ITRON Internatinal Meeting '99

Introduction to the ITRON Project

29th Sep.

Kiichiro

ITRON Committee, TRON Association
TOSHIBA Corporation

ITRON Project Home Page
http://www.itron.gr.jp/

ITRON Project

- a project to standardize RTOS and related specifications for embedded systems
  (*esp.* small-scale embedded systems)
- one of the subprojects of the TRON Project
- a joint project of industry and academia
  (*not a government project*)

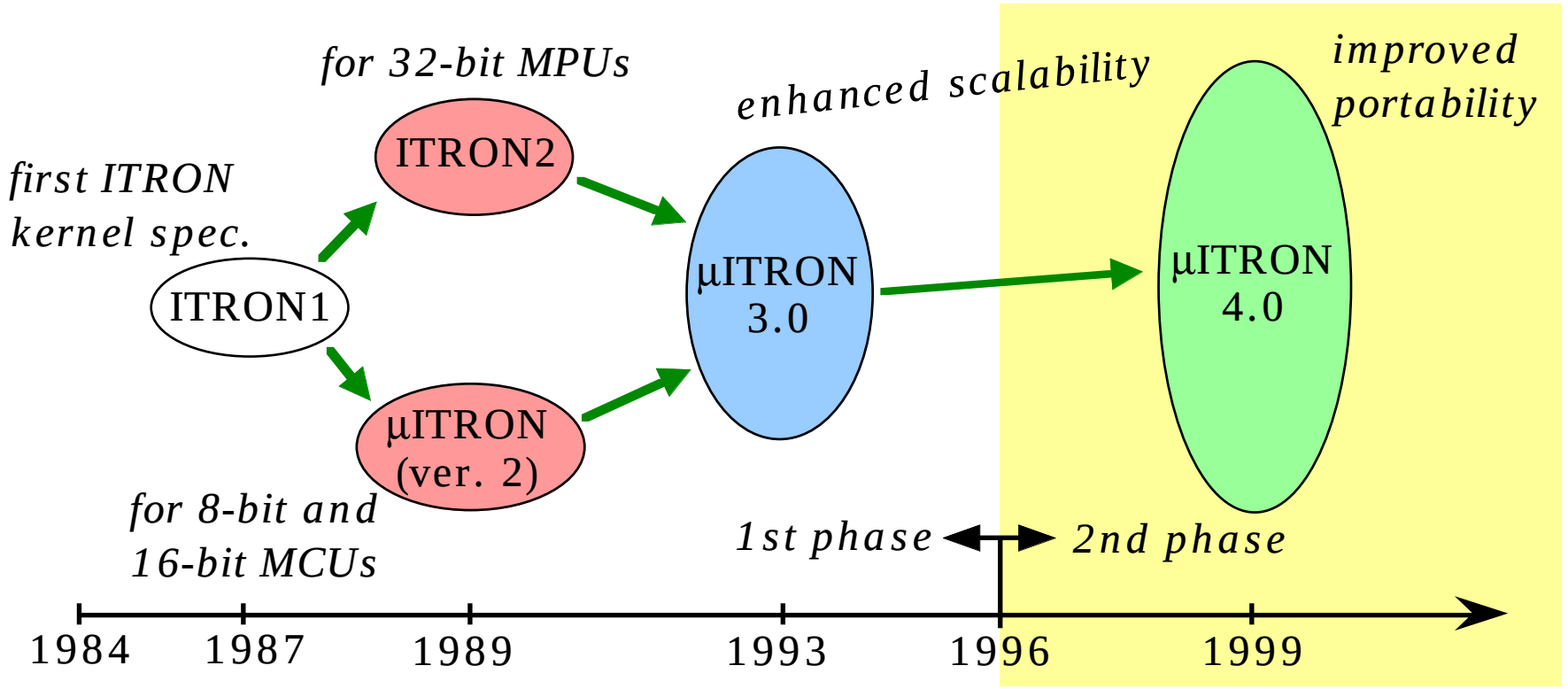
  core members:
  Fujitsu, Hitachi, Mitsubishi Electric,
  NEC, Toshiba, Oki Electric Industry

