Full Lifecycle Modeling: Using Enterprise Architecture Updates to Guide Decentralized Organizations
Overview

- Lifecycle Modeling Language Overview
- Enterprise Architecture and Systems Study Interrelation
- Systems Study Methodology
- Systems Study Data Manipulation
- Summary
- Backup Slides
LIFECYCLE MODELING LANGUAGE (LML) OVERVIEW
Lifecycle Modeling Language (LML)

- LML combines the logical constructs with an ontology to capture information
  - SysML – mainly constructs – limited ontology
  - DoDAF Metamodel 2.0 (DM2) ontology only
- LML simplifies both the “constructs” and ontology to make them more complete, yet easier to use
- Goal: A language that works across the full lifecycle
LML Ontology* Overview

- **Taxonomy**:  
  - 12 primary element classes  
  - Many types of each element class  
    - Action (types = Function, Activity, Task, etc.)

- **Relationships**: almost all classes related to each other and themselves with consistent words  
  - Asset performs Action/Action performed by Asset  
  - Hierarchies: decomposed by/decomposes  
  - Peer-to-Peer: related to/relates

*Ontology = Taxonomy + relationships among terms and concepts  
** Taxonomy = Collection of standardized, defined terms or concepts
LML Taxonomy

- Technical
  - Action
  - Artifact
  - Asset
  - Characteristic
  - Input/Output
  - Link
  - Statement

- Programmatic/Technical
  - Cost
  - Issue
  - Location
    - Physical, Orbital, Virtual
  - Risk
  - Time
    - Duration, Timeframe, Point-in-Time
<table>
<thead>
<tr>
<th>ACTION</th>
<th>OBJECTS</th>
<th>RELATIONS</th>
<th>CHARACTERISTIC</th>
<th>COST</th>
<th>INPUT/OUTPUT</th>
<th>ISSUE</th>
<th>LOCATION</th>
<th>RISK</th>
<th>STATEMENT</th>
<th>TIME</th>
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<tbody>
<tr>
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<td>decomposed by related to</td>
<td>references</td>
<td>captures consumes preformed by produces</td>
<td>specified by</td>
<td>incurs</td>
<td>generates</td>
<td>causes receives</td>
<td>-</td>
<td>located at</td>
<td>causes mitigates resolves</td>
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<td>decomposed by related to</td>
<td>referenced by</td>
<td>specified by</td>
<td>referenced by</td>
<td>referenced by</td>
<td>causes referenced by</td>
<td>defines protocol for referenced by</td>
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<td>incurs</td>
<td>-</td>
<td>causes resolves responds to</td>
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<td>specified by</td>
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<td>INPUT/OUTPUT</td>
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<td>-</td>
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<td>decomposed by related to</td>
<td>causes resolves</td>
<td>transferred by</td>
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<td>causes mitigates resolves</td>
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<tr>
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<td>located</td>
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<td>caused by mitigated by resolved by</td>
<td>located at</td>
<td>mitigates resolved by</td>
<td>based on</td>
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<td>basis of</td>
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<td>TIME</td>
<td>taken by occurred by</td>
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<td>occurred by</td>
<td>occurred by</td>
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<td>delays occurred by</td>
<td>occurred by</td>
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</table>

- decomposed by/decomposes
- orbited by/orbits
- related to/relates
LML Logic

No constructs – only special types of Actions
ENTERPRISE ARCHITECTURE AND SYSTEMS STUDY INTERRELATION
Enterprise Architecture (EA)

- Previous EA
  - DODAF 1.0
  - Starting Point for Updated EA

- Updated EA
  - DODAF 2.0
  - Develop with Operational and Functional Focus
  - Conduct Reviews with Representative Subset of COI
  - Incorporate COI Comments

- Updated EA ‘As-Is’ Models
  - Functional Model

- Updated EA Transition Plan
  - Transition from ‘As-Is’ to ‘To-Be’ Architectures
  - Organizational and Technical Transition Initiatives

- Updated EA ‘To-Be’ Models
  - Functional Model
  - Notional Physical Model
Why Update the EA?

