XCF Concepts and Coding: A Multi-system Application Example

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Abstract

The increasing importance of Sysplex enabled applications requires an understanding of XCF (Sysplex Services for Communication). This session illustrates the coding and usage of XCF services within a simple, multi-system application. The following topics will be discussed:

- XCF Concepts: Sysplex, Group and Member
- XCF Services: Group, Signaling and Status Monitoring
- Member attributes and states
- An overview of XCF macros
- Walk-through the code of the XCF sample application

This presentation is primarily intended for z/OS systems programmers and system level developers. It assumes some familiarity with assembly language programming.

Agenda

- Introduction
- Sysplex concepts
- Sysplex services for communication
- XCF Communication Services
- Member Attributes
- Overview of XCF macros
- RXC – the sample multi-system application
- RXC Installation

Introduction

RXC is a package developed to demonstrate XCF operation

- RXC operates as either a single or multi-system application
- The RXC Server performs all XCF related services
- The RXC Server operates in Supervisory State and Key 0

The following IBM publications document XCF:

• z/OS MVS Setting Up a Sysplex	SA22-7625
• z/OS MVS Programming Sysplex Services Guide	SA22-7617
• z/OS MVS Programming Sysplex Services Reference	SA22-7618

Sysplex Concepts

- The **Base Sysplex** is a collection of MVS systems that cooperate, using certain hardware and software products, to process work. IBM introduced the Sysplex (system complex) in September of 1990 and provided XCF as a standard mechanism for inter-processor communications.
- **Cross-system coupling (XCF)** services allow multiple instances of an application or subsystem, running on different systems in a sysplex, to share status information and communicate with each other.
- A **Parallel Sysplex** supports a greater number of systems and significantly improves communication and data sharing among those systems. It is also implies the presence of a physical or simulated Coupling Facility.

Sysplex + Coupling Facility = Parallel Sysplex

- The **Coupling Facility** enables high performance multi-system data sharing
- **Coupling Facility Channels** provide high speed connectivity between the coupling facility and the central processor complexes (CPC)
- **Sysplex Timers** synchronize the time-of-day (TOD) clocks of multiple CPC's in a sysplex

Sysplex Concepts

- **XCF** - Sysplex Services for Communication permits multiple instances of an application to:
  - Inform others of their status (active, failed, etc...)
  - Obtain information about the status of other instances of the application
  - Send messages to and receive messages from each other

- **ARM** - Sysplex Services for Recovery allows an application to:
  - Request an application restart in the event of application or system failure
  - Wait for another job to restart before restarting
  - Indicate its readiness to accept work
  - Request that automatic restart no longer be permitted

- **XES** - Sysplex Services for Data Sharing allow multiple instances of an application running on different systems in a sysplex to implement high-performance, high-availability data sharing by using a coupling facility. Applications can maintain and access data in three types of structures (list, lock, or cache).
  - Share data organized as a set of lists (list structure)
  - Determine whether a local copy of cached data is valid (cache structure)
  - Automatically notify other users when a data update invalidates their local copies of cached data (cache structure)
  - Implement efficient, customized locking protocols, with user-defined lock states and contention management (lock structure)

Sysplex Services for Communication

- **What is a multi-system application?**

  A multi-system application is a program that has functions distributed across MVS systems in a multi-system environment

- **What is a group?**

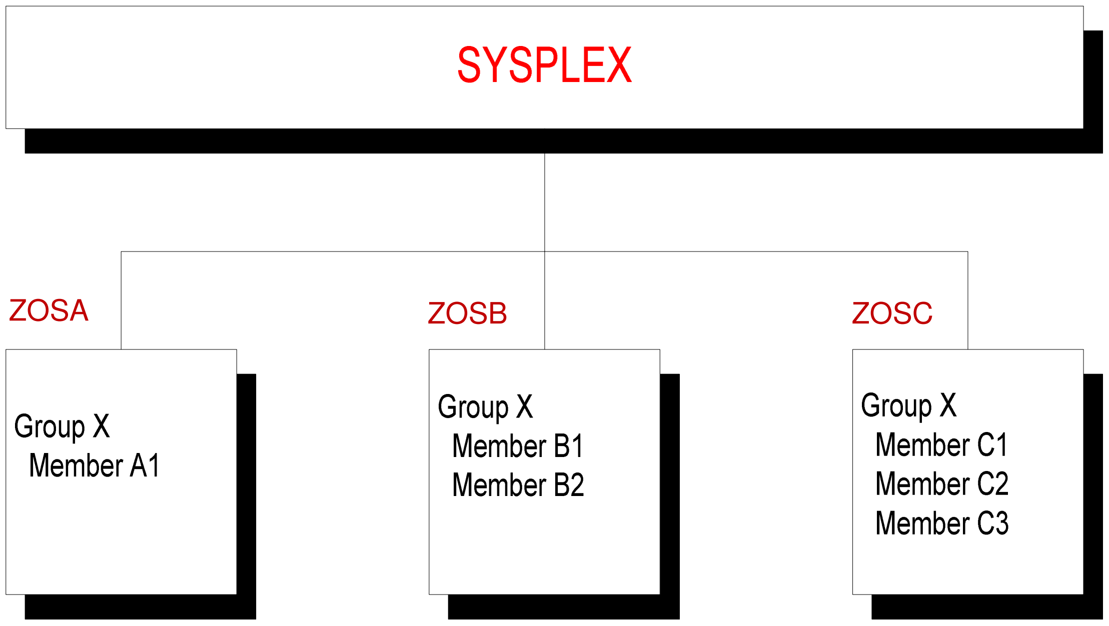
  A group is the set of related members defined to XCF by a multi-system application. A group represents a complete logical entity to XCF

