



Unidade 6

DB2 for IBM i



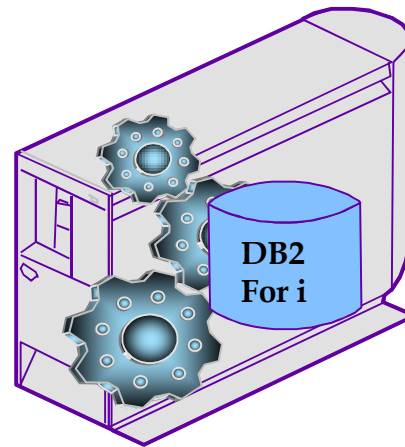
Prof. Aparecido V. de Freitas
Doutor em Engenharia da Computação pela EPUSP





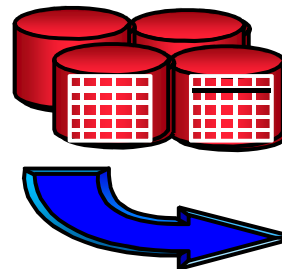
Integrated RDBMS

- Referential integrity
- Stored procedures
- Two-phase commit
- System catalog
- Triggers
- Scrollable cursors
- Query governor
- C2 security
- Open interfaces (ODBC, DAL)
- DRDA
- Multi-language support
- Online backup and restore
- Parallel data access
- Recovery Optimizer
- SQL Optimizer



