IBM TRAINING

Session V24

Virtual Networking with z/VM Guest LANs and the z/VM Virtual Switch

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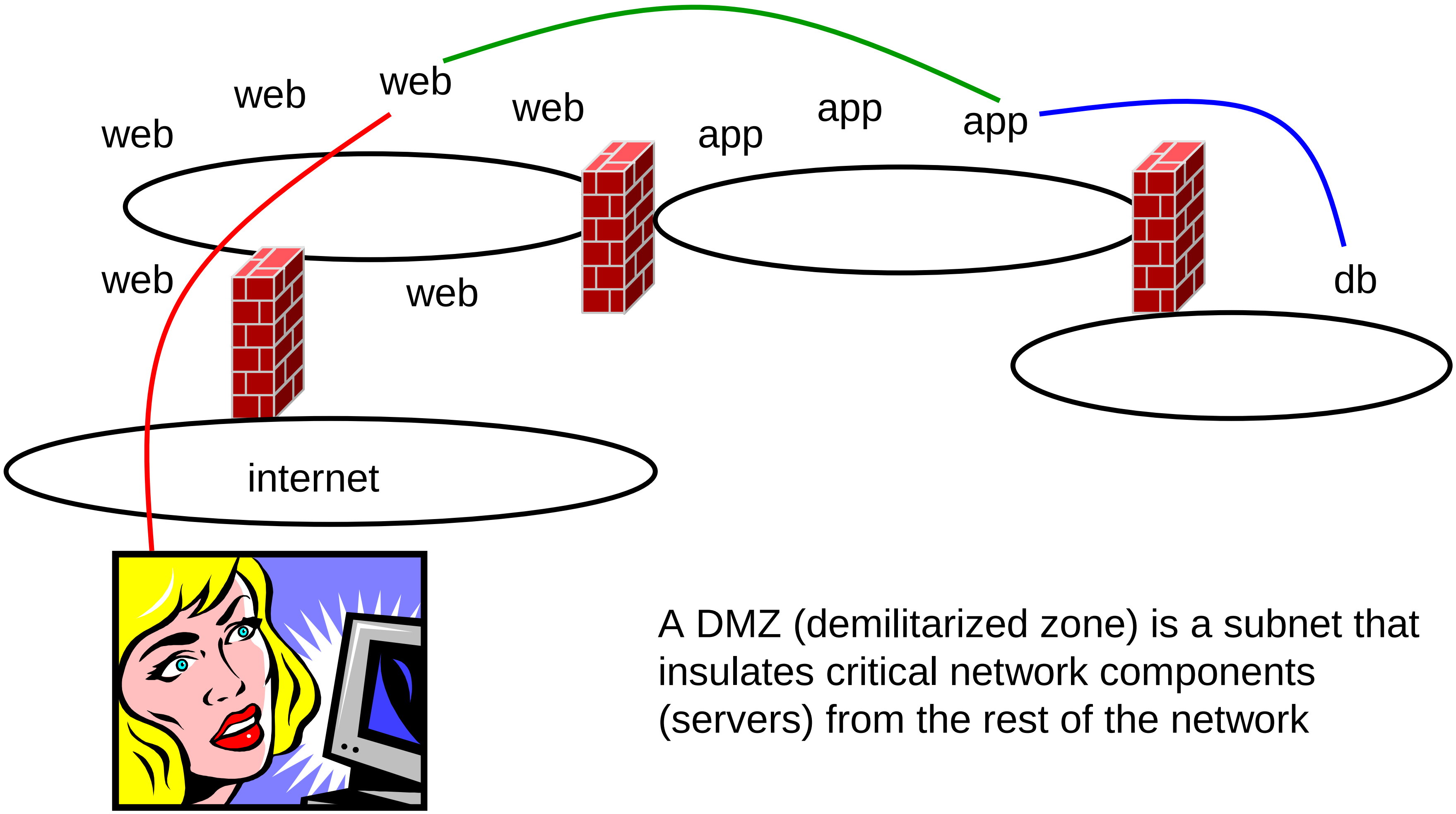
Topics

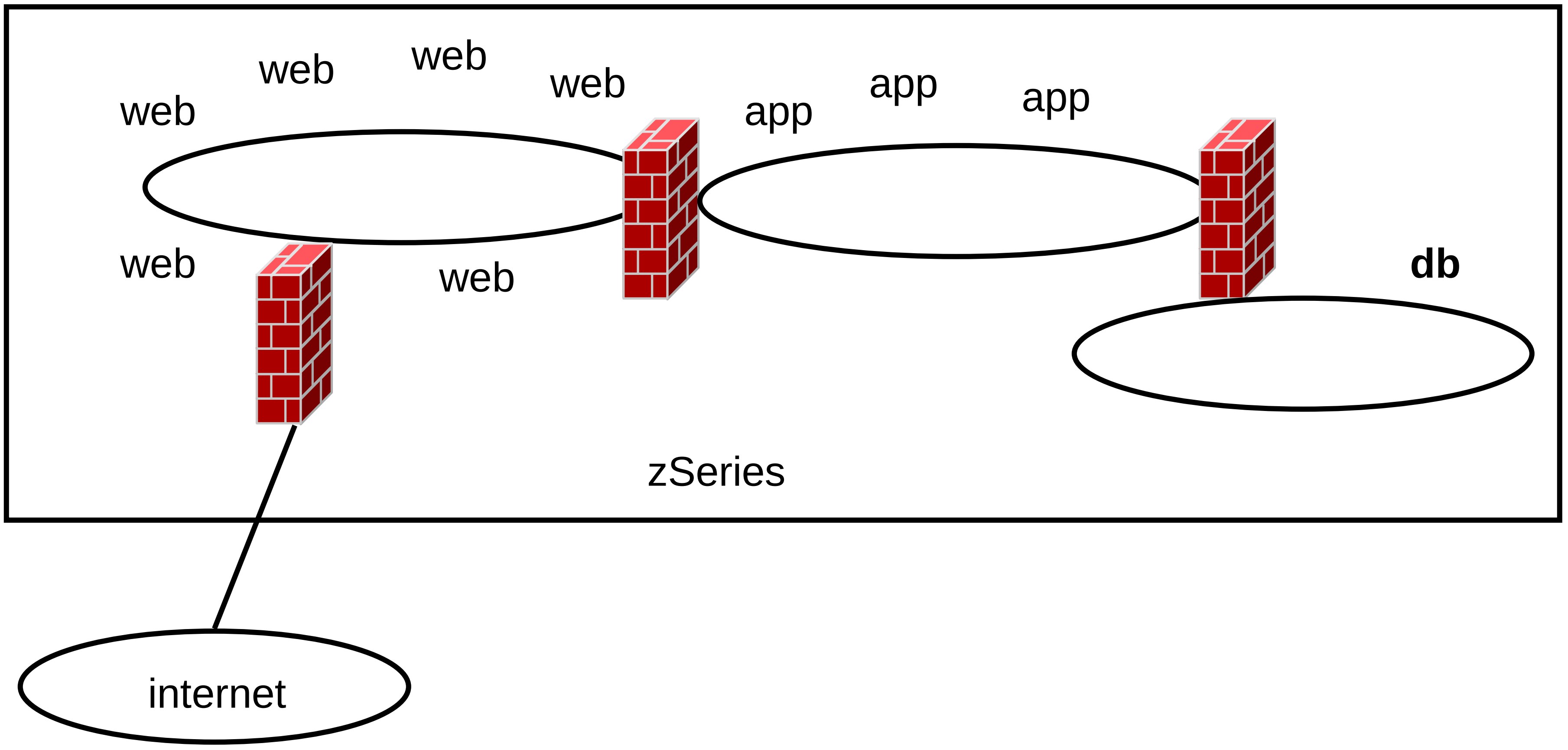
- Overview
- Guest LANs
- Virtual Network Interface Card
- Virtual Switch
- What’s new in z/VM Version 5.1 and 5.2

