Joint Test and Evaluation Methodology (JTEM)

Systems Engineering for Testing in a Joint Mission Environment (JME)

National Defense Industrial Association
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Test & Evaluation in Systems Engineering Track
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Overview

- JTEM Problem Statement
- Capability Test Methodology (CTM)
- CTM Systems Engineering Thread
- Summary

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JTEM Problem Statement

Processes and methods for designing and executing tests of systems of systems in the joint mission environment are not well defined or understood. Nor is there a clear understanding of how to assess system performance as it pertains to capabilities supporting joint missions.

Overall Goal: Recommended Best Practices for a consistent approach to describing, building, and using an appropriate representation of a particular Joint Mission Environment across the acquisition lifecycle.

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JTEM Capability Test Methodology (CTM) v2.0

6 Steps
14 JTEM Processes

0. Develop T&E Strategy

- T&E Strategy (TES)
- T&E Master Plan (TEMP)

- Develop Capability/SoS Description
- Develop Joint Operational Context for Test (JOC-T)
- Develop Evaluation Strategy
- Develop/Refine Capability Crosswalk

Capability Set Focus

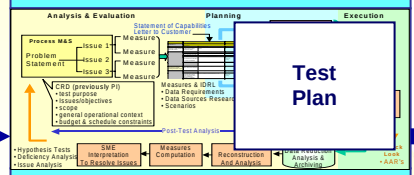
1. Characterize Test

- Program Introduction Document (PID)
- Statement of Capabilities (SOC)

- Develop Test Concept
- Refine Evaluation Strategy
- Technical Assessment

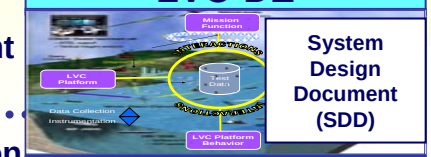
Capability Subset Focus

2. Plan Test



- Develop Test Design
- Perform LVC Distributed Environment Analysis
- Develop Test Plan

3. Implement LVC-DE



- Design LVC Distributed Environment Configuration
- Integrate LVC Distributed Environment

Event Focus

4. Manage Test Execution

5. Evaluate Capability

- Analyze Data
- Evaluate SoS Performance & Joint Mission Effectiveness

Test Concept

Joint Operational Context for Test

Test Data

Integrated Vignettes

LVC Distributed Environment Design

Joint Mission Environment

Test Control & Monitoring

LVC – Live, Virtual, Constructive
LVC-DE – Live, Virtual, Constructive Distributed Environment
SoS – System of Systems

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What is the Joint Mission Environment?

OSD/JS J7

JS J8/J7
"Capability Lead"

USJFCOM J8/J7

AT&L/
Service/Joint Acq Programs

JTEM

JMETC

Components

Analytic Agenda
DPS, MSFD, FYAB

JOpsC Family
JOC, JFC, JIC

JCIDS
JCD, ICD, CDD, JCIDS DoDAF Views (e.g., OVs, SVs)

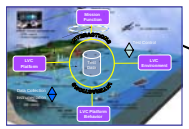
AOA

JCAs

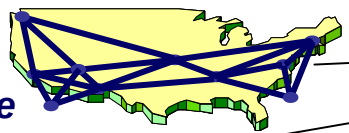
UJTL/Service Task Lists

TES/TEMP
STAR

Methods and Processes



Infrastructure



Joint Operational Context for Test (JOC-T)
Mission
Blue
Threat
Environment
Interactions
JOC-T DoDAF Views

Live, Virtual, Constructive Distributed Environment (LVC-DE)
JME Foundation Model (JFM)
JME DoDAF Views
Models,
Middleware, Infrastructure

JME instantiated for a capability test execution

USN/MC Co
Sea Environme
Air Componer
Surface Compo
Subsurface Comp
CONOPS
Link Models
C2/ISR
Space

AF-ICE CORE
USAF Air Componen
USAF C2/ISR
USAF Weapo
USAF Link Mo
USAF CONO
IADS Tools
Space

Threat Systems
NASIC, MSIC, ATSO, NGIC, etc...

USA 3CE CORE
USA Ground Environm
USA BMC2
USA Platforms
USA CONOPS
USA Link Models
USA Air Components
USA Weapons

Common CORE Tools
InterTEC
Stealth Viewer

Common Joint CORE
FDCE
JSIC
JITC

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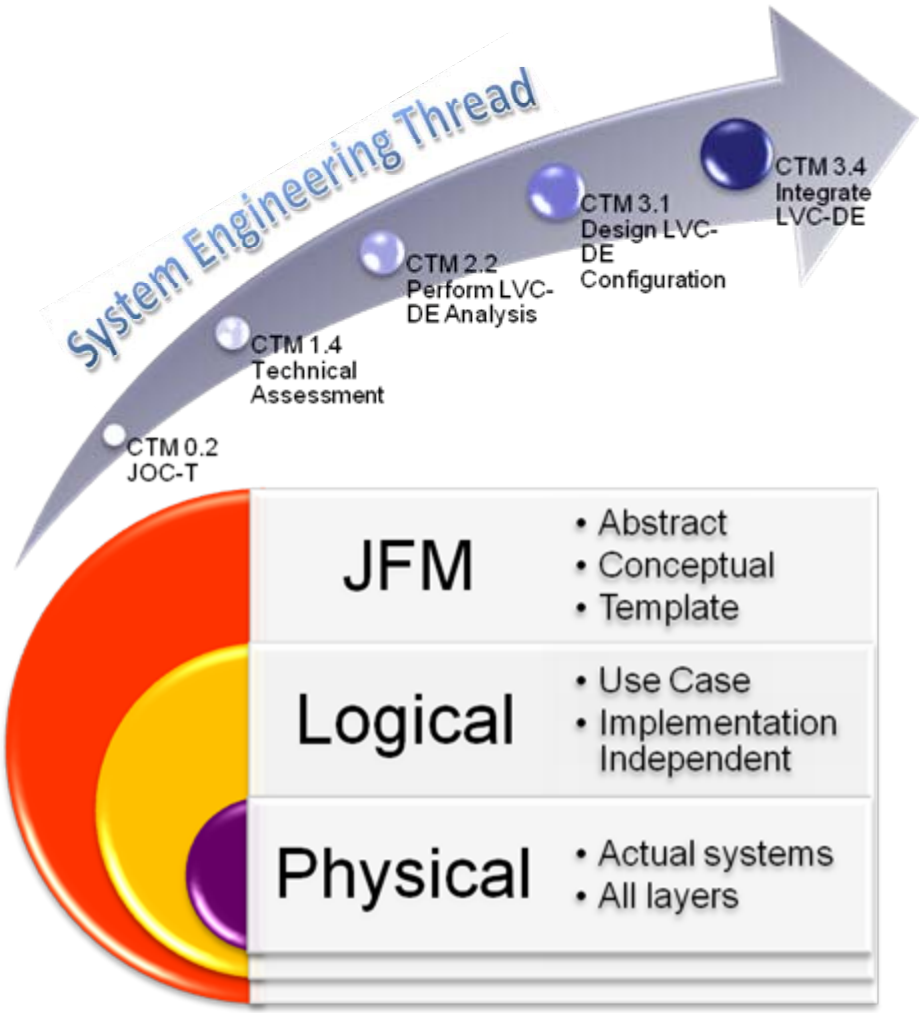
System Engineering Process



