A45

TCP/IP and IMS
The Choices, Considerations, and Design

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Abstract

Transmission Control Protocol/Internet Protocol (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 presentation discusses the network architecture as well as the various methods by which such systems can communicate with IMS using TCP/IP such as terminal emulation, printer capability, and the use of Sockets. It also addresses Web interoperability and issues that have to be considered such as security and performance.

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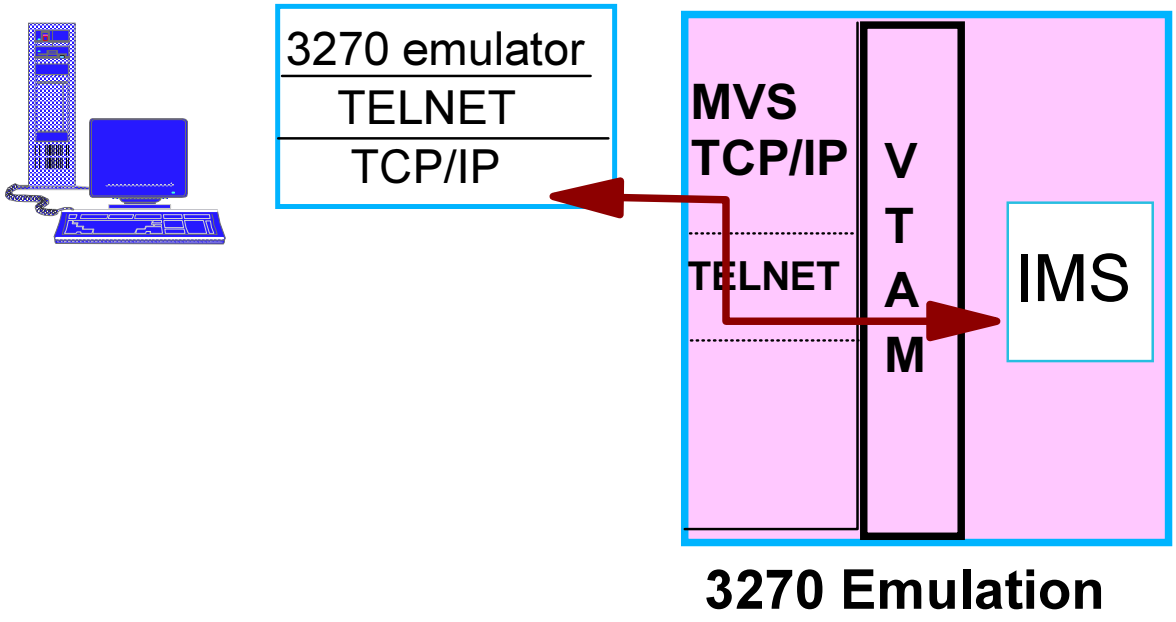
TCP/IP and IMS - Topics

- **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

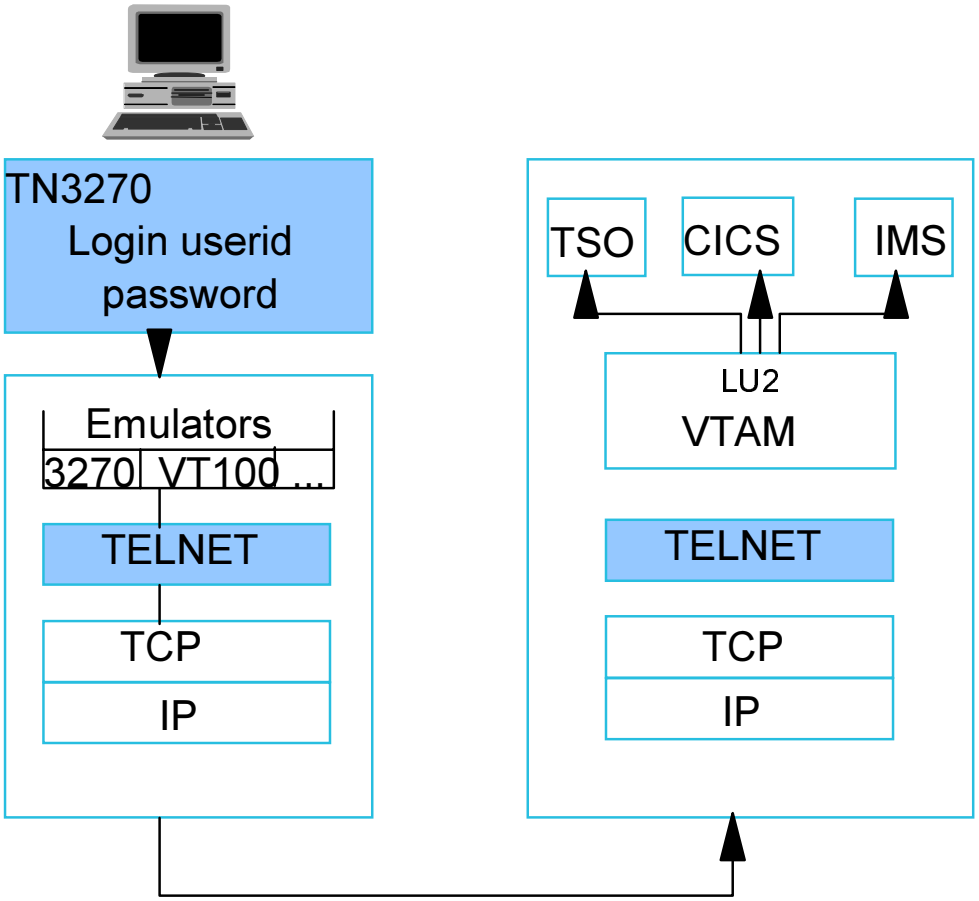


3270 Emulation

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

TELNET...




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

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

    ALLOWAPPL TSO
    ...

