Chapter 4 Specification

Strategic Information Systems Planning

This chapter is keyed to the components shown in Figures 23 and 24. The starting point is to have a complete high-level overview of information requirements through strategic information planning. This method of looking at the specification process is integrated and gives weight to all the areas where specifications need to be made. That is why Application requirements is used here instead of the more usual 'functional requirements'. Applications have functional requirments but so do operations and technical aspects. The documentation of each of these requirement areas becomes the content of a Request for Proposal.

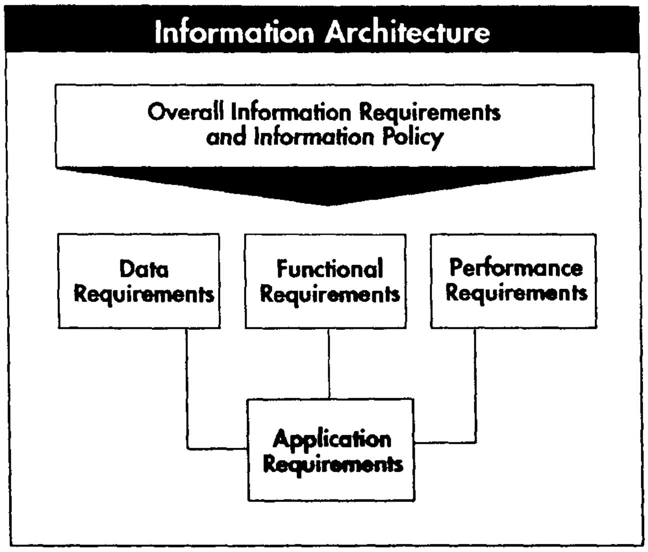

figure 23

Strategic IS planning is a methodology for development and implementation of applications that predicates any application development on a thorough understanding of the overall information needs of the organization. It is expressed many different ways that are variations on the theme of combining information planning with corporate strategic plans and standard systems development methods to efficiently produce applications that will effectively serve the organization.

Information Architecture

Information Architecture is a component of overall Strategic Information Systems (IS) Planning shown in Figure 23. Information architecture defines the overall informational requirements of the organization providing the context for any specific application development. Some of the general actions in the Getting Started section are information planning activities and different approaches to IS planning are outlined there. We will not deal in any more detail with strategic IS planning or information planning—more comprehensive and competent instructions are available from other sources and are listed in the bibliography for this section—but assume it has been done to an extent that is acceptable to the institution and project team. In reality, often this is done by saying there is no overall plan yet but something needs to be done about the current problem.

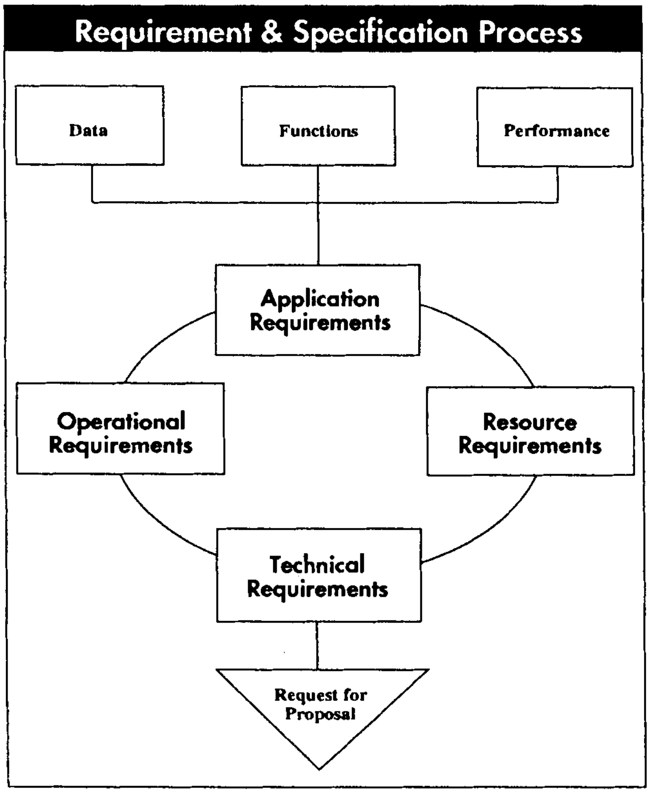

figure 24

Application Requirements

Application requirements should describe what the application must do, what information it needs to work with, who will use it and how well it must perform. These requirements are usually categorized into: functional, performance, data as shown in Figure 25.

