Chapter 22

Software Configuration Management

Slide Set to accompany

Software Engineering: A Practitioner's Approach, 7/e

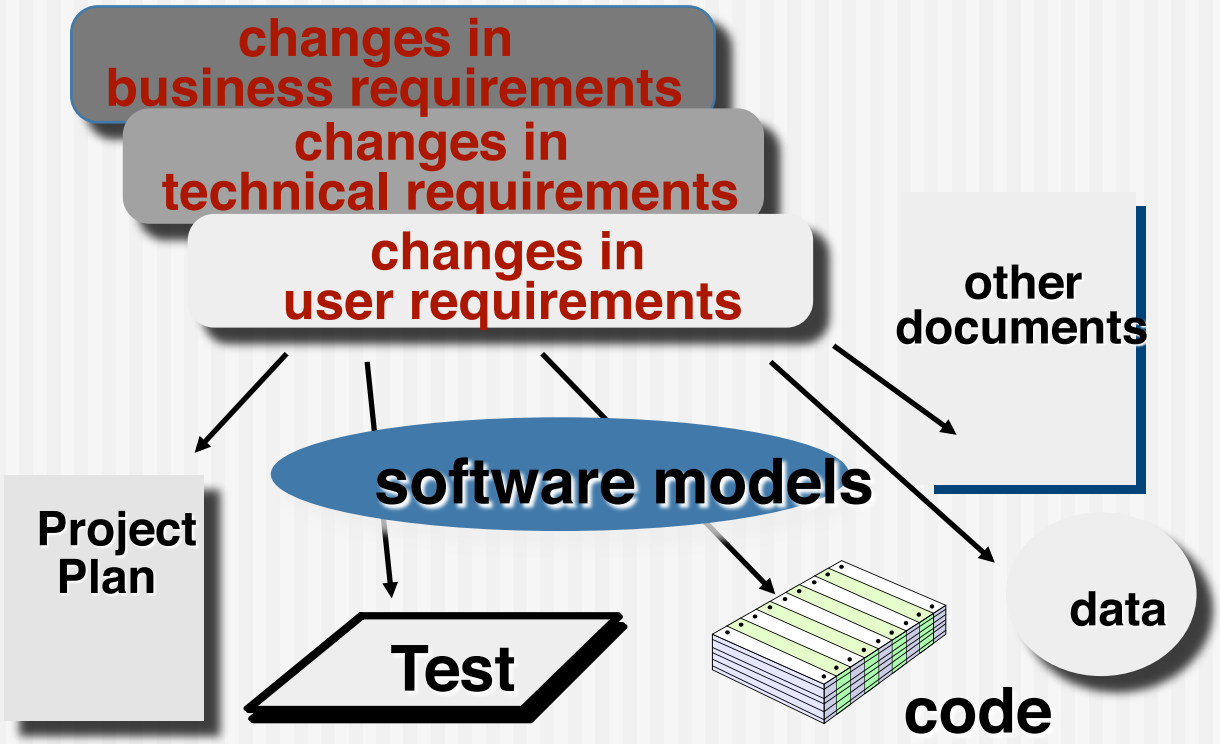
by Roger S. Pressman

The “First Law”

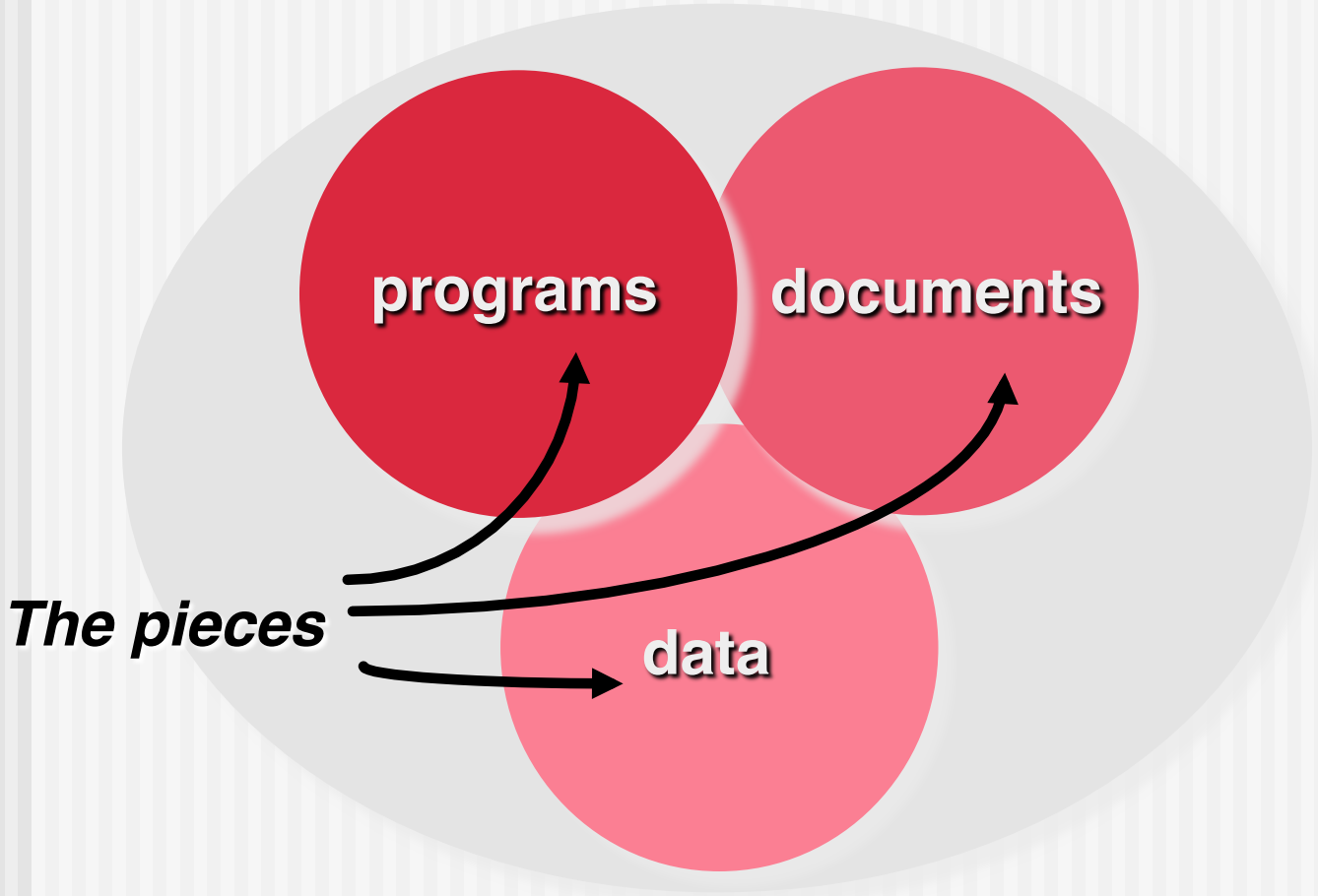
No matter where you are in the system life cycle, the system will change, and the desire to change it will persist throughout the life cycle.

