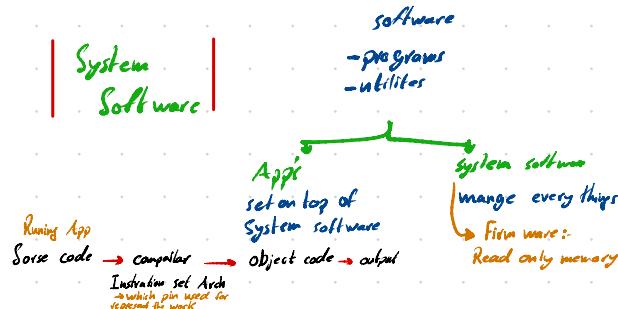




**IBM z/OS Mainframe  
Practitioner Professional  
Certificate**

# Computer Architecture

**Hardware**  
- mother Board



Address space → For user's with size up to 16 exabyte  
TB → PB → exabyte

## Main Frame

memory → storage  
central storage → frame  
virtual storage → page  
Auxiliary storage → slot →

memory central A:  
4 Kb → frame → slot  
page paging page

## Virtualisation :- Logical partition (LPAR)

Way that LPAR build → a lot of processor's and few I/O adapters  
or  
a lot of I/O adapters and few processor

Processor CP →

System Assist processor SAP → Link CP → I/O adaptor → Channel path ID CHPID  
physical path ID PCHID

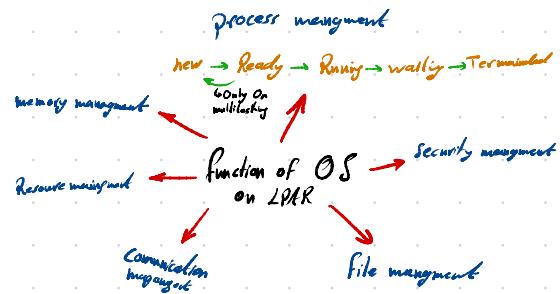
IFL → Run Linux

ZIIP → Run Java

## Main Frame

One OS that  
could run multiple  
OS

**z/VM**  
Run multiple OS  
directly "type 1  
Hypervisor"



## OS

<b>z/OS</b>	<b>z/TPF</b>	<b>z/VM</b>
	\$	Hypervisor
<b>z/VSE</b> small size	Linux for IBM/z	KVM/z

Z/OS

↳ components :-



SNA TCP/IP :- network to zPAR

CISC :- translation process

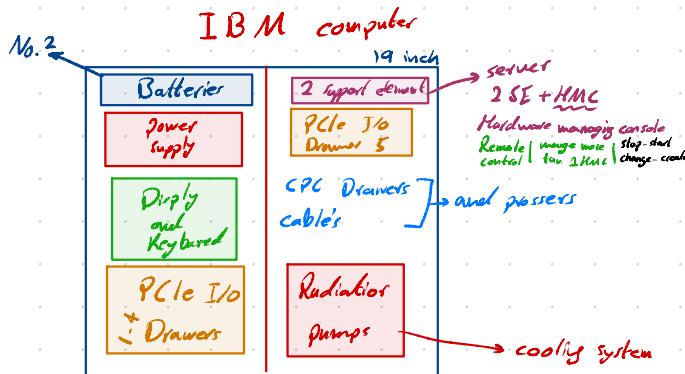
TSO :- Time sharing option

Why mainframe :-

Linux on mainframe \* consolidation

Real time transaction  
Batch transaction

Parallel Sysplex  
IODF configs



capability

Intelligent Resource DirectorIRD

↳ Dynamic channel Path management  
And channel sub system

HyperSocket → z/OS  
no cable

Hyper dispatch

↳ z/DAC → Reduce complexity and time

VFM → Virtual Flash memory

↳ storage for additional support to run java....

z/ture

↳ login users - accounts ...