- Performance
- Integration
- Interoperability
- Security
- Flexibility

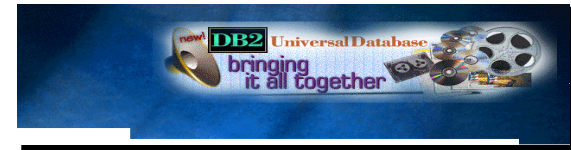
Structured Data



Unstructured Data

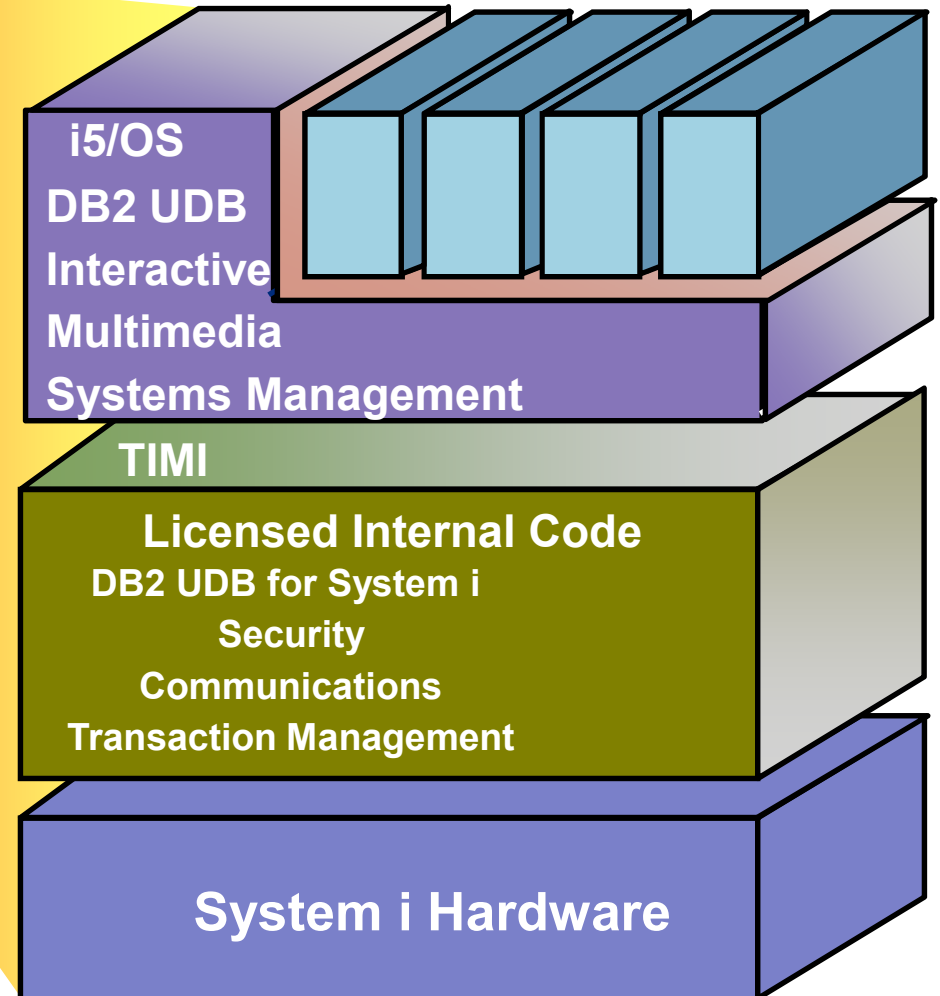


Documents, Spreadsheets,
Multimedia Objects

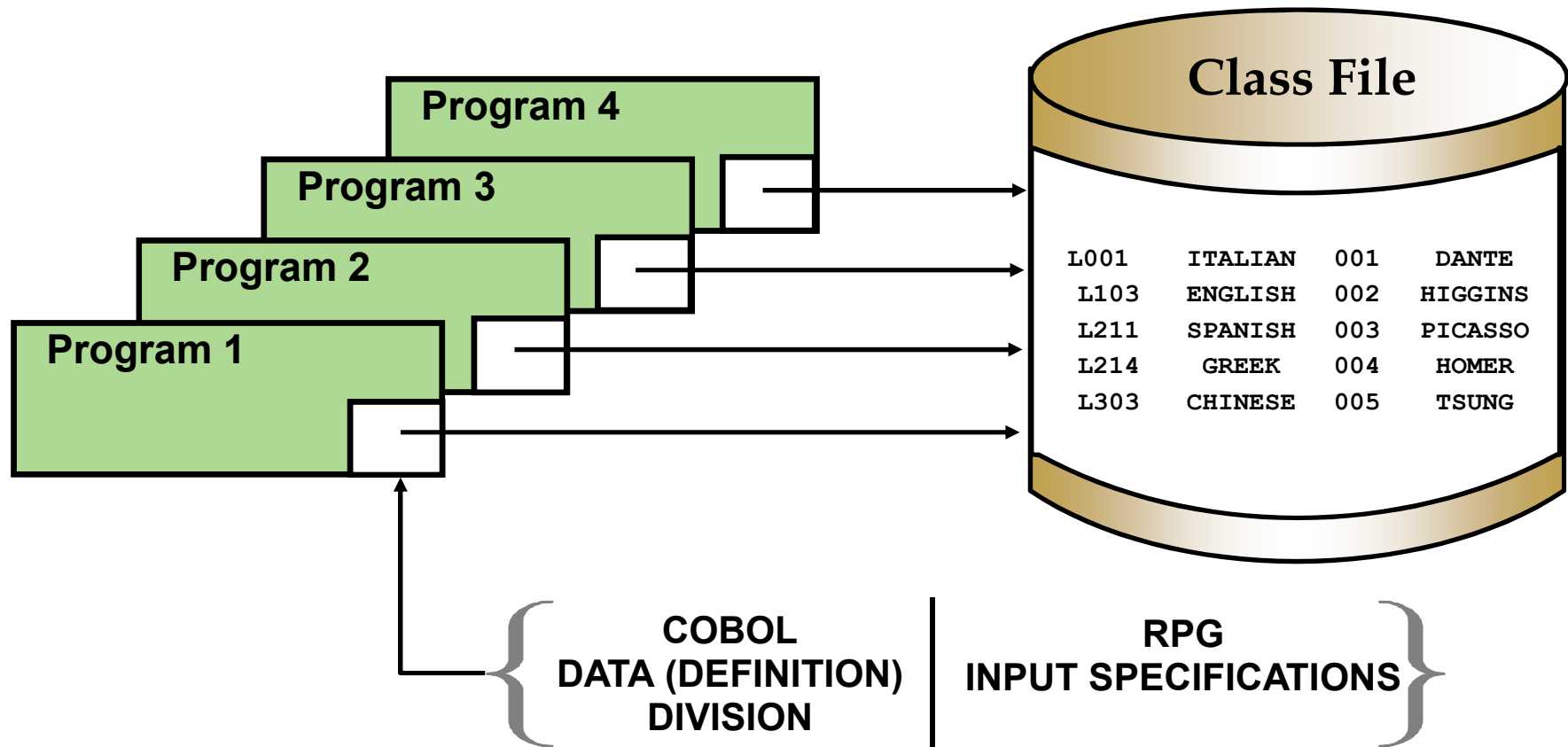




DB2 for IBM i é integrado



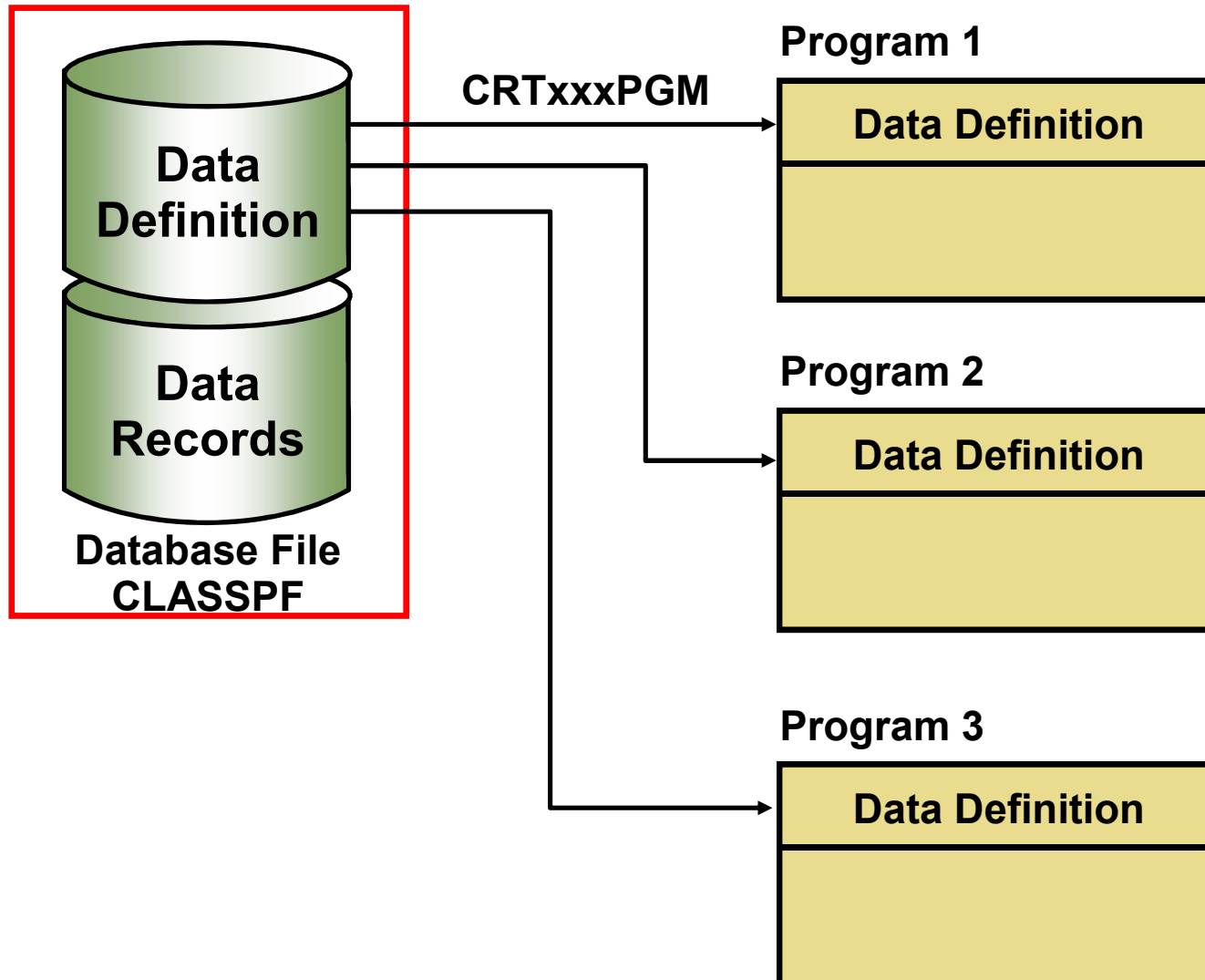
Definição tradicional de dados



Mudança no formato do arquivo requer mudança na definição dos dados em cada programa



Definição externa





Exemplo – Definição Externa

CLASSPF			
Field	Data Type	Field Length	Column Heading
CRSCODE	CHAR	4	Crs Code
CRSTITLE	CHAR	7	Course Title
INSTNO	CHAR	3	Ins No
INSTLNAME	CHAR	7	Instr Name
L001	ITALIAN	001	DANTE
L103	ENGLISH	002	HIGGINS
L211	SPANISH	003	PICASSO
L214	GREEK	004	HOMER
L303	CHINESE	005	TSUNG

Definição dos dados

Dados





O modelo Relacional

- Todos os dados são armazenados em Tabelas
- Visões lógicas dos dados de uma Tabela são criadas usando os operadores lógicos de sequência, seleção, projeção, união e join
- Qualquer alteração nos dados de uma tabela é imediatamente refletida em todas as visões lógicas
- No modelo relacional não há ponteiros interligando os registros





O modelo Relacional

CURSO		INSTRUTOR	QTD	CLASSE	
Cód.	Nome			Sala	Max
A1	Cobol	Paulo Roberto	39	10	30
B3	RPG	Jose Carlos	48	09	60
C4	Sistemas	Antonio Carlos	59	02	70
D3	Assembler	Maria Helena	30	03	47





