Modeling DoDAF Specific, Related, or Similar Architectures

QualiWare White Paper:

QualiWare's Approach to Representation and Adherence to the Department of Defense Architecture Framework (DoDAF)

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Abstract

This white paper defines how QualiWare's Lifecycle Manager can represent and support the Department of Defense Architecture Framework (DoDAF) in particular, but will also address how other similar or related frameworks can be supported. This paper is intended to provide examples of how the DoDAF Architecture Products can be supported and represented, and does not address all possible diagram types/templates that could be utilized to represent the DoDAF and its products.

Introduction

Businesses around the world have always been motivated to change and transform their organizations due to productivity, efficiency and effectiveness, competition, and/or profitability. This motivation sometimes leads organizations to utilize Quality Management methods, Business Process Management methods and tools, Business Activity Monitoring and/or Business Intelligence, or Enterprise Architecture Managements in an effort to transform or change some area of their business.

Enterprise Architecture (EA) provides holistic views of an organization with graphical and textual descriptions of strategies, information, systems, resources and processes, and the relations between these. An EA can and should be the basis for organizational changes in the same way that an architectural plan guides any building or other construction project. The EA views—or "models"—show the context of main structures and processes within the organization. When an EA is properly constructed and utilized, a business can not only visualize but will also align and permit convergence to the top level business architecture with the information technologies that are implemented and used across the business. The EA and the relationships between the architecture products and the components of the architecture products should also be the vehicle for conducting impact analyses in the interest of recurring change management needs or requirements.

The ideal EA framework should be flexible enough to let a business define one or a few dimensions at a time, versus setting off on a course to build each and every dimension concurrently, each with explicit layers of definition; for this comprehensive path can prove to be a long process for a business and one that is often viewed as unaffordable or impossible.

A business can build its Enterprise Architecture incrementally and an EA must be flexible enough to allow the definition of architecture dimensions over time, as a business grows and market conditions change.

DoDAF Overview

The following section provides a summary and overview of the DoDAF only as a background to the sections and samples that will follow. We will not provide a comprehensive description of the DoDAF and its history, as this information is readily available on the internet.

The DoD determined approximately a decade ago that a common approach to architecture definition was essential to communication and interoperability between its operations. The DoDAF provides the rules and guidance for developing and representing architectural artifacts. The DoDAF also defines a series of work/architecture products to support the architecture definition and representation, and these work/architecture products describe the architecture and are intended to communicate the architecture.

The DoDAF provides guidance for describing the architectures but does not provide direction on the specific means by which architectures are to be constructed or implemented.

The DoDAF architectural descriptions (i.e., work products) are defined in terms of views, with each view conveying differing aspects of the architecture. The DoDAF views include:

- All Views (AV) - Describes the Scope and Context (Vocabulary) of the Architecture
- Operational Views (OV) - Identifies What needs to be Accomplished and Who does it
- Systems Views (SV) - Relates Systems, Services, and Characteristics to Operational Needs
- Technical Standards Views (TV) - Prescribes Standards and Conventions

Figure 1 shows the relationships between the four DoDAF views.

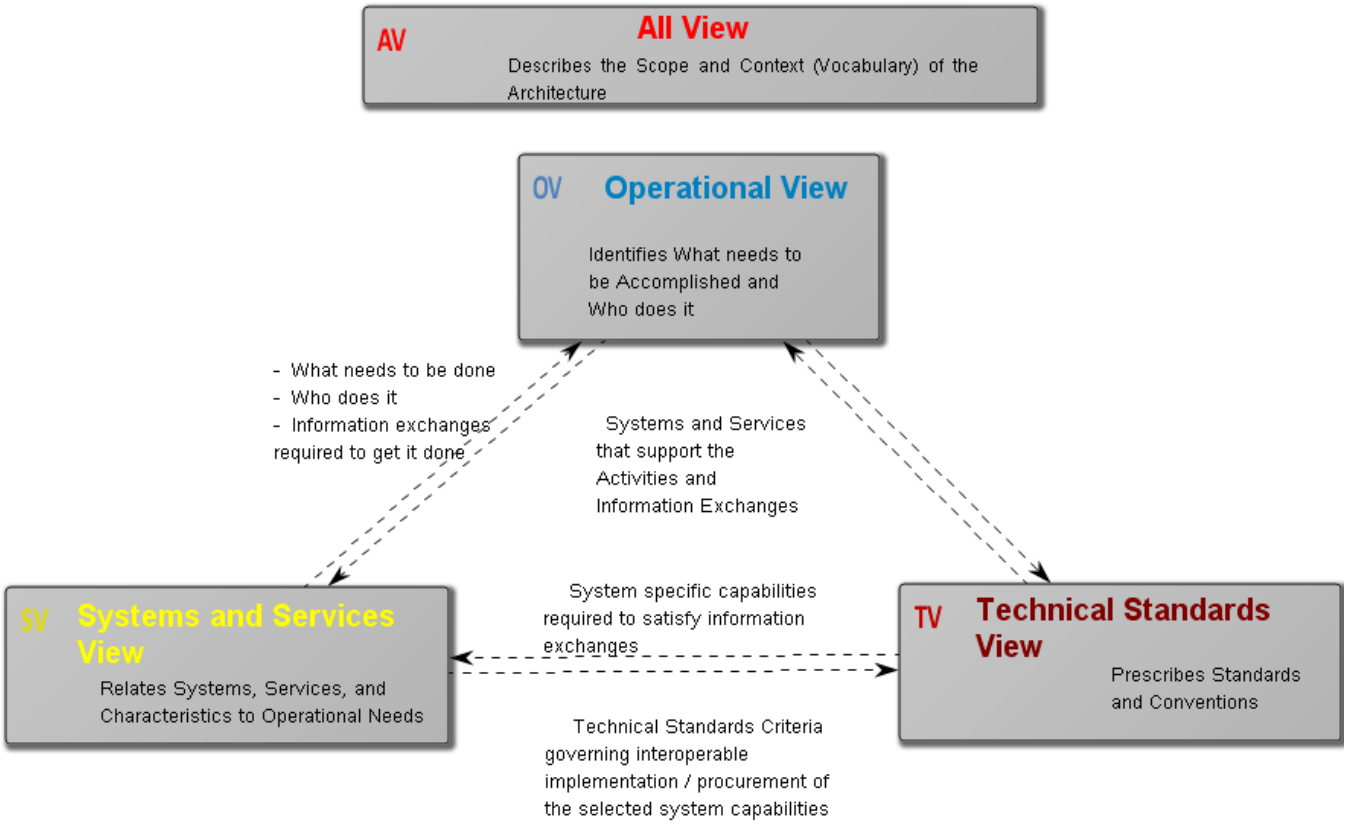


Figure 1

The DoDAF architecture products are shown in Table 2. Each product aligns with the appropriate view as documented above (i.e., AV, OV, SV, TV). A later table will identify the types of diagrams or templates within QualiWare Lifecycle Manager by which each product can be supported.

Framework Product	Architecture Product Name	Architecture Product Description
AV-1	Overview and Summary Information	Scope, purpose, intended users, environment depicted, analytical findings.
AV-2	Integrated Dictionary	Architecture data repository with definitions of all terms used in all products.
OV-1	High-Level Operational Concept Graphic	High-level graphical/textual description of operational concept.
OV-2	Operational Node Connectivity Description	Operational nodes, connectivity, and information exchange need lines between nodes.
OV-3	Operational Information Exchange Matrix	Information exchanged between nodes and the relevant attributes of that exchange.
OV-4	Organizational Relationships Chart	Organizational, role, or other relationships among organizations.
OV-5	Operational Activity Model	Capabilities, operational activities, relationships among activities, inputs, and outputs; overlays can show cost, performing nodes, or other pertinent information.
OV-6a	Operational Rules Model	One of three products used to describe operational activity -- identifies business rules that constrain operation.
OV-6b	Operational State Transition Description	One of three products used to describe operational activity -- identifies business process responses to events.
OV-6c	Operational Event-Trace Description	One of three products used to describe operational activity -- traces actions in a scenario or sequence of events.
OV-7	Logical Data Model	Documentation of the system data requirements and structural business process rules of the Operational View.
SV-1	Systems and Services Interface Description	Identification of systems nodes, systems, system items, services, and service items and their interconnections, within and between nodes.
SV-2	Systems and Services Communication Descrip	Systems nodes, systems, system items, services, and service items and their related communications lay-downs.
SV-3	Systems to Systems, Services to Systems, and	Relationships among systems and services in a given architecture; can be designed to show relationships of interest; e.g., system-type interfaces, planned vs. existing interfaces, etc.
SV-4a	Systems Functionality Description	Functions performed by systems and the system data flows among systems functions.
SV-4b	Services Functionality Description	Functions performed by services and the service data flow among service functions.
SV-5a	Operational Activity to Systems Function Trac	Mapping of system functions back to operational activities.
SV-5b	Operational Activity to Systems Traceability M	Mapping of Systems back to capabilities or operational activities.
SV-5c	Operational Activity to Services Traceability M	Mapping of Services back to operational activities.
SV-6	Systems and Services Data Exchange Matrix	Provides details of system or service data elements being exchanged between systems or services and the attributes of that exchange.
SV-7	Systems and Services Performance Paramete	Performance characteristics of Systems and Services View elements for the appropriate timeframe(s).
SV-8	Systems and Services Evolution Description	Planned incremental steps toward migrating a suite of systems or services to a more efficient suite, or toward evolving a current system to a future implementation.
SV-9	Systems and Services Technology Forecast	Emerging technologies and software/hardware products that are expected to be available in a given set of timeframes and that will affect future development of the architecture.
SV-10a	Systems and Services Rules Model	One of three products used to describe system and service functionality -- identifies constraints that are imposed on systems/services functionality due to some aspect of systems design or implementation.
SV-10b	Systems and Services State Transition Descrip	One of three products used to describe system and service functionality -- identifies responses of a system/service to events.
SV-10c	Systems and Services Event-Trace Description	One of three products used to describe system and service functionality -- identifies system/service specific refinements of critical sequences of events described in the Operational View.
SV-11	Physical Schema	Physical implementation of the Logical Data Model entities; e.g., message formats, file structures, physical schema.
TV-1	Technical Standards Profile	Listing of standards that apply to Systems and Services View elements in a given architecture.
TV-2	Technical Standards Forecast	Description of emerging standards and potential impact on current Systems and Services View elements, within a set of timeframes.

Table 2

Within QualiWare Lifecycle Manager (QLM), there are many different types of templates based on differing methodologies. For instance, if an organization wants to model its business using UML-based approaches, it is possible to do so. Or, other typical business modeling templates can be employed and/or mixed with templates from the UML-based approach. This permits the organization and its users the ultimate flexibility to document and represent the architectures as they wish or need them. Table 3 identifies the templates within QLM that could be utilized to build and represent the architecture products.

Framework Product	Architecture Product Name	Architecture Product Description	QLM Template Options
AV-1	Overview and Summary Infor	Scope, purpose, intended users, environment depicted, analytical findings.	Requirement RequirementModel StrategyModel
AV-2	Integrated Dictionary	Architecture data repository with definitions of all terms used in all	Definition Glossary
OV-1	High-Level Operational Conce	High-level graphical/textual description of operational	BusinessDiagram FreeHandDiagram
OV-2	Operational Node Connectivi	Operational nodes, connectivity, and information exchange need lines between nodes.	OrganizationDiagram BusinessObjectModel UseCaseDiagram WorkFlowDiagram ClassDiagram CollaborationDiagram BusinessDiagram
OV-3	Operational Information Exch	Information exchanged between nodes and the relevant attributes	Matrix
OV-4	Organizational Relationships	Organizational, role, or other relationships among	OrganizationDiagram ClassDiagram
OV-5	Operational Activity Model	Capabilities, operational activities, relationships among activities, inputs, and outputs; overlays can show cost, performing nodes, or other pertinent information.	ActivityDiagram WorkFlowDiagram UseCaseDiagram SequenceDiagram BusinessProcessDiagram BusinessProcessNetwork
OV-6a	Operational Rules Model	One of three products used to describe operational activity -- identifies business rules that	BusinessRule BusinessRulesModel
OV-6b	Operational State Transition Description	One of three products used to describe operational activity -- identifies business process	StateDiagram
OV-6c	Operational Event-Trace Desc	One of three products used to describe operational activity -- traces actions in a scenario or	SequenceDiagram WorkFlowDiagram
OV-7	Logical Data Model	Documentation of the system data requirements and structural business process rules of the	DataModelDiagram ClassDiagram
SV-1	Systems and Services Interfac	Identification of systems nodes, systems, system items, services, and service items and their	ApplicationArchitectureDiagram DeploymentDiagram
SV-2	Systems and Services Commu	Systems nodes, systems, system items, services, and service items and their related communications lay-downs.	InfrastructureDiagram ApplicationArchitectureDiagram ClassDiagram ServiceModel
SV-3	Systems to Systems, Services	Relationships among systems and services in a given architecture; can be designed to show relationships of interest; e.g.,	Matrix
SV-4a	Systems Functionality Descrip	Functions performed by systems and the system data flows among systems functions.	DataFlowDiagram ApplicationArchitectureDiagram UseCaseDiagram ClassDiagram
SV-4b	Services Functionality Descrip	Functions performed by services and the service data flow among service functions.	Services ServiceGroup DeployedService ApplicationArchitectureDiagram DataFlowDiagram
SV-5a	Operational Activity to Syster	Mapping of system functions back to operational activities.	Matrix
SV-5b	Operational Activity to Syster	Mapping of Systems back to capabilities or operational	Matrix
SV-5c	Operational Activity to Servic	Mapping of Services back to	Matrix
SV-6	Systems and Services Data Ex	Provides details of system or service data elements being exchanged between systems or	Matrix
SV-7	Systems and Services Perform	Performance characteristics of Systems and Services View	Matrix
SV-8	Systems and Services Evolutic	Planned incremental steps toward migrating a suite of systems or services to a more efficient suite, or toward evolving	TransformationPlan
SV-9	Systems and Services Technol	Emerging technologies and software/hardware products that are expected to be available in a given set of timeframes and that	Technology TransformationPlan Matrix StrategicRoadmap
SV-10a	Systems and Services Rules M	One of three products used to describe system and service functionality -- identifies constraints that are imposed on systems/services functionality	BusinessRule InformationSystem ServiceGroup Services Matrix
SV-10b	Systems and Services State Tr	One of three products used to describe system and service functionality -- identifies	StateDiagram BusinessProcessDiagram
SV-10c	Systems and Services Event-T	One of three products used to describe system and service functionality -- identifies system/service specific	SequenceDiagram BusinessProcessDiagram
SV-11	Physical Schema	Physical implementation of the Logical Data Model entities; e.g., message formats, file structures,	ClassDiagram RelationalDiagram
TV-1	Technical Standards Profile	Listing of standards that apply to Systems and Services View elements in a given architecture.	Matrix TechnicalStandard InformationSystem ServiceGroup Services Technology
TV-2	Technical Standards Forecast	Description of emerging standards and potential impact on current Systems and Services View elements, within a set of	TechnicalStandard TransformationPlan StrategicRoadmap Technology

