

# ActiveMQ in Action: Common Problems and Solutions

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# Common Questions

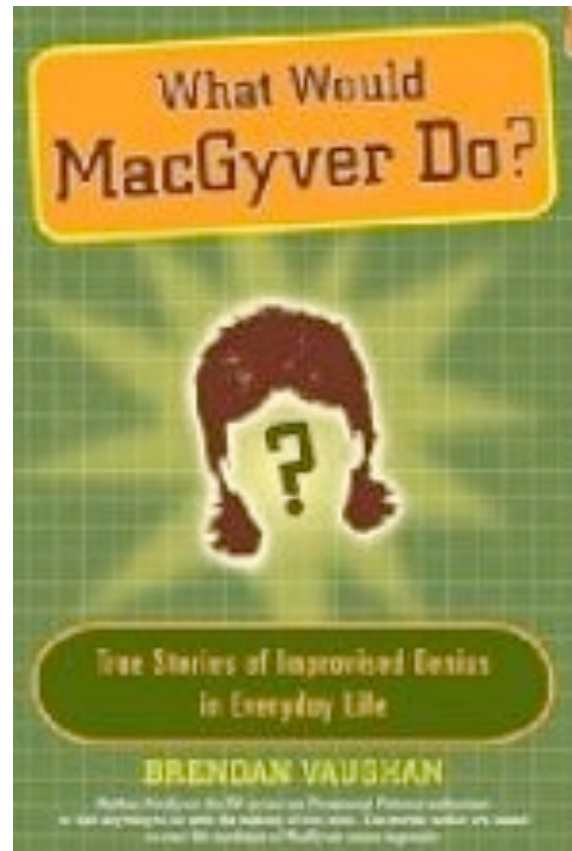
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- Should I create my JMS clients from scratch?
- How do I manage connections efficiently?
- How do I consume only certain messages?
- Why is ActiveMQ locking up or freezing?
- Do I need a network of brokers?
- Should I use a master/slave configuration?



# Should I create JMS clients from scratch?

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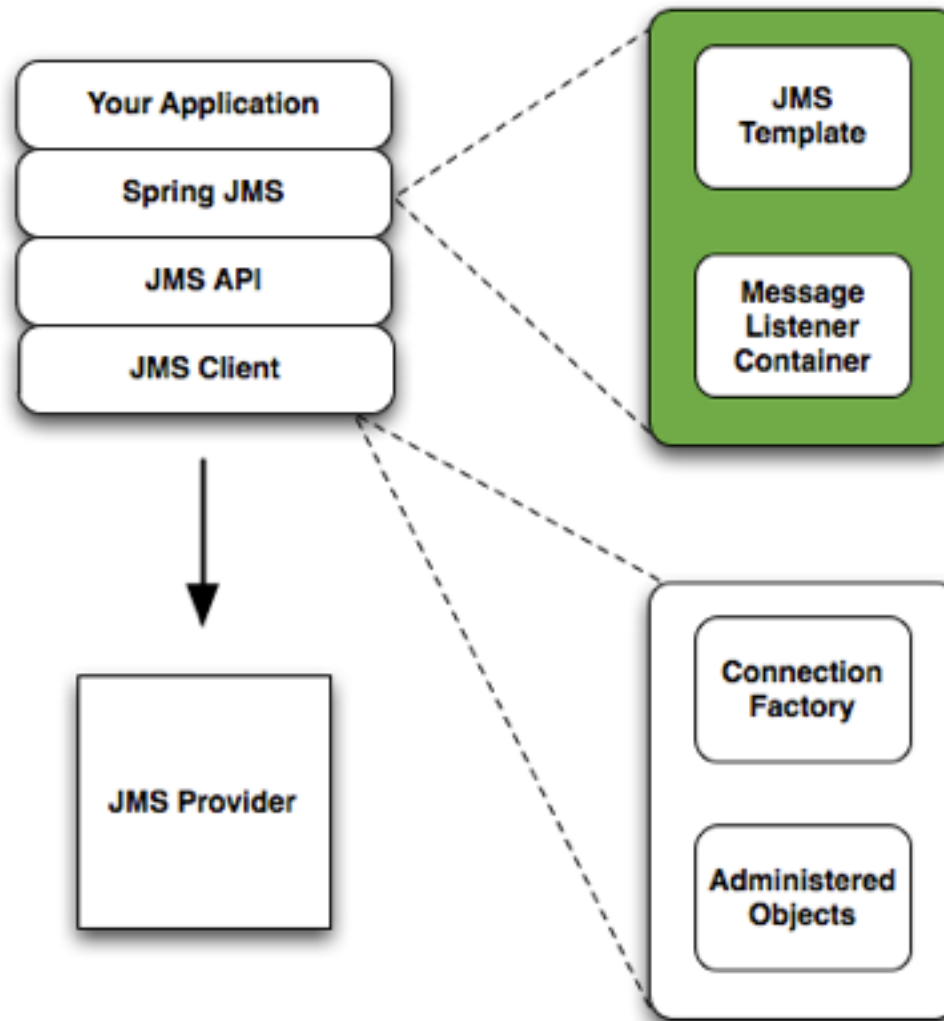


