Insight: Operability Testing for High Availability Systems

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CSC
EXPERIENCE. RESULTS.

Agenda

- Background

- System Management Overview

- Case Study: Insight

- The Benefits of Insight

The Aegis Weapons System

- Aegis is the world's premier naval surface defense system. It is capable of simultaneous operation defending against air, surface, subsurface and ballistic missile threats.

- There have been 7 major releases, known as baselines, in the nearly 4 decade history of Aegis.

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

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.
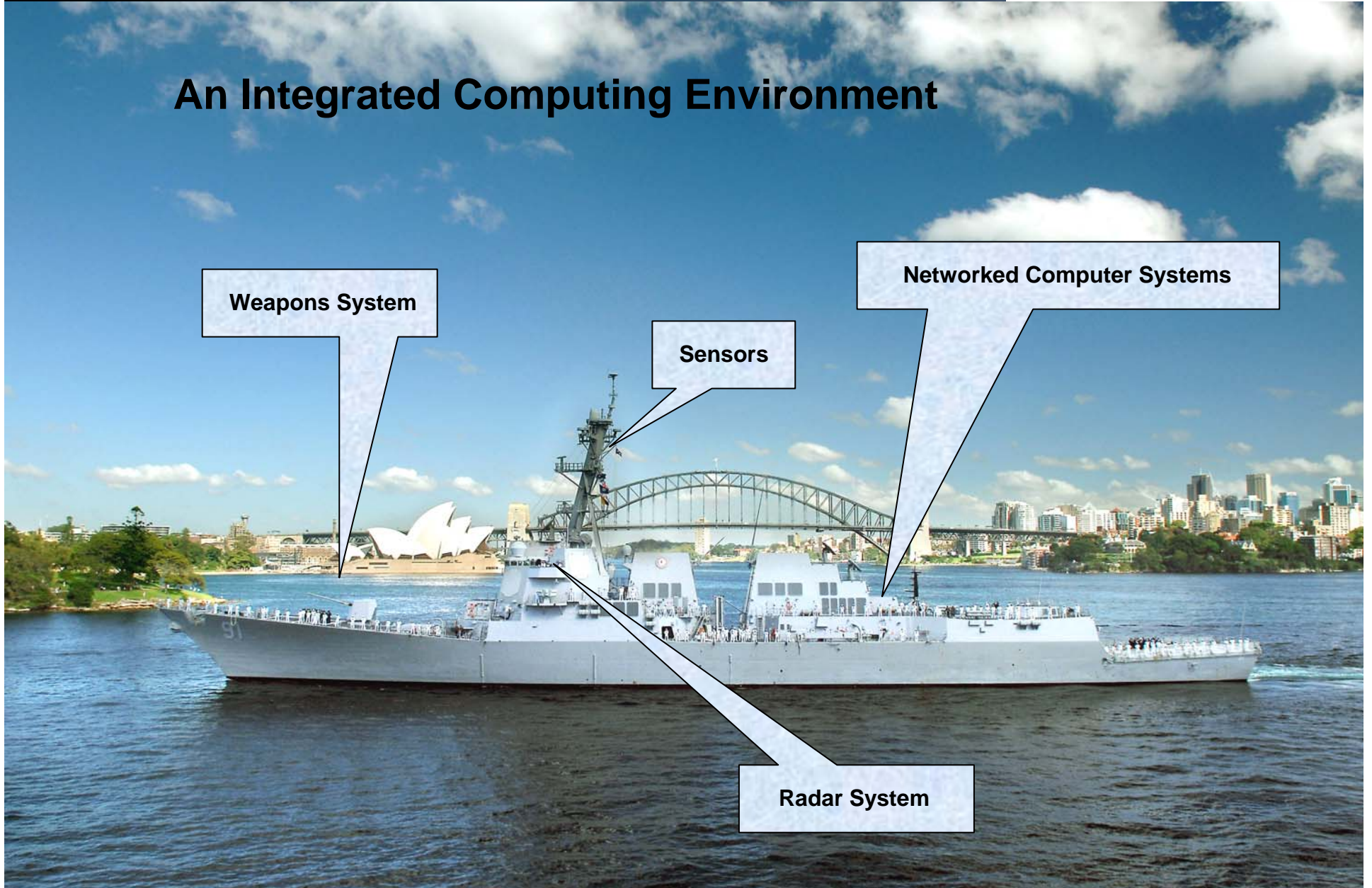
An Integrated Computing Environment

