

Open Architecture and Call Control

Open Architecture Advantage

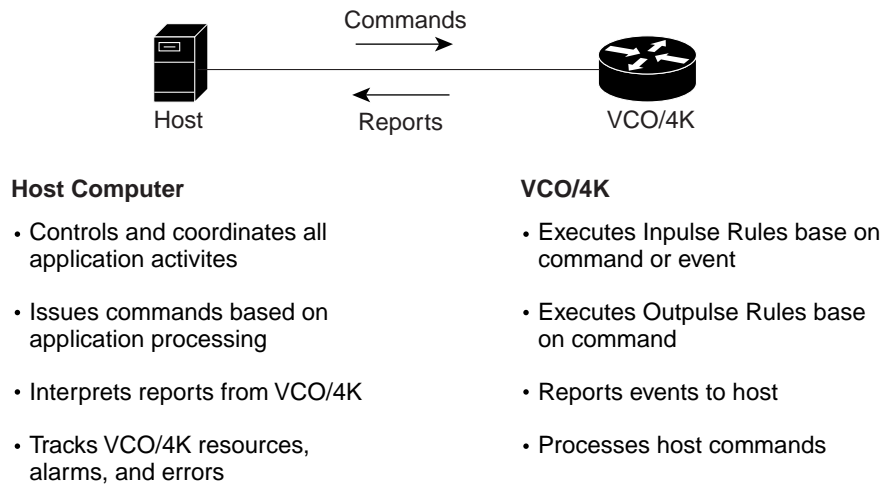
Cisco Systems' approach to open architecture enables the seamless integration of computer and telecommunication environments. With the VCO/4K, a host computer can not only initiate pre-defined call treatments, but also provide call control access to every aspect of call handling, delivering the power and flexibility of a fully open telecommunications system.

The VCO/4K's open architecture provides the following benefits:

- Call treatment is under the application developer's control, enabling rapid development and deployment of new services. You can add new services and features to an application by making minor modifications to VCO/4K resource definitions.
- Decoupled VCO/4K hardware and software architectures support the addition of new interfaces and service circuit types. The VCO/4K accelerates the adoption of new technology.
- Host communication interfaces and protocols are compatible with a variety of host computers—from PCs to mainframes. You can choose the host computer, operating system, and development language to suit an application.
- Support for a full range of network interface and service circuit types allows maximum flexibility.
- Standard interfaces are compatible with equipment from a variety of vendors, such as voice store-and-forward, facsimile, analog telsets, and others. You are never constrained to proprietary interfaces, or locked into a single vendor.
- The VCO/4K provides a consistent control interface for the host computer, regardless of the resource. This makes the VCO/4K an effective bridge between diverse network environments. For example, you can outpulse a called number collected in an ISDN D-channel message as multi-frequency (MF) digits; the VCO/4K performs the required translation.
- As a network concentrator, the VCO/4K dramatically improves trunk utilization, helps reduce investment in expensive computer and peripheral equipment, and reduces the cost of the overall application solution.

Most VCO/4K-based applications rely on interaction between a host computer and the VCO/4K. This interaction is characterized by the application's software architecture. Figure 3-1 illustrates the VCO/4K under host control.

Figure 3-1 VCO/4K Under Host Control



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Basic Application Architecture

