



Creating Test Efficiencies in Enterprise Systems

Presenter:

Megan Jais

Army Test and Evaluation Command





Agenda

- Introduction
- Defining Enterprise Resource Planning (ERP) Systems
- Challenges
- Methodologies and Tools



Introduction

The reliability evaluation of enterprise resource planning (ERP) systems is fairly recent in the Army acquisition world

The expectation to operate globally results in relatively high reliability, availability, and maintainability (RAM) requirements

- Necessitates longer test durations to demonstrate requirements with high confidence IAW DA PAM 73-1

High requirement → longer test → higher cost

What tools and methodologies can be used to create RAM test efficiencies for enterprise systems?





What is an ERP System?

- Automated information system that integrates all departments and functions across a company into a **single, integrated, centralized database** software suite that will serve all the different departments' needs
- Utilized within the Department of Defense (DoD) to:
 - Simplify business operations
 - Optimize processes
 - Maximize efficient financial and logistics management capabilities
- Designated as Major Automated Information Systems (MAIS) under DoD acquisition process





Challenges

- Numerically high reliability requirement will necessitate longer test duration to demonstrate the reliability with high confidence IAW DA PAM 73-1
- Material developers are largely schedule and cost driven
- Shortfall in the number of operating hours can:
 - Result in a very high risk test
 - Low probability of meeting the requirement
 - Inability to determine if RAM requirements were demonstrated
 - Prohibit/delay acquisition milestones
 - Prohibit/delay fielding decisions





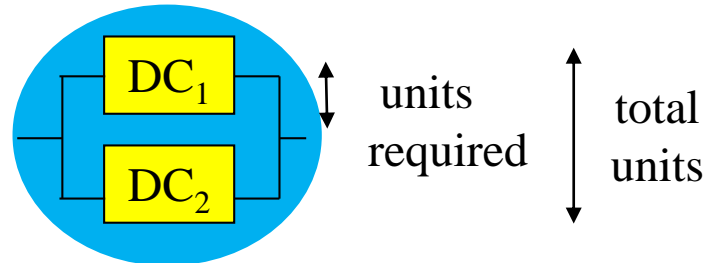
Additional RAM T&E Methodologies and Data Sources for ERP Systems

- Active Redundancy
- Automated Data Sources
- Operational Monitoring (OM) & Continuous Monitoring (CM)



Active Redundancy

- ERP system consists of two (or more) identical actively redundant data centers (DC).
 - Normally, both data centers operate at 50% capacity. However, if one becomes non mission capable, the other operates seamlessly at 100% capacity, and no capability is lost .

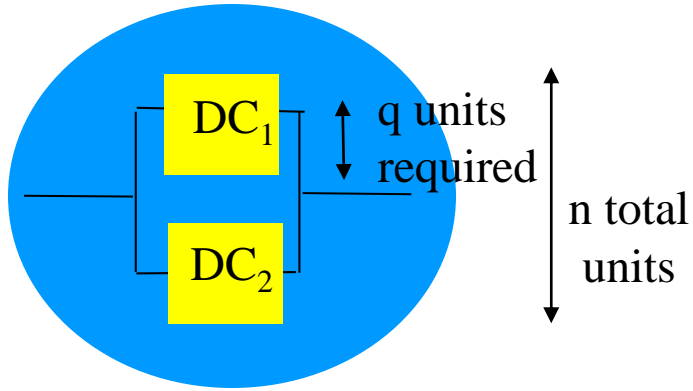


- Each DC will have a lower reliability requirement than the overall system level reliability requirement.

→ lower requirement → shorter test → less cost



Example of Active Redundancy



Simplified View – TTS System

- Tactical Training System (TTS) is an ERP system that consists of two actively redundant DCs
- Planned 14 day (approximately **336 hours**) test time is **not adequate** to demonstrate the derived Mean Time Between Outages (MTBO) **requirement of 672 hours** with high confidence **at the system level**

Assumptions for Evaluation:

1. Assumes identical repair rates (μ) and failure rates (λ)
2. TTS consists of two *actively redundant* data centers, denoted by n ($n=2$)
3. System needs at least one of two DCs to perform sufficiently, denoted as $(n-q)$ out of n required for success; q ($q=1$) is the number of units allowed to fail without causing a system failure
4. Three states possible:
 - a. Both data centers are up \rightarrow TTS fully mission capable
 - b. One data center is up, one server is down \rightarrow TTS fully mission capable
 - c. Both data centers down for any period of time \rightarrow TTS non-mission capable, and a system level **outage** is the result

$$\lambda_{\frac{(n-q)}{n}} = \frac{n!(\lambda)^{q+1}}{(n-q-1)!(u)^q}$$

Active Redundancy Equation





Example of Active Redundancy (Continued)

Reliability Evaluation Plan

Primary: Demonstrate the system-level MTBO (direct observation of the dual server configuration)

– 1082 minimum hours (**45 day test**)

Secondary: DC level data IAW the active redundancy equation to estimate system-level (dual data center configuration) MTBO

– 153 minimum hours (**7 day test**)

Limitations

1. Latent failures (failures that may not occur until the system has operated in the field for a certain amount of time) may not have a chance to surface
 - Increased consumer risk
2. The confidence bounds of the system's requirement are unknown with 80% confidence when using active redundancy equations. As a result, an approximation can only be generated

Each DC needs to have a MTBO ≥ 95 hrs to interpolate that the system level requirement (dual server configuration) would be met

The use of active redundancy is a *second best* option when demonstrating the requirement outright is not possible



Automated Data Sources

- Server and maintenance logs and help desk tickets (HDTs) provide continuous and automated monitoring of servers to track failure and maintenance data
 - During the test
 - Automated data collection decreases or replaces manual data collectors during test events
 - **Reduces test costs**
 - Before/After the Test
 - Can be used in combination with continuous and operational monitoring to capture reliability data prior/after the test to gain additional operating hours and any associated failure data
- The use of these data sources must be agreed upon by the T&E community prior to the test
 - Evaluator must have a clear understanding of how to read and interpret these data sources





Automated Data Source Example: Help Desk Tickets (HDTs)

Impact Code	Create Date/ Time	Resolved Date/ Time	Help Desk Ticket#	Status	Summary	Details	Resolution	HD Category
3 : Medium	3/1/2013 1653	3/10/2013 1003	HD497	Resolved	System Freezes while hitting a drop down box	I am currently still having issues with the main menu. When I click on a drop down box or a tab the system will freeze. This occurs on all transactions.	After researching issue, the Garrison System Administrator was able to back out the incompatible version of Java and install the current client version. I instructed the user to back out future pushes of the incompatible version until we can push an updated compatible version of Java out.	TIER_3_Help_Desk - Functionality
1 : Critical	3/14/2013 0826		HD369	Work in Progress	Portal is down, no portal access.	Portal is down, no portal access	Network infrastructure in data center. Problem report to be attached.	TIER_2_Help_Desk - Functionality

- HDT are reviewed by a help desk representative
 - Provide additional information from subject matter experts that test incident reports may lack
- Range from descriptions of failures to:
 - Requests for account access
 - Training issues
 - Roles and permissions
 - User complaints/suggested enhancements

