

JUG Saarland Meetup 27

Apache Camel

a versatile open-source integration framework

Frank Dietrich
(Clearstream S.A., Luxembourg)



Agenda



- What is Enterprise Application Integration?
- What are Enterprise Integration Pattern?
- What is Apache Camel?
- What does Apache Camel provide to us?
- Apache Camel architecture
- Supported components and data formats
- Deployment model
- Tools and examples

What is Enterprise Application Integration?

Enterprise Application Integration is not a single tool it rather describes the process of linking enterprise applications within a single organization together. With the goal to simplify and automate business processes. While at the same time avoiding having to make changes to existing applications or data structures.

Enterprise Integration is not an easy task. As it has to deal with:

- ... multiple applications
- ... running on multiple platforms
- ... in different locations
- ... processing data in different formats

Example for common problems

Assuming a company selling electronic parts with one local store.

- order processing and billing happen in the local store
- all steps are handled by a custom POS software

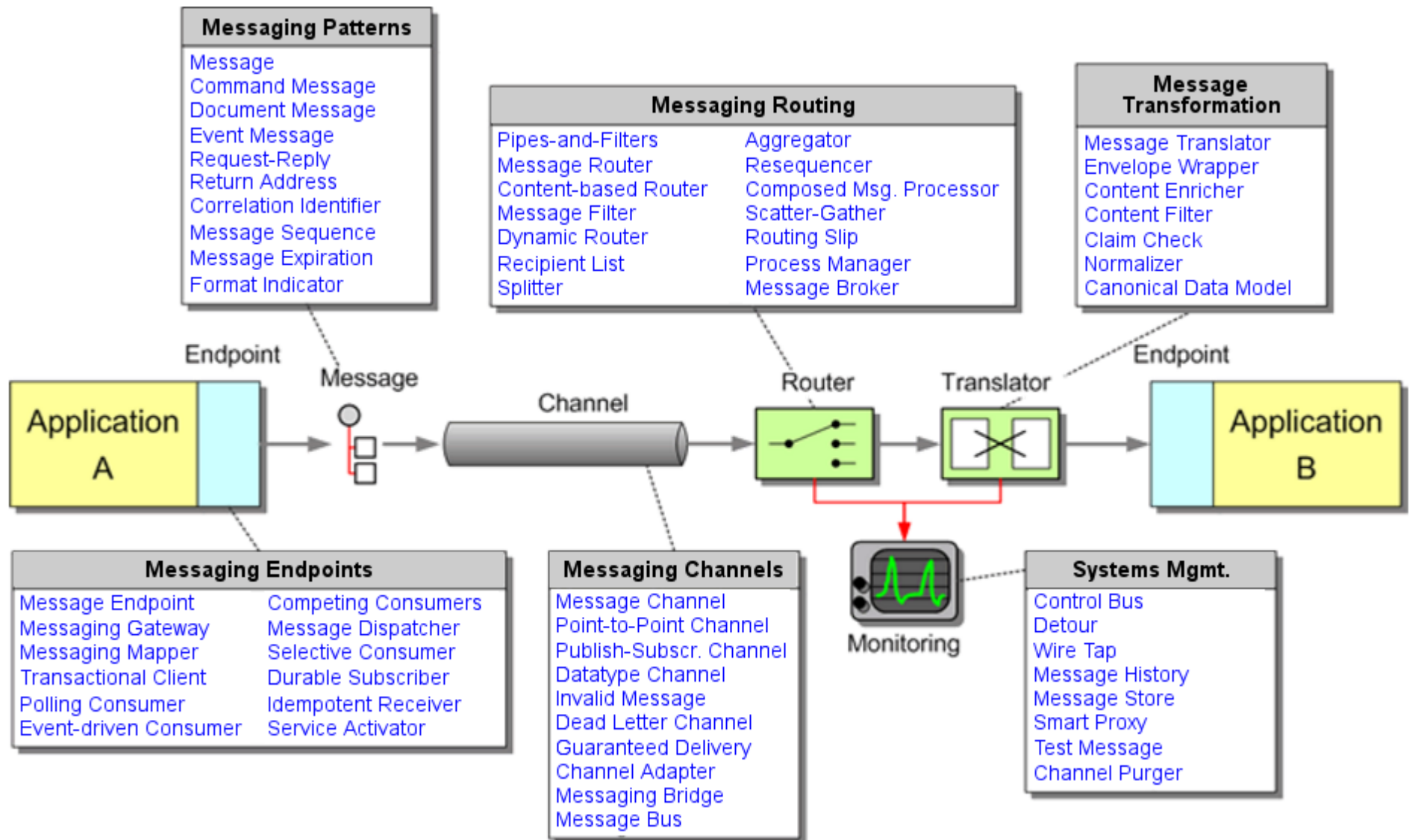
After the company rises she might need to solve following:

- orders coming from different media, e.g. email, website, ...
- shipping goods to the customer or other stores
- billing address differ from shipping address

