Software Configuration Management and Software Process Modelling

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5.2.47
Information Systems
March 31, 2007

Learning Goal

To be able to apply CM concepts

- Configuration Management
- CM Plan
- Change Management
- CM Item identification
- Builds management

To be able to apply software process modelling concepts

- Software process as a program
- Software process modelling technique

Configuration management

New versions of software systems are created as they change:

- For different machines/OS;
- Offering different functionality;
- Tailored for particular user requirements.

Configuration management is concerned with managing evolving software systems:

- System change is a team activity;
- CM aims to control the costs and effort involved in making changes to a system.

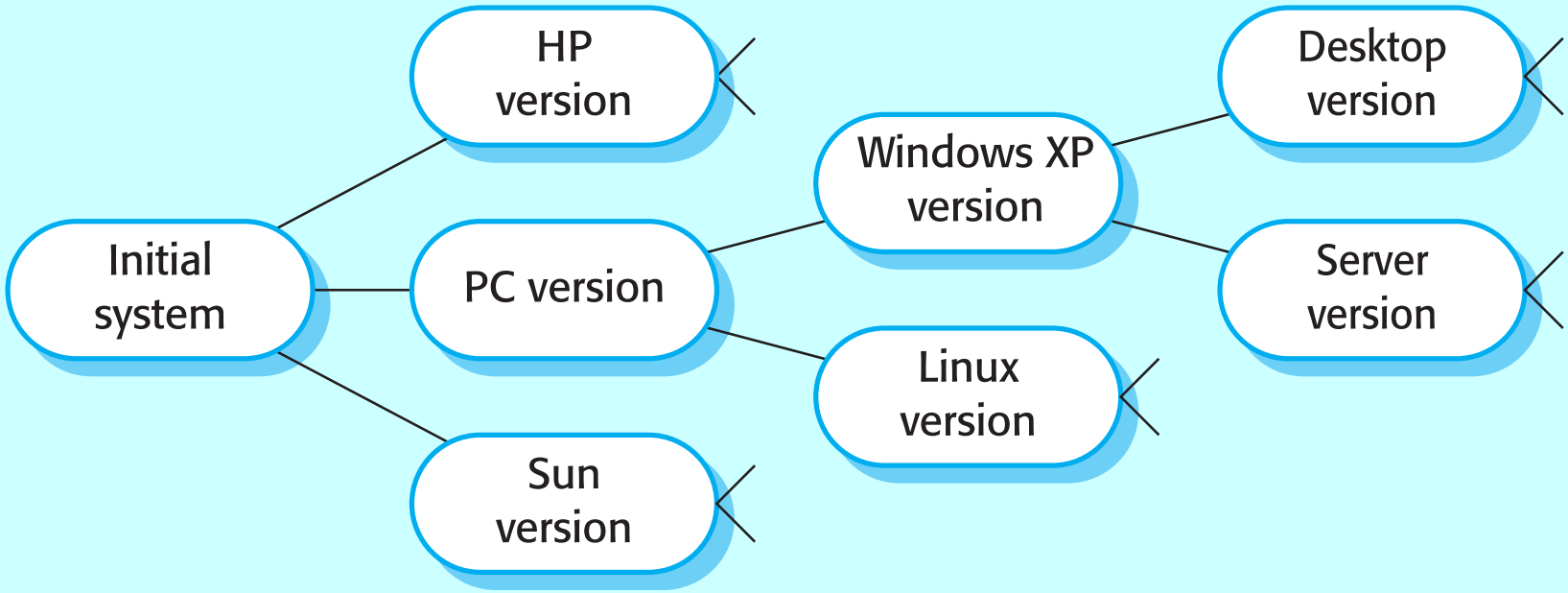
Configuration management

Involves the development and application of procedures and standards to manage an evolving software product.

CM may be seen as part of a more general quality management process.

When released to CM, software systems are sometimes called *baselines* as they are a starting point for further development.

System families



CM Planning

Configuration management planning

All products of the software process may have to be managed:

- Specifications;
- Designs;
- Programs;
- Test data;
- User manuals.