Bersoff, et al, 1980

What Are These Changes?



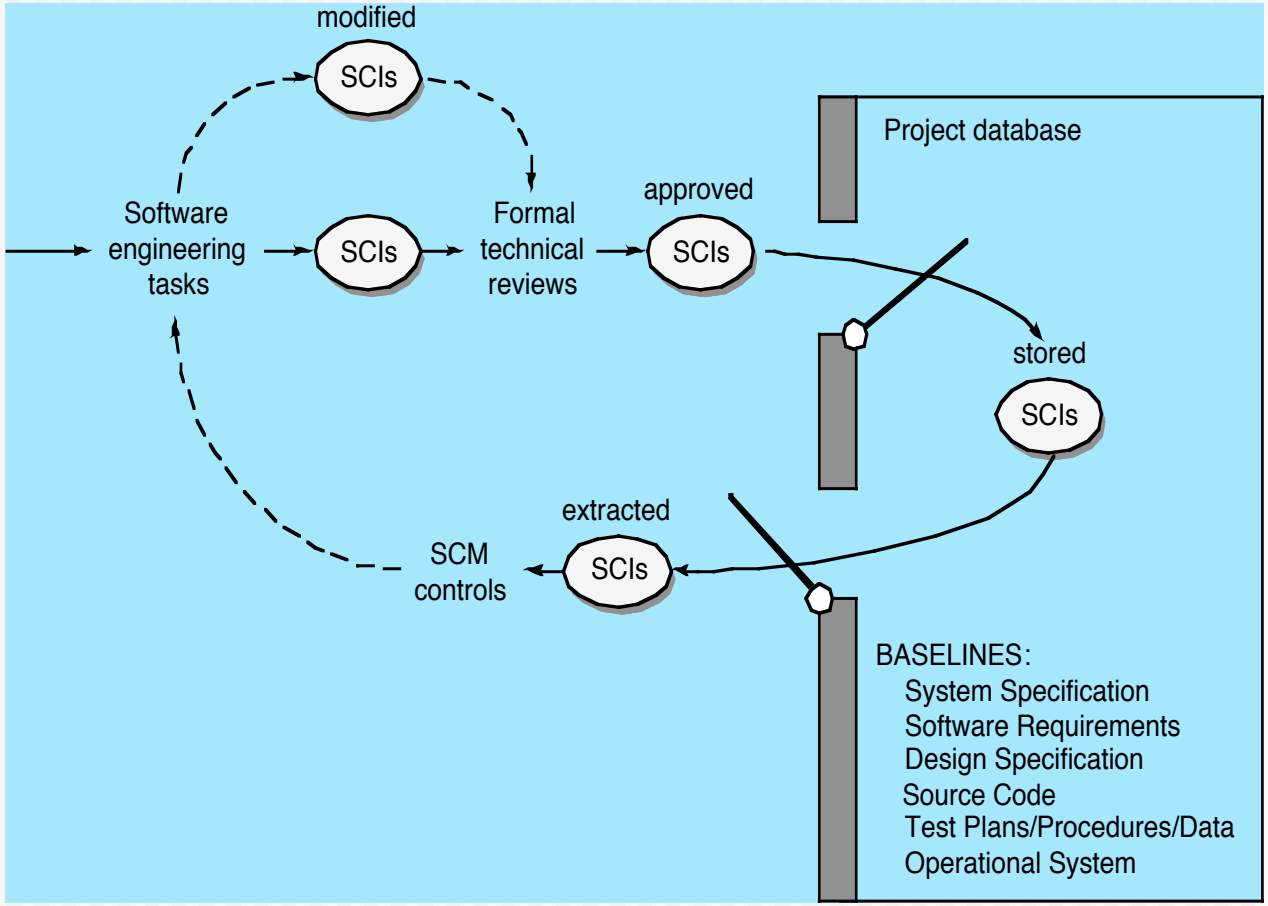
The Software Configuration



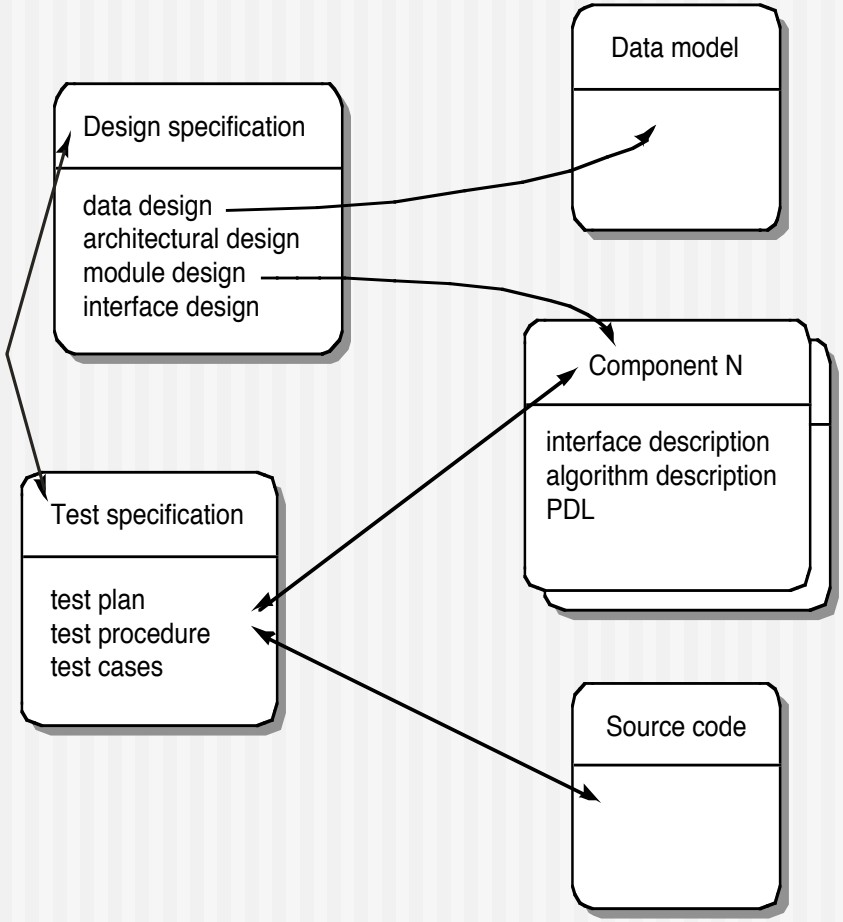
Baselines

- The IEEE (IEEE Std. No. 610.12-1990) defines a baseline as:
  - A specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures.
- a baseline is a milestone in the development of software that is marked by the delivery of one or more software configuration items and the approval of these SCIs that is obtained through a formal technical review

Baselines



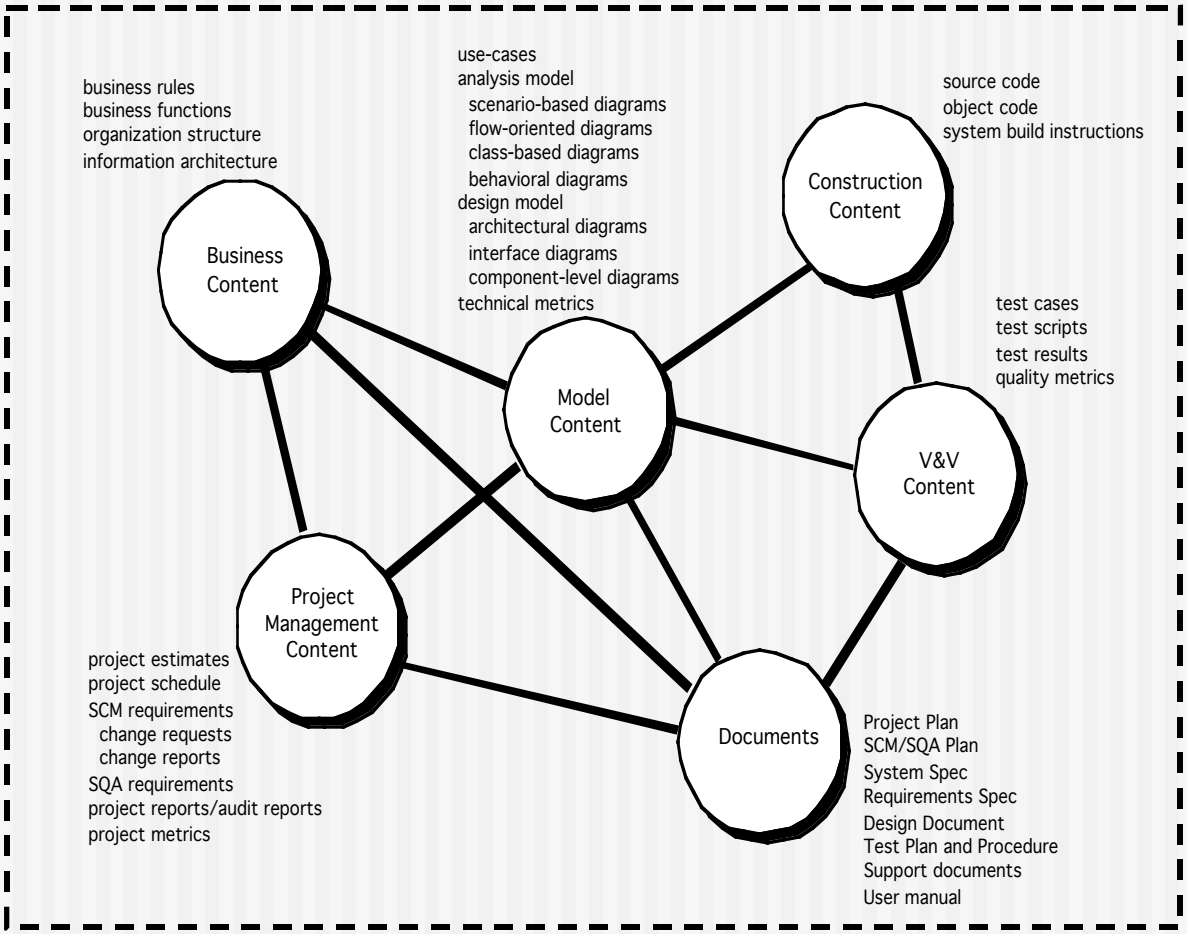
Software Configuration Objects



SCM Repository

- The SCM repository is the set of mechanisms and data structures that allow a software team to manage change in an effective manner
- The repository performs or precipitates the following functions [For89]:
  - Data integrity
  - Information sharing
  - Tool integration
  - Data integration
  - Methodology enforcement
  - Document standardization

Repository Content



Repository Features

- **Versioning.**
  - saves all of these versions to enable effective management of product releases and to permit developers to go back to previous versions
- **Dependency tracking and change management.**
  - The repository manages a wide variety of relationships among the data elements stored in it.
- **Requirements tracing.**
  - Provides the ability to track all the design and construction components and deliverables that result from a specific requirement specification
- **Configuration management.**
  - Keeps track of a series of configurations representing specific project milestones or production releases. Version management provides the needed versions, and link management keeps track of interdependencies.
- **Audit trails.**
  - establishes additional information about when, why, and by whom changes are made.

