

Business Process Digitalization and Cloud Computing

2. Enterprise Systems Architectures

Andrea Morichetta, Phd

Computer Science Division

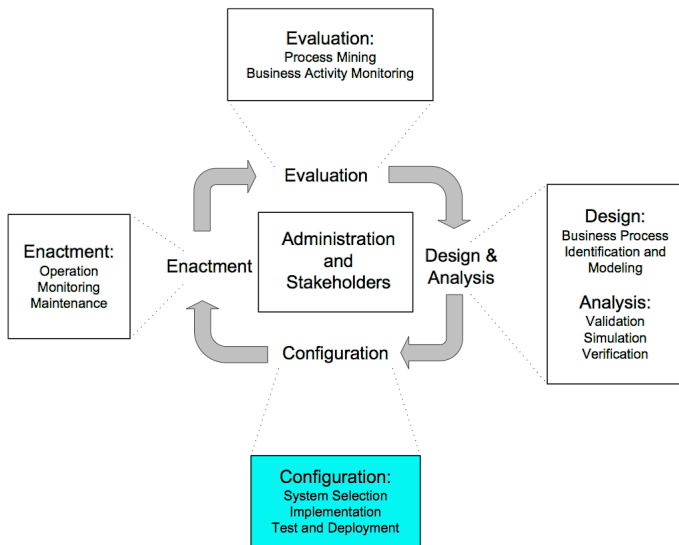
October 3, 2018



Table of contents

1. Enterprise application and their integration

Business Process Lifecycle: Configuration



M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

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.

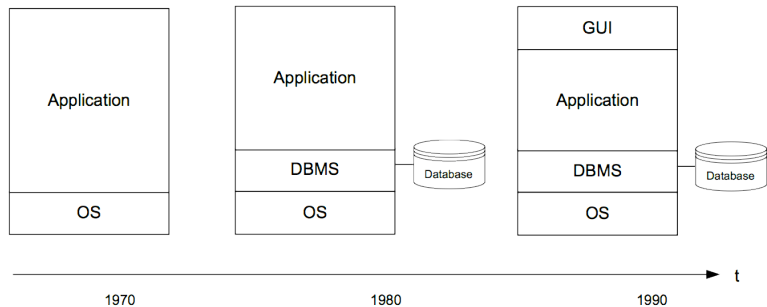
Software architecture

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



Programming
interfaces (OS)

Relational
Database

Advanced
user interface

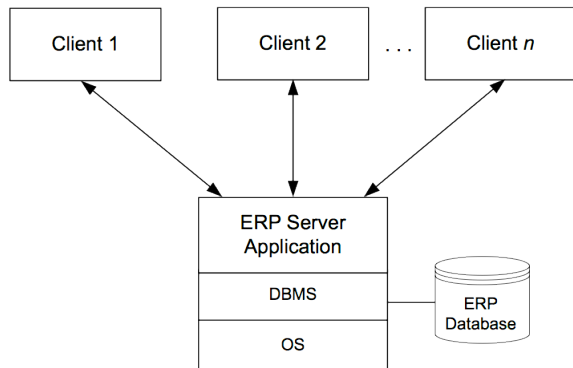
M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

Early systems architecture

Changes:

- **Hard** to implement
- Full of **dependency** and **replication**
- Any **modification** of an application was a complex and **error-prone activity**, with domino effect (e.g. change of customer address format)

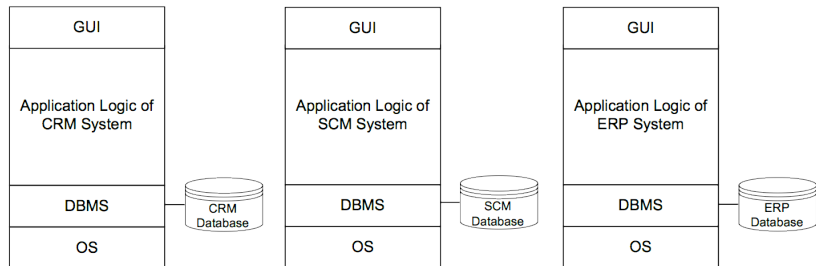
Two-tier Client-Server architecture



M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

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

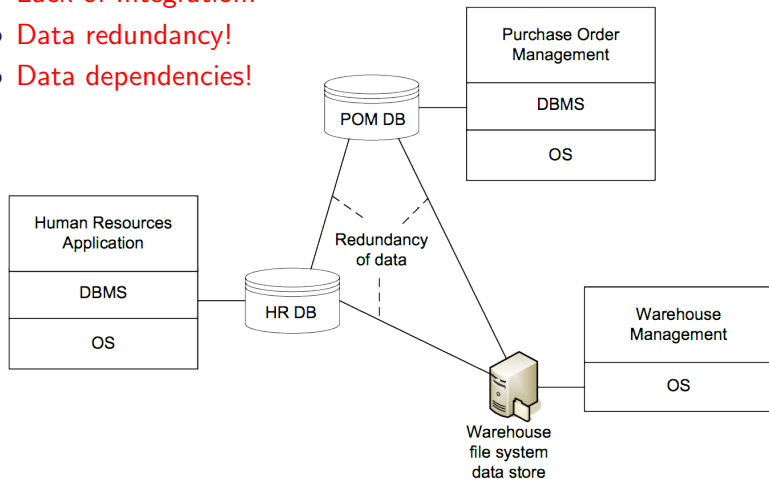
Siloed enterprise application



- Independent applications
- Connected but not logically integrated

Enterprise systems

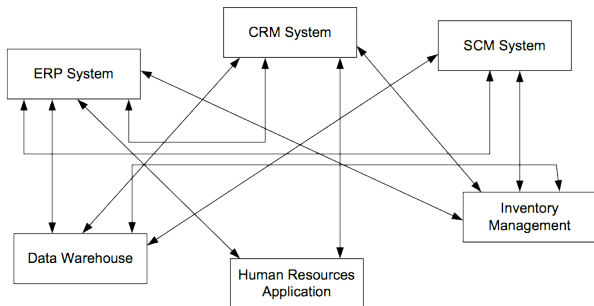
- Lack of Integration!
- Data redundancy!
- Data dependencies!



