

E16

High Availability IMS Using TCP/IP

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Abstract

TCP/IP has evolved to become the accepted standard for networking. As a result, there is now an ever-increasing need to support interoperability over a TCP/IP network to access applications/data on host environments such as IMS. This session focuses on solutions that address generic routing and failover considerations in this environment. It also discusses the use of functions and capabilities that are available in both sysplex and non-sysplex configurations.

TCP/IP and IMS - Topics

▲ Primary requirements for IMS access

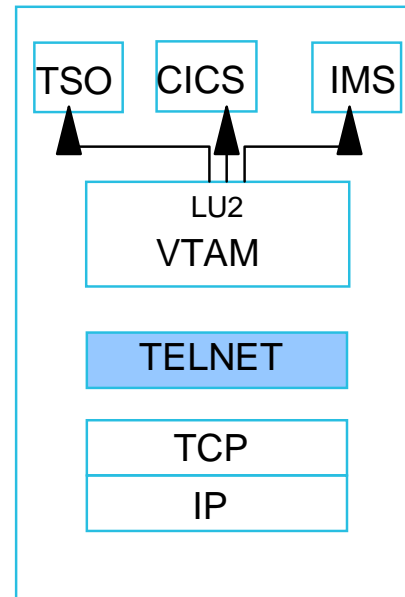
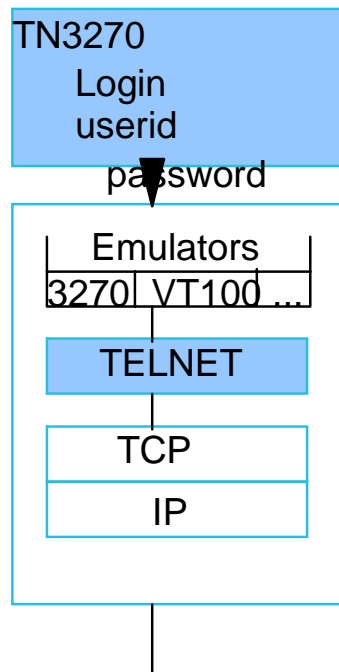
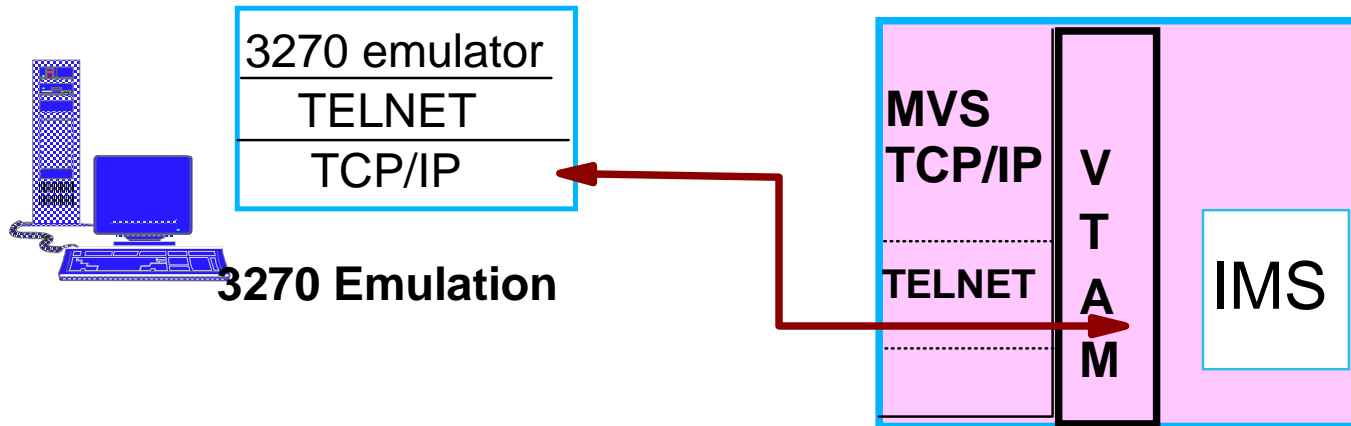
- Remote login - terminal emulation
- Printer support
- Program-to-program
 - ▶ Web access
 - ▶ Sockets support
 - **IMS Connect**
 - **Extended Sockets**

▲ Usability

- Workload distribution and failover
 - ▶ Network Dispatcher
 - ▶ Routers
 - ▶ VIPA
 - ▶ Sysplex Distributor

Internet

Remote Login - Terminal Emulation



```

BEGINVTAM
  ** LOGMODES **
  3278-2 LMD32782
  ...

  ** LU POOL **
  TCP00001 TCP00002
  TCP00003 TCP00004 ...
  ...

  ALLOWAPPL TSO
  ...

  RESTRICTAPPL IMS
  **e.g. only 3 users**

  USER user1 user2 user3
    
```

Remote Terminal Protocol (TELNET)

▲ Widely implemented "internet standard" application

▲ Provides login to remote/local host

- Allows a user at one site to establish a TCP connection to a login server (Telnet daemon) at another site
- Passes keystrokes from the user terminal and returns the output

▲ Provides "transparency"

- Gives the appearance that the user's terminal is directly attached to the remote machine

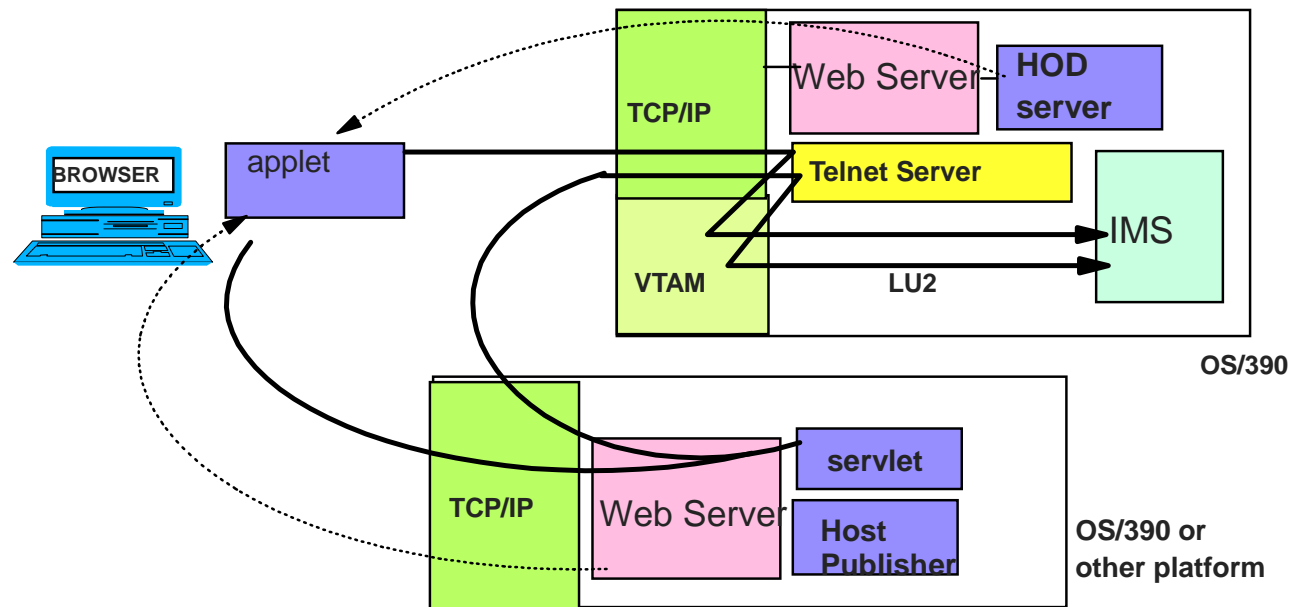
▲ TELNET server on MVS

- Establishes a session with IMS through VTAM
 - ▶ LU2
- Allows the TCP/IP client to access IMS transaction

