

TIBCO Substation ES™

Concepts

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Preface

This manual describes TIBCO Substation ES concepts.

Topics

- [Changes from the Previous Release of this Guide, page viii](#)
- [Related Documentation, page ix](#)
- [How to Contact TIBCO Support, page xi](#)

Changes from the Previous Release of this Guide

This section itemizes the major changes from the previous release of this guide.

New Content (in v2.5)

Expanded and revised description of fault tolerance in the Advanced Deployments chapter. For details, see [Fault Tolerance with Load Balancing on page 48](#).

Related Documentation

This section lists documentation resources you may find useful.

TIBCO Substation ES Documentation

The following documents form the Substation ES documentation set:

- *TIBCO Substation ES Concepts*: Read this manual for an overview of Substation ES.
- *TIBCO Substation ES Installation*: Read this manual for instructions on site preparation and installation.
- *TIBCO Substation ES Operations and Administration*: Read this manual for details on operations and administrative tasks.
- *TIBCO Substation ES Configuration and Resources*: Read this manual for instructions on configuring communications and data conversions, and descriptions of the sample programs.
- *TIBCO Substation ES Messages and Codes*: Use this manual as a reference to error and information messages and codes.
- *TIBCO Substation ES Release Notes*: Read this document for information about new features, deprecated features, and open and closed issues.

Other TIBCO Product Documentation

You can find it useful to read the documentation for the following TIBCO products:

- *TIBCO Rendezvous™* and *TIBCO Enterprise Message Service™* software: These are TIBCO Software's real-time transport layers that are used by the Substation ES software.
- *TIBCO Rendezvous for z/OS Installation and Configuration*: Read this manual for instructions on installing and operating TIBCO Rendezvous on IBM z/OS systems.
- *TIBCO Rendezvous for z/OS COBOL Reference* and *TIBCO Rendezvous C Reference*: Read these manuals for instructions on the TIBCO Rendezvous for z/OS COBOL and C APIs.
- *TIBCO Enterprise Message Service User's Guide*: Read this manual for instructions on TIBCO EMS functionality.
- *TIBCO Enterprise Message Service C & COBOL API Reference*: Read this manual for instructions on the TIBCO EMS C and COBOL APIs.

Third Party Documentation

You may also find the following IBM documents useful:

Table 1 *Related Documents*

Publication Title
IBM CICS External Interfaces Guide
IBM CICS System Definition Guide
IBM CICS Transaction Server for z/OS CICS RACF Security Guide
IBM IMS/ESA Administration Guide: System
IBM IMS/ESA Customization Guide
IBM IMS/ESA Installation Volume 1: Installation and Verification
IBM IMS/ESA Installation Volume 2: System Definition and Tailoring
IBM ISPF Dialog Developers Guide and Reference
IBM RACF User's Guide
IBM SecureWay Security Server RACF Security Administration Guide

You can find many of the IBM documents in these CD-ROM sets:

- *Online Library Omnibus Edition MVS Collection*
- *Online Library Omnibus Edition z/OS Collection*

How to Contact TIBCO Support

For comments or problems with this manual or the software it addresses, please contact TIBCO Support as follows.

- For an overview of TIBCO Support, and information about getting started with TIBCO Support, visit this site:

<http://www.tibco.com/services/support>

- If you already have a valid maintenance or support contract, visit this site:

<https://support.tibco.com>

Entry to this site requires a user name and password. If you do not have a user name, you can request one.

Chapter 1 **Introduction**

This chapter introduces Substation ES and discusses its features and design.

Topics

- [Overview, page 2](#)
- [Architecture, page 4](#)
- [Common Services, page 6](#)
- [System Services, page 7](#)
- [Management, page 8](#)
- [Metadata Configuration, page 9](#)
- [Substation ES Messaging Agents, page 10](#)
- [Message Flow, page 11](#)
- [Service Levels, page 16](#)

Overview

Substation ES subscribes to and publishes data to TIBCO applications and transaction processing systems (such as CICS and IMS) that are running in the z/OS operating system environment.

TIBCO applications are those that can communicate with Substation ES using a messaging protocol supported by Substation ES (for example, TIBCO Rendezvous and TIBCO EMS). Examples of such applications include TIBCO BusinessWorks, TIBCO BPM, message-enabled web applications and programs using messaging applications APIs.

Substation ES provides the following functionality:

- Handles all communication between TIBCO applications and CICS and IMS transaction processing applications. The TIBCO applications can be running anywhere on the network, while the transaction processing applications are running in the z/OS environment.
- Data translation between TIBCO applications and the CICS and IMS transaction processing systems. Data mapping is specified through a series of ISPF panels that define how each field is to be converted based on the direction in which the data is exchanged. Substation ES also includes the facilities for ensuring the integrity of transactions.
- A flexible set of system startup and initialization parameters that control setup and configuration.
- A console interface for monitoring and controlling Substation ES when it is activated.
- Tracing and logging facilities.
- Feedback on Substation ES processing, message handling and runtime errors using TIBCO messaging via user data fields.

Substation ES is especially useful at sites that plan to augment the processing capabilities provided by z/OS applications with newer applications that run on PC's and workstations. In this case, system administrators want the flexibility and ease of usage offered by popular data entry systems while retaining the powerful back-end processing capabilities of their mainframe systems.

For example, a large financial institution wishes to make the financial information stored in applications in the z/OS environment more widely available to its customers. The institution can use Substation ES and TIBCO applications to build a bridge that allows customers to submit requests for information from personal computers at branch offices, or through the Internet using a web browser.

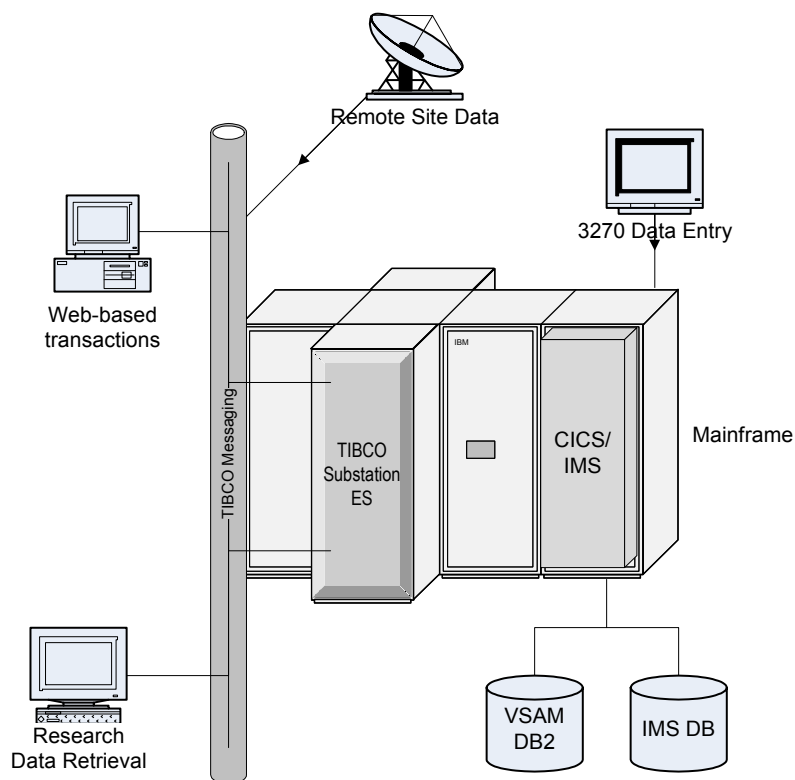
Additionally, applications in the z/OS environment can use Substation ES to publish data or access data generated by other types of applications. The information is transmitted by TIBCO application messages.

For example, a CICS application could publish a running tally of the number of widgets that have been ordered through an order processing system. Using Substation ES, this information can be made available world-wide to all employees of a company over their intranet.

In another example, the institution could use Substation ES to subscribe to events and notify transaction processing applications on the z/OS when an order is processed in one of the institution's branch sites. The branch sites can be using a PC-based order taking system and local database, but the applications on the z/OS would stay informed.

The following diagram shows some of the flexibility that can be designed into a system-wide enterprise where information must be shared between applications using different operating system and a mix of computing platforms.

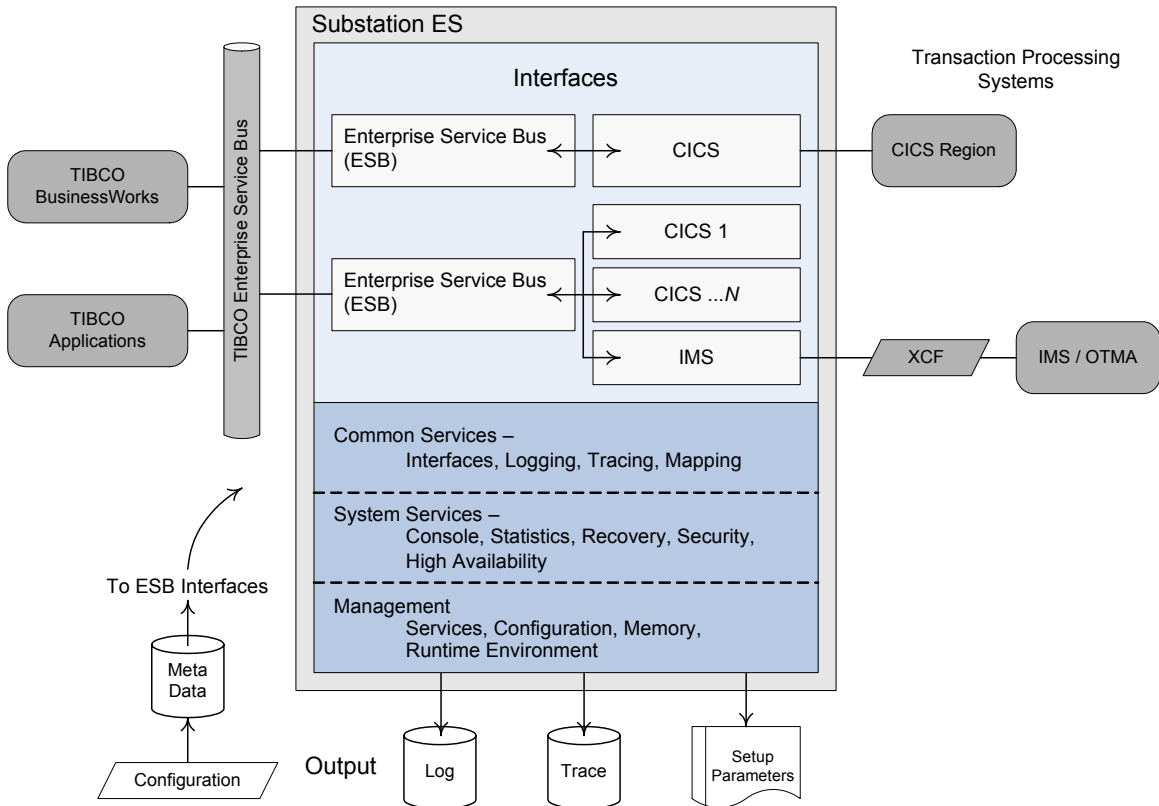
Figure 1 System Wide Enterprise Design



Architecture

Substation ES is an MVS application that runs in a single region. The following diagram shows the basic design:

Figure 2 Substation ES Architecture



Substation ES Components

Substation ES can be divided into functional areas or layers, each responsible for a given set of tasks and services.

- Interfaces

Interfaces initiate, control and terminate sessions, as well as manage the flow of data between Substation ES and transaction processing systems. The ESB Interface (formerly referred to as the Transformer) performs the translation of

data types between TIBCO applications and the CICS or IMS transaction processing applications. For details on the CICS and IMS interfaces, see [Chapter 2, CICS Interface for Substation ES](#) and [Chapter 3, IMS Interface for Substation ES](#).

- [Common Services](#)

These internal services are always available for the Substation ES interfaces. They are used by interface processes to perform logging, tracing, common facilitation of system monitoring, and error and statistics capturing. Common services are always multi-tasked, since they run in worker thread subtasks.

- [System Services](#)

System services are processed only by the Substation ES main task or by the Substation ES administration interface. Substation ES provides access to all interfaces, so these services can be requested for execution when required. System services consist of Substation ES unit of work handling, interfaceabend detection, the MVS system console interaction facility, statistics monitoring, and recovery from disconnects or other system failures.

- [Management](#)

Substation ES management is flexible and efficient in managing multiple interfaces in a single region, handling each interface's logistics according to its configuration, responding to operational commands to allow 24x7 operations, and providing remote application users with status and real-time information.

- [Metadata Configuration](#)

Metadata configuration information is the name for the configuration items (recipes and triggers) that are used to perform data exchange between TIBCO applications and the transaction processing applications on the z/OS. These items are entered and updated via the ESB Interface configuration panels.

Common Services

The logging and tracing facilities provide the ability to track the progress of transactions and to handle errors.

Logging Agent

The Substation ES Logging Agent processes requests for log entries, constructs the log header information, formats the input and writes it to the designated device. Log entries represent individual events that are recorded at specific points while Substation ES is active.

Log entries consist of a header and a variable data portion and are grouped into either *escalated* or *selectable* categories. An escalated category indicates that log events are increased as the level value specified by the user is increased. The selectable category includes log entries that are written at specific focus points within the execution thread in the region where Substation ES operates.

Tracing Agent

The Substation ES Tracing Agent processes requests for trace entries. It constructs the trace header information, formats the input and writes it to the selectable configured device. Trace entries are individual events recorded at specific locations in the execution code path during the time the Substation is active.

Trace entries consist of a header and a variable data portion. Trace entries are also grouped into escalated or selectable categories. An escalated category indicates that trace events are increased according to a value that is specified by the administrator. The selectable category specifies trace entries that are written at specific focus points within the execution thread of the Substation ES region.

