Complex Information Systems

Integration Problem. Different Approaches. Current Trends.

In this section

- The advantages and limitations of messaging as compared to other integration techniques
- When to send a message, what it should contain, and how to use special message properties
- How to determine the message channels

Introduction

Applications rarely live in isolation

Usually applications can be made better by integrating it with other applications

Fundamental challenges:

- Networks are unreliable
- Networks are slow
- Any two applications are different
- Change is inevitable

Introduction

Four main approaches

- File Transfer
- Shared Database
- Remote Procedure Invocation
- Messaging

What is Messaging?

Technology, that enables high-speed, asynchronous, program-to-program communication (with reliable delivery)

Messages

Channels

Sender or producer

Receiver of consumer

What is a Messaging System?

Messaging capabilities provided by separate software

messaging system or message-oriented middleware (MOM)

Coordinates and manages the sending and receiving of messages + backed up with DB

What is a Messaging System?

A message is transmitted in five steps:

1. Create — The sender creates the message and populates it with data.

2. Send — The sender adds the message to a channel.

3. Deliver — The messaging system moves the message from the sender's computer to the receiver's computer, making it available to the receiver.

4. Receive — The receiver reads the message from the channel.

5. Process — The receiver extracts the data from the message.

Why Use Messaging?

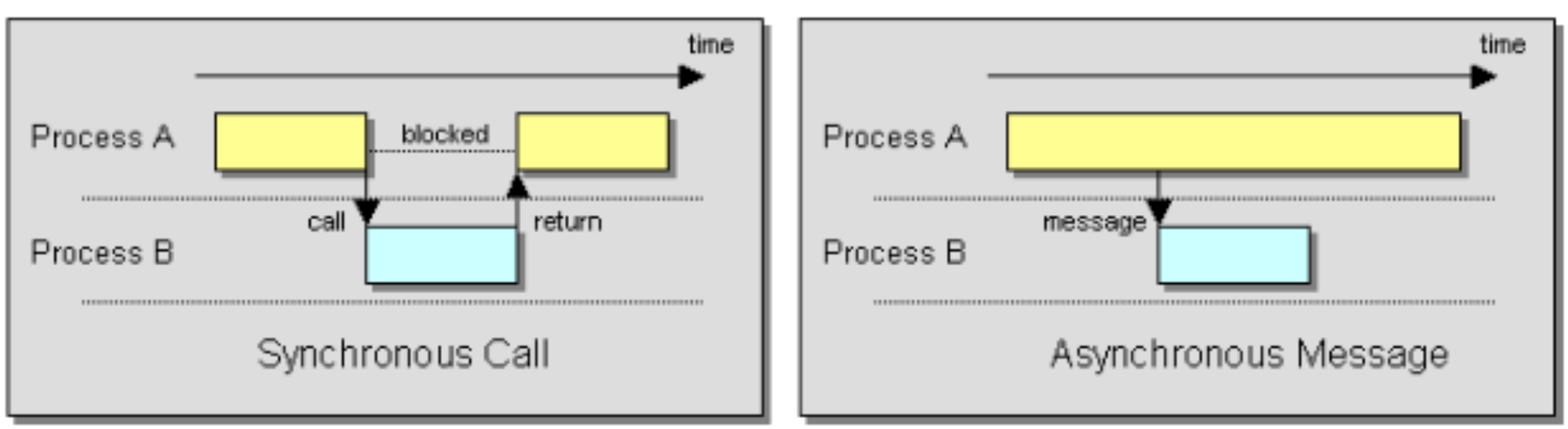
Benefits:

- Remote Communication
- Platform/Language Integration.
- Asynchronous Communication.
- Variable Timing.
- Throttling.
- Reliable Communication.
- Disconnected Operation.
- Mediation.
- Thread Management.

Challenges of Asynchronous Messaging

- Complex programming model.
- Sequence issues.
- Synchronous scenarios.
- Performance.
- Limited platform support.
- Vendor lock-in.