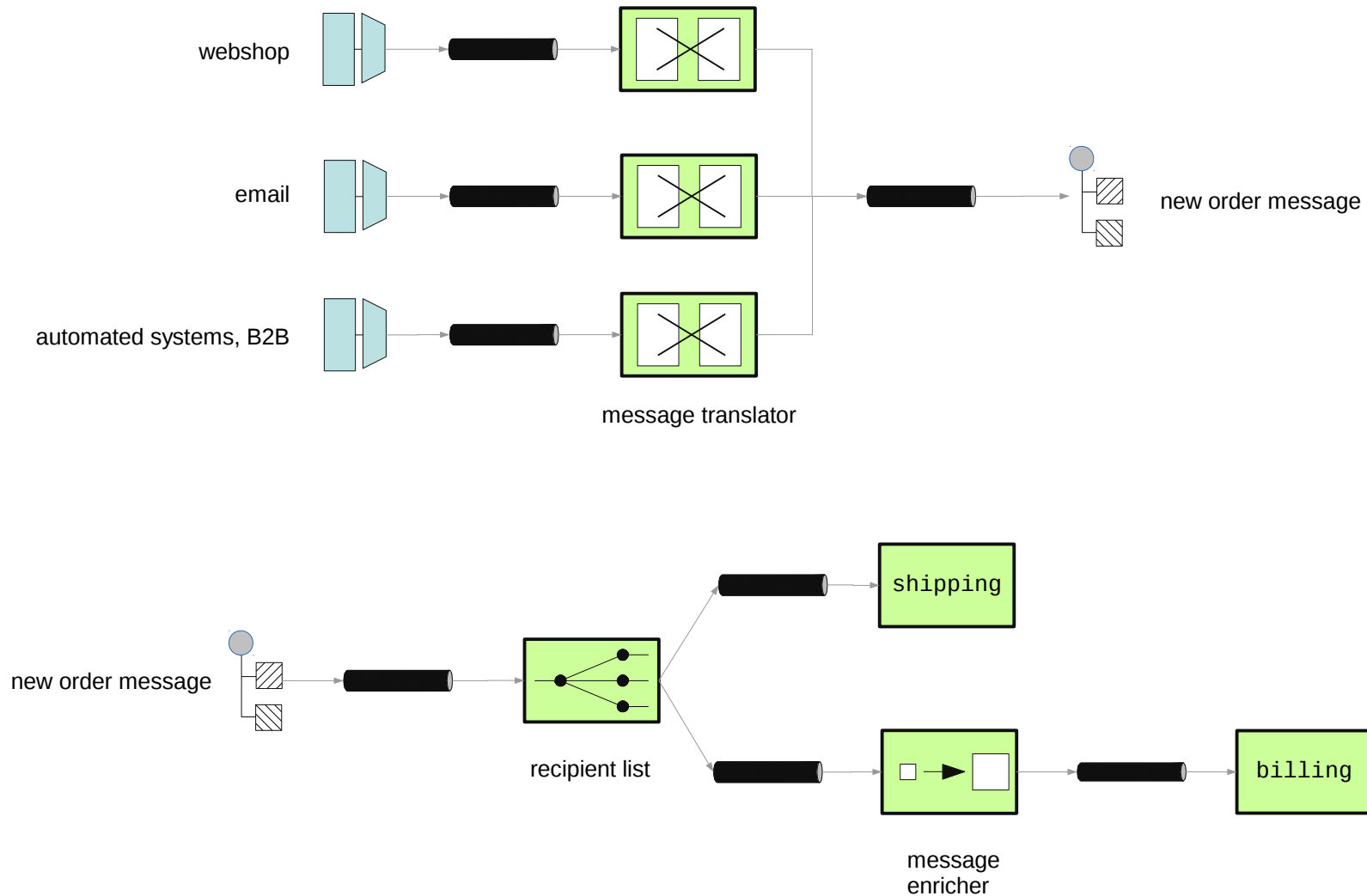
What are Enterprise Integration Pattern?

- Design pattern for Enterprise Application Integration and message oriented middleware
- 9 categories
 - Integration Styles – file transfer, shared database, ...
 - Integration Types – information portal, data replication, ...
 - Messaging Systems – channels, pipes and filters, ...
 - Message Channel – point-to-point, publish-subscribe, ...
 - Message Construction – command message, event message, ...
 - Message Router – content-based-router, message-filter, ...
 - Message Transformation – content enricher, claim check, ...
 - Messaging Endpoints – polling / event-driven consumer, ...
 - System Management – detour, wire tap, ...

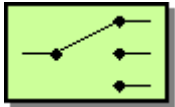
Messaging pattern



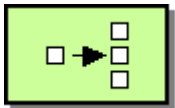
Example for common problems



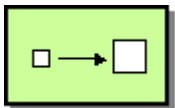
EIP pattern examples



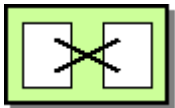
Content based router – pass messages depending on conditions



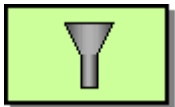
Splitter – message contains multiple elements, to be processed in a different way



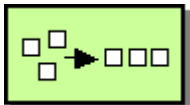
Content enricher – originator does not have all required data



Message translator – systems using different data formats to communicate



Message filter – avoid receiving uninteresting messages



Resequencer - get a stream of related but out-of-sequence messages back into the correct order

EIP - theory and praxis

- Enterprise Integration Pattern provide the theory
- one implemented solution is Apache Camel



What is Apache Camel?

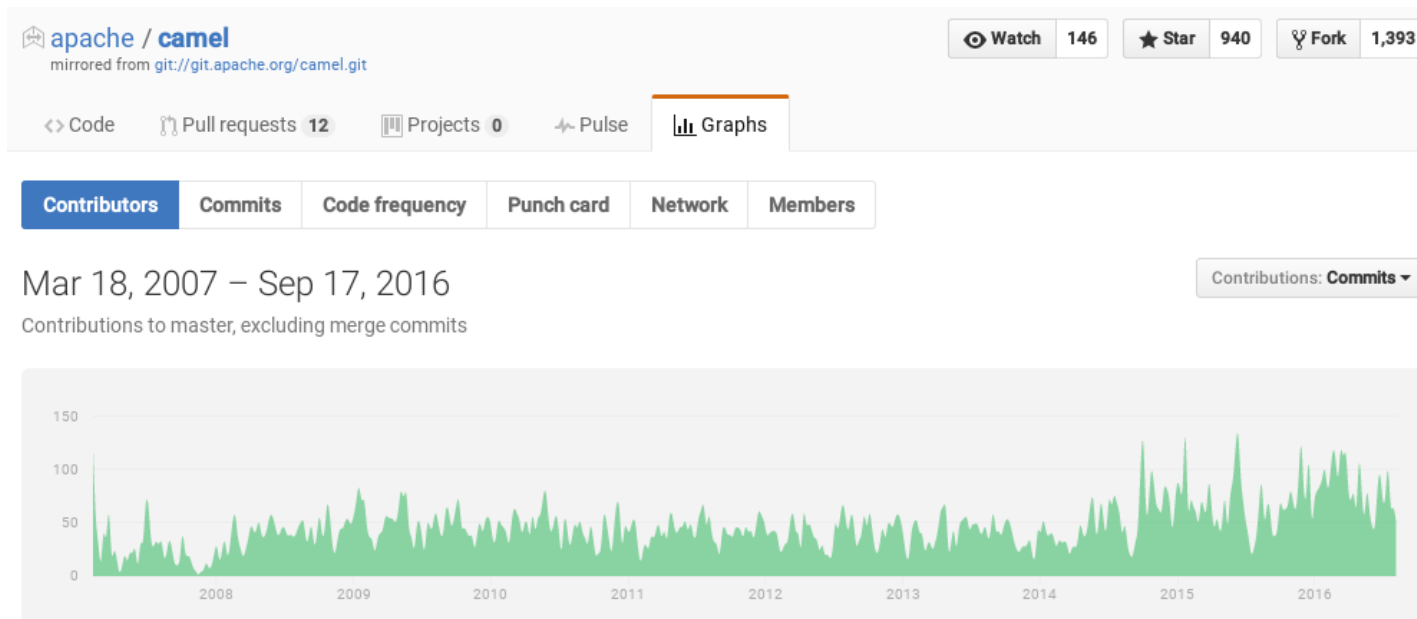
- Quotation from the webpage (<http://camel.apache.org>)

