Building Business Capability

Incorporating Enterprise Risk Management into Enterprise Architecture

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Objectives

- Provide an EA framework that integrates with the solution architecture
- Uses open standards and is extensible
  - Configuration changes
  - Metamodel changes
  - Report modifications and additions
- Tracks the architectural views
- Shows the enablement of business processes
- Shows various points in time (As-Is / To Be)
- Extend the EA framework with ERM concepts
An Integrated Approach to Enterprise Architecture & Enterprise Risk Management

Based on Numerous Standards
- RM-ODP
- RUP
- TOGAF
- ArchiMate
- COSO

Models the Different Architectural Views
- Business
- Information Systems
- Infrastructure

Provides Information for Strategic Planning
- Business Process Realizations
- Future State Roadmaps
- Project Portfolio Management

Integrates with Risk Management
- Objectives
- Risks & Opportunities
- Risk Responses
- Manual & Automated Controls
- Transactional and Analytical Data

GRC Integrated Framework
- Continuous Monitoring
  - ERM / Key Risks
  - Financial, Business and IT Controls
  - KPIs / Key Metrics

Business Architecture
- Business Processes, Organization, People

Application Architecture
- Services

Data Architecture
- Data Information

Technology Architecture
- Hardware, Software, Network

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Imagine your architecture as a 3-dimensional space
Architectural Assets
Modeling Enterprise Architecture

Architectural Stakeholders

Audit & Compliance Personnel

Who is Interested?

- Senior Business Management
- Application Architects
- Senior IT Managers
- Data Architects
- QA Personnel
- Business Architects
- Project Management
- Operations Staff
- Business Experts
- Infrastructure Architects
- Developers

Business Processes
Servers
Use Cases
Network Topology
Objectives
Databases
Applications
Lots More!
How Do We Address All of Their Needs?

Modeling Enterprise Architecture

Architectural Stakeholders

Audit & Compliance Personnel

Senior Business Management

Application Architects

Data Architects

Q/A Personnel

Senior IT Managers

Business Architects

Project Management

Operations Staff

Business Experts

Infrastructure Architects

Developers

Business Processes

Servers

Network Topology

Objectives

Use Cases

Databases

Applications

Lots More!
Modeling Enterprise Architecture

Service Driven Multi-dimensional Set of Architectural Views

Through a Separation of Concerns

To address the needs of:
- The Stakeholders
- The Business Processes
- The Future
Modeling Enterprise Architecture

TOGAF Provides Architectural Views with Services

Through a Separation of Concerns

Horizontal Slices provide an inventory of architectural assets and their relationships within each view (layer)
Modeling Enterprise Architecture

TOGAF Provides Architectural Views with Services

Business Architecture

Information Systems Architecture

Infrastructure Architecture

EA Services “Glue” the Layers Together

Using an Enterprise Level Service Taxonomy

Different layers have different life-cycles
EA Services provide stable specifications of architectural needs and a categorization of architectural elements
Modeling Enterprise Architecture

TOGAF Provides Architectural Views with Services

Higher level elements require generic services
Lower level elements provide specific service specializations
Architectural elements implement the service specializations
ArchiMate provides a layered approach to show how IT is aligned with the Business and provide a means to discover architectural requirements.
Modeling Enterprise Architecture

**Vertical Slices**

*Business Process Realization Architectural Requirements*

- Business Architecture
- Information Systems Architecture
- Infrastructure Architecture

**Horizontal Slices**

*Architectural Views*

- Service Requirements
- Service Specializations

**Temporal Slices**

Roadmaps show how the architecture is to change over time. Projects align with the Roadmaps to affect the change.
Enterprise Risk Management

Planning

Business Process Realization

Project Portfolio Management

Execution

Continuous Monitoring

Service Requirements

Risk Mediation

Information Systems Architecture

Service Specializations

Infrastructure Architecture

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Driving the Project Portfolio

Risk Mitigation & Process Improvement

Business Process Development

Technology Progression

Project Portfolio
Architectural Details

- The Implementation
  - Built on the open standards of UML & SQL
  - Guided by metamodels
Goals of an ERM Framework

- To discover and validate the existing controls within the architecture
- To discover those that are needed but absent
- To determine the level of support required for missing controls
- To design a control solution that provides continuous monitoring of the effectiveness of the controls
- To provide strategic and tactical input into the project portfolio to ensure the appropriate level of risk mitigation and monitoring is in place
Financial Risk Management

Key Elements of an ERM Framework

- Objective Categories
- Strategic Objectives
- Objectives
- Risks
- Risk Responses
- Controls