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

    USER user1 user2 user3
```

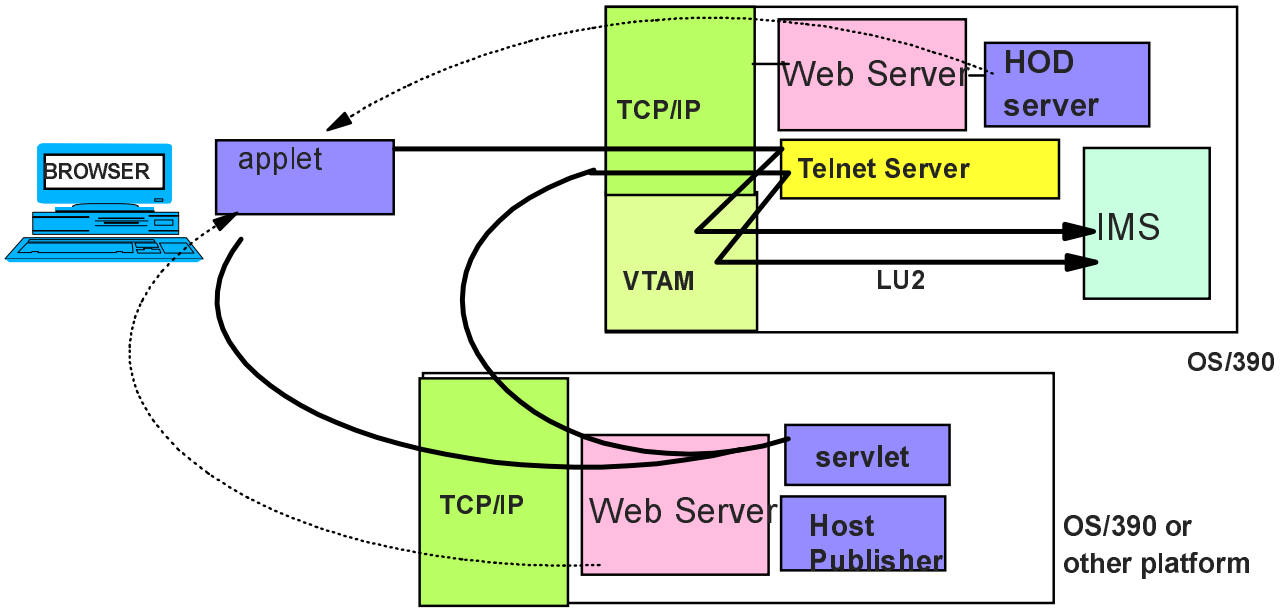
TN3270 and TN3270E

- **OS/390 R5**
  - Telnet re-written to be more like VTAM
  - Performance and usability enhancements
- **OS/390 R6**
  - Secure Sockets Layer (SSL) support
  - Performance enhancements
- **OS/390 R7**
  - Hostname - LU Mapping
  - Performance enhancements
- **OS/390 R8**
  - Telnet takeover support - client reconnection to same LU
  - Improved SSL client authentication to support certificates
- **OS/390 R10**
  - Enh. to SSL support - single port for basic and secure connections
  - Resource pooling - clients specify LU pool instead of specific LU

Web Access Via Telnet

Host On-Demand/ Host Integration Solution

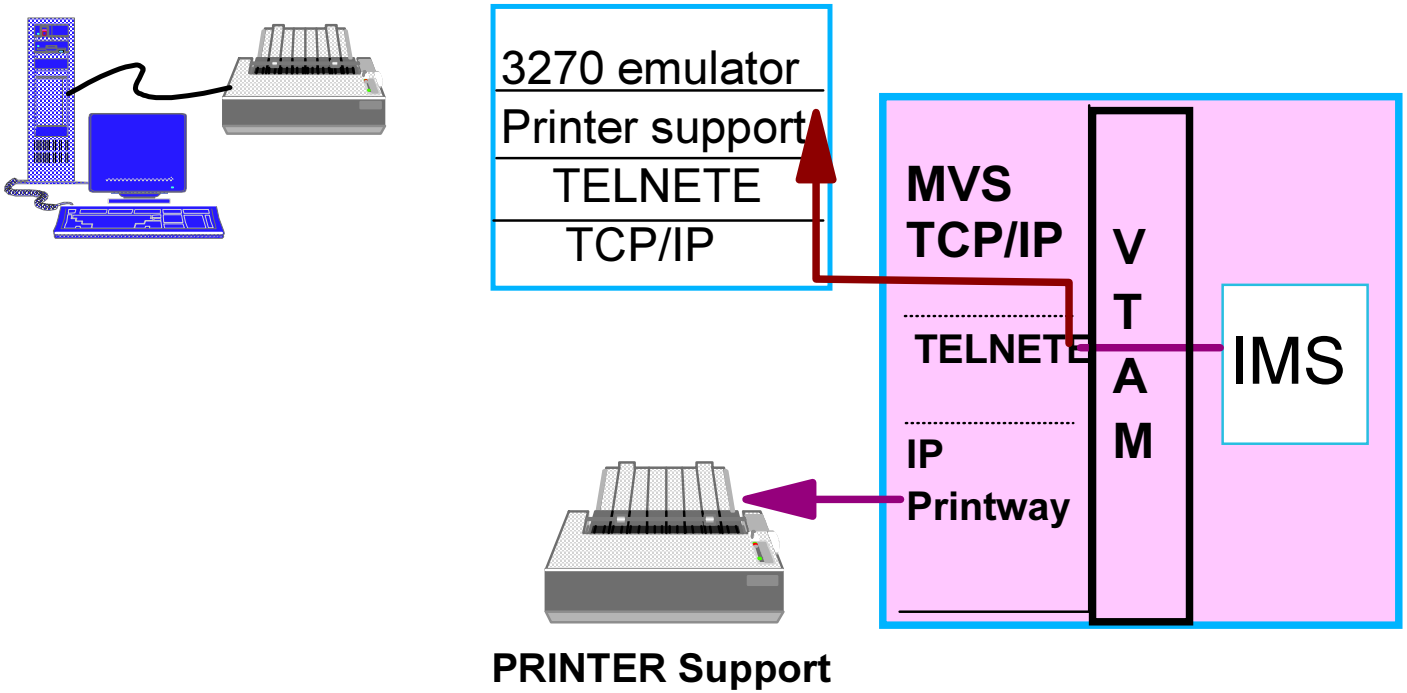
- Downloads a Java applet (includes a TN3270 emulator)
  - Provides GUI functions, screen customization
- Host Access Class Library API
  - Allows access to the emulator data stream to extend
