

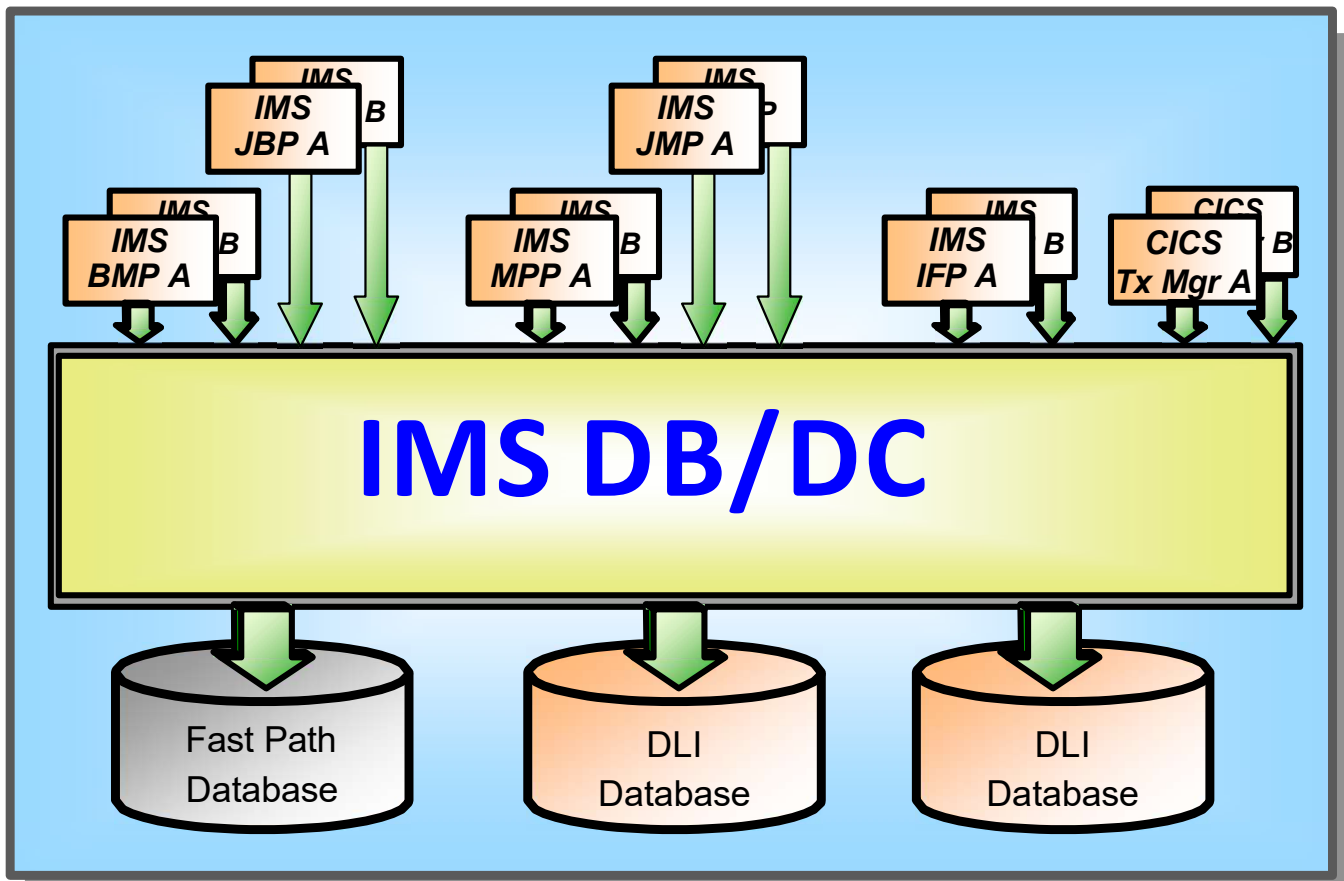
UNIT1 – IMS OVERVIEW

DATABASE (DB) and Transaction Management (DC or TM)

After completing this unit, you should be able to:

- Understand basic concepts of DL/1 (DL/I)
- Identify the IMS services that are provided by the Database Manager and Transaction Manager Features
- Describe the functions provided by the different **IMS** Address Spaces

IMS DB/DC overview



IMS allows access to:

Fast Path DEDBs, MSDBs and IMS DL/I Full Function databases, from:

- Batch Message Programs (BMPs) in two varieties ;
Message-oriented (which access message queues) and
Non-Message-oriented (which do not access message queues)
- Message Processing Programs (MPPs)
- Interactive Fast Path Programs (IFPs)

There are also two additional types of regions for processing Java programs ; Java Batch Processing (JBP) which are similar to non-Message oriented BMPs and Java Message Processing (JMP) which are similar to MPPs

One or more CICS Systems on the same LPAR as IMS

What is a Database System?

"A system that allows multiple independent users to have concurrent access to a central repository of information..."

