Delivering Effective Solutions in the Age of Open Source Technology

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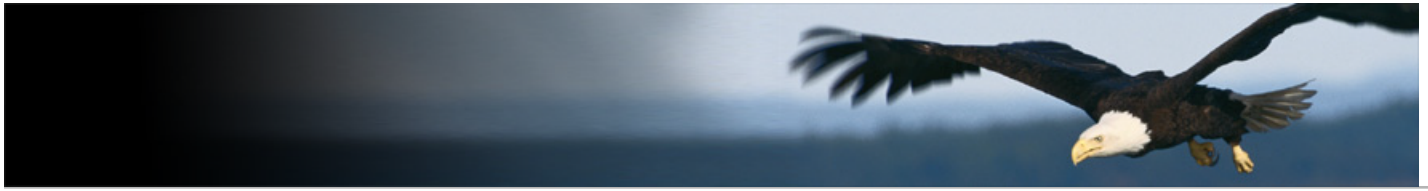
EXPERIENCE. RESULTS.



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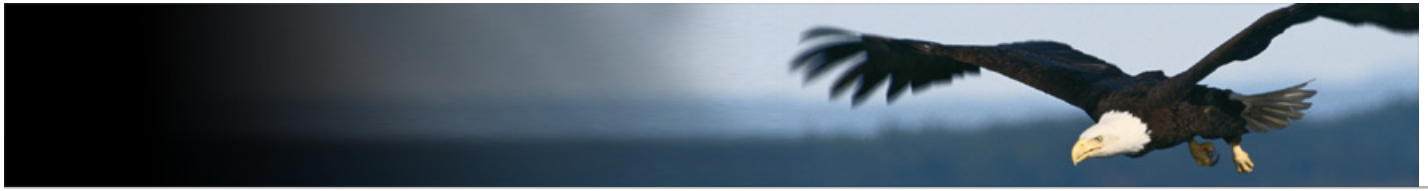
Overview

- A Changing Landscape
  - Embracing the Open Source Movement
  - Organizational Impacts
- Navigating the Open Source Waters
  - Selection Criteria
  - Licensing
- Aegis Case Studies
  - A Migration to Open Architecture
  - ADI (Advanced Display Infrastructure)
  - Insight: Distributed Systems Management Toolset
- Conclusion



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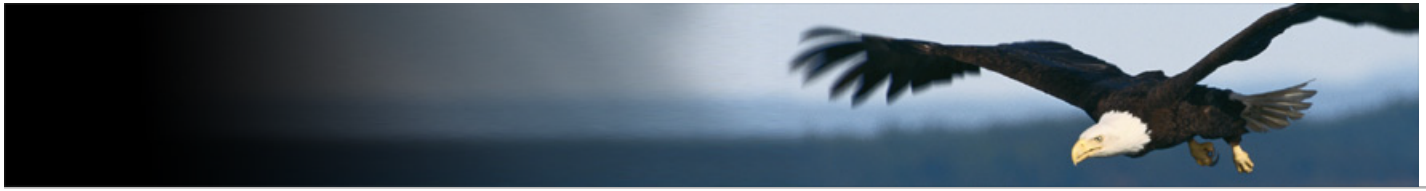
What is Open Source?

- Open Source As Defined by the Open Source Initiative

  Open Source software is software licensed such that when distributed in binary form, it comes with the source code. In addition to being available in source form, the software is also freely redistributable, modifiable, without discrimination, without ties to a specific product, without placing restrictions upon other software, and is technology neutral. (Perens)

- Open Source As Defined by Mitre and DOD

  "[Open Source] is software with its source code available that may be used, copied, and distributed with or without modifications that may be offered either with or without a fee." (Kenwood xi)



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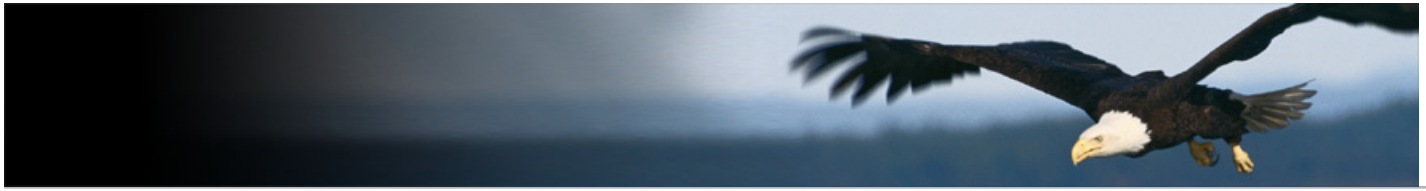
What is Open Source? (cont.)

- Practically Speaking

  Open Source is software which is freely available for use, inspection, modification, porting, and redistribution.

Open Source is a cultural phenomenon that is breaking into the commercial world and changing the rules.



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Companies:
IBM, DEC

Products:
Large-scale commercial computers

Programs:
Available in forums and magazines

1991
Linus Torvalds releases source code for Linux

1992
Air Force begins work on ADA 95 Compiler. GNU is the basis

1998
Open Source Initiative (OSI) created as marketing agent to support free software

1950 1960 1970 1980 1985 1990 1995 2000 2005

1983-1985
Free Software Foundation rolls out GNU, a UNIX-like distribution mechanism

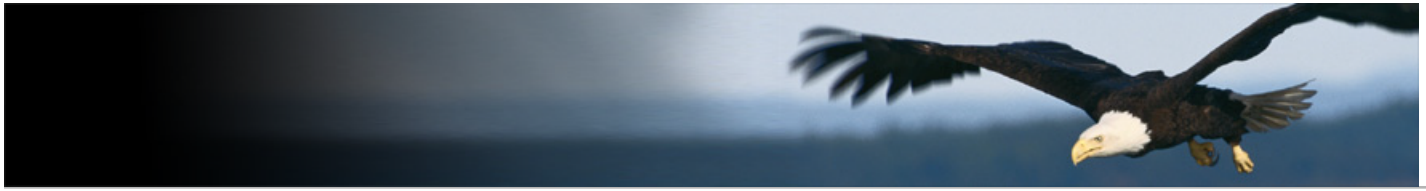
1989
UC - Berkeley releases BSD UNIX.

Cygnus Corp founded to provide support for GNU and Open Source

1992
386BSD 0.1 released as first free UNIX-like OS

1993-1995
SlackWare Linux is started. Becomes popular as an alternative to MS Windows

2002
Concurrent Computer Corp. releases initial version of its Real-Time Linux OS.



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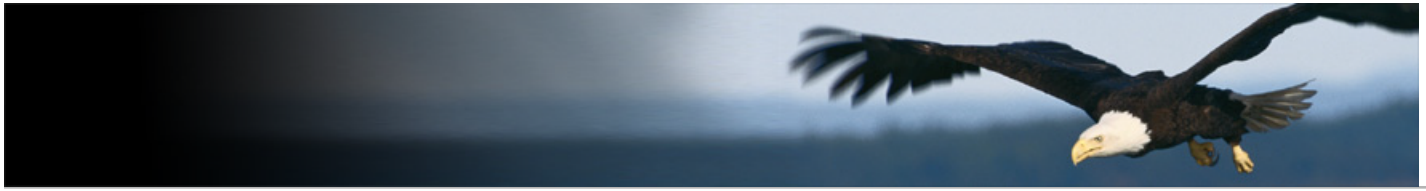
What Does This Mean For Us?

