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Special Reports-1

Advanced Technologies for Nuclear Power Plants

Toward Energy Security and Preserving the Global Environment
SASAKI Norio

Trends in Advanced Technologies for Nuclear Power Plants
SUDO Akira
Toshiba has been tackling technical challenges to secure nuclear power plant safety, stable plant operation, and high utilization of increasingly aged plants. Our final goal is to maximize the total electric power output throughout the plant life with minimum construction costs, while developing plants with the world's highest standard of safety. We have also been contributing to the establishment of the nuclear fuel cycle, and to the management and disposal of radioactive waste. In addition, we are promoting the establishment of future hydrogen production technologies using nuclear energy.

Construction of New Boiling Water Reactors
SHIGA Shigenori / MAEKAWA Osamu / NAGAI Kimio
The Hamaoka Nuclear Power Station Unit No. 5 of Chubu Electric Power Co., Inc. was put into commercial operation in January 2005, becoming the third advanced boiling water reactor (ABWR) in the world. Moreover, the Higashidori Nuclear Power Station Unit No. 1 of Tohoku Electric Power Co., Inc. is now at the startup test stage.

Toshiba is currently deploying ABWRs for the international market based on the improved design and construction experience obtained with these domestic nuclear power plants.

Next-Generation ABWR and Future Nuclear Power Plants
SHIOIRI Akio / SUZUKI Shigeru / FUJII Toshihiro
Toshiba is now promoting technical studies for the next-generation advanced boiling water reactor (ABWR) based on its large accumulation of experience in BWR design and construction. This paper describes high-end technologies to rationalize the reactor and turbine/generator system.

The concepts of future nuclear power plants such as the AB1600/AB1000, which will be the successors to the current generation of ABWRs, are also explained, including the compact containment reactor (CCR), the supercritical-water-cooled reactor (SCWR), and the "Super-Safe, Small & Simple" (4S) reactor.

Integrated Renewal of Nuclear Power Plants
OKAMURA Kiyoshi / TAKAHASHI Reiji / TANAKA Kazuhiko
With the increasing number of aging nuclear power plants, maintaining the integrity of the reactor pressure vessel and reactor internals has become essential to secure stable and efficient operation of such plants. Securing stable operation means the elimination of plant shutdowns due to trouble and the reduction of outage times. As a result, plant operating hours will be improved, contributing to the profit of the electric power company.

Toshiba is promoting the integrated renewal of nuclear power plants that have been operating for more than 30 years since commissioning, as well as the upgrading of their performance.

Nuclear Fuel Cycle and Advanced Back-End Technology
YAMAGUCHI Shinichi / TOYOHARA Masumitsu / SHIBANO Takayuki
Completion of the nuclear fuel cycle and establishment of adequate and economical waste management technology are essential issues for the continuous stable promotion of nuclear power generation.

As a total nuclear plant supplier, Toshiba is actively participating in the construction and pre-operation activities of the Rokkasho Reprocessing Plant of Japan Nuclear Fuel Ltd., which has started uranium tests. We are also concentrating efforts on the development of back-end technology for realization of the advanced nuclear fuel cycle, aiming for further improvement in the utilization of resources and decreased environmental effects.

Nuclear Hydrogen Production Systems
OZAKI Akira / KUBOTA Kenichi / YAMADA Kazuya
Hydrogen is now attracting attention as a future energy carrier. Toshiba is engaged in research and development of hydrogen production using nuclear energy. We have selected three hydrogen production technologies according to the heat source temperature. Steam reforming of dimethyl ether (DME) can utilize the low-temperature heat of approximately 250°C produced by a light-water reactor. High-temperature steam electrolysis can be realized with higher temperature heat sources exceeding 500°C such as a gas reactor or a fast reactor. At high temperatures of more than 900°C, thermochemical processes such as the iodine-sulfur (IS) method, using a high-temperature gas-cooled reactor, are applicable.

Our R&D efforts are focused on the development of a high-performance catalyst for steam reforming of DME, cell development for high-temperature steam electrolysis, and efficiency improvement as well as material development for the IS method.

Special Reports-2

State-of-the-Art Communication Technologies for the Internet Society in the Broadband Era

Toward the Realization of a Ubiquitous Network Society
MASAKI Toshio

Trends in New Communication Technologies over IP Communication Platform
SHIRAKAWA Masakazu
The Internet Protocol (IP), which was developed as a protocol for communication between computers, has recently come to be regarded as a key for realizing a high-speed, low-cost network that is applicable not only to voice and data but also multimedia communication. The revolution related to IP technologies seems to be never-ending, and even public telecommunication network operators, which place emphasis on overall network quality design, are now giving serious consideration to such technologies as an essential factor in the next-generation communication infrastructure. Efforts will be made to expand IP addresses and increase the reliability of the communication network in order to realize the application of IP technologies to various spheres including home electronic appliances.

