

How z/VM Begins

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- Last updated 2015-06-18 by Tim Greer

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Agenda

- How does z/VM know how to start?
 - Where is SYSTEM CONFIG?
 - Where is CLOAD?
 - What else could there be?

- A walk through SYSTEM CONFIG

- What starts automatically? And how?
 - OPERATOR's PROFILE EXEC
 - AUTOLOG1

- What might you want to change?
 - USER DIRECTory
 - SYSTEM CONFIG
 - PROFILE EXECs
 - IPLPARMS

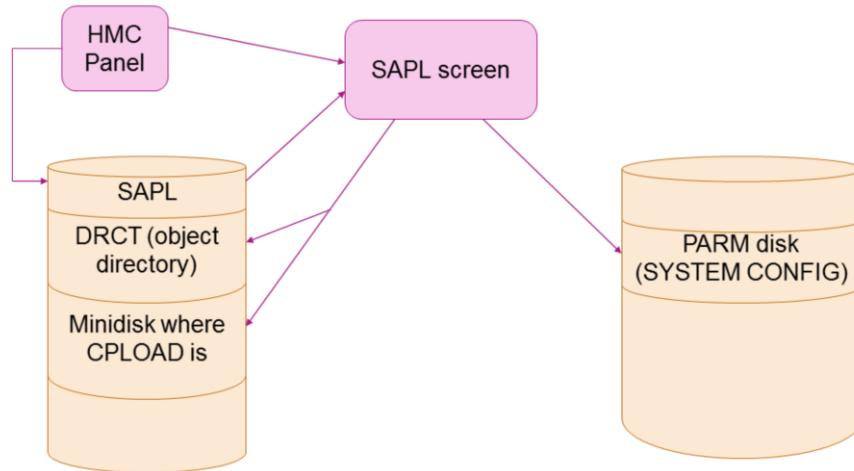
Not to scale! We will start with the HMC load panel, spend a little time on the SAPL screen, then spend a lot of time with SYSTEM CONFIG. PROFILE EXEC content is left as reading exercise, but we will point out how OPERATOR and AUTOLOG1 are chosen. Finish up by acknowledging USER DIRECT and mentioning some users that need configuration.

How does z/VM know where to start?

- How far back to go...?
- Hardware Management Console
- SAPL screen
 - SYSTEM CONFIG
 - CLOAD MODULE

Should we start with mining the minerals to build a z13? No, that's too far back. We'll start with the LOAD panel from the HMC. (Implies your LPAR is already defined with storage size, processors, etc., and you know how to select it on the HMC.) The LOAD panel specifies the DASD on which the Stand Alone Program Loader (SAPL) is. SAPL specifies the name and location of the system configuration file (default: SYSTEM CONFIG) as well as the name and location of the program that is CP (default: CLOAD MODULE). SAPL can also specify other stuff, such as where the system operator is to be logged on.

Finding the first pieces



A visual summary of what we are about to walk through.

HMC Load panel

Load - S34:SSPX1

CPC: S34:SSPX1
Image: S34:SSPX1
Load type: Normal Clear SCSI SCSI dump
 Store status
Load address: *0AD01
Load parameter: 20
Time-out value: 60 (60 to 600 seconds)
Worldwide port name: 0
Logical unit number: 0
Boot program selector: 0
Boot record logical block address: 0
Operating system specific load parameters: [Empty text area]

OK Reset Cancel Help

This is typical appearance of the load panel on the Hardware Management Console (HMC). The parameter values originally came from customizing the Activation Profile of the LPAR, but they're saved from whatever was used most recently.

