

Special Reports

Software Engineering

Software Engineering in the Web Era

AGUSA Kiyoshi

Approach for Strengthening Embedded Software Development Capability

EGUCHI Kazutoshi

Embedded software has recently shown drastic increases in complexity and scale with the progress of embedded systems. Embedded software development has become a critical element of embedded system development.

In these circumstances, Toshiba is promoting the strengthening of embedded software development capability through a strategy of "software development process innovation." This strategy is composed of "software platform innovation," "software production innovation," and "software people innovation."

Software Process Improvement Activities

KUSANAGI Takumi / INO Masashi / ISHIKAWA Takashi

In order to develop a software product effectively and efficiently, an organizational-level development process with a mechanism for continuous maintenance and improvement must be established. For continuous organizational improvement, it is important to have an organization-wide framework for strategic process improvement that includes appropriate assessment and improvement methods, as well as human resource development for these activities.

The Toshiba Group is promoting software process improvement (SPI) activities based on such a framework, while solving problems corresponding to the circumstances of the relevant Development Divisions.

Adaptation and Deployment Scheme for CMM and CMMI Assessments

FUJIMAKI Noboru / YAMADA Atsushi / IIDA Takuro / FUJIMOTO Akihisa

More than 100 Capability Maturity Model (CMM) or CMM Integration (CMMI)-based assessments have been introduced and implemented in approximately 40 departments of the Toshiba Group to comprehend opportunities for improvements and to drive software process improvement (SPI) activities since 2000. These have been realized by a corporation-wide scheme of CMM/CMMI-based assessments that supports SPI and optimizes the process of making internal assessments as well as Carnegie Mellon University/Software Engineering Institute (CMU/SEI)-authorized assessments. This scheme, provided and maintained by the Corporate Software Engineering Process Group (Corporate SEPG), encompasses the Software Engineering Center and affiliate SEPGs. Recently, not only assessments applying CMMI staged representation but also those applying CMMI continuous representation have been carried out in order to further enhance efficiency.

Development and Deployment of Software Design Methodology

KAYASHIMA Shimon / TAMAKI Yuji

In recent years, not only has there been a dramatic increase in the complexity and size of software but also a shortening of the product development cycle. The lack of a proportional increase in the size of software teams has resulted in the necessity to increase productivity. However, this has resulted in a huge increase in development and maintenance costs. Based on our experience, we have come to the conclusion that the essential cause of this problem is the lack of coherent software design policies.

Toshiba has been working in the following areas to solve this issue: (1) procedures to formalize techniques for deciding the design policy and the construction of software architecture based on it, and (2) accumulation of know-how on how to sustain architecture without destroying it.

Development and Deployment of Software Quality Assurance Techniques

MORI Toshiaki / SAKURABA Noriko / NAKANO Takashi

With the exponential growth in the scale of development of embedded software, an increasing number of software defects are being detected inside products after shipment. Software engineers therefore often spend considerable time on debugging and testing.

In response to these circumstances, Toshiba has proposed "W model" as a framework for consistent quality management through the product development process. This includes quality visualization for upstream activities and a software testing body of knowledge for downstream activities.

Application of Linux as Embedded Operating System for Digital Consumer Products

NOZUE Hiroshi / KUMAGAI Hiroki / SAKUMA Takeshi

Many digital consumer products require rich functionality and a short development cycle. As a result, Linux is increasingly being applied as an embedded operating system.

Toshiba has resolved some of the technical problems of standard Linux, by such measures as enhancing its real-time functions and reducing its memory footprint. Moreover, through the activities of the CE Linux Forum, which has been established by electronics manufacturers and semiconductor companies from around the world, we are making efforts to resolve further issues related to this field.

Global Framework for Development of System LSI Software

SHINOHARA Junichi / MIYATA Takashi / TOMINAGA Yoshiaki

System large-scale integrated circuits (system LSIs) are utilized in many electronic devices such as cellular phones, digital consumer products, and automobile components, where they serve as the functional core.

Toshiba supplies operating systems, firmware, and middleware to LSI users and has engineering teams to support global LSI users. We operate a software development process including software requirement specification and design techniques, as well as an engineer skill evaluation system, to maintain these global engineering teams.