Multi-DMZ Network

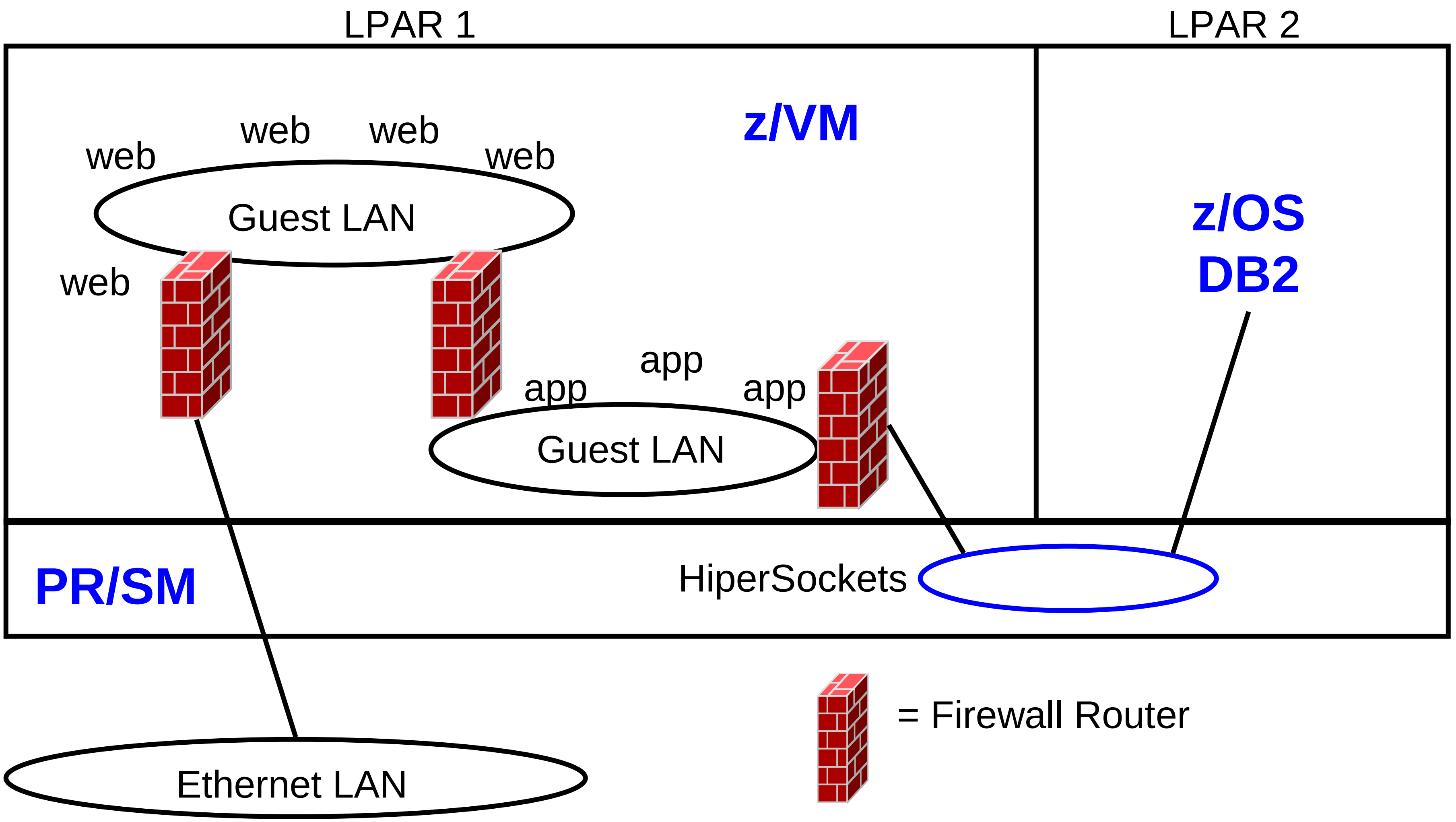


A DMZ (demilitarized zone) is a subnet that insulates critical network components (servers) from the rest of the network

Multi-DMZ Network on zSeries



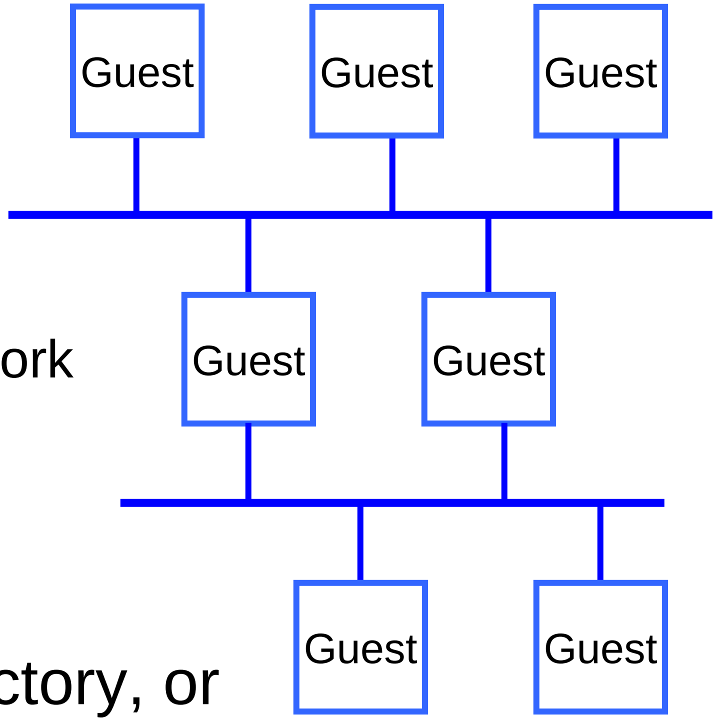
Multi-DMZ Network with Guest LANs



Guest LANs

z/VM Guest LAN

- A simulated LAN segment
  - Ethernet: IPv4 and IPv6
  - HiperSockets: IPv4 and IPv6
  - No built-in connection to outside network
- As many as you want
- Created in SYSTEM CONFIG, directory, or by CP DEFINE LAN command



Primary Guest LAN Attributes

- Name & Owner
- Type
- Access list
- Maximum frame size (HiperSockets only)

- Some attributes can be changed after the LAN is defined

- There are some others not discussed here
  - Maximum number of connections
  - Accounting

LAN Name and Owner

- The LAN name is a simple 1-8 character token
- The LAN owner is a VM user ID or “SYSTEM”
- (name, owner) is unique within the system
- A Class G LAN owner can
  - modify the LAN access list
  - delete the LAN
- A Class B user can create, modify, or detach any LAN

HiperSockets or Ethernet

TYPE HIPERsockets | QDIO [IP | ETHERNET]

- HiperSockets
  - Synchronous
  - Low latency
  - Slightly smaller path length in CP (less CPU time)
- QDIO
  - OSA-Express in QDIO mode
  - Asynchronous
  - Higher latency than HiperSockets
  - Higher CPU cost
  - IP = Layer 3, ETHERNET = Layer 2

z/VM 5.1

Access list

- Unrestricted
  - Any user can connect (couple) to this LAN
  - Hint: CP QUERY LAN can show you who is connected
- Restricted
  - Only users in the access list can connect (couple) to this LAN
  - LAN owner uses CP SET LAN to GRANT or REVOKE access
  - CP QUERY LAN can show you the current access list
  - CP QUERY LAN can show you who is connected
- **External Security Manager**
  - RACF/VM support for new VMLAN objects

Maximum Frame Size (HiperSockets only)

MFS 16K | 24K | 40K | 64K

- Simulates CHPID OS=*value* specification in IOCDS for HiperSockets (TYPE=IQD) chpids
  - Does not apply to QDIO

- Largest MTU specification = (MFS - 8K)

- Hints:
  - If LAN is isolated, use large MFS and large MTU
  - If LAN has external gateway, use MFS 16K and match external MTU (e.g. 1492)
  - Jumbo frame (MTU 8992) gateway needs 24K MFS

Persistent vs. Transient LAN

- Persistent / Transient is inferred from other attributes
  - Any LAN owned by user “SYSTEM” is *persistent*
  - Any LAN created by SYSTEM CONFIG is *persistent*
  - All other LANs are *transient*

- A *persistent* LAN must be explicitly deleted by CP DETACH LAN

- A *transient* LAN is automatically deleted when the last user uncouples from the LAN

Setting Guest LAN defaults and limits

- Set global VM LAN attributes in the SYSTEM CONFIG file:

```
VMLAN LIMit PERSistent INFinite|maxcount
VMLAN LIMit TRANSient INFinite|maxcount
VMLAN ACNT|ACCOUNTing SYSTEM ON|OFF
VMLAN ACNT|ACCOUNTing USER ON|OFF
VMLAN MACPREFIX 020000-02FFFF
VMLAN MACIDRANGE SYSTEM x-y [USER a-b]
```

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- *Maxcount* of 0 prevents dynamic definition
- SET VMLAN to change dynamically

