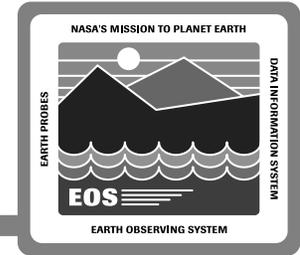


Integration and Test (I&T)

Les Wheeler

19 January 1995

Introduction

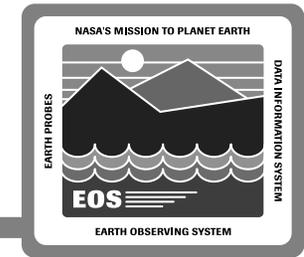


Integration and Test (I&T)
Segment Release & Development Plan
Lines-of-code estimates

Les Wheeler
Randy Dalnekoff
Randy Dalnekoff

I&T Approach

Build Thread Methodology



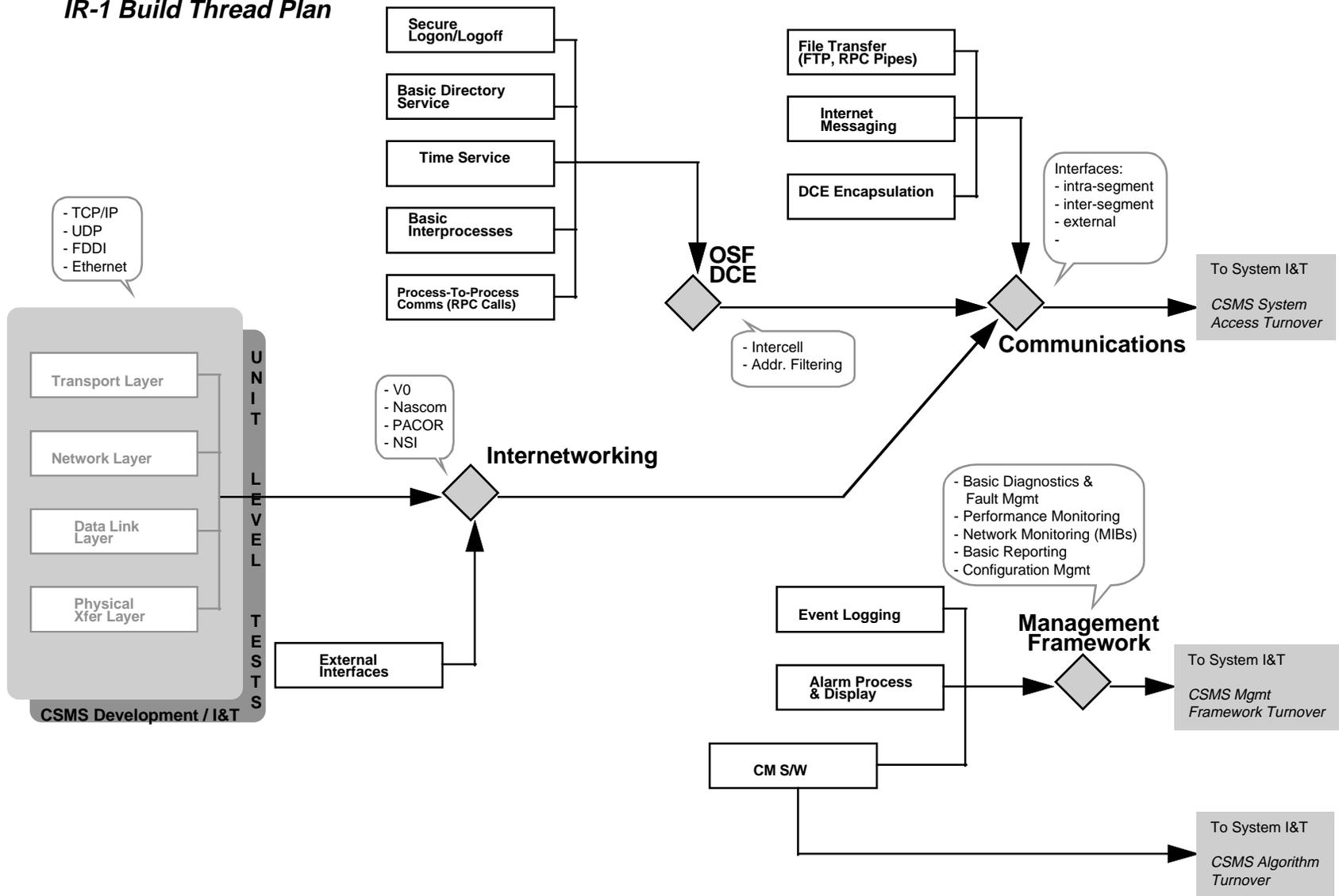
Incremental aggregation of functions to arrive at the CSMS deliverables (builds) to system test:

