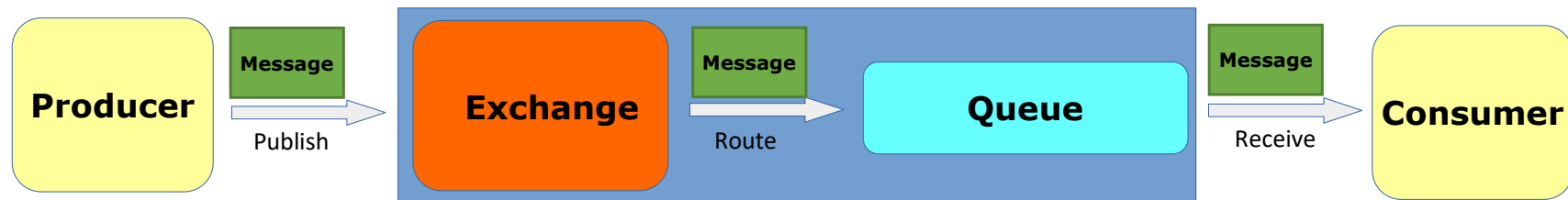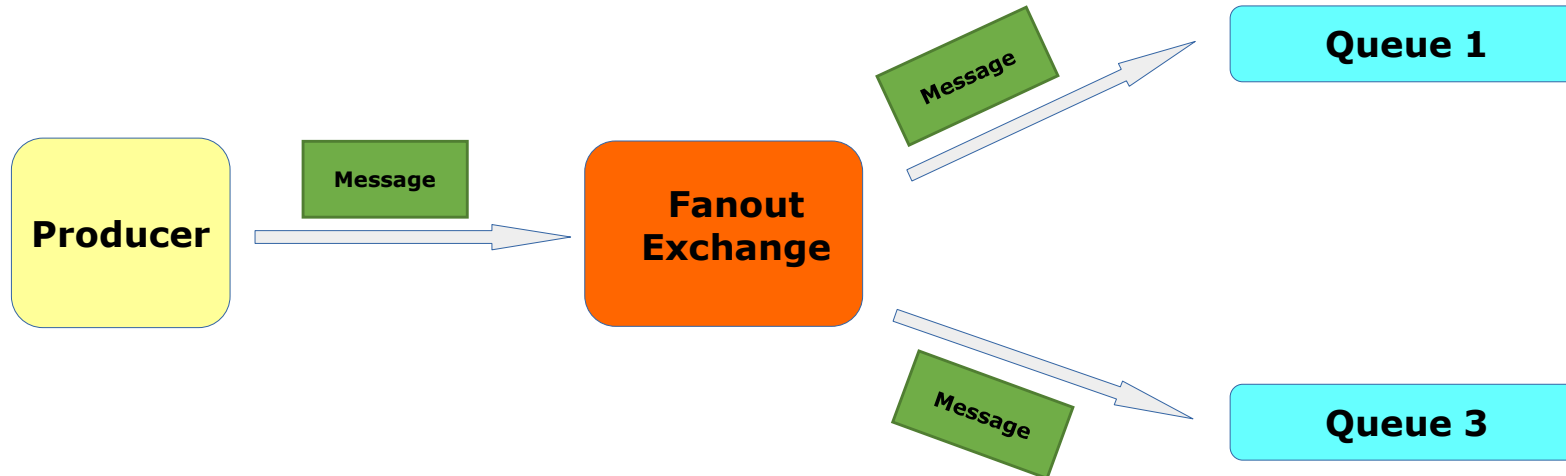# Exchanges

- Exchanges are the message router elements of RabbitMQ.
- Producers does not send messages directly to queues, they send them to exchanges.
- Queues are bound to one or more exchanges with a binding definition or configuration.
- Exchanges receive messages from producers and route them to zero or more queues which are bound to them.
- Exchanges can route a message only to the queues that are bound to them.
- There are four exchange types;
  - Fanout
  - Direct
  - Topic
  - Headers
- There is at least one exchange in a RabbitMQ system. This predefined exchange is called "default exchange" and its type is "direct". Every newly created queue is implicitly bound to this exchange.

