GC30-3057-2
File No. S370-30

Program Product

ACF/TCAM, Version 2
General Information: Introduction

IBM

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This edition is a major revision of, and obsoletes, GC30-3057-1. This publication applies to Version 2, Releases 1, 2, and 3, of the ACF/TCAM program product (5735-RC3, base license number 9001 and Multisystem Networking Facility feature license number 6003); it also applies to all subsequent releases and modifications unless otherwise indicated in new editions or Technical Newsletters. Changes are periodically made to the information herein; before using this publication in connection with the operation of IBM systems, refer to the *IBM System/370 Bibliography,* GC20-0001, for the editions that are applicable and current.

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Preface

This publication provides an overview of Advanced Communications Function for the Telecommunications Access Method (ACF/TCAM), Version 2, Releases 1, 2, and 3. The ACF/TCAM program product supports IBM's Systems Network Architecture (SNA) and operates with OS/VS1 and OS/VS2 MVS. The manual describes ACF/TCAM's operation with NCP/VS, Version 5, or ACF/NCP/VS, Releases 1, 2, or 3 executing in an IBM 3705 Communications Controller; the generic term network control program is to refer to either of these programs.

The manual is directed primarily to data processing managers, their technical staff, and others who desire information that will enable them to evaluate Version 2 of the ACF/TCAM program product. The reader of this manual should be familiar with the basic concepts of data communication.

This manual is divided into four chapters and a glossary.

"Chapter 1. An Overview of ACF/TCAM, Version 2" is a high-level description of the entire ACF/TCAM program product; new functions for Version 2 are not singled out in this chapter.

"Chapter 2. Summary of New Capabilities in ACF/TCAM, Version 2, Releases 1 and 2" describes each new function for Release 1 and Release 2 of ACF/TCAM, Version 2.

"Chapter 3. Summary of New Capabilities in ACF/TCAM, Version 2, Release 3" describes each new function for Release 3 of ACF/TCAM, Version 2.

"Chapter 4. Migration and Planning Considerations" tells which network control programs will operate with each new ACF/TCAM function, and the devices and subsystems that can be used with Version 2 of ACF/TCAM.

The "Glossary of Terms and Abbreviations" contains terms and abbreviations used in the manual that may be unfamiliar to the reader.

Related Reading

ACF/NCP/VS (Network Control Program and System Support Programs) General Information, GC30-3058. The shortened title as used in text is *ACF/NCP-SSP General Information.*

Introduction to Advanced Communications Function, GC30-3033.

Introduction to the IBM 3704 and 3705 Communications Controllers, GA27-3051. This manual contains information about NCP/VS, Version 5, and ACF/NCP/VS, Release 1, only.

Network Communication Control Facility General Information, GC27-0429.

Network Problem Determination Application General Information, GC34-2010.

Programmed Cryptographic Facility General Information, GC28-0942.

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Chapter 1. An Overview of ACF/TCAM, Version 2

IBM's Advanced Communications Function for the Telecommunications Access Method (ACF/TCAM) is a program product that resides in a host processor and directs traffic in a network. ACF/TCAM operates under control of either OS/VS1 or OS/VS2 MVS. ACF/TCAM conforms to IBM's Systems Network Architecture (SNA) while also allowing stations attached to binary synchronous and start-stop lines to be used in the network. This manual describes ACF/TCAM, Version 2, Releases 1, 2, and 3. The term ACF/TCAM is used throughout the remainder of the manual to mean ACF/TCAM, Version 2.

Note: The term network has at least two meanings. A *public network* is a network established and operated by common carriers or telecommunication Administrations for the specific purpose of providing circuit-switched, packet-switched, and leased-circuit services to the public. A *user application network* is 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 transport services offered by common carriers or telecommunication Administrations. Network, as used in this publication, refers to a user application network.

ACF/TCAM controls the network from a host processor. As shown in Figure 1-1, an IBM 3705 Communications Controller can be either local to its host processor—that is, physically attached to one or more host-processor data channels; or it can be remote—that is, at a distance from the host processor that precludes its being attached to a data channel[1]. A remote controller is connected to a local controller by an SDLC data link. (Local controllers are also called channel-attached controllers and remote controllers are also called link-attached controllers.) Figure 1-1 shows that some stations can also be attached to a host-processor data channel; these are called *local stations.* As used throughout this publication, the term data link, or simply link, refers to the communication facility over which information is transmitted between a remote device (station or communications controller) and a local communications controller.

The line discipline for the communication between communications controllers is synchronous data link control (SDLC); the line discipline between a communications controller and a station can be binary synchronous (BSC), start-stop (SS), or SDLC. In Chapter 4, Figure 4-1 lists all of the stations that can coexist in a network with ACF/TCAM, their attachment (local or remote), and their line disciplines.

The basic unit of data that ACF/TCAM transmits throughout the network is called a *message.* ACF/TCAM manages the flow of messages between:

- Itself and application programs
- The host processor and communications controllers
- The host processor and remote stations
- The host processor and local stations

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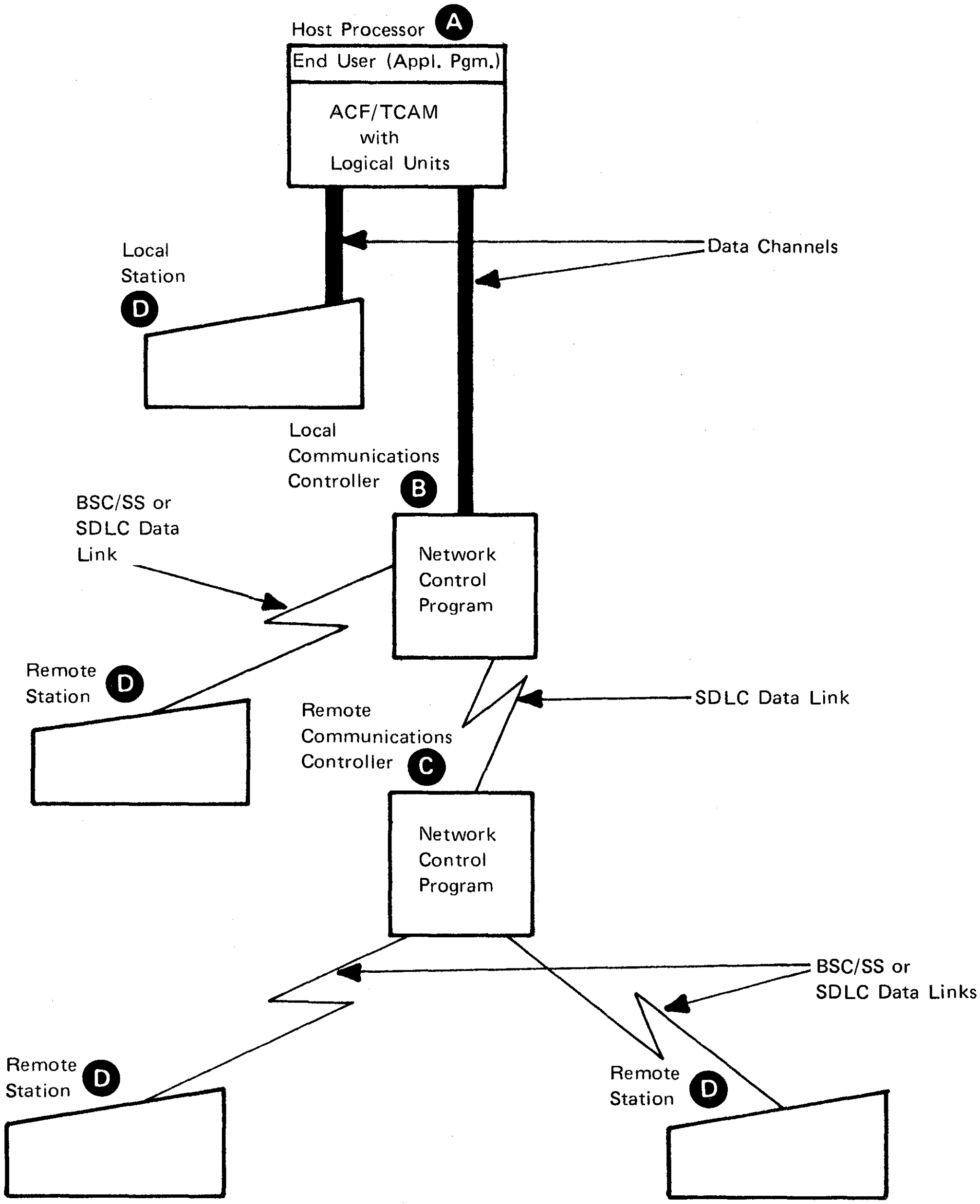
[1]ACF/TCAM can also operate with an IBM 2701 Data Adapter Unit or an IBM 2702 or 2703 Transmission Control. ACF/TCAM's operation with these control units is not described in this publication.



- The *host processor* (A) is the processing unit with an operating system, an access method, and application programs; it oversees the entire network.
- The *communications controller* (B) manages the details of line control and routing of data through the network. It can route data to the host processor, to or from another communications controller (C), or from a remote station.
- *Stations* (D) provide attachment for one or more input/output devices. Unless a distinction is required, the term station is used throughout this publication to mean both an SDLC station and a BSC/SS station.
- At the ends of the network are *end users.* These may be people (such as terminal operators), application programs, or input/output devices (such as card readers or printers). They represent the origin or destination of much of the information that is routed throughout the network. End users themselves are not identified to the network; they gain access to network resources through logical units, which have unique network names.
- *Logical units* are an end user's access to the services of the network and may be part of either a program or a hardware component.

Figure 1-1. Resources in an ACF/TCAM Network

The Message Control Program

The job-step task for ACF/TCAM is the ACF/TCAM initiator program, which monitors the ACF/TCAM region. The initiator should have the highest priority in the operating system; it, in turn, attaches subtasks that perform ACF/TCAM functions[2]. The initiator's most important subtask is the message control program. The system programmer codes ACF/TCAM macro instructions to define the functions that he wants ACF/TCAM to perform. These macros generate tables, lists of control information defining the ACF/TCAM environment, and message-handler routines (referred to as message handlers). *Message control program (MCP)* is a generic term for the code generated by these ACF/TCAM macros. The coding requirements and restrictions for ACF/TCAM macros are the same as those for other assembler-language macro instructions.

Some customers whose message handlers require little or no customization can use (with modification, if desired) an IBM-supplied model message control program. Other customers—particularly those with complex networks—may choose to incorporate their own assembler-language code into the message handlers, customizing them for precisely the functions needed. In addition to the model MCP, IBM also supplies a TSO MCP and TSO message handler.

ACF/TCAM Application Programs

The term *ACF/TCAM application program* or simply *application program,* as used here and throughout this manual, refers to customer-written application programs that interface with the MCP using ACF/TCAM's basic (READ/WRITE/CHECK) or queued (GET/PUT) data-transfer macros. ACF/TCAM application programs may process messages entered from stations, and may themselves enter messages to be sent to other stations and application programs. The interface between an ACF/TCAM application program and the MCP is called the *GET/PUT application program interface (API).* (Use of the term GET/PUT API implies that either GET/PUT macros or READ/WRITE/CHECK macros can be used.) In addition to the GET/PUT API for customer-written application programs, ACF/TCAM provides a compatible subset of the ACF/VTAM record API for certain IBM-supplied subsystems that were written to run with ACF/VTAM. These subsystems are listed in Chapter 2 under the topic "ACF/TCAM's Subsystem Support." Differences in ACF/TCAM's operation with subsystems are pointed out under this topic and where applicable throughout the manual.

Application programs operate asynchronously with ACF/TCAM. ACF/TCAM application programs are independent of line activities (such as line scheduling) and attachment concerns (such as whether a station is local or remote). Since ACF/TCAM application programs are insulated from most ACF/TCAM operations, application programs used with other versions of TCAM will execute with ACF/TCAM.

An ACF/TCAM application program views the network as a sequential flow of data accessed in much the same way as a tape drive would be accessed. Because of this, the application programmer can test the logic of an application

[2]The other subtasks that the ACF/TCAM initiator attaches are system service programs; they are discussed in Chapter 2 under the topic, "Installability and Usability Enhancements."

program before it is actually used for message processing. For example, input "messages" can come from a tape drive or card reader with output going to a printer.

ACF/TCAM application programs can issue operator commands and macro instructions to monitor and change the status of a network. This capability allows an installation to use a programmed operator for network control. Network-control procedures can be a combination of operator actions and application-program execution. For example, instead of typing a long series of ACF/TCAM operator commands, an operator could type an installation-defined command that would cause the appropriate sequence of ACF/TCAM operator commands to be issued from an application program. Additionally, if an installation wished to keep a log of all or some of its network activities, an application program could keep such a log. The topic "Network Communication," later in this chapter also discusses the use of operator commands and network-control macros from an application program.

Message Queuing[3]

ACF/TCAM is a queued access method; that is, ACF/TCAM is designed to handle messages arriving at an unpredictable rate. ACF/TCAM maintains message queues that hold messages until they can be sent to their destinations. A message entering ACF/TCAM can be queued on direct-access storage devices, in main storage, or both.

When messages are queued on direct-access storage devices, ACF/TCAM can provide:

- Message retrieval
- Message rerouting
- Sending to multiple destinations *(broadcasting)*
- Interception of messages destined for inactive stations
- Checkpoint/restart capability

Queuing messages in main storage is faster than queuing them on direct-access storage devices. However, main-storage queuing without backup queuing on secondary storage has these disadvantages:

- It ties up main storage that could be used otherwise
- It restricts message retrieval capabilities
- It does not allow checkpoint/restart, message rerouting, or message interception

Main-storage queuing with backup queues on secondary storage uses more main storage than queuing on secondary storage alone; it may also results in longer response times than queuing in main storage alone. Yet, this queuing method combines many attractive features of each individual method. For many applications, this is an acceptable compromise between the speed of main-storage-only queuing and the reliability of queuing on direct-access storage devices.

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[3]ACF/TCAM performs no message queuing when a customer accesses the services of the subsystems mentioned in Chapter 2 under "ACF/TCAM's Subsystem Support."

Resource Sharing

ACF/TCAM allows resources to be shared among users of the network. A customer can define the network so that any ACF/TCAM application program can communicate with stations or other application programs without regard for their physical locations. Resources that make up the paths between application programs and remote stations are also shared. ACF/TCAM uses these resources (such as communications controllers and data links) on behalf of application programs and stations only as long as needed to complete a specific data transfer request.

In an SNA-based network controlled by ACF/TCAM, a terminal operator gains access to the services of the network through an ACF/TCAM device message handler[4]. *Device message handlers* route messages to and from devices in the network. *(Application message handlers,* route messages to and from application programs.) That is, the terminal operator in an SNA session is connected (by a logon operation) to a device message handler. This device message handler is now in a position to analyze each message (or transaction) from the station. The system programmer can code a device message handler so that it resolves any dependencies of stations before messages are routed to an application program. When message handlers are used in this way:

- Application programmers do not have to understand device dependencies
- Device dependencies are not duplicated in each application program
- New types of stations can be supported without impacting application programs

One level of network sharing is the capability of a station to direct messages to multiple application programs, stations, or both through one message handler With SNA, terminal operators have a second layer of network sharing—the capability of selecting the device message handler that will be used during an SNA session. The different device message handlers might provide specific functions related to a particular application or be generalized to handle mixed input for many applications. In the latter case, a terminal operator who is in an SNA session with an ACF/TCAM device message handler can switch between applications without having to end the current SNA session and start another.

Communications Controllers

ACF/TCAM uses the IBM 3705-I and 3705-II Communications Controllers to communicate with the network; these controllers manage the flow of data between ACF/TCAM and remote stations. Communications controllers use SDLC data links to communicate with each other[5].

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[4]There are differences in the use of message handlers when messages are flowing to or from a subsystem. The topic "ACF/TCAM's Subsystem Support" in Chapter 2 discusses these differences.

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[5]Multiple links between two network control programs (NCPs) can operate simultaneously only if the NCPs are Release 3 of ACF/NCP/VS. Also with Release 3 of ACF/NCP/VS, a single remote controller can be connected to multiple local controllers, and remote controllers can be connected to each other. Refer to Chapter 3 for additional information.

The communications controller is programmable and is controlled by either an IBM network control program (NCP) or the emulation program (EP)[6].
The generic term *network control program,* or simply *NCP,* is used in this manual when referring to either the IBM Network Control Program/Virtual Storage (NCP/VS), Version 5, or to the IBM Advanced Communications Function for the Network Control Program/Virtual Storage (ACF/NCP/VS), Releases 1, 2, and 3. NCP/VS, Version 5, can be used for single-domain communication, while ACF/NCP/VS can be used for both single-domain and multiple-domain communication. (Domains are discussed under the next topic "Network Characteristics".) Refer to "Network Control Programs Required for Specific New ACF/TCAM Functions" in Chapter 4 for additional information. The publications, *ACF/NCP-SSP General Information,* GC30-3058 (for ACF/NCP/VS), and *Introduction to the IBM 3704 and 3705 Communications Controllers,* GA27-3051 (for NCP/VS, Version 5), have more information about network control programs and the emulation program.

The network control program fulfills the concept of distributed function in SNA-based networks by performing many communication-control functions that ACF/TCAM would otherwise have to perform. General descriptions of networks in this publication refer to ACF/TCAM's operation with communications controllers loaded with the network control program. With the network control program, the communications controller performs network-control functions and operates its attached lines in *network control mode.*

The network control program can be generated with the *partitioned emulation programming (PEP) extension* the extension allows a communications controller to operate some lines in emulation mode while concurrently operating other lines in network control mode. The PEP extension allows flexibility for the customer who is migrating from a network controlled by TCAM and the emulation program (EP).

Network Characteristics

A *domain* is the collection of network resources controlled by a system services control point (SSCP)[7]. A *single-domain network* has one SSCP controlling one domain; a *multiple-domain network* has more than one SSCP, each controlling its own domain. The resources controlled by an SSCP include application programs, subsystems, communications controllers, network control programs, stations, data links, and data channels. Figure 1-1 is an example of a single-domain network; Figure 1-2 is an example of of a multiple-domain network.
Single-domain networks can operate with multiple concurrent application programs and both SNA and non-SNA stations with extensive sharing of network resources. Yet, while two or more single-domain networks may

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[6]The *emulation program* allows a local 3705 to emulate the operation of an IBM 2701, 2702, or 2703 of any combination of the three. A communications controller loaded with the emulation program operates its attached lines in *emulation mode*

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[7]The functions of an SSCP are defined by systems network architecture (SNA). ACF/TCAM and ACF/VTAM each have SSCPs; further discussion of SSCPs is beyond the scope of this manual. Refer to *Introduction to Advanced Communications Function,* GC30-3033, for additional information.