Table 3

DoDAF Architecture Product Examples

The remainder of this white paper will provide example diagrams, matrices, and views of how QLM can support the various DoDAF Architecture Products. QLM is a product that is easily tailored to meet the specific representation, relationship, and property needs of the various architectures that will be built within the repository. This means that terminology relevant to the DoDAF and its architecture artifacts and derivatives can be unique to each and every project, and not necessarily unique to any specific business modeling approach or methodology, but still providing the ability for systems and software engineers to work with the views of the architecture products that they are most familiar with.

We felt it important to establish an overarching EA Framework for the DoDAF and its Architecture Products, presented from a QualiWare Lifecycle Manager perspective. The following figure (Figure 4) shows how the architecture products are aligned with each other and sets a sample framework for building the multiple levels of detail necessary to ensure successful implementations.

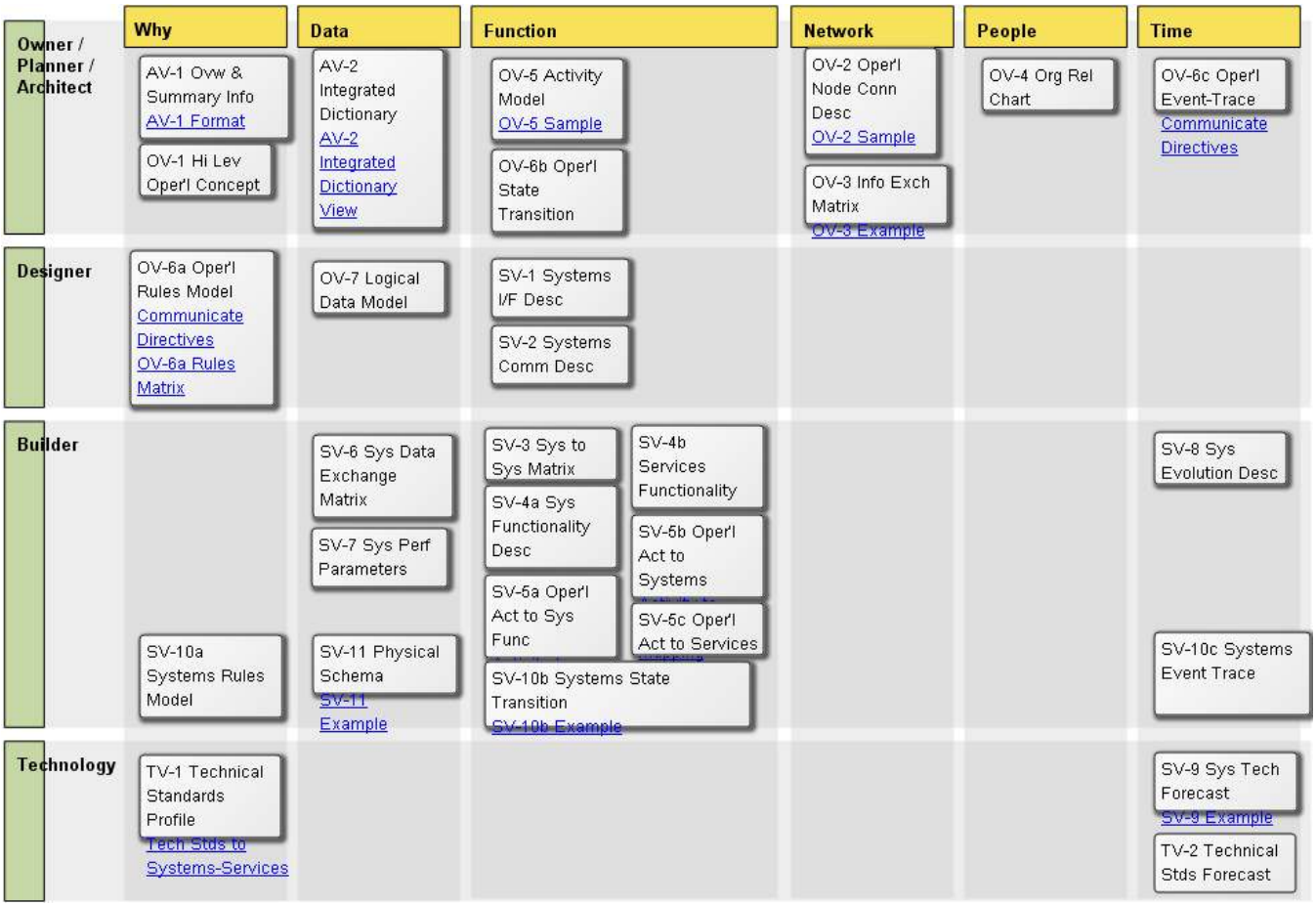


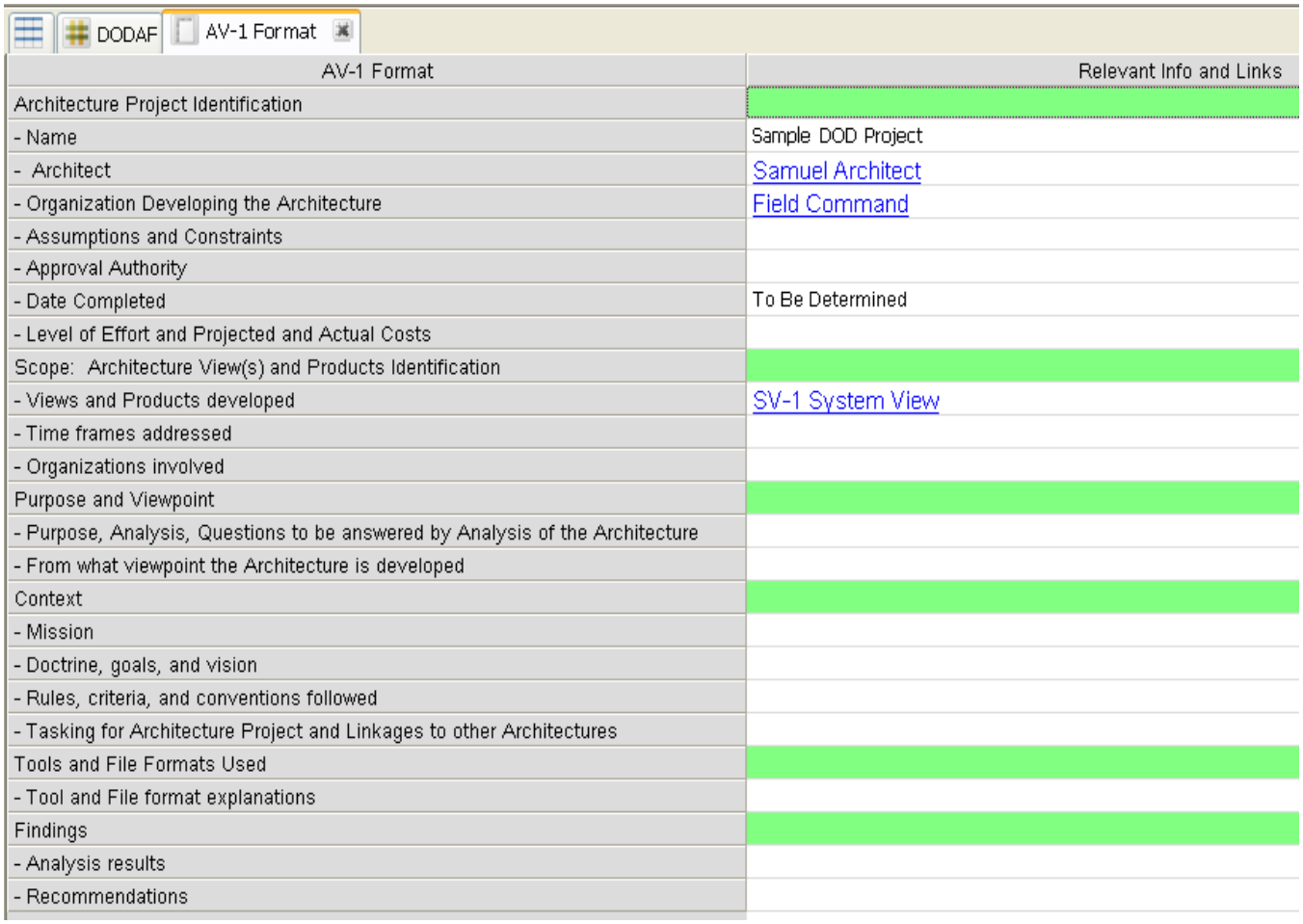
Figure 4

Each cell in the architecture framework in Figure 4 can link to one or more templates and instances of diagrams or other specific objects within diagrams so that the architecture framework can not only act as an overview to the overall architecture, but also as a "dashboard" of sorts. When the cell in the framework is selected, appropriate dialogs will permit the user to navigate directly to the appropriate architecture product.

Each Architecture Product can be represented through pre-defined templates or through standard templates available in QLM. In this set of example architecture products, we will include one view of each architecture product. It is important to mention again that the organization building architecture based on the DoDAF can tailor the product without any code change to support the architecture representation needs of the customer and its users.

AV-1: Overview and Summary Information

Since AV-1 (Overview and Summary Information) is an executive level set of information that describes the project, within QLM we are simply utilizing a matrix to represent this architecture product. The interesting thing is that the information can be text or can be an actual hyperlink to another model, diagram, or any pertinent piece of architectural information. When published or provided to the executives, it is possible to not only have a report or page showing this information, but it can be seen and reviewed electronically (typically via HTML accessed via a Web browser) so that each executive can select the hyperlinks and review underlying detail. The following figure (Figure 5) shows how QLM would support building the overall AV-1 template and detail for each line item on the AV-1.



AV-1 Format	Relevant Info and Links
Architecture Project Identification	
- Name	Sample DOD Project
- Architect	Samuel Architect
- Organization Developing the Architecture	Field Command
- Assumptions and Constraints	
- Approval Authority	
- Date Completed	To Be Determined
- Level of Effort and Projected and Actual Costs	
Scope: Architecture View(s) and Products Identification	
- Views and Products developed	SV-1 System View
- Time frames addressed	
- Organizations involved	
Purpose and Viewpoint	
- Purpose, Analysis, Questions to be answered by Analysis of the Architecture	
- From what viewpoint the Architecture is developed	
Context	
- Mission	
- Doctrine, goals, and vision	
- Rules, criteria, and conventions followed	
- Tasking for Architecture Project and Linkages to other Architectures	
Tools and File Formats Used	
- Tool and File format explanations	
Findings	
- Analysis results	
- Recommendations	

Figure 5

AV-2: Integrated Dictionary

Definition of terms used in any given architecture are defined and stored in the Integrated Dictionary, essentially a Glossary. QLM can represent the terms as "Definitions" with appropriate metadata, and the overall Dictionary can be represented in the form of a Matrix. In the following figure (Figure 6) there is only a Definition field shown, but any number of fields can be included to support display of the appropriate metadata. Each term is a hyperlink within the Matrix, and thus the detail can be viewed for any term by simply selecting the appropriate hyperlink.

