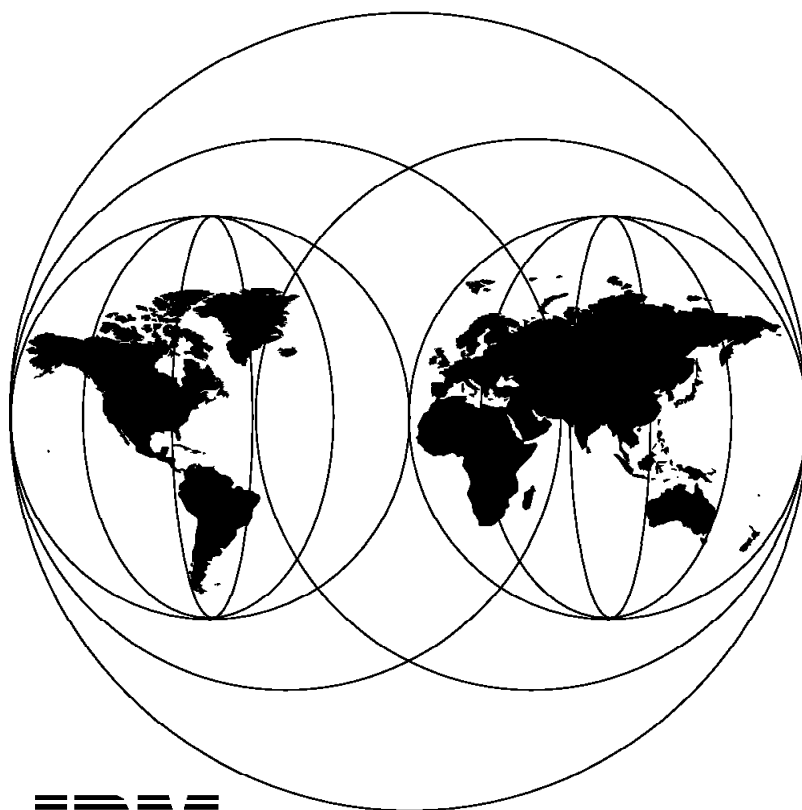


**Lotus Solutions for the Enterprise**  
**Links between VSE/ESA and Lotus Notes**

May 1997



**IBM**

**International Technical Support Organization**  
**Boeblingen Center**





International Technical Support Organization

SG24-2037-00

**Lotus Solutions for the Enterprise**  
**Links between VSE/ESA and Lotus Notes**

May 1997

**Take Note!**

Before using this information and the product it supports, be sure to read the general information in Appendix A, "Special Notices" on page 43.

**First Edition (May 1997)**

This edition applies to Version 2, Release 2 of VSE/ESA Program Name, Program Number 5690-VSE.

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## Preface

You have a variety of options to choose from if you want to link Lotus Notes and your VSE/ESA system.

All of these links are there to offer you the best of two worlds: You can combine the strength of the groupware and messaging facilities of Lotus Notes on workstations with the power of your VSE/ESA as the backbone of your mission critical processes. You can integrate your existing transactions and use your enterprise data across the network from your workstations. This protects your investment in the S/390 platform and at the same time opens up your enterprise for new and exciting opportunities.

These opportunities are too good to ignore. Therefore, this book presents you with an overview of the links which are available today. For the two basic links, the CICS Link and the MQseries Link more details are included as well.

This redbook was written for managers and senior professionals who work in the system design and analysis area and who are interested in extending the reach of their VSE/ESA system.

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## The Team That Wrote This Redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Böblingen Center.

**Ulrich Kettner** is responsible for CICS/VSE and CICS/VSE related client/server solutions in the International Technical Support Organization, Böblingen Center. He was the leader of a project which resulted in sessions for an IBM workshop presenting classes worldwide on VSE/ESA client/server solutions. A second result of this project was the writing of this book.

**Wu Xiao Hua** is a system administrator in the Bank of China. She has a very strong VSE background. Her interest in this topic results from the fact that the Bank of China plans to link their VSE/ESA environment to Lotus Notes.

**Huang Hong** works for Advanced Business Solutions Co. which is an IBM PC dealer in the People's Republic of China and provides extensive support and education for the Bank of China.

**Wu Hai Lin** is a solutions sales specialist In IBM China. He supports, among other customers, Bank of China projects.

All residents contributed to producing presentation material and demos for the workshop mentioned above and to the writing of this book.

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## Comments Welcome

**Your comments are important to us!**

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## Chapter 1. Two Worlds, Linked Together

For good reasons, in many installations, the world of Lotus Notes and the world of Enterprise Systems coexist. Both worlds have their unique characteristics and their own benefits.

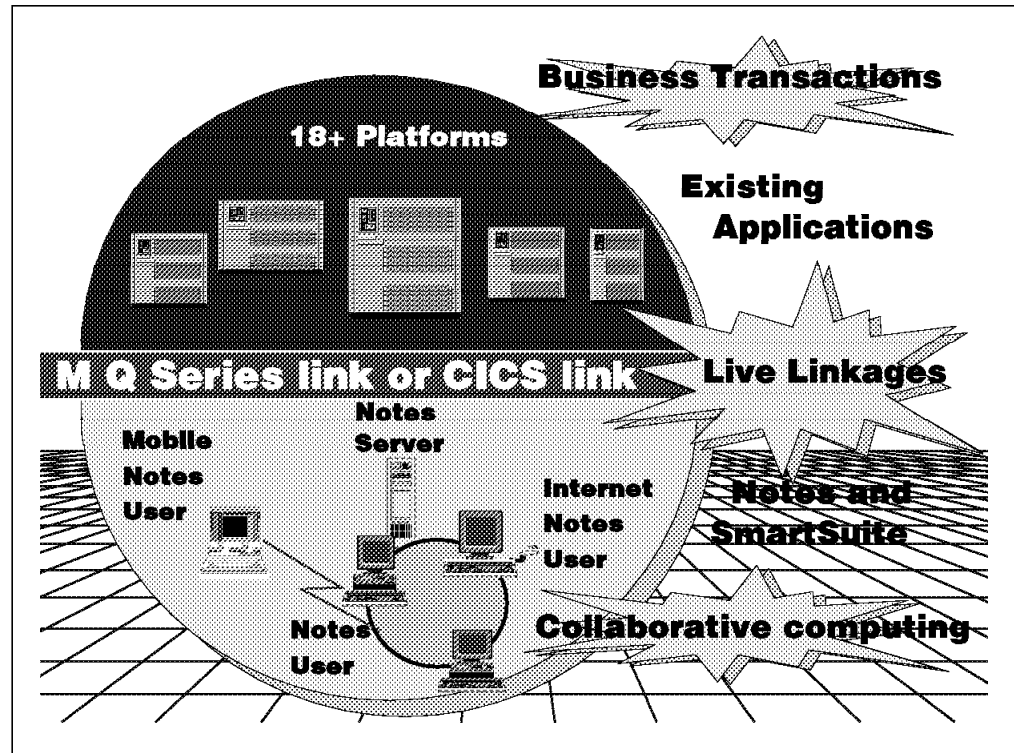


Figure 1. Linking Two Worlds Together

Linking these worlds together will give you a chance to take advantage of the benefits of both worlds. You can combine the world-class messaging and groupware features of Lotus Notes with the traditional strengths of a /390 transaction processing system hosting a wealth of mission critical data and programs. This extends the reach of your Lotus Notes applications. At the same time you make optimal use of your investment in host data and host applications.

---

### 1.1 The Two Worlds

Many customers already know and love Lotus Notes. Lotus Notes is the leading client/server environment for developing and deploying strategic groupware applications. Over 7500 companies use Notes to improve key business processes such as customer service, sales and account management and product development.

Lotus Notes helps companies to communicate, collaborate and coordinate information and business processes within and beyond their organizational boundaries to achieve improved business results.

Lotus Notes supports all the major workstation operating systems including AIX, HP-UX, Macintosh, OS/2, Solaris, Windows and Windows NT.

Lotus Notes is the computing home for many users, but it is not the only environment that will exist in a company.

In other parts of the world many companies today have a significant investment in enterprise business applications. These applications and the data the applications manage, are the true resource of the data processing center. In fact, take these systems away from a company and it is likely to go out of business within a month.

Many enterprises depend unreservedly on mission-critical CICS applications developed over the long-term, often using sophisticated data access, such as multiple relational database management systems, that reflect the nature of their business. Simple database retrieval can give a Notes user access to relational data, but a volatile database means that local data soon gets out of sync. With CICS, however, transactional processing ensures that your vital corporate data is kept in step. Using links from Lotus Notes to CICS-based systems increases the value of your investment in CICS by the size of your Notes community.

## 1.2 The Links

All your users have a common interest: to make best use of your company's greatest asset, its corporate information. MQSeries Link for Lotus Notes and CICS Link for Lotus Notes unifies your Notes and other communities so that Notes users can complement their own data with your vital application running on other platforms and data.

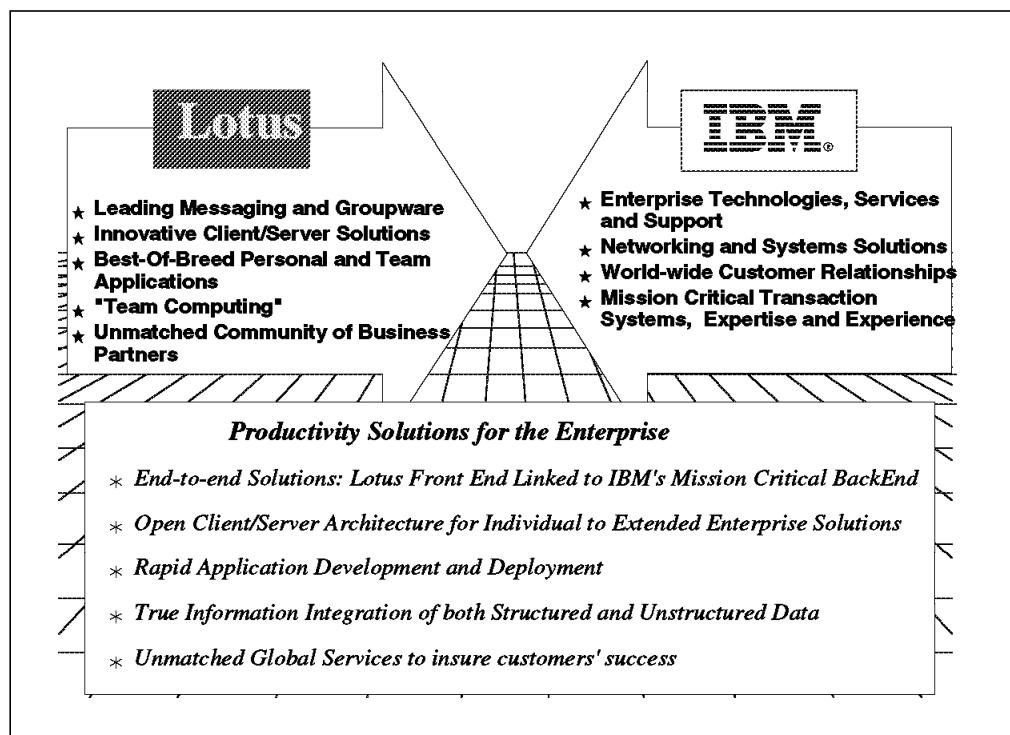


Figure 2. The Best of Two Worlds

## 1.2.1 Access to the Power of Transaction Processing Systems

What you can do with the MQSeries Link for Lotus Notes and CICS Link for Lotus Notes is to get the best of both worlds by providing a live link from Notes into those existing applications. Notes users can access both data and transactions on an enterprise server. That enterprise server can reside on any of the platforms supported by MQSeries or CICS.

Alternative methods of accessing transaction systems and data exist, for example:

- terminal emulation
- staged data (data copied to server)
- direct data access (for example, through Distributed Relational Data Access)

However, they all have limitations and present problems to your information technology department.

They do not maintain security/integrity of business critical applications, cannot leverage existing transaction processing systems, and do not provide application level connectivity. In addition, they are not transparent to the end users and not platform independent.

With MQSeries Link for Lotus Notes and CICS Link for Lotus Notes, Lotus Notes can act as a common front end to a variety of otherwise stand-alone and incompatible systems. This gives you the ability to access actual transaction systems (for example, CICS, IMS) or non-Notes systems (for example, OS/400, DEC VMS VAX) so that you can make best use of your company's greatest asset, its corporate information. Yet information is only of real value when it is readily available. This is where these links for Lotus Notes show their true value.

