z/OS Security for Linux on a Zseries
Session 1791

Frank J. De Gilio
IBM Design Center
degilio@us.ibm.com

zSeries Linux is Very Cool

- Great for rapid development environment
- Used widely for intranet server consolidation
- Starting to be looked at for Internet application
- On zSeries Linux gets
  - Rapid Instance (image) creation
  - zSeries hardware qualities of service
  - Glass house SMS support
  - HiperSockets
  - A helping hand from z/OS (if you want)

First things First – Harden That Linux

- Most distributions are still not build as enterprise Linux instances.
- Enterprise Linux instances should have a specific function
- Create hardened instances and clone them
- Keep in mind the services that you need and don’t need.
- Use tools to help perform Linux hardening

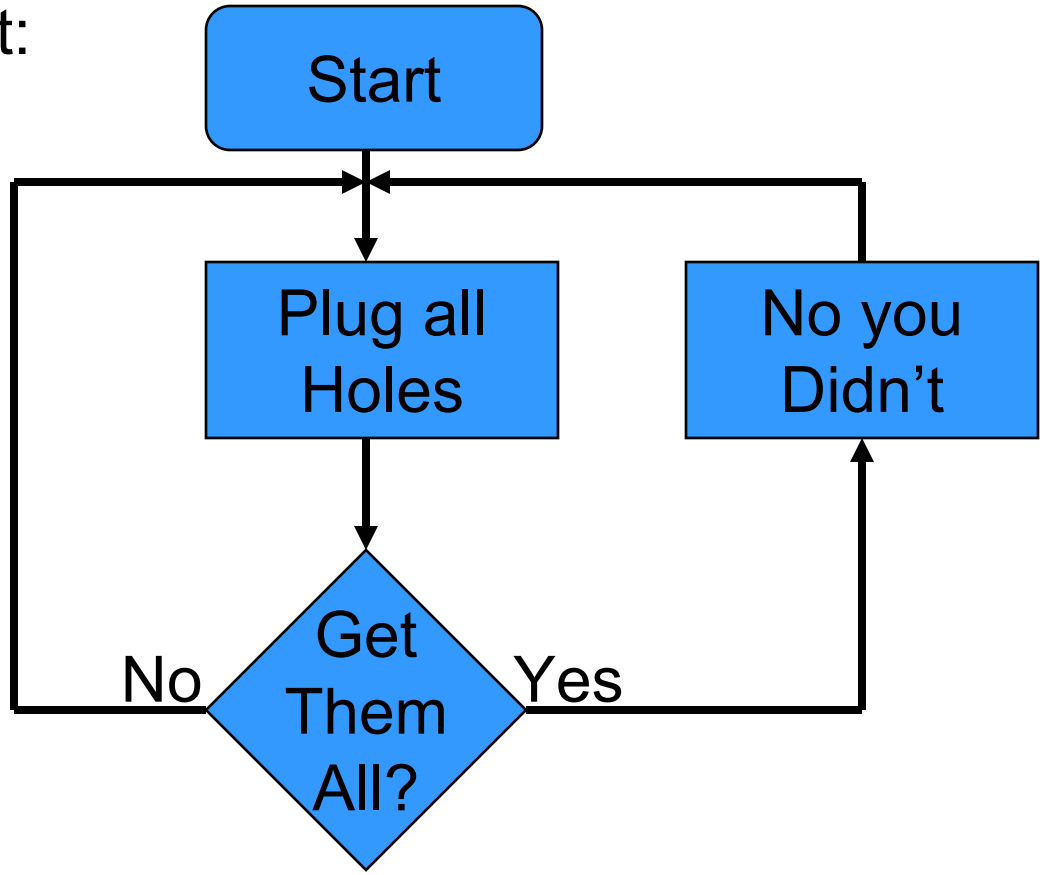
Just Because I'm Paranoid…..

Securing Linux Flowchart:

You are never done!

This is a full time job!

Lots and Lots of Research!



Linux Hardening With the Help of Tools

- Bastille
  - Comprehensive System View
  - Educational (Especially for new Linux users)
  - Support from the Linux Community
  - Is not officially available for Linux on zSeries
    - Install source
    - Tweak to support Linux on zSeries
    - Used Curses Support
- NMAP
  - Now with a Windows interface

Nmap Results: Before Hardening

Port	State	Service
21/tcp	open	ftp
23/tcp	open	telnet
25/tcp	open	smtp
37/tcp	open	time
79/tcp	open	finger
80/tcp	open	http
110/tcp	open	pop-3
111/tcp	open	sunrpc
513/tcp	open	login
514/tcp	open	shell
515/tcp	open	printer
767/tcp	open	phonebook
901/tcp	open	samba-swat
2049/tcp	open	nfs

These Ports were all open “out of the box”.

NMAP Results: After Bastille

Port	State	Service
21/tcp	open	ftp
23/tcp	open	telnet
25/tcp	open	smtp
37/tcp	open	time
79/tcp	open	finger
80/tcp	open	http
110/tcp	open	pop-3
765/tcp	open	webster
901/tcp	open	samba-swat
2049/tcp	open	nfs

Ports for:
Sunrpc
Login
Shell
Printer
Phonebook
are gone.

NMAP Results: After Further Hardening

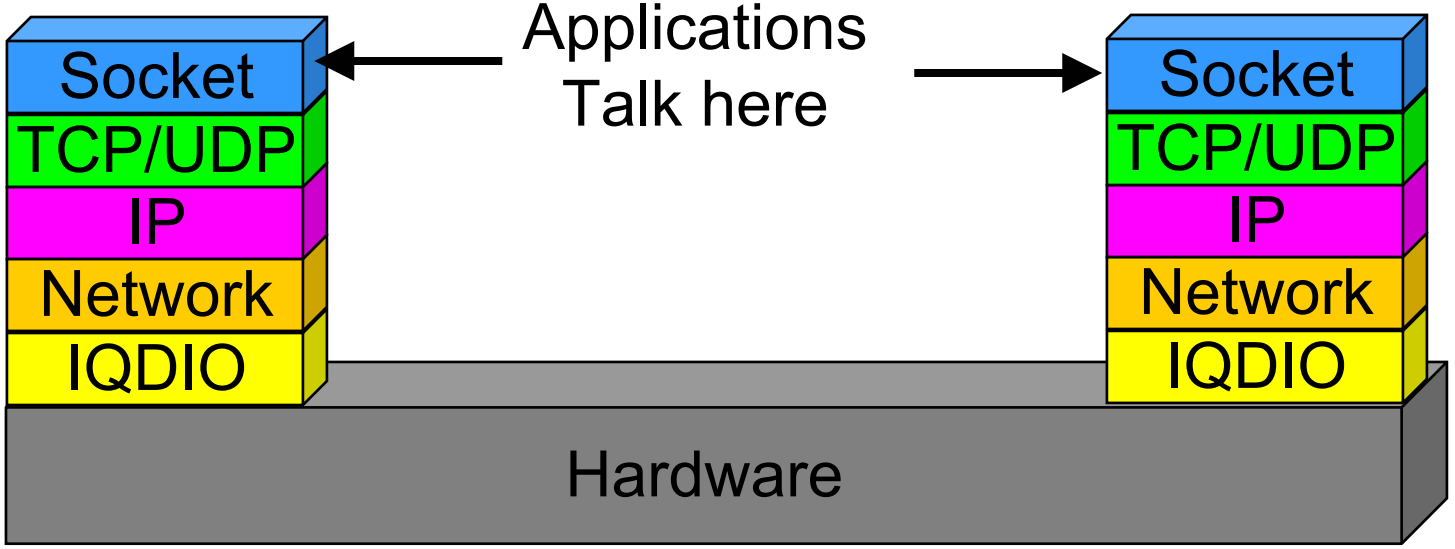

```
Port        State       Service
21/tcp      open        ftp
23/tcp      open        telnet
80/tcp      open        http
```

These results are misleading since the ftp and telnet ports are managed by inetd.