- **What is a member?**

  A member is a specific function of a multi-system application that is defined to XCF and assigned to a group by the multi-system application. XCF allows up to 1023 members in a group.

Sysplex Services for Communication

System-Group member relationships in a sysplex



XCF Communication Services

Group services

- The IXCCREAT macro *defines* a member to XCF. The member is in the "created" state and can later be activated with an IXCJOIN macro
- The IXCLEAVE, IXCQUIES, IXCDELET, and IXCTERM macros *disassociate* members from XCF services
- The IXCSETUS macro *changes* a member's user state value
- The IXCMOD macro changes a member's status-checking interval
- The IXCQUERY macro provides the issuer with information about groups, members, and systems in the sysplex
- The IXCJOIN macro defines a member to XCF and activates it. The following User Exit Routines can be identified: Group, Message, Notify and Status
- The User Group Exit routine can notify group members about changes that occur to members of the group, or systems in the sysplex

XCF Communication Services

Signaling services

- The IXCJOIN macro lets you identify user routines to do processing on behalf of a member : Message user exit routine, Message Notify user routine, Group exit and Status exit
- The IXCMSGO macro (message-out service) allows members to *send* messages to other members in their group, as well as to send responses to messages received
- The IXCMSGI macro (message-in service) allows the message user exit routine to *receive* messages from a member and allows the message notify user routine to receive responses from a member
- The IXCMSGC macro (message control service) allows members to save, discard, reprocess or obtain information about messages or responses that have been sent

XCF Communication Services

Status monitoring services

provide a way for members to actively participate in determining their own operational status, and to notify other members of their group when that operational status changes. To accomplish this, XCF provides the following:

- The ability to identify an installation written status user-routine (via the IXCJOIN macro), which determines whether a member is operating normally
- The ability to identify an installation written group user-routine, which allows a member to maintain current information about other members in the group, and systems in the sysplex
- The status user-routine and the group user-routine work together with XCF in the following sense:
  - Specifying a status user-routine, status field, and status checking interval on the IXCJOIN macro causes XCF to begin monitoring a specific field that the member identifies. When the member fails to update the field within the specified time interval, or resumes updating after a failure, XCF schedules the status user-routine to check on the member.
  - When the status user-routine confirms that the member's status changed (either it failed to update its status field or resumed updating), XCF notifies the group user-routines of other members in the group about the change in the member's status. The group user-routines can then take appropriate action.

Member Attributes

Members with Permanent Status Recording (P.S.R.)

