Using z/OS Communications Server to perform OSA Diagnostics

Hugh Hockett – hhockett@us.ibm.com
IBM, Raleigh, NC, US

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Using z/OS Communications Server to perform OSA Diagnostics

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Project:	Communications Server
Track:	SNA/IP Integration, If you are in Network support and management
Classification:	Technical
Speaker:	Hugh Hockett, IBM
Abstract:	z/OS Communications Server provides several tools for diagnosing network and OSA related problems. In this session we'll discuss how to take advantage of these tools including Packet Trace, Network Traffic Analyzer, QDIO Diagnostic Synchronization, and several Netstat and VTAM commands including VTAM tuning statistics. This session will also introduce the latest V1R12 diagnosis features including the Display OSAINFO command and the TCP/IP Callable Network Management Interface (NMI).

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Agenda

- Introduction to OSA/Network Diagnostics
- Component Trace (CTRACE)
- Packet Trace
- Service Assistant for z/OS Comm Server
- OSA-Express Network Traffic Analyzer
- Display OSAINFO Command (V1R12)
- Networking Problem Diagnosis Example
- NMI (New Additions in V1R12)
- OSA Related Messages and Error Codes
- QDIO Diagnostic Synchronization

- Appendix A: Component Trace Commands
- Appendix B: Netstat Commands
- Appendix C: VTAM Tuning Statistics
- Appendix D: VTAM TRLE Display

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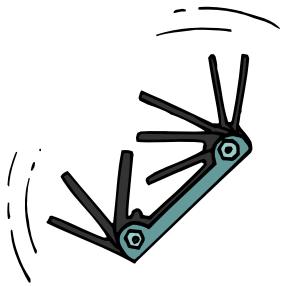
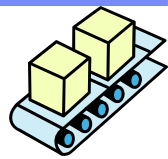
Introduction

- Many different types of OSA related problems you might want to solve:
  - Network flows, contents of data, timing issues
  - Device configuration issues
  - Performance issues and device statistics
  - Device errors and collecting documentation for IBM support

- Several z/OS Communications Server tools for collecting OSA related diagnostics
  - Traces
  - Commands and Displays
  - Network Management APIs
  - Error messages
  - Synchronizing documentation



- Multiple ways to approach a problem and multiple tools that can be used



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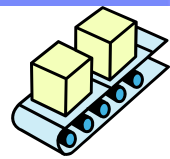
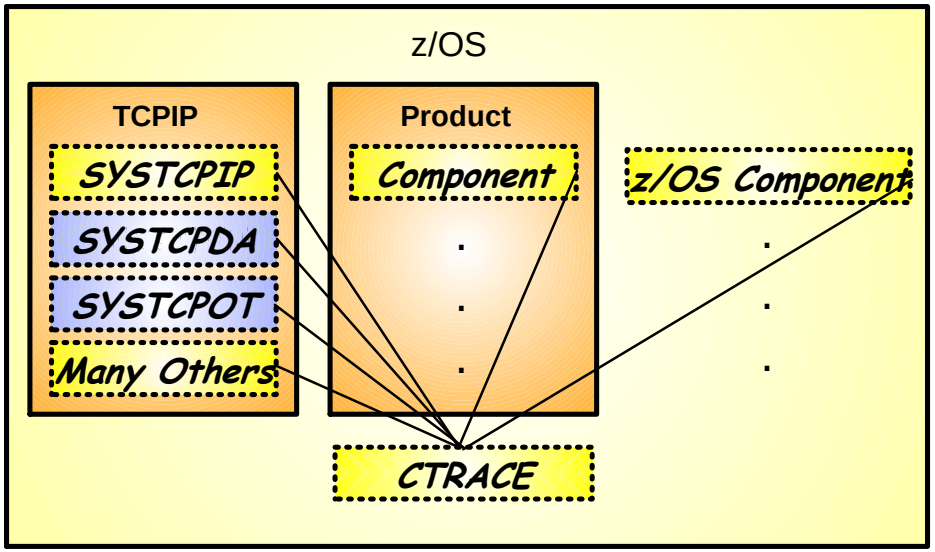
Component Trace (CTRACE)

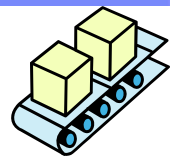
Introduction to Component Trace



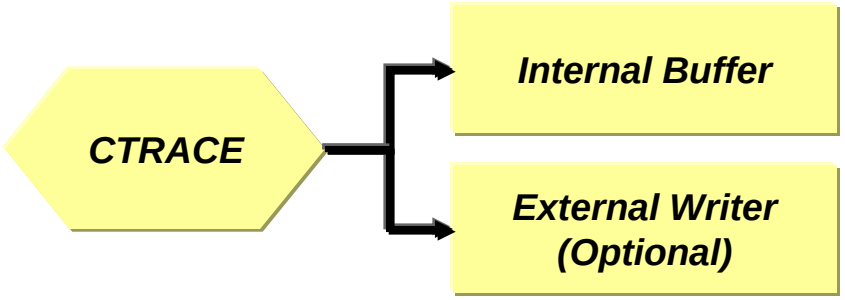
- Component Trace (CTRACE) is a centralized z/OS facility that collects trace data from different components.
- "Components" can be products or functions within products.
- Two CTRACE components for z/OS Communications Server we will look at in this presentation are:
  - SYSTCPDA – Packet Trace
  - SYSTCPOT – OSA-Express Network Traffic Analyzer (OSAENTA)



Introduction to Component Trace cont.



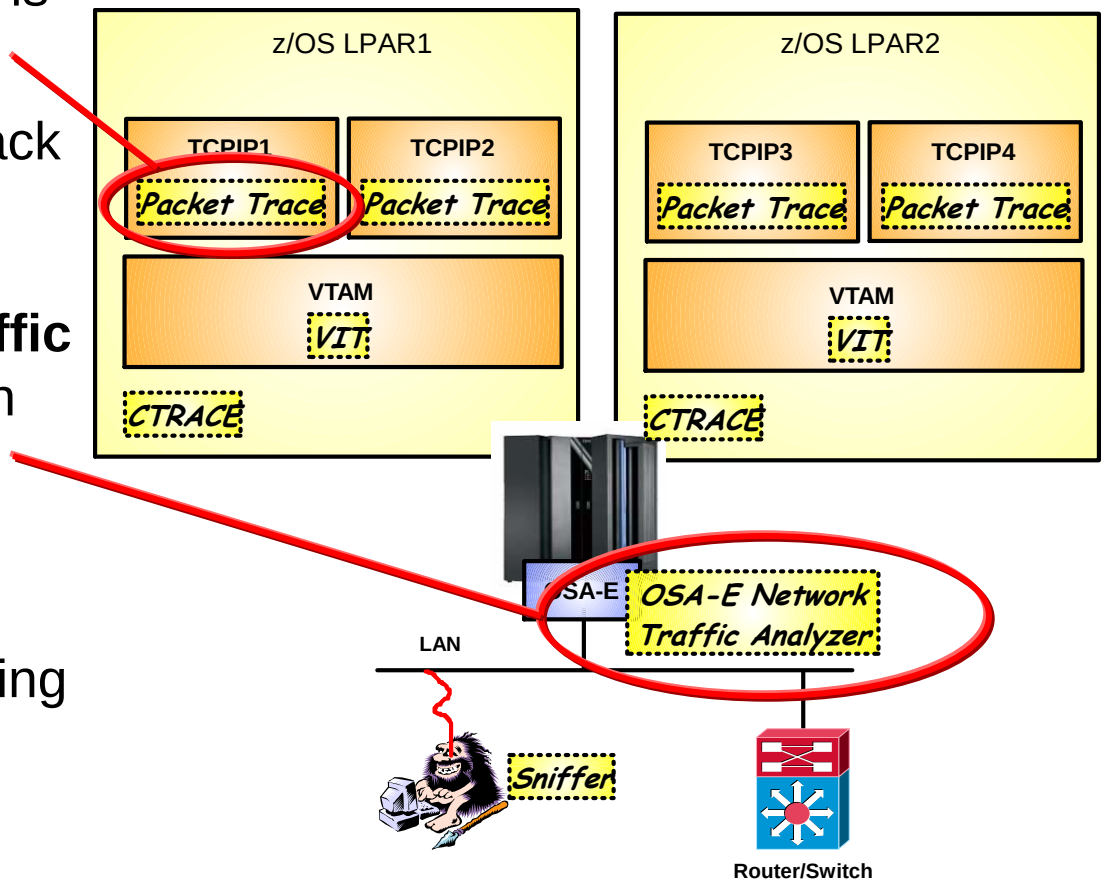
- CTRACE collects trace records and adds them to an internal buffer
- Internal buffer can be written to an external file if requested (for larger traces that would wrap the internal buffer)



- Internal buffers are captured in a DUMP and formatted using the CTRACE subcommands or panel in the Interactive Problem Control System (IPCS)
- Network Management Interface (NMI) can be used to capture some component traces in real time

Deciding Which Trace to Use

- **Packet Trace** (SYSTCPDA) is a TCP/IP stack level trace
  - Scope of trace is the stack
- **OSA-Express Network Traffic Analyzer** (SYSTCPOT) is an OSA level trace
  - Scope of trace is local LPAR or entire CHPID depending on HMC setting

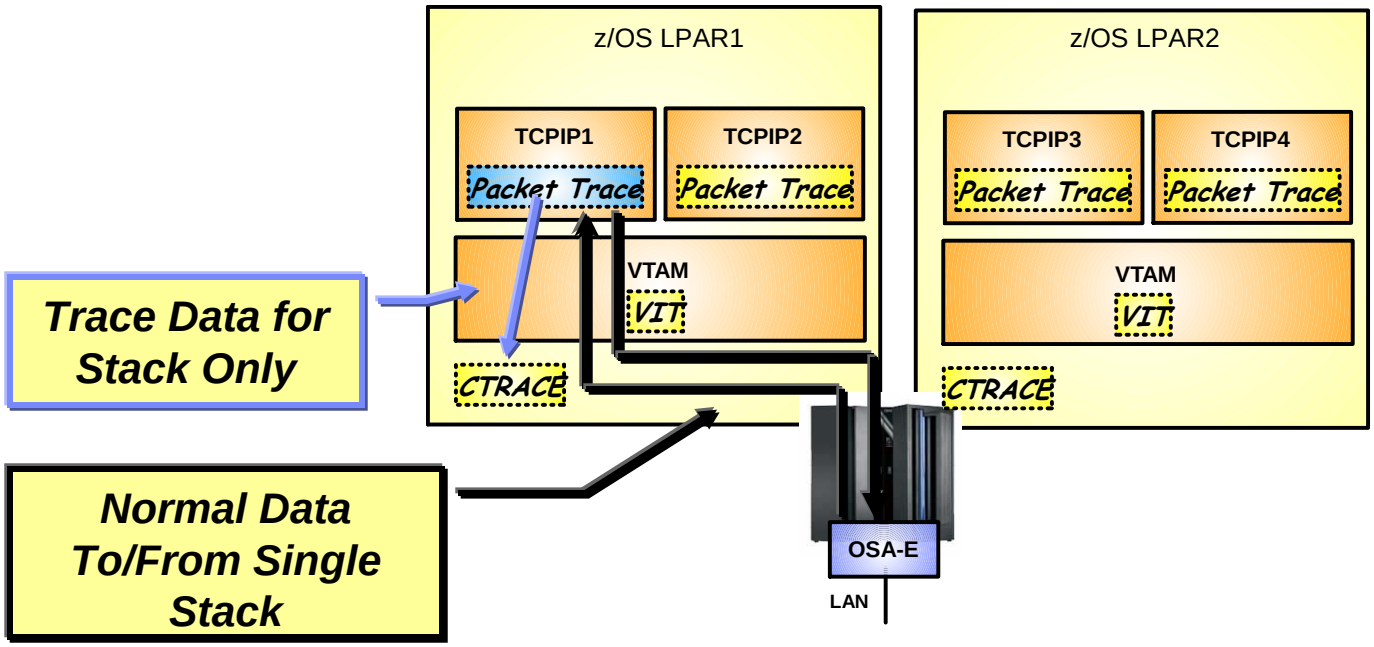


Using z/OS Communications Server to perform OSA Diagnostics

Packet Trace

Introduction to Packet Trace

- Packet Trace captures packets entering and leaving a TCP/IP stack.
- Trace data is collected using the SYSTCPDA component of CTRACE
- Trace point is in the stack so inbound data must actually make it to the specified stack to be traced.
  - No ARP packets, MAC headers for IPv4, or OSA dropped packets



How to use Packet Trace

- **Start CTRACE** for the desired component to collect trace records
  TRACE CT,ON**,COMP=SYSTCPDA**,SUB=(TCPCS1)
  R n,END
  - **Start Packet Trace** to generate trace records for all interfaces
    V TCPIP,TCPCS1,PKT,ON
    - Recreate the problem
  - **Stop Packet Trace**
    V TCPIP,TCPCS1,PKT,OFF
- **Stop CTRACE** for the component
  TRACE CT,OFF,**COMP=SYSTCPDA**,SUB=(TCPCS1)
- Issue the DUMP command to capture internal buffer

  DUMP COMM=(dump title here)
  R n,JOBNAME=(TCPCS1),DSPNAME=('TCPCS1'.*),CONT
  R n,SDATA=(CSA,RGN,TRT),END
- IBM Technote: How to Collect PKTTRACE and CTRACE on z/OS
  http://www-01.ibm.com/support/docview.wss?uid=swg21292013

Note: You can also use statements in a TCPIP PROFILE or Obeyfile to turn on/off Packet Trace

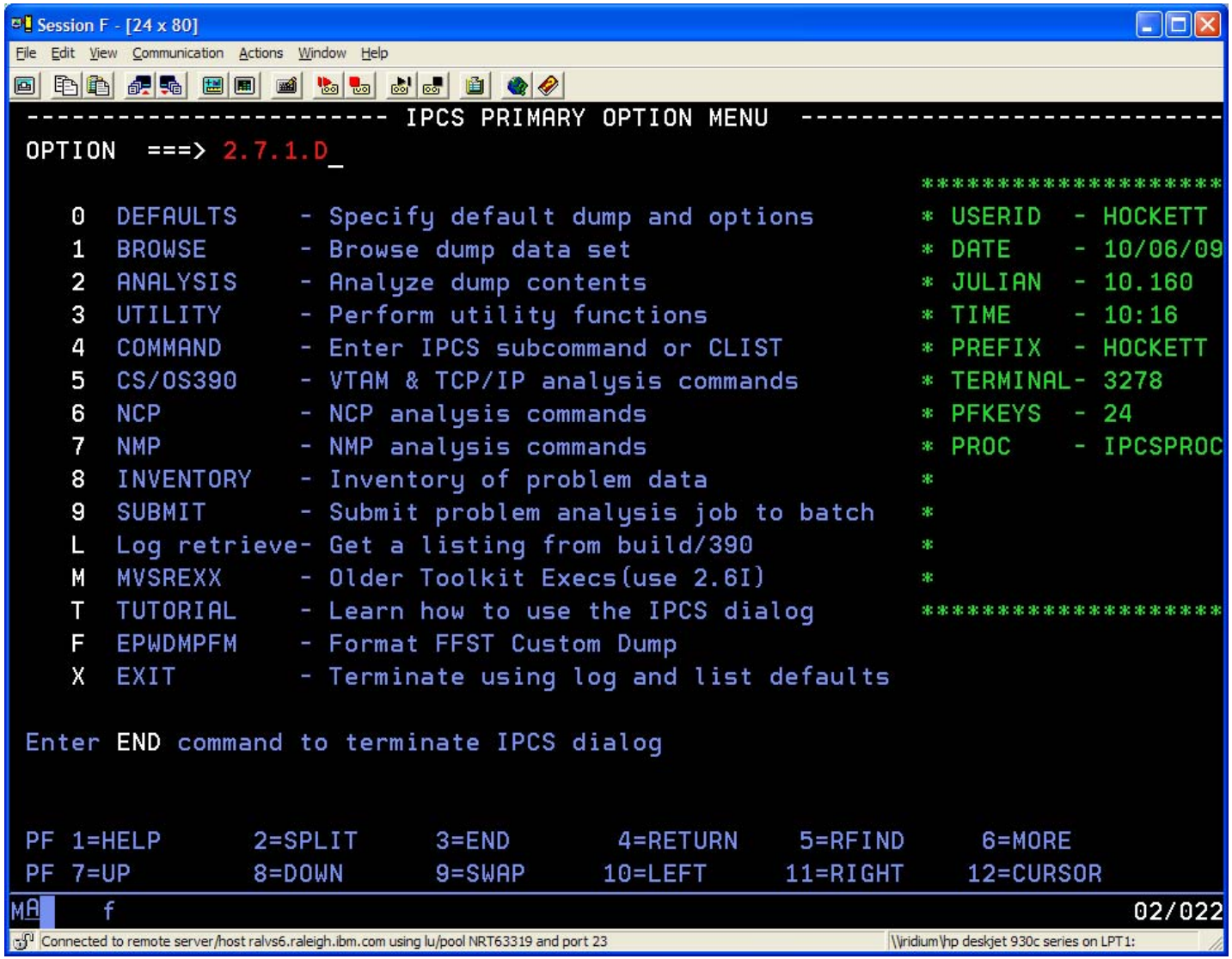
How to use Packet Trace - Filters

- You can filter what is captured to reduce the size of the trace
  V TCPIP,TCPCS1,PKT,ON,LINKN=QDIO4101L,IP=172.16.1.1,ABBREV=100,PORTNUM=8088,PROT=6
  Note: See IP System Administrator's Commands for a complete list of filters
- You can use ABBREV= keyword to shorten trace records (chop off data)
- Filters are -AND- on same command, -OR- on different commands
- Use Netstat DEvlinks/-d to display active traces at an interface level

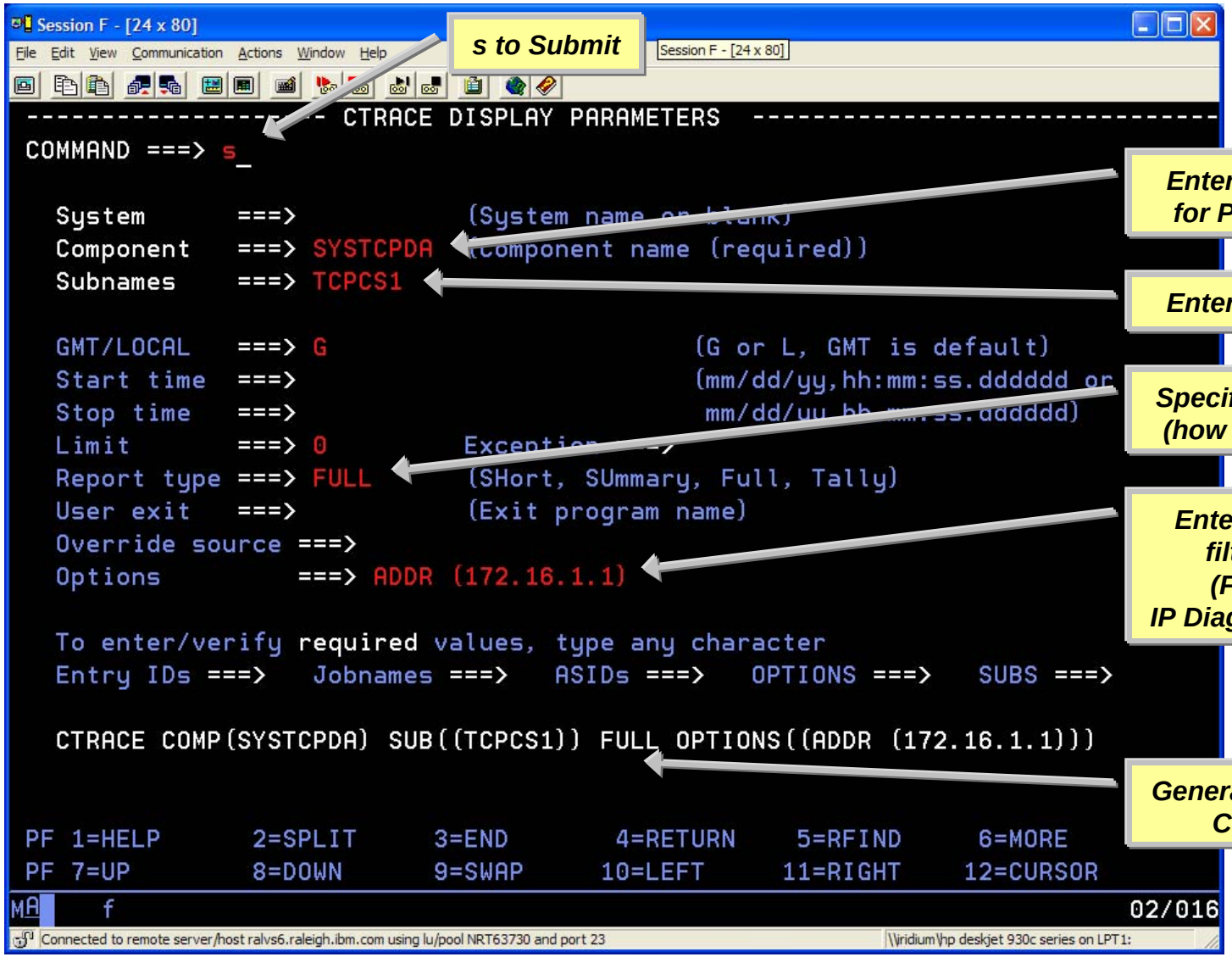
```
10.45.42  D TCPIP,TCPCS1,N,DEV,INTFN=QDIO4101
10.45.42  EZD0101I NETSTAT CS V1R12 TCPCS1 567
DEVNAME: QDIO4101           DEVTYPE: MPCIPA
  DEVSTATUS: READY
  LNKNAME: QDIO4101L          LNKTYPE: IPAQENET   LNKSTATUS: READY
.
  PACKET TRACE SETTING:
     PROTOCOL: TCP                TRRECCNT: 00000007  PCKLENGTH: 00100
     DISCARD:  NONE
     SRCPORT:  *                  DESTPORT: *         PORTNUM: 8088
     IPADDR:   172.16.1.1         SUBNET:   *
```

Number of Records Captured

Format CTRACE - IPCS 2.7.1.D

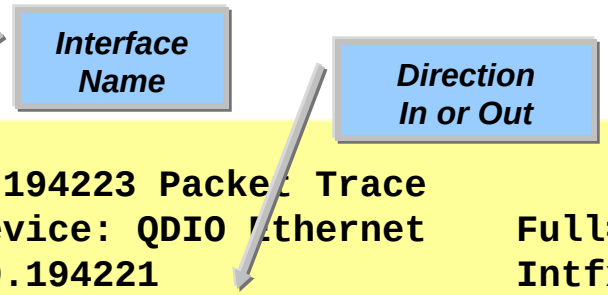


Format CTRACE - IPCS 2.7.1.D



Packet Trace – Sample Record

- Part 1 of 2




```
190 MVS206   PACKET   00000004 16:15:19.194223 Packet Trace
 From Interface    : QDIO4101L          Device: QDIO Ethernet    Full=57
  Tod Clock        : 2010/06/14 16:15:19.194221                  Intfx: 35
  Segment #        : 0                  Flags: Adj In
  Source           : 172.16.1.2
  Destination      : 172.16.1.1
  Source Port      : 8088               Dest Port: 8087  Asid: 002F TCB: 0000000
  QID              : 1
 IpHeader: Version : 4                  Header Length: 20
  Tos              : 00                 QOS: Routine Normal Service
  Packet Length    : 57                 ID Number: 0030
  Fragment         :                    Offset: 0
  TTL              : 64                 Protocol: TCP            CheckSum: 206C
  Source           : 172.16.1.2
  Destination      : 172.16.1.1
```

Packet Trace – Sample Record cont.