HiperSockets – Just The Facts

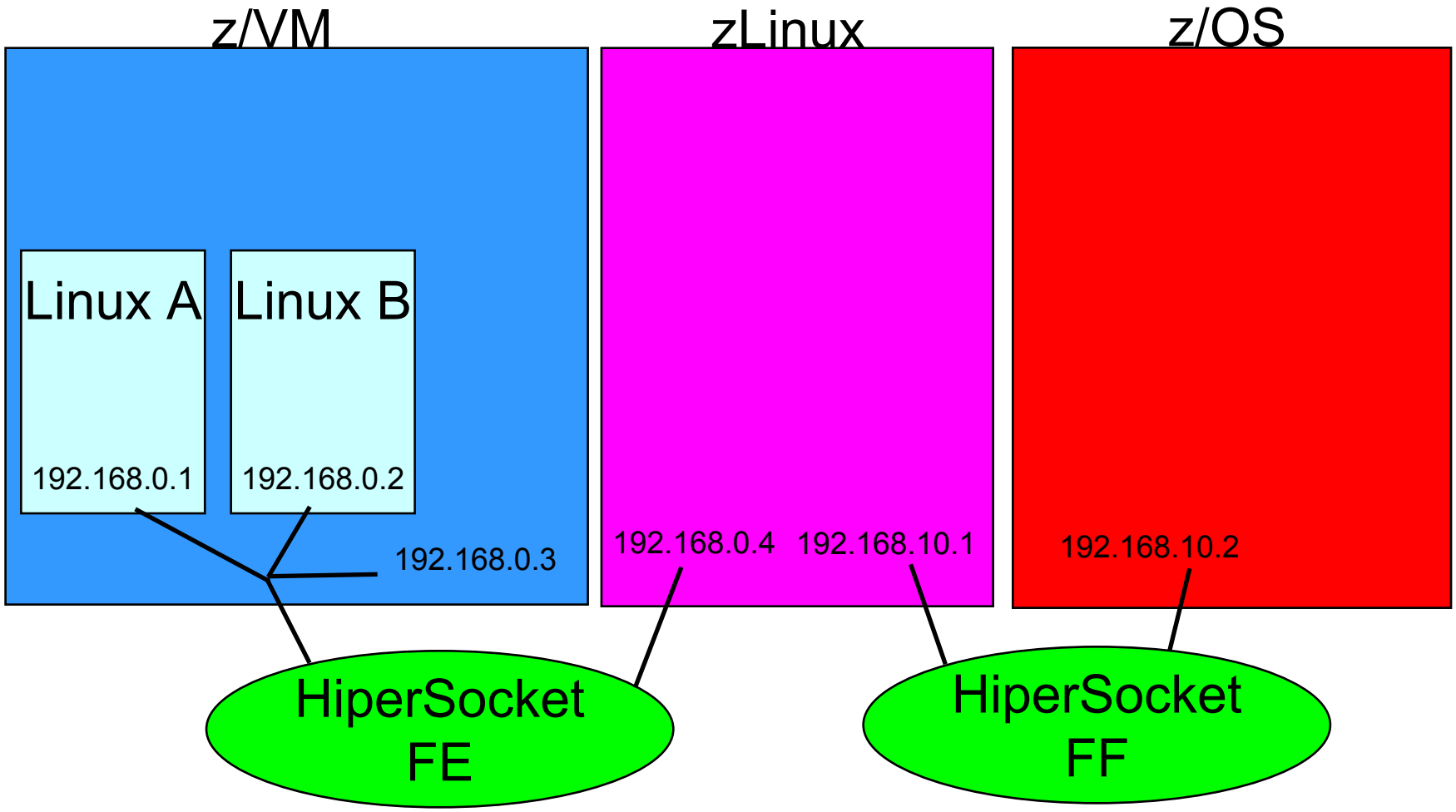
- HiperSockets = Internal Queued Direct IO
- Microcode maintained lookup table
- Three devices for each stack
  - Read Control
  - Write Control
  - Data Exchange
- 1024 Devices across all HiperSockets
- Supports Virtual IP Addressing and Dynamic Virtual IP Addressing

Cool HiperSocket Stack Picture



Maximum frame size 64K
(TCPIP MTU 56K)

HiperSockets – a Network View



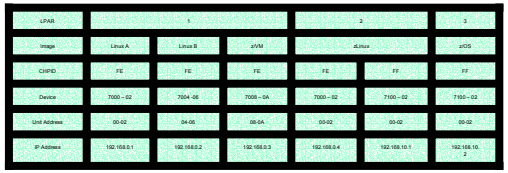
HiperSocket Tables

LPAR	1			2		3
Image	Linux A	Linux B	z/VM	zLinux		z/OS
CHPID	FE	FE	FE	FE	FF	FF
Device	7000 – 02	7004 -06	7008 – 0A	7000 – 02	7100 – 02	7100 – 02
Unit Address	00-02	04-06	08-0A	00-02	00-02	00-02
IP Address	192.168.0.1	192.168.0.2	192.168.0.3	192.168.0.4	192.168.10.1	192.168.10.2

Microcode at Work!!!

Linux

192.168.10.1



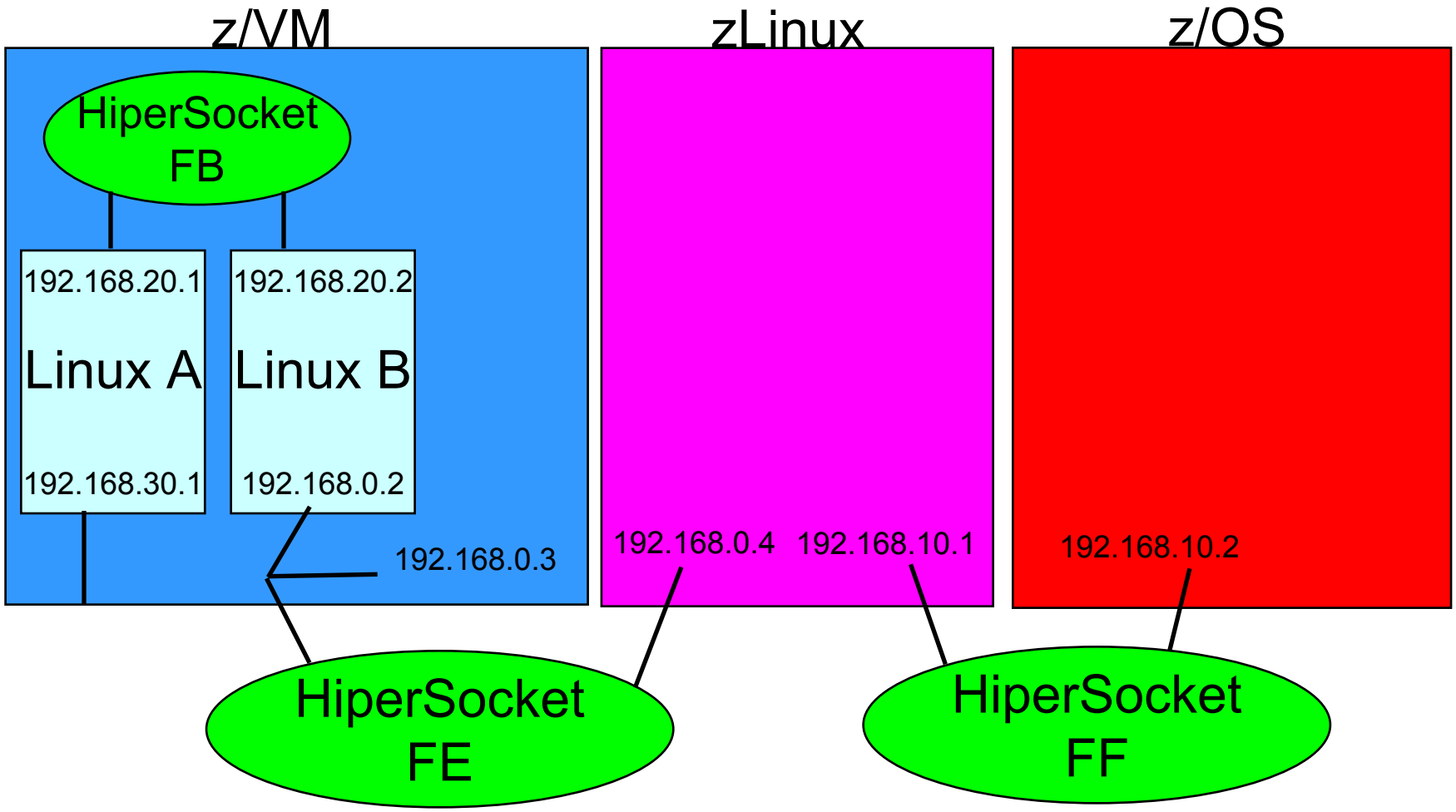
z/OS

192.168.10.2

VM Guest LAN Support

- Virtual HiperSockets (Virtual Virtual sockets?!?)
- Emulates HiperSockets within a VM image
- Maximum number of unused CHPIDs -1
- 3072 I/O devices per guest LAN
- 1024 guests (TCP/IP stacks)
- Faster communication between Linux images than HiperSockets

