Realigning the Enterprise Architecture Practice to achieve lab missions

Rennie Scott - Tammy Whited presenting
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Abstract

Today's DOE Labs face the ever-increasing requirement of managing and responding to the accelerating environments of complexity and disruptive change. Adapting to this challenge requires holistic analysis, system thinking, and meticulous attention to detail.

Fermilab's Office of Enterprise Architecture was identified as the area of investment to respond to the growing challenge. This presentation will be a descriptive overview of Fermilab's initiative to re-examine and refresh its approach to Enterprise Architecture.

It will cover the revised vision, scope, developments, challenges, and lessons learned. It will go into depth on developing solutions for new capabilities, tools, and practices that are the areas targeted for maturity and growth.

Finally, we will provide the current milestones we've achieved and the trending results. Finally, the presentation will close with an overview of the future steps on our roadmap goal of maximizing value to our stakeholders.
The Core Computing Division (CCD) was a division of the Computing Sector responsible for delivering technology services to the Fermilab community that would be considered "classic" IT functions, e.g., email, virtual servers, and networking.

As with other IT organizations, they also provide domain-specific technology solutions, e.g., HR, Finance, Facilities, etc.

The demand for these domain-specific technologies is managed and prioritized by the Information System Portfolio Management Team (IS-PMT). A somewhat formalized but "Agile" method by which the domain areas request the new services they would like CCD to schedule for the upcoming fiscal years.

The process worked well, but growing pressures on all areas of the lab and accelerating demands for digital transformation require refinement and maturation.
The Growing Challenges

An overview of the growing challenges to Computing
value creation
While CCD delivers a lot of value to individual stakeholders, the domains, including computing, can be very siloed in their interpretation of priorities.
Communication Across Domain Silos

Experts can conceptualize things differently when communicating across domains (even in the same organization). Although illustrated in the humorous 1970s cartoon “The Tree Swing” metaphor,” we often forget this when we get into the details of a solution…

Figure 2 ¹,²

¹ Image Source: The Cheeky Monkey Media Blog “User Stories are the Rosetta Stone to Becoming Tech-lingual” https://www.cheekymonkeymedia.ca/blog/user-stories-are-the-rosetta-stone-to-becoming-tech-lingual/
Aligning on Outcomes

Often expert stakeholders will give you solutions to implement instead of collaborating on the details of what they are trying to achieve. This typically doesn’t provide optimal solutions for domain stakeholders or Computing.

Figure 3

1 (Rennie Scott, 2022) NLIT 2022 Conference, Fermilab
Managing Complexity

What can seem like a straightforward project can get more and more complex as you start to find a solution and understand the data, systems, and microservices that the final solution must integrate.
We needed a broader landscape approach

Computing needs a way to focus on managing these stakeholder engagements to understand better and manage the technical, risk, and complexity of these projects before they go to the technical experts.

• Let's focus on maturing and building out our Enterprise Architecture Capability.

• Wrinkle! Our Enterprise Architect resigned.

• Opportunity! Three senior internal staff have approached with interest in filling the role.
The Choice
All three candidates bring different but equally valuable and needed aspects of the Enterprise Architect role. But they also need to continue the vital work they’re involved in. Here is the proposal:
• Tammy will be the Enterprise Architect at 50% FTE allocation
• Craig and Rennie will be Co-Deputy Enterprise Architects at 25% allocation each.

RoadMap
• Year 1 – Acclimate to the role and develop the EA maturity plan project.
• Year 2 – Budget allocation to implement new EA Practice Project and tools using new projects for refinement
• Year 3 – If the experiment work is positive and there is actual value creation, we may reallocate all three as 100% FTE to the Enterprise Architect roles
An overview of progress in Year 1
Year 1 - Overview

• Roadmap Targets:
  – Acclimate to the role, identify areas of focus
  – Develop a Year 2 plan for developing the practice
Year 1: Identified areas for maturity

- **Demand Management**
  - Tammy, designated as the Demand Manager, worked with Deputy CIO on engaging with the business stakeholders to roadmap future projects through the IS-PMT workflow.

- **Risk Management**
  - Rennie was assigned to sit on the Enterprise Risk Management Board as the Computing Risk Manager.

- **Requirements Engineering**
  - Craig assigned development and continued maturing of the requirements engagement framework.

- **Modeling & Design**
  - Rennie was designated the EA Repository Manager and began modeling critical areas of the Demand process and Service Management.
Year 1: Identified areas for maturity (continued)

• Managing Architecture Governance and Architectural Change
  – Tammy leads the development of the EA governance framework
    • Re-established bi-weekly Community Collaboration Meeting for computing staff presentations of cross-enterprise technical initiatives.
    • She established the Technical Risk Assessment sub-group in collaboration with cybersecurity.
    • We have implemented phase one technical procurement approval workflow.

