Lecture-30

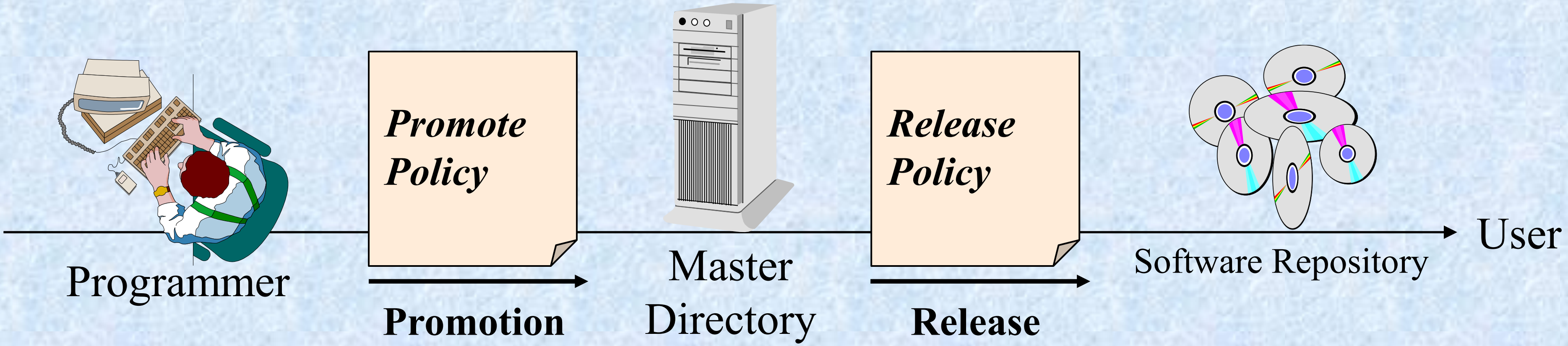
Configuration Management

Change management

- Change management is the handling of change requests
  - **A change request leads to the creation of a new release**
- General change process
  - **The change is requested (this can be done by anyone including users and developers)**
  - **The change request is assessed against project goals**
  - **Following the assessment, the change is accepted or rejected**
  - **If it is accepted, the change is assigned to a developer and implemented**
  - **The implemented change is audited.**
- The complexity of the change management process varies with the project. Small projects can perform change requests informally and fast while complex projects require detailed change request forms and the official approval by one more managers.

Controlling Changes

- Two types of controlling change:
  - ***Promotion:*** **The internal development state of a software is changed.**
  - ***Release:*** **A changed software system is made visible outside the development organization.**



Promote Policy

Release Policy

Programmer

Promotion

Master Directory

Release

Software Repository

User

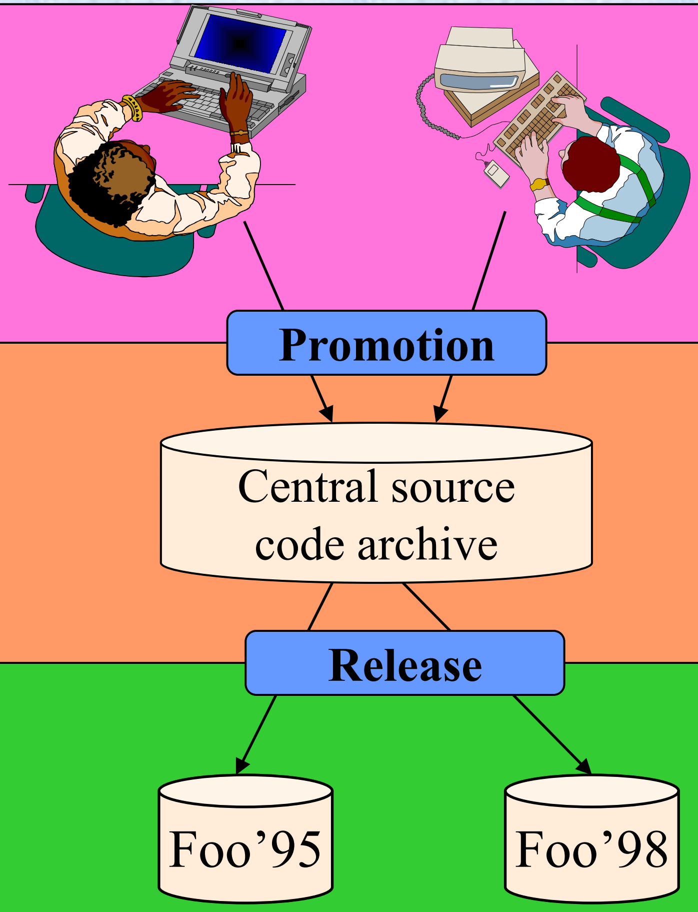
- Approaches for controlling change (Change Policy)
  - **Informal (good for research type environments and promotions)**
  - **Formal approach (good for externally developed CIs and for releases)**