Thinking Asynchronously



Commercial Messaging Systems

Messaging vendors' products into the following four categories:

1. Operating Systems
2. Application Serves
3. EAI Suites
4. Web Services Toolkits

Pattern Form

Structure:

Name

Icon

Context

Problem

Forces

Solution

Sketch

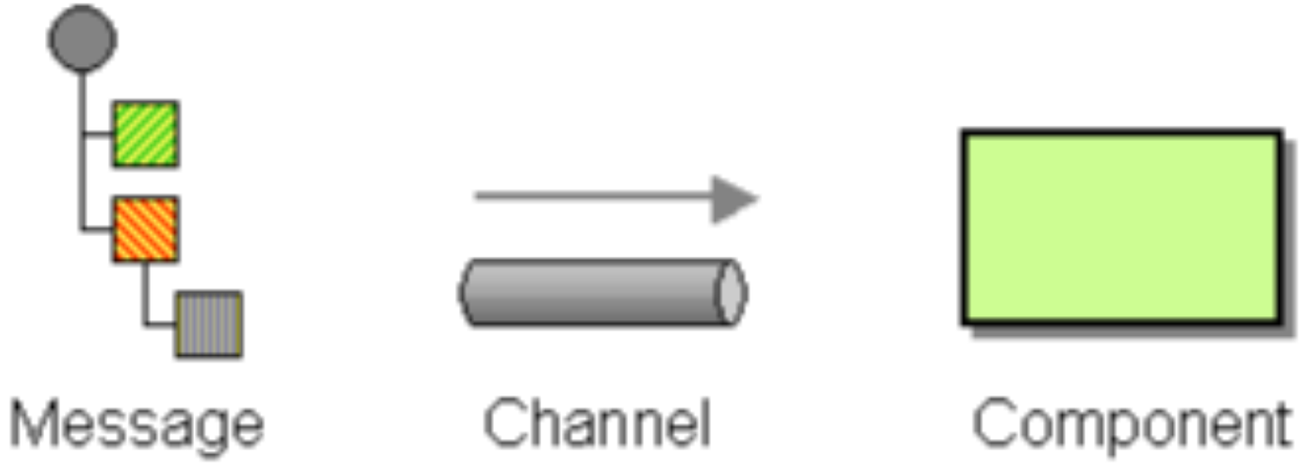
Results

Next

Sidebars

Examples

Diagram Notation



The Need for Integration

Hundreds or thousands of applications are custom-built, third-party, part of legacy systems, etc.

Business applications are complex → writing them are hard

ERP vendors created large business applications, but perform a fraction of the business functions required

Integration Challenges

Integration requires a significant shift in corporate politics

Integration efforts typically have far-reaching implications on the business

Only few standards have established themselves in this domain

Existing XML Web Services standards address only a fraction of the integration challenges

The Wide World of Integration

Six types:

- Information Portals
- Data Replication
- Shared Business Functions
- Service-Oriented Architectures
- Distributed Business Processes
- Business-to-Business Integration