Application Requirements Specification

Statements of:

- functional requirement
- performance requirement
- data requirement

Supported by descriptions of:

- current practices
- information flow and processes
- future or desired practices
- data content and structure
- performance indicators

figure 25

Functional requirements

It will be necessary to produce a number of documents in order to bring the information on functions together. Examples of these are documents that describe current practices, information flow, and processes.

These can be extremely detailed and formal with each one requiring a substantial document which are then unified or they can be rolled-up into a more concise form. The approach is dictated by circumstances: the scope of the project, time available, level of detail required.

Again, different methodologies will use different techniques to extract this information. The essential steps, shown in Figure 26 are: document work flow and process in practice, review for difficulties and problems, resolve problems, plan modifications to work flow and process, automate the desired process and flow.

Functional Requirements

Document current practices and workflow

Review current practices for problems

Resolve current problems

Plan revisions and modifications

Automate the desired practice and flow

figure 26

An example of a work flow and procedures diagram is shown in Figure 27.

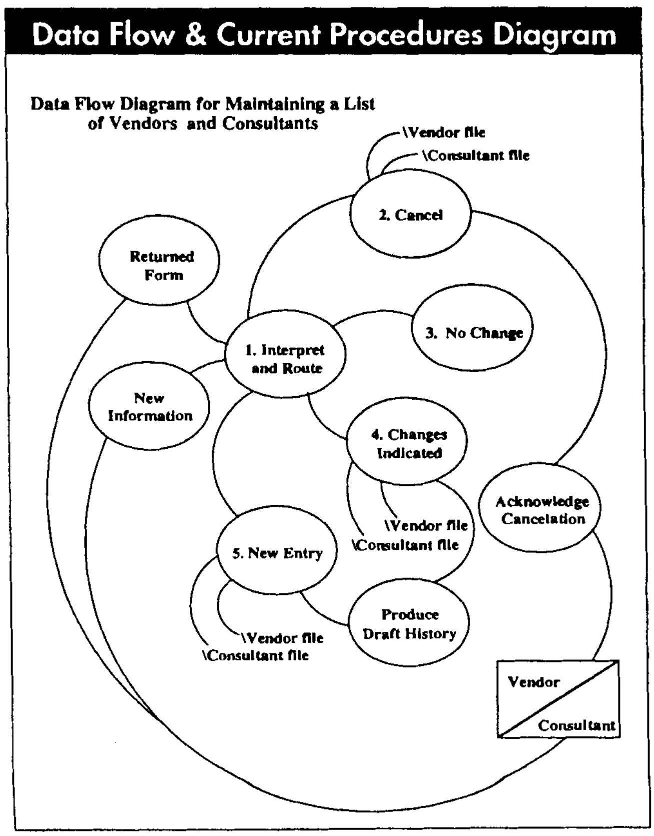

figure 27

Data Requirements

Data definition is the activity that most often is associated with the requirements specification process. Data definition identifies the information that will be used in the system and is gathered from forms and Reports; previously identified elements of information; records, files, and repositories. These are then documented in a data dictionary.

Forms and Reports are a rich source of information and are very useful in establishing what the input and output is. Each form or report used should be identified and linked to who uses it, what it is used for, how many copies are made and where they go, and the elements of information used on them. The notion of "using" can be further broken down into creating, using, updating, changing.

Doing this process will start two other lists: a list of data elements and a list of processes and procedures that when worked out in detail and rendered using systems analysis conventions are data flow diagrams. The same information can be modeled using one of the many modelling methodologies.

All records, files and other repositories of information should be identified and located. They will need to be examined for their role or function, who uses them for what purpose, what information they contain, and what restrictions they might require. The same is done for processes and tasks.

Throughout, elements or "fields" of information are going to be identified. They need to be kept in an organized list that describes the name of the element, its meaning and any other important information about it. This list goes by different names: the data element list is the name used in this guide to emphasize the difference between a simple list of elements and a data dictionary which also contains relationship information. Figure 28 refers to sources of the information required to document information needed by a system.

Data Dictionary as Documentation

The Data Dictionary is an ordered set of written definitions, names, structure, organization and relationships between all the elements identified. The Data Dictionary is used in conjunction with the Data Flow Diagrams and natural language statements of requirements by systems designers to construct the system.

Usually more than a simple list of elements is required. Elements will have relationships to other elements that need to be recorded. For example, salutation, first name and last name are all elements related to the identification of a person. Again, there are a number of ways that the Data Dictionary can be constructed.