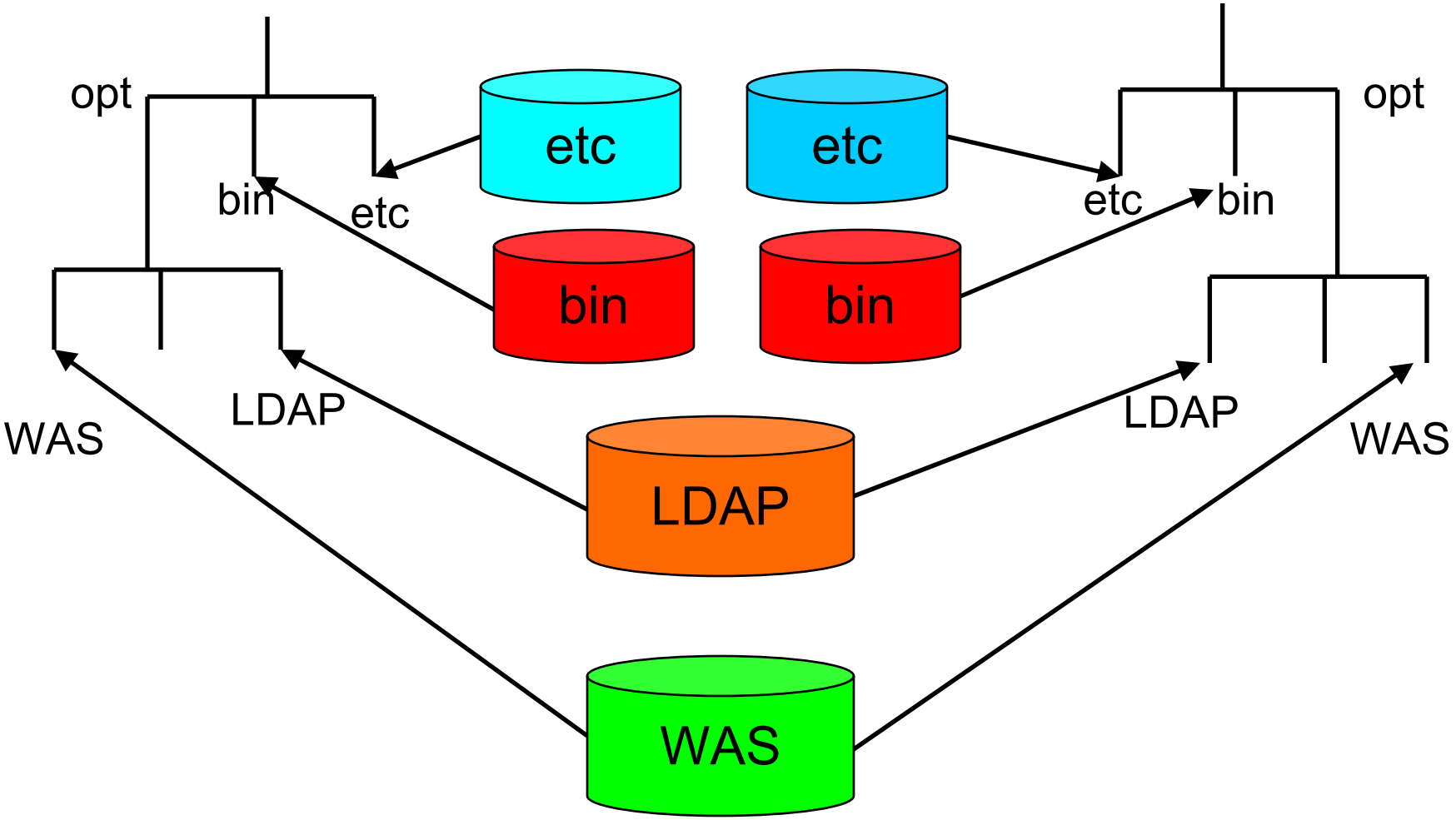
Wheels Within Wheels



Rsockets – Beyond the Hipe

- Fast – If you like that kind of thing
- VM Guest LANs faster for inter Linux communication
- Don’t expect IIOP flows to be faster…
- More secure communication
  - Unsniffable traffic between connections
  - Reduces the need for SSL
  - Lessens the dependency on encryption
    - Real performance benefits
- Less mercurial configuration than the wire stuff

Using VM to Clone Linux

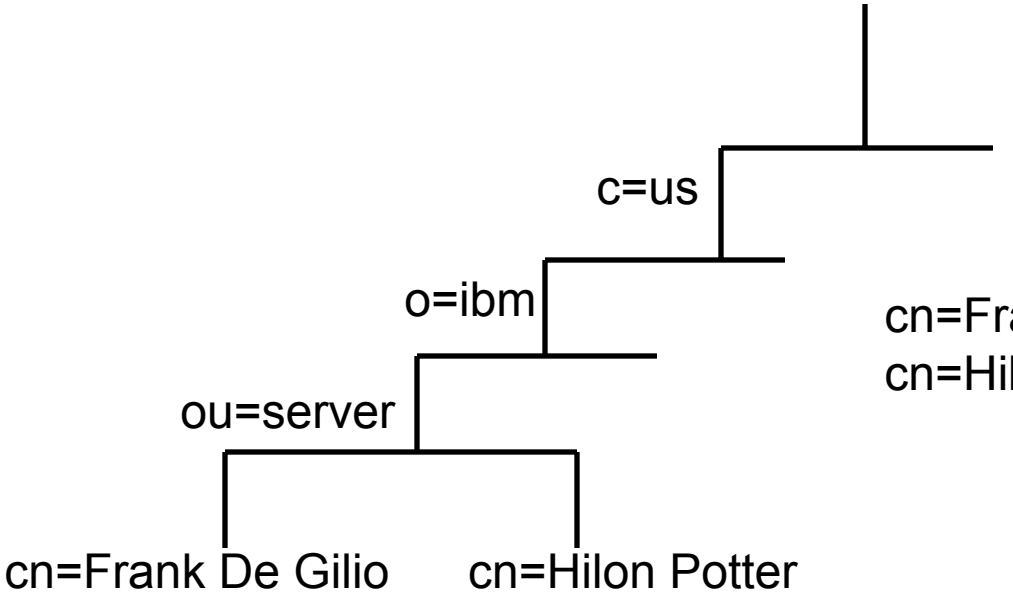


PAM Who?

- Plugable Authentication Module
- Allows you to create security for each service you provide
- This allows you to limit access to services.
- Create layers of security to access certain functions.
- A bunch of different PAMs are available:
  - PAMSMB – Use NT to authenticate Linux Users
  - CUECAT – Bar code reader based authentication
  - PAMAFS – Use AFS to authenticate
  - LDAPPAM – Use LDAP to authenticate user

LDAP A Security Database

- Lightweight Directory Access Protocol
- Limited function database
- Relatively Static Data
- Based on a Directory (hierarchical) structure