# Should I create JMS clients from scratch?

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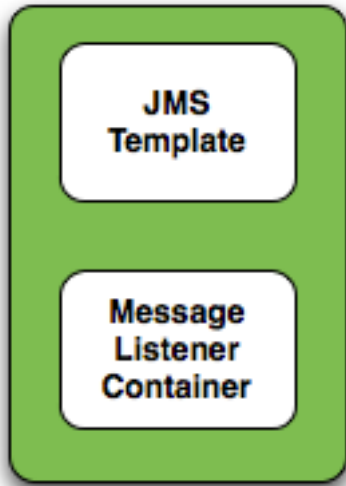
- Question:
  - Would you create a HTTP client from scratch?
  - Would you create a SMTP client from scratch?
- Answer:
  - Sometimes, but mostly no
- **Solution:**
  - Use Spring JMS

# Spring JMS



# Spring JMS

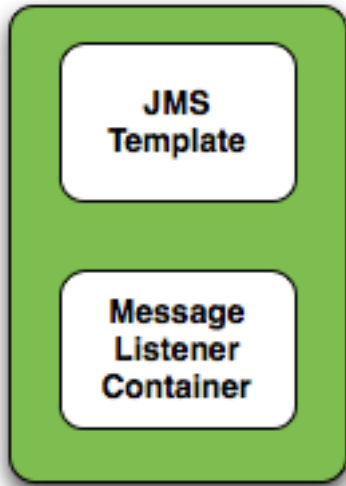
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- **JMS Template**
  - Send and receive messages synchronously
- Message Listener Container
  - Receive messages asynchronously
  - Message-Driven POJOs (MDPs)

# Spring JMS

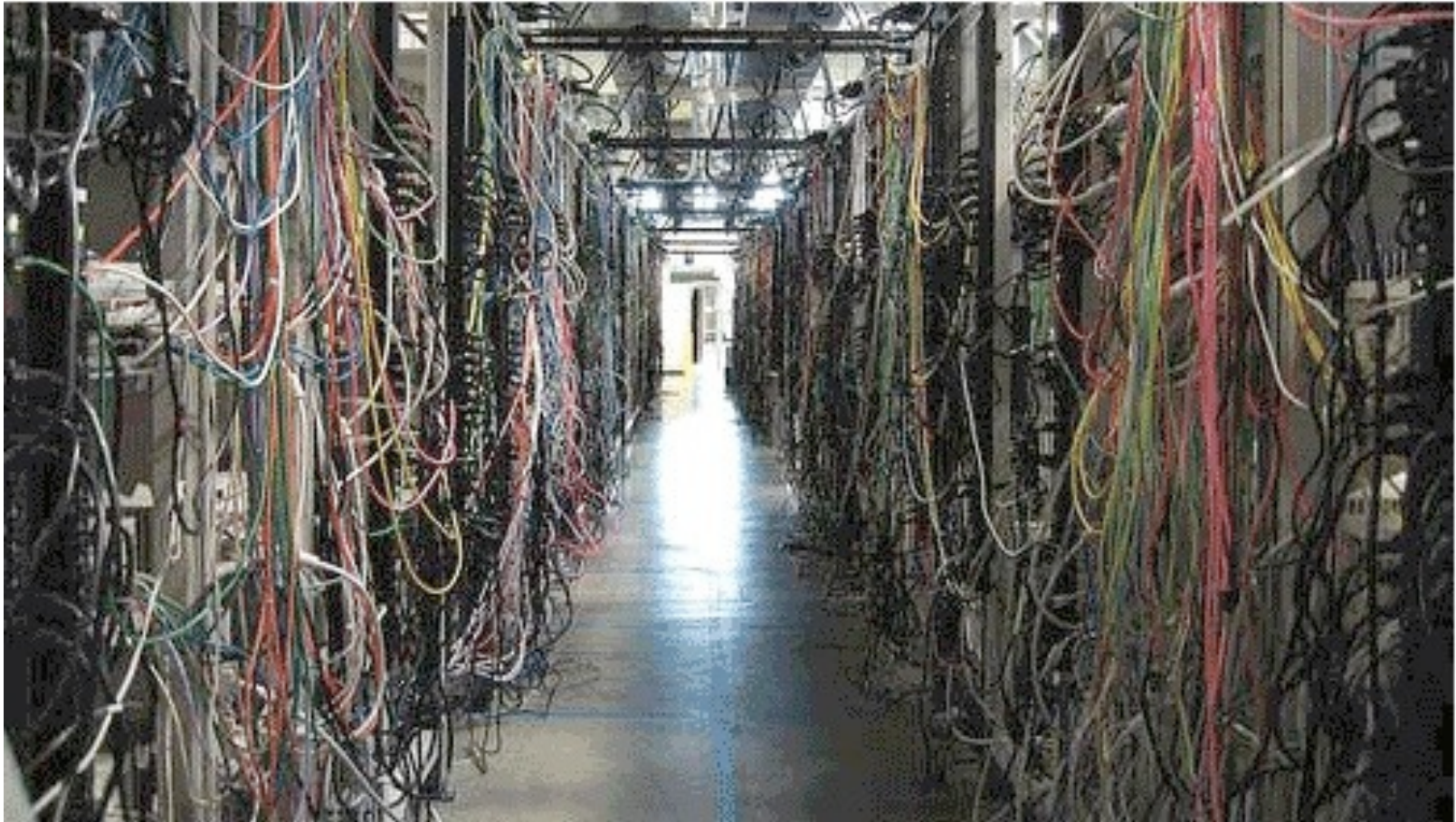
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- JMS Template
  - Send and receive messages synchronously
- **Message Listener Container**
  - Receive messages asynchronously
  - Message-Driven POJOs (MDPs)

# How do I manage connections efficiently?

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# How do I manage connections efficiently?

