Introduction to AMQP Messaging with RabbitMQ

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Why Messaging?

- Get data from point A to point B
- Decouple publishers and consumers
- Queueing for later delivery
- Asynchronous
- Load balancing and scalability

RabbitMQ

- RabbitMQ is an AMQP messaging broker
- Developed and maintained by Rabbit Technologies Ltd, www.rabbitmq.com
- Joint venture between Cohesive Flexible Technologies (www.cohesiveft.com) and LShift (www.lshift.net)
- Core development team in London, UK
- Rabbit is a part of AMQP Working Group

AMQP

- Advanced Message Queueing Protocol
- http://www.amqp.org
- Broadly applicable for enterprise
- Totally open
- Platform agnostic
- Interoperable
- Standard port is 5672/tcp
- List of brokers:
  - http://jira.amqp.org/confluence/display/AMQP/AMQP+Products

AMQP Working Group

Cisco Systems

Deutsche Börse Systems

Goldman Sachs

IONA

Novell

Red Hat

WSO2

Credit Suisse

Envoy Technologies

iMatix

JPMorgan Chase

Rabbit Technologies

TWIST

29West

Before AMQP...

- Start sending blobs from A to B with direct tcp
- Add queuing semantics (discard vs queue)
- Add serialization of metadata (int vs table)
- Add network abstraction (tcp vs multicast)
- Add auth and ACL
- Add virtual connections (channels)
- Add high availability
- Result would be very similar to AMQP !!!

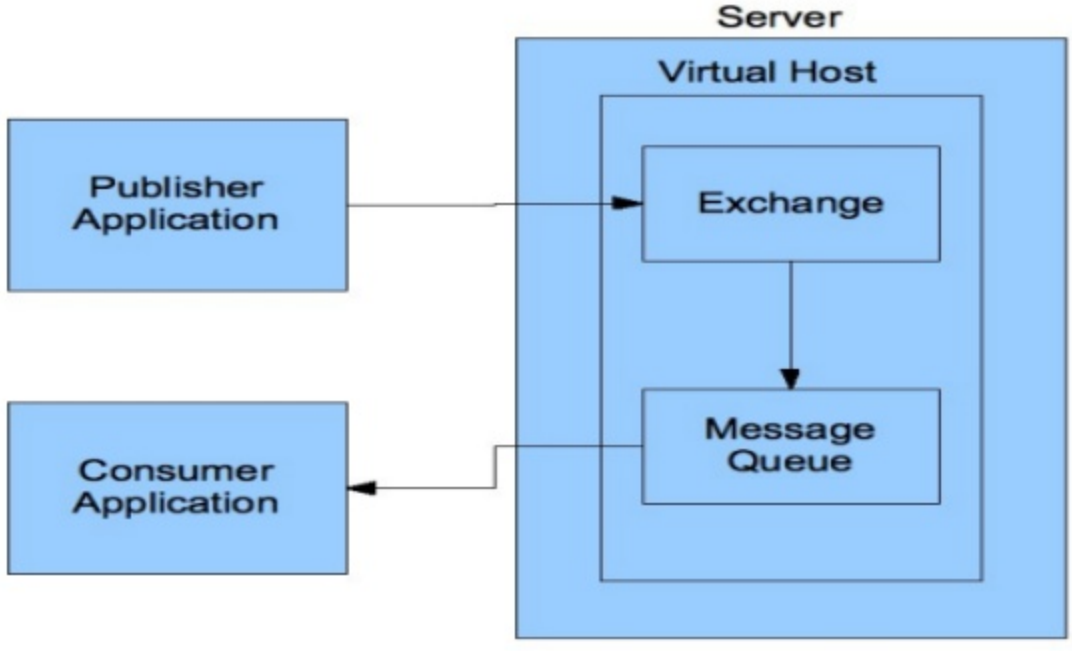
AMQP Protocol

- Network wire-level protocol
  - Defines how clients and brokers talk
  - Data serialization (framing), heartbeat
  - Hidden inside client libraries
- AMQP Model
  - Defines routing and storing of messages
  - Defines rules how these are wired together
  - Exported API

