Open Message Queue

mq.dev.java.net

Dave Whitla
Technical Architect
Wotif.com

Agenda

- Architectural forces
- The Java Message Service
- What is Open Message Queue?
- How do I develop with Open Message Queue?
- The Wotif.com experience

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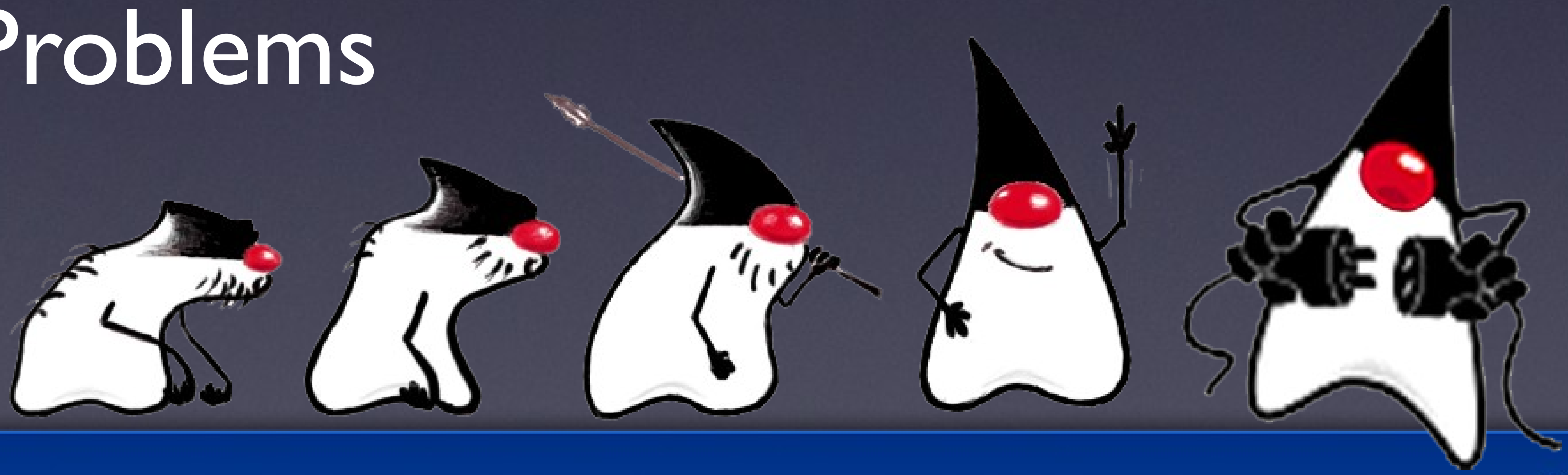
Application Evolution

- As applications grow they need to evolve
- The Monolith
- Absence of Discrete Components
- Performance Issues
- Central Bottleneck
- Scalability Problems

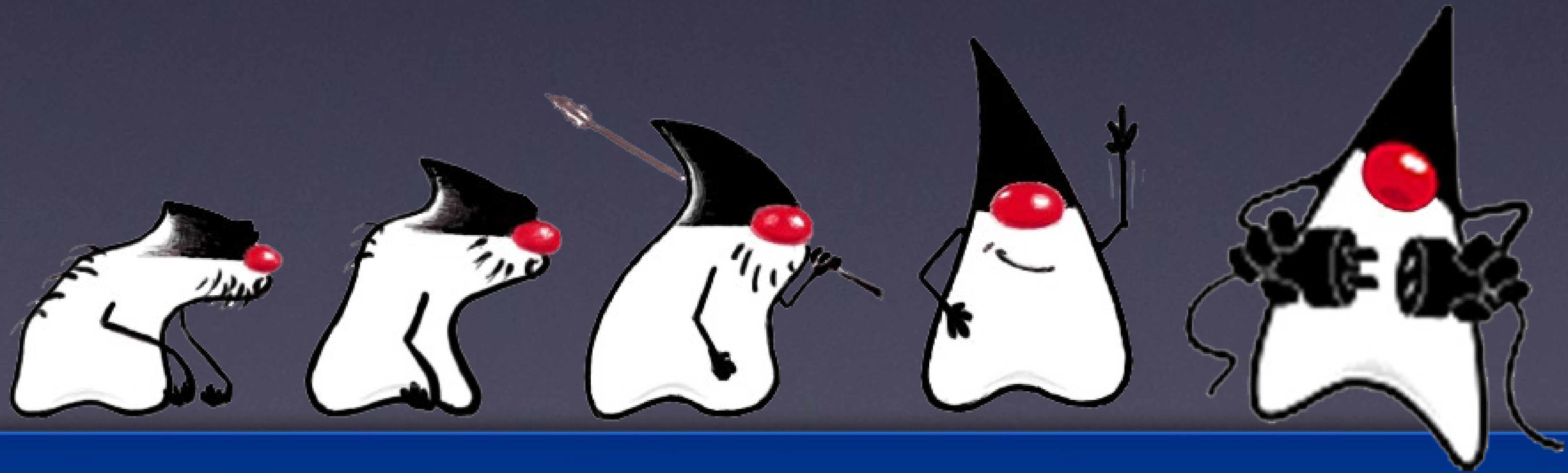


Application Evolution

Message Oriented Middleware

- An “event-driven” architecture
- A shared, centralised event notification service

- Reduces unnecessary “polling” communication
- Reduces instance, API, performance and availability coupling
- Components are coupled only to the messaging domain



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The Java Message Service

- Originally developed to allow Java access to existing systems
- Now widely adopted by existing MOM vendors

Core concepts:

- Provision of routing and delivery services
- Support for point-to-point and publish-subscribe patterns
- Synchronous and asynchronous message receipt
- Support for reliability assurance
- Built-in support for common existing message formats

The JMS Provider

JMS Providers must “provide” the following:

- Client libraries that implement the JMS interfaces
- Functionality for routing and delivery of messages
- Administrative tools for management, monitoring and tuning

- Lowest common denominator of MOM features
- Providers typically cannot communicate directly with each other

