



Whitemarsh
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Data Management Program:
Projects and Data Asset Products

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1. Introduction

In general, data management, as in information technology discipline, supports the collection, development and maintenance of information about data required by the enterprise constituency of organizations to accomplish its mission tasks. Data management planning produces complete, implementable projects that include all data asset product specifications in the form of metadata, measures, studies, plans, prototypes, models and databases necessary to: 1) enable subsequent and improved data integration and reuse; and 2) provide improved project scooping, responsiveness to business change, management of systems development sequencing and prioritization, and level of business involvement.

Data management planning also results in the development of the data asset project action plans that set out the plans to achieve the net-centric goals for data.

Data management planning projects do not actually effect the creation and/or evolution of data assets. Rather data management planning projects identify, plan, and manage data asset project accomplishment. Data asset projects thus develop and/or use the data asset product's metadata necessary to create or evolve a specific data asset, that is, the existing and proposed: a) data model(s); b) business rules that govern the definition, production, storage, ownership, management, exchange formats, and replication of data, based on data categories (e.g., per-soldier personnel data); and c) data standardization/interoperability efforts and issues that relate to accomplishing the organization's mission(s).

To eliminate the possibility of stovepipe data assets, a certain class of data asset projects may need to create products in the areas of mission, event, information systems, function, and organization so that the various data assets can be set within their proper contexts thus ensuring proper integration across all other data assets of the enterprise, within a community of interest and/or across communities of interest.

To illustrate, a primary focus of a data asset project within data management planning may be to model data and create the specification of how data will be stored, transferred and managed. Thus, a data model may state that a person's name is related to the person's Social Security Number (SSN). Data models alone are not sufficient to specify that the SSN is Privacy Act data and must be protected from unauthorized access, nor will it say how the Person Identifier is created, assigned, physically stored in databases, and formatted for data exchange. These additional rules are part of other data asset products that might be created in this or other data asset projects. Because there exists an integrated metadata repository that would contain all these data asset product specifications they could be available for use by all. Simply put, the purpose of data management planning is to create and manage an environment within an enterprise that enables the development of data assets that are flexible, interoperable, and evolvable. Anything short of that is failure.

data management planning projects begin with a problem statement that is then taken through a rigorous functional and technical analysis process, resulting in a feasible solution for



implementation at the appropriate enterprise level, ranging from specific, pair-wise, database-to-database exchanges up to enterprise level data sharing in a "virtual, distributed single database" environment.

The steps are: 1) Developing the problem statement, 2) Performing requisite analysis, 3) Configuring relevant data asset projects, and 4) Managing data asset projects including proofs of concept.

1) Developing the problem statement. The problem statement includes an external statement of, requirement, or deficiency to identify the need, or the identification of (a) deficiency to be addressed, (b) new need to be addressed, or (c) need for improved performance to be addressed.

2) Performing requisite analysis. The process of requisite analysis includes employing enterprise missions, functions, and organization to frame or focus the analysis. If possible, refine this analysis to the point of specifying the problem space to the appropriate level of detail. Develop an initial data management planning project problem statement. Identify the specific objectives that must be achieved and data asset products produced to support mission performance. This is a statement of desired results, with specific, quantifiable, and measurable outcomes and products that constitute project accomplishment.

Use existing and legacy data models to produce a characterized (completely documented) normalized data model representation of the current data-for-exchange environment. Use existing database documentation and meta-data to develop an understanding of the current data environment. Review the information with user representatives to verify the "as is" or current environment documentation. The product of this review is a verified specification of the current environment.

3) Configuring relevant data asset projects. Each data asset action plan includes work breakdown structures that are the task statements that support the achievement of the data asset project. The data asset project also includes the various data performance goals and objectives that are to be achieved. Alternative approaches are created and evaluated through Proof of Principle Projects that validate the recommended alternative (risk reduction) or validate the specifications (for issuance to the developer).

4) Managing data asset projects. Managing the data asset includes the accomplishment of the actual data asset projects. Additionally, it includes monitoring and evaluating the proper use of a created data asset, that is, cycling back lessons learned reports, issue resolution reports, or refinement of performance metrics that were employed in the development effort. In the data asset project, the nature of the technical solution, evaluations via the functional (user) and technical environments are accomplished. Within the constraints of priorities the data exchange requirements, the data use environment, the existing models and data standards, the current legacy data, and the associated meta-data are developed to a sufficient level to begin work on establishing the new or improved capabilities.