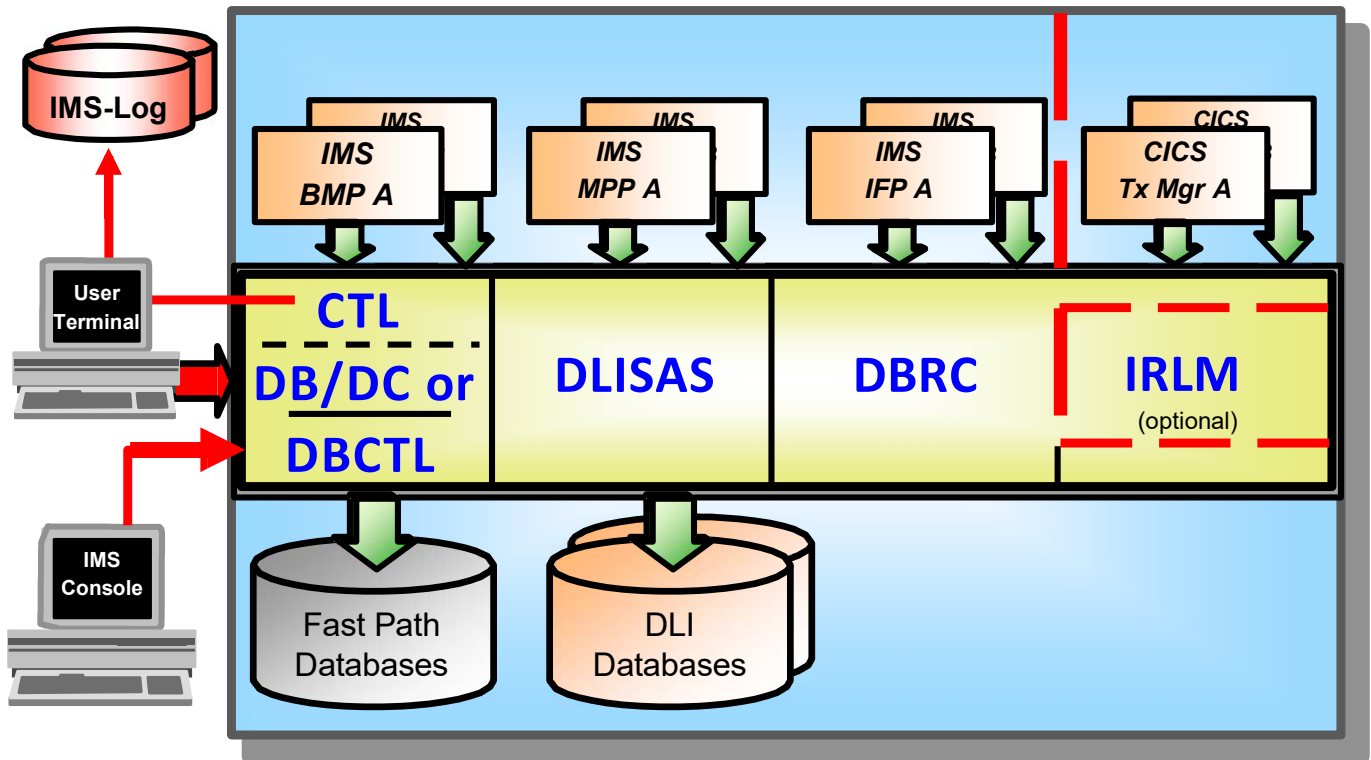
Advantages:

Centralized files for all applications (they provide both integrity and efficiency; a database allows to store all information in a consistent manner and to provide system software to ensure its integrity)

Elimination of duplicate space and effort

Single information source provides complete, accurate information processing

IMS System Components Overview



Each IMS system is usually made up of at least three address spaces:

IMS Control Region

DL/I Subordinate Address Spaces (DLISAS)

Database Recovery Control (DBRC)

Based on configuration and workload requirements, up to 999 dependent regions (BMPs, MPPs, JBP, JMPs, or CICS-Threads) can also be associated with each IMS system. Additionally,

Either the Inter Region Lock Manager (IRLM) or IMS (internal) Program Isolation (PI) function will be used to perform the necessary locking functions in an IMS environment

- On this example, we are illustrating an IMS system using an IRLM as its external lock manager

IMS System Integrity functions

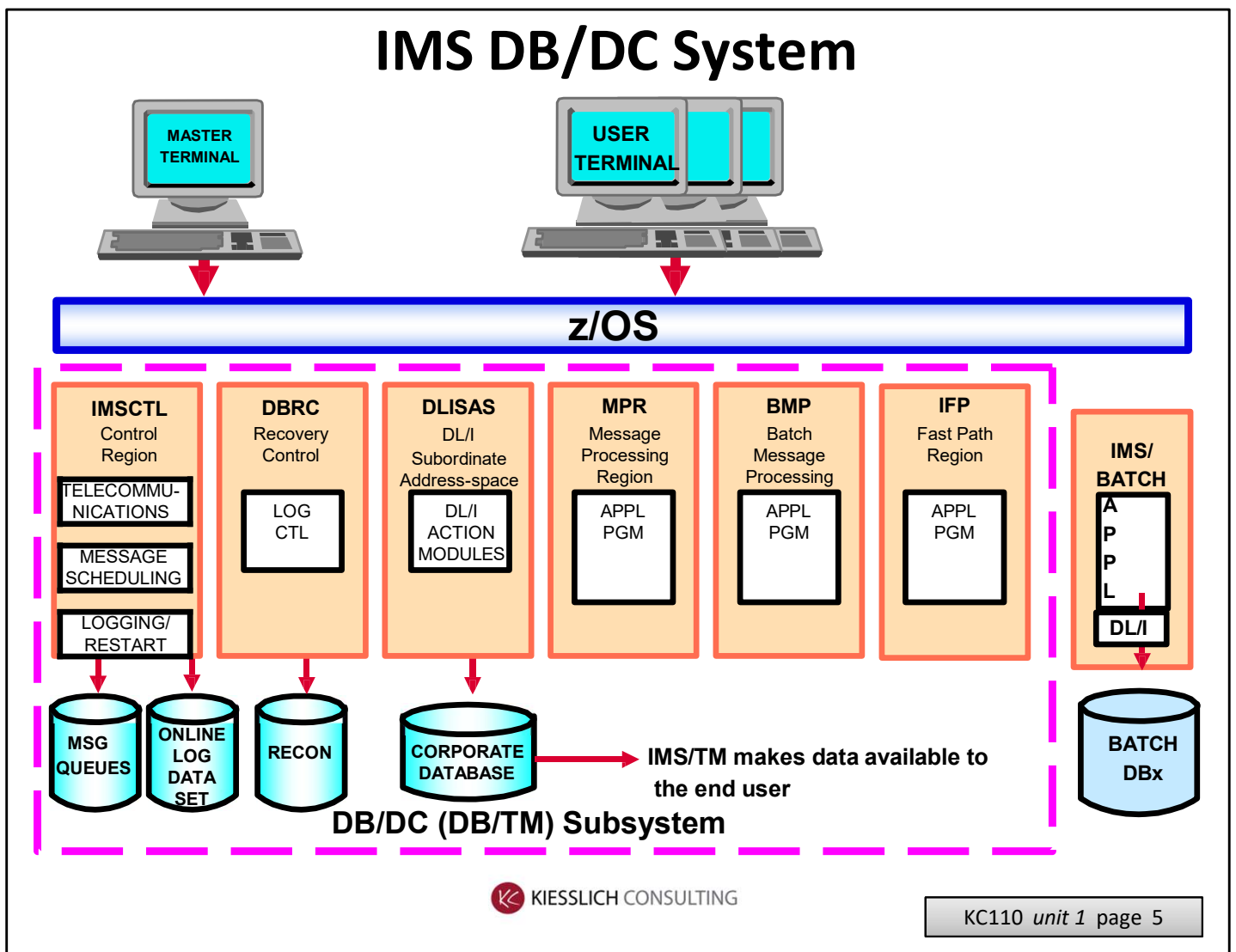
- Common Logging Facility:
 - Database changes, transactions, system status changes
- Uses *Two-Phase Commit* protocol with DB2 and other Subsystems (MQ,CICS) to coordinate commit or abort across all resources modified in a unit of work (UOW)
- Automatic system checkpoints:
 - Based on system activity
 - System Recovery and Emergency Restart
- Database Recovery Control
 - Automated tracking of Logs and authorizing DBs used by IMS system
- Dynamic Backout
 - Automatic backout for program ABENDs:
 - Databases are returned to prior consistent state – as though transaction never occurred
 - Facilitates sharing of data by multiple programs - locks are released
- Normal Restart
 - Start with unprocessed input/output from previous execution

DBRC: Level 1 - Log control
2 – Database control

Integrity also for /ERE !