  - Create customized e-business applications



Host Publisher

- Provides a servlet that provides the TN3270 client support

Printer Support

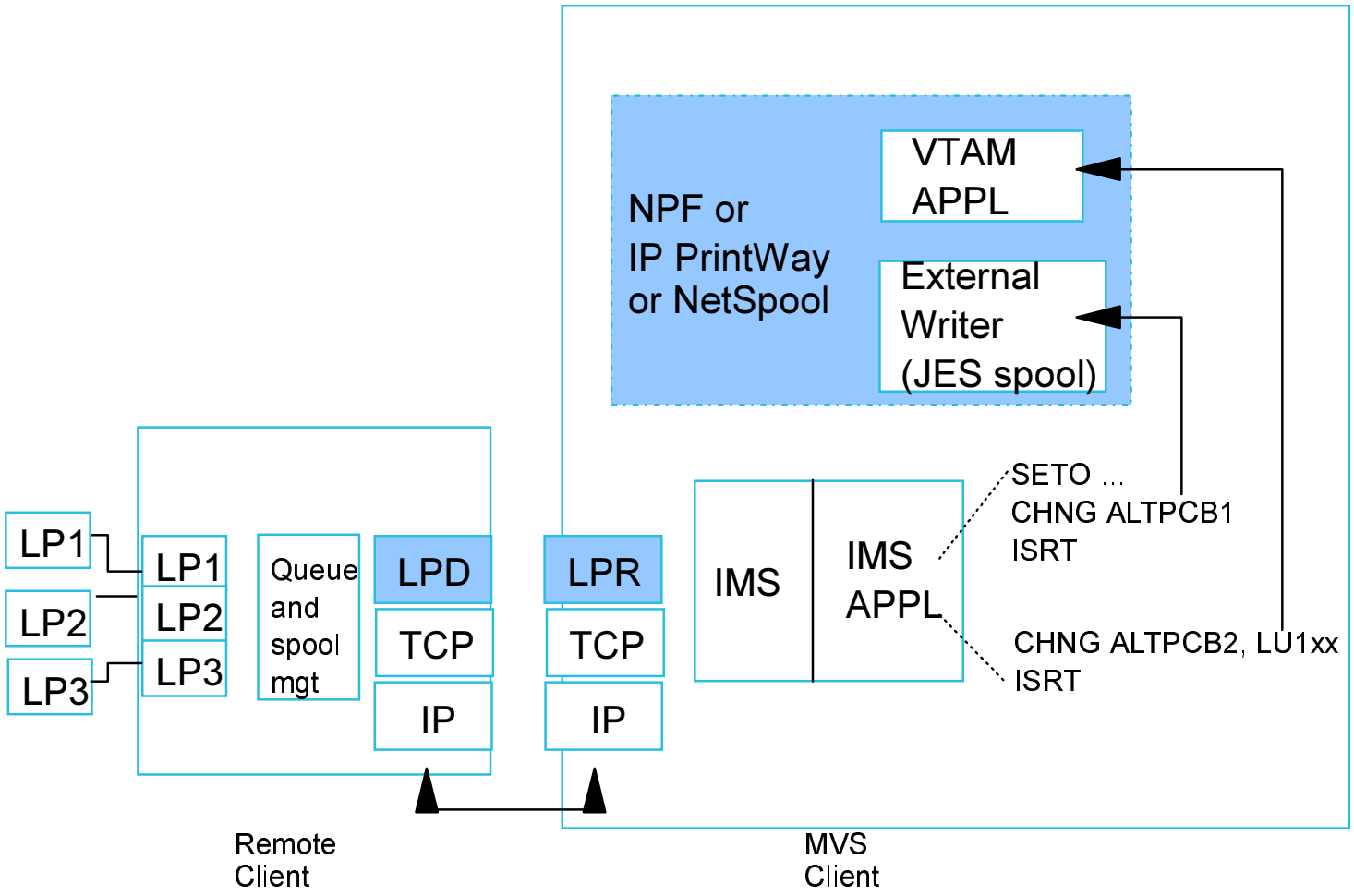


Printer Support

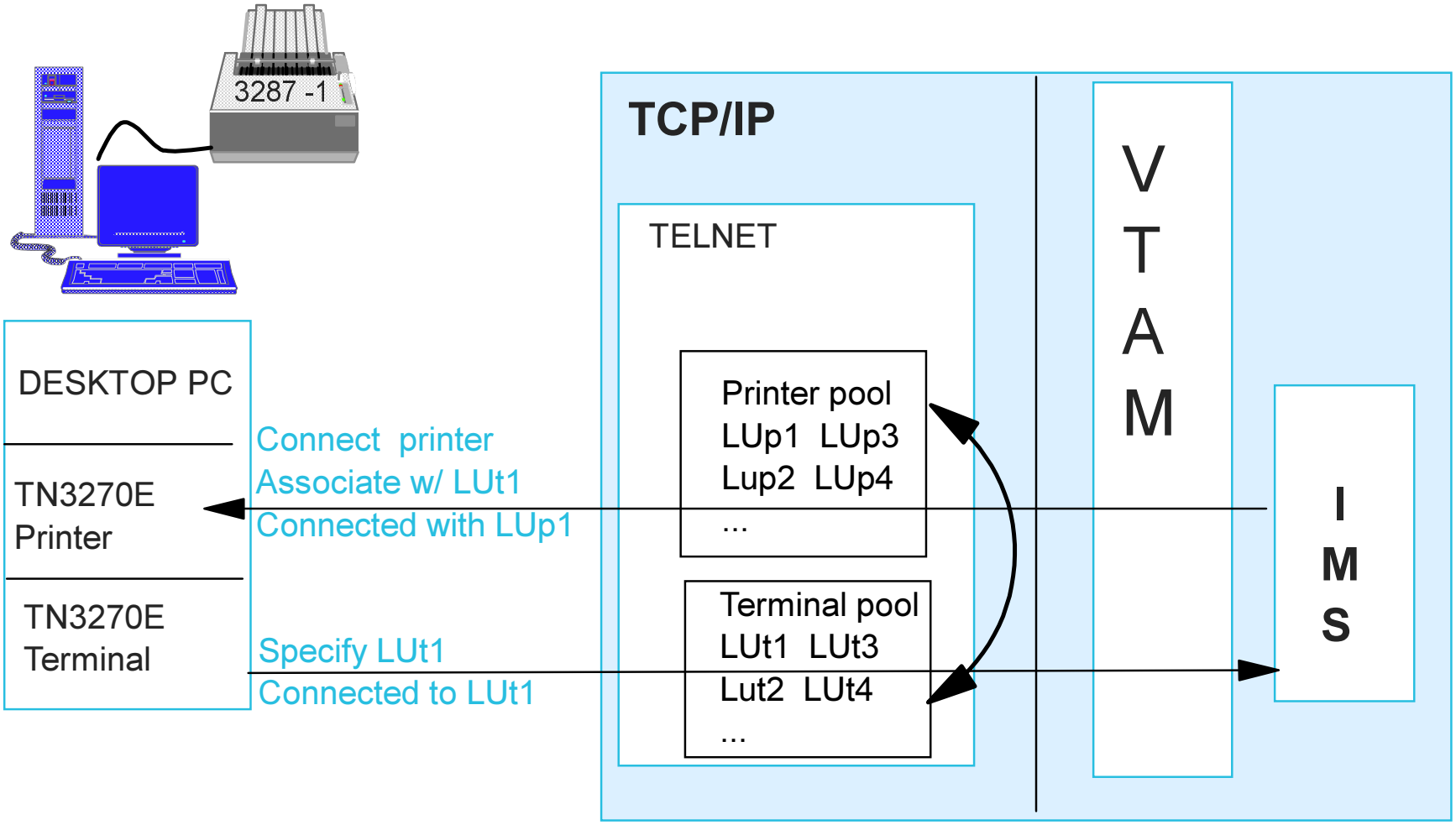
Line Printer Daemon Protocol (LPR/LPD)

- 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
- LPD (Line Printer Daemon) provides the server capability
  - Performs local print spooling
- LPR (Line Printer Requestor) provides the client capability
  - Responds to LPR protocol commands

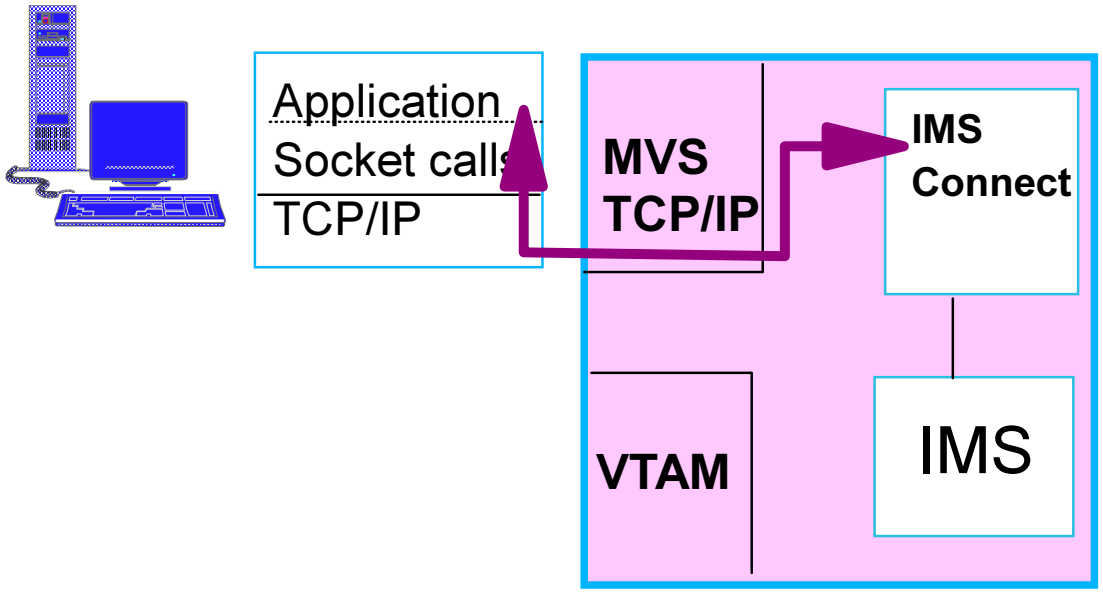
Network Print Facility(NPF) or NetSpool/IP PrintWay - PSF for OS/390



TN3270E Print - Telnet Printer Emulation

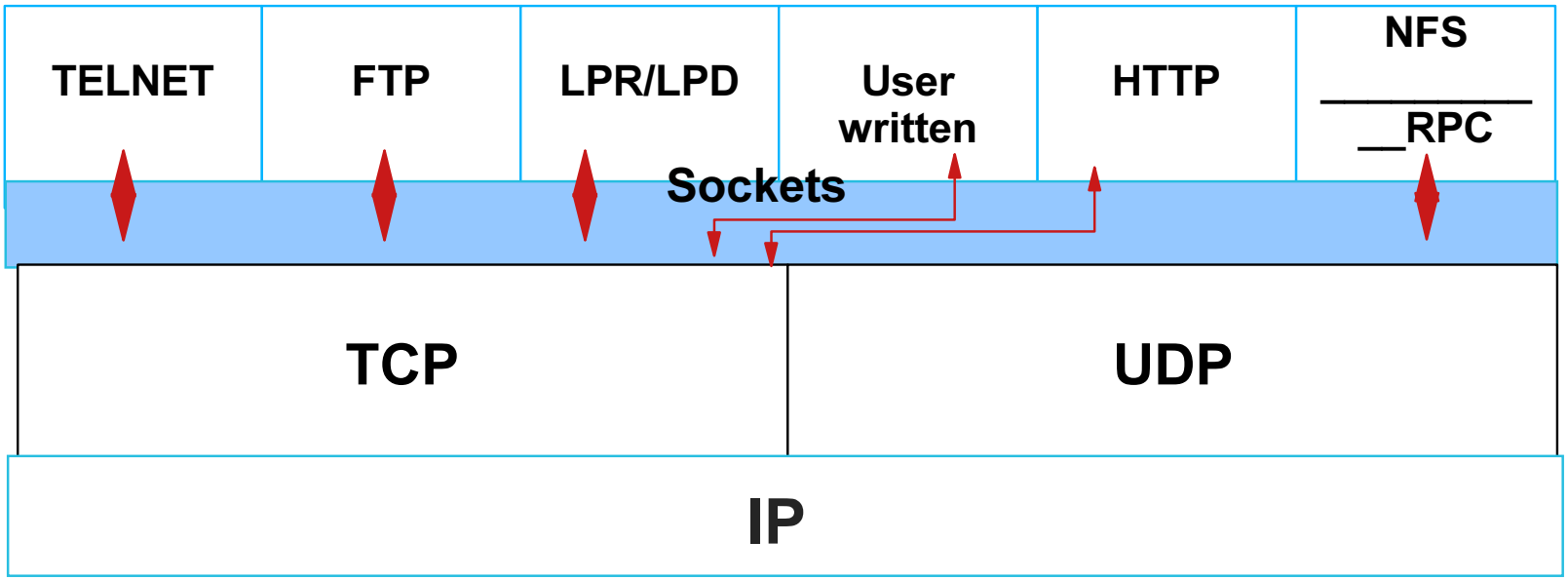


Program-to-Program



Program-To-Program Support

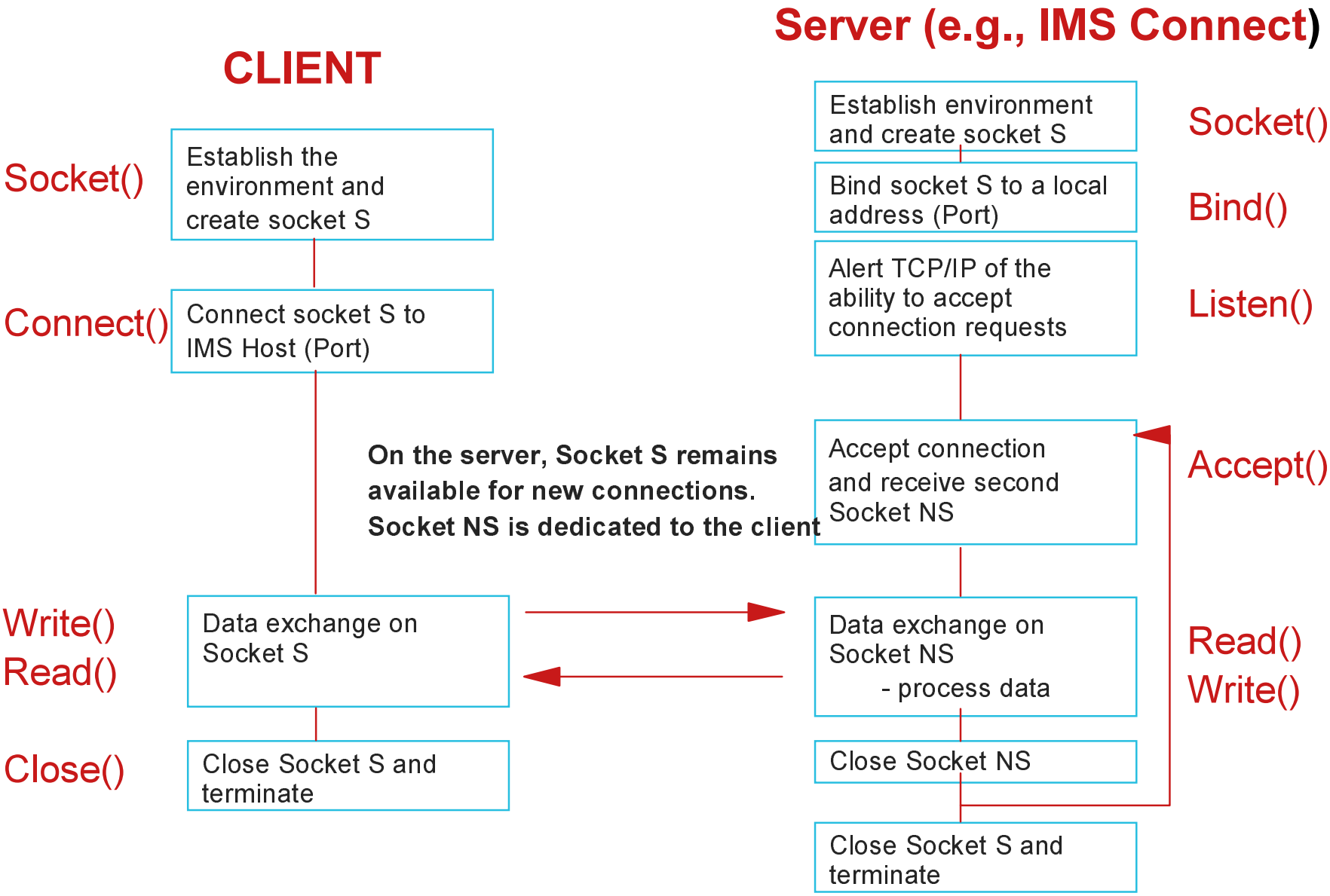
- **Direct communication between two programs requires:**
  - "Sockets"
    - An endpoint for communication
    - An api for programs to request communication services



Program-To-Program Support ...

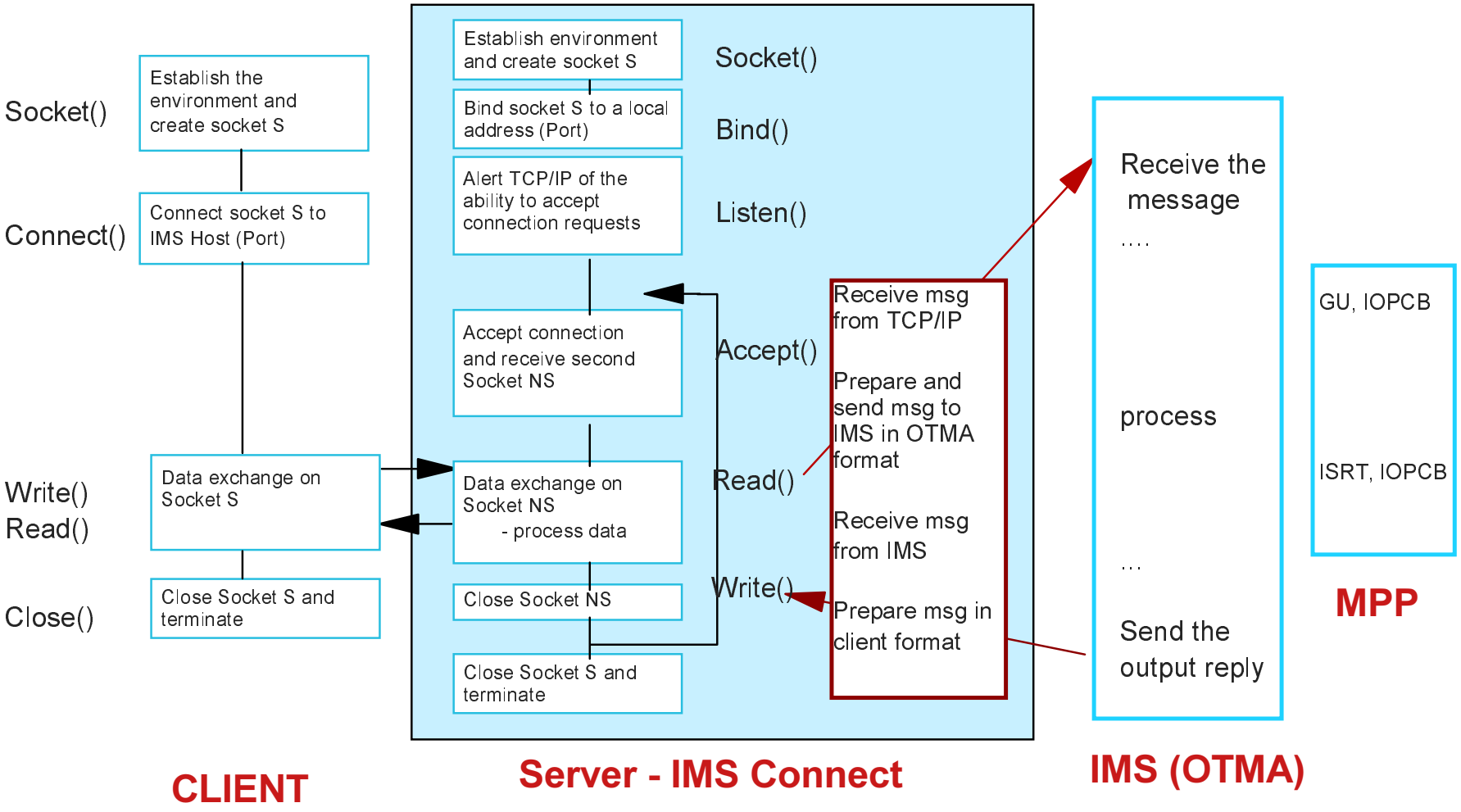
