SRA Computer Training Library

SNA Fundamentals

PERSONAL REFERENCE GUIDE

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COURSE INTRODUCTION

The SNA Fundamentals course introduces the student to SNA data communications networks. It describes the purpose of Systems Network Architecture (SNA), the logical structure of SNA data communications networks, message formats used in the SNA network, data flow, operational sequences for controlling and configuring network resources, and SNA terms.

The course identifies IBM products that implement SNA networks and describes how those products are structured according to SNA. Both single domain and multiple domain network configurations are discussed.

The course begins with the introduction of SNA fundamentals and relates them to IBM SNA products. This is followed by a description of how SNA networks are activated and controlled. Next there is a discussion on how application programs communicate with other application programs and with terminal products. Lastly there is a discussion on error detection and error recovery.

Audience

This course is designed primarily for programmers and other technical people who will be working with SNA data communications networks.

Prerequisites

The recommended prerequisites for this course are:

- Introduction to System/370.
- Introduction to an IBM VS operating system.
- Knowledge of communications systems concepts, which include:
  - Major characteristics of communications systems applications.
  - Functions of major elements of a communications system.
  - Network control.
  - Data flow in a communications system.
  - Synchronous method of data transmission.
  - Interrelationships among the elements of communications systems.

Objectives

At the completion of this course you should be able to:

- Define SNA terms.
- Identify the major components of an SNA network and describe their major functions.
- Describe data formats that are used in an SNA network.

- Describe the routing technique used in an SNA network.
- List operational sequences to activate and deactivate SNA resources.
- List operational sequences to establish connections between users of an SNA network.
- Describe how communication is controlled between network users.
- Identify data streams used in an SNA network.
- Describe how network errors and exception conditions are reported and processed.

Course Materials

In order to complete this course as designed, you will need the following materials:

This Personal Reference Guide (SR20-8492) is your personal guide for taking the course. It contains the directions you need for using the Text and videotape. It also contains the exercises and summaries for each mini-course. The PRG is your book to keep. Use it for recording all your answers and notes.

The Text (SR20-8490) and (SR20-8491) contains instructional material for the course. It is organized as a series of mini-course booklets contained in two three-ring binders.

The videotape contains the instructional material for Mini-Course 3.

Bibliography

The manuals listed below are not required to complete the course. They may be of interest to you for additional reference. The manuals may be ordered from your IBM branch office:

```
SNA Concepts and Products  (GC30-3072)
SNA Technical Overview  (GC30-3073)
SNA-Introduction to Sessions Between Logical Units  (GC20-1869)
SNA-Sessions Between Logical Units  (GC20-1868)
Transaction Programmer's Reference Manual for LU Type 6.2  (GC30-3084
SNA Format and Protocol Reference Manual  (SC30-3112)
```

Study Time

Since this is an independent study course, the completion time may vary depending on the ability and experience of the individual student. However, most students' study time should range from 12 to 16 hours if all mini-courses are completed. You will find estimated study times indicated with each mini-course.

How To Take The Course

Before you begin, you should have your own copy of this Personal Reference Guide (PRG). The PRG contains all of the exercises and answers which support the instructional material in the Text. It also contains the mini-course introductions, objectives, and summaries from the Text. As you read the Text, keep your PRG open to the appropriate mini-course section. Jot down any material you feel is relevant to your needs. Highlight those sections of the summary that are important to your job. By making good use of your PRG, you will build a reference in which you can easily find much of the information you need.

The instructional material is contained in the Text. The Text is organized into a series of mini-courses which contain directions which refer you to the appropriate sections of this PRG.

Course Outline

Introduction to Systems Network Architecture (SNA)

SNA Nodes

SNA Routing Technique

SNA Data Formats

Activating/Deactivating Network Resources

Establishing/Terminating LU-LU Sessions

Data Characteristics and Control Modes

Data Flow Control on LU-LU Sessions

Suspending Data Flow on LU-LU Sessions

LU-LU Data Streams

Logical Unit Types

Multiple Domains

Error/Status Reporting and Processing

Mini-Course 1. Introduction to Systems Network Architecture (SNA)

Overview

This mini-course provides an overview of **Systems Network Architecture (SNA).** This includes a definition of SNA, a description of the logical structure of an SNA network, an introduction to the logical components of an SNA network, and definitions of SNA terms.

Objectives

When you complete this mini-course you should be able to:

- Explain what Systems Network Architecture defines.
- Name the two major components of an SNA network.
- Define the terms end-user, session, and subarea.
- Describe the major functions of a system services control point (SSCP), a physical unit (PU), and a logical unit (LU).
- Describe the structure of a network address and identify SNA resources that are assigned a network address.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 90 minutes

● ***Please turn to the Text and begin your study in Mini-Course 1. The Text will indicate when to return to the PRG to do the exercise.***

Summary

We have briefly discussed the structure of the major components in an SNA network and some of the functions of those components. SNA defines **logical units (LUs)** to handle transmission of messages between end users and defines **protocols (rules)** that logical units abide by so that communication is efficient, orderly, and reliable.

SNA defines **physical units (PUs)** for managing resources for each SNA node in the network.

SNA defines a central point of control, the **system services control point (SSCP)**. The SSCP monitors, manages, and controls the resources in its domain.

An interface to a network operator is provided which allows a network operator to communicate with the SSCP, thereby monitoring and controlling the network.

An SNA network is divided into subareas. Each subarea is numbered and consists of a subarea node and attached peripheral nodes.

Network addresses are assigned to SSCPs, logical units, and to physical units. A network address is made up of a subarea address and an element address. All message units contain an origin network address and a destination network address. The subarea address is used to route a message unit to a destination subarea node and the element address is used by the subarea node to route the message unit to the destination network addressable unit.

Now do Exercise 1.1.

Exercise 1.1

1. SNA is a comprehensive specification for data communications systems. List four descriptions provided by these specifications.

2. SNA networks consist of nodes that are interconnected by data links. Name the two SNA node categories.

3. Name the two major logical components of an SNA network.

4. Define the term end user.

5. List three network addressable units and give a brief description of each.

6. Define the term session.

7. List three sessions in the appropriate order that must exist for two end users to communicate.

8. What SNA component transmits data between network addressable units?

9. What SNA component manages the transmission of data across links?

10. What is a subarea?

11. What makes up a network address?

12. What logical resources are assigned a network address?

- ***When you have completed the exercise, turn to the answer section at the back of this Guide and check your answers. Then you may go on to Mini-Course 2.***

Mini-Course 2. SNA Nodes

Overview

This mini-course expands on Systems Network Architecture (SNA) components, SNA sessions, subareas, and network addresses. This mini-course discusses further the structure of an SNA network, how SNA nodes are interconnected, and it relates SNA components to the IBM products that implement the SNA components.

Objectives

When you complete this mini-course you should be able to:

- List the physical unit types that can make up an SNA network.
- Name the SNA components that make up each SNA node.
- Name the link facilities that can connect each SNA node.
- Name the link protocols that can manage communication on communications links that connect SNA nodes.
- List SNA nodes that can be connected via parallel links.
- List IBM products that implement SNA components in SNA nodes.

Required Materials

The following materials are needed to complete this mini-course.

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 90 minutes

● ***Please turn to the Text and begin your study in Mini-Course 2.***

Summary

Subarea nodes and peripheral nodes are classified as physical unit types. A subarea node is either a type 5 or a type 4 node. A type 5 subarea node contains an SSCP which controls and monitors the network.

A type 4 subarea node does not contain an SSCP. It manages its resources under direction from its controlling SSCP in the host subarea node.

A peripheral node is either a type 1 or a type 2 node and does not contain an SSCP. Typically, type 1 peripheral nodes have less functional capability than type 2 peripheral nodes.

SNA nodes are interconnected by links and the link facilities may be data channels or telecommunication links (telephone lines, satellite links, and microwave links). Type 4 subarea nodes may be interconnected by multiple parallel links that are assigned to logical groupings called transmission groups. A transmission group may consist of one or more links and is treated as one logical link. Transmissions over a transmission group use all of the links in the group.

Type 5 subarea nodes are implemented by SNA access methods (ACF/VTAM, ACF/VTAME, and ACF/TCAM) and application subsystems. Application subsystems (e.g., CICS or a user-written subsystem) implement logical units and the SNA access method supplies a piece of each logical unit. The SNA access method also implements the SSCP, the physical unit (PU), path control, and data link control.

Type 4 subarea nodes are implemented by ACF/NCP/VS.

Peripheral nodes are implemented by hardware and/or software. DPPX (in an 8100) is an example of program code that implements SNA components.

Now do Exercise 2.1.

Exercise 2.1

1. List the SNA nodes and their physical unit types that make up an SNA network.

   ____

   ____

2. What SNA components make up a host subarea node?

   ____

3. What IBM products implement SNA components in a host subarea node?

   ____

   ____

   ____

4. What SNA components make up a type 4 subarea node?

   ____

5. List four functions performed by a type 4 subarea node.

   ____

   ____

   ____

   ____

6. What IBM products implement the type 4 subarea node?

   ____

7. What SNA components make up a peripheral node?

   ____

8. Which link facilities can connect a host subarea node to a type 4 subarea node or to another type 5 subarea node?

   ____

   ____

   ____

   ____

9. Which link facilities can connect a type 5 subarea node to a peripheral node?

____

____

10. Which link facilities can connect a type 4 subarea node to a peripheral node or to another type 4 subarea node?

____

11. What node types can be connected via parallel links?

____

12. What link protocol(s) can be used for the following?

a. A type 5 to type 4 link connection.

____

b. A type 5 to type 5 link connection.

____

c. A type 5 to types 1 and 2 link connection.

____

d. A type 4 to type 4 link connection.

____

e. A type 4 to types 1 and 2 link connection.

____

13. Which SNA nodes can the following links connect?

a. Cross-subarea links.

____

____

____

b. Peripheral links.

____

____

● ***When you have completed this exercise, turn to the answer section at the back of this Guide and check your answers. Then you may go on to Mini-Course 3.***

Mini-Course 3. SNA Routing Technique

Overview

You have learned that an SNA network can be made up of many subarea nodes and many peripheral nodes and that one or more network addressable units (SSCPs, PUs, LUs) reside in each node. A message unit traveling from one network addressable unit (NAU) to another NAU may pass through several subarea nodes on its way to the destination NAU. A network with several nodes may have more than one path available between NAUs. The path control network in each node needs a way to select the appropriate path for each message unit. SNA specifies the mechanism for defining routes and assigning sessions to those routes. This mini-course discusses that SNA routing mechanism.

Objectives

When you complete this mini-course you should be able to:

- State the use of explicit routes and describe their characteristics.
- State the use of virtual routes and describe their characteristics.
- State the use of a route table.
- State the use of a class of service table.
- Describe when and how a class of service is selected.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The videotape

Estimated Study Time

- 30 minutes

● ***Please view the videotape for Mini-Course 3. Then return to the PRG to read the summary and do the exercise.***

Summary

Virtual routes and explicit routes are used to assign sessions to physical routes with transmission characteristics compatible with the needs of the session. At session initiation, the session is assigned to a virtual route, and the virtual route is associated with a specific explicit route by network definitions, thereby, assigning the session to a physical route (explicit route). All session traffic flows over this route for the duration of the session.

Physical routes are defined as explicit routes and each explicit route is assigned an explicit route number. Some explicit routes may provide faster transmission than others, some may be more reliable, and others may be more secure.

Virtual routes define logical routes in the network. Each virtual route consists of a virtual route number and a transmission priority (0, 1, or 2). When a session is assigned to a virtual route, the virtual route number is mapped to an appropriate explicit route and the transmission priority is assigned to session traffic. Session traffic with a higher transmission priority can go ahead of session traffic with a lower transmission priority.

A list of virtual routes makes up a class of service. A class of service is named and resides in the class of service table. The class of service table can contain a named class of service for each type of session (e.g., interactive and batch) in the network.

The session initiation operation specifies a class of service name. A virtual route (virtual route number and transmission priority number) is selected from the class of service and the virtual route number is mapped to the appropriate explicit route. The session is now assigned to a route.

Now do Exercise 3.1.

Exercise 3.1

1. What is an explicit route?

____

____

2. What is the purpose of explicit routes?

____

3. What components make up an explicit route?

____

4. One end of an explicit route terminates/originates in a ____________ subarea node.

5. (True/False) Only one explicit route can be defined between any two subareas.

6. (True/False). An explicit route is defined in each subarea node that makes up the route.

7. (True/False). For each explicit route defined from a host subarea node to a destination subarea node, a reverse explicit route must be defined.

8. What is the content and use of route tables that reside in subarea nodes?

____

____

____

____

____

9. What is the purpose of the virtual route?

____

____

10. What makes up a virtual route?

____

____

11. A virtual route is logically defined between two end ______________ nodes.

12. Where are virtual routes mapped to explicit routes?

13. What is a class of service?

14. When is a class of service assigned to a session?

15. How is a session associated with a class of service?

16. (True/False). Multiple virtual routes may be defined between two end subarea nodes.

● ***Check your answers, then you may go on to Mini-Course 4.***

Mini-Course 4. SNA Data Formats

Overview

You have been introduced to the logical structure of an SNA network, the components that make up a network, the connectivity of the SNA components, the SNA routing technique for traffic in the network, and to SNA terms. We will now discuss the format of the different types of data that can flow in the network.

Objectives

When you complete this mini-course you should be able to:

- List SNA data formats and the SNA components that process each format.
- Describe blocking and segmenting and identify the SNA component that performs each function.
- List SNA request types.
- List SNA request unit categories.
- Identify transmission header (TH) and request header (RH) content.
- Describe the structure of a response.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 30 minutes

● ***Please turn to the Text and begin your study in Mini-Course 4.***

Summary

Requests and responses are transmitted between network addressable units (SSCPs, PUs, LUs). A request contains user data and control information (called a data request) or an SNA command (called a command request). A response is an acknowledgement (positive or negative) to a data or a command request.

The basic unit of transmission is a path information unit (PIU) which consists of a transmission header (TH), request header (RH), and a request unit (RU). The main purpose of the TH information is for routing the PIU through the path control network. The request header contains information that describes the contents of the request unit and information for managing communication between the two session partners.

A network addressable unit, e.g., a logical unit, builds a basic information unit (combination of an RU and an RH) and gives it to path control which attaches a transmission header, forming a PIU. Path control gives one or more PIUs to data link control for transmission across a link. Data link control attaches link control information to the PIU, forming a basic link unit (BLU).

Sending and receiving data link control components add and remove link control information. Sending and receiving path control components add and remove transmission headers. Sending network addressable units, e.g., logical units, build basic information units (BIUs) by attaching a request header to the request unit. Receiving logical units remove the request header and present the request-unit data to the end-user. Network addressable units process basic information units. Path control components process PIUs, and data link control components process basic link units (BLUs).

Path control can block and segment PIUs before giving them to data link control and can deblock and desegment traffic received from data link control. A block (called a basic transmission unit) consists of one or more PIUs. Segmenting is the breaking up of a PIU into smaller pieces called basic information unit (BIU) segments. The first segment includes a transmission header, request header, and may be part of the request unit. Following segments include a transmission header and part of the request unit.

Requests that travel on a session fall into three categories: (1) session control (SC), (2) data flow control (DFC), and (3) function management data (FMD). User data flows in FMD requests and several SNA commands flow in FMD requests. LU-LU sessions use DFC requests to control data flow on the session. The SSCP and logical units use the SC requests to control sessions.

Now do Exercise 4.1.

Exercise 4.1

1. Given the following figure, identify the appropriate SNA data format at items A., B., C., and D. by matching them against the numbered items below.

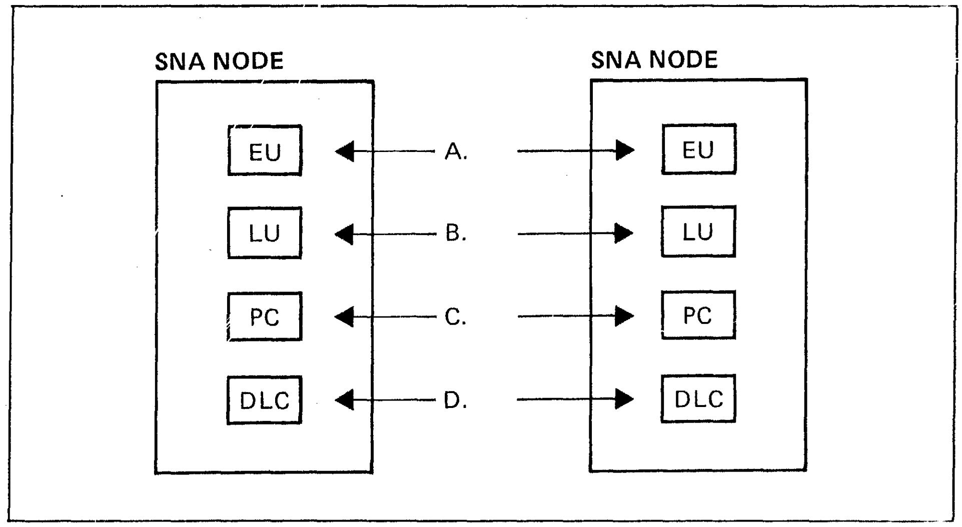

Figure 4-1. Figure for Review Exercise 4.1 Question 1

A. ______________________________

B. ______________________________

C. ______________________________

D. ______________________________

1. Path information unit (PIU).

2. User message.

3. Basic information unit (BIU).

4. Basic link unit (BLU).

2. Given the following figure, identify the appropriate PIU formats at items A., B., and C. by matching them against the numbered items below.