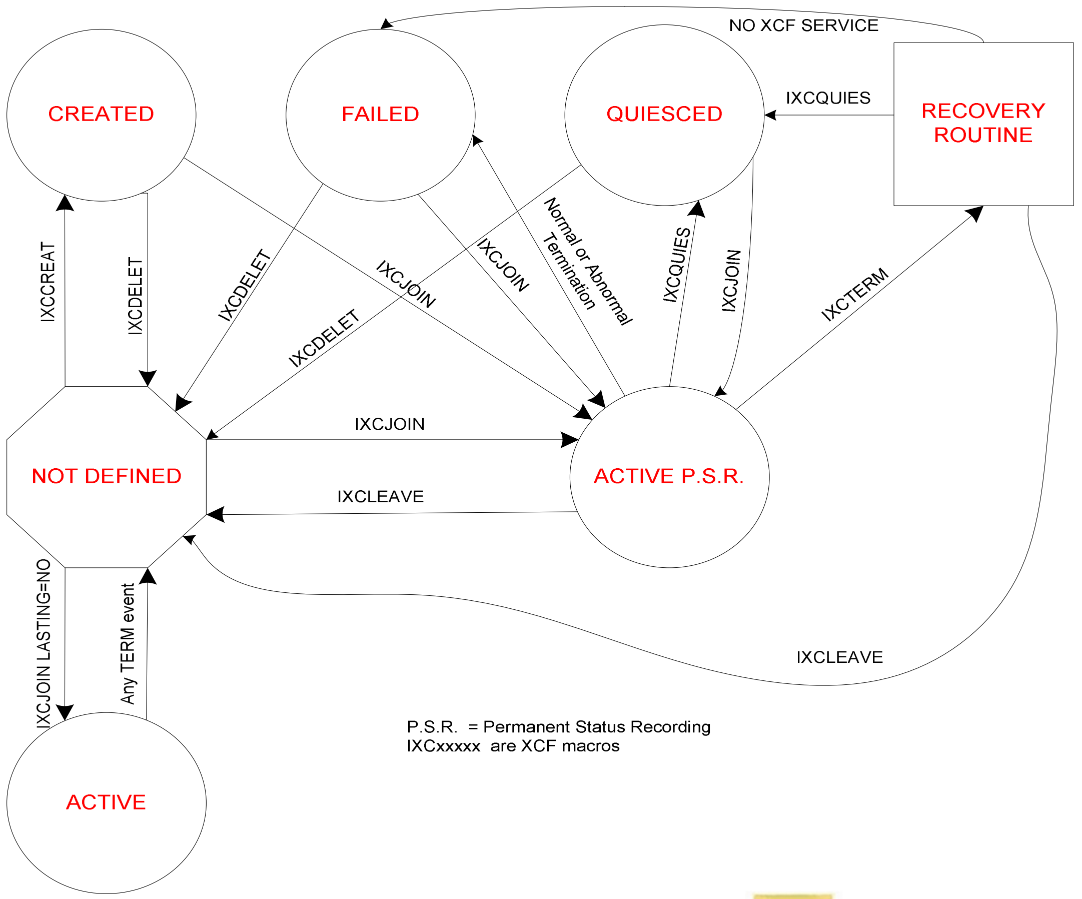
- Maintain a record of the member's existence (including the member's current member state and user state values) even when the member is dormant or has failed.
- Recognizes five discrete states for the member:
  Active, Created, Quiesced, Failed, and Not-Defined
- Use P.S.R. when it is important to know what happened to a member the last time it was running

Members without Permanent Status Recording

- XCF recognizes only two member states: Active and Not-defined

Member Attributes –
Member states

Member States



P.S.R. = Permanent Status Recording
IXCxxxxx are XCF macros

Member Attributes –
User Status Field

User State Field (USF)

A 32-byte user state field is associated with a member. User state information is available to members as follows:

- XCF includes the USF as part of the parameter list it passes to the group user-routines
- XCF includes the USF as part of the data it returns to the caller of the IXCJOIN, IXCCREAT and IXCQUERY macros

Examples of USF usage:

- As a unique counter
- As a role indicator
- To record steps in a process
- To indicate for a failed member that a restart is in progress
- XCF stores the USF for members with P.S.R., even if they are not in the “Active” state

Member Attributes –
Member token

The member token

When you define a member to XCF through IXCCREAT or IXCJOIN, XCF assigns a member token to the member that is unique within the sysplex. The member token that XCF returns on the IXCCREAT or IXCJOIN macros can change. XCF assigns a **new** member token when:

- A created member issues IXCJOIN to become active
- A quiesced or failed member issues IXCJOIN to become active once again
- A member terminates (becomes failed or not-defined) because its associated task, job step task, address space or system terminates and the member is then restarted

Aside from these circumstances, a member token remains the same for the duration of the sysplex. Authorized routines use the member token when requesting XCF services on behalf of a member.

Member Attributes –
User Exit Routines

The User Routines

Every member of an XCF group can define one or more

of the following user-routines to XCF:

- Message user-routine
- Status user-routine
- Group user-routine
- Message Notify user-routine

Member Attributes –
User Exit Routines

The Message User-Routine

The Message user-routine enables an active member of an XCF group to receive messages from other members of the group. Without a Message user-routine, a member cannot receive any messages. The message user-routine can also be used to provide a response to a message, when the member is capable of participating in a protocol that involves sending a response to a sender.

Member Attributes –
User Exit Routines

The Status User-Routine

The Status user-routine determines whether a member is operating normally. By identifying a Status user-routine, the member alerts XCF to begin monitoring a field that the member might be updating. If the member fails to update the field within a member-specified time interval, XCF schedules the Status user-routine to determine if a problem exists. (XCF schedules the Status user-routine only for active members.) If a problem does exist, XCF notifies other active members of the group through their Group user-routines. Code a Status user-routine when you want XCF to monitor the status field of a member.

Member Attributes –
User Exit Routines

The Group User-Routine

The Group user-routine enables XCF to notify an active member of a group when there is a change in the operational state of any other member in the group, or a change to the status of any system in the sysplex. If a member does not have a Group user-routine, XCF cannot notify that member of changes that occur.

Member Attributes –
User Exit Routines

The Message Notify User-Routine

The Message Notify user-routine enables XCF to notify a sender about the completion of a message. If the sender specifies that a response to a message is required, the Message Notify user-routine can be used to process the collected responses. If the sender specifies that a response is not required, XCF notifies the sender about the status of the message.

Member Attributes –
Member Association

Member Association

- Member association is specified via the MEMASSOC parameter on the IXCJOIN macro.   This allows you to handle normal and abnormal member termination when IXCDELET, IXCTERM, IXCLEAVE and IXCQUIES macros are not issued.