SCM Elements

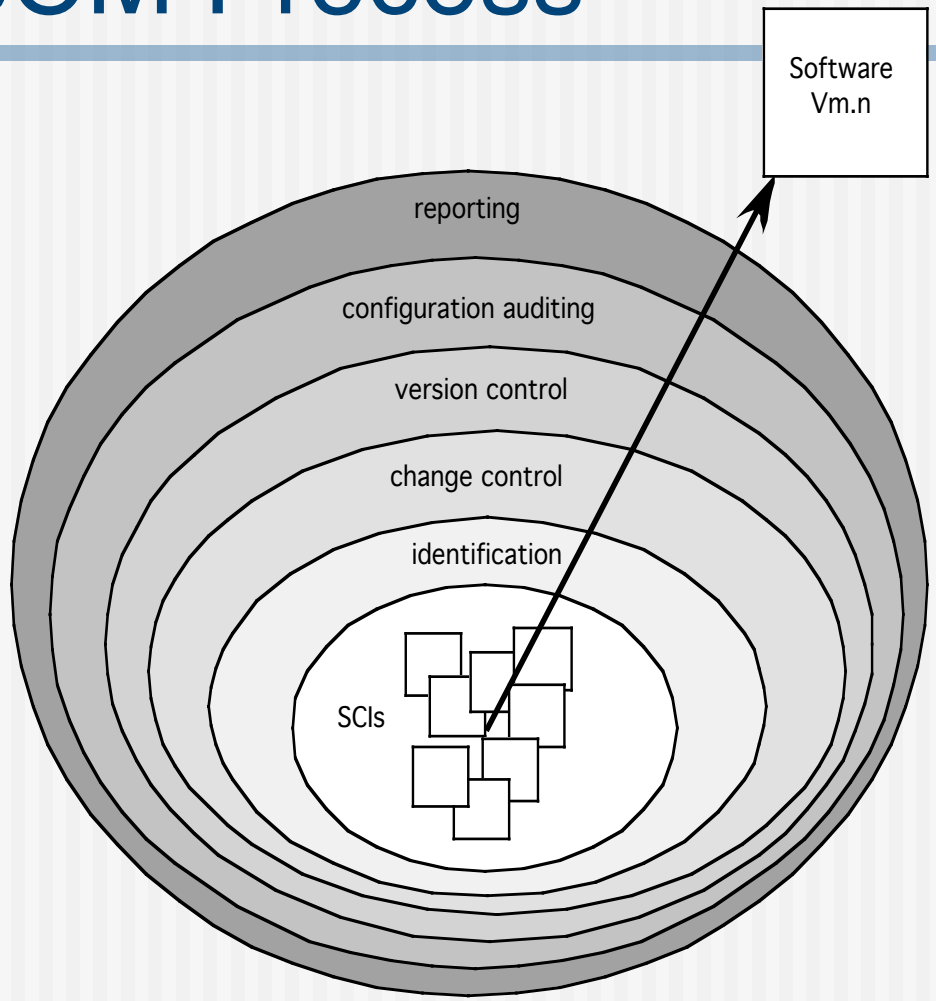
- *Component elements*—a set of tools coupled within a file management system (e.g., a database) that enables access to and management of each software configuration item.
- *Process elements*—a collection of procedures and tasks that define an effective approach to change management (and related activities) for all constituencies involved in the management, engineering and use of computer software.
- *Construction elements*—a set of tools that automate the construction of software by ensuring that the proper set of validated components (i.e., the correct version) have been assembled.
- *Human elements*—to implement effective SCM, the software team uses a set of tools and process features (encompassing other CM elements)

The SCM Process

Addresses the following questions …

- How does a software team identify the discrete elements of a software configuration?
- How does an organization manage the many existing versions of a program (and its documentation) in a manner that will enable change to be accommodated efficiently?
- How does an organization control changes before and after software is released to a customer?
- Who has responsibility for approving and ranking changes?
- How can we ensure that changes have been made properly?
- What mechanism is used to appraise others of changes that are made?