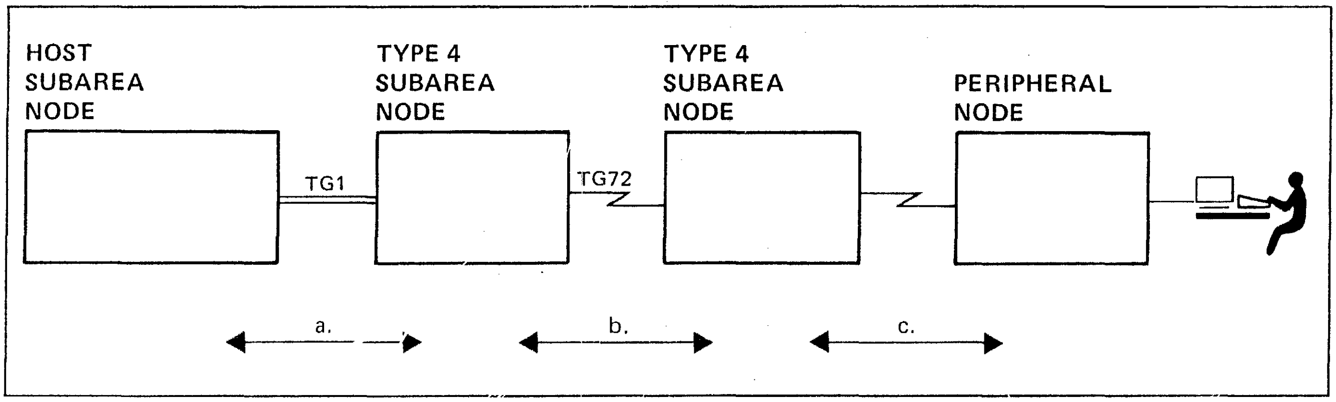

Figure 4-2. Figure for Review Exercise 4.1 Question 2

A. ______________________________

B. ______________________________

C. ______________________________

1. FID0.
2. FID1.
3. FID2.
4. FID3.
5. FID4.

3. What does it mean to block PIUs and what SNA component performs blocking?

____

____

____

____

____

____

4. What does it mean to segment and what SNA component performs segmenting?

5. Identify the following items that reside in a transmission header and which items reside in a request header.

   a. Chaining indicators.

   b. Response indicators.

   c. Destination address.

   d. Origin address.

   e. Sequence number of the associated request.

   f. Bracket indicators.

   g. Explicit route and virtual route numbers.

6. What can a request unit contain?

7. Name the types of requests that travel on sessions.

8. List request unit categories and identify the session that each category is used on.

9. (True/False). A response may consist of a transmission header (TH) and a response header (RH) only.

10. How does a logical unit determine whether a received response is positive or negative?

● ***Check your answers, then you may go on to Mini-Course 5.***

Mini-Course 5. Activating/Deactivating Network Resources

Overview

Now you should have an understanding of the logical structure of an SNA network. You should know the major functions performed by the SNA components that make up the network, and be familiar with the data formats and types of data transmitted through the network. You should also understand the routing technique for establishing routes for traffic between SNA resources.

We will now discuss how an SNA network operates, how we activate it, how we control it, and how to make it serve end-users.

This mini-course discusses the rationale for activating SNA network resources, and the SNA command sequences for activating and deactivating the resources.

Objectives

When you complete this mini-course you should be able to:

- Define the terms domain and data-traffic state.
- Describe the activation hierarchy for SNA network resources.
- Describe how network resources are made known to the SSCP.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 90 minutes

● ***Please turn to the Text and begin your study in Mini-Course 5.***

Summary

All network resources are defined to the SSCP by the network definer. The SSCP uses the definitions to activate and gain control of the resources. Once a resource has been activated, the SSCP can monitor and control it and, for certain errors, can automatically recover the resource. Logical units must be active before LU-LU sessions can be established.

Physical units, logical units, and links are activated by the SSCP.

There is a hierarchy for activating network resources. A logical unit is the lowest in the hierarchy. Assume that a peripheral logical unit that is attached to a type 4 subarea node is to be activated. The hierarchy of activation is:

1. Physical unit (type 4 node).

2. Link (type 4 node).

3. Physical unit (peripheral node)

4. Logical unit (peripheral node).

Now do Exercise 5.1.

Exercise 5.1

1. In SNA terms, what is a domain?

   ____

   ____

2. What SNA resources can be activated by an SSCP?

   ____

   ____

3. List SNA requests that an SSCP sends to activate a:

   a. Physical unit.

      ____

   b. Logical unit.

      ____

   c. Link.

      ____

4. Given the following figure, assume that the SSCP is to activate LU21. Also assume that the host node resources are active and all other nodes are operative, that is, ready to be activated. List the resources, in the proper order, that the SSCP must activate before it can activate LU21.

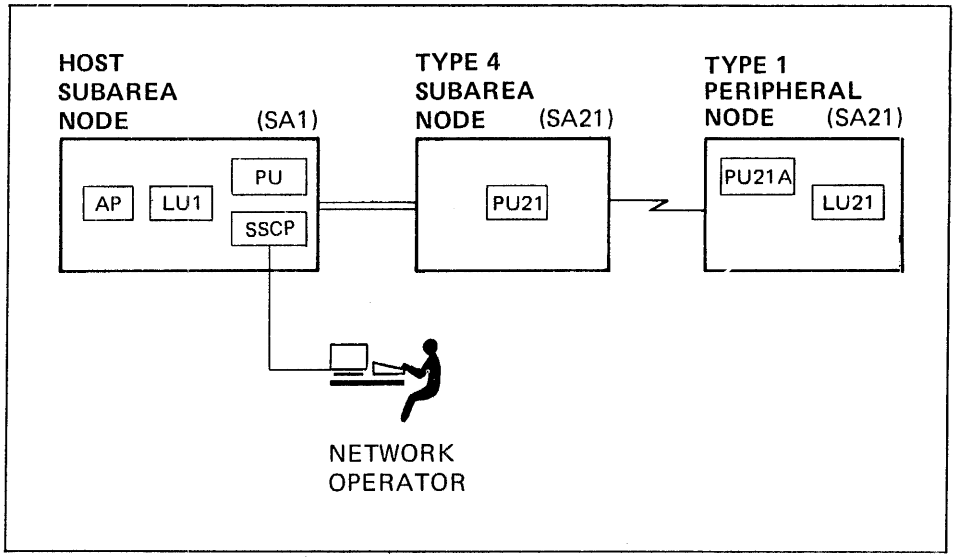

Figure 5-1. Figure for Review Exercise 5.1 Question 4

____

____

____

____

5. How is an SSCP made aware of network resources?

____

6. Why must a SDT request be sent to a PU.T4 node after an ACTPU request has been sent by the SSCP to establish the SSCP-PU session?

____

____

____

____

____

____

____

____

● *Check your answers, then you may want to return to Mini-Course 5 at the heading "Activating a Specific Network Configuration". The remainder of Mini-Course 5 contains more detail on activating network resources. If you don't need the additional information, then go on to Mini-Course 6.*

Mini-Course 6. Establishing/Terminating LU-LU Sessions

Overview

You have been introduced to the request sequences for activating physical units and logical units in preparation for establishing LU-LU sessions. This mini-course describes how LU-LU sessions are established and terminated.

Objectives

When you complete this mini-course you should be able to:

- Describe how LU-LU sessions are established.
- Describe how LU-LU sessions are terminated.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 90 minutes

Please turn to the Text and begin your study in Mini-Course 6.

Summary

Sessions can be initiated between two logical units by either logical unit, by a third logical unit, by the network operator, or by the SSCP automatically initiating the session based on resource definitions. A secondary logical unit initiates a session with a logon request and the primary logical unit initiates a session with an acquire operation.

Some logical units perform an unformatted logon and some perform a formatted logon. Unformatted logon is a user selected character string and the formatted logon is accomplished with the INITiate SELF (INIT-SELF) request.

The owning SSCP processes a logical unit connection request. The SSCP receives the connection request on the SSCP-LU session and notifies the primary logical unit to issue a BIND request to establish the session.

LU-LU session termination can be initiated by either logical unit or by the network operator. A logical unit can submit a request to the SSCP and the SSCP assists in session termination. A logical unit can submit a request (DFC request) to its session partner or it can send a user selected character string to its session partner requesting that the session be terminated. The primary logical unit terminates the session with an UNBIND request.

Now do Exercise 6.1.

Exercise 6.1

1. What is the purpose of LU-LU sessions?

2. What SNA request establishes an LU-LU session and what resource sends the request?

3. What are the conditions for establishing an LU-LU session?

4. Describe the formatted and unformatted session initiation requests.

5. What resources can initiate an LU-LU session?

____

____

____

____

6. A session initiation request flows on the ______________ session.

7. Given the following list of requests, arrange them in the proper order when establishing an LU-LU session, identify the resources that send and receive the request, and describe the use of each request.

   SESSST.

   BIND.

   INIT-SELF.

   SDT.

   CINIT.

   a. ____

   ____

   ____

   ____

   ____

   ____

   b. ____

   ____

   ____

   ____

   ____

   ____

c.

d.

e.

8. Assuming that a secondary logical unit submits a user-defined logon, e.g., "LOGON LU1", list in order the sequence of requests to establish the LU-LU session and prepare the session to handle all types of requests.

9. What resources can request the termination of an LU-LU session?

10. List the requests that can be used to ask for LU-LU session termination. Also identify the resources that send and receive each request.

11. Given the following list of SNA requests, arrange them in the correct order for terminating an LU-LU session. Also identify the resources that send and receive each request and describe the use of each request.

   a. CTERM.

   ____

   ____

   ____

   ____

   b. TERM-SELF.

   ____

   ____

   ____

   ____

   c. SESSEND.

   ____

   ____

   ____

   ____

   d. UNBIND.

   ____

   ____

   ____

   ____

● ***Check your answers, then you may go on to Mini-Course 7.***

Mini-Course 7. Data Characteristics and Control Modes

Overview

We know that the SSCP gains control over SNA resources by activating them and gives up control by deactivating them. We also know how LU-LU sessions are established so that end-users can communicate via those logical units. We will now talk more about requests and responses such as sequence numbering and grouping requests into logical entities. We will also talk about how responses are associated with the appropriate request, and the pacing of session traffic.

We know that user data, control information, and acknowledgements are transmitted through the network by a path information units (PIUs). A PIU that contains user data and/or control information is also called a request. A PIU that contains an acknowledgement to a request is called a response.

Requests and responses are transmitted between network addressable units (SSCPs, LUs, and PUs). Many requests and responses can be flowing in the network simultaneously. Requests and responses can flow on three types of sessions that we have discussed.

- SSCP-PU.
- SSCP-LU.
- LU-LU.

Objectives

When you complete this mini-course you should be able to:

- Describe the terms normal-flow and expedited-flow.
- Describe the technique used to transmit requests and responses in order.
- Describe how a logical unit matches responses to requests.
- Describe the SNA chaining technique.
- Name the forms of responses.
- Describe request and response control modes.
- Describe the SNA pacing (session level) technique.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)

- The Text

Estimated Study Time

- 90 minutes

● ***Please turn to the Text and begin your study in Mini-Course 7.***

Summary

Requests and responses travel through the network on one of two flows: (1) normal-flow, or (2) expedited-flow. Requests that contain user data, certain requests that contain control information, and their associated responses travel on the normal-flow. Requests and responses that travel on the normal-flow must arrive at their destination in the same order in which they were sent. Other requests and responses travel on the expedited-flow. Expedited-flow traffic can go ahead of normal-flow traffic at certain points in the network. Expedited-flow requests are used for controlling purposes or to indicate some exceptional condition to the session partner.

Normal-flow requests sent on LU-LU sessions and some requests sent on SSCP-PU sessions are sequence numbered. Sequence numbers are used to keep requests in the order that they were sent and to match responses with their associated requests.

Requests may be sent as single element request chains or related requests may be grouped into multiple element request chains. In some cases multiple element request chains provide better performance over single element chains. Also, chaining is a way of subdividing long messages into sizes appropriate for sending to logical units.

SNA defines two responses: (1) definite response 1 (DR1), and (2) definite response 2 (DR2). Requests may specify one of three forms of response: (1) definite, (2) exception, or (3) no response. A request can specify one of the following: definite DR1, exception DR1, definite DR2, exception DR2, definite DR1 and DR2, or exception DR1 and DR2. If a request specifies a definite response, the request receiver must return a positive response to accept the request or return a negative response to reject the request. If a request specifies an exception response, the request receiver returns a negative response for any request that is not acceptable.

For each session, a request and response control mode must be specified for the primary-to-secondary flow and for the secondary-to-primary flow. The request and response modes are:

- Immediate request mode.
- Delayed request mode.
- Immediate response mode.
- Delayed response mode.

SNA defines two types of pacing: (1) session level pacing, and (2) virtual route pacing. Session level pacing can be specified for primary-to-secondary flow and for secondary-to-primary flow. Session level pacing can be in one stage or in two stages and assists in the prevention of flooding destination logical units and their associated boundary function. The destination boundary function and logical unit determine the rate at which a logical unit can send requests.

The purpose of virtual route pacing is to assist in preventing virtual routes from becoming saturated during peak traffic times.

Now do Exercise 7.1.

Exercise 7.1

1. Name two session flows that requests and responses can travel on and give a brief description of each flow.

2. Identify which of the following sessions have sequence numbered requests and responses flowing on them.

   a. SSCP-SSCP.

   b. SSCP-PU.

   c. SSCP-LU.

   d. LU-LU.

3. What technique is used to keep requests in order?

4. (True/False). Requests and responses on the normal-flow from primary to secondary are sequence numbered independently of those on the normal flow from secondary to primary.

5. How does a logical unit match a received response with a request that was sent earlier?

6. State two reasons why chaining of requests can be useful.

7. How do session partners control chaining of requests?

8. (True/False). Each request can ask for three responses.

9. Name the three forms of responses.

10. A logical unit is sending a definite response chain consisting of five elements, what form of response does each element specify?

11. Given the following four request and response control modes, match them with the appropriate description from the numerically itemized list.

a. Immediate request mode.

b. Delayed request mode.

c. Immediate response mode.

d. Delayed response mode.

____

____

____

1) Responses must be returned in the order that the requests were received.

2) Allows one outstanding definite response chain.

3) Responses can be returned in any order regardless of the order that the requests were received.

4) A chain sender can send multiple request chains without waiting for a response after each chain is sent.

12. (True/False). For each LU-LU session, a request and response control mode must be specified for each session partner.

● ***Check your answers, then you may go on to Mini-Course 8.***

Mini-Course 8. Data Flow Control on LU-LU Sessions

Overview

This mini-course describes how data flow between logical units is managed through the use of headers, request units, response units, control modes, parameters, and indicators.

Objectives

When you complete this mini-course you should be able to:

- Describe the use and content of the BIND request.
- Describe the operation of each send/receive mode.
- Describe bracket protocol operation.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 72 minutes

● ***Please turn to the Text and begin your study in Mini-Course 8.***

Summary

A primary logical unit sends a BIND request to the secondary logical unit to establish an LU-LU session. The session parameters in the BIND request specify the protocols (rules) for the session. One protocol specified is a send/receive mode:

- Full-duplex.
- Half-duplex flip-flop.
- Half-duplex contention.

For full-duplex mode, both logical units can send at any time.

For half-duplex flip-flop mode, only one logical unit is allowed to send at a time. At any given point in time one logical unit is a sender and the other logical unit is a receiver. The sender can change the status of the two logical units by including the change direction indicator (CDI) in the request header (RH) of a request that is sent to the receiver.

For half-duplex contention mode, both logical units are in contention mode if neither logical unit is sending. Once a logical unit begins to send, it becomes the sender and the other logical unit becomes the receiver. If both logical units send at the same time, the logical unit that was identified as the contention winner in the BIND request becomes the sender and the other logical unit becomes the receiver.

Session parameters can specify the bracket protocol.

Brackets isolate one unit of work from another unit of work, e.g., isolating one transaction from another transaction. A begin bracket indicator (BBI) in the request header of a request starts a bracket and an end bracket indicator (EBI) in the request header of a request ends the bracket.

The BIND request established one logical unit as the bracket's first speaker and the other logical unit as the bracket's bidder. The first speaker can begin a bracket at any time but the bidder must get permission from the first speaker to begin a bracket. A logical unit bids to begin a bracket by either sending a BID request to the first speaker or by sending a data request whose request header contains a BBI.

Now do Exercise 8.1.

Exercise 8.1

1. What operation establishes protocols (rules) for an LU-LU session?

2. Describe the purpose of the following list of BIND request fields.

   a. FM profile.

   b. TS profile.

   c. FM usage.

      1) Primary protocols.

      2) Secondary protocols.

      3) Common protocols.

   d. TS usage.

e. PS profile.

f. PS usage.

3. Describe the difference between the negotiable and non-negotiable BIND request sequence.

4. Give a brief description of the following send/receive modes.

   a. Full-duplex.

b. Half-duplex flip-flop.