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- JMS connections are expensive to constantly create and destroy
- Create a group that never closes, i.e., pooling
- **Solutions:**
  - ActiveMQ PooledConnectionFactory
  - Spring CachingConnectionFactory

# ActiveMQ PooledConnectionFactory

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- Based on Apache Commons Pool
  - Generic object pooling framework from the ASF
- Highly configurable
  - Instantiate your own custom GenericObjectPool
- Could be improved
  - Upon hitting pool limit, grow the pool instead of blocking
  - Throw exception when the pool is exhausted
- Caches JMS Sessions and MessageProducers

# Spring CachingConnectionFactory

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- Based on Spring SingleConnectionFactory
  - Ignores calls to Connection.close()
- Caches JMS Sessions and MessageProducers
- By default only one session is cached
  - Increase the sessionCacheSize!
- Consumers are not closed until Session is closed
  - NOTE: Cache strategy uses the JMS selector as a key

# How do I consume only certain messages?

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**ActiveMQ is not a database!**

# How do I consume only certain messages?

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- ActiveMQ is for sending and receiving events
- ActiveMQ is NOT a message store
- **Solutions:**
  - Use message selectors
  - Correct application design

# JMS Selectors

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- Allows a client to filter messages from a destination
- Filters message headers only, not payload
- Conditional expressions using a subset of SQL
- Provide boolean evaluation of message headers

<b>Literals</b>	<b>Booleans TRUE/FALSE; numbers such as 5, -10, +34; numbers with decimal or scientific notation such as 43.3E7, +10.5239</b>
<b>Identifiers</b>	<b>A header field</b>
<b>Operators</b>	<b>AND, OR, LIKE, BETWEEN, =, &lt;&gt;, &lt;, &gt;, &lt;=, =&gt;, +, -, *, /, IS NULL, IS NOT NULL</b>

# JMS Selector Examples

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```
// Select messages with a header named symbol whose value is APPL
String selector = "symbol = 'APPL'";

// Create a consumer that only receives messages about Apple Computer stock
MessageConsumer consumer =
    session.createConsumer(someDestination, selector);
```

```
// Select messages with a header named symbol whose value is APPL
// and with a header named price that is greater than the previous price
String selector = "symbol = 'APPL' AND price > " + getPreviousPrice();