Network Wire-Level Protocol

- Information is organized into “frames”
- Independent threads of control within a single socket connection are called “channels”
- For each channel, frames run in sequence
- Each frame consists of header (type, channel id, payload size), payload, frame end packet
- Frames can be protocol methods (commands), structured content (message headers), data

AMQP Model


Server
Virtual Host
Publisher Application
Exchange
Message Queue
Consumer Application

Virtual Hosts

- Created for administrative purposes
- Access control
- Each connection (and all channels inside) must be associated with a single virtual host
- Each virtual host comprises its own name space, a set of exchanges, message queues and all associated objects

Exchange

- A message routing agent
- Can be durable – lasts till explicitly deleted
- Can be temporary – lasts till server shuts down
- Can be auto-deleted – lasts till no longer used
- There are several types of exchanges, each implements a particular algorithm
- Each message is delivered to each qualifying queue
- “Binding” - a link between queue and exchange

Direct Exchange Type

- Uses string as routing key
- Queue binds to exchange with key K
- Publisher sends message with key R
- Message is passed to this queue if K=R
- Direct exchange named “amq.direct” is always pre-created in each virtual host

Fanout Exchange Type

- No routing key
- What goes in must go out
- Can be used for load balancing

Topic Exchange Type

- Uses pattern as routing key (“a.b.c.d”)
- Queues can use wildcard characters in binding
- * matches a single word, # - zero or more words
- “amq.topic” is pre-created in each vhost
- *.stock.# matches usd.stock and eur.stock.db but not stock.nasdaq

Message Queue

- named “weak FIFO” buffer
- FIFO is guaranteed only with 1 consumer
- Can be durable, temporary (private to 1 consumer) or auto-deleted
- A message routed to a queue is never sent to more than one client unless it is being resent after failure or rejection
- You can get server to auto generate and assign queue name for your queue – this is usually done for private queues

One more time...

- Each message received by an exchange will be delivered to each qualifying (matching) queue
- A message routed to a queue is never sent to more than one client unless it is being resent after failure or rejection

Messages

- Message is the atomic unit of processing
- Can be persistent (delivery guarantee in case network failure or server crash)
- Can have a priority level (not yet implemented in RabbitMQ broker)

Message Content

- Messages carry content (header + body)
- Content body is opaque block of binary data
- Broker never modifies content body
- AMQP defines several “content classes,” each with specific syntax (which headers can be used) and semantics (which methods are available for such messages)

