International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# CICS Communication Frameworks: Deep Dive into Intercommunications and External Interfaces

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**Abstract:**
Customer Information Control System (CICS) is a core OLTP (Online Transaction Processing) server on IBM's z/OS environment. It enables high-volume, high-performance transaction processing that businesses depend on every day.
Interactions between CICS regions, other z/OS subsystems, and external or remote applications form the backbone of enterprise-grade mainframe systems. With the growing footprint of distributed applications, there is an increasing need for CICS interactions. These CICS interactions are important because most core business logic and data still live on the mainframe, and surrounding distributed applications depend on CICS to complete their work.
CICS provides flexible and reliable communication methods, offering protocols and interfaces that meet modern enterprise environments' changing demands.
This paper explores the communication options available with CICS in different contexts: multi-region setups, connections to non-CICS applications on z/OS, and communication with external systems.

**Keywords:** CICS; z/OS; multi-region operation (MRO); intersystem communication; SNA; IPIC; TCP/IP; EXCI; DSNACICS; DB2 stored procedure; mainframe; remote communication.

## INTRODUCTION

CICS has evolved to support increasingly complex and distributed enterprise architectures. Modern implementations require robust interaction frameworks between multiple CICS regions, subsystems residing on z/OS, and external or remote applications. The increase in distributed workloads, driven by microservices, APIs, and modern application platforms, has accelerated the evolution of CICS connectivity. CICS continues to serve as the backbone for mission-critical workloads while providing flexible and adaptable connectivity techniques to support the demands of distributed and cloud-native applications.
At a high level, CICS communications can be classified into two sections depending on where the counterpart is located and how the communication is happening.

- **Intercommunications**:
- Multiregion communication happens between the CICS regions on the same MVS image or in the same MVS complex and can communicate with each other. [1]
- Intersystem communication happens with other CICS regions or non-CICS systems with similar communication capabilities across different systems. [1]
- CICS provides several methods to facilitate these inter-system communications. [1]
- IBM also provides several options to communicate with other z/OS applications, such as DB2 stored procedure calls, triggering a batch job on z/OS, etc.
- **External Interfaces:**
- CICS provides several external interfaces to make the CICS application services available to various external users. [1]

This paper reviews both intercommunications and external communications that CICS offers, detailing different options for each type of communication.

**Intercommunications**

While CICS can be a single system with all the required data resources and terminals, in practice, CICS will not be a single system, and we will sever other CICS and non-CICS systems working together to form a platform, especially for complex banking and healthcare platforms. This multiple-system environment provides better domain isolation. In a multi-system environment, CICS can communicate with other systems with similar communication facilities; this communication between CICS and other systems is called intercommunication. [1]

**Intercommunication Facilities**

Before exploring different options to establish inter-system communications, this section will explore different facilities provided by CICS that the systems can benefit from using the intercommunications between systems.

- **Function Shipping**: Function shipping in CICS provides an application program with access to resources to which another CICS system has access. [1] Below remote resources can be accessed using function shipping:
- VSAM or BDAM file resources that are located on a remote CICS system. [1]
- IMS Database Manager (IMS DM) or DL/I databases associated with a remote CICS Transaction server or VSE system. [1]
- Send data and receive data from temporary storage queues located on remote systems. [1]
- Access to intrapartition or extrapartition transient-data queues on remote systems. [1]
- **Asynchronous processing**: Asynchronous processing allows a CICS transaction to initiate a transaction in a remote system and to pass data to it. The reply is not returned to the task that initiated the remote transaction, hence the name asynchronous processing. For example, CICS transactions can use 'EXEC CICS START' in remote CICS regions using MRO, ISC, or IPIC to start transactions asynchronously in a remote CICS system. [1]
- **Transaction routing**: Transaction routing allows a transaction and an associated terminal to be owned by a different CICS region. It can take various forms, as below:
- A terminal owned by one CICS region can run a transaction owned by another CICS region. [1]
- A transaction started by automatic transaction initiation (ATI) can acquire a terminal owned by another CICS system. [1]
- A transaction running in one CICS region can allocate a session to an APPC device owned by another CICS region. [1]
- **Distributed Program Link (DPL)**: A CICS distributed program link enables a CICS program (the client program) to call another CICS program (the server program) in a remote CICS region. Below are some of the benefits of DPL:
- DPL helps isolate the user interface layer from the business application. [1]
- DPL also obtains performance benefits by running programs closer to the resources they access. [1]
- DPL offers a simple alternative to writing distributed transaction processing (DTP) applications. [1]
- **Distributed transaction processing (DTP)**: CICS through DTP allows a CICS transaction to communicate with a transaction running in another system. This process of distributing the functions of a transaction over several transaction programs within a network is called distributed transaction processing (DTP). The transactions are designed and coded specifically to communicate with each other, thereby using the intersystem link with maximum efficiency. From the CICS point of view, the communication in DTP is synchronous, which means that it occurs during a single invocation of the CICS transaction and that requests and replies between two transactions can be directly associated. [1]