Weapons System

Sensors

Networked Computer Systems

Radar System

System Management Overview

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

Aegis System Management

- In the current baselines, System Management for the Aegis Weapons System is comprised of multiple components.

- Each component exists as a standalone entity.

- Together, they interoperate to provide an end-to-end solution for Operational Readiness Assessment of the combat system.
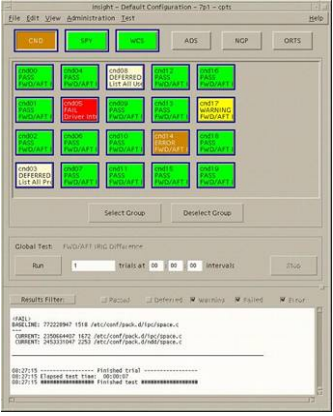
Insight is a key component for managing the operating environment of the Aegis Weapons System
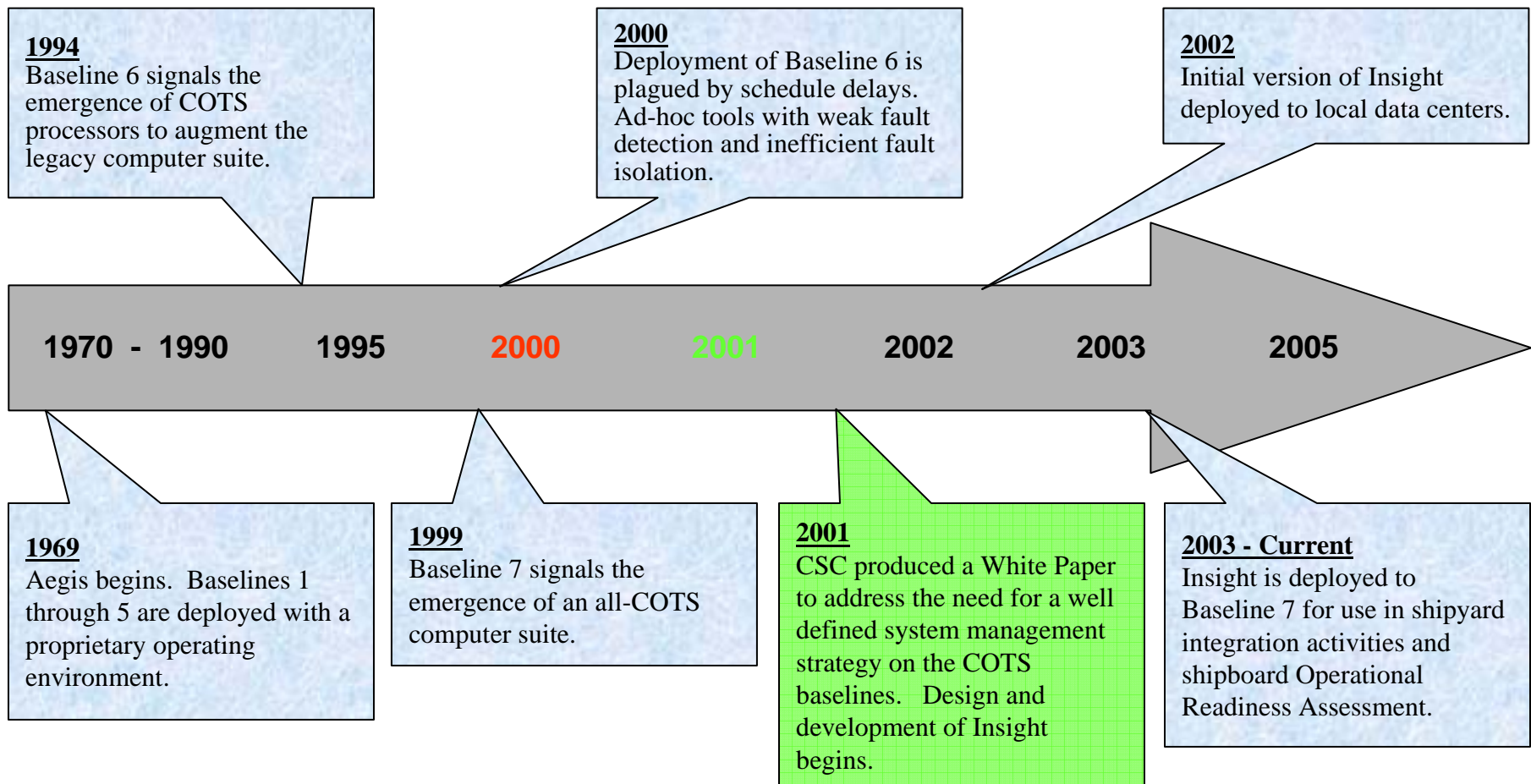
Case Study: Insight