- JFM identifies generic capabilities, environments, behaviors, and tasks
- Logical Design applies the JFM to a use case (e.g., JCAS, JFIRES, etc.) independent of implementation
- Logical Design is transformed into a physical design
- Physical interfaces transformed to executable software
- Physical Design solutions are integrated into a JME (moves to LVC-DE repository for reuse)

JTEM Capability Test Methodology (CTM) v2.0

6 Steps 14 JTEM Processes

1. Characterize Test

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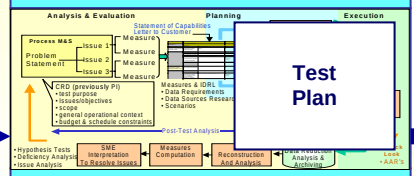
- Refine Evaluation Strategy
- Technical Assessment

Capability Subset Focus

2. Plan Test



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Test Concept

Joint Operational Context for Test

Test Data

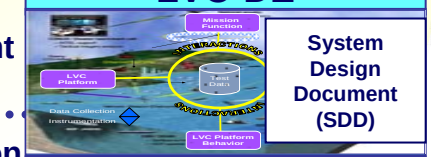
Integrated Vignettes

LVC Distributed Environment Design

Joint Mission Environment

Test Control & Monitoring

3. Implement LVC-DE



- Design LVC Distributed Environment Configuration
- Integrate LVC Distributed Environment

Event Focus

4. Manage Test Execution

5. Evaluate Capability

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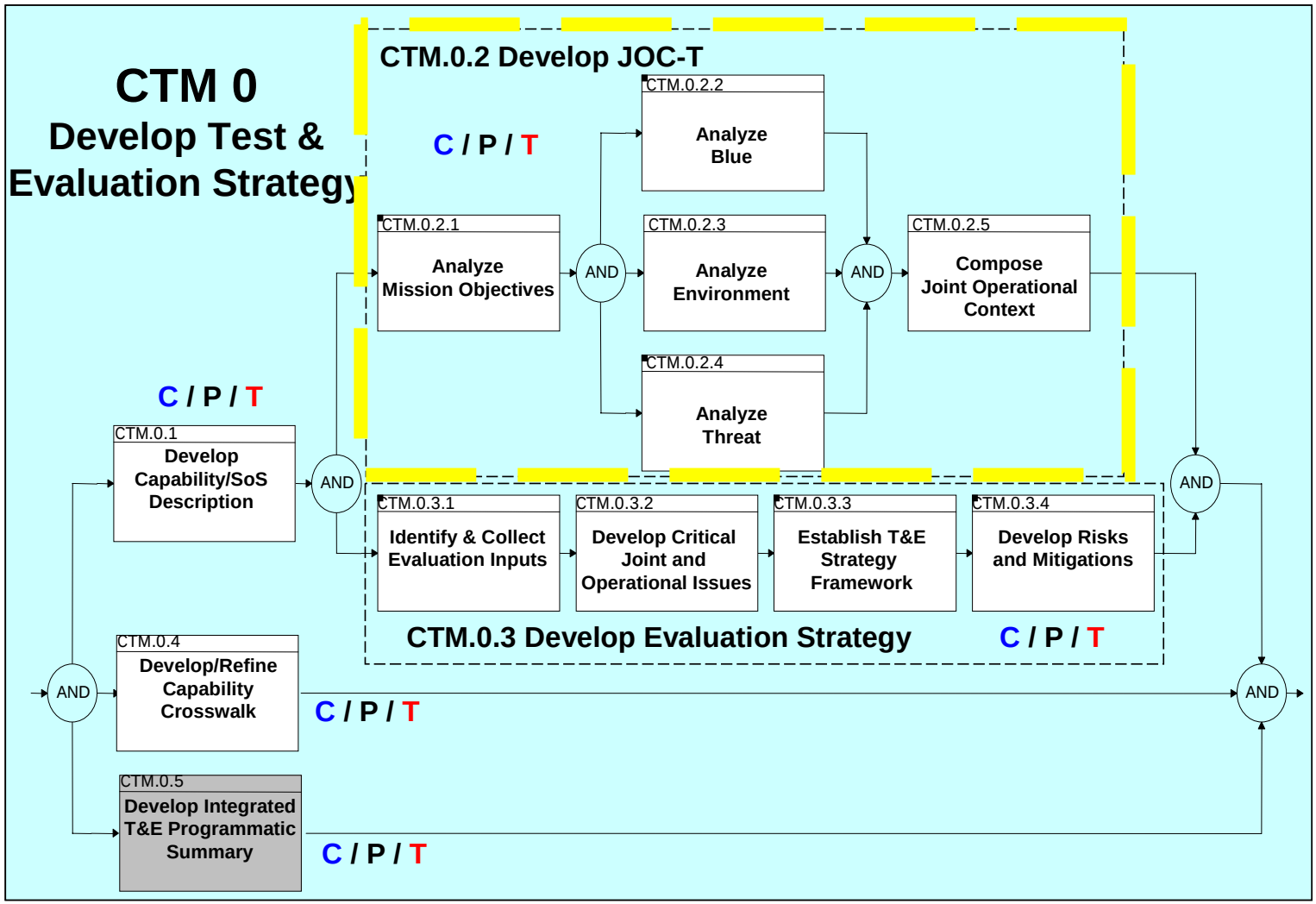
JME Foundation Model (JFM)

