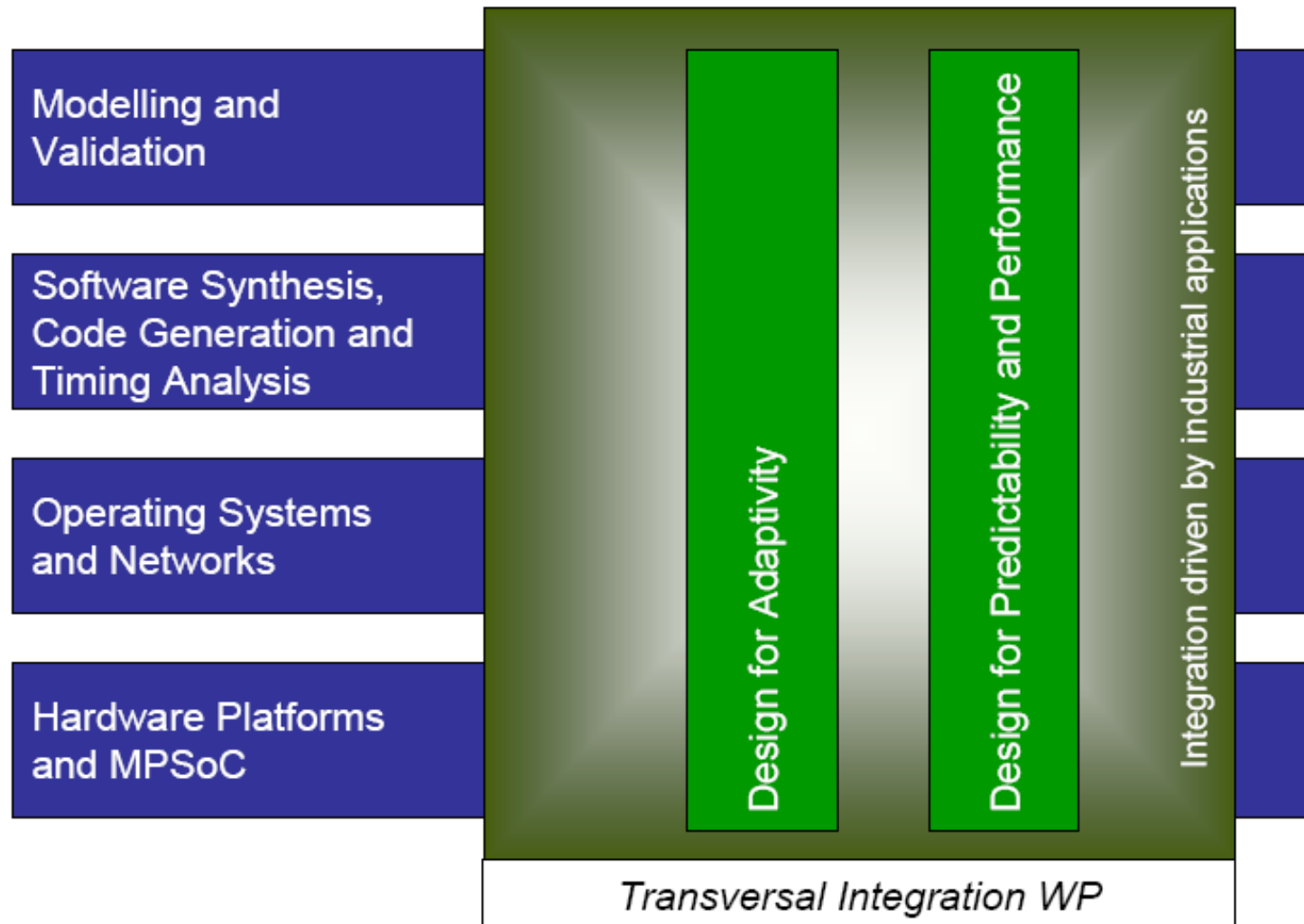*Transversal Activity*

Achievements and Perspectives :

Industrial Applications

leader: Alberto Sangiovanni Vincentelli

University of Trento

High Level Objectives: Structure of the WP

Building Excellence

Aims:

- Involve industry in Artist Design to foster research interactions and discussions on trends and challenges

- Keep Clusters informed about industrial trends and opportunities

- Integrate research teams working on different tools and design approaches so that the outcome is industrially relevant

Instruments:

- Meetings with interested partners and industry representatives at Conferences, Workshops and special Artist Design events

- Encourage start-up creation

Main Trends in the Area

- High-tech industry is transforming into an ecosystem of system integrators and (1,2,3,...-tier) component suppliers

- To maintain quality and productivity such ecosystems must be managed as virtual vertically integrated industries

- This goal requires an explicit understanding of the relevant design flow(s) in an ecosystem, and ways to integrate methods and tools into such flows

- Research on design methods and tools that disregards design flows runs the risk of being industrially irrelevant

Industrial Integration
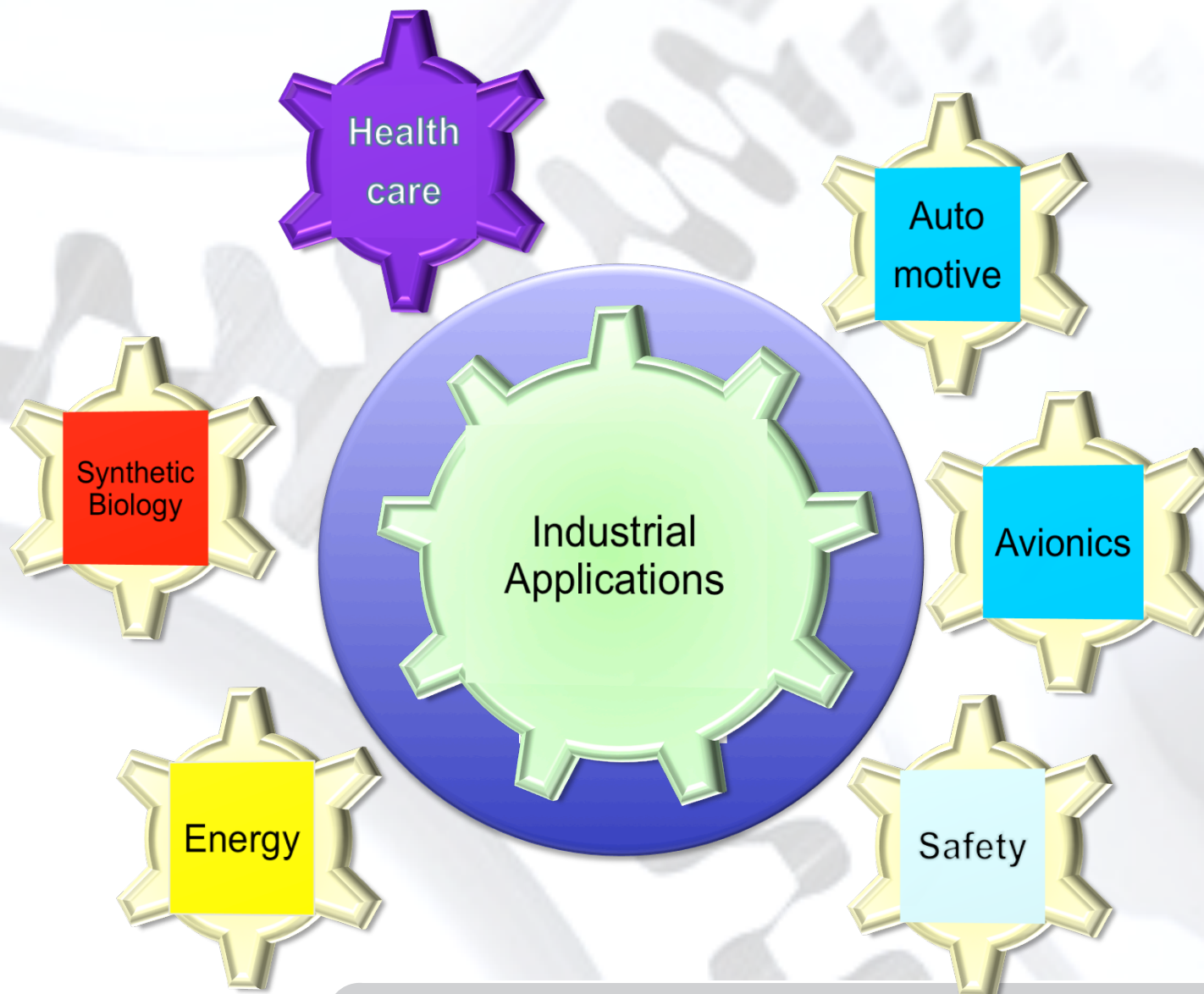
Overview of the Cluster's Activities

Design flows for automotive and aerospace

Leader: ASV (TRENTO)

- *interaction with COMBEST, ARTEMIS, US companies and research organizations…*

- *outcome: meetings and impact on new directions (see interviews New York Times, KTVU Channel 2 SFO, CESAR, MBAT, iFEST, Recomp, DANSE…., 2 invited papers in Proceedings of the IEEE on automotive and software design, META project, Musyc…)*

Design flows for health and nomadic

Leader ESI

- *interaction with GENESYS, ARTEMIS, …, NOKIA, Philips, NXP*

- *outcome: meetings and industrial contracts*

Investigate other important application domains

Leader: ASV (Trento)

- *Energy Efficient Buildings*

- *Synthetic biology*

Overall Assessment

Achievements

- Vision confirmed by industrial participants

- Successful Workshops on novel applications and flows (Greenembed at CPS week, International Workshop on Bio Design Automation)

  – More than 100 participants from Academia, large and small industry, VC, research organizations, government agencies

- Start-ups (at least 7, some are still under wraps) and direct contacts with industry (e.g., Luca Benini Chief Architect at STM Advanced System Technology Division)

LARGE European Projects

- CESAR

- MBAT

- RECOMP

- DANSE

- …….