System Services

The console interface provides a convenient means for administrating, monitoring and controlling events and services. It is also used to check on the status of components and interfaces that are operating in the Substation ES region. For instance, system administrators and operations personnel can identify pending requests and replies and manage them from this console.

Substation ES provides the following configuration and administrative components:

- System Startup Parameters
- System Initialization Parameters that are stored in a PDS member file
- Transformation DCUI panels
- Substation ES configuration and reporting utilities

System Parameters

The System Initialization Parameters are processed as input during the creation of the Substation ES region. These parameters dictate how various components operate. The System Initialization Parameters are defined in PDS members that are coded as 80-byte records.

- The **SSP** member is used to specify configuration details of the logging and tracing device information that pertain to Substation ES.
- The **SSI** member is used for identification and operational parameters.

Substation ES includes default versions of these members. These members must be edited to suit the requirements of a given site. A complete listing of all the configuration parameters and their values is provided in the *TIBCO Substation ES Installation*.

Interface Parameters

The configuration items used at startup to initialize and configure the ESB Interface reside in a Partitioned Data Set (PDS) member.

The configuration items used to describe TIBCO RV/EMS messages and transaction input reside within a VSAM file.

- The **ADM** member is used for configuring the administration and operations Interface.
- The **XFR** member is used for configuring the ESB Interface.

- The **IMS** member is used for configuring the IMS Interface for the transaction processing system.
- The **CICS** member is used for configuring the CICS Interface for the transaction processing system.

These members must be edited to suit the requirements of a given site. A complete listing of all the configuration parameters and their values is provided in the *TIBCO Substation ES Installation*.

Management

The following are the management facilities provided by Substation ES:

- Reporting of usage and statistics for each interface.
- Internal management of interfaces and the flexibility to specify concurrent worker tasks to manage payloads of different sizes, duration and throughput rates.
- An active operational command interface that listens and responds to user requests from the local host consoles or to remote commands send via the ESB.
- Configuration metadata entities can actively be created, updated, disabled or enabled while Substation ES is in operation.
- Connectivity to TIBCO ESB components and transaction processing systems is monitored; recovery and re-connection is established automatically when an external system becomes available again.

Metadata Configuration

The configuration items used to describe TIBCO messages and transaction input reside within a VSAM file. Substation ES has a number of features for managing the flow and exchange of data between applications.

The ESB Interface

The ESB Interface translates the data contained in the messages that are passed between TIBCO applications and the transaction processing applications on the z/OS system. The translations are carried out based on the data mapping parameters that are specified through the Transformation Definition Panels that define how each field in the message is to be converted.

The ESB Interface converts the data in TIBCO RV/EMS messages according to the specified mapping and sends it on to the appropriate Substation ES Interface, where it is made available for processing by a transaction processing application such as CICS or IMS. The ESB Interface also converts data that is generated by transaction processing applications in the z/OS environment into messages containing data that is suitable for delivery to TIBCO messaging applications that are subscribing to this data on the network.

The configuration items used at startup to initialize and configure the ESB Interface reside in a Partitioned Data Set (PDS) member.

Conversion Agent

The Conversion Agent manages the dynamic parameter settings that can be configured while the Substation ES is running. It also ensures that the current metadata matrix objects are loaded into memory and made available for the ESB Interface when the Substation ES is started.

Substation ES Messaging Agents

When TIBCO applications issue requests to publish or to subscribe to messages, these are processed by Substation ES using Receipt and Delivery agents. These agents manage the receipt and delivery of the messages in an asynchronous manner.

Message Receipt Agent

The Message Receipt Agent is a TIBCO RV/EMS listener, (or group of listeners), that performs the following functions:

- Listens to TIBCO RV/EMS messages being delivered to a subject or destination. The subject or destination that is being listened to is determined at configuration time.
- Makes sure that there is a proper reply subject or destination or in-box name so that the Message Delivery Agent can route the returned data to the appropriate subscriber.
- Forwards received messages to the ESB Interface for message translation, if necessary.

Message Delivery Agent

The Message Delivery Agent is a TIBCO RV/EMS sender, (or group of senders), that performs the following, functions:

- Determines whether an acknowledgement is required by the calling TIBCO messaging applications upon delivery of a given message. If a message delivery is unsuccessful, and the service is guaranteed, all updates to recoverable resources are backed out.
- Delivers return codes, acknowledgements, condition codes and result sets in the form of TIBCO RV/EMS messages back to TIBCO messaging applications or their clients, such as TIBCO BusinessWorks.

Delivers acknowledgements and result sets according to the flow control protocol for the service level that is active for a given subject (for example, reliable, certified, or guaranteed). Details for the type of service level required are specified by the messaging application, recipe, or trigger that has been defined for the request.

Message Flow

Substation ES accepts TIBCO RV/EMS messages that originate from applications located anywhere on the network. Conversely, Substation ES also accepts messages or events generated by transactions that are running within the CICS or IMS regions in the z/OS environment.

Substation ES transforms the following types of messages, enabling them to be passed between applications.

- Requests from TIBCO BusinessWorks or other TIBCO messaging applications to obtain data from a transaction processing program (CICS or IMS). In this case, a data set is returned to the requesting application.
- Requests from TIBCO BusinessWorks or another TIBCO messaging applications for data to be supplied to a transaction processing program (CICS or IMS). In this case, the data is supplied to the transaction processing program. There is no return data set and there can be a status return, that is, an acknowledgement of receipt.
- CICS or IMS application initiated requests (trigger events) to supply data or events to listening TIBCO messaging applications.

Request or Reply

Substation ES can subscribe to messages generated by external TIBCO applications; these are transformed into a z/OS data formats and passed to CICS or IMS systems for processing. For example, a TIBCO application can publish a request for data to a CICS or IMS application running on z/OS. That application optionally responds with some acknowledgement or returns a result set.

Triggers

Substation ES can also publish data on behalf of CICS or IMS applications. In this case, the data is translated from the z/OS data format and packaged as a TIBCO RV/EMS message for delivery to an external application that is subscribing to this data.

When Substation ES receives a request, the request is checked for authentication and to see if the format is valid. It is sent to the ESB (Enterprise Service Bus) Interface (formerly referred to as the Transformer) where necessary data translations are performed. The ESB Interface translates data types and formats between TIBCO applications and CICS or IMS applications. The translations are

based on the translation definitions specified in the transformation configuration panels. The data mapping defines how each field in a given message is translated as it is passed from a TIBCO application to the CICS or IMS application and vice versa.

Substation ES Interfaces provide the mechanism for communicating and passing information between the Substation ES and the transaction processing systems, databases and other services that are available on the z/OS platform. Substation ES Interfaces give TIBCO applications (that can be running on any platform) a means of accessing platform-specific applications in the IBM z/OS environment. Substation ES Interfaces for z/OS are robust, scalable and are able to deliver a high level of transaction throughput.

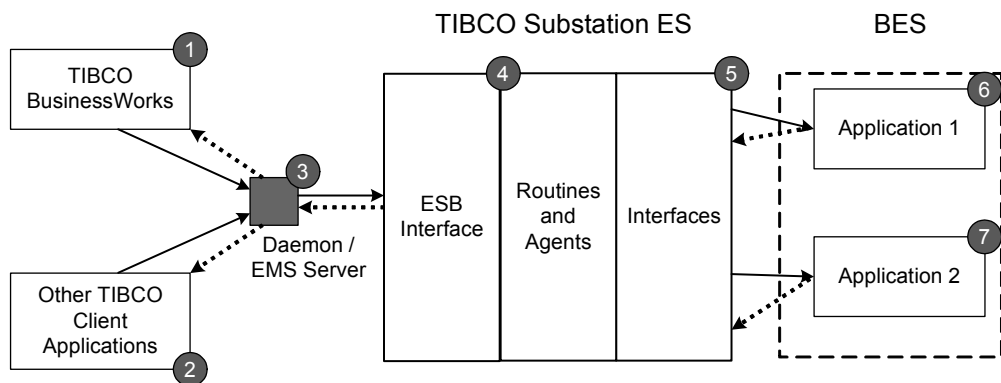
Message Flow from a TIBCO Application

There are three types of message flows:

- Request or Reply that takes place in both the CICS and IMS environments
- Trigger that takes place in both the CICS and IMS environment
- CICS-initiated Request or Reply that takes place only in the CICS environment

These message flows are illustrated in the figures below.

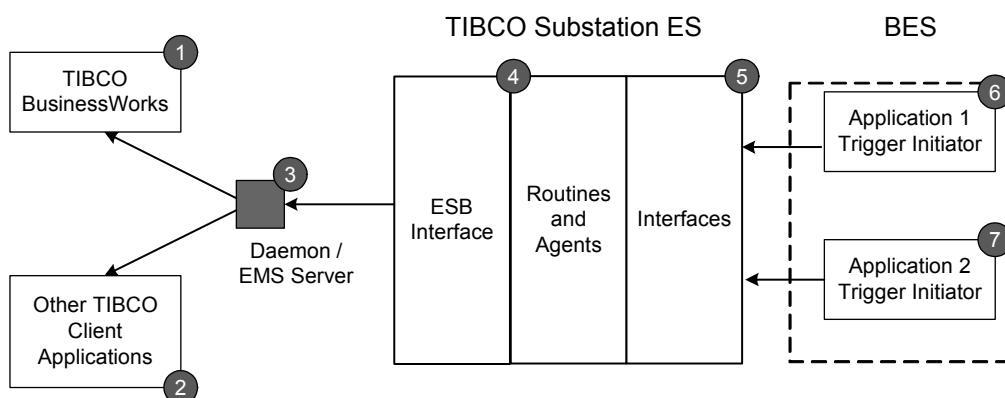
Figure 3 Message Flow for Request Reply



- Either TIBCO BusinessWorks (1) or another TIBCO messaging client application (2) initiates a request that is passed to a messaging Daemon or EMS Server (3). The initiating request is shown by solid arrows.

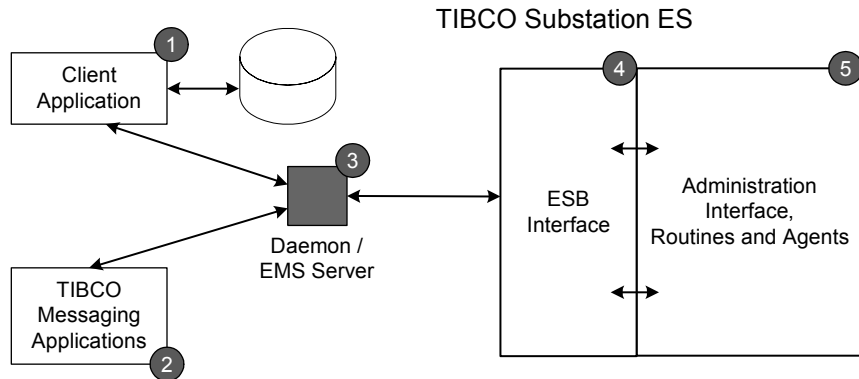
- The Daemon or EMS Server (3) forwards the request to Substation ES, where the ESB Interface (4) receives and transforms the message data, sends it to the appropriate Interface (5).
- The Interface delivers the request to the application in the Back End System (abbreviated BES). In this example, the request is sent to Application 1 and Application 2 (6 and 7) within the z/OS environment.
- The return result set (or return acknowledgement) is shown by the dotted arrows returning to the initiating applications.

Figure 4 Message Flow for Triggers



- In a trigger message, the request initiates within an application in the Back End System (BES) within the z/OS environment. In the figure above, Application 1 or 2(6 or 7) initiates the request.
- The appropriate Interface (5) within Substation ES receives the request and sends it to the ESB Interface (4).
- The ESB Interface (4) transforms it to a TIBCO RV/EMS message that is carried by the Daemon or EMS Server (3). From there it can be sent to TIBCO BusinessWorks (1) or other TIBCO messaging clients (2).
- In trigger messages, no result set or acknowledgement is sent back to the initiator (6 or 7). Therefore, there are no dotted arrows back to the initiators on this figure.

Figure 5 Message Flow for Data Transformation



Substation ES can be used as a very effective tool to transform data from different mainframe sources to TIBCO messaging applications and the reverse.

- A client application (1) read records from a database or files and publishes each record to Substation ES as an Opaque message. The structure of the record need not be known to the application at this point.
- The ESB Interface (4) receives the record, does not perform conversions on the input and just hands it to the Substation ES Administrative Interface (5).
- The Substation ES Administrative Interface (5) hands it back to the ESB Interface (4) where an outbound conversion can be performed, depending on the configuration specified.
- The record now converted to a TIBCO RV/EMS message can be published to a subscribing TIBCO messaging application (2)

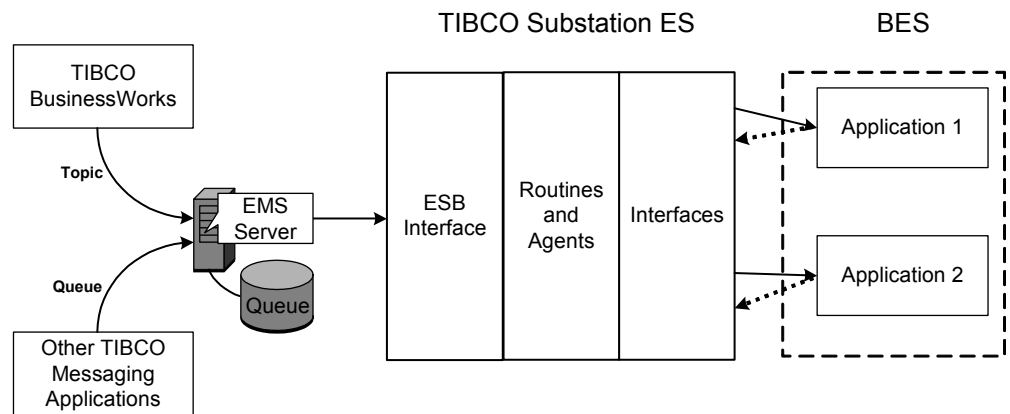
Message Flow Using EMS

Substation ES supports the TIBCO EMS. EMS implements several message services, including Java Message Service (JMS) that in turn supports two messaging models:

- Queues (point-to-point) – messages are stored in a queue until they are processed.
- Topics (publish and subscribe) – messages are addressed to a topic.

