DIMETRA APPLICATION PROGRAMMING INTERFACE (API) TRAINING

Dimetra Control Interface

CADI / MultiCADI

Course Structure

Module 1 - Course Introduction

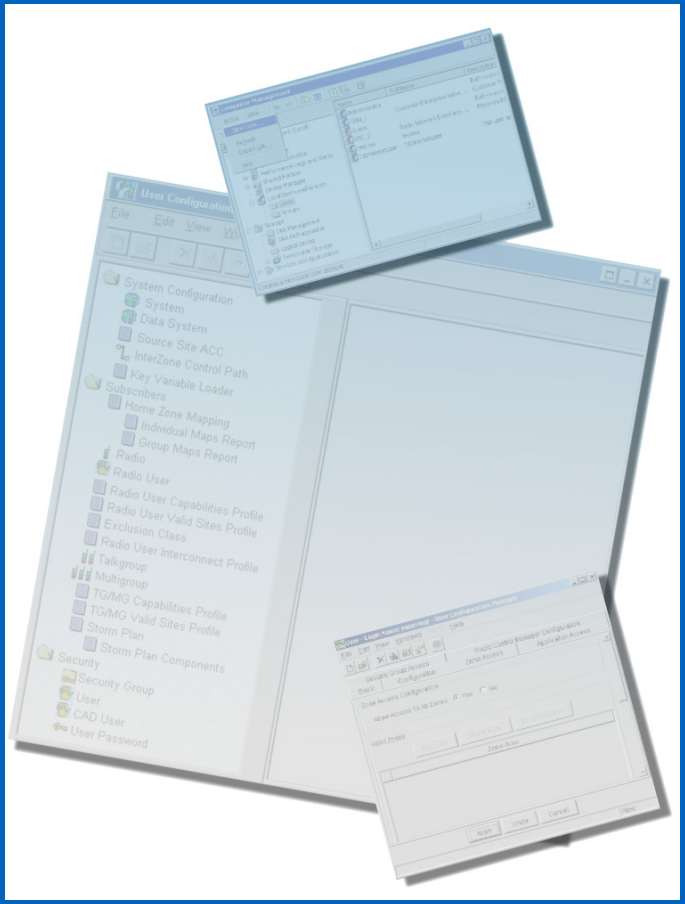
Module 2 – CADI Overview

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

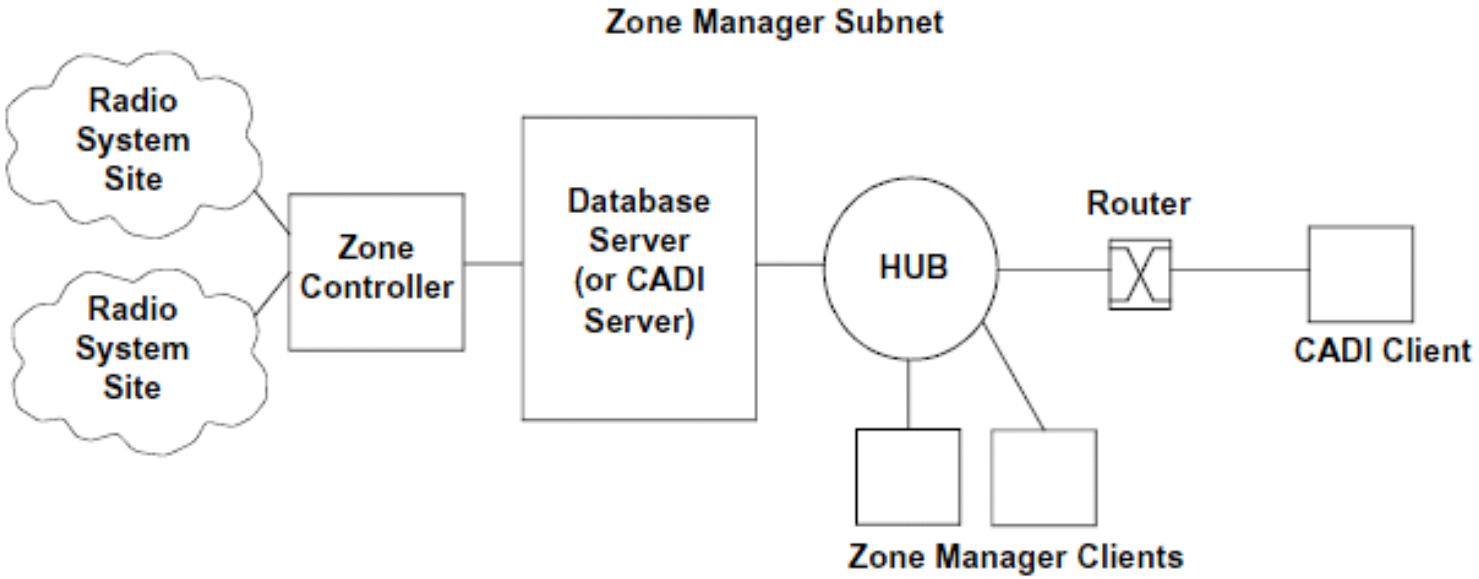
Login via CAD user account. Password is required

Only one active CADI session per zone at a time

CADI Design & Development

Network Layout

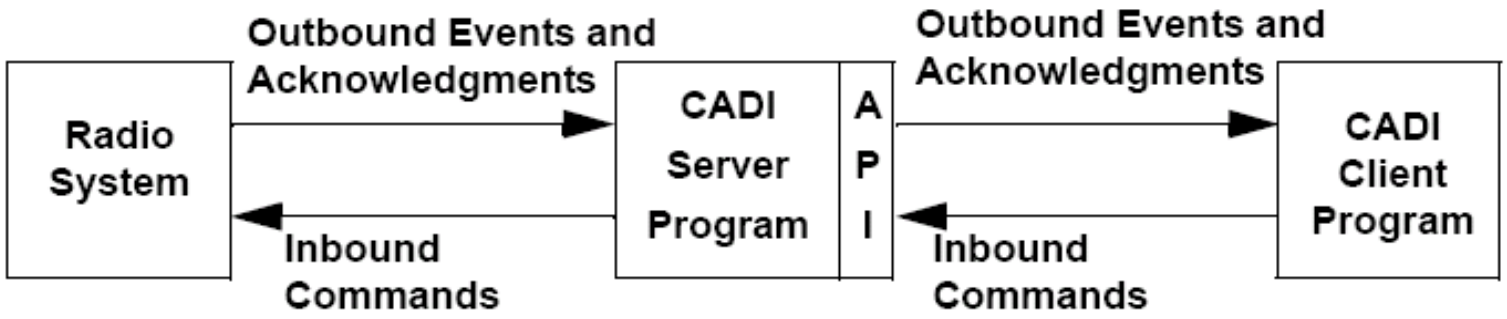
CADI API requires IP connectivity to CADI Server



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

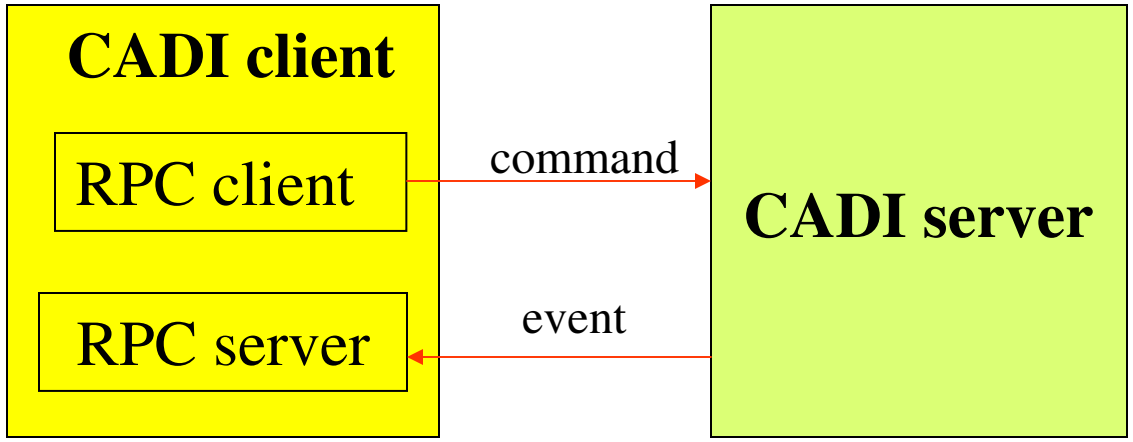
On UNIX system, no need special libraries

