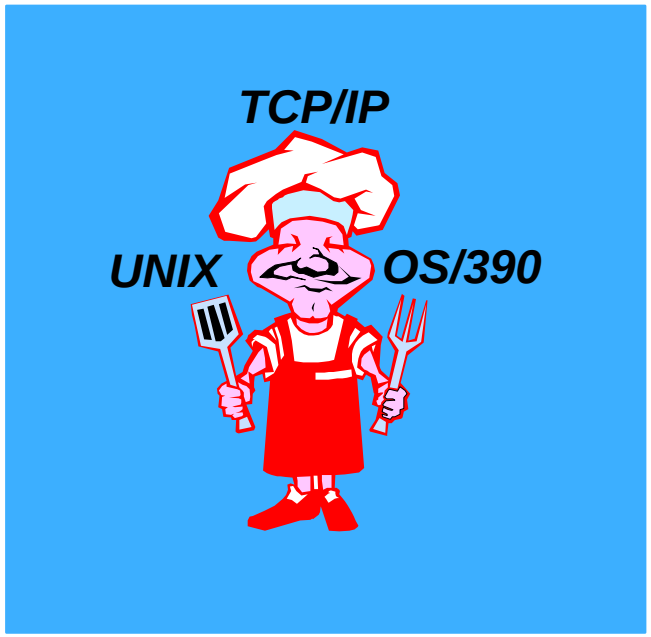
N06

Quick Guide to TCP/IP in CS for OS/390: An Implementation Cookbook



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Abstract

- N06: Quick Guide to TCP/IP in OS/390 V2R5+ -- An Implementation Cookbook
- Speaker: Gwendolyn J. Dente, Advanced Technical Support
- Audience: Technical IP Implementer
  - Prerequisites: (1) Basic to Intermediate skills for TCP/IP Concepts and Implementations; (2) Experience with implementing earlier versions of TCP/IP on MVS
- Abstract: How does a quick guide to implementing TCP/IP on OS/390 sound? Since OS/390 V2R5, the TCP/IP stack in CS for OS/390 is fully integrated with UNIX System Services. This brings advantages and challenges to the TCP/IP system programmer accustomed to TCP/IP V3R2. If you want a list of ingredients and a simple set of instructions for setting up the UNIX System Services environment, for establishing the RACF environment, for dealing with problem determination, then join us this informative double session.
- Acknowledgments: Many thanks to Alfred Christensen, Gus Kassimis, and Tony Amitrano of CS for OS/390 Development, for providing many of the visuals and notes in this presentation.

Agenda

- What has changed since V3R2? (A really quick overview!)
- THE DETAILS: How do I just get the new stack working?
  - Coding Familiar Things (Part 1)
  - Coding New Things (or ... What we haven't told you yet!) (Part 2)
- FAST PATH: Case Study for Single Stack
  - Summary of RACF Commands
  - Bibliography
  - List of "Gotcha's"
  - Implementation Plan Sample
  - Test Plan Sample
- TO BE READ AT YOUR LEISURE: What You Still Should Learn
  - (Around Page 118)
  - Resolvers
  - API Migration
  - Multi-Stack Configurations

What Has Changed Since V3R2?

(A Quick Review)

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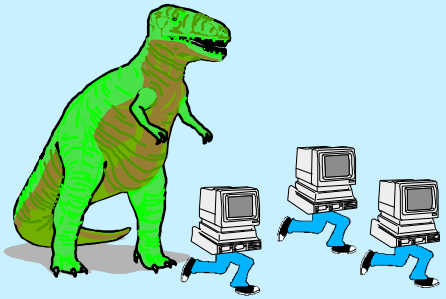
The News About CS on OS/390

- Major S/390 strategic initiatives, such as server consolidation, network computing, and new applications - all rely on fast and robust TCP/IP services on OS/390:
  - improved performance
  - ability to scale TCP/IP application workload
  - better availability
  - more security features
  - more functions (both base and application functions)



Mainframes are back!

- The OS/390 UNIX environment is a major TCP/IP application environment:
  - TCP/IP and OS/390 UNIX integration
  - TCP/IP application transition to OS/390 UNIX
  - Fast implementation of new servers or clients based on code ported from other UNIX platforms
- SNA/APPN and TCP/IP will co-exist for many years in the OS/390 environment:
  - OS/390 TCP/IP and SNA/APPN services integration

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Features: TCP/IP on OS/390 V2R5

- Rewritten Stack (MVS + Unix)
- Enhanced DLC Support (MPC+, etc.)
  - Shared library with VTAM
- Shared CSM with VTAM
- TN3270E
- DNS/WLM; DHCP and DDNS
- Converged C-FTP Client and Server
- Optimal Segment Size
- Telnet: Dynamic Changes + Enhanced USSTable Support
- Multiple Default Routes (GATEWAY)
- Fast Recovery / Fast Restart (RFC2001)
- TIMED, TFTPD

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Features: TCP/IP on OS/390 V2R6

- **OSPF (OMPROUTE)**
- **Sendmail**
- **Multicast Support**
- **Multipath**
- **Long, Fat Pipes (RFC 1323 - "Window Scaling")**
- **Telnet: Secure Sockets Layer (SSL) Support**
- **Telnet: Multiple VTAM Blocks/Ports**
- **Enterprise Extender**

Features: TCP/IP on OS/390 V2R7

- System Symbolics in PROFILE and TCPDATA
- Path MTU Discovery
- XCF Dynamics
- Gigabit Ethernet
- Telnet: TN3270 Name Mapping
- Fiber Channel Support
- Type of Service
- Fast Cache Response Accelerator

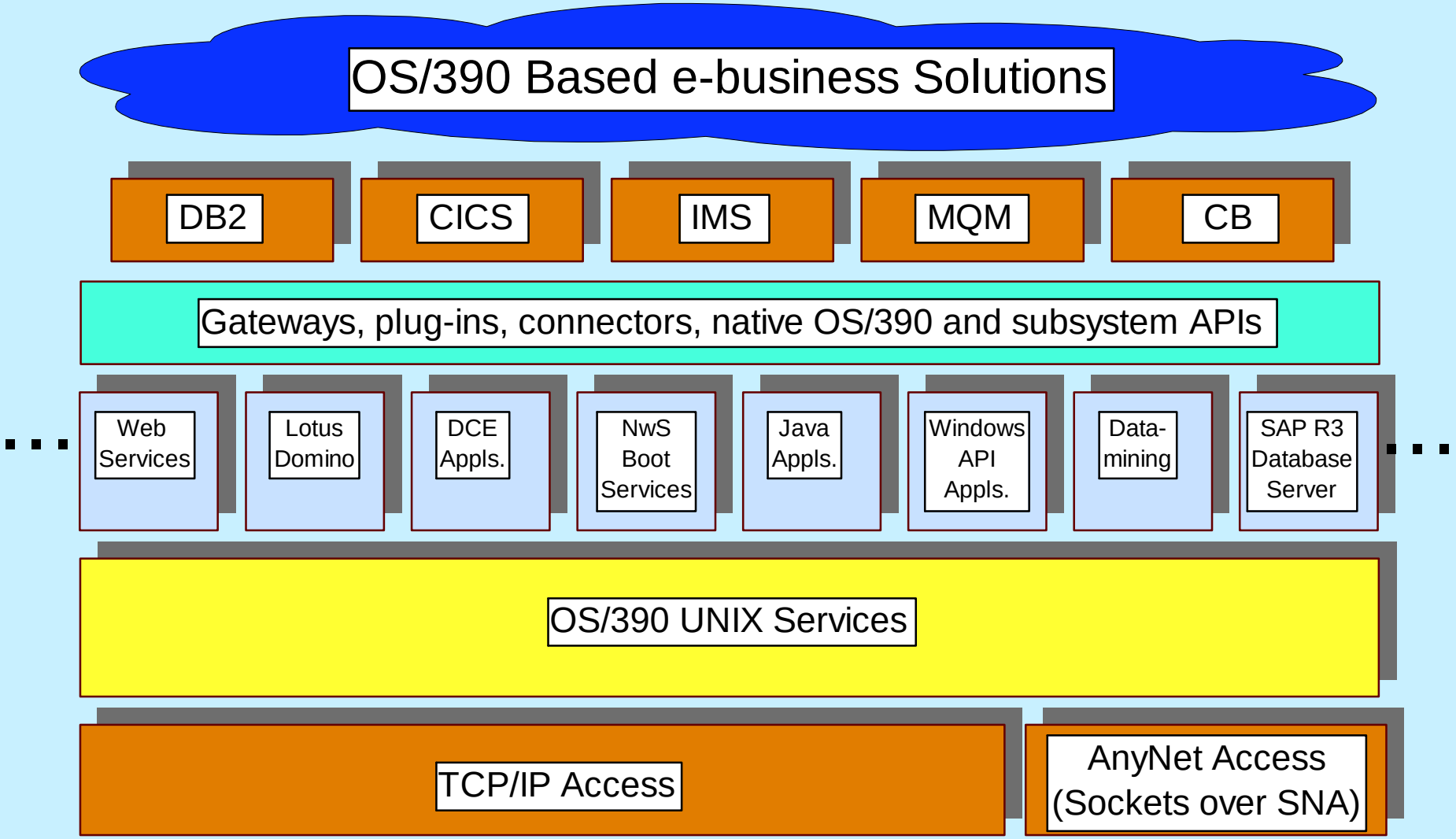
Features: TCP/IP on OS/390 V2R8

- Dynamic VIPA Support (Dynamic Recovery of VIPA)
- Simplified Customization and Verification of TCP/IP
- Re-IPL Avoidance for PFS (Dynamic Change of BPXPRMnn)
- TCP/IP Registration and De-Registration with ARM
- Enhanced Multipath Load Balancing
- Internet Key Exchange (IKE) Support for IPSEC
- MPC OSA for Fast Ethernet and FDDI
- XCF PU Activation Redesign (Activates prior to VTAM)
- Extended Ping (specification of source address)
- IP Trace Data Collection with Filter of IP Addresses/Ports
- Improved PD/PSI (New UNIX Commands)
- Enhancements to QOS (Quality of Service)
- Reduced ECSA Usage
- Synonyms for UNIX commands: "ping" = "oping"

The Big Differences with Pre-V2R5

- Native MVS and Unix are merged.
  - Two Different Search Paths
  - Native MVS datasets and Hierarchical File System (HFS)
  - RACF Security for Unix
- MVS Monitoring Commands for IP
- MVS Start and Stop of Devices
- New Loopback
- Discontinued VMCF/IUCV
- OBEY Command, not TSO OBEYFILE
- New, Changed, Removed DLCs (No OFFLOAD)
- More ...

OS/390 UNIX and OS/390 e-business



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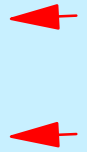
TCP/IP Naming: Evolution

External Name	Internal Name	Release, FMIDs
IBM TCP/IP V3R1 for MVS	TCP/IP V3R1	GA 30-Sep-1994 HTCP310 (base)
OpenEdition MVS Applications feature	OE apps feature	GA 29-Dec-1994 JTCP317 Feature of TCP/IP V3R1
IBM TCP/IP V3R2 for MVS	TCP/IP V3R2	GA 27-Sep-1996 HTCP320 (base)
OpenEdition MVS Applications feature	OE apps feature	GA 27-Sep-1996 JTCP327 Feature of TCP/IP V3R2
OS/390 TCP/IP OpenEdition for MVS/ESA and OS/390 R3 and R4	TCP/IP V3R3 or stage 1	GA 27-Jun-1997 JTCP329 Feature of TCP/IP V3R2
OS/390 eNetwork Communications Server V2R5 IP	TCP/IP V3R4 or stage 2 CS V2R5 IP	GA 27-Mar-1998 HTCP340 and JTCP349
OS/390 eNetwork Communications Server for OS/390 V2R6 IP	CS V2R6 IP	GA 27 Sept. 1998 HTCP350 and JTCP359
OS/390 eNetwork Communications Server for OS/390 V2R7 IP	CS V2R7 IP	GA 26 March 1999 HTCP370 and JTCP379
SecureWay Communications Server for OS/390 V2R8 IP	CS V2R8 IP	GA 24 Sept. 1999 HTCP380 and JTCP389



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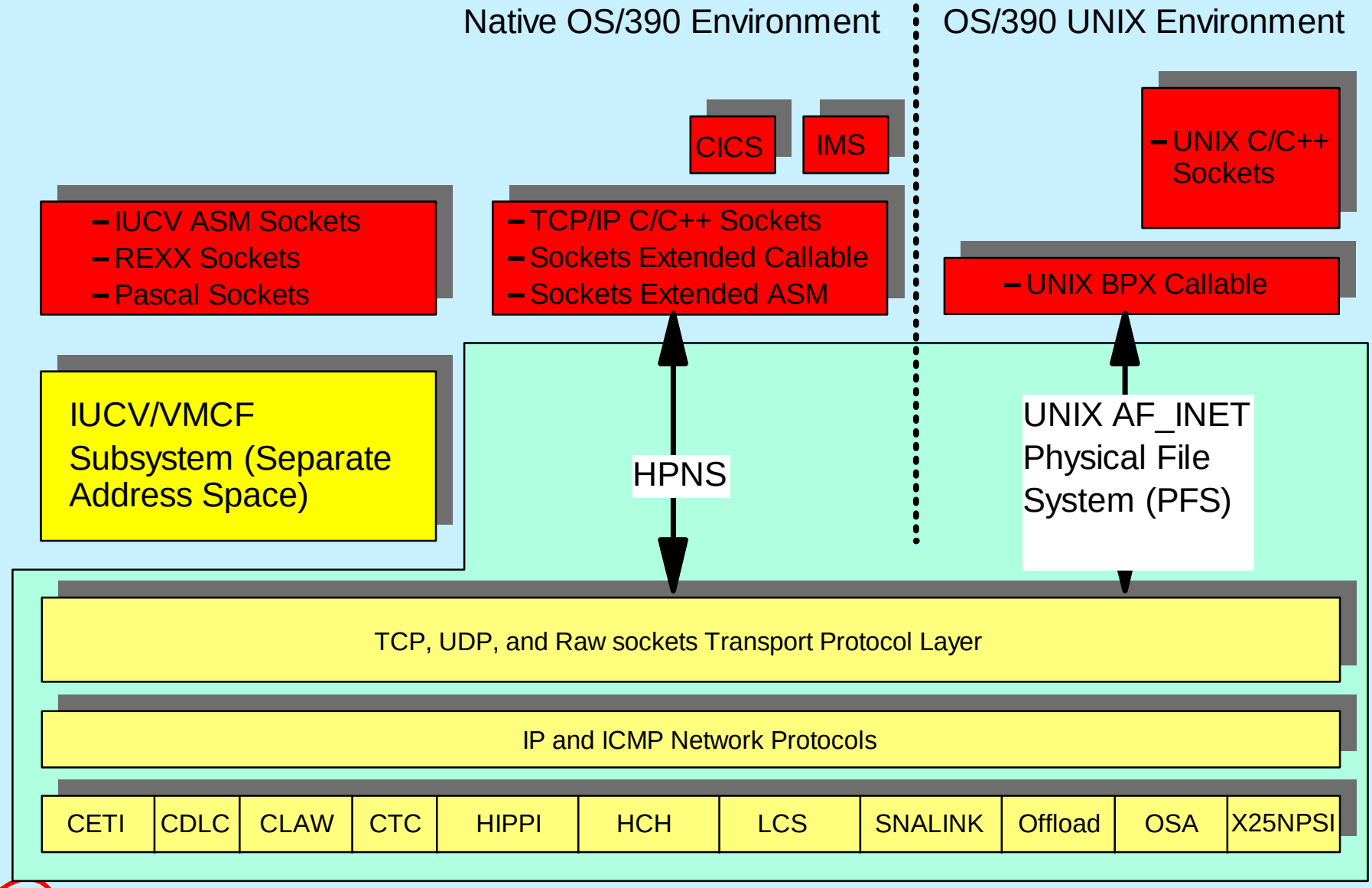
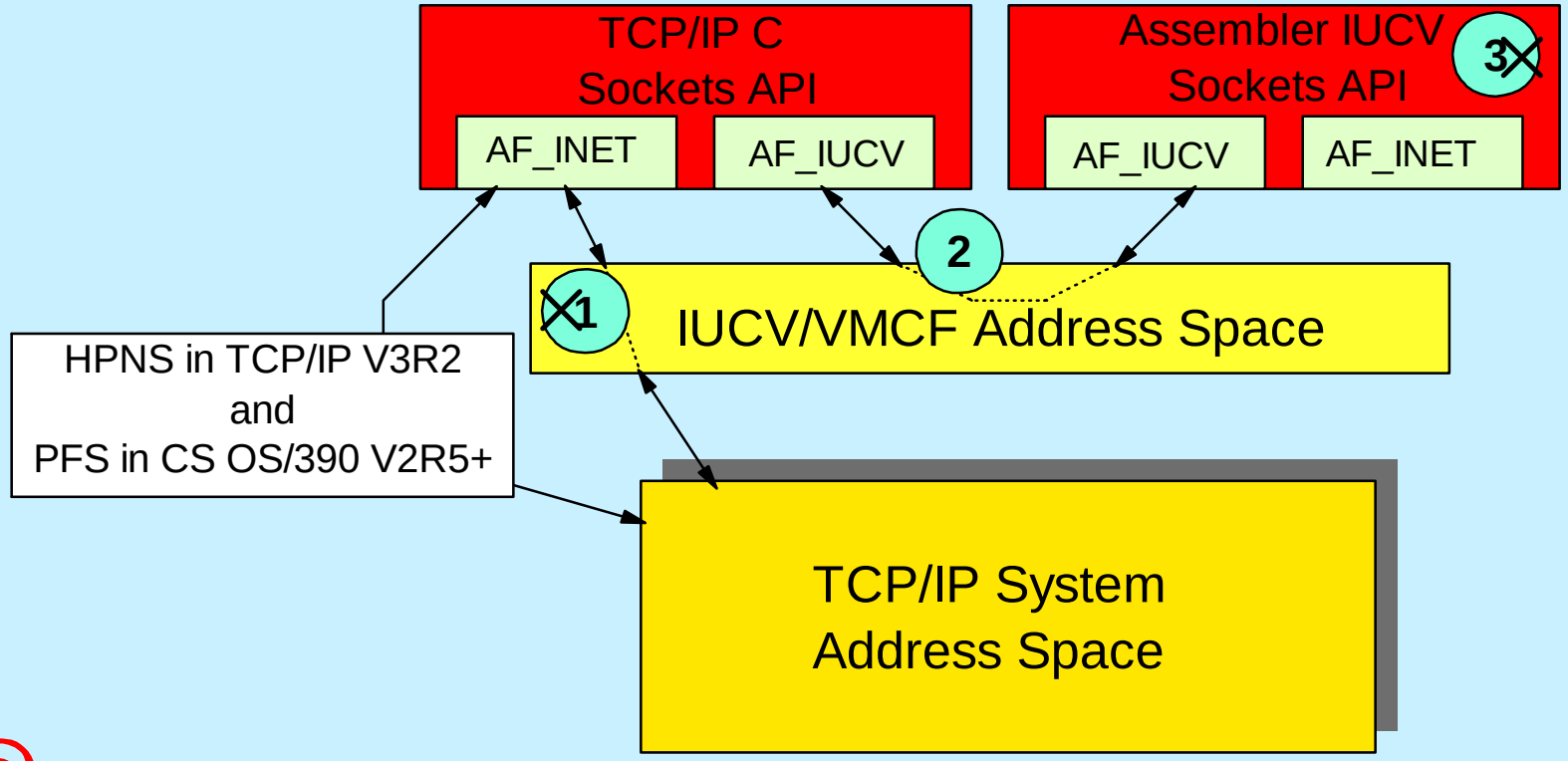
TCP/IP V3R2 API Structure



VMCF / IUCV

VMCF/IUCV Support consists of:

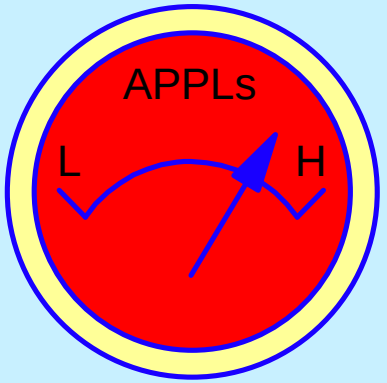
1. AF_INET services to communicate between application AS and TCP/IP AS (not used in CS OS/390 V2R5+)
2. AF_IUCV local socket communication support (still supported in CS OS/390 V2R5+, but for the TCP/IP supplied C-socket API only)
3. Assembler IUCV sockets API (not supported in CS OS/390 V2R5+)



The Full-Function Stack in OS/390 V2Rn

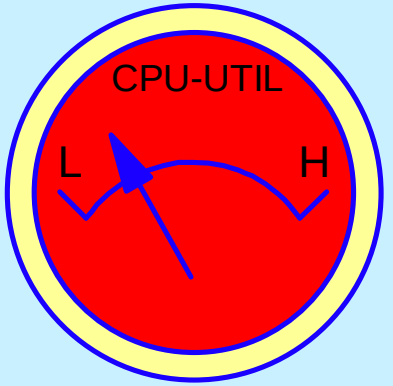
New Process Model

- Fully MP (Multi-processor) Capable
- Full duplex (bi-directional) processing and data transfer paths
- Run outbound user requests under a single context
- Run inbound TCP/IP stack requests under single context
- Call/Return Model
- Minimal data copies
- Minimal task switches



New I/O Process Model - Multi-Path Channel

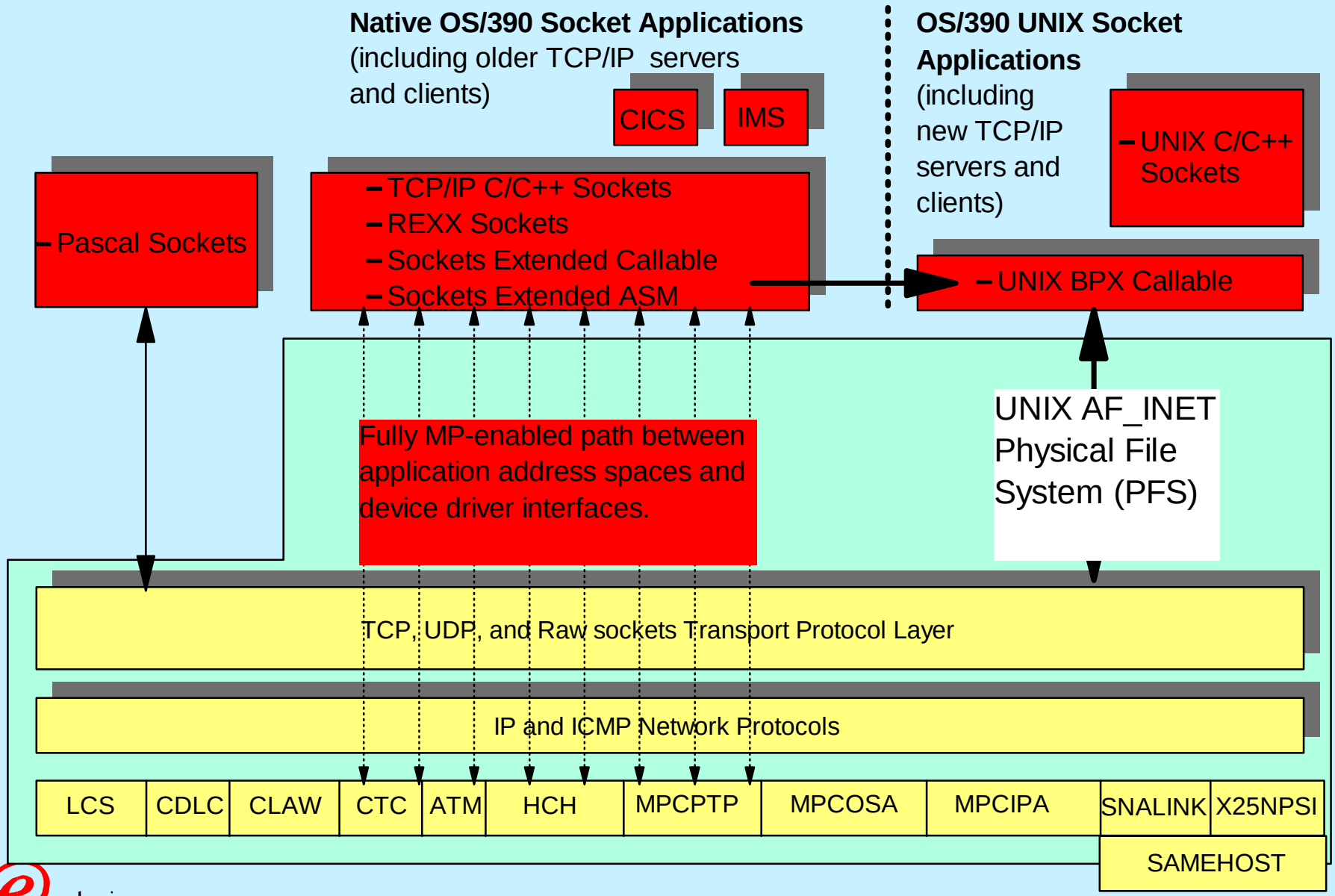
- MPC (Multi-Path Channel) common I/O structure for VTAM and TCP/IP
- Executes multiple I/O dispatchable units of work
- Tightly integrated with Storage Management Model



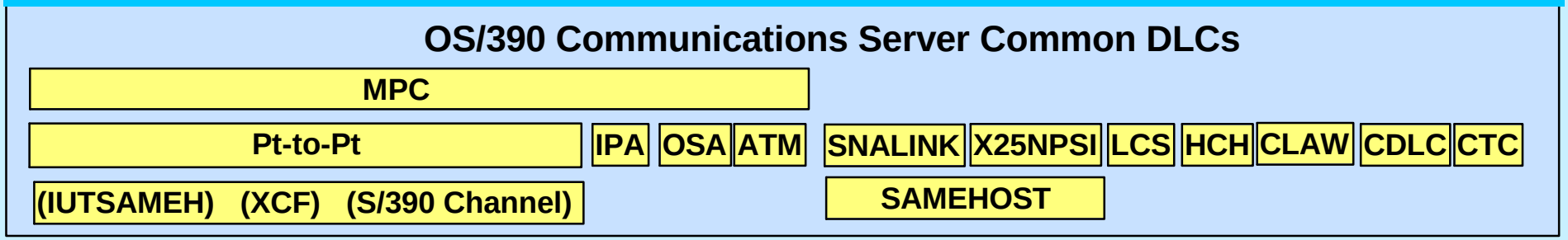
New Storage Management Model - Communications Storage Manager

- MVS cellpool-like services
- Handles contraction/expansion of storage resources automatically
- Handles storage requests of varying sizes and types (pageable, pinned)
- Tightly integrated with I/O model

