CREDC: Research Lifecycle Support Framework

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Goal of This Presentation

What we hope to accomplish

- Develop the case for the Research Lifecycle Support Framework
- Develop the case for Verification and Validation
- Provide an overview of the Framework

What we would like from you

- Suggestions for improvement
Motivation

- Packaging & sharing of research outputs
- Identification of industry needs
- Integration of existing research & standards
- Utilization of tools, methods & datasets
- Adoption of verified processes
- Validation of user requirements

Guide researchers throughout the project lifecycle to produce verifiable, reproducible and reusable research catering to the industry needs.
Role of the Framework in Guiding Researchers

What is the importance of this research activity?
What constitutes the right solution?
What resources are available?

Streamlined procedure
Early detection of faults
Improvement of quality
Less rework
Reduced costs
Aids technology transition
What Constitutes the Right Solution?

**Verification**

“building the system the right way?”

- How the project was documented
- What operations installed
- How the customer was billed
- How it was supported

**Validation**

“building the right system?”

- What marketing advertised
- What the customer really needed
Sample Resources

Software-Focused

- Development tools
  - Build automation
  - Compilers
  - Debugger
  - Integrated Development Environment

- Testing Frameworks
  - *Unit

- “Realistic” simulation or in situ tests

- Security analysis tools

Hardware-Focused

- Power system models and specifications (synthetic or real)

- Measurement devices

- Protection devices

- Realistic power grid use-cases

- Datasets (synthetic or real)

- Power system tools for simulation, modeling and optimization

- Networking protocols

- Network simulators

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The Framework

<table>
<thead>
<tr>
<th>V&amp;V Guidebook</th>
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<tbody>
<tr>
<td>• V&amp;V- what, why, when, how?</td>
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<tr>
<td>• Pointers to domain-specific information</td>
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<tr>
<td>• Simplified V&amp;V test plan template</td>
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<tr>
<th>Appendix: Resources</th>
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<tr>
<td>• List of available resources (IT &amp; OT)</td>
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<td>• Packaging &amp; sharing procedure</td>
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Repository managed by UIUC:

From CREDC activities

- Codebase
- Assumptions
- Topologies
- Use cases
- Datasets
- Side products (tools / codes)
- Lessons learned

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## Dual Benefits

### Researchers
- Streamlines approach to project execution
- Leverage existing work
- Verify the design and development process
- Provide list of resources
- Easy to follow and implement
- Good teaching tool
- Researchers can appeal the programmatic evaluation outcome

### Leadership
- Accommodate industry input into requirements
- Incorporate accepted standards and procedures
- Alignment of activities to sector needs
- Stimulate investment in EDS cyber security
- Maximize return on investment
- Provide actionable feedback to researchers
V&V Guidebook
V&V through the Research Lifecycle

- Research lifecycle has been divided into 4 Smart Grid Levels (SGLs) for easy identification and tracking of levels.
## Steps in Different SGLs

<table>
<thead>
<tr>
<th>Steps</th>
<th>SGL 1 (Concept Formulation)</th>
<th>SGL 2 (Development &amp; Integration)</th>
<th>SGL 3 (Lab Testing)</th>
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<tbody>
<tr>
<td>Determine stakeholder requirements</td>
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<td>Develop domain-specific use-cases</td>
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<td>Unit tests</td>
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<td>Code reviews</td>
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<td>Integration tests</td>
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<td>Boundary testing, input validation &amp; output validation</td>
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<td>Cybersecurity assessment</td>
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<td>System tests</td>
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<td>User acceptance tests</td>
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Implementation & Evolution of Framework
Framework Adoption

First quarter after Framework adoption
- Identify SGL of the project
- Determine parts of the framework that fit the project-specific needs
- Select at least one of the following approaches for leveraging the Framework in the project lifecycle
  - Review of V&V test plan by CREDC peers
  - Review of use-cases and project codes by CREDC peers
  - V&V testing based on guidebook

Last quarter of project lifecycle
- Inform how the Framework was utilized
- Report the results
V&V Framework Evolution

- First quarter after Framework adoption: Provide initial feedback regarding what additional support is desired
- Last quarter of project lifecycle: Provide feedback regarding how the Framework fit in the lifecycle, and lessons learned
  - What worked
  - What didn’t work

Somewhere, something went terribly wrong

https://www.emaze.com/@ACRZIOTC/evolution-of-computers
Thank You!

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