Restart discussion later (/ERE cold- comm / base / sys)

IMS DB/DC System



IMS DC: is a message driven system working with message queues.

Local IMS - Local Queue Datasets (long msgs , short msgs, QBLKS , for in/out msgs / cmd responses)

SharedQueues - MSG QUEUE STRUCTURE on CF

Startup procs : [Procedures used in IMS environments - IBM Documentation](https://www.ibm.com/docs/en/ims/15.5.0?topic=definition-procedures-used-in-ims-environments)

(<https://www.ibm.com/docs/en/ims/15.5.0?topic=definition-procedures-used-in-ims-environments>)

-> Please search for Region Controller PARM specifying =(xxx ,,,,,,) .. „Region type“

IMS DB/DC Dependent Regions (1 of 2)

- The RTE for your applications

- Maximum of 4095 *Dependent Regions (PSTs)*
 - Message Processing (MPRs) and Java Message Processing (JMPs) Regions :
 - Selective start-up at IMS initialization or some later time (Automation)
 - Processes *online* transactions from terminals
 - IMSCTL automatically *schedules* application programs for execution to process IMS/DB databases, or DB2 tables
 - Many different application programs can be processed in a given MPR throughout processing period
 - But only one at a time
 - Batch Message Processing (BMP) and Java Batch Processing (JBPs) Regions:
 - Started when JOB submitted by operations or scheduling software
 - Runs one application-program to process queued messages, IMS databases, DB2 tables, and/or MVS files while IMS DB/TM system is available
 - JBP Regions do not access IMS Queues

IMS DB/DC systems can provide connections for a variety of dependent regions. The maximum total number of dependent regions that can connect to an IMS Control Region is configured by systems programmers, but can not exceed 4095.

IMS DB/DC Dependent Regions (2 of 2)

- The RTE for your applications

– Interactive Fast Path (IFP) regions:

- Processes *online* transactions from terminals:
 - Very similar in use to MPR Regions
 - For large transaction volumes that require fast response
- Can access IMS databases or DB2 Tables
 - Name is misleading since IFP Regions do NOT need to access Fast Path databases
- Bypass IMS/TM Scheduler and instead use Expedited Message Handler (EMH) scheduling
 - EMH Scheduling uses a very simple FIFO scheduling algorithm

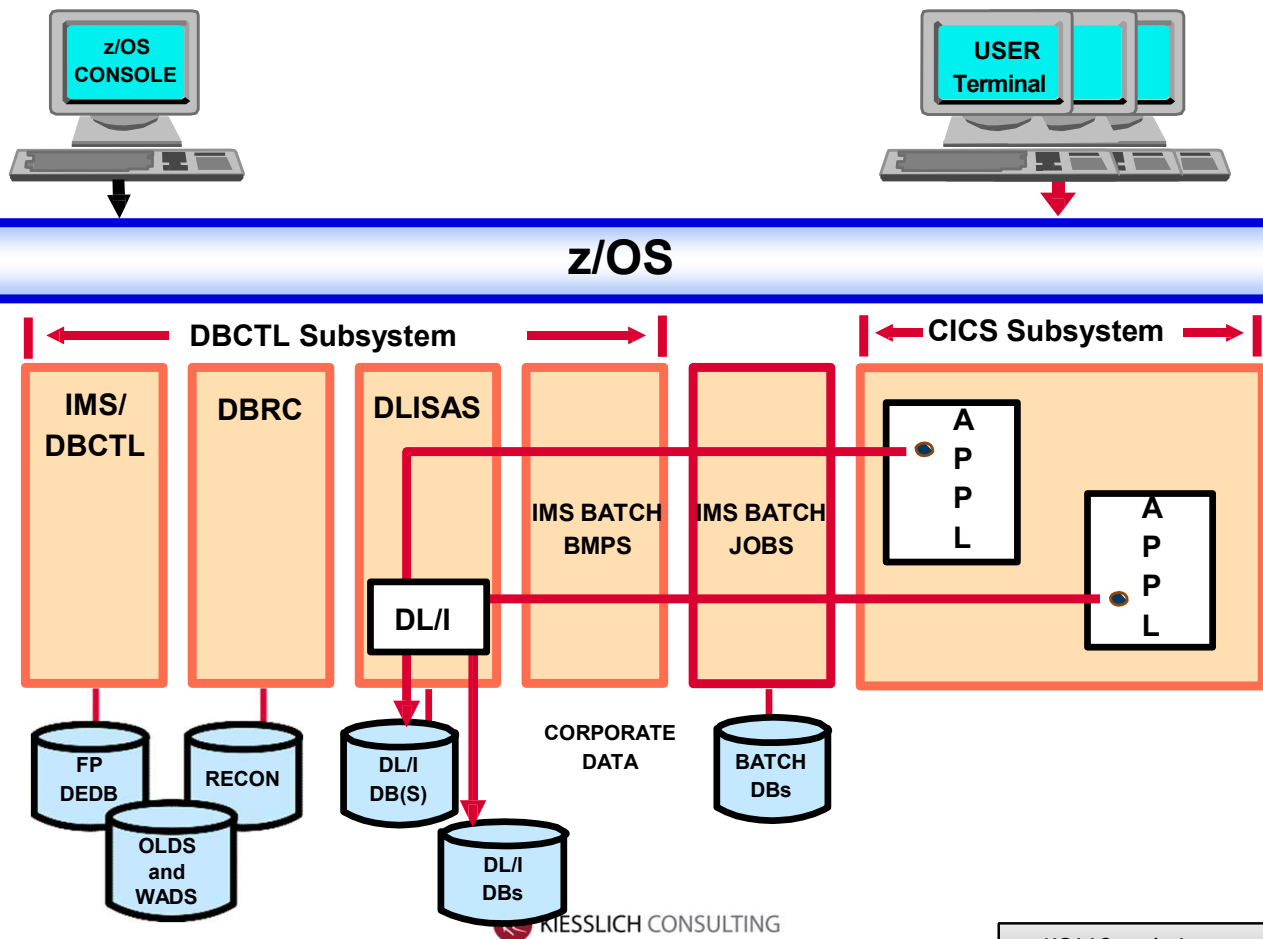
– CICS Connections:

- CICS Systems are not *Dependent Regions* from the IMS Perspective
- However, IMS DB/DC Systems can serve in the role of an IMS DBCTL system and permit multiple connections to multiple CICS Regions:
 - Each of these connections between CICS and IMS counts against the 4095 (999) maximum dependent region count
 - DBCTL description on next foils

Notes:

IMS DB/DC systems can provide connections for a variety of dependent regions including the DBCTL functions required by CICS.