By using these links, users can get real-time read and write access to the on-line transaction processing (OLTP) system, and, completely or at least partially reuse existing OLTP applications in new Notes applications. Only one copy of the organization's critical data needs to be managed and maintained. Therefore, the data a Lotus Notes user gets is always current.

Users can realize cooperative processing between Notes and transaction systems by initiating a request to execute an existing application on an enterprise server. That application contains all the business rules to query or update the raw data and to transform it into the information required by the Notes users.

By connecting Notes and enterprise servers, the end user becomes the Notes graphical user interface with which he is familiar, including data owned by the information technology department which guarantees data currency, integrity, access control, logging, recovery and so on.

## 1.2.2 Support for Mobile Users

With the link, mobile Notes users need feel they are no further away from corporate data than across the hallway. For instance, Notes users with a laptop computer can maintain local replica of CICS link data, and work off-line. When they reconnect to the server, Notes replication synchronizes the changes across the enterprises, renewing their data to the current corporate level. Only those fields which have changed are updated on the mobile workstation, minimizing communications costs.

### 1.2.3 Rapid Application Development

Users can benefit from Notes rapid application development and deployment (RADD) environment, by which the front end application using the link can be designed and coded very quickly. The whole end-to-end solution can be achieved with minimum effort and made available for use very rapidly.

The development of the actual application is not much different from any other Notes development effort. All the definition, design and testing take place in the Notes development environment.

Taking CICS Link for Lotus Notes for instance, all that Notes developers need to know is the structure of the data in the communications area of the CICS application they will use. Corresponding fields in the Notes form are mail-enabled and mapped to fields in CICS via a Notes control database; the link takes care of the rest.

To access transaction systems or non-Notes system data, the Notes developer only needs to know the key fields that are used in the host system to access the data and what fields they wish to have accessed. The linkage technology provides a programming interface for computers and networks from multiple vendors and offers a simple, reliable means of building distributed and client/server applications. The link shields the Notes application builder from the multi-vendor, multi-protocol complexity of today's business networks and provides application-location transparency.

Integration can extend even beyond the enterprise, to the universe of Internet users. Lotus Internotes provides access to Notes data for Internet users anywhere in the world. So now your customers and business partners, everywhere, can take advantage of the unique data-sharing abilities of Notes to reach as far as your vital corporate CICS applications.

---

## Chapter 2. Introducing the Involved Products

In this chapter we will summarize the main concepts and the main strengths of the products which are to be linked together:

- Lotus Notes as the leading messaging and groupware product
- VSE/ESA as the entry-level and intermediate S/390 operating environment offering an integrated system package with attractive client/server, on-line transaction processing, and batch services
- CICS for VSE/ESA and CICS Clients:
  - CICS/VSE as the VSE/ESA member of the CICS family of transaction processing monitors which includes a common application programming interface (EXEC CICS API) and intersystem communication between other members of the CICS family
  - the IBM CICS Clients family which comprises workstation products that communicate with the entire family of CICS application servers.
- MQSeries products for VSE/ESA and for workstations which enable applications to communicate across platforms using a message queuing interface.

---

### 2.1 What is Lotus Notes all about?

Lotus Notes is the world's leading messaging and groupware product. It is an information-managing system for sharing information, making it easy to communicate with colleagues, collaborate on projects, and coordinate strategic projects.

## Coordinate Strategic Business Processes

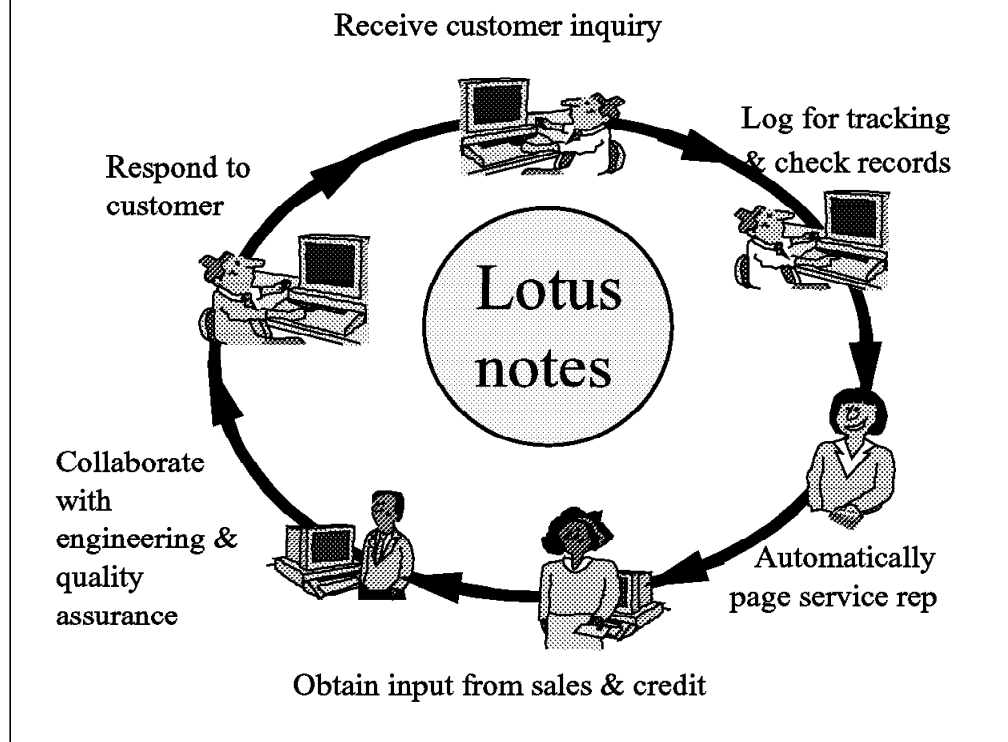


Figure 3. Coordinating Strategic Business Processes

A Lotus Notes system comprises a server and a number of clients, connected over a LAN or other asynchronous connection. The Lotus Notes clients connect to the Lotus Notes server so that they can share information in the server databases, and send and receive mail. Lotus Notes uses a distributed document database technology which is:

- highly scalable
- secure
- easily integrated with the Internet.

Administration of Notes is simple and helps to optimize the use of resources.

Lotus Notes allows you to implement strategic systems. Strategic systems enable an enterprise to create a 'corporate memory', a repository of experience, expertise and unique business knowledge of an organization. They:

- are designed to support extended workgroups
- include occasionally connected users, such as sales people, executives who travel, people who work at home....
- traverse enterprises to bring together suppliers, customers and business partners
- use a different model for communications
- depend on the ability of users to send messages
- store information in easily accessible document repositories. Documents are composed of semi-structured information and can include:



- other documents
- reports
- faxes
- letters
- scanned images
- and even video and sound.

Lotus Notes is not a single technology, but a powerful combination.

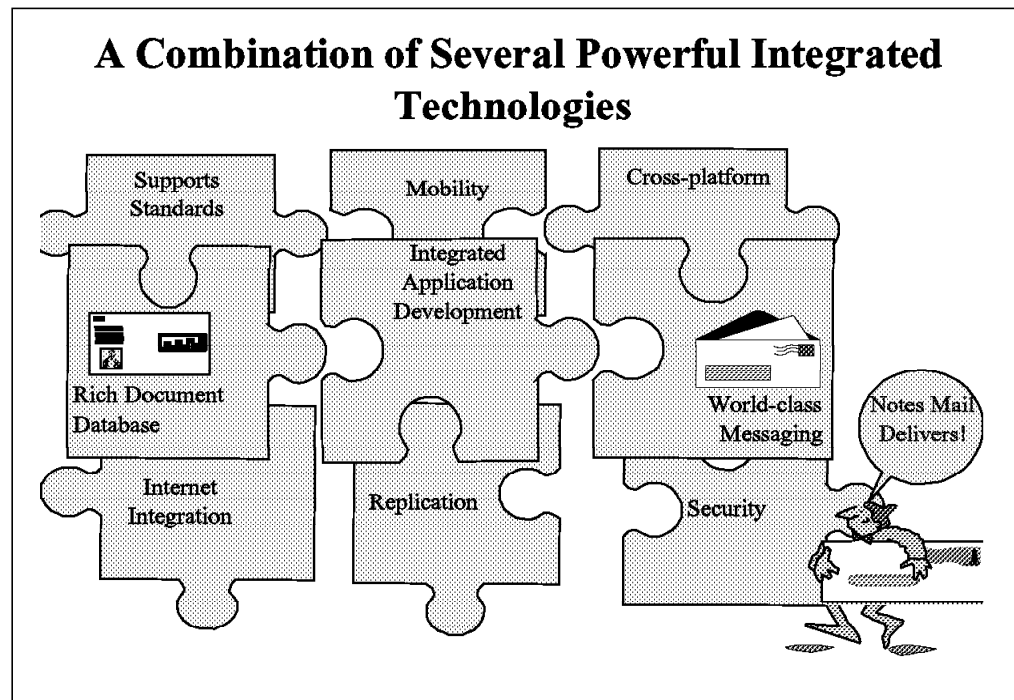


Figure 4. A Combination of Technologies

In its center is the document database. This is combined with world-class messaging facilities and with an application development environment which includes tools for rapid application development and application deployment facilities. It offers an elegant, intuitive, integrated development environment with graphical navigators and forms for customer interfaces. Application enhancements are distributed with the data! All applications can be run across all Lotus Notes platforms.

Lotus Notes development environment has layers:

1. Basic development facilities
  - forms, views, templates.
2. Advanced programming facilities
  - formulas, macros, data dictionary.
3. Extensions integrating Lotus Notes applications into non-Notes environments
  - database integration
  - desktop application integration
  - Notes-specific application development tools

- Notes API

Some of the Lotus Notes terminology that you saw and will see more of in this book:

<b>Databases</b>	Every Lotus Notes application uses at least one database. A database is a collection of related documents. Most databases reside on the Lotus Notes server.
<b>Documents</b>	Documents are the equivalent of "records" in a relational database. Each document is structured according to a particular form.
<b>Forms</b>	A form defines the format and layout for documents. Each form can contain fields, static text, graphics and buttons, which define how data is to be entered and processed. More than one form may be used in the same database. Designing a Lotus Notes form is like designing a screen layout.
<b>Fields</b>	Fields are the individual areas comprised in a form. Every field you define must have a name and a data type. There may be many fields in one form.
<b>Views</b>	A view is a tabular summary of the documents in a database. You may define many views for one database, each selecting different documents and sorting them in a different sequence.
<b>Formulas</b>	Lotus Notes has a formula-writing language and a set of built-in @functions that let you write formulas to calculate the contents of and control the display of fields, views, and forms.
<b>Macros</b>	You can write macros, using the formula-writing language, to perform specific tasks. Macros can be activated by selecting a button on a menu.
<b>Buttons</b>	You can create buttons on forms or in documents. A button contains a formula that performs some action on the document.
<b>Replication</b>	Lotus Notes provides the capability of synchronizing copies of databases on different servers. The copies are called "replicas" and the process of maintaining the copies is called "replication". When databases are replicated, information in them that has been updated is updated in all replicas.

### 2.1.1 Lotus Notes Platforms

Lotus Notes Release 4.5 currently supports the following environments with more to come:

#### Notes Clients

- IBM OS/2
- Microsoft Windows 3.1
- Microsoft Windows 95
- Microsoft Windows NT (Intel and Alpha)

- Apple Macintosh OS (68k and PowerPC)
- IBM AIX
- Sun Solaris (SPARC and x86)
- HP-UX

#### Notes Servers

- IBM OS/2
- Microsoft Windows 95
- Microsoft Windows NT (Intel and Alpha)
- Novell NetWare
- IBM AIX
- Sun Solaris (SPARC and x86)
- HP-UX

#### Supported Network Protocols

- AppleTalk
- NetBIOS/NetBEUI
- SPX
- TCP/IP
- VINES
- X.PC
- X.25
- SNA

---

## 2.2 VSE/ESA

VSE/ESA offers entry-level and intermediate S/390 users an integrated system package with attractive client/server, on-line transaction processing, and batch services. VSE/ESA is also the S/390 operating system of choice for multiple or centrally managed, remote unattended systems. VSE/ESA can be used alone, or in combination with VM/ESA.