Terminology: SCM Directories

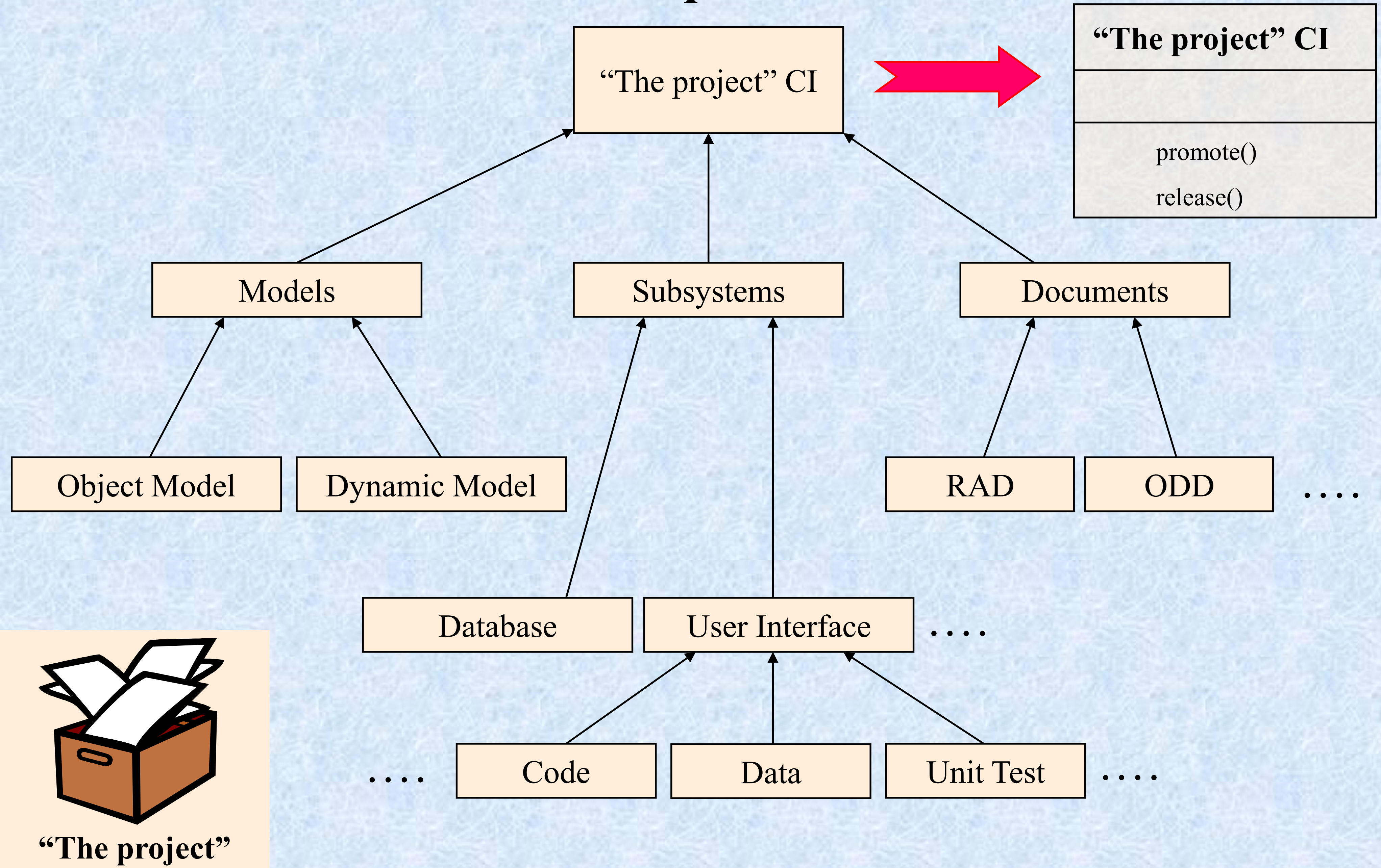
- Programmer’s Directory (IEEE: Dynamic Library)
  - **Library for holding newly created or modified software entities.**
  - **The programmer’s workspace is controlled by the programmer only.**
- Master Directory (IEEE: Controlled Library)
  - **Manages the current baseline(s) and for controlling changes made to them.**
  - **Entry is controlled, usually after verification.**
  - **Changes must be authorized.**
- Software Repository (IEEE: Static Library)
  - **Archive for the various baselines released for general use.**
  - **Copies of these baselines may be made available to requesting organizations.**