## Millicode

- ↳ system initialization powers → INIT steps → initial machine Load
- ↳ Running more OS = instruction called SIE in nutshell

## Sysplex

- STP → system time protocol
- GRS → Global Resource Serialization → multiple access
- XCF → Cross coupling Facility → app and sysplex "communicate"
- Coupling Links → connect LPARs to processors → direct memory
- CDS → contain information for parallel processing

## WLM

- ↳ work management → performance tuning

## Sysplex configuration

\* sysplex with only one LPAR = is it sysplex = Y, monoplex

Base sysplex

parallel sysplex → Coupling facilities running multiple z/OS up to 32 z/OS

Rolling IPL down 4 of 16 upgrade them back plex never goes down

z/OS security

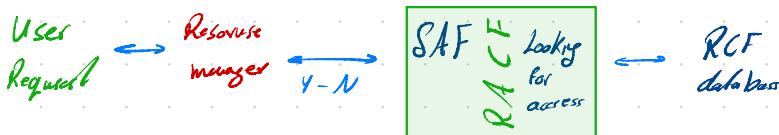
## confidentiality

Resource → file - device - system access - app

availability

integrity → for app

access any thing



HSM By 4767 crypto co-processor

## Login

if the user enter password 8 char or less pass  $\Rightarrow$  as password  
greater than 8  $\Rightarrow$  passphrase

## RACF user profile

User ID - Owner of ID - password - special passphrase - Groups attributes

## Access of data set

Alter - Control - Update - Read - Execute - NONE  
full  $\downarrow$  Create - delete - Load Lib - CANT  
Master catalog

## Transaction

↳ encryption and key  
4 bit - 16  
5 bit - 32  
256 - high level  
char = 2 bit

Semantic encryption, encryption and decrypt - Basic

## public Key cryptography

public key  $\uparrow$  private key  
 $\xrightarrow{\text{mathematically}}$   
Encrypt      decrypt

## Encryption

Processor

CPU CF

$\downarrow$   
CP assist  
for cryptographic asset  
= speed up VPN, SSL

PCIe card

spatially  
decryp - increyp  
Crypto express  
Card  
 $\curvearrowright$  Secure Key  
not clear being  
clear Key  
performance up  
fetch protected  
better ephemeral  
Key - wrapped Key

## IOCDs

Direc Access storage devices "DASD"

IOCDs: Input output control data set

$\hookrightarrow$  to represent the connection between resources and system outside the main frame  
VFICOnswitch

IOCP: Input output configuration program stored in SE  
Control units

$\hookrightarrow$  to build IOCPs

- ① LPAR partitions
- ② Channel path CHPID  
mainframe  $\rightarrow$  PCHID
- ③ control units disk - tape
- ④ I/O Device  $\rightarrow$  talk to

## Steps

ID statement define Ones opti

Resource statement MIF ID for multiple LPAR reqn

CHPID statement channel shared, span opti

Control statement  $\begin{cases} \text{characteristic of control unit} \\ \text{channel path} \\ \text{unit address} \end{cases}$  opti

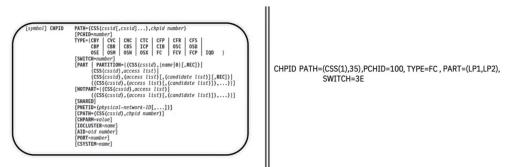
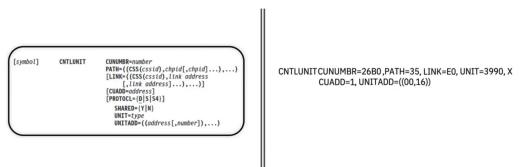
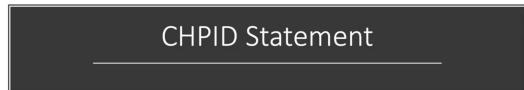
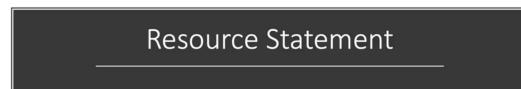
IO Device number statement talk to device opti

Connection Between LPAR through CHPID out PCHID through FICON unit out to 3390 DASD unit

- ① ID
  - $\Sigma MSG1 = \{IO of JOCOS\}$
  - $\Sigma MSG1 = \{\text{when update}\}$
  - $\Sigma SYSTEM = \{\text{processor } [E, \text{number}]\}$
  - $\Sigma LSYSTEM = \{\text{name}\}$
  - $\Sigma TOK = \{\text{token}\}$

② Resource partition  $CSS(CSSID)$ , name  $(name)$ , MIF image ID  
 $\text{exmp: } (CSS(1), (LP1, 2), LP2, (LP3, 5))$