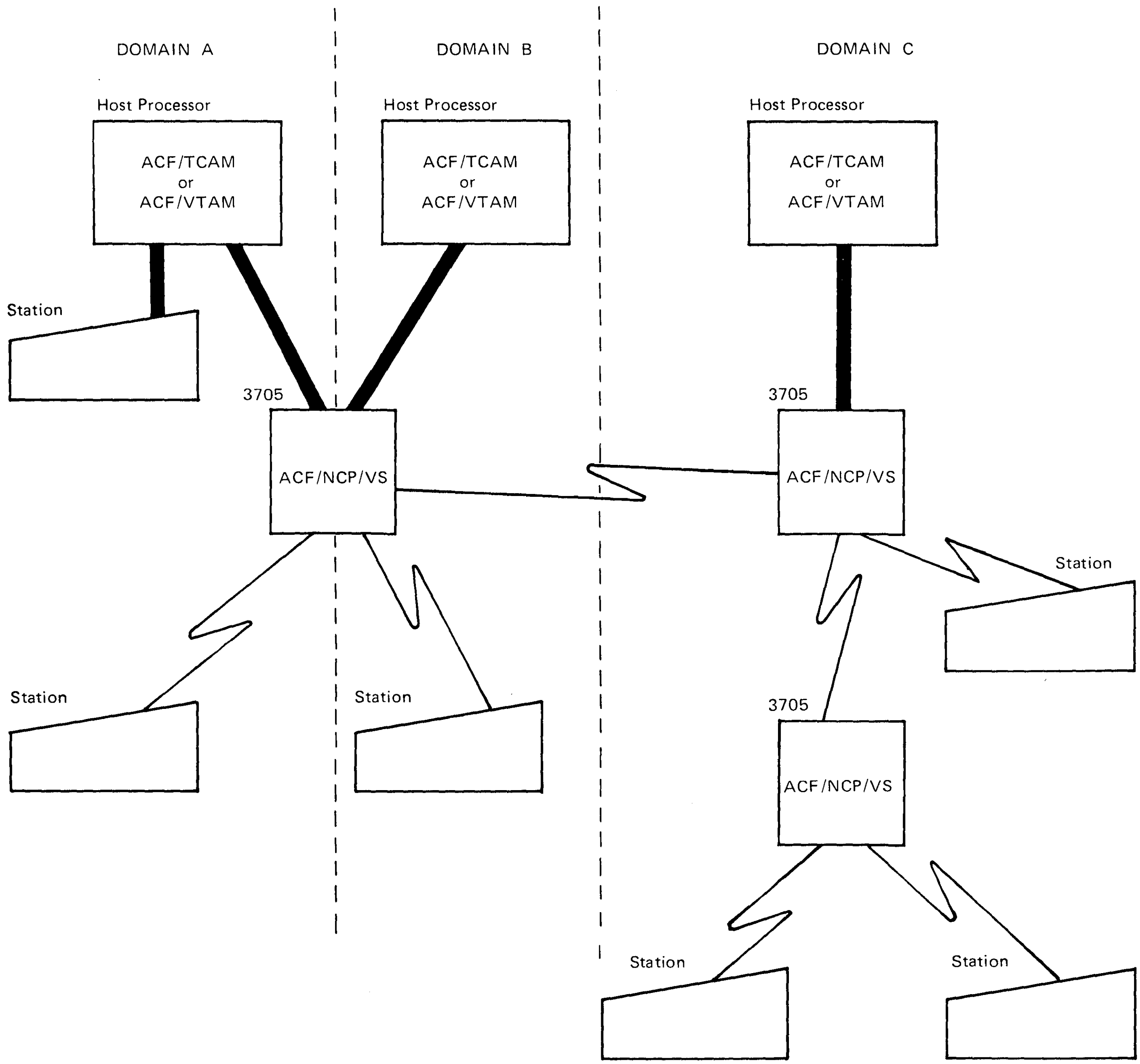

Figure 1-2. An Example of a Multiple-Domain Network

coexist—even sharing the same host processor and the same communications controller—the networks remain independent of each other; they lack the capability of communicating with each other.

With ACF/TCAM's Multisystem Networking Facility (an optional feature), two or more interconnected domains can be consolidated into a multiple-domain network. The concept of communication between resources in different domains is called *networking*. With networking, an application program or subsystem in one domain can exchange data with an application program, subsystem, or station in another domain. The advantages of networking include:

- Extended sharing of resources across domains
- Elimination of redundant applications programs in two or more domains
- Possible decrease in cost by utilizing cross-domain resources
- Concurrent transmission of data over multiple routes between ACF/NCP/VSs[8]
- Backup capability for critical applications or stations, including the capability of using alternate routes for failed links or ACF/NCP/VSs

IBM 3705 Communications Controllers containing ACF/NCP/VS are used to interconnect domains. This interconnection can be (1) by one or more SDLC data links between controllers or (2) by using the shared-ACF/NCP/VS capability of a single communications controller. Both of these methods of interconnection are shown in Figure 1-2. The publication, *ACF/NCP-SSP General Information,* GC30-3058, and *Introduction to Advanced Communications Function,* GC30-3033, have more information about ACF/NCP/VS's sharing capability.

Network Security

Most installations have security procedures for those who access the services of the network. ACF/TCAM provides the following measures that an installation can incorporate into its network security plan:

- Passwords to be used by application programs when issuing network-control macros
- Verification of an application's authority to access a destination queue
- The security and authorization service facility (See "Installability and Usability Enhancements" in Chapter 2.)
- Message logging
- Exit routines that can be used when SNA sessions between logical units are established and terminated

Additionally, IBM's Programmed Cryptographic Facility can be used with ACF/TCAM. With this program product, data transmitted during an SNA session can be enciphered and deciphered. More information about the cryptographic facility is in the publication, *Programmed Cryptographic Facility General Information,* GC28-0942.

Network Management

After ACF/TCAM has been defined, operator commands and certain application-program macros are used to manage the network.

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[8]Multiple routes can be used with Release 3 only. See "Multiple Routing" in Chapter 3 for additional information.

(Application-program macros are briefly discussed later under this topic.) ACF/TCAM operator commands can be issued by a human operator, an application program, or a combination of both, thus allowing an installation flexibility in planning its network-control procedures.

Two operator control system service programs are subtasks of ACF/TCAM's initiator program: basic operator control (required) and extended operator control (optional). Both basic and extended operator commands can be entered from the system console, a terminal, or an application program. Once ACF/TCAM is active, basic operator commands can be used to:

- Monitor the network and its resources
- Change the network configuration
- Request services such as traces and dumps
- Establish connectivity to a network control program
- Start and stop message traffic to a destination
- Start and stop a network control program
- Stop ACF/TCAM

Operator commands are the vehicle for network tuning, network reconfiguration, and problem determination. The network operator issues Display commands to request network status information. The information displayed enables the operator to determine what other operator commands are required either to remedy the situation or to request additional information, such as a trace.

Extended operator control allows commands to be issued that are not required to control the domain; these commands can be used to perform operations such as displaying information about stations, queues, and ACF/TCAM buffer units. The extended operator control system service program is required in order to use:

- ACF/TCAM's extended networking capability
- The online retrieval system service program
- The save/restore message queues system service program
- The automatic purge/copy/redirect facility

Refer to "Installability and Usability Enhancements" in Chapter 2 for additional information on extended operator control and the items listed above.

In multiple-domain networks, operator commands can be used to request information about cross-domain resources. Depending upon the configuration and user-provided authorization, the operator in one domain may have access to the operator control facility in another domain. In this case, that operator can send cross-domain operator commands to the operator control facility of the ACF/TCAM message control program controlling the other domain. This capability allows the operator to inspect and manage resources belonging to the other domain.

Application programs can issue network-control macros as well as operator commands. These macros allow the program to:

- Examine and change the contents of certain ACF/TCAM control blocks
- Resume sending messages to a destination that has not been allowed to receive messages
- Stop ACF/TCAM

An installation can prohibit unauthorized use of these macros by requiring that a security password be coded with the macros in an application program.

Problem Determination

In some cases, the Display commands or an error message can point to the problem in a network. However, problem determination is complex for large networks, and additional means of problem determination are required. Isolation of a problem in large networks is made even more difficult since a problem at one point in the network may manifest itself in many other places. Therefore, in addition to operator commands and error messages, ACF/TCAM has the following facilities that can be used to gather information for problem determination:

- Message logging
- Error recording
- Hardware tests
- Dumps and traces

Additionally, the Network Communications Control Facility and the Network Problem Determination Application program products can operate with ACF/TCAM. These program products can be used to isolate network problems. Refer to the following publications for more information: *Network Communication Control Facility General Information,* GC27-0429, and *Network Problem Determination Application General Information,* GC34-2010.

Message Logging: ACF/TCAM's message logging facility enables an installation to record the messages handled by a particular message control program; this record is kept on a sequential data set. Message logging can be used by an installation for accounting purposes without requiring that a message-logging application program be written. Additionally, message logging can be a useful debugging tool. Inclusion of a carefully designed message-logging facility in a message handler permits a trace of the flow of messages through a message control program, thus allowing quick diagnosis of errors while debugging the message control program. By anticipating the need for debugging aids when designing a message-logging facility, an installation can provide a useful diagnostic tool with very little programming effort. Because of its modular design, the message-logging facility can be easily removed after the message control program has been debugged without requiring that portions of the message control program be rewritten.

Error Recording: The error-recording facility helps to reduce the time that network components are inoperative by providing information useful in diagnosing data-link and station problems. ACF/TCAM creates error records for resources attached to communications controllers. These records contain statistical data about errors detected by the network control program. ACF/TCAM also internally maintains this error information for individual links and stations; the network operator can issue an operator command that will display error statistics. Additional related information about error recording is in Chapter 2 under the topic, "Intensive Mode Error Recording."

Hardware Tests: An SNA-terminal operator can run a test to verify that his station can communicate with its host processor. The terminal operator sends a test request to the host. If the test was successful, the host replies with either the test message sent by the terminal operator or with the default test message.

In a similar type of test, the network operator can verify that communication is established between a remote SNA station (cluster node or terminal node) and its host processor. The operator begins the test by issuing an operator command from the operator control station; the results of the test are sent to the operator control station. Communication between the host processor and other stations on the nonswitched data link are not disrupted.

ACF/TCAM provides the teleprocessing online test executive (TOTE) as another means of diagnosing network problems. TOTE allows online diagnostic tests to be performed for various stations in the network. The devices that can be used with TOTE are listed in Chapter 4.

Dumps and Traces: Dumps and traces supply detailed information that can be used in determining the cause of a problem. The ACF/TCAM ABEND dump records the status of the message control program at the time that it failed. In the dump, all of the basic ACF/TCAM control blocks are formatted, and the customer can optionally print several other control blocks. The ACF/TCAM dump is in addition to the operating-system ABEND dump.

ACF/TCAM also provides a number of optional traces for diagnosing problems. A trace program records its information while ACF/TCAM is in operation, thus permitting the customer to see certain control areas as they change. The ACF/TCAM customer may choose to have trace information recorded in a COMWRITE data set and later use the COMEDIT utility to format and print the data set.

Release 3 of ACF/TCAM has additional problem-determination facilities; refer to "Network Problem Determination" in Chapter 3 for additional information.

Recovering from Problems in the Network

This topic discusses four levels of recovery in ACF/TCAM-controlled networks: ACF/TCAM's disk error-handling facility; communications-controller error-recovery procedures, ACF/TCAM's checkpoint/restart facility; and network recovery.

ACF/TCAM's Disk-Error-Handling Facility: When a disk input/output error occurs during an attempt to read from or write on a disk, ACF/TCAM detects the error and gathers descriptive information about the error. Whenever a disk input/output error interrupt occurs, ACF/TCAM examines the appropriate bits and takes action accordingly. If intervention is required, control is returned to the operating system. When an irrecoverable error occurs, the operating system issues an abnormal termination message.

Communications-Controller Error-Recovery Procedures: The network control program performs most device error-recovery procedures for remote devices in the network. The network control program will attempt recovery from most device-oriented errors; ACF/TCAM's error-recovery routines are used only for errors occurring when data is transmitted between the host and the communications controller.

ACF/TCAM's Checkpoint/Restart Facility: ACF/TCAM's checkpoint/restart facility allows ACF/TCAM to be restarted with minimum loss of messages following closedown or system failure. Information about the status of ACF/TCAM's environment is periodically recorded in a checkpoint data set; this is called taking a *checkpoint.* If ACF/TCAM closes down or if a system failure occurs, checkpoint records are used to re-create the environment when ACF/TCAM is restarted.

Messages queued in main storage only cannot be checkpointed; that is, they cannot be recovered after a system failure or closedown. Messages queued on direct-access storage devices can be accessed when ACF/TCAM is restarted. In order to recover main-storage message queues, the customer must have a backup message queue data set on one or more direct-access storage devices.

When the checkpoint/restart facility is used for network control programs, ACF/TCAM maintains a checkpoint data set for each network control program in the domain. Checkpoint records are written when certain changes occur in the status of a data link or remote station.

Network Recovery: When failures occur in the network, the network operator can issue operator commands that permit:

- A backup data link (either switched or nonswitched) to be activated to replace a failed link
- Resources to be switched from one domain to another

Additional network recovery capabilities are available with ACF/TCAM, Version 2, Release 3; these are discussed in Chapter 3 under the topic "Improved Network Recovery."

Chapter 2. Summary of New Capabilities in ACF/TCAM, Version 2, Releases 1 and 2

This chapter describes functions provided by Version 2 of the ACF/TCAM program product as extensions to Version 1 of ACF/TCAM. These functions are available for both single- and multiple-domain networks except as noted. In addition to the individual new functions described in this chapter and in Chapter 3, Version 2 of ACF/TCAM provides the following general enhancements:

- Improved assembler performance for large message control programs
- Default bind images for externally initiated LU-LU sessions
- The capability of cancelling operator commands in a user's message handler
- Blocking of outbound messages going to a communications controller

SNA 4.1

New Capabilities in ACF/TCAM, Version 2, Release 1

The new items for Version 2, Release 1 of ACF/TCAM are grouped under the headings (1) installability and usability enhancements, (2) communication network management, and (3) enhanced data communication capabilities.

Installability and Usability Enhancements

The structure of ACF/TCAM, Version 2, and its related programs is different from earlier versions of TCAM. This fact, coupled with the addition of the items listed below, makes Version 2 of ACF/TCAM easier to install and use than earlier versions:

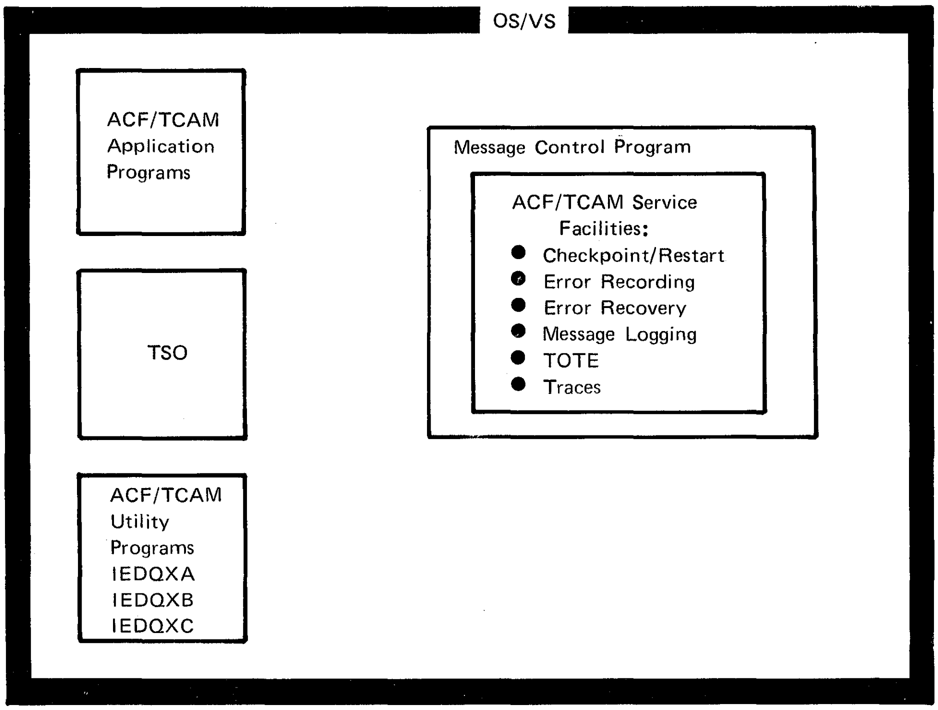
- An initiator program
- System service programs
- A model message control program
- Additional service facilities
- Enhancements to the Multisystem Networking Facility that expand the networking capabilities defined by Systems Network Architecture

The ACF/TCAM Initiator Program

With earlier versions of TCAM, the operating system's reader/interpreter reads the JCL for the message control program (MCP), causing it to be executed as the job-step task. An MCP failure could cause all of TCAM to fail. The job-step task of Version 2 of ACF/TCAM is the ACF/TCAM initiator (program); it monitors the ACF/TCAM region, and in turn, invokes the message control program and system service programs as subtasks. Figure 2-1 shows these differences between earlier versions of TCAM and ACF/TCAM, Version 2; each program is invoked by the program in the surrounding block.

ACF/TCAM's task-subtask structure allows the message control program and the system service programs to execute asynchronously, with the initiator program monitoring their operation. Initiator commands may be entered from the system console to initiate or terminate a subtask or to display status information. Informational messages are displayed when subtasks are initiated or terminated (either normally or abnormally).