Virtual MAC Addresses

- Each instance of CP should have a unique VMLAN MACPREFIX
- Virtual MAC = MACPREFIX || MACID
- VMLAN MACIDRANGE
  - SYSTEM – The range of MACIDs from which CP will select a dynamically defined MAC
  - USER – The range of MACIDs reserved by CP for NICDEF. All MACIDs on NICDEFs must be in this range.
  - USER is a subset of SYSTEM

Create a Guest LAN

- DEFINE LAN in SYSTEM CONFIG

```
DEFINE LAN name [OWNERid ownerid]
           [TYPE HIPERsockets|QDIO]
           [MAXCONN INFinite|nnnn]
           [MFS 16K|24K|40K|64K]
           [ACCOUNTing ON|OFF]
           [UNRESTricted|RESTricted]
           [GRANT userlist]

Examples:

DEFINE LAN QDIO5 OWNER SYSTEM TYPE QDIO
```

- CP DEFINE LAN to create dynamically

```
DEFINE LAN NET9 OWNER SYSTEM RESTRICTED TYPE QDIO
```

Grant Guest LAN Access

- DEFINE LAN and MODIFY LAN in SYSTEM CONFIG

```
MODIFY LAN  name
           [OWNERid ownerid | OWNERID SYSTEM]
           [GRANT userid]

Example:

DEFINE LAN HIPER1 OWNER SYSTEM RESTRICTED
MODIFY LAN HIPER1 OWNER SYSTEM GRANT LINUX01
MODIFY LAN HIPER1 OWNER SYSTEM GRANT LINUX02
```

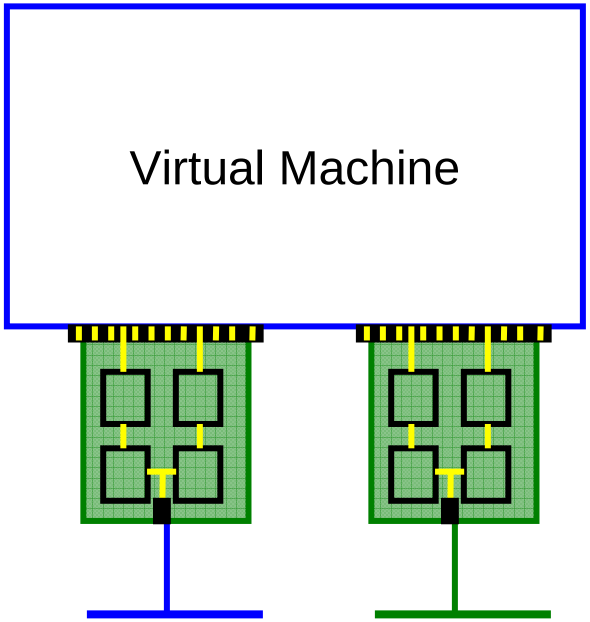
- CP SET LAN to change dynamically

```
CP SET LAN HIPER1 OWNER SYSTEM GRANT LINUX03
```

Virtual Network Interface Card

Virtual Network Interface Card (NIC)

- A simulated network adapter
  - OSA-Express QDIO
  - HiperSockets
  - Must match LAN type
- 3 or more devices per NIC
  - More than 3 to simulate port sharing on 2nd-level system or for multiple data channels
- Provides access to Guest LAN or Virtual Switch
- Created by directory or CP DEFINE NIC command



Guest LAN or virtual switch

Virtual NIC - User Directory

- May be automated with USER DIRECT file:

```
NICDEF vdev [TYPE HIPERS | QDIO]
            [DEVices devs]
            [LAN owner name]
            [CHPID xx]
            [MACID xxyyzz]

Example:

NICDEF 1100 LAN SYSTEM SWITCH1 CHPID B1 MACID B10006
```

z/VM 5.1

Combined with VMLAN MACPREFIX to create virtual MAC

Virtual NIC - CP Command

- May be interactive with CP DEFINE NIC and COUPLE commands:

```
CP DEFINE NIC vdev
        [[TYPE] HIPERsockets|QDIO]
        [DEVices devs]
        [CHPID xx]

CP COUPLE vdev [TO] owner name

Example:

CP DEFINE NIC 1200 TYPE QDIO
CP COUPLE 1200 TO SYSTEM CSC201
```

NIC CHPID parameter

CHPID xx

- Specifies the Channel Path ID number (in hex) to use for this NIC

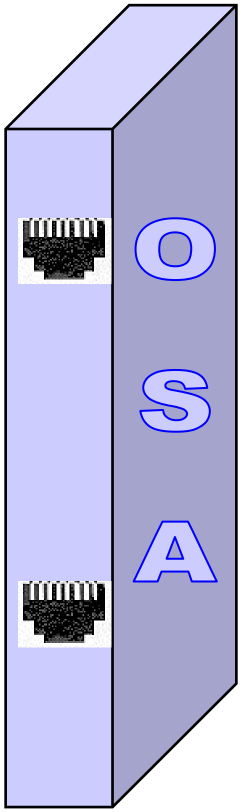
- Needed for z/OS guest because HiperSockets are managed by CHPID number

- **This is a virtual CHPID number**

Virtual Switch

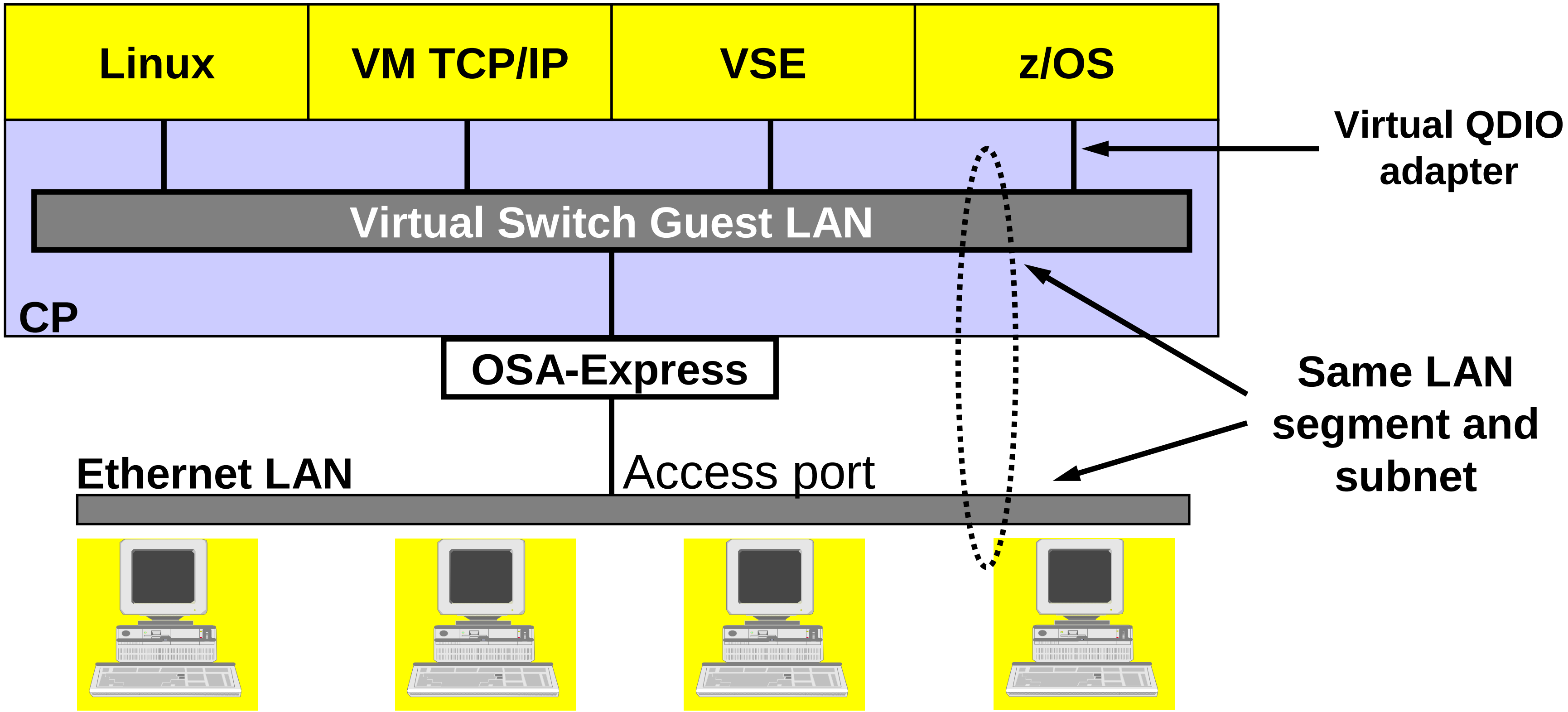
What's a 'switch' anyway?

