



MISSION SOLUTIONS ENGINEERING

Open Source Technology for Enterprise Health Management

Edward Beck
Solutions Architect

Mission Solutions Engineering, LLC.

- Design, development, and integration of real-time software for the U.S. Navy's Aegis weapons system, and its derivatives, since 1969
- Embraced an Open Technology Development paradigm to support Navy Open Architecture initiatives
- Decade of experience in the evaluation, selection, integration and maintenance of OSS for Mission Systems development.

Set of Activities

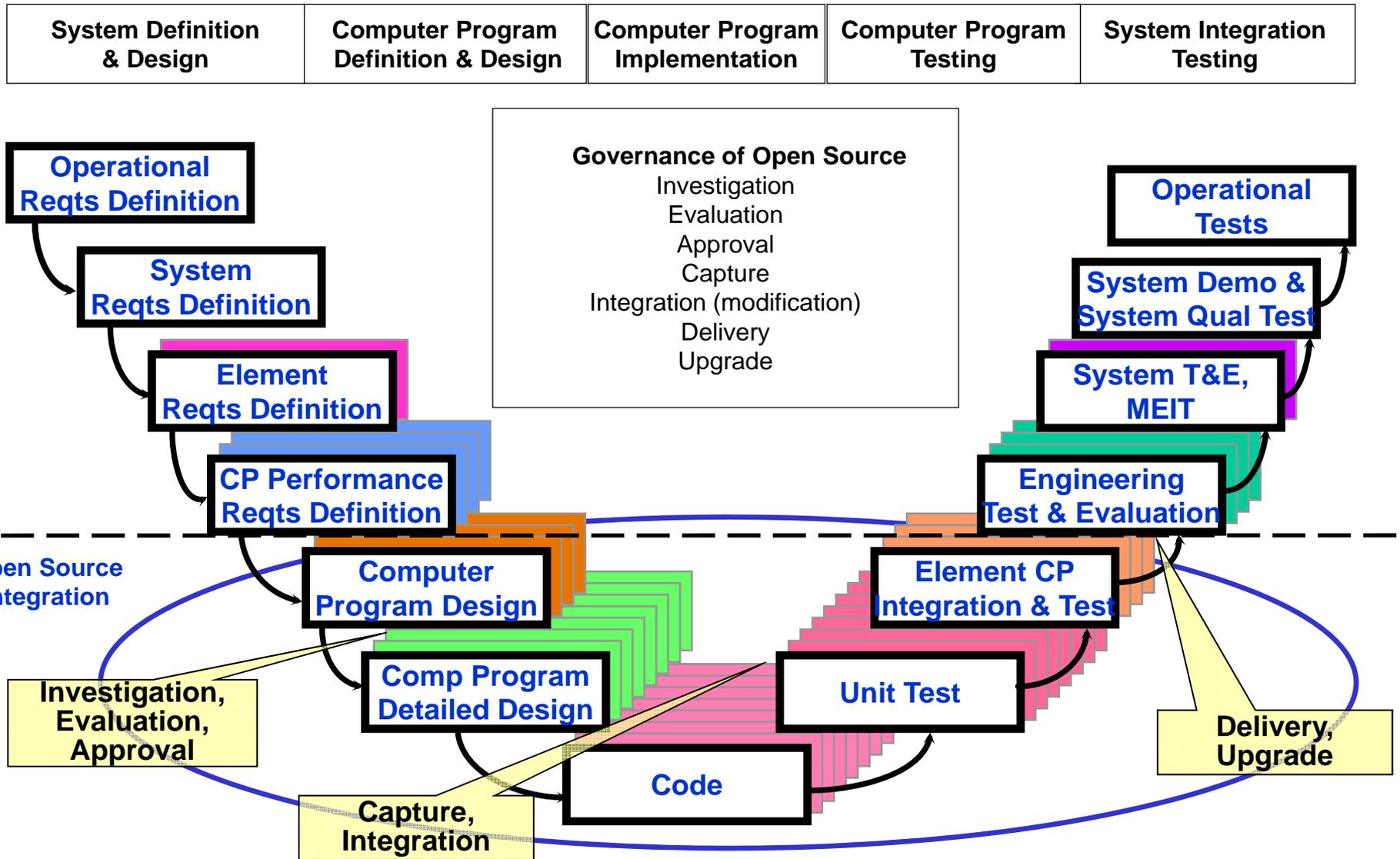
- Governance
 - Adherence to well-defined processes
- Acquisition
 - Matching requirements with best-of-breed components
- Legal
 - Review and approval of Open Source license types
- Security
 - Engineering analysis to mitigate vulnerability risk
- Integration
 - Full life-cycle engineering activities



Set of Activities

- **Governance**
 - **Adherence to well-defined processes**
- Acquisition
 - Matching requirements with best-of-breed components
- Legal
 - Review and approval of Open Source license types
- Security
 - Engineering analysis to mitigate vulnerability risk
- Integration
 - Full life-cycle engineering activities

Software Development Process



Applying Open Source Technology is an Organizational Effort

- Our Engineering Organization is tasked with the investigation, evaluation, and integration of Open Source software according to a strict set of criteria
- The Contracts Organization provides authorization for the use of Open Source software based on the type of license associated with the component
- An Open Source Library is maintained by our Configuration Management Organization as a “trusted source” for officially sanctioned Open Source components