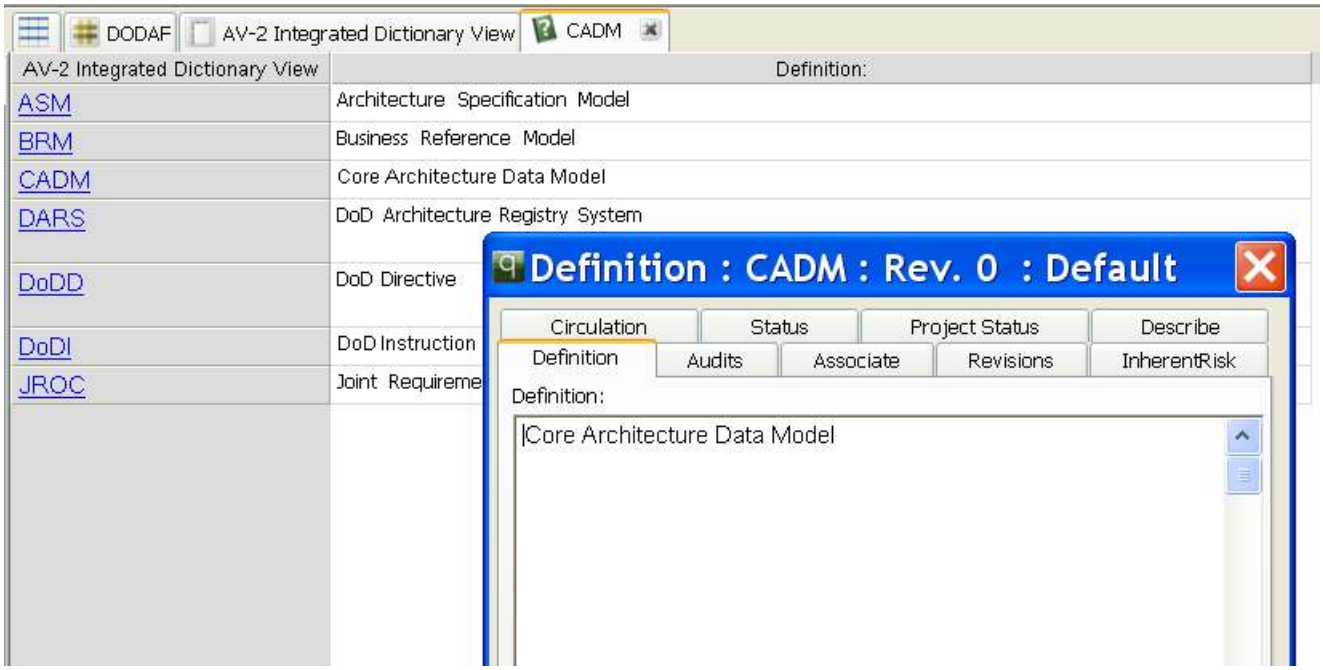


Figure 6

OV-1: High-Level Operational Concept Graphic

OV-1 diagrams are very free-form and provide a very high level graphical view of the mission, scope and roles of some initiative. In QLM, there are multiple diagram/model types that can be utilized to depict such a view or perspective of a mission or initiative. In this example, we have chosen to build a very simplistic view of a mission, with assets being utilized around the world to deal with a specific target. There will be many of these types of diagrams and they can be related to any sort of operation or initiative. Figure 7 shows this simple mission/initiative view. The OV-1 can be depicted in a number of diagram/model types within QLM including: BusinessDiagram, FreeHandDiagram. Also because of the flexible nature of QLM, a unique template or diagram type can be built to allow representation of OV-1 diagrams.

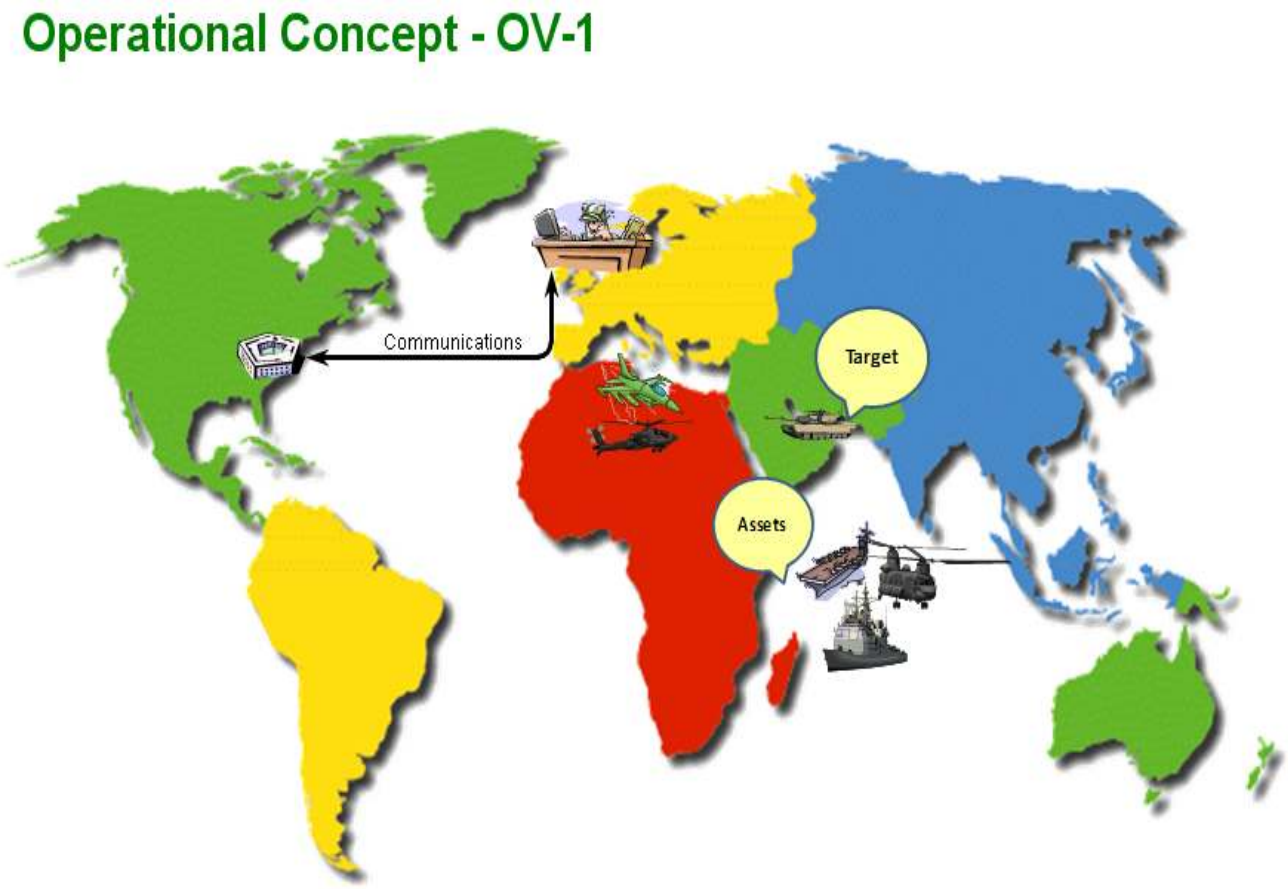


Figure 7

OV-2: Operational Node Connectivity Description

The OV-2 graphically depicts the operational or organizational nodes with relationships or linkages shown between them indicating a need to exchange information. Internal and external linkages or lines of communication can be included in this architecture product. The OV-2 can be depicted in diagram/model types within QLM including: OrganizationDiagram, BusinessObjectModel, UseCaseDiagram, WorkFlowDiagram, ClassDiagram, CollaborativeDiagram, BusinessDiagram. Figure 8 shows an example of how QLM might support the OV-2. While there are multiple diagram types that can depict the OV-2, the OrganizationDiagram is being used in Figure 8 to show the relationships or linkages between organizational or operational nodes.

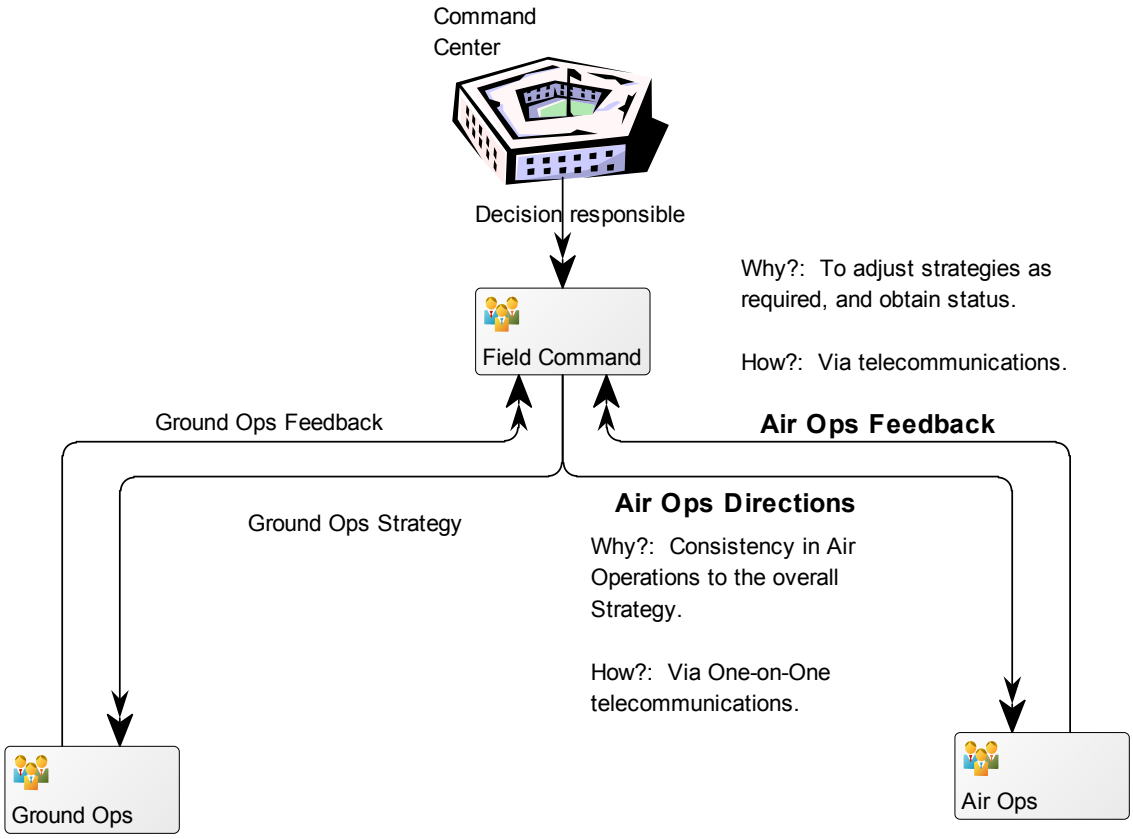


Figure 8

OV-3: Operational Information Exchange Matrix

The OV-3 provides a view of information exchanges and identifies who exchanges what information, with whom, why the information is necessary, and how the information exchange must occur. A matrix in QLM contains a set of hyperlinks so that when any hyperlink is selected, a broad set of properties can be displayed including lower level details about why and how the communication between the operational nodes occurs. Figure 9 shows a matrix of the relationships between the operational nodes as shown in Figure 8.

DODAF | OV-3 Example

OV-3 Example	Sends	SendsTo	Receives	ReceivesFrom
Command Center	Decision Responsible	Field		
Field Command	Ground Ops Strategy Air Ops Directions and Feedback	Ground Ops Air Ops	Decision Responsible Air Ops/Field Command	Command Center
Ground Ops	Ground Ops/Field Command	Field Command	Ground Ops Strategy	Field Command
Air Ops	Air Ops/Field Command	Field	Air Ops Directions and Feedback	Field Command

Figure 9

OV-4: Organizational Relationships Chart

The OV-4 reflects the relationships between organizations or resources involved in architecture. The purpose is to clarify the relationships that can exist between any levels of organizational units and can also reflect relationships from both an internal and external nature. Roles and skill needs can be displayed and expressed in such a relationship view. While there are multiple diagram types within QLM to support such a view of Organizational Relationships, Figure 10 is showing a typical Organization Diagram to depict this organizational view with roles, etc.

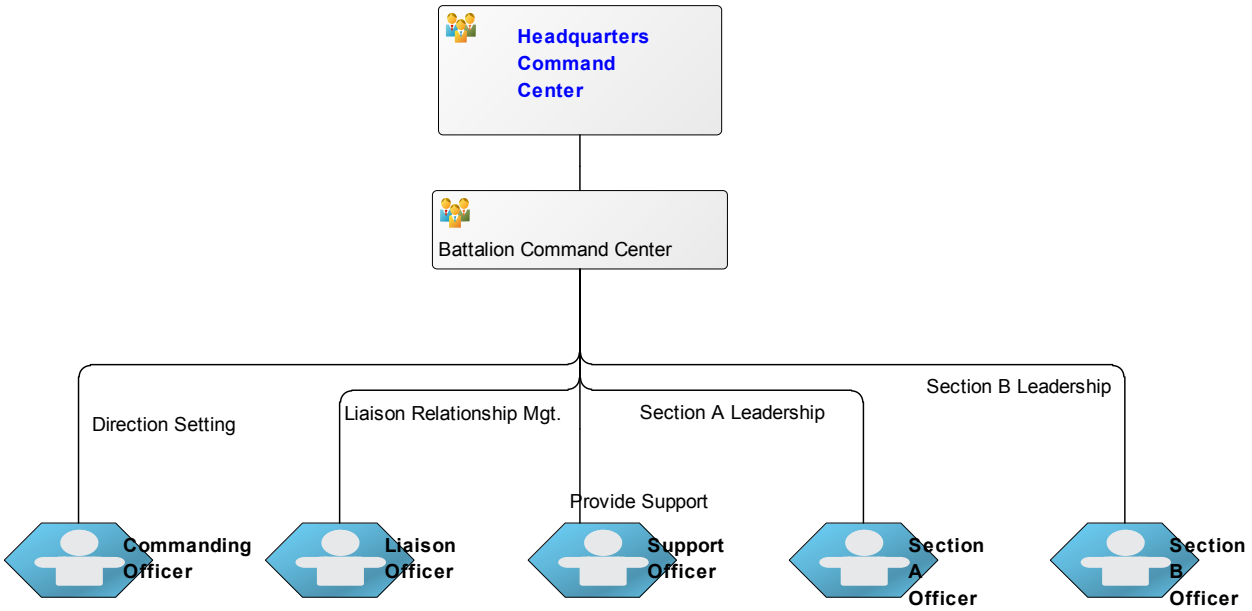


Figure 10

OV-5: Operational Activity Model

The Operational Activity Model describes the operations that are normally conducted in the course of achieving some mission or other business capability. The typical process constructs of Input→Process→Output are utilized to depict internal and external flows of information. In QLM there are multiple diagram/model types to support the definition of such operational activity views: e.g., ActivityDiagram, WorkFlowDiagram, UseCaseDiagram, SequenceDiagram, BusinessProcessDiagram, BusinessProcessNetwork. There can be multiple levels of Activity (i.e., Process) definition in QLM, and each level can break down to lower levels of detail, and the activity/process views can be connected end-to-end to ensure an overall view of the process handoffs and dependencies. Figure 11 shows as simplistic view of a high level process where one of the sub-processes/activities breaks down to a lower level process view. There are many types and methods supported for Activity/Process models, including the typical value chain based views and the operational swim-lane based views.