// Create a consumer that only receives messages about Apple Computer stock
// that has increased in price
MessageConsumer consumer =
    session.createConsumer(someDestination, selector);
```

# JMS Selectors

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- Very powerful, but like a sharp knife
- Applied to every message on a destination
  - Can cause unnecessary overhead

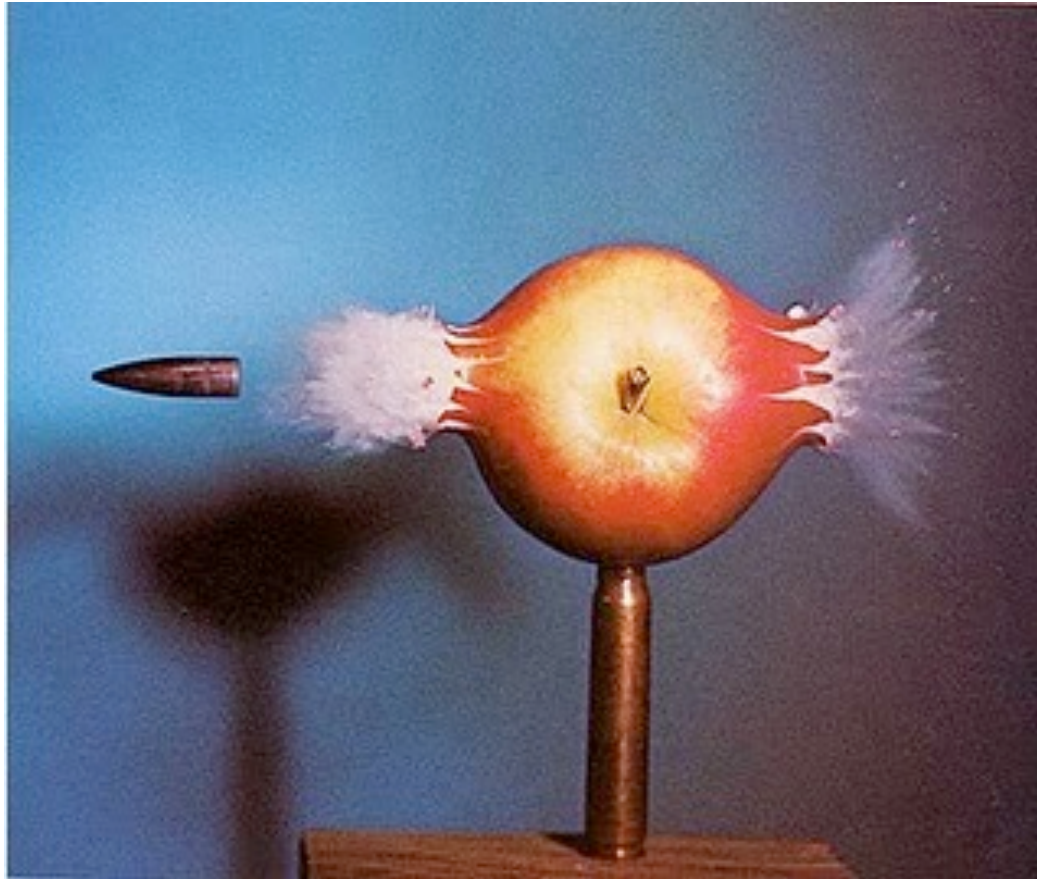
# Correct Application Design

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- ActiveMQ is for sending and receiving events
- ActiveMQ is NOT a message store
- Phase one, consume the messages
  - Lightweight processing
- Phase two, conduct further processing
  - Heavyweight processing
- I.e., a proper service-oriented architecture

# Why is ActiveMQ is locking up or freezing?

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# Why is ActiveMQ is locking up or freezing?

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- JVM memory
- Broker memory
- Prefetch limit
- Producer flow control
- Message cursors

# JVM Memory

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- ActiveMQ start script
  - As of 5.4.x JVM is given 256mb of memory (min and max)
- You may need to increase this!

# Broker Memory

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- ActiveMQ controls how much memory it can use
- Will not automatically use all the JVM memory
- Configurable but commented out by default

# Broker Memory Example

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```
<broker brokerName=" myBroker" ...>
...
<systemUsage>
  <systemUsage>
    <memoryUsage>
      <memoryUsage limit=" 64 mb" />
    </memoryUsage>
    <storeUsage>
      <storeUsage limit=" 100 gb" />
    </storeUsage>
    <tempUsage>
      <tempUsage limit=" 10 gb" />
    </tempUsage>
  </systemUsage>
</systemUsage>
...
</broker>
```

# Prefetch Limit

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- Prevents a consumer from being flooded with messages
- Applied on a per client basis
- Incorrect prefetch limit + slow consumer = messages remain in a queue unconsumed
- Results in some consumers being starved of messages
- NOTE: Be careful with connection pools

# Prefetch Limit Example

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```
...  
<bean id="connectionFactory"  
  class="org.apache.activemq.ActiveMQConnectionFactory"  
  p:brokerURL="tcp://localhost:61616"  
  p:prefetchPolicy-ref="prefetchPolicy" />  
  
<bean id="prefetchPolicy"  
  class="org.apache.activemq.ActiveMQPrefetchPolicy"  
  p:queuePrefetch="1" />  
...
```

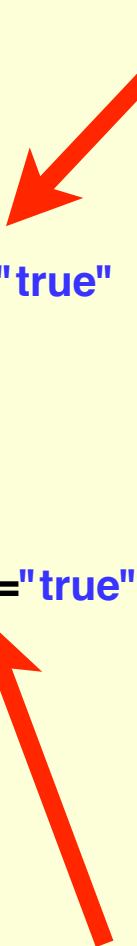
# Producer Flow Control

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- Prevents producer from flooding broker
- If memory exceeds limit, a producer will be paused
- NOTE: This setting is enabled by default

# Broker Memory Example

