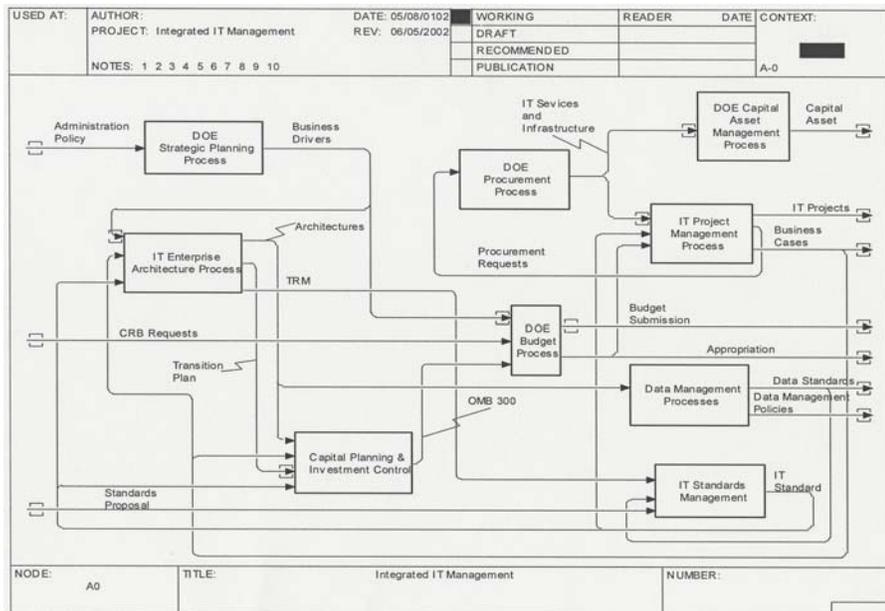




U.S. Department of Energy Information Technology Investment Management Framework



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1. Introduction

The Chief Information Officer (CIO) of a Government Agency has an essential role as part of the senior management team. The CIO role is to lead in the use of information technology (IT) as a strategic resource in accomplishing the Department's missions. To be in a position to provide this leadership, the CIO must establish a coherent, integrated framework of IT management processes. At the Department of Energy (DOE), processes that significantly affect IT management fall into three broad categories: Departmental management, core IT management, and IT control. The following are the key processes within each of these categories.

- *Departmental Management Processes*
 - DOE Strategic Planning Process
 - DOE Budget Process
 - DOE Procurement Process
 - DOE Capital Asset Management Process

- *Core Information Technology Management Processes*
 - IT Enterprise Architecture Process
 - IT Capital Planning and Investment Control Process
 - IT Project Management Process

- *Information Technology Control Processes*
 - Data Management Process
 - IT Standards Management Process

Figure 1-1, Integrated IT Planning and Management Process Flow, illustrates the key information flows among these processes. The information flows serve to inform executive decision-making or act as control points.

The purpose of this document is to identify the significant processes affecting the management and use of IT, map the relationships among those processes, and highlight the information flows between processes required to successfully leverage IT as a strategic resource within the Department. The document defines a "to be" integrated IT management framework though the specific processes are at varying levels of maturity. The processes create meta data about IT investments and projects important to the Department's management. The data must be readily available to management to assist in decision-making related to corporate and other IT investments and projects.

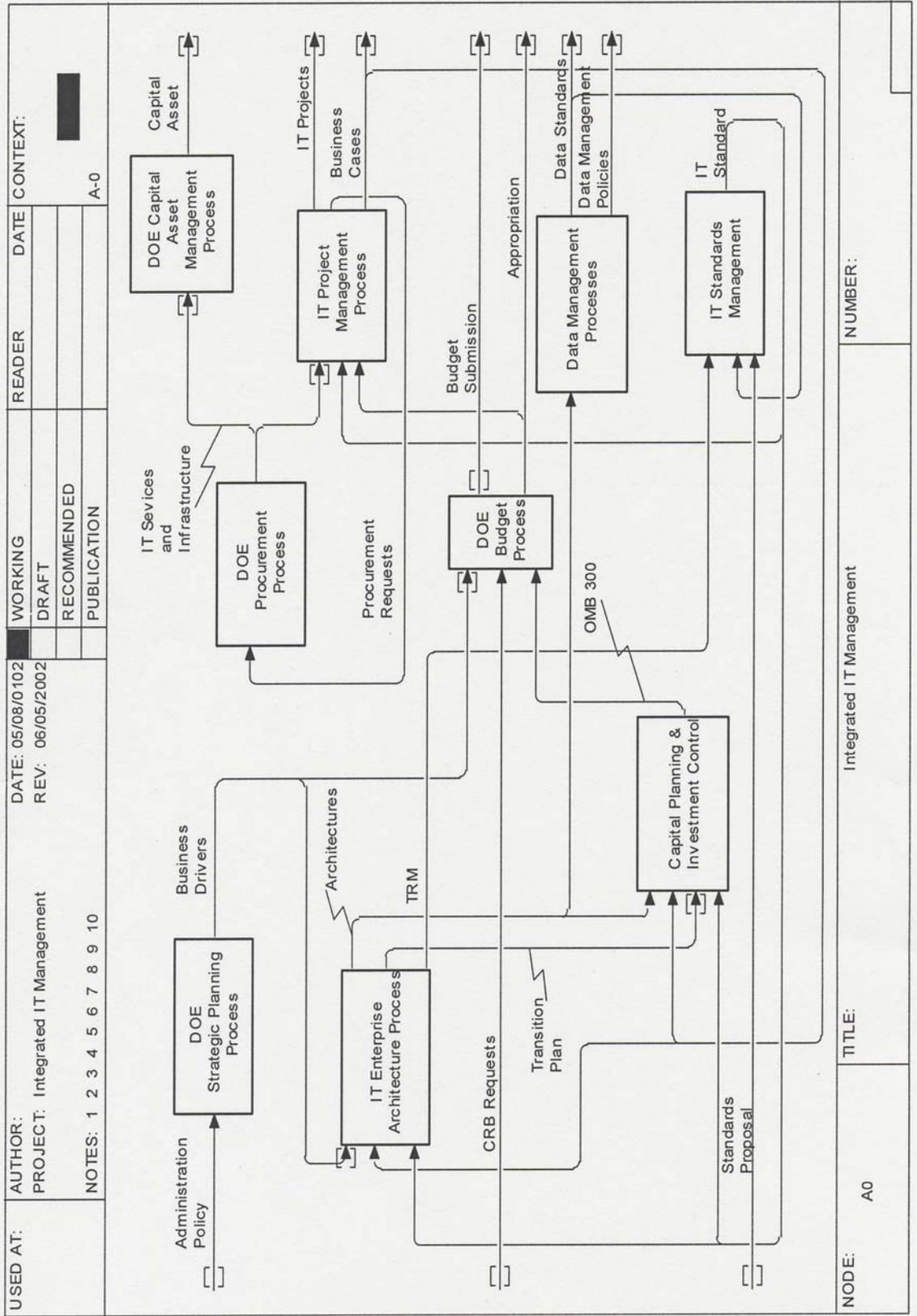


Figure 1-1, Integrated IT Planning and Management Process Flow

It is important to note that the CIO role in managing each of the identified processes varies. For Departmental management processes, the CIO works with process owners to establish the timing and content of information flows that serve as a link between key processes; however, since the CIO does not own the processes, this must be done via collaboration and partnering rather than by direct management and implementation. For the IT core management and control processes, the CIO is the process owner for the enterprise and can directly control the process implementation and data flows required to best serve the organization. The CIO must guide and oversee the IT management processes within the programs and sites owned by the respective Program Offices and site organizations.

Subsequent chapters of this document provide descriptions of each of the key processes and the supporting information linkages. The descriptions of the Departmental management processes are designed to highlight major steps and are not intended to be detailed process descriptions. The descriptions of the Core Information Technology Management and Information Technology Control Processes contain the following.

- Definition of major activities and products that the process accomplishes or produces
- Identification of key linkages and information flows with other processes

The document contains 10 process flow diagrams. These diagrams use the Integrated DEFinition (IDEF) Process Modeling Methodology and the Input, Control, Output, and Method (ICOM) convention. The ICOM components are defined as follows.

- **Input** identifies the major information used by the process to produce the output(s). The information can come from an external source or from another process. For example, Administration Policy is an input in the DOE strategic planning process.
- **Control** identifies the major legislation; law; Office of Management and Budget (OMB) and DOE directives; or policy statements that establish, govern, or direct the process and can define what is produced. For example, the Government Performance and Results Act (GPRA) controls the DOE strategic planning process.
- **Output** defines the major product(s) produced by the process. The *DOE Strategic Plan* is the primary product of the DOE strategic planning process.
- **Method** indicates whether the process is supported by a specific IT system (e.g., IT Investment Portfolio System (ITIPS) for the Capital Planning and Investment Control (CPIC) process) or by a DOE manual.

2. DOE Strategic Planning Process

2.1 Purpose

The purpose of strategic planning is to ensure that through effective preparation, Department of Energy (DOE) programs, and support activities are positioned to achieve long-term Departmental goals and objectives. Strategic planning assists the Secretary, Deputy Secretary, and Under Secretaries in setting the long-term directions and policies for the Department and in making decisions on near-term priorities and resource allocations. It assists those who develop and implement programs by providing guidance for multiyear program plans and budgets. The requirements of the Government Performance and Results Act (GPRA) guide DOE strategic planning initiatives.

Strategic planning deals with the question of what objectives the programs and activities of the Department should strive to achieve. The Departmental Strategic Plan is the foundation for all DOE planning, budgeting, execution, control, and evaluation activities by Program Offices and support organizations. Headquarters programmatic and crosscutting strategic planning and strategic planning at the field level supplement the Departmental Strategic Plan. Strategic planning is the foundation for multiyear program and operational plans that drive daily DOE activities.

The vision, mission, goals, objectives, and performance measures contained in the DOE Strategic Plan define the boundaries for the organization. Under the Departmental Strategic Plan, each Program Office and site develops individual plans based on, and linked to, the Departmental goals, objectives, and measures. In addition, goals and objectives are linked to each budget request line item in the DOE budget formulation process to ensure that requested funds are directed toward accomplishment of DOE goals.

2.2 Process Description

The intent of strategic planning is to build consensus around organizational goals, objectives, and priorities; provide the basis for resource allocations and operational planning; define baselines for controlling outcomes; and help to evaluate Departmental performance. The Department's long-term goals, objectives, priorities, and performance measures are defined, agreed to, and published in the form of the Departmental Strategic Plan, Program Strategic Plans, Annual Performance Plan, and the Information Resource Management (IRM) Strategic Plan.

2.2.1 Define Vision and Missions

Every 3 years (approximately) the senior management team convenes to formulate the Department's vision and mission statements. The definition of the DOE vision and mission statements reflects the Administration's energy policies and the Department's continuing, long-term defense, energy technology development, scientific research, environmental quality, and corporate management functions and responsibilities.

Defining DOE vision and mission statements is an iterative process in which an initial definition is developed, submitted for discussion and review by the Department's senior executives, then revised and submitted for another round of discussion and review. This process continues until a consensus is reached on the formulation for the vision and mission statements.

2.2.2 Define Goals, Objectives, and Strategies

DOE goals and objectives are defined based on the vision and mission statements. The goals are long-term, outcome-oriented definitions of what the Department needs to achieve to fulfill its missions and vision. To the extent possible, goals are designed to be measurable and quantifiable. Strategic objectives define the major accomplishments to achieving the goals. Objectives are measurable, achievable, and have reasonable targets with deadlines. DOE goals and objectives reflect information from the Administration, Congress, Office of Management and Budget (OMB), Program Offices, field sites, contractors, and senior staff. The goals and objectives are based on the results of program evaluations. The formulation of DOE goals and objectives is accomplished through an iterative process. The goals and objectives are defined, reviewed by DOE executives, and revised until consensus is achieved.

In addition, strategies to achieve the objectives are defined. This is primarily a program planning process in which high-level program management and technical activities are defined to delineate how the objective is to be achieved. Program and technical staff develop the strategies.

2.2.3 Establish Program Strategic Performance Goals

The objectives and strategies are used to define program strategic performance goals. Performance goals are quantified statements of the intended outcome or output from a major program during the next 5 years. They specify the basis by which DOE will ascertain the rate of progress it is making toward achieving the objective. They can define key programmatic events that are critical to achieving the objective. The performance goals are defined, reviewed, and accepted.

2.2.4 Issue Strategic Plan

The draft DOE Strategic Plan is prepared. The contents vary but, at minimum, it contains the Department's vision and mission statements; defines the Department's goals, objectives, and strategies and describes the general performance measures. Once the draft Strategic Plan is complete and approved by the senior management team, it is published for review and comment by the public, Government Agencies including OMB, and other organizations. In addition, the draft Plan can be discussed with Congressional committees. The draft Plan is modified based on the comments from the external sources. It is finalized and published for use by all Departmental Elements.

2.2.5 Develop Program and IRM Strategic Plans

Once the DOE Strategic Plan is established, the strategic planning process is rolled down through the levels of the Department. Each program develops a program strategic plan consistent in form and content with the Departmental plan, and each site and facility develops a site strategic plan consistent with the Department and program strategic plans.

In addition, some function-specific strategic plans, such as the DOE IRM Strategic Plan, are developed. These function-specific strategic plans must link to the over arching DOE goals and objectives identified in the DOE Strategic Plan.

2.2.6 Prepare Annual Performance Plan

The Annual Performance Plan (APP) uses the contents of the DOE Strategic Plan. The APP contains the Department's mission statement, goals, strategic objectives, and program strategic performance goals. The APP also includes annual performance targets. The annual performance targets are measures of program/subprogram outputs that contribute to the achievement of the program strategic performance goal. They must be Presidential, specific, quantifiable, meaningful, achievable, comprehensive, concisely written, understandable to the public, and auditable. The annual performance targets are defined and presented for each of the 5 years.