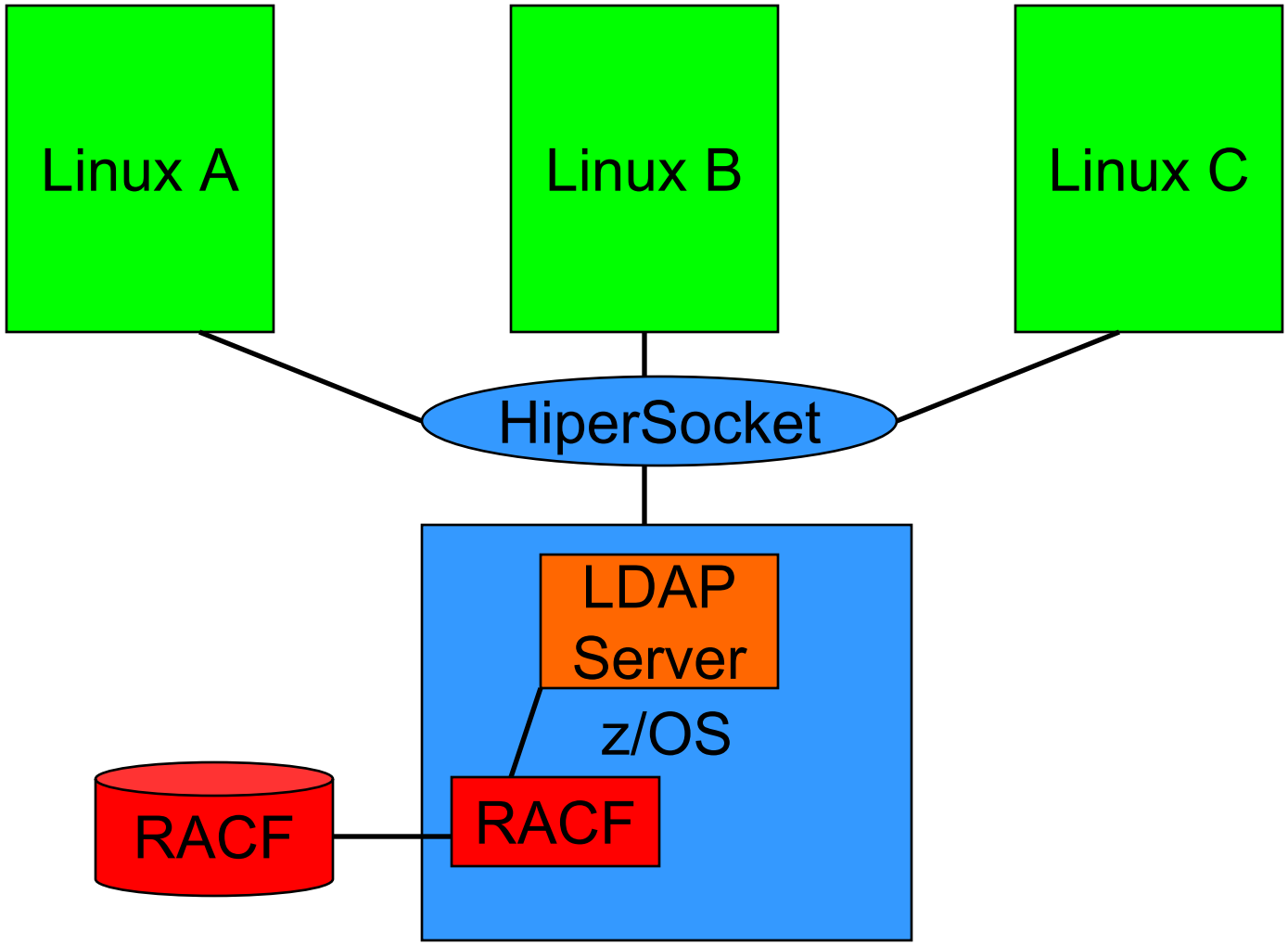


cn=Frank De Gilio, ou=server,o=ibm,c=us
cn=Hilon Potter, ou=server,o=ibm,c=us

A DN Has Attributes

- Name
- Location data
- Phone number
- Userid
- Password
- Login information
- Stuff like that

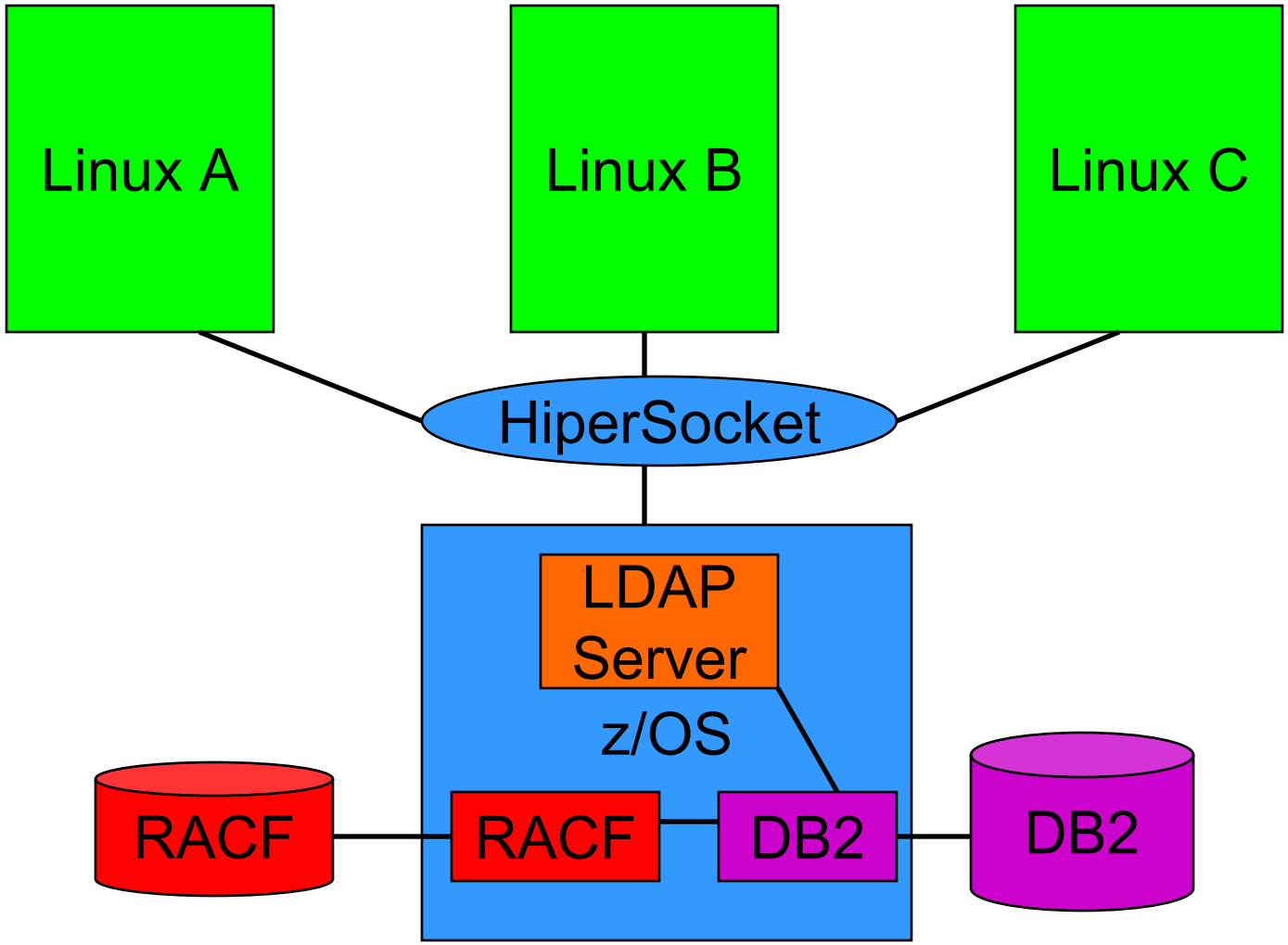
Things That Make You Go Hmmm….



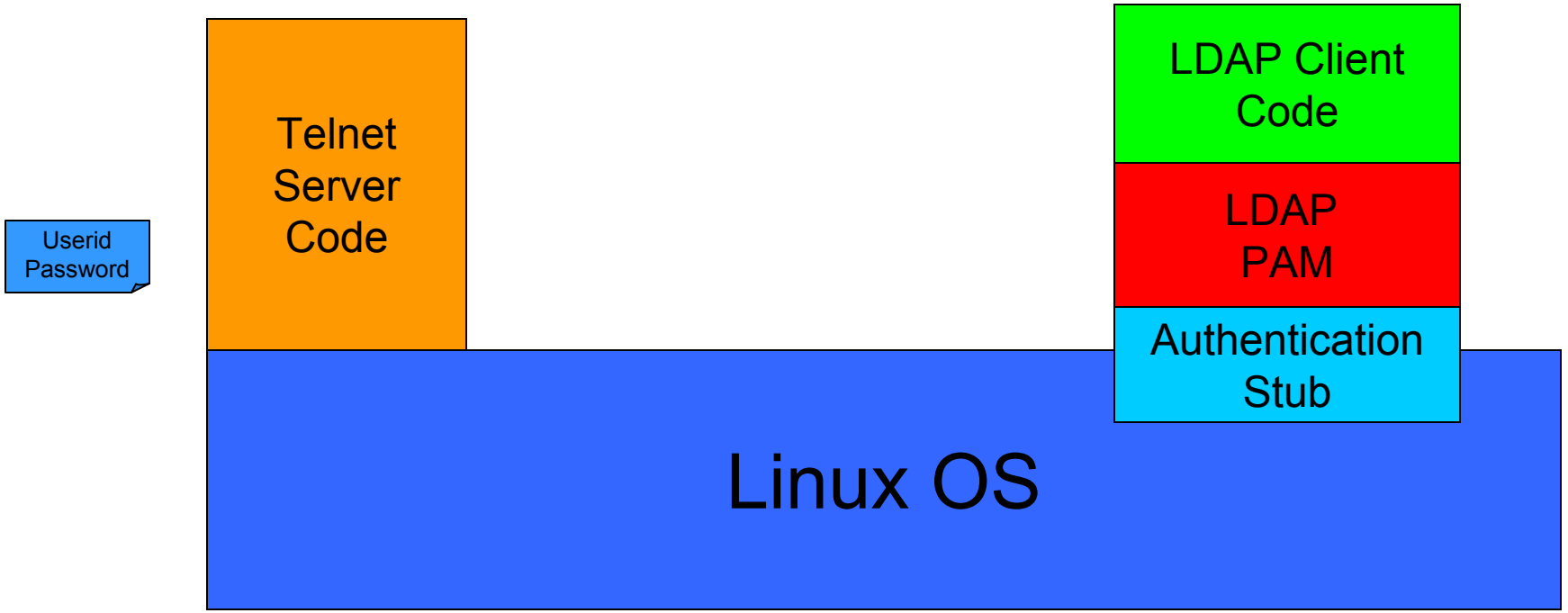
Linux PAM LDAP to RACF

- In theory a good idea....
  - RACF is a good security server
  - LDAP interface makes it accessible
  - One stop for security on all systems
- In Practice not so good...
  - RACF schema is not very flexible
  - Wont support multiple hosts well
  - End up having data in /etc/passwd too