- «Strategic Objective»
  - Maintain ROI

- «Objective»
  - Maintain Cash Conversion Period of 25 Days or Less

- «Risk»
  - Late Payments

- «Risk Response»
  - Avoid Payments

- «Control»
  - Outstanding Invoice Alert

- «Risk»
  - Increase in Inventory Value

- «Risk Response»
  - Increase in Inventory Value

- «Control»
  - Inventory Value Control

- «Risk»
  - Increase in Inventory Value

- «Risk Response»
  - Accept Late Payments

- «Control»
  - Customer Credit Limit Establishment

- «Control»
  - Inventory Purchase Approval

- «Control»
  - Inventory Value Control

- «Control»
  - Outstanding Invoice Alert
Enterprise Risk Management

Objective Categories and Strategic Objectives

Key Elements of an ERM Framework

- Objective Categories
  - Provide a way of organizing the objectives

- Strategic Objectives
  - Address different concerns within the category
  - Are top level objectives
Enterprise Risk Management

Objectives

Key Elements of an ERM Framework

- Objectives detail the strategic objectives

  - Are of three types
    - Operational
    - Reporting
    - Compliance

- Objective data points
  - Measure: Indicates how the objective is measured
  - Target: What the desired measure is
  - Tolerance: The permitted deviation from the target
Enterprise Risk Management

Risks

Key Elements of an ERM Framework

- Risks may adversely impact the objectives
- Risk data points
  - Event Level
    - Indicates the scope of the risk
    - Industry, Entity, Business Unit, Process
  - Leading indicator
    - Predicts future likelihood of the risk
  - Escalation trigger
    - The measure of the leading indicator that triggers the need for action
  - Likelihood
    - The likelihood that the risk will occur within the time horizon
  - Time horizon
    - The time period during which the risk may occur
  - Impact
    - Quantitative cost should the risk occur
    - May be a financial cost, a hit to the company’s reputation, etc
Enterprise Risk Management

Risk Responses

Key Elements of an ERM Framework

- Risk Responses provide possible solutions to mitigate the risks
  - Each risk may have one or more risk response
  - Each risk response represents a trade off between the cost of the risk and the cost of the mitigation
  - Each response may be to avoid, reduce, share, or accept the risk

- Risk response data points (residual risk)
  - Estimated cost of implementation
  - Residual impact
  - Residual likelihood
  - Residual impact
Key Elements of an ERM Framework

- Controls provide a means to mitigate risk
- Controls relate to actions that are taken
  - Following policies
    - manual check lists
  - Performing business activities
    - Manual activities described in the business process model
  - Invoking IT solutions
    - IT services that represent the automation of activities from the business process model
  - Charting compilations
    - Typically, spreadsheets containing 10’s to 100’s of controls at a fine grained level
    - For example, the dozens of controls within SAP regarding the month-end closing process
Enterprise Risk Management

Controls

Key Elements of an ERM Framework

- Controls should be verified by
  - Reports showing the results of the control’s actions
    - Some are manually generated and others automatically generate by the IT solution

- Control results should be continuously monitored by...
  - People
  - Automated systems

- Controls may have remedial actions should objectives not be met
  - Manual activities
  - Automated systems

- Control results should be reviewed to determine whether adjustments must be made
Enterprise Risk Management

Key Elements of an ERM Framework

- The key objective of instituting an ERM policy is not to automate as much of the process as is possible...
- But rather to balance the cost of the impact of each risk against the cost of implementing a risk response to the risk...
- And having implemented the selected risk responses, to continuously monitor the effectiveness of their controls to ensure that objectives are met within their level of approved tolerance
- The focus of this presentation has been on risk mitigation, but the same framework can be used for performance evaluation
Enterprise Risk Management

Phases of ERM

Planning

- Establish Risk Environment
- Set Objectives
- Identify Risks that May Impact the Objectives
- Determine Candidate Risk Responses
  - Determine Control Rationalization
    - Make Manual Remediation Changes
    - Make System Remediation Changes

Risk
  - Likelihood
  - Impact
  - Time Horizon
  - Leading Indicator
  - Escalation Trigger

Objective
  - Measure
  - Target
  - Tolerance

Risk Response
  - Risk Response 1
    - Residual Risk
    - Cost of Implementation
    - Manual Detective Control 1
    - Manual Control 2
    - Manual Control 3
  - Risk Response 2
    - Residual Risk
    - Cost of Implementation
    - Manual Detective Control
    - Automated Preventive Control
    - Automated Detective Control

Impacts

Avoids, Reduces, Shares or Accepts

Selected Response

Candidate Response
Phases of ERM

- Planning
- Execution

Enterprise Risk Management
Enterprise Risk Management

Phases of ERM

- Planning
- Execution
- Risk Meditation
- Implementation
- Continuous Monitoring