- 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

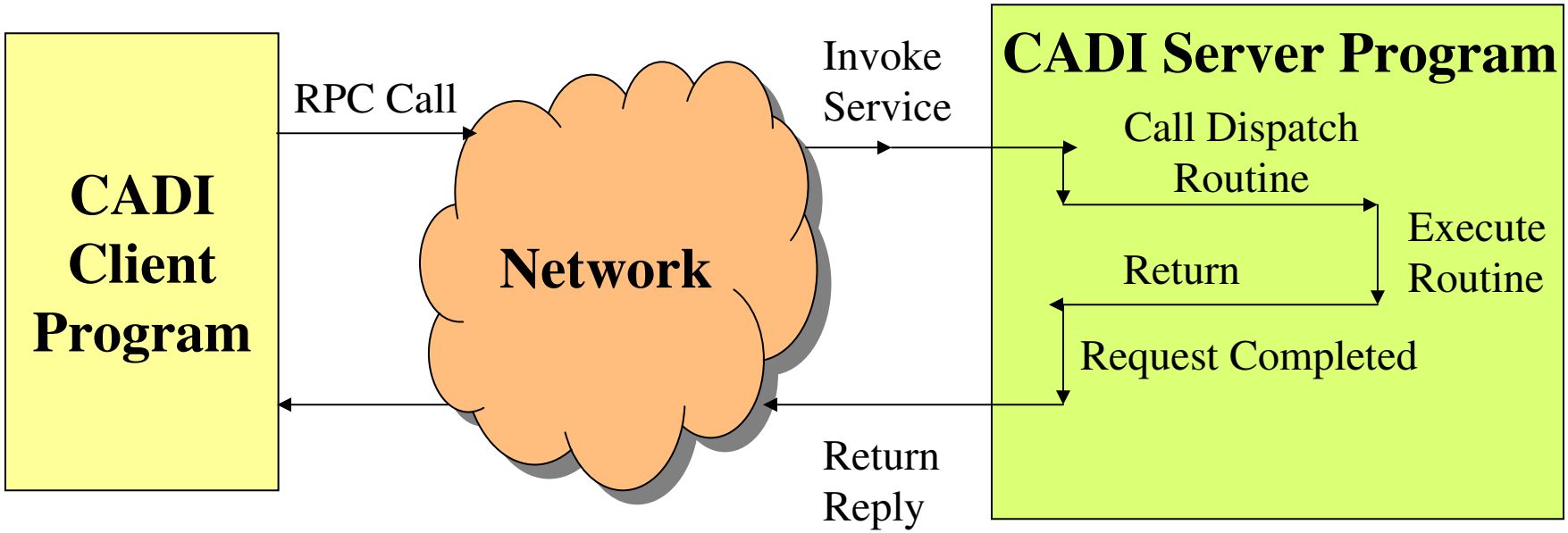
RPC works on top of TCP/IP

Server starts an RPC service and waits for function call

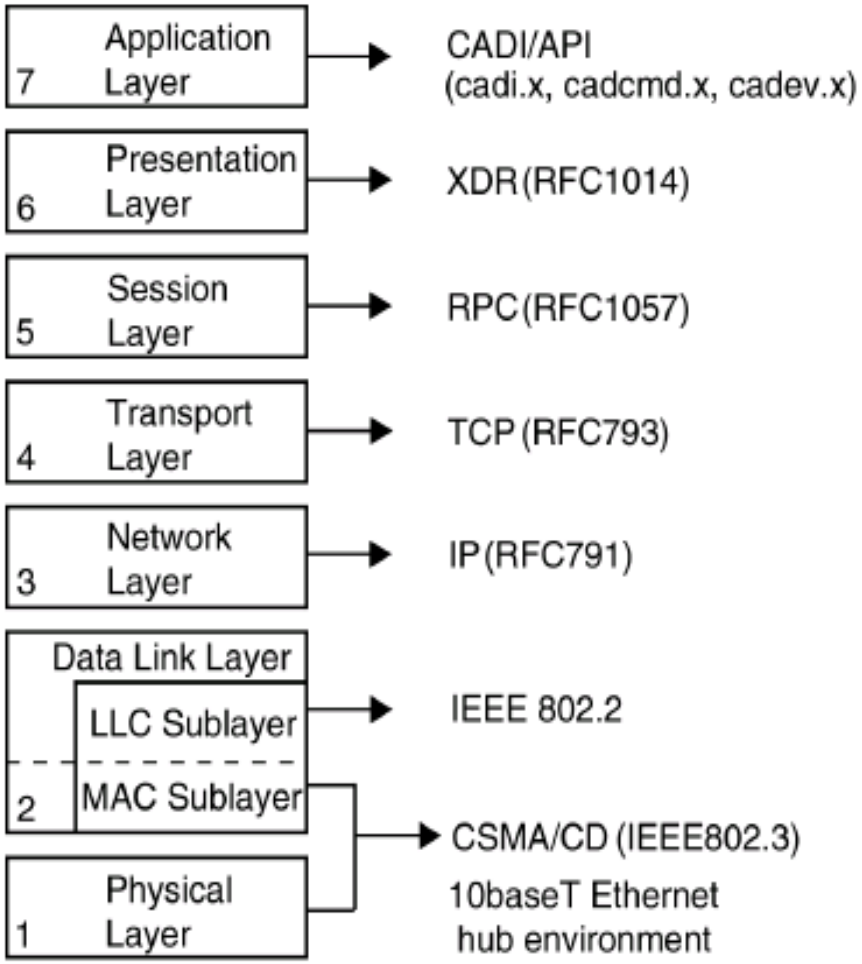
Function called on the client side

Processing is done on server side and result returned to caller

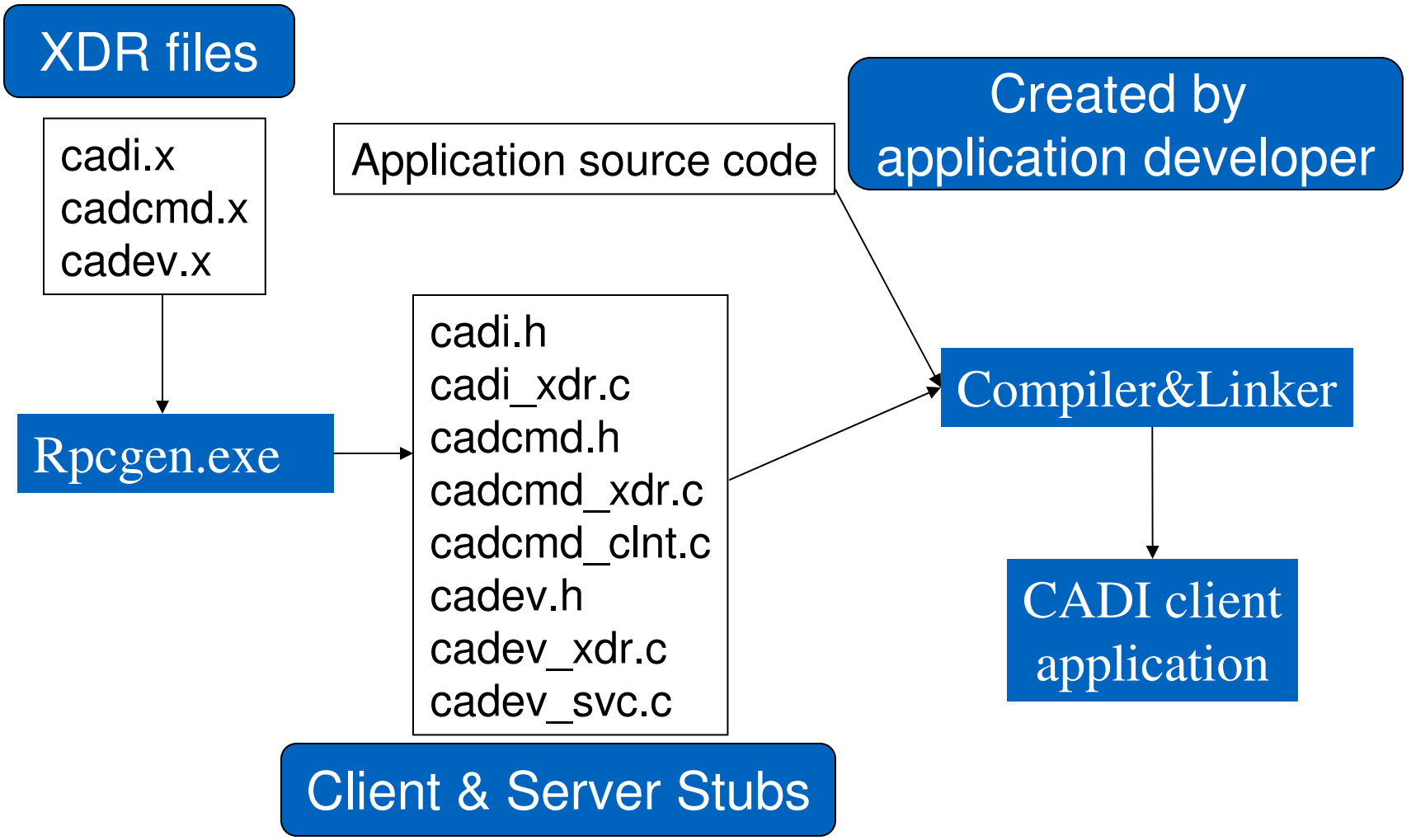
RPC Diagram


CADI
Client
Program
RPC Call
Network
Invoke
Service
CADI Server Program
Call Dispatch
Routine
Execute
Routine
Return
Request Completed
Return
Reply

RPC and OSI


7 Application Layer
CADI/API
(cadi.x, cadcmd.x, cadev.x)
6 Presentation Layer
XDR (RFC1014)
5 Session Layer
RPC (RFC1057)
4 Transport Layer
TCP (RFC793)
3 Network Layer
IP (RFC791)
Data Link Layer
LLC Sublayer
IEEE 802.2
2 MAC Sublayer
CSMA/CD (IEEE802.3)
1 Physical Layer
10baseT Ethernet
hub environment

RPCgen


XDR files
cadi.x
cadcmd.x
cadev.x
Application source code
Created by application developer
Rpcgen.exe
cadi.h
cadi_xdr.c
cadcmd.h
cadcmd_xdr.c
cadcmd_clnt.c
cadev.h
cadev_xdr.c
cadev_svc.c
Compiler&Linker
CADI client application
Client & Server Stubs