```
<broker brokerName="myBroker" ...>
...
<destinationPolicy>
  <policyMap>
    <policyEntries>
      <policyEntry topic="" producerFlowControl="true"
        memoryLimit="10mb">
        <pendingSubscriberPolicy>
          <vmCursor />
        </pendingSubscriberPolicy>
      </policyEntry>
      <policyEntry queue="" producerFlowControl="true"
        memoryLimit="10mb">
      </policyEntry>
    </policyEntries>
  </policyMap>
</destinationPolicy>
...
</broker>
```



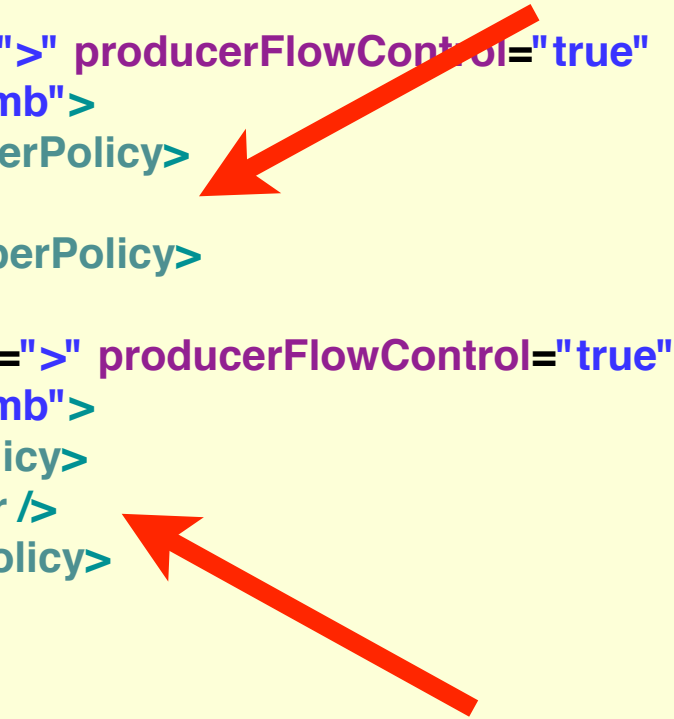
# Message Cursors

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- Only so many messages can be held in memory
- Message cursors provide a configurable message paging
- Two types of cursors
  - VM cursors
    - Holds only message reference in memory
  - File cursors
    - Flushes both message and reference to disk
- <http://activemq.apache.org/how-do-i-configure-activemq-to-hold-100s-of-millions-of-queue-messages-.html>

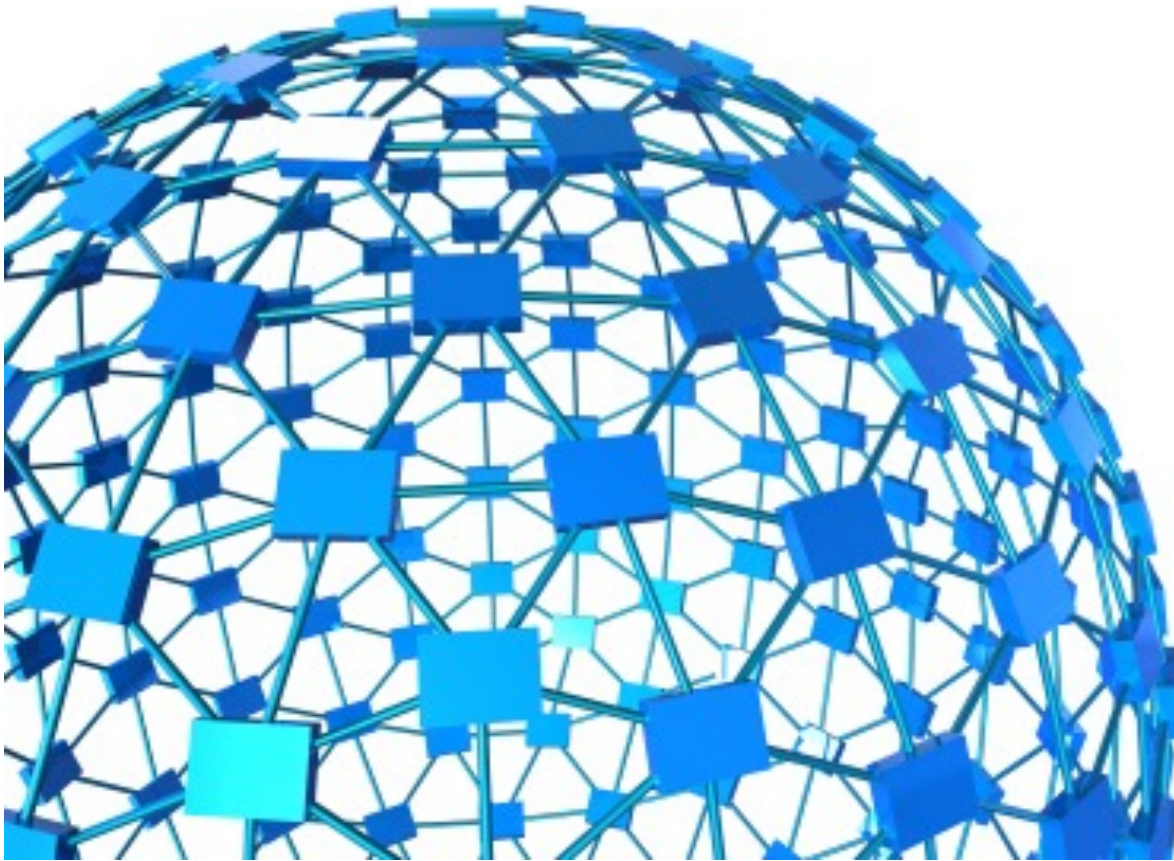
# Broker Memory Example

