



European Research Initiatives in Real-Time/Embedded/Control Systems and Software

**Workshop on new visions for software design and
productivity research and applications**

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IST Programme
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CONTENT



- 1. European ICT Scene, The Software Component**
- 2. Major European Research initiatives**
- 3. R&D: Emphasis on Real-Time/Embedded/Control**
- 4. “Ambient and All-weather software”?**

Vision for future R&D programmes

- 5. US-EU collaboration and contacts**
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2. Major European Research Initiatives



- **European Commission Framework Programme 17 Bi € / 4 y:**
includes: IST Programme 3,6 Bi € / 4 y
(Information Society Technologies)
includes: Software » 15 %
(generic apps)
 - **EUREKA, ITEA (Software intensive systems) 3,2 Bi € / 8 y**
- primarily RT, Embedded, Control
 - **National Programmes in Embedded Systems (examples)**
 - Sweden
 - The Netherlands
 - Austria
 - Germany
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THE IST PROGRAMME



- Framework programme 5 (1998-2002), running
- Framework programme 6 (2003-2006), approved, 17,5 Bi €

IST = Information Society Technologies
(Computing, Communications, e-business,
related services)



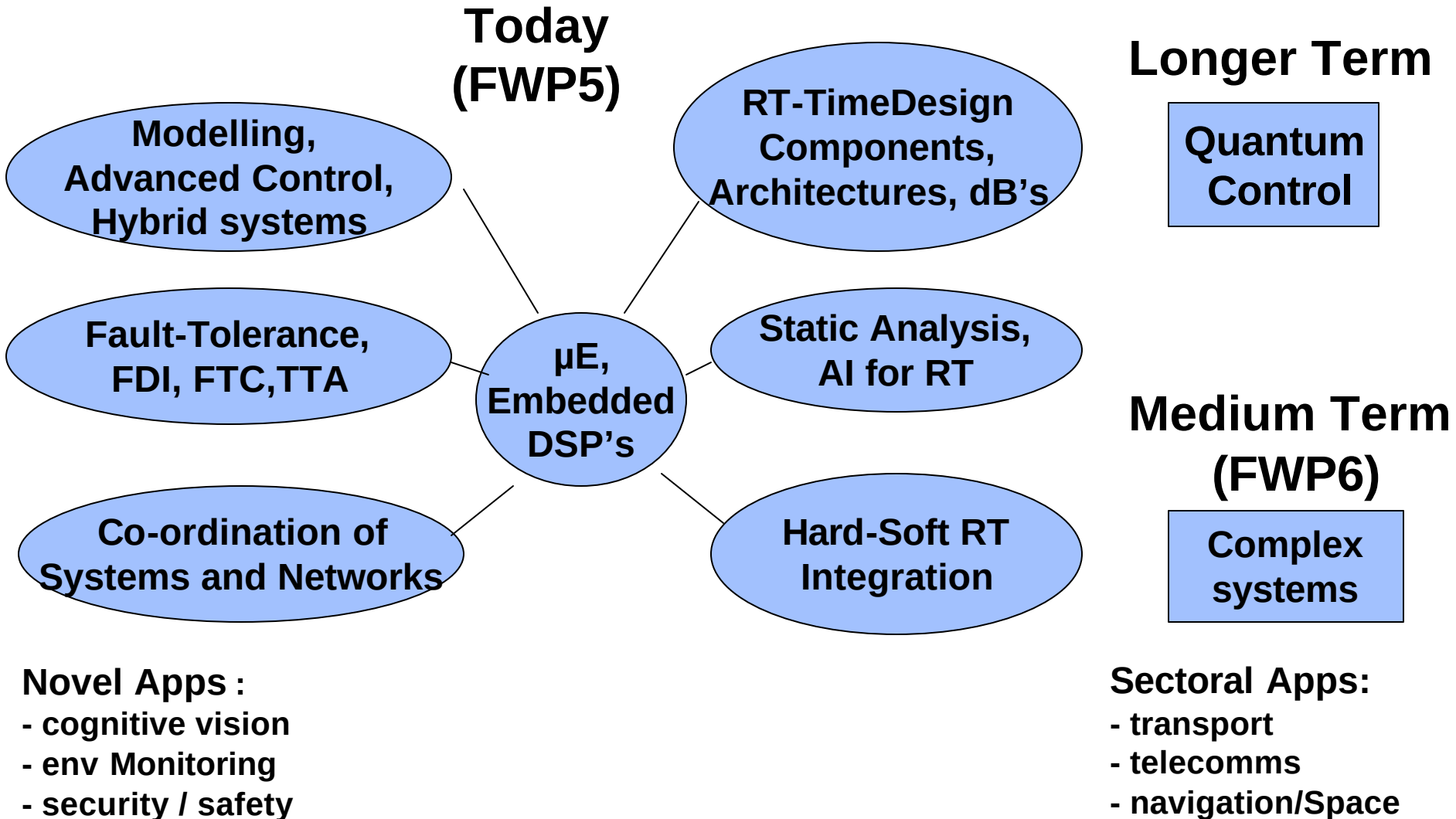
3. R&D Emphasis on RT/Embedded/Control



- **Traditional drivers:**
 - High-speed transport
 - Process control and automation
 - Consumer electronics
 - Defense, nuclear
 - **New economy:**
 - Service banking e-commerce
 - Internet, bandwidth management
 - Telecoms (mobile, fixed, core), satellites
 - Liberalised utilities
 - Value constellations, infotainment
 - **“New world”:**
 - Complexity
 - Uncertainty
 - Social dimension
 - Global dimension
-



Interacting Domains & Synergies



Note : Several projects funded in all above areas



Research Topics related to Software and Systems



- IST Workprogramme 2001:
 - Networked Embedded Systems
 - Distributed Real Time systems, Controls, Vision
 - S/w architectures and component-based develop.
 - Advanced DSP's
 - Global Computing (*Long term research*)
 - IST Workprogramme 2002:
 - Advanced Control Systems, Cognitive Vision
 - Dynamic adaptable systems and software
 - Perception systems (*Long term research*)
 - Complex Algorithms (*Long term research*)
-



Information Society Technologies



**Communication
and
computing
infrastructures**

**Components
and
micro-systems**

**Knowledge and
interface
technologies**

Applied IST research addressing major societal and economic challenges

Main areas for FWP6



Framework 6 (2003-2006)

draft Dec 2001



- Some initial topics for software and systems (draft for approval)
 - *New strategies, algorithms, and tools for systematic and accurate design, prototyping and control of **complex distributed systems**, including networked embedded systems, distributed sensing, computing, storage resources and their intercommunication. Dynamic resources allocation will be a key feature as well as cognitive techniques for generic information content, object and event recognition."*



THE EUREKA ITEA PROGRAMME

(1999 - 2007)