CESAR – Cost-efficient methods and processes for safety relevant embedded systems

Objective
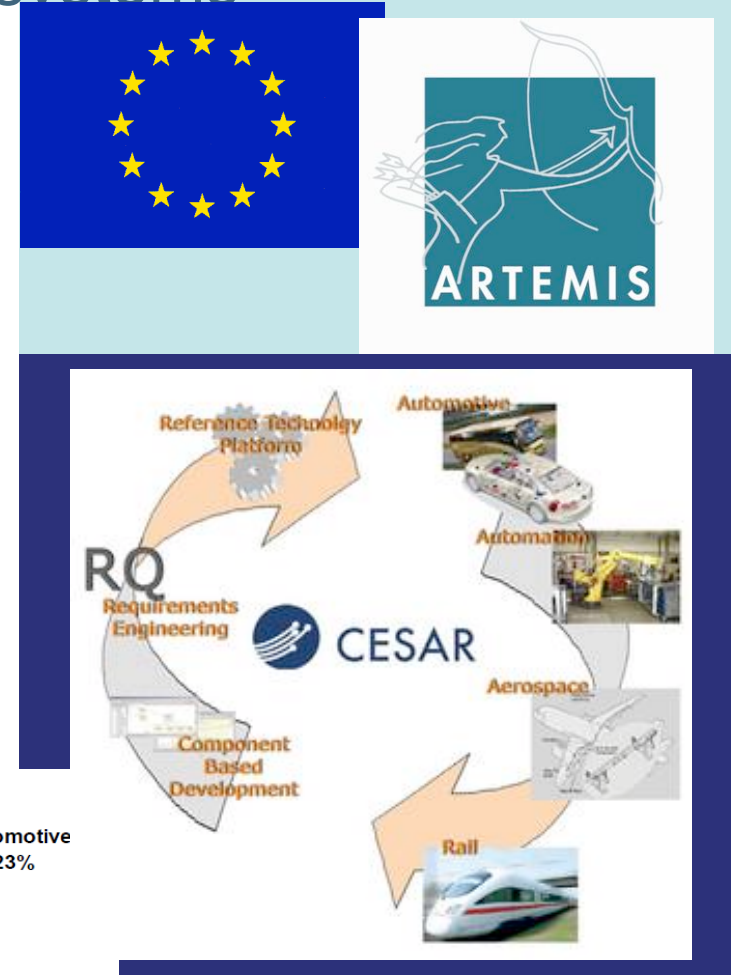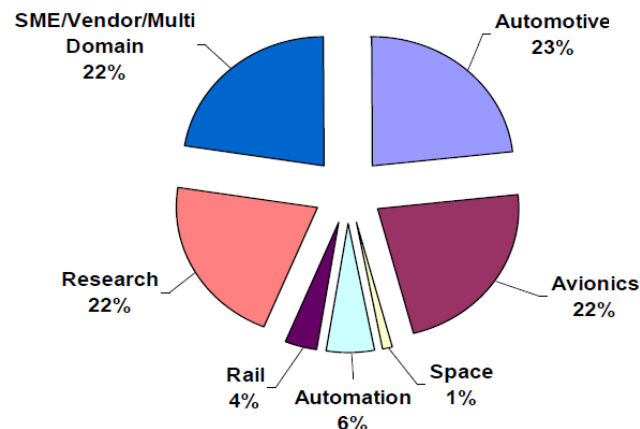
▶ **Interoperability Standard (IOS)** for the development of relevant embedded systems, which are compliant to domain-specific safety standards

Approach

▶ Common semantical basis(Meta Modeling)

▶ Focussing on

  ▶ Requirements Engineering

  ▶ Component-based design

  ▶ Development process

▶ Implemented as a Reference Technology Platform (RTP)

▶ Innovative analysis techniques based on the IOS

▶ Cross domains

  ▶ But with domain specific tailoring

Partners

▶ 55 partners

▶ Industry driven

  ▶ (78% Industry / 22% Academics)

▶

8.2.2011

Reference Technology Platform (RTP) for the Development of Safety Critical Embedded Systems

- Interoperability of tools

- High industrial need

- Work on this topic in several ARTEMIS projects (CESAR, MBAT, iFEST, …) as well as in national projects (in Germany)

- Coordination actions between projects

Graphic: SafeTRANS
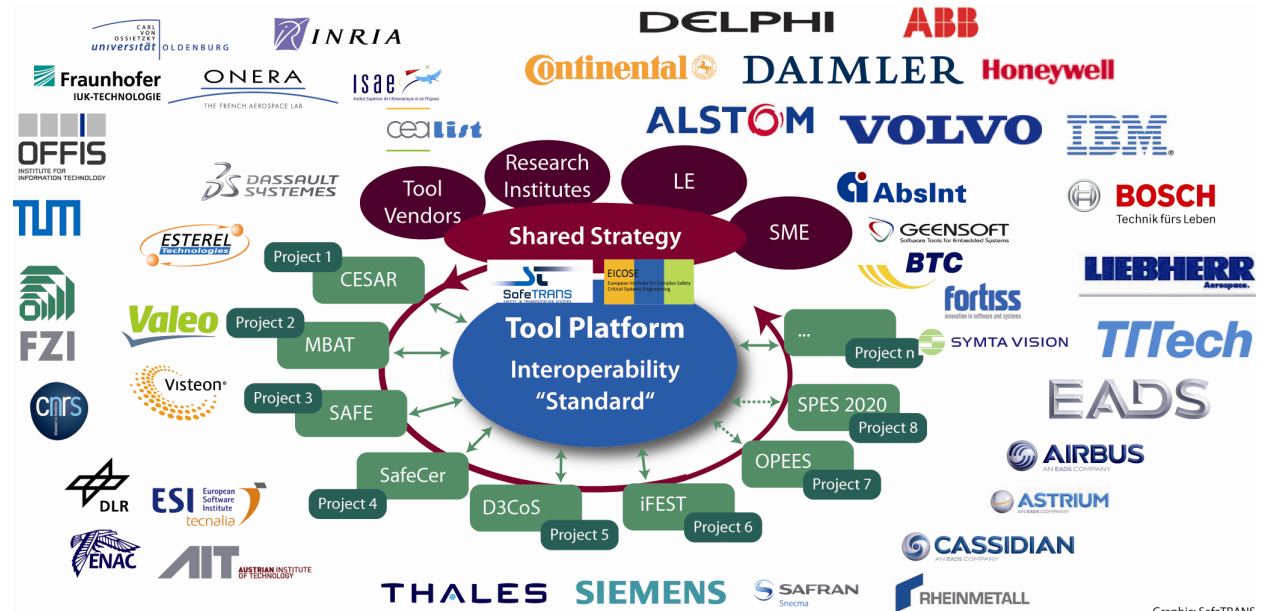
- Workshops

  – May 17, 2011 Berlin: SafeTRANS Industrial Day on "Reference Technology Platforms for the development of safety critical embedded system"

  – March 1, 2012 Nuremberg: ARTEMIS Technology Conference "Towards a Vision of Interoperability Standard for Critical Embedded Systems" (*Co-located with Embedded World 2012*)

CESAR Partners

Automotive Industry

- ACCIONA - ES
- AVL - AT
- Delphi - FR
- Fiat Research Center - IT
- Infineon Technologies – DE
- Infineon Technologies Austria - AT
- Volvo Technology Corporation – SE

Avionics + Space

- Airbus – DE
- Airbus – FR
- Airbus - UK
- AleniaSIA-IT
- Astrium Satellites - FR

Cassidian (EADS Defence Electronics) - DE
EADS Innovation Works - DE
Hellenic Aerospace Industries - GR
Messier-Bugatti - FR
SAGEM - FR
SNECMA - FR
Thales – FR
Thales Avionics – FR
Thales Communications - FR
TURBOMECA - FR

