Business Process Digitalization and Cloud Computing

2. Enterprise Systems Architectures

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Computer Science Division

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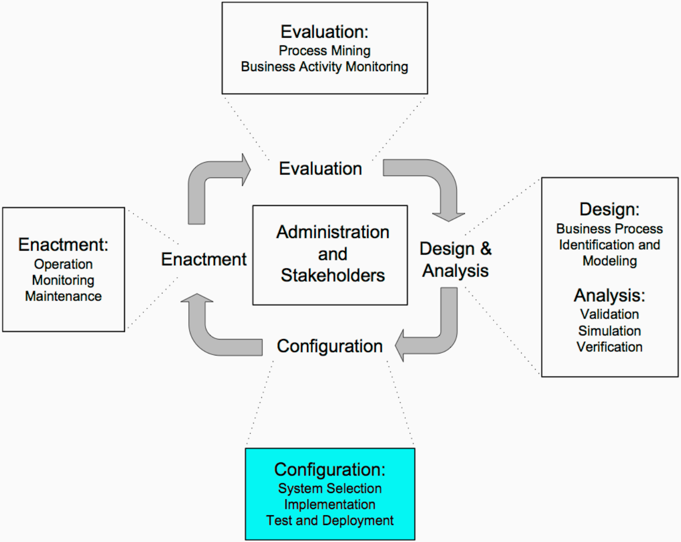
1. Enterprise application and their integration

Enterprise application and their integration

Business Process Lifecycle: Configuration



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Principles

Edsger Dijkstra principles:

Separation of concerns permit to handling the system complexity.

- reuse: subsystem can be used in different applications.
- flexibility: response to change, modified and exchanged.

Information hiding provide an interface which protects the communication with the program from its implementation

Software architecture

Software architecture play a central role in handling the complexity of software system.

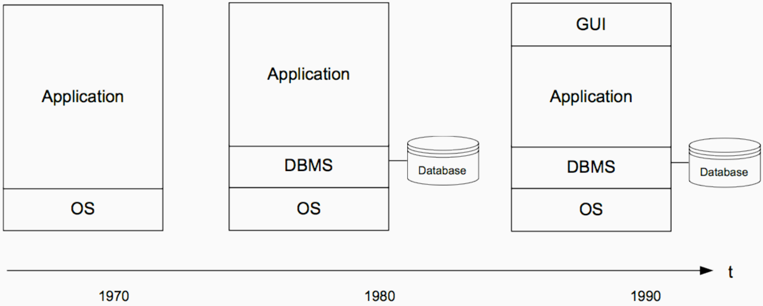
Software architecture

defines a structure that organizes the **software elements** and the **resources** of a software system

Software elements and resources

are represented by subsystems, with specific responsibilities and relationships

Early systems architecture



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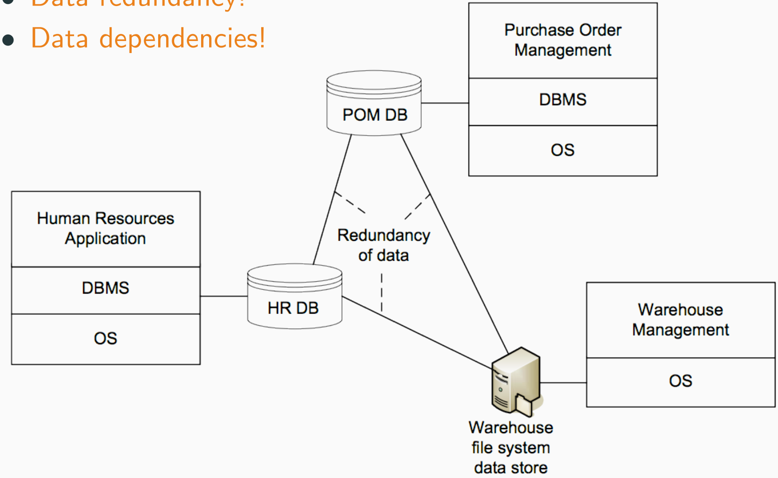
Programming interfaces (OS)

Relational Database

Advanced user interface

Enterprise systems

- Lack of Integration!
- Data redundancy!
- Data dependencies!