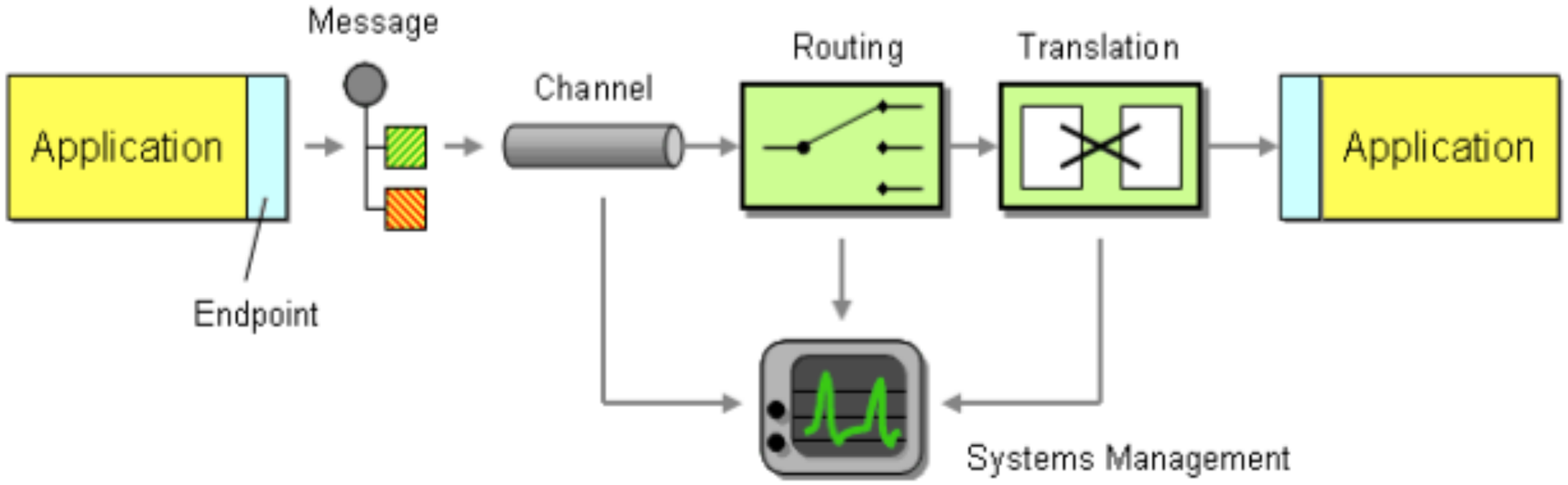
Loose Coupling

Core principle: educe the assumptions two parties (components, applications, services, programs, users) make about each other when they exchange information

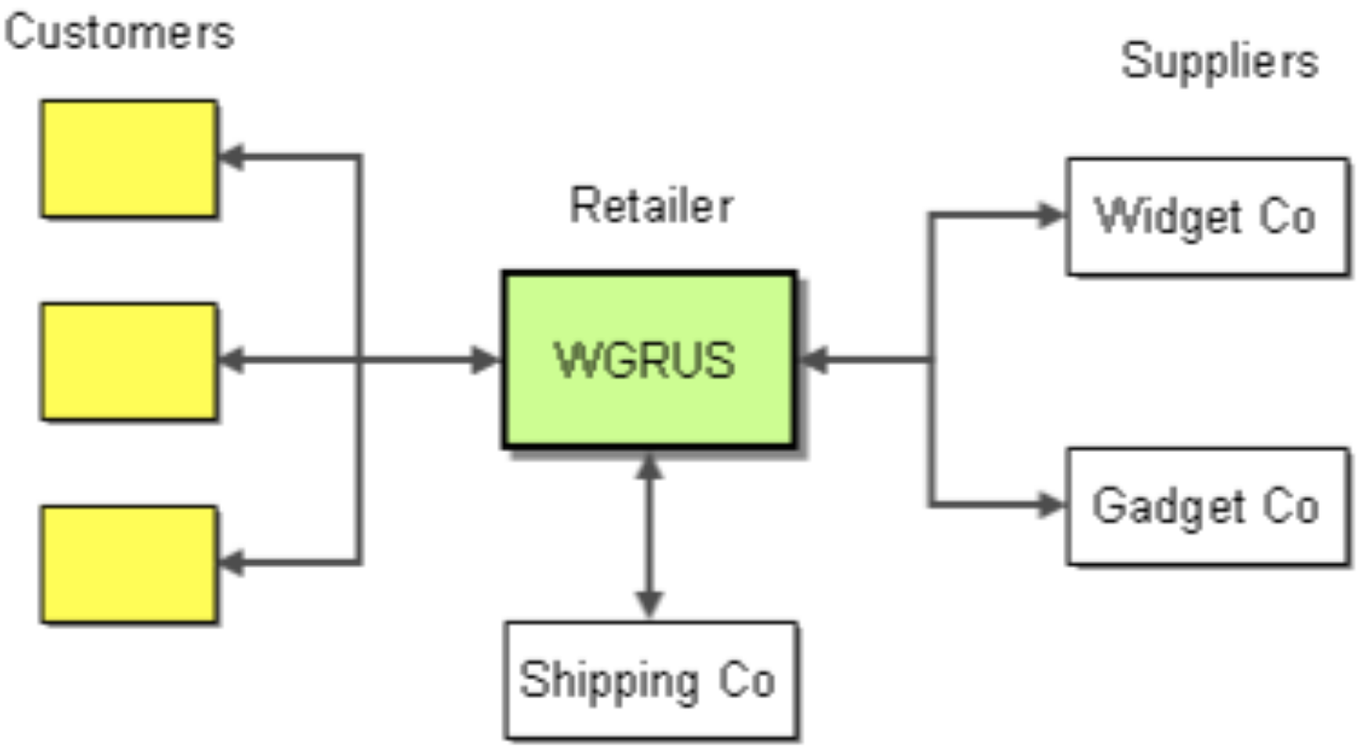
Tight coupling: local method invocation

Make remote communications simple by packaging a remote data exchange into the same semantics as a local method call.