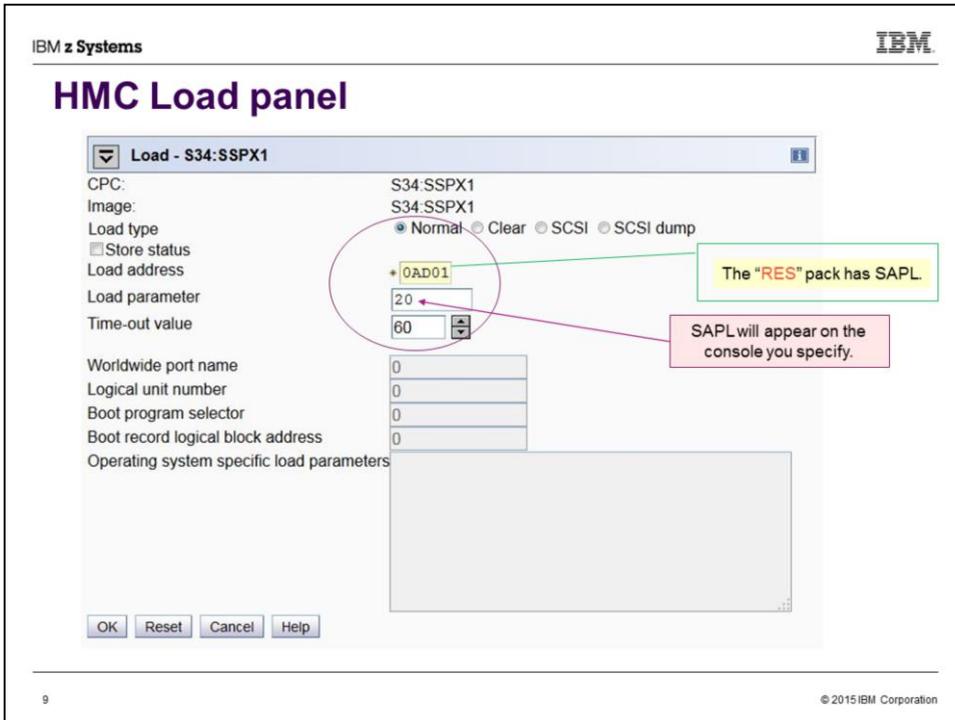
HMC Load panel

Load - S34:SSPX1

CPC: S34:SSPX1
Image: S34:SSPX1
Load type: Normal Clear SCSI SCSI dump
 Store status
Load address: *0AD01
Load parameter: 20
Time-out value: 60 (60 to 600 seconds)
Worldwide port name: 0
Logical unit number: 0
Boot program selector: 0
Boot record logical block address: 0
Operating system specific load parameters: [Empty text area]

OK Reset Cancel Help

Look here!

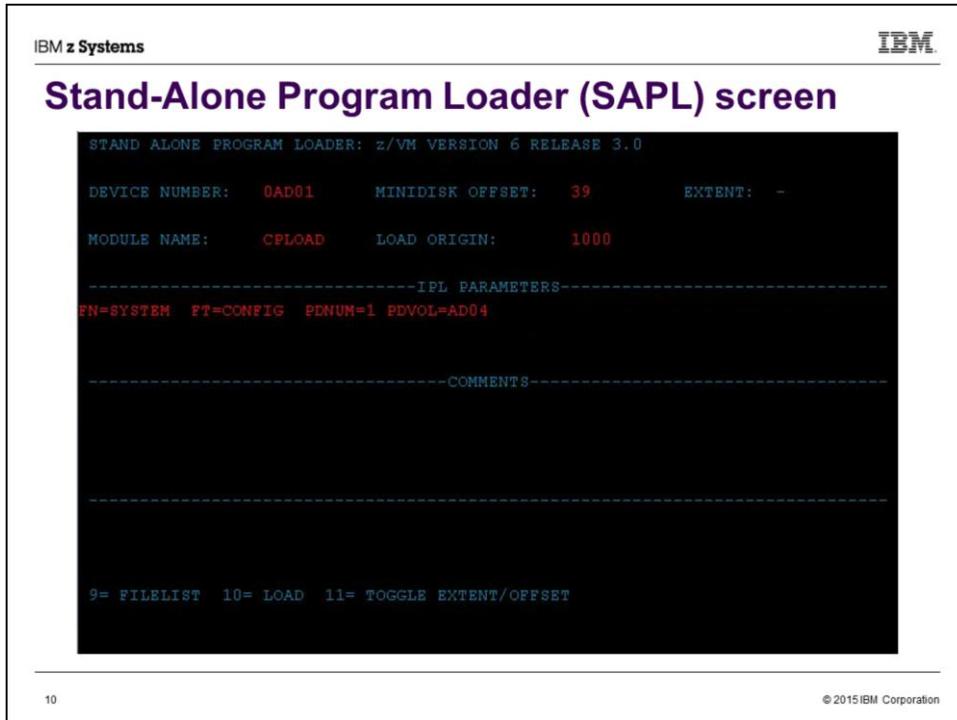


“Load address” is the DASD pack you will “IPL”. The program that will be loaded is SAPL, the Stand Alone Program Loader.

“Load parameter” is the console address. This needs to be in SYSTEM CONFIG. Besides numbers, it could be SYSG.

Load type is usually “Normal”. “Clear” makes sure memory is zeroed – might be useful for security or if you expect to soon be taking a Stand-Alone Dump.

A failing load will time out, but not in the 60 seconds this seems to imply.



When your LOAD completes (may take only a few seconds, could be minutes) you see the screen of the Stand Alone Program Loader. The SALIPL utility was used by Install to fill in the details.