Web Access Via Telnet

▲ Host On-Demand/ Host Integration Solution

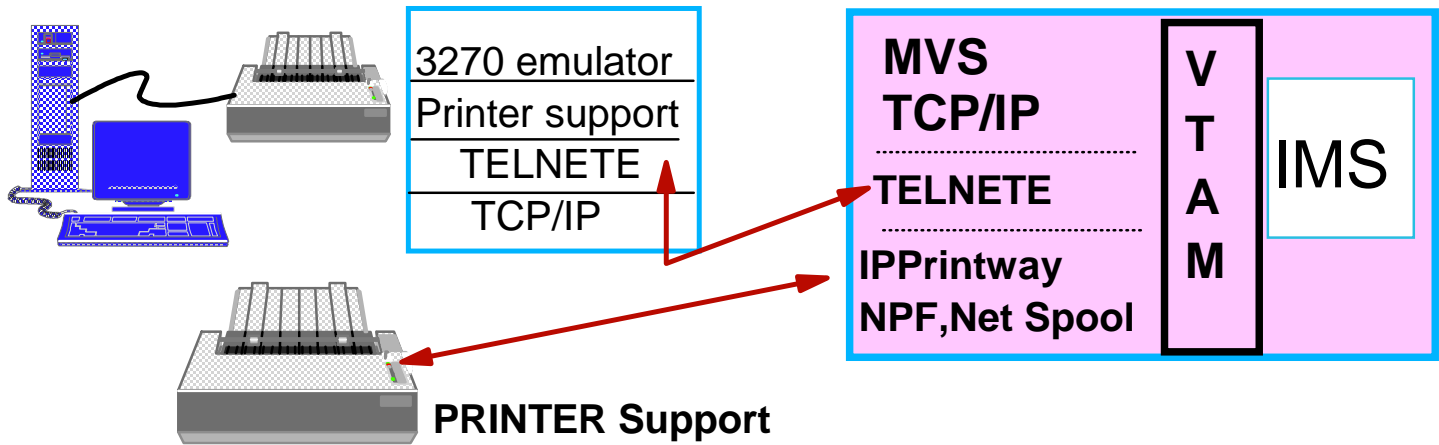
- Downloads a Java applet (includes a TN3270 emulator)
 - ▶ Provides GUI functions, screen customization
- Host Access Class Library API
 - ▶ Allows access to the emulator data stream to extend
 - ▶ Create customized e-business applications



▲ Host Publisher

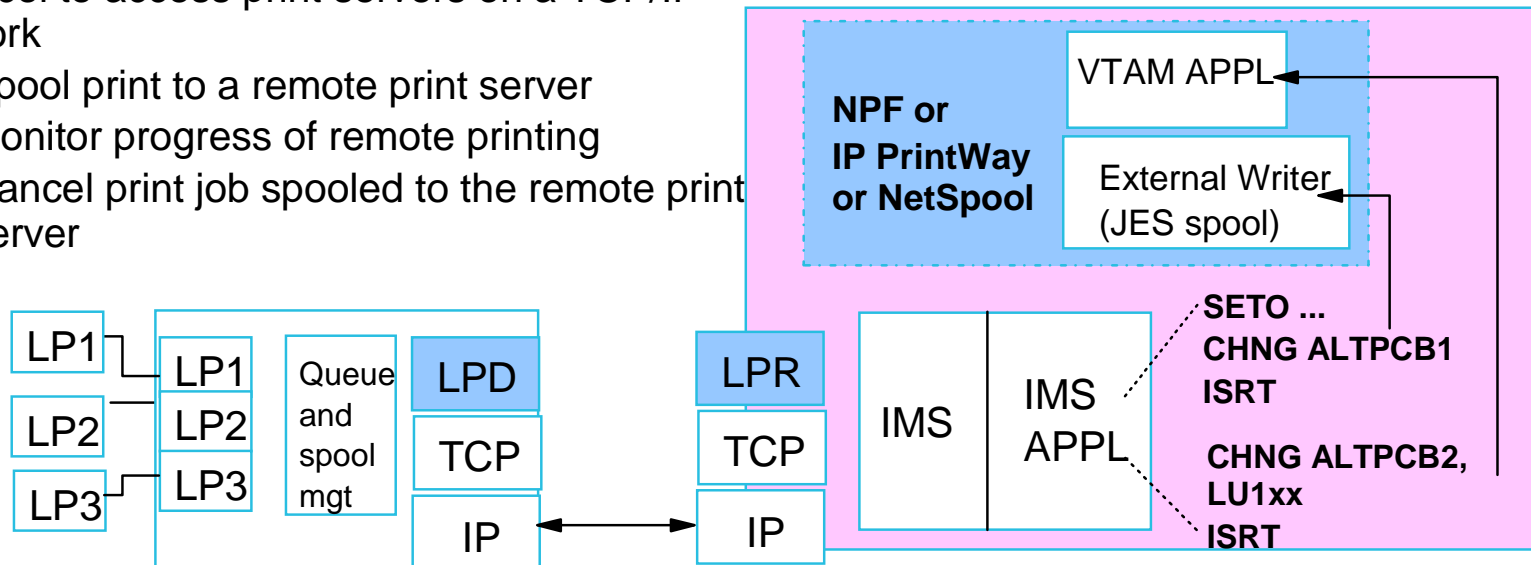
- Provides a servlet that provides the TN3270 client support

Printer Support

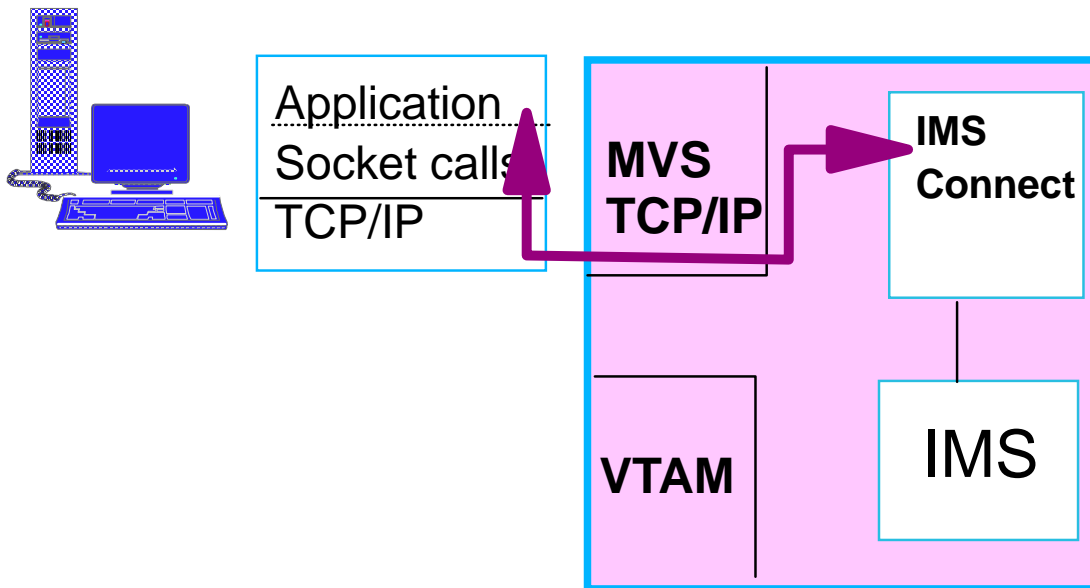


▲ Line printer Daemon Protocol (LPR/LPD)

- Protocol to access print servers on a TCP/IP network
 - ▶ Spool print to a remote print server
 - ▶ Monitor progress of remote printing
 - ▶ Cancel print job spooled to the remote print server