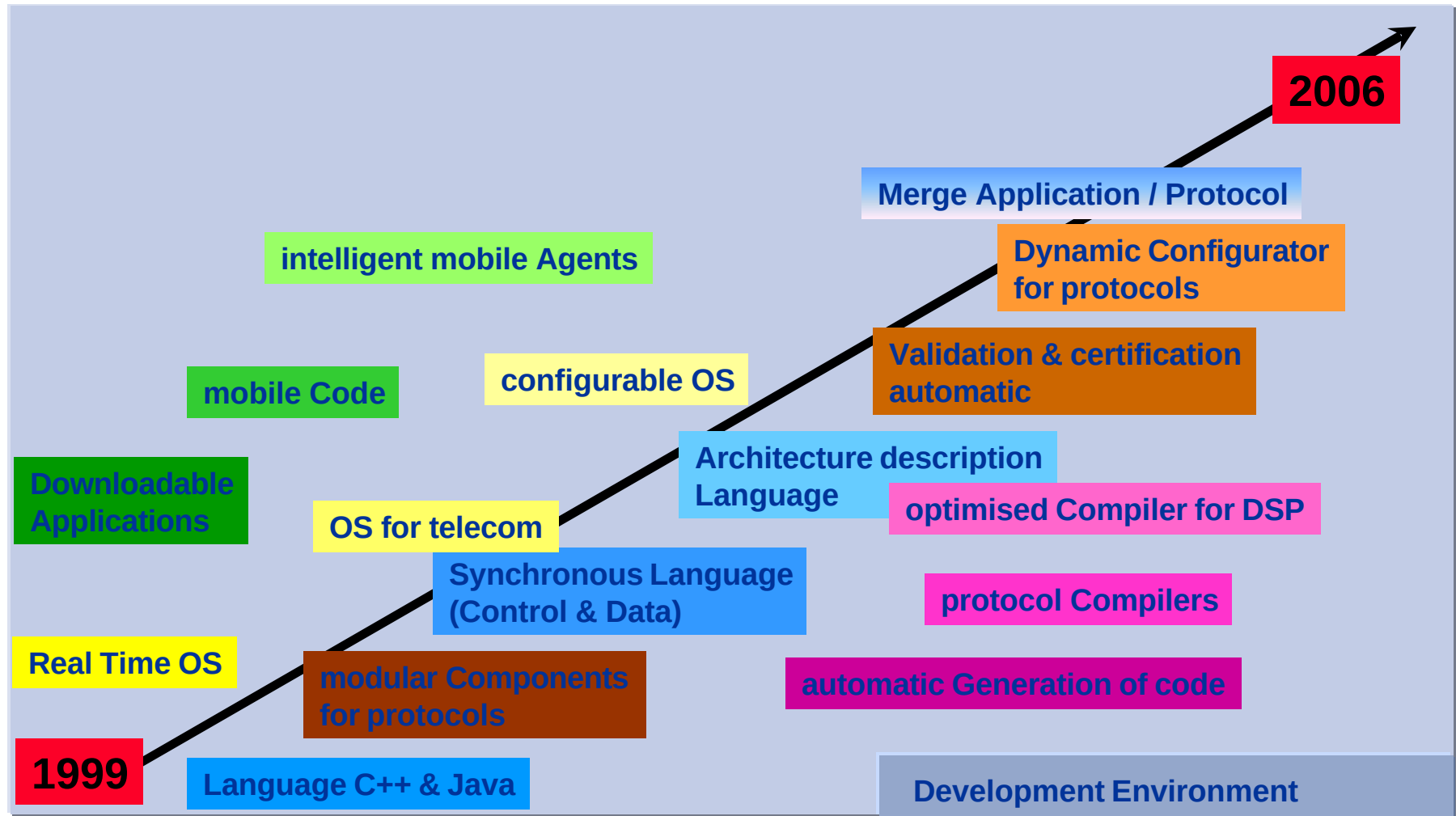
ITEA: Software Engineering

Main challenges: *productivity with quality*

- **Exploit domain properties**
- **Software architecture**
- **Increase reuse, composable systems**
- **Downloadable, portable software**
- **And more...**

