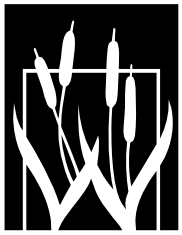

Whitemarsh
Information Systems Corporation

RFP Development
(Request for Proposal)
for
Business Information Systems

Whitemarsh Information Systems Corporation
2008 Althea Lane
Bowie, Maryland 20716
Tele: 301-249-1142
Email: Whitemarsh@wiscorp.com
Web: www.wiscorp.com

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1.0 Objective

The objective of this paper is to present the Whitemarsh approach to creating a valid, reliable and repeatable RFPs (Request for Proposal) for a business information system. Without a high-quality RFP, the chances for success are dramatically reduced. In an analysis of 13 U.S. Government Accountability Office (GAO) reports on business information system failures, at least 50% of the reasons for failure were squarely tied to inadequate requirements and design. A good RFP should prevent that.

2.0 Topics Covered

The topics is this paper include:

- Rationale
- RFP Technical Specification Components
  - Mission, Scope, and User Community
  - Data Models
  - Function Models
  - Business Information Systems
  - Business Event and Transaction Models
  - Interface Systems
  - System Control Components
- Candidate Architectures for the Proposed business information system
- Prototyping and Metadata Management
- Materials in Support of Business Information System RFP Sections C, D, F, J, L, and M
- Special Study Reports about Alternative Architectures, Development Methodologies
- Summary and Return on Investment

3.0 Rationale

An RFP is a Request for Proposal. RFPs are intended to be the terms, conditions, and specifications of work to be done by some other organization. For government agencies, the other organization is often a contractor. For large corporations the different organization is either a contractor or a different internal organization.

The most critical aspect of an RFP is that it is valid, reliable, and repeatable. By Valid, an RFP must accurately reflect what is needed to be developed. By Reliable an RFP should produce proposals that are all priced within a reasonably narrow range, say, +/- 10%. By Repeatable, an RFP should produce proposals that are sufficiently similar in technical understanding and work approach from the different organizations bidding the work.

The process of creating the correct technical specification component of an RFP is involves the creation of the following technical components:

- Missions, Scope and User Community
- Data Models
- Function Models
- Business Information Systems
- Business Event and Transaction Models
- Interface Systems
- System Control Components

These seven collections of artifacts, which are really metadata, need to be discovered, appropriately materialized and formatted and then incorporated within the appropriate section of the business information system RFP. The reason these artifacts are metadata is because they are not a real business information systems, but are specifications about a business information systems. Hence these specifications exist at a meta level. This conforms to a classic definitions of metadata as descriptions one or more levels removed from the real objects.

These RFP technical specification components should be fully defined, and the resulting work products be completely cross referenced. Further, these work products should be stored, for example, in a metadata management system's database that support comprehensive interrelationships, multiple-use, and sophisticated reporting. This then enables adequate appreciation by a bidder in order to make accurate and price-competitive proposals.

If an award is made without this information, schedule delays will be inevitable because there will a significant quantity of engineering change proposals due to unknown but existing requirements, unknown but existing business processes, unknown but existing data integrity rules, unknown but existing data standardization and migration systems, and the like. The inevitable engineering change proposals that will occur when these missing components become known will cause schedule slippages, milestones to be missed, costs to escalate.

Data models are of critical importance because they are ultimately the center of business information systems. Hence archeological efforts on behalf of data model discovery, and development become a key component of RFP artifact development. The stored and persistent data of an enterprise represents the materialization of the business-policy basis of each database. Changes in a data model often has a pervasive change effect on many information systems. Hence, understanding the data models within existing business information systems is essential to define the core pathway, scope, complexity and size of the proposed business information system.

Once the seven collections of artifacts have been developed, they can be used as the basis for the development of a series of prototypes using business information system generators such as Clarion (www.softvelocity.com). These function-based prototypes should be validated through cycles of demonstrations. At the end of each cycle, the seven collections of artifacts should be upgraded so that at the end there is a completely up-to-date and end-to-end set of specifications within the RFP. Thereafter, as changes are accomplished, artifact components are updated and cross-references updated.

4.0 RFP Technical Specification Components

The RFP technical specification components, detailed below in a summary fashion are:

- Missions, Scope and User Community
- Data Models
- Function Models
- Business Information Systems
- Business Event and Transaction Models
- Interface Systems
- System Control Components

Figure 1 presents an enumeration of the technical specification components including their interrelationships. The data models are shown in the core of this figure. The table below provides a high level description of each of the data models. These are further defined in Sections 4.2, and 4.2.1 through 4.2.7. The remaining components are described in Sections 4.1, and 4.3 through 4.7.

Data Models	
Data Elements	Data elements are the collections of business-centric, database and DBMS independent business facts that are employed as the fact-based components within the data structures of the concepts, logical, physical, view, and XML data models.
Concepts	Concept data models are building-block data structures such as person, address, business transaction, organization, location within the enterprise that are, in turn, employed within logical and physical database models in support of standardization and semantic homogeneity. Every attribute from a concept data models maps back to a single data element.

Data Models	
Logical	Logical data models are data models of databases that are independent of DBMSs (Database Management Systems such as Oracle). Logical data models employ data structures from the concepts data model. Logical data model data structures are all interrelated so that there is a seamless set of inter-data relationships.
Physical	Logical data models are data models of databases that are tuned to the specific needs of DBMSs such as Oracle and meet the performance needs of business information systems. Physical data models employ data structures from the concepts data model. Logical data model data structures are all interrelated so that there is a seamless set of inter-data relationships.
View	View data models are data structure interfacing mechanisms that exist between physical data models and business information systems. View data models are dependent on physical data models and also specific DBMSs.
XML	XML data models are hierarchically organized data structures that are both independent of business information systems and databases. Business information systems read and write XML data, which, in turn, access physical databases through DBMSs.