- Part 2 of 2

```
TCP
  Source Port       : 8088  ()          Destination Port: 8087  ()
  Sequence Number   : 828742768         Ack Number: 2385624847
  Header Length     : 32                Flags: Ack Psh
  Window Size       : 32768             CheckSum: 7FD4 FFFF Urgent Data Pointer:
   Option           : NOP
   Option           : NOP
   Option           : Timestamp         Len: 10 Value: 84050FB6 Echo: 84050A87

Ip Header           : 20                IP: 172.16.1.2, 172.16.1.1 Offset:  0
000000 45000039 00300000 4006206C AC100102  AC100101

Protocol Header     : 32                Port: 8088, 8087          Offset: 14
000000 1F981F97 31659C70 8E31BF0F 80188000  7FD40000 0101080A 84050FB6 84050A8

Data                : 5      Data Length: 5                     Offset: 34
000000 A385A2A3 5A                          |test!           ..¢.Z          |
```

- Lots more information on Packet Trace and filters in the IP Diagnosis Guide

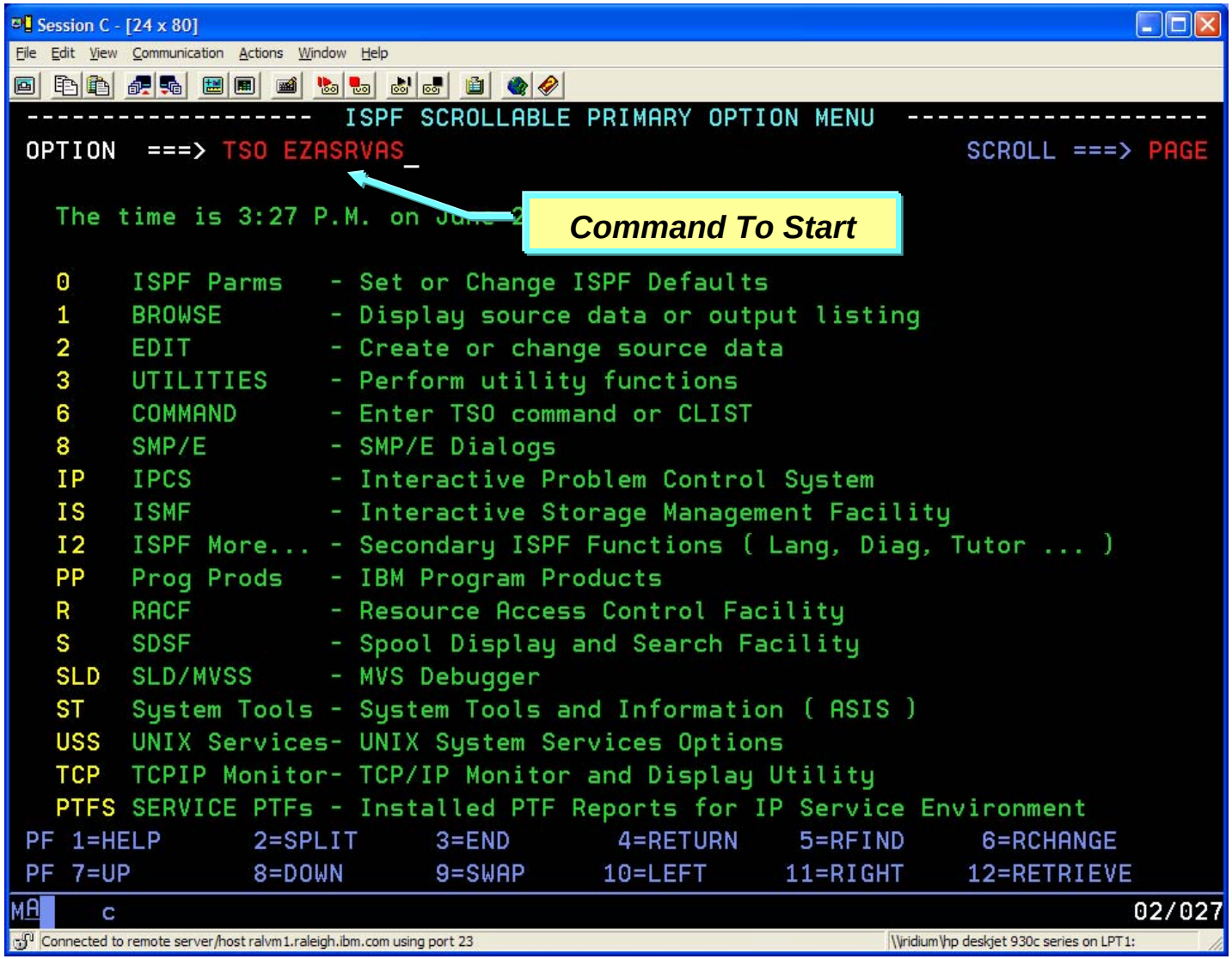
Using z/OS Communications Server to perform OSA Diagnostics

IBM Service Assistant for z/OS Communications Server

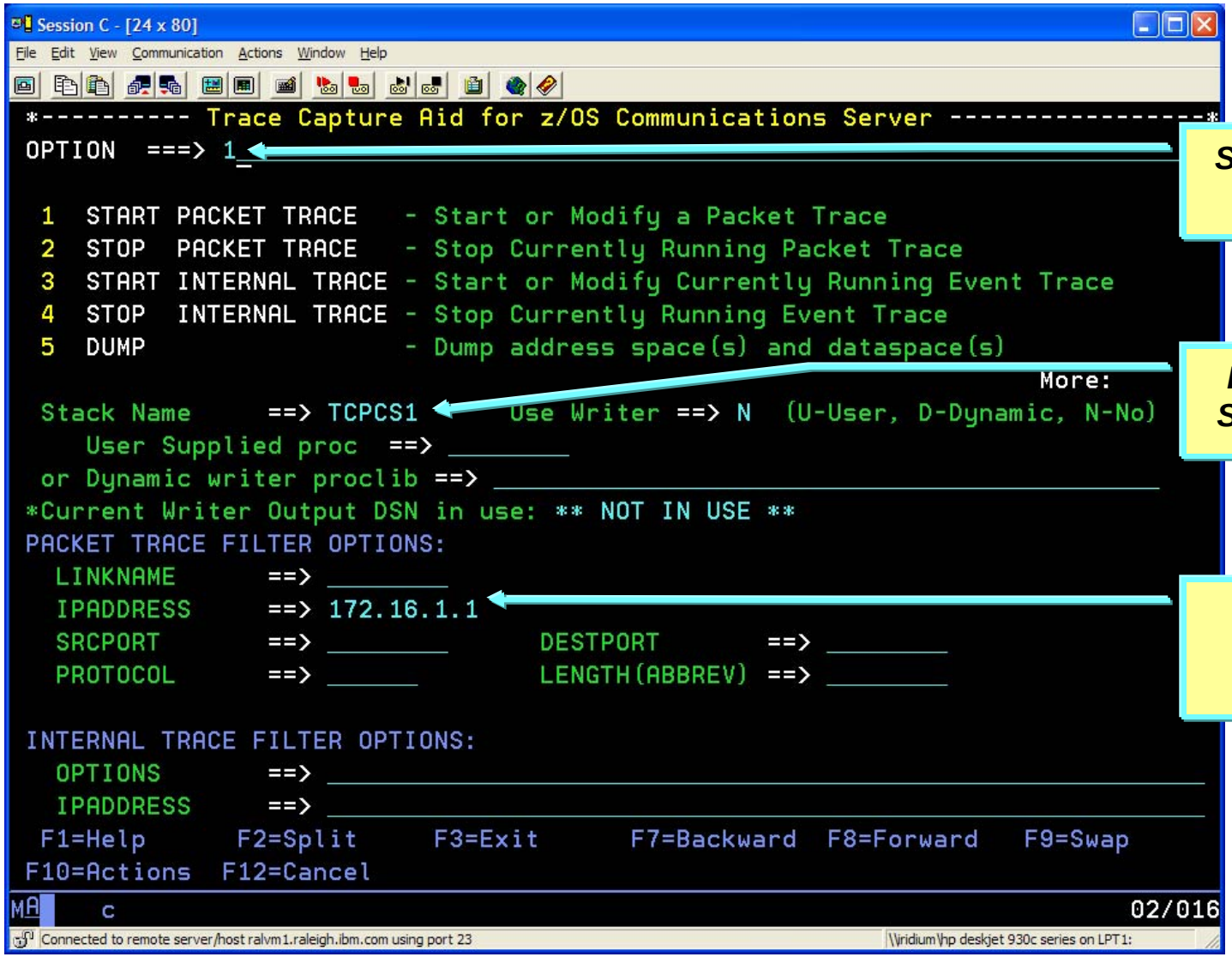
IBM Service Assistant for z/OS Communications Server

- ISPF Panel used to collect trace information
  - Packet Trace (SYSTCPDA)
  - TCP/IP Internal Trace (SYSTCPIP) (not discussed here)
- Fill in the fields, panel will automatically issue all trace commands for you
- Can also issue the DUMP command once your trace is complete
- Download and Install from IBM support website
  - http://www.ibm.com/support/docview.wss?uid=swg24020585
  - Need a TSO id that has CONSOLE authority
- How to start: From ISPF issue TSO EZASRVAS

IBM Service Assistant for z/OS Communications Server



IBM Service Assistant for z/OS Communications Server

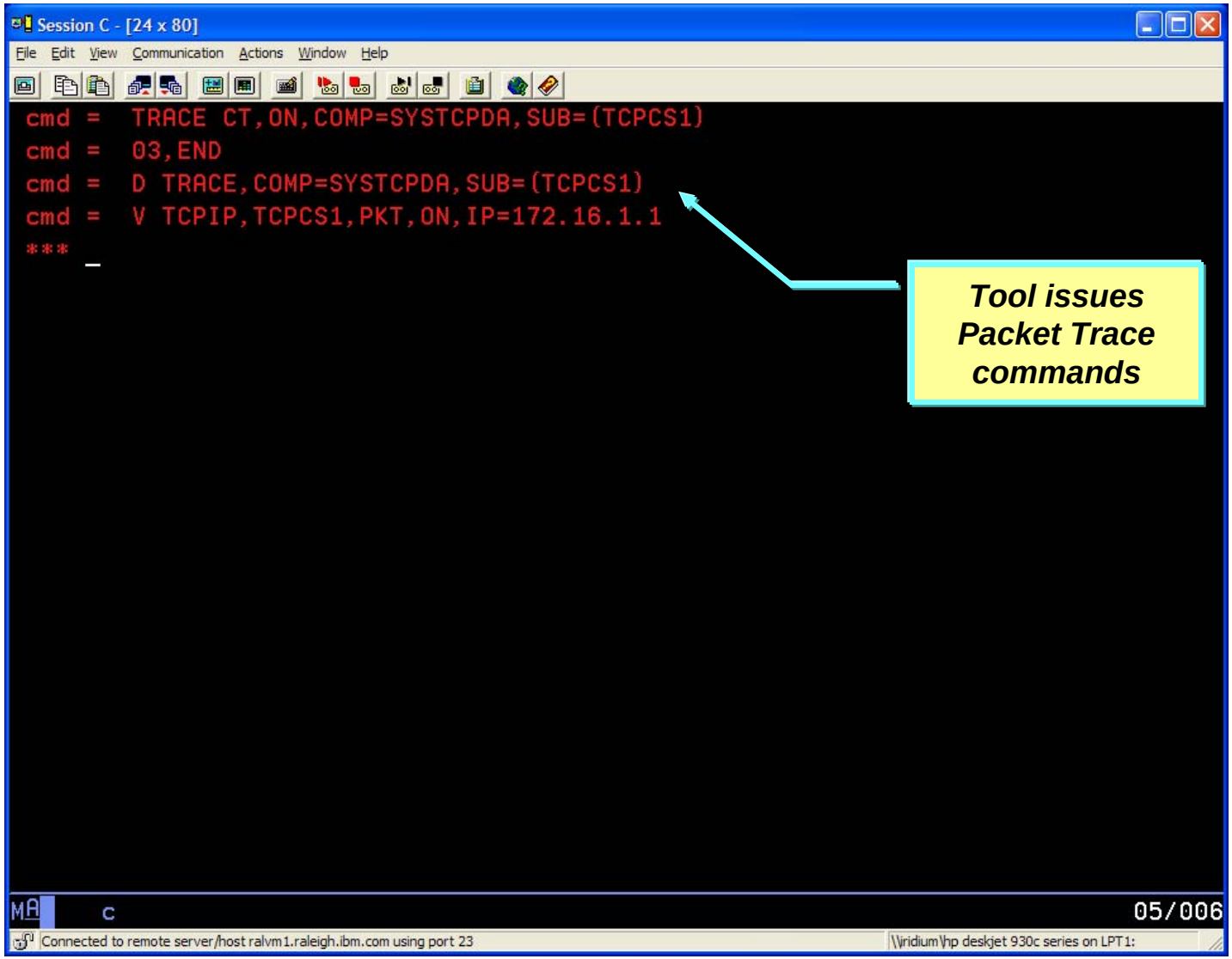


Start Packet Trace

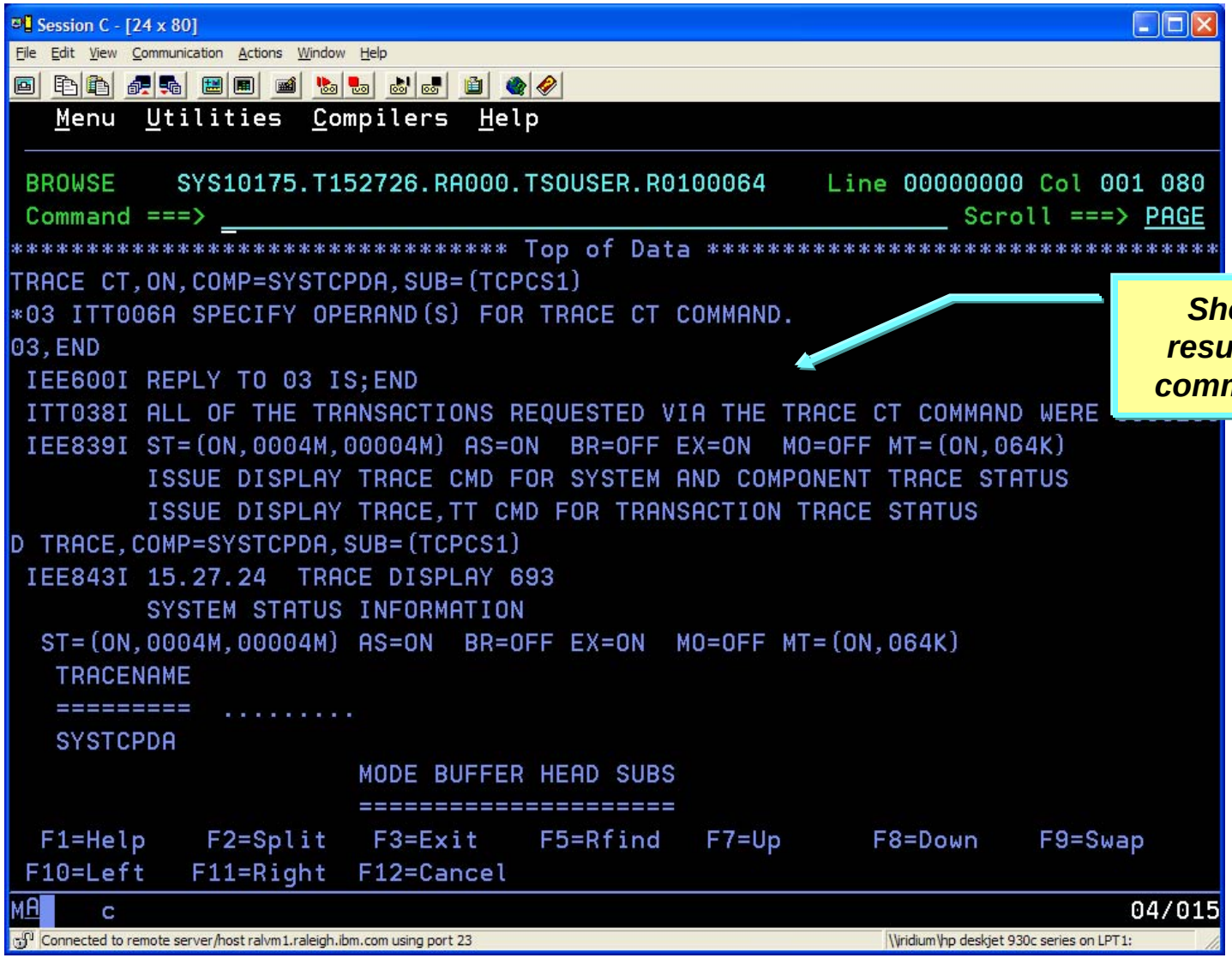
Fill in your Stack Name

Fill in any pre-trace filters

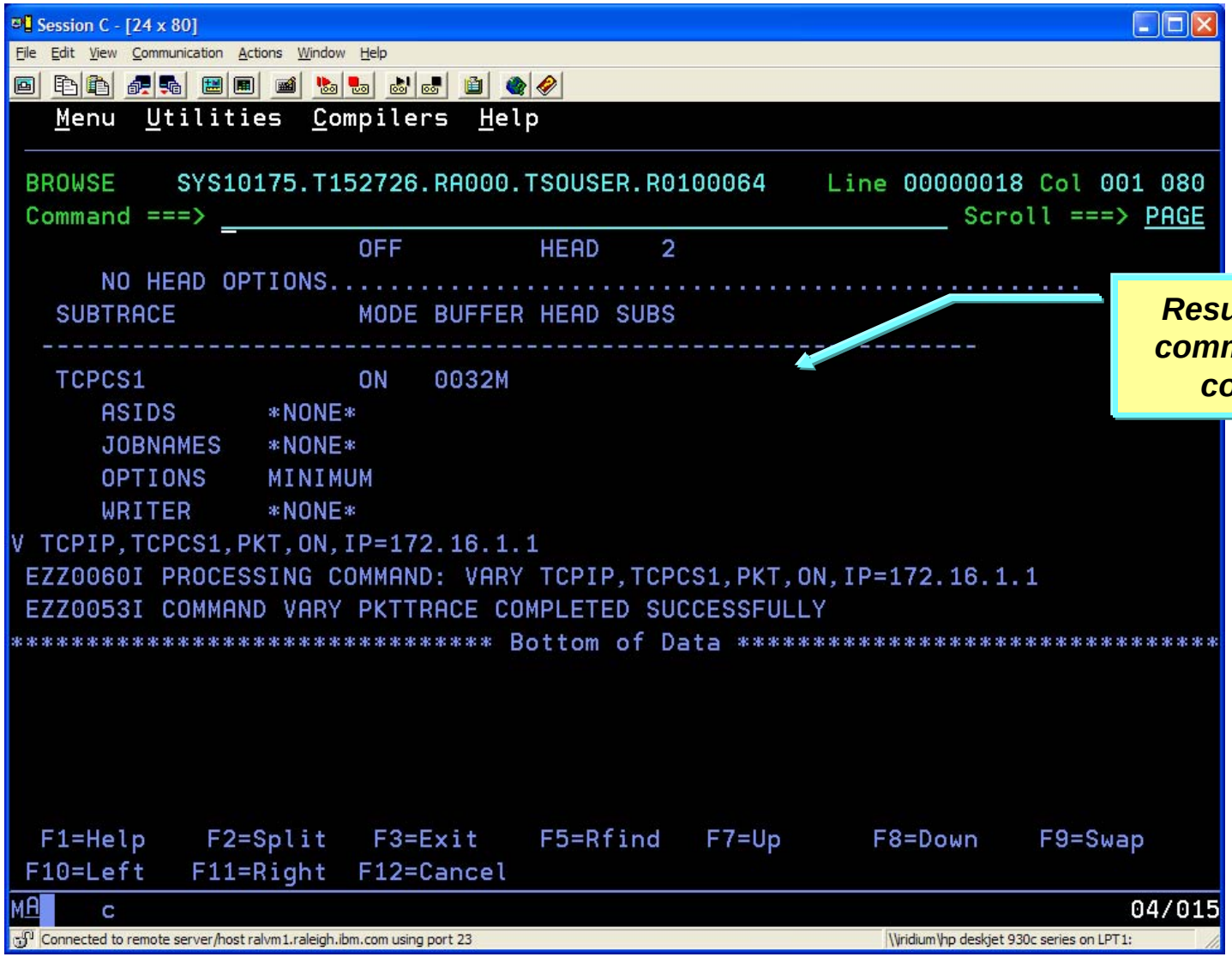
IBM Service Assistant for z/OS Communications Server