![Diagram of ERM Phases]

- Risk Response 2
  - Manual Detective Control
  - Automated Preventive Control
  - Automated Detective Control

- Risk Response 3
  - Automated Detective Control
  - Automated Preventive Control
  - Automated Detective Control

- Risk Response 4
  - Automated Detective Control
  - Automated Preventive Control
  - Automated Detective Control

- Manually Generated Compliance Report
- Spreadsheets, Access Databases, etc.
- System Generated Compliance Report

Determine if Objectives Have Been Met

Continue monitoring

No

Yes

Selects

Creates Executive Reports

Objectives were met?

Make Manual Remediation Changes

Make System Remediation Changes

Determine Control Rationalization

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Enterprise Risk Management Example

Example: Hazardous Waste Risk Management

**Objective Category**
Hazardous Waste Risk Management

**Objective**
Ensure No Environmental Damage is Incurred Along with any Subsequent Fines.

**Strategic Objective**
Maintain a Safe, Productive Workplace, Complying with all Regulations

**Risk**
- Corrosion on Barrels Causes Material to Leak
  - Candidate Response: Accept Barrel Leakage
  - Candidate Response: Reactive Barrel Replacement
  - Selected Response: Proactive Barrel Replacement

- Unsafe Transport Conditions Cause Barrels to Explode in Transit
  - May Impact Objective
  - Candidate Response: Maintain Fire Retardent Systems
  - Selected Response: Maintain Drilling Equipment at Optimum Performance

- Equipment Failure Causes Deep Water Pump Failure
  - Candidate Response: Maintain Fire Retardent Systems
  - Selected Response: Maintain Drilling Equipment at Optimum Performance

- Responsible Party/Parties Falsify Documents
  - Three Individuals within at Least Two Reporting Hierarchies Must Verify Document Accuracy

- Reactive Barrel Replacement

**Selected Response**
- May Impact Objective
- Candidate Response
- Selected Response
Enterprise Risk Management Example

Risk Responses

1st Candidate Response

«Risk Response»
Accept Barrel Leakage
Enterprise Risk Management Example

2nd Candidate Response

- **Organizational Unit**
  - Vendor Management
  - Vendor Relations Manager
  - George Benard

- **Control**
  - Vendor Control
    - Policy: Vendor Selection Requirements
    - Control Action
    - Control Verification
    - Report: Vendor Selection Check Off Sheet

- **Control**
  - Manual Barrel Inspection Control
    - Activity: Inspect Barrels for Defects
    - Control Verification
    - Report: Barrel Inspection Report
    - Control Remediation
    - Activity: Replace Barrels
    - Activity: Paint Barrel

- **Risk Response**
  - Reactive Barrel Replacement
    - Addresses Response
    - Addresses Response

- **RACI Role**
  - Addreses Response
  - Control Action
  - Control Remediation
Enterprise Risk Management Example

Selected Response

«Organizational Unit»
Vendor Management

«Control»
Vendor Control

«RACI Role»
Informed

Vendor Relations
Manager

George Benard

«Control»
Manual Barrel Inspection Control

«Activity»
Inspect Barrels for Defects

«Report»
Vendor Selection Check Off Sheet

«Control»
Automated Barrel Monitoring Control

«IT Service»
Inventory Management Service

«Report»
Inventory Aging Report

«Activity»
Paint Barrel

«Activity»
Replace Barrels

«Control Remediation»

«Control Verification»

«Control»
Proactive Barrel Replacement

«Addresses Response»

«Control»
Vendor Control

«RACI Role»
Accountable

«Control Action»

«RACI Role»
Responsible

«Policy»
Vendor Selection Requirements

«Control Verification»

«RACI Role»
Informed

«Control Action»

«Control Remediation»

«Control Verification»

«Control Remediation»

«Control Remediation»

«Control Remediation»

«Control Remediation»