VoIP System -- IP Telephony System over IP Network Based on SIP Technology
MACHIDA Atsushi / MORI Toshiki / OCHIAI Tamiya
The advent of a new era of information technology has led to the realization of a sophisticated communication technology called Voice over Internet Protocol (VoIP) with voice packet servers. This application using VoIP technology is expected to allow the implementation of cost-effective computer-related systems.

Toshiba has been developing a scalable VoIP system for enterprise networks with the Avaya server system. This system will adopt the Session Initiation Protocol (SIP), and will permit a reliable and flexible network to be actualized by a redundant server system.

Wireless LAN Access Points with Sophisticated Functions
SUZUKI Koichi / WATANABE Hiroyuki / OCHIAI Tamiya
Wireless LAN was initially considered to have the disadvantage of increased risk of tapping and hacking compared to a hard-wired network due to the use of radio frequency technology. However, corporations have rapidly started to adopt wireless LANs as a result of the development of enhanced security. In order to further expand their application in the corporate environment, the implementation of sophisticated functions is desired.

To meet this requirement, Toshiba has developed new wireless LAN access points that can accommodate networks with different segments. These access points effectively transmit data including real-time voice and video data.

IP-Based Exchange System for Telecommunication Network Operators
SUZUKI Muneyuki / NAGASHIMA Hiroaki / YAMAMOTO Keiji / WATANABE Nobuaki
The rapid advance of IP (Internet Protocol) technologies is inducing both fixed and mobile network operators to reestablish their infrastructures using IP networks. Personal handyphone system (PHS) network operators are also requesting their own networks free from existing frameworks, to accept soaring demand for high-speed data communication.

We have codeveloped an IP-based exchange system jointly with a network operator. This system realizes voice and data communication over IP networks without using the integrated services digital network (ISDN). The main hardware components are designed redundantly to provide high reliability, and the system enables centralized supervision and control. Further enhancement and refinement of the system will be continued.

Content Delivery System Using DVD Recorders
KURIHARA Shinichi / UNNO Hiroaki / ITOH Hiroaki
The increasing diffusion of broadband Internet connections is making online video content distribution more practical. In order to start a full-fledged online video content distribution service, robust protection of contents, a cost-effective and scalable distribution server system, and low-cost and access-friendly terminal recorders are required.

To meet these requirements, Toshiba has developed the DVD over IP$_{TM}$ system, a content delivery system using DVD recorders that utilizes content protection for recordable media (CPRM) and has two totally different servers for key control and content distribution. Conventional RD-X4 DVD recorders were remodeled for the terminal recorders after improving their functionality by upgrading the software. We have now started a trial service.

Fully IP-Based Video Surveillance System
YAMAGUCHI Shuichi
Video surveillance systems covering a wider area are required in order to save labor and improve the collection of surveillance information. Due to the recent spread of Internet Protocol (IP) technology as an infrastructure, such a wide-area system can be realized more easily by an IP-based video surveillance system.

Toshiba has developed a video surveillance system that provides high-quality IP-based video transmission using MPEG-2 encoding and multicast communication of video information. An application framework has also been developed for this system that is more flexible and easier to configure and manage, thus saving setting time.

Network Digital Video Recorders
TORIUMI Yoshitsugu / NITANAI Yasuyuki / YAMAGUCHI Tohru
The importance of image surveillance security systems has recently been rapidly increasing. Using surveillance camera images, various crimes and incidents are solved more frequently. Not only are the images useful as evidence, but the crime prevention effect of such systems is beginning to be clearly recognized as well. Information leaks and accidents are also becoming a major risk affecting both the corporate world and society as a whole. The image surveillance security market continues to expand due to these reasons, with image recording equipment incorporating increasingly advanced features through digitization. Demand is also arising for the application of such equipment to remote surveillance of unmanned areas and to operating support systems via a network.

This paper introduces the trends in the image surveillance security market and solutions provided Toshiba's network digital video recorders, which are a key component of an image surveillance security system.

Feature Articles

W21T CDMA2000 1xEV-DO Cellular Phone for Japanese Market
AOTO Kunihiko / IKEDA Katsuhiko / FUKUMOTO Yuji
The CDMA2000 1xEV-DO (evolution data only) service has been offered by au since November 2003. This service provides a maximum forward-link communication speed of 2.4 Mbps, allowing large-volume contents to be downloaded. For this purpose, enhancement of external memory such as miniSD^{TM} and faster processing of such contents are required.

