

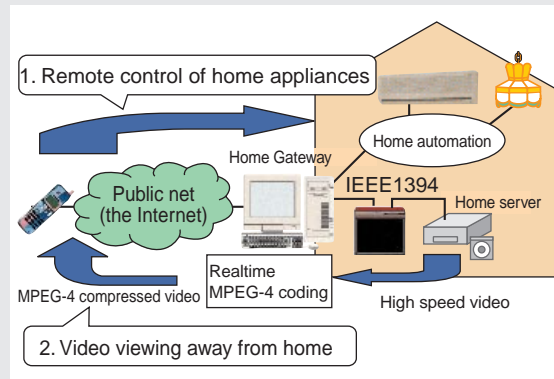
With the transition to the In-House Company System in April 1999, research and development at the corporate level restarted as the "Corporate Support Service" and is progressing towards technology seeds creation that contributes to new product development in the medium to long term view, together with the short-term business support for each member of the Toshiba Group. In the information communication system field, which is a field to be emphasized, noticeable results have been achieved in the mobile information communication technology whose future development is expected such as wireless AV network technology. Substantial results have also been achieved in the system design field, the mechanical system field, the semiconductor basic research field, and the material and device field. In the manufacturing engineering field, a semiconductor package flip-chip bonder that enables high-density packaging was developed.

Development of Home Gateway

Toshiba has developed a home gateway. The home gateway is an "ingress" node to the home, which is deployed between the public network (such as the Internet) and the home network (such as IEEE1394 and home automation network).

This includes various technologies such as the Web server technology (user interface using home page), real-time MPEG-4 coding, MPEG-4 over RTP (Realtime Transport Protocol) /IP (Internet Protocol), and Java platform. Another feature is that you can use any kinds of home networks and access networks.

By using the Home Gateway, you can control your home appliances from your cellular phone or personal computer (PC) away from home, and you can check what your video has recorded.



Home Gateway system

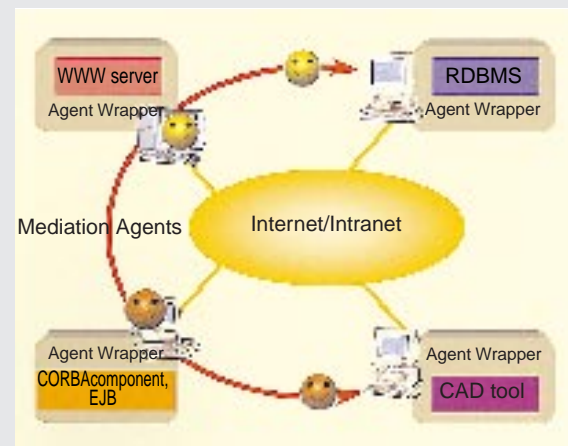


Graphical user interface of Home Gateway

Development of the Multi-Agent Middleware System Bee-gent™

Bee-gent™ is a middleware system in which each agent individually controls a coordination process of a group of distributed applications in an enterprise. Bee-gent™ enables rapid development of new distributed systems.

Bee-gent™ consists of Agent Wrappers that wrap existing systems and Mediation Agents that coordinate the Agent Wrappers. The Mediation Agents realize open distributed systems by moving around the sites where the Agent Wrappers exist and communicating with the Wrappers. This system is being applied to Toshiba's information system for environmentally-conscious product design and plant remote maintenance system. In addition, Bee-gent™ complies with the international standard for agent technology and an interoperability experiment has been operated with the agent systems of other companies.



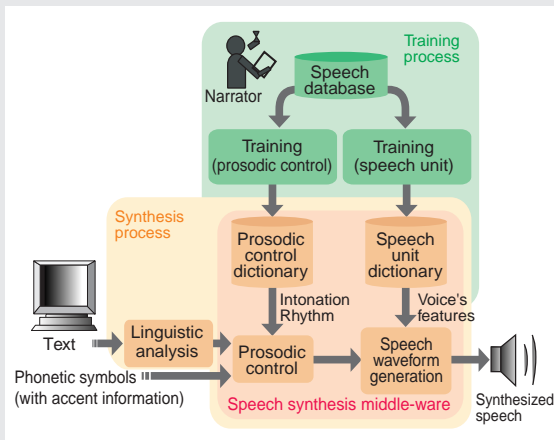
WWW: World Wide Web
 CORBA: Common Object Request Broker Architecture
 EJB: Enterprise JavaBeans
 RDBMS: Relational DataBase Management System
 CAD: Computer Aided Design

