Introducing Interoperability Productions

Version 2024.1
2024-07-02

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Introducing Interoperability Productions
InterSystems IRIS Data Platform Version 2024.1 2024-07-02
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1

InterSystems IRIS Basics: Connecting Systems Using Interoperability Productions

This article explains how you can connect systems together with InterSystems IRIS® data platform *interoperability productions*.

For an online hands-on activity that lets you create a simple production that organizes files on a local file system and use file adapters to read and write the files, see Creating a Basic Production in InterSystems IRIS.

1.1 Why Connect Systems?

Connecting systems involves allowing messages from one system to be processed by another system. For example, the following scenarios require connecting systems:

- To improve efficiency, systems originally designed to perform a single function need to be integrated. For example, you can gain efficiency by integrating individual systems that track inventory, order materials, record sales, and control shipping.
- After a merger, systems that perform the same function in the separate organizations need to work together for the unified organization to be effective.

When connecting systems together, you may be faced with challenges such as:

- Systems use different communication protocols: one system may use TCP, another uses SOAP, and a third uses REST.
- Systems use different messages with different formats or based on different standards.
- You may be required to guarantee that messages are delivered successfully to the right system and be able to detect and correct failures.
- You have to monitor the system transferring the messages, provide a queue for messages if too many come at one time, and monitor overall system performance to ensure that there aren't any roadblocks.

While it is possible to code a custom application to connect systems, it is much easier and faster to develop an InterSystems IRIS production. InterSystems IRIS provides a framework that allows you to connect systems and either minimizes or eliminates the need for custom code.

1.2 Introducing Productions

An InterSystems IRIS production is an integration framework for easily connecting systems and for developing applications for interoperability. A production provides built-in connections to a wide variety of message formats and communications protocols. You can easily add other formats and protocols – and define business logic and message transformations either by coding or using graphic wizards. Productions provide persistent storage of messages, which allow you to trace the path of a message and audit whether a message is successfully delivered. A production consists of business services, processes, and operations:

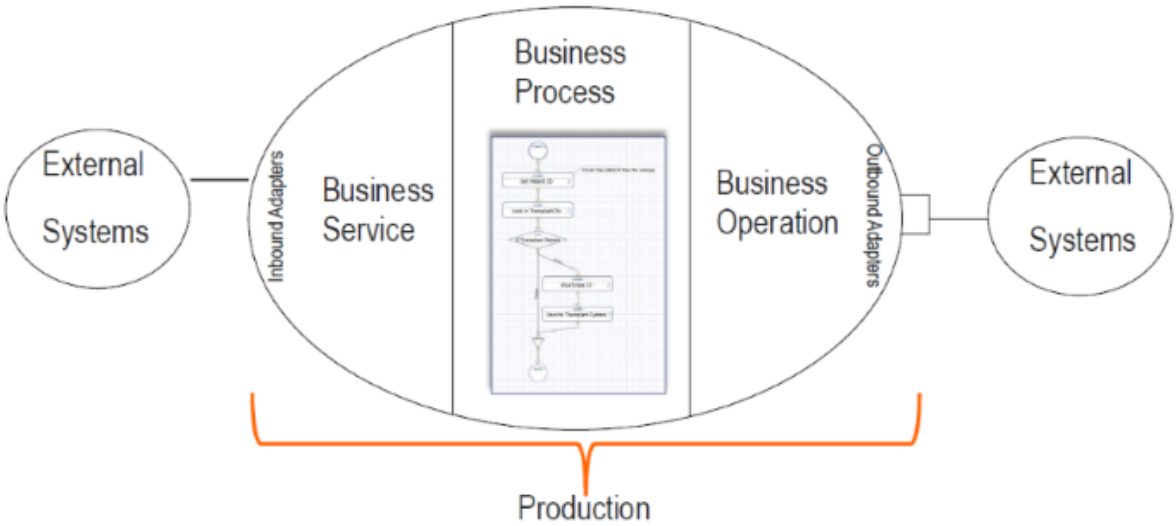
- Business services connect with external systems and receive messages from them.
- Business processes allow you to define business logic, including routing and message transformation.
- Business operations connect with external systems and send the messages to them.

When connecting systems together, it can be challenging to get them to understand the other system's messages and documents. For example, consider the following problem:

- You have two separate systems: one is collecting data from multiple networked devices and the other is a work order system that tracks broken devices and the repair process.
- The current process depends on human intervention to monitor the devices and initiate the repair process. This has caused delays and is unreliable.
- You have been given the task to connect the two systems together: to monitor the data being collected and to automate initiating the repair process. You know how to detect faulty devices in the data collection system and know how to initiate a repair, but the two systems store data in incompatible formats even when the data represents the same item.
- You also need to record the actions when a repair is initiated from the data collection system.

You can solve this problem using an InterSystems IRIS production. It provides the framework for defining an interface that accepts messages from the data collection system, transforming the message into one that can be understood by the repair system, and then sending it to the repair system. It also stores a record of the message path.

