

## Software Reuse with Analysis Patterns

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## Domain Knowledge Reuse



Reuse  
Analysis  
Patterns

- **Domain Analysis:** Discovering common elements across a domain. Neighbors (1984)
- **Application:** Reuse of non-code artifacts such as
  - Specifications
  - Use cases
  - Analysis models
  - Design
- **Benefits:** Produce more reliable and flexible software at reduced time-to-market
- **Analysis Patterns** as a method to support domain knowledge reuse

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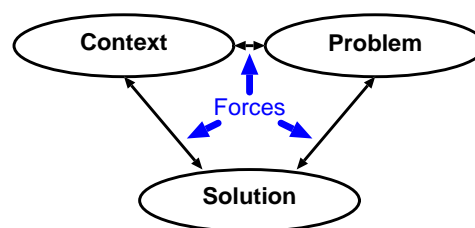
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## Analysis Patterns



Reuse  
Analysis  
Patterns

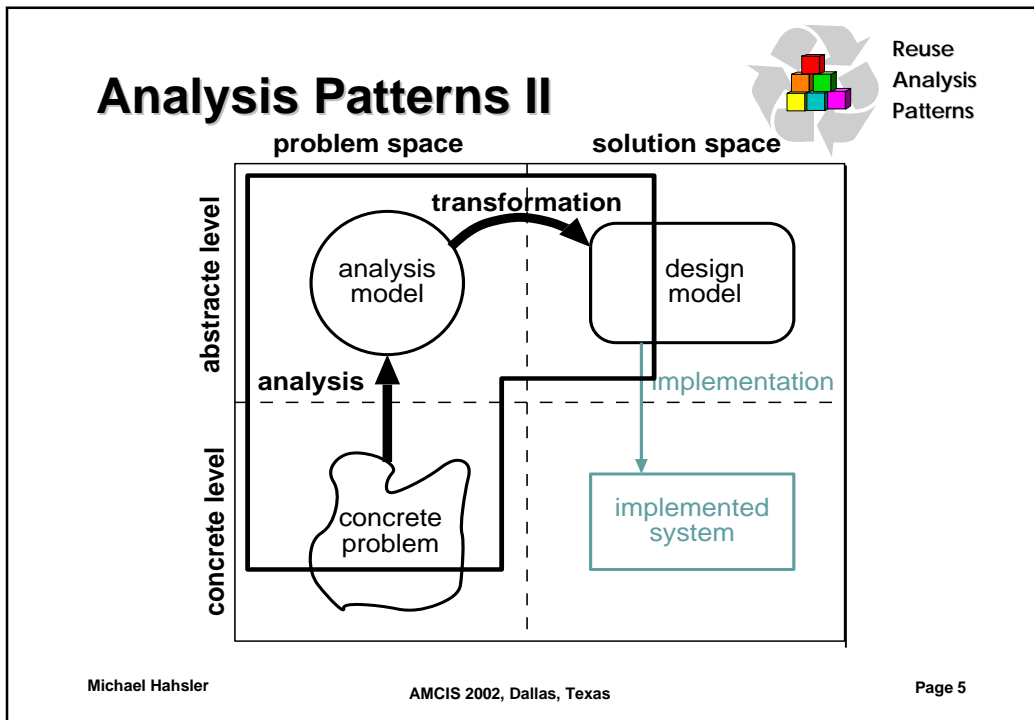
- Similar to **Design Patterns**
- **Martin Fowler (1997):** Capture conceptual models in an application domain for cross application reuse
- **Focus** on organizational, social and economic aspects

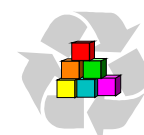


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- ## A Template for Analysis Patterns
- 
- **Pattern Name** (Gamma et al. 1995; Buschmann et al.1996)
  - **Intent** (Gamma et al. 1995) What problem does it address?
  - **Motivation** (Gamma et al. 1995) A scenario
  - **Forces and Context** (Alexander 1979) Should be resolved by the analysis pattern.
  - **Solution** (Buschmann et al. 1996) Balance of forces achieved, all relevant aspects
  - **Consequences** (Gamma et al. 1995; Buschmann et al. 1996) What trade-off exist?
  - **Design** [New] Design suggestions, Examples.
  - **Known Uses** (Gamma et al. 1995; Buschmann et al. 1996)
- Reuse Analysis Patterns
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## Examples



- A family of analysis patterns that deal with a series of pressing problems in
  - cooperative work
  - collaborative information filtering and sharing
  - knowledge management
- **Analysis Pattern: A Simple Pinboard**
- Analysis Pattern: Structured Pinboard
- **Analysis Pattern: Virtual Library**

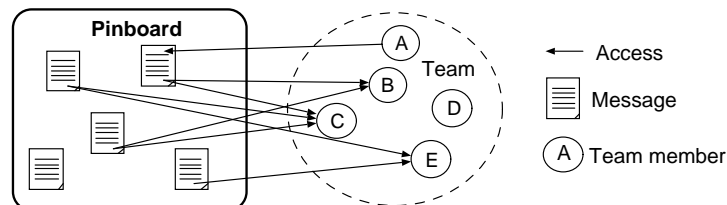
## Analysis Pattern: A Simple Pinboard



**Intent** How can a dispersed group share information efficiently?

### Forces

- Efficient group communication is vital.
- Frequent meetings in person are not feasible.
- The risk of information overload is present.