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

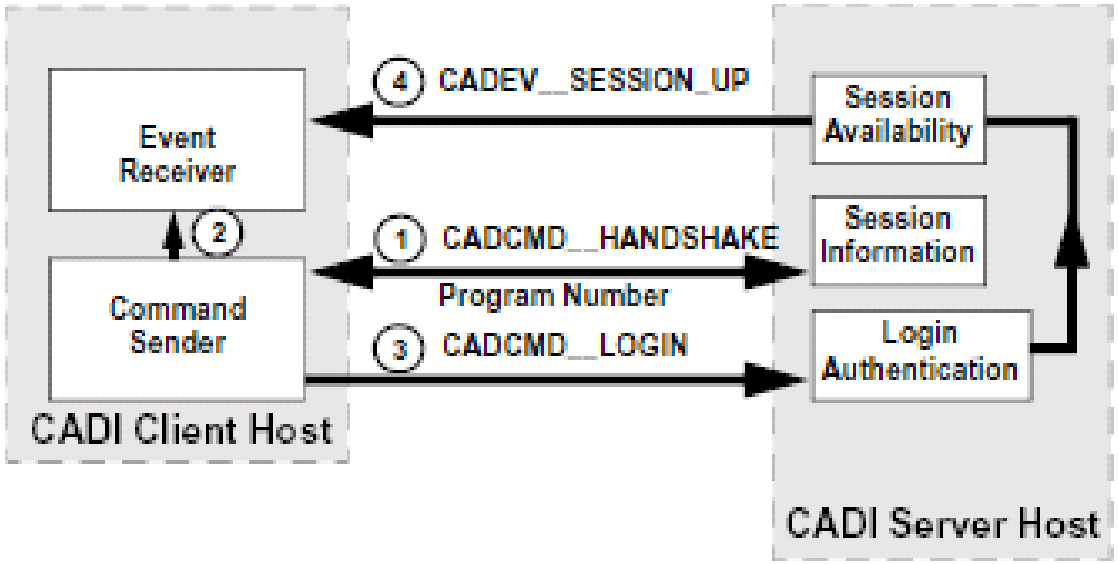
CADI Session Initialization

Call CADCMD__HANDSHAKE

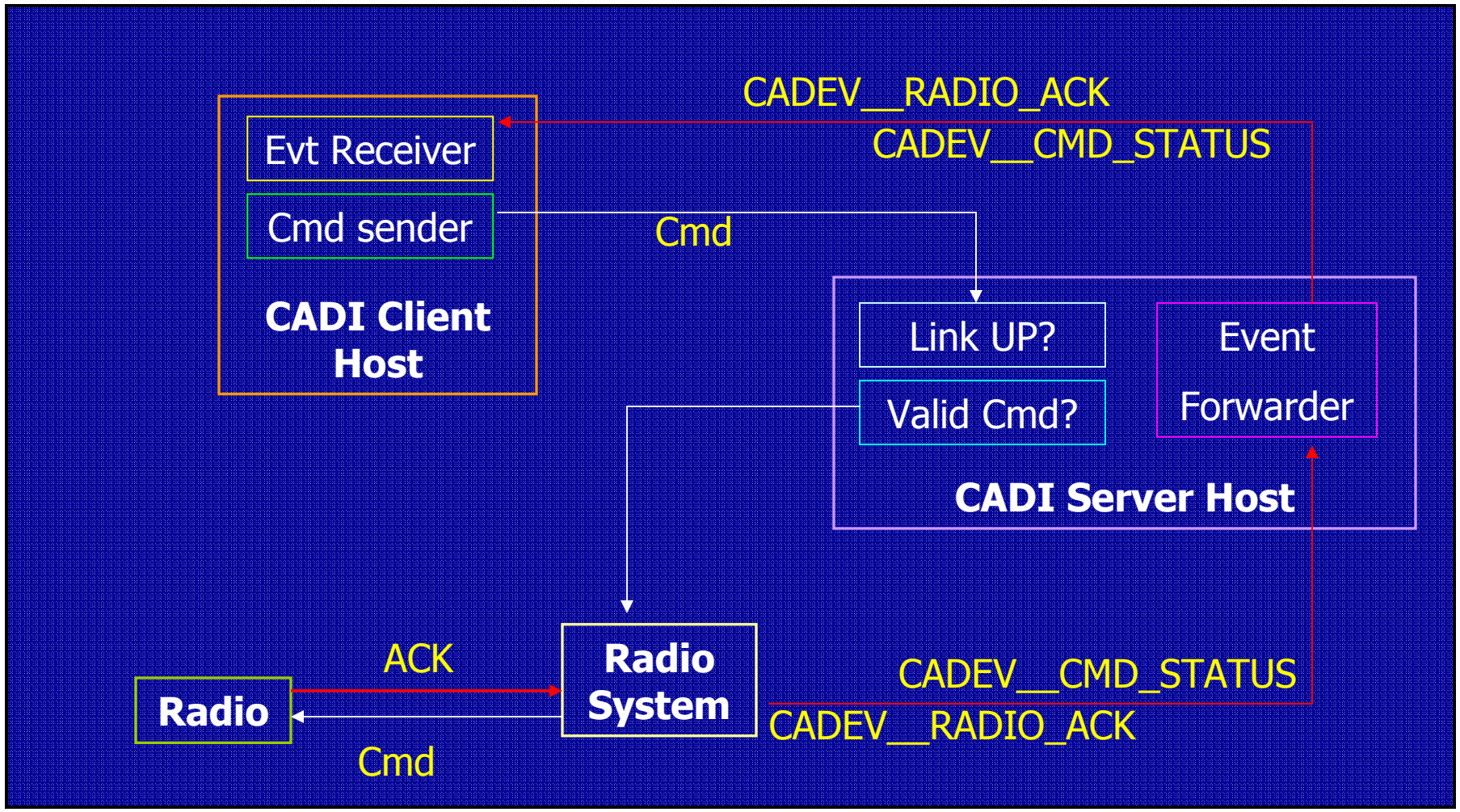
Start Event Listening service

Call CADCMD__LOGIN

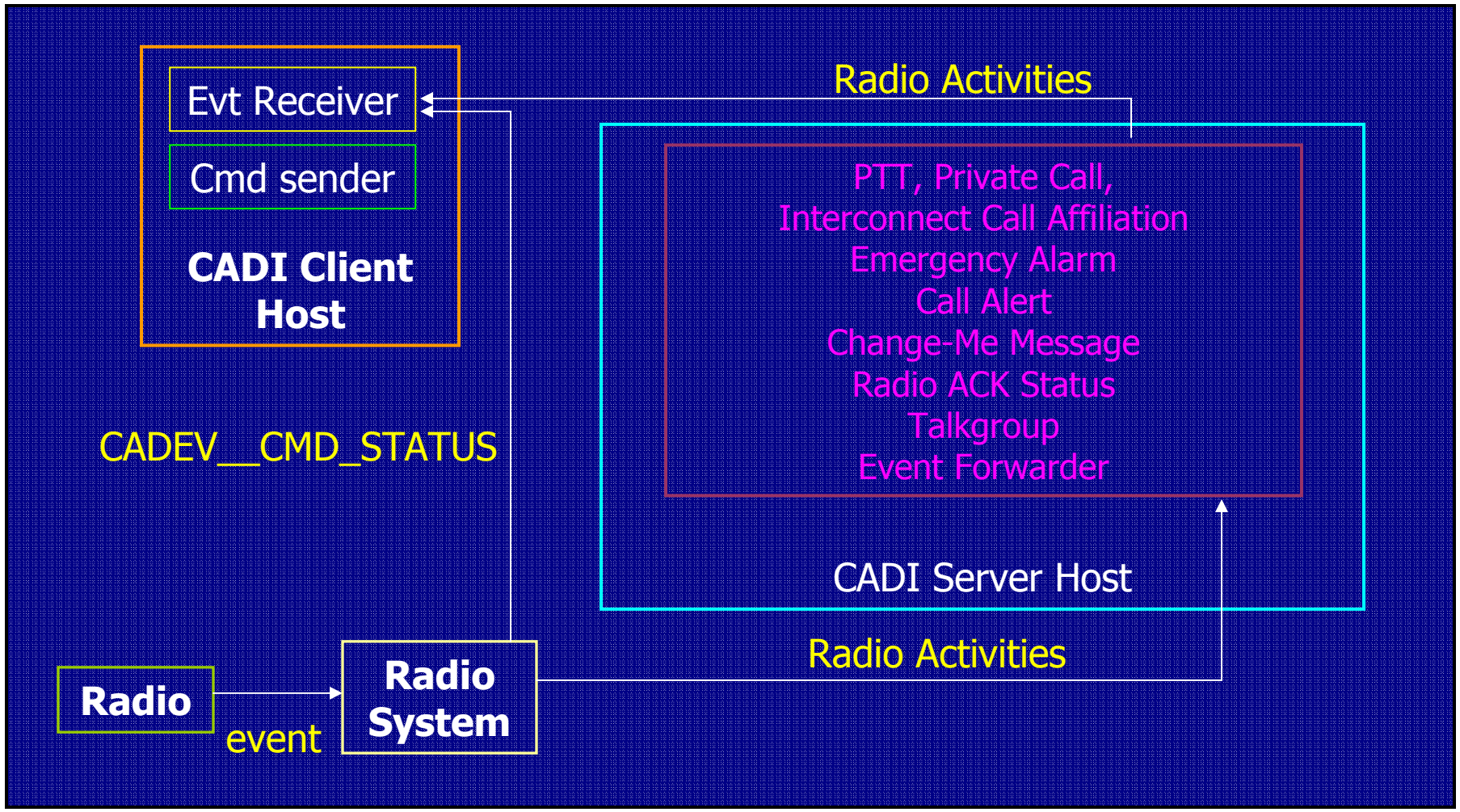