**Intercommunication Types**

Through intercommunication facilities available, CICS allows the implementation of different types of distributed transaction processing across various systems. [1] This section details the different available intercommunication methods and the respective intercommunication facilities available through each method.

**Multiregion Operation (MRO)**

Multiregion operation (MRO) allows intercommunications between the CICS regions in the same MVS image or the same MVS sysplex. MRO does not support communication between CICS and non-CICS systems, such as IMS. [1]

The external CICS Interface (EXCI) uses a special form of MRO link to support the below use cases:

- Communication between MVS batch programs and CICS region. [1]
- DCE (Distributed Computing Environment) remote procedure calls to CICS programs. [1]

MRO doesn't need any networking setup. CICS supports region-to-region communication, which is called interregion communication (IRC). [1]

IRC can be implemented in three ways:

- Using the CICS-supplied interregion program (DFHIRP) loaded in the link pack area (LPA) of MVS and through the support in CICS terminal control management modules. DFHIRP has to be started by a type 3 supervisor call (SVC). For convenience, this implementation of multiregion operation is called MRO(IRC) because you select it by specifying ACCESSMETHOD(IRC) on the CONNECTION definition.
- The MVS cross-memory (XM) services can be selected as an alternative to the CICS type 3 SVC mechanism. In this case, DFHIRP only opens and closes the interregion links.
- Using the cross-system coupling facility (XCF) facility. XCF is required for MRO links between CICS regions in different MVS images of an MVS sysplex.

MRO supports all the base CICS intercommunication facilities as mentioned below [1]:

- Function shipping
- Asynchronous processing
- Transaction routing
- Distributed program link
- Distributed transaction processing

IP Interconnectivity (IPIC)

This option of intersystem communication works over a TCP/IP protocol network and, hence, the name IP interconnectivity or IPIC. [1]

Below are some details about IPIC:

- IPIC connection requirements:
- TCP/IP service needs to be activated in the participating CICS regions. [1]
- IPCONN resource should be defined with the outbound connection link details like IP hostname, port, etc., for the destination connection. [1]
- TCPIPSERVICE resource should be defined with the inbound connection attributes to listen and accept connections from other systems. [1]
- Below is the example setup showing that the CICSA system and CICSB region are connected using IPIC.