The following illustrates a simple production:



1.3 Learn More About Interoperability Productions

For more information about productions, see:

- Creating a Basic Production in InterSystems IRIS (online activity)
- Formal Overview of Productions
- Developing Productions
- Configuring Productions
- Developing Business Rules

2

Introduction to Interoperability Productions

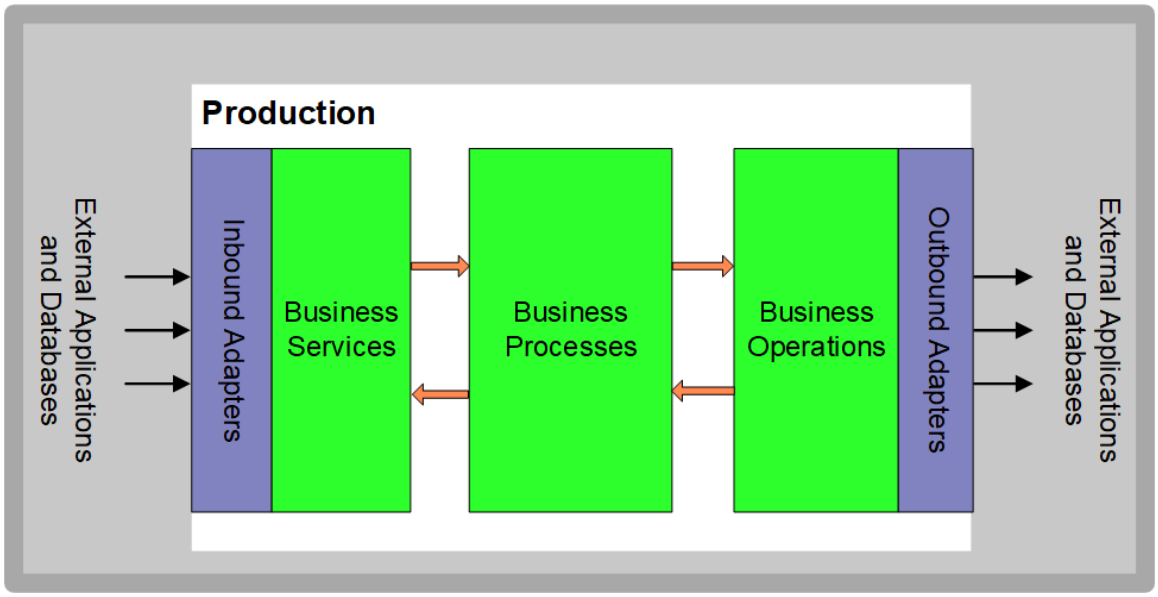
The purpose of interoperability productions is to enable you to connect systems so that you can transform and route messages between them. To connect systems, you develop, configure, deploy, and manage productions, which integrate multiple software systems. This topic introduces productions and some of the basic terminology.

2.1 Production Basics

An interoperability production is an integration framework for easily connecting systems and for developing applications for interoperability. A production provides built-in connections to a wide variety of message formats and communications protocols. You can easily add other formats and protocols – and define business logic and message transformations either by coding or using graphic interfaces. Productions provide persistent storage of messages, which allow you to trace the path of a message and audit whether a message is successfully delivered. The elements in a production are known as *business hosts*. There are three kinds of business hosts, with different purposes as follows:

- Business services connect with external systems and receive messages from them. Business services relay the messages to other business hosts in the production.
- Business processes allow you to define business logic, including routing and message transformation. Business processes receive messages from other business hosts in the production and either process the requests or forward them to other business hosts.
- Business operations connect with external systems and send the messages to them. Business operations receive messages from other business hosts in the production and typically send them to external systems.

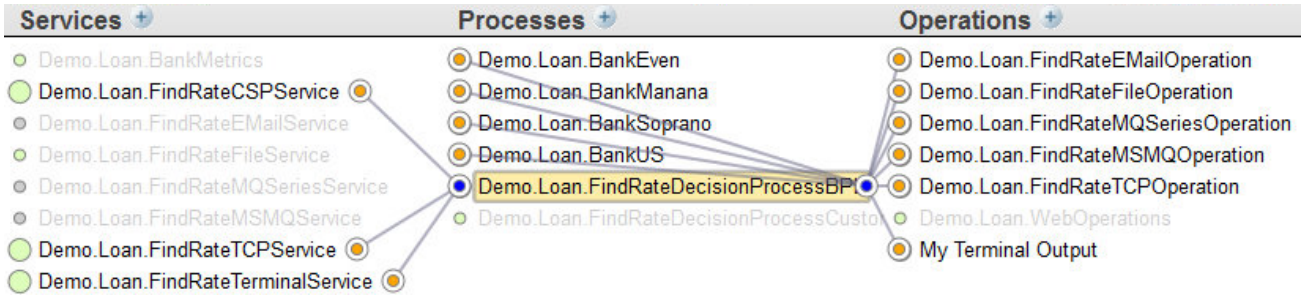
The following figure provides a conceptual overview of a production and business hosts.



Business hosts communicate with each other via messages. All messages are stored in the InterSystems IRIS® database and can be seen via the Management Portal.

In most cases (but not all), a business service has an associated *inbound adapter*. The role of an inbound adapter is to accept input from entities external to the production. Similarly, a business operation usually has an associated *outbound adapter*. The role of an outbound adapter is to send output to entities external to the production. InterSystems IRIS provides a large set of adapters to handle different technologies. For example, you use a different adapter for files than you do for FTP. It is also possible to define your own adapters.

The following figure shows an actual production, as seen in the Management Portal:



This view shows all the connections to and from one business host, **Demo.Loan.FindRateDecisionProcessBPL**. Note that this view does not display adapters because these are incorporated into the business service and business operation definitions.

