z/VM TCP/IP Configuration

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This presentation is an in depth look at configuration of the z/VM TCP/IP server. Basic and advanced configuration topics will be discussed, with an emphasis on practical examples. Topics such as elementary routing, network hardware, and security are discussed in as much depth as necessary to provide an understanding of how to configure them on the z/VM TCPIP server. Common configuration errors will also be addressed. While prior experience with z/VM TCP/IP is not necessary for attendees, some basic knowledge of z/VM mini disk structure is assumed.

Agenda

- **General CMS TCP/IP Client Configuration**

- **Defining the TCP/IP Server**

- **Configuring the TCP/IP Server**

- **Commonly Occurring Errors**

General CMS Client Configuration

TCPIP DATA File

- **Information used by both clients and servers**

  - **Resolver Information**
    - host name
    - domain name
    - resolver preferences
    - resolver tracing
    - DNS servers to use

  - **Stack virtual machine name**

  - **Telnet client TLS default (z/VM 5.3.0)**

  - **E-mail servers**

- **Should reside on the TCP/IP Server's 592 disk (client code)**

Sample TCPIP DATA

TCPIPUSERID   TCPIP2

NSINTERADDR   10.6.3.252
NSINTERADDR   10.6.3.253

HOSTNAME   vmhost1

DOMAINORIGIN   testnet.bigblue.com

SECURETELNETCLIENT   YES

Defining a TCP/IP Server

The DTCPARMS File

- **Defines a server and various startup parameters**
- **Formatted as a CMS Names file (:*<tag>*.*<value>* pairs)**
- **Search Order**
    - **<userid> DTCPARMS**
    - **<nodeid> DTCPARMS**
    - **SYSTEM DTCPARMS**
    - **IBM DTCPARMS**
- **All but IBM DTCPARMS should reside on the TCP/IP server's 198 disk**

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Sample SYSTEM DTCPARMS

:nick.TCPIP   :type.SERVER   :class.STACK

:attach.1f08-1f09, 1e00-1e02

:vnic.e100 SYSTEM LAN1

:vctc.800 LINUX1 500,

       801 LINUX1 501

DTCPARMS Tags

- **Required Tags**

  - **:NICK.**

    - **The user ID of the server being configured**

  - **:TYPE.**

    - **For IBM servers the type is "server"**

  - **:CLASS.**

    - **Defines what sort of server is being configured (FTP, TCP/IP Stack, MPRoute)**

DTCPARMS Tags (cont.)

- **Other Important Tags**
  - **:ATTACH.**
    - **Attach a device to your TCP/IP Server**
  - **:VNIC.**
    - **Define and couple a virtual network card to a guest LAN or VSWITCH**
  - **:VCTC.**
    - **Define and couple a virtual channel-to-channel device to another user**
- **Also Typical**
  - **:OWNER.**
    - **Define the owner of the TCP/IP Server (Default: TCPMAINT)**
  - **:EXIT.**
    - **Run a user defined exit**

Server Profile Exits

- **Global exit called for all servers: TCPRUNXT EXEC**

- **Server-specific exit called via :Exit. tag**

- **Input: when called, server class**

- **Output: DTCPARMS-type tags**

- **Call 'types': SETUP, BEGIN, END, ADMIN and ERROR**
- **Example:**
  arg calltype class .
  if calltype = "SETUP" & class = "STACK" then
  begin
  /* ... find current node ID... */
  if nodeID = DRnodeID then
  /* Do some DR setup here */
  end

Configuring the TCP/IP Server

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PROFILE TCPIP

- **Primary TCP/IP server configuration file**

- **Search order:**

  - ➤ **<userid> TCPIP**

  - ➤ **<nodeid> TCPIP**

  - ➤ **PROFILE TCPIP**

- **Only one is used**

- **Should reside on the TCP/IP server's 198 disk**

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Configuration Statements - Pool Sizes

- **Pool size configuration statements MUST appear first in the TCP/IP configuration file**

