Federation

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Federation

- It transmit messages between brokers without requiring clustering.
- Features:
  - Loose coupling
  - WAN-friendly
  - Specificity
  - Scalability

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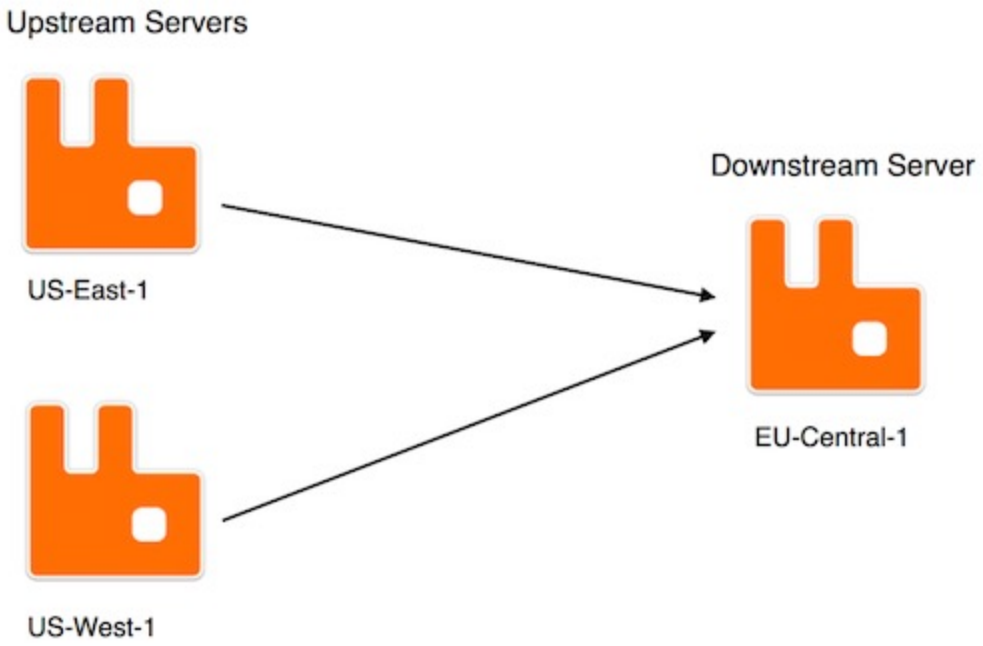
Federation

- exchanges and queues *federated*
- receive messages from one or more *upstreams*



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Federation

- Route messages published upstream to a local queue
- Allows a local consumer receive messages from an upstream queue.
- Can connect to a specific vhost, use TLS, use multiple authentication mechanisms.

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Federation - Configuration

- One or more upstreams that define federation connections to other nodes.
  - **runtime parameters**
  - or the **federation management plugin**
- One or more policies that match exchanges/queues and makes them federated.

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Federation - Configuration

- All the nodes of the cluster should have the federation plugin enabled.
- Three levels of configuration involved in federation:
  - Upstreams (each upstream defines a remote connection endpoint)
  - Upstream sets(each upstream set groups together a set of upstreams to use for federation.)
  - Policies(each policy selects a set of exchanges, queues or both, and applies a single upstream or an upstream set to those objects)

```
rabbitmq-plugins enable rabbitmq_federation
```

```
rabbitmq-plugins enable rabbitmq_federation_management
```

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Federation - Configuration

- Upstreams and upstream sets are both instances of runtime parameters.
- Parameters and policies can be set in three ways
  - either with an invocation of rabbitmqctl,
  - a call to the management HTTP API,
  - or (usually) through the web UI presented by rabbitmq_federation_management

Federation – Configuration Example

Define an upstream:

rabbitmqctl	`rabbitmqctl set_parameter federation-upstream my-upstream \` `'{"uri":"amqp://server-name","expires":3600000}'`
rabbitmqctl (Windows)	`rabbitmqctl set_parameter federation-upstream my-upstream ^` `"{""uri"":""amqp://server-name"",""expires"":3600000}"`
HTTP API	PUT `/api/parameters/federation-upstream/%2f/my-upstream` `{"value":{"uri":"amqp://server-name","expires":3600000}}`
Web UI	Navigate to `Admin` > `Federation Upstreams` > `Add a new upstream`. Enter "my-upstream" next to Name, "amqp://server-name" next to URI, and 36000000 next to Expiry. Click Add upstream.