CADEV__SESSION_UP event received



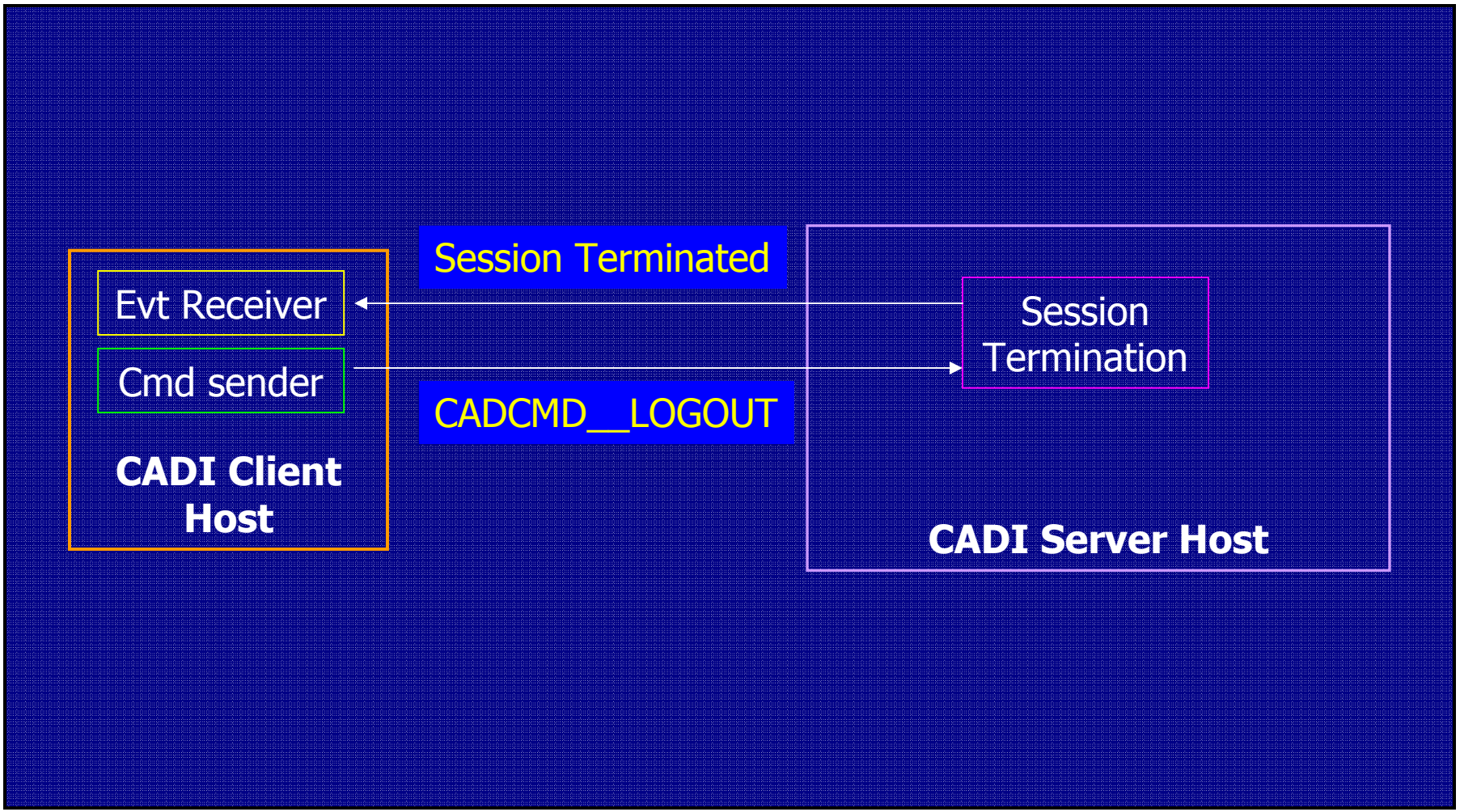
CADI Inbound Command Process



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
CADCMD__LOGIN
CADCMD__LOGOUT

connection management

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:

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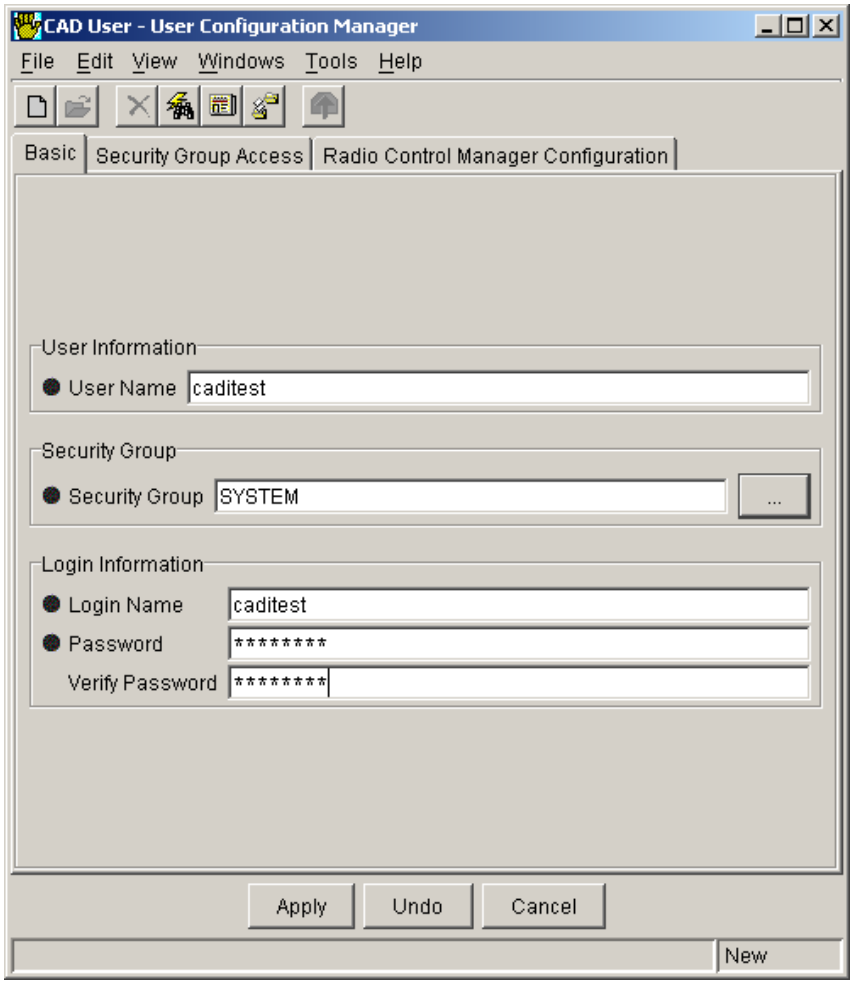
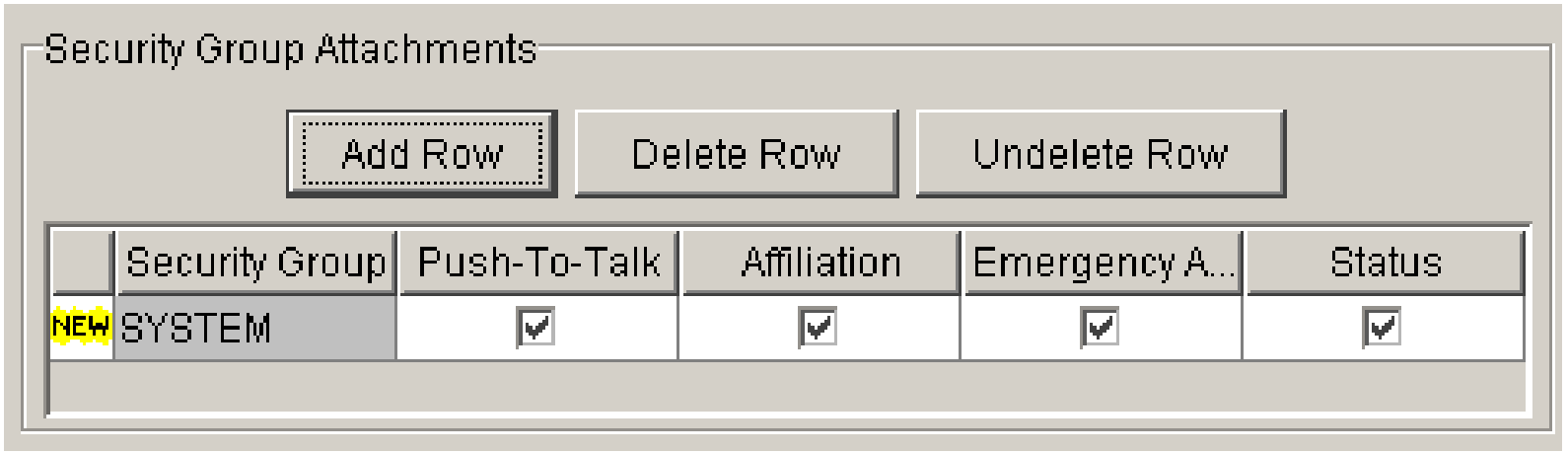
- Affiliation
- Emergency Alarm
- Status Events

CADI Account Setup

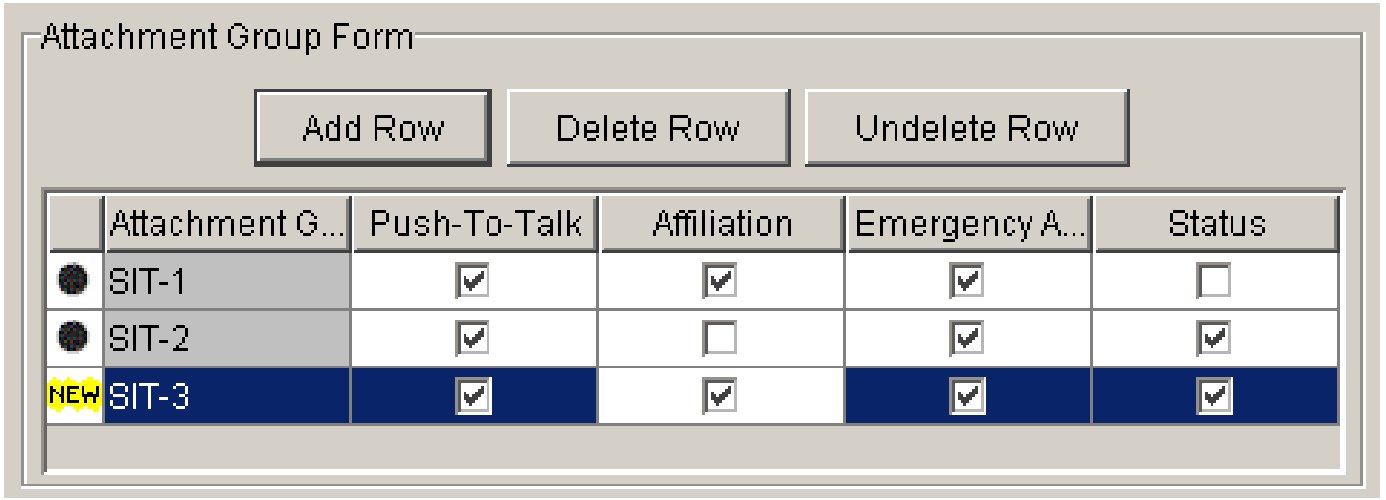
CAD Account - Setup



CAD Account - Filtering



CAD Account – Filtering (Cont)