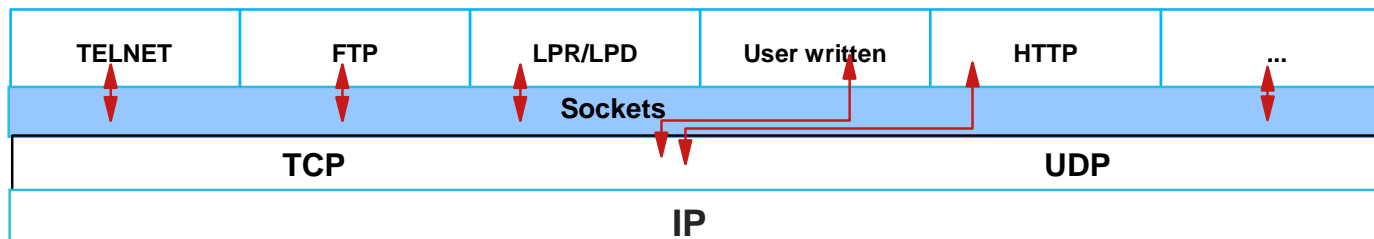
Program-to-Program



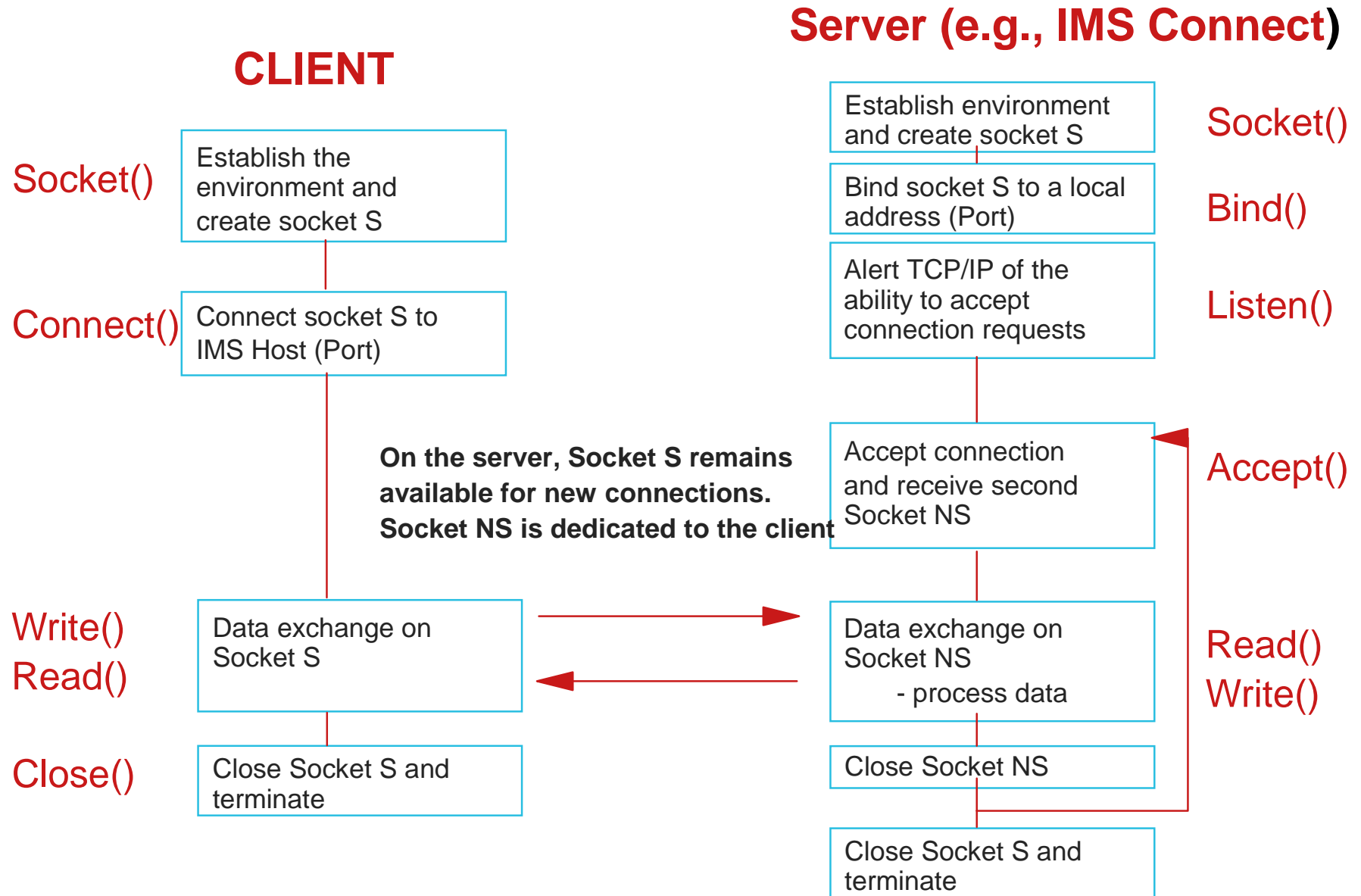
Program-To-Program Support

▲ Direct communication between two programs requires:

- "Sockets"
 - ▶ An endpoint for communication
 - Socket = (IP address, Port number)
 - Uniquely identifies an application
 - ▶ An api for programs to request communication services
 - Opens a socket (requests a connection)
 - Specifies the service desired (e.g., reliable stream delivery)
 - Binds a socket to a specific destination (PORT)
 - Sends or receives data

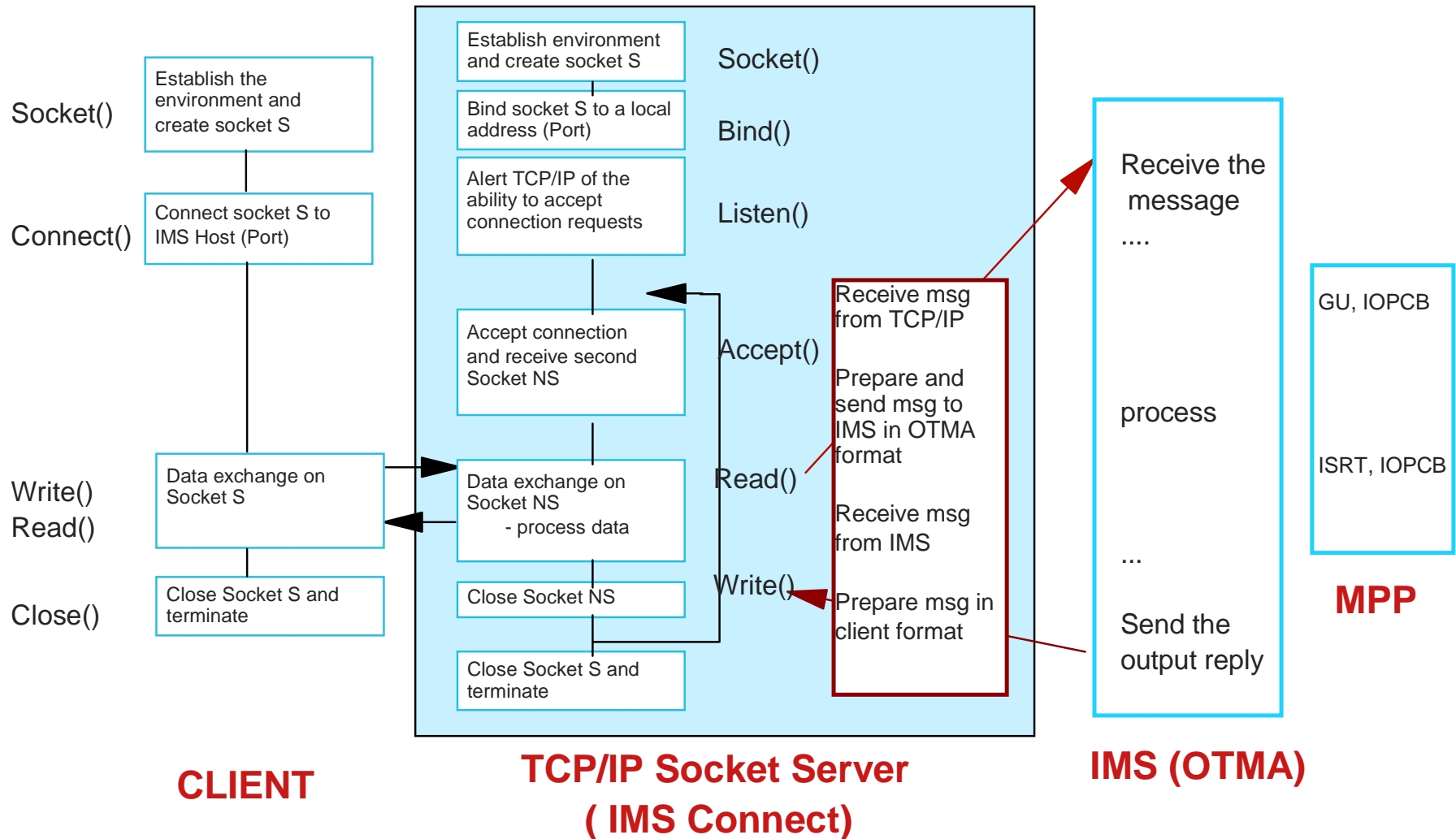


Socket Application Basic Design



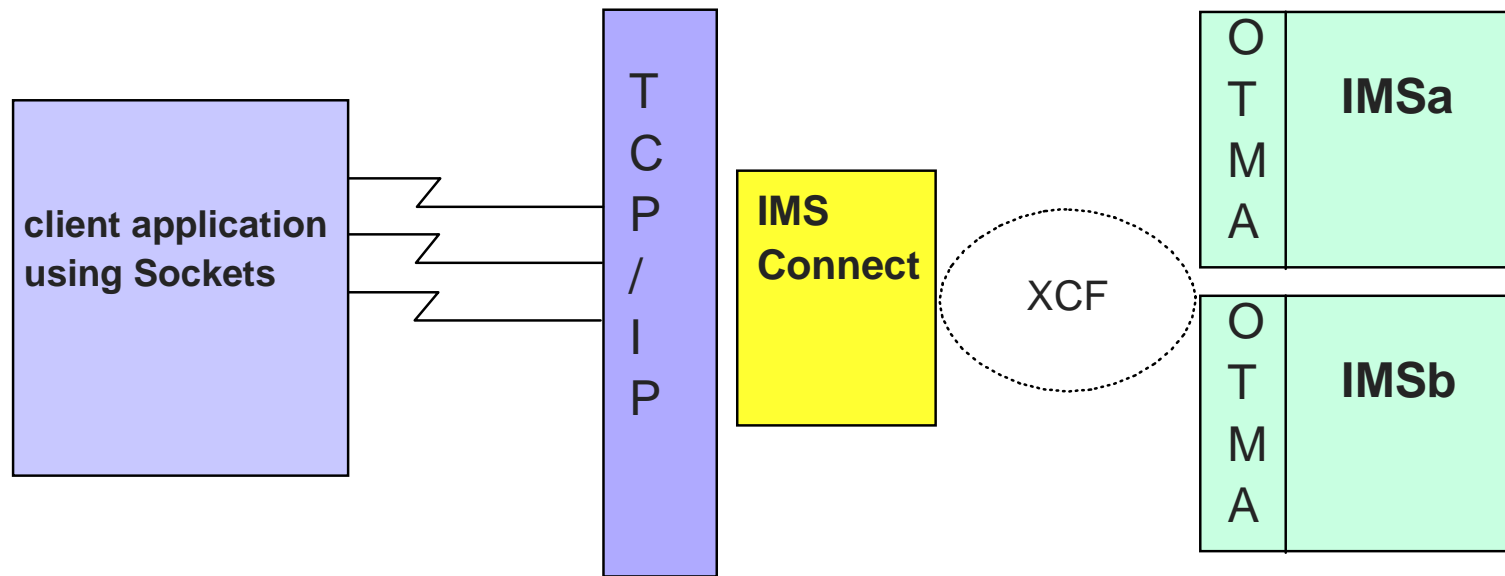
Socket Application Basic Design ...