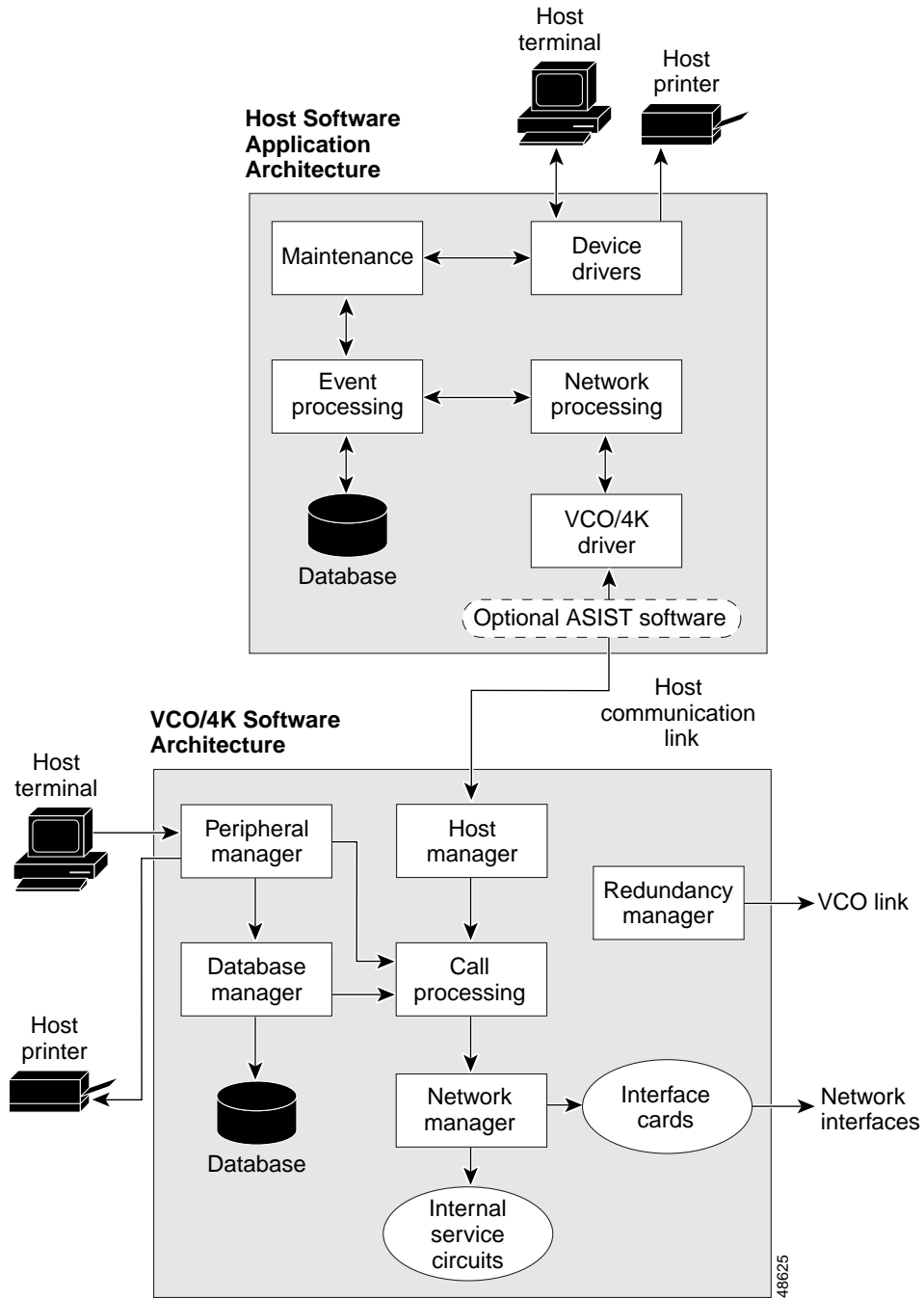
An application's software architecture defines the environment and processes required to implement the desired features and functions. VCO/4K-based applications use two integrated software architectures:

Generic Call Control (resident on the VCO/4K)—Provides multilevel call control, call processing, internal communication handling, system administration facilities, internal maintenance, and diagnostics.

Host Software (resident on the host)—Combines the operating system, programming language, existing applications, and VCO/4K-specific processes.

The VCO/4K generic and host application software are connected using the host communication links. Figure 3-2 shows a sample application software architecture.

Figure 3-2 Sample Application Software Architecture



The host computer can control every element of a call through the VCO/4K and dynamically coordinate the delivery of call and database information. The VCO/4K concentrates network interface and service circuit resources of different types into a single manageable entity.

General VCO/4K Call Flow

During a VCO/4K call, the following general actions are performed:

- A call request is detected.
- Information is collected.
- The call is managed depending on the collected information.