____

____

____

____

c. Half-duplex contention.

____

____

____

____

5. Which session partner is established as the sender when the BIND request specifies half-duplex flip-flop protocol?

____

____

____

6. An LU-LU session uses half-duplex flip-flop send/receive mode. How is the sender/receiver status of each logical unit changed?

____

____

____

____

7. What is the purpose of bracket protocol?

____

____

____

____

____

8. Session parameters that specify brackets to be used also specify one logical unit as the bracket's ______________ speaker and one logical unit as the

9. For bracket protocol, which logical unit is allowed to begin a bracket and which is allowed to end a bracket?

● *Check your answers, then you may go on to Mini-Course 9.*

Mini-Course 9. Suspending Data Flow on LU-LU Sessions

Overview

You have been introduced to data flow control for LU-LU sessions. In this mini-course we are going to expand on that topic. We will discuss the data flow protocols quiesce and shutdown.

Objectives

When you complete this mini-course you should be able to:

- Describe the use of the protocols:
  - quiesce
  - shutdown

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 30 minutes

● ***Please turn to the Text and begin your study in Mini-Course 9.***

Summary

The quiesce and shutdown protocols are used to suspend data flow temporarily or in preparation to terminate the session.

The quiesce protocol can be used to temporarily quiesce a session partner because the partner is sending information too fast to be processed or the quiesce can be in preparation to terminate the session. Either session partner can use the quiesce protocol. The following command requests are used to quiesce a session and to remove the session from the quiesced state:

- Quiesce at end of chain (QEC).
- Quiesce complete (QC).
- Release quiesce (RELQ).

A primary logical unit can use the shutdown protocol in preparation for terminating the session. The primary logical unit sends the SHUTDown (SHUTD) request to the secondary logical unit (LU) asking for an orderly close-down of the session. The secondary LU, at a logical point, sends the SHUTdown Complete (SHUTC) request indicating that it is ready for the session to be terminated. The secondary LU is not allowed to send a request on the normal-flow once it sends the SHUTC request. Rather than send the UNBIND request to terminate the session the primary logical unit can send the RELQ request to the secondary logical unit to remove it from the quiesced state and processing can continue. Typically the UNBIND request is sent to terminate the session.

Now do Exercise 9.1.

Exercise 9.1

1. Give a brief description of the following protocols.

   a. Quiesce.

   ____

   ____

   ____

   ____

   b. Shutdown.

   ____

   ____

   ____

   ____

2. Identify the SNA requests shown in the numerical list below that implement each of the following protocols.

   a. Quiesce.

   ____

   b. Shutdown.

   ____

   1) SHUTC.

   2) RELQ.

   3) QEC.

   4) QC.

   5) SHUTD.

3. Which session partner is allowed to invoke the following protocols?

   a. Quiesce.

   ____

   b. Shutdown (SHUTD).

   ____

● ***Check your answers, then you may go on to Mini-Course 10.***

Mini-Course 10. LU-LU Data Streams

Overview

Our previous discussions of data requests that flow on LU-LU sessions have concentrated more on the transmission header (TH) and the request header (RH) than on the request unit (RU). This mini-course discusses the makeup of RUs that contain user data. We will talk about the interface codes used to represent a user data stream and control information that may be included in the data stream interspersed with user data.

Objectives

When you complete this mini-course you should be able to:

- Describe the content of data streams that flow on LU-LU sessions.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 30 minutes

● ***Please turn to the Text and begin your study in Mini-Course 10.***

Summary

A data stream on an LU-LU session may be represented in either the EBCDIC or ASCII interface codes. Typically it is EBCDIC. Two data streams are defined for use: (1) 3270 data stream and (2) an SNA character string (SCS). The 3270 data stream is used in sessions with certain 3270 logical units and SCS is used in sessions with programmed logical units, certain 3270 logical units, and with other peripheral logical units that include the 3767, 8100, 3600, 3630, 3770, Series 1, S/32, S/34, and the S/38.

The two data streams define different control characters while both sets of graphics are essentially the same. The control characters are used for controlling destination end-users as well as for formatting the presentation of the data to the destination end-user.

In addition to user data and control information, a data request may contain function management headers (FMHs), each having a specific format and each including specific kinds of information for the destination logical unit. An FMH can:

- Identify the device to which the destination logical unit is to deliver the user data.

- Specify data management activities, such as creating, scratching, and erasing a data set, and erasing, adding, and replacing data set records.

- Specify compression and compaction information for compressing and compacting data.

A data stream can contain user data and interspersed control characters for formatting and device control. It also can contain FMHs which provide a standardized communication vehicle between logical units. Finally, it can contain string control bytes (SCBs) that identify to a receiving logical unit the data stream characters that have been compressed or compacted.

Now do Exercise 10.1.

Exercise 10.1

1. Name the interface codes that may be used to represent data in a LU-LU session data stream and identify the one that is used most of the time.

   ____

2. What SNA defined item may be included in a request unit to identify a specific device to which the receiving logical unit is to deliver the user data?

   ____

3. What SNA defined item may be included in a data stream to identify the specific characters that were compressed or compacted?

   ____

4. What operation establishes whether two logical units are allowed to use FMHs in their LU-LU session?

   ____

   ____

5. How does a logical unit determine whether a received request unit contains one or more FMHs?

   ____

   ____

   ____

   ____

   ____

   ____

6. Where in a request unit can an FMH reside?

   ____

   ____

7. How does a receiving logical unit recognize a second FMH in the same request unit?

   ____

   ____

● ***Check your answers, then you may go on to Mini-Course 11.***

Mini-Course 11. Logical Unit Types

Overview

This mini-course discusses the SNA classifications of logical units. These are classified according to the SNA functions supported by each logical unit. To begin with, we will review the functions of logical units and expand on our previous discussion of the logical structure of logical units.

Objectives

When you complete this mini-course you should be able to:

- Explain the significance of LU type classifications.
- List the LU types defined by SNA and identify product types (e.g., application programs, printers, and displays) that each LU type is appropriate for.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 42 minutes

● ***Please turn to the Text and begin your study in Mini-Course 11.***

Summary

SNA products are classified according to the SNA functions that they support and the logical unit(s) that reside in each product assumes that classification. Logical units are classified as LU type 0, 1, 2, 3, 4, 6, or 7. Session parameters in the BIND request specify the LU type.

Now do Exercise 11.1.

Exercise 11.1

1. Explain the significance of LU type classifications.

2. For each LU type listed below, name the types of products that would participate in an LU-LU session. For example, an LU type for application programs that communicate with single display devices.

   a. LU Type 0.

   b. LU Type 1.

   c. LU Type 2.

   d. LU Type 3.

   e. LU Type 4.

f. LU Type 5.

g. LU Type 6.

h. LU Type 7.

3. Which LU types use the SNA data stream?

4. Which LU types use half-duplex flip-flop?

5. What BIND field specifies LU type?

6. What BIND field specifies the data stream?

- ***Check your answers, then you may go on to Mini-Course 12.***

Mini-Course 12. Multiple Domains

Overview

So far in this course we have talked about single domain networks. Everything that was said about single domain networks is applicable to multiple domain networks. Now we will discuss those things that are unique to multiple domain networks.

Objectives

When you complete this mini-course you should be able to:

- List the type of links that can connect domains to form a multiple-domain network.
- List the definitions required for logical units in different domains to establish sessions with each other.
- List the sessions that must exist before sessions can be formed between logical units that reside in different domains.
- Identify resources that can be owned simultaneously by multiple SSCPs.
- Describe the sequence of SSCP activities to take over ownership of resources whose SSCP has failed.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 90 minutes

● ***Please turn to the Text and begin your study in Mini-Course 12.***

Summary

Multiple domain networks include two or more SSCPs and associated network resources. Domains can be connected via SDLC links or by data channels. There is an addressable subset of each SSCP called a cross domain resource manager (CDRM). For each domain, definitions must be included for the CDRM in that domain and for the CDRMs in other domains in order for the logical units in one domain to communicate with the logical units in other domains.

Each CDRM must establish a session with all other CDRMs if LU-LU sessions are to be established between the domains. Also, in the domain that initiates the cross-domain session, the logical unit in the other domain (called a cross-domain resource) must be defined in the initiating domain as a cross-domain resource.

Once all the CDRMs are defined, CDRM-CDRM sessions can be established. Cross-domain resources are defined so that logical units in one domain can initiate sessions with logical units in other domains.

We have learned that type 4 subarea nodes and non-switched SDLC links can be owned by multiple SSCPs simultaneously. Ownership of peripheral PUs and LUs attached to type 4 nodes can be switched between SSCPs. Peripheral PUs and LUs in a host subarea node can have only one owner and that is the SSCP in that host node.

If a host node fails, it is possible for another host node (SSCP) to take over ownership of some of the resources that were owned by the SSCP in the failed host node. Once the failed host has been restored, it can reenter the network.

Now do Exercise 12.1.

Exercise 12.1

The configuration shown in the following figure is to be used to answer the questions in this exercise. The configuration includes three domains, six subareas, and several physical units and logical units. All resources shown in a domain are defined to the SSCP in that domain and are active. Definitions are not supplied for cross-domain sessions.

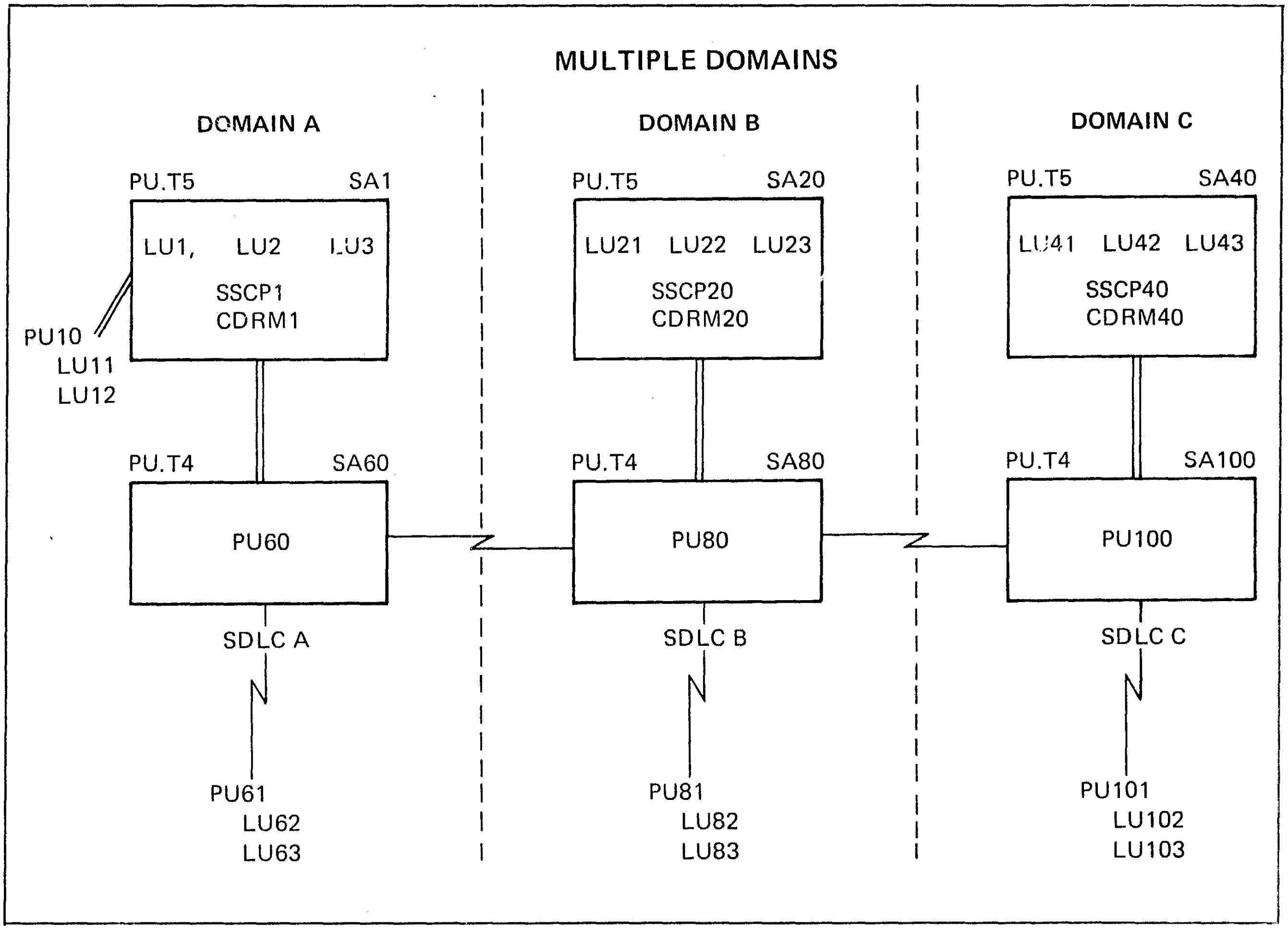

Figure 12-1. Figure for Review Exercise 12.1

1. LU62 in domain A is to logon to LU41 in domain C. List the definitions required in both domains and list the sessions, in order, that must exist for the LU62-LU41 session to be established.

Domain A	Sessions	Domain C
________________	________________	________________
________________	________________	________________
________________	________________	________________

2. LU21 in domain B is to initiate a session with LU11 in domain A. List the definitions required in both domains and list the sessions, in order, that must exist for the LU11-LU21 session to be established.

Domain A	Sessions	Domain B
__________	__________	__________
__________	__________	__________

3. LU23 in domain B is to go into session with LU43 in domain C. Either logical unit can initiate the session. List the definitions required in both domains and list the sessions, in order, that must exist for the LU23-LU43 session to be established.

Domain B	Sessions	Domain C
__________	__________	__________
__________	__________	__________
__________	__________	__________

4. All logical units can initiate a session, all peripheral logical units can go into session with all host logical units, and all host logical units can go into session with any other host logical unit. List the definitions required in all domains and list the sessions that must exist for the LU-LU sessions to be established.

Domain A	Domain B	Domain C
__________	__________	__________
__________	__________	__________
__________	__________	__________
__________	__________	__________
__________	__________	__________
__________	__________	__________
__________	__________	__________
__________	__________	__________

Sessions
____
____

5. SSCP1 in domain A is to take over ownership of resources in domains B and C should the host node in those domains fail. Identify the resources in domains B and C that must be defined to SSCP1 and list the activities, in order, for SSCP1 to take over resources in each domain.

6. List the SNA resources in all domains that can be owned simultaneously by SSCP1, SSCP20, and SSCP40.

● ***Check your answers, then you may go on to Mini-Course 13.***

Mini-Course 13. Error/Status Reporting and Processing

Overview

This mini-course identifies types of errors that are detected in an SNA network, identifies resources that report and process errors, and describes how errors are reported.

Objectives

When you complete this mini-course you should be able to:

- Describe how network errors are reported to an owning SSCP.
- List recovery options for the SSCP.
- Describe how errors and exception conditions are reported on LU-LU sessions.
- List recovery options on an LU-LU session.

Required Materials

The following materials are needed to complete this mini-course:

- This Personal Reference Guide (PRG)
- The Text

Estimated Study Time

- 42 minutes

● ***Please turn to the Text and begin your study in Mini-Course 13.***

Summary

The physical unit (PU) in each node reports physical errors to its owning SSCP. The SSCP logs the errors and sends messages to the network operator.

Several exception conditions can occur on LU-LU sessions. The session partner that recognizes an exception condition may report it to the other logical unit. If a logical unit receives a request that is unacceptable, it sends a negative response to its session partner to report why the the request was unacceptable.

Request sequence errors can occur on an LU-LU session because of a component failure. For example, a logical unit sends several requests but they don't arrive at their destination because of a component failure. Also, the session is terminated because the path for the session becomes inoperative. When the session is reestablished, the logical unit that sent the requests has a different sequence number count than the logical unit that was to receive the requests. The primary logical unit can use the set and test sequence number (STSN) request to test for the current sequence number count at both logical units and then set them appropriately.

The LU-LU session must be in the data-traffic-reset state for sequence numbers to be tested and set.

A logical unit can recognize and report other types of exception conditions. For example, a logical unit is associated with a display station. If an operator powers-off or powers-on the station, the logical unit sends an LU status (LUSTAT) request to its session partner to report the status.

Now do Exercise 13.1.

Exercise 13.1

1. What SNA resource reports network errors to an SSCP?

2. What is the criteria used by a type 4 physical unit to conclude that contact with an adjacent node is lost and that it is a permanent error?

3. What is the criteria used by a type 4 physical unit to conclude that contact with an adjacent node is lost and that it is a temporary error?

4. What recovery action does the SSCP take for:

   a. Permanent errors?

b. Temporary errors?

5. What vehicle is used to report errors on a LU-LU session?

6. What SNA resource reports errors and exception conditions that occur on an LU-LU session?

7. What SNA resource performs recovery functions on an LU-LU session?

8. What happens to an LU-LU session when a non-recoverable error occurs?

9. List the error categories as defined by SNA.

10. An LU-LU session can be in a data-traffic-reset state or in a data-traffic-active state.

a. In which state must the session be in order for FMD requests and DFC requests to flow?

b. In which state must the session be in order to test and set sequence numbers for the primary and the secondary logical unit?

c. List the requests that change the data-traffic state of an LU-LU session.

