Tool Repositories, ESCHER and continuing the legacy of the CHESS ITR

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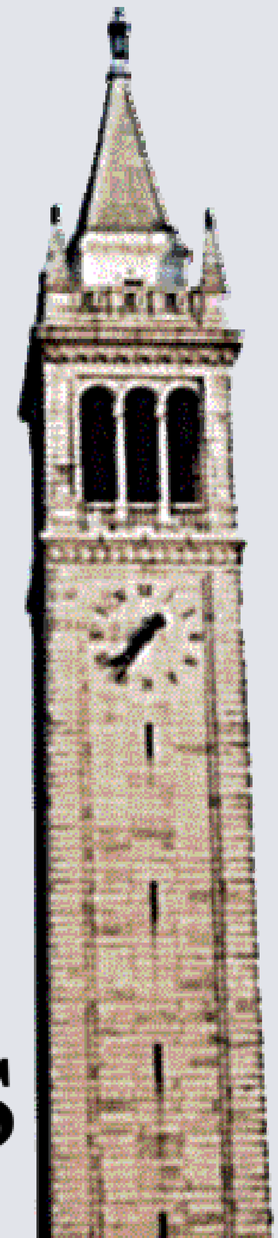


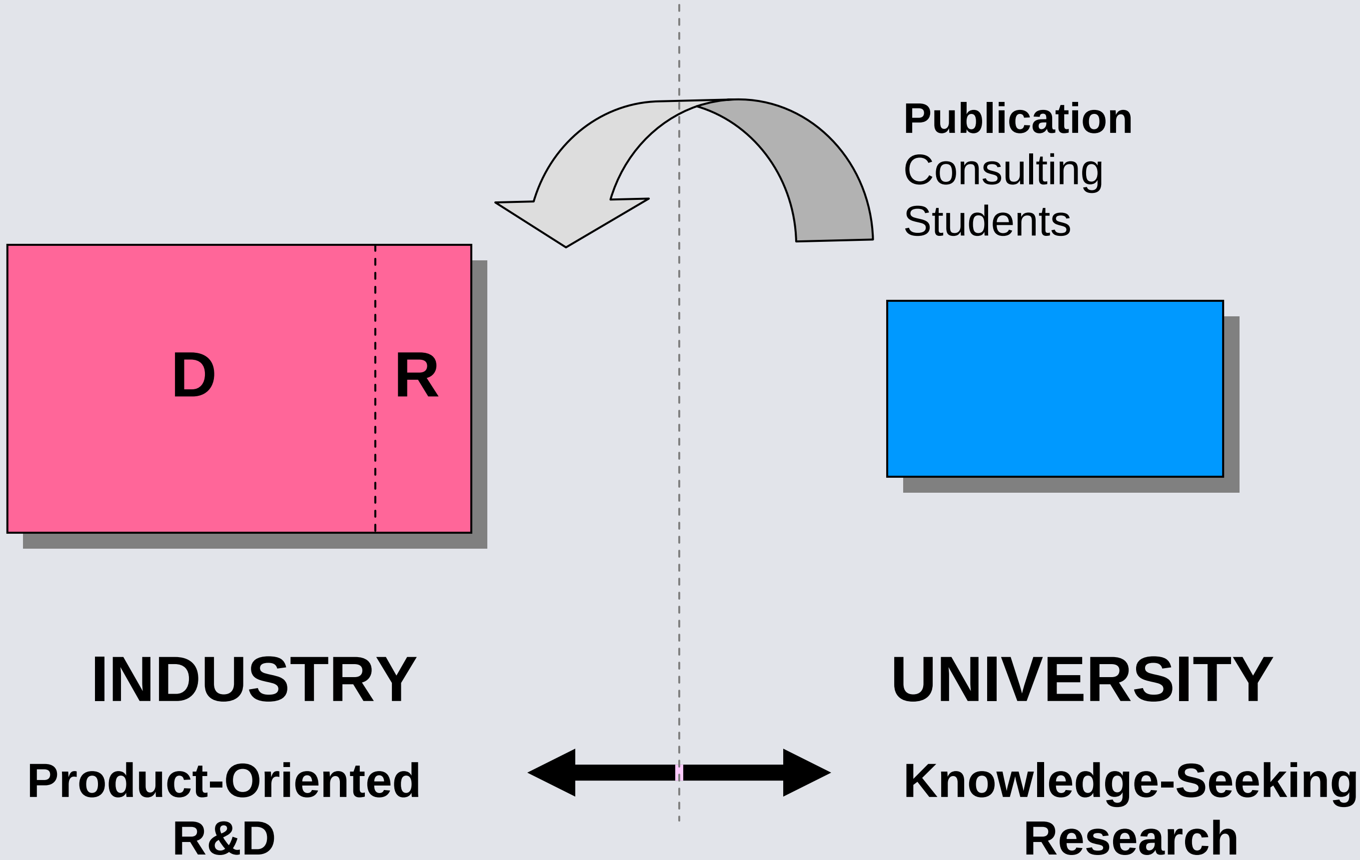
Chess Review
October 4, 2006
Alexandria, VA

