Work Force Development in Transportation
From the Perspective of Developing a Strategic Enterprise Architecture

American Association of State Highway Transportation Officials (AASHTO)
Transportation Curriculum Coordination Council
2016 Annual Meeting
Columbus, Ohio
April 12, 2016

Robert Cooney
eVision Partners, Inc.
Agenda and Session Goals

- Provide an overview of an Enterprise Architecture (EA) Program
- Discuss elements of an EA program from the perspective of workforce development and other human capital management disciplines
- Discuss key EA implementation strategies, benefits and risks
- Wrap-up and questions
Objective of an Enterprise Architecture (EA)

To better align future technology investments in support of executing the agency’s mission
Recent Enterprise Architecture Experience
What is Enterprise Architecture?

Term first used by John A. Zachmann in a 1987 journal article on information systems architecture

EA is intended to address two problems

- System complexity – more and more money being spent on IT systems
- Poor business alignment - Becoming more and more difficult to keep the expensive systems aligned with business needs
Examples of Current State DOT Business Drivers

- Greater Transparency
- Greater Accountability
- Enhanced Organizational Efficiency and Effectiveness
- Enhanced Collaboration with Partners
- Flat or Reduced Budgets
- Reduced Staffing Levels
- Increased Utilization of Alternative Delivery Models

Technology can help an organization address these challenges
Technology Struggles to Address Business Challenges

Technology solutions can be complex, costly and risky

Data is everywhere but getting access to the right information at the right time is difficult

Technology projects seem to take much longer than they should

Business units resist the change necessary to effectively implement the technology solution

IT departments viewed as a cost center and not a source of business value
Typical Responses to Misalignment

Technology Response

• Establish technology standards that appear arbitrary & cumbersome to the business
• Implement complex software development processes
• Require extensive documentation for new systems or system changes

Business Response

• Develop its own applications with minimal involvement from IT
• Exclude technology leaders from key technology based decisions
Enterprise Architecture Seeks to Achieve Business and Technology Alignment

- Not just alignment but collaboration
- Investment in and delivery of technology solutions reflect business priorities
- Business decisions consider technology implications

Adapted from “Enterprise Architecture and TOGAF”, presentation by Alan McSweeney
Enterprise Architecture Objectives

Strategic Enterprise Asset Base

- Establish the organizational mission
- Identify information necessary to perform the mission
- Identify technologies necessary to perform the mission
- Provide transitional processes for implementing required technologies

The primary purpose of an EA is to **inform**, **guide**, and **constrain** the technology decisions for the enterprise

Based on Federal CIO Council Definition, 1999
Rationale for Implementing EA

- **Alignment**
  - Ensuring technology enables business plan/goals

- **Integration**
  - Consistent business rules
  - Seamless flow of information across the enterprise

- **Change**
  - Faster response to changing business requirements

- **Time-to-market**
  - Reducing systems development time

- **Convergence**
  - Reducing size of technology portfolio
  - Implementing standardized solutions

## Enterprise Architecture Components

<table>
<thead>
<tr>
<th>Business Architecture</th>
<th>Information Systems Architecture</th>
<th>Technical Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do we do?</td>
<td>What information is required?</td>
<td>Data</td>
</tr>
<tr>
<td>Who does it?</td>
<td>Where is a function performed?</td>
<td>Applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integration Technology</td>
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<td>Geospatial Analysis</td>
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<td>Security</td>
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<td></td>
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<td>Document Management</td>
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<tr>
<td></td>
<td></td>
<td>Network &amp; Communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hardware Platforms</td>
</tr>
</tbody>
</table>

**Business Architecture**
- What do we do?
- Who does it?
- What information is required?
- Where is a function performed?

**Information Systems Architecture**
- Data
- Applications
- Integration

**Technical Architecture**
- Application Technology
- Integration Technology
- Data Technology
- Collaboration
- Network & Communications
- Hardware Platforms
## Typical EA Deliverables

| Baseline architecture or “As-Is” | • Current business practices  
| • Current application portfolio  
| • Existing technical infrastructure |
| Target architecture or “To-Be” | • Future or end-state enterprise  
| • Captures organization’s strategic vision/plans |
| Sequencing plan | • Strategy for transitioning from baseline to target architecture |
| Other enterprise architecture products | • Graphics, models, narratives |
TOGAF
The Open Architecture Framework
EA Project Approach
Montana Department of Transportation (MDT)

MDT Strategic Enterprise Architecture (EA) Design and Implementation Plan Approach

- **Business Architecture**
  - Existing Business Processes
  - Legislative Mandates
  - Industry Best Practices
  - "To-Be" Business Processes

- **Information Systems Architecture and Data**
  - Existing Applications and Data
  - Statewide Applications
  - "Ideal" Systems Architecture
  - Application and Data Architecture (Current and "To-Be")

