



DIMETRA APPLICATION PROGRAMMING INTERFACE (API) TRAINING

**Dimetra Control Interface
CADI / MultiCADI**





Course Structure

Module 1 - Course Introduction

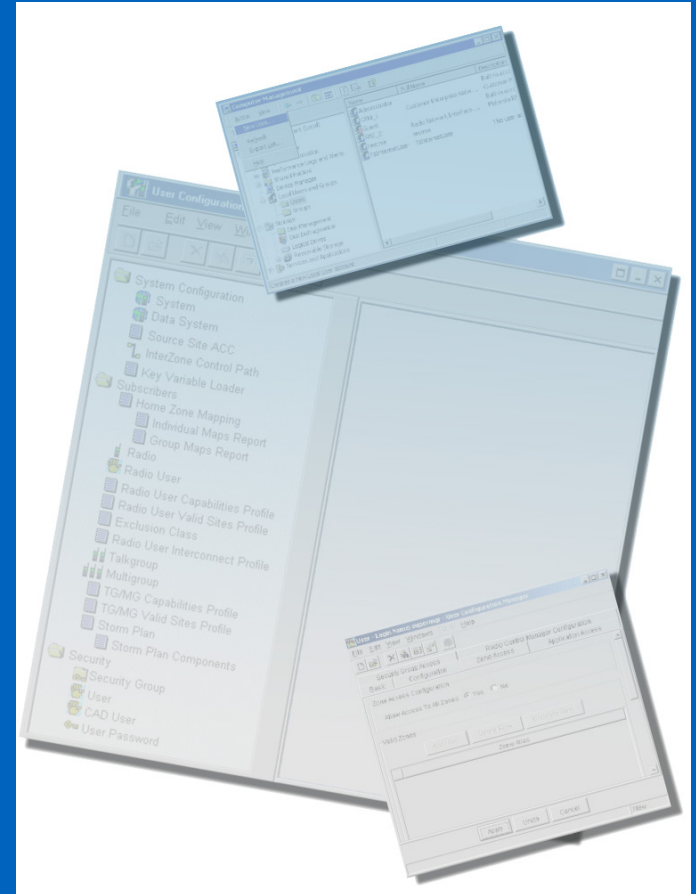
Module 2 – CADI Overview

Module 3 – CADI Design & Development

Module 4 – MultiCADI Overview

Module 5 – MultiCADI operation

Module 6 – Summary





CADI Overview

CADI API



Provides an interface used by CAD application

Perform dispatch functions remotely

Radio system supported:

- SmartZone ®
- SmartZone ® OmniLink
- ASTRO ® 25
- Dimetra TM
- SmartNET ®

CADI API (Cont)



CADI client application has direct access to commands and events used by the radio system and its NM applications

Remote Procedure Call (RPC)

Login via CAD user account with password

CADI API (Cont)



Only one active CADI session per zone at a time

Allows

- Submit radio commands
- Submit queries to check radio system status
- Monitor radio events

CADI API



Provides an interface for external application (CADI Client) to communicate

Enable users to perform dispatch function remotely

CADI Client application has direct access to commands and events used by the radio system and its network management applications

Form of API is Remote Procedure Call (RPC)

- MS-Windows platform needs to install Open Network Computing (ONC) RPC toolkits
- Connect to Zone Manager