© Cisco Corp

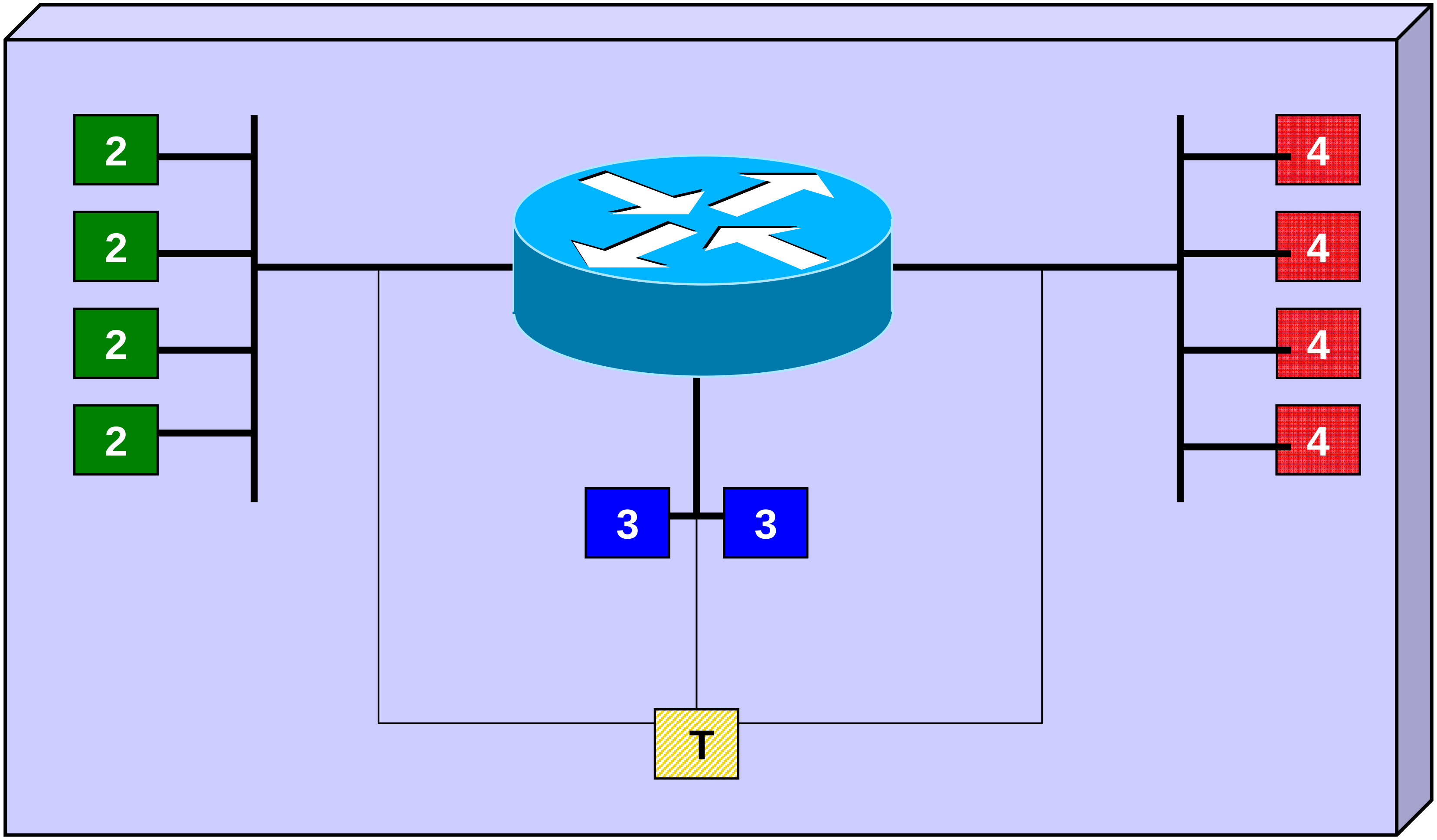


- A box that creates a LAN
- It can be remotely configured
  - E.g. Turn ports on and off
- Similar to a home router

