



## Automotive and open-source: Current solutions and future developments

Evidence Srl:

**Paolo Gai**, [pj@evidence.eu.com](mailto:pj@evidence.eu.com)

Marco Di Natale, [marco@sssup.it](mailto:marco@sssup.it)

Cobra AT:

Graziano Mangarotti, [g.mangiarotti@cobra-at.com](mailto:g.mangiarotti@cobra-at.com)

Daniele Di Ciccio, [D.DiCiccio@cobra-at.com](mailto:D.DiCiccio@cobra-at.com)

Giordano De Maria, [g.demaria@cobra-at.com](mailto:g.demaria@cobra-at.com)

Massimiliano Carlesso, [m.carlesso@cobra-at.com](mailto:m.carlesso@cobra-at.com)

**...in other words...**

**...what happened in the last three years?**

# agenda

- (brief) Evidence company profile
- update on open-source software usage in the automotive domain
- licensing issues with open-source projects
- proposal for a shared collaboration on development of open-source automotive software

# Evidence

company profile

25, happy and running!



# The company

Founded in 2002 as spin-off company of the  
Real-Time Systems Lab at Scuola Superiore S.Anna



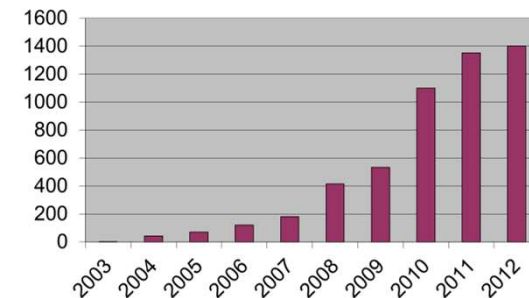
~25 qualified people with an average age of 30 years

10+ years of experience in academic and industrial projects

One third of the company has a PhD degree



## We are growing!



## Our Mission:

design and development  
software for small  
electronic devices

[www.evidence.eu.com](http://www.evidence.eu.com)



# Products and services

**ERIKA** ENTERPRISE

**RT DRUID**

open source OSEK/VDX RTOS and IDE

**E4** CODER

**SM** CUBE

simulation and code generation tool  
based on open-source tools

**EveLIN** BSP

**EveLIN** SDK

BSP and SDK for Embedded Linux systems  
Custom drivers, application development



# Open source in automotive

an update...



## the basic idea

- **Cost reduction** is an important factor in automotive
- Every company is implementing (or buying) every time the same subsystems
  - RTOS (OSEK/VDX or AUTOSAR)
  - Device Drivers
  - Diagnostic protocols

there is an opportunity to

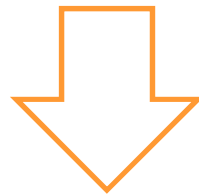
**share**

software components not in the core business

# sharing in automotive

Sharing source code in automotive means:

nobody makes a **free gift** to competitors



we need a **platform**  
where each company  
adds a small part

# guidelines for an open-source platform

- Is there an active community for the project?
- Does the license allow closed source projects?
- Does the project support automotive hardware?

# First example: the Eclipse framework

The core business of tool makers is on new functionalities, not in the text editor!



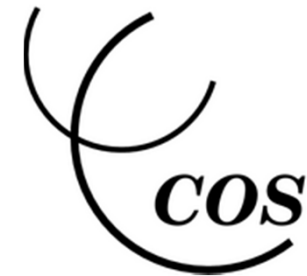
- The automotive world adopted Eclipse since years
- Artop is a common Tool Platform for AUTOSAR
  - why writing another AUTOSAR XML importer?
- Artop is based on EMF and Sphinx

<http://www.eclipse.org/proposals/sphinx/>

<http://www.artop.org/>

## Second Example: code generation tools

We used the open source tool ScicosLab as a base platform for providing simulation and code generation for control algorithms



The result is the tool



(more information on the Evidence booth)

<http://www.e4coder.com>

## Third Example: Linux in infotainment

Many new infotainment systems on car are based on Linux and Android



Automotive Grade Linux - <http://www.linuxfoundation.org>

Tizen - <https://www.tizen.org>

**TIZEN**

Genivi - <http://www.genivi.org/>



... just take a look at the latest news on **WIRED** ...