Figure 2-1 illustrates the process flow of the DOE strategic planning process.

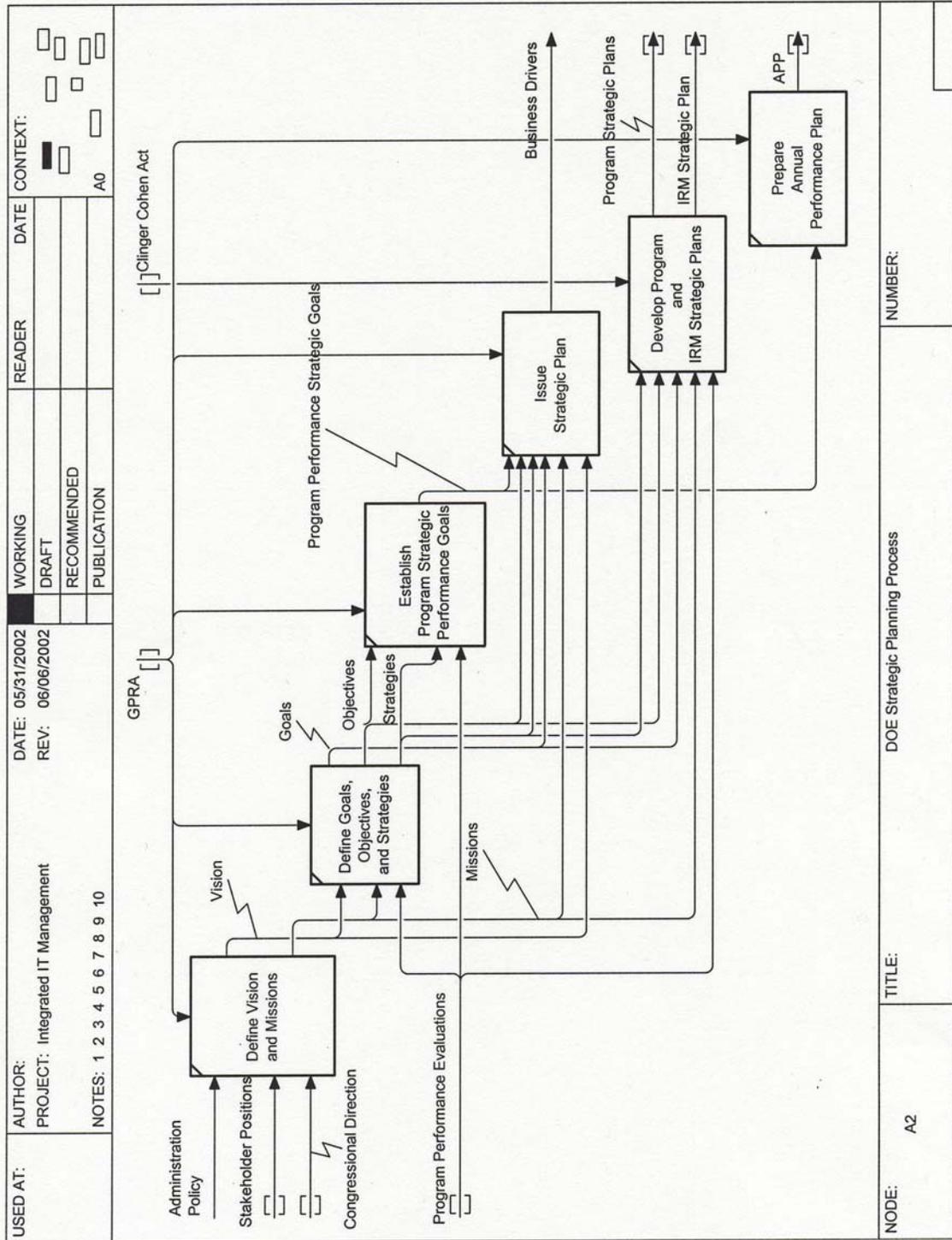


Figure 2-1, DOE Strategic Planning Process

2.3 Linkages

The DOE strategic planning process has linkages with the following.

- *DOE Budget Process* - The DOE strategic planning process directly impacts the DOE budget process. The Strategic Plan guides and structures the DOE budget priorities and funding. The budget components must link directly to strategic objectives, strategies, program strategic performance goals, and annual performance targets. The Five Year Budget Guidance reflects the funding necessary to meet the Strategic Plan objectives.
- *IT Enterprise Architecture Process* - The Department's information technology (IT) enterprise architecture reflects DOE strategic goals, objectives, and strategies. The DOE Strategic Plan and direction are key business drivers that frame the target architecture and transition strategies.
- *Capital Planning and Investment Control Process (CPIC)* - In the CPIC process, each major IT investment must explicitly identify the DOE strategic goals and objectives supported by the investment. A primary and regular consideration in assessing the value of new and existing IT investments is the degree to which they align with strategic planning goals and organizational mission. Throughout the CPIC process, IT investments need to support priorities as articulated in Departmental and program strategic planning processes, and the missions, goals, and objectives of the Department and suborganizations.

While the need for alignment with strategic planning and organizational mission is implicit during most of the CPIC process, this requirement is explicit in the *Guide to IT Capital Planning and Investment* during the IT selection scoring process. There are several other references in the Guide to the linkage of IT investment decisions and strategic planning. The level to which an investment maps to the DOE and IRM Strategic Plans and similar suborganization documents has a direct and significant impact on its continued viability in the competition for inclusion in the IT portfolio and eventual funding support.

- *IT Project Management Process* - The business component of the IT project management process requires that IT projects demonstrate support for DOE long-term business objectives and strategies. In addition, ongoing IT projects are evaluated as to their continuing ability to effectively and efficiently meet DOE business needs.

3. DOE Budget Process

3.1 Purpose

The Department of Energy (DOE) budget formulation process is the vehicle by which programs and projects are proposed and justified for funding. It is the primary mechanism for funding the Department's operations. The DOE budget execution process ensures that funds are used and expended for approved purposes.

3.2 Process Description

The Department's budget process stretches over a period of approximately 1.5 years and can be longer if appropriations are not enacted by September 30. The budget process has four distinct formulation phases: field budget, corporate review budget (CRB), Office of Management and Budget (OMB) budget, and the Congressional budget.

After funds are appropriated, these phases are followed by the budget execution phase. Below is a summary of the major steps in the process. The dates reflect a typical budget process.

Certain major IT-based projects (e.g., NERSC-3, ESnet, etc.) are specifically included in the DOE budget. Information on other information technology (IT) initiatives is gathered and submitted as a crosscut attachment to the budget. In other words, while there is no IT budget requested by the Department, information on IT projects that will be funded as part of other program or mission requests is used to help justify the program requests. Therefore, while IT budget data is compiled and approved by IT executives and managers, it must be closely linked with Program Office and site budget requests being approved and submitted by the budget officers.

3.2.1 Develop Field Budget

The Chief Financial Officer (CFO) issues the Field Budget Call in January to start the formal DOE budget process. The Call provides budget and fiscal guidance and instructions to the DOE field organizations concerning the requirements for their submission of budget requests for the upcoming budget year. The Call is prepared in coordination with Headquarters Program organizations, such as the Office of Environmental Management, Office of Science, the National Nuclear Safety Administration, and the Field Management Council. The CFO provides a handbook and Headquarters Program organizations provide supplementary program guidance. The Office of the Chief Information Officer (OCIO), in coordination with DOE Program Offices, provides specific guidance regarding data on IT investments.

In response to the Call, field organizations collect, analyze, and review budget requests from contractors, such as the National Laboratories. Organizations are required to provide the requested information to Headquarters Elements in April. Field budget

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requests are sent to the CFO organization and relevant Headquarters Program organizations. Headquarters organizations, in coordination with field organizations, analyze the field submissions and Program Secretarial Offices (PSOs) present major issues to the DOE Secretary, Deputy Secretary, and Under Secretary. The DOE principals provide general policy and program guidance, priorities, and budget guidance in response.

3.2.2 Establish the Corporate Review Budget

The CFO issues guidance in mid-May for preparing the CRB and funding targets. CRB submissions are made to the CFO in mid-to-late June. After reviews and discussions with Headquarters organizations, the CFO makes budget recommendations to the DOE principals. The DOE principals may hold meetings with the PSOs to address unresolved issues. Preliminary budget decisions are made by the Secretary and communicated back to the Headquarters organizations. An appeal process takes place in late July or early August. Final decisions by the DOE principals are made in early August. Based on these decisions and on CFO guidance, Headquarters organizations prepare formal budget request materials for OMB. The CFO collects this material and submits it to OMB in September.

3.2.3 Formulate the OMB Budget

OMB analyzes the DOE submission, conducts hearings as necessary with Departmental Offices, and issues a passback of the initial allowance to the Department in late November. There is a subsequent appeal process with OMB, and possibly with the President, into late December. After final allowances are made, the Department prepares its budget request to Congress. This request is part of the President's budget and is submitted to Congress by the first Monday in February.

3.2.4 Present the Congressional Budget

Congressional action includes House and Senate Authorization and Appropriations Subcommittee hearings with Departmental officials starting in late February and sometimes extending into June. After the hearings and Congressional committee deliberations, preliminary budget decisions are transmitted to the Department for potential appeals. Final, full committee decisions are brought before the House and Senate. After reaching agreement, the enrolled budget bills are sent to the President and, once signed, are enacted as appropriation legislation.

3.2.5 Budget Execution and Control

The final approved budget is enacted sometime in late summer and Agencies are given access to funding starting October 1, the start of a new fiscal year. At that point, budget execution begins, and Program Offices, sites, and projects execute activities based on the approved budget amounts. After enactment, OMB provides funds to the Department to initiate the new fiscal year budget execution phase on October 1. The CFO makes

allotments, supported by financial plans and programmatic guidance on how the funds are to be used. Financial and program controls are established to ensure that the funds are used in accordance with various mandates. At this point, financial obligations can be made for approved projects.

Frequently, throughout the entire budget process, adjustments are made to the portfolio of planned programs because of reduced funding requests. This can cause a reprioritization of proposed and ongoing projects; projects can be deferred, stretched out, re-scoped, or terminated.

Further details on the DOE budget process are available in the CFO Budget Formulation Guidance documents such as the OMB, CRB, and Field Budget Calls and Handbooks.

Figure 3-1 illustrates the process flow of the Department's budget formulation and execution cycle.

3.3 Linkages

The DOE budget process has linkages with the following.

- *DOE Strategic Planning Process* - The mission, goals, and objects identified in the strategic planning process are expressly linked to each program and project budget request. The Five Year Budget Guidance reflects the funding necessary to meet the strategic plan objectives. Changes to program plans made during the budget process can impact the strategic objectives, strategies, and performance goals.
- *DOE Procurement Process* - The most obvious linkage is that the budget process provides the funding that DOE programs need to procure goods and services. In addition, the budget process often results in specific guidance on procurement actions and controls, particularly for major investments.
- *IT Enterprise Architecture Process* - The formulation process often results in changes to program plans, including the Department's IT initiatives. These changes impact the EA transition strategy and plan. Moreover, the comments and guidance from OMB and Congress on the Department's IT initiatives provide information that results in modifications to the target architecture (specifically the application and technology architectures) and the transition strategy.
- *Capital Planning and Investment Control Process* - The CPIC process has several points at which it interfaces with the budget process. These linkages cover the entire budget cycle.

One linkage occurs when a decision is made to include a proposed IT project in an IT investment portfolio submitted to the DOE principals for consideration. Depending on initial guidance, the portfolio may have to be re-prioritized and individual projects re-scoped. Similar changes can also occur after the OMB budget passback and Congressional markup of the budget request. Once an appropriation is enacted and funds are allocated, further reconsideration of the IT portfolio may have to be made within the CPIC process to account for final available funding resources and possible project or program guidance from OMB and Congress.

In accordance with OMB Circular A-11, additional data on proposed IT initiatives must be collected from across DOE and submitted in the form of the information management (IM) crosscut Exhibit 53 (Agency IT Investment Portfolio), Exhibit 300s (Capital Asset Plan and Business Cases), and IT Capital Plan. The OCIO sends out guidance DOEwide to collect the data needed to prepare these exhibits in time to accompany the annual budget submission to OMB in early September. These exhibits are packaged by the CFO as part of its complete budget request, with OMB budget analysts receiving the entire official budget request and the OMB management staff receiving a copy of the IT asset information for review and advising on IT issues. OMB management analysts can use these crosscut exhibits for other

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management purposes, including making funding recommendations to the OMB budget staff. The budget staff uses the exhibits to evaluate program justifications for financial purposes, including comparing them to a budget request for a particular capital asset to determine if the data between the two are consistent.

4. DOE Procurement Process

4.1 Purpose

Consistent with Federal procurement and acquisition regulations, the Department of Energy (DOE) has a procurement process and organization to ensure that Federal dollars spent to acquire assets or services are properly justified, documented, and expended.

4.2 Process Description

There are basic rules and regulations common to most DOE procurements, including those for information technology (IT) products and services. The *Department of Energy Acquisition Regulations* (DEAR) and the *Federal Acquisition Regulations* (FAR) govern the DOE procurement process. The FAR and the DEAR recognize that IT procurements require special rules; therefore, devote sections to setting forth such unique rules (refer to FAR Part 39 and DEAR Part 939).

The major steps in the procurement process at DOE Headquarters are summarized below in an abbreviated manner for a typical, complex, high-dollar value acquisition of a non-commercial nature.