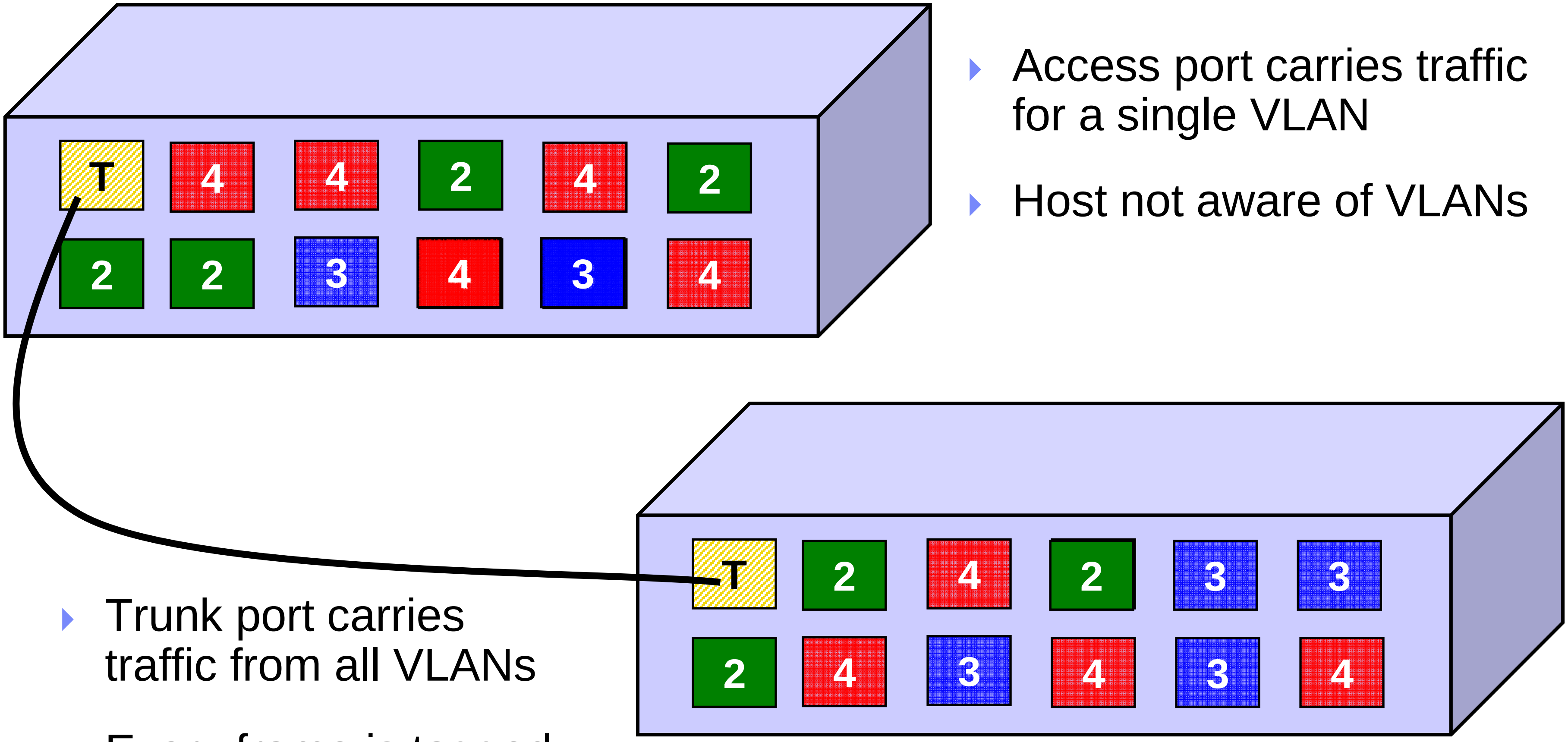
z/VM Virtual Switch – VLAN unaware



A VLAN-aware switch: An inside look



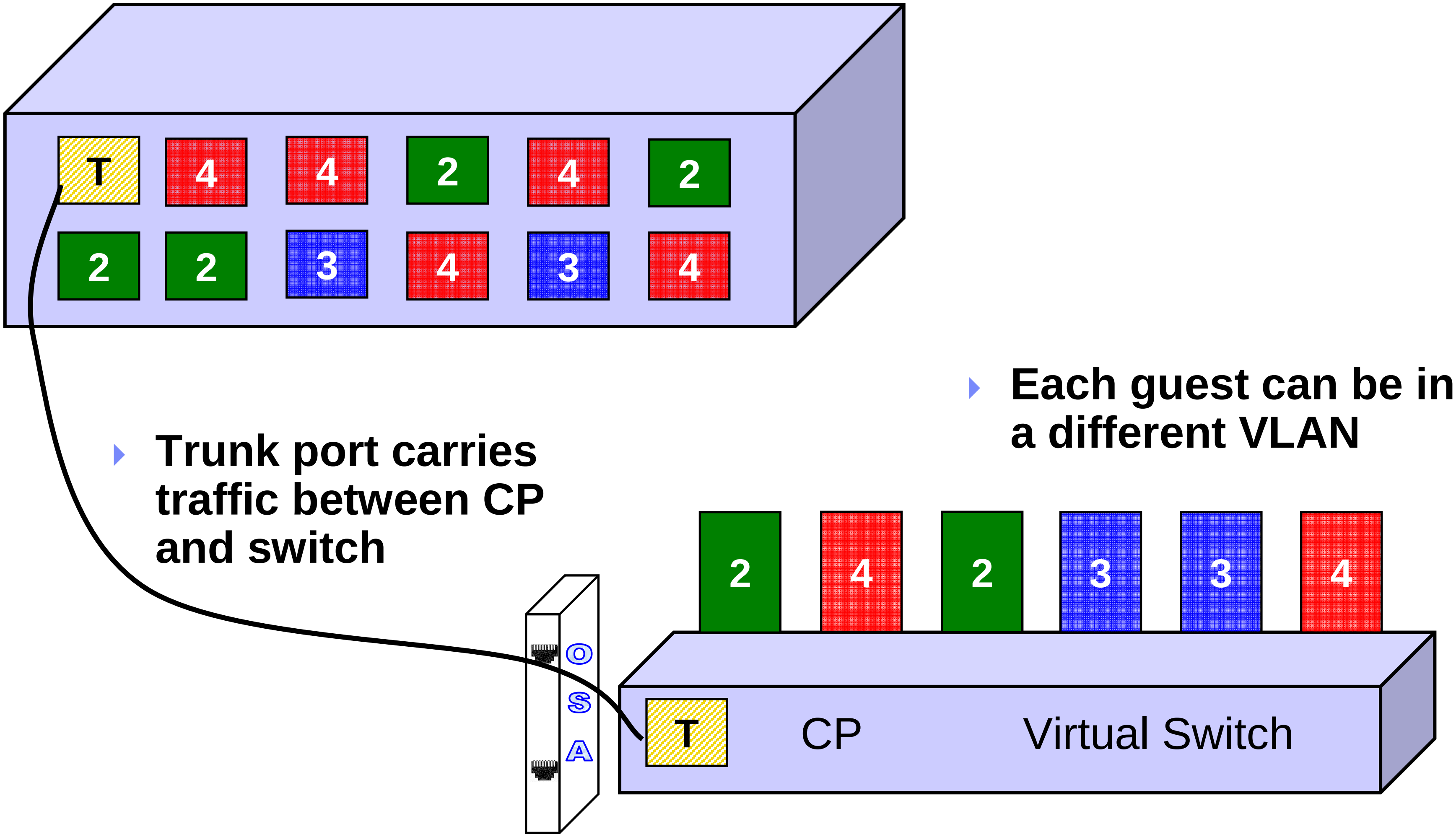
Trunk Port vs. Access Port



- Access port carries traffic for a single VLAN
- Host not aware of VLANs

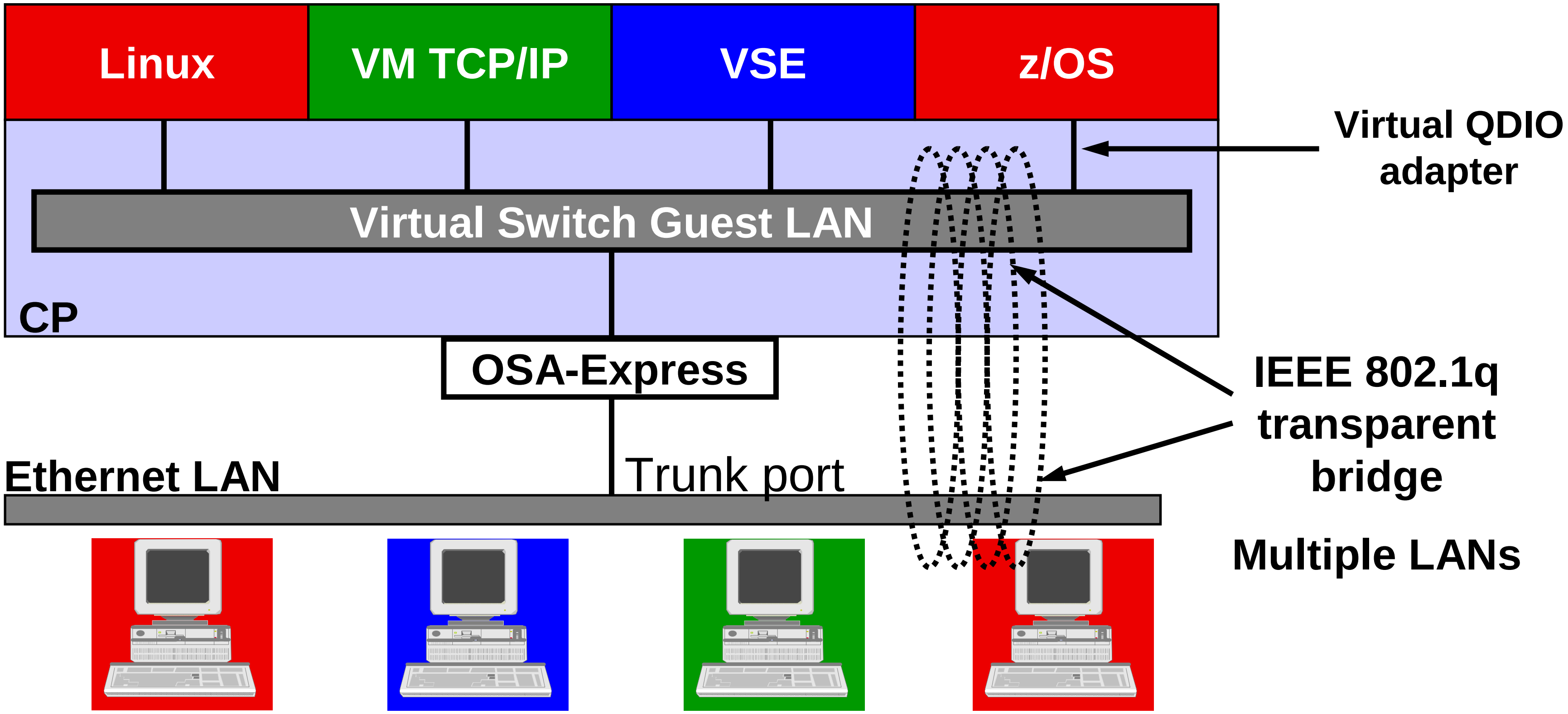
- Trunk port carries traffic from all VLANs
- Every frame is tagged with the VLAN id