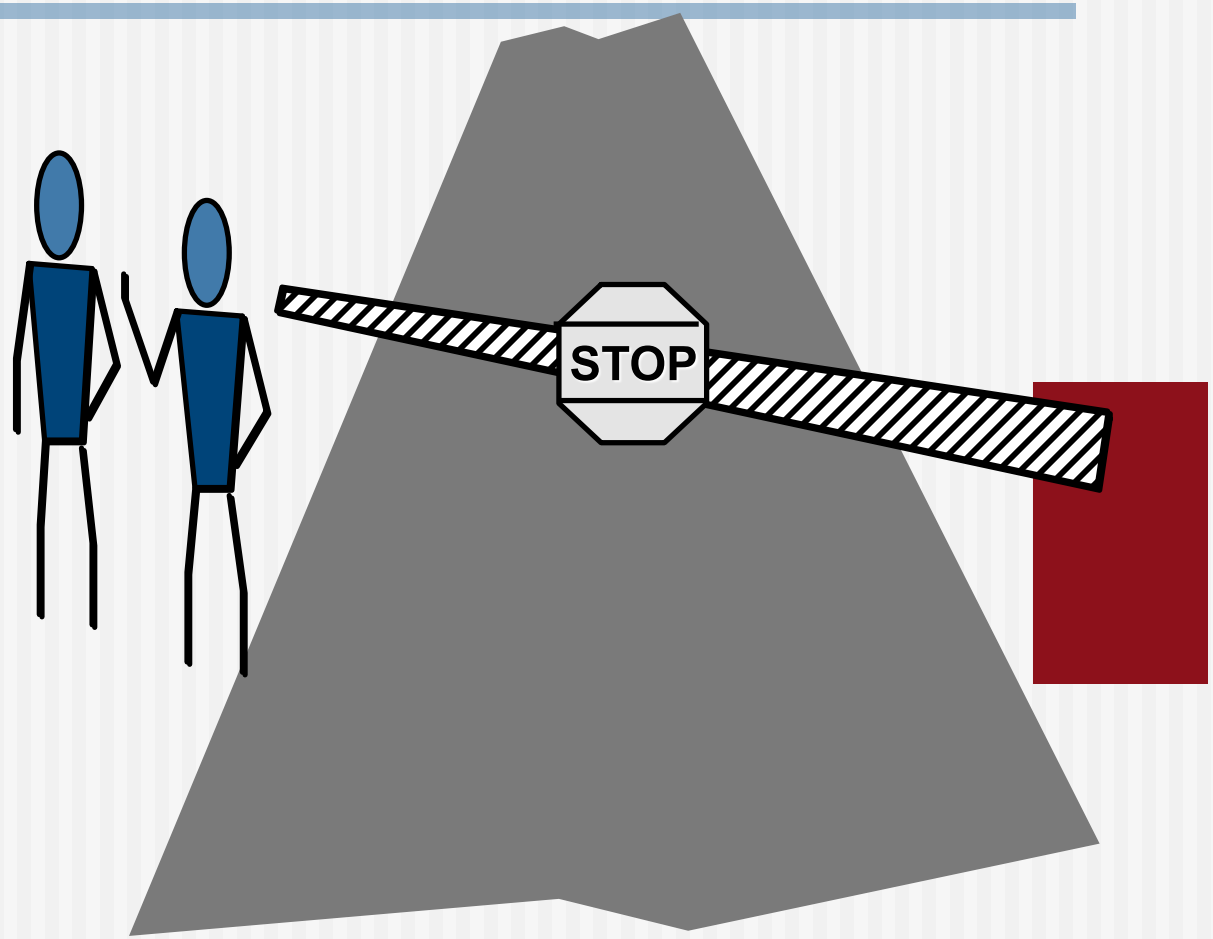
The SCM Process



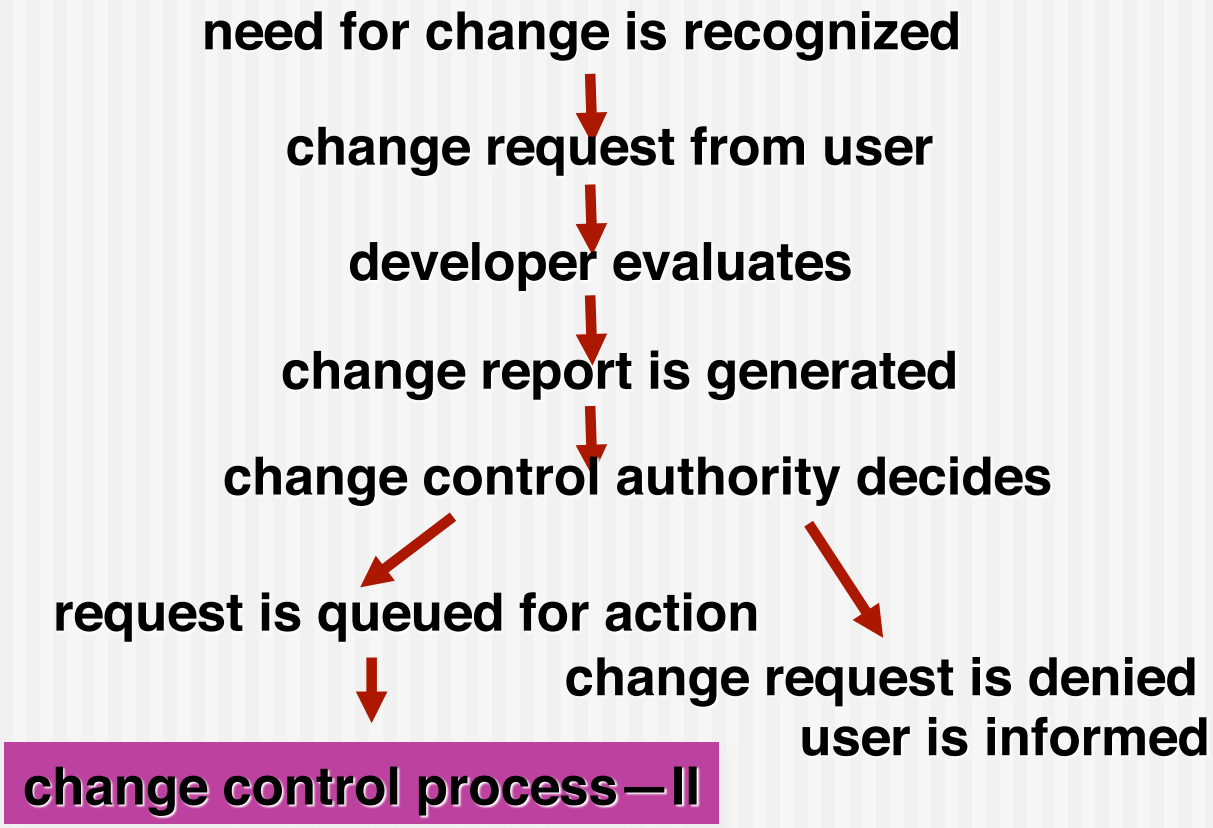
Version Control

- Version control combines procedures and tools to manage different versions of configuration objects that are created during the software process
- A version control system implements or is directly integrated with four major capabilities:
  - a *project database (repository)* that stores all relevant configuration objects
  - a *version management* capability that stores all versions of a configuration object (or enables any version to be constructed using differences from past versions);
  - a *make facility* that enables the software engineer to collect all relevant configuration objects and construct a specific version of the software.
  - an *issues tracking* (also called *bug tracking*) capability that enables the team to record and track the status of all outstanding issues associated with each configuration object.

