Enterprise Programmering 2

Lesson 10:
AMQP and RabbitMQ

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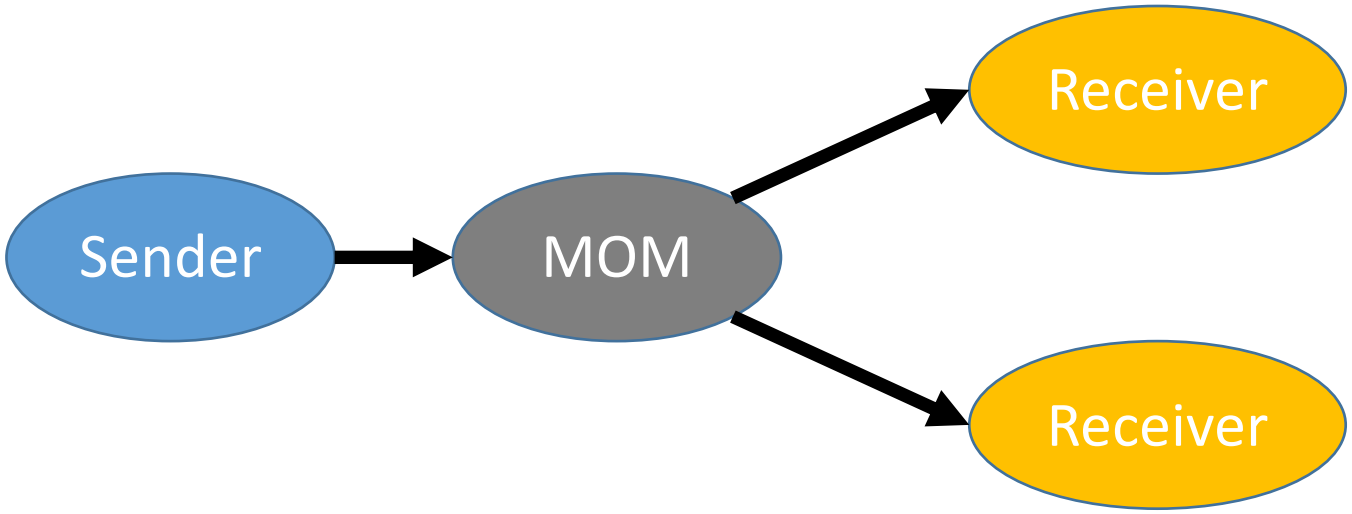
Goals

- Understand the need for a Message Oriented Middleware (MOM) in MicroServices
- Learn different topologies of MOM communications
- Learn how to use RabbitMQ from Spring

MOMs

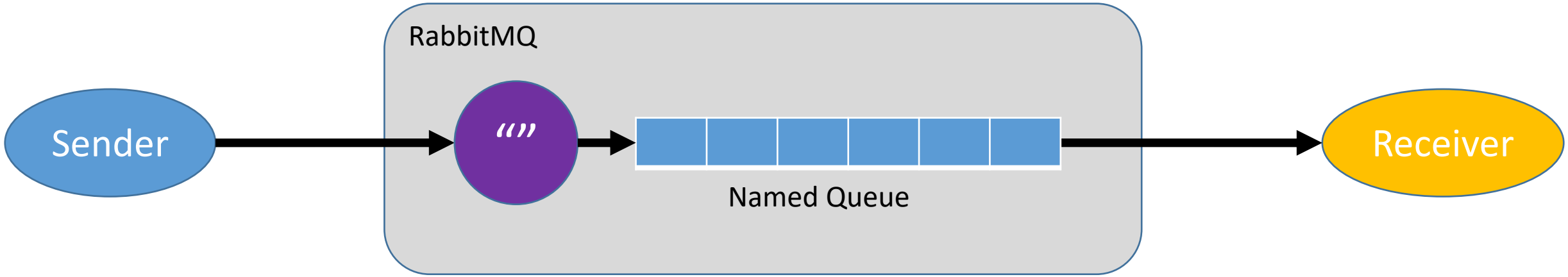


- Decoupling *sender* from *receiver(s)*: the sender does not know who the receivers are
- *Sender* will *publish* messages to a *queue*, and *receivers* will *subscribe* to such messages
- Why?
  - **Maintainability**: can add/remove senders/receivers in the future with little to no change in the architecture
  - Services can react to events asynchronously

