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Special Reports
Advancement of Home Networks

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***Creating New Lifestyles by Connecting Home Appliances with the Internet**
KOSUGI Takao

***Technical Trends in Home Area Networks**
SAITO Takeshi TERAMOTO Keiichi
Digitization of the home environment, led by the popularity of technologies such as digital broadcasting, personal computers, and the Internet, has diffused the boundaries between information, communication, broadcasting, the audiovisual field, and consumer electronics. In the near future, we will see appliances connected to home area networks as well as the Internet, over which various services will be provided.

This paper describes what will become possible with home area networks, as well as the significance of such applications. Next, the major existing technologies are surveyed and Toshiba's activities in that area are introduced. "Wireless, Internet, and services" are the key words of Toshiba's home area network technology.

***FEMINITY$_{TM}$ Series Home Network System for Network Home Appliances**
ISSHIKI Masao HIRAHARA Morio KISHIMOTO Takuya
With the recent advances in the information technology (IT) and communication fields, market demand is shifting from a hardware orientation to a software orientation seeking value in the provision of contents and services.

Toshiba has adopted Bluetooth^{TM} technology for home appliances for the first time in the industry, and produced home digital appliances that can send and receive information such as new operation modes and recipes based on the user's lifestyle. The name of this product series is FEMINITY$_{TM}$. All contents sent to these network home appliances are supplied from the "FEMINITY$_{TM}$ Club" Web site on the Internet.

Toshiba will continue to develop contents that fulfill market needs and to further improve the convenience of network home appliances.

***Standard Technologies for Home Network Systems (Bluetooth^{TM}, ECHONET^{TM})**
TAJIKA Yosuke TOBA Akira KYUMA Shuichi
With the rapid progress of home network and network appliance technologies, home network systems have advanced to the initial stage of developing commercial products from the stage of research and development. Although some existing audiovisual (AV) equipment, information terminals, and their controllers in the home are connected with each other, proprietary communication protocols have been used. In order to provide users with new and extensive services, it is essential for home network systems to assure efficient interoperability among both different categories of appliances such as AV components, information appliances, and security tools, and products developed by different vendors.

This paper introduces standard technologies for home networks and network appliances that enable fully cooperative work among network appliance, focusing in particular on Bluetooth^{TM} and ECHONET^{TM} which have been adopted for Toshiba's first network home appliances (FEMINITY$_{TM}$ series). A software stack conforming to Bluetooth^{TM} and ECHONET^{TM} specifications has already been developed and implemented in FEMINITY$_{TM}$ products.

***Trends in IEEE802.11 and LSI Chip Set under Development by Toshiba**
TAKAGI Masahiro ADACHI Tomoko TAKAGI Eiji
IEEE802.11-compliant 2.4 GHz wireless LAN, now popular as "wireless Ethernet" in offices, is about to spread into public areas and home. On the other hand, the IEEE802.11 Working Group is still extending its standards in several directions such as higher data rate, quality of service, enhanced security, and adaptation to European wireless regulations. These standardization activities are expected to enable wireless LAN applicable to high-fidelity video transmission, highly secure networks, and so on.

Toshiba is developing an IEEE802.11a LSI chip set which achieves up to 54 Mbps in the 5 GHz band, and is also considering the adoption of these new functionalities.

***ASP Service for Network Home Appliances**
HASEBE Harumi OOSAKA Naohisa
Advancement of the ubiquitous network is expected around the world and the information technology environment of home appliances will be transformed step by step. Home appliances normally do not have a clearly defined relationship with the network, but with the development of network home appliances they will be renewed as digital home appliances.

This paper introduces the technology for supply of services by an application service provider (ASP) to digital home appliances via the network. Toshiba is proposing an architecture for this technology called "HARC" (Home Applications on Request Computing) as well as a concept for designing such a system as a method to improve the control of home appliances.

***Home Appliances Using Next-Generation Internet Technology（IPv6）**
NAGAMI Kenichi ISHIHARA Takeshi YONEYAMA Seijiro
Personal computers and the Internet have recently become widely used in the home as well as the office. In the future, home appliances such as air conditioners and VCRs will be connected on a home network.

Toshiba is now shipping home appliances with Internet connection capability. Such capability is in high demand among users who wish to check and operate appliances from outside the home. This can be achieved with Internet Protocol version 6 (IPv6), the next-generation Internet technology. We have developed a prototype system for IPv6 home appliances and have operated them in two showrooms, houses of users, and an event hall.

***WBG-1000/1200 Wireless LAN Broadband Gateway Series**
ISHIBASHI Yasuhiro SEKI Michio KOBAYASHI Takero
The WBG-1000 and WBG-1200 residential routers integrate broadband (ADSL) and wireless LAN (IEEE802.11b) in one device. The WBG series was developed with the aim of merging the deployment of broadband networks and Toshiba's wireless strategy, in order to develop new business and usage models.

Broadband network and wireless LAN technologies are expected to further progress in the future, and the home/small- to medium-scale business (SMB) market will expand with these technologies. Following the development of the first-generation WBG products, Toshiba is shipping the new WBG series featuring significant improvements.

***Home Networking as Starting Point for Ubiquitous B-to-B-to-C Service**
KANAI Hideyuki ISSHIKI Masao
With the strong growth of broadband Internet services, many companies?especially manufacturers of home electronic products?are trying to take the initiative in the home network business. Over the past several years, many companies had high hopes for the opportunities presented by Internet business. Most of these companies, however, were disappointed. Nevertheless, the home network business is different from conventional Internet businesses, and major opportunities still exist in the market.