Login via CAD user account. Password is required

Only one active CADI session per zone at a time

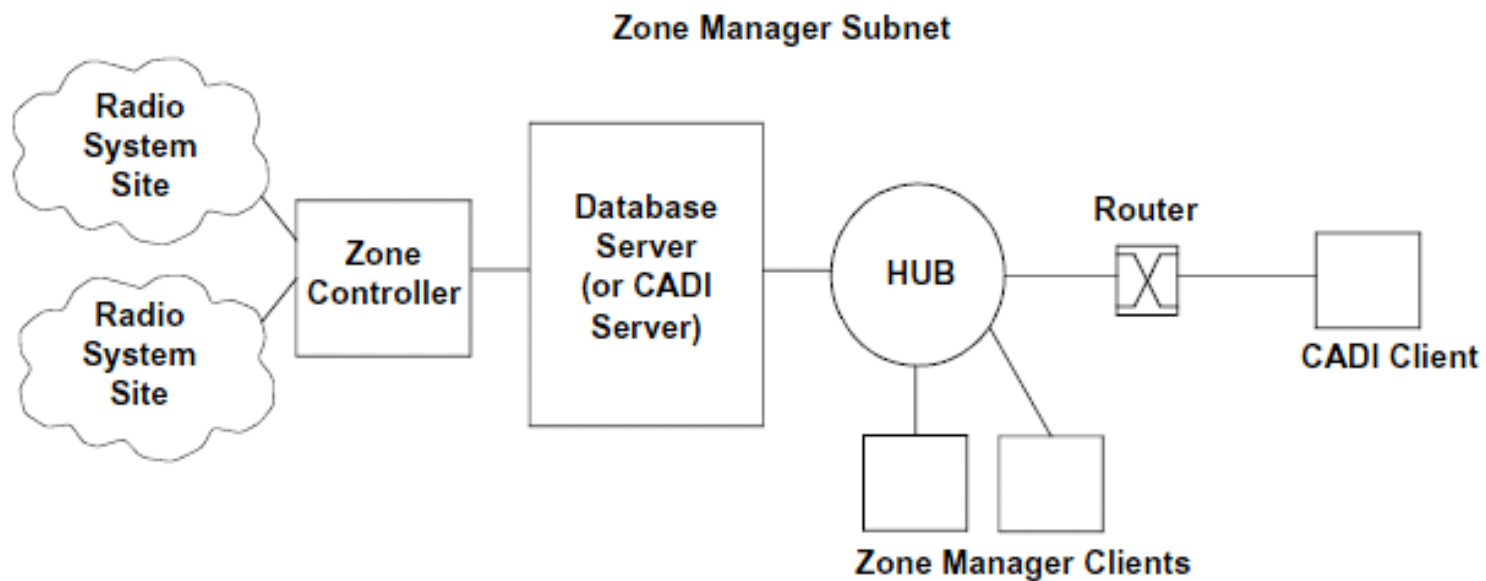


CADI Design & Development

Network Layout



CADI API requires IP connectivity to CADI Server

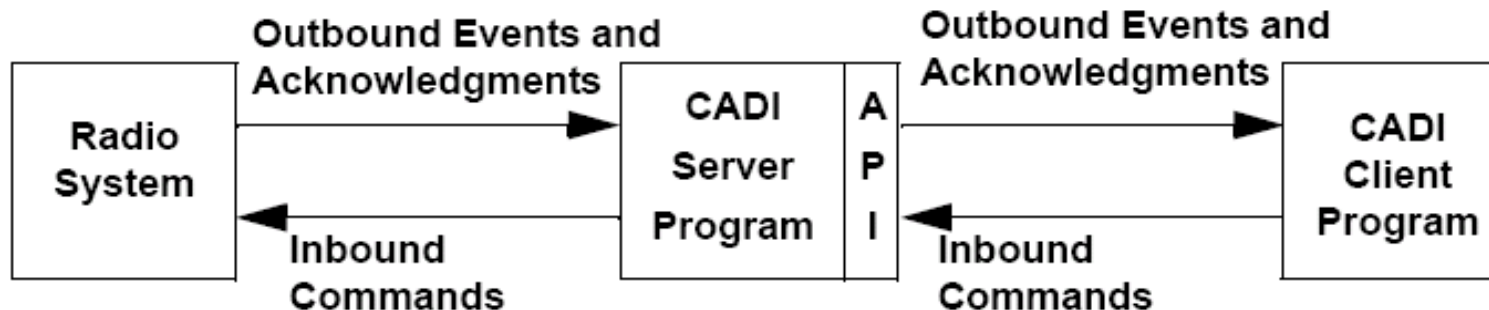


CADI API Basic Operational Flow



Requires:-

- CADI Server Program
- CADI Client Program
- Network Connection



CADI Server Program



Installed with radio system's NMS software

Zone Database Server / ATR Server

CADI Client Application



Can use any programming language that supports Open Network Computing (ONC) implementation of Remote Procedure Call (RPC) method to transport commands and events between hosts

ONC is a widely deployed remote procedure call system

CADI Client App (Cont)



On Windows System, ONC Distinct RPC as middleware package

- <http://www.distinct.com/>
- www.askcody.com

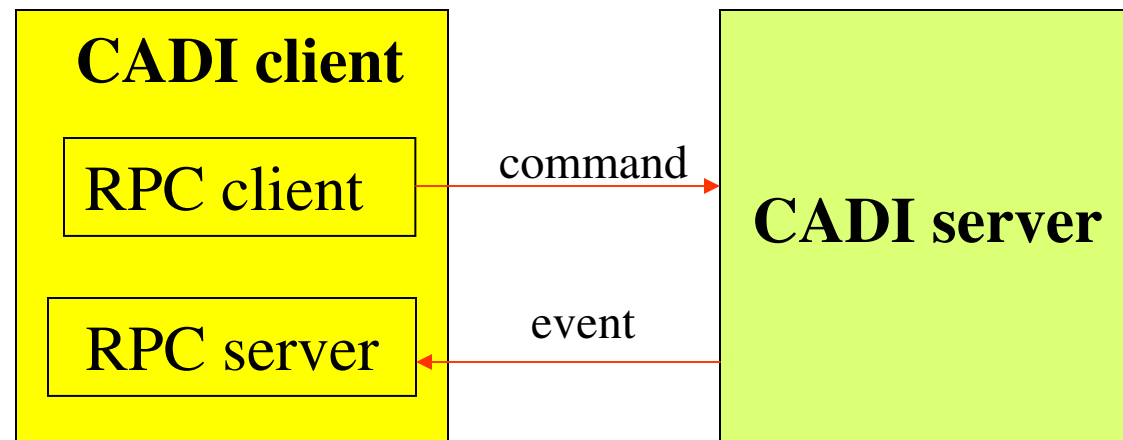
On UNIX system, no need special libraries

- Rpc.h, cadi.h, cadcmd.h, cadev.h

Command and Event Modules



Command sending module acts as RPC Client
Event handling module acts as RPC Server



Event Filtering



Events can be filtered based on individual talkgroups and security groups

Where there are conflicts, talkgroup filters have higher priority than security group filters

The following events may be filtered:

- PTT
- Affiliation
- Emergency Alarm
- Status Events

CADI API Installation



CADI Client application resides on customer-supplied host machine

Installed RPC protocol definition files (supplied)

Network connection between client and server



Remote Procedure Call (RPC)