An EMS Server acts as an intermediary between TIBCO messaging applications and the ESB Interface, as illustrated below:

Figure 6 Message Flow Using EMS



Service Levels

For TIBCO Rendezvous

Substation ES currently supports the reliable service level for message communication to TIBCO Rendezvous applications. The usage and implementation of this service level is specified in the Substation ES configuration, coordinated by the Substation ES and adhered to by the Substation ES Interface.

For the reliable service level, Substation ES receives a message and forwards a request to the appropriate Substation ES Interface to execute a transaction. If necessary, a receipt of the delivery, execution status and the output result set can be returned to the TIBCO messaging applications. The execution path of this service level within the Substation ES is lightweight and can be used by many applications to submit inquiries or supply information.



No context information is stored so if a network loss occurs or if the applications on the z/OS fail to respond, no result is returned to the TIBCO messaging applications.

For TIBCO EMS

Substation ES supports both the reliable and guaranteed service levels for message delivery for EMS, as follows:

Reliable Auto Acknowledge – EMS client library automatically confirms the receipt of a message.

Reliable No Acknowledge – EMS client library does not send or a receipt of the message during processing.

Guaranteed All – Substation ES calls the EMS client library and explicitly confirms receipt of a message only once after all Substation ES processes and executions controlled by Substation ES for a given message complete successfully.

Guaranteed Substation Processing – Substation ES calls the EMS client library and explicitly confirms receipt of a message when Substation ES processes complete execution successfully. Processing is considered complete when a response message is successfully delivered to its destination. This is regardless of any type of message that is delivered back by Substation ES, error or application type messages.

Chapter 2

CICS Interface for Substation ES

This chapter describes the CICS Interface used by Substation ES to pass data between TIBCO messaging applications and CICS applications in the z/OS operating environment.

Topics

- [The CICS Interface, page 18](#)
- [CICS Methods of Invocation, page 23](#)
- [Substation ES Interface Components, page 24](#)
- [Data Communications, page 26](#)

The CICS Interface

Substation ES CICS Interface manages the communications and coordinates the exchange of data between the Substation ES and the CICS transaction processing system. TIBCO messaging applications can subscribe to data, request acknowledgements or request sets of results from CICS transaction processing applications. In addition, Substation ES can publish data on behalf of CICS applications to subscribing TIBCO messaging applications.

When TIBCO RV/EMS messages are received by Substation ES, the messages are transformed into formatted data buffers. The data buffers are sent to the CICS Interface that combines them with a request header depending on the method of invocation. There are different Methods of Invocation (MOI's) used by the CICS Interface from which requests are interpreted. A reply from the CICS program can be returned to an awaiting user subscription as a TIBCO RV/EMS message.

The CICS Interface operates as a sub-task within Substation ES region. It uses IBM's External CICS Interface (EXCI) protocol in order to communicate with CICS regions. The CICS Interface employs a multi-threaded design that can accommodate multiple sessions or pipes communicating with each CICS region. Up to thirty CICS Interface instances can operate and coexist concurrently within the Substation ES region. The only limit is that each interface is restricted to communicating with just one CICS region at a time.

The number of CICS Interfaces that are utilized by Substation ES is specified through the system initialization parameters that provides a high degree of scalability for handling the data processing requirements of a given site. Here are some of the features offered by the CICS Interface:

- Allows multiple CICS Interfaces to be allocated for each Substation ES. This provides the ability to communicate with many CICS regions.
- Provides flexible configuration options that are specified during the start up process for Substation ES.
- Requires no special API to perform CICS initiated outbound events (triggered events).
- Supports reliable and guaranteed message delivery services.
- Up to four Substation ES interface instances can connect simultaneously to a single CICS region.

Figure 7 Substation ES with CICS Configurations

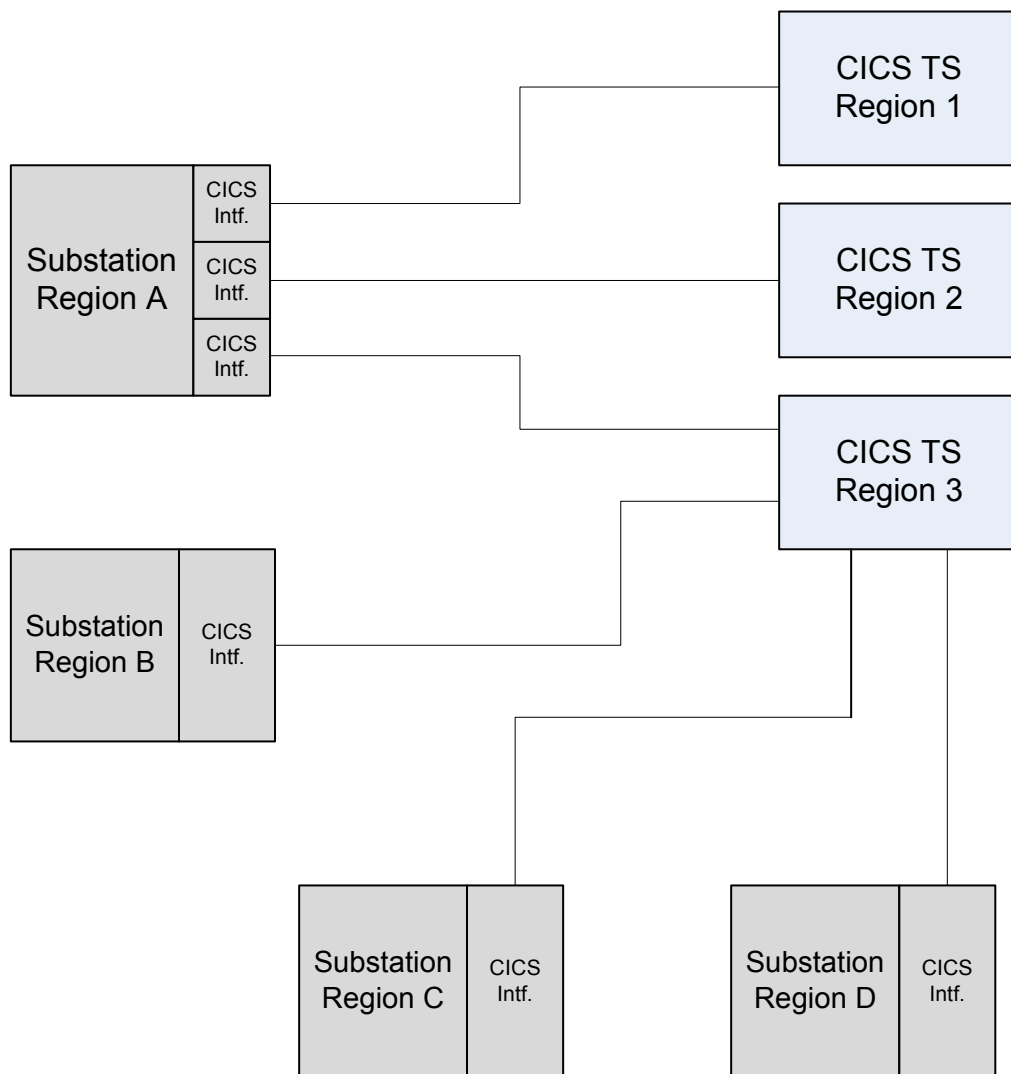
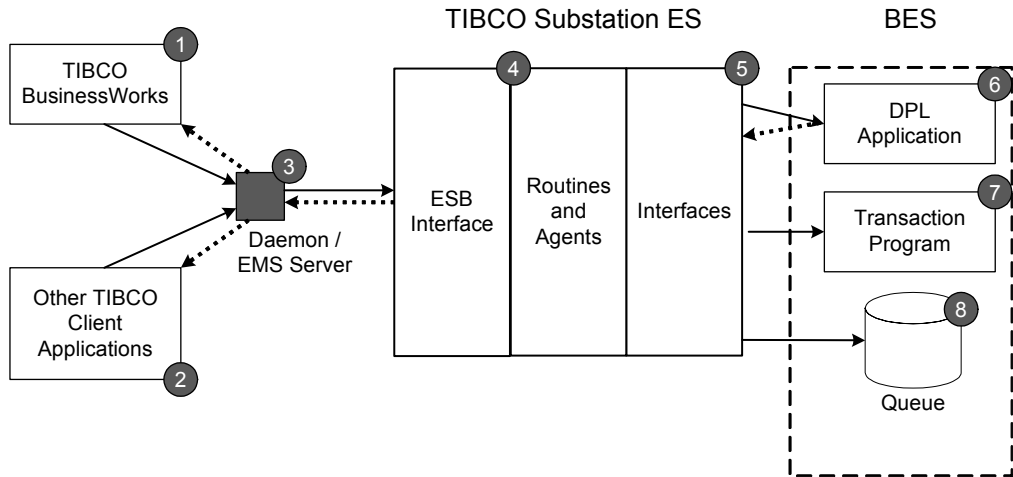
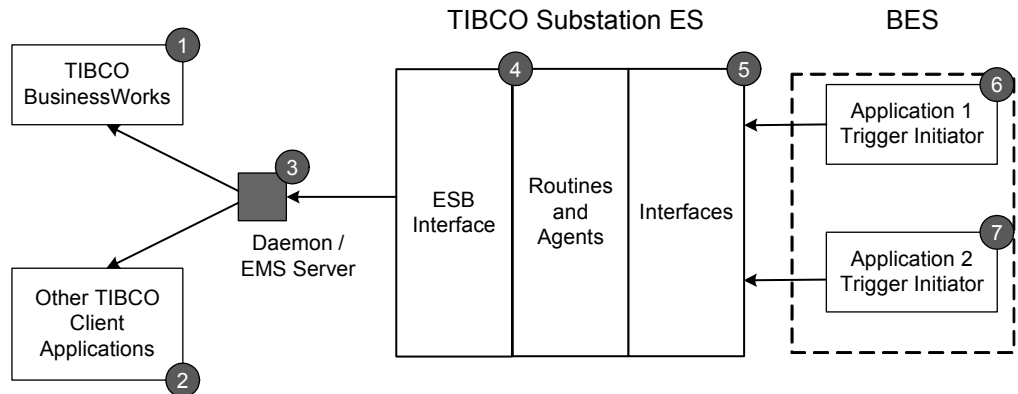


Figure 8 CICS Interface Message Flow for Request Reply



- Either TIBCO BusinessWorks (1) or another TIBCO messaging client application (2) initiates a request that is passed to a messaging Daemon or EMS Server (3). The initiating request is shown by solid arrows.
- The Daemon or EMS Server (3) forwards the request to Substation ES, where the ESB Interface (4) receives and transforms the message data, then sends it to the appropriate Interface (5).
- The Interface delivers the request to the application in the Back End System (abbreviated BES). In this example, the request is sent a DPL application (6) or Transaction Program (7) or Queue (8).
- Only the DPL application (6) returns a result set (or return acknowledgement). This is shown by the dotted arrows returning to the initiating applications.

Figure 9 Message Flow for CICS Triggers



- In a trigger message, the request initiates within an application in the Back End System (BES) within the z/OS environment. In the figure above, Applications 1 and 2 (6 and 7) initiate the request.
- The appropriate Interface (5) within Substation ES receives the request and sends it to the ESB Interface (4).
- The ESB Interface (4) transforms it to a TIBCO RV/EMS message that is carried by the Daemon or EMS Server(3). From there it can be sent to TIBCO BusinessWorks (1) or other TIBCO messaging clients (2).
- In trigger messages, no result set or acknowledgement is sent back to the initiator (6 or 7). Therefore, there are no dotted arrows back to the initiator.

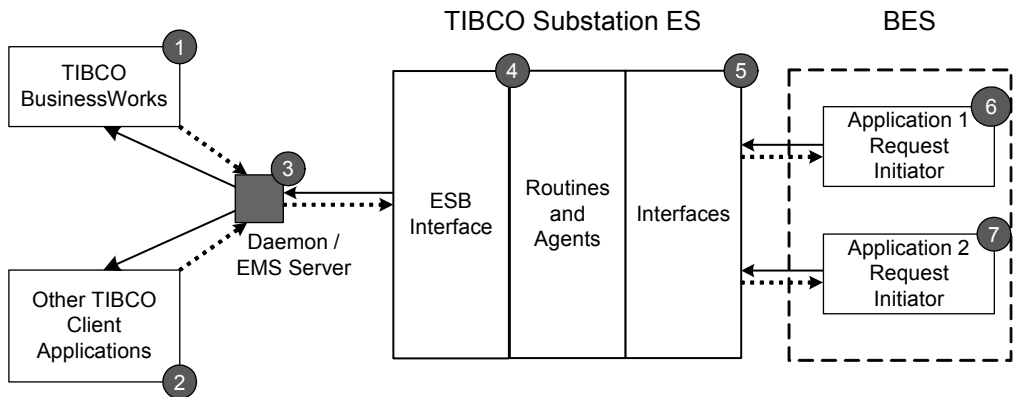
Using High Volume Triggers (HVT)

You should consider using the CICS HVT functionality provided by Substation ES in the following scenarios:

- When you expect a high volume of messages/queue records to be sent from CICS regions.
- When users require ordered delivery of information.
- When applications need to send more than 32K of information.
- When you use EMS as your transport and you require guaranteed message delivery for triggered information.

For details on implementing HVT, see *TIBCO Substation ES Operations and Administration*.