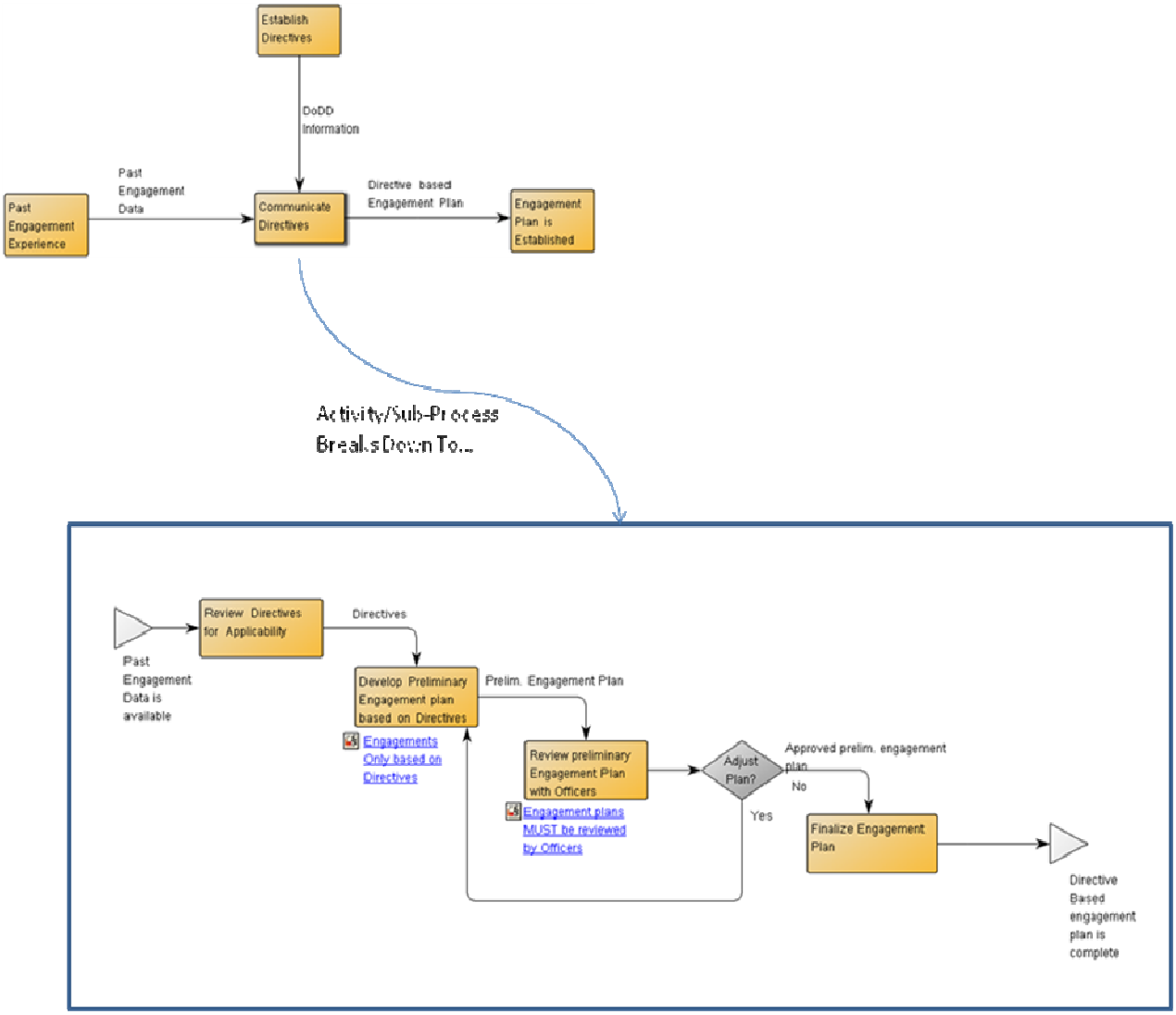


Figure 11

OV-6a: Operational Rules Model

The Operational Rules Model defines what the business must do or what it cannot do; i.e., in the context of business rules. If we apply the definition of a rule being a constraint to some behavior, then it is simple to understand that a process map (e.g., as depicted in Figure 11) could have activities that are constrained by some sort of rule or regulation. These constraints are very common in regulated industries, businesses, and organizations. In Figure 11, there are hyperlinks shown below a couple of the activities. These represent rules that apply to that one specific activity. Rules could be applied at the higher process/activity level as well. A Rule may have sub-level rules, therefore having a structure

where the sub-level rules will inherit the properties of the parent rule. QLM has the regulatory or rule based modeling support built into the tool so that business rules can be expressed, graphically articulated, and linked to the appropriate activities from an operational perspective. Rules expressed and stored in QLM can be linked to other business architecture elements such as data/information, information systems, people in the organization, etc. For the architecture user, QLM also provides the ability to view rule applicability through matrices or other such reports and outputs. Figure 12 shows one such matrix.

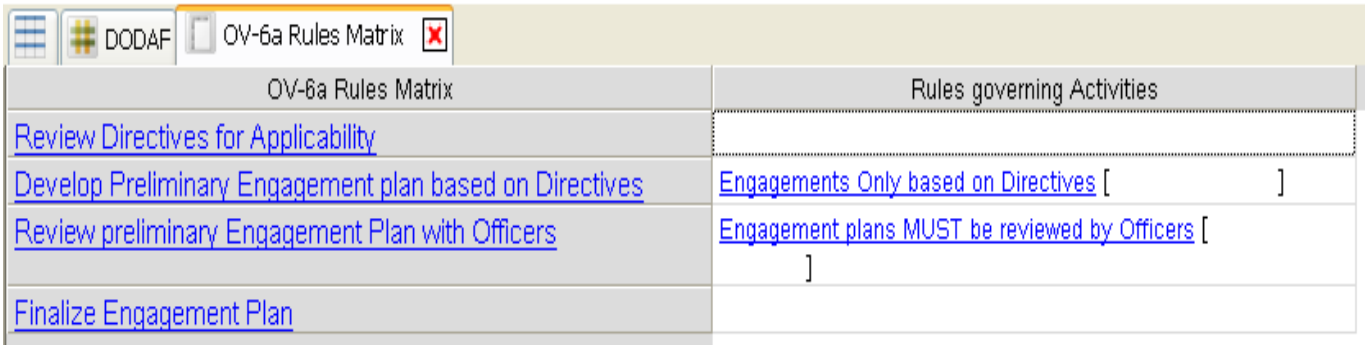


Figure 12

OV-6b: Operational State Transition Description

The Operational State Transition Description, or in this case a diagram, is a method of describing how an operational node or activity responds to business events or conditions, and how it changes its state. Such a diagram represents the set of events to which an architecture will respond; i.e., by taking an action to move to a new state. In QLM, such a state transition description is supported by the StateDiagram template. Figure 13 shows an example of such a diagram. A state transition description can be used to support some sort of process or activity view, in that the process when executed could result in new states of the operational node, or in the case as depicted in Figure 13, the military recruit.

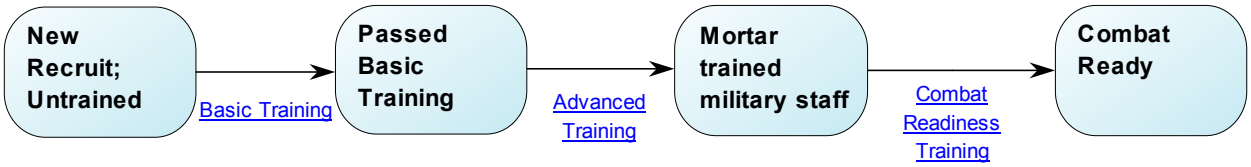


Figure 13

OV-6c: Operational Event-Trace Description

The operational event-trace description provides a time-ordered examination of the information exchanges between participating operational nodes in the context of some particular scenario. It is important to identify operational node interactions and threads between the operational nodes and their relevant activities. Just like typical business process maps, it is often in the process handoffs that processes break down and do not perform as conceived or designed. The event-trace description is a good tool in clearly articulating such operational handoff expectations. In QLM we can utilize the typical UML based SequenceDiagram, UseCaseDiagram, or a WorkFlowDiagram to depict such process handoffs, or event-trace descriptions. Figure 14 provides an example of such a model.

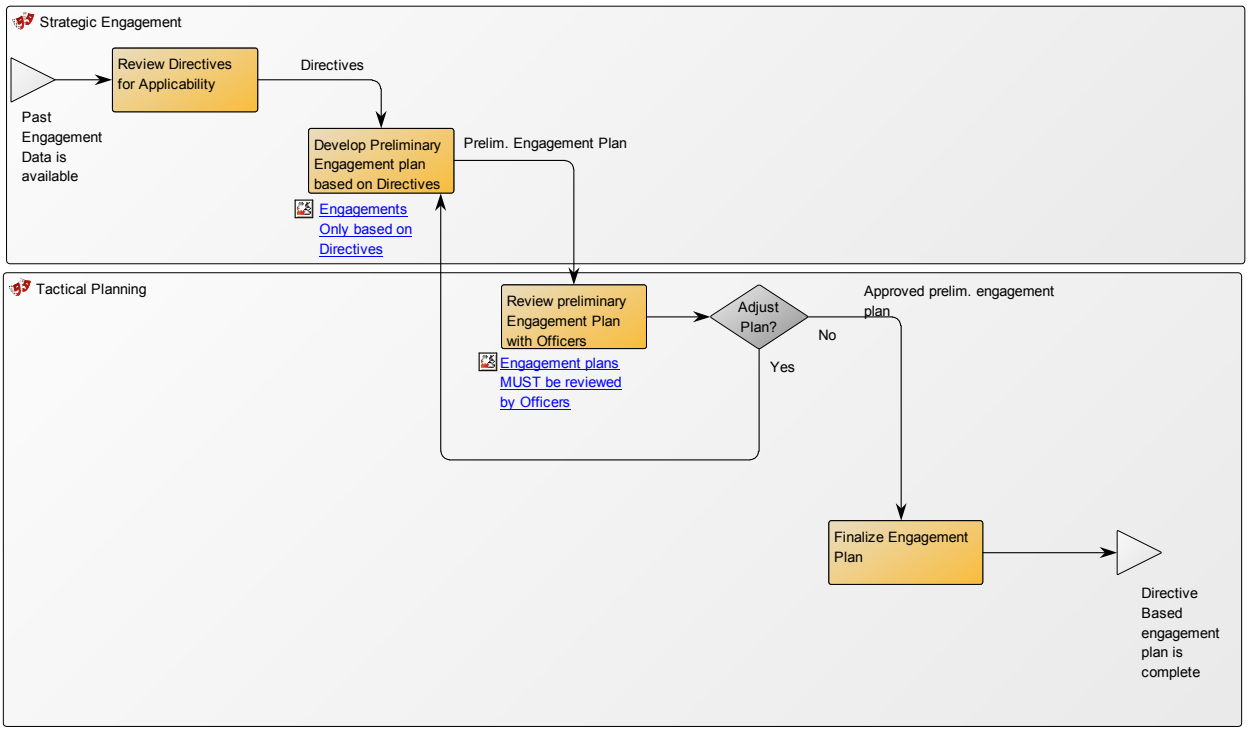


Figure 14

OV-7: Logical Data Model

The Logical Data Model provides a basis and common design point for how operational nodes and systems supporting the nodes, across any number of architectures will communicate and stay consistent with an overall architecture. This model is essential to supporting interoperability between architectures and the operational nodes operating within those architectures. OV-7 defines the architecture domain system data types or entities, and the relationships among the data types. In a typical enterprise architecture framework the logical data model is aligned with the overall area of data or information architecture, or in Zachman's constructs, the "What" column. Figure 15 shows a sample of such a logical data model.