Purchase Order Management
DBMS
OS
POM DB
Redundancy of data
Human Resources Application
DBMS
OS
HR DB
Warehouse Management
OS
Warehouse file system data store

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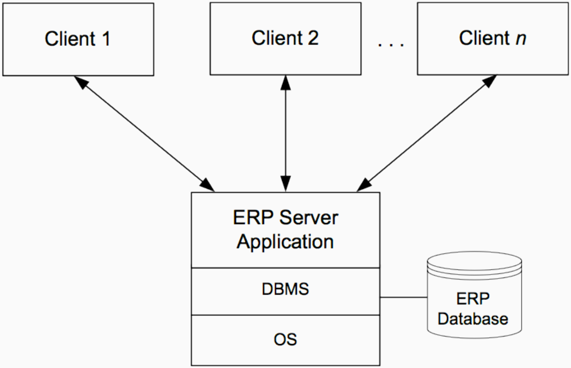
Two-tier Client-Server architecture



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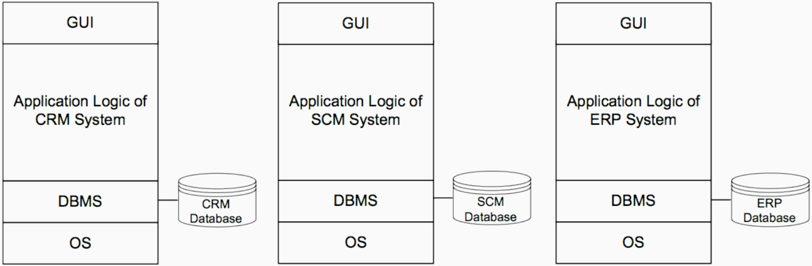
- One centralized database
- Integrated server applications
- Remote data access

Siloed enterprise application


GUI
Application Logic of CRM System
DBMS
OS
CRM Database
GUI
Application Logic of SCM System
DBMS
OS
SCM Database
GUI
Application Logic of ERP System
DBMS
OS
ERP Database

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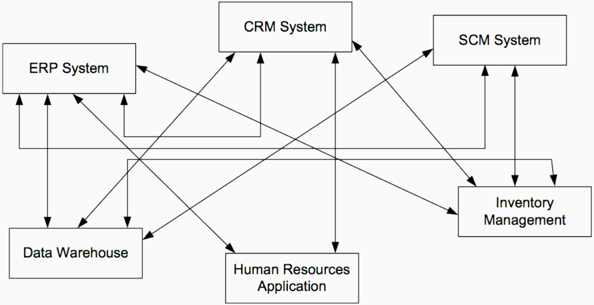
- Indepent applicaitons
- Connected but not logically integrated

Enterprise Application Integration

- Enterprises are facing the challenge of integrating **complex software systems in a heterogeneous information technology** landscape
- Enterprise Application Integration is defined as the use of software and computer systems architectural principles to **integrate a set of enterprise computer applications**

Point-to-Point integration



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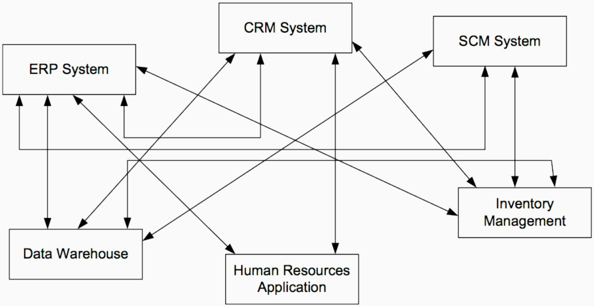
- Each integration project requires design and implementation
- Too many **interfaces** to develop $N \times N$
- How many **links**?

$$\sum_{i=1}^{N-1} i = ??$$

Point-to-Point integration



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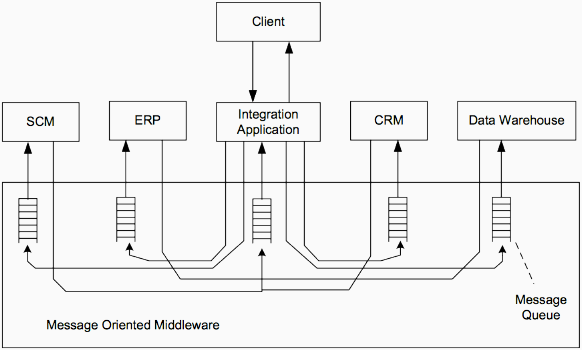
- Each integration project requires design and implementation
- Too many **interfaces** to develop $N \times N$
- How many **links**?