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Federation – Configuration Example

- Define a policy

rabbitmqctl	`rabbitmqctl set_policy --apply-to exchanges federate-me "^amq\." \ '{"federation-upstream-set":"all"}'`
rabbitmqctl (Windows)	`rabbitmqctl set_policy --apply-to exchanges federate-me "^amq\." ^ "{""federation-upstream-set"":""all""}"`
HTTP API	PUT `/api/policies/%2f/federate-me {"pattern":"^amq\.", "definition":{"federation-upstream-set":"all"}, \ "apply-to":"exchanges"}`
Web UI	Navigate to Admin > Policies > Add / update a policy. Enter "federate-me" next to "Name", "^amq\." next to "Pattern", choose "Exchanges" from the "Apply to" drop down list and enter "federation-upstream-set" = "all" in the first line next to "Policy". Click "Add" policy.

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Federation – Configuration Example

- Check that the policy

```
rabbitmqctl list_exchanges name policy | grep federate-me
```

- check that federation links for each exchange have come up with Admin > Federation Status > Running Links

```
rabbitmqctl eval 'rabbit_federation_status:status().'
```

- There will be one federation link for each upstream that is applied to an exchange.

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Federating Clusters

- Define policies and parameters on any node in the downstream cluster.
- Exchange federation links will start on any node in the downstream cluster
- Queue federation links will start on the same node as the downstream queue.
- To connect to an upstream cluster, you can specify multiple URIs in a single upstream.

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Securing Federation Connections with TLS

- Federation connections (links) can be secured with TLS.
- To configure Federation to use TLS, one needs to
  - Use the amqps URI scheme instead of amqp
  - Specify CA certificate and client certificate/key pair via **URI query parameters** when configuring upstream(s)
  - **Configure Erlang client to use TLS**

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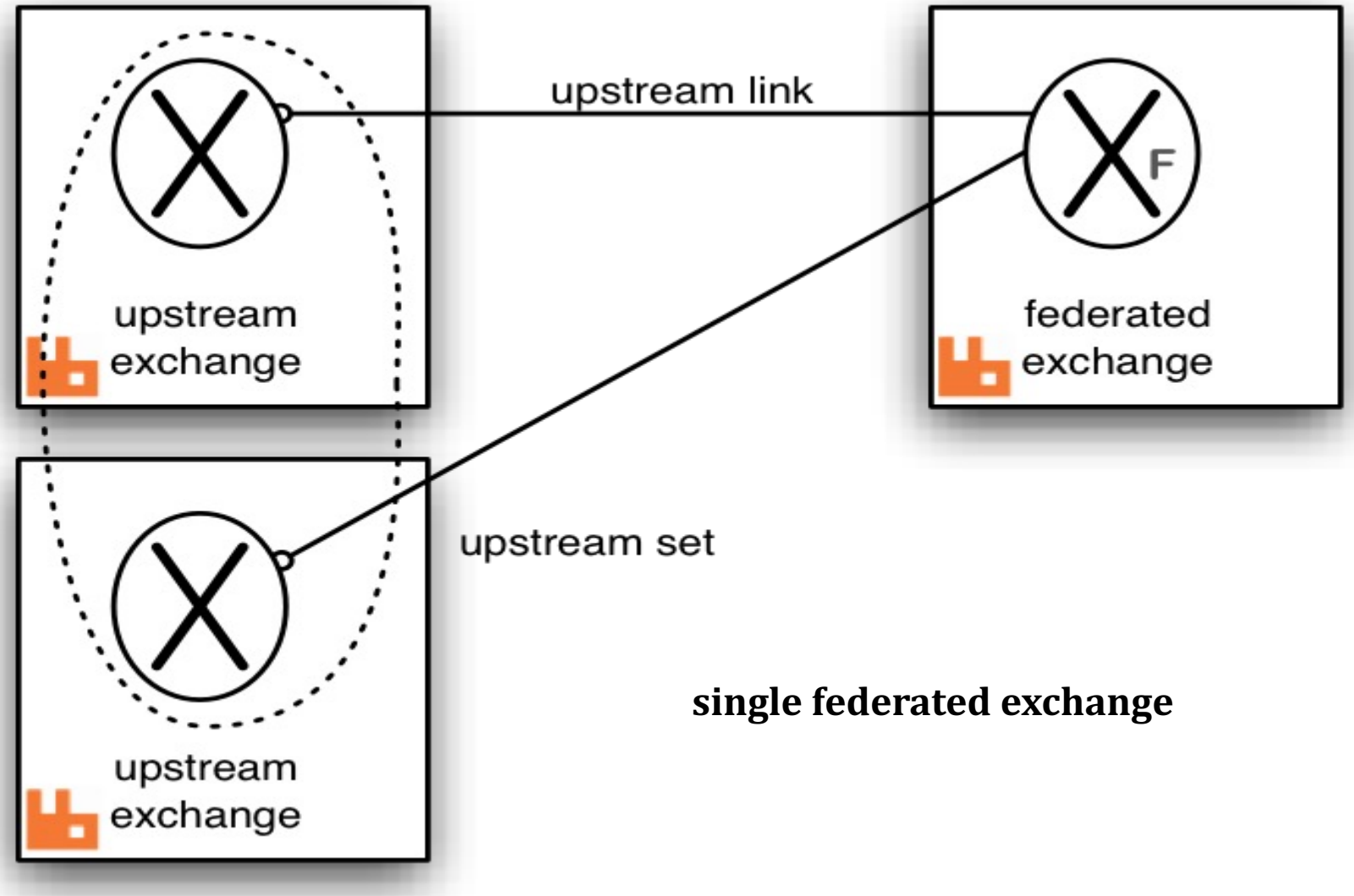
Federated Exchanges