Thread - software, data, hardware, and procedures that implement a function or set of related functions

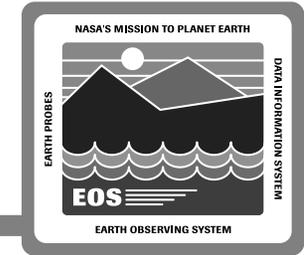
Builds - are an assemblage of threads that progressively lead to logical sets of segment capabilities

Build/thread enables the isolation of problems and a time-phased approach to testing

IR-1 Build Thread Plan



Segment I&T's Relationship to the Development Process



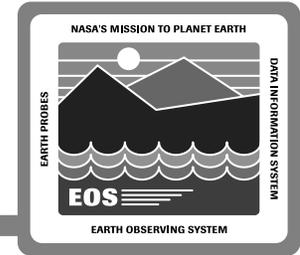
I&T is an integral part of the development process:

System design/requirements by release
Preliminary design/level 4 requirements
Component decomposition
Design traceability
Detail design

Code & Unit Test

Segment build/thread
Test case definition
Components to test cases
Requirements to test cases
Test procedures/test bed configuration/test data/test drivers
Build/thread testing & test results
Turnover to systems test

Segment I&T Process



Note - Segment development and segment I&T occur in the EDF:

Development shares the same CM & NCR tools as segment I&T

Custom code enters formal CM at unit test ITRR

There is a Test Readiness Review (TRR) at the start of segment I&T

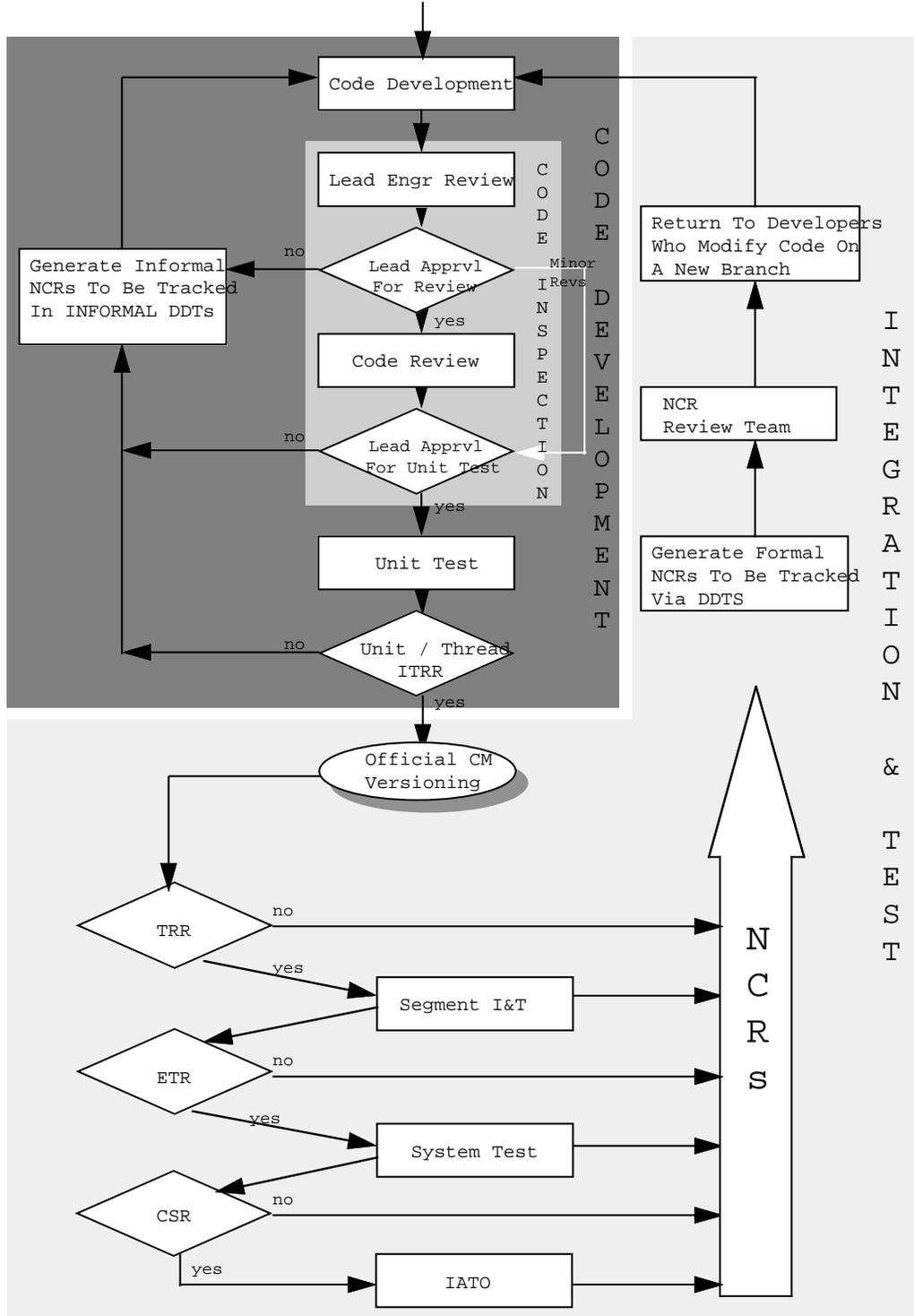
I&T is an iterative process with development - QA, SI&T and IV&V may witness segment tests