2. Classes of Data Management Projects

Specific types of projects include:

- Data management Projects
- Component Architecture Projects
- Concept of Operations Projects
- Data Management Planning Environment Projects
- Data Management Metadata Repository Infrastructure Projects
- Training and Awareness Projects
- Methodology Projects
- Technical Support Projects

Each **data management project** is to be accomplished in support of some aspect of the data management overall program. Thus, there are projects related to the data management program's architecture, governance, and components. Each project has a firm goal, specific objectives, a workplan, metrics, deliverables (that is, data asset products), and a schedule that must be accomplished. All deliverables must fit within the overall set of all deliverables from all the other data management projects.

Component architecture projects are specifically targeted at the engineering, design, deployment, and long-term evolution and maintenance of the components within the data management. Included are its overall process, specific standards such as SQL, XML, 11179 Data Element metadata, work predicting and assessing metrics, control through project management, details about the technical components of data management such as EID, ADS, IESS, XML (as appropriate for data transport), and finally the metadata repository system that creates, holds, and interrelates all data asset products within and across all communities of interest. Each component architecture project would be scoped, its work plan developed, resource loaded and staffed, and managed during its accomplishment.

Concept of Operations projects are those that address either the data management program in general, or specific components of the data management architecture. Thus, there would be concepts of operations documents addressing process, standards, metrics, project management, data management technical components, and the federated metadata repository environment. Each project would be scoped, its workplan developed, resource loaded and staffed, and managed during its accomplishment.

Data Management Planning Environment projects are generally in three areas: metadata management, the ongoing evolution of the environment's functionality, and extensions to functionality.

Data management Metadata Repository Infrastructure projects focus on the creation of key metadata that is required to be discovered and loaded into the data management metadata



repository such that it can be productively employed in data management component architecture projects.

Training and Awareness projects are those that cause the creation of various presentations, workshops, courses, and support services such as hot-line, on-line tutorials, and the like.

Methodology projects are created so that different groups of persons, whether contractor or enterprise, produce the same set of data asset product deliverables from the same or similar requirements. The methodology is to be at least one or more levels more detailed than the actual management of the work. Methodologies have well engineered data asset product deliverables and metrics for work efforts. Methodologies are accompanied by training, workshops, and as needed, consulting. Methodologies may address any aspect of the data management effort. Ultimately, methodologies are procedural guidance that enables quality products to be developed.

Data management technical support projects are those engineered to make experts available to those performing a data management related project.

Data management planning projects result in the identification of specific data asset projects.



3. Products Required for Specific Data Management Projects

3.1 Data management Projects

Data management projects include various classes of projects that are required to successfully accomplish the data management with respect to architecture, governance, and components. Included for example are policies and procedures that are required for the data management, communities of interest, enterprise identifiers, reference data, ISO 11179 data elements, data model templates, and any communities of practice groups for areas such as data modeling.

For each of these projects, the work plans are created and include, for example, the data asset product deliverables, work unit efforts, and required working environment characteristics, and skills with levels required for these projects to be successful. The classes of data management projects include:

- Data management architecture projects
- Concept of operations projects
- Data management planning environment projects
- Data management metadata repository Projects
- Training and awareness projects
- Methodology projects
- Technical support projects

3.2 Data Management Architecture Projects

As stated above, data management architecture projects are specifically targeted at the engineering, design, deployment, and long-term evolution and maintenance of the components of the data management. Components of the data management program include:

- The data management overall process (3.2.1),
- Specific governing technology standards such as SQL, XML, ISO Standard 11179 for Data Element metadata (3.2.2),
- Metrics employed to help plan, manage, and evaluate (3.2.3),
- Project management activities for various data management projects (3.2.4),
- Data asset projects including deploying enterprise data standards such as EID, ADS, IESS, XML (as appropriate for data transport) (3.2.5) within data asset projects, and finally
- Defining, employing, and managing the metadata repository system that creates, holds, and interrelates all data asset products within and across all communities of interest (3.2.6).

Each data management architecture project would be scoped, its work plan developed, resource loaded and staffed, and managed during its accomplishment.