ESCHER Research Institute

- Established in 2003 as a new model for transitioning government funded research to industry.
- Vanderbilt spinout: January 04
- Activities:
  - Repository setup and operation
  - Roadmapping
  - Contract management
  - Outreach

R&D Model - 1

1980's



Why Do We Need Escher ?

Driving Forces

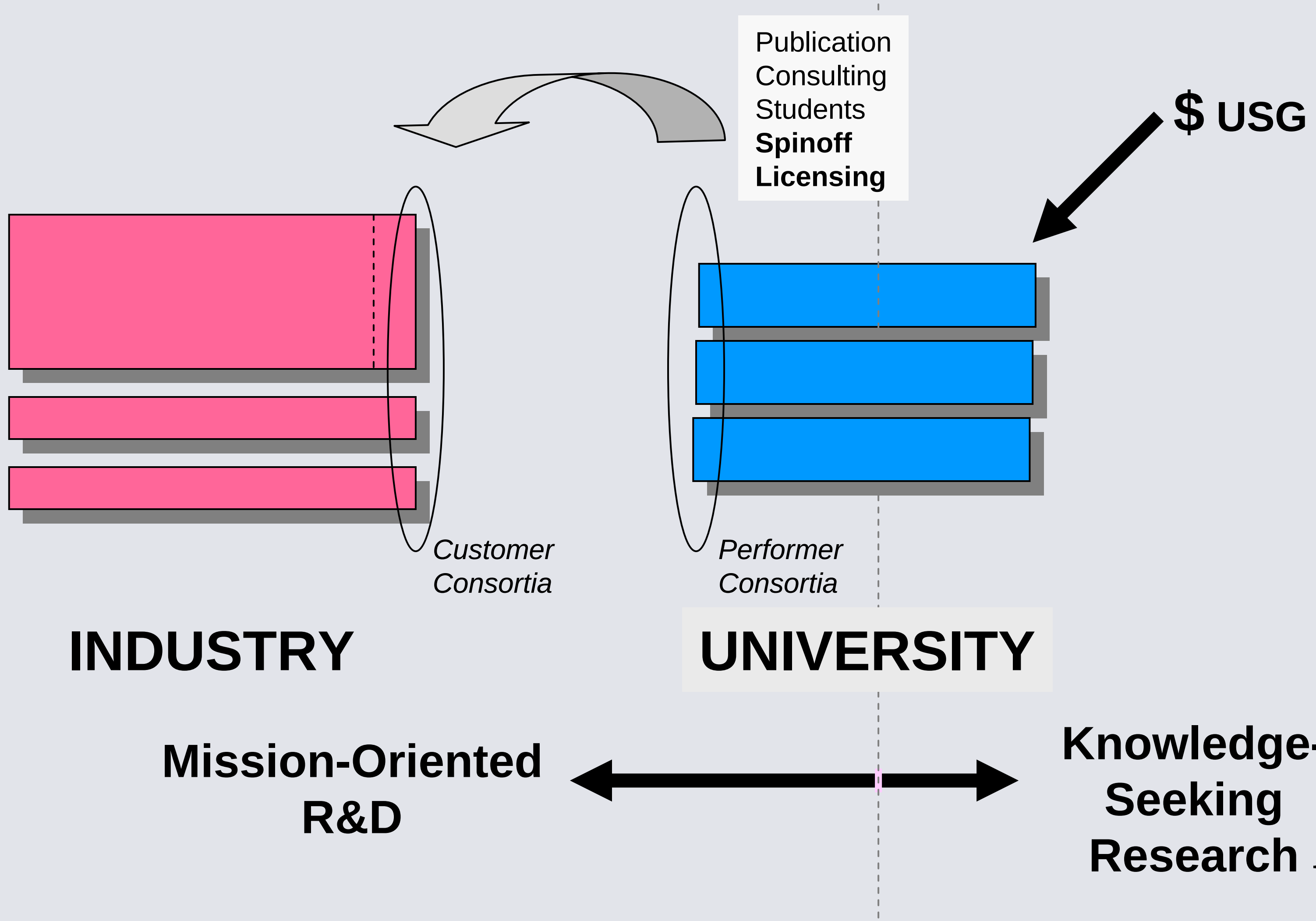
- Accelerating product development cycles
- Global competition – global marketplace
- Easy access to venture capital
- Heightened government responsiveness
- R&D friendly legislation
- More system innovations – fewer “gadgets”

