Pattern-oriented Software Architecture

5/3/2004

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What these slides will cover…

- What is a pattern?
- What types of pattern are there?
- Why do we use patterns in software architecture?
- What does a pattern look like?
- How can we use patterns in our work?

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What is a pattern?

Definition:

A particular recurring design problem that arises in specific design contexts, and presents a well-proven generic scheme for its solution. The solution scheme is specified by describing its constituent components, their responsibilities and relationships, and the ways in which they collaborate.

Taken from *Pattern-Oriented Software Architecture*, Buschmann et al.

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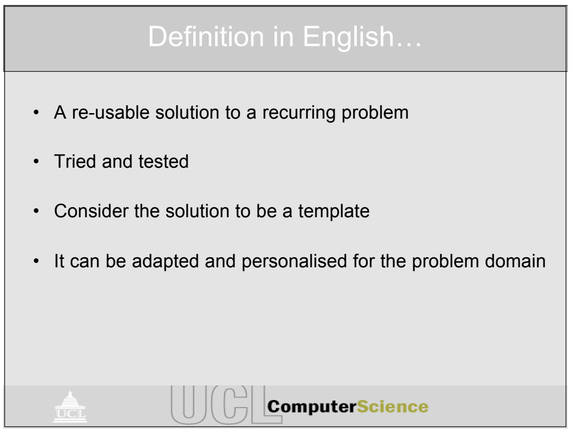
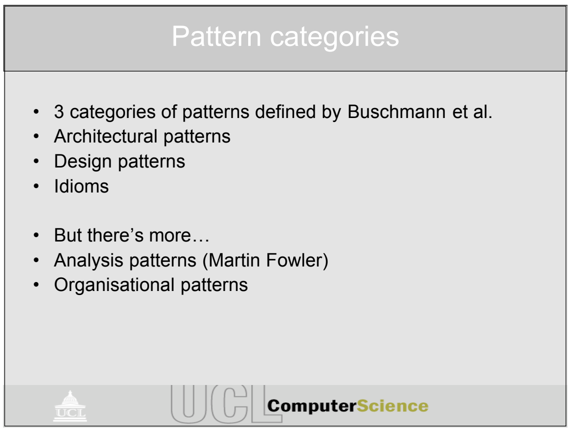


Definition in English…

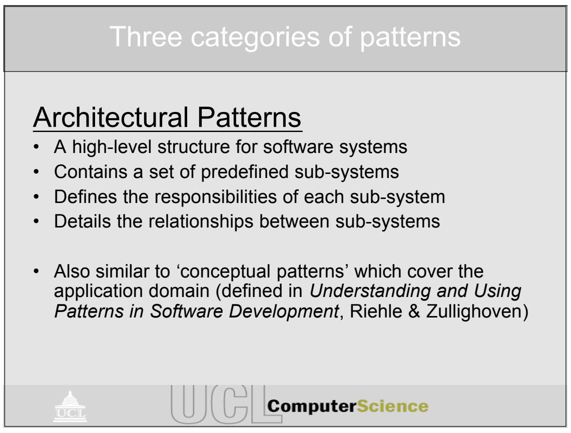
- A re-usable solution to a recurring problem
- Tried and tested
- Consider the solution to be a template
- It can be adapted and personalised for the problem domain



Pattern categories

- 3 categories of patterns defined by Buschmann et al.
- Architectural patterns
- Design patterns
- Idioms

- But there's more…
- Analysis patterns (Martin Fowler)
- Organisational patterns