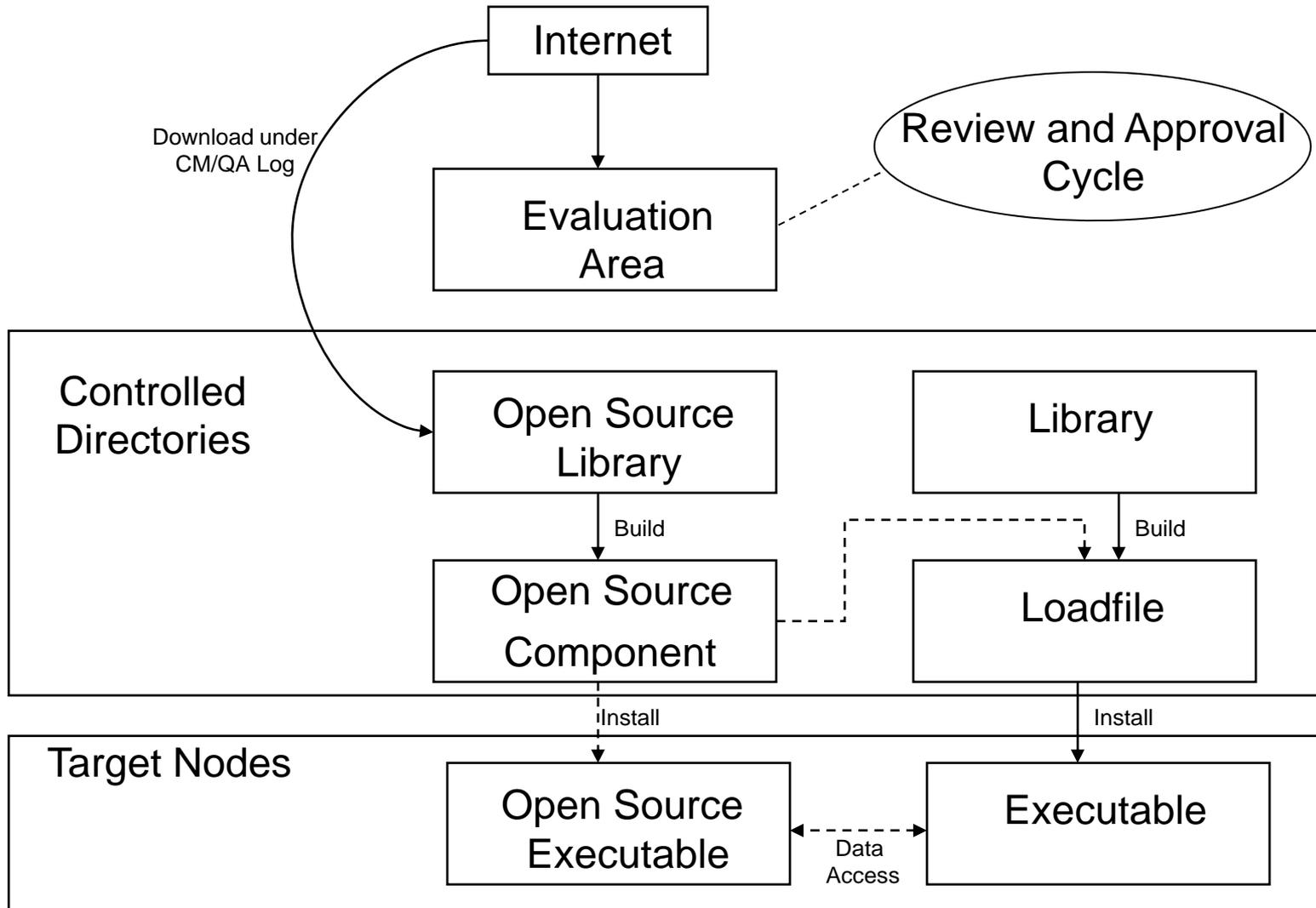
Adopting New Development Processes

- Investigation
 - Based on system requirements, a search of available Open Source repositories is made to determine if a component exists that meets system needs
- Evaluation
 - Candidate Open Source component is subjected to internal tests and reviews
 - Licensing agreement is reviewed
- Approval
 - Candidate Open Source component is recommended for inclusion into the system architecture
- Capture
 - Official Download and CM of Open Source Product

Adopting New Development Processes (cont.)

- Modification
 - Alterations to Open Source component due to locally encountered issues
- Delivery
 - Delivery of Open Source Product for use in the project
- Upgrade
 - Capture and subsequent re-delivery of the next generation of the Open Source component