Figure 10 Message Flow for CICS-initiated Request Reply



- In CICS Request Reply, the initial request comes from an application in the Back End System (BES) of the z/OS environment. In the figure above, the request initiates from Application 1 and 2 (6 and 7). The path of the initial request is shown by solid arrows.
- The request is received by the Interface (5) of Substation ES and passed to the ESB Interface (4). The request is sent to the messaging Daemon or EMS Server (3).
- The Daemon or EMS Server (3) sends it to TIBCO BusinessWorks (1) or another TIBCO messaging client (2), depending on the message delivery criteria.
- The CICS application (1, 2) waits for a response from the external messaging application. A timeout value specified by (1, 2) determines the time applications are prepared to wait for a response.
- In all these transactions, result set or acknowledgement are returned, as shown by the dotted arrows of the figure.

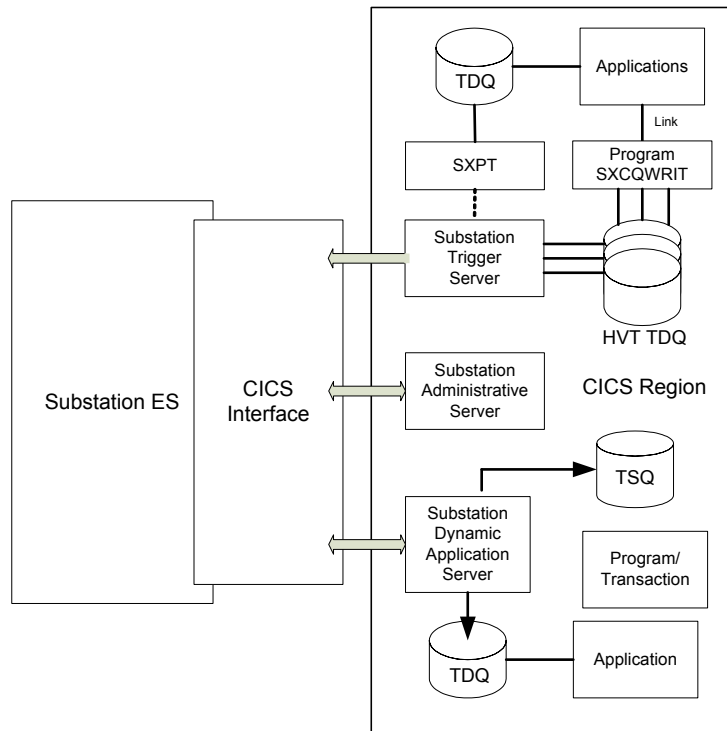
CICS Methods of Invocation

The CICS Interface allows data to be communicated to the CICS region in various Methods of Invocation, as follows:

- Invokes CICS program from the CICS Interface via a DPL
- Writes the formatted data buffer to a CICS TDQ for subsequent processing.
- Writes the formatted data buffer to a CICS TSQ for subsequent processing
- Initiates a CICS transaction from the CICS resident TIBCO Substation ES server.
- Optionally the COMMAREA can be passed to initiated transactions.
- Transfers control (XCTL) to a user application from the CICS resident Substation ES server.

The figure below gives an overview of message flow using the CICS Interface.

Figure 11 CICS Message Flow Overview



Substation ES Interface Components

The CICS Interface of Substation ES utilizes three Substation ES servers that exist in the CICS region as follows:

- SS Dynamic Applications Server

This server resides within the CICS region and its primary function is to extend a CICS transaction request, thus allowing access to other CICS resources and transactions that cannot be DPL enabled. A request can initiate a CICS program, a CICS transaction or write the formatted data buffer content to a TDQ. These functions are enabled by selecting the appropriate MOI option in the Transformation configuration panels. The COMMAREA can be sent to programs or transactions.



All requests performed by this server only return the results of the CICS function and not the result set from the application as the requests are performed asynchronously.

- SS Trigger Server

This server resides within the CICS region and its primary function is to wait for events to be written to a CICS TDQ and signals the Substation ES CICS interface to extract them from the queue. The CICS Interface forwards the events or requests to the ESB Interface, where the data is translated according to the ESB Interface configuration. The data is published by Substation ES as a TIBCO RV/EMS message. The name of the TDQ associated with this trigger server is specified in the CICS members of the system initialization parameters. The trigger server handles reliable and guaranteed triggers, as well as CICS-initiated request or reply messages. Each trigger facility can be disabled when it is not required by the Substation ES implementation.

- SS Administrative Server

This server resides within the CICS region and is primarily responsible for performing housekeeping functions and responding to Substation ES operational requests.

CICS TD Queue

The Substation CICS interface uses TDQ's to read outbound events and, when requested, to write inbound data. The names of these TDQ's must be defined prior to starting Substation ES. A TD Queue can be defined in CICS as a remote queue that can be used by more than one CICS server region. The CICS TD Queue should be a logically recoverable intra-partition Transient Data Queue (TDQ) that is recoverable on warm and emergency restarts. For more information about TDQ's, refer to the CICS System Definition Guide.

Substation ES CICS Event Post Transactions

The Substation ES CICS Event Post Transactions listed below reside within the CICS region. When events are written to the outbound TDQ, these transactions are triggered. For the CICS Interface to be notified of outbound events, the CICS administrator must ensure the transaction-ids are declared in the TDQ definition. These transactions use a Substation ES-supplied transaction class that ensures that only “one” of these transactions are active within a CICS region at any given time.

- SXPT – reliable transaction
- SXPG – guaranteed transaction
- SXPO – ordered transaction
- SXPE – error message transaction

Data Communications

Communications between TIBCO Substation ES CICS Interface and the CICS region requires a communications area. This area is commonly known as the COMMAREA. The maximum supported size for the COMMAREA is 32000 bytes or characters as a limit of 32K is imposed by VTAM. The CICS Application Guides suggests a maximum area of 16K.

When Substation ES CICS Interface issues a DPL call to a user application, the formatted data buffer is passed into the COMMAREA. From there it is transferred to the application.

When the CICS Interface communicates with TIBCO Substation ES CICS resident servers, it prefixes the COMMAREA with header and control information. If the COMMAREA must be passed to another transaction or program, the header is stripped and COMMAREA is transferred.

The length of a bigger TDQ record cannot exceed the supported maximum length size as there is a direct correlation between the TDQ record and the COMMAREA.

Chapter 3

IMS Interface for Substation ES

This chapter describes the IMS Interface for Substation ES. This interface provides the connection between TIBCO messaging applications and IMS applications in the z/OS operating system environment. Transformation and forwarding of information is regarded as an integral part of Substation ES functionality.

Topics

- [Architectural Overview, page 28](#)
- [Substation ES IMS Interface Components, page 30](#)
- [Message Flow for IMS, page 35](#)
- [Communication Service Levels, page 39](#)
- [Substation ES OTMA Interface, page 42](#)
- [IMS Interface Deployment, page 44](#)
- [Constraints and Configuration, page 45](#)
- [Advantages of the Substation ES IMS Interface, page 46](#)

Architectural Overview

The Substation ES IMS Interface enables external applications to communicate (publish or request or reply) with transactions mainly resident in IMS Message Processing Program (MPP) regions. Additionally IMS applications such as MPP's, BMP's and 3270 can also publish or redirect (trigger) output to external applications via the Substation ES IMS Interface.

The Substation ES IMS Interface is coupled to the host-side of Substation ES that allows multiple users to simultaneously connect and communicate with IMS Transaction Manager. To fully understand the role and position of the Substation ES IMS Interface within z/OS, you must know about the architecture of Substation ES. Refer to [Architecture on page 4](#).

The Substation ES IMS Interface uses IBM's cross-system coupling facility (XCF) and the IMS OTMA protocol to communicate with IMS Transaction Manager. IMS Open Transaction Manager Access (OTMA) is a transaction-based, connectionless client/server protocol.

Substation ES receives requests published by TIBCO messaging clients. Substation ES determines what level of service is required for a particular message, forwards the messages to the Substation ES IMS Interface. The interface interacts with IMS according to the desired service level. Messages sent to IMS transactions can therefore be either transactional or non-conversational.

The transaction's level of service is dependent on parameters that are configurable in Substation ES. The level of service also depends on the type of TIBCO messaging client initiating the request.

General Overview

- TIBCO messaging applications are normally the source of the external messages and requests that are received by Substation ES. Substation-to-Substation communication via the messaging layer could be another source for messages. The ESB Interface transforms TIBCO messaging application requests into a buffer, and forwards the buffer to the Substation ES IMS Interface. The Substation ES IMS Interface, in turn, attaches the buffer to an OTMA header and passes the message via OTMA to IMS applications.
- TIBCO clients can publish requests that initiate IMS transactions. Alternatively, IMS applications can publish events or messages from 3270 applications or from within BMP or MPP regions to TIBCO messaging applications listening to these events.

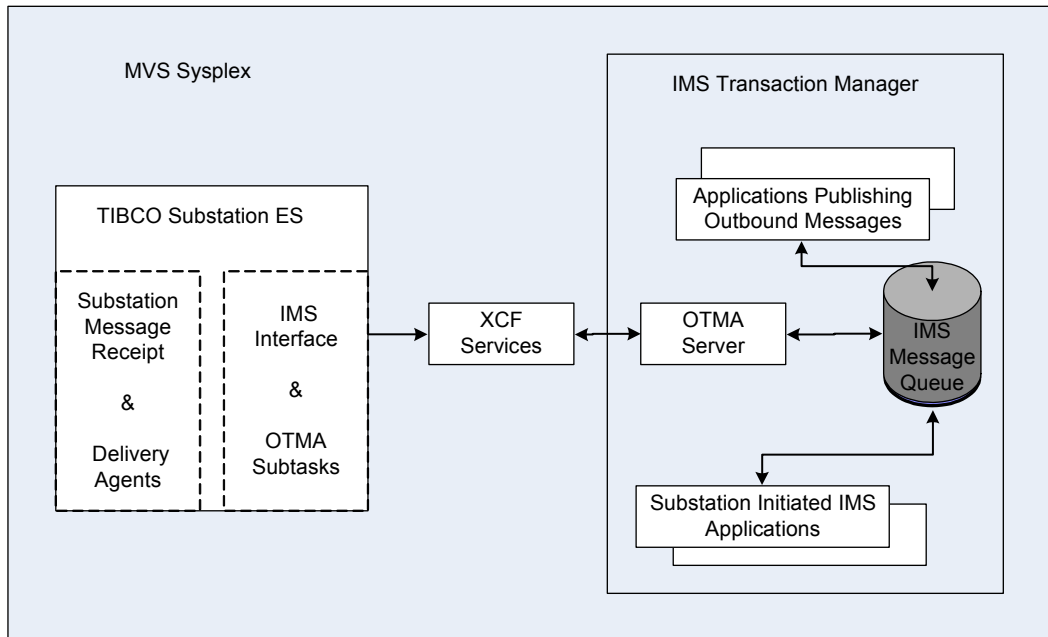
- Communication between the Substation ES IMS Interface and IMS is handled by the Substation ES OTMA Interface. Communication is using IBM's Open Transaction Manager Access (OTMA) facility.
- Exit routines provided with IMS that allow an IMS OTMA system to determine and change the destination of IMS OTMA messages are required for routing messages to the Substation ES IMS Interfaces. Developers or system administrators must modify these exits for trigger messages to be delivered to an awaiting Substation ES IMS Interface. The OTMA Prerouting Exit Routine (DFSYPX0) and OTMA Destination Resolution Exit Routine (DFSYDRU0) exits are examples of the current requirement.

Substation ES IMS Interface Components

The Substation ES IMS Interface consists of the following components:

- **XCF Services.** Substation ES IMS Interface connects to an XCF Group. XCF Services register and announce the joining of the Substation ES IMS Interface as a XCF member.
- **OTMA Server.** This server accepts requests from and returns results to the Substation ES IMS Interface. The OTMA environment includes a server that allows connections to one or more clients.
- **Substation ES IMS Interface.** This interface establishes the connection and enables communication to IBM's IMS transaction processing system
- **Substation ES OTMA Interface.** This interface is the logical connection between the OTMA server and the Substation ES IMS Interface (OTMA client)
- **IMS OTMA Exits.** This consists of a Prerouting Exit Routine and the Destination Resolution Exit Routine.

Figure 12 Substation ES IMS Interface Components



Additional details about these components are described in subsequent sections.

Substation ES IMS Interface

The Substation ES IMS Interface is a multi-threaded application that executes in the same address space as the host-side of Substation ES. A Substation ES IMS Interface can have many concurrent sub-tasks (OTMA clients) communicating with an IMS Transaction manager.

You set the number of threads that can be concurrently opened, as well as other IMS connectivity settings and Substation ES required parameters. These are set at startup by specifying values for the System Initialization Parameters for the IMS Interface. See the *TIBCO Substation ES Installation and Administration* for available startup options.

You can configure multiple Substation ES IMS Interfaces that can execute concurrently from an single Substation ES. Each Substation ES IMS Interface can simultaneously communicate with one or more IMS Transaction managers.

When a Request or Reply message from an external application is received, the ESB Interface receives it and performs the transformation. If the transformation is successful, an event condition notifies the Substation ES IMS Interface that a request must be processed.

The request, together with contents received from the TIBCO messaging application, is validated and packaged into an OTMA message by the Substation ES OTMA Interface.

Substation ES IMS Interface can also receive data from IMS Transaction Manager applications. In this case, the data is processed as follows:

1. Forwarded as buffers (IOAREA) by the applications to an IOPCB or Alternate IOPCB.
2. Redirected by the IMS OTMA Prerouting exit.
3. Delivered to the Substation ES IMS Interface by OTMA via XCF.

The OTMA message is forwarded for transformation and finally delivered to an awaiting TIBCO messaging application.