- **Technology Architecture**
  - Existing Technology Architecture
  - Statewide Architecture
  - "Ideal" Technology Architecture
  - Technology Architecture

- **Strategic Enterprise Architecture Design**
  - Strategic Options and Initiatives
  - Implementation Plan
  - MDT Enterprise Architecture
Business Architecture

Typical Challenges
• Changing expectations from policy makers and external stakeholders
• Frequent changes in business priorities
• Lack of standardization across business units/processes

Potential Strategies
• Detailed understanding of business drivers and requirements
• Mapping of technology solutions to business requirements
• Proactive engagement with technology staff as business priorities change
Michigan Public Service Architecture
Example of Business Mapping

Goal Area: The Economy

<table>
<thead>
<tr>
<th>Business Drivers and Outcomes</th>
<th>Sample of Strategic Information Technology Projects</th>
<th>Supporting Enterprise Architecture Strategies Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustain and Create Business Investment and Jobs in Michigan:</td>
<td>On-line Business Startup Wizard</td>
<td>Identity Management</td>
</tr>
<tr>
<td>- Retain and strengthen Michigan's existing manufacturing, agriculture and tourism base by creating new jobs.</td>
<td>An online web service has been established to fast track the application process for tax identification numbers and business startup tasks, shortening the startup process by 6 weeks.</td>
<td>The State of Michigan will be making more resources available to businesses, and some of these resources will require strict controls around secure information such as tax data.</td>
</tr>
<tr>
<td>- Facilitate employment by making it easier for employers and employees to find each other.</td>
<td>MiTAPS</td>
<td>Service Oriented Architecture</td>
</tr>
<tr>
<td>- Make the regulatory process easier to navigate for Michigan businesses.</td>
<td>Online permitting system used to facilitate the application and approval processes. This system will be extended to support as many permitting processes as possible to make Michigan a better place to do business.</td>
<td>Supporting the secure exchange of data is one of the critical functions that MDIT must fulfill moving forward. As these needs increase, and timeframes shorten, a successful SOA strategy will play a vital role in meeting the data needs of business functions supported by the State of Michigan.</td>
</tr>
<tr>
<td>- Make State Government a good partner with businesses in Michigan</td>
<td>eProcurement</td>
<td>Hosting and Data Center Consolidation</td>
</tr>
<tr>
<td></td>
<td>A project in process intended to improve the way the State of Michigan procures goods and services, making better use of tax revenues and facilitating the processes for doing business with the State of Michigan.</td>
<td>Just as businesses are expanding their hardware and data center capabilities to meet emerging technology needs, the State of Michigan must continue to provide the expanded data center services needed to help government services keep pace with an ever changing economy.</td>
</tr>
<tr>
<td></td>
<td>Michigan Talent Bank</td>
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<tr>
<td></td>
<td>A web portal focused on talent retention in Michigan by allowing employers to post jobs and to review resumes posted by Michigan job seekers.</td>
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<tr>
<td></td>
<td>Family Automated Screening Tool (FAST)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An electronic screening tool used to identify barriers to employment for families in need. It is intended to help people become successful members of Michigan’s workforce.</td>
<td></td>
</tr>
</tbody>
</table>
Example: High-Level Business Model – Enterprise Asset Management

- Commercial & Customer Operations
- Organisational Direction
- External Stakeholders

- Strategic Business Planning
- Capital Projects & Outage Delivery
- Procurement
- Inventory
- Finance
- Risk & Review

- Operational Planning
- Asset Intervention Planning
- Asset & Systems Engineering
- Work Management

- Organisation & People (HR)
- Monitoring & Control Systems
- Operations

- Information Management

© Asset Management Consulting Ltd.
MDT EA Analysis Framework
### MDT Example: Business Drivers Mapped to Critical Success Factors – Asset Management

<table>
<thead>
<tr>
<th>Business Driver</th>
<th>Quality</th>
<th>Safety</th>
<th>Cost Effectiveness</th>
<th>Economic Vitality</th>
<th>Environmental Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct maintenance and asset management operations in a streamlined and efficient manner</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform winter maintenance activities that provide consistent levels of service and optimize MDT resources</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Continue to research new equipment, materials, and processes to improve winter driving conditions of roadways</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Note: The table indicates the alignment of each business driver with the critical success factors.*
Examples of Business Drivers
Work Force Development/HCM (1 of 2)

- Embrace and promote knowledge management practices such as training, continuing professional development, and succession planning techniques
- Leverage technology to deliver training and other employee development activities in an efficient and effective manner
- Promote a behavior-based culture of safety department-wide
Examples of Business Drivers
Work Force Development/HCM (2 of 2)

- Lead in labor relations and human resource management in ways that demonstrate the value of each employee, and provide appropriate compensation, benefits, meaningful evaluations, and recognition.
- Achieve open and honest communications within the DOT and external stakeholders.
- Promote an environment that embraces change.
Information Systems Architecture

**Typical Challenges**
- Silo systems
- Redundant systems
- Duplicate and inconsistent data
- Complex integration
- Significant testing effort to avoid business disruptions
- Longer time to market
- Increased project costs

**Potential Strategies**
- Documentation of baseline architecture
- Business centric architectural views
- Enterprise data model
- Integration strategy & models
Ohio DOT
Strategic Enterprise Architecture Design
Talent Management System

Traditional Enterprise Resource Planning (ERP) systems focus on transaction processing and administration of HR processes.