- **An application program using the sockets api**
  - Opens a socket (requests a connection)
  - Specifies the service desired (e.g., reliable stream delivery)
  - Binds a socket to a specific destination (PORT)
  - Sends or receives data
- **SOCKET = (IP address, PORT number)**
  - Uniquely identifies each application
- **Two sockets conversing <> similar to a session**

Socket Application Basic Design

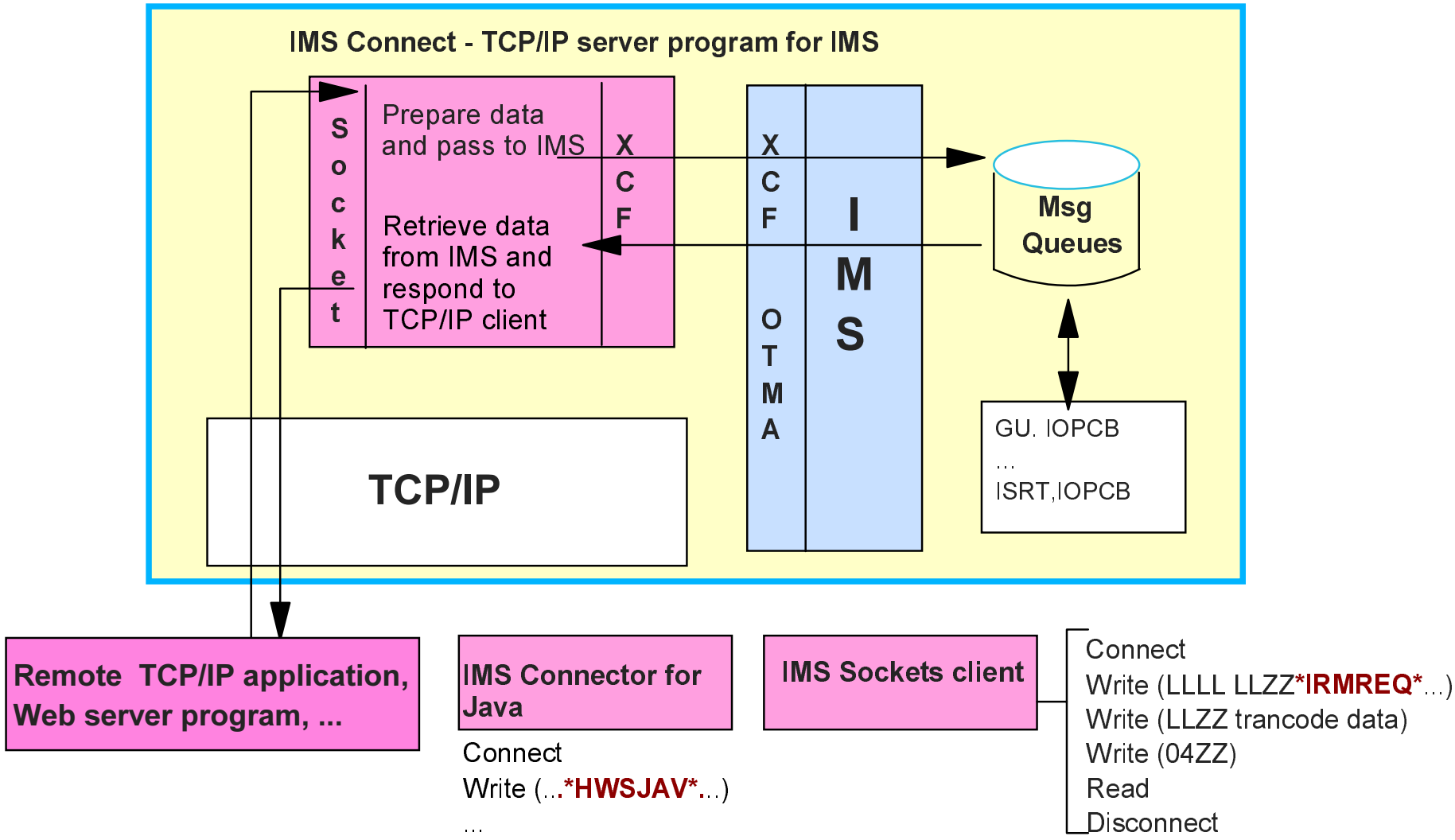


Socket Application Basic Design ...

Add IMS into the picture

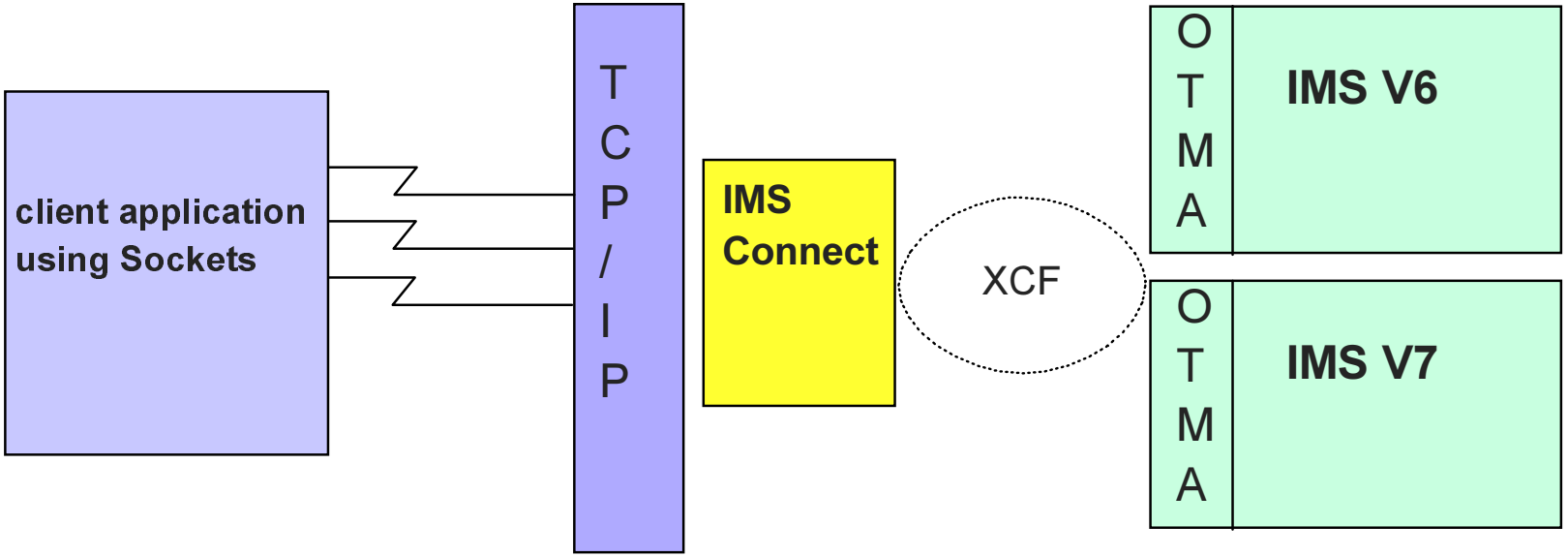


IMS TCP/IP Connection - IMS Connect



IMS Connect ...

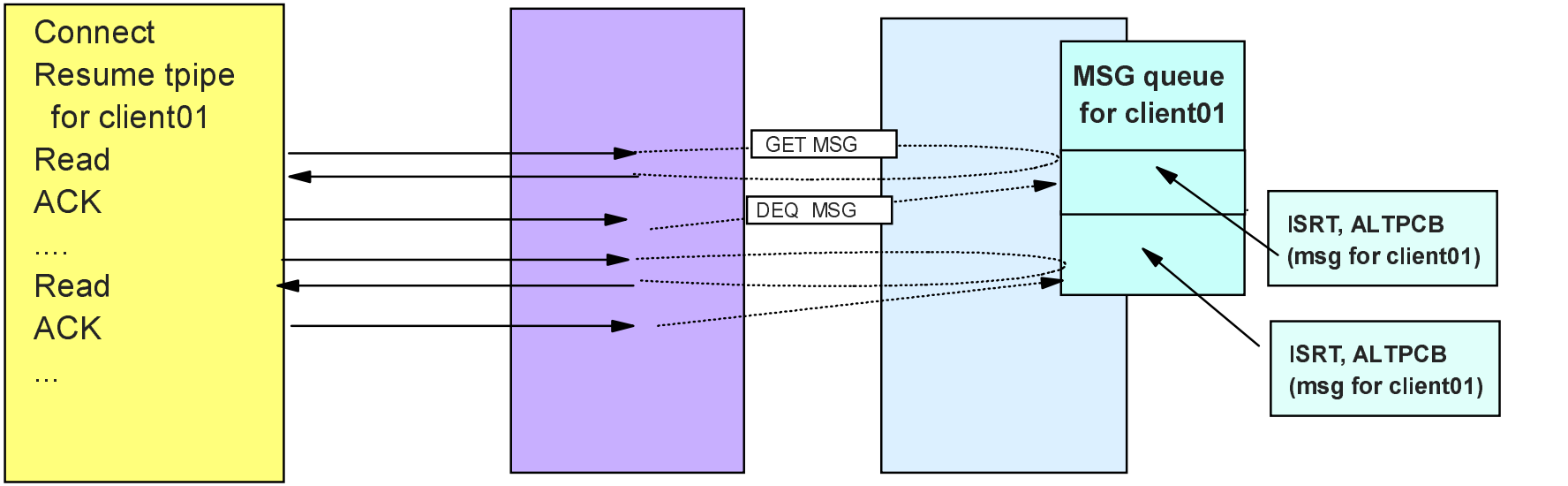
TCP/IP sockets support for IMS



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

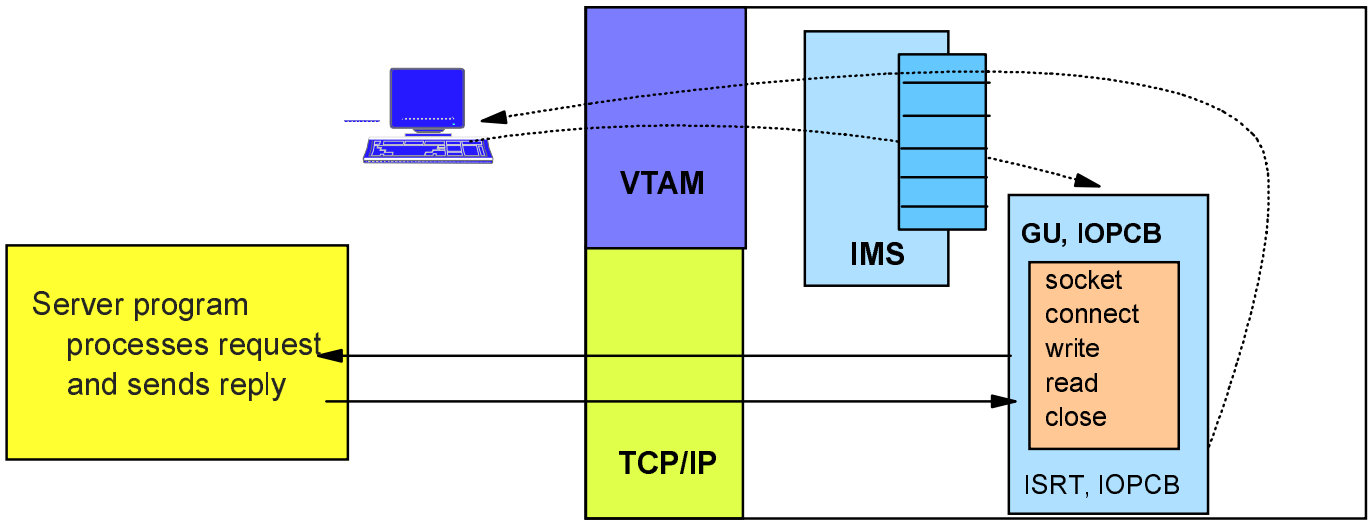
IMS Connect ...

- **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
  - 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() / Read() — transfers data
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);
```