Useful for evaluating **reliability** and **identifying failure modes**





Automated Data Source Example: Server Logs

Yr	Mo			Begin	End	Diff	Min	Component	System	Was it Scheduled?	Reason
Jul-05	August	Wed	8/31/2011	18:05	18:24	0:19	19	GHTY9048547	P	Y	CR# 9899 - Oracle Bug 6990306: drain_asyncs and putapage hang was applied to plmm40001103
Jul-05	August	Wed	8/31/2011	19:22	19:39	0:17	17	GHTY8573625	P	Y	CR# 9899 - Oracle Bug 6990306: drain_asyncs and putapage hang was applied to plmm40001203
Jul-05	September	Thu	9/1/2011								
2011	September	Fri	9/2/2011								
2011	September	Sat	9/3/2011	11:45	13:14	1:29	89	VG5YX	VGO9	N	Application outage. Noticed during a morning check of the MDM systems. MDM was bounced, then Portal was bounced to correct the problem.
2011	September	Sun	9/4/2011	11:00	12:25	1:25	85	WY7CI	WY7	N	DB bug - Deadlock in the database on WY7 required DB bounce. Bug fix required for page hang. Will be fixed by CR #879 which puts in patch.
2011	September	Mon	9/5/2011								
2011	September	Tue	9/6/2011								
2011	September	Wed	9/7/2011								
2011	September	Thu	9/8/2011	9:16	14:18	5:02	302	AM5YI	AM8	Y	Slow/not 100%. AM8 unavailable. AM8 repositories had to be reloaded. AM8 had to be bounced.
2011	September	Thu	9/8/2011	10:09	10:35	0:26	26	AM5YI	AM8	Y	Slow/not 100%. MDM wasn't completely accessible. AM8 was bounced and then the MDM repositories were reloaded.
2011	September	Thu	9/8/2011	10:35	11:48	1:13	71	VG5YX	VGO9	Y	Portal bounce to reconnect MDM repositories to Portal, as a result of the error above.
2011	September	Fri	9/9/2011								
2011	September	Sat	9/10/2011								
2011	September	Sun	9/11/2011								
2011	September	Mon	9/12/2011	19:00	21:00	2:00	120	AM2CI	AM2	Y	CR159: customer - Blank country code
2011	September	Mon	9/12/2011	19:00	21:00	2:00	120	AM2CI	AM2	Y	CR629: customer - Blank country code
2011	September	Mon	9/12/2011	19:00	21:00	2:00	120	AM2CI	AE2	Y	CR 125: CR-E-LOG CVS Increase Query Capability

Continuously monitor and record any instance when a change (both scheduled and unscheduled) is made to the server's software

Server logs can be customized to provide necessary data fields

- Evaluator must work with developer to communicate data needs and understand logs

Useful for evaluating **availability** and **maintainability**





Automated Data Source Example: Maintenance Logs

Start Date	Start Time	End Date	End Time	Name	System ID	Impact Code	Impact	Change #	Change Description
09/15/2011	21:00	09/15/2011	21:30	cvm342	P14	5	This is a system in the backup datacenter. No end user impact.	CHCD.8596	Implement Security Patch for databases to meet Oracle IAVA requirements.
09/15/2011	21:00	09/15/2011	21:30	cvm333	P14	5	End users not affected	CHCD.8574	Due to the increased end user load, we need to increase cvbnm333.
09/15/2011	21:00	09/15/2011	21:30	cvm356	P14	2	All interactive / transactional users are affected	CHCD.8963	Install patch version 556.9

Record all scheduled and unscheduled maintenance actions performed on the system

- Software patches, configuration changes, and code repairs all require documentation and approval, resulting in a paper trail of all maintenance actions

Maintenance logs can be formatted to correlate an availability impact code to each server downtime occurrence

Useful for evaluating **availability** and **maintainability**





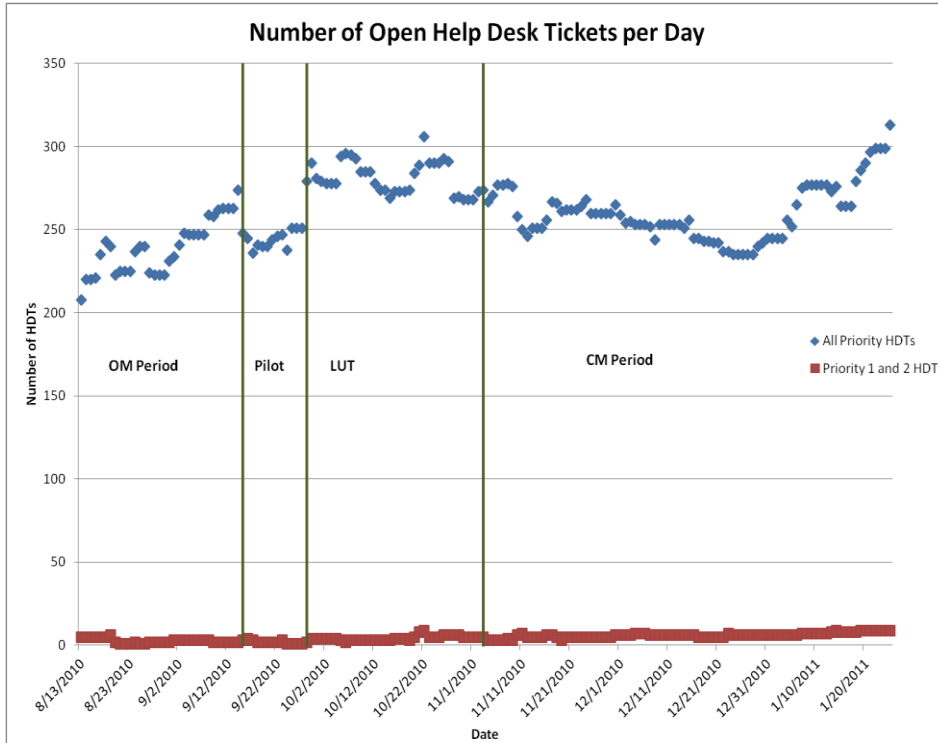
Operational Monitoring (OM) & Continuous Monitoring (CM)