The CM and NCR tools are used to control the process

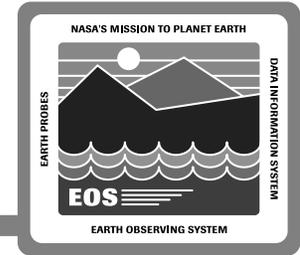
There is an Element Test Review (ETR) at segment I&T to system test turnover

CM - Configuration Management, NCR - Non Conformance Reporting

Configuration Control & Non-Conformance Tracking



I&T Test Plan Overview



Separate document per release:

Section 1 - Scope, Purpose, Organization

Section 2 - Related documents

Section 3 - Test process, build thread plan

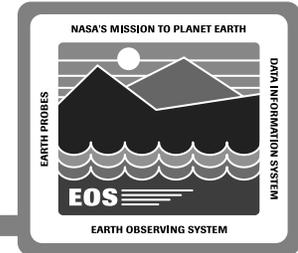
Section 4 - Build/Thread descriptions and test cases, builds and threads are uniquely identified for data base purposes (RTM)

Appendix A - Description of test tools

Appendix B - Level 4 requirements by test case (RTM)

Appendix C - Components by test case, equivalent to the component table in the Release and Development Plan

Thread Test Example Performance Management



Performance Management Thread Test(TC028)

Purpose: Verify the Release A functionality of the Performance Management Application Service

Test Case 1: Performance Monitoring of Network Components(TC028.001)

Test Case 2: Performance Monitoring of Hosts(TC028.002)

Test Case 3: Performance Monitoring of Comm. Stacks(TC028.003)

Test Case 4: Performance Monitoring Thresholds(TC028.004)

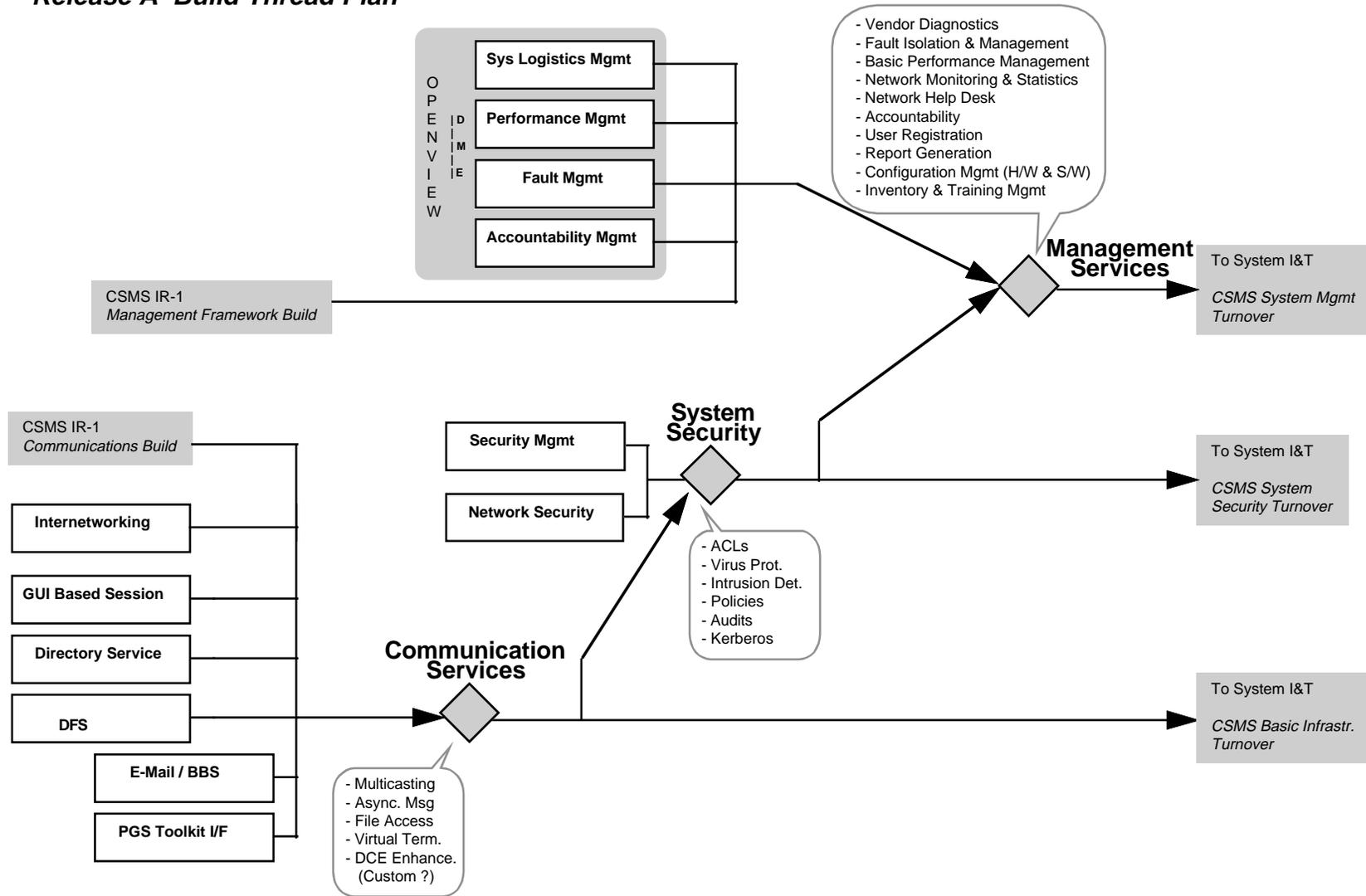
Test Case 5: History Log Verification(TC028.005)