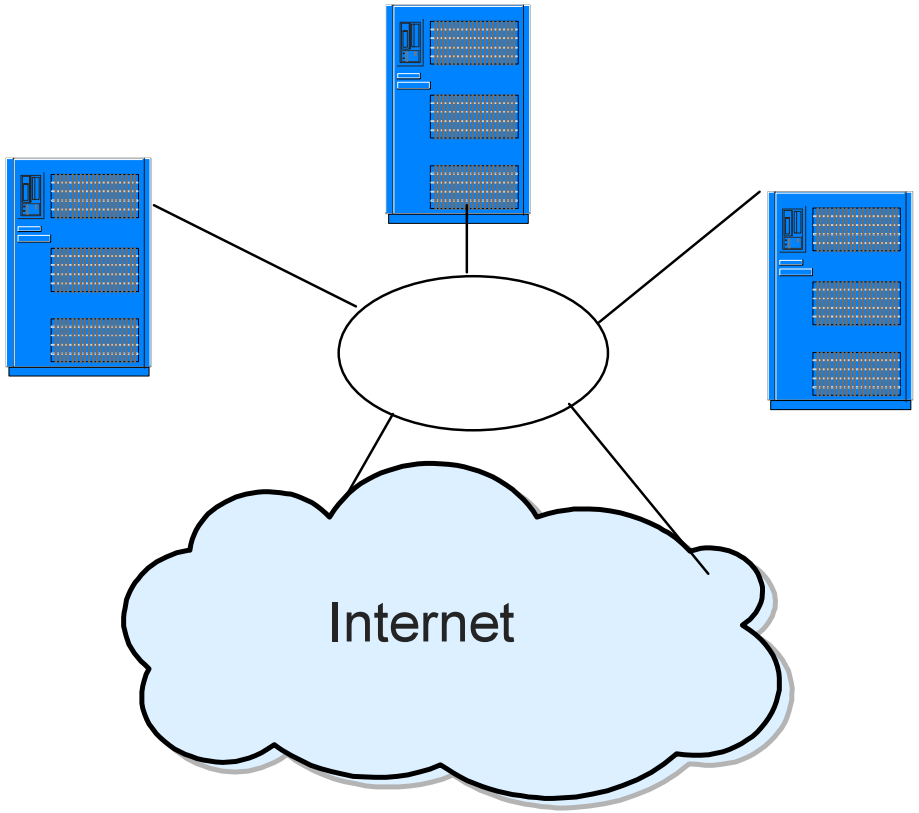
EZASOKET interface delivered in PDS "hlq.SEZATCP"