IMS Database Control Subsystem



Notes:

An IMS system is configured as Database Control (DBCTL) if CICS will be the only transaction manager (CCTL) accessing IMS databases.

IMS DBCTL "*Dependent Regions*" resp. *THREADS* (1 of 3)

- Maximum of 4095 connections to IMS DBCTL:
 - Each CICS that uses the services of an IMS Control region can have multiple connections,
 - Each of these connections is called a ***thread***
 - Multiple CICS regions might use the services of a single IMS Control region
 - Batch Message Processing (BMP) regions are also available to IMS DBCTL Systems (Similar to BMPs in IMS DB/DC System) :
 - Started when JOB submitted by operations
 - Runs one application-program to process IMS/DB databases, and/or MVS files

Notes:

It's obvious that IMS DBCTL systems provide reduced functionality compared to IMSDB/DC systems (no TM, no msg queues, no such scheduling). All Transaction management functions are provided by CICS (CCTL).

IMS DBCTL "*Dependent Regions*" resp. *THREADS* (2 of 3)

- Unlike with IMS/TM, these batch-type programs will not process input from IMS queues --- cannot in a DBCTL environment as **no msg queue** exists! (No TM part, so no Terminals, no WTOR, no ... **)
- this BMP region type is called “non-message driven” ... or “batch-oriented”
- Anyway, if running in a DC Environment (Message queues) this type can produce output going to a msg queue
- The connection limit (999 /4095) applies to the one IMS system for the total number of threads (all CICS connection and ODBA threads) and BMPs.

** But CICS transaction CDBM allows some limited operating, other chances to „operate“ are via Subsys ID from E/MCS consoles

- Connection limit: see also MAXPST parm

IMS DBCTL "*Dependent Regions*" resp. **THREADS (3 of 3)**

- ✓ IMS DB/DC (or IMS DBCTL) and CICS must run under the same MVS image (z/OS) because the interface uses Cross Memory Services !!
- ✓ More than one CICS subsystems can be connected to one IMS, but a single CICS can be connected to only one IMS system at a time

→ see Definition of DRA table – Database Resource Adapter

[DRA startup table - IBM Documentation](#)

(<https://www.ibm.com/docs/en/ims/15.5.0?topic=dra-startup-table>)

→ see CICS Setup Connect to IMS by CDBC

[Connection, disconnection, and inquiry transactions for the CICS DBCTL interface - IBM Documentation](#)

(<https://www.ibm.com/docs/en/cics-ts/6.x?topic=dbctl-connection-disconnection-inquiry-transactions-cics-interface>)

→ see CICS providing IMS Operation by CDBM

[CDBM operator transaction - IBM Documentation](#)

(<https://www.ibm.com/docs/en/cics-ts/6.x?topic=dbctl-cdbm-operator-transaction>)

IMS System Address Spaces (1 of 2)

- IMS Control Region is always required:
 - Can be configured as a DB/DC, DCCTL or DBCTL Region
 - Provides common Service functions such as logging and scheduling
 - Provides IMS data communication facilities for DB/DC or DCCTL
 - Provides the DBCTL functions required for CICS access to IMS DBs
 - Multiple CICS regions might use the services of single IMS Control region
- Data Base Recovery Control (DBRC) Address Space is always required:
 - Assists in providing IMS System integrity by tracking all IMS Systems logs
 - Also optionally provides for database recovery support for IMS Full Function and Fast Path databases
 - Stores system and database recovery information in Recovery Control (RECON) data sets

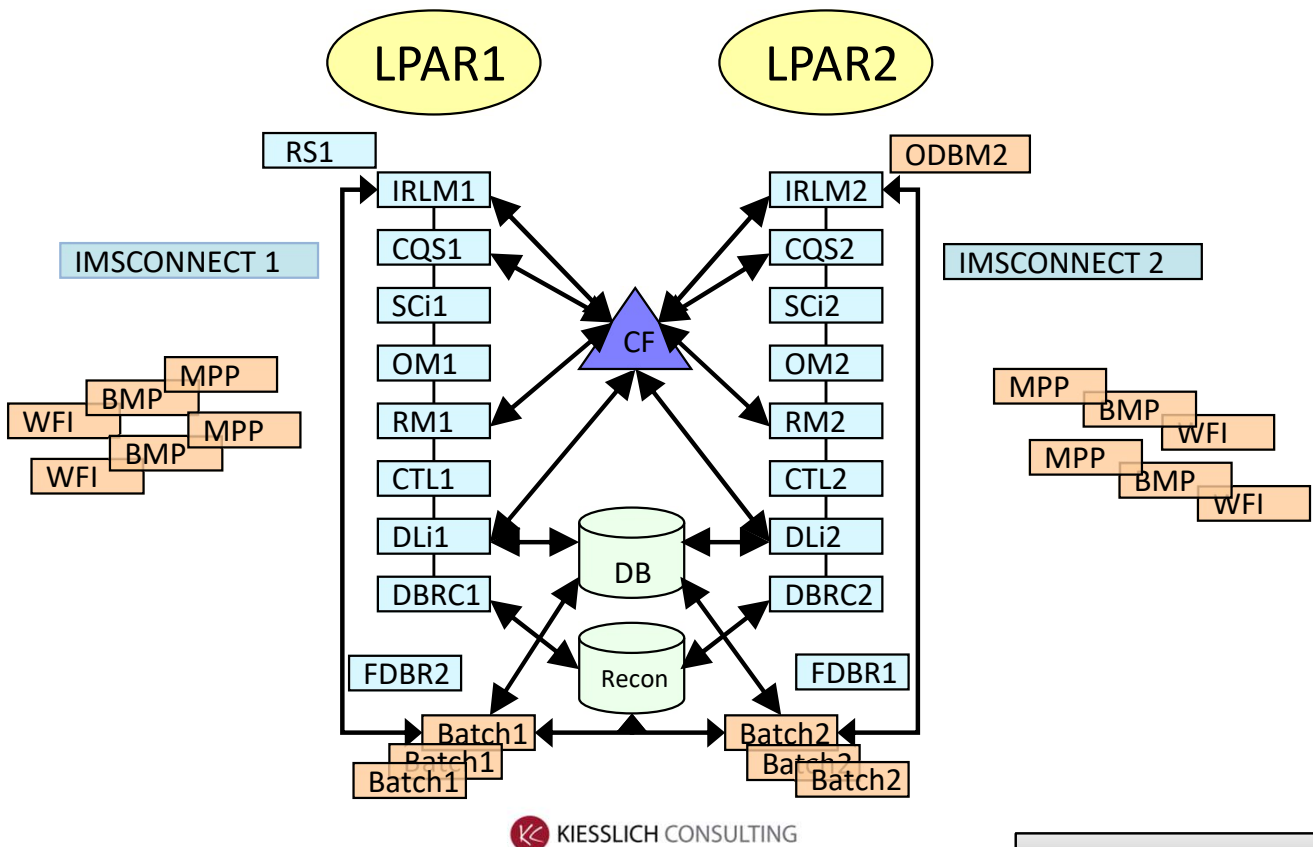
In addition to a Control Region, an IMS System image requires some other address spaces; there are also other optional address spaces that can be used if desired (mandatory for specific functions as f.i. TYPE 2 commands require the Common Service Layer – CSL – and its address spaces)