- Open Source Technology is a viable solution that must be considered in today's design models.
- Incorporating Open Source components into the System Architecture can significantly reduce the implementation effort
  - Cost benefits can be substantial
    - Aegis case studies: ADI and Insight
- Open Source components can enhance overall project quality
  - Open Source Projects have hundreds of users over multitudes of applications
  - Bugs are found quickly and incorporated back into the Open Source Repository



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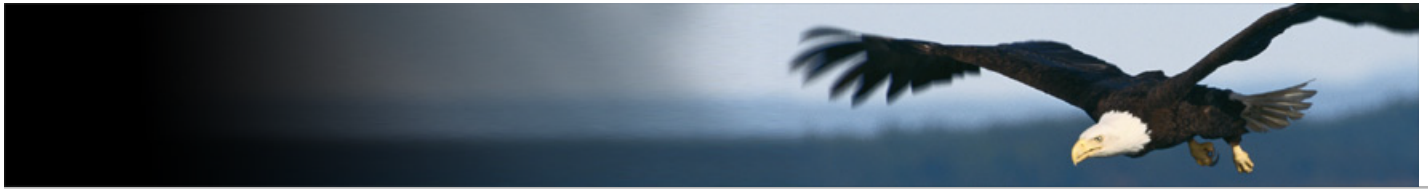
The New Frontier Of System Development

- Open Source product search.
  - Review available components based on current requirements
  - *It is also a continuous process*
    - ***Anticipate requirements and search for available components***
- Prototyping and Evaluation.
  - Experimental phase
  - *Core group focused on Open Source "test code"*
- Component Integration.
  - Merge the Open Source and Mainstream software
  - *Rigorous testing*

Searching for Open Source components has become a key task of the development staff.



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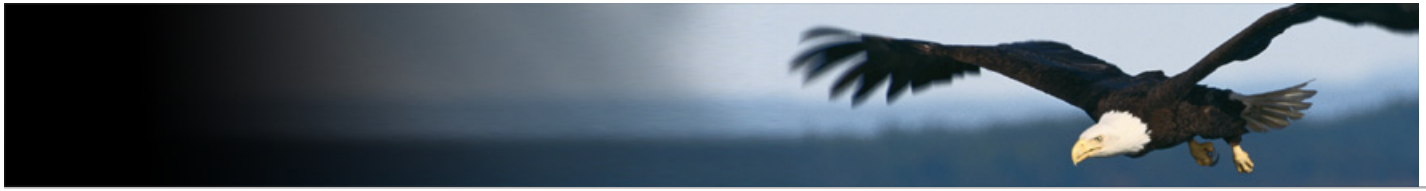
Where Do You Begin The Search Effort?

- Thousands of Open Source projects are readily available for evaluation and use
  - Websites are too numerous to count
    - freshmeat.net
    - sourceforge.net
    - slashdot.org
    - …..etc.
- Open Source is no longer just the domain of hobbyists and academics
  - Corporations beginning to contribute to Open Source efforts
    - IBM and Linux
    - Concurrent Computer Corporation and RedHawk Linux
    - Netscape and Mozilla



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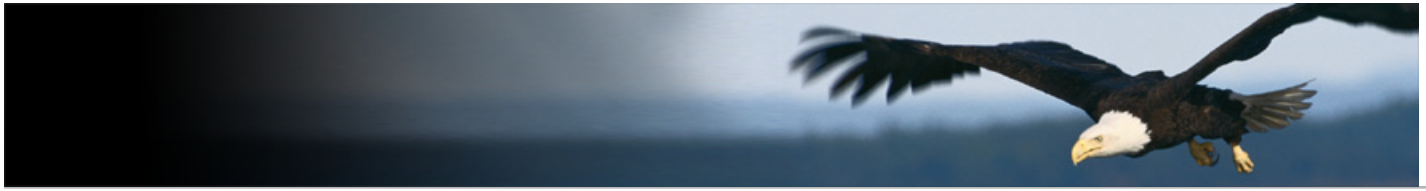
Selection Criteria Guideline

- Is it actively released, and how often is it released?
- Is it being actively developed?
- Is it an established project?
- Is it being used and tested by a wide community?
- Does the project have a problem tracking system?
- Is there adequate developer response?
- Does the project have an established version control methodology?
- Does the source code appear to be adequately documented and maintained?
- What type of license does it have?
- Is it portable?



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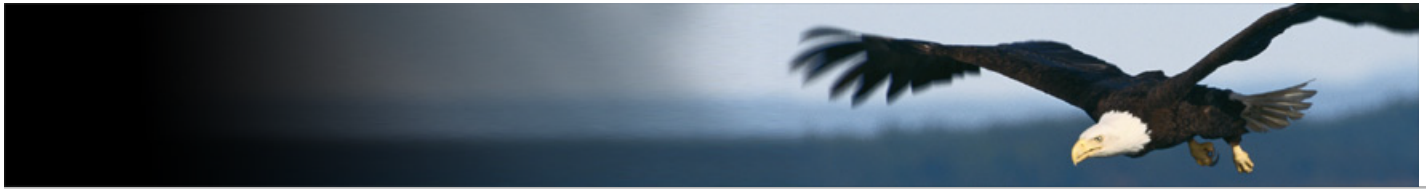
Licensing

- What is an Open Source License?

  An Open Source License is a software agreement that makes software available to the user and meets the definition of Open Source as provided by the Open Source Initiative.

- What the License means:
  - The license under which Open Source software is released determines how a company/individual can use that software.
  - License restrictions vary by component.
  - Some general license guidelines can be found at www.opensource.org



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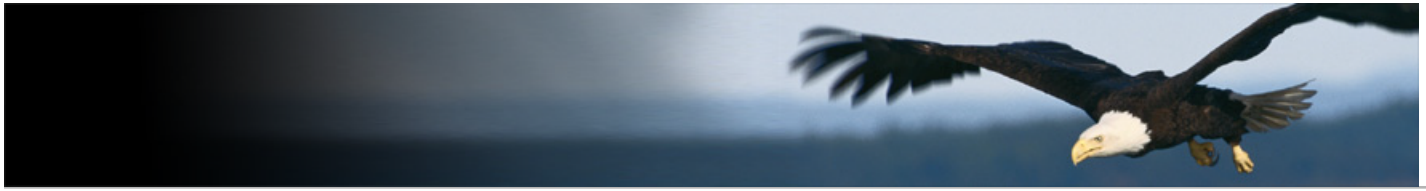
Licensing (cont.)

- GPL (General Public License)
  - Most common license in use today
  - Derivative is LGPL (GNU Lesser General Public License)
    - Less restrictive than GPL when Open Source is combined with proprietary software
- Organizations need to be disciplined about their use of Open Source software.
  - Contracts
  - Configuration Management
- Open Source legal and business issues need to be taken seriously.



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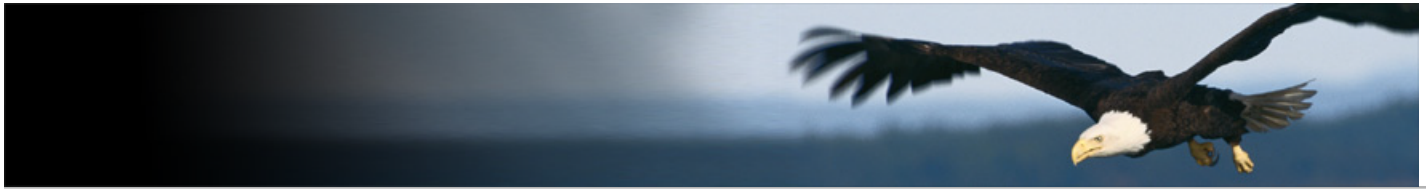
A Capsule Comparison of Open Source

- Pros
  - Costs less than comparable commercial products
  - Components are often created by subject matter experts
  - Multi-Platform availability
  - Popular components with wide community interest are often very stable products
  - Lends itself to rapid prototyping
- Cons
  - Components may lack commercial polish, with inadequate user documentation
  - Some effort may be required to become proficient in using the component
  - Components, although free, may include licensing agreements that are inappropriate for application integration
  - Integrating Open Source code creates Configuration Management, Quality Assurance and Liability concerns



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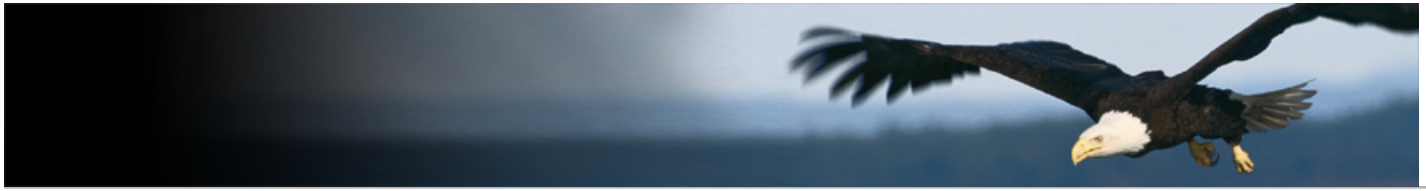
AEGIS Case Studies

- The Aegis Weapons System is the most sophisticated missile system the United States Navy has ever put to sea. It is an interconnected suite of computers interfaced to numerous sensors and devices throughout the ship.

