ERIKA Enterprise: Operating system and open-source components for automotive systems

Paolo Gai, Evidence Srl, pj@evidence.eu.com
Marco Di Natale, Evidence Srl, marco@sssup.it
Giordano De Maria, Cobra AT, g.demaria@cobra-at.com
Giuseppe Finazzi, Freescale, giuseppe.finazzi@freescale.com
Marco Sacchi, Freescale, marco.sacchi@freescale.com
agenda

- (brief) Evidence company profile
- AUTOSAR and OSEK/VDX
- make, buy, or…
- open platforms and ERIKA Enterprise
- first experiences in automotive systems with Cobra-AT and Freescale
Evidence

company profile
Evidence profile

- Founded in 2002, spin-off company of the Scuola Superiore S.Anna
- 15 people
- Mission: design and development of software for small electronic devices
- Evidence won the first prize at Start Cup Pisa 2005
- selected by “Corriere della Sera” as one of the most innovative Italian young entrepreneurs
(some) customers and partners

OSEK, microcontrollers, schedulability analysis

Linux, SW devel.

Partnerships

3rdParty

all rights reserved
Products

Real-Time Operating Systems:
- ERIKA Enterprise – Tiny RTOS
- Embedded Linux – High performance OS

Development tools:
- RT-Druid – For ERIKA Enterprise
- Evelin SDK – For Embedded Linux

Hardware:
- Flex – Electronic board with ERIKA
ERIKA Enterprise: Operating system and open-source components for automotive systems
the future is AUTOSAR...

- the AUTOSAR initiative started to increase portability and reuse of functional components
- AUTOSAR is based on a system-level view integrating software components allocated on hardware of choice of the car manufacturer
- from *federated architectures*
  - ECUs connected to a network
- to *integrated architectures*
  - hardware hosting cooperating software components
AUTOSAR goals

• In the long term
  – the hardware designs will be optimized
  – less ECUs
  – more competition among providers of
    • subsystem producers
    • base software
    • application software

• objective:

  cost reduction
the present... is OSEK/VDX!

• most developers currently use OSEK/VDX
  – OSEK/VDX is a subset of AUTOSAR OS
  – AUTOSAR is in any case expected to come for future projects

• smaller projects do not use operating systems

Why?
nothing!
AUTOSAR and COTS software

- AUTOSAR is enabling software to become a commodity
- A set of common components is being developed and proposed to subsystem makers

but

- What currently happens is that, if not required by the customer, developers sometimes do not buy components to avoid royalties and license costs
  - RTOS
  - Diagnostic protocols (KWP2000, …)
we believe that
there is space for
openly sharing
software components
not in the core business
Linux and Android

• This is already happening in the automotive industry
• Android is being considered as an alternative to proprietary solutions for infotainment systems
• This is not happening (yet) on smaller microcontroller systems
• Why?
what we need is an open platform
- supporting a wide range of microcontrollers
- implementing a set of basic services
- enabling companies to **share components** which are not part of the core business
the first building block

- the first building block is an OSEK/VDX RTOS

- Many projects started to provide an Open OSEK/VDX operating system
  - Arctic Core

- some of them are
  - at the early stage
  - available for i386 only
  - not commercially supported by a company
we propose

• an open-source RTOS
• implementing the OSEK/VDX standard
• Made in Italy

• as the base platform to build a set of open components for automotive systems
ERIKA Enterprise supports the OSEK/VDX API
Complete implementation of the following components:

- OSEK OS (BCC1, BCC2, ECC1, ECC2)
- OSEK OIL
- OSEK ORTI using Lauterbach Trace32
- Additional conformance classes (FP, EDF, FRSH)

Prototype implementation of:
- OSEK COM (CCCA, CCCB, CCC0, CCC1), no OIL support
microcontrollers

currently available for
- Microchip dsPIC
- Altera NIOS II (with multi-core support!)
- Atmel AVR

existing support (not yet mainline)
- ARM7TDMI (Samsung KS32C50100, Triscend A7, ST Janus, ST STA2051, UniBO MPARM)
- Tricore 1
- PPC 5xx (PPC 566EVB)
- Hitachi H8 (RCX/Lego Mindstorms)
- C167/ST10 (Ertec EVA 167, tiny/large mem. model)

under development
- Microchip PIC32 (done by SSSA)
- Tricore2 (done in the PREDATOR FP7 Project)
Microchip dsPIC, BCC1

OSEK BCC1, monostack, 2 Tasks, 1 resource

Code footprint (24-bit instructions): 379 (1137 bytes)
• ISR2 stub (for each IRQ) 27
• IRQ end 36
• kernel global functions 99
• ActivateTask 57
• GetResource 12
• ReleaseResource 41
• StartOS 26
• Task end (TerminateTask) 81

Data footprint (bytes)
• ROM 18
• RAM 52
RT-Druid

- Development environment for Erika Enterprise
- Compliance with OSEK OIL
- Schedulability analysis plugin
- Integration with AUTOSAR XML
- Template applications support
- Easy development:
  - Multicore support: multicore issues automatically handled
  - Support for hardware debugging
  - Based on the well-known Eclipse IDE
licensing

ERIKA Enterprise is available under the GPL + Linking Exception

- possibility to statically link a proprietary application with the source code

RT-Druid IDE is currently with a demo license, will be released soon under EPL
community

http://erika.tuxfamily.org

- SVN repository, Wiki, Forum
- More than 15 universities using ERIKA
- Application notes
- Available libraries
  - Console
  - 802.15.4 (with beaconed mode / GTS support)
  - Scilab/Scicos
  - Motor control
  - TCP/IP, and others
RT-Druid is used in the INTERESTED FP7 by Magneti Marelli, AbsInt, CEA

Used for:
- Specification of the mapping of the various functionalities
- Schedulability analysis
- Sensitivity analysis
- Integration into the AUTOSAR build flow
• ERIKA Enterprise has been selected by Cobra-AT
• porting on Freescale S12XS
• released open-source as part of ERIKA Enterprise
http://erika.tuxfamily.org

Evidence Srl
Via Carducci 64/A
56010 S.Giuliano Terme
Pisa - Italy

Web: http://www.evidence.eu.com
E-mail: info@evidence.eu.com
Phone: +39 050 99 11 224