Technical Brief

May 2012

SEARCH
The National Consortium for Justice Information and Statistics

Using Open Source Infrastructure to Implement the Global Reference Architecture

By Yogesh Chawla
SEARCH

The Global Reference Architecture (GRA)[1] identifies a small but significant set of infrastructure components that are core to any GRA implementation. These components include:

- **Adapters:** Components that implement the "provider" side of a service interaction, typically by receiving messages and interacting with the internal systems or business processes of a service provider agency.

- **Connectors:** Components that implement the "consumer" side of a service interaction, typically by observing data changes or "triggers" in a consumer agency's internal systems or business processes, and initiating a message transmission to a service provider.

- **Intermediaries:** Special adapters that "mediate" information exchanges between participating organizations, performing such operations as transformations, routing, validation, and message aggregation; intermediaries reside on a broker, which exists in a "common space" between the partner organizations.

The communication between these components must adhere to the GRA Service Interaction Profiles (SIPs), which in practice means that interactions must be via standards-conformant Web Services protocols.

[1] The GRA is an information exchange solution designed to cut 80 percent of implementation time and costs for state and local justice agencies through reuse of established promising practices in information technology architecture and design. For details, see http://it.ojp.gov/default.aspx?area=nationalInitiatives&page=1015

Figure 1 shows how these components relate to one another in the context of a typical justice information exchange.

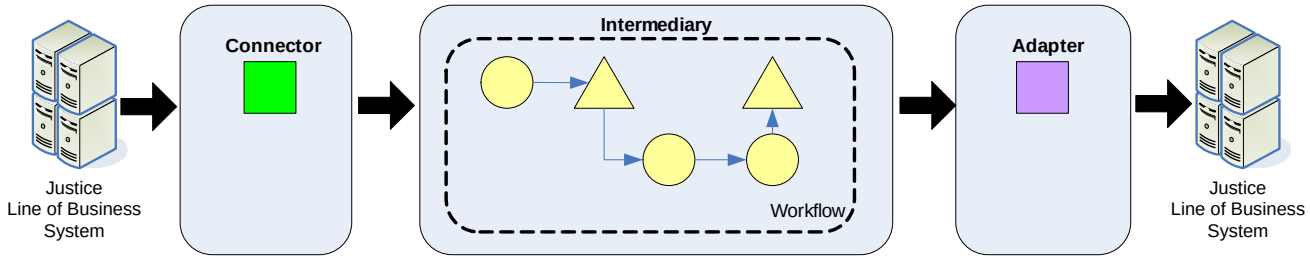

Figure 1: Infrastructure components in a typical justice information exchange

A primary goal of this approach is to avoid point-to-point information exchanges, which tend to be brittle, inflexible, and costly to maintain over time. The separation of integration (information flow) logic from the specifics of interacting with each partner system also tends to produce reusable information exchanges.

A fundamental decision that organizations must make when implementing the GRA is the choice of technology infrastructure to support these three types of components. Until recently, this infrastructure involved a significant up-front financial investment and a limited choice among closed source[2] solutions. Fortunately, the open source software community has produced software components that provide the necessary functionality and support, and enable businesses to choose an option that is not tied to a specific vendor or platform.

While there are many proprietary technologies that can align with the GRA[3] and several open source options, this *Technical Brief* focuses on one open source technology suite that has demonstrated its ability to conform to the GRA: **Apache ServiceMix**.[4]

ServiceMix is an open source enterprise service bus (ESB) that conforms to industry standards such as the Open Services Gateway Initiative (OSGi) and Java Business Integration (JBI). It can serve as a container for all three GRA infrastructure component types (adapters, connectors, and intermediaries). Typically, developers use Apache Camel[5] to implement the components, leveraging Camel's rich library of integration

[2] Products developed in which the customer has no access to the source code are considered "closed source."

[3] These products are often referred to as **enterprise service buses**, **message brokers**, or **middleware solutions**. These solutions can be GRA-conformant if so designed, but may also include proprietary capabilities that perform similar functions to those defined in the GRA, such as Web Services standards.

[4] See http://servicemix.apache.org

[5] Apache Camel is an open source implementation of many popular Enterprise Integration Patterns (EIPs). It can be used in the adapter, connector, and intermediary layers. In the adapter and connector layer, Apache Camel can interact with many different protocols and translate between them. These

capabilities, including protocol transformations, XML data transformations using the eXtensible Stylesheet Transformation (XSLT) language, and XML schema validation. Both ServiceMix and Camel use Apache CXF[6] to provide robust support for the standard Web Services stack required by the GRA.

In the typical integrated justice scenario, a justice agency can deploy a single instance of ServiceMix to host all of its adapters and connectors. On the connector side, the agency would use Camel to interact with internal systems using any one of several mechanisms:

- Camel can support File Transfer Protocol (FTP) to "listen" for an existing FTP batch file transmission.
- Camel can use database support to respond to a database trigger.
- Camel can leverage CXF integration to interact with an internal Web Service.