The latest VSE/ESA release is Version 2 Release 2. Built on the strengths of VSE/ESA Version 2 Release 1, VSE/ESA Version 2 Release 2 addresses your needs in traditional areas of VSE and S/390 and offers substantial improvements. You will reduce the cost of computing and increase your application growth with VSE/ESA Version 2 Release 2. It provides:

- A smooth transition to the Year 2000 challenge
- Excellent Turbo Dispatcher Enhancements
  - Runs VSE/ESA POWER in parallel work units
  - Provides balancing of CPU time for each balanced partition
- LANRES/VSE Extensions
  - Establishes server environment for attached OS/2 LANs
  - Provides data access for VSAM KSDS and ESDS files

- DWF for Windows with similar functionality to DWF for OS/2 on:
  - Windows 3.1 and 3.11
  - MS Windows 95
- Programming Languages
  - 31-bit C Language for VSE Run-Time Support, Year 2000-ready
  - LE for VSE Version 1 Release 4
  - Source Level Debugger for COBOL for VSE and PL/I for VSE
- IBM 3590 High Performance Tape Subsystem support

### 2.2.1 VSE/ESA Platforms

VSE/ESA provides native support for S/390 processors and other ESA capable processors. This includes exploitation of multiple processors in one Central Electronic Complex (CEC).

Specifically, the new S/390 Parallel Enterprise Services with storage from 128MB to 2GB are supported:

- S/390 9672 Model R11 - Uniprocessor model
- S/390 9672 Model R21, R31, R41, R51, R61 - Multiprocessor models with 2 to 6 processors, natively supported through the new VSE/ESA Turbo Dispatcher

The ESA capable models of the following processors are supported by VSE/ESA; in the case of multiprocessor models through the new VSE/ESA Turbo Dispatcher:

- All ES/9000 models
- ES/3090-9000T
- ES/4381 Models 90E, 91E, 92E
- ES/3090 E/J/S

---

## 2.3 The CICS Family

CICS is a family of modern transaction processing products that enables your business to exploit applications and data on many different hardware and software platforms. CICS is the de facto standard for transaction processing in the enterprise.

CICS/VSE is required to link Lotus Notes applications to VSE/ESA.

CICS clients on workstations offer a facility (External Call Interface, ECI) which can be used to access CICS/VSE applications from workstation applications.

### 2.3.1 The Server: VSE/ESA and CICS/VSE

CICS/VSE is a member of the CICS family of transaction processing monitors which includes a common application programming interface (EXEC CICS API) and intersystem communication (ISC) between the products. The CICS family is available on MVS/ESA, VSE, AS/400, OS/2(TM) and on AIX(TM) for the RISC System/6000(TM) platform.

The latest CICS/VSE release is CICS/VSE Version 2 Release 3. It provides enhanced functionality to CICS users in the VSE environment and is a major base product component of VSE/ESA Version 2 Release 2.

This new release provides a platform that has enhanced programmer interfaces as well as support for Language Environment (LE) for VSE/ESA and associated languages. In addition it provides a tool to aid in the migration of customers from the use of internal CICS security to an external security manager (ESM) that will be required in subsequent versions.

CICS/VSE fully supports all ISC functions for CICS to CICS communication. These functions are:

- function shipping
- transaction routing
- distributed program link
- asynchronous processing
- distributed transaction programming

For CICS clients connections CICS/VSE 2.3 supports the External Call Interface (ECI). This is the interface used by the Lotus Notes CICS gateway. The PTF level of CICS/VSE 2.3 which is shipped with VSE/ESA 2.2 also supports the External Presentation Interface (EPI).

### **2.3.2 The IBM CICS Clients**

The IBM CICS Clients family comprises workstation products that communicate with the entire family of CICS application servers. CICS clients therefore bring the advantages of client/server operation to your transaction processing.

The IBM CICS Clients family comprises:

- IBM CICS Client for DOS
- IBM CICS Client for OS/2
- IBM CICS Client for Windows
- IBM CICS Client for Macintosh.

The IBM CICS Clients are separately orderable products, but are also provided as part of Transaction Server for OS/2 Warp (a member of the IBM software servers suite).

The CICS Client for OS/2 also includes the CICS gateway for Lotus Notes and CICS Internet gateway.

The CICS clients can communicate with the following CICS server products:

- CICS for OS/2 Version 2.0.1, and higher
- CICS for Windows NT Version 2
- 'CICS on Open Systems', that is:
  - CICS for AIX
  - CICS for HP 9000
  - CICS for Digital UNIX.
- CICS/400 Version 3 Release 1, and higher

- CICS for MVS/ESA Version 3 Release 3, and higher
- CICS/MVS Version 2 Release 1.2
- CICS/VSE Version 2 Release 2 and higher.

The CICS clients can communicate using the following protocols:

- Network Basic Input/Output System (NetBIOS)
- Transmission control protocol/Internet protocol (TCP/IP)
- Advanced program-to-program communication (APPC).

CICS clients communicate with CICS application servers such as CICS/VSE using APPC, usually through a local area network (LAN) and Systems Network Architecture (SNA) gateway. In an IBM LAN, gateway communication facilities are provided by an SNA product running on the gateway machine, for example, IBM Communications Manager/2 (CM/2). The CICS clients can communicate with a server by three mechanisms:

- The External Call Interface (ECI), which enables the design of new applications to be optimized for client/server operation, with the business logic on the server and the presentation logic on the client.

The ECI enables a non-CICS client application to call a CICS program synchronously or asynchronously, as a subroutine. The client application communicates with the server CICS program using a data area called a Communication Area (COMMAREA). The COMMAREA is passed to the CICS server on the call, and the CICS program typically populates it with data accessed from files or databases, and then returns it to the client for manipulation or display.

- The External Presentation Interface (EPI), which enables modern technologies, such as graphical or multimedia interfaces, to be used with traditional 3270 CICS applications.
- 3270 terminal and printer emulation. This provides CICS 3270 emulation for CICS servers to which the client is connected.

---

## 2.4 The MQSeries Family

MQSeries products enable applications to use message queuing to participate in message-driven processing. With message-driven processing, applications can communicate across the same or different platforms, by using the appropriate message queuing software products. For example, MVS/ESA and OS/400 applications can communicate through MQSeries for MVS/ESA and MQSeries for OS/400 respectively. With MQSeries products, all applications use the same kind of message queuing application interface, building messages with the same message headers. Communications protocols are hidden from the applications.

### 2.4.1 MQI - a Common Application Programming Interface

MQSeries products implement a common application programming interface, the message queue interface (MQI), that is used on whatever platform the applications run on. The calls made by the applications and the messages they exchange are common. This makes it much easier to write and maintain applications than using traditional methods. It also facilitates the migration of message queuing applications from one platform to another.

The MQI offers calls to:

- connect and disconnect to a queue manager
- open and close queues and communication channels
- put/get messages into/from queues
- commit and rollback work
- inquire and set object attributes

## 2.4.2 Time-independent Applications

A characteristic of communications using message queuing is that the communication is asynchronous.

With message queuing, the exchange of messages between the sending and receiving programs is time independent. This means that the sending and receiving applications are decoupled so that the sender can continue processing without having to wait for the receiver to acknowledge the receipt of the message. The receiving application may be busy when the message is sent. Indeed, the receiving application doesn't even need to be running. MQSeries holds the message in the queue until it can be processed.

## 2.4.3 Message-driven Processing

Message-driven processing is a style of application design.

With this style, the application is divided into a number of separate, discrete, functional blocks, with each block having well defined input and output parameters. Each functional block is coded as an application program, with its input and output parameters being interchanged between other application programs by placing their values in messages, which are then put in queues.

By use of the appropriate MQSeries programming mechanisms, an application program can start executing as a result of one or more messages arriving in a queue. If required, the program can terminate when all the messages in a queue have been processed.

MQSeries applications can transfer data with an extremely high degree of confidence. Message delivery can be implemented using a syncpoint mechanism, and the message queue manager logs or journals, for the recovery of important data in the event of system failure.

All resources, such as queues, can be protected using the security facilities available on the operating platform.

## 2.4.4 MQSeries Platforms

MQSeries products are available on the following platforms:

- Host
  - IBM MVS/ESA
  - IBM VSE/ESA
  - Tandem NonStop Kernel
- Midrange
  - IBM OS/400 (IMPI & RISC)
  - Digital Open VMS VAX

- Pyramid DC/OSx
- Workstations
  - IBM AIX
  - NCR (AT&T GIS) UNIX
  - Siemens Nixdorf SINIX
  - Hewlett Packard HP-UX (incl. Stratus Continuum)
  - Sun Solaris & SunOS
  - Digital Unix
  - Linux
- Desktop
  - IBM OS/2
  - Microsoft Windows NT
  - Microsoft Windows, Windows 95
  - Windows 95 (32 bit)
  - SCO Unixware
  - SCO Unix
  - SCO Unix (L2)
  - DOS Client
  - MacOS (OEM)



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## Chapter 3. The CICS and MQSeries Gateways to Lotus Notes

The purpose of gateways between Lotus Notes and host systems is to make host processing intelligence available to Lotus Notes users. This is made possible by providing facilities which allow you to include host data into Lotus Notes documents.

In this chapter we will describe the main concepts and the main components of the links you can set up between your Lotus Notes and your VSE/ESA host system. The links we address are:

- the IBM CICS Gateway for Lotus Notes
- the MQLink from Lotus Notes to VSE/ESA

Both links are controlled by an 'agent'. An agent runs on a Notes server workstation. The agent uses Notes documents and messages to facilitate the links. The links are table driven, interface information is contained in Notes documents, the Lotus side of the interface is information about the form of the Notes user document.

To make use of the links, a Notes client needs to be connected to a Notes server which in turn connects to the host system.

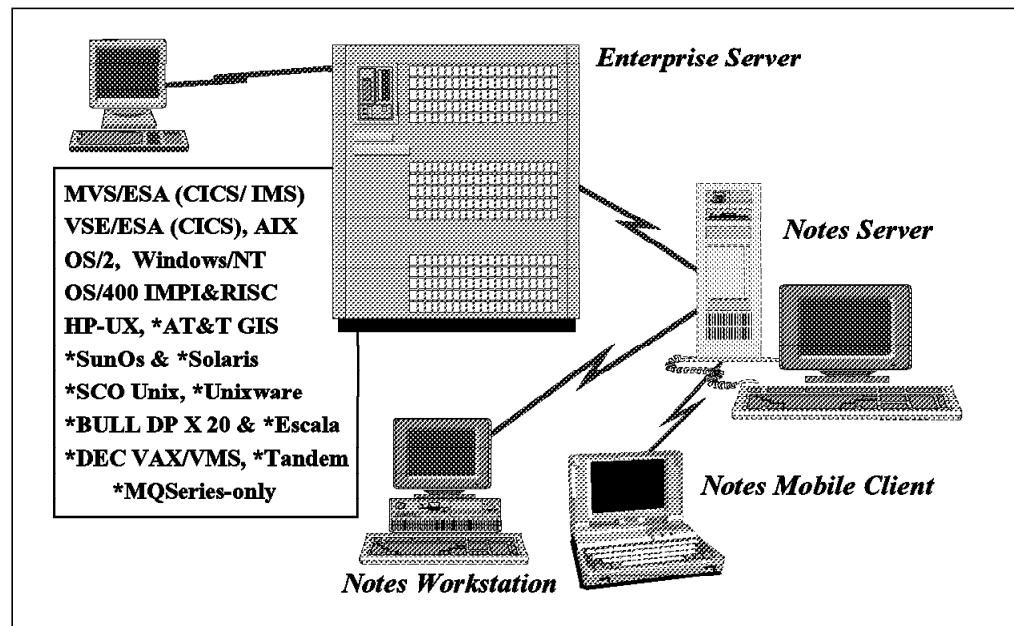


Figure 5. Clients, Servers, Hosts

The CICS Gateway and the MQLink are initiated from a Lotus Notes user through a Lotus Notes application. Through these links a host application is started that supplies the data which, through the links is included into the Notes document. They "pull" data from a host.

The CICS link Extra and the MSLink Extra discussed in Chapter 4, "More Ways to Link Lotus Notes and VSE/ESA" on page 33 are "push" types of links. This is host initiated and transfers data to Lotus Notes documents without interaction with a Notes application.

Another link between Lotus Notes and systems (such as VSE/ESA) on which an MQSeries product is available is the MQSeries Link LotusScript Extension (MQLSX). It gives your Lotus Notes applications, written in LotusScript, the ability to communicate with applications running in non-Notes environments, using MQSeries. The MQLSX is an Application Programming Interface (API) that you call from LotusScript to access the Message Queue Interface (MQI). This interface goes beyond the scope of the document and is not discussed any further here.