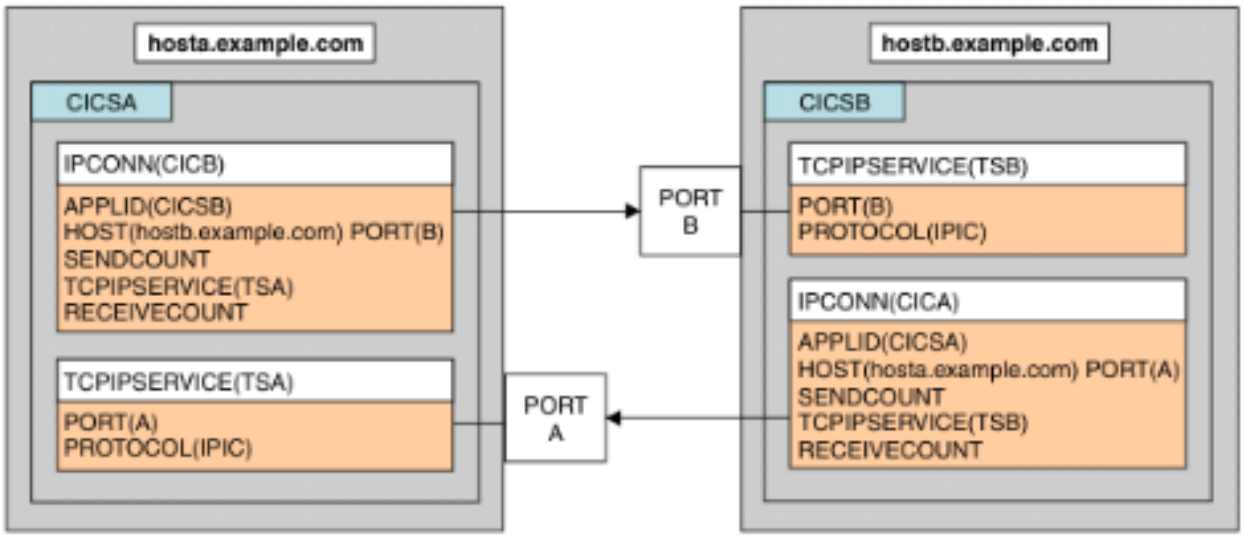


Figure 1: Illustrating IPIC connectivity between two CICS regions. [1]

- IPIC connections support synchronization level 2, full CICS sync pointing, and rollback. [1]
- In CICS TS 4.1 and later, each IPIC connection between CICS regions can use up to two sockets (TCP/IP connections) for redundancy and better throughput. Even in the case of multiple connections, if any of the sockets fails, the entire IPCONN connection is considered broken. [1]
- Starting from CICS 5.2, IPIC can also be set up as a highly available cluster connection option by using the z/OS communication server to establish the HA cluster of regions. [1]

Below are different intercommunication facilities available using IPIC:

- Distributed Program Link (DPL). [1]
- Asynchronous processing. [1]
- Transaction routing of 3270 terminals, where an APPLID uniquely identifies terminal-owning-region (TOR). [1]
- Enhanced transaction routing between CICS regions. [1]
- ECI requests from CICS transaction gateway 7.1 or later. [1]
- Function shipping of all file control, transient data, and temp storage requests between CICS regions 4.2 or higher. [1]
- Threadsafe processing for the mirror program and LINK commands in CICS TS 4.2 or later. [1]

**Intersystem Communication (ISC) over SNA**

CICS provides intercommunications facilities for intersystem communication over SNA (ISC over SNA). ISC over SNA implements the IBM Systems Network Architecture (SNA), which defines data formats and communication protocols for communication between systems in a multiple-system environment. You can use SNA between CICS and any other system that supports APPC or LUTYPE6.1 communications. [1] Subsystems can be connected for intersystem communication in three basic forms:

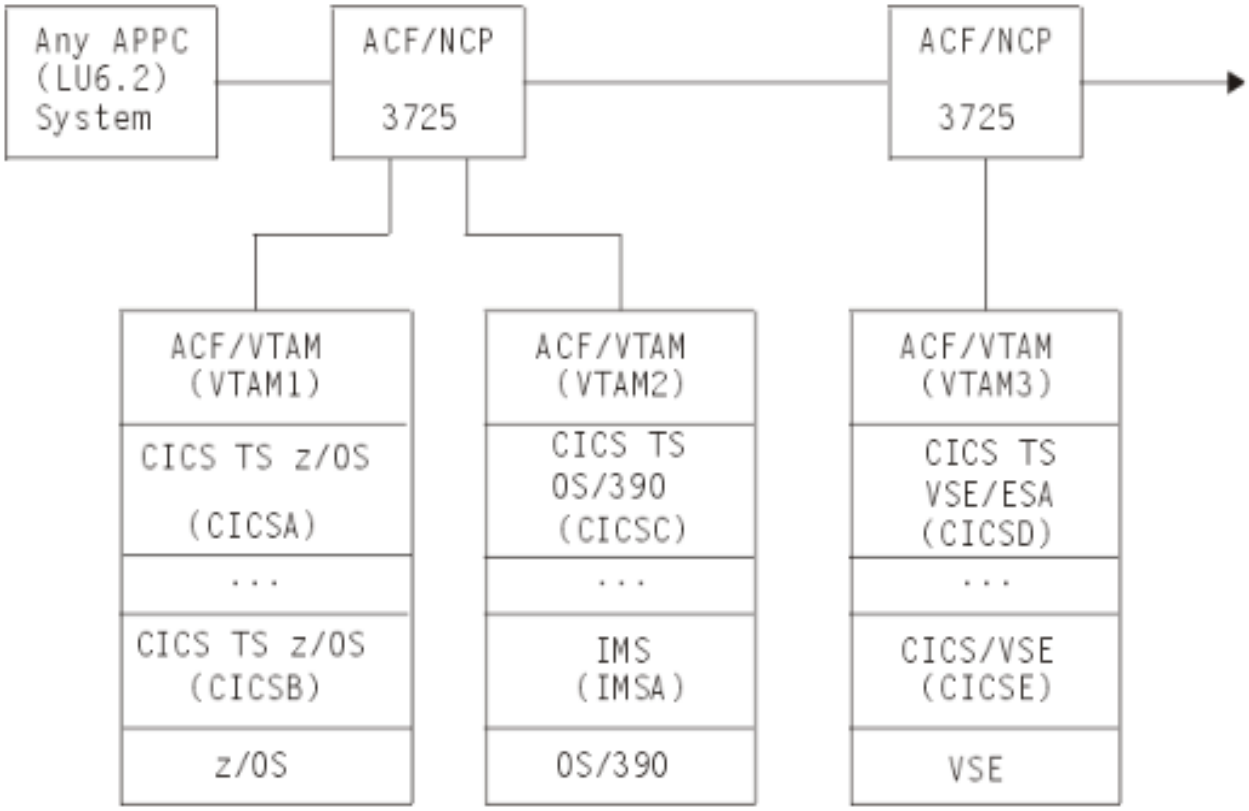


Figure 2: Illustrating different possible ISC connections.

- ISC in a single-host operating system (intrahost ISC) is possible through the application-to-application facilities of ACF/SNA. While we can use intrahost ISC between two or more CICS regions within the same MVS system, it's preferred that MRO be used instead. For example, in the above picture, this option helps establish communication between CICSA and CICSB, CICSC and IMSA, and CICSD and CICSE. [1]
- ISC between physically adjacent operating systems is possible by configuring a multichannel adapter that allows the connection of two SNA domains, for example, VTAM1 and VTAM2, in the above figure. [1]
- ISC between physically remote operating systems is the typical use case for ISC over SNA. For example, in the above picture, CICSD and CICSE can be connected to CICSA, CICSB, and CICSC using this option. [1]

SNA supports all the basic CICS intercommunication facilities as mentioned below [1]:

- Function shipping
- Asynchronous processing
- Transaction routing
- Distributed program link
- Distributed transaction processing

The table below illustrates different CICS facilities and their possibilities using different intercommunication methods:

| | IRC Interregion communication | Intersystem communication over TCP/IP | | Intersystem communication over SNA (using ACF/ z/OS Communications Server) | | | |
|---|---|---|---|---|---|---|---|
| | MRO | IPIC | | LUTYPE6.2 (APPC) | | LUTYPE6.1 | |
| Facility | CICS | CICS | non-CICS (for example, CICS TG) | CICS | non-CICS (for example, CICS TG) | CICS | IMS |
| Function Shipping | Yes | Yes (See note) | No | Yes | No | Yes | No |
| Asynchronous Processing | Yes | Yes (See note) | No | Yes | No | Yes | Yes |
| Transaction Routing | Yes | Yes (See note) | Yes | Yes | No | No | No |
| Distributed program link | Yes | Yes (See note) | Yes | Yes | No | No | No |
| Distributed transaction processing | Yes | No | No | Yes | Yes | Yes | Yes |

Figure 3: Depicting different intercommunication facilities and the CICS facilities available when communicating with other systems.[1]

**External Interfaces**

As shown below, CICS supports several external interfaces through external resource managers or other facilities offered by CICS.