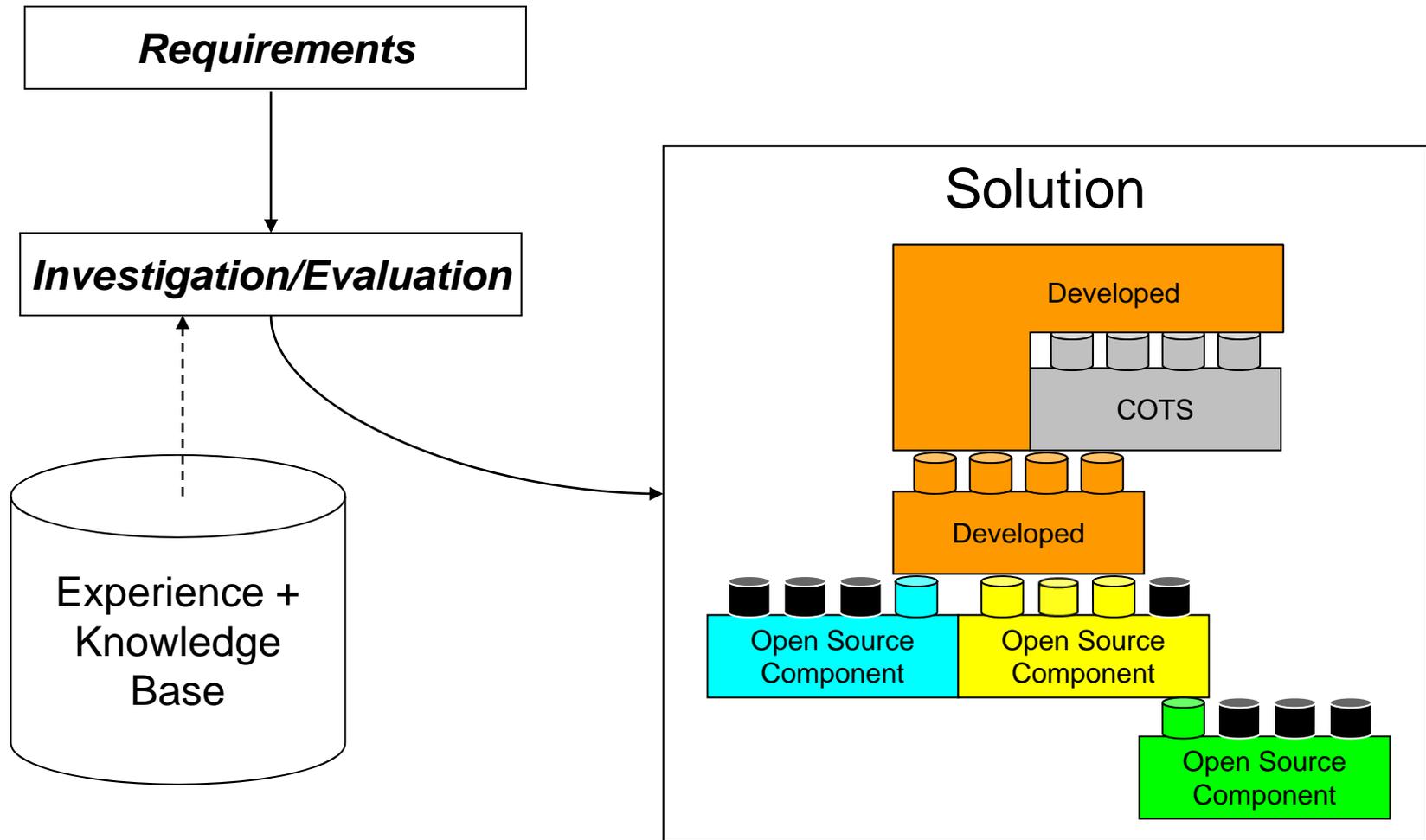
Open Source Life Cycle



Set of Activities

- Governance
 - Adherence to well-defined processes
- **Acquisition**
 - **Matching requirements with best-of-breed components**
- Legal
 - Review and approval of Open Source license types
- Security
 - Engineering analysis to mitigate vulnerability risk
- Integration
 - Full life-cycle engineering activities

Satisfying Requirements with Open Source Components



Where Does The Search Effort Begin?

- Thousands of Open Source projects are readily available for evaluation and use
 - Websites and projects are too numerous to mention
- Engineering expertise
 - Knowledge base within our center
- Leverage our Open Source Knowledge Community
 - Access to thousands of experienced employees worldwide
- Corporations are contributing to Open Source efforts
 - Open Source is no longer just the domain of hobbyists

Selection Criteria Guideline

- Established project?
- License type?
- Security concerns?
- Actively maintained?
- Adequate support?
- Supported platforms?

Set of Activities

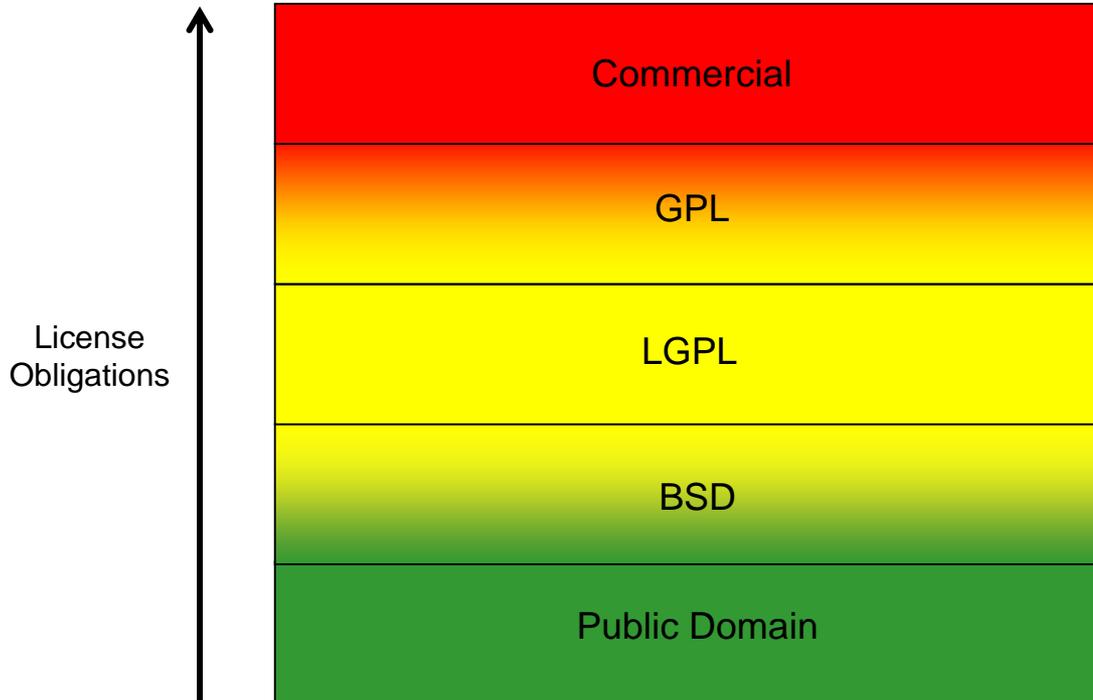
- Governance
 - Adherence to well-defined processes
- Acquisition
 - Matching requirements with best-of-breed components
- **Legal**
 - **Review and approval of Open Source license types**
- Security
 - Engineering analysis to mitigate vulnerability risk
- Integration
 - Full life-cycle engineering activities