Standard SCM Directories

- Programmer's Directory
  - **(IEEE Std: "Dynamic Library")**
  - **Completely under control of one programmer.**
- Master Directory
  - **(IEEE Std: "Controlled Library")**
  - **Central directory of all promotions.**
- Software Repository
  - **(IEEE Std: "Static Library")**
  - **Externally released baselines.**



Promotion and Release are Operations on CIs

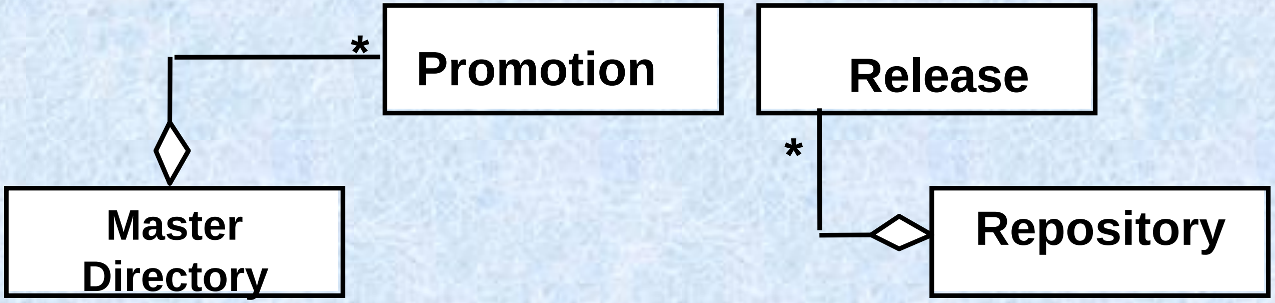


Let‘s Create a Model for Configuration Management

- We just learned that promotions are stored in the master directory and releases are stored in the repository