IBM Service Assistant for z/OS Communications Server

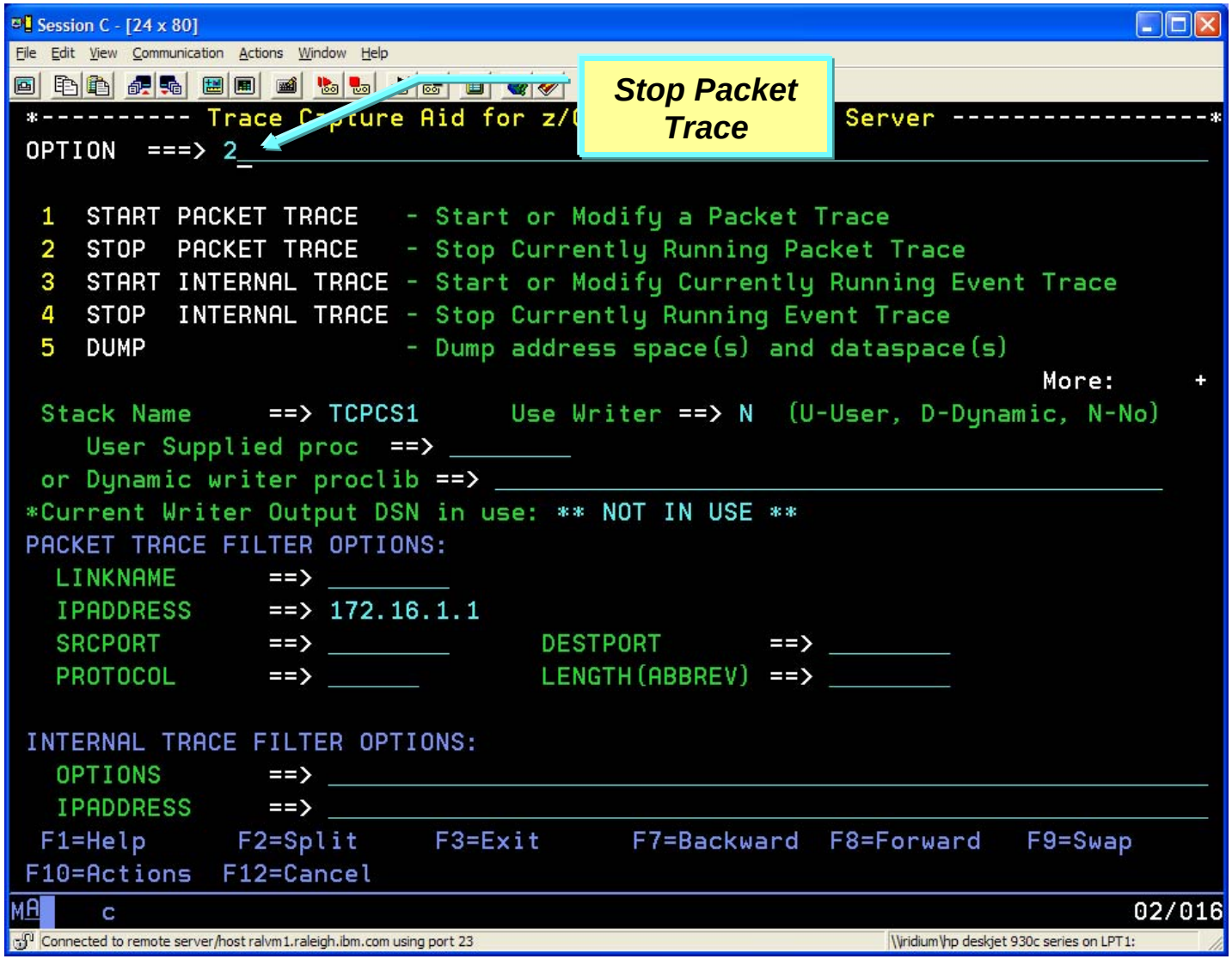


IBM Service Assistant for z/OS Communications Server



Results of commands cont.

IBM Service Assistant for z/OS Communications Server



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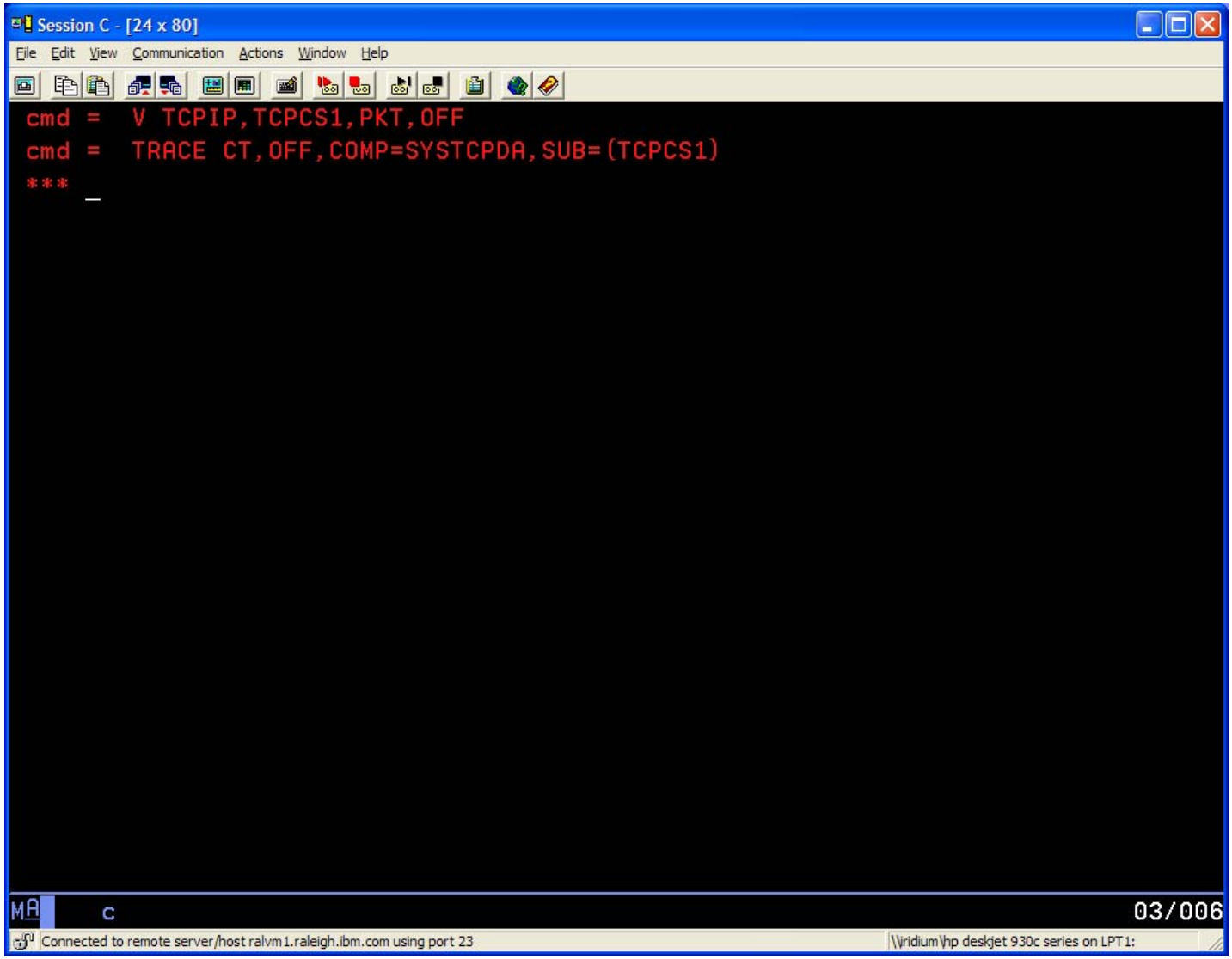
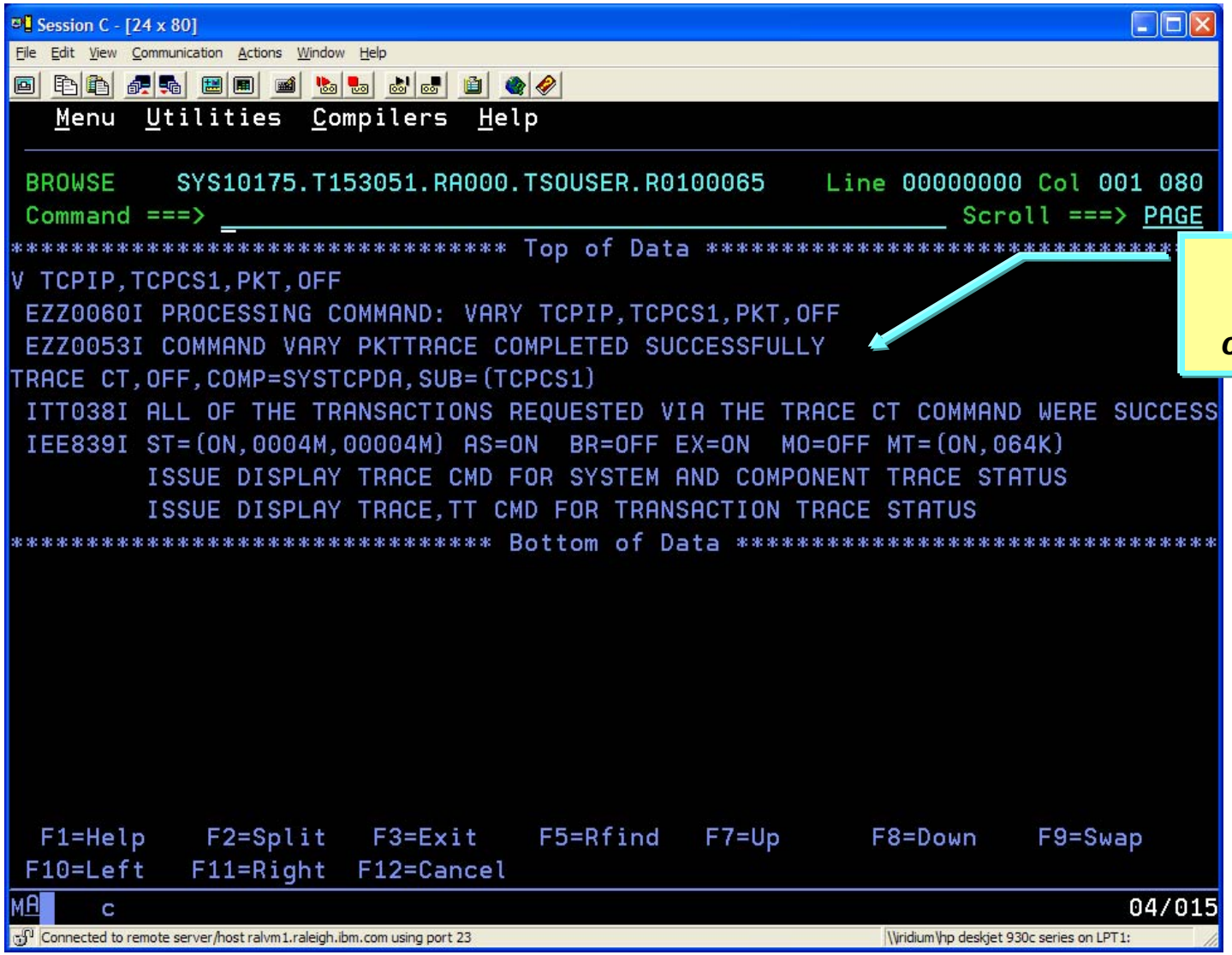
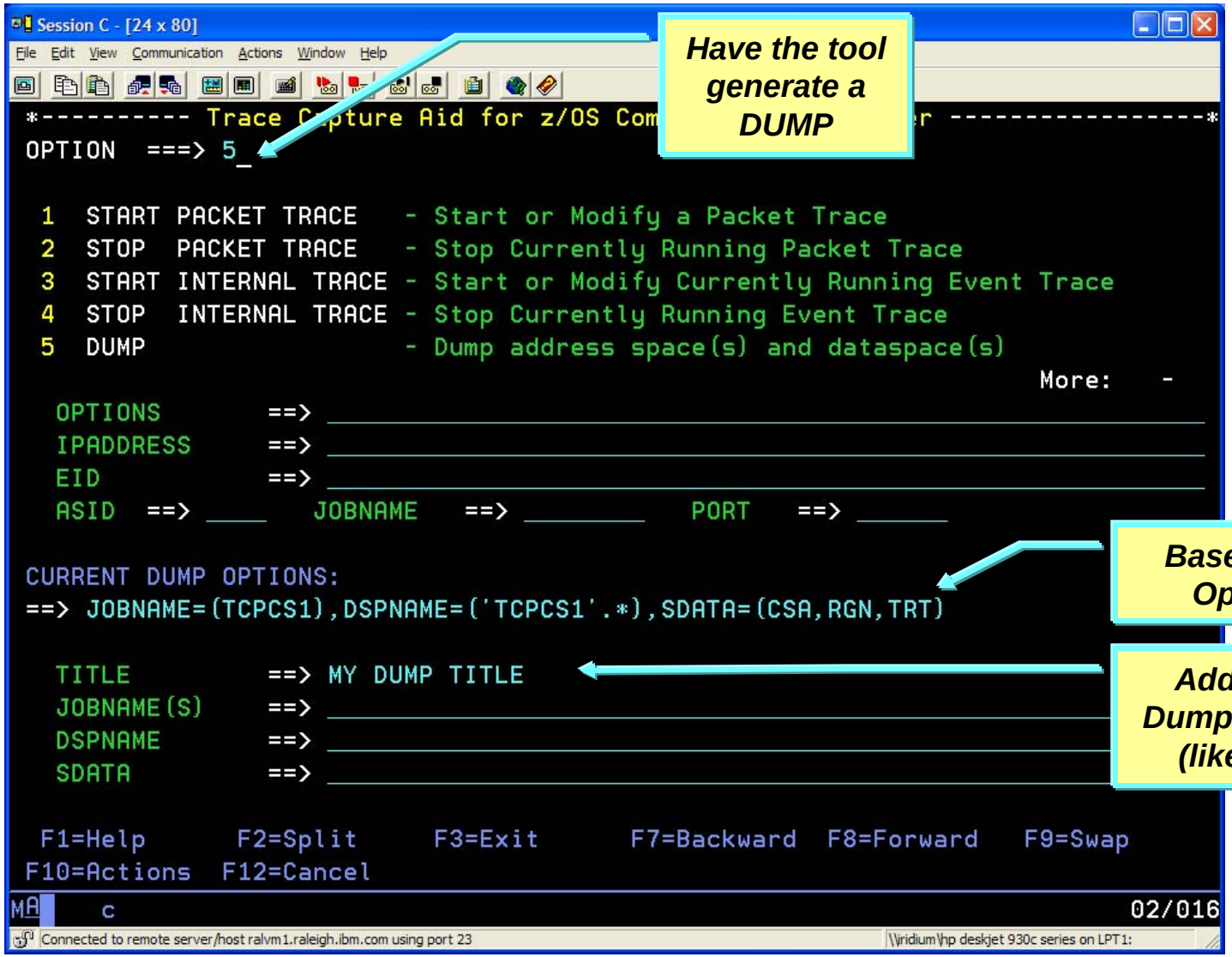