▲ Add IMS into the picture



IMS Connect ...

▲ TCP/IP sockets support for IMS

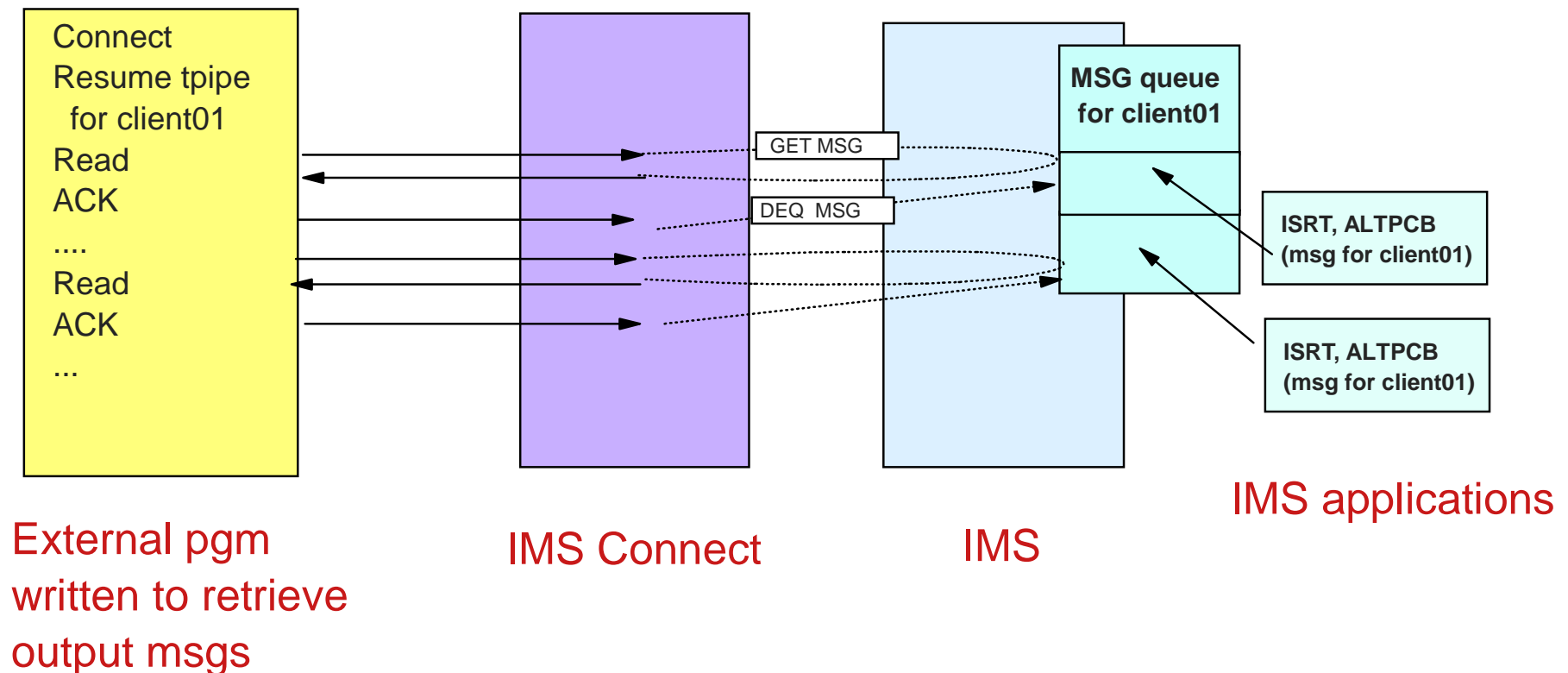


- Provides "implicit" support for IMS applications
 - ▶ Continue to use DL/I calls: GU, ISRT
- Primarily for inbound requests from external clients
 - ▶ Access to transactions

IMS Connect ...

▲ Originating a message from the IMS application

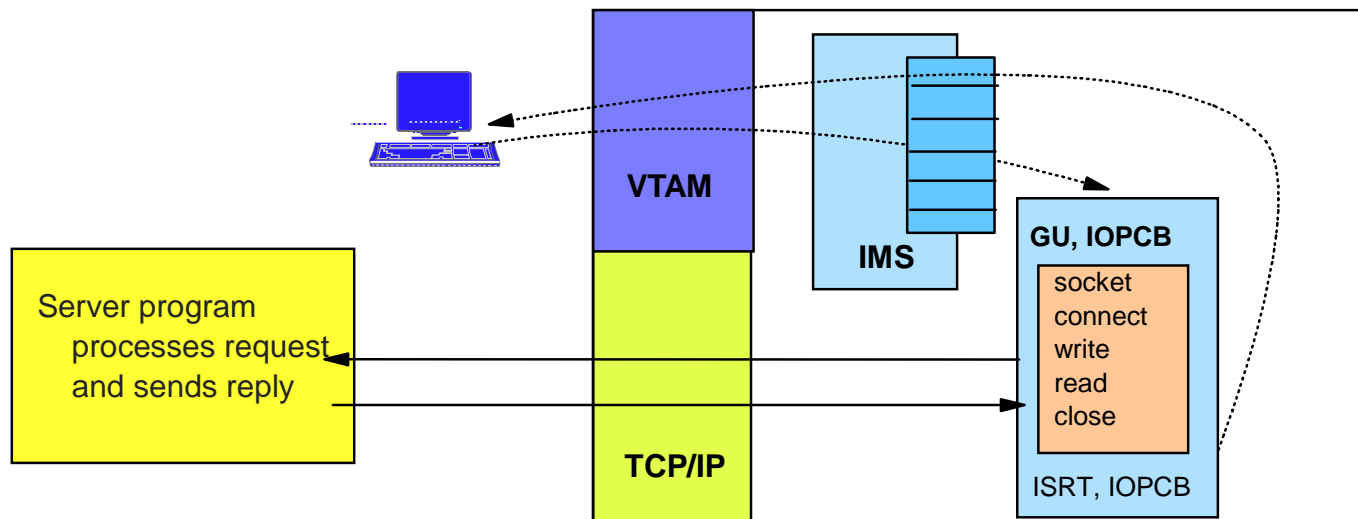
- ISRT, ALTPCB
 - ▶ Asynchronous outbound support



Outbound Explicit Sockets

▲ IMS applications can issue TCP/IP socket calls

- Outside IMS control and knowledge
- Synchronous communication where the IMS application is the client



Outbound Explicit Sockets ...

▲ OS/390 sockets support

- Standard sockets api - C, Java
- Extended sockets api - Assembler, Cobol, PL/I
 - Callable sockets api

Extended Socket functions:

Initapi() - establishes the extended sockets environment if Cobol, Assembler, or PL/I

Socket() - allocates a socket on which communication will flow

Connect() - defines and connects to a server

Write() transfers data

Read()

Close() - closes the connection

Cobol:

```
CALL 'EZASOKET' USING SOC-FUNCTION parm1, parm2, .. ERRNO RETCODE.
```

Assembler:

```
CALL EZASOKET,(SOC-FUNCTION,__parm1, parm2, ...__ERRNO RETCODE),VL
```

PL/I:

```
CALL EZASOKET (SOC-FUNCTION__parm1, parm2, ...__ERRNO  
RETCODE);
```

EZASOKET interface delivered in PDS "hlq.SEZATCP"