3.2.1 Data Management Overall Process

The data management itself has an overall process, including the various classes of projects cited in Section 3.2, above. Within the definition of the data management overall process, a prototypical methodology, types of metrics to determine the resources required, and products produced are all identified. Identified as well are how the data asset products are integrated with all other related data asset products, how conflicts in data asset products will be identified, investigated, and resolved. Identified are how the projects should be staffed, resourced, and managed. Finally, identified are how the data asset products should be reviewed, corrected, and lessons learned recycled into project methodology, metrics, and product specification and construction.

3.2.2 Governing Technology Standards

Data management standards efforts identify the de jure and de facto standards and standards organizations that affect net centric products in an enterprise. Examples of standards include SQL, XML, ISO 11179, the U.S. Department of Defense Architecture Framework (DoDAF), and the United States Federal Enterprise Architectures. Identified also are the required level of participation in these standards organizations. Determined are the strategies to deploy these standards throughout the enterprise to ensure maximum interoperability at minimum cost. Determined as well are if any specific enterprise profiles have to be created, then determined is if conformance tests need to be created and executed to enforce the profiles, and finally, determined is any RFP and contract language necessary to enforce the enterprise profiles. Estimated finally are the resources required to develop profiles and conformance tests.

3.2.3 Metrics

The determination of metrics includes the identification of which metrics must be captured to measure the cost and benefits of the data management program. Determined for each metadata product within each data management program, are the appropriate metric that measures the product's quantity, quality, level of integration with other metadata product, and finally the level of reuse of this product with other metadata products. Identified too are the capture mechanisms and how the captured statistics are to be reported from the metadata repository.

Identified too is how the metrics are to be captured within the metadata repository's project management component so that earned value reporting can be performed within each project, across work environments, by type of database project, and across individuals and skill levels of individuals and skill types. Identified finally are how project management statistics can be reported across customer organizations.



3.2.4 Project Management

The project management component of the data management identifies the complete set of data asset products needed to represent project management within a data management environment. Identified are the predominant project, data asset product deliverables and task templates necessary for all classes of database projects. Identified as well are the supporting data asset product metadata needed for complete project management such as staff, resources, skill levels and metrics, work environment characteristics and metrics.

For each data asset product, the work effort is identified for a prototypical unit of work, for example, defining a database table column. Then, across a collection of data asset products that may constitute a complex product, the appropriate set of ratios are identified (e.g., the quantity of columns in a table) that can, in turn, be employed to compute the total size of an data management project at various stages in the database project's life cycle.

Identified too are the different work environment characteristics that affect work estimates and including how work environment characteristics are to be combined to result in an overall work environment effect on any given task. Identified as well are the necessary skills and skill levels required for an overall database project and how these skills and levels are to be applied to any given project task. Included too are how skill level characteristics are to be combined with work environment characteristics. Finally, identified are how a final task resource estimate is to be created that involves data asset product deliverable work efforts by task, work environment characteristics, and skill level characteristics.

Finally, identified are how work accomplishment metrics are to be captured and applied to project estimates and how these are going to be employed to refine work effort metrics, work environment metrics, and skill level metrics.

3.2.5 Data Asset Projects

For a specific data asset project the data performance planning steps (Performing the requisite analysis, and configuring relevant data asset projects) must at least:

- Identify the missions that are to be addressed by this database project. Estimate the quantity of mission levels and the amount of resources (staff hours) required to perform complete mission description.
- Identify the organizations that are to be involved in this database project. Estimate the quantity of organization levels and the amount of resources (staff hours) required to perform complete organization descriptions. Indicate the level of effort required to properly intersect and describe missions and organizations.



