Software Configuration Management

Modified from Roger S. Pressman, Software Engineering:

A Practitioner's Approach 8th Edition, McGraw Hill, 2014

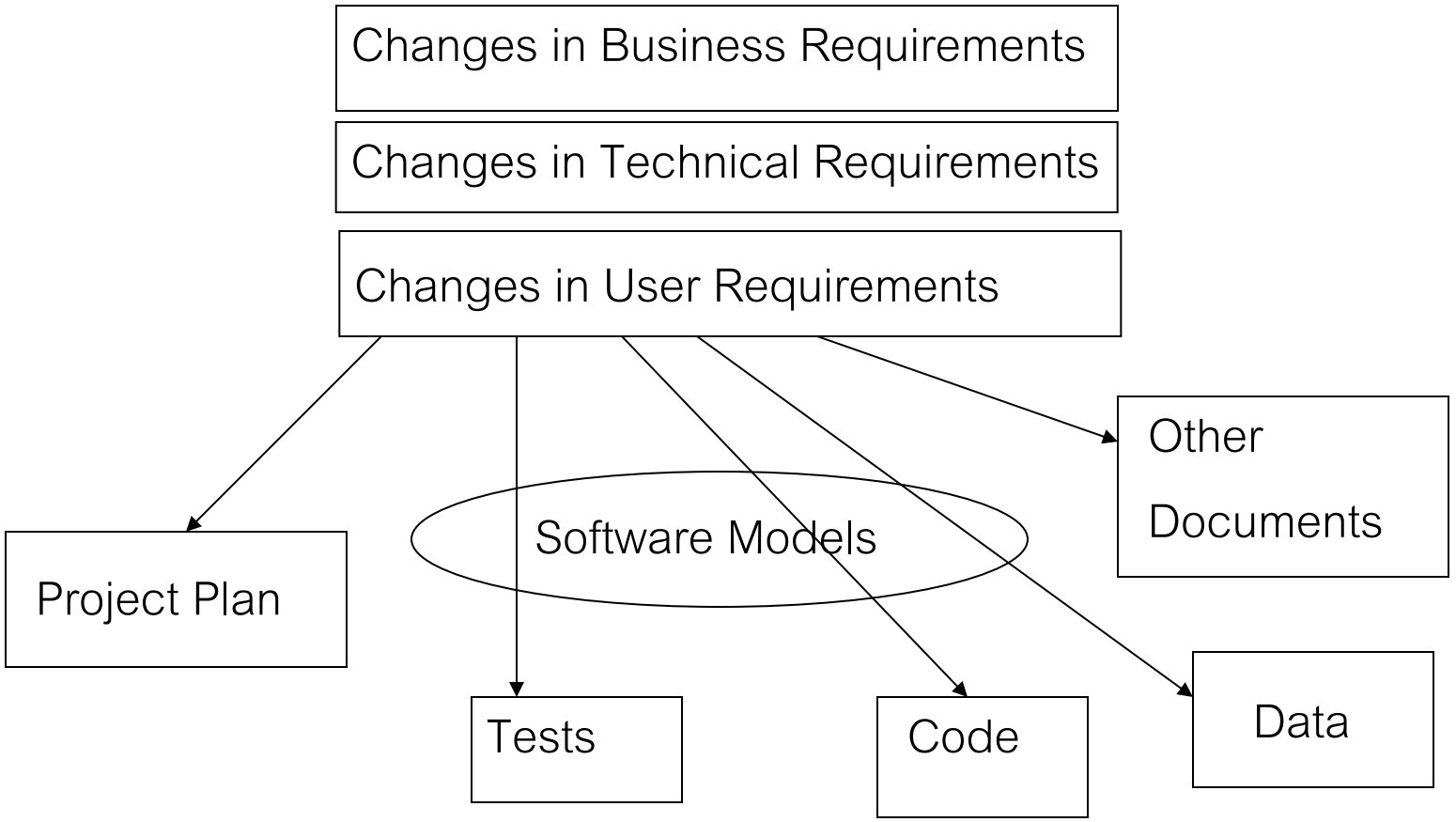
Software Configuration Management

- **Software configuration management (SCM)** is a set of activities that have been developed to manage change throughout the life cycle of computer software.
- The First Law [Bersoff, et al. 1980]
  - "No matter how you are in the system lifecycle, the system will **change**, and the desire to **change** it will persist throughout the life cycle"

What is the origin of changes?