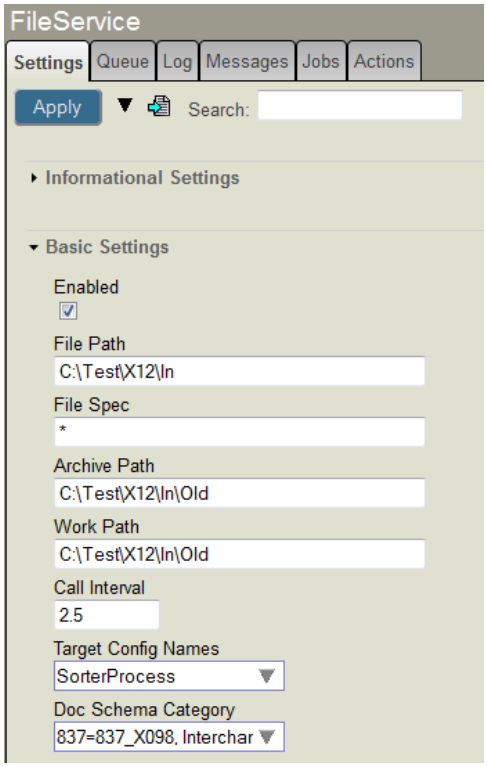
2.2 Settings

A production typically includes a large number of settings. *Settings* are configurable values that control the behavior of a production. Settings can affect a production in many ways. For example, a setting can specify:

- The TCP port on which a business service should listen.
- How frequently to check for new input.
- The external data source name (DSN) to use.
- The TLS configuration to use when connecting to an external entity.

- How long to stay connected.
- And so on.

An important feature of InterSystems IRIS is that a system administrator can modify settings while a production is running. The changes take effect immediately. The following shows an example of the web page that the system administrator uses to make such changes:



The production and its business hosts have settings provided by InterSystems IRIS; they correspond to properties of the production and business host classes. You can define additional settings in exactly the same way, by defining your own subclasses of InterSystems IRIS classes. You can also remove settings so that the corresponding properties are hardcoded and not configurable.

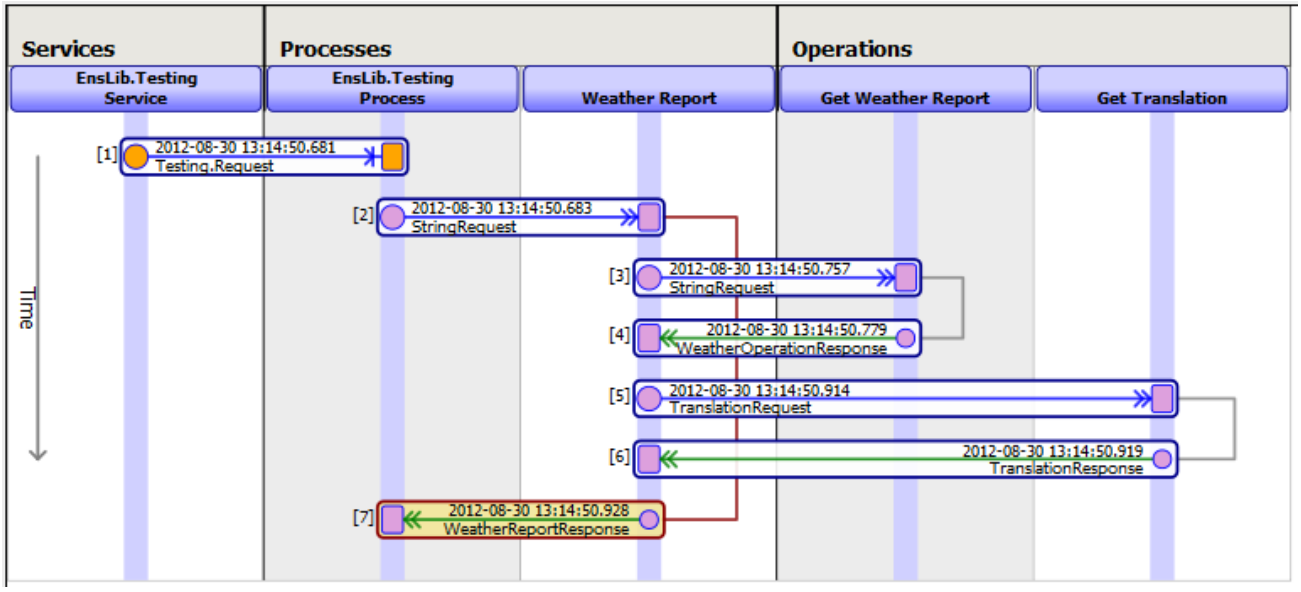
2.3 Message Flow in a Production

An interoperability production typically processes incoming events as follows:

1. An inbound adapter receives an incoming event, transforms it into a message object, and passes it to its associated business service.
2. The business service creates a follow-on request message, and passes this new message to a business process or business operation within the production.
3. A business process that receives a request message executes a predefined set of activities, in sequence or in parallel. These activities may include sending follow-on messages to other business hosts. Business processes are also responsible for most or all of the business logic in the production.
4. A business operation encapsulates the capabilities of a resource outside InterSystems IRIS, usually an external software application. The business operation transforms properties of the request message object into a format usable by the external application API.

5. An outbound adapter manages the details of communicating with a specific external system or application from within the production. It transmits the API call to the external entity.
6. The response from the external system or application can trigger a cascade of response messages back to the external entity that started the flow of events. Details depend on the design choices made by the production developers.