Problem: There can be many promotions and many releases

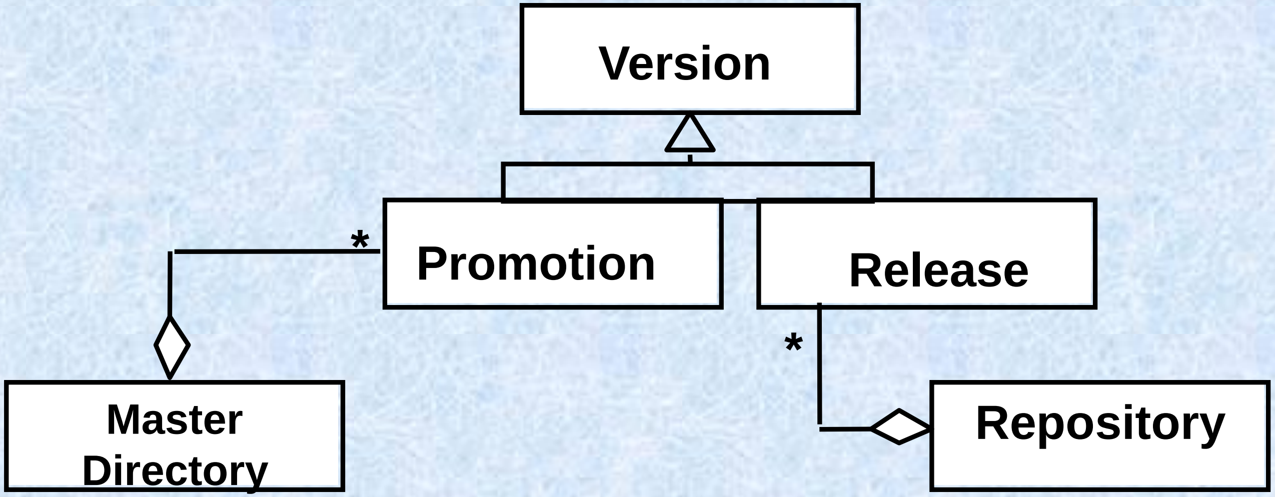
Solution: Use Multiplicity



Let‘s Create a Model for Configuration Management

- Insight: Promotions and Releases are both versions

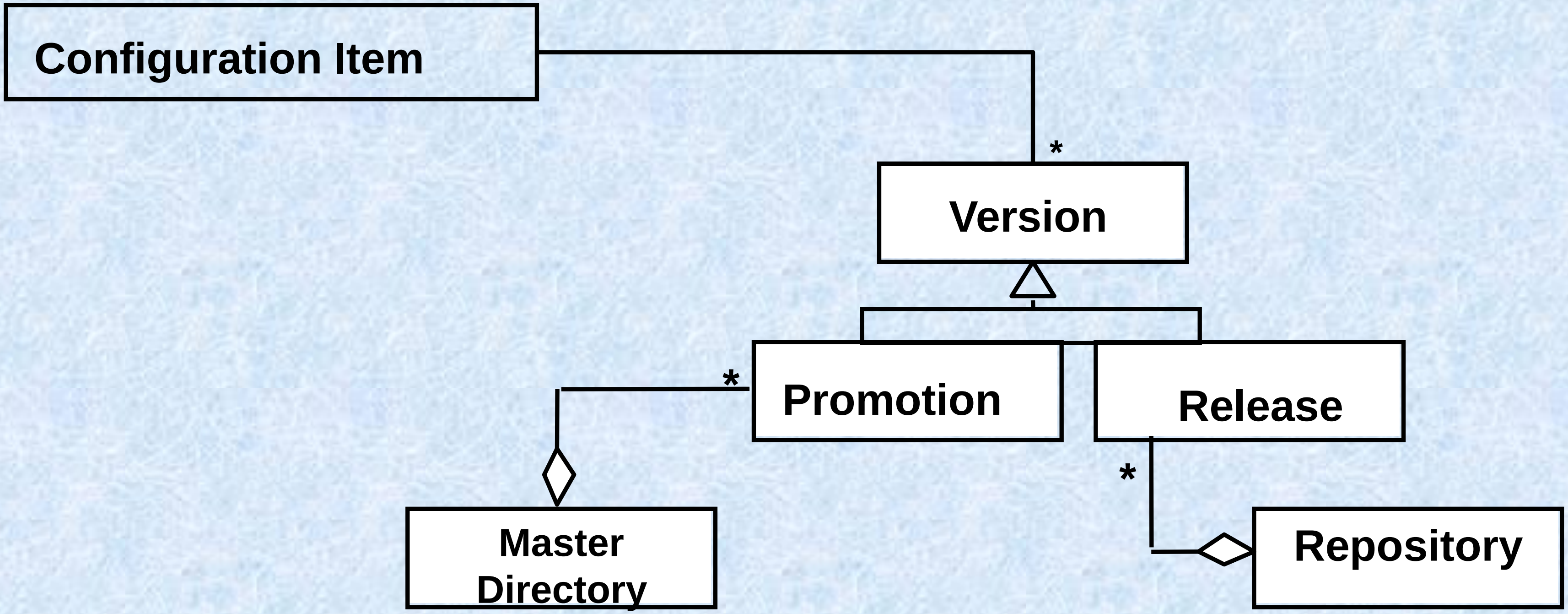