Beware: Open Source Licensing

- Although Open Source may be free, it is not completely free of restrictions
 - Unless the software has been placed in the public domain, access to Open Source software is subject to stated conditions of use, or license terms, determined by the owner
- Licensing is a complex issue
 - There are about 20 major license types in the Open Source community
 - Need to be aware of the restrictions associated with each

Open Source licenses must be carefully reviewed by area experts.

License Terms



The chart represents the primary license types: Commercial, GPL, BSD and public domain. GPL and commercial carry the most license obligations but are at opposite ends of the proprietary scale regarding source code ownership and availability.

Source: CSC *Open Source: Open for Business*

Established Procedures

- Our process engages the Contracts organization for review and approval of each license
- Additional steps
 - Create guidance document on license evaluation
 - Provide knowledge training on the various OSS license types
 - Create automated workflow for the review and approval process of OSS licenses
 - Establish a well-know list of OSS license types that are acceptable for organizational use

Set of Activities

- Governance
 - Adherence to well-defined processes
- Acquisition
 - Matching requirements with best-of-breed components
- Legal
 - Review and approval of Open Source license types
- **Security**
 - **Engineering analysis to mitigate vulnerability risk**
- Integration
 - Full life-cycle engineering activities

Systems Assurance

- Ensure Security
 - Mitigate vulnerabilities
- Maintain Quality
 - Software stability
- Eliminate **Fear Uncertainty Doubt**
- Embrace use of Open Source

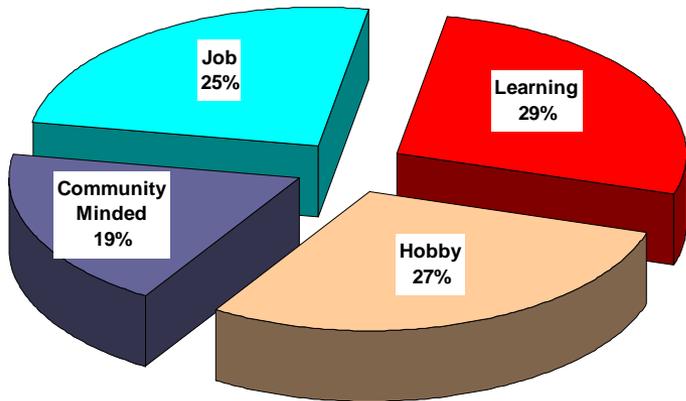
Security: Safety in Numbers

- Open Source and Security appear to be an oxymoron, but in fact are highly compatible
 - The very openness of the software ensure rigorous reviews and testing, bolstering security
- In practice, source code availability allows a large community of developers to inspect and review the code for security flaws
- Developers are driven by fame: finding a security weakness in a complex system is a challenging task that is recognized and lauded by peers.

The Growth of Open Source



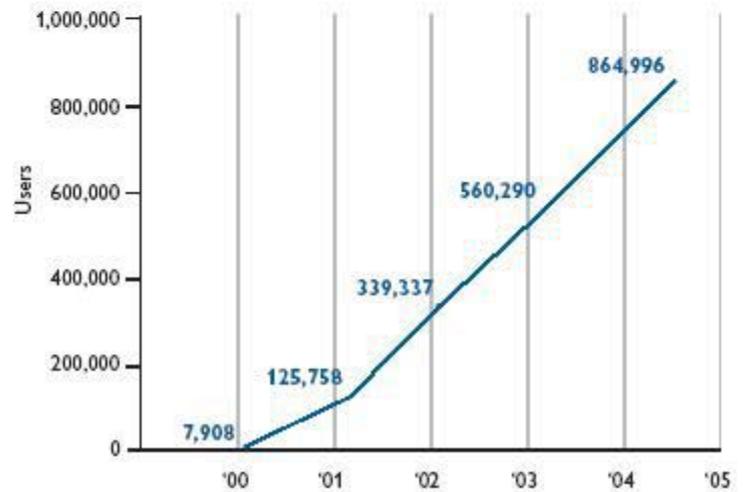
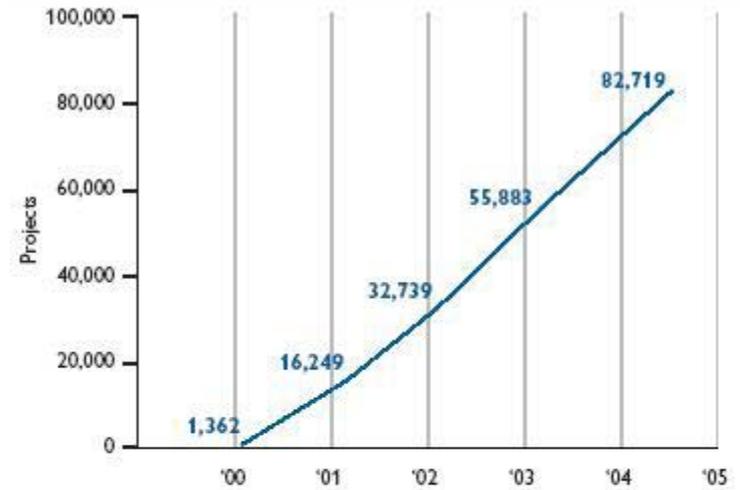
“The mysterious people designing open-source software are the same people working for you right now”