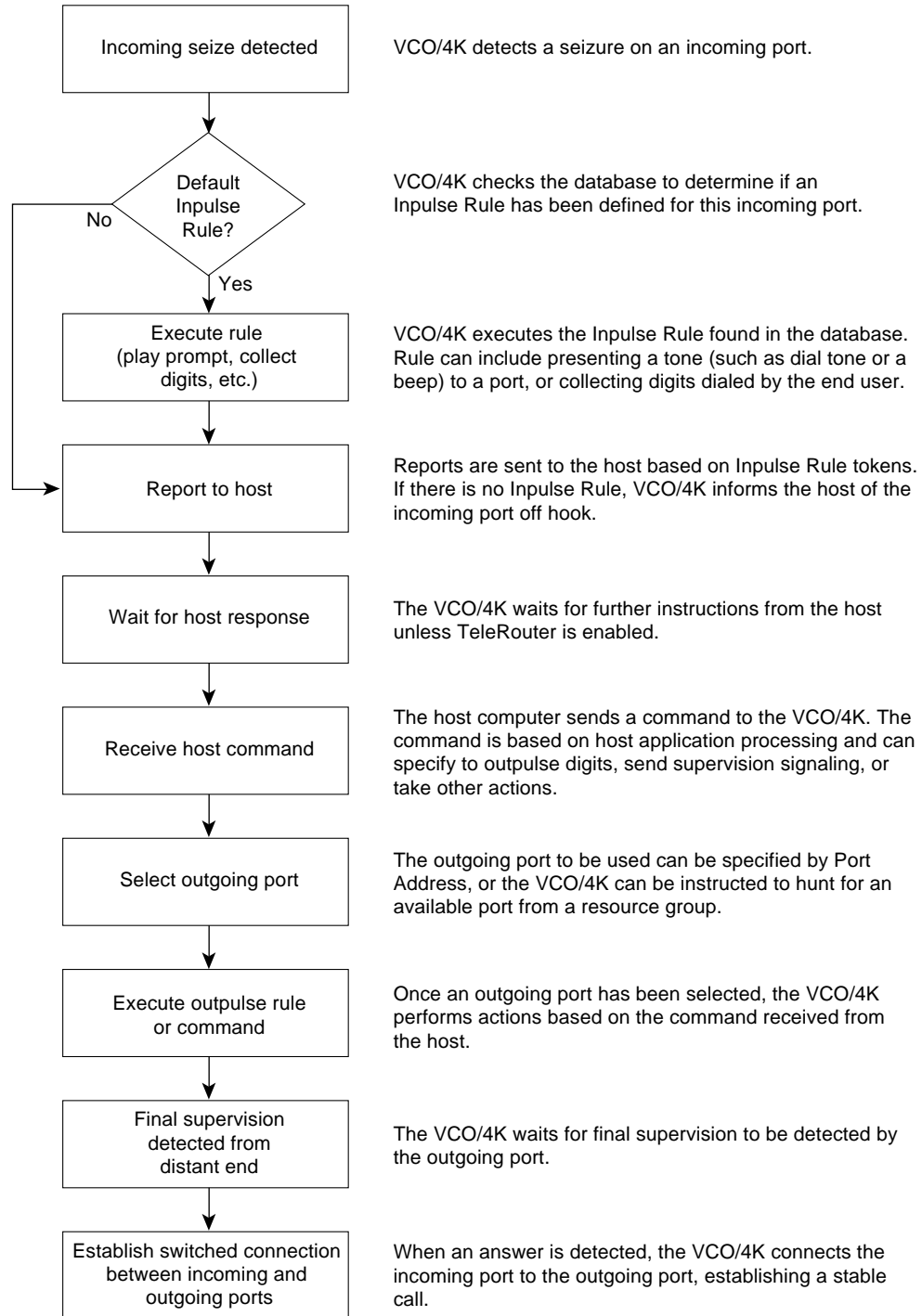
A sample VCO/4K call flow is shown in Figure 3-3.



Note

This example shows a simple incoming call. More complicated call scenarios can be implemented using the host application.

Figure 3-3 Sample Call Flow



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Call Control Elements

Call control elements provide the multilevel programmability that makes the VCO/4K effective in a wide range of applications. VCO/4K call control elements include the following:

- Resource definitions in the VCO/4K database
- Inpulse and outpulse rules
- Templates
- VCO/4K commands
- VCO/4K reports

These elements combine with call processing to provide the host computer with a consistent control interface for different network interface and service circuit types. The VCO/4K system uses rules, templates, and tables to provide call control.

Resource Definition

VCO/4K system administration software provides a menu-driven interface to define the system's configuration and resource characteristics. VCO/4K call processing uses this information to determine autonomous processing or other special resource management. The VCO/4K system database maintains the following information:

Configuration—Includes the type and physical location of the internal communications bus, the network interface, and service circuit cards and the relationship between this information, and the logical port addresses used in host commands and reports.