RPC Introduction



RPC allows functions to be called remotely across a network

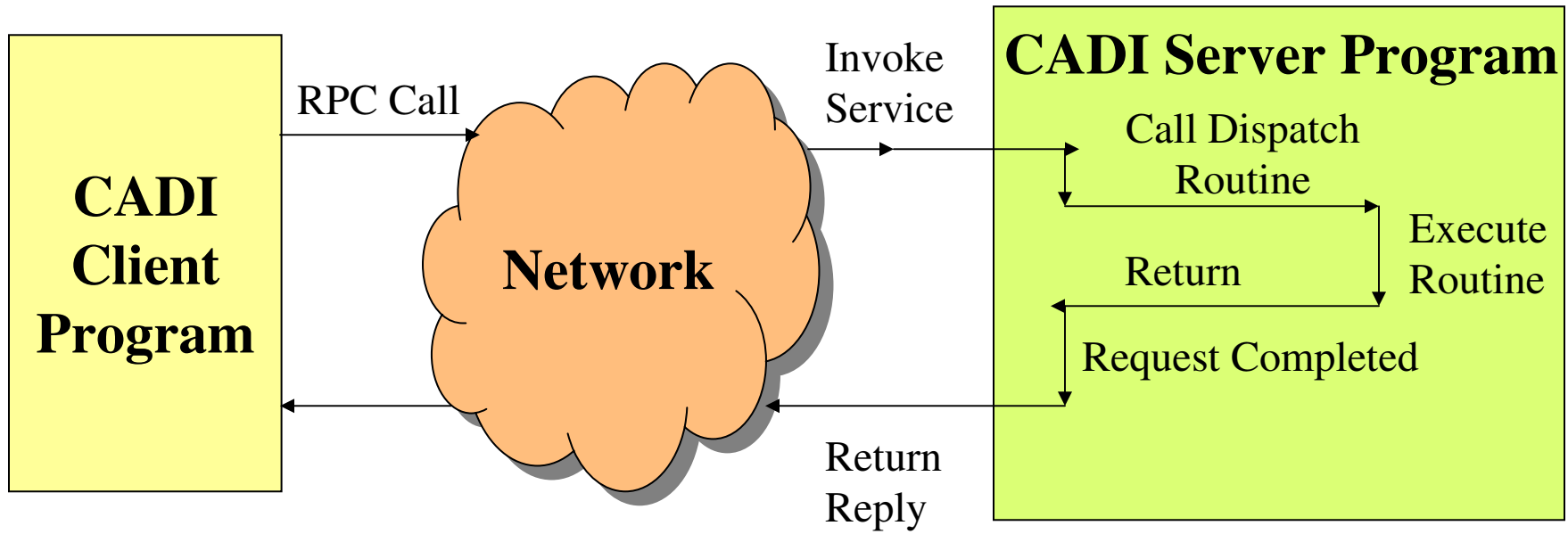
RPC works on top of TCP/IP

Server starts an RPC service and waits for function call

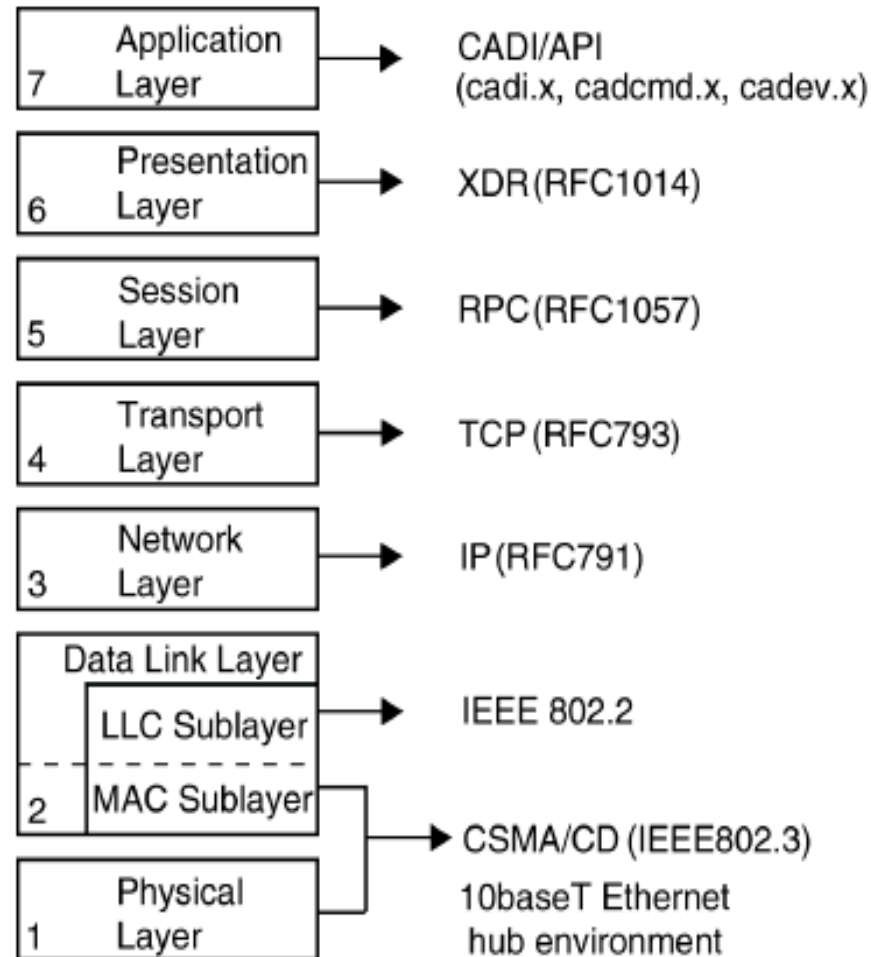
Function called on the client side

Processing is done on server side and result returned to caller

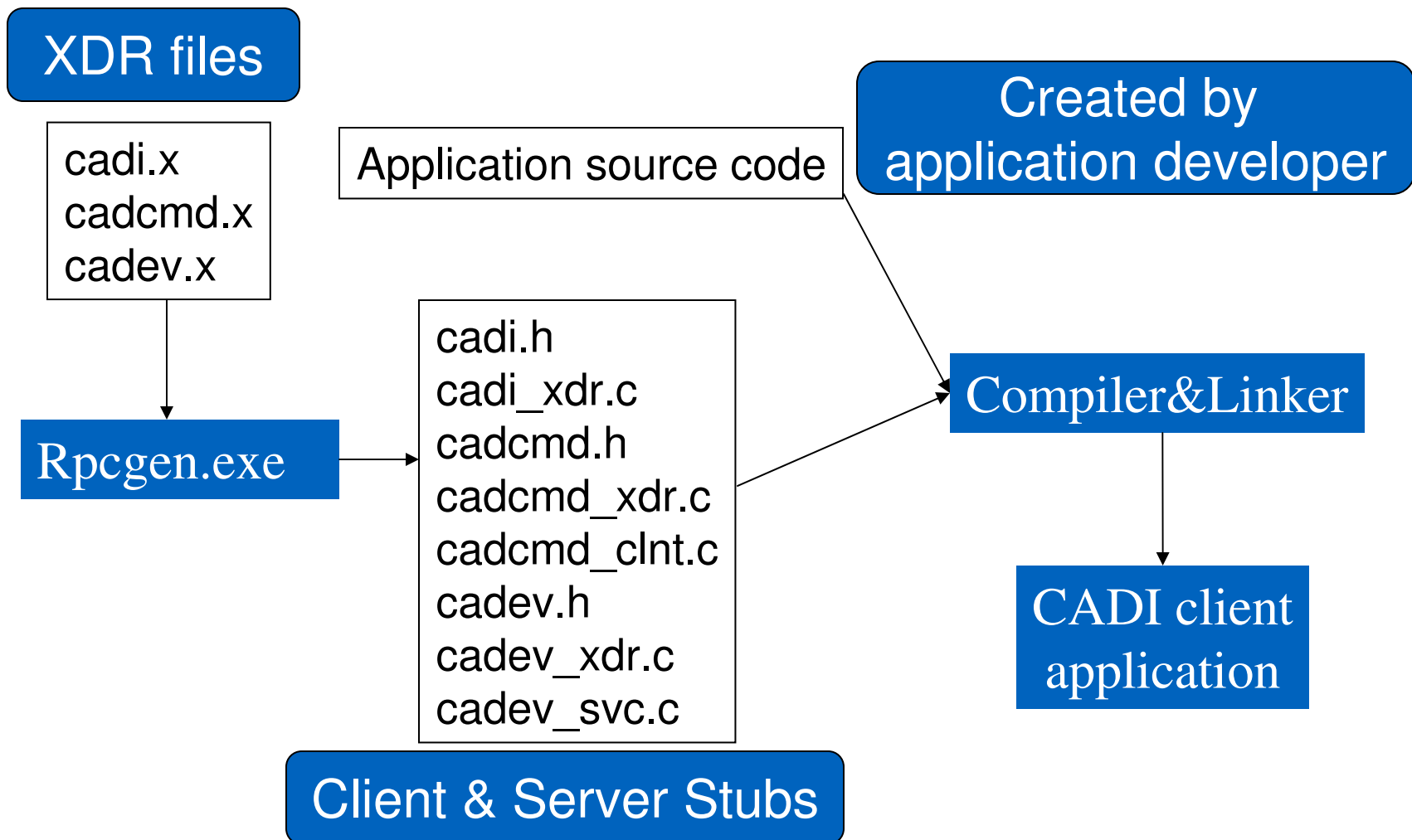
RPC Diagram



RPC and OSI



RPCgen



Troubleshooting RPC



Ping

- RPC uses TCP/IP as a transport. We can check whether IP connection is good by using the ping utility