Result:

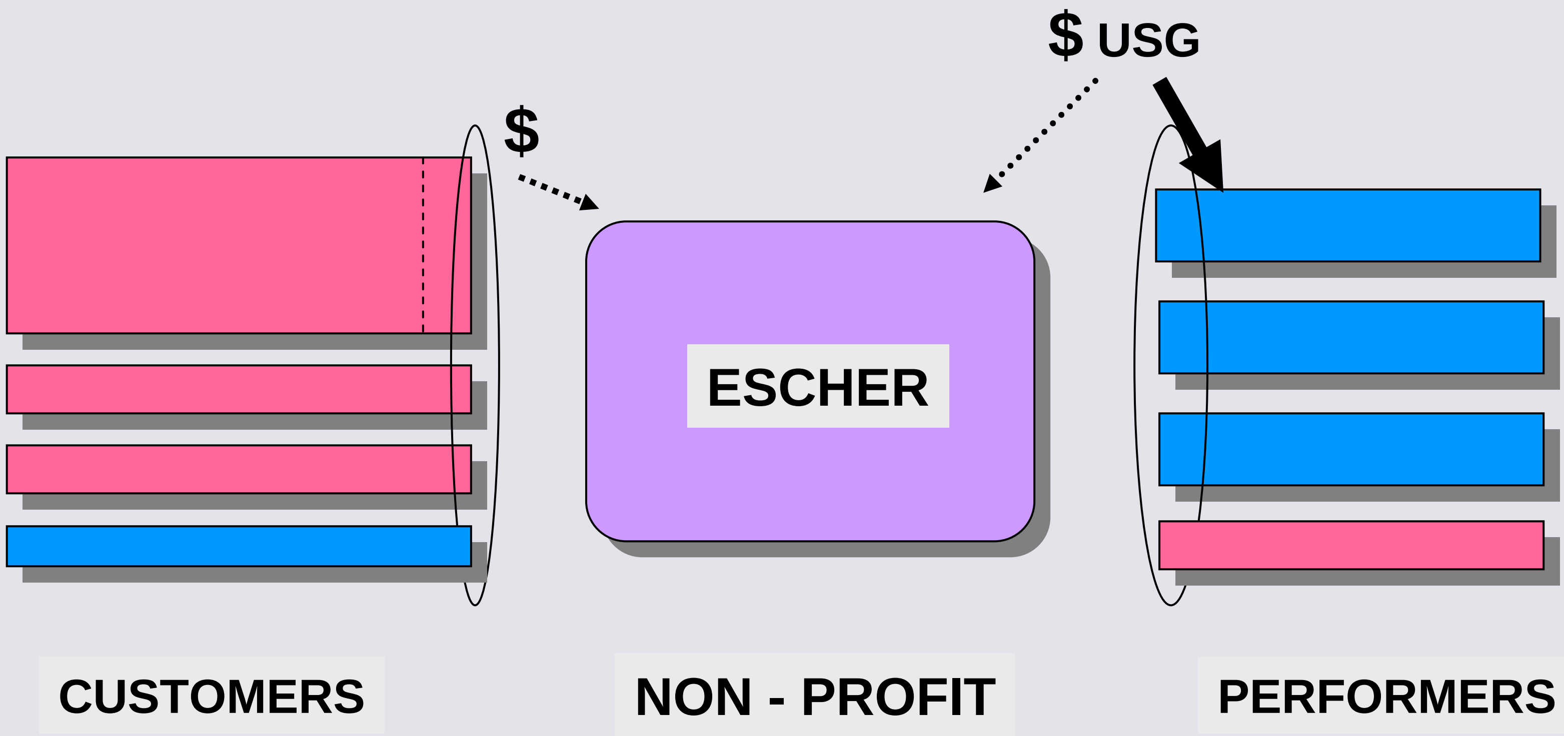
- Demise of large industrial research labs
- Weakened ability to <u>create and hold</u> a technology advantage
- Increased emphasis on consortia, partnering, and cost – sharing
- Increased importance of “community development”