IBM Service Assistant for z/OS Communications Server



Shows results of commands

IBM Service Assistant for z/OS Communications Server



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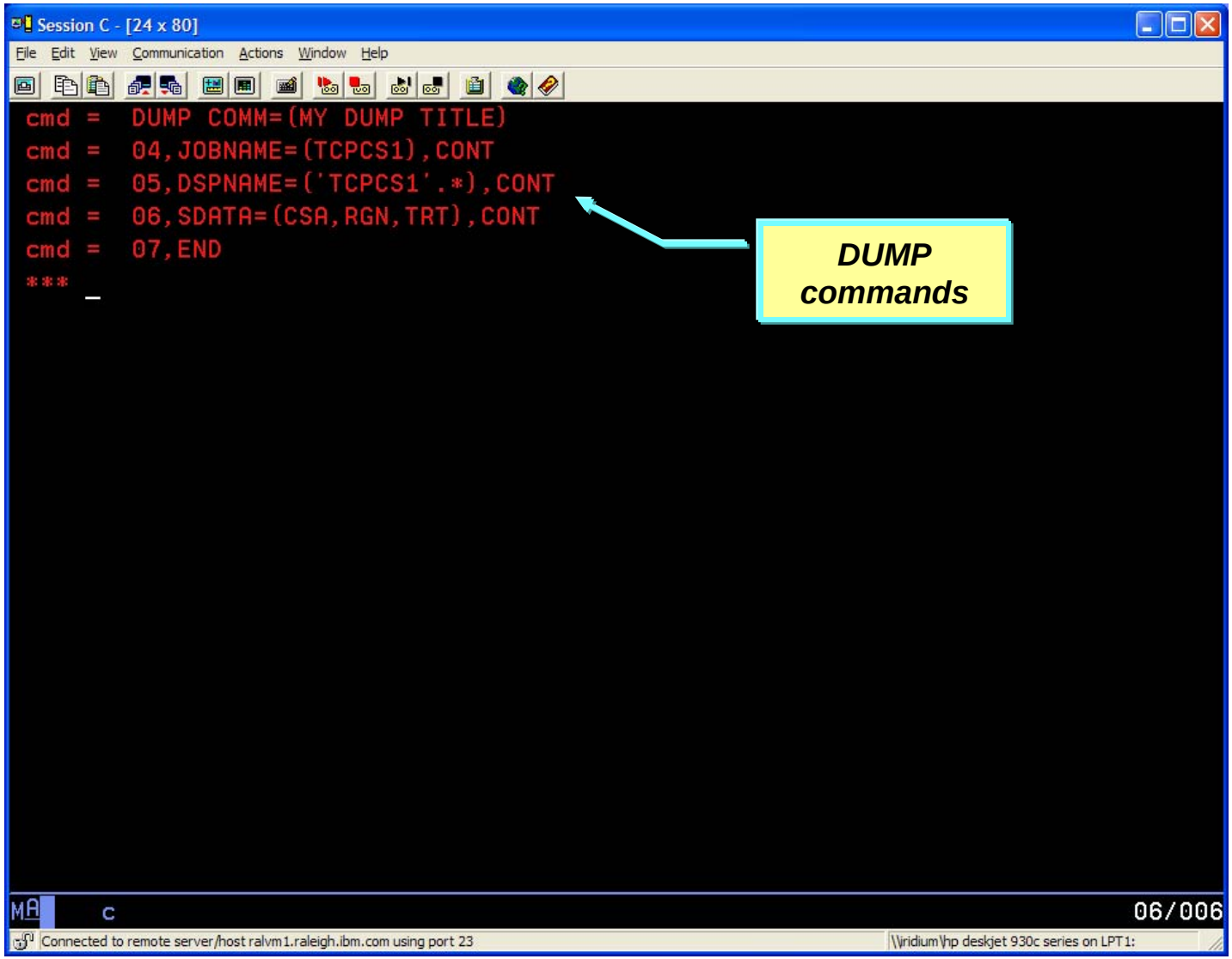
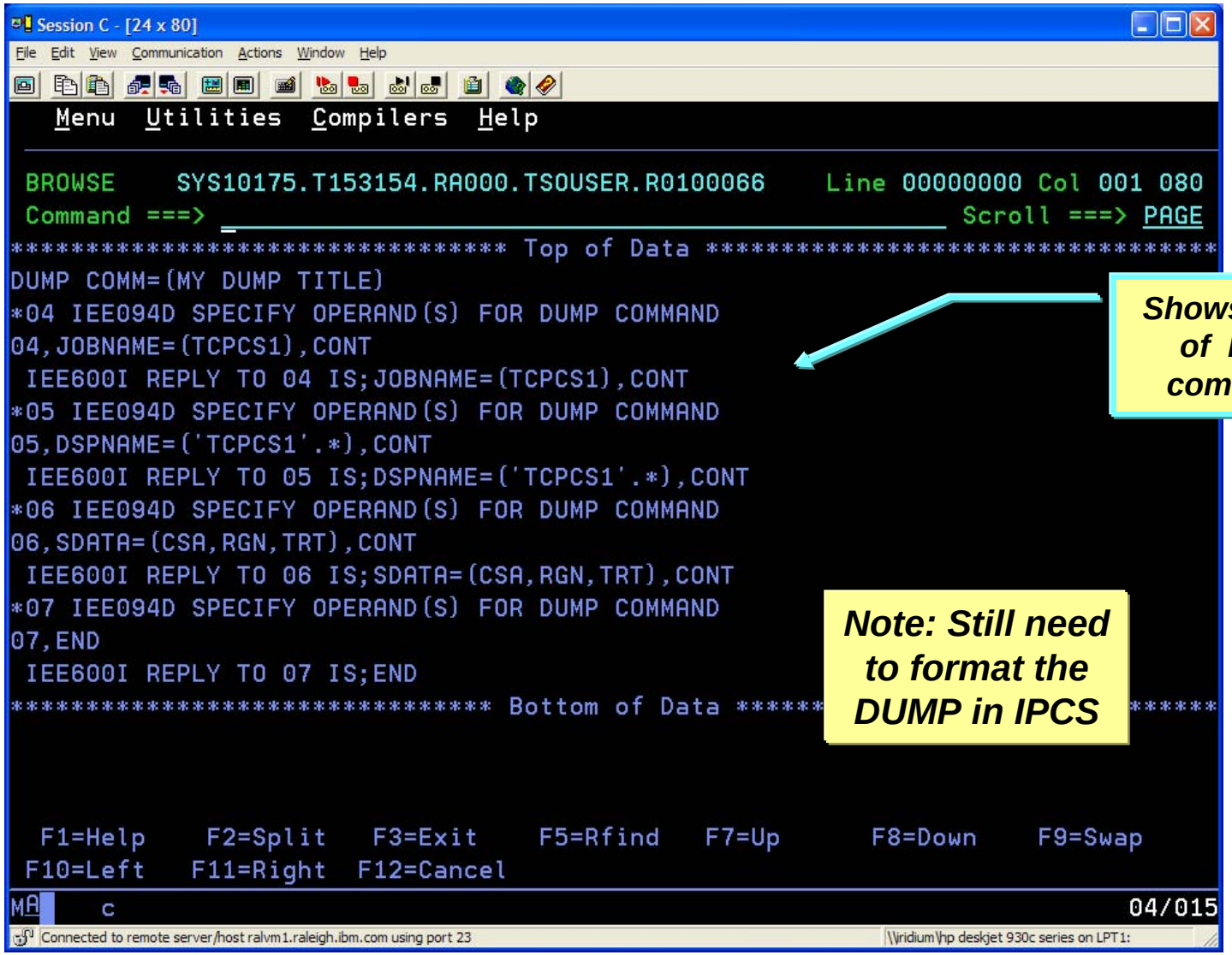


IBM Service Assistant for z/OS Communications Server



Shows results of DUMP commands

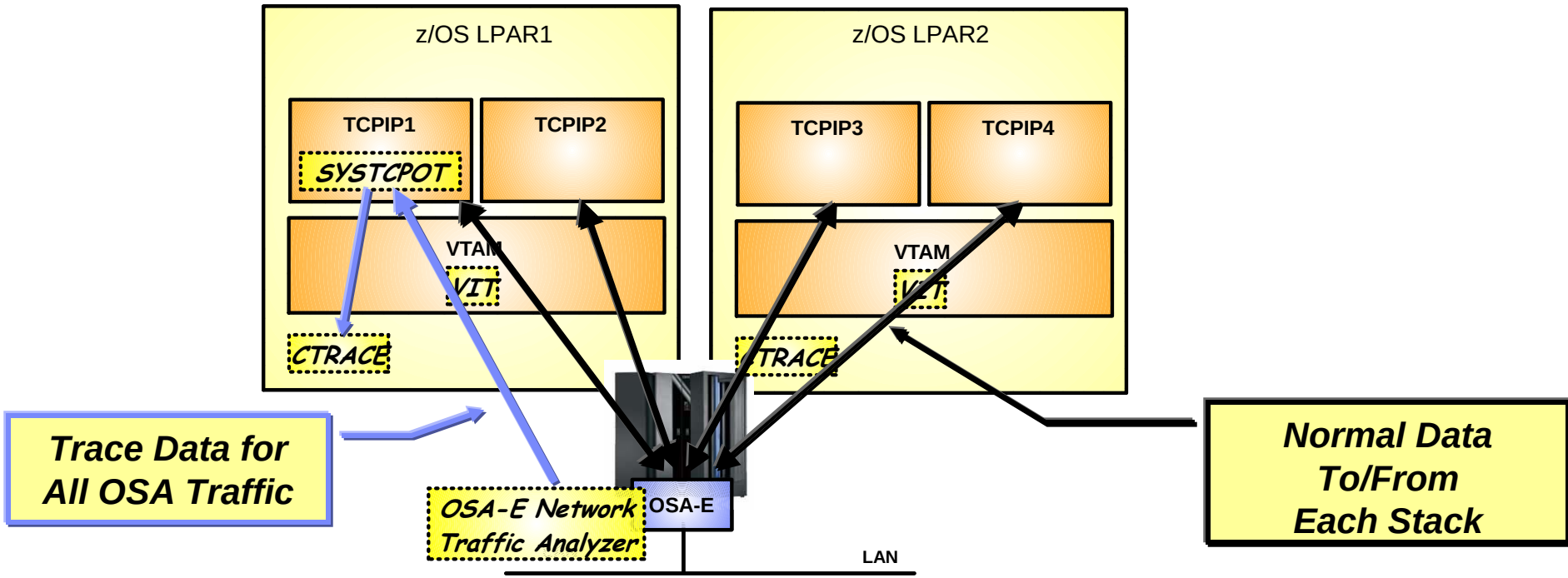
Note: Still need to format the DUMP in IPCS

Using z/OS Communications Server to perform OSA Diagnostics

OSA-Express Network Traffic Analyzer (OSAENTA)

OSA-Express Network Traffic Analyzer *(OSAENTA)*

- Used to trace inbound and outbound data directly from OSA including:
  - ARP packets
  - SNA Packets
  - Packets to and from other stacks shared by OSA
  - MAC Headers (including VLAN tags)
  - Dropped packets
- Trace data is collected using the SYSTCPOT component of CTRACE
- Only one OSAENTA trace can be active at a time for an OSA



OSA-Express Network Traffic Analyzer *(OSAENTA)*

- Requirements:
  - OSA-Express2 or OSA-Express3
  - Additional datapath device is needed for trace device (TRLE definition)
  - Must update the OSA settings in the HMC SE to allow OSAENTA
    - Enable tracing only for local LPAR (Default)
    - Enable tracing for entire CHPID
    - Disabled (no one can use OSAENTA)
- Resources:
  - OSA-Express Implementation Guide (Redbook) has detailed instructions http://www.redbooks.ibm.com/redpieces/abstracts/sg245948.html?Open&open&
  - OSAENTA FAQ: http://www-01.ibm.com/support/docview.wss?uid=swg21253260&aid=3
  - z/OS Communications Server IP Diagnosis Guide

OSAENTA Commands

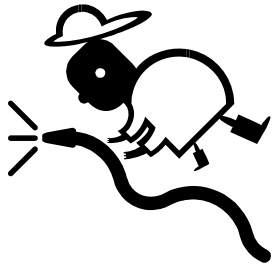
- **Start CTRACE** for the desired component to collect trace records
  TRACE CT,ON,**COMP=SYSTCPOT**,SUB=(TCPCS1)
  R n,END
  - **Start OSAENTA** to generate trace records for all interfaces
    V TCPIP,TCPCS1,OSAENTA,ON,PORTNAME=QDIO4101,
    IPADDR=172.16.1.1,PORTNUM=8088
    - Recreate the problem
  - **Stop OSAENTA**
    V TCPIP,TCPCS1,OSAENTA,OFF
- **Stop CTRACE** for the component
  TRACE CT,OFF,**COMP=SYSTCPOT**,SUB=(TCPCS1)
- **-OR-** use the OSAENTA statement in your TCPIP.PROFILE (same syntax)
  OSAENTA ON PORTNAME=QDIO4101 IPADDR=172.16.1.1 PORTNUM=8088
- Issue the DUMP command to capture internal buffer

  DUMP COMM=(dump title here)
  R n,JOBNAME=(TCPCS1),DSPNAME=('TCPCS1'.*),CONT
  R n,SDATA=(CSA,RGN,TRT),END

Optional Filters

OSAENTA Trace Filters

- Specific filters are strongly recommended, tracing too much data can affect performance on a heavily used OSA!



- **Filter types**
  - Device ID
  - Ethernet frame type
  - TCP/UDP port
  - MAC address
  - IP address/range
  - Discard reason code
  - VLAN ID
  - IP protocol
- Up to eight values per filter type
- Filters are cumulative across multiple OSAENTA commands
- Default ABBREV= value is 224 bytes, maximum 480

OSAENTA

- After starting OSAENTA trace, you can display the status of the trace using the Netstat DEvlinks/-d command:

```
D TCPIP,TCPCS1,NETSTAT,DEV
    OSA-Express Network Traffic Analyzer Information:
      OSA PortName: QDIO4101          OSA DevStatus:     Ready
        OSA IntfName: EZANTAQDIO4101  OSA IntfStatus:    Ready
        OSA Speed:    1000            OSA Authorization: Logical Partition
       OSAENTA Active Trace Statistics:
         DataMegs:   0                   Frames:           7
         DataBytes:  451                 FramesDiscarded:  4
         FramesLost: 0                   TimeActive:       7
       OSAENTA Trace Settings:         Status: On
         DataMegsLimit: 1024             FramesLimit:      2147483647
         Abbrev:        224              TimeLimit:        10080
         Discard:       EXCEPTION
       OSAENTA Trace Filters:          Nofilter: NONE
         DeviceID: *
         Mac:      *
         VLANid:   *
         ETHType:  *
         IPADDR:   172.16.1.1/32
         Protocol: *
         PORTNUM:  08088
```

Scope of Trace

Total Frames Traced

Discards Traced

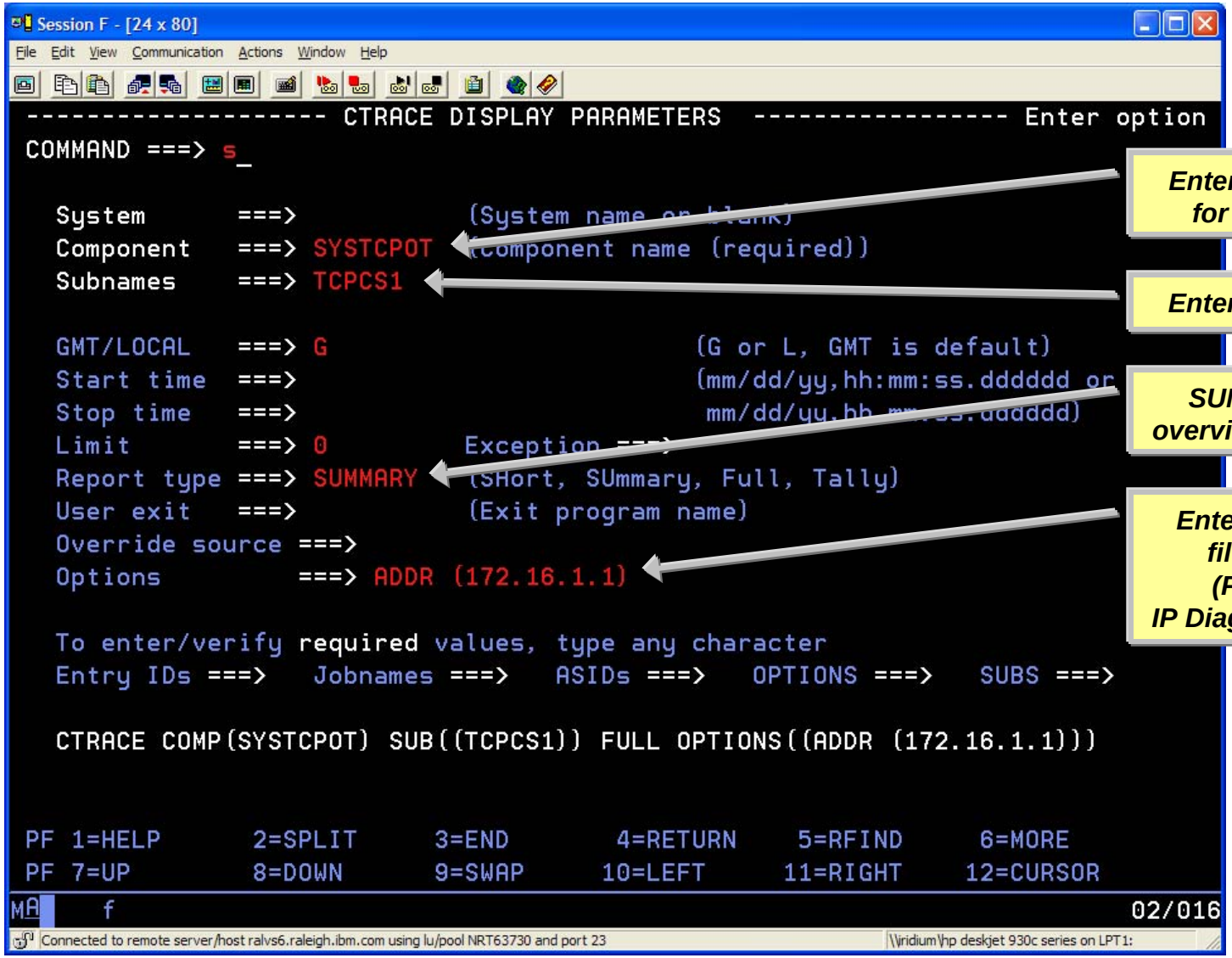
Trace Statistics

Trace Settings

Pre-Trace Filters

ABBREV= value

OSAENTA - IPCS 2.7.1.D – SUMMARY Report



Enter SYSTCPOT for OSAENTA

Enter stack name

SUMMARY for overview of records

Enter post-trace filters here. (Full list in IP Diagnosis Guide)

OSAENTA Trace – Sample SUMMARY Report

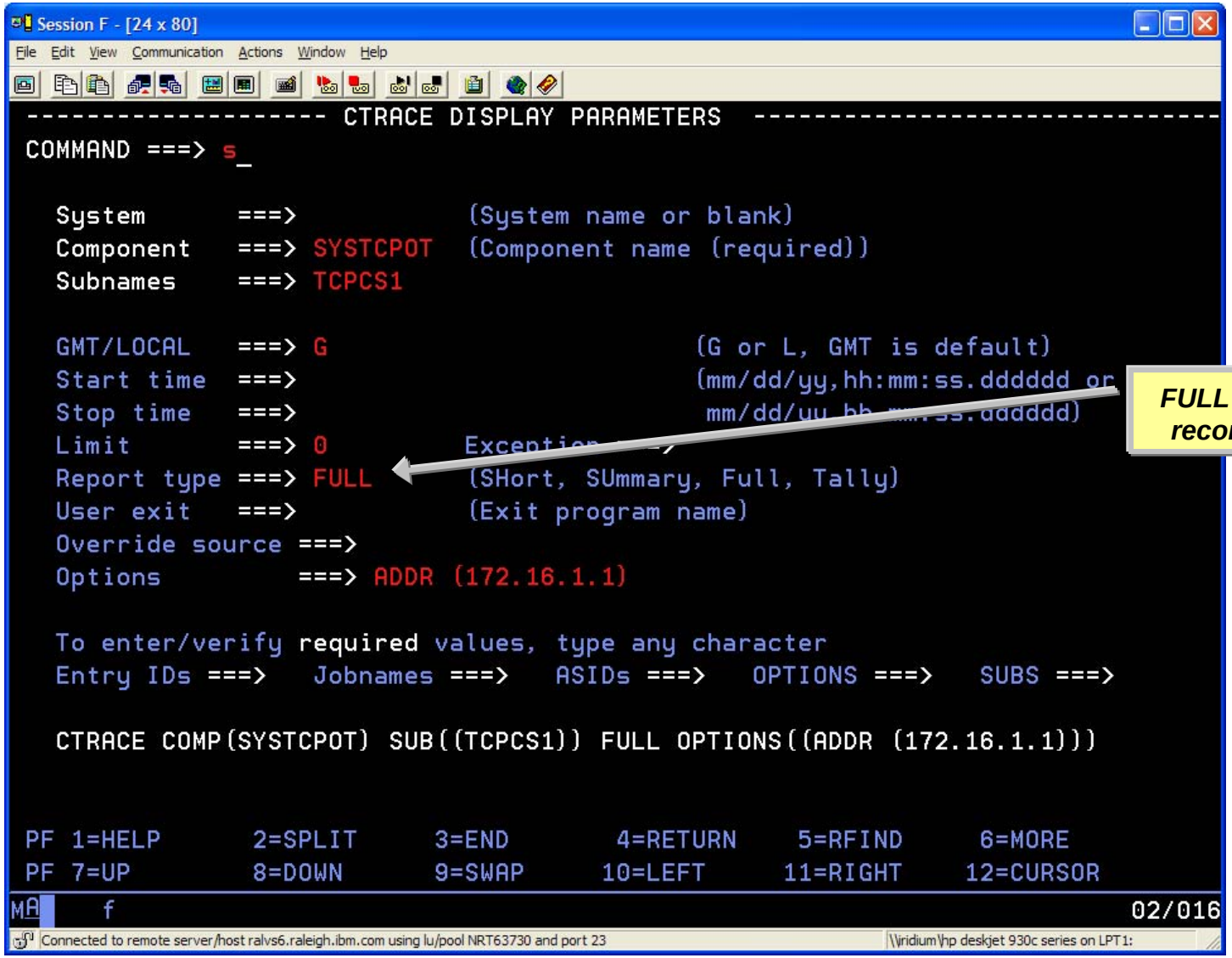
- Summary shows a brief 2 lines per packet

```
**** 2010/06/08
I - Inbound packet
O - Outbound packet

DP   Nr hh:mm:ss.mmmmmm IpId    Seq_num    Ack_num  Wndw Flags
IT    1 17:41:42.343913 0185 3444708225          0 32768 SYN

OT    2 17:41:42.350653 020E 2923755195 3444708226 32768 ACK SYN

IT    3 17:41:42.355109 0186 3444708226 2923755196 32768 ACK

IT    4 17:41:43.843883 0189 3444708226 2923755196 32768 ACK PSH
                        A385A2A3 5A      *test!    ..¢.Z   *
OT    5 17:41:44.082991 020F 2923755196 3444708231 32763 ACK
```