Test Case 6: Performance Trending(TC028.006)

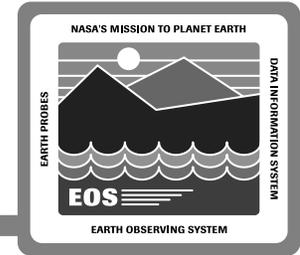
Test Case 7: Performance Benchmark Tests(TC028.007)

CSMS I&T Plan Volume 2: Release A Section 4.12

Release A Build Thread Plan



Thread Test Example Content



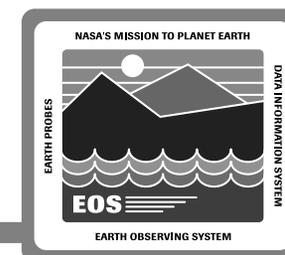
Thread

- Thread description
- Special resources required for the test

Test cases

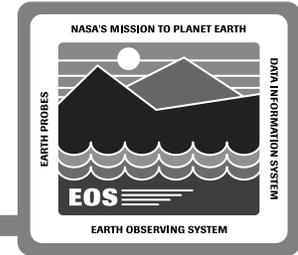
- Test inputs
- Test steps
- Test outputs
- Success criteria
- Assumptions and constraints

Appendix C: CSC to Build/Thread Description Matrix



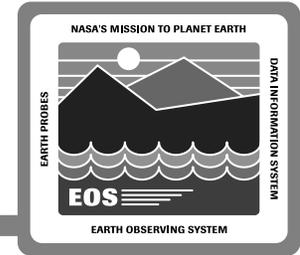
Build/Thread	RTM ID	Sub	Service Class	Source	SLOC	TRK	EP
Perf. Mgmt	TC028	CSS	Event Logger Service	Dev	3,000	I	EP6
Perf. Mgmt	TC028	CSS	Event Service	Dev. + COTS	6,000	I	EP6
Perf. Mgmt	TC028	MSS	Performance Mgt: Analysis	COTS	2,000	F	n/a
Perf. Mgmt	TC028	MSS	Performance Mgt: Monitoring	Dev.	500	F	n/a
Perf. Mgmt	TC028	MSS	Performance Mgt: Reporting	COTS	500	F	n/a

Appendix B: Verification Traceability Matrix



Requirement #	Requirement Description	Build/Thread Case ID	Verification Method	Test Status
C-MSS-66110	The MSS Performance Management Application Service shall be capable of retrieving the following data for all peripherals: a. device errors	TC028.002	Test	
C-MSS-66120	The MSS Performance Management Application Service shall be capable of determining the operational state of all network components, hosts, and peripherals to be: a. on-line, b. off-line, c. in test mode	TC028.002	Test	
C-MSS-66130	The MSS Performance Management Application Service shall be capable of receiving operational state change notifications from network components, hosts, applications and peripherals.	TC028.002	Test	
C-MSS-66140	The MSS EMC Performance Management Application Service shall have the capability to request performance data from : a. Site Performance Management Applications, b. other external systems as defined in section 5.1	TC028.005	Test	
C-MSS-66150	The MSS EMC Performance Management Application Service shall be capable of receiving performance data from : a. Site Performance Management Applications, b. other external systems as defined in section 5.1	TC028.005	Test	