The member remains active:

- until the task that issued the IXCJOIN macro terminates (MEMASSOC=TASK)
- until the job step task under which the IXCJOIN macro was issued terminates (MEMASSOC=JOBSTEP)
- until the address space in which the IXCJOIN macro was issued terminates (MEMASSOC=ADDRSPACE)

Member Attributes –
XCF managed response collection

XCF managed response collection

Your application can request that XCF is to manage the collection of responses to messages you send. Once collected, XCF presents the set of responses to the sender for individual processing. To exploit this feature, both sending and receiving members must reside on systems running the appropriate z/OS level. The sending member, when sending a message, specifies **GETRESPONSE=YES** on the IXCMSGO macro. In addition, the receiving member must have specified **CANREPLY=YES** on the IXCJOIN macro to be able to provide a response.

Overview of XCF macros

IXCCREAT	Defines a member to XCF, but the member cannot use signaling and status monitoring services (yet. Possible when "Active")	Ndef -> Cre
IXCDELET	Disassociates a "Created", "Quiesced" or "Failed" member from XCF	Cre,Qui,Fail -> Ndef
IXCJOIN	Enables a member to join an XCF group. Member status becomes "Active"	Ndef,Cr,Qui, Failed->Act
IXCLEAVE	Disassociates an "Active" member from XCF	Act->Ndef
IXCMG	Provides tuning and capacity planning data	N/A
IXCMOD	Changes the status checking interval	N/A
IXCMSGC	Message control service	N/A

Overview of XCF macros

IXCMSGI	Receive a message	N/A
IXCMSGO	Send a message to one or more members	N/A
IXCQUERY	Return info about members	N/A
IXCQUIES	Disassociate an “Active” member from the group but retain its P.S.R. information	Active -> Quiesced
IXCSETUS	Change a member’s User Status Field (USF)	N/A
IXCSYSCL	Notify the system a member completed cleanup processing	N/A
IXCTERM	Terminate a member. Abnormally end a task-associated member	Active -> Failed or Not-Defined

RXC Software Package –
RXC Environment

RXC environment

RXC was developed and tested on a 4 LPAR System z:

• ZOSA	LPAR-A running z/OS V1.12
• ZOSB	LPAR-B running z/OS V1.12
• ICFA	Internal Coupling Facility
• ICFB	Internal Coupling Facility

Both ICFA and ICFB are configured symmetrically with I/O paths to both the ZOSA and ZOSB systems

RXC Software Package –
RXCAPPL Program

The RXCAPPL application

RXCAPPL reads or writes the first record in the RXCCNTL file

```
R1  -> OS parameters:
       H'll',CL1'code',CL8'ddname',CL8'record'
       where: ll      = Length of the parameter string
                       (set by the Operating System)
              code    = 'G' Get control record
                      = 'P' Put control record
              ddname  = DDNAME of the allocated control dataset
              record  = contents of record to be written (when Put)
```

The following JCL runs RXCAPPL in standalone mode:

```
//RXCAPPL EXEC PGM=RXCAPPL,PARM='GRXCCNTL ’
//STEPLIB  DD  DSN=RXC.LOAD,DISP=SHR
//RXCCNTL  DD  DSN=RXC.CNTLFILE,DISP=OLD
```

In multi-system mode, RXCXCF loads and calls RXCAPPL

RXC Software Package –
RXCISPF Dialog

RXCISPF is an ISPF dialog to access the RXCAPPL program

The REXX exec RXCISPF invokes the REXX function RXCUSER to access the RXCAPPL program, either directly or via the RXCXCF server. To start the dialog from ISPF Option 6, type the following command: `EX ‘&HLQ.PDS(RXCISPF)’`

```
                  XCF Communications Demonstration Dialog
Command ===> ____________________________________________________

Application mode . . .  M (S=Single-system; M=Multi-system)

Select desired function _

P - Put (update) record in the control file
G - Get record from the control file
Q - Check if the local RXCXCF server is active
T - Request to terminate the local RXCXCF server

Record Put or Get from control file ________
```

RXC Software Package – RXCUSER

REXX Function – RXCUSER

RXCUSER is a load module and REXX function called by the RXCISPF exec. Its syntax is:

```
CALL RXCUSER mode, func, record

mode       'S' = Single-system application invocation
           'M' = Multi-system application invocation
func       'G' = Get control record
           'P' = Put (update) control record
           'Q' = Query if RXCXCF is active on the local system
           'T' = Terminate RXCXCF on the local system

Record     a CHAR(8) data record to be used with func=’P’
```

The RXCUSER function sets the RESULT and RC variables on return

RXC Software Package –
Example of RXCUSER invocation

Example 1

In this example, the caller receives the control record in the RESULT variable

```
Call RXCUSER 'M','G'
Say 'RC='rc
Say 'Record='result
```