single federated exchange

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Federated Exchanges

- A federated exchange links to other exchanges (called *upstream* exchanges).
- Logically , messages published to the upstream exchanges are copied to the federated exchange, as though they were published directly to it.
- The upstream exchanges do not need to be reconfigured
- Upstream exchanges do not have to be on the same broker or in the same cluster.

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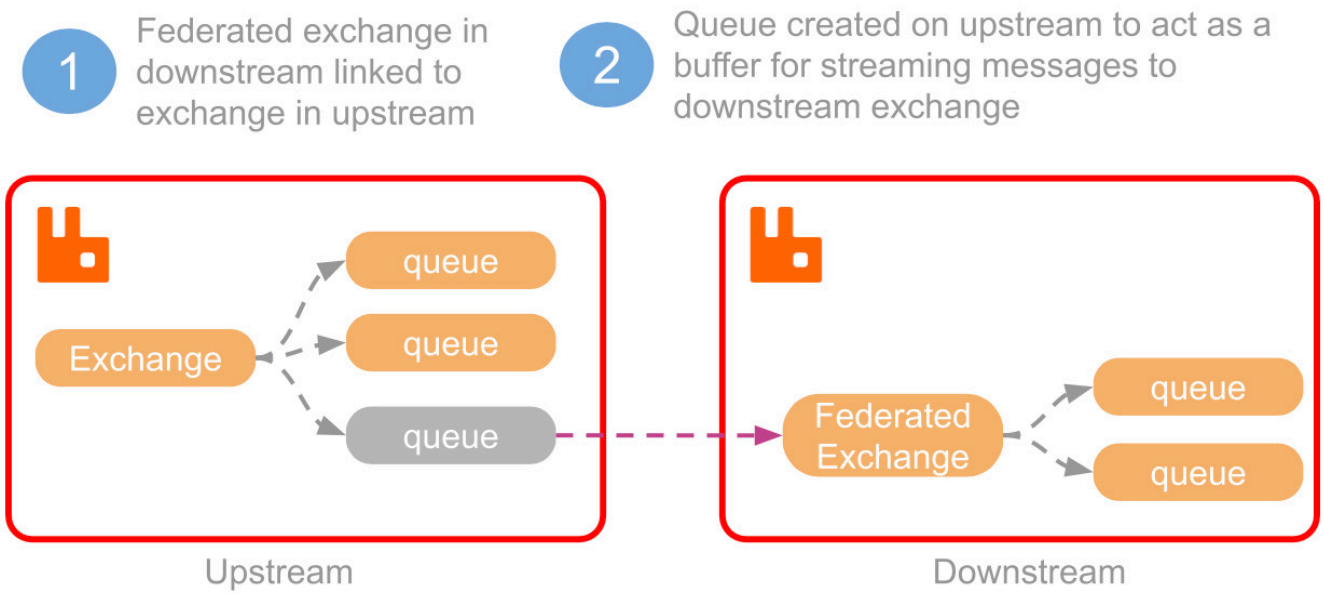
exchange federation



