RedLion

An Infrastructure to Enable Crowd-sourced Design and Collaboration for Complex Defense Applications

Jack Zentner  
Senior Research Engineer  
Georgia Tech Research Institute  
Atlanta, GA 30332  
jack.zentner@gtri.gatech.edu

Nick Bollweg  
Research Scientist II  
Georgia Tech Research Institute  
Atlanta, GA 30332  
nicholas.bollweg@gtri.gatech.edu

Drew Pihera  
Research Scientist II  
Georgia Tech Research Institute  
Atlanta, GA 30332  
drew.pihera@gtri.gatech.edu

Danny Browne  
Research Engineer I  
Georgia Tech Research Institute  
Atlanta, GA 30332  
daniel.browne@gtri.gatech.edu
The needs of crowd-sourced hardware

• Design of cyber-electro-mechanical systems vs the design of software
• Ensuring data provenance while enabling sharing
• Concurrent design and how to ensure design intent across distributed design teams with versioning
• Semantic search, discovery, introspection and linking of design artifacts
• IP-rights and varying governance models
• Multi-classification level enclaves
Hardware vs Software Design

• Hardware designers are not software developers
  o What does synthesis and sizing mean for software?
  o Formal design languages such as SysML only now beginning to be leveraged in Hardware design

• Hardware systems are not the same as software systems
  o Hardware designs are merely abstractions of the system

• Different tools, different artifacts, different needs
Ensuring data provenance while enabling sharing

- Data provenance is a key enabler to help ensure IP rights
- Knowing the provenance of the artifacts and data associated with any project enables better reuse metrics
- Strong data provenance and version control supports the verification stages of systems design
Concurrent design and how to ensure design intent?

- Software developers use integrated unit testing to ensure design intent in collaborative development.
- Integrated unit testing for hardware design would, in general, require automated execution of engineering codes.
- Ideally each designer would be able to use a different suite of tools.
Semantic search, discovery, introspection and linking of design artifacts

• Interface oriented design for hardware development is not generally supported in code integration tools
• Semantic linking of codes/artifacts enables tool agnostic design and development
• Semantic search and discovery enables better re-use and faster differentiation across possible solutions
IP-rights and varying governance models

• Why IP-rights and governance is Important
  o Well-understood ground rules make it easier to gain participants in the short term.
  o A vibrant collaborative hardware community reduces costs and eases maintenance for everyone.
  o Limit confusion and liability.

• Hardware IP management is different than software
  o Hardware governed by patents
  o Software by copyrights
  o Open source hardware usually not patented
Multi-classification level enclaves

• Open -> Proprietary -> ITAR Controlled -> Classified
  o Ideally information/designs would seamlessly flow from low to high but have strict controls in the other direction
  o How to ensure US citizen status for open yet ITAR controlled projects?

• The whole goal of the AVM project is to enable a 5x reduction in time to develop military vehicles
What is RedLion?

• A web-centric framework to enable collaborative hardware design
• Built on the enterprise-grade, open source technology stack used on 30k projects by 300k users on SourceForge.net
• Bootstrapped by $1.4M in DARPA funding to support the Adaptive Vehicle Make program and accredited to subset of NIST 800-53
• Open source (MIT License variant) and fully extensible and customizable
Required Software Components

Core Services
- Web Server Stack
- DVCS & WebDAV
- Cryptographic Services
- Indexing Engine
- Index Search

Component Interoperability
- Basic Data Ontology
- Semantic Triple Store
- Semantic Search

Extensibility
- App Engine
- Hook Script Engine

META Integration
- SysML App
- AADL App
- Modelica App

Designer Collaboration
- Wiki with Forums
- Integrated Chat Client
- Tasking App
What does RedLion Do?

1. Revision control: git, mercurial, rug, svn, ...
2. Federated search: forge-to-forge, global, project
3. Change tracking: ticketing, branching, merging, artifact/asset diff
4. Collaboration: wiki, discussion, design review
5. Context-awareness: syntax hi-lite, CAD view
6. Access control: roles, permissions
7. Notification: check-ins, comments, tickets, ...
8. One-click project provisioning