- Identify the functions that are to be affected by the database project. Estimate the quantity of function levels and the amount of resources (staff hours) required to perform complete function descriptions. Indicate the level of effort required to properly intersect and describe missions-organizations, with functions.
- Identify the information needs that are to be addressed by the database project. Estimate the quantity of information needs and the amount of resources (staff hours) required to perform complete information need descriptions and classifications. Indicate the level of effort required to properly intersect and describe missions-organizations-function, with information needs.
- Identify the enterprise resources that are involved in the database project. Estimate the quantity of resources, the approximate quantity of resource life cycle nodes, the intersections among resource life cycle nodes, and the amount of resources (staff hours) required to perform complete resource life cycle analysis. Indicate the level of effort required to properly intersect and describe resource life cycle nodes with information needs.
- Identify the existing application systems that are to be involved as either feeders or receivers of database data. Estimate the quantity of application systems and the amount of resources (staff hours) required to perform complete identification of feeder and/or receivers of database data. Identify the strategy for database to feeder/receiver system interaction, that is, IEES, or point-to-point. Justify the choice of interface method in terms of both initial and then ongoing effort and cost.
- Identify the quantity of database domains that are involved in the database project. Estimate the amount of resources (staff hours) required to perform complete database domain analysis. Estimate the quantity of entities likely to be in each database domain. Indicate the level of effort required to properly intersect and describe database domains with missions.
- Identify the quantity of entities that are involved within each database domain. Estimate the amount of resources (staff hours) required to perform complete entity analysis including identifying the quantity of data elements required for all entity-attribute creation. Estimate the amount of time to create each database domain's entity relationship diagram, and then the amount of time to create a merged entity relationship diagram including resolving all apparently similar but different entities and all apparently different but same entities. Indicate the strategy through which all names, definitions, and abbreviations are to be automatically generated.
- Identify the quantity of ISO 11179 data elements that are involved with the database effort. Estimate the amount of resources (staff hours) required to create all the upper levels of ISO 11179 data element metadata associated with concepts, conceptual value domains, value domains, and data element concepts. Estimate the amount of time to



properly intersect all these data element metadata components. Indicate the strategy through which all names, definitions, and abbreviations are to be automatically generated.

- Identify the quantity of specific databases, tables, columns, and relationships that are likely to be created during the database project. Estimate the amount of resources (staff hours) required to perform complete database design at the conceptual, logical, and physical levels. Estimate the quantity of views likely to be needed to intersect each database with the various information systems. Indicate the strategy through which all names, definitions, and abbreviations are to be automatically generated.
- Identify the quantity of database object classes that are likely to be created during the database project. For each database object, estimate the quantity of database object states, database object tables, database object table processes, and database object information systems. Estimate the resources (staff hours) required to perform a complete database object class analysis and specification.
- Identify the quantity of business rules for each of the seven types. Estimate the amount of resources (staff hours) likely to be needed to centrally define the business rules, allocate the rules to the various columns, tables, and other process employments such as assertions, triggers, and information systems.
- Identify the method of data transport among the various views of the different information systems. For example, messages, XML schemas and data streams and the like. For either, estimate the quantity of each and estimate the quantity of resources required for their development. Indicate the strategy through which all tags are to be automatically generated. Given that there is a need for XSLTs, indicate the strategy that will be employed to automatically generate these XSLTs.

For each of the above product creations, create appropriate:

- Work breakdown (WBS) structure,
- Gantt, and
- Pert charts

then, merge all WBS lists into a single project management system and resource load the overall project. Determine the critical path.

3.2.6 Data Management Metadata Repository System

Create the architecture for the data management metadata repository system. That is, its various missions, data model that supports the various data asset product metadata artifacts within the data management missions, the full design of the information systems that must support all the



metadata products that are to be loaded, updated, reported, and evolved, all the business rules that must be honored to effect quality metadata capture and maintenance.

Create the strategy for developing, deploying, and operating the data management metadata repository system within an enterprise environment, and within and across Communities of Interest.

Create the resource estimates that indicate the effort required to create the data management metadata repository system, all supporting documentation, user guides, and to incorporate the data management metadata repository operations within all appropriate seminars, books, white papers, and workshops.

3.3 Concept of Operations Projects

Identify the various classes of projects that exist within data management. That is, develop concept of operations documents along with a full methodology and appropriate use documents for the data management repository for:

- Component Architecture Projects
- Data Management Planning Environment Projects
- Training and Awareness Projects
- Methodology Projects, and
- Technical Support Projects

For each concept of operations document, create a topical outline and then estimate of resources for completion. The topical outline would include for example,

- Identification and description of the problem addressed.
- The overall strategy for addressing the problem, including an enumeration of the phases that comprise the overall solution.
- A moderate level of detail for each phase that outlines the approach to accomplishing the effort.
- The products required at the start of each phase.
- The projects produced at the end of each phase.
- The quality measures required at the end of each phase to assess quality.
- The metrics that are to be captured within each phase.



- The overall result and method of measuring success or failure.