IMS System Address Spaces (2 of 2)

- DL/I Subordinate Address Space:
 - Also called *DLI SAS* or *Separate Address Space*
 - Contains DL/I code, control blocks and buffers for the databases as well as an ENQ/DEQ pool (locking related), if IRLM is not used
 - Usually present ... [but only definitive required if CICS is connected as CCTL]
 - Official terminology: Required if a *Coordinated Controller* (CCTL) is connected to the IMS System
 - A CCTL is usually just another way of saying *CICS*
- Inter Region Lock Manager (IRLM) is Optional (old : IMS RLM)
 - Can be used instead of PI
 - When using block level **data sharing**, IRLM is **mandatory**
- Additional / Optional Address Spaces:
 - Common Queue Server (CQS) ASID used for Shared Queues
 - Common Service Layer (CSL) was introduced in IMS V8 to aid in managing multiple IMS Systems working together as an **IMSPLEX**
 - CSL Address Spaces f.i. : Operations Manager (OM), Resource Manager (RM), maybe ODBM Servers , as well Structured Call Interface (SCI) Address Space, ...

DLISAS is required too, if ODBA / ODBM instances are connected

2 way IMSPLEX mit Shared Queues, Repository Server und ODBM



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RS (Optional):
Subsys)

REPOsitory Server (DRD) , maybe also talking about RDDS (per IMS

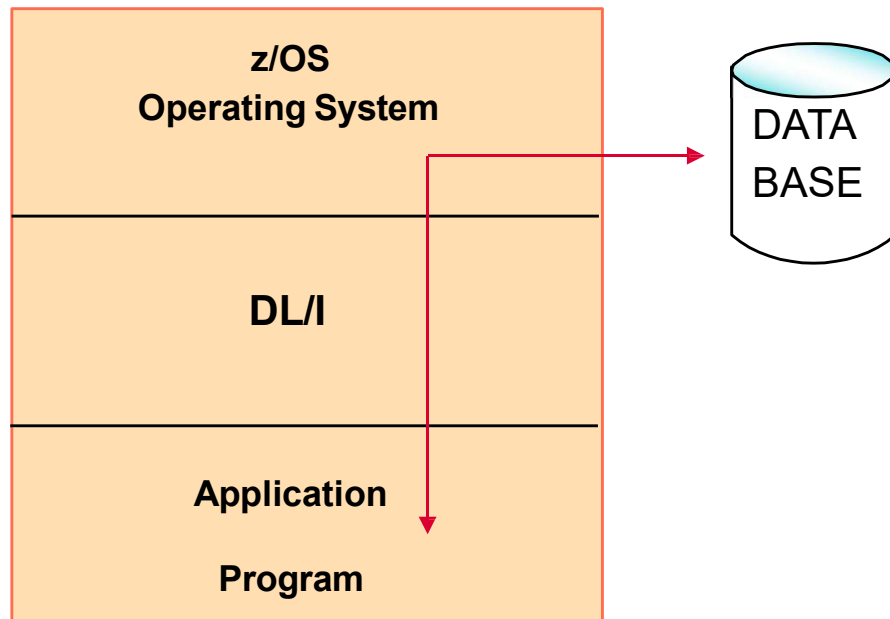
ODBM (optional):

Open DataBase Manager (+ IMS CATALOG) für distrib. Access aus JAVA
u.a. clients zum IMS/DB (ähnlich dem ODBA aus zB. DB2 StoredProcs
in IMS/DB hinein)

FDBR (Optional):
eine XCF GROUP)

Fast DB Recovery (ein Tracking IMS;
gets active when the tracked IMS fails; beide – CTL und FDR – joinen