- **These may not be changed while the stack is running**

- **Values determined by TCP/IP stack's workload**

- **16 different pool statements are available in 3 formats:**

  - **xxxBUFFERPOOLSIZE or xxxENVELOPEPOOLSIZE**

    - **<statement> <number of buffers allocated> <buffer size>**

  - **xxxPOOLSIZE**

    - **<statement> <number of control blocks allocated>**

  - **FIXEDPAGESTORAGEPOOL**

    - **FIXEDPAGESTORAGEPOOL <initial number> <maximum number>**

Configuration Statements - Pool Sizes (cont.)

```
netstat pool
VM TCP/IP Netstat Level 520

TCPIP Free pool status:

Object                No. alloc      No. free       Lo-water       Permit size
======                =========      ========       ========       ===========
ACB                        5006          4958           4794               500
CCB                         755           662            654                75
Dat buf                    1200          1165           1123               120
Sm dat buf                 5000          4804           4787               500
Tiny dat buf                108            98             96                10
Env                        1250          1229           1154               125
Lrg env                      75            74             75                 7
RCB                          51            49             48                 5
SCB                        2014          1949           1823               201
SKCB                        256           216            195                25
TCB                        5000          4764           4740               500
UCB                         512           501            499                51
Add Xlate                  1512          1512           1512                 5
NCB                        1501          1501           1501                 5
IP Route                   3015          2837           2832                60
IPv6 Route                 3018          3018           3018                60
Segment ACK              100000         99967          99877             10000
FPSP total locked pages: 852, Unused locked pages: 270
FPSP allocation threshold: 41313, Low-water mark: 0
TCPIP machine size: 256M, Pools: 60573K, Avail: 170956K, Max block: 159400K
Ready; T=0.01/0.01 11:13:12
```

Configuration Statements - LargeEnvelopePoolSize

- **<buffer size> must be at least as large as that of smaller envelope buffers**

- **Acts as an upper bound on the MTU value**

- **CTC connected hosts should have matching buffer sizes**

- **Example:**

  - **LARGEENVELOPEPOOLSIZE 100 32K**

Configuration Statements - Privileged Users

- **INFORM**
  - **Specifies users who should be informed of major stack events**
    - **Pool expansion**
    - **Denial of service attacks**
    - **Dynamic configuration changes**
- **OBEY**
  - **Specifies users which can issue privileged stack commands**
    - **OBEYFILE, NETSTAT OBEY**
    - **Use of raw sockets**
    - **Use privileged services on IBM servers (via SMSG)**
    - **Note: As of 5.3.0, OBEY authority is no longer needed to run TRACERTE**
- **Examples:**
  - **INFORM tcpmaint ENDINFORM**
  - **OBEY tcpmaint maint migueld mproute ENDOBEY**

Configuration Statements - AssortedParms

- **Various miscellaneous stack settings**

- **Look at what is available and decide what you need**

- **Of particular interest**

  - **EqualCostMultipath**

  - **IgnoreRedirect (if not running a dynamic router)**

  - **SourceVipa (if using virtual IP addresses)**

- **Example:**

  - **ASSORTEDPARMS**

    equalcostmultipath

    ignoreredirect

    ENDASSORTEDPARMS

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Configuration Statements - AUTOLOG, PORT

- **AUTOLOG**
  - ➢ **Defines which servers to start when the stack comes up**
  - ➢ **Stack will restart the server if it is logged off**
- **PORT**
  - ➢ **Gives permission for a server to listen on a port**
  - ➢ **Low ports (0-1023) are restricted by default**
  - ➢ **Listed ports are monitored unless NOAUTOLOG is specified**
  - ➢ **Used to start the Telnet server (assign a port to INTCLIEN)**
- **Examples:**
  - ➢ **AUTOLOG**
    ftpserve 0
    ENDAUTOLOG
  - ➢ **PORT**
    20 tcp ftpserve noautolog
    21 tcp ftpserve

