Technology Opportunities

Useful things from DARPA’s Evolutionary Design of Complex Software (EDCS) Program

John Salasin, Ph.D.
Program Aims

- Paradigm-shifting, theoretical breakthrough
- Paradigm-shifting, useful, theoretical breakthrough (implies usage context)
- Significant, measurable improvement
- Everyone wants it (mass market products)

Goal: Major advances with measurable improvements in our ability to evolve software
Evolutionary Software

- Need: Change in satellite coverage patterns with new sensor data integrated.

Information needed about current operational capabilities and expected performance on existing hardware

Concerns about cost require modification of planned approach

A modification proposed with more localized impact on system architecture

SPO requests performance impact study with respect to current capabilities.

Design Management System provides infrastructure for storing/accessing information.

Distributed collaboration and negotiation tools used to track the increasing number of inter-related issues / concerns.

Architecture Description Languages allow analyses with respect to multiple views (e.g., performance, fault tolerance) and at different levels of granularity.

Dynamic Languages facilitate rapid prototyping of functionality and to examine trade-offs.
Evolutionary Software

Explanation from reverse engineering and Design Management system is immediately available.

Architecture representations used to automatically generate simulations of SGS in context of the global digital infrastructure.

Dynamic system visualization tool provides view of the entire global intelligence and command and control infrastructure of which the updated sub-system will be a part.

Prototype code optimized for deployment and/or deployed code generated from architecture description.

Code analysis tools guarantee user-defined properties. Architectural representations used to generate test data and “oracles”.

Old test cases/data reused where appropriate. New test cases generated.
“Cluster” organization

Architecture expresses rationale, validated against rationale

Tests, analyses, proofs based on architectural specifications

High Assurance

DOOL

Architecture expresses attributes, guides optimizations

All artifacts accessible through IM capabilities, IM capabilities accommodate diverse approaches

Rationale Capture

Architecture/Generation

Information Management
Current Efforts: USC/CSE, TRW & Aerospace

1) Demonstrate alternative architecture analysis and architecture modification using development rationale
2) Demonstrate re-engineering and analysis of legacy code
3) Demonstrate the design, prototyping and validation of new algorithms
4) Demonstrate rationale actively being captured and adopted into the evolution process
Future Efforts

Transition program being proposed.