What is Insight?

- An integrated computing system management toolkit.

- It is a highly configurable suite of open source, commercially available, and developed tools that perform system management functions across the enterprise.
    - Hardware and software diagnostics
    - Performance monitoring
    - Network management
    - System control
    - Validation and verification

# The Catalyst For Insight

1994
Baseline 6 signals the emergence of COTS processors to augment the legacy computer suite.

2000
Deployment of Baseline 6 is plagued by schedule delays. Ad-hoc tools with weak fault detection and inefficient fault isolation.

2002
Initial version of Insight deployed to local data centers.

1970 - 1990   1995   2000   2001   2002   2003   2005

1969
Aegis begins. Baselines 1 through 5 are deployed with a proprietary operating environment.

1999
Baseline 7 signals the emergence of an all-COTS computer suite.

2001
CSC produced a White Paper to address the need for a well defined system management strategy on the COTS baselines. Design and development of Insight begins.

2003 - Current
Insight is deployed to Baseline 7 for use in shipyard integration activities and shipboard Operational Readiness Assessment.

Insight Component Architecture

- Framework
  - Graphical User Interface, Network Services, and Remote Agents

- Tools
  - Configurable collection of "best-of-breed" products and utilities to perform system management functions

- Configuration Data
  - Easily tailors Insight to the needs of the open architecture enterprise being managed