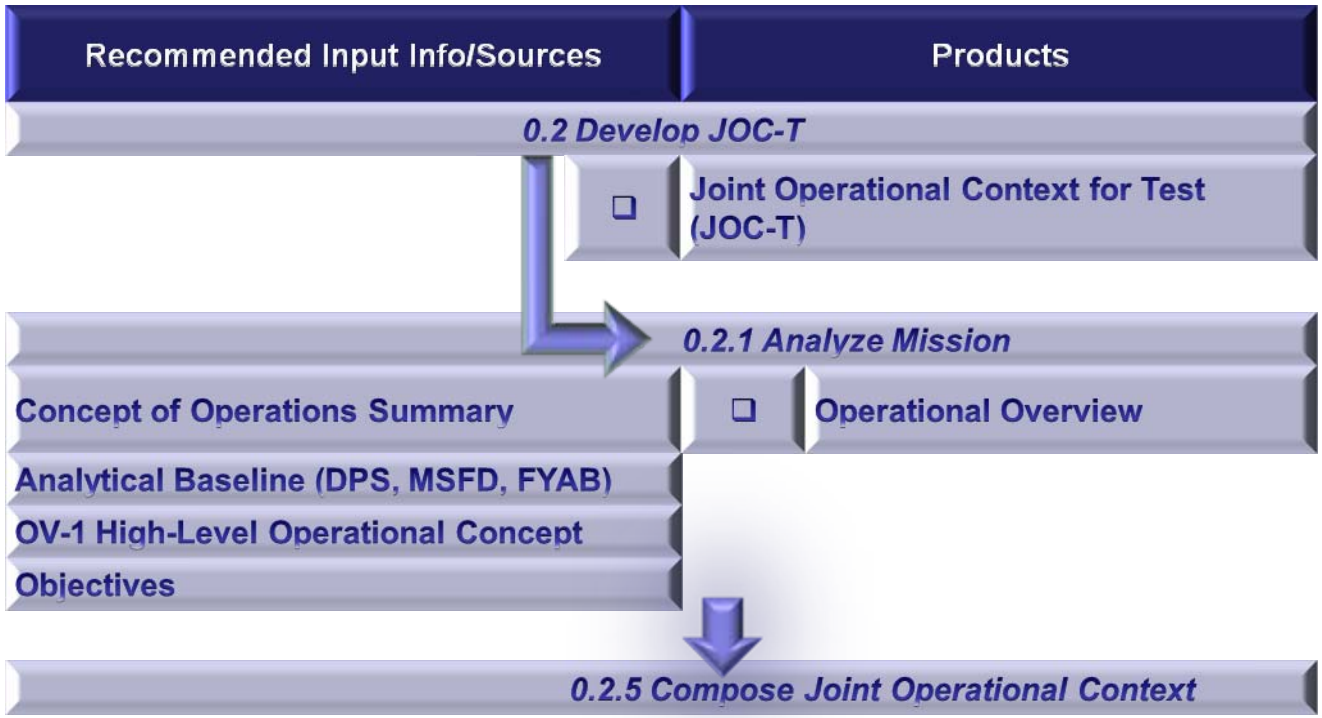
- Conceptual model to enable implementation-independent reasoning in an idealized framework
- Provides abstract interface descriptions and the logical and quantitative relationships between those interfaces
- The goal of the JFM is to provide a frame of reference for LVC-DE configuration design
- The JFM Description is an evolutionary document that will be modified over time to promote the robustness of the JME

The JFM is a design template to guide the development and reuse of LVC-DE systems.

CTM 0.2: Develop JOC-T



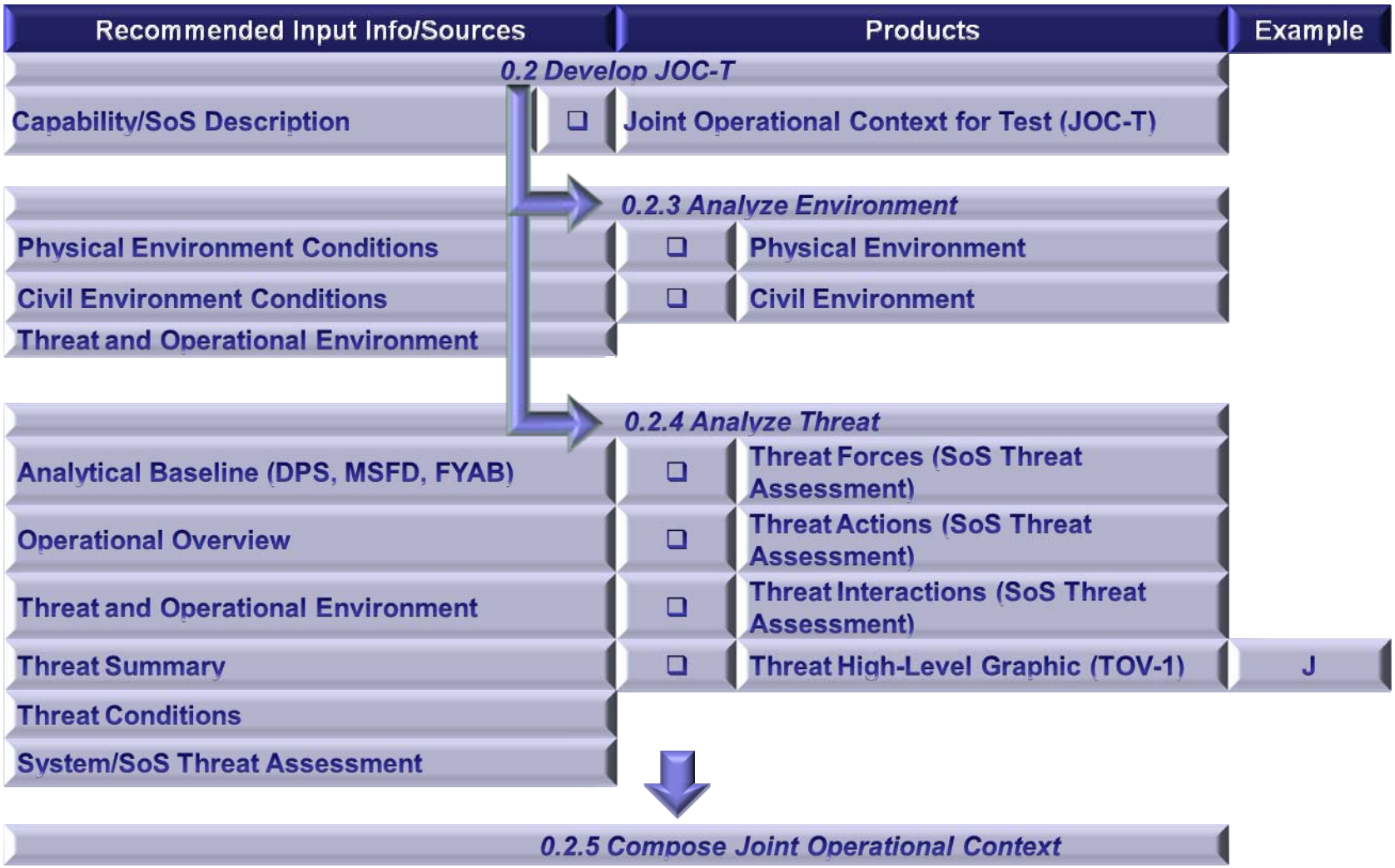
CTM 0.2.1: Analyze Mission Objectives



CTM 0.2.2: Analyze Blue

Recommended Input Info/Sources	Products	Example
0.2 Develop JOC-T		
	❑ Joint Operational Context for Test (JOC-T)	
0.2.2 Analyze Blue		
Joint Tasks	❑ Blue Forces	
Forces and Related Conditions	❑ Blue Actions	
Tasks Steps/Mission Threads (JTA, other sources)	❑ Blue Interactions	
Capability Discussion		
System/SoS Capabilities Required for Current Increment		
SoS Synchronization		
OV-1 High-Level Graphic	❑ Blue High-Level Graphic (BOV-1)	A
OV-5 Operational Activity Model	❑ Blue Operational Node Connectivity Model (BOV-5)	B
OV-2 Operational Node Connectivity Description	❑ Blue Operational Node Connectivity Description (BOV-2)	C
OV-4 Organizational Relationship Chart	❑ Blue Notional Relationship Chart/Task Organization (BOV-4)	D
SV-1 System/SoS Interface Description	❑ Blue SoS Interface Description (BSV-1)	E
SV-5 Operational Activity to System/SoS Function Traceability Matrix	❑ Blue SoS Operational Activity to System/SoS Function Traceability Matrix Description (BSV-5)	F
SV-4 System/SoS Functionality Description	❑ Blue SoS Functionality Description (BSV-4)	G
SV-6 System/SoS Data Exchange Matrix	❑ Blue SUT Information Exchange Matrix (BSV-6)	H
0.2.5 Compose Joint Operational Context		