  US companies (or its subsidiaries):
  Cygnus Solutions, Hewlett-Packard,
  Metrowerks, Mentor Graphics

  acadmia:
  Univ. of Tokyo, Toyohashi Univ. of Technology
- open standard policy

ITRON Real-Time Kernel Spec. – History

- The 1st phase of the project focused on *real-time kernel* specifications.
- four generations of the ITRON kernel specifications



Requirements on Standard RTOS Specification

- deriving maximum performance from hardware
  - → *reducing the cost of final products*
- improving software productivity
  - → *easy training of software engineers*
  - → *facilitating the reuse of software components*
- applicable to various scales and types of processors
  scalability – 8-bit to 64-bit MCUs/MPUs
- truly open standard

The ITRON specifications have been designed to meet these requirements.

Design Principles of the ITRON Specifications

- design concept: *loose standardization*

  maximum performance cannot be obtained with strict standardization

- design principles
  - allow for adaptation to hardware, avoiding excessive hardware virtualization
  - allow for adaptation to the application
  - emphasize software engineer training ease
  - organize specification series and divide into levels
  - provide a wealth of functions

Typical ITRON-specification Kernel Applications

Audio/Visual Equipment, Home Appliance

TVs, VCRs, digital cameras, settop box, audio components, microwave ovens, rice cookers, air-conditioners, washing machines, ...

Personal Information Appliance, Entertainment/Education

PDAs (Personal Digital Assistants), car navigation systems, personal organizers, game gear, electronic musical instruments, ...

PC Peripheral, Office Equipment

printers, scanners, disk drives, CD-ROM drives, copiers, FAX, word processors, ...

Communication Equipment

answer phones, ISDN telephones, cellular phones, PCS terminals, ATM switches, broadcasting equipment, wireless systems, satellites, ...

Transportation, Industrial Control, and Others

automobiles, plant control, industrial robots, elevators, vending machines, medical equipment, ...

Implementation Status

! *We do not know how many kernels are implemented based on the ITRON specifications.*

- about 50 registered implementations for about 40 processors
- several non-registered commercial implementations

→ *ITRON-spec. kernels have been implemented for almost all major processors for embedded systems.*