There are interrelationships among the different data models that are explained in Section 4.2. Surrounding these data models are the remaining six technical specification components. Each of these components are related to one or more of the data models and are related to each other. Table 1 identifies the specific interrelationships between the six technical specification components and the various data models. Table 2 presents the cross reference among the six technical specification components.

High level descriptions of all these seven technical specification components are presented in Sections 4.1 through 4.7. Explained also in these sections are the effects on an RFP if these components are missing or under specified. The lessons from history in the development and execution of poorly constructed RFPs are plain. Success is the business information system's development is accidental, and failure in terms of cost, schedule, quality and functionality is almost always assured.

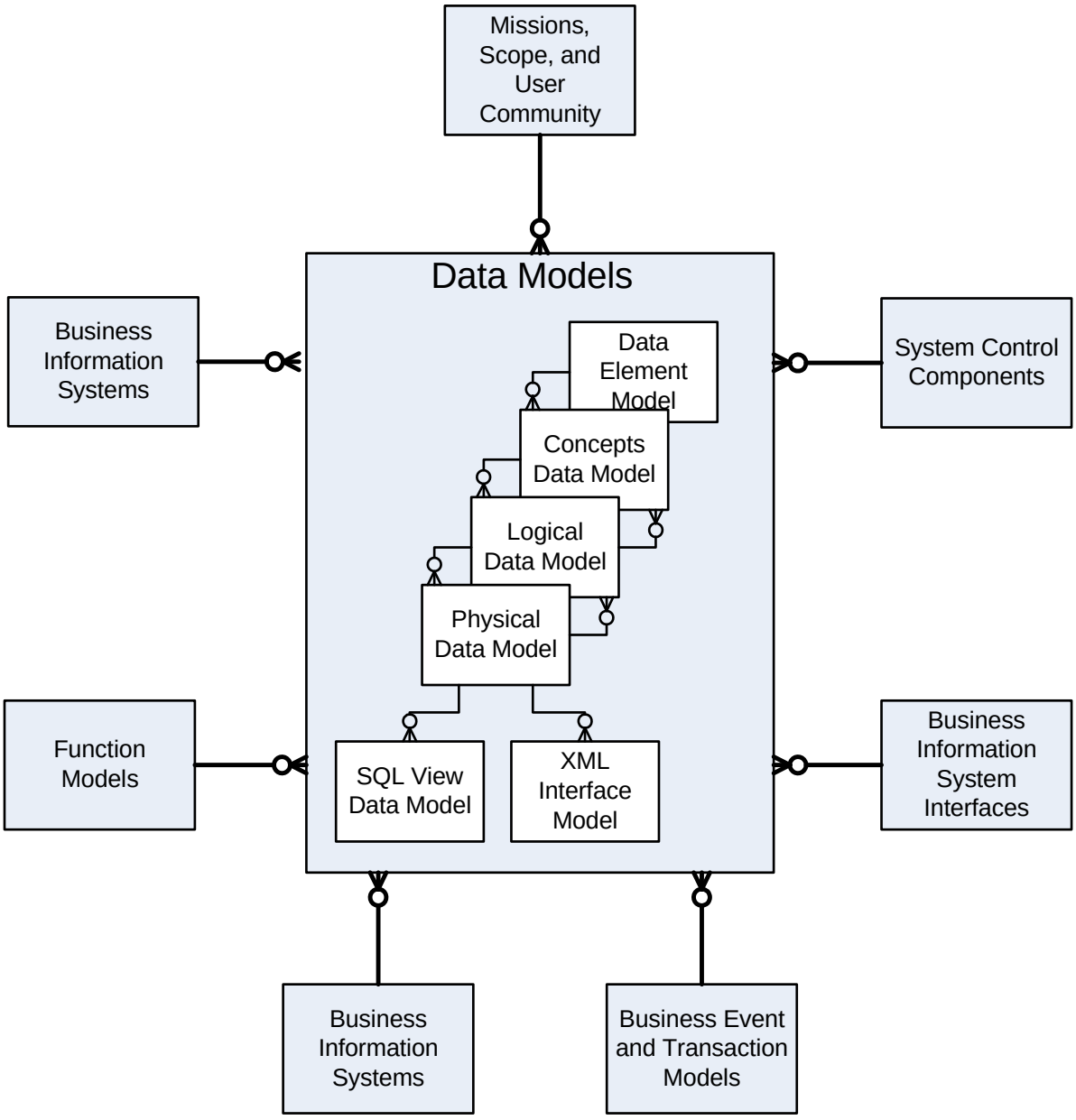

Figure 1. Interrelationship among artifact collections.

Involved Component	Interrelated Data Model					
	Data Element	Concepts Data Model	Logical Data Model	Physical Data Model	View Data Model	XML Data Model
Missions, Scope and User Community		✔	✔			
Business Information Systems			✔	✔	✔	✔
Function Models		✔	✔		✔	
Business Event and Transaction Models				✔	✔	✔
Business Information System Interfaces	✔			✔	✔	✔
System Control Components				✔		✔

Table 1. Interrelationship between Data Models and Involved Components.

Involved Component	Missions, Scope and User Community	Business Information Systems	Function Models	Business Event and Transaction Models	Business Information System Interfaces	System Control Components
Missions, Scope and User Community	na	✔	✔	✔	✔	✔
Business Information Systems	✔	na	✔	✔	✔	✔
Function Models	✔	✔	na	✔	✔	✔
Business Event and Transaction Models		✔	✔	na	✔	
Business Information System Interfaces		✔	✔		na	✔
System Control Components		✔	✔	✔	✔	na

Table 2. Interrelationship between Involved Components and Involved Components.