Fanout Exchange

- The simplest exchange type, it sends all the messages it receives to all the queues that are bound to it.

- It simply ignores the routing information and does not perform any filtering.

- Like a postman that photocopies all the mails and puts one copy into each mailbox.
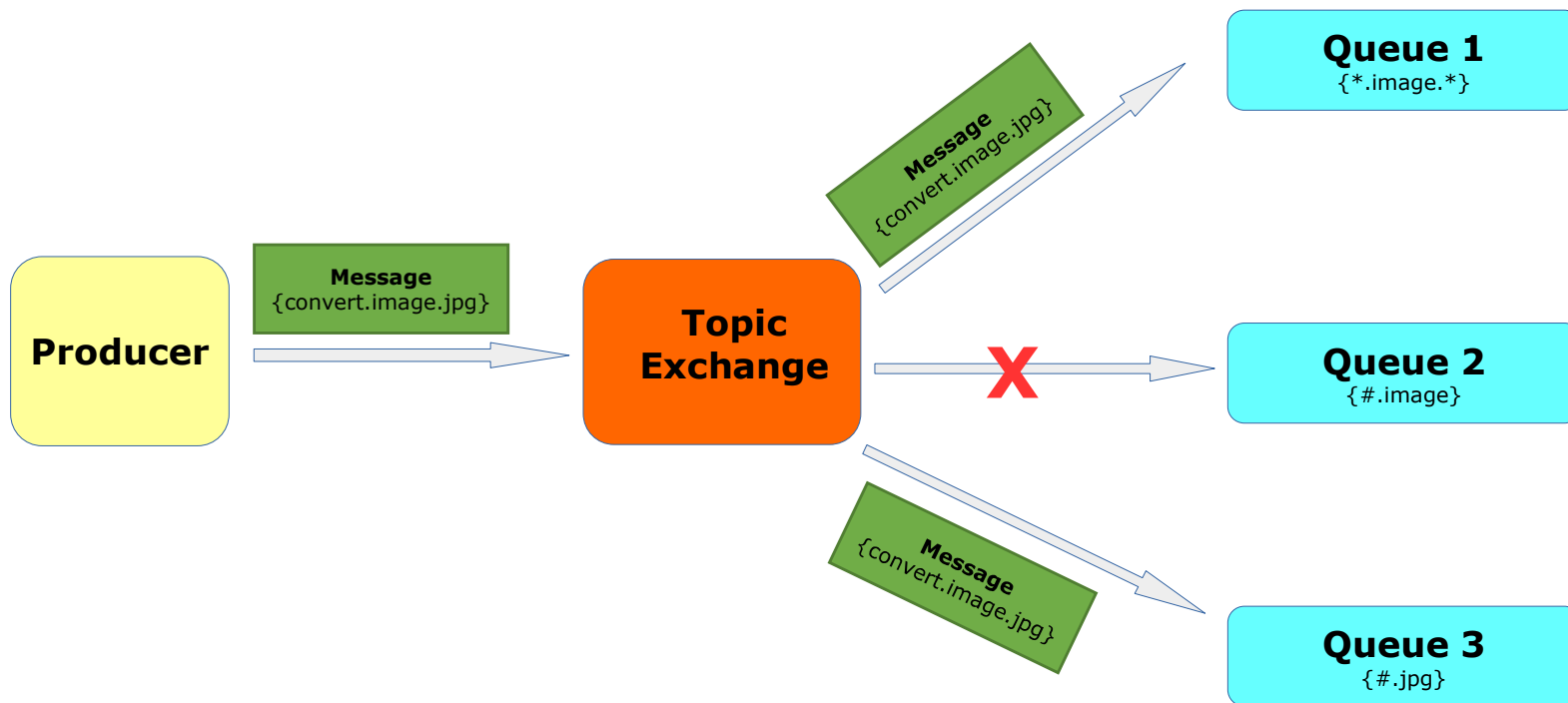
Direct Exchange