- Baseline Data
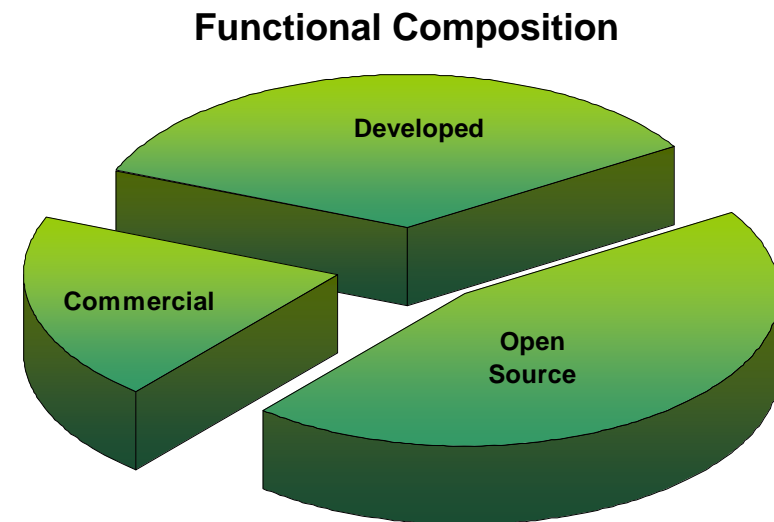 - Repository of expected OE configuration state information
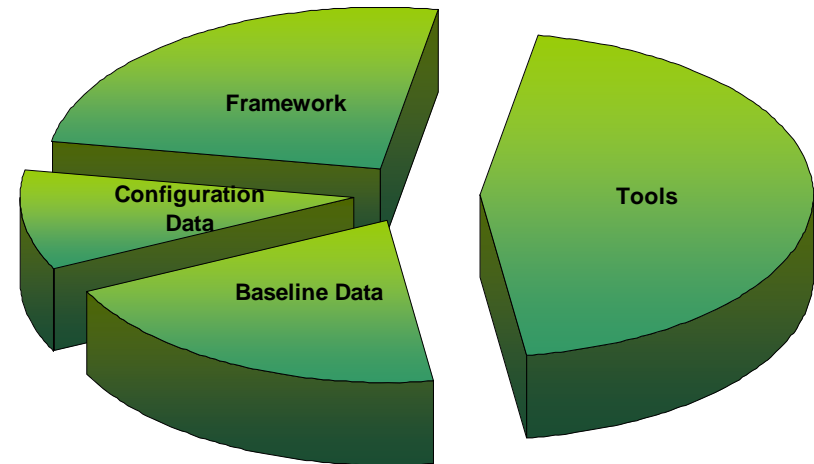
Extensive Use Of Open Source Technology

- 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

Capitalizing on Open Source saved approximately $1M in development costs

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- Assess health status of the applications
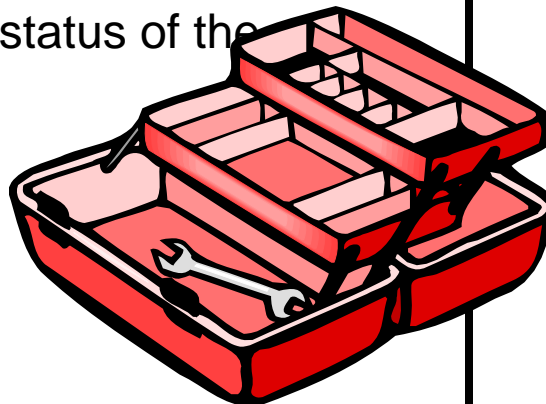
Insight's Toolkit