4.1 Mission, Scope, and User Community

The missions and scope materials for existing business environments should fully describe the ultimate objective of the proposed business information system. Necessary also would be a description of all the different user communities that are expected to be served. That is, those that create and update data, that report data and that perform special analyses on the business information systems containing data. This material is important in the RFP so that bidders can fully understand the nature, scope, and user communities that are already served and that will be served by the replacement system.

4.2 Data Models

There are of six (6) distinct types of data models. These are:

- Data element models
- Concepts data models
- Logical data models
- Physical data models
- View data models
- XML data models

Collectively these data models form the overall data topology across existing business information systems and proposed business information systems. The core of Figure 1 illustrates the data model architecture. Correctly engineered, there are one-to-many relationships across these data models. When these data models are interrelated with both existing and proposed business information systems, there automatically exists relationships –through the data models– between the existing and proposed business information systems. While obviously there are one-to-many mappings between the logical to physical to view and XML data models within existing business information system databases, and between these same models for proposed business information system databases, there is also mappings between each of these data models and the existing business information system databases and the proposed business information system databases.

Figure 1 shows a left-side set of one-to-many relationships going "down." This relationship supports two meanings. The first is the mapping of an individual component of a model, and the second is the mapping of a whole collection from within a data model. In the Data Element model there can be individual data elements such as Person First Name, and there can be collections of data elements within a specific data element concept collection, for example, Person Related Information such as Person Identifier, Person Birth Date, Person First Name, Person Middle Name, and Person Last Name.

In the first type of left-side one-to-many relationship, the individual data element, Persons First Name would be semantically mapped to zero, one, or more attributes within different entities. For example, to Employee First Name, to Customer Contact First Name, or to Causality Insurance Contract First Name.

In the second type of "left-side" relationship, a whole collection of data elements can be mapped to a whole collection of attributes across one or more entities. For example, all the Data Elements within a Data Element Concept collection called Biographic Data Elements might be mapped to the entity, Person Information, or to the entity, Customer Contact Information. In this case, the mapping of the data elements, Person Identifier, Person First Name, etc., is mapped to a corresponding set of attributes within one or more entities.

On the right-side of Figure 1, there is also a set of one-to-many relationships. This set, like the left-side one-to-many relationships has two meanings: individual component, and whole collections. The meanings of the right-side one-to-many relationship are different from the left-side one-to-many. The first type of right-side relationship, the mapping of an individual component is not one-to-many, but one-to-one. Thus, an individual DBMS Column, for example, EmpFrstNam can be inherited from only one higher level component, for example, the single column, EmployeeFirstName.

The second type of right-side relationship, the mapping of collections can be one-to-many. That is, one collection can map to one set of columns within one table of a single Logical Data Model while another collection from the same Physical Data Model can be mapped to a different collection within a different Logical Data Model. Hence, the collections can be seen as "from" one Physical Data Model to zero, one, or more Logical Data Models.

4.2.1 Data Element Models

Data element models should be set within the context of the 2002 version of the ISO 11179. Data Element Metadata model. As such, it will contain data element support information for business fact: concepts, conceptual domains, conceptual value domains and value domain data types, value domains, data element concepts, data elements, and necessary support sets of value domain values that are to be supported across the myriad of database tables for each database schema involved in the proposed business information system database.

The data elements defined in this model are the basis of the semantics employed by contextual facts. That is, facts specified in, for example, containers such as entities, tables, DBMS tables, screens, or reports. Data Elements are thus defined-once and its semantics are deployed many times across all these different containers.

Data elements, if they are at the enterprise level, facilitate the creation of integration and interoperability at the "fact" level across an entire suite of databases. Properly engineered, enterprise-level data elements also support automatic name and definition generation across database collections. If data elements are mapped to database table columns, business information system bidders will have the ability to better understand both the existing databases

and the proper creation of the set of proposed business information system replacement databases. Their understanding will be facilitated because while the database table columns may be named differently they will be mapped to the same enterprise-level data element.

4.2.2 Concept Data Models

Concept data models are data models of all the different concepts including for example, person, address, business transaction, organization, location, and the different classes of reference data. These concept data models form templates to the different data constructs within the existing databases. Concept data models are just what their name implies, the data models of concepts. They are not a conceptual form of a data model.

A concepts data model is a data model of a specific concept, represented as a container such as student, school, organization, or address. These containers (e.g., student or school) must be specified before they can be implemented in one or more different database table collections that ultimately become operational through a DBMS such as Oracle. Concept data models are not data models of databases. Rather, they are data models of concepts within and across functional areas. Concept data models are independent of database engineering. Attributes of the entities from within concept data models are deployments of the semantics of from within the Data Element data models.

Like enterprise data elements, concept data models should be mapped to the data structures within proposed business information system's databases. This mapping will facilitate common understanding 1) across the various databases within the proposed business information system, and 2) from the existing business information system databases to the proposed business information system databases. Data elements and concept data models will also increase the ability to have integration, interoperability, and non-redundancy.

A final benefit from these concept data models is that they assist in the accomplishment of data standardization and migration between the existing and proposed database environments.

4.2.3 Logical Data Models

Logical data models are database models that are independent of database management systems (DBMSs). Physical databases are designed from one or more logical data models and conform to different data architecture classes, which are described in Section 4.2.7. Each of these different data architecture class databases will have a logical data model in addition to its physical data model.

The logical data models are designed in third-normal form and have database table column names and data types that are independent of any implementing DBMS such as Oracle.