Open Source Developer Profile

Source: CSC *Open Source: Open for Business*

THE OPEN SOURCE COMMUNITY TAKES OFF



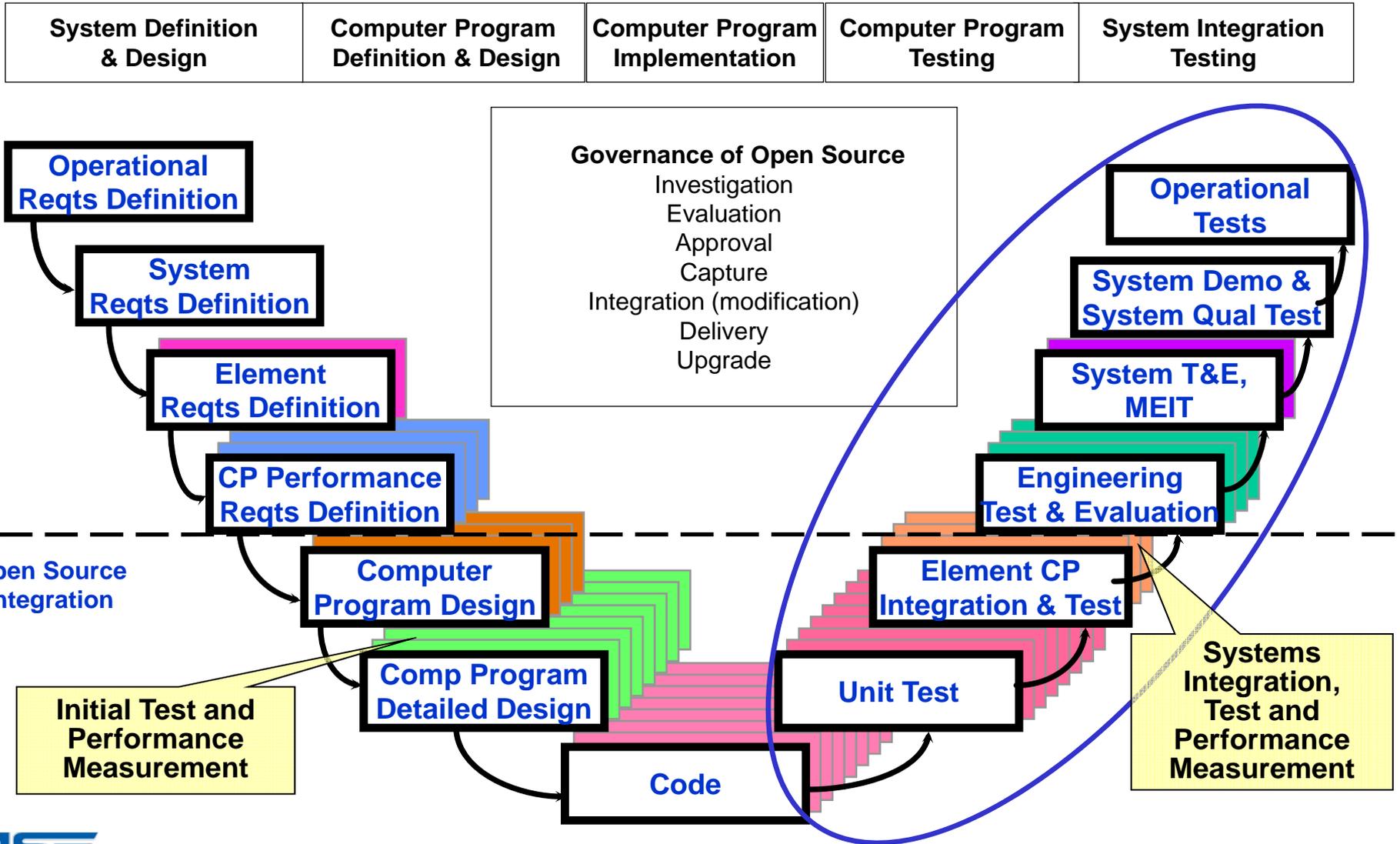
Source: SourceForge

Security and Safety Measures

- Virus Scans
- Backdoor checks
- Code inspections
- Performance tests
 - Memory consumption
 - CPU utilization
 - Process/Thread allocation



Multiple Testing Levels



Set of Activities

- Governance
 - Adherence to well-defined processes
- Acquisition
 - Matching requirements with best-of-breed components
- Legal
 - Review and approval of Open Source license types
- Security
 - Engineering analysis to mitigate vulnerability risk
- **Integration**
 - **Full life-cycle engineering activities**