O modelo Relacional

- TABELA = ARQUIVO
- LINHA = REGISTRO
- COLUNA = CAMPO

No sistema IBM i

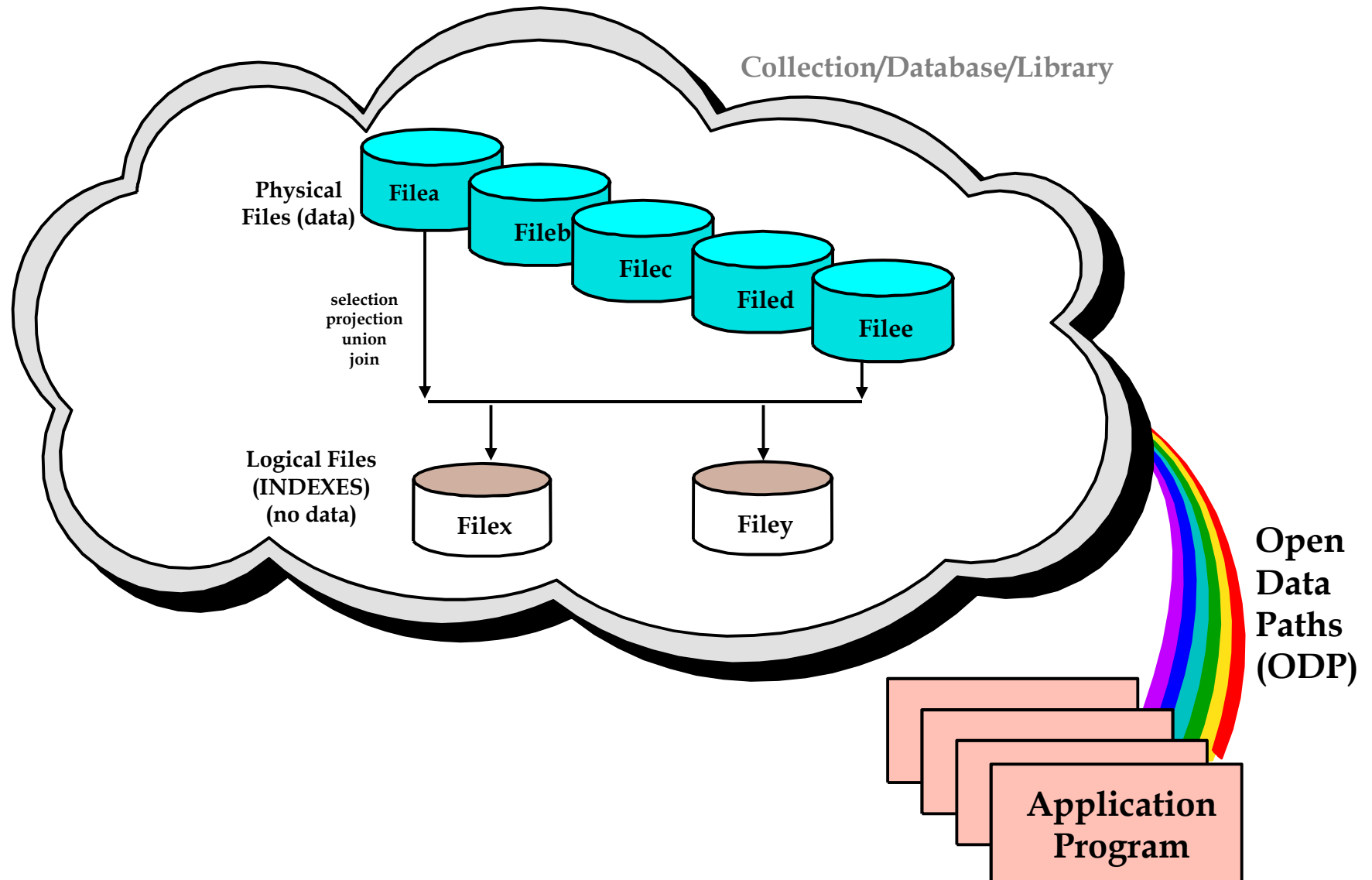
TABELA = ARQUIVO FÍSICO

VISÃO = ARQUIVO LÓGICO





Arquivos Físicos/Lógicos





Arquivo Físico

Formato

R	ALUNOS	
	MATRIC	5 0
	NOME	30 A
	ENDERECO	25 A

Access Path

CHAVE: MATRIC

Dados

REGISTROS DE DADOS





Arquivo Físico - Múltiplos Membros

Formato

R	ALUNOS	
	MATRIC	5 0
	NOME	30 A
	ENDERECO	25 A

Membros

CHAVE: MATRIC
REGISTROS DE DADOS

Escola A

CHAVE: MATRIC
REGISTROS DE DADOS

Escola B

CHAVE: MATRIC
REGISTROS DE DADOS

Escola C





Um arquivo pode ter membros

```
Display Physical File Member
File . . . . . : CUSTOMERS      Lib
Member . . . . . : SECOND       R
Control . . . . . :             Col
Find . . . . . :

*...+....1....+....2....+....3....+....4....
918374Davon   A C249 North St LondonTX752175
833245Lee     D S21B NW 135 StClay NY130410
123859Jenner  T PPO Box 79 BrotonVT050460
345485James   S A3 Alpine Way Helen GA305459
393457Peters  D A13 Myrtle Dr HectorNY148411
323472Wang    C M208 Snow PassDenverCO802260
889900Hoover  E J787 Lake Dr SydneyMN563425
423438HumphreyH W59 Archer Rd SutterCA956850
693829Thomas  A N3 Dove CircleCasperWY826099
593029WilliamsE D485 SE 2 Ave BangorTX752180
192837Lee     F L5963 Oak St ForestNY148410
583990Abraham M T392 Mill St IslandMN563429
```

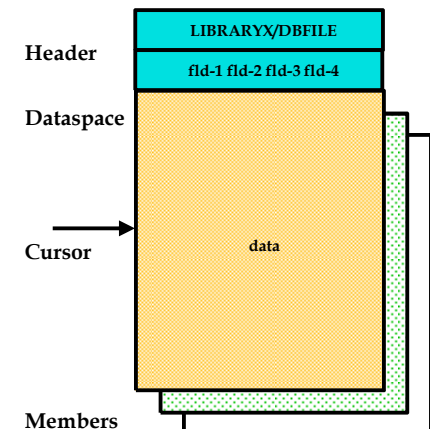
***** END OF DATA *****

```
Display Physical File Member
File . . . . . : CUSTOMERS      Library . . . . . : ERPDATA
Member . . . . . : CUSTCDT       Record . . . . . : 1
Control . . . . . :             Column . . . . . : 1
Find . . . . . :

*...+....1....+....2....+....3....+....4....+....5....+....6
938472Henning G K4859 Elm Ave DallasTX752175000300370000000000
839283Jones   B D21B NW 135 StClay NY130410400101000000000000
392859Vine    S SPO Box 79 BrotonVT050460700104390000000000
938485Johnson J A3 Alpine Way Helen GA3054599992398750003350
397267Tyron   W E13 Myrtle Dr HectorNY148411000100000000000000
389572Stevens K L208 Snow PassDenverCO8022604001005875000150
846283Alison  J S787 Lake Dr Isle MN563425000300100000000000
475938Doe     J W59 Archer Rd SutterCA9568507002025000010000
693829Thomas  A N3 Dove CircleCasperWY826099999200000000000000
593029WilliamsE D485 SE 2 Ave DallasTX752180200100250000000000
192837Lee     F L5963 Oak St HectorNY1484107002048950000050
583990Abraham M T392 Mill St Isle MN563429999305000000000000
***** END OF DATA *****
```

```
Display Physical File Member
File . . . . . : CUSTOMERS      Library . . . . . : ERPDATA
Member . . . . . : THIRD       Record . . . . . : 1
Control . . . . . :             Column . . . . . : 1
Find . . . . . :

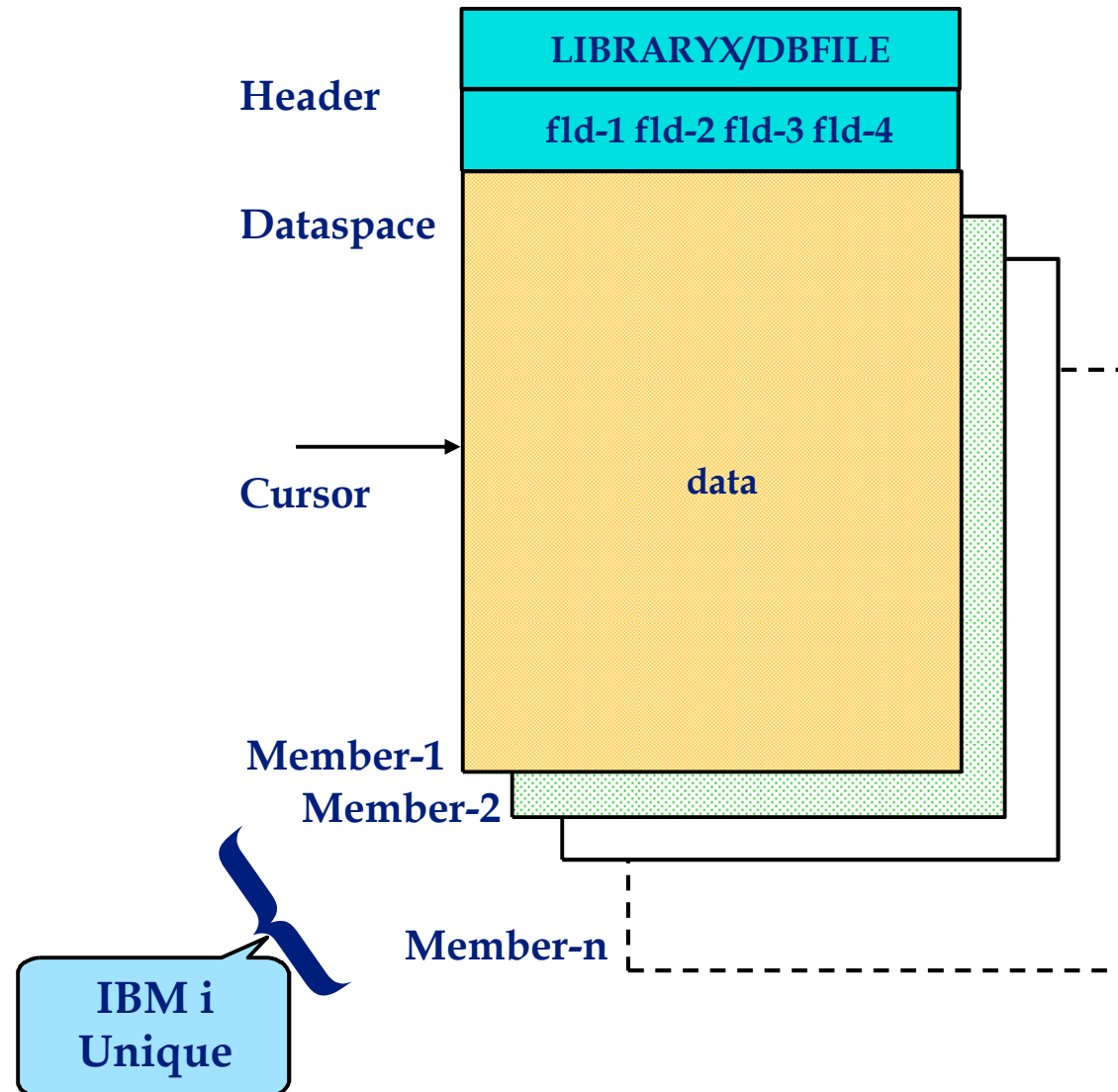
*...+....1....+....2....+....3....+....4....+....5....+....6
323472Wang    C M208 Snow PassDenverCO8022604001005875000150
889900Hoover  E J787 Lake Dr SydneyMN563425000300100000000000
423438HumphreyH W59 Archer Rd SutterCA9568507002025000010000
693829Thomas  A N3 Dove CircleCasperWY826099999200000000000000
593029WilliamsE D485 SE 2 Ave BangorTX752180200100250000000000
192837Lee     F L5963 Oak St ForestNY1484107002048950000050
583990Abraham M T392 Mill St IslandMN563429999305000000000000
***** END OF DATA *****
```