$$\sum_{i=1}^{N-1} i = \frac{N(N-1)}{2}$$

Message oriented middleware



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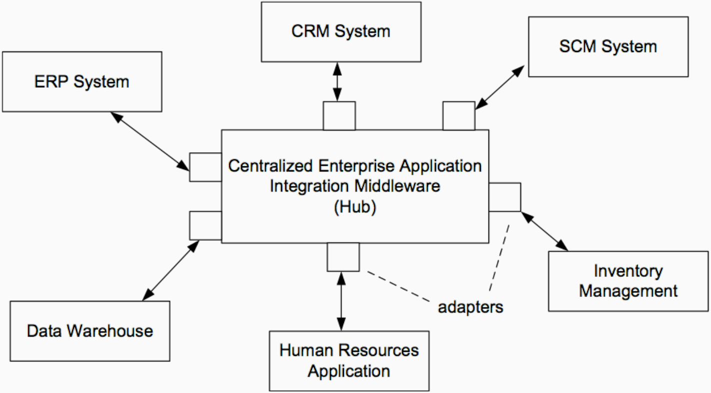
- Cooperation realized using the **integration application**
- process not directly connected
- Messages must be queued and enqueued
- Point-to-point connection in message oriented middleware

Hub-and-Spoke integration


CRM System
SCM System
ERP System
Centralized Enterprise Application Integration Middleware (Hub)
Inventory Management
adapters
Data Warehouse
Human Resources Application

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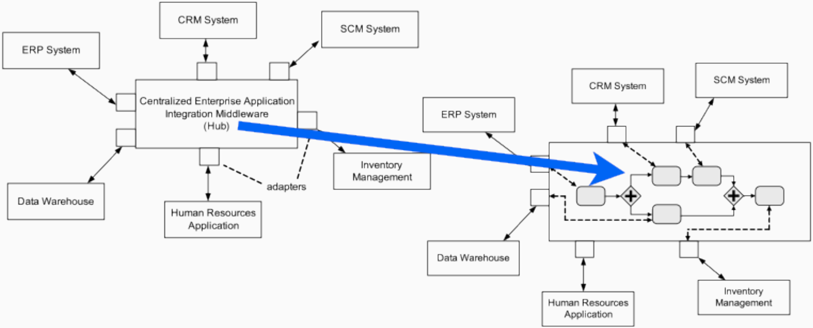
- Centralized hub
- Connection can be reduced
- How many link? N

Hub-and-Spoke integration



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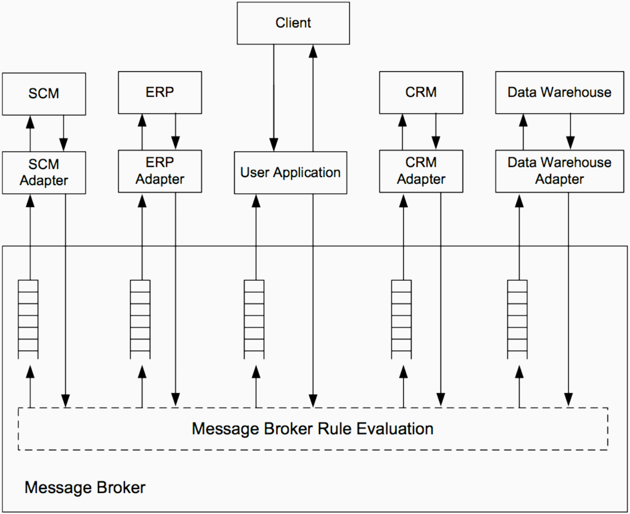
Message brokers - Publish/Subscribe

- On a technical level, **message brokers** can be used to realize a hub and spoke enterprise application integration system
    - Message brokers are software systems that allow a user to define **rules** for communication between applications
    - Changes can be specified in a **declarative way** in the central hub, rather than by coding in the applications
    - The **queues** are used for guaranteed delivery of messages
- **Publish/subscribe** is a mechanism to link applications to message brokers
    - The idea is that applications can **subscribe to certain messages** or types of messages
    - Applications can also publish messages

Message Brocker integration



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- Uses declarative rules that de-couples senders from receivers

Problems!!

- The message broker contains **considerable application logic**
- This **application logic is hidden in the rules** that the message broker uses to relay messages
- Complex dependencies between rules can emerge, so that changing one rule might have undesired implications on the overall system behavior
- **Configuration and management of adapters** and message brokers can become cumbersome

Questions?