# SFWR ENG 3A04: Software Design II

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Term 1, 2008–2009

**Acknowledgments**: Material based on *Software Architecture Design* by Tao et al. (Chapter 2)

# Outline of Part I

# Outline of Part II

# Part I

## Review of Previous Lecture

# Part II

## Today's Lecture

- The architect must be aware of

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  - the alternatives in proposing design solutions
  - which alternatives that are more suitable to capture the functional and non-functional requirements
- This awareness comes from understanding the software architecture design space with all its dimensions

- A software architecture can be given from several perspectives

# Software Architecture Design Space
## Introduction

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  - Software code units (Elements are source, binary code files, software modules, or software component deployment units)

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  - Allocation structure (Project management structure)
- Each type of structure uses different connector types and different performance attributes than the others

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## Software Architecture Design Space Software Code Structure

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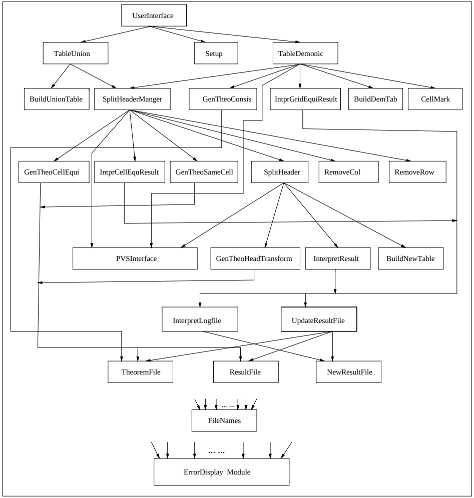


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- The graph depicting the "uses" relation is therefore often called a call graph

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- Sequence: Some connectors must be used in a particular sequence (label the connector with a sequence ID and a sequence number)

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  - the communication media may vary from copper/optical cable or wireless based LAN to the Internet, etc.

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- Self-descriptive: Allows external software systems to invoke its target method without the pre-installation of any software specific for the method

  *Bluetooth devices from different companies may be able to discover each other and exchange information*

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*See previous Call Graph*

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- The elements of a software architecture are usually refined through multiple transformation steps based on the project requirement specification

- Each software element may have different synchronization and performance constraints

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  *As in the case of a server element, an element could be invoked only by a limited number of other elements at execution time, or it could be invoked by unlimited number of other elements (Performance issue rise)*

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  - It can take advantage of thread and resource pooling, data caching, and dynamic element life cycle management for conserving resources

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        - to minimize the total communication traffic

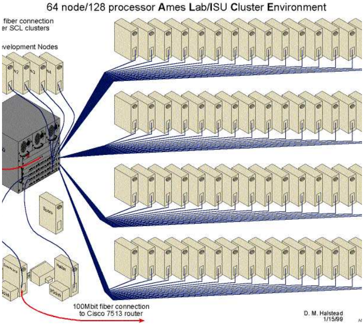


Figure: A cluster of 64 dual-processor Pentium Pros

# Software Architecture Design Space Software Elements

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  - A well-defined interface should be used (encapsulate the sub-system's design and implementation details)

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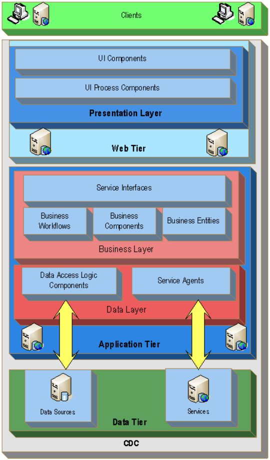
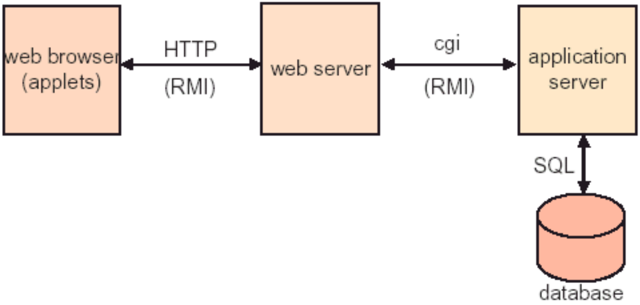
## Application of many Layers and Physical Tiers



Example of a multitier architecture



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  - If the two elements are mapped to two different computers, then remote method invocation or Web service invocation could be used

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- For a system to support callback between its two sub-systems, the two sub-systems must be connected by a two-initiator connector

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- Connector implementation type perspective:

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Introduction

Software Code Structure

Software Runtime Structure

Software Management Structure

Software Elements

Software Connectors

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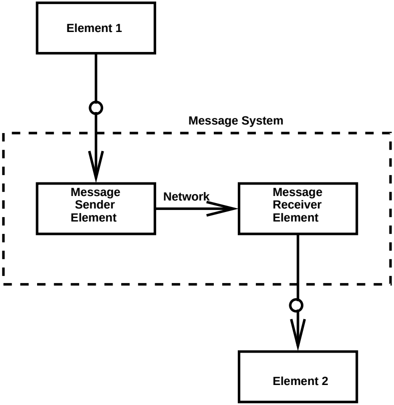
  - Network (are normally implemented with the proxy design pattern)

Connector, information carrier, Implementation type, span



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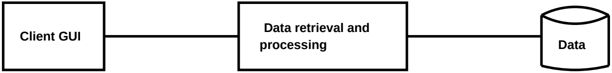
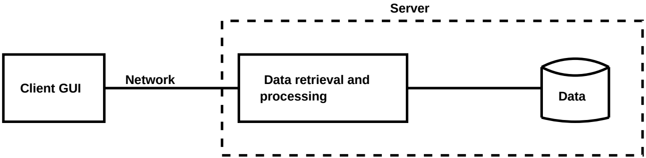
- Seamless integration of multiple software architectural styles in realizing different subsystems or different architectural levels of the same system

Step 1 (standalone):



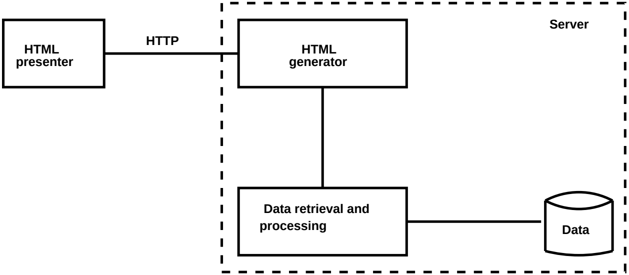

Standalone data presenter

Step 2 (network):




**Networked data presenter**

Step 3 (HTML and HTTP based):




HTML and HTTP based data presenter

Step 4 (Layered Architecture):