Solution: Use Inheritance



Let‘s Create a Model for Configuration Management

- Problem: A configuration item has many versions

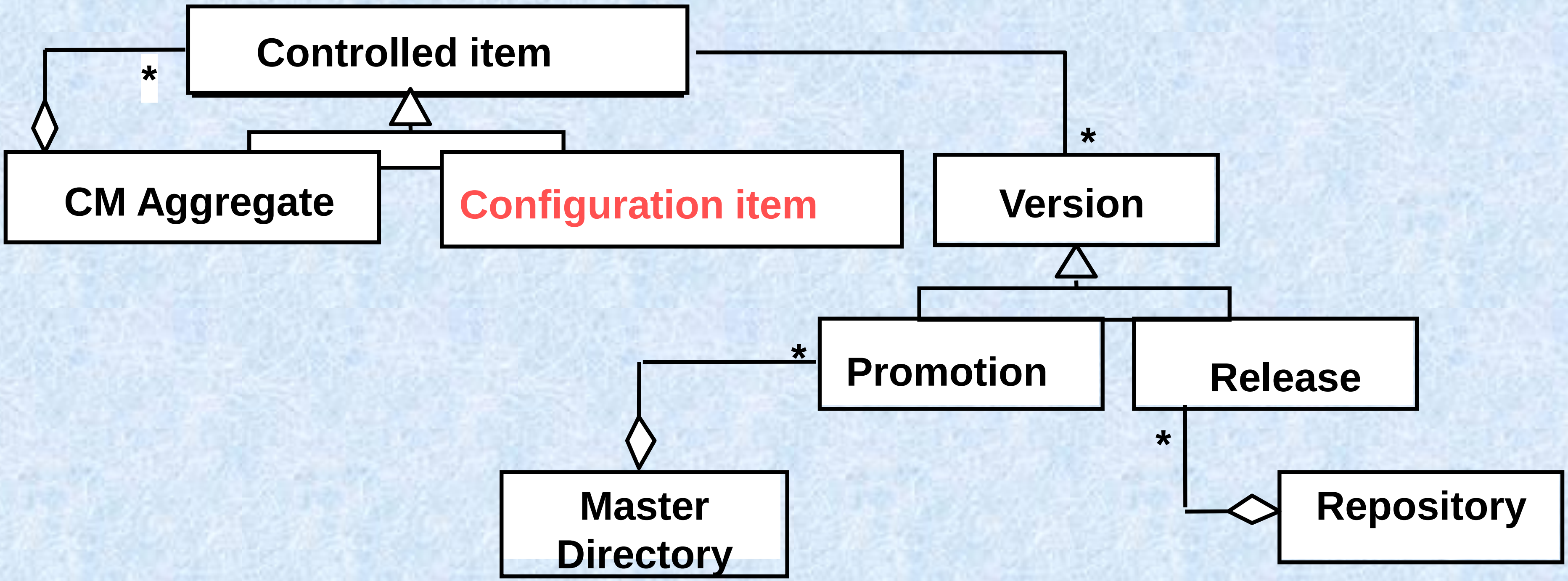
Solution: Create a 1-many association between Configuration Item and Version