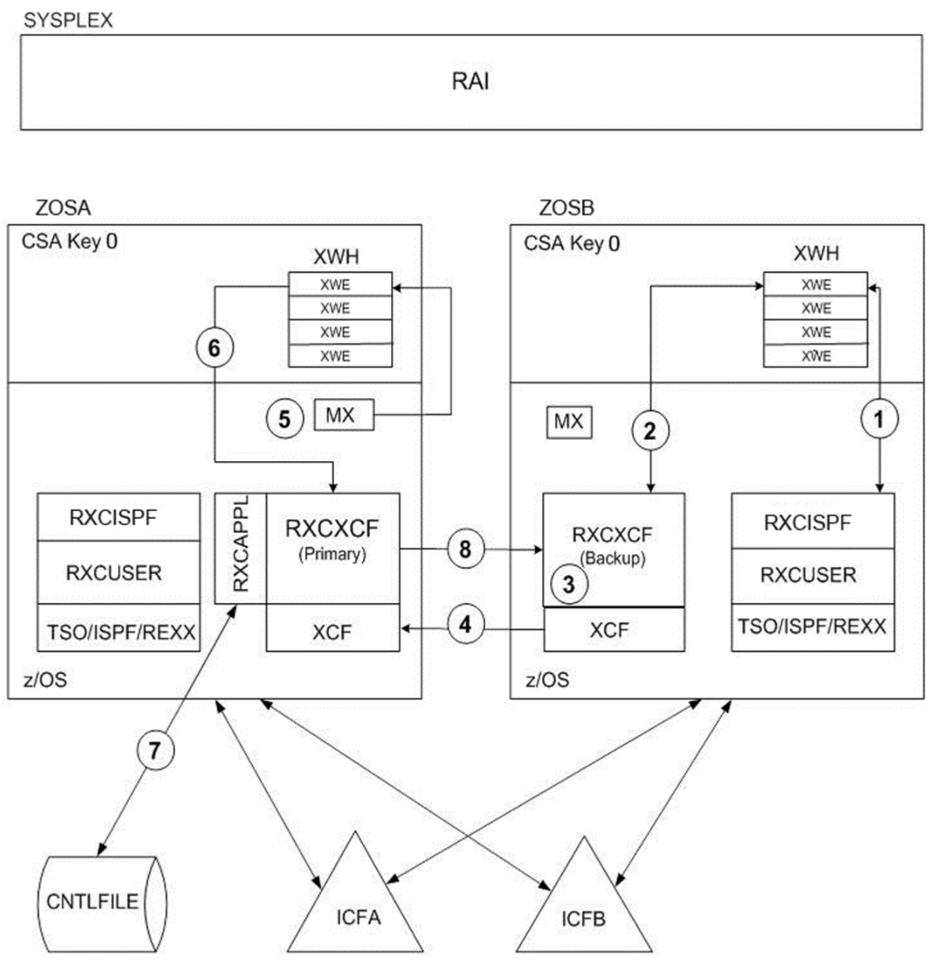
Example 2

In this example, the caller updates the control record with the value ‘ICE9NINE’

```
Call RXCUSER 'M','P',’ICE9NINE’
Say 'RC='rc
```

RXC Software Package

RXC Remote processing



RXC Software Package

0. Run RXCXCF on ZOSA and ZOSB as started tasks or submitted jobs

1. The user executes the command: `‘EX ‘&HLQ.PDS(RXCISPF)’`

   The user specifies the ‘Application Mode’ as M (multi-system) and the function as ‘G’ to get a control record. The RXCISPF REXX exec issues:

   ```
   CALL RXCUSER ‘M’,’G’
   ```

   RXCUSER locates a pointer to the RXC work queue structures in ECSA, Key 0 storage via the Name-Token service. RXCUSER then invokes the authorized TSO command processor RXCUAUTH via TSOEXEC to update these structures. RXCUAUTH reserves a free slot of the XWH area (an XWE control block) and formats it. Next, RXCUAUTH issues a WAIT macro using the ECB defined in the XWE area.

2. The RXCXCF program monitors the XWH queue for new work

RXC Software Package

3. RXCXCF detects a new XWE request on the XWH queue. Because it is not the Primary, RXCXCF sends the XWE to the primary system via the IXCMSGO macro.

4. XCF on system ZOSB sends the message to XCF on system ZOSA. XCF on system ZOSA schedules the message user-routine RXCXM through which the incoming message is processed (on behalf of the RXCXCF member on ZOSA).

5. The RXCXM user-routine issues an IXCMSGI macro to receive the message into a local area. It then reserves an XWE slot in the XWH on the ZOSA system and copies the received message into the reserved slot. Finally, RXCXM issues a POST to signal RXCXCF of the new queued element.

6. RXCXCF is dispatched because of the POST issued by RXCXM. The new XWE is used to build a parameter list for RXCAPPL. RXCXCF then calls RXCAPPL to Get a control record.