Configuration Statements - INTERNALCLIENTPARMS

- **Specifies settings for the Telnet server (internal client)**

  - **Timeout values**

  - **Exit routines**

  - **Linemode options**

  - **Dynamic TLS Settings (z/VM 5.3.0)**

- **Look through the options and decide what works best for you**

- **Example:**

  - **INTERNALCLIENTPARMS**
    NOTN3270E
    PORT 23
    SECURECONNECTIONS allowed
    TLSLABEL mylabel
    ENDINTERNALCLIENTPARMS

Configuration Statements - Device and Link

- **Configure network interfaces to the stack**

- **Examples:**
  - **Real QDIO Ethernet Device**
    - DEVICE qdio0 OSD 1e00 PRIROUTER
      LINK eth0 QDIOETHERNET qdio0 MTU 1500
  - **Virtual QDIO Ethernet Device**
    - DEVICE qdio1 OSD e100 NONROUTER
      LINK veth0 QDIOETHERNET qdio1 MTU 32768
  - **LCS Ethernet Device**
    - DEVICE lcs0 LCS 1f08
      LINK eth1 ETHERNET 0 lcs0 MTU 1500
  - **Virtual Channel to Channel Device**
    - DEVICE ctc0 CTC 800
      LINK vctc0 CTC 1 ctc0 MTU 32760

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Configuration Statements - HOME

- **Configures IP addresses and subnet masks for each link**
  - **If a subnet mask is specified, a subnet route will be generated for that interface (i.e. You won't need a GATEWAY entry for it)**

- **Determines which VIPA address is associated with each link**

- **Examples:**

  - **With VIPA**
    - **HOME**

7.0.0.1	255.255.255.0	lcs1
8.0.0.1	255.255.255.252	vipa1
9.1.0.3	255.255.255.0	qdio1
8.0.0.2	255.255.255.252	vipa2
9.2.0.2	255.255.255.0	qdio2

  - **Without VIPA**
    - **HOME**

10.6.3.159	255.255.255.0	eth0
192.8.12.19	255.255.255.240	veth0
192.8.12.12/27		eth1
192.4.0.1	255.255.255.252	vctc0

Configuration Statements - GATEWAY and START

- **GATEWAY – Defines static routes**

- **START – Starts devices**

- **Examples:**

  - **GATEWAY**

10.6.3.0	**255.255.255.0**	**=**		**eth0**	**0**
192.8.12.19	**255.255.255.240**	**=**		**veth0**	**0**
192.8.12.12/27		**=**		**eth1**	**0**
192.4.0.2	**HOST**	**=**		**ctc0**	**0**
DEFAULTNET			**10.6.3.1**	**eth0**	**0**
DEFAULTNET			**192.8.12.1**	**eth1**	**0**

  - **START qdio0**
    START qdio1
   **START lcs0**
    START ctc0

z/VM TCP/IP 5.3.0 and Interface High Availability

- **IP takeover is supported to minimize the impact of an hardware interface failure**

  - **QDIO ethernet and LCS ethernet devices only**

- **No special parameters or options necessary**

  - **If the TCP/IP stack determines two interfaces are on the same network, IP takeover will be enabled for those interfaces**

  - **For IPv4, determination is based on the IP addresses and subnet masks of the interfaces**

    - **Subnet masks may be defined on the HOME statement, the GATEWAY statement, or in the MPROUTE CONFIG file**

IP Takeover Details

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OSA1
10.1.1.1

OSA2
10.1.1.2

10.1.1.0/24

Host 10.1.1.3 forms a connection with 10.1.1.1 (OSA1)

10.1.1.3

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IP Takeover Details (cont.)

z/VM TCP/IP

OSA1
10.1.1.1

OSA2
10.1.1.2
10.1.1.1

10.1.1.0/24

OSA1 Fails

10.1.1.3

OSA2 informs host that traffic for 10.1.1.1 should be sent through this interface