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

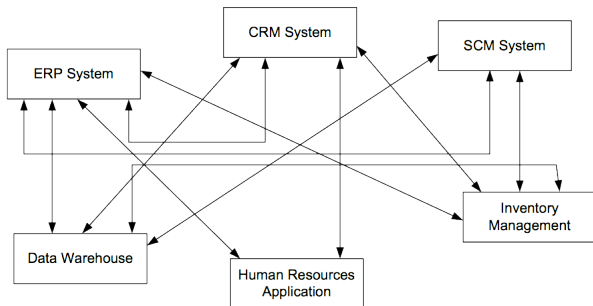


M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

- 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

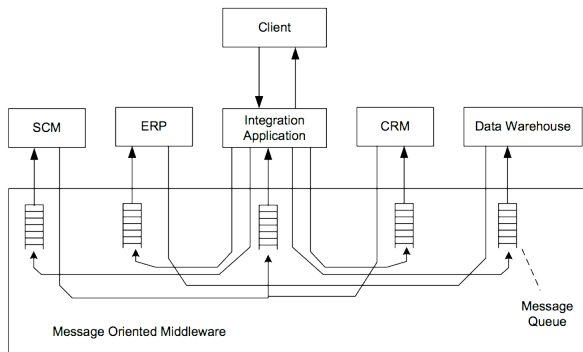


M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

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

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

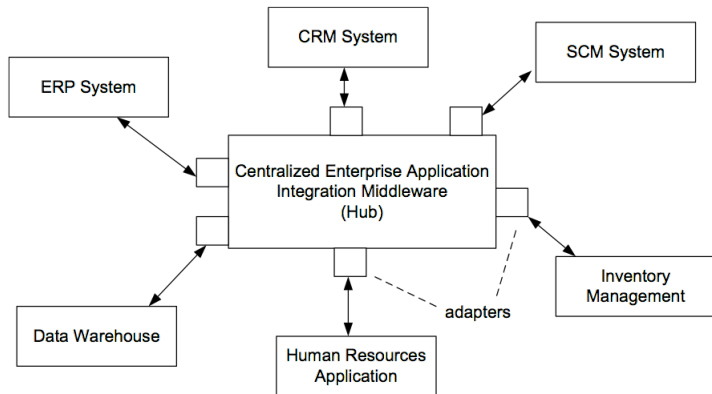
Message oriented middleware



M. Weske: Business Process Management,
© Springer-Verlag Berlin Heidelberg 2012, 2007

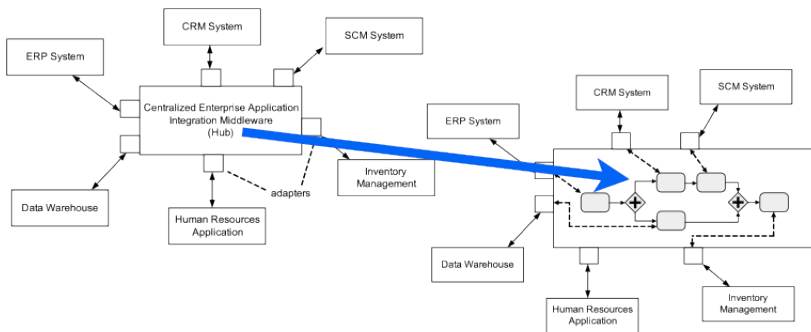
- Cooperation realized using the **integration application**
- Process **not directly connected**
- Messages must be **queued** and **enqueued**
- Point-to-point connection in message oriented middleware

Hub-and-Spoke integration



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

Hub-and-Spoke integration

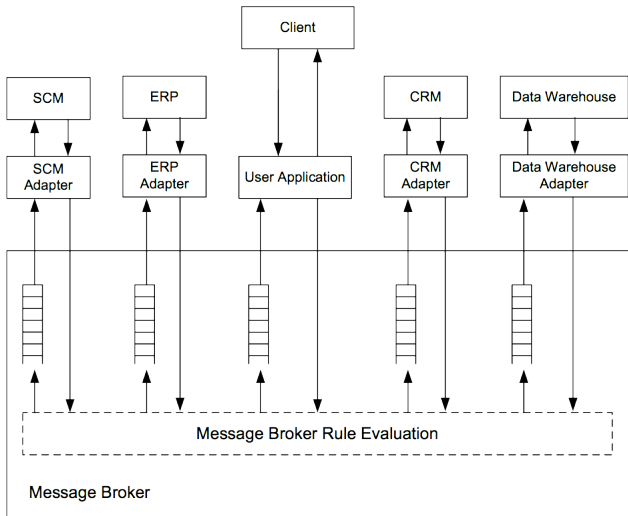


M. Weiske: Business Process Management, © Springer-Verlag Berlin Heidelberg 2007

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 Broker integration



M. Weske: Business Process Management.
© Springer-Verlag Berlin Heidelberg 2012, 2007

- 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?