Earlier Versions of TCAM:



ACF/TCAM, Version 2:

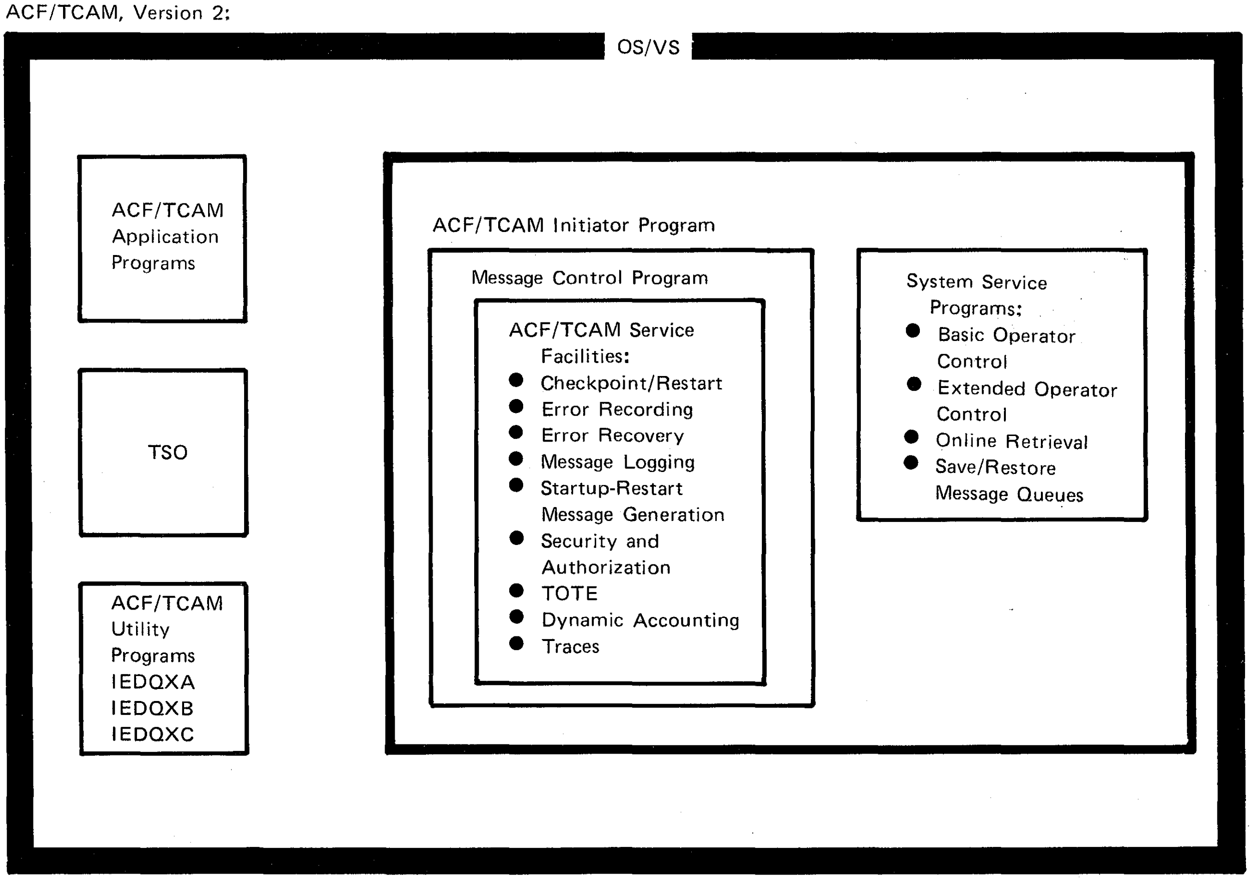


Figure 2-1. ACF/TCAM, Version 2, Compared to Earlier Versions of TCAM

The initiator should have the highest priority in the operating system; it continues to execute when a subtask fails and can automatically restart a failed subtask after optionally taking one of several types of online dumps. This scheme bypasses the job management overhead otherwise required to restart the region or partition. The initiator can also associate a backup program with a subtask; if the subtask fails, and continues to fail when restarted, the backup program can be initiated instead of the failing program.

System Service Programs

System service programs are subtasks of ACF/TCAM's initiator program, as is the message control program. (See Figure 2-1.) Four of the IBM-supplied system service programs are described below; two others are described under the topic "Extending ACF/TCAM's Networking Capabilities" later in the chapter. Optionally, the customer can write additional system service programs.

Basic Operator Control System Service Program: This program is required; it includes commands required to keep a single- or multiple-domain network operational. The function and use of this program corresponds to that of the operator control facility in earlier versions of TCAM.

Extended Operator Control System Service Program: This optional program provides commands that can be used in some phases of network operation, but that are not required to control the network. Extended operator commands are required to use ACF/TCAM's extended networking capabilities, described later in the chapter.

Online Retrieval System Service Program: This program allows disk-queued messages (either sent or unsent) to be retrieved when an extended operator command is issued from an authorized station or application program. Message retrieval can be restricted to messages entered or transmitted on a specified day or unrestricted to include all messages entered or transmitted. Single or multiple messages may be retrieved based on a message's:

- Origin
- Destination
- Origin and destination
- Input sequence number
- Output sequence number
- Time of transmission

Save/Restore Message Queues (SMQ) System Service Program: This program allows an installation to perform a cold restart without losing disk-queued messages; this is useful when a warm restart is not wanted or is impossible because of changes made to the message control program that require it to be reassembled. When invoked with an SMQ command entered at the system console, the SMQ program searches the message queue data set for unsent messages either on all queues or for specifically named queues. After finding the messages, the program writes them on a sequential storage medium (such as magnetic tape). Another SMQ command causes the program to read the messages from the tape and restore the disk with the message queue data set. (SMQ commands are neither basic nor extended operator commands.)

Model Message Control Program

A model message control program (MCP) is shipped as part of the ACF/TCAM program product. The model defines a network; if this network meets an installation's needs, the model can be used as it is shipped. If an installation's requirements do not correspond to the functions supplied in the model, the model can be modified and then used. In any case, the model MCP provides examples of the correct use of ACF/TCAM macros and can be useful even when an installation defines its own MCP.

Additional ACF/TCAM Service Facilities

ACF/TCAM service facilities execute under control of the message control program and are invoked as needed. (See Figure 2-1.) In addition to the service facilities available with earlier versions of TCAM, Version 2 of ACF/TCAM includes the three described below.

Startup-Restart Message Generation Facility: This facility makes it easier for an installation to have variable-content messages generated and sent following startup or restart of the message control program.

Security Authorization Service Facility: This facility permits only authorized stations to access certain applications or system service programs (basic and extended operator control, and online retrieval). In conjunction with the authorization facility, ACF/TCAM maintains access-authorization flags in option fields (from the OPTION macro) associated with the stations. When a security breach is attempted from an unauthorized station, an installation-defined procedure can be initiated; for example, notifying a central security monitor after rejecting the unauthorized action.

Dynamic Accounting Service Facility: This facility allows an installation to accumulate statistics on network utilization for eventual analysis by online or offline user-written programs; the statistics are gathered online. This information can be used for problem determination or for network management.

Extending ACF/TCAM's Networking Capabilities

The Multisystem Networking Facility (MSNF) is an optional feature of ACF/TCAM that permits multiple-domain networks to be created. (See "Network Characteristics" in Chapter 1.) ACF/TCAM's MSNF functions are divided into *basic networking* functions, which are generally applicable to all SNA-based networks, and *extended networking* functions, which build upon the basic functions by using host-to-host data flows. Extended networking functions are not architected as part of SNA, but are designed to complement SNA capabilities.

In ACF/TCAM, Version 2, Release 1, SNA allows only one route to be defined between the subarea originating message traffic and the destination subarea *(end subareas)*[1]. ACF/TCAM's extended networking utilizes one or more of these routes to form extended routes. An *extended route* is a series of one or more SNA routes that connect one host node to another host node in an

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[1]In terms of ACF/TCAM, a *subarea* is the collection of network resources controlled by either a message control program or a network control program. With ACF/TCAM, Version 2, Release 3, up to eight routes can be defined between end subareas. Refer to "Multiple Routing" in Chapter 3 for additional information.

extended route. With extended networking, a destination subarea for an SNA route might be a "stopover" in an extended route; from that point, ACF/TCAM uses another SNA route to send the traffic to either its destination subarea or to another stopover. By using SNA routes in this manner, ACF/TCAM can provide more than one extended route between two host nodes; this capability allows:

- An alternate extended route to be used when the primary extended route is inoperative
- Multiple extended routes to share the data traffic flowing between two host nodes

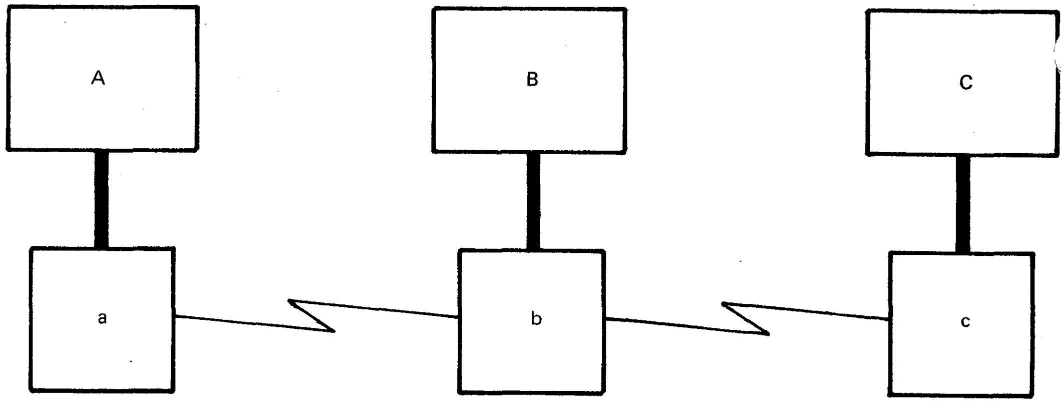
Extended routes, alternate extended routes, and multiple extended routes are totally separate concepts from parallel links, multiple routing, and the alternate SNA routes discussed in Chapter 3. Though totally separate, extended networking and the capabilities available with ACF/TCAM, Version 2, Release 3, can be used together to provide an installation with many possibilities for message traffic flow and network backup.

Data flowing on an extended route flows through one or more utility sessions. Utility sessions exist between host nodes in the extended network and are used to send data from host to host. (See Figure 2-2.) Utility sessions allow message traffic to be automatically rerouted to its destination over an alternate extended route when a physical element in the primary extended route fails. In addition to extended routing and utility sessions, ACF/TCAM provides extended networking capabilities by using:

- An internodal routing facility, based upon ACF/TCAM's ability to route messages by keys and using extended routes.
- The internodal awareness system service program, which is present in each host node; the program monitors the availability of other host nodes and selected applications in the network and broadcasts the availability status to the other host nodes.
- The internodal sequence number synchronization system service program, which is used to recover from transmission errors when they are detected.

Transmission Categories in an Extended Network: In a typical multiple-domain network, different classes of traffic related to different application types have characteristics that require specific types of system support. For example, applications may differ in the way that they need to respond to failures. In addition, in a network with a mixture of application types, it is important to balance urgency to cost; for some nonconversational applications, fast delivery is not important, while for other applications, it may be critical. It is also very desirable to limit the use of data links between domains and guarantee conversational response time by controlling the flow of low-priority, high-volume traffic.

ACF/TCAM's extended networking allows an installation to define transmission categories; a *transmission category* is a user-defined group containing a subset of the messages flowing over utility sessions in the extended network. The network designer perceives all messages in the same transmission category as having similar characteristics, specifies handling characteristics that will define each transmission category, and decides which types of applications will be assigned to each category. Different ways of



A, B, and C are ACF/TCAM, Version 2

a, b, and c are ACF/NCP/VS

The SNA route defined between A and C is:

A → a → b → c → C

This also corresponds to the primary extended route defined between A and C.
An alternate extended route between A and C could be:

A → a → b → B → b → c → C

Utility sessions exist between:

A and B	(A → a → b → B)
A and C	(A → a → b → c → C)
B and C	(B → b → c → C)

Figure 2-2. The Relationship between SNA Routes and Extended Routes

performing the following ACF/TCAM operations may be applied to messages in different transmission categories:

- Queuing messages (in main storage or on disk)
- Message priority
- Sequence checking
- Error handling
- Load balancing[2]
- Data Staging[3]

An ACF/TCAM extended network may use up to sixteen transmission categories for specialized message handling. The message control program for each host node in an extended network has defined within it the transmission

[2]Load balancing is the distribution of the data traffic between two hosts among all available extended routes connecting them.

[3]Data staging uses utility sessions to move high-volume, low-priority message traffic from host to host, progressively approaching the destination host.

categories that can be used with each other host in the network. Transmission categories provide the network designer with a manageable way of grouping like data and of ensuring uniform treatment of all data in the same class of traffic. Transmission categories can be used in conjunction with the class-of-service capability available with ACF/TCAM, Version 2, Release 3; refer to "Multiple Routing" in Chapter 3 for additional information on class of service.

Summary of the Enhancements Provided by Extended Networking: Extended networking supports large networks having different types of applications by providing:

- Generalized host-to-host data flow support for data-collection, data-distribution, and transaction-routing applications
- A rational division of different types of cross-domain message traffic into transmission categories, and a means of specifying different types of message handling and scheduling for different transmission categories
- Data staging and load balancing capabilities
- Preservation of message priority levels across domains

Extended networking provides error-recovery procedures, including:

- Automatic rerouting of messages over an alternate extended route (using different utility sessions) to the destination in the event of a failure of a cross-domain link, an ACF/NCP/VS, or a host on the primary extended route
- Automatic monitoring of the availability of cross-domain host nodes, and applications, and optional rejection of messages whose destination node or application is currently unavailable
- Automatic assignment and checking of output sequence numbers for internodal message traffic (traffic between host nodes), and automatic retransmission of messages when a sequence-number gap is detected

ACF/TCAM provides a set of macros for defining the extended network, including macros that expand into message handlers for handling cross-domain message traffic. ACF/TCAM also provides model message control programs that can facilitate the task of defining certain types of networks.

Communication Network Management

Version 2 of ACF/TCAM includes additional problem-determination and network-operation functions that can assist in optimizing management and control of a customer's network.

Enhanced SDLC Data Link Testing

ACF/TCAM has two new tests that can be performed to verify that communication has been established between a host processor and an SNA station (cluster node or terminal node). One, the SSCP-LU echo test, is performed by an SNA-station operator; the other by the network operator.

A station operator initiates a test by entering a test request. The host replies with either the test message sent by the operator in the test request or with the default test message. The host transmits the test message as many times as the terminal operator specified or as many times as defaulted to in the test request. Although this test cannot be run across domain boundaries, it is still useful when cross-domain problems occur; that is, the terminal operator can determine whether the station's connection to its owning host is part of the problem. This test can run with NCP/VS, Version 5, and any release of ACF/NCP/VS.

The network operator initiates a test by entering a test request from the operator control station specifying the SNA station to be tested, a test message (optional), and the number of times the test message is to be sent. The SNA station (cluster node or terminal node) being tested must be on a nonswitched data link. The test determines whether the station being tested is communicating with its owning host. Communication between the host and other stations on the data link is not disrupted. Test results are sent to the operator control station. This test requires either Release 2 or 3 of ACF/NCP/VS.

Intensive Mode Error Recording

Normally during error recovery, the network control program records the initial error status that started the error recovery process; for permanent errors, it also records the final error status that caused a permanent error record to be built. The network control program does not ordinarily record information about temporary errors that may occur between the initial error status and the final error status. However, when the network operator issues an operator command requesting intensive mode error recording, the ACF/NCP/VS also records temporary errors. This additional information can often preclude the need for specific testing in an attempt to re-create an error, thereby easing problem determination. Intensive mode error recording has been available with previous versions of TCAM for remote stations that use the 2701 data adapter and the 2702 and 2703 control units or the communications controllers in emulation mode; with Version 2 of ACF/TCAM operating with either Release 2 or 3 of ACF/NCP/VS, intensive mode error recording is also available for SNA stations on SDLC lines controlled by ACF/NCP/VS.

Dynamic Reconfiguration of Remote SNA Stations

Change is a frequent occurrence in all networks, but change becomes severe for installations that have:

- Large Networks
- Many new stations being added
- 24-hour operation
- Frequent configuration change requiring fast reaction time

With Version 2 of ACF/TCAM, an installation can selectively add remote SNA stations to or delete them from a network; the stations must be on nonswitched lines. This capability allows an installation to:

- Change the network without regenerating the ACF/NCP/VS or reloading the communications controller

- Bypass a failure in the SDLC link between a communications controller and a remote station by dynamically reassigning the affected physical and logical units to a backup link

Enhanced Network-Control-Program Storage Display

With Version 2 of ACF/TCAM, the network operator can issue one command that will display up to 256 bytes of contiguous storage in the 3705

Communications Controller. With previous versions of TCAM, only 32 bytes could be displayed. The Display command can be issued while the network control program is operating. This capability reduces the need to stop, reload the network control program, and restart the network in order to collect problem-determination information.

ACF/TCAM's Support of New Problem-Determination Products

The Network Communication Control Facility and the Network Problem Determination Application program products can be used with Version 2 of ACF/TCAM. These products offer an installation programmed assistance for problem determination and network operation. More information about these program products is in the following publications: *Network Communication Control Facility General Information,* GC27-0429, and *Network Problem Determination Application General Information,* GC34-2010.

Enhanced Data Communication Capabilities

Version 2 of ACF/TCAM provides improved flexibility for SNA session operation, data security, and support for additional devices.

Negotiable Session-Initiation Parameters

An SNA Bind Session request (referred to here as a Bind request) sent from a primary logical unit to a secondary logical unit establishes an SNA session. The Bind request contains a set of protocols (Bind parameters) that will be followed during the session. With Version 1 of ACF/TCAM, the secondary logical unit had to either accept the Bind request it received or reject it. With Version 2 of ACF/TCAM, the primary and secondary logical units can "negotiate" on which parameters to include with the Bind request as follows:

1. The Primary Logical Unit (PLU) issues a negotiable Bind request with the parameters defined for the request.

2. Upon receiving the request, the secondary logical unit (SLU) can accept the request, reject it, or change certain parameters if they disagree with the session protocols that the SLU wants.

3. If the PLU receives a changed Bind image and accepts the modified Bind parameters, normal data traffic begins for the session; otherwise, the PLU sends an Unbind request. The PLU can again attempt to establish the session by sending either a nonnegotiable Bind request or another negotiable Bind request.

The negotiable Bind request relieves the primary logical unit of having to store Bind parameters for all types of secondary logical units. Use of the Negotiable Bind request can simplify network definition and reduce the amount of storage used for Bind Parameters. Both session partners must support the use of negotiable Bind Session requests.

Other Enhancements

In addition to the use of the negotiable Bind request, ACF/TCAM enhanced capabilities include:

- The capability of using IBM's Programmed Cryptographic Facility program product. The cryptographic facility allows data flowing in LU-LU sessions to be encrypted and decrypted, thus offering an installation a means of securing data transmitted in the session.

- Local attachment of the 3274 Control Unit and 3790 System. These systems can be used in both single- and multiple-domain networks.

- Use of the IBM 3705-II Communications Controller, Models J, K, and L ACF/TCAM can operate with these models as local controllers, remote controllers, or both.