CS for OS/390 V2Rn TCP/IP API Structure

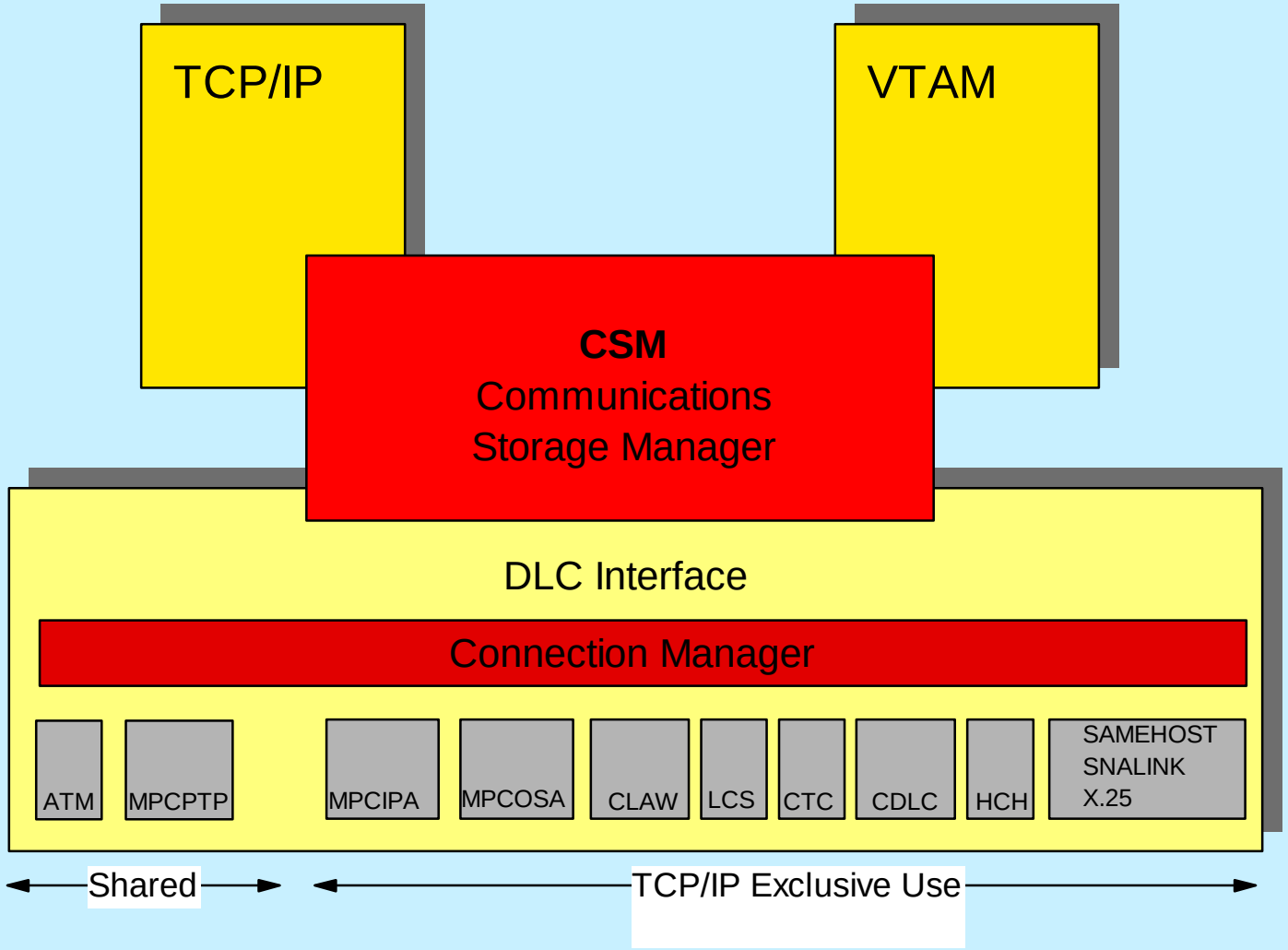


Device Driver Overview

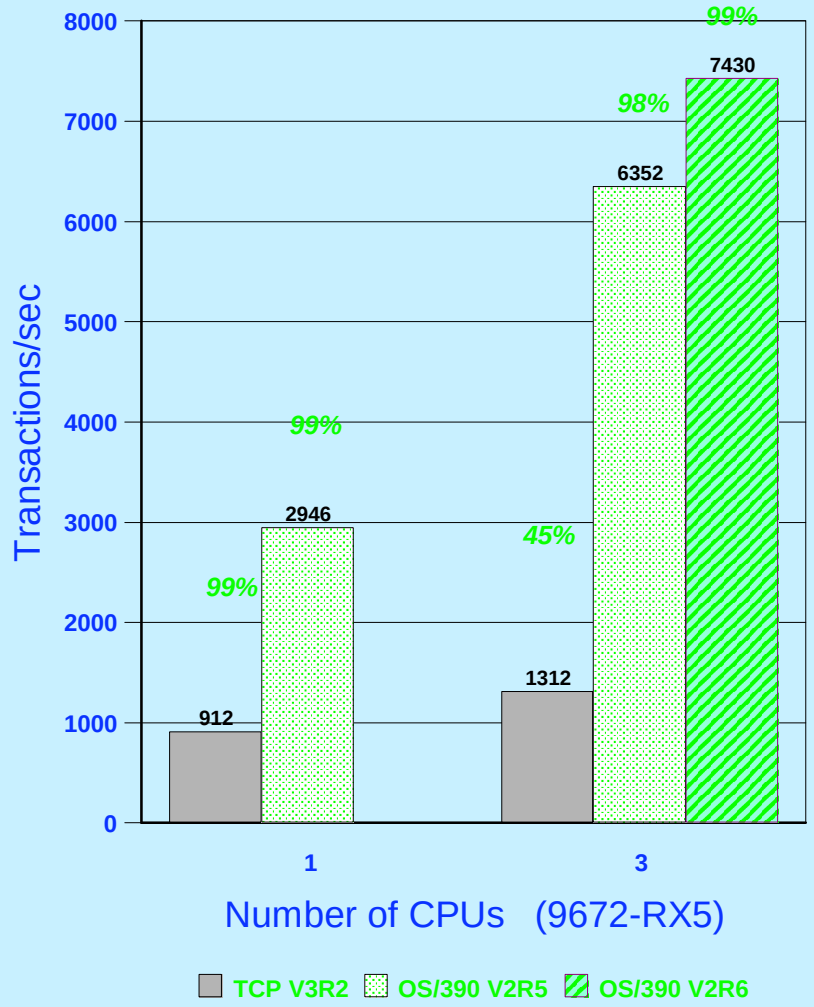


- Common OS/390 Communications Server DLCs
- SAMEHOST (replaces IUCV storage link for SNALINK and X.25)
- MPC connections
  - IUTSAMEH (replaces old IUCV stack-to-stack and adds Enterprise Extender)
  - XCF to other OS/390 TCP/IP stacks in a sysplex
  - MPCPTP (Point-to-Point) to RS/6000, IBM2216, IBM3746 MAE, other MVS System over S/390 Channel
  - MPCIPA for QDIO to OSA-Express (V2R7)
  - MPCOSA for HPDT MPC with Fast Ethernet or FDDI (V2R8)
  - ATM Support - Classic IP over ATM (RFC1577)
    - OSA-2 Adapter
    - Support for both PVCs and SVCs
- No support for CETI, Hippi, and Offload

Common DLC for VTAM and TCP/IP in CS



Request/Response Workload



Percentages shown on top of the bars are the maximum achievable average CPU utilization

Performance Metrics

Number of CPUs	Improvement in Throughput	
	OS/390 R5	OS/390 R6
1	3.23X	
3	4.84X	5.66X

Number of CPUs	Reduction in CPU msec per tran	
	OS/390 R5	OS/390 R6
1	69%	
3	55%	61%

Scalability

STACK	1 CPU	3 CPUs
TCP V3R2	1.0	1.44
OS/390 V2R5	1.0	2.16
OS/390 V2R6	1.0	

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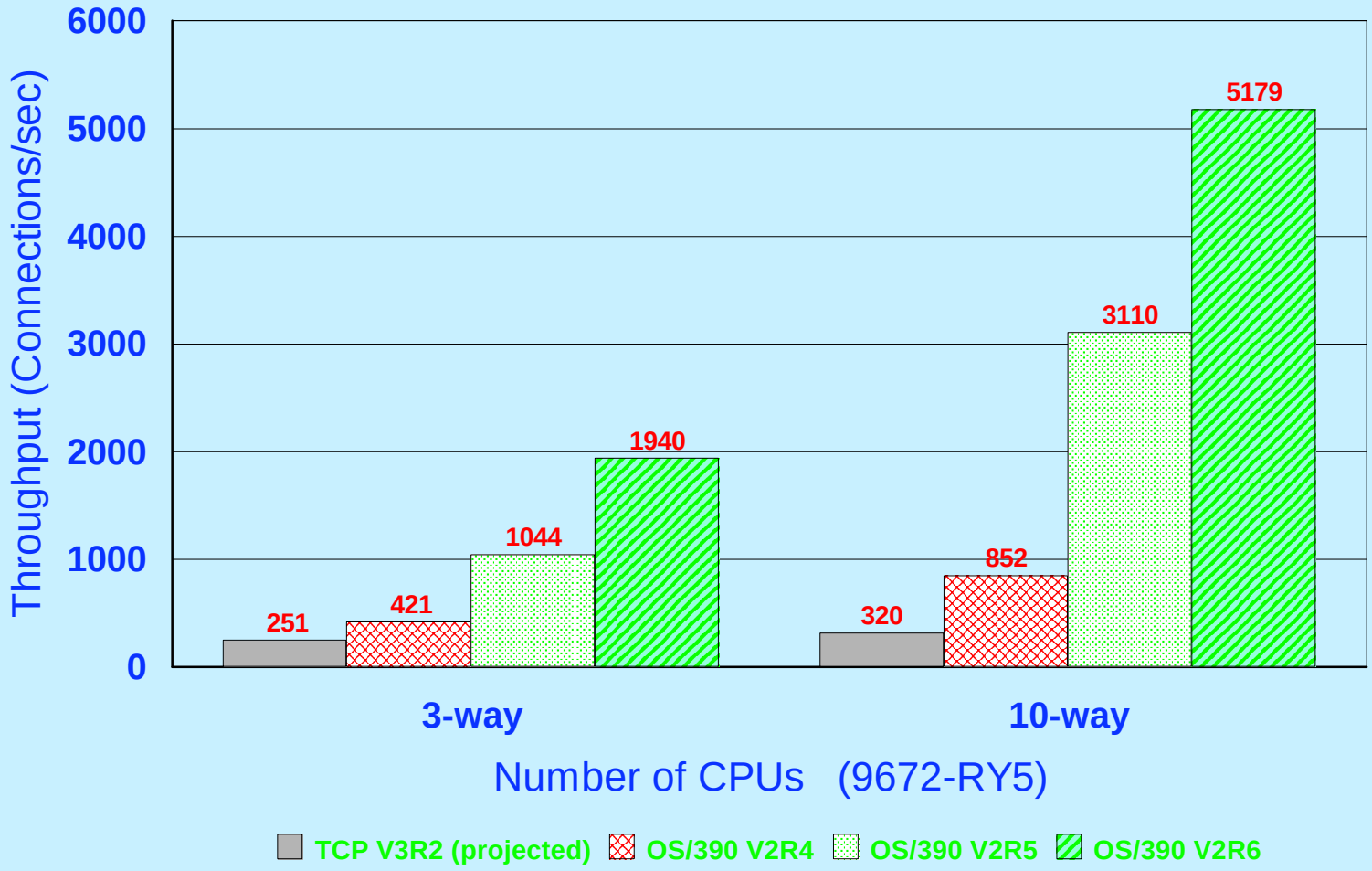
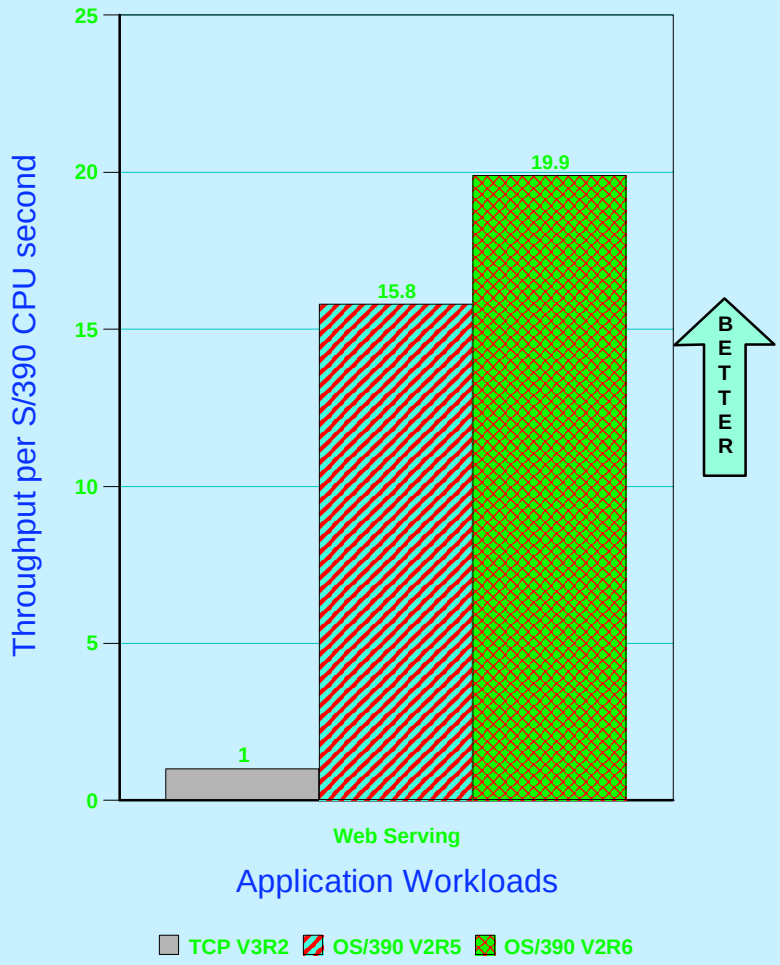
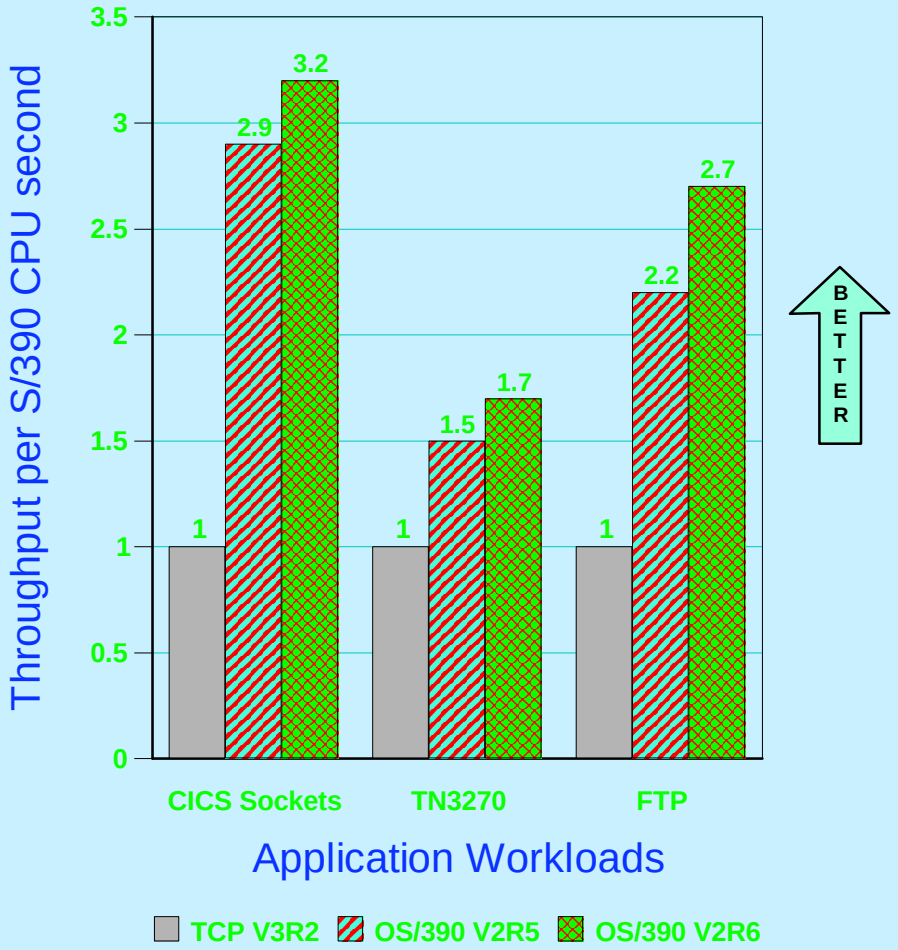
Connect/Request/Response Workload



Application Performance





- Scalable performance
- Significant Increase in capacity (32,000 TN3270 sessions tested)
- 2864 TN3270 transactions/sec on a 3-way G4 processor

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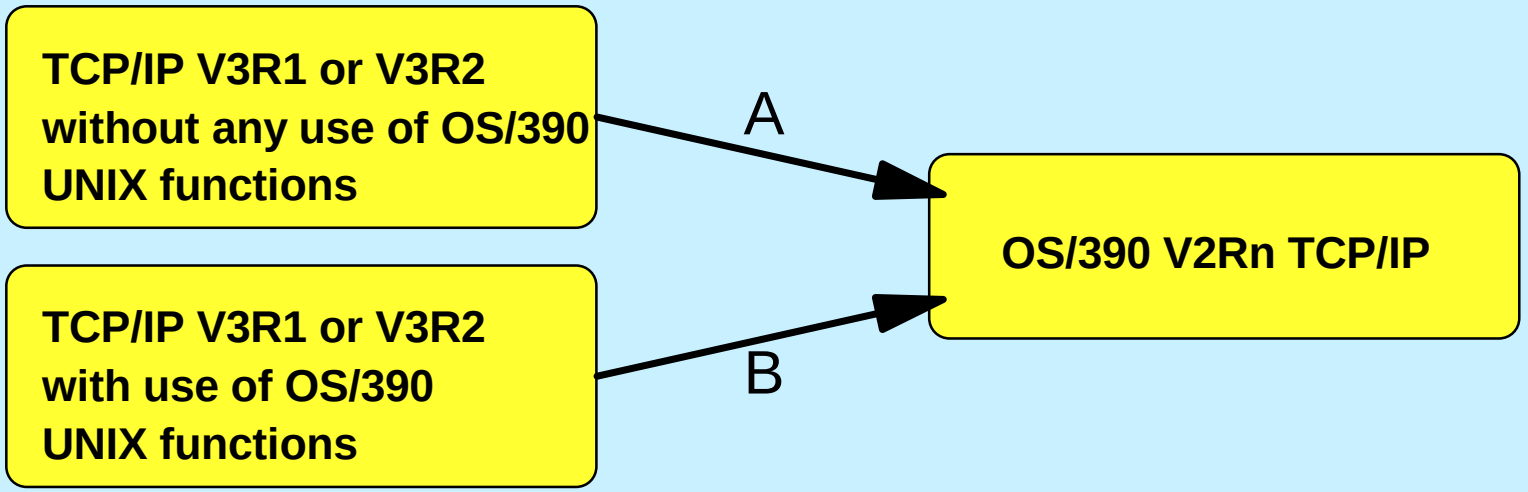
Migration Scenarios



A **Basic configuration of the OS/390 UNIX environment including basic UNIX server security - is required.**

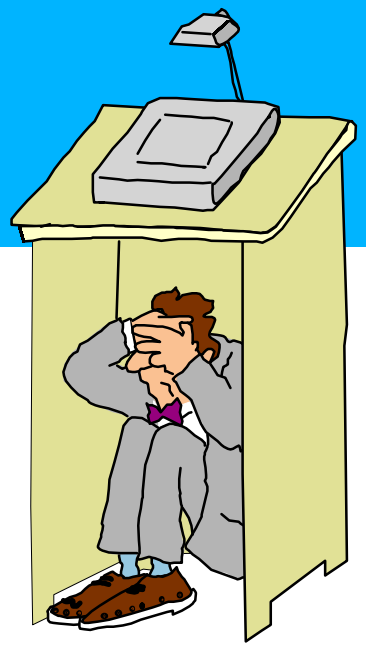
Depending on which server functions are needed, additional UNIX-style configuration may be required. Most typically for this migration scenario is the FTP server and the RouteD server that have both changed to now exploiting OS/390 UNIX System Services.

B **OS/390 UNIX is already configured for installations that belong in this category. A review of the UNIX configuration is recommended.**

Migration activities will primarily be dictated by which servers, the installation wants to deploy.

DETAILS, DETAILS

Just Let Me Get This Working!
(How to Get the Stack Up)
(Part 1)



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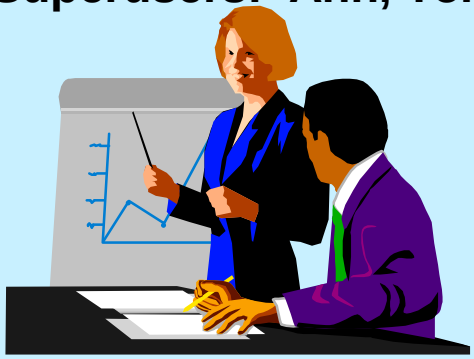
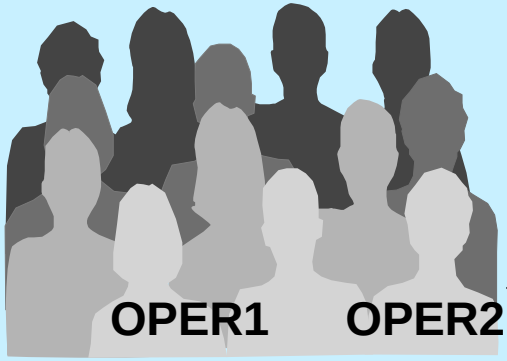
TCP/IP, Its Users, Its Pre-reqs

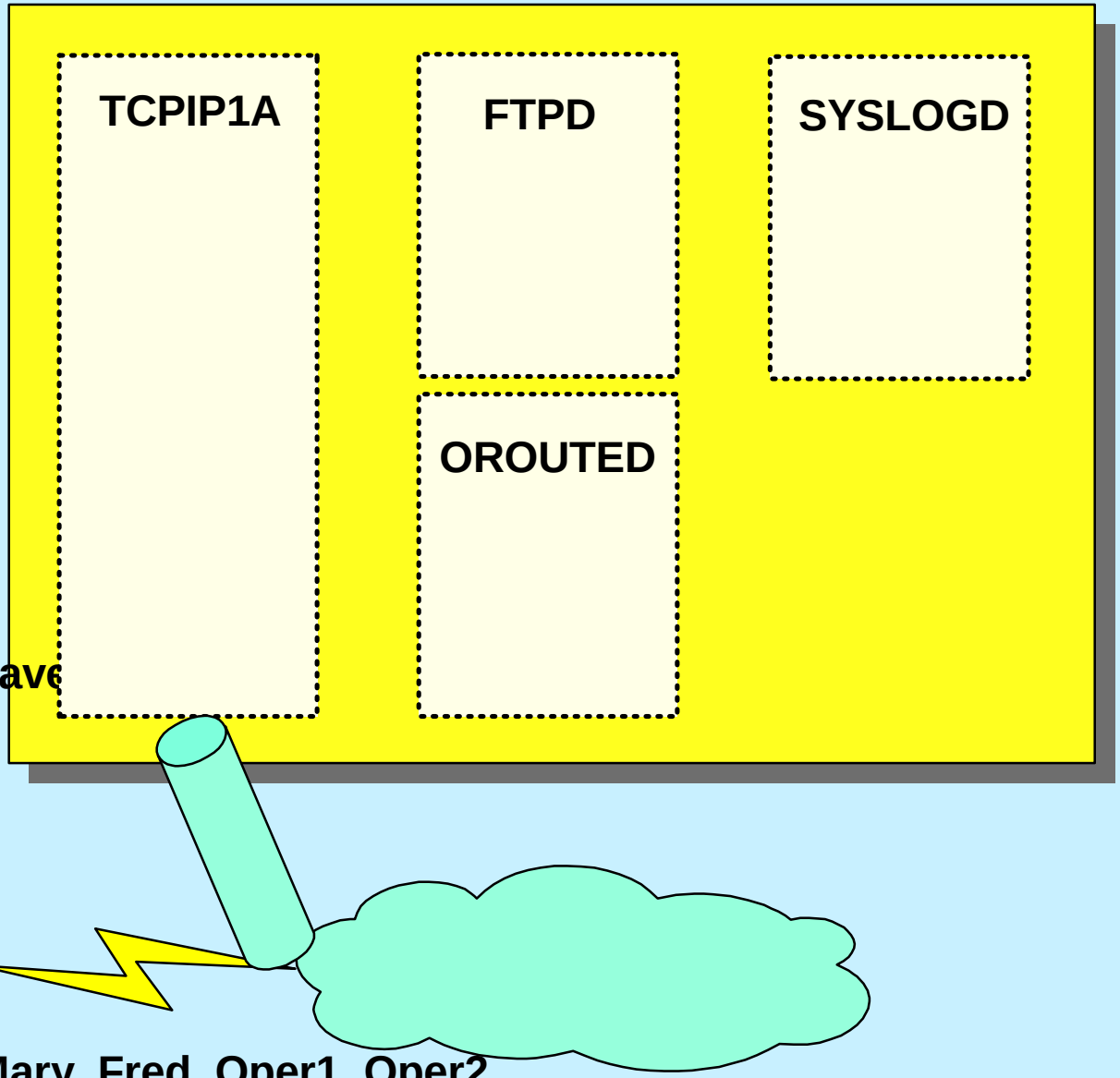
Superusers: Ann, Tom



BPX.SUPERUSER: Sue, Dave



OPER1 OPER2



BPX.DEFAULT.USER: Mary, Fred, Oper1, Oper2

Profile TCP/IP

- **An existing V3R1 or V3R2 PROFILE.TCPIP data set can be read and used by TCP/IP in OS/390 V2R5 or higher. Some statements are obsolete, and informational messages will be displayed about those.**

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PROFILE: Now, This Makes Sense!

- Instead of ASSORTEDPARMS
  - New IPCONFIG
  - New TCPCONFIG
  - New UDPCONFIG
  - New SACONFIG
  - New SMFCONFIG
- Instead of INTERNALCLIENTPARMS
  - New TELNETPARMS
- No Buffer Specifications
  - Use CSM and ECSA
- Changed Tracing Keywords
- New DLC Definitions
  - DELETE possible
- SHAREPORT
- INCLUDE separate file in PROFILE
- OBEY Command
- System Symbolics (V2R7)

Remember: The old profile will work (except for deleted DLCs), but you should clean it up to reflect the new keywords!

You can issue a

D TCPIP,,N,CONFIG

to see how many parts of your old profile have been converted!

Old TCP/IP PROFILE V3R2

```
; Flush the arp tables every 5 minutes
ARPAGE 5
SYSCONTACT
  GDENTE (T/L xxx-xxxx)
ENDSYSCONTACT
;
SYSLOCATION
   IBM Networking Systems Center
ENDSYSLOCATION
;
DATASETPREFIX TCPIP.V3R2G
; ------------------------------------------------------------------
; Hardware definitions:
;   OFFLOAD for 3172
;
DEVICE   OFFDEV         CLAW   340   TCPIP   OS2TCP  NONE
LINK     OFFIPLINK      OFFLOADLINK1     1           OFFDEV
LINK     OFFTR1         OFFLOADAPIBROAD  9.67.38.1   OFFDEV  OFFIPLINK
;
; IUCV1 represents an IUCV connection to a second MVS TCP/IP V3.2
; stack running on the same processor or LPAR
DEVICE   IUCV1     IUCV      XYZZY     XYZZY     TCPIP2    A
LINK     ILINK1    IUCV      1         IUCV1
;
PRIMARYINTERFACE OFFTR1
```

Changed or Gone!

(ARPAGE > ARPTO)

Changed Meaning!

