VAX Message Router

Introduction to Message Router

digital™

AA-KR17A-TE

Message Router

Introduction to Message Router

Version 3.0

digital™

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Preface

This book introduces Message Router. It describes what Message Router is and how it works.

Intended Readers

This book is intended for anyone who is interested in Message Router, particularly in managing Message Router.

Structure of this Book

This book is divided into four chapters:

- Chapter 1 explains what Message Router is and introduces the three components of Message Router. These components are:
  - The Transfer Service
  - The Directory Service
  - The Management Service
- Chapter 2 describes how the Transfer Service works.
- Chapter 3 describes how the Directory Service works.

- Chapter 4 describes the Management Service.

Associated Books

For an overview of MAILBUS, read the *Introduction to MAILBUS.*

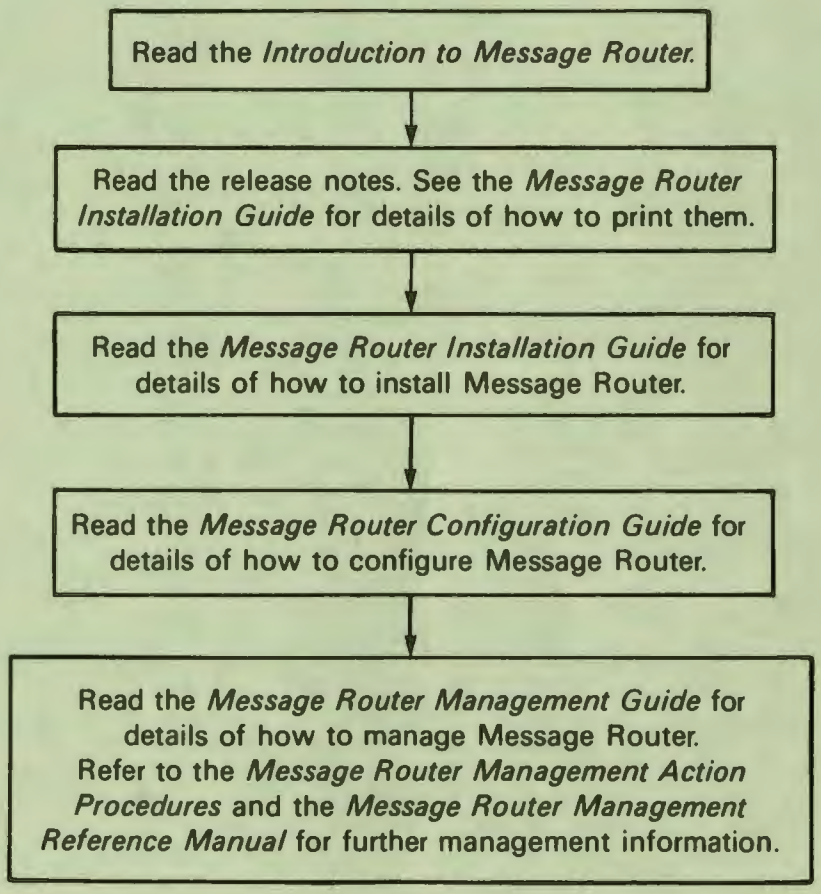
If you are going to install Message Router, read the *Message Router Installation Guide.*

If you are going to manage Message Router, read the following books:

- The *Message Router Release Notes.* These are provided on the distribution media and the *Message Router Installation Guide* describes how to print out a copy of the Release Notes.
- The *Message Router Configuration Guide.* This book describes how to use the configuration procedure to set up your Message Router system.
- The *Message Router Management Guide.* This book describes how to manage Message Router.
- If you are running Message Router with exception reporting (see Section 4.3), the *Message Router Management Action Procedures.*
- The *Message Router Management Reference Manual.* This book gives details of the Message Router utilities, accounts and files.

Figure 1 shows you how to use the publications provided with Message Router.

Figure 1: Message Router Documentation Map



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1

Introduction to Message Router

1.1 What Is Message Router?

Message Router is the base of an electronic mail system. It can transfer messages across a mail network. Message Router can also keep a list of users who use the mail system so that each user can be identified.

Message Router contains a Transfer Service, a Directory Service and a Management Service:

- The Transfer Service is responsible for delivering messages through the mail network. It was available as Version 2.0 of Message Router. The Transfer Service is described in Chapter 2.
- The Directory Service maintains a list of subscribers on the mail network. It contains a current record of the names and addresses of subscribers on the network. The Directory Service is described in Chapter 3.
- The Management Service monitors the mail network for error and exception conditions and helps with the routine management of Message Router. The Management Service is described in Chapter 4.

The Transfer Service and Directory Service are optional. You can run Message Router with or without the Transfer Service or Directory Service. Each service is needed only if it is required by the User Agent that you have on your network. The definition of a User Agent is given in Section 1.2.

1.2 Using Message Router

Message Router does not have users. It is not visible to users of mail systems. Instead, users see User Agents, and it is the User Agents that interface with Message Router. You cannot use Message Router without a User Agent.

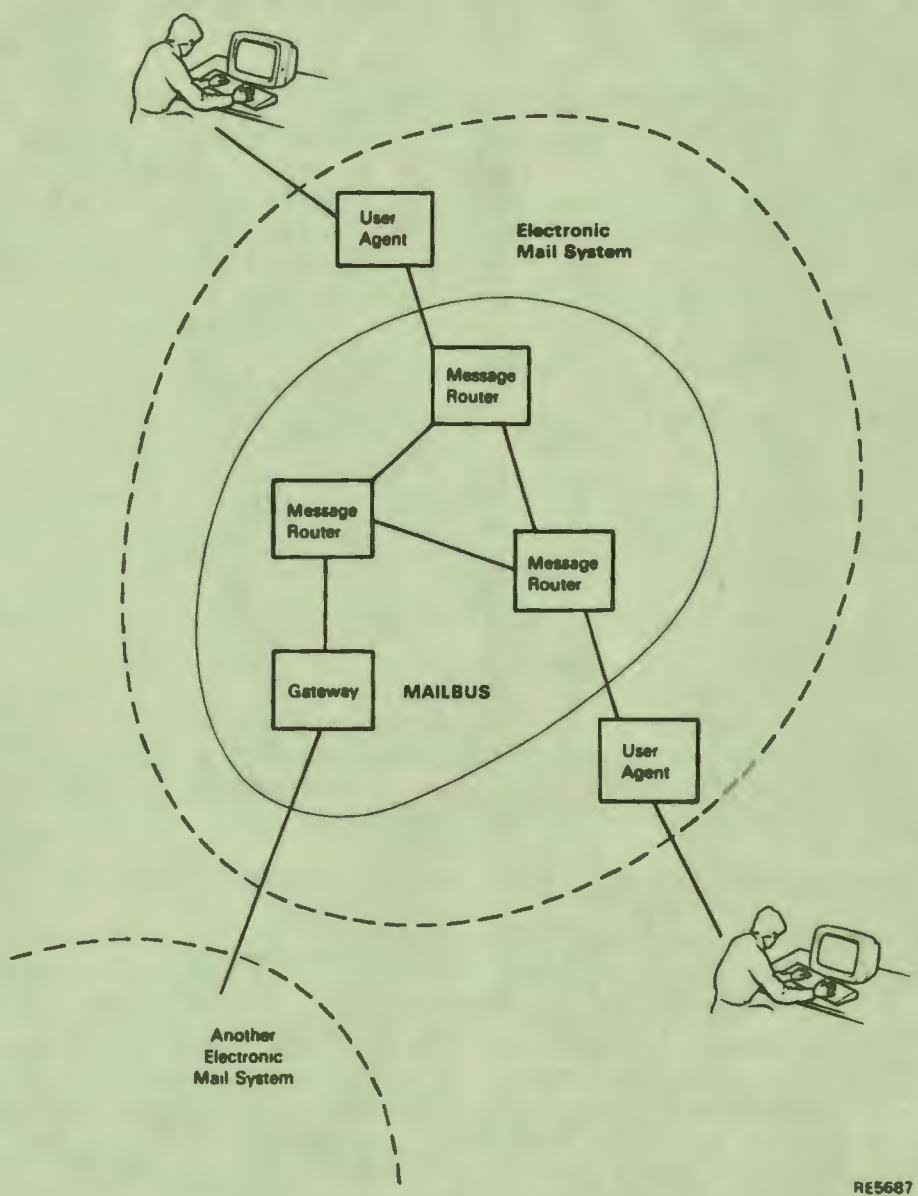
A *User Agent* provides an interface that allows users to send and receive messages from other users on the same machine. If a user wants to exchange messages with a user on a different machine, he still uses a User Agent to create the message. However, the User Agent cannot pass the message to another machine. Instead, the User Agent passes the message to Message Router, which then routes the message through the network to the destination machine. A typical DIGITAL User Agent is ALL-IN-1.

A user may want to communicate with a user of a different electronic mail system. In this case, the message is sent through a *Gateway*. The user still uses a User Agent to create the message and the User Agent passes the message to Message Router. Message Router, in turn, passes the message to a Gateway. A Gateway changes the format of a message to suit that of the receiving electronic mail system. It passes messages between the two electronic mail systems. Typical DIGITAL Gateways are the Message Router VMS mail Gateway (MRGATE) and the Message Router X.400 Gateway (MRX).

Message Router and its Gateways form the MAILBUS. For more information about MAILBUS, see the *Introduction to MAILBUS*.

The interaction between users, User Agents, Gateways, and Message Router is shown in Figure 1-1.

Figure 1-1: Interaction Between Users, User Agents, Gateways and Message Router



1.3 Managing Message Router

You can have many Message Routers in a network. They can be managed in any of the following ways:

- Individually, with a manager at each machine or node.

  The manager of an individual node is responsible for maintaining the local Message Router database. Because Message Router runs on a network, there are some planning decisions that affect all of the Message Router systems in a network and not just individual node systems, for example, the type of routing used and the number of world search nodes in the network. Therefore, each node manager must coordinate these planning decisions with the other Message Router managers on the network.

- As a network, with a single network manager for the whole network.

  A single network manager can maintain all the Message Router databases from a single point in the network. This person can then be the focus for all network-related problems.

- A combination of individual node management and network management.

Each single Message Router can be managed completely manually, automatically or a combination of these. The amount of manual management that Message Router needs depends on the way that you configure Message Router, (see Section 4.1).

Managing a Message Router system involves the following tasks:

- Installing the system from the media provided. This procedure must be done on every node in the mail network and is fully described in the *Message Router Installation Guide.*

- Designing the configuration of the Message Router system, taking into consideration the number of nodes on the system and the expected message throughput. Your configuration decisions for Message Router on an individual node or cluster must also agree with the decisions for the Message Router network. All the configuration options are described in the *Message Router Configuration Guide.*

- Creating the Directory Service nodes list on the master node (see the *Message Router Configuration Guide*).
- Configuring Message Router on your node (see the *Message Router Configuration Guide*). This procedure must be done on every node in the mail network.
- Creating the Transfer Service and Directory Service databases using the management utilities, and populating the Transfer Service nodes list (see the *Message Router Configuration Guide*). This task must be done on every node in the mail network. The amount of manual database creation you do depends on the configuration options that you choose.
- Regularly monitoring the MBMANAGER account on the node specified during configuration (see Section 1.4) for exception conditions and following the relevant MAPs, if you choose to run Message Router with exception reporting. MAPs (Management Action Procedures) and exception reporting are introduced in Section 4.3.
- Regularly maintaining Message Router as described in the *Message Router Management Guide*, if you choose not to run Message Router with the maintenance command procedures (see Section 4.4).
- Regularly monitoring the Message Router system for error conditions as described in the *Message Router Management Guide*, if you choose not to run Message Router with exception reporting.
- Regularly updating the Transfer Service and Directory Service databases to reflect changes in the network as described in the *Message Router Configuration Guide*.
- Supplying information to Gateway or User Agents managers, for example, the password of the MBMANAGER account and the type of configuration running on your Message Router system.