New Capabilities in ACF/TCAM, Version 2, Release 2

ACF/TCAM's Subsystem Support

Release 2 of ACF/TCAM, Version 2, through a compatible subset of ACF/VTAM's record application interface (API), will provide support for all ACF/VTAM functions being used by the subsystems listed below. Consult your IBM representative for the applicable versions and releases of the subsystems.

- Customer Information Control System (CICS)[4]
- Distributed System Executive (DSX)
- Information Management System (IMS)
- Job Entry System 2 and 3 (JES2 and JES3)
- Host support for the IBM 3650 Programmable Store System
- Virtual Storage Personal Computing (VSPC), OS/VS1 only

At execution, the customer's job stream must indicate that the ACF/TCAM subsystem interface is to be used instead of the ACF/VTAM record API; the function provided by ACF/TCAM is the same as that provided by ACF/VTAM. Subsystems in different hosts can communicate over a single session using ACF/TCAM's subsystem interface. The diagram that follows shows the difference between the path of a message destined for a customer-written application program and the path of a message destined for a subsystem.

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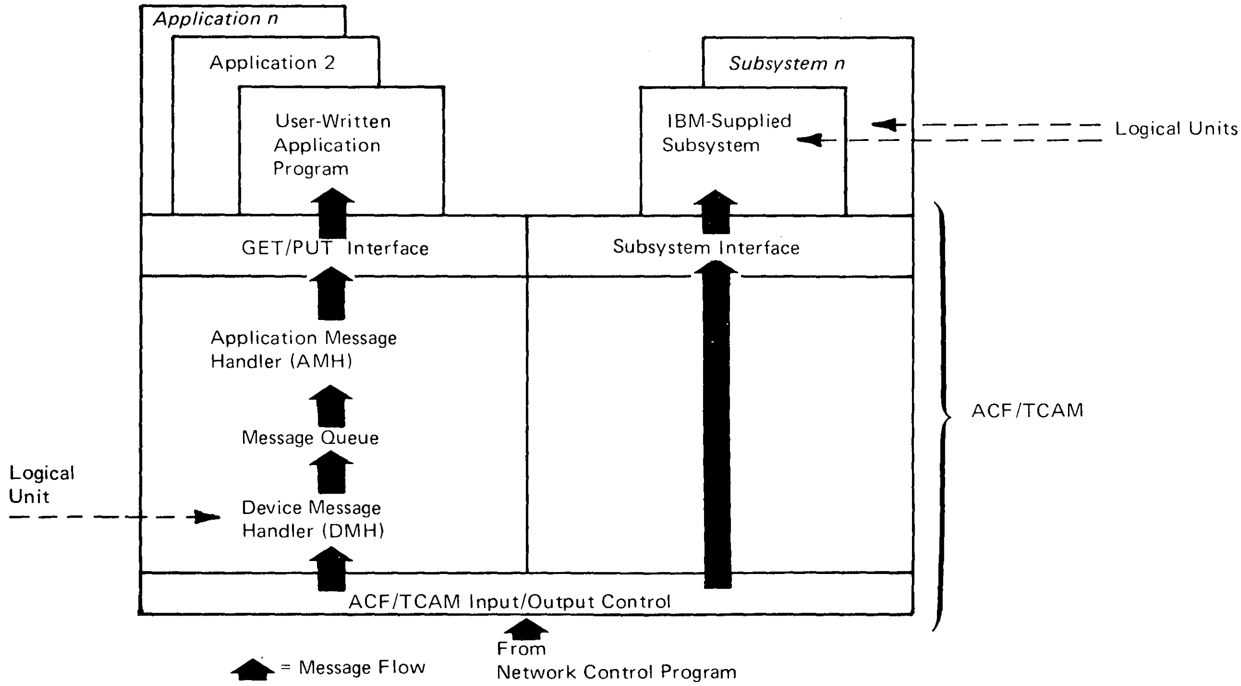
[4]CICS can continue to use the GET/PUT interface as in previous versions of TCAM; with ACF/TCAM, Version 2, Release 2, CICS can also use the subsystem interface.



Note: The user may optionally specify a DMH, or a DMH and an AMH to perform limited editing of messages; only a restricted subset of message-handler functions can be used for this purpose.

As shown in this diagram, ACF/TCAM does no message queuing when a customer accesses the services of a subsystem. The chart that follows summarizes the relationship between ACF/TCAM, Version 2, and other host programs in the network.

ACF/TCAM V2,R2

ACF/TCAM V2,R1

OS/VS1	OS/VS2(MVS)	Type of Application	Program Name	GET/PUT Interface	Subsystem Interface
●	●	Data Base/Data Communication	CICS/VS	●	●
●	●		IMS/VS		●
	●	Remote Job Entry	JES2/RJE		●
	●		JES2/NJE		●
	●		JES3/RJP		●
	●	Interactive	TSO*		
●			VSPC		●
●	●		IIS	●	
●	●	Device Support	SSS	●	
●	●		3650 Host Support		●
●	●		DSX	●	●
●	●	Network Communications Control	NCCF	●	

* TSO uses TGET and TPUT.

Chapter 3. Summary of New Capabilities for ACF/TCAM, Version 2, Release 3

Level 3 of Advanced Communications Function (ACF) provides new functions that can improve the reliability, availability, serviceability, and usability of SNA-based networks[1]. The combination of ACF/TCAM, Version 2, Release 3, and ACF/NCP/VS, Release 3, increases the options that an installation has when configuring and managing its network. Release 3 of ACF/TCAM, Version 2, also offers additional means of determining the causes of problems in the network. Each new function of ACF/TCAM, Version 2, Release 3, is discussed in the topics that follow.

In this chapter, the term "network control program" refers to the IBM ACF/NCP/VS program product.

ACF/TCAM's Support of Extended Network Control Program Interconnection

Prior levels of ACF impose constraints on the location in a network of communications controllers and their network control programs. For example, a remote controller cannot be connected to more than one local controller nor can it be connected, in turn, to another remote controller[2]. These constraints limit the number of possible network configurations and restrict the number of paths over which network traffic can flow. Figure 3-1 shows two host processors, each connected to a channel-attached communications controller. Each channel-attached controller is connected in turn to a link-attached controller; the two channel-attached controllers are joined by a data link. Under prior levels of ACF, no other links can connect the controllers to each other.

Release 3 of ACF/NCP/VS provides the same functional capabilities for both channel-loaded and link-loaded network control programs. Any controller can be connected to any other controller in the network. Figure 3-2 shows a configuration with each controller now linked to every other controller. Figure 3-3 shows how link-attached controllers can be joined in tandem; of the 15 possible connections between controllers, 11 are shown. The topics "Multiple Routing," "Improved Network Recovery," and "Configuration Flexibility" later in this chapter explain the advantages of having these added connections.

Network control programs (NCPs) and SDLC links can be shared concurrently by multiple SSCPs, regardless of where the NCPs and links are located in the network. Improved shareability of resources, together with the availability of alternate routes between subareas, facilitates an SSCP's ability to take over control of a resource when the current owner (SSCP), or the path to that owner, has become inoperative. These capabilities, along with the SSCP restart

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[1]Level 3 of Advanced Communications Function (ACF) includes ACF/TCAM, Version 2, Release 3; ACF/VTAM, Release 3; and ACF/NCP/VS, Release 3. If you are unfamiliar with SNA concepts and terminology, you should read Chapters 2 and 3 of *Introduction to Advanced Communications Function,* GC30-3033. Most of the information in Chapter 4 of that manual is included here in this chapter.

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[2]Use of the terms local controller and remote controller is explained in Chapter 1 under the topic "Communications Controllers."

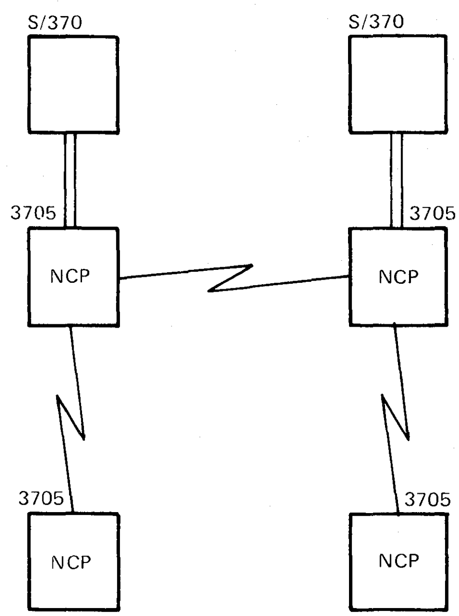


Figure 3-1. Links between NCPs Supported by ACF Level 2

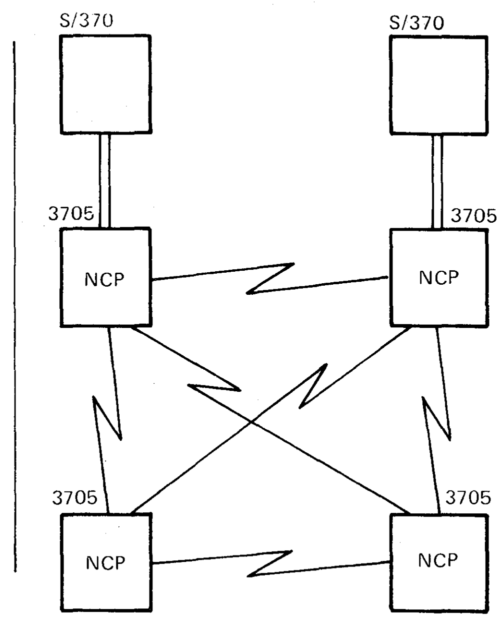


Figure 3-2. Links between NCPs Supported by ACF Level 3

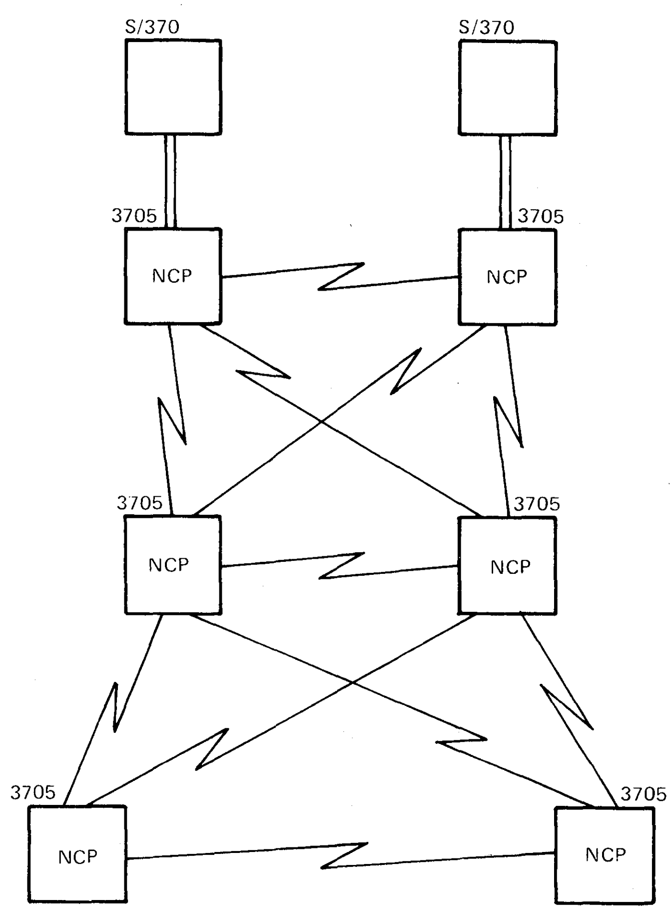


Figure 3-3. Links between NCPs Supported by ACF Level 3--Tandem Remotes Added

and SSCP takeover functions described later in this chapter, can improve the availability of a network--that is, its ability to continue functioning despite temporary failures of certain of its elements. Refer to "Improved Network Recovery" later in the chapter.

Parallel Links

With Release 3 of ACF/NCP/VS, two network control programs can communicate simultaneously over two or more SDLC links, called *parallel links.* Any number of links between the network control programs may operate concurrently; hardware capabilities (such as line sets) determine the number of links that can be physically installed between the 3705s. The characteristics of the links may differ; some may be high-speed links, while others may be low-speed links. Each link can be activated and deactivated independently of the other links between the network control programs.

Parallel links, when used in conjunction with the transmission group capability (described in the next topic), can increase the message flow between two network control programs. Also, by distributing the total data flow among multiple links in transmission groups, an installation can minimize the disruption to SNA sessions caused by failure of a single link or by the need to deactivate a link for reasons such as maintenance or testing. Parallel links provide a basis for alternate routing of messages between two adjacent subareas. With alternate routing, the data that would ordinarily flow over an inoperative link is automatically redirected over the remaining links in the transmission group. Thus, the reliability and availability of the paths between network control programs are improved. (Refer to *ACF/NCP-SSP General Information,* GC30-3058, for addition information on parallel links.)

Transmission Groups

Multiple active SDLC links between network control programs can be grouped logically so as to appear to the network as a single logical connection. The term *transmission group* is used to represent a logical connection between two network control programs, even if the "group" contains only one link. The term also represents the logical connection between the host processor and the network control program, even though this connection consists only of a single data channel.

Two network control programs can be joined by up to eight transmission groups; any single link can be assigned to only one transmission group. Each network control program dynamically distributes outgoing data traffic among the currently active links in a transmission group. Failure or deactivation of any of the active links in the group (so long as it is not the sole remaining link) results in automatic redistribution of data traffic among the remaining links without disruption of any of the sessions currently in progress using those links. Application programs and user (LU-LU) sessions are entirely unaware of and not concerned with any redistribution of traffic within a transmission group due to an inoperative link. Figure 3-4 shows five links between network control programs divided into two transmission groups.

There is no limit on the number of links that may form a transmission group, except for any limits imposed by the line attachment hardware of the communications controller. However, all links within the same transmission group should have similar characteristics such as line speeds and propagation delays. This is recommended because data traffic is assigned to any available

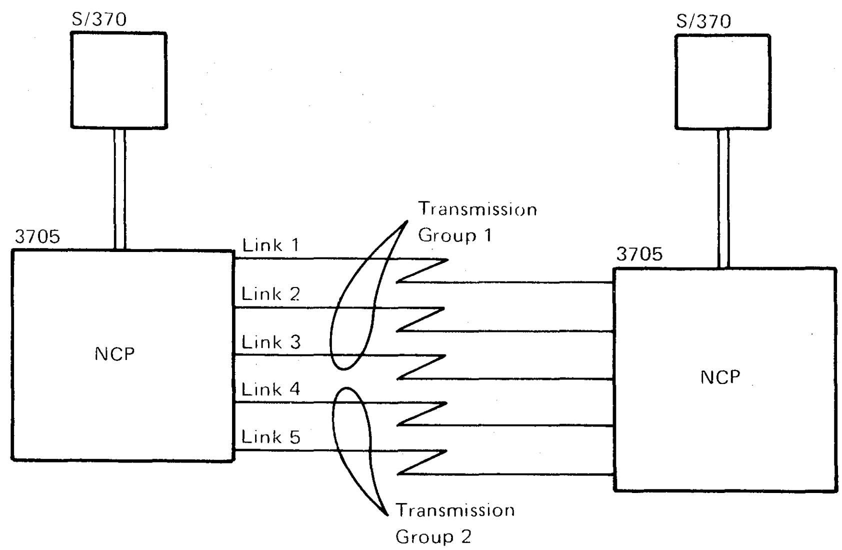


Figure 3-4. Two Transmission Groups between NCPs

link in a group regardless of the individual link characteristics. Take as an example a group that includes two links, one operating at 2400 bits per second (bps) and the other at 9600 bps. While the 2400 bps link is transmitting data, any other traffic that arrives is assigned to the 9600 bps link. Because PIUs must be placed in correct sequence at the receiving end of the transmission group, it is possible that many PIUs transmitted over the 9600 bps link would have to wait on a queue at the receiving end while a PIU which must be processed before them is being transmitted over the slower link.

SDLC links need not be associated with transmission groups when the network control programs are defined. Only when a network control program activates a particular link upon command from ACF/TCAM does the actual link become associated with a particular transmission group. A switched link may be moved from one transmission group to another to help equalize traffic loads or to compensate for link failures.

Multiple Routing

With earlier versions of TCAM, only one route can be defined between a pair of subareas. All data traffic sent by sessions established between those subareas is transmitted over that single route. Any failure of a physical element of the route, such as a link, interrupts all SNA sessions using that route and their data traffic until the failing element is restored or another element (such as a backup link) is substituted for the failing element. Then SNA sessions must be reestablished and resynchronized before transmission of user data can resume.

An SNA-based network controlled by Level 3 of ACF can have up to eight different physical routes between the same pair of subareas. This capability, *multiple routing,* can greatly improve the reliability and availability of a network and reduce network disruption caused by failed network elements. Figure 3-5 shows two subareas (host A and network control program B) joined by four different routes.

Each SNA session between a pair of subareas is associated with a specific route; several SNA sessions may be associated with the same route. Figure 3-6 shows the configuration of Figure 3-5 with sessions added. All data within a given session flows over the same route; that is, session data flow is not divided among routes. The availability of multiple routes allows the total number of SNA sessions between a pair of subareas to be distributed among the routes. When failure of a physical element in one route makes that route inoperative, the sessions using that route are disrupted. New sessions to replace those disrupted by route failure may be established over any of the remaining routes, as desired. Figure 3-7 shows how failure of one route can result in its sessions being reestablished over the remaining three routes.