Apache Camel is a versatile open-source integration framework based on known Enterprise Integration Patterns.

- entirely framework is written in Java
- routing and mediation rules are defined in a domain specific language (Java, Spring/Blueprint XML, Scala)

History of Apache Camel

- 2003 - Gregor Hohpe and Bobby Wolf published the book „Enterprise Integration Pattern“
- 2007 – first commit from James Strachan (creator of Groovy)
- actual version is 2.17
- more then 230 contributors on <https://github.com/apache/camel>



Why the name Camel?

- it stands for

Concise
Application
Message
Exchange
Language

- other explanations:

- some members of the team used to love Camel[®] cigarettes
- the name is short, simple and easy to remember
- ...
- more on <http://camel.apache.org/why-the-name-camel.html>



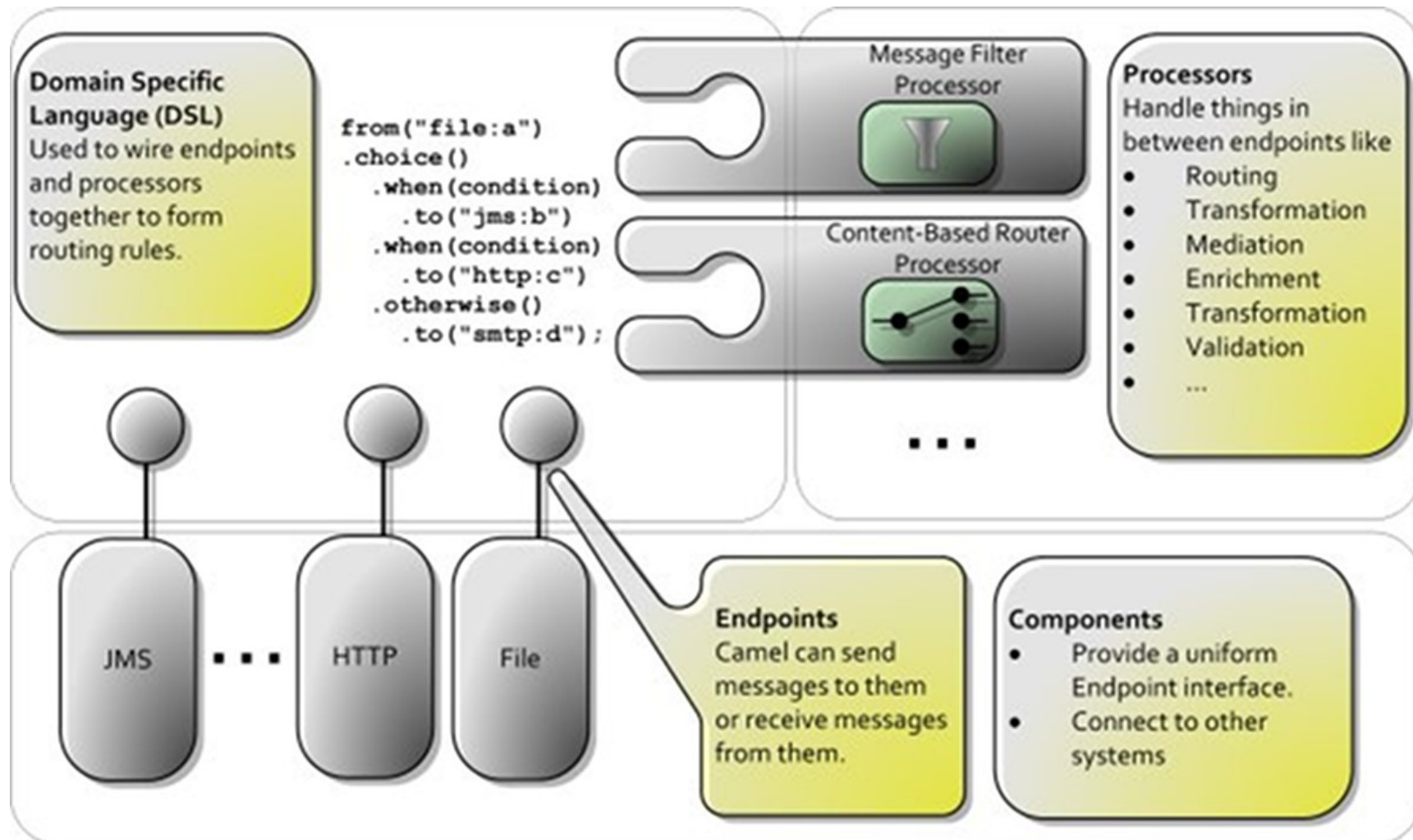
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What does Apache Camel provide to us?