Thousands of separate documents may be generated for a large, complex software system.

Frequent system building

It is easier to find problems that stem from component interactions early in the process.

This encourages thorough unit testing - developers are under pressure not to 'break the build'.

A stringent change management process is required to keep track of problems that have been discovered and repaired.

The CM plan

Defines the types of documents to be managed and a document naming scheme.

Defines who takes responsibility for the CM procedures and creation of baselines.

Defines policies for change control and version management.

Defines the CM records which must be maintained.

The CM plan

Describes the tools which should be used to assist the CM process and any limitations on their use.

Defines the process of tool use.

Defines the CM database used to record configuration information.

May include information such as the CM of external software, process auditing, etc.

Configuration item identification

Large projects typically produce thousands of documents which must be uniquely identified.

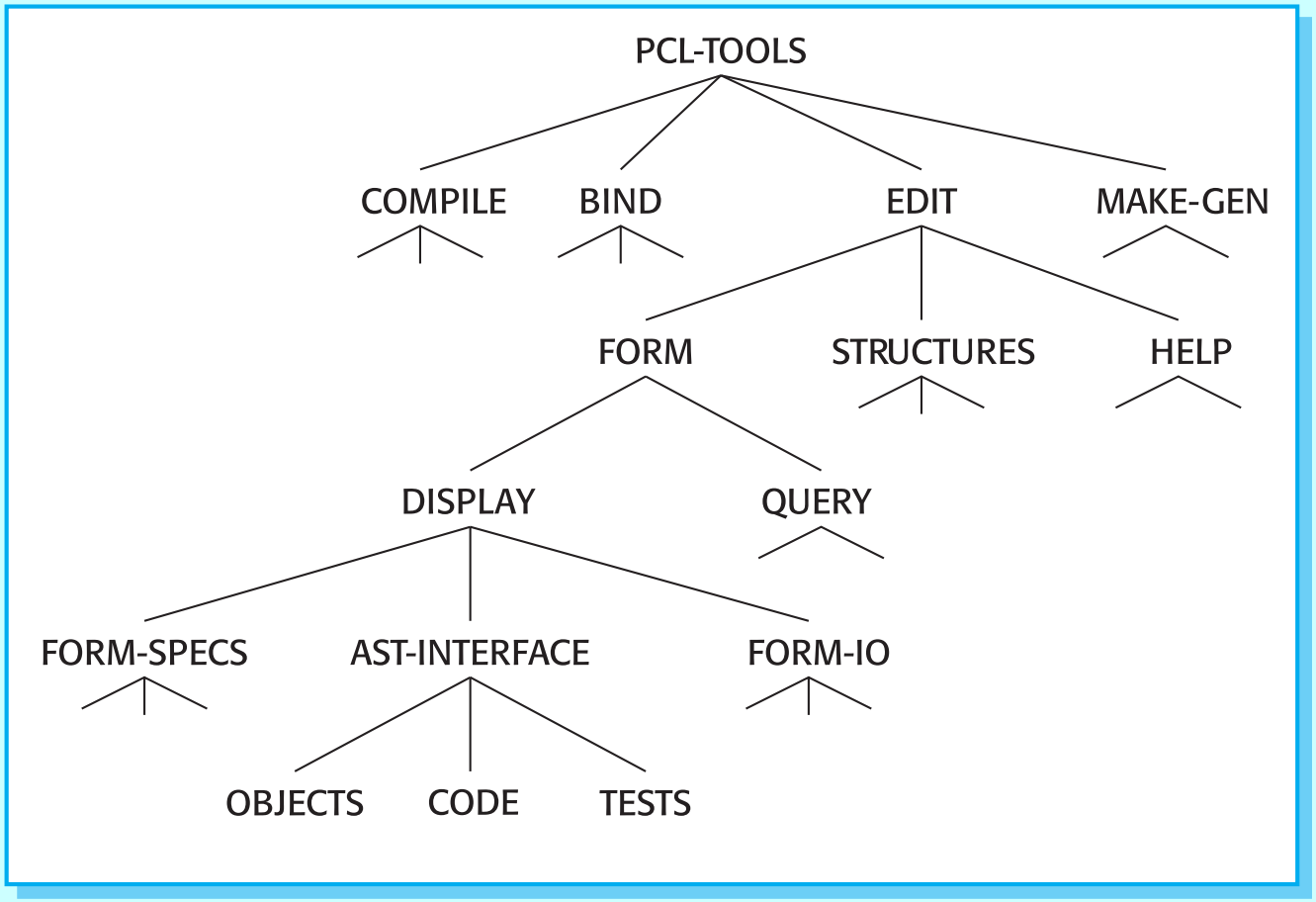
Some of these documents must be maintained for the lifetime of the software.