1.4 Message Router Accounts

Several accounts are used by Message Router. These are:

- MBMANAGER, which is the main account used to manage Message Router.
- MBWATCH, which is the account used for the exception reporting routines. The exception reporting routines are introduced in Section 4.3.
- MRNET, which is the account that the Transfer Service listeners run under. Transfer Service listeners are introduced in Section 2.3.
- DDSNET, which is the account that the Directory Service listeners run under. Directory Service listeners are introduced in Section 3.4.
- MRMANAGER, which is the account used to manage previous versions of Message Router.

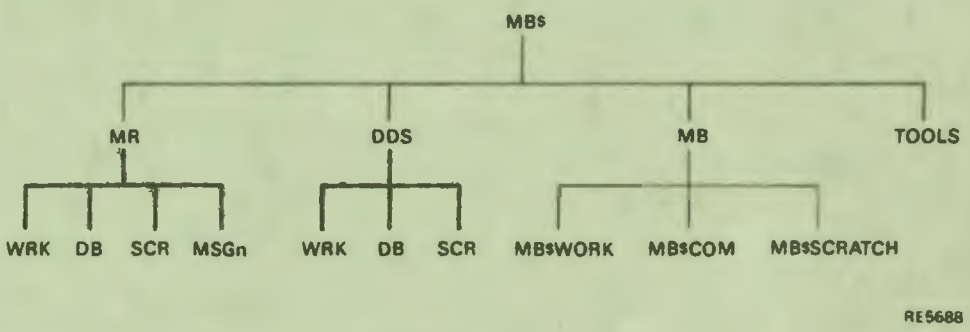
  MRMANAGER is provided only for compatibility with previous versions of Message Router. Do not use this account to manage Message Router Version 3.0.

NOTE: MBWATCH, MRNET, and DDSNET are not interactive accounts. You cannot log in to them.

1.5 Message Router Directory Structure

The VMS directory structure of Message Router is more complex than in previous versions because Message Router is now made up of three components. Figure 1-2 shows the upper levels of the Message Router directory structure. For details of the files used by the components of Message Router, refer to the *Message Router Management Reference Manual.*

Figure 1-2: Message Router Directory Structure



The MB$ directory is the directory used by the MBMANAGER account.

The subdirectories of the MB$ directory contain the following:

- The MR subdirectory contains files specific to the Transfer Service component of Message Router.
- The DDS subdirectory contains files specific to the Directory Service component of Message Router.
- The MB subdirectory contains files specific to the exception reporting routines. These routines are a major part of the Management Service component of Message Router (see Section 4.3).
- The TOOLS subdirectory contains files specific to the Management Service component of Message Router. This is the login directory of the MBMANAGER account.

2

The Transfer Service

2.1 Transfer Service Operation

Users, User Agents and Gateways are identified by the Transfer Service in the Message Router network as mailboxes. Each Transfer Service database contains a list of mailboxes and routing information that it uses to deliver messages. The extent of the routing information that is included in the Transfer Service database depends on the type of routing used in the network (see the *Message Router Configuration Guide*).

If a message is sent to users at several distant nodes, the Transfer Service sends the minimum number of messages needed to reach all those users.

The Transfer Services at separate nodes communicate with each other to transfer messages across the network. If a node on a route is not operating, the Transfer Service on the preceding node stores the message until the inoperative node is restored to the network. The stored message is then forwarded to the restored node and continues its route through the network. This is the store-and-forward operation that the Transfer Service uses.

Each node in the network that is to process message traffic with a store-and-forward capability, must have a Message Router system that includes the Transfer Service.

Transfer Services are connected together over a DECnet link (object type 22). Transfer Services can be connected to User Agents over a DECnet link or through a shareable image using a procedural interface to a shared Transfer Service listener.

2.2 What Is a Message?

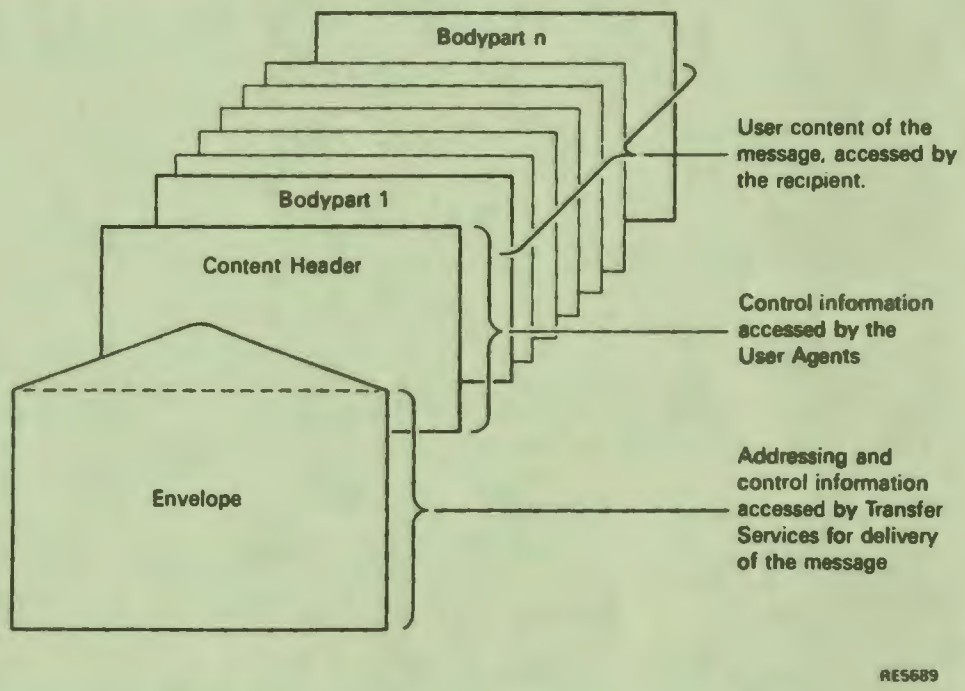
The Transfer Service acts as a postal service for electronic messages. A message consists of an envelope and its contents.

When a letter is sent through the post, only the name and address on the envelope are used by the postal service to deliver it to the destination mailbox. It is only at this point that the letter inside the envelope is read by the recipient.

Similarly, only the name and address on the envelope of a message are used by the Transfer Service to deliver it to the destination mailbox, and then the contents of the message are examined by the receiving User Agent. The User Agent reads the header information on the content to identify the recipient of the message and then delivers it to the recipient. The recipient then reads the user content of the message, that is, the body of the message.

Figure 2-1 shows the structure of a typical message; there can be any number of bodyparts.

Figure 2-1: Structure of a Message



Messages are encoded by User Agents using the encoding method described on the message format specification produced by the United States National Bureau of Standards (NBS). This encoding method corresponds to the X.400 Series message format specification produced by the International Telegraph and Telephone Consultative Committee (CCITT) and in particular to the X.411 Recommendation for Message Transfer Layers.

2.3 Transfer Service Components

Figure 2-2 shows the logical components that make up a Transfer Service system, namely:

- A shared image listener or a DECnet listener.

  The shared image listener is integrated with the User Agent for posting and fetching messages. The DECnet listener is connected to the User Agent over a DECnet link and sends and fetches messages for the User Agent.

- A talker.

  This is responsible for transferring messages to Transfer Services on other nodes.

- A logger.

  This records information about message traffic from all the Transfer Service components on the node.

- A Transfer Service Management (MRMAN) utility.

  MRMAN creates and maintains the Transfer Service database. It accepts commands interactively from the keyboard, or from messages sent to the special MRMAN queue.

- The Transfer Service database. This comprises a mailbox directory, a message queue and message files, as shown in Figure 2-3

Figure 2-2: Structure of a Transfer Service System

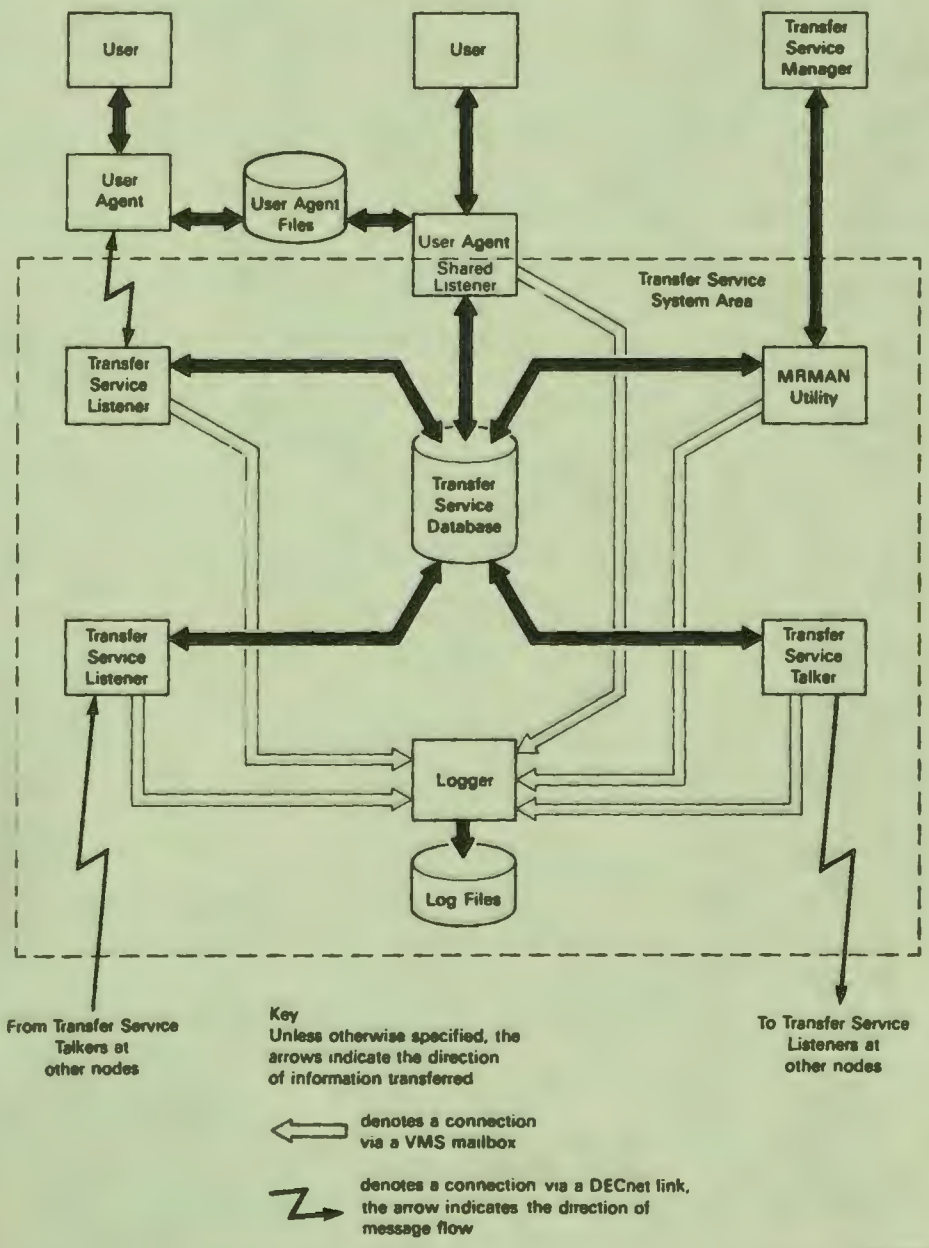
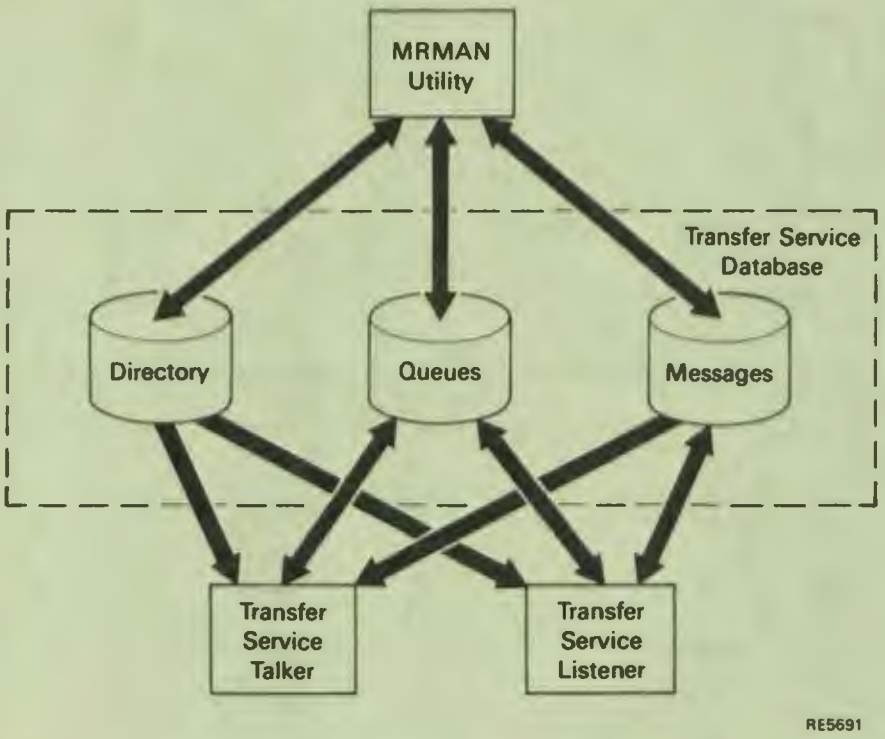