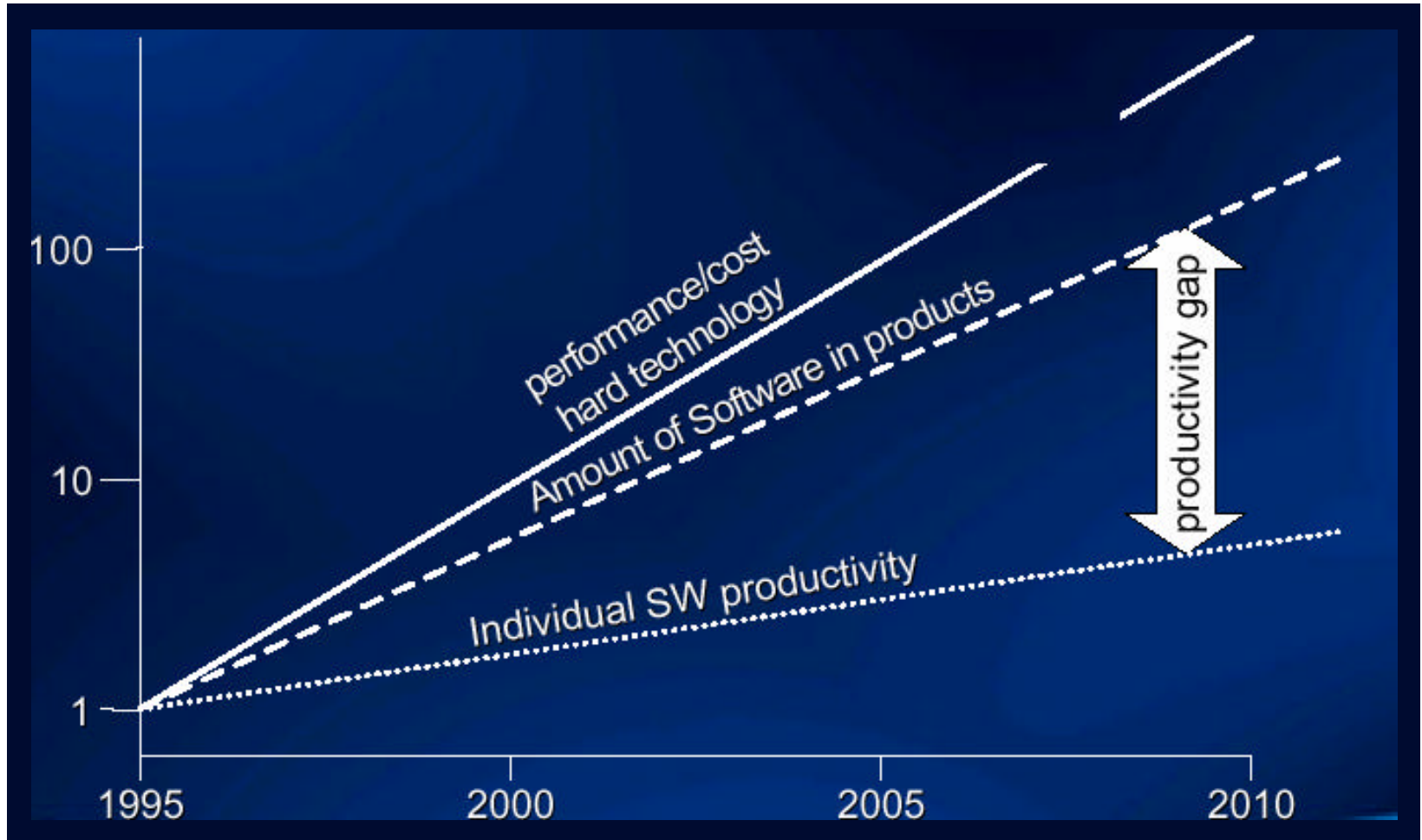


ITEA: Some Elements





ITEA: Productivity Gap





4. “Ambient and All-weather Software”?



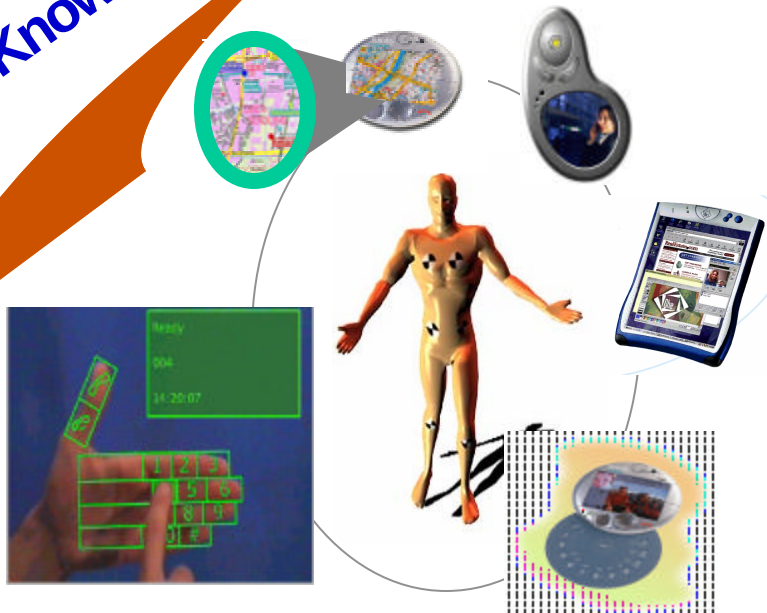
- Industry and services need urgently high performance, easy to handle, robust software
 - Real-time requirements become commodity, but their paradigms will influence software developments