Equipment Management

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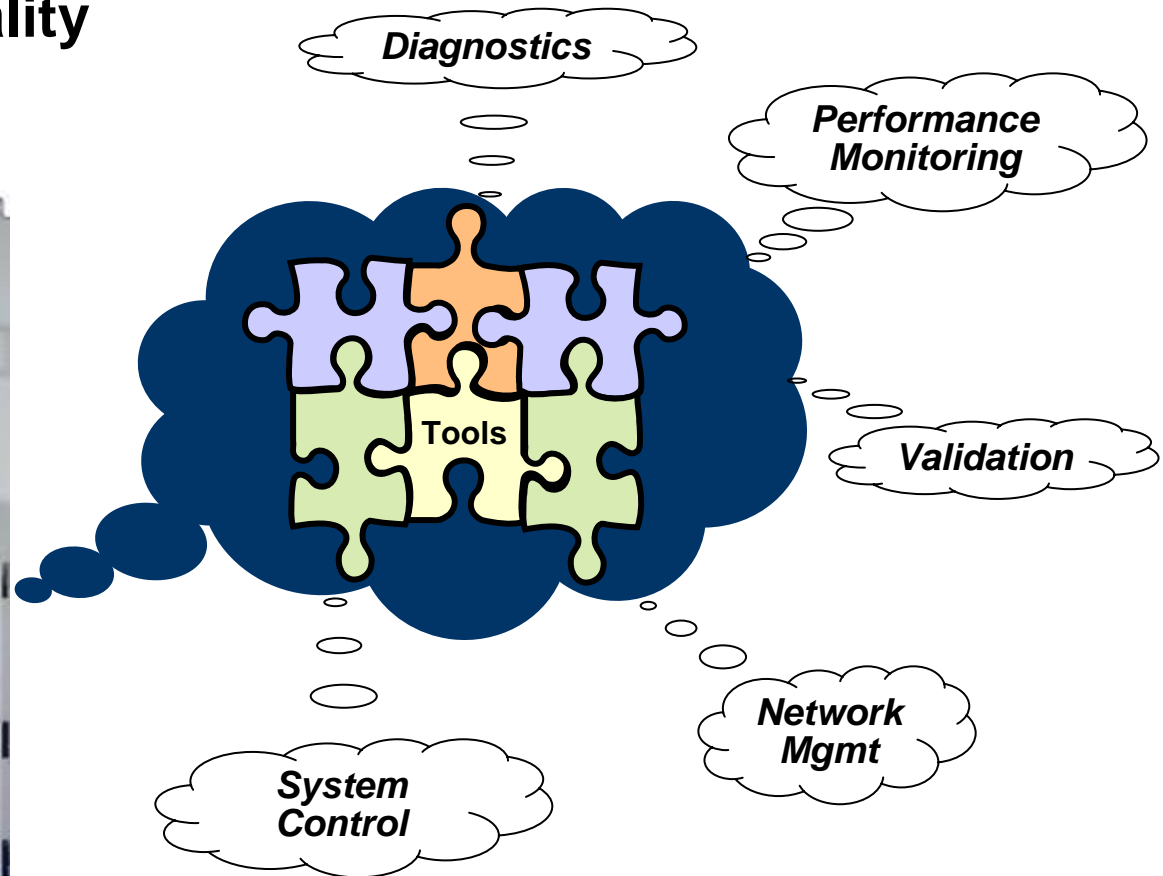
Fault Detection / Fault Isolation

Root Cause Analysis

Insight Functionality

- **On-demand Testing**
- **Runtime Monitoring**
- **Interactive Control**

Diagnostics

Performance Monitoring

Tools

Validation

Network Mgmt

System Control

Consistent Interface for Disparate Tools

- Standardizes test execution
- Hides tool variability from the user
- Provides common results

Solaris

HP

Linux

Insight standardizes the execution and results of each tool, regardless of platform or tool origin

Hardware and Software Diagnostics

- Fault Detection / Fault Isolation (FD/FI)

- Assess the operational state of hardware and software components
  - NTDS Devices
  - I/O Boards
  - Specialized Processors
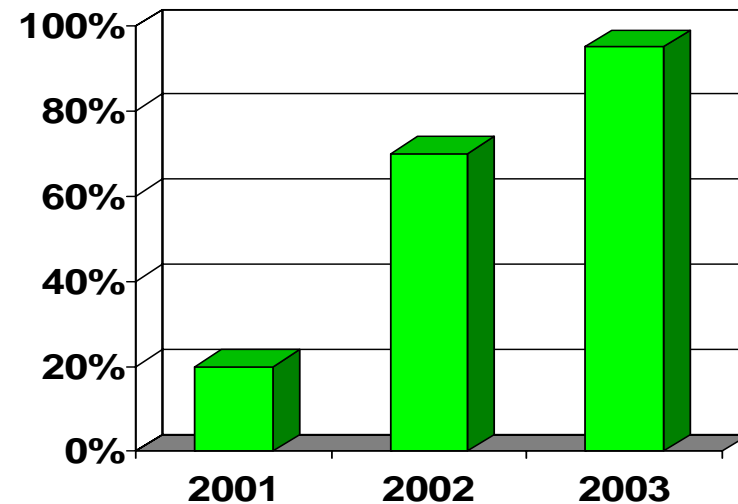 - Tactical Interfaces
  - Middleware Components

Increased Productivity

Integration Productivity Rate

The availability of Insight has increased the productivity rate to over 90% by providing rapid identification of operating environment issues.