Automation

ABB – SE, NO
Danieli Automation – IT

Rail

ABB - NO
Ansaldo - IT
Siemens – DE

- **Vendors/High-tech Companies**

  - AbsINT- DE
  - Critical Software - PO
  - Dassault Systems- FR
  - Elsag Datamat Test Automation – IT
  - ESI - ES
  - Esterel Technologies – FR
  - Formal Software Construction Ltd* - UK
  - Geensoft- FR
  - BTC Embedded Systems AG- DE
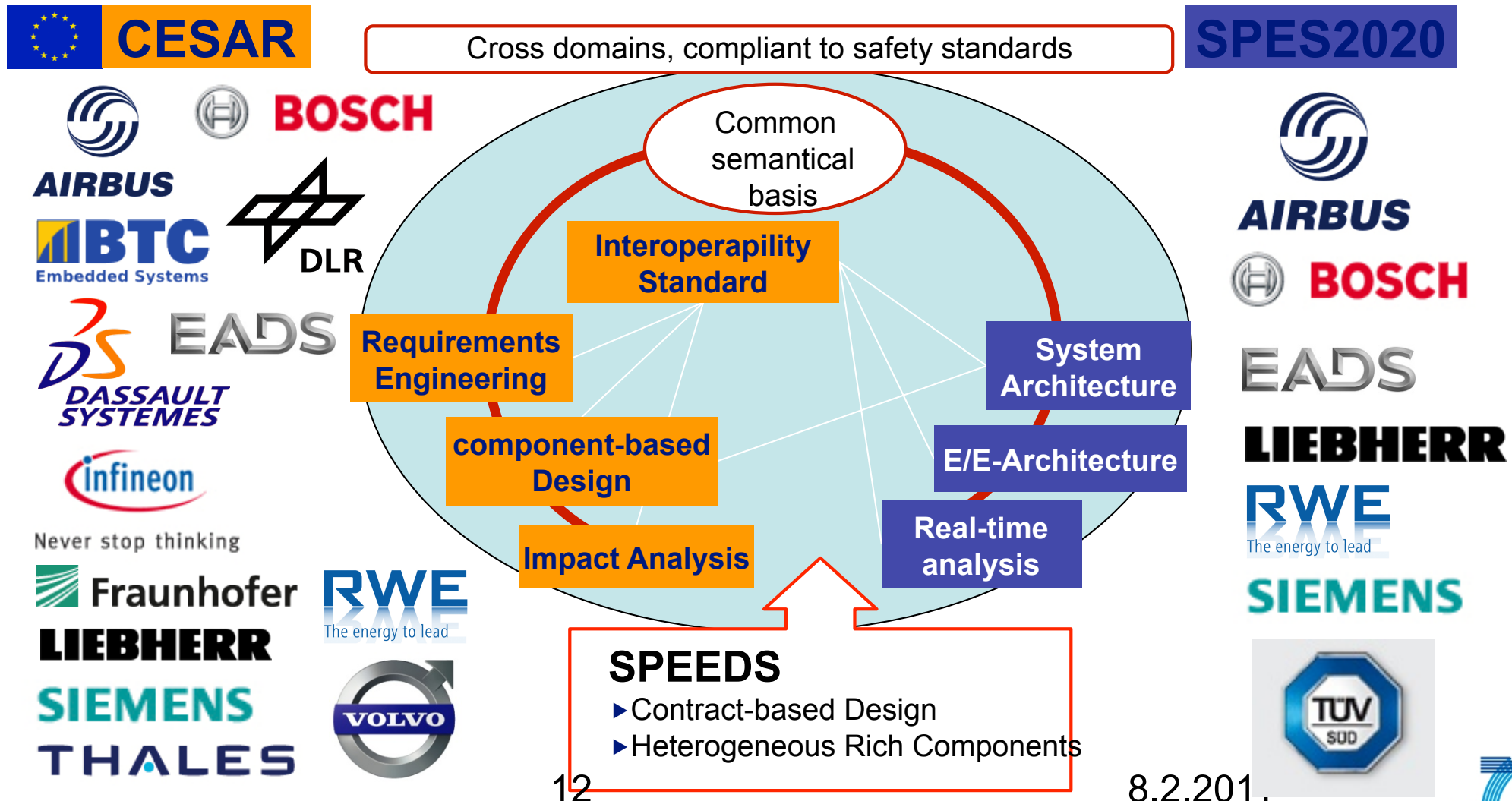 - Quintec – UK
  - ViF - AT

Research Institutes

Aristotle University of Thessaloniki- GR
CEA List -FR
CNRS Heudiasyc, IRIT, LAAS - FR
DLR Institute of Transportation Systems – DE
Fraunhofer Gesellschaft; Fokus & IESE - DE
INRIA - FR
Industrial Systems Institute - GR
Kungliga Tekniska Högskolan- SE
Norwegian University of Science and Technology
National Technical University of Athens - GR
OFFIS - DE
ONERA -FR
Oxford University - UK
SINTEF - NO
University Bologna - IT
University of Trieste- IT
University of Manchester - UK

Countries:

- Austria
- France
- Germany
- Greek
- Italy
- Norway
- Portugal
- Spain
- Sweden
- UK

National View (Germany) CESAR and SPES2020

CESAR

Cross domains, compliant to safety standards

SPES2020

Common semantical basis

Interoperapility Standard

Requirements Engineering

component-based Design

System Architecture

E/E-Architecture

Impact Analysis

Real-time analysis

SPEEDS
▶ Contract-based Design
▶ Heterogeneous Rich Components

12

8.2.201 .

Aramis

- Coordinator: Prof. Dr.-Ing. Jürgen Becker, Karlsruhe Institute of Technology
- Duration: 3 years
- Start: 12/2011, End: 11/2014
- Funded by: German BMBF (approx. 36 Mio Euros)

(Federal Ministry of Education and Research)

GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

OEM

AUDI · BMW · CASSIDIAN · EADS · DAIMLER · AIRBUS AN EADS COMPANY

Tier 1

BOSCH · Audi Electronics Venture GmbH · Continental · DIEHL · LIEBHERR Aerospace

Semiconductor

infineon · intel · freescale semiconductor

Research Institutions

TUM TECHNISCHE UNIVERSITÄT MÜNCHEN · TECHNISCHE UNIVERSITÄT CAROLO-WILHELMINA ZU BRAUNSCHWEIG · KIT Karlsruher Institut für Technologie · OFFIS · Fraunhofer IESE AiSEC · Universität Stuttgart · fortiss innovation in software and systems · UNIVERSITÄT PADERBORN Die Universität der Informationsgesellschaft · Technische Universität Kaiserslautern
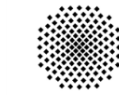
Tool/Software

SYSGO EMBEDDING INNOVATIONS · AbsInt Angewandte Informatik GmbH · WIND RIVER · vector · OPENSYNERGY · SYMTA VISION
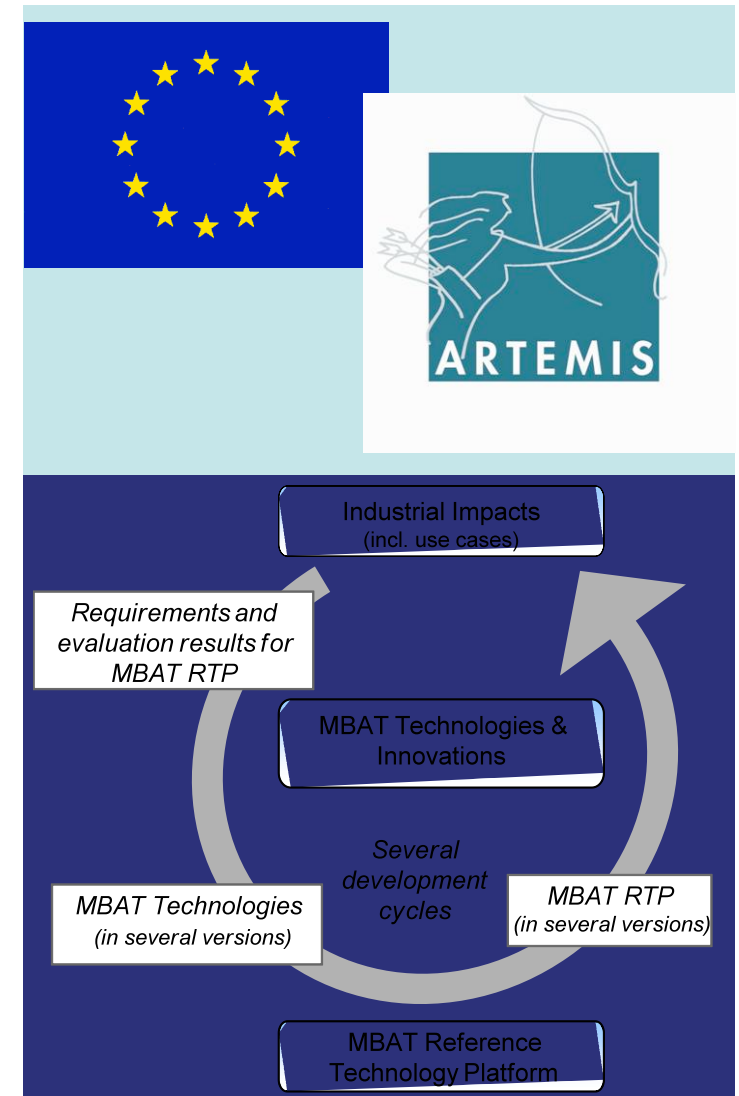
SEVENTH FRAMEWORK PROGRAMME