As a demonstration, the following figure shows a trace of a set of related messages, which a production sent in response to an initial message (in this case sent by the testing service in the Management Portal rather than by an exterior source):



The processing can also include workflow, which makes it possible to incorporate human interaction into automated business processes. Uses of workflow within the enterprise might include order entry, order fulfillment, contract approval, or help desk activities. Other Production Options provides more information.

3

Connectivity Options for Productions

InterSystems IRIS® enables you to define inbound and outbound connections to a wide variety of technologies. There are three general categories of options: adapters, specialized business host classes, and gateways.

If the built-in tools do not meet your needs, you can create your own components. Also see the InterSystems Technology Reference.

3.1 Adapter Library

InterSystems IRIS provides many adapters, and you can define your own. InterSystems IRIS provides adapters for the following scenarios:

Amazon CloudWatch

Monitor an application by collecting data for a metric defined in Amazon CloudWatch. See Using the Amazon CloudWatch Adapter.

Amazon SNS

Send Amazon SNS messages.

See Using External Messaging Platforms from Within Productions.

Cloud storage

Read and write data from a cloud storage provider such as Amazon Web Services (AWS), Azure Blob Storage (Azure) or Google Cloud Platform (GCP). When using an InterSystems product to access cloud storage, you have two options: use an interoperability production or call low-level APIs.

See Accessing Cloud Storage.

Email

Receive email messages via the POP3 protocol and send email messages via the Simple Mail Transfer Protocol (SMTP).

See Using Email Adapters in Productions.

File

Read and write files on the local network. Open, create, delete, modify, and move files. The file content can be character or binary data.

See Using File Adapters in Productions.

Also see Business Host Classes That Use File Adapters.

FTP

Receive and send files between local and remote systems via the File Transfer Protocol (FTP). The file content can be characters or binary data. The adapters support FTP over TLS and SFTP.

See Using FTP Adapters in Productions.

Also see Business Host Classes That Use FTP Adapters.

Healthcare data

InterSystems IRIS for Health™ and HealthShare® Health Connect provide adapters for numerous healthcare data formats, listed elsewhere. InterSystems IRIS® data platform does not include these features.

HTTP

Perform custom HTTP port listening, XML listening, or raw HTML handling. Supports the standard HTTP operations Post, Get, Put, and Delete. The adapters support proxy servers.

See Using HTTP Adapters in Productions.

Also see Business Host Classes That Use HTTP Adapters.

JMS (Java Message Service)

Send and receive JMS messages.

See Using External Messaging Platforms from Within Productions.

Kafka

Send and receive Kafka messages.

See Using External Messaging Platforms from Within Productions.

LDAP

Send requests to an LDAP server and receive responses.

See the EnsLib.LDAP.OutboundAdapter entry in the Class Reference.

Managed File Transfer (MFT)

Send and receive files from Box, DropBox, and Kiteworks managed file services.

MQSeries

Send and receive messages in IBM WebSphere MQ (MQ Series) format. Message content can be a specific data type or a binary data stream. The adapter can simply send the message, or send it and then pull the corresponding response from the message queue.

See Using IBM WebSphere MQ Adapters in Productions.

MQTT

Receive and send Message Queuing Telemetry Transport (MQTT) messages. See Using MQTT Adapters in Productions.

Pipe

Execute a shell command and communicate with it via pipes. The adapters can handle character data or a binary data stream.

See the EnsLib.Pipe.InboundAdapter and EnsLib.Pipe.OutboundAdapter entries in the Class Reference.

RabbitMQ

Send and receive RabbitMQ messages.

See Using External Messaging Platforms from Within Productions.

SAP

Interface with the SAP Java Connector (SAP JCo).

See Using the SAP Java Connector in Productions for details.

Siebel

Send requests to a Siebel server and receive responses.

See the EnsLib.Siebel.HTTPOutboundAdapter entry in the Class Reference.

SOAP

Listen for SOAP requests on a local TCP port or via a standard web server. Dispatches outbound requests by acting as a SOAP client to an external SOAP server. In this special case, adapters are not necessarily involved.

See Creating Web Services and Web Clients in Productions.

SQL

Execute SQL statements against a remote database via an ODBC-defined or JDBC-defined connection.

See Using SQL Adapters in Productions.

TCP

Manage an incoming or outgoing TCP connection. The adapters allows simultaneous handling of multiple connections. They also supports character and binary data streams, counted data blocks, and framed protocols.

See Using TCP Adapters in Productions.

Also see Business Host Classes That Use TCP Adapters.

Telnet

Initiate and manage a Telnet connection.

See the EnsLib.Telnet.OutboundAdapter entry in the Class Reference.

To use an adapter, you define a business host class that uses the adapter class. For a general description of this process, see Developing Productions. The topics in the previous list provide details that apply to the specific adapters.

As noted previously, you can also define your own adapters. For information, see Developing Productions.

3.2 Specialized Business Host Classes

For specific scenarios, InterSystems IRIS® provides specialized business service classes and business operation classes so that (usually) no coding is needed:

- Files
- FTP
- HTTP and SOAP
- TCP
- REST

For practical reasons, the following sections might not cover all the specialized business host classes that InterSystems IRIS provides. To find all the specialized business host classes that specify an adapter, perform a search in an IDE, and look for `Parameter ADAPTER` within the EnsLib package.

Also, InterSystems IRIS for Health™ and HealthShare® Health Connect provide specialized business hosts for numerous healthcare data formats, listed elsewhere. InterSystems IRIS® data platform does not include these features.

3.2.1 Business Host Classes That Use File Adapters

InterSystems IRIS provides business host classes that use the file adapters. The following table summarizes the supported content types and indicates where to find information.