The value of logical data models to proposed business information system development vendors is that they will have a clear understanding of the data structures that are, through their

physical data models, to be employed by the business information systems for data collection, update, and reporting.

The logical data models have backwards mapping to the concepts and data element models. This enables the proposed business information system development vendors to better understand all the interrelationships among database tables within and across all the existing databases, and from the existing databases to the proposed new databases. This mapping additionally enables the development of accurate estimates for data standardization and migration between existing and future environments.

4.2.4 Physical Data Models

Physical data models are the database models employed by specific DBMSs that are employed by business information systems in the creation, updating, reporting, and analyses of business data. These data models are mapped to logical data models, and are the source of mappings to the view data models and the XML data models.

A physical data model is a data model of a database that is bound to a specific database management system (DBMS) such as Oracle. In this state, that is, dependent upon a particular DBMS and upon the performance requirements of a particular software application, the data model is termed "physical." These data models are the operational data models bound to application software systems through view data models. These data models are often not in third normal form to meet needed performance requirements. DBMS columns from the DBMS tables from within these operational data models are deployments of a single column of a table from a logical data model.

There may be multiple physical data models for each logical data model. These different physical data models may serve different functional groupings of end-users such as original data capture users, reporting users, or analysis users.

Mappings are necessary between the logical and physical data models so that proposed business information system development vendors can understand all the different database interface programs that currently exist and that must continue to exist in the proposed replacement business information system. Additionally, this type of mapping is needed to support the proper specification and binding of data standardization and migration between existing and future environments.

Operational databases that correspond to the physical databases should be examined to determine the faithfulness of adhering to the set of data type and value domain value rules established for database table column mapped data elements. This information is essential for the proper configuration of value domain value mappings between and among existing business information systems, between existing databases, and between existing business information systems and the proposed business information system.

Vendors will only be able to make accurate bids in terms of both time and money if this information is readily available within the appropriate RFP section.

4.2.5 View Data Models

View data models are the specification of the interfaces between databases, their DBMS engines, and the information systems that access database data. View data models can create new data through certain view clauses, can enforce certain business rules, and can include sophisticated multiple-table relationships and subset selections. View data models are inherently mapped to their host DBMS as view are a form of DBMS schema object.

View data models enable application systems to select, employ, and update databases according to their physical data models without having to include physical data model details within the application systems.

It is important to have views defined within the appropriate section of the RFP so that proposed business information system development vendors can submit accurate bids. Without this information, there will not be sufficient information to quantify the count and complexity of data conversion programs that will have to be created in support of data standardization and migration between the existing and future environments. Inaccurate estimates will make dates associated with proposed time-lines and milestones very problematic and will subject the overall proposed effort subject to a large quantity of engineering-change proposals that will significantly delay the proposed business information system development and increase its cost.

4.2.6 XML Data Models

The ***XML data models*** are the specification of interfaces among information systems. Data from one database is extracted through an information system and conformed to one XML schema and is then provided to a different information system for input to a different database. XML models are essential within modern architectures when information systems are not directly connected.

The structure of XML data is expressed through an XML schema that is employed to then understand the contents of XML data records. XML schemas are created through special software applications. XML data streams are created by source application software systems and are subsequently read and processed by target application software systems.

Data might be collected from one source into a database and then extracted and conformed to an XML schema for transmission to a different computing platform for use by a different information system and database.

It is important to have a high quality mapping between the XML data model schemas and the physical data models so that the level and extent of data integration and interoperability can be determined. For every disconnect there must then be a bridge program constructed that standardizes the data that is to be exchanged.

It is important that the business information system development vendors know about the existing XML schemas and the mappings between the XML schemas and the physical data models so they can properly determine the quantity and complexity of the programs that perform extracts and transformations.

Not having XML schema information has the same down-side effects as view data models, that is, risking proposed time-lines and milestones, and causing a large quantity of engineering-change proposals that will significantly delay the proposed business information system development and increase its cost.

4.2.7 Data Architecture Classes

Each physical data model can be further classified by its data architecture class. That is, whether it is:

- Original data capture - a database engineered to receive data from end-users and/or interfaced information systems.
- Transaction data staging area - a database that has semantically conformed data in terms of precision, granularity, temporal characteristics, and reference data value domain values.
- Operational data store - a database that stores data across a broad subject area but is commonly restricted to just several years of data.
- Wholesale data warehouse - a database that is like a ODS database except that it covers many years, and has been formatted to be in report-efficient formats.
- Retail data warehouse or data mart - a database that is a subset of a wholesale data warehouse and is either designed to be in a "star-schema" format or in an "E-R" format.
- Reference data (also seen as Master Data and/or Authoritative Data Source - a set of individual database tables and/or collections of database tables that represent stable values or collections of values that are employed as "references" for other data or is "the" authoritative/definitive source for this data.

4.3 Function Models

Function models are the “human” behavior models that govern the interaction between the existing business information system users, and the databases. Function models are materialized in the following forms:

- End-user screen specifications and their step-by-step sequences and inter-screen invocations.

- Batch processing systems including their steps, sequences and alternative processing routes and inter-batch process system invocations.

- Business rules and their specifications that get executed on behalf of data quality checking, completeness, transformation, and computation.

- Use case diagrams that specify the behavior to be performed. Included are step-by-step sequences, invocation of business rules, and invocation of other use cases.

- Data mapping between the required behavior model components and the databases, These are commonly expressed in an SQL view form of syntax.

- Information systems and contained subsystems down to processing modules mappings to the function models and contained processes within the function models.