TCP/IP and the Sysplex

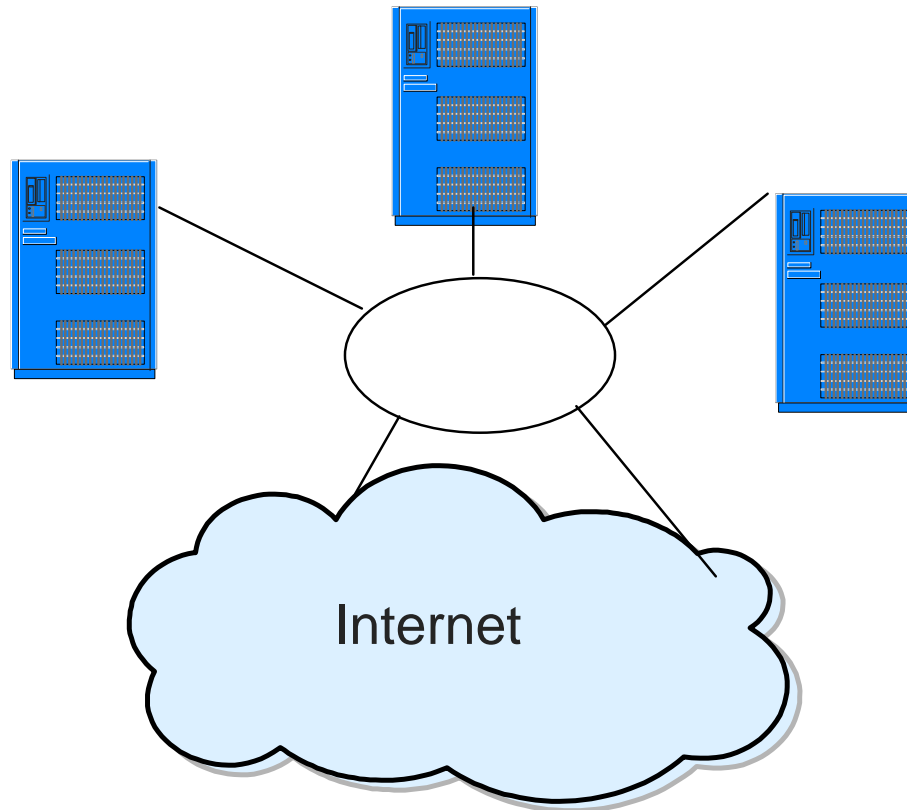
– Workload Distribution, load balancing and failover

- DNS/WLM**
- VIPA**
- Sysplex Distributor**

Sysplex

▲ Collection of connected S/390 processors

- Enables horizontal growth
- Provides a single system image



Workload Distribution and Load Balancing

DNS/WLM

▲ TCP/IP Domain Name Service (DNS) interfaces with the MVS Workload Manager (WLM) to

- Distribute workload based on user-defined goals
 - ▶ Clustered host names, clustered server names, weighted IP addresses

▲ Client requests a connection based on a cluster name

- Establishes connection with the host/server picked by DNS/WLM

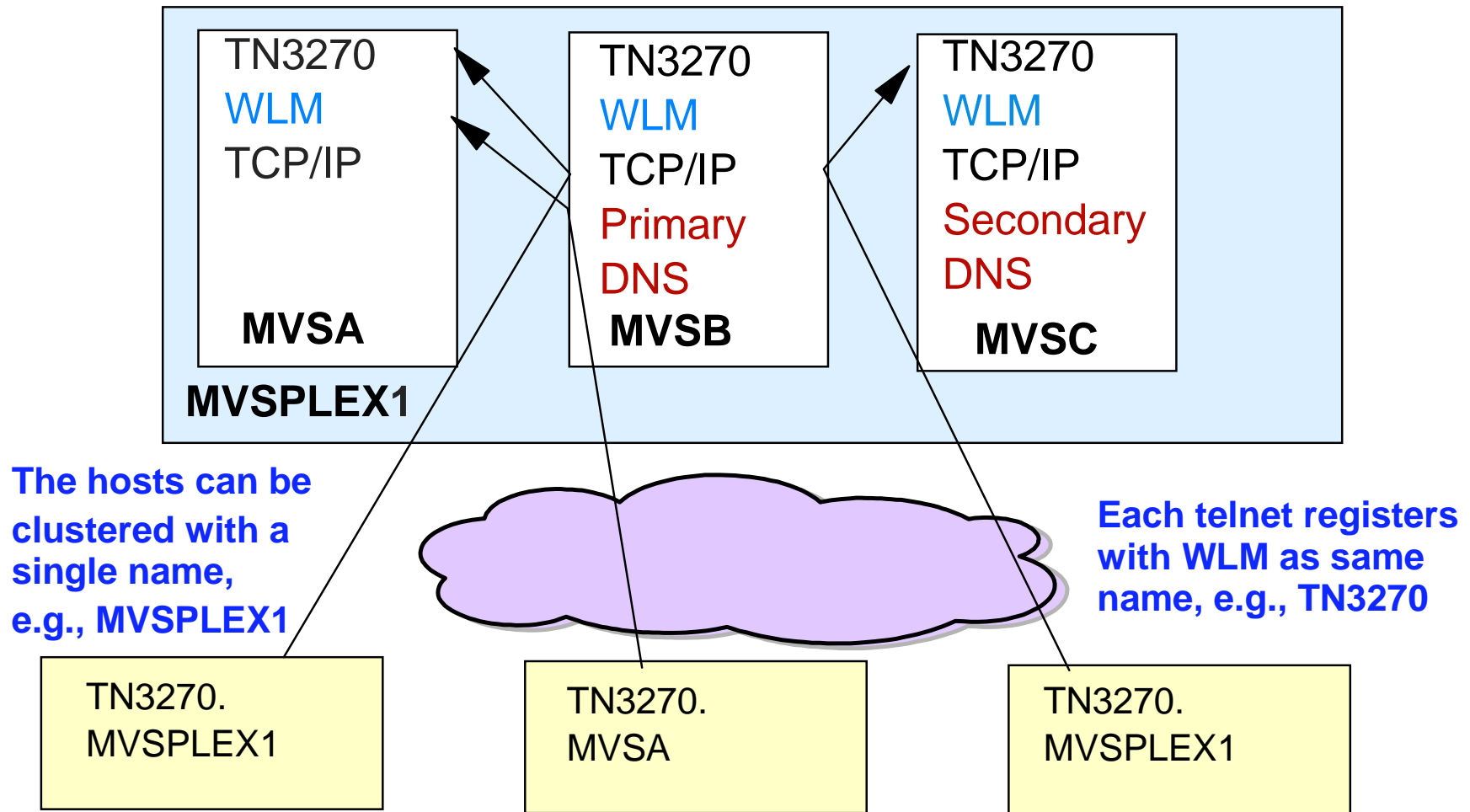
▲ Benefits

- Distributes connections based on current load and capacity
- Dynamically avoids crashed hosts and servers

▲ *Tends to be used for long running connections such as Telnet sessions*

Workload Distribution and Load Balancing ...

DNS/WLM ...



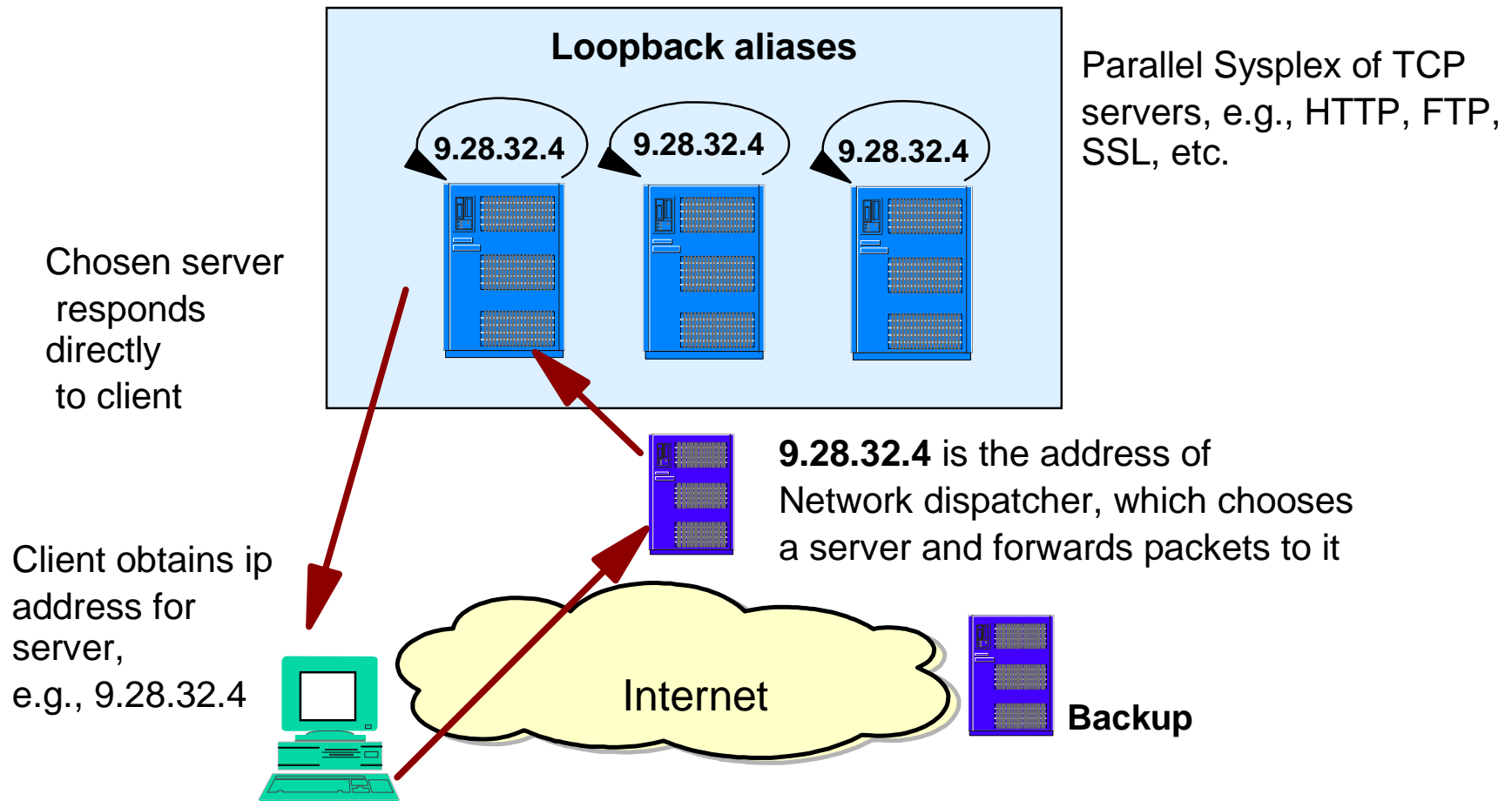
Workload Distribution and Load Balancing ...