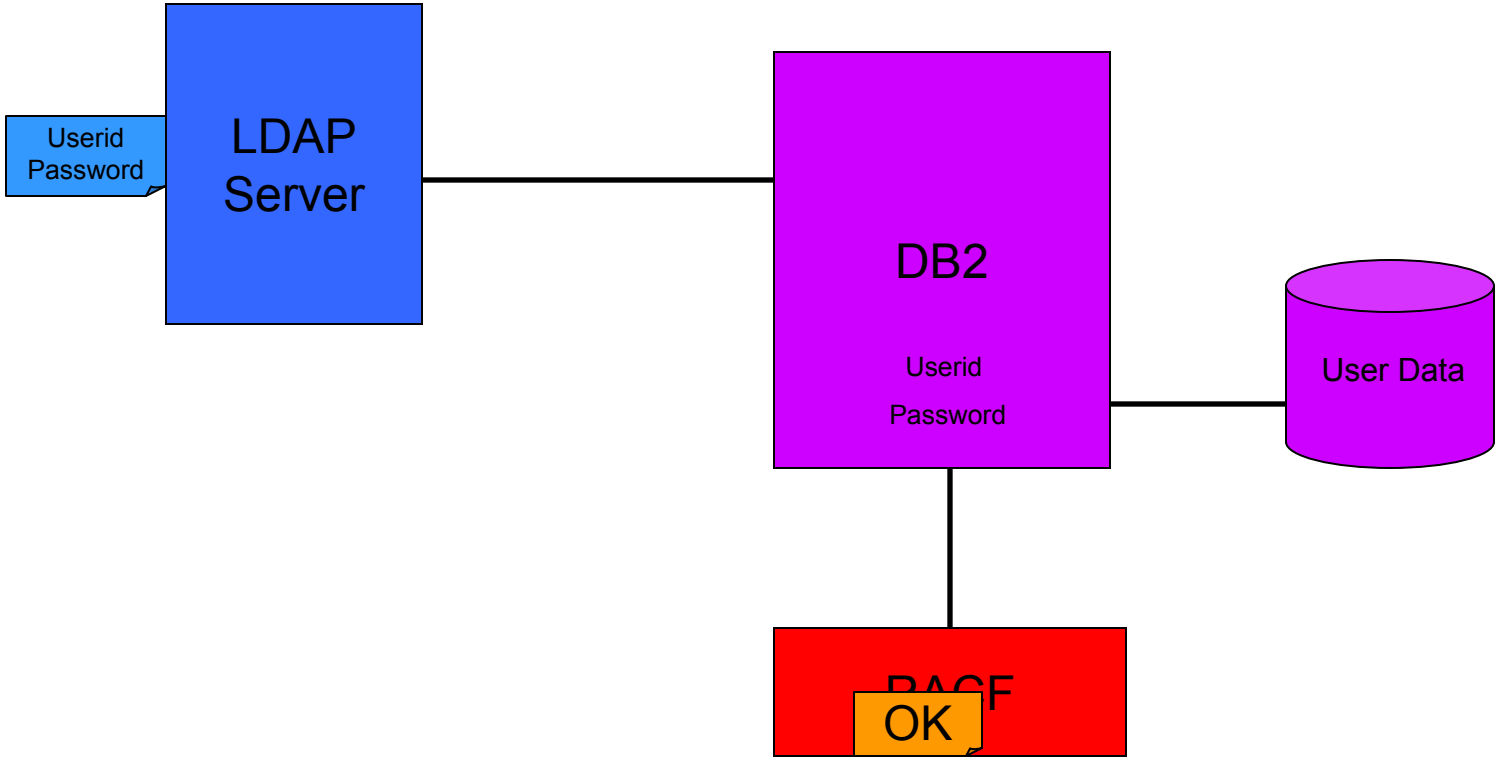
But Wait! There's More….