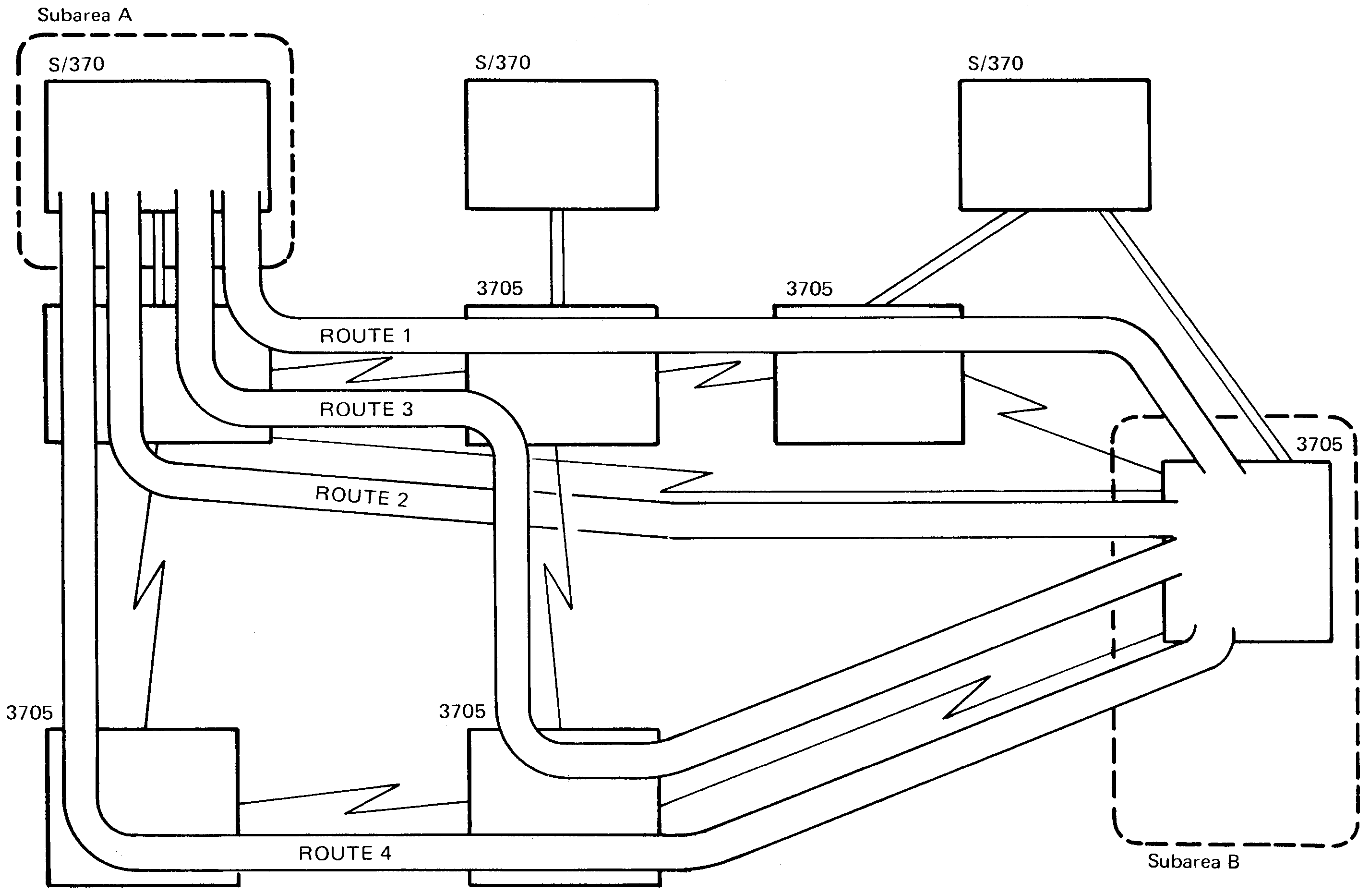


Figure 3-5. Two Subareas Joined by Four Routes

MULTIPLE (ALTERNATE) ROUTING

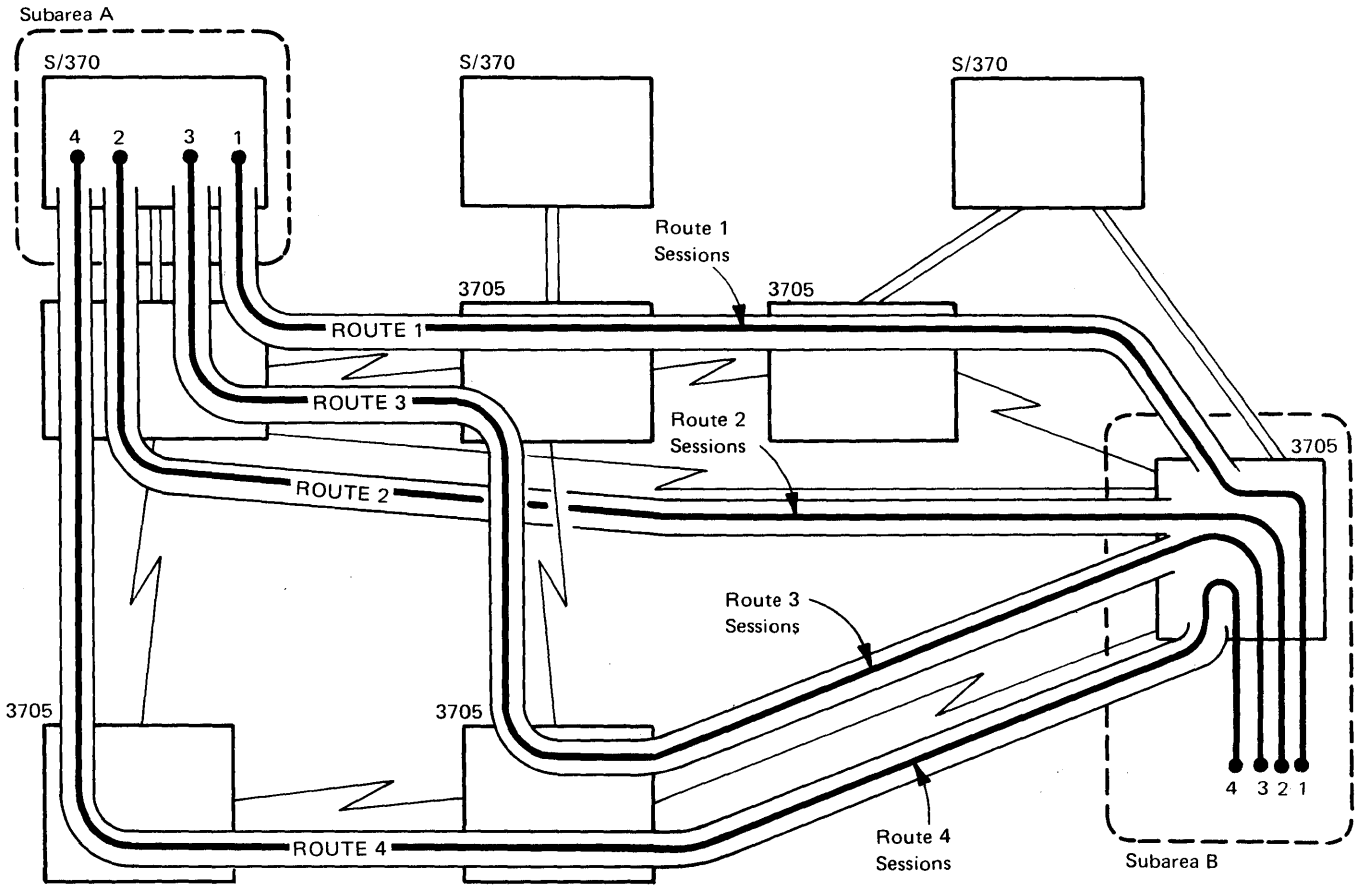


Figure 3-6. SNA LU-LU Sessions between Subareas Distributed over Four Routes

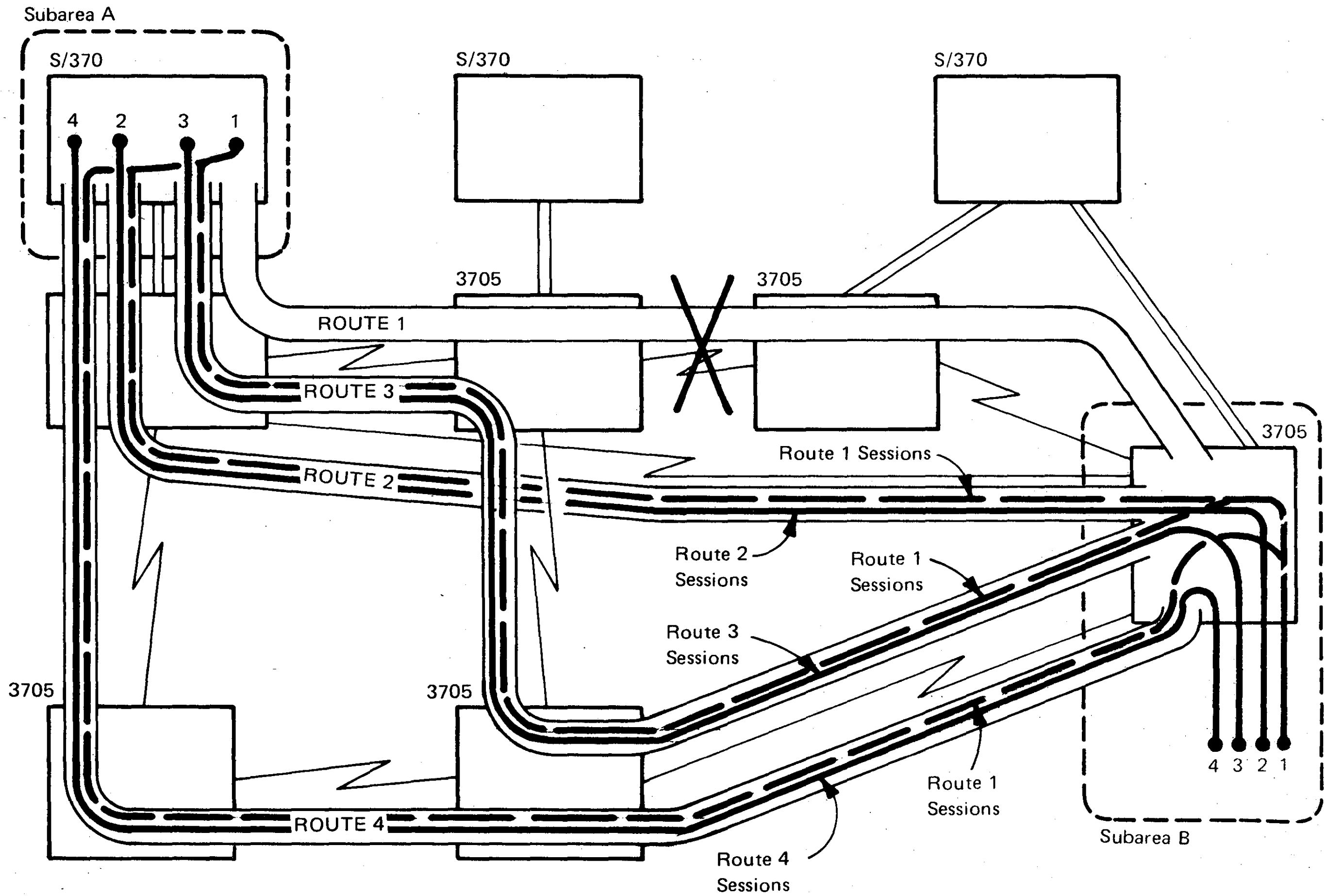


Figure 3-7. SNA LU-LU Sessions of a Disrupted Route Distributed over Remaining Operational Routes

Multiple routing may be considered at a physical level and at a logical level. The term applied to the physical level is explicit routing. An *explicit route* is a sequence of physical network elements (such as links and controllers) over which two subareas communicate. Examples of physical elements are host processors, communications controllers, and the transmission groups (links and channels) that connect them. Up to eight explicit routes can be established between any two subareas. Two or more explicit routes may have certain physical elements (or all elements) in common. For instance, a single transmission group or a single network control program may be an element in several explicit routes, as shown in Figure 3-8.

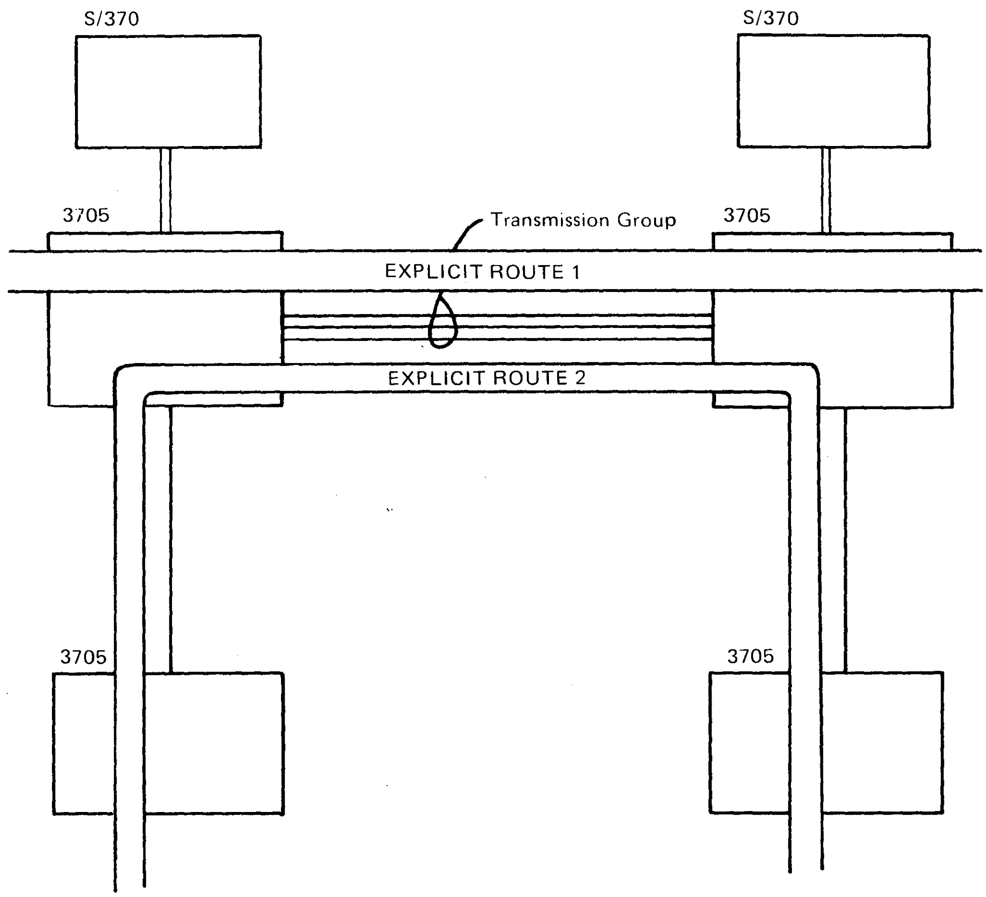


Figure 3-8. Explicit Routes Sharing Physical Elements (Two 3705s and One Transmission Group)

The logical level of routing is called virtual routing. A *virtual route* is a logical connection between a pair of subareas that participate in SNA sessions. Each virtual route in a network is bidirectional and associated with an explicit route. A given explicit route can accommodate multiple virtual routes.

An explicit route is a combination of physical network elements, each of which has certain data transmission characteristics, such as bandwidth and transmission rate. The reliability of an element also may be considered as one of the characteristics. The combined characteristics of all of the elements that form the explicit route determine the data transmission characteristics of that route. Because a virtual route is supported by an explicit route, it assumes the characteristics of the explicit route, and has an important additional characteristic: transmission priority.

Level 3 of ACF allows three levels of transmission priority, which are assigned to data flowing in SNA sessions on a virtual-route basis. This route-level transmission priority is important because data transmission requirements for SNA sessions vary. For example, inquiry/reply sessions usually require faster data transmission and more predictable response times than data collection sessions. Since sessions for several different kinds of applications may be in progress over a given route, data for sessions requiring fast data flow can be transmitted ahead of data for sessions in which slower data flow is acceptable.

The three route-level transmission priorities, combined with the eight possible virtual route numbers, allow up to 24 virtual routes between two subareas. A given explicit route can accommodate many virtual routes. The virtual routes supported by a given explicit route have in common the explicit route's inherent physical attributes; the virtual routes differ only in their relative transmission priorities.

The system programmer is responsible for selecting, for each kind of session between a pair of subareas (that is, inquiry/reply LU-LU session, SSCP-PU session, etc.) the virtual routes with characteristics best matching the requirements of that kind of session, relative to the requirements of other kinds of sessions. In making the selection, the programmer must consider the physical characteristics of the explicit routes to be used along with the route-level transmission priority. Some explicit routes, and therefore the corresponding virtual routes, may be inherently better than others. Explicit routes that comprise fewer physical elements in tandem, for example, would be typically favored over those having more elements. The longer routes might be used only for backup purposes when the shorter routes become inoperative.

Sometimes several virtual routes may have approximately the same characteristics and therefore be equally suitable for transferring data during a given kind of SNA session. ACF/TCAM, Version 2, Release 3, allows a programmer to specify a list of several virtual routes to which a session may be assigned. The list of one or more virtual routes represents the *class of service* furnished to a session. A class of service is associated with an SNA session when the session is established. ACF/TCAM host LUs can explicitly specify a particular class of service name. If none is specified, a default class of service is assigned to the session. The SSCP resolves the class of service name to a list of virtual routes, from which one virtual route is chosen at session initiation. The selected virtual route remains assigned until the session ends.

ACF/TCAM and network control programs activate and deactivate virtual routes as needed. They also activate (but do not deactivate) explicit routes associated with the virtual routes. Network operators do not activate or deactivate routes of either kind, but they do activate and deactivate the NCPs and links that form explicit routes.

If none of the virtual routes in the virtual-route list is available, the request to establish the SNA session is rejected. A later attempt must be made to establish the session. ACF/TCAM provides a virtual-route-availability monitoring option that allows the host LU to be notified automatically when a virtual route in the requested virtual route list becomes available. When the LU is notified, it may automatically retry the session-initiation request.

Transmission categories (discussed in Chapter 2 under "Extending ACF/TCAM's Networking Capabilities") are independent of class of service. However, the network designer can define classes of service that accommodate specific transmission categories. For example, a utility session supporting a transmission category designed for data-staging applications may be assigned one class of service, while a utility session supporting a transmission category of inquiry/reply applications may be assigned another class of service.

Network Flow Control Enhancements

The flow of data through a network varies from time to time; many networks anticipate and plan for peak data traffic conditions during the conduct of business. Traffic peaks can also result from conditions such as the failure of a virtual route and the consequent diversion of its traffic to an alternate virtual route. The alternate virtual route may become overburdened with the extra traffic it is asked to carry. Unexpected demands for data transmission by certain end users (individuals or application programs) also may impose peak traffic conditions on parts of the network. Thus, not only does the total traffic in a network vary, but the distribution of the traffic in various parts of the network may vary as well.

Whenever the rate at which data is presented to a network exceeds the capacity of the routes over which the data must flow, data congestion occurs. Severe or prolonged congestion in one part of a network may be propagated to other parts, causing overall network efficiency to suffer. On a network-wide basis, network control programs continuously monitor data flow over transmission groups and signal any congestion to network resources (network control programs and access methods) which are the endpoints of the virtual routes supported by the congested transmission groups. The access methods and network control programs then react by limiting the amount of data they send over the affected virtual routes until the congestion clears. The monitoring of data flow and limiting of data occur automatically, requiring no action by end users.