- Routes messages to the queues based on the "routing key" specified in binding definition.
- In order to send a message to a queue, routing key on the message and the routing key of the bound queue must be exactly the same.
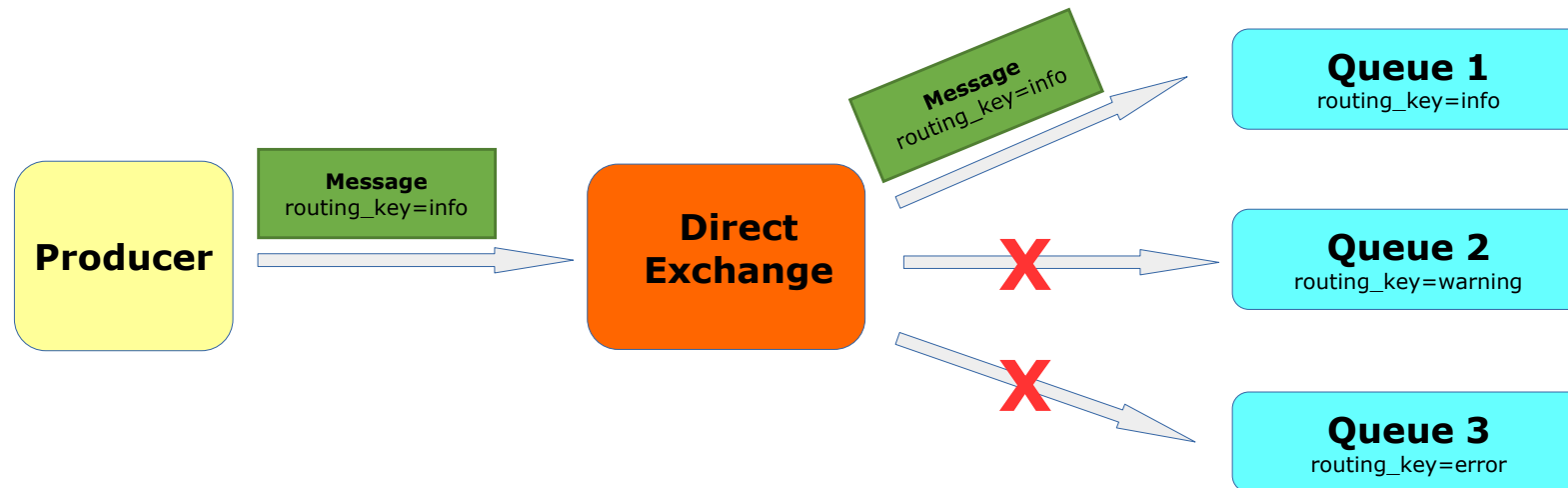
Topic Exchange

- Uses routing key in order to route a message, but does not require full match, checks the pattern instead.
- Checks whether the routing key "pattern" of a queue matches the received message's routing key.
- Routing key may include more than one word, separated by dots.
- Routing key of a queue can contain wild cards for matching message's routing key.
- Available wild cards are as follows:
  - * (asterisk): Matches exactly one word.
    - "*.image" will match "convert.image", but not "convert.bitmap.image" or "image.jpg"
  - # (hash): Matches zero or more words.
    - "image.#" will match "image.jpg" and "image.bitmap.32bit" but not "convert.image"

Topic Exchange

Producer

Message
{convert.image.jpg}

Topic Exchange

Message
{convert.image.jpg}

Queue 1
{*.image.*}

X

Queue 2
{#.image}

Message
{convert.image.jpg}

Queue 3
{#.jpg}

Headers Exchange

- Uses message headers in order to route a message to the bound queues.

- Ignores the routing key value of the message.

- A message may have many different headers with different values.

- While binding to this type of exchange, every queue specifies which headers a message may contain and whether it requires "all" or "any" of them to be exist in the message.