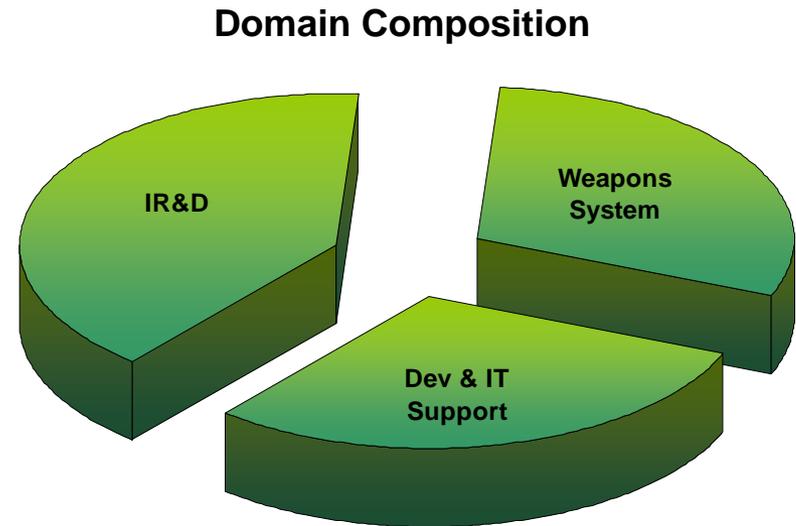
Open Source Case Studies



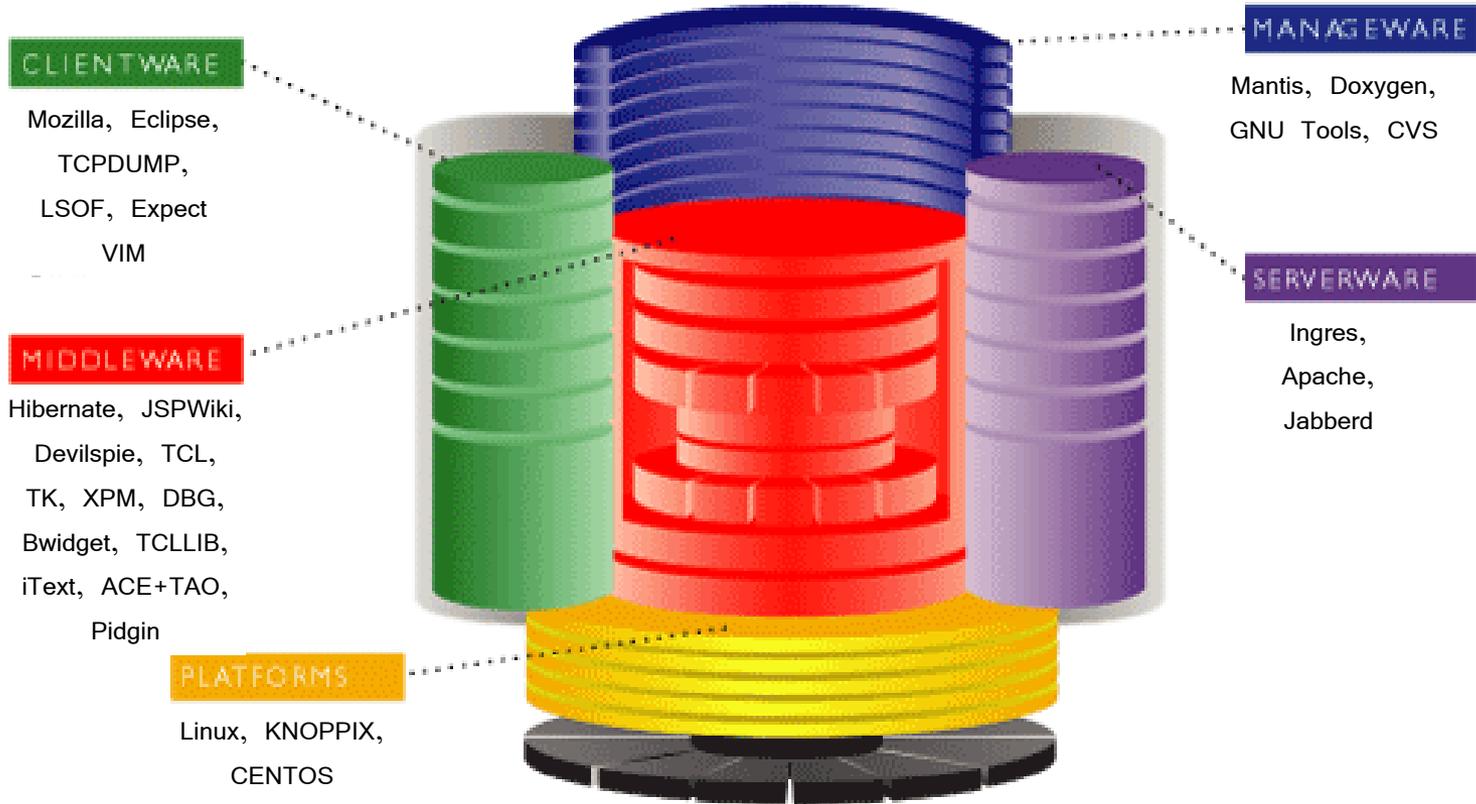
- MSE has successfully leveraged Open Source technology in the development and support of the AEGIS weapons system.