• Application Portfolio Management & SQA Program
  – Rennie assigned as Application Portfolio Manager
  – Expand the Lab capabilities model for a capabilities-based planning model to rationalize and align application lifecycles.

• Mature the Solution Architect Role
  – Craig continues maturing, defining the Solution Architect role, and developing repeatable project engagements and deliverables.
Model the IS-PMT Process Architecture
An overview of progress in Year 2
Year 2 – Plan To Build the EA Practice

Received funding to renovate the practice:

• Contracted Enterprise Architecture consultants to advise us on best practices:
  – Select EA Frameworks
  – Get Focused on EA training
  – Develop EA Processes

• Modeling and the EA repository

• Evaluated and select EA Tools
An overview of our selected EA Frameworks

- TOGAF®
- Fermilab Enterprise Architecture Framework
All the architects were TOGAF® 9.2 trained and began working on IS-PMT Projects using the Architectural Development Method (ADM) and Business, Application, Data, Technology (BDAT) Architecture approach.

The TOGAF® standard is a methodology and framework for planning, designing, implementing, and governing enterprise information technology architectures. It was developed and is managed by The Open Group and additional information can be found on its site: [https://www.opengroup.org](https://www.opengroup.org)
Fermilab Enterprise Architecture Framework (FLEAF)

- Working with the consultants, we developed the FLEAF architecture:
- A customize framework utilizing:
  - TOGAF®
  - IT4IT®
  - BPMN®
  - Archimate®
  - FEAF
  - ITIL®
  - IT-CMF
  - NIST Cybersecurity Framework
  - APQC Process Classification Framework
- The entire framework specification is 66 pages; several highlighted overviews follow in the next slides.
FLEAF Services Context

Vision  Mission  Goals  Operating Model

Business Strategy  IT Strategy

Portfolio Planning

AS-IS

Enterprise Architecture

Intermediate

Business Architecture

Information Architecture

Application Architecture

Technology Architecture

TO-BE

Business Architecture

Information Architecture

Application Architecture

Technology Architecture

EA Repository

Enterprise Roadmap

Standards and Governance

Architecture Review Board

Reference Architectures Reusable Assets

Transformation Projects
The FLEAF Metamodel

Author: Daniel Lambert - Copyright 2022 – All Rights Reserved
Overview of our Enterprise Architecture Tools
Year 1 - Architecture Tools

• We started with Open-Source Tools:
  – Archi – for small architecture models
  – Camunda Modeler – for BPMN models
  – StarUML – for small contained UML models
  – Continued to use Visio for stakeholder engagements
By Year 2, we needed to grow our capabilities to a platform that would offer the following capabilities:

- Act as our centralized TOGAF repository
- Native format version control
- Model collaboration tools
- Integration options to resource legacy artifacts and documentation
- Granular user and group access controls
- Easy and controllable user access to models for review, approval, and comment
- Integrate with our CMDB, project portfolio, and Service Management system; ServiceNow.
- Be able to scale and provide future capabilities without much technical overhead.
We selected Sparx Systems Suite for our toolset:

- **Sparx Enterprise Architect** – for modeling and requirements management
- **Sparx Pro-Cloud Server** – Repository service and integration with ServiceNow for live information integration and service processes
- **Sparx Prolaborate** – Customizable web service interface for stakeholder, management, and technical SME access to models and artifacts for comment, reference, and informational uses
The Repository Architecture

20100 - Sparx EA Application Architecture

* Future State Architecture for Sparx Enterprise Architecture Products
  * Sparx Enterprise Architecture Desktop Clients
  * Sparx Pro Cloud Server
  * Sparx ProLegrate

Architects & Modelers

flows

Sparx EA

< Client Applications >

Supporting Services

- Active Directory
- SAML
- SMTP
- ServiceNow

Sparx EA Application Service

serves

ResAPI

HTTPS BDS

Sparx Pro Cloud Server

< Server Applications >

Application Databases

- EA Repository
- ProLerate Database

Sparx ProLerate

< Server Applications >

Supporting Services

- ODBC

Technology Services

- EA Server
  - Windows Server
  - Asp.Net
  - IIS

- Database Server
  - ODBC/OLED8
  - MySQL Server

Business Users

Developers & Architects

Web Browser

serves

serves

serves

serves

realizes

realizes
Year 2 - Modeling

Our modeling framework and approach
"Telling stories with visuals is an ancient art. We’ve been drawing pictures on cave walls for centuries. It’s like what they say about the perfect picture book. The art and the text stand alone, but together, they create something even better.” – Deborah Wiles.