11. What request can a logical unit use to report the exception conditions, printer out of forms or display device powered off?

12. Assume that the LU-LU session is using the send/receive mode half-duplex flip-flop and the secondary logical unit is in receive status.

a. What request can the secondary logical unit use to ask its session partner for a change direction indicator (CDI)?

b. On what flow (normal or expedited) does the request sent by the secondary logical unit travel?

● ***Check your answers, then turn to the Mastery section in this Guide and take the Mastery Test.***

Exercise Answers

Answers for Exercise 1.1

1. SNA is a comprehensive specification for data communications systems. List four descriptions provided by these specifications.

    - ***Logical structure of data communication networks.***
    - ***Protocols for synchronizing communication between network resources.***
    - ***SNA message formats.***
    - ***Operational sequences for controlling network resources, network configuration, and for transmitting information through the network.***

2. SNA networks consist of nodes that are interconnected by data links. Name the two SNA node categories.

    - ***Subarea node.***
    - ***Peripheral node.***

3. Name the two major logical components of an SNA network.

    - ***Network addressable units (NAUs).***
    - ***Path control network.***

4. Define the term end user.

    In SNA, an end user is the ultimate source or destination of application data flowing through an SNA network. An end user may be an application program or a terminal operator.

5. List three network addressable units and give a brief description of each.

    - ***system services control point (SSCP) is a set of SNA components that monitors, manages, and controls the SNA network. If there are multiple SSCPs in the network, then each SSCP will own parts of the network.***
    - ***A physical unit is a set of SNA components in an SNA node that manages and monitors that node's SNA resources (such as a communications link).***
    - ***A logical unit is a set of SNA components that provides services for end-users. These services allow end-users to communicate with each other.***

6. Define the term session.

    In SNA, a session is a logical connection between two network addressable units (NAUs). A session must be established between two NAUs before they can communicate with each other.

7. List three sessions in the appropriate order that must exist for two end users to communicate.

   - *SSCP-PU.*
   - *SSCP-LU.*
   - *LU-LU.*

8. What SNA component transmits data between end users?

   The path control network which consists of two major components: (1) path control component and (2) the data link control component.

9. What SNA component manages the transmission of data across links?

   data link control (DLC).

10. What is a subarea?

    In SNA, a subarea is a logical division of the network and each division is assigned a unique subarea number. A subarea consists of a subarea node and attached peripheral nodes. The division of the network into subareas is the basis of network addresses.

11. What makes up a network address?

    In SNA, a network address consists of a subarea address and an element address.

12. What logical resources are assigned a network address?

    SSCPs, physical units, and logical units are assigned network addresses.

Answers for Exercise 2.1

1. List the SNA nodes and their physical unit types that make up an SNA network.

   - ***Subarea nodes (types 4 and 5).***
   - ***Peripheral nodes (types 1 and 2).***

2. What SNA components make up a host subarea node?

   SSCP, PU, LUs, path control, and data link control.

3. What IBM products implement SNA components in a host subarea node?

   ACF/VTAM, ACF/VTAME, and ACF/TCAM implement the SSCP, the PU, part of each LU, path control, and data link control. Application subsystems (e.g., CICS, IMS, and TSO) and user-coded programs implement the major part of each LU.

4. What SNA components make up a type 4 subarea node?

   PUCP and PU.

5. List four functions performed by a type 4 subarea node.

   a. ***Controls communications links attached to it (polling and addressing).***

   b. ***Deletes and inserts line control characters.***

   c. ***Translates character codes.***

   d. ***Performs error recovery for attached links and peripheral nodes..***

6. What IBM products implement the type 4 subarea node?

   ACF/NCP/VS.

7. What SNA components make up a peripheral node?

   PUCP, PU, LUs, path control, and data link control.

8. Which link facilities can connect a host subarea node to a type 4 subarea node or to another type 5 subarea node?

   Processor channels. Also, if the processor and the SNA access method support the integrated communications adapter (ICA), a type 4 subarea node can be connected to a type 5 subarea node by telephone lines, satellite links, and microwave links.

9. Which link facilities can connect a type 5 subarea node to a peripheral node?

   Processor channels. Telephone lines, satellites links, and microwave links can be used if the processor and the SNA access method support the integrated communications adapter (ICA).

10. Which link facilities can connect a type 4 subarea node to a peripheral node or to another type 4 subarea node?

    Telephone lines, satellites, and microwave.

11. What node types can be connected via parallel links?

    Type 4 nodes can be connected to type 4 nodes via parallel links.

12. What link protocol(s) can be used for the following?

    a. A type 5 to type 4 link connection.

       Channel protocol (CCWs).

    b. A type 5 to type 5 link connection.

       Channel protocol (CCWs).

    c. A type 5 to types 1 and 2 link connection.

       Channel protocol and SDLC protocols.

    d. A type 4 to type 4 link connection.

SDLC protocol.

e. A type 4 to types 1 and 2 link connection.

SDLC protocol.

13. Which SNA nodes can the following links connect?

- Cross-subarea links.

  Cross-subarea links can connect type 5 subarea nodes to type 5 subarea nodes, type 4 subarea nodes to type 4 subarea nodes, and type 4 subarea nodes to type 5 subarea nodes.

- Peripheral links.

  Peripheral links can connect peripheral nodes to subarea nodes (types 4 and 5).

Answers for Exercise 3.1

1. What is an explicit route?

   An explicit route is a user-defined physical path between an origin subarea and a destination subarea.

2. What is the purpose of explicit routes?

   Explicit routes define physical paths through the SNA network for session traffic.

3. What components make up an explicit route?

   Subarea nodes and transmission groups make up explicit routes.

4. One end of an explicit route terminates/originates in a in a ***host*** subarea node.

5. (True/False) Only one explicit route can be defined between any two subareas.

   False. Multiple explicit routes can be defined between any two subareas. Each explicit route between the same two subareas must have a unique explicit route number.

6. (True/False). An explicit route is defined in each subarea node that makes up the route.

   True. Route definitions in each subarea node define only part of each explicit route. Explicit route definitions in a particular subarea node specify the transmission group that is to be used to get to the next subarea along the route.

7. (True/False). For each explicit route defined from a host subarea node to a destination subarea node a reverse explicit route must be defined.

   True. A reverse explicit route must be defined for each explicit route. The reverse explicit route definitions must specify the same physical path that the forward explicit route definitions define.

8. What is the content and use of route tables that reside in subarea nodes?

   Route tables contain definitions of explicit routes and definitions that map VRs to ERs. Route table definitions are used for routing message units on an explicit route from an origin subarea to a destination subarea; in addition, the route table in the host subarea node is used in the process of assigning a session to an explicit route.

9. What is the purpose of the virtual route?

   The virtual route is a technique to assign a session to a class of service.

10. What makes up a virtual route?

    A virtual route is made up of virtual route number and a transmission priority.

11. A virtual route is logically defined between two end ***subarea*** nodes.

12. Where are virtual routes mapped to explicit routes?

    Virtual routes are mapped in host subarea node route tables. Lists of virtual routes are included in a class of service table.

13. What is a class of service?

    A class of service consists of a list of virtual route number and transmission priority pairs. Each virtual route number is associated with a particular explicit route and that explicit route has the physical characteristics that the network definer specifies for a class of service. The transmission priority and the physical route characteristics of a virtual route is the class of service provided for the session that is assigned to the virtual route.

14. When is a class of service assigned to a session?

    A class of service is assigned to a session when the session is initiated.

15. How is a session associated with a class of service?

    At session initiation, a class of service is selected by name. The class of service consists of a list of virtual route number (VRN) and transmission priority number (TPN) pairs. The first available virtual route in the list is assigned to the session. Routing definitions in the host subarea node associate the virtual route number with a particular explicit route.

16. (True/False). Multiple virtual routes may be defined between two end subarea nodes.

    True.

Answers for Exercise 4.1

1. Given the following figure, identify the appropriate SNA data format at items A., B., C., and D. by matching them against the numbered items below.

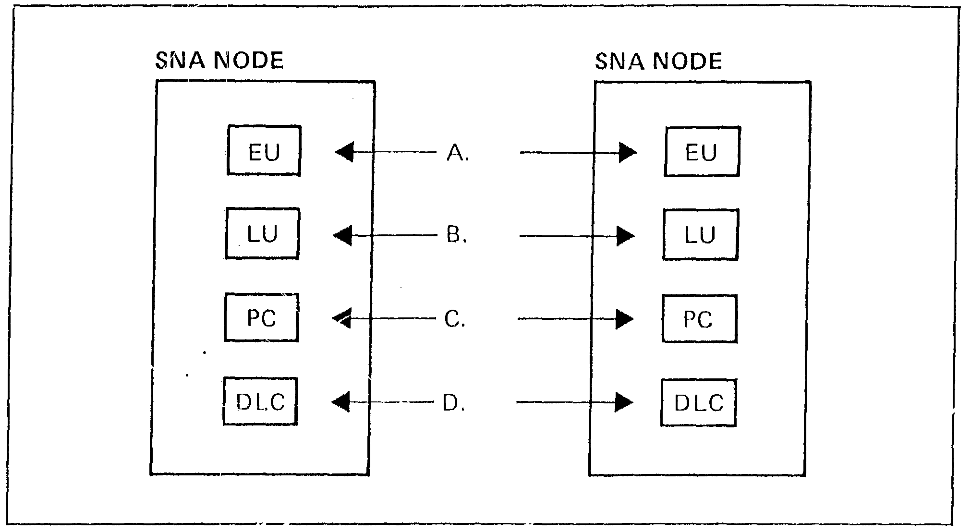

Figure A-1. Figure for Review Exercise 4.1 Question 1

1. Path Information Unit (PIU).
2. User Message.
3. Basic Information Unit (BIU).
4. Basic Link Unit (BLU).

a. 2.

b. 3.

c. 1.

d. 4.

2. Given the following figure, identify the appropriate PIU formats at items A., B., and C. by matching them against the numbered items below.

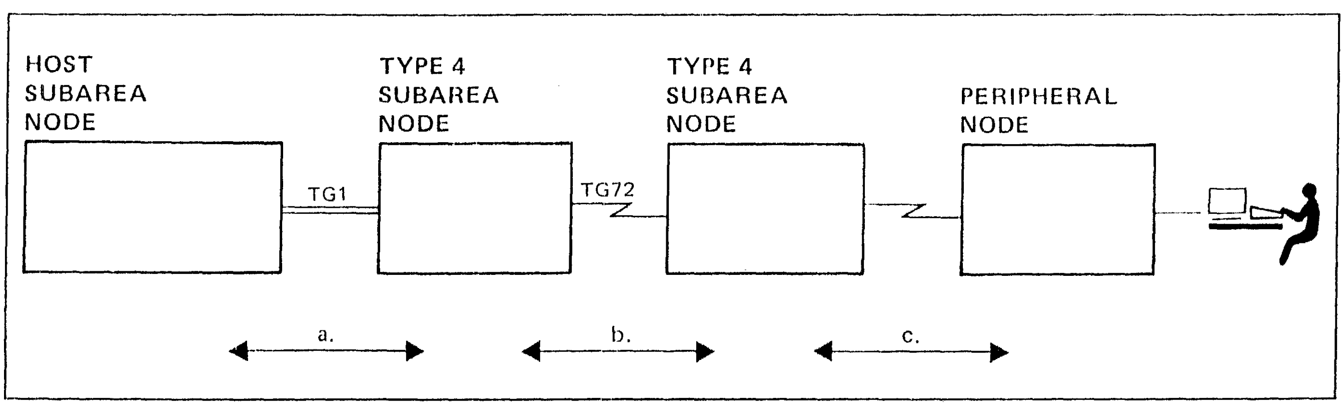

Figure A-2. Figure for Review Exercise 4.1 Question 2

1. FID0.

2. FID1.

3. FID2.

4. FID3.

5. FID4.

a. 1, 2, and 5.

b. 1, 2, and 5.

c. 3 and 4.

3. What does it mean to block PIUs and what SNA component performs blocking?

   Blocking means to assemble multiple PIUs for sending from one subarea node to another node as one transmission. Path control in a subarea node, e.g. a host subarea node, blocks PIUs and the block is called a basic transmission unit (BTU). Path control gives a BTU to data link control for transmission across a link to an adjacent subarea node. The receiving path control deblocks the BTUs.

4. What does it mean to segment and what SNA component performs segmenting?

   Segmenting can be performed when a PIU is too large for a receiving network component to handle. The PIU is separated into smaller units called BIU segments. A sending path control (subarea node or peripheral node) separates the segments and the receiving path control assembles the BIU segments. Path control in all SNA nodes may segment and all except path control in a boundary function can assemble segments.

5. Identify the following items that reside in a transmission header and which items reside in a request header.

   a. Chaining indicators.

      RH.

   b. Response indicators.

      RH.

   c. Destination address.

      TH.

   d. Origin address.

      TH.

e. Sequence number of the associated request.

TH.

f. Bracket indicators.

RH.

g. Explicit route and virtual route numbers.

TH.

6. What can a request unit contain?

   A request unit can contain user-data and SNA commands.

7. Name the types of requests that travel on sessions.

   Data requests (containing user-data) and command requests (containing SNA commands). A third request, called an exception request is generated when an SNA component detects an error in a request before it reaches its destination. The SNA component generates an exception request, includes sense data and forwards it instead of the original request.

8. List request unit categories and identify the session on which each category is used.

   Session control (SC), data flow control (DFC), and function management data (FMD) requests travel on sessions. SC is used on SSCP-SSCP, SSCP-PU, SSCP-LU, and on LU-LU sessions. DFC is used on LU-LU sessions. FMD requests are used on SSCP-SSCP, SSCP-PU, SSCP-LU, and on LU-LU sessions.

9. (True/False). A response may consist of a transmission header (TH) and a response header (RH) only.

   True. A positive response to a data request does not include a request unit. Negative responses and positive responses to command requests include information in the response unit.

10. How does a logical unit determine whether a received response is positive or negative?

    The response type Indicator in the associated RH indicates whether the response is positive or negative.

Answers for Exercise 5.1

1. In SNA terms, what is a domain?

   A domain consists of an SSCP and the SNA resources that it controls.

2. What SNA resources can be activated by an SSCP?

   Physical units (PUs), logical units (LUs), and links.

3. List SNA requests that an SSCP sends to activate a:

   a. Physical unit.

      ACTPU request.

   b. Logical unit.

      ACTLU request.

   c. Link.

      ACTLINK request.

4. Given the following figure, assume that the SSCP is to activate LU21. Also assume that the host node resources are active and all other nodes are operative, that is, ready to be activated. List the resources, in the proper order, that the SSCP must activate before it can activate LU21.

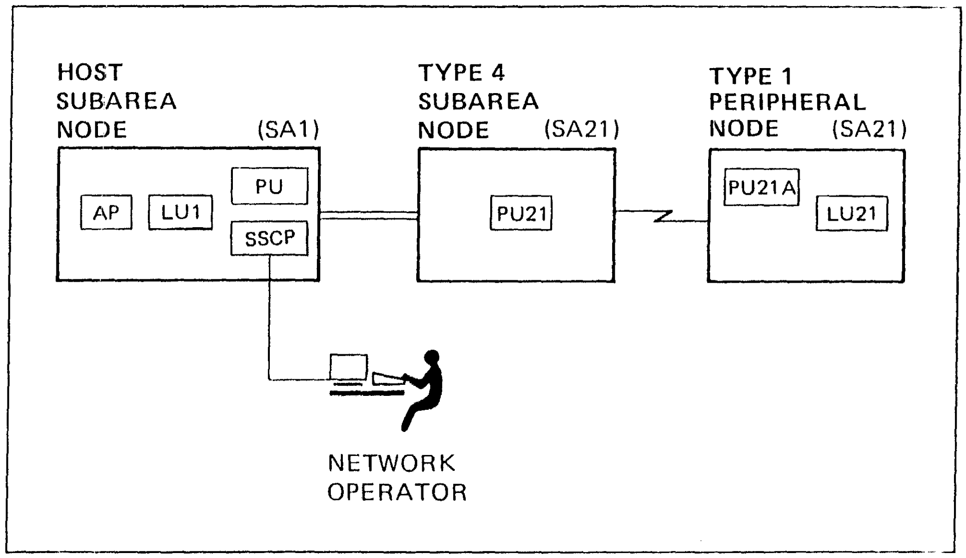

Figure A-3. Figure for Review Exercise 5.1 Question 4

physical unit "PU21," physical unit "PU21A," and logical unit "LU21."

5. How is an SSCP made aware of network resources?

   The network definer defines network resources to the SSCP.

6. Why must a SDT request be send to a PU.T4 node after an ACTPU request has been sent by the SSCP to establish the SSCP-PU session?

   The SSCP-PU session is left in the data-traffic-reset state after the ACTPU request establishes the session. Certain requests (e.g., ACTLINK) cannot flow on a session that is the data-traffic-reset state. And because the SSCP sends the ACTLINK requests to the PU.T4 to activate its links, the SDT request must be used to put the session into data-traffic-active state.

Answers for Exercise 6.1

1. What is the purpose of LU-LU sessions?

   An LU-LU session is a logical connection between the two logical units that allows them to communicate with each other. LU-LU sessions are required for end-users to be able to communicate with each other.