```
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        memoryLimit="10mb">
        <pendingSubscriberPolicy>
          <vmCursor />
        </pendingSubscriberPolicy>
      </policyEntry>
      <policyEntry queue=">" producerFlowControl="true"
        memoryLimit="10mb">
        <pendingQueuePolicy>
          <fileQueueCursor />
        </pendingQueuePolicy>
      </policyEntry>
    </policyEntries>
  </policyMap>
</destinationPolicy>
...
</broker>
```



# Do I need a network of brokers?

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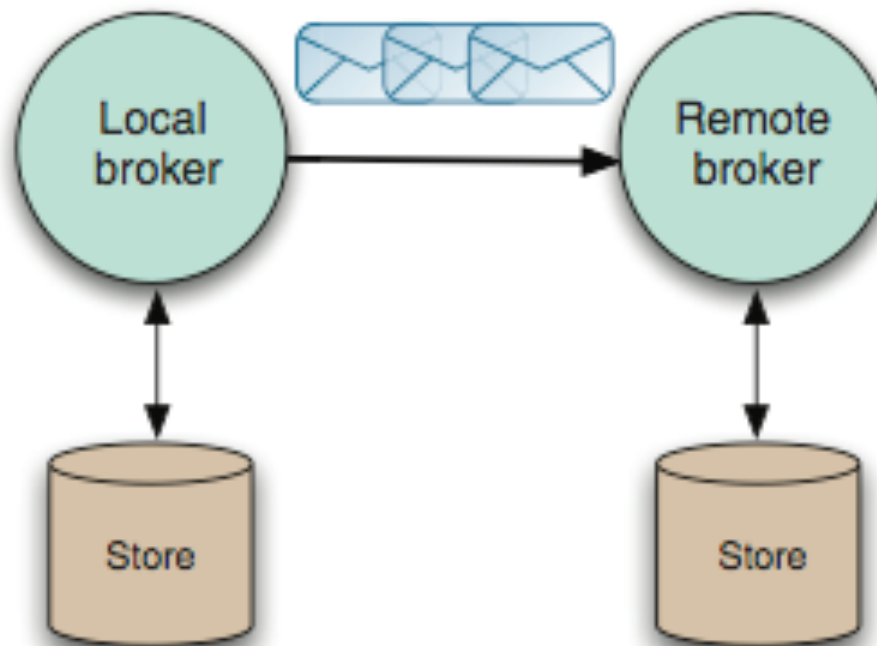
# Do I need a network of brokers?

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- What is a network of brokers?
  - Clustered ActiveMQ instances
- How are they clustered?
  - They pass messages between broker instances
  - Send a message to one broker, consume the message from a different broker
- Where might this be useful?
  - Situations where a centralized broker is not suitable
- How does this work?
  - Using store and forward

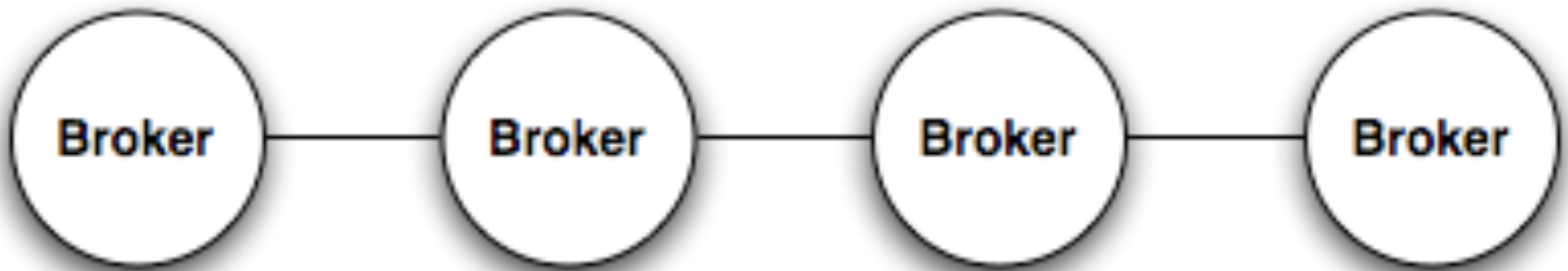
# Store and Forward

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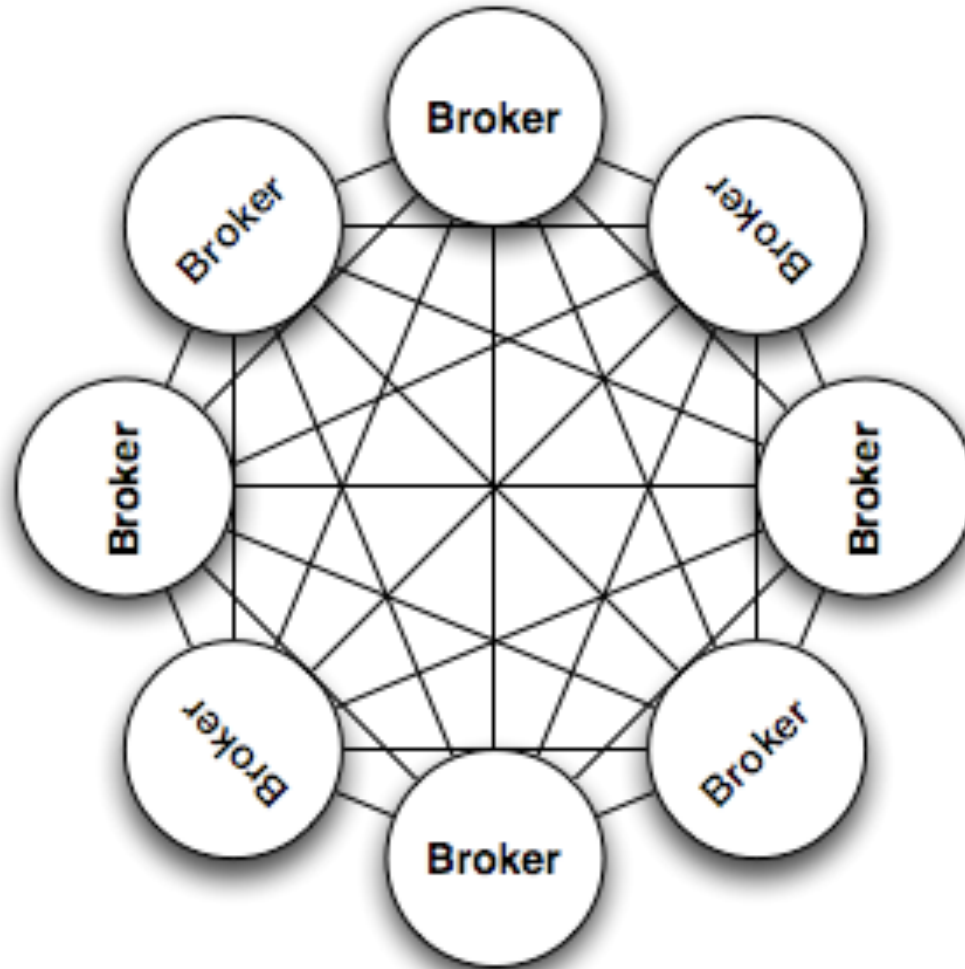
# Topology Example

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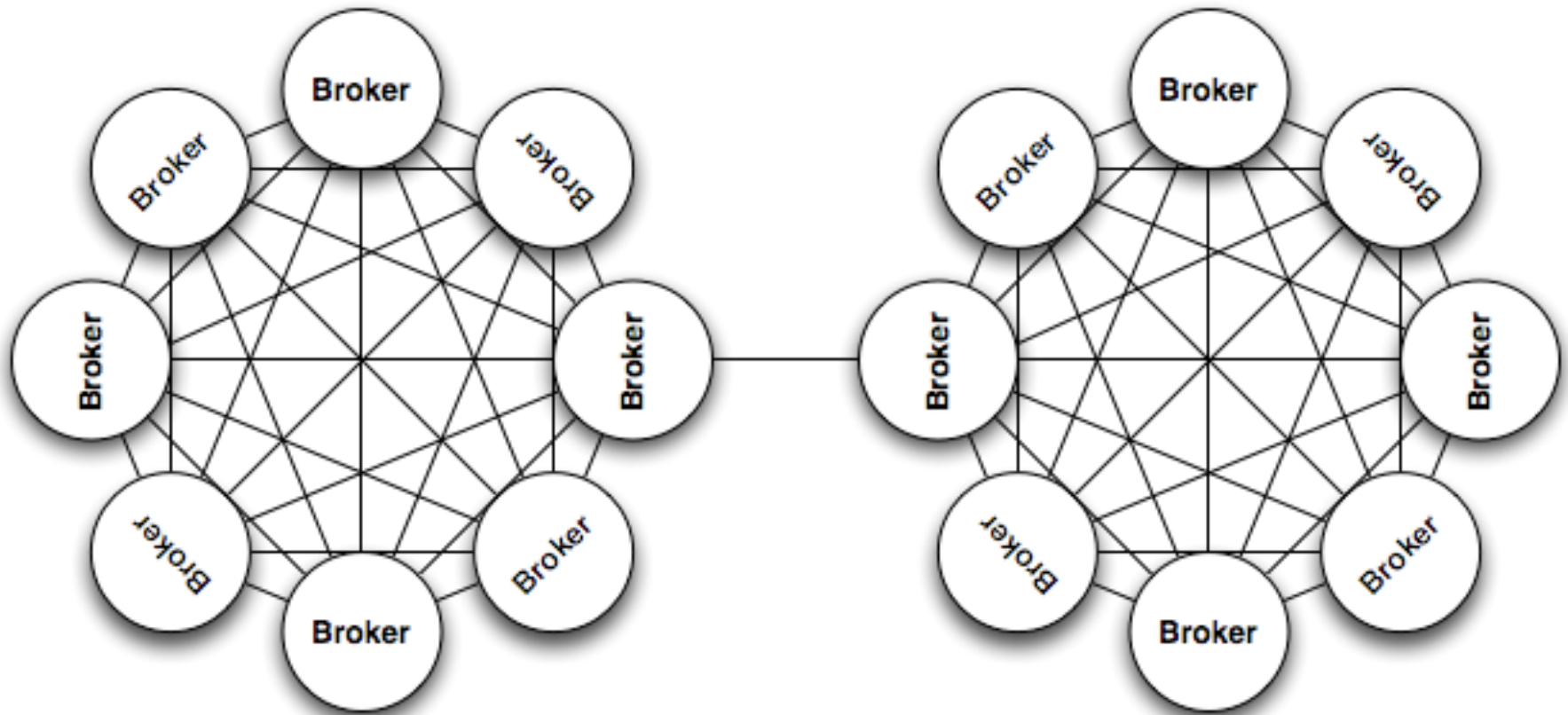
# Topology Example

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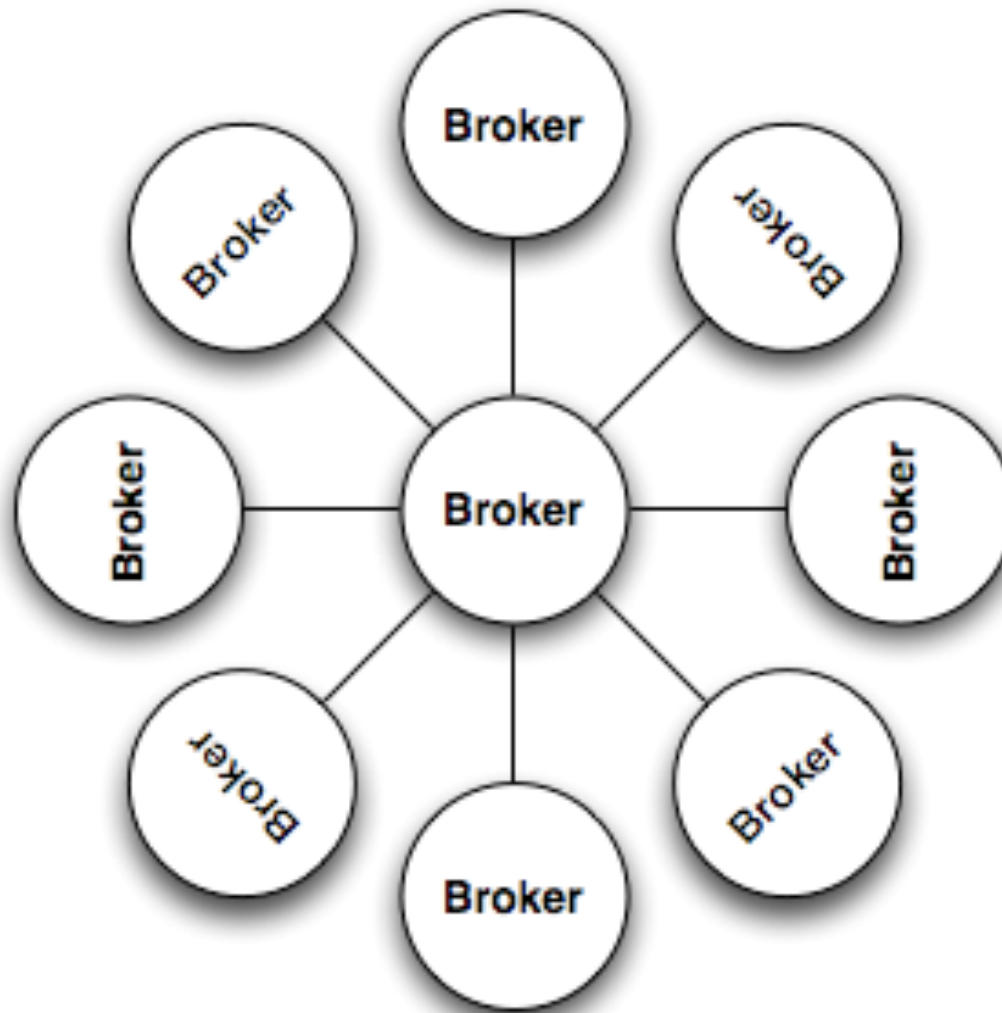