V2Rn Startup With V3R2 Profile

```
IEA989I SLIP TRAP ID=X33E MATCHED.  JOBNAME=*UNAVAIL, ASID=003B.
S NM2ATCP
$HASP100 NM2ATCP  ON STCINRDR
IEF695I START NM2ATCP  WITH JOBNAME NM2ATCP  IS ASSIGNED TO USER TCPIPUX
 , GROUP OMVSGRP
$HASP373 NM2ATCP  STARTED
IEE252I MEMBER CTIEZB01 FOUND IN SYS1.PARMLIB
EZZ0300I OPENED PROFILE FILE DD:PROFILE
EZZ0309I PROFILE PROCESSING BEGINNING FOR DD:PROFILE
EZZ0311I ACBPOOLSIZE STATEMENT ON LINE 71 IS OBSOLETE
EZZ0311I ADDRESSTRANSLATIONPOOLSIZE STATEMENT ON LINE 72 IS OBSOLETE 667
.....
EZZ0401I SYNTAX ERROR IN FILE: DD:PROFILE ON LINE: 92 AT: 'SCREEN'
EZZ0324I UNRECOGNIZED STATEMENT SCREEN FOUND ON LINE 92
EZZ0311I INFORM STATEMENT ON LINE 103 IS OBSOLETE
EZZ0311I OBEY STATEMENT ON LINE 111 IS OBSOLETE
EZZ0311I SYSCONTACT STATEMENT ON LINE 132 IS OBSOLETE
EZZ0311I SYSLOCATION STATEMENT ON LINE 141 IS OBSOLETE
EZZ0318I XYZZY WAS FOUND ON LINE 190 AND SNALINK WAS EXPECTED
EZZ0328I DEVICE IUCV1 ON LINE 191 HAS NOT BEEN DEFINED OR HAS BEEN DELETED
EZZ0328I LINK NAME ILINK1 ON LINE 276 HAS NOT BEEN DEFINED OR HAS BEEN DELETED
EZZ0401I SYNTAX ERROR IN FILE: DD:PROFILE ON LINE: 300 AT: 'NOOE'
EZZ0324I UNRECOGNIZED STATEMENT NOOE FOUND ON LINE 300
EZZ0323I TRANSLATE STATEMENT ON LINE 364 HAD NO ENTRIES
EZZ0303I INITIAL PROFILE FILE CONTAINS ERRORS
```

After a fallback period, clean this up!

Telnet Coding Changes

- TELNETPARMS Block
- Multiple BEGINVTAM/ENDVTAM BLOCKS
- TN3270E LOGMODES
- Printer LU Mapping
- HNNAME and HNGROUP for DNS names instead of IPaddr
- New and Changed USSTABLE Parameters

Usability:

1) SYSREQ & ATTN Keys!
2) D TCPIP,,T,... for Telnet
3) VTAM Display commands show IP Addresses of Telnet connections.

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TCPIP.DATA File (Resolver Configuration)

```
TCPIPJOBNAME TCPIP1A
;
; HOSTNAME specifies the TCP host name of this system.  If not
; specified, the default HOSTNAME will be the node name
specified
; in the IEFSSNxx PARMLIB member.
;
HOSTNAME  TCPIP1A
;
; DOMAINORIGIN specifies the domain origin that will be appended
; to host names passed to the resolver.  If a host name contains
; any dots, then the DOMAINORIGIN will not be appended to the
; host name.
;
DOMAINORIGIN  mycompany.com
NSINTERADDR  10.1.1.1
DATASETPREFIX SYS1.TCPIP
```

TCP/IP Procedure

- The TCP/IP started task procedure has changed; use the new sample in hlq.SEZAINST(TCPIPROC) as a base for your TCP/IP procedure:
  - EXEC PGM= is now EZBTCPIP
  - SYSPRINT DD card contains run time diagnostics from TCP/IP
  - ALGPRINT and CEEDUMP are new DD cards
  - SYSERR, SY1DEBUG, SY2DEBUG and SY3DEBUG are obsolete DD cards
  - TNDBCSCN, TNDBCSXL, TNDBCSER are DD cards for TELNET NLS

```
//TCPIP1A    PROC PARMS='CTRACE(CTIEZB00)'
//TCPIP1A    EXEC PGM=EZBTCPIP,
//             PARM='&PARMS',
//             REGION=0,TIME=1440
//SYSPRINT DD SYSOUT=*,DCB=(RECFM=FB,LRECL=137,BLKSIZE=137)
//ALGPRINT DD SYSOUT=*,DCB=(RECFM=FB,LRECL=137,BLKSIZE=137)
//SYSOUT   DD SYSOUT=*,DCB=(RECFM=FB,LRECL=137,BLKSIZE=137)
//CEEDUMP  DD SYSOUT=*,DCB=(RECFM=FB,LRECL=137,BLKSIZE=137)
//SYSERROR DD SYSOUT=*
//*TNDBCSCN DD DSN=TCPIP.SEZAINST(TNDBCSCN),DISP=SHR
//*TNDBCSXL DD DSN=TCPIP.SEZAXLD2,DISP=SHR
//*TNDBCSER DD SYSOUT=*
//PROFILE  DD DISP=SHR,DSN=SYS1.TCPPARMS(PROFILE)
//SYSTCPD  DD DSN=SYS1.TCPPARMS(TCPDATA),DISP=SHR
```

CTRACE External Writer Procedure

```
//CTWTR   PROC
//*
//*  For running CTRACE with OS/390 V2R5 IP
//*  CTWDASD PROC
//*  Refer:  SYS1.PROCLIB(CTWDASD)
//*  COMPID:   OPER
//*  DOC:      This procedure is the IPCS CTRACE External Writer Proc.
//*            Used by TCP/IP Data Tracing.
//*  MORE:  Also See PTTCP
//*  ------------------------------------------------------------
//*
//IEFPROC  EXEC PGM=ITTTRCWR
//TRCOUT01 DD   DSNAME=TCPIP.PTRACE.CTRACE,UNIT=SYSDA,
//             VOL=SER=RDM7A5,
//             SPACE=(4096,(100,10),,CONTIG),DISP=(OLD,KEEP),DSORG=PS
//*            SPACE=(4096,(100,10),,CONTIG),DISP=(NEW,CATLG),DSORG=PS
```

Packet Trace External Writer Procedure

```
//PKTWTR  PROC
//*
//*  For running CTRACE with OS/390 V2R5 IP
//*  CTWDASD PROC
//*  Refer:  SYS1.PROCLIB(CTWDASD)
//*  COMPID:   OPER
//*  DOC:      This procedure is the IPCS CTRACE External Writer Proc.
//*            Used by TCP/IP Data Tracing.
//*  MORE:  Also See PTTCP
//*
//IEFPROC  EXEC PGM=ITTTRCWR
//TRCOUT01 DD   DSNAME=TCPIP.PTRACE.PACKET,UNIT=SYSDA,
//             VOL=SER=RDM7A5,
//             SPACE=(4096,(100,10),,CONTIG),DISP=(OLD,KEEP),DSORG=PS
//*            SPACE=(4096,(100,10),,CONTIG),DISP=(NEW,CATLG),DSORG=PS
```

Common Errors When Migrating

- **TCP/IP initialization fails with the following messages:**

```
EZZ42031 OPENEDITION-TCP/IP CONNECTION ERROR  FOR
TCPIPA-BPX1IOC,8008C981,FFFFFFFF,0000009E,12B2005A
EZZ4204I TCPIP INITIALIZATION FOR TCIPIA FAILED
```

An incorrect jobname was specified in the SUBFILESYSTYPE NAME() definition in the BPXPRMxx member for a CINET configuration (multi-stack). In this scenario, the NAME() must match TCPIPA. In CS/390 IP 2.5 the name in BPXPRMxx must be the started task name. In previous releases, the name has to be the ID defined in RACF that is associated with TCPIP.

- **TCP/IP initialization fails with the following messages:**

```
  EZZ42031 OPENEDITION-TCP/IP CONNECTION ERROR FOR
TCPV34A-BPX11OC,8008139A,FFFFFFFF,00000079,12D2025E
EZZ42041 TCPIP INITIALIZATION FOR TCPV34A FAILED.
   ==> The 0079 value is EINVAL - The parameter is incorrect
      ==> The 025E value is JRSocketCallParmError - A socket
syscall   contains incorrect parameters.
```

An incorrect Entry point name has been specified in the SUBFILESYSTYPE ENTRYPOINT() definition. The correct value is ENTRYPOINT(EZBPFINI). Depending on the release of TCPIP that is being started, verify the correct program is being started.

Common Errors When Migrating

- TCP/IP initialization fails with the following messages:
  - **EZZ3203I OPENEDITION-TCP/IP CONNECTION ERROR FOR TCPV34-BPXISOC/00000003,FFFFFFFF,0000045A,112B0000**

EZZ4204I TCPIP INITIALIZATION FOR TCPIP34 FAILED.

==> The 045A value is EAFNOSUPPORT - The address family is not supported.

These messages indicate that AF_INET was not defined or did not initialize properly. Check for any earlier OpenEdition messages and verify that the OpenEdition NETWORK DOMAINNAME(AF_INET) statement is in your BPXPRMxx member.

- Once TCP/IP is running, your main operator is not allowed to START and STOP TCP/IP Devices:

```
V TCPIP,,START,LCS1
IEE345I VARY     AUTHORITY INVALID, FAILED BY SECURITY PRODUCT
ICH408I USER(GDENTE2 ) GROUP(TTY     ) NAME(GWEN DENTE
)
   MVS.VARY.TCPIP CL(OPERCMDS)
   INSUFFICIENT ACCESS AUTHORITY
   FROM MVS.VARY.TCPIP.** (G)
```

Common Errors When Migrating

- **When using ftpd, user receives following message:**

```
setuid failed(157/0B7F02AF):  EDC5157I An internal error has
occurred.
```

- **OR, ... When logging into otelnet server, user receives message:**

```
EDC5157I An internal error has occurred.rsn=090C02AF
==> 02AF -  The specified function is not supported in an address
space where a load was done from an unauthorized library.
```

  - *The sticky bit is not turned on for /usr/lpp/tcpip/sbin/server pgm name*
  - *The hlq.SEZALINK dataset is not:*
    - *APF authorized*
    - *In the linklist*
    - *Marked program controlled to RACF*
  - *The SCEERUN dataset is not:*
    - *In the linklist*
    - *Marked as program controlled to RACF*
  - *The userid associated with otelnetd:*
    - *Not a superuser*
    - *Has not been given RACF read access to the BPX.DAEMON facility*

Common Errors When Migrating

- Receiving message EZZ0310I when issuing DISPLAY (or VARY) command
- The COMPID is 5655HAL00 and the RELEASE is R340. UQ15529 is on. No other output is given. Itrace shows:
- < EZACFMUT> Line < 363>: cfMsg: entered from <EZACFYAC> Line < 825>
- < EZACFMUT> Line < 386>: cfMsg: catgets got default msg, errno = (133)
- < EZACFMUT> Line < 406>: cfMsg: going to msgto_upper...
- < EZACFMUT> Line < 429>: cfMsg: toCONS, cmdInProgress.
- EZZ0310I FILE DD:PROFILE CONTAINS NO STATEMENTS
- The 133 errno means that ENOSPC or "no space available" to create IPC member id.
- It is possible that the "/tmp" HFS file has no space. For example, the disk could be full.

Common Error Messages When Migrating

- After issuing a command from TSO such as ftp:

  USER ABEND CODE 4093 REASON CODE 00000090

  This code indicates that the user ID issuing the command does not have an OMVS RACF segment defined for it. Define an OMVS segment for this user ID or activate the Default OMVS segment support. You can also receive the code 4093 when starting FTPD from a started task. The ID associated with FTPD does not have a home path defined.

- When starting TCPIP you get the following messages:

  EZZ0154I CONFIGURATION: UNABLE TO OPEN MESSAGE CATALOG "xxxxx.CAT" -EDC5129I NO SUCH FILE OR DIRECTORY. (followed by several message numbers with no text.)

  This usually means that a symbolic link is missing for the message catalog. Rerunning EZAOEMDR (V2R5) or EZAISMKD (V2R6+) resolves the symbolic link. Execute the command: TSO EXEC 'hlq.SEZAINST(EZA ...)'

Common Error Messages When Migrating

- When starting syslogd and receive the following error:

  BPXF024I (IBMUSER) Aug 11 06:18:45 syslogd: cannot create /dev/log: EDC8114I Address family not supported.

  This means that AF_UNIX has not been defined in BPXPRMxx member; adding this will require an IPL.

  ```
  FILESYSTYPE TYPE(IBMUDS) ENTRYPOINT(BPXTUINT)
  NETWORK DOMAINNAME(AF_UNIX)
                  DOMAINNUMBER(1)
                  MAXSOCKETS(2000)
                  TYPE(IBMUDS)
  ```

- The log files that are defined in /etc/syslog.conf need to exist before starting syslogd. If they do not exist, the message 'No such file or directory exists.' will be displayed. To create the files issue the following command:

  touch /log.filename

Common Error Messages When Migrating

- Socket applications using the CS for OS/390 TCP/IP APIs fail with an ERRORNO of 156:
  - ERRORNO 156 indicates an OpenEdition process initialization failure. This is usually an indication that a proper OMVS RACF segment is not defined for the user ID associated with the application.
    - The RACF OMVS segment may not be defined or may contain errors such as an improper HOME() directory specification. The HOME directory can be '/', but not required.
    - If the OMVS segment is not defined, you may also receive the following message:

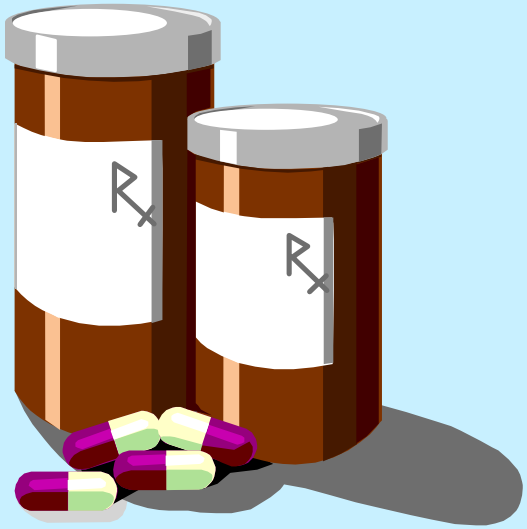
```
ICH4081 USER(USER8    ) GROUP(SYS1    )   NAME(TSO USERID
USER8)  CL(PROCESS )  OMVS SEGMENT NOT DEFINED
```

Common Errors at V2R6 or Higher

```
S OMPROUTE
$HASP100 OMPROUTE ON STCINRDR
IEF695I START OMPROUTE WITH JOBNAME OMPROUTE  IS ASSIGNED TO
USER TCPIP1A, GROUP OMVSGRP
$HASP373 OMPROUTE STARTED
JOBNAME  PROCSTEP STEPNAME  CPU TIME     EXCPS     RC
OMPROUTE STARTING OMPROUTE  00:00:00       46     00
EZZ7800I OMPROUTE STARTING
IEE252I MEMBER CTIORA00 FOUND IN SYS1.PARMLIB
ICH408I USER(TCPIP1A ) GROUP(OMVSGRP ) NAME(######################)
  MVS.ROUTEMGR.OMPROUTE CL(OPERCMDS)
  INSUFFICIENT ACCESS AUTHORITY
  ACCESS INTENT(CONTROL)  ACCESS ALLOWED(NONE   )
EZZ7897I USER IS NOT RACF AUTHORIZED TO START OMPROUTE
EZZ7805I OMPROUTE EXITING ABNORMALLY - RC(11)
NM2AOMPR --NONE-- *OMVSEX   00:00:00       521     11
$HASP395 NM2AOMPR ENDED
```

What We Forgot to Do!

- Didn't set up "full-function" OMVS System (UNIX System Services)
  - Didn't implement SMS for HFS datasets in UNIX
  - Defined BPXPRMnn for OMVS incorrectly
  - Didn't run jobs to set up symbolic links for necessary files and commands
- Didn't set up other PARMLIB definitions
  - Including Tuning for OS/390: CSM, CSA, SQA
- Didn't pre-allocate necessary files (SYSLOGD)
- Didn't set up RACF properly
  - Didn't assign OMVS Segments to Users of System
  - Didn't authorize users to issue commands
  - Didn't protect libraries via RACF with "program control"
- Didn't allocate enough space for /tmp (used for logs, for example)
- Didn't allocate user directories for UNIX users.



Gingko Biloba

DETAILS, DETAILS

Just Let Me Get This Working!

(Part 2)

(Translation: What We Haven't Told You Yet!)

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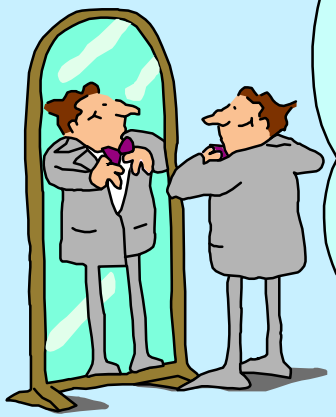
Has SMS Been Configured?


```
D SMS
IGD002I 12:04:15 DISPLAY SMS 962
SCDS = SYS1.SMS.SCDS
ACDS = SYS1.SMS.ACDS
COMMDS = SYS1.SMS.COMMDS
DINTERVAL = 150
REVERIFY = NO
ACSDEFAULTS = YES
    SYSTEM     CONFIGURATION LEVEL    INTERVAL SECONDS
    MVSNM2     1999/07/08 12:04:04           15
REPLY WITH VALID NCCF SYSTEM OPERATOR COMMAND
```

Is OMVS Running?

```
D OMVS
BPXO042I 11.55.29 DISPLAY OMVS 956
OMVS     000E ACTIVE           OMVS=(07)

D OMVS,F
BPXO044I 11.55.38 DISPLAY OMVS 958
OMVS     000E ACTIVE           OMVS=(07)
TYPENAME   DEVICE ----------STATUS---------- MODE QJOBNAME
QPID
HFS              5 ACTIVE                    RDWR
  NAME=OMVS.GDENTE.HFS
  PATH=/u/gdente
HFS              3 ACTIVE                    RDWR
  NAME=OMVS.NM2.TMP
  PATH=/tmp
HFS              2 ACTIVE                    RDWR
  NAME=OMVS.V2R7.ETC.HFS
  PATH=/etc
HFS              1 ACTIVE                    RDWR
  NAME=OMVS.V2R7.PUT9904.BASE.HFS
  PATH=/
```



Where is my UNIX guru? Maybe you are looking at him?!

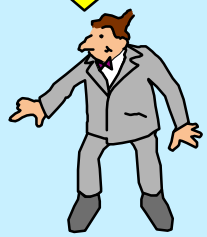
What Processes are Running in OMVS?

```
 D OMVS,A=ALL
BPXO040I 11.55.44 DISPLAY OMVS 960
OMVS     000E ACTIVE          OMVS=(07)
USER     JOBNAME  ASID        PID       PPID STATE   START     CT_SEC
OMVSKERN BPXOINIT 0013          1          0 MKI   08.28.49        .06
  LATCHWAITPID=          0 CMD=BPXPINPR
  SERVER=Init Process                    AF=    0 MF=00000 TYPE=FILE
TCPIP1A  TCPIP1A  003C   16777218          1 MR    08.33.44    127.59
  LATCHWAITPID=          0 CMD=EZBTCPIP
TCPIP1A  TCPIP1A  003C   16777219          1 1R    08.33.49    127.59
  LATCHWAITPID=          0 CMD=EZBTMCTL
OMVSKERN INETD6   0032   50331652          1 1FI   08.31.34        .05
  LATCHWAITPID=          0 CMD=/usr/sbin/inetd /etc/inetd.conf
OMVSKERN ETCRC7   0033   16777221          1 1KI   08.31.34        .05
  LATCHWAITPID=          0 CMD=/usr/sbin/cron
TCPIP1A  TCPIP1A  003C   33554439          1 1F    08.33.49    127.59
  LATCHWAITPID=          0 CMD=EZACFALG
OMVSKERN SYSLOGD5 0036          8          1 1FI   08.31.34       1.22
  LATCHWAITPID=          0 CMD=/usr/sbin/syslogd -f /etc/syslog.conf
TCPIP1A  TCPIP1A  003C          9          1 1F    08.33.52    127.59
```

What HFS's Are Mounted & Where?

```
D OMVS,F
BPXO044I 15.16.32 DISPLAY OMVS 828
OMVS     000E ACTIVE          OMVS=(07)
TYPENAME   DEVICE ----------STATUS---------- MODE QJOB
HFS             12 ACTIVE                    RDWR
  NAME=OMVS.HOMEDIRS.HFS
  PATH=/u/users
HFS              5 ACTIVE                    RDWR
  NAME=OMVS.SYSPROG1.HFS
  PATH=/u/sysprog1
HFS              3 ACTIVE                    RDWR
  NAME=OMVS.NM2.TMP
  PATH=/tmp
HFS              2 ACTIVE                    RDWR
  NAME=OMVS.V2R7.ETC.HFS
  PATH=/etc
HFS              1 ACTIVE                    RDWR
  NAME=OMVS.V2R7.PUT9904.BASE.HFS
  PATH=/
```

Remember "D OMVS,O" also!



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Are VMCF and TNF Initialized?

```
S EZAZSSI,P=MVSNM2
.................
$HASP373 EZAZSSI  STARTED
.................
EZY6015I TNF Start Initiated
.................
EZY6018I TNF Initialization Complete
EZY6008I VMCF Start Initiated
.....................
EZY6011I VMCF Initialization Complete
JOBNAME  PROCSTEP STEPNAME  CPU TIME     EXCPS     RC
EZAZSSI  STARTING STARTEM   00:00:00         6     00
$HASP395 EZAZSSI  ENDED
```

User Non-Restartable or Restartable VMCF/TNF

****

We prefer Restartable!

- **Create Restartable platform initialization procedure in your PROCLIB - sample member is EZAZSSI:**

```
//EZAZSSI PROC P=&SYSNAME
//STARTVT EXEC PGM=EZAZSSI,PARM=&P
```

- **Add an entry to your COMMNDxx member in your PARMLIB to start the platform after IPL, before you start TCP/IP:**

```
COM='S EZAZSSI,P='nodename'
```

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SYS1.PARMLIB

SCHEDxx

```
PPT PGMNAME(MVPTNF)
      NOCANCEL
      KEY(0)
      NOSWAP
      PRIV
      SYST
PPT PGMNAME(MVPXVMCF)
      NOCANCEL
      KEY(0)
      NOSWAP
      PRIV
      SYST
PPT PGMNAME(EZAPPFS)
      KEY(1)
      NOSWAP
PPT PGMNAME(EZAPPAAA)
      NOSWAP
PPT PGMNAME(SNALINK)
      NOCANCEL
      KEY(6)
      NOSWAP
      SYST
PPT PGMNAME(EZBTCPIP)
      NOCANCEL
      KEY(6)
      NOSWAP
      PRIV
      SYST
      SPREF
      LPREF
```

IEASYSxx

```
CSA(3000,250M)
SQA(8,448)
```

IVTPRMxx

```
FIXED MAX(120M)
ECSA MAX(30M)
```

IEFSSNxx

```
TNF
VMCF
```

LNKLSTxx

```
hlq.SEZALINK
hlq.SEZALNK2
```

BPXPRMxx

```
ROOT FILESYSTEM('OMVS.ROOT')
      TYPE(HFS) MODE(RDWR)

MOUNT  FILESYSTEM('OEA.TCP34C.HFS')
      TYPE(HFS) MODE(RDWR)
      MOUNTPOINT('usr/lpp/tcpip')

FILESYSTYPE TYPE(INET)
      ENTRYPOINT(EZBPFINI)

NETWORK DOMAINNAME(AF_INET)
      DOMAINNUMBER(2)
      MAXSOCKETS(60000)
      TYPE(INET)
```

1

LPALSTxx

```
hlq.SEZALPA
```

PROGxx

```
hlq.SEZATCP
hlq.SEZADSIL
hlq.SEZALINK
hlq.SEZALNK2
hlq.SEZALPA
hlq.SEZAMIG
```

IKJTSOxx

```
AUTHCMD NAMES(
MVPXDISP
TRACERTE
NETSTAT)
```

CTIEZBxx

```
TRACEOPTS
      ON
      BUFSIZE(4M)
      OPTIONS('MINIMUM')
```

1 **Separate File System for IP Code at V2R5.**

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You **Can** Teach an Old Dog New Tricks!

- **Essential Unix System Services Definitions**
  - **BPXPRMnn and Tuning for UNIX Storage**
  - **HFS Directories and Mountpoints**
- **Security for CS V2Rn IP:**
  - **RACF**
    - **BPXISEC1 - TSO CLIST for RACF**
  - **ACF2 and TopSecret**
- **Who Is a Superuser?**

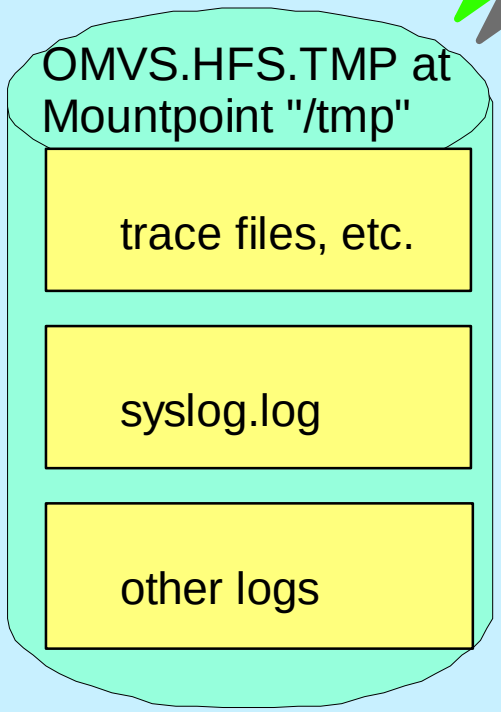
Specific UNIX System Services Requirements for TCP/IP

- HFS required - DFSMS must be used
  - Some TCP/IP components installed into ***usr/lpp/tcpip*** - UNIX based servers, clients, and commands
  - Starting with OS/390 V2R6, SERVPAC installs TCP/IP components into the root HFS
- From OS/390 V2R4, UNIX system services use the Workload Manager for scheduling new processes (no specific definitions are needed).
  - UNIX system services no longer require APPC/MVS to be configured.
- TCP/IP is defined to OS/390 UNIX as an AF_INET Physical File System (PFS):
  - Single stack - Integrated sockets file system type (INET)
  - Multiple stacks - Common INET file system type (CINET)
  - Definitions in **BPXPRMxx** parmlib member
- Syslogd used for logging from UNIX-style servers (including SNMP subagents)

How to Handle /tmp

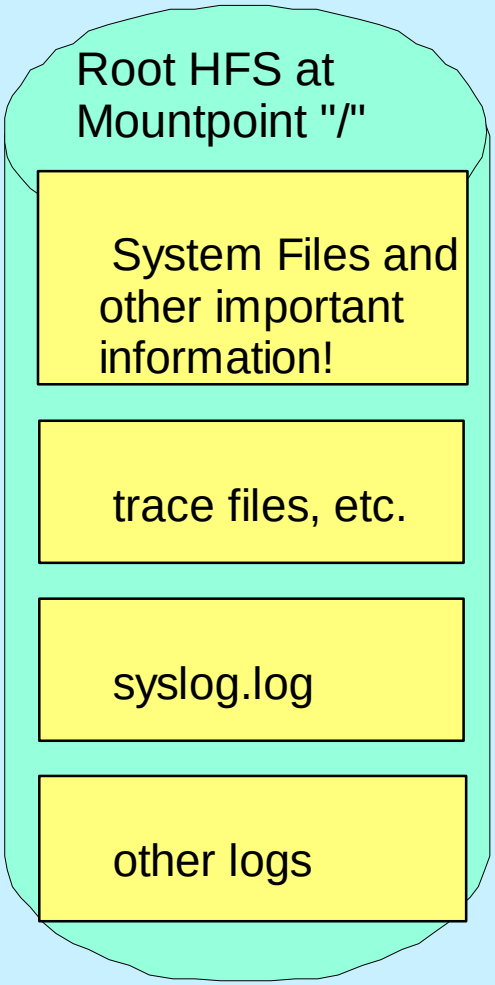
Unless you are using a Temporary File System for your log files, always use a separate HFS and mount it at /tmp.

YES!



NO!

If you place log files and other files that can grow very large into the Root Directory, you can fill up the entire HFS and waste space needed by other system jobs.