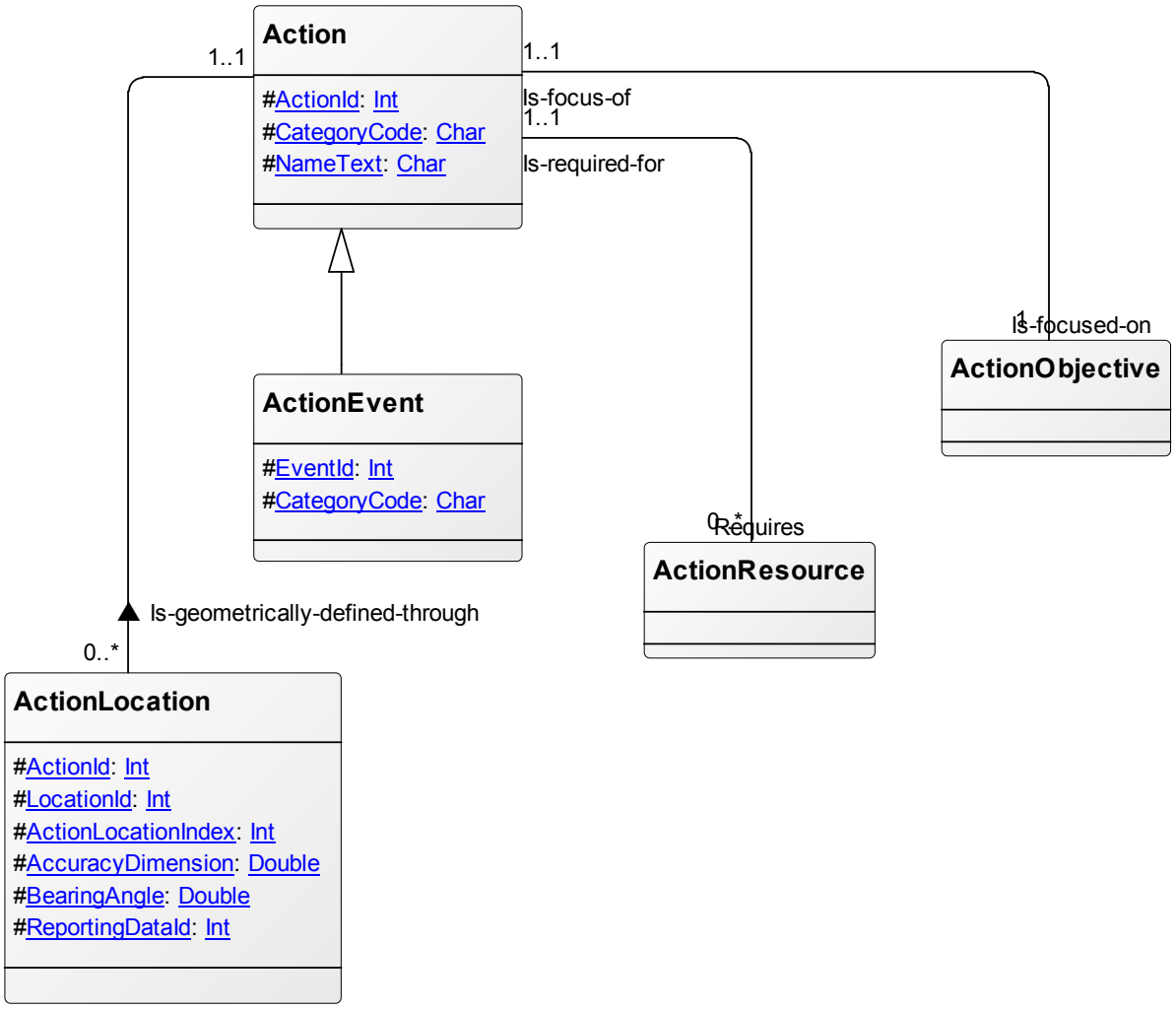


Figure 15; Class Diagram Example

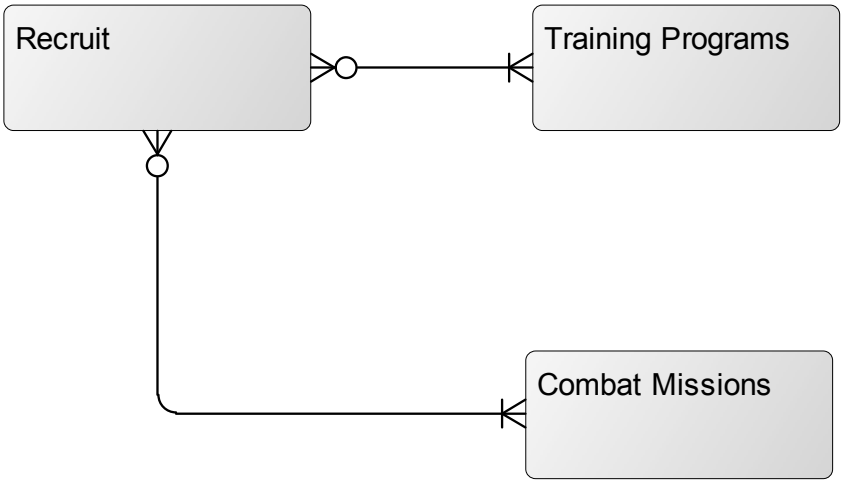


Figure 15; *ER Diagram Example*

SV-1: Systems and Services Interface Description

The Systems and Services Interface Description identifies system nodes, systems within the nodes, and systems that support operational nodes. Interfaces between the systems are identified, and these interfaces can show the type of interface technology, as well as the data/information attributes of the interface. While figure 16 shows a relatively simple systems view with only a few interfaces, there could be many multi-directional interfaces. Within QLM a Systems Description as defined for SV-1 can have the systems also linked to the Services that the system supports (i.e., from an SOA perspective). Software and Technology information can also be linked to the Systems. In QLM the SV-1 can be described by templates such as the ApplicationArchitectureDiagram or the DeploymentDiagram. Figure 16 is utilizing the ApplicationArchitectureDiagram template.

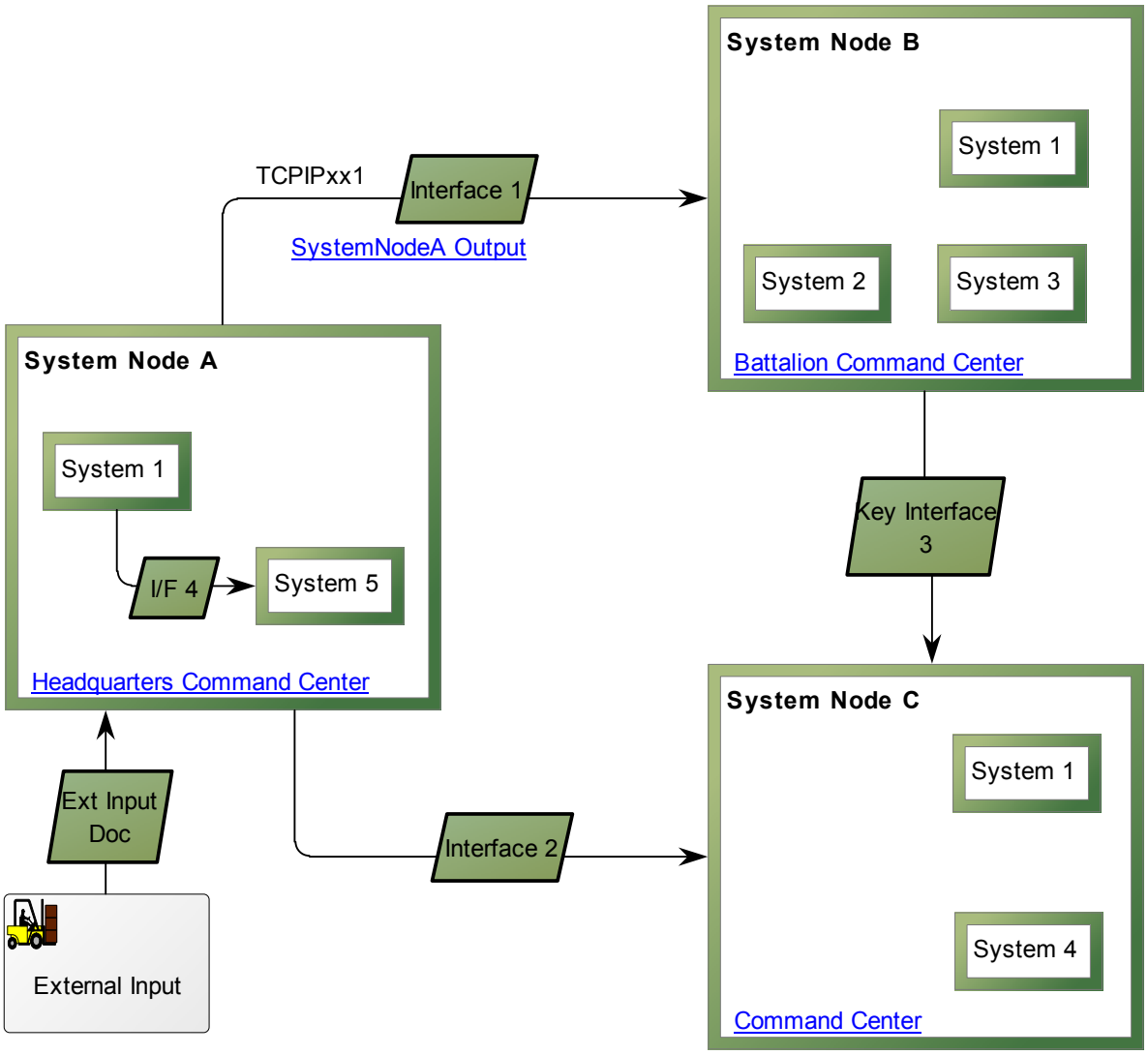


Figure 16

SV-2: Systems and Services Communication Description

The Systems and Services Communication Description documents the specific communication links or communication networks and the details of their configurations through which a system interfaces with other systems. The SV-2 architecture product can be used to document how interfaces as described in the SV-1 product are supported by physical media, technologies, and infrastructures. The SV-2 product helps with infrastructure and system acquisition plans and decisions. In QLM the SV-2 can be supported by multiple diagram types including: InfrastructureDiagram,

ApplicationArchitectureDiagram, ClassDiagram, or a ServiceModel. Figure 17 is built using an InfrastructureDiagram to show an example of one such SV-2 product.

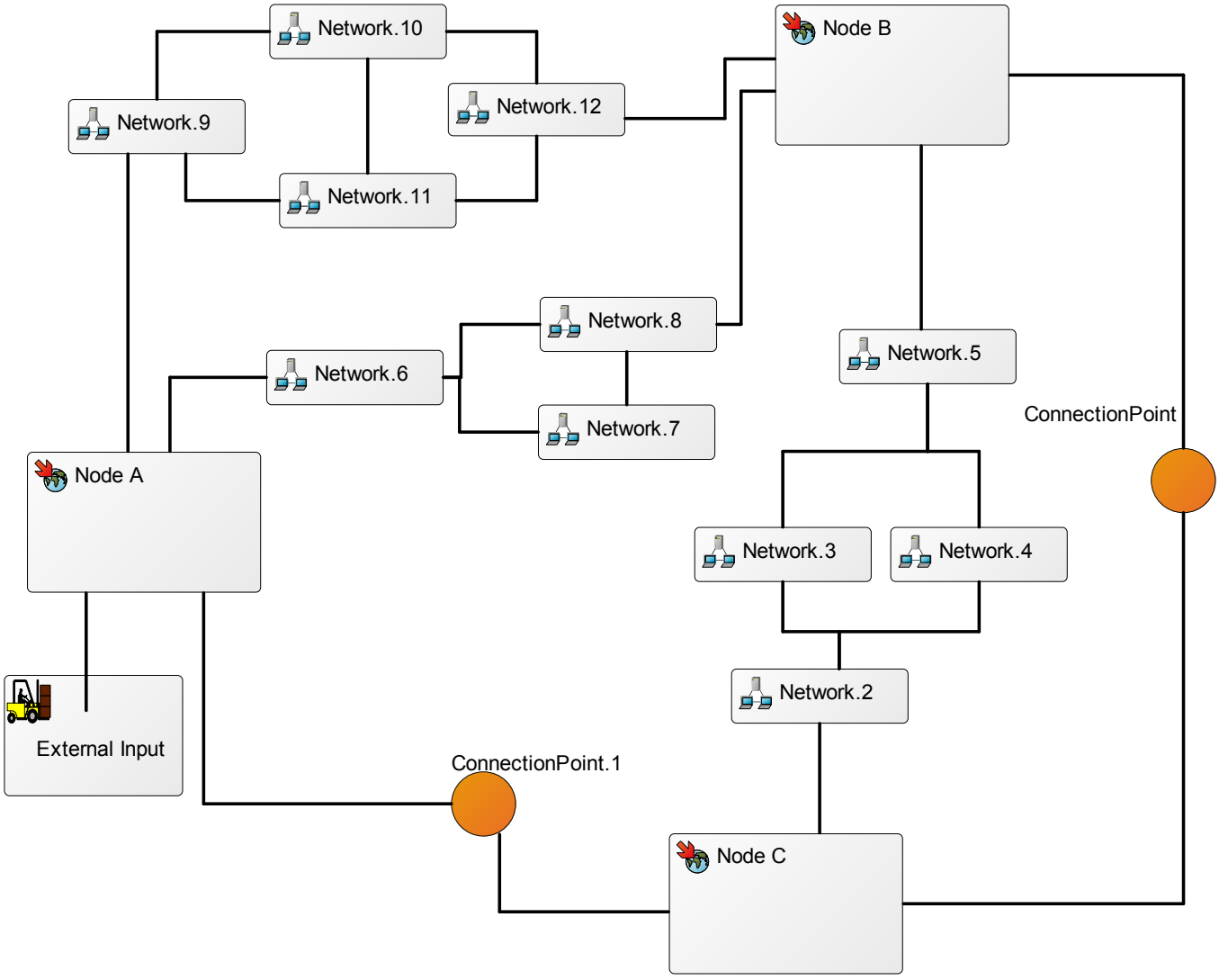


Figure 17

A single network object in QLM can contain a significant set of properties. In Figure 18 we are showing a sample view of the properties of one of the network objects as was contained in Figure 17.