Document naming scheme should be defined so that related documents have related names.

A hierarchical scheme with multi-level names is probably the most flexible approach.

- PCL-TOOLS/EDIT/FORMS/DISPLAY/AST-INTERFACE/CODE

Configuration hierarchy



The configuration database

All CM information should be maintained in a configuration database.
This should allow queries about configurations to be answered:

- Who has a particular system version?
- What platform is required for a particular version?
- What versions are affected by a change to component X?
- How many reported faults in version T?

The CM database should preferably be linked to the software being managed.

Change Management

Change management

Software systems are subject to continual change requests:

- From users;
- From developers;
- From market forces.

Change management is concerned with keeping track of these changes and ensuring that they are implemented in the most cost-effective way.

Change request form

Change Request Form

Project: Proteus/PCL-Tools **Number:** 23/02
Change requester: I. Sommerville **Date:** 1/12/02
Requested change: When a component is selected from the structure, display the name of the file where it is stored.

Change analyser: G. Dean **Analysis date:** 10/12/02
Components affected: Display-Icon.Select, Display-Icon.Display

Associated components: FileTable

Change assessment: Relatively simple to implement as a file name table is available. Requires the design and implementation of a display field. No changes to associated components are required.

Change priority: Low

Change implementation:
Estimated effort: 0.5 days

Date to CCB: 15/12/02 **CCB decision date:** 1/2/03
CCB decision: Accept change. Change to be implemented in Release 2.1.
Change implementor: **Date of change:**
Date submitted to QA: **QA decision:**
Date submitted to CM:
Comments

Change tracking tools

A major problem in change management is tracking change status.

Change tracking tools keep track the status of each change request and automatically ensure that change requests are sent to the right people at the right time.

Integrated with E-mail systems allowing electronic change request distribution.

Derivation history

This is a record of changes applied to a document or code component.

It should record, in outline, the change made, the rationale for the change, who made the change and when it was implemented.

It may be included as a comment in code. If a standard prologue style is used for the derivation history, tools can process this automatically.

Component header information

```
// BANKSEC project (IST 6087)
//
// BANKSEC-TOOLS/AUTH/RBAC/USER_ROLE
//
// Object: currentRole
// Author: N. Perwaiz
// Creation date: 10th November 2002
//
// © Lancaster University 2002
//
// Modification history
// Version      Modifier     Date          Change        Reason
// 1.0          J. Jones     1/12/2002     Add header    Submitted to CM
// 1.1          N. Perwaiz   9/4/2003      New field     Change req. R07/02
```

Version and release management

Invent an identification scheme for system versions.

Plan when a new system version is to be produced.

Ensure that version management procedures and tools are properly applied.

Plan and distribute new system releases.

Version and Release Management

Versions/variants/releases

Version An instance of a system which is functionally distinct in some way from other system instances.

Variant An instance of a system which is functionally identical but non-functionally distinct from other instances of a system.

Release An instance of a system which is distributed to users outside of the development team.

Version identification

Procedures for version identification should define an unambiguous way of identifying component versions.

There are three basic techniques for component identification

- Version numbering;
- Attribute-based identification;
- Change-oriented identification.