Concept of distributed system using Bee-gent™

High-Quality Speech Synthesis Middle-Ware

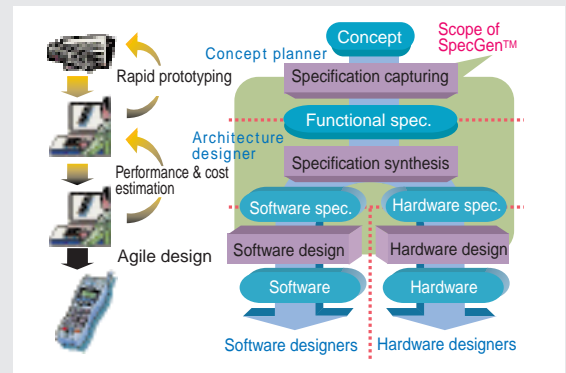
Toshiba has developed a new speech synthesis system, TOS Driven TTS (TOTally Speaker Driven Text-To-speech System). It generates highly natural synthetic speech by using two dictionaries that are automatically generated from a narrated speech database using a newly developed off-line training method. The two dictionaries are a prosodic control dictionary and a speech unit dictionary. The former represents features of the narrator's prosodic patterns, such as intonation pattern and rhythm pattern. The latter represents features of narrator's voice.

Toshiba has also developed speech synthesis middle-ware as an application for several MPU/OS platforms. Since the system is very compact, it is suitable for many ITS systems such as car navigation systems, and it also can be used by many speech systems that currently use only pre-recorded speech.



Configuration of totally speaker driven text-to-speech system

SpecGen™ System Specification Synthesis Tool



Product design process with SpecGen™

Toshiba has developed an embedded system design tool SpecGen™ which supports system specification synthesis.

Specification synthesis means the design activity to explore and decide the software or hardware architecture which implements the functional requirements of the target system.

SpecGen™ uses SpecC language which supports both software design and hardware design in a common programming language. VisualSpec™ is a design authoring tool based on SpecC language which realizes a seamless integration through functional design phase to architectural design phase of the embedded systems.

SpecGen™ enhances an IP (Intellectual Property)-reuse centric system design and achieves interoperability between software design tools and EDA (Electronic Design Automation) tools.

Advanced Lithium-Ion Battery (ALB)

The advanced lithium-ion battery (ALB) with a thickness of 3.6 mm and weight of 13 g was commercialized for cellular phones; the thickness and weight are less than those of any lithium-ion battery.

The ALB enables cellular phones to be thinner and lighter. A thickness of 3.6 mm and a high energy density per unit of weight of 160 Wh/kg were achieved for the ALB by using improved electrodes, a new liquid electrolyte with thermal stability, and a laminate thin film bag. The ALB has high discharge performance at low temperatures and is extremely safe. Since it is simple to produce larger and thinner ALBs, the ALB is expected to be extensively applied to mobile devices.



Advanced lithium-ion battery

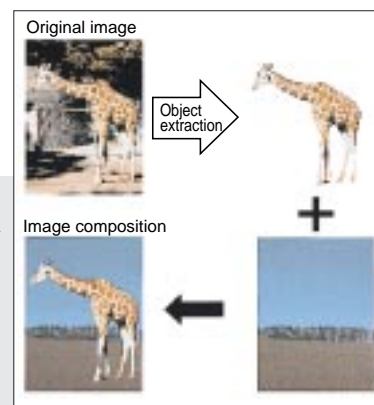
Object Extraction from Images

Toshiba has developed a technique to extract objects from images captured by a digital still camera or movie camera. The extracted images can be transmitted using the international standard

for multimedia coding MPEG-4 (Moving Picture Experts Group 4), and this would result in the wide distribution of composite images, e.g. images whose background has been replaced by another image.

A method called fractal contour extraction can extract the contour accurately from a rough object shape. Self-similarity is calculated around the object contour, and a fractal curve is generated as the contour line based on the self-similarity. The method developed is capable of extracting not only smooth curves but also sharp corners and details. Highly accurate extraction was achieved with extraction error of less than one pixel.

Once the object shape was set in the first frame, the object in motion could be extracted automatically using the fractal method and motion compensation.