1. A decision is made by a DOE organization to acquire a good or service for which it has a mission need and funding authority.
2. A project manager prepares a procurement request, which includes among other things a statement of work and a recommendation regarding the procurement strategy (e.g.; competition, sole source with a justification, or a small business set-aside). An Integrated Project Team (IPT) is formed consisting of staff with a variety of skills such as budget, legal, procurement, etc. to work with the project manager in developing the acquisition strategy. The make-up of the IPT varies throughout the project lifecycle.
3. The procurement request is forwarded for approval to the appropriate management level in that organization. The specific chain of approval is determined by the individual organization.
4. After its approval, the procurement request is forwarded to that organization's budget office to record a commitment of funds for the specific acquisition. This is a control step to ensure that funds are available for the purposes of the acquisition.
5. The budget officer sends the procurement request to the Office of the Chief Financial Officer (OCFO) to reserve funds in the Department's accounting system. This results in a Certification of Funds Availability. The CFO then forwards the procurement request to the Headquarters Procurement Office.
6. In consultation with the project manager, the contracting officer decides whether the acquisition should be set-aside for small businesses or whether another type of solicitation should be used. This is the point at which the contracting officer makes a decision on whether or not a sole source action is appropriate.

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7. The project manager develops a solicitation package depending on the type of solicitation. The package defines what the Department wants to acquire, how the proposals are to be evaluated, what the proposals must contain, when they must be received, what type of contract is to be entered into, and other terms and conditions. The solicitation package is reviewed, approved, and issued. The Department can hold a bidders' conference to explain the solicitation and respond to questions.
8. The bidders usually have 30 to 45 days to submit proposals in response to a solicitation. Depending on special circumstances, a lesser or greater period can be specified. Proposals are made in writing but are submitted orally if the solicitation directions require it.
9. An evaluation team is assembled to evaluate the proposals against pre-determined criteria and prepare an analysis report.
10. After the initial evaluation, the contracting officer and the evaluation team decide whether to select a winner based on the initial evaluation or to seek additional information from the bidder.
11. If additional information is required, the list of bidders is narrowed to a competitive range of those with the best proposals. Questions are provided to the remaining bidders.
12. The evaluation team reviews and evaluates the bidder's responses to the questions. If face-to-face meetings with bidders are desired, the evaluation team conducts the meetings.
13. Bidders are requested to submit their best and final offers.
14. The evaluation team assesses any changes to the proposals resulting from the best and final offers, and advises the contracting officer of their final evaluation.
15. The winning proposal is selected; interested Congressional parties may be notified of the selections.
16. Losing bidders are notified and sometimes debriefed. In some cases, a losing bidder can decide to appeal the results of the evaluation and intention to award the contract. The bidder must file the appeal in accordance with Departmental regulations, the appeal is reviewed, and a decision is made to accept or reject the appeal.
17. The contract is negotiated and awarded.

Figure 4-1 illustrates the DOE procurement process.

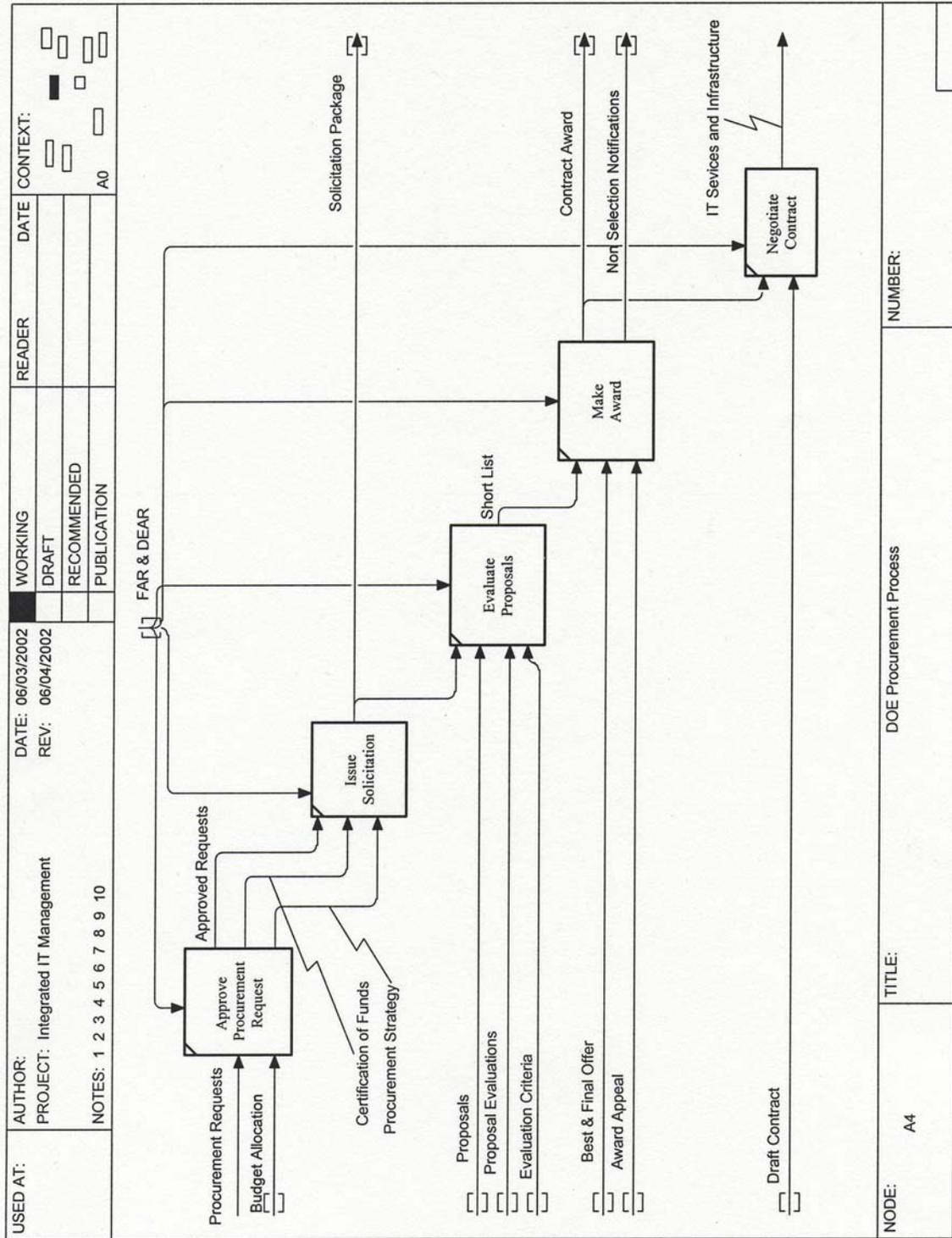


Figure 4-1, DOE Procurement Process

4.3 Linkages

The DOE procurement process has linkages with the following processes.

- *DOE Budget Process* - The budget process provides the necessary funds. As indicated above, the procurement process has a specific control point when the project officer must confirm the existence of adequate funds to support the procurement. In addition, during the budget formulation and execution phase, specific constraints or guidance related to the procurement of goods and services can be issued by Congress, the Office of Management and Budget (OMB), or the Department's senior executives.
- *Capital Planning and Investment Control (CPIC) Process* - Beyond an implicit understanding that IT procurements are investments to be managed before, during, and after actual procurement happens, the CPIC process makes explicit reference to the acquisition process. The scoring methodology for corporate IT initiatives includes scoring criteria related to the acquisition of IT items.
- *IT Project Management Process* - The acquisition of IT software development and support services and of IT infrastructure components and support services are governed by DOE procurement policies and guidelines and must follow DOE procurement processes.
- *IT Standards Management Process* - The IT standards are used as part of the specifications of the hardware and software to be acquired and are also used as evaluation criteria. The IT Standards link to the Department's enterprise architecture (EA). The use of the standards in the DOE procurement process ensures that the proposed procurement is compliant with the EA technology layer.

5. DOE Capital Asset Management Process

5.1 Purpose

Consistent with several Office of Management and Budget (OMB) Circulars, the Department of Energy (DOE) established a new Policy (DOE Policy 413.1, June 2000) and related Order (DOE Order 413.3, October 2000) to provide project management direction governing the planning, programming, budgeting, and acquisition of capital assets. Capital assets are defined as land, structures, equipment, and information technology (e.g., hardware, software, and applications) that have a useful life of 2 years or more. The principal goal of the Policy and Order is to significantly revise DOE project management practices to increase accountability and improve performance in delivering projects that are on schedule, within budget, and fully capable of meeting mission objectives. DOE Order 413.3 contains several references to information technology projects, but does not set out specific requirements for the management of these projects to distinguish them from construction projects—the principal focus of the Order. A draft *Program and Project Management Manual* that establishes the detailed requirements for managing capital asset projects was published in February 2002 and is undergoing DOEwide review. The draft Manual includes requirements for the management of major software engineering projects.

5.2 Process Description

DOE Order 413.3 defines specific requirements for the acquisition of capital assets, including authorities and responsibilities of line managers and review and approval officials and boards. The Order also identifies the relationships among key project management decisions, the budget and acquisition processes, and project baseline change control actions.

The capital asset management process identifies critical decisions that must be made as a project progresses through its lifecycle. A critical decision is a formal determination or decision at a specific point in a project phase that allows the project to continue to the next phase and commit resources. The critical decisions vary as to the type of project (e.g., traditional construction project, major systems projects, environmental restoration facility disposition, and software engineering). In general, project managers are required to provide justification and analytical, planning, cost, and performance data at the following project stages.

- Preconceptual planning
- Conceptual design
- Preliminary design
- Final design
- Construction
- Operations

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Approval authority is based primarily on the cost of the project, but other factors such as health and safety considerations or public/policy sensitivities are considered. Major systems (MS) projects (those over \$400 million or otherwise singled out) are reviewed and an Energy Systems Acquisitions Advisory Board, chaired by the Deputy Secretary, as the Department's Senior Acquisition Executive, makes critical decision approvals. Other Departmental officials and managers are designated as Acquisition Executives and have decision authority for non-MS projects. Project cost thresholds of \$400 million, \$100 million, \$20 million, and \$5 million determine who has decision-making authority.

The capital asset management process addresses the requirement for formal control of project baselines. It outlines the requirement to identify and report on variances with baselines. Baseline changes are considered for new technical, work scope, funding, or other levels.

The capital asset management process includes a description of the acquisition process for capital asset projects. The acquisition process includes the following.

- Preconception planning that focuses on the program's strategic goals and objectives. In addition, an integrated project team (IPT) must be established for the project.
- Project planning that includes identification of key risks. The risks must be identified, analyzed, and determined to be eliminated, mitigated, or manageable. Risk management must occur throughout the project's lifecycle.
- Acquisition is initiated by the preparation of an acquisition strategy. An independent project review (IPR) is necessary for MS projects. The IPR reviews and validates the mission need and funding request.
- The next step is the development of a conceptual design to include a preliminary baseline range and Acquisition Plan. A project and engineering fund (PED) is established for certain types of projects.
- The next step is the development of the preliminary and final design. The project manager must finalize a Project Execution Plan. A performance baseline independent external review (IER) is completed for projects in excess of \$5million. The IER includes an independent cost estimate (ICE). It is designed to verify that the mission need is satisfied; validate the proposed technical, cost, and schedule baseline; and assess the overall status of the project management and control system.
- The project is included in the Department's budget submission. An execution readiness review (EIR) is performed on certain projects.

The capital asset management process outlines project execution functions. It mandates the use of a Project Execution Plan that establishes Headquarters Program Office and Field roles and responsibilities and defines how the project is executed. Specific acquisition requirements such as a Source Selection Plan for competitive acquisitions and

business clearances for contracts that are individually negotiated are mandated. Acquisition executives hold quarterly performance reviews with project managers. Peer reviews are also encouraged. For projects with total costs greater than \$20 million, reports must include earned value, management system performance, and financial status. The purpose of the reviews is to identify areas of concern and take corrective actions before major problems occur. Projects that encounter significant cost and schedule variances and technical issues, or other problems can be placed on the Chief Operating Officer Watch List for special attention.

Figure 5-1 illustrates the DOE capital asset management process.

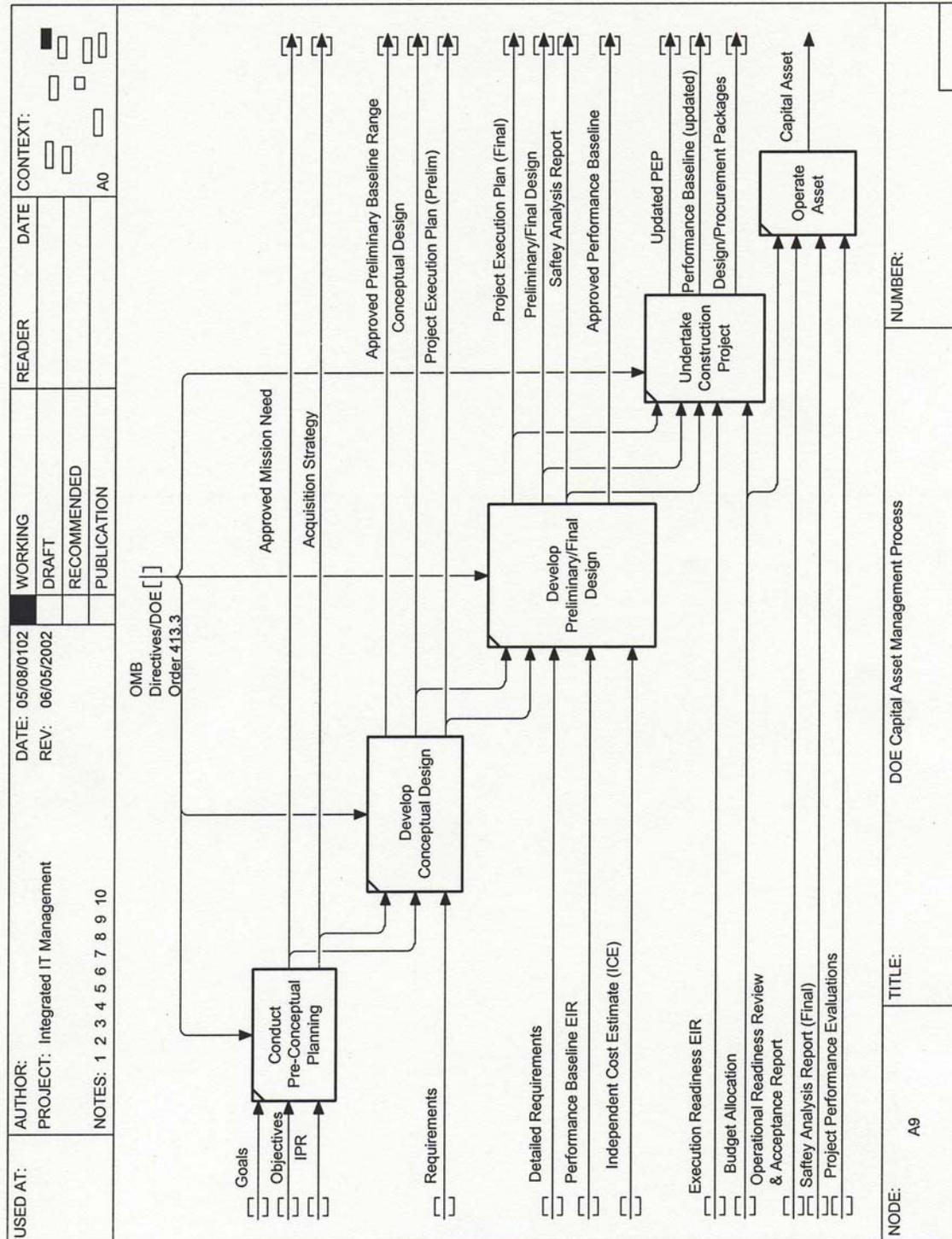


Figure 5-1, DOE Capital Asset Management Process

5.3 Linkages

The DOE capital asset management process has linkages with the following processes.