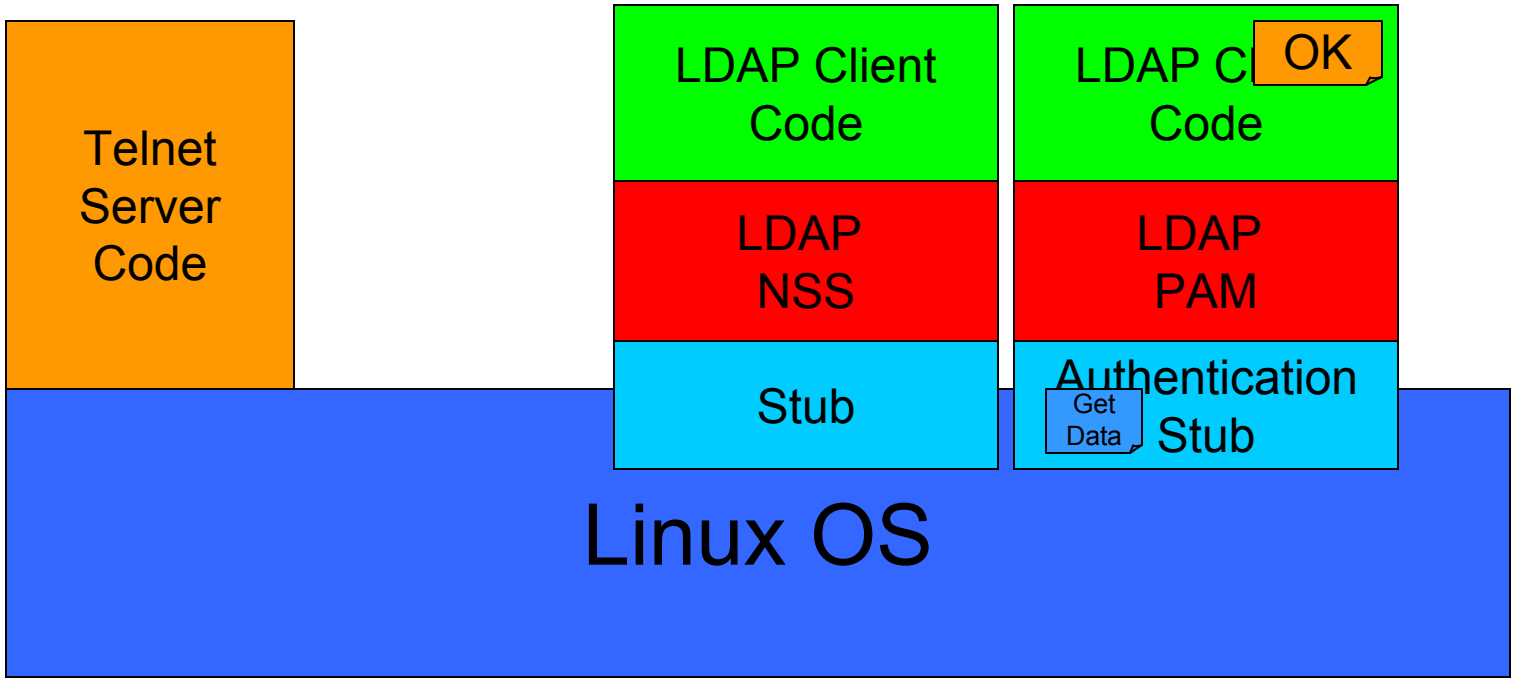
Start with LDAP PAM



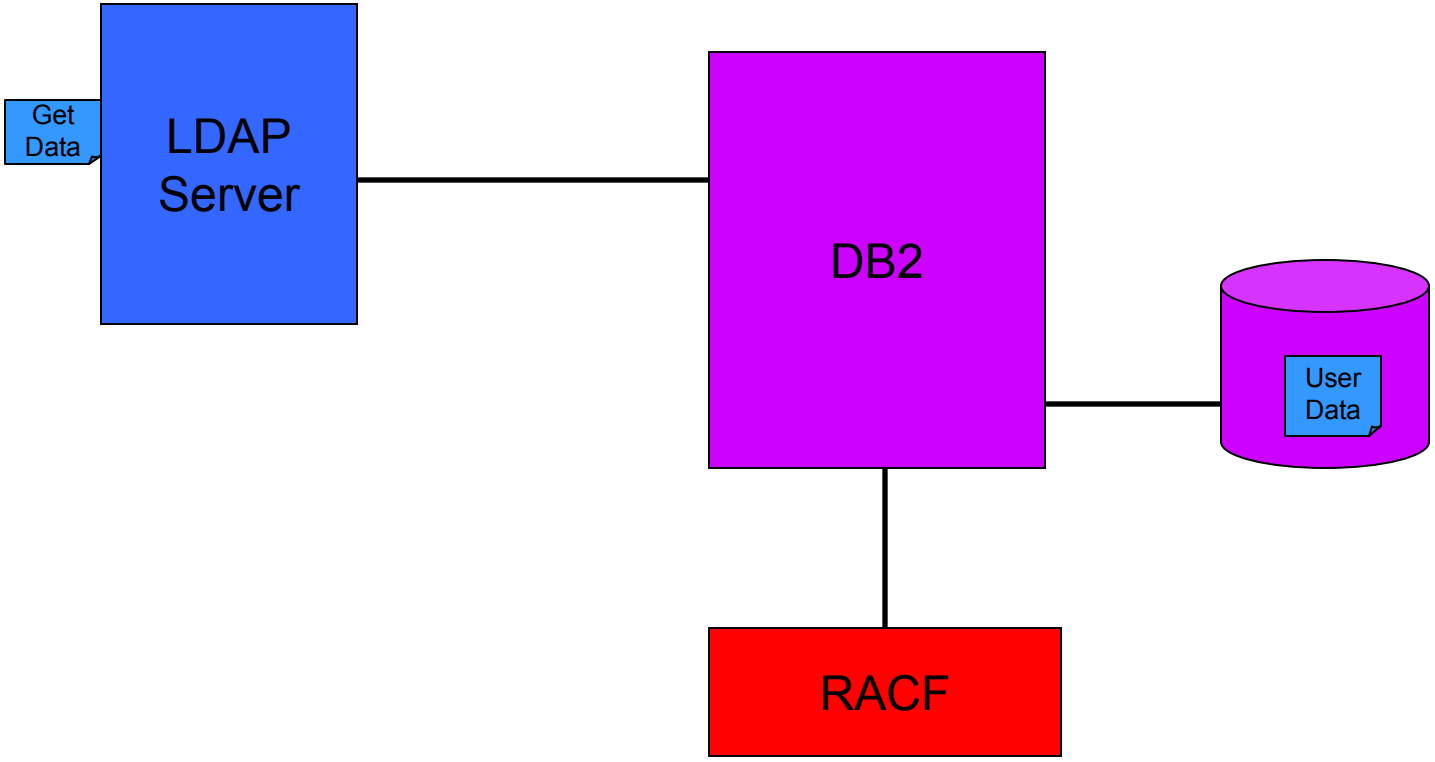
In to LDAP on z/OS



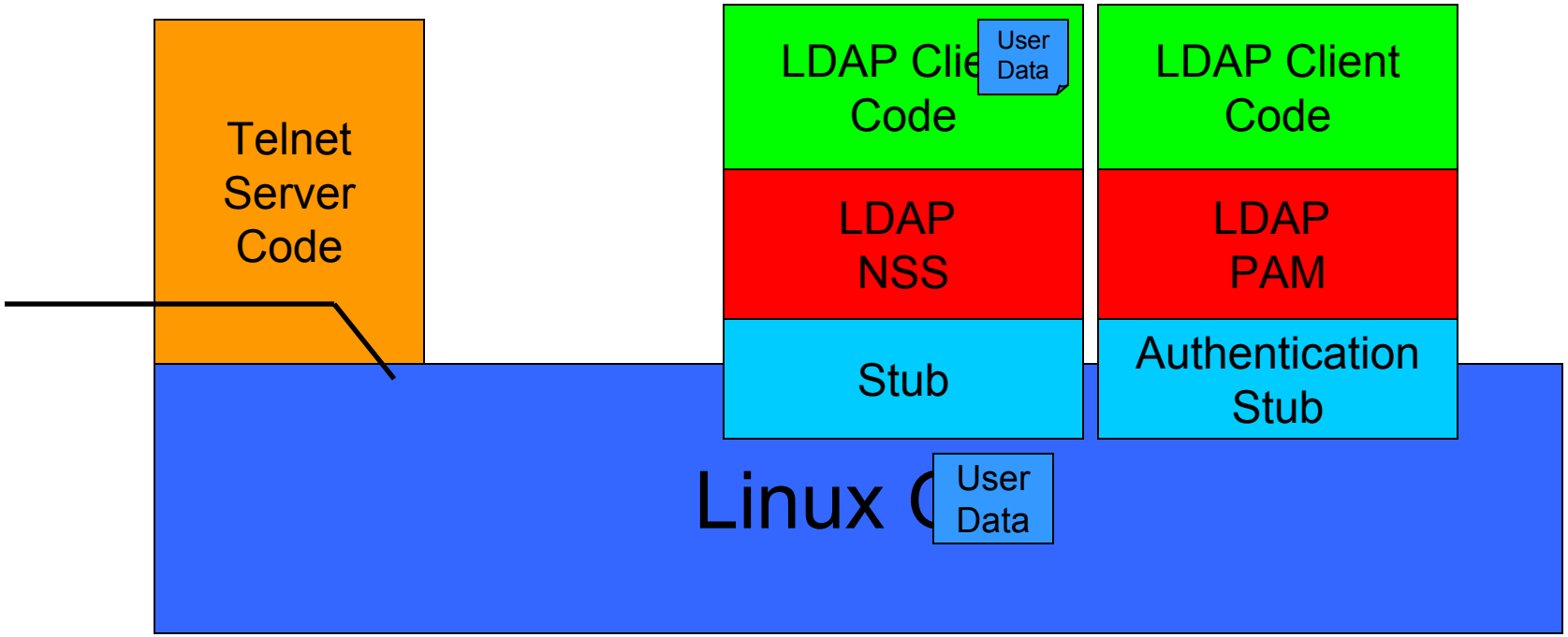
Now Get User Identity



From LDAP on z/OS



Ready to Go


Telnet
Server
Code
LDAP Clie
Code
User
Data
LDAP Client
Code
LDAP
NSS
LDAP
PAM
Stub
Authentication
Stub
Linux C
User
Data

O.K. How do I make this Work?

- Install an LDAP client
  - ldap-clientd-3.2.2-1.s390.rpm or an openldap open source package
- Install an LDAPPAM module:
  - PAM LDAP rpm - pam_ldap-56-74.s390.rpm
  - Could be one with the distribution
- Install NSS module:
  - Name differs depending on distribution
  - Probably packaged with distribution

Configure PAM module

File name depends on distribution:

host 192.168.100.140

port 389

base o=nis

binddn cn=admin

bindpw secret

ldap_version 3

pam_login_attribute uid

#pam_check_host_attr yes

Define PAM Options For Each Access


```
aslan@lingilio:/etc/pam.d >ls
chfn  ftpd   other   ppp    rlogin  samba  su1   xdm
chsh  login  passwd  rexec  rsh     su     sudo

# default configuration: /etc/pam.d/other
auth        required      /usr/lib/security/pam_warn.so
auth        required      /usr/lib/security/pam_deny.so
account     required      /usr/lib/security/pam_deny.so
password    required      /usr/lib/security/pam_warn.so
password    required      /usr/lib/security/pam_deny.so
session     required      /usr/lib/security/pam_deny.so
```

PAM Configuration Details

Column 1:

- Auth - Who is it?
- Account - Restrictions on this user.
- Session - Before/After execution
- Password - For changing the password

PAM Configuration Details *(Coninued)*

Column 2:

- Requisite - Gotta pass this one
- Required - If this fails others will be checked
- Sufficient - If this passes no other modules will be checked
- Optional - Can determine what the application gets

Column 3:

- Module (path) followed by args

PAM LDAP Configuration Telnet

```
auth        sufficient    /lib/security/pam_ldap.so
auth        requisite      /lib/security/pam_unix.so nullok
#set_secrpc
account    sufficient    /lib/security/pam_ldap.so
account    required     /lib/security/pam_unix.so
password sufficient    /lib/security/pam_ldap.so
password required     /lib/security/pam_unix.so nullok use_first_pass
    use_authtok
session    required     /lib/security/pam_unix.so none # debug or trace
session    required     /lib/security/pam_limits.so
#session    sufficient    /lib/security/pam_ldap.so
```

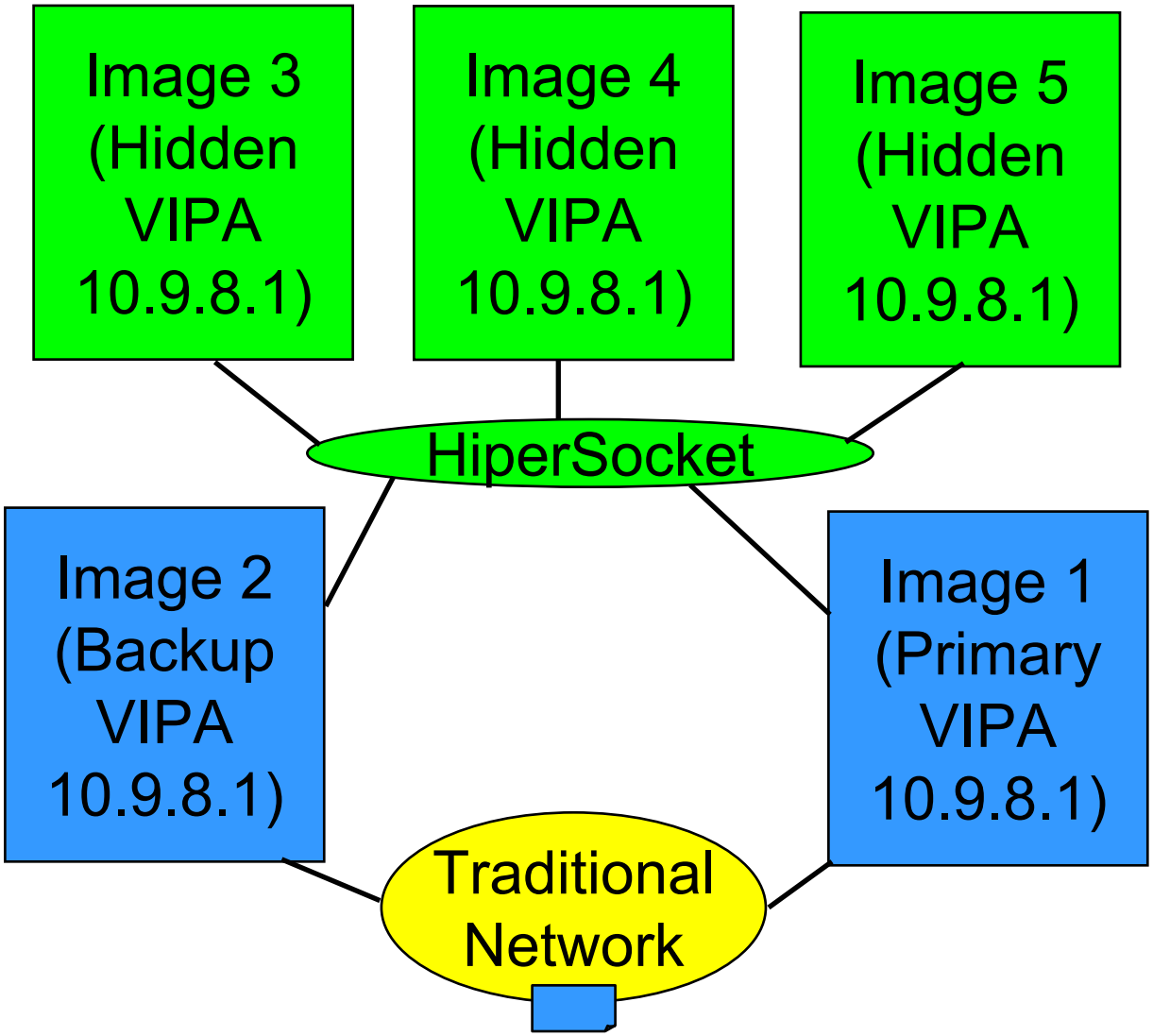
Define The User To LDAP on z/OS

- Using TDBM back end
- Native authentication
- Schema Additions
  - NIS schema
  - posixAccount schema
- Must have:
  - cn: common name
  - sn: surname
  - uid: userid (must be unique)
  - uidnumber Linux uid number
  - gidnumber Linux gid number
  - home directory: users home directory when logged in
  - Login shell: program to use when the user is logged in

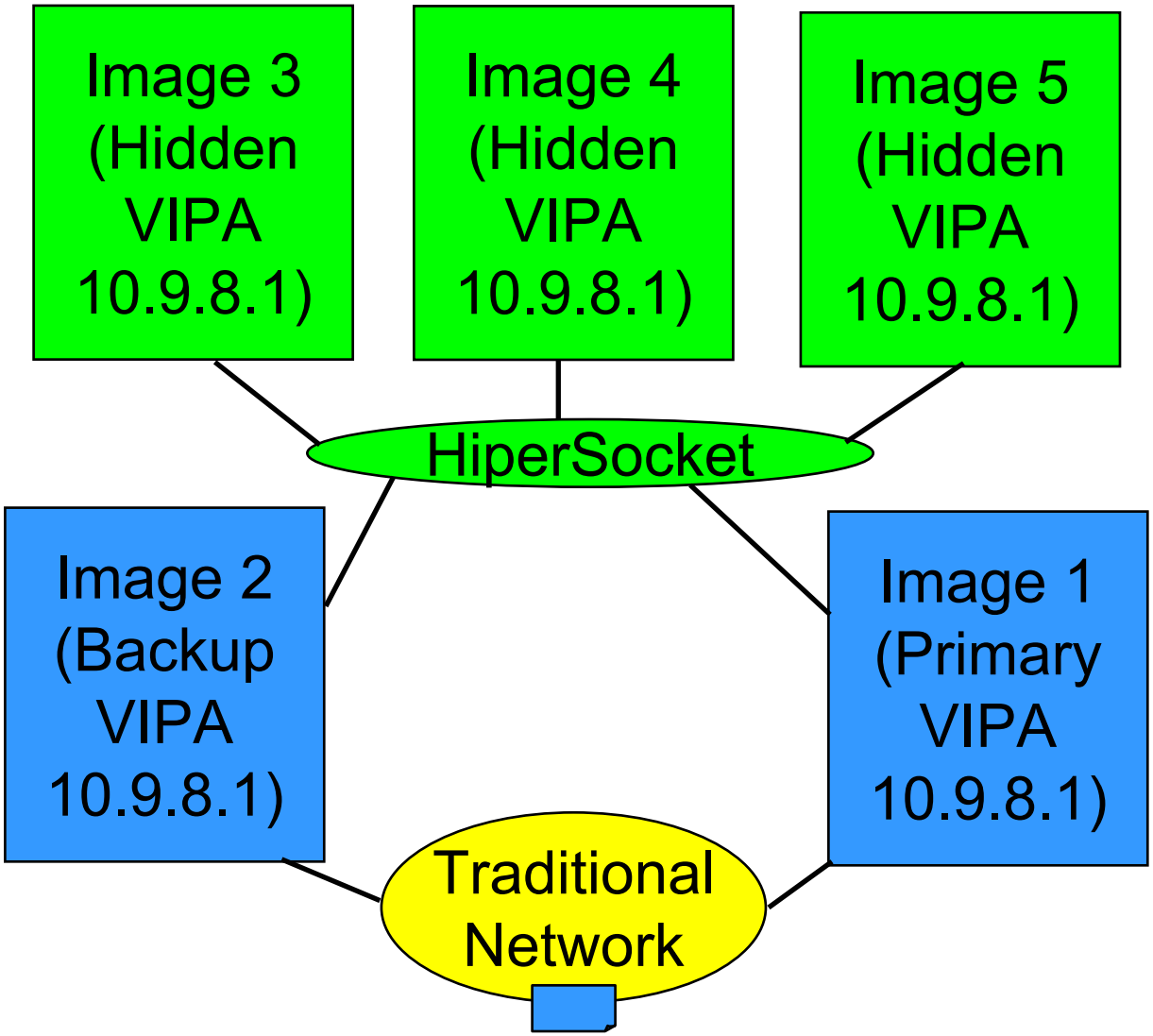
Things to Remember!