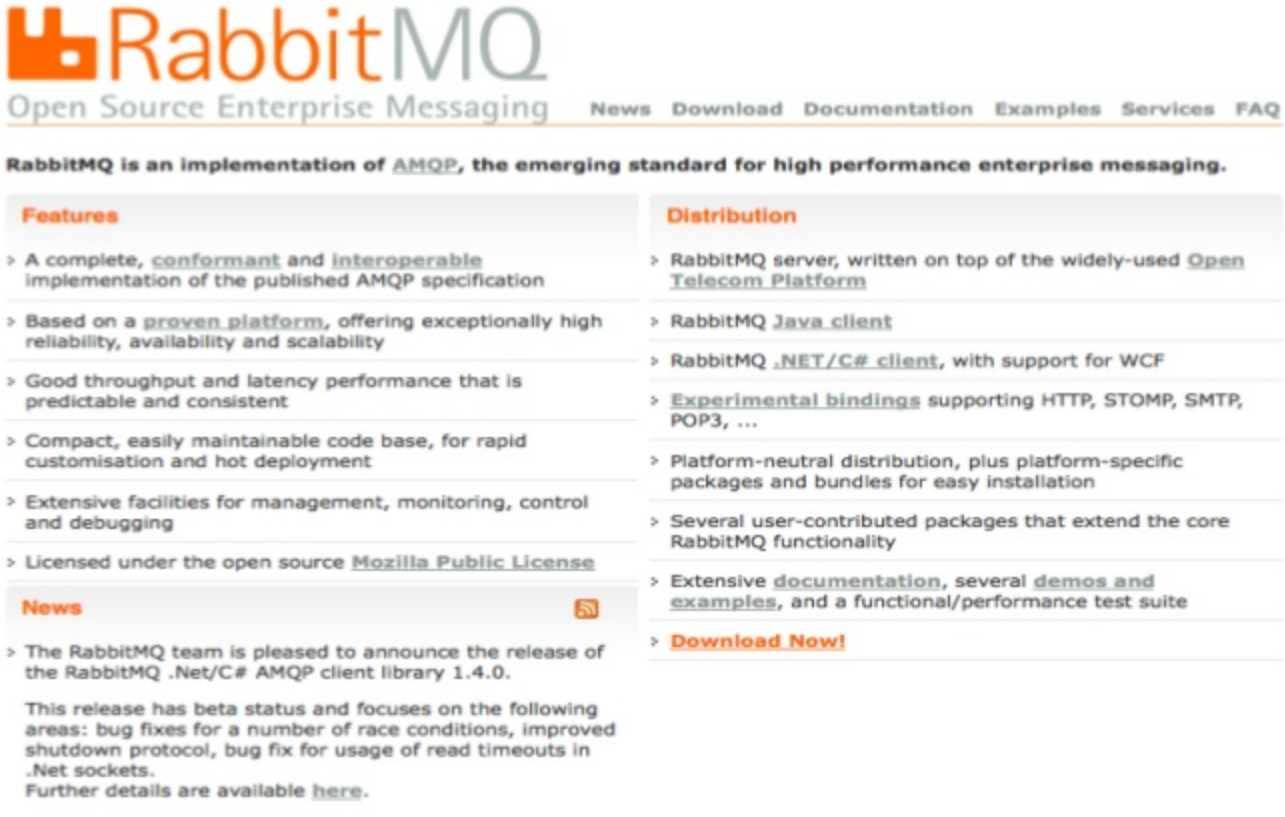
Basic Content Type

- Implements regular messaging model
- basic.consume – start a queue consumer
- basic.cancel – cancel a consumer
- basic.publish – publish a message
- basic.ack – acknowledge message(s)
- basic.reject – reject a message
- basic.get – get message (synchronous)

AMQP Specification XML

- Details of each of these methods can be found in AMQP Spec
- Spec defines the protocol (like RFC)
- Spec is meant to be parsed to generate AMQP library code (XML)
- <class> section for every class: connection, channel, access, exchange, queue, basic, file, stream and others
- Look for <method> nodes inside each class

RabbitMQ


RabbitMQ
Open Source Enterprise Messaging
News Download Documentation Examples Services FAQ
RabbitMQ is an implementation of AMQP, the emerging standard for high performance enterprise messaging.
Features
A complete, conformant and interoperable implementation of the published AMQP specification
Based on a proven platform, offering exceptionally high reliability, availability and scalability
Good throughput and latency performance that is predictable and consistent
Compact, easily maintainable code base, for rapid customisation and hot deployment
Extensive facilities for management, monitoring, control and debugging
Licensed under the open source Mozilla Public License
News
The RabbitMQ team is pleased to announce the release of the RabbitMQ .Net/C# AMQP client library 1.4.0.
This release has beta status and focuses on the following areas: bug fixes for a number of race conditions, improved shutdown protocol, bug fix for usage of read timeouts in .Net sockets.
Further details are available here.
Distribution
RabbitMQ server, written on top of the widely-used Open Telecom Platform
RabbitMQ Java client
RabbitMQ .NET/C# client, with support for WCF
Experimental bindings supporting HTTP, STOMP, SMTP, POP3, ...
Platform-neutral distribution, plus platform-specific packages and bundles for easy installation
Several user-contributed packages that extend the core RabbitMQ functionality
Extensive documentation, several demos and examples, and a functional/performance test suite
Download Now!