Figure 2-3: Accessing the Transfer Service Database



2.4 Transferring a Message

A message is constructed in the required format by a User Agent that usually uses the User Agent interface routines supplied by Message Router. These routines hide most of the complexity of the encoding scheme from the User Agent and are described in the *Message Router Programming Guide*. Once a message has been constructed by the User Agent, the User Agent must *select a mailbox*, before any other transactions can occur between the User Agent and the Transfer Service. The Transfer Service verifies the identity of each User Agent or remote Transfer Service that is selecting a mailbox before it accepts or delivers the message.

Following successful identification and selection, the User Agent *posts* the message to the Transfer Service. The message is transferred to the Transfer Service in the form of files and/or records. When the message has been posted to the Transfer Service, it accepts responsibility for the message. The Transfer Service does not restrict the content of the message. For example, the Transfer Service can handle messages in the form of text, voice, facsimile or graphics.

When the message is posted to the Transfer Service, the Transfer Service assigns a unique identification code to it, and also adds the date and time of posting to the message. In other words, the message is *marked and timestamped.*

The Transfer Services on intervening nodes pass the message through the network to the destination node. Intervening nodes *store* the message in transit and analyze the list of message recipients and then *forward* it towards its destination by transferring it to the next Transfer Service. The route that the message takes is determined from information on the message envelope and the routing information in the Transfer Service mailbox directory specified by the Message Router manager.

When the message has reached its destination, the Transfer Service *delivers* the message to the recipient's User Agent. The Transfer Service can either deliver the message automatically or wait to be polled by the User Agent. The Transfer Service automatically delivers the message either by *submitting a specified batch job* on behalf of the User Agent or by *notifying a specified VMS mailbox* when messages are delivered to the User Agent's mailbox queue. When the message is accepted by the User Agent, the Transfer Service hands over responsibility for the message to the User Agent.

The sender of the message can choose to be informed that the message has been successfully delivered. The Transfer Service can *confirm delivery* or report problems to any message sender. It deletes from the system any messages that cannot be delivered and notifies either the operator or the sender that the message was deleted.

As a message passes through the network, its progress is *logged* by the Transfer Services that handle it. The Transfer Service log files help you to analyze system use and performance.

The Transfer Service can keep a journal of message traffic. Messages originated by a User Agent at a node can be archived in the *source message journal* on that node. Messages that are delivered to local User Agent or Gateway mailboxes at a node can be archived in the *destination message journal* on that node.

You need to write a User Agent to fetch the messages from the journal mailbox, so this facility is useful only if you are going to write a User Agent. The *Message Router Programming Guide* gives details of how to write a User Agent for Message Router.

3

The Directory Service

3.1 Introduction

The Directory Service provides a distributed *replicated* database of *information*. The Directory Service does not provide an interface for users. It must be used through a User Agent, or a Gateway, such as the Message Router/S Gateway. However, managers can access the Directory Service by using the MBMAN utility (see the *Message Router Management Reference Manual*).

The MBMAN utility allows you to add or delete entries in the Directory Service database. These actions are usually performed by the User Agent or Gateway manager, but if you are running the Directory Service without a User Agent, you can use the MBMAN utility to maintain the database.

Each piece of *information* in the Directory Service database is called an *object*. The types of objects are:

- Subscriber
- User Agent
- Domain
- MTA

- World search list
- Nodes list
- Template

Each of these objects is described fully in Section 3.5.

An object is made up of *attributes* and values for the attributes. Typical attributes are GIVENNAME, which is the given name of the subscriber, and ORGNAME, which is the name of the organization to which the subscriber belongs. For more information about attributes, see the *Message Router Management Reference Manual.*

Attributes and their values can be used in two different ways and some attributes can be used in both ways. They can be the information supplied by a User Agent to find a particular object. That is, they are *action attributes*. A typical action attribute is the SURNAME attribute for a subscriber object.

The other way that attributes and their values can be used is for the User Agent to find out information about an object. An example of an attribute that can be used like this is the internal telephone number, INTPHONE, for a subscriber attribute. The SURNAME attribute for a subscriber object can also be used in this way.

The information in the Directory Service database is *replicated* at different points in the mail network for faster access. A point where the database is replicated is called a *world search node*. A world search node keeps a copy of all the objects in the Directory Service database.

Only one node in the Directory Service network can keep the *master copy* of an object. When an object needs to be updated, the Directory Service first updates the master copy of the object and then replicates the update to all other copies of the object stored in world search nodes. The update process is described in Sections 3.4.3 and 3.4.4. The master copy of an object is the most up-to-date version of the object.

Copies of objects can also be kept in the *cache* database on nodes that are not world search nodes. The cache database is a temporary store for objects that are not kept on the local node but are fetched from a world search node. Objects are kept in the cache database depending on how frequently they are fetched from the world search node. The most recently called objects are stored there.

If an object that has been updated is stored in a cache, the cache copy is not updated immediately. Instead, the cache copy is updated when one of the Directory Service maintenance command procedures, DDS$REFRESH.COM, runs (see Section 4.4).

3.2 The Master Node

The first node on which you configure the Directory Service must be the master node. The *master node* is the node that owns the Directory Service nodes list (see Section 3.5.6), the template (see Section 3.5.7), and any world search lists (see Section 3.5.5).

3.3 The Database

The Directory Service database used to hold objects has two parts:

1. A *permanent database*, which comprises two files:
   - The permanent database file
   - The permanent attribute index file
2. A *cache*, which comprises two files:
   - The cache database file
   - The cache attribute index file

The extent of the permanent database file depends on whether or not the local node is a world search node. If the local node is not a world search node, the permanent database file contains the objects whose master copy is maintained at this node.

If the local node is a world search node, the permanent database file contains objects that are replicated from all the other nodes in the network, as well as the objects whose master copy is maintained at this node. Each world search node's permanent database contains the same information, that is, all the objects in the network.

The cache database file contains objects not in the permanent database that have been accessed most recently at the local node by users. You can use the configuration procedure to change the size of the cache database (see the *Message Router Configuration Guide*). The master copies of these objects

are held at other nodes. None of the objects whose master copy is maintained at the local node is kept in the cache database on the local node.

The *dds-id* is an identifier that uniquely identifies each object in the network. The Directory Service generates a dds-id for each object as it creates the object.

When a search is invoked on a node, the user supplies a set of attributes and values that identify the object or objects that he wants to access. These attributes are action attributes (see the *Message Router Management Reference Manual*) and these attributes are used to search the permanent attribute index file to find the dds-ids of objects that have the required attributes.

Once the Directory Service has compiled a list of dds-ids that identify objects with the required attributes, it reads the details of the objects from the permanent database file. The Directory Service returns the details of the matching objects to the User Agent and the user chooses which objects to use. If the search did not produce the required object, the User Agent can request the Directory Service to extend the search to the cache or to a world search node.

Alternatively, the User Agent does not need to get the results of the local search and then ask the Directory Service to search the cache. Instead, the User Agent can specify that the Directory Service searches all parts of its database until it finds an object that matches the given attributes. The User Agent can also ask the Directory Service to search all parts of its database and return all the objects that match the given attributes.

The Directory Service searches its database in an order specified by the User Agent. The usual search pattern is that it searches the permanent database on the local node, then the cache on the local node and, if required, the permanent database on a world search node. If the local node is a world search node, the Directory Service only ever searches the local permanent database. See the relevant User Agent documentation for information about the types of searches that a user can request.

3.4 How Does the Directory Service Work?

The Directory Service uses detached processes, that is, *servers*, to execute transactions. The types of transactions that the Directory Service carries out are:

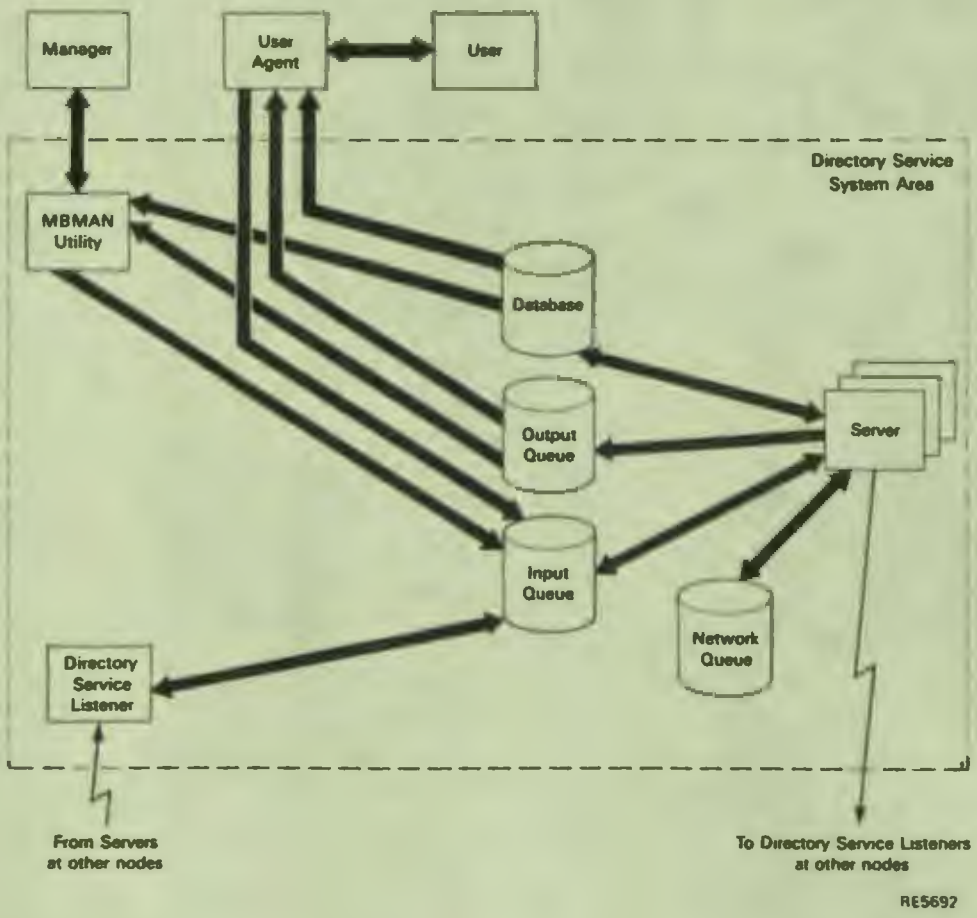
- A local enquiry where the information is in the local database
- A remote enquiry where the information is held on a remote world search node
- A local update where the information in the local node is updated and then the updated information is replicated in the world search nodes
- A remote update where the master copy of the object is held at another node

There are three types of Directory Service servers:

- Input queue server, which accepts transactions on the local database.
- Network queue server, which is a talker and makes DECnet connections to remote Directory Services for remote transactions. The network queue server can also act as a listener and accept the results of a remote enquiry if the results are available while the DECnet connection is still made.
- Listener, which accepts transactions or results from remote Directory Services.