# Topology Example

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# Topology Example

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# Topology Example

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# Should I use a master/slave config?

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# Should I use a master/slave config?

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- What is a master/slave configuration?
  - It helps to provide high availability for ActiveMQ
- What does that mean?
  - ActiveMQ brokers are configured for warm failover
  - If one broker fails or becomes unreachable, another one takes over
- Where might this be useful?
  - In situations that need highly available message brokers
- How does this work?
  -

# Types of Master/Slave

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- Shared nothing master/slave
- Shared storage master/slave
  - Shared database
  - Shared file system

# Shared Nothing Master/Slave

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- Sometimes called pure master/slave
- Uses a fully replicated data store
  - Does not depend on database or file system
- Slave broker consumes all message states from the Master broker (messages, acks, tx states)
- Slave does not start any networking or transport connectors
- Master broker will only respond to client when a message exchange has been successfully passed to the slave broker

# Shared Nothing Master/Slave

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- If the master fails, the slave optionally has two modes of operation:
  1. Start up all it's network and transport connectors
    - All clients connected to failed Master resume on Slave
  2. Close down completely
    - Slave is simply used to duplicate state from Master
- Clients should use failover transport:

```
failover://(tcp://masterhost:61616, tcp://slavehost:61616)?randomize=false
```

# Shared Database Master/Slave

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- Uses tables in a relational database to store data
- No restriction on the number of brokers
- Simple configuration (JDBC URL)
- Clustered database mitigates single point of failure
- One master selected at random
  
- Clients should use failover transport:

```
failover://(tcp://masterhost:61616, tcp://slavehost:61616)?randomize=false
```

# Shared File System Master/Slave

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- Utilizes a directory on a shared file system to store data
- No restriction on number of brokers
- Simple configuration (point to the data dir)
- Shared file system mitigates single point of failure
- One master selected at random
  
- Clients should use failover transport:

```
failover://(tcp://masterhost:61616, tcp://slavehost:61616)?randomize=false
```

# Thank You!

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## Q&A

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