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



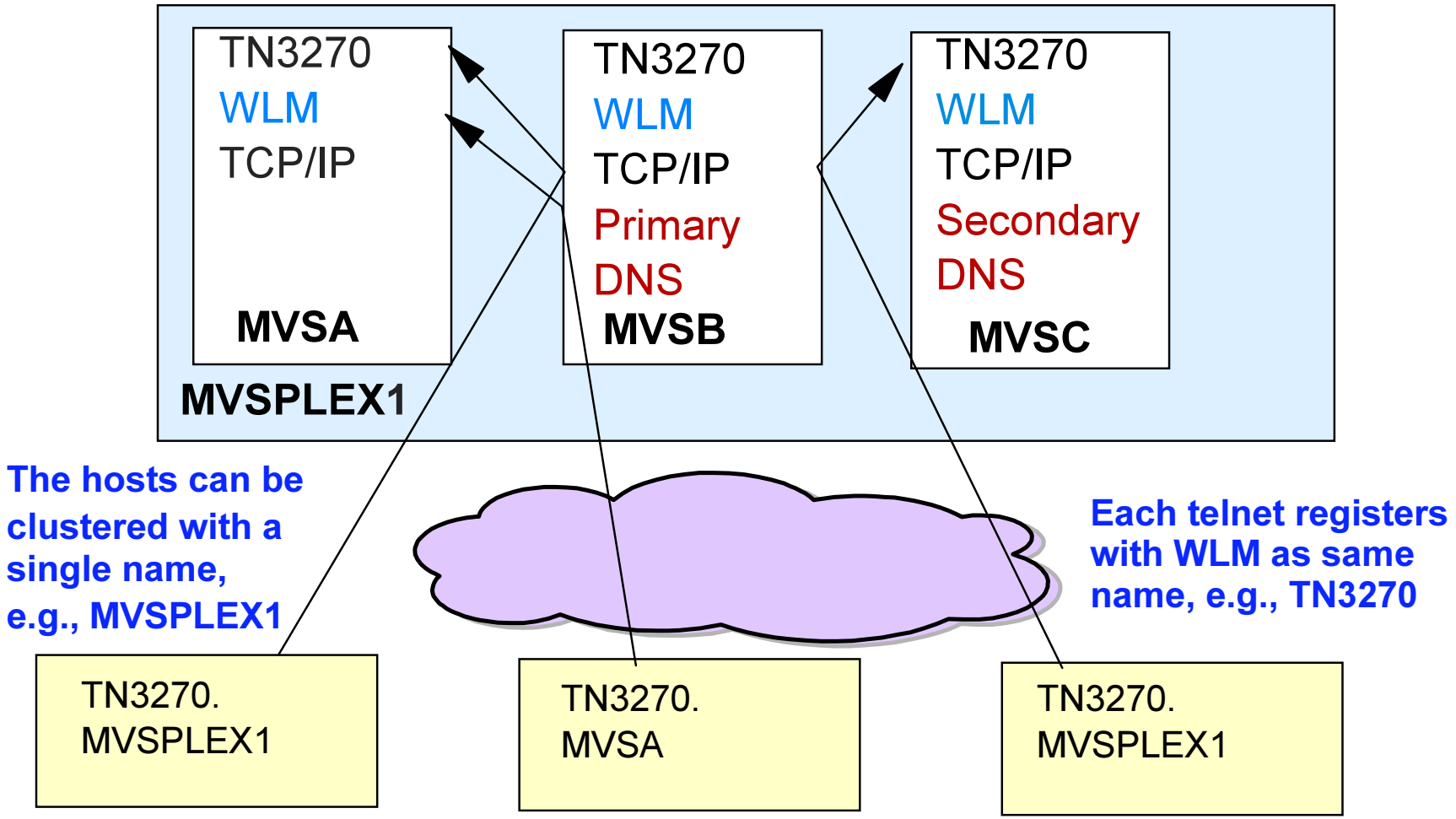
Workload Distribution and Load Balancing

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 ...



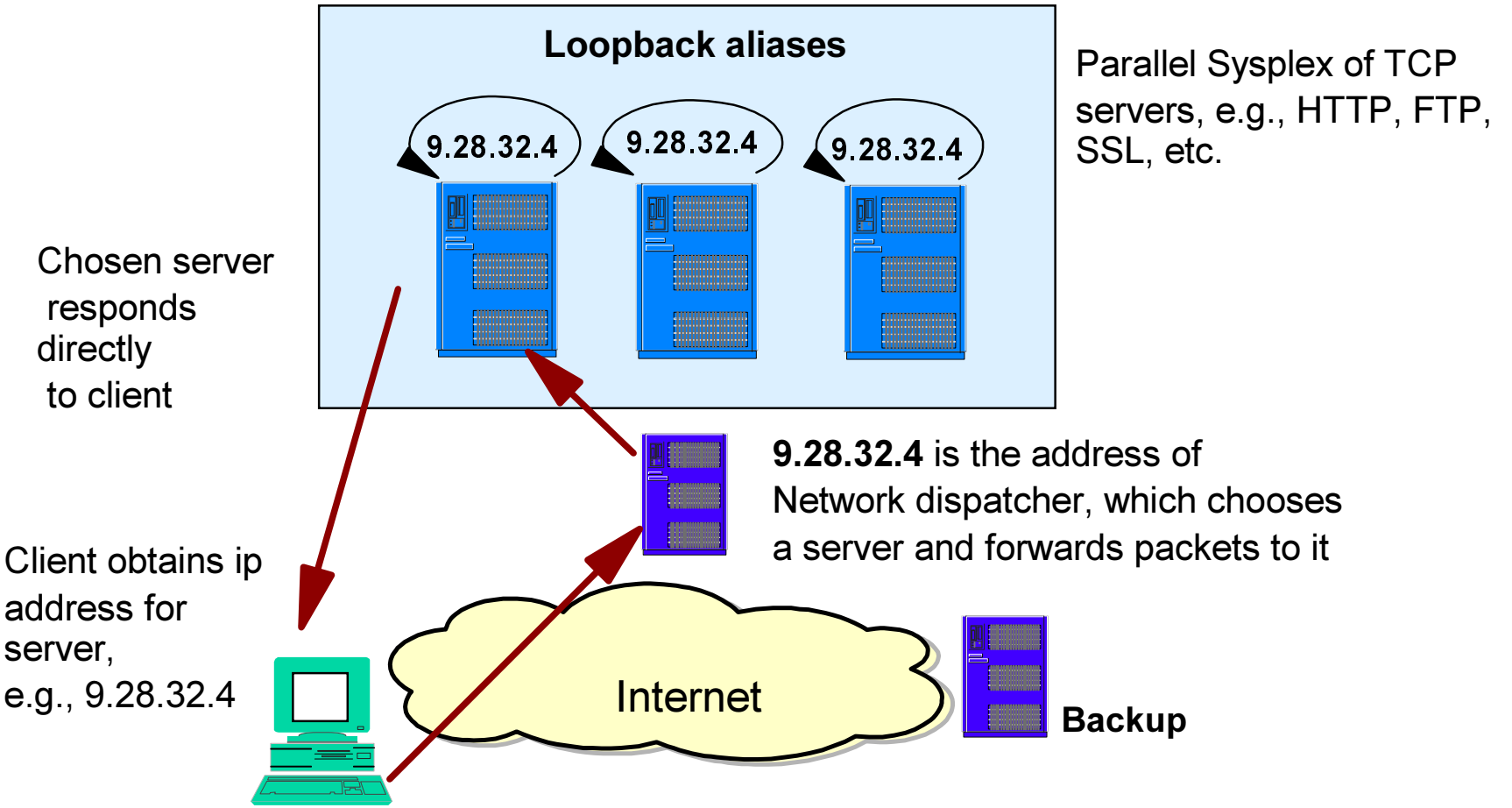
Workload Distribution and Load Balancing ...

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

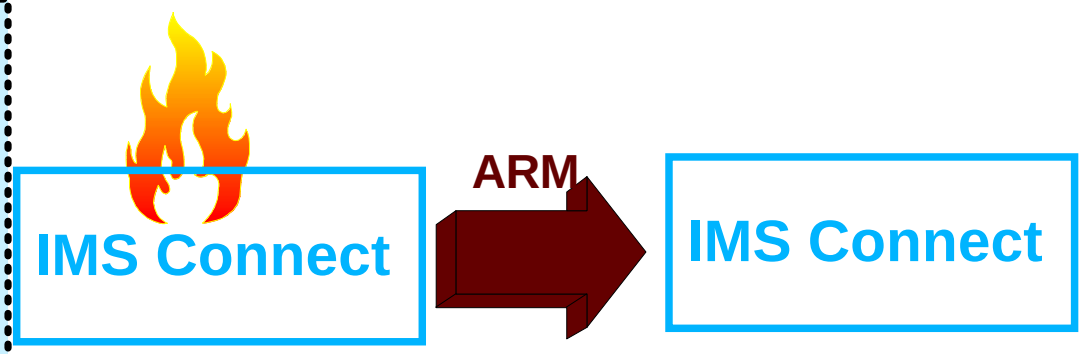
- **IBM/Cisco alliance**
- **Cisco MultiNnode Load Balancing (MNLB)**
  - Software solution on routers/switches for IP workload balancing
    - Can interact with WLM on OS/390
  - Similar in concept to the Network dispatcher