The behavior models of the existing business information systems set within end user screens, batch processing systems, business rules, use case diagrams, data mappings, and information systems and contained subsystems need to be discovered and put into a form that can be reviewed as to their correctness, complexity and completeness. Thereafter, these specifications should be placed in the appropriate section of the RFP.

Only when a comprehensive functional analysis is accomplished will a vendor be able to correctly assess the quantity, breadth, and complexity of the work that has to be migrated from the existing information systems environments to the new environment. The down-side from not accomplishing a comprehensive assessment and materialization of function models is that collections of business rules will not be uncovered, information systems necessary for the correct accomplishment of the proposed business information system's work will be missed, and there will be an under appreciation of the scope and effort required in a valid bid from a business information system development vendor.

4.4 Business Information Systems

Existing business information systems need to be identified, assessed and materialized into the appropriate section of the RFP. The three classes that should be described are:

- Existing business information systems.

- New business information systems for the proposed replacement system.

- Data standardization and migration systems that must exist and execute between the existing business information systems and the proposed business information system replacement system.

Each business information system needs to be identified and described as to its construction characteristics. Included for example would be its programming language, engineering, intra-flow, inter-information system invocations, self-contained and defined data structures, encapsulated definition of business rules, transformation rules, data integrity checks, and employment of self-contained reference data.

Every one of these information system constructs will affect the quantity and skill level of the resources that will have to be bid by a proposed business information system vendor. Again, without the complete specifications of these information system materials, all the usual cautions apply. That is, copious engineering change proposals, missed milestone, and unacceptable information system products.

4.5 Business Event and Transaction Models

Business events are situations that occur in the environment that may require special before and after processing, process sequence tracking and audit trails, and may include knowing and storing the very context upon which the business event occurred. It may also require knowing which business event occurred before and then afterwards.

Business events are independent of database data model which sets out the natural relationships among the data. Business events are also independent of the function model that sets out the human behavior functions that occur. Business events are however closely interrelated with both data and function models and must be supported by mappings.

Business event models are commonly based on rules and regulations that may exist as internal or enterprise-wide policies or standard functional area policies.

Business events add a whole new layer of complexity into an effort such as the migration of an existing business information system operating environment into a proposed business information system operating environment. That is because the business event models in each environment might be very different and, in some cases, irreconcilable. Regardless, the business event models need to be thoroughly discovered, stored, reported, reviewed and then integrated with the other technical specification components.

Again, without the complete specifications of these business events, not only will the usual cautions apply, that is, engineering change proposals, missed milestone, and unacceptable information system products, but also there might be significant errors in the audit ability and traceability of business transactions.

4.6 Interface Systems

Almost all business information systems interface with other business information systems. Each such interface needs to be identified and thoroughly specified. The common components of an interface system are the data models of the interface, which may range from a direct interface mechanism such as SQL views, to fixed format data file, to a comma delimited file, to an XML based data exchange. In any of these interface alternatives, the key issues are data types, levels of precision, the proper use of reference data values, whether the exchanged data is atomic or derived, and the like.

Each interface has to be specified such that there is little room for ambiguity. Specified too, has to be the frequency and volume of data required for each interface execution. Also specified must be the required consequences of interface failures.

Again, the usual cautions apply. Additionally, if the interfaces specification material contained within the RFP are too little, interfaces are missed, or are under specified, there will be engineering change proposals, missed milestones, and unacceptable information system products.

4.7 System Control Components

There are a number of components that deal with system control. Mainly they deal with:

- Audit Trails - the ability to roll-back a given update, and/or to follow a trail of previous updates for a particular business event.

- Backup and Recovery - the ability to recover to the last successfully completed transaction or to specified date and time of a collection of successfully completed transactions.

- Message Processing - the posting of messages to end-users and/or recording to processing logs for batch processing as the consequence of some event that occurred during the execution of a transaction or the instigation/termination of a transaction.

- Security and Privacy - the ability to allow and/or prevent accessing (insert, delete, modify, read, or select) data and/or processes by classes of users and/or individual users.

The existing set of system control facilities of these and others need to be identified and recorded from within the existing business information system. As with the sections above, the usual set of cautions apply. That is, if there are missed audit trails, or databases and/processes not able to be backed or restored, or messages that are not complete or posted, or security and privacy

facilities missed, it is likely that these missed items will result in engineering change proposals that will in the end cause missed dates, milestones, and result in increased costs.

5.0 Candidate Architectures for the Proposed business Information System

In-depth interviews need to be conducted with functional users to understand which components of the functionality represented by the specifications developed in Section 4.0 need to exist within the proposed business information system.

Specific analyses should distinguish the functionality that is different because of style from differences due to fundamentally different types of data, processing steps, critically different business rules, and the like. These types of analyses should be conducted across the missions, data models, function models, developed information systems, business event and transaction models, interface systems, and system control components. Each such analysis should develop a set of conclusions and alternatives.

The result of these analyses is a differences report to the stakeholders of the proposed business information system so that they can make a judgment about the conclusions and a choice among the alternatives. It is the proper purview of the stakeholders to make these judgments and alternative choices because otherwise the business information system development vendor will be charged with deciding the fundamental data, functions, processes, interfaces, etc.

Once the choices are made, a candidate architecture document that embraces these missions through system control components should be created. The candidate architectures will be an expression of the To-Be of the proposed business information system. This To-Be document becomes a key component in the appropriate section of the RFP.

Together, these As-Is and To-Be sections represent expressions of the technical requirements so that vendors can properly configure their proposal that represents the transformation of the As-Is business information systems to the one To-Be business information system.

6.0 Prototyping and Metadata Management

The seven sets of materials cited in Section 4.0 should be stored in a metadata management system. These materials should be elaborately cross referenced and reportable. These materials should support the production of traceability from requirements through to prototyped functional operations.