CTM 0.2.3/4: Analyze Environment/Analyze Threat



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Capability Subset Focus

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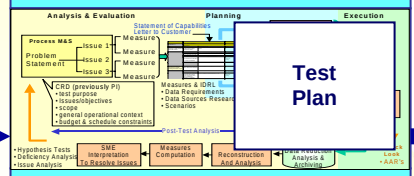

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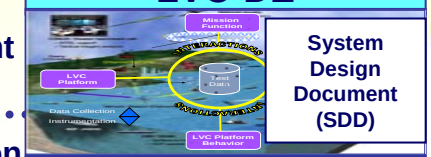
- Perform LVC Distributed Environment Analysis
- Develop Test Plan

3. Implement LVC-DE



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- Integrate LVC Distributed Environment

4. Manage Test Execution

Event Focus

5. Evaluate Capability

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Test Concept

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Test Data

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Joint Mission Environment

Test Control & Monitoring

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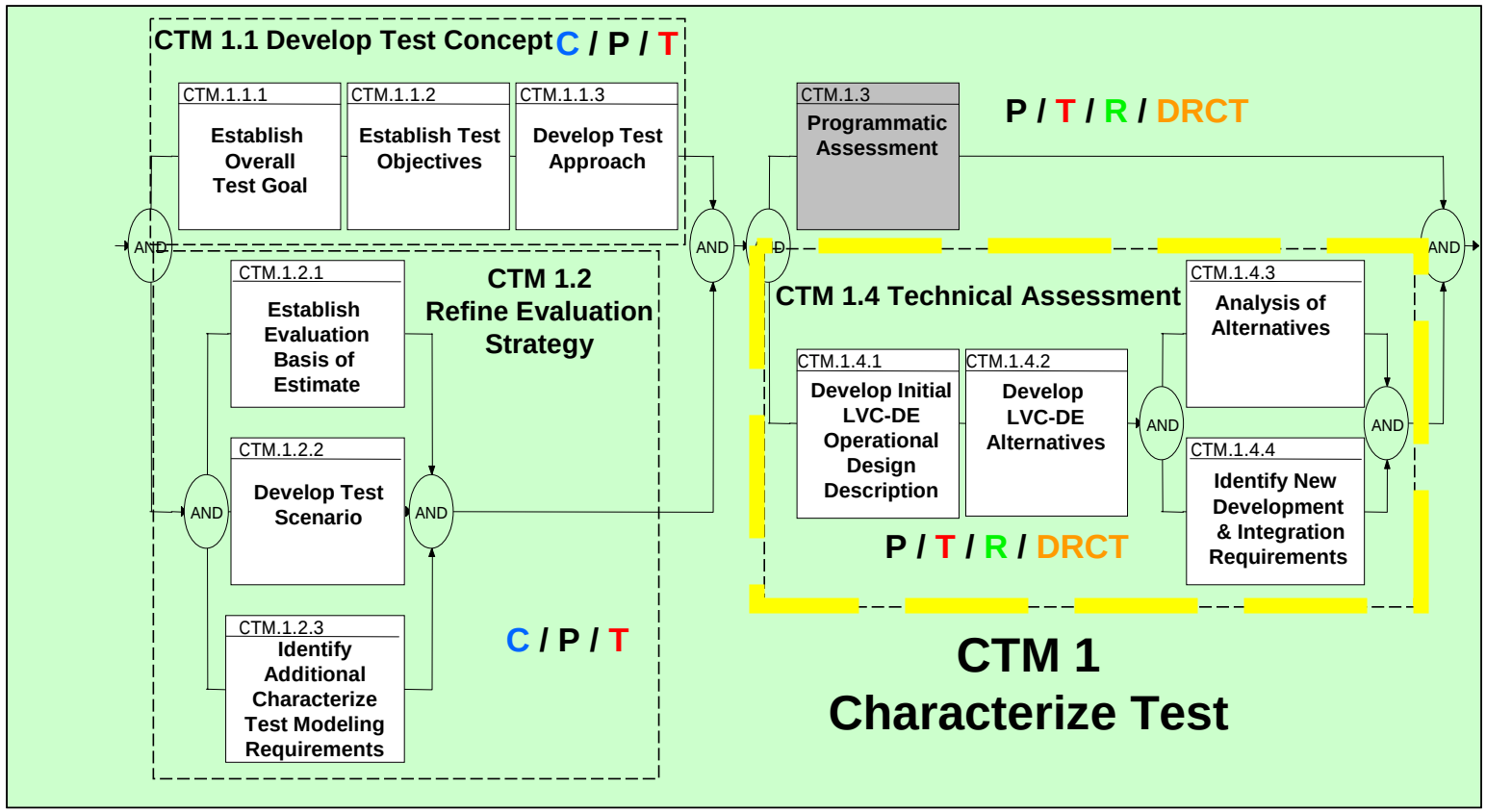
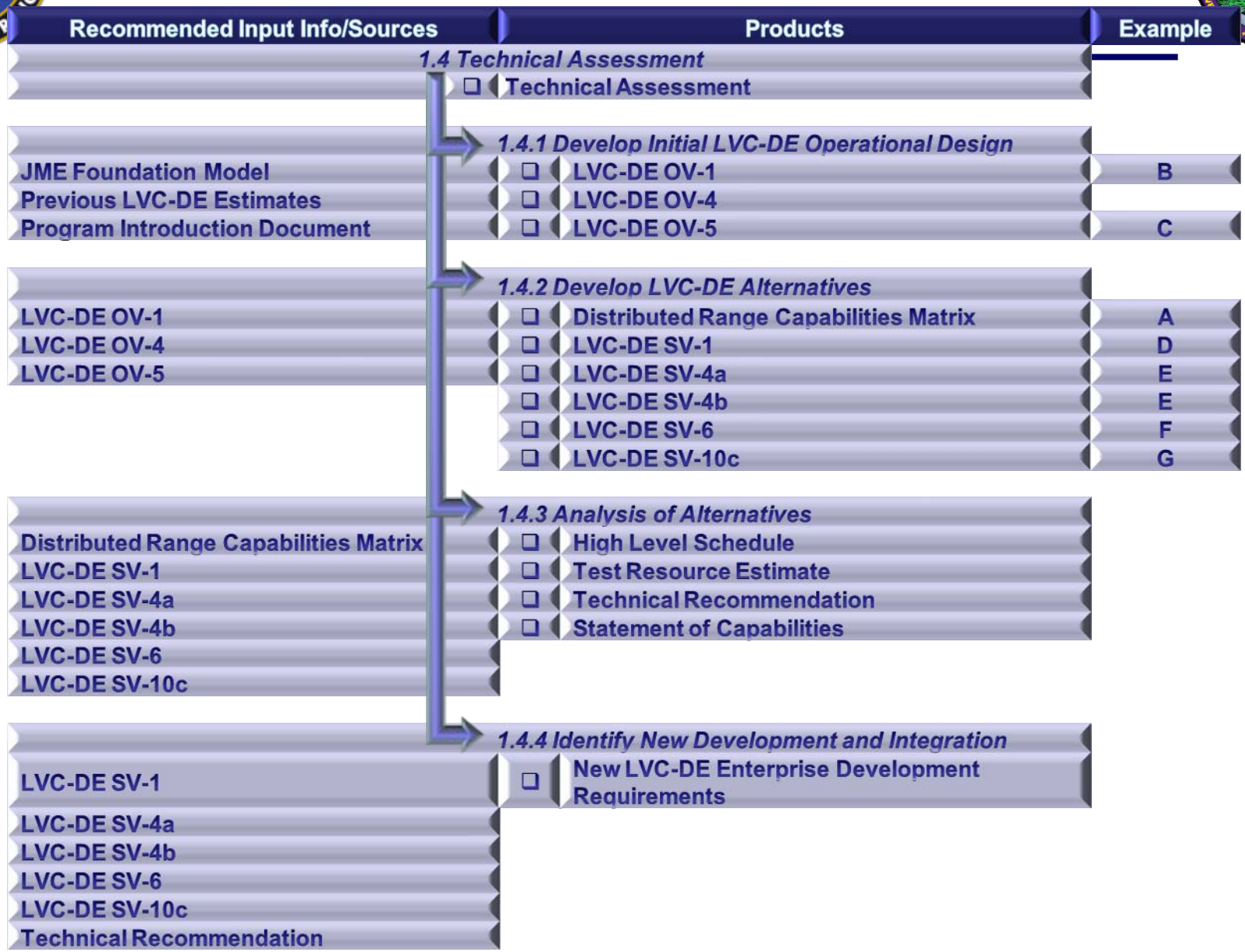
CTM 1.4: Technical Assessment