Talent Management systems focus on providing strategic assistance in accomplishing long-term enterprise goals for the agency’s human capital (talent).
Talent Management System
Key Functionalities

- Performance management
- Compensation management
- e-Recruiting
- Learning management and career development
# Learning Management
## Typical Functionality

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage qualifications associated with a position</td>
<td>Manage current and former employee training history</td>
</tr>
<tr>
<td>Provide online registration functions for classes</td>
<td>Manage class roster and track class attendance including class registration priorities based on agency business rules</td>
</tr>
<tr>
<td>Provide a web-based course authoring and course delivery capability</td>
<td>Integrate with other third party course delivery functions to automatically populate the employee training record based on course completions</td>
</tr>
</tbody>
</table>
# Learning Management System

## Key Benefits

- Centralized source of learning
- Reduced cost to deliver training program
- Improved documentation in terms of ensuring compliance with training and certification requirements
- Easier to evaluate staff – before, during and after course
- Easier to upgrade and revise course materials
- Improved access to information for State DOT staff
- Self-service functionality which empowers employees to manage more of their own training program
Other System Trends
HR & Workforce Development

Leveraging more capabilities available in statewide HR solutions

- To decommission or replace legacy DOT agency applications

Electronic on-boarding/out-processing

Enterprise Safety Management systems
# Safety Management

## Typical Functionality

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain/manage safety policies</td>
<td>Monitor the assignment, status and completion of safety program tasks and activities</td>
</tr>
<tr>
<td>Track required permits and renewal dates</td>
<td>Support tracking of completion of required courses and safety certifications</td>
</tr>
<tr>
<td>Track completion of required maintenance or monitoring activities</td>
<td>Document and track safety incident</td>
</tr>
<tr>
<td>Provide a chemical management system</td>
<td>Manage/track occupational safety medical evaluation</td>
</tr>
</tbody>
</table>
Typical Challenges
• Lack of standardization
• Multiple hardware vendors
• Multiple software vendors & solutions
• Higher total cost of ownership

Potential Strategies
• Technology standards
• Common services available for use across the enterprise
• Structured technology evaluation process
Michigan Solution Maturity Model

EA Portfolio Assessment

Common methodologies, enterprise-wide standards, high level of support, scalable solutions

Maturity

1. Underutilized (But Mature)

2. Niche Solutions

3. High Utility (Not Mature)

4. Optimal State
   Sustainable and Leveraged

Utility

Entities/organizations that make use of a solution, visibility, business importance
Technical Platform Delivery Options

<table>
<thead>
<tr>
<th></th>
<th>In-House</th>
<th>IaaS</th>
<th>PaaS</th>
<th>SaaS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
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<td></td>
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<tr>
<td>Data</td>
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<tr>
<td>Runtime</td>
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<td>Middleware</td>
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<td>OS</td>
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<td>Virtualization</td>
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<td>Servers</td>
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<td>Storage</td>
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<tr>
<td>Networking</td>
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</table>

Legend:
- **User's Scope**
- **Service Provider's Scope**

Choice of Delivery Platform Significantly Impacts Future IT Staffing Requirements & Skills Requirements
Software as a Service (SaaS) Defined

- Licensed on a subscription basis and centrally hosted
- Web-based
- Multi-tenant
  - Serves multiple businesses and users, and partitions its data accordingly
  - Limits opportunity to customize system to meet agency specific business needs
Key EA Implementation Strategies

- Implementation Roadmap
- Technology Governance
- Enterprise Architecture Team
- Technology Investment Process
- Organizational Change Management
## Enterprise Architecture Team Roles

### Chief Architect
- Manage overall EA program
- Manage EA governance processes
- Lead establishment of enterprise technology standards and policies.
- Lead architecture reviews of new and existing projects
- Implement on-going EA change management program

### Business Architect
- Develop understanding of business environment
- Cultivate relationships with business stakeholders
- Maintain in-depth knowledge of strategic business plans
- Own and maintains business architecture

### Application/Solution Architect
- Design and oversee implementation of end-to-end integrated systems
- Design and implement architectural initiatives that create business value and improve organizational efficiency

Depending on size of organization, roles are often shared.
## Enterprise Architecture Team Roles (2 of 2)