UNIT1_1 Basic Concepts



What is DL/I and DL/1

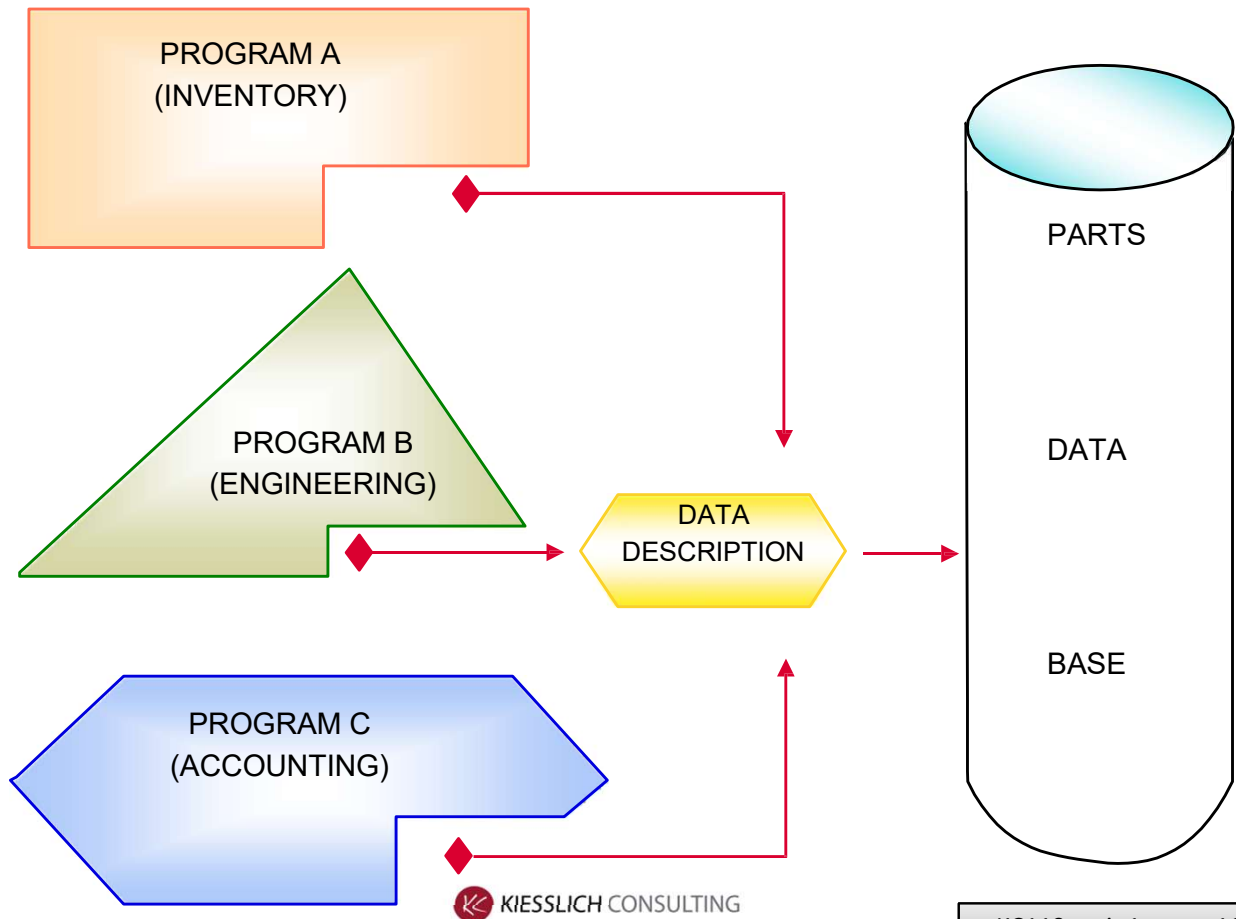
Data Language/One is the name of this database with a very specific language for access; strict hierarchical

Data Language/I – Interface - is the data management facility that serves as an interface between an application program and the database for type DL/1:

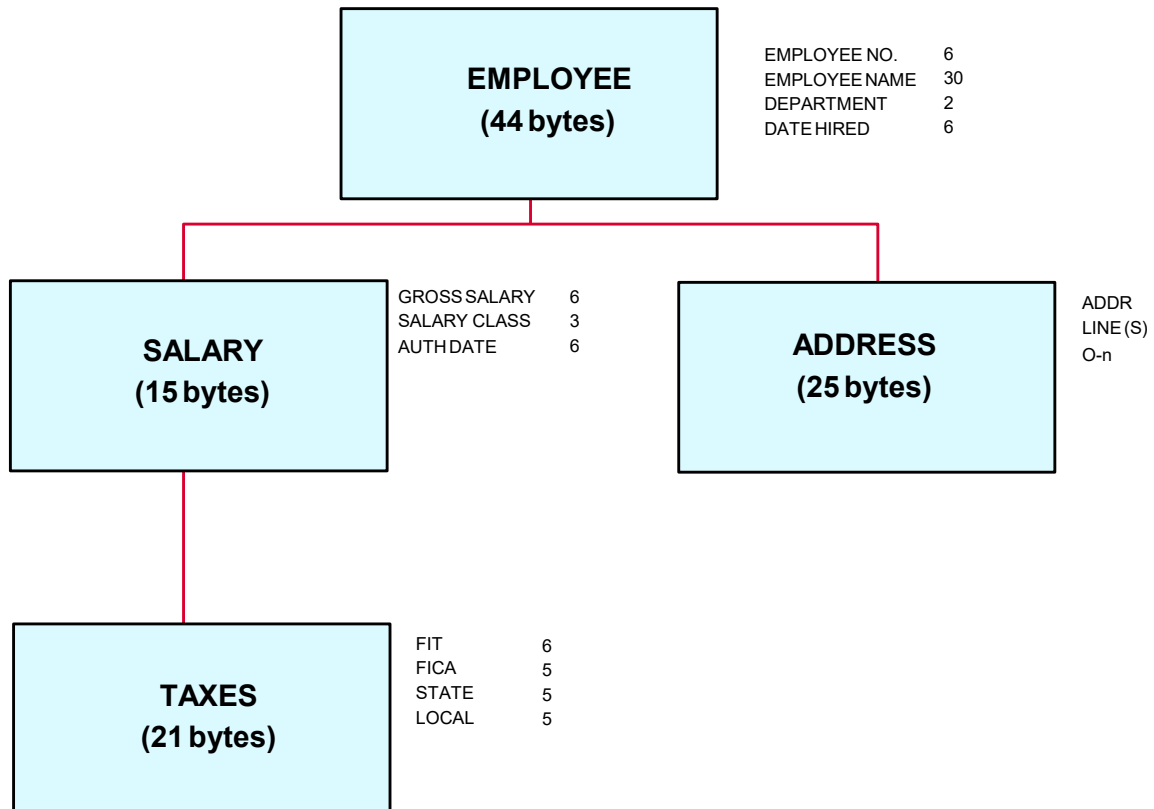
- CBLTDLI,
 - PLITDLI,
 - REXX2DLI
 - AIBTDLI [Application programming design - IBM Documentation](https://www.ibm.com/docs/en/ims/15.5.0?topic=programming-application-design)
- (<https://www.ibm.com/docs/en/ims/15.5.0?topic=programming-application-design>)

...

Database Approach



DL/I Hierarchy (1 of 2)



Notes:

ROOT:

The **highest-level** (no parent) segment in a hierarchy.