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## 3.1 The IBM CICS Gateway for Lotus Notes

The IBM CICS Gateway for Lotus Notes enables the connection of Notes application users to applications on the wide range of industry platforms running CICS. For the Notes client user, access to an application at a Notes server is seamless via workspace icons. Using the code provided by the CICS gateway to Lotus Notes, the Notes server application issues CICS ECI calls to one or more target systems. Replies are placed in a Notes server database, with the client user notified - the user may then refresh his workspace form with the new information.

### 3.1.1 How the CICS Gateway Works

CICS gateway for Lotus Notes runs as an "add-in task" on the Lotus Notes server and uses the facilities of the Lotus Notes application programming interface (API) to communicate with Lotus Notes applications. On the other hand it communicates with a CICS client using the CICS External Call Interface (ECI). The CICS client then routes the ECI request to a CICS server. In our case the CICS server is a CICS/VSE system.

Lotus Notes users on Notes clients running applications on the Notes server are not aware that these applications are any different from any other Lotus Notes applications. The add-in task and the ECI connections to a CICS server are transparent to the user.

The following picture shows the flow of control for the CICS gateway:

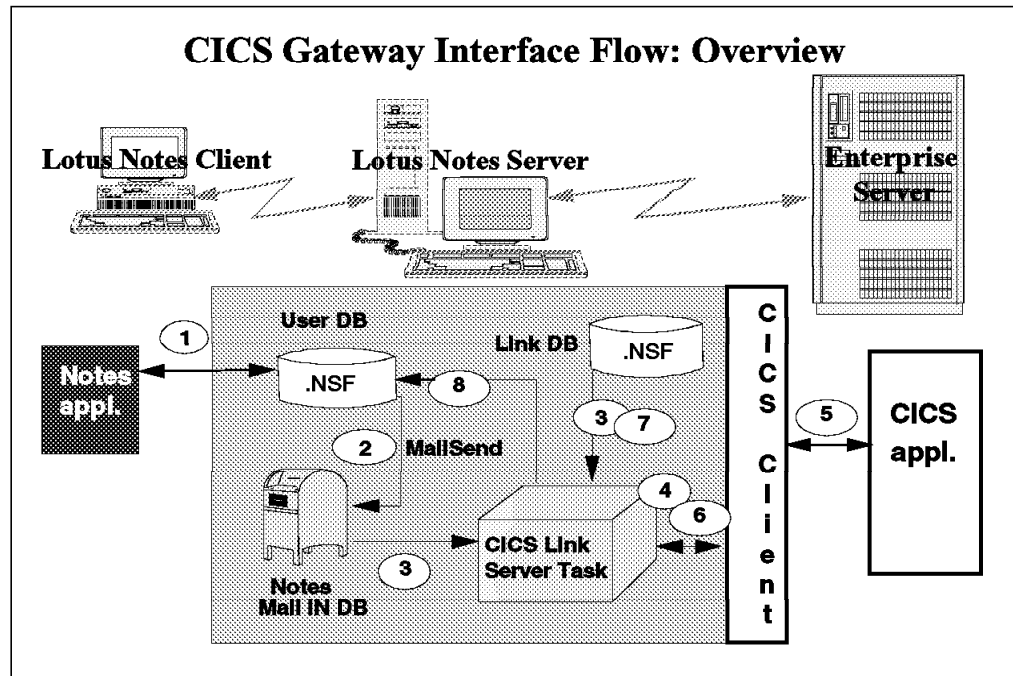


Figure 6. CICS Gateway Interface Flow

**Explanation:**

1. A Lotus Notes user on a Notes client workstation accesses the Lotus Notes application held in a Notes user database on a Notes server workstation.
2. In the Notes application a request to get data is sent to a Mail-In database together with input data for the request.
3. The CICS gateway polls the Mail-In database and reads the request and input data.  
It selects the appropriate document for this request from the link database. The link database contains the interface definition between the Lotus application and the host application.
4. The gateway passes the information to the CICS client using the ECI.
5. The CICS client routes the request to the CICS server passing the input data in a COMMAREA. On the host a CICS program is started which reads the input data from the COMMAREA, processes the request and returns the result via the CICS client.
6. The CICS client passes the COMMAREA data to the CICS gateway for Lotus Notes.
7. The CICS gateway for Lotus Notes reads the link database again to get the output mapping information.
8. Finally it updates the user document in the Lotus Notes database.

**3.1.2 Prerequisites for CICS Gateway for Lotus Notes**

In the following we list what you need to use CICS gateway for Lotus Notes.

- CICS link is made available by the gateway function of the CICS Client for OS/2 or for Windows NT. For OS/2 it is an integral part of the CICS Client for OS/2 V2.0 and Transaction Server for OS/2 V4.0. For Windows NT it is

available within the CICS Client for Windows NT V2.0 from IBM Transaction Server V4 for OS/2 or AIX, or CICS Client V2.

- Lotus Notes Server R4 for OS/2 and Windows NT
- Lotus Notes Client Release 4.0 or higher
- Any CICS server that provides ECI function:
  - CICS/ESA V3.3, CICS for MVS/ESA V4.1 or higher
  - CICS/MVS V2.1.2
  - CICS/VSE V2.2 or higher
  - CICS for OS/400 V3.1 or higher
  - CICS/6000 V1.2, CICS for AIX, V2.1 or higher
  - CICS for Digital UNIX
  - CICS for HP 9000
  - CICS for Siemens Nixdorf SINIX, V2.1
  - CICS for OS/2 V2 multi-user, and CICS for OS/2 V3
  - CICS for Windows NT V2 multi-user

For further information on the link, see IBM CICS Clients Gateways, SC33-1748-00. Check the specification sheet for IBM CICS Client, GC33-1450-02.

### 3.1.3 CICS Link Components

The CICS Link for Lotus Notes consists of the following components:

#### Lotus Notes application

The Lotus Notes application could be a new or existing application that requires some interaction with CICS, for example some information from a CICS database.

You normally include into the application:

- input fields

These fields are filled with data within the Lotus application and sent to the CICS host application as input.

- output fields

These fields are filled with data by the CICS host application and sent to the Lotus Notes application.

- some application statements

As a minimum, a MailSend function must be included which triggers the request by sending mail to the Mail-In database.

#### User database

The user database is a standard part of any Lotus Notes installation. It contains the Lotus Notes applications.

#### Mail-In database

The Mail-In database is a Lotus Notes database, which receives the request to access a CICS host application. The mail message also contains the input data that is to be passed from the Lotus Notes client to CICS.

**Link database** The Link database provides control information for the CICS gateway for Lotus Notes. It contains, for every defined link between Lotus Notes and CICS, a document that describes the interface between the Lotus Notes application and the CICS host application. This Link database document contains information concerning:

- the mapping of fields from the Lotus Notes application to the CICS COMMAREA
- CICS user ID and password to control access to CICS
- names of application programs and databases

The Link database is sometimes also called Meta database.

**CICS gateway for Lotus Notes**

The CICS Link for Lotus Notes monitors the Mail-In database for requests from a Lotus Notes application. It finds the appropriate document in the Link database. It sets up a COMMAREA with the input data and issues an ECI call. On completion of the ECI call it receives the COMMAREA from the CICS host application. It inserts the output fields obtained from the COMMAREA into the Lotus Notes document.

**The CICS application** A CICS application runs in order to service the request from the Lotus Notes application. It communicates with the workstation by exchanging COMMAREAs.

**The CICS server** The CICS server owns the CICS application and its resources.

**The CICS client** The CICS client interfaces between the Lotus Notes server and the CICS server. It handles EPI calls coming from a non-CICS application (in our case, the CICS Link).

### 3.1.4 Setting up the CICS Gateway for Lotus Notes to CICS/VSE

The following sections will only cover an overview of the setup of the CICS Link between OS/2 and VSE/ESA.

Before you can use the CICS gateway for Lotus Notes, you need to install Lotus Notes Version 3.3 or later and CICS Client for OS/2.

#### 3.1.4.1 Lotus Notes Setup

You need a Lotus Notes Server to be able to use the CICS gateway for Lotus Notes.

You need Lotus Notes clients to run Lotus Notes applications.

For installation and setup of Lotus Notes Servers and Clients, please refer to the Lotus Notes documentation.

No special setup considerations apply if you want to use the CICS gateway for Lotus Notes.

### **3.1.4.2 Setting up the CICS Gateway for Lotus Notes**

When you install the CICS Client for OS/2, one of the components is the CICS gateway for Lotus Notes. This is installed into a directory called \CICSLI\LOTUS and includes a sample application, which is installed into \CICSLI\SAMPLES\LOTUS.

We recommend that you look at this sample application. You may choose to use it as a base for developing your own applications.

To set up a CICS gateway for Lotus Notes system you need to:

1. create a Link database
2. populate the Link database by composing a document for your application
3. create a Mail-In database
4. load the server add-in task, \$CCLNSAT
5. load the help files

For more detailed information, please refer to the on-line book 'IBM CICS Client Gateway' of CICS Client for OS/2.

### **3.1.4.3 Setting up the CICS Client**

On the same workstation where the Lotus Notes Server and the CICS gateway for Lotus Notes are running, you need to install and set up a CICS client in order to be able to handle ECI calls and link the CICS/VSE.

After installing the CICS Client for OS/2 you have to set up the CICSLI.INI file. In this file you can enable communication between the CICS client and CICS/VSE by defining your VSE system as the target host system and enabling SNA communications.

### **3.1.4.4 Setting up Communications**

On the same workstation where the Lotus Notes Server and the CICS gateway for Lotus Notes and the CICS client are running, you need to set up SNA communications with VSE/ESA. Using the Communications Manager/2 you need to:

- configure the link to VSE/ESA; for example, IBM Token-Ring
- define a connection which includes
  - defining local LU and PU names
  - specifying partner LU name
  - specifying the LAN destination address

On the VSE/ESA side you need to add matching VTAM definitions. You normally need to define:

- an XCA major node to define the communications controller
- a switched major node to specify the LAN resources
- an application major node for the CICS system under VSE.

### 3.1.4.5 Setting up CICS/VSE

CICS/VSE must be enabled to communicate with the CICS client on the workstation. This means that you need to define connections and sessions. You can do this by using Resource Definition Online; that is, the CEDA transaction.

In addition, the applications called by the Lotus Notes application and their resources have to be defined.

### 3.1.4.6 Operating the Link

The following components must be up and running:

- The Lotus Notes Server  
Start the Server by double clicking the Server icon in the Lotus Notes folder.
- The CICS gateway for Lotus Notes  
Load the gateway from the Lotus Notes server as a server add-in task.
- The CICS Client  
Start it from the Start Client icon in the CICS Client folder.
- The Communications Manager/2  
Start it, making sure that the right configuration is used. The link to VSE must become active and sessions must be established when VTAM and CICS on the VSE side are up and running.
- VTAM on VSE/ESA  
Normally VTAM starts automatically after you IPLed VSE. The VTAM definitions for communication with the workstation will also become active automatically if you included them into the right VTAM lists.  
You may want to check that the connections are established by issuing VTAM DISPLAY NNET commands.
- CICS on VSE/ESA  
Again, normally CICS, the connections and sessions and the programs should become available automatically.

If necessary, check and activate resources through CEMT commands.

**Note:** It is important to remember that the CICS gateway for Lotus Notes will only work if all components are available at the time the request for VSE services is issued by the Lotus Notes application.

Any failing communication component will result in an error.

The user will have to issue the request once more after the failing component has been fixed.

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## 3.2 The MQSeries Link for Lotus Notes

The IBM MQSeries Link for Lotus Notes (or short: the MQSeries link) is very similar to the CICS Link for Lotus Notes. The basic difference is that it uses Messages and Queuing services to communicate between the Lotus Notes server workstation and the host system rather than CICS ECI calls.

The IBM MQSeries link enables Lotus Notes users to connect to all IBM and non-IBM platforms that support MQSeries. The MQSeries link executes on the Lotus Notes server. It includes services to:

- support a Lotus Notes database that holds information to be sent and received from the host.
- set up a Lotus Notes mapping database, which maps the information from a Notes format into an MQSeries format, and vice-versa.
- establish the MQSeries link environment.