- Recent Aegis baselines have focused on re-engineering the weapons system to take advantage of commercially available off-the-shelf (COTS) operating environments (OE).

- CSC has begun to leverage Open Source technology in the development of the "next-generation" software for AEGIS
  - Advanced Display Infrastructure (ADI)
  - Insight: Distributed Systems Management Toolset for Enterprises



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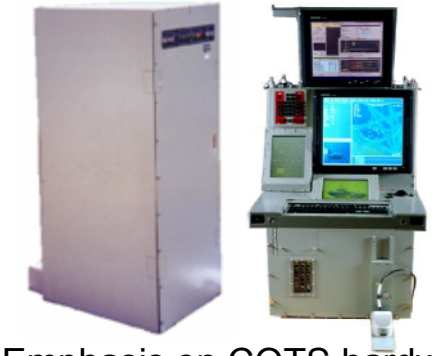
A Migration To Open Architecture

Proprietary Systems

Manufactured hardware and developed software

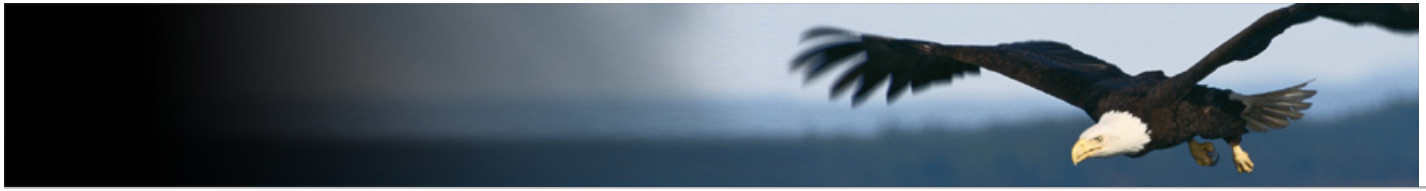
Open Systems



Emphasis on COTS hardware and software integration

Not Available **Limited Availability** **Readily Available**

Availability of Open Source Components



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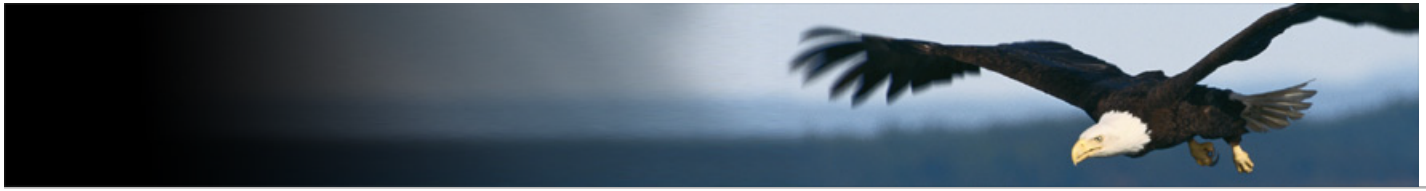
Applying Open Source Technology is an Organizational Effort

- Our Engineering Organization is tasked with the investigation and evaluation 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



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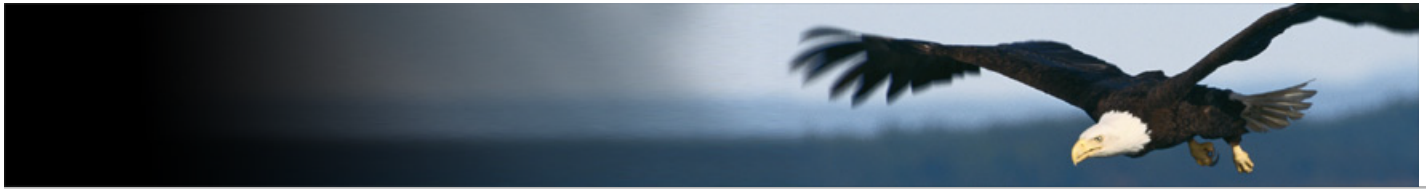
Adopting New Development Processes

- 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 review to determine its viability as a system component
  - 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



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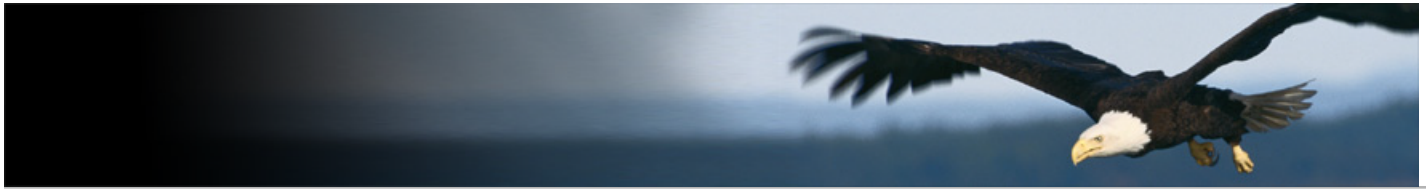
Adopting New Development Processes (cont.)

- 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
- Modification
  - Alterations to Open Source component due to locally encountered issues