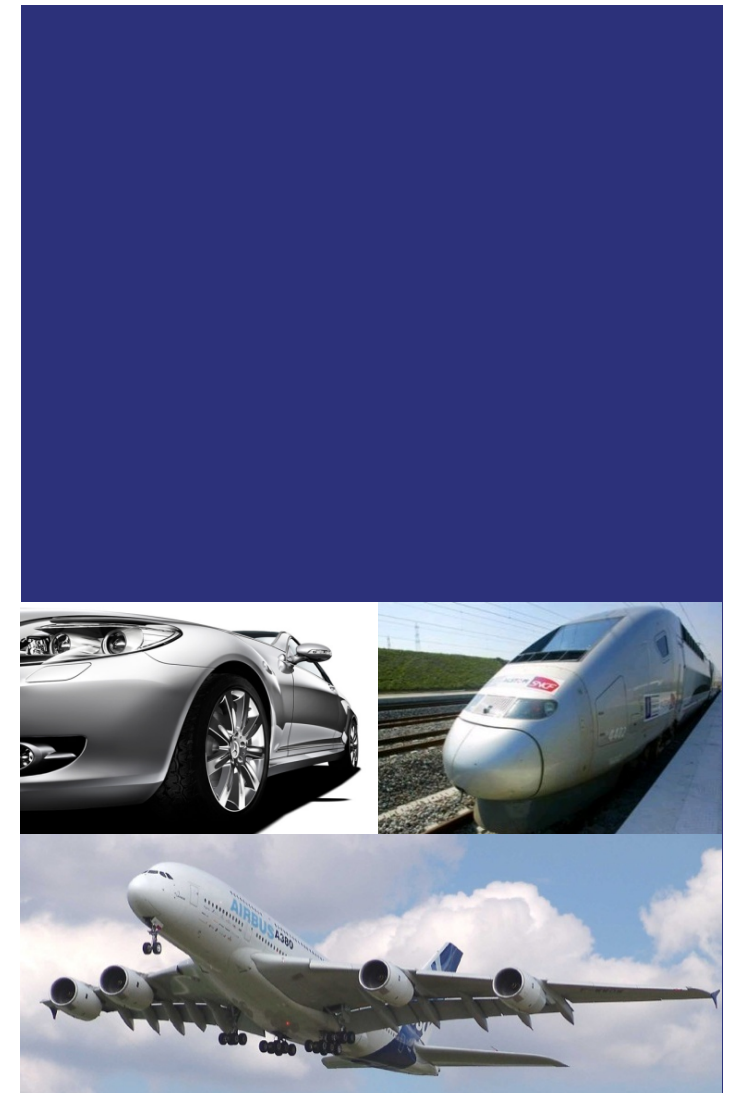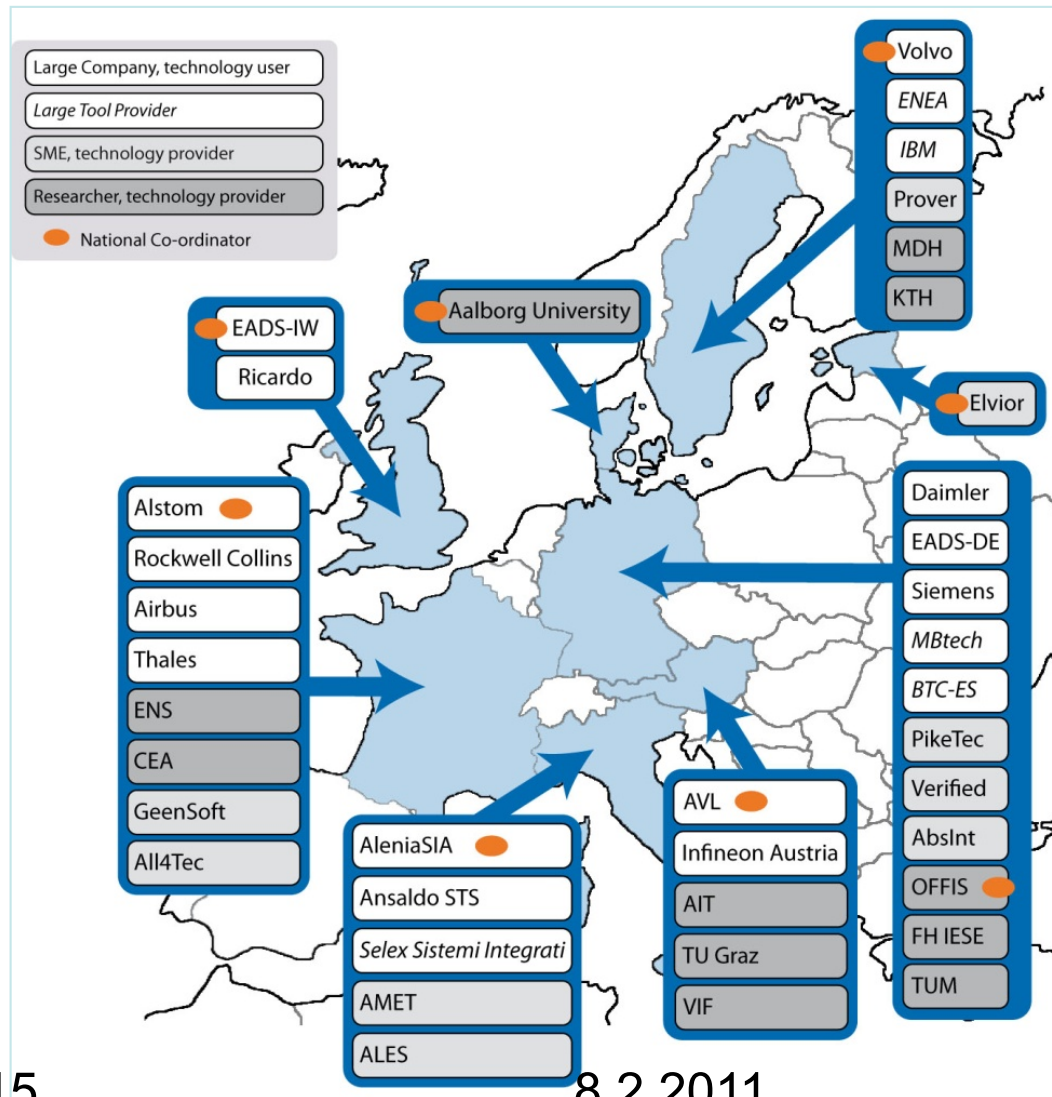# MBAT – Combined Model-based Analysis and Testing of Embedded Systems

Objectives

▶ Provide Europe with a new leading-edge Reference Technology Platform for effective and cost-reducing Validation and Verification of Embedded Systems

Approach

▶ Based on meta models and compatible components to enable construction of customized System Analysis & Test Environments

▶ Combined Model-based Analysis & Test Methodology including innovative analysis and test case generation techniques on different development levels

▶ Tool support based on an interoparability standard (RTP)

  ▶ Compliant to CESAR RTP

▶ Industry driven (cross domains)
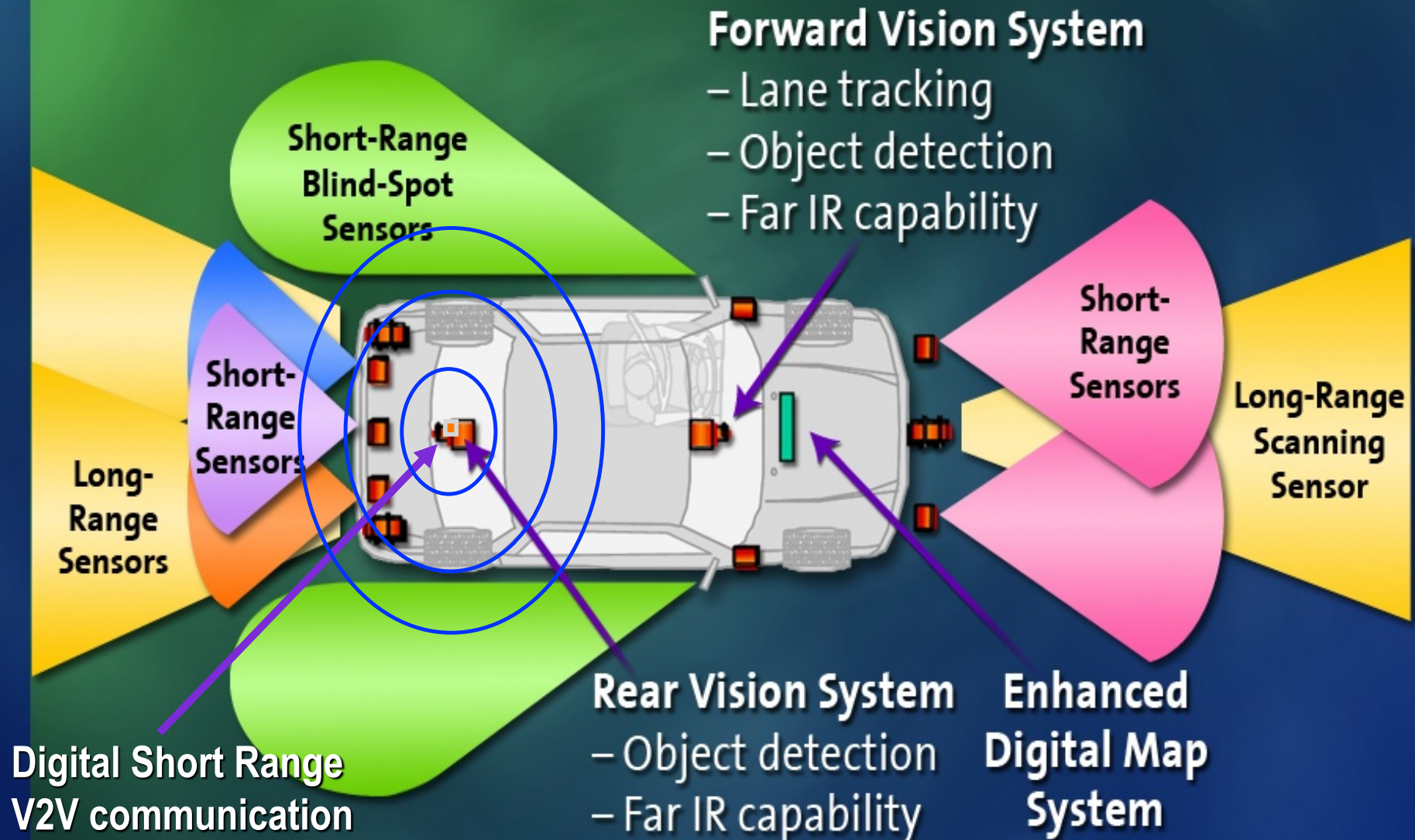
  ▶ Business needs

  ▶ Use case and derived requirements

14

MBAT Partners

The refuse-to-collide car!