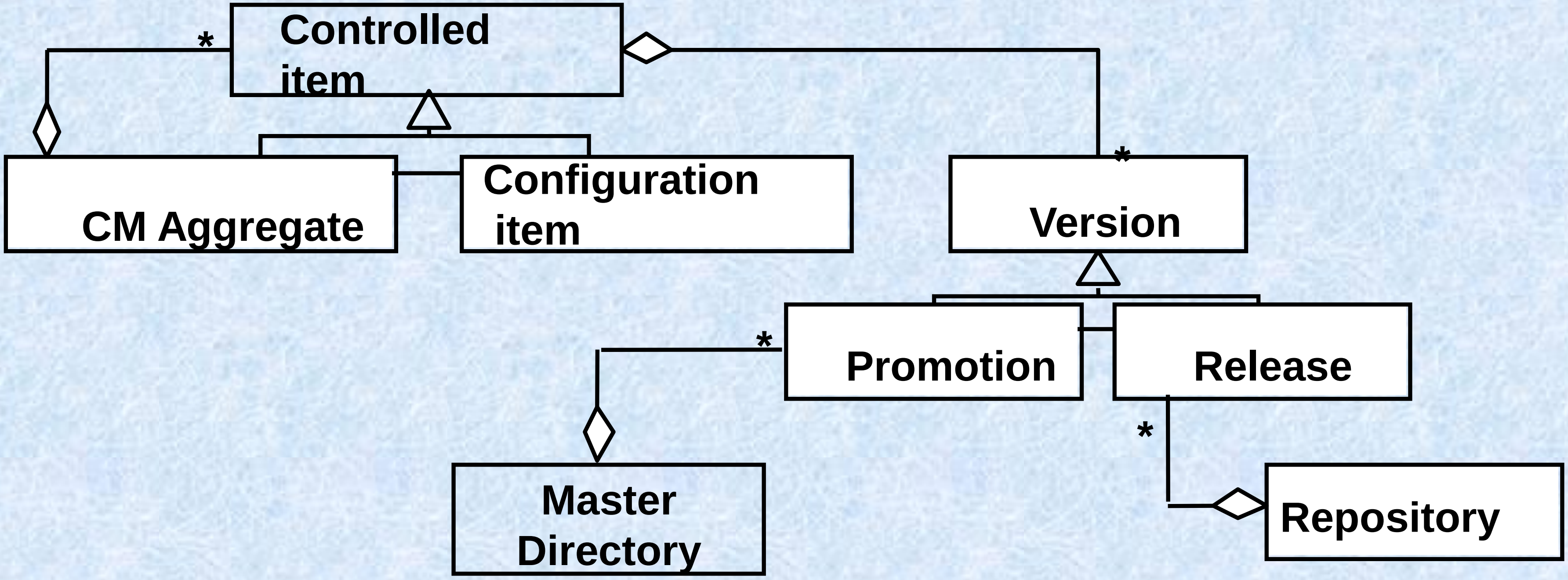
Let‘s Create a Model for Configuration Management

- Problem: Configuration items can themselves be grouped

Solution: Use the composite design pattern



Configuration Item Model (UML Class Diagram)



Change Policies

- Whenever a promotion or a release is performed, one or more policies apply. The purpose of change policies is to guarantee that each version, revision or release (see next slide) conforms to commonly accepted criteria.

- Examples for change policies:

  “No developer is allowed to promote source code which cannot be compiled without errors and warnings.”

  “No baseline can be released without having been beta-tested by at least 500 external persons.”

Terminology: Version vs. Revision vs. Release

- Version:
  - **An *initial* release or re-release of a configuration item associated with a *complete compilation* or recompilation of the item. Different versions have different functionality.**

Question: Is Windows98 a new version or a new revision compared to Windows95 ?

- Revision:
  - ***Change* to a version that corrects only errors in the design/code, but does not affect the documented functionality.**

- Release:
  - **The *formal distribution* of an approved version.**

Tasks for the Configuration Managers

Define configuration items

Define promote /release policies

Software Configuration Management Planning

- Software configuration management planning starts during the early phases of a project.

- The outcome of the SCM planning phase is the

  Software Configuration Management Plan (SCMP)

  which might be extended or revised during the rest of the project.

- The SCMP can either follow a public standard like the IEEE 828, or an internal (e.g. company specific) standard.

The Software Configuration Management 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.
- Describes the *tools* which should be used to assist the CM process and any limitations on their use.
- Defines the *configuration management database* used to record configuration information.