3.4 Data Management Planning Environment Projects

Identify the areas of the data management repository that are most relevant for data management program participation. Determine the mapping between the data management metadata repository. Promote changes to the data management repository data model if any significant components of the data management metadata repository are missing from the data management repository. Promote changes to the data management metadata repository if any significant data management repository components are missing.

Identify the strategy for extracting data management metadata and importing it into the data management repository, and vice versa.

Identify, develop, test, and field the ability of one data management metadata repository to replicate metadata to another, and to merge metadata to another.

Engineer a quality and ease of use feedback process that uncovers the need for the modification of existing functionality, or the creation of new functionality within the data management metadata repository

For each of these projects, a work plan and an estimate of resources must be created.

3.5 Data Management Metadata Repository Infrastructure Projects

There are a number of projects that are critical. These include:

Discovery and then loading of the meta category value class types, meta category value classes, and meta category values including all definition fragments and word abbreviations. These ultimately form all the modifier and class word allocations for all data element concepts, data elements, attributes, and columns.

Discovery and then loading of a full set of data types for value domains, SQL, and all appropriate DBMSs. Included in this is the interrelationship among all these data types.

Discovery and then loading of the non-redundant set of ISO 11179 data elements from within the existing set of all DDDS data elements. Included as well is the allocation of these ISO 11179 data elements to the upper layers of 11179. Discovering and allocating all value domains to the ISO 11179 data elements.

Discovery and then loading of the non-redundant set of data model templates from existing data models within the enterprise. Included in this effort is the allocation of all data model attributes



to the previously loaded ISO 11179 data elements that were non-redundantly mined. Also included in this effort is the mining of all value domains that may exist and then the reconciliation of these value domains to those previously allocated to the ISO 11179 Data elements.

For each of these projects, a work plan and an estimate of resources must be created.

3.6 Training and Awareness Projects

Identify the various courses, presentations, workshops, and white papers necessary to fully convey the data management. Prepare a description of each and place each within an overall curriculum for data management. For each of these courses, presentations, workshops, and white papers, a work plan and an estimate of resources must be created.

3.7 Methodology Projects

For each of the products identified within the set of data management artifacts, identify the work plans, data asset product deliverables, work unit efforts, and required working environment characteristics, and skills with levels required for this artifact to be created as well as evolved and maintained.

3.8 Technical Support Projects

Identify the types of technical supports that must be provided to an enterprise in support of delivering the data management program. Identify the resources that are required to develop the technical support, that is, telephone, website of materials, and a FAQ. Identify the need for special interest groups and cause them to be created and managed.



4.0 Data Asset Product Specifications

As the data asset projects are accomplished the various data asset product specifications are either developed and/or maintained. These products address:

- Data asset project plans
- Conceptual data models
- [ISO 11179] data elements
- Data integrity rules
- Database domains
- Database objects
- Logical data models
- Physical data models
- View data models and Inter View Mappings (includes relationships to AIS)

4.1 Data Asset Project Plans

Data Asset Project plans should contain at least the following:

1. Project Plan administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
2. Project plan objects
 - a. Project Plan tasks
 - i. Task
 - ii. Predecessors
 - iii. Critical dates
 - iv. Unit effort
 - v. Deliverable unit quantity
 - b. Project Plan milestones
 - c. Project Plan employed resource information
 - d. Project Plan deliverables
 - e. Project Plan success factors
3. Project plan inter-object relationships
 - a. Task references deliverable
 - b. Task references previous tasks
 - c. Milestone references feeder tasks



- d. Task references previous milestone
- 4. Project Plan related objects
 - a. Project plan references project plan
 - b. Project plan references EID
 - c. Project plan references data asset

4.2 Conceptual Data Models

Conceptual data models should contain at least the following:

- 1. Conceptual data model administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
- 2. Conceptual model objects
 - a. Subject
 - b. Entities
 - c. Attributes
 - d. Relationships
 - i. Primary Key
 - (1) Primary key attributes
 - ii. Candidate Key
 - (1) Candidate key attributes
 - iii. Foreign Key
 - (1) Foreign key attributes
- 3. Conceptual model inter-object relationships
 - a. Subject contains subjects
 - b. Subject contains entity
 - c. Entity contains entity subtypes
 - d. Entity contains attributes
 - e. Attribute contains attributes
 - f. Entity contains primary key
 - g. Entity contains foreign key
 - h. Entity contains candidate key
 - i. Primary key contains foreign key
 - j. Primary key contains primary key attributes
 - k. Attribute contains primary key attributes