CTM 1.4: Technical Assessment



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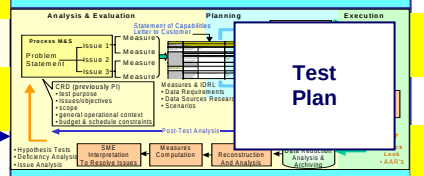

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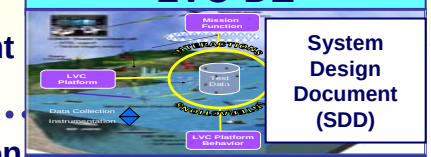
LVC Distributed Environment Design

3. Implement LVC-DE



- Design LVC Distributed Environment Configuration
- Integrate LVC Distributed Environment

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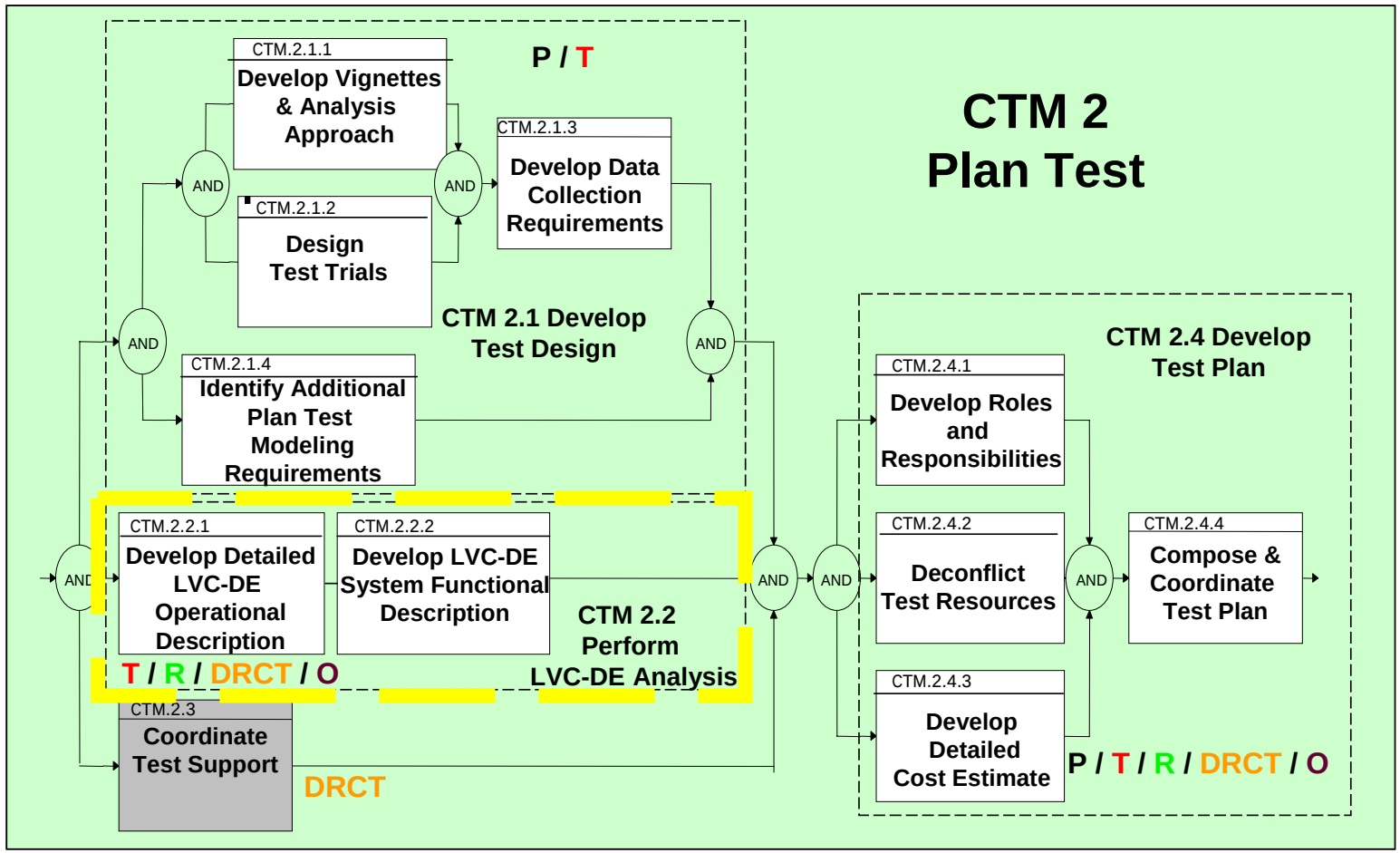
CTM 2.2: Perform LVC-DE Analysis