TCP Three-Way Handshake

We'll do a FULL report next to see this packet #4

OSAENTA - IPCS 2.7.1.D – FULL Report



FULL for complete records and data

OSAENTA Trace – Sample FULL Report

- Part 1 of 2

OSAENTA Interface Name

Direction In or Out

MAC Header!

```
4 MVS206   OSAENTA  00000007 17:41:43.843883 OSA-Express NTA
From Interface    : EZANTAQDIO4101                          Full=71
 Tod Clock        : 2010/06/08 17:41:43.843883
Frame: Device ID  : 00000E2A        Sequence Nr: 23        Discard: 0 (OK)
 Segment #        : 0               Flags: Adj In Nta Frame L3
 Source           : 172.16.1.2
 Destination      : 172.16.1.1
 Source Port      : 8088            Dest Port: 8087  Asid: 0000 TCB: 00000000
 QID              : 1
EtherNet II       : 0800            Internet IP (IPv4)     Len: 0x0039 (57)
 Destination Mac  : 40000E-280300   ()
 Source Mac       : 40000E-300300   ()
IpHeader: Version : 4               Header Length: 20
 Tos              : 00              QOS: Routine Normal Service
 Packet Length    : 57              ID Number: 0189
 Fragment         :                 Offset: 0
 TTL              : 64              Protocol: TCP        CheckSum: 1F13 FFFF
 Source           : 172.16.1.2
 Destination      : 172.16.1.1
```

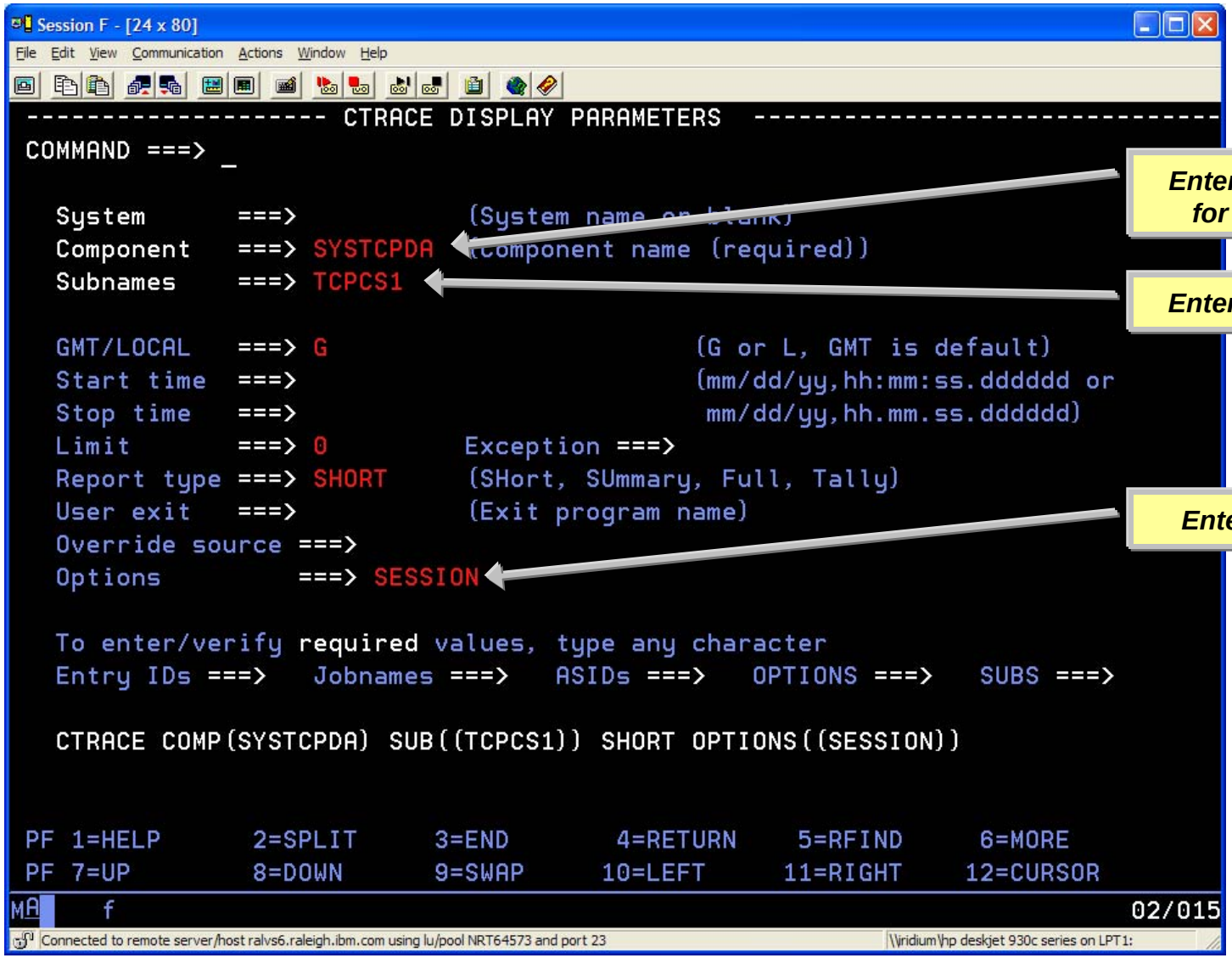
OSAENTA Trace – Sample FULL Report cont.

- Part 2 of 2

```
TCP
 Source Port       : 8088  ()          Destination Port: 8087  ()
 Sequence Number   : 3444708226        Ack Number: 2923755196
 Header Length     : 32                Flags: Ack Psh
 Window Size       : 32768             CheckSum: 53B6 FFFF
  Option           : NOP
  Option           : NOP
  Option           : Timestamp         Len: 10 Value: 66258E88 Echo: 662588D3

MAC Header         : 14                                  Offset:  0
000000 40000E28 03004000 0E300300 0800

Ip Header          : 20                IP: 172.16.1.2, 172.16.1.1 Offset:  E
000000 45000039 01890000 40061F13 AC100102  AC100101

Protocol Header    : 32                Port: 8088, 8087          Offset: 22
000000 1F981F97 CD521382 AE44F6BC 80188000  53B60000 0101080A 66258E88 662588D3

Data               : 5      Data Length: 5                      Offset: 42
000000 A385A2A3 5A                          |test!           ..¢.Z           |
```

MAC Header!

OSAENTA - IPCS 2.7.1.D – SESSION Report



Enter SYSTCPOT for OSAENTA

Enter stack name

Enter SESSION

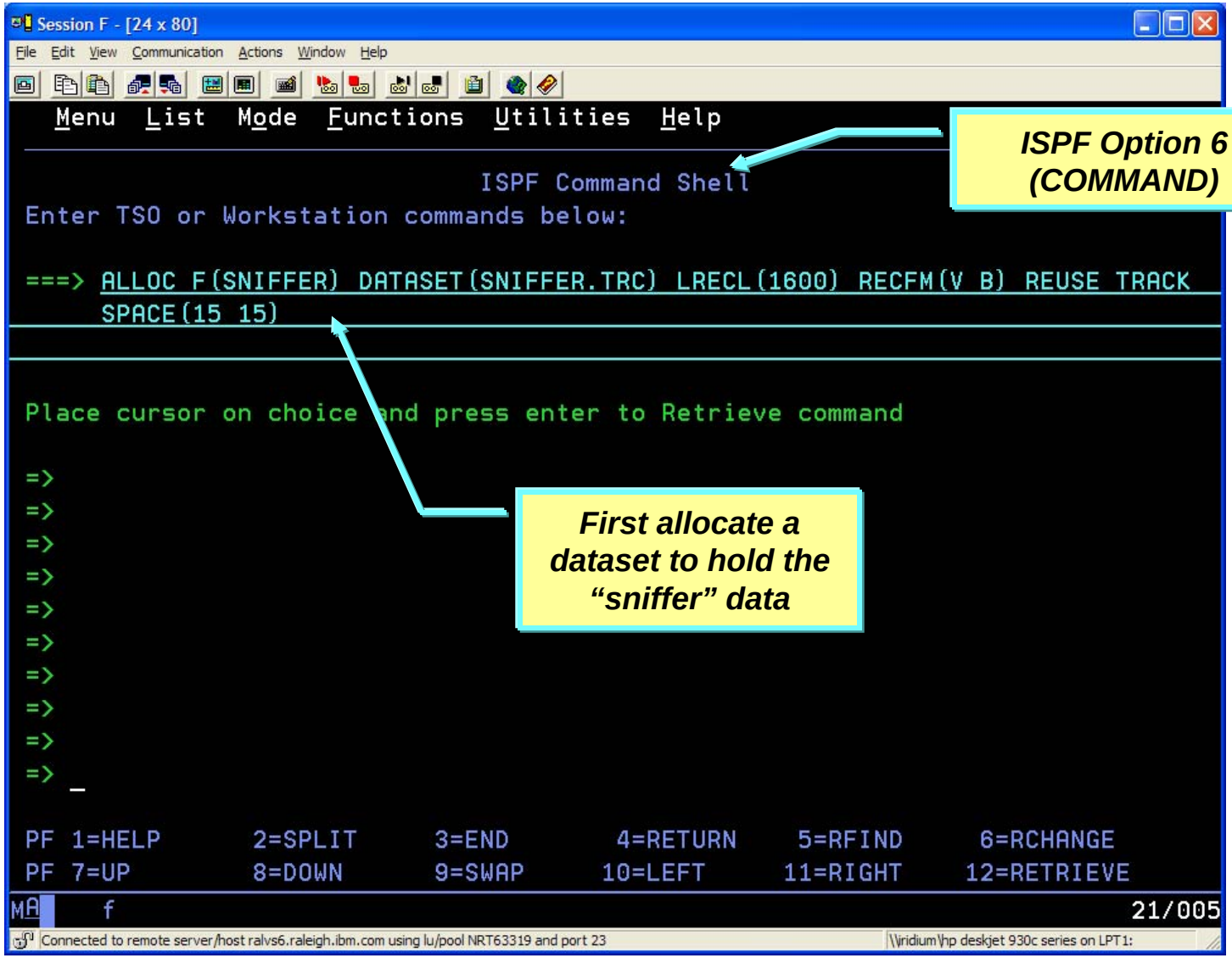
OSAENTA Trace – Sample SESSION Report

- Session report shows information for TCP and UDP sessions

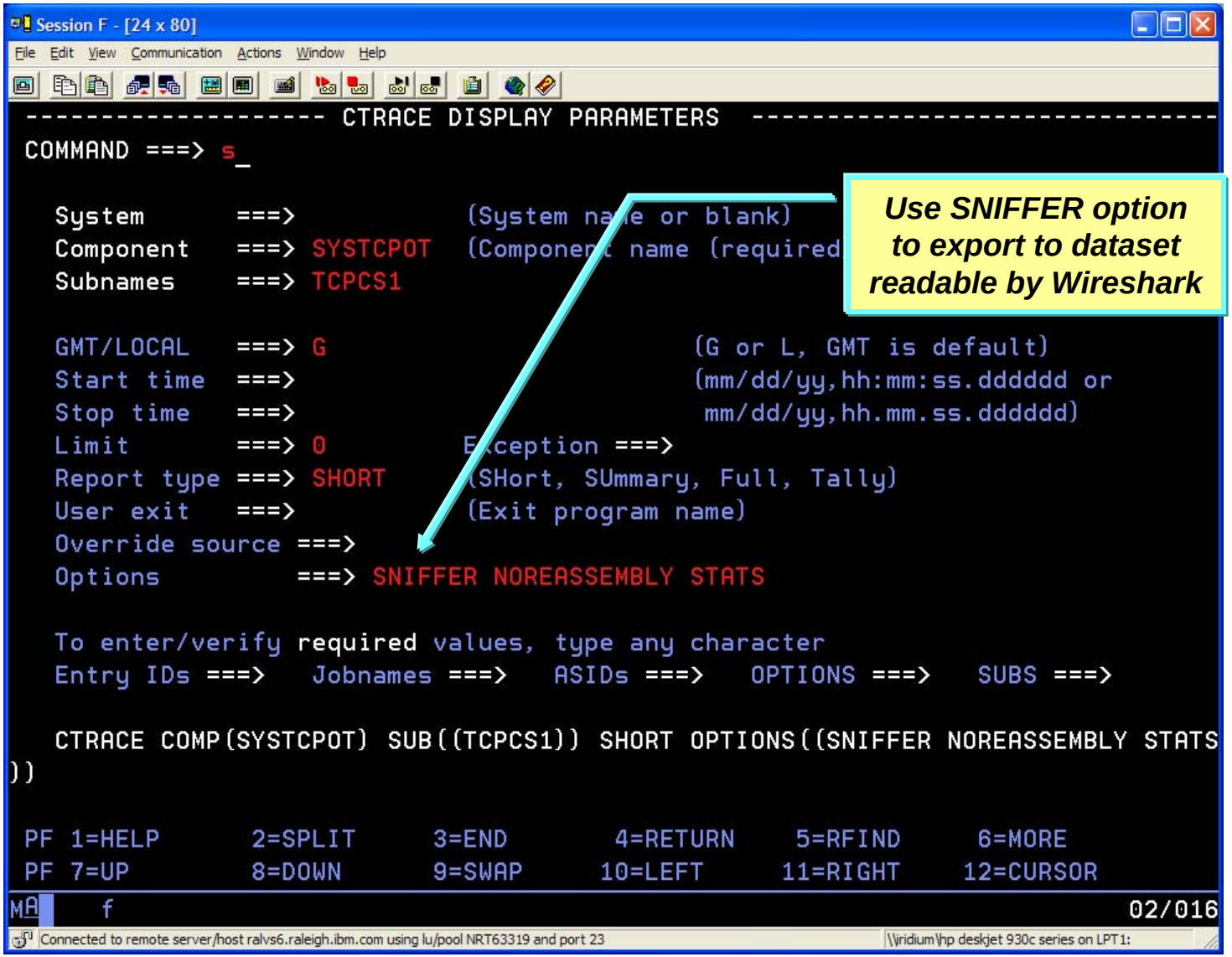
```
5 packets summarized
 Local Ip Address:                                  172.16.1.1
 Remote Ip Address:                                 172.16.1.2
Host:                                    Local,          Remote
 Client or Server:                      SERVER,          CLIENT
 Port:                                    8087,            8088
.
Data Quantity & Throughput:            Inbound,        Outbound
.
Data Segment Stats:                    Inbound,        Outbound
.
Window Stats:                          Inbound,        Outbound
.
TcpHdr    IO F         Seq         Ack RcvWnd  Data Delta Time       TimeStamp
      S    I   3444708225           0  32768     0   0.000000 17:41:42.343913
   A  S    O   2923755195  3444708226  32768     0   0.006740 17:41:42.350653
   A        I u 3444708226  2923755196  32768     0   0.004456 17:41:42.355109
   AP       I . 3444708226  2923755196  32768     5   1.488774 17:41:43.843883
   A        O   2923755196  3444708231  32763     0   0.239108 17:41:44.082991
```

Shows all the packets related to this TCP connection

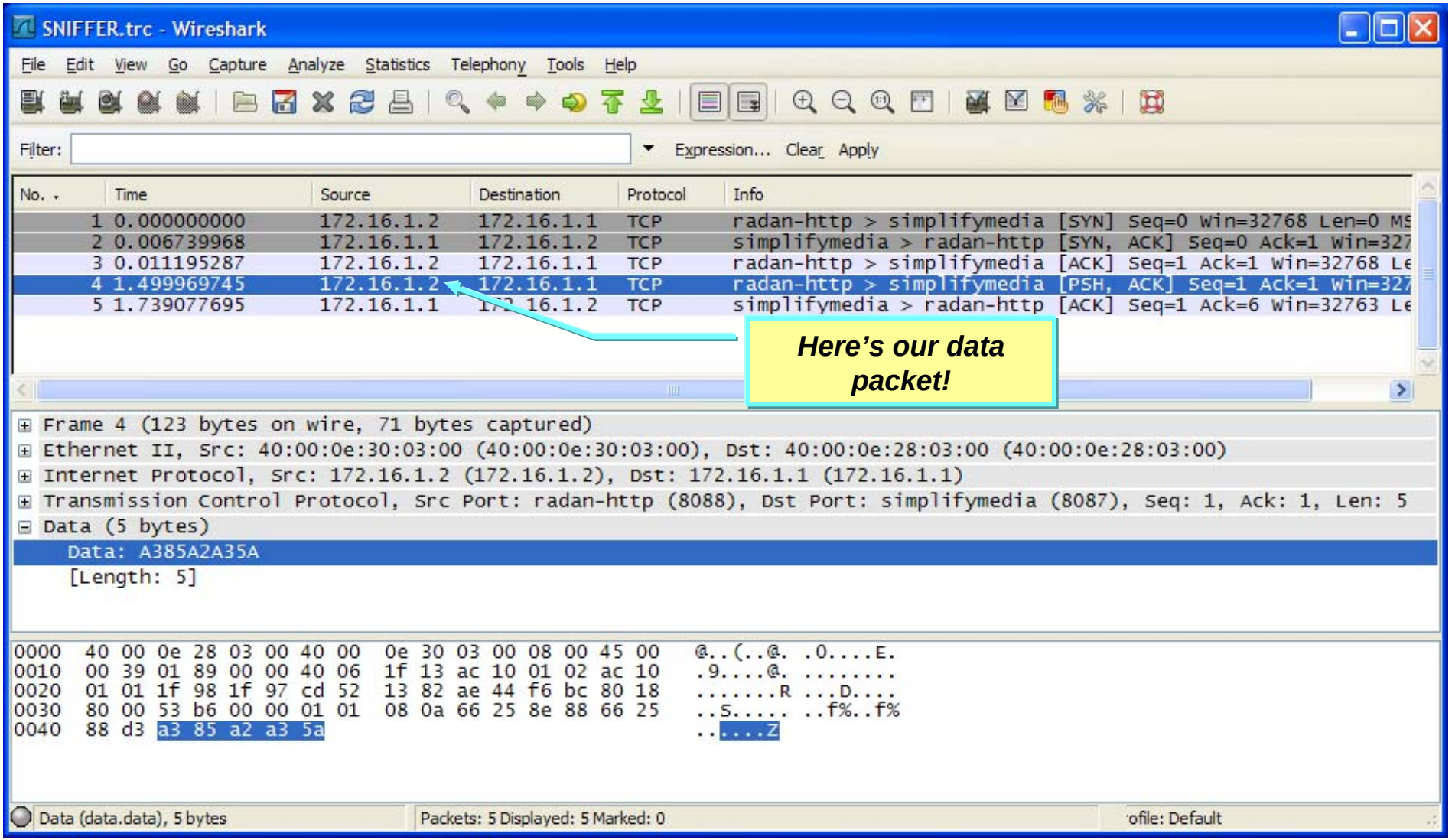
OSAENTA – Export to Wireshark



OSAENTA – Export to Wireshark



OSAENTA – Export to Wireshark



Using z/OS Communications Server to perform OSA Diagnostics

Operator Command to Display OSA Information

Display OSAINFO

- Operator command to query and display information directly from OSA
- New in z/OS Communications Server V1R12
- Requires OSA-Express3 in QDIO mode (OSD) running on an IBM System z10
- Scope of reply is a single interface on a single stack
- Command syntax:

D TCPIP,*procname*,OSAINFO,INTFN=*intf_name*

Note: intf_name can be an Interface name or Link name

Display OSAINFO Example – Base Information

- Shows general information about the OSA and active protocols

General Info

Protocol Specific

```
D TCPIP,,OSAINFO,INTFN=V6O3ETHG0
EZZ0053I COMMAND DISPLAY TCPIP,,OSAINFO COMPLETED SUCCESSFULLY
EZD0031I TCP/IP CS V1R12  TCPIP Name: TCPCS1    15:39:52
Display OSAINFO results for IntfName: V6O3ETHG0
PortName: O3ETHG0P  PortNum: 00  Datapath: 2D64   RealAddr: 0004
PCHID: 0270         CHPID: D6    CHPID Type: OSD  OSA code level: 5D76
Gen: OSA-E3         Active speed/mode: 10 gigabit full duplex
Media: Singlemode Fiber        Jumbo frames: Yes  Isolate: No
PhysicalMACAddr: 001A643B887C  LocallyCfgMACAddr: 000000000000
Queues defined Out: 4  In: 3   Ancillary queues in use: 2
Connection Mode: Layer 3       IPv4: No   IPv6: Yes
SAPSup: 00010293               SAPEna: 00010293
IPv6 attributes:
  VLAN ID:   12            VMAC Active: Yes
  VMAC Addr: 0206100B2068  VMAC Origin: Cfg       VMAC Router: All
  AsstParmsEna: 00215C60   OutCkSumEna: 00000000  InCkSumEna: 00000000
```