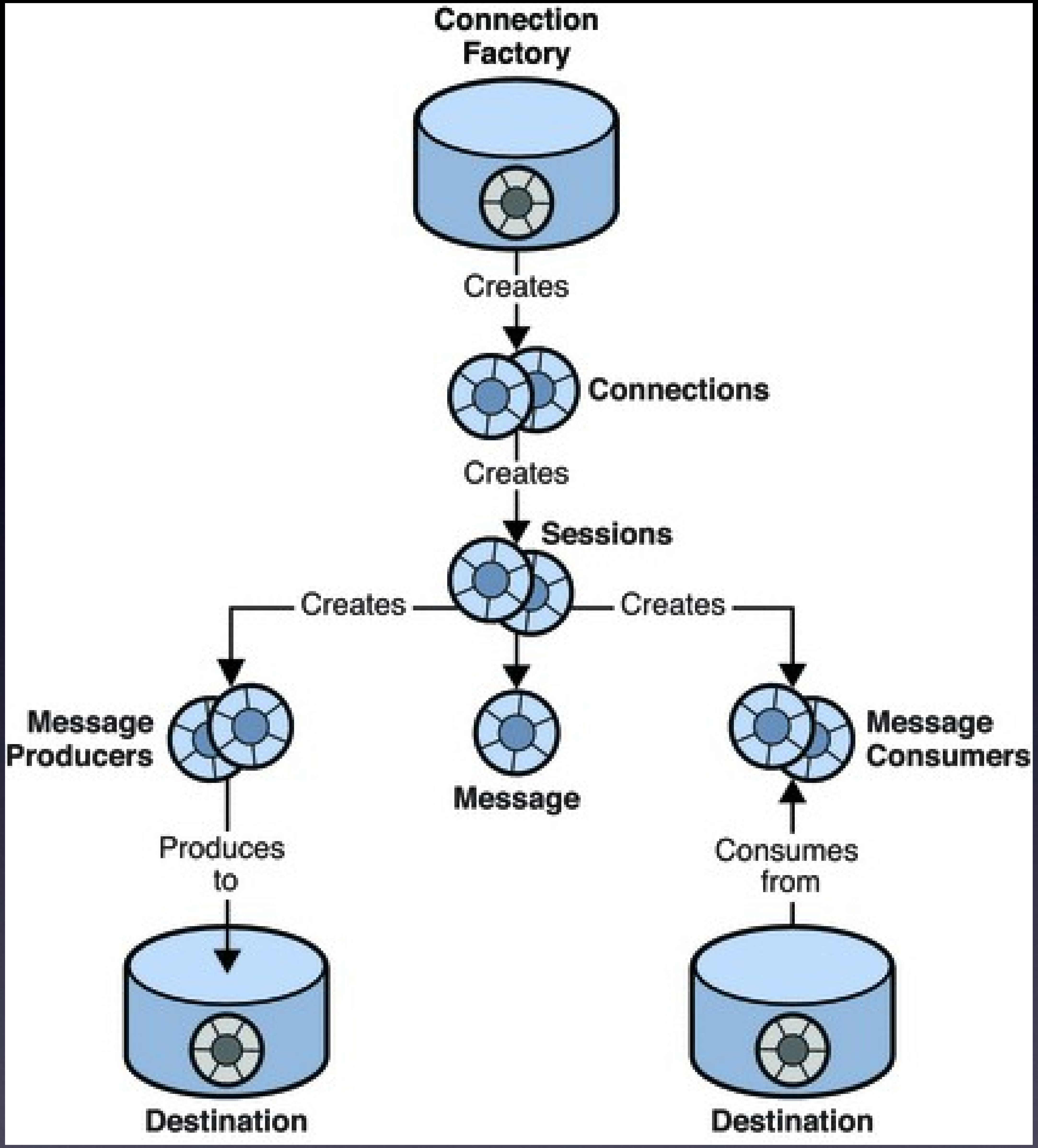
Messaging Objects & Domains

JMS Messaging Objects

- Connection
- Session
- Producer / Consumer
- Destination
- Message

JMS Messaging Domains

- Point-to-Point (Queues)□
- Publish-Subscribe (Topics)□



Messaging Objects & Domains

JMS Messaging Objects

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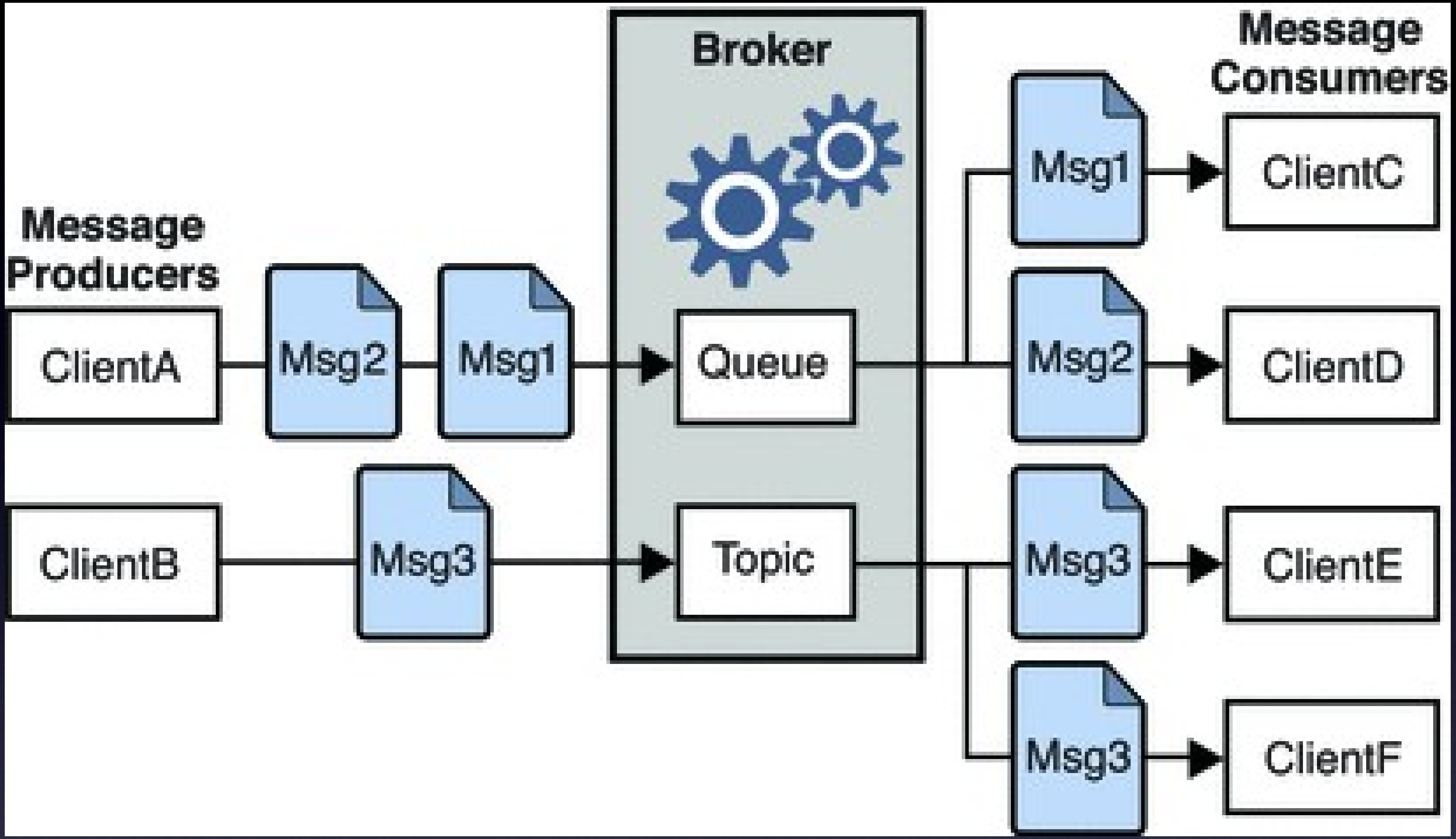