PARENT:

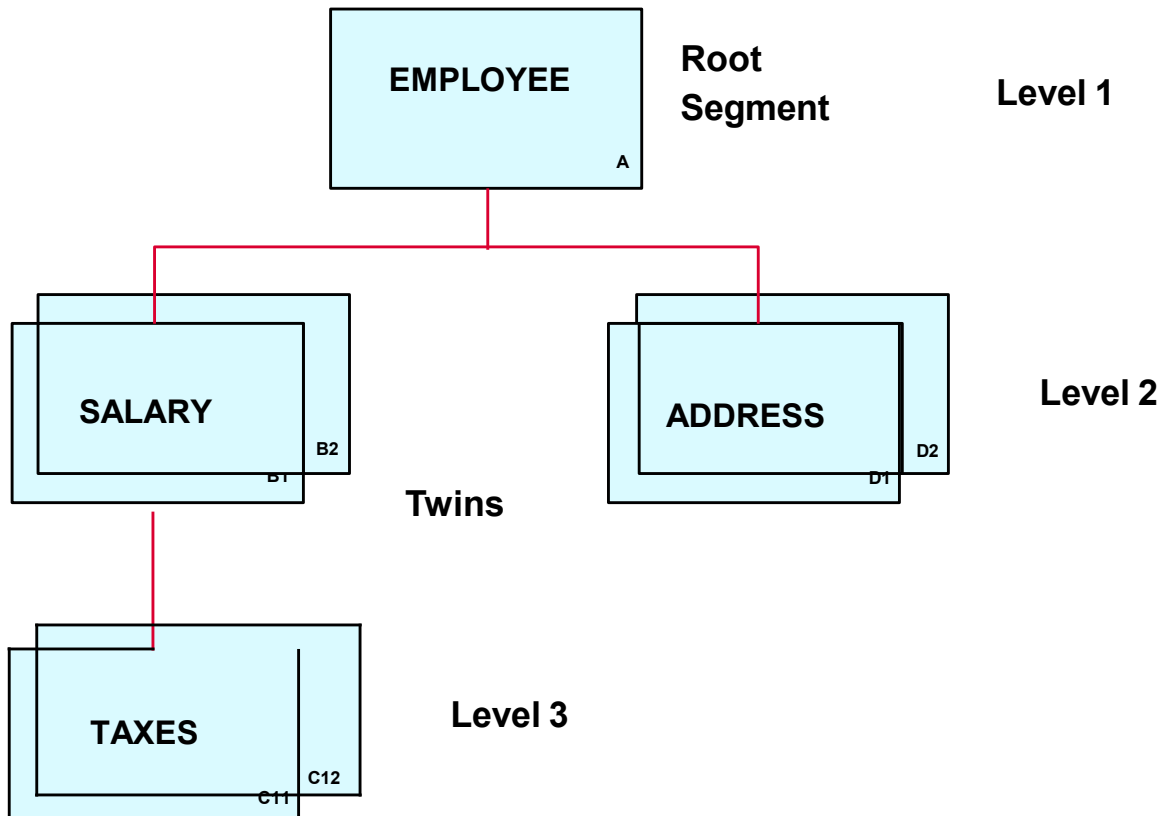
A Segment **above** a dependent segment.

CHILD:

A Segment **below** and dependent on a higher-level segment.

There is a maximum of 255 segment **types**.

DL/I Hierarchy (2 of 2)



Notes:

Twins:

Multiple occurrences of the same segment type under the same parent occurrence.

Levels:

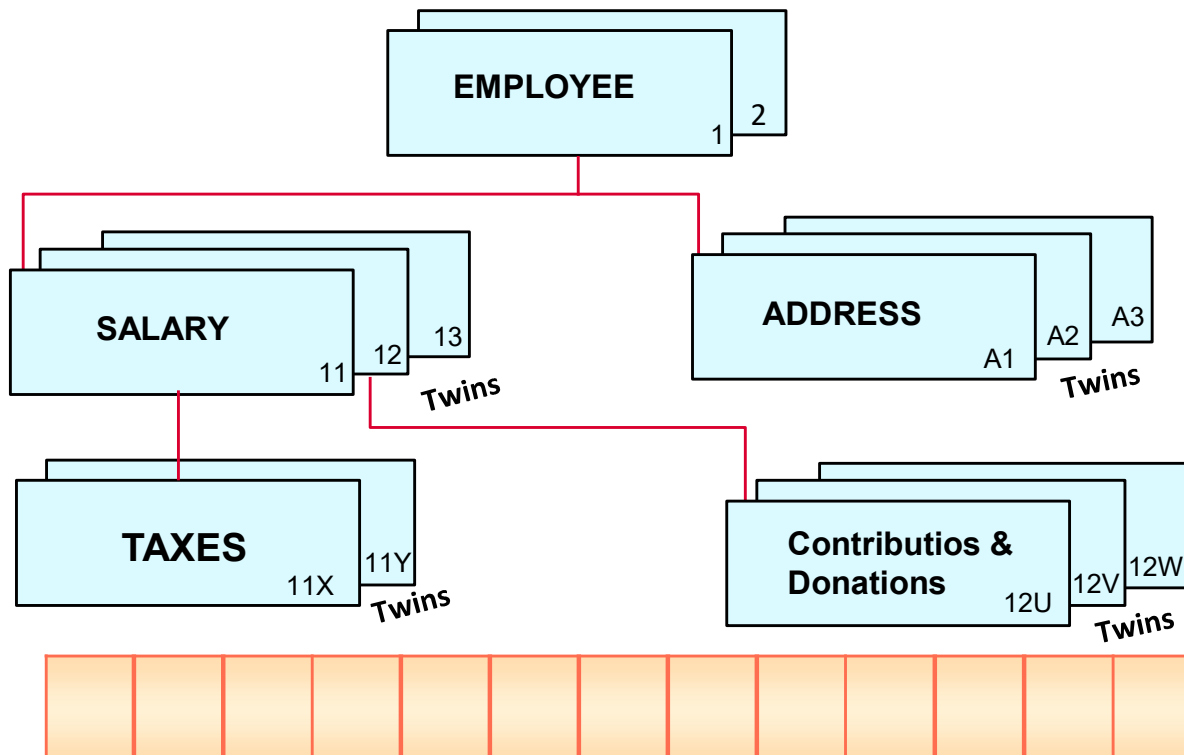
The position of segments in relation to the root and other segments. There is a maximum of 15 segment hierarchic levels.

Database Record:

A Root Segment and all of its dependents. A database consists of 1-n database records.