Display OSAINFO Example – Registered Addresses

- Shows all the IPv4 and IPv6, Unicast and Multicast Addresses

OSA will do ARP offload for this addr

```
Registered Addresses:
  IPv4 Unicast Addresses:
    ARP: Yes  Addr: 16.2.16.107
    Total number of IPv4 addresses:      1
  IPv4 Multicast Addresses:
    MAC: 01005E000001  Addr: 224.0.0.1
    Total number of IPv4 addresses:      1
  IPv6 Unicast Addresses:
    Addr: FE80::11:16:32:104
    Total number of IPv6 addresses:      1
  IPv6 Multicast Addresses:
    MAC: 333300000001  Addr: FF02::1
    MAC: 3333FF010001  Addr: FF02::1:FF01:1
    MAC: 3333FF010002  Addr: FF02::1:FF01:2
    MAC: 3333FF010003  Addr: FF02::1:FF01:3
     Total number of IPv6 addresses:      4
```

Display OSAINFO Example – QDIO Inbound Workload Queueing

- For QDIO Inbound Workload Queueing, Routing Variables are registered to receive traffic on each queue

5-Tuples

DVIPAs

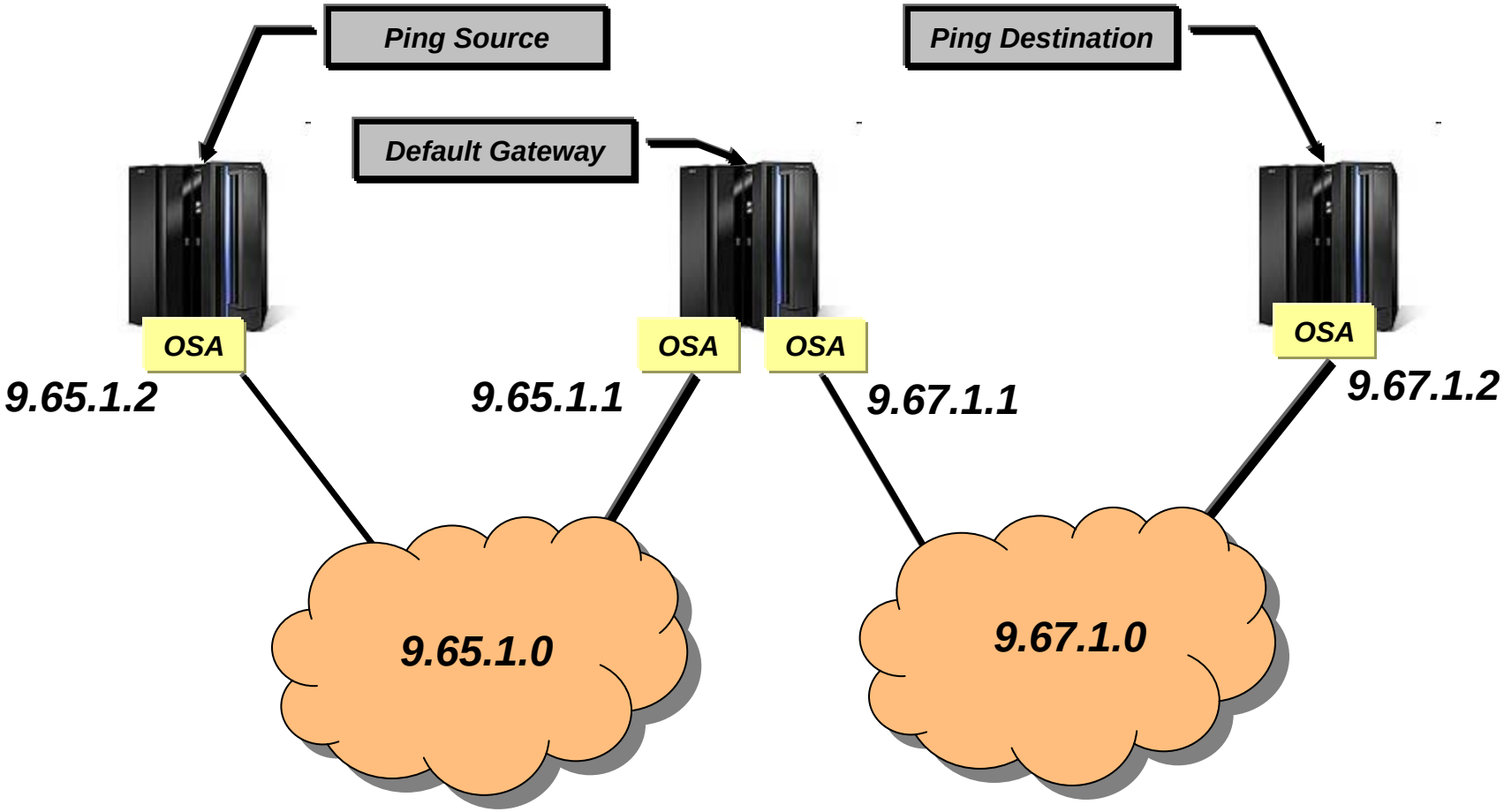
```
Ancillary Input Queue Routing Variables:
  Queue Type: BULKDATA  Queue ID:  2  Protocol: TCP
    Src: 2000:197:11:201:0:1:0:1..221
    Dst: 100::101..257
    Src: 2000:197:11:201:0:2:0:1..290
    Dst: 200::202..514
    Total number of IPv6 connections:      2
  Queue Type: SYSDIST   Queue ID:  3  Protocol: TCP
    Addr: 2000:197:11:201:0:1:0:1
    Addr: 2000:197:11:201:0:2:0:1
    Total number of IPv6 addresses:      2
36 of 36 Lines Displayed
End of report
```

Using z/OS Communications Server to perform OSA Diagnostics

Network Problem Diagnosis Example

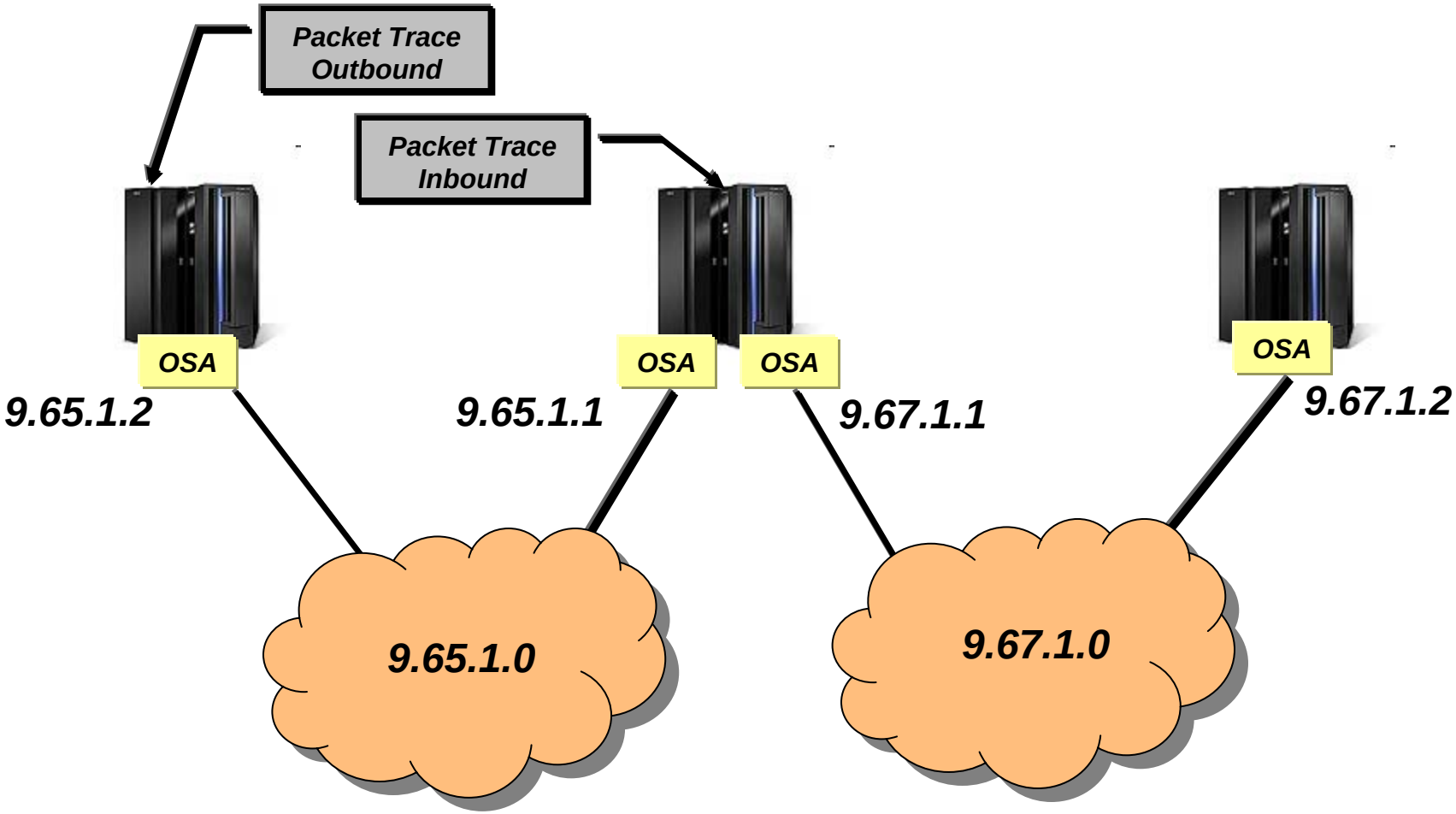
Network Problem Diagnosis Example

- Ping from 9.65.1.2 to 9.67.1.2 is failing



Packet Trace

- First look at packet traces from source stack and gateway stack



Packet Trace – Outbound Ping (Source Stack)

- Packet leaves the source stack ok

Interface Name

Direction In or Out

```
1 MVS209   PACKET   00000004 15:52:24.182305 Packet Trace
To Interface      : QDIO4102L          Device: QDIO Ethernet    Full=284
 Tod Clock        : 2010/06/22 15:52:24.182303                  Intfx: 35
 Segment #        : 0                  Flags:  Ping Out
 Source           : 9.65.1.2
 Destination      : 9.67.1.2
 Source Port      : 0                  Dest Port: 8     Asid: 0020 TCB: 007FF1
 Next Hop         : 9.65.1.1
IpHeader: Version : 4                  Header Length: 20
 Tos              : 00                 QOS: Routine Normal Service
 Packet Length    : 284                ID Number: 0019
 Fragment         :                    Offset: 0
 TTL              : 255                Protocol: ICMP       CheckSum: 0371 FFFF
 Source           : 9.65.1.2
 Destination      : 9.67.1.2

ICMP
 Type/Code        : ECHO               CheckSum: 5456 FFFF
```

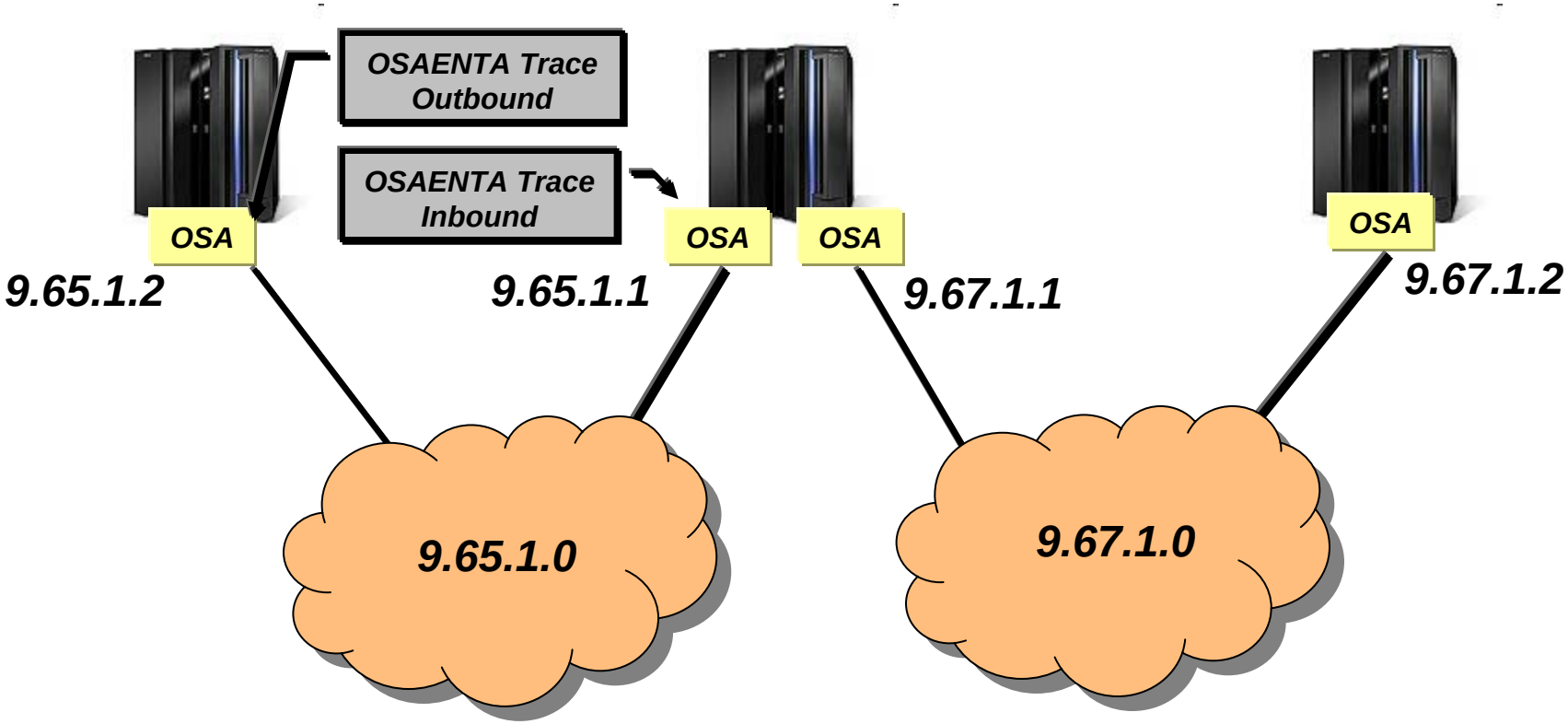
Packet Trace – Inbound Ping (Gateway Stack)

- Packet never arrives at the gateway stack and does not appear in the packet trace

```
ITT10003I There are no trace buffers in the dump for COMP(SYSTCPDA)SUB((
          TCPCS1))
```

OSA-Express Network Traffic Analyzer Trace

- Packet was never received by gateway stack
- Next obtain an OSAENTA trace on both the sending and receiving OSAs
- Use DISCARD=ALL filter to trace all dropped packets



OSAENTA – Outbound Ping (Source Stack)

- Packet leaves the source OSA ok

Interface Name

Discard Code OK

```
 1 MVS209   OSAENTA  00000007 15:52:24.186100 OSA-Express NTA
To Interface      : EZANTAQDIO4102                          Abbrev=224
 Tod Clock        : 2010/06/22 15:52:24.186100
Frame: Device ID  : 00000E32        Sequence Nr: 0    Discard: 0 (OK)
 Segment #        : 0               Flags:  Ping Out Nta L3
 Source           : 9.65.1.2
 Destination      : 9.67.1.2
 Source Port      : 0               Dest Port: 8     Asid: 0000 TCB: 00000000
IpHeader: Version : 4               Header Length: 20
 Tos              : 00              QOS: Routine Normal Service
 Packet Length    : 284             ID Number: 0019
 Fragment         :                 Offset: 0
 TTL              : 255             Protocol: ICMP       CheckSum: 0371 FFFF
 Source           : 9.65.1.2
 Destination      : 9.67.1.2

ICMP
 Type/Code        : ECHO            CheckSum: 5456 0000
```

OSAENTA – Inbound Ping (Gateway Stack)

- Packet arrives at the gateway OSA

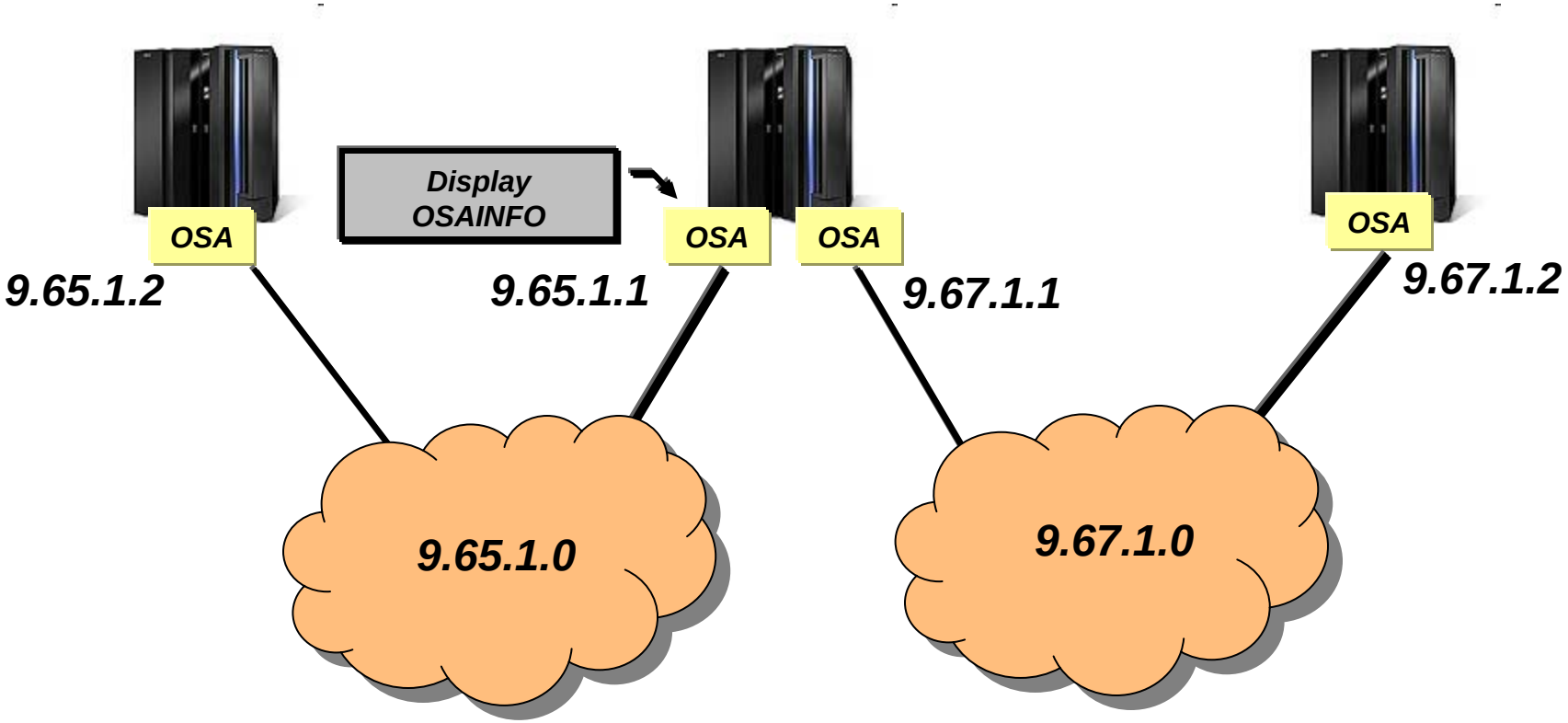
Interface Name

Packet Discarded!

```
1 MVS206   OSAENTA  00000007 15:52:24.186725 OSA-Express NTA
To Interface      : EZANTAQDIO4101                          Abbrev=224
 Tod Clock        : 2010/06/22 15:52:24.186725
Frame: Device ID  : 00000E2A          Sequence Nr: 0   Discard: 0025 (IP MISMATCH)
 Segment #        : 0                 Flags:  Ping Out Nta L3 Dscrd
 Source           : 9.65.1.2
 Destination      : 9.67.1.2
 Source Port      : 0                 Dest Port: 8     Asid: 0000 TCB: 00000000
IpHeader: Version : 4                 Header Length: 20
 Tos              : 00                QOS: Routine Normal Service
 Packet Length    : 284               ID Number: 0019
 Fragment         :                   Offset: 0
 TTL              : 255               Protocol: ICMP      CheckSum: 0371 FFFF
 Source           : 9.65.1.2
 Destination      : 9.67.1.2

ICMP
 Type/Code        : ECHO              CheckSum: 5456 0000
```

Display OSAINFO Command

- Find out why the packet was discarded at the gateway OSA
- Check for registered IP Addrs
- Check if OSA is acting as PRIROUTER for this interface