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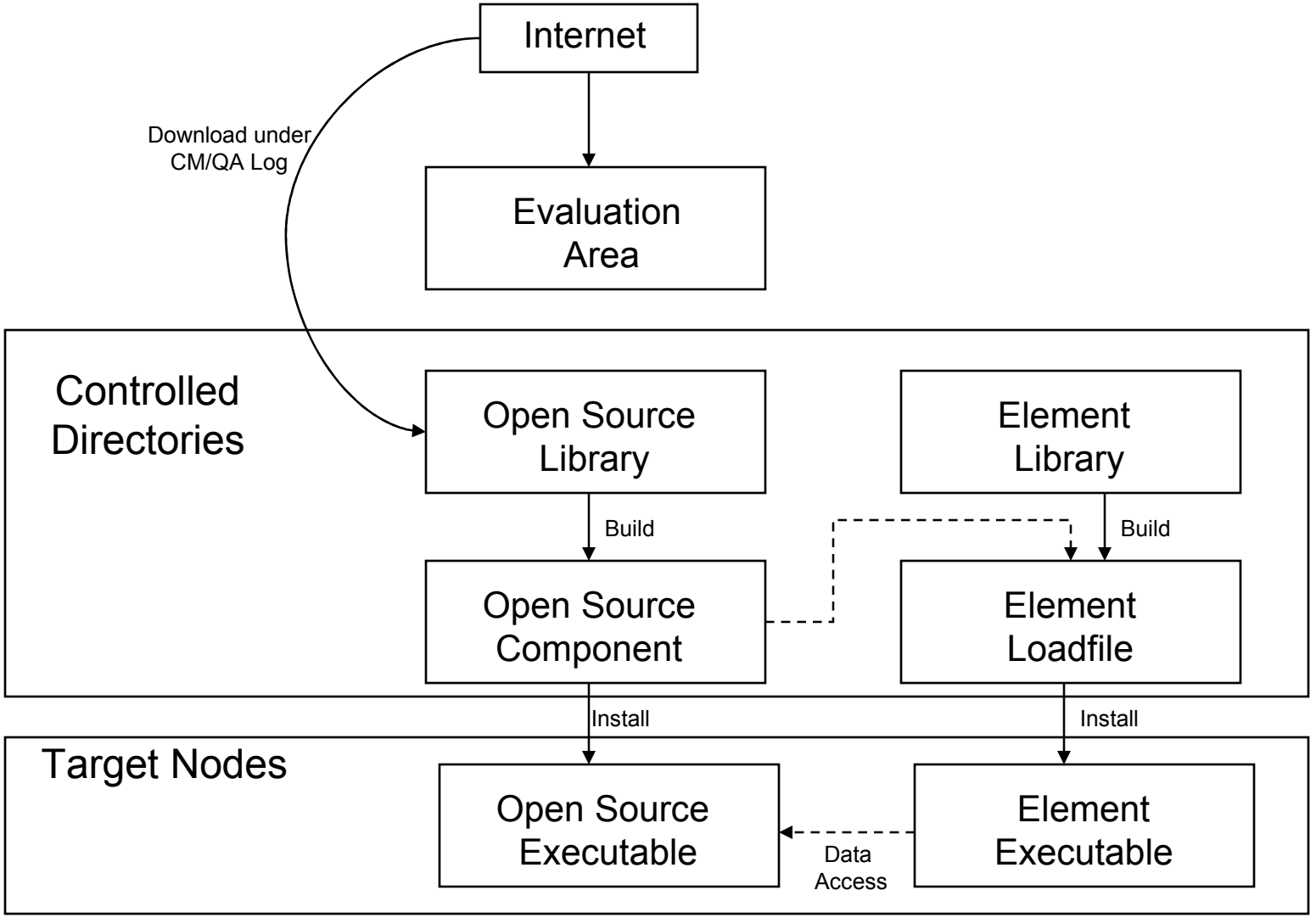
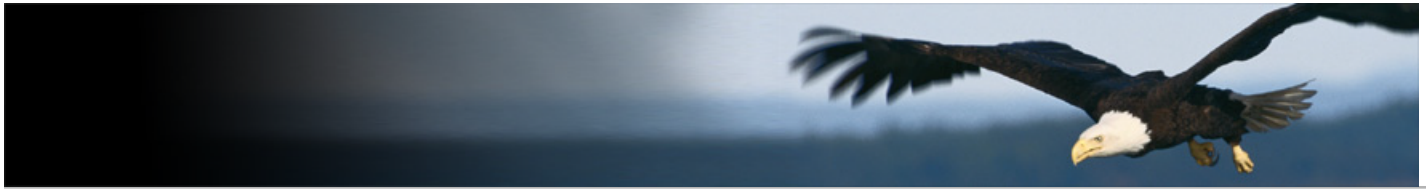
Open Source Life Cycle





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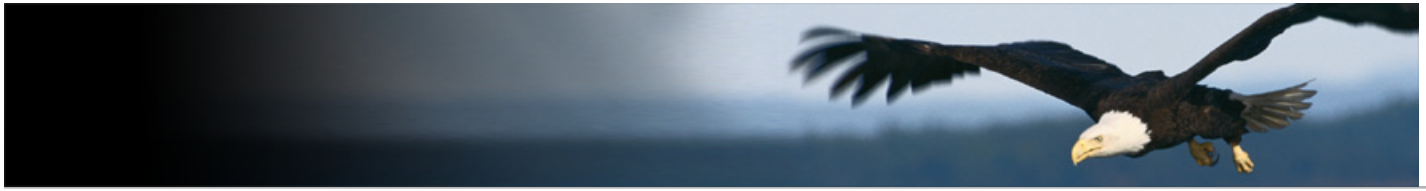
A Sampling of Open Source Components

- TCL/TK – a graphical user interface toolkit
- Expect – a tool for automating interactive applications
- XPM – X Pixmap library used to store color images
- DBG – a debug library
- LSOF – used to list open file descriptors
- Flex/Bison – a language parser
- ACE/TAO – CORBA compliant network services
- Mozilla – web browser
- TCPDUMP – captures network packets
- AIDE – verifies integrity of the filesystem
- Mantis – an issues tracking database
- GKrellM – system monitor



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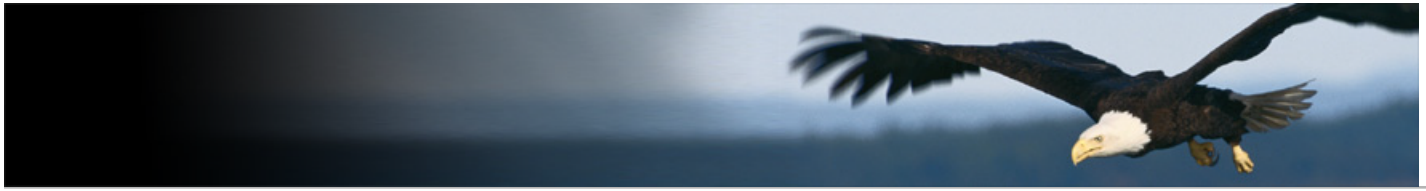
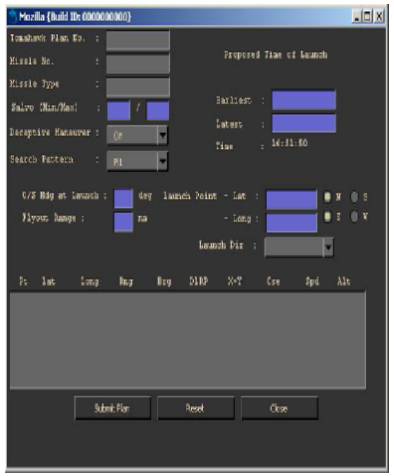
ADI (Advanced Display Infrastructure)



EXPERIENCE. RESULTS.

- Advanced Display Infrastructure (ADI) is a prototypical display application that CSC has developed to answer the question about what a tactical display application for the future should look like.
- ADI consists of a number of COTS, Open Source, and independently developed applications integrated together to form a complete display infrastructure for tactical and non-tactical operations.

Windows



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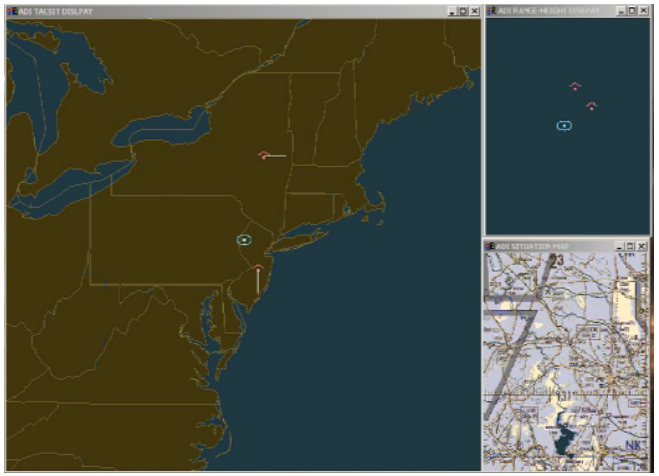
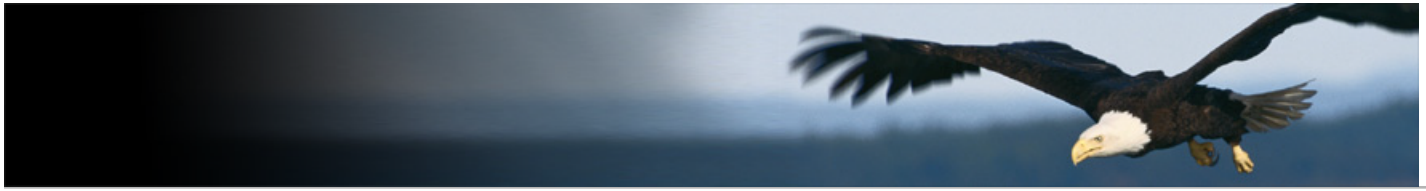