Basically, the MQSeries link supports the two way exchange of data between Lotus Notes and MQSeries queues. It generates MQSeries messages in response to requests from Lotus Notes applications. The Queue Managers of the MQSeries products on the respective platforms are responsible for the routing of requests and answers between the workstation where the Lotus Notes server is located and the host server where the MQSeries application provides the requested services,

### **3.2.1 How the MQSeries Link Works**

In the same way as the CICS gateway for Lotus Notes, the MQSeries link runs as an "add-in task" on the Lotus Notes server and uses the facilities of the Lotus Notes application programming interface (API).

It uses the MQSeries API to put messages into a request queue and to get messages out of an answer queue.

The MQSeries Queue Manager then routes the request message to a Queue Manager on the server system. In our case the server system is VSE/ESA under which MQSeries for VSE must be running.

Again, identical to the situation described above for the CICS Link, Lotus Notes users on Notes clients running applications on the Notes server are not aware that these applications are any different from any other Lotus Notes applications. The add-in task and the MQSeries connections are transparent to the user.

The following picture shows the flow of control for the MQSeries Link for Lotus Notes:



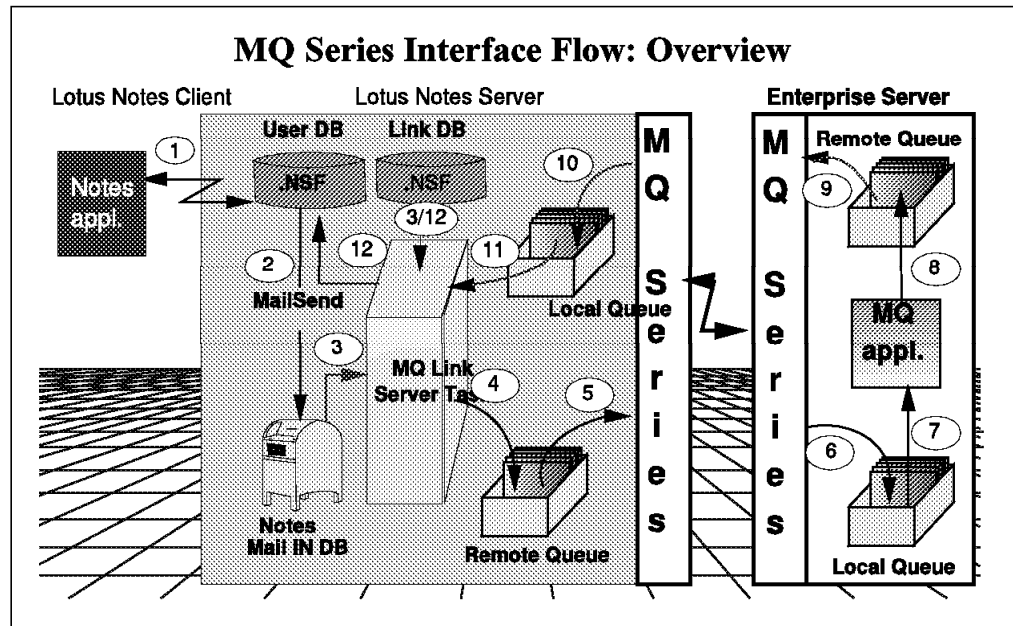


Figure 7. MQSeries Link Interface Flow

**Explanation:**

1. A Lotus Notes user on a Notes client workstation accesses the Lotus Notes application held in a Notes user database on a Notes server workstation.
2. In the Notes application a request to get data is sent to a Mail-In database together with input data for the request.
3. The MQSeries Link for Lotus Notes polls the Mail-In database and reads the request and input data. It also selects the appropriate document for this request from the link database. The link database contains the interface definition between the Lotus application and the host application.
4. The gateway puts a request into the request queue. This queue is a remote queue. Its destination is a queue on the host server system.
5. The MQSeries queue manager transfers the input data to its partner on the host queue.
6. The MQSeries queue manager on the host puts the request into a local queue.
7. Through the MQSeries triggering mechanism the host application is started.
8. The host application gets the message with the input data, processes the request and puts the answer into a remote queue.
9. The host queue manager transfers the answer back to the Lotus Notes server workstation.
10. The queue manager there puts it into a local queue.
11. The MQSeries Link for Lotus Notes gets the message with the answer from the queue and reads the mapping information from the Link database to map the output.
12. Finally it puts the data into the document in the user database.

### 3.2.2 Prerequisites for MQSeries Link for Lotus Notes

In the following we list what you need in order to use MQSeries gateway for Lotus Notes.

- on the Lotus Notes Server workstation:
  - Notes Server release 3.2 or later
  - the MQSeries product for the respective platform
  - the MQSeries Link for the respective platform:
    - MQSeries link for Lotus Notes for OS/2, as an integral part of the MQSeries for OS/2 V2.0.1 product.
    - MQSeries link for Lotus Notes for Windows NT, available within the MQSeries for Windows NT V2.0 product.
    - MQSeries link for Lotus Notes for AIX, available as MQSeries Software Developer's Kit (SDK), MA68.
    - MQSeries link for Lotus Notes for HP-UX, available within the MQSeries for HP-UX V2.2.1 product.
    - MQSeries link for Lotus Notes for Sun Solaris, released in V2.1 of the MQSeries for Sun Solaris product.
- You can link to any system with an MQSeries product. For a list of systems, please refer to 2.4.4, "MQSeries Platforms" on page 13.

### 3.2.3 MQSeries Link Components

The MQSeries Link for Lotus Notes is made up of the following components:

#### Lotus Notes application

This is identical to an application using the CICS Link. It can be a new or existing application that requires some interaction with a host server.

You normally include into the application:

- input fields

These fields are filled with data within the Lotus application and sent to the host application as input.
- output fields

These fields are filled with data by the host application and sent to the Lotus Notes application.
- some application statements

As a minimum a MailSend function must be included which triggers the request by sending mail into the Mail-In database.

#### User database

This is identical to the CICS Link. The user database is a standard part of any Lotus Notes installation. It contains the Lotus Notes applications.

#### Mail-In database

This is identical to the CICS Link. The Mail-In database is a Lotus Notes database, which receives the request to access a CICS host application. The mail message also contains the input data that is to be passed from the Lotus Notes client to CICS.

**Link database** This is similar to the CICS Link. The Link database provides control information for the MQSeries Link. It contains, for every defined link, a document that describes the interface between the Lotus Notes application and the host application. This Link database document contains information concerning:

- the mapping of fields from the Lotus Notes application to the request message and reply message.
- names of Lotus application forms and databases.
- names of request and reply queues.

The Link database is sometimes also called Meta database.

**MQSeries Link for Lotus Notes**

The MQSeries Link for Lotus Notes monitors the Mail-In database for requests from a Lotus Notes application. It finds the appropriate document in the Link database. Instead of using a COMMAREA and an ECI call for communication (as the CICS Link does), the MQSeries Link puts a message into the request queue. It also puts a message into a work queue which is used to match request and reply messages. The MQSeries Link monitors the reply queue for reply messages from the host application. It then inserts the output fields obtained from the reply message into the Lotus Notes document.

**The host application** A host application runs in order to service the request from the Lotus Notes application. It communicates with the workstation using MQSeries messages.

It is an MQSeries program using the MQSeries application programming interface (API) to get and put messages from/into queues.

In our case, with a VSE/ESA system as the host, the application is at the same time an MQSeries and a CICS application: For VSE/ESA MQSeries itself and MQSeries applications run under control of CICS/VSE.

**The MQSeries server** The MQSeries server owns the host application and its resources.

In addition, message queues are required to pass requests and answers.

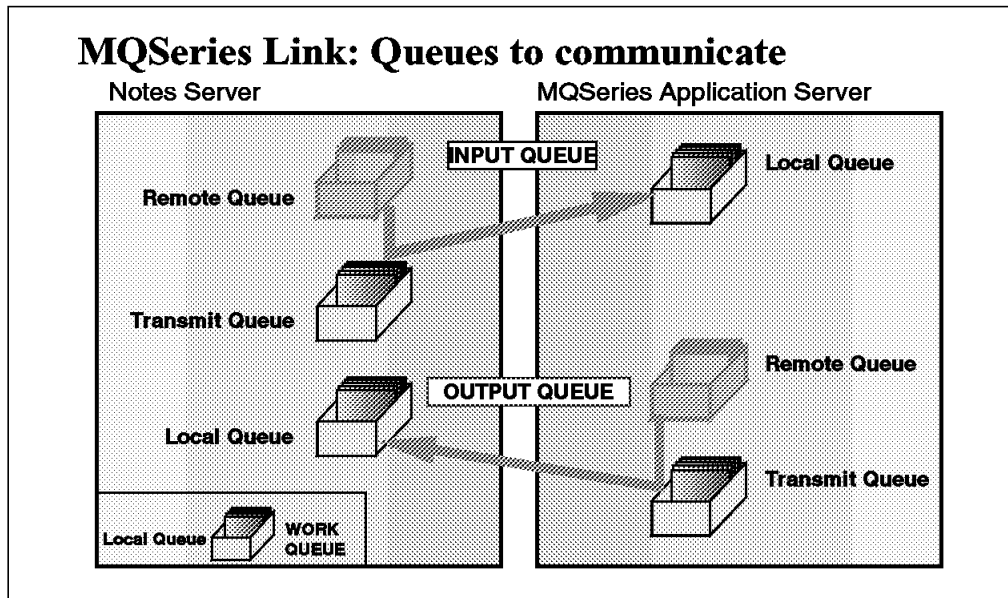


Figure 8. MQSeries Link Queues

#### Input queue definitions

The input queue is the queue into which the MQSeries Link for Lotus Notes puts messages with requests for the server system.

The input queue must be defined as:

- a remote queue to the MQSeries queue manager on the Lotus Notes Server system
- a local queue to the MQSeries queue manager on the application server system.

A transmit queue on the Lotus Notes Server system is required to facilitate message routing between the two systems.

#### Output queue definitions

The output queue is the queue into which the server application puts messages with answers for the MQSeries Link for Lotus Notes.

The output queue must be defined as:

- a remote queue to the MQSeries queue manager on the application server system.
- a local queue to the MQSeries queue manager on the Lotus Notes Server system

A transmit queue on the application server system is required to facilitate message routing between the two systems.

#### Work queue definition

The work queue is a queue into which MQSeries Link for Lotus Notes puts information to coordinate answers received with requests sent.

The work queue must be defined as a local queue to the MQSeries queue manager on the Lotus Notes Server system.

### **3.2.4 Setting up the MQSeries Link for Lotus Notes to CICS/VSE**

The following sections will only cover an overview of the setup of the MQSeries Link between OS/2 and VSE/ESA.

Before you can use the MQSeries Link, you need to install Lotus Notes Version 3.3 or later and MQSeries for OS/2.

#### **3.2.4.1 Lotus Notes Setup**

This is the same as for the CICS Link.

You need a Lotus Notes Server to be able to use the MQSeries Link for Lotus Notes

You need Lotus Notes clients to run Lotus Notes applications.

For installation and setup of Lotus Notes Servers and Clients, please refer to the Lotus Notes documentation.

No special setup considerations apply if you want to use the MQSeries Link.

#### **3.2.4.2 Setting up the MQSeries Link for Lotus Notes**

When you install the MQSeries for OS/2, one of the components is the MQSeries Link for Lotus Notes.

The installation includes samples. We recommend that you look at this sample application. You may choose to use it as a base for developing your own applications.

To set up a MQSeries Link for Lotus Notes you need to:

1. create a Link database
2. populate the Link database by composing a document for your application
3. create a Mail-In database
4. load the server add-in task, \$MQLINK
5. load the help files

For more detailed information, please refer to on-line MQSeries books.

#### **3.2.4.3 Setting up MQSeries**

You need to set up MQSeries on the two systems involved. In the case we discuss here this means setting up:

- MQSeries for OS/2
- MQSeries for VSE/ESA.

##### **MQSeries for OS/2**

On the same workstation where the Lotus Notes Server and the MQSeries Link are running you need to install and set up the respective MQSeries product in order to be able to handle:

- queues which
  - receive messages from the MQSeries Link
  - transmit message to the MQSeries queue manager on the host
  - receive message from the MQSeries queue manager on the host
- channels to send and receive messages to and from the MQSeries queue manager on the host.

After product installation you have to perform the following steps to complete basic setup:

- create a queue manager
- start the queue manager
- create default objects
- create a dead letter queue.

These steps can be performed through the MQSeries for OS/2 command interface.

After completing basic setup you should verify your installation through the supplied sample applications.