«Control Remediation»
Enterprise Risk Management Example

Healthcare Example
Enterprise Risk Management Example

Healthcare Example

- «Risk» Unsigned Patient Authorization Form
  - «Selected Response»
    - «Addresses Response»
      - «Control» Manual Patient Admission Control
        - «Control Action»
          - «Control Verification»
            - «Control Remediation»
              - «Control Action»
                - «Control Action»
                  - «Activity»: Walk Through Inspection
                    - «Policy»: Patient Admission Policy
                      - «Activity»: Contact Patient for Additional Info
                        - «Report»: Walk Through Inspection Report
                          - «Control Remediation»
                            - «Report»: Patient Forms Inspection Report
                              - «Control Remediation»
                                - «Control Action»
                                  - «Control Action»
                                    - «Control Action»
                                      - «Activity»: Ask Patient for Missing Information
                                        - «Report»: Automated Forms Inspection Report
                                          - «Control Remediation»
                                            - «Activity»: Scan and Verify Admissions Form: Document Scanning Service
                                              - «Control Remediation»
                                                - «Control Action»
                                                  - «Control Action»
                                                    - «Control Action»
                                                      - «Control Verification»
                                                        - «Control Remediation»
                                                          - «Control Action»
                                                            - «Activity»: 10% of Population: Sample Patient Documentation
                                                              - «Report»: Walk Through Inspection Report
                                                                - «Addresses Response»
                                                                  - «Control» Automated Patient Admission Control
                                                                    - «Control Action»
                                                                      - «Control Action»
                                                                        - «Activity»: Contact Patient for Additional Info

- «Risk Response» Unsigned Mixed Response
  - «Addresses Response»
    - «Control» Manual Patient Admission Control
      - «Control Action»
        - «Control Action»
          - «Control Action»
            - «Activity»: Walk Through Inspection
              - «Policy»: Patient Admission Policy
                - «Activity»: Contact Patient for Additional Info
                  - «Report»: Walk Through Inspection Report
                    - «Control Remediation»
                      - «Report»: Patient Forms Inspection Report
                        - «Control Remediation»
                          - «Control Action»
                            - «Control Action»
                              - «Control Action»
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                                          - «Control Action»
                                            - «Control Action»
                                              - «Control Action»
                                                - «Control Verification»
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                                                    - «Control Action»
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                                                        - «Report»: Walk Through Inspection Report
                                                          - «Addresses Response»
                                                            - «Control» Automated Patient Admission Control
                                                              - «Control Action»
                                                                - «Control Action»
                                                                  - «Control Action»
                                                                    - «Activity»: Contact Patient for Additional Info

Enterprise Risk Management Example
Integrating ERM with EA
# Enterprise Risk Management Example

<table>
<thead>
<tr>
<th>Objective Category</th>
<th>Strategic Objective</th>
<th>Objective</th>
<th>Risk</th>
<th>Risk Response</th>
<th>Control</th>
<th>Control Action</th>
<th>Control Verification</th>
<th>Control Remediation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Waste Risk Management</td>
<td>Maintain a Safe, Productive Workplace, Complying with all Regulations</td>
<td>Operations: Ensure No Environmental Damage is Incurred Along with any Subsequent Fines</td>
<td>Measure: Financial Cost of Clean Up Including Fines</td>
<td>Target: Financial Impact &lt; $500,000 per year</td>
<td>Tolerance: +/- $50,000 per year</td>
<td>Event Level: Business Unit</td>
<td>Escalation Trigger: Financial impact of combined incidents reaches $50,000</td>
<td>Likelihood: 10% of the barrel population leaks within 5 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corrosion on Barrels Causes Material to Leak</td>
<td>Candidate Response: Accept Barrel Leakage</td>
<td>Response Type: Accept</td>
<td>Residual Likelihood: 10% of the population leaks within 5 years</td>
<td></td>
<td></td>
<td>Residual Impact: $500,000 per year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Candidate Response: Reactive Barrel Replacement</td>
<td>Response Type: Reduce</td>
<td>Residual Likelihood: 5% of the barrel population leaks within 5 years</td>
<td></td>
<td></td>
<td>Residual Impact: $250,000 per year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vendor Control</td>
<td>Vendor Selection Policy: Vendor Selection Requirements</td>
<td>Policy</td>
<td>Detective</td>
<td>Vendor Selection Check Off Sheet</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Selected Response: Proactive Barrel Replacement</td>
<td>Response Type: Avoid</td>
<td>Residual Likelihood: 1% of the barrel population leaks within 5 years</td>
<td></td>
<td></td>
<td>Residual Impact: $50,000 per year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Automated Barrel Monitoring Control</td>
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</tr>
</tbody>
</table>
Enterprise Risk Management
Non-Architectural View
What We Have Accomplished

- Captured each architectural view along with life-cycle information
- Shown how the applications and database schemas interact to realize key scenarios
- Shown the key architectural elements involved in the business process realizations
- Added roadmaps and projects to provide portfolio management
- Integrated risk management with the business policies, activities, and services of the architectural views
Going From Chaos