JMS Messaging Domains

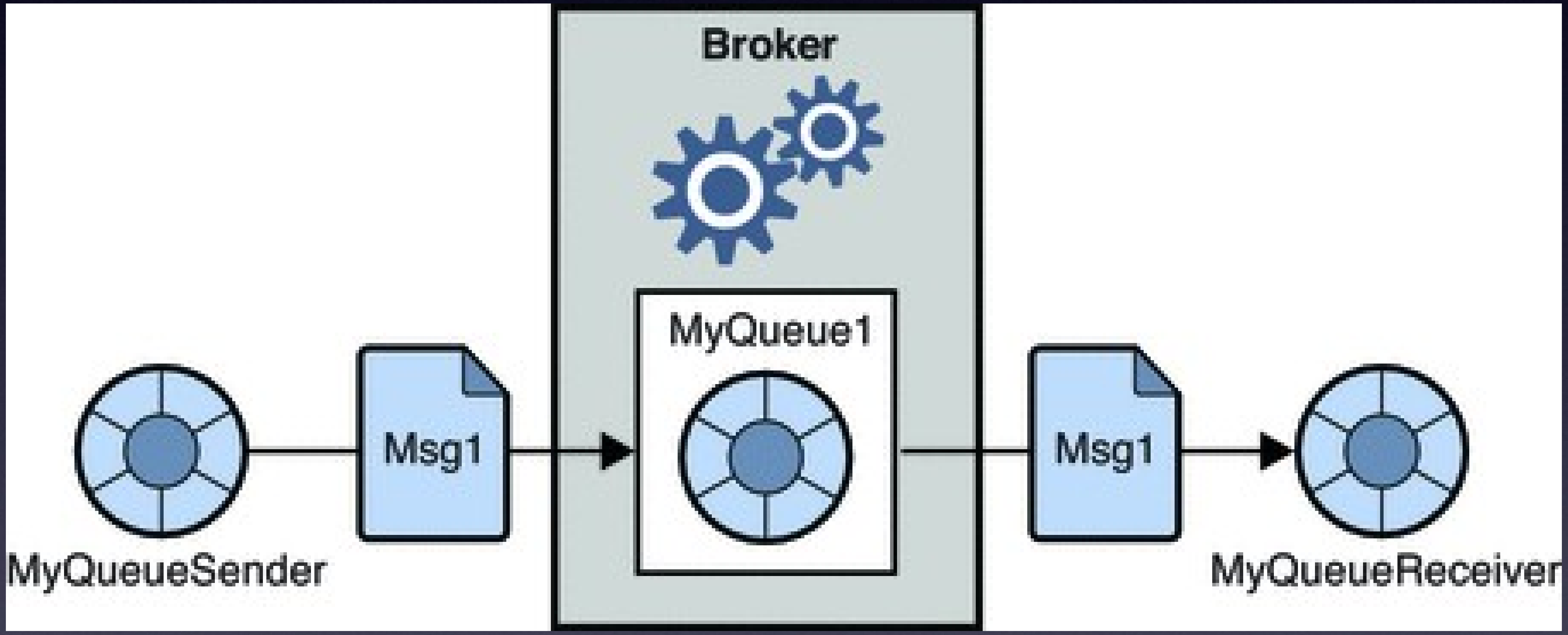
- Point-to-Point (Queues) □
- Publish-Subscribe (Topics) □

Point-to-point Messaging

Senders produce messages to

Queues from which

Receivers consume



Point-to-point Messaging

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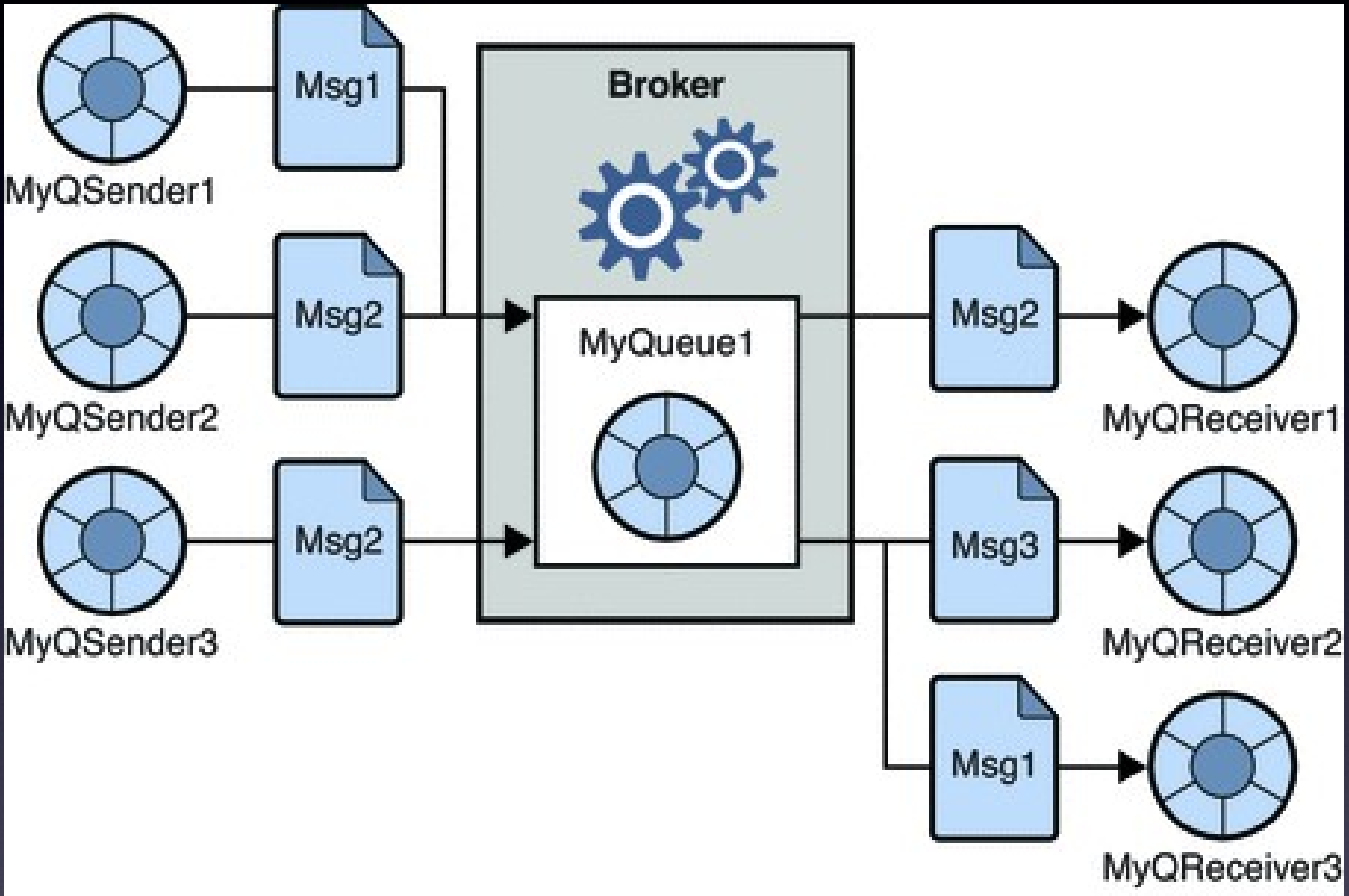
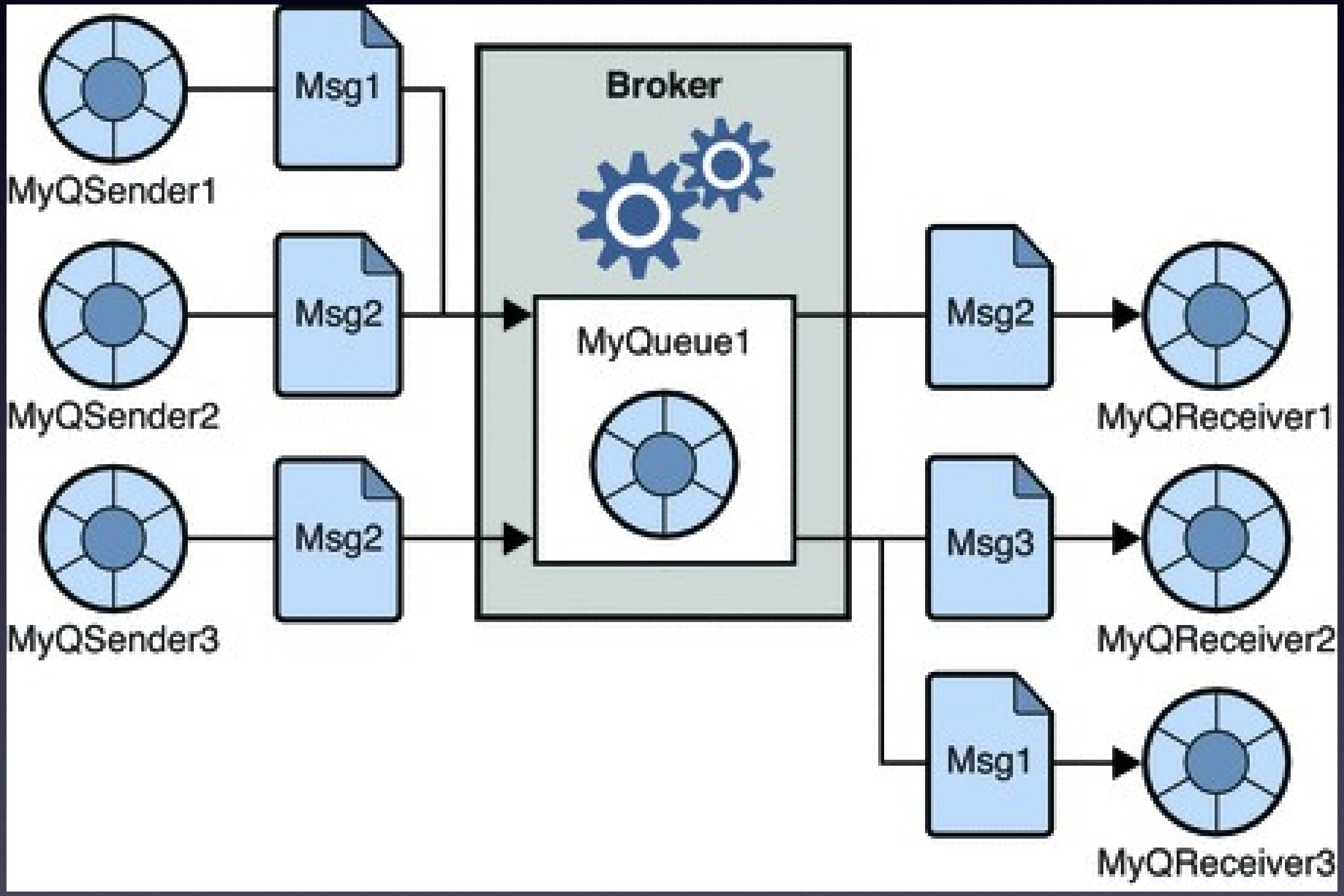