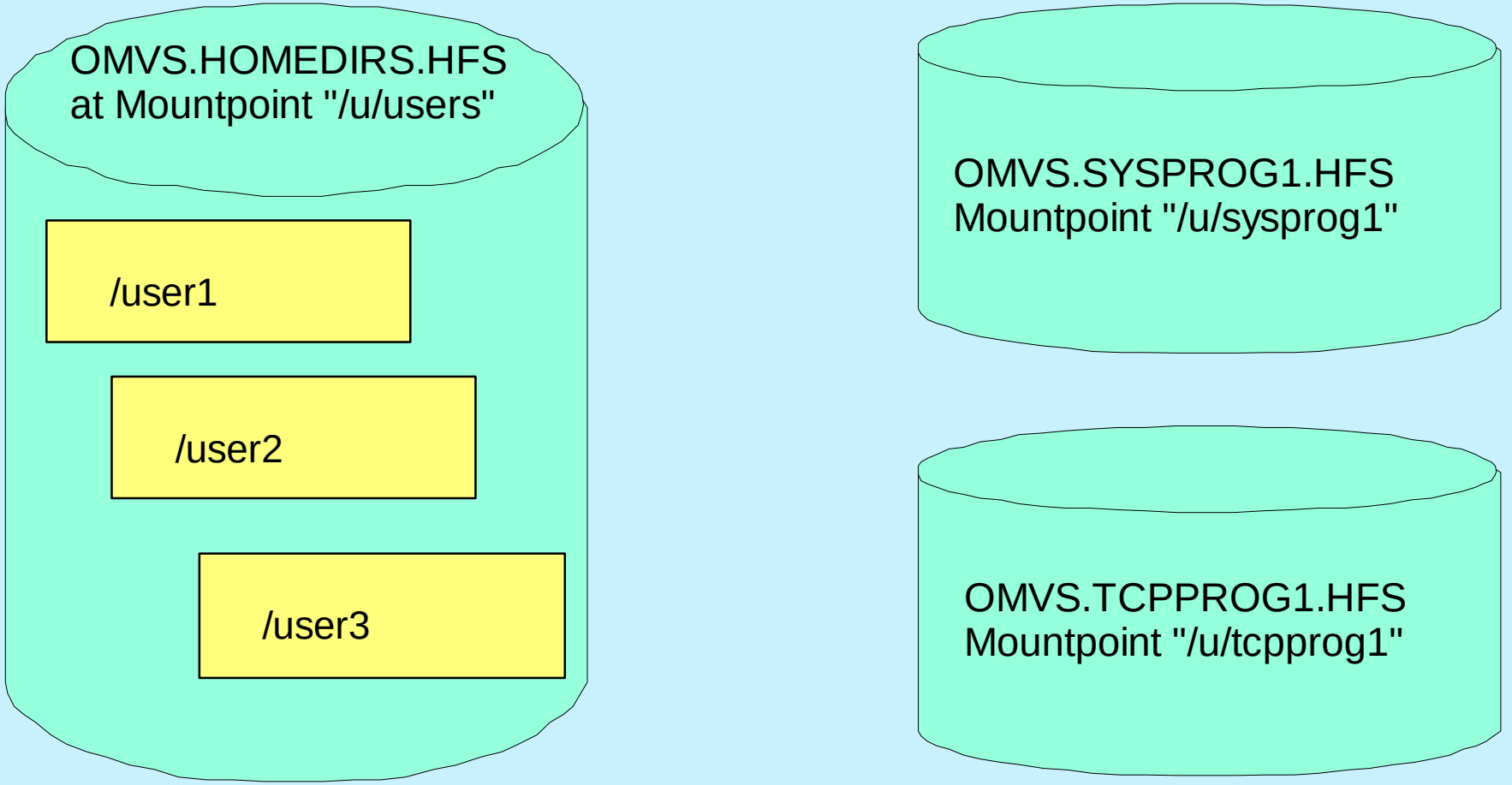


How to Handle UNIX Users

A single HFS for all UNIX Users:

Or ... A combination

A separate HFS for certain UNIX Users (Could be implemented with AUTOMOUNT):



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BPXPRMxx for Single Stack

- FILESYSTEM TYPE: defines an OS/390 UNIX Physical File System (PFS)
  - Type UDS= Local domain sockets
  - Type INET= Networking sockets
  - ENTRYPOINT
    - EZBPFINI (V2R5, 6, 7, etc.) stack
    - OESTACK (V2R6 HSAS stack)
    - BPXTIINT (TCP V3R1, V3R2)
    - ISTOPEIT (V2Rn AnyNet)
    - BPXTUINT (AF+UNIX UDS Support
- NETWORK
  - DOMAINNAME: socket file system domain (AF_UNIX for local or AF_INET for TCP/IP)
  - DOMAINNNUMBER: 1 for AF_UNIX or 2 for AF_INET
  - MAXSOCKETS: Max. sockets supported
  - TYPE: Same as related FILESYSTYPE

BPXPRMxx (V2R7 System)

```
ROOT    FILESYSTEM('OMVS.V2R7.PUT9904.BASE.HFS')
        TYPE(HFS)
        MODE(RDWR)

FILESYSTYPE TYPE(INET)
     ENTRYPOINT(EZBPFINI)

NETWORK DOMAINNAME(AF_INET)
     DOMAINNUMBER(2)
     MAXSOCKETS(60000)
     TYPE(INET)
```

BPXPRMxx (V2R5 System)

```
ROOT FILESYSTEM('OMVS.ROOT')
     TYPE(HFS) MODE(RDWR)

MOUNT  FILESYSTEM('OEA.TCP34C.HFS')
     TYPE(HFS) MODE(RDWR)
     MOUNTPOINT('usr/lpp/tcpip')

FILESYSTYPE TYPE(INET)
     ENTRYPOINT(EZBPFINI)

NETWORK DOMAINNAME(AF_INET)
     DOMAINNUMBER(2)
     MAXSOCKETS(60000)
     TYPE(INET)
```

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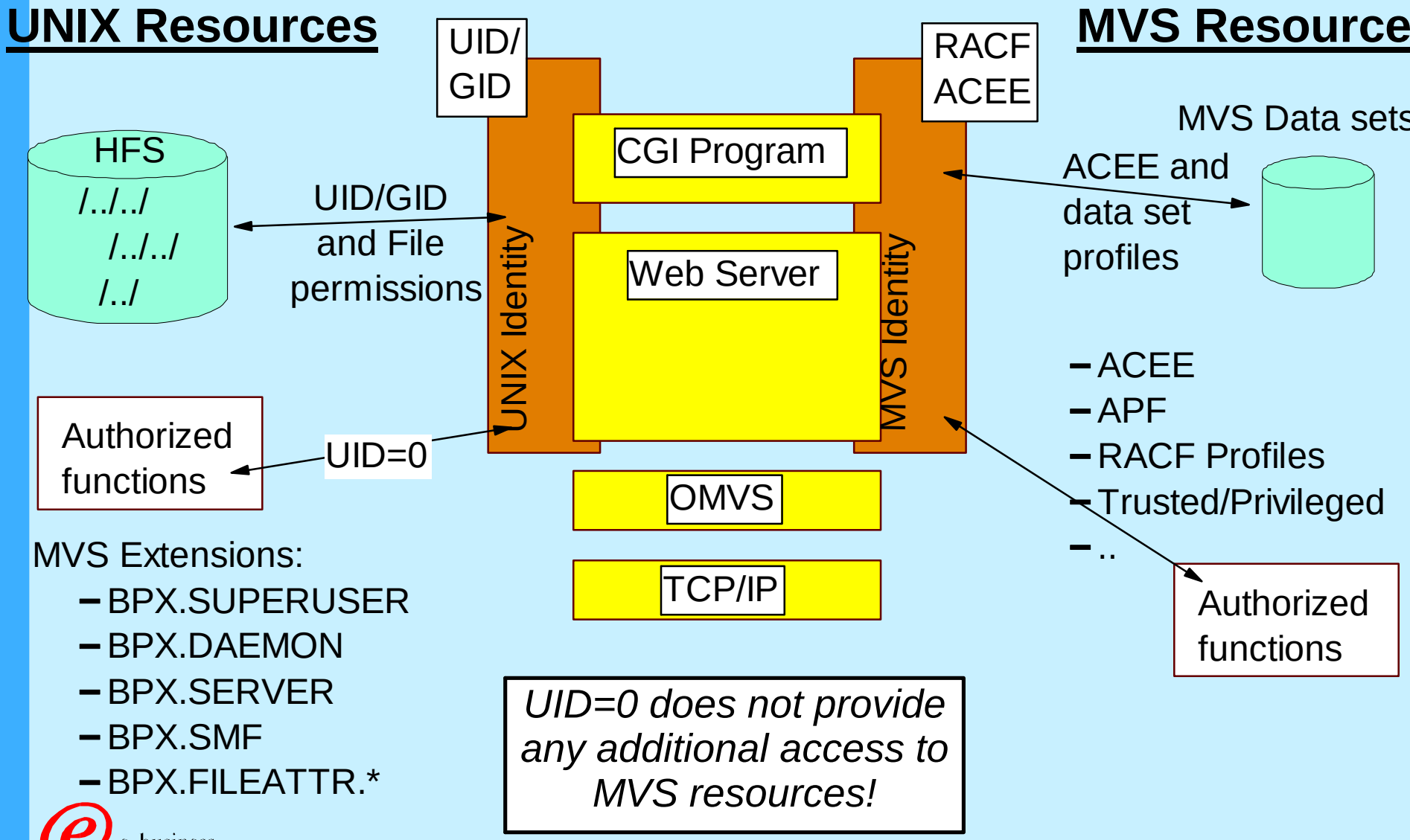
Security: MVS + UNIX



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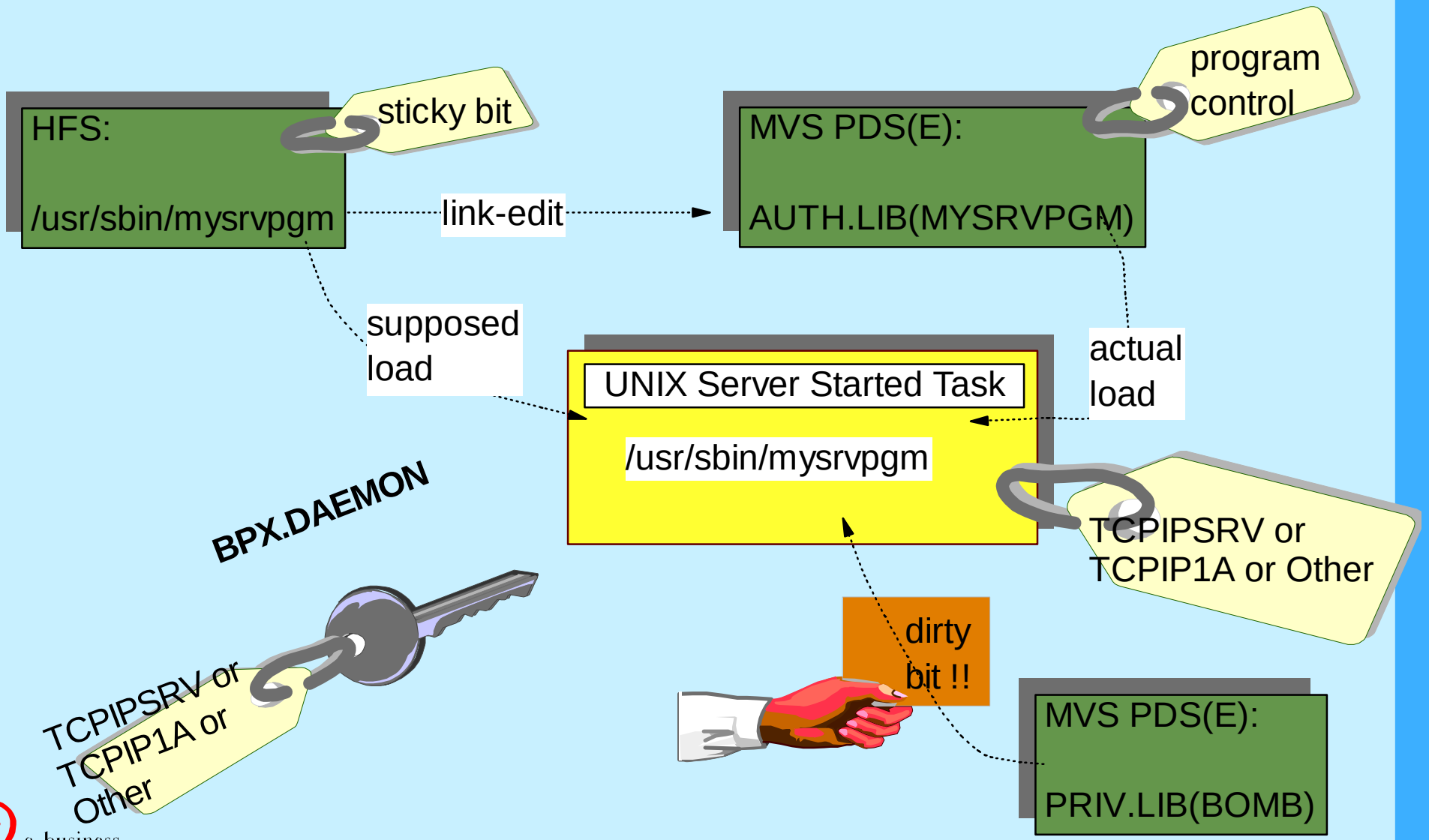
RACF Requirements for Servers & UNIX Users

- Use of any OS/390 UNIX function requires an OMVS segment for the user ID associated with the unit of work. Any direct or indirect users of TCP/IP components must have an OMVS segment.
  - OMVS Segment has assigned to it: OMVS Group, OMVS User ID (UID), UNIX HOME Directory, Initial Shell Program
- Some TCP/IP components exploit UNIX Services under the covers:
  - Socket APIs (other than PASCAL)
  - TSO and UNIX shell commands (i.e. FTP, nslookup, dig, ndb)
  - Servers - even non-UNIX based servers (i.e. NCPROUTE, SMTPD,etc.)
  -
- There are Userids with OMVS Segments that are associated with Servers.
- There are Userids with OMVS Segments that are associated with other users ("human users").

What is a Superuser?

- **Has a UID of 0 (zero)**
  - **May access every resource in the UNIX System Services Environment**
  - **May access files in HFS, redefine access rights to files**
  - **May change the identity of the process that is running with a UID of zero (0).**
    - **System administrator or SMP/E Installer has UID of 0**
    - **Server programs that need to change the identity of forked processes run with a UID of 0**
- **Alternatives to Permanent Superuser**
  - **BPX.SUPERUSER facility class (Recommended)**
    - **User with UID of non-0 can switch to Superuser Status with "su" shell command; can switch out with "exit" command**
- **Generally, all TCP/IP-related started tasks are associated with a Superuser ID (UID of 0).**
  - **A Different Superuser ID per Started Task, or**
  - **A "Shared" Superuser ID for all Started Tasks**
- **Some Servers Require Additional Authorization ...**

UNIX Server Security: Daemon Security



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BPX.DAEMON UNIX Security Definitions

- **The FTP server and the servers started via INETD need superuser authority and optionally Daemon authority. Use existing Superuserid or define separate Superuser ID; PERMIT READ authority to the BPX.DAEMON facility class.**
- **Basic Definitions:**
  - **ADDUSER TCPIPSRV DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/') PROGRAM('/bin/sh'))**
  - **RDEFINE STARTED FTPD.* STDATA(USER(TCPIPSRV) GROUP(OMVSGRP))**
  - **RDEFINE FACILITY BPX.DAEMON UACC(NONE)**
    - **-SETROPTS CLASSACT(FACILITY) GENERIC(FACILITY) AUDIT(FACILITY)**
    - **-SETROPTS RACLIST(FACILITY)**
  - **PERMIT BPX.DAEMON CLASS(FACILITY) ID(TCPIPSRV) ACCESS(READ)**
    - **-SETROPTS RACLIST(FACILITY) REFRESH**
- **Definitions for Program Controlled Libraries:**
  - **RDEFINE PROGRAM * ADDMEM('TCPIP.SEZALINK'/volume/NOPADCHK) UACC(READ)**
  - **RDEFINE PROGRAM * ADDMEM('CEE.SCEERUN'/volume/NOPADCHK) UACC(READ)**
  - **SETROPTS WHEN(PROGRAM)**
  - **RDEFINE PROGRAM * ADDMEM('SYS1.LINKLIB' /volume/NOPADCHK) UACC(READ)**

RACF Requirements for "Human" Users

- Use of any OS/390 UNIX function by a "human" user who needs to access anything in the HFS requires an OMVS segment for this user ID also.
  - OMVS Segment has assigned to it: OMVS Group, OMVS User ID (UID), UNIX HOME Directory, Initial Shell Program
- SMPE Implementer/Installer needs Superuser Authority: UID(0)
  - NOTE: Not everyone needs to be a Superuser!
- General Users who need HFS access require an OMVS segment (Users accessing FTP, OTELNET, RLOGIN, etc.)
  - NOTE: TN3270 Users do not need OMVS segment.
  - A default OMVS user ID can be defined for users that do not have a specific OMVS segment definition. Security administrators need to define and activate this support explicitly. (Facility Name = BPX.DEFAULT.USER)
  - A specific OMVS User ID can be defined for users with this requirement.
- The HOME directory must allow READ and EXECUTE authority.
- Check your MAXPROCUSER value in BPXPRMxx (must be high if many users use the default user UID)

Userid and OMVS Segment Philosophies

- **Considerations:**
  - **Think about ease of maintenance for Security Product.**
  - **Think about ease in identifying source of message, especially in SYSPLEX environment.**
- **Approaches for Superusers**
  - **Maintenance Userids (e.g., for SMPE) and Userids associated with Started Tasks are permanent Superusers**
  - **Selected System and Network Programmers are authorized for switching to Superuser status (Facility Class = BPX.SUPERUSER)**
- **Approaches for Individual Users who need to get to OTELNET, FTP, etc.**
  - **Individual Userid**
  - **Default User (Facility Class = BPX.DEFAULT.USER)**

Started Task Userid Naming Convention

MVS1

Task Name	*Userid*
TCPIP	*TCPIP*
FTPD	*FTPD*

1

MVS2

Task Name	*Userid*
TCPIP	*TCPIP*
FTPD	*FTPD*

MVS1

Task Name	*Userid*
TCPIP1A	*TCPIP1A*
FTPD1A	*FTPD1A*

2

MVS2

Task Name	*Userid*
TCPIP2A	*TCPIP2A*
FTPD2A	*FTPD2A*

MVS1

Task Name	*Userid*
TCPIP1A	*TCPIP1A*
FTPD1A	*TCPIP1A*

3

MVS2

Task Name	*Userid*
TCPIP2A	*TCPIP2A*
FTPD2A	*TCPIP1A*

UNIX Definitions in a Procedure (BPXISEC1)

```
PROC 0
/*********************************************************************/
/*   LICENSED MATERIALS - PROPERTY OF IBM.                           */
/*                                                                   */
/*   5647-A01                                                        */
/*                                                                   */
/*   (C) COPYRIGHT IBM CORP. 1999 ALL RIGHTS RESERVED                */
/*                                                                   */
/*   US GOVERNMENT USERS RESTRICTED RIGHTS - USE,                    */
/*   DUPLICATION OR DISCLOSURE RESTRICTED BY GSA ADP                 */
/*   SCHEDULE CONTRACT WITH IBM CORP.                                */
/*                                                                   */
/*********************************************************************/
/*                                                                   */
/*  This is a sample TSO CLIST which provides all the RACF commands */
/*  needed for the setup of OS/390 UNIX System Services.            */
/*                                                                   */
/*  This CLIST is being provided as a central location for these     */
/*  commands and should be used by customers in conjunction with     */
/*  the OS/390 UNIX System Service Planning book to reference        */
/*  detailed information. You may also need to refer to:             */
/*  ...........................................................................
```

UNIX Definitions in a Procedure (BPXISEC1)

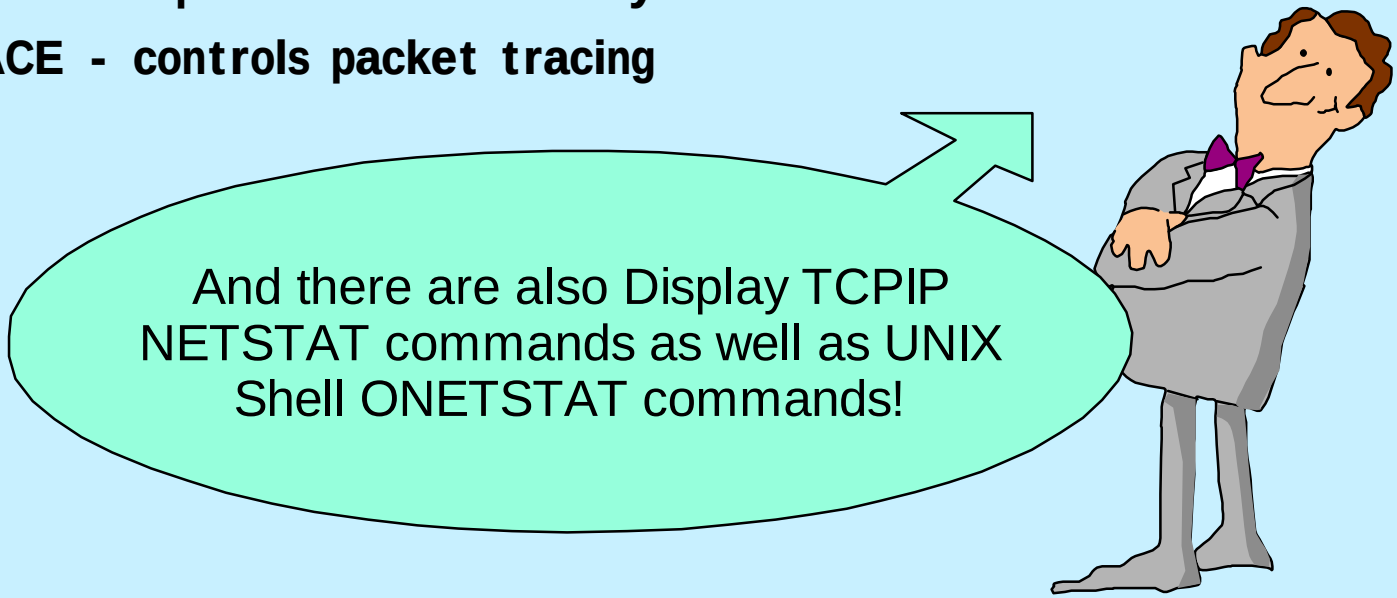
```
/*********************************************************************/
/*  Block 1 - Defining owning user ID and group ID                   */
/*                                                                   */
/* To define the OMVSKERN and OMVSGRP entries.                       */
/*                                                                   */
/* ADDGROUP OMVSGRP OMVS(GID(x))                                     */
/* ADDUSER OMVSKERN DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/') +         */
/*   PROGRAM('/bin/sh')) PASSWORD(yyyyyyy)                           */

/*********************************************************************/
/*  Block 2 - OMVS Cataloged Procedure                               */
/*                                                                   */
/* You must define OMVS to the RACF STARTED FACILITY.                */
/* Customers who want to use the started procedure table (ICHRIN03) */
/* instead, should refer to the OS/390 UNIX Planning book.           */
/*                                                                   */
/* SETROPTS GENERIC(STARTED)                                         */
/* RDEFINE STARTED OMVS.* STDATA(USER(OMVSKERN) GROUP(OMVSGRP) +     */
/*   TRUSTED(YES))                                                   */
/* SETROPTS CLASSACT(STARTED) RACLIST(STARTED)                       */
/* SETROPTS RACLIST(STARTED) REFRESH                                 *
```

UNIX Definitions in a Procedure (BPXISEC1)

```
/*********************************************************************/
/*  Block 27 - Defining specific programs to Program Control       */
/* If you choose not to define the data set where daemon programs   */
/* reside (ie. SYS1.LINKLIB) as program controlled, then you can    */
/* define specific daemon programs as program controlled.           */
/* Refer to the OS/390 UNIX System Service Planning book for the    */
/* list of specific daemon programs.                                */
/* Customizable entries:                                            */
/* ====================                                             */
/*  a) xxxxxx - The name of the daemon program.                     */
/*  b) SYS1.LINKLIB - the name of data set you want program         */
/*     controlled.                                                  */
/*  c) VOLSER - The name of the volume where data set resides.      */
/*     This can be substitued with '******' (including single       */
/*     quotes) to refer to the SYSRES. VOLSER can also be           */
/*     omitted, to mean any volume where the library resides.       */
/* SETROPTS WHEN(PROGRAM)                                           */
/* RDEFINE PROGRAM xxxxxx ADDMEM('SYS1.LINKLIB'/VOLSER/NOPADCHK) +  */
/*   UACC(READ)                                                     */
/* SETROPTS WHEN(PROGRAM) REFRESH                                   */
```

MVS Operator Commands

- **VARY TCPIP,<procname>,parameter**
  - **START - starts a device**
  - **STOP - stops a device**
  - **DATTRACE - traces socket data**
  - **DROP - drops a connection**
  - **HELP - displays command syntax**
  - **OBEYFILE - replaces the TSO obeyfile command**
  - **PKTTRACE - controls packet tracing**



MVS Operator Commands (2)

```
D TCPIP,,HELP,NETSTAT
EZZ0372I D...HELP<NETSTAT>(,ALLCONN|ARP|BYTEINFO|CACHINFO|
EZZ0372I CONFIG|CONN|DEVLINKS|HOME|ROUTE|PORTLIST|SOCKETS|DROP)
```

```
D TCPIP,,HELP,TELNET
EZZ0373I D...HELP<TELNET>(,APPL|DEFAULTS|DEVICETYPE|IPGROUP|
EZZ0373I LUGROUP|HNGROUP|LUMAP|PROFILE|WLM|
EZZ0373I WHEREUSED|ACT|INACT|
EZZ0373I QUIESCE|RESUME|STOP|LINKNAME|CONNECTION)
```

Operator Command Security

- **Restrict VARY TCPIP command via RACF profiles under OPERCMDS class**
  - **Activate the RACF OPERCMDS class**
    - SETROPTS CLASSACT(OPERCMDS)
    - SETROPTS GENERIC(OPERCMDS)
    - SETROPTS GENCMD(OPERCMDS)
    - SETROPTS RACLIST(OPERCMDS)
  - **Restrict all VARY commands to designated userid(s)**
    - RDEFINE OPERCMDS (MVS.VARY.TCPIP.**) UACC(NONE)
    - PERMIT (MVS.VARY.TCPIP.**) ACCESS(CONTROL) CLASS(OPERCMDS) ID(USER1)
    - SETROPTS RACLIST(OPERCMDS) REFRESH
    - SETROPTS GENERIC(OPERCMDS) REFRESH
  - **Restrict specific VARY commands by using PERMIT for the following:**
    - MVS.VARY.TCPIP.DROP
      - - also used for NETSTAT/onetstat DROP support
    - MVS.VARY.TCPIP.OBEYFILE
    - MVS.VARY.TCPIP.PKTTRACE
    - MVS.VARY.TCPIP.DATTRACE
    - MVS.VARY.TCPIP.STARTSTOP
    - MVS.VARY.TCPIP.TELNET.ACT
    - MVS.VARY.TCPIP.TELNET.INACT
    - MVS.VARY.TCPIP.TELNET.QUIESCE
    - MVS.VARY.TCPIP.TELNET.RESUME
    - MVS.VARY.TCPIP.TELNET.STOP
    - EXAMPLE: PERMIT MVS.VARY.TCPIP.DROP ACCESS(CONTROL) CLASS(OPERCMDS) ID(OPER1)

UNIX Security without RACF

- For ACF/2 and TopSecret, consult Web Pages:
  - http://www.cai.com/solutions/os390/sca/cookbooks.htm