Stand-Alone Program Loader (SAPL) screen

STAND ALONE PROGRAM LOADER: z/VM VERSION 6 RELEASE 3.0

DEVICE NUMBER: AD01 MINIDISK OFFSET: 39 EXTENT: -

MODULE NAME: CPLOAD LOAD ORIGIN: 1000

-----IPL PARAMETERS-----

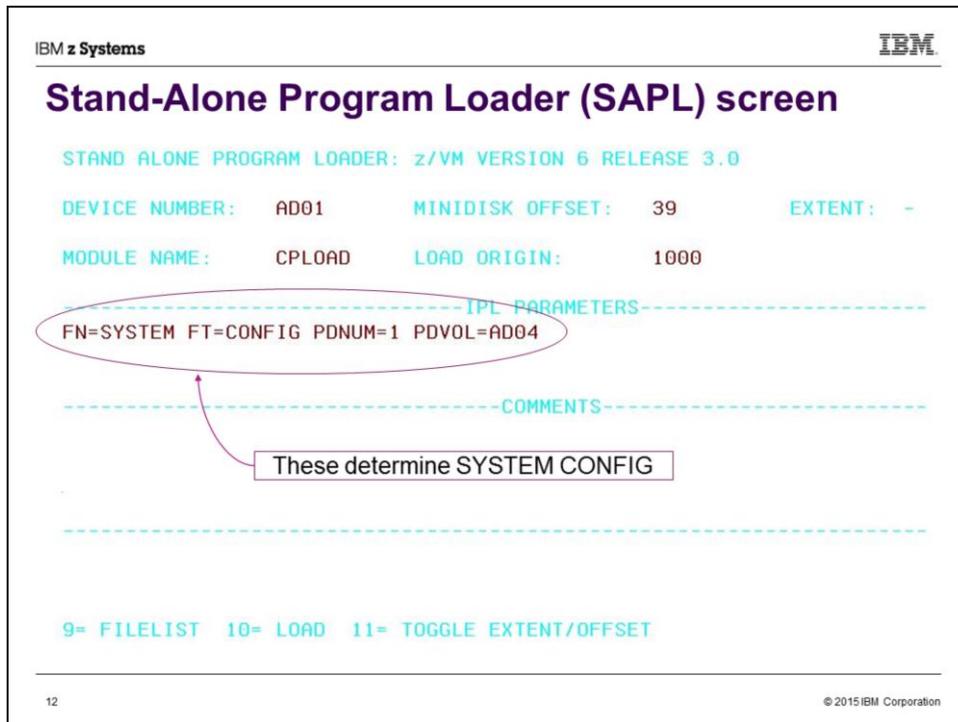
FN=SYSTEM FT=CONFIG PDNUM=1 PDVOL=AD04

-----COMMENTS-----

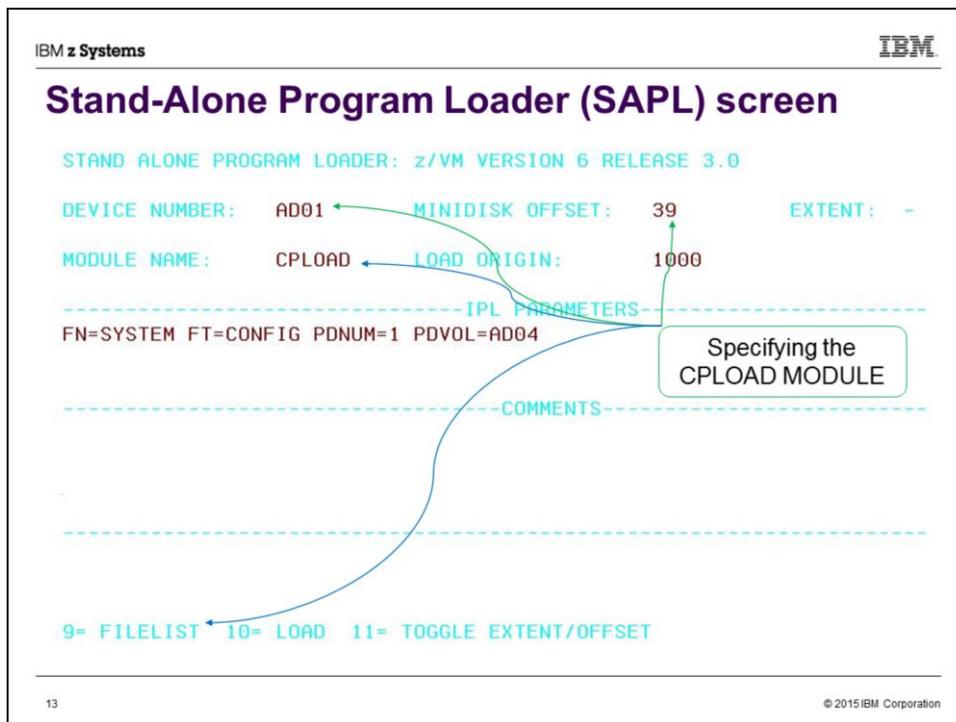
.