Substation ES IMS Interface for OTMA

Substation ES IMS Interface for OTMA is a multi-threaded OTMA client. Each instance of this interface operates as a subtask of the Substation ES IMS Interface Task. You determine the number of client or worker subtasks by configuring parameters at Substation ES startup. The Substation ES IMS Interface for OTMA is transparent to the users.

The primary responsibilities of the Substation ES IMS Interface for OTMA are the following:

- Establish a communications environment with IMS, such as allocating and initializing OTMA required control blocks and Substation communication buffers.
- Establish communications with XCF and connect to the IMS Server.
- Join as a member of the IMS XCF group and initiate a client bid with the IMS Control region
- Notify the Substation ES IMS Interface that initialization has completed and wait to process requests and events
- Relay all processing actions to the Substation ES IMS Interface for logging and or auditing
- Process incoming requests by attaching buffered information to an OTMA header and forwarding the messages to IMS.
- Receive replies from IMS applications that participated in a typical Request or Reply transaction
- Process IMS outbound events via a very efficient SRB processing mechanism

XCF Services

XCF is the transport layer and is responsible for OTMA message delivery between the Substation ES IMS Interface and the OTMA server.

The XCF group name must be specified in Substation ES startup parameters and are used in connecting to the IMS server at initialization time. The group name used by Substation ES IMS Interface and the targeted IMS server must be the same.

The IMS server must be started first as the XCF Group is created and owned by IMS.

If Substation ES detects that IMS has not been started, the Substation ES IMS Interface is terminated. All members of the XCF group are clients, except IMS, which is the server. Substation ES IMS Interface, acting as a client, communicates with IMS using the XCF interface by sending OTMA messages to IMS. IMS in return sends the result set back to the Substation ES IMS Interface.

OTMA Server

The OTMA server resides within the IMS control region. The OTMA server is supplied by IBM and can accept multiple connections from individual or multiple Substation ES IMS Interfaces. Though easily generalized, the OTMA implementation is specific to IMS in an MVS sysplex environment.

The key to message flow for OTMA is the transaction pipe, the logical connection between the OTMA server and the Substation ES IMS Interface. IMS uses the concept of a logical terminal (LTERM) to ensure that responses are associated with the correct requesters. OTMA does not use an LTERM but still must maintain a connection between the client and IMS. This connection is the transaction pipe, or Tpipe.

Transaction Pipe

Substation ES uses a Transaction Pipe (Tpipe) to communicate with the OTMA server. This is similar to the way a LTERM communicates with IMS. Some of the characteristics of Tpipes and LTERMs are described below.

- A LTERM or Tpipe uses a queue where the transaction output is kept before it is returned to the requester.
- For each LTERM or Tpipe, IMS maintains a connection between the queue and the physical node that receives the output.
- Tpipes allow the Substation ES IMS Interface to associate its transactions with a transaction-pipe name.
- IMS uses the Tpipe name to associate all input and output with the particular Substation ES IMS Interface. The association between the transaction output and its ultimate destination (the originating device) is not made within IMS (as is the case with LTERMs), but is the responsibility of the Substation IMS Interface.
- When Substation ES uses a Tpipe, IMS does not know anything about the actual user of the transaction that is often a user of the IMS application. Therefore, when a Tpipe is used
 - the Substation ES IMS Interface has complete control over the output of Request or Reply transactions.
 - For outbound requests, the IMS application must specify the same Tpipe name as that specified on Substation ES IMS Interface startup parameters.

Each Substation ES IMS Interface uses at most two Tpipe definitions.

- One Tpipe name is for Request or Reply requests
- Another Tpipe name for triggered (IMS outbound) requests

The Tpipe names are supplied in the startup parameters for Substation ES. The names are also included in the message-control information segment of the OTMA message prefix for requests.

Substation ES IMS Interface supports both synchronized or non-synchronized Tpipes. For a synchronized Tpipe

- All output messages are serialized through a single process.
- Sequence numbers can be assigned to messages.

IMS OTMA Exits

IMS OTMA exits are required when IMS applications must redirect output or when IMS applications send outbound-only triggered messages to an OTMA Tpipe. These exits, supplied by IBM, are as follows:

OTMA Prerouting Exit Routine (DFSYPRX0) You can use the OTMA Prerouting exit routine to determine and change the destination of IMS Open Transaction Manager Access (OTMA) output messages. The messages can be routed to an OTMA client or to IMS TM for processing, but this exit routine cannot determine the final destination for the message.

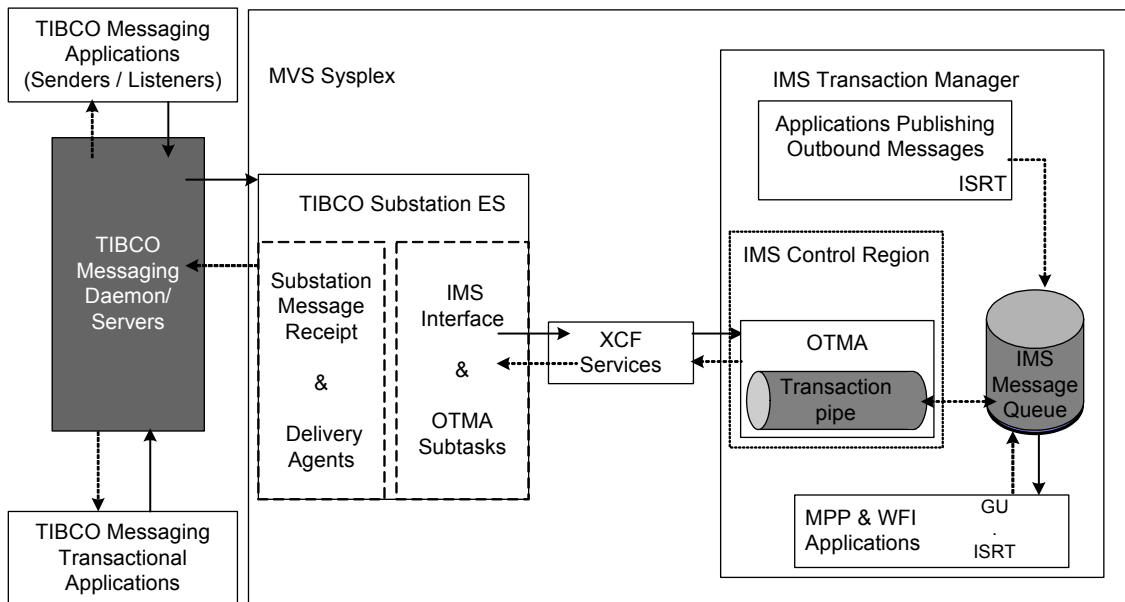
OTMA Destination Resolution Exit Routine (DFSYDRU0) You can use the OTMA Destination Resolution exit routine to determine and change the final destination of IMS Open Transaction Manager Access (OTMA) output messages. A Substation ES IMS Interface sample exit (DFSYDRUS) is provided for use with the sample Substation ES Installation Verification Programs (IVPs).

For more information about these exits, refer to the *IMS/ESA Customization Guide*

Message Flow for IMS

Within the scope of Substation ES, messages and requests are synonymous. TIBCO application messages are transformed into requests with content and forwarded to the Substation ES IMS Interface, via XCF to the IMS OTMA server and finally to the IMS application for processing.

Figure 13 IMS Interface Message Flow for Request or Reply

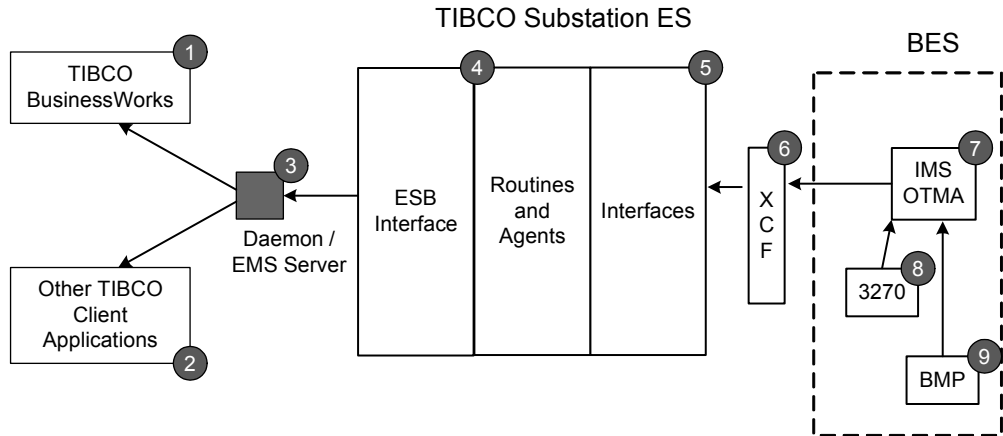


Substation ES accepts TIBCO application messages from the following sources:

- Messages originating from a TIBCO messaging applications anywhere in the network.
- Messages originating from a TIBCO transactional clients. The TIBCO transactional client messages are first sent to the TIBCO Transactional store-and-forward Daemons. The Daemons notify TIBCO Substation ES transactional agents of messages to be processed.
- Messages originating from transactions running within the IMS BMP and MPP regions. These are known and have been described as triggered messages.
- Messages originating from other installations of Substation ES via host-side processes or transactions.

For a general or more detailed overview of message flow between messaging applications and Substation ES Interfaces, see [Message Flow on page 11](#).

Figure 14 Message Flow for IMS Trigger



- In an IMS Trigger, the initial request comes from a Back End System (BES) application in the z/OS environment. In the figure above, it can initiate from a Batch Message Program (BMP) (9) or a 3270 (8) device that passes it to IMS OTMA (7).
- IMS OTMA forwards it to the ESB Interface (6) which sends it to the IMS Interface (5) in Substation ES.
- The Interface forwards it to the ESB Interface (4) and the Daemon or EMS Server (3), as in the trigger example ([Figure 4, Message Flow for Triggers, page 13](#)).
- The Daemon or EMS Server (3) can send it to either TIBCO BusinessWorks (1) or another TIBCO messaging client (2).
- In trigger transactions, no result set or acknowledgement are returned, as shown by the absence of dashed arrows in the figure.

External Request or Reply Message Flow

TIBCO messaging applications can forward and receive messages from z/OS IMS transactions.

Substation ES can initiate and execute IMS transactions using the information received from messaging applications as input to transactions. You can configure Substation ES to determine whether the messaging application expects to receive a result or delivery notification of delivered messages.

Implementing a Request or Reply solution is normally non-intrusive. Existing host-side transactions and programs can be executed without changes. A typical Request or Reply interaction is described below.

- TIBCO messaging application publishes a message intended for a Substation ES that has an active subscription for the message.
- Substation ES receives the message and transforms the contents of the message into a user configured formatted buffer area.
- Substation ES sends the buffer together with control and execution information to the Substation ES IMS Interface.
- The Substation ES IMS Interface constructs an OTMA message that contains a prefix and application information (LLZZ and buffer) and sends the OTMA message to IMS on a designated Tpipe.
- When IMS receives the OTMA message, IMS actions are to either execute the command or schedule the applicable transaction for execution
- If IMS was unsuccessful in executing its intended actions, a message is normally returned to the Substation ES IMS Interface. The message is logged and the messaging application receives an unsuccessful return code and message.

If IMS executed the actions successfully, the message that is created as a result of the IMS executed process(es) is returned to the Substation ES IMS Interface on the originating Tpipe. By using one of the appropriate OTMA or IMS exits, the destination name (Tpipe) can be altered.

- The Substation ES IMS Interface now extracts application data from the OTMA message and returns the data in the buffer area to the ESB Interface.
- The buffer received from the host side Interface is now transformed into a reply message. The format, type and destination of the message intended for the TIBCO messaging applications are configurable within Substation ES.
- The message is now published to TIBCO messaging applications based on the level of service and destinations configured on the transformation recipe.

Triggered Message Flow from an IMS Transaction

Implementing a triggered message flow is normally intrusive. Additional code enabling an IMS application to write a message to an IMS queue using an alternate IOPCB must be added to application logic.

However, if output from an application only needs to be redirected to Substation ES, the redirection of the message can be accomplished by using the IMS OTMA exits.

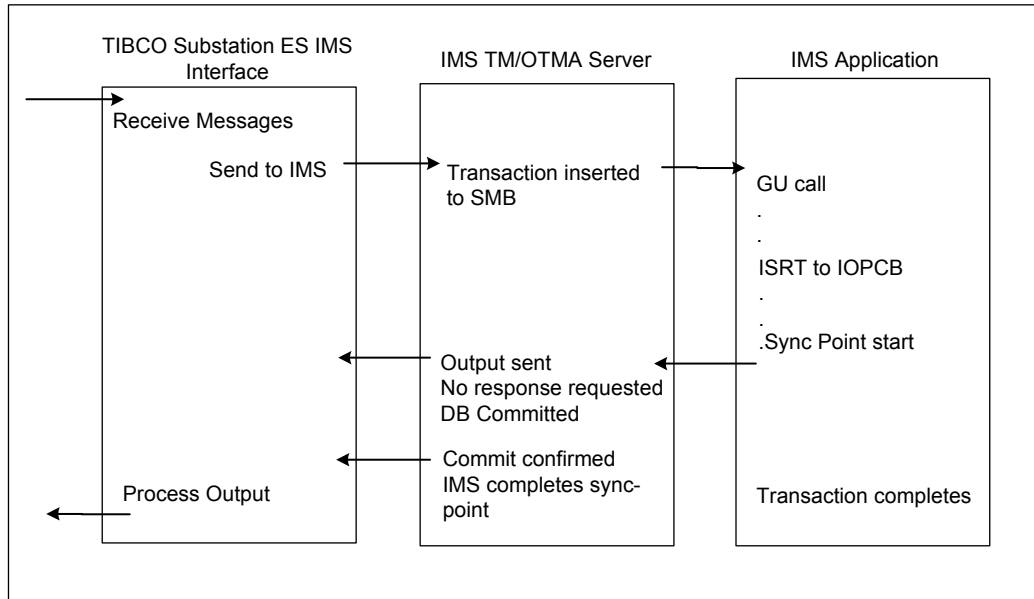
A typical triggered message flow interaction is described below.