Figure 3-1 shows the structure and interworking of the Directory Service system.

Figure 3-1: Structure of a Directory Service System

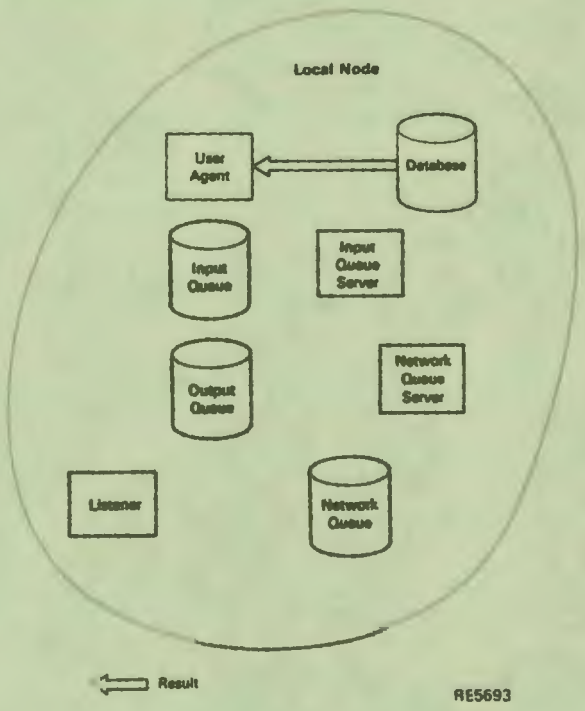


3.4.1 Local Enquiry

For a local search, the User Agent searches the local Directory Service database directly for objects that match the enquiry. The results of the enquiry are returned to the User Agent from the database.

Figure 3-2 shows the processes involved in a local enquiry.

Figure 3-2: Local Enquiry



3.4.2 Remote Enquiry

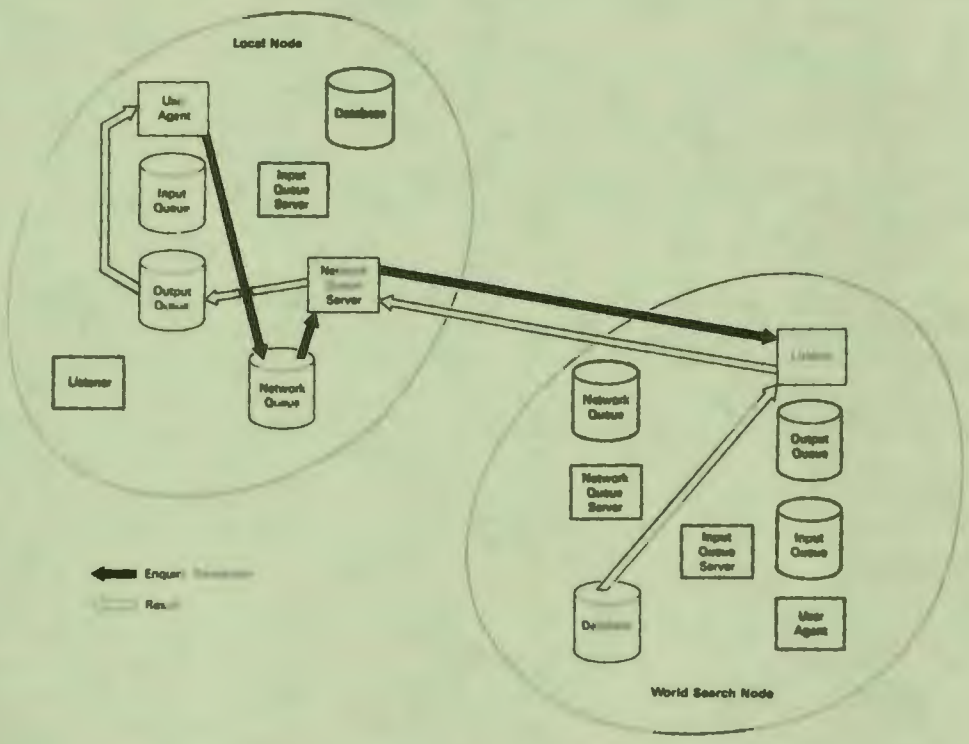
If the Directory Service does not find any objects in the local database that match the enquiry, the User Agent can choose to make a remote enquiry, that is, a search on a world search node. The Directory Service places the enquiry on the network queue. A network queue server takes the enquiry from the network queue and makes a connection to a world search node. A listener on the world search node executes the enquiry and returns the results on the same network connection.

The network queue server on the local node places the result in the output queue and the User Agent collects it from there.

The User Agent can choose to make the world search follow automatically from an unsuccessful local search. Alternatively, it can choose to prompt the user to escalate the search to a world search node. The User Agent can also choose to specify that the Directory Service searches its complete database, irrespective of whether or not the local search found an object that matched the given attributes. The interface of the Directory Service with users is determined by the User Agent.

Figure 3-3 shows the processes involved in a remote enquiry.

Figure 3-3: Remote Enquiry



3.4.3 Local Update

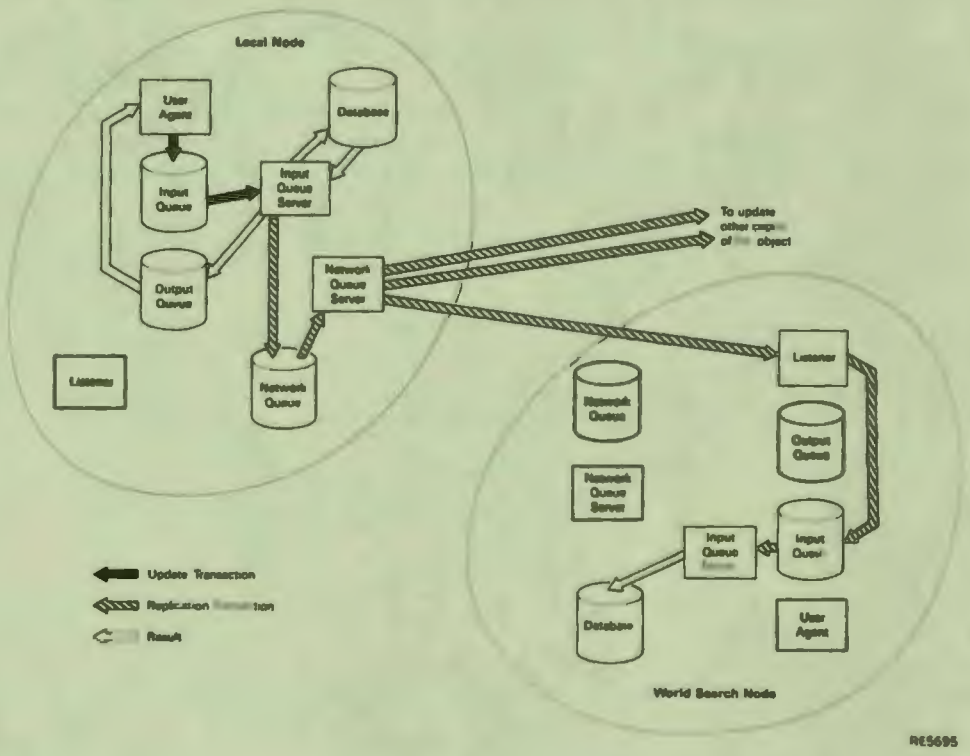
To update an object, the User Agent places the update transaction in the input queue. The input queue server takes the transaction from the input queue and, if the master copy of the object is maintained at the local node, updates the object in the local database. The Directory Service places the result of the update in the output queue, and the output queue server returns the result to the User Agent.

If the master copy of the object is not maintained at the local node, the Directory Service on the local node starts a remote update (see Section 3.4.4).

The Directory Service also ensures that all other copies of the object that are kept in the world search nodes on the network are updated. It places the replication transaction on the network queue. The network queue server makes DECnet connections to the remote world search nodes in the network, and the transaction is passed to the listeners on these nodes. The listeners place the replication transactions in the input queues, and the input queue servers update the objects in the world search databases. The Directory Service does not return a result for replication transactions.

Figure 3-4 shows the processes involved in a local update.

Figure 3-4: Local Update



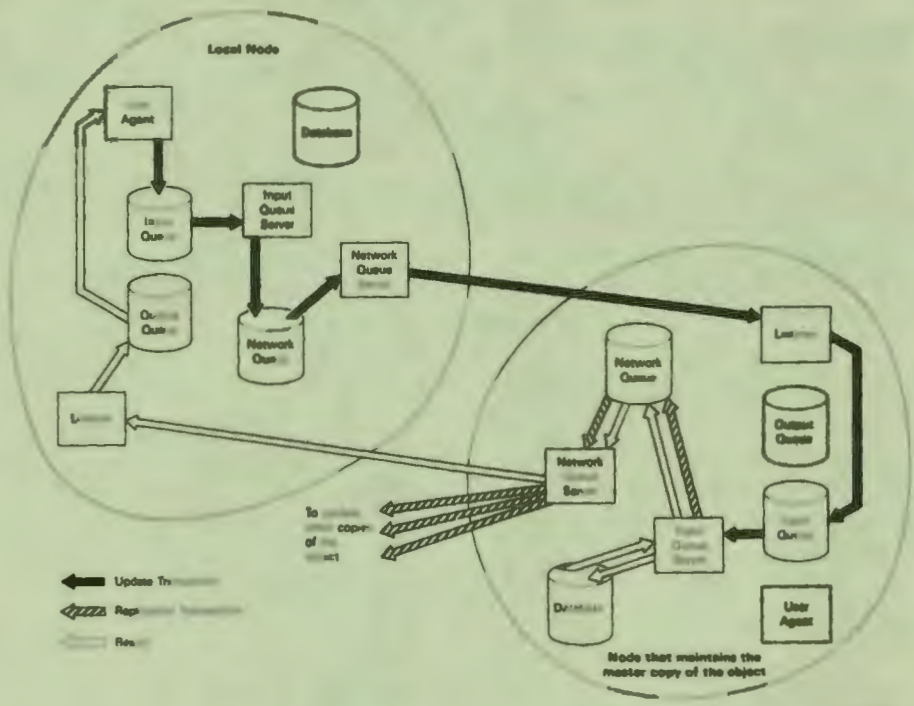
3.4.4 Remote Update

If the master copy of the object is not maintained at the local node, the input queue server places the update transaction in the network queue.

The network queue server takes the update transaction and connects to the node that maintains the master copy of the object that is being updated. The listener on the remote node accepts the transaction and places it in the input queue. The Directory Service updates the object in its database in the same way as for a local update (see Section 3.4.3) and returns the result to the node that started the update transaction. The node that maintains the master copy of the object replicates the update through the network as described for a local update.

Figure 3-4 shows the processes involved in a remote update.

Figure 3-5: Remote Update



3.5 The Directory Service Objects

3.5.1 Subscriber

A subscriber to the Directory Service is a person who uses the Directory Service. There is one subscriber object for each subscriber in the network. Subscriber objects are created when a subscriber is registered with the Directory Service.