- A framework which let us focus on business problems
- Minimize dependencies between integrated applications
- A large set of components and supported data formats prevent us from reinventing the wheel
- Its modular architecture allows to plugin own component or data format
- A test kit for unit and integration testing



Camel architecture



Supported components

- current 184 components addressable via an URI
 - amqp (ActiveMQ, RabbitMQ, MQTT, ...)
 - aws (EC2, SNS, S3, ...)
 - cassandra
 - cxf (JAX WS/JAX RS, REST)
 - direct (endpoint in the same Camel Context)
 - direct-vm (endpoint in the same JVM)
 - docker
 - dropbox
 - ejb
 - elasticsearch
 - file
 - ftp
 - ...
- complete list: <http://camel.apache.org/components.html>



Apache Camel Components



Automating Tasks

Component / Artifact / URI	Description
Timer / camel-timer	Used to generate message exchanges when a time flies. Events can only be consumed from this endpoint.
Quartz / camel-quartz	Provides a scheduled delivery of messages using the Quartz 1 scheduler.
Quartz2 / camel-quartz2	Provides a scheduled delivery of messages using the Quartz 2 scheduler.

Amazon

Component / Artifact / URI	Description
AWS-CW / camel-aws	For working with Amazon's CloudWatch (CW).
AWS-DB / camel-aws	For working with Amazon's Simple Database (SD).
AWS-DDB / camel-aws	For working with Amazon's DynamoDB (DDB).
AWS-S3 / camel-aws	For working with Amazon's SimpleDB (SDB).
AWS-SES / camel-aws	For working with Amazon's Simple Email Service (SES).
AWS-SNS / camel-aws	For working with Amazon's Simple Notification Service (SNS).
AWS-SQS / camel-aws	For working with Amazon's Simple Queue Service (SQS).
AWS-S3 / camel-aws	For working with Amazon's Simple Storage Service (S3).

Basics

Component / Artifact / URI	Description
Bean / camel-bean	Use the Bean Binding to bind message exchanges to beans based on the class name. It is also used for injecting and binding POJOs.
Class / camel-class	Use the Bean Binding to bind message exchanges to beans based on the class name. It is also used for injecting and binding POJOs.
Context / camel-context	Used to refer to endpoints within a separate CamelContext to provide a simple Black Box composition approach so that routes can be contained into a CamelContext and then used as a sub-component in other CamelContexts.
DataFormat / camel-dataformat	For working with DataFormat's and regular expressions to parse and format data.
Exec / camel-exec	For executing system commands.
Language / camel-language	Executes Languages scripts.
Printer / camel-printer	Facilitates creation of printer endpoints to local, remote and wireless printers. The endpoints provide the ability to print camel directed messages.
Properties / camel-properties	Facilitates using property placeholders directly in endpoint URIs.
Ref / camel-ref	Component for lookup of existing endpoints in the Registry.

Chat

Component / Artifact / URI	Description
IRC / camel-irc	For Inter Relay Chat (IRC) communication.
XMPP / camel-xmpp	Working with the Extensible Messaging and Presence Protocol (XMPP).

Clusters

Component / Artifact / URI	Description
JGroups / camel-jgroups	Provides exchange of messages between Camel infrastructure and JGroups clusters.
ZooKeeper / camel-zookeeper	Working with ZooKeeper clusters.

Content Repositories

Component / Artifact / URI	Description
CHS / camel-chs	Uses the Apache Chemistry class API to interface with Content Management Interoperability Services (CMIS).
JCR / camel-jcr	Stores messages in a Java Content Repository (JCR) compliant repository like Apache Jackrabbit.

Endpoint Communications

Component / Artifact / URI	Description
Direct / camel-direct	Synchronous call to another endpoint from same CamelContext.
Direct-VM / camel-direct-vm	Synchronous call to another endpoint in another CamelContext running in the same Java virtual machine (JVM).
Disruptor / camel-disruptor	Provides asynchronous SEDA behavior much as the standard SEDA Component, but utilizes a single thread to process messages, thus allowing you to use the Disruptor architecture across web applications.
Disruptor-VM / camel-disruptor-vm	Provides asynchronous SEDA behavior much as the standard SEDA Component, but utilizes a single thread to process messages, thus allowing you to use the Disruptor architecture across web applications.
SEDA / camel-seda	Asynchronous call to another endpoint in the same Camel Context. Single threaded event driven architecture (SEDA).
VM / camel-vm	Asynchronous call to another endpoint in the same JVM.

ESB

Component / Artifact / URI	Description
JBI / camel-jbi	For Java Business Integration (JBI) integration such as working with Apache ServiceMix.
NMR / camel-nmr	Integration with the Normalized Message Router (NMR) in Apache ServiceMix.
Vert.x / camel-vertx	Working with the Vert.x event bus.

Feeds

Component / Artifact / URI	Description
Atom / camel-atom	Working with Apache Atom for atom integration, such as consuming an atom feed.
RSS / camel-rss	Working with RSS for Rich Site Summary (RSS) integration.

File I/O and Transfer

Component / Artifact / URI	Description
File / camel-file	Sending messages to a file or polling a file or directory.
FileWatch / camel-file-watch	Processing fixed width or delimited files or messages using the FileWatch library.
FTP / camel-ftp	Sending and receiving files over File Transfer Protocol (FTP).
FTPS / camel-ftp	Sending and receiving files over FTPS (TLS and SSL).
HDFS / camel-hdfs	For sending/receiving files to Hadoop Distributed File System (HDFS) filesystem.
IO / camel-io	Support for the io project using the Client API of the Java Secure Channel (JSC) project.
LDAP / camel-ldap	Working with LDAP for LDAP integration, such as consuming an LDAP feed.
SMTP / camel-smtp	Sending and receiving files over SMTP Secure (TLS and SSL).
Stream / camel-stream	Read or write to an input/output stream rather than the Unix pipes.