- "x-match" is the special header key whose value can be "all" or "any". It determines the "match all" or "match any" logic for the matching process.
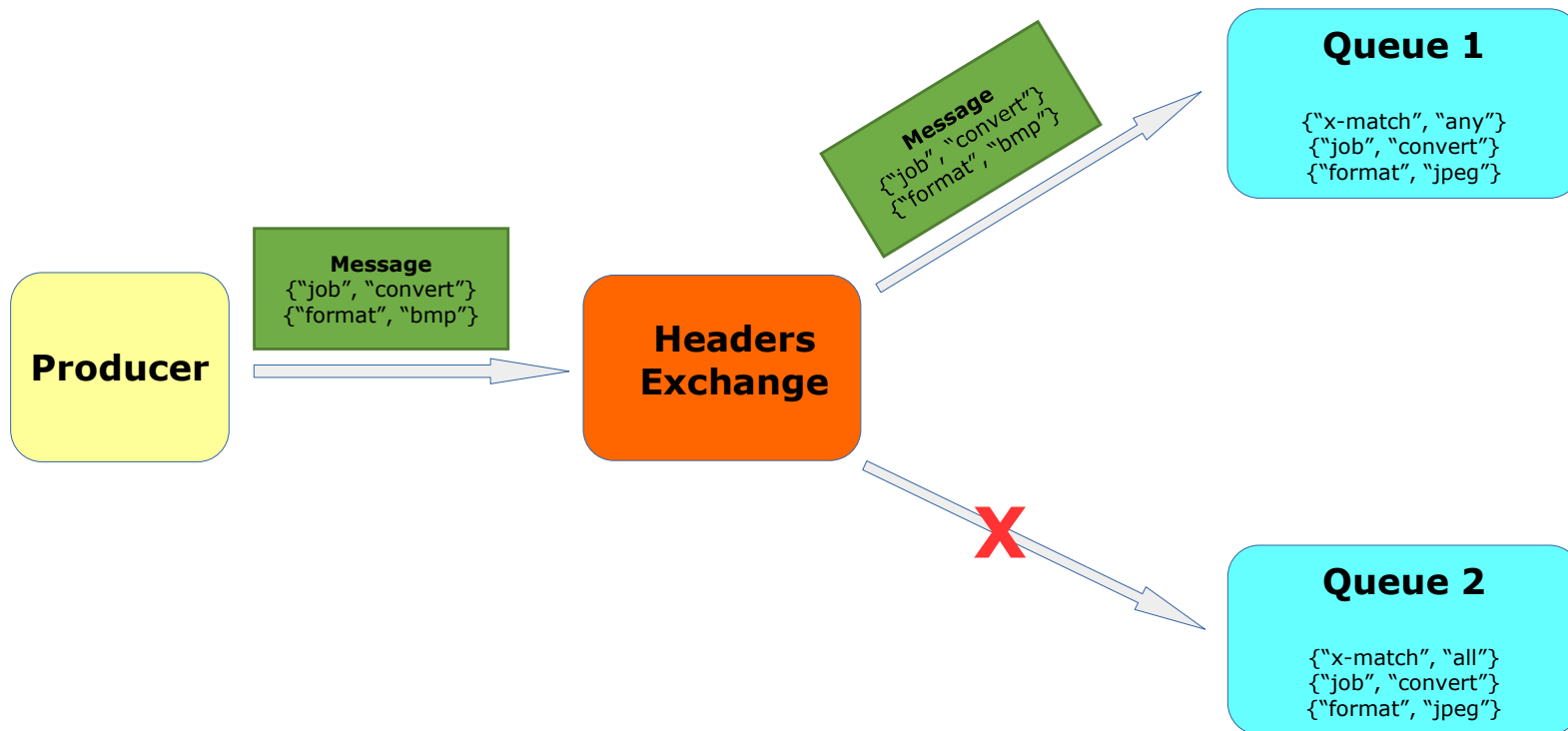
- Sample queue configurations;

Queue 1	Queue 2
Headers:	Headers:
{"x-match", "all"}	{"x-match", "any"}
{"job", "convert"}	{"job", "convert"}
{"format", "jpeg"}	{"format", "jpeg"}