Network Dispatcher - Websphere Edge Server

- ▲ **Software on IBM routers (e.g., 2216 and 3746 MAE)**
- ▲ **Establishes session with MVS WLM if servers are OS/390**
 - Balances workload based on workload goals
 - Never selects an unavailable server
- ▲ **Client receives IP address of the Network Dispatcher**
 - Packets are forwarded to chosen server unmodified
 - Server accepts packet because of alias on Loopback interface which matches the address of the Network Dispatcher (cluster address)
- ▲ ***Used for "short duration" applications like web traffic***
 - Inbound data goes through the router
 - Outbound data goes directly to the client

Workload Distribution and Load Balancing ...

Network Dispatcher ...



Workload Distribution and Load Balancing ...

Cisco

▲ IBM/Cisco alliance

▲ Cisco MultiNode Load Balancing (MNLB)

- Software solution on routers/switches for IP workload balancing
 - ▶ Can interact with WLM on OS/390
- Similar in concept to the Network dispatcher

Failover

ARM

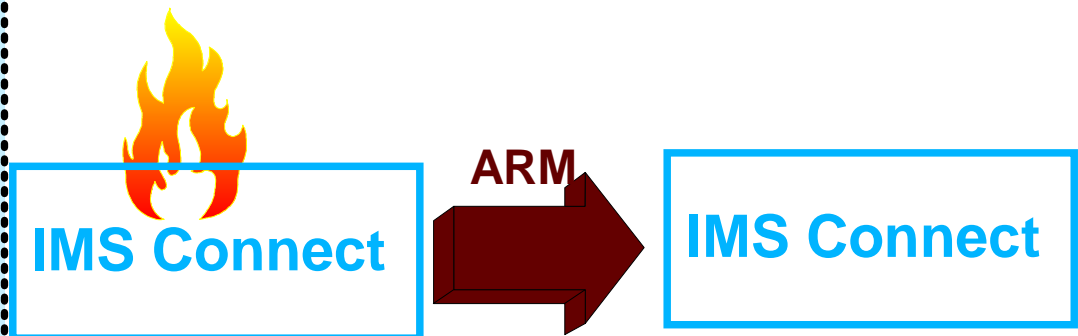
▲ ARM (Automated job and started task restart)

- Managed by MVS - supports abends and MVS failures
- Sysplex wide
 - ▶ Allows application to be restarted on a different MVS

▲ Use

- Application, e.g., IMS has code to register/unregister with ARM
- Programs that do not have code to invoke ARM, e.g., IMS Connect
 - ▶ Can use ARMWRAP
 - Via execution JCL
 - Downloaded from the Web

```
//IMSCONN PROC ..  
/* invoke armwrap to register IMS Connect with ARM  
//REGSTEP EXEC PGM=ARMWRAP,  
//   PARM=('REQUEST=REGISTER'...  
//.....  
/* invoke IMS Connect  
//CONNSTP EXEC PGM=HWSHWS00 ...  
//.....  
//UNREG EXEC PGM=ARMWRAP,  
//   PARM=('REQUEST=UNREGISTER)
```



ARMWRAP

▲ Information about ARMWRAP

- <http://www.redbooks.ibm.com>
 - ▶ Search on "z/OS Automatic Restart Manager"
 - This brings you to an abstract page where you can access the book

▲ Download ARMWRAP code

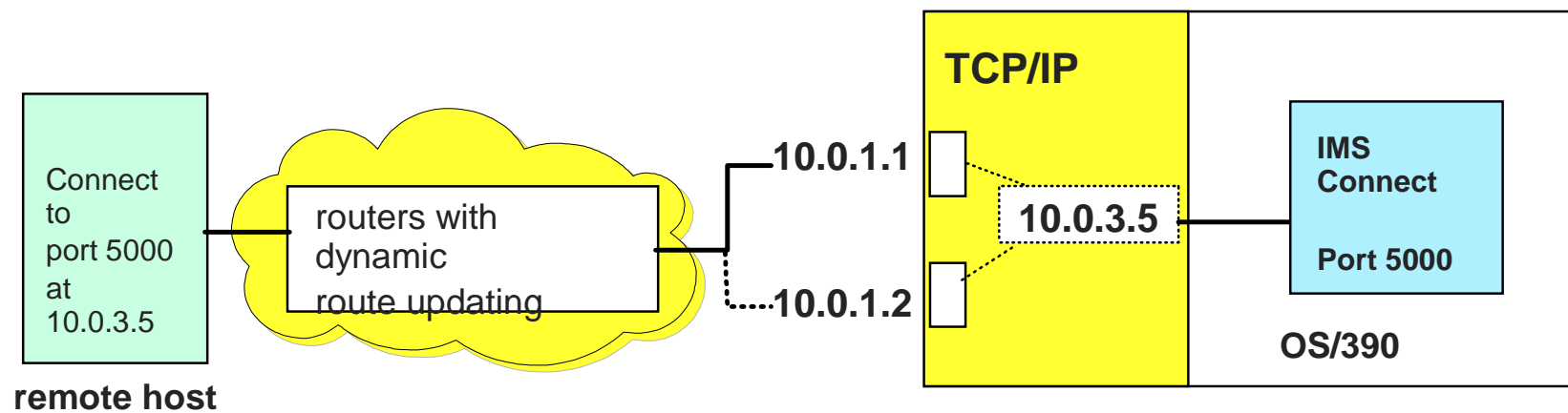
- On the redpaper abstract page click on "Additional Material"
 - ▶ <ftp://www.redbooks.ibm.com/redbooks/REDP0173/>
 - PDS in IEBCOPY UNLOAD format containing usermods to install the ARMWRAP program

Failover ...

Static VIPA

▲ Static Virtual IP Addressing (VIPA)

- First VIPA implementation
- Eliminates an application's dependence on a particular network interface (IP address)
 - ▶ Non-disruptive rerouting of traffic in the event of failure
 - ▶ A defined VIPA does not relate to any physical network attachment
 - Multiple network interfaces on a single TCP/IP stack



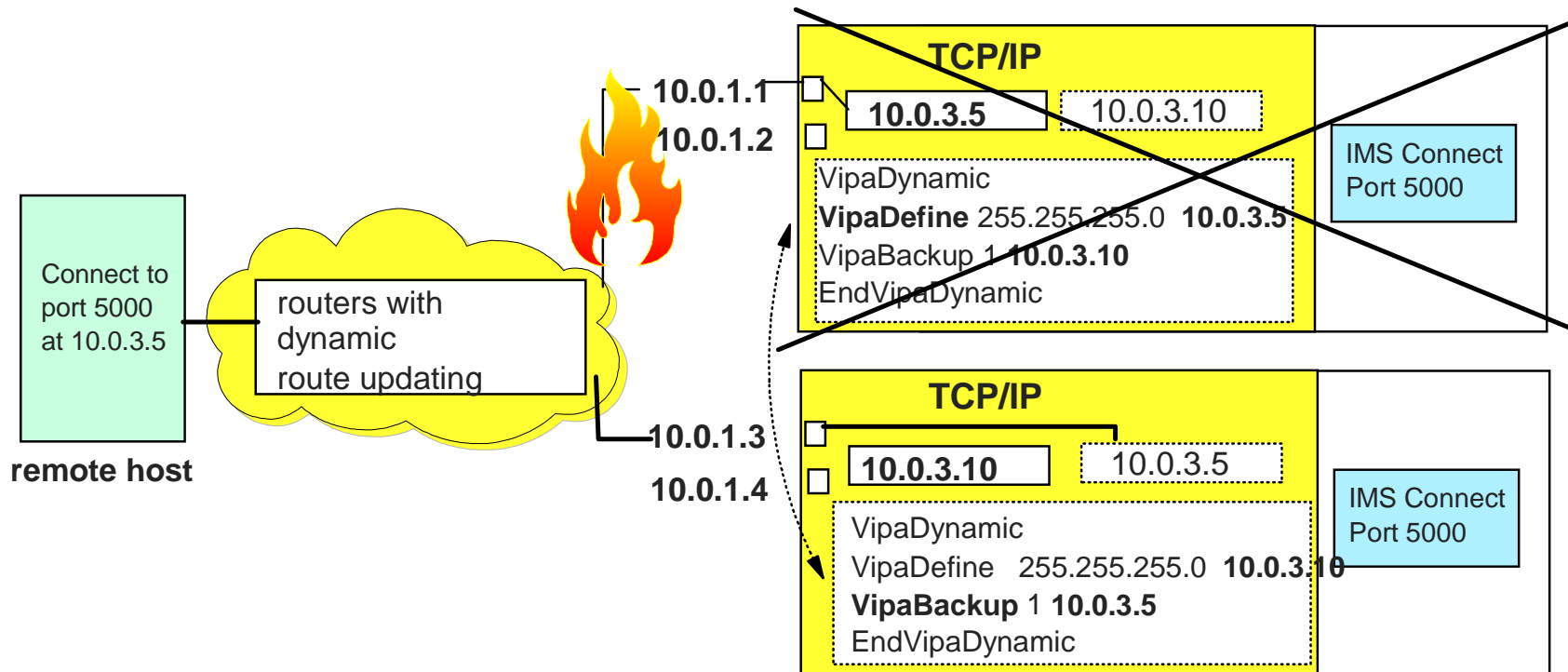
Note: The real network interfaces 10.0.1.1 and 10.0.1.2 appear to be intermediate hops

Failover ...