Google

Component / Artifact / URI	Description
OAuth / camel-oauth	Used by web applications to implement an OAuth consumer.
OAuth2 / camel-oauth2	Provides connectivity to the OAuth 2.0 service of Google Apps Engine for use with OAuth 2.0 applications.
Google / camel-google	Used by Google Apps Engine for use with OAuth 2.0 applications.
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HTTP

Component / Artifact / URI	Description
AMC / camel-amc	To call external HTTP services using Apache HttpClient.
AMC / camel-amc	HTTP-based event routing tool used to deliver messages to the Java Camel implementation of the Bayeux Protocol.
HTTP / camel-http	For calling out to external HTTP servers using Apache HTTP Client 4.x.
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Java Message Service

Component / Artifact / URI	Description
ActiveMQ / camel-activemq	For JMS Messaging with Apache ActiveMQ.
ActiveMQ / camel-activemq	Uses ActiveMQ's fast disk journaling implementation to store message bodies in a rolling log file.
JMS / camel-jms	Working with JMS provider.
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LDAP

Component / Artifact / URI	Description
LDAP / camel-ldap	Performing searches on Lightweight Directory Access Protocol (LDAP) servers.
Spring-LDAP / camel-spring-ldap	Camel wrapper for Spring LDAP. Spring LDAP is a library for simplifying LDAP operations, based on the pattern of Spring's JdbcTemplate.

Mail

Component / Artifact / URI	Description
IMAP / camel-imap	Receiving email using Internet Message Access Protocol (IMAP).
IMAPS / camel-imaps	Receiving email using secured IMAP.
POP3 / camel-pop3	Receiving email using Post Office Protocol (POP3) and JavalMail.
POP3S / camel-pop3s	Receiving email using secured POP3 and JavalMail.
SMTP / camel-smtp	Sending email using Simple Mail Transfer Protocol (SMTP) and JavalMail.
SMTPS / camel-smtps	Sending email using secured SMTP and JavalMail.

Maintenance and Monitoring

Component / Artifact / URI	Description
Browse / camel-browse	Provides a simple BrowseableEndpoint which can be used for testing, visualization tools or debugging. The endpoint is available in all Camel applications.
CentralBus / camel-centralbus	CentralBus EIP that allows to send messages to endpoints for managing and monitoring your Camel applications.
Log / camel-log	Uses Jakarta Commons Logging to log the log messages to the log file or the log system like log4j.
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Log / camel-log	Uses Jakarta Commons Logging to log the log messages to the log file or the log system like log4j.

Messaging

Component / Artifact / URI	Description
AMQP / camel-amqp	For Messaging with the Advanced Message Queuing Protocol (AMQP).
AMQP / camel-amqp	Working with the Expert Library for Event Stream Processing.
AMQP / camel-amqp	Working with the Expert Library for Event Stream Processing.
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Networking

Component / Artifact / URI	Description
DNS / camel-dns	To lookup domain information and non domain Name System (DNS) queries using DNSUtils.
HL7 / camel-hl7	For working with the HL7 MLLP protocol using HL7Utils.
HL7 / camel-hl7	For working with the HL7 MLLP protocol using HL7Utils.
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OSGi

Component / Artifact / URI	Description
EventAdmin / camel-eventadmin	Receiving OSGi EventAdmin events.
EventAdmin / camel-eventadmin	Receiving OSGi EventAdmin events.
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EventAdmin / camel-eventadmin	Receiving OSGi EventAdmin events.

Persistence

Component / Artifact / URI	Description
CouchDB / camel-couchdb	To integrate with Apache CouchDB.
CouchDB / camel-couchdb	To integrate with Apache CouchDB.
CouchDB / camel-couchdb	To integrate with Apache CouchDB.
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Platform Support

Component / Artifact / URI	Description
Activiti / camel-activiti	For working with Activiti, a light-weight workflow and Business Process Management (BPM) platform which supports BPMN 2.0.
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Activiti / camel-activiti	For working with Activiti, a light-weight workflow and Business Process Management (BPM) platform which supports BPMN 2.0.

Remote Services

Component / Artifact / URI	Description
Axis / camel-axis	Working with Apache Axis for data serialization.
Axis / camel-axis	Working with Apache Axis for data serialization.
Axis / camel-axis	Working with Apache Axis for data serialization.
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Axis / camel-axis	Working with Apache Axis for data serialization.

Search Engines

Component / Artifact / URI	Description
ElasticSearch / camel-elasticsearch	For interfacing with the ElasticSearch server.
ElasticSearch / camel-elasticsearch	For interfacing with the ElasticSearch server.
ElasticSearch / camel-elasticsearch	For interfacing with the ElasticSearch server.
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Security

Component / Artifact / URI	Description
Crypto / camel-crypto	Used to sign and verify exchanges using the X.509 signature specification.
Crypto / camel-crypto	Used to sign and verify exchanges using the X.509 signature specification.
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Crypto / camel-crypto	Used to sign and verify exchanges using the X.509 signature specification.

Social Media

Component / Artifact / URI	Description
Facebook / camel-facebook	Providing access to all of the Facebook APIs accessible using Facebook4J.
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Special support

Component / Artifact / URI	Description
Cache / camel-cache	The cache component facilitates creation of caching endpoints and processes using EhCache as the cache implementation.
Cache / camel-cache	The cache component facilitates creation of caching endpoints and processes using EhCache as the cache implementation.
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Spring

Component / Artifact / URI	Description
Spring / camel-spring	Working with Spring Application Events.
Spring / camel-spring	Working with Spring Application Events.
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Templates

Component / Artifact / URI	Description
Freemarker / camel-freemarker	Generates a response using a FreeMarker template.
Freemarker / camel-freemarker	Generates a response using a FreeMarker template.
Freemarker / camel-freemarker	Generates a response using a FreeMarker template.
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Testing

Component / Artifact / URI	Description
Dataset / camel-dataset	For load and test testing, the Dataset provides a way to create huge numbers of messages for sending to components or asserting that they are consumed correctly.
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Web Services