Physical Switch to Virtual Switch



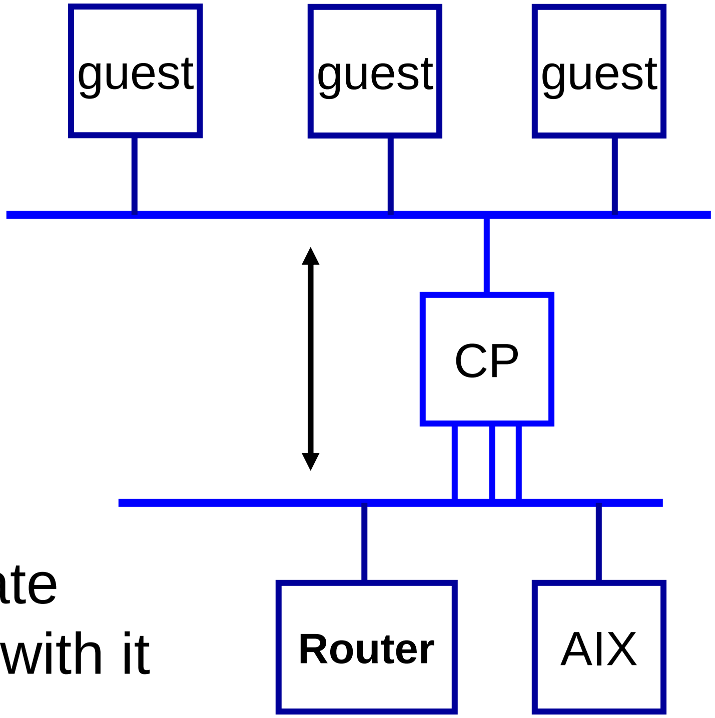
- **Trunk port carries traffic between CP and switch**
- **Each guest can be in a different VLAN**

z/VM Virtual Switch – VLAN aware



z/VM Virtual Switch

- A special-purpose Guest LAN
  - Ethernet IPv4
  - Built-in IEEE 802.1q bridge to outside network
  - IEEE VLAN capable



- Each Virtual Switch has up to 3 separate OSA-Express connections associated with it
- Created in SYSTEM CONFIG or by CP DEFINE VSWITCH command

Virtual Switch Attributes

- Name
- Associated OSAs (maximum 3)
- A controlling virtual machine (minimal VM TCP/IP stack server)
  - Controller not involved in data transfer
  - Do not ATTACH or DEDICATE
  - User needs IUCV *VSWITCH authorization
  - User needs VSWITCH CONTROLLER statement in PROFILE TCPIP
- Similar to Guest LAN
  - Owner SYSTEM
  - Type QDIO
  - Persistent
  - Restricted

Create a Virtual Switch

- SYSTEM CONFIG or CP command:

```
DEFINE VSWITCH name
                 [RDEV NONE | cuu [cuu [cuu]] ]
                 [CONNECT | DISCONNECT]
                 [CONTROLLER * | userid]
                 [IP IPTIMEOUT 5 NONROUTER | ETHERNET]

                 [VLAN UNAWARE | VLAN native_vid]
                 [PORTTYPE ACCESS | PORTTYPE TRUNK]

Example:

DEFINE VSWITCH SWITCH12 RDEV 1E00 1F04 CONNECT
```

z/VM 5.1

Change the Virtual Switch access list

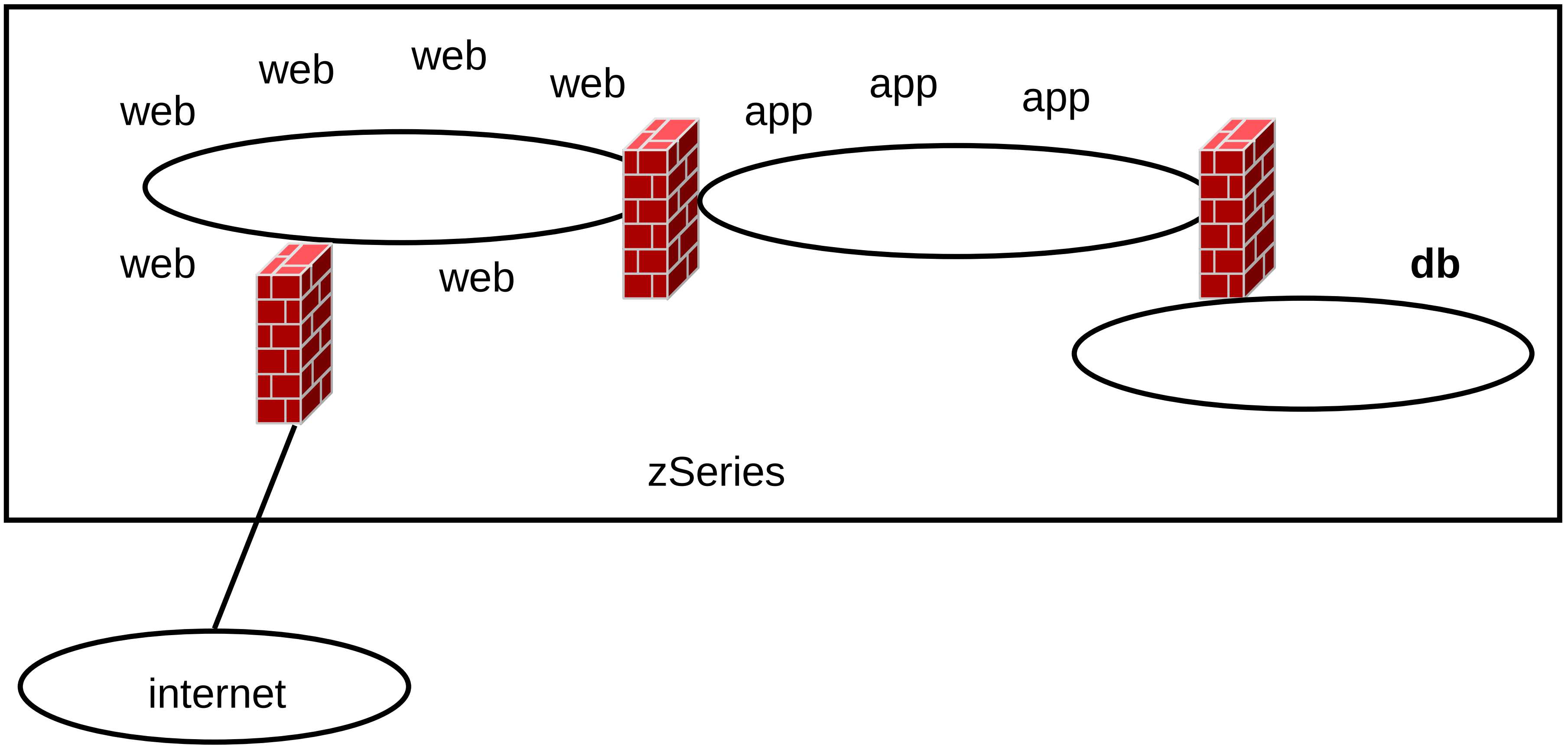
- Specify after DEFINE VSWITCH statement in SYSTEM CONFIG to add users to access list

```
MODIFY VSWITCH name GRANT  userid
SET                        [VLAN vid1 vid2 vid3 vid4]
                           [PORTTYPE ACCESS | TRUNK]
                           [PROmiscuous | NOPROmiscuous]

SET    VSWITCH name REVOKE userid

Examples:
MODIFY VSWITCH SWITCH12 GRANT LNX01 VLAN 3 7 105
CP SET VSWITCH SWITCH12 GRANT LNX02 PORTTYPE TRUNK
                                        VLAN 4-20 22-29


CP SET VSWITCH SWITCH12 GRANT LNX02 PRO
```