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

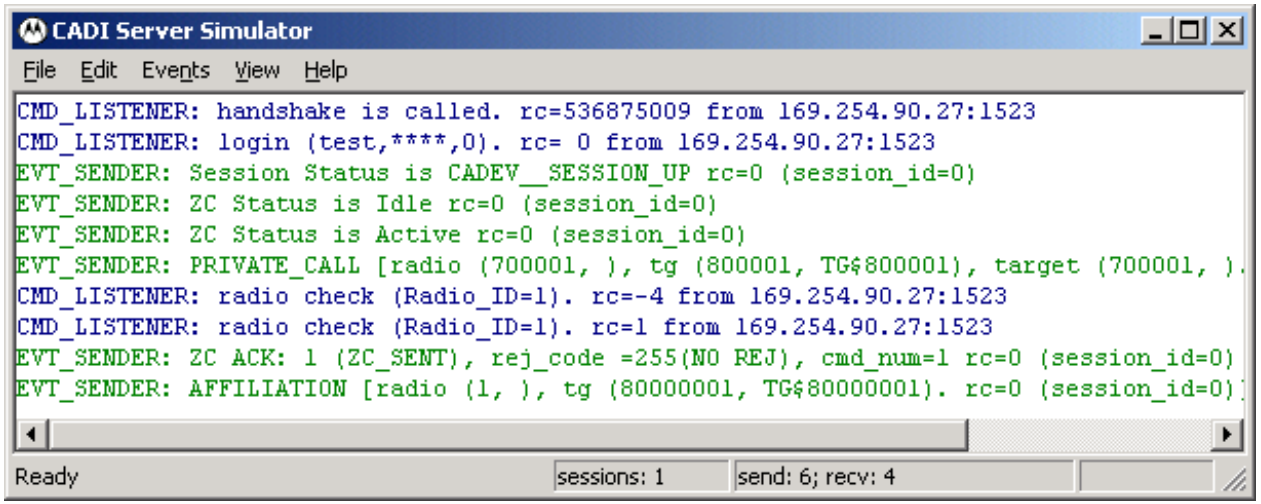
CADI Development Tools

CADI Server Simulator

Simulator for testing and learning CADI API

Available with CADI SDK

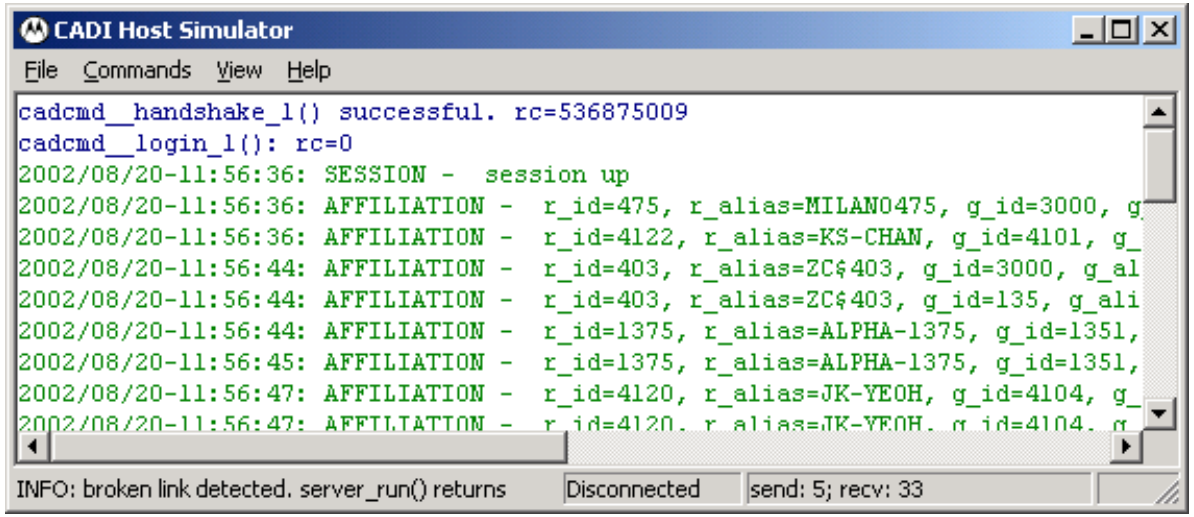
Simulate events and respond to commands



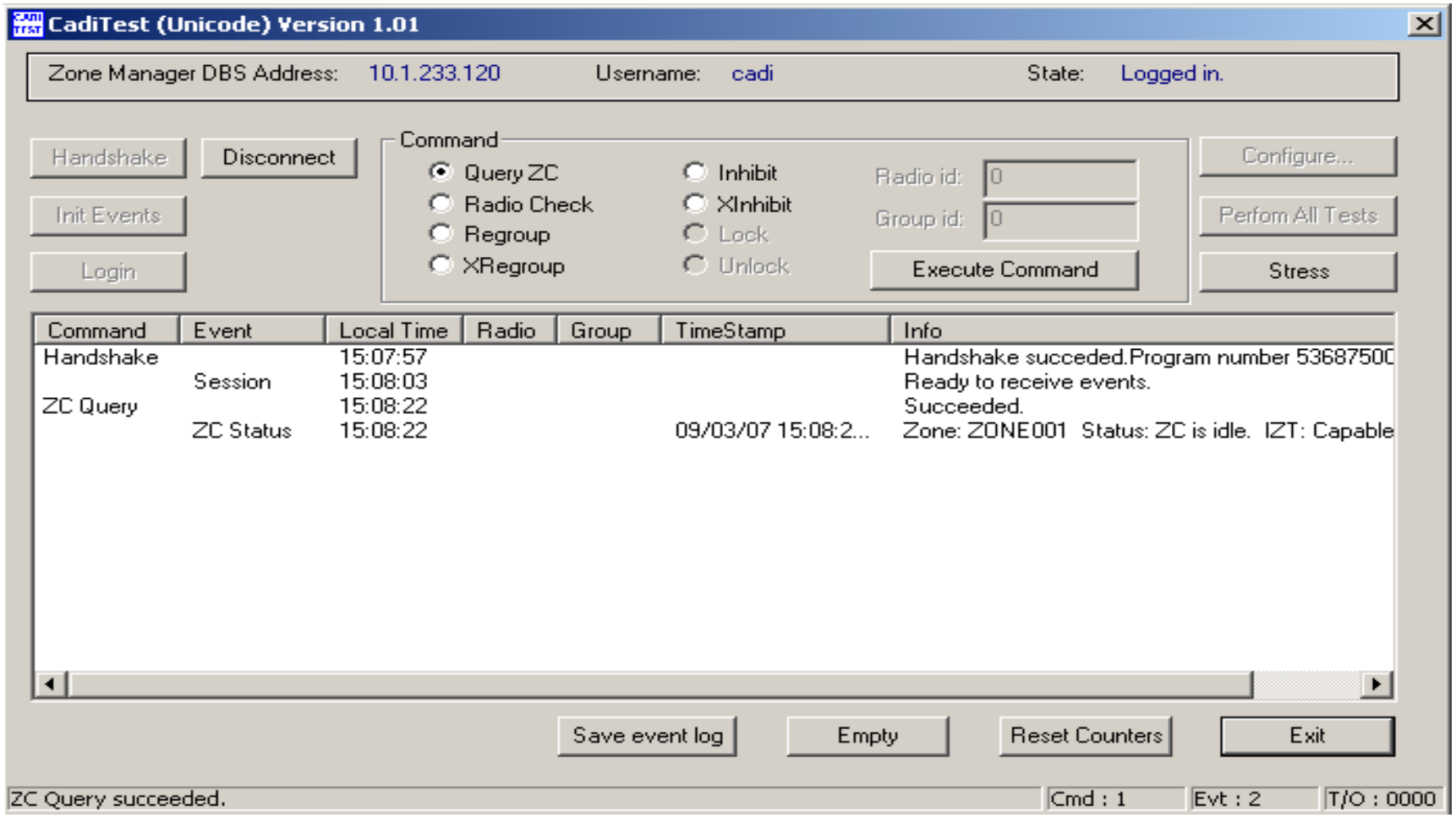
CADI Host Simulator

Sample client for testing/learning CADI functions

Available with CADI SDK

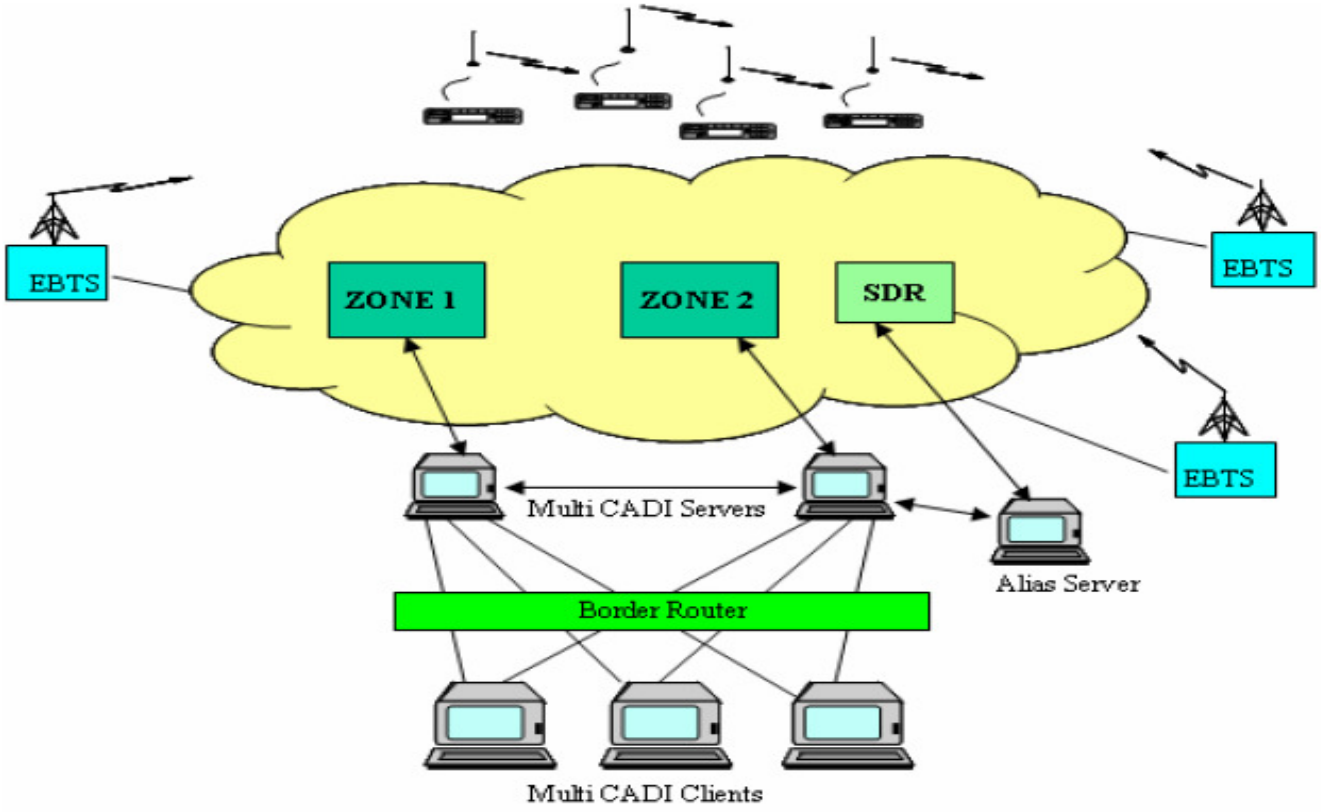


CadiTest (Unicode)



Multi–CADI Overview