Component / Artifact / URI	Description
SOAP / camel-soap	Working with Apache CXF for web services integration.
SOAP / camel-soap	Working with Apache CXF for web services integration.
SOAP / camel-soap	Working with Apache CXF for web services integration.
SOAP / camel-soap	Working with Apache CXF for web services integration.
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XML

Component / Artifact / URI	Description
Bean Validation / camel-bean-validation	Validates the payload of a message using the Java Validation API (JSR 303). Hibernate Validator is the reference implementation.
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Supported data formats

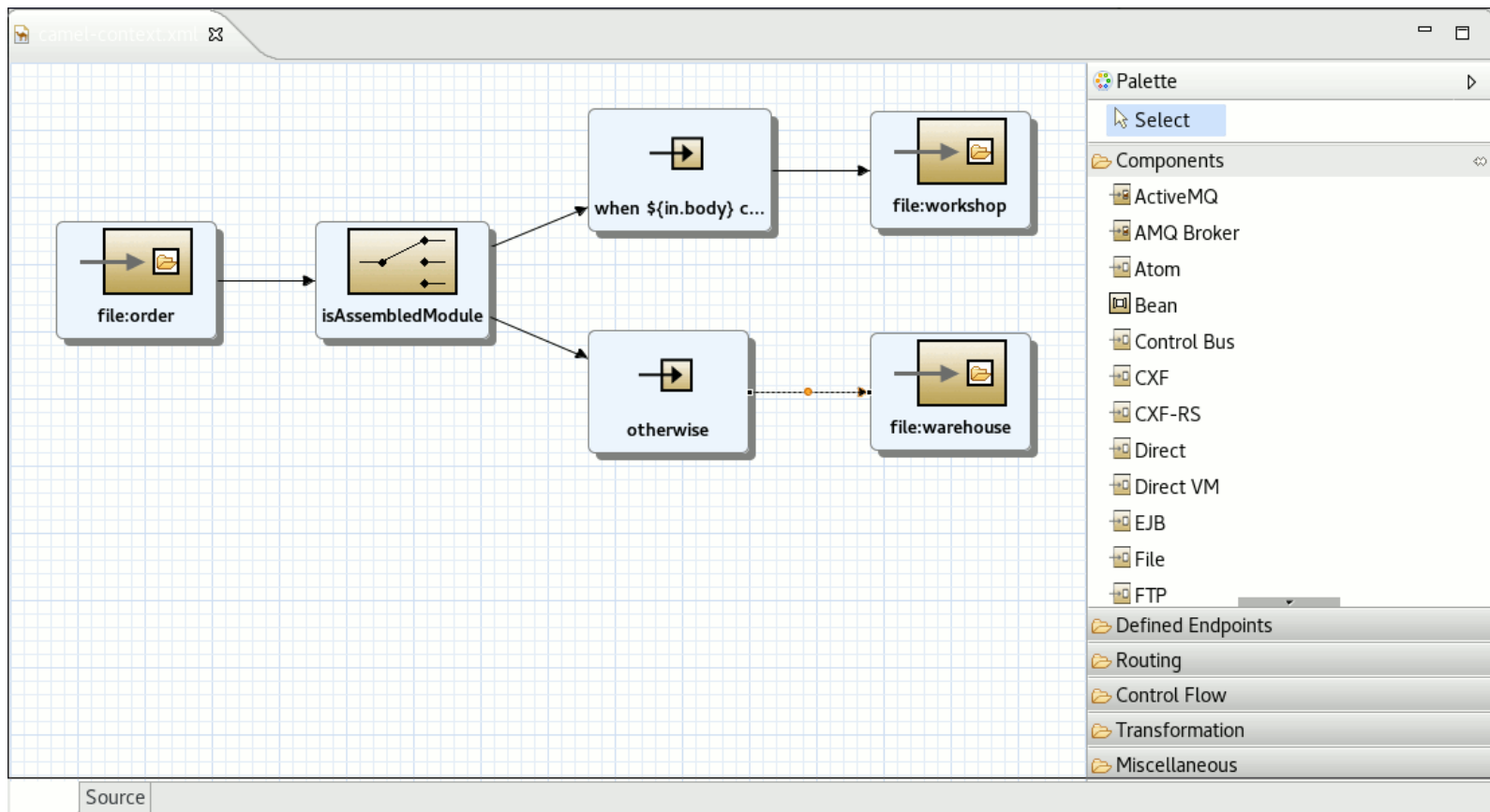
- Current 40 supported formats
 - JVM object marshalling (Serialisation)
 - object marshalling (JSON, Protobuf, ...)
 - object/XML marshalling (JAXB, XmlBeans, ...)
 - object/XML/webservice (SOAP)
 - flat-data marshalling (CSV, EDI, FIX, ...)
 - domain specific marshalling (HL7)
 - compression (Gzip, ZIP, LZF)
 - security (JCE, PGP, XMLSecurity)
 - miscellaneous (Base64, MIME, Barcode, custom data format, ...)
- complete list: <http://camel.apache.org/data-format.html>

Deployment model

- Strategy
 - no dependency to the container
- Options
 - standalone (Java SE application)
 - Spring (Spring Boot)
 - WAR (web container: Tomcat, Jetty, ...)
 - JEE (application server: Glassfish, JBoss AS, Oracle Weblogic, ...)
 - OSGi (Apache Karaf Container, Eclipse Equinox)
 - Cloud (Google App Engine)