360° Safety with Integrated Sensor Strategy

Forward Vision System
- Lane tracking
- Object detection
- Far IR capability

Short-Range Blind-Spot Sensors

Short-Range Sensors

Long-Range Sensors

Short-Range Sensors

Long-Range Scanning Sensor

Digital Short Range V2V communication

Rear Vision System
- Object detection
- Far IR capability

Enhanced Digital Map System

The Promise: The Tire of the Future

New materials: enhanced performances, reduced rolling resistance, lower noise, reduced puncture risk, nanotechnologies, new compounds, new tread design, "self sealing" technologies.

New design technologies: virtual engineering for reducing time to market & engineering costs.

New electronics technologies inside the tire: pressure monitoring, friction, slip, tire consumption, contact force, "health" check-up information extraction & transmission....
The Tire as an Intelligent Sensor!

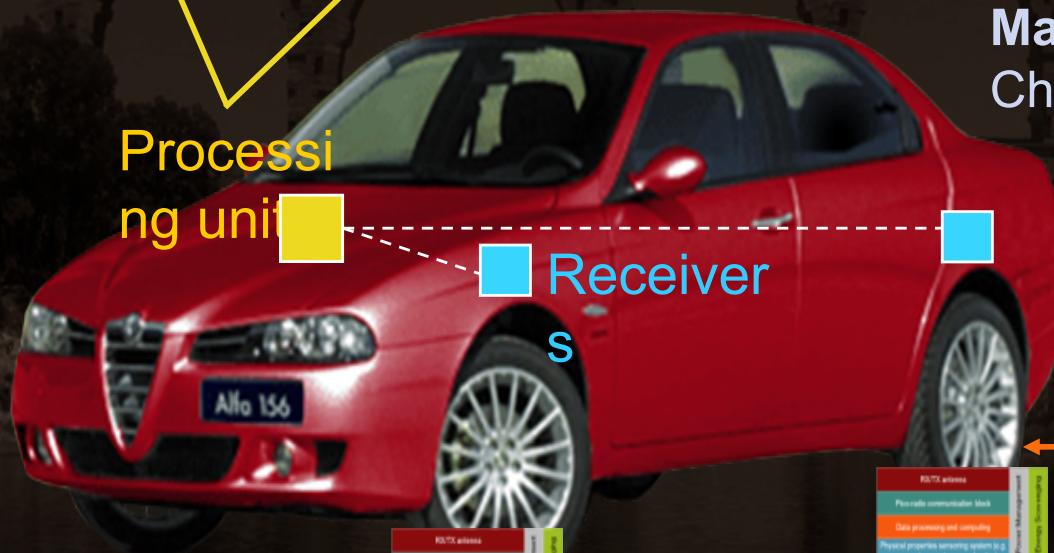# The Promise: Cyber™ Tire System

Major broadcast channel in Italy

Vehicle dynamics control system

User Applications

Processing unit

Receivers

Marco Tronchetti Provera
Chairman of Pirelli

Cyber™Tire
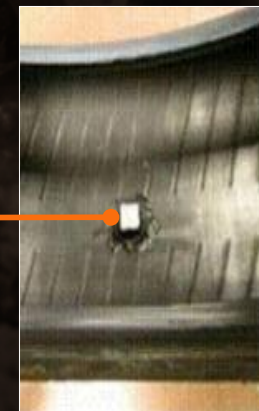
Cyber™Tire

Cyber™Tire Pirelli Development Partners

Politecnico di Milano
Feature Extraction, Kinematics pre-conditioner

Politecnico di Torino
Prototype Vehicle Integration, Engineering Support

UMC
IP and chip manufacturing

Valtronic Technologies SA
assembly and packaging technologies

University of California, Berkeley
Ultra low power Radio
⋯⋯⋯⋯
Control and Modeling

Advanced new communication protocols

Encrea S.r.L.
Breakthrough energy supply and power management technologies

Accent S.p.A.
acquisition, processing and advanced architectural technologies

RX/TX antenna

Pico-radio communication block

Data processing and computing

Physical properties sensing system (pressure, temperature, acceleration)

Power Management

Energy Scavenging

Energy Efficiency

Based on Trento SEEC 2009 - Network

Government Institution
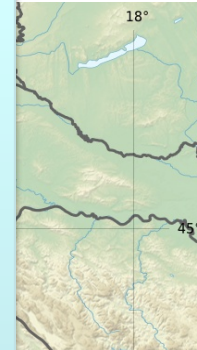
ArtistDesign Partners

Small and Medium Enterprises

Large Companies

Venture Capitalist

artist

Workshop on Green and Smart Embedded System Technology: Infrastructures, Methods and Tools

GREEMBED 2010

April, 12th Stockholm

In conjunction with CPSWEEK

Organizers:

Alberto Sangiovanni Vincentelli, U. Berkeley & U. Trento, USA
Huascar Espinoza, ESI-Tecnalia, Spain
Roberto Passerone, University of Trento, Italy
Marco Di Natale, University of St. Anna, Italy
José Javier De Las Heras, ACCIONA, Spain
Daniela Cancila, CEA LIST, France

Organized & Funded by:

Network of Excellence on Embedded Systems

ARTEMIS eDIANA Project

FP7 COMBEST Project

SEVENTH FRAMEWORK PROGRAMME

Intelligent systems that gather, synthesize and apply information will change the way entire industries operate.
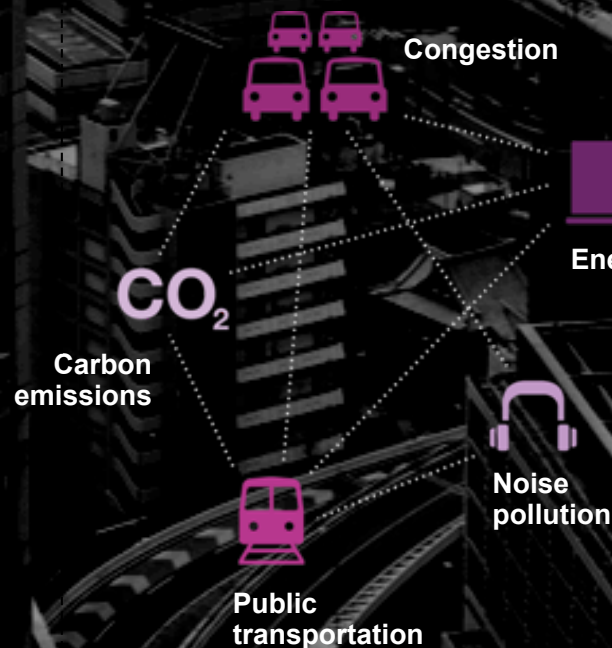
Smart water

Apply monitoring and management technologies to help optimize the availability, delivery, use, and quality of water as well as related systems including energy and chemical treatment.
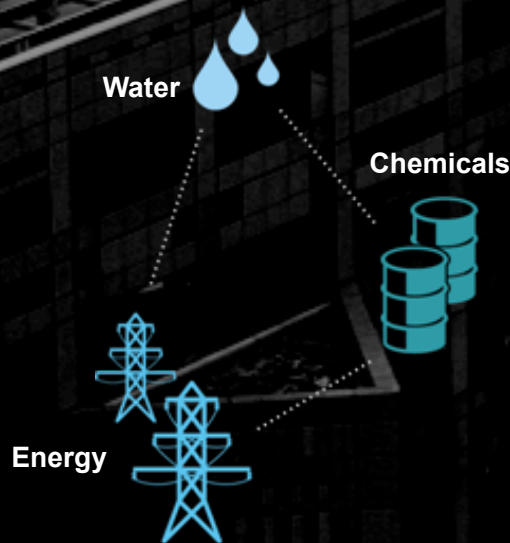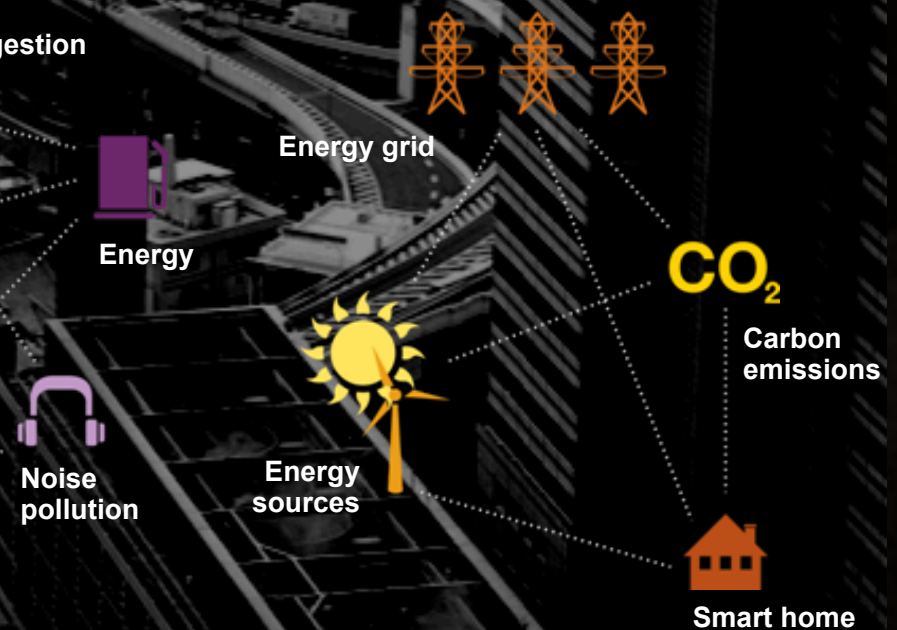
Smart traffic