Architecture Principle: EA will develop communication, perspectives, and architectural governance models whenever feasible.

- Previously, we leveraged models and diagrams to communicate complex ideas and solutions across business, scientific, technical, and management domains.
- Comprehending complex topics can take many iterations of discussions and reinterpretations across organizations. Visual representations using well-delineated models facilitate rapid understanding and correct false assumptions and specific areas of stakeholder concerns.
- Holistic visual models used in conjunction with requirements or user stories and data models help developers to focus on the end user’s goals and increase inherent modularity for future expansion and solution maintainability. This reduces technical debt and increases change delivery.
- This is not inherently a matter of how intelligent people are; it is biologically the way human cognition functions.” Our brains process visual content at an incredibly high speed. In fact, by one estimate, visuals communicate information 60,000 times faster than text.”

1 Erin McCoy, 2019 How Our Brains Are Hardwired For Visual Content: https://killervisualstrategies.com/blog/how-our-brains-are-hardwired-for-visual-content.html
Chosen Modeling Languages & Model Framework

- Archimate - the Architectural Landscape Container Framework
- BPMN – Business Process and Workflow modeling
- UML & Visio - Application and Technology modeling
ArchiMate® is an enterprise architecture visual modeling language for use in modeling the strategy, business processes, information flow, infrastructure, and systems of an organization. It is excellent for abstracting high-level architectural landscapes to empower stakeholders to assess and consequences and impacts of decisions and changes.

The ArchiMate® 3.1 language and specification was developed and is managed by The Open Group; additional information can be found on its site: https://www.opengroup.org
# ArchiMate Structure and Behavior Elements

The ArchiMate® language is much too rich to cover in this presentation, but a summary of the elements is included below from the specification. Several models will also be presented through the rest of the presentations for examples.

## ArchiMate Structure and Behavior Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Specializations</th>
<th>Definition</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active Structure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal active structure element</td>
<td>Represents an entity that is capable of performing behavior.</td>
<td>Internal active structure element</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Represents an aggregate of two or more internal active structure elements, working together to perform some collective behavior.</td>
<td>Collaboration</td>
<td></td>
</tr>
<tr>
<td>Interface (external active structure element)</td>
<td>Represents a point of access where one or more services are exposed to the environment.</td>
<td>Interface</td>
<td></td>
</tr>
</tbody>
</table>

## Behavior

<table>
<thead>
<tr>
<th>Element</th>
<th>Specializations</th>
<th>Definition</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal behavior element</td>
<td>Represents a unit of activity that can be performed by one or more active structure elements.</td>
<td>Internal behavior element</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Represents a sequence of behaviors that achieves a specific result.</td>
<td>Process</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>Represents a collection of behavior based on specific criteria, such as required resources, competencies, or location.</td>
<td>Function</td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>Represents a unit of collective behavior that must be performed by two or more active structure elements, either assigned directly or aggregated in a collaboration.</td>
<td>Interaction</td>
<td></td>
</tr>
<tr>
<td>Service (external behavior element)</td>
<td>Represents an explicitly defined exposed behavior.</td>
<td>Service</td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>Represents a state change.</td>
<td>Event</td>
<td></td>
</tr>
</tbody>
</table>

## Passive Structure

<table>
<thead>
<tr>
<th>Element</th>
<th>Specializations</th>
<th>Definition</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive structure element</td>
<td>Represents an element on which behavior is performed.</td>
<td>Passive structure element</td>
<td></td>
</tr>
</tbody>
</table>

## Structural Relationships

<table>
<thead>
<tr>
<th>Structural Relationships</th>
<th>Notation</th>
<th>Role Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>← composed of</td>
<td>← composed in</td>
</tr>
<tr>
<td>Aggregation</td>
<td>← aggregates</td>
<td>← aggregated in</td>
</tr>
<tr>
<td>Assignment</td>
<td>← assigned to</td>
<td>← has assigned</td>
</tr>
<tr>
<td>Realization</td>
<td>← realizes</td>
<td>← realized by</td>
</tr>
</tbody>
</table>