Open Source Allocation in Product Area Domains

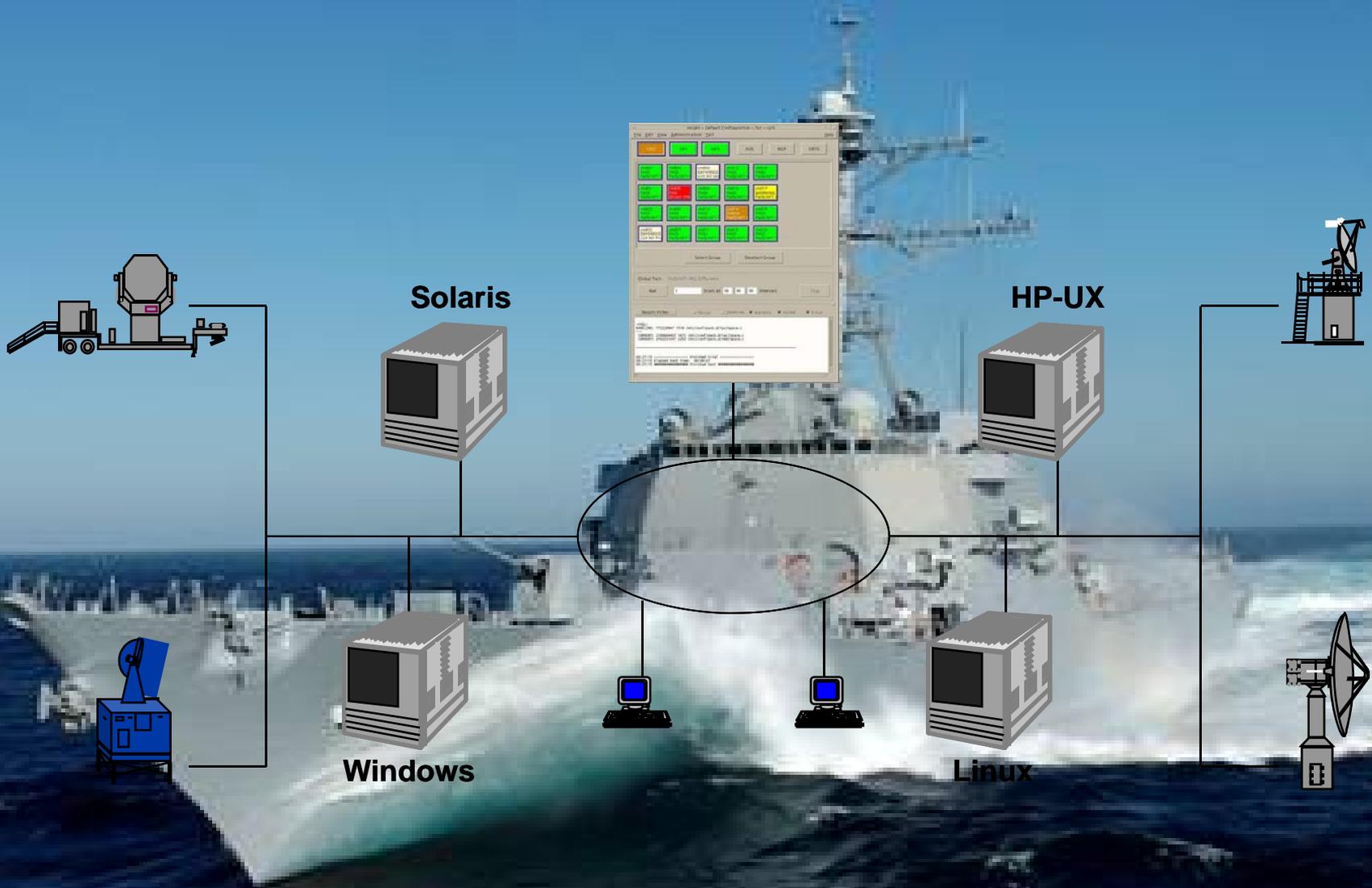
- Integrated 90+ Open Source components on the Aegis program
 - 30% are deployed within the certified real-time weapons system
 - 40% are used on IR&D projects in support of future programs
 - 30% are used as development tools and IT support programs