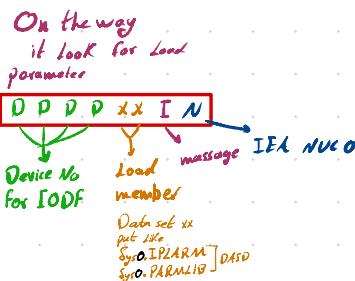
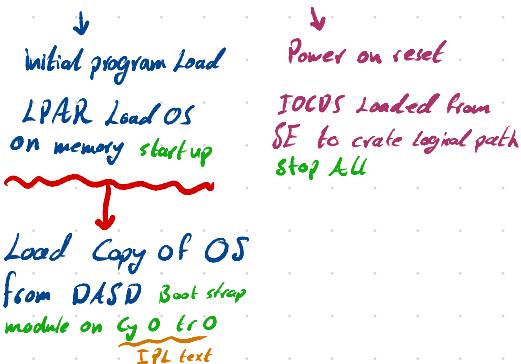
③ CHPID CHPID path  $(CSS(1), 35)$ ,  $(PCHID=100)$ ,  $TYPE=FC$ ,  $PART=(LP1, LP2)$ ,  $SWITCH=3E$



# Activation profile :-

CPC  $\Rightarrow$  Central processor complex  
information about CPC, LPER, OS  
Stored on SE  $\rightarrow$  boot up

## IPL vs POR



## Profile

Reset  $\rightarrow$  Now the license internal code set storage

OFF  $\rightarrow$  On

IOCDS  $\rightarrow$  Hardware storage

Sub channels  $\rightarrow$  online

Image  $\rightarrow$  memory - processor

Load  $\rightarrow$  channel address for load OS

Group  $\rightarrow$  share object

# Command Line on Mainframe

## ISPF

Interactive system productivity facility

For access facility

Login to TSO

X or F12 to Logout

## TSO

Time system Option

## Data set : to store data

### Type of data set

Sequential



Record → data set

partitioned



Record → member → data set

directly  
PDS  
PDSE enhancement

its start from 1 up 22 segment

Example of name

Mohamed. LOVE. CCR

high level another low-level  
qualifier qualifier qualifier

there is at period

8 32. FOR. PIZZA

Special example

I. SURE. DO. LOVE. THIS. SYSTEM

## On ISPF

Op 3 → Op 2 → A → project  
 group → sequential has no  
 type → directory  
 PDSE → library  
 data set allocated

### Handy commands

Enter → save on edit mode

F3 → save and back

F12 → not save and back

F → Find

HILITE → set color

COLS → Rulers

CHANGE

Bounds → Source

3.3 → Copy or = 3.3

3.2 → Rename All number

for Replace → C and S (all)