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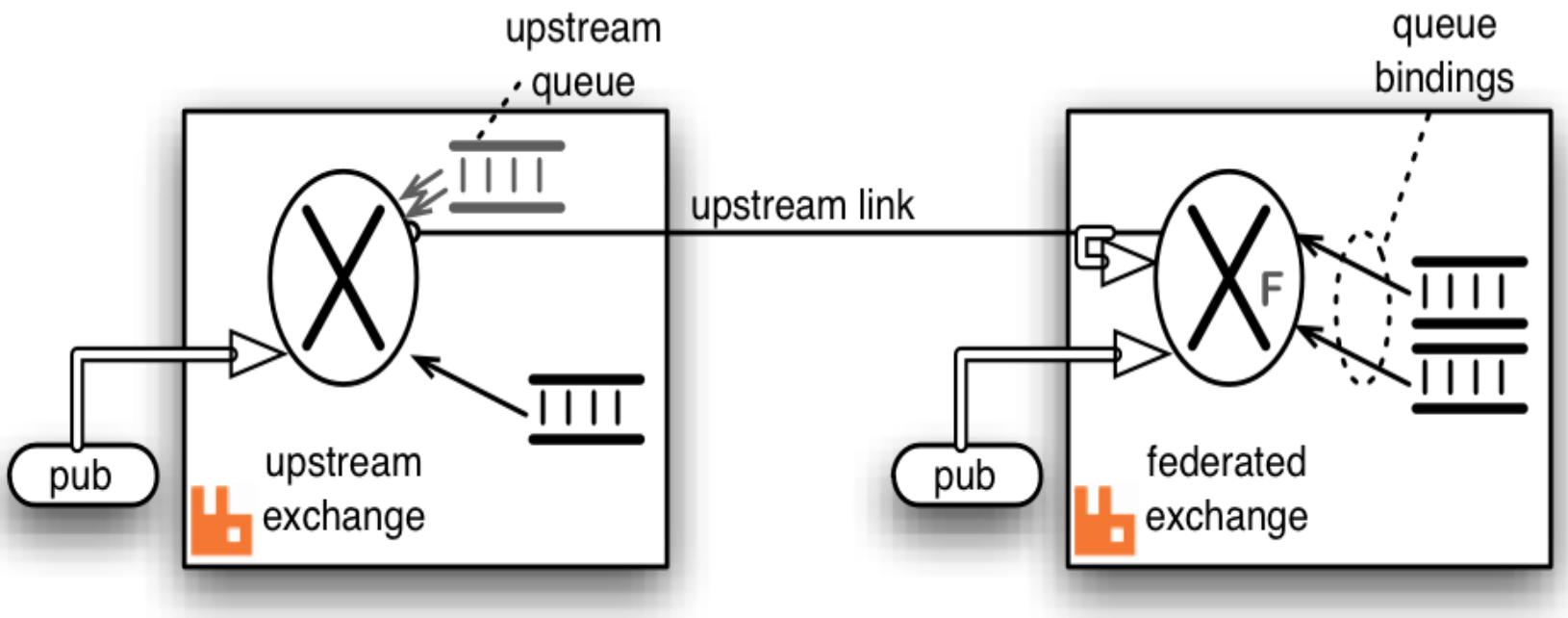
Federated Exchanges

- single federated exchange linking to a single upstream exchange



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Federated Exchanges

- Inter-broker communication is implemented using AMQP (optionally secured with SSL).
- Bindings are grouped together and bind / unbind commands are sent to the upstream exchange.
- FE only receives messages for which it has a subscription.
- The bindings are sent upstream asynchronously - so the effect of adding or removing a binding is only guaranteed to be seen eventually.