File Contents	See
EDIFACT documents	Routing EDIFACT Documents in Productions
X12 documents	Routing X12 Documents in Productions
XML documents	Routing XML Virtual Documents in Productions
Fixed-column or delimited text	Using the Record Mapper and Using the Complex Record Mapper
Any	Using the File Passthrough Service and Operation Classes

3.2.2 Business Host Classes That Use FTP Adapters

InterSystems IRIS provides business host classes that use the FTP adapters. The following table summarizes the supported content types and indicates where to find information.

File Contents	See
EDIFACT documents	Routing EDIFACT Documents in Productions'
X12 documents	Routing X12 Documents in Productions'
XML documents	Routing XML Virtual Documents in Productions'
Fixed-column or delimited text	Using the Record Mapper and Using the Complex Record Mapper
Any	EnsLib.FTP.PassthroughService and EnsLib.FTP.PassthroughOperation in the Class Reference

3.2.3 Business Host Classes That Use HTTP and SOAP Adapters

InterSystems IRIS provides business host classes that use the HTTP adapters. The following table summarizes the supported content types and indicates where to find information.

File Contents	See
EDIFACT documents	Routing EDIFACT Documents in Productions'
Any	Pass-through Service and Operation Walkthrough

3.2.4 Business Host Classes That Use TCP Adapters

InterSystems IRIS provides business host classes that use TCP adapters. The following table summarizes the supported content types and indicates where to find information.

File Contents	See
X12 documents	Routing X12 Documents in Productions'
Any	EnsLib.TCP.PassthroughService and EnsLib.TCP.PassthroughOperation in the Class Reference

3.2.5 Business Host Classes That Support REST

InterSystems IRIS provides business host classes that support REST. See Using REST Services and Operations in Productions.

3.3 Gateways and External Servers

InterSystems IRIS provides the following gateways and external servers:

- The SQL Gateway, which provides access from InterSystems IRIS to external databases via JDBC and ODBC. You can, for example, link to tables and views in external sources and access the data in them in the same way you access any local data. See Using the InterSystems SQL Gateway.
- An InterSystems External Server allows you to instantiate and manipulate objects written in an external language as if they were native objects within InterSystems IRIS. See Using InterSystems External Servers. In most cases, using the PEX framework to interact with an external language from a production is preferred over using the `$system.external` interface provided by the external server.

4

Business Processes and Business Logic

This topic describes the kinds of logic supported in business processes in interoperability productions.

4.1 Introduction

Business processes are the middle part of any production. They accept requests from host classes inside the production —business services or business processes—and then either process the requests or relay them to other host classes inside the production for processing.

InterSystems recommends the following division of labor within a production: Use business services to receive input from outside of the production and simply forward it (as messages) into the production. Use business processes to handle any needed business logic. Use business operations to receive messages from within the production and simply generate output for destinations outside of the production. That is, centralize the business logic within the business processes.

Accordingly, InterSystems IRIS® provides extensive support for complex logic within business processes, and this logic can be defined by nontechnical users.

First, a business process can contain its own complex logic. It can also use the following reusable items:

- *Data transformations* calculate and apply changes to message contents.
- *Business rules* change the behavior of business processes at decision points or send messages to specific destinations based on message type, message contents, or where the message came from.

InterSystems IRIS provides tools that enable nontechnical users to define business processes, data transformations, and business rules. These users can view and edit the logic visually without programming or diagramming skills.

Note that there is overlap among the lower-level options available in business processes, data transformations, and business rules. For a comparison, see Comparison of Business Logic Tools. It is worthwhile to review these options before deciding how to organize your logic.

4.2 Types of Business Processes

InterSystems IRIS provides the following general types of business process:

- *BPL processes*, which are based on the class Ens.BusinessProcessBPL. To create these processes, you use a graphical editor that is intended for use by nontechnical users. See Developing BPL Processes.

The name of these processes comes from BPL (Business Process Language), which is the XML-based language that InterSystems IRIS uses to represent their definitions.

- *Routing processes*, which are based on the class EnsLib.MsgRouter.RoutingEngine or EnsLib.MsgRouter.VDocRoutingEngine.

  InterSystems IRIS provides a set of classes to route specific kinds of messages. The following links indicate the routing process to use for different kinds of messages:

Message Type	See
EDIFACT	Routing EDIFACT Documents in Productions'
X12	Routing X12 Documents in Productions'
XML	Routing XML Virtual Documents in Productions'

  To use these classes, no coding is generally necessary. It is, however, necessary, to provide a set of business rules.