CTM 2.2: Perform LVC-DE Analysis

Recommended Input Info/Sources	Products	Example
	2.2 Perform LVC-DE Analysis	
	❑ LVC-DE Analysis	
	2.2.1 Develop Detailed LVC-DE Operational Description	
JME Foundation Model	❑ LVC-DE OV-1 (Refined)	
Data Analysis Plan	❑ LVC-DE OV-2	A
Test Concept	❑ LVC-DE OV-4 (Refined)	
System and Joint Mission Evaluation Strategy	❑ LVC-DE OV-5 (Refined)	
LVC-DE OV-1 High Level Operational Concept	❑ LVC-DE OV-6c	B
	❑ LVC-DE OV-7	C
	2.2.2 Develop LVC-DE System Functional Description	
LVC-DE OV-1	❑ LVC-DE SV-4a (Refined)	
LVC-DE OV-2	❑ LVC-DE SV-4b (Refined)	
LVC-DE OV-4	❑ LVC-DE SV-6 (Refined)	
LVC-DE OV-6c	❑ LVC-DE OV-10c (Refined)	
LVC-DE OV-7	❑ Environmental Specifications	
LVC-DE SV-4a (Initial)	❑ Refined Configuration Mgt Plan	
LVC-DE SV-4b (Initial)	❑ Refined V&V Plan	
LVC-DE SV-6 (Initial)		
LVC-DE OV-10c (Initial)		

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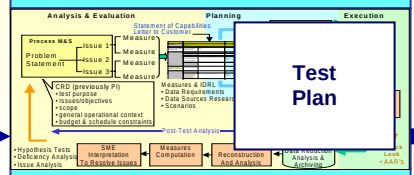

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LVC Distributed Environment Design

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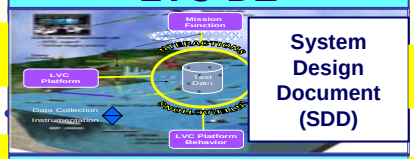
Test Control & Monitoring

3. Implement LVC-DE



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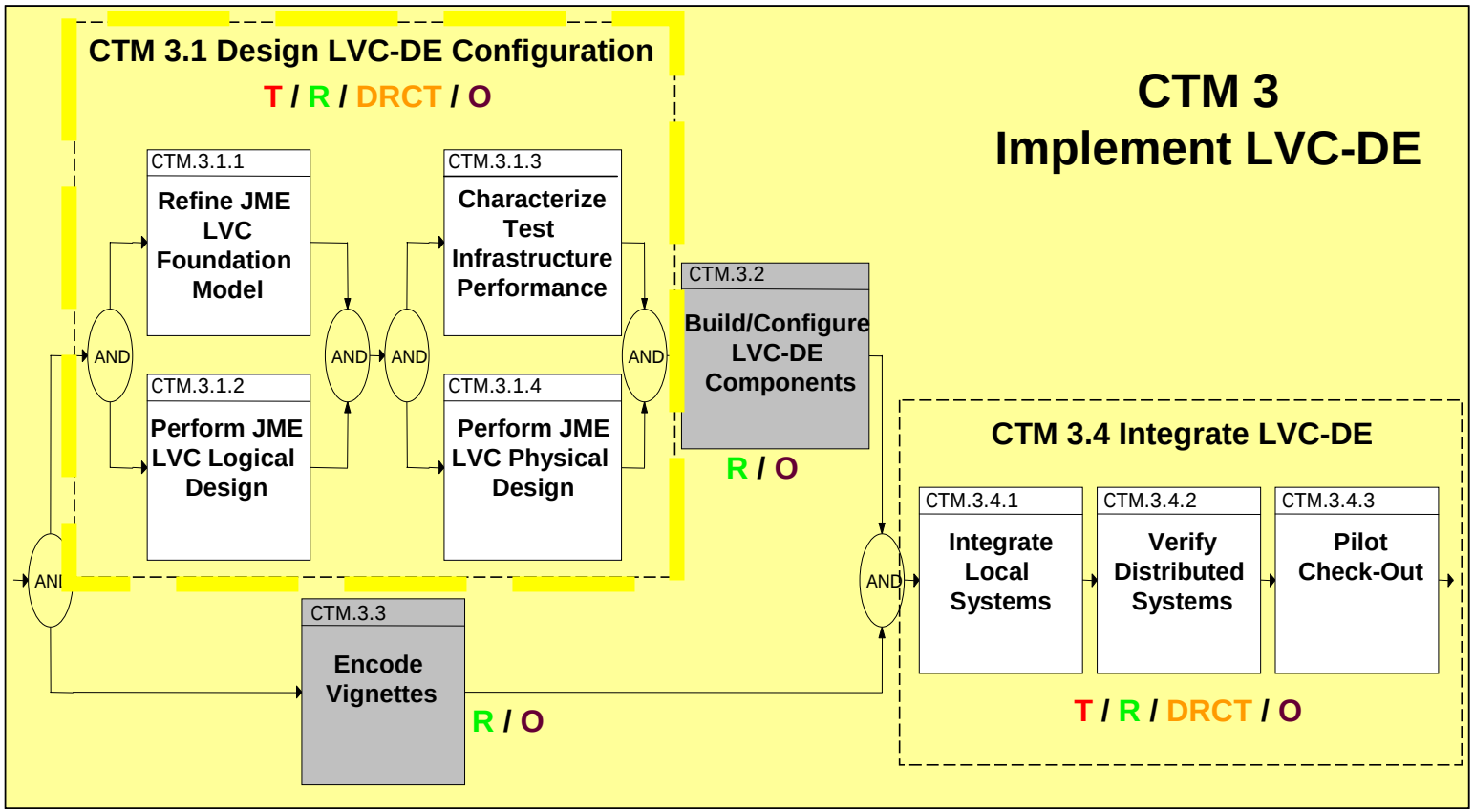
CTM 3.1: Design LVC-DE Configuration