Estrutura de um arquivo físico

- File header
 - File description
 - » Qualified file library/name
 - » Owner
 - » Object authority
 - » Number of records
 - Field level description
 - » Field names
 - » Attributes
- Dataspace
 - Actual data
 - Multiple file members
 - » Not used by SQL
- Index space
 - Index
- Cursor

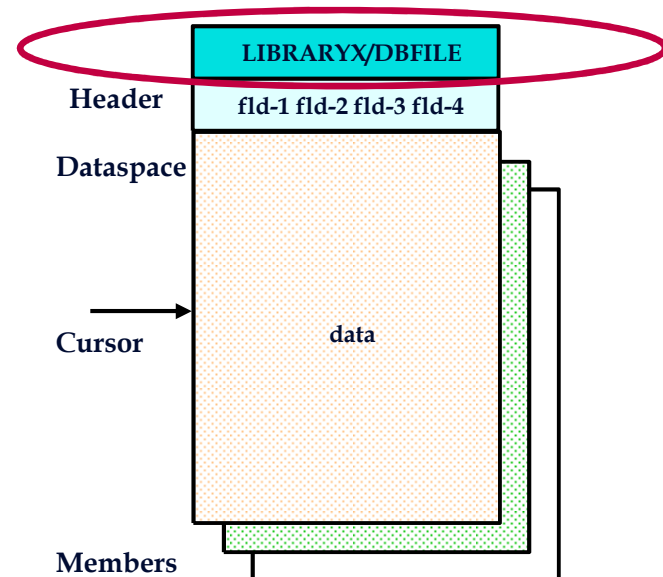




Atributos do arquivo

- File description header
 - Explicit file name
 - » Library name
 - » File name (10 characters)
 - Alternative file name (20 characters)
 - File type
 - » Data
 - » Source - program code
- Database attributes
 - File definitions
 - » Externally described
 - Column (or field) level specifications
 - Field information stored with file
 - » Program described
 - Row (or Record) level description
 - Field information within program(s)
 - File creation date
 - File size limits
 - » Record length
 - » Initial records
 - » Size of increment
 - » Number of increments

Comando DSPFD

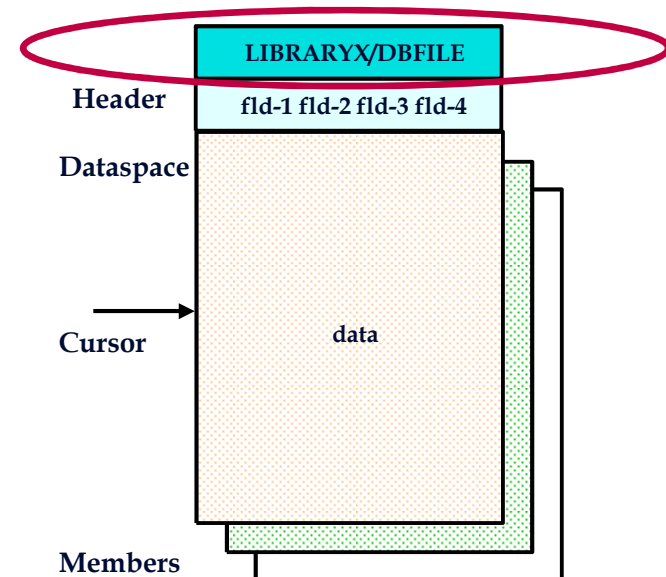




Atributos do arquivo

- Database attributes
 - Number of members
 - » Maximum
 - » Current
- Reuse deleted records
- Force write to disk
- File activity
 - Number
 - » Opens/closes
 - » Update/delete operations
 - Date of last
 - » Change
 - » Save
 - » Restore
- File member information
 - Name/creation date
 - Last update (date/time)
 - Number or records

Comando DSPFD

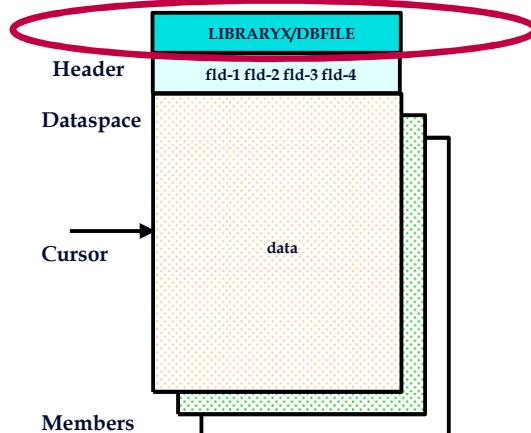




Formato do Registro

- Columns (field) information

- Field name
- Data type
 - Character
 - Numeric
 - Binary
- Length
- Buffer positions
- Usage
 - Input/output
- Column heading



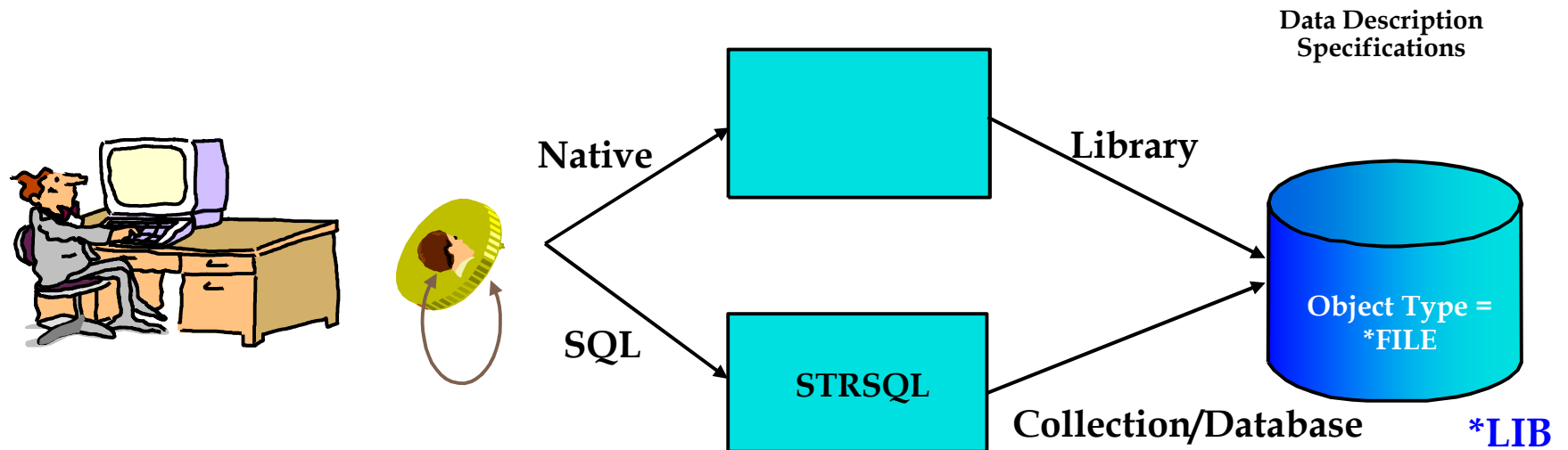
Comando DSPFFD

ERPDATA.CUSTOMERS - Teamlpr3.rchland.ibm.com(S105w11m)