- *DOE Strategic Planning Process* - As indicated above, one of the key functions of the capital asset management process is to ensure that the project directly supports and meets mission needs and objectives. The mission needs and objectives are defined in the DOE Strategic Plan.
- *DOE Budget Process* - The capital asset management process has direct links to the DOE budget process. The capital asset management process is synchronized with the budget process so that key funding and budget justification information is supplied from the capital asset management process to the budget process. In turn, the feedback and guidance provided by the successive Departmental, OMB, and Congressional reviews and decisions directly impact the planning, conduct, and evaluation of the Department's capital asset projects.
- *DOE Procurement Process* - As outlined above, the capital asset management process specifies specific acquisition processes and products for the types of projects that fall under its purview. The two processes must be coordinated and synchronized.
- *IT Capital Planning and Investment Control Process* - Because project management is required for capital assets including IT capital assets, there appears to be a close and steady relationship between the CPIC process and the capital asset management process. Whether for a standalone IT project or where IT is an integral component of a larger project such as a particle accelerator, capital asset management is a significant part of the CPIC process, and DOE Order 413.3 is consistent with DOE IT CPIC documentation.

The relationship of capital asset management to the CPIC process starts during the development of an initial proposal for an IT investment in the screening phase of CPIC. Here, mission need is addressed; costs, returns, and risks are assessed; and performance measures are addressed. In a similar manner to the requirements of DOE Order 413.3, the CPIC process includes a review and approval process by a board structure chaired by the Deputy Secretary. There is also a similar project management oversight and control process that continues throughout the entire lifecycle of an IT investment, including approval, implementation, review, and close out. The CPIC process contains the essential project selection, management, and oversight elements contained in the Department's project and asset management Orders.

- *IT Project Management Process* - The IT project management process must reflect the capital asset management process for those projects that meet the capital asset definition and dollar threshold.

6. IT Enterprise Architecture Process

6.1 Purpose

An information technology (IT) enterprise architecture (EA) is the explicit description and documentation of the current and desired relationships among business and management processes and the technology that supports the processes. An EA describes the current and target architectures as well as the transition strategy. The EA strengthens management of the Department's information and the effective use of IT by:

- Supporting an integrated capital planning and investment control for IT
- Improving the governance and effectiveness of the Department's IT planning and budgeting processes
- Increasing the efficiency, effectiveness, interoperability, and standardization of its major information systems
- Establishing business, data, applications, and technology infrastructures at the Departmental level
- Providing a migration strategy to a technology environment that meets the Department's strategic business objectives

The Clinger-Cohen Act of 1996 and the Office of Management and Budget (OMB) Circular A-130 mandate that Agencies develop and maintain enterprise architectures. DOE is in the process of developing its EA in accordance with OMB directives and guidance from the Federal Chief Information Officers Council.

6.2 Process Description

The process for developing and maintaining the DOE EA is described below. The process is based the Federal Enterprise Architecture Framework, which is one of the three architecture frameworks recommended by the Federal Chief Information Officers Council (see *A Practical Guide to Federal Enterprise Architecture*, Version 1.0, February 2001).

The Department's EA addresses at a high level the business functions and data required to perform DOE key business operations. It also summarizes the significant applications that support DOE current and future business functions and data, and characterizes the technology infrastructure. The EA framework assumes that crosscutting management functions are addressed by corporate solutions. Program and site specific functions are addressed by Program Office and site architectures and solutions. Program Office and site specific architectures are to align with the DOE EA and provide detailed business,

data, applications, technology, and security components for program and site functions. The Lead Program Secretarial Offices (LPSOs) are in the process of developing or enhancing architectures related to their specific lines of business for Headquarters and the field. The architecture frameworks and processes used by the Program Offices and sites vary. The development and maintenance of the EA is governed by an EA Program Plan. The Plan identifies the objectives, scope, products, methodology, resources, and schedule for developing and maintaining the EA. It highlights major managerial initiatives (e.g.; the President's Management Agenda, e-Government) that the architecture needs to incorporate. The EA Program Plan also outlines EA governance structures and processes.

6.2.1 Baseline Architecture

The "as is" or baseline architecture defines the Department's current business, data, applications, technology, and security environment.

The development of the current business model is the first and arguably most important step in the architecture process. The business model defines what DOE does as an enterprise but does not define detailed work processes. The business model identifies the key business areas and business functions that comprise the business areas. The business model is developed by collecting and reviewing strategic plans, budget submissions, organization manuals, and other similar documents; identifying and documenting the key business areas that DOE is responsible for and is performing; and identifying and documenting the major groups of work within the business areas (i.e., business functions). DOE business area representatives review and validate the business model.

The DOE enterprise data architecture is derived from the business model. The business model is reviewed to identify and define the major information groups (i.e., data areas) that support DOE business. The business functions are reviewed to identify and define the lower-level information objects used by the business functions. The draft data architecture consists of the data areas and classes. Representatives from the DOE business areas validate the data architecture.

The baseline applications architecture consists of an inventory of the Department's existing computer systems that support the business functions and manage the Department's data. The baseline applications architecture is developed by collecting and validating a standard set of information on each existing application. The information can be collected by conducting a survey using a standardized data collection instrument, by obtaining information from existing systems inventories, and by reviewing documents such as budget submissions. The DOE organization that owns the application reviews and validates the information.

The baseline technology architecture defines the major hardware, software, and communications technologies that support DOE computer systems and communications. The baseline technology architecture is established by collecting information on DOE business and scientific technology resources. This information can be collected using a

survey, by obtaining information and documents from Operations, and by conducting interviews. The DOE organization responsible for the technology infrastructure reviews and validates the baseline information.

The baseline technology architecture also contains a baseline technical reference model (TRM) and a set of IT standards. The TRM defines the technology service areas that categorize and classify the Department's overall technical environment. The enterprise TRM is defined using the National Institute of Standards and Technology (NIST) taxonomy. The baseline IT standards define the existing technology standards for each service area. The IT standards management process (refer to chapter 10, IT Standards Management Process) produces the baseline standards profile.

The baseline security architecture outlines current and known security threats and risks, security frameworks, and mitigation and technical measures. The security architecture covers topics such as identification, authentication, and non-repudiation; transaction audit, trail creation, and analysis; data and communications access control; cryptography management; virus detection and prevention; fraud prevention, detection, and mitigation; and intrusion prevention and detection. The baseline security architecture is developed by reviewing documents similar to those produced by the DOE Cyber Security Program and by collecting relevant information from Computer Security Officers.

6.2.2 Target Architecture

The "to be" or target EA defines the Department's future business, data, applications, and technology environments. It reflects the impact of advances in technology on DOE business, changes in DOE business on its technology, and mandates from Administration and Departmental executives. The target architecture reflects the Department's business vision and focus. The target architecture contains the same business, data, applications, technology, and security layers as the baseline architecture.

A number of analytical tools are developed to support the target architecture. These tools are primarily matrices that define the relationship among various components of the baseline architecture. Analysis of the relationships identifies opportunities for improving the Department's IT support and infrastructure. The key matrices are business function-to-DOE organization, business function-to-data area/class, existing application-to-data area/class, existing application-to-technology, and DOE organization-to-location.

The "to be" enterprise business architecture is developed first as it defines the Department's target business environment. The "to be" business architecture reflects the impact of the key business drivers such as the Department's business vision and strategic direction on the Department's business areas and functions. For example, it defines how e-Government impacts the Department's business operations and information flows. The "to be" enterprise business architecture is developed iteratively. A "to be" concept of operations is developed, reviewed, and revised until it accurately defines and characterizes the Department's future business environment.

The "to be" data architecture portrays the impact of the "to be" business architecture on the Department's data environment and needs. The "to be" business architecture is analyzed to identify and describe any major new information needs. New data areas and classes are defined as required. In addition, the "to be" data architecture characterizes the data management environment needed to support the "to be" business environment. Data management concepts such as data sponsorship, data sharing, use of data repositories, advanced data storage and transmission techniques, and the impact of data quality mandates such as the OMB Data Quality Guidelines are analyzed to develop a data management concept of operations.

The "to be" applications architecture has a short- and long-term perspective. The short-term perspective is derived from the analytical tools. The application-to-data class matrix identifies opportunities to share data among applications. The application-to-technology matrix identifies applications recommended for replacement because they rely on out-dated or non-standard technologies. The "to be" applications architecture identifies the high-level requirements for systems to increase data sharing and replace out-dated applications. The second perspective is long-term and identifies high-level system requirements to meet the business and data concept of operations.

The "to be" technology architecture characterizes the technology infrastructure necessary to support the "to be" applications and to meet the data management requirements inherent in the "to be" data architecture. It addresses the impact of advances in specific technologies such as e-Services. In addition, it identifies changes needed to the Department's TRM and can define a new TRM. Requirements for new or modified standards are defined based on changes to the TRM and the technological changes identified in the "to be" technology architecture.

The "to be" security architecture is derived from the "to be" data, applications, and technology architecture. It identifies and defines the security threats and risks found in the "to be" environment. It also identifies and defines changes in security processes, technical methods, and security infrastructure necessary to counter the threats.

6.2.3 Transition Strategy

The transition strategy is developed to identify the actions necessary to move from the baseline to the target environment. The actions are grouped into projects that encompass logical and related actions. A standard template is defined for the projects so that adequate information is developed. The template includes project purpose, objectives, tasks, organizational roles and responsibilities, resources requirements, and linkages/dependencies. Three types of projects are defined below.

- Business process re-engineering/business process improvement (BPR/BPI) projects describe the business process re-engineering or improvement actions necessary to modify the Department's business processes to meet the "to be" business environment. These projects identify the major processes, information flows, output, and regulation changes to support the changed business functions. In addition, they

can identify organizational changes, staffing re-alignments, and training actions that are important components of a redesigned business function.

- System development projects define the activities necessary to define, develop, acquire, test, and install the computer systems to meet the "to be" requirements. A variety of system development projects are defined including developing a completely new system, re-hosting an existing system, or enhancing an existing system. In addition to defining the systems development projects, the transition strategy also identifies those existing systems to be retired and establishes a retirement/replacement schedule.
- Infrastructure development projects identify and characterize the improvements needed to the Department's infrastructure to support the systems portfolio. The infrastructure projects define the actions to design, specify, acquire, test, install, and operate the computer hardware, operating software, network and communications hardware and software to meet the bandwidth, processing, data storage, and other operational requirements.

Once the transition projects are identified, the transition sequence is established. The transition sequence indicates the relative priority of executing the transition projects. It is established based on the dependencies and linkages among the three types of projects. The transition sequence also takes into account financial and other resources required to implement the transition. This process results in a phased transition approach.