AMQP/RabbitMQ

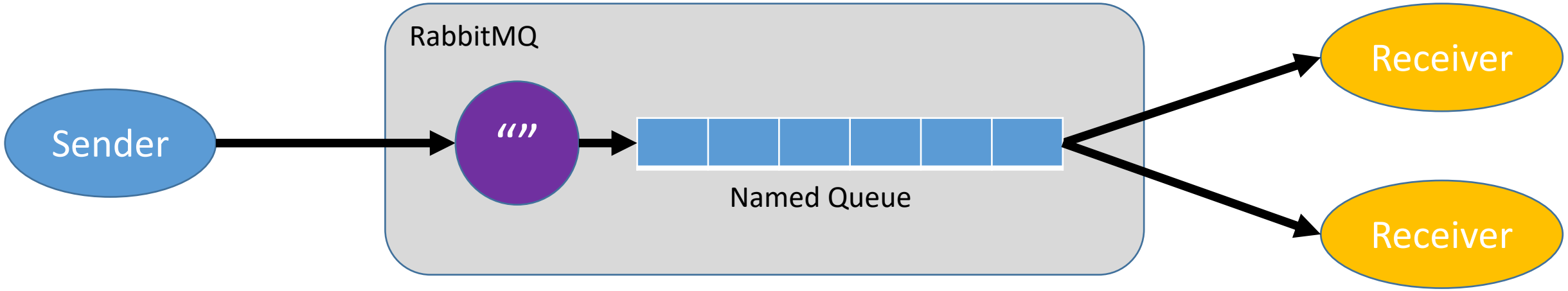
- Advanced Message Queuing Protocol (*AMQP*)
- Defines protocol of how messages should be formatted and sent
- *RabbitMQ* is a MOM using *AMQP*
- Written in Erlang
  - we will start it via Docker

Queue



- RabbitMQ keeps queues of messages
- Each queue has a name
- Sender sends to a named exchange in RabbitMQ
- Default exchange “” (empty name) copies messages to the specified queue by name
- Receiver pulls from such queue

Distributed Work

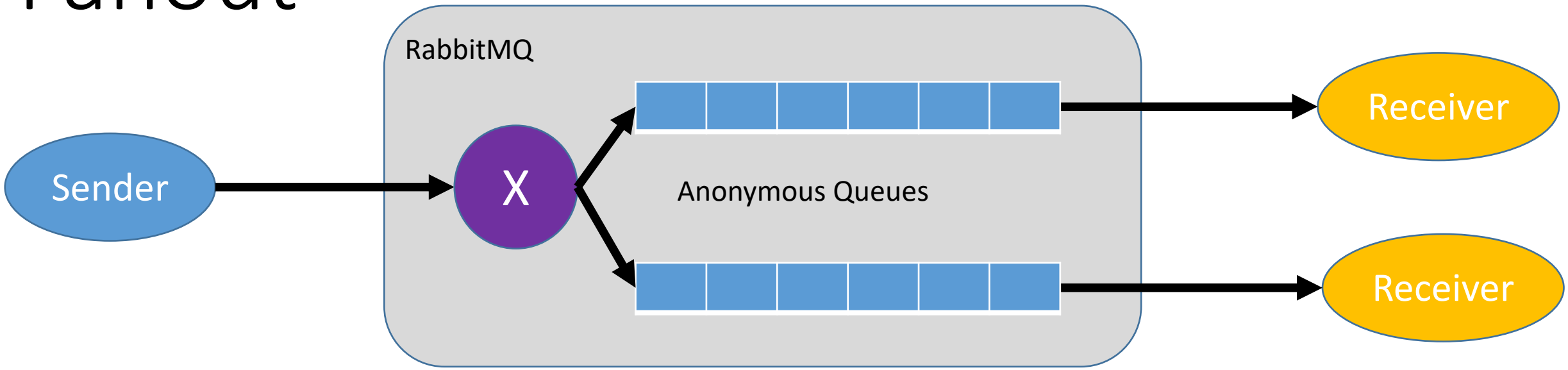


- There can be several Receivers pulling from a queue
- Useful when a message requires non-trivial processing
  - If a Receiver is stuck with a long task, the other Receivers can meanwhile work on all the other messages pushed on the queue
- A message can only go to 1 Receiver
- *Prefetch*: for optimization reasons, Receiver could pull several messages at same time, instead of waiting to process current one before pulling the next
  - important if time delay from RabbitMQ is significant compared to cost of processing 1 message