8-bit to 64-bit MCUs/MPUs

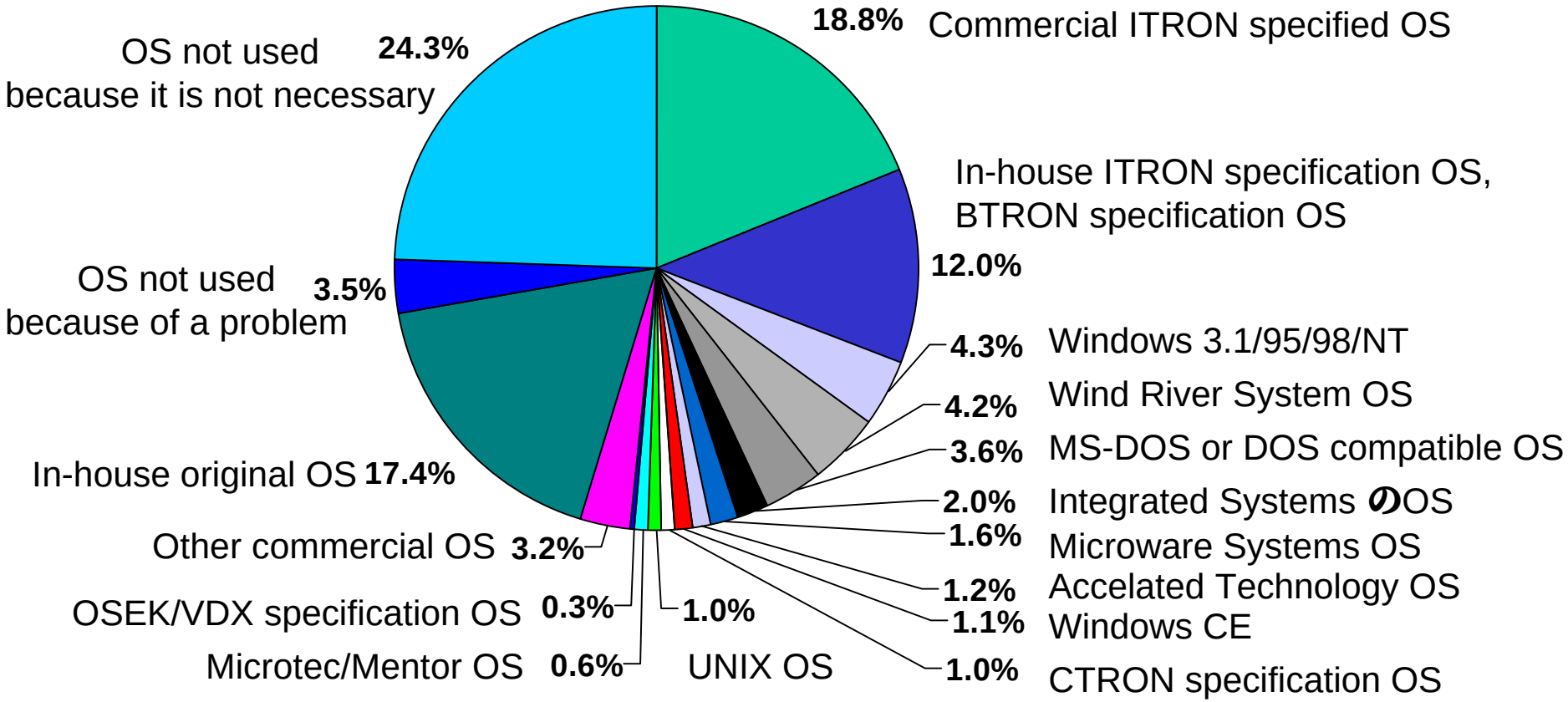
→ *Some of them are developped by U.S. companies.*

U S Software, Cygnus Solutions, and ...

- uncountable in-house implementations
- some freely distributed implementations

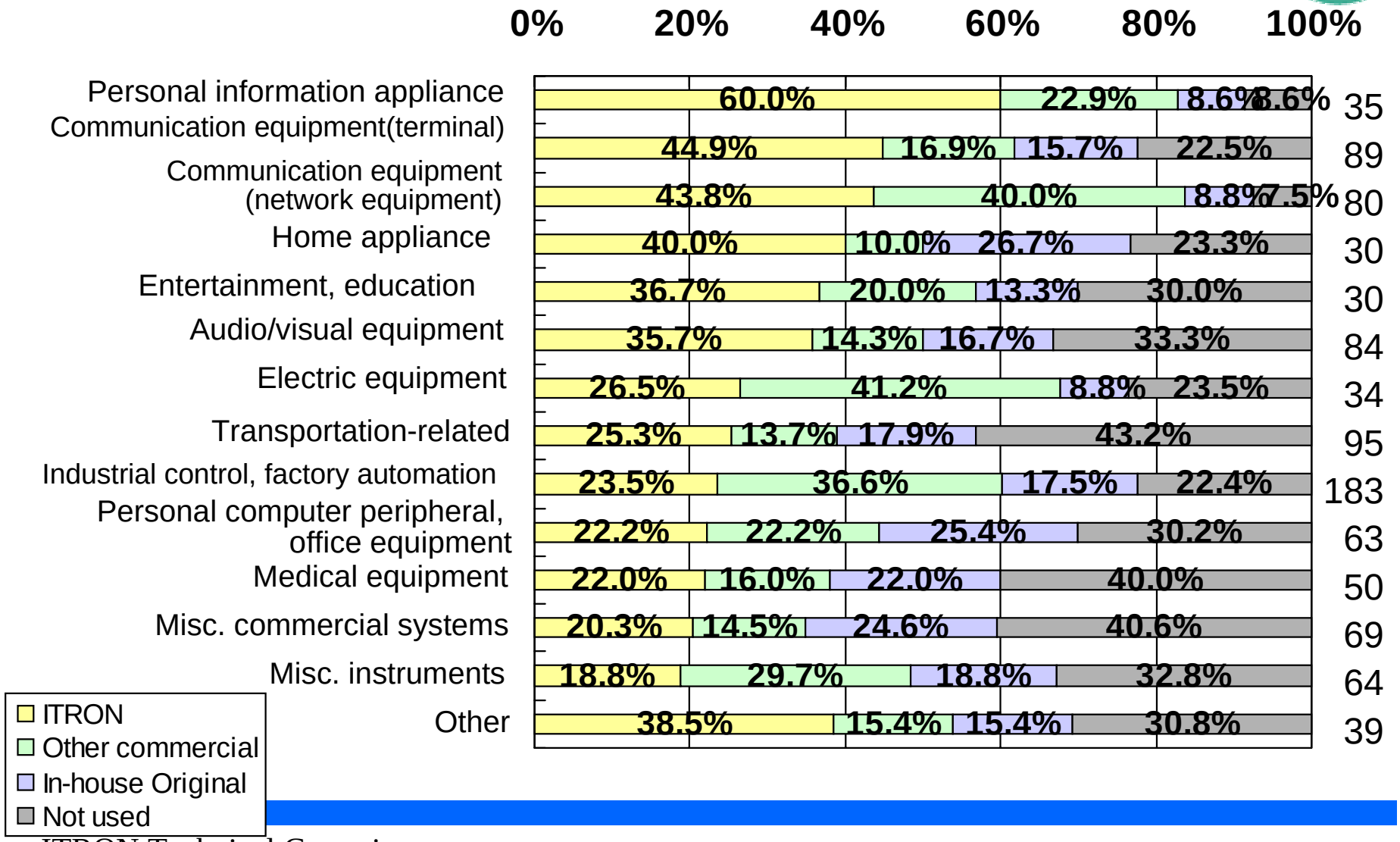
OS Embedded of Recently Developed Embedded Systems