These materials should also support the creation of functional prototypes across the whole of refined set of business information system requirements. These prototypes can be created in a matter of days to at most a staff week and should be presented as part of the functional models development and validation.

As each functional prototype is created, it should be demonstrated to the functional subject matter experts for review and comment. The results of the reviews should be folded back into changes to the data models, the functional models, and the business event and transaction models.

At each such cycle, all the seven classes of artifacts that are stored in the metadata management system should be updated. Updated traceability is automatic. Immediately thereafter another functional prototype will be created and its review recommenced. Figure 2 illustrates the process of developing functional prototypes. The return on investment of this strategy is very significant. The key characteristic of this diagram is that all the cycles to the left of "V1" should be accomplished and manifest within the seven technical specification components of the RFP before the RFP is released. In short, the RFP should not released until at least after week 18. The production version would be started thereafter and would be completely accomplished within 18 months.

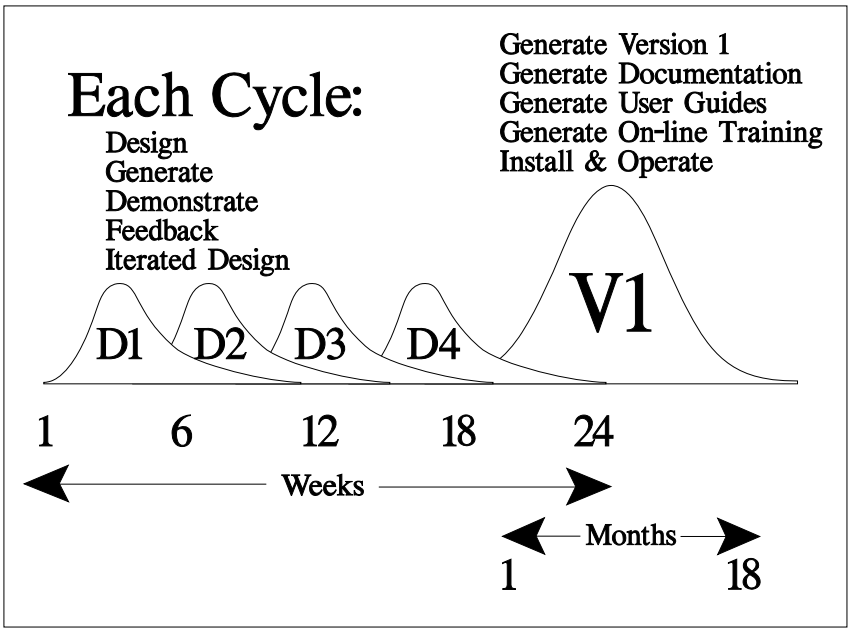

Figure 2. Prototype design iterations leading to one-correct production version.

Functional prototyping should occur across entire breadth of the business information system until the functional experts are satisfied that close to 100% of all the functional requirements have been teased out of their hidden corners and have been manifest as functional prototypes the metadata specifications. The result of this effort should be a completely updated and thoroughly cross-referenced, and represented as the set of the seven sets of metadata artifacts.

It is important to state that the collection of functional prototypes are almost always not a ready-for-prime-time production class system. Rather, they are what their name implies: Functional Prototypes of the proposed business information system. Bidders, will be able to actually see and use the final set of functional prototypes as they will be contained within a laboratory that is made available to vendors to "kick the tires," and to see operations from existing business information systems (with demonstration data).

7.0 Materials in Support of All RFP Sections

In addition to the extensive set of materials developed during the activities described above, already issued RFPs should be reviewed to extract the policies, procedures, knowledge about the acquisition regulations, and the like. These can be used to create a detailed outline for the RFP's sections. In U.S. Federal Government RFPs, these sections are: A through M. The majority of the materials from Section 4.0 of this short paper go into Sections C and J. The U.S. Federal RFP sections are set out in Table 3.

Section	Title	Brief Description
A	Solicitation/contract form	Cover sheet for the RFP that contains basic administrative information such as issue and due dates, important contacts and addresses and the like.
B	Supplies, or services and prices/costs	Identifies what is intended to be purchased including brief descriptions for the products and/or services. Identifies the type and kind of technical data that is to be conveyed in the purchase.
C	Descriptions/specifications/statement of work	Declarative statements about what the contractor is to accomplish. This could include statements the types of services, or the procedures and equipment to be used to accomplish the work.
D	Packaging and marking	Identifies and defines the required packaging, packing, and marking of the deliverables that are to be provided to the government. This would include, for example, entering all deliverables as "data records and relationships" into a metadata management system such as the Metabase.
E	Inspection and Acceptance	Defines the inspection, acceptance, quality assurance, and reliability of the products and/or services that are to be provided to the government.
F	Deliveries or Performance	Specification of the time, place, and method of delivery for the contact deliverables. This includes specification of what constitutes delivery. For example, if the delivery material is the Metabase system then what might constitute delivery is that the government is able to retrieve the delivered products from the Metabase systems.
G	Contract Administration Data	This administrative information and/or procedures for submitting invoices, and for getting paid.
H	Special contract requirements	This may include clauses related to conflicts of interest, evaluation of contractor performance, state and local taxes, identification of key personnel, compensation for overtime, and possible award fees.