9= FILELIST 10= LOAD 11= TOGGLE EXTENT/OFFSET

The previous screen was what the SAPL screen really looks like. But we are switching to a white background to improve legibility.



PDNUM is "PARM disk number". PDVOL is "PARM disk volume". So we are pointing to the PDNUMth PARM disk on DASD pack PDVOL (in this case, the 1st on AD04), and then specified filename/filetype of SYSTEM CONFIG. Notice that the PDVOL is **not** the same as the load address in this case.



Use the file CPLOAD MODULE on the minidisk that starts at cylinder 39 on DASD AD01. The device number was filled in for you by virtue of choosing it on the HMC Load Screen. As an alternative to accepting CPLOAD or knowing the name of another CP version, you can mash PF09 to see a FILELIST of all the files on the indicated minidisk, and choose from among the MODULEs you see there.

The device number specified here is known as the System Residence volume (SYSRES is defined as “where CPLOAD is”). CP will look for DRCT space first on SYSRES, so we are in effect telling where to find the system directory (object directory) as well.

Fun facts

- The minidisk with CPLOAD MODULE does not need to be allocated PARM.
- ...Unless you want to find it by “Extent” rather than “Offset”.

See next slide for highlighting of extent vs. offset.

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SAPL screen – EXTENT vs. OFFSET

STAND ALONE PROGRAM LOADER: z/VM VERSION 6 RELEASE 3.0

DEVICE NUMBER:	AD01	MINIDISK OFFSET:	39	EXTENT:	-
MODULE NAME:	CPLoad	LOAD ORIGIN:	1000		

-----IPL PARAMETERS-----
FN=SYSTEM FT=CONFIG PDNUM=1 PDVOL=AD04

-----COMMENTS-----

9= FILELIST 10= LOAD 11= TOGGLE EXTENT/OFFSET

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You can toggle between using “OFFSET” and “EXTENT” by using PF11. But “EXTENT” refers to the minidisks that have been allocated as PARM using CPFMTXA. If the minidisk you want to point to wasn’t so allocated (i.e. it is PERM), then you must use OFFSET.

Fun facts (continued)

- The minidisk with CLOAD MODULE does not need to be allocated PARM.

- ...Unless you want to find it by “Extent” rather than “Offset”.

- You can pick any MODULE to load
 - It doesn’t need to be named CLOAD
 - It doesn’t have to be CP, either!
 - Examples: DDR, ICKSADSF

- ...Which means, we haven’t even started VM yet.

SAPL can be used to start any stand-alone program. It does not have to be an operating system, although if you try to write such a program you quickly learn to appreciate what an operating system provides.

Since here we could choose any program on the minidisk, we actually have not started VM yet.

```
IBM z Systems IBM  
  
What else might go on the SAPL screen?  
  
STAND ALONE PROGRAM LOADER: z/VM VERSION 6 RELEASE 3.0  
DEVICE NUMBER:   BCB1      MINIDISK OFFSET:   39      EXTENT:   --  
MODULE NAME:     CPVIEJ0    LOAD ORIGIN:       2000  
  
-----IPL PARAMETERS-----  
FN=STSSIOF FT=CONFIG PDNUM=1 PDVOL=BCB0  cons=SYSG store=6G  
  
-----COMMENTS-----  
  
-----  
  
9= FILELIST 10= LOAD 11= TOGGLE EXTENT/OFFSET  
  


---

  
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```

Here we have changed a number of things. Note first that we have specified the console where OPERATOR will be connected (cons=SYSG). We have also specified that the system is to IPL with 6G of storage.

Other changes: Module name, filename of the system configuration file, PDVOL, Device Number, Load Origin.

Incidentally, Load Origin of 2000 is what CP actually uses (or rather, switches to) nowadays, even if you specify something different.

A walk through SYSTEM CONFIG

- **Who** am I?
- **Where** is all my stuff?
- **What** am I allowing?
- **When** do I adjust the time?
- **Why**...?
- **How** to specify various things?

The “Who? What? When? ...” journalism mantra illustrates the importance of SYSTEM CONFIG in providing answers to key questions. (The mantra alliteration works better in German.)

Who am I?

▪ System_Identifier statement

- System_Identifier * * SLUG1
- System_Identifier 2097 031757 GUERNSEY Gateway Cow
- System_Identifier * * &LPARNAME
- System_Identifier_Default BEAR

▪ SSI statement (if in an SSI)

```
SSI SLUG PDR_VOLUME VMCOM1,  
  SLOT 1 SLUG1  
/*  SLOT 2 @@MEMSLOT2, */  
/*  SLOT 3 @@MEMSLOT3, */  
/*  SLOT 4 @@MEMSLOT4  */
```

Several example System_Identifier forms are shown. The first is from an actual single-member SSI install. That form would not work if there were multiple members all using the same SYSTEM CONFIG. When you have multiple System_Identifier statements, CP reads from the top down, using the last one that applies. (So, &LPARNAME in this case. System_Identifier_Default is used only if none apply.)

The SSI statement is also from the single-member SSI install. This statement tells CP where the PDR is, and which members get which slot.

Where is all my stuff?

▪ DASD Statements