- Uses the time when the server is completely configured and up and running prior to (OM) or after (CM) the actual test to gain additional operating hours and any associated failure data
 - OM:
 - “Go live” occurs weeks prior to the start of record test for training and interoperability purposes
 - Configuration must remain constant between OM and record test
 - CM:
 - ERP system remains in use by test participants for real-time missions after record test period has ended
 - Help Desk remains up and running
- Server logs, maintenance logs, and HD tickets can be used to evaluate server reliability during OM & CM
- No guarantee that the data from OM or CM can be aggregated with Record Test data; comparison tests, trend tests, and goodness-of-fit tests should be applied to determine feasibility of that effort



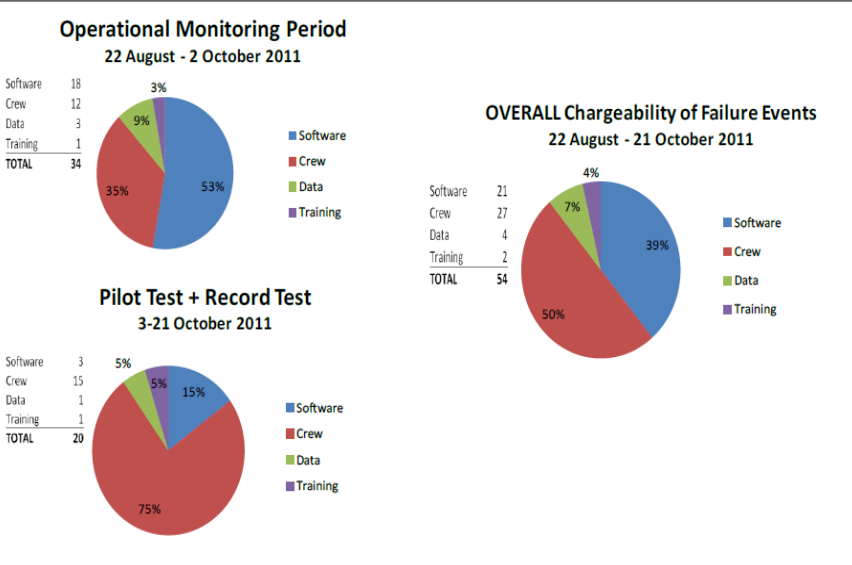


Examples of Products using CM & OM



The total number of open Priority 1 & 2 HDTs remained below 10 per day, which suggests that the failure rate has remained stable throughout the August-January time frame, despite software changes and fluctuations in the quantity of users

CM & OM allow the evaluator to track the occurrence of help desk tickets over time, monitor trends in reliability failures, and observe the effects of system upgrades



During OM, users receive over-the-shoulder (OTS) training; once OTS training ceased at the start of Pilot Test, crew/operator errors increased significantly, indicating that OTS training period may need to be increased



Summary

- ERP systems often have high RAM requirements which necessitate long tests
- Several methodologies can be used to gain additional operating hours and failure data without increasing test duration or cost
 - Active Redundancy
 - Reduces test time by evaluating the data centers in parallel rather than a dual configuration
 - Should be used as a secondary evaluation methodology when full testing of requirement is not possible
 - Automated Data Sources
 - Automated data collection process can replace the need to hire data collectors
 - It is critical that the evaluator work with the materiel developer to have an adequate understanding of how to read and interpret these logs
 - Operational & Continuous Monitoring
 - Uses the time when the server is completely configured and up and running prior to (OM) or after (CM) the actual test to gain additional reliability data
 - Not a guarantee that the data from OM or CM can be aggregated with Record Test data; comparison, trend, and goodness-of-fit tests should be applied