Oct 12<sup>th</sup>, 2012

The Next Battleground for Open vs. Closed: Your Car

## Wired, Oct 12<sup>th</sup> 2012

“A luxury automaker recently told me its IVI system contains about 1,900 use cases – “of which we only consider about 3 percent unique to our products; the other 97 percent are common across all car companies.” Let me emphasize that: THREE percent. Can these companies really afford to pour a lot of time and money into such a small amount of differentiation?”

“But here’s the paradox: **The automotive industry is going to have to collaborate in order to differentiate.**”

“**Competitors collaborate on the code and requirements to produce a common base, upon which they differentiate and compete with each other.**”

<http://www.wired.com/opinion/2012/10/automakers-become-software-makers-the-next-battle-between-open-and-closed/>

# What about small ECUs?

Is this happening on small ECUs? **Yes!**

Typical scenario:

- OSEK/VDX / AUTOSAR RTOS
- small footprint constraints



<http://erika.tuxfamily.org>



<http://www.arccore.com>



# Main difference: licensing

All relates to the 4 freedoms:

- freedom to **use** a software  
Commercial - Windows
- freedom to **distribute** a software  
Shareware - WinZip
- freedom to **modify** a software  
(**without releasing source**)  
BSD License – FreeBSD
- freedom to **get the same freedom the author gave you**  
(**with source code**)  
GPL License - Linux

# The licenses

Arctic Core uses dual licensing (GPL2 + Commercial)  
to go in production you have to either:

- buy a license
- or release the application source code

The community is typically limited to avoid **license pollution**

ERIKA Enterprise uses a **GPL2 + Linking Exception**

**You are free to include closed source code for free**

(but you need to cite the project in your product as it happens  
with Linux-based infotainment systems)

# License as platform enabler

The GPL2+Linking Exception license helped building a community of companies using ERIKA as a common platform

# Cobra AT

The first one was Cobra AT



with:

2009 – feasibility for a OEM product  
based on Freescale S12XS

2012 – integration in an after-market / OES product  
based on Freescale S12G

(integration work performed by Massimiliano Carlesso)

# Magneti Marelli

Then came Magneti Marelli Powertrain Bologna



With support for:

- PPC MPC5674F (Mamba)
- MPC5668G (Fado)
- Multicore support
- AUTOSAR Memory Protection

# Then...



Aprilia Motor Racing on PPC



FAAM on S12XS



esi-RISC port (made by Pebble Bay)