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

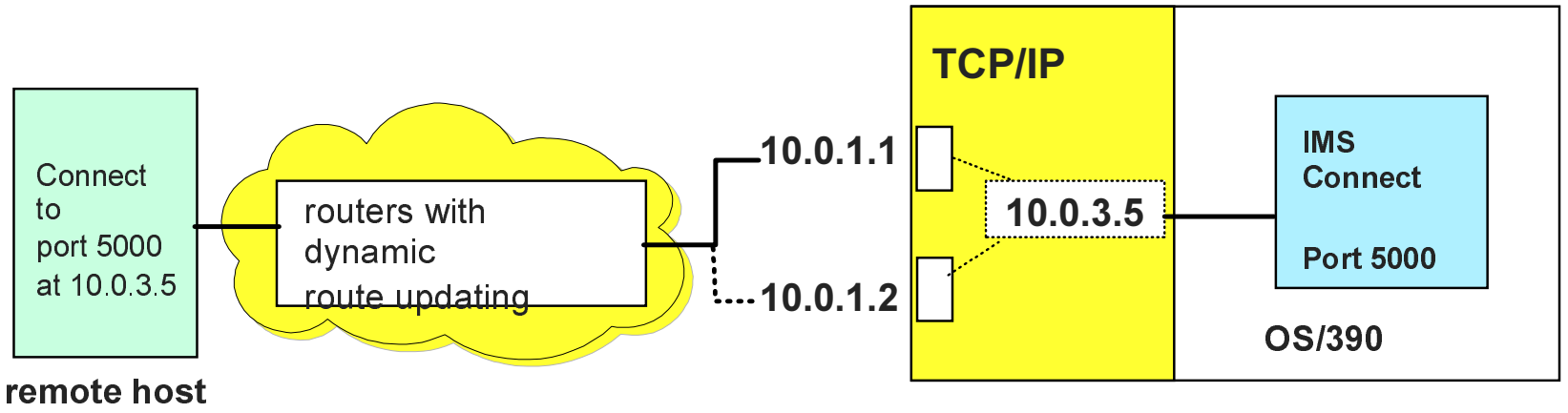
```
//IMSCONN PROC ..
//* invoke armwrap to register IMS Connect with ARM
//REGSTEP EXEC PGM=ARMWRAP,
//       PARM=('REQUEST=REGISTER'...
//.....
//* invoke IMS Connect
//CONNSTP EXEC PGM=HWSHWS00 ...
//.....
//UNREG EXEC PGM=ARMWRAP,
PARM=('REQUEST=UNREGISTER)
```



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

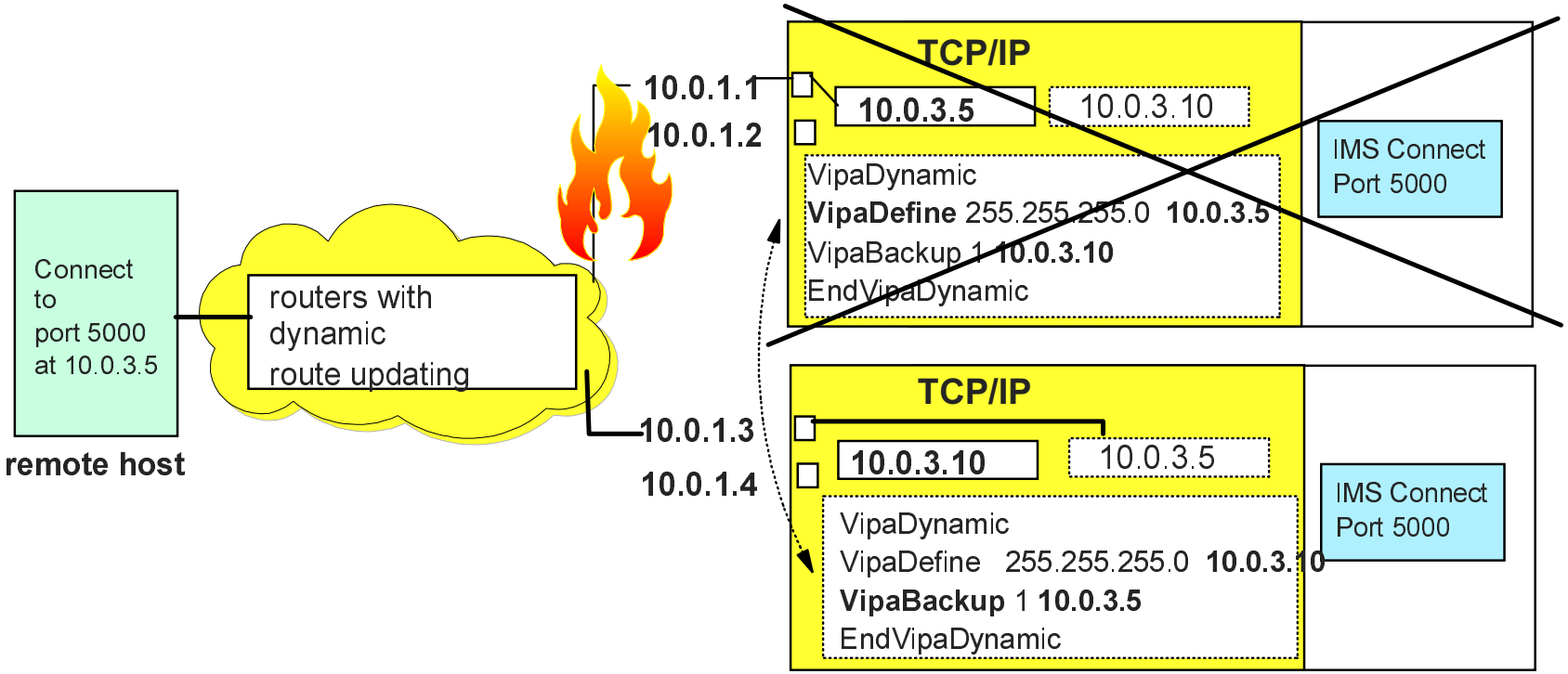


Note: The real network interfaces 10.0.1.1 and 10.0.1.2 appear to be intermediate hops

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



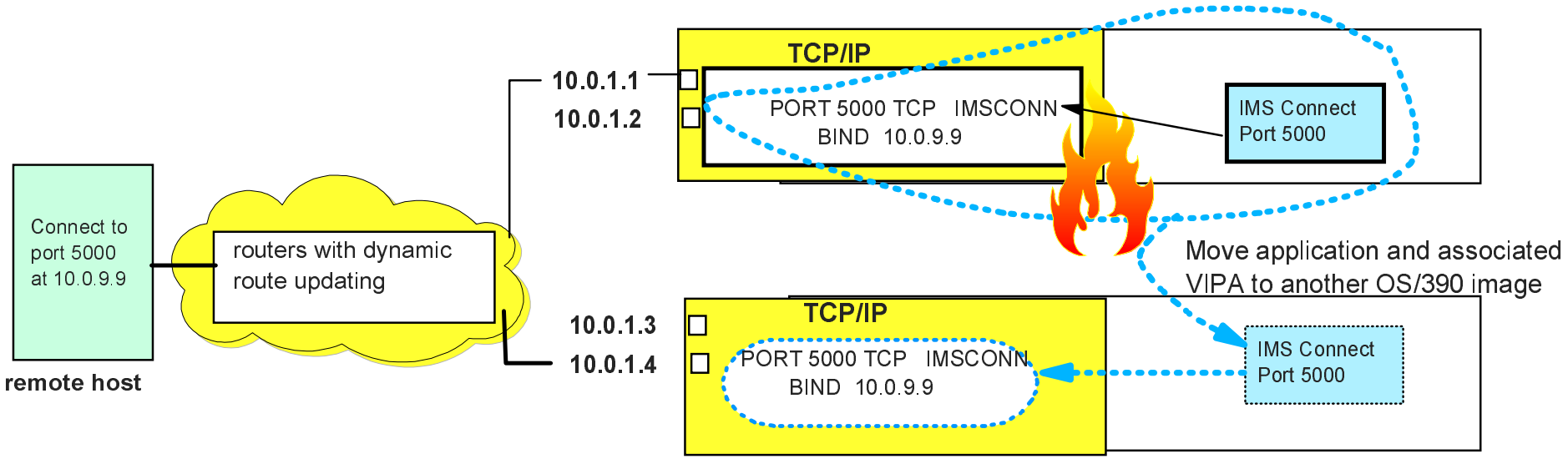
Note: Server application may need to be started on the same port on the backup host