Test Tools



Requirements Traceability Tool - RTM

Software Configuration Management - ClearCase

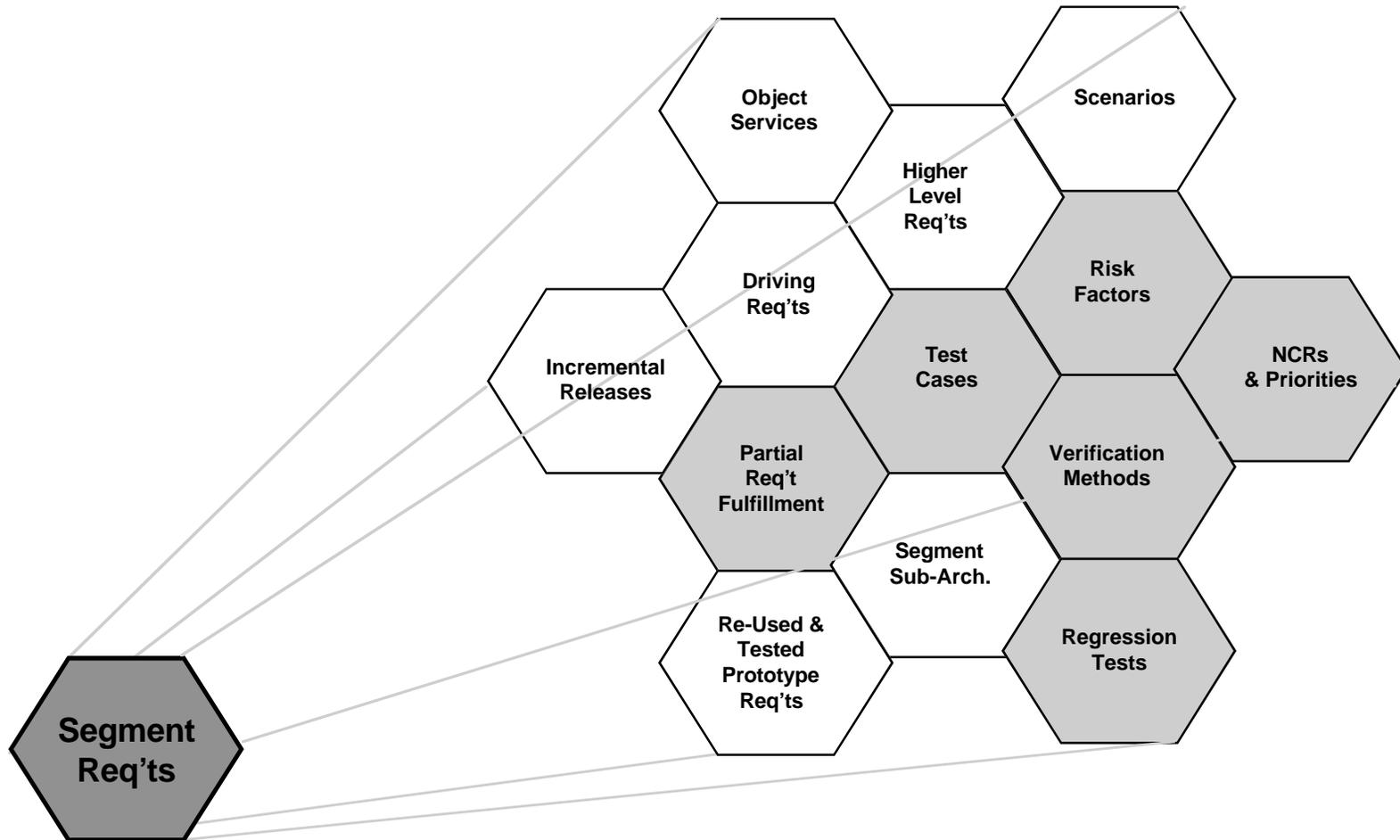
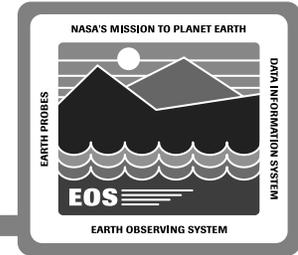
Non Conformance Reporting - Distributed Defect Tracking System (DDTS)

Capture and Playback Tool - XRunner (regression Testing)