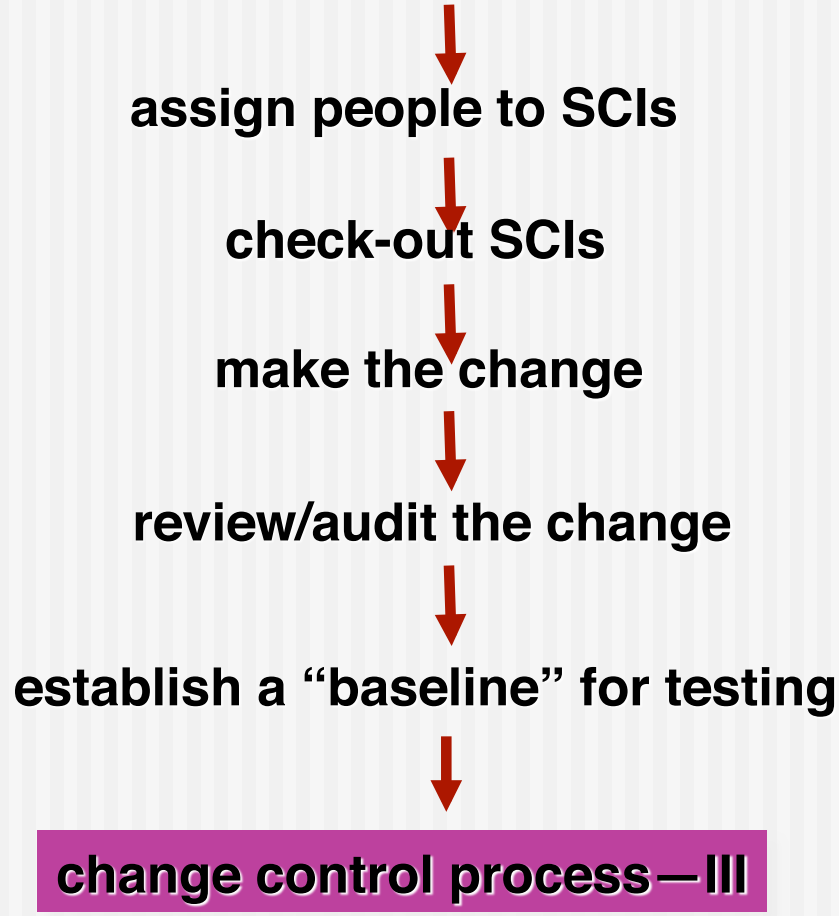
Change Control



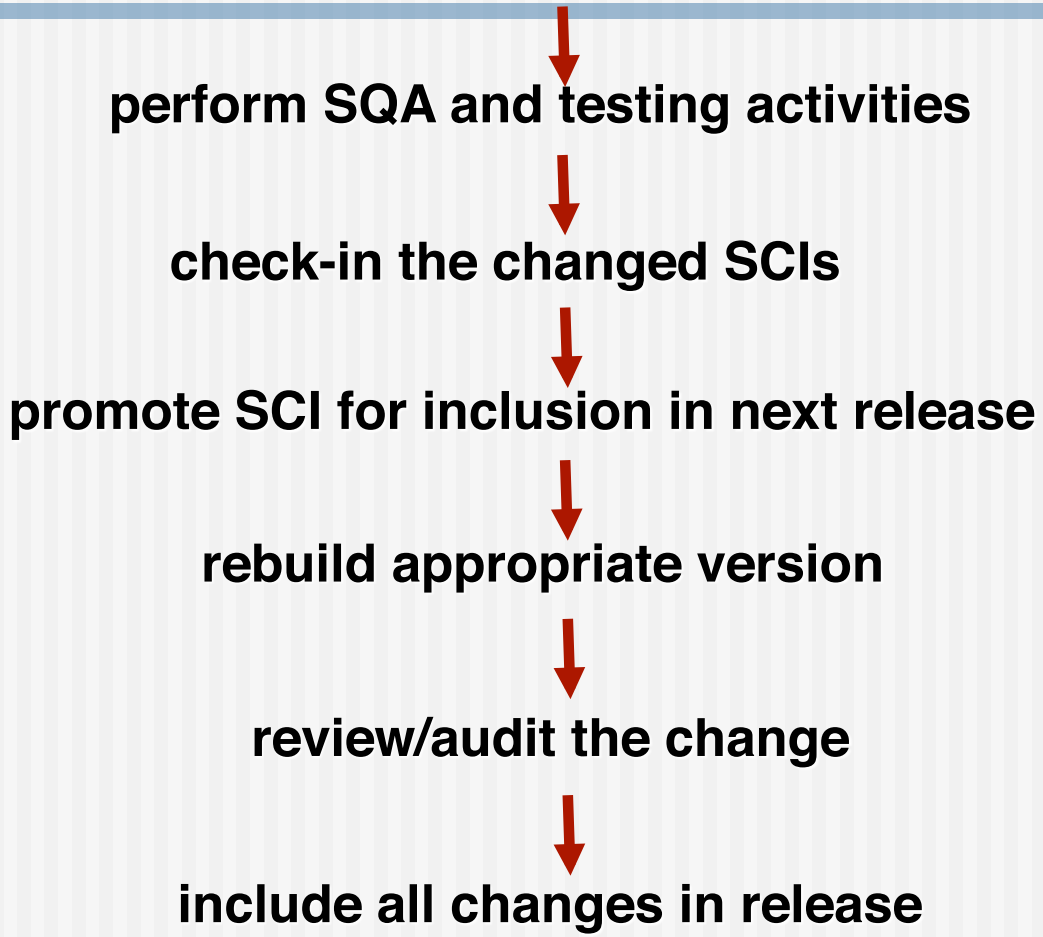
Change Control Process—I



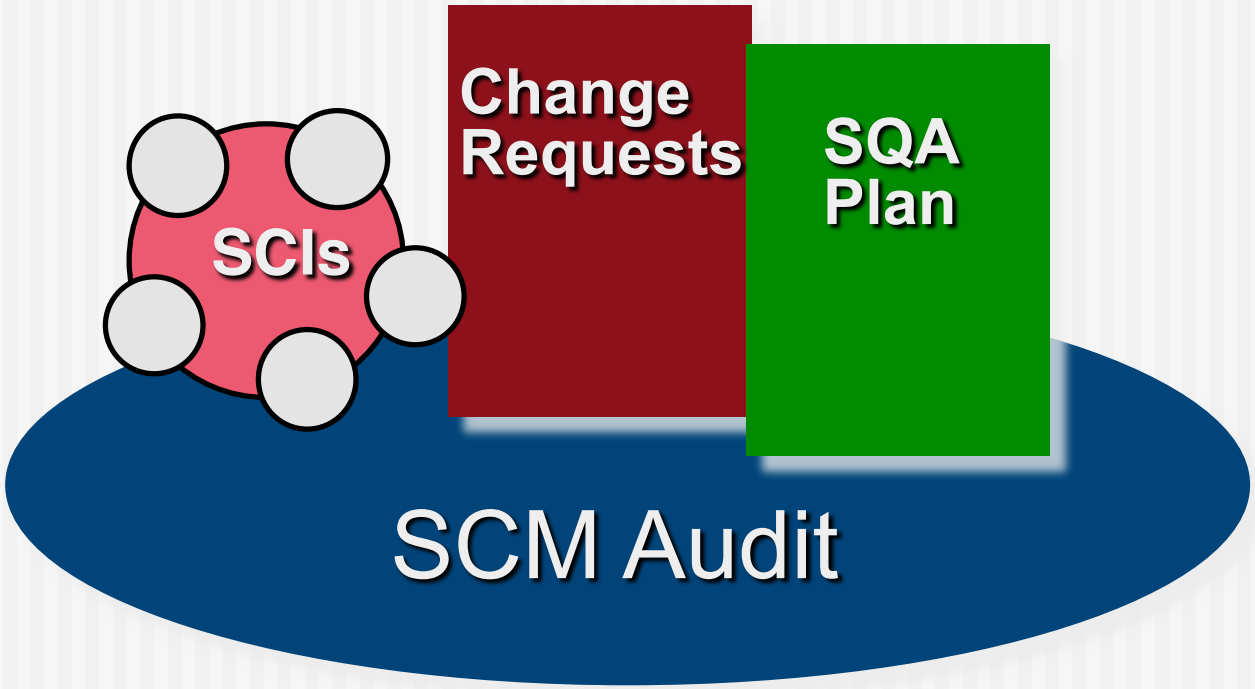
Change Control Process-II



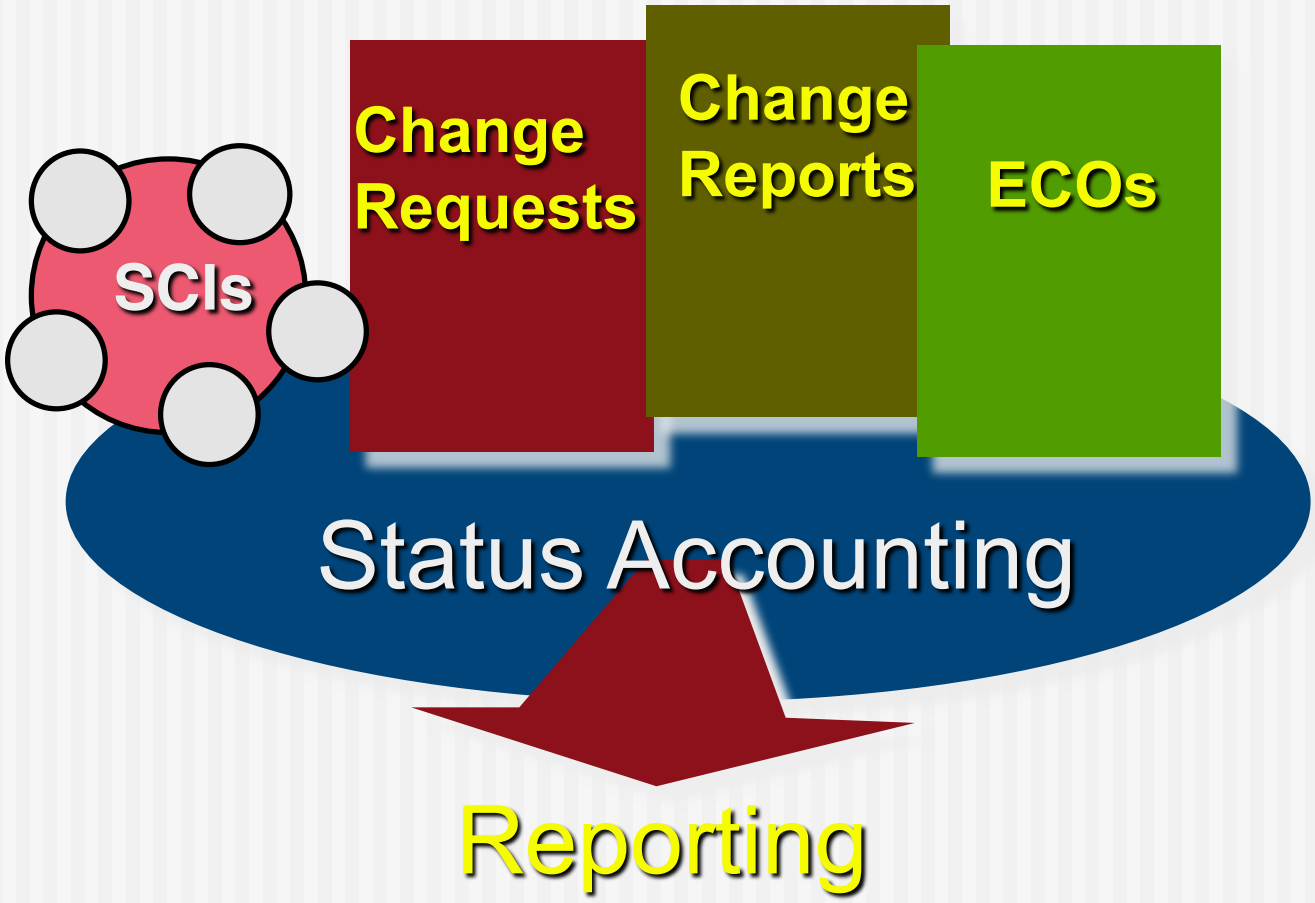
Change Control Process-III



Auditing



Status Accounting



SCM for Web Engineering-I

- **Content.**
  - A typical WebApp contains a vast array of content—text, graphics, applets, scripts, audio/video files, forms, active page elements, tables, streaming data, and many others.
  - The challenge is to organize this sea of content into a rational set of configuration objects (Section 27.1.4) and then establish appropriate configuration control mechanisms for these objects.
- **People.**
  - Because a significant percentage of WebApp development continues to be conducted in an ad hoc manner, any person involved in the WebApp can (and often does) create content.

SCM for Web Engineering-II

- **Scalability.**
  - As size and complexity grow, small changes can have far-reaching and unintended affects that can be problematic. Therefore, the rigor of configuration control mechanisms should be directly proportional to application scale.
- **Politics.**
  - Who 'owns' a WebApp?
  - Who assumes responsibility for the accuracy of the information on the Web site?
  - Who assures that quality control processes have been followed before information is published to the site?
  - Who is responsible for making changes?
  - Who assumes the cost of change?