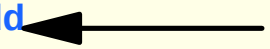
MAKESITE and New Loopback

userid.HOSTS.LOCAL

```
HOST : 9.67.43.100 : NAMESERVER ::::
HOST : 9.67.43.126 : RALEIGH ::::
HOST : 129.34.128.245, 129.34.128.246 : YORKTOWN ::::
;
 NET  : 9.67.43.0 : RALEIGH.IBM.COM ::::
 NET  : 9.67.43.0 : RALEIGH.IBM.COM ::::
;
 GATEWAY : 129.34.0.0 : YORKTOWN-GATEWAY ::::
```

```
MVS TCP/IP Makesite
Initializing tables ...
Computing tables ...
Writing out userid.HOSTS.SITEINFO ...
Writing out userid.HOSTS.ADDRINFO ...
```

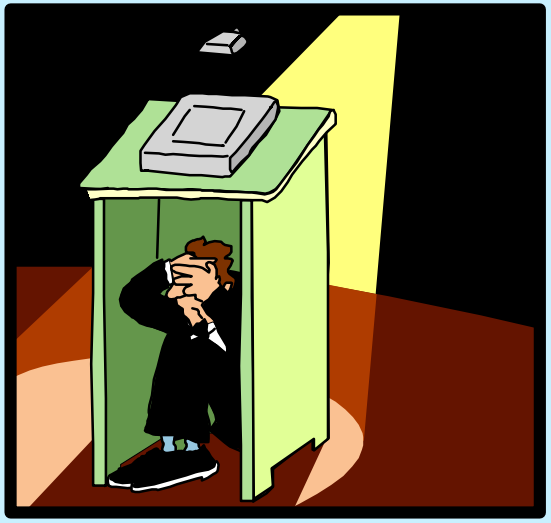
```
 Running IBM MVS TCP/IP CS V2R7 TCP/IP Configuration
Tester

 The TCP/IP system parameter file used will be SYSTCPD DD.
 The FTP configuration parameter file used will be
"SYS1.TCPPARMS(FTPDATA)".
 The following IP addresses are the HOME IP addresses ...
 aa.bb.cc.dd
 127.0.0.1
```



Setting Up the SYSLOGD Server

What Happened to My Joblog?!!

```
************** TOP OF DATA **********************
  J E S 2  J O B  L O G  --  S Y S T E M  S 7 3

--- TUESDAY,   20 JUL 1999 ----
IEF695I START TCPIP1A  WITH JOBNAME TCPIP1A  IS
$HASP373 TCPIP1A  STARTED
IEE252I MEMBER CTIEZB01 FOUND IN SYS1.PARMLIB
EZZ0300I OPENED PROFILE FILE DD:PROFILE
EZZ0309I PROFILE PROCESSING BEGINNING FOR DD:PROF
.................
EZZ0334I IP FORWARDING IS ENABLED
.................
```

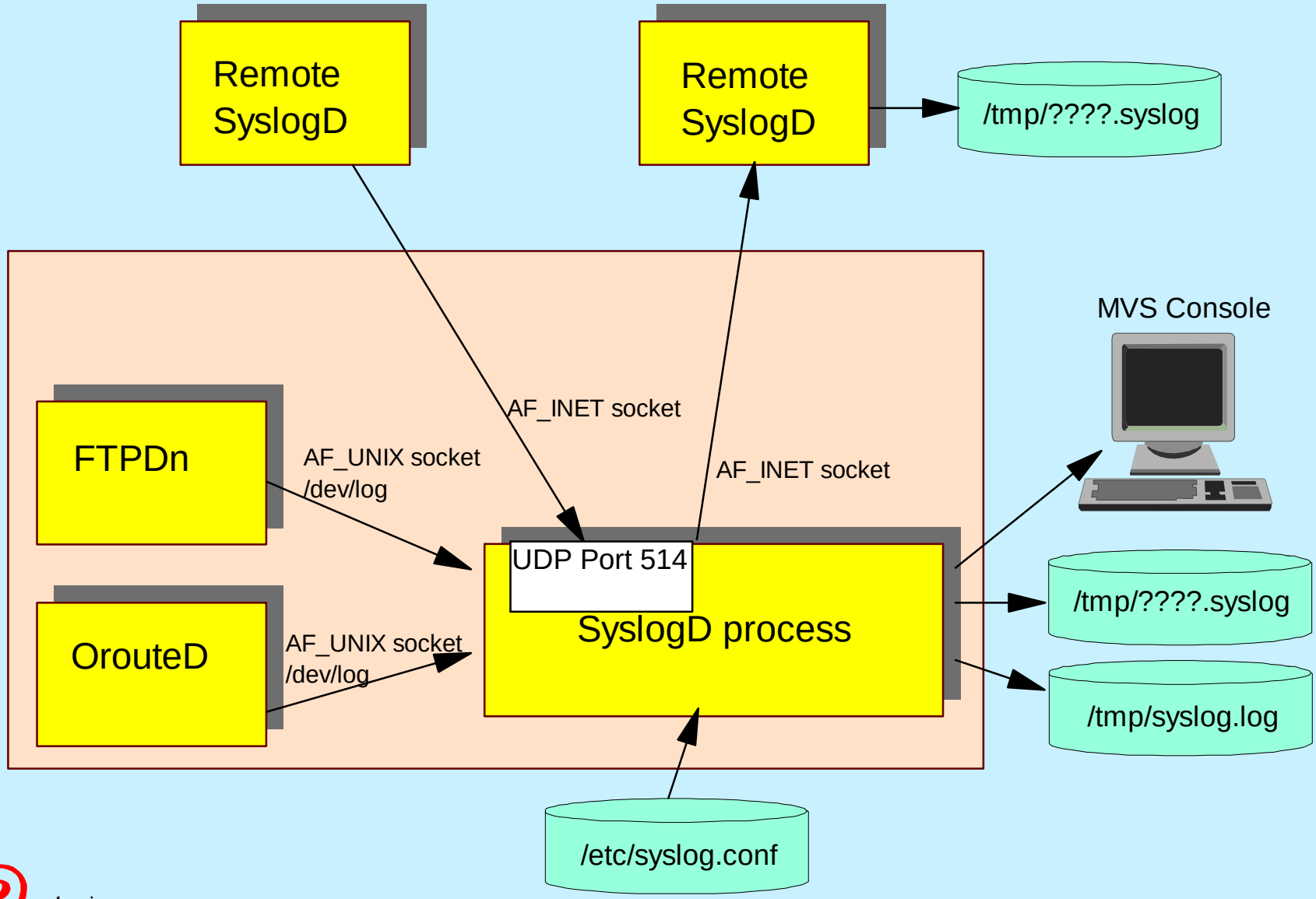


What happened here?

This looks somewhat familiar, but there is not as much here as there used to be!

```
  Display  Filter  View  Print  Options  Help
-------------------------------------------------------------
SDSF DA S73 MVSNM2  PAG  0 ...  6 NO DISPLAYABLE DATA
COMMAND INPUT ===>                          SCROLL ===> CSR
NP   JOBNAME  STEPNAME PROCSTEP ...  REAL PAGING    S
     NM2AHOD3 STEP1              ...   1 1278   0.00   0.
S    NM2AFTP1 STEP1              ...   1 1418   0.00
0.
     NM2AINET STEP1              ...   1 1296   0.00   0.
     NM2AHOD5 *OMVSEX            ...   1 3410   0.00   0.
```

SYSLOGD Logging Daemon



SYSLOGD Configuration

- **Logging rules are maintained in the /etc/syslog.conf file.**
- **A logging rule consists of an identifier and a destination.**
- **Identifiers consist of a logging *facility* name and a *priority* code.**

  Facility_name.Priority_code Destination

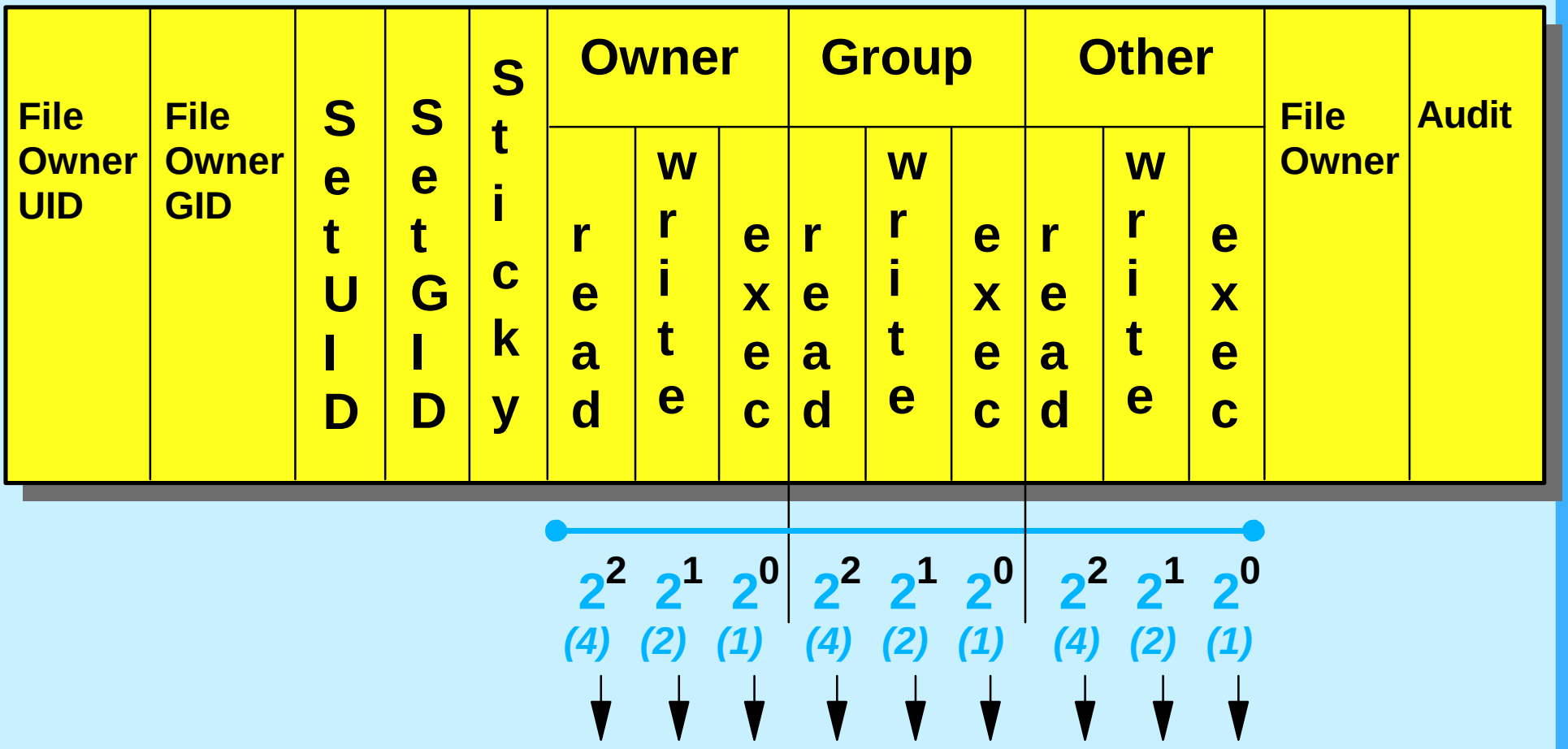
An Easy SYSLOG.CONF File (Syslogd Configuration File)

```
#
# All messages go to a single log.
*.*                /tmp/syslog.log
```

File Security vs. Data Set Security

- MVS Data Set Security:
  - RACF Administrator: Has access to all data sets
  - All Other Users: Have access to a data set if RACF profile permits
- UNIX File Security:
  - Superusers: Have access to all files
  - All Other Users: Have access to a file if permission bits allow

Permission Bits for HFS Files



Permission of 755 is:	1	1	1	1	0	1	1	0	1
Permission of 644 is:	1	1	0	1	0	0	1	0	0

Changes to TCP/IP Profile for SYSLOGD

Set Aside Port for SYSLOG as an OMVS Process; You might include it in Autolog

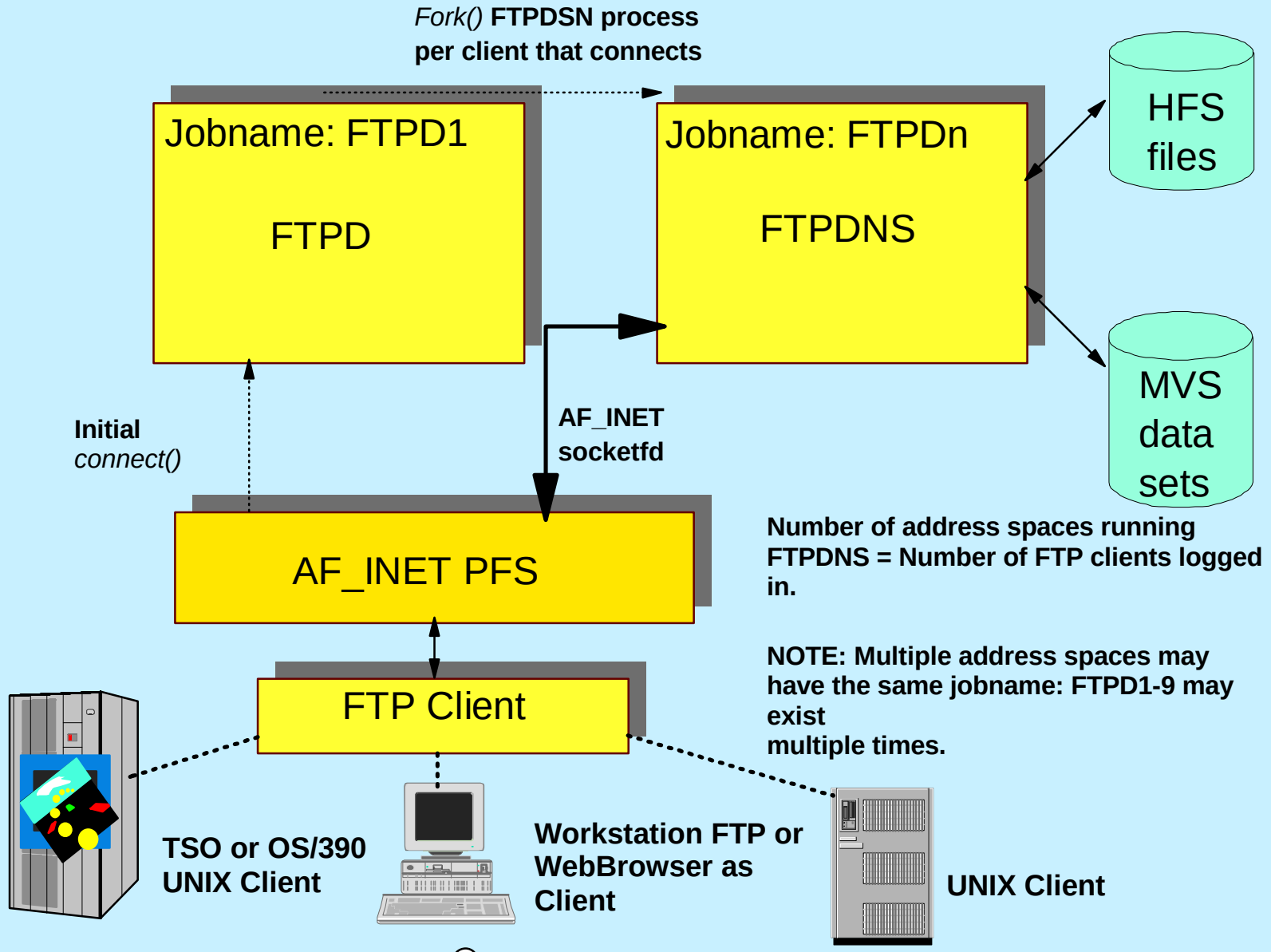
```
AUTOLOG 5
;  NM2ASYSL                    ; SYSLOG Daemon as PROC
ENDAUTOLOG

PORT
    514 UDP OMVS               ; SYSLOG Daemon
```

You could start with a Procedure and even autolog it ... BUT MUCH BETTER ...  **Start SYSLOG Daemon with /etc/rc...**

```
# Start the SYSLOG daemon for logging UNIX activity
_BPX_JOBNAME='SYSLOGD' /usr/sbin/syslogd -f
/etc/syslog.conf &
#  /usr/sbin/syslogd -f /etc/syslog.conf &
# Start the INET daemon for remote login activity
_BPX_JOBNAME='INETD' /usr/sbin/inetd /etc/inetd.conf &
#  /usr/lpp/tcpip/sbin/dhcpsd -f /etc/dhcpsd.cfg &
sleep 5
echo /etc/rc script executed, `date`
```

Migration of Selected Servers

FTP Server: Process Flow



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Oh, No! The Task Ended!

```
S FTPD
$HASP100 FTPD  ON STCINRDR
IEF695I START FTPD  WITH JOBNAME FTPD  IS ASSIGNED TO USER FTPD,
GROUP OMVSGRP
$HASP373 FTPD  STARTED
+EZY2702I Server-FTP: Initialization completed at 11:52:05 on 07/21/99.
JOBNAME  PROCSTEP STEPNAME  CPU TIME     EXCPS     RC
FTPD1    --NONE--    STEP1       00:00:00     84        00
JOBNAME  PROCSTEP STEPNAME  CPU TIME     EXCPS     RC
FTPD     STARTING   FTPD        00:00:00    658       00
$HASP395 FTPD  ENDED
.....................
IEA989I SLIP TRAP ID=X33E MATCHED.  JOBNAME=*UNAVAIL, ASID=0037.
D A,FTPD*
IEE115I 16.51.02 1999.202 ACTIVITY 780
 JOBS    M/S   TS USERS   SYSAS   INITS  ACTIVE/MAX VTAM    OAS
00006   00014   00001       00024    00021    00001/00050         00012
 FTPD1 STEP1  FTPD        OWT     AO   A=002E  PER=NO  SMC=000
```

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FTP Server: Sample Definitions

PROFILE.TCPIP

```
AUTOLOG
    FTPD      JOBNAME FTPD1       ; FTP server

PORT
    20 TCP OMVS           ; FTP server data
    21 TCP FTPD1          ; FTP server control
```

You must reserve the data port to OMVS and not FTPD1 - it is used by all FTP server address spaces, which may be named FTPD1 through FTPD9.

FTPD JCL Procedure

```
//FTPD PROC
//FTPD  EXEC PGM=FTPD,REGION=0K,TIME=NOLIMIT,
// PARM='POSIX(ON) ALL31(ON) ENVAR("_CEE_ENVFILE=DD:MYVARS")/'
//STEPLIB  DD DSN=USER.LINKLIB,DISP=SHR
//MYVARS   DD DSN=USER1.ALFRED.CNTL(FTPENV),DISP=SHR
//SYSFTPD  DD DSN=USER1.ALFRED.TCPPARMS(FTPSDATA),DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(RECFM=F,LRECL=132,BLKSIZE=132)
//SYSIN    DD DUMMY
//SYSERR   DD SYSOUT=*
//SYSOUT   DD SYSOUT=*,DCB=(RECFM=F,LRECL=132,BLKSIZE=132)
//CEEDUMP  DD SYSOUT=*
```

If you have written FTP user security exits, they must be accessible through the standard MVS search order, for example, through STEPLIB.

Remember all STEPLIB libraries must be RACF PROGRAM controlled.

If you use filetype SQL, also remember the DB2 load library.

FTP Server: Changed Keywords

Critical: IP Migration and Planning Guide

New keywords:

- CTRLCONN (ASCII code page for control connection)
- DB2PLAN (DB2 Plan name)
- QUOTESOVERRIDE (How to interpret quotes in file names)
- SBDATACONN (ASCII - EBCDIC code pages for data connection)
- STARTDIRECTORY (Initial current directory: MVS HLQ / home directory)
- UMASK (File mode creation mask)
- WLMCLUSTERNAME (WLM registration cluster name)
- UCSHOSTCS (Code set for inbound UCS-2 data transfers)
- UCSTRUNC (Truncation on inbound Unicode data transfers)
- UCSSUB (Substitution for inbound Unicode data transfers)

Removed keywords:

- EXTRATASKS (not applicable to the OE implementation)
- PORT (in /etc/services instead - still supported as EXEC PARM option)
- XLATE (replaced by CTRLCONN and SBDATACONN)
- CCXLATE (replaced by CTRLCONN)

FTP: Changed Site Cmmands

New Commands:

- CHMOD
- CTRLCONN
- QUOTESOVERRIDE or NOQUOTESOVERRIDE
- SBDATACONN
- UMASK
- UCSHOSTCS
- UCSSUB or NOUCSSUB
- UCSTRUNC or NOUCSTRUNC

Removed Commands:

- XLATE (replaced by SBDATACONN and CTRLCONN)

Client FTP.DATA Changes

- **Some New and Changed Keywords:**
  - AUTOTAPEMOUNT (Automatically allocate tape volumes or not)
  - BUFNO (Number of buffers to use when reading/writing data)
  - CTRLCONN (ASCII code page for control connection)
  - DB2PLAN (DB2 Plan name)
  - QUOTESOVERRIDE (How to interpret quotes in file names)
  - SBDATACONN (ASCII - EBCDIC code pages for data connection)
  - STARTDIRECTORY (Initial current directory: MVS HLQ / home directory)
  - *TRAILINGBLANKS (Transfer trailing blanks from fixed record length data sets)*
  - *WRAPRECORD (Data wrapped to next record in absence of NL character)*
  - UMASK (File mode creation mask)
  - UCSHOSTCS (Code set for inbound UCS-2 data transfers)
  - UCSTRUNC (Truncation on inbound Unicode data transfers)
  - UCSSUB (Substitution for inbound Unicode data transfers)

- **Removed keywords:**
  - CCTRANS (Replaced by CTRLCONN)
  - NCP (Obsolete)
  - SBTRANS (Replaced by SBDATACONN)

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Reminder: BPX.DAEMON, Program Control

- FTPD must be associated with a user that has an OMVS segment.
- BPX.DAEMON Facility
  - The FTP server and the UNIX versions of the TelnetD, REXECD, and RSHD servers require READ access. INETD and CRON also require READ access.
- PROGRAM CONTROL
  - Once BPX.DAEMON is enabled the following load libraries need to be program controlled:
    - *hlq*.SEZALINK, *hlq*.SEZATCP, *cee.version*.SCEERUN, SYS1.LINKLIB
    - Any load libraries containing installation FTP security exits
  - Example definitions:
    - SETROPTS WHEN(PROGRAM)
    - ADDSD '*hlq*.SEZALINK' UACC(READ)
    - ADDSD '*hlq*.SEZATCP' UACC(READ)
    - ADDSD '*cee.version*.SCEERUN' UACC(READ)
    - ADDSD 'SYS1.LINKLIB' UACC(READ)
    - RDEFINE PROGRAM * ADDMEM('SYS1.LINKLIB'/volser/NOPADCHK) UACC(READ)
    - RALTER PROGRAM * ADDMEM('*hlq*.SEZALINK'/volser/NOPADCHK) UACC(READ)
    - RALTER PROGRAM * ADDMEM('*hlq*.SEZATCP'/volser/NOPADCHK) UACC(READ)
    - RALTER PROGRAM * ADDMEM('*cee.version*.SCEERUN'/volser/NOPADCHK)UACC(READ)

OROUTED Procedure: Sezainst

```
//OROUTED  EXEC PGM=BPXBATCH,REGION=4096K,TIME=NOLIMIT,
//         PARM='PGM /usr/lpp/tcpip/sbin/orouted -ep -t -t'
//*
//*
//STDOUT   DD PATH='/tmp/orouted.stdout',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP)
//*
//STDERR   DD PATH='/tmp/orouted.stderr',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP)
//STDENV   DD PATH='/etc/orouted.env'
//*
//CEEDUMP  DD SYSOUT=*,DCB=(RECFM=FB,LRECL=132,BLKSIZE=132)
```

OROUTED Server: Modified Sample

PROFILE.TCPIP

```
AUTOLOG
   OROUTED              ; Dynamic Route Update server
IPCONFIG VARSUBNETTING  ; Enable variable length subnet masks
PORT
   520 UDP OROUTED      ; Dynamic Route Update Server
BSDROUTINGPARMS true
     TR1       2000       0     255.255.255.128 0
ENDBSDROUTINGPARMS
```

VARSUBNETTING is required for RIPv2 protocols.

OROUTED JCL Procedure

```
//OROUTED PROC
//*
//OROUTED EXEC PGM=OROUTED,
// PARM='POSIX(ON) ENVAR("_CEE_ENVFILE=DD:STDENV")/-ep -t -t'
//STDOUT   DD SYSOUT=*
//STDERR   DD SYSOUT=*
//CEEDUMP  DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//STDENV   DD DSN=USER1.ALFRED.CNTL(ROUTDENV),DISP=SHR
```

OrouteD Environment Variables

```
RESOLVER_CONFIG=//'USER1.ALFRED.TCPPARMS(TCPDATA)'
ROUTED_PROFILE=//'USER1.ALFRED.TCPPARMS(ROUTPROF)'
GATEWAYS_FILE=//'USER1.ALFRED.TCPPARMS(GATEWAYS)'
TZ=EST5EDT
```

OrouteD Profile

```
RIP_SUPPLY_CONTROL: RIP1
RIP_RECEIVE_CONTROL: ANY
```

OrouteD Gateways Definitions

```
options interface.poll.interval 15
options interface.scan.interval 180
```

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RACF Definitions: OROUTED/OMPROUTE

- Starting with V2R6 of OS/390, OROUTED uses additional security. The RACF definitions below are not necessary at V2R5 with OROUTED.
  - The same type of security is necessary to implement OMPROUTE (available at V2R6 and higher).
  - Example definitions for OROUTED:
    - **RDEFINE OPERCMDS(MVS.ROUTEMGR.OROUTED) UACC(NONE)**
    - **PERMIT MVS.ROUTEMGR.OROUTED ACCESS(CONTROL) CLASS(OPERCMDS) ID(started task id or userid under UNIX)**
    - **SETROPTS RACLIST(OPERCMDS) REFRESH**
  - Example definitions for OMPROUTE:
    - **RDEFINE OPERCMDS(MVS.ROUTEMGR.OMPROUTE) UACC(NONE)**
    - **PERMIT MVS.ROUTEMGR.OMPROUTE ACCESS(CONTROL) CLASS(OPERCMDS) ID(started task id or userid under UNIX)**
    - **SETROPTS RACLIST(OPERCMDS) REFRESH**

Fast Path: Skip the Details!