6.2.4 Enterprise Architecture Maintenance

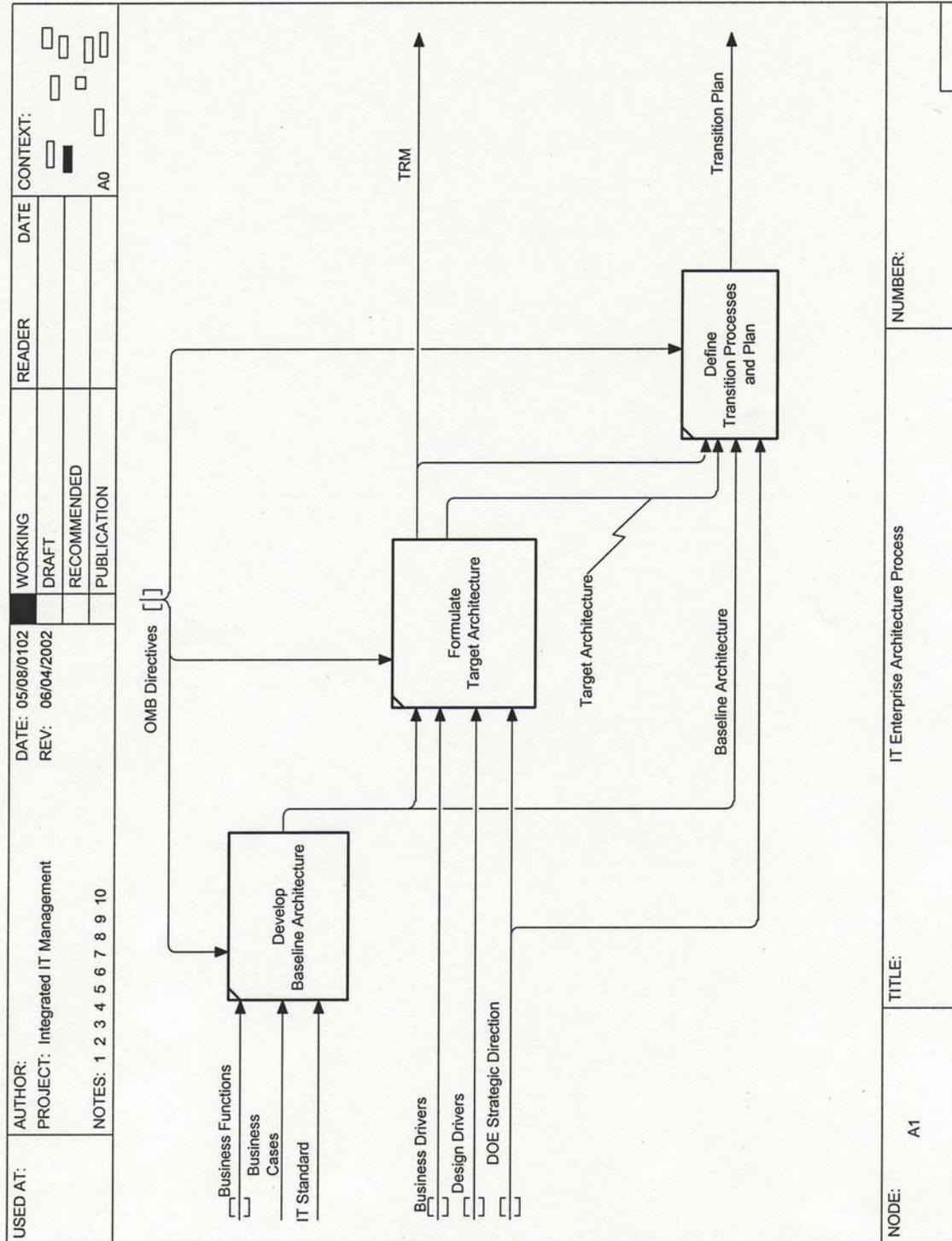
Once the EA is established, it must be maintained. The EA must be modified to reflect changes in business strategy and objectives, advances in technology, input from Program Office and site architectures, and other events. Two maintenance processes are used: periodic and ad-hoc.

The periodic maintenance process occurs at a scheduled period usually annually and in time to support the budgeting and capital planning and investment control processes. The components of the EA are reviewed to determine if any changes to the business, data, applications, technology, and security components are required. The baseline architecture should be updated to reflect the progress made in implementing the transition projects. The "to be" architecture, particularly the applications and technology components, need to be analyzed and updated based on technology changes. In addition, the TRM and Standards Profile should be updated, if required.

The ad hoc maintenance process is a result of a major event triggering the need to update the architecture. Events such as new business or technology direction from the Administration and Departmental executives (e.g., the President's Management Agenda), a significant change in the Department's organization (e.g., the establishment of the National Nuclear Security Administration), a major and unforeseen event (e.g., a terrorist attack) can trigger the need to update the enterprise architecture. The impact of the

trigger event on the business, data, applications, technology, and security layers of the baseline and "to be" architectures is assessed; the relevant changes to the components are identified and defined; and the components are updated.

Figure 6-1 illustrates the IT enterprise architecture process.



NODE: A1

TITLE: IT Enterprise Architecture Process

NUMBER:

Figure 6-1, Enterprise Architecture Process

6.3 Linkages

The IT enterprise architecture process has linkages with the following.

- *DOE Strategic Planning Process* - The EA uses the Department's strategic goals, objectives, strategies, and performance measures as drivers for the target architecture. The EA aligns the Department's IT initiatives and infrastructure with the Department's business objectives and strategies as defined by the DOE Strategic Plan.
- *IT Capital Planning and Investment Control Process* - The CPIC process specifically addresses an ongoing or proposed IT initiative's compliance with the Department's EA. The selection phase of the CPIC process includes questions that determine linkages from the initiatives to the business, data, application, technology, standards, and TRM components of the EA. The degree to which the initiative complies with the EA is a key determinant in whether the initiative is funded. The control and evaluate phases of the CPIC process determines whether the initiative remains in compliance with the EA.
- *IT Project Management Process* - The EA transition plan identifies projects that are subject to the IT project management process, which defines the system and infrastructure development phases for IT initiatives. The phases control how the EA transition projects are undertaken. In addition, the IT project management process incorporates touch points with the EA to provide information to determine its continued compliance with the EA and if required, modify the business activities and data class definitions, application capabilities, and technology components of the EA.
- *Data Management Process* - The data architecture layer of the EA establishes the framework for the Department's data management process. The "to be" architecture describes the major actions necessary to manage the Department's data resources. The data management process also provides the EA with information to refine the definitions of the data classes and define the technical processes used to manage the Department's data.
- *IT Standards Management Process* - The EA incorporates the IT standards produced by the IT standards management process. In addition, major changes to the technology architecture trigger the need to update the IT standards.

7. Capital Planning and Investment Control Process

7.1 Purpose

To maximize the return to the Department on its substantial investment in information technology (IT) resources, a structured IT capital planning and investment control (CPIC) process is underway. Under this process, each ongoing or proposed IT investment is subject to consistent selection criteria, control mechanisms, and evaluations to ensure that all IT investments are justified and well managed.

In addition, the CPIC process allows the Department to view its IT investments as a portfolio of items ensuring an appropriate balance among infrastructure, administrative, and scientific IT investments. This systematic approach enables the Department to achieve the maximum organizational benefit and reduce duplication and IT redundancy.

7.2 Process Description

The CPIC process must include three components: selection, control, and evaluation. The process must be iterative, build from the Department's enterprise architecture (EA) (i.e., transition plan), and be documented. The Office of Management and Budget (OMB) has established specific requirements for each component. Table 7-1 lists and describes the requirements for each component.

Table 7-1, CPIC Process Components and Requirements		
Select	Control	Evaluate
1. Evaluate investments to determine whether they support core mission functions.	1. Ensure that performance measures and management processes monitor actual performance as compared to expected results.	1. Conduct post implementation reviews (PIR).
2. Ensure that system improvement or new system development investments are made only when no alternative private sector or Governmental source can efficiently meet the need.	2. Conduct periodic reviews of information systems to determine continued support for mission needs or reflect the impact of changes in mission needs.	2. Evaluate investments to ensure positive return on investment (ROI) and decide whether they continue to meet Departmental mission requirements
3. Support work processes that have been simplified or redesigned.	3. Ensure that information systems proceed on time towards specific milestones according to the lifecycle.	3. Document lessons learned and use them to redesign oversight mechanisms and performance levels.
4. Reduce risks by avoiding custom designed components, using components that can be tested or prototyped, and ensuring that users are involved and supportive.	4. Use a risk mitigation strategy.	4. Re- assess the investment's business case, technical compliance, and compliance against the EA.

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Table 7-1, CPIC Process Components and Requirements		
Select	Control	Evaluate
5. Demonstrate a projected ROI that is equal to or better than alternative uses of available public resources.	5. Ensure that financial systems comply with OMB requirements for such systems.	5. Update the EA and CPIC process, as needed.
6. Use a cost benefit analysis (CBA) for each investment throughout its lifecycle.	6. Ensure that the information system incorporates records management and disposition requirements.	
7. Use a portfolio approach to monitor IT investments and prevent redundancy.	7. Ensure adherence to the Departmental EA.	
8. Ensure consistency with Federal, Departmental, and program-level enterprise architectures.		
9. Ensure that system improvement and system development investments do not unnecessarily duplicate IT capabilities within the Department, from other Agencies, or from the private sector.		
10. Ensure that the ongoing or planned IT investment maximizes the usefulness of information, minimizes the reporting burden on the public, and maintains information integrity, usability, availability, and confidentiality.		
11. Establish investment and evaluation oversight mechanisms.		
12. Ensure that the prerogatives of State, local, and tribal governments are not unnecessarily restricted.		
13. Ensure that the selected system or process facilitates accessibility.		

7.2.1 Select Component

Figure 7-1 depicts the current process for the development and selection of an annual IT portfolio. Individual sites and Program Offices develop and propose annual IT portfolio proposals based on mission needs and reviews of IT business cases. IT investments (new and ongoing) are selected for the portfolio based on defined selection criteria consistent with the requirements of OMB Circulars A-11 and A-130. Subsequently, the proposed portfolios are reviewed and approved by a board of senior program managers at various locations. The proposed portfolios are forwarded, with budget request data, to lead programs at Headquarters Program Offices for integration into program-wide IT

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portfolios. These program-wide portfolios are merged with staff office IT portfolios to create the Department's IT portfolio.

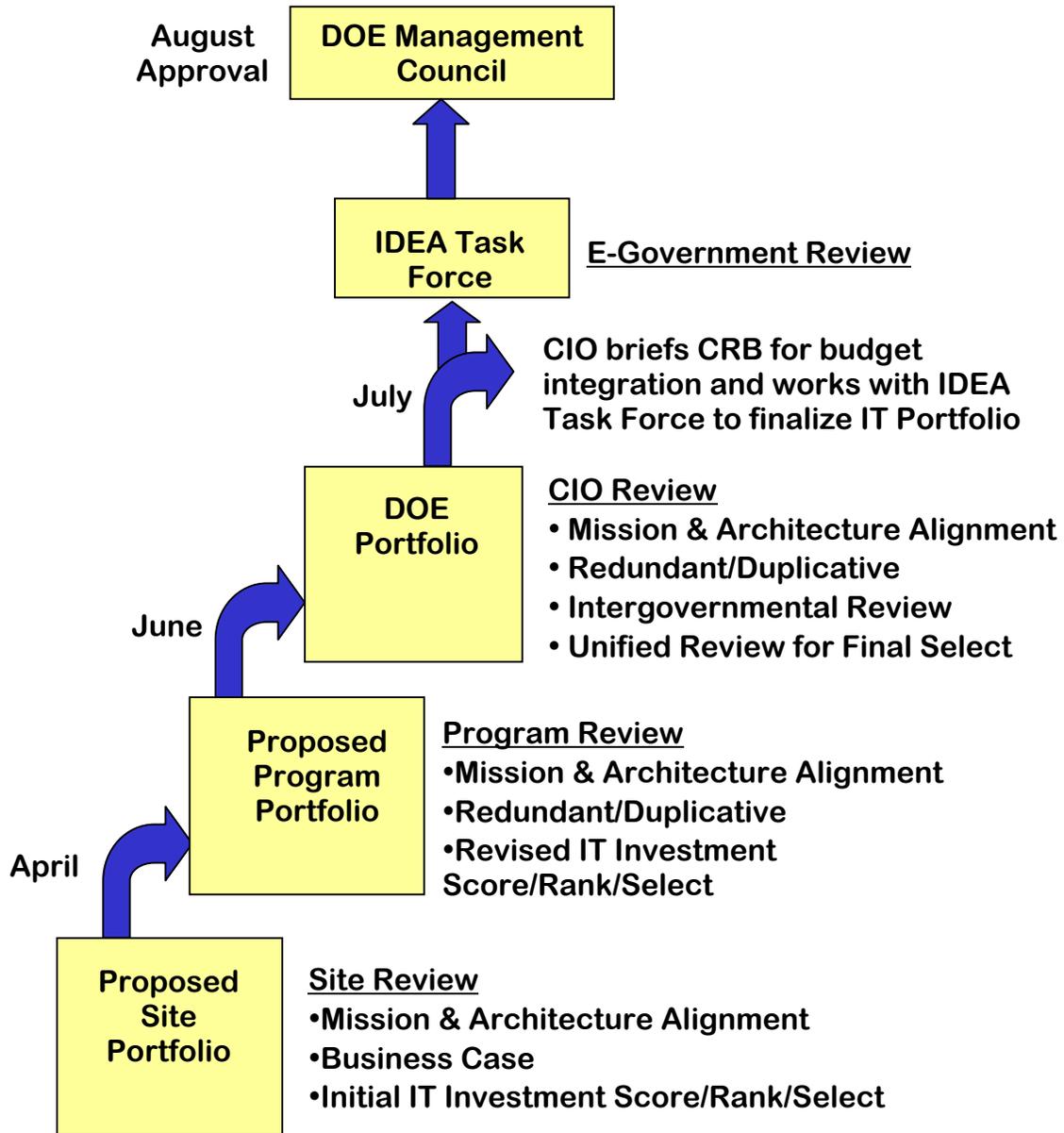


Figure 7-1, Annual IT Portfolio Selection Process

7.2.2 IT Investment Control and Evaluation

Part of the documentation that must be included in the IT business cases is the expected costs and benefits and the performance measures used to track investment progress. IT managers periodically review performance measures for each IT investment to track progress against projected benefits. IT investments not performing according to expectations (within 90 percent of plan) are subject to additional detailed reviews, managerial corrective actions, or termination.

7.2.3 Evaluation Component

A special review that should be noted is the post-implementation review performed on IT systems three to six months after they are fully deployed. The purpose of this review is to determine if the IT investment achieved the expected benefits projected in the business case. This review is important not only to determine the future viability of the IT investment, but also to assist IT managers in improving IT proposal business case requirements to better inform future IT selection decision-making. Post-implementation review criteria are provided by the Office of the Chief Information Officer (OCIO) as part of the updated *DOE Guide to IT Capital Planning and Investment Control*.

Figure 7-2 illustrates the CPIC process select, control, and evaluate activities.