Section	Title	Brief Description
I	Contract Clauses	A compendium of contract clauses that the vendor must adhere to as required by law or regulation. Each contract clause has a number, date, and title such that the vendor can review the clause.
J	List of Attachments	The set of possible attachments that are possibly applicable to the procurement. Each attachment has an identifying number, title, and then the content of the attachment. Included for example are Statement of Work, Technical Award Factors, Technical Proposal Instructions, Cost Proposal Factors, Past Performance Questionnaire, and the like.
K	Representations, Certifications, and other statements of offerors or respondents	The list of Representations, Certifications, and other statements of offerors or respondents that must be provided by the vendor.
L	Instructions, conditions, and notices to offerors or respondents	An enumeration of provisions and information that is not included in the other RFP sections. Included are instructions on what to include in the proposal, how to organize it into volumes and sections, how to prepare it, and how it should be delivered to the government.
M	Evaluation factors for award.	Declarative statements that identify the areas of the vendor's proposal that are to determine the evaluative value along with the relative value of one are to the other. Relative point scores may also be identified that are to be awarded.

Table 3. Organization Structure of a U.S. Government RFP.

In addition to the actual RFP materials, a laboratory should be created that proposed bidders can visit to exercise existing business information systems and prototypes of proposed business information systems. Vendors can then see what the As-Is specifications look like in terms of existing business information system transactions.

Part of establishing this laboratory is a comprehensive set of sample data that does not violate any privacy and security guidelines. Business transaction based scenarios need to be created along with typical data so that visiting vendors can actually experience the operation of business functions, business events, information systems, interfaces, and the like. At the end of a set of demonstrations for a particular proposed vendor, the sample databases and transaction file should be restored.

The laboratory should also contain a complete set of the proposed business information system functional prototypes. Finally, a read-only copy of the metadata management system along with all the metadata-based seven artifacts should be provided to the business information system bidders.

Collectively, these RFP based materials enable the bidders to gain a thorough understanding of the existing business information system and the seven collections of artifacts.

Further, bidders are able to both “see and experience” existing business information systems transactions and events. Finally, bidders are able to see the functional prototypes of the proposed business information system. Armed with these materials, artifacts, and prototypes, there should be nothing left for the bidders to guess when they create a proposal for a production class version of business information system.

8.0 Special Studies

Part of the development of any RFP is the execution of special studies that, for example, compare and contrast likely proposed business information system architectures, development methodologies, artifact deliverables formats, performance metrics, predetermined competitive ranges for bids, and key strategies employed to ensure that the proposed business information system effort is fully supported by an independent verification and validation (IV&V) contractor.

Each special studies should be outlined and presented to stakeholders as a technical presentation. Upon review, revision, and approval, special studies need to be conducted quickly in support of a prototyped set of findings, conclusions and recommendations. Once reviewed, revised, and approved, the special study is accomplished and the findings, conclusions, and recommendations submitted to the stakeholders for their consideration.

Engineering the accomplishment of IV&V, is especially important. That is because IV&V--properly executed--enables stakeholders to know that a project, as extensive and as critical as business information systems are, is properly managed, is making the right hardware and infrastructure decisions, is fully conforming to the database architecture requirements, and has its contained business information systems properly configured to ensure integrity, reliability and repeatability.

As the proposed business information system is accomplished, the seven collections of artifacts created within Section 4.0 will form the technical basis of comparison between the proposed business information system and the actual accomplished work. This proposed-to-actual traceability is the “verification and validation” responsibility of the IV&V organization.

9.0 Summary and Return on Investment

The resulting set of materials that form the technical-foundation of the RFP are valid, reliable, and repeatable. First, they are valid because the function-based prototypes that are cycled through the functional and technical subject matter experts "tease out" the naturally occurring and intrinsic hidden requirements. Hence the specification, as evidenced by the RFP technical specification components and functional prototypes, "is" what is required.

Second, the work products are reliable mechanisms to produce bids in a narrow price range because all the work products are identified and detailed to such an extent that there's very

little room for guessing. This of course assumes that bidders have experience in developing the business information systems based on RFP technical specifications.

Third, the work products are repeatable because the overall process to build a business information system has been documented and validated for many years. Hence the proposed process employed by the bidders will be essentially the same.

In summary, because the RFP technical specification components are valid, reliable and repeatable, the resulting bids are likely to enable the correct selection of an implementation contractor that will accomplish a correct implementation the first time.

There are two natural reactions to the accomplishment of this work by the contracting organization. First, that these products should be the bidder's responsibility, and second, it's too costly. As to the first reaction, it's the bidders responsibility, if that were appropriate, why are the majority of development efforts late, cost more, or be less than expected? In the Standish Group's "CHAOS Summary 2009," report, it stated,

> "This year's results show a marked decrease in project success rates, with 32% of all projects succeeding which are delivered on time, on budget, with required features and functions" says Jim Johnson, chairman of The Standish Group, "44% were challenged which are late, over budget, and/or with less than the required features and functions and 24% failed which are cancelled prior to completion or delivered and never used."

Could it possibly be because the requirements are not fully known at time the work is bid? In a study of 13 $100+ million IT failure analyses by the U.S. Government's Accountability Office, more than 50% of these failures were attributed to inadequate artifact specification and capture within the requirements and design phases of IT efforts. Again, could it possibly be because the requirements are not fully known at time the work is bid? Iterated and validated requirements and prototyped-based functional designs are manifest through the RFP technical specification components.

As to the second reaction, cost, based on a start-from-scratch effort, the likely cost is about 5% of the business information systems implementation. In a recent $100+ million IT failure on which Whitemarsh performed the data management IV&V function, the cost to develop these RFP technical specification components would have been 1%. Whitemarsh suspects 1% would have been very easy to justify to prevent the 99% failure. The reason why the cost is so little is because that the objective is not the actual business information system but to valid, reliable and repeatable business information system specifications that can be bid by a set of contractors.