- New business or market conditions dictate changes in product requirements or business rules.
- New stakeholder needs demand modification.
- Reorganization or business growth/downsizing causes changes in project priorities or team structure.
- Budgetary or scheduling constraints cause a redefinition of the system or product.

What can be Changed?



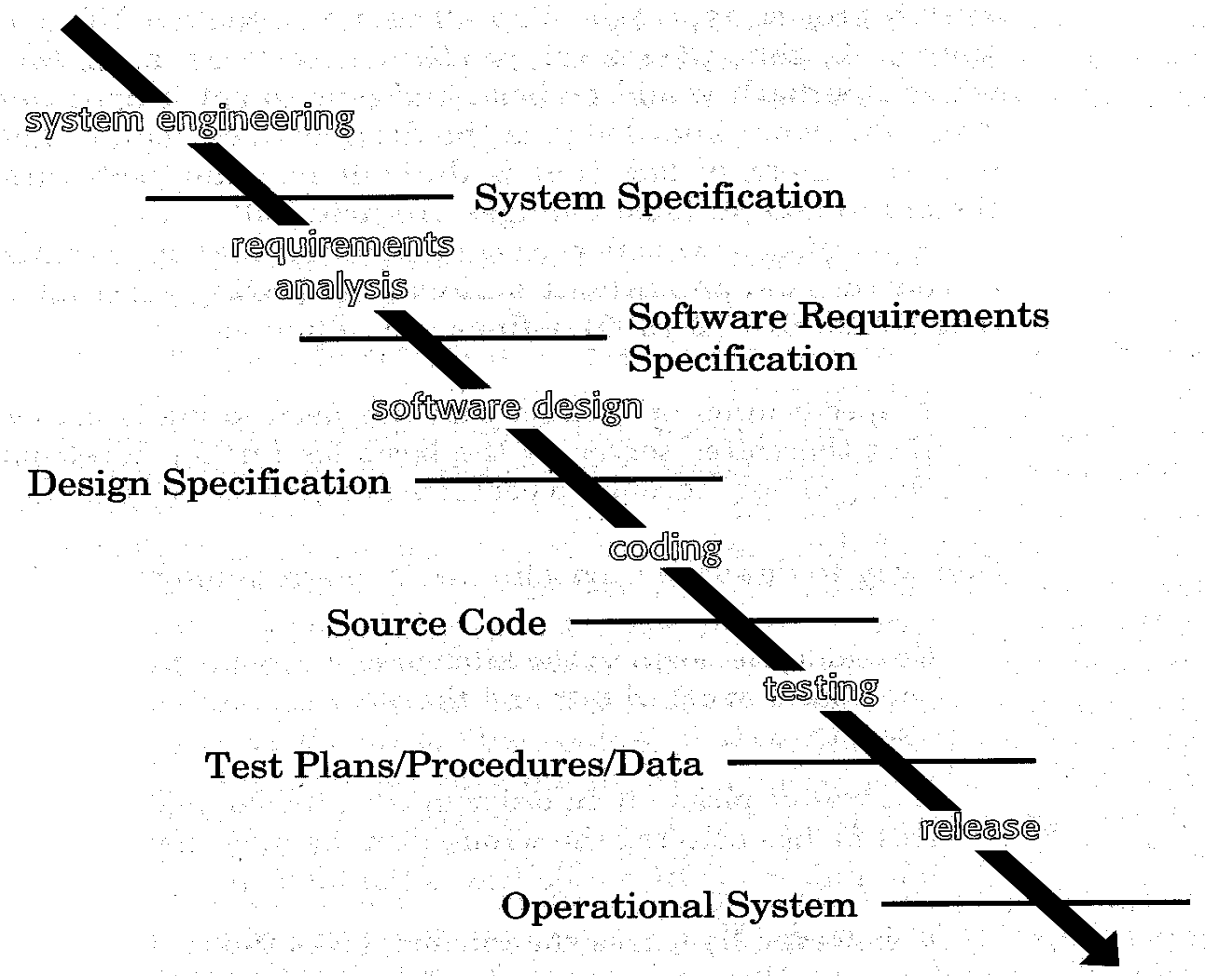
Software Configuration Items

- Software Configuration Items (SCIs) refer to the output of the software process.
- SCIs may be divided into three board categories:
    1. Computer programs (both source code and executable forms)
    2. Work products (a tangible artifact used during a software development project; for example, a requirements specifications or class model diagram.)
    3. Data or content (contained within the program or external to it)

Examples of SCIs

- Project plan
- Requirements specification
- Design specification: data design, architectural design, module design, interface design descriptions
- Source code
- Test specification: test plan and test procedure, test cases and recorded results, operation and user manual
- Data and content