 - Computing and Communications lead to cognition and control with software enabled applications, platforms and networking as the emerging substrate
 - A scenario for “Ambient Intelligence” was proposed for Framework programme 6 / IST
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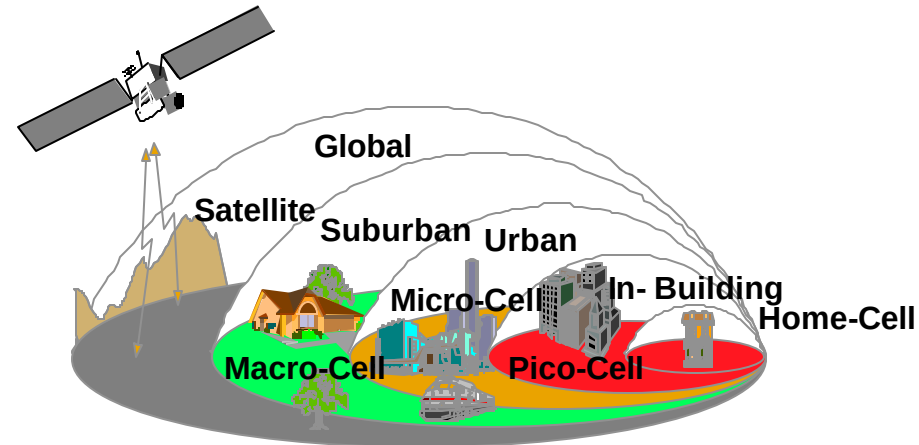
'Ambient Intelligence'