Table	Columns	Key Constraints	Foreign Key Constraints	Check Constraints	Materialized Query	Partitioning
Column Name	Short Name	Data Type	Length	Nullable	Default Value	Text
CUSNUM	CUSNUM	NUMERIC	6,0	No	0	Customer number field
LSTNAM	LSTNAM	CHARACTER	8	No	''	Last name field
INIT	INIT	CHARACTER	3	No	''	First and middle initial field
STREET	STREET	CHARACTER	13	No	''	Street address field
CITY	CITY	CHARACTER	6	No	''	City field
STATE	STATE	CHARACTER	2	No	''	State abbreviation field
ZIPCOD	ZIPCOD	NUMERIC	5,0	No	0	Zip code field
CDTLMT	CDTLMT	NUMERIC	4,0	No	0	Credit limit field
CHGCOD	CHGCOD	NUMERIC	1,0	No	0	Charge code field
BALDUE	BALDUE	NUMERIC	6,2	No	0	Balance due field
CDTDUE	CDTDUE	NUMERIC	6,2	No	0	Credit due field

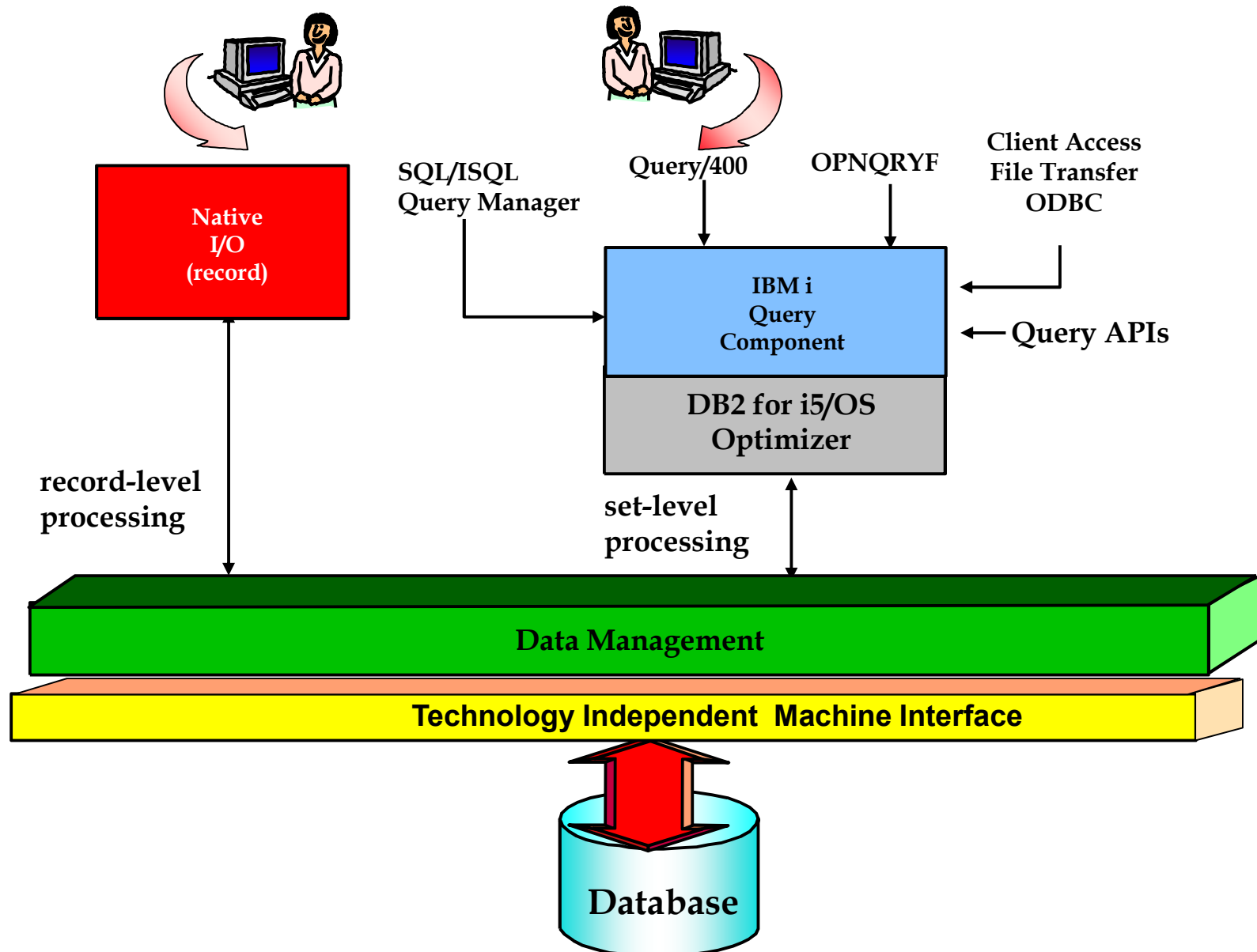
Show SQL OK Cancel Help ?

Duas interfaces





Acessando o database





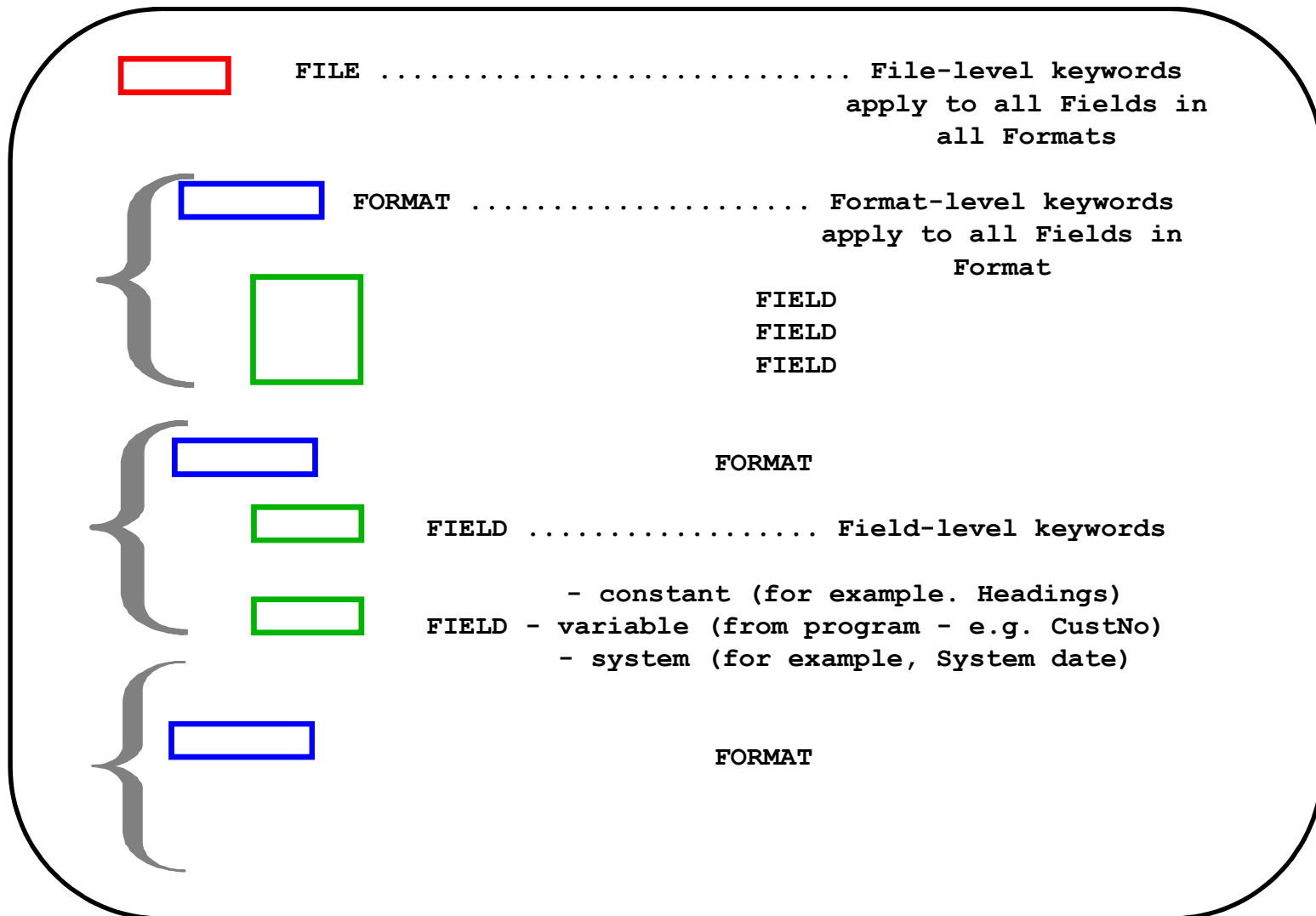
O que é DDS ?