Multi-CADI on Multi Zone System



Multi-CADI Operation

Provide additional capabilities for the CADI

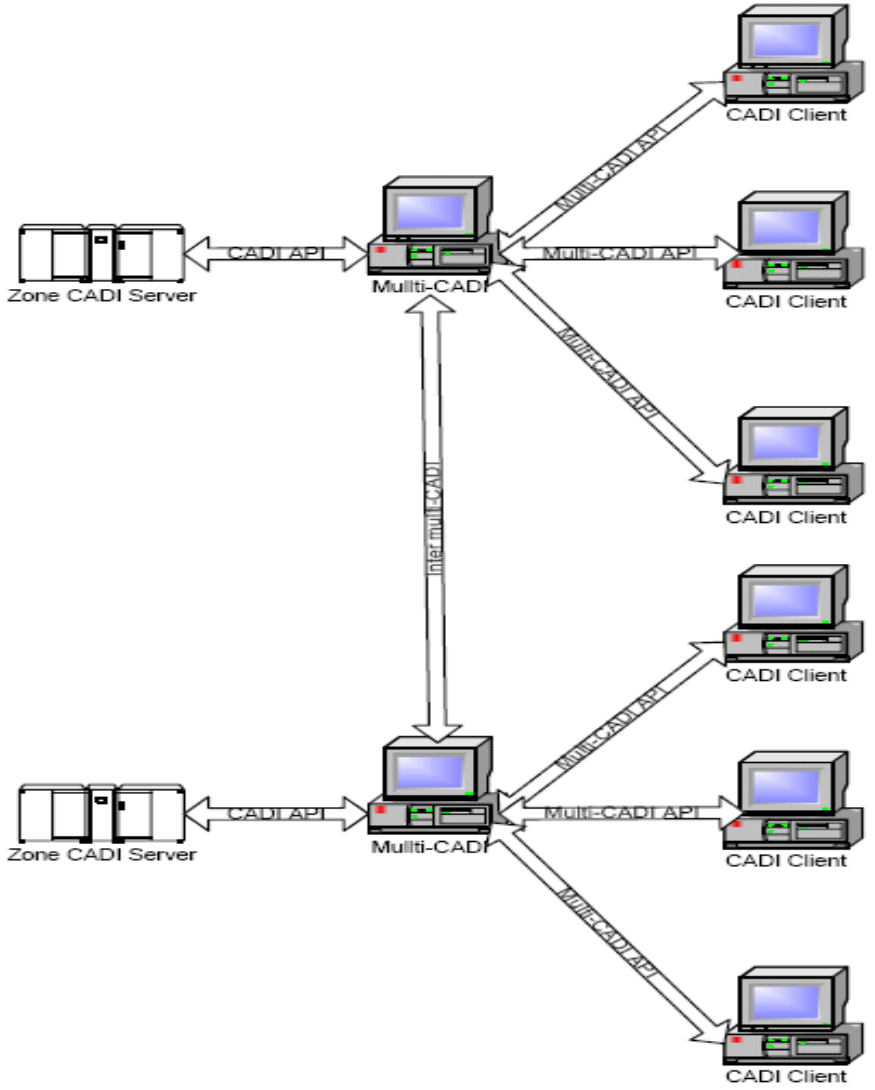
- Supports 25 concurrent client sessions plus an alias server client
- Distribution of system and client events, validation of system and client commands are based upon ISSI filtering of client's own control
- Support client commands and event to/from alias server client for access to aliasing services
- Forward system commands/events to homezone cadi 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