Use real-time traffic prediction and dynamic tolling to reduce congestion and its byproducts while positively influencing related systems.
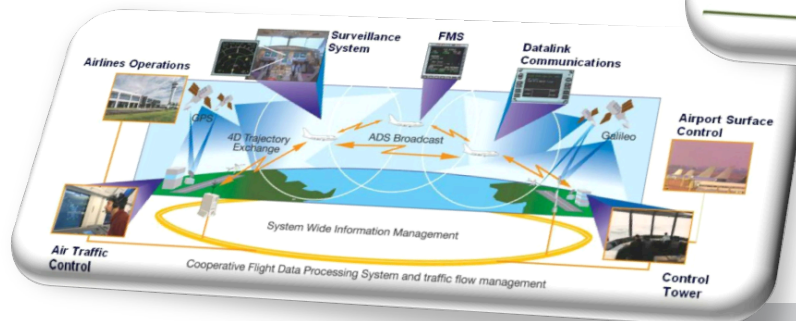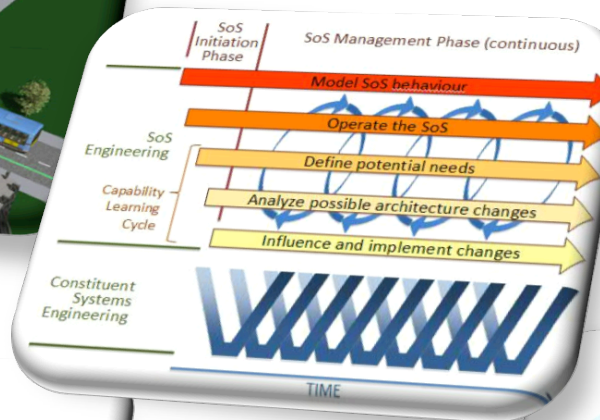
Smart energy

Analyze customer usage and provide customized products and services that help to boost efficiency from the source through the grid to the end user.

Water

Chemicals

Energy

Congestion

CO_2

Carbon emissions

Public transportation

Noise pollution

Energy

Energy sources

Energy grid

CO_2

Carbon emissions

Smart home

Designing for Adaptability and evolutioN in System of systems Engineering (DANSE)

Synthetic Biology

Engineering Tomorrow's Designs
Synthetic Biology

The creation of novel biological functions and tools by modifying or integrating well-characterized biological components into higher-order systems using mathematical modeling to direct the construction towards the desired end product.
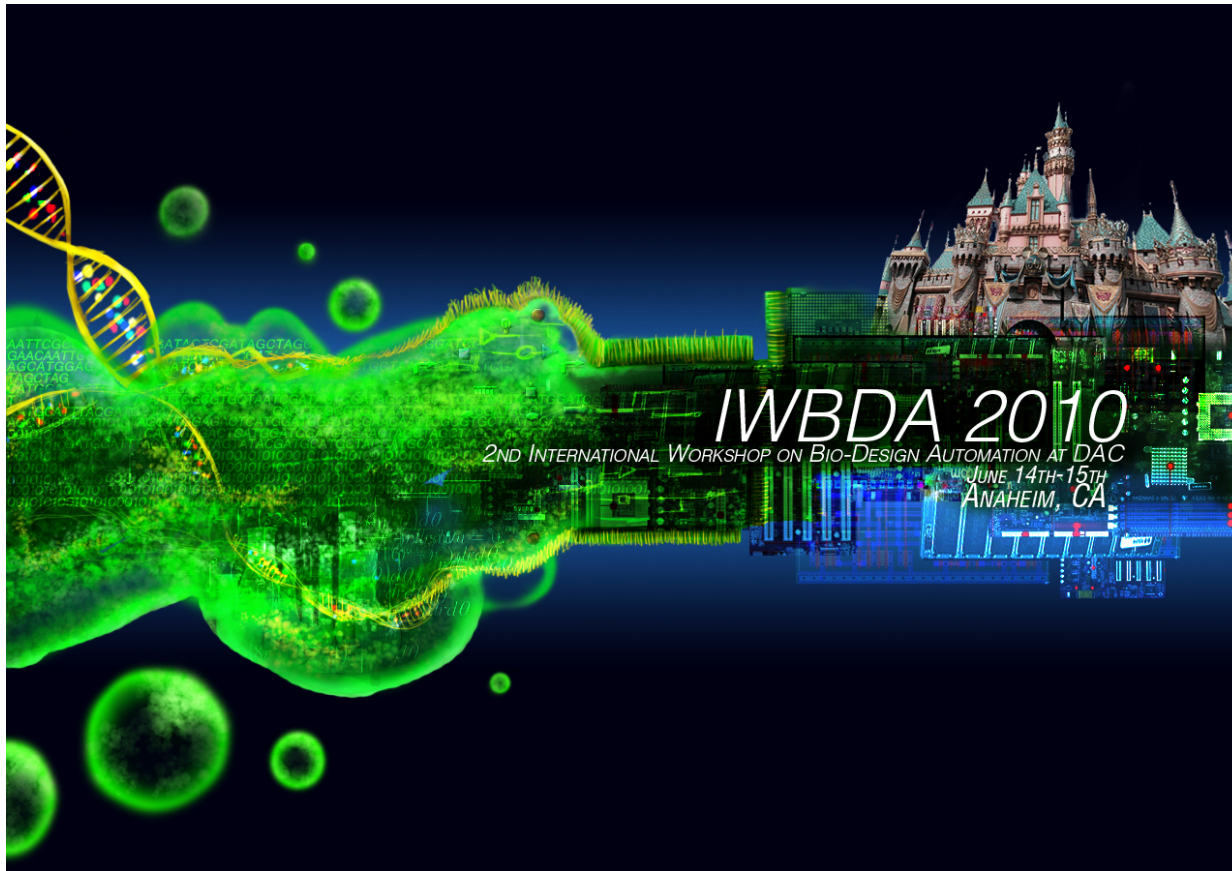
Building life from the ground up (Jay Keasling, UCB)
Keynote presentation, World Congress on
Industrial Biotechnology and Bioprocessing,
March 2007.

Development of foundational technologies:

Tools for hiding information and managing complexity

Core components that can be used in combination reliably

Synthetic Biology

International Workshop on Bio-EDA
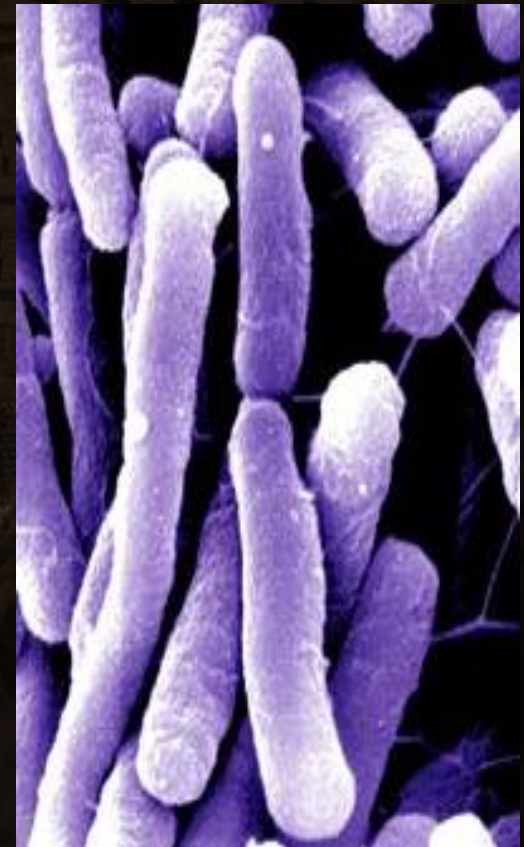June 14-15th, Anaheim CA, at the Design Automation Conference (DAC)

www.biodesignautomation.org

Synthetic Biology

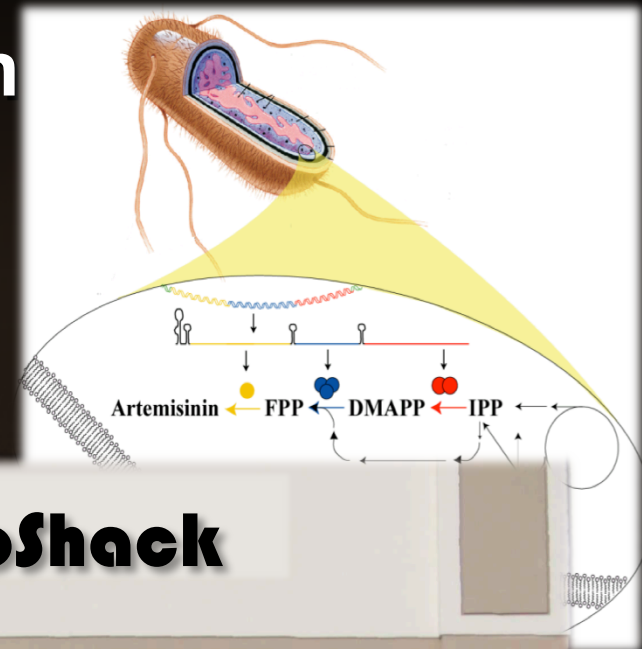συν●θη●σισ *n.* 1.a. the combination of separate elements to form a coherent whole.