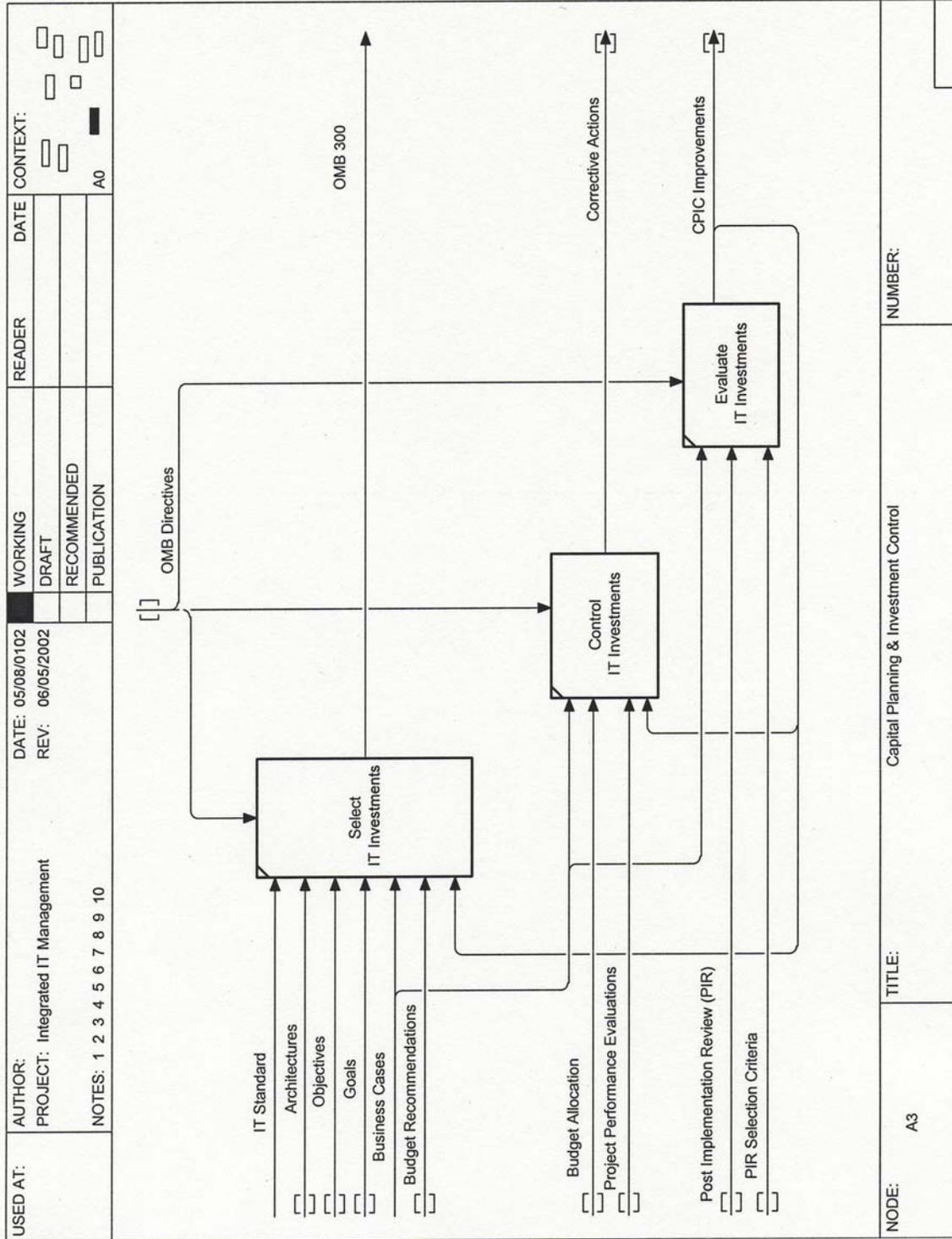


Figure 7-2, Capital Planning and Investment Control Process

7.2.4 CPIC Process Roles and Responsibilities

DOE Management Council

The CIO presents the proposed Department IT portfolio to the DOE Management Council, a board of senior DOE executives for review and approval. Once approved the final IT portfolio is submitted to OMB with the Department's annual budget request.

Innovative DOE e-Gov Applications (IDEA) Task Force

In support of this review, the CIO works with the IDEA task force, which focuses on identifying and coordinating IT e-Government initiatives in support of the President's Management Agenda.

Chief Information Officer

The Department CIO receives reviews all proposed Program and staff office IT portfolios. Approval of proposed IT investments is based on the following criteria.

- Redundant and duplicative investments cannot be proposed for multiple programs
- Program IT investments cannot duplicate functionality provided by corporate IT solutions
- IT investments must support Department missions and goals
- IT investments must be consistent with the DOE enterprise architecture
- IT investments must support and integrate with Governmentwide IT initiatives such as e-Government

Program and Staff Office

Program IT managers review the submitted proposals to ensure the following.

- Redundant and duplicative investments are not proposed at multiple sites and offices
- Proposed IT investments support Department missions and goals
- Proposed IT investments are consistent with the DOE enterprise architecture and program architectures

Proposed program-wide IT portfolios are reviewed and approved by a board of senior program managers and submitted to the Departmental CIO for review and integration into the DOE IT portfolio.

DOE Site/Organization

Site IT program managers review individual IT investment business cases and select investments for a proposed site portfolio to ensure that missions and goals are effectively and efficiently supported by the proposed site portfolio and that the proposal is consistent with site IT architecture. Individual IT investment business cases are reviewed to ensure that they are compliant with the requirements of OMB Circulars A-11 and A-130 and adequately justify the investment. The proposed site portfolio is sent to the appropriate Headquarters Program Office for review and inclusion in a program-wide portfolio.

7.2.5 CPIC Governance Structure

At each level of IT portfolio development, project managers with IT staff support, are responsible for developing IT business cases and submitting them to boards of senior managers for review and approval. Senior management boards are to be comprised of program and business managers well versed in the missions of the organization. They decide which IT proposals merit selection for funding based on standard IT selection criteria, including conformance to information architectures. The board must have members with crosscutting capabilities to be able to select IT investments that reflect mission requirements, are justified and planned, and reflect organizational priorities.

Parallel IT governance structures must be established at each site and Program Office that develops a proposed IT portfolio for submission. At whatever organizational level the governance board exists, the board must be fully conversant with the missions and goals of the organization and be able to make high-quality IT selection decisions.

7.2.6 CPIC Process Requirements

To guide IT managers and IT review boards at all levels of the Department, the CIO establishes the minimum standard CPIC process requirements, which must be followed by all Departmental Elements. This is accomplished by the publication of a detailed guide. The updated DOE Guide to IT Capital Planning and Investment Control, while providing flexibility to respond to individual office requirements, establishes roles and responsibilities, minimum tasks that must be accomplished (e.g., enterprise architecture reviews), standard criteria that must be used for IT selection, and the documentation that must be developed and reported for all IT investments. The Guide specifies the concepts outlined in this framework and relates them to all Departmental Elements.

7.3 Linkages

The capital planning and investment control process has linkages to the following processes.

- *DOE Strategic Planning Process* - In the CPIC process each major IT investment must explicitly identify the DOE strategic goals and objectives supported by the investment. A primary and regular consideration in assessing the value of new and existing IT investments is the degree to which they align with the strategic planning goals and organizational mission. Throughout the CPIC process, IT investments need to support priorities as articulated in Departmental- and program-level strategic planning processes, and the missions, goals, and objectives of the Department.
- *DOE Budget Process* - The timing and information flows of the CPIC process are established to integrate with the DOE budget process. Key decision points at the site, Program Office, and Department levels occur consistent with budget formulation phases. Site, program, staff office, and Departmental IT portfolios are presented to executive decision boards with budget request material to ensure integration. It is

critical that the CPIC process be aligned with the annual budget formulation cycle to ensure that IT investment decisions are reflected in the Agency budget request and that approved IT investments are appropriately funded.

- *DOE Capital Asset Management Process* - Because project management is required for capital assets including IT capital assets, there is a close relationship between the CPIC process and the capital asset management process. Whether for a standalone IT project or where IT is an integral component of a larger project such as a particle accelerator, capital asset management is a significant part of the CPIC process, and DOE Order 413.3 is consistent with DOE IT CPIC documentation.

The relationship of capital asset management to the CPIC process starts during the development of an initial proposal for an IT investment in the CPIC process screening phase. Here, mission need is addressed; costs, returns, and risks are assessed; and performance measures are addressed. Additional detailed documentation is developed as part of the development of the business case during the scoring phase. In a similar manner to the requirements of DOE Order 413.3, the CPIC process includes a review and approval process with a board structure chaired by the Deputy Secretary. In addition, there is a similar project management oversight and control process that continues throughout the entire lifecycle of an IT investment, including approval, implementation, review, and close out. The CPIC process contains the essential project selection, management, and oversight elements contained in the Department's project and asset management orders.

- *IT Enterprise Architecture Process* - The CPIC process specifically addresses an ongoing or proposed IT initiative's compliance with the Department's EA. The selection phase of the CPIC process includes questions that determine the linkage of an initiative with the business, data, application, technology, standards, and TRM components of the EA. The degree to which the initiative complies with the EA is a key determinant in whether the initiative is funded. The control and evaluate phases of the CPIC process determine whether the initiative remains in compliance with the EA.
- *IT Project Management Process* - The CPIC process uses information developed by the IT project management process in the CPIC select, control, and evaluate phases. The CPIC select process uses the business case data to justify the proposed investment and prepare documentation required by OMB (e.g., Exhibit 53, OMB 300, etc.). The CPIC control phase uses information from the project planning and control activities to monitor the project's performance and progress. Corrective actions to address project risks or to improve performance constitute another information flow. The CPIC evaluate phase uses the results of the post implementation review to assess the project's overall performance. The lessons learned session provides information to improve project selection, control, and evaluation structures, criteria, processes, and tools.

- *IT Standards Management Process* - IT standards are used to evaluate the technical components of a proposed IT initiative/project during the select phase. The degree to which a proposed initiative/project conforms to (i.e., uses) standards is a key indicator of the level of technical risk. The continued conformance to IT standards is a key factor in the control phase.

8. IT Project Management Process

8.1 Purpose

The Department of Energy (DOE) recognizes the importance of high quality, systematic project management as a key success factor in the accomplishment of planned project objectives and the realization of projected benefits. Project management has two tightly linked components: a business and a technical component. The business component focuses on project initiation and justification, project planning and control, and project evaluation and closeout. The technical component deals with requirements definition; technical design; acquisition or development; and testing, installation, and operation of the software and hardware assets.

8.2 Process Description

The following describes the major activities that make up the business and technical components of information technology (IT) project management.

8.2.1 IT Project Business Management

The business component of IT project management encompasses the tools and techniques to formulate, plan, implement, and manage IT projects. The business component closely follows the activities and structures stipulated by DOE Order 413.3 (refer to chapter 5, DOE Capital Asset Management Process) as these are proven, critical project management methods. The business component is broken down into three major activities: project initiation and justification, project planning and control, and project evaluation and closeout.

Project initiation and justification focuses on demonstrating how the IT project links to and supports specific business and performance objectives. The objectives can be at the DOE, Program Office, or site level. The IT project must be justified from a business perspective by building a business case. The business case is used by the Capital Planning and Investment Control Process (CPIC) process (refer to chapter 7, Capital Planning and Investment Control Process) and by the enterprise architecture (EA) process (refer to chapter 6, IT Enterprise Architecture Process). Building a business case includes the following activities.

- Creating a needs statement that clearly articulates why the IT project is required in business terms and how it meets specific business objectives. The linkage to the business objectives must be defined and the way the IT project helps achieve those business objectives clearly described. The owner(s) of the business function(s) impacted by the IT project or the project sponsor must be responsible for the needs statement and be prepared to defend it.

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- Conduct a feasibility analysis that identifies the business process and related technical alternatives for achieving the business objectives. The high-level risks and costs associated with each alternative must be identified. The alternatives and associated risks are analyzed to identify the alternative that best meets the business objectives with the least amount of risk.
- Conduct a rigorous cost benefit analysis on the selected alternative. The cost benefit analysis is conducted in accordance with the Office of Management and Budget (OMB) guidelines. Costs (e.g., labor, hardware acquisition, software acquisition, operations, maintenance, training, etc.) should be identified and estimated. To the extent possible, the benefits must be quantified. The estimated return on investment (ROI) is calculated for the IT project. The results of the cost benefit analysis should be used to confirm the results of the feasibility analysis.
- Establish performance measures. The performance measures demonstrate the transformational nature of the IT project. Performance measures are developed by identifying the key items to be measured, refining the items, defining the degree of accuracy needed, validating the performance measures with the project's stakeholders, identifying data sources for the performance measures, and developing the performance management process and reporting structure.

Project planning and control establishes the tools and techniques needed to plan an IT project, monitor its execution, and make business and technical decisions as the IT project progresses. In effect, it establishes an integrated lifecycle management structure for an IT project. Project planning and control produces information needed by other IT management processes such as CPIC and DOE management processes such as the budget. An earned value management system is used to monitor project cost, schedule, and performance. Project planning and control includes the following activities.

- Develop an IT project plan that structures and controls the execution of the IT project. Developing the IT project plan is accomplished by creating a comprehensive work breakdown structure (WBS), determining the critical path for project execution, estimating project timelines and costs, establishing a project organization (usually in the form of an integrated project team or IPT), and developing a communication plan.
- Identify major milestones and project deliverables to establish the key outcomes for the project. The milestones and deliverables identify the products with which progress can be measured as part of monitoring the project. The major milestones and deliverables for an IT project are based on the whether it is a system development or IT infrastructure project.
- Develop a risk management plan to eliminate, avoid, or mitigate risks to the project's success. The business and technical risks need to be identified, the impact on the project's critical path defined, the probability of occurrence established, and mitigation measures developed.

- Monitor the project's execution by defining and implementing an IT project monitoring system. The project monitoring system usually includes identifying key control points, establishing a project review schedule, and holding informal and formal project monitoring meetings that can include external independent reviews. The project's progress is usually evaluated based on the rate at which it is meeting the major milestones and producing the deliverables. The project's performance is evaluated based on the degree to which it is meeting the performance measures.
- Implement corrective actions to address risks and address issues identified as part of the IT project monitoring system. The corrective action needs to be defined, responsibility for implementing the action determined, the corrective action undertaken, and its impact on the risk or issue assessed.