## Analysis Pattern: Virtual Library



**Intent** A Virtual Library is used to provide easy access to distributed information sources.

**Motivation** At a university much research and teaching material is available online, but most of it is hard to find...

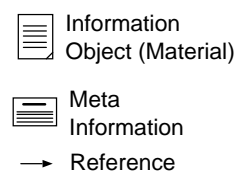
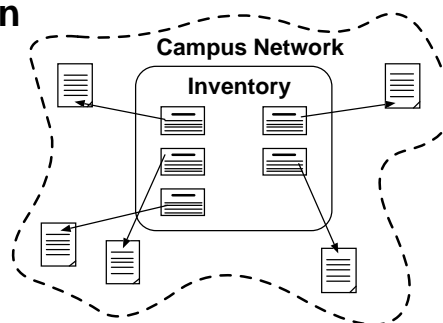
### Forces

- Need for a central access point to dispersed information.
- Independent information provider with different objectives and using different technologies.
- High change rate of the provided information.

## Analysis Pattern: Virtual Library II



### Solution



### Consequences

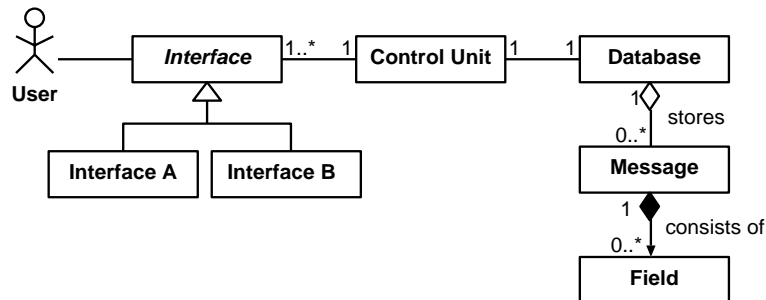
- Information objects physically stay with their owners.
- Consistency problems.

## Analysis Pattern: Virtual Library III



### Design

- Separation between the three main components
- Facade pattern, Interpreter pattern, Visitor pattern



## Quantifying Benefits of Analysis Patterns



- Data from the implementation of two small information systems based on the Analysis Pattern *Virtual Library*
- Analyze Code Reuse as an indicator of overall Reuse
- Boehm's COnstructiv COst MOdel to quantify benefits (lines of code -> effort in man months)

## The Analyzed Projects



Real Projects from the Virtual University Project at the Vienna University of Economics and BA

Project	Size in LOC	Team Size	Actual Effort in MM
Calendar of Research Events	4021	1	0,5
Digital Library	7616	2	6

## The Calendar of Events



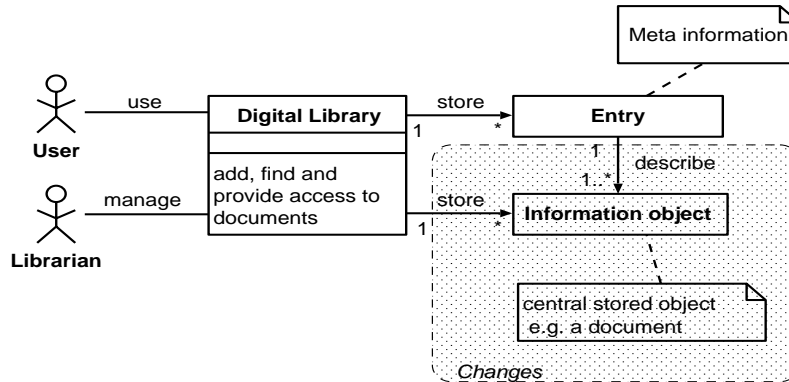
- Link collection for conferences with meta information, old conferences are archived automatically.
- Perfectly covered by the analysis pattern *Virtual Library*.

	Unit	Total Code	Reused Code	Code Reuse
PERL	LOC	3743	3502	93,56%
HTML	LOC	278	192	69,06%
Sum	LOC	4021	3694	91,67%
Sum	MM	10,35	9,46	91,40%

# A Digital Library



- Massive changes necessary:
  - components necessary to store and manage the actual documents



# A Digital Library II



In use for Working Papers and PhD Thesis  
<http://epub.wu-wien.ac.at>

	Unit	Total Code	Reused Code	Code Reuse
PERL	LOC	6954	3687	53,02%
HTML	LOC	662	224	33,84%
Sum	LOC	7616	3911	51,35%
Sum	MM	20,23	10,05	49,68%

## Conclusion



- Libraries, components, frameworks, design patterns, and other similar methods are indispensable today
- Analysis patterns to document domain knowledge in a structured and make it reusable
- We provided evidence that analysis patterns offer a significant code reuse potential (between 49% and 91% for our small examples)

## Research Questions



- How analysis patterns can help to provide a common vocabulary for system developers and users?
- How analysis patterns can help to classify and organize documented domain knowledge to make it easily accessible for reuse?
- How analysis patterns can help to teach effective analysis strategies?
- How analysis patterns can help to describe and understand large systems?