Case Study for Single Stack (Summary)

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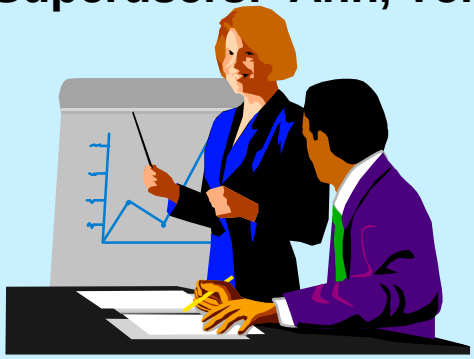
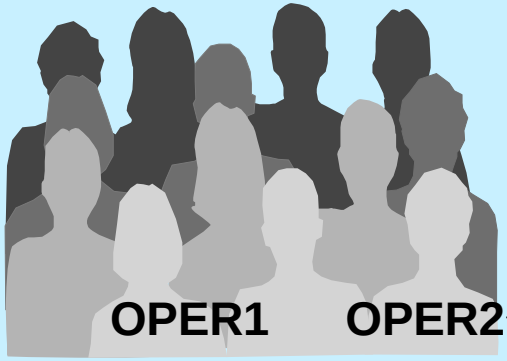
TCP/IP, Its Users, Its Pre-reqs

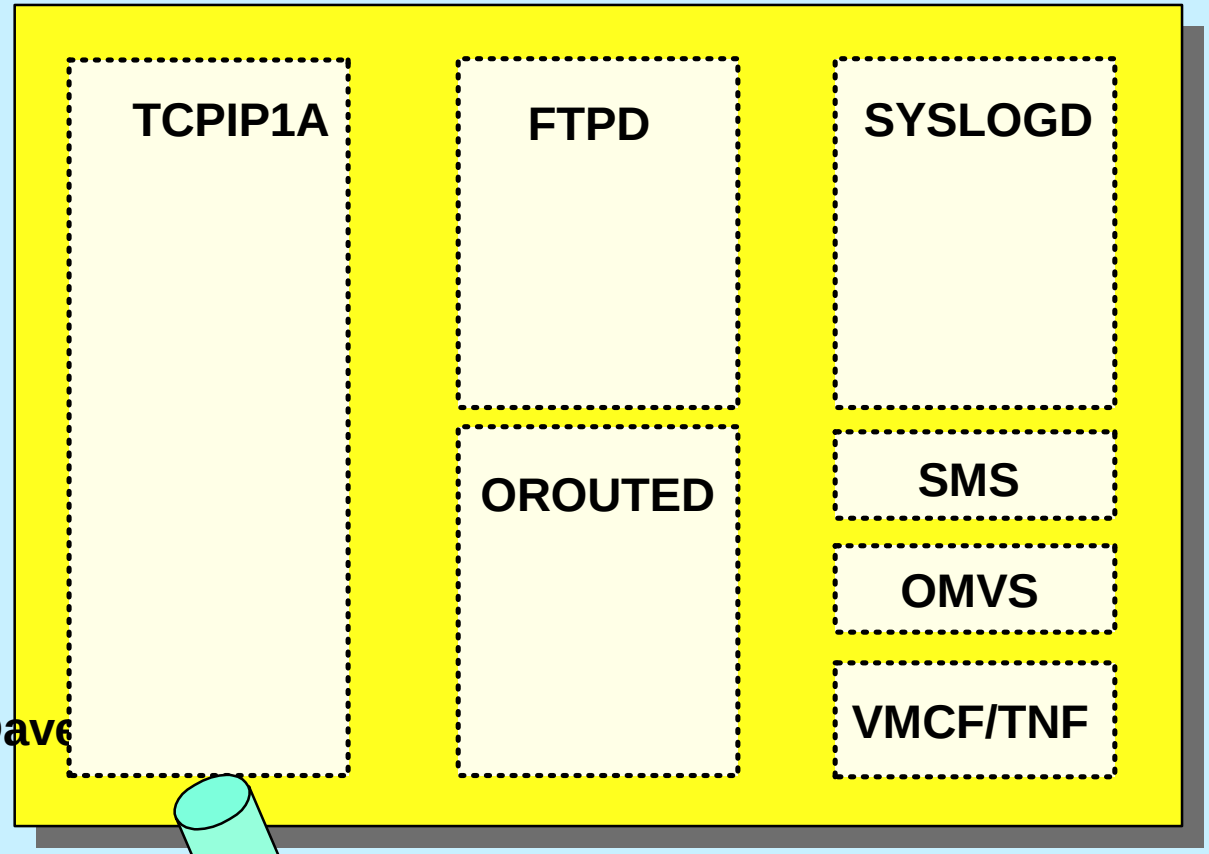
Superusers: Ann, Tom

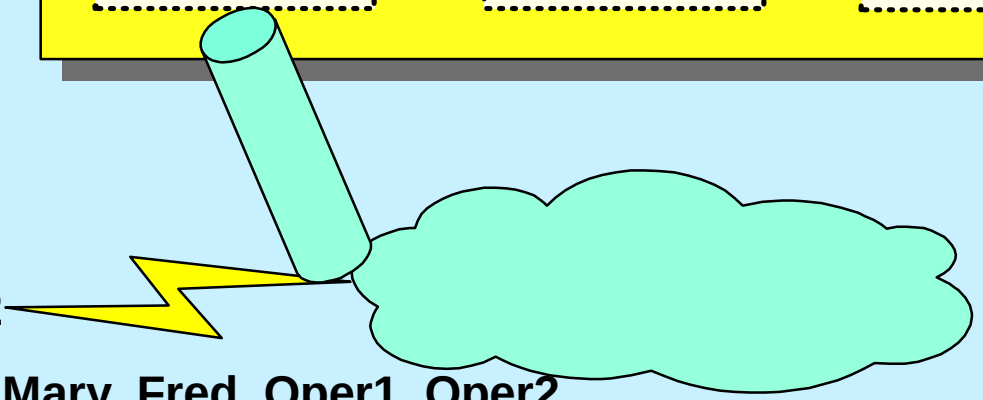


BPX.SUPERUSER: Sue, Dave



OPER1 OPER2





BPX.DEFAULT.USER: Mary, Fred, Oper1, Oper2

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The Preliminaries

- Is SMS running? (Work with Storage Management Support for this.)
- Have TNF and VMCF started successfully?
- Is a full-function OMVS running? (Work with UNIX Implementer on this.)
  - Is a full SYS1.PARMLIB(BPXPRMxx) definition in place?
- Have user file systems (HFS) been mounted on appropriate mountpoints?
  - Have the user directories been created and the ownership of them changed to the users themselves?
- Have PARMLIB changes been made? (See IP Migration Guide and FLASH for TCP/IP Hints and Tips.) (See following page for reminder.)
- Have RACF definitions for OMVS segments and for UNIX facilities been put in place? (See next few pages for reminders.)

SYS1.PARMLIB

SCHEDxx

```
PPT PGMNAME(MVPTNF)
      NOCANCEL
      KEY(0)
      NOSWAP
      PRIV
      SYST
PPT PGMNAME(MVPXVMCF)
      NOCANCEL
      KEY(0)
      NOSWAP
      PRIV
      SYST
PPT PGMNAME(EZAPPFS)
      KEY(1)
      NOSWAP
PPT PGMNAME(EZAPPAAA)
      NOSWAP
PPT PGMNAME(SNALINK)
      NOCANCEL
      KEY(6)
      NOSWAP
      SYST
PPT PGMNAME(EZBTCPIP)
      NOCANCEL
      KEY(6)
      NOSWAP
      PRIV
      SYST
      SPREF
      LPREF
```

IEASYSxx

```
CSA(3000,250M)
SQA(8,448)
```

IVTPRMxx

```
FIXED MAX(120M)
ECSA MAX(30M)
```

IEFSSNxx

```
TNF
VMCF
```

LNKLSTxx

```
hlq.SEZALINK
hlq.SEZALNK2
```

BPXPRMxx

```
ROOT FILESYSTEM('OMVS.ROOT')
      TYPE(HFS) MODE(RDWR)

MOUNT  FILESYSTEM('OEA.TCP34C.HFS')
      TYPE(HFS) MODE(RDWR)
      MOUNTPOINT('usr/lpp/tcpip')

FILESYSTYPE TYPE(INET)
      ENTRYPOINT(EZBPFINI)

NETWORK DOMAINNAME(AF_INET)
      DOMAINNUMBER(2)
      MAXSOCKETS(60000)
      TYPE(INET)
```

1

LPALSTxx

```
hlq.SEZALPA
```

PROGxx

```
hlq.SEZATCP
hlq.SEZADSIL
hlq.SEZALINK
hlq.SEZALNK2
hlq.SEZALPA
hlq.SEZAMIG
```

IKJTSOxx

```
AUTHCMD NAMES(
MVPXDISP
TRACERTE
NETSTAT)
```

CTIEZBxx

```
TRACEOPTS
      ON
      BUFSIZE(4M)
      OPTIONS('MINIMUM')
```

1 **Separate File System for IP Code at V2R5.**

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RACF Worksheet + Definitions

Superusers ("Humans"): Ann and Tom	**ADDGROUP OMVSGRP OMVS(GID(1))** **ADDUSER ANN DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/ '))** **ADDUSER TOM DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/ '))**
Superusers (Started Tasks): TCPIP1A for any task associated with TCPIP1A stack.	**ADDUSER TCPIP1A DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/ '))** **SETROPTS CLASSACT(STARTED) RACLIST(STARTED)** **RDEF STARTED TCPIP.* STDATA(USER(TCPIP1A))** **RDEF STARTED FTPD.* STDATA(USER(TCPIP1A))** **RDEF STARTED SYSLOGD.* STDATA(USER(TCPIP1A))** **SETROPTS RACLIST(STARTED) REFRESH**
BPX.SUPERUSER (Switch to Superuser) Sue, Dave	**ADDUSER SUE DLFTGRP(OMVSGRP) OMVS(UID(91) HOME('/ '))** **ADDUSER DAVE DFLTGRP(OMVSGRP) OMVS(UID(92) HOME('/ '))** ** **RDEFINE FACILITY BPX.SUPERUSER UACC(NONE)** **PERMIT BPX.SUPERUSER CLASS(FACILITY) ID(SUE) ACCESS(READ)** **PERMIT BPX.SUPERUSER CLASS(FACILITY) ID)DAVE) ACCESS(READ)**

RACF Worksheet + Definitions

BPX.DEFAULT.USER (Default Users):
for Mary
for Fred
for OPER1
for OPER2
	`ADDGROUP OEDFLTG OMVS(GID(777777))`
	`ADDUSER OEDFLTU DFLTGRP(oedfltg) NAME('OE DEFAULT USER') -`
	`OMVS(UID(999999)HOME('/u/default') PROGRAM('/bin/echo'))`
	`RDEFINE FACILITY BPX.DEFAULT.USER APPLDATA('OEDFLTU/OEDFLTG')`
	`SETROPTS CLASSACT(FACILITY)`
	`SETROPTS RACLIST(FACILITY) REFRESH`

BPX.DAEMON	`RDEFINE FACILITY BPX.DAEMON UACC(NONE)`
	`SETROPTS CLASSACT(FACILITY) GENERIC(FACILITY) AUDIT(FACILITY)`
	`SETROPTS RACLIST(FACILITY)`
	`PERMIT BPX.DAEMON CLASS(FACILITY) ID(TCPIP1A) ACCESS(READ)`
	`SETROPTS RACLIST(FACILITY) REFRESH`

Operator Commands
for Ann
for Tom
for Sue
for Dave
for OPER1
for OPER2
	`SETR CLASSACT(OPERCMDS)`
	`SETR GENERIC(OPERCMDS)`
	`SETR GENCMD(OPERCMDS)`
	`SETR RACLIST(OPERCMDS)`
	`RDEFINE OPERCMDS (MVS.VARY.TCPIP.**) UACC(NONE)`
	`PERMIT MVS.VARY.TCPIP.** ACCESS(CONTROL) CL(OPERCMDS) ID(ANN)`
	`.......... and so on for Tom, Sue, Dave, OPER1, OPER2,.........`
	`SETR GENERIC(OPERCMDS) REFRESH`
	`SETR RACLIST(OPERCMDS) REFRESH`

RACF Worksheet + Definitions

Protecting Programs	**RDEFINE PROGRAM * ADDMEM('SYS1.LINKLIB' /volume/NOPADCHK) UACC(READ)** **RDEFINE PROGRAM * ADDMEM('TCPIP.SEZALINK'/volume/NOPADCHK) UACC(READ)** **RDEFINE PROGRAM * ADDMEM('CEE.SCEERUN'/volume/NOPADCHK) UACC(READ)** **SETROPTS WHEN(PROGRAM)**
OROUTED or OMPROUTE Initialization at V2R6 or higher	**RDEFINE OPERCMDS(MVS.ROUTEMGR.OROUTED) UACC(NONE)** **PERMIT MVS.ROUTEMGR.OROUTED ACCESS(CONTROL) -** **CLASS(OPERCMDS) ID(TCPIP1A)** **SETROPTS RACLIST(OPERCMDS) REFRESH** ********************** **RDEFINE OPERCMDS(MVS.ROUTEMGR.OMPROUTE) UACC(NONE)** **PERMIT MVS.ROUTEMGR.OMPROUTE ACCESS(CONTROL) -** **CLASS(OPERCMDS) ID(TCPIP1A)** **SETROPTS RACLIST(OPERCMDS) REFRESH**

Avoiding the "Gotchas"

- Have you ensured access to the following documentation?
  - CS V2Rn
    - Migration Guide
    - IP Configuration Guide
    - Messages Manuals
    - SNA and IP Codes
    - User's Guide
  - FLASHES on IP Migration Hints and Tips
    - at www.ibm.com/support/techdocs
      - N3192 (V2R7)
      - W98042 (V2R6)
      - W98019 (V2R5)

Avoiding the "Gotchas" (cont'd.)

- OS/390 V2Rn ...
  - Unix Planning
  - User's Guide
  - Messages
- Redbooks
  - CS for OS/390 V2Rn Implementation Guide
    - Configuration and Routing (SG24-5227)
    - OpenEdition Applications (SG24-5228)
    - MVS Applications (SG24-5229)
- Miscellaneous
  - Parallel Sysplex Test Report (GC28-1963)

Avoiding the "Gotchas" (cont'd.)

- Convert Programs that use IUCV/VMCF sockets.
- Examine Telnet Server changes and create plan of action
  - USSTable Changes (Variables)
  - LU Selection Timing: TN3270 vs. TN3270E
    - Allowappl "pool coding"
  - Emulator Implications
- Plan for changed DLCs: No Offload, IOCDS changes for Hyperchannel, etc.
- Plan for improved performance
  - Can your router/network infrastructure handle the increased throughput? Adjust buffers, etc.
  - Have you followed ALL the tuning recommendations in Performance APARS II11710, II11711, II11712?
    - Have you tuned OS/390 to handle the increased CSA, CSM, SQA and address space requirements, for example?
  - Have you taken into consideration the tuning information in Telnet Info APAR II11574? (Includes information for V3R2 and higher.)

Avoiding the "Gotchas" (cont'd.)

- Understand and plan reaction to changes in multicast support if you are using dynamic routing.
  - FLASH 3191 at www.ibm.com/support/techdocs
- Ensure you understand VIPA Host Route implications if you are using OMPROUTE.
  - FLASH 3190 at www.ibm.com/support/techdocs
  - PTF PW25823
- Have you created a test plan that will be executed from a non-Superuser userid? (Operations, FTP, Telnet, etc.)
- Have you made plans to educate the operators?
  - A console log with new activities (tasks ending, new messages, VTAM displays, new Operator Commands, etc.)

Avoiding the "Gotchas" (cont'd.)

- Have you documented for yourself, the operators, and the helpdesk the ...
  - Location of the new log information
  - New trace procedures (CTRACE)
  - New IPCS procedures and processes
  - The behaviour of the USSTABLE MSG10 with MSG7
- Have you worked with the Unix System Services implementers to develop a plan to maintain separate HFS's on these mountpoints and backup the files in them?
  - /etc, /tmp, /u, etc.
- Have you worked with the Security Administrator to ensure that the appropriate OMVS segments, RACF facility classes, and RACF authorizations for operators and others have been put in place?

Other Useful Documentation

- **OS/390 UNIX Questions and Answers**
  - **http://www.s390.ibm.com/products/oe/bpxqa11.html**
- **ACF/2 and TopSecret Security for UNIX**
  - **http://www.cai.com/solutions/os390/sca/cookbooks.htm**

Implementation Plan: Single Stack

1. **Plan for Applications that are no longer supported (VMCF/IUCV Sockets).**
2. **Plan for Interfaces that are no longer supported (Offload, etc.)**
3. **Add BPXPRMnn information for single stack.**
4. **Ask OS/390 and UNIX implementers to tune for UNIX environment.**
5. **Add User mountpoints.**
6. **Create OMVS Segments in RACF...**
   - **For Users**
   - **For Procedures**
7. **Execute RACF for Procedure names.**
   - **TCP/IP:**
   - **FTP:**
   - **OROUTED:**
8. **Execute RACF for Authorized Libraries.**
9. **Execute RACF for Operator Commands.**
10. **Execute RACF for Dynamic Routing Protocol.**
11. **Create JCL for Procedures: TCPIP1A, OROUTED, FTPD.**

Follow Instructions in:

1) IP Migration Guide

2) FLASH for TCP/IP Hints and Tips at www.ibm.com/support/techdocs (N3192 for V2R7; W98042 for V2R6; W98019 for V2R5)

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Implementation Plan: Single Stack

12. **Create required files:**
    - SYS1.TCPPARMS(TCPPROF)
    - SYS1.TCPPARMS(TCPDATA)
    - SYS1.TCPPARMS(FTPDATA)
    - SYS1.TCPPARMS(STDENV)
    - SYS1.TCPPARMS(RTDPROF)
13. **Create HOSTS.LOCAL and Run MAKESITE**
14. **Create definitions in /etc/rc for SYSLOGD startup.**
15. **Create and Execute Test Plan**
    - Test FTP changes
    - Test TELNET and USSTable Changes and all TN3270(E) emulators
    - Test new MVS 'Vary TCPIP' and 'Display TCPIP' Commands
    - Test Tracing with CTRACE
    - Examine Contents of SYSLOG.LOG
16. **Create and Execute Test Plan for Stress Test**
    - Look for Tuning Issues (VTAM Buffers, CSM, CSA, SQA, etc.)
    - Look for network issues on routers to accommodate increased performance
17. **Hold Training Session for Operators and Update Runbooks.**

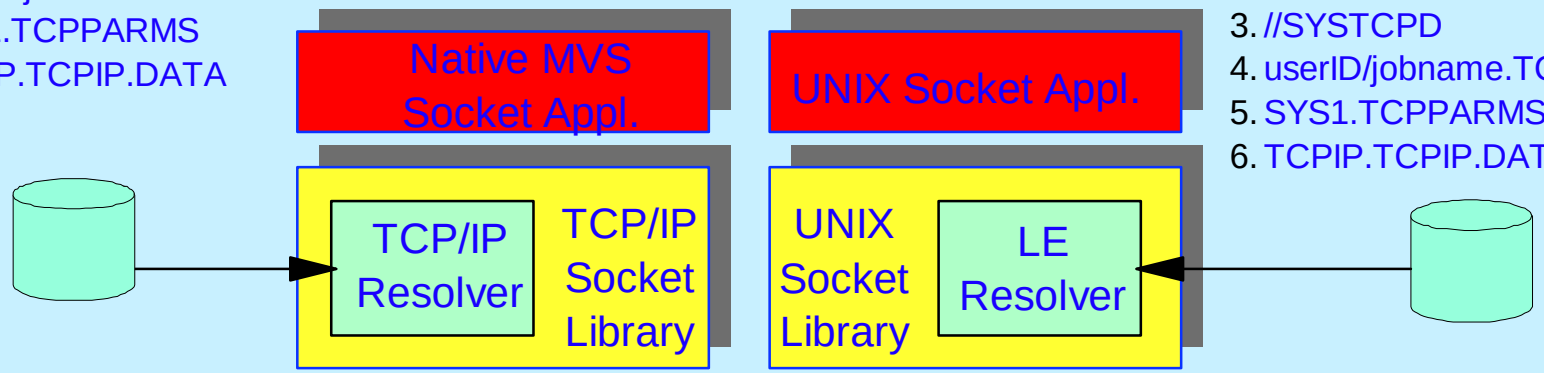
Test Plan Sample

- **Test with Appropriate USERIDs**
  - **Don't use SUPERUSER userid for all tests! This will mask results!**
- **Run statistics (discarded packets, etc.) for all routers prior to and after migration; analyze for any requirements to optimize network tuning for increased performance of CS for V2Rn IP.**
- **Monitor System Performance to determine if OS/390 tuning is necessary.**
  - **RMF**
  - **D NET,CSM,OWNERID=ALL**
  - **D NET,BFRUSE**
- **Test New Trace Structures**

What You Still Need to Know!
Resolver, API Migration
(Read This Later)

Resolvers & Socket Libraries

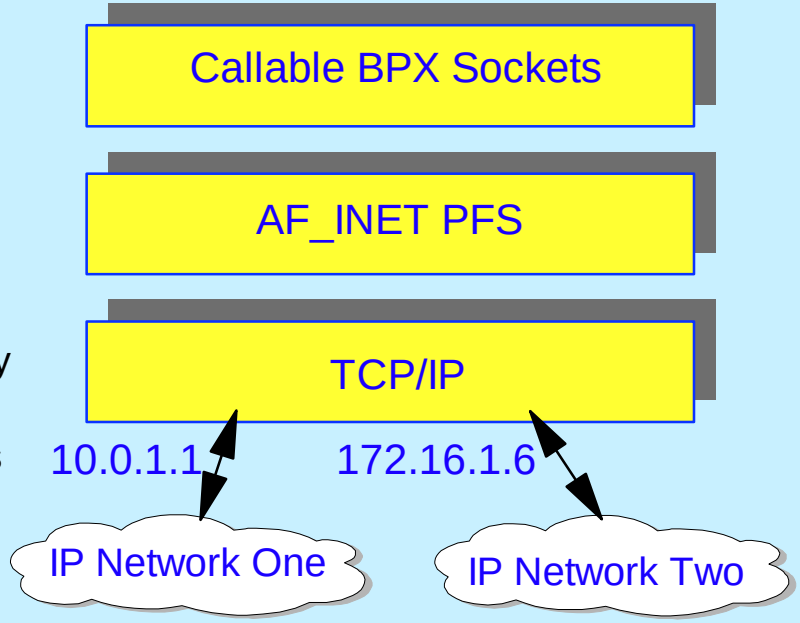
1. //SYSTCPD
2. userID/jobname.TCPIP.DATA
3. SYS1.TCPPARMS
4. TCPIP.TCPIP.DATA



1. RESOLVER_CONFIG
2. /etc/resolv.conf
3. //SYSTCPD
4. userID/jobname.TCPIP.DATA
5. SYS1.TCPPARMS
6. TCPIP.TCPIP.DATA

***No Change** in setup for native MVS socket programs!*

TIP:
Member EZAGETIN in your hlq.SEZAINST library can be used to allocate and initialize the data sets that are needed by the TCP/IP resolver.



Avoid SYSTCPD DD statement for UNIX socket applications; use the RESOLVER_CONFIG environment variable instead as first search location.

Resolver Data Approaches

Two general approaches:

1. Use separate MVS data sets or files for the two resolvers - MVS data sets for the native TCP/IP resolver, and HFS files for the LE resolver.

TCP/IP Resolver:
[TCPIP.DATA]
hlq.ETC.PROTO
hlq.ETC.SERVICES
hlq.HOSTS.ADDRINFO
hlq.HOSTS.SITEINFO
hlq.STANDARD.TCPXLBIN

LE Resolver:
/etc/resolv.conf
/etc/protocol
/etc/service
/etc/hosts
hlq.STANDARD.TCPXLBIN

2. Share the same MVS data sets between both resolvers.

- Do *not* create the LE resolver files in the /etc directory
- Either use SYS1.TCPPARMS(TCPDATA) [recommended], or use the SYSTCPD DD statement for the TCP/IP resolver and point the LE resolver to your MVS data set TCPIP.DATA via the RESOLVER_CONFIG environment variable
- Let both resolvers find the remaining resolver configuration data sets via the DATASETPREFIX value in your TCPIP.DATA

How to Set RESOLVER_CONFIG Environment Variable

- In the UNIX shell:

```
➢export RESOLVER_CONFIG="//'USER1.ALFRED.CNTL(TCPDATAT)'"
```

- In a BPXBATCH STDENV input file or data set:

```
➢RESOLVER_CONFIG=//'USER1.ALFRED.CNTL(TCPDATAT)'
```

- In a POSIX(ON) program's EXEC PARM string:

```
➢//FTPD  EXEC PGM=FTPD,REGION=0K,TIME=NOLIMIT,
 // PARM='POSIX(ON) ALL31(ON) ENVAR("RESOLVER_CONFIG=//''USER1.ALFRED.CNX
 //             TL(TCPDATAT)''")/ PORT 621 TRACE'
```

Col. 72 !!!!!

Col. 16 !!!!!

- In a POSIX(ON) program's environment variable input file or data set:

```
➢//FTPD  EXEC PGM=FTPD,REGION=0K,TIME=NOLIMIT,
 // PARM='POSIX(ON) ALL31(ON) ENVAR("_CEE_ENVFILE=DD:MYVARS")/ PORT 621 X
 //             TRACE'
 //MYVARS    DD *
 RESOLVER_CONFIG=//'USER1.ALFRED.CNTL(TCPDATAT)'
 /*
```

Socket API Support Matrix

Socket Library	AF_INET Support	AF_UNIX Support	TCP/IP V3R2	TCP/IP OE OS/390 R4	TCP/IP OS/390 R5
OS/390 UNIX C Sockets	Yes	Yes	Yes	Yes	Yes
OS/390 UNIX Callable BPX Sockets (Note 1)	Yes	Yes	Yes	Yes	Yes
TCP/IP MVS C Sockets	Yes		Yes		Yes
TCP/IP MVS Sockets Extended ASM Macro	Yes		Yes		Yes
TCP/IP MVS Sockets Extended Callable	Yes		Yes		Yes
TCP/IP MVS REXX Sockets	Yes		Yes		Yes
TCP/IP MVS ASM IUCV Socket API	Yes		Yes		
TCP/IP MVS Pascal Sockets	Yes		Yes		Yes

Note 1: BPX callable sockets is a low-level, high-performing assembler API without a resolver.

C, REXX, Pascal, Sockets Extended API Migration

Socket API	From TCP/IP V3R1	From TCP/IP V3R2
TCP/IP C-sockets	Relink	No change
Sockets Extended Call API	No change*	No change
Sockets Extended Assembler macro API	No change*	No change
Compiled REXX sockets	Recompile and relink	Recompile and relink
Interpreted REXX sockets	No change	No change
Pascal API	Relink	Relink

- **Programs that use raw sockets require relink with AC(1) to an APF authorized load library**
- **For C programs, be aware that only the LE runtime libraries are supported; programs may need to relinked to LE 1.8 or higher**
- **Be aware that once a C program has been compiled and linked with C and LE on OS/390 V2R5, it *may* not run on previous LE releases.**
- **Some errno values on failing socket calls have changed (ENOTCONN is now EPIPE)**
- **OMVS segment is required for all non-PASCAL socket programs (Default OMVS segment is sufficient)**
- **New socket options:**
  - **ioctl() - SIOCGMONDATA**
  - **setibmsockopt() and getibmsockopt() - SO_IGNORESOURCEVIPA and SO_OPTMSS**
- **Some Pascal API functions have been removed or changed (see the Planning and Migration Guide for details)**

Bells and Whistles: Advanced Issues (Additional BPXPRMnn Parms, INETD, Multiple Stacks, etc.)

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Additional BPXPRMnn Parameters (1)

- **MAXPROCSYS: Maximum # of concurrently active processes (Uses pageable storage and address space) (Default = 200)**
- **MAXPROCUSER: Maximum # of processes for a single OMVS UID. (Default = 25)**
- **MAXUIDS: Maximum # of unique OMVS UIDs concurrently active. (Default = 200)**
- **MAXFILEPROC: Max. # of files allocated per single UNIX user. (Default = 64)**
  - **"File Descriptor not available" means too few MAXFILEPROC. Default is probably not adequate, especially with CICS Sockets or AnyNet. Set to 2000.**
- **MAXCORESIZE: Max. core dump file size (bytes) per process. (Default = 4MB)**
- **MAXASSIZE: Address Space region size. (Default = 40 MB)**

BPXPRMxx

```
ROOT FILESYSTEM('OMVS.ROOT')
     TYPE(HFS) MODE(RDWR)
.....................................
MAXPROCSYS(200)
MAXPROCUSER(50)
MAXUIDS(100)
MAXFILEPROC(64)
MAXCORESIZE(4194304)
MAXASSIZE(41943040 )
```

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Additional BPXPRMnn Parameters (2)

- **MAXCPUTIME: CPU time (seconds) allowed per process. (Default = 100)**
- **MAXFILESIZE: Max. file allowed to be created per process. (Default = 2GB)**
- **MAXPTYS: Max. # of pseudo-TTY sessions concurrently active. (Each shell session requires 2; Default = 256; Recommended is MAXUIDS * 4)**
- **MAXRTYS: Max. # remote concurrently active remote terminal sessions for the Outboard Communication Server. (4 per user recommended)**

BPXPRMxx

```
.....................
MAXCPUTIME(100)
MAXFILESIZE(2147483647)
MAXPTYS(256)
MAXRTYS(256)
```

Additional BPXPRMnn Parameters (3)

- **Threads: support for multiple separate units of dispatchable work within a process. Provide concurrent and asynchronous processing without overhead of creating new address spaces.**
- **MAXTHREADS: Max. # of threads for a single process. (Default = 200)**
- **MAXTHREADTASKS: Max. # of MVS tasks created with pthread_create (BPX1PTC) per single user (Default = 50)**

BPXPRMxx

.....