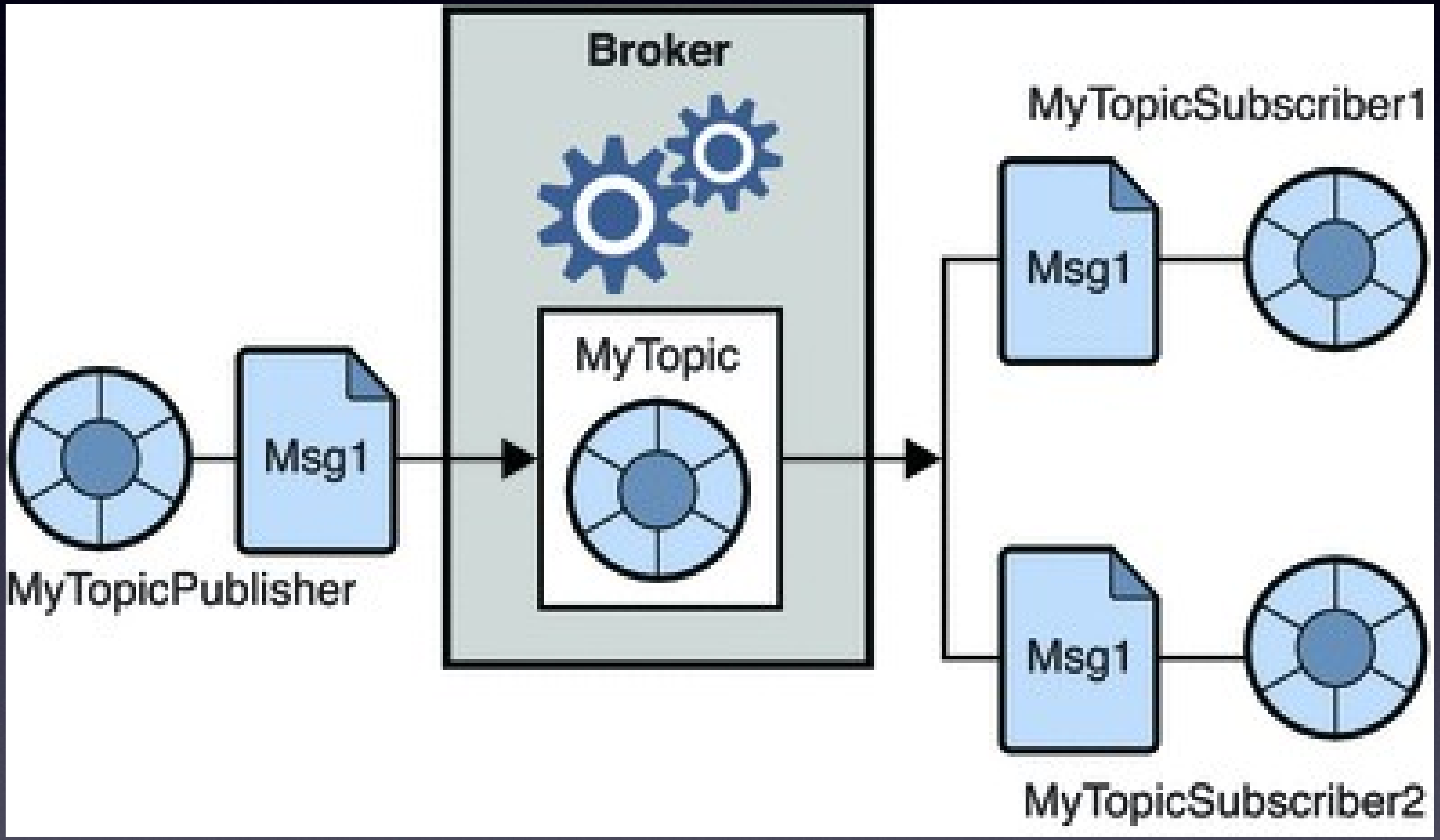
Point-to-point Messaging

- Multiple Senders per Queue
- Multiple Receivers per Queue (OpenMQ extension)□
- No send-receive timing dependency