RPC info

- Should come with your RPC installation
- RPC info will list RPC server connections on a host
- Test RPC is set up correctly
- Test server is running

CADI Operations



CADI Session Initialization

CADI Inbound Command Process

CADI Outbound Event Process

CADI Session Termination

CADI Session Initialization

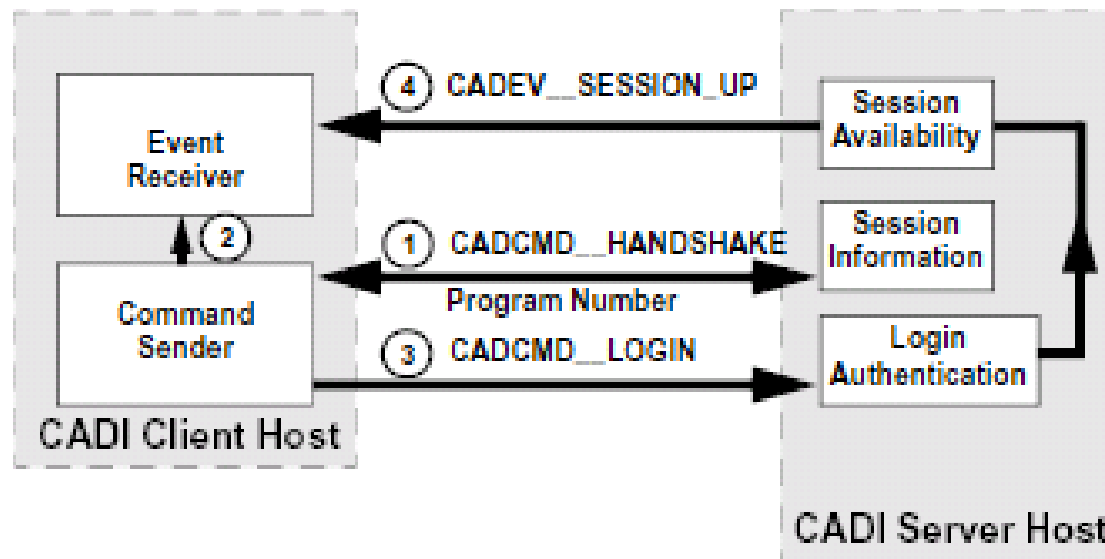


Call CADCMD__HANDSHAKE

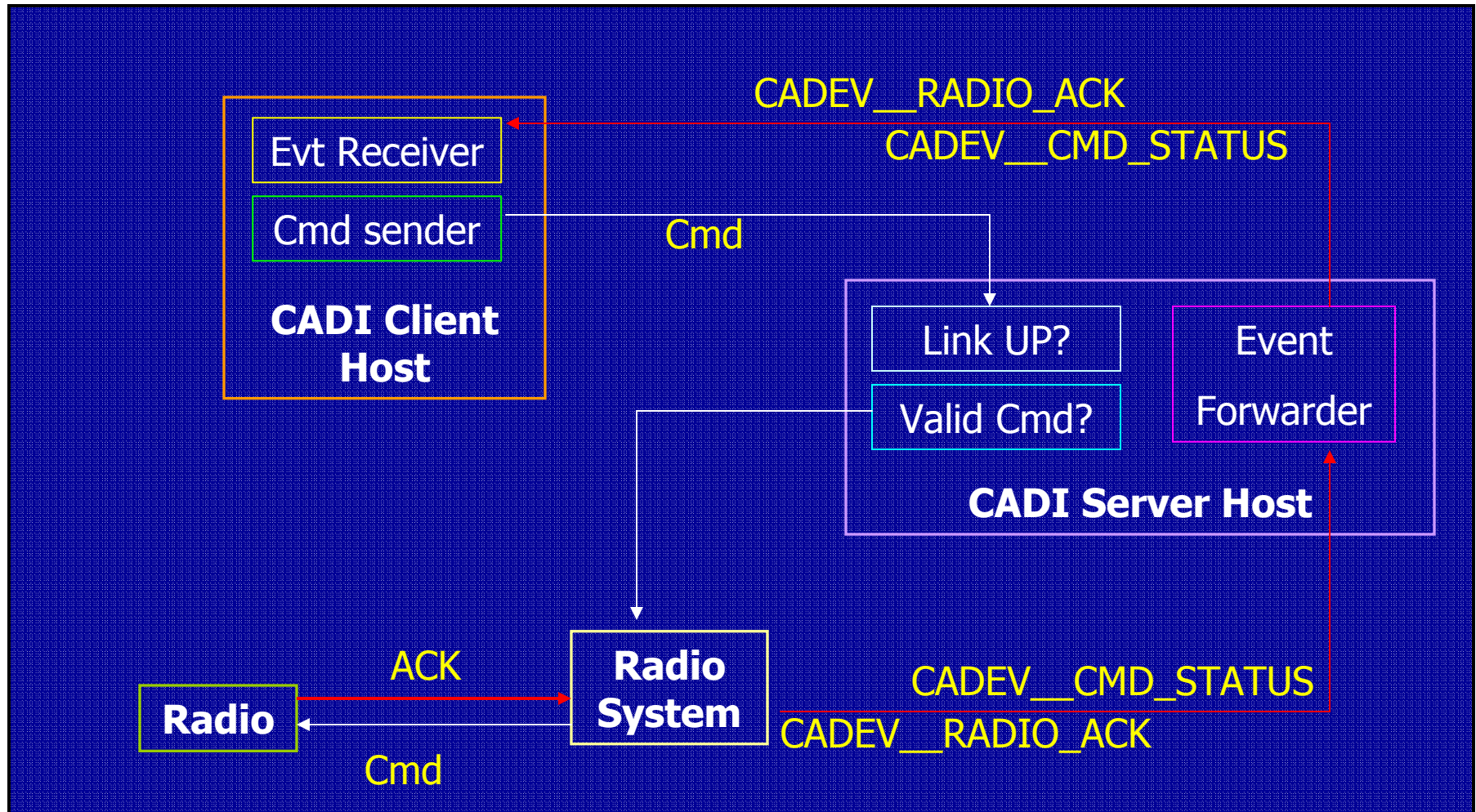
Start Event Listening service

Call CADCMD__LOGIN

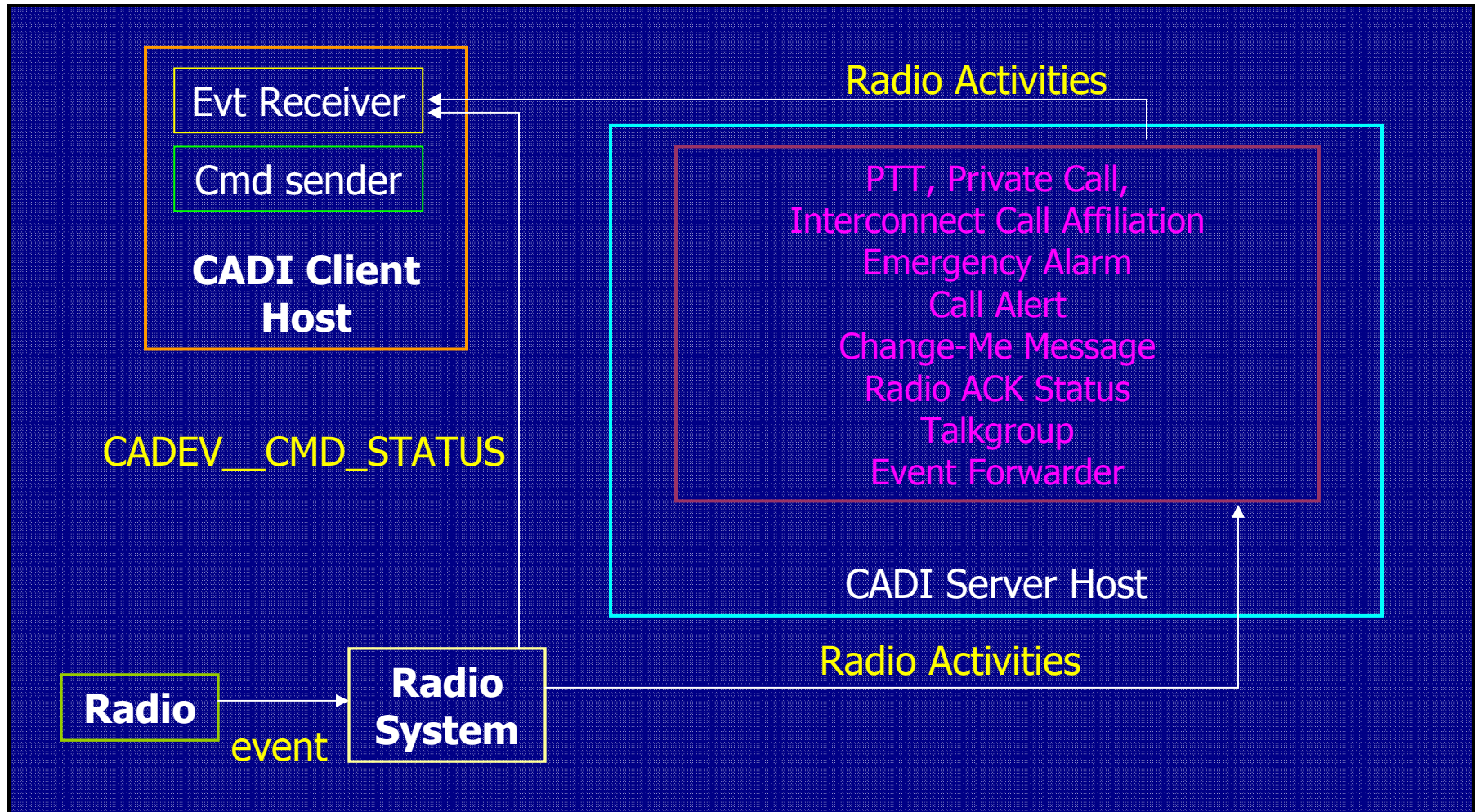
CADEV__SESSION_UP event received



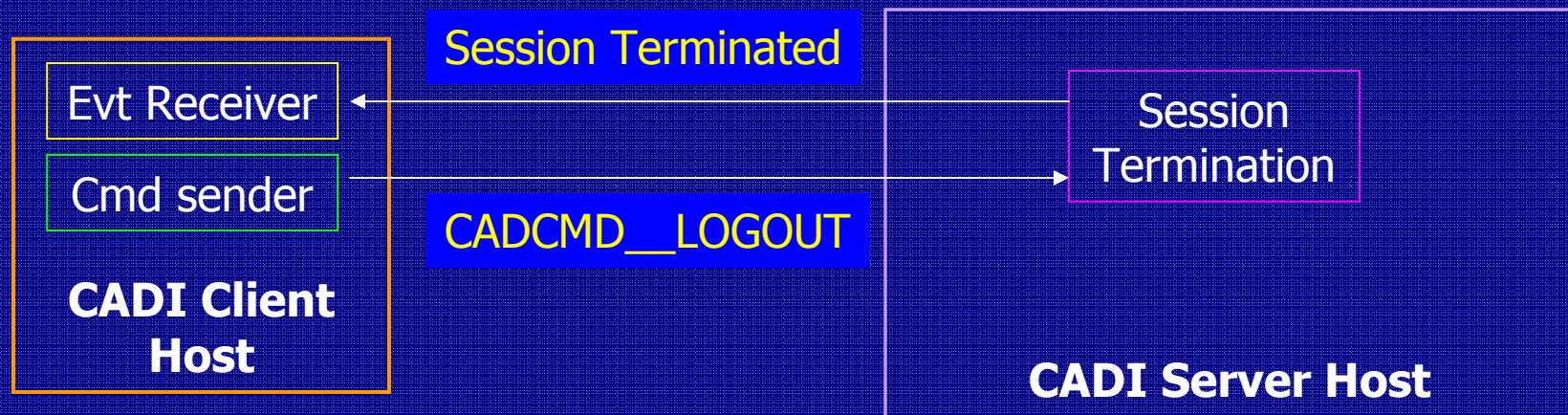
CADI Inbound Command Process



CADI Outbound Event Process



CADI Session Termination



Error Codes for CADI Commands



When a CADI command is rejected, negative value will be returned

May use CADCMD__GET_LAST_ERROR to retrieve additional information of the previous CADI command

Returned data : CADCMD__ERROR_INFO



CADI Commands and Events

CADI Commands



D6.2 supports CADI API V1 & V3 (unicode)

CADCMD__HANDSHAKE	}	connection management
CADCMD__LOGIN		
CADCMD__LOGOUT		
CADCMD__ZC_QUERY		
CADCMD__RADIO_CHECK		
CADCMD__INHIBIT		
CADCMD__XINHIBIT		
CADCMD__REGROUP		
CADCMD__XREGROUP		
CADCMD__XREGROUP_W_GID		

CADI Events



CADEV__AFFILIATION
CADEV__DEAFFILIATION
CADEV__EMERGENCY_ALARM
CADEV__GROUP_CALL
CADEV__INTERCON_CALL
CADEV__PRIVATE_CALL
CADEV__STATUS
CADEV__CMD_STATUS
CADEV__RADIO_ACK
CADEV__SESSION
CADEV__ZC_STATUS

Event Filtering



Events can be filtered based on individual talkgroups and security groups

Where there are conflicts, talkgroup filters have higher priority than security group filters

The following events may be filtered:

- PTT
- Affiliation
- Emergency Alarm
- Status Events



CADI Account Setup

CAD Account - Setup



CAD User - User Configuration Manager

File Edit View Windows Tools Help

Basic Security Group Access Radio Control Manager Configuration

User Information

● User Name

Security Group

● Security Group ...