A subscriber object is held in the permanent database file of the node where its master copy is maintained and in the permanent database files of any world search nodes. A subscriber object can also be held in the cache database files of nodes where the object was the result of a recent world search on the Directory Service database.

3.5.2 User Agent

A User Agent allows users to send and receive mail messages. The Directory Service database contains a User Agent object for each User Agent that is being used in the network, and stores it at the node where the User Agent is.

3.5.3 Domain

A domain is a Message Handling System that is managed by an administration or an organization. A domain object describes a Gateway to another domain. There is one domain object for each domain that is accessible to the network.

A domain object is held in the permanent database file of the node where its master copy is maintained and in the permanent database files of any world search nodes.

3.5.4 MTA

An MTA is a Message Transfer Agent. An MTA object describes a Gateway to an MTA in the local domain. Such a Gateway is only needed if the MTA in the local domain is not a DIGITAL Message Router, for example, an Message Router/S Gateway.

An MTA object is held in the permanent database file of the node where its master copy is maintained and in the permanent database files of any world search nodes.

3.5.5 World Search List

There is a world search list for each world search node. The Message Router manager decides which nodes are world search nodes. The world search list objects are replicated on all the nodes in the network.

3.5.6 Nodes List

The Directory Service nodes list is a list of all the nodes in the Directory Service network. When the Directory Service is first installed on the network, the Message Router manager creates the nodes list on the master node using MBMAN (see the *Message Router Configuration Guide*). The manager can add and delete entries from the nodes list using MBMAN. The nodes list is one object that is replicated on all the other nodes in the network.

3.5.7 Template

The template determines which attributes are action attributes and provides other default settings, for example, the access control for the different types of objects. These values are set by the Directory Service and cannot be modified. The template is created on the master node when the Directory Service is first installed on the network. The template is one object that is replicated on all the other nodes in the network.

The template object is accessed by the Directory Service for its internal operations.

4

The Management Service

The Management Service part of Message Router includes:

- The configuration procedure
- The control procedure
- The exception reporting routines
- The periodic maintenance command procedures

4.1 The MAILBUS Configuration Procedure

Before you can use Message Router on a node, you must configure it. The MAILBUS configuration procedure, MB$CONFIG sets up the components of Message Router.

Message Router must be set up consistently throughout the network. The configuration procedure allows you to set up Message Router so that it is consistent. You must consider network-wide decisions as well as individual node decisions.

The configuration procedure offers you a default configuration which suits most Message Router systems. If the default configuration does not suit your Message Router system, you can use the configuration procedure to

customize the default configuration. Refer to the *Message Router Configuration Guide* to decide what type of configuration your Message Router system requires.

The configuration procedure also allows you to change the MBMANAGER account password and to make any time zone corrections that are needed. DIGITAL recommends that you change the account password frequently.

Details of using the configuration procedure for both a default configuration and a customized configuration are given in the *Message Router Configuration Guide*.

Details of the configuration procedure commands are given in the *Message Router Management Reference Manual*

4.2 The MAILBUS Control Procedure

You can stop and start each of the components of Message Router by using the MAILBUS control procedure, MB$CONTROL. Details of the control procedure commands are given in the *Message Router Management Reference Manual*.

4.3 Exception Reporting Routines

The configuration procedure allows you to choose if you want to run the exception reporting routines on your system. The exception reporting routines monitor the network for exception conditions.

If you run the exception reporting routines on your network, by default, one node in the network receives exception reports. This node is the network management node. The exception reports highlight errors or unusual occurrences in the system. However, if your network is large or has a complex topology, you might want to divide the Management Service operation on your network into areas. Each management area has its own network management node that receives exception reports for the nodes in that area.

Typical conditions that the routines monitor the network for are:

- If an account is running out of disk space
- If an essential process stops running

- If the DECnet connection to a remote node breaks

The exception reports include a reference to a MAP number. A MAP is a Management Action Procedure and describes what you should do to recover from the error condition or to rectify the unusual occurrence. Some exception reports only supply information to tell you that a condition in the network has changed; for example, a remote node was offline, but has come back online again.

For details of the exception reports and MAPs refer to the *Message Router Management Action Procedures.*

4.4 Maintenance Command Procedures

By default, the maintenance command procedures are set to run daily and perform housekeeping operations on the files in the Message Router system. You can use the configuration procedure to change how often the command procedures run. There are four maintenance command procedures:

- MR$TIDY.COM maintains the Transfer Service part of Message Router
- DDS$TIDY.COM maintains the Directory Service part of Message Router
- DDS$DEFER.COM executes the deferred transactions for any Directory Service objects that are waiting to be updated
- DDS$REFRESH.COM maintains the entries in the Directory Service cache database

Typical operations performed by the maintenance command procedures are:

- Creating new log files so that they are a manageable size and purging old ones
- Compressing the relevant database files
- Purging old messages from the Transfer Service queue file

During configuration you can choose whether or not to run the maintenance command procedures and how frequently they should run (see the *Message Router Configuration Guide*).

For full details about the tasks that the maintenance command procedures perform, refer to the *Message Router Management Guide*. If you choose not to run these command procedures, you must spend more time manually managing your Message Router system as described in the *Message Router Management Guide*.

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Reader's Comments

Please give us your comments and suggestions on this manual. They help us to improve the quality and usefulness of our publications.

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Completeness of information:	_____	_____	_____
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2. Did you find errors in this manual? Please specify by page and paragraph, or mark corrections on pages and attach copies to this form.

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Information that is missing:	_____	_____
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3. What suggestions do you have for improving this manual?

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   - ☐ Technical
   - ☐ Nontechnical
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Network Concepts

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DDP Evolution and Network Concepts

TEST/EXERCISE

1. Circle the letter of the statement which best defines "Distributed Processing".

   a. Distributed processing is a processing technique which must always use minicomputers.

   b. Distributed processing is a processing method which must have some kind of a communication network.

   c. Distributed processing is any computer system that uses remote intelligent terminals to reduce the load on the main computer.

   d. Distributed processing is the technique by which you not only use large-scale computers but also minicomputers and microcomputers in a business, each one doing the job it does best.

2. For each of the statements below, write the letter "B" if it describes a function of a batch processor, or the letter "I" if it describes a function of an interactive processor.

   ___ a. Allows the user to correct mistakes immediately.

   ___ b. Provides a method for processing groups of related transactions as a single job.

   ___ c. Provides the ability of repeating the same sequence of steps over and over.

   ___ d. Permits the user to communicate directly with the processor by means of a terminal.

   ___ e. Makes efficient use of the computer.

   ___ f. Systems range from microprocessor-based terminals to central processing computers that operate clusters of timeshared terminals.

DDP Evolution and Network Concepts

TEST/EXERCISE

3. Match each of the descriptions listed on the left with the correct interactive processing techniques listed on the right. Each technique listed may be used one or more times or not at all.

Descriptions	Techniques
___ Data processing application used by people with no computer-specific training.	A. Query processing B. Form-Oriented Query Language C. Statement-oriented query language D. Transaction processing
___ Allows user to only communicate with the selected applications program.	
___ The user makes a request by typing phrases according to the language's rules of punctuation and syntax.	
___ Allows non-programmers to define processing operations.	
___ Allows the user to design the forms that the processor displays on the screen.	

DDP Evolution and Network Concepts

TEST/EXERCISE

4. For each data processing system description provided, identify the data processing system it describes by placing of the letter of each data processing system next to its description. Each answer may only be used once.

   Data Processing Systems

   A. Centralized
   B. Decentralized
   C. Distributed

   Descriptions

   ___ Processing functions divided among several nodes in a network each sharing their resources.

   ___ A single computer handles all the processing for a complete network.

   ___ Processing functions divided among several nodes in a network.

   For each of the following questions, circle the letter of the statement which provides the best answer.

5. Data communications make use of which of the following communications media?

   a. Telephone lines

   b. Coaxial cables

   c. Microwave towers

   d. Satellites

   e. All of the above

DDP Evolution and Network Concepts

TEST/EXERCISE

6. The capabilities of a distributed processing network include:
   a. File transfers between systems
   b. Down-line loading of programs
   c. Both a and b
   d. None of the above
7. Identify two access modes used in commercial applications.
   a. Sequential and random
   b. Sequential and interactive
   c. Interactive and random
   d. None of the above

DDP Evolution and Network Concepts

ANSWER SHEET

1. Circle the letter of the statement which best defines "Distributed Processing".

   a. Distributed processing is a process technique which must always use minicomputers.

   b. Distributed processing is a processing method which must have some kind of communication network.

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2. For each of the statements below, write the letter "B" if it describes a function of a batch processor, or the letter "I" if it describes a function of an interactive processor.

   I a. Allows the user to correct mistakes immediately.

   B b. Provides a method for processing groups of related transactions as a single job.

   B c. Provides the ability of repeating the same sequence of steps over and over.

   I d. Permits the user to communicate directly with the processor by means of a terminal.

   B e. Makes efficient use of the computer.

   I f. Systems range from microprocessor-based terminals to central processing computers that operate clusters of timeshared terminals.

DDP Evolution and Network Concepts

ANSWER SHEET

3. Match each of the descriptions listed on the left with the correct interactive processing techniques listed on the right. Each technique listed may be used one or more times or not at all.

	Descriptions	Techniques
D	Data processing application used by people with no computer-specific training.	A. Query processing B. Form-Oriented query language C. Statement-oriented query language D. Transaction processing
D	Allows user to only communicate with the selected applications program.	
C	The user makes a request by typing phrases according to the language's rules of punctuation and syntax.	
A	Allows non-programmers to define processing operations.	
B	Allows the user to design the forms that the processor displays on the screen.	

DDP Evolution and Network Concepts

ANSWER SHEET

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   Data Processing Systems

   A. Centralized
   B. Decentralized
   C. Distributed

   Descriptions

   C Processing functions divided among several nodes in a network each sharing their resources.

   A A single computer handles all the processing for a complete network.

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   For each of the following questions, circle the letter of the statement which provides the best answer.

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DDP Evolution and Network Concepts

ANSWER SHEET

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   (a.) Sequential and random

   b. Sequential and interactive

   c. Interactive and random

   d. None of the above

Network Fundamentals

TEST/EXERCISE

1. Which of the following is an example of a network node?
   a. Processors and their software
   b. Storage devices
   c. Printers and terminals
   d. All of the above
2. What type of services can be provided by network nodes?
   a. Host processing only
   b. Host processing and remote processing
   c. Front end processing and remote concentration
   d. Both b and d

TEST/EXERCISE

3. Match each of the features listed on the left with the correct network function listed on the right. Each network function listed may be used one or more times or not at all.

Features	Network Functions
___ Most or all data processing and communication processing performed by one central node.	A. Front end processing B. Host processing C. Remote processing D. Remote concentration
___ Stand-alone system that is also connected to a network.	
___ Decreases the number of lines needed to connect a cluster of remote terminals to a host.	
___ Handles data processing operations that would otherwise have to be performed by the host.	
___ Relieves the host processor of communications functions.	
___ Takes over part or all of the communications tasks.	

4. Data processing networks use a wide selection of transmission media. The physical lines that connect nodes in a network fall in which group(s)?

   a. Switched lines

   b. Private leased lines

   c. Switched lines and private leased lines

   d. None of the above

TEST/EXERCISE

5. For each switching technique description provided, identify the switching technique it describes by placing the letter of the switching technique next to its description. Each answer may only be used once.

   Switching Techniques

   A. Circuit switching
   B. Message switching
   C. Packet switching

   Descriptions

   ___ No preassigned end-to-end path for data to follow. Each message is given an address at the source node.

   ___ Normal telephone switching systems used. Every piece of information entered at the calling point is immediately conveyed to the called point.