Publish-subscribe Messaging

Publishers produce messages to
Topics from which
Subscribers may consume after they have subscribed



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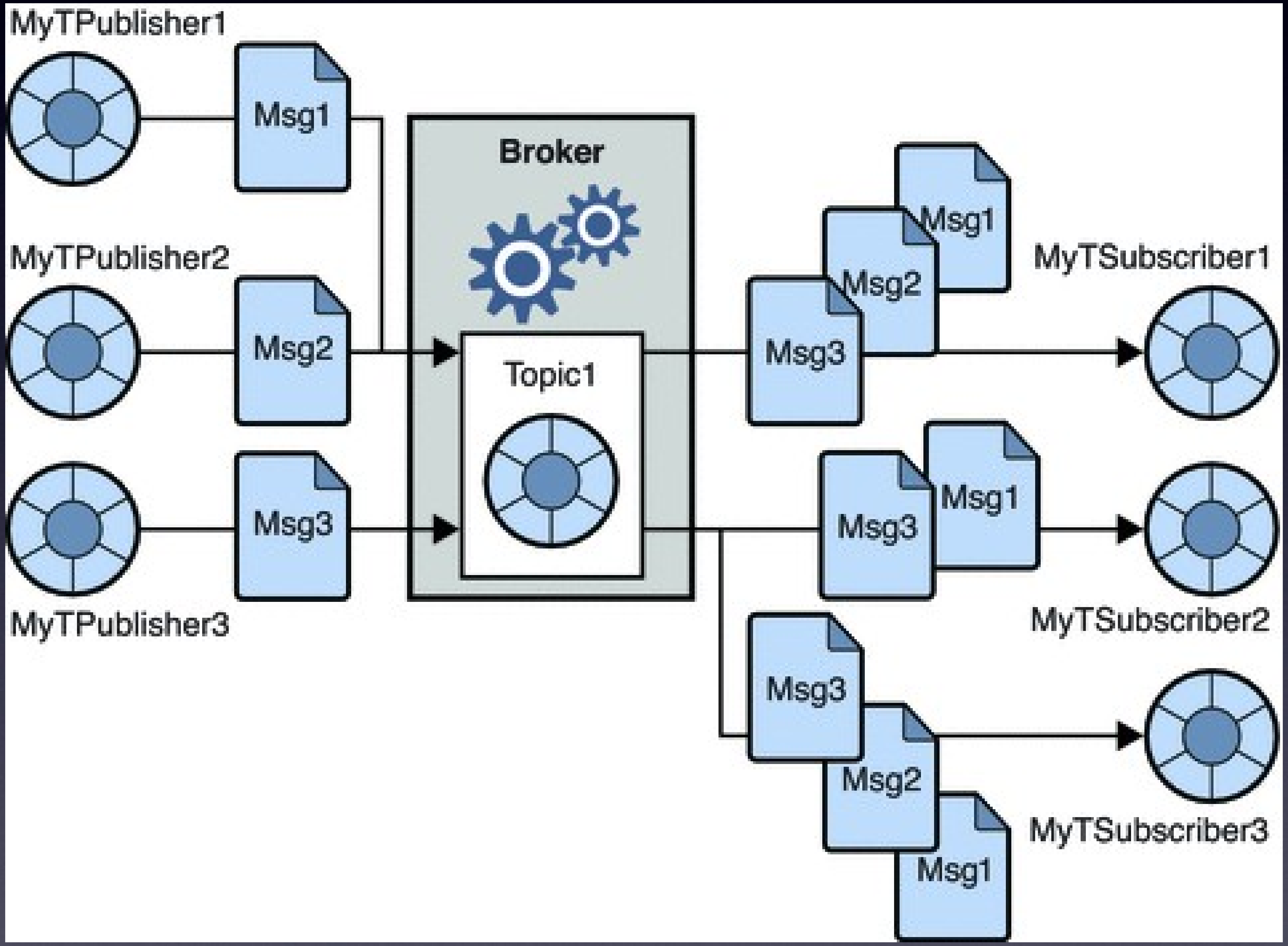
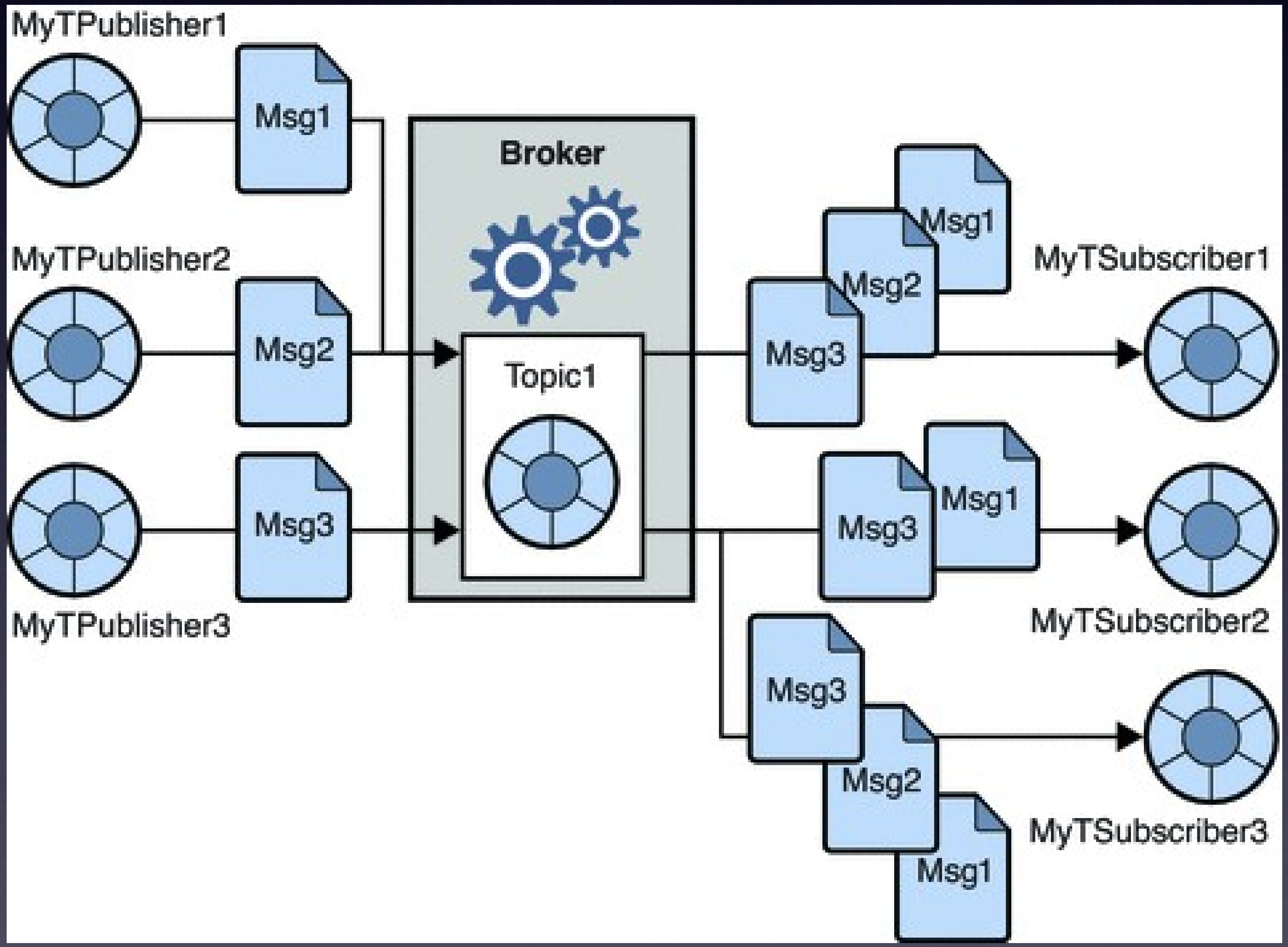