For the MQSeries Link for Lotus Notes you need, in addition, to set up distributed queue management. This includes:

- enabling LU6.2 communication in the OS/2 QM.INI file.
- defining additional queues. As a minimum you need:
  - a local queue to receive messages from VSE/ESA
  - a local work queue
  - a remote queue to send messages to VSE/ESA
  - a transmit queue to handle messages which are to be sent to VSE/ESA
- defining channels. As a minimum you need:
  - a sender channel to VSE/ESA
  - a receiver channel from VSE/ESA

**Note:** Since MQSeries on VSE/ESA does not handle EBCDIC/ASCII translation all translation must be done by the queue manager on OS/2. This can be enforced by setting appropriate parameters in the definitions of the sender channel which is used to send messages to VSE/ESA and the local queue which is used to receive messages from VSE.

### **MQSeries for VSE/ESA**

On your host system where your host MQSeries applications are to run you need to install and set up the respective MQSeries product in order to be able to:

- support applications which use the MQSeries API to get messages from queues and put messages into queues.
- handle queues which
  - receive messages from the workstation
  - receive messages from the host application

- transmit message to the MQSeries queue manager on the workstation.
- handle channels to send and receive messages to and from the MQSeries queue manager on the workstation.

After product installation you have to perform the following steps to complete basic setup:

- define VSAM files for queues
- customize CICS/VSE:
  - add MQSeries data sets into the FCT
  - add an intrapartition destination into the DCT
  - define MQSeries programs and transactions, preferably using Resource Definition Online (RDO).
- set up MQSeries. This includes:
  - defining a queue manager
  - defining local queues.

These steps are performed using the panels supplied by MQSeries for VSE/ESA.

After completing basic setup you should, again, verify your installation through the supplied sample applications.

For the MQSeries Link for Lotus Notes you need, in addition, to set up distributed queue management. Symmetrically to the MQSeries for OS/2 definitions this includes:

- a local queue to receive messages from OS/2
- a remote queue to send messages to OS/2
- a transmit queue to handle messages which are to be sent to OS/2
- a sender channel to OS/2
- a receiver channel from OS/2

**Note:** MQSeries on VSE/ESA supports triggering, that is it supports a mechanism which allows applications to be started automatically when messages arrive in a queue. This triggering is very useful to start the host application which delivers the data to the workstation automatically each time a request comes into the queue from Lotus. Therefore, the local (input) queue on VSE will very often be defined with the parameters required for triggering.

#### **3.2.4.4 Setting up Communications**

Setting up communications for the MQSeries Link for Lotus Notes is again very similar to the setting up of communications for the CICS Link.

On the same workstation where the Lotus Notes Server and the MQSeries Link for Lotus Notes and MQSeries for OS/2 are running you need to set up SNA communications with VSE/ESA. Using the Communications Manager/2 you need to:

- configure the link to VSE/ESA; for example, IBM Token-Ring
- define a connection which includes
  - defining local LU and PU names

- specifying partner LU name
- specifying the LAN destination address

The only additional definition for the Communication Manager is the definition of a transaction program: The MQSeries program which handles incoming messages from VSE/ESA must be known as a transaction program to CM/2.

Identical to the CICS Link case, you need to add matching VTAM definitions. You normally need to define:

- an XCA major node to define the communications controller
- a switched major node to specify the LAN resources
- an application major node for the CICS system under VSE.

### 3.2.4.5 Setting up CICS/VSE

MQSeries for VSE/ESA runs under control of CICS/VSE. Therefore, additional CICS definitions are required for basic MQSeries for VSE/ESA as described above. In addition CICS/VSE must be enabled to communicate with the MQSeries on OS/2. This means that you need to define connections and sessions again. In the same way as for the CICS Link you can do this by using Resource Definition Online; that is, the CEDA transaction.

In addition, the MQSeries applications used and their resources have to be defined to CICS/VSE.

### 3.2.4.6 Operating the Link

The following components must be up and running:

- The Lotus Notes Server  
Start the Server by double clicking the Server icon in the Lotus Notes folder.
- The MQSeries Link for Lotus Notes  
Load the link from the Lotus Notes server as a server add-in task.
- MQSeries on OS/2  
Start it from the MQSeries supplied icon in the MQSeries folder or from an OS/2 command prompt.
- MQSeries sender and receiver channels  
If they are not started automatically with the queue manager you can start them from an OS/2 command prompt using the MQSeries command interface.
- The Communications Manager/2  
Start it, making sure that the right configuration is used. The link to VSE must become active and sessions must be established when VTAM and CICS on the VSE side are up and running.
- VTAM on VSE/ESA  
Normally VTAM starts automatically after you IPLed VSE. The VTAM definitions for communication with the workstation will also become active automatically if you included them into the right VTAM lists.  
  
You may want to check that the connections are established by issuing VTAM DISPLAY NNET commands.



- CICS on VSE/ESA

Again, normally CICS, the connections and sessions and the programs should become available automatically.

If necessary check and activate resources through CEMT commands.

- MQSeries on VSE/ESA

If queue manager or queues or channels are not started automatically you can start them through CICS panels supplied by the MQSeries product for VSE/ESA.



## Chapter 4. More Ways to Link Lotus Notes and VSE/ESA

In addition to the links described in Chapter 3, “The CICS and MQSeries Gateways to Lotus Notes” on page 15 there are extensions:

- the CICS and MQ link extra
- Lotus Notes Script Extension
- Lotus Notes Enterprise Integrator.

We will give a brief description of these extensions here.

### 4.1 MQ Link Extra

The MQSeries for OS/2 link extra for Lotus Notes follows similar principles as the MQSeries Link for Lotus Notes but it reverses the direction: Where MQSeries Link for Lotus Notes starts on the workstation side with a Lotus Notes application, MQSeries for OS/2 link extra for Lotus Notes starts at the host.

MQSeries for OS/2 link extra for Lotus Notes provides MQSeries applications with a means of sending data to a Lotus Notes environment. This data can be used to update or add one or more documents to a Lotus Notes database. Document updates may span more than one document in Lotus Notes databases. Specification of what action to take, which document and which fields to update is contained in an MQSeries for OS/2 link extra for Lotus Notes link database.

#### 4.1.1 How MQSeries for OS/2 Link Extra for Lotus Notes Works

The figure below outlines the flow of data from an MQSeries host application to a Lotus Notes application.

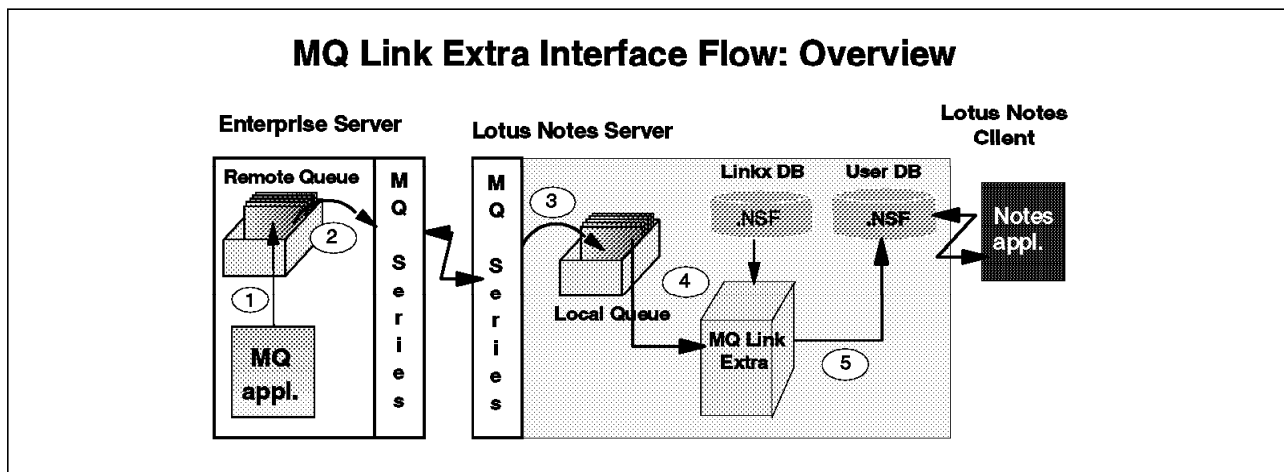


Figure 9. MQSeries for OS/2 Link Extra for Lotus Notes Flow

The following steps are performed:

1. The MQSeries host application puts a message into a remote queue.
2. MQSeries transmits the message to the workstation.
3. MQSeries puts the message into the local queue on the workstation.

4. MQ link extra has either to be started from an OS/2 command prompt or is triggered by the incoming message. It gets the message from the local queue and maps it against the Linkx link database.
5. MQ link extra updates the Notes documents.

#### 4.1.2 Prerequisites for MQSeries for OS/2 Link Extra for Lotus Notes

MQSeries link extra is available as a Software Developer's Kit (SDK) for the following platforms:

- MQSeries link extra for Lotus Notes for OS/2 (MA3H)
- MQSeries link extra for Lotus Notes for Windows NT (MA71)
- MQSeries link extra for Lotus Notes for AIX (MA6A)
- MQSeries link extra for Lotus Notes for HP-UX (MA6B)
- MQSeries link extra for Lotus Notes for Sun Solaris (MA6C)

MQSeries link extra requires Lotus Notes Server Version 3.2 or later. An MQSeries product on the workstation and the host is required.

#### 4.1.3 Components for MQSeries for OS/2 Link Extra for Lotus Notes

The components used for MQSeries for OS/2 link extra for Lotus Notes are similar to the MQSeries Link for Lotus Notes components. The main differences are addressed below.

##### MQ Link Extra link database

This is a Lotus Notes database that needs to be populated with a description of how the message data maps to fields in a given Lotus Notes document. It names the Lotus Notes user database which contains the document(s). It allows you to specify a key field to select specific documents within the selected database. The value of the key field in the document is matched against the value of the equivalent field in the message sent using the specified comparison operator (=, <, >, <=, >=). Additional fields can be specified and compared with fixed values. Only those Lotus Notes documents which match the specified criteria are processed.

The logical processing rules (for example, If found Insert, Insert always) for each message retrieved are also specified in the database. One of 10 predefined rules must be used.

##### MQSeries for OS/2 link extra for Lotus Notes

MQSeries for OS/2 link extra for Lotus Notes runs as an independent process, not as a server add-in task of the Lotus Notes server. The process is started through triggering or from an OS/2 command prompt. When triggering is desired, an application queue with triggering turned on is needed along with a process definition that will run the MQSeries link extra, MQLINKX.EXE.

##### Queues and channels

Since MQSeries for OS/2 link extra for Lotus Notes only transmits from the host to the workstation and not vice versa, fewer queues and channels are required:

- a remote queue on VSE/ESA
- a transmit queue on VSE/ESA
- a sender channel on VSE/ESA
- a local queue on OS/2
- a receiver channel on OS/2

## 4.2 CICS Link Extra

The CICS link extra is similar to the MQSeries for OS/2 link extra for Lotus Notes as far as the direction is concerned: It also starts on the host side and updates Lotus Notes documents on the workstation. It is similar to the CICS Link as far as transferring information is concerned: It uses COMMAREAs to transfer information from one CICS application to another.

It provides CICS applications with a means of sending data to a Lotus Notes environment without requiring MQSeries products on the involved systems. In the same way as MQSeries for OS/2 link extra for Lotus Notes, this data can be used to update or add one or more documents to a Lotus Notes database. Document updates may span more than one document in Lotus Notes databases. Specification of what action to take, which document and which fields to update is contained in a link database.

### 4.2.1 How CICS Link Extra Works

The figure below outlines the flow of data from a CICS host application to a Lotus Notes application.