Outline of a Software Configuration Management Plan (SCMP, IEEE 828-1990)

1. Introduction
   - **Describes purpose, scope of application, key terms and references**
2. Management (WHO?)
   - **Identifies the responsibilities and authorities for accomplishing the planned configuration management activities**
3. Activities (WHAT?)
   - **Identifies the activities to be performed in applying to the project.**
4. Schedule (WHEN?)
   - **Establishes the sequence and coordination of the SCM activities with project mile stones.**
5. Resources (HOW?)
   - **Identifies tools and techniques required for the implementation of the SCMP**
6. Maintenance
   - **Identifies activities and responsibilities on how the SCMP will be kept current during the life-cycle of the project.**

SCMP Section 1: Introduction

1.1 Simplified overview of the configuration management activities.

1.2 Scope:

- **Overview description of the project**
- **Identification of the CI(s) to which software configuration management will be applied.**

1.3 Identification of other software to be included as part of the SCMP (support software and test software)

1.4 Relationship of SCM to hardware of system configuration management activities

1.5 Degree of formality and depth of control for applying SCM to project.

1.6 Limitations and time constraints for applying SCM to this project

1.7 Assumptions that might have an impact on the cost, schedule and ability to perform defined SCM activities.

SCMP Section 2: Management

2.1 Organization

- **Organizational context (technical and managerial) within which the SCM activities are implemented. Identifies**
  - **All organizational units (client, developers, managers) that participate in an SCM activity**
  - **Functional roles of these people within the project**
  - **Relationship between organizational units**

2.2. Responsibilities

- **For each SCM activity list the name or job title to perform this activity**
- **For each board performing SCM activities, list**
  - **purpose and objectives**
  - **membership and affiliations**
  - **period of effectivity, scope of authority**
  - **operational procedures**

3. Applicable Policies

- **External constraints placed on the SCMP**

SCMP Section 3: Activities

3.1 Configuration Identification

3.2 Configuration Control

3.3 Configuration Status Accounting

3.4 Configuration Audits and Reviews

3.5 Interface Control

3.2 Configuration Control

Defines the following steps

3.2.1 How to identify the need for a change (layout of change request form)

3.2.2 Analysis and evaluation of a change request

3.2.3 Approval or disapproval of a request

3.2.4 Verification, implementation and release of a change

3.2.1 Change Request

- Specifies the procedures for requesting a change to a baselined CI and the information to be documented:
  - **Name(s) and version(s) of the CI(s) where the problem appears**
  - **Originator’s name and address**
  - **Date of request**
  - **Indication of urgency**
  - **The need for the change**
  - **Description of the requested change**

3.2.2 Evaluation of a Change

- Specifies the analysis required to determine the impact of proposed changes and the procedure for reviewing the results of the analysis.

3.2.3 Change Approval or Disapproval

- This section of the SCMP describes the organiztion of the configuration control board (CCB).
- Configuration Control Board (CCB)
  - **Can be an individual or a group.**
  - **Multiple levels of CCBs are also possible, depending on the complexity of the project**
- Multiple levels of CCBs may be specified.
  - **In small development efforts one CCB level is sufficient.**
- This section of the SCMP also indicates the level of authority of the CCB and its responsibility.
  - **In particular, the SCMP must specify when the CCB is invoked.**

3.2.4 Implementing Change

- This section of the SCMP specifies the activities for verifying and implementing an approved change.
- A completed change request must contain the following information:
  - **The original change request(s)**
  - **The names and versions of the affected configuration items**
  - **Verification date and responsible party**
  - **Identifier of the new version**
  - **Release or installation date and responsible party**
- This section must also specify activities for
  - **Archiving completed change requests**
  - **Planning and control of releases**
  - **How to coordinate multiple changes**
  - **How to add new CIs to the configuration**
  - **How to deliver a new baseline**

3.3 Configuration Status Accounting

- This section of the SCMP must contain the following sections
  - **What elements are to be tracked and reported for baselines and changes?**
  - **What types of status accounting reports are to be generated? What is their frequency?**
  - **How is information to be collected, stored and reported?**
  - **How is access to the configuration management status data controlled?**