Audit & Compliance Personnel
To Strategic Planning

Vertical Slices

Business Process Realization Architectural Requirements

Horizontal Slices

Architectural Views

Business Process Realization

Business Architecture

Information Systems Architecture

Infrastructure Architecture

Temporal Slices

Roadmaps

Current State

Future State

Continuous Monitoring

Objectives – Risks - Controls
Modeling Enterprise Architecture

Supporting Architectural Slides

- Business Architecture
- Information Systems Architecture
- Infrastructure Architecture

Current State

Business Process Realization

Future State

Service Requirements

Service Specializations
Business Architecture

- Concerns of Business Architecture
  - Business Objectives
  - Business Needs (High Level Requirements)
  - Business Processes
  - Business Information
  - Business Policies and Rules
  - Requirements
    - Business needs (high level requirements)
    - Use cases
Business Architecture

Business Processes

- Membership Policy Definition Process
- Program Policies
- Roster Eligibility Policies
- Registration Process
- Game Officials Registration
- Game Officials Setup
- Venues, Calendars, and Game Officials Setup Process
- Schedule Games Process
- Season Execution Process
- Post-Season Event Process
- «EA2 Receive Event» League Registration Opening Date
- «EA2 Receive Event» League Registration Final Close Date
- «EA2 Receive Event» League Setup Date
- «EA2 Receive Event» Season Opening Date
- «EA2 Receive Event» Season Close Date
- «EA2 Receive Event» Season Setup Date
- «EA2 Receive Event» Season Close Date
- «Initiates»
- «Ends»
- «Impacts»
- «Impacts»
Business Architecture

Business Information Model
Business Policies and Rules

- **Policy**: Game Eligibility Policy
  - **notes**: A club may place certain player eligibility restrictions on its programs, divisions, leagues, and/or teams.

- **Rule**: Player Suspension Status Prohibition
  - **notes**: A player may not be on a Game Roster nor play in any Games while he/she is on suspended status.

- **Rule**: Player Active Status Prohibition
  - **notes**: A player may not be on a Game Roster nor play in any Games while he/she is on inactive status.

- **Rule**: Multiple Roster Per Day Prohibition
  - **notes**: A club may choose to restrict a player from being on more than one team’s roster for a given day, even if that player is on multiple teams. In other words, this would restrict a player from playing in more than one game on a given day.
Business Architecture

Requirements Traceability

Diagram showing business need to rate players, activity to rate players statistically, and quality attribute for statistical rating performance.
<table>
<thead>
<tr>
<th>Business Objective</th>
<th>Business Need</th>
<th>Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase sales and usage of the Recreational Team Development service through added automation.</td>
<td>Coach and Player ID Cards: The system must have the ability to generate Coach and Player ID cards in accordance with any governing organizations, e.g. Eastern Pennsylvania Youth Soccer Association (EPYSA).</td>
<td>Prepare Coach &amp; Player ID Cards, v1.00</td>
</tr>
<tr>
<td>League, Division, Team Setup: The system must have the ability to setup leagues and their divisions for different sports and to use players' statistics to setup recreational teams.</td>
<td>Assign Player to Division, v1.00</td>
<td>Assign Player to League, v1.00</td>
</tr>
<tr>
<td></td>
<td>Assign Player to Team, v1.00</td>
<td>Assign Player to Team, v1.00</td>
</tr>
<tr>
<td>Rate Players: The system must provide the ability to rate players by ability, using the player attributes that have been setup by the Program Manager for this purpose.</td>
<td>Rate Players Statistically, v1.02</td>
<td></td>
</tr>
</tbody>
</table>
Modeling Enterprise Architecture

- Concerns of Application Architecture
  - Roles and actors
  - Composition of logical components
  - Interface definitions
  - Interactions through interfaces
    - Implementation of interfaces (Provided Interface)
    - Requirement for an interface (Required Interfaces)
    - Integration styles to be employed
  - Application behavior
  - Technology Requirements
Application Architecture

Business System Components

Diagram showing components of a Business System, including:
- Program Management Business System
- Program Manager
- Team Assigner
- Player Rating Front End Application
- Player Rating Engine
- Program Development DB Schema
Application Architecture

Interface Definitions and Usage

- **App Interface**
  - `iPlayer Rating Session`
  - `+ ratePlayersStatistically(int) : void`
  - `+ setPlayerRating(int) : void`
  - `+ updateRatingDefs() : void`

- **Presentation**
  - `Player Statistical Rating Presentation`

- **Work Session**
  - `Player Rating Session`
  - `Async iPlayer Rating Pages`

- **Asynchronous**
  - `iPlayer RatingPages`

- **Presentation**
  - `Player Manual Rating Presentation`
Application Architecture