Publish-subscribe Messaging

- More than one producer possible per topic
- More than one subscriber possible per topic
- All subscribers receive all messages
- Send-receive timing dependency
- Durability
- Broadcast



Common & Unified Domain

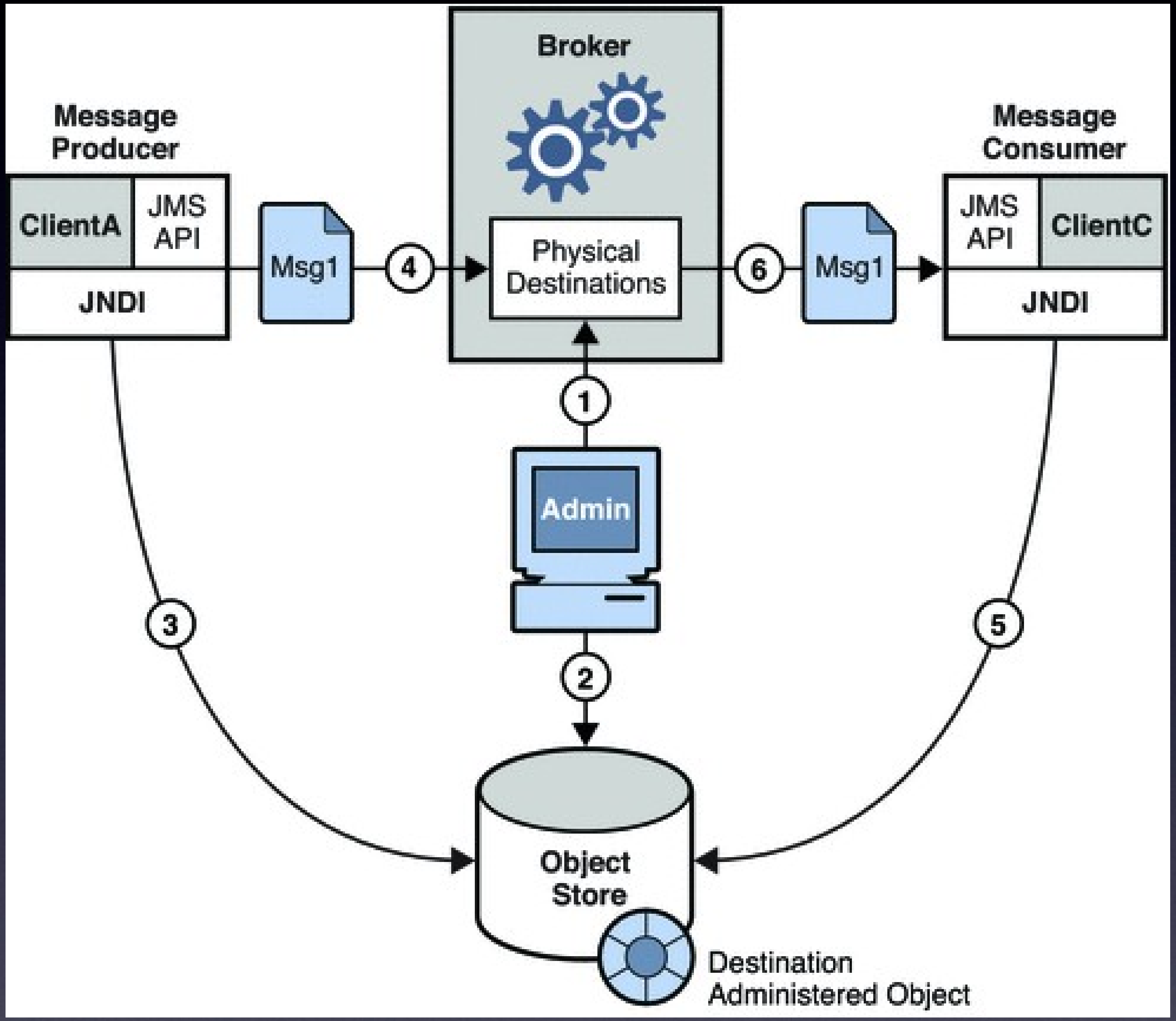
- Messages can be consumed synchronously or asynchronously
- Consumers can filter which messages they receive
- Messages are placed in destinations in sent order
- Message consumption order cannot be guaranteed

Base Type (Unified Domain)□	Point-to-Point Domain	Publish-Subscribe Domain
Destination	Queue	Topic
ConnectionFactory	QueueConnectionFactory	TopicConnectionFactory
Connection	QueueConnection	TopicConnection
Session	QueueSession	TopicSession
MessageProducer	QueueSender	TopicPublisher
MessageConsumer	QueueReceiver	TopicSubscriber

Administered Objects

- JMS scheme is extensible
- Need for vendor portability of JMS object references
- Two fundamental objects which vary in construction requirements from one vendor to the next:
  - Connections (or rather their factories)□
  - Destinations

Administered Objects



Administered Objects

Administered Objects provide clear benefits:

- Administrators can tune messaging performance globally by reconfiguring these objects. No code changes necessary.
- Administrators can control destination proliferation on the broker.
- Developers can catch programming errors early which might otherwise silently create an incorrect destination.
- They shield developers from vendor-specific provider details maintaining vendor portability without code changes.

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What is Open Message Queue?

