Design

Design process [2.2.2]
Architectures [6]
Reuse [16]
Component-based design [17]

The V-model

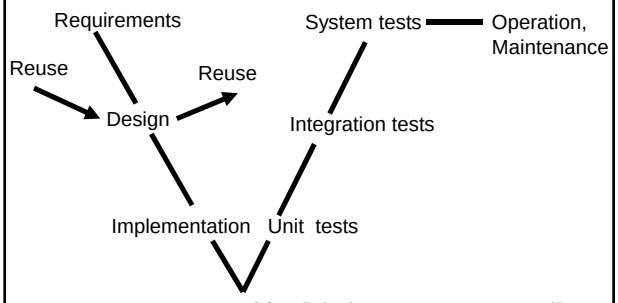
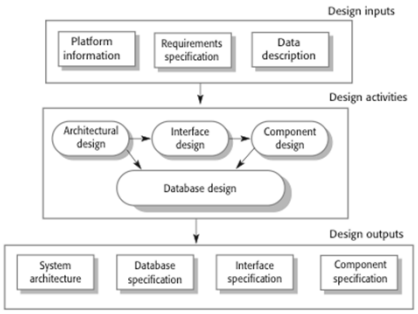


Figure 2.5 A general model of the design process



Design methods

- ”Structured methods” 70’s/80’s
  - Asking the right questions
  - Models
    - decomposition, architecture
    - levels of abstraction (formality, detail)
    - focus on an aspect
  - Notations … UML
  - Tools

Architecture is based on non-functional requirements [6.1 18.1]

- Performance - Scaleability
- Robustness
- Reliability - Availability
- Safety - Security
- Simplicity - Maintainability
- Reuse - Reusability

physical
decomposition
logical

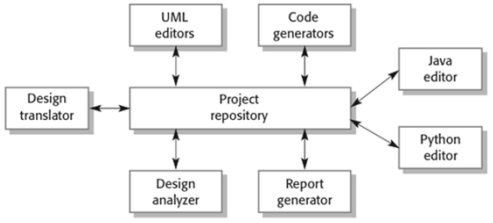
Architectural views

conceptual
processes communication
physical
development
logical

Architectural patterns

- Understanding legacy systems
- Common understanding
- Reuse of designs

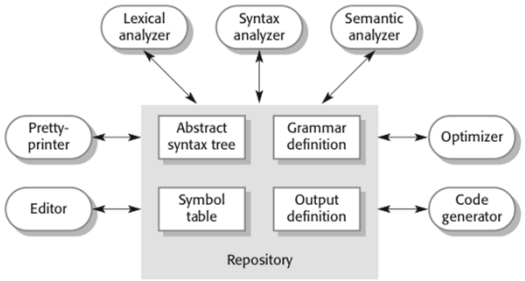
Repository architecture [6.3.2]



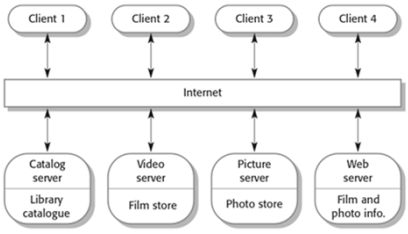
+ easy to share data
+ independent applications

- fixed data representation
- security
- bottleneck: repository

Figure 6.20 A repository architecture for a language processing system



Client-server architecture [6.3.3]



+ easy to extend
+ security (implement in server)

- bottleneck: network

Logical 3-tier [18.3.3]

- Presentation
- Computation (Business logic)
- Data

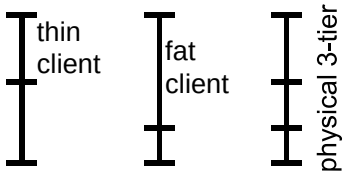
Logical 3-tier [18.3.3]

Example: stocks in the bank

- Presentation — Menus, graphs, etc.
- Computation (Business logic) — Authentication, Computation, Verifying orders
- Data — (time series) How much you own, Value of stocks

Physical implementation

- Presentation
- Computation
- Data



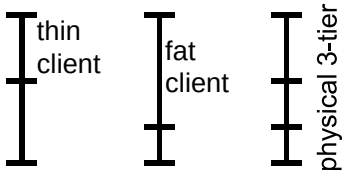
Physical implementation

- Presentation
- Computation
- Data

+ simple client (browser, COTS)
+ security
- server load

Physical implementation

- Presentation
- Computation
- Data

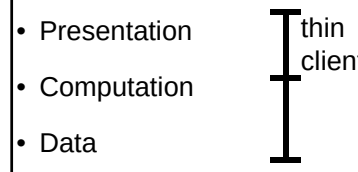


+ simple client
+ security
- server load

- need to install client
- security (raw data)
+ server load

Physical implementation

- Presentation
- Computation
- Data

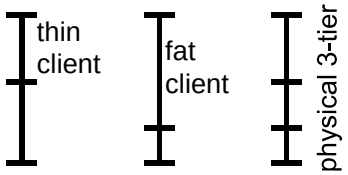


- Games
- In-house systems (CAD, CASE)