- An IMS application inserts a message to the IMS message queue, specifying the trigger Tpipe name
- Substation ES IMS Interface for OTMA is notified of the messages and consumes the information from the IMS queues using the OTMA protocol
- If the message is valid and recognized by Substation ES IMS Interface, the message is placed on a Substation ES inbound queue, making the request eligible for transformation
- When transformation has taken place, a message formatted for TIBCO messaging application is sent to the Substation ES Delivery Agent. If transformation for a trigger message is unsuccessful, the message is stored in the Substation ES Dead Message Queue (DMQ) for IMS.
- The message is now published to TIBCO messaging applications based on the level of service and destinations configured on the transformation recipe.

Communication Service Levels

Reliable

Figure 15 Reliable Message Flow (send-then-commit)



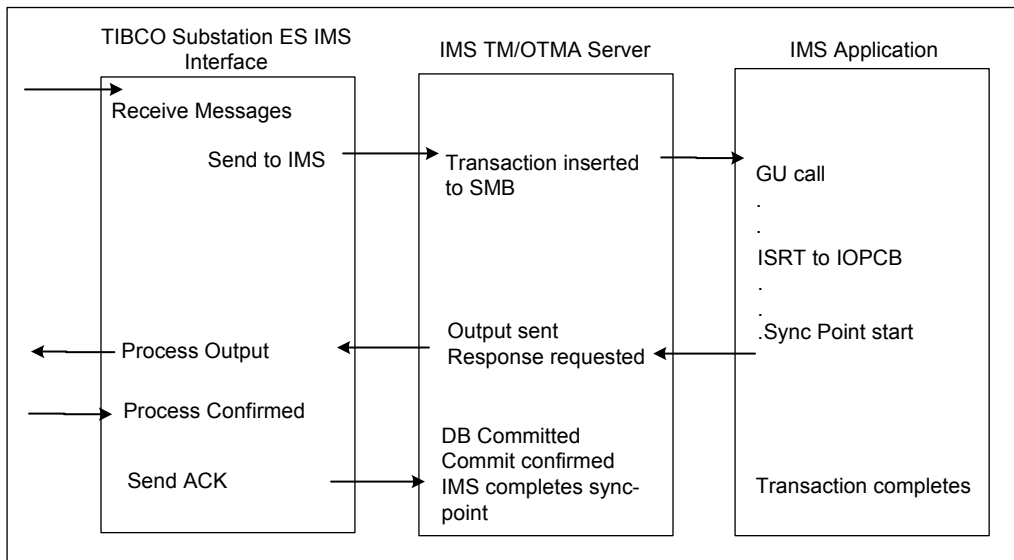
Usage Overview (send-then-commit or Commit Mode 1)

When executing IMS transactions in reliable mode, the following are applicable:

- IBM RRS is not required to complete a request using Substation ES.
- Transaction pipes need not be synchronized.
- The Synchronization Level is specified as *None* in the OTMA message prefix.
- Message receipt from IMS by the Substation ES IMS Interface is in random order because XCF does not guarantee ordering.
- Send-Then-Commit with confirm is currently not supported.

Transactional

Figure 16 Transactional Message Flow (commit-then-send)



Usage Overview (commit-then-send or Commit Mode 0)

To ensure a transactional request is executed, the following items are applicable:

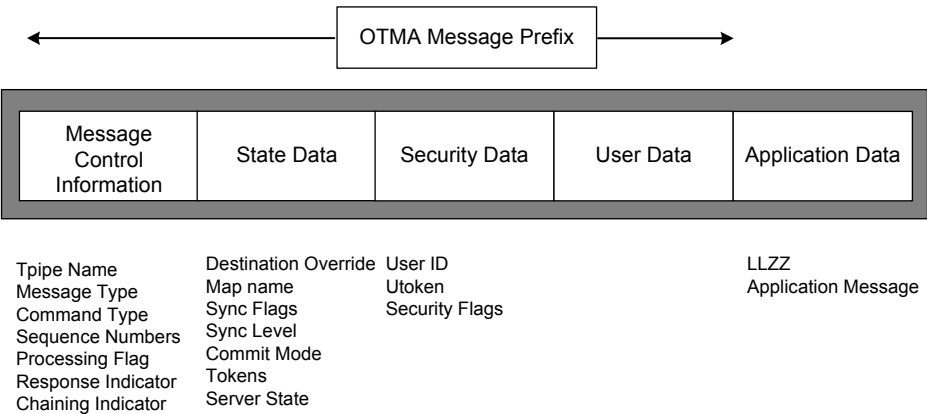
- RRS must be started in the MVS image where IMS and Substation ES are running.
- The Substation ES service level for a particular recipe must be set to `transactional`.
- The Synchronization Level is set for the Tpipe. IMS maintains sequence numbers for recoverable input and output for the Tpipe.
- Acknowledgment is always requested by both IMS and the Substation ES IMS Interface.
- TIBCO messaging applications must publish the messages using the TIBCO application transactional protocols.

When Substation ES and the Substation ES IMS Interface must initiate protected conversations (such as accessing multiple resource managers under one unit of recovery in an RRS/MVS environment), Substation ES acquires and owns the UOW context identification. The UOW context is passed to the Substation ES IMS Interface and provides the context ID in the state-data segment of the OTMA message prefix.

Substation ES OTMA Interface

The layout of OTMA messages is shown below:

Figure 17 Substation ES IMS Interface OTMA Message Layout



Communication information passed between the Substation ES IMS Interface and the OTMA server is contained within an OTMA message. Refer to the *IMS/ESA OTMA Guide and Reference* for a detailed information about the OTMA message segments. An overview of the OTMA message segments:

Prefix

- Message-control information segment must be provided for every message.
- State Data segment contains transaction-related information and has different formats.
- Security Data segment is mandatory for every transaction or command.
- User Data segment is variable length and is managed by the Substation IMS OTMA Interface

Application Data

- Can be either a valid IMS command or a transaction. The data in this segment is unchanged by the receiver (OTMA server), and is transmitted directly to an application that can obtain or send the data in the IO-Area using DL/I calls.

IMS Interface Message Summary

OTMA Messages

- Messages entering IMS from OTMA contain both the OTMA message prefix and other defined IMS message prefixes. Excluding the user data section, the OTMA message prefix can become very large, sometimes over 200 bytes in length. The OTMA message prefix, including the user data section, is stored on IMS message queue data sets that increases usage of the queue buffer pool.

Application Messages

- The current maximum size of a Substation ES message passed from and to the IMS Interface message is 32K – 512 bytes

IMS Applications

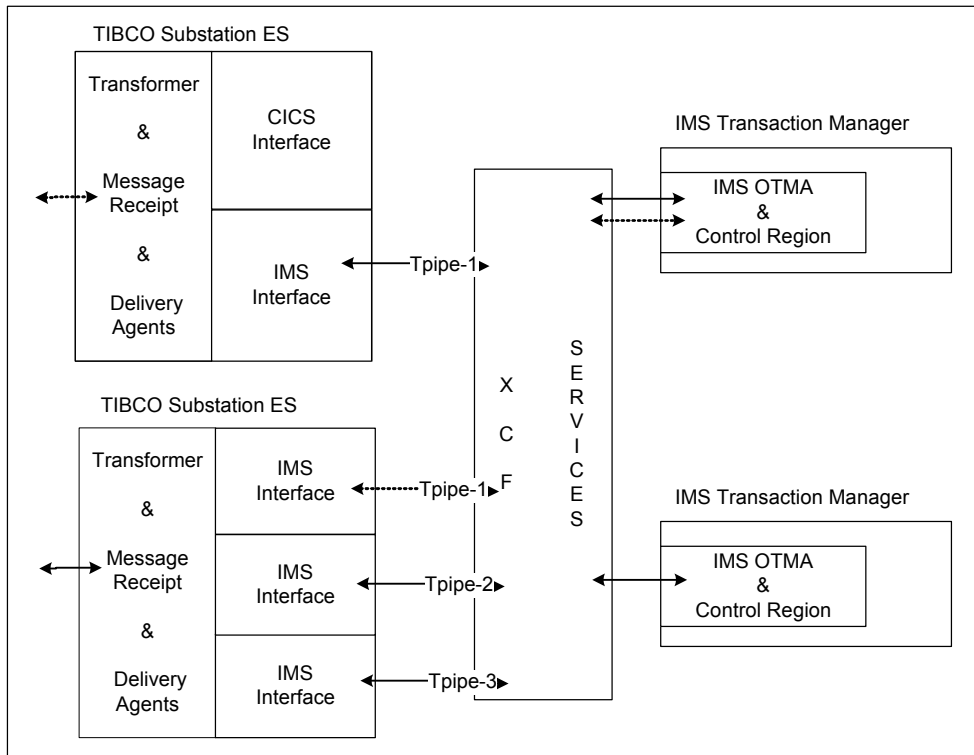
- Existing Fast Path application programs can be executed using OTMA, and these must run as send-then-commit transactions.
- Parameters with the OTMA transaction that contradict this commit mode cause the transaction to be rejected.
- IMS performs uppercase translation. The ULC keyword must be specified on the transaction definition if lowercase characters are to be preserved

IMS Interface Deployment

Substation ES and the IMS Interface can be deployed in a variety of ways to suit system, application and workload requirements. The following are possible configurations:

- One Substation ES region can start and communicate with various non-related host-side Interfaces. For example a CICS and IMS interface can be active within a single Substation ES.
- The IMS Control Region and Substation ES can each reside in the same or an adjacent LPAR as long as XCF communicates with both LPARs.
- Substation ES can communicate with many IMS Interfaces and therefore can communicate with multiple IMS Control Regions.
- When multiple IMS Interfaces are started for the same Substation ES, each IMS Interface can communicate with the same or different IMS Control Regions.

Figure 18 IMS Interface Deployment



Constraints and Configuration

IBM OTMA API

A primary reason the Substation ES Interface does not use the standard IBM supplied OTMA API is that the OTMA Callable Interface does not support the commit-then-send option of IMS OTMA protocol. The resynchronization feature of IMS OTMA is also not supported.

Substation ES IMS Interface

Requirements

To initialize and install the Substation ES IMS Interface, OS/390 V2R10 or above, z/OS V1.6 and above, and IMS 8.1 or later are required.

Naming Conventions

OTMA places a restriction on the naming of either a client or a transaction pipe. Refer to the *IMS/ESA OTMA Guide and Reference* for a full list of naming conventions that must be adhered to.

Current Substation ES IMS Interface Restrictions

These restrictions are applicable for all versions of the Substation ES IMS Interface.

- The commit-then-send option of IMS OTMA is not supported.
- IMS outbound messages (Triggers) cannot be multi segmented.
- The message resynchronization feature of IMS OTMA is not currently supported.

Advantages of the Substation ES IMS Interface

- The Substation ES IMS Interface is easy to install and operate, including implementing applications using this facility.
- No coding (Non-Intrusive) or only minor changes (Intrusive) can be needed to activate and use the Substation ES IMS Interface with existing applications.
- Extracts out the details of OTMA and XCF.
- Submits IMS transactions and commands and receives IMS reply messages.
- Enables programs running on non-IBM platforms and from other z/OS subsystems to connect to multiple IMS servers or regions.
- Flexible and scalable.

Chapter 4 **Advanced Deployments**

This chapter discusses using Substation ES in a z/OS SYSPLEX environment. Two topics are considered – the operation of Substation ES and its usage of TIBCO Enterprise Messaging Service (EMS), and Substation ES's interaction with CICS.

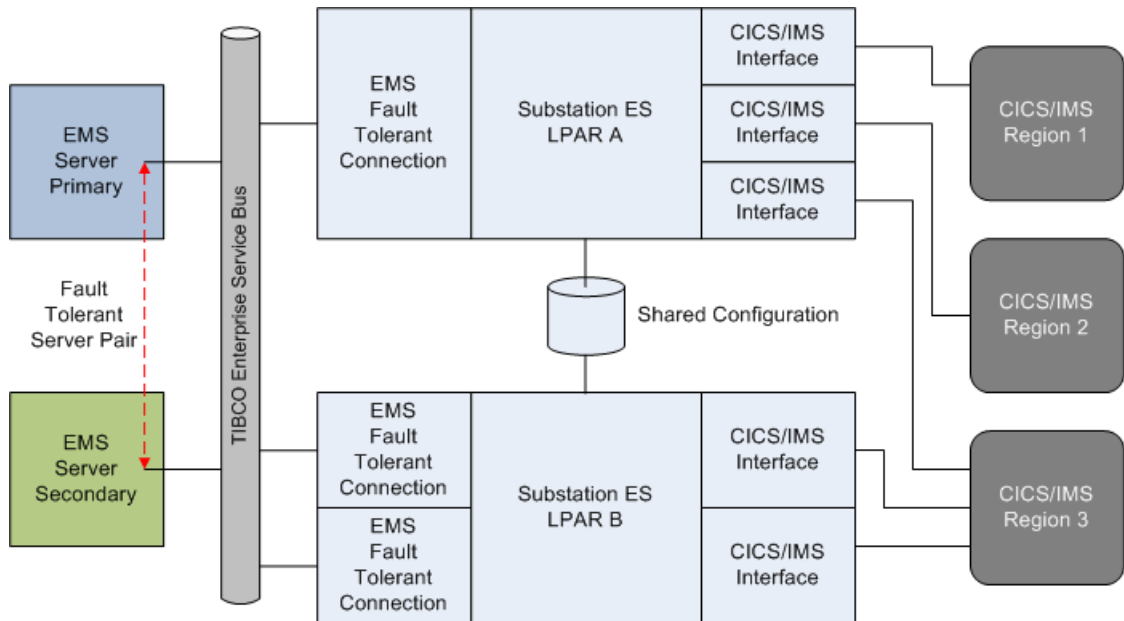
Topics

- [Fault Tolerance with Load Balancing, page 48](#)
- [SYSPLEX, page 51](#)
- [Multi-CICS Environment, page 54](#)

Fault Tolerance with Load Balancing

Substation ES runs as a separate address space in z/OS. It communicates with TIBCO EMS servers, and as such operates as an EMS client. It can be configured to talk to a single EMS server, multiple EMS servers, a Fault Tolerant (FT) EMS pair, or all of the above (where each can be configured separately within a single address space). The CICS and IMS interfaces allows Substation ES to talk to one or more back-end systems. This means that many configuration permutations are possible.