10. Metabase System Support

As the methodology tasks from Section 5 are accomplished, specification and implementation artifacts are created, interrelated, and are stored into the metabase. The metabase system modules that are directly involved in the accomplishment of business event management are:

Module Name	Role in Business Event Management
Mission, Organization, Function Position Assignment	This module enables the capture of all the business functions that are involved in the identification of the business events that need to be captured.
Business Information System	This module enables the capture of the hierarchies and networks of business information systems and their modules that ultimately are to be executed to accomplish enterprise missions. This data becomes many of the Figure 6 top and middle block records.
Data Element Model	This module enables the specification of the business data elements that become the foundation semantics of attribute of entities and columns of table that in turn will form the data structures necessary to capture the business event data.
Specified Data Model	This module enables the creation of the data models based on the concepts that must be captured within the business event data models. Included in each data model are entities, attributes, and relationships. Attributes are mapped back to data elements from the data element model.
Implemented Data Model	This module enables the creation of the data models based on the real databases that are to exist in support of the data structures for business event classes and transactions. Included in each database models are tables, column, and inter-table relationships. Columns are mapped back to data elements from the data element model.
Operational Data Model	This module enables the creation of the DBMS bound data models that will contain the actual business event class and transaction that support business event capture, tracking and management. Included in each database models are DBMS tables, DBMS columns, and DBMS interrelationships.
View Data Model	This module enables the creation of the specifications of specific interchanges between application systems that are tracking business events and the databases that are storing the tracked business events.
Resource Life Cycle Analysis	This module enables the identification, capture, and interrelationships of the enterprise resources and their resource life cycle nodes that reflect the result of the execution of a collection of business events to achieve the resource life cycle states necessary by the organizations as they execute their functions to accomplish enterprise missions.
Database Object Model	This model enables the complete specification of all the database tables and processes that are involved in the capture of the business events from across all the business information systems. The database object classes are then allocated to the Resource Life Cycle nodes.
Use Case Model (Winter 2010)	This model is created during requirements analysis and design. It essentially becomes the detailed function model and is interrelated with the Mission-Organization-Function model, Database Object Classes, and the Business Information Systems models. Each use case ultimately becomes the employment of a business event.
Document and Form Model	This model is created during the requirements phase and identifies, describes

Module Name	Role in Business Event Management
	and details the various forms and/or documents and contents of the forms and documents that must be addressed during the development of a complete inventory of business events. This model, like the use case model is interrelated with the Mission-Organization-Function model, and the Business Information Systems models.

11. Conclusions

The practical application of the points made in this paper include:

- RPFs are critical first glimpses of what is needed to be built.
- Seven collections of artifacts are the necessary and sufficient set of RFP technical specification components.
- Only 35% of Business Information Systems are Successful, and while .350 is great for baseball, it's terrible for IT.
- Analyses of GAO reports on 13 $100+ Million IT systems showed that close to 50% of all failures start with insufficient requirements.
- Business information system requirements must be manifest through the seven collections of artifacts, thoroughly prototyped, and included in the RFP.
- Prototyping can not only be fast and profoundly effective in validating and evolving the seven collections of artifacts, it is also a critical step that must be accomplished prior to RFP release.
- There can be light at the end of the tunnel and it doesn't have to be a train.

12. References

The following references to Whitemarsh materials provide a more detailed exposition practical application of the significant content of this paper.

The following documents are available free from the Whitemarsh website:

Free Whitemarsh Materials	
Paper	**URL**
Managing Data Models	http://wiscorp.com/sp/sp04.pdf
Enterprise Architectures	http://wiscorp.com/sp/sp08.pdf
Engineering and Managing Information Systems Plans	http://wiscorp.com/sp/sp11.pdf
Manufacturing Project Plans	http://wiscorp.com/sp/sp12.pdf
Earned Value Management	http://wiscorp.com/sp/sp15.pdf
Business Event Management	http://www.wiscorp.com/sp/sp16.pdf
Data Modeler Architecture and Concept Of Operations Reverse and Forward Engineering Guide Metabase Module User Guides	http://www.wiscorp.com/metabase_demo.html
Comprehensive Metadata Management (short paper).	http://www.wiscorp.com/featured_papers.html
DAMA 2002 - Metadata Architecture for Enterprise Wide Data Sharing - Problem Specification DAMA 2003 - Metadata Architecture for Enterprise Wide Data Sharing - Problem Solution	http://www.wiscorp.com/DatabaseDesignInformation.html
Comprehensive Metadata Management	http://www.wiscorp.com/ComprehensiveMetadataManagement.pdf
Metabase Overview	http://www.wiscorp.com/Metabase.zip
Metabase User Guides	http://www.wiscorp.com/MetabaseUserGuides.zip
Data Management Conferences	http://www.wiscorp.com/dama2002.zip http://www.wiscorp.com/dama2003.zip http://www.wiscorp.com/wrad2000.zip

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Iterations of Database Design	http://www.wiscorp.com/DatabaseDesign.htm
Data Is Executed Policy	http://www.wiscorp.com/DatabaseProjects.htm
Data Management Program - Work Breakdown Structures Knowledge Worker Framework Database Objects Managing Database - Four Critical Factors	http://www.wiscorp.com/wwmembr/mbr_products_edb.html
Work Breakdown Structures	http://www.wiscorp.com/wwmembr/mbr_products_dp.html
Data Architecture Classes Guidelines for Data Architecture Class - Data Warehouse	http://www.wiscorp.com/wwmembr/mbr_products_dd.html

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Paper	**URL**
Work Breakdown Structures Database Project Work plan Templates Information Systems Development Methodology Phases 1 and 2 Whitemarsh Project Estimating Work plan Development	http://www.wiscorp.com/wwmembr/mbr_products_dp.html