## Dependency Relationships

<table>
<thead>
<tr>
<th>Dependency Relationships</th>
<th>Notation</th>
<th>Role Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving</td>
<td>← serves</td>
<td>← served by</td>
</tr>
<tr>
<td>Access</td>
<td>← accesses</td>
<td>← accessed by</td>
</tr>
<tr>
<td>Influence</td>
<td>← influences</td>
<td>← influenced by</td>
</tr>
<tr>
<td>Association</td>
<td>← associated with</td>
<td>← associated from</td>
</tr>
</tbody>
</table>

## Dynamic Relationships

<table>
<thead>
<tr>
<th>Dynamic Relationships</th>
<th>Notation</th>
<th>Role Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering</td>
<td>← triggers</td>
<td>← triggered by</td>
</tr>
<tr>
<td>Flow</td>
<td>← flows to</td>
<td>← flows from</td>
</tr>
</tbody>
</table>

## Other Relationships

<table>
<thead>
<tr>
<th>Relationship Connectors</th>
<th>Notation</th>
<th>Role Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization</td>
<td>← specializes</td>
<td>← specialized by</td>
</tr>
</tbody>
</table>

## Relationship Connectors

<table>
<thead>
<tr>
<th>Relationship Connectors</th>
<th>Notation</th>
<th>Role Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fermilab Model Example
MongoDB(Service) As-Is

MongoDB Service
Service Realization Viewpoint
Rev 1.0
Mar 15, 2021
Rennie Scott

Legend
- Application Component
- Application Service
- Business Actor
- Business Service
- Device
- Junction
- Node
- Technology Service
Deeper Business Modeling Details: BPMN

• To drill deeper into the ArchiMate® business process elements, we’ve adopted the Object Management Group® (OMG) Business Process Modeling and Notation Standard (BPMN™).

• BPMN™ is an open standard notation visual modeling language for business analysis, applications, and enterprise process workflows.

• We’ve recently acquired Bpanda an application that will allow business organizations and stakeholders to enter in-text steps that will generate first-pass BPMN diagrams that can then be imported into the repository.
Finally, to drill deeper into Application and Technical ArchiMate® elements, we’ve adopted the Object Management Group® (OMG) Unified Modeling Language (UML) An open modeling language used for constructing and documenting software, complex systems, and artifacts.

We model UML in Sparx Enterprise Architect, import UML XML specification files, or hyperlink them in the repository. We can also import or link to Visio artifacts.
Fermilab Model Example
UML - Use Case Model for a Host Management Sub-System

Model::Hosts - Business Use Case

- Submit a change to the existing host list
- Add a new Affiliation Host
- Remove an Affiliation Host
- Change a Hosts Priority
- Approve changes to the Affiliation Hosts List
- Receive notifications of Changes to the hosts list

Participants:
- Submitter
- Division Head
- Affiliation Rep
- Users Office
- Visa Office
- FVA Office Manager
Having just completed Year 2 an overview of our Year 3 Plans
Year 3 - Plans

• All three of the enterprise architects are now at 100% FTE
• Having implemented many foundational pillars in Year 2, we are currently focused on connecting them across the landscape.
• Develop and operationalize our EA services with standardized and repeatable deliverables.
• Implement connected workflows and automation for governance.
• Develop a one-stop portal for EA service requests, repository models, KPI, and digital portfolio access.
• Roadmap planning to continue the march towards establishing Enterprise Architecture as a Fermilab Center of Excellence.
Value Creation of the Initiative

- Common communication tool
- A standard method for modernization initiatives
- Controlled project artifacts
- Foundation for SQA and Risk Management lab processes
- Better stakeholder identification
- Outcomes better understood by all
Conclusion

Thank you for allowing us to share our journey thus far with you. If you would like to discuss anything covered in this presentation or would like further details, please reach out to one of the Fermilab Enterprise Architecture Team:

- Tammy Whited twhited@fnal.gov
- Craig Mohler cmohler@fnal.gov
- Rennie Scott rennie@fnal.gov
Extra Materials

Additional model examples
Fermilab Model Example
Service Catalog Management (Business Architecture)
Fermilab Model Example
Centralized Repository Management To-Be (draft)
Fermilab Model Example
Centralized Repository Management To-Be (draft)

Potential Customers
- Experiments
- Affiliations
- Scientific Computing Division
- Office of the CIO
- Core Computing Division

Current Customers
- Customer: PIP II
- Customer: SQMS

Open Questions:
- Who's accountable/responsible for the individual repository access & permission?
- License Management and funding at scale?
- Customer facing Git Repo SME Business Service?
- Overlapping service capabilities consolidation and reduction opportunities?

Legend:
- application service
- business actor
- business interface
- business service
- grouping
- product
- technology service
Complete
Fermilab Service Management Model
Strategic Viewpoint