Dynamic VIPA

▲ Automatic VIPA Takeover

- OS/390 V2R8
- Support for other TCP/IP stacks to be backup VIPA address
 - ▶ Allows an active stack to assume the load of a failing stack
 - Stacks share information using OS/390 XCF messaging



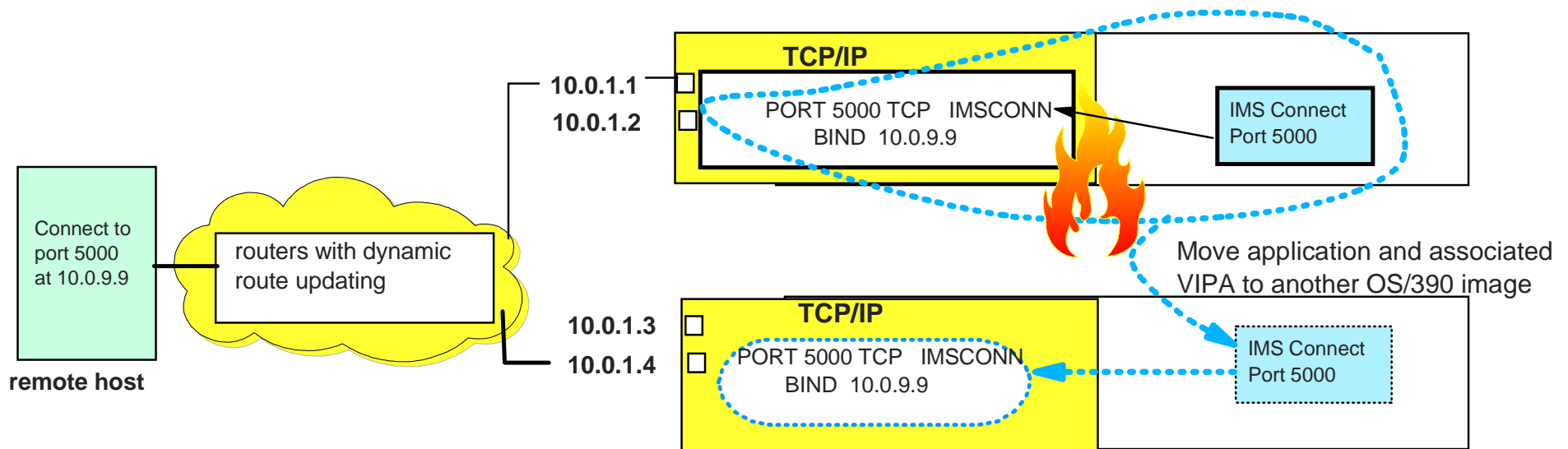
Note: Server application may need to be started on the same port on the backup host

Failover ...

Dynamic VIPA ...

▲ Application-initiated Dynamic VIPA

- Allows a server application to create and activate its own VIPA
 - Moves with the application wherever the application is started or restarted
- Invoked via api call or through a utility or through a TCP/IP configuration statement
- IMS Connect does not issue the api call
 - USE the configuration statement in *hlq.PROFILE.TCPIP*
 - PORT *portnum* TCP *startedtaskname* BIND *ipaddress*



Failover ...

▲ ARM and Application-initiated Dynamic VIPA

- Automatically move the application and DVIPA to another MVS if primary fails

```
//IMSCONN PROC ..  
//...  
/* invoke armwrap to register IMS Connect with ARM  
/*   Register element 'EXAMPLE' using element type of  
/*   'XAMP'with ARM. Restart on all types of terminations.  
//REGSTEP EXEC PGM=ARMWRAP, PARM=('REQUEST=REGISTER'  
//           'TERMTYPE=ALLTERM,ELEMENT=EXAMPLE',  
//           'ELEMTYPE=XAMP,READYBYMSG=N')  
//.....  
//  
//.....  
/* invoke IMS Connect  
//CONNSTP EXEC PGM=HWSHWS00 ...  
//  
//  
//.....  
/* unregister with ARM  
//UNREG EXEC PGM=ARMWRAP, PARM=('REQUEST=UNREGISTER)
```

To invoke application-initiated DVIPA, add a PORT definition in *hlq.TCPIP.PROFILE*

PORT xxx TCP startedtaskname BIND ipaddr

This will be activated when IMS Connect initializes - this is the recommended approach

As an alternative to the above, IMS Connect JCL can include the following step

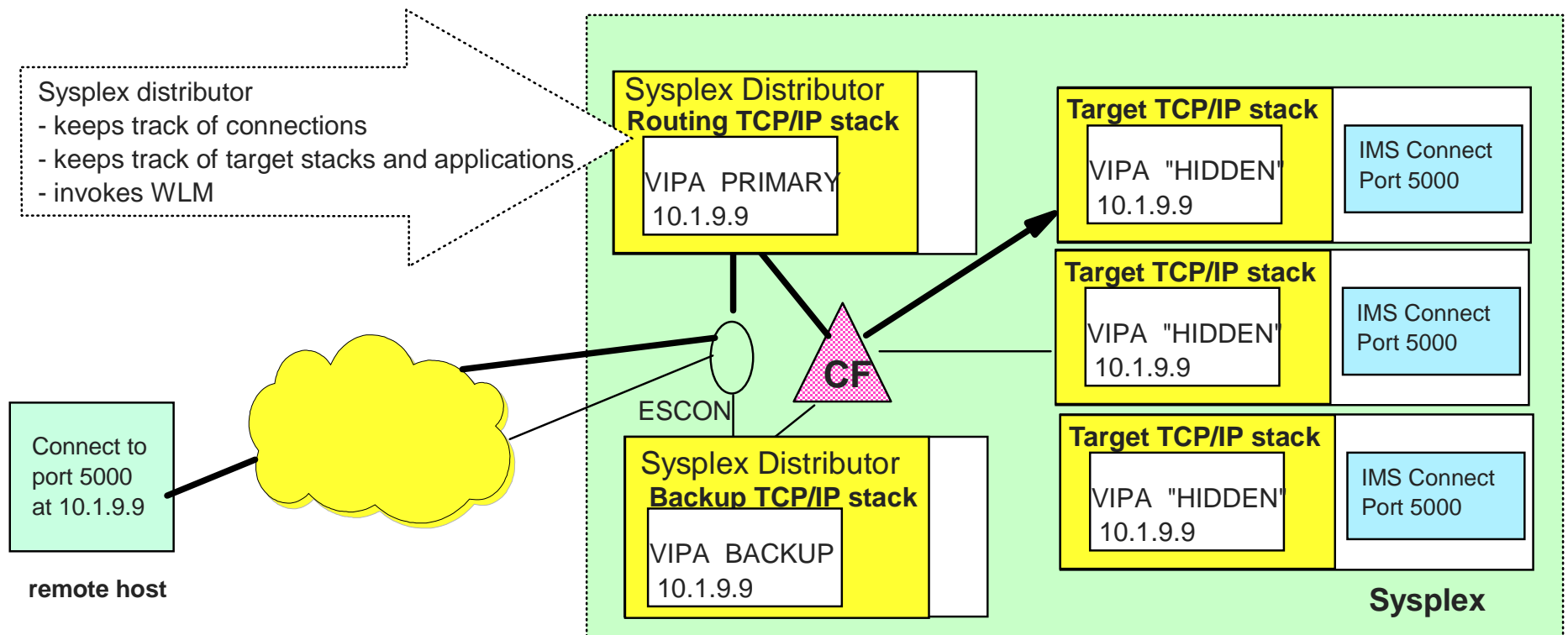
```
//TCPDVP EXEC PGM=MODDVIPA,....  
//           PARM='-p TCPIP -c 10.0.9.9'  
//.....
```