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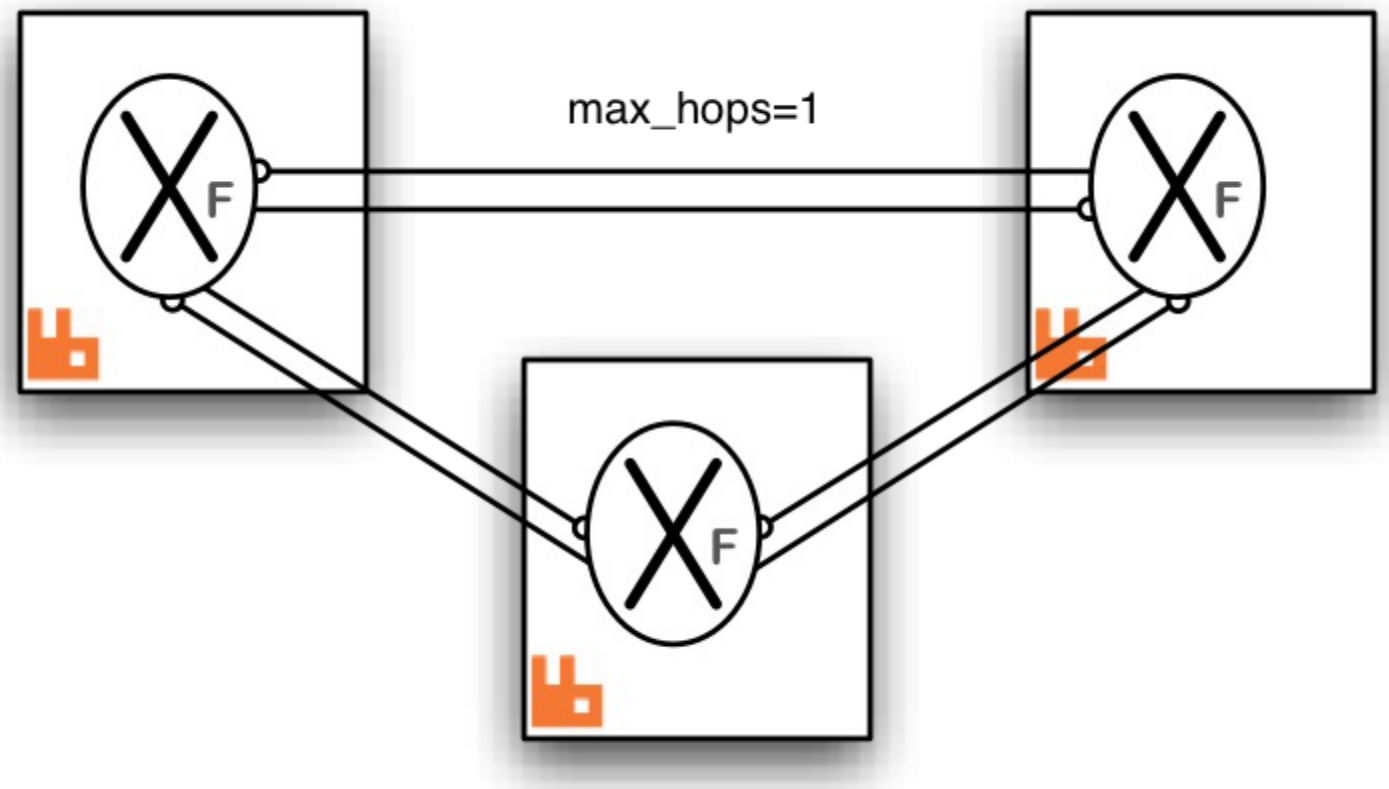