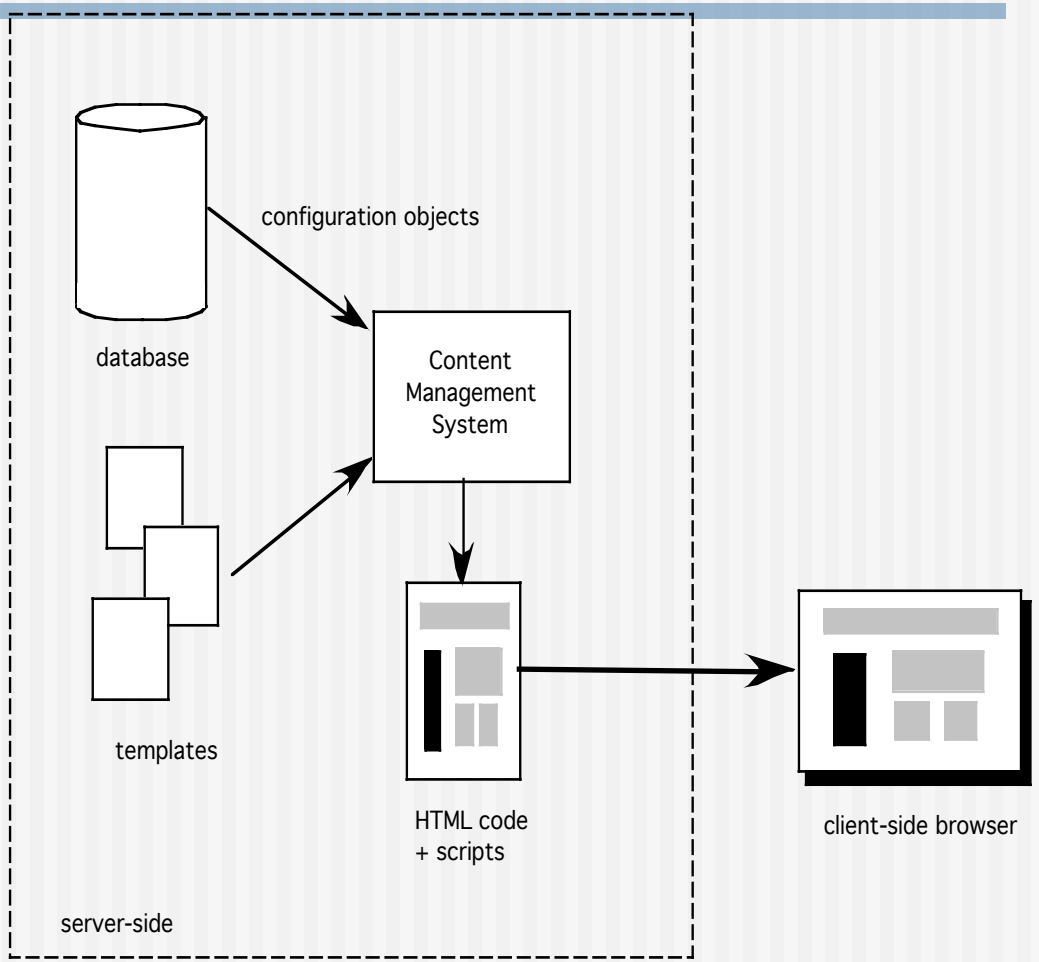
Content Management-I

- **The collection subsystem** encompasses all actions required to create and/or acquire content, and the technical functions that are necessary to
  - convert content into a form that can be represented by a mark-up language (e.g., HTML, XML
  - organize content into packets that can be displayed effectively on the client-side.
- **The management subsystem** implements a repository that encompasses the following elements:
  - *Content database*—the information structure that has been established to store all content objects
  - *Database capabilities*—functions that enable the CMS to search for specific content objects (or categories of objects), store and retrieve objects, and manage the file structure that has been established for the content
  - *Configuration management functions*—the functional elements and associated workflow that support content object identification, version control, change management, change auditing, and reporting.

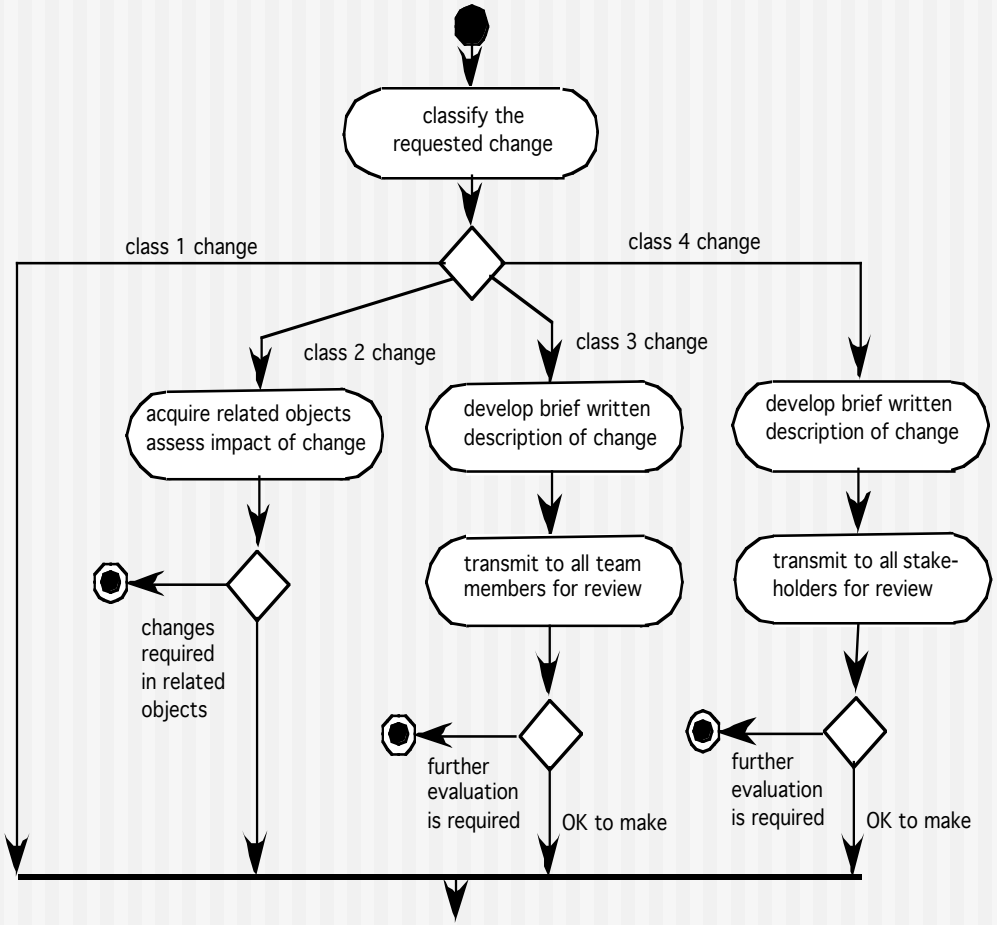
Content Management-II

- The **publishing subsystem** extracts from the repository, converts it to a form that is amenable to publication, and formats it so that it can be transmitted to client-side browsers. The publishing subsystem accomplishes these tasks using a series of templates.
- Each *template* is a function that builds a publication using one of three different components [BOI02]:
  - *Static elements*—text, graphics, media, and scripts that require no further processing are transmitted directly to the client-side
  - *Publication services*—function calls to specific retrieval and formatting services that personalize content (using predefined rules), perform data conversion, and build appropriate navigation links.
  - *External services*—provide access to external corporate information infrastructure such as enterprise data or "back-room" applications.

Content Management



Change Management for WebApps-I



Change Management for WebApps-II