   ___ High-speed form of switching good for interactive transaction processing.

6. Which of the following topologies provide the simplest network topology structure?

   a. Multipoint

   b. Centralized star

   c. Hierarchical tree

   d. Ring

   e. None of the above

7. Complete the following statement: In a multipoint topology, several remote nodes, often called _____ or _____, share the same physical line with one node designated as the _____.

TEST/EXERCISE

8. Three multipoint procedures for dealing with the problems of line sharing are listed below. In the space provided next to each description listed, place the letter of the procedure it describes. Each procedure listed may be used one or more times or not at all.

Procedures

A. Line contention
B. Roll-Call polling
C. Hub polling

Descriptions

___ Based on "first come, first served." If a node tries to send a message but finds the line in use, it gives up and tries later.

___ Master node controls the multipoint line and polls each tributary node in turn, using a table stored in memory.

___ Uses query-and-response method, which keeps the host in constant dialog with the remote nodes.

Network Fundamentals

ANSWER SHEET

1. Which of the following is an example of a network node?
   a. Processors and their software
   b. Storage devices
   c. Printers and terminals
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   a. Host processing only
   b. Host processing and remote processing
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Network Fundamentals

ANSWER SHEET

3. Match each of the features listed on the left with the correct network function listed on the right. Each network function listed may be used one or more times or not at all.

	Features	Network Functions
B	Most or all data processing and communication processing performed by one central node.	A. Front end processing B. Host processing C. Remote processing D. Remote concentration
C	Stand-alone system that is also connected to a network.	
D	Decreases the number of lines needed to connect a cluster of remote terminals to a host.	
C	Handles data processing operations that would otherwise have to be performed by the host.	
A	Relieves the host processor of communications functions.	
A	Takes over part or all of the communications tasks.	

Network Fundamentals

ANSWER SHEET

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   Switching Techniques

   A. Circuit switching
   B. Message switching
   C. Packet switching

   Descriptions

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   A Normal telephone switching systems used. Every piece of information entered at the calling point is immediately conveyed to the called point.

   C High-speed form of switching good for interactive transaction processing.

Network Fundamentals

ANSWER SHEET

6. Which of the following topologies provide the simplest network topology structure?

   a. Multipoint

   b. Centralized star

   c. Hierarchical tree

   d. Ring

   (e.) None of the above

7. Complete the following statement: In a multipoint topology, several remote nodes, often called tributaries or satellites, share the same physical line with one node designated as the master.

8. Three multipoint procedures for dealing with the problems of line sharing are listed below. In the space provided next to each description listed, place the letter of the procedure it describes. Each procedure listed may be used one or more times or not at all.

   Procedures

   A. Line contention

   B. Roll-Call polling

   C. Hub polling

   Descriptions

   A Based on "first come, first served." If a node tries to send a message but finds the line in use, it gives up and tries later.

   B Master node controls the multipoint line and polls each tributary node in turn, using a table stored in memory.

   C Uses query-and-response method, which keeps the host in constant dialog with the remote nodes.

Communications Fundamentals

TEST/EXERCISE

1. Which of the following statements best defines data communications?

   a. A processing technique which must always use minicomputers.

   b. The transmission of data that can be represented in a computer over transmission media such as telephone lines.

   c. Communication processing techniques used to process related transactions as a single job.

   d. None of the above.

2. Match the code in the column on the right with the correct description from the column on the left. Codes may be used once, more than once, or not at all.

Description	Code
___ 5-bit paper tape code	A. SBT
___ 7-bit plus a parity bit	B. BAUDOT
___ 6-bits	C. EBCDIC
___ 8-bits, no character parity bit	D. ASCII

TEST/EXERCISE

3. Read each statement listed below. Circle the letter of each statement which describes a feature of the EIA RS-232-C standard.

   a. Requires two wires to complete the loop for transmitting data, and two wires to complete the loop for receiving data.

   b. Uses voltage levels for representation of binary ones and zeros.

   c. Provides signals for controlling modems and the data link.

   d. Defines unbalanced circuits.

   e. Uses both balanced and unbalanced circuits to carry interface signals.

   f. Requires four basic elements: current source, transmission wires, a switch to interrupt the current flow, and a detector to sense current in the circuit.

   g. Provides standards for interconnection between DTE and DCE.

4. For each of the statements below, circle the letter of each statement which describes a feature of asynchronous operation.

   a. Has a common timing element between transmitter and receiver.

   b. Uses a special character to initiate transmission.

   c. Frames each transmitted character with a "start" and "stop" bit.

TEST/EXERCISE

5. A customer has an installed system in one city which needs to communicate with a second system in another city 2000 miles away. From the following list of types of physical media, circle the letter of those which are feasible solutions.

   a. Leased line circuits

   b. Satellite channels

   c. Fiber optic cables

   d. Current loops

   e. Switched line circuits

6. Match the following modulation technique descriptions to the correct modulation technique described by placing the proper letter representing each technique in front of its description. Answers may be used one or more times or not at all.

Description	Techniques
____ The carrier frequency varies with the modulation signal.	A. Amplitude modulation B. Frequency modulation C. Phase modulation D. Binary modulation
____ The strength of the carrier varies with the modulating signal.	
____ The degree of shift of the carrier varies with the modulating signal.	
____ Each pulse of the signal may carry more than one bit of information.	

TEST/EXERCISE

7. Read each statement listed below. Circle the letter of each statement which describes a feature of the EIA RS-449 standard.

   a. Most common interface standard used today.

   b. Provides compatibility with current standards.

   c. Uses both balanced and unbalanced circuits for transmission and reception of data.

   d. Distance of greater than 50 feet and speeds greater than 20 kbps are allowed.

   e. Provides control for modems and the data link.

8. Next to each communication need, place the letter of the modem feature which identifies it. Modem features may be used once, more than once, or not at all.

Communication Need	Modem Feature
___ Computer dials number	A. Analog loopback
___ Modem can test itself	B. Transmit only
___ Local modem's transmit data is returned to DTE	C. Self-Test
___ Remote modem turns data around	D. Receive only
___ Can only initiate calls	E. Originate only
	F. Answer only
	G. Attended operation
	H. Unattended operation
	I. Digital loopback

TEST/EXERCISE

9. Circle the letter of the type of transmission media described by the following statement:

   Transmission utilizes the line-of-sight method.

   a. Open wire pairs

   b. Wire cable

   c. Coaxial cables

   d. Satellites

   e. None of the above

10. What is the classification of the data communications line which utilizes a bandwidth in the range of 300 Hz to 3000 Hz?

   a. Subvoice band

   b. Voice band

   c. Wideband

   d. None of the above

Communications Fundamentals

ANSWER SHEET

1. Which of the following statements best defines data communications?

   a. A processing technique which must always use minicomputers.

   (b.) The transmission of data that can be represented in a computer over transmission media such as telephone lines.

   c. Communication processing techniques used to process related transactions as a single job.

   d. None of the above.

2. Match the code in the column on the right with the correct description from the column on the left. Codes may be used once, more than once, or not at all.

Description		Code
B	5-bit paper tape code	A. SBT
D	7-bit plus a parity bit	B. BAUDOT
A	6-bits	C. EBCDIC
C	8-bits, no character parity bit	D. ASCII

Communications Fundamentals

ANSWER SHEET

3. Read each statement listed below. Circle the letter of each statement which describes a feature of the EIA RS-232-C standard.

   a. Requires two wires to complete the loop for transmitting data, and two wires to complete the loop for receiving data.

   b. Uses voltage levels for representation of binary ones and zeros.

   c. Provides signals for controlling modems and the data link.

   d. Defines unbalanced circuits.

   e. Uses both balanced and unbalanced circuits to carry interface signals.

   f. Requires four basic elements: current source, transmission wires, a switch to interrupt the current flow, and a detector to sense current in the circuit.

   g. Standards for interconnection between DTE and DCE.

Communications Fundamentals

ANSWER SHEET

4. For each of the statements below, circle the letter of each statement which describes a feature of asynchronous operation.

   a. Has a common timing element between transmitter and receiver.

   b. Uses a special character to initiate transmission.

   (c.) Frames each transmitted character with a "start" and "stop" bit.

5. A customer has an installed system in one city which needs to communicate with a second system in another city 2000 miles away. From the following list of types of physical media, circle the letter of those which are feasible solutions.

   (a.) Leased line circuits

   (b.) Satellite channels

   c. Fiber optic cables

   d. Current loops

   (e.) Switched line circuits

Communications Fundamentals

ANSWER SHEET

6. Match the following modulation technique descriptions to the correct modulation technique described by placing the proper letter representing each technique in front of its description. Answers may be used one or more times or not at all.

	Description	Techniques
B	The carrier frequency varies with the modulation signal.	A. Amplitude modulation B. Frequency modulation C. Phase modulation D. Binary modulation
A	The strength of the carrier varies with the modulating signal.	
C	The degree of shift of the carrier varies with the modulating signal.	
D	Each pulse of the signal may carry more than one bit of information.	

7. Read each statement listed below. Circle the letter of each statement which describes a feature of the EIA RS-449 standard.

a. Most common interface standard used today.

(b.) Provides compatibility with current standards.

(c.) Uses both balanced and unbalanced circuits for transmission and reception of data.

(d.) Distance of greater than 50 feet and speeds greater than 20 kbps are allowed.

(e.) Provides control for modems and the data link.

Communications Fundamentals

ANSWER SHEET

8. Next to each communication need, place the letter of the modem feature which identifies it. Modem features may be used once, more than once, or not at all.

	Communication Need	Modem Feature
H	Computer dials number	A. Analog loopback
C	Modem can test itself	B. Transmit only
A	Local modem's transmit data is returned to DTE	C. Self-Test
I	Remote modem turns data around	D. Receive only
E	Can only initiate calls	E. Originate only
		F. Answer only
		G. Attended operation
		H. Unattended operation
		I. Digital loopback

Communications Fundamentals

ANSWER SHEET

9. Circle the letter of the type of transmission media described by the following statement:

   Transmission utilizes the line-of-sight method.

   a. Open wire pairs

   b. Wire cable

   c. Coaxial cables

   d. Satellites

   e. None of the above

10. What is the classification of the data communications line which utilizes a bandwidth in the range of 300 Hz to 3000 Hz?

   a. Subvoice band

   b. Voice band

   c. Wideband

   d. None of the above

Architecture Overview

TEST/EXERCISE

1. Read each statement listed below. Circle the letter of each statement which describes a network architecture goal.

   a. Transparency of communication functions.

   b. Transmission modes for all lines.

   c. Types of communication interfaces required.

   d. Identification of topologies to be used.

   e. Distance requirements between DTE and DCE.

   f. Types of configurations to be used (i.e., multipoint, point-to-point, etc.)

2. Next to each ISO layer description, place the letter of the ISO layer which identifies it. ISO layers may be used once, more than once, or not at all.

ISO Layer Description	ISO Layer
___ Provides the means for transmitting bits, in sequence, between adjacent systems.	A. Application B. Presentation C. Session D. Transport E. Network F. Data Link G. Physical
___ Provides the means for communicating applications to organize and synchronize the dialogue between each other.	
___ Provides the means for routing individual messages, through multiple systems, to the required destination end system.	
___ Resolves syntax differences between local system data formats and OSI format.	
___ Provides the services to users of OSI.	

Architecture Overview

TEST/EXERCISE

3. Next to each network functional layer description, place the letter of the functional layer which identifies it. Functional layers may be used once, more than once, or not at all.

Descriptions	Layers
____ Normally responsible for establishing a virtual path between a user application task at one node to a user application task at another node.	A. User Functions B. Network Functions C. Data Link Functions D. Physical Link
____ Provides user interface to the network.	
____ Ensures that data transmission over links are complete, correctly formatted and sequenced, and error free.	
____ Includes the software I/O driver and the communications equipment, including the hardware interface and the modem.	