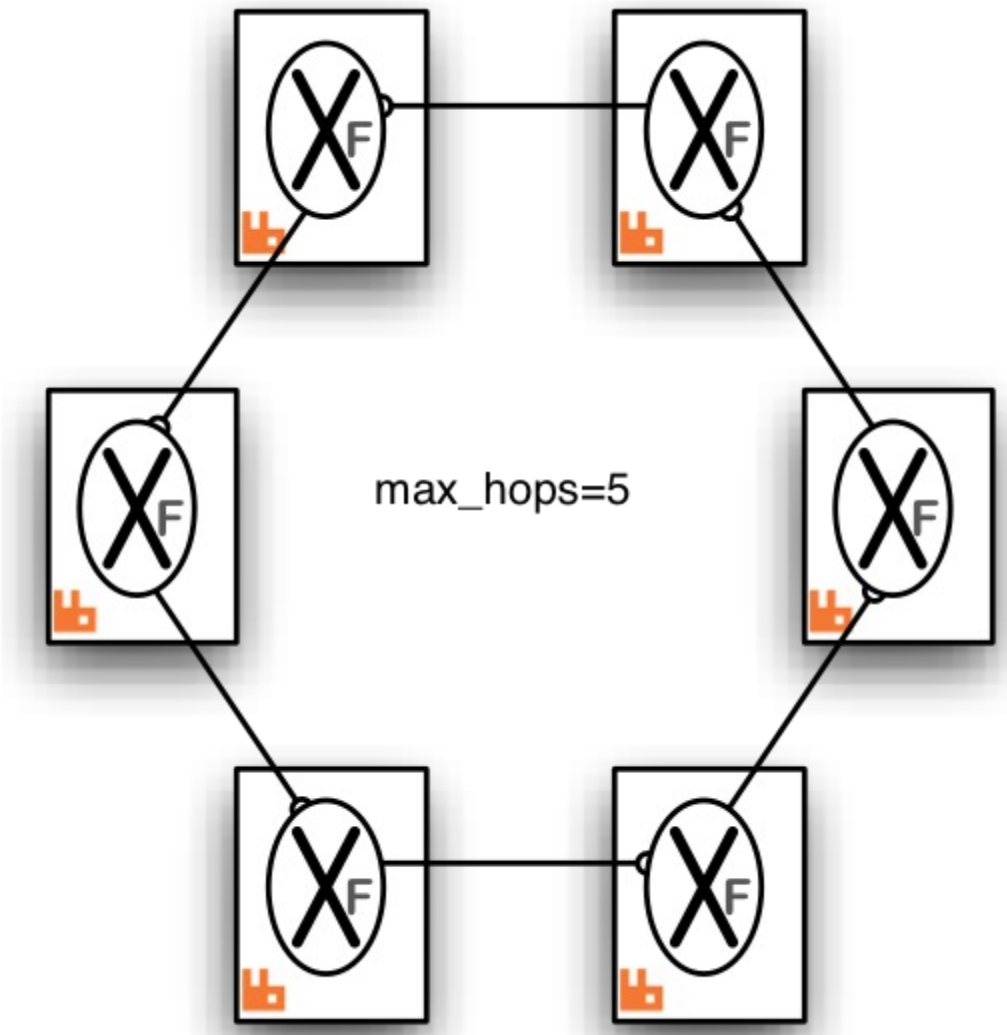
Federated Exchanges