A Loosely Coupled Integration Solution



Widget-Gadget Corp - An Example



Widget-Gadget Corp - An Example

- Take Orders: Customers can place orders via Web, phone or fax
- Process Orders: Processing an order involves multiple steps, including verifying inventory, shipping the goods and invoicing the customer
- Check Status: Customers can check the order status
- Change Address: Customers can use a Web front-end to change their billing and shipping address
- New Catalog: The suppliers update their catalog periodically. WGRUS needs to update its pricing and availability based in the new catalogs.
- Announcements: Customers can subscribe to selective announcements from WGRUS.
- Testing and Monitoring: The operations staff needs to be able to monitor all individual components and the message flow between them.

Integration styles

Some applications

may be custom developed in-house, while others are bought from third-party vendors

may run on multiple platforms

may be geographically dispersed

may need integrated even though they were not designed for that

Application Integration Criteria

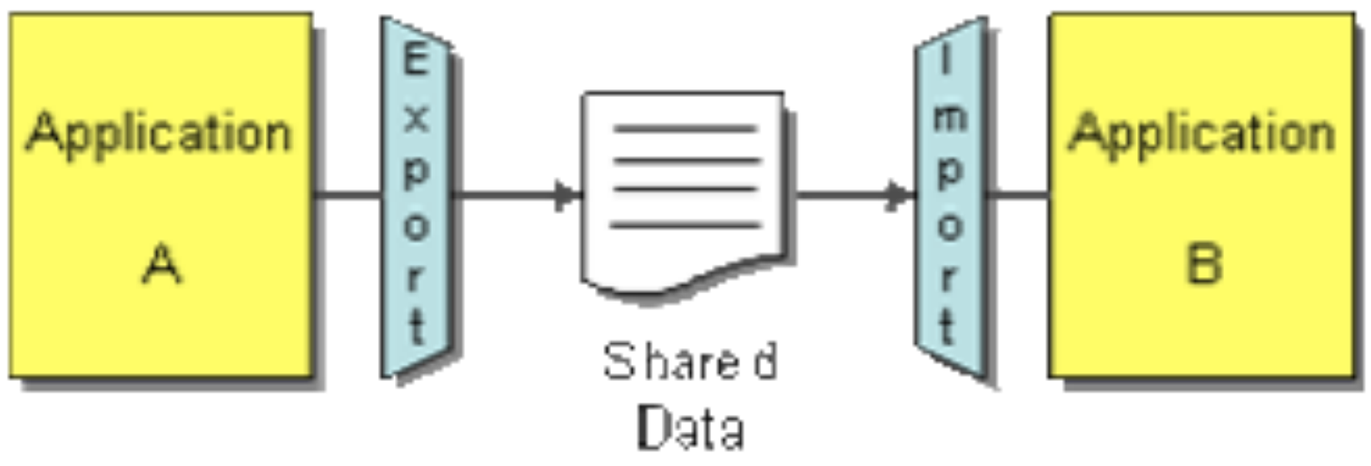
First criterion: **application integration** itself

Other main decision criteria are:

- Application coupling
- Integration simplicity
- Integration technology
- Data format
- Data timeliness
- Data or functionality
- Asynchronity