Valid answers: 945



OS Use and Application Field

Valid answers : 945



ITRON Project – *2nd Phase*

- broaden the scope of the standardization to related aspects listed below
- software components (*software IP*, *middleware*)
  - satisfying the preconditions for promoting the development and circulation of software components
  - standard API for software components
- development environments
  - interface between real-time kernel and development environments
    eg) language binding, debugging support
- application-specific standards
  - satisfying application-specific requirements

2nd Phase Activities

Preconditions for software components

- µITRON4.0 Specification *released in June. 1999*
- Conformance Testing Method *near future*
- Application Design Guidelines

Standard API for software components

- ITRON TCP/IP API Specification *released in May 1998*
- JTRON2.0 Specification *released in Oct. 1998*
- Device Driver Design Guidelines *current*

Development environments

- µITRON4.0 Debugging Interface Specification *current*
- C++/EC++ Language Binding *near future*

Application-specific standards

reflected to µITRON4.0

- RTOS for Automotive Control Application

JCG Project

- Three software components for µITRON-specification kernels are being developped
  - reference implementation of JTRON2.0 specification
  - CORBA module for small-scale embedded systems
  - GUI module for small-scale embedded systems

Developped software will be opened when completed (*around April 2000*).

! JCG Project is funded by the Japanese government through IPA (Information-technology Promotion Agency)

Organization

- TRON Association
  - ITRON Committee
    - Planning/Publicity Working Group
    - JCG Project Committee
    - U.S. Chapter (under planning)
    - µITRON4.0 Specification Study Group *open!*
      - kernel specificaion WG
      - debugging interface specification WG
      - device driver design guideline WG
      - application design guideline WG
    - Java Technology on ITRON-spec. OS WG
    - Embedded TCP/IP Technical Committee

Summary

- µITRON real-time kernel is a de-facto industry standard in Japan.
- major results of 2nd phase activities

  µITRON4.0 Real-Time Kernel SpecificationITRON TCP/IP API Specification JTRON2.0 Specification

- continue the effort to meet industry's needs

  ITRON Project is an open activity and is waiting for your contributions.

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