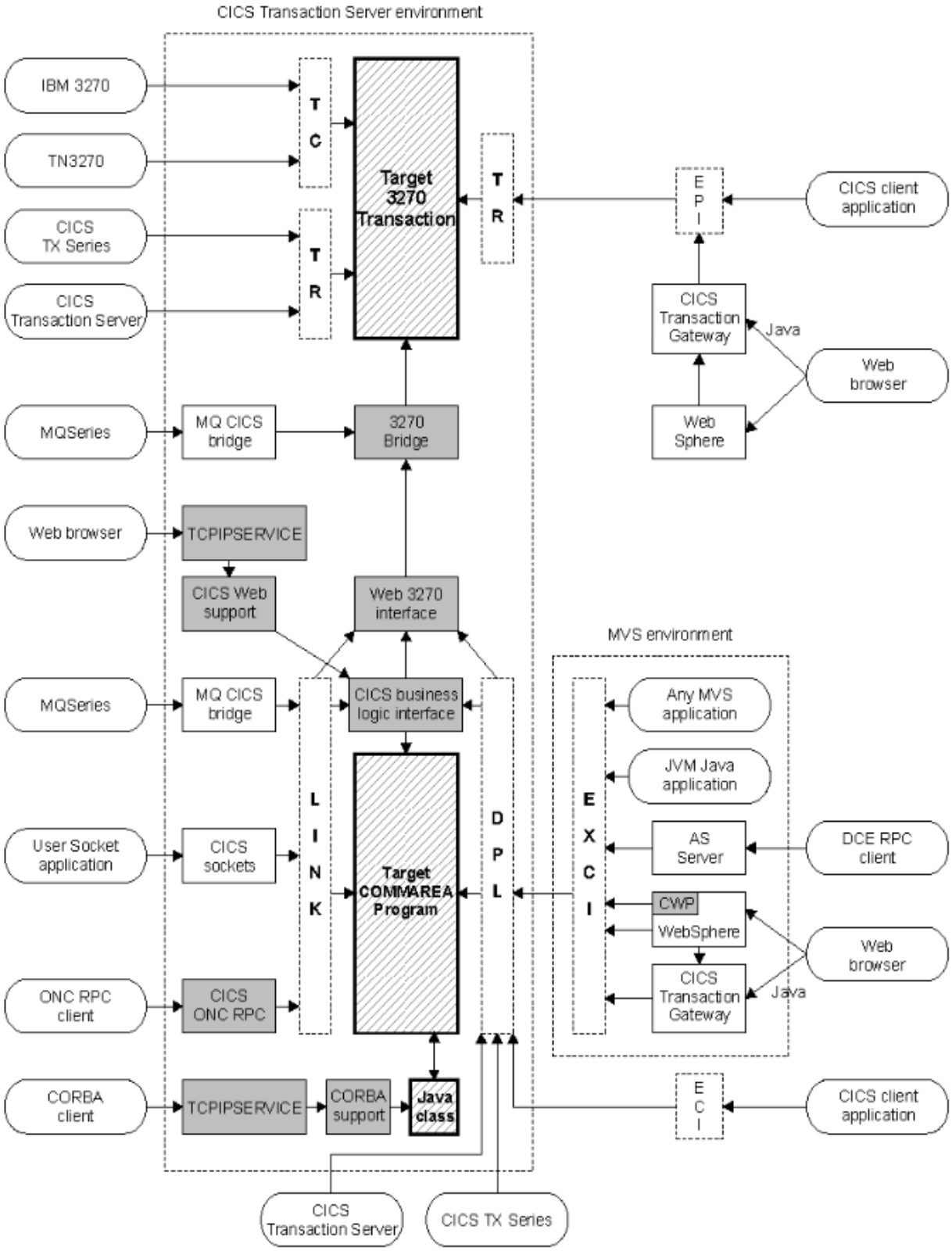


Figure 4: Depicting different external interfaces to access existing business logic. [1]