- Small complete graph - Topology



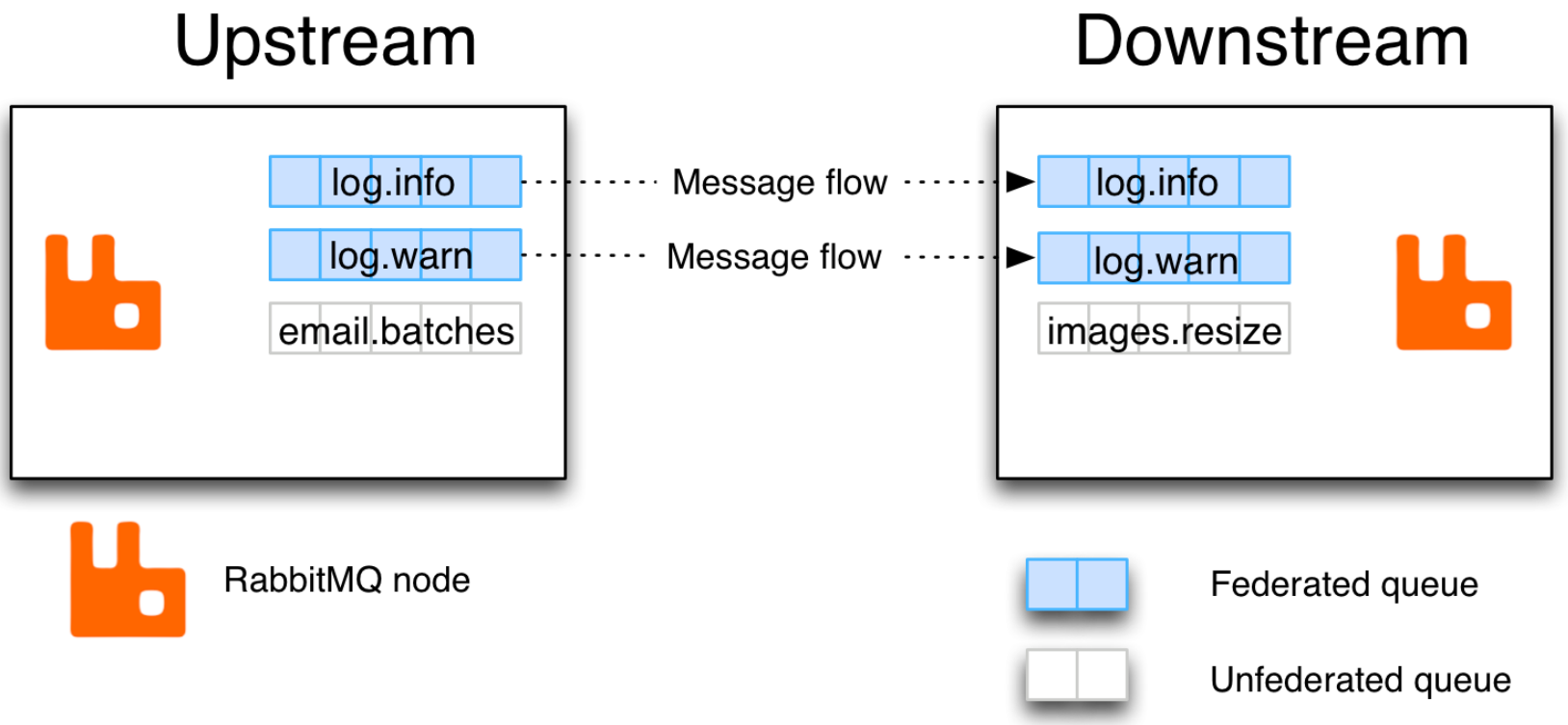
Ring - Topology



The `"max-hops"` property is set to 5 so that every exchange in the ring sees the message exactly once.

Federated Queues

- A way of balancing the load of a single queue across nodes or clusters.



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Federated Queues

- A federated queue links to other queues (called *upstream* queues).
- It retrieve messages from upstream queues in order to satisfy demand for messages from local consumers.
- Upstream queues do not need to be reconfigured
- Do not have to be on the same broker or in the same cluster.

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Use Cases

- Have the same "logical" queue distributed over many brokers.
- Each broker would declare a federated queue with all the other federated queues upstream.

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Using Federated Queues

- Declared just like any other queue, by applications.
- *Downstream* (consuming) nodes need to be configured.
- Configuration is done by declaring *policies*
- Matching queues will be federated.