7. RXCAPPL receives control and reads a control record from the CNTLFILE and then returns the record and control to RXCXCF

RXC Software Package

8. RXCXCF on ZOSA issues an IXCMSGO macro to send the completed XWE to the requesting system. XCF on system ZOSB schedules the RXCXM Message user-routine. As in 5, RXCXM places the received XWE on the XWH queue and posts RXCXCF to process the work. Meanwhile, XCF on system ZOSA schedules the RXCXN Message Notify user-routine that will free the processed XWE element.

   Finally, RXCXCF on ZOSB is dispatched as a result of the preceding POST and issues a Cross Memory POST for the ECB of the RXCISPF dialog. RXCUAUTH iw dispatched and obtainw the returned control record from the XWE. RXCUAUTH then releases the XWE slot and exits. RXCUSER resumes and places the control record value in the REXX variable RESULT. RXCUSER then returns control to the RXCISPF dialog. Lastly, the RXCISPF dialog displays the returned record on an ISPF panel.

RXC Software Package –
RXCXCF messages

```
>>> Submit job RAI@XCFA on ZOSA
RXCJOIN - Member joined the group - RC=04 Reason=0004
RXCQUERY- Primary is active
RXCXCF  - Member assumes Primary role
RXCXCF  - System Name-Token Created.  XMB=00006E80 XWH=08D2EE88
RXCXG   - Member=ZOSB Type=01 OldSt=00 NewSt=03 FLG2=84 US=B
RXCXG   - NotAct -> Active. Role=B

>>> Execute ‘&HLQ.PDS(RXCISPF)’ from ZOSB with func = ‘G’
RXCXM   - Msg#=00000024 Flags=000000
RXCXM   - Prepare for MSGI
RXCXM   - Receive successful
RXCXM   - Check mode
RXCXM   - Request
RXCXM   - XWE copied
RXCXM   - REQUEST processed
RXCXM   - Free message block
RXCXM   - POST issued
RXCAPPL - GET Completed
RXCXCF  - RXCAPPL executed
RXCMSGO - ORIGIN=01000005001D0001 TARGET=02000003001D0002 MSG#=00000024
RXCXN   - Enter: Type=01 Flags=0000 Rec#=00000001
RXCXN   - Work Queue Element released
RXCMSGO - IXCMSG0 Issued: Primary -> User (response)
```

RXC Software Package –
RXCXCF messages

```
>>> Execute '&HLQ.PDS(RXCISPF)' from ZOSA
RXCXS   - Stat=08-*S.U.M.   << Status Update Missing >>
RXCXS   - Stat=00- S.U.R.   << Status Update Resumed >>
RXCXG   - Member=ZOSBType=07 OldSt=03 NewSt=03 FLG2=A4 US=B
RXCXG   - Member=ZOSBType=09 OldSt=03 NewSt=03 FLG2=84 US=B
RXCAPPL - GET Completed
RXCXCF  - RXCAPPL executed
RXCXCF  - XPOST to USER was issued

>>> P RAI@XCFA – shutdown RXCXCF on ZOSA
RXCXS   - Stat=08- S.U.M.
RXCXCF  - Exit EVENTS loop
RXCXCF  - Enter PASSBACK
RXCXG   - Member=ZOSBType=02 OldSt=03 NewSt=03 FLG2=84 US=P
RXCXCF  - Pass Primary role to Backup successful
RXCLEAV - IXCLEAVE completed successfully

>>> RAI@XCFA now inactive
```

RXC Software Package –
RXCXCF messages

```
>>> Submit job RAI@XCFB on ZOSB

>>> Execute ‘&HLQ.PDS(RXCISPF)’ with func = ‘G’ on ZOSB
RXCQUERY- Primary is active
RXCQUERY- Backup is active
RXCJOIN - Member joined the group - RC=00 Reason=0000
RXCXCF  - System Name-Token Created.  XMB=00006E80 XWH=08DF7E88
RXCMSGO - ORIGIN=02000003001D0002 TARGET=01000005001D0001 MSG#=00000024
RXCMSGO - IXCMSG0 Issued: User -> Primary (request)
RXCXM   - Msg#=00000024 Flags=000000
RXCXM   - Prepare for MSGI
RXCXCF  - XPOST to USER was issued

>>> Execute ‘&HLQ.PDS(RXCISPF)’ with func = ‘G’ on ZOSA
no messages – this system is unaware of ZOSA activities
```