R&D Model - 2

2000's



The ESCHER Model



Escher is a New Approach to Transition

Unknowns

- **Scope:** Specific programs / Embedded Systems/Specific Industry / Software Program / any IT results
  What scope can be managed?
- **Structure:** Research Institute vs. Industry Association, Membership vs. No Members, Governance that involves companies but protects long-term vision
- **Funding:** Government/ Industry Mix, Need for long-term commitment, Program vs. Office, Deliverables vs. Overhead (Repository)
- **Value Proposition:** Business case that justifies long term participation,
  Who in the government is feeling the "pain" of the inefficient transition process?

Mission

The **Escher Research Institute** is:

A **non – profit corporation** that provides **services** to enable the **transition** of **government - funded information technology research** results to **customers**.

Services

- Consortium Management
  - Pooled funding sources for a single project
  - Coordination of multiple performers
  - “Neutral party” non-competitive status – smoothing IP and other issues
  - Mechanism for maturing / customizing results for customers
  - Unified customer voice provides guidance to perfomers
- Software Repository
  - Virtual “transition partner” with quality requirements
  - Bridging timing mismatch
    - Keeping teams together during the interim
    - Keeping results “fresh” until markets mature
  - Researchers can build on prior results – programs build on one another
- Roadmapping

Value Proposition

To government :

- Better / Easier Program Management
  - “Honest broker” consortium management
  - End game for early stage technology program
  - Collaborative development – build on previous results

To industry :

- Pooled funding saves money – management hassle
- Avoids anti-trust problems
- Coordinated voice in influencing government funding direction

To university performers :

- Access to industrial funding
- Transition path multiplies value of university research
- Avoids peer-managed consortium problems
- More value means it is easier to attract government funding