4. Which of the following defines or describes a function of network protocols?

   a. Provides each network layer control by a separate set of rules designed to solve operating problems which may occur in data transfers.

   b. A set of rules for defining the communications system.

   c. Rules which modules in one node must follow in order to communicate with modules in another node.

   d. All of the above.

Architecture Overview

TEST/EXERCISE

5. For each statement listed below, circle the letter of each statement which describes a feature of byte-count oriented data link protocols.

   a. Uses a large number of control characters and permits synchronous operation.

   b. Encloses messages and control information in frames and is commonly referred to as a "bit-stuff" protocol.

   c. Solves the problem of transparency without the use of special control characters or bits.

6. What three basic parts or fields make up a data link protocol message?

   a. Header, body, trailer

   b. Header, trailer, block check

   c. Sequence, response, trailer

   d. Control, flag, trailer

   e. None of the above

7. Which data link protocol message format uses a byte count field for transparency?

   a. SDLC

   b. BISYNC

   c. DDCMP

   d. All of the above

Architecture Overview

TEST/EXERCISE

8. Exiting data is passed on from the user to the user functions layer. Modules in this layer then pass the message down to the next layer. Circle the letter of the statement which best describes what happens next.

   a. The message then moves over the link to the destination node, and then moves up through the corresponding layers.

   b. The message is then passed down through each corresponding layer, receiving control information at each layer in the form of headers and trailers.

   c. The message headers are interpreted and stripped off by succeeding layers until the message in its original form passes to the receiving user.

   d. The message is then passed to the data link layer, and then the physical link layer, to be transmitted over the link.

9. Circle the letter of the statement which identifies the network layer which performs the same functions as the ISO OSI modem session layer.

   a. User Functions layer

   b. Network Functions layer

   c. Data Link layer

   d. Physical Link layer

   e. None of the above

Architecture Overview

TEST/EXERCISE

10. Circle the letter of the statement which best describes the function of a network interface.

    a. Provides the hardware and software needed to interface one node to another.

    b. Provides the mechanism that a module in one layer uses to communicate with a module in another layer.

    c. Provides the routines needed to confirm the integrity of a network.

    d. All of the above.

Architecture Overview

ANSWER SHEET

1. Read each statement listed below. Circle the letter of each statement which describes a network architecture goal.

   a. Transparency of communication functions.

   b. Transmission modes for all lines.

   c. Types of communication interfaces required.

   d. Identification of topologies to be used.

   e. Distance requirements between DTE and DCE.

   f. Types of configurations to be used (i.e., multipoint, point-to-point, etc.)

2. Next to each ISO layer description, place the letter of the ISO layer which identifies it. ISO layers may be used once, more than once, or not at all.

	ISO Layer Description	ISO Layer
G	Provides the means for transmitting bits, in sequence, between adjacent systems.	A. Application B. Presentation C. Session D. Transport E. Network F. Data Link G. Physical
C	Provides the means for communicating applications to organize and synchronize the dialogue between each other.	
E	Provides the means for routing individual messages, through multiple systems, to the required destination end system.	
B	Resolves syntax differences between local system data formats and OSI format.	
A	Provides the services to users of OSI.	

Architecture Overview

ANSWER SHEET

3. Next to each network functional layer description, place the letter of the functional layer which identifies it. Functional layers may be used once, more than once, or not at all.

Descriptions	Layers
B Normally responsible for establishing a virtual path between a user application task at one node to a user application task at another node.	A. User Functions B. Network Functions C. Data Link Functions D. Physical Link
A Provides user interface to the network.	
C Ensures data transmission over links are complete, correctly formatted and sequenced, and error free.	
D Includes the software I/O driver and the communications equipment, including the hardware interface and the modem.	

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   a. Provides each network layer control by a separate set of rules designed to solve operating problems which may occur data transfers.

   b. A set of rules for defining the communications system.

   c. Rules by which modules in one node must follow in order to communicate with modules in another node.

   (d.) All of the above.

Architecture Overview

ANSWER SHEET

5. For each statement listed below, circle the letter of each statement which describes a feature of byte-count oriented data link protocols.

   a. Uses a large number of control characters and permits synchronous operation.

   b. Encloses messages and control information in frames and is commonly referred to as a "bit-stuff" protocol.

   (c.) Solves the problem of transparency without the use of special control characters or bits.

6. What three basic parts or fields make up a data link protocol message?

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   b. Header, trailer, block check

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   a. SDLC

   b. BISYNC

   (c.) DDCMP

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Architecture Overview

ANSWER SHEET

8. Exiting data passed on from the user are passed on to the user functions layer. Modules in this layer then pass the message down to the next layer. Circle the letter of the statement which best describes what happens next.

   a. The message then moves over the link to the destination node, and then moves up through the corresponding layers.

   (b.) The message is then passed down through each corresponding layer, receiving control information at each layer in the form of headers and trailers.

   c. The message headers are interpreted and stripped off by succeeding layers until the message in its original form passes to the receiving user.

   d. The message is then passed to the data link layer, and then the physical link layer to be transmitted over the link.

9. Circle the letter of the statement which identifies the network layer which performs the same functions as the ISO OSI modem session layer.

   a. User Functions layer

   (b.) Network Functions layer

   c. Data Link layer

   d. Physical Link layer

   e. None of the above

Architecture Overview

ANSWER SHEET

10. Circle the letter of the statement which best describes the function of a network interface.

    a. Circle the letter of the hardware and software needed to interface one node to another.

    b. Provides the mechanism that a module in one layer uses to communicate with a module in another layer.

    c. Provides the routines needed to confirm the integrity of a network.

    d. All of the above.

Digital Network Architecture and DECnet

TEST/EXERCISE

1. Which of the following service(s) is provided by DECnet facilities?

   a. Device sharing

   b. File sharing

   c. Program sharing

   d. Intertask communications

   e. All of the above

2. Match each of the descriptions listed on the left with the correct DECnet feature listed on the right. Each feature may be used one or more times or not at all.

Descriptions	Features
___ DECnet implementation which allows two programs within a network to exchange data over a virtual path.	A. Remote file access B. Routing C. Task-to-task communications D. Remote terminal E. Multipoint F. Loopback testing G. Terminal-to-terminal communications H. Down-line loading I. Network management facilities
___ Enables a terminal user to run a DECnet utility or issue command to execute a command file in a remote node.	
___ Provides the network manager tools for controlling and monitoring node activity.	
___ The network function that determines the physical path along which data travels to its destination.	
___ Provides direct access to remote node's operating system.	

Digital Network Architecture and DECnet

TEST/EXERCISE

3. Which DNA layer is used by system managers to control and monitor network operations?

   a. User layer

   b. Network Management layer

   c. Network Applications layer

   d. Network Services layer

   e. All of the above

4. Which DNA layer is used to test links at both the data link and logical link level?

   a. Network Management layer

   b. Network Applications layer

   c. Data Link layer

   d. Physical Link layer

   e. None of the above

5. Which DNA layer is designed to contain a number of separate commonly-used modules that access data and provide other often-used services to the users?

   a. User layer

   b. Network Management layer

   c. Session Control layer

   d. Transport layer

   e. None of the above

Digital Network Architecture and DECnet

TEST/EXERCISE

6. Which DNA layer provides a system-independent process-to-process communication service that allows two processes to exchange data reliably and sequentially, regardless of their location in the network?

   a. User layer

   b. Network Management layer

   c. Network Applications layer

   d. Network Services layer

   e. All of the above

7. Which DNA layer provides both routing and nonrouting implementations of DECnet?

   a. Session Control layer

   b. Network Services layer

   c. Transport layer

   d. Data Link layer

   e. None of the above

8. Which DNA service enables a user level process in one node to communicate with a user level process in another node via a logical link?

   a. User-to-User service

   b. Remote Application service

   c. Network Management service

   d. None of the above

Digital Network Architecture and DECnet

TEST/EXERCISE

9. Provided is a list of steps describing dataflow of a message at the source node. Read each step and in the space provided, number the steps in their order of occurrence.

   ___ The Network Services module adds its control information and passes the datagram to the Transport layer.

   ___ The source user requests a connection to the destination user and passes connect data.

   ___ The Data Link module adds its protocol header information and prepares the enveloped message for transmission.

   ___ The Session Control module receives the data, determines a destination address and places the data in a transmit buffer, adding control information to the message.

   ___ The Physical Link module transmits the enveloped message over the data link.

   ___ The Transport module adds a header, then selects an outgoing channel for the message based on routing information.

Digital Network Architecture and DECnet

TEST/EXERCISE

10. When data messages are routed across the network, it is possible that they must be routed through a node which is not the destination. Circle the letter of the statement which best describes how this procedure is accomplished.

    a. The message is processed by both the Physical and Data Link layers and is passed to the Transport layer where the destination is determined.

    b. The message is received by the Physical Link layer and passed on to the Data Link layer where the destination node address is determined from the header of the message. If the address is different than its own, it is reassembled and passed on to the Physical Link layer for further transmission.

    c. The message is processed by each layer up the architecture until it reaches the Network Management layer, where it is determined if the message is to be fully processed. If the destination node address is different than its own, it is cycled back down through the architecture to be further transmitted.

    d. Messages can only be processed by nodes that are identified by the node address in the header of the message. If a data message must be routed through a node which is not identified as the destination node, the message is fully ignored and further transmitted.

Digital Network Architecture and DECnet

ANSWER SHEET

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Digital Network Architecture and DECnet

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Digital Network Architecture and DECnet

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Digital Network Architecture and DECnet

ANSWER SHEET

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System Network Architecture

TEST/EXERCISE

1. Circle the letter of the statement which best describes or defines an SNA "end user."

   a. An end user may be an application program running in the host.

   b. End users are not part of the network itself.

   c. End users are the ultimate sources and destinations of the data transmitted over the network.

   d. All of the above.

2. Match each of the descriptions listed on the left with the correct "network addressable unit" (NAU) listed on the right. Each NAU may be used one or more times or not at all.

Descriptions	NAU
___ Provides an end user with access to a data communication network.	A. Logical Units B. System Service Control C. Physical Units
___ In a host node they are system programs.	
___ A collection of software modules residing in the host.	
___ Functions include bringing up the network.	

3. Circle the letter of the statement which identifies the types of sessions that are possible in an SNA environment.

   a. SSCP to PU

   b. SSCP to LU

   c. LU to LU

   d. All of the above

System Network Architecture

TEST/EXERCISE

4. SNA layers provide communication functions which fall into two broad categories: end-to-end services and transmission services. Which SNA layers provide services which include all functions required to establish sessions and maintain communications between two users?

   a. NAU Services and Data Flow Control

   b. NAU Services and Transmission Control

   c. Data Flow Control, Path Control, and Data Link Control

   d. NAU Services, Data Flow Control, and Transmission Control

   e. Path Control and Data Link Control

5. Which two SNA layers make up a common transmission network that is shared by all communicating half-sessions?

   a. Data Flow Control and Transmission Control

   b. Transmission Control and Path Control

   c. Path Control and Data Link Control

   d. Data Link Control and Data Flow Control

6. Circle the letter of the statement which identifies features defined by SNA protocols.

   a. The syntax of commands and headers

   b. The meaning of commands and headers and the actions they initiate

   c. The sequence in which commands and headers are sent

   d. All of the above

System Network Architecture

TEST/EXERCISE

7. In which layer of SNA are request/response units (RUs) created?

   a. Data Flow Control

   b. Transmission Control

   c. Path Control

   d. Data Link Control

   e. None of the above

8. In which layer of SNA are function subsets made available?

   a. NAU Services Layer

   b. Transmission Control

   c. Path Control

   d. Data Link Control

   e. All layers

9. Match each of the descriptions listed on the left with the correct PU type listed on the right. Each PU type may be used one or more times or not at all.

Descriptions	PU Types
___ Provides attachment for one I/O device.	A. Terminal B. Cluster controller C. Communications controller D. Host
___ Handles transmission services for a subarea of the network.	
___ Provides data processing for remote users, and in some cases intermediate and boundary functions.	
___ Provides control functions for various I/O devices and may have a data-processing capability.	