3.4 Configuration Audits and Reviews

- This section of the SCMP identifies audits and reviews for the project.
  - **An audit determines for each Configuration Item if it has the required physical and functional characteristics.**
  - **A review is a management tool for establishing a baseline.**
- For each audit or review the plan has to define:
  - **Objective**
  - **The Configuration Items under review**
  - **The schedule for the review**
  - **Procedures for conducting the review**
  - **Participants by job title**
  - **Required documentation**
  - **Procedure for recording deficiencies and how to correct them**
  - **Approval criteria**

Tasks for the Configuration Managers (Summary)

Define configuration items

Define promote /release policies

Define activities and responsibilities

Form of an SCMP

- Form:
  - **The SCMP can be a separate document or a section embedded in another document, for example in the SPMP, titled "Software Configuration Management Plan".**
- Minimum information
  - **6 Sections: Introduction, Management, Activities, Schedules, Resources and Plan Maintenance**
- Consistency Criteria (to be used at a SCMP review meeting):
  - **All activities defined in the SCMP (Section 3.1 to 3.6) are assigned to an organizational unit or person.**
  - **All identified Configuration items (Section 2.1) have defined processes for baseline establishment and change control (Section 3.2)**
  - **All activities are associated with resources (section 5) to accomplish the activities.**
- Such a SCMP can include the following sentence:
  - **"This SCM Plan conforms with the requirements of IEEE Std 828-1990."**

Tailoring the SCMP

- The IEEE standard allows quite a bit flexibility for preparing an SCMP.
- To conform to the rest of the project, the SCMP may be
  - **tailored upward:**
    - **to add information**
    - **to use a specific format**
  - **tailored downward**
    - **Some SCMP components might not apply to a particular project.**
    - **Instead of omitting the associated section, mention its applicability.**
    - **Information that has not been decided on at the time the SCMP is approved should be marked as “to be determined”.**

Conformance to the IEEE Standard 828-1990

- Presentation format & Minimum information
  - **A separate document or a section embedded in another document titled "Software Configuration Management Plan".**
  - **6 Sections: Introduction, Management, Activities, Schedules, Resources and Plan Maintenance**
- Consistency Criteria:
  - **All activities defined in the SCMP (Section 3.1 to 3.6) are assigned to an organizational unit or person and they are associated with resources to accomplish the activities.**
  - **All Configuration items identified in Section 2.1 have defined processes for baseline establishment and change control (Section 3.2) .**
- If the above criteria are met, the SCMP can include the following sentence:

  "This SCMP conforms with the requirements of IEEE Std 828-1990."
- Note: The consistency criteria can also be used at a SCMP review meeting

Example SCM Plans (from the Guide IEEE 1042.1990)

Life-cycle Phase	Project Type	Size	SCM Tools	Life Span	Writing	Character of Project
A Development	Critical	Medium	Advanced	Short	Highly Structured	Complex system contracted to another company
B Concept	Prototype	Small	Basic	Short	Informal	Small software development project
C Maintenance	Support Software	Large	On-line	Full Life-Cycle	Structured	SCMP used by organization using contracted SW
D All	Commercial	Small	Integrated	Full Life-Cycle	Informal	Development of embedded applicatåions

ARENA or TRAMP: Concept. Prototype, Small, On-line, Short, Informal

Tools for Software Configuration Management

- Software configuration management is normally supported by tools with different functionality.
- Examples:
  - **RCS**
    - **very old but still in use; only version control system**
  - **CVS (Concurrent Version Control)**
    - **based on RCS, allows concurrent working without locking**
    - **http://www.cvshome.org/**
    - **CVSWeb: Web Frontend to CVS**
  - **Perforce**
    - **Repository server; keeps track of developer’s activities**
    - **http://www.perforce.com**
  - **ClearCase**
    - **Multiple servers, process modeling, policy check mechanisms**
    - **http://www.rational.com/products/clearcase/**

Tasks for the Configuration Managers

SCMP following the IEEE 828-1990 standard

Define configuration items

Define promote /release policies

Define activities and responsibilities

Set up configuration management system