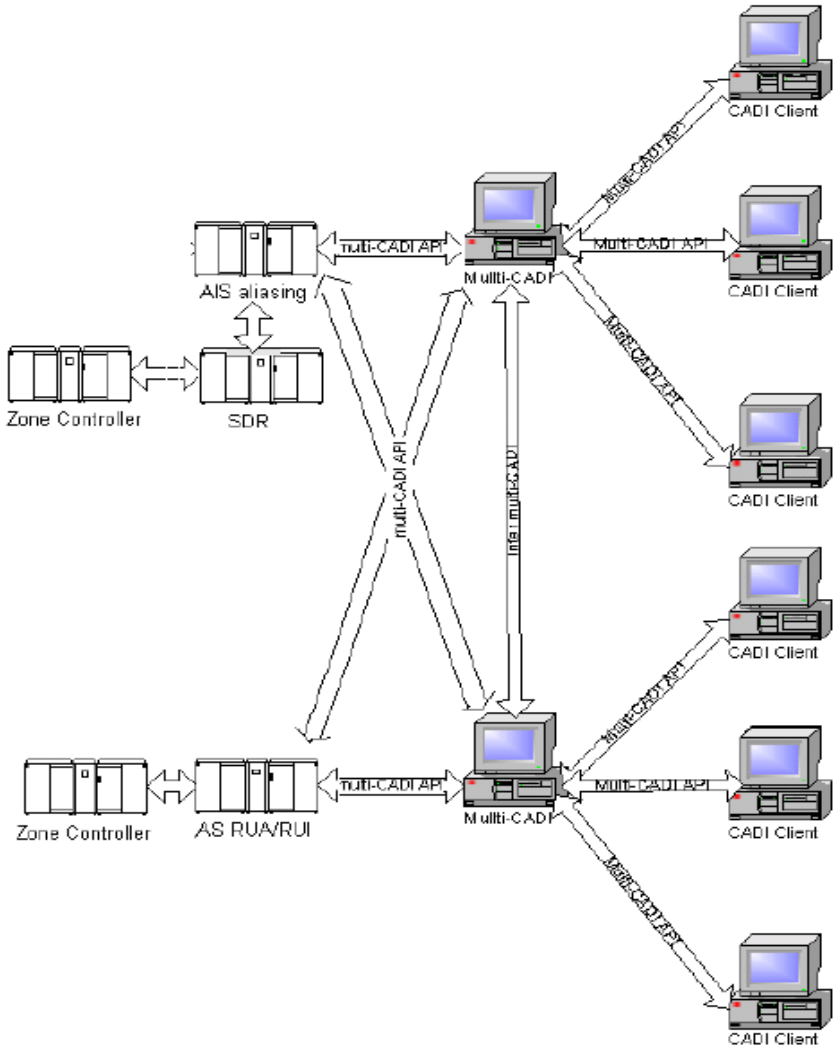
Multi-CADI Operation

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:

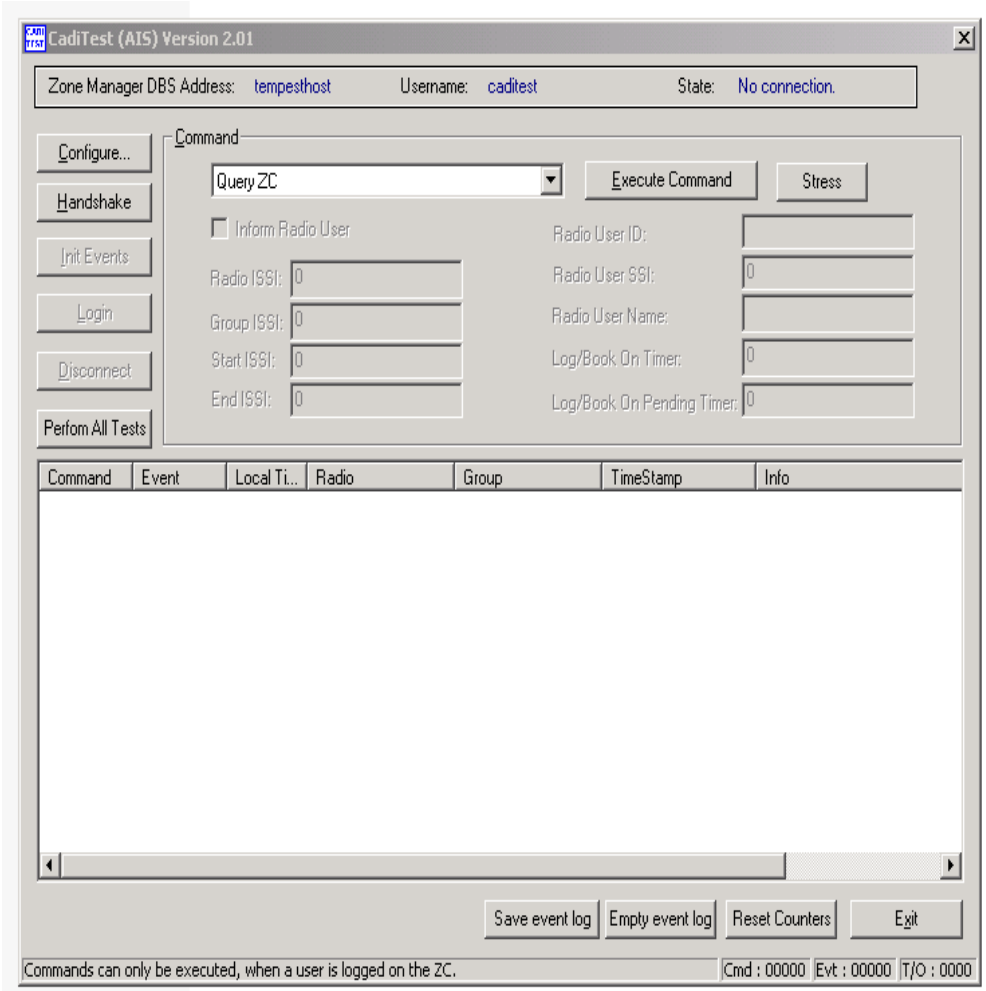
- 25 clients
- 26 clients, with AIS or RUA/RUI feature

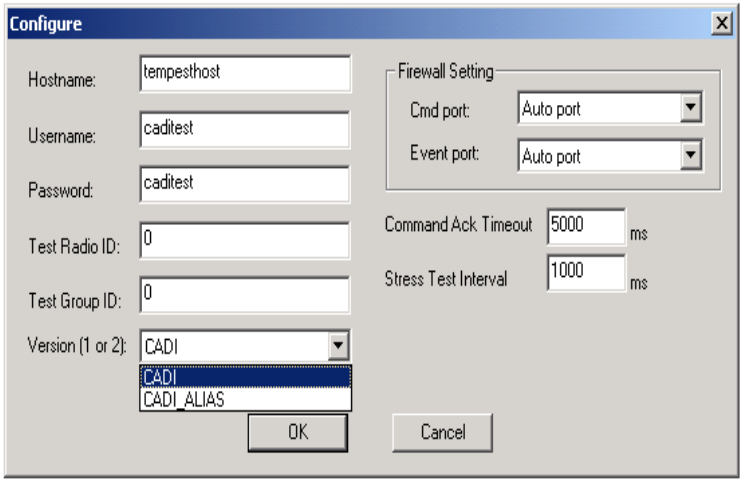
Command rate:

- 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)





Summary

Summary

Dimetra Control Overview

CADI

- RPC
- Designs
- Commands and Events
- Development

Multi-CADI

THANK YOU...