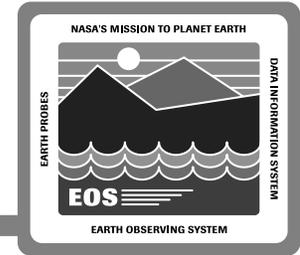
Automated Client Server Testing - LoadRunner (performance testing)

Enterprise Management Framework - OpenView

Multi-Dimensional Requirements & Risks Mappings (RRM)



EP Test



Opportunity to develop the test process and use the test tools

ClearCase, DDTs, and XRunner were used in EP4

EP4 build/thread plan

There is an EP4 Test Plan and Procedures Note Book

There was an EP4 TRR, ETR/CSR

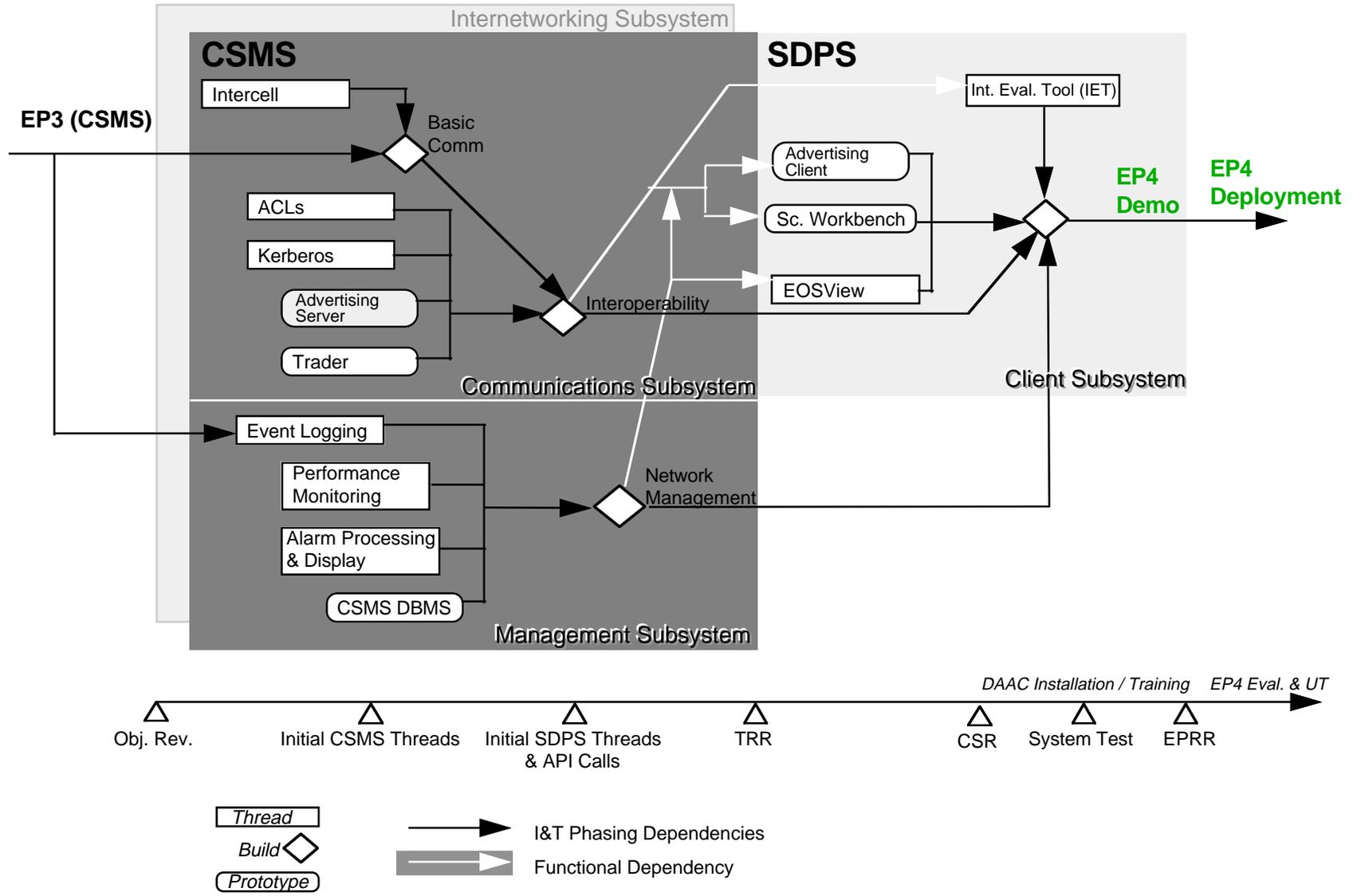
A configuration management process was used in the unit test to I&T hand off