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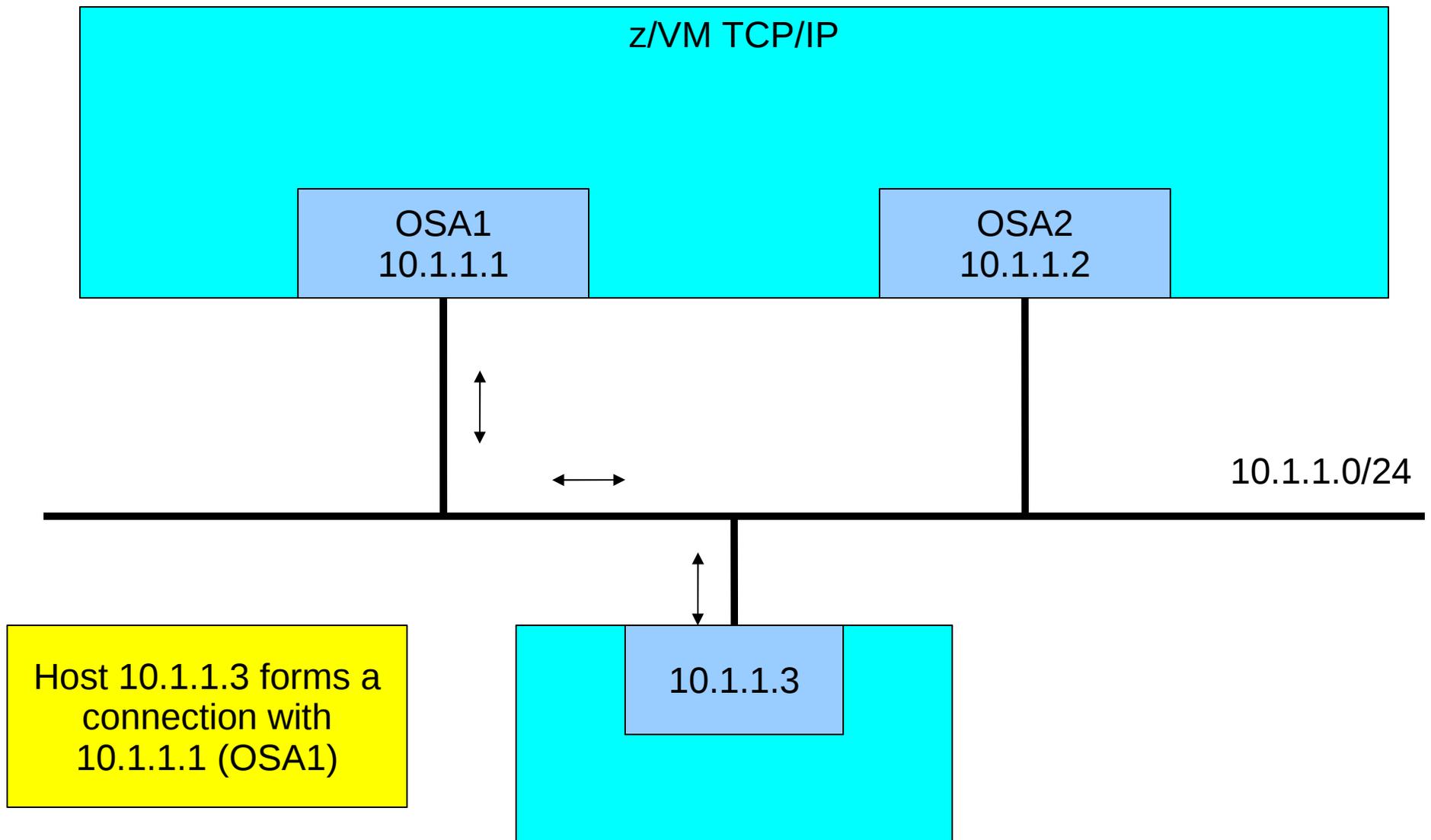