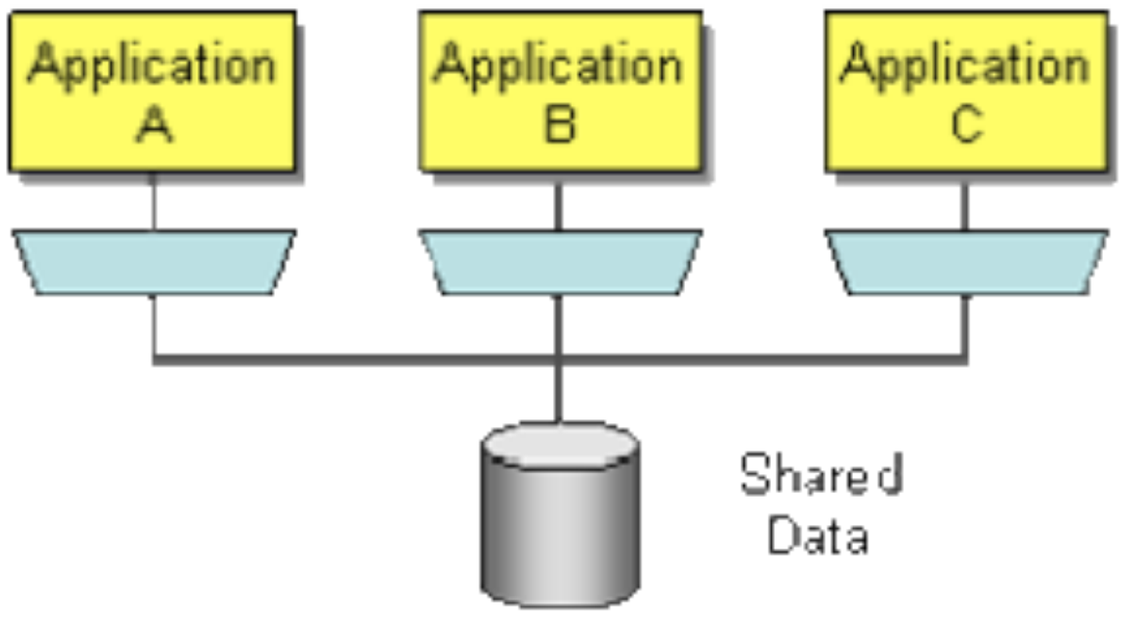
File Transfer

Have each application produce files of shared data for others to consume, and consume files that others have produced.



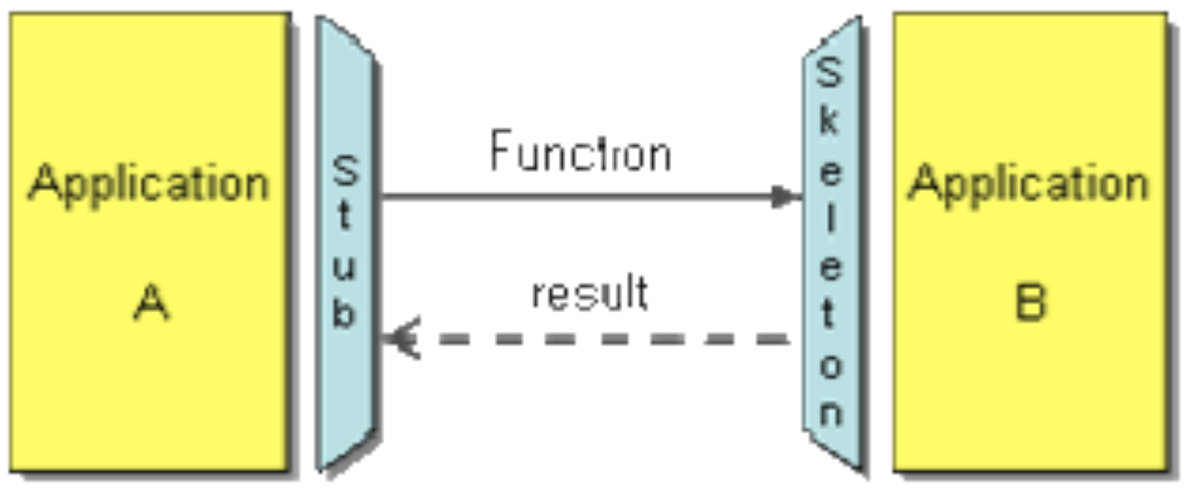
Shared Database

Have the applications store the data they wish to share in a common database.



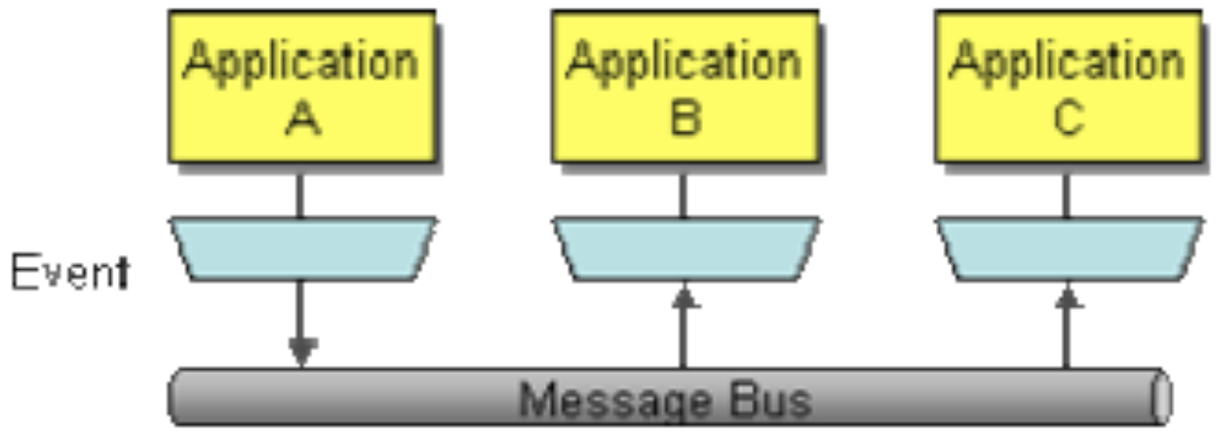
Remote Procedure Invocation

Have each application expose some of its procedures so that they can be invoked remotely, and have applications invoke those to run behavior and exchange data.