2. What SNA request establishes an LU-LU session and what resource sends the request?

   The primary logical unit sends the BIND request to establish an LU-LU session.

3. What are the conditions for establishing an LU-LU session?

   A path must be available between the two logical units, both logical units must be capable of meeting the needs of their associated end-users, the logical units must be authorized to communicate with each other, and the two logical units must agree on a set of protocols that specify how the session is to behave.

4. Describe the formatted and unformatted session initiation requests.

   The INIT-SELF (FMD request) is a formatted request that can be used by a primary logical unit or a secondary logical unit that has the capability. The logical unit sends the INIT-SELF request to the SSCP on the SSCP-LU session and the SSCP assists in establishing the LU-LU session.

   An unformatted session initiation request is user-defined and is sent to the SSCP on the SSCP-LU session. The SSCP converts the unformatted request to a formatted request (INIT-SELF) and processes the INIT-SELF request. The INIT-SELF request asks the SSCP to notify the primary logical unit about the session-initiation request. The SSCP does that with a control initiate (CINIT) request.

5. What resources can initiate an LU-LU session?

   An LU-LU session can be initiated by the primary logical unit, the secondary logical unit, another logical unit, the network operator, or automatic session initiation by the SSCP based on resource definitions.

6. A session initiation request flows on the ***SSCP-LU*** session.

7. Given the following list of requests, arrange them in the proper order when establishing an LU-LU session, identify the resources that send and receive the request, and describe the use of each request.

   a. INIT-SELF.

      INIT-SELF request. This request can be sent by either the primary local unit or the secondary logical unit to the SSCP. The request is used to ask the SSCP to assist in establishing a session between the logical unit that submitted the request and a logical unit named in the request.

b. CINIT.

CINIT request. The SSCP sends the CINIT request to the primary logical unit asking it to send a BIND request to the logical unit named in the CINIT request. The CINIT request contains the information (e.g., session parameters) required by the primary logical unit for establishing the LU-LU session.

c. BIND.

BIND request. The primary logical unit sends the BIND request to the secondary logical unit to establish the session. The BIND request contains session parameters that specify protocols that describe how the session is to behave.

d. SESSST.

SESSST request. The primary logical unit sends the SESSST request to its SSCP notifying it that the session with the secondary logical unit has been established.

e. SDT.

SDT request. The primary logical unit sends the SDT request to the secondary logical unit to put the LU-LU session in a data-traffic-active state. FMD requests (user data is sent in FMD requests) and DFC requests cannot flow on the session until it is in the data-traffic-active state.

8. Assuming that a secondary logical unit submits a user-defined logon, e.g., "LOGON LU1," list in order the sequence of requests to establish the LU-LU session and prepare the session to handle all types of requests.

   a. LOGON LU1. The secondary logical unit submits this logon to its SSCP.

   b. INIT-SELF. The SSCP generates this request from the logon.

   c. CINIT request. The SSCP sends this request to the primary logical unit asking it to send a BIND request to the logical unit named in the CINIT request.

   d. BIND request. The primary logical unit sends this request to the secondary logical unit to establish the session.

   e. SESSST request. The primary logical unit sends this request to its SSCP notifying it that a session has been established with the secondary logical unit.

   f. SDT request. The primary logical unit sends this request to the secondary logical unit to put the session in the data-traffic-active state.

9. What resources can request the termination of an LU-LU session?

   Primary and secondary logical units and the network operator.

10. List the requests that can be used to ask for LU-LU session termination. Also identify the resources that send and receive each request.

   a. *TERM-SELF (FMD request). The primary or the secondary logical unit sends this request to its SSCP requesting the SSCP to assist in terminating the LU-LU session.*

   b. *SHUTD (DFC request). The primary logical unit sends this request to notify the secondary logical unit that it is ready to terminate the session. The secondary logical unit is required to send the SHUTC request to the primary logical unit when it is ready to terminate the session.*

   c. *RSHUTD (DFC request). The secondary logical unit sends this request to the primary logical unit requesting session termination. The primary logical unit sends the UNBIND request when it is ready to terminate the session.*

   d. *User-defined logoff (FMD request). The secondary logical unit sends this request to the primary logical unit.*

11. Given the following list of SNA requests, arrange them in the correct order for terminating an LU-LU session. Also identify the resources that send and receive each request and describe the use of each request.

   a. CTERM.

   b. TERM-SELF.

   c. SESSEND.

   d. UNBIND.

   - *TERM-SELF request. The primary or secondary logical unit sends this request asking the SSCP to assist in terminating the LU-LU session. The TERM-SELF request names the other logical unit.*

   - *CTERM request. The SSCP sends the CTERM request to the primary logical unit asking it to send the UNBIND request to the named secondary logical unit.*

   - *UNBIND request. The primary logical unit sends the UNBIND request to the secondary logical unit to terminate the LU-LU session.*

   - *SESSEND. The primary and secondary logical unit send this request to their SSCP notifying it that the session has been terminated. For logical units that reside in type 1 or type 2 nodes, the boundary function sends the SESSEND request on behalf of those logical units.*

Answers for Exercise 7.1

1. Name two session flows that requests and responses can travel on and give a brief description of each flow.

   a. Normal-flow. Data requests, certain command requests, and their associated responses travel on the normal-flow. The normal-flow is primarily for end user traffic.

   b. Expedited-flow. Certain command requests and their associated responses travel on the expedited-flow. For example, a logical unit that is in receiver status can ask its session partner for a change direction indicator by sending the SIG request on the expedited-flow.

2. Identify which of the following sessions have sequence numbered requests and responses flowing on them.

   a. SSCP-SSCP.

      Requests and responses on an SSCP-SSCP session are not sequence numbered. They are assigned an identifier.

   b. SSCP-PU.

      Requests and responses on an SSCP-PU session may be sequence numbered.

   c. SSCP-LU.

      Requests and responses on an SSCP-LU session are not sequence numbered.

   d. LU-LU.

      Requests and responses on an LU-LU session that travel on the normal-flow are sequenced numbered. Traffic on the expedited-flow are assigned identifiers, not sequence numbers.

3. What technique is used to keep requests in order?

   Each request is assigned a sequence number.

4. (True/False). Requests and responses on the normal-flow from primary to secondary are sequence numbered independently of those on the normal flow from secondary to primary.

   True.

5. How does a logical unit match a received response with a request that was sent earlier?

   The logical unit compares the sequence number of responses to sequence numbers of requests. Matching sequence numbers indicate that the response is for the request.

6. State two reasons why chaining of requests can be useful.

   a. ***When requests are too large for a logical unit to accept, the sending logical unit can break the request into a multiple element request chain.***

   b. ***When a logical unit is sending single element definite response chains, a response is returned for each request. When the requests are sent as multiple element definite response chains, only one response is required for the chain. This can cause fewer responses to flow in the network and possibly better network performance.***

7. How do session partners control chaining of requests?

   The chain sender supplies chaining indicators that are placed in the request header (RH) of each request. The chaining indicators indicate first, middle, last, or only element of chain. The chain receiver uses the chaining indicators to determine the beginning and the end of the chain.

8. (True/False). Each request can ask for three responses.

   False. Each request can ask for one, two, or no responses. The two responses are definite response 1 (DR1) and definite response 2 (DR2). Typically, a request specifies only one response.

9. Name the three forms of responses.

   Definite response chain, exception response chain, and no response. For a definite response chain, one response must be returned for a chain (single or multiple element). For an exception response chain, a response is returned for a request only if the request is unacceptable. For a no-response specification, the chain receiver does not return responses regardless of whether the received chain elements are acceptable.

10. A logical unit is sending a definite response chain consisting of five elements, what form of response does each element specify?

    Elements 1 through 4 specify exception response and element five specifies definite response.

11. Given the following four request and response control modes, match them with the appropriate description from the numerically itemized list.

a. Immediate request mode.

b. Delayed request mode.

c. Immediate response mode.

d. Delayed response mode.

1) Responses must be returned in the order that the requests were received.

2) Allows one outstanding definite response chain.

3) Responses can be returned in any order regardless of the order that the requests were received.

4) A chain sender can send multiple request chains without waiting for a response after each chain is sent.

a. 2. For immediate request mode, a chain sender must wait for a response to each request chain before sending the next chain.

b. 4. For delayed request mode, a chain sender can send multiple request chains and not have to wait for a response on each chain before sending the next.

c. 1. For immediate response mode a request chain receiver must return responses in the order that the request chains were received.

d. 3. For delayed response a request chain receiver is not required to return responses in the order that the request chains were received.

12. (True/False). For each LU-LU session, a request and response control mode must be specified for each session partner.

True. Session parameters must specify a request and response control mode for the primary logical unit and for the secondary logical unit.

Answers for Exercise 8.1

1. What operation establishes protocols (rules) for an LU-LU session?

The primary logical unit sends the BIND request to the secondary logical unit to establish the session. The BIND request contains session parameters which specify protocols (rules) for the session.

2. Describe the purpose of the following list of BIND request fields.

   a. FM profile.

      FM profile specifies a subset of SNA protocols for controlling communication between two network addressable units (SSCP, PU, LU).

   b. TS profile.

      TS profile specifies a subset of SNA protocols that the transmission control layer of a network addressable unit is to abide by.

   c. FM usage.

      FM usage supplements the FM profile specification. It contains the following three fields.

      1) Primary protocols.

         Primary protocol field. This field specifies the protocols that the primary logical unit are to abide by.

      2) Secondary protocols.

         Secondary protocol field. This field specifies the protocols that the secondary logical unit is to abide by.

      3) Common protocols.

         Common protocol field. This field specifies protocols that applies to both logical units.

   d. TS usage.

      TS usage supplements the TS profile specification. It specifies pacing values and maximum request unit sizes that each logical unit can accept.

   e. PS profile.

      PS profile. This field specifies a logical unit type. SNA defines certain logical unit types and each type supports a particular subset of SNA protocols.

   f. PS usage.

      PS usage. This field supplements the PS profile specification. Each logical unit contains services, called presentation services, that communicate with end-users. PS usage specifies protocols for communicating with end-users. This field specifies function management header usage, types of character strings used, and the type of code used, for example, EBCDIC or ASCII.

3. Describe the difference between the negotiable and non-negotiable BIND request sequence.

   The non-negotiable BIND request is sent by the primary logical unit to the secondary logical unit. The secondary logical unit can either accept the session parameters with a positive response or reject them with a negative response. The negotiable BIND request (The second byte of the BIND request indicates either negotiable or non-negotiable) is sent by the primary logical unit to the secondary logical unit. The secondary logical unit can examine the session parameters and return a positive response if they are acceptable. If the session parameters are not acceptable, the secondary logical unit can include its choice of session parameters in the positive response returned to the primary logical unit. The positive response establishes the session but the primary logical unit can terminate the session if it doesn't like the returned session parameters.

4. Give a brief description of the following send/receive modes.

   a. Full-duplex.

      Full-duplex send/receive mode allows both session partners to send to each other at the same time. The requests flowing in both directions are independent of each other.

   b. Half-duplex flip-flop.

      Half-duplex flip-flop send/receive mode allows only one session partner to send at a time. The BIND establishes one session partner as the first sender. The sender has the responsibility of changing the sender/receiver status of the two session partners.

   c. Half-duplex contention.

      Half-duplex contention send/receive mode allows both session partners to start to send. If both start to send at the same time, the session partner that was established as the contention winner by the session parameters will win the contention. That is, the contention winner rejects the request from the other logical unit but the request sent by the contention winner will be accepted by the contention loser. While a request chain is being sent, one of the logical units is in sender status and the other logical unit is in receiver status. At the completion of the request chain, both logical units return to contention status which means either can start to send.

5. Which session partner is established as the sender when the BIND request specifies half-duplex flip-flop protocol?

   The FM usage (common protocols) specification in the BIND request specifies which logical unit is the first sender.

6. An LU-LU session uses half-duplex flip-flop send/receive mode. How is the sender/receiver status of each logical unit changed?

   FM usage (common protocols) in the BIND request specifies one of the logical units as the first sender. The sender can change the sender/receiver status by including the change direction indicator (CDI) in the request header (RH) of a request sent to the receiver.

7. What is the purpose of bracket protocol?

   Bracket protocol assists the user to separate one unit of work from another unit of work. A unit of work consists of related sequences of requests that flow between pairs of logical units. SNA defines two indicators (Begin Bracket Indicator and End Bracket Indicator) and two command requests (BID and RTR) to implement brackets.

8. Session parameters that specify brackets to be used also specify one logical unit as the bracket's ***first*** speaker and one logical unit as the ***bidder***.

9. For bracket protocol, which logical unit is allowed to begin a bracket and which is allowed to end a bracket?

   The logical unit that is defined as the bracket's first speaker can begin a bracket without getting permission from its session partner. The logical unit that is defined as the bidder must get permission from the bracket's first speaker to begin a bracket. The bidder can bid to start a bracket by sending the BID request or by sending a request that contains a begin bracket indicator (BBI) in the associated request header (RH). The bracket's first speaker accepts the bid with a positive response or rejects the bid with a negative response.

   Session parameters specify which session partner can end brackets. Either or both session partners can be defined to end brackets but the primary logical unit is usually defined to end brackets.

Answers for Exercise 9.1

1. Give a brief description of the following protocols.

   a. Quiesce.

      The quiesce protocol can be used to temporarily suspend traffic on the normal-flow either in preparation to terminate the session or because a session partner is running low on some resource, such as a buffer pool.

   b. Shutdown.

      The primary logical unit can use the shutdown protocol to suspend its partner's normal-flow traffic in preparation for an orderly shutdown of the session.

2. Identify the SNA requests shown in the numerical list below that implement each of the following protocols.

   a. Quiesce.

      2, 3, and 4.

   b. Shutdown.

      1, 2, and 5.

      1) SHUTC.

      2) RELQ.

      3) QEC.

4) QC.

5) SHUTD.

3. Which session partner is allowed to invoke the following protocols?

   a. Quiesce.

   Either session partner is allowed to invoke the quiesce protocol.

   b. Shutdown (SHUTD).

   The primary logical unit invokes the shutdown protocol.

Answers for Exercise 10.1

1. Name the interface codes that may be used to represent data in a LU-LU session data stream and identify the one that is used most of the time.

   EBCDIC and ASCII. Typically, EBCDIC is used to represent data.

2. What SNA defined item may be included in a request unit to identify a specific device to which the receiving logical unit is to deliver the user data?

   A Function Management Header.

3. What SNA defined item may be included in a data stream to identify the specific characters that were compressed or compacted?

   String Control Bytes.

4. What operation establishes whether two logical units are allowed to use FMHs in their LU-LU session?

   A BIND operation. A BIND parameter specifies whether FMHs may be used in the session.

5. How does a logical unit determine whether a received request unit contains one or more FMHs?

   Two indicators are set in the associated Request Header (RH). The Request Unit (RU) category indicator identifies the request as an FMD request and the format indicator specifies that the RU is formatted. An FMD request that flows on an LU-LU session is a data request, and a formatted data request contains one or more FMHs.

6. Where in a request unit can an FMH reside?

   A single FMH must start in byte one of the request unit. A second FMH must follow immediately the first FMH.

7. How does a receiving logical unit recognize a second FMH in the same request unit?

   A receiving logical unit recognizes a second FMH in the same request unit by examining the concatenation indicator in the first FMH.

Answers for Exercise 11.1

1. Explain the significance of LU type classifications.

   Logical unit type designation is a convenient way of classifying SNA products according to the subset of SNA functions that they perform. Also, it is useful in selecting a set of SNA products to use in a particular application.

2. For each LU type listed below, name the types of products that would participate in an LU-LU session. For example, an LU type for application programs that communicate with single display devices.

   a. LU Type 0.

      LU Type 0. This LU type is implementation defined and does not fall within profile groupings defined by SNA.

   b. LU Type 1.

      LU Type 1. This LU type is for communication between application programs and terminals that support single or multiple devices.

   c. LU Type 2.

      LU Type 2. This LU type is for communication between application programs and single display devices.

   d. LU Type 3.

      LU Type 3. This LU type is for communication between application programs and a single printer without a keyboard.

   e. LU Type 4.

      LU Type 4. This LU type is for communication between two terminal logical units or between an application program and a terminal that supports single or multiple devices.

   f. LU Type 5.

      LU Type 5. This LU type is not defined.

   g. LU Type 6.

      LU Type 6. This LU type is for communication between application subsystems.

   h. LU Type 7.

      LU Type 7. This LU type is for communication between an application program and a single display terminal.

3. Which LU types use the SNA data stream?

   LU type 1 and LU type 4.

4. Which LU types use half-duplex flip-flop?

   LU Type 2 and LU Type 3.

5. What BIND field specifies LU type?

   PS Profile field.

6. What BIND field specifies the data stream?

   PS Usage field.

Answers for Exercise 12.1

The configuration shown in the following figure is used to answer the questions in this exercise. The configuration includes three domains, six subareas, and several physical units and logical units. All resources shown in a domain are defined to the SSCP in that domain and are active. Definitions are not supplied for cross-domain sessions.