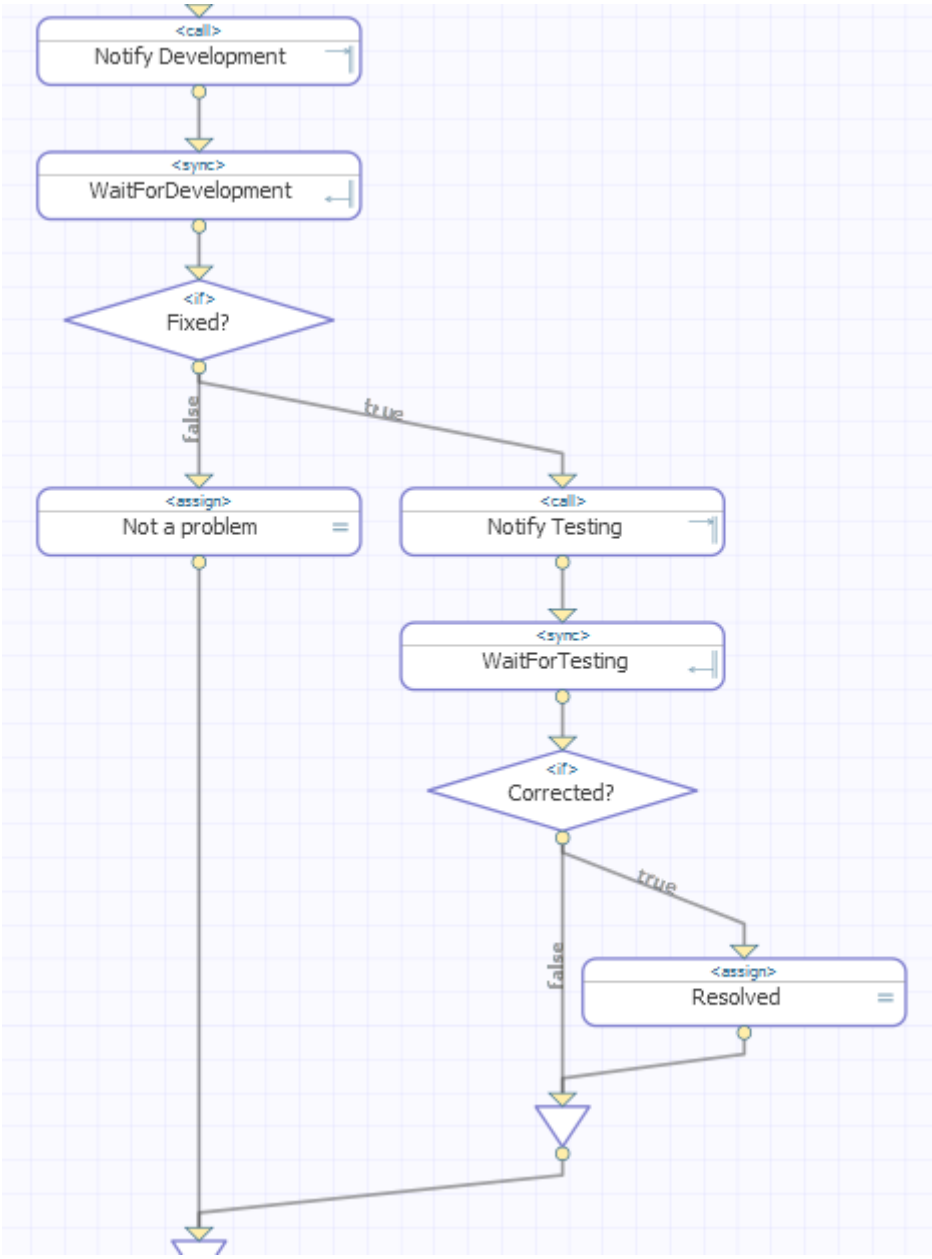
- *Custom business processes*, which are based on the class Ens.BusinessProcess. Note that all the previously listed business process classes inherit from this class. In this case, it is necessary to use a supported IDE to develop custom code.

  The EnsLib and Demo packages provide many examples.

  For information on defining custom business processes, see Developing Business Processes.

A production can include any mix of these business processes.

The following shows a partial example of a BPL business process, as displayed in the BPL editor:



4.3 Data Transformations

A *data transformation* creates a new message that is a transformation of another message. You can invoke a data transformation from a business process, another data transformation, or a business rule.

When you *transform* a message, your data transformation swaps out the old message body object (the source) and exchanges it for a new one (the target). Some of the transformations that occur during this process can include:

- Copying values from properties on the source to properties on the target.
- Performing calculations using the values of properties on the source.
- Copying the results of calculations to properties on the target.
- Assigning literal values to properties on the target.

- Ignoring any properties on the source that are not relevant to the target.

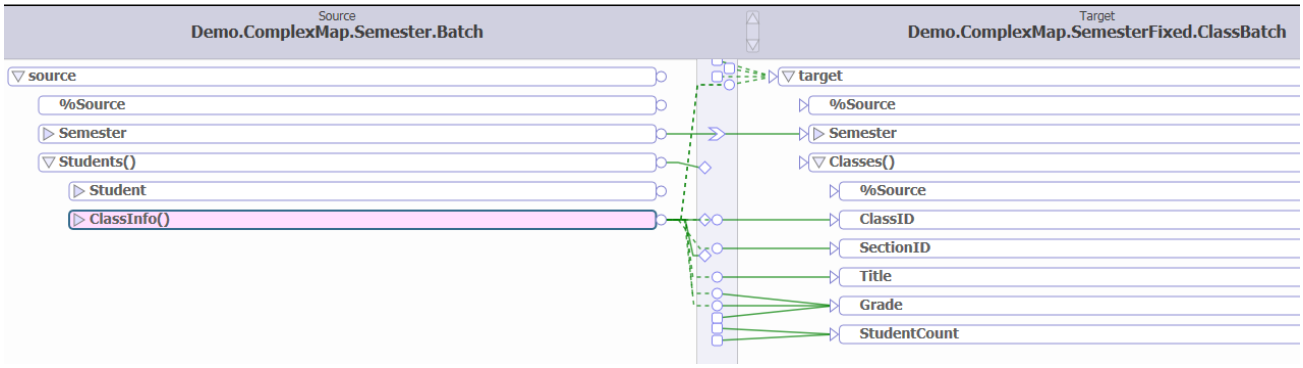
A data transformation is a class based on Ens.DataTransform or its subclass, Ens.DataTransformDTL.