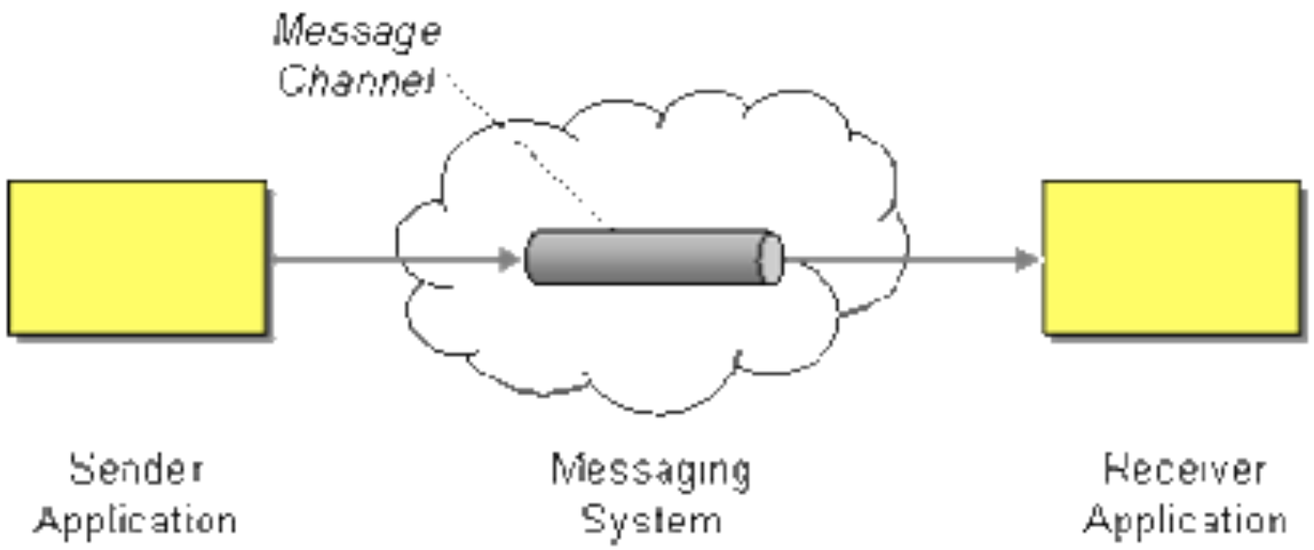
Messaging

Have each application connect to a common messaging system, and exchange data and invoke behavior using messages.



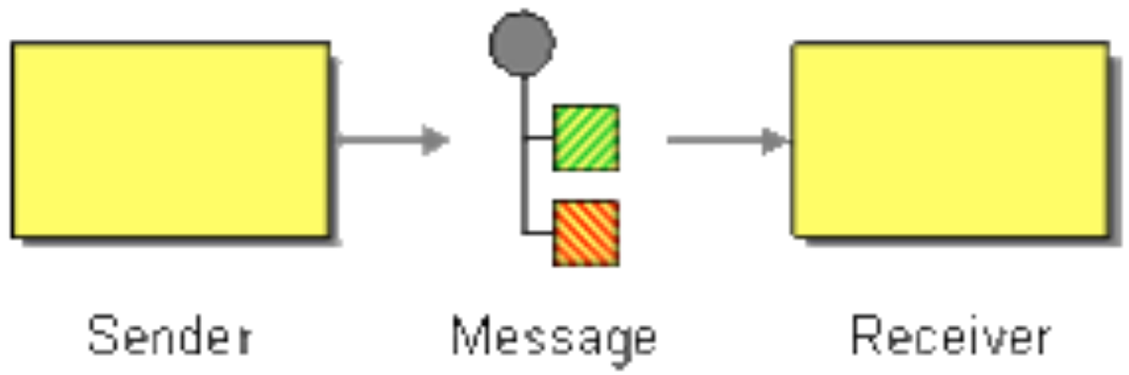
Message Channel

Messaging applications transmit data through a Message Channel, a virtual pipe that connects a sender to a receiver.