	2001	2002	2003

Rapid Resolution = Increased Productivity = Significant Savings

Performance Monitoring

- Assess infrastructure performance under operational conditions
  - CPU utilization
  - Memory utilization
  - Process activities
  - Disk usage
  - I/O activity
  - Kernel-level trace

- Data is represented in real-time as well as archived for statistical representation

Insight assesses operational readiness of combat system components from a single console

Disk

Powermax

Solaris

Linux

HP-UX
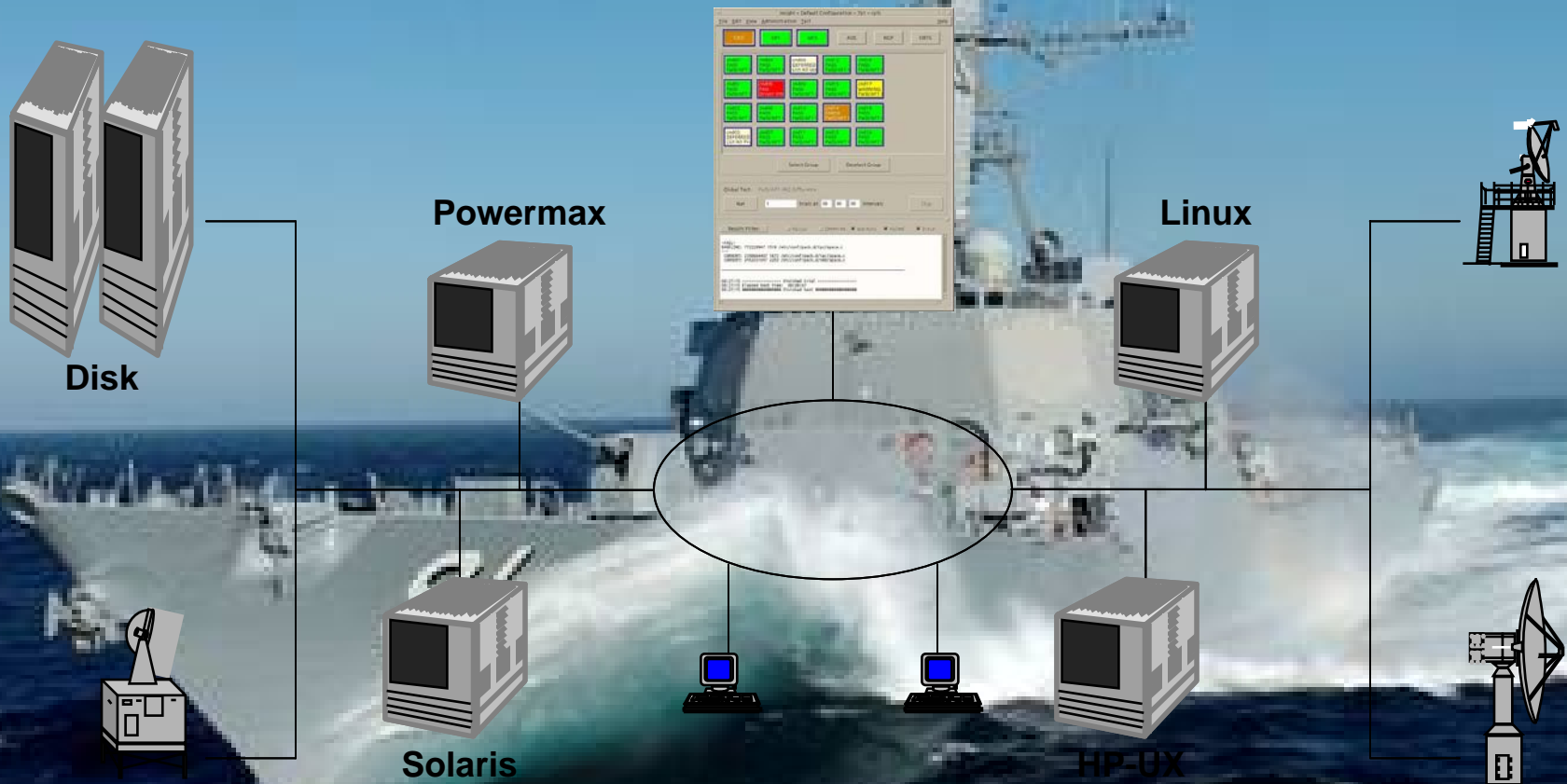
Validation and Verification

- System Operability Test

- Checks a number of Operating Environment configuration parameters to determine overall system operability
  - Configured Devices
  - Filesystem Integrity
  - Kernel Tunables
  - Network Tunables
  - Installed Packages
  - OS Version and Patches
  - Firmware

- Ensures that the current state of a host's OE is consistent with established baseline data

Automated Validation of the Operating Environment

Integration and Test Facility

=

Deployed System

**Insight ensures that the deployed configuration
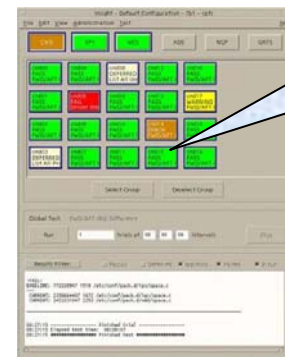is identical to the staged environment**

Automated System Validation: Months to Minutes

There are over 6000 configuration parameters on each node that are optimized for the application