- **Data Definition Specifications**
- **Usada para:**
 - Definir arquivos de database, registros e campos
 - Definir layouts de relatórios
 - Definir arquivos de telas (display)
- **Linguagem nativa de definição de dados do IBM i**





Níveis de definição DDS





DDS para relatório - Exemplo



DDS para relatório - Exemplo

Annotations for the DDS example:

- Record format name: **R UNADD_FMT**
- Reference DB file/field definition: **REF(VENDOR_PF)**
- Reference: **UNDNBR**
- Field name: **UNDNAME**
- This field is defined in this PRTF: **UNDADDR**
- Space after: **2 'VENDOR: '**
- Literal: **14EDTCDE(2)**

DDS Code Snippet:

```
.....AAN01N02N03.....
000001 A* File Level
000002 A
000003 A* Record Level
000004 A R UNADD_FMT
000005 A
000006 A
000007 A
000008 A* Field Level
000009 A
000010 A
000011 A
000012 A
000013 A
000014 A
000015 A
000016 A UNDNBR R
000017 A UNDNBR R
000018 A UNDNBR R
```

Functions:

```
SKIPB(001)
TEXT('VENDOR ADDRESS FORMAT')
FONT(222)

55'VENDOR ADDRESS' UNDERLINE
100DATE EDTCDE(Y)
110TIME
125PAGNBR EDTCDE(J)
SPACEA(1)
2'VENDOR: '
14EDTCDE(2)
30SPACEA(1)
30SPACEA(1)
```


DDS para tela - Exemplo

```

CODE - <AECAUX>AS06VILIB/QDDSSRC(ITEMINQ)
File Edit View Actions Options Windows Help Extras
Row 1      Column 1      Replace
.....AAN01N02N03.....Functions.....Comments..
000100      A      REF(*LIBL/ITEM_PF)
000200      A      CA03(03 'Exit')
000201      A      INDARA
000300      A      **
000400      A      R PROMPT
000500      A      PGHNAH      10A 0 3 7
000600      A      3 35'Item Inquiry'
000700      A      COLOR(WHT)
000800      A      3 64DATE
000900      A      EDTCDE(Y)
001000      A      8 20'Item Number . . . . .:'
001100      A      ITHNBR      R      D 1 8 45
001200      A      40      ERRMSG('Item not found on file - pl-
001300      A      ease correct' 40)
001400      A      20 7'Press I
001500      A      21 7'F3=Exi
001600      A      COLOR(B
001700      A      **
IBM Live Parsing Editor
  
```

1

2

4

5

3

```

CODE - <AECAUX>AS06VILIB/QDDSSRC(ITEMINQ)
File Edit View Actions Options Windows Help Extras
Row 21     Column 4      Replace
.....AAN01N02N03..Name.....RLen...TpBlinPosFunctions.....Cor
001800      A      R DETAIL
001900      A      CA12(12 'Cancel')
002000      A      PGHNAH      10A 0 3 7
002100      A      3 35'Item Inquiry'
002200      A      COLOR(WHT)
002300      A      3 64DATE
002400      A      EDTCDE(Y)
002500      A      8 20'Item Number . . . . .:'
002600      A      ITHNBR      R      0 8 45
002700      A      9 20'Description . . . . .:'
002800      A      ITHDESCR      R      0 9 45
002900      A      11 20'Quantity on hand . . . . .:'
003000      A      ITHQTYOH      R      0 11 45EDTCDE(2)
003100      A      30      DSPATR(HI)
003200      A      12 20'Quantity on order . . . . .:'
003300      A      ITHQTYOO      R      0 12 45EDTCDE(2)
003400      A      30      DSPATR(HI)
003500      A      14 20'Supplier Number . . . . .:'
003600      A      UNDNBR      R      0 14 45
003700      A      15 20'Supplier Catalogue No . . .:'
003800      A      ITHVNDCAT#R      0 15 45
003900      A      30
004000      A      17 7'** NOTE ** The total quantity avai-
004100      A      lable is low (<20) - reorder'
004200      A      DSPATR(HI)
004300      A      21 7'F3=Exit F12=Cancel'
004400      A      COLOR(BLU)
  