Toshiba has developed the W21T CDMA2000 1xEV-DO cellular phone for the Japanese market, our first cellular phone of this type. The W21T integrates various technologies to realize the processing of large-volume contents, and can also be used with the Chaku-uta-Full^{TM} service launched by au in November 2004. With these features, the W21T is a significantly enhanced multimedia cellular phone.

GR-NF417G "Non-fluorocarbon the SENZOHKO" Refrigerator
SAEKI Tomoyasu / TANIGUCHI Kazuhisa / FUJII Kanako
Surveys of users' needs for refrigerators reveal that they place a high priority on energy saving and on freshness preservation. Accordingly, Toshiba has been aiming its product development at securing these two functions. In 2003, we developed the digital signal processor (DSP) vector control system and the vacuum insulation panel to enhance energy saving, in addition to the twin cooling system introduced in 1998 to enhance freshness preservation. These technological developments enjoy a high reputation in the market.

In 2004, we adopted aluminum-deposited vacuum insulation panels as well as improvements in compressor efficiency in pursuit of advanced refrigerators with higher energy-saving performance. For freshness preservation, we commercialized a new type of refrigerator, the GR-NF417G "Non-fluorocarbon the SENZOHKO" model, which is equipped with a frost-free freezing compartment to prevent frosting of frozen food.

NEOSLIM Z SQUARE$_{TM}$ Square-Shaped Fluorescent Lamps and Lighting Applications
NISHIMURA Kiyoshi / SUGISHITA Naoki / YANAGIDA Koji
Toshiba Lighting & Technology Corp. has developed the NEOSLIM Z SQUARE$_{TM}$ series of square-shaped fluorescent lamps that change the common conception of fluorescent lamps. Since the discharge length is four times that of a straight lamp, the efficiency is increased by 13-20 %. The lamp life is also improved (15,000 hours) by a metal oxide layer that protects against glass erosion by mercury.

The flat-shaped NEOGRID$_{TM}$ luminaire for office lighting systems realizes a nondirectional shape and luminous intensity distribution. The luminous flux of the NEOGRID$_{TM}$ luminaire has been increased by 25 % compared with a conventional luminaire by improving the steel material. The NEOSLIM V SLIMSQUARE$_{TM}$ home luminaire, featuring a structure in which all sides of the luminaire are opened, brightly illuminates not only the floor but the ceiling as well. Illuminance distribution calculations have shown that all corners of a room also become brighter.

Asset Management System Utilizing IC Tag Technology
AKIMOTO Makoto
In the life insurance business sector, it has become a widely established practice for sales personnel and financial planners to carry around laptops and other mobile devices, which number in the tens of thousands, serving as operations support systems for customer management, life planning, and insurance design. Mitsui Life Insurance Co., Ltd. has introduced into its operations support system 14,800 "mobile personal computers" (nicknamed "M-boy") supplied by Toshiba. The realization of efficient mobile personal computer asset management has arisen as a major business challenge for both Mitsui Life Insurance Co., Ltd. and MLI Systems Inc., given the personnel management requirements due to the high turnover unique to the insurance sector.

In order to resolve this and other issues, Toshiba Solutions Corp. utilizes a wireless automatic recognition technology known as radio frequency identification (RFID) for its mobile personal computers and has constructed systems for the execution of shipment and inventory management using this technology. The applicable IC tag technology is a key technology in this era of ubiquitous computing. Through the introduction of this technology into these systems, precise and efficient asset management can be achieved, contributing to operational cost reductions in the systems used by Mitsui Life Insurance Co., Ltd. and MLI Systems Inc.

MAGNIA$_{TM}$ 3400/3405R Entry-Class High-Performance IA Servers
OHNO Tetsuo / TAKEYAMA Hidetoshi / FURUYA Taisuke
Toshiba has developed the new MAGNIA$_{TM}$ 3400/3405R high-performance two-way Intel® architecture (IA) servers featuring the Intel® Xeon^{TM} processor with extended-memory 64-bit technology (EM64T). The MAGNIA$_{TM}$ 3400 has a chassis usable for both pedestal and rack mounting, while the MAGNIA$_{TM}$ 3405R has a rack-optimized chassis. Both models have three major characteristics: high performance, high reliability, and high expandability. Reliability is strengthened by the incorporation of redundant memory, which has conventionally been a feature of high-end models. The MAGNIA$_{TM}$ 3400/3405R entry-class servers are also equipped with a redundant array of inexpensive disks (RAID) controller, system setup tools, and system management software, all originally developed by Toshiba, enabling these servers to respond to various needs.

Frontiers of Research & Development

Perpendicular Magnetic Recording Hard Disk Drive for Next-Generation Storage