Insight provides accurate validation for the entire computer suite within 3 minutes

Manual validation of the configuration for the entire computer suite would take nearly 4 staff months

Automated validation provides complete confidence in the deployed configuration and saves significant taxpayer dollars

Network Management

- Assess health status and performance of the local area network
  - LAN operability
  - Routes
  - Network utilization

System Control

- Manage the run-time state of the tactical applications
  - System Initialization
  - Shutdown
  - Reboot

Run-time state of the system can be monitored and controlled from a single console

Concept of Operations

- Insight is used throughout the life-cycle of the combat system.
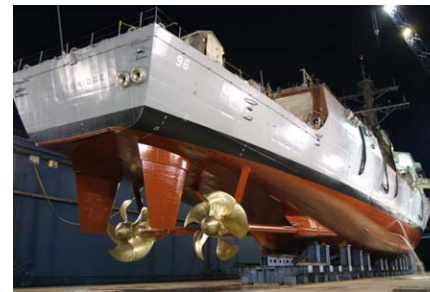
Development Data Center

Validation of the build environment

Staging and Test Facility

System validation, diagnostics, operability tests

Shipyard Integration

Deployed Systems

Runtime status monitoring, operability tests, diagnostics

Insight has become standard operating procedure for Aegis

Safety Checks

Insight's safety agent prevents intrusive functions during tactical operations.

The Benefits of Insight

A Vital Maintenance Solution for the Aegis Weapons System

Proprietary systems had an available toolset.