MAXTHREADS(200)

MAXTHREADTASKS(50)

Single-Stack or Multi-Stack Configuration

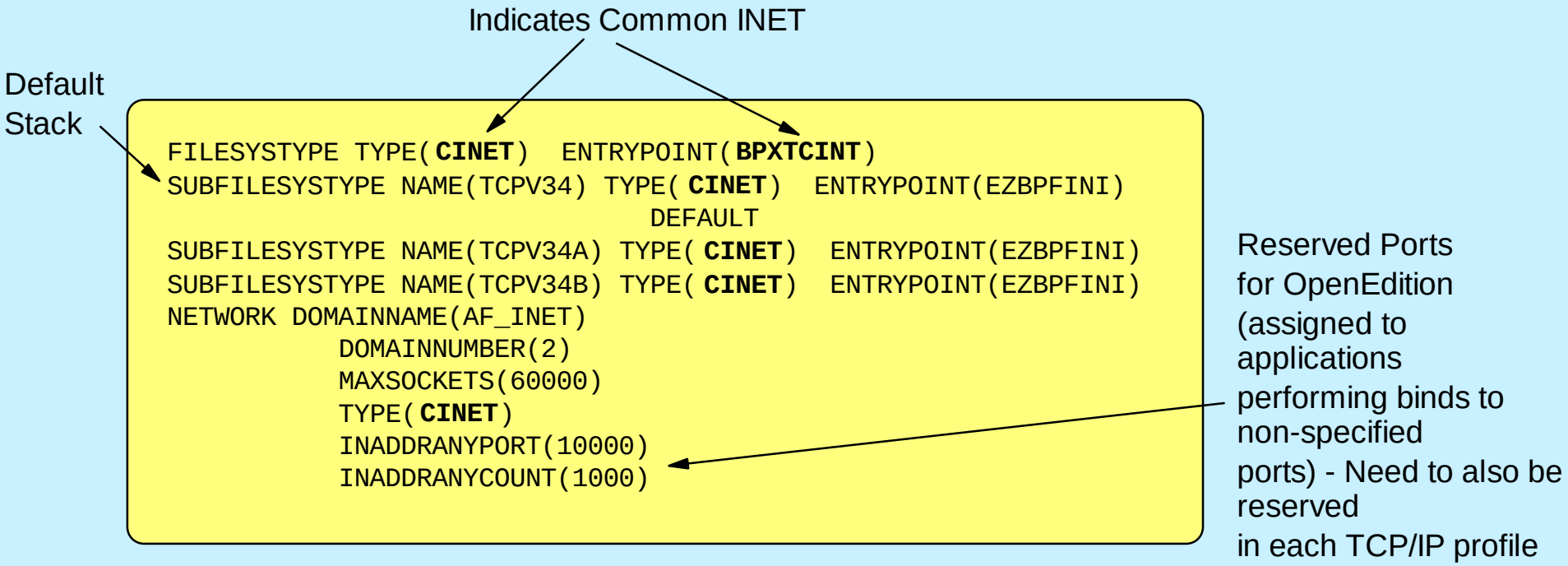
- A single-stack configuration is by far the simplest to set up and manage as compared to a multi-stack configuration.
- If you must support both the UNIX version and the native MVS version of the telnet server, the remote execution server, and the remote shell server on their well-known port numbers - then you need a two-stack configuration.
- To avoid a two-stack configuration, even when you have to support both sets of one or more of the above mentioned servers, consider:
  - Use the UNIX rlogin server instead of the UNIX telnet server
  - Use alternate port numbers for one set of servers (the least frequently used)
- There is no capacity or performance benefits of running a multi-stack configuration with the new TCP/IP stack.
- If you are migrating from a non-UNIX environment that uses TCP/IP V3R2, you should start out with a single-stack environment.

Basic Changes for Multiple Stacks

- BPXPRM Changes
- Resolver Configuration Issues
- Generic Servers
- Commands for Multistack
  - Must specify Stack Name in Command:
    - e.g., D TCPIP,TCPIP1A,N,CONFIG

Multiple Stacks: BPXPRMnn

- Establishing a Common INET environment
  - Multiple stacks - Common INET file system type (CINET)
  - Sample Definition in **BPXPRMnn** parmlib member



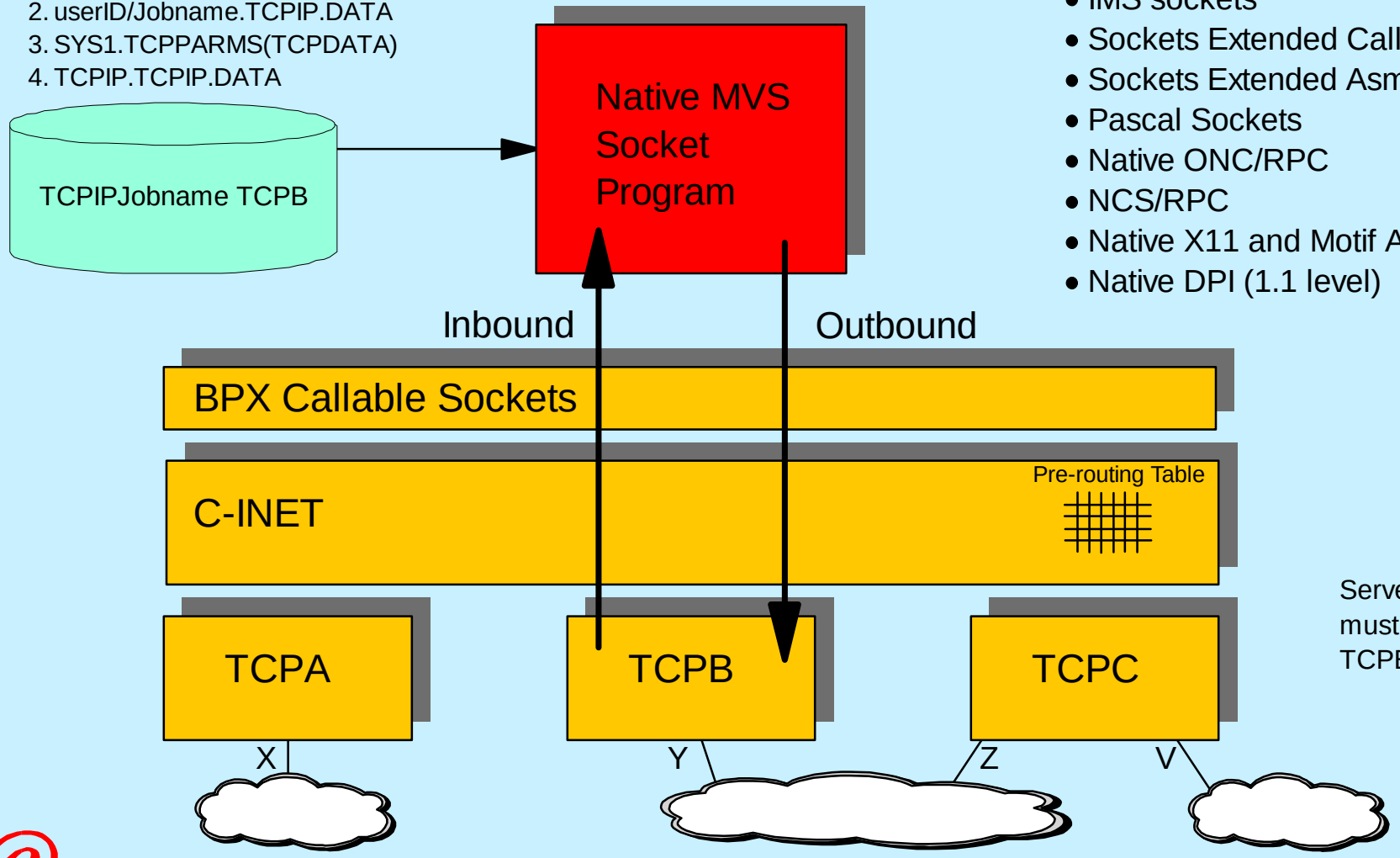
SUBFILESYSTYPE NAME keyword refers to Jobname/address-space name of TCP/IP started task; not the started task user ID of the TCP/IP started task.

Native MVS Socket Programs

Standard search order for TCPIP.DATA:

1. //SYSTCPD DD statement
2. userID/Jobname.TCPIP.DATA
3. SYS1.TCPPARMS(TCPDATA)
4. TCPIP.TCPIP.DATA

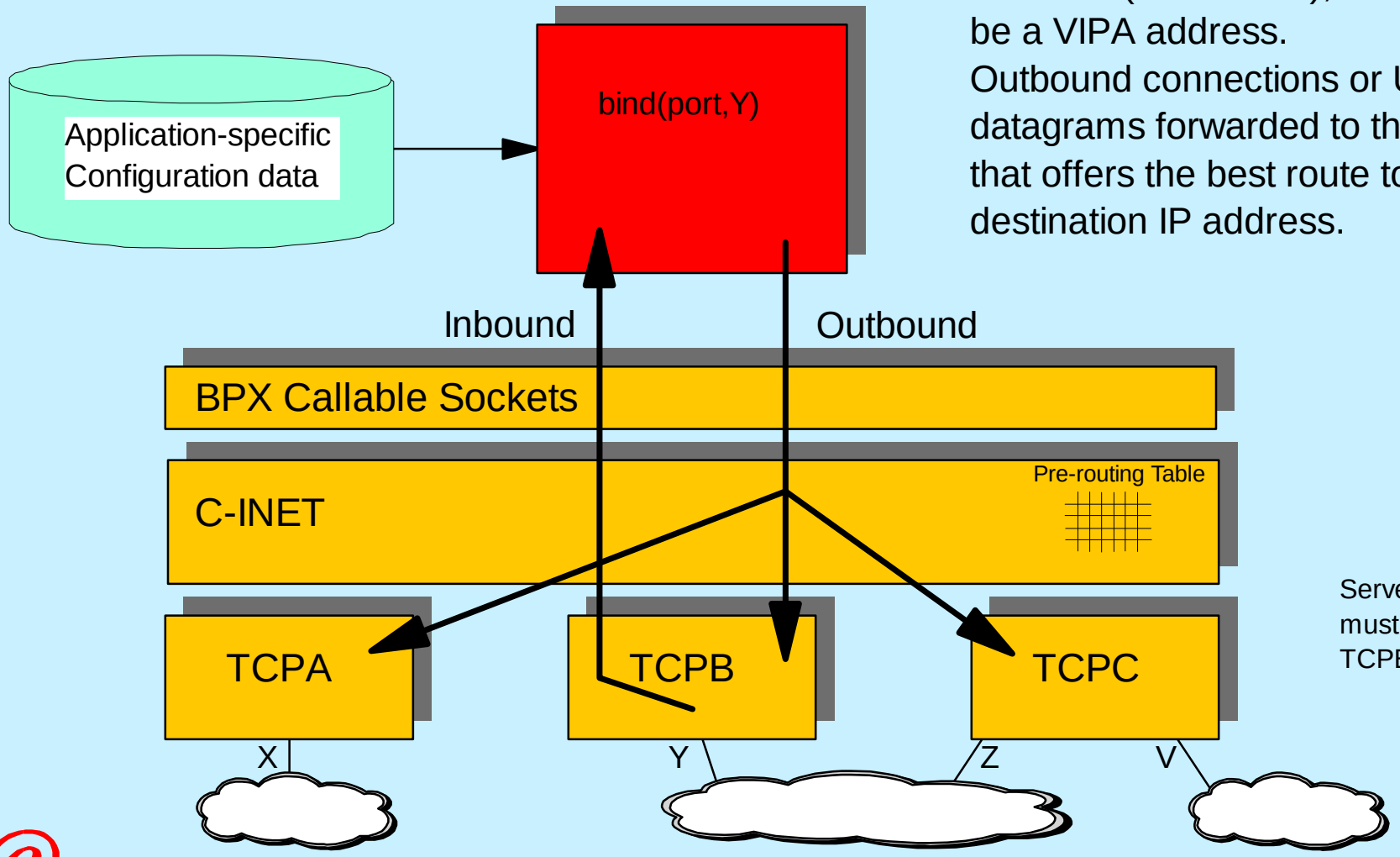
- TCP/IP C-sockets
- CICS sockets
- IMS sockets
- Sockets Extended Call API
- Sockets Extended Asm. macro API
- Pascal Sockets
- Native ONC/RPC
- NCS/RPC
- Native X11 and Motif APIs
- Native DPI (1.1 level)



Server port number must be reserved in TCPB.

BIND-Specific UNIX Socket Program

Will accept incoming connections or UDP datagrams over specified interface (IP address), which could be a VIPA address.
Outbound connections or UDP datagrams forwarded to the stack that offers the best route to the destination IP address.



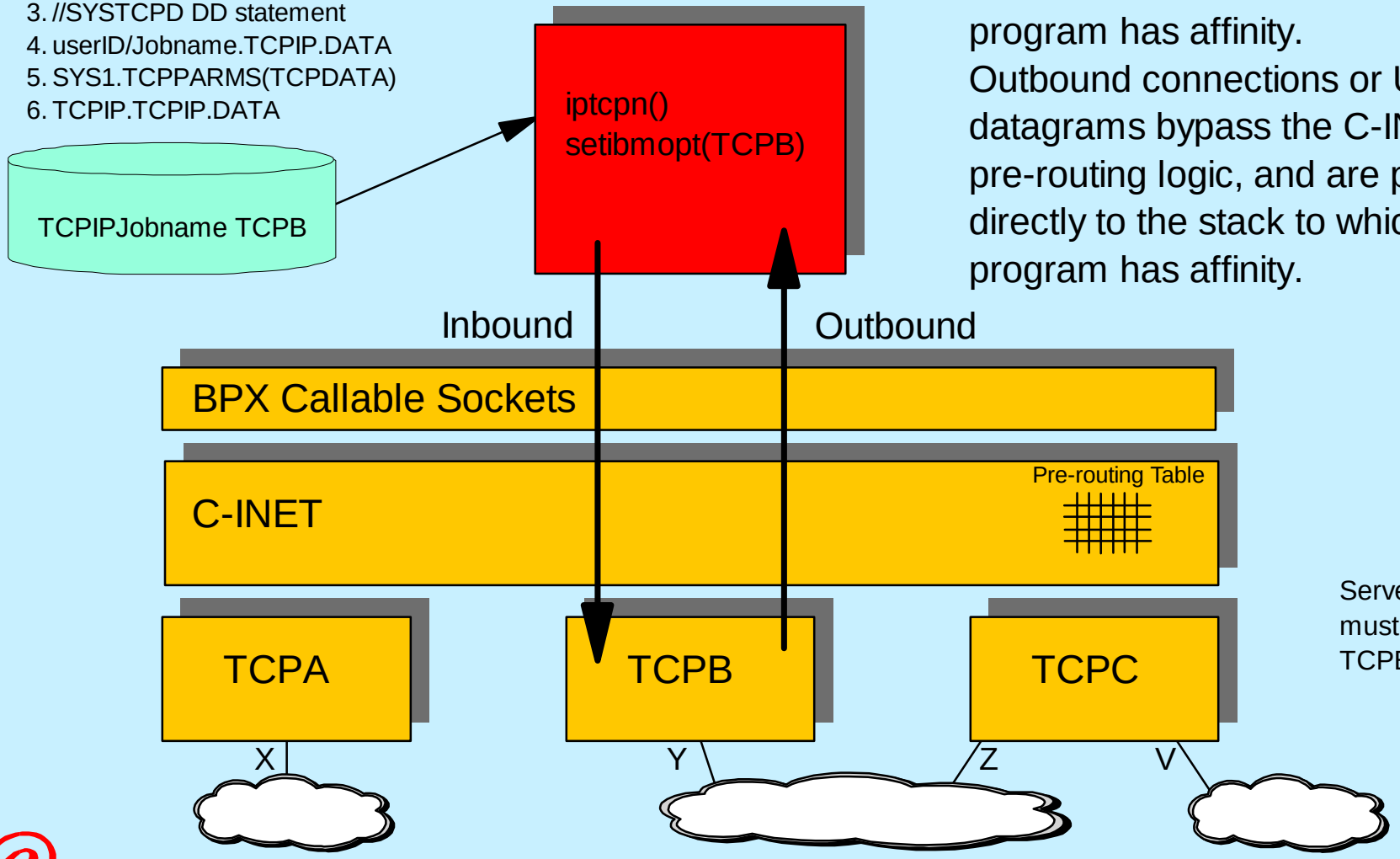
Server port number must be reserved in TCPB.

Stack-Affinity UNIX Socket Program

Standard search order for resolver configuration file:

1. RESOLVER_CONFIG environment variable
2. /etc/resolv.conf
3. //SYSTCPD DD statement
4. userID/Jobname.TCPIP.DATA
5. SYS1.TCPPARMS(TCPDATA)
6. TCPIP.TCPIP.DATA

Will accept incoming connections or UDP datagrams over any interface of the stack to which the program has affinity.
Outbound connections or UDP datagrams bypass the C-INET pre-routing logic, and are passed directly to the stack to which the program has affinity.

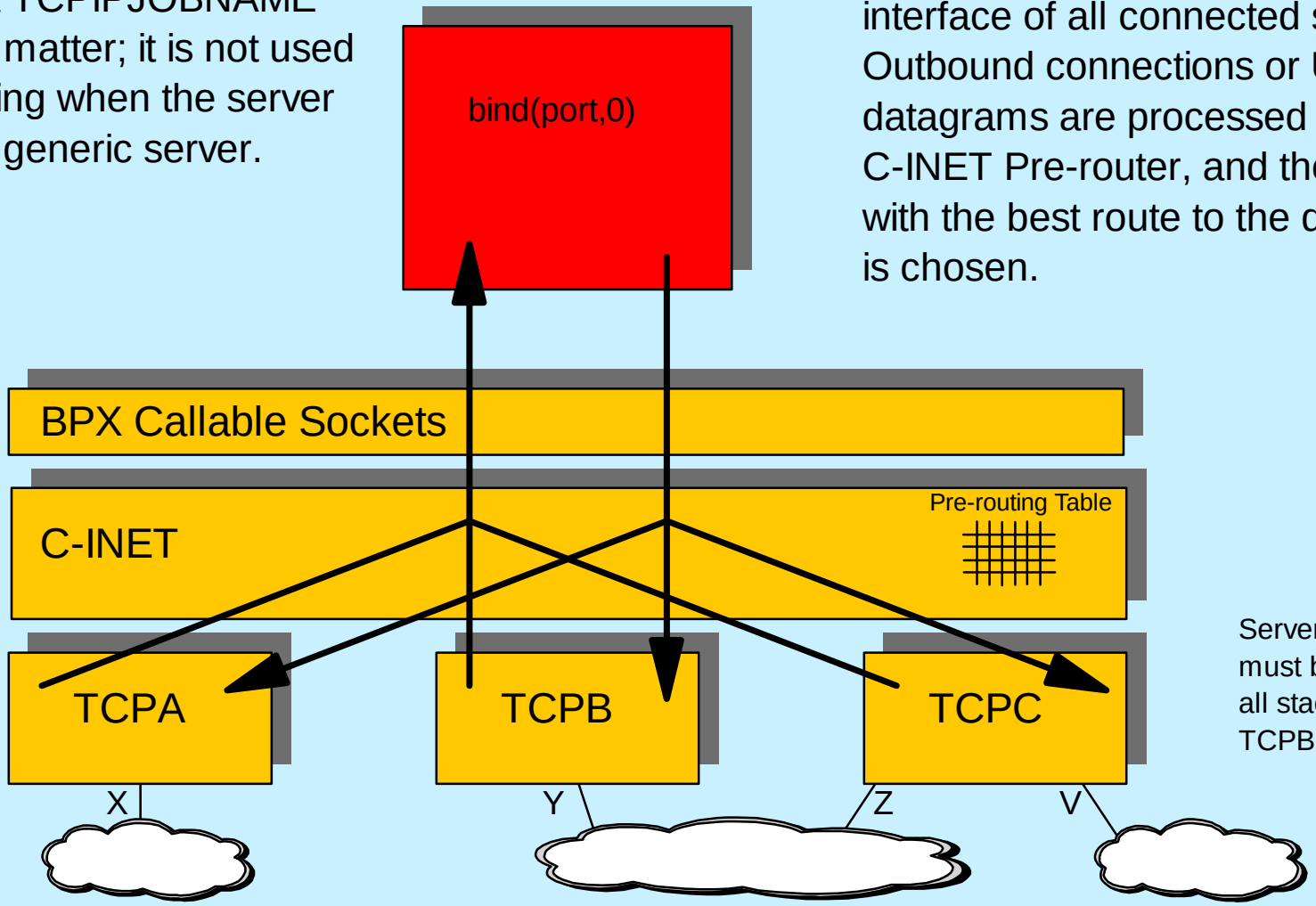


Server port number must be reserved in TCPB.

Generic UNIX Socket Program

If the chosen resolver configuration file has a TCPIPJOBNAME does not matter; it is not used for anything when the server is a pure generic server.

Will accept incoming connections or UDP datagrams over any interface of all connected stacks. Outbound connections or UDP datagrams are processed by the C-INET Pre-router, and the stack with the best route to the destination is chosen.



Server port number must be reserved in all stacks: TCPA, TCPB, and TCPC.

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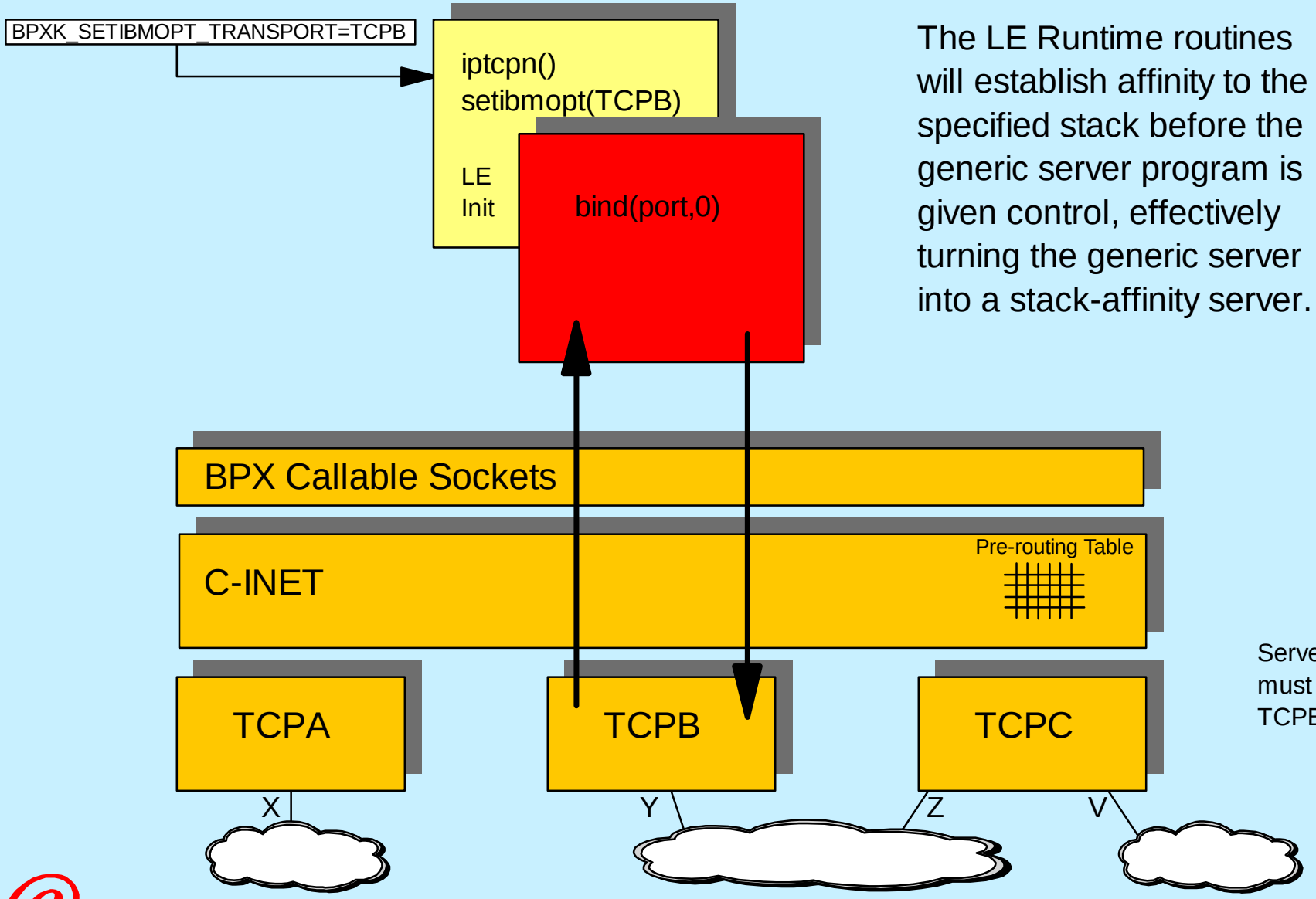
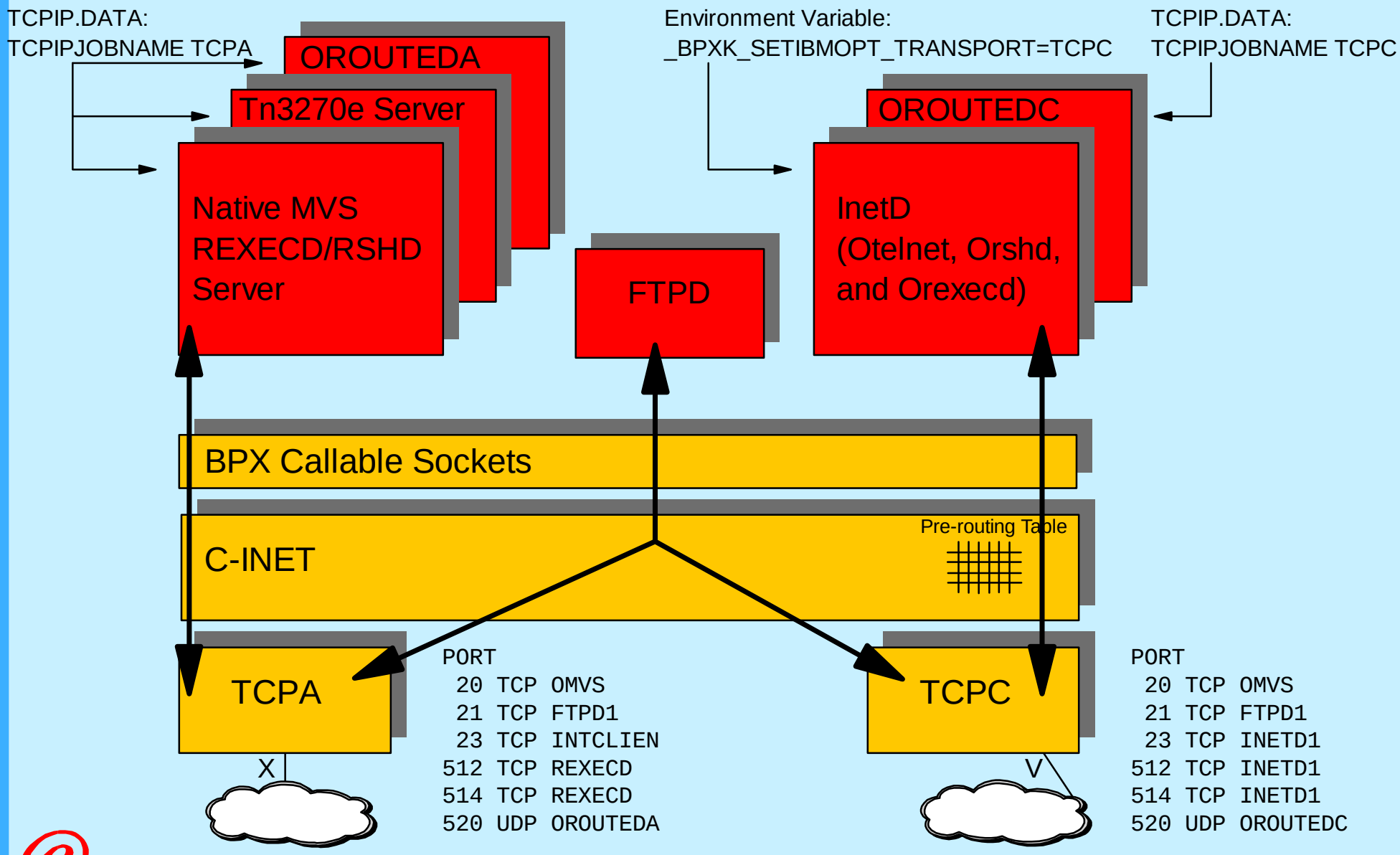
Converting UNIX Socket Program from Generic to Stack-Affinity



The LE Runtime routines will establish affinity to the specified stack before the generic server program is given control, effectively turning the generic server into a stack-affinity server.