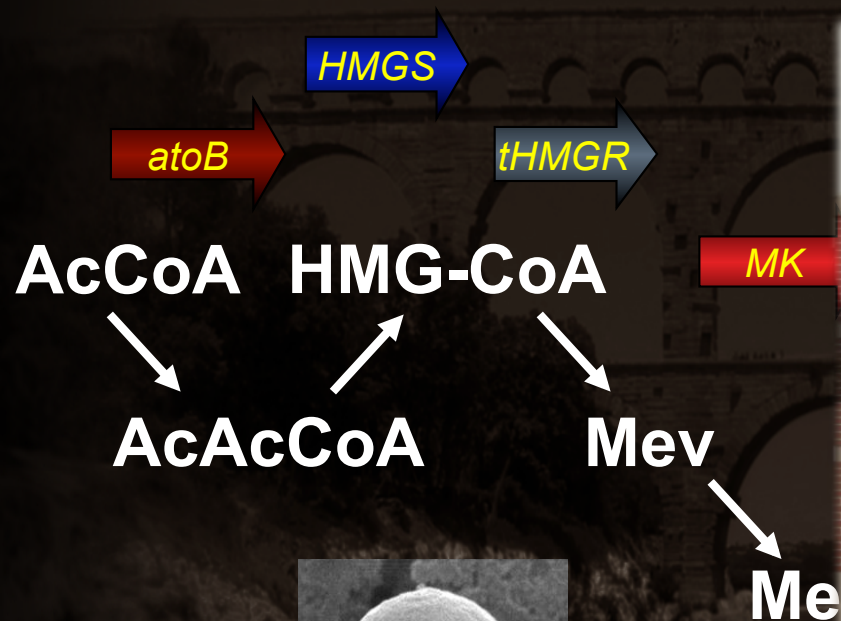- **Synthetic biology seeks, through understanding, to design biological systems and their components to address a host of problems that cannot be solved using naturally-occurring entities**

- **Enormous potential benefits to medicine, environmental remediation and renewable energy**

Microbial Synthesis of Artemisinin

Off-the-shelf parts?

HMGS

atoB

tHMGR

AcCoA   HMG-CoA

MK

AcAcCoA   Mev

Me

BioShack

CPR

Artemisinin

Artemisinin ← FPP ← DMAPP ← IPP

Courtesy: Jay Keasling

Applications of Synthetic Biology

Energy Crop
- **Water saving**
- **No fertilizer**
- **Doubled photosynthetic efficiency**

Biodiesel and bio-jet fuel
- No compromise
- Fully compatible with existing infrastructure

Natural product drugs
- Capture all of the chemistry in nature
- Construct a microbe that can produce any natural product

Courtesy: Jay Keasling

Amyris

- Amyris had its technological foundation in 2001 in the Keasling lab at Berkeley.

- "Keasling's magic bug, genetically enhanced from a soup of DNA obtained from bacteria and the plant world, is a five-carbon base chemical and a high-value target in the world of what is now known as the field of renewable chemicals — its a path to isoprenoids, which are themselves a family of some 50,000 molecules that have applications or pathways for pharmaceuticals, fragrances, cosmetics and fuels."

- Keasling filed the patent in 2001, and Amyris itself was eventually formed and funded by 2006 with $14.1 million in Series A investments from Kleiner Perkins and Khosla Ventures among other early backers.

IPO in 4° Quarter 2010
From 680Mil cap to 1.365Bil at the top
To 464Mil today
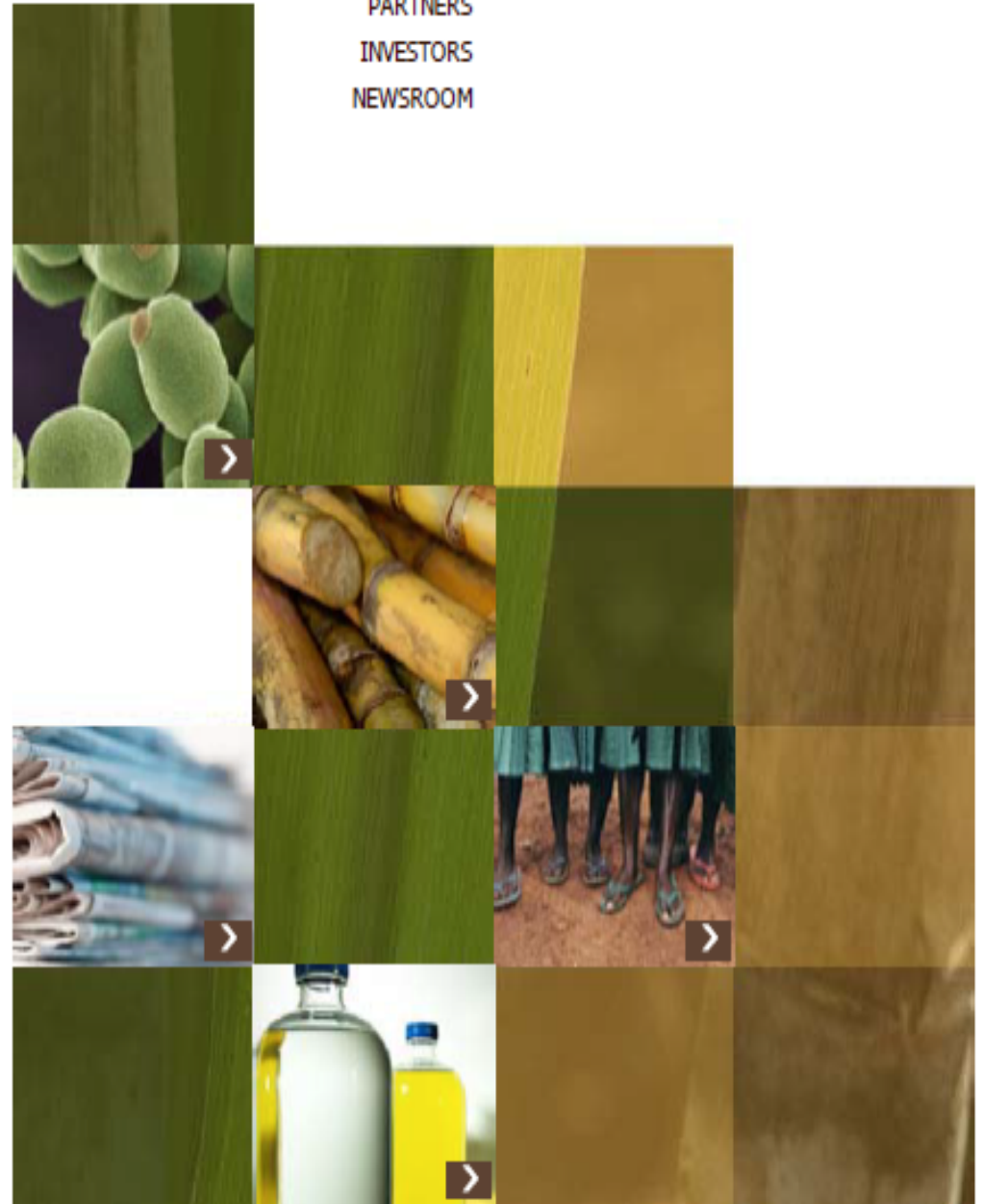
Total and Amyris Partner to Produce Renewable Fuels

Total and Amyris strategic partnership expanded to accelerate development and marketing of renewable fuels

PARIS, France and EMERYVILLE, Calif.-- November 30, 2011 - Total (CAC: TOTF.PA) and Amyris, Inc. (NASDAQ: AMRS) signed agreements to expand their current R&D partnership and form a joint venture to develop, produce and commercialize a range of renewable fuels and products.

Total and Amyris have agreed to expand their ongoing research and development collaboration to accelerate the deployment of Biofene® and develop renewable diesel based on this molecule produced from plant sugars. The ambitious R&D program, launched in 2010 and managed jointly by researchers from both companies, aims to develop the necessary stages to bring the next generation renewable fuels to market at commercial scale. Total has committed to contribute $105 million in funding for an existing $180 million program.