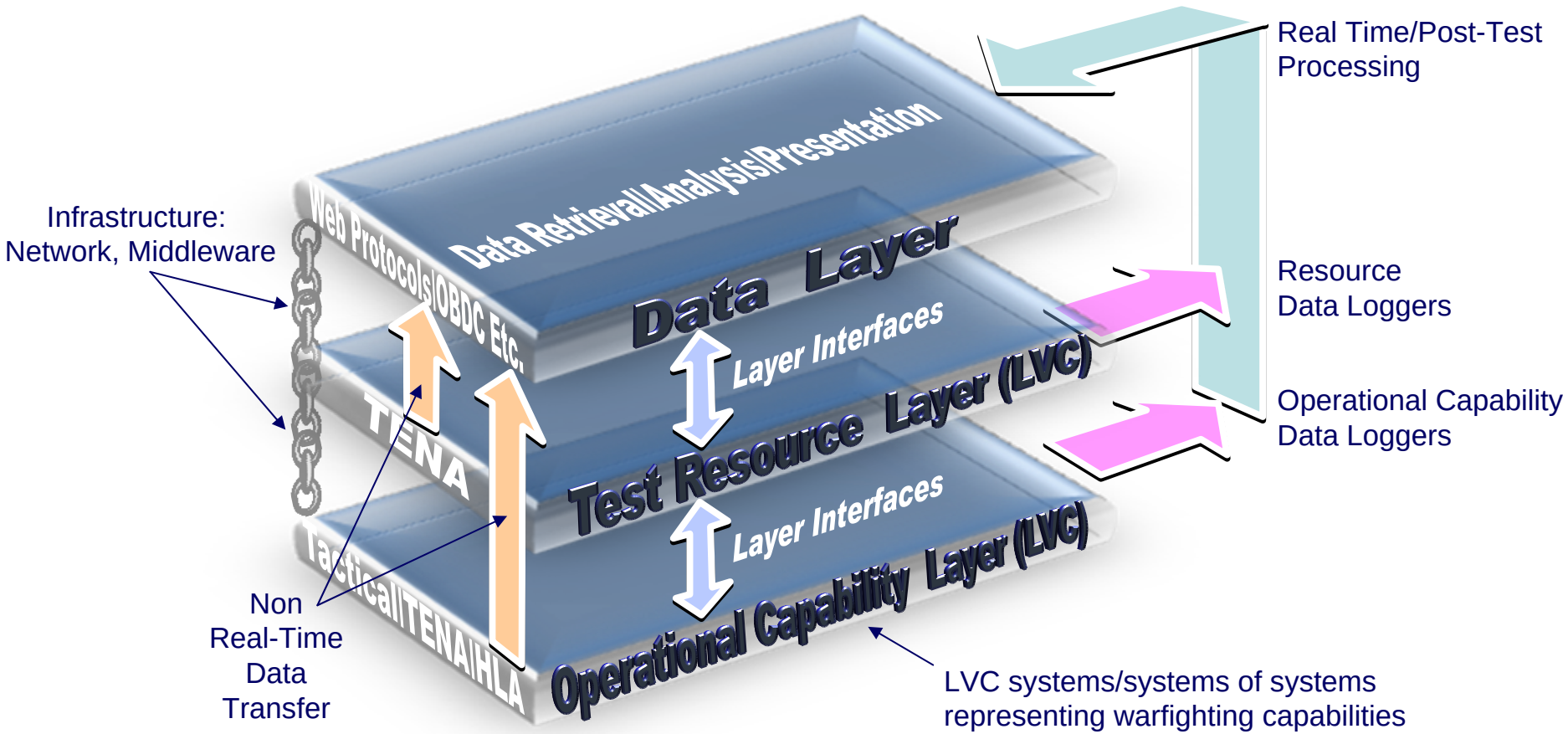
CTM 3.1: Design LVC-DE Configuration

Recommended Input Info/Sources	Products
	3.1 Design LVC-DE Configuration
	❑ LVC-DE Configuration
	3.1.1 Refine JME LVC-DE Foundation Model (JFM)
Enterprise JME Foundation Model with AV-2, TV-1	❑ JME Foundation Model (JFM) Design
LVC-DE OV-1, 2, 4, 5, 6c, 7, SV-4, 6, 10c	❑ AV-2 (refined)
	❑ TV-1 (refined)
	❑ LVC-DE OV-1 (refined)
	❑ LVC-DE SV-4a/b (refined)
	❑ LVC-DE SV-6, (refined)
	❑ LVC-DE SV-10c (refined)
	3.1.2 Perform JME LVC-DE Logical Design
JME Foundation Model Design	❑ JME LVC-DE Logical Design
LVC-DE OV-1, 2, 4, 5, 6c, 7, SV-4a/b, 6, 10c	❑ LVC-DE OV-1 (Logical)
Data Analysis Plan	❑ LVC-DE OV-2 (Logical)
Vignettes	❑ LVC-DE OV-4 (Logical)
LVC-DE Test Approach Description	❑ LVC-DE OV-5 (Logical)
Components and Interface V&V	❑ LVC-DE OV-6c (Logical)
Initial V&V Plan	❑ LVC-DE OV-7 (Logical)
Initial Configuration Management Plan	❑ LVC-DE SV-4a/b (Logical)
	❑ LVC-DE SV-6 (Logical)
	❑ LVC-DE SV-10c (Logical)
	❑ LVC-DE AV-2 (Logical)
	❑ LVC-DE TV-1 (Logical)
	❑ V&V Plan
	❑ LVC-DE Design Gap Analysis