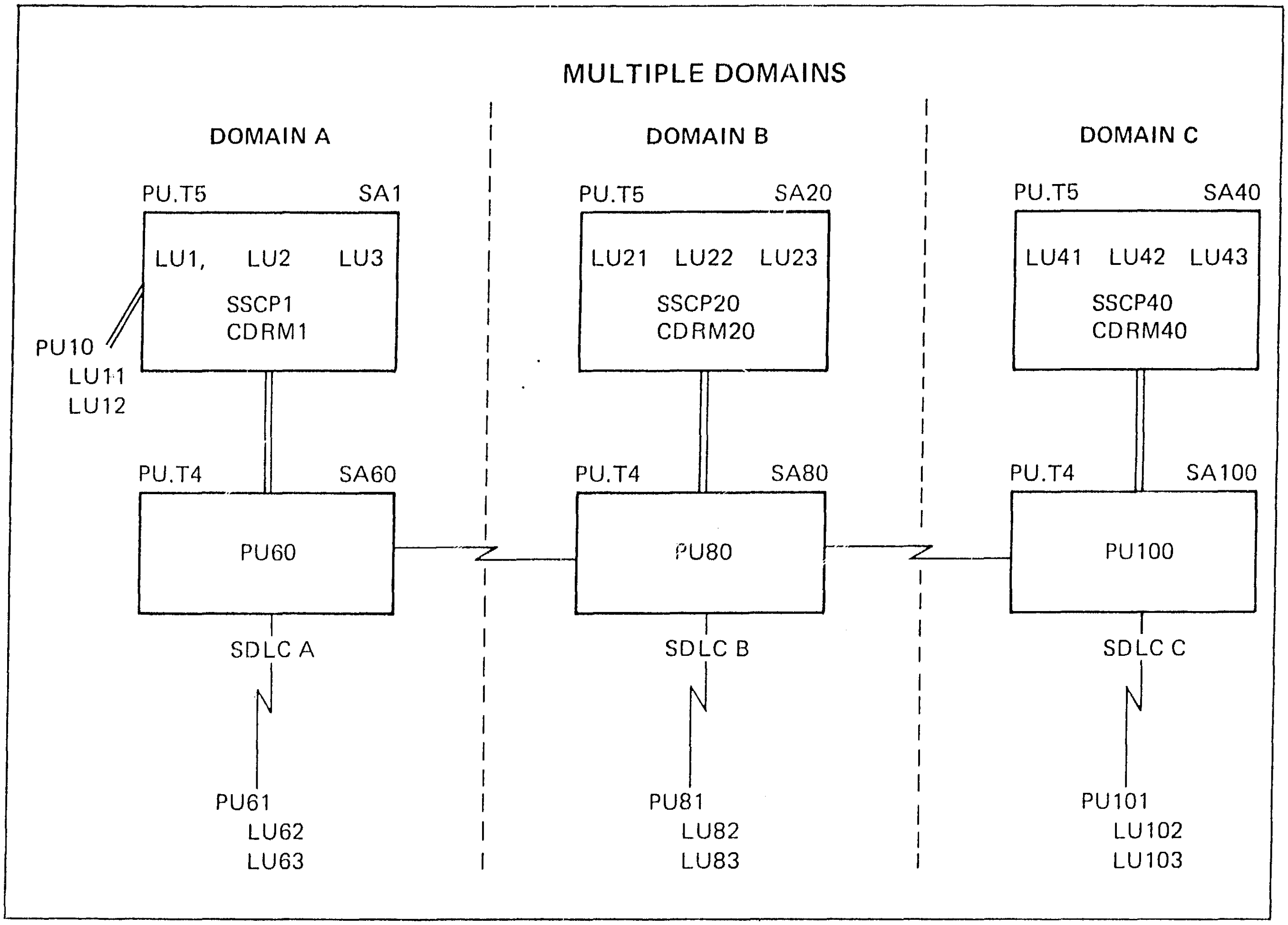

Figure A-4. Figure for Review Exercise 12.1

1. LU62 in domain A is to logon to LU41 in domain C. List the definitions required in both domains and list the sessions, in order, that must exist for the LU62-LU41 session to be established.

Domain A		Sessions	Domain C
CDRM1	*CDRM SUBAREA 1*	*CDRM1-CDRM40*	*CDRM40 CDRM SUBAREA 40*
CDRM40	*CDRM SUBAREA 40*	*LU62-LU41*	*CDRM1 CDRM SUBAREA 1*
LU41	*CDRSC CDRM40*		

In domain A, the host CDRM (CDRM1) and the external CDRM (CDRM40) must be defined. In domain C, the host CDRM (CDRM40) and the external CDRM (CDRM1) must be defined. LU41 in domain C must be defined in domain A as a cross-domain resource because the session is initiated in domain A. CDRM1 must know where the resource is located to send the session initiation request (CDINIT) to the CDRM in that domain. The CDRM1-CDRM40 session must exist before

LU-LU sessions can be established between the two domains. Session setup is done on the CDRM1-CDRM40 session.

2. LU21 in domain B is to initiate a session with LU11 in domain A. List the definitions required in both domains and list the sessions, in order, that must exist for the LU11-LU21 session to be established.

Domain A		Sessions	Domain B	
CDRM1	*CDRM SUBAREA 1*	*CDRM1-CDRM20*	*CDRM20*	*CDRM SUBAREA 20*
CDRM20	*CDRM SUBAREA 20*	*LU11-LU21*	*CDRM1*	*CDRM SUBAREA 1*
			LU11	*CDRSC CDRM1*

LU21, a host logical unit in domain B, initiates a session with LU11, a peripheral logical unit in domain A. Therefore, LU11 must be defined in domain B as a cross-domain resource. The CDRM definitions and CDRM session must exist for the LU21-LU11 session to be established.

3. LU23 in domain B is to go into session with LU43 in domain C. Either logical unit can initiate the session. List the definitions required in both domains and list the sessions, in order, that must exist for the LU23-LU43 session to be established.

Domain B		Sessions	Domain C	
CDRM20	*CDRM SUBAREA 20*	*CDRM20-CDRM40*	*CDRM40*	*CDRM SUBAREA 40*
CDRM40	*CDRM SUBAREA 40*	*LU23-LU43*	*CDRM20*	*CDRM SUBAREA 20*
LU43	*CDRSC CDRM40*		*LU23*	*CDRSC CDRM20*

LU43 in domain C must be defined in domain B as a cross-domain resource and LU23 in domain B must be defined in domain C as a cross-domain resource because the session can be initiated from either domain. Therefore, both CDRMS (CDRM20 and CDRM40) must know where to send the CDINIT request. Both are host logical units.

4. All logical units can initiate a session, all peripheral logical units can go into session with all host logical units, and all host logical units can go into session with any other host logical unit. List the definitions required in all domains and list the sessions that must exist for the LU-LU sessions to be established.

Domain A		Domain B		Domain C	
CDRM1	*CDRM SUBAREA 1*	*CDRM20*	*CDRM SUBAREA 20*	*CDRM40*	*CDRM SUBAREA 40*
CDRM20	*CDRM SUBAREA 20*	*CDRM1*	*CDRM SUBAREA 1*	*CDRM1*	*CDRM SUBAREA 1*
CDRM40	*CDRM SUBAREA 40*	*CDRM40*	*CDRM SUBAREA 40*	*CDRM20*	*CDRM SUBAREA 20*
LU21	*CDRSC CDRM20*	*LU1*	*CDRSC CDRM1*	*LU1*	*CDRSC CDRM1*
LU22	*CDRSC CDRM20*	*LU2*	*CDRSC CDRM1*	*LU2*	*CDRSC CDRM1*
LU23	*CDRSC CDRM20*	*LU3*	*CDRSC CDRM1*	*LU3*	*CDRSC CDRM1*
LU82	*CDRSC CDRM20*	*LU11*	*CDRSC CDRM1*	*LU11*	*CDRSC CDRM1*
LU83	*CDRSC CDRM20*	*LU12*	*CDRSC CDRM1*	*LU12*	*CDRSC CDRM1*
LU41	*CDRSC CDRM40*	*LU62*	*CDRSC CDRM1*	*LU62*	*CDRSC CDRM1*
LU42	*CDRSC CDRM40*	*LU63*	*CDRSC CDRM1*	*LU63*	*CDRSC CDRM1*
LU43	*CDRSC CDRM40*	*LU41*	*CDRSC CDRM40*	*LU21*	*CDRSC CDRM20*
LU102	*CDRSC CDRM40*	*LU42*	*CDRSC CDRM40*	*LU22*	*CDRSC CDRM20*
LU103	*CDRSC CDRM40*	*LU43*	*CDRSC CDRM40*	*LU23*	*CDRSC CDRM20*
		LU102	*CDRSC CDRM40*	*LU82*	*CDRSC CDRM20*
		LU103	*CDRSC CDRM40*	*LU83*	*CDRSC CDRM20*

Sessions
CDRM1-CDRM20
CDRM1-CDRM40
CDRM20-CDRM40

All logical units in domains B and C must be defined as cross-domain resources in domain A because sessions can be initiated from domain A for all of those logical units. All logical units in domains A and C must be defined as cross-domain resources in domain B because sessions can be initiated from domain B for all of those logical units. All logical units in domains A and B must be defined as cross-domain resources in domain C because sessions can be initiated from domain C for all of those logical units.

All CDRMs must be defined in the three domains and CDRM-CDRM sessions must exist between all the CDRMS for cross-domain sessions to exist between logical units in each domain.

5. SSCP1 in domain A is to take over ownership of resources in domains B and C should the host node in those domains fail. Identify the resources in domains B and C that must be defined to SSCP1 and list the activities, in order, for SSCP1 to take over resources in each domain.

   To take over domain B, all resources in subarea 80 must be defined to SSCP1. SSCP1 activates PU80, the SDLC link, PU81, LU82, and LU83. To take over domain C, all resources in subarea 100 must be defined to SSCP1. SSCP1 activates PU100, the SDLC link, PU101, LU102, and LU103.

6. List the SNA resources in all domains that can be owned simultaneously by SSCP1, SSCP20, and SSCP40.

   PU60, SDLC A, PU80, SDLC B, PU100, SDLC C.

Answers for Exercise 13.1

1. What SNA resource reports network errors to an SSCP?

   The physical unit in each node reports errors for its resources. Errors are reported on the SSCP-PU session.

2. What is the criteria used by a type 4 physical unit to conclude that contact with an adjacent node is lost and that it is a permanent error?

   A permanent "contact lost" error occurs when a type 4 node is attempting to send requests across a link to an adjacent node and link errors occur on every transmission. Once a predefined number of re-tries have been performed the physical unit sends an INOP request to its SSCP indicating a permanent error.

3. What is the criteria used by a type 4 physical unit to conclude that contact with an adjacent node is lost and that it is a temporary error?

   Assume that a type 4 node is connected by a link to a type 2 node and the type 2 node does not answer when the type 4 node sends to it. The type 4 node times out (timeout duration is specified by the network definer) and sends an INOP request to its SSCP reporting a temporary lost contact with the adjacent node. Both adjacent nodes can be type 4 nodes and, if contact is lost between the two nodes, both nodes report the condition to their respective owning SSCPs.

4. What recover action does the SSCP take for:

   a. Permanent errors?

      The SSCP does not try to recovery resources when a permanent error occurs. The SSCP reports the error to the network operator and when the error condition is corrected the operator can issue commands to restore the network to its status at the time the error occurred.

   b. Temporary errors?

      The SSCP attempts to recover the resource or resources that were affected by the temporary error. Typically contact is lost with one or more physical unit types. The SSCP initiates a contact procedure for the first physical unit in the affected path. If contact is established, the SSCP activates those physical units and logical units that were active at the time of the error. If a physical unit does not respond to a contact, the contact procedure will continue indefinitely unless the network operator issues a command to terminate the operation.

5. What vehicle is used to report errors on an LU-LU session?

   A negative response is used to report errors on an LU-LU session.

6. What SNA resource reports errors and exception conditions that occur on an LU-LU session?

   The receiving logical unit sends a negative response to its session partner if the received request is unacceptable. An exception condition, such as when an operator powers-off a display, is reported by the associated logical unit to its session partner.

7. What SNA resource performs recovery functions on the LU-LU session?

   Usually the primary logical unit performs recovery functions for the LU-LU session. However, if two programmed logical units that reside in type 5 nodes are in session, either one may perform recovery activities.

8. What happens to an LU-LU session when a non-recoverable error occurs?

   An LU-LU session is terminated when a non-recoverable error occurs on the session.

9. List the error categories as defined by SNA.

X'00'	***User sense data only.***
X'08'	***Request reject.***
X'10'	***Request error.***
X'20'	***State error.***
X'40'	***RH usage error.***
X'80'	***Path error.***

10. An LU-LU session can be in a data-traffic-reset state or in a data-traffic-active state.

    a. In which state must the session be in order for FMD requests and DFC requests to flow?

       An LU-LU session must be in the data-traffic-active state for FMD requests (contains either user date or SNA commands) and DFC requests to travel on the session.

    b. In which state must the session be in order to test and set sequence numbers for the primary and the secondary logical unit?

       An LU-LU session must be in the data-traffic-reset state to test and set sequence numbers.

    c. List the requests that change the data-traffic state of an LU-LU session.

       The BIND request establishes an LU-LU session in the data-traffic-reset state. The SDT request changes the LU-LU session from data-traffic-reset state to data-traffic-active state. The CLEAR request is used to change a session from data-traffic-active state to data-traffic-reset state.

11. What request can a logical unit use to report the exception conditions, printer out of forms or display device powered off?

    LUSTAT request.

12. Assume that the LU-LU session is using the send/receive mode half-duplex flip-flop and the secondary logical unit is in receive status.

    a. What request can the secondary logical unit use to ask its session partner for a Change Direction Indicator (CDI)?

       SIG request.

b. On what flow (normal or expedited) does the request sent by the secondary logical unit travel?

Expedited-flow.

MASTERY

Mastery Test

1 An SNA network consists of:

a. End users, network addressable units, and the path control network.

b. User application program, network addressable units, and the path control network.

c. Physical units, logical units, SSCP, data link control, and path control.

d. Operating system, SNA access method, ACF/NCP/VS, and terminals.

2. Which one of the following components control an SNA network?

a. SSCP.

b. ACF/NCP/VS.

c. Operating system.

d. Host processor.

3. What is the unit of information transmitted between subarea nodes?

a. Path information unit (PIU).

b. Basic link unit (BLU).

c. Basic information unit (BIU).

d. Request/response unit (RU).

4. What is the unit of information transmitted between a subarea node and a peripheral node?

a. Path information unit (PIU).

b. Basic link unit (BLU).

c. Basic information unit (BIU).

d. Request/response unit (RU).

5. What is the unit of information transmitted between a network addressable unit and path control?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

6. What is the unit of information that is processed by network addressable units?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

7. What is the unit of information that is processed by path control?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

8. What is the unit of information that is processed by data link control?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

9. Which one of the following is not a session within an SNA network?

   a. LU-LU.

   b. PU-PU.

   c. SSCP-PU.

   d. SSCP-LU.

   e. SSCP-SSCP.

10. Which of the following resources are assigned a network address?

a. Physical units, logical units, SSCPs, data link control.

b. Physical units, logical units, links, path control.

c. Physical units, logical units, SSCPs, data link control.

d. Physical units, logical units, SSCPs, links.

11. The SNA network consists of a host subarea node, a type 4 subarea node, and peripheral nodes attached to the type 4 subarea node. A host logical unit (LU1) is to have a session with a peripheral logical unit (LU12). LU12's physical unit is PU12A and PU12 is the physical unit in the type 4 subarea node. Select the correct sequence of sessions to accomplish the LU1-LU12 session.

a. SSCP-LU1, SSCP-PU12A, SSCP-LU12, SSCP-PU12, LU1-LU12.

b. SSCP-PU12, SSCP-PU12A, SSCP-LU12, LU1-LU12, SSCP-LU1.

c. SSCP-LU1, SSCP-PU12, SSCP-PU12A, SSCP-LU12, LU1-LU12.

d. SSCP-LU12, SSCP-PU12A, SSCP-PU12, SSCP-LU1, LU1-LU12.

12. What establishes a session between a host logical unit and a peripheral logical unit?

a. A logon from the peripheral logical unit.

b. A logon from the host logical unit.

c. A BIND request from the peripheral logical unit.

d. A BIND request from the host logical unit.

13. Which one of the following is **not** found in a request unit (RU)?

a. Error information.

b. Function management header.

c. Request sequence number.

d. SNA command.

14. How are responses matched to requests?

   a. By sequence numbers.

   b. There can be only one outstanding response when responses are specified.

   c. By the origin and destination network addresses in the requests and responses.

   d. By comparing the information in the request unit and the response unit.

15. Sequence numbers are assigned to responses by:

   a. The logical unit that transmits the response.

   b. The logical unit that sent the request.

   c. The end user.

   d. Path control.

16. A subarea consists of:

   a. One subarea node and any attached peripheral nodes.

   b. Only subarea nodes.

   c. Only peripheral nodes.

   d. Two adjacent subarea nodes.

17. Full-duplex protocol means that:

   a. Independent requests may travel on the normal-flow in both directions simultaneously.

   b. Requests and responses may travel on the normal-flow simultaneously.

   c. Requests can travel on the normal-flow simultaneous with requests on the expedited-flow in the opposite direction.

   d. Responses are not specified for any requests.