```
SLUG1:  CP_Owned  Slot  1  M01RES
        CP_Owned  Slot  5  VMCOM1
...
SLUG1:  BEGIN
        User_Volume_List  M01W01 M01W02 M01W03
SLUG1:  END
```

▪ System data from last run

```
SLUG1:  System_Residence,
        Checkpoint  Valid M01RES  From CYL 21  For 9 ,
        Warmstart  Valid M01RES  From CYL 30  For 9
```

After figuring out who we are, we next need to find out where everything is. Notice the system name being used to specify the specific system these statement(s) apply to. Minidisks are on both CP_Owned and User_Volume DASD, but PAGE, SPOL, TDSK, DRCT and Checkpoint/Warmstart all must be on CP_Owned.

The System_Residence volume is also where CP will first check for a DRCT area.

What am I allowing? (part 1)

```
Priv_Classes ,  
  Operator      A ,  
  IOCP_Read    CE ,  
  IOCP_Write    C ,  
  HW_Service    F ,  
  User_Default  G
```

```
System_Userids ,  
  Operator OPERATOR ,  
  Account  DISKACNT ,  
  Dump     OPERATNS ,  
  Erep     EREP
```

Both privilege classes and system UserID names are pretty standard. It's probably a bad (confusing) idea to mess with them. If you want to change the privilege class of specific commands, use the MODIFY statement, e.g. "Modify Command SHUTDOWN PRIVCLASS Z".

What am I allowing? (part 2)

```
Operator_Consoles ,  
  0020 0021 0022 0023 0E20 03E0 0E21 1020 ,  
  System_3270 System_Console
```

```
Emergency_Message_Consoles ,  
  0020 0021 0022 0023 0E20 03E0 0E21 1020 ,  
  System_Console
```

“System_3270” = SYSG, “System_Console” = SYSC. What is the difference between an Emergency Message Console and the Operator Console? Emergency messages can’t go to SYSG. SYSC always exists – it’s the “Operating System Messages” icon on the HMC -- so there is always somewhere for emergency messages to go. SYSC is line mode, so you can’t use the SAPL screen there, but it can be the Operator Console if SYSTEM CONFIG is configured to allow automatic IPL. There is only one Operator Console, but emergency messages go to all the specified consoles that exist.

The system operator (user OPERATOR by default) gets logged on to one of the Operator_Consoles when the system comes up. For this reason, all the specified consoles should be in a physically secure location. Likewise for security, if you specify (on the SAPL screen) an operator console that is not currently available (e.g. “cons=SYSG” and you forgot to start the 3270 integrated console session), the system will not IPL. Instead, you will get an HCP1010W wait state.

What am I allowing? (part 3)

```
Features ,
Disable ,
  Set_Privclass ,
  Auto_Warm_IPL ,
  Clear_TDisk ,
Retrieve ,
  Default 20 ,
  Maximum 255 ,
MaxUsers noLimit ,
Passwords_on_Cmds ,
  Autolog yes ,
  Link yes ,
  Logon yes ,
Vdisk Userlim 144000 blocks
```

A few features are set up by Install, including some you may want to change, such as allowing passwords on commands. But FEATURES makes available options not listed here, e.g. Set_Privclass, other autostart/restart options.

When do I adjust the time?

Timezone_Definition EDT West 04.00.00
Timezone_Definition EST West 05.00.00
Timezone_Definition CDT West 05.00.00

...

Timezone_boundary on 2015-03-08 at 02:00:00 to EDT
Timezone_boundary on 2015-11-01 at 02:00:00 to EST
Timezone_boundary on 2016-03-13 at 02:00:00 to EDT
Timezone_boundary on 2016-11-06 at 02:00:00 to EST

Self-explanatory, but fun to be able to specify Newfoundland time, NFD West 02.30.00

Why...?

“No, no! There is no ‘why’.”

-- Yoda

How to specify various things? (part 1)

- Language:
 - User_Defaults CPLANG UCENG

- Powers of Special Characters:
 - Character_Defaults ,
 - Char_Delete OFF ,
 - Escape "" ,
 - Line_Delete OFF ,
 - Line_End '#' ,
 - Tab OFF

There are not many choices for language nowadays. Show of hands: Who wants their system to use UCENG?

Character defaults can also be specified in hex, e.g. “Line_End x'7B' ”.

How to specify various things? (part 2)

- Choose the logo screen:

```
CP_Access MAINT CF1 A
CP_Access MAINT CF3 C
...
Logo_Config LOGO CONFIG
```

You can create various logos and put them in multiple files. For CP to see them, the files have to be on a minidisk that CP has accessed. It is possible for the system to be using multiple logos, e.g. one for direct connects, another for everything else.

How to specify various things? (part 3)

- Devices ,
 Online_at_IPL 0000-FFFF,
 Sensed 0000-FFFF

- Form_Default ...

- PRODUCT PRODID 6VMRSC30 STATE DISABLED ...
 ...
 (Note that these are generally licensed products.)

Since we pick up DASD by label, it can be useful to make some DASD offline_at_IPL in order to avoid unintentionally picking up DASD with the same labels as that intended for this system. You definitely need to be aware of this possibility if you do multiple installs, use default values for labels, and allow your LPARs access to each other's DASD.

Notice that here we show RSCS DISABLED. If you tried to bring up RSCS, it would die with a message amounting to "You forgot to SET PRODUCT PRODID 6VMRSC30 STATE ENABLED."

How to specify various things? (part 4)

- Where is the directory really?
- *Source* directory USER DIRECT starts out on PMAINT.2CC
- CPFMTXA shows allocation map of SYSRES disk:

PERM	0	0	1	
DRCT	1	20	20	← Object directory
PERM	21	38	18	
PARM	39	158	120	
PARM	159	159	1	
PARM	160	279	120	
PERM	280	3338	3059	

Use DIRECTXA to write USER DIRECT out to the DRCT area. That is, to write the source directory to the object directory. CP looks for the DRCT area first on the system residence (SYSRES) disk, the IPL disk, then on CPOWNeD volumes in slot order. (You might notice also that there is a PARM disk starting at cylinder 39. Recall that is where the SAPL screen told the system to find the CPLOAD it was IPLing. Also notice the 18 cyl of PERM starting at 21 – that’s the checkpoint and warmstart areas.)

While the source directory starts out on PMAINT.2CC, it doesn’t necessarily stay there. If you use DIRMAINT, it has its own place(s) to keep it.

Some esoteric information: While install puts SAPL, DRCT, checkpoint/warmstart areas, and the minidisk with CPLOAD all on the same volume, it is possible to spread this stuff around. The DASD with SAPL is known as the IPL volume; the DASD with CPLOAD is SYSRES, the System Residence volume. By changing the Device Number on the SAPL screen, you can point to a SYSRES other than the IPL volume. SYSTEM CONFIG has a System_Residence line defining where the checkpoint and warmstart areas are, and CP will use the first DRCT area on that volume if a DRCT area exists there. Otherwise it looks on CPOWNeD volumes in slot order.

Fun Facts

- SYSTEM CONFIG has many other statements available
- FEATURES statement has many powers
- Multiple FEATURES statements are allowed, and are useful
- Many SYSTEM CONFIG statements have corresponding SET commands
- CPSYNTAX exists to check SYSTEM CONFIG changes before you re-IPL

A reason to use multiple FEATURES statements, rather than a single one consisting of many lines joined with commas, is protection against mistakes. Unless you specify otherwise, CP handles errors in SYSTEM CONFIG by simply ignoring the statement on which the error occurs. So if you make a typo on your short FEATURES statement, all the other FEATURES statements will still be valid, but if the typo was on your one huge statement, CP will ignore it all.

What starts automatically? And how?

- OPERATOR runs PROFILE EXEC

...and everything follows from there.

Or...

- AUTOLOG1 runs PROFILE EXEC

...and everything follows from there

Or...

- AUTOLOG1 starts RACF, then starts AUTOLOG2...

Or...

- Go look at SYSTEM CONFIG for hints

On a new install, OPERATOR's PROFILE EXEC does nothing (and OPERATOR does not even IPL CMS). But AUTOLOG1 starts several users. You can IPL the system with the NOAUTOlog option to make OPERATOR the only user that gets logged on.

- It might be worth noting that on a system with an External Security Manager, e.g. RACF, the ESM needs to get started before everything else. So AUTOLOG1 will XAUTOLOG RACF. AUTOLOG2 exists to then take over the configured tasks; AUTOLOG2 is not set up to do anything – or even be logged on – on a non-ESM system.
- Operations Manager is a product that, among other things, can help in control tasks such as “don't start UserB until UserA is up and running.”

System UserIDs may be autologged

System_Userids ,
 Operator OPERATOR noDisconnect ,
 Account DISKACNT Autolog ,
 Startup AUTOLOG1 Autolog ,
 Dump OPERATNS ,
 Erep EREP Autolog ,
 Symptom OPERSYMP Autolog

(This SYSTEM CONFIG statement automatically logs on 5 users.)

Actually, System UserIDs **will** be autologged

System_Userids ,
 Operator OPERATOR noDisconnect ,
 Account DISKACNT ,
 Startup AUTOLOG1 Autolog ,
 Dump OPERATNS ,
 Erep EREP ,
 Symptom OPERSYMP

(This SYSTEM CONFIG statement automatically logs on the same 5 users.)

The “Startup” user AUTOLOG1 is not a “System UserID”, though, so it still needs the “Autolog” parameter.

System UserID surprises

```
System_Userids ,  
  Operator OPERATOR noDisconnect ,  
  Dump OPERATNS
```

(This SYSTEM CONFIG statement results in the following startup messages.)