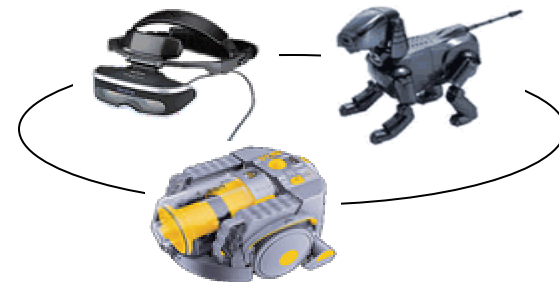
Knowledge Technologies



Anthropocentric Interfaces



Seamless & Rich Connectivity



Intelligent Environments



A Vision of Ambient Intelligence



The characteristics :

Embedded

Many invisible distributed devices throughout the environment,

Personalized

that can be tailored towards your needs and can recognize you,

Adaptive

that can change in response to you and your environment, and

Anticipatory

that anticipate your desires as far as possible without conscious mediation



Ambient Intelligence: In Action



In the Office

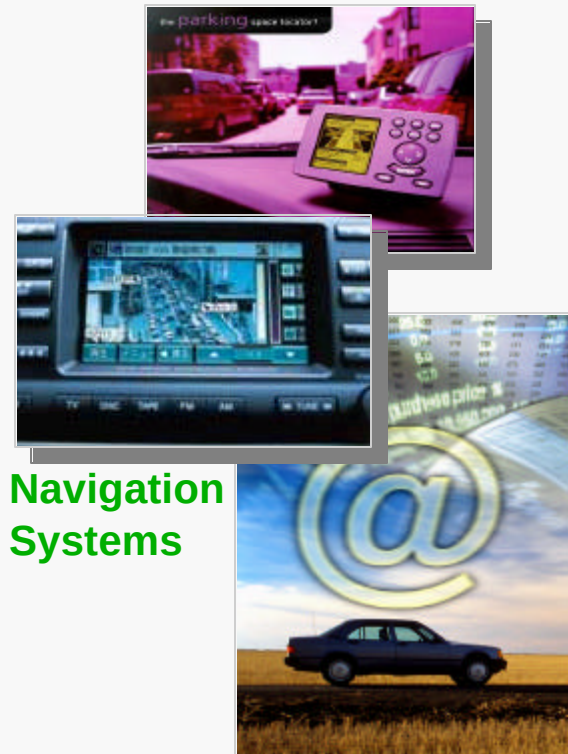
Video Walls &
Virtual-Real
Meetings



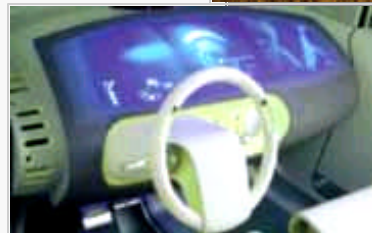
Foldable Workstations



In Transport Systems



Navigation
Systems



Driver Assistance

In the Home

Immersive TV



Medical Mirror



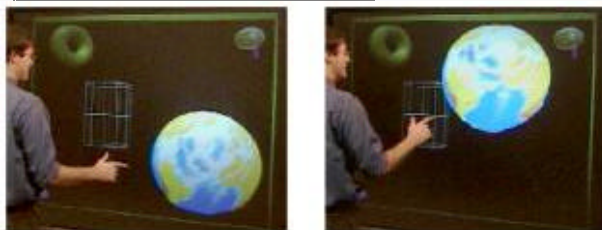
"Call My-Agent"