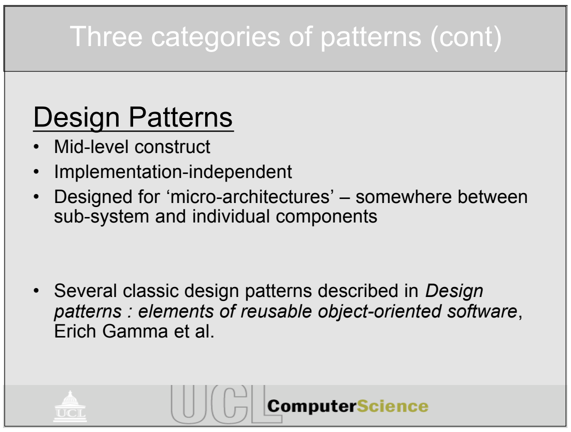


Three categories of patterns

Architectural Patterns

- A high-level structure for software systems
- Contains a set of predefined sub-systems
- Defines the responsibilities of each sub-system
- Details the relationships between sub-systems

- Also similar to 'conceptual patterns' which cover the application domain (defined in *Understanding and Using Patterns in Software Development*, Riehle & Zullighoven)

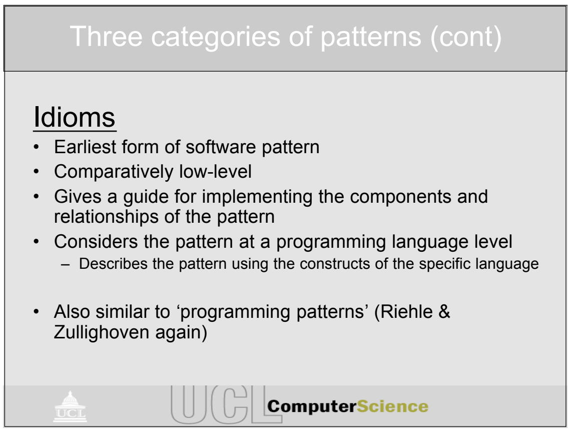


Three categories of patterns (cont)

Design Patterns

- Mid-level construct
- Implementation-independent
- Designed for ‘micro-architectures’ – somewhere between sub-system and individual components

- Several classic design patterns described in *Design patterns : elements of reusable object-oriented software*, Erich Gamma et al.

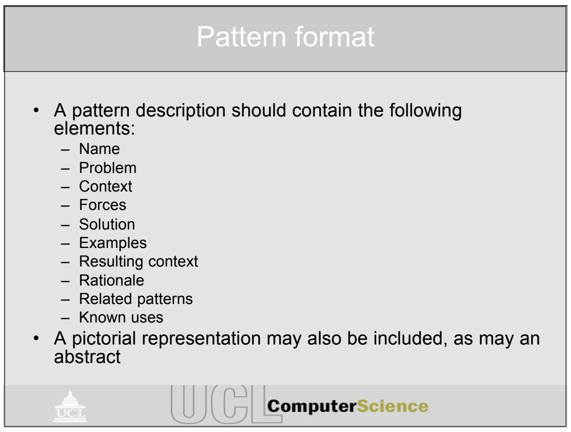


Three categories of patterns (cont)

Idioms

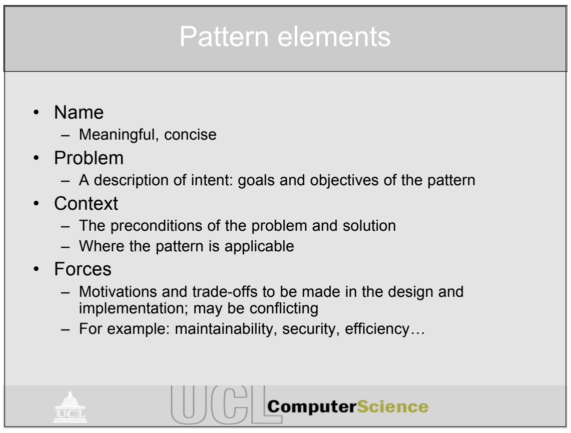
- Earliest form of software pattern
- Comparatively low-level
- Gives a guide for implementing the components and relationships of the pattern
- Considers the pattern at a programming language level
  - Describes the pattern using the constructs of the specific language

- Also similar to ‘programming patterns’ (Riehle & Zullighoven again)