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Data Architect        | • Design and implement enterprise data and metadata structures  
                        • Create plans to integrate business systems and workflows  
                        • Implement best practices for master data management and integration |
| Technical Architect   | • Design and guide implementation of specific technical solutions to support business initiatives  
                        • Lead establishment of standards for hardware platforms, software and other infrastructure components |
| EA Tool Expert        | • Provide training and knowledge transfer on EA tools and methods                                                                               |

Depending on size of organization, roles are often shared.
Best Practice
IT Project Scoping and Screening

Project Origination Document

Project Origination Checklist

- Project scope
- Funding sources
- Financial impact
- Operating budget impact
- Partnering opportunities
- Required disciplines
- Resources required
- Procurement strategy
- Risk analysis
- Service impacts
- Customer impact
- Regional impact
- Environmental factors

Planning Level
Full Project Lifecycle Cost Estimate
IT Investment Prioritization Tool

- **Budget Constraints Actual Funding**: Shows your optimal project portfolios for various budget increments.

- **Comparative ranking based on established criteria of the Agency**.

- **Improving competitiveness of projects**
  Selecting the optimal project mix to maximize the collective benefit, while balancing other factors such as risk, budget or staffing constraints and political considerations.
# Organizational Change Management

<table>
<thead>
<tr>
<th>Stakeholder identification and impact analysis</th>
<th>Communications</th>
<th>Business process re-design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job design</td>
<td>Business procedures</td>
<td>System procedures</td>
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<td>End user training</td>
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</table>
## Organizational Change Management Plan

<table>
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<tr>
<th>Reason/ case for change</th>
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<tbody>
<tr>
<td>Vision</td>
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<tr>
<td>Change objectives</td>
</tr>
<tr>
<td>Change details</td>
</tr>
<tr>
<td>Critical needs</td>
</tr>
<tr>
<td>Performance management</td>
</tr>
<tr>
<td>Communication plan</td>
</tr>
</tbody>
</table>
Mobile applications allow for substantial re-engineering of business processes/job functions

Self-serve technologies are also transforming business processes and job functions

- Employee self-service
- Partner self-service
Organizational Change Management
Workforce Development Impacts

Increased need for knowledge workers

- Challenge of re-tooling “transaction processors” to information workers

Changes in required IT skill mix

- Less application developers needed with increased use of commercial off-the-shelf and Cloud-based applications
- Continued need for project management experience
- Increased need for contract management experience
## Benefits of EA Program (1 of 2)

<table>
<thead>
<tr>
<th>Documentation of business drivers</th>
<th>• Promote better planning and decision making</th>
</tr>
</thead>
</table>
| Improved communication & collaboration | • Both within the business organizations and with the technology organizations  
• Establish a standardized vocabulary |
| Business centric architectural views | • Help to communicate the complexity of large systems  
• Depict interaction between systems  
• Facilitate on-going management of complex environments |
| Focus on the strategic use of emerging technologies | • Drive implementation of business efficiencies  
• Drive process standardization  
• Enable business to meet changing requirements |
Benefits of EA Program (2 of 2)

- **Improved sharing of information across the enterprise**
  - Consistency, accuracy, timeliness
  - Integrity, quality, availability, access

- **Structured technology investment process**
  - Identify benefits, impacts, and lifecycle cost
  - Analyze in a consistent way alternatives, risks, and tradeoffs
  - Prioritize candidate projects based on business value

- **Better leveraging of technology spend**
  - Build more quality and flexibility into applications without increasing cost
  - Achieve economies of scale through sharing services
  - Expedite integration of legacy, migration, and new systems
  - Ensure legal and regulatory compliance
## Barriers/Challenges and Potential Mitigation Strategies

<table>
<thead>
<tr>
<th>Barriers/Challenges</th>
<th>Potential Mitigation Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of clear executive sponsorship</td>
<td>• Early engagement of executive management</td>
</tr>
<tr>
<td>Changes in leadership</td>
<td>• Early wins to demonstrate business value</td>
</tr>
<tr>
<td></td>
<td>• Build champions at all management levels</td>
</tr>
<tr>
<td>Lack of key business and technology champions</td>
<td>• Engage early through governance team</td>
</tr>
<tr>
<td>Challenges in obtaining organizational buy-in</td>
<td>• Develop champions at all staff levels</td>
</tr>
<tr>
<td></td>
<td>• Organizational change and communication plan</td>
</tr>
<tr>
<td>Budgetary constraints</td>
<td>• Right-size plan based on available funding</td>
</tr>
<tr>
<td>Implementation plan too ambitious</td>
<td>• Phased deployment plan</td>
</tr>
<tr>
<td>Initiative unable to gain momentum</td>
<td>• Early wins to demonstrate business value</td>
</tr>
</tbody>
</table>
Questions and Discussion
Contact Information

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