Application Context Diagram

- Shows the Business Applications, Services, DB Schemas and their interactions through interfaces for a given scenario.
## Application Architecture

### Application Component Context Diagram

- Detailed view of the application components and their interactions

<table>
<thead>
<tr>
<th>External Actors</th>
<th>Presentation Tier</th>
<th>Work Space Tier</th>
<th>Business Service Tier</th>
<th>Enterprise Resource Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Designer</td>
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</tr>
</tbody>
</table>

**Diagram Details:**
- **External Actors:** Team Designer
- **Presentation Tier:**
  - **Select FLDT Pages**
  - **Select FLDT Session**
- **Work Space Tier:**
  - **Player Rating Session**
  - **Player Rating Service**
- **Business Service Tier:**
  - **Player Rating Service**
  - **Sports Program Service**
  - **League Service**
- **Enterprise Resource Tier:**
  - **Logging Service**
  - **Member Management DB Schema**
  - **Program Development DB Schema**

*Images not provided in this text representation.*
Application Architecture

Integration Styles

Details the integration styles represented on the context diagrams.
Application Architecture

Application Behavior
- Details the system flow of component interactions
## Configuration Item Logical Dependencies

<table>
<thead>
<tr>
<th>Dependent Type</th>
<th>Dependent</th>
<th>Interface</th>
<th>Interface Type</th>
<th>Provider</th>
<th>Provider Type</th>
<th>Provider Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business App</td>
<td>Player Rating Front End</td>
<td>iLeague</td>
<td>ESB</td>
<td>League Service</td>
<td>Service</td>
<td>Software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iPlayer</td>
<td>ESB</td>
<td>Player Service</td>
<td>Service</td>
<td>Software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iPlayerRating</td>
<td>Sync</td>
<td>Player Rating Service</td>
<td>Service</td>
<td>Software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iSports Program</td>
<td>ESB</td>
<td>Sports Program Service</td>
<td>Service</td>
<td>Software</td>
</tr>
<tr>
<td>Presentation</td>
<td>Establish Sports Program Presentation</td>
<td>iEst Prog Presentation</td>
<td>Async</td>
<td>Program Mgt Session</td>
<td>Work Session</td>
<td>Software</td>
</tr>
<tr>
<td></td>
<td>Member Management Presentation</td>
<td>iMember Management Session</td>
<td>Async</td>
<td>Member Management Session</td>
<td>Work Session</td>
<td>Software</td>
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<tr>
<td></td>
<td>Player Manual Rating Presentation</td>
<td>iPlayer Rating Pages</td>
<td>Async</td>
<td>Player Rating Session</td>
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<td>Program Mgt Svc</td>
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</table>
# Application Architecture

## Sample Report – Shows Where Data is Being Passed

<table>
<thead>
<tr>
<th>Content Passed</th>
<th>Provider.Interface</th>
<th>Receiver</th>
<th>Diagram Name</th>
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<tr>
<td>Activation : Entity</td>
<td>Select PLDT Session, Select PLDT Pages (Async)</td>
<td>Select PLDT Presentation</td>
<td>Rate Players Statistically, v2.01 - Component View</td>
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<td>SportsProgram : Entity</td>
<td>Program Development DB Schema SQL (R/W)</td>
<td>SportsClubService</td>
<td>Rate Players Statistically, v2.01 - Integration View</td>
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</table>

*Note: Diagram names represent various views of the application architecture, focusing on data flow and utilization.*
## Application Architecture

Sample Report – Data Flow through a Set of Scenarios

### Enterprise Sequence Information Flows

<table>
<thead>
<tr>
<th>Information Flow</th>
<th>Sequence #</th>
<th>Content Passed</th>
<th>Content Type</th>
<th>Receiver</th>
<th>Provider</th>
<th>Message</th>
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<th>Interface Type</th>
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<td>Player Rating Front End</td>
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</tbody>
</table>
Concerns of Data Architecture

- DB Schemas
- DB schema access
- ETL Jobs with scheduling information
- Stored procedures
- XML documents
- Enterprise level data definitions
Data Architecture

DB Schemas with Logical/Physical Design
Data Architecture

XML Documents
Data Architecture

ETL Jobs

<table>
<thead>
<tr>
<th>ETL Job</th>
<th>Member to ProgDev</th>
<th>ETL Job</th>
<th>Nightly Registration Transfer</th>
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<td>Schedule = «Schedule»Nightly</td>
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Infrastructure Architecture

- Concerns of Infrastructure Architecture
  - Actors, and Vendors
  - Network and Site information
  - IT Software and Services
  - Hardware Model Configurations
  - Deployed Hardware Based on the Models
  - Execution Environments
# Infrastructure Architecture