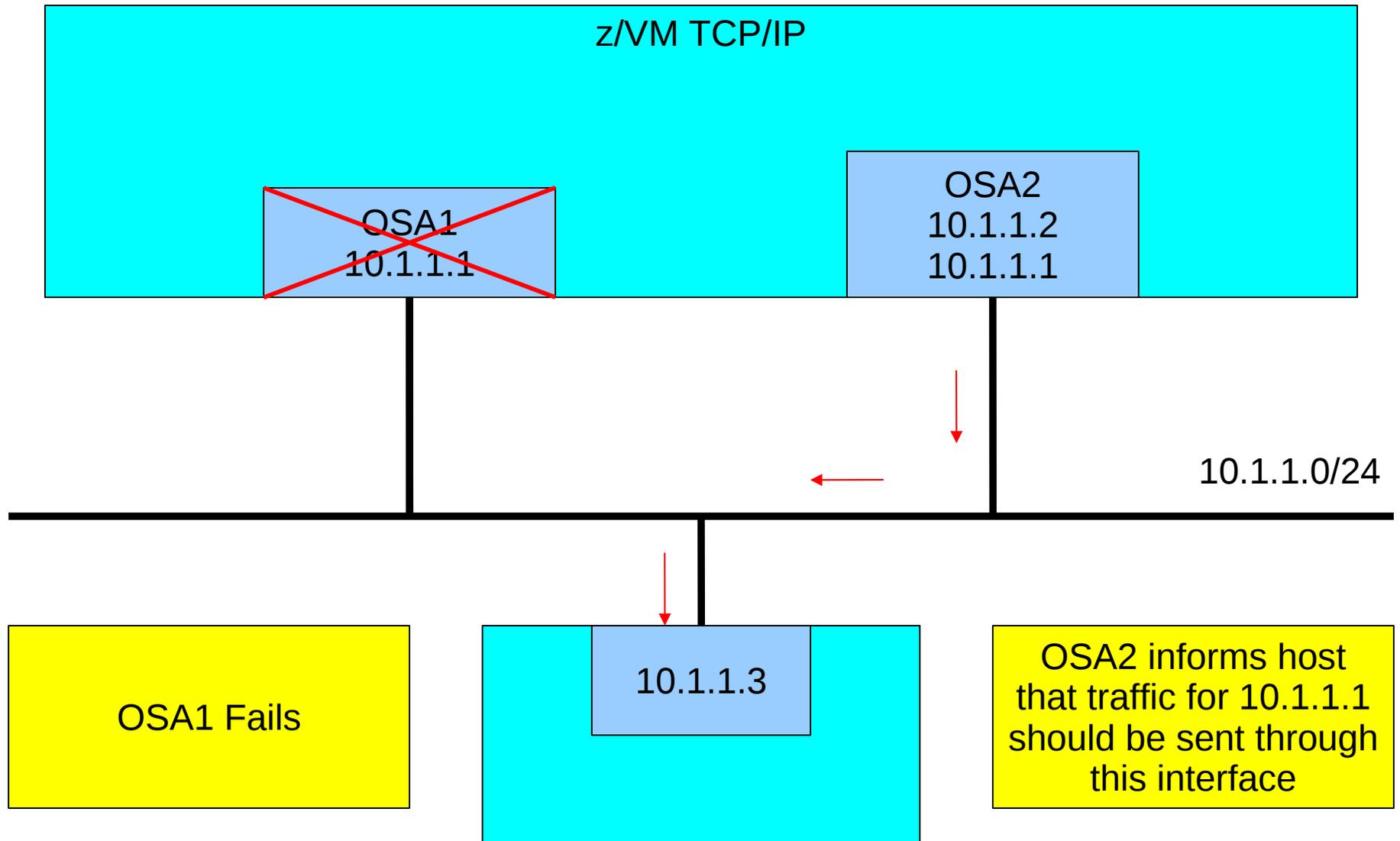
IP Takeover Details (cont.)