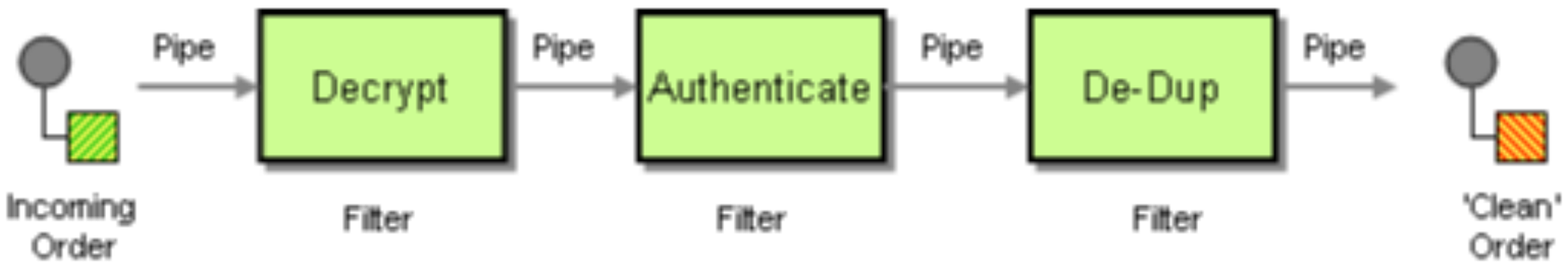
Message

A Message is an atomic packet of data that can be transmitted on a channel.



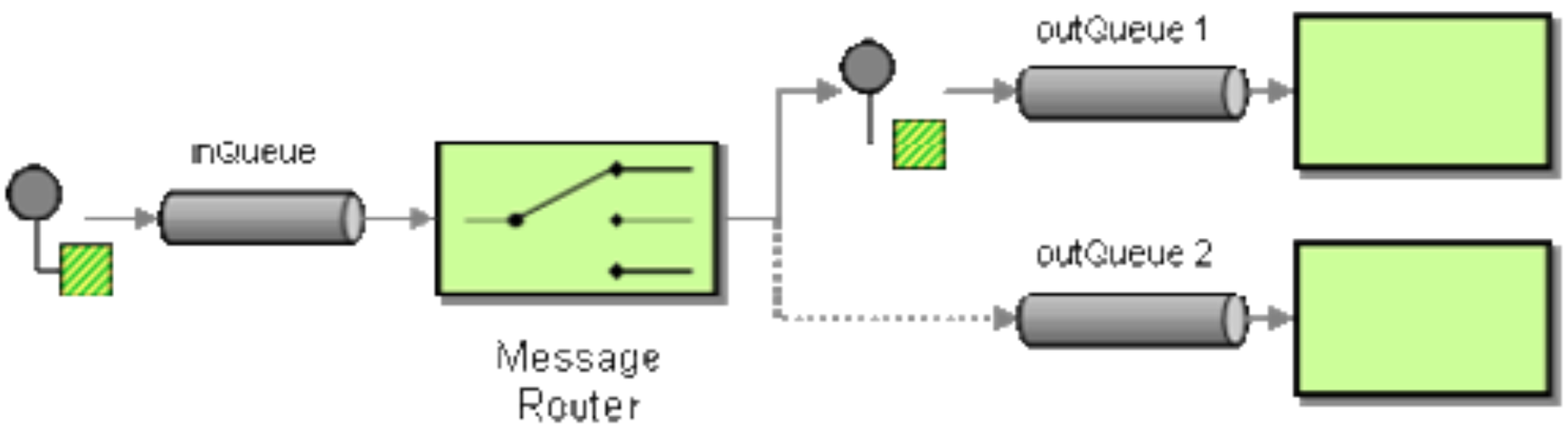
Pipe and Filters

A Pipes and Filters architecture describes how multiple processing steps can be chained together using channels.