Login Information

● Login Name

● Password

Verify Password

Apply Undo Cancel

New

CAD Account - Filtering



Security Group Attachments

	Security Group	Push-To-Talk	Affiliation	Emergency A...	Status
NEW	SYSTEM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CAD Account – Filtering (Cont)



Attachment Group Form

	Attachment G...	Push-To-Talk	Affiliation	Emergency A...	Status
●	SIT-1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
●	SIT-2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
NEW	SIT-3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CAD Account - Regroup



Regroup command requirement

- Radio must have primary talkgroup assigned
- Primary talkgroup must belong to security group in attachment list OR
- Primary talkgroup in talkgroup attachment list
- Target talkgroup belongs to security group in attachment list



CADI Development Tools

CADI Server Simulator



Simulator for testing and learning CADI API

Available with CADI SDK

Simulate events and respond to commands

```
CADI Server Simulator
File Edit Events View Help

CMD_LISTENER: handshake is called. rc=536875009 from 169.254.90.27:1523
CMD_LISTENER: login (test,****,0). rc= 0 from 169.254.90.27:1523
EVT_SENDER: Session Status is CADEV_SESSION_UP rc=0 (session_id=0)
EVT_SENDER: ZC Status is Idle rc=0 (session_id=0)
EVT_SENDER: ZC Status is Active rc=0 (session_id=0)
EVT_SENDER: PRIVATE_CALL [radio (700001, ), tg (800001, TG$800001), target (700001, )].
CMD_LISTENER: radio check (Radio_ID=1). rc=-4 from 169.254.90.27:1523
CMD_LISTENER: radio check (Radio_ID=1). rc=1 from 169.254.90.27:1523
EVT_SENDER: ZC ACK: 1 (ZC_SENT), rej_code =255(NO REJ), cmd_num=1 rc=0 (session_id=0)
EVT_SENDER: AFFILIATION [radio (1, ), tg (80000001, TG$80000001). rc=0 (session_id=0)]

Ready sessions: 1 send: 6; rcv: 4
```

CADI Host Simulator



Sample client for testing/learning CADI functions
Available with CADI SDK

```
cadcmd_handshake_1() successful. rc=536875009
cadcmd_login_1(): rc=0
2002/08/20-11:56:36: SESSION - session up
2002/08/20-11:56:36: AFFILIATION - r_id=475, r_alias=MILANO475, g_id=3000, g
2002/08/20-11:56:36: AFFILIATION - r_id=4122, r_alias=KS-CHAN, g_id=4101, g
2002/08/20-11:56:44: AFFILIATION - r_id=403, r_alias=ZC$403, g_id=3000, g_al
2002/08/20-11:56:44: AFFILIATION - r_id=403, r_alias=ZC$403, g_id=135, g_ali
2002/08/20-11:56:44: AFFILIATION - r_id=1375, r_alias=ALPHA-1375, g_id=1351,
2002/08/20-11:56:45: AFFILIATION - r_id=1375, r_alias=ALPHA-1375, g_id=1351,
2002/08/20-11:56:47: AFFILIATION - r_id=4120, r_alias=JK-YE0H, g_id=4104, g
2002/08/20-11:56:47: AFFILIATION - r_id=4120, r_alias=JK-YE0H, g_id=4104, g

INFO: broken link detected. server_run() returns  Disconnected  send: 5; rcv: 33
```


CadiTest (Unicode)



CadiTest (Unicode) Version 1.01

Zone Manager DBS Address: 10.1.233.120 Username: cadi State: Logged in.

Handshake Disconnect Command Radio id: 0 Group id: 0 Configure...
Init Events ☒ Query ZC ☐ Inhibit ☐ XInhibit Perform All Tests
Login ☐ Radio Check ☐ Lock ☐ Unlock Execute Command Stress
 ☐ Regroup ☐ XRegroup

Command	Event	Local Time	Radio	Group	TimeStamp	Info
Handshake		15:07:57				Handshake succeeded. Program number 53687500
	Session	15:08:03				Ready to receive events.
ZC Query		15:08:22				Succeeded.
	ZC Status	15:08:22			09/03/07 15:08:2...	Zone: ZONE001 Status: ZC is idle. IZT: Capable

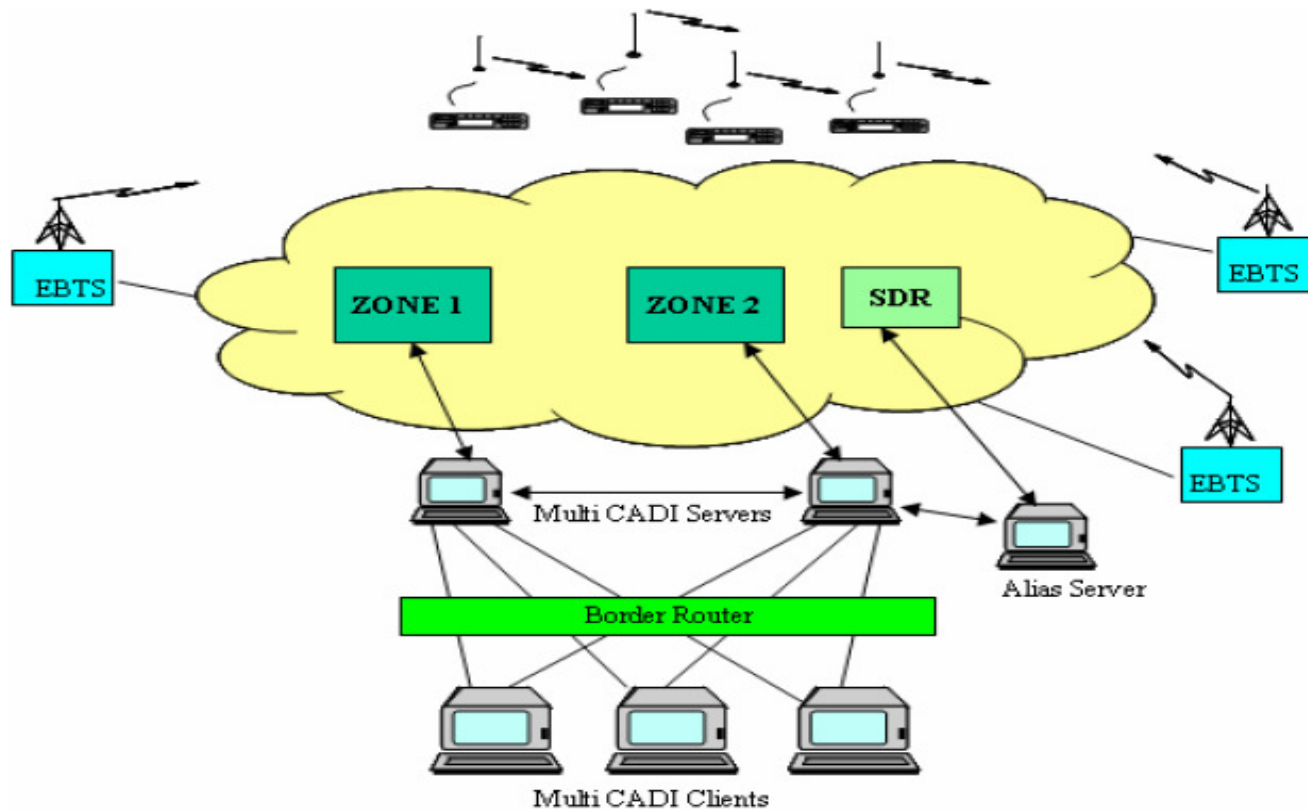
Save event log Empty Reset Counters Exit