Skill Enhancement Education for Software Engineers

HARASHIMA Shuji / OIKAWA Daizo / NIHIRA Hiroyuki

Software development for embedded systems such as cellular phone and digital TV systems has become larger in scale while development times have become shorter. Moreover, the necessary technologies are required to respond more rapidly in line with movements in the sales climate for these products. In such a business environment, skill enhancement for software engineers is highly important.

The Toshiba Group is now promoting a tailor-made education system for this purpose based on skill standards.

Feature Articles

Laser-Ultrasonic Nondestructive Testing and Its Application to Nuclear Industry

OCHIAI Makoto / MIURA Takahiro / YAMAMOTO Satoshi

Laser-ultrasonics is a novel technology that enables remote and noncontacting generation and detection of ultrasound. Toshiba has developed new nondestructive testing (NDT) techniques based on laser-ultrasonics. One of these techniques allows the detection of surface-breaking microcracks having a depth of 0.1 mm, and the measurement of their depth with an accuracy of 0.2 mm when the depth exceeds 0.5 mm. A laser-ultrasonic NDT system for nuclear reactor internals was developed and its performance was verified through full-scale mock-up experiments. The system has been applied to industrial nuclear power plants since December 2004.

Vodafone 803T W-CDMA Phone

NISHIMURA Satoshi / SHONAI Yutaro / TAKAHASHI Shinya

The market for third-generation (3G) phones will move from the 3G pilot models to 3G entry models, in order to boost the numbers of 3G users in Europe and Japan. Many variations of 3G phones are therefore being brought onto the market by vendors. These phones include high-tier models equipped with a camera having a resolution of 2.0 megapixels or more, and low-tier models with a 0.3-megapixel (VGA) camera.

Toshiba has developed the Vodafone 803T as the successor to current 3G mobile phones including the Vodafone 902T and 903T models. We expect the 803T to contribute to the further popularization of 3G technology due to its music player features. The 803T has a dual radio module, incorporates both global system for mobile communication (GSM) and wideband code division multiple access (W-CDMA) technologies, and offers global roaming. A characteristic of its design is that it looks like a music player, with a narrow width of 47 mm. The 803T can also download full music tracks via the full track music download service. This model provides new features in a 3G mobile phone through its innovative music console function.

AW-80/70VB Vertical Type Washer-Dryer

NISHIMURA Takashi

Washing machines are expected to post steady sales of 4.5 million units in the Japanese market in fiscal year 2005, with the share of washer-dryers showing a remarkable increase. Sales of washer-dryers amounted to 0.9 million units in 2004 and are expected to reach 1.1 million units in 2005, representing almost a quarter of washing machine sales. In the washer-dryer market, drum type and vertical type models are selling competitively, with each having a roughly equal share. Customers want vertical type washer-dryers to provide energy-saving performance throughout the overall process from washing to drying, in addition to washing performance and quiet operation.

In response to these needs, Toshiba has launched the new AW-80/70VB vertical type washer-dryer on the market. The AW-80/70VB features high energy-saving performance, high washing performance, and low-noise operation.

Optimal Control for Wastewater Treatment Process Based on Total Cost Index

YAMANAKA Osamu / OBARA Takumi / YAMAMOTO Katsuya

Wastewater treatment plants need to reduce nitrogen and phosphorus as well as organic matter due to the stringent standards recently introduced for effluent water quality in Japan. At the same time, the plants are required to reduce operating costs such as energy costs associated with aeration and/or pumping.

To meet these requirements, Toshiba has been developing an optimal process control system that optimizes the set points of actuators such as blowers and pumps. We have proposed a total cost index in the optimal process control system that considers effluent costs corresponding to the effluent quality as well as operating costs. We have also developed a novel algorithm to calculate the optimal operating conditions based on the total cost index, by combining process simulation techniques, a heuristic search algorithm, and nonlinear programming.

Frontiers of Research & Development

Radio Propagation Measurement Technology for Next-Generation Wireless Network

Compact Equipment for Treatment of Organic Waste with Sulfur Using Supercritical Water