There are many ways of constructing a data element list and there seems to be no international standard. There is however work ongoing in this area through ISO JTC1 SC14. Sources of current information on the status of standards in this area are the Computer Interchange of Museum Informa-

Sources of Information in Data Definition

Existing forms and reports

- identify each form and report
- link each form to a process
- identify the information elements

Previously identified information elements

- identify elements
- standardize naming conventions
- provide definitions
- standardize values (if required)

Records, files and repositories

- identify and locate
- determine permissible access
- identify elements used
- identify associated processes

Processes and tasks

- define task
- describe sequences
- identify conditional steps

figure 28

tion (CIMI) project of the Museum Computer Network or CIDOC. CIMI is publishing data element dictionary guidelines as part of its collaborative work with CIDOC.

Figure 29 shows a reasonable structure. The importance is to get a consistent list of elements needed and to standardize the information gathered about each element.

Data Element Dictionary Components

Name	full name of the element
Tag	any abbreviated label used substituting for the name
Definition	definition of it
Scope Note	note on the scope and use
Data Type	indication of the type of data contained in the element
Examples	useful examples
Entry Rules	any rules for the format, syntax, or authorities
Validations	any restrictions placed on values
Standard	any standard used as a basis for determining structure or content
Notes	any relevant comments
Relations	related elements
Others	• date of creation • record of changes • where used • type of indexing • extent to which it is needed

figure 29

Data Model as Documentation

Another way to show relationships in the Data Dictionary is to include Data Models. A Data Model provides a representation of the information and the relationships between them in diagrammatic form. Models are created by first gathering data elements into groups. These groups are reviewed and any elements that appear more than once are put into their own group through a process known as normalization. Then the relationships between the groups are shown graphically. Figure 30 illustrates the way data models are structured.

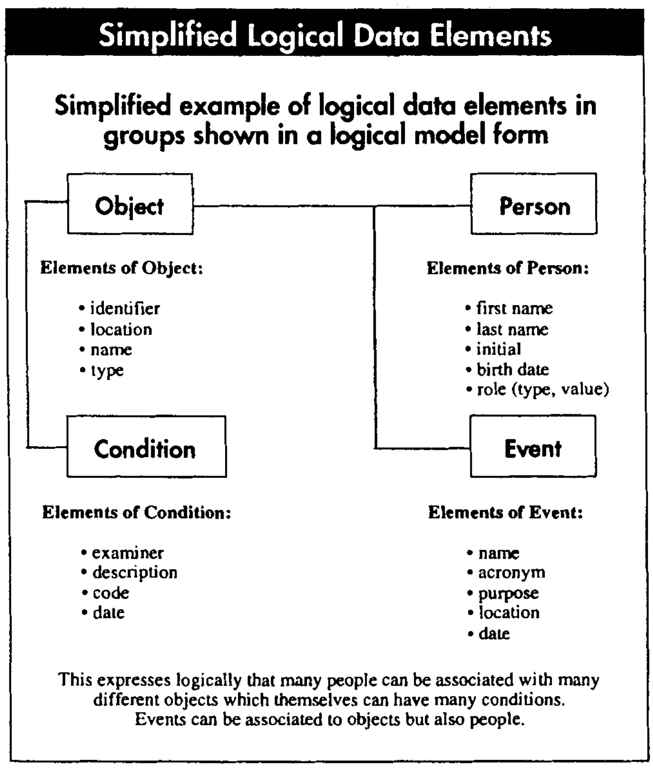

figure 30

Performance Requirements

It is necessary to specify how well an application should perform as well as what it should perform. Performance specifications may well turn out to be the determining factor in the selection process if different systems all do the same things but in different ways.

Specifications should be created for user interface features, response time, provision of user help, nature and extent of error messages and how these will be evaluated.

Performance specifications are the basis for conformance tests done during the acceptance phase.

Performance specifications should be very precise especially in the response times. try to define the acceptable response time variation based on the process (entry, update, retrieval) the number of records (for example 1000, 1,000, 100,000) and the number of concurrent users.

Performance Requirements are summarized in Figure 31

Performance Requirements

Interface features
- menus
- devices
- colour
- commands

Response time
- creating data
- modifying
- retrieving
- reporting

Help
- amount
- operation
- link to documentation

Error messages
- usefulness
- completeness
- link to documentation

figure 31

All requirements statements should be verifiable, consistent, precise, without redundancy, and of the appropriate level of detail.