- If you use Ens.DataTransformDTL, the transformation is called a *DTL transformation*. To create these transformations, you use a graphical editor that is intended for use by nontechnical users. For details, see Developing DTL Transformations.

  The name of these transformations comes from DTL (Data Transformation Language), which is the XML-based language that InterSystems IRIS uses to represent their definitions.

- If you use Ens.DataTransform, the transformation is a *custom transformation*. In this case, you must use a supported IDE. For information on defining these, see Developing Productions.

The following shows an example DTL transformation, as seen in the DTL editor:



4.4 Business Rules

A *business rule* (also known as a *business rule set*) can return a value, transform data, or both. You can invoke a business rule from a business process or from another business rule.

A business rule is a class based on Ens.Rule.Definition. You define these in the Management Portal, which provides a visual editor for the benefit of nontechnical users. The following shows a partial example, as seen in this editor:

For details, see Developing Business Rules.

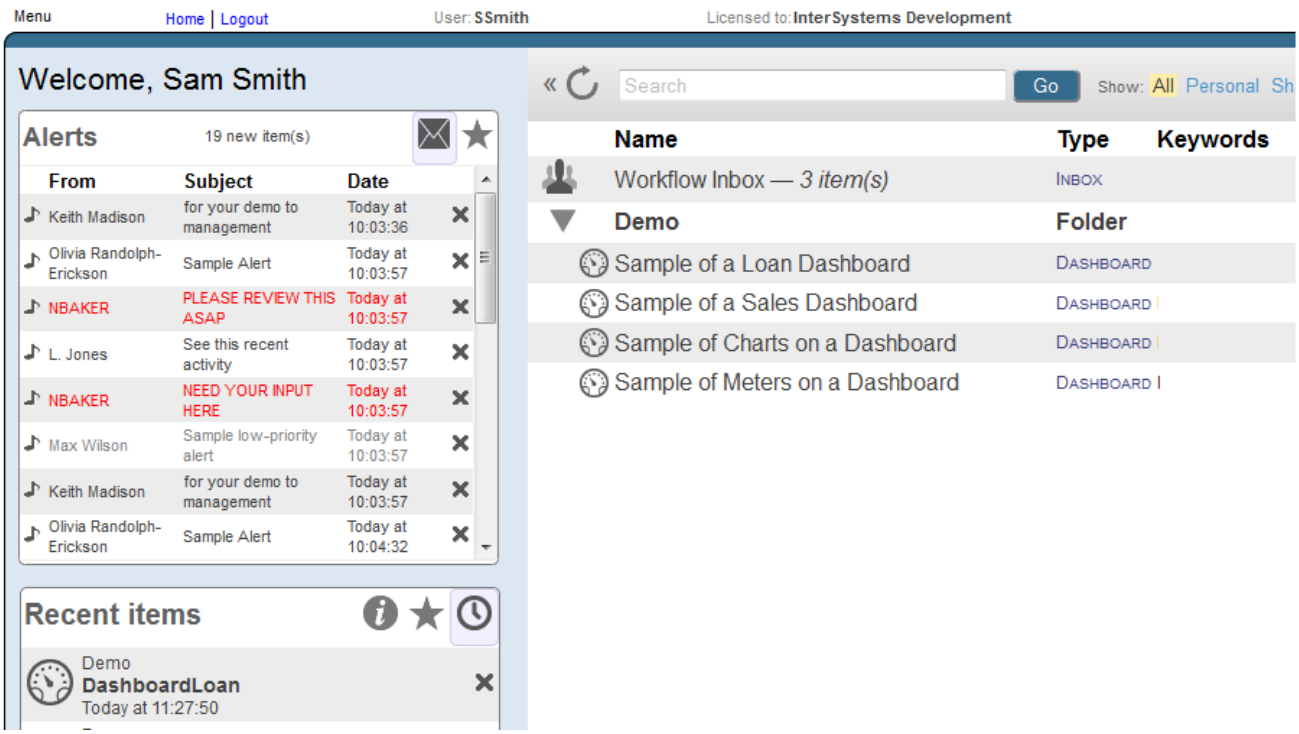
5

Other Production Options

This topic provides an overview of other options related to interoperability productions.

5.1 User Portal

The *User Portal* (formally called the *InterSystems User Portal*) is intended for direct use by end users, in contrast to such back end tools as IDEs and the Management Portal. The following shows an example:



The User Portal is designed to enable end users to do the following tasks:

- View and dashboards, which can include production business metrics
- View and manage workflow tasks.
- Send messages to other users of the User Portal, as seen in the upper left corner of the previous figure.