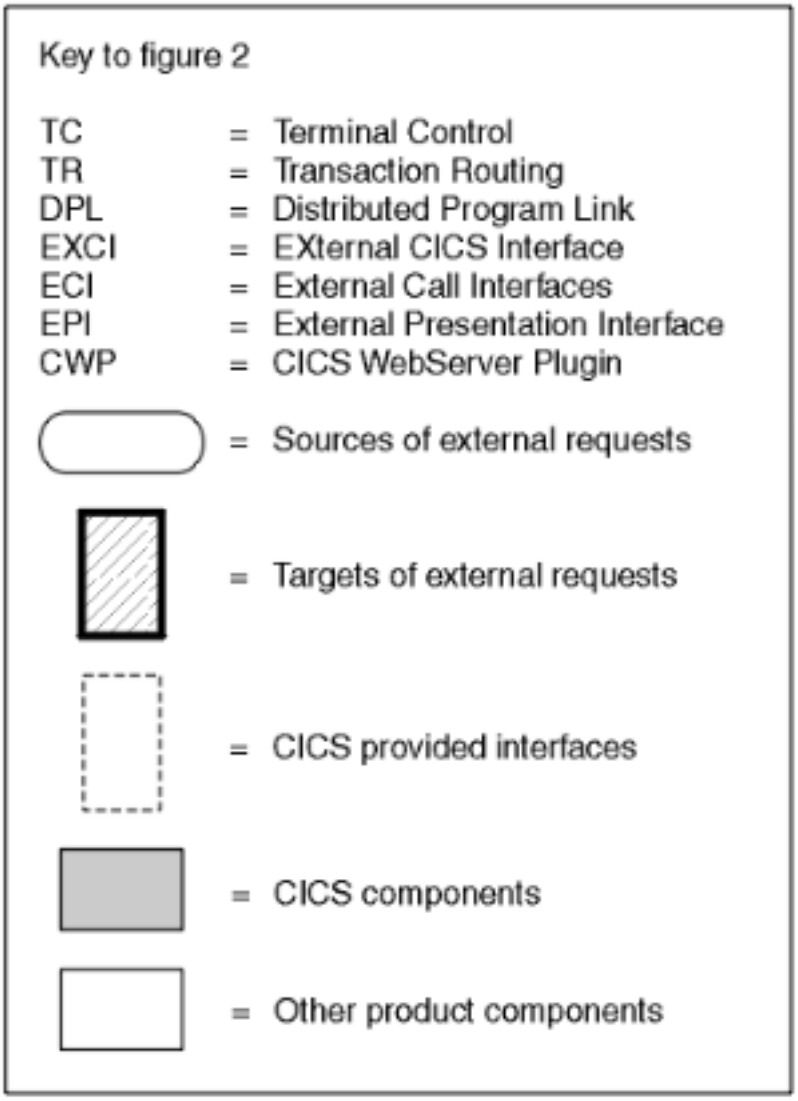


Figure 5: Legend for the above external interfaces picture. [1]

Below are some of the external applications that can communicate with CICS and the respective methods they use:

- **WebSphere MQ**: WebSphere MQ users can use the CICS 3270 bridge to access CICS transactions. [1] [2]
- **MVS Applications:** Applications running in MVS address spaces can use the External CICS Interface (EXCI) to access the CICS program. WebSphere Application Server running on z/OS can communicate with CICS through EXCI (using CTG). [1]
- **ONC RPC clients**: ONC (Open Network Computing) RPC (Remote Procedure Call) is an open-source RPC framework developed by Sun Microsystems. ONC RPC clients can use CICS ONC RPC support to access CICS programs. [1]
- **DCE RPC clients**: DCE (Distributed Computing Environment) is an architecture defined by the Open Software Foundation (OSF). DCE RPC clients use the Application Support (AS) server to access CICS programs. [1]
- **User Socket applications:** User socket applications can use the CICS Sockets feature of the CICS Transaction Server. [1]
- **Web browsers**: CICS provides several options to support web browsers. Some possibilities include CICS web support, IBM WebSphere Application Server for z/OS, and CICS TG (transaction gateway) that can

accept client connections and route them to CICS using EXCI, IPIC, or APPC CICS interconnectivity protocols. [1] [2]

- **Java-enabled Web browsers**: Java-enabled web browsers can use applets that communicate with CICS. Writers of applets can use Java™ classes provided with CICS to construct external call interface (ECI) and external presentation interface (EPI) requests. The web browsers communicate with web servers and the CICS Transaction Gateway. [1]
- **CICS client applications**: CICS client applications can run on various client operating systems and interface with CICS applications using the ECI, EPI, or ESI interfaces provided by CICS Transaction Gateway. [1]
- **CICS programs**: Programs running in CICS servers on any platform can use EXEC CICS LINK to call a CICS program, or transaction routing can be used to send transaction requests to CICS Transaction Server. [1]
- **Telnet clients**: Telnet clients can use TN3270 to start transactions. [1]
- **3270 Users**: Users of the IBM 3270 terminals can start transactions through the terminals. [1]

Overall, the IBM CICS transaction server provides an extensive list of possibilities for interacting and integrating with CICS and non-CICS systems across z/OS and outside of z/OS systems.

## CONCLUSION

CICS remains the backbone for big enterprise transaction processing and running mission-critical workloads, with solid legacy support and high-end API and integration capabilities. CICS interactions are vital to enterprise architecture in large-scale financial, retail, healthcare, and government systems. This paper detailed communication methods within and beyond CICS, covering multi-region configurations, integrations with other z/OS applications, and external communications.

CICS offers various options for different integrations, interfaces, and communications. While multiple possibilities may exist for a particular integration, it is important to understand the different features these possibilities offer and choose the right one that suits the requirements.

## REFERENCES

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