On data set F4 → search word

# TSO

command → Time sharing option

Full graphical interface like z/owe

ISPF → op6

To enter TSO command  $\downarrow$  TSO follow by command  
TSO Ready p1p nature

L1STDS List of data sets

Operands

→ Help L1STDS Operand

Positional

Keyword set mode

# System programmer Sysprog

managing

IODF

when upgrade - expand the system  
list of resources → security

## JES

Job entry subsystem

Reserve the job

Schedule them to run

Control the output

work  
**JES2**

**JES3**

- \* accept job for execution
- \* Queue the job
- \* Accept the output

spool

\* input and output

patch job

- similar needs
- store
- done - error

## JCL

scripting language

Specify the resors

communicate  $\rightarrow$  program

works accord to priorities

Job → user have JCL

submit

Read JES store in spool  
referred

Correct and com 73 / 80  
ignored

## Submitting job to JES

ISPF → opt 2 → Other partition z/OS unix file → list of data sets member put S

Procedure → commands in sets → prob lib

↳ stored in system data set

Reference by name

## Catalog

## In Stream

II [stepname] EXEC procedure\_name

15 level of enable

Sample name

PROC

Step 1

Dynamic system symbol

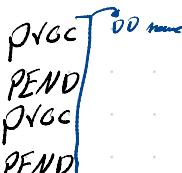
change on IPL

Log → recharge

Static system symbol

set at IPL time

PEND



defined

Serial  
Device  
Excl  
EWK1

In Inheritance

# VSAM

Virtual storage access method

↳ to get app to write data

- Record Instream

- control Instream

↳ continuous storage in DASD

2 I/Os compatible

## RACF

→ OS/VS, CICS, TSO

DFSMS, SMPI/E, communication server, SMF  
WLM

RMF  
→ monitor mode 2 monitors

Type of database

KSDS Key sequential data set common

PRDS Relative Record data set

ESDS Entry sequence data set

LDS Linear data set

## System libraries

Final

SYS1, LinkLIB → MST JCL00, initial subsystem

LINKLIB  
↳ dynamic  
Fixed  
modified  
pageapple

NUCLEUS → load up the OS

PROCLIB → system function lives on IBM

PARMLIB → similar to Linux /etc

Search for modules

IPL → Job pack area

Task LIB

Step 4b - Job lib

LINKLIB  
↳ dynamic 1  
Fixed 2  
modified ?  
pageapple 4

Link list → sys1.linklib

\* LLA → Lib Lookaside

to reduce the amount of I/O to search data from PDS

\* VLF → Virtual Lookaside

named obj

To see the concatenation Enter D PARMLIB

To see the last IPL Enter D IPLINFO

# Application

## Transaction

### ACID properties

**Atomicity**  
Is it happened

**consistency**

move on one time  
Without leave data  
Important

**Isolation**

how smoothly run  
the data  
scale & complex

**Durability**

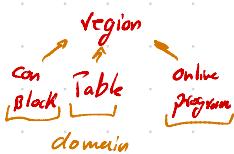
→  $\rightarrow$   $\rightarrow$

### CICS

Long time / ATMs

Bills

Last very short time



Transaction manager (TM)

Program manager (PM)

Storage manager (SM)

### IMS

Information managing system

Hierarchical database

database manager

Transaction manager

System manager

### DB2

Exceptional availability

Maintain Scalability

Deployment flexibility

Low cost

Data in table

SQL

Acid properties

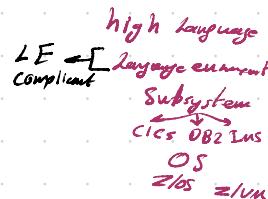
### Language environment

Languages: Cobol, Fortran, PL/I, Assembler, C, C++, Java, Py, swift, nodeJS

high → Binary

Compiler → source code, executable code,

Interpreted → Interpreter to figure out what need done



# Generation data groups GDG

its a historically related datasets on chronological order GV number Import

## RAIM

Redundant array of independent memory

How  $\Rightarrow$  processor unit has one memory unit out of 5 DIMM 1 DIMM is Redundant memory  
use channel or full column

## Networking

PCIe  $\rightarrow$  OSA

$\hookrightarrow$  open system adapter - network card

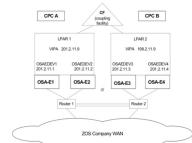
TCP/IP started task  $\rightarrow$  off when SysProg

IP address is 32 bit represented in decimal from 0  $\rightarrow$  255 = IPv4  $\exists$  IPv6 = 128 bits  
 $\hookrightarrow$  on hexadecimal

Program runs on socket



VIPA/LNK1 entry  $\Rightarrow$  VIPA



TCP/IP profile

$\hookrightarrow$  statements

- $\hookrightarrow$  device link  $\rightarrow$  which network device to use
- $\hookrightarrow$  home statement  $\rightarrow$  set IP address
- $\hookrightarrow$  subsequent link statement  $\rightarrow$  how to use them

## Utilities

Called from JCL copy datasets and member

System utilities

ICKDSF

$\hookrightarrow$  install, initialize, manage] DASD

IENINITT

$\hookrightarrow$  Initialize tapes for long term storage

IEHLIST

$\hookrightarrow$  View OS volumes Catalog

Data set utilities

start IEB

$\hookrightarrow$  IEBCOPY

$\hookrightarrow$  copy, merges, PDS, PRSE  
and  
Compression  
and  
Converts

$\hookrightarrow$  IEBGENER

$\hookrightarrow$  Backup dataset, make partition  
Print content dataset, convert  
data format

$\hookrightarrow$  IEFBR14

$\hookrightarrow$  do nothing



DFSORT  
powerfull

# Z/OSMF in nutshell

done!

need Java, OMVS, COM server

"Unix"

Unix System Services USS

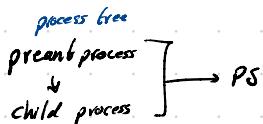
↳ its environment implementation → OS commands LS, GREP, CAT, MKDIR, CD, OPUT, OGET

drive USS ↗ Ishell OMVS ) same API

Unix system file type ZFS

↳ Splex-aware  
↳ File mounted locally in the LPAR

## USS processes and permissions



block

- ↳ RACF profile
- ↳ information USS user ID
- ↳ splex user ID
- ↳ group ID

① Directory D  
② File -  
if

RW X    RW X    RW X

User    Group    World

- |   |       |              |
|---|-------|--------------|
| ① | - - - | No access    |
| ② | - - x | Execute only |
| ③ | - w - | Writeonly    |
| ④ | r - - | Read only    |
| ⑤ | r - x |              |
| ⑥ | r w - |              |
| ⑦ | r w x |              |

full access from command line 777

chmod filename access