Figure 32 illustrates general features of requirements specifications.

Features of Requirements Statements

Requirements statements are:
- an articulation of what must be provided with quality conditions

Requirements statements should include:
- what must be done
- what information is needed to do it with
- who will use it
- how well it must work

Requirements statements should be:
- verifiable
- consistent
- appropriately detailed

figure 32

Decomposition

A process called decomposition is used in creating requirements to move from general to specific information. The example in Figure 33 follows the process down one possible branch of the tree for application functional requirements. In doing so we move from general goals to very specific requirements.

This process can be replicated, with the appropriate adjustments, to produce requirements for the technical environment and for performance.

Top-Down Decomposition Example

Goal	Provide staff with easy access to accurate and complete information about collections related activities of the museum.
Objective	Convert core object record and cataloguing process to automated system. Implement automated inventory and location control system. Institute a professional inhouse newsletter.
Requirement	Service all existing manual functions (see attached data flow diagram). Provide additional functionality in report generation. Provide enhanced printing capability for all curatorial departments. etc.
Specification	Generate 25 standard reports (samples attached) currently produced manually. Generate ad hoc reports using data from any field in the application. Confidential information exists in certain fields (list attached) and this information should be available only to authorised users (see security requirements). etc.

figure 33

Reviewing Requirements

Creating requirements can be exciting and it is easy to get carried away. It is usually necessary to review the stated requirements against a set of criteria so they can be weighted and prioritized. It is also helpful to know if the requirement is only relevant to part or all of the system, how important it is to the system, and what impact it will have on the system.

Figure 34 shows a checklist helpful in evaluating the requirements to ensure reliability and validity.

Evaluating Requirements Statements

For each requirement ask the following questions:

- **Does the requirement apply to the whole system or just portions?**
- **Is the scope clearly stated?**

- **What is the impact on the system?**
- **Does it make unjustifiable demands?**
- **Does it impact other parts of the system?**

- **Is it mandatory and any system without it would not be considered or...**
- **Is it desirable and can be used as a feature by which to compare alternate proposals?**

figure 34

Role of Standards

One aspect of defining data is determining if standards will be used when that data is recorded in the system. Standardization involves adopting common methods that allow for more consistent, effective work and communication and agreeing not to change the rules or methods unilaterally.

There are many types of standards shown in Figure 35, but the most relevant

Types of Standards		
Level of Discourse	**Name**	**Examples**
General characterization of system	Information System Standards	Collections management Inventory
What constitutes a record	Data Structure Standards	Object record Location history record
What is said	Data Content Standards	City/State/Country
How it is said	Data Value Standards	ANSI X3.38 standard codes for US States. Gazetteers

figure 35

are those which deal with what constitutes a record (which elements are needed to describe art objects, natural history specimens, etc.) and how the information in the field is determined, structured, and validated.

Structure Standards

There is no current agreement within the museum community on structural standards especially in collections documentation. National organizations like CHIN in Canada and the MDA in the UK have developed national standards that serve as excellent benchmarks for others to follow. Groups like the Art Information Task Force (AITF), Computer Interchange of Museum Information (CIMI), Association for State and Local History (AASLH) are working towards agreements and will be willing to provide information on how to incorporate museum information structural standards into automation projects. Most vendors have established their own structural standards.

Content and Value Standards

Many organizations already have content and value standards in use. They may be as institution-specific as codes for the various departments or authorized signing authorities, or of broader interest such as artist name files. Lists of this type are referred to as authorities or authority files. Other published, well known authority files are the *Art and Architecture Thesaurus* and *Revised Nomenclature*.

During data definition the extent to which these standards could be applied can be discussed.

Technical Requirements

The technical environment includes the processing hardware and peripherals, software, netware (networking and cabling), and communications environment as shown in Figure 36. Specifying the processing or technical environment should be done in consultation with knowledgeable people. If there is no one on staff who is knowledgeable in this area consultants will have to be used. Even if there are technically competent people on staff it is a good policy to have an outside opinion especially in this area where change occurs so rapidly. One of the identifying features of a professional is their use of other professionals to do specific tasks. Apply this principle liberally in planning the technical environment.

Technical Requirements

Processors & peripherals

- computers
- printers
- monitors

Software

- applications
- database
- management

Netware

- cabling

Communications

- remote access

figure 36

External advisors and consultants can only be used effectively if the client clearly communicates their needs. Rather than asking your consultant to make recommendations about specific choices, it may be better to have them examine the issues and analyse options.