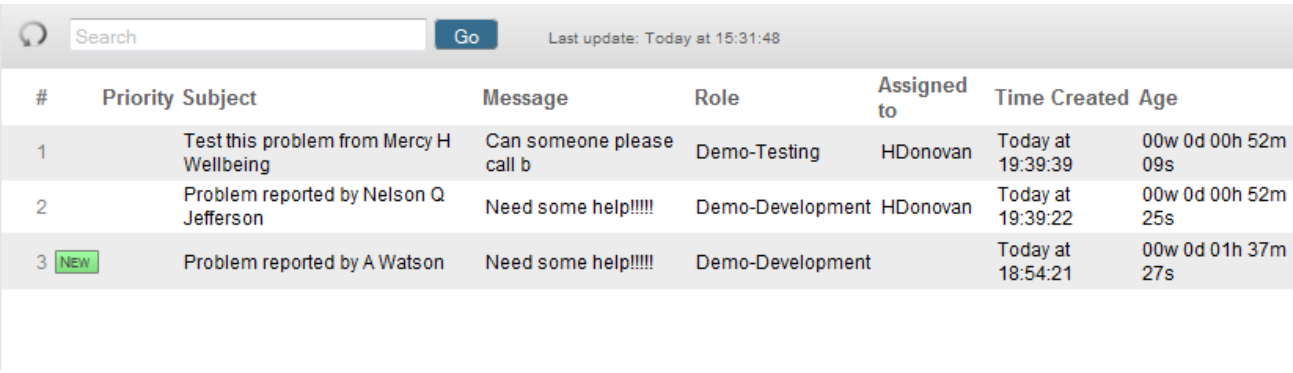
For details, see Using Dashboards and the User Portal.

5.2 Workflow

InterSystems IRIS® supports workflow within productions. *Workflow* makes it possible to incorporate human interaction into automated business processes. Uses of workflow within the enterprise might include order entry, order fulfillment, contract approval, or help desk activities.

A production achieves workflow using a business process and set of business operations. A business process receives a request, organizes the tasks required to fulfill that request, and then calls upon business operations to perform these tasks.

Each of these business operations assigns the task to a workflow role, which places the task into the workflow inbox of each user who belongs to that role. To access this inbox, users work with the User Portal.



When a user marks as a task as complete, the workflow engine continues with the next processing step.

For details, see Defining Workflows.

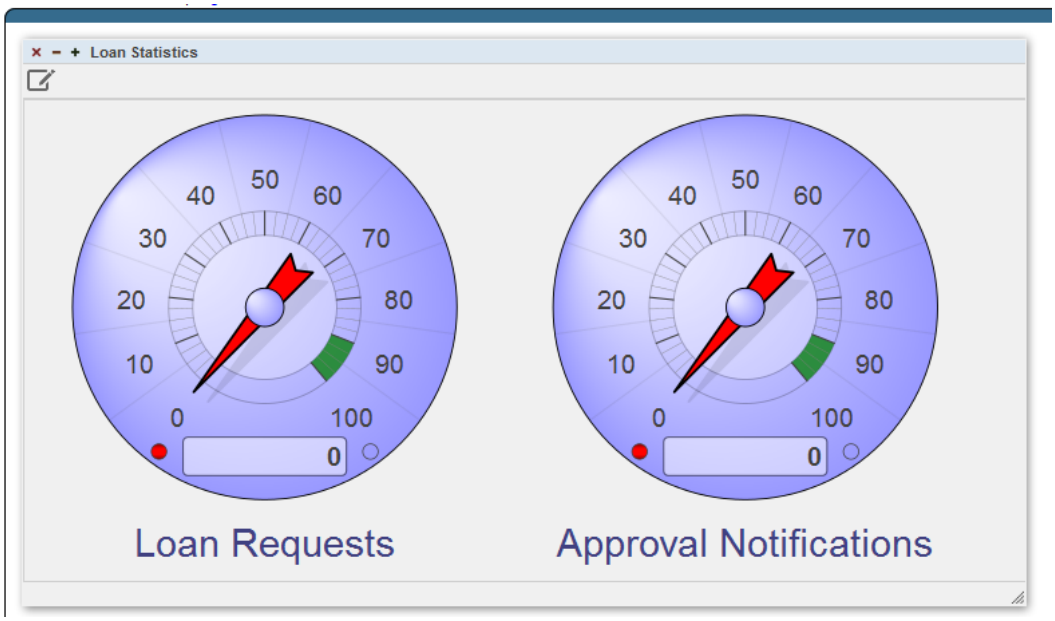
5.3 Business Activity Monitoring

InterSystems IRIS includes all the elements required to include *business activity monitoring* (*BAM*) as part of an enterprise integration project.

First, it provides *business metrics*, which are specialized business service classes that calculate specific values at a configurable time interval. These calculations can take a variety of forms, involving calls to business operations, federated databases, the InterSystems IRIS database, or any arbitrary source code contained within the business metric class. See Defining Business Metrics.

Second, it provides *dashboards*, which are web pages that provide a real-time, graphical display of metric values. Each dashboard presents one or more meters, and these display business metrics. InterSystems IRIS provides a complete set of built-in meters that includes speedometers, light bars, traffic lights, and others.

The following shows an example dashboard that displays business metrics:



To getting started with dashboards, see Creating Dashboards.

5.4 Alerts

An *alert* sends notifications to applicable users while a production is running, in the event that an alert event occurs. The intention is to alert a system administrator or service technician to the presence of a problem. Alerts may be delivered via email, text pager, or another mechanism. For details, see Programming in InterSystems IRIS.

5.5 Publish and Subscribe Message Delivery

Productions also support *publish and subscribe* message routing. This technique routes a message to one or more subscribers based on the fact that those subscribers have previously registered to be notified about messages on a specific topic. For details, see Managing Productions.

5.6 Message Bank

The *Enterprise Message Bank* is an optional remote archiving facility where you can collect messages, Event Log items, and search table entries from *multiple* client productions. It consists of the following components:

- The Message Bank server, which is a simple production consisting exclusively of a Message Bank service that receives submissions from any number of client productions.
- A client operation (the Message Bank operation) that you add to a production and configure with the address of a Message Bank server.

To get started, see Defining an Enterprise Message Bank.