RabbitMQ

- RabbitMQ is a broker written in Erlang
- RabbitMQ team also provides Java and .NET clients
- Implements AMQP 0-8 spec
- Experimental products include AMQP-over-HTTP + Javascript libraries, Erlang client, gateway for STOMP clients, XMPP (Jabber) gateway
- RabbitMQ 1.4 was released July 29, 2008

RabbitMQ.com

- http://www.rabbitmq.com/download.html
- http://www.rabbitmq.com/documentation.html
- http://www.rabbitmq.com/api-guide.html (Java)
- http://www.rabbitmq.com/examples.html

RabbitMQ Clustering

- Unique feature of RabbitMQ broker
- Implemented with Erlang distributed nodes
- Data/state replication with full ACID properties
- Exception: queues (visible/reachable from everywhere, reside on node which created them – to be changed in future versions)
- 1 client = 1 socket. Cluster helps scale!
- High Availability

Client libraries

- RabbitMQ – Java, C#, Erlang, Javascript
  http://www.rabbitmq.com/download.html
- Apache Qpid – java, c++, python, ruby, C#
  http://cwiki.apache.org/qpid/download.html
- With Qpid, remember to use official spec XML!
- Pyamqplib - python
  http://barryp.org/software/py-amqplib/
- Non-blocking sockets addon for pyamqplib
  http://lists.rabbitmq.com/pipermail/rabbitmq-discuss/2008-March/000937.htm

Client libraries (continued)

- Ruby - http://www.github.com/tmm1/amqp
- ActionScript 3 (Flash) - http://github.com/0x6e6562/as3-amqp/tree/master
- Want to write your own client? See how easy it is! http://hopper.squarespace.com/blog/2008/6/21/build-your-own-amqp-client.html
- Ruby (Qpid) + RabbitMQ example http://somic-org.homelinux.org/blog/2008/06/24/ruby-amqp-rabbitmq-example/

Community

- rabbitmq-discuss mailing list
- http://lists.rabbitmq.com
- Not a single thread ignored by core team!
- Excellent signal to noise ratio
- http://groups.google.com/group/rabbitmq-discuss
- The best support mailing list I have ever been a part of!

SCM

- http://hg.rabbitmq.com/rabbitmq-server
- http://hg.rabbitmq.com/rabbitmq-java-client/
- http://hg.rabbitmq.com/rabbitmq-codegen/
- Get Mercurial from http://www.selenic.com/mercurial
- hg clone repo_url
- http://lists.rabbitmq.com/pipermail/rabbitmq-discuss/2008-July/001372.html

Broker Performance

- http://www.lshift.net/news.20071116intelrabbit
- Achieved throughput of 1.3 million msg/sec
- http://news.cnet.com/8301-13846_3-9983286-62.html
- XMPP + RabbitMQ = Twitter That Doesn't Go Down

Best Way to Read the Spec

- Start with specification PDF 0-9 or 0-10
- Do not start with PDF from 0-8!
- Figure out fundamentals and concepts first
- Most client API auto generate method code
- pyamqplib has nice docstrings
- All AMQP commands are <method> in XML
- Methods are grouped in classes
- RabbitMQ currently implements AMQP 0-8