Display OSAINFO – Base Information

- Shows general information about the OSA and active protocols

General Info

Protocol Specific

```
d tcpip,tcpcs1,osainfo,intfn=qdio4101l
EZZ0053I COMMAND DISPLAY TCPIP,,OSAINFO COMPLETED SUCCESSFULLY
EZD0031I TCP/IP CS V1R12  TCPIP Name: TCPCS1    12:00:20
Display OSAINFO results for IntfName: QDIO4101L
PortName: QDIO4101  PortNum: 00  Datapath: 0E2A   RealAddr: 0E2A
PCHID: 1234         CHPID: C1    CHPID Type: OSD  OSA code level: 5D76
Gen: OSA-E3         Active speed/mode: 1000 mb/sec half duplex
Media: Multimode Fiber          Jumbo frames: Yes  Isolate: No
PhysicalMACAddr: 40000E280300   LocallyCfgMACAddr: 000000000000
Queues defined Out: 4  In: 1    Ancillary queues in use: 0
Connection Mode: Layer 3        IPv4: Yes  IPv6: No
SAPSup: 000FB001                SAPEna: 000FB001
IPv4 attributes:
  VLAN ID: N/A                  VMAC Active: No
  Defined Router: Non           Active Router: No
  AsstParmsEna: 00002457        OutCkSumEna: 0000001A  InCkSumEna: 0000001A
```

Configured as NONROUTER

Display OSAINFO – Registered Addresses

- Shows all the registered IPv4/IPv6 Unicast/Multicast addresses in the OSA Address Table (OAT)

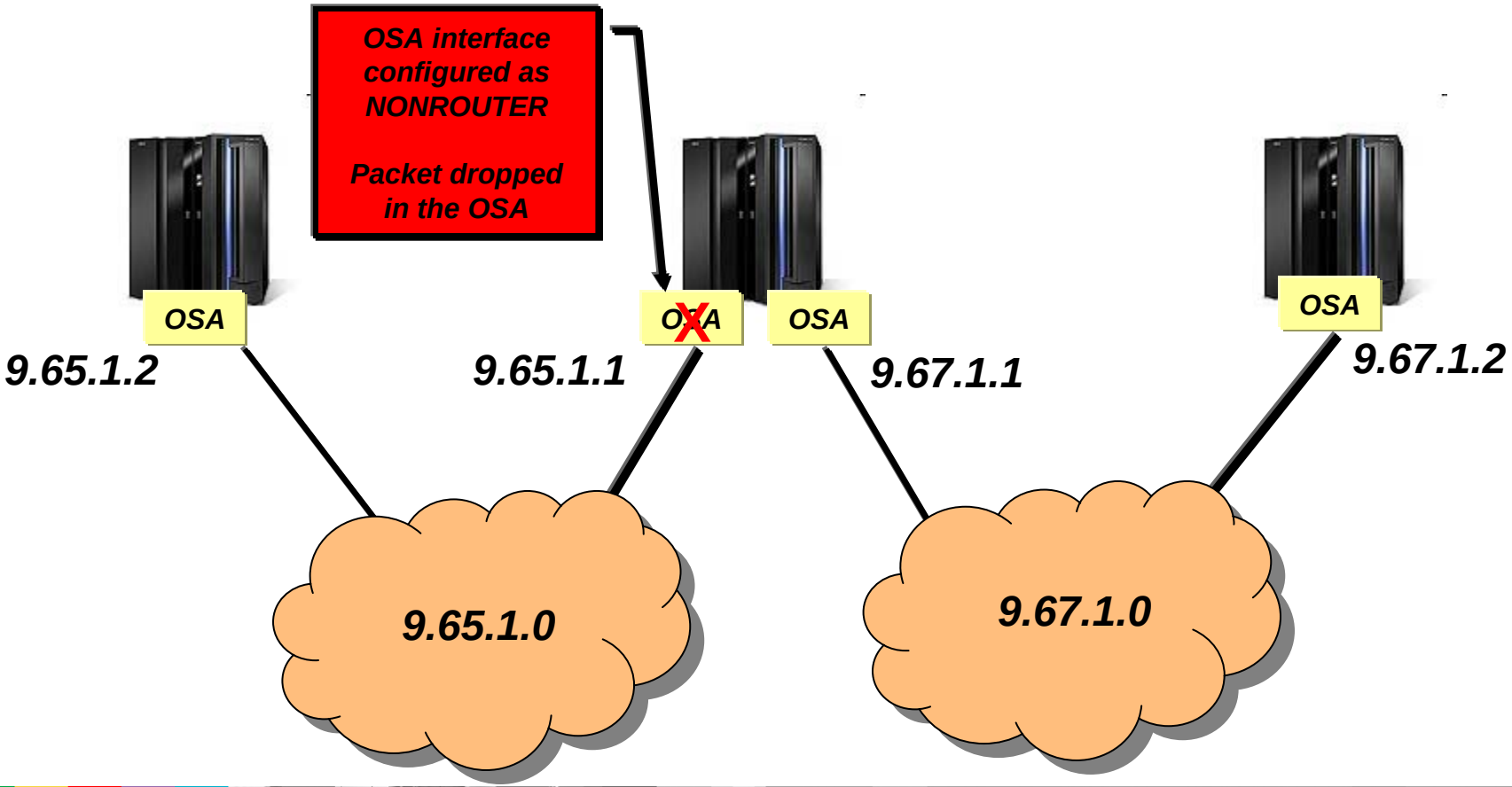
```
Registered Addresses:
  IPv4 Unicast Addresses:
    ARP: No   Addr: 9.65.0.1
    ARP: Yes  Addr: 9.65.1.1
    ARP: No   Addr: 9.65.2.1
    ARP: No   Addr: 9.66.1.1
    ARP: No   Addr: 9.66.2.1
    Total number of IPv4 addresses:      5
  IPv4 Multicast Addresses:
    MAC: 01005E000001  Addr: 224.0.0.1
    Total number of IPv4 addresses:      1
27 of 27 lines displayed
End of report
```

Destination address of ping is not in the OAT

Home Address

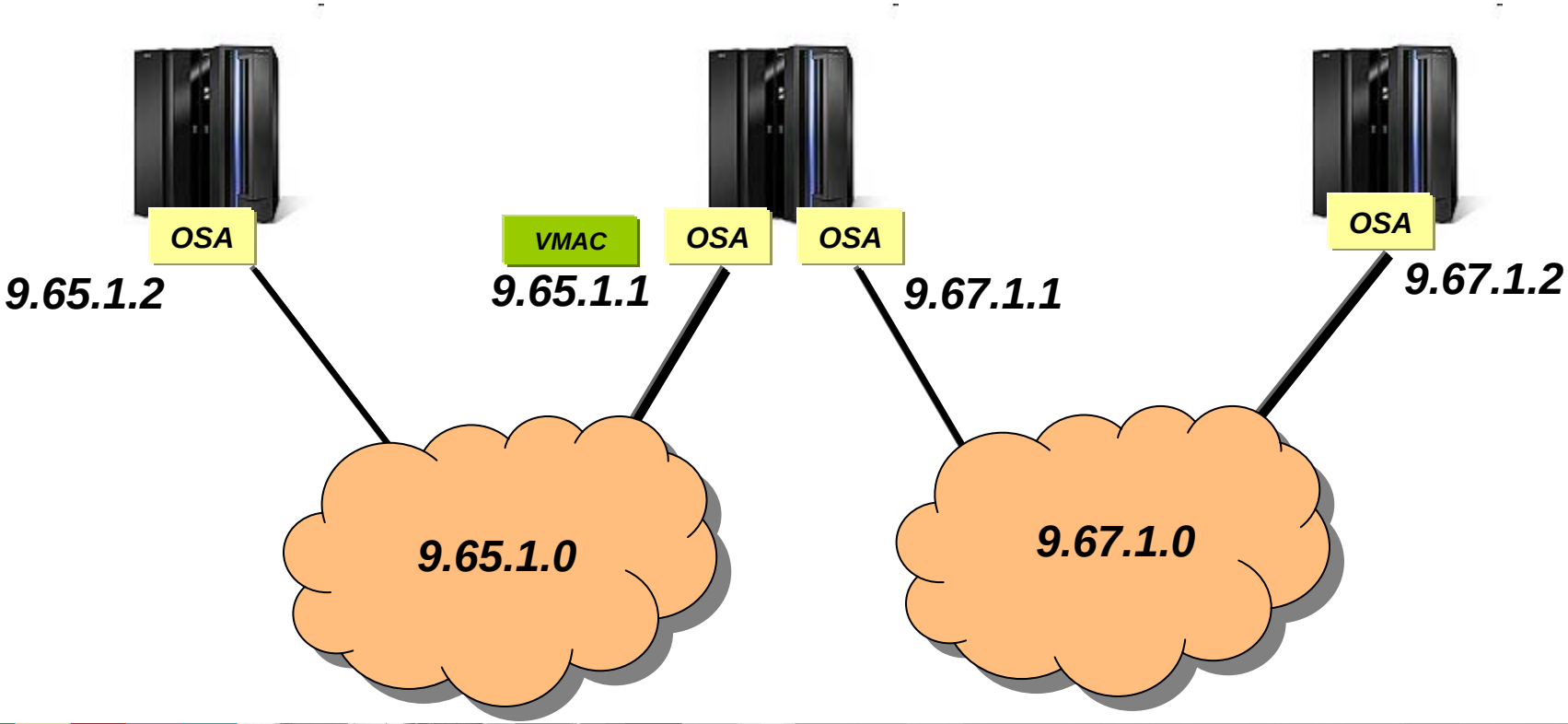
Network Problem Diagnosis Example

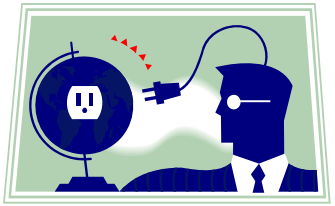
- Ping is failing because OSA interface is not configured as a PRIROUTER and destination address is not in the OSA Address Table (OAT)
- Solution is to configure the interface as a PRIROUTER



VMAC – An alternative to PRIROUTER

- Had we configured a VMAC (with the default ROUTEALL option) for this interface the stack would have received and forwarded the ping.
- VMAC eliminates the need for a PRIROUTER/SECROUTER and gives each interface its own unique MAC address

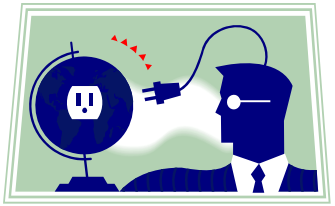




Using z/OS Communications Server to perform OSA Diagnostics

TCP/IP callable Network Management Interface (NMI)

NMI – Network Management Interface

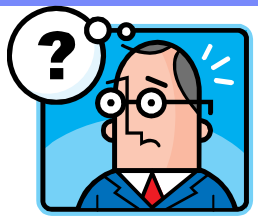


- NMI is a programming interface for network operations
- Retrieve and format records as they are collected (real time) for:
  - Packet Trace (SYSTCPDA)
  - OSAENTA (SYSTCPOT)
- z/OS Communications Server V1R12 added the following NMIs:
  - Network interface information
    - GetIfs - Provides TCP/IP network interface attributes and IP addresses
    - GetIfStats - Provides TCP/IP network interface counters
    - GetIfStatsExtended - Provides data link control (DLC) network interface counters

Using z/OS Communications Server to perform OSA Diagnostics

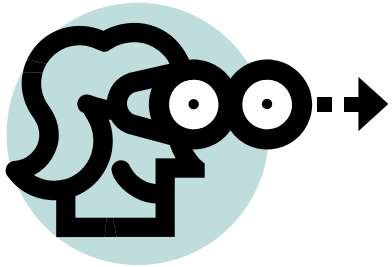
OSA Related Messages and Error Codes

Problem Diagnosis Questions



- Questions you can ask include:
  - Is the process that is causing the problem a new procedure, or has it worked successfully before?
  - If it was an existing procedure that was previously successful, *what has changed*?
  - What messages are being generated that could indicate what the problem is? These could be presented on the terminal if the process is conversational, or in the batch or subsystem job log, or in the system log (SYSLOG).
  - Can the failure be reproduced, and if so, what steps are being performed?
  - Has the failing process generated a dump?

Places to look for diagnostics information



- z/OS Console or System Log (SYSLOG)
  (IPCS VERBX MTRACE)
  - OPERLOG - merged, sysplex-wide system message log
- SYSPRINT, SYSERR, SYSERROR or SYSDEBUG datasets
- TCP/IP Job Log
- SYS1.LOGREC – hardware and software errors
  (IPCS VERBX LOGDATA)
- Generalized Trace Facility (GTF) - trace to show system processing through events occurring in the system over time
- Component Trace (CTRACE)
  - Packet Trace (SYSTCPDA)
  - OSA-E Network Traffic Analyzer (SYSTCPOT)
  - TCP/IP Internal Trace (SYSTCPIP)

OSA Related Messages and Error Codes

- **z/OS Communications Server: IP and SNA Codes**
  Chapter 3. Data link control (DLC) status codes
  - **Example 1**: TCP/IP error message when starting OSAENTA (OSA-E Network Traffic Analyzer) without an extra datapath device available

```
EZZ4336I ERROR DURING ACTIVATION OF INTERFACE EZANTAQDIO4101
- CODE 8010302D DIAGNOSTIC CODE 02
```

- Byte 0: X’80’ Permanent error
  Explanation: Request rejected due to failure of either a system or network function.
- Byte 1: X'10‘ LLC layer local error
  Explanation: A primitive was processed and an error was found by the local VTAM.
- Bytes 2&3 : X'302D‘ No datapath devices available
  Explanation: A ULP cannot use a QDIO device because there are no datapath channel addresses available.

OSA Related Messages and Error Codes

– **Example 2**: Device INOP for a bad inbound packet detected by z/OS Communications Server

```
IST1578I DEVICE INOP DETECTED FOR QDIO4201 BY ISTLLCIE CODE = 101
EZZ4338I ERROR REPORTED ON INTERFACE QDIO4201I
- CODE 80100040 DIAGNOSTIC CODE 03
```

- Bytes 2&3: X'0040‘ INOP-deact SAP
  Explanation: SAP has become inoperative.

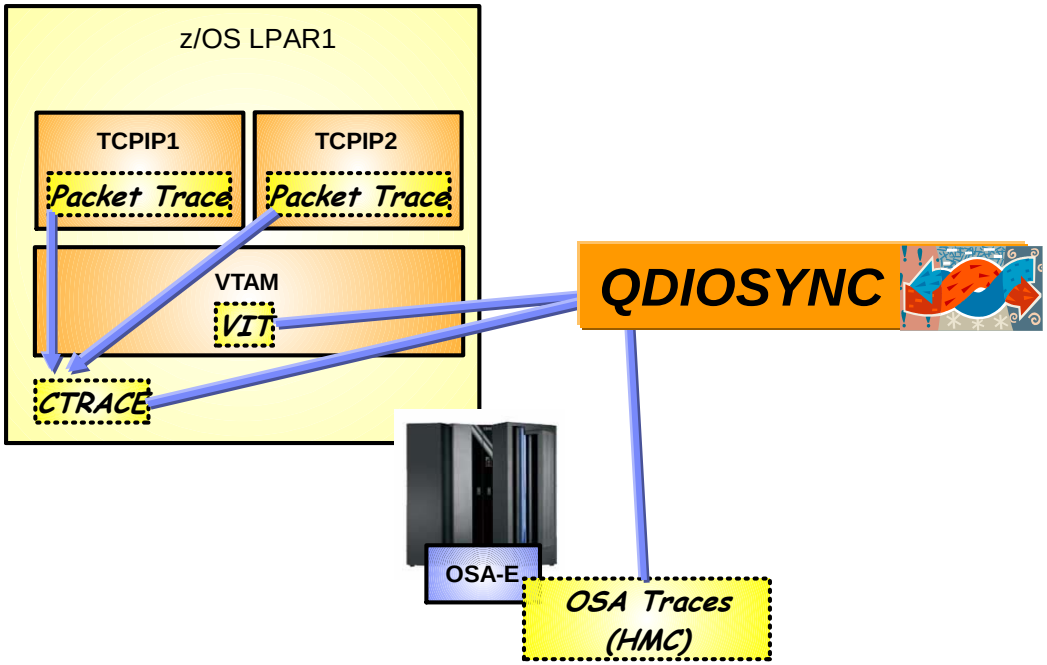
- INOP Codes: Generally follow these rules
  1 -> 99 : VTAM Internal Error
  100 -> 199 : Probable Hardware Error
  200 -> 255 : Should Not Occur Condition

Using z/OS Communications Server to perform OSA Diagnostics

QDIO Diagnostic Synchronization

QDIO Diagnostic Synchronization

- OSA has its own trace tables (just like TCP/IP CTRACE and VTAM VIT)
- OSA trace table is normally captured using HMC
- QDIO Diagnostic Synchronization can make sure OSA trace tables are captured at the same time TCP/IP and VTAM traces are captured



QDIO Diagnostic Synchronization

- TRLEs must first be **armed**:
  MODIFY *vtam_procname*,TRACE,TYPE=QDIOSYNC,ID=*
- You can view the status with Display TRLE or Display TRACE commands

  IST2184I QDIOSYNC = ALLINOUT - SYNCID = QDIO101 - SAVED = NO
- OSA trace tables are then captured when:
  - The OSA-Express adapter detects an unexpected loss of host connectivity. (e.g. INOP)

    -or-
  - The OSA-Express adapter receives a CAPTURE signal from the host.
    - The VTAM-supplied message processing facility (MPF) exit (IUTLLCMP) is driven.
    - VTAM or TCP/IP functional recovery routine (FRR) is driven with a SLIP PER trap that specifies ACTION=RECOVERY.

QDIO Diagnostic Synchronization – MPF Exit

- Sample MPF parmlib member to capture OSA traces

```
* This MPFLSTxx identifies the messages which lead to capture of
* armed OSA-Express devices. If any of the following message are
* issued, IUTLLCMP (VTAM provided MPF exit) gains control and
* schedules the capture of all armed OSA-Express devices.
*
* EZZ4343I ERROR xxxx REGISTERING IP ADDRESS<IP_Addr> FOR ...
* EZZ4339I INTERFACE interface_name FAILED - ADAPTER SIGNAL ...
* EZZ4327I ERROR XXXX REGISTERING IP ADDRESS
* EZZ4328I ERROR XXXX SETTING ROUTING FOR DEVICE
EZZ4343I,SUP(NO),USEREXIT(IUTLLCMP)
EZZ4339I,SUP(NO),USEREXIT(IUTLLCMP)
EZZ4327I,SUP(NO),USEREXIT(IUTLLCMP)
EZZ4328I,SUP(NO),USEREXIT(IUTLLCMP)
```

- You should also set a corresponding SLIP trap **for each message** in the parmlib member to initiate a host dump and capture TCP/IP and VTAM traces.

```
SL DEL,ID=MEZ1,END
SL SET,ID=MEZ1,MSGID=EZZ4343I,A=(STOPGTF,SVCD),MATCHLIM=1,
JOBLIST=(TCP*,NET*),
DSPNAME=('TCP*'.*,01.CSM*,'NET*'.IST*),
SDATA=(RGN,ALLNUC,CSA,LSQA,PSA,SQA,SUM,SWA,TRT,LPA),
END
```

QDIO Diagnostic Synchronization – SLIP PER

- For some problems IBM may provide you with a module offset
- To capture on a module offset you will need to code a SLIP PER trap on a **specific address** that specifies **ACTION=RECOVERY**.

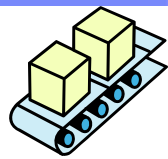
```
SL DEL,ID=MEZ2,END
SL SET,IF,ID=MEZ2,RA=(3A412EBC),A=(STOPGTF,RECOVERY,SVCD),
MATCHLIM=1,JOBLIST=(TCP*,NET*),
DSPNAME=('TCP*'.*,01.CSM*,'NET*'.IST*),
SDATA=(RGN,ALLNUC,CSA,LSQA,PSA,SQA,SUM,SWA,TRT,LPA),
END
```

- Note: SLIP PER can have a significant affect on system performance

For more information

URL	Content
http://www.twitter.com/IBM_Commserver	IBM Communications Server Twitter Feed
http://www.facebook.com/IBMCommserver	IBM Communications Server Facebook Fan Page
http://www.ibm.com/systems/z/	IBM System z in general
http://www.ibm.com/systems/z/hardware/networking/	IBM Mainframe System z networking
http://www.ibm.com/software/network/commserver/	IBM Software Communications Server products
http://www.ibm.com/software/network/commserver/zos/	IBM z/OS Communications Server
http://www.ibm.com/software/network/commserver/z_lin/	IBM Communications Server for Linux on System z
http://www.ibm.com/software/network/ccl/	IBM Communication Controller for Linux on System z
http://www.ibm.com/software/network/commserver/library/	IBM Communications Server library
http://www.redbooks.ibm.com	ITSO Redbooks
http://www.ibm.com/software/network/commserver/zos/support/	IBM z/OS Communications Server technical Support – including TechNotes from service
http://www.ibm.com/support/techdocs/atsmastr.nsf/Web/TechDocs	Technical support documentation from Washington Systems Center (techdocs, flashes, presentations, white papers, etc.)
http://www.rfc-editor.org/rfcsearch.html	Request For Comments (RFC)
http://www.ibm.com/systems/z/os/zos/bkserv/	IBM z/OS Internet library – PDF files of all z/OS manuals including Communications Server

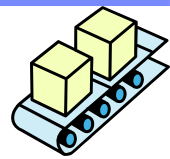
For pleasant reading ….