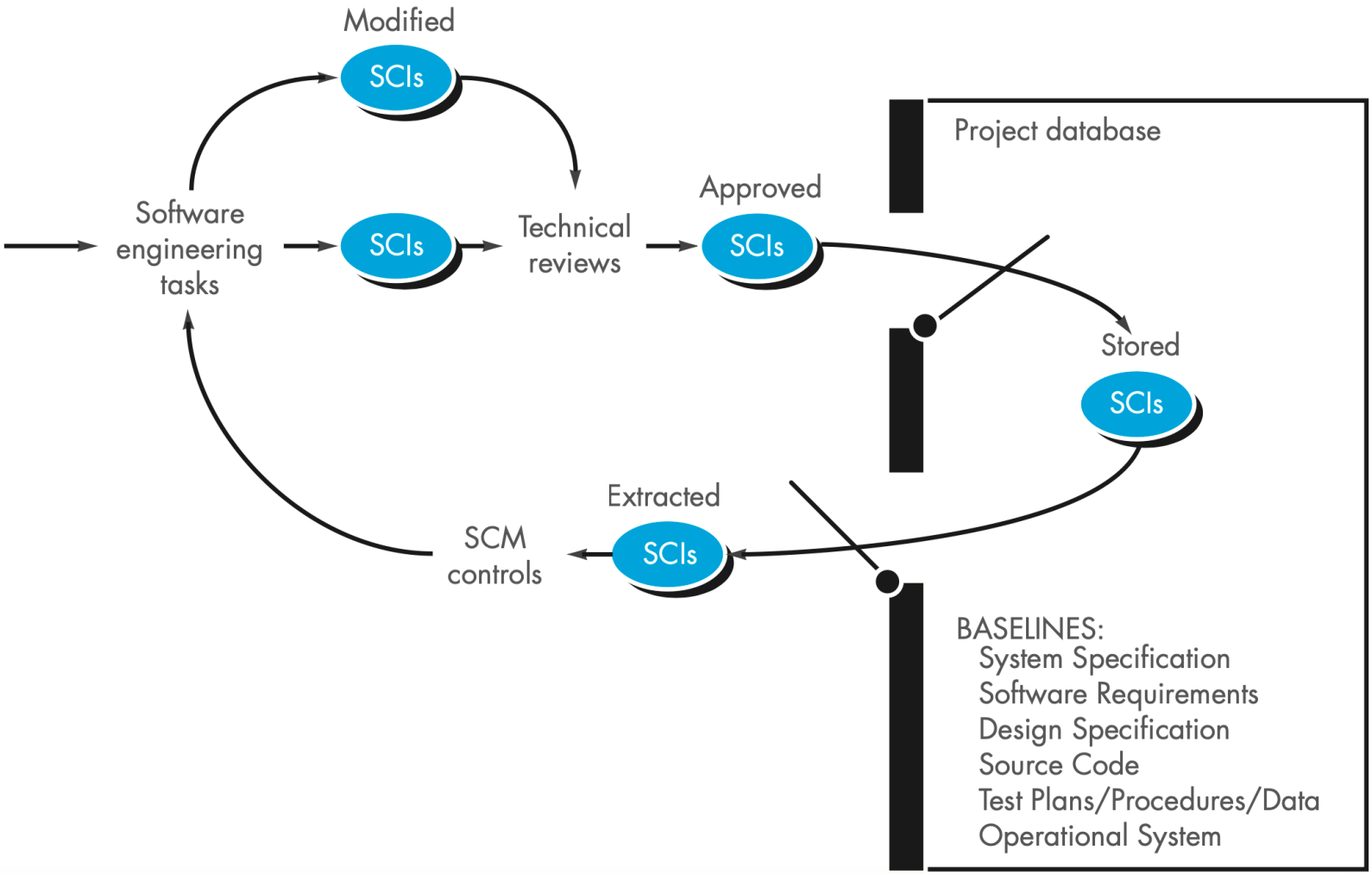
SCIs in Software Development Process



Baselines

- The IEEE (IEEE Std. No. 610.12-1990) defines a **baseline** as:
  - "a specification 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"
- Before a software configuration item becomes a baseline, change may be made quickly and informally.
- However, once a baseline is established, changes can be made, but a Formal Technical Review (FTR) must be applied to evaluate and verify each change.

Baselined SCIs and the project database



The SCM Process

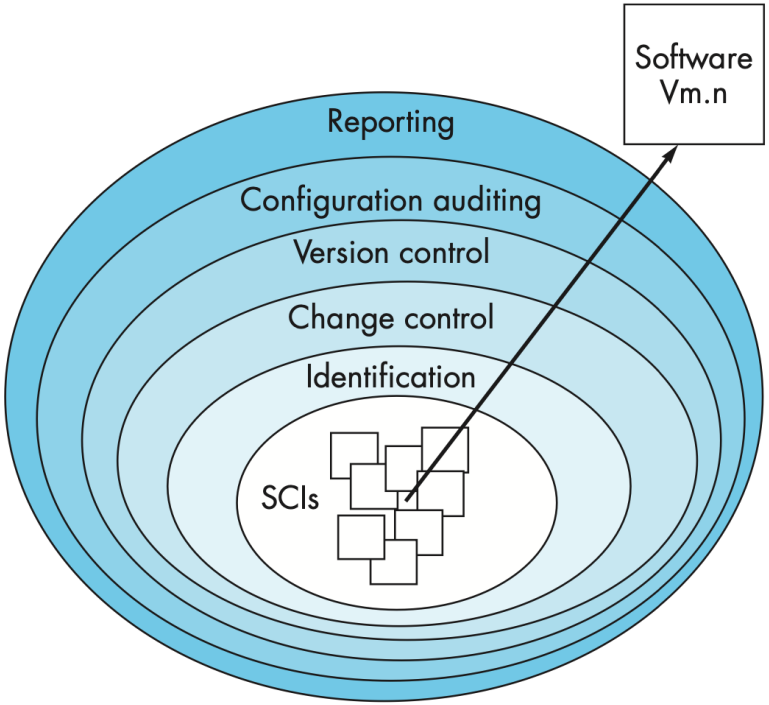
- The software configuration management process defines a series of tasks that have four primary objectives:
  1. to identify all items that collectively define the software configuration.
  2. to manage changes to one or more of these items.
  3. to facilitate the construction of different versions of an application.
  4. to ensure that software quality is maintained as the configuration evolves over time.

SCM Questions

- How do we manage requests for change?
- What and where are the software components?
- What is the status of each software component?
- How does a change to one component affect others?
- How do we resolve conflicting to changes?
- How do we maintain multiple versions?
- How do we keep the system up to date?