Figure 19 Fault Tolerance with Load Balancing



Implementation

A pair of EMS servers working in parallel provides a single EMS Server view with no loss of service if either server fails.

The EMS servers can be placed on different subnets so a failure of one subnet will not cause loss of service.

Configure multiple Substation ES address spaces (in different LPARs) sharing the same service configuration, each listening to the same EMS queues. If Substation ES A gets a message from an EMS queue, and does not respond with a reply (as would happen if Substation ES A, or LPAR A fails), the EMS server will retain the message on the queue and give it to the next "listen" from Substation ES B. From the business view, there is no loss of service.

The CICS regions can be AORs, TORs (with AORs behind them) or TORs in a CICSplex.

- If Substation ES is interfacing with AOR CICS and the CICS address space fails (not the transaction, but the address space), Substation ES will disable all recipes associated with the CICS address space and stop listening to the queues defined in the recipes. If other recipes are in the Substation ES A or B define processing of a queue for another CICS address space, then that process will continue to handle messages.
- If Substation ES is interfacing with TOR CICS or TOR in a CICSplex, then fault tolerance must be build into those environments

Issues

Both Substation ES address spaces are processing messages. This configuration is an ACTIVE - ACTIVE setup. Substation ES does not support an ACTIVE - PASSIVE setup where one Substation ES does all the processing and the other gets control when there is an outage.

Substation ES currently does not do CICS dynamic routing. Recipes are dedicated to a back end system (BES) but the ability to override the BES designation by specifying properties or information on the input message is possible. Dynamic routing of CICS transactions and programs via Substation is possible and supported by a CICS TOR-AOR setup or a CICSplex.

Load Balancing with EMS

Internally, Substation ES has its own dispatching based on the MAXUOW configuration parameter and on the service payload. The MAXUOW parameter specifies the maximum concurrent activities Substation ES can perform at any point. This, together with EMS load balancing servers and connection factories, is the way load balancing is typically performed, and overhead for some of these operations occurs where the payload for a service originates.

There are two limitations to the EMS / Substation ES load balancing techniques:

- Do not specify load balancing in situations with durable subscribers. If a client program, that creates a durable subscriber, connects to Server A using a load-balanced connection factory, then Server A creates and supports the

durable subscription. If the client program exits and restarts, and this time connects to Server B, then Server B creates and supports a new durable subscription. However, pending messages on Server A remain there until the client reconnects to Server A.

- Do not specify load balancing when your application requires strict message ordering. Load balancing distributes the message load among multiple servers, which inherently violates strict ordering.

Limiting the Resources Substation ES Consumes in a CICS Region

Each Substation ES interface has a worker parameter that represents the number of concurrent tasks it dispatches to perform activities for its related work. In the CICS Interface it is associated with concurrent connections to a CICS region. Specify the appropriate number of workers for the resources available and the workload that need to be performed. A value of between 10 and 25 is normally adequate.

Monitoring Transaction Execution and Queues

If there is a shortage of specified workers, or resources are not available to execute transactions, requests are queued internally and the MAXUOW limit will eventually be reached. Internal Substation ES logic will slow down in the asynchronous inputs causing the backlog and issue appropriate STRESS level messages. Use the operational command SHOW,UOW to determine if any excessive queue waits have occurred.

SYSPLEX

The architectural operations of Substation ES are compliant with the SYSPLEX environment but do not use SYSPLEX features. For instance, the load balancing features of a SYSPLEX are redundant for Substation ES, since this is achieved within the configuration and operations of Substation ES communications together with the TIBCO EMS architecture.

TIBCO EMS supports the message queue and broadcast topic messaging structures (represented here in very simplistic terms; for detailed information, please refer to the appropriate EMS documentation). Queues are used for higher latency applications, while topics are generally used for broadcast, administrative and low latency applications. A message queue is exactly as it sounds - a series of messages held in a queue. Queues can be persistent or non-persistent. A topic is type of message that is broadcast to all clients who are listening to the particular topic, or have expressed interest in listening to a particular topic (known as durable subscribers). Topics are always non-persistent, except in the case of a durable subscriber, where the message is kept until the subscriber consumes the message.

Substation ES supports these messaging techniques, which are activated by dynamic configuration. However, when multiple Substation ES instances share the same configuration file (repository), the following considerations are notable:

- **Queues** – where there are two or more Substation ES instances picking up messages from a single queue, each message will only be consumed once by an instance of Substation ES.
- **Topics** – topics differ from queues in that a message to a topic is processed by all of the consumers currently active in all connected Substations. Where there are multiple back-end systems, and each needs to process the same message, this is obviously advantageous. However, where there is a single CICSplex, the same message could be processed multiple times.

The group construct within Substation ES provides a way for a single connection service to consume topic messages in a shared configuration environment.

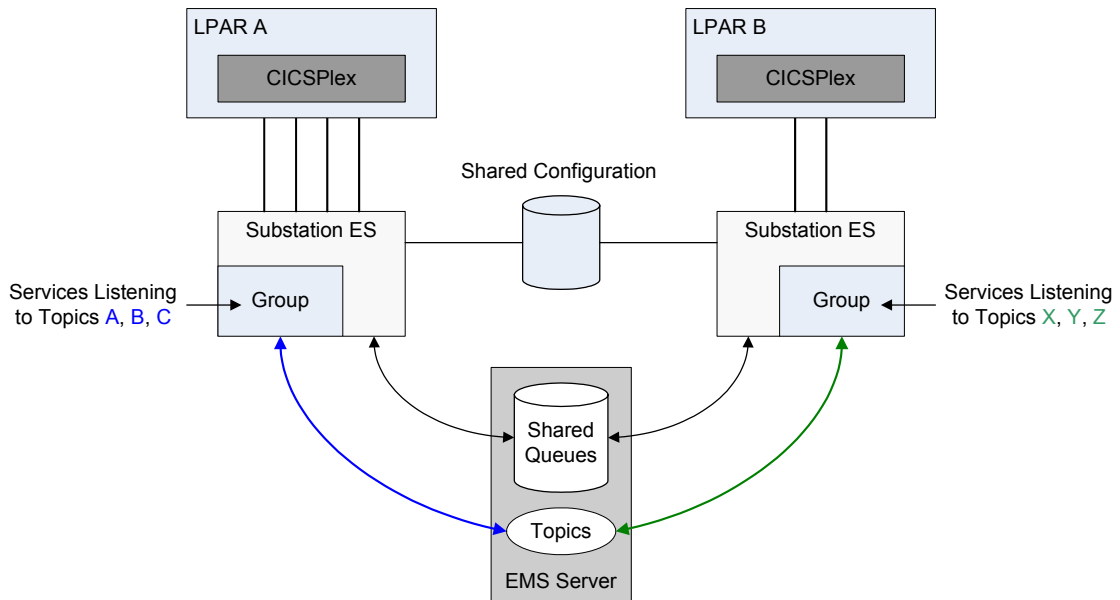
Where there is a SYSPLEX and a CICSplex across multiple LPARS, a common approach is to have two or more Substations processing messages (with a common configuration file). These Substations can be configured in two ways: both active, but each only processing its own messages, or one running and the other a standby, configured but not running. When a failure is detected, the standby is started to process the messages that were destined for the failed Substation.

During a failover or restart of a Substation ES instance, messages that are produced using topics are not lost if the Substation ES consumer service is registered as a durable subscriber. Topic consumers that are not durable will only receive messages when they are enabled.

CICSplex Environment

The following diagram shows a sample configuration of Substation ES in a PLEX environment:

Figure 20 Substation ES in a PLEX Environment



Transactional and event driven processing interruption is normally less than 10 seconds during a Substation ES switchover period, assuming all components the Substation ES connects to and communicates with have been started and are available for processing.

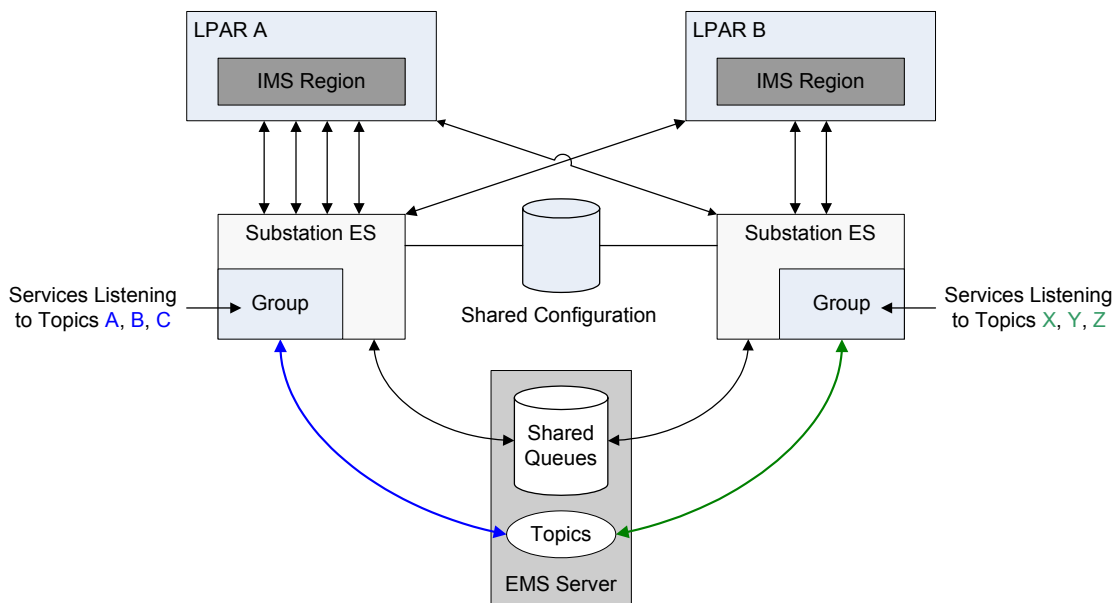


For additional details, see "Substation ES in a CICSplex Environment" in *TIBCO Substation ES Operations and Administration*.

IMS SYSPLEX Environment

The following diagram shows a sample configuration of Substation ES in an IMS SYSPLEX environment:

Figure 21 Substation ES in an IMS SYSPLEX Environment



Transactional and event driven processing interruption is normally less than 10 seconds during a Substation ES switchover period, assuming all components the Substation ES connects to and communicates with have been started and are available for processing.

Multi-CICS Environment

Substation ES interacts with CICS in a number of ways, and the CICS features Substation ES uses depend on how it is configured. There are also considerations pertaining to the applications that are interacted with, and whether they are CICSplex conformant.

There are many scenarios in which Substation ES can be used in a CICSplex. These scenarios are not dependant on the features of Substation ES itself, but take advantage of the fact that Substation ES is simply an EXCI client using MRO capabilities. As such, Substation ES can leverage the way a CICS system is configured.



For additional information on CICSplex, see "Substation ES in a CICSplex Environment" in *TIBCO Substation ES Operations and Administration*.

Scenarios

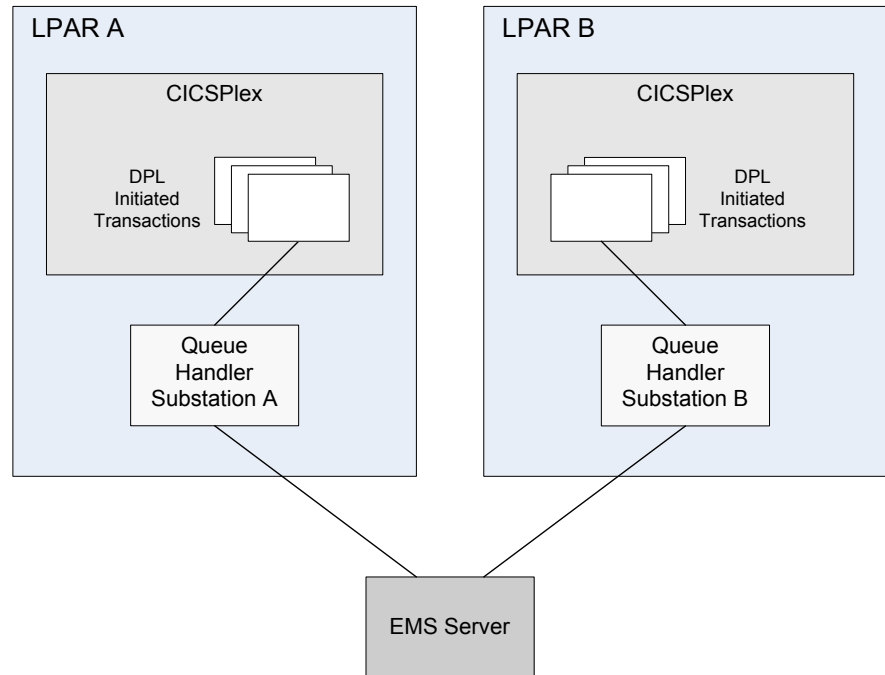
For transactions that have some form of application AOR affinity, Substation ES should be configured as with a standalone CICS system. For the transactions that are able to run in a CICSplex, the following are some of the scenarios that exist:

- [Externally Initiated Request or Request/Reply](#)
- [Externally Initiated "Fire & Forget" \(External Transaction Start\)](#)
- [Externally Initiated "Fire and Forget" to TD or TS Queue](#)
- [CICS to TD Queue \(CICS Initiated "Fire and Forget"\)](#)
- [CICS Initiated Request Reply](#)

Externally Initiated Request or Request/Reply

In this scenario, there is a Substation ES in each z/OS LPAR, each Substation ES uses EMS messaging via queues, and connections to CICS use the VTAM Generic APPLID. Any active Substation ES can pick up messages from the server for processing. In the event a Substation ES or LPAR fails, a second Substation ES instance will continue to process messages from the queues.