Headers Exchange

Producer

Message
{"job", "convert"}
{"format", "bmp"}

Headers Exchange

Message
{"job", "convert"}
{"format", "bmp"}

Queue 1

{"x-match", "any"}
{"job", "convert"}
{"format", "jpeg"}

X

Queue 2

{"x-match", "all"}
{"job", "convert"}
{"format", "jpeg"}
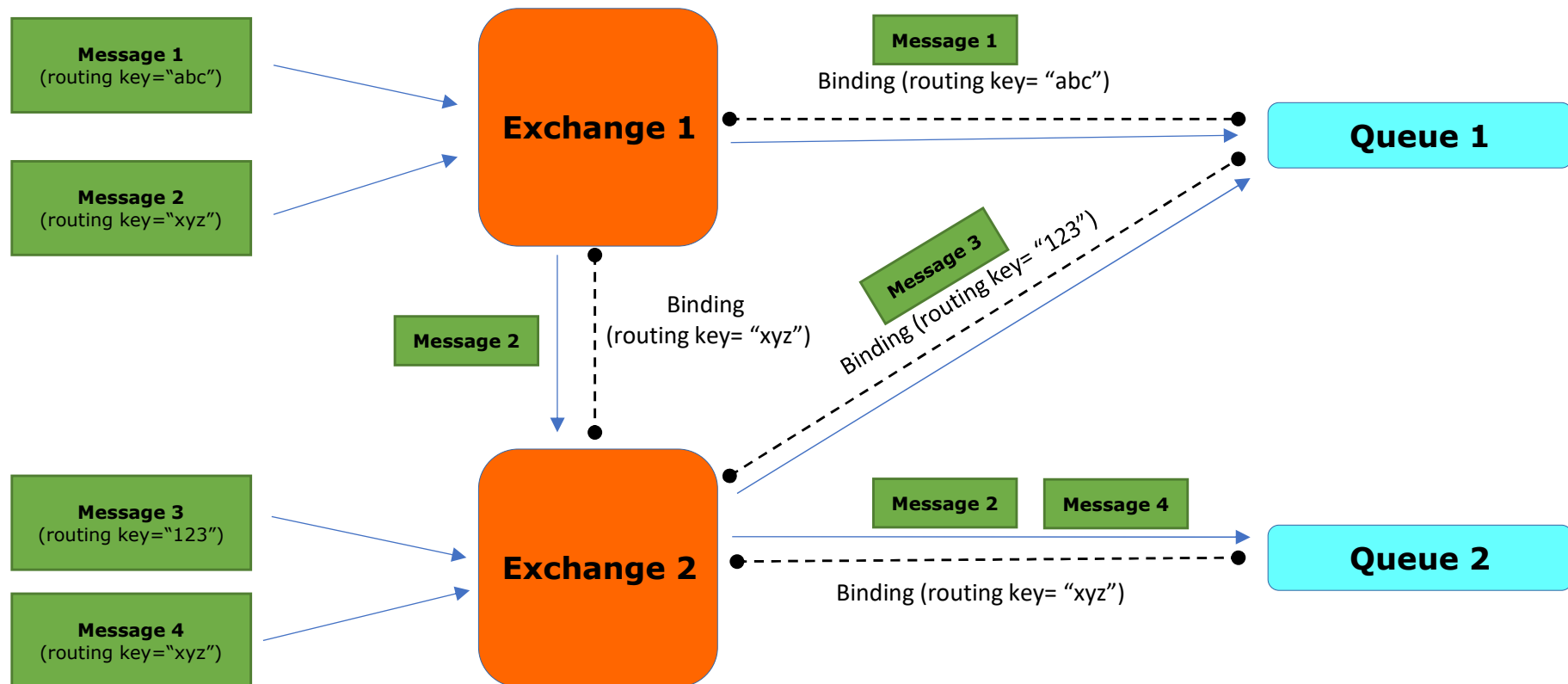
Default Exchange

- When a new queue is created on a RabbitMQ system, it is implicitly bound to a system exchange called "default exchange", <u>with a routing key which is the same as the queue name</u>.

- Default exchange has no name (empty string).