Congestion indicators that can be set in path information units (PIUs) are the means of signaling congestion. For example, a network control program can set a congestion indicator upon detecting that its queue for a particular transmission group is overloaded or if the program is in slowdown mode because its buffers are depleted. ACF/TCAM sets congestion indicators (1) when the number of main-storage units used reaches installation-defined thresholds or (2) when the reusable message queue data set on disk is being reorganized and the reorganization subtask is unable to keep up with the flow of new message traffic. The flow-control mechanism in the access methods and network control programs interpret the congestion indicators and modify the algorithms by which traffic is allocated to virtual routes in a way that causes the congestion to dissipate. The term *route pacing* is applied to the monitoring and flow-control mechanism used to alleviate congestion on virtual routes.

ACF/TCAM provides flow control for LU-LU sessions when the logical unit is:

- A subsystem. Requests and responses from the subsystem are queued in the subsystem's address space until the required path is cleared of congestion.

- A message handler. The user specifies the maximum number of buffers that can be concurrently assigned to the destination logical unit. This number is initially assigned when the message control program is defined; it can be overridden when the LU-LU session is established.
- A channel-attached cluster controller containing an LU which is in session with an LU in another subarea. When inbound pacing is used, the session-level pacing response is withheld whenever the virtual route carrying its session is congested. When no inbound pacing is performed for the cluster controller, no data is read from the entire cluster while the LU-LU session for any LU of the cluster is using a congested virtual route.

Network Problem Determination

Level 3 of ACF provides improved capabilities for determining the cause of failures in a network. These, known collectively as *network problem determination* capabilities, facilitate identifying the physical elements that have failed.

Session Outage Notification

In a network controlled by Level 3 of ACF, any interruption of a virtual route causes the ends of the sessions using that route to be notified in a procedure called *session outage notification.* Data flowing along a route in a network passes through a series of network elements, all of which must be operational. All network routes are subject to interruption through failure (or deactivation) of any of their elements. When such a failure occurs, all sessions using the affected route are disrupted and the end users are notified. Network elements that can fail and therefore cause session disruption (also called *session outage)* are:

- A host processor or its software
- A data channel
- A communications controller or its network control program
- A link between network control programs (if the link was the last operational link in a transmission group)
- An SNA station
- An SDLC link or channel connection to an SNA station

Many elements of an SNA-based network, such as SSCPs and network control programs, contain information about the current status of ongoing LU-LU sessions. This information normally passes along the SSCP-SSCP and SSCP-LU sessions associated with the LU-LU sessions. When a failure in the network disrupts a session, it is important that this changed status of the session be communicated not only to the session partners, but also to all other affected SNA network functions (such as SSCPs).

In networks using prior levels of ACF, the notification is communicated along the SSCP-SSCP session. Some failures, however, can disrupt the SSCP-SSCP session along with the LU-LU session, thus preventing notification of session outage from reaching affected SNA functions. For example, an SSCP that owns an LU for which an LU-LU session has been disrupted may not learn of the disruption and therefore be unable to allow another session to be established with that LU.

A network controlled by Level 3 of ACF does not rely on the continued existence of an SSCP-SSCP session to communicate information about disruption of an LU-LU session. Instead, when a failure disrupts any kind of SNA session (CDRM-CDRM, SSCP-PU, SSCP-LU, or LU-LU), network control programs and access methods on either side of the disruption notify the session partners, and all other affected SNA functions and network operators, of the occurrence of the outage.

The improved notification available with Level 3 of ACF provides increased opportunities for sessions to be reestablished, especially if alternate routes are available.

Route Verification

Route verification allows the network operator to verify that any or all explicit routes between the ACF/TCAM subarea and any other subarea are active and usable. The ACF/TCAM SSCP sends test data on explicit routes associated with virtual routes in a specified class of service. If the explicit route is operational over its entire length, the destination subarea responds to the testing host node, which in turn notifies the operator that the route is operational. If a failed (or inactive) physical element causes the explicit route to be inoperative, the subarea that detects the failed (or inactive) element notifies the ACF/TCAM SSCP. The notification identifies:

- The number of the inoperative explicit route.
- The subarea that detected the inoperative explicit route.
- The ID of the transmission group corresponding to the next part of the route. The ID is composed of subarea number of the next node in the explicit route and the number of the failing transmission group.
- The subareas at each end of the explicit route.
- The reason code for the failure.

The notification isolates the failure to a specific transmission group or subarea. The subarea detecting the failure also notifies all its owning SSCPs that a route-verification test failed and identifies the subarea that originated the test. The SSCPs in turn pass this information to their respective network operators.

ACF/TCAM also provides an operator command that allows the operator to display the status of a transmission group; with this command, the operator can learn:

- The transmission group number
- The names of the links in the group
- The subarea numbers of the two connected subareas
- Whether a link is active within a transmission group

Another operator command allows the operator to display the virtual route number and transmission priority of each session specified in the command.

Extended Network-Control-Program Ownership

Level 3 of ACF allows ownership of any link between network control programs (NCPs) to be shared among up to eight SSCPs in the network, regardless of whether the link is attached to a resource in the domain of the owning SSCP. Thus several SSCPs can activate a link between NCPs; information maintained in the NCPs reflects the current number of SSCPs that own (have activated) the link. Each SSCP may relinquish ownership of the link when it has no further use for it, without actually causing the link to be deactivated. Only when a Deactivate Link command is received from the last remaining owner does the network control program actually deactivate the link.

In addition, Level 3 of ACF allows an SSCP to assume ownership of NCPs and associated resources that are not adjacent to resources currently owned by the SSCP; that is, with level 3 of ACF the domain controlled by an SSCP may be *topographically disjoint.*

Dynamic Network-Control-Program Dump

This dynamic dump facility allows the network operator to request a dump at any time without interrupting NCP execution or disrupting any sessions in progress. The dump listing *does not* represent a snapshot of all storage captured in a single instant. Instead, ACF/TCAM requests the dump data in 256-byte segments; the data in each 256-byte segment is not necessarily collected at the same time. The NCP dump data set is defined as in earlier versions of TCAM.

Line Trace with Transmission Group Option

ACF/TCAM allows the network operator to issue an operator command that will trace a transmission group. (Refer to "Transmission Groups" earlier in this chapter.) The transmission group trace facility traces all path information units (PIUs) over the links in the group just as though the group were a single link. The request for a transmission group trace is specified as an option of the operator command used to request a line trace. The transmission group trace remains active as long as the associated line trace remains active. If the associated line becomes inactive for any reason, the line trace is terminated and, consequently, so is the transmission group trace even though there may be other active lines remaining in the transmission group. The operator may restart the transmission group trace by requesting a line trace with the transmission group option for another line in the group.

Configuration Flexibility

Capabilities with Level 3 of ACF give installations new flexibility in configuring their SNA-based networks. Two new functions are the basis for this new flexibility: extended network-control-program interconnection and extended network-control-program ownership.

Extended network-control-program (NCP) interconnection, allows any communications controller to be connected to any other communications controller in the network. Link-attached controllers can be connected in tandem and can, thereby, be located where they are needed in the network. (Refer to the topic "Extended Network-Control-Program Interconnection" earlier in this chapter.)

Extended network-control-program (NCP) ownership in Level 3 of ACF allows up to eight SSCPs, regardless of their locations in the network, to own the link or links between any two NCPs. With this capability, a single SSCP can own all network resources, including such links. In a network containing multiple host processors, control of the network can be vested in a single host processor. This multiple-processor arrangement is called a *communication management configuration* all network resources are defined in, and controlled by, a single host called the *communication management processor*. The SSCP in the communication management processor is notified of any inoperative links or NCPs in the network. Prior levels of ACF allow a limited communication management configuration, but all SSCPs in the configuration had to share an NCP.

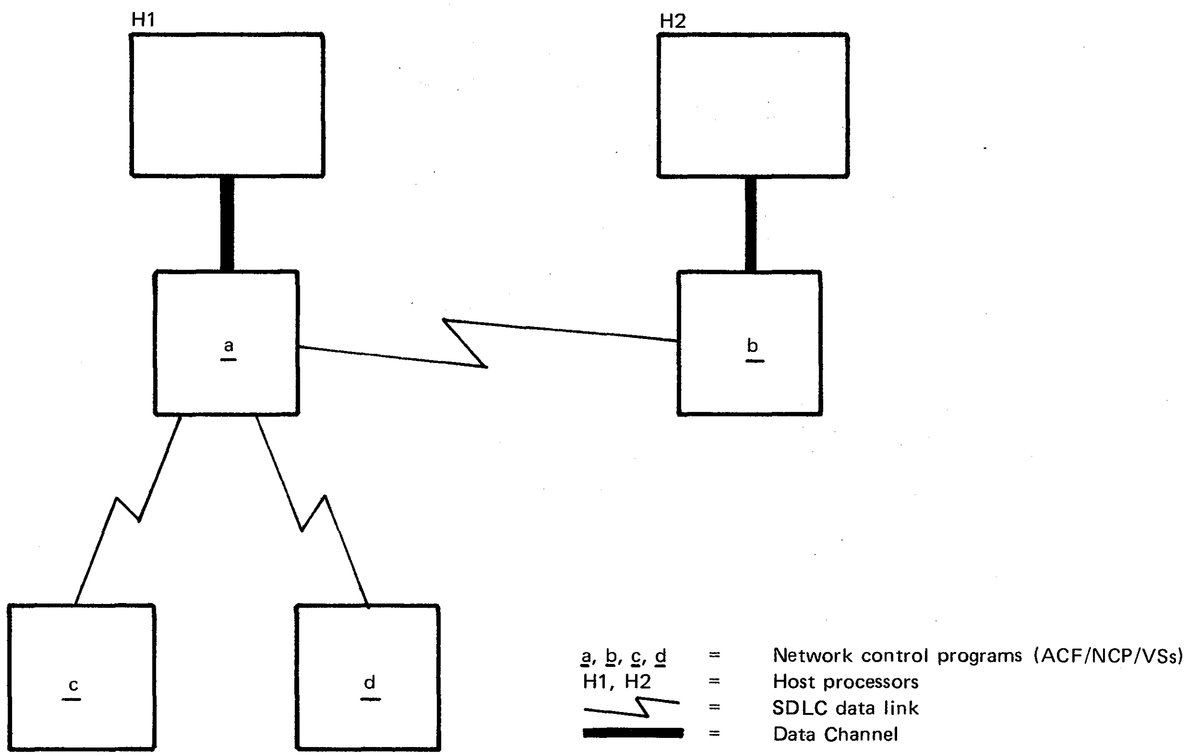
Level 3 of ACF also allows a host containing ACF/TCAM to exchange data-link-control parameters with its channel-loaded network control programs. After this contact is made, the host can send data throughout the network without owning any resources, including its channel-loaded NCPs. In a communication management configuration, such a host is called a *data host.* A data host does not manage any network resources; it is free to perform only application processing. A data host contacts its channel-loaded NCPs for data routing purposes only; it does not activate the NCPs or any of their attached resources. When defining ACF/TCAM in a data host, the system programmer does not have to define channel-attached NCP nor any of their attached resources. He need only define cross-domain SSCPs with which the data host's SSCP will communicate. A data host does not require access to the network control program's Resource Resolution Table (RRT). The SSCP in each data host is notified if any of the routes that it uses become inoperative. Locating problems in a communication management configuration is easier because the responsibility belongs to the network operator at the communication management processor; coordination among operators at widely dispersed locations is unnecessary.

Improved Network Recovery

New functions available with Level 3 of ACF can substantially improve the reliability and availability of SNA-based networks. For example, the parallel link capability allows an installation to distribute the total data flow among multiple links, thereby minimizing disruption to SNA sessions caused by failure (or deactivation) or a single link.

Improved network recovery is also a major benefit of extended NCP interconnection. (See "Extended Network Control Program Interconnection" earlier in this chapter.) Improved recoverability results from removal of distinctions between network control programs loaded over a data channel and those loaded over a data link. Network control programs prior to ACF/NCP/VS, Release 3, that are loaded over a link cannot operate links to other domains. Figure 3-9 illustrates a situation in which a network control program (NCP) fails in a channel-attached controller that is also link attached to other controllers. If the controller in which the failure occurred is reloaded over a link, it becomes in effect a remote controller. Although the controller is again operational, and sessions with resources it controls can be reestablished, it cannot communicate with any remote communications controllers or with resources attached to those controllers. Nor can it communicate over data links with controllers (and their resources) in other domains. A significant portion of the network may thus be lost to use for as long as the reloaded controller operates as a remote controller. Extended NCP interconnection removes these limitations by providing the same functional capabilities for both channel-loaded and link-loaded network control programs. (Refer to Figure 3-9.)

Extended NCP ownership allows multiple SSCPs to concurrently share ownership of NCPs and SDLC links, regardless of where the NCPs and links are located in the network. (See "Extended Network-Control-Program Ownership" and "Configuration Flexibility" earlier in this chapter.) A network designer can define his network so that any SSCP in the network can take over a failed NCP, its links, and its attached resources.



NCP a fails. — means H1 fails ?

Prior to Level 3 of ACF:

NCP a is reloaded over link ab; NCP a is now a remote (link-loaded) NCP. Link-loaded NCPs cannot communicate with other link-loaded NCPs. Therefore, NCP a cannot communicate with NCP c, NCP d, or any of their attached resources.

Level 3 of ACF:

Controller C1 is reloaded over link ab. The function provided by a link-loaded NCP is the same as that provided by a channel-loaded NCP. NCP a can communicate with NCP c, NCP d, and their attached resources.

Figure 3-9. Improved Network Recovery with Extended NCP Interconnection

Improved shareability of resources, together with the availability of alternate routes between subareas, can improve the ability of an SSCP to take over control of a resource when the current owner (SSCP), or the path to that owner, has become inoperative. These capabilities, along with the SSCP restart and SSCP takeover functions described in topics that follow, can improve the availability of a network--that is, its ability to continue functioning despite temporary failures of certain of its elements.

Alternate Routing when a Virtual Route Is Lost

If a virtual route is lost because one or more of the physical elements in its supporting explicit route becomes inoperative, the access methods and network control programs notify all logical units participating in LU-LU sessions using the route, the primary logical units participating in pseudo LU-LU sessions with BSC/SS stations, and all SSCPs involved in the SSCP-SSCP, SSCP-PU, and SSCP-LU sessions, that the sessions have been terminated. The SSCPs and logical units can then reinitiate the sessions, assuming that the corresponding end users wish to continue communicating and that an alternate virtual route is available.

An SNA session may be reestablished over an available alternate route in the same class of service, or a different class of service may be specified. If no other virtual route is available in the same or different class of service, the session cannot be reestablished. A route must become available in order for the session to be reestablished.

Because failure of an explicit route is disruptive to data flow, the logical units participating in each disrupted session must perform resynchronization processing to determine whether data was lost and react accordingly.

One kind of failure does not cause sessions to be disrupted. Because of the way data is queued for a transmission group, the failure (or deactivation) of a link in a multiple-link transmission group causes the data for all sessions using the link to be sent instead over a different link in the same group. Therefore, unless the failing link was the only link in the group, no sessions are interrupted and no data is lost.

Level 3 of ACF provides the same alternate routing capabilities for non-SNA stations as it does for SNA stations, with the following difference. In ACF/TCAM, non-SNA stations may be specified as eligible or ineligible to participate in cross-domain sessions. A station specified as eligible is subject to the same class-of-service selection as is an LU-LU session. On the other hand, class-of-service selection is not available for a station specified as ineligible to participate in cross-domain sessions. The virtual route assigned to sessions with ineligible stations is the same virtual route used for SSCP-PU sessions between the SSCP and the network control program that controls the stations.

Nondisruptive SSCP Restart

In prior levels of ACF, any reestablishment of an SSCP-PU or SSCP-LU session following failure of a network element in the route used by such sessions causes any active cross-domain LU-LU sessions involving corresponding LUs to be disrupted. With Level 3 of ACF, these LU-LU sessions are not interrupted by restarting the SSCP-PU or SSCP-LU sessions, provided that the associated physical units are capable of being reactivated without themselves resetting their logical units. Nondisruptive restart is available only for SNA stations supporting the function on nonswitched links;

available only for SNA stations supporting the function on nonswitched links; this function does not apply to SNA stations on switched links nor to any non-SNA stations.

SSCP Takeover

In networks controlled by Level 3 of ACF, a backup SSCP designated by the user can take over certain resources of a failed SSCP without disrupting any current LU-LU sessions involving those resources. (The physical units associated with the LUs must be capable of being reactivated without themselves resetting their logical units, as stated in the previous topic, "Nondisruptive SSCP Restart") Prior levels of ACF also permit a backup SSCP to acquire resources, but in every case the LU-LU sessions for acquired LUs are disrupted.

Whenever the SSCP-PU session for the network control program is interrupted, the network control program informs all remaining SSCPs that own it (that is, have issued Activate commands for it) of the loss of the SSCP. The SSCPs, in turn, notify their respective network operators by operator-awareness messages. The operators can then perform the appropriate, installation-defined takeover procedures. At a convenient time, after the original SSCP is active again, the operators can cause the backup SSCP to relinquish the resources it acquired. The procedure is:

1. Terminate the LU-LU sessions for the resources acquired by the backup SSCP.
2. Relinquish the backup SSCP's ownership of those resources.
3. Reestablish the original SSCP's ownership of the resources.

Reducing Cross-Domain Resource Definitions

ACF/TCAM, Version 2, Release 3, simplifies the task of specifying a network by removing the requirement of defining every cross-domain resource to each domain that is to receive session-initiation requests from such resources.

Cross-domain resources need only be defined in the domain that initiates the requests. Besides simplifying the task of specifying a network, this capability facilitates changing the network configuration. After a station is added to a network via the dynamic reconfiguration facility, it can request a session with a host LU in any domain. Defining the added station or its logical units to the domain beforehand is not necessary, provided that ACF/TCAM session-authorization processing in the domain will accept the session-initiation request.

Chapter 4. Migration and Planning Considerations

ACF/TCAM, Version 2, uses the OS/VS1 or the OS/VS2 (MVS) operating system. ACF/TCAM can be used with any of the host processors that use these operating systems and have the conditional swapping feature. This chapter has information on migrating from earlier versions of TCAM, the releases of ACF/NCP/VS required for ACF/TCAM, Version 2, functions, and device charts.