RXC Software Package –
RXCXCF messages

```
>>> P RAI@XCFA – Stop Primary on ZOSA
RXCXM    - Receive successful
RXCXM    - Check mode
RXCXM    - XWE=00000001808D37F000F8FE80001000C7F0F7F1F6F2F0F0F3
RXCXM    - RESPONSE processed
RXCXM    - Free message block
RXCXM    - POST issued
RXCXN    - Enter: Type=01 Flags=0000 Rec#=00000001
RXCXG    - Member=ZOSA Type=07 OldSt=03 NewSt=03 FLG2=A4 US=P
RXCXG    - Member=ZOSA Type=09 OldSt=03 NewSt=03 FLG2=84 US=P
RXCXS    - Stat=08-*S.U.M.    << Status Update Missing >>
RXCXS    - Stat=00- S.U.R.    << Status Update Resumed >>
RXCXS    - Stat=08- S.U.M.    << Status Update Missing >>
RXCXG    - Member=ZOSB Type=02 OldSt=03 NewSt=03 FLG2=84 US=P
RXCXG    - Member=ZOSA Type=01 OldSt=03 NewSt=00 FLG2=84 US=P
RXCXG    - Active -> NotAct. Role=P
RXCXCF   - Takeover request
RXCXCF   - Member assumes Primary role
>>> P RAI@XCFB – Stop Backup on ZOSB
RXCXS    - Stat=08- S.U.M.
RXCXCF   - Exit EVENTS loop
RXCXCF   - Enter PASSBACK
RXCSETUS- Failed in IXCSETUS macro - RC=04 Reason=0008
RXCLEAV - IXCLEAVE completed successful
>>> RAI@XCFB is inactive
```

RXC Software Package –
Console display

```
>>> D XCF,GRP,RXCGROUP,ALL
IXC333I  15.50.46  DISPLAY XCF 659
   INFORMATION FOR GROUP RXCGROUP
   MEMBER NAME:        SYSTEM:     JOB ID:    STATUS:
   ZOSA                ZOSA        RAI@XCFA   ACTIVE
   ZOSB                ZOSB        RAI@XCFB   ACTIVE

 INFORMATION FOR GROUP RXCGROUP MEMBER ZOSA

 MEMTOKEN: 01000004 001D0001      ASID: 0018

 SIGNALLING SERVICE
   MSGO ACCEPTED:          1  NOBUFFER:          0
   MSGO XFER CNT:          1  LCL CNT:           0  BUFF LEN:   956

   MSGI RECEIVED:          1  PENDINGQ:          0
   MSGI XFER CNT:          1  XFERTIME:       4595

   EXIT 02AB8F00: 02/15/2012 15:50:43.195741 MC 00:00:00.000357

 GROUP SERVICE
   EVNT RECEIVED:          3  PENDINGQ:          0

   EXIT 02AD49B0: 02/15/2012 15:49:49.259460 09 00:00:00.000234
```

RXC Software Package –
RXC Datasets

`&HLQ.PDS`	This distribution library contains the RXC source objects: JCL, REXX exec and assembler language CSECTs and macros
`&HLQ.NCAL`	This library contains the assembled RXC CSECTs that are link-edited with the NCAL option. This library is created at installation time from the assembler source modules of the **`&HLQ.PDS`** library.
`&HLQ.LOAD`	This library contains the RXC load modules created by linking members of the **`&HLQ.NCAL`** library
`&HLQ.CNTLFILE`	This sequential dataset is used to store a control record. This library is allocated at product installation time.

RXC Software Package – Members of the &HLQ.PDS library

JCL

$$ALLOC	Allocate the RXC libraries
$$ASM	Assemble the CSECTS and link-edit the load modules
$APPL	Execute the RXCAPPL program as a standalone batch job
$XCF	Execute the RXCXCF server as a batch job

JCL Procedures

ALLOC	Allocate the RXC target libraries
AL	Assemble an entry point CSECT and link-edit an RXC load module
ALN	Assemble an RXC CSECT and link-edit it with the NCAL option

REXX program

RXCISPF	A REXX exec and ISPF dialog that invokes the REXX function named RXCUSER as an interface to the RXCAPPL (and RXCXCF) programs

RXC Software Package –
Macros

#ENTRY	CSECT entry code
#EXIT	CSECT exit code
#PLIST	Build parameter list
#SUBENT	Subroutine entry code
#SUBEXIT	Subroutine exit code
@DFT	System defaults
@CPB	TSO Command Processor Buffer
@DSA	Map of Dynamic Save Area
@DSAEND	End of Dynamic Save Area
@REGS	Register equates
@XAP	Parameters passed to RXCAPPL
@XCB	RXC command processor command buffer
@XMB	RXC Main Anchor Block
@XMC	Message Control Information (see IXCMSGO)
@XNT	Name-Token Pair values
@XWE	Work Queue Element
@XWH	Work Queue Header

RXC Software Package – Assembler CSECTS

RXC$DFT	System defaults
RXCAPPL	Application to Get or Put a record from the Control file
RXCCREAT	IXCCREAT macro code
RXCDELET	IXCDELET macro code
RXCINIT	RXC initialization and termination
RXCJOIN	IXCJOIN macro code
RXCLEAVE	IXCLEAVE macro code
RXCMG	IXCMG macro code
RXCMOD	IXCMOD macro code
RXCMSGO	IXCMSGO macro code
RXCQUERY	IXCQUERY macro code
RXCQUIES	IXCQUIES macro code
RXCREL	Release Work Queue Element (XWE)
RXCRES	Reserve Work Queue Element (XWE)
RXCSETUS	IXCSETUS macro code
RXCSYSCL	IXCSYSCL macro code
RXCTERM	IXCTERM macro code
RXCUACP	Called by RXCUSER to ATTACH RXCUAUTH (via TSOEXEC)
RXCUAUTH	Authorized program invoked by RXCUSER to update CSA, Key 0 storage
RXCUSER	Load module and REXX function that interfaces with RXCXCF
RXCWTO	Issue WTO (Write To Operator) messages
RXCXCF	RXC server and main XCF interface
RXCXG	XCF Group user exit routine
RXCXM	XCF Message user exit routine
RXCXN	XCF Message Notify user exit routine
RXCXS	XCF Status user exit routine