In the Camel connector, the agency can transform data, filter out sensitive information, encrypt data for transmission, and even split batch transmissions into individual transactions. Ultimately, the Camel connector initiates an information exchange by sending one or more Web Services messages to a broker.

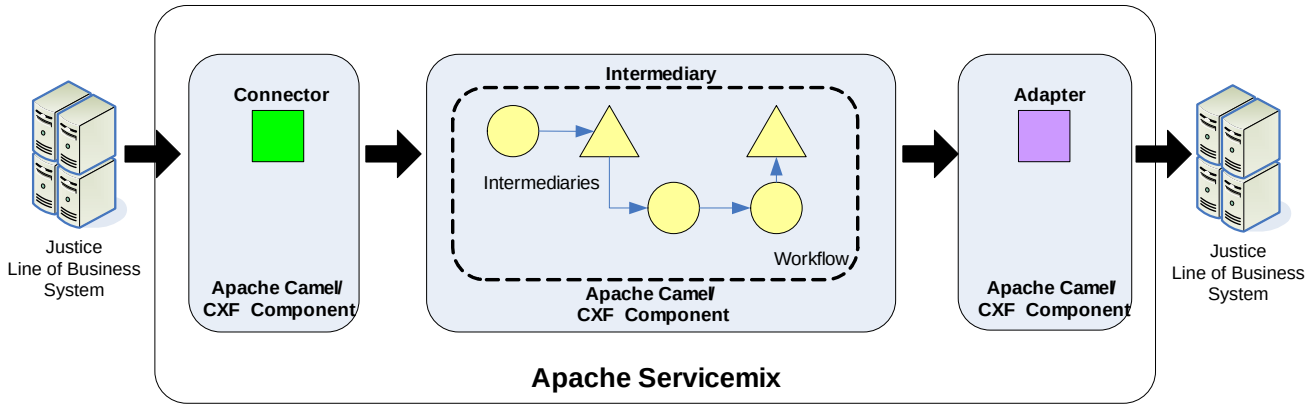

Figure 2: Typical ServiceMix configuration

As shown in figure 2, the partnership of justice agencies provisions a broker in common by hosting a centralized instance of ServiceMix. As in the adapter/connector layer, the broker is a separate instance of ServiceMix that also leverages Camel. The typical intermediary is a Camel component (or set of components, linked together) that implements a business process or flow *between partners* rather than interacting directly with either line-of-business system. For example, an intermediary may transform a complex input message into a simpler form required by a particular partner. Or,an intermediary may receive a query request, disseminate the request to several partners, and

---

protocols include: FTP, Web Services, JMS/Message Queues, File System, HTTP, and LDAP. For more information about Apache Camel, see http://camel.apache.org/components.html

[6] See http://cxf.apache.org

aggregate the results. Camel includes dozens of components that support virtually any integration scenario.[7]

Finally, in this scenario, a message emerges from the broker destined from another partner, which uses an adapter to manage the interaction between the broker and the destination line-of-business system. The adapter is yet another instance of ServiceMix and leverages any of Camel's components and capabilities. In this configuration, the adapter receives the Web Service message from the broker and initiates interaction with the partner agency's business processes or internal systems. For example, the adapter may use a Camel component to trigger an internal business process at the partner agency (e.g., initiating a charging recommendation with a prosecutor) or to request information owned by that agency (e.g., searching for person information as part of a federated query).

This *Technical Brief* discusses one approach to developing a GRA-conformant information sharing infrastructure using open source components. The combination Apache ServiceMix, CXF, and Camel provide all of the capabilities needed to implement a GRA-conformant infrastructure. They can be used to build all required components (adapters, connectors, and intermediaries) and manage all interactions between systems. These open source products require no licensing costs, and provide a viable and cost-effective strategy for implementing the GRA.

This project was supported by Grant No. 2009-D1-BX-K007 awarded by the Bureau of Justice Assistance. The Bureau of Justice Assistance is a component of the Office of Justice Programs, which also includes the Bureau of Justice Statistics, the National Institute of Justice, the Office of Juvenile Justice and Delinquency Prevention, the SMART Office, and the Office for Victims of Crime. Points of view or opinions in this document are those of the author and do not represent the official position or policies of the United States Department of Justice.

Captain Thomas W. Turner
Chairman

Ronald P. Hawley
Executive Director

Scott M. Came
Deputy Executive Director

SEARCH
7311 Greenhaven Drive, Suite 270 • Sacramento, CA 95831
(916) 392-2550 • (916) 392-8440 (fax) • www.search.org

[7] Apache Camel (http://camel.apache.org/enterprise-integration-patterns.html) is an implementation of EIPs, as described by Gregor Hohpe and Bobby Wolfe in their book *Enterprise Integration Patterns* (www.enterpriseintegrationpatterns.com).