- A Java Message Oriented Middleware server
- A complete JMS provider implementation
- Provides a reference implementation of the JMS APIs
- OpenMQ IS Sun Java System Message Queue
- A member of the GlassFish community
- "Stand-alone" or embedded within GlassFish
- Completely open source software with a strong community
- Project home at mq.dev.java.net

Licencing & Availability

- Complete source code
  - Dual licence CDDL and GPLv2 like GlassFish
- Stable binaries and source are are available for each release
  - Since version 4.0 / GlassFish V1
  - Today 4.1 / GlassFish V2
  - Promoted builds (unstable) of next generation 4.2

OpenMQ Components

OpenMQ is composed of 3 major elements

- Messaging Server
  - known as a “broker”
- Client Libraries
  - Java language runtime
  - C language runtime
  - JCA 1.5 adaptor for JEE containers
- Administration Tools
  - Command-line tools
  - GUI tool
  - JMX API

OpenMQ Features

Broker features:

- The full JMS specification
- Clustering / load-balanced and failover (HA service)□
- Dead Message Queue
- SOAP over HTTP, SOAP over JMS, SSLJMS and TLS transport
- Multiple Queue Receiver extension
- No-Acknowledge extension
- Message body compression and encryption
- Message store - file or JDBC - for guaranteed delivery

OpenMQ Features

Client features:

- Java and C client libraries
- JCA 1.5 resource adaptor
- Client runtime logging
- Connection event notification

OpenMQ Features

Administration features:

- Destination consumer limits
- Destination message count limits
- Quiesce destinations and/or broker for managed hot upgrades
- JMX API - remote programmatic management and monitoring
- Pure Java GUI (uses JMX)□
- Comprehensive command-line tools

OpenMQ Features

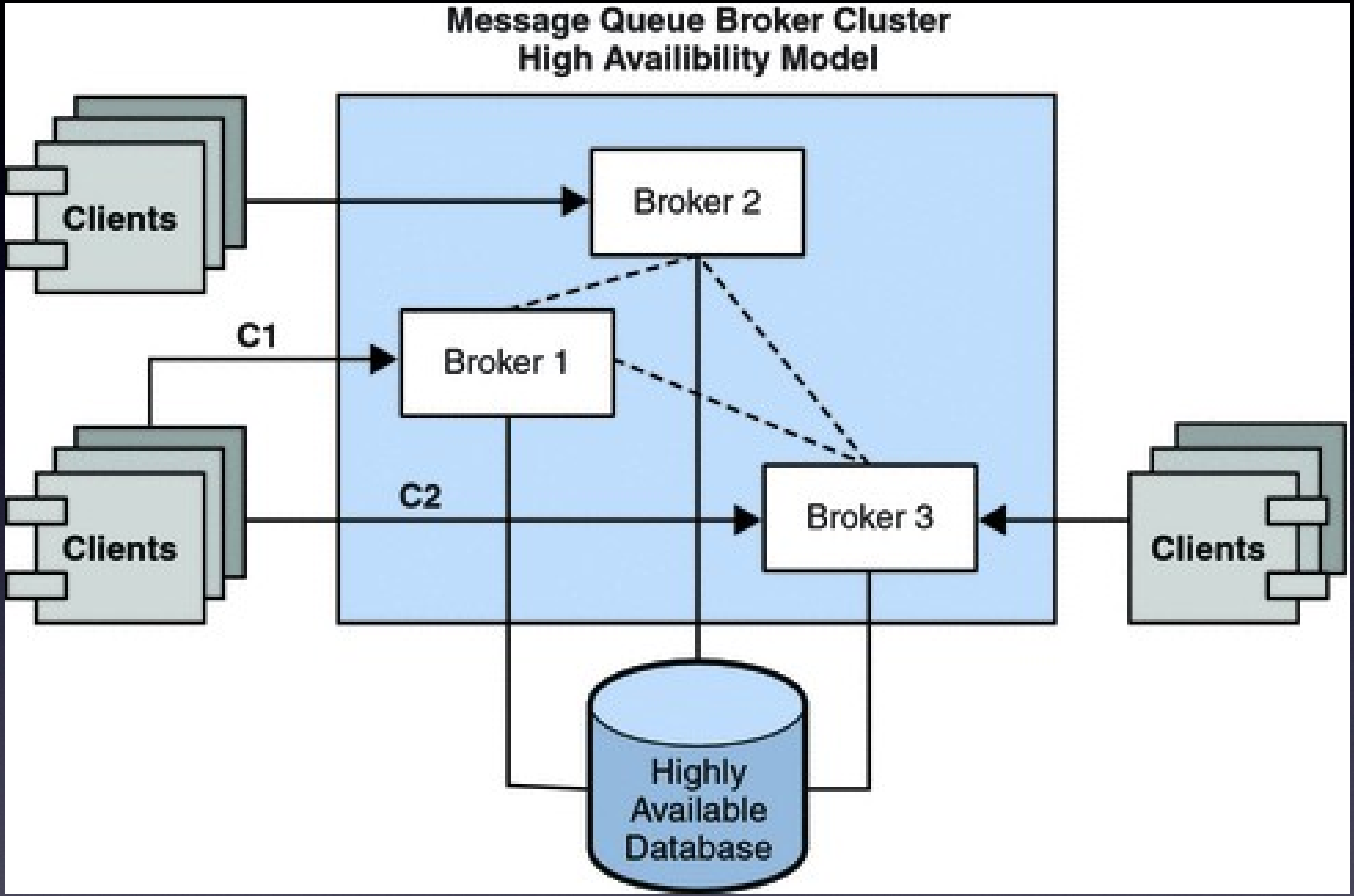
New in version 4.1:

- New installer built from OpenInstaller
- HA service AND data with HA storage
- Pluggable JAAS authentication
- Improved deployment and performance in GlassFish

Scaling & Redundancy

- Vertical Scaling
- Stateless Horizontal Scaling
  - Stateless Redundancy (service failover)□
- Stateful Horizontal Scaling
  - Conventional Clustering (service availability)□
  - HA Clustering (service + data availability)□

Scaling & Redundancy



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Producing and Consuming

	Producing a Message	Consuming a Message
1	Administrator creates a ConnectionFactory administered object	
2	Administrator creates a physical destination and the administered object refence to it	
3	Client obtains a ConnectionFactory instance through a JNDI lookup	
4	Client obtains a Destination instance through a JNDI lookup	
5	Client uses the ConnectionFactory to create a Connection to the broker (sets properties)□	
6	Client uses the Connection to create a Session and sets properties for message reliability	
7	Client uses the Sesion to create a MessageProducer	Client creates a MessageConsumer
8	Client uses the Session to create a Message	Client starts the Connection
9	Client uses the Session to send the Message	Client receives the Message

Message Consumption

3 factors affect how the broker delivers messages to a consumer

- Synchronous / Asynchronous
- Property Selector Filtering (eg colour = “red” or size > 10)□
- Subscription Durability (Topics only)□

Reliable Messaging

- Message delivery occurs in two separate steps
- Messages have 3 opportunities for loss
- Reliable delivery only applies to persistent messages
- Two mechanisms for ensuring reliable delivery
    - Persistent message storage
    - Acknowledgements / Transactions