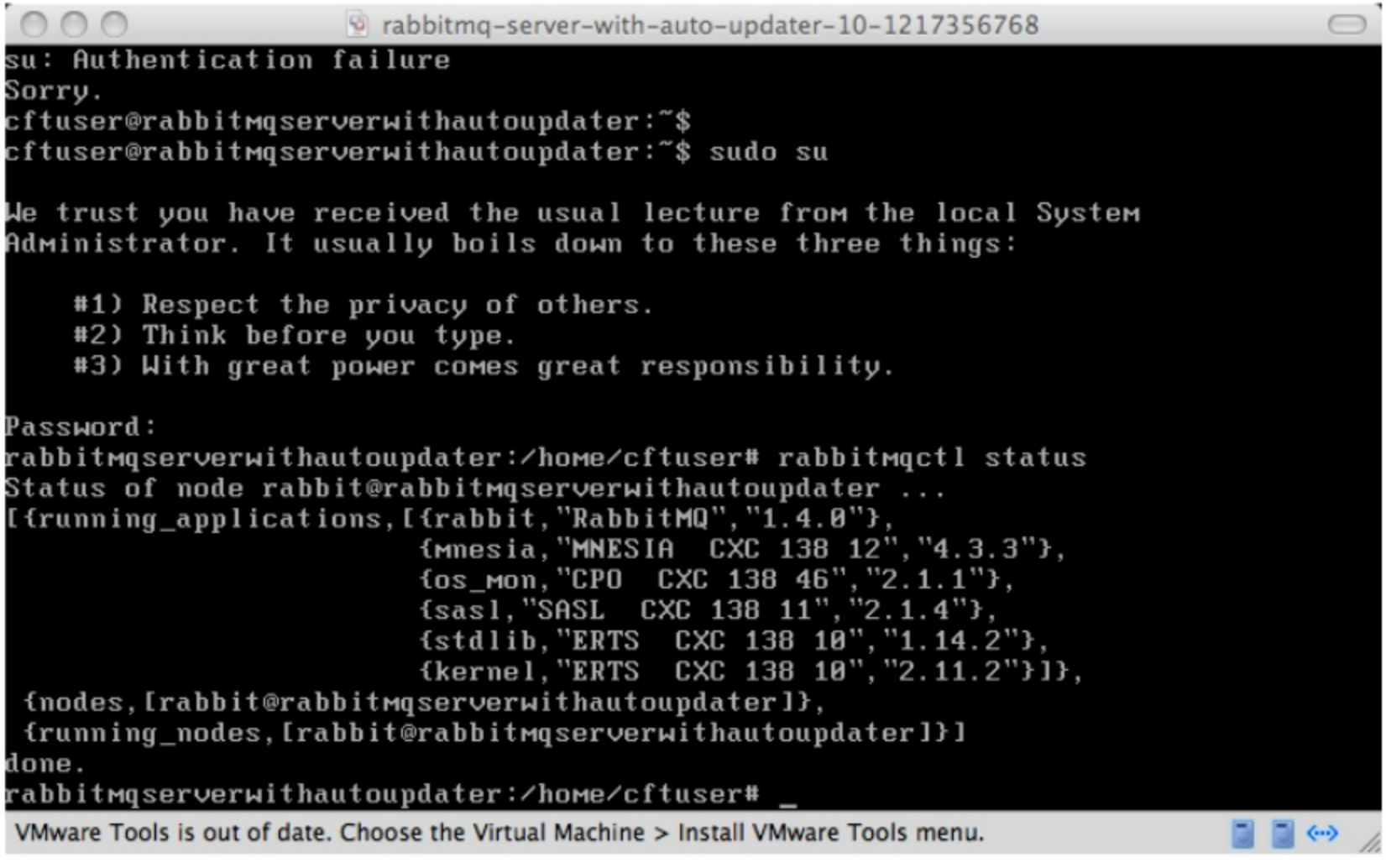
Broker on Your Laptop

- You can get erlang to run on Windows
- Watch out for firewall interfering with epmd (tcp 4369)
- Check out Windows Bundle available on RabbitMQ.com download page

RabbitMQ Elastic Server

- If you prefer Linux
- http://elasticserver.com
- Assemble a RabbitMQ virtual machine
- Requires a free VMWare player or deploy to Amazon EC2 cloud
- http://es.cohesiveft.com/site/rabbitmq (ver. 1.2)
- Or get a VM with auto updater from this url:
- http://es.cohesiveft.com/server/details/3243-rabbitmq-server-with-auto-updater-10-1217356768-VMware

RabbitMQ Elastic Server



Using Rabbit at Cohesive

- GUI “sidekick” - loads same data models (MVC) as GUI, actions are triggered by messages instead of user clicks
- Web front end dispatches jobs
- Backend sends status updates
- Some actions triggered from cron
- Can have many distributed “sidekicks”

Thank you!

Photo credit: http://flickr.com/photos/53366513@N00/67046506/