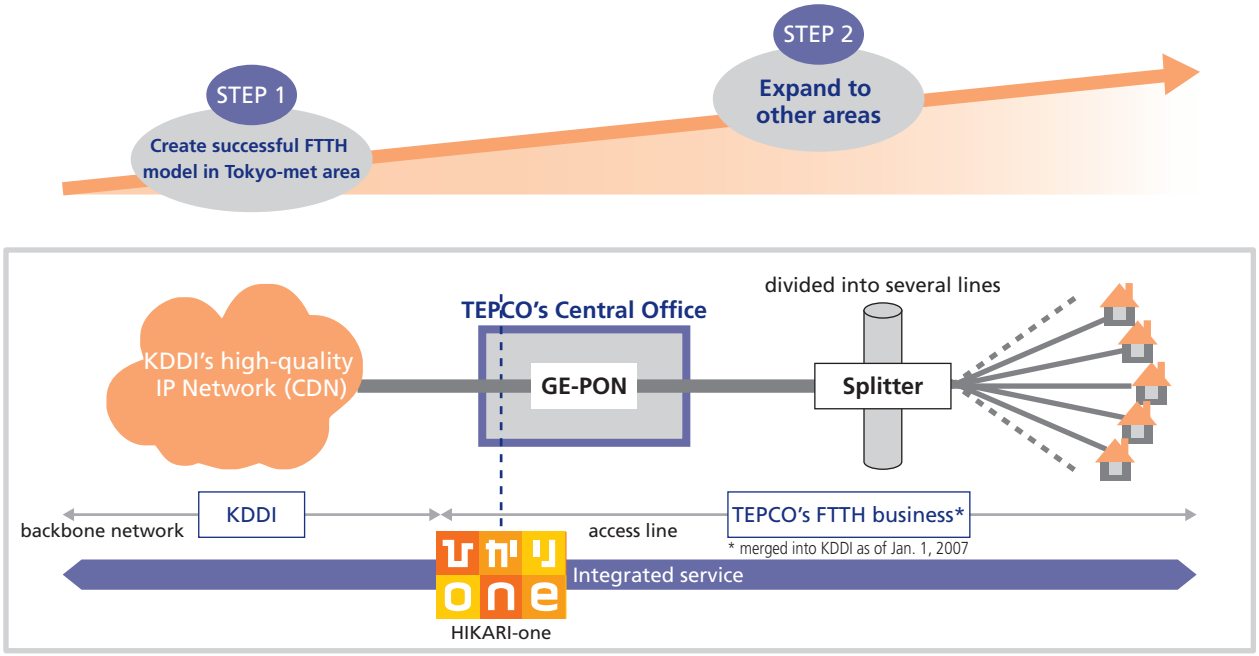
We believe that to heighten the intrinsic appeal of FTTH, we need to create an environment where subscribers can enjoy high definition television (HDTV) programs or high-quality video over our FTTH service. We are pressing forward with technical development to make that a reality. As an overall marketing goal, we are aiming to establish a successful business model for our FTTH business while capturing a 30% share of the Tokyo metropolitan market, which has a high penetration rate for broadband services among households.

Note: For further details, please see "Technology and R&D" on page 24.

Fixed-line Business Turns Profitable

We anticipate that our "KDDI METAL PLUS" service will move into the black in the fiscal year ending March 2008. Of the four core categories in the Fixed-line Business then, "KDDI METAL PLUS", FTTH, legacy service for consumers, and service for corporate clients, all but the FTTH business will be profitable. Carefully monitoring the increase in demand for video distribution over FTTH, we intend to allocate the improved profits of other services for expanding the subscriber base of our FTTH business. Through this process, we plan to achieve an early recovery of profitability in our overall Fixed-line Business.

Figure 2: FTTH Initiatives



Technology and R&D

R&D for IMT-Advanced, a Next-Generation Mobile System

KDDI has developed demonstration and testing equipment to verify the various technologies necessary for ultra-large capacity communications systems. KDDI aims to use the equipment for testing IMT-Advanced, the successor system to IMT-2000 (the 3rd-generation mobile systems).

Researchers have set targets of achieving IMT-Advanced bitrates of 100 Mbps under high-mobility conditions, and approximately 1 Gbps in semi-stationary conditions. The specifications of the testing equipment are configured to allow use of the 100MHz frequency band for downlink, enabling real-time communications of approximately 750 Mbps, a speed on a par with that of optical fiber. To achieve such ultra-large capacity wireless transmission it is necessary to test and put in place key technologies—multicarrier transmission (OFDM[1]) and MIMO[2]—under actual operating conditions. KDDI is proceeding with field trials that include tests of such new technologies as rotational multiple modulation technology—devised by the KDDI R&D Laboratories and known as the R-OFDM[3] system—as well as twin turbo decoding. R-OFDM provides stable large-capacity transmission even over poor transmission routes, and has been adopted by 3GPP2, one of the standardization bodies for the 3rd-generation mobile systems, as an option for the 3.9G[4] standard.

With IMT-Advanced, which is expected to be commercialized after 2010, customers will be able to enjoy a high-performance, high-quality communication service equivalent to that of FTTH and similar fixed-line communications, even when on the move.