ZC Query succeeded. Cmd : 1 Evt : 2 T/O : 0000



Multi-CADI Overview

Multi-CADI on Multi Zone System



Multi-CADI Operation



Provide additional capabilities for the CADI

- Supports 25 concurrent client sessions plus an alias server client
- Distribution of system and client events, validation of system and client commands are based upon ISSI filtering of client's own control
- Support client commands and event to/from alias server client for access to aliasing services
- Forward system commands/events to homezone cadl server/clients of associated ISSI
- Additional validation for DGNA commands
- Importing of home zone map file in support of the command/event forwarding

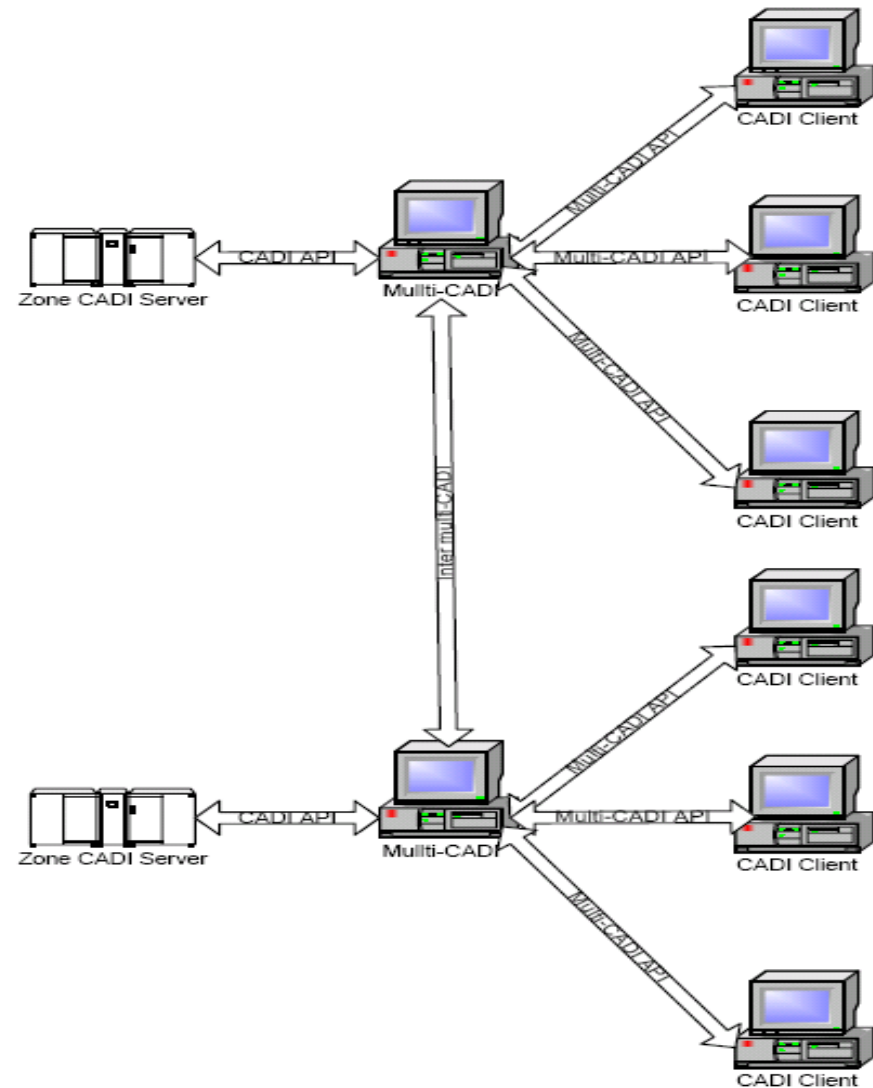
Interfaces to a CADI server as a single CADI client

Login via CAD user account. Password is required

Multi-CADI Operation



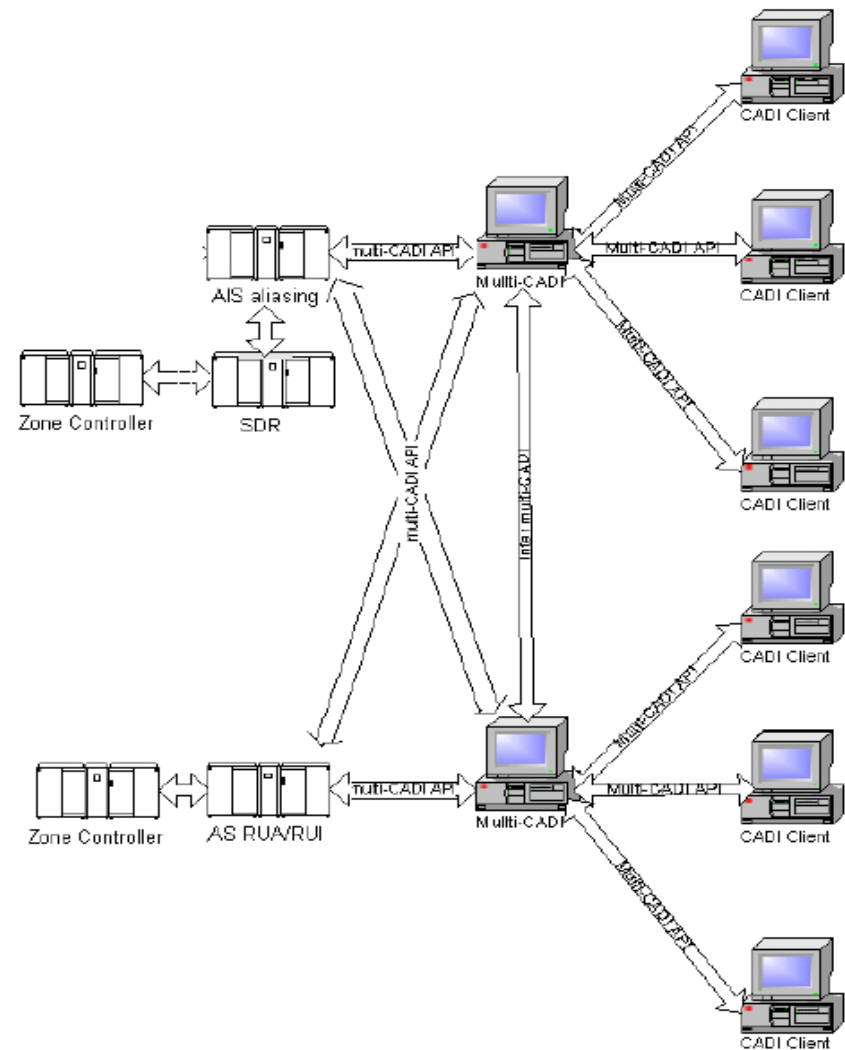
Multi-CADI
configuration for
system
commands/events