RXC Software Package –
Load modules

Members of the &HLQ.LOAD library

RXCAPPL	an application program to Get or Put a control record. Can run standalone or in multi-system mode
RXCXCF	RXC server and XCF interface
RXCUSER	REXX function that provides an interface to the RXCAPPL program (via RXCXCF in multi-system mode)
RXCUAUTH	Authorized TSO command processor invoked by RXCUSER (via TSOEXEC) to update RXC structures in CSA, Key 0 storage

RXC Software Package - Configuration

RXC configuration defaults

```
RXC$DFT  CSECT
RXC$DFT  AMODE 31
RXC$DFT  RMODE ANY
         DC    CL8'RXCGROUP'    XCF Group Name
         DC    H'4'             Maximum number of members
         DC    H'10'            Number of Work Queue Elements
         DC    AL4(180*100)     XCF status update interval
         DC    AL4(2*100)       STIMERM wakeup interval
         DC    AL4(1000)        STIMER pops before terminating
         DC    C'Y'             Issue IXCJOIN: Y or N
         DC    CL3' '
         END   RXC$DFT
```

RXC Installation

RXC is distributed as a single file (in TSO TRANSMIT command format) whose name is RXC.XMI. See the $README member of the &HLQ.PDS library for a complete set of installation instructions. In brief, the installation steps are as follows:

1. Choose a High Level Qualifier (&HLQ) for the RXC datasets and a DASD volume (&VOLSER) on which to allocate them

```
&HLQ        = ___________________________
&VOLSER     = _________

Dataset name  . . . : &HLQ.XMIT
Device type . . . . : 3390
Organization  . . . : PS
Record format . . . : FB
Record length . . . : 80
Block size  . . . . : 3120
1st extent blocks . : 90
Secondary blocks  . : 5
```

RXC Installation

2. Upload the RXC.XMI file to your z/OS system into the previously allocated &HLQ.XMIT dataset. Use BINARY file transfer – ***without data conversion of any kind***

3. Once the file is uploaded, execute the following TSO command:

   ```
   RECEIVE INDSN(‘&HLQ.XMIT’)
   ```

   When prompted:

   ```
   INMR901I Dataset dsname from user-id on N1
   INMR906A Enter restore parameters or 'DELETE' or 'END' +
   ```

   Respond:

   ```
   DSN(‘&HLQ.PDS’) VOLUME(&VOLSER)
   ```

   On completion, RECEIVE allocates the &HLQ.PDS dataset on the specified DASD volume

RXC Installation

4. Create the RXC libraries

- Modify the JCL in the '&HLQ.PDS($$ALLOC)' member
- Specify a valid job card
- Submit the job
- The highest completion code expected is CC 0000

Once the job completes, the following datasets should be allocated:

```
&HLQ.CNTLFILE
&HLQ.LOAD
&HLQ.NCAL
&HLQ.PDS
```

RXC Installation

5. ***Assemble and link edit the RXC modules***
   - Review and modify the JCL procedure members AL and ALN of ‘&HLQ.PDS’ to specify the &HLQ to be assigned to the RXC datasets
   - Modify the JCL in the ‘&HLQ.PDS($$ASM)’ member
   - Specify a valid job card
   - Modify the PROCLIB DDNAME to reference the ‘&HLQ.PDS’ dataset
   - Submit the job - the highest completion code expected is CC 0004
6. ***APF authorize the &HLQ.LOAD library on each LPAR in the Sysplex***

   The RXCXCF and RXCUAUTH load modules require APF authorization.

   From the MVS console, enter the following command:

   ```
   SETPROG APF,ADD,DSNAME=&HLQ.LOAD,VOLUME=&VOLSER
   ```

   <u>See the $README member of the &HLQ.PDS library for additional steps that are required</u>
7. ***Once installed, edit and submit the JCL in the $XCF member of &HLQ.PDS on <u>each</u> LPAR in the SYSPLEX – one as Primary, another as Backup and the rest as USER***

RXC Installation

The RXC software and documentation download RXC.ZIP:

- Source materials in TSO TRANSMIT format
- This SHARE presentation
- From the home page of **www.relarc.com**, click "Download" on the bottom banner, then click "**XCF Concepts and Coding**"
- Direct link: **http://www.relarc.com/form/rxc**

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