ESCHER Structure

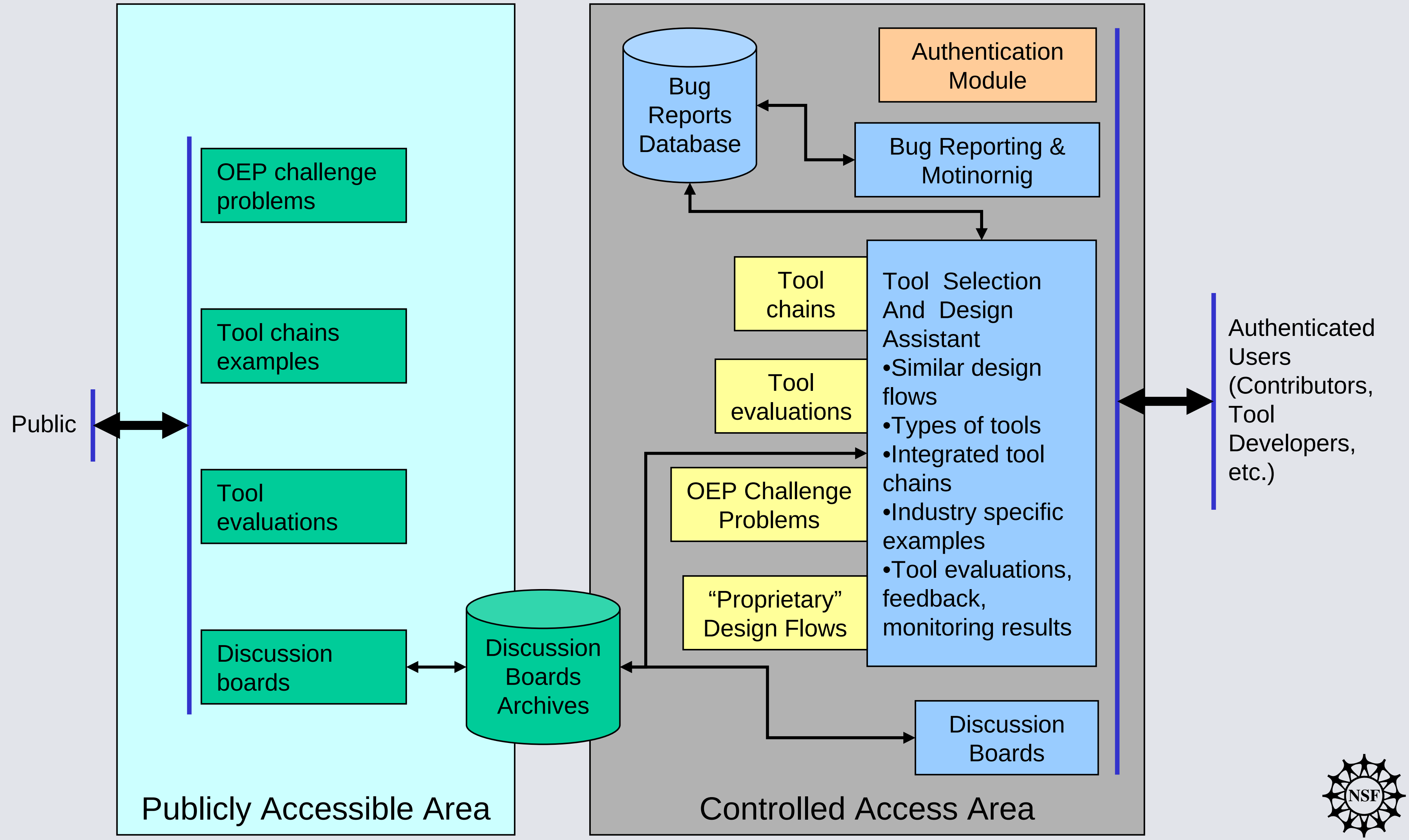
- **Structure**: 501(c)(3) Non-profit Research Institute
- **Initial Board of Directors**
  - Prof. Janos Sztipanovits – Vanderbilt U
  - Prof. Shankar Sastry – UC Berkeley
  - Prof. Doug Schmidt – Vanderbilt U
- **Initial Funding**
  - **Corporate:** General Motors, Raytheon, Boeing
  - **Government:** National Science Foundation, DARPA,
- **Initial Focus:** Tool Chain for Embedded System Design based on Model – Integrated Computing (MIC)

Repository Criteria

OTIF →

Tool Qualification Criteria	Type of Criteria
Intellectual Property (IP) Rules	Inclusion
Tool Dependencies	Inclusion
Functional Integrity	Compliance
Integratability	Compliance
Documentation	Compliance
User Support Criteria	Compliance
Development QA Processes	Compliance
Domain Applicability	Informational

Repository Architecture



Repository Portal 1/3

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Tools

Below you will find an ESCHER summary and links for several tools. Each tool described below is developed by organizations separate from ESCHER. For more information on a specific tool, please visit that tool's website via the provided link.

Basic Tools

- CHARON - Hybrid systems modular specification and design tool
- AIRES - Timing and schedulability analysis tool
- Giotto - Time-triggered programming environment
- Checkmate - Hybrid systems analysis tool
- TimeWeaver - Embedded systems component modeling and design tool

Tool Suites

- Model-Integrated Computing (MIC) Tool Suite
  - GME - Meta-programmable modeling tool
  - UDM - Model management tool
  - GREaT - Model transformation tool
  - DESERT - Design space exploration tool
- Ptolemy II Tool Suite - Modeling and Design tool suite

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GME

GME Tool Info

GME

The Generic Modeling Environment is a configurable toolkit for creating domain-specific modeling and program synthesis environments. The configuration is accomplished through metamodels specifying the modeling paradigm (modeling language) of the application domain. The modeling paradigm contains all the syntactic, semantic, and presentation information regarding the domain; which concepts will be used to construct models, what relationships may exist among those concepts, how the concepts may be organized and viewed by the modeler, and rules governing the construction of models. The modeling paradigm defines the family of models that can be created using the resultant modeling environment.

The metamodeling language is based on the UML class diagram notation and OCL constraints. The metamodels specifying the modeling paradigm are used to automatically generate the target domain-specific environment. The generated domain-specific environment is then used to build domain models that are stored in a model database or in XML format. These models are used to automatically generate the applications or to synthesize input to different COTS analysis tools.