Layers of the SCM process

- The SCM questions (in the previous slide) lead to the definition of five SCM tasks — identification, version control, change control, configuration auditing, and reporting



1. Identification of Objects

Two types of objects can be identified [Cho89]:

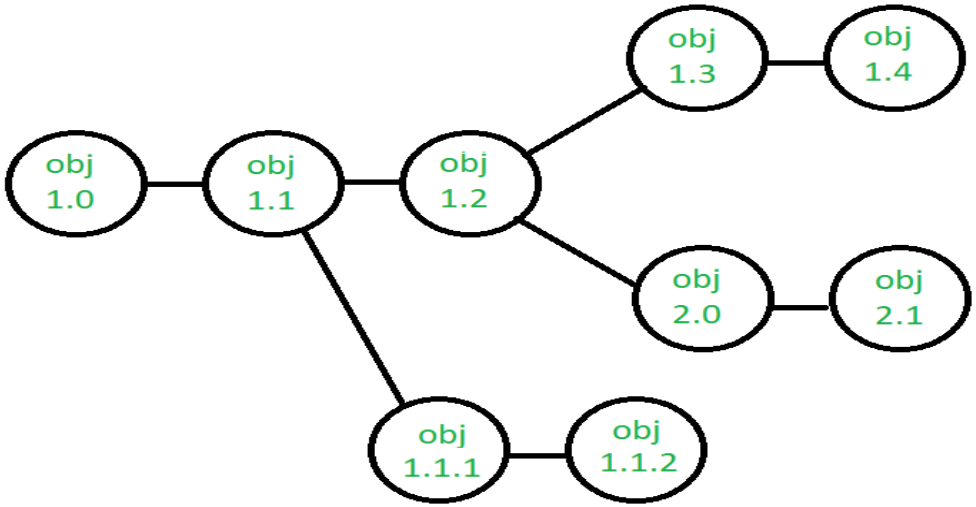
1. Basic objects -- a unit of information that you create during analysis, design, code, or test.
   - For example, a section of a requirements specification, part of a design model, source code for a component, or a suite of test cases that are used to exercise the code.
2. Aggregate objects -- a collection of basic objects and other aggregate objects.
   - For example, a Design Specification.

1. Identification of Objects (cont.)

- Each object has a set of distinct features that identify it uniquely:
  - The object name -- a character string that identifies the object unambiguously.
  - The object description -- a list of data items that identify the SCI type (e.g., model element, program, data) represented by the object, a project identifier, and change and/or version information.
  - Resources -- “entities that are provided, processed, referenced or otherwise required by the object” [Cho89].
  - The realization -- a pointer to the “unit of text” for a basic object and null for an aggregate object.