- Do not store root in LDAP (I learned the hard way)
  - Also other (nobody...admin...)
- Store user account info into LDAP
- Control all of Linux images authentication with 1 database
  - Attribute host allows an administrator to define which hosts the user can use
- If using HiperSockets, might be able to avoid SSL
- Password is not retrievable from RACF

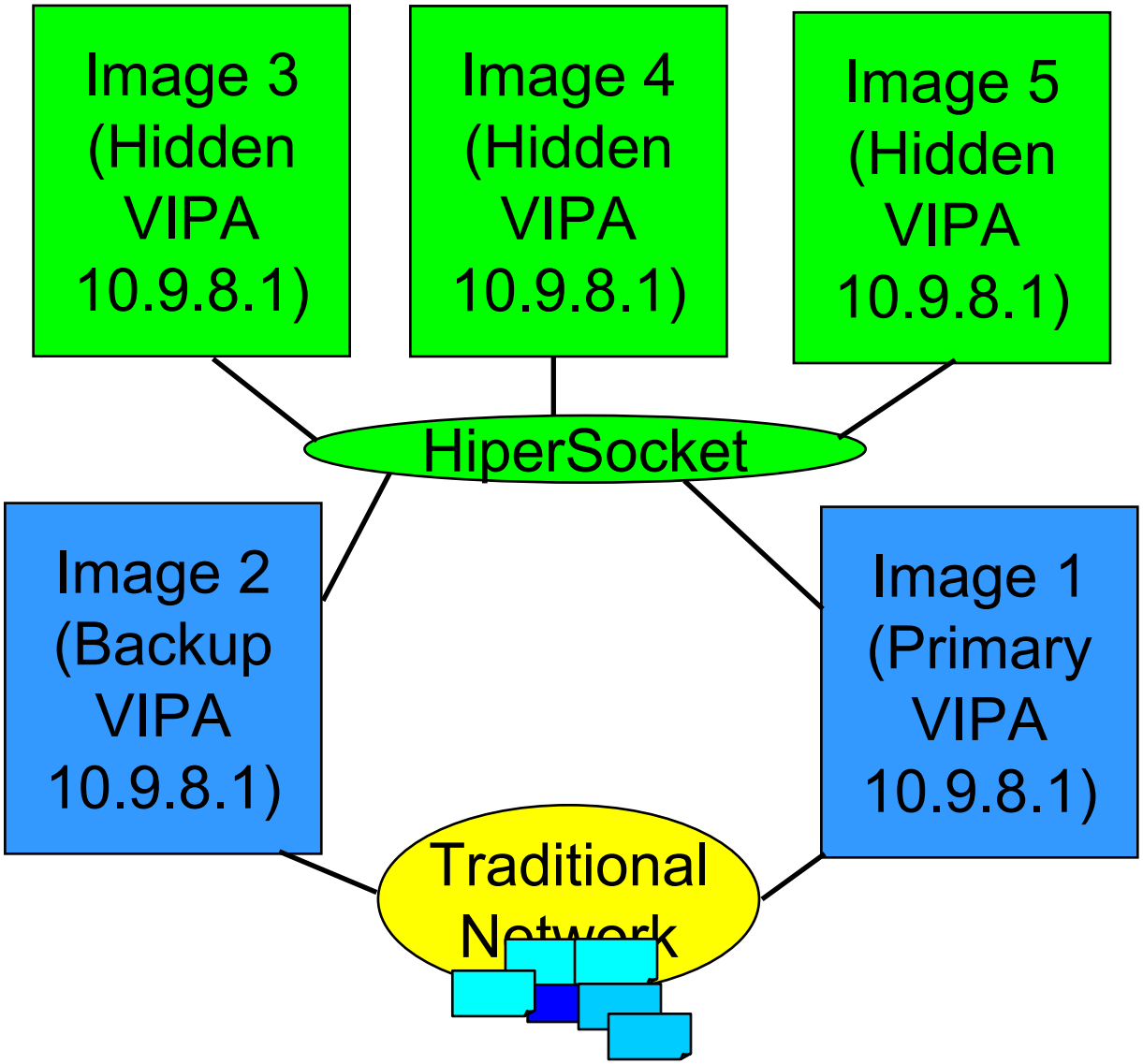
HiperSockets and Sysplex Distributor



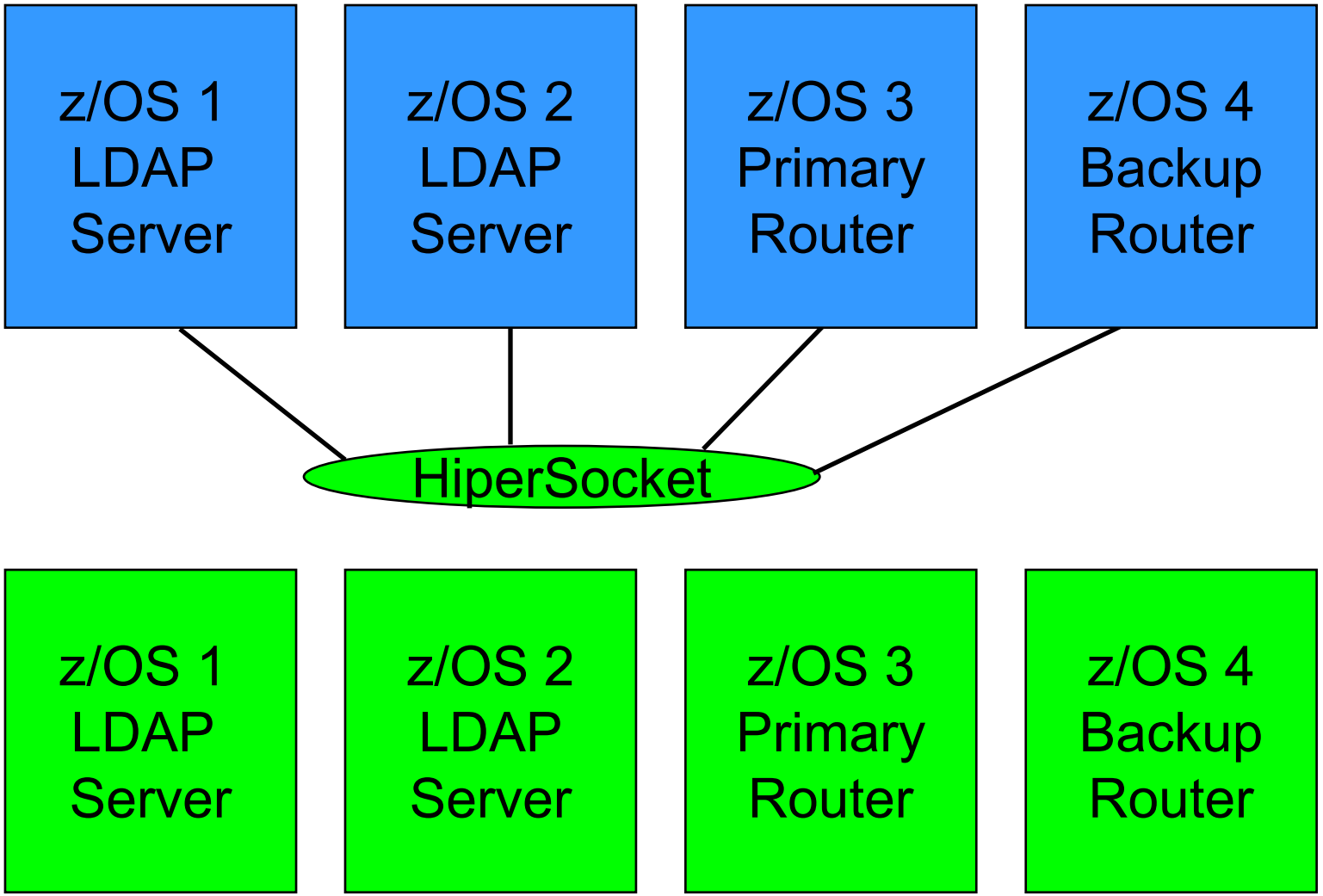
HiperSockets and Sysplex Distributor



HiperSockets Sysplex Distributor WLM



HiperSockets and Sysplex Distributor



Wake Up It's Almost Over!

- Linux on z/Series is the same as every other Linux
  - Must be hardened
  - Vulnerable to network attacks
  - Must be diligent to ensure that all holes covered
- Linux on z/Series is different from every other Linux
  - Simple cloning will allow to quickly clone hardened Linux
  - HiperSockets allow for fast secure communication between images
  - LDAP TDBM and RACF can be used as a back end for Linux authentication