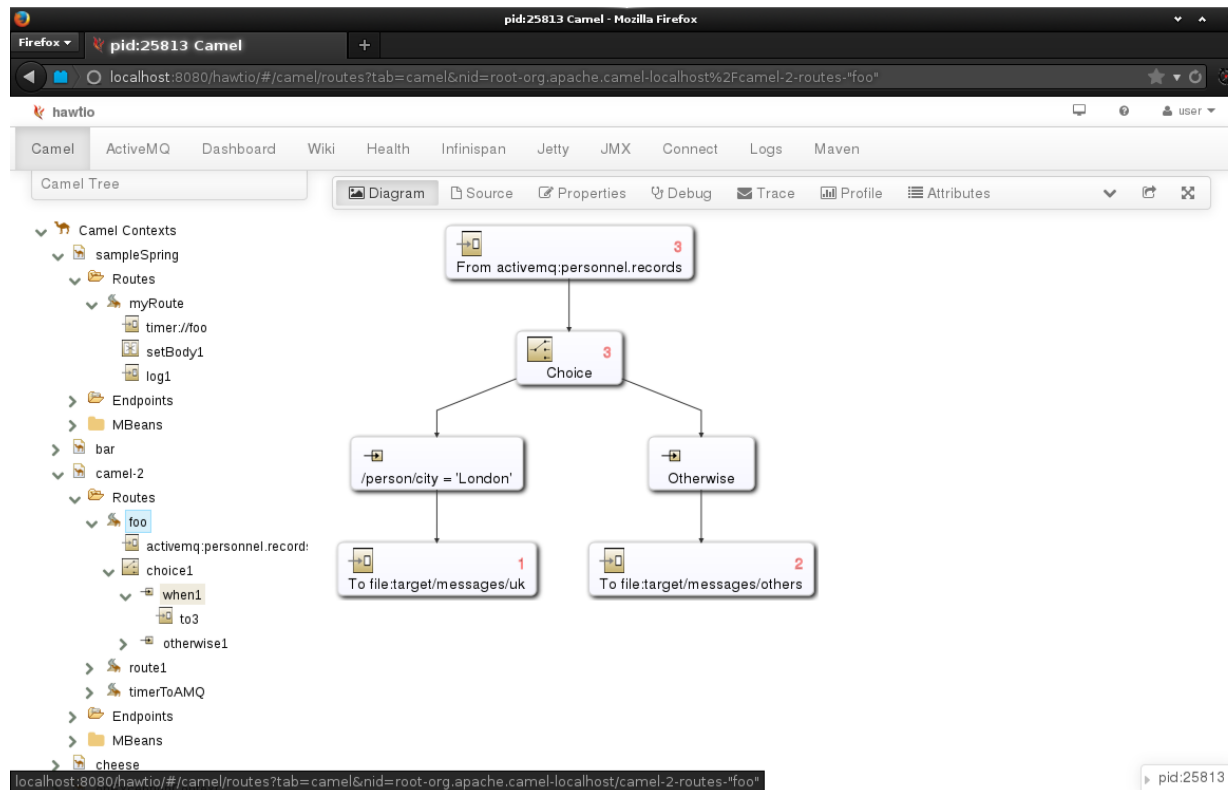
Tools

JBoss Tools for Apache Camel - an open source set of Eclipse plugins for creating Apache Camel projects, editing Camel routes using a graphical editor

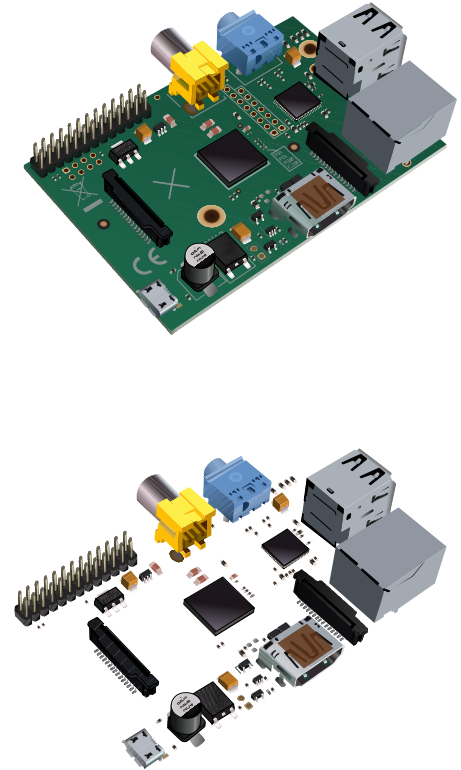
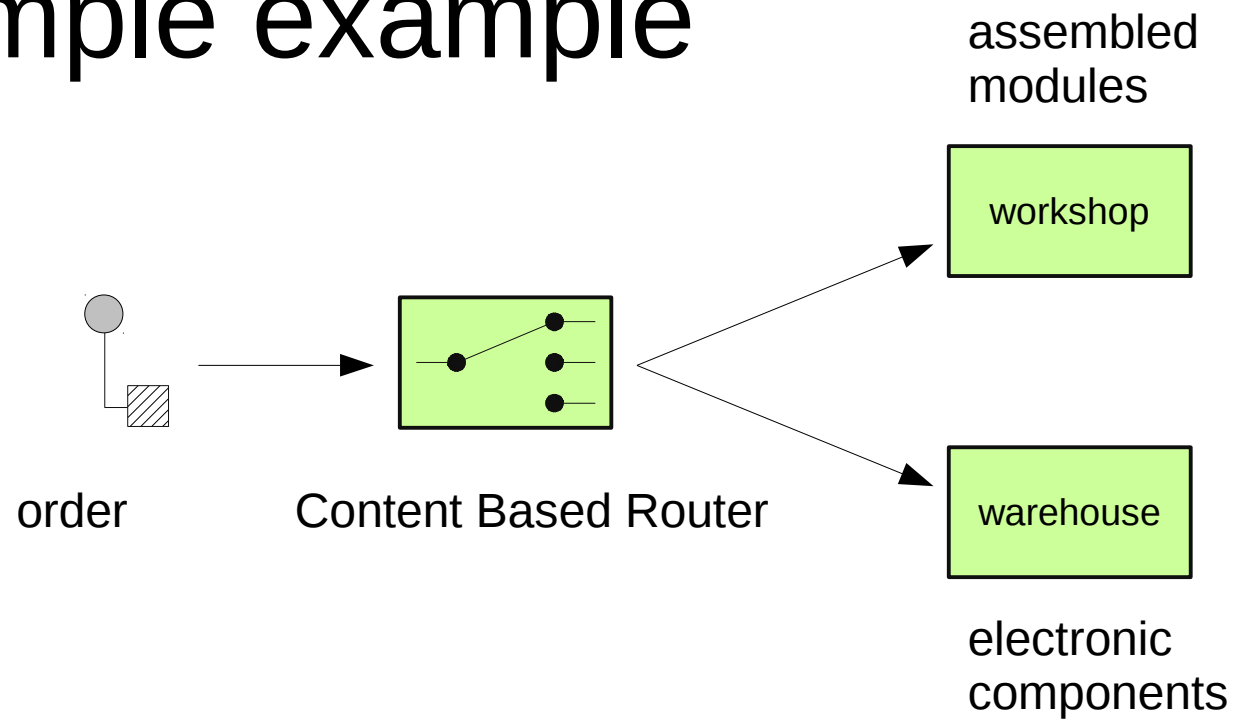