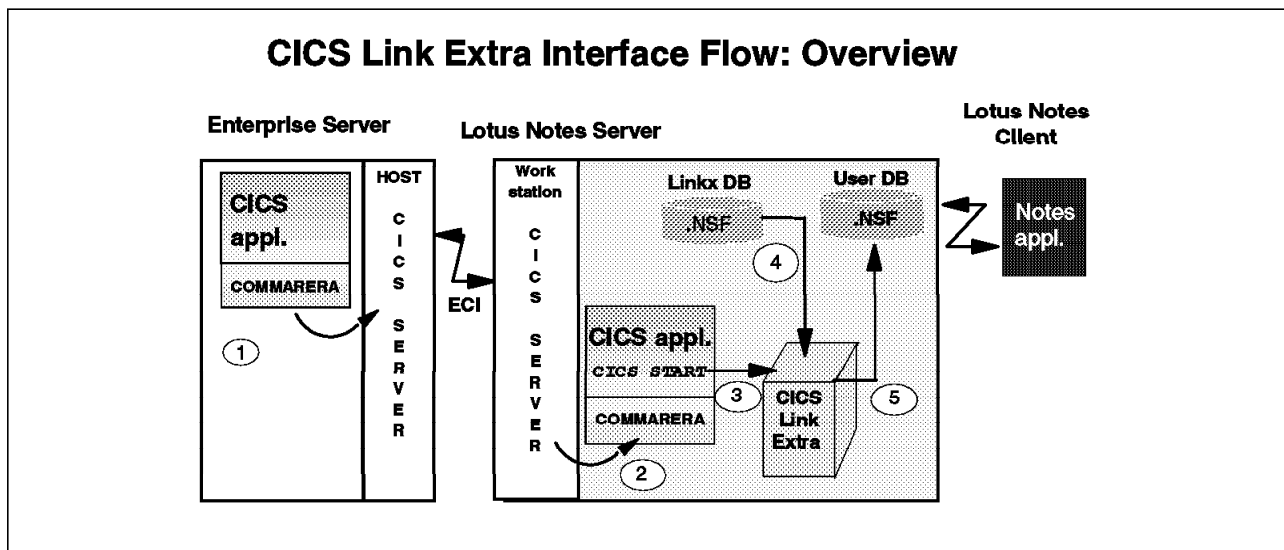


Figure 10. CICS Link Extra Flow

The following steps are performed:

1. The CICS host application sets up the data in the CICS COMMAREA and issues an ECI call to a CICS application on the workstation.
2. CICS on host and workstation transfer the COMMAREA. The workstation CICS initiates the called CICS application.

3. The CICS application on the workstation starts CICS link extra as an independent process.
4. CICS link extra gets the data from the COMMAREA and maps it against the Linkx link database.
5. CICS link extra updates the Notes documents.

## 4.2.2 Prerequisites for CICS Link Extra

CICS link extra is available as a SupportPac on the following platforms:

- CICS link extra for Lotus Notes for OS/2 (CA39)
- CICS link extra for Lotus Notes for Windows NT (CA80)

CICS link extra for Lotus Notes requires Notes Server release 3.2 or later. It also requires a CICS server, installed on the Notes Server; that is, CICS for OS/2 V2.0.1 or later, or CICS for Windows NT V2.0 or later.

## 4.2.3 Components for CICS Link Extra

CICS link extra uses similar components to MQSeries for OS/2 link extra for Lotus Notes.

In particular the link database is used in the same way to define rules and criteria.

Of course, no queues are required.

---

## 4.3 MQSeries Link LotusScript Extension

LotusScript is an embedded, BASIC scripting language with a powerful set of language extensions that enable object-oriented application development within and across Lotus products. LotusScript, and its development toolset, provide a common programming environment across Lotus applications on all platforms supported by Lotus and is currently available in Lotus Notes V4.0.4, Approach 96, Freelance 96 and Word Pro 96. LotusScript allows you to place more complex scripts in a variety of locations and events than traditional Notes 4 macros.

LotusScript offers a wide variety of features of a modern, fully object-oriented programming language. Its interface to Notes is through predefined object classes. It extends the development capabilities of Notes by providing:

- a powerful, object oriented programming language that leverages the knowledge of BASIC and Visual Basic with organizations. LotusScript has a set of extensions beyond Visual Basic, which provides additional power and utility when writing applications using Notes.
- a full-fledged debugger and syntax-directed editor.
- access to a broad range of Notes product functions through the Notes Classes.
- access to external class libraries defined using the LSX Toolkit.

MQSeries link LotusScript Extension (MQLSX) gives your Lotus Notes applications, written in LotusScript, the ability to communicate with applications running in non-Notes environments, using MQSeries.

MQSeries link LotusScript Extension is an Application Programming Interface that you call from LotusScript to access the Message Queue Interface (MQI). This integration between Lotus Notes and MQSeries software extends the scope of Notes to include transactions and data that are part of other environments.

#### **4.3.1 How MQSeries Link LotusScript Extension Works**

MQSeries link LotusScript Extension provides classes, events and methods for MQSeries, for use from within a LotusScript program. MQLSX gives the application developer immense flexibility, including:

- requests for information from multiple heterogeneous systems
- incorporation of further selection criteria or processing of the returned information
- use of the workflow capabilities of Notes to distribute results or seek approval
- incorporation of results in integrated desktop applications.

The MQLSX code does not make calls to Notes. It is up to the application developer to handle what is updated in Notes, splitting the messages received from MQSeries into fields, and adding them to new or existing documents.

MQLSX could also be run direct from Lotus Smartsuite applications, for example to complete a 1-2-3 spreadsheet with the latest information, as LotusScript is common to all Lotus products.

#### **4.3.2 Prerequisites for MQSeries Link LotusScript Extension**

The MQSeries link LotusScript Extension is available as a Software Developer's Kit (SDK) for several platforms:

- MQSeries link LotusScript Extension for Intel platforms (MA03)
  - OS/2
  - Windows 3.1
  - Windows 95
  - Windows NT
- MQSeries link LotusScript Extension for UNIX platforms (MA05)
  - AIX
  - HP-UX
  - Sun Solaris

MQSeries link LotusScript Extension requires LotusScript as an integral part of the development platform, for example Notes release 4 or later. If using MQLSX with Notes, then this can be done with either Notes Clients or the Notes Server.

Whether LotusScript applications are going to be used from the Notes Client or the Notes Server, an MQSeries Server or MQI Client is required on the machine hosting MQLSX. MQSeries is also required on the target system(s).

## 4.4 Enterprise Integrator for Lotus Notes

The Enterprise Integrator for Lotus Notes is a set of enhancements to the MQSeries LotusScript Extension provided with Domino.Connect. These will make the task of developing and managing an Extended Enterprise Application more straightforward.

The Enterprise Integrator includes:

1. A set of classes that provide a Notes programmer with a simple interface to communicate with enterprise applications. These classes provide a common set of verbs, hiding details of any transaction management system being used by the enterprise application.
2. Built-in ability to access unmodified enterprise applications running under CICS and IMS, as well as native MQSeries applications on other enterprise server platforms.
3. Enhanced message building facilities. Notes programmers can build and interpret messages by reading and writing named fields within the message without having to know precise details of the message format. The system will provide default values for fields that the programmer does not set explicitly, if this is appropriate.
4. Integration of the Identification and Authentication services of Lotus Notes with the access controls provided by CICS and IMS.

### 4.4.1 How Enterprise Integrator Works

The figure below outlines the components involved in the Enterprise Integrator.

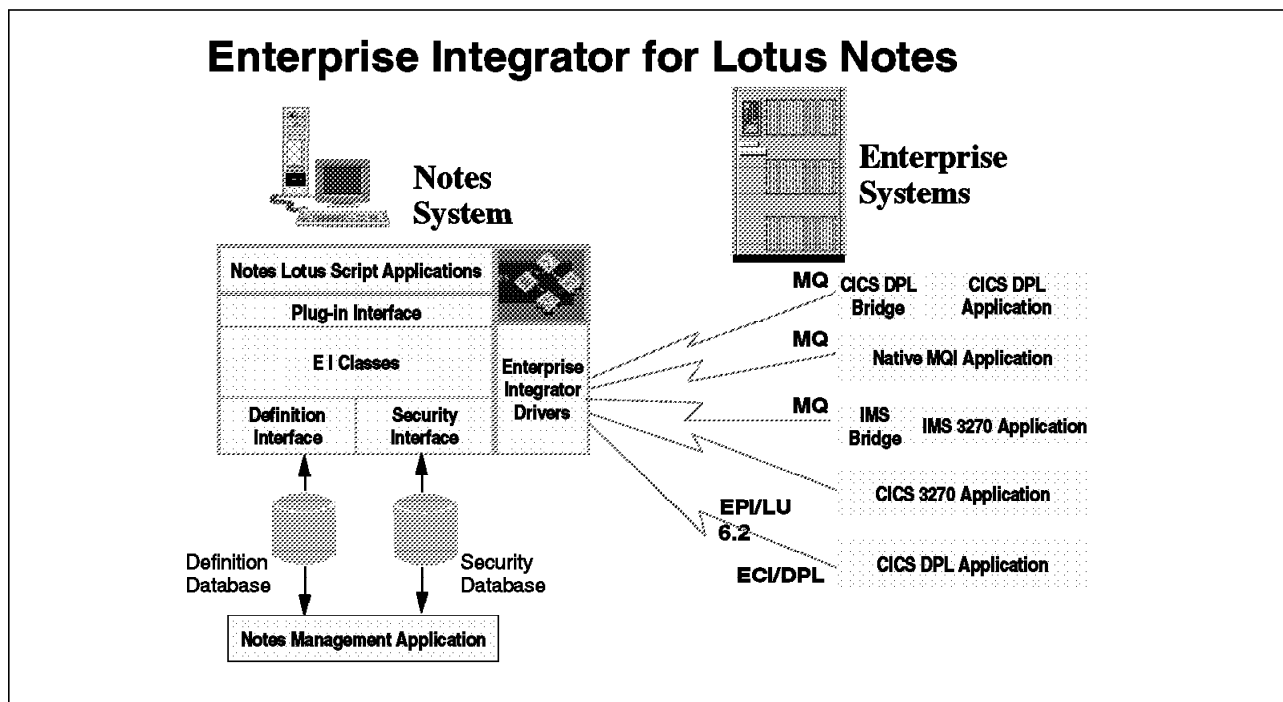


Figure 11. Enterprise Integrator

A LotusScript Extension (LSX) provides the LotusScript programmer with the Enterprise Integrator (EI) interface classes. The two key classes from this interface are the EIService and EIMessage classes.



The EIService class provides a universal interface suitable for driving a variety of styles of back-end enterprise applications. It can support single-shot or multiple-interaction conversation run in either synchronous or asynchronous modes. The LotusScript program instantiates an object from this class in order to be able to communicate with the back-end enterprise application.

Individual communications with this application are then effected via the EIMessage objects. These encapsulate the parameter on a field level which flow to and from the enterprise application.

Objects from the EIService and EIMessage classes derive their characteristics from tables held in a Notes Definition Database. This provides a library of predefined objects. The definition for an EIService object contains information such as the type of transaction system on which it runs, and the communications mechanism used to access it. The LotusScript programmer does not need to be aware of this information as it does not need to be coded in the LotusScript application itself.

The Definition Database also contains definitions for the EIMessage objects required. An EIMessage object consists of a set of typed, named fields. These fields are presented to the LotusScript programmer as properties of the EIMessage object. The LotusScript programmer can read and write fields in the message using simple assignment statements, knowing nothing more than the names of the fields in question. This is directly analogous to the interface that Notes itself provides to the individual fields within a Notes document.

#### **4.4.2 Application Access through Enterprise Integrator**

When the LotusScript application constructs a message using the EIMessage class and submits it via an EIService object, the Enterprise Integrator invokes a driver to access the transaction itself. The Enterprise Integrator includes a variety of different drivers (the choice of which to use is governed by the EIService object definition). The following drivers are provided:

- Native MQSeries message
- IMS transaction via MQSeries
- CICS DPL via MQSeries
- CICS DPL via CICS ECI
- CICS 3270 transaction via CICS EPI

The native MQSeries message driver interfaces to MQSeries-aware enterprise applications. The IMS driver allows access to unchanged 3270-oriented transactions via the IMS bridge capability built into MQSeries for MVS/ESA V1.1.4. Access to CICS 3270-oriented transactions is provided through the CICS External Presentation Interface (EPI). CICS DPL-based programs can be accessed either through the CICS client (via the ECI interface) or through MQSeries using the newly-provided MQSeries DPL bridge. This is a CICS/ESA application that responds to incoming MQSeries messages and invokes unmodified CICS DPL-based programs.

### **4.4.3 Prerequisites for Enterprise Integrator**

The Enterprise Integrator comes with Domino.Connect.

Depending on the drivers used to access enterprise applications it requires MQSeries products on workstations and enterprise systems or appropriate CICS clients and servers.

## Chapter 5. Positioning and Summary

The following table compares the various ways how you can link Lotus Notes applications and host applications.