Example of object extraction and image composition

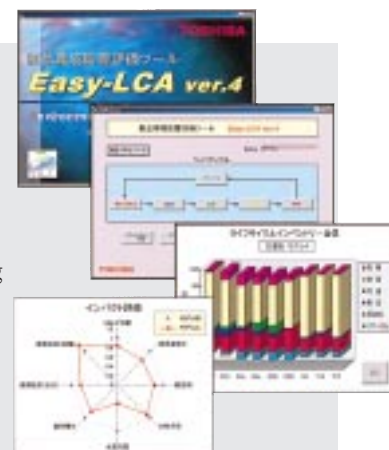
Life Cycle Assessment Tool for Designing Environmentally-Conscious Products

Life cycle assessment (LCA), which evaluates environmental load of a product throughout its life cycle, has drawn attention due to the increased environmental awareness of industry and product users.

Until now, implementation of LCA was entrusted solely to a small group of professionals specializing in LCA. However, the usage of LCA for the development of environmentally-conscious products, it calls for a LCA evaluation method which designers can use themselves during the planning phase of a product.

To achieve that goal, Toshiba has

developed a practical LCA method that can be used to support the development of environmentally-conscious products and a software package called "EASY-LCA ver.4". This was achieved by analyzing the 1995 Input-Output Tables of Japan. By utilizing this method, the person conducting the LCA can make calculations free of complicated valuation processes. For this reason, this software can be put into practical use as a support tool during the design phase of products in the development of the environmentally-conscious products.



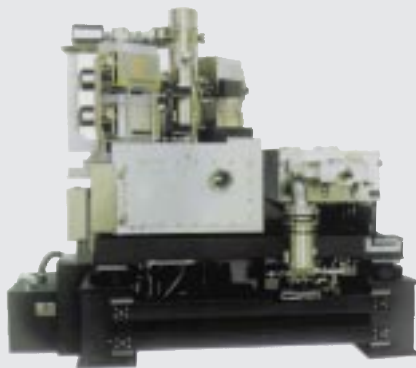
"EASY-LCA ver.4" life cycle assessment tool

EX-11 High-Speed and High-Accuracy Electron Beam Mask Writing System Promising 0.15 μm Device Technology Node

Optical 4x to 5x reduction printing lithography is now most popular in LSI circuit pattern fabrication on wafers. Photomask fabrication technology is an issue of great importance in optical lithography, because the photomask is used as the negative, and circuits with submicron structure continue to be made smaller.

Toshiba has developed the high performance electron beam writing system EX-11 for photomask fabrication of 0.15 μm devices. EX-11 is an advanced lithography system, which utilizes a variable-shaped beam, vector scanning, high acceleration voltage of 50 kV and continuous stage-movement strategy.

Toshiba has developed many breakthrough technologies, such as high-speed data conversion, automatic control of electron optical column, in-situ cleaning for electron optical deflectors, real-time proximity effect correction based on original algorithms, multi-pass writing, long-range fogging effect reduction and distortion-free mask clamping. These technologies enable EX-11 to satisfy the mask accuracy specifications for 0.15 μm devices.



EX-11 electron beam mask writing system

Flip Chip Bonder for Semiconductor Packages

Toshiba has developed a flip chip bonder for semiconductor packages in collaboration with Shibaura Mechatronics Co. This bonder has high-performance in industry terms, with a cycle time of 1.9 seconds per IC (excluding bonding time) and bonding accuracy of $\pm 10 \mu\text{m}$.



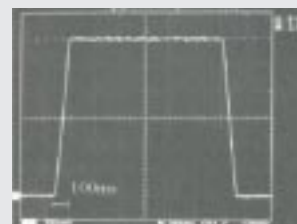
Flip chip bonder for semiconductor packages

This bonder provides the highest cycle time by using the shortest IC transfer course from wafer to bonding position, lightweight head, and high-speed X-Y table. In addition, the pitch transfer method can reduce the time lost taking substrates in and out, and can therefore realize increased productivity. The bonding head has a direct pressurization mechanism that uses one motor that goes up and down and controls impact force to less than 3 N. This bonding head can therefore achieve smooth pressurization from 5 N to 196 N and low-damage bonding.

By adjusting the layout of the wafer supply unit, this flip chip bonder can realize the smallest packages in the trade.



Bonding head



Impact force