Class of Service (COS)—Assigns software operating characteristics to individual interface ports.

Inpulse Rule—Determines autonomous processing of incoming network interfaces when a call is requested.

Resource Grouping—Sorts resources by type, and COS (if applicable). Similar resources are placed in a resource group to help the VCO/4K and host keep track of their availability.

Inpulse and Outpulse Rules

Call processing requires various signaling and supervision actions, such as collecting or sending digits. Use inpulse and outpulse rules to define the sequence of these actions for each type of call that the application manages.

The VCO/4K system's inpulse and outpulse rules screens give you the ability to define up to 256 inpulse rules and 256 outpulse rules with individual tokens for each action within a rule.

Like telephony subroutines, rules are *called* in a host command, processed by another rule, or in the case of inpulse rules, executed when a call is detected on an incoming port. Processing overhead decreases for both host computer and host communication interfaces because rule processing occurs on the VCO/4K.

Use inpulse and outpulse rules to condition a network interface to wait for supervision events, to collect MF, MFCR2, dual tone multifrequency (DTMF), or Dial Pulse (DP) digits, and to store received digit strings in an internal VCO/4K call record.

Inpulse Rules

Inpulse rule tokens include the following:

- **Reporting Control**—Determines when event and digit collection reports are sent to the host computer.
- **Signaling Mode**—Indicates whether incoming digits are MF, MFCR2, DTMF, or DP.
- **Digit Collection Set Up**—Defines the conditions under which digit collection is performed.
- **Digit Collection**—Enables the appropriate receiver circuit type (as indicated by the Signaling Mode token), and specifies the call record digit field in which digits are stored.
- **Supervision Control**—Presents in-band or out-of-band signaling to the distant end (i.e., wink, answer, tone, or voice prompt), or waits a specified length of time before continuing rule processing.
- **Processing Control**—Allows construction of rules with more than 16 tokens, and allows processing of outpulse rules.

Special tokens are provided for the processing of calls using TeleRouter and ISDN PRI software.

An administrator’s screen showing the inpulse rules table appears in Figure 3-4.

Figure 3-4 Inpulse Rules Table screen

| I N P U L S E R U L E S T A B L E | | | | |
|-----------------------------------|-----------|-----------|-----------|-------------|
| RULE # 1 | RULE # 2 | RULE # 3 | RULE # 4 | RULE # 5 |
| MF | MF | ISDN RX 3 | NO REPP | REP END |
| WINK ENAB | WINK ENAB | ISDN TX 4 | REP NEXXT | DTMF |
| IP ANI | IP ANI 7 | _____ | ISDN RX 9 | DIGITS 11 |
| DTMF | _____ | _____ | _____ | REP NEXT |
| TONE ENAB 3 | _____ | _____ | _____ | IP FIELD 1 |
| TONE FDIG 1 | _____ | _____ | _____ | WAIT TIME 5 |
| DIGITS 10 | _____ | _____ | _____ | ROUTE A1 |
| IP FIELD 1 | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
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Outpulse Rules

Use outpulse rules to condition a network interface to wait for supervision events and outpulse MF, MFCR2, or DTMF digits. Digits can be those collected by an inpulse rule or supplied in a host command. The VCO/4K automatically converts the digits into the specified format, regardless of the format in which they were supplied.

Outpulse Rule tokens are functionally divided into the following five groups:

Reporting Control—Determines if event reports are sent to the host computer.

Signaling Mode—Indicates the type of outpulse signaling required, such as MF digits, MFCR2 digits, DTMF digits, or tones.

Supervision Control—Conditions the network interface to detect and respond to an answer supervision event before continuing with rule processing. Indicates which configurable Answer Supervision template or preconfigured template to use for supervision.

Digit Field—Determines when and what digits or tones are outpulsed.

Processing Control—Allows construction of rules with more than 16 tokens, and allows processing of inpulse rules.

Special tokens are provided for processing ISDN PRI software.