System Network Architecture

TEST/EXERCISE

10. Match each of the descriptions on the left with the correct IBM software product listed on the right. Each product may be used once or not at all.

Descriptions	IBM Software Products
___ Designed to run on smaller systems in conjunction with CICS.	A. VTAM B. TCAM C. EXTM D. CICS E. IMS F. TSO G. NCP
___ Transaction processing system.	
___ A data base control system that controls hierarchically designed data bases.	
___ Corresponds to the Path Control and Data Link Control layers of SNA.	
___ A general timesharing offering.	

System Network Architecture

ANSWER SHEET

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System Network Architecture

ANSWER SHEET

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System Network Architecture

ANSWER SHEET

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System Network Architecture

ANSWER SHEET

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B	Provides control functions for various I/O devices and may have a data-processing capability.	

10. Match each of the descriptions on the left with the correct IBM software product listed on the right. Each product may be used once or not at all.

	Descriptions	IBM Software Products
C	Designed to run on smaller systems in conjunction with CICS.	A. VTAM B. TCAM C. EXTM D. CICS E. IMS F. TSO G. NCP
D	Transaction processing system.	
E	A data base control system that controls hierarchically designed data bases.	
G	Corresponds to the path control and data link control layers of SNA.	
F	A general timesharing offering.	

X.25

TEST/EXERCISE

1. Circle the letter of the statement which identifies features of X.25.

   a. Specifies the interface between DTE and DCE on the PPSN.

   b. Defines communications procedures between DTEs and DCEs only.

   c. Protocol developed by CCITT for communications between a user and a PPSN.

   d. Is not a network architecture for end-to-end communications.

   e. All of the above.

2. Match each of the descriptions listed on the left with the correct X.25 level listed on the right. Each level may be used one or more times or not at all.

Descriptions	X.25 Levels
___ This level specifies the connection between DTE and DCE and modems.	A. Level 1 - Physical Interface B. Level 2 - Frame level C. Level 3 - Packet level
___ Describes the message format and the control procedures for the exchange of messages between DTE and DCE.	
___ Describes the link access procedure to be used for data exchanges between DCE and DTE.	

TEST/EXERCISE

3. Match each of the descriptions listed on the left with the correct X.25 feature listed on the right. Each feature may be used one or more times or not at all.

Descriptions	X.25 Features
___ Facilities of a PPSN which permit the connection of virtual terminals.	A. ITI B. PAD C. PVC
___ Defined as an asynchronous hardwired terminal that wants to communicate over a PPSN, but cannot be programmed according to the X.25 format.	
___ Cannot be set up between a start-stop mode DTE and terminal.	

4. X.25 defines only the lowest levels of a network architecture. Which higher-level function is left up to the user to implement?

   a. Internal addressing and protection within a DTE

   b. End-to-end error control and sequencing

   c. All higher-level network functionality

   d. All of the above

X.25

TEST/EXERCISE

5. Circle the letter of the statement which describes the function of a PPSN.

   a. Is concerned with getting messages to both the DTE and DCE.

   b. Is responsible for making sure that each packet makes it from one packet-switching exchange to another without error.

   c. Is responsible for making sure that a complete message gets from one user to another.

   d. Provides all types of task-to-task communications and remote terminal capabilities.

   e. All of the above.

X.25

ANSWER SHEET

1. Circle the letter of the statement which identifies features of X.25.

   a. Specifies the interface between DTE and DCE on the PPSN.

   b. Defines communications procedures between DTEs and DCEs only.

   c. Protocol developed by CCITT for communications between a user and a PPSN.

   d. Is not a network architecture for end-to-end communications.

   (e.) All of the above.

2. Match each of the descriptions listed on the left with the correct X.25 level listed on the right. Each level may be used one or more times or not at all.

	Descriptions	X.25 Levels
A	This level specifies the connection between DTE and DCE and modems.	A. Level 1 - Physical Interface B. Level 2 - Frame level C. Level 3 - Packet level
C	Describes the message format and the control procedures for the exchange of messages between DTE and DCE.	
B	Describes the link access procedure to be used for data exchanges between DCE and DTE.	

X.25

ANSWER SHEET

3. Match each of the descriptions listed on the left with the correct X.25 feature listed on the right. Each feature may be used one or more times or not at all.

	Descriptions	X.25 Features
B	Facilities of a PPSN which permit the connection of virtual terminals.	A. ITI B. PAD C. PVC
A	Defined as an asynchronous hardwired terminal that wants to communicate over a PPSN, but cannot be programmed according to the X.25 format.	
C	Cannot be set up between a start-stop mode DTE and terminal.	

4. X.25 defines only the lowest levels of a network architecture. Which higher-level function is left up to the user to implement?

   a. Internal addressing and protection within a DTE

   b. End-to-end error control and sequencing

   c. All higher-level network functionality

   (d.) All of the above

X.25

ANSWER SHEET

5. Circle the letter of the statement which describes the function of a PPSN.

   a. Is concerned with getting messages to both the DTE and DCE.

   b. Is responsible for making sure that each packet makes it from one packet-switching exchange to another without error.

   c. Is responsible for making sure that a complete message gets from one user to another.

   d. Provides all types of task-to-task communications and remote terminal capabilities.

   e. All of the above.

Local Area Networks

TEST/EXERCISE

1. Circle the letter of the statement which describes features of a Local Area Network.

   a. Utilizes communications facilities.

   b. Utilizes packet techniques.

   c. Can be used to connect multiple computers and terminals which are located geographically in the same area.

   d. Discrete data paths such as switched or leased lines are not needed between communicating devices.

   e. All of the above.

2. Match each of the descriptions listed on the left with the correct LAN topology listed on the right. Each topology may be used one or more times or not at all.

Descriptions	LAN Topologies
___ Single bus provided and all stations are attached to it by means of taps. Signals from a station branch out from the tap in both directions.	A. Star B. Loop C. Ring D. Common Bus E. Broadband Bus
___ A circular chain of signal repeaters with links between them.	
___ Stations can only communicate directly with the central computer.	
___ Interstation traffic must be switched through the central controller.	
___ Network stations can only communicate with each other by sending messages into the network via repeaters.	

Local Area Networks

TEST/EXERCISE

3. The transmission technique most widely used in LANs is that of timesharing, know as TDMA. Which timesharing technique is used by most ring networks?

   a. Polling

   b. Reservation

   c. Contention

   d. Token passing

   e. All of the above

4. What method is used by CSMA/CD to detect and correct collisions?

   a. The colliding stations back off and retransmit later at different times.

   b. Stop transmitting and allow busier stations to finish transmitting.

   c. Use the "talk-while-listen" node to determine if the link is available before transmitting.

   d. None of the above.

5. Which type of media is commonly used in smaller networks that serve relatively limited numbers of microcomputers?

   a. Telephone cabling systems with modem eliminators

   b. Twisted pair with conventional protocols

   c. Coaxial cables

   d. All of the above

Local Area Networks

TEST/EXERCISE

6. What is the most common objective in designing LAN software?

   a. Provide new software packages which permit communications between the smaller LANs and the larger fully distributed networks.

   b. Establish reliable communications between user software processes.

   c. Enable users to use current applications without disrupting on-going applications.

   d. All of the above.

7. Circle the letter of the statement which describes a basic approach tat permits reliability in a centralized system without greatly increasing overhead or cost.

   a. Support rapid-fire polling and transmission utilizing time multiplexing as opposed to frequency multiplexing.

   b. Extend bus capabilities by using microwave links.

   c. Eliminate the time-consuming use of token-passing systems with optional redundant network switching.

   d. Utilize current plant wiring configurations.

   e. None of the above.

8. What relationship is there between a LAN and the automated office of the future?

   a. All systems and subsystems within a local area (such as an office) will be able to communicate with each other.

   b. The automated office will be provided the ability to be interfaced directly to all nodes in a LAN.

   c. Word processing applications currently being used will become part of the LAN environment.

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Local Area Networks

ANSWER SHEET

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2. Match each of the descriptions listed on the left with the correct LAN topology listed on the right. Each topology may be used one or more times or not at all.

	Descriptions	LAN Topologies
D	Single bus provided and all stations are attached to it by means of taps. Signals from a station branch out from the tap in both directions.	A. Star B. Loop C. Ring D. Common Bus E. Broadband Bus
C	A circular chain of signal repeaters with links between them.	
A	Stations can only communicate directly with the central computer.	
A	Interstation traffic must be switched through the central controller.	
C	Network stations can only communicate with each other by sending messages into the network via repeaters.	

Local Area Networks

ANSWER SHEET

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Local Area Networks

ANSWER SHEET

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Common Carriers

TEST/EXERCISE

1. Match each of the descriptions listed on the left with the correct U.S. domestic common carrier listed on the right. Each common carrier may be used one or more times or not at all.

	Description	U.S. Domestic Common Carrier
___	Provides the subscriber with a modem and a standard telephone line.	A. The Bell system B. Western Union C. Satellite carriers
___	Provides leased line service for customers who wish to reserve lines for their own private use.	
___	Provides worldwide Telex service and TWX service to service both the U.S. and Canada.	
___	Provides WATS service and charges based on a flat monthly rate, based on the zone of coverage.	

Common Carriers

TEST/EXERCISE

2. Match each of the descriptions listed on the left with the correct value-added or Public Packet-Switching Network listed on the right. Each type of network may be used one or more times or not at all.

Descriptions	Networks
___ Features include error detection, code conversion between dissimilar devices, and dynamic routing of data in packets up to 1024 bytes.	A. ARPANET B. TYMNET C. TELENET D. DATAPAC E. TRANSPAC F. DATEX-P G. PSS
___ Features include dynamic routing, error control, collect call billing, and several security options.	
___ Services include the establishment of data communications links between terminals and computers, and between computers and computers.	
___ Supports both intelligent terminals and simple character-mode terminals.	

3. Circle the letter of the statement which describes features of the Public Packet-Switching Network (PPSN).

   a. Evolving to fill the need for a data communications service that is faster, more economical, and more dependable than can be provided by conventional communication circuits.

   b. Based on a number of geographically distributed switching nodes, connected by high-speed links, to which you attach your computer or terminal.

   c. Terminals are connected to the PPSN via leased circuits or dial-up lines.

   d. All of the above.

Common Carriers

TEST/EXERCISE

4. Circle the letter of the statement which describes features of the following International Common Carriers:

   - RCA Global Communications
   - International Telephone and Telegraph World Communications
   - Western Union International

   a. Provide a choice of satellite or ground links for the same price.

   b. Leased lines provided to over 100 foreign countries, with speeds ranging from 19.6 Kbps to 1 Mbps (depending on the bandwidth used by the individual communications line).

   c. Datel service which permits subscribers to connect to the switched telephone system of any PPSN.

   d. All of the above.

Common Carriers

ANSWER SHEET

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	Description	U.S. Domestic Common Carrier
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A	Provides leased line service for customers who wish to reserve lines for their own private use.	
B	Provides worldwide Telex service and TWX service to service both the U.S. and Canada.	
A	Provides WATS service and charges based on a flat monthly rate, based on the zone of coverage.	

Common Carriers

ANSWER SHEET

2. Match each of the descriptions listed on the left with the correct value-added or public packet-switching network listed on the right. Each type of network may be used one or more times or not at all.

	Descriptions	Networks
C	Features include error detection, code conversion between dissimilar devices, and dynamic routing of data in packets up to 1024 bytes.	A. ARPANET B. TYMNET C. TELENET D. DATAPAC E. TRANSPAC F. DATEX-P G. PSS
D	Features include dynamic routing, error control, collect call billing, and several security options.	
B	Services include the establishment of data communications links between terminals and computers, and between computers and computers.	
F	Supports both intelligent terminals and simple character-mode terminals.	

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Common Carriers

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