- l. Foreign key contains foreign key attributes
 - m. Attribute contains foreign key attributes
 - n. Candidate key contains candidate key attributes
 - o. Attribute contains candidate key attributes
4. Conceptual model related objects
 - a. Attribute references [ISO 11179] data element
 - b. Attribute references value domain structure
 - c. Subject references EID

4.3 [ISO 11179] Data Elements

[ISO 11179] Data Elements should contain at least the following:

1. [ISO 11179] data element administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
2. [ISO 11179] Data Element Objects
 - a. Concepts
 - b. Concept structure
 - c. Concept structure type
 - d. Conceptual value domains
 - e. Conceptual value domain structure
 - f. Conceptual value domain structure type
 - g. Data element concepts
 - h. Data element concept structure
 - i. Data element concept structure type
 - j. Value domains
 - k. Value domain structure
 - l. Value domain structure type
 - m. Value domain values
 - n. Value domain value structure
 - o. Value domain value structure type
 - p. Data types
 - q. Compound data elements
 - r. Derived data elements
 - s. Data element classifications



3. [ISO 11179] Data Element inter-object relationships
 - a. Concepts
 - i. Concept contains concept structures
 - ii. Concept is contained in concept structures
 - iii. Concept structure type contains concept structures
 - b. Conceptual value domains
 - i. Conceptual value domain contains conceptual value domain structures
 - ii. Conceptual value domain is contained in conceptual value domain structures
 - iii. Concept value domain structure type contains concept value domain structures
 - c. Data element concepts
 - i. Data element concept contains data element concept structures
 - ii. Data element concept is contained in data element concept structures
 - iii. Data element concept structure type contains Data element concept structures
 - d. Data element classifications
 - i. Data element classification contains data element classification structures
 - ii. Data element classification is contained in data element classification structures
 - iii. Data element classification type contains data element classification structures
 - e. Value domains
 - i. Value domain contains value domain structures
 - ii. Value domain is contained in value domain structures
 - iii. Value domain structure type contains value domain structures
 - f. Value domain values
 - i. Value domain value contains value domain value structures
 - ii. Value domain value is contained in value domain value structures
 - iii. Value domain value structure type contains value domain value structures
 - g. Compound data elements
 - i. Compound data element contains compound data element structure
 - ii. Compound data element is contained in compound data element structure
 - iii. Compound data element structure type contains compound data element structures
 - h. Data element concept references conceptual value domain structure
 - i. Data element concept references concept structure
 - j. Data element references data element concept structure
 - k. Data element references value domain structure
 - l. Compound data element contains data element
 - m. Derived data element contains data element
 - n. Value domain references conceptual value domain structure
 - o. Value domain value references value domain structure
4. [ISO 11179] data element model related objects
 - a. Concept references EID
 - b. Conceptual value domain references EID
 - c. Value domain references EID
 - d. Data element concept references EID
 - e. [ISO 11179] data element references EID



4.4 Data Integrity Rules

Data Integrity Rules should contain at least the following:

1. Data integrity rules administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
2. Data integrity rule objects
 - a. Data integrity rule
 - b. Data integrity rule pseudo code
 - i. Data integrity rule contained items
 - (1) Data integrity rule object class
 - (2) Data integrity rule object
 - (3) Data integrity rule object value
 - (a) alphabetic value
 - (b) numeric value
 - ii. Data integrity rule inter-contained item operator
 - c. On success action
 - d. On failure action
3. Data integrity rule inter-object relationships
 - a. Data integrity rule references data integrity rule
4. Data integrity Rule related objects
 - a. Attribute references data integrity rule contained item
 - b. Entity references data integrity rule
 - c. Column references data integrity rule contained item
 - d. Table references data integrity rule
 - e. DBMS column references data integrity rule contained item
 - f. DBMS table references data integrity rule
 - g. View column references data integrity rule contained item
 - h. View references data integrity rule
 - i. [ISO 11179] data element references data integrity rule contained item
 - j. Data element concept references data integrity rule contained item
 - k. Compound data element references data integrity rule contained item
 - l. Derived data element references data integrity rule contained item
 - m. Database object table process references data integrity rule
 - n. Data integrity rule references EID



4.5 Database Domains

Database Domains should contain at least the following:

1. Database domain administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx,yy.zz)
2. Database domain objects
 - a. Database domain
3. Database domain inter-object relationships
 - a. Database domain contains database domain
4. Database domain related objects
 - a. Database domain references mission

4.6 Database Objects

Database Objects should contain at least the following:

1. Database objects administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx,yy.zz)
2. Database object objects
 - a. Database object tables
 - b. Database object information systems
 - c. Database object states
 - d. Database object information system states
 - e. Database object table processes
3. Database object inter-object relationships
 - a. Database object contains database object tables
 - b. Database object contains information systems
 - c. Database object contains states
 - d. Database object state contains database object information system states
 - e. Database object information system contains database object information system states
4. Database object related objects
 - a. Database object table references table



- b. Database object table process references data integrity rule
- c. Database object references database domain

4.7 Logical Data Models

Logical data models should contain at least the following:

1. Logical data model administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
2. Logical model objects
 - a. Schema
 - b. Tables
 - c. Columns
 - d. Relationships
 - i. Primary Key
 - (1) Primary key columns
 - ii. Candidate Key
 - (1) Candidate key columns
 - iii. Foreign Key
 - (1) Foreign key columns
3. Logical model inter-object relationships
 - a. Schema contains table
 - b. Table contains table subtypes
 - c. Table contains columns
 - d. Column contains columns
 - e. Table contains primary key
 - f. Table contains foreign key
 - g. Table contains candidate key
 - h. Primary key contains foreign key
 - i. Primary key contains primary key columns
 - j. Column contains primary key columns
 - k. Foreign key contains foreign key columns
 - l. Column contains foreign key columns
 - m. Candidate key contains candidate key columns
 - n. Column contains candidate key columns



4. Logical data model related objects
 - a. Column references [ISO 11179] data element
 - b. Column references value domain structure
 - c. Column references SQL data type
 - d. Column references attribute
 - e. Schema references EID

4.8 Physical Data Models

Physical data models should contain at least the following:

1. Physical data model administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx.yy.zz)
2. Physical model objects
 - a. DBMS Schema
 - b. DBMS Tables
 - c. DBMS Columns
 - d. Relationships
 - i. Primary Key
 - (1) Primary key DBMS Columns
 - ii. Candidate Key
 - (1) Candidate key DBMS Columns
 - iii. Foreign Key
 - (1) Foreign key DBMS Columns
 - iv. Secondary Key
 - (1) Secondary key DBMS Columns
3. Physical model inter-object relationships
 - a. DBMS Schema contains DBMS Table
 - b. DBMS Table contains DBMS Table subtypes
 - c. DBMS Table contains DBMS Columns
 - d. DBMS Column contains DBMS Columns
 - e. DBMS Table contains primary key
 - f. DBMS Table contains foreign key
 - g. DBMS Table contains candidate key
 - h. Primary key contains foreign key
 - i. Primary key contains primary key DBMS Columns



- j. DBMS Column contains primary key DBMS Columns
 - k. Foreign key contains foreign key DBMS Columns
 - l. DBMS Column contains foreign key DBMS Columns
 - m. Candidate key contains candidate key DBMS Columns
 - n. DBMS Column contains candidate key DBMS Columns
 - o. Secondary key contains secondary key DBMS Columns
 - p. DBMS Column contains secondary key DBMS Columns
4. Physical data model related objects
- a. DBMS Column references value domain structure
 - b. DBMS Schema references database
 - c. DBMS Column references data type
 - d. DBMS Column references column
 - e. DBMS Schema references EID

4.9 View Data Models

View data models should contain at least the following:

- 1. View data model administrative information
 - a. Identification information
 - i. Organization authors
 - ii. Person authors
 - b. Configuration management information
 - i. Status (development, test, production)
 - ii. Version (xx,yy.zz)
- 2. View Objects
 - a. View
 - b. View column
 - c. View column structure
 - d. View column structure type
 - e. View column structure process
 - f. View column DBMS column
- 3. View inter-object relationships
 - a. View contains view columns
 - b. View column contains view column structure
 - c. View column structure type contains view column structure
 - d. View column structure process contains view column structure
 - e. View column contains view column DBMS column
- 4. View related objects



- a. View columns
- b. View column DBMS column references DBMS column
- c. View column references [ISO 11179] derived data element
- d. View column references [ISO 11179] compound data element
- e. View references business information system