Version numbering

Simple naming scheme uses a linear derivation

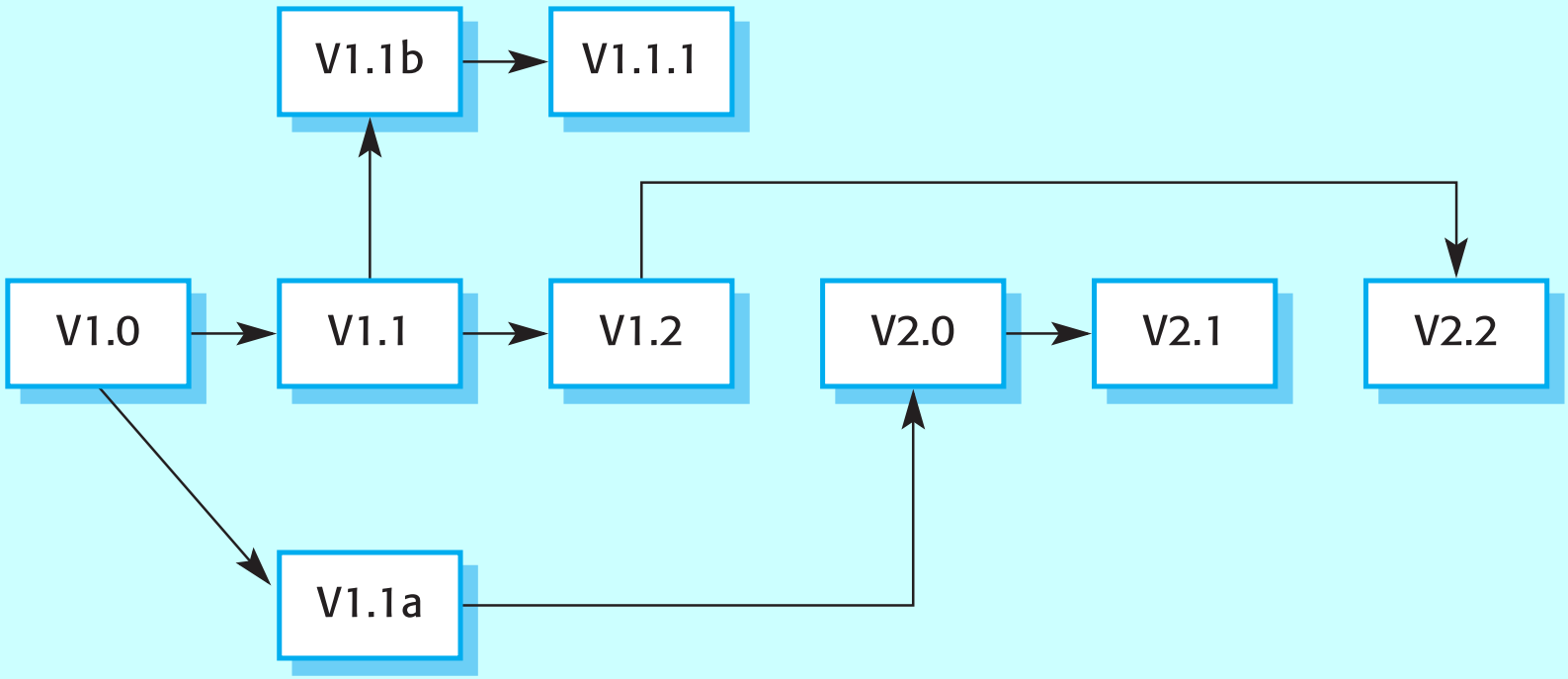
- V1, V1.1, V1.2, V2.1, V2.2 etc.

The actual derivation structure is a tree or a network rather than a sequence.

Names are not meaningful.

A hierarchical naming scheme leads to fewer errors in version identification.

Version derivation structure



Attribute-based identification

Attributes can be associated with a version with the combination of attributes identifying that version

- Examples of attributes are Date, Creator, Programming Language, Customer, Status etc.

This is more flexible than an explicit naming scheme for version retrieval; However, it can cause problems with uniqueness - the set of attributes have to be chosen so that all versions can be uniquely identified.

In practice, a version also needs an associated name for easy reference.

Attribute-based queries

An important advantage of attribute-based identification is that it can support queries so that you can find 'the most recent version in Java' etc.