Toshiba is working to create new business-to-business-to-consumer (B-to-B-to-C) business models, which will open up many business opportunities for companies. We believe that home networking is the starting point for ubiquitous networking.

Feature Articles

***CDM-9500 GPS-Capable High-Performance Portable Cellular Phone**
HYODO Masakuni KAJI Akemi YANAGISAWA Taketo
In the North American market, the trend in cellular phones service has been moving from voice-oriented service capability to data-oriented service capability including data transmission. An increasing number of cellular phones are also equipped with a large color LCD and can handle not only diverse contents, but also contents interoperating with the Global Positioning System (GPS).

Toshiba has developed the CDM-9500 clamshell type phone incorporating a large color LCD as well as the latest sophisticated functions. Although the CDM-9500 has a large, 2.1-inch color LCD taking advantage of its clamshell form, we have been able to maintain compact dimensions of 97×48×26 mm and a weight of 128 g. In addition, we have equipped the CDM-9500 with data service functions such as BREWTM and the latest microbrowser to enhance the availability of mobile users.

***Sinusoidal Drive Inverters for Air Conditioners--Application to High-Performance Compressor Motor Drives**
SEKIHARA Toshikazu HIRUMA Atsuyuki
The power consumption of air conditioners has decreased substantially due to advancements in inverter technology and other factors. However, further energy savings are still required for air conditioners from the standpoint of global environmental preservation.

We have developed new sinusoidal drive inverters for compressor motors to realize high-performance compressors with features such as high efficiency, low vibration, and low noise. These inverters have been applied to the "Plasma Daiseikai$_{TM}$" series, "Super Power Eco$_{TM}$" series, and "Vector IPDU$_{TM}$" series products. We also received the Shinpo-sho (Progress Award) from the Institute of Electrical Engineers of Japan in recognition of its dissemination of low-cost technology for household electrical appliances.

***Project Management Technology**
KANAJI Katsuyuki OBI Toshiyuki IIZUKA Kazutoshi
Toshiba has developed a project management (PM) methodology based on the Guide to the Project Management Body of Knowledge (PMBOK) to support the entire project life cycle. We have also developed a PM assessment methodology that conforms with the PMBOK.

The PM assessment methodology is based on PM/return on investment (ROI) studies, and visualizes the degree of PM execution for each project. In addition, it is able to identify PM activities that affect the project cost, schedule, and quality. As a result, energy can be concentrated on improvement of PM for important problems that directly affect the project cost, schedule, and quality.

***Integrated Microelectronic Switchboards for Substations of Sanyo Shinkansen Line**
YAMAZAKI Shuji AOKI Toshio
Twenty-five years have passed since the Sanyo Shinkansen Line was opened to traffic, and the local switchboards controlling and protecting the systems of the substations have aged to the point where a decision was made to replace them. To realize new switchboards with improved reliability, greater compactness, maintenance-free operation, and higher functionality, we adopted the latest microelectronic equipment. Furthermore, using function-intensive digital relays with a real-time operating system installed and a multi-CPU configuration, we combined the functions of the equipment and developed integrated microelectronic switchboards that are more complex, more reliable, and maintenance-free compared with conventional switchboards.

***Packet Communication System over IP Network**
SATO Hideo KANEMOTO Koichi WAKATA Yasushi
In recent years, computer communication systems have been changing from proprietary architecture to open (Transmission Control Protocol/Internet Protocol: TCP/IP) architecture. In line with this trend, the Japan Agricultural Cooperatives (JA) system is changing from the legacy mainframe-centric system to the TCP/IP system.

Although the AX series are Toshiba's best-selling X.25 packet switches, in order to rapidly respond to this market trend we have developed a next-generation system called the GX series. The GX series uses TCP/IP as a foundation and offers a better price-performance ratio than the AX series. The GX series is expected to be well accepted by customers who wish to migrate from the legacy X.25 system to the more cost-effective TCP/IP-based system.

***ZnO Nonlinear Resistors for Lightning Arrestor with World's Highest Operating Voltage**
ANDOH Hideyasu UDAGAWA Takeshi FUKANO Takato
Development work for the miniaturization of lightning arrestors has been continuously progressing. If the operating voltage (gradient voltage) of the zinc oxide (ZnO) elements for lightning arrestors is increased, significant miniaturization of lightning arrestors can be attained by reduction of the number of ZnO elements.

Toshiba already developed high-gradient ZnO elements with an operating voltage of 400 V/mm in 1997, and has now developed ultrahigh-gradient ZnO elements that have an operating voltage of 600 V/mm. These ultrahigh-gradient elements were applied to a gas-insulated switchgear (GIS) lightning arrestor for 800 kV systems, and attained a 40 % reduction in the volume of the lightning arrestor.

***CrossMission$_{TM}$.NET-Compatible Application Server**
HIRANO Kazunori TADAKUMA Yuji
CrossMission$_{TM}$ is the first Microsoft ® .NET-based application server in the world. It offers a development environment and application execution environment for system engineers to build various systems on the Internet platform. Toshiba TEC Corporation has been developing its own framework for Microsoft ® Windows ® to develop point of sales (POS) terminals and store server applications. All CrossMission$_{TM}$ development tools are compatible with Microsoft Visual Studio .NET, while the middleware components coincide with the Microsoft .NET Framework and the Common Language Runtime (CLR). CrossMission$_{TM}$ combines extensive class libraries, standardized background services, and standardized graphical user interface components.

Techno Notes

***Cellular Phones Realizing New Lifestyles from Your Palm**

Toshiba Technologies for the New Century

18.Mask Pattern Generation by Electron Beam Lithography