GME has a modular, extensible architecture that uses MS COM for integration. GME is easily extensible; external components can be written in any language that supports COM (C++, Visual Basic, C#, Python etc.). GME has many advanced features. A built-in constraint manager enforces all domain constraints during model building. GME supports multiple aspect modeling. It provides metamodel composition for reusing and combining existing modeling languages and language concepts. It supports model libraries for reuse at the model level. All GME modeling languages provide type inheritance. Model visualization is customizable through decorator interfaces.

Documents

Documentation:

- Feature Summary
- GME Multi User Readme

Papers:

- The Generic Modeling Environment
- Model Integrated Computing in the Large
- Composition and Cloning in Modeling and Meta-Modeling

Downloads

- 5.11.18
- 5.9.21
- 4.11.10
- 4.8.25
- 4.5.18
- 4.3.17
- 4.2.3
- 3.10.13
- 3.4.29

Dependencies

none

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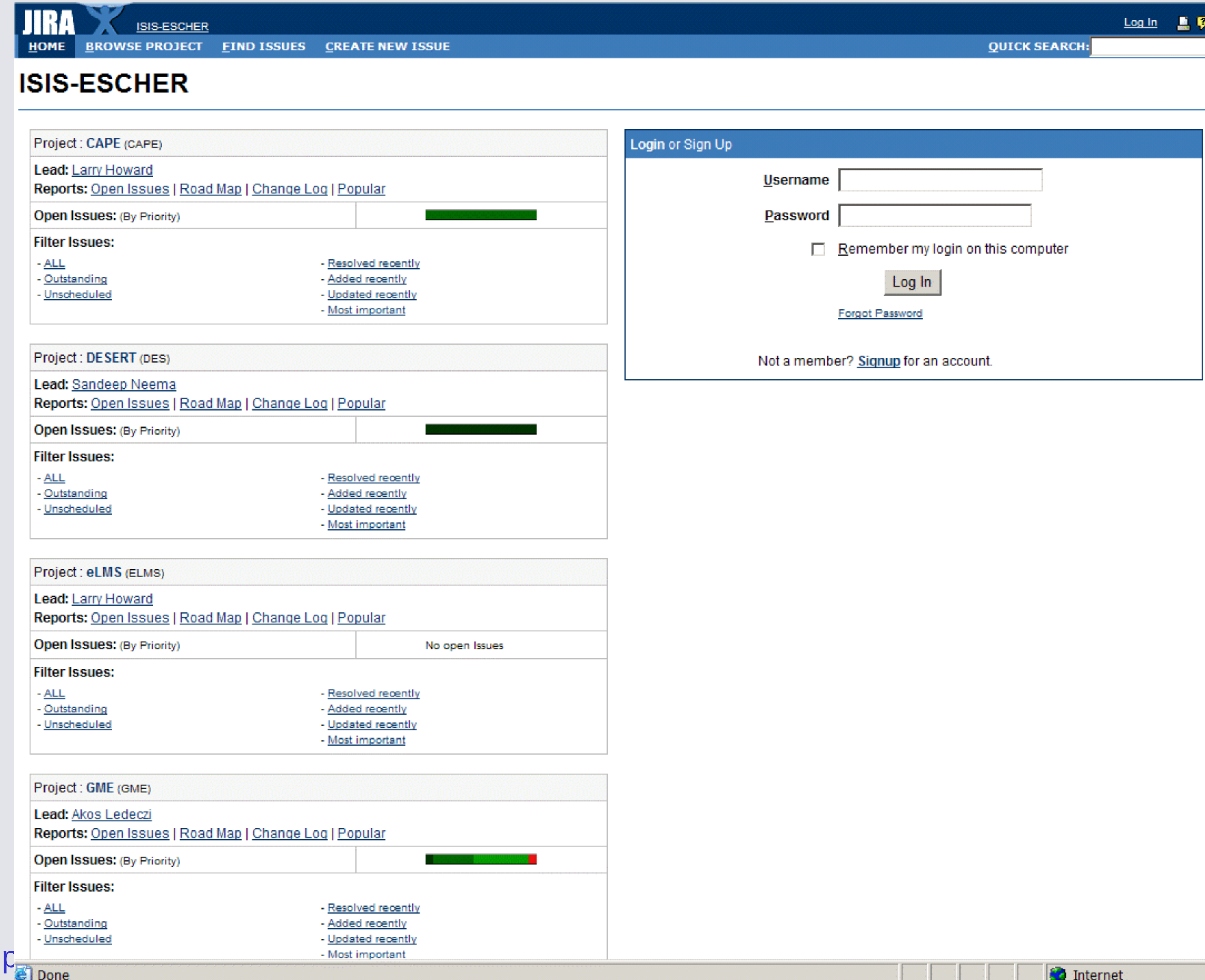
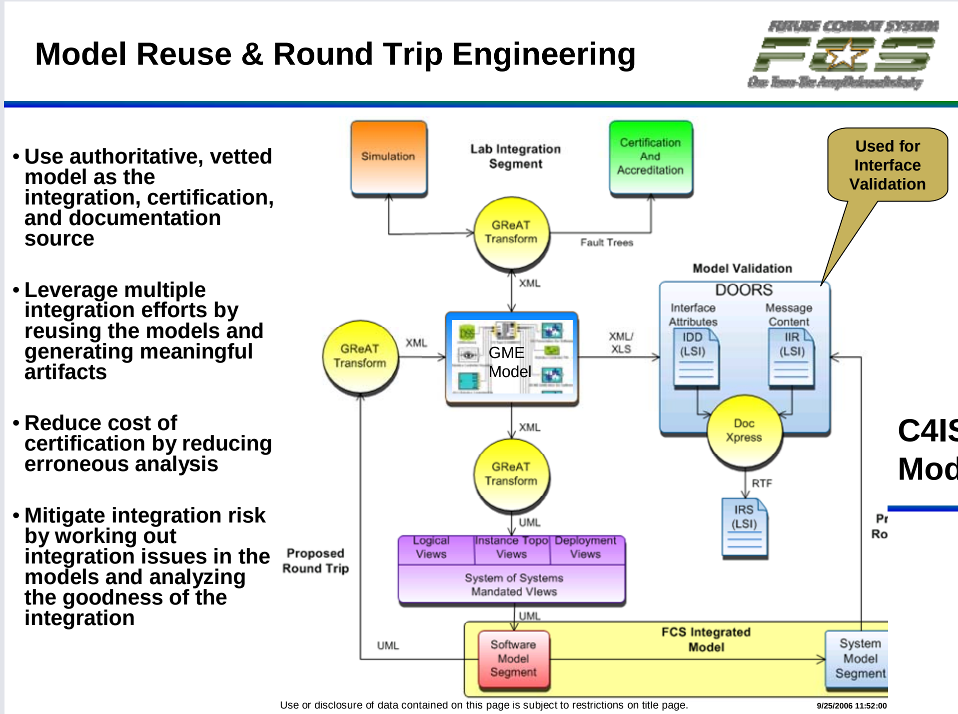