The query selects a version depending on attribute values

- AC3D (language =Java, platform = XP, date = Jan 2003).

Change-oriented identification

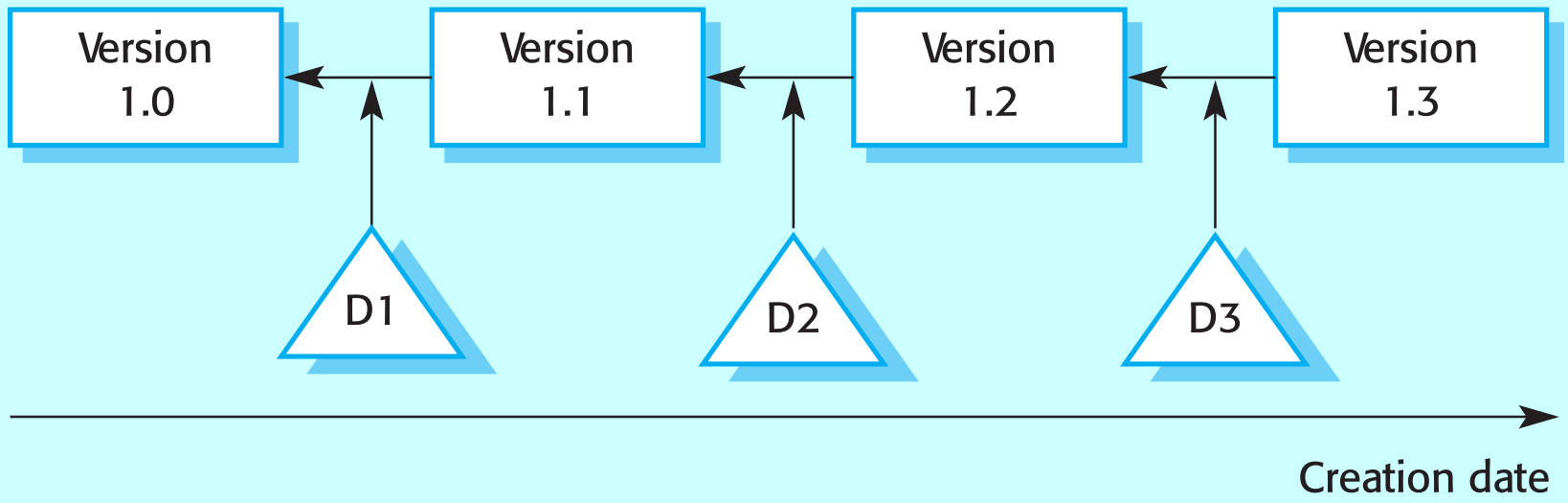
Integrates versions and the changes made to create these versions.

Used for systems rather than components.

Each proposed change has a change set that describes changes made to implement that change.

Change sets are applied in sequence so that, in principle, a version of the system that incorporates an arbitrary set of changes may be created.

Delta-based versioning



Release management

Releases must incorporate changes forced on the system by errors discovered by users and by hardware changes.

They must also incorporate new system functionality.

Release planning is concerned with when to issue a system version as a release.

System releases

Not just a set of executable programs.
May also include:

- Configuration files defining how the release is configured for a particular installation;
- Data files needed for system operation;
- An installation program or shell script to install the system on target hardware;
- Electronic and paper documentation;
- Packaging and associated publicity.

Systems are now normally released on optical disks (CD or DVD) or as downloadable installation files from the web.

Release problems

Customer may not want a new release of the system

- They may be happy with their current system as the new version may provide unwanted functionality.

Release management should not assume that all previous releases have been accepted. All files required for a release should be re-created when a new release is installed.

Release decision making

Preparing and distributing a system release is an expensive process.

Factors such as the technical quality of the system, competition, marketing requirements and customer change requests should all influence the decision of when to issue a new system release.

Release creation

Release creation involves collecting all files and documentation required to create a system release.

Configuration descriptions have to be written for different hardware and installation scripts have to be written.

The specific release must be documented to record exactly what files were used to create it. This allows it to be re-created if necessary.