MODDVIPA is the OS/390 V2R10 utility
EZBXFDVP is the OS/390 V2R8 utility
(distributed in TCPIP.SEZALINK library)

Sysplex Distributor

▲ Sysplex function - Single IP address for a cluster of Hosts

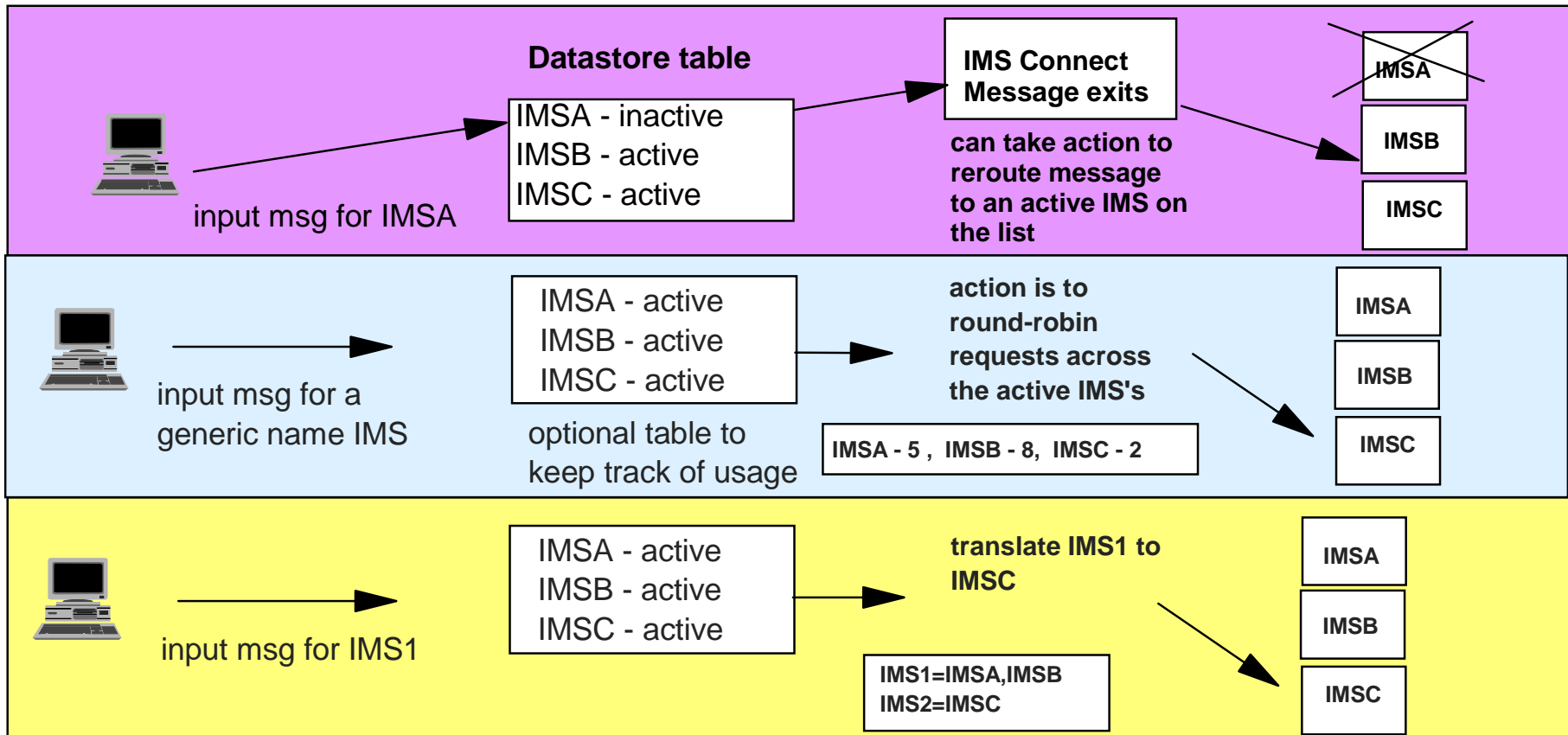
- Sysplex-wide VIPA - OS/390 V2R10
- Workload balancing across multiple servers
 - ▶ Performs a Network Dispatcher type function on the S/390
- High availability - enhanced Dynamic VIPA and Automatic Takeover
 - ▶ Allows movement of VIPAs without disrupting existing connections



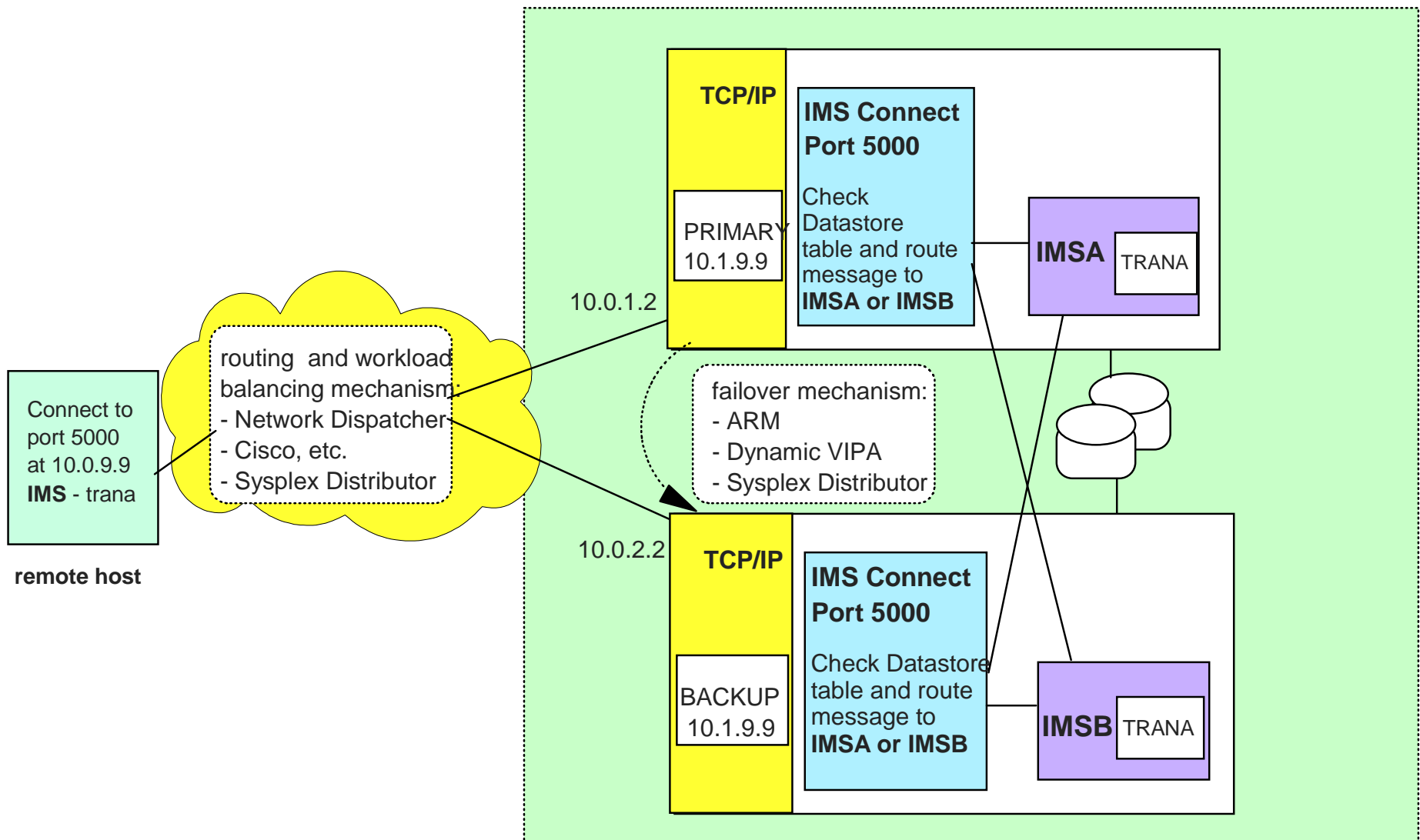
IMS Connect workload balancing and Failover

Once a message destination is resolved to a particular host and IMS Connect system

- IMS Connect can access multiple IMS Systems
- Message exits can reroute a message to a different target IMS
 - ▶ The Datastore table provides information as to which systems are active



In a Nutshell



References

▲ <http://www.ibm.com/servers/s390/os390/bkserv>

- OS/390 IBM CS V2R10.0: IP Configuration SC31-8726
- OS/390 V2R8.0 SecureWay CS IP Configuration SC31-8513-03
- OS/390 V2R8.0 SecureWay CS IP API Guide SC31-8516-03

▲ <http://www.redbooks.ibm.com/>

- TCP/IP in a Sysplex SG24-5235
- IBM Communications Server for OS/390 V2r10 TCP/IP Implementation Guide SG24-5227
- IBM Communications Server for OS/390 TCP/IP 2000 Update Technical Presentation Guide SG24-6162