## Sample Report – Server Deployments

## Server Configurations

<table>
<thead>
<tr>
<th>Server</th>
<th>O/S</th>
<th>Configuration Item Type</th>
<th>Configuration Item</th>
<th>Configuration Item Type</th>
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<td>Solaris 9</td>
<td>Business App</td>
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<td>SCMS-01::Compaq DL380</td>
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<td>:Program Mgt Session</td>
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<td></td>
<td>:Team Assignment Session</td>
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<tr>
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<td></td>
<td>DBMS</td>
<td>Client::Oracle 10.0</td>
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<td>SCMS-03::SunFire 6800</td>
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<td>Business App</td>
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<td>::TeamService</td>
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</table>
EA Service Taxonomy

EA Service Taxonomy Provides...

- A way to create stable architectural requirements while tracking the underlying changes in the elements realizing the requirements
- A way to categorize the functionality provided by architectural elements and a way to eliminate redundant implementations
- A way to plan the introduction and elimination of entire technologies with minimal effort
TOGAF provides a starter taxonomy of applications, interfaces, and services than can be modified to fit your environment.
Data Management
- Data dictionary/repository services
- Database management system (DBMS) services
- Object Oriented Database Management System services
- File management services
- Query processing functions
- Screen generation functions
- Report generation functions
- Networking/concurrent access functions
- Warehousing functions

TOGAF provides a starter taxonomy of applications, interfaces, and services than can be modified to fit your environment.

EA Service Taxonomy
TOGAF provides a starter taxonomy of applications, interfaces, and services than can be modified to fit your environment.

Software Engineering Services
- Programming language services
- Object code linking services
- Computer Aided Software Engineering (CASE) environment and tools services
- Graphical User Interface (GUI) building services
- Scripting language services
- Language binding services
- Run Time Environment services
- Application Binary Interface services

Combination of callable (SOA) and non-callable services - a superset of an SOA service taxonomy.
## EA Service Taxonomy

<table>
<thead>
<tr>
<th>Service Layer</th>
<th>Service Category</th>
<th>Service</th>
<th>Service Specialization</th>
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<tbody>
<tr>
<td>EA IT Service</td>
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<td>Backup/Recovery Service</td>
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<td>Tape Encryption Backup/Restore Service</td>
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<td>Fiber-Optic Data Storage Service</td>
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<td>iSCSI Data Storage Service</td>
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<td></td>
<td>Multipath I/O Data Storage Service</td>
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<td>NAS Data Storage Service</td>
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<td>Distributed File System</td>
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<td>RPC Service</td>
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</tr>
</tbody>
</table>

Service Specializations provide technology and/or standards-based methods for implementing Services.

Infrastructure elements provide implementations of the Service Specializations.

---

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### Extended Service Taxonomy

#### EA Business Services
- Capabilities required by external constituents
- Implemented by Business Processes’ Activities

#### EA Information System Services
- Capabilities required by Business Activities
- Implemented by Business Applications and enterprise level DB Schemas

#### EA Infrastructure (IT) Services
- Capabilities required by Business Applications
- Infrastructure supplies service specializations
- Implemented by IT Software
# Extended Service Taxonomy

## Sample Report – EA Service Taxonomy (IT Service Layer)

<table>
<thead>
<tr>
<th>Service Layer</th>
<th>Service Category</th>
<th>Service</th>
<th>Service Specialization</th>
<th>Service Specialization Begin Date</th>
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<td>Communication Services</td>
<td>Telecommunication Services</td>
<td>VOIP Service</td>
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<td>Distribution File System Services</td>
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</table>
Business Process Realizations
This shows each layer’s required services and the configuration items that provide the services within the context of the Business Process.

<table>
<thead>
<tr>
<th>Business Process Activity</th>
<th>Required IS Service</th>
<th>IS Service Provider Required IT Service</th>
<th>IS Provider Dates</th>
<th>IT Service Providing Specialization</th>
<th>IT Service Realization Dates</th>
<th>IT Service Provider</th>
<th>IT Provider Dates</th>
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<tbody>
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<td>Sports Program Development Process</td>
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<td>Assign Coaches to Teams, v1</td>
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<td>Assign Players to Divisions &amp; Teams, v2</td>
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<td>Player Management Service</td>
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<td>Info Mgt Service</td>
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<td>Player Rating Front End (Business App)</td>
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<td>Execution Environment Service</td>
<td>App Server Service</td>
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<td>Player Rating Service (Service)</td>
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<td>Member Management DB Schema (EDB Schema)</td>
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<td>Program Development DB Schema (EDB Schema)</td>
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<td>DBMS Service</td>
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<tr>
<td>Setup Divisions &amp; Teams, v1</td>
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</table>
Roadmaps and Projects