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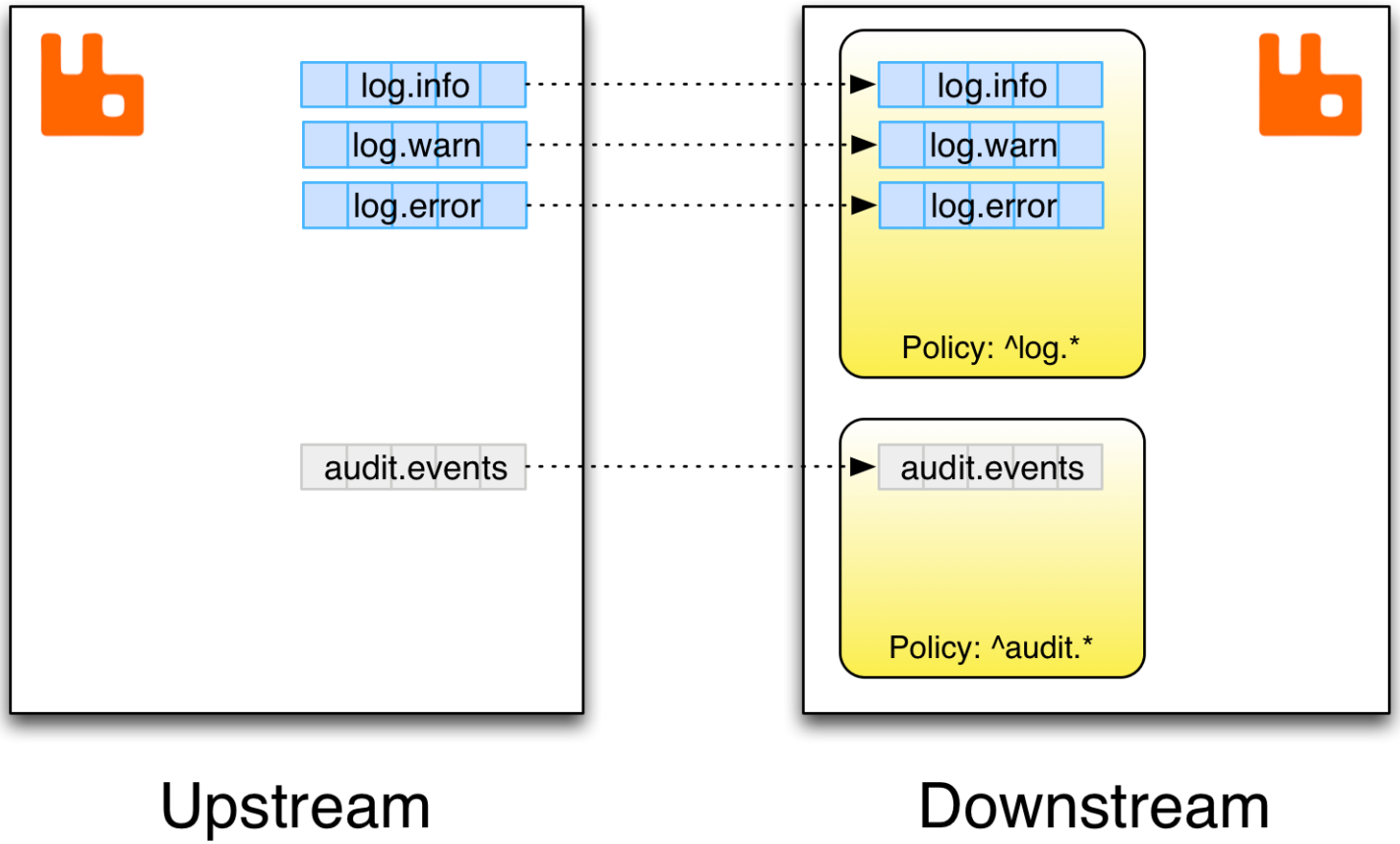
Federated Queues



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Federated Queues - Working

- connect to all its upstream queues using AMQP
- each upstream queue is listed with the connection properties
- only retrieve messages when it has run out of messages locally
  - consumer priorities.

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Federated Queues - Working

- Message ordering is only preserved for messages which have made exactly the same journey between nodes
- Each individual queue applies its arguments separately
  - x-max-length

- No limit to how many times a message can be forwarded between FQ

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Pitfalls

- cannot currently cause messages to traverse multiple hops between brokers based solely on need for messages in one place

Lab : Federation