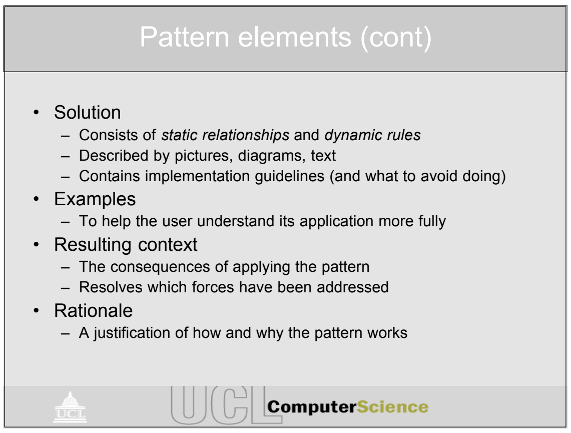
Pattern format

- A pattern description should contain the following elements:
  - Name
  - Problem
  - Context
  - Forces
  - Solution
  - Examples
  - Resulting context
  - Rationale
  - Related patterns
  - Known uses
- A pictorial representation may also be included, as may an abstract



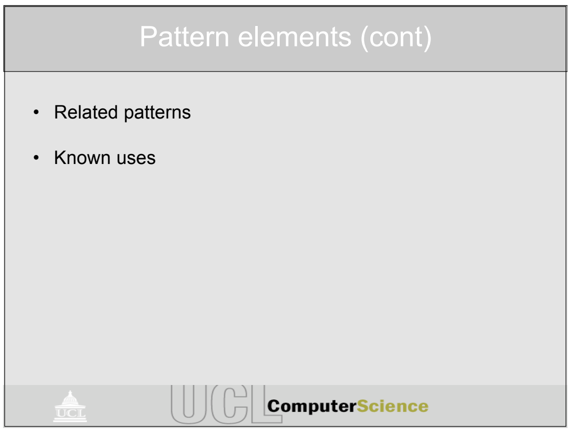
Pattern elements

- Name
  - Meaningful, concise
- Problem
  - A description of intent: goals and objectives of the pattern
- Context
  - The preconditions of the problem and solution
  - Where the pattern is applicable
- Forces
  - Motivations and trade-offs to be made in the design and implementation; may be conflicting
  - For example: maintainability, security, efficiency…



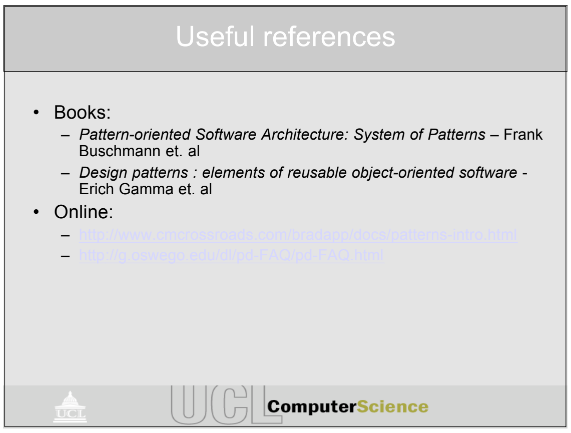
Pattern elements (cont)

- Solution
  - Consists of *static relationships* and *dynamic rules*
  - Described by pictures, diagrams, text
  - Contains implementation guidelines (and what to avoid doing)
- Examples
  - To help the user understand its application more fully
- Resulting context
  - The consequences of applying the pattern
  - Resolves which forces have been addressed
- Rationale
  - A justification of how and why the pattern works



Pattern elements (cont)

- Related patterns
- Known uses



Useful references

- Books:
  - *Pattern-oriented Software Architecture: System of Patterns* – Frank Buschmann et. al
  - *Design patterns : elements of reusable object-oriented software* - Erich Gamma et. al
- Online:
  - http://www.cmcrossroads.com/bradapp/docs/patterns-intro.html
  - http://g.oswego.edu/dl/pd-FAQ/pd-FAQ.html

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