Video Stream

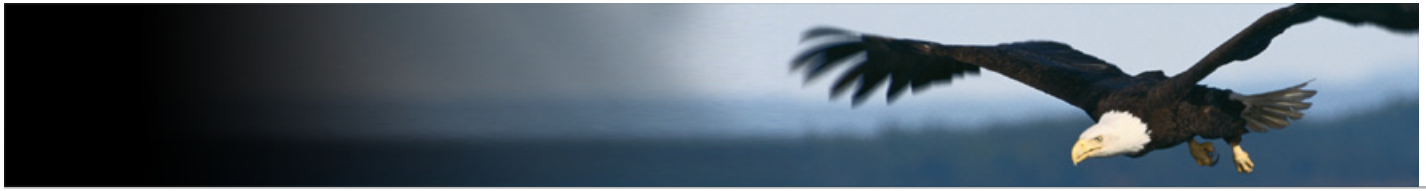


EXPERIENCE. RESULTS.

ADI – The Capabilities

- ADI Provides
  - A configurable, extensible and scalable framework for the development of display applications
  - A generic display subsystem for existing legacy applications
  - A tool for GUI/HSI prototyping that results in reusable project code
- Platform neutral
  - Based on open standards
- ADI uses
  - Open Source Software Solutions (Web Browser, OE infrastructure Abstraction)

ADI is CSC's solution to future display requirements, today. Display components are being delivered in the Aegis Open Architecture system.



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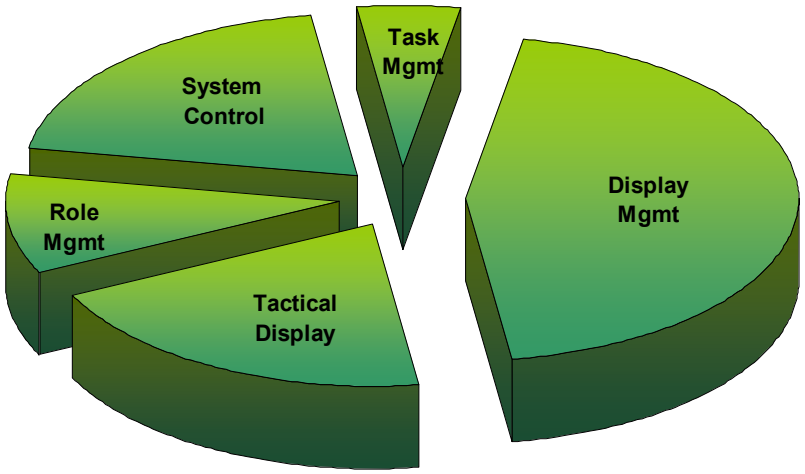
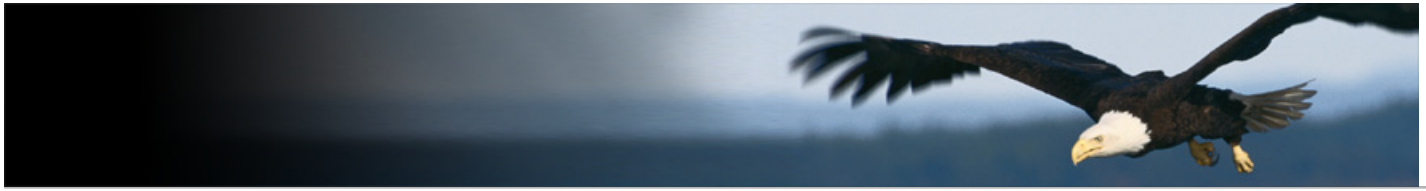
ADI Component Architecture and Open Source Utilization

- Display Management
  - Mozilla
  - Apache
  - XMLRPC-C
- Tactical Display
  - ACE/TAO
  - Commercial Product
- Task Management
  - ACE/TAO
- Role Management
  - ACE/TAO
- System Control
  - ACE/TAO





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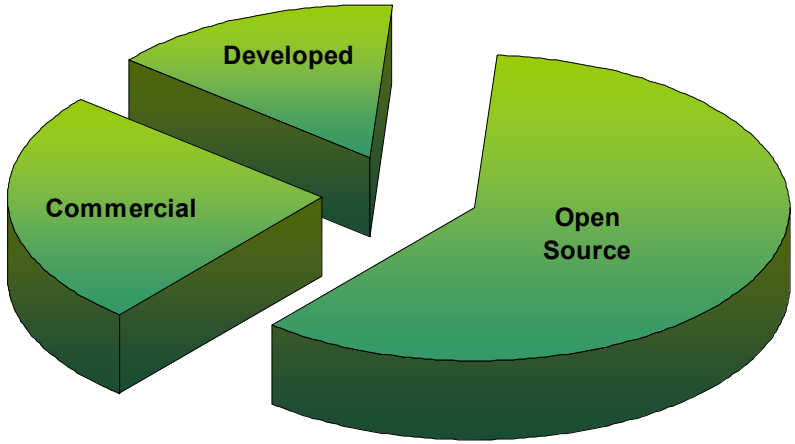
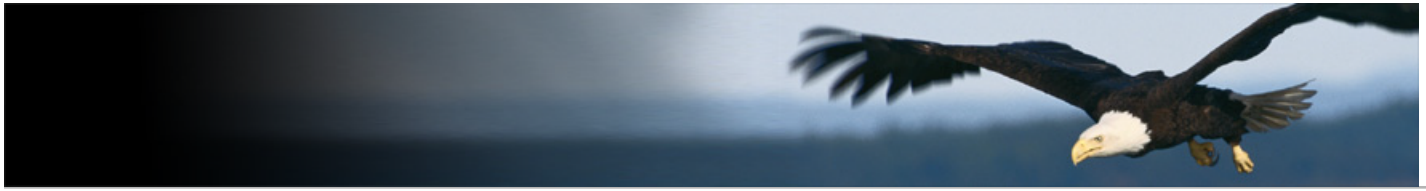
Extensive Use Of Open Source Technology

- Over 60% of ADI is comprised of Open Source software
  - Permits selection of “OA – compliant” components
  - Reduces development time
  - Leverages intellectual resources from the world wide development community

Functional Composition



Open Source is incorporated within every functional component of ADI.



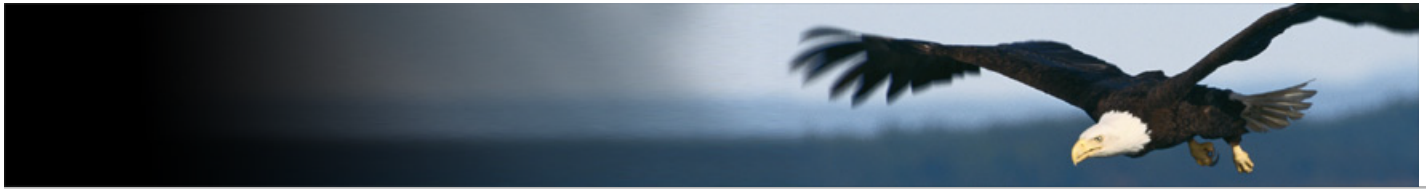
EXPERIENCE. RESULTS.