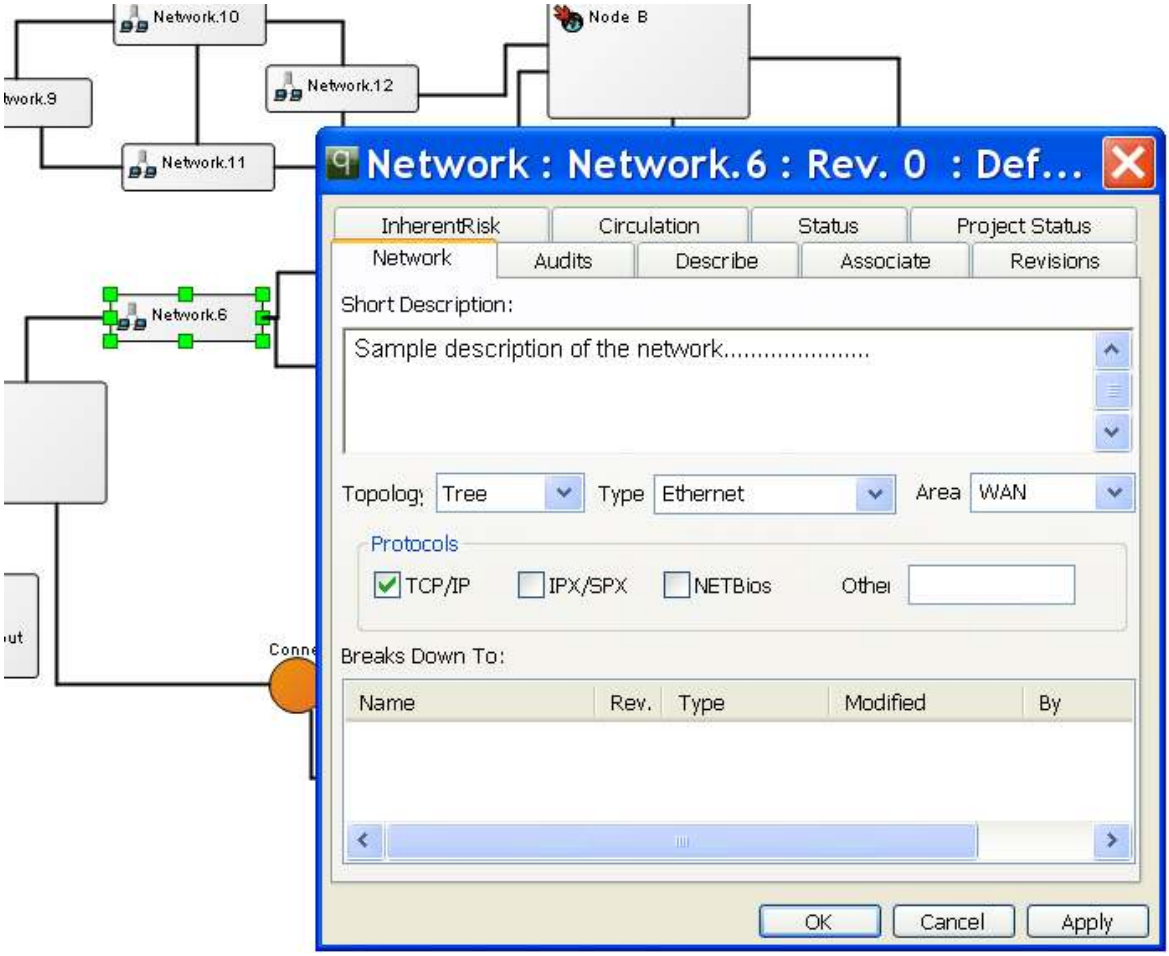


Figure 18

SV-3: Systems to Systems, Services to Systems, and Services to Services Matrix

The SV-3 architecture product provides a quick overview of the interface characteristics as will be presented in the SV-1 architecture products. There can be any number of SV-3 views. In Figure 19, we have elected to show the set of overall systems, their nodes, the interfaces (by showing what connections a system has to other systems or nodes), and the services that are supported by the systems. With QLM, a combined matrix view can be built or separate matrix views reflecting the system to system view, services to systems, etc. It is also possible within QLM to use the matrix as a reporting tool, gap analysis tool, and the user is able to select the object via the matrix, open it, and edit the properties. When the user returns to the matrix, it will automatically be updated to reflect the changed properties.

SV-3 Sample	Frames	Sys. I/F'd From:	Sys. I/F To:	Services supported by System:
System 1			System 5	Service-ABC Service-DEF
System 5		System 1		
System 2				Service-EFG Service-FGH
System 3				
System 4				Service-GHI
System Node A	System 1 System 5 I/F 4	External Input	System Node B System Node C	
System Node B	System 1 System 2 System 3	System Node A	System Node C	
System Node C	System 1 System 4	System Node A System Node B		

Figure 19

SV-4a: Systems Functionality Description

The Systems Functionality Description documents functional hierarchies and system functions, and the system data flows between the systems and functions. This architecture product describes the system functions and the flow of system data among system functions. The scope of the SV-4a can vary, in that it can be enterprise wide or it may be system specific. In QLM, a Systems Functionality Description is best described through the use of diagram templates including: DataFlowDiagram, ApplicationArchitectureDiagram, UseCaseDiagram, ClassDiagram. Figure 20 shows a typical DataFlowDiagram template being used to describe Systems Functionality.

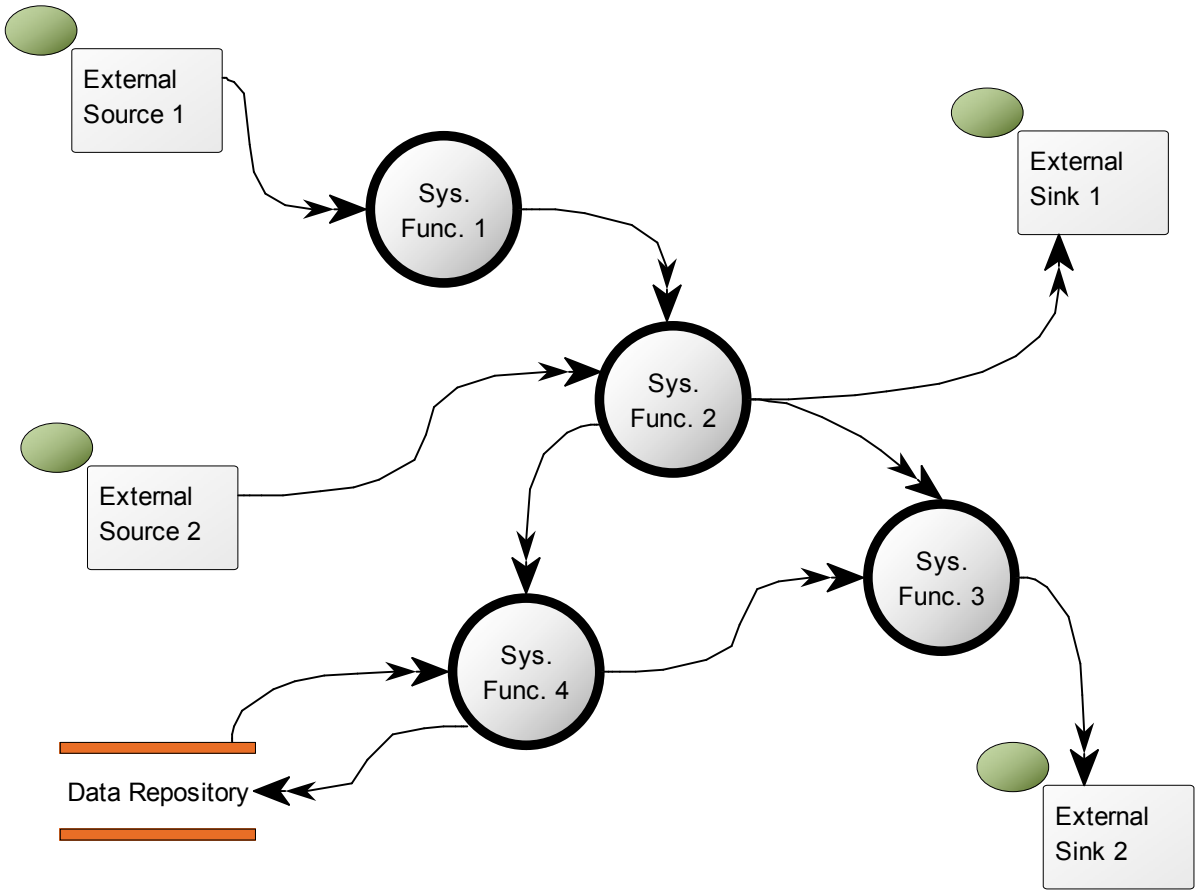


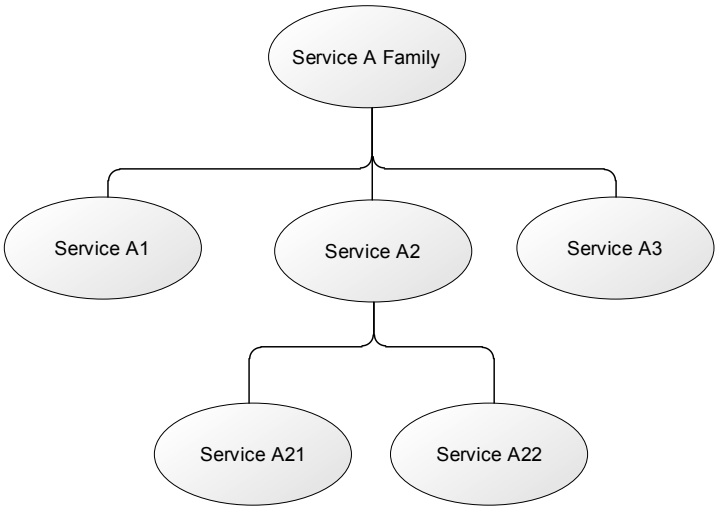
Figure 20

Simple functional decomposition diagrams can also be utilized to describe system functionality, even including matrices that have linkages between systems and functions that the systems support. What the matrix may not show is the data flow and this is where the strength of a diagram such as is shown in Figure 20 adds value to the overall architecture.

SV-4b: Services Functionality Description

The Services Functionality Description should capture and depict how services are orchestrated to deliver functionality associated with some operational need. The Services Functionality Description will show data flows between the services similar to how the data flows were shown for the System Functional view in Figure 20. Multiple levels of detail can be built to break down the views of a service to adequately reflect the sub-services that are contained within a higher level service. So there may be hierarchical views of the Services functionality. In QLM, templates such as Service, ServiceGroup, DeployedService, ApplicationArchitectureDiagram, or DataFlowDiagram can be utilized to describe the SV-4b architecture product. Service decomposition views can be used to show service relationships.

Figure 21 shows one such service decomposition and immediately following is a service based data flow showing relationships between services.



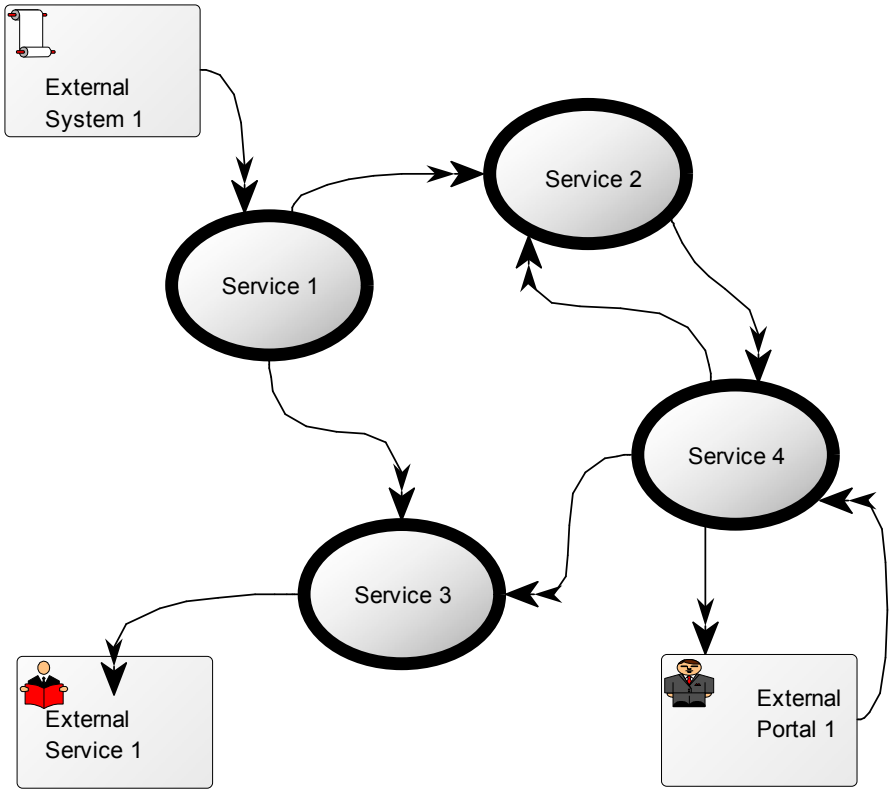


Figure 21

SV-5a: Operational Activity to Systems Function

The Operational Activity to Systems Function information depicts the mapping of operational activities to system functions and thus identifies the transformation of an operational need into a set of actions performed by one or more systems or the functions of the system. It is natural to think about systems and the functions provided by the systems as supporting the business processes, sub-processes, and activities that the business expects to have performed at the operational level. Therefore, the mapping between the operational activities of the business and its system functions are a key part of the overall architecture. Figure 22 shows a sample matrix of such a mapping.