- Previous EA ‘As-Is’: Documents current state of functionality as of previous EA completion.
- Previous EA ‘To-Be’: Documents desired future state of functionality as of previous EA completion.
- Updated EA ‘As-Is’: Documents current state of functionality.
- Updated EA ‘To-Be’: Documents desired future state of functionality.

**Questions and Answers**

1. **What is the current process?**
2. **What is the desired process?**
3. **How effective were past policy actions?**
4. **What needs to change?**
5. **What is being done differently?**
6. **How has the vision changed?**

**Delta**

- Delta describes the difference between the previous planned and updated actual processes.
- Delta assesses the effectiveness of past decisions and directives.
- Delta describes the required transitions to achieve the ‘To-Be’ functionality.
- Delta influences policy and procurement decisions.
- Delta describes the change in the way the community operates from the previous to the updated EA.
- Delta describes the change in operational vision from the previous to the updated EA.
EA Transition Plan

Q4
What needs to change?

Updated EA ‘As-Is’

• Delta describes the required transitions to achieve the ‘To-Be’ functionality.
• Influences policy and procurement decisions

Q7
How to implement changes?

Updated EA ‘To-Be’

Updated EA Transition Plan

• Transition from ‘As-Is’ to ‘To-Be’ Architectures
• Organizational and Technical Transition Initiatives

Organizational Transition Initiatives

Technical Transition Initiatives

Transition Initiative Timeline
The Systems Study Findings will show how existing systems might be leveraged to implement the desired processes and changes as defined in the Updated EA.
SYSTEMS STUDY METHODOLOGY
Systems Study Path Forward

1. Updated EA ‘As-Is’ Functional Models
   - Review Updated EA ‘As-Is’ Functional Requirements

2. Updated EA ‘To-Be’ Functional Models
   - Review Updated EA ‘To-Be’ Functional Requirements
   - Review Updated EA ‘To-Be’ Systems and Services Functional Allocations

3. Conduct System Evaluation Criteria
   - Develop System Evaluation Criteria
   - Map Evaluation Criteria to Updated EA
   - Map Evaluation Criteria to Transition Initiatives

4. Conduct System Evaluations
   - Establish Data Collection Methods
   - Identify Current Systems
   - Conduct System Evaluations

5. Develop EA ‘As-Is’ Physical Architecture
   - Review Current Systems’ Functionality
   - Develop Systems ‘As-Is’ Physical Architecture

6. Develop Systems Study Findings
   - Review System Evaluations Results
   - Develop Systems Study Findings
Systems Study Path Forward

1. Updated EA ‘As-Is’ Functional Models
   - Operational Resource Flow
     - Review Updated EA ‘As-Is’ Functional Requirements

2. Conduct System Evaluations
   - Current Systems Interconnectivity
     - Establish Data Collection Methods
     - Identify Current Systems
     - Conduct System Evaluations
   - Current Systems
     - Current Systems Criteria Evaluation Results

3. System Evaluations
   - Documentation and Findings

4. Develop EA ‘As-Is’ Physical Architecture
   - Current Systems Physical Architecture
     - Review Current Systems’ Functionality
     - Develop Systems ‘As-Is’ Physical Architecture
Requirements Analysis

2

Updated EA ‘To-Be’ Functional Models

Service Functional Allocation
System Functional Allocation
Operational Resource Flow
System Functions

□ Review Updated EA ‘To-Be’ Functional Requirements
□ Review Updated EA ‘To-Be’ Systems and Services Functional Allocations

3

Develop System Evaluation Criteria

Criteria Descriptions
Criteria Measures
Criteria System Function Allocation
Criteria Transition Initiative Allocation

□ Develop System Evaluation Criteria
□ Map Evaluation Criteria to Updated EA
□ Map Evaluation Criteria to Transition Initiatives
Systems Study Path Forward

1. Develop System Evaluation Criteria
   - Develop System Evaluation Criteria
   - Map Evaluation Criteria to Updated EA
   - Map Evaluation Criteria to Transition Initiatives