TI Stellaris Cortex M4F, Renesas 2xx  
and AUTOSAR-like drivers



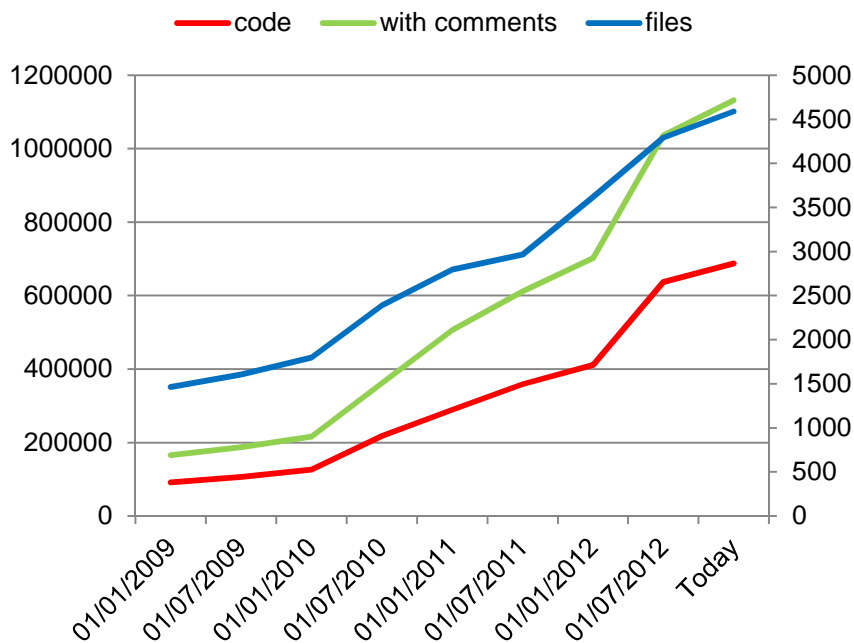
Demo @ Freescale Automotive seminar

Other companies – PPC Leopard and Infineon AURIX

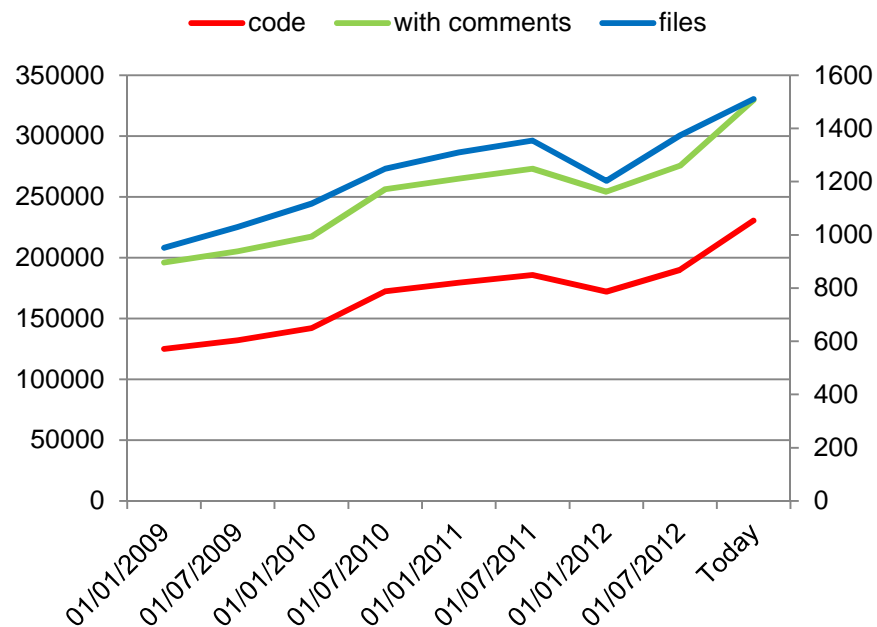
# the result in code size

The code base increased 3x during last three years

## ERIKA Enterprise



## RT-Druid



# MISRA C compliancy

A subset of ERIKA Enterprise has been checked for MISRA C compliancy

- tools used: FlexeLint 9.00h
- subset tested
  - OSEK kernel conformance classes, plus FP conformance class
  - CPU: PPC e200 single and multicore core, with/without memory protection
  - Compiler attributes for Diab 5.5 for PPC
- FlexeLint has been configured using Magneti Marelli Lin 7.10, with some additional exceptions which will be documented soon on the ERIKA Enterprise Wiki





# OSEK/VDX Certified

ERIKA Enterprise has been

**certified OSEK/VDX Compliant**



work done in the context of the OSTIS Industria 2015 project on a TI Stellaris Cortex M4F


ERIKA Enterprise is the first OSEK/VDX certified RTOS **Made in Italy!**

ERIKA Enterprise is the first **open-source** OSEK/VDX certified RTOS!



# The open platform proposal

We propose to create

- shared collaboration on development of open-source automotive software
- that will create an open source platform
- based on a license allowing static linking of closed source code (we propose GPL2+Linking exception)
- leveraging the  project as a base
- for sharing open source code not in the core business

# Contacts



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Marco Di Natale,

[pj@evidence.eu.com](mailto:pj@evidence.eu.com)  
[marco@sssup.it](mailto:marco@sssup.it)



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[D.DiCiccio@cobra-at.com](mailto:D.DiCiccio@cobra-at.com)  
[g.demaria@cobra-at.com](mailto:g.demaria@cobra-at.com)  
[m.carlesso@cobra-at.com](mailto:m.carlesso@cobra-at.com)

## discussion hints...

As a car-maker:

What are your thoughts about open-source licenses and their usage in automotive products?

As an company producing automotive subsystems:

What about creating a common project?