```
XAUTOLOG OPEREREP  
HCPAUT053E OPEREREP not in CP directory  
XAUTOLOG OPERACCT  
HCPAUT053E OPERACCT not in CP directory  
XAUTOLOG OPERSYMP  
Command accepted
```

(CP defaulted to OPERxxxx names; of these, only OPERSYMP happens to be defined in the standard install.)

If SYSTEM CONFIG fails to specify UserIDs for EREP, ACCT, and SYMP, CP defaults to these OPERxxxx UserIDs. Unfortunately, of these, the standard install defines only OPERSYMP. Recall that install used EREP and DISKACNT for the other two.

What might you want to change?

- SYSTEM CONFIG statements
- USER DIRECTory
- PROFILE EXECs
 - OPERATOR
 - AUTOLOG1/AUTOLOG2
- Configuration files
 - TCPIP: DTCPPARMS, PROFILE TCPIP, etc.
 - RSCS: PROFILE GCS, PROFILE RSCS, RSCS CONFIG
- SET IPLPARMS and/or SALIPL

Of course we could go on and on here. Other examples of products needing configuration include PerfKit, DIRMAINT, and RACF.

Some hints to figure out what is going on

- Look in SYSTEM CONFIG
- Look at PROFILE EXEC of OPERATOR, AUTOLOG1
- Look at spooled console of OPERATOR
 - See who gets autologged by whom
 - See whether users stay logged on (If they fail IPL, this suggests they have not been set up)
 - Check for complaints about errors in SYSTEM CONFIG
- Look at USER DIRECT
 - Entries can have CMD statements
- QUERY IPLPARMS, QUERY CPLOAD, QUERY CPLEVEL

It's easy to get used to ignoring the startup messages, but sometimes excellent clues – or even straight answers – are there.

The possibility of COMMAND/CMD statements in USER DIRECT was an afterthought. Install does not put them there, but a SYSADMIN before you came along might have.

Q IPLPARMS shows what was used on the SAPL screen (or was set by the last SET IPLPARMS).

Q CPLOAD gives PDVOL label and PD offset (sort of the same information as PDNUM/PDVOL that you might see from Q IPLPARMS, but isn't affected by an intervening SET IPLPARMS).

Also note that IPLPARMS can be set as part of a SHUTDOWN REIPL command.

A special slide for users of 2nd level systems

Getting to the SAPL screen:

```
TERM CONMODE 3270  
DEF 9 AS 20 (if needed)  
IPL AD01 CLEAR LOADPARM 20
```

Skipping the SAPL screen:

```
(Use SALIPL to set up parameters as needed)  
TERM CONMODE 3270  
DEF 9 AS 20 (if needed)  
IPL AD01 CLEAR
```

Note: In REXX, you can put all 3 CP commands on one line, separated by x'15'.
'TERM CONMODE 3270' || x2c(15) || 'DEF 9 20' || x2c(15) || 'IPL AD01 CLEAR'

This is a slide for people who IPL VM 2nd-level, i.e. as a guest. Notice that the difference in whether you get the SAPL screen or not is the use of the LOADPARM on the IPL statement. Use CP Q CONS to find out if your console is at address 009 (or anything else) and needs to be changed to 20 (to match what is in SYSTEM CONFIG). If you want to do everything in a REXX EXEC, use SALIPL to specify the CLOAD MODULE, IPLPARMS, etc. and then use the x'15' trick to put all the statements that kill CMS onto one line, which will of course be the last line your EXEC executes.

A special slide for users of 2nd level systems

Getting to the SAPL screen:

```
TERM CONMODE 3270  
DEF 9 AS 20 (if needed)  
IPL AD01 CLEAR LOADPARM 20
```

Skipping the SAPL screen:

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(Use SALIPL to set up parameters as needed)  
TERM CONMODE 3270  
DEF 9 AS 20 (if needed)  
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```

Note: In REXX, you can put all 3 CP commands on one line, separated by x'15'.
'TERM CONMODE 3270' || x2c(15) || 'DEF 9 20' || x2c(15) || 'IPL AD01 CLEAR'

In case anyone missed the difference between getting the SAPL screen or skipping it, inclusion of the LOADPARM parameter controls this.

Summary

- HMC Load panel specifies disk with SAPL, and a console.
- SAPL screen points to
 - System configuration file (SYSTEM CONFIG), by way of PARM
Disk volume and PARM disk number (PDVOL, PDNUM)
 - CPLOAD MODULE, by way of SYSRES volume and extent/offset
- CP reads SYSTEM CONFIG to learn initialization parameters, establish features, choose DASD, etc.
- CP finds object directory in DRCT space on SYSRES volume
- System UserIDs specified in SYSTEM CONFIG are autologged
- PROFILE EXECs in system UserIDs specify what happens next

For More Information ...

Web sites:

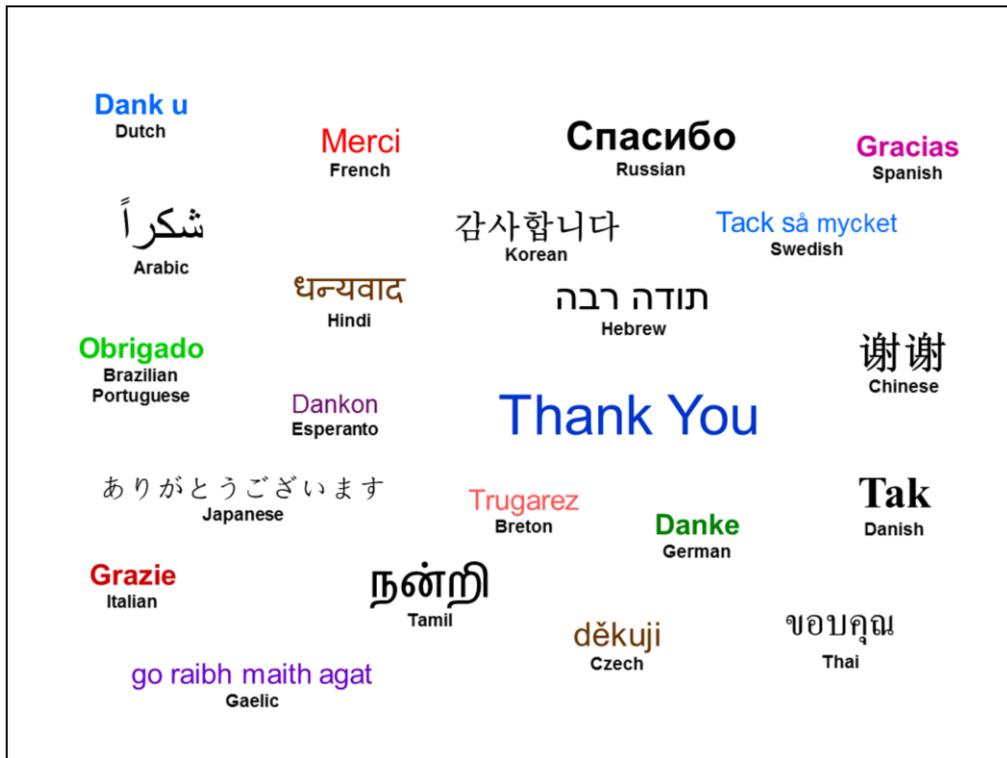
- <http://www.vm.ibm.com/> -- zVM on the Web
- <http://www.vm.ibm.com/library> -- the online zVM Library
- <http://www.vm.ibm.com/education> -- presentations, classes and information

Via mailing lists:

- IBMTCP-L@VM.MARIST.EDU
- IBMVM@LISTSERV.UARK.EDU
- LINUX-390@VM.MARIST.EDU

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Isn't it nice that they have translated all those foreign words and phrases on this slide for you? I had no idea "Merci" meant "French".

Glossary – brief explanation of some terminology

- CPFMTXA - Utility for formatting and specifying usage of ("allocating") DASD.
- CPLOAD MODULE - Default name of the Control Program for VM (in a sense, this *is* VM).
- DASD - Direct Access Storage Device.
- DIRECTXA - Utility for compiling the source directory and writing it as the object directory.
- DRCT - Region on SYSRES volume allocated for the object directory.
- HMC - Hardware Management Console.
- IPL - Initial Program Load. As a verb, this means to start whatever program is on a device.
- PARM disk - Region allocated for special minidisks intended for SYSTEM CONFIG, etc.
- SALIPL - Utility used to write SAPL to cylinder 0 (or blocks 5 to 207) of DASD.
- SAPL - Stand Alone Program Loader. Used to initialize and start other programs.
- SYSRES volume - DASD specified on SAPL screen where DRCT and CPLOAD are.
- System Configuration File - File containing configuration data; usually SYSTEM CONFIG.
- System Console - Screen where system operator (OPERATOR) gets logged on.
- System Directory - Definitions of all users on the system. Compiled form is in DRCT area.