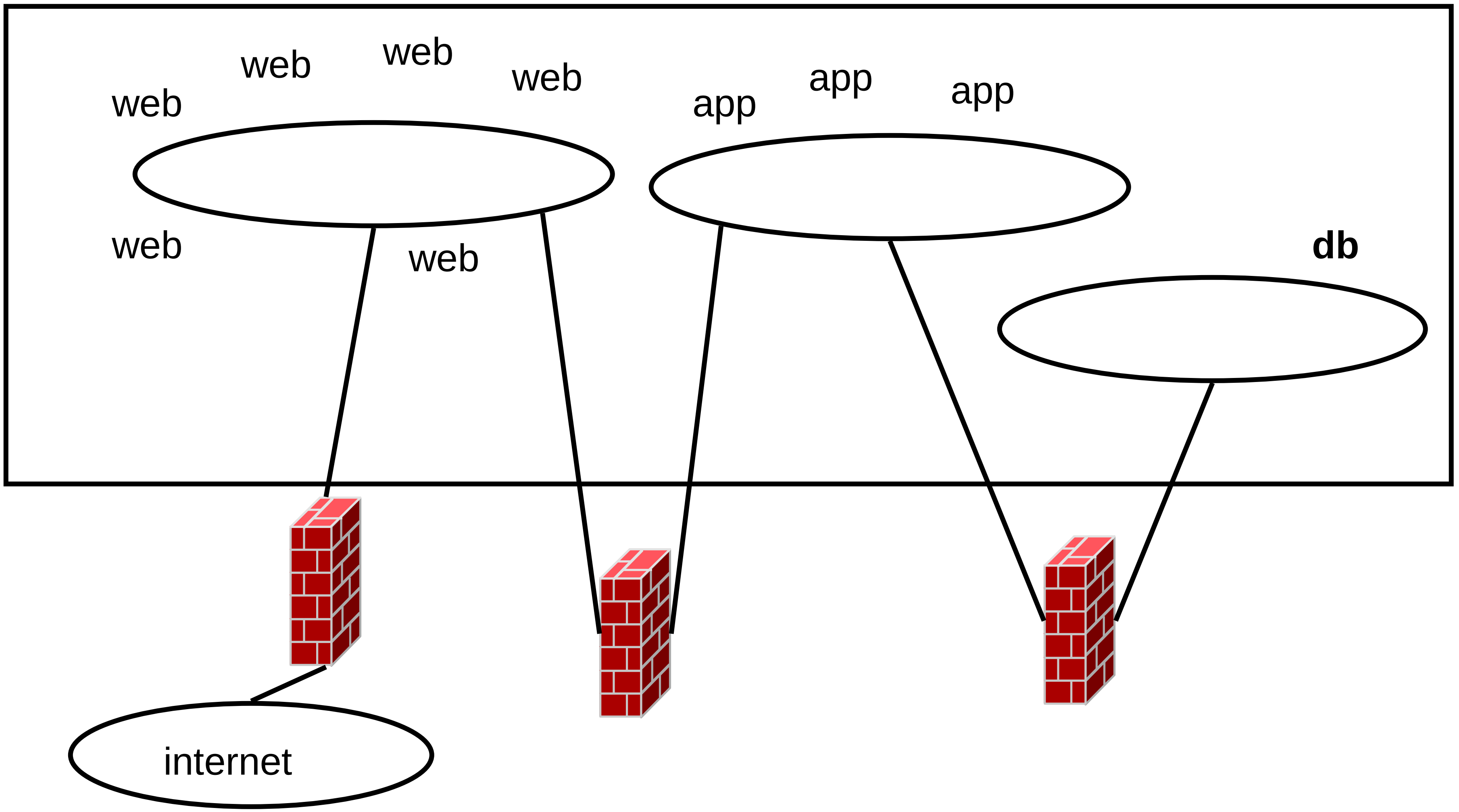
z/VM 5.2

- z/VM 4.4 supports “VLAN ANY”, but it’s removed in z/VM5.1!

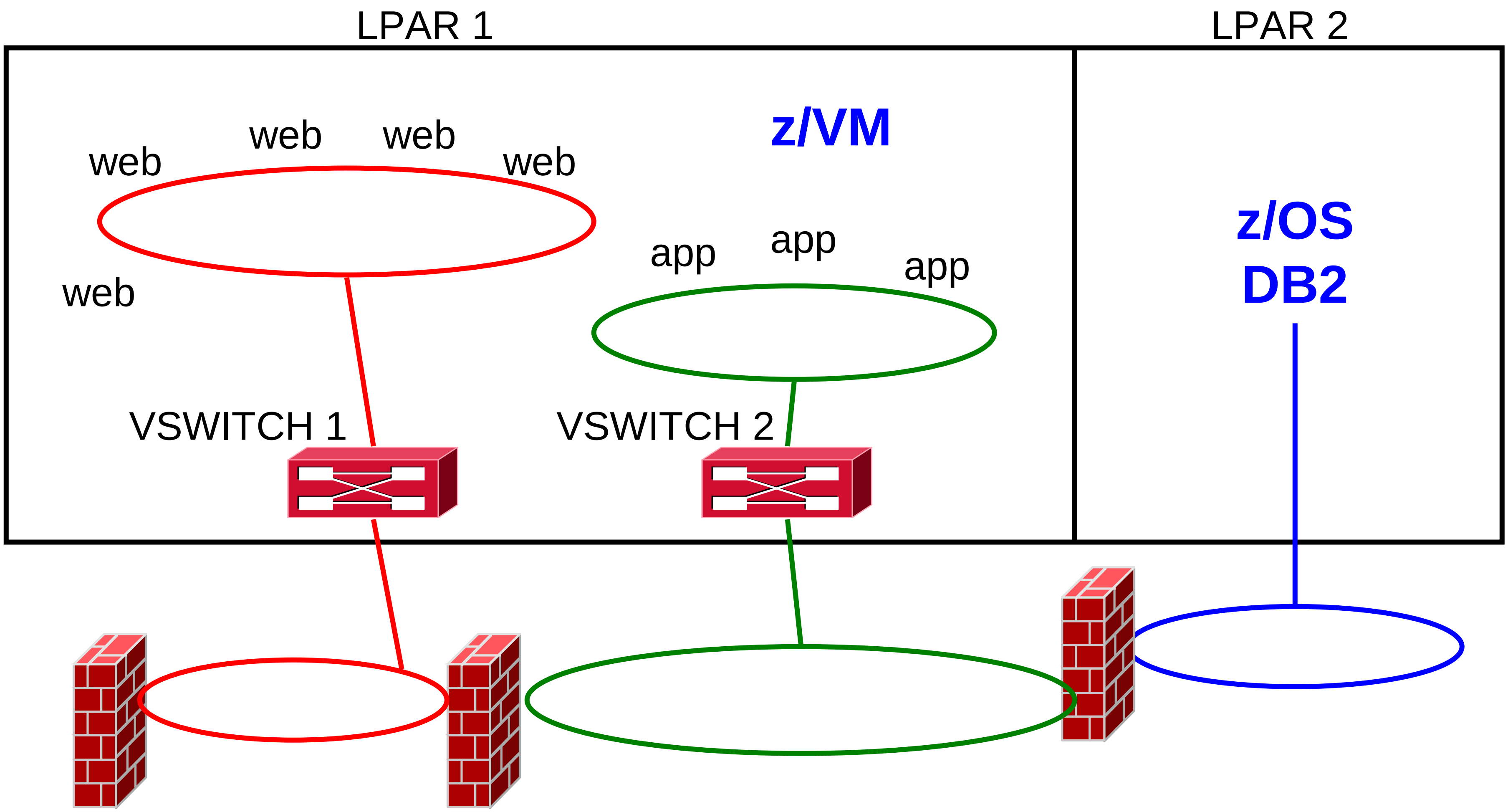
Multi-DMZ Network on zSeries - Reloaded



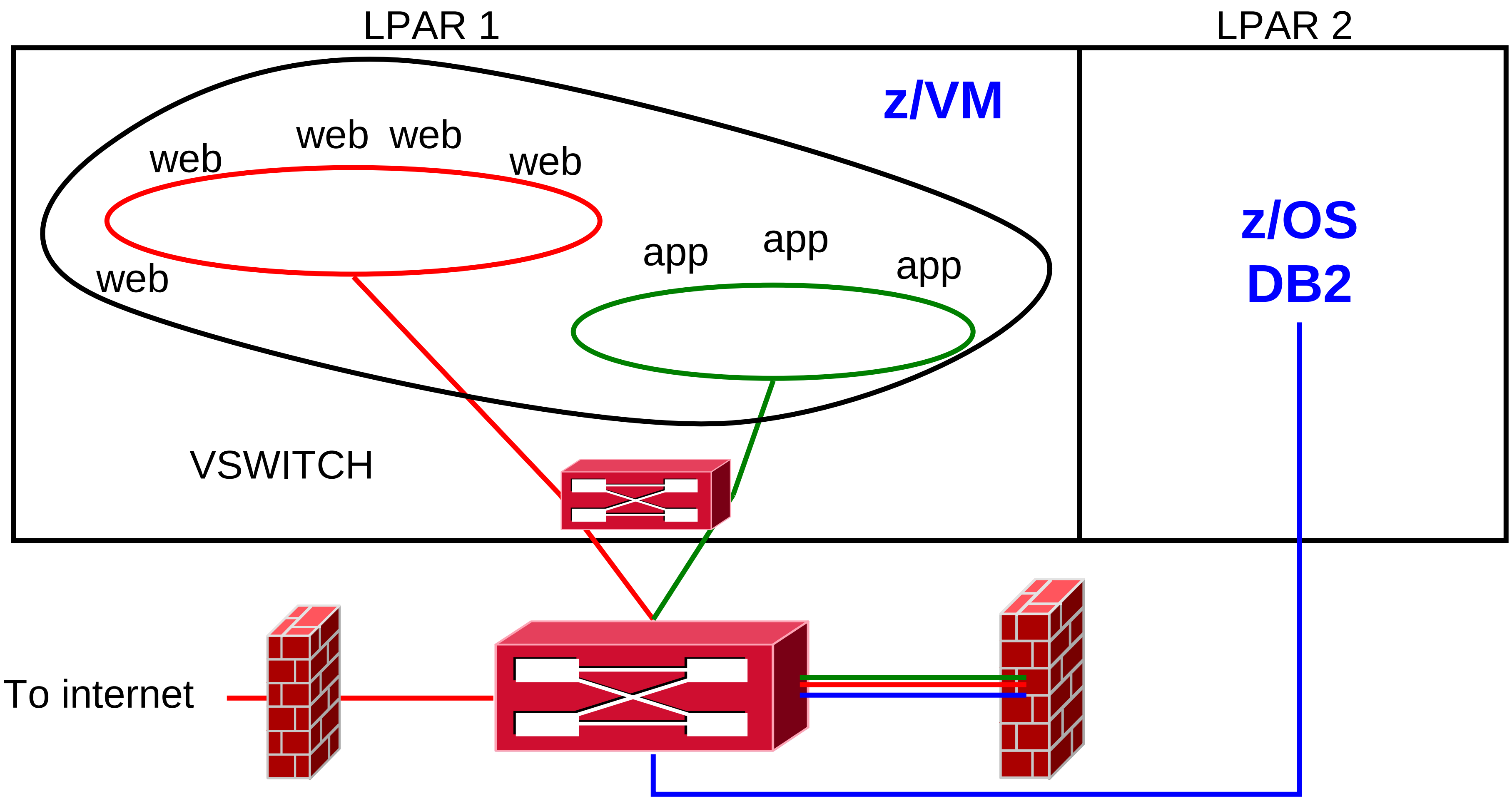
Multi-DMZ Network on zSeries with outboard firewall