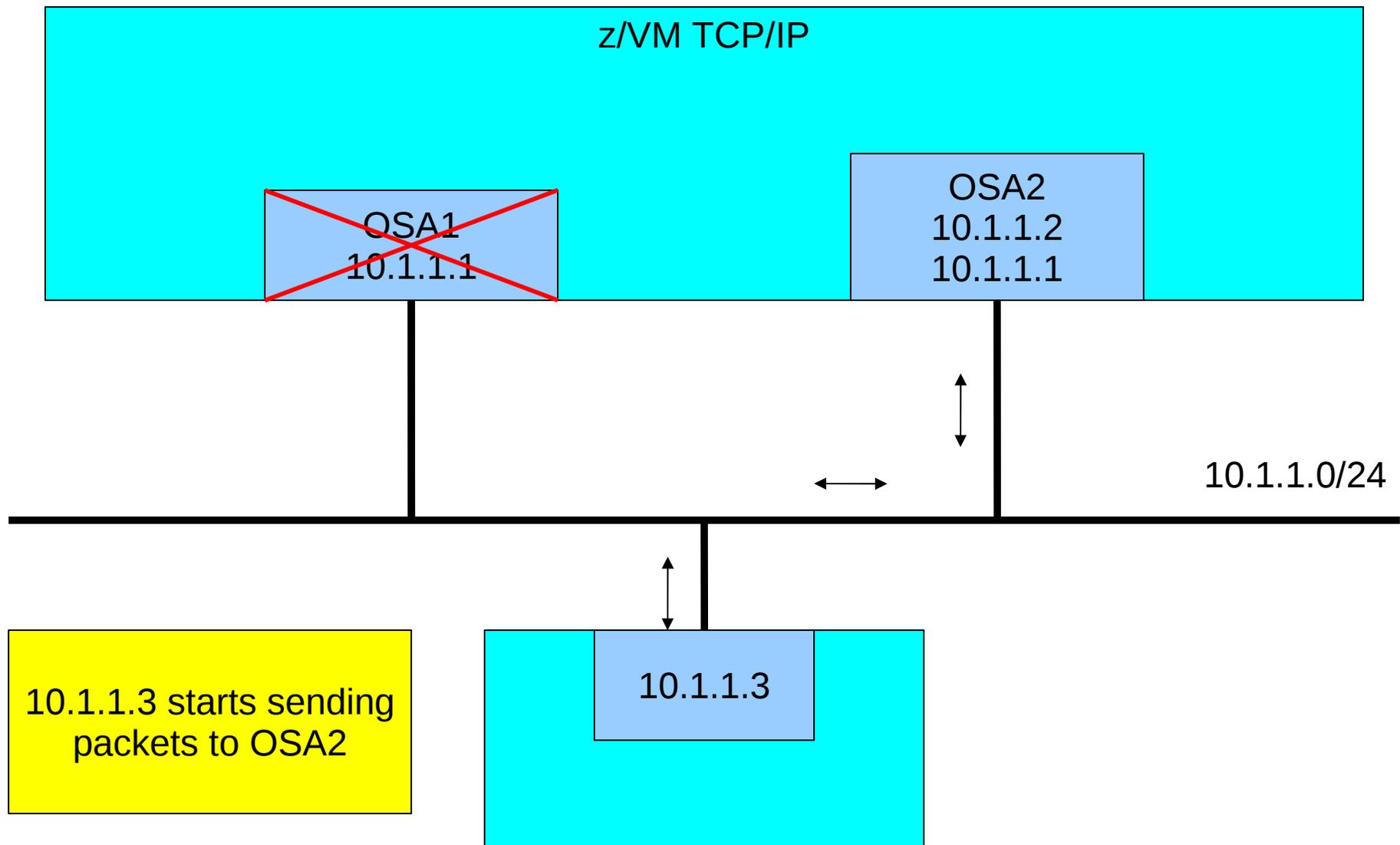
Verifying the Configuration