Repository Status

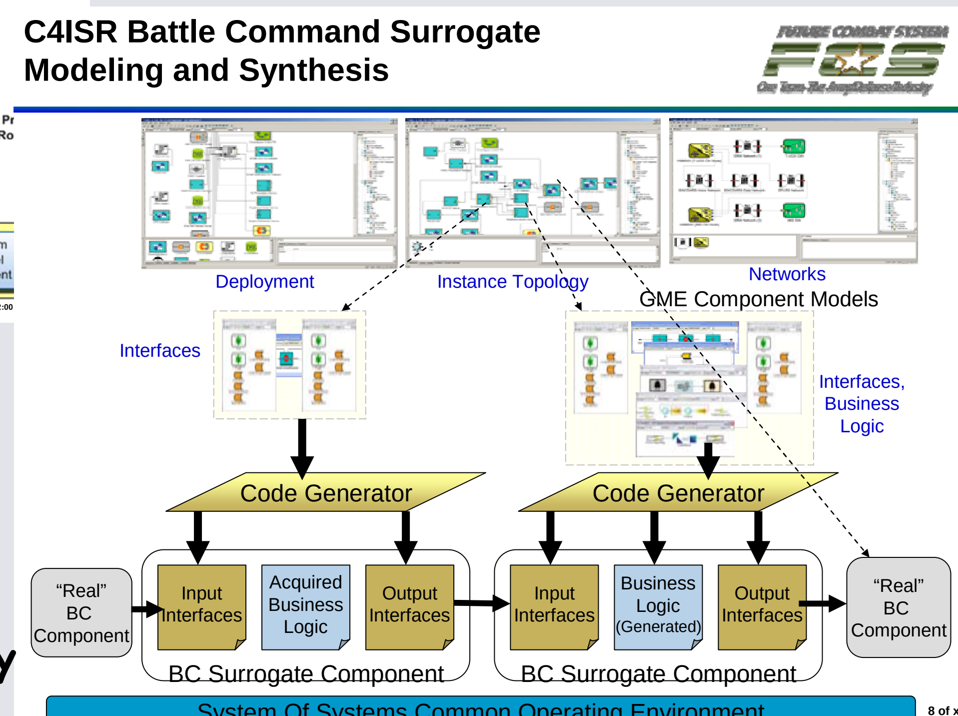
- Fully operational
- Research groups engaged in the maturation program maintain quality criteria
- Active user community at both sides of the wall
- Strong interest in the tool and in the transitioning model