2. Conduct System Evaluations
   - Establish Data Collection Methods
   - Identify Current Systems
   - Conduct System Evaluations

3. Develop Systems Study Findings
   - Review System Evaluations Results
   - Develop Systems Study Findings

4. Documentation and Findings

5. System Evaluations

6. Criteria Descriptions
    - Current Systems Interconnectivity
    - Current Systems
    - Criteria Evaluation Results

7. Criteria Measures

8. Criteria System Function Allocation

9. Criteria Transition Initiative Allocation

10. Criteria System Function Allocation

Systems Study Path Forward

1. Conduct System Evaluations
   - Current Systems Interconnectivity
   - Current Systems
   - Criteria Evaluation Results
     - Establish Data Collection Methods
     - Identify Current Systems
     - Conduct System Evaluations

2. Develop EA ‘As-Is’ Physical Architecture
   - Current Systems Physical Architecture

3. Develop Systems Study Findings
   - Collated Evaluation Results
   - Documented Findings
   - Recommendations
     - Review System Evaluations Results
     - Develop Systems Study Findings

4. Documentation and Findings
   - Review Current Systems’ Functionality
   - Develop Systems ‘As-Is’ Physical Architecture
SYSTEMS STUDY DATA MANIPULATION
Criteria Evaluation Results Data

Conduct System Evaluations

System A Criteria Evaluation Results
- Enter
- XLS
- Convert
- CSV
- Import CSV File

System B Criteria Evaluation Results
- Enter
- XLS
- Convert
- CSV
- Import CSV File

System n Criteria Evaluation Results
- Enter
- XLS
- Convert
- CSV
- Import CSV File

Import Criteria Occurrence Script

EA Model
Determining Systems Potentially Impacting Changes

1a Determine criteria mapped to TI

Statement
Type=Vision
Transition Initiative

based on / basis of

Artifact
Type=DRAWINGS: Architecture Product
documented by / documents

decomposes / decomposed by

Characteristic
Type=Criteria
Criteria

Text
Measure

augmented by / augments

Action
Type=System Function
Function

specifies / specified by

1b Determine criteria mapped to system function

2 Determine criteria occurrences mapped to criteria

Characteristic
Type=Criteria
Occurrence
Criteria 1.1 [System A]

instantiates / instantiated by

Evaluate

Determine non-zero value occurrences

Determine highest value occurrence

Asset
Type=System
System A

specifies / specified by

3a

Characteristic
Type=Criteria
Occurrence
Criteria 1.1 [System B]

instantiates / instantiated by

Most Significant Impacting Systems

3b

Characteristic
Type=Criteria
Occurrence
Criteria 1.1 [System C]

instantiates / instantiated by

Determine systems mapped to criteria occurrences

4

 Significant Criteria Occurrences

Most Significant Criteria Occurrence

Determine systems potentially impacting changes
Findings Document Creation

* The following cross matrices are created:

- Criteria Items to Systems Cross Matrix
- Criteria Items to Systems Cross Matrix with Criteria Values
- Functions to Systems Cross Matrix
- Functions to Systems Cross Matrix with Values
- Summary Level Criteria Items to Systems Cross Matrix
- Summary Level Criteria Items to Systems Cross Matrix with Criteria Values
- Transition Initiatives to Systems Cross Matrix
- Transition Initiatives to Systems Cross Matrix with Values
System Interconnectivity Data

Conduct System Evaluations

System A
Interconnectivity Analysis

System B
Interconnectivity Analysis

System n
Interconnectivity Analysis

System
Connected Systems
System-System Links
System Function Inputs
System Function Outputs
System Security Requirements
IO to Link Allocation

Enter

EA Model
Physical Architecture Model Rendering

1. Determine system function mapped to system
2. Determine functional correlation
3a. Determine applicability of system function IDEF0
3b. Determine system functions with IDEF Diagrams
Physical Architecture Document Creation