- need to install client
- security (raw data)
+ server load

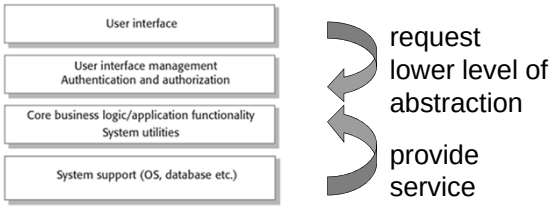
Physical implementation

- Presentation
- Computation
- Data



+ scaleable
+ best of two worlds
- double network delays
- complex

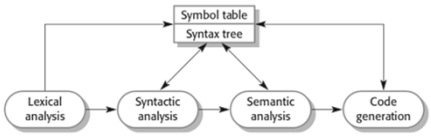
Layered architecture [6.3.1]



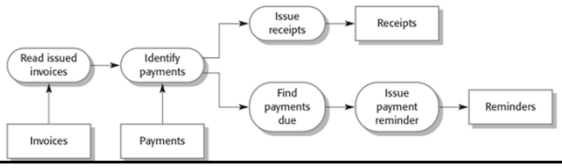
+ reuse:
  + share lower layers
  + replace layer

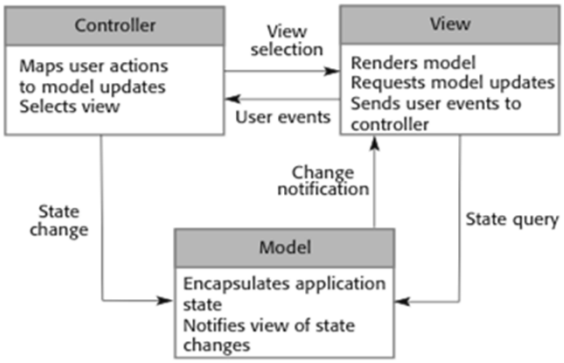
- performance
- need to bypass layers

Pipe and filter [6.3.4]

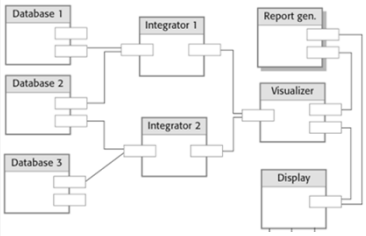


Process view





Distributed components [18.3.4]



- CORBA - Common Object Request Broker Architecture
- EJB - Enterprise Java Beans
- Microsoft - COM, COM+, .NET

Reuse [16]

- System (COTS)
- Configurable system
  - Product line (ERP)
- Large subsystem
  - wrapped legacy system
  - frameworks, services
- Libraries
- Components

Level — Patterns

- System (COTS)
- Configurable system — Architecture
  - Product line (ERP)
- Large subsystem — Model-based engineering
  - wrapped legacy system
  - frameworks, services — Program generators
- Libraries — Design patterns
- Components

Reuse also

- Requirements
- User interface
  - standardization improves usability
  - documentation
- Test suites
  - regression testing

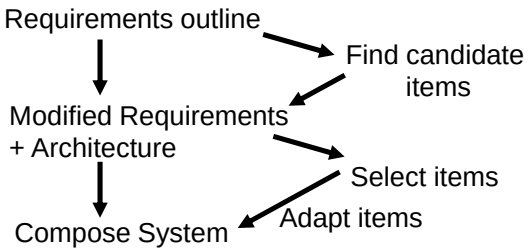
Reuse - why? [Fig.16.1]

- Less work
  - shorter time to market
  - effective use of specialists
  - cheaper
- You know it
  - less process risk
  - dependability [warning: Ariane 5 Fig.17.9]
- Standards compliance

Reuse - problems [Fig.16.2]

- Need to invest in reusable items
- Finding reusable items
  - searching, understanding, adapting
- Lack of control
  - dependence on supplier, support
  - maintenance
  - "not invented here"
  - tool support for integration

Reuse - process [17.2]



Component-Based Software Engineering (CBSE) essentials

- ✧ Independent components specified by their interfaces.
- ✧ Component standards to facilitate component integration.
- ✧ Middleware that provides support for component inter-operability.
- ✧ A development process that is geared to reuse.

CBSE problems

- ✧ Component trustworthiness - how can a component with no available source code be trusted?
- ✧ Component certification - who will certify the quality of components?
- ✧ Emergent property prediction - how can the emergent properties of component compositions be predicted?
- ✧ Requirements trade-offs - how do we do trade-off analysis between the features of one component and another?

Component development for reuse

- ✧ Specially constructed by generalising existing components.
- ✧ Component reusability
  - stable domain abstractions
  - hide state representation
  - as independent as possible
  - publish exceptions through the component interface
- ✧ Trade-off between reusability and usability
  - More general interface
    = greater reusability
    = more complex = less usable.

Changes for reusability

- ✧ Remove application-specific methods.
- ✧ Change names to make them general.
- ✧ Add methods to broaden coverage.
- ✧ Make exception handling consistent.
- ✧ Add a configuration interface for component adaptation.
- ✧ Integrate required components to reduce dependencies.