R&D for Advanced Video Services over FTTH

The advent of FTTH has enabled smooth transmission of high definition video and other large-volume transmissions impossible with ADSL lines. There are high expectations in the industry for even more sophisticated services using FTTH, including such highly realistic transmissions as digital cinema. KDDI has developed "JH-4000", a codec for digital cinema transmissions that uses proprietary compression controls and meets Hollywood standards. This technology allows digital cinema video to be compressed in real time while retaining extremely high image quality, despite the fact that digital cinema image resolution is around four times that of high definition video at 4096 pixels x 2160 lines. It is a promising technology for use in video transmission systems at digital cinema theaters and elsewhere.

Testing equipment for next-generation mobile systems

Notes:

1. OFDM (Orthogonal Frequency Division Multiplex). Comprising parallel transmission by multiple subcarriers, this technology is suited to large-capacity wireless transmissions using wide-frequency bands. It has been adopted for terrestrial digital broadcasts and WiMAX.
2. MIMO (Multiple-Input Multi-Output). This technology enables multiple parallel transmissions through airspace by using several antennas for both the transmitter and receiver. With 2X2 MIMO, the bitrate can be nearly doubled under good conditions.
3. R-OFDM (Rotational-OFDM). This technology enables user data modulation symbols to be de-coded with a rotating matrix before allocation to subcarriers, rather than being allocated to subcarriers directly. This allows for transmission stability under multipath propagation conditions, such as in mobile communications.
4. 3.9G: The general name for systems using the same carrier frequencies as IMT-2000 (the 800MHz or 2GHz bands, etc.), which aims to realize a high peak rate of 50 to 300 Mbps. As part of the process of evolution from IMT-2000 to IMT-Advanced, 3GPP is engaged in discussions over LTE (Long Term Evolution), with 3GPP2 on UMB (Ultra Mobile Broadband).

Fumio Watanabe, Ph.D
Executive Director
General Manager,
Network Engineering Division
Core Technology Sector

Competitive Edge of au Infrastructure

It is often said that au was the first carrier to successfully develop 3G mobile services in Japan. However, there really is not much difference in terms of technology between the CDMA2000 system used by KDDI and the W-CDMA system by other mobile carriers in Japan. That said, there are other differences, of which two in particular stand out. The first is called "an overlay approach," which describes the process whereby KDDI introduced the 3G system on top of its 2G system as CDMA2000 has backward compatibility with cdmaOne. What this means is that 3G handsets are available right from the start seamlessly all over the nation. The other difference is a creation of a world of mobile Internet through CDMA2000 1xEV-DO, which KDDI launched in November 2003 under the brand name of WIN. Developed specifically for optimal data-based communications, this protocol enabled KDDI to pioneer the development of mobile Internet services. Competitors finally caught up with the introduction of the 3.5G HSDPA system in August 2006, but KDDI countered with the launch of an upgrade, EV-DO Rev. A, in December 2006. In terms of infrastructure, then, KDDI is about two years ahead of its peers.

Reorganization of the 800MHz Band

By July 2012, the Japanese Government plans to reorganize the 800MHz band, reversing the frequencies for uplink (handset to base station) and downlink (base station to handset)—currently the opposite of systems used overseas—and re-allocating the frequencies in blocks. Because other mobile carriers have difficulties in building their areas over the 2GHz bandwidth, it is said that KDDI will be under great pressure in developing its 2GHz network as well as dealing with the revision of the 800MHz system. However, KDDI will use a different method than its competitors. As with its evolution to a 3G system, KDDI takes an overlay approach again to build 2GHz service area on top of 800MHz areas and make them compatible. Mobile phone handsets also work over different frequencies. In addition to the current 800MHz band, handsets have dual-band or even triple-band function with the 2GHz and the new 800MHz bands. Consequently, KDDI makes sure that customers do not feel uneasy about the use of different frequencies and that they can continue to enjoy the services as usual.

The Post-Rev. A System and "Ultra 3G"

The 3rd-Generation Partnership Project 2 (3GPP2), a standard-setter for CDMA2000 operators, has finalized the protocol standards for EV-DO Rev. B, an upgrade for EV-DO Rev. A. Next down the line is the so-called 3.9G system, which is UMB (Ultra Mobile Broadband) for CDMA operators and LTE (Long Term Evolution) for the W-CDMA camp. These technologies are similar; both are based on the same wireless standard of OFDM (Orthogonal Frequency Division Multiplex) with 100Mbps- communications speeds. Standardization will be mostly completed during 2007, with commercialization possible by as early as 2010. KDDI has yet to decide what type of system to bring in after Rev. A, but believes it needs to identify how to deliver new value to its customers with the introduction of its next system.

KDDI proposes "Ultra 3G" as its NGN (Next Generation Network), which is an access-independent network and integrates mobile, fixed, wired and wireless systems to provide a variety of seamless services. The company is also aiming to achieve FMBC (Fixed Mobile and Broadcast Convergence), integrating communications and broadcasting. KDDI is fully committed to driving forward its preparations for "Ultra 3G", which will allow the company to demonstrate its advantages as a carrier with both mobile and fixed-line capabilities.