Sampling of Integrated Open Source Components



Insight: Distributed Systems Management Toolset



A Migration to Open Architecture

Proprietary Systems



Manufactured hardware and developed software



Open Technology



Emphasis on COTS hardware and software integration

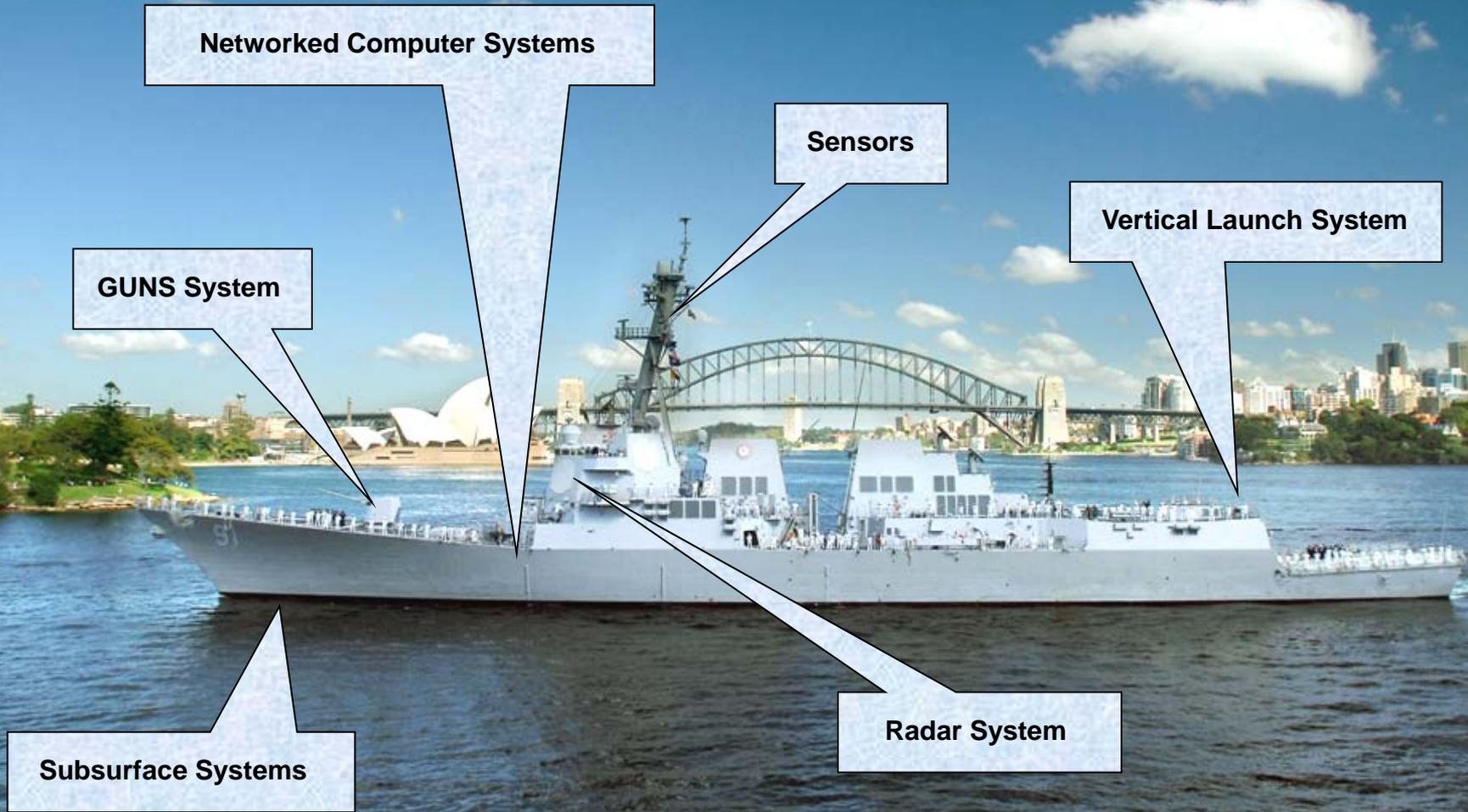
Computing System Management functions have become more complex with the adoption of COTS technology.

Open Technology



- An Aegis ship not much different from a large-scale commercial data center.
- The weapons system is comprised of a standard operating environment with unique components not seen in commercial architectures.

An Enterprise Computing Environment



Application Management

- **Manage where applications are running**
- *Manage runtime state of the applications*
- *Manage recovery and reconfiguration*
- **Assess health status of the applications**

Equipment Management

- **Node/Server Management**
 - Diagnostics
 - Performance Monitoring
- **Network Management**
- **Asset Management**
 - Validation and Verification
 - *Software Distribution*

**Fault Detection / Fault Isolation
Root Cause Analysis**

Insight: Distributed Systems Management Toolset

- Highly configurable suite of open source, commercially available, and developed tools that perform system management functions across the enterprise

Development Site



Validation of the build environment

Test Facility



System validation, diagnostics, operability tests

Shipyard Integration



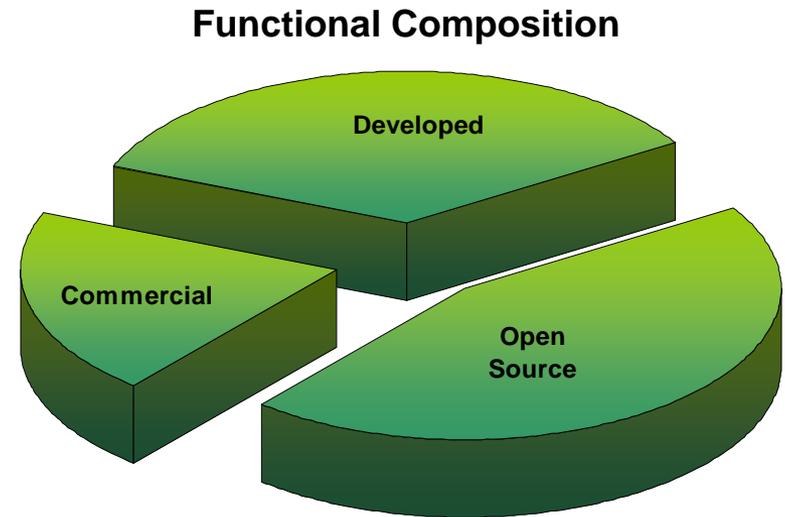
Deployed Systems



Runtime status monitoring, operability tests, diagnostics

Extensive Use Of Open Source Technology

- Over 40% of Insight is comprised of Open Source software
 - Permits selection of cost effective, best-of-breed solutions
 - Reduces development time
 - Allows for extensible functionality



Open Source is incorporated within every functional component of Insight.

The Open Source Benefits For Insight

Sample cost and schedule

	Open Source		MSE Developed	
	Expect/TCL, XPM, DBG	LSOF, AIDE, TCPDUMP	Framework	Tools
Source Lines	102,266	38,417	10,238	8,812
Development Cost	\$2,676,404*	\$1,005,372*	\$267,938*	\$230,610*
Effort - Staff Months	227	85	23	19

*Costing number derived from industry standard numbers as determined by the SLOCCount estimation tool. Refer to <http://www.dwheeler.com/sloccount> for details.

Contact Information

Edward Beck

Mission Solutions Engineering, LLC

304 W. Rt 38

Moorestown, New Jersey 08057

Phone: (856) 252-2055

Email: edward.beck@missionse.com