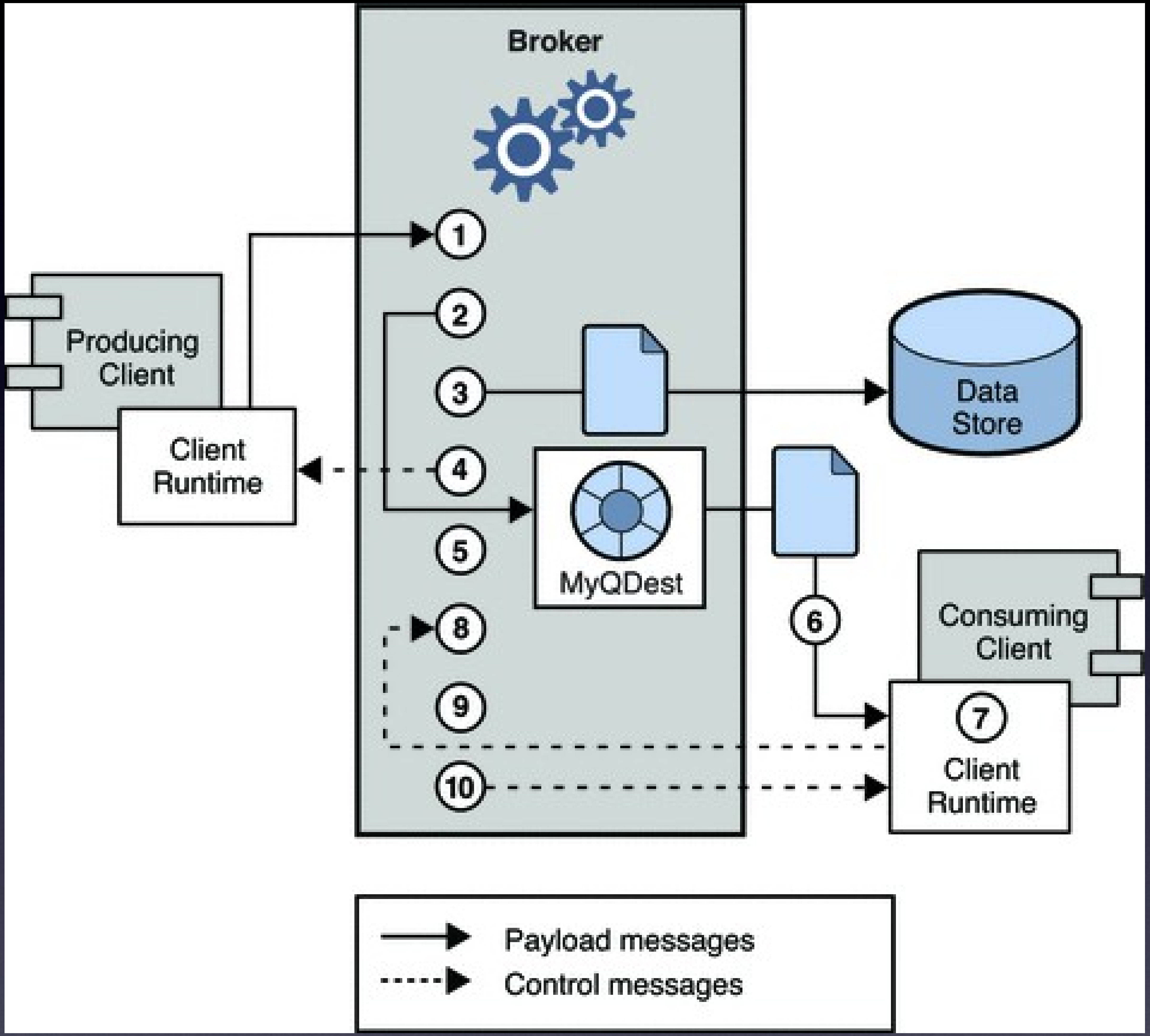
Acknowledgements

- Sent between client and broker
- Production
  - Message received, placed in destination and persisted
  - send() blocks
- Consumption
  - AUTO_ACKNOWLEDGE
  - CLIENT_ACKNOWLEDGE
  - DUPS_OK_ACKNOWLEDGE
  - NO_ACKNOWLEDGE (OpenMQ extension)□

Transactions

- Groups production and/or consumption of one or more messages into an atomic unit
- Applies to a single Session
- Therefore not end-to-end
- End-to-end requires distributed transactions (JTA)□
  - Requires a distributed transaction manager (GlassFish)□
  - Cover multiple XA resources using a two-phase commit

Message Lifecycle



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Wotif.com

- Application evolving - messaging is at the core of our architecture
- ESB patterns rather than products

Features we were looking for:

- Active product support and development
- High performance and robustness
- JMX monitoring and administration
- High availability - migration path from HA service to HA data
- Standards support - JAAS authentication

Features we have made good use of:

- Scripting of the CLI tools for simple deployment
- Flexibility in redundancy implementation

Dive into OpenMQ now at

mq.dev.java.net

Message Consumer Example

```java
package somepackage;

import java.util.logging.Level;
import java.util.logging.Logger;
import javax.annotation.PostConstruct;
import javax.annotation.Resource;
import javax.ejb.MessageDriven;
import javax.ejb.MessageDrivenContext;
import javax.ejb.TransactionAttribute;
import javax.ejb.TransactionAttributeType;
import javax.ejb.ActivationConfigProperty;
import javax.jms.JMSException;
import javax.jms.Message;
import javax.jms.MessageListener;
import javax.jms.TextMessage;

@MessageDriven(
    name = "SomeMDB", mappedName = “jms/SomeTopic”,
    activationConfig = {
        @ActivationConfigProperty(propertyName = "destinationType", propertyValue = "javax.jms.Topic"),
        @ActivationConfigProperty(propertyName = "acknowledgeMode", propertyValue = "Auto-acknowledge"),
        @ActivationConfigProperty(propertyName = "messageSelector", propertyValue = "Colour = ‘red’"),
        @ActivationConfigProperty(propertyName = "subscriptionDurability", propertyValue = "Durable")□
    }
□)
public class SomeMDB implements MessageListener {

    private static final Logger LOGGER = Logger.getLogger(SomeMDB.class.getName());

    @Resource
    private MessageDrivenContext ejbContext;
    @EJB
    private SomeService someService;
    private MessageHandler handler;

    @PostConstruct
    public void postConstruct() {
        handler = new MessageHandler(someService);
    }

    @TransactionAttribute(TransactionAttributeType.NOT_SUPPORTED)□
    public void onMessage(Message jmsMessage) {
        try {
            handler.handleMessage((TextMessage) jmsMessage);
        } catch (Exception e) {
            LOGGER.log(Level.SEVERE, "Message could not be processed, message has been swallowed, please resend the message", e);
            // Need to explicitly acknowledge the message, as the transaction rollback seems to stop it.
            try {
                jmsMessage.acknowledge();
            } catch (JMSException jmse) {
                // ignore
            }
            ejbContext.setRollbackOnly();
        }
    }
}
```

Message Consumer Example

```
    <enterprise-beans>        <message-driven>            <ejb-name>RelayMDB</ejb-name>            <mapped-
name>jms/InputTopic</mapped-name>            <resource-ref>                <res-ref-
name>jms/RemoteConnectionFactory</res-ref-name>                <res-
type>javax.jms.ConnectionFactory</res-type>                <mapped-
name>jms/RemoteConnectionFactory</mapped-name>                <injection-target>                    <injection-
target-class>com.wotif.bogus.RelayMDB</injection-target-class>                    <injection-target-
name>jmsConnectionFactory</injection-target-name>                </injection-target>            </resource-ref>
     <message-destination-ref>                <message-destination-ref-name>jms/OutputTopic</message-
destination-ref-name>                <message-destination-type>javax.jms.Topic</message-destination-type>
         <message-destination-usage>Produces</message-destination-usage>                <mapped-name>jms/
SomeTopic</mapped-name>                <injection-target>                    <injection-target-
class>com.wotif.bogus.RelayMDB</injection-target-class>                    <injection-target-
name>outputTopic</injection-target-name>                </injection-target>            </message-destination-ref>
   </message-driven>    </enterprise-beans>
```

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