Figure 22 Externally Initiated Request or Request/Reply



Externally Initiated "Fire & Forget" (External Transaction Start)

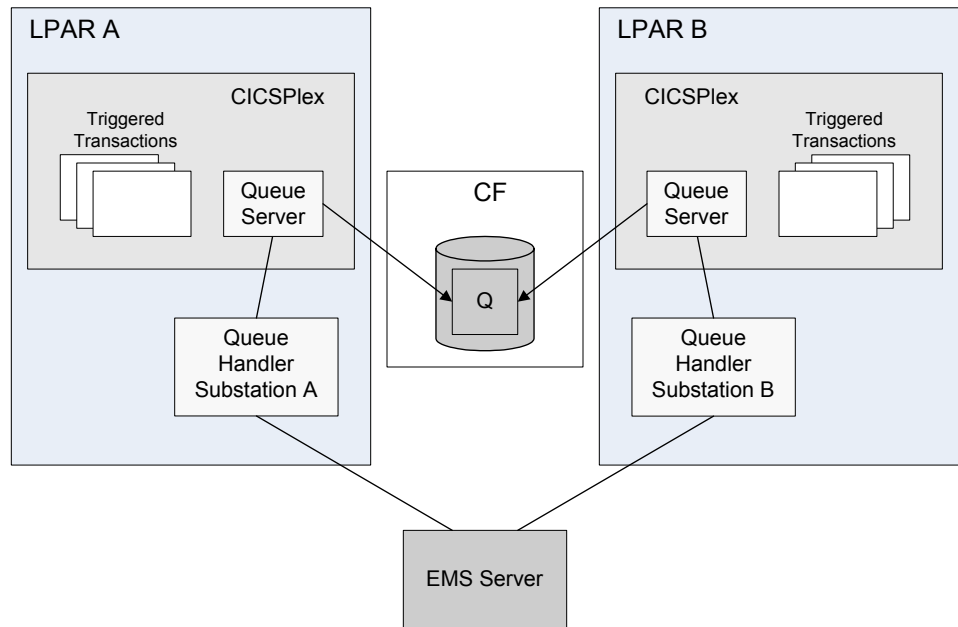
Same architecture as the previous scenario, except that CICS transactions are invoked via a START.

Externally Initiated "Fire and Forget" to TD or TS Queue

Same architecture as the previous scenarios except that the inbound data is written to a CICS TS / TD Queue. TD Queues can be local to that AOR, or shared with another AOR.

You can create a dual-purpose definition of that resource in a CSD file that is shared by the local and remote systems. This reduces disk storage and maintenance, because only one CSD file record is required for each shared resource.

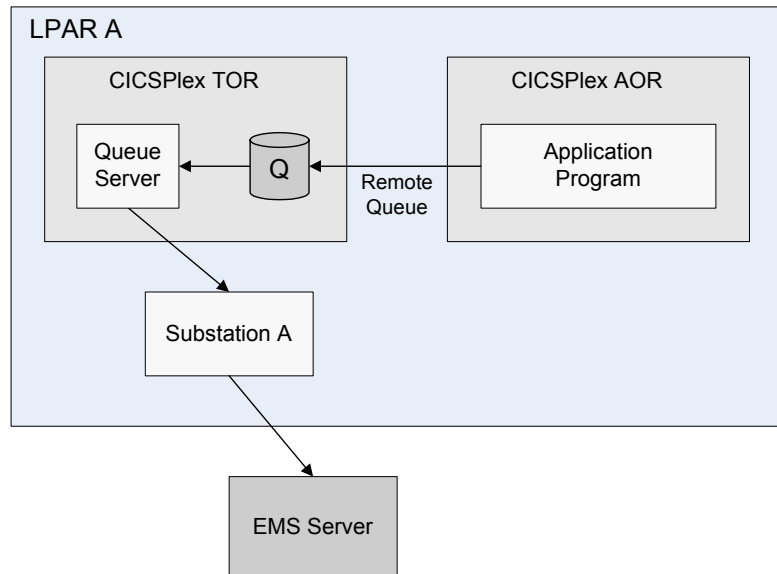
Figure 23 Externally Initiated to TS/TD Queue



CICS to TD Queue (CICS Initiated "Fire and Forget")

A CICS application writes data to "publish" to a TD Queue. The Substation ES queue server is initiated within the CICSplex in the region to which that Substation ES is connected. Substation ES picks up the message and publishes it to EMS.

Figure 24 CICS Application to TD Queue

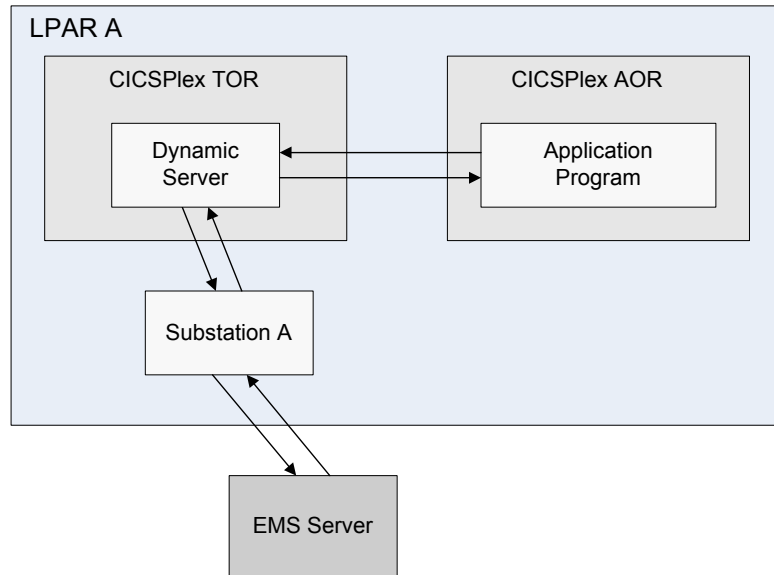


CICS Initiated Request Reply

A CICS program initiates an external request that expects a response. It does this by Linking to a supplied CICS program that passes the COMAREA to Substation ES, then waits for a response (for a pre-defined time).

At present, this scenario causes an affinity between the initiating CICS application program and the Substation ES handling the request.

Figure 25 CICS Application Initiated Request Reply



Glossary

A

Asynchronous processing

A means of distributing the processing of an application between systems in an intercommunication environment. The processing in each system is independent of the session on which requests are sent and replies are received. No direct correlation can be made between requests and replies and no assumptions can be made about the timing of replies.

APF (Authorized Program Facility)

A facility that enables identification of programs that are authorized to use restricted functions.

Audit trail

A manual or computerized means for tracing the transactions affecting the contents of a record.

B

Back End System

The CICS or IMS transaction processing system provided by IBM.

Batch processing

Type of data processing in which a number of input items are grouped for processing serially with a minimum of operator intervention and no end-user interaction. (2) Serial processing of computer programs. (3) Pertaining to the technique of executing a set of computer programs so that each is completed before the next program of the set is started.

BMP (Batch Message processing Program)

An IMS batch processing program that has access to online databases controlled by DBCTL and message queues. BMPs run online, but like programs in a batch environment, they are started with job control language (JCL).

C

CEMT

A CICS transaction that invokes all the master terminal functions. These functions include inquiring and changing the value of parameters used by CICS, altering the status of system resources, terminating tasks, and shutting down CICS

CICS (Customer Information Control System)

IBM's general-purpose online transaction processing (OLTP) software is an e-business, industrial-strength, server for mission-critical applications. It is a layer of middleware that integrates all the basic software services required by OLTP applications together with a rich set of resources and management services in a highly available, reliable, and scalable manner, enabling its customers to concentrate on the tasks relevant to their particular business

COBOL (Common business-oriented language)

An English-like programming language designed for business data processing applications.

Cold Start

The standard initialization sequence performed by the TIB z/OS Substation initialization program. In a cold start, all resource definitions are refreshed. Resources dynamically installed or changed by the operations or XML Interface in a previous execution are lost.

COMMAREA (Communication area)

A CICS area that is used to pass data between tasks that communicate with a given terminal. The area can also be used to pass data between programs within a task.

Console

An input/output device on a computer, reserved for communication between the computer operator or maintenance engineer and the computer.

Coupling Facility

A special logical partition that provides high-speed caching, list processing, and locking functions in a sysplex.

D

DCB (Data Control Block)

An MVS control block used by access method routines in storing and retrieving data.

DCUI (Data Configuration User Interface)

The user interface in which data transformation are configured.

DPL (Distributed Link Request)

A facility that allows a CICS client program to call a server program running in a remote CICS region, and to pass and receive data using a communications area.

Dump

A representation of the contents of selected areas of main storage used to find out whether a program is functioning as intended and to analyze problems.

E

ECB (Event Control Block)

An MVS or VSE control block that represents the status of an event.

ESTAE (Extended Specify Task Abnormal Exit)

An ESTAE is a recovery routine to which the system passes control when an error occurs in the mainline routine. The recovery routine's objective is to intercept the error and potentially perform one or more tasks:

EXCI (External CICS Interface)

(CICS Transaction Server only.) A CICS application programming interface that helps to make CICS applications more easily accessible from non-CICS environments.

F

Function

A specific purpose of an entity, or its characteristic action.

G**GTF (Generalized Trace Facility)**

In MVS, a trace data-collection routine. GTF traces the following system events: seek addresses on START I/O records, SRM activity, page faults, I/O activity, and supervisor services. Execution options specify the system events to be traced.

H**Heuristic Decision**

A decision that enables a transaction manager to complete a failed in-doubt unit of work (UOW) that cannot wait for re synchronization after recovery from the failure.

Under the two-phase commit protocol, the loss of the coordinator (or loss of connectivity) that occurs while a UOW is in-doubt theoretically forces a participant in the UOW to wait forever for re synchronization. While a subordinate waits in doubt, resources remain locked and, in CICS Transaction Server for z/OS, the failed UOW is shunted pending resolution.

I**IMS (Information Management System)**

A database manager used to allow access to data in DL/I databases. IMS provides for the arrangement of data in an hierarchical structure and a common access approach in application programs that manipulate IMS databases.

J**JCL (Job Control Language)**

Control language used to describe a job and its requirements to an operating system.

L**LUW (Logical Unit of Work)**

A sequence of processing actions (database changes, for example) that must be completed before individual actions can be regarded as committed. When changes are committed (by successful completion of the LUW and recording of the syncpoint on the system log), they do not need to be backed out after a subsequent failure of the task or system. The end of an LUW is marked in a transaction by a syncpoint, issued either by the user program or by CICS/IMS at the end of task. In the absence of user syncpoints, the entire task is an LUW.

M**MPP (Message Processing Program)**

A region used for processing IMS messages.

MVS (Multiple Virtual Storage)

An operating system for processing systems consists of one or more mainframe processors.

Multitasking

Concurrent execution of application programs within a CICS region.

Multithreading

Use, by several transactions, of a single copy of an application program.

O**OTMA**

IMS Open Transaction Manager Access. A transaction-based, connectionless client/server protocol. The simplified four layer model is often used in descriptions of UNIX networks. In the four layer model, OTMA is the process layer. In the Open Systems Interconnecting (OSI) model, OTMA is the session layer. It can be best to think of OTMA as a combined session and transport layer.

P**Parameter (ISO)**

A variable that is given a constant value for a specified application and that can denote the application. (2) Data passed between programs or presented to a program at startup

Pipe

A one-way communication path between a sending process and a receiving process.

R**RACF (Resource Access Control Facility)**

An IBM program that provides for access control by identifying and verifying users to the system, authorizing access to protected resources, logging detected unauthorized attempts to enter the system, and logging detected accesses to protected resources.

Routine

A program or sequence of instructions called by a program. Typically, a routine has a general purpose and is frequently used.

RRS (Resource Recovery Service)

The z/OS system component that provides the services that a resource manager calls to protect resources. RRS is the z/OS system level syncpoint manager.

S**SAF**

The system authorization facility (SAF) is part of the operating system and conditionally directs control to RACF, if RACF is present, or to a user-supplied processing routine, or both, when receiving a request from a resource manager

Sysplex

A set of MVS systems communicating and cooperating with each other through certain multi-system hardware components and software services to process customer workloads. See also MVS system, parallel sysplex.

T**Transaction**

A unit of application data processing (consisting of one or more application programs) initiated by a single request, often from a terminal. A transaction can require the initiation of one or more tasks for its execution.

U

UOW (Unit of Work)

A sequence of processing actions (database changes, for example) that must be completed before individual actions performed by a transaction can be regarded as committed. After changes are committed (by successful completion of the UOW and recording of the syncpoint on the system log), they become durable, and are not backed out in the event of a subsequent failure of the task or system.

UOW (In-doubt work unit)

In CICS/ESA and IMS/ESA, a piece of work that is pending during commit processing; if commit processing fails between the polling of subsystems and the decision to execute the commit, recovery processing must resolve the status of work units that is in doubt.

V

VSAM (Virtual Storage Access Method)

An access method for direct or sequential processing of fixed-and variable-length records on direct access devices.

X

XCF (Cross System Coupling facility)

XCF is a component of MVS that provides functions to support cooperation between authorized programs running within a sysplex.

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