```




Field Reference File

Formato

R	ALUNOS	
	MATRIC	5 0
	NOME	30 A
	ENDERECO	25 A

~~**Access Path**~~

~~CHAVE. MATRIC~~

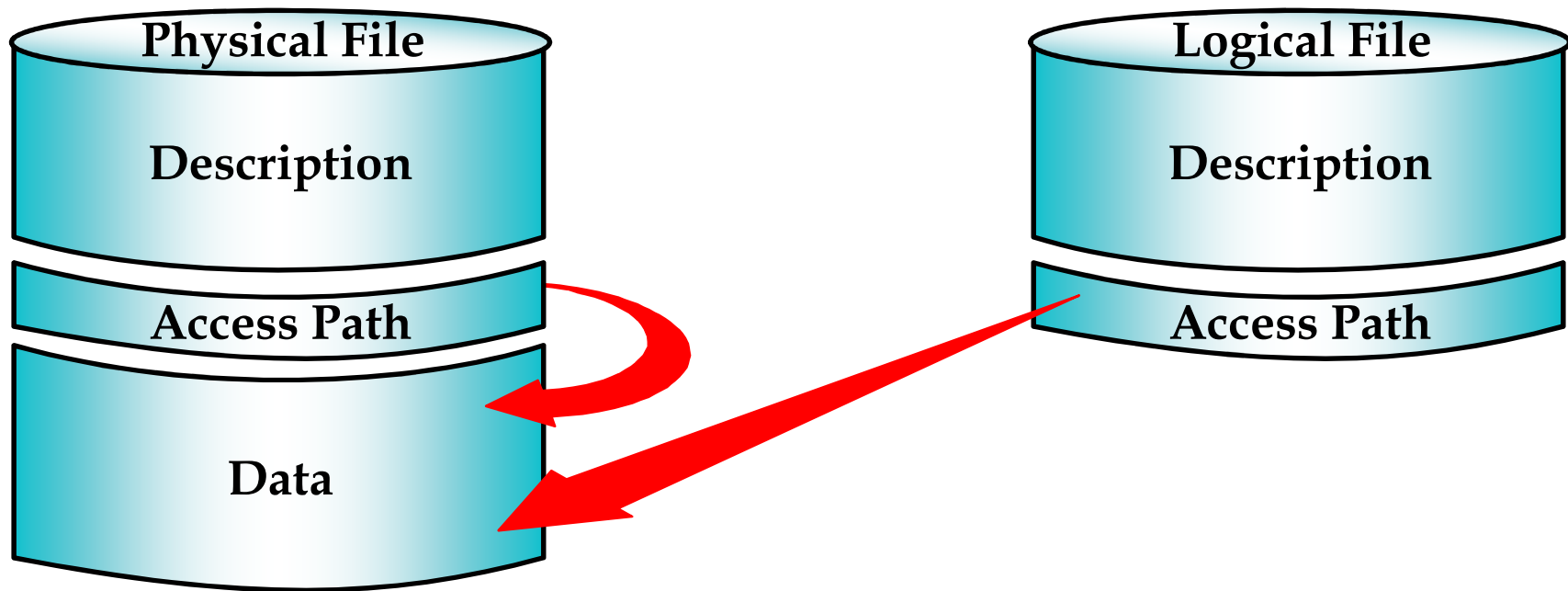
~~**Dados**~~

~~REGISTROS DE DADOS~~





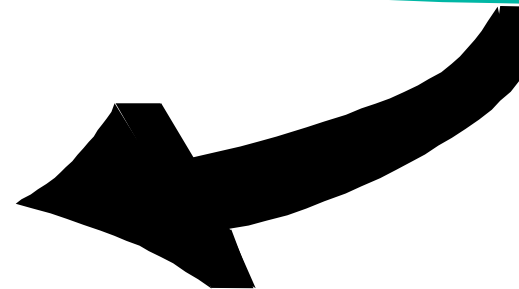
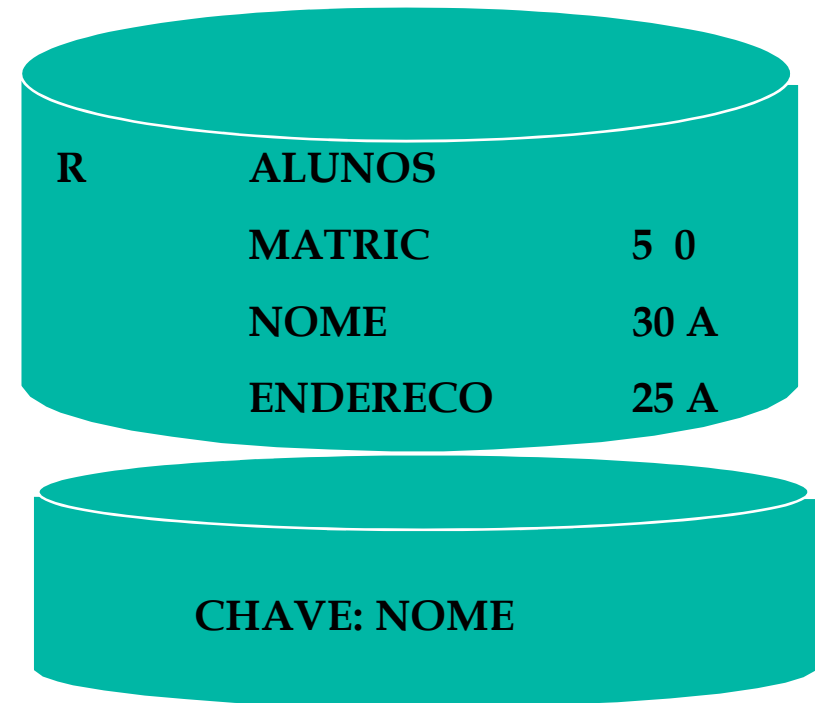
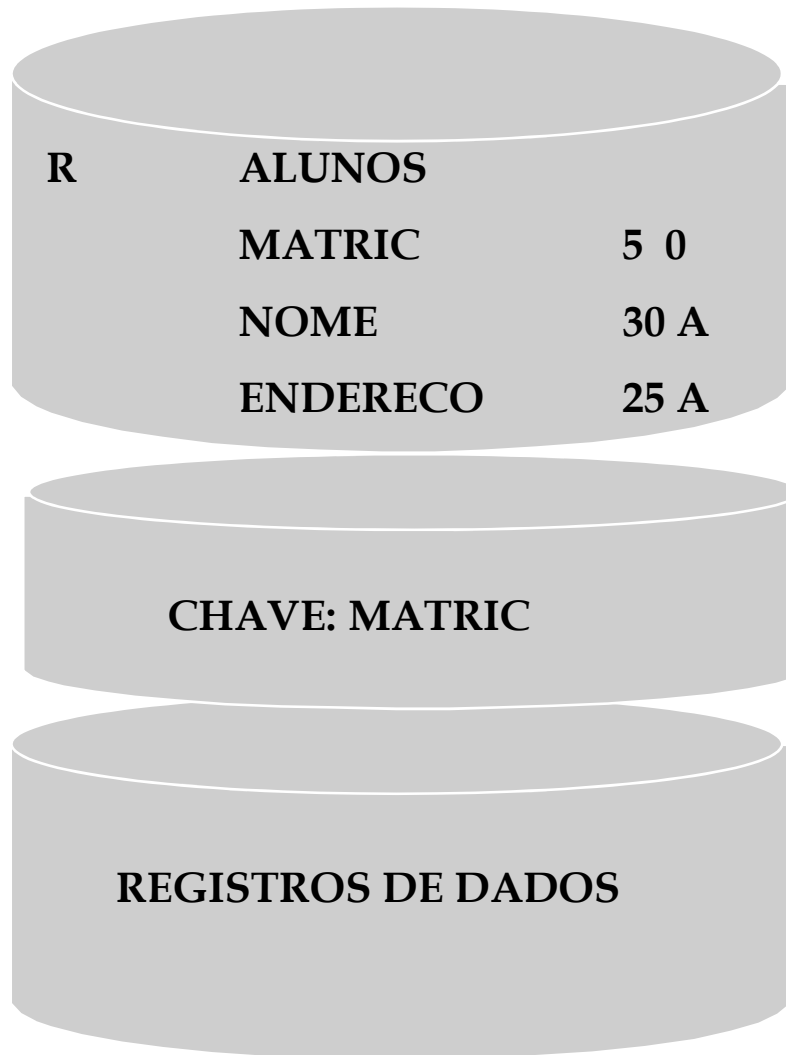
Arquivo Lógico



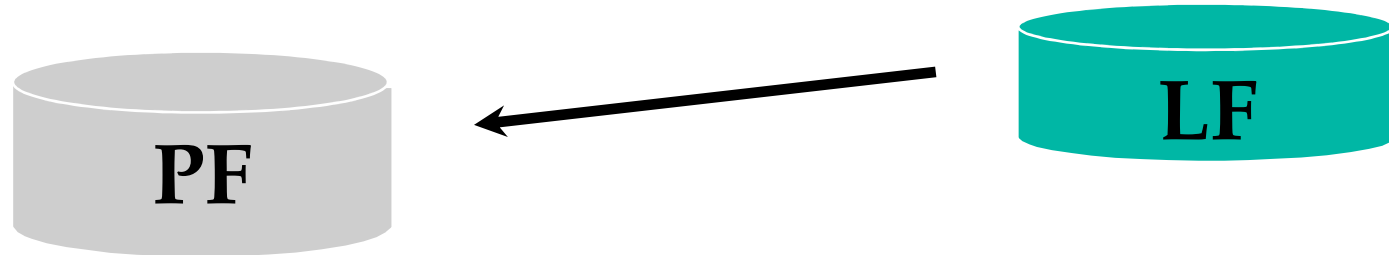
- Object = *FILE File
- Type: Logical
- SQL Views e Indexes são também arquivos lógicos



Arquivos Lógicos



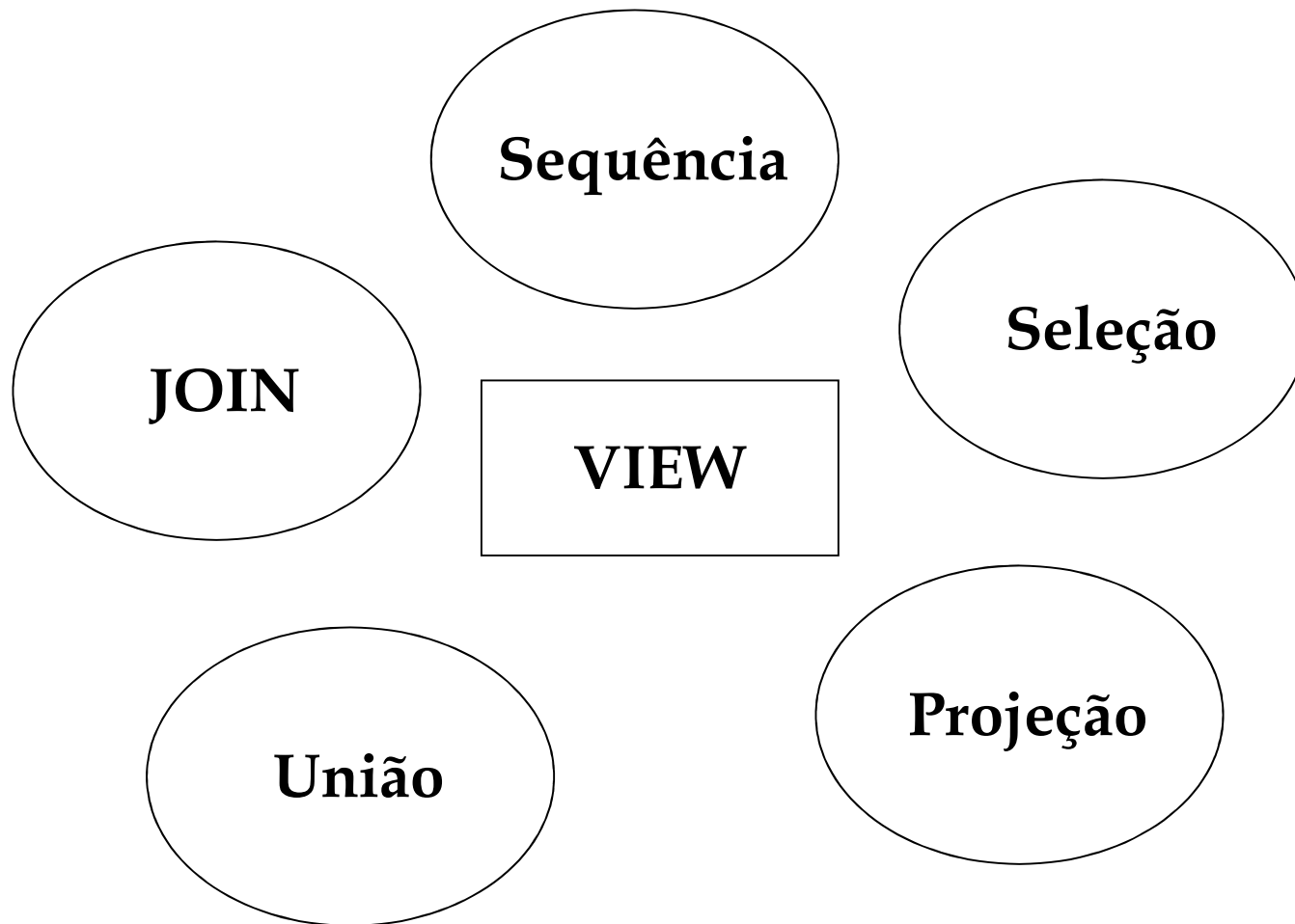
Arquivos Lógicos



- Critério de Seleção de campos/registros
- Um ou mais arquivos físicos
- Não contém dados
- Não é necessário programação (somente DDS)
- Ordenação através de campos chaves