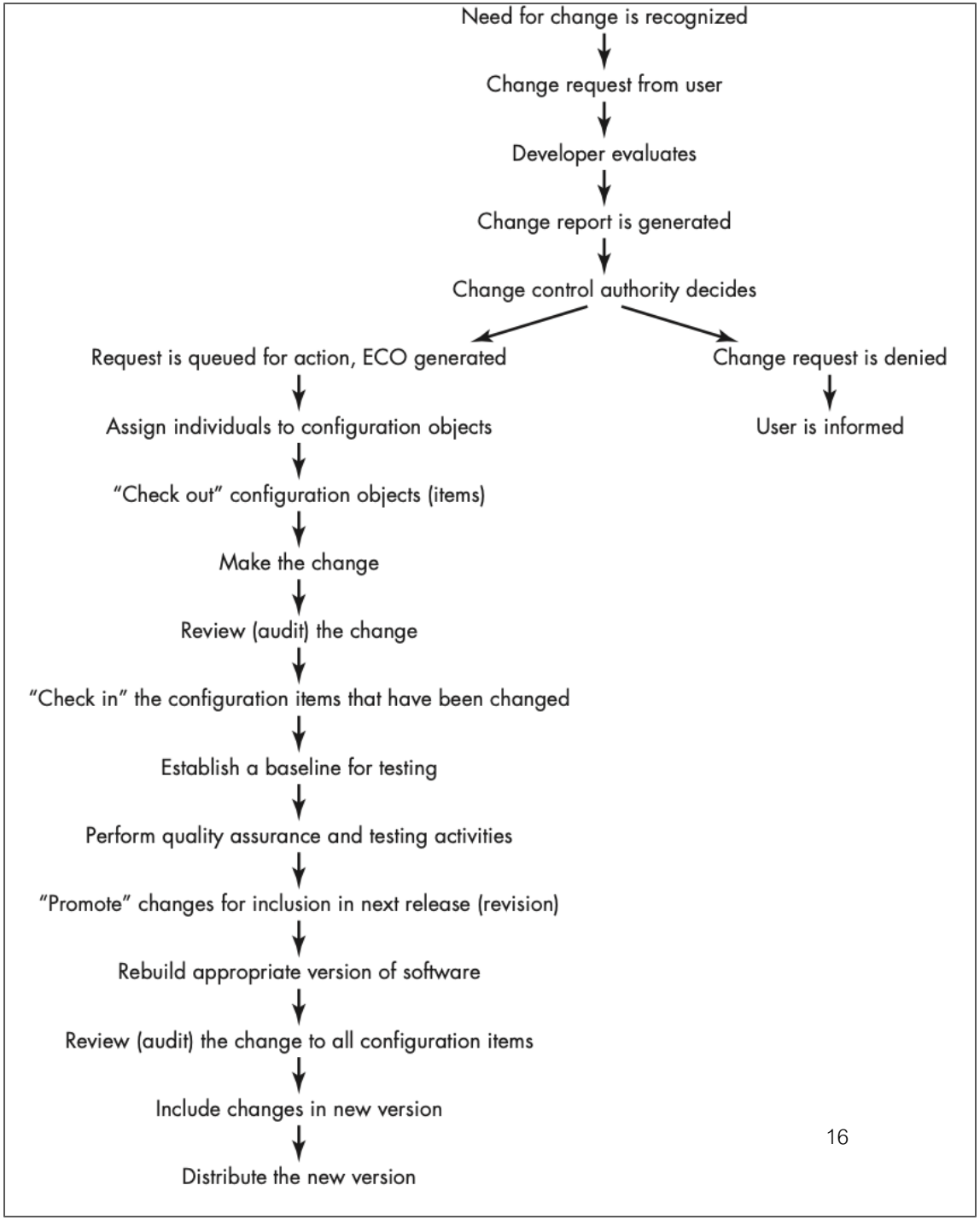
2. Version Control

- **Version control** combines procedures and tools to manage different versions of configuration objects.
- An **evolution graph** for any object may created to show the change history of the object.



3. Change Control

- **Change control** combines human procedures and automated tools to provide a mechanism for the control of change.
- The **change control process** is illustrated >>



4. Configuration Audit

- How can a software team ensure that the change has been properly implemented? -- The answer is twofold:
  (1) the formal technical review (FTR)
  (2) the software configuration audit.
- FTR focuses on the technical correctness of the configuration object that has been modified.
- A **software configuration audit** complements the technical review by assessing a configuration object for characteristics that are generally not considered during review.

4. Configuration Audit (cont.)

- The audit asks and answers the following questions:
  - Complements the Formal Technical Review by assessing a configuration object that are not considered during review
  - Has the change been made, highlighted?
  - Has a reviewed been conducted?
  - Has the software process or standard been followed
  - Have the change date and change author been specified?
  - Have the SCM procedures for noting the change, recording it, and reporting it been followed?
  - Have all related SCIs been properly updated?

5. Configuration Status Reporting (CSR)

- Configuration status reporting is an SCM task that answers the following questions: (1) What happened? (2) Who did it? (3) When did it happen? (4) What else will be affected?
- A CSR entry is made when
  - An SCI is assigned new or updated identification
  - A change is approved
  - A configuration audit is conducted
- Output from CSR may be placed in an online database