The Open Source Benefits For ADI

Sample cost and schedule for **Display Management**

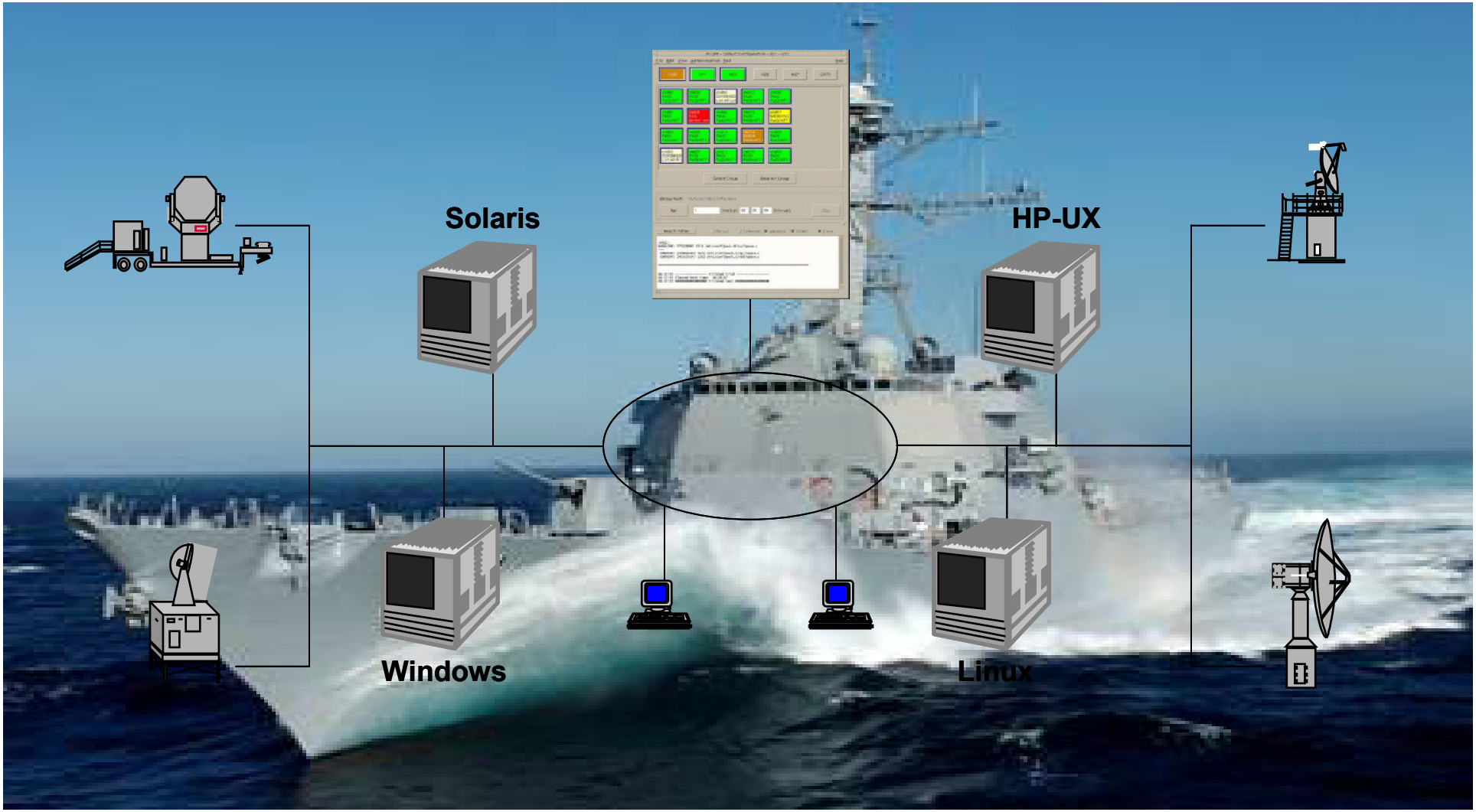
	Open Source Mozilla, XMLRP-C Apache, ACE	CSC Developed Display Manager
Source Lines	2,588,246	1,573
Development Cost	$103,585,139*	$62,951*
Effort	493 Staff-Years	3.6 Staff-Months

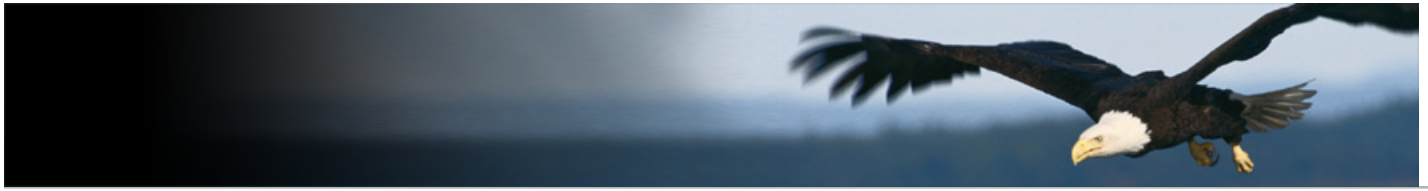
*Costing number derived from industry standard numbers as determined by the SLOCCount estimation tool. Refer to http://www.dwheeler.com/sloccount for details.



EXPERIENCE. RESULTS.

Insight: Distributed Systems Management Toolset





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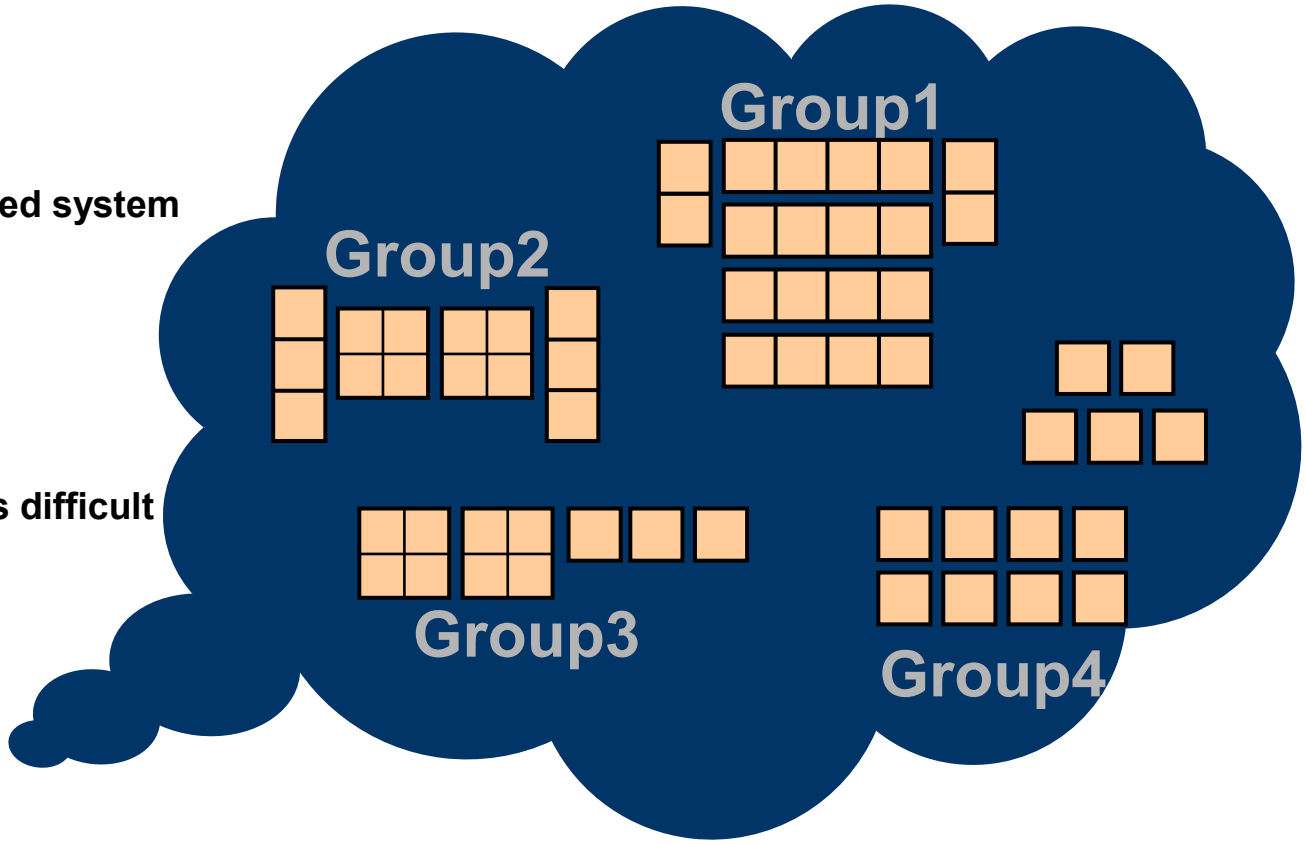
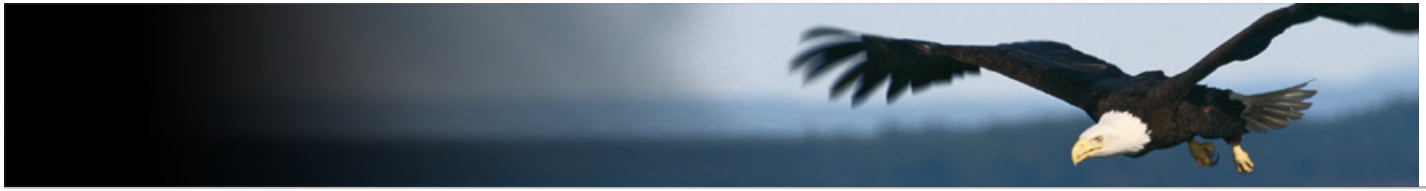
What is *Insight?*