18. Half-duplex protocol means that:

   a. Responses **cannot** travel on a session simultaneous with requests.

   b. Requests on the normal-flow may travel in one direction at a time.

   c. Requests on the normal and expedited-flow may travel in the same direction.

   d. Responses must be specified for every request.

19. Request and response control modes (immediate and delayed) are specified for each LU-LU session. Which of the following statements is true?

   a. A request mode (immediate or delayed) is specified for the primary logical unit and a response mode (immediate or delayed) is specified for the secondary logical unit.

   b. A request mode (immediate or delayed) is specified for the secondary logical unit and a response mode (immediate or delayed) is specified for the primary logical unit.

   c. A request and response mode (immediate or delayed) is specified for both session partners.

   d. A request and response mode (immediate or delayed) is specified for the primary logical unit and a response mode (immediate or delayed) is specified for the secondary logical unit.

20. When an LU-LU session is using half-duplex protocol, which network addressable unit(s) can change the flow direction?

   a. Only the receiving logical unit.

   b. Only the sending logical unit.

   c. Both logical units.

   d. The SSCP.

21. How is the direction of flow changed in a session that uses half-duplex protocol?

   a. By the change direction request.

   b. By the change direction indicator in the request unit (RU).

   c. By the change direction indicator in the request header (RH).

   d. By the chance direction indicator in the transmission header (TH).

22. A session is established to use half-duplex contention protocol. Which logical unit may send first?

   a. First sender is defined in the BIND request.

   b. The primary logical unit.

   c. The secondary logical unit.

   d. Either logical unit.

23. Brackets are identified by:

a. Begin bracket indicators (BBI) and end bracket indicators (EBI) in request headers (RH).

b. Begin bracket indicators (BBI) and end bracket indicators (EBI) in transmission headers (TH).

c. Begin bracket indicators (BBI) and end bracket indicators (EBI) in request units (RU).

d. Begin bracket and end bracket requests.

24. In a session that uses bracket protocol, how is a logical unit specified to be either the first speaker or bidder?

a. By network definitions.

b. By the BID request.

c. By the BIND request.

d. The first logical unit to send is the first speaker.

25. The last request chain of a bracket is being transmitted. Which request of the chain will specify the end of the bracket?

a. The first request of the chain.

b. The last request of the chain.

c. Anyone of the requests.

d. All of the requests.

26. Concerning request chains, which one of the following is **not** true?

a. There may be a single element (request) in a chain.

b. There are two or more elements (requests) in every chain.

c. Requests on the normal-flow are sent as elements of a chain.

d. Requests on the expedited-flow are sent as elements of a chain.

27. Which request is sent by the receiving logical unit to ask its session partner to temporarily stop sending?

a. Quiesce Complete (QC).

b. Quiesce at End of Chain (QEC).

c. RELease Quiesce (RELQ).

d. Logical Unit STATus (LUSTAT).

28. Which one of the following requests terminate a session?

   a. All of the following.

   b. UNBIND.

   c. SHUT Down (SHUTD).

   d. TERMinate-SELF (TERM-SELF).

29. Which network addressable unit can initiate an LU-LU session?

   a. Primary logical unit only.

   b. Secondary logical unit only.

   c. Primary or secondary logical unit.

   d. SSCP only.

30. Which network addressable unit can initiate the action for LU-LU session termination?

   a. Primary logical unit only.

   b. Secondary logical unit only.

   c. Primary or secondary logical unit.

   d. SSCP only.

31. What operation establishes protocols for an LU-LU session?

____

32. How are request chains identified on an LU-LU session?

____

____

33. Name the three forms of responses.

____

34. On what session does a session initiation request for an LU-LU session flow?

____

35. A request unit can contain ____________ data, ________ commands, and __________ data.

36. There are two types of requests, __________ and ______________.

37. Name three request unit categories.

____

____

____

38. FID0, FID1, FID2, FID3. and FID4 PIUs travel between nodes.

What FID types flow between subarea nodes?

____

What FID types flow between subarea nodes and peripheral nodes?

____

39. What is the technique called to control the rate of flow on an LU-LU session?

____

40. __________________ routes define physical routes between pairs of subarea nodes.

41. A list of virtual routes is called a ______________________________.

42. A class of service table consists of ______________________ ________________.

43. Parallel cross-subarea links are assigned to a grouping called a ____.

44. A transmission priority and a virtual route number make up a ________________ route.

45. Name the logical unit types defined by SNA.

____

46. How are logical unit types specified?

____

47. Define the term domain.

____

48. Name two resource definitions that are unique to multiple domain networks and are required for logical units in one domain to communicate with logical units in other domains.

____

____

49. On what session does an SNA node report network errors to the SSCP?

____

50. List two ways that exception conditions on LU-LU sessions are reported to session partners.

____

____

- ***When you have completed the mastery test, turn to the answer section at the back of this Guide and check your answers. You may want to review the text material for any items you miss.***

Mastery Test Answers

1. An SNA network consists of:

   a. End users, network addressable units, and the path control network.

   b. User application program, network addressable units, and the path control network.

   c. ***Physical units, logical units, SSCP, data link control, and path control.***

   d. Operating system, SNA access method, ACF/NCP/VS, and terminals.

2. Which one of the following components control an SNA network?

   a. ***SSCP.***

   b. ACF/NCP/VS.

   c. Operating system.

   d. Host processor.

3. What is the unit of information transmitted between subarea nodes?

   a. Path information unit (PIU).

   b. ***Basic link unit (BLU).***

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

4. What is the unit of information transmitted between a subarea node and a peripheral node?

   a. Path information unit (PIU).

   b. ***Basic link unit (BLU).***

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

5. What is the unit of information transmitted between a network addressable unit and path control?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. ***Basic information unit (BIU).***

   d. Request/response unit (RU).

6. What is the unit of information that is processed by network addressable units?

   a. Path information unit (PIU).

   b. Basic link unit (BLU).

   c. ***Basic information unit (BIU).***

   d. Request/response unit (RU).

7. What is the unit of information that is processed by path control?

   a. ***Path information unit (PIU).***

   b. Basic link unit (BLU).

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

8. What is the unit of information that is processed by data link control?

   a. Path information unit (PIU).

   b. ***Basic link unit (BLU).***

   c. Basic information unit (BIU).

   d. Request/response unit (RU).

9. Which one of the following is not a session within an SNA network?

   a. LU-LU.

   b. ***PU-PU.***

   c. SSCP-PU.

   d. SSCP-LU.

   e. SSCP-SSCP.

10. Which of the following resources are assigned a network address?

    a. Physical units, logical units, SSCPs, data link control.

    b. Physical units, logical units, links, path control.

    c. Physical units, logical units, SSCPs, data link control.

    d. ***Physical units, logical units, SSCPs, links.***

11. The SNA network consists of a host subarea node, a type 4 subarea node, and peripheral nodes attached to the type 4 subarea node. A host logical unit (LU1) is to have a session with a peripheral logical unit (LU12). LU12's physical unit is PU12A and PU12 is the physical unit in the type 4 subarea node. Select the correct sequence of sessions to accomplish the LU1-LU12 session.

   a. SSCP-LU1, SSCP-PU12A, SSCP-LU12, SSCP-PU12, LU1-LU12.

   b. SSCP-PU12, SSCP-PU12A, SSCP-LU12, LU1-LU12, SSCP-LU1.

   c. ***SSCP-LU1, SSCP-PU12, SSCP-PU12A, SSCP-LU12, LU1-LU12.***

   d. SSCP-LU12, SSCP-PU12A, SSCP-PU12, SSCP-LU1, LU1-LU12.

12. What establishes a session between a host logical unit and a peripheral logical unit?

   a. A logon from the peripheral logical unit.

   b. A logon from the host logical unit.

   c. A BIND request from the peripheral logical unit.

   d. ***A BIND request from the host logical unit.***

13. Which one of the following is **not** found in a request unit (RU)?

   a. Error information.

   b. Function management header.

   c. ***Request sequence number.***

   d. SNA command.

14. How are responses matched to requests?

   a. ***By sequence numbers.***

   b. There can be only one outstanding response when responses are specified.

   c. By the origin and destination network addresses in the requests and responses.

   d. By comparing the information in the request unit and the response unit.

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   a. ***One subarea node and any attached peripheral nodes.***

   b. Only subarea nodes.

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   a. ***Independent requests may travel on the normal-flow in both directions simultaneously.***

   b. Requests and responses may travel on the normal-flow simultaneously.

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   a. Responses **cannot** travel on a session simultaneous with requests.

   b. ***Requests on the normal-flow may travel in one direction at a time.***

   c. Requests on the normal and expedited-flow may travel in the same direction.

   d. Responses must be specified for every request.

19. Request and response control modes (immediate and delayed) are specified for each LU-LU session. Which of the following statements is true?

   a. A request mode (immediate or delayed) is specified for the primary logical unit and a response mode (immediate or delayed) is specified for the secondary logical unit.

   b. A request mode (immediate or delayed) is specified for the secondary logical unit and a response mode (immediate or delayed) is specified for the primary logical unit.

   c. ***A request and response mode (immediate or delayed) is specified for both session partners.***

   d. A request and response mode (immediate or delayed) is specified for the primary logical unit and a response mode (immediate or delayed) is specified for the secondary logical unit.

20. When an LU-LU session is using half-duplex protocol, which network addressable unit(s) can change the flow direction?

   a. Only the receiving logical unit.

   b. ***Only the sending logical unit.***

   c. Both logical units.

   d. The SSCP.

21. How is the direction of flow changed in a session that uses half-duplex protocol?

   a. By the change direction request.

   b. By the change direction indicator in the request unit (RU).

   c. ***By the change direction indicator in the request header (RH).***

   d. By the chance direction indicator in the transmission header (TH).

22. A session is established to use half-duplex contention protocol. Which logical unit may send first?

   a. First sender is defined in the BIND request.

   b. The primary logical unit.

   c. The secondary logical unit.

   d. ***Either logical unit.***

23. Brackets are identified by:

   a. ***Begin bracket indicators (BBI) and end bracket indicators (EBI) in request headers (RH).***

   b. Begin bracket indicators (BBI) and end bracket indicators (EBI) in transmission headers (RH).

   c. Begin bracket indicators (BBI) and end bracket indicators (EBI) in request units.

   d. Begin bracket and end bracket requests.

24. In a session that uses bracket protocol, how is a logical unit specified to be either the first speaker or bidder?

   a. By network definitions.

   b. By the BID request.

   c. ***By the BIND request.***

   d. The first logical unit to send is the first speaker.

25. The last request chain of a bracket is being transmitted. Which request of the chain will specify the end of the bracket?

   a. ***The first request of the chain.***

   b. The last request of the chain.

   c. Anyone of the requests.

   d. All of the requests.

26. Concerning request chains, which one of the following is **not** true?

   a. There may be a single element (request) in a chain.

   b. ***There are two or more elements (requests) in every chain.***

   c. Requests on the normal-flow are sent as elements of a chain.

   d. Requests on the expedited-flow are sent as elements of a chain.

27. Which request is sent by the receiving logical unit to ask its session partner to temporarily stop sending?

   a. Quiesce Complete (QC).

   b. ***Quiesce at End of Chain (QEC).***

   c. RELease Quiesce (RELQ).

   d. Logical Unit STATus (LUSTAT).

28. Which one of the following requests terminate a session?

a. All of the following.

b. ***UNBIND.***

c. SHUT Down (SHUTD).

d. TERMinate-SELF (TERM-SELF).

29. Which network addressable unit can initiate an LU-LU session?

a. Primary logical unit only.

b. Secondary logical unit only.

c. ***Primary or secondary logical unit.***

d. SSCP only.

30. Which network addressable unit can initiate the action for LU-LU session termination?

a. Primary logical unit only.

b. Secondary logical unit only.

c. ***Primary or secondary logical unit.***

d. SSCP only.

31. What operation establishes protocols for an LU-LU session?

The BIND operation.

32. How are request chains identified on an LU-LU session?

Begin chain indicators (BCI) and end chain indicators (ECI) in request headers.

33. Name the three forms of responses.

Definite response, exception response, and no response.

34. On what session does a session initiation request for an LU-LU session flow?

SSCP-LU session.

35. A request unit can contain ***user*** data, ***SNA*** commands, and ***sense*** data.

36. There are two types of requests, ***data*** and ***command.***

37. Name three request unit categories.

Session control (SC), data flow control (DFC), and function management data (FMD).

38. FID0, FID1, FID2, FID3. and FID4 PIUs travel between nodes.

What FID types flow between subarea nodes?

FID0, FID1, and FID4

What FID types flow betwen subarea nodes and peripheral nodes?

FID2 and FID3

39. What is the technique called to control the rate of flow on an LU-LU session?

Session level pacing.

40. ***Explicit*** routes define physical routes between pairs of subarea nodes.

41. A list of virtual routes is called a ***class of service.***

42 A class of service table consists of ***classes of service.***

43. Parallel cross-subarea links are assigned to groupings called ***transmission groups.***

44. A transmission priority and a virtual route number make up a ***virtual*** route.

45. Name the logical unit types defined by SNA.

LU types 0, 1, 2, 3, 4, 6, and 7.

46. How are logical unit types specified?

By the BIND request.

47. Define the term domain.

A domain consists of an SSCP and the resources controlled by the SSCP.

48. Name two resource definitions that are unique to multiple domain networks and are required for logical units in one domain to communicate with logical units in other domains.

Cross-Domain Resource Managers (CDRMs) and Cross-Domain Resources (CDRSCs).

49. On what session does an SNA node report network errors to the SSCP?

SSCP-PU session.

50. List two ways that exception conditions on LU-LU sessions are reported to session partners.

By responses and by the LUSTAT request.

Reference

This glossary includes terms defined in Systems Network Architecture; these are prefixed by "In SNA,". Also included are some terms used in this publication that are not specific to SNA.

Advanced Communication Function for the Network Control Program (ACF/NCP/VS). A program product that provides communication controller support for single-domain and multiple-domain data communication.

Advanced Communication Function for the Telecommunications Access Method (ACF/TCAM). A program product that provides single-domain data communications capability, and, optionally, multiple-domain capability.

Advanced Communication Function for the Virtual Telecommunications Access Method (ACF/VTAM). A program product that provides single-domain data communication capability and, optionally, multiple-domain capability.

Advanced Communication Function for VTAM Entry (ACF/VTAME). A program product that provides single-domain and multiple-domain data communication capability for an IBM 4331 that may include communication adapters.

basic information unit (BIU). In SNA, the unit of data and control information that is passed between half-sessions. It consists of a request/response header (RH) followed by a request/response unit (RU).

basic link unit (BLU). In SNA, the unit of data and control information transmitted over a data link by data link control.

bidder. In SNA, the logical unit defined at session initiation as having to request and receive permission from the other logical unit to begin a bracket.

boundary function. In SNA, (1) a capability of a subarea node to provide protocol support for adjacent peripheral nodes, such as: (a) transforming network addresses to local addresses, and vice versa; (b) performing session sequence numbering for low-function peripheral nodes; and (c) providing session-level pacing support. See also *path control network, network addressable unit.* (2) The component that provides these capabilities.

boundary node. A subarea node with boundary function.