Migrating From TCAM 10 or ACF/TCAM, Version 1, to ACF/TCAM, Version 2

TCAM 10 will operate with the following network control programs:

- NCP/VS, Version 5
- ACF/NCP/VS, Release 1
- ACF/NCP/VS, Release 2 (with appropriate TCAM 10 PTFs)

ACF/TCAM, Version 1, will operate with the following network control programs:

- NCP/VS, Version 5
- ACF/NCP/VS, Release 1
- ACF/NCP/VS, Release 2 (with appropriate ACF/TCAM, Version 1, PTFs)
- ACF/NCP/VS, Release 3 (with appropriate ACF/TCAM, Version 1, PTFs)

ACF/TCAM, Version 2, Releases 1, 2, and 3, will operate with the following network control programs:

- NCP/VS, Version 5
- ACF/NCP/VS, Release 1 (with appropriate ACF/NCP/VS PTFs)
- ACF/NCP/VS, Release 2 (with appropriate ACF/NCP/VS PTFs)
- ACF/NCP/VS, Release 3

Functions supported by TCAM 10 or ACF/TCAM, Version 1 (with the appropriate network control program), are also applicable for ACF/TCAM, Version 2, with the following exceptions:

- A host node cannot be used as a transient node (intermediate network node)
- OS/VS2 SVS does not operate with ACF/TCAM, Version 2

Network Control Programs Required for Specific New ACF/TCAM, Version 2, Functions

The following ACF/TCAM, Release 1, functions can be used with NCP/VS, Version 5, and ACF/NCP/VS, Releases 1, 2, and 3:

- Enhanced dynamic display of NCP storage (with appropriate NCP/VS, Version 5 PTF)
- Station-operator-initiated SDLC link test (with appropriate NCP/VS, Version 5, PTF)
- ACF/TCAM's use of the Programmed Cryptographic Facility program product

The following ACF/TCAM, Release 1, functions can be used with ACF/NCP/VS Release 1, 2, or 3:

- Multisystem Networking Facility support of channel-attached 3790 Systems and 3274 Control Units
- ACF/TCAM's use of the Network Communications Control Facility program product

The following ACF/TCAM, Release 1, functions can be used with ACF/NCP/VS, Releases 2 and 3:

- Negotiable session-initiation parameters for secondary LUs
- Network-operator-initiated SDLC link test
- Intensive mode recording of SDLC data link errors
- Dynamic reconfiguration of SNA devices
- ACF/TCAM's use of 3705-II Communications Controller, Models J, K, and L

For ACF/TCAM, Release 2, the subsystem interface function can be used with: NCP/VS, Version 5, and ACF/NCP/VS, Releases 1, 2, or 3.

With the exception of dynamic NCP dump support and reduced cross-domain definitions, the new capabilities of ACF/TCAM, Version 2, Release 3, are supported only in conjunction with ACF/NCP/VS, Release 3. The dynamic NCP dump capability can be used with NCP/VS, Version 5, and all releases of ACF/NCP/VS. Reduction of definition requirements for cross-domain resources is available with all releases of ACF/NCP/VS.

Multiple-Domain Considerations

The following ACF/TCAM, Version 2, enhancements are effective (1) between two hosts containing ACF/TCAM, Version 2, and (2) between a host containing ACF/TCAM, Version 2, and a host containing ACF/VTAM, Release 2:

- Negotiable session-initiation parameters
- Channel-attached 3274 Control Unit and 3790 Communication System
- ACF/TCAM's use of the Network Communications Control Facility program product[1]

ACF/TCAM, Version 2, can use the Programmed Cryptographic Facility program product only when communicating with a host containing ACF/TCAM, Version 2, or any release of ACF/VTAM.

The following enhancement is effective only from a host containing ACF/TCAM, Version 2, when communicating with a host containing ACF/TCAM, Version 1 or 2, or containing ACF/VTAM, Release 1: channel-attached 3274 and 3790 networking

A host with ACF/TCAM, Version 2, Release 3 can coexist in a multiple-domain network with hosts containing any of the access methods listed below.

- ACF/TCAM, Version 1
- ACF/TCAM, Version 2, Releases 1 and 2
- ACF/VTAM, Releases 1, 2, and 3

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[1]Also effective between (1) ACF/TCAM, Version 2, and ACF/TCAM, Version 1, hosts and (2) between ACF/TCAM, Version 2, and ACF/VTAM, Release 1, hosts.

In such cases, however, the function available with ACF/TCAM, Release 3, will be determined by the capabilities of the access method with which it communicates, and is generally that of the earliest level access method.

Devices That Can Be Used with ACF/TCAM Version 2

Host Processors

ACF/TCAM, Version 2, can operate in any of the host processors used for OS/VS1 and OS/VS2 MVS; ACF/TCAM requires that the processor be capable of executing Compare and Swap instructions.

Direct-Access Storage Devices

For disk message queues:

- 2314 Storage Control
- 3330 Disk Storage Models 1 and 2
- 3340 Disk Storage and Control
- 3350 Direct Access Storage

For checkpoint data sets, all of the devices listed for disk message queues can be used; rotational position sensing (RPS) is not used.

For COMWRITE data sets, all devices supported by the Basic Sequential Access Method (BSAM) can be used.

Communications Controllers

- IBM 3705-I Communications Controller
- IBM 3705-II Communications Controller

Transmission Control Units

- IBM 2701 Data Adapter Unit
- IBM 2702 Transmission Control
- IBM 2703 Transmission Control

SNA Cluster Controllers

- IBM 3274 Control Unit
- IBM 3276 Control Unit Display Station
- IBM 3601 Finance Communication Controller
- IBM 3631 Plant Communication Controller
- IBM 3632 Plant Communication Controller
- IBM 3791 Controller
- IBM 8130 Processor
- IBM 8140 Processor

Communication System Devices

All of the communication devices that can be used with ACF/TCAM, Version 2, are listed in Figure 4-1; the figure also lists the devices that can use the subsystem interface in ACF/TCAM, Release 2. Figure 4-2 lists the devices that can use the teleprocessing online test executive (TOTE).

Start-Stop Stations	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	Subsystem Interface
1030 Data Collection System	√	—	—	—	—
1050 Data Communication System	√	√	√	√	—
1060 Data Communication System	√	—	—	—	—
2260 Display Station	√	—	√	—	—
2265 Display Station	√	—	√	—	—
2740 Communication Terminal	√	√	—	—	—
2741 Communication Terminal	√	√	√	√	—
2760 Optical Image Unit	√	—	—	—	—
AT&T 83B3 or WU 115A (Line Control Type)	√	√	—	—	—
CPT-TWX (M33/35)	Note 1	Note 1	Note 1	Note 1	—
WT Teletype (CC1TT 2 and 5)	√	√	—	—	—

BSC Stations	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	Subsystem Interface
1130 Computing System	√	√	—	—	—
1826 Data Adapter Unit	√	√	—	—	—
2715 Transmission Control	√	√	—	—	—
2770 Data Communication System	√	√	—	—	—
2780 Data Transmission Terminal	√	√	—	—	—
2972 General Banking Terminal System	Note 2	Note 2	—	—	—
3270 Information Display System	Note 2	Note 2	Note 2	Note 2	Note 2
3670 Brokerage Communication System	√	—	—	—	—
3735 Programmable Buffered Terminal	√	√	—	—	—
3740 Data Entry System	√	√	—	—	—
5110 Portable Computer	√	√	—	—	—
System/3	√	√	—	—	—
System/360, Model 20	√	—	—	—	—
System/360	√	√	—	—	—
System/370	√	√	—	—	—

SDLC Stations	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	Subsystem Interface
3270 Information Display System	—	Note 3	—	Note 3	Note 3
3600 Finance Communication System	—	√	—	—	√
3614 Consumer Transaction Facility	—	Note 2	—	—	Note 2
3624 Consumer Transaction Facility	—	Note 2	—	—	Note 2
3650 Programmable Store System, Models A25, B25, A75, B75, C75, and D75	—	—	—	—	√
3767 Communication Terminal	—	√	—	√	√
3770 Data Communication System	—	√	—	—	√
3790 Communication System	—	√	—	Note 6	√
6670 Information Distributor	—	√	—	—	Note 4
Series/1	—	√	—	—	—

Notes:

1. On switched lines only.
2. On nonswitched lines only.
3. 3276-11, -12, -13, -14 on both switched and nonswitched lines; 3271-11, -12, 3274-1C, and 3275-11, -12 on nonswitched lines only.
4. Configurations 9165 and 9169 only.
5. Supported as 2740-1 on both switched and nonswitched lines; supported as 2740-2 on nonswitched lines only.
6. TSO support applies only to 3790 with 3270 data stream compatibility.

Figure 4-1. Communication Devices and Stations Supported by ACF/TCAM, Version 2 (Part 1 of 3)

Stations Supported as Compatible SS Stations

Station	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	SUBSYSTEM INTERFACE
3767 Communication Terminal (as 2740)	Note 5	Note 5	–	–	–
3767 Communication Terminal (as 2741	√	√	√	√	–
5100 Portable Computer (as 2741)	√	√	√	√	–
5110 Portable Computer (as 2741)	√	√	√	√	–
Communicating Magnetic Card SELECTRIC Typewriter (as 2741)	√	Note 1	√	√	–
System/7 (as 2740)	√	√	–		–

Stations Supported as Compatible BSC Stations

Station	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	SUBSYSTEM INTERFACE
3274 Control Unit, Model 1C (as 3271)	Note 2	Note 2	Note 2	Note 2	Note 2
3276 Control Unit Display Station, Models 1, 2, 3, and 4 (as 3271)	Note 2	Note 2	Note 2	Note 2	Note 2
3770 Data Communication System (as 2770)	√	√	–	–	–
3780 Data Transaction Terminal (as 2770)	√	√	–	–	–
5275 Direct Numerical Control Station (as 3275)	Note 2	Note 2	Note 2	Note 2	Note 2
6670 Information Distributor (as 2770)	√	√	–	–	–
8100 Processor (as 3270)	Note 2	Note 2	Note 2	Note 2	Note 2
Series/1 (as System/3)	–	√	–	–	–
System/7 (as System/3)	√	√	–	–	–
System/32 (as System/3)	√	√	–	–	–
System/34 (as System/3)	√	√	–	–	–

Stations Supported as Compatible SDLC Stations

Station	ACF/TCAM via EP	ACF/TCAM via NCP	TSO via EP	TSO via NCP	SUBSYSTEM INTERFACE
3270 Information Display Station (as 3790)	–	√	–	√	√
3631 Plant Communication Controller (as 3601)	–	√	–	√	–
3632 Plant Communication Controller (as 3602)	–	√	–	√	–
3770 Data Comunication System (as 3767)	–	√	–	√	√
5937 Industrial Terminal	–	–	–	–	√
8130 Processor (as 3791)	–	√	–	√	√
8140 Processor (as 3791)	–	√	–	√	√
System/32 (as 3770)	–	√	–	√	√
System/34 (as 3767, 3770, 3791)	–	√	–	√	√
System/38 (as 3770)	–	√	–	√	√

Notes:

1. On switched lines only.
2. On nonswitched lines only.
3. 3276-11, -12, -13, -14 on both switched and nonswitched lines; 3271-11, -12, 3274-1C, and 3275-11, -12 on nonswitched lines only.
4. Configurations 9165 and 9169 only.
5. Supported as 2740-1 on both switched and nonswitched lines; supported as 2740-2 on nonswitched lines only.
6. TSO support applies only to 3790 with 3270 data stream compatibility.

Figure 4-1. Communication Devices and Systems Supported by ACF/TCAM, Version 2 (Part 2 of 3)

Stations Supported via Local Attachment	ACF/TCAM	TSO	Subsystem Interface
2260 Display Station	√	√	–
2715 Transmission Control Unit	√	–	–
3270 Information Display System (3272-1, -2; 3274-1A, -1B, -1D)	√	√	√
3790 Communication System, Configurations 9165 and 9169 only	√	Note 6	√
7770 Audio Response Unit	√	–	–

Notes:

1. On switched lines only.
2. On nonswitched lines only.
3. 3276-11, -12, -13, -14 on both switched and nonswitched lines; 3271-11, -12, 3274-1C, and 3275-11, -12 on nonswitched lines only.
4. Configurations 9165 and 9169 only.
5. Supported as 2740-1 on both switched and nonswitched lines; supported as 2740-2 on nonswitched lines only.
6. TSO supported applies only to 3790 with 3270 data stream compatibility.

Figure 4-1. Communication Devices and Stations Supported by ACF/TCAM, Version 2 (Part 3 of 3)

Control Station	Test Device	Alternate Printers	
X	X	X	*IBM 1030 Data Collection System
X	X	X	IBM 1050 Data Communication System
X	X	X	*IBM 1060 Data Communication System
	X		IBM 1130 Computing System (station)
X	X	X	*IBM 2260 Display Station with IBM 2848 Display Control (local and remote)
X	X	X	*IBM 2265 Display Station with IBM 2845 Display Control
X	X	X	IBM 2740 Communication Terminal (Models 1 and 2)
X	X	X	IBM 2741 Communication Terminal
X	X	X	*IBM 2760 Optical Image Unit
X	X	X	IBM 2770 Data Communication System
X	X	X	IBM 2780 Data Transmission Terminal
	X		IBM 2790 Data Communication System
X	X	X	IBM 3270 Information Display System (Models 11 and 12)
X	X	X	IBM 3275 Display Station
X	X	X	IBM 3277 Display Station
	X	X	IBM 3284 Printer
	X	X	IBM 3286 Printer
X	X	X	*IBM 3670 Brokerage Communication System
X	X	X	IBM 3767 Communication Terminal (Models 1 and 2)
X	X	X	IBM 3770 Communication Terminal (Models 1 and 2)
	X	X	IBM 3780 Data Communication Terminal
	X		IBM System 360/Model 20 (station)
	X		IBM System/360, Models 25 and above (station)
	X		IBM System/370, Models 125 and above

*Supported by TOTE on 2701, 2702, and 2703 lines only.

TOTE supports the following control units:

Control Terminal	Test Device	Alternate Printers	
	X		IBM 2701 Data Adapter Unit
	X		IBM 2702 Transmission Control
	X		IBM 2703 Transmission Control
	X		IBM 2715 Transmission Control Unit
	Note 2		IBM 3271 Control Unit, Models 1, 2 and 11, 12
	Notes 1 and 2		IBM 3272 Control Unit
	Note 1		IBM 3705 Communications Controllers
	X		IBM 7770 Audio Response Unit Model 3

In addition, if the test device is a symbolically named link off the 3705, TOTE will run a test to the link. These tests may test 3705 hardware, modems, autocall adapters, or exercise the SDLC link with the test command.

Notes:

1. In OS/VS1 only.
2. Tested by certain test when run against the appropriate 3275, 3277, 3284, and 3286.

Figure 4-2. Devices That Can Be Used with TOTE

Glossary

This glossary contains definitions reproduced from the *American National Dictionary for Information Processing*, copyright 1977 by the Computer and Business Equipment Manufacturers Association, copies of which may be purchased from the American National Standards Institute at 1430 Broadway, New York, New York 10018.

ANSI definitions are identified by an asterisk. The symbol (ISO) at the beginning of a definition indicates that the definition has been approved for inclusion in the *Data Processing Vocabulary* of the International Organization for Standardization. The symbol (SC1) indicates that the definition is from an early working paper of ISO Technical Committee 97/Subcommittee 1 and that agreement has not yet been reached among its members.

ACF: Advanced Communications Function.

Advanced Communications Function (ACF): A group of three IBM program products (ACF/TCAM, ACF/VTAM, ACF/NCP/VS) that use the concepts of SNA and the capabilities of such products as the IBM 3705 Communications Controllers, SNA cluster controllers, and terminals to support online applications in large or small networks. The Multisystem Networking Facility of ACF/TCAM, ACF/VTAM, and ACF/NCP/VS allows the interconnection of two or more domains into one consolidated and coordinated multiple-domain network. See also *Multisystem Networking Facility*.

Advanced Communications Function for the Telecommunications Access Method (ACF/TCAM): The method used to transfer data between main storage and remote or local stations. ACF/TCAM application programs use either GET and PUT or READ, WRITE, and CHECK macro instructions to request the transfer of data, which is performed by message handlers. The message handlers synchronize the transfer, thus eliminating delays for station input/output operations. The Multisystem Networking Facility is an optional feature of ACF/TCAM that allows a multiple-domain network to be created.

alternate extended route: An extended route between a pair of host nodes, used to route messages in a particular transmission category when the primary extended route for that transmission category is unavailable due to the failure of a component. See also *extended route, primary extended route, route*.

AMH: Application message handler.

API: Application program interface. See also *GET/PUT interface* and *subsystem interface*.

application message handler (AMH): A user-defined routine that processes messages that are received by the message control program (MCP) from an application program or that are sent by the MCP to an application program. See also *message handler*. Contrast with *device message handler*.

application program: A program written for or by a user that applies to the user's work. In ACF/TCAM, a program that uses the GET/PUT interface.

asynchronous: Without regular time relationship; unexpected or unpredictable with respect to the execution of a program's instructions.

automatic purge/copy/redirect: A collection of message-handler and extended operator control functions that permit messages to be conditionally or unconditionally redirected to another destination, copied to another destination, or purged (that is, not sent to any destination).

basic networking: Functions available with the Multisystem Networking Facility that are basic to all SNA-based networks. Contrast with *extended networking*.

basic operator command: An operator command directed to the basic operator control system service program (SSP).

basic operator control SSP: A *system service program* that processes a set of basic operator commands that allow the operator to determine the status of the network and to alter, activate, and deactivate portions of that network by entering appropriate commands from the system console, a remote station, or an application. The basic operator control SSP is required in order to execute an ACF/TCAM, Version 2, message control program.

binary synchronous communication (BSC): Communication using binary synchronous line discipline. See *binary synchronous transmission*.

binary synchronous transmission: Data transmission in which synchronization of characters is controlled by time signals generated at the sending and receiving stations. Contrast with *start-stop transmission* and *synchronous data link control*.

bind image: In SNA, a string of parameters specifying allowable protocols for LU-LU sessions.

broadcast: The simultaneous transmission of data to a number of stations.

BSC: Binary synchronous communication.