Creative Spaces

Courtesy PHILIPS

3D Design





EXAMPLE OF A COLLABORATIVE NETWORK IN REAL TIME SOFTWARE AND SYSTEMS



ARTIST



Advanced Real-Time Systems

Accompanying Measure Project

(subject to EC contract)

(Expected to start March 2002)

IST-2001-34820

December 2001

Coordinator:

Joseph Sifakis

Verimag, France

E-mail: sifakis@imag.fr



ARTIST implementation



Action1: Hard Real-time

Consolidate and further improve a strong European competence and know-how that is strategic for safety or mission critical applications (Synchronous languages-TTA- Fixed priority scheduling)

Action2: Component based Design and Development

Transfer, enhance interaction between teams working on compositionality/composability problems and software&systems engineering teams involved in the definition of standards e.g. UML, SDL

Action3: Adaptive Real-Time Systems for QoS Management

Soft real-time approaches and technology for telecommunications, large open systems and networks.

Teams with expertise in real-time operating systems and middleware



Relations to European Projects (1/3)



- **Hard Real-time Systems**

**SACRES (Solutions for SAfety Critical Real-time Embedded Systems) 1996-1999,
SafeAir (Avionics Systems Development Environment) (IST-1999-10913, 2000-2002),**

ESACS (Enhanced Safety Assessment for Complex Systems, GRD1-2000-25060)

CC (Control and Computation 2002-2004)

FIT - Fault Injection for TTA (IST-1999-10748), 2000-2002:

**PAMELA - Prospective Analysis For Modular Electronic Integration In Airborne
Systems (G4RD-CT-1999-00086), 2000-2001**

DSoS - Dependable Systems of Systems (IST-1999-11585), 2000-2003

**SETTA - Systems Engineering for Time-Triggered Architectures (IST-1999-10043),
2000-2001;**

**NEXT TTA - High-Confidence Architecture for Distributed Control Applications
(Proposal No. IST-2001-32111):**

EAST-EEA project from the ITEA program (EUREKA)



Relations to European Projects (2/3)



- **Component based design and development**

IST-1999-20608 CARTS

IST-1999-11557 INTERVAL

IST-1999-10069 AIT-WOODDES

IST-2001-33522 OMEGA



Relations to European Projects (3/3)



- **Adaptive Real-Time Systems for QoS Management**

FIRST - EC (IST-2001-32467) Flexible Integrated Real-Time Systems Technology

CORTEX - EC (IST-2000-26031) CO-operating Real-time senTient objects: architecture and EXperimental evaluation

•

GLOBDATA - Esprit (IST-1999-20997)

COMITY (Esprit Project No. 23015) Co-design Method and Integrated Tools for Advanced Embedded Systems MaRTE Minimal Real-Time Operating System for Embedded Applications





Associated Industrial Partners



Initial list

Snecma Control Systems, Philippe Baufreton

Esterel Technologies, Gerard Berry

TNI-Valiosys, Jean-Luc Lambert,

TTTech, Judith Sattlberger,

EADS-Aerospatiale,. Francois Pilarski

Dassault-aviation, Emmanuel Ledinot

FRANCE TELECOM, Dr. Pierre Combes

ABB Automation Technology Products, Staffan Elfving Vice President

R&D controller development

THALES Research & Technology, Dr. Dominique Potier

BMW AG, SW-Qualitat und SW-Absicherung EE-72 Joachim Dunkel,

ERICSSON, Bjarne Dacker



EU- US Collaboration



- Scientific collaboration in real-time, embedded software, systems and controls,
Example: EMSOFT <> ARTIST Network
 - Joint workshops on Dependability and Infrastructure protection
 - Agency to Agency cooperation IST <> NSF, DARPA, NIST
 - Useful links :
www.cordis.lu/ist, www3.eureka.be,
www.itea-office.be, <http://europa.eu.int>
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