Server port number must be reserved in TCPB.

Using Single Port: Native MVS & UNIX Servers



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Controlling Applications with Multi-Stack

To control which stack(s) a socket program uses in a multi-stack environment, the following information is needed:

1. Is the program a native MVS socket program?
   - ➡ Use standard TCPIP.DATA with TCPIPJOBNAME.

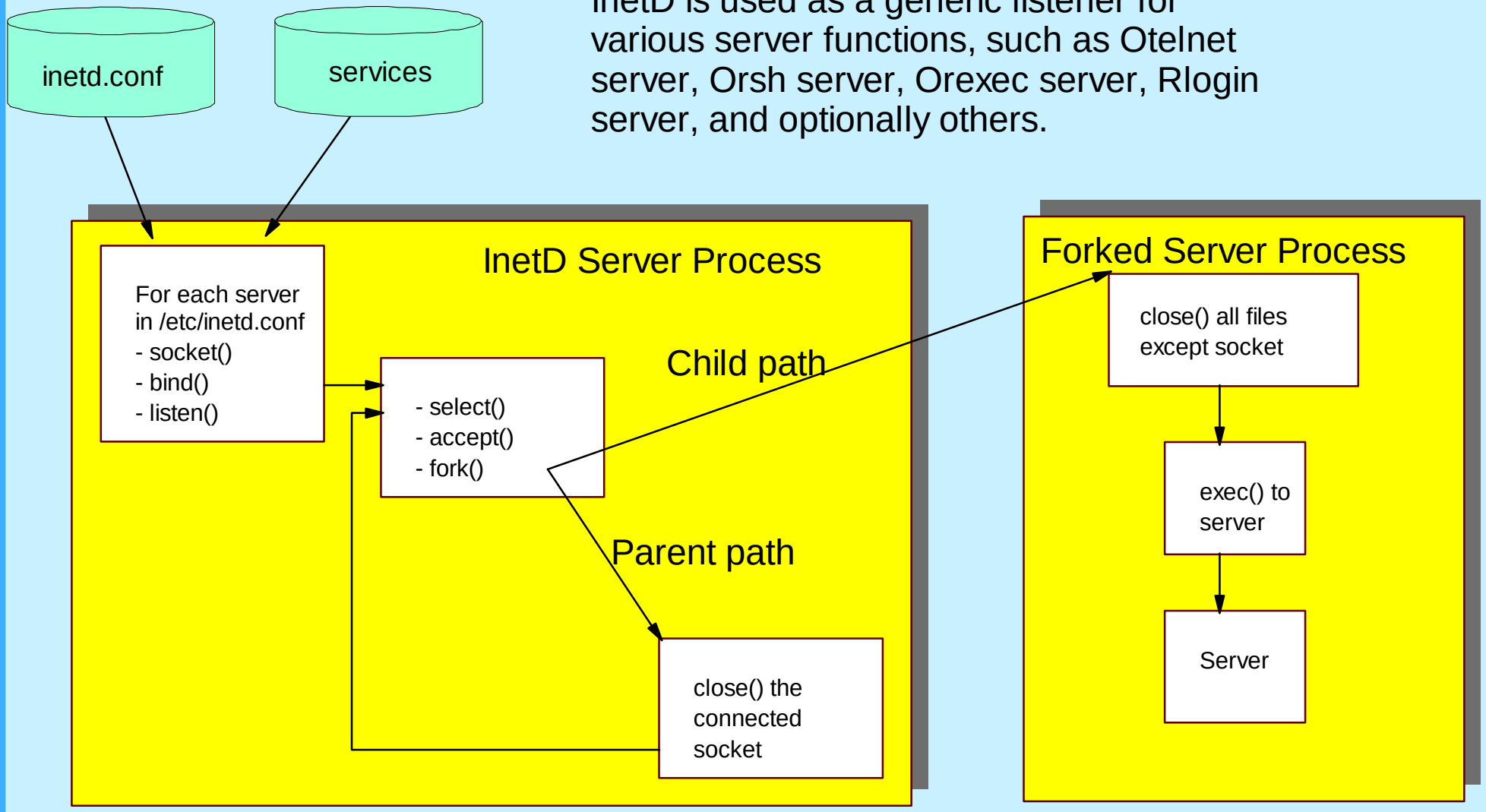
2. Is the program a bind-specific UNIX socket program?
   - ➡ Use application's configuration options to specify which IP address to accept incoming traffic over. Optionally use _BPXK_SETIBMOPT_TRANSPORT to establish stack-affinity for outbound traffic (can be used in JCL only!).

3. Is the program a stack-affinity UNIX socket program?
   - ➡ Use resolver configuration file with TCPIPJOBNAME to specify which stack to establish affinity to.

4. Is the program a generic UNIX socket program?
   - ➡ Use _BPXK_SETIBMOPT_TRANSPORT to establish stack-affinity (if so is desired; you may want some generic servers to execute as generic servers).

INETD Overview

InetD is used as a generic listener for various server functions, such as Otelnet server, Orsh server, Orexec server, Rlogin server, and optionally others.



INETD Definition Samples

InetD Configuration File

```
otelnet   stream tcp nowait bpxroot /usr/sbin/otelnetd otelnetd -l
shell     stream tcp nowait BPXROOT /usr/sbin/rshd rshd -LV
login     stream tcp nowait BPXROOT /usr/sbin/rlogind rlogind -m
exec      stream tcp nowait BPXROOT /usr/sbin/rexecd rexecd -LV
```

Services File

```
otelnet 623/tcp
exec    512/tcp
login   513/tcp
shell   514/tcp cmd
```

Start with UNIX /etc/rc

```
# Start the SYSLOG daemon for logging UNIX activity
_BPX_JOBNAME='SYSLOGD' /usr/sbin/syslogd -f /etc/syslog.conf
&
#  /usr/sbin/syslogd -f /etc/syslog.conf &
# Start the INET daemon for remote login activity
_BPX_JOBNAME='INETD' /usr/sbin/inetd /etc/inetd.conf &
#  /usr/lpp/tcpip/sbin/dhcpsd -f /etc/dhcpsd.cfg &
# Start the CRON daemon for automated, timed operations
_BPX_JOBNAME='CRON' /usr/sbin/cron &
#          /usr/sbin/cron &
sleep 5
echo /etc/rc script executed, `date`
```

Selected Socket Servers

Function	Language	Socket API	Server-type
OSNMPD	C/C++	OE C-Sockets	Stack-Affinity Server
SMTP NJE Gateway	Pascal	Pascal Sockets	Native MVS
FTP Server	C/C++	OE C-Sockets	Generic
FTP Client	C/C++	OE C-Sockets	Stack-Affinity Client
Tn3270(e)	PLX/Assembler	BPX Callable Sockets	Stack-Affinity Server
OE Telnet Server	C/C++	OE C-Sockets	Generic (INETD)
LPD Server	Pascal	Pascal Sockets	Native MVS
REXECD/RSHD Server	C/C++	TCP/IP C-Sockets	Native MVS
OE REXECD	C/C++	OE C-Sockets	Generic (INETD)
OE RSHD	C/C++	OE C-Sockets	Generic (INETD)
NCPROUTE	C/C++	TCP/IP C-Sockets	Native MVS
OE RouteD Server	C/C++	OE C-Sockets	Stack-Affinity Server
OE DNS Server	C/C++	OE C-Sockets	Stack-Affinity Server
OE TFTP Server	C/C++	OE C-Sockets	Generic Server
OE DHCP Server	C/C++	OE C-Sockets	Generic Server
ADSM	PLX/Assembler	Sockets Extended Macro	Native MVS
MQ Series	PLX/Assembler	BPX Callable Sockets	MQ configuration option
DB2 DRDA	PLX/Assembler	BPX Callable Sockets	TBD
SAP R3 Database Server	C/C++	OE C-Sockets	TBD
NFS	C/C++	OE C-Sockets	?
Domino Go Web Server	C/C++	OE C-Sockets	Bind-specific/Generic Server
Domino/390	C/C++	OE C-Sockets	Generic Server

Appendix A

Comparison: Formats of PROFILE.TCPIP V3R2 vs. V2R5+

e-business

Old TCP/IP PROFILE V3R2

```
; ------------------------------------------------------------
;                MVS TCP/IP Version 3 Release 2
;
; ------------------------------------------------------------
;
; The various pool sizes can be customized for your environment.
; Please see the Planning and Customization manual for details on
; improving your system's overall performance by changing these
; values.
ACBPOOLSIZE                1000
LARGEENVELOPEPOOLSIZE      50   8192
SMALLDATABUFFERPOOLSIZE    1200
TINYDATABUFFERPOOLSIZE     500
;
; ------------------------------------------------------------
NOTRACE SCREEN
; Inform the following users of serious errors
INFORM
    GDENTE
ENDINFORM
;
OBEY
  GDENTE ROUTED SNMPQE SNMPD
ENDOBEY
```

Gone!

Old TCP/IP PROFILE V3R2

```
; Flush the arp tables every 5 minutes
ARPAGE 5
SYSCONTACT
  GDENTE (T/L xxx-xxxx)
ENDSYSCONTACT
;
SYSLOCATION
   IBM Networking Systems Center
ENDSYSLOCATION
;
DATASETPREFIX TCPIP.V3R2G
; ------------------------------------------------------------------
; Hardware definitions:
;   OFFLOAD for 3172
;
DEVICE   OFFDEV         CLAW   340   TCPIP   OS2TCP  NONE
LINK     OFFIPLINK      OFFLOADLINK1     1           OFFDEV
LINK     OFFTR1         OFFLOADAPIBROAD  9.67.38.1   OFFDEV  OFFIPLINK
;
; IUCV1 represents an IUCV connection to a second MVS TCP/IP V3.2
; stack running on the same processor or LPAR
DEVICE   IUCV1     IUCV      XYZZY     XYZZY     TCPIP2    A
LINK     ILINK1    IUCV      1         IUCV1
;
PRIMARYINTERFACE OFFTR1
```

Changed or Gone!

(ARPAGE > ARPTO)

Changed Meaning!

Old TCP/IP PROFILE V3R2

```
; AUTOLOG the following servers.
AUTOLOG
    EZAFTSRV     ; FTP C SERVER V3R2
    ROUTED       ; RouteD Server
ENDAUTOLOG
;
; ------------------------------------------------------------------
; Reserve PORTs for the following servers.
PORT
;   20 TCP FTPSERVE  NOAUTOLOG ; FTP Server (default data port)
;   21 TCP FTPSERVE            ; FTP Server
    20 TCP EZAFTSRV  NOAUTOLOG ; FTP C Server (default data port)
    21 TCP EZAFTSRV            ; FTP C Server
    23 TCP INTCLIEN            ; TELNET Server
;
; ------------------------------------------------------------------
;
; HOME Internet addresses of each link in the host.
;

HOME
;   9.nn.yy.170    VLINK1   ;this address needs to be verified as valid
    9.nn.y.170     TR1
```

Gone! New FTP and OROUTED Servers

Changed Port 20 on new FTP Server

Old TCP/IP PROFILE V3R2

```
;
ASSORTEDPARMS
  IGNOREREDIRECT
; NOFWD
; SOURCEVIPA
  TCPIPSTATISTICS
  VARSUBNETTING
ENDASSORTEDPARMS
;
NOOE
;
GATEWAY
;
; ; Static Routing information
; ; See also BSDROUTINGPARMS below
;
; Network  First hop   Driver   Packet size  Subnet mask  Subnet value
;
  DEFAULTNET 9.82.1.103  TR1       2000       0
;
;BSDROUTINGPARMS false
;   VLINK1    2000       0     255.255.255.0   0
;   TR1       2000       0     255.255.255.0   0
;ENDBSDROUTINGPARMS
```

Converted!

Gone, OE Automatic and Required!

Extra Capability; Multiple Defaults!

Old TCP/IP PROFILE V3R2

```
TRANSLATE
; Set Telnet timeout to 10 minutes
INTERNALCLIENTPARMS TIMEMARK 600 ENDINTERNALCLIENTPARMS
; Define the VTAM parameters required for the TELNET server
BEGINVTAM
; Define logon mode tables to be the defaults shipped with the latest
3278-3-E NSX32703 ; 32 line screen - default of NSX32702 is 24 line screen
; Define the LUs to be used for general users
DEFAULTLUS
      TCP20001 TCP20002 TCP20003 TCP20004 TCP20005
ENDDEFAULTLUS
IPGROUP MSG10   255.255.255.0:9.nn.y.0 ENDIPGROUP
USSTCP USSTCPIP TR1   ; Establish default USS association for all
                    ; hosts in IPGROUP MSG10
LUSESSIONPEND    ; On termination of a TELNET server connection
                    ; the user will revert to the DEFAULTAPPL
DEFAULTAPPL NVAS2 ; Set default application for all TELNET sessions
LINEMODEAPPL TS2  ; Send all line mode terminals directly to TSO
ALLOWAPPL TSO* DISCONNECTABLE
ALLOWAPPL *
ENDVTAM
; ------------------------------------------------------------------
; Start all defined devices.
START LCS1
```

Gone

Converted

Converted

TCP/IP Profile in CS for OS/390 V2Rn

```
TCPCONFIG
;   INTerval  5                ; In minutes - Keep alive packet 0-35791
;   RESTRICTLowports
    UNRESTRICTLowports
    TCPSENDBfrsize  16384      ; Range is 256-256K - Default is 16K
    TCPRCVBufrsize  16384      ; Range is 256-256K - Default is 16K
;   TCPMAXRCVBufrsize 256K     ; V2R6 for RFC 1323 (Long Fat Pipes)
    SENDGARBAGE FALSE          ; Packet contains no data
;   SENDGARBAGE TRUE           ; Packet contains 1 byte of random data

UDPCONFIG
;   RESTRICTLowports
    UNRESTRICTLowports
    UDPCHKsum                   ; Do checksum
;   NOUDPCHKsum                 ; Don't do checksum
    UDPSENDBfrsize 16384        ; Range is 1 - 65535- Default is 16K
    UDPRCVBufrsize 16384        ; Range is 1 - 65535- Default is 16K
;   UDPQueuelimit               ; Limit inbound UDP Queue
;   NOUDPQueuelimit             ; Do not Limit inbound UDP Queue
```

TCP/IP Profile in CS for OS/390 V2Rn

```
IPCONFig
   ARPTO  300             ; In seconds (ARPAGE was MINUTES)
;  CLAWUSEDoublenop       ; Applies only to first-level MVS systems
   DATAGRamfwd
;  NODATAGRamfwd
;  DYNAMICXCF IPAddress subnetmask metric    ; V2R7
;  NODYNAMICXCF                              ; V2R7
;  FIREWALL
   NOSOURCEVIPA
;  SOURCEVIPA
;  NOVARSUBNETTING        ; For RIPV1
   VARSUBNETTING          ; For RIPV2
;  NOSYSPLEXRouting
;  SYSPLEXRouting
   IGNORERedirect
;  NOMULTIPATH  ; V2R6
;  MULTIPATH    ; V2R6
;  NOPATHMTUDISCovery    ; V2R7
;  PATHMTUDISCovery      ; V2R7
   REASSEMBLytimeout 15 ; In seconds
   STOPONclawerror
   TTL    60              ; In seconds, but actually Hop count
```

TCP/IP Profile in CS for OS/390 V2Rn

```
SACONFig
   COMMUNity FRED
;  COMMUNity communit_string
;  OSASF -1
;  OSASF osasf_port_number
   AGENT 161
;  AGENT agent_port_number
;  DISABLed
   ENABLed
;  SETSDISAbled
;  SETSENAbled
;  ATMENabled

ROUTESA_CONFIG
   COMMUNity FRED
;  COMMUNity communit_string
   AGENT 161
;  AGENT agent_port_number
;  DISABLed
   ENABLed
```

TCP/IP Profile in CS for OS/390 V2Rn

```
;SMFCONFIG
;  TCPINIT
;  NOTCPINIT
;  TCPTERM
;  NOTCPTERM
;  FTPCLIENT
;  NOFTPCLIENT
;  TN3270CLIENT
;  NOTN3270CLIENT
;  TCPIPStatistics
;  NOTCPIPStatistics
; PKTTRACE FULL .. OFF
; ITRACE ON CONFIG SUBAGENT
;
```

TCP/IP Profile in CS for OS/390 V2Rn

```
AUTOLOG 5
   NM2AROU JOBNAME NM2AROU    ; RouteD Server
   NM2AFTP JOBNAME NM2AFTP1   ; FTP Server
;  NM2ASYSL                   ; SYSLOG Daemon as PROC
;  NM2AINET                   ; INETD started as PROC for OTELNETD, et
ENDAUTOLOG
PORT
    20 TCP OMVS NOAUTOLOG       ; FTP Server
    21 TCP NM2AFTP1             ; FTP Server
    23 TCP INTCLIEN             ; Telnet Server
   723 TCP INTCLIEN             ; Telnet Server for dual block capabi
    25 TCP OMVS                 ; Sendmail server
    37 TCP NM2ATIME NOAUTOLOG   ; TIMED Server
    53 TCP NM2ADNSA             ; Domain Name Server - Parent Process
    53 UDP NM2ADNSA             ; Domain Name Server - Parent Process
    80 TCP NM2AWEB1 SHAREPORT    ; Domino base webserver (NM2AWEBn)
    80 TCP NM2AWEB2
```

TCP/IP Profile in CS for OS/390 V2Rn

```
; ------------------------------------------------------------
; Hardware definitions:
;
DEVICE   CTC1      CTC        528  IOBUFFERSIZE 32768 AUTORESTART
LINK     CLINK1    CTC        1    CTC1
;   VIPA Devices
DEVICE   VDEV1     VIRTUAL    0
LINK     VLINK1    VIRTUAL    0    VDEV1
DEVICE   VDEV2     VIRTUAL    1
LINK     VLINK2    VIRTUAL    0    VDEV2
;   IUTSAMEH represents an internal connection to a second stack
;   running on the same processor or LPAR (For reference: SAMEHOST
;   connections replaced IUCV connections from previous versions/
;   releases of MVS TCP/IP.)  Or for ENTERPRISE Extender
 DEVICE   IUTSAMEH  MPCPTP
 LINK     LNK2BTCP  MPCPTP    IUTSAMEH
```

TCP/IP Profile in CS for OS/390 V2Rn

```
; LCS devices
DEVICE   LCS1       LCS        3F0    IOBUFFERSIZE 20480 AUTORESTART
LINK     TR1        IBMTR      0      LCS1
;
; ***************************************************
; MPC Definition
; VTAM requirement for TRLE Definition in VTAM VBUILD=TRL
; The DEVICE name must match the TRLE name in VTAM
; The TRLE entry must have MPCLEVEL=HPDT (default)
; Support is for ESCON and 2216
; ***************************************************
;DEVICE TRL2216A MPCPTP  AUTORESTART
;LINK   TRL2216A MPCPTP TRL2216A
; ***************************************************
; SNALU03 represents an SNALink connection to HANSL.
; ***************************************************
;DEVICE   SNALU03   SNAIUCV   SNALINK   LHNCST1N  NM2ASL2
;LINK     SNA4      SAMEHOST  4         SNALU03
```

TCP/IP Profile in CS for OS/390 V2Rn

```
; ************************************************************
;XCF Definition
; VTAM requirement for TRLE Definition in VTAM VBUILD=TRL
; The DEVICE name must match the TRLE name in VTAM
; The TRLE entry must have MPCLEVEL=HPDT (default)
; Support is for ESCON and 2216
; ************************************************************
HOME
    192.168.251.1  VLINK1    ; 1st VIPA Link (for V2R6)
    192.168.251.3  VLINK2    ; 2nd VIPA Link (for V2R6)
    9.82.1.170     TR1       ;
    9.82.67.170    LNK2BTCP
    9.82.68.170    CLINK1
```

TCP/IP Profile in CS for OS/390 V2Rn

```
; ------------------------------------------------------------
;
; PRIMARYINTERFACE Statement has new meaning.  = Default Local
; Host for use by GETHOSTID() function.  If not specified, first
; Interface in HOME list is PRIMARYINTERFACE.
;
;; GATEWAY
; Network  First Hop  Link Name Packet Size  Subnet Mask  Subnet Valu
; 9.82.36.2       =      TRL2216A    16000     0.255.255.0  0.82.36.0
; 9               =      TR1         2000      0.255.255.0  0.82.1.0
; 9               =      LNK2BTCP    4000      0.255.255.0  0.82.67.0
; 172.16.0  192.168.1.2 ld2216      1400          0
; 192.168.194.0       =      LINK1  1500      0.0.0.224    0.0.0.32
; 192.168.194.0 192.168.1.2  ld2216 1500      0.0.0.224    0.0.0.32
; DEFAULT    9.82.36.2      TRL2216A    4000          0
; DEFAULT    9.24.105.127   EN1         4000          0
; DEFAULTNET 9.82.1.103     TR1         2000          0
```

TCP/IP Profile in CS for OS/390 V2Rn

```
;    Link      Maxmtu   Metric   Subnet Mask      Dest Addr
 BSDROUTINGPARMS true
    VLINK1       4000        0     255.255.255.0   0
    VLINK2       4000        0     255.255.255.0   0
    TR1          4000        0     255.255.255.0   0
    LNK2BTCP     4000        0     255.255.255.0   9.82.67.171
    CLINK1       4000        0     255.255.255.0   9.82.68.150
;   TRL2216A    16000        0     255.255.255.0   9.82.36.2
;   LINK3746     2000        0     255.255.255.0   9.82.60.1
 ENDBSDROUTINGPARMS
;; NOTE:  COMMENT out ASSORTEDPARMS for V2R5 to avoid confusion.

;ASSORTEDPARMS
;  NOFWD
;  RESTRICTLOWPORTS
;ENDASSORTEDPARMS
; NOFWD             issues the informational message EZZ0334I
; RESTRICTLOWPORTS issues the informational message EZZ0338I
```

No longer needed here - transferred to other places.

TCP/IP Profile in CS for OS/390 V2Rn

```
;INCLUDE TCP.TCPPARMS(TELN03A)
;********************************* Top of Data ***********************
; Member SYS1.TCPPARMS(telnet3a) telnet
; ******************************************************************
 TELNETPARMS
; TESTMODE
    PORT 23
    INACTIVE 3600
    TIMEMARK 1200
    SCANINTERVAL 1200
    DISABLESGA
    SMFINIT STD
    SMFTERM STD
;   WLMCLUSTERNAME TN3270E TN3270 TELNET ENDWLMCLUSTERNAME
 ENDTELNETPARMS
 BEGINVTAM
    PORT 23
    ; Define logon mode tables to be the defaults shipped with the
    ; latest level of VTAM
```

TCP/IP Profile in CS for OS/390 V2Rn

TN3270E Logmodes

```
BEGINVTAM
  PORT 23
TELNETDEVICE 3277     D4B32782          ; 24 x 80
TELNETDEVICE 3278-2   D4B32782,SNX32702 ; 24 x 80
TELNETDEVICE 3278-2-E NSX32702,SNX32702 ; 24 X 80
TELNETDEVICE 3278-3   D4B32783,SNX32703 ; 32 x 80,  primary 24 x 80
TELNETDEVICE 3278-3-E NSX32703,SNX32703 ; 32 X 80,  PRIMARY 24 X 80
TELNETDEVICE 3278-4   D4B32784,SNX32704 ; 43 x 80,  primary 24 x 80
TELNETDEVICE 3278-4-E NSX32704,SNX32704 ; 43 X 80,  PRIMARY 24 X 80
TELNETDEVICE 3278-5   D4B32785,SNX32705 ; 27 x 132, primary 24 x 80
TELNETDEVICE 3278-5-E NSX32705,SNX32705 ; 27 X 132, PRIMARY 24 X 80
TELNETDEVICE 3279-2   D4B32782          ; 24 x 80
TELNETDEVICE 3279-2-E NSX32702          ; 24 X 80
TELNETDEVICE 3279-3   D4B32783          ; 32 x 80,  primary 24 x 80
TELNETDEVICE 3279-3-E NSX32703          ; 32 X 80,  PRIMARY 24 X
```

TCP/IP Profile in CS for OS/390 V2Rn

Symbolics and Fully-Qualified Hostnames (V2R7)

```
TELNETDEVICE 3279-5-E NSX32705      ; 27 X 132, PRIMARY 24 X 80
  TELNETDEVICE LINEMODE INTERACT    ; linemode terminals
  TELNETDEVICE DYNAMIC    ,D4C32XX3 ; tbd by application (QUERY)
  TELNETDEVICE 3287-1     ,DSC2K    ; printer 2 kbyte bfr LU3
    ; Define the LUs to be used for general users.
  DEFAULTLUS
;     TCP20P01 .. TCP20P03 ; printers
      TCP20001 .. TCP20005
  ENDDEFAULTLUS
  PRTGROUP PRTLUS TCP20P01 TCP20P01 TCP20P03 ENDPRTGROUP
  LUGROUP TCPHOD TCP20031 TCP20032 TCP20033 ENDLUGROUP
  LUGROUP TSTGROUP TST&SYSCLONE.TN01 .. TST&SYSCLONE.TN03
  IPGROUP MSG10   255.255.255.0:9.82.1.0 ENDIPGROUP
  HNGROUP TCPGRP fred.washington.ibm.com ENDHNGROUP
  LUMAP TCP20009 TCPGRP SPECIFIC
; LUMAP TCP20031 9.82.1.161 GENERIC TCP20P01
  LUMAP TCPHOD 9.82.1.161 GENERIC PRTLUS
  USSTCP USS25A             ;       default USS association for
```

TCP/IP Profile in CS for OS/390 V2Rn

```
  LUSESSIONPEND    ; On termination of a TELNET server connection
                   ; the user will revert to the DEFAULTAPPL
  MSG07            ; To send error message 07 back to USSTAB
  DEFAULTAPPL NVAS2;
  LINEMODEAPPL TS2  ; Send all line mode terminals directly to TSO
  ALLOWAPPL TSO* DISCONNECTABLE ;
  ALLOWAPPL * ; Allow all applications that have not been previously
              ; specified to be accessed
ENDVTAM
; Start all the defined devices.
START LCS1
;START SNALU03
START IUTSAMEH      ; IUTSAMEH LINK (Enterprise Ext + 2nd stack)
; START TRL2216D    ; MPC+ link to 2216D at addr. 6EA/6EB
; START DEV3746     ; 900 frame
; START DCISET      ; CISCO
```


Ω
(The End, but We Hope It Was Not Greek to You!)
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