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

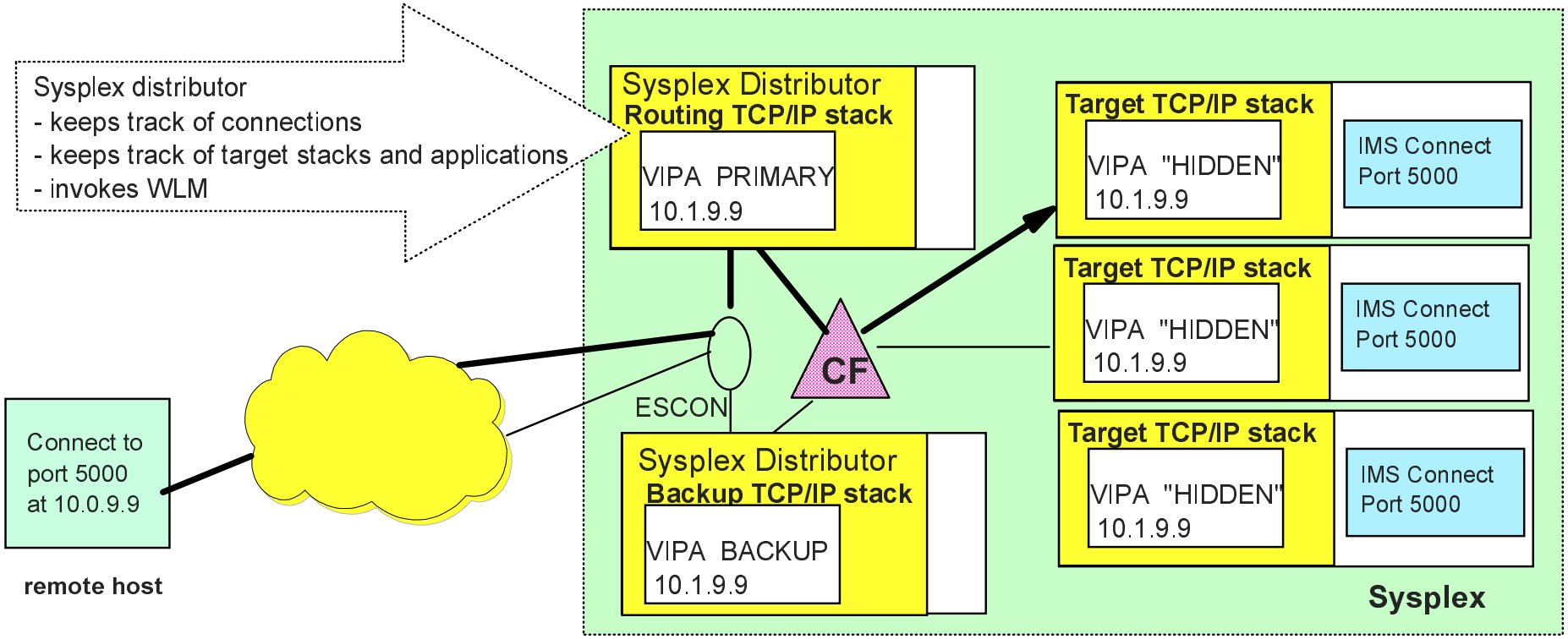
```
//TCPDVP  EXEC PGM=MODDVIPA,....
//          PARM='-p  TCPIP -c 10.0.9.9'
//....
```

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

Sysplex Distributor

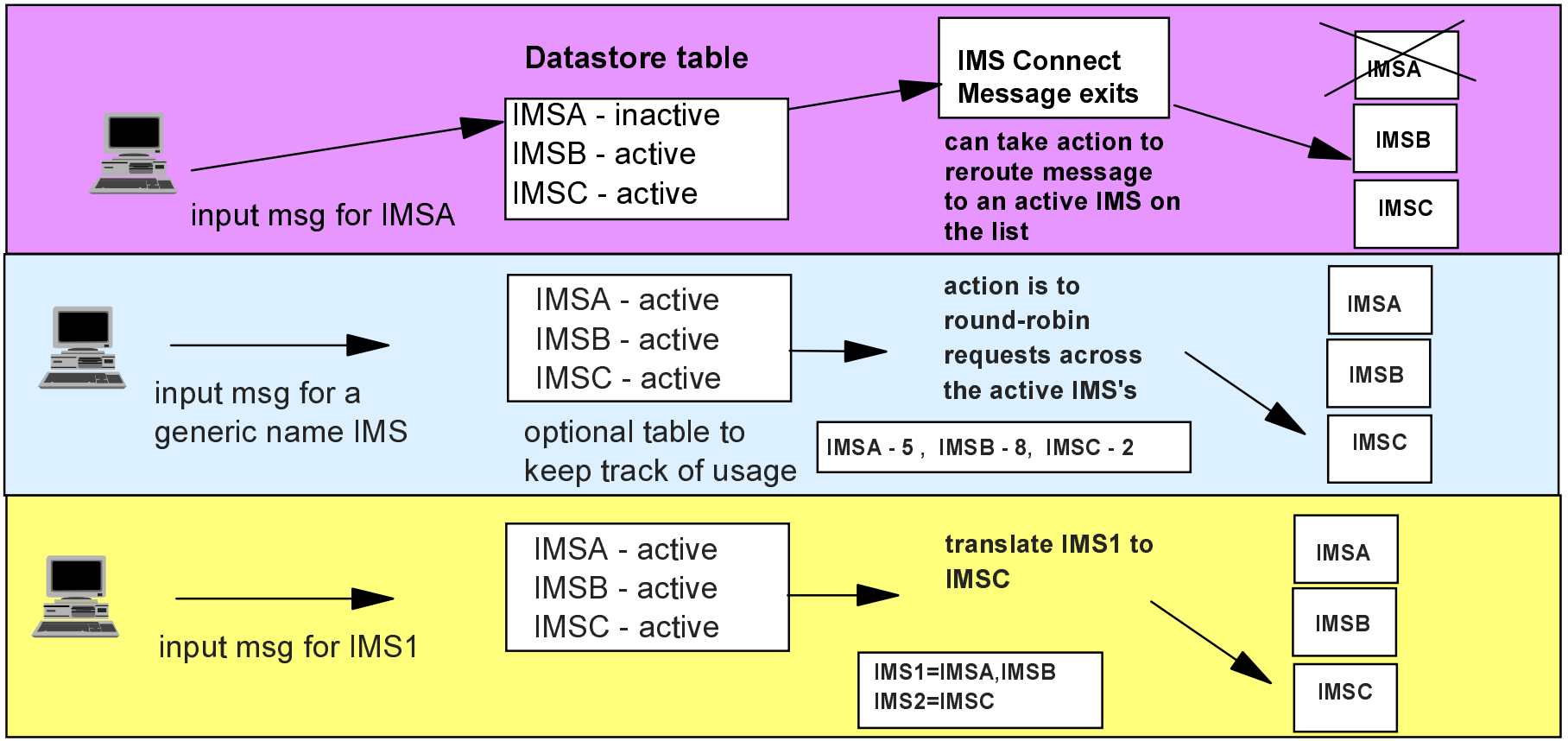
Sysplex function - Single IP address for a cluster of Hosts

- Sysplex-wide VIPA - OS/390 V2R10
- Workoad 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

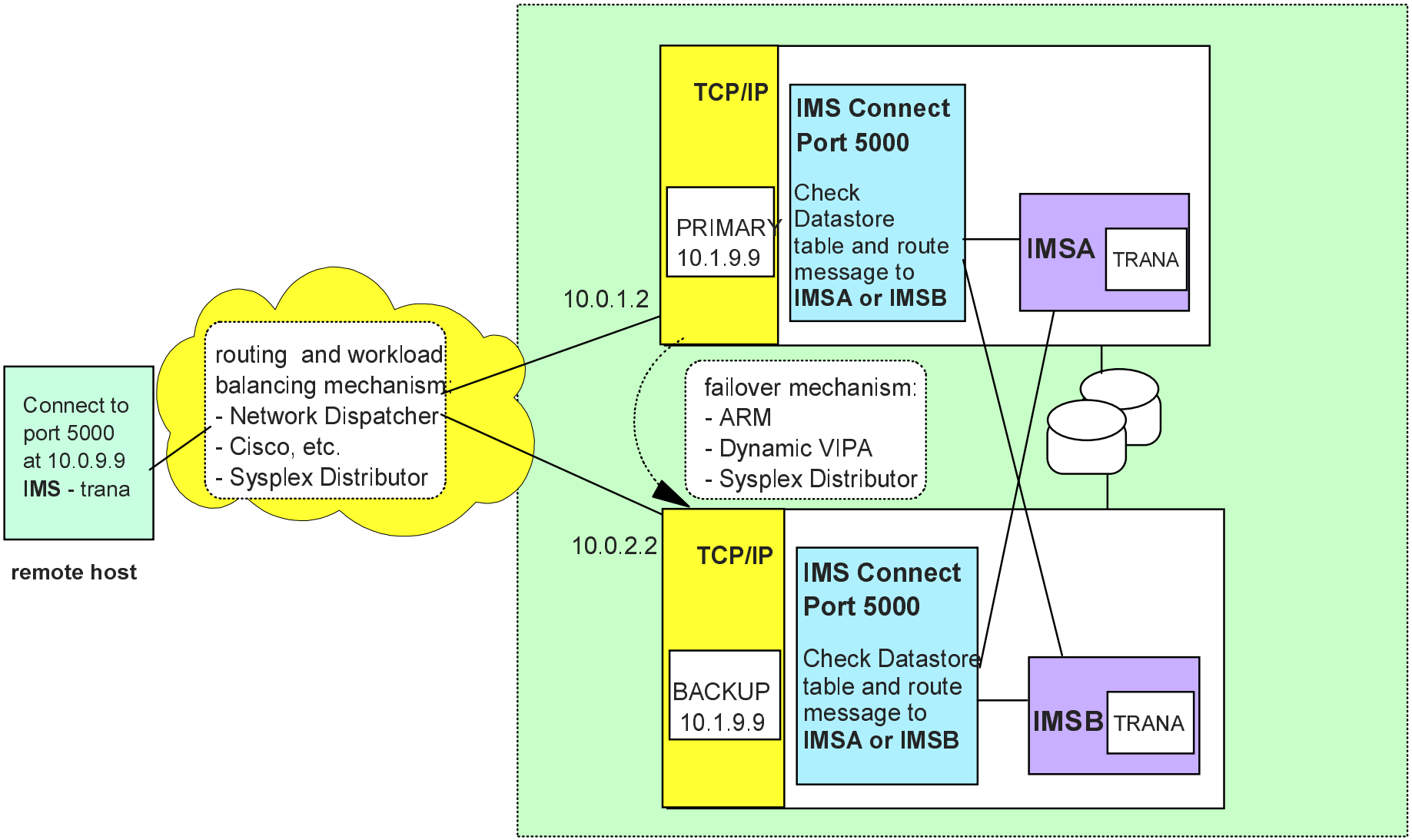


IMS Connect workload balancing and Failover

- **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

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  - 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

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