Multi-CADI Operation (Cont)



Zone Multi-CADI
configuration for
AIS/RUIS client
commands/events



Multi-CADI API & RPC



cadi.x

cadcmd.x

cadex.x

cadiais.x

cadiruis.x

cadaiscmd.x

cadaisev.x



Multi-CADI API Command Reference

CADI System Commands



D6.2 supports MultiCADI API V10 & V30

CADCMD__HANDSHAKE

CADCMD__LOGIN

CADCMD__LOGOUT

CADCMD__ZC_QUERY

CADCMD__RADIO_CHECK

CADCMD__INHIBIT

CADCMD__XINHIBIT

CADCMD__REGROUP

CADCMD__XREGROUP_W_GID

CADI Client Commands



CADRUISCMD__CLIENT_REQ_BOOK_ON
CADRUISCMD__CLIENT_REQ_BOOK_OFF
CADRUISCMD__QUERY_RUI_CONFIG
CADRUISCMD__QUERY_PISSI_CONFIG
CADRUISCMD__QUERY_PROFILE_ONLY_CONFIG
CADRUISCMD__QUERY_RUI_BINDING
CADRUISCMD__QUERY_RISSI_BINDING
CADRUISCMD__CREATE_RUI_ONLY
CADRUISCMD__DELETE_RUI_ONLY
CADRUISCMD__CREATE_RUI_WITH_PROFILE

CADI System Events



CADEV__AFFILIATION
CADEV__DEAFFILIATION
CADEV__EMERGENCY_ALARM
CADEV__GROUP_CALL
CADEV__INTERCON_CALL
CADEV__PRIVATE_CALL
CADEV__STATUS
CADEV__CMD_STATUS
CADEV__RADIO_ACK
CADEV__SESSION
CADEV__ZC_STATUS

CADI Client Events



CADRUISEV__ALIAS_SERVER_ONLINE
CADRUISEV__ALIAS_SERVER_OFFLINE
CADRUISEV__LOG_ON_SUCCESS
CADRUISEV__LOG_ON_FAILURE
CADRUISEV__LOGFF
CADRUISEV__CLIENT_REQ_BOOK_ON
CADRUISEV__CLIENT_REQ_BOOK_OFF
CADRUISEV__FORCE_OFF
CADRUISEV__LOG_BOOK_ON_PENDING_TIMEOUT
CADRUISEV__AS_STATE_UP_FULLY
CADRUISEV__AS_STATE_UP_PARTLY
CADRUISEV__AS_STATE_UP_NO_OPR
CADRUISEV__AS_GLOBAL_STATE_DOWN

Client Session Control Guidelines - Initialization



As defined in CADI API

Multi-CADI return a program number (536875010 – 536877635) to a CADCMD_HANDSHAKE command

Client username and password must be configured in Multi-CADI to establish a session

Client Session Control Guidelines - Maintenance



Receiving “ZC link is down”

- Session still establish with Multi-CADI
- Client can submit commands and receive events
- CADI system commands may be rejected and CADI system events may not be received

Check session status

- Send RPC NULLPROC
- Terminate session if link failed
- Sends every 10s (up to 1min) after RPC Timeout occurred. If successful, resubmit the command; else logout and re-login

Receiving RPC NULLPROC

- When multi-CADI checks client status
- Do not respond if no session established or reply with RPC Error

Receiving RPC Errors

- Close the session and re-login

Client Session Control Guidelines – Terminate & Firewall Consideration



Termination process as defined in the CADI API

Firewall consideration:

- Use RPC Portmapper
- Bind port number 8700 for access to CADI command service
- Bind port number 9700 for access to CADI event service

Capacity and Performance Considerations



Multi-CADI supports up to:

- 25 clients
- 26 clients, with AIS or RUA/RUI feature

Command rate:

- 2 cmds per sec to CADI Server
- 10 AIS cmds per sec or 60 RUIS cmds per sec from total clients (non-batch command)
- 1 cmds per 5 secs from total clients (batch command)



Multi-CADI Development Tools

CadiTest (AIS)



CadiTest (AIS) Version 2.01

Zone Manager DBS Address: **tempesthos** Username: **caditest** State: **No connection.**

Configure...
Handshake
Init Events
Login
Disconnect
Perform All Tests

Command

Query ZC **Execute Command** **Stress**

☐ Inform Radio User

Radio User ID: Radio User SSID: 0

Radio SSID: Radio User Name: 0

Group SSID: Log/Book On Timer: 0

Start SSID: Log/Book On Pending Timer: 0

End SSID: 0

Command	Event	Local Ti...	Radio	Group	TimeStamp	Info
---------	-------	-------------	-------	-------	-----------	------

Save event log **Empty event log** **Reset Counters** **Exit**

Commands can only be executed, when a user is logged on the ZC. Cmd : 00000 Evt : 00000 T/O : 0000

Configure

Hostname: **tempesthos**

Username: **caditest**

Password: **caditest**

Test Radio ID: **0**

Test Group ID: **0**

Version (1 or 2): **CADI**
CADI
CADI_ALIAS

Firewall Setting

Cmd port: **Auto port**

Event port: **Auto port**

Command Ack Timeout: **5000** ms

Stress Test Interval: **1000** ms

OK **Cancel**



Summary

Summary



Dimetra Control Overview

CADI

- RPC
- Designs
- Commands and Events
- Development

Multi-CADI

THANK YOU...



iProtect Classification as Appropriate
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