Templates

Templates let you precisely define call handling and are a unique feature of the VCO/4K open architecture. Like rules, templates (similar to If-Then statements) determine the VCO/4K response to specified events. There are three types of templates:

Answer Supervision—Specifies the signaling events to be detected and the VCO/4K response. Answer Supervision templates are called by outpulse rules. Signaling events include true answer, hookflash, wink, and call progress tone events, such as dial tone, busy, reorder, voice cessation, audible ringback, or the cessation of audible ringback.

ISDN Answer Supervision—Determines the VCO/4K response to specific ISDN D-channel messages. The ISDN Answer Supervision templates are called by outpulse rules. These templates are included with the ISDN PRI software.

ISDN Message Templates—Determines the processing, storing, and reporting of specific D-channel messages when called by inpulse rules. When called by outpulse rules, these templates determine the construction and transmission of specific D-channel messages. ISDN Message templates are specific to the ISDN PRI software.

Configure all three types of templates using VCO/4K system administration.

VCO/4K Commands

An extensive and flexible command set enables direct host computer control of the VCO/4K. Additionally, VCO/4K commands enable system maintenance, configuration, and status control. VCO/4K commands include the following:

- **Resource Control**—Provides direct host control of call routing and digit collection, including voice prompting, setting up conferences, and collecting spoken digits. Additionally, Resource Control commands begin impulse and outpulse rule processing.
- **Configuration Control**—Allows you to control system operating parameters, including the timing source for digital network interfaces, host alarms, and redundant system control.
- **System Status**—Indicates the current operating status and availability of VCO/4K resources.
- **System Diagnostics**—Allows the host to alter normal call processing functions, such as connecting resources and controlling supervision on network interface ports.
- **System Maintenance**—Allows the host to activate or deactivate individual ports on network interface or service circuit cards.

VCO/4K Reports

VCO/4K reports provide the host with precise, consistent information about events and processes. The system rules, templates, and resource definitions determine the content and timing of a report. VCO/4K reports include the following:

- **Resource Control**—Provides the host with information about events related to call processing, including collected DP, DTMF, MF, and MFCR2 digits, port changes of state, rule processing completion, and exception handling.
- **System Status**—Indicates the operating status and availability of VCO/4K resources and alarm conditions.
- **Configuration Control**—Indicates system operating parameters, including host alarms and redundant system control.

Host Interface

The VCO/4K open architecture supports a wide range of host computers, from micros to mainframes.

Optional VCO/4K Ethernet Communications software enables Ethernet TCP/IP communications between the VCO/4K and one or more host computers. The VCO/4K Ethernet Communications software supports a single physical link with up to eight logical connections (sockets), Telnet access to system administration, and NFS capability for system log and trace files. Because of its rate of data transfer, Ethernet is especially suited to applications with heavy call volumes or ISDN applications.

Use VCO/4K system administration utilities to configure host links.

Maintenance and Diagnostics

VCO/4K system administration provides maintenance and diagnostic utilities to track and isolate system fault conditions. Maintenance and diagnostic utilities include

- Menu-driven user-interface
- MS-DOS file system compatibility
- Card and port data display
- Test routines for service circuit cards and network interfaces
- Call progress tone monitoring on network interfaces

The VCO/4K continuously monitors the status of all interfaces and internal components. If a fault is detected, the VCO/4K sends a time-stamped alarm message to the system printer and a logfile to the hard drive and host computer. System alarms include the following:

- Fatal
- Critical
- Major
- Minor
- Aux 1
- Aux 2
- Nonalarmed events

A host command sets and clears Aux 1 and Aux 2 alarms. The VCO/4K tallies the occurrence of each alarm. The alarm count is reset at system initialization. System administration utilities let you view alarms on a system-wide, card, or host-link basis. Figure 3-5 shows a VCO/4K System Alarms Display screen.

Figure 3-5 VCO/4K System Alarms Display

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SYSTEM ALARMS DISPLAY
Alarm Severity: Major Audible Cutoff ( Y/N ) -
Alarm Description Occurrences
ALM038: PRI D-Channel Failure 3
ALM039: PRI/T1 Carrier Lost 4
ALM040: PRI/T1 Card Failure 2

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VCO/4K alarm processing is consistent with Bellcore Technical Reference TR-TSY-000474. This reference specifies network maintenance requirements for network elements.

SNMP Network Management

With SNMP agent support, many of the operational functions performed on the system console can be remotely performed with an SNMP network management application.

The VCO/4K SNMP agent conforms to established SNMP Version 1 standards.