IT project evaluation and closeout assesses the project's overall performance and develops lessons learned to improve decision making about future IT projects. It also includes the ongoing evaluation of operational systems to determine what action should be taken. IT project evaluation and closeout includes the following activities.

- Conduct a post implementation review (PIR). The PIR is required as part of the IT project management and CPIC processes. It determines if the IT project achieved the expected benefits as defined by the business case. In addition, it assesses whether the project's progress was acceptable, whether risks were managed, whether corrective actions were identified and implemented, and the overall effectiveness of the project management structures and methods.
- Hold a lessons learned session to identify actions to improve the business and technical tools and techniques used to plan, implement, monitor and control the IT project.
- Monitor operational IT projects to assess their continued support for DOE business objectives. Operational IT projects require periodic assessment to determine if they still meet business needs and performance measures. In addition, their technical viability should be examined in light of advances in technology. The structured evaluation should determine and document if the operational IT project should be continued, modified, or replaced using newer technology or retired.

8.2.2 Software Project Management

The management of IT software projects is primarily a technical process that is well defined, structured, and documented. Many commercial-off-the-shelf (COTS) software project management processes and tools exist and can be used to manage an IT software project. The Office of the Chief Information Officer (OCIO) has provided guidance for the development of software in the form of a *Departmental Information Systems Engineering Guide*. It should be noted that major IT software projects must be preceded or complimented by a business process re-engineering (BPR) or business process improvement (BPI) initiative. The underlying business processes must be evaluated and

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specific improvements in terms of processing effectiveness and efficiency undertaken. The IT software project must not just automate existing business processes; it should provide automated support for processes that transform the business function. In general, the activities that are normally undertaken include the following.

- *Define technical approach* - The technical approach depends upon many factors to include the type of IT software project (e.g., new system development, system enhancement, technical migration, etc.), the technical environment, the availability of tools to support the project, etc. The technical approach is defined, key technical milestones and deliverables identified, and technical roles and responsibilities defined.
- *Define requirements* - The functional and technical requirements that the software system is to meet are defined. Initial requirements are collected using joint application development/rapid application development (JAD/RAD) techniques and sessions, surveying, interviewing key stakeholders, or document review. The functional (i.e., business) requirements are defined, documented, and approved by the key stakeholders. In addition, key technical performance measures (e.g., response time, availability, etc.), security, and accessibility (i.e., Section 508) are defined, documented, and approved. The requirements are used to define a testing strategy and establish test scenarios/cases. In particular, DOE evaluates whether a COTS solution can be used to meet the requirements.
- *Procure IT software products and services* - Through the procurement process, DOE acquires IT software products and services to meet requirements (refer to chapter 4, DOE Procurement Process).
- *Design, develop, and test software modules* - The design, development, and testing of the software modules is an iterative process and one that is largely controlled by the use of a COTS solution. Custom development can be required to adapt the COTS solution to meet DOE requirements. Certain special applications may have to be developed because no suitable COTS solution can be identified. Conceptual, logical, and physical data modeling is conducted in parallel with software development. Security and accessibility software and processes are included in the relevant modules. Unit, system, and integration testing is performed with the participation of the end users using test scenarios and cases.
- *Establish user environment* - The business environment in which the software system operates and supports is modified to integrate system functionality. The degree to which exiting business processes must be changed or even re-engineered depends upon the impact of the systems functionality on the business processes. Changes to the business processes are identified, defined, and implemented. The end user organization must undertake a BPR/BPI project as a complementary activity to the IT software project. Training of users, development of user manuals and aides, and fine-tuning of the software modules is undertaken.

- *Install and operate IT software system* - The IT software modules are migrated from the development/testing environment to the production environment. A final test can be undertaken to ensure that all required changes have been made. The end users confirm that they can successfully use the system. The end users formally accept the system. The system is placed in operation. Existing systems may be replaced or retired.

8.2.3 IT Infrastructure Project Management

IT infrastructure projects are projects that acquire and deploy technology resources to support DOE system, data, and communication operations. The technology resources vary and include mainframes, servers, routers, communication lines, desktop and portable computers, printers, specialized equipment, etc. The IT infrastructure projects include the specification, acquisition, and deployment of operating and general use software. The specific process used to manage the technical component of IT infrastructure projects reflects the type of technology involved; however, the general process is the same. The activities normally undertaken are similar to those for IT software projects and are outlined below.

- *Define technical approach for the IT infrastructure project* - The technical approach depends upon certain factors to include the type of IT infrastructure project (e.g., new hardware, communication network upgrade, replacement of personal computers, migration to a new operating system), the existing infrastructure, the availability of technical support from vendors, etc. The technical approach is defined, key technical milestones and deliverables identified, and technical roles and responsibilities defined.
- *Develop specifications* - The technical functionality and configuration is detailed. This can involve using analytical tools (e.g., communication network load analysis and modeling) to model the infrastructure component. Existing IT standards are used to structure and guide the technical specifications. Vendors and suppliers may be contacted to obtain technical information. The specifications include performance, reliability, and other types of measures that define the operating standards for the infrastructure components. Security and accessibility requirements must be taken into account in developing the specifications. The technical specifications are developed, reviewed, and approved. They may also be the subject of an independent or external review to ensure that they are technically sound and meet DOE needs.
- *Procure IT infrastructure components* - DOE acquires all of its IT infrastructure components from commercial companies, DOE laboratories, other Government Agencies, etc. The DOE procurement process is described in chapter 4.
- *Install, test, and operate the IT infrastructure component(s)* - The equipment and software is installed. A series of tests are conducted to ensure that the performance and other operating standards are met. Training is conducted to equip DOE and other staff to manage and operate the IT infrastructure component. This training may be

extensive and long-term (e.g., training on a new enterprise software capability such as e-mail). Technical support staff such as help desk analysts must be trained. The IT infrastructure component is formally accepted and placed into operation.

Figure 8-1 illustrates the IT project management process. The software project management and infrastructure project management processes are not included.

IT Investment Management Framework

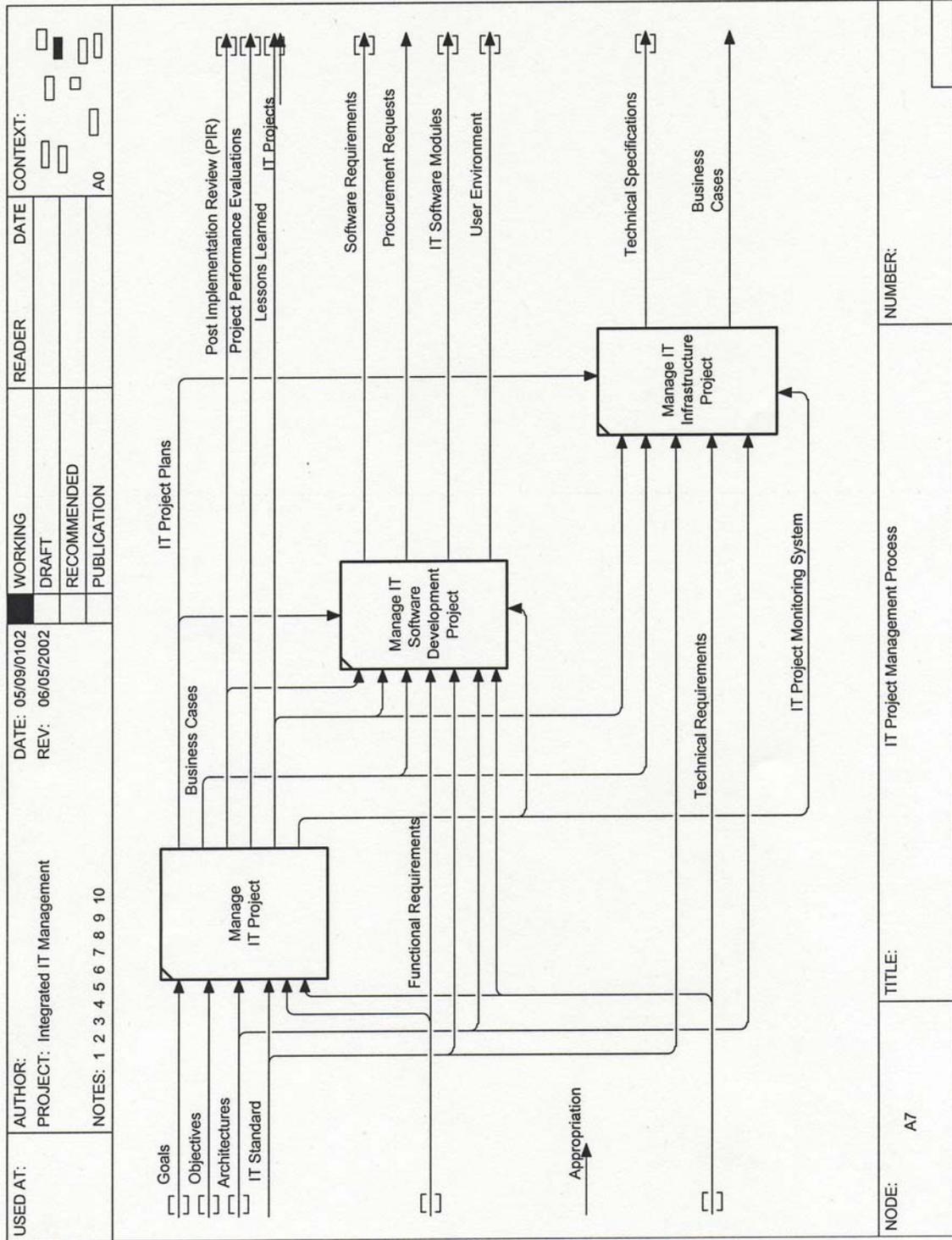


Figure 8-1, IT Project Management Process

8.3 Linkages

The IT project management process has linkages with almost all of the other IT management and planning processes.

- *DOE Strategic Planning Process* - The business component of the IT project management process requires IT projects to demonstrate support for DOE long-term business objectives and strategies. In fact, the business case for IT projects must clearly articulate this support. In addition, ongoing IT projects are evaluated as to their continuing ability to effectively and efficiently meet DOE business needs.
- *DOE Procurement Process* - As indicated above, the acquisition of IT software development and support services and of IT infrastructure components and support services is governed by DOE procurement policies and guidelines and must follow DOE procurement processes.
- *Enterprise Architecture Process* - The EA transition plan identifies projects that are subject to the IT project management process. The IT project management process defines the system and infrastructure development phases for IT initiatives. The phases control how the EA transition projects are undertaken. In addition, the IT project management process incorporates touch points with the EA to provide information to determine its continued compliance with the EA and if required, modify the business activities and data class definitions, application capabilities, and technology components of the EA. The EA also provides the basis for determining the scope and initial requirements for IT software and infrastructure projects. The business model can be used to identify the business functions impacted by the proposed IT software system; the data architecture contains the data areas and classes used, and the application architecture can be used to identify applications with which the system must interface or replace.
- *Capital Planning and Investment Control Process* - The CPIC and IT project management processes must be linked. The CPIC process uses information developed by the IT project management process in the CPIC select, control, and evaluate phases. The CPIC select process uses the business case data to justify the proposed investment and prepare documentation required by OMB (e.g., Exhibits 53 and 300). The CPIC control phase uses information from project planning and control activities to monitor the project's performance and progress. Corrective actions to address project risks or improve performance constitute another information flow. The CPIC evaluate phase uses the results of the post implementation review to assess the project's overall performance. The lessons learned session provides information to improve project selection, control, and evaluation structures, criteria, processes, and tools.
- *Data Management Process* - The IT project management process, particularly for IT software projects, uses the products and processes of the data management process.

IT software projects must comply with data quality and other guidelines; use standardized data; ensure that data stewards are in place; and develop data collection, storage, transmission, and dissemination processes in accordance with the data management guidelines and standard techniques.

- *IT Standards Management Process* - IT standards guide the design, development, testing, and acceptance of IT systems. In addition, they are used to specify IT infrastructure components and software.

9. Data Management Process

9.1 Purpose

A data management process implements and manages Department of Energy (DOE) data in such a way that all data resources are employed as efficiently as possible in support of DOE mission and operational business objectives. It makes DOE data accessible, credible, and usable. It provides a framework of data resources available and responsive to the functional areas within the Department, and it needs to do so as efficiently as possible. A data management process creates and maintains the enterprise data model and drives the DOE data management function. It supports activities needed to comply with the Office of Management and Budget (OMB) Data Quality Guidelines.