PreFetching

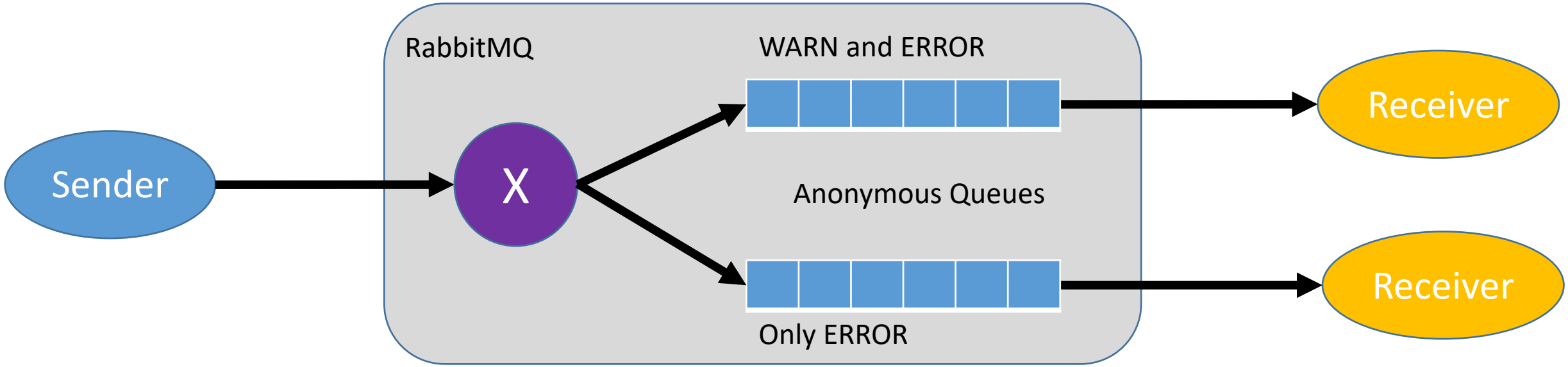
- Communicating with AMQP has a cost, as connection on network, eg, cost() = **X + (m * Y)**
  - **X**: some constant cost of the connection
  - **Y**: cost per message
  - **m**: number of messages that are fetched
- Typically, **Y** is small compared to **X**
- It is hence common to read several **m** messages on a queue from same client, in one go

Fanout



- Broadcast of a message to several Receivers
- Sender needs to specify name of the exchange (eg, *X*)
- Each receiver creates its own anonymous queue
  - Queue with a random unique name, which we don't care for
- Exchange *X* copies incoming messages on all queues

Direct Exchange



- Broadcast like Fanout, but each message has a *Key*
  - eg, INFO, WARN and ERROR when dealing with log messages
- When Receiver creates a queue, it specifies the Keys it wants to be notified to
- In above example:
  - INFO messages copied to no queue
  - WARN messages copied to only 1 queue
  - ERROR messages copied to both queues

Topic Exchange

- Broadcast like Direct Exchange
- But finer grained way to specify routing to queues
- *Topic*: list of words separated by “**.**”
- Receiver specifies the topic it wants to pull for
- Special symbols: “*****” substitutes 1 word, “**#**” substitute 0 or more words
- Ex, consider topic “*author.country.kind*” for news
  - “**.norway.**”: any news from Norway, regardless of author or kind
  - “*smith.#*”: any news from author Smith

Git Repository Modules

- *NOTE: most of the explanations will be directly in the code as comments, and not here in the slides*
- **advanced/amqp/base-queue**
- **advanced/amqp/distributed-work**
- **advanced/amqp/fanout**
- **advanced/amqp/direct-exchange**
- **advanced/amqp/topic-exchange**
- **advanced/amqp/amqp-rest**