- **Use NETSTAT once the stack is up and running**

  - **NETSTAT GATE**

    - Display the stack's routing table

  - **NETSTAT HOME**

    - Display the stack's HOME list

  - **NETSTAT DEVLINKS**

    - Display the DEVICE and LINK information and status

  - **NETSTAT CONFIG ALL**

    - Display information on ASSORTEDPARMS, INTERNALCLIENTPARMS, OBEY, PERMIT, PORT, RESTRICT, TRACE and TRANSLATE statements.

Sample PROFILE TCPIP

LARGEENVELOPEPOOLSIZE 100 32K

OBEY tcpmaint maint migueld ENDOBEY

INFORM tcpmaint ENDINFORM

ASSORTEDPARMS
equalcostmultipath
ignoreredirect
ENDASSORTEDPARMS

INTERNALCLIENTPARMS
notn3270E
port 23
ENDINTERNALCLIENTPARMS

PORT
23 tcp INTCLIEN

Sample PROFILE TCPIP (cont.)

DEVICE qdio0 OSD 1e00 PRIROUTER
LINK eth0 QDIOETHERNET qdio0 MTU 1500

DEVICE qdio1 OSD e100 NONROUTER
LINK veth0 QDIOETHERNET qdio1 MTU 32768

DEVICE lcs0 LCS 1f08
LINK eth1 ETHERNET 0 lcs0 MTU 1500

DEVICE ctc0 CTC 800
LINK vctc0 CTC 1 ctc0 MTU 32760

HOME
10.6.3.159   255.255.255.0   eth0
192.8.12.19   255.255.255.240 veth0
192.8.12.12   255.255.255.240 eth1
192.4.0.1   255.255.255.252 vctc0

Sample PROFILE TCPIP (cont.)

```
GATEWAY
192.4.0.1        HOST        192.4.0.2        ctc0      0
DEFAULTNET                   10.6.3.1         eth0      0
DEFAULTNET                   192.8.12.1       eth1      0

START qdio0
START qdio1
START lcs0
START ctc0
```

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Commonly Occurring Errors

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Common Hardware Errors

- **Forgot to attach all addresses for a particular adapter**
- **Wrong device type on DEVICE statement**
  - ➢ **You have to relate chpid type to device type**
- **Wrong adapter number on LINK statement**
  - ➢ **Identifies which port on a multiport device**
  - ➢ **'0' and '1' on CTC (or cross-couple instead)**

Common Routing Errors

- **Incorrect MTU size in routing configuration statements**

  - ➢**Consult hardware documentation**

  - ➢**Talk to your network administrator!**

  - ➢**Everyone on LAN segment should use the same value**

- **Wrong subnet masks or values**

  - ➢**BSD format should help with this**

The #1 Problem: Incorrect TCPIP DATA file

- **Copy on the incorrect disk (should be on TCPMAINT 592)**
  - ➢ **User's A-disk**
  - ➢ **Server's A-disk**
  - ➢ **TCPMAINT 198**
- **Incorrect NSINTERADDR value**
  - ➢ **Ignorance of network changes is no excuse!**
- **TCPIPUSERID pointing to wrong TCP/IP stack virtual machine**
  - ➢ **IBM servers will not come up**

Summary

- **A TCP/IP server requires three (3) configuration files**

    - A DTCPARMS file (<userid>, <nodeid>, or SYSTEM)

    - A TCPIP file (<userid>, <nodeid>, or PROFILE)

    - A TCPIP DATA file

- **Communication with networking team is essential to having z/VM happily running on the network**

Read More About It

- **z/VM Networking Website**

  - **http://www.vm.ibm.com/networking/**

- **TCP/IP Configuration**

  - *TCP/IP Planning and Customization*

- **IETF RFCs**

  - **http://www.rfc-editor.org**

- *TCP/IP Illustrated, Vol. 1*, Stevens, Addison Wesley,
  ISBN 0-201-63346-9

Contact Information

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- **Mailing lists:**
  A number of listservs relevant to z/VM are available. Information on how to subscribe and view/search archives can be found at the following website:
  http://www.vm.ibm.com/techinfo/listserv.html

  Of particular interest:
  IBMVM@listserv.uark.edu
  IBMTCP-L@vm.marist.edu
  LINUX-390@vm.marist.edu