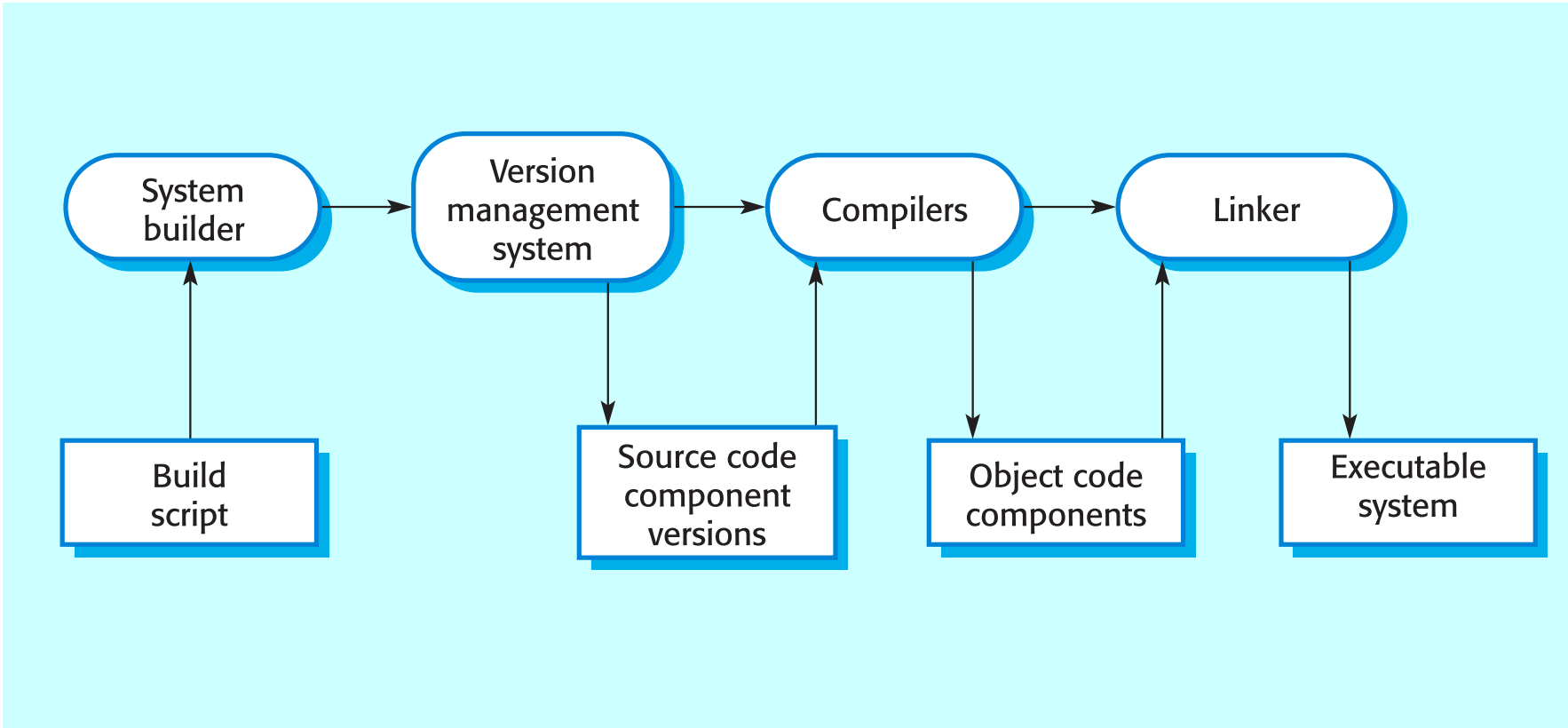
System building

The process of compiling and linking software components into an executable system.

Different systems are built from different combinations of components.

This process is now always supported by automated tools that are driven by ‘build scripts’.

System building



System building

Building a large system is computationally expensive and may take several hours.

Hundreds of files may be involved.

System building tools may provide

- A dependency specification language and interpreter;
- Tool selection and instantiation support;
- Distributed compilation;
- Derived object management.

Component dependencies