Note: A subarea node may be a boundary node, an intermediate routing node, both, or neither, depending on how it is used in the network.

bracket protocol. In SNA, a data flow protocol in which exchanges between logical units are achieved through the use of brackets. A bracket is an exchange of one or more message units between two logical units that accomplishes some task defined as uninterruptible. Examples are data base inquiries/replies, update transactions, and remote job entry output sequences to work stations.

chain. In SNA, a set of one or more related requests that are sent through the network as a recognizable entity. Each request is identified as being the first, middle, last, or only element in the chain.

class of service (COS). In SNA, a designation of the path control network characteristics, such as path security, transmission priority, and bandwidth, that apply to a particular session. The end user designates class of service at session initiation by using a symbolic name that is mapped into a list of virtual routes, any one of which can be selected for the session to provide the requested level of service.

cluster controller node. A peripheral node that can control a variety of devices.

communication adapter. An optional hardware feature, available on certain processors, that permits communication lines to be attached to the processors.

communication controller node. A subarea node containing no system services control point (SSCP).

compaction. In SNA, the transformation of data by packing two characters in a byte so as to take advantage of the fact that only a subset of the allowable 256 characters is used; the most frequently sent characters are compacted.

compression. In SNA, the replacement of a string of up to 64 repeated characters by an encoded control byte to reduce the length of the data stream sent to the LU-LU session partner. The encoded control byte is followed by the character that was repeated (unless that character is the prime compression character, typically the space character).

configuration services. In SNA, one of the types of network services in the system services control point (SSCP) and in the physical unit (PU); configuration services activate, deactivate, and maintain the status of physical units, links, and link stations. Configuration services also shut down and restart network elements and modify path-control routing tables and address-transformation tables.

connection point manager (CPM). In SNA, a sublayer in transmission control that handles some routing functions and session level pacing.

cross-domain. In SNA, pertaining to control or resources involving more than one domain.

cryptography. The transformation of data to conceal its meaning.

data flow control (DFC). In SNA, a request/response unit (RU) category used for requests and responses exchanged between the data flow control layer in one half-session and the data flow control layer in the session partner.

data flow control (DFC) layer. In SNA, the layer within a half-session that (1) controls whether the half-session can send, receive, or concurrently send and receive request units (RUs); (2) groups related RUs into RU chains; (3) delimits transactions via the bracket protocol; (4) controls the interlocking of requests and responses in accordance with control modes specified as session activation; (5) generates sequence numbers; and (6) correlates requests and responses.

data link control (DLC) layer. In SNA, the layer that consists of the link stations that schedule data transfer over a link between two nodes and perform error control for the link. Examples of data link control are SDLC for serial-by-bit link connection and data link control for the System/370 channel.

definite response. In SNA, a form of response requested in a request header which specifies that a response must be returned.

definite response chain. In SNA, a request chain whose last (or only) request of the chain specifies a definite response. All other requests of the chain (if any) specify exception response.

delayed request mode. In SNA, a mode in which the sender of requests can have multiple definite response chains outstanding (not yet responded to) at a time.

delayed response mode. In SNA, a mode in which the receiver of requests can return responses to the sender in an order different from which they were received.

distributed data processing (DDP). Data processing in which some or all of the processing, storage, and control functions, in addition to input/output functions, are situated in different places and connected by transmission facilities.

domain. In SNA, a system services control point (SSCP) and the physical units (PUs), logical units (LUs), links, and associated resources that the SSCP has the ability to control by means of activation requests and deactivation requests. See also *shared control.*

element address. In SNA, a value in the element address field of the network address identifying a specific resource within a subarea. See also *subarea address.*

end user. In SNA, the ultimate source or destination of application data flowing through an SNA network. An end user may be an application program or a terminal operator.

exception response. In SNA, the response specified in a request header that requires only negative responses be returned.

exception response chain. In SNA, a request chain that specifies an exception response in each chain element.

explicit route (ER). In SNA, the path control network components, including a specific set of one or more transmission groups, that connect two subarea nodes. An explicit route is identified by an origin subarea address, a destination subarea address, an explicit route number, and a reverse explicit route number. See also *path, route extension, (REX), virtual route.*

first speaker. In SNA, the logical unit defined at session initiation as having the ability to begin a bracket without requesting permission from the other logical unit.

flow control. In SNA, the process of managing the rate at which data traffic passes between components of the network. The purpose of flow control is to optimize the rate of flow of message units, with minimum congestion in the network; that is, to neither overflow the buffers at the receiver or at intermediate nodes, nor leave the receiver waiting for more message units. See also *pacing, session-level pacing, virtual route (VR) pacing.*

FMD services layer. In SNA, the layer within a requests and responses to particular NAU services manager components that provides session network services or session presentation services, depending on the type of session.

full-duplex protocol. In SNA, a data flow protocol that allows simultaneous two way independent request flow in a session.

function management (FM) header. In SNA, one or more headers, optionally present in the leading request units (RUs) of an RU chain, that allow one half-session in an LU-LU session to: (1) select a destination at the session partner and control the way that the end-user data it sends is handled at the destination, (2) change the destination or the characteristics of the data during the session, and (3) transmit between session partners status or user information about the destination (for example, a program or device).

half-duplex contention protocol. In SNA, a data flow control protocol that allows only one logical unit in a session to send at a time. Both logical units are in contention status when the session is established. Either logical unit is allowed to send and the first logical unit to send becomes the sender and the other logical unit becomes the receiver. If both start to send at the same time, the contention winner (established at session initiation) becomes the sender and the other logical unit becomes the receiver.

half-duplex flip-flop protocol. In SNA, a data flow control protocol that allows only one of the logical units to send at a time. The first sender is defined at session initiation. The sending logical unit can give the the receiver permission to send by sending it a change direction indicator.

immediate—request mode. In SNA, an operational mode in which a sending logical unit must wait for a response to a definite response chain before sending another request chain.

immediate—response mode. In SNA, an operational mode in which the receiver of requests returns all responses to the sender in the same order as the requests were received.

host node. A subarea node that contains a system services control point (SSCP); for example, a System/370 computer with OS/VS2 and ACF/TCAM.

intermediate routing function. In SNA, a path control capability within a subarea intermediate function. A path control capability within a subarea node that receives and routes path information units (PIUs) that neither originate in nor are destined for network addressable units (NAUs) in that subarea node.

intermediate routing node. A subarea node with intermediate routing function.

Note: A subarea node may be a boundary node, an intermediate routing node, both, or neither, depending on how it is used in the network.

layer. In SNA, a grouping of related functions that are logically separate from the functions in other layers; the implementation of the functions in one layer can be changed without affecting functions in other layers. See also *NAU services manager layer, FMD services layer, data flow control layer, transmission control layer, path control layer, data link control layer.*

link. In SNA, the combination of the link connection and the link stations joining network nodes; for example: (1) a System/370 channel and its associated protocols, (2) a serial-by-bit connection under the control of synchronous data link control (SDLC).

Note: A link connection is the physical medium of transmission; for example, a telephone wire or a microwave beam. A link includes the physical medium of transmission, the protocol, and associated communication devices and programming; it is both logical and physical.

link connection. In SNA, the physical equipment providing two-way communication between one link station and one or more other link stations; for example, a communication line and data circuit terminating equipment (DCE).

link station. In SNA, the combination of hardware and software that allows a node to attach to and provide control for a link.

local address. In SNA, an address used in a peripheral node in place of a network address and transformed to or from a network address by the boundary function in a subarea node.

logical unit (LU). In SNA, a port through which an end user accesses the SNA network in order to communicate with another end user and through which the end user accesses the functions provided by system services control points (SSCPs). An LU is capable of supporting at least two sessions - one with an SSCP, and one with another logical unit - and may be capable of supporting many sessions with other logical units. See also *network addressable unit (NAU).*

LU. Logical unit.

LU-LU session. In SNA, a session between two logical units in an SNA network. It provides communication between two end users, or between an end user and an LU services component.

message unit. In SNA, a generic term for the unit of data processed by any layer; for example, a basic information unit (BIU), a path information unit (PIU), a request/response unit (RU).

multiple-domain network. A network with more than one system services control point (SSCP). Contrast with *single-domain network.*

NAU. Network addressable unit.

NAU services manager layer. In SNA, the layer that (1) controls network operations via LU-LU, SSCP-LU, SSCP-PU, and SSCP-SSCP sessions and (2) coordinates end-user interactions on LU-LU sessions.

network address. In SNA, an address, consisting of subarea and element fields, that identifies a link, a link station, or a network addressable unit. Subarea nodes use network addresses; peripheral nodes use local addresses. The boundary function in the subarea node to which a peripheral node is attached transforms local addresses to network addresses and vice versa. See also *network name.*

network addressable unit (NAU). In SNA, a logical unit, a physical unit, or a system services control point. It is the origin or the destination of information transmitted by the path control network. See also *network name, network address, path control (PC) network.*

Note: Each NAU has a network address that represents it to the path control network. (LUs may have multiple addresses for parallel LU-LU sessions.) The path control network and the NAUs together constitute the SNA network.

network name. In SNA, the symbolic identifier by which end users refer to a network addressable unit (NAU), a link station, or a link.

network operator. In SNA, a person or program responsible for controlling the operation of all or part of a network.

network services (NS). In SNA, the services within network addressable units (NAUs) that control network operation via SSCP-SSCP, SSCP-PU, and SSCP-LU sessions.

node. In SNA, an endpoint of a link or a junction common to two or more links in a network. Nodes can be distributed or host processors, communication controllers, cluster controllers, or terminals. Nodes can vary in routing and other functional capabilities. See also *peripheral node and subarea node.*

pacing. In SNA, a technique by which a receiving component controls the rate of transmission of a sending component to prevent overrun or congestion. See also *flow control, session-level pacing, virtual route (VR) pacing.*

parallel links. In SNA, two or more links between adjacent subarea nodes.

parallel sessions. In SNA, two or more concurrently active sessions between the same two logical units (LUs) using different pairs of network addresses. Each session can have independent session parameters.

path. In SNA, the series of path control network components (path control and data link control) that are traversed by the information exchanged between two network addressable units (NAUs). A path consists of a virtual route and its route extension, if any. See also *explicit route.*

path control (PC) layer. In SNA, the layer that manages the sharing of link resources of the SNA network and routes basic information units (BIU) through it. Path control routes message units between network addressable units (NAU) in the network and provides the paths between them. It converts the BIUs from transmission control (possibly segmenting them) into path information units (PIU) and exchanges basic transmission units (BTUs) - one or more PIUs - with data link control.

path control (PC) network. In SNA, the part of the SNA network that includes the data link control and path control layers. See also *boundary function, SNA network, user-application network.*

path information unit (PIU). In SNA, a message unit consisting of a transmission header (TH) alone, or of a TH followed by a basic information unit (BIU).

PC. Path control.

peripheral link. In SNA, a link that connects a peripheral node to a subarea node. See also *route extension (REX).*

peripheral LU. In SNA, a logical unit in a peripheral node.

peripheral node. In SNA, a node that uses local addresses for routing and therefore is not affected by changes in network addresses. A peripheral node requires boundary function assistance from an adjacent subarea node.

peripheral PU. In SNA, a physical unit in a peripheral node.

physical unit (PU). In SNA, the component that manages and monitors the resources (such as attached links and adjacent link stations) of a node, as requested by an SSCP via an SSCP-PU session. Each node of an SNA network contains a physical unit. See also *peripheral PU, physical unit type, subarea PU.*

Note: An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links and adjacent link stations.

physical unit control point (PUCP). In SNA, a component that provides a subset of system services control point (SSCP) functions for activating the physical unit (PU) within its node and its local link resources. Each peripheral node and each subarea node without an SSCP contains a PUCP.

protocol. In SNA, the meanings of, and the sequencing rules for, requests and responses used for managing the network, transferring data, and synchronizing the states of network components.

PU. Physical unit.

request. In SNA, a message unit that signals completion of a particular action or protocol. For example, INITIATE SELF is a request for activation of a LU-LU session.

request header (RH). In SNA, a request unit (RU) header preceding a request unit.

request unit (RU). In SNA, a message unit that contains control information such as a request code or FM header, end-user data, or both.

request/response header (RH). In SNA, control information, preceding a request/response unit (RU), that specifies the type of RU (request unit or response unit) and contains control information associated with that RU.

request/response unit (RU). In SNA, a generic term for a request unit or a response unit.

response. (1) In SNA, a message unit that acknowledges receipt of a request; a response consists of a response header (RH), a response unit (RU), or both. (2) In SDLC, the control information (in the C-field of the link header) sent from the secondary station to the primary station.

response header (RH). In SNA, a header, optionally followed by a response unit (RU), that indicates whether the response is positive or negative and that may contain a pacing response.

response unit (RU). In SNA, a message unit that acknowledges a request unit; it may contain prefix information received in a request unit. If positive, the response unit may contain additional information (such as session parameters in response to BIND SESSION), or if negative, contains sense data defining the exception condition.

RH. Request/response header.

route. See explicit route, virtual route.

route extension (REX). In SNA, the path control network components, including a peripheral link, that comprise the portion of a path between a subarea node and a network addressable unit (NAU) in an adjacent peripheral node.

routing. The function of forwarding a message unit along a particular path through a network as determined by parameters carried in the message unit, such as the destination network address in a transmission header.

RU. Request/response unit.

SDLC. Synchronous Data Link Control.

sequence number. In SNA, the numerical value assigned to requests on the normal-flow.

session. In SNA, a logical connection between two network addressable units (NAUs) that can be activated, tailored to provide various protocols, and deactivated, as requested. The session activation request and response can determine options relating to such things as the rate and concurrency of data exchange, the control of contention and error recovery, and the characteristics of the data stream. Sessions compete for network resources such as the links within the path control network. See *LU-LU session, SSCP-LU session, SSCP-PU session, SSCP-SSCP session.*

Note: For routing purposes, each session is identified by the network (or local) addresses of the session partners.

session activation. in SNA, the process of exchanging a session activation request and a (positive) response between network addressable units (NAUs). Contrast with session deactivation.

session deactivation. In SNA, the process of exchanging a session-deactivation request response between network addressable units (NAU). Contrast with *session activation.*

session-level pacing. In SNA, a flow-control technique that permits a receiving half-session to control the data transfer rate (the rate at which it receives request units) on the normal flow. It is used to prevent overloading a receiver with unprocessed requests when the sender can generate requests faster than the receiver can process them. See also *pacing, virtual-route (VR) pacing.*

session limit. In SNA, the maximum number of concurrently active LU-LU sessions a particular logical unit (LU) can support.

session partner. In SNA, one of the two network addressable units having an active session.

session presentation services. In SNA, a component of the FMD services layer that provides, within LU-LU sessions, services for the application programmer or terminal operator such as formatting data to be displayed or printed.

session services. In SNA, one of the types of network services in the system services control point (SSCP) and in a logical unit (LU). These services provide facilities for a logical unit (LU) or a network operator to request that the SSCP initiate or terminate sessions between logical units.

shared control. In SNA, sequential or concurrent control of network resources - physical units (PUs), logical units (LUs), links, link stations and their associated resources - by two or more control points.

share limit. In SNA, the maximum number of control points that can concurrently control a network resource.

single-domain network. In SNA, a network with one system services control point (SSCP). Contrast with *multiple-domain network.*

SNA network. In SNA, the part of a user-application network that conforms to the formats and protocols of Systems Network Architecture. It enables reliable transfer of data among end users and provides protocols for controlling the resources of various network configurations. The SNA network consists of network addressable units, boundary function components, and the path control network.

SNA node. In SNA, a node that supports SNA protocols.

SSCP. System services control point.

SSCP-LU session. In SNA, a session between a system services control point (SSCP) and a logical unit (LU). The session enables the LU to request the SSCP to help initiate LU-LU sessions.

SSCP-PU session. In SNA, a session between a system services control point (SSCP) and a physical unit (PU); SSCP-PU sessions allow SSCPs to send requests to and receive status information from individual nodes in order to control the network configuration.

SSCP-SSCP session. In SNA, a session between the system services control point (SSCP) in one domain and the SSCP in another domain. An SSCP-SSCP session is used to initiate and terminate cross-domain LU-LU sessions.

subarea. In SNA, a portion of the SNA network consisting of a subarea node, any attached peripheral nodes, and their associated resources. Within a subarea node, all network addressable units, links, and adjacent link stations (in attached peripheral or subarea nodes) that are addressable within the subarea share a common subarea address and have distinct element addresses.

subarea address. In SNA, a value in the subarea field of the network address that identifies a particular subarea. See also *element address.*

subarea LU. In SNA, a logical unit in a subarea node.

subarea node. In SNA, a node that uses network addresses for routing and whose routing tables are therefore affected by changes in the configuration of the network. Subarea nodes can provide boundary function support for peripheral nodes. See also *peripheral node.*

subarea PU. In SNA, a physical unit in a subarea node.

Synchronous Data Link Control (SDLC). In SNA, a discipline for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop.

system services control point (SSCP). A focal point within an SNA network for managing the configuration, coordinating network operator and problem determination requests, and providing directory support and other session services for end users of the network. Multiple SSCPs, cooperating as peers with one another, can divide the network into domains of control, with each SSCP having a hierarchical control relationship to the physical units and logical units within its own domain. See also *physical unit control point (PUCP).*

systems network architecture (SNA). In SNA, the description of the logical structure, formats, protocols, and operational sequences for transmitting information units through and controlling the configuration and operation of networks.

Note: The purpose of the layered structure of SNA is to allow the ultimate origins and destinations of information - that is, the end users - to be independent of, and unaffected by, the way in which the specific SNA network services and facilities used for information exchange are provided.

TC. Transmission control.

terminal node. A peripheral node that is not user-programmable, having less processing capability than a cluster controller node. Examples are the IBM 3277 Display Station, 3767 Consumer Transaction Facility, 3614 Communications Terminal, and 3624 Consumer Transaction Facility.

TH. Transmission header.

transmission control (TC) layer. In SNA, the layer within a half-session that synchronizes and paces session-level data traffic, checks session sequence numbers of requests, and enciphers and deciphers end-user data. Transmission control has two components: the connection point manager and session control.

transmission group. In SNA, a group of links between adjacent subarea nodes, appearing as a single logical link for routing of messages.

Note: A transmission group may consist of one or more SDLC links (parallel links) or of a single System/370 channel.

transmission header (TH). In SNA, control information, optionally followed followed by a basic information (BIU) or a BIU segment, that is created and used by path control to route message units and to control their flow within the network. See also *path information unit (PIU).*

user-application network. A configuration of data processing products (such as processors, controllers, and terminals) established and operated by users for the purpose of data processing or information exchange, which may use services offered by communication common carriers or telecommunication Administrations. Contrast with *public network.*

virtual route (VR). In SNA, a logical connection (1) between two subarea nodes that is physically realized as a particular explicit route, or (2) that is contained wholly within a subarea node for intra-node sessions. A virtual route between distinct subarea nodes imposes a transmission priority on the underlying explicit route, provides flow control through virtual-route pacing, and provides data integrity through sequence numbering of path information units (PIUs). See also *explicit route, path, route extension (REX).*

virtual route (VR) pacing. In SNA, a flow control technique used by the virtual route control component of path control at each end of a virtual route to control the rate at which path information units (PUs) flow over the virtual route. VR pacing can be adjusted according to traffic congestion in any of the nodes along the route. See also *pacing, session-level pacing.*

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