Using z/OS Communications Server to perform OSA Diagnostics

Appendix A: Component Trace Commands (CTRACE)

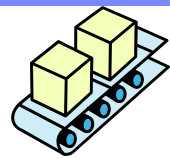
Steps for using CTRACE



- **Start CTRACE** for the desired component to collect trace records
  TRACE CT,*ON*,COMP=*component_name*,SUB=(*procedure_jobname*)
  R n,END
  - **Start Packet Trace or OSAENTA** to generate trace records
    - Recreate the problem
  - **Stop Packet Trace or OSAENTA**
- **Stop CTRACE** for the component
  TRACE CT,OFF,COMP=*component_name*,SUB=(*procedure_jobname*)

- Issue the DUMP command to capture the internal CTRACE buffers
- To view CTRACE records analyze the DUMP in IPCS using:
  CTRACE panel (2.7.1.D)
  or
  CTRACE subcommands (2.7.1)

Commands for CTRACE cont.



- To **modify** the **internal trace buffer size**:
  TRACE CT,*nnnM*,COMP=*component_name*,SUB=(*procedure_jobname*)
  Note: nnnM is a value like 64M
  Note: Internal buffer trace size and other options are also configurable in SYS1.PARMLIB
- To **display** information about the status of the CTRACE component:
  DISPLAY TRACE,COMP=*component_name*,SUB=(*procedure_jobname*)

```
11.04.44   d trace,comp=systcpda,sub=(tcpcs1)
11.04.44   IEE843I 11.04.44  TRACE DISPLAY 253
          SYSTEM STATUS INFORMATION
 ST=(ON,0004M,00004M) AS=ON   BR=OFF EX=ON   MO=OFF MT=(ON,064K)
  TRACENAME
  =========
  SYSTCPDA                  MODE  BUFFER HEAD  SUBS
                            ========== ============
                            OFF             HEAD    3
     NO HEAD OPTIONS
  SUBTRACE                  MODE  BUFFER HEAD  SUBS
 ---------------------------------------------------------------------
  TCPCS1                    ON    0512M
     ASIDS          *NONE*
     JOBNAMES       *NONE*
     OPTIONS        MINIMUM
     WRITER         *NONE*
```

Component Name

Trace Status (ON or MIN)

External Writer Status

Internal Buffer Size

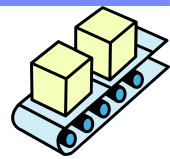
Collect CTRACE records with the DUMP command

- To collect CTRACE records issue the DUMP command for your TCPIP stack (in this example the stack name is TCPCS1)

```
DUMP COMM=(dump title here)
R n,JOBNAME=(TCPCS1),DSPNAME=('TCPCS1'.*),CONT
R n,SDATA=(CSA,RGN,TRT),END
```

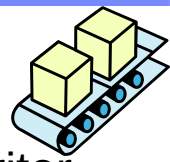
Note: This step is not necessary if you are using an external writer

Packet Trace – Format Records in IPCS

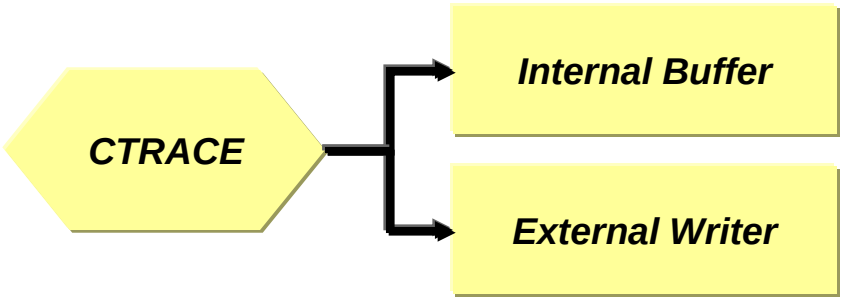


- To format packet trace using IPCS panels, follow these steps:
  - Log on to TSO
  - Access IPCS
  - Select option 2 (ANALYSIS) from the option list
  - Select option 7 (TRACES) from the option list
  - Select option 1 (CTRACE) from the option list
  - Select option D (Display) from the option list
- You can also use option 6 (COMMAND) to enter CTRACE commands from the command line
- You can also use a JCL batch job to format component traces

CTRACE External Writer (optional)



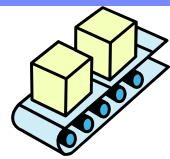
- If you need to collect a large amount of trace data you can use an external writer
- External writer can be an MVS data set or VSAM linear data set for fast writing (See IP Diagnosis Guide: Tips for using component trace external writer)
- Saves trace data to an external writer in addition to the internal buffer (can wrap)



- First create a JCL procedure in SYS1.PROCLIB for the external writer

```
//CTWTR1 PROC
//IEFPROC EXEC PGM=ITTTRCWR
//TRCOUT01 DD DSNAME=USERID.TRACE.DATA,UNIT=SYSDA,
//         SPACE=(1024,(2000,100),,CONTIG),DISP=(NEW,CATLG),DSORG=PS
//SYSPRINT DD SYSOUT=*
```

CTRACE External Writer (optional) cont.



- Steps for using an external writer:
  - Start the external writer

    TRACE CT,WTRSTART=*procedure_name*
    - Start CTRACE for the component and connect external writer:

      TRACE CT,*ON*,COMP=*component_name*,SUB=(*procedure_jobname*)

      R *n*,**WTR=*procedure_name***,END
      - Start the component trace (Packet Trace or OSAENTA)
        - Recreate the problem
      - Stop the component trace (Packet Trace or OSAENTA)
    - Disconnect the external writer from CTRACE

      TRACE CT,ON,COMP=*component_name*,SUB=(*procedure_jobname*)

      R nn,WTR=DISCONNECT,END
    - Stop CTRACE for the component

      TRACE CT,OFF,COMP=*component_name*,SUB=(*procedure_jobname*)
  - Stop the external writer

    TRACE CT,WTRSTOP=*procedure_name,FLUSH*

Using z/OS Communications Server to perform OSA Diagnostics

Appendix B: NETSTAT commands for OSA information and statistics

Netstat Commands

- Netstat commands can be used to find out how an OSA is currently configured and show network statistics for given OSA.
- All information is from the stack's perspective
  - OSA Interface Status and Statistics
    Netstat DEvlinks/-d
  - TCPIP Profile Configuration
    Netstat CONFIG/-f
  - IP Address List
    Netstat HOme/-h
  - OSA's IPv4 ARP Cache (ARP Offload)
    Netstat ARp/-R
  - Stack's IPv6 Neighbor Cache
    Netstat ND/-n

Netstat DEvlinks/-d report

- Displays active configuration information about an OSA interface

Active Configuration

```
D TCPIP,TCPCS1,NETSTAT,DEVLINKS
EZD0101I NETSTAT CS V1R12 TCPCS1 573
INTFNAME: QDIO4101L          INTFTYPE: IPAQENET   INTFSTATUS: READY
   PORTNAME: QDIO4101  DATAPATH: 0E2A     DATAPATHSTATUS: READY
   SPEED: 0000001000
   IPBROADCASTCAPABILITY: NO
   CFGROUTER: NON                       ACTROUTER: NON
   ARPOFFLOAD: YES                      ARPOFFLOADINFO: NO
   CFGMTU: NONE                         ACTMTU: 8992
   IPADDR: 172.16.1.1/0
   VLANID: NONE                         VLANPRIORITY: DISABLED
   READSTORAGE: GLOBAL (4096K)
   INBPERF: DYNAMIC
     WORKLOADQUEUEING: YES
   CHECKSUMOFFLOAD: YES
   SECCLASS: 255                        MONSYSPLEX: NO
   ISOLATE: NO                          OPTLATENCYMODE: YES
MULTICAST SPECIFIC:
.
```

Netstat DEvlinks/-d report cont.

- Also displays interface statistics, LAN groups, and OSAENTA settings

```
INTERFACE STATISTICS:
   BYTESIN                          = 12834
   INBOUND PACKETS                  = 16
   INBOUND PACKETS IN ERROR         = 0
   INBOUND PACKETS DISCARDED        = 0
   INBOUND PACKETS WITH NO PROTOCOL = 0
   BYTESOUT                         = 5132
   OUTBOUND PACKETS                 = 10
.
IPV4 LAN GROUP SUMMARY
LANGROUP: 00001
  NAME              STATUS      ARPOWNER          VIPAOWNER
  ----              ------      --------          ---------
  QDIO4101L         ACTIVE      QDIO4101L         YES
  QDIO4201L         ACTIVE      QDIO4201L         NO
.
OSA-EXPRESS NETWORK TRAFFIC ANALYZER INFORMATION:
NO OSA-EXPRESS NETWORK TRAFFIC ANALYZER INTERFACES ARE DEFINED
10 OF 10 RECORDS DISPLAYED
END OF THE REPORT
```

Statistics In and Out

Interfaces on Same LAN

OSAENTA Settings

Netstat CONFIG/-f report

- Displays TCP/IP configuration information about IP, TCP, UDP, SMF parameters, GLOBALCONFIG profile statement, network monitor, data trace, and autolog settings.

```
15.12.55  D TCPIP,TCPCS1,N,CONFIG
15.12.55  EZD0101I NETSTAT CS V1R12 TCPCS1 263
TCP CONFIGURATION TABLE:
DEFAULTRCVBUFSIZE:  00016384  DEFAULTSNDBUFSIZE: 00016384
DEFLTMAXRCVBUFSIZE: 00524288  SOMAXCONN:         0000000010
MAXRETRANSMITTIME:  120.000   MINRETRANSMITTIME: 0.500
.
UDP CONFIGURATION TABLE:
DEFAULTRCVBUFSIZE: 00065535  DEFAULTSNDBUFSIZE: 00065535
CHECKSUM:          YES
.
IP CONFIGURATION TABLE:
FORWARDING: YES    TIMETOLIVE: 00064  RSMTIMEOUT:  00060
IPSECURITY: NO
ARPTIMEOUT: 01200  MAXRSMSIZE: 65535  FORMAT:      LONG
IGREDIRECT: NO     SYSPLXROUT: YES    DOUBLENOP:   NO
```

Netstat HOme/-h report

- Displays information about each home IP address and its associated link or interface name.

```
16.17.08  D TCPIP,TCPCS1,N,HOME
16.17.08  EZD0101I NETSTAT CS V1R12 TCPCS1 507
HOME ADDRESS LIST:
LINKNAME:   VIPA4811L
  ADDRESS:  10.81.1.1
    FLAGS:  PRIMARY
LINKNAME:   VIPA4821L
  ADDRESS:  10.82.1.1
    FLAGS:
LINKNAME:   QDIO4101L
  ADDRESS:  172.16.1.1
    FLAGS:
LINKNAME:   QDIO4201L
  ADDRESS:  172.16.2.1
    FLAGS:
.
```

Netstat ARp/-R

- Shows the IPv4 ARP cache information
- Because of ARP Offload information is queried from OSA
- OSA is queried every 30 seconds for updates

```
16.08.33  D TCPIP,TCPCS1,N,ARP
16.08.33  EZD0101I NETSTAT CS V1R12 TCPCS1 462
QUERYING ARP CACHE FOR ADDRESS 172.16.1.1
INTERFACE: QDIO4101L          ETHERNET: 40000E280300
QUERYING ARP CACHE FOR ADDRESS 172.16.1.2
INTERFACE: QDIO4101L          ETHERNET: 40000E300300
2 OF 2 RECORDS DISPLAYED
END OF THE REPORT
```

Netstat ND/-n report

- Shows IPv6 neighbor cache entries (no ND offload to OSA)

```
20.58.55  D TCPIP,TCPCS1,N,ND
20.58.55  EZD0101I NETSTAT CS V1R12 TCPCS1 745
QUERY NEIGHBOR CACHE FOR FE80::16:2:1
  INTFNAME: QDIO6SHR            INTFTYPE: IPAQENET6
  LINKLAYERADDR: 40000E2C0300   STATE: REACHABLE
  TYPE: HOST                    ADVDFLTRTR: NO
QUERY NEIGHBOR CACHE FOR FE80::16:1:1
  INTFNAME: QDIO6SHR            INTFTYPE: IPAQENET6
  LINKLAYERADDR: 40000E280300   STATE: REACHABLE
  TYPE: HOST                    ADVDFLTRTR: NO
QUERY NEIGHBOR CACHE FOR FE80::16:2:1
  INTFNAME: QDIO6101            INTFTYPE: IPAQENET6
  LINKLAYERADDR: 40000E2C0300   STATE: REACHABLE
  TYPE: HOST                    ADVDFLTRTR: NO
3 OF 3 RECORDS DISPLAYED
END OF THE REPORT
```

Using z/OS Communications Server to perform OSA Diagnostics

Appendix C: TNSTATS command for collecting VTAM level device statistics

VTAM Tuning Statistics (TNSTAT)

- Shows VTAM level statistics for a TRLE over a specified time interval.
- Shows stats like number of interrupts, number of buffers, byte/packet counts, error counts, accelerated packets, etc
- To **start** VTAM tuning statistics for a TRLE:
  MODIFY *vtam_procname,*TNSTAT,TRLE=IUTIQDIO,CNSL,TIME=3

Number of Minutes

- To **stop** VTAM tuning statistics for a TRLE:
  MODIFY *vtam_procname,NO*TNSTAT,TRLE=IUTIQDIO
- When results are displayed on the time interval the counters are reset
- Tip: If you want VTAM to present the results on your command just set a high initial time value and then change the time interval to a different value when you are ready to see the results.
- See the *SNA Network Implementation Guide* for descriptions of the fields

VTAM Tuning Statistics (TNSTAT) Example

- Shows the **read and write control channel** statistics

```
IST1230I TIME     = 09433824   DATE     = 09271      ID  = QDIO101 321
IST1231I IPDU     =          0 OPDU     =          0
IST1569I INLP     =          0 ONLP     =          0
IST1232I TSWEEP   =          0 QSWEEP   =          0
IST924I ------------------------------------------------------------
IST1233I DEV      = 0E29       DIR      = WRITE
IST1234I BSIZE    =       4096 MAXBYTES =          0
IST1235I SIO      =          0 SLOWDOWN = ****NA****
IST1236I BYTECNTO =          0 BYTECNT  =          0
IST1570I NBYTECTO =          0 NBYTECT  =          0
IST924I ------------------------------------------------------------
IST1233I DEV      = 0E28       DIR      = READ
IST1234I BSIZE    =       4092 MAXBYTES =          0
IST1235I SIO      =          0 SLOWDOWN =          0
IST1236I BYTECNTO =          0 BYTECNT  =          0
IST1570I NBYTECTO =          0 NBYTECT  =          0
IST924I ------------------------------------------------------------
```

Write Control Channel

Read Control Channel

VTAM Tuning Statistics (TNSTAT) Example

- Shows **data channel** statistics for all **read queues**

```
IST1233I DEV      = 0E2A        DIR      = RD/1 (PRIMARY)
IST1719I PCIREALO =          0 PCIREAL  =        1179
IST1720I PCIVIRTO =          0 PCIVIRT  =           0
IST1750I PCITHRSO =          0 PCITHRSH =         144
IST1751I PCIUNPRO =          0 PCIUNPRD =           0
IST2316I EARLYINO =          0 EARLYINT =           0
IST2317I ULPRETUO =          0 ULPRETU  =           0
IST1752I RPROCDEO =          0 RPROCDEF =           0
IST1753I RREPLDEO =          0 RREPLDEF =           0
IST1754I NOREADSO =          0 NOREADS  =           0
IST1721I SBALCNTO =          0 SBALCNT  =         214
IST1722I PACKCNTO =          0 PACKCNT  =         500
IST2185I FRINVCTO =          0 FRINVCT  =           0
IST1236I BYTECNTO =          0 BYTECNT  =      173982
IST1810I PKTIQDO  =          0 PKTIQD   =           0
IST1811I BYTIQDO  =          0 BYTIQD   =           0
IST924I -------------------------------------------------------
IST1233I DEV      = 0E2A        DIR      = RD/2 (BULKDATA)
,
IST1233I DEV      = 0E2A        DIR      = RD/3 (SYSDIST)
.
```

Primary Read Queue (1)

PCI Interrupts

SBAL Internal Buffers

Normal Packets/Bytes

Accelerated Packets/Bytes

Ancillary Input Queues (2+)

VTAM Tuning Statistics (TNSTAT) Example

- Shows **data channel** statistics for all **write queues**

```
IST1233I DEV      = 0E2A        DIR      = WR/1
IST1755I SBALMAX  =           2 SBALAVG  =           1
IST1756I QDPTHMAX =           0 QDPTHAVG =           0
IST1723I SIGACNTO =           0 SIGACNT  =          14
IST1721I SBALCNTO =           0 SBALCNT  =          14
IST1722I PACKCNTO =           0 PACKCNT  =          14
IST2242I SIGMCNTO =           0 SIGMCNT  =           0
IST1236I BYTECNTO =           0 BYTECNT  =        1375
IST1810I PKTIQDO  =           0 PKTIQD   =           0
IST1811I BYTIQDO  =           0 BYTIQD   =           0
IST924I -------------------------------------------------
IST1233I DEV      = 0E2A        DIR      = WR/2
.
IST1233I DEV      = 0E2A        DIR      = WR/3
.
IST1233I DEV      = 0E2A        DIR      = WR/4
```

SIGA Write Instructions

SBAL Write Buffers

Packet/Byte Counts

Accelerated Packets/Bytes

4 Write Priority Queues

Using z/OS Communications Server to perform OSA Diagnostics

Appendix D: VTAM's Display TRL command for more device information

Display TRL – Read and Write Control Channels

- Shows the status of control channels, OSA microcode level, and QDIOSYNC status

```
D NET,TRL,TRLE=QDIO101
IST097I DISPLAY ACCEPTED
IST075I NAME = QDIO101, TYPE = TRLE
IST1954I TRL MAJOR NODE = TRLCS
IST486I STATUS= ACTIV, DESIRED STATE= ACTIV
IST087I TYPE = LEASED             , CONTROL = MPC , HPDT = YES
IST1715I MPCLEVEL = QDIO       MPCUSAGE = SHARE
IST2263I PORTNAME = QDIO4101   PORTNUM =   0   OSA CODE LEVEL = 5D76
337I CHPID TYPE = OSD  CHPID = C1
184I QDIOSYNC = ALLINOUT - SYNCID = QDIO101 - SAVED = NO
IST1577I HEADER SIZE = 4096 DATA SIZE = 0 STORAGE = ***NA***
221I WRITE DEV = 0E29 STATUS = ACTIVE     STATE = ONLINE
577I HEADER SIZE = 4092 DATA SIZE = 0 STORAGE = ***NA***
IST1221I READ  DEV = 0E28 STATUS = ACTIVE     STATE = ONLINE
IST924I -------------------------------------------------------
```

OSA Microcode Level

QDIOSYNC Status

Read and Write Channel Status

Display TRL – Datapath Device

- Shows detailed information for each datapath device including input and output queue usage

```
IST1221I DATA  DEV = 0E2A STATUS = ACTIVE     STATE = N/A
IST1724I I/O TRACE = OFF  TRACE LENGTH = *NA*
IST1717I ULPID = TCPCS1
IST2310I ACCELERATED ROUTING DISABLED
IST2331I QUEUE   QUEUE     READ
IST2332I ID      TYPE      STORAGE
IST2205I ------  --------  --------------
IST2333I RD/1    PRIMARY   1.0M(16 SBALS)
IST2333I RD/2    BULKDATA  1.0M(16 SBALS)
IST2333I RD/3    SYSDIST   1.0M(16 SBALS)
IST2305I NUMBER OF DISCARDED INBOUND READ BUFFERS = 0
IST1757I PRIORITY1: UNCONGESTED PRIORITY2: UNCONGESTED
IST1757I PRIORITY3: UNCONGESTED PRIORITY4: UNCONGESTED
IST2190I DEVICEID PARAMETER FOR OSAENTA TRACE COMMAND = 00-05-00-00
IST1801I UNITS OF WORK FOR NCB AT ADDRESS X'15AD0010'
IST1802I P1 CURRENT = 0 AVERAGE = 0 MAXIMUM = 0
IST1802I P2 CURRENT = 0 AVERAGE = 0 MAXIMUM = 0
IST1802I P3 CURRENT = 0 AVERAGE = 0 MAXIMUM = 0
IST1802I P4 CURRENT = 0 AVERAGE = 0 MAXIMUM = 0
IST924I -------------------------------------------------------
IST314I END
```

Accelerator Status

Inbound Workload Queues

Write Priority Queues Status