Hierarchical Sequence

traversal rules



Notes:

Hierarchic (Sequential) Processing Order

1. Top-to-bottom
2. Front-to-back
3. Left-to-right

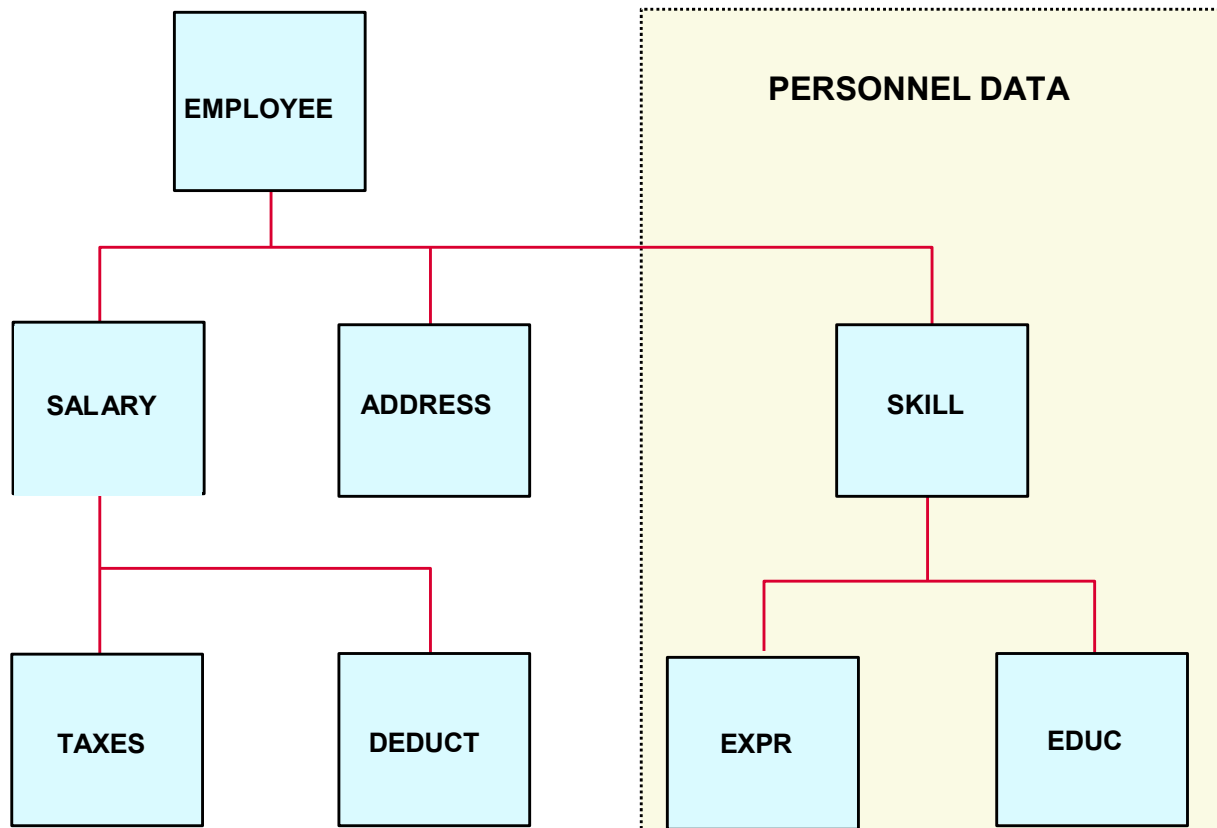
Kleine Übung:

Platzieren der Nummern in die Boxen,

in der Reihenfolge der "processing order" ... by sequential processing" (GN)

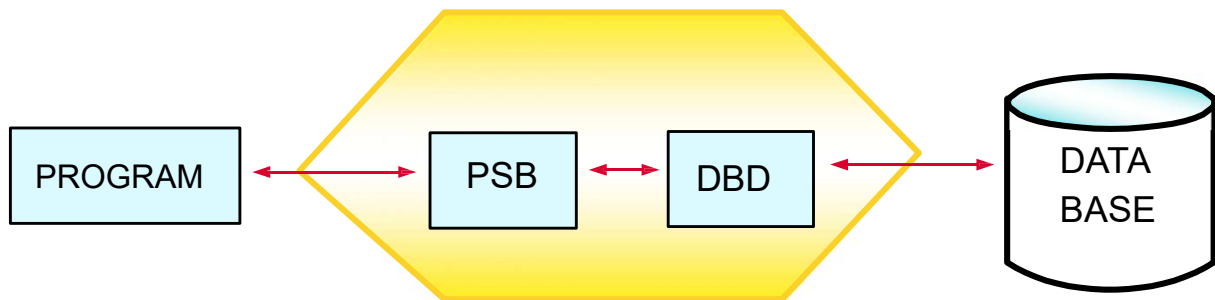
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DL/I - DBD easy to Expand



“Data Independence” –

Separate the program from the physical characteristics of the databases



- Advantages:
 - Simplifies application program development
 - Provides security, integrity, and consistency of a database
 - Facilitates changes to database

Notes:

PSB=Program Specification Block: Program view of the databases.

DBD=Database Description: Physical characteristics of the databases.

Logical View / ~~Physical View~~ Layout



Find an employee
with a specified
skill (programmer?)

Execute complex
IMS, VSAM, z/OS, and
DASD low-level code

```
PCB      TYPE=DB , DBDNAME=EMPLOYEE , PROCOPT=A , KEYLEN=45
SENSEG   NAME=EMPLOYEE , PROCOPT=G
SENSEG   NAME=SALARY , PARENT=EMPLOYEE , PROCOPT=GR
SENSEG   NAME=TAXES , PARENT=SALARY
SENSEG   NAME=DEDUCT , PARENT=SALARY
PCB      TYPE=DB , DBDNAME=PROJECT , PROCOPT=G , KEYLEN=22
SENSEG   NAME=PROJECT
.
.
PSBGEN   LANG=COBOL , PSBNAME=EMPLPROJ
END
```

Der PCB repräsentiert eine IMS DB,

Die folgenden SENSEG statements machen das Programm, was diesen PSB benutzt, damit sensitiv gegen just diese Segmnente – somit evtl. nicht gegen alle existierenden Segmente in dieser / diesen Datenbank / -en.

Es gelten auch hier die traversal rules beim Processing durch die IMS DB, allerdings eben nur gegen jene per SENSEG definierten.

Im Umkehrschluss heißt das aber auch, dass der Pfad der Hierarchie folgend eingehalten werden muss. Zu jedem Child / dependent Segment, was das Programm lesen / verändern darf, muss das Parent Segment ebenfalls per SENSEG bekannt sein.