ArtistDesign Kickoff Meeting

Paris, January 29-30, 2008

Cluster presentation

Operating Systems and Networks

Cluster Leader : Giorgio Buttazzo

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Objectives

Support the development of future embedded systems with high complexity and dynamic behavior. In particular:

- support scalability to facilitate the porting of RT applications to different platforms;
- simplify the management of resources to control the growing complexity of embedded systems;
- increase programming flexibility, for specifying functional and performance requirements to simplify test and verification;
- increase programming productivity, by raising the level of abstraction of the resource management services;
- increase system adaptivity to react to environmental changes, still providing a sufficient level of performance;
- increase robustness to tolerate transient and permanent overloads due to wrong design assumptions or unpredictable changes.

Relevance and Impact for Embedded Software and Systems

- When RT systems work in dynamic environments, a static design approach cannot be pursued due to cost, power, space and memory constraints.
- The major application domains include Consumer Electronics, Telecoms, Multimedia Systems, Automotive Applications, Medical Systems, Industrial Automation, Assisted Living.
- In such domains, the characteristics of the load or the system cannot be easily predicted in advance, thus system adaptation is highly desired to adjust the level of performance (quality) in a controlled fashion.

Activities

1. Resource-Aware Operating Systems
   Leader: Giorgio Buttazzo (Scuola Superiore Sant'Anna - Italy)
   - Adaptive OS mechanims
   - Microkernels and virtualization
   - Composability of RTOSs
   - RTOS for multi-core devices
2. Scheduling and Resource Management
   Leader: Alan Burns (York - UK)
   - Multi-resource platforms (policies, analysis, models)
   - Adaptive (energy aware) resource management
   - Contract-based scheduling
3. Real-Time Networks
   Leader: Luis Almeida (University of Aveiro - Portugal)
   - Real-time protocols, Sensor networks, MANETS, Energy-aware protocols, QoS adaptation, …

Core Partners

Scuola Sup. S. Anna	Real-time scheduling
Univ. of Aveiro	Dynamic reconfiguration in distributed embedded systems
Univ. of Porto	Wireless Sensor Networks, Multiprocessor Scheduling, QoS-Aware Computing
Univ. of Cantabria	Flexible Scheduling Framework, Distributed Real-Time Systems
Univ. of York	Advanced scheduling and resource modeling and management
TU of Kaiserslautern	Real-time resource management and media processing
IMEC	Run-time resource managements
Lund University	Adaptive control methods for real-time systems

Affiliated Academic Partners

University of Pavia	Real-time sensory processing
University of Catania	Real-time networks and scheduling
Univ. of Mallorca	Fault-tolerance
Tech. Univ. of Madrid	QoS resource management
Univ. C. III of Madrid	QoS resource management, real-time java
TU of Valencia	Operating Systems
Tech. Univ. Catalonia	Real-time and control
University of Dresden	Operating Systems and Microkernels

Affiliated Industrial Partners

Ericsson	Telecommunication systems
NXP	Multimedia processing
Microchip Technology	Hardware platforms
WindRiver	Real-Time Operating Systems
Evidence srl	Operating systems and Tools
CSEM – Switzerland	Networks
PARADES	Design Tools
Rapita	Performance analysis tools

Tools and platforms

- FRESCOR
- SHARK (Pisa)
- ERIKA + FLEX (Evidence)
- TRUETIME (Lund)
- VIRTUALTIME (Rapita)
- OpenZB (Porto)

Spreading excellence

- International Conferences
  - ECRTS, RTSS, RTAS, EmSoft, DATE
  - Workshops
  - Tutorials
- Special issues in journals
- Participation in standards
  - Posix
  - OSEK
  - RT-Java and Ada
  - OMG standard for Modelling and Analysis

Education

Training courses and summer schools on

- Real-Time Systems Development – with practical experience
- OSEK Compliant Real-Time Kernels – with practical experience
- Real-Time Distributed Systems and Networks
- Real-Time Control
- Adaptive Resource Management

Education

Educational kit

- Develop an educational kit for embedded systems, based on Microchip dsPIC technology, consisting of a number of modules that can easily be composed depending on specific application purposes.
- The idea is to build a community within ARTIST to develop
  - tools for design and development embedded systems
  - libraries to simplify the access to the hardware devices (sensors, servomotors, wireless modules)
  - a number of sample real-time control applications that can be easily replicated by the users

International collaborations

- University of Virginia (John Stankovic)
  sensor networks
- UIUC (Lui Sha, Tarek Abdelzaher)
  sensor networks and real-time control
- UNC @ Chapel Hill (Sanjoy Baruah)
  multiprocessor scheduling
- UC @ Berkeley (Sangiovanni Vincentelli)
  design methodologies and tools
- Florida State University (Ted Baker)
  multiprocessor scheduling
- Universidade Federal Fluminense Brasil (Julius Leite)
  energy aware scheduling
- Universidad Bahia Blanca Argentina (Rodrigo Santos)
  real-time scheduling
- Washington Univ. In St. Luis (Chenyang Lu)
  RT and control
- IIT Mumbai (Krithi Ramamritham)
  RT storage systems

Indicators for integration

- Joint publications in international journals and proceedings related to real-time and embedded computing systems;
- Organization of joint educational activities on real-time operating systems and networks, like training courses, summer schools, or student competitions;
- Organization of workshops for discussing new trends and solutions on operating systems and networks;
- Creation of a repository for relevant publications, algorithms, and libraries related to real-time operating systems.

Plan for Year 1

- Define the key features and critical problems in component-based operating systems.
- Focus on RTOS for multicore devices, with the objective of making optimal usage of the CPUs available, as well as minimizing power consumption.
- Produce a Taxonomy on resource management techniques (policies, analysis and models) – probably on a Wiki (including networking issues)
- Deliver the Education kit

Plan for Year 1

- Cluster meeting (2-day) 2nd and 3rd October
- RTN workshop at ERCTS 2008.
- OSPERT workshop at ECRTS 2008.
- APRES workshop at RTAS 2008.