- The type of default exchange is "direct".

- When sending a message, if exchange name is left empty, it is handled by the "default exchange".
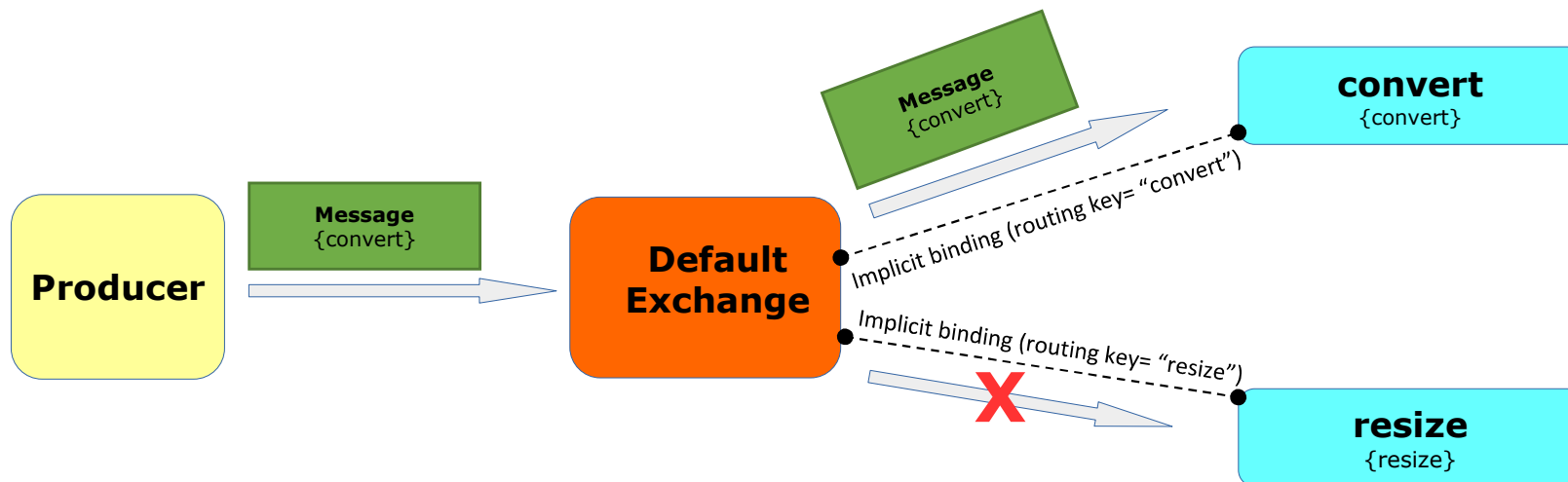
Exchange to Exchange Binding

- Like binding a queue to an exchange, it is possible to bind an exchange to another exchange.

- Binding and message routing rules are the same.

- When an exchange is bound to another exchange, messages from the source exchange are routed to the destination exchange using the binding configuration.

- Finally, destination exchange routes these messages to its bound queues.

Exchange to Exchange Binding - Sample

Message 1
(routing key="abc")

Message 2
(routing key="xyz")

Exchange 1

Message 1
Binding (routing key= "abc")

Queue 1

Message 2

Binding
(routing key= "xyz")

Message 3
Binding (routing key= "123")

Message 3
(routing key="123")

Message 4
(routing key="xyz")

Exchange 2

Message 2   Message 4

Binding (routing key= "xyz")

Queue 2

Alternate Exchange

- Some of the messages that are published to an exchange may not be suitable to route to any of the bound queues.

- These are unrouted messages.

- They are discarded by the exchange, so they are lost.

- In order to collect these messages, an "alternate exchange" can be defined for any exchange.

- Alternate exchange can be defined by setting the "alternate-exchange" key for an exchange.

- Any unrouted message is finally sent to defined "alternate-exchange".

- Any existing exchange can be set as an "alternate exchange" for another exchange.

- Fanout exchanges, which do not perform any filtering, are good for using as an "alternate exchange".

Alternate Exchange - Sample