As shown in figure 37, the number of users, their locations, and what they need to do will have a major influence on the choice of technical environment. Other factors are the need for mobility and the composition of work groups.

The types and number of applications needed will also be a factor as will any special demands they might make such as only being available for certain types of hardware, requiring a minimum configuration to operate, or not working well in combination with other applications.

The equipment currently in service usually has an influence. While it may be desirable to have 25 new 386sx micros it may be another matter to suggest the fifteen 286 machines bought just last year be replaced! The solution to this dilemma that repeats itself in other technical areas is to recognize—and get management to agree—that the technical environment has a useful life cycle. It is a fact of life that no system and no technology will be appropriate forever. It is common to consider a useful lifespan for a technical environment being 3–5 years.

Because of this the extendability and "openness" of systems is an important factor affecting hardware, software and data. It is most important for data that will most certainly have to be moved from one environment to another.

Issues in Technical Requirements

Number of users and location	distribution extent of use mobility applications needed work groupings
Application demands	number of applications performance standards capacity standards
Installed base	extent and nature reusable/replaceable compatibility - operating system, interface
Future plans	extendability/openness stability of environment/manufacture/vendor
Life span	time before replacement phased replacement
Cost	affordability amortization justification
Support, maintenance	cost

figure 37

Resource Requirements

It's obvious that automation projects can't be done without resources but just how many kinds of resources are needed and the impact on normal operations is surprising. Figure 38. Financial and human resources will be consumed voraciously as will administrative resources and time.

Human resources will need to be drawn from in-house staff and externally. Staff will be involved formally in the project team, called upon to contribute occasionally, and asked to support the project activities. This will need to be acknowledged as real and important work and it's impact on other business monitored. There will be associated costs from operational budgets and other intangibles like the "IOU's" inevitable in a project like this. Outside consulting and other services will be required and must be budgeted for—both fees and the time necessary to supervise the work.

Types of Resources

Human resources
- staff
- consultants

Administrative
- liaison
- project support
- reporting

Financial
- capital
- operating

Nature of Costs

Multi year budgets

Life cycle costs
- one time
- recurring
- intangible

figures 38 & 39

Administrative and logistical resources will be required to service the needs of the project. If these resources are not under direct control of the project leader they will have to be negotiated and budgeted for.

Financial costs will be one-time, recurring, or intangible within a single lifecycle and all will be repeatable in the next lifecycle. Moving from one system to another will always involve a transition period where there will be the costs of running both systems to contend with.

A chronic difficulty—besides not ever having enough money—is institutional budget cycles usually run on an annual cycle, but automation projects rarely can be planned and executed in one year. Special planning and consideration, not to mention cooperation of the financial managers, is needed to accommodate this type of problem.

See Figure 39.

Budgeting

Budgeting is important for all the same reasons budgeting is important elsewhere and operates in the same way. The key is including all the necessary categories, being realistically prepared for the costs then prepared to negotiate and compromise both with the finance department and the system development team.

Inadequate budget is one of the major impediments to successful systems implementation and special care should be taken to ensure all likely costs are identified. Figure 40 shows the usual budget categories.

Budget Categories		
Hardware cpu/server workstations/terminals UPS tape backup mass storage modem printer	**Software** licenses: operating systems, applications, utilities customization source code base applications	**Netware** network interface cards cable and labour concentrators
Installation/Training training installation documentation	**Data** data conversion data entry offsite storage	**Soft $** administration staff time project support
Shipping and freight shipping courier postage	**Misc** Taxes and duty inflation system cutover rentals research and reference	**Travel** airfare accommodation meals conference fees
Communications telephone fax email	**Recurring Costs** upgrades enhancements insurance	**Consulting** project management options evaluation planning (15% of aquisition)
Support user support technical support training	**Maintenance** 15% of hw/sw budget	**Contingency** use it ! 5–15%

figure 40

The planing process itself will require a budget that is roughly equal to 15% of the system acquisition budget.

Putting it all together

The process of specifying requirements produces an incredible amount of information that comes from many sources and takes many forms. The analysis of a system will inevitably produce this tangle. Figure 24 shows how the output of the planning and specification process is concentrated and prepared for the next steps in the systems implementation process.

This collection of material will be large and unruly and never as tidy as it appears in the illustrations. It will occupy a lot of space and will need to be culled and rearranged for distribution and use in the next phases.

Request for Proposal

The Request for Proposal (RFP) brings together all the products of the planning and specification process and organizes them in a manageable form. This is covered in the next chapter.

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