In addition, Total and Amyris have agreed to form a 50-50 joint venture company that will have exclusive rights to produce and market renewable diesel and jet fuel worldwide, as well as non-exclusive rights to other renewable products such as drilling fluids, solvents, polymers and specific biolubricants. The venture aims to begin operations in the first quarter of 2012.
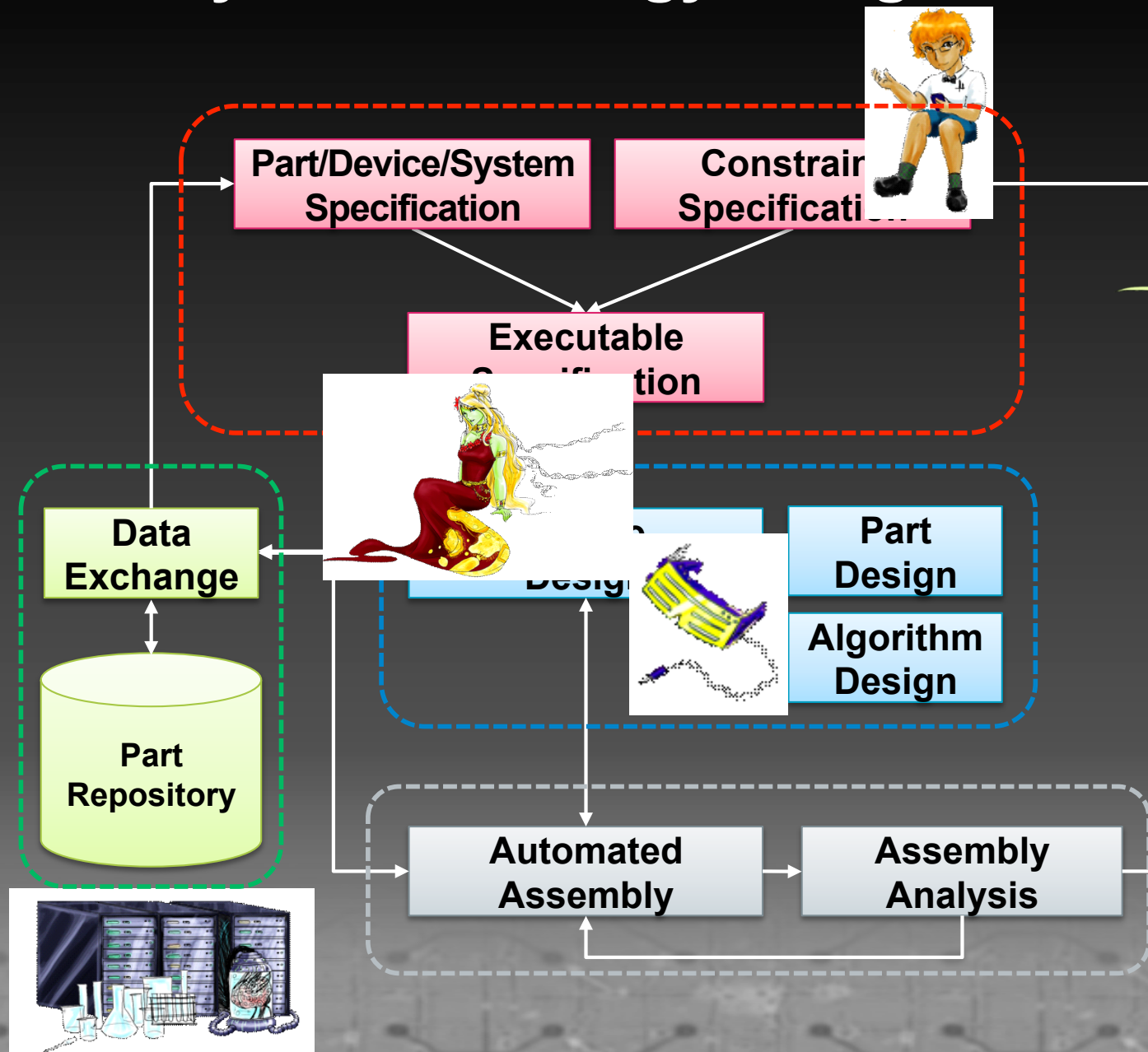
Engineered Superbugs Boost Hopes Of Turning Seaweed Into Fuel

PBD Synthetic Biology Design Flow

Part/Device/System Specification

Constraint Specification

Executable Specification

Data Exchange

Part Repository

Part Design

Algorithm Design

Automated Assembly

Assembly Analysis
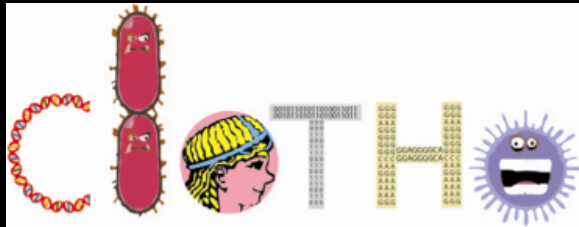
1. **Specification** - Eugene

2. **Design** – Clotho and Spectacles

3. **Assembly** – Kepler
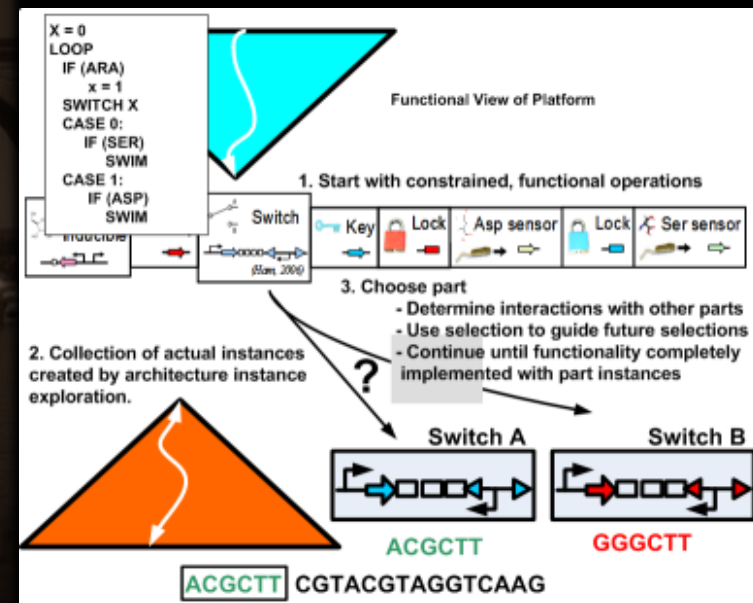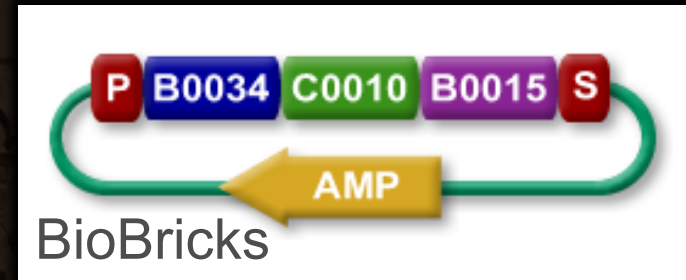
   Future Work:

4. Standards – SBOL

Platform-based Design Environment for Synthetic Biological Systems

Douglas Densmore (Dept. of ECE, Boston University, formerly UCB),
J.Christopher Anderson (Bioengineering, UCB),
Alberto Sangiovanni-Vincentelli (EECS, UCB)

Clotho (Greek: Κλωθώ) — the "spinner" — spun the threads of life with her distaff to bring a being into existence.

BioBricks

- **Clotho is a design environment for the creation of biological systems from standardized biological parts.**
- **Composed of "views", "connectors", "interfaces" and "tools"**
- **iGEM 2008 and 2009 Winner "Best Software Tool" and Gold Medal.**
- **Alpha version available at *biocad-server.eecs.berkeley.edu/wiki.***

GSRC Annual Symposium

The Novo Nordisk Foundation
Center for Biosustainability

Research | **Innovation** | **Organization** | **About**

The Novo Nordisk Foundation Center for Biosustainability is an international research center at the Technical University of Denmark. The Center aims at transforming current chemical production to a more sustainable, biobased industry and is funded by a grant from Novo Nordisk Foundation.

The Center conducts research in metabolic engineering and synthetic biology to facilitate the emergence of the next generation of microbial production strains through development and application of new cutting edge technologies.

Two key objectives are

- identifying the spectrum of chemistry that can be produced biologically
- shortening the time of production strain development through intelligent design of cell factories.

Impact on society by innovation has a high priority and the Center collaborates worldwide with biotech companies and chemical industry to facilitate the dissemination and exploitation of its results.

Contact:
Novo Nordisk Foundation Center for Biosustainability,
Technical University of Denmark
Fremtidsvej 3
DK-2970 Hørsholm
Reception: +45 4525 8000
biosustain@biosustain.dtu.dk
Google maps
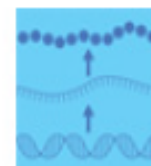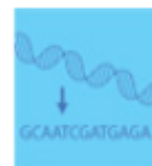
Start-ups founded by Artist Design Partners

- AbsInt (http://www.absint.com/), R. Wilhelm, USAAR, area: performance analysis

- SymtaVision, (www.symtavision.com), R. Ernst TUB spin-off, area: real-time system analysis and optimization for automotive and aerospace applications

- UP4ALL (www.uppaal.com) P. Pettersson, W. Yi, K. Larsen, A. David, U. Aalborg, area: formal methods

- Informatik Centrum Dortmund (ICD) (http://www.icd.de/index_eng.html), P. Marwedel, CEO, area: software for IT systems

- HiQE and Reniance (http://www.hiqe-capital.com/) (Italy) and GreenBox (US), ASV, area: energy efficiency HealthMicro (http://sutisoft.com/hm1_3f/team.html)(US), ASV, area: health devices

- Eminence, G. Buttazzo, RTOS for multiprocessor Systems

- iNoCs, (http://www.inocs.com/), L. Benini, Uni. Bologna, area: Networks on chip.

- Rapita, (http://www.rapitasystems.com/) A. Burns, York, Chair of Board area: tools and services for worst-case execution time analysis (and associated forms of analysis)

New Masters program at KTH in Embedded systems

- Starts autumn 2011

- Initiated and supported by ICES

  - A collaboration between the four KTH schools (ICT, CSC, EES and ITM)

  - Active involvement of industry

- Three specializations:

  - *Embedded platforms*

  - *Embedded software*

  - *Embedded control*

- CDIO education approach and innovation/ entrepreneurship (EIT ICTLabs)