Roadmaps
- Define the future state representation of the architecture

Roadmap Phases
- Provide an iterative/incremental implementation

Projects
- Align to Roadmap Phases and implement the architectural vision
Roadmaps & Business Process Realizations

External Roles and Actors

Business Services

Business Architecture
Business Processes & Activities

IS Service Requirements

Information Systems Architecture
Business Software & Enterprise DB Schemas

IT Service Requirements

Infrastructure Architecture
Architecturally Significant Infrastructure Software

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CMDB Style Sample Report

This report shows the deployment status of configuration items for a five year period. It organizes them by the IT Service they provide. The report can also show configuration items that provide Business and IS services.

<table>
<thead>
<tr>
<th>Service Layer</th>
<th>Service Category</th>
<th>Service</th>
<th>Service Specialization</th>
<th>Service Provider</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>IT Service</td>
<td>Communication Services</td>
<td>FAX Service</td>
<td></td>
<td>Alchemy (IT App)</td>
<td>Commissioned</td>
<td>Current</td>
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<td></td>
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<td>RightFax (IT App)</td>
<td>Current</td>
<td>Current</td>
<td>Current</td>
<td>Decommissioned</td>
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<tr>
<td>Data Management</td>
<td>Info Mgt Service</td>
<td>DBMS Service</td>
<td>Oracle 9.2 (DBMS)</td>
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<tr>
<td>Execution Environment Services</td>
<td>App Server Service</td>
<td>Internet Explorer 7.x (Browser)</td>
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<td></td>
<td>Execution Environment Service</td>
<td>Internet Explorer 6.x (Browser)</td>
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<td></td>
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<td>Mozilla (browser)</td>
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<td></td>
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<td>Netscape (Browser)</td>
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<td></td>
<td>Oracle 9.2 (DBMS)</td>
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<tr>
<td>Operating System Service</td>
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<td></td>
<td>Mac OS X (C/S)</td>
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<td>Decommissioned</td>
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<tr>
<td></td>
<td>Process Control Service</td>
<td></td>
<td>Solaris 8 (C/S)</td>
<td>Decommissioned</td>
<td>Current</td>
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<tr>
<td></td>
<td>Transaction Process Monitoring Service</td>
<td></td>
<td>Solaris 9 (C/S)</td>
<td>Current</td>
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<td>Windows XP (C/S)</td>
<td>Current</td>
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<td>C++ Programming</td>
<td>Visual C++ (IT App)</td>
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</table>
Project Scope

- Linking a Project to all Impacted Architectural Elements
  - Business Objectives → Business Needs → Use Cases → Use Case Realizations
**Project Scope**

**Linking a Project to all Impacted Architectural Elements**

- Business Objectives → Business Needs → Use Cases → Use Case Realizations
## Project Scope

Sample report showing all architectural elements impacted by a project, including elements from all Use Case Realization diagrams

### Project Context Report

<table>
<thead>
<tr>
<th>Project</th>
<th>Business Objective</th>
<th>Business Need</th>
<th>Use Case</th>
<th>Use Case Realization</th>
<th>CI Category</th>
<th>CI Type</th>
<th>Configuration Item Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player Rating Replacement</td>
<td>Increase sales and usage of the Recreational Team Development service through added automation.</td>
<td>Coach and Player ID Cards: The system must have the ability to generate Coach and Player ID cards in accordance with any governing organizations, e.g., Eastern Pennsylvania Youth Soccer Association (EAYSA).</td>
<td>Prepare Coach &amp; Player ID Cards, v1.00</td>
<td>Prepare Coach &amp; Player ID Cards, v1.00</td>
<td>Hardware</td>
<td>PC</td>
<td>Player Rating PC::Windows PC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assign Player to Division, v1.00 Assign Player to League, v1.00 Assign Player to Team, v1.00</td>
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<td></td>
<td>League, Division, Team Setup: The system must have the ability to setup leagues and their divisions for different sports and to use players’ statistics to setup recreational teams.</td>
<td>Rate Players: The system must provide the ability to rate players by ability, using the player attributes that have been setup by the Program Manager for this purpose.</td>
<td>Rate Players Statistically, v1.02</td>
<td>Rate Players Statistically, v2.01</td>
<td>Hardware</td>
<td>PC</td>
<td>Player Rating PC::Windows PC</td>
</tr>
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</tbody>
</table>

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Enterprise Risk Management

Non-Architectural View

[Diagram showing ERM hierarchy with objective categories and risks]