Multi-DMZ Network with VSWITCH (A)



Multi-DMZ Network with VSWITCH (B)



With 1 VSWITCH, 3 VLANs, and a multi-domain firewall

What's new?

z/VM 5.2 Post-GA Support – VM63952

- Hipersockets IPv6 support
- VSWITCH GRVP support
  - GARP (Generic Attribute Registration Protocol) VLAN Registration Protocol
  - Provides VLAN pruning in conjunction with Physical Switch
  - VLAN Aware only

New in z/VM 5.2…

- Support for LAN Sniffers
  - CP command or device driver control ("promiscuous mode")
    - SET VSWITCH GRANT, SET LAN GRANT, SET NIC
  - External security manager
    - RACF/VM CONTROL access to VMLAN profile
  - Guest receives copies of all frames sent or received

- Pre-defined VSWITCH controllers
  - DTCVSW1 and DTCVSW2
  - Same as shown in Getting Started with Linux
    - Add them to AUTOLOG1
    - Remove "VSWITCH CONTROLLER ON" from PROFILE TCPIP in your production stacks

New in z/VM 5.1…

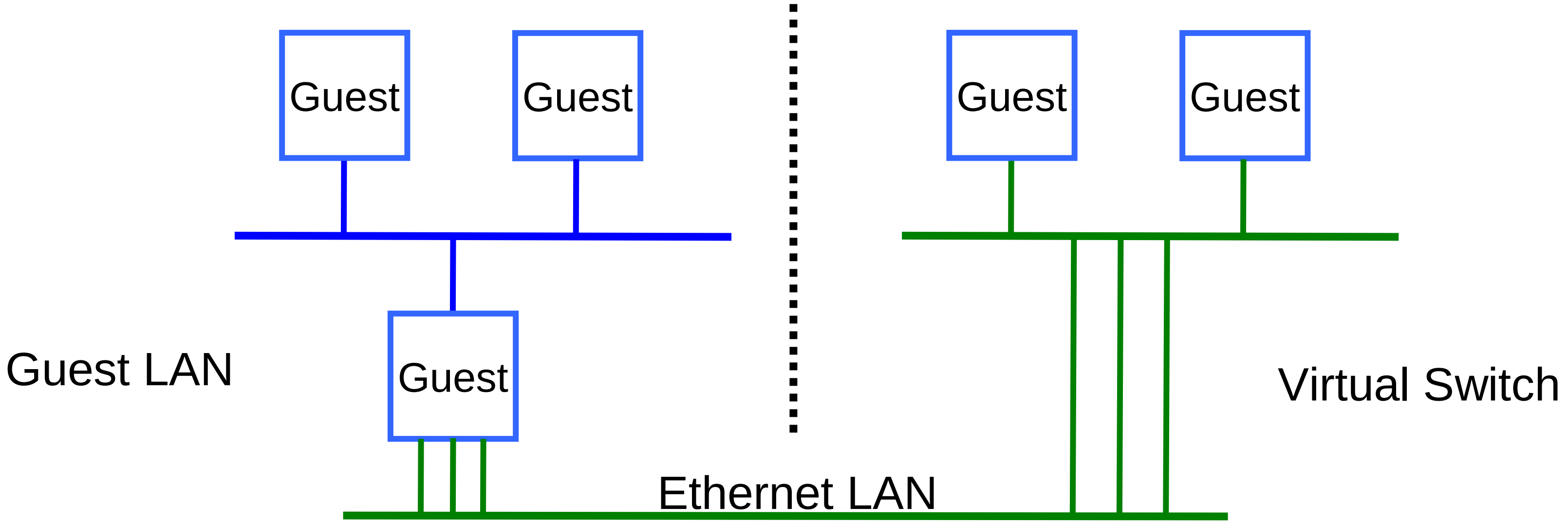
- ESM control for all guest LANs and VSWITCHes, including VLAN ID control
  - RACF: Class VMLAN, Profile owner.lanname or owner.lanname.vid
  - All Guest LANs and VSwitches can be controlled
- Layer 2 (MAC) communications
  - Fulfillment of Statement of Direction
  - All types of traffic, not just IP
  - Virtual NIC MAC appears on network
  - VMLAN updates to allow specification of ranges used for automatic and static MAC address assignments
- Better VSWITCH stall detection, error reporting, and error recovery.

New in z/VM 5.1…

- IEEE 802.1q compliance changes
  - VLAN ANY is gone
  - VSWITCH can be defined as VLAN-aware (or not). Default is “not”.
  - When a NIC couples to a VLAN-aware VSWITCH, it will be assigned a PORTTYPE attribute
    - ACCESS: VLAN tags not given to or accepted from guest
    - TRUNK: VLAN tags are given to and expected from guest
  - Default PORTTYPE comes from DEFINE VSWITCH
    - Can be overridden by MODIFY VSWITCH GRANT
  - Some configurations require migration effort

Some Final Thoughts…

Guest LAN vs. Virtual Switch



- Virtual router is required
- Different subnet
- External router awareness
- Guest-managed failover

- No virtual router
- Same subnet
- Transparent bridge
- CP-managed failover

Network Configuration

- In general, configure a Guest LAN network like any other network
  - Subnet routing

- Use the VSWITCH whenever possible
  - Exploit IEEE VLAN if you can

- By having virtual and real configurations be the same, you can easily test network configuration before deployment with real hardware

Built-in Diagnostics

- **CP QUERY VMLAN**
  - to get global VM LAN information (e.g. limits)
  - to find out what service has been applied
- **CP QUERY LAN ACTIVE**
  - to find out which users are coupled
  - to find out which IP addresses are active
- **CP QUERY NIC DETAILS**
  - to find out if your adapter is coupled
  - to find out if your adapter is initialized
  - to find out if your IP addresses have been registered
  - to find out how many bytes/packets sent/received

Support Summary

z/VM V5.2	▪Virtual SPAN ports for sniffers
z/VM V5.1	▪Virtual trunk and access port controls ▪Removal of VLAN ANY ▪Layer 2 (MAC) frame transport ▪Improved virtual switch error detection & recovery ▪External security manager access control
z/VM V4	▪IPv4 Virtual Switch with IEEE VLANs ▪IPv4 HiperSocket Guest LAN ▪IPv4 and IPv6 QDIO Guest LAN

References

- Publications:
  - z/VM CP Planning and Administration
  - z/VM CP Command and Utility Reference
  - z/VM TCP/IP Planning and Customization
  - z/VM Connectivity Planning, Administration and Operation
- Links:
  - http://www.ibm.com/servers/eserver/zseries/os/linux/
  - http://www.linuxvm.org/
  - http://www.vm.ibm.com/virtualnetwork/

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  http://ibm.com/vm/techinfo/listserv.html

Thanks for Listening!