Figure 22

SV-5b: Operational Activity to Systems

The Operational Activity to Systems information depicts the mapping of operational activities to systems and thus identifies the transformation of an operational need into a set of actions performed by one or more systems. It is natural to think about systems as supporting the business processes, sub-processes, and activities that the business expects to have performed at the operational level. Therefore, the mapping between the operational activities of the business and its systems are a key part of the overall architecture. Figure 23 shows a sample matrix of such a mapping.

DODAF | Activity to Systems Mapping

Activity to Systems Mapping	Activities supported by the Systems...
System 1	Establish Directives
System 5	Communicate Directives
System 2	Review Directives for Applicability
System 3	Develop Preliminary Engagement plan based on
System 4	Engagement Plan is Established Finalize Engagement Plan Review preliminary Engagement Plan with Officers

Figure 23

SV-5c: Operational Activity to Services

The Operational Activity to Services information depicts the mapping of operational activities to services and thus identifies the transformation of an operational need into a set of actions supported by one or more services. It is natural to think about services as supporting the business processes, sub-processes, and activities that the business expects to have performed at the operational level. A service can support an overall process or a subset of a process (e.g., one or multiple activities within a process). Therefore, the mapping between the operational activities of the business and its services are a key part of the overall architecture. Figure 24 shows a sample matrix of such a mapping.

DODAF | Activity to Services Mapping

Activity to Services Mapping	Activities supported by the Services...
Service 1	Communicate Directives Establish Directives Review Directives for Applicability
Service 2	Develop Preliminary Engagement plan based on Directives Past Engagement Experience
Service 3	Communicate Engagement Plan
Service 4	Finalize Engagement Plan Past Engagement Experience

Figure 24

SV-6: Systems and Services Data Exchange

The SV-6 specifies the characteristics of the system data exchanged between systems and this architecture product focuses on automated information exchanges that are implemented in systems. Figure 25 shows two relatively simple matrices, one where the Systems are shown with the links to data interchanges, and the second showing the data interchanges and the data entities that are actually passed via the data interchange. With QLM the user has the ability to generate multiple matrix views of any type of architecture information, and the matrix is dynamically updated as information about the items on the matrix are updated.

Systems-Services Data Exchange	Sends	Receives	Frames	FramedBy
System 1	I/F 4			System Node A System Node B System Node C
System 5		I/F 4		System Node A
System 2				System Node B
System 3				System Node B
System 4				System Node C
System Node A	Interface 1 Interface 2	Ext Input Doc	System 1 System 5 I/F 4	
System Node B	Key Interface 3	Interface 1	System 1 System 2 System 3	
System Node C		Interface 2 Key Interface 3	System 1 System 4	

InformationFlow Detail	Breaks Down To:
Interface 1	SystemNodeA Output Directives
Interface 2	Directives Past Engagement Experience Info Resources Applied to Engagement
Key Interface 3	Engagement Plan Data
I/F 4	Preliminary Directives
Ext Input Doc	Past Engagement Experience Info

Figure 25

SV-7: Systems and Services Performance Parameters Matrix

Performance parameters of the systems within an architecture in both current and future timeframes can be linked. The SV-7 architecture product simply links those performance indicators to the systems or services, and shows those linkages in a matrix view. Within QLM a performance indicator can be linked to any object, thereby permitting performance related data to be linked to systems, functions, services, processes, sub-processes, activities, computer infrastructure(s), networks, etc. So, there may be many different matrices that contain that same set of performance indicators with supporting detail. Figure 26 shows a very simplistic view of the linkages between a set of systems and linked performance indicators. In this case, we did not make up any data on the KPI's themselves to show properties or variables for the KPI, but if they were known and captured, the matrix would also show that data.

System Performance Data	Perf. Parameters
System 1	KPI-1 [ ]
System 5	KPI-2 [ ] KPI-3 [ ]
System 2	KPI-4 [ ]
System 3	KPI-5 [ ] KPI-6 [ ]
System 4	KPI-7 [ ]

Figure 26

SV-8: Systems and Services Evolution Description

This evolution description captures the plans that describe the steps and stages a system or an overall architecture will go through over some period of time. This description, when used in conjunction with the SV-9 and TV-2 architecture products provides a definition of how the architecture and its systems will change over some specific timeframe, and this product denotes the project implementations and sequence of those implementations to reach a desired target state for the system or architecture. In

QLM this type of evolution description can be described in our TransformationPlan template. While there are other templates that could work, the TransformationPlan purpose and intent is to describe this type of staged development or implementation plan. Figure 27 provides a sample view of such a TransformationPlan diagram.

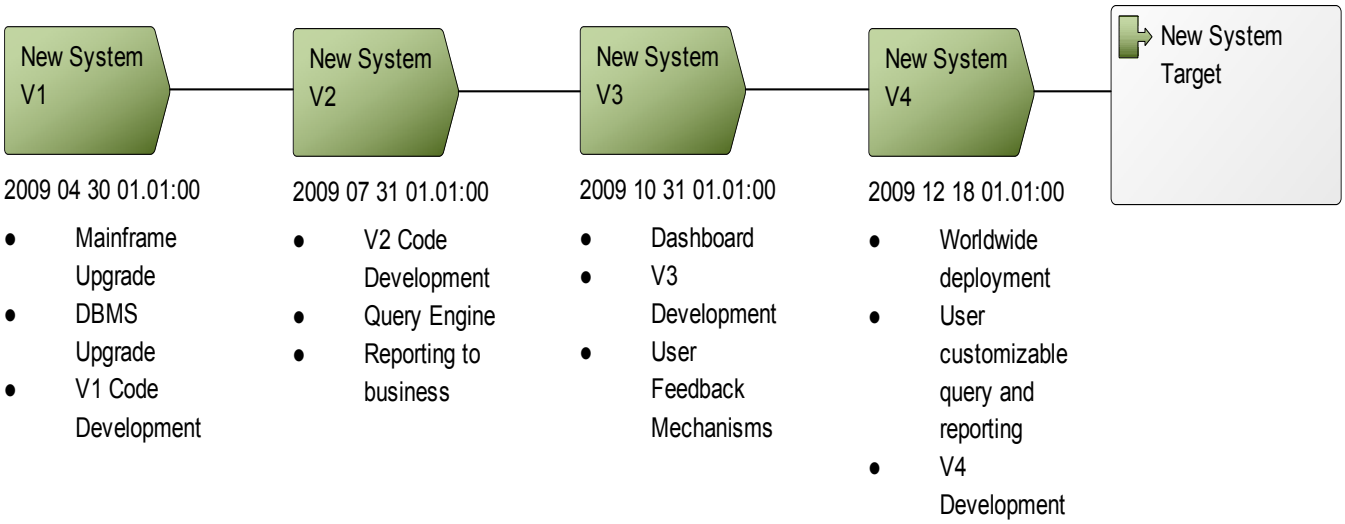


Figure 27

SV-9: Systems and Services Technology Forecast

The SV-9 architecture product provides a summary of emerging technologies that impact the architecture and its existing and planned systems. This forecast provides a description of emerging technologies and specific hardware and software products. This technology forecast identifies the technology directions and timeframes for the technologies and how the technologies influence the overall architecture. In QLM, there are templates to support such a technology forecast including: Technology, TransformationPlan, StrategicRoadmap, and a Matrix could also be utilized to document such a forecast. Figure 28 utilizes a TransformationPlan diagram template to reflect some to the technologies that need to be forecasted and tracked.

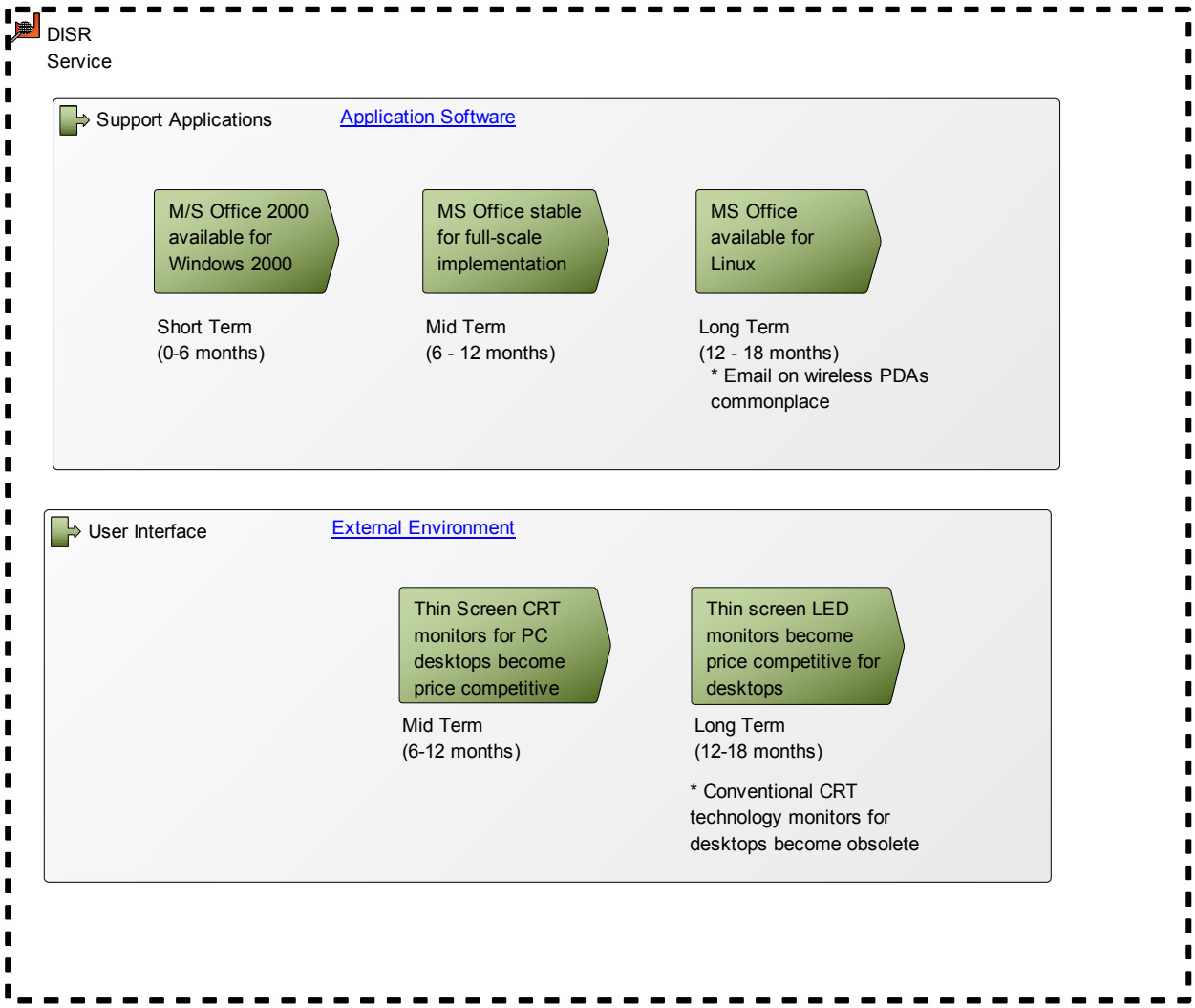


Figure 28

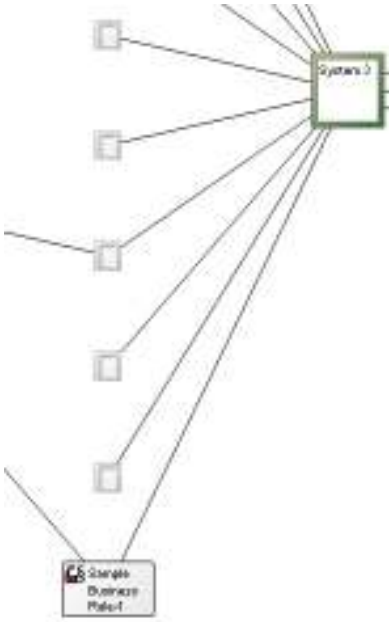
SV-10a: Systems and Services Rules Model

The SV-10a architecture product describes the rules under which the architecture and/or its systems behave under specified conditions. A rule can be a simple statement regarding expected or required behavior, or may consist of pre- and post-conditions of systems and their functions. Rules permit the understanding of behavior or constraints that are to be imposed on systems, their functions, or even the processes and activities as defined within the architecture. There could be an actual rules model constructed in QLM, but most often the BusinessRule template is used to simply document the rule, and then linkages are made between the BusinessRule and the objects that are to have the rule

imposed on them. Figure 29 shows one example of how a BusinessRule can be documented, and then secondarily there is a view showing the linkage between the BusinessRule and one system.

The Dialog where the rule is expressed.

The Dialog permitting the linkage.