- Aegis is a real-time distributed system
- Many proprietary interfaces
- Needed:
  - Configuration validation
  - Diagnostic capability
- An off-the-shelf solution was difficult



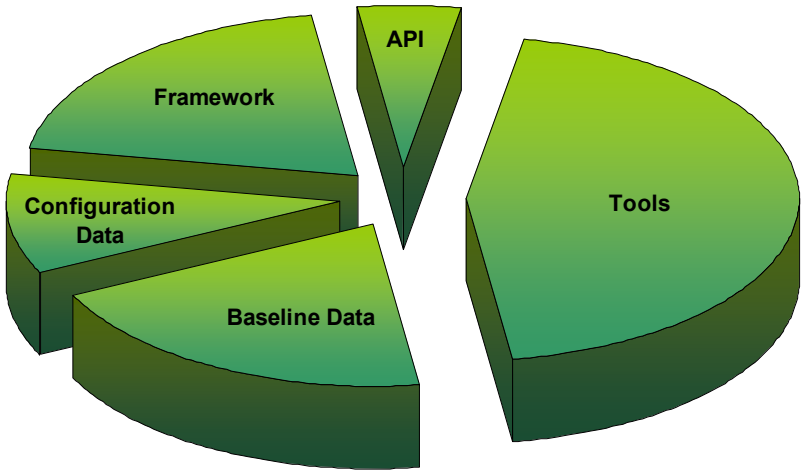
The goal of Insight is to let an operator at a single workstation assess the operational state of the heterogeneous equipment suite in real-time.

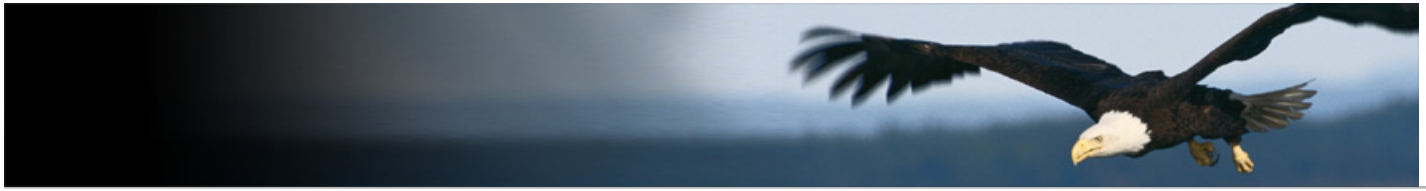


EXPERIENCE. RESULTS.

Insight Component Architecture and Open Source Utilization

- Framework
  - TCL/TK
  - Expect
  - XPM
  - DBG
- Tools
  - TCPDUMP
  - LSOF
  - AIDE
  - GKrellM
- Configuration Data
  - Flex/Bison
- API
  - DBG



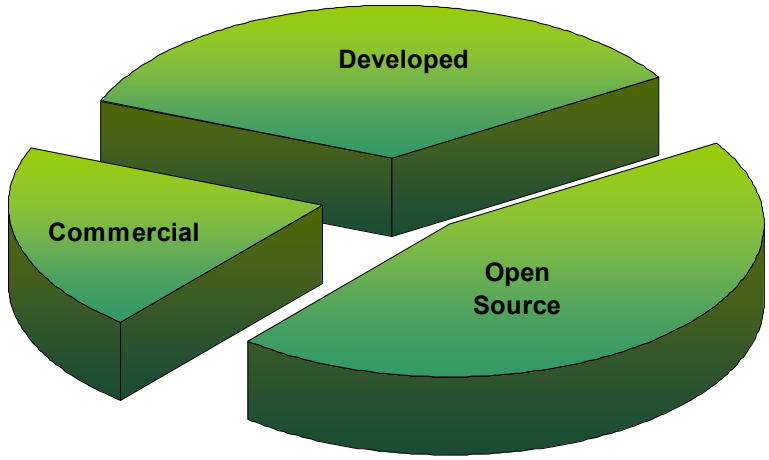


EXPERIENCE. RESULTS.

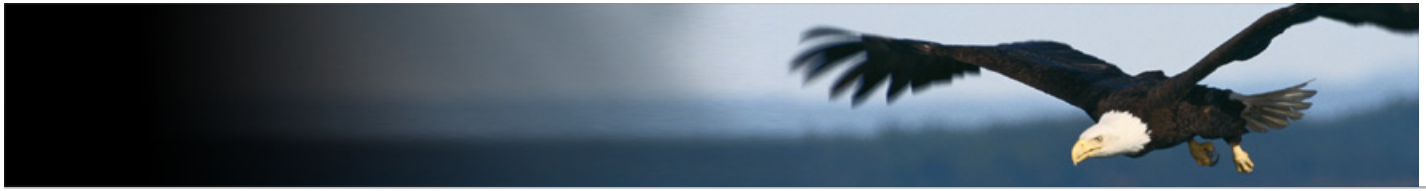
Extensive Use Of Open Source Technology

- Over 40% of Insight is comprised of Open Source software
  - Permits selection of cost effective, best-of-breed solutions
  - Reduces development time
  - Leverages intellectual resources from the world wide development community