BSC or SS station: A station on a BSC or start-stop line.

buffer: (1) *A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another. (2) An area of storage that is temporarily reserved for use in performing an input/output operation, into which data is read or from which data is written.

channel: See *data channel*.

channel-attached: A station or communications controller that is connected directly to a host processor's data channel by a local cable. Contrast with *link-attached.*

checkpoint: To periodically record information about ACF/TCAM's environment; this information is used to re-create that environment when ACF/TCAM is restarted following closedown or a system failure.

checkpoint data set: An optional ACF/TCAM data set that contains the checkpoint records used to reconstruct the message control program's environment after closedown or system failure when the ACF/TCAM checkpoint/restart facility is utilized.

checkpoint records: Records that contain the status of a job and the system at the time the records are written by the checkpoint routine. These records provide the information necessary for restarting a job without having to return to the beginning of the job.

checkpoint/restart facility: A facility that records the status of the network at designated intervals or following certain events. After system failure, the system can be restarted and continue without loss of messages.

class of service: A list of several virtual routes to which an LU-LU session may be assigned. See also *virtual route.*

closedown: The orderly deactivation of the message control program.

cluster controller: A device that can control the input/output operations of more than one device. See also *communication controller.*

CMC: Communications management configuration.

cold restart: Startup of a message control program (MCP) following either closedown or system failure. A cold restart ignores the previous environment (that is, the MCP is started as if this were the initial startup). It is the only type of restart possible when no checkpoint/restart facility is used. Contrast with *warm restart.*

communication control unit: Either a *communications controller* or a *transmission control unit* (TCU).

communications controller: A type of communication control unit whose operations are controlled by a program stored and executed in the unit. It manages the details of line control and routing of data through a network. It can route data to the host processor, or it can route data to or from a cluster controller or station. As used in this publication, the term applies exclusively to the IBM 3705 Communications Controller. Contrast with *transmission control unit.* See also *cluster controller.*

communication management configuration (CMC): A configuration available with Level 3 of ACF in which a single SSCP owns and controls all of the resources in a network.

communication management processor: In a communication management configuration, the host processor that owns and controls all resources in the network. Contrast with *data host.*

COMWRITE: A sequential data set in which trace information is written.

cross-domain: Pertaining to data communication between *domains.*

cross-domain communication: Synonym for *networking.*

cross-domain LU: A logical unit (LU) located in another domain.

cryptographic: Pertaining to the transformation of data to conceal its meaning.

data channel: A device that connects a processor with the I/O control units. Synonymous with *I/O channel.*

data host: In a communication management configuration, a host processor that owns no network resources, including its channel-loaded network control programs. Contrast with *communication management processor.*

data link: See *link.*

data staging: An extended networking technique in which high-volume, low-priority message traffic is moved from one host node to another, progressively approaching the destination host. Data staging allows such traffic to be moved at a convenient time to avoid overloading cross-domain links and to protect response times for high-priority cross-domain inquiries.

decipher: The process of converting enciphered data into clear data. Synonymous with *decrypt.* Contrast with *encipher.*

decrypt: Synonym for *decipher.*

destination: The place to which a message being handled by an ACF/TCAM message handler is to be sent.

device message handler (DMH): A user-defined routine that processes messages being received by the message control program (MCP) from a station or being sent by the MCP to a station. See also *message handler.* Contrast with *application message handler.*

direct access storage device (DASD): A device in which the access time is effectively independent of the location of the data.

distributed function: The use of programmable stations and controllers to perform operations that are otherwise done by the host processor, such as network control, processing, and error-recovery operations.

DMH: Device message handler.

domain: The collection of network resources controlled by one SSCP located. See also *multiple-domain network*, *single-domain network*.

dynamic accounting facility: An ACF/TCAM *service facility* that gathers resource utilization data for processing by user-supplied applications.

emulation mode: The function of a network control program (NCP/VS or ACF/NCP/VS) that enables it to emulate a transmission control unit. Contrast with *network control mode*.

emulation program (EP): A control program that allows a channel-attached 3705 Communications Controller to emulate the function of an IBM 2701 Data Adapter Unit, IBM 2702 Transmission Control, or an IBM 2703 Transmission Control. Contrast with *network control program*.

encipher: The process of converting clear data into *enciphered data*. Synonymous with *encrypt*. Contrast with *decipher*.

enciphered data: Data that is intended to be illegible to all except those who legitimately possess the means to reproduce the clear data.

end user: The ultimate source or destination of information flowing through the network. It may be an application program, an operator, or a data medium (such as cards or tapes).

end user-SSCP echo test: A diagnostic aid that permits an SNA station operator to ensure that the path to the owning host is functional.

EP: Emulation program.

error record: Five bytes assigned to each message processed by a message handler. These bytes indicate physical or logical errors that have occurred during transmission or during subsequent processing or queuing of the message; they are checked by error-handling macros in the inmessage and outmessage subgroups of a message handler. Synonymous with *message error record*.

error-recovery procedures: A set of internal ACF/TCAM routines that attempt to recover from transmission errors.

EU-SSCP echo test: See *end user-SSCP echo test*.

explicit route: A sequence of physical network elements (such as links and communications controllers) over which two subareas communicate. See also *subarea*. Contrast with *virtual route*.

extended NCP interconnection: The capability available with ACF/NCP/VS, Release 3, that allows the same functions to be performed by both channel-loaded and link-loaded network control programs (ACF/NCP/VSs, Release 3). With this capability, any communications controller can be connected to to any other communications controller in the network.

extended NCP ownership: A capability available with Level 3 of ACF that allows the link between two network control programs to be owned by a maximum of eight SSCPs.

extended network: A multiple-domain network that is controlled by the ACF/TCAM extended networking capability.

extended networking: A collection of ACF/TCAM macros, system service programs, and message-handler facilities that facilitate network definition, network management, and error recovery in a *multiple-domain network*.

extended operator command: An operator command directed to the extended operator control system service program (SSP).

extended operator control SSP: A *system service program* that supports a set of extended operator commands that are not required in order to control an ACF/TCAM network, but that are useful in some data communication environments. The extended operator control SSP is required if one or more of the following ACF/TCAM functions is used by the MCP:

- The extended networking capability
- The online retrieval SSP
- The automatic purge/copy/redirect capability

extended route: In an extended network, a series of one or more SNA routes connecting one host node to another host node. See also *alternate extended route* and *primary extended route*.

GET/PUT interface: The means by which user-written ACF/TCAM application programs communicate with the message control program using either GET/PUT macros or READ/WRITE/CHECK macros. Use of one of these sets of macros is implied when this term is used. Contrast with *subsystem interface*.

host LU: An SNA logical unit (LU) in a host processor; an ACF/TCAM host LU consists of a DMH, an LU services component, and MCP code. Contrast with *outboard LU*.

host node: In SNA, a node that contains a *host processor*. An example is a System/370 computer with OS/VS2 and ACF/TCAM.

host processor: The controlling processor with its operating system, access method, and application programs. A *system services control point (SSCP)* may be located in the host processor.

incoming message: A message transmitted from a station to the host processor.

initiator: The component of ACF/TCAM that is executed as the job-step task. The initiator starts, monitors, and restarts the message control program, ACF/TCAM system service programs, and user-supplied system service programs. It also provides abend dump facilities and is capable of displaying status information at the system console.

inquiry/reply: An ACF/TCAM application in which a device message handler receives a message from a station and then routes it to an application program that processes the data in the message and generates a reply; the reply is routed by the device message handler to the inquiring station.

internodal awareness SSP: In an extended network, a *system service program* in a host node that communicates with internodal awareness SSPs in other host nodes to:

1. Monitor the status of other host nodes in the network and inform other host nodes of the presence of its own host node.
2. Monitor the status of applications located in other domains of the network and inform other host nodes of the status of applications located in its own host.

internodal sequence number synchronization SSP: A *system service program* that operates in an extended network. It (1) requests retransmission from any cross-domain host node of sequence-numbered messages not received on a utility session and (2) retransmits sequence-numbered messages flowing on a utility session when requested to do so by another host node or an extended operator command. Internodal sequence number synchronization SSPs in all host nodes in the extended network cooperate with each other to perform these functions.

I/O channel: Synonym for *data channel.*

Level 3 of ACF: ACF/TCAM, Version 2, Release 3; ACF/VTAM, Release 3; and ACF/NCP/VS, Release 3.

line: (1) Any physical medium, such as a wire or telephone circuit, that connects one or more stations to a *communication control unit.* (2) Loosely, a data link; see *link.*

link: (1) In SNA, the physical connections and the connection protocols between network control programs and between *network control programs* , and *cluster controllers* and *terminals.*

link-attached: A station or communications controller that is connected to a channel-attached communications controller by means of a data link. Contrast with *channel-attached.*

link test level 2: A diagnostic aid that provides the capability to test a single SNA station on a nonswitched link while other stations on the link remain available to the host.

load balancing: An extended networking technique for balancing the message flow between any pair of host nodes by assigning different paths to different messages flowing between the nodes.

local: See *channel-attached.*

local station: A station whose control unit is connected directly to a computer data channel by a local cable. Also referred to as a channel-attached station. Contrast with *remote station.*

log data set: A data set consisting of the messages or message segments recorded on a secondary-storage medium by the ACF/TCAM logging facility.

logical unit (LU): The means by which an end user accesses the network in order to communicate with another end user. It is also the means by which an end user accesses the services provided by the *system services control point* (SSCP). See also *host LU, outboard LU, physical unit, system services control point.*

logging service facility: An ACF/TCAM *service facility* that selectively causes messages or message segments to be copied onto a sequential storage medium. The log produced by the logging service facility provides a record of message traffic through the MCP.

LU: Logical unit.

LU-LU session: In SNA, a session between two logical units in the network. It provides communication between two *end users*, each associated with one of the logical units.

MCP: Message control program.

message: A combination of characters and symbols transmitted from one point to another in a network.

message control program (MCP): A generic term referring to any specific implementation of an ACF/TCAM access method, including I/O routines, buffering routines, activation and deactivation routines, service facilities, and SNA support.

message error record: Synonym for *error record.*

message handler (MH): A sequence of user-specified macro instructions that invoke routines that examine and process control information in message headers and perform functions necessary to prepare messages for forwarding to their destinations.

message priority: The order in which messages in a destination queue are transmitted to a destination, relative to each other. Higher-priority messages are forwarded before lower-priority messages. See also *transmission priority.*

message queue data set: An ACF/TCAM data set that contains one or more destination queues.

message routing: A major MCP function, which involves determining the correct destination for each message entered from a station, LU, or application and placing each message on the appropriate destination queue.

MH: Message handler.

MSNF: Multisystem Networking Facility

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

multiple routing: A capability available with Level 3 of ACF that allows up to eight physical routes between a pair of subareas.

Multisystem Networking Facility (MSNF): An optional feature of ACF/TCAM and ACF/VTAM that permits these access methods, together with ACF/NCP/VS, to control a *multiple-domain network.*

NCP: Network control program; this generic term is used in this publication when referring to NCP/VS, Version 5, and ACF/NCP/VS, Releases 1, 2, and 3.

network: In data processing, a user-application network.

network control program: A control program for the IBM 3705 Communications Controller generated by the user from a library of IBM-supplied modules. As used in this publication, network control program refers to the IBM programs NCP/VS, Version 5, and ACF/NCP/VS, Releases 1, 2, and 3. Contrast with *emulation program.*

networking: In a multiple-domain network, communication between domains. Synonymous with *cross-domain communication.*

node: In SNA, an addressable point in a network.

nonswitched line: A connection between a *remote station* and a *host processor* that does not have to be established by dialing. Contrast with *switched line.*

online retrieval SSP: A *system service program* that allows operators at designated stations or logical units (LUs) to retrieve disk-queued messages based upon origin or destination, time of entry, or input or output sequence number.

operator command: A command entered at an operator control station, the system console, or from an application program to examine or alter the status of the network during execution.

operator control: See *basic operator control SSP* and *extended operator control SSP.*

option field: A storage area containing data relating to a particular station, component, line, or application program. Certain message-handler routines that need origin- or destination-related data to perform their functions have access to data in an option field. User-written message-handler exit routines also have access to data in an option field.

outboard LU: An SNA logical unit (LU) located outside a host processor in an SNA cluster controller node or a terminal node. Contrast with *host LU.*

pacing: In SNA, a technique by which a receiving LU controls the rate of transmission of a sending LU to prevent overrun. See also *route pacing.*

parallel links: Two or more SDLC links between two network control programs (ACF/NCP/VS, Release 3).

primary logical unit (PLU): A logical unit that issues a Bind Session request to establish an *LU-LU session;epi10. the logical unit that controls an LU-LU session. Contrast with secondary logical unit.* See also *logical unit.*

public network: A network established and operated by communication common carriers or telecommunications Administrations for the specific purpose of providing circuit-switched, packet-switched, and leased-circuit services to the public. Contrast with *user application network.*

queue: (1) A line or list formed by items in a system waiting for service; for example, tasks to be performed or messages to be transmitted in a message-routing system. (2) To arrange in, or form, a queue. See also *queuing.*

queuing: The programming technique used to handle transactions arriving at an unpredictable rate. See also *queue.*

remote: See *link-attached.*

remote station: A station that is connected to a computer data channel through either a communication control unit or an audio response unit. Also referred to as a link-attached station. Contrast with *local station.*

route: In an SNA network, a series of interconnected SDLC links and SNA nodes over which messages flow from one subarea to another subarea.

route pacing: The monitoring and flow-control mechanism that ACF/TCAM uses to alleviate congestion on virtual routes. See also *pacing.*

route verification: A capability available with ACF/TCAM, Version 2, Release 3, which allows the network operator to verify that any or all explicit routes between the ACF/TCAM subarea and any other subarea are active and usable.

save/restore message queues SSP: A *system service program* that saves unsent messages on tape and restores them to an altered message control program (MCP) following a cold restart. This program also facilitates recovery when the message queue data set on nonreusable disk becomes full and may be used to obtain an online dump of unsent messages from one or more destination queues on disk.

SDLC: Synchronous data link control.

secondary logical unit (SLU): In an SNA LU-LU session, the partner that receives the Bind Session request.

service facility: An auxiliary routine designed to support the message control program (MCP). It runs under the control of the MCP itself and is invoked by the MCP on an as-needed basis. Contrast with *system service program* and *utility*.

session: See *SNA session*.

session outage notification: A procedure available with ACF/TCAM, Version 2, Release 3, which notifies the ends of an SNA session when a virtual route is interrupted.

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

SLU: Secondary logical unit.

SMQ: See *save/restore message queues SSP*.

SNA: Systems Network Architecture.

SNA session: A logical connection between two network addressable units (NAUs) to allow them to communicate. SNA sessions can exist between SSCPs (SSCP-SSCP session), between an SSCP and a physical unit (SSCP-PU session), between an SSCP and a logical unit (SSCP-LU session), and between logical units (LU-LU session).

SS: Start-stop transmission.

SSCP: System services control point.

SSCP backup: An ACF/TCAM facility allowing an SSCP located in one domain to assume ownership of resources located in an *adjacent domain*, either as a result of host-node failure in the adjacent domain or as a means of processor load-balancing.

SSCP-LU session: An SNA session between the system services control point (SSCP) and a logical unit (LU). It is used to support logical-unit-related control and use of the communication system. Each logical unit in the network must participate in session with the SSCP that provides services for that logical unit.

SSCP-PU session: An SNA session between the system services control point (SSCP) and a physical unit (PU) that is used to control the physical configuration of a network and to control an individual node.

SSP: See *system service program*.

startup/restart message generation facility: An ACF/TCAM *service facility* that generates and sends tailored messages to stations and outboard LUs when the message control program (MCP) is started or restarted.

start-stop (SS) transmission: Asynchronous transmission in which a group of bits is preceded by a start bit that prepares the receiving mechanism for the reception and registration of a character and is followed by at least one stop bit that enables the receiving mechanism to come to an idle condition pending the reception of the next character. Contrast with *binary synchronous transmission, synchronous data link control*.

station: (1) A point in a network at which data can enter or leave. (2) In SNA, one of the input or output points on an SDLC data link. (3) One or more computers, terminals, or devices at a particular location. See *NCP station, non-NCP station, SNA station non-SNA station*.

subarea: In terms of ACF/TCAM, the collection of resources directly controled by a message control program or a network control program.

subsystem interface: For ACF/TCAM, the subset of ACF/VTAM record-mode instructions that allows IBM-supplied subsystems to operate with ACF/TCAM, Version 2, Releases 2 and 3. Contrast with *GET/PUT interface*.

switched line: A communication line in which the connection between the host processor and a remote station is established by dialing. Contrast with *nonswitched line*.

synchronous data link control (SDLC): A discipline for managing synchronous, transparent, serial-by-bit information transfer over a communication channel. Transmission exchanges may be full-duplex or half-duplex over switched or nonswitched data links. The communication channel configuration may be point-to-point, multipoint, or loop. Contrast with *binary synchronous transmission, start-stop transmission*.

system service program (SSP): IBM-supplied or user-supplied programs that perform system-oriented auxiliary functions in support of the message control program (MCP). System service programs run under the control of the initiator as attached subtasks. See also *basic operator control SSP, extended operator control SSP, online retrieval SSP, save/restore message queues SSP, internodal awareness SSP, internodal sequence number synchronization SSP*.

system services control point (SSCP): In SNA, a network addressable unit that provides configuration, maintenance, and session services via a set of command processors—network services—supporting physical units and logical units. The SSCP must be in session with each logical unit and each physical unit for which it provides these services.

Systems Network Architecture (SNA): The total description of the logical structure, formats, protocols, and operational sequences for transmitting information units through a communication system.

TCAM: Telecommunications access method. See *Advanced Communications Function for the Telecommunications Access Method (ACF/TCAM).*

teleprocessing online test executive (TOTE): A facility that permits either a system console operator or a remote control station user to test transmission control units and remote stations that are not attached through the NCP.

terminal: Synonymous with *station.*

terminal node: An SNA station that uses IBM-supplied code for line and device control and is not programmable, having less processing capability than a cluster controller node. Examples are the IBM 3270, 3767, and 3770 systems. See also *host node, NCP node, cluster controller node.*

transmission category: A subset of the messages flowing over utility sessions in an extended network.

transmission control unit (TCU): A communication control unit whose operations are controlled solely by programmed instructions from the host processor to which the unit is attached; no program is stored or executed in the unit.

transmission group: (1) The logical connection between two network control programs (ACF/NCP/VS, Release 3). The group contains one or more active SDLC links. (2) The logical connection between the host processor and the network control program (ACF/NCP/VS, Release 3), even though this connection consists only of a single data channel.

TSO: Time sharing option. An optional configuration of the operating system providing conversational time sharing from remote stations.

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 common carriers or telecommunication Administrations. Contrast with *public network.*

utility: An auxiliary routine designed to support the message control program (MCP), which runs under the control of the operating system. Contrast with *system service program, service facility.*

utility session: In an extended network, a session used to transmit message traffic between host nodes. One utility session is established between each pair of host nodes for each transmission category defined for the pair of host nodes. Data messages being routed from host to host flow on the utility session corresponding to their transmission category.

virtual route: A logical connection between a pair of subareas that participates in session. Contrast with *explicit route.*

warm restart: Restart of ACF/TCAM following either a quick or a flush closedown; the ACF/TCAM checkpoint/restart facility restores the ACF/TCAM environment as nearly as possible to its condition before closedown or failure. Contrast with *cold restart.*

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