ContextView showing the linkage between the Rule and the System

Figure 29

SV-10b: Systems and Services State Transition Description

The SV-10b architecture product is a graphical method of describing a system or its function(s) response to various events and the resulting state. The diagram shows the set of events to which the systems in the architecture will respond to some action and a new resulting state. In QLM such state transitions can be depicted in multiple diagram templates, but the StateDiagram is the best method for describing these system and function states. Figure 30 depicts a sample StateDiagram to meet the needs of the SV-10b product.

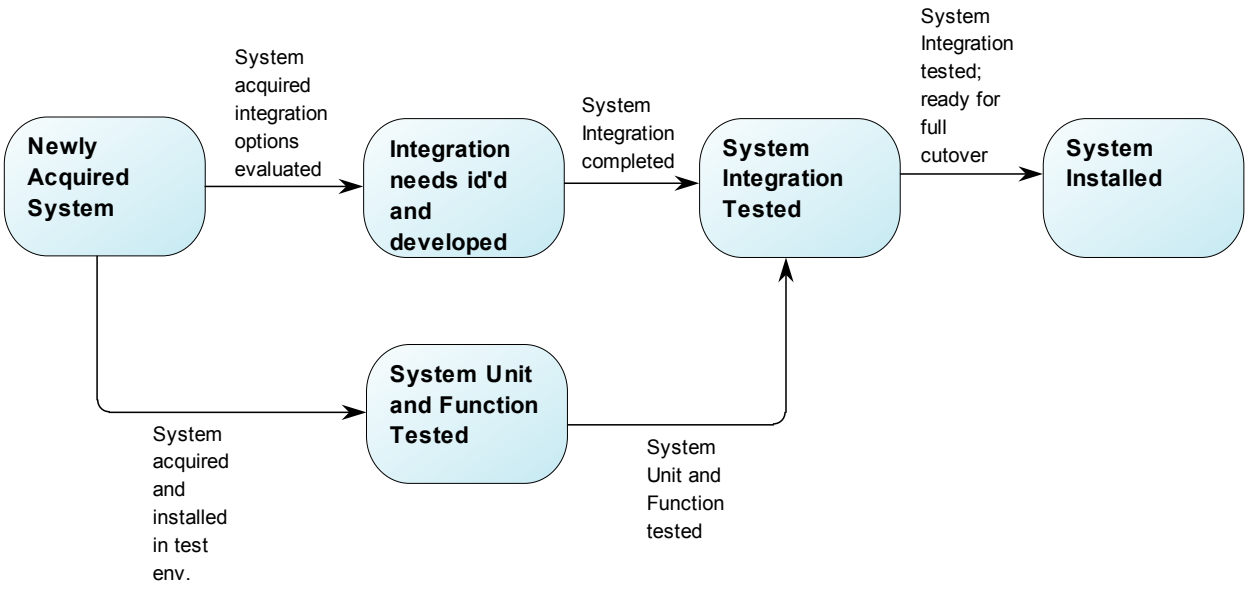


Figure 30

SV-10c: Systems and Services Event-Trace Description

This architecture product provides a time-ordered view of the system data elements exchanged between participating systems, functions, and human roles in an overall architecture as a result of some specific business scenario. In QLM there are multiple diagram types or templates that support this type of event-trace description, but the SequenceDiagram is well suited to this description. The tracing of actions and system data exchanges that occur in some business scenario can be explicitly defined and documented, and aligned with the process and system architecture perspectives. Figure 31 provides an example of a SequenceDiagram.

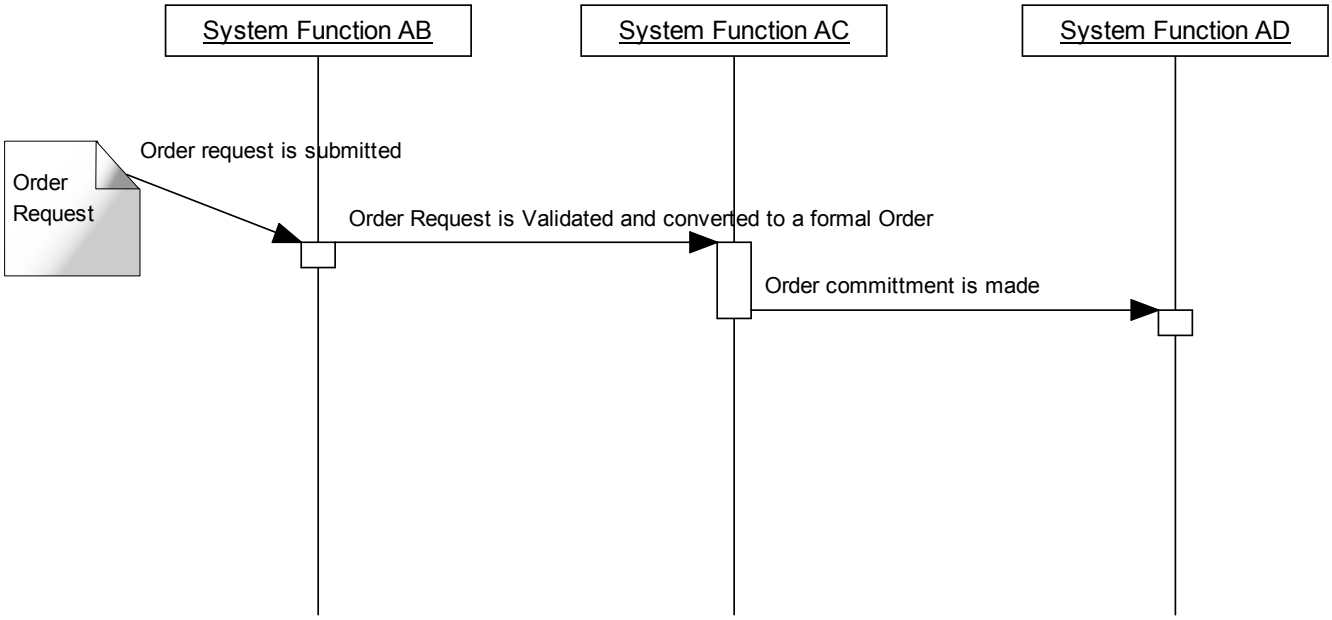


Figure 31

SV-11: Physical Schema

This architecture product defines the structure of various kinds of system data that are utilized by the systems in the architecture. The physical schema typically defines the physical data structures that are used by systems and the processes supported by the systems. The schema will define the tables, the columns of the tables, and the relationships that must exist between the tables in the data structure. This architecture product can be represented in QLM through ClassDiagram or RelationalDiagram templates, and the business will decide which to use depending on whether they are following UML methods and constructs or typical Entity-Relationship methods and constructs. Figure 32 provides an example of a RelationalDiagram that represents a physical schema. For simplicity, Columns are defined in only one of the tables.

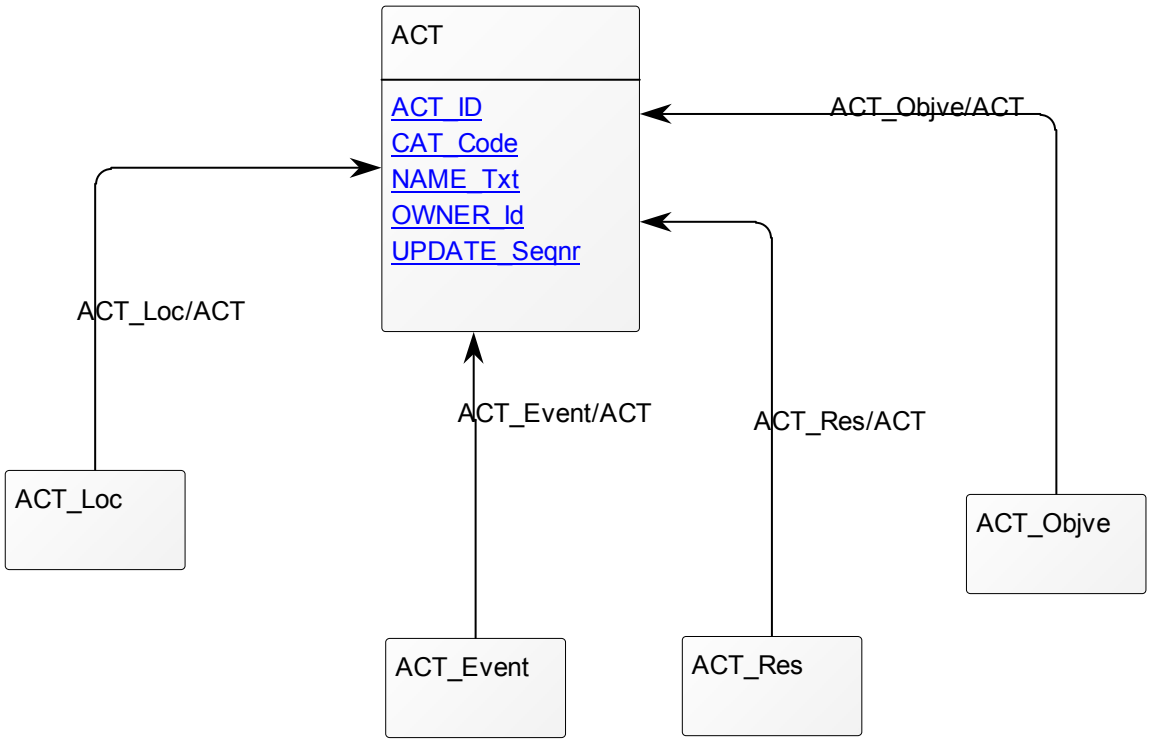


Figure 32

TV-1: Technical Standards Profile

This architecture product identifies various systems standards or rules that when complied with will constrain the choices that can be made in the design and implementation of systems, functions and overall architectures. The technical standards will typically govern what hardware and software products may be used and implemented, including what database technologies and data formats are required. In QLM, such technical standards can be represented through current templates, but it may be more desirous to have new templates built for such technical standard specification. Currently in QLM, there are templates such as Technology, Regulation, or Business Rule that could express such technical standards. A technical standard can then be linked to information systems, services, service groups, computers, infrastructures, etc. Figure 33 provides a sample matrix of such standards and how they might apply to anything from Systems to Services to Computers, etc.

Tech Stds to Systems-Services	Standards are applicable to...
Business Modeling Std 478.1	Service-EFG System 5
Information Processing Std 123.a	Service 1 Service 3 Service 4 Sys. Func. 2 Sys. Func. 3
Information Security 789.c	System 1 System 3 System 5 System Node C Service-ABC Service-GHI
Information Transfer Std 234.b	System Node A System Node B System Node C

Figure 33

TV-2: Technical Standards Forecast

This architecture product lists emerging or evolving technology standards relevant to the systems and functions within the architectures of the business. In this forecast, it is expected that the technical standards forecast should be aligned and coordinated with the architecture transition plans. In QLM, the StrategicRoadmap, TransitionPlan, and the Technical Standards either represented through current templates or through a future template, can be used to define and display this forecast or plan. Just like the SV-8 or SV-9 architecture products, the technical standards forecast can be built and linked to the overall architecture. Refer to the SV-8 or SV-9 related figures to understand how this forecast could be represented.

Conclusion

Architecture frameworks and business architectures must and will evolve over time. It is natural that as a result of Change Management and Continual Improvement that the architecture representations of businesses and organizations will change and grow as the business and our global interactions grow and change. Even John Zachman with his Enterprise Architecture framework didn't believe that one framework and a discipline to comply with that framework was the end all. His framework simply provides us with a model of how an Enterprise Architecture can be represented, linked, and managed.

At QualiWare we believe it imperative that a flexible and adaptive tool and architecture management solution be employed for architecture frameworks such as the DoDAF, and many other frameworks. There is not one single approach and not one single tool to represent the architecture products. At QualiWare we also believe it imperative to engage the total organization in the building and management of the architecture products. That doesn't mean that hundreds or thousands of people are involved in the building of the architecture products, but it does mean that where there is a larger audience with a need to know, they can also be afforded the opportunity to provide feedback and ideas for improvement to the architects. QualiWare Lifecycle Manager allows the larger business team to be involved and engaged through the use of web based tools and capabilities. Not everyone in the organization needs to have architecture management experience, but many people may need the information that resides in the many architectures that will be built over time.

About the Author

Steven Arbogast has over 30 years of experience in IT and business management at IBM. Steve is the President of QualiWare, Inc., a North American subsidiary of the Copenhagen, Denmark company, QualiWare ApS. Steve has extensive experience in logistics management and related systems, supply chain management, fulfillment process and related systems, sales and product configuration as part of customer relationship management, project management, process and data reengineering, information management, enterprise application integration, including the integration of back-end business systems and applications with e-business web-based applications. Steve led corporate level business architecture teams and the work of those teams is still widely used within IBM in their overall Enterprise Architecture management.

With 40 total years of experience in managing both business and IT environments, Steve understands the strategic planning, business operational, technical and organizational components necessary for effective business change management and has helped companies build and implement management systems that have fostered and sustained a continual improvement philosophy and overall management system. Steve can be contacted at arbo@qualiware.com.

QualiWare In Canada

QualiWare is available in Canada through CloseReach Ltd., an Ottawa based consulting services firm specializing in business/enterprise architecture, web content management, business systems development and training. CloseReach QualiWare related services include: implementation planning, installation, configuration and certification, training and data import/conversion. CloseReach can be contacted at 613-794-8809 or by email at QualiWare@CloseReach.ca .