CTM 3.1: Design LVC-DE Configuration

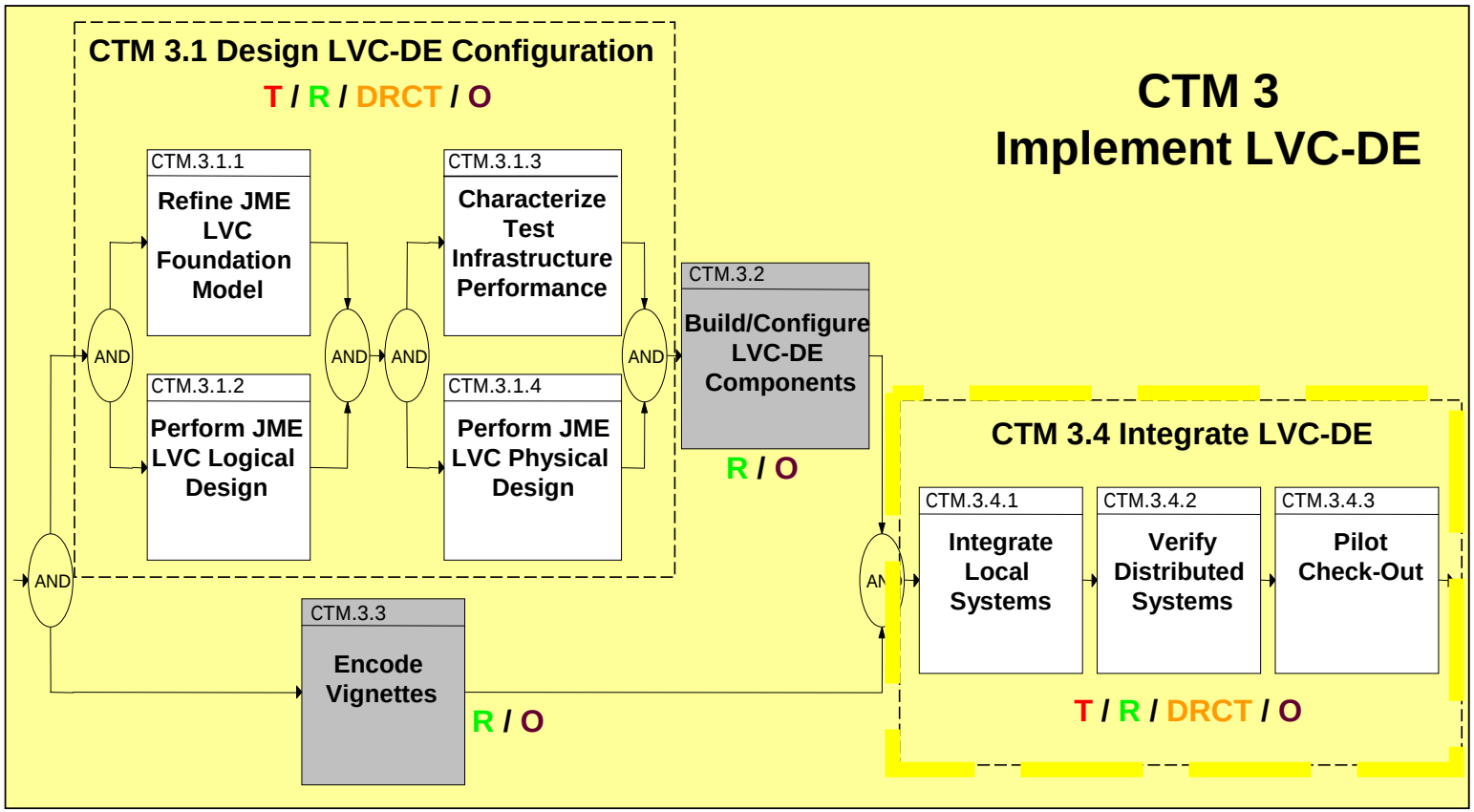
Recommended Input Info/Sources	Products
	3.1 Design LVC-DE Configuration
	❑ LVC-DE Configuration
	3.1.3 Characterize Test Infrastructure Performance
	❑ JME Infrastructure Characterization Plan
	❑ JME Infrastructure Characterization Report
	3.1.4 Perform JME LVC-DE Physical Design
JME LVC-DE Logical Design with LVC-DE OV-1, 2, 4, 5, 6c, 7, SV-4a/b, 6, 10c, AV-2, TV-1 (LDD)	❑ JME LVC-DE Physical Design
JME Infrastructure Characterization Plan	❑ LVC-DE OV-1 (Physical)
JME Infrastructure Characterization Report	❑ LVC-DE OV-2 (Physical)
V&V Plan	❑ LVC-DE OV-4 (Physical)
LVC-DE Design Gap Analysis	❑ LVC-DE OV-5 (Physical)
Repository of LVC Capabilities	❑ LVC-DE OV-6c (Physical)
	❑ LVC-DE OV-7 (Physical)
	❑ LVC-DE, SV-4a/b (Physical)
	❑ LVC-DE, SV-6 (Physical)
	❑ LVC-DE, SV-10c (Physical)
	❑ LVC-DE AV-2 (Physical)
	❑ LVC-DE TV-1 (Physical)
	❑ Configuration Management Plan

Instantiated JME

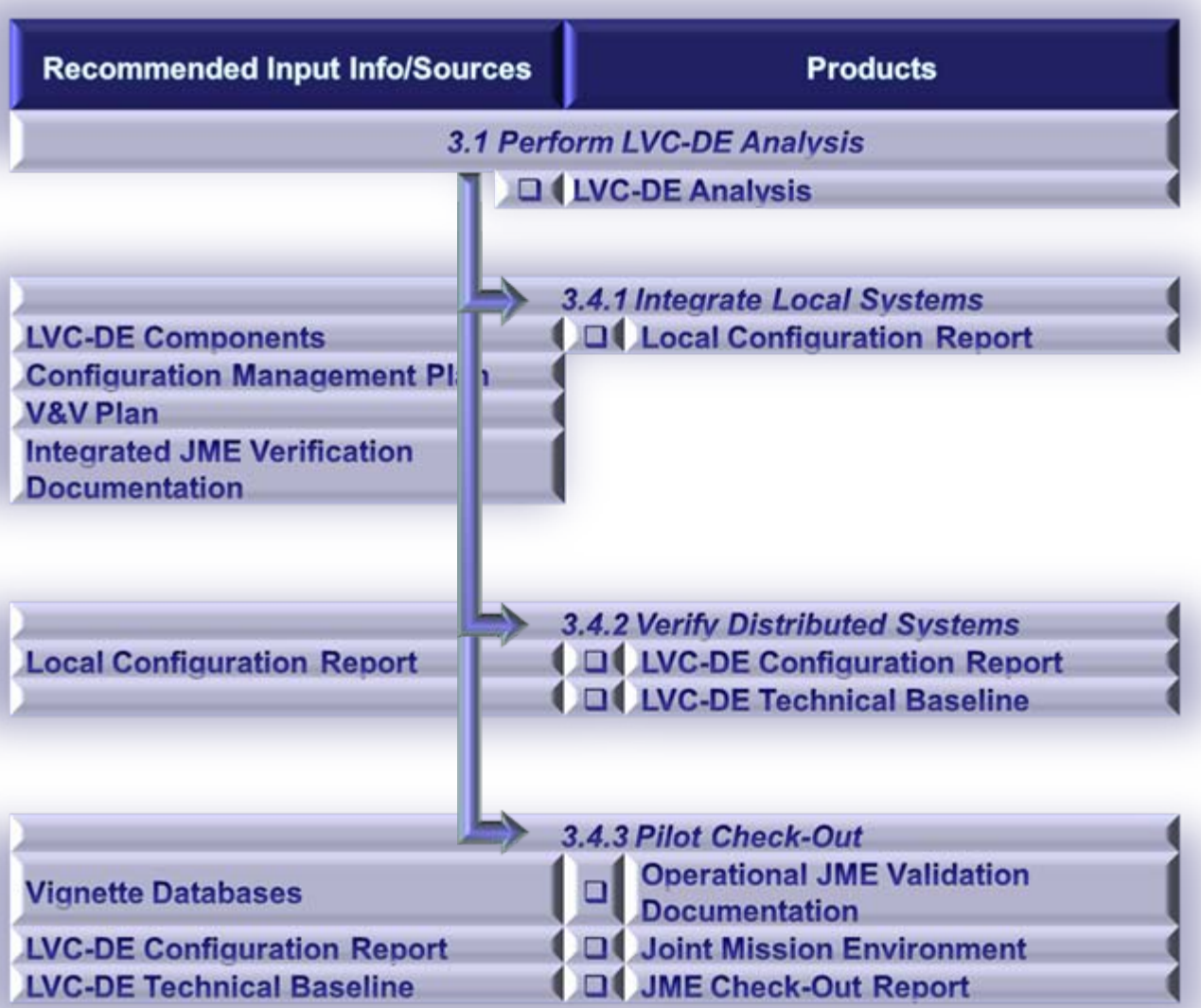


Physical Design configuration includes systems in Operational, Test, and Data layers

CTM 3.4: Integrate LVC-DE



CTM 3.4: Integrate LVC-DE



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- Capability Test Methodology (CTM)
- CTM Systems Engineering Thread
- Summary

Summary

- JTEM mission is to develop methods and processes (M&P) for realistic testing in a live, virtual, constructive distributed environment (LVC-DE)
- CTM systems engineering process provides an effective building block approach to JME development - “Design Once - Use Many”
  - JFM
  - Logical Design
  - Physical Design

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