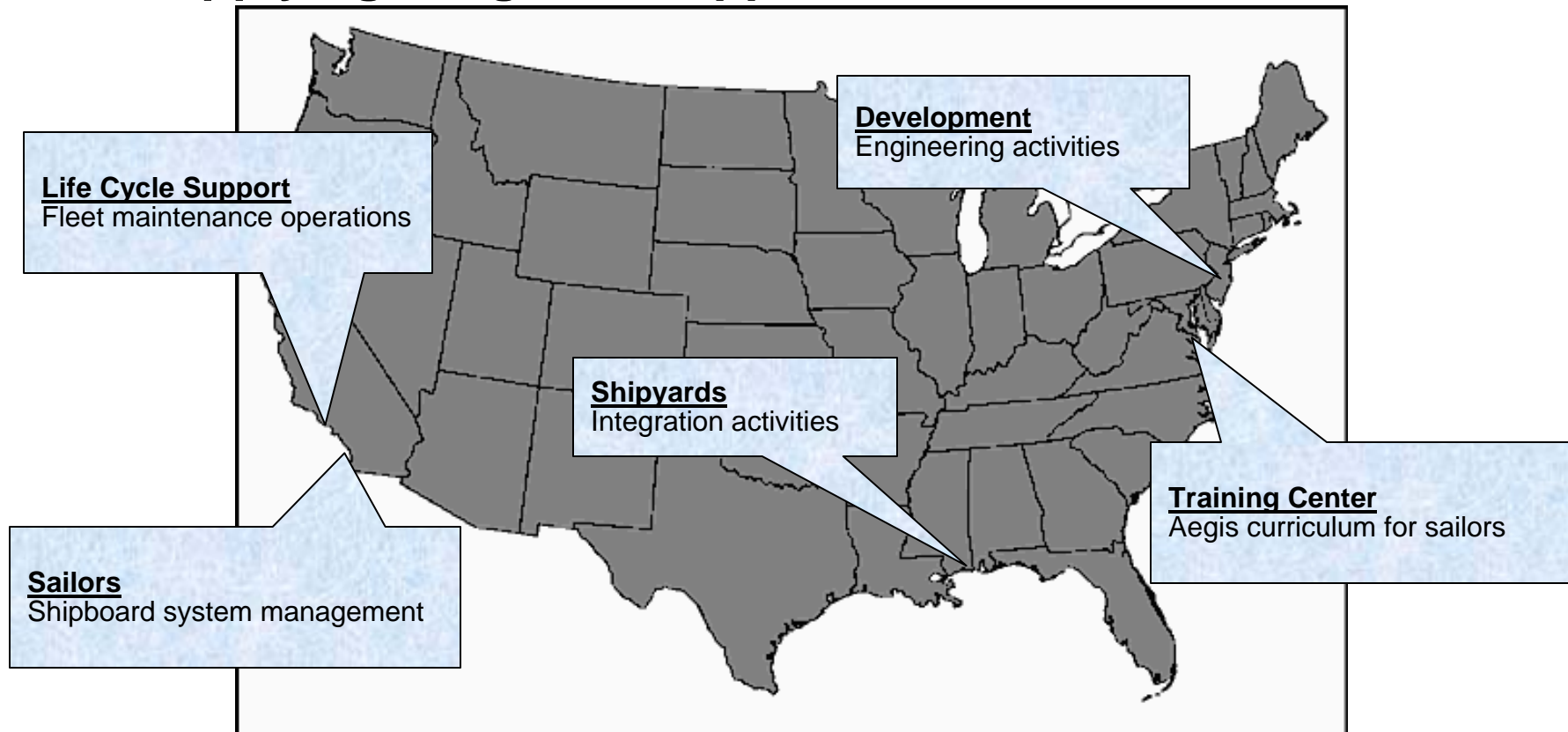Insight provides a robust toolset for COTS systems.

Applying Insight to Support Various Activities

Development
Engineering activities

Life Cycle Support
Fleet maintenance operations

Shipyards
Integration activities

Training Center
Aegis curriculum for sailors

Sailors
Shipboard system management

Insight is a key component for Aegis System Management

Enhanced Operational Readiness

Dispatching engineers to troubleshoot shipboard issues:

$75K

Delaying a missile test due to system instability:

$1M

Meeting deployment schedules and increasing credibility with your customer:

Priceless

Insight is playing a vital role ensuring that ships are deployed on schedule for immediate use in various theatres of operation

"Innovation: Delivered"

- **Deployed for 3 ½ years**
- **Multiple Baselines**
- **Domestic and Foreign Test Sites**
- **Domestic and Foreign War Ships**
- **Certified for Tactical Operations**

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