Functional Composition



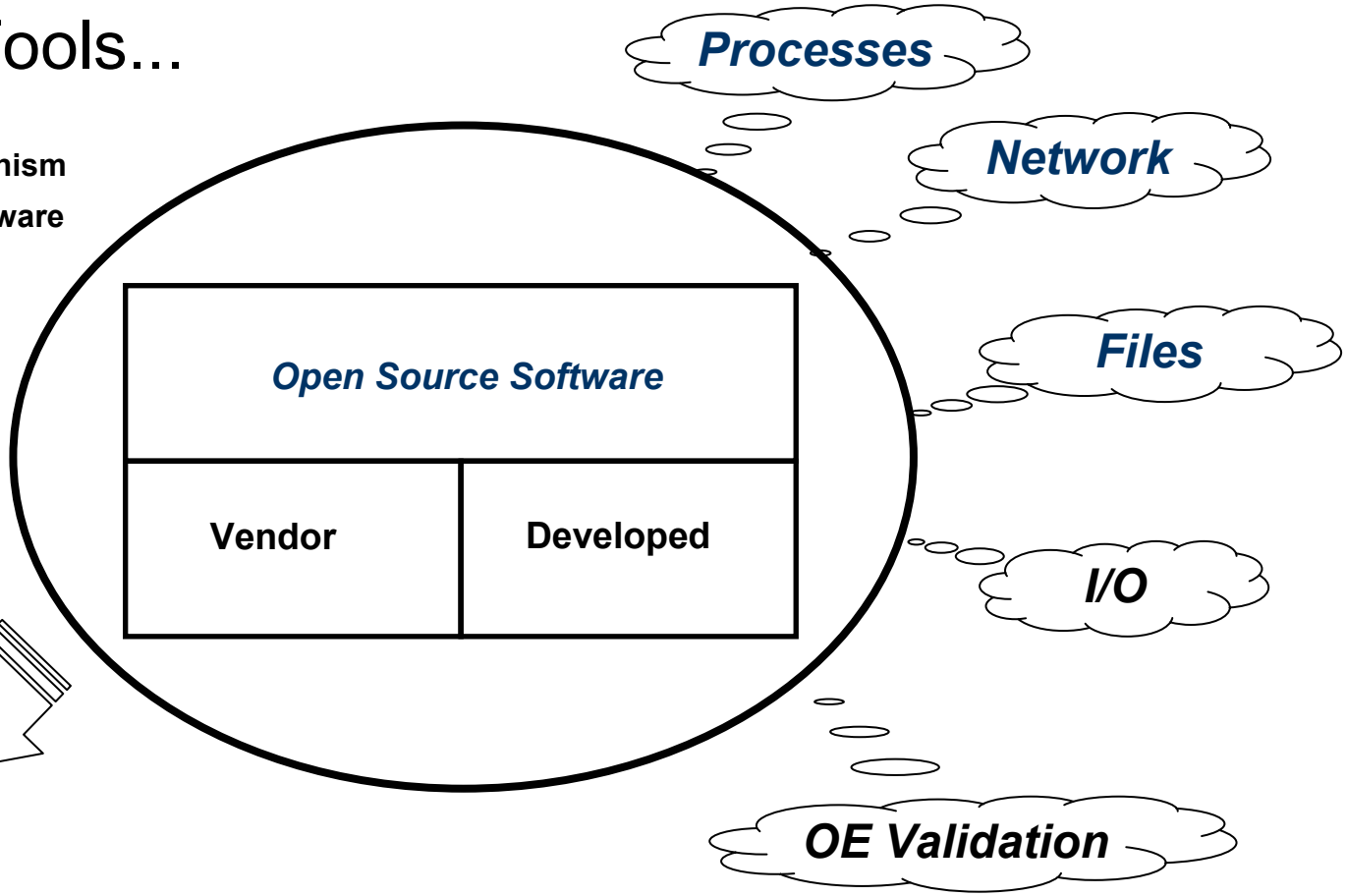
The Open Source community is our first choice for enhancing the functional capabilities of Insight.



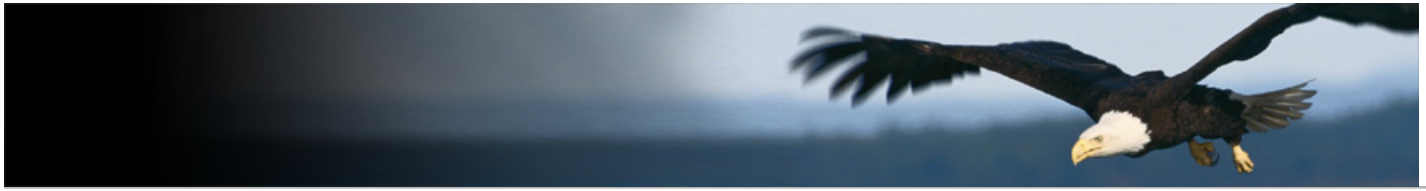
EXPERIENCE. RESULTS.

Tools, Tools, Tools...

- Platform for disparate tools
- Consistent launching mechanism
- Leveraged Open Source software
  - LSOF - Processes
  - TCPDUMP - Network
  - AIDE – File System
  - GKrellM – Monitor



Insight tools are a configurable collection of "best-of-breed" products and utilities to perform system management functions.



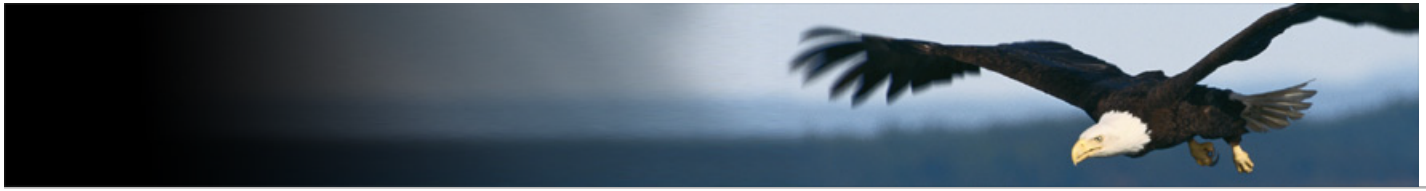
EXPERIENCE. RESULTS.

The Open Source Benefits For Insight

Sample cost and schedule

	Open Source		CSC 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.

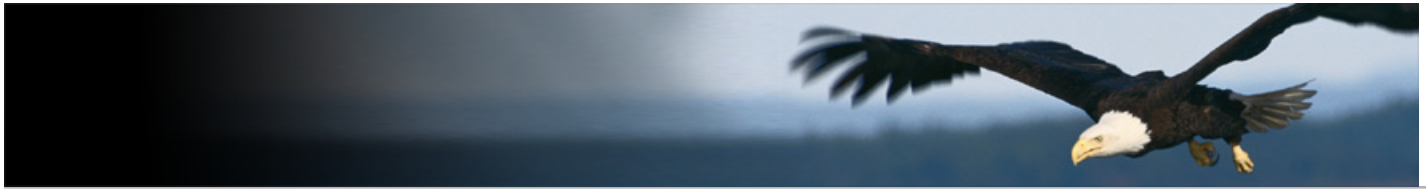


EXPERIENCE. RESULTS.

CSC's Roadmap to Open Source Technologies

- LEF (Leading Edge Forum) activities
  - "Open Source: Open for Business"
    - Research report on open source trends

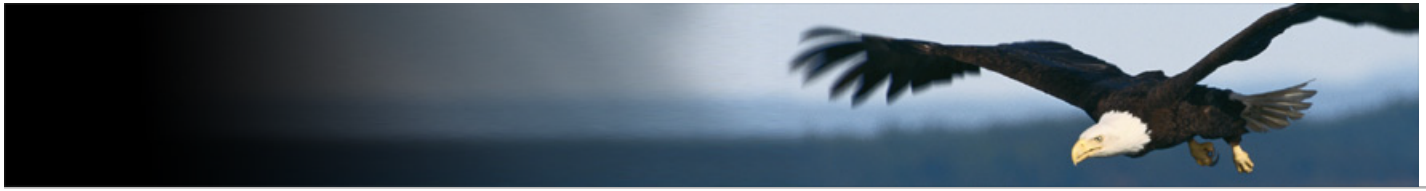
- Knowledge Community
  - Central repository of Open Source information
  - FAQ
  - Available corporate-wide, through the CSC web portal



EXPERIENCE. RESULTS.

Conclusion

- We successfully leveraged the use of Open Source components to deliver effective solutions for several projects.
  - Integration of approximately 2,600,000 lines of Open Source
  - Development cost savings in the millions of dollars
- Increased knowledge base from examining Open Source components generated by subject matter experts.
- Design and development activities are now focused on software evaluation and prototyping.
- Enhanced the process for Configuration Management and Quality Assurance.



EXPERIENCE. RESULTS.

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