- Extract EA Model
- Create 'As-Is' Physical Architecture Scripts
- Decompose System Function IDEF0-A0
- Create Related Physical System Functional Contexts' IDEF0s
- Create Related Physical System User and External System Functions' IDEF0-A0s
- Create System Hierarchy Diagram
- Enter Systems Interconnectivity Diagrams Briefing
- Convert 'As-Is' Physical Architecture RTF to Word File
- Present 'As-Is' Physical Architecture RTF File
- Generate Systems Interconnectivity Diagrams Briefing

Related Physical System User and External System Functions' IDEF0-A0s
System Hierarchy Diagram
Related Physical System Functional Contexts' IDEF0s
Decomposable System Function IDEF0
System Function IDEF0-A0
IDEF
IDEF
IDEF
IDEF
IDEF
IDEF
The following cross matrices are created:

1. Criteria Items to Systems Cross Matrix
2. Criteria Items to Systems Cross Matrix with Criteria Values
3. Functions to Systems Cross Matrix
4. Functions to Systems Cross Matrix with Values
5. Summary Level Criteria Items to Systems Cross Matrix
6. Summary Level Criteria Items to Systems Cross Matrix with Criteria Values
7. Transition Initiatives to Systems Cross Matrix
8. Transition Initiatives to Systems Cross Matrix with Values
SUMMARY
Summary

- Enterprise Architecture (EA) updates answer questions regarding the state and direction of the enterprise.
- Systems Study findings show how existing systems might be leveraged to implement the desired processes and changes as defined in the Updated EA.
- Systems Study data should be stored in the architecture database and mapped to the EA and Transition Initiatives.
## Enterprise State and Direction Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Architectural Product / Product Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 What is the current process?</td>
<td>Updated EA ‘As-Is’ Functional Architecture</td>
</tr>
<tr>
<td>Q2 What is the desired process?</td>
<td>Updated EA ‘To-Be’ Functional Architecture</td>
</tr>
<tr>
<td>Q3 How effective were past policy actions?</td>
<td>Previous EA ‘To-Be’ Functional Architecture / Updated EA ‘As-Is’ Functional Architecture Delta</td>
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<tr>
<td>Q4 What needs to change?</td>
<td>Updated EA ‘As-Is’ Functional Architecture / Updated EA ‘To-Be’ Functional Architecture Delta</td>
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<td>Q5 What is being done differently?</td>
<td>Previous EA ‘As-Is’ Functional Architecture / Updated EA ‘As-Is’ Functional Architecture Delta</td>
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<tr>
<td>Q6 How has the vision changed?</td>
<td>Previous EA ‘To-Be’ Functional Architecture / Updated EA ‘To-Be’ Functional Architecture Delta</td>
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<tr>
<td>Q7 How to implement changes?</td>
<td>Updated EA Transition Plan</td>
</tr>
<tr>
<td>Q8 What is used to implement current process?</td>
<td>Updated Systems ‘As-Is’ Physical Architecture</td>
</tr>
<tr>
<td>Q9 What can be used to implement changes?</td>
<td>Updated Systems Study Findings</td>
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Physical Architecture Diagram Summary

- **System Function IDEF0-A0**: Shows the inputs and outputs for the system functions. The system is shown as the IDEF mechanism and the data processing requirements are shown as the IDEF controls.

- **System User Function IDEF0-A0**: Shows the inputs and outputs from the view of the system user. The system user is shown as the IDEF mechanism.

- **System Functional Context – User IDEF0**: Shows the relationship between the system functions and the system user functions.

- **System Functional Context – Systems IDEF0**: Shows the relationship between the system functions and other systems' functions.

- **System Functional Context – External Systems IDEF0**: Shows the relationship between the system functions and external systems' functions.

- **System Functional Context – Detailed User IDEF0**: Shows the relationship between the decomposed system functions and the system user functions.

- **System IIo Slide**: Shows a hierarchical view of the system and subsystems.

- **EA Model**: Visually represents the system relationship with other systems, system decomposition, inputs, outputs, and network requirements.

- **Word File**: Shows a decomposed view of the system functions.

- **PPT**: Shows the relationship between the system functions and other systems' functions.