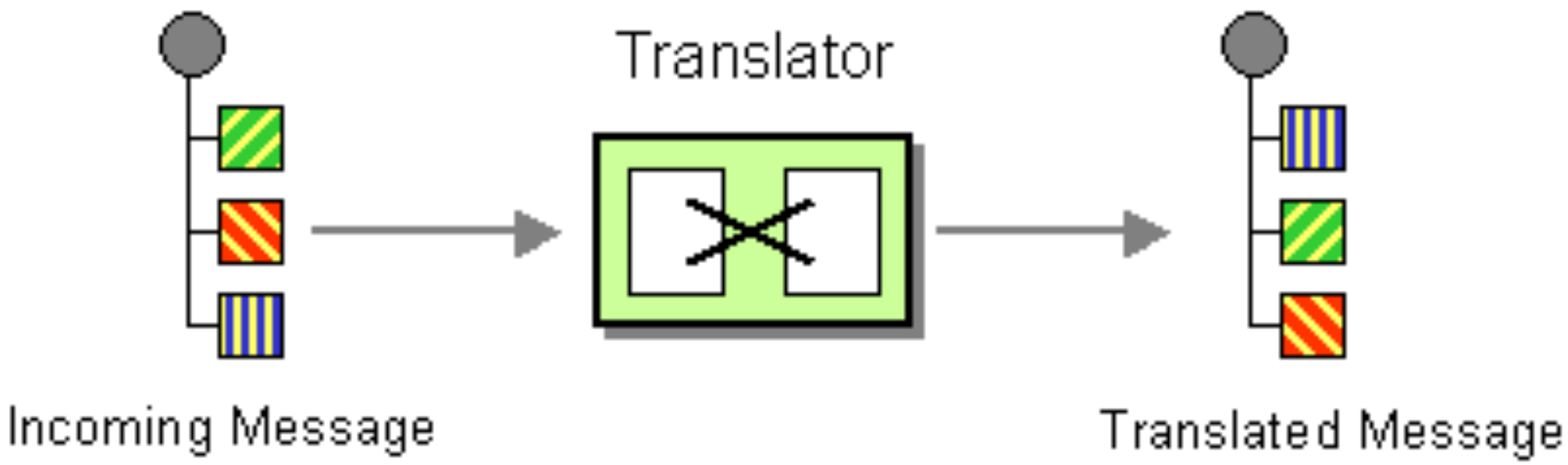
Message Route

An application component and filter in the pipes-and-filters architecture, which will determine how to navigate the channel topology and direct the message to the final receiver, or at least to the next router.



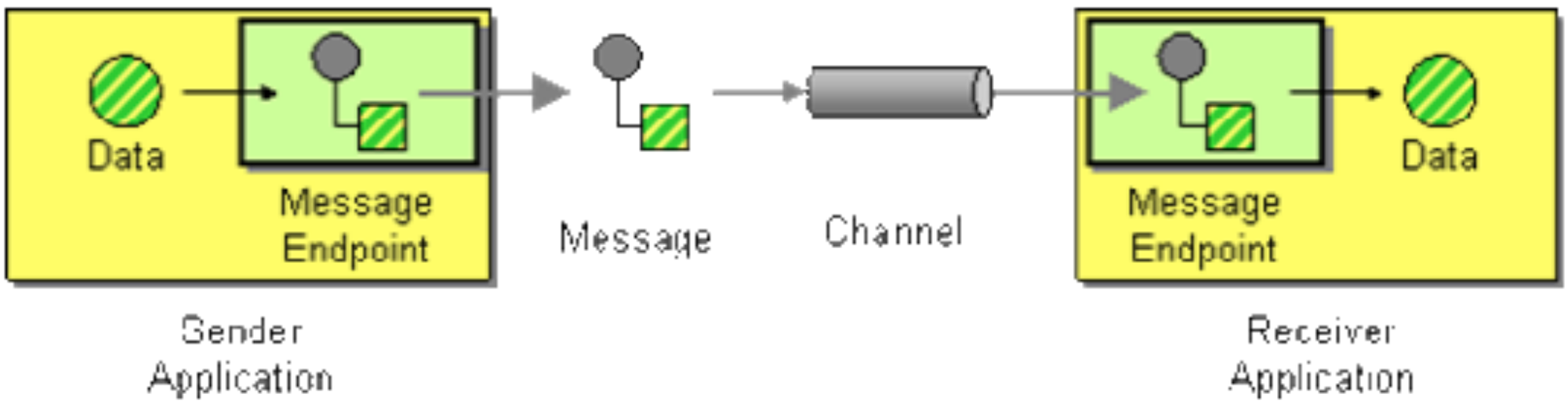
Message Translator

Converts the message from one format to another.



Message Endpoint

Coordinated endpoints enable the application to send and receive messages.



System Management

Typical *System Management* solution monitors how many messages are being sent or how long it took a message to be processed

> not inspect the message data except maybe for some fields in the message header such as the message identifier or the Message History

Business Activity Monitoring (BAM) solutions focus on the payload data contained in the message