An NCR process was used to manage discovered problems

EP I&T is conducted as a team effort

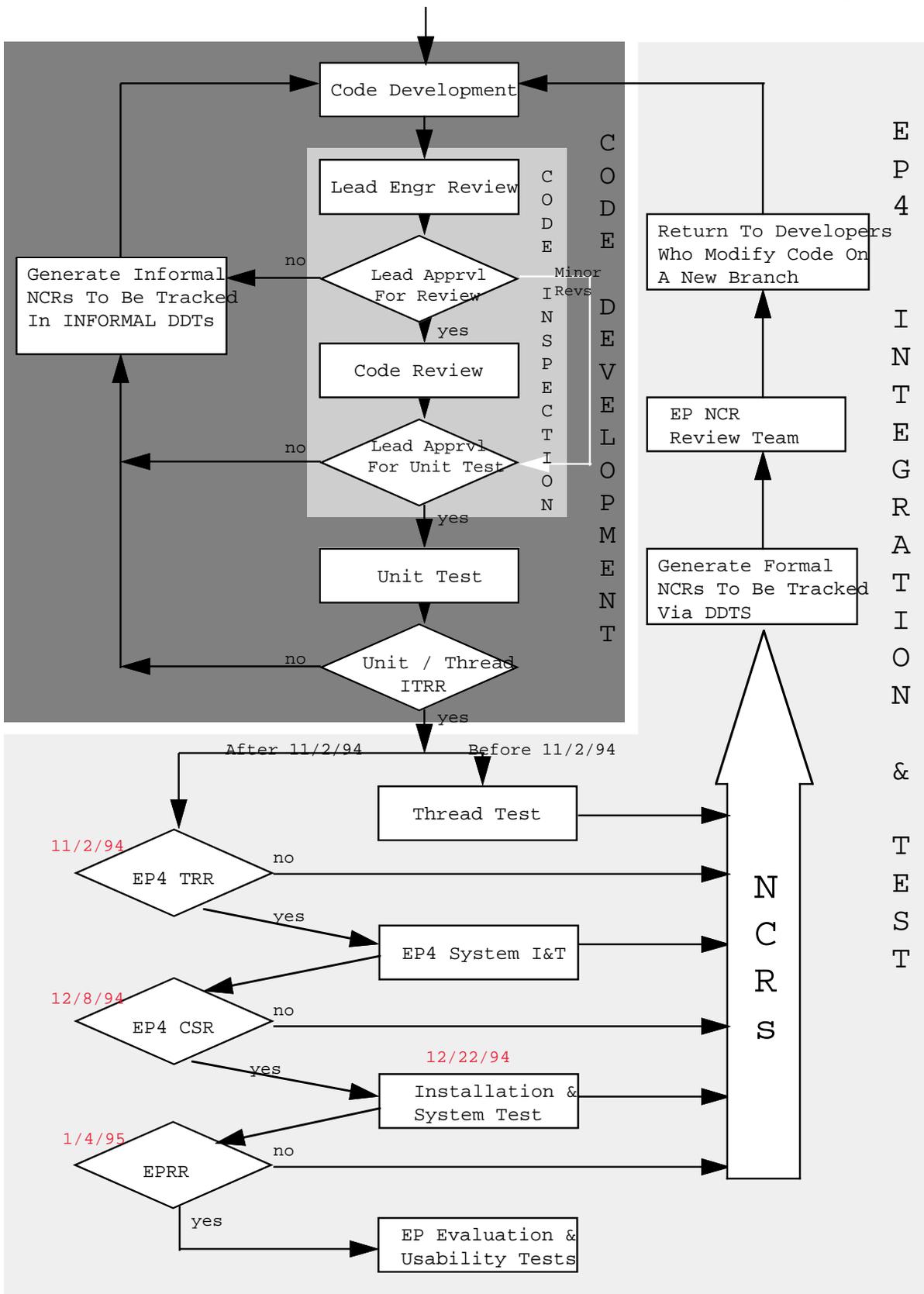
EP4 I&T supports both EP5 and IR-1 testing

EP4 Build/Thread Plan



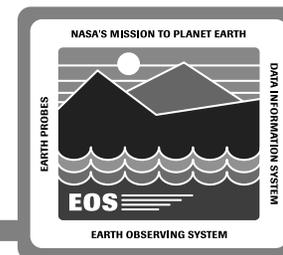
EP4 Configuration Control & Non-Conformance Tracking