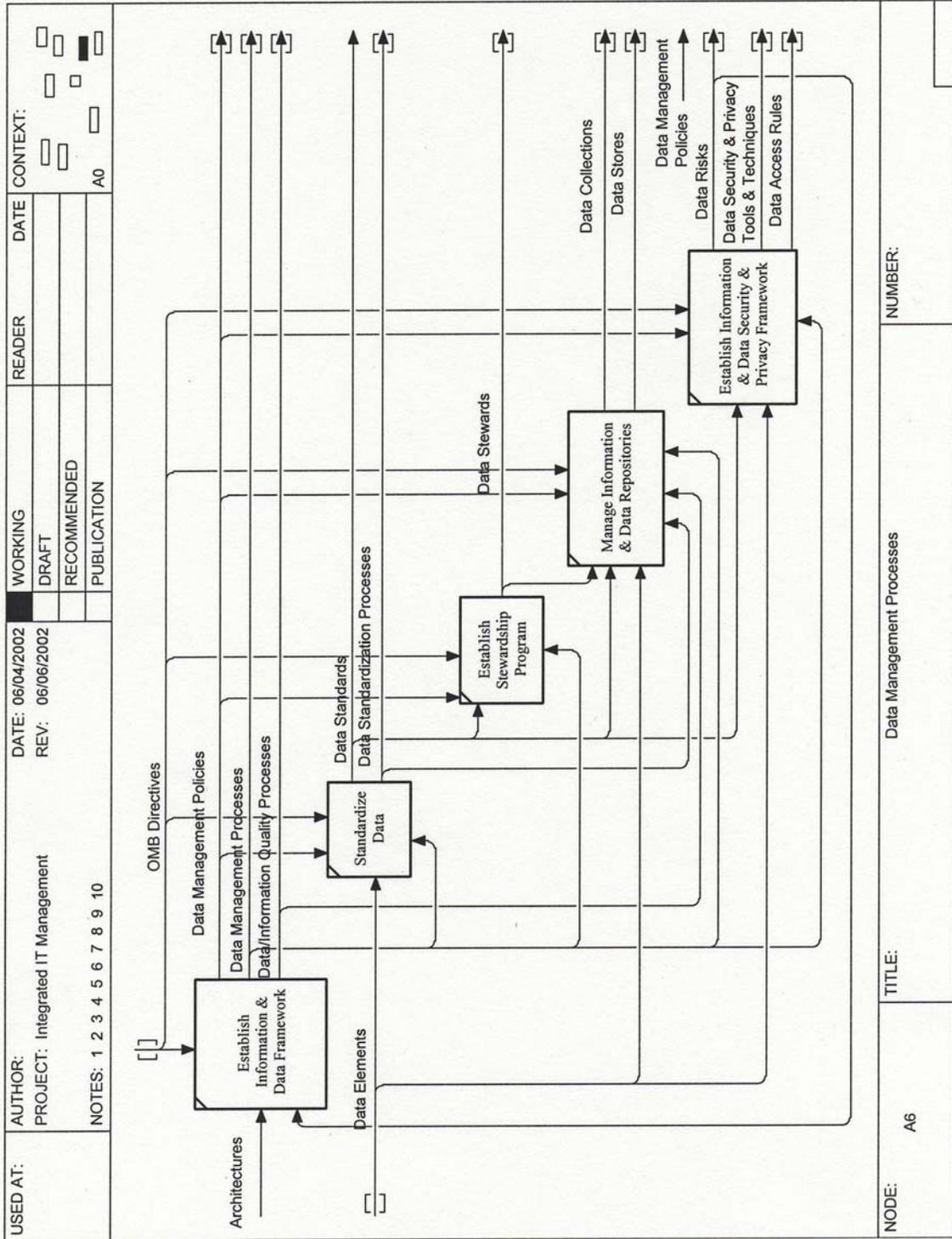
9.2 Process Description

DOE manages a diverse and complex data environment. DOE data ranges from basic elements to highly, complex scientific observations. DOE information and underlying data must comply with the recently issued OMB Information Quality Guidelines, other OMB data regulations (e.g., Geospatial) and comply with Federal, State, and other laws and regulations. Managing data in an organization like DOE requires a flexible, responsive process that is not overly centralized. DOE programs must remain responsible for their program-specific information and data, but operate within a DOE enterprise data framework. The enterprise data framework establishes and manages the enterprise structures, policies, processes, tools, and techniques for managing DOE data. The approach manages the quality of DOE data throughout the data lifecycle. The data lifecycle consists of several phases: data collection, storage, transmission, analysis, dissemination and publication, and archiving. The following activities are included in the data management process.

- *Establish the Information and Data Management Framework* - The managerial and technical functions and responsibilities for managing DOE information and data need to be established. The DOE organizations (e.g., Office of the Chief Information Officer (OCIO), Program Offices) that own information and data are identified. Enterprise information and data management policies are developed, reviewed, and approved to provide guidance and inform enterprise- and program-level activities. The processes mandated by OMB Information Quality Guidelines must be developed and implemented. In particular, Departmental information quality guidelines need to be prepared and issued; an administrative process for handling complaints about DOE published information (including statistical and scientific information) needs to be developed and implemented; and a reporting mechanism to provide annual reports to OMB related to the processing of information quality complaints also needs to be put in place. A process for reviewing the quality of information before dissemination must be implemented at the enterprise level and for certain Program Offices (e.g., Energy Information Administration).

- *Standardize Data* - A key technical activity is to develop data standards. The standards are important in that they structure the contents of information flows to internal and external stakeholders. E-Government solutions rely on standard data. E-Government solutions use extensible markup language (XML) for data transmission. XML reflects an agreement by a community of interest on the tags and standards for transmitting data using the Web. Standards for data naming, definition, content, etc. must be established, reviewed, approved, and published. The development of data standards must be coordinated by the OCIO; the standards must reflect a consensus by all of the interested parties including the programs and external stakeholders. In addition, technical data standardization processes must be developed and implemented. The technical data standardization processes detect and reduce the occurrences of homonyms, synonyms, and aliases or data elements; thereby, reducing the total number of data elements and minimizing maintenance to duplicate data fields. The third focus of the data standardization is to develop and maintain metadata. Metadata is data about the data. The primary purpose of metadata is to describe each standardized data element.
- *Establish Stewardship Program* - Stewards are employees of the organizations that perform the business functions that create the information and data. Stewards need to be identified, familiarized with their stewardship functions and responsibilities, and given the requisite authority. Stewards lead the development of specific standards of information and data quality that are appropriate for the various categories of information and data. In addition, stewards serve as points-of-contact for the information and data, answering questions about the data from users who need information and responding to complaints.
- *Manage Information and Data Repositories* - The management of information and data repositories involves technical processes and procedures to collect, store, and archive DOE information and data. A collection review process must be established to analyze DOE data collection activities to identify and eliminate duplicative data collections. Data storage policies and procedures must be developed to structure the development and maintenance of DOE information and data repositories to include data warehouses, data marts, and databases.
- *Establish Information and Data Security and Privacy Framework* - A security and privacy framework governs the security and privacy of DOE information and data. The framework must identify the key security risks and mitigation measures. It must outline the roles and responsibilities of the stewards, cyber security staff, and others in developing, implementing, operating, and improving DOE information and data security and privacy mechanisms, techniques, and tools. It must define information and data collection, storage, transmission, and archival security techniques and tools. The security and privacy framework must structure the definition and assignment of information and data repository access roles and views.

Figure 9-1 illustrates the data management functions and their relationships.



NODE: A6 TITLE: Data Management Processes NUMBER:

Figure 9-1: Data Management Processes

9.3 Linkages

The data management process has linkages with the following processes.

- *Enterprise Architecture Framework Process* - The data architecture layer of the EA establishes the framework for the Department's data management process. The "to be" architecture describes the major actions necessary to manage the Department's data resources. The data management process also provides the EA with information to refine the definitions of the data classes and define the technical processes used to manage the Department's data.
- *IT Project Management Process* - The IT project management process, particularly for IT software projects, uses the products and processes of the data management process. IT software projects must comply with data quality and other guidelines; use standardized data; ensure data stewards are in place; and develop data collection, storage, transmission, and dissemination processes in accordance with the data management guidelines and standard techniques.
- *IT Standards Management Process* - IT standards include standards for data interchange and management. These standards impact data transmission, security, and storage requirements.

10. IT Standards Management Process

10.1 Purpose

The purpose of the Information Technology (IT) standards management process is to establish and maintain an IT Standards Profile that supports Department of Energy (DOE) IT services. DOE is expected to adopt standards that must be enforced consistently throughout the Agency. The IT Standards Profile must include a security standards profile specific to DOE IT security services. The establishment and maintenance of an IT Standards Profile is mandated by the Office of Management and Budget (OMB) and is specified in OMB Circular A-130.

10.2 Process Description

DOE has established a corporate IT Standards Program within the Office of Chief Information Officer (OCIO). The Department's *Profile of Adopted Standards* reflects Departmentwide consensus on standards supporting the DOE technology service areas as defined by the technical reference model (TRM). The *Profile* integrates international, National, Federal, and industry standards.

The OCIO has established a management plan for the IT Standards Program. The management plan outlines IT standards development, the IT Standards Adoption and Retirement Process, the use of IT standards by DOE Program Offices and sites, and the administration and management of the IT Standards Program. The Plan recognizes that an IT standard can originate from a variety of sources including standards consortia, voluntary, and Federal standard organizations. DOE employees participate in many of these organizations.

DOE has established a corporate IT Standards Adoption and Retirement Process. The process is initiated by the presentation of a standards proposal. A standard can be proposed by an individual or by an affinity group. The proposal can recommend adoption of a new or updated standard from a recognized standard organization or the retirement of an obsolete standard. The OCIO Standards Program Manager screens the proposal and identifies interested parties and experts to assist in the technical review of the proposal. DOE Program Offices and sites review the proposed standard; it can be modified as a result of the review process. If a consensus is reached, the proposed standard becomes an interim standard. After it receives final approval, the interim standard becomes a formal adopted standard.

In addition, the OCIO Standards Program Manager can identify the need to update the standards contained in the *Profile*. The update process is triggered by changes in technology or IT strategic direction. The OCIO conducts a technical review of existing standards and develops a standards proposal, if required.

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The DOE IT standards provide technical guidance to Program Offices and sites. Program Offices and sites including contractors are encouraged to establish their own IT standards and assessment programs. IT project managers are responsible for reviewing the *Profile of Adopted Standards* and using the standards in developing software and acquiring hardware. IT project managers may identify the need to modify an existing standard or to recommend the adoption of a new standard. This can lead to a standards proposal.

Figure 10-1 illustrates the IT Standards Adoption and Retirement Process.

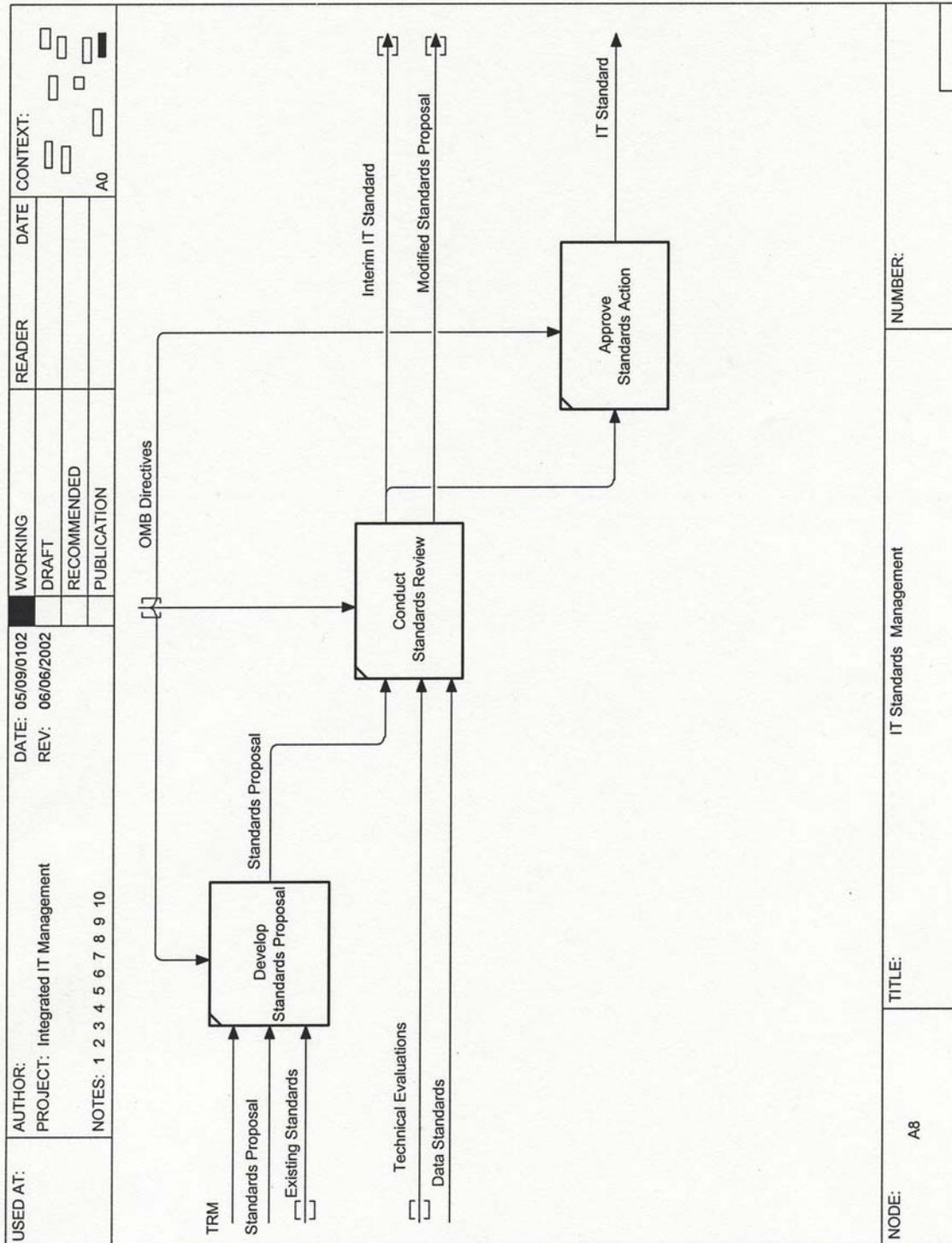


Figure 10-1, IT Standards Adoption and Retirement Process

10.3 Linkages

The DOE IT standards management process has linkages with the following processes.

- *IT Enterprise Architecture Process* - OMB A-130 mandates that an Agency's enterprise architecture include a standards profile. Moreover, the definition of the target technology architecture can result in the identification of new technologies that impact the DOE TRM and the existing *Profile of Adopted Standards*. In either case, this can result in the requirement to update DOE standards.
- *IT Capital Planning and Investment Control Process* - IT standards are used to evaluate the technical components of a proposed IT initiative/project during the select phase. The degree to which a proposed initiative/project conforms to (i.e., uses) standards is a key indicator of the level of technical risk. The continued conformance to IT standards is a key factor in the control phase.
- *IT Project Management Process* - IT standards guide the design, development, testing, and acceptance of IT systems.
- *DOE Procurement Process* - IT standards are used to specify hardware, software, and communications components. They are included in the requests for bids/proposals and are used to evaluate the technical merit of bids/proposals.
- *IT Data Management Process* - IT standards include standards for data interchange and management. These standards impact data transmission, security, and storage requirements.