Tools

Hawtio - an open source HTML5 web application for visualizing, starting/stopping and tracing Apache Camel routes, browsing endpoints, sending messages to endpoints as well as browsing and sending to ActiveMQ destinations, viewing logs and metric charting

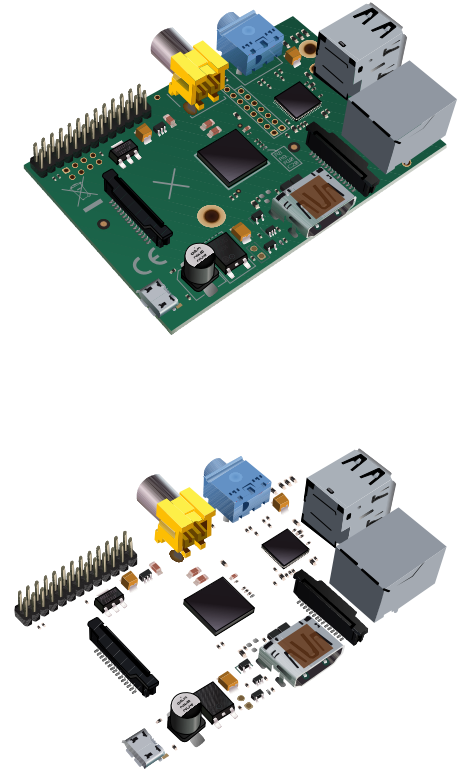
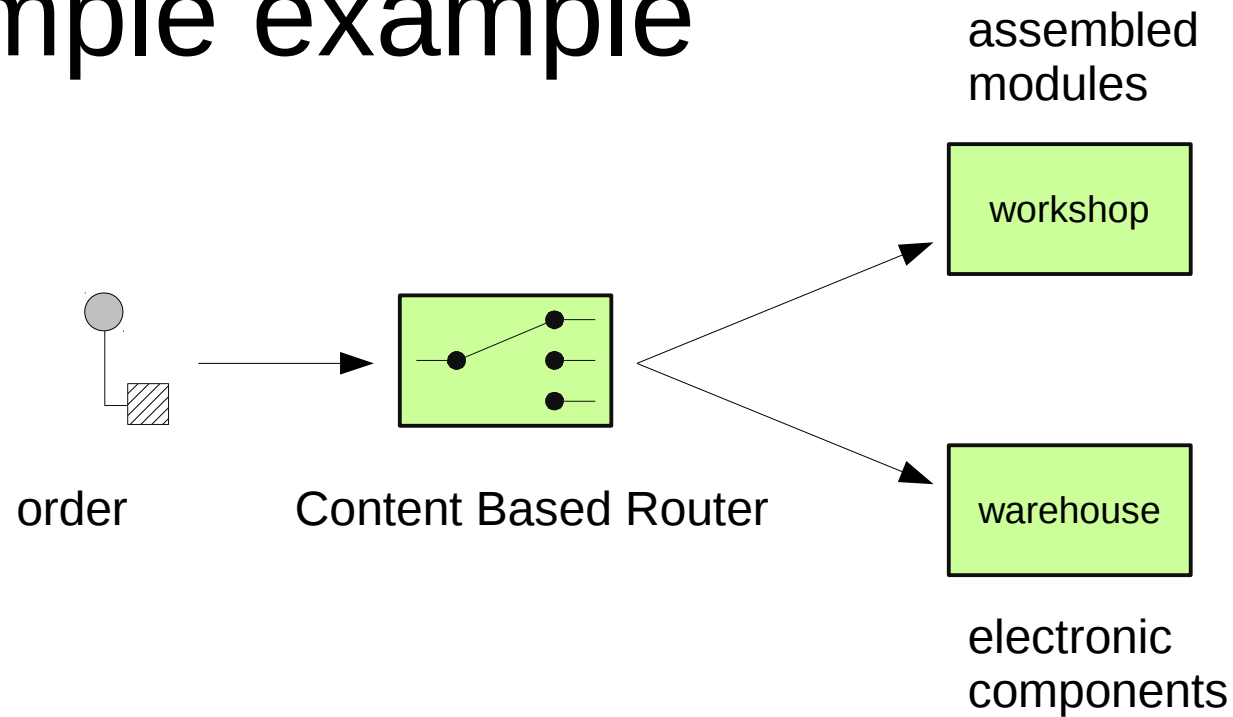


Simple example



in human language
from **order**
choice
when **isAssembledModule** to **workshop**
otherwise to **warehouse**

Simple example



```
# in Java DSL
from(order)
    .choice()
        .when(isAssembledModule).to(workshop)
        .otherwise().to(warehouse)
```

Appendix

- User guides

<http://camel.apache.org/user-guide.html>

<http://karaf.apache.org/documentation.html>

- Enterprise Integration Pattern

<http://www.enterpriseintegrationpatterns.com/patterns/messaging/>

- Wildfly + Camel integration

<https://github.com/wildfly-extras/wildfly-camel>

- Blogs

<http://www.davsclaus.com/search/label/apache%20camel>

<http://blog.christianposta.com/tags/#camel>