LW-19

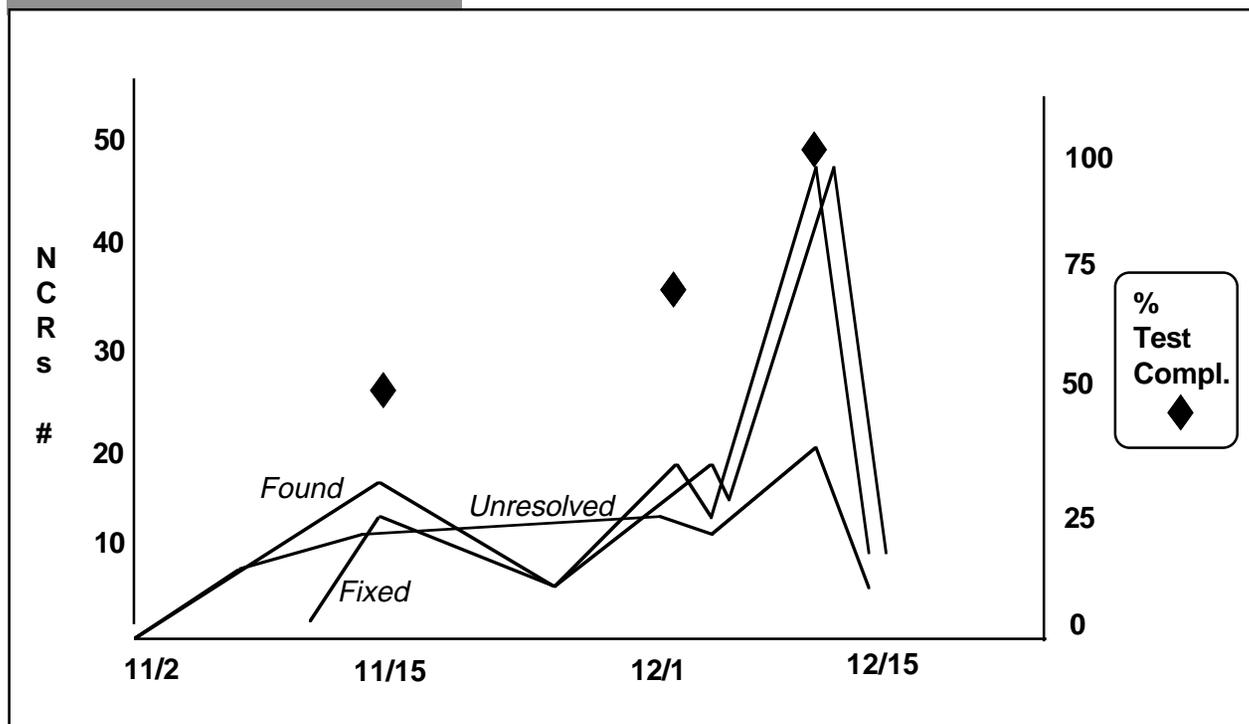


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EP4 NCR Summary

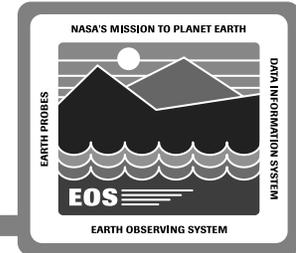


Problem Resolution Rate



Report Date: 12/14/94 15:06

EP4 NCR Summary (cont.)



Total Problems by Severity

Severity 1	16 (13.1%)
Severity 2	30 (24.6%)
Severity 3	56 (45.9%)
Severity 4	9 (7.4%)
Severity 5	11 (9.0%)
TOTAL	122

Report Date: 12/14/94 15:06

Unresolved Problems

Severity 1	2
Severity 2	3
Severity 3	1
Severity 4	0
Severity 5	0
TOTAL	6

Report Date: 12/14/94 15:06

Total Problems by State

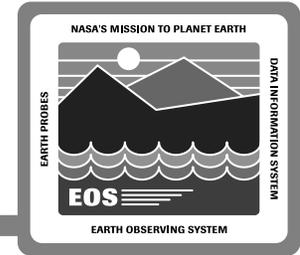
New	1 (0.8%)
Assigned	2 (1.6%)
Open	3 (2.5%)
Resolved	3 (2.5%)
Verified	93 (76.2%)
Duplicate	15 (12.3%)
Postponed	5 (4.1%)
TOTAL	122

Report Date: 12/14/94 15:06

NCR Severity Level Definitions:

- Severity 1** - Catastrophic bug without work around that causes total failure or unrecoverable data loss.
- Severity 2** - Bug which severely impairs functionality. Work around might exist but is unsatisfactory.
- Severity 3** - Bug that causes failure of noncritical system aspects. There is a reasonably satisfactory work around.
- Severity 4** - Bug of minor significance. Work around exists or, if not, the impairment is slight.
- Severity 5** - Very minor defect. Work around exists or the problem can be ignored.

Segment I&T Summary



Build thread methodology

Segment I&T's relationship to the development process

Segment I&T process

Segment I&T Plan

Thread test planning

Test tools

EP testing