<i>Table 1 (Page 1 of 2). Comparing the Links</i>						
	<b>CICS Link</b>	<b>MQ Link</b>	<b>CICS Link Extra</b>	<b>MQ Link Extra</b>	<b>LotusScript Extension</b>	<b>Enterprise Integrator</b>
<b>typical usage</b>	request host data online from Lotus application	request host data online from Lotus application	offline replication of host data to Lotus	offline replication of host data to Lotus	programmed access to host data from Lotus	programmed access to host data from Lotus
<b>also possible</b>	online update of host data from Lotus application	online update of host data from Lotus application	offline replication of host data to Lotus	offline replication of host data to Lotus		
<b>based on</b>	CICS ECI	messaging and queueing	CICS ECI	messaging and queueing	messaging and queueing, LotusScript	messaging and queueing, and/or CICS ECI, and/or CICS EPI, LotusScript
<b>initiated by</b>	Lotus Notes application	Lotus Notes application	host application	host application	LotusScript application	LotusScript application
<b>Notes-host communication</b>	two way	one or two way	one way	one way	one or two way or multiple	one or two way or multiple
<b>sync/async</b>	normally synchronous	asynchronous	normally synchronous	asynchronous	asynchronous	both possible
<b>runs on</b>	Notes server as add-in task	Notes server as add-in task	Notes server as independent process	Notes server as independent process	Notes server or Notes client	Notes server or Notes client
<b>driven via</b>	Link database	Link database	Link database	Link database	LotusScript program	LotusScript program
<b>available for</b>	OS/2, Windows NT	OS/2, Windows NT, AIX, HP-UX, Sun Solaris	OS/2, Windows NT	OS/2, Windows NT, AIX, HP-UX, Sun Solaris	OS/2, Windows 3.1, Windows 95, Windows NT, AIX, HP-UX, Sun Solaris	all Domino.Connect platforms

<i>Table 1 (Page 2 of 2). Comparing the Links</i>						
	<b>CICS Link</b>	<b>MQ Link</b>	<b>CICS Link Extra</b>	<b>MQ Link Extra</b>	<b>LotusScript Extension</b>	<b>Enterprise Integrator</b>
<b>server platforms</b>	AIX Digital Unix HP-UX MVS/ESA OS/2 OS/390 OS/400 SINIX Sun Solaris VSE/ESA Windows NT	AIX AT&T GIS UNIX Digital VMS VAX HP-UX MVS/ESA OS/2 (with DOS and DOS/Windows clients) OS/400 SCO UNIX SINIX and DC/OSx SunOS Sun Solaris Tandem NonStop Kernel UnixWare« VSE/ESA Windows Windows NT	AIX Digital Unix HP-UX MVS/ESA OS/2 OS/390 OS/400 SINIX Sun Solaris VSE/ESA Windows NT	AIX AT&T GIS UNIX Digital VMS VAX HP-UX MVS/ESA OS/2 (with DOS and DOS/Windows clients) OS/400 SCO UNIX SINIX and DC/OSx SunOS Sun Solaris Tandem NonStop Kernel UnixWare« VSE/ESA Windows Windows NT	AIX AT&T GIS UNIX Digital VMS VAX HP-UX MVS/ESA OS/2 (with DOS and DOS/Windows clients) OS/400 SCO UNIX SINIX and DC/OSx SunOS Sun Solaris Tandem NonStop Kernel UnixWare« VSE/ESA Windows Windows NT	AIX AT&T GIS UNIX Digital VMS VAX HP-UX MVS/ESA OS/2 (with DOS and DOS/Windows clients) OS/400 SCO UNIX SINIX and DC/OSx SunOS Sun Solaris Tandem NonStop Kernel UnixWare« VSE/ESA Windows Windows NT
<b>prereq on workstation</b>	Notes server 3.3, CICS client or server	Notes server 3.3, MQSeries client or server	Notes server 3.3, CICS server	Notes server 3.3, MQSeries client or server	Notes server 4.0, MQSeries client or server	Domino.Connect MQSeries client or server or CICS client or server
<b>prereq on server</b>	CICS server	MQSeries	CICS server	MQSeries	MQSeries	CICS or IMS or MQSeries
<b>flexibility</b>	medium	medium	low	low	high	high
<b>complexity</b>	low	low	low	low	high	medium

The table shows that you have a wide variety of options to choose which link between Lotus Notes and VSE/ESA offers the best solution for your environment.

The links are there to offer you the best of two worlds: combine the strength of the groupware and messaging facilities of Lotus Notes on workstations with the power of your VSE/ESA as the backbone of your mission critical processes. You can integrate your existing transactions and use your enterprise data across the network from your workstations. This protects your investment in the /390 platform and at the same time opens up your enterprise for new and exciting opportunities.

Now it's up to you to make use of these opportunities and extend the reach of your VSE/ESA beyond pure transaction processing!

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## Appendix A. Special Notices

This publication is intended to help gain an understanding of the Lotus Notes links to VSE/ESA. It was written for managers and senior professionals who work in the system design and analysis area and who are interested in extending the reach of their VSE/ESA system.

The information in this publication is not intended as the specification of any programming interfaces that are provided by VSE/ESA, any of the MQSeries products or Lotus Notes. See the PUBLICATIONS section of the IBM Programming Announcement for these products for more information about what publications are considered to be product documentation.

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The following document contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples contain the names of individuals, companies, brands, and products. All of these

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CICS/VSE	ES/3090
ES/4381	ES/9000
IBM	IMS
Language Environment	MQ
MQSeries	MVS/ESA
OS/2	OS/390
OS/400	PowerPC
PS/2	RISC System/6000
RS/6000	S/390
SupportPac	System/390
VM/ESA	VSE/ESA
VTAM	

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Digital	Digital Equipment Corporation
Domino	Lotus Development Corporation
Freelance	Lotus Development Corporation
Gateway	Gateway Systems Corporation
HP	Hewlett-Packard Company
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Intel	Intel Corporation
Lotus	Lotus Development Corporation
Lotus Notes	Lotus Development Corporation
LotusScript	Lotus Development Corporation
Macintosh	Apple Computer, Incorporated
MacOS	Apple Computer, Incorporated
Microsoft	Trademarks or registered trademarks of Microsoft Corporation
Windows	
Windows NT	
Windows 95 logo	
MS	Microsoft Corporation
NCR	NCR Corporation
NetWare	Novell, Incorporated
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ProShare	
LANDesk	
ActionMedia	
PostScript	Adobe Systems, Incorporated

Replication	Lotus Development Corporation
SCO	The Santa Cruz Operation, Incorporated
Siemens	Siemens Company
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## Appendix B. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

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### B.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see "How to Get ITSO Redbooks" on page 49.

- *Lotus Solutions for the Enterprise, Volume 3, Using the IBM CICS Gateway for Lotus Notes*, SG24-4512
- *CICS Clients Unmasked*, GG24-2534
- *CICS/VSE to CICS/OS2 and CICS/6000, A Guide to Client/Server Solutions*, GG24-4262
- *Connecting a PS/2 under OS/2 to a VSE/ESA Host System*, GG24-4257

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### B.2 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 2-4 times a year at significant savings.

CD-ROM Title	Subscription Number	Collection Kit Number
System/390 Redbooks Collection	SBOF-7201	SK2T-2177
Networking and Systems Management Redbooks Collection	SBOF-7370	SK2T-6022
Transaction Processing and Data Management Redbook	SBOF-7240	SK2T-8038
AS/400 Redbooks Collection	SBOF-7270	SK2T-2849
RS/6000 Redbooks Collection (HTML, BkMgr)	SBOF-7230	SK2T-8040
RS/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

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### B.3 Other Publications

These publications are also relevant as further information sources.

- *CICS/VSE, Intercommunication Guide, Version 2 Release 3*, SC33-0701
- *CICS Family: Interproduct Communication*, SC33-0824
- *CICS Family: Communicating from CICS on System/390*, SC33-1697
- *CICS Clients Gateways*, SC33-1821
- *MQSeries for VSE/ESA User's Guide*, SC33-1142
- *MQSeries for OS/2 System Management Guide*, SC33-1371

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## B.4 Other Sources

The following Web sites are also relevant as further information sources:

- *the VSE/ESA home page*, <http://www.ibm.de/go/d00000166>
- *the IBM Hursley home page*, <http://w3.hursley.ibm.com/>
- *the IBM CICS Product Family home page*, <http://www.hursley.ibm.com/cics/>
- *the IBM MQSeries Product Family home page*,  
<http://www.hursley.ibm.com/mqseries>
- *the Extended Transaction Models home page*,  
<http://www.hursley.ibm.com/etmlinks>
- *the Lotus home page*, <http://www2.Lotus.com/home.nsf>

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## How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, CD-ROMs, workshops, and residencies. A form for ordering books and CD-ROMs is also provided.

This information was current at the time of publication, but is continually subject to change. The latest information may be found at URL <http://www.redbooks.ibm.com>

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## How IBM Employees Can Get ITSO Redbooks

Employees may request ITSO deliverables (redbooks, BookManager BOOKs, and CD-ROMs) and information about redbooks, workshops, and residencies in the following ways:

- **PUBORDER** — to order hardcopies in United States
- **GOPHER link to the Internet** - type `GOPHER.WTSCPOK.ITSO.IBM.COM`
- **Tools disks**

To get LIST3820s of redbooks, type one of the following commands:

```
TOOLS SENDTO EHONE4 TOOLS2 REDPRINT GET SG24xxxx PACKAGE
TOOLS SENDTO CANVM2 TOOLS REDPRINT GET SG24xxxx PACKAGE (Canadian users only)
```

To get BookManager BOOKs of redbooks, type the following command:

```
TOOLCAT REDBOOKS
```

To get lists of redbooks:

```
TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET ITSOCAT TXT
TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET LISTSERV PACKAGE
```

To register for information on workshops, residencies, and redbooks:

```
TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ITSOREGI 1996
```

For a list of product area specialists in the ITSO:

```
TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ORGCARD PACKAGE
```

- **Redbooks Home Page on the World Wide Web**  
<http://w3.itso.ibm.com/redbooks>
- **IBM Direct Publications Catalog on the World Wide Web**  
<http://www.elink.ibm.link.ibm.com/pbl/pbl>

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## List of Abbreviations

<b>AIX</b>	Advanced Interactive Executive	<b>MQ</b>	Message Queue
<b>API</b>	Application Program Interface	<b>MQI</b>	Message Queue Interface
<b>BASIC</b>	Beginners All-purpose Symbolic Instruction Code	<b>MVS/ESA</b>	Multiple Virtual Storage/Enterprise Systems Architecture
<b>CEDA</b>	Resource Definition Online Transaction	<b>NT</b>	Microsoft Windows NT
<b>CEMT</b>	Master Terminal Transaction	<b>OLTP</b>	On-line Transaction Processing
<b>CICS</b>	Customer Information Control System	<b>OS/2</b>	Operating System/2
<b>COBOL</b>	Common Business Oriented Language	<b>OS/400</b>	Operating System for AS/400
<b>CPU</b>	Central Processing Unit	<b>PC</b>	Personal Computer
<b>DCT</b>	Device Control Table	<b>PL/I</b>	Programming Language 1
<b>DPL</b>	Distributed Program Link	<b>POWER</b>	Priority Output Writers, Execution processor, and input readers
<b>DWF</b>	Document Writing Feature	<b>PS/2</b>	IBM Personal System/2
<b>ECI</b>	Extended Call Interface	<b>PTF</b>	Program Temporary Fix
<b>EPI</b>	External Presentation Interface	<b>PU</b>	Physical Unit
<b>ESA</b>	Enterprise Systems Architecture	<b>RISC</b>	Reduced Instruction-Set Computer
<b>ESDS</b>	Entry Sequenced Data Set	<b>S/390</b>	IBM System/390
<b>FCT</b>	File Control Table	<b>SNA</b>	Systems Network Architecture
<b>HP-UX</b>	Hewlett-Packard UNIX	<b>VAX</b>	Virtual Address Extension
<b>IBM</b>	International Business Machines	<b>VMS</b>	Virtual Memory System
<b>IMS</b>	Information Management System	<b>VSAM</b>	Virtual Storage Access Method
<b>ISC</b>	Intersystem Communication	<b>VSE</b>	Virtual Storage Extended
<b>ITSO</b>	International Technical Support Organization	<b>VSE/ESA</b>	Virtual Storage Extended/Enterprise Systems Architecture
<b>KSDS</b>	Key Sequenced Data Set	<b>VTAM</b>	Virtual telecommunications access method
<b>LAN</b>	Local Area Network	<b>XCA</b>	External Communications Adapter
<b>LU</b>	Logical Unit		





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