Transitioning Highlights: FCS Program



ESCHER played crucial role in acceptance of the MIC tool suite in the FCS program

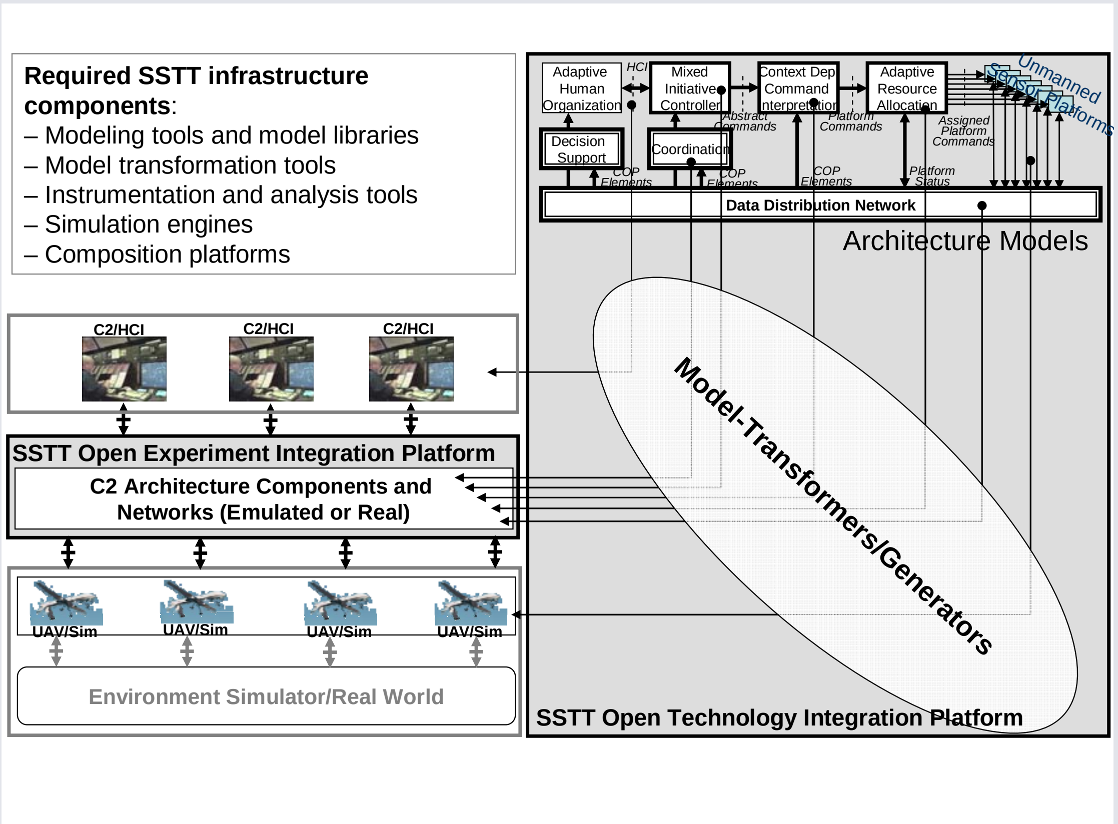
The ESCHER Repository continue growing and improving due to the generated user interest



Challenges in scaling and complexity contributed to research ideas in meta-model composition

Result is better understanding the opportunities and limits of the technology

Transitioning Highlights: Software and Systems Test Track



ESCHER was part of the Boeing/Raytheon team winning the Phase I of the SSTT project in June, 2006

This is the first time that ESCHER acts as an independent contractor