Arquivos Lógicos





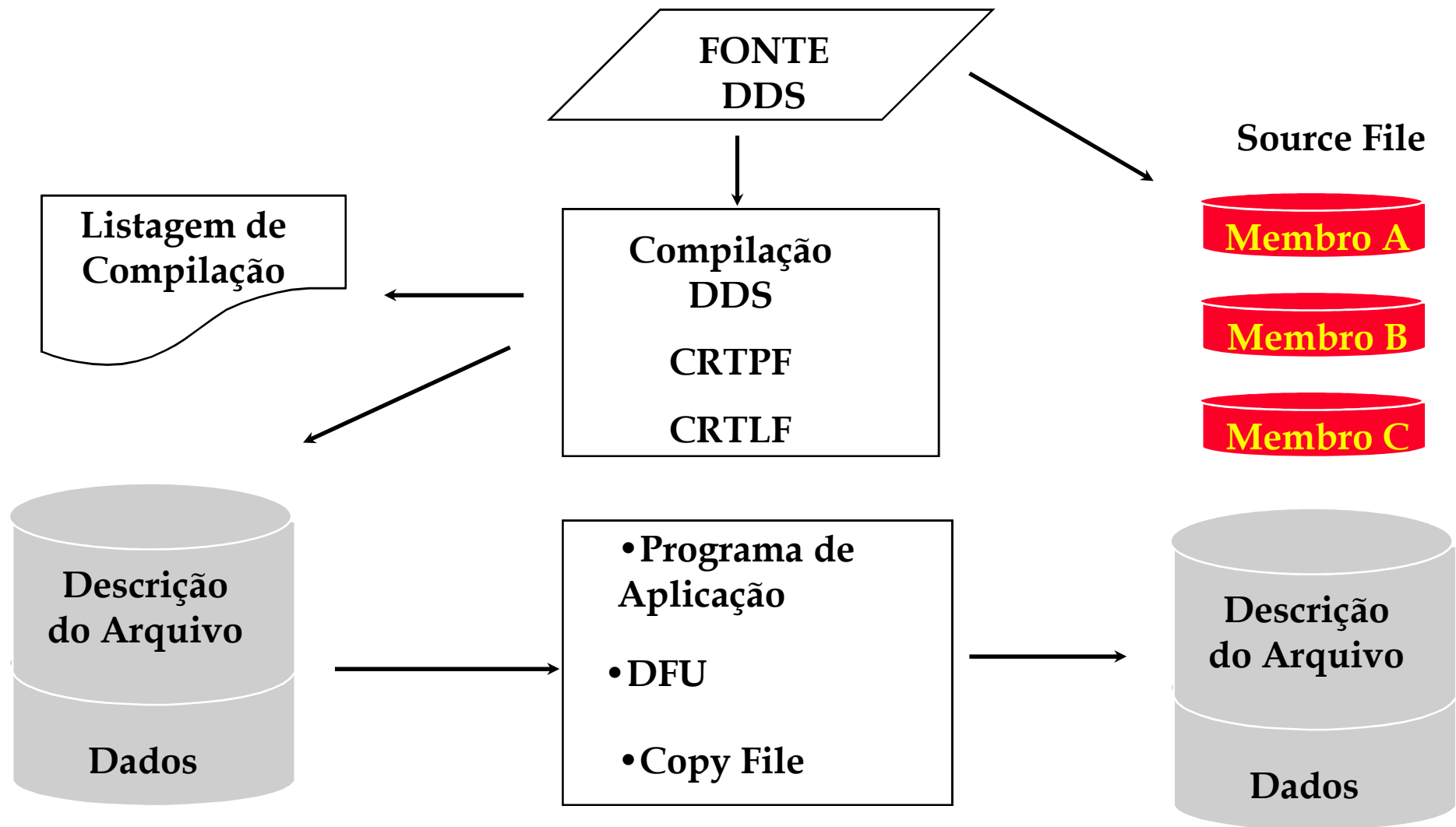
Mais Terminologia

SQL Term	Native IBM i Term
TABLE	FILE
ROW	RECORD
COLUMN	FIELD
VIEW	LOGICAL FILE
INDEX	KEYED LOGICAL FILE
COLLECTION	LIBRARY





Criação de Arquivos





Exemplo de DDS

Form Type 6		Name Type 17	Name 19	Ref 29	Leng 30	Data Type 35	DEC 36	USE 38	Locn		Function 45
									Lin 39	Pos 42	
A		R	REGEMP								
A			EMP#		3		0				COLHDG('EMP ' 'COD')
A											RANGE(001 888)
A			NOME		15						COLHDG('NOME')
A											CHECK(ME)
A			SOBRENOME		10						CHECK(ME)
A											COLHDG('SOBREN')
A			INICIAL		1						COLHDG('INICIAL')
A			IDADE		2		0				COLHDG('IDADE')
A			SALARIO		6		2				COLHDG('SALARIO')
A											EDTCDE(J)
A			CIDADE		12						COLHDG('CITY')
A		K	EMP#								





Copy File

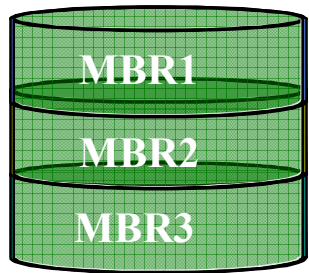
- Permite a Cópia/Duplicação de Arquivos
- Permite Cópia com Seleção de Registros
- Reformatação de Campos
- Suporte a arquivos de dados e de fontes
- Mudança de dispositivos
- Impressão de Registros



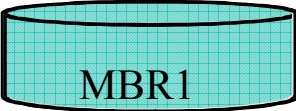

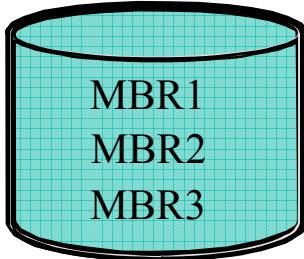



Copy File

Parâmetros FROMMBR e TOMBR



FROM FILE

FROMMBR	*FIRST	MBR3	*ALL	*ALL
TOMBR	*FIRST	*FIRST	*FIRST	FROMMBR
TOFILE				



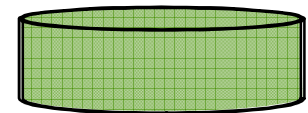


Copy File - Copiando Membros

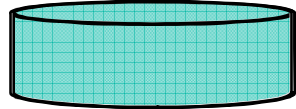
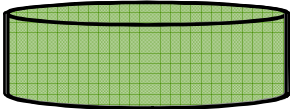
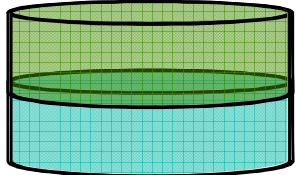
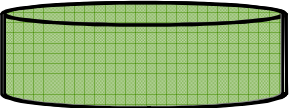
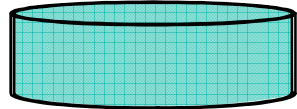
- CPYF FROMFILE(ITAU1) TOFILE(ITAU2)
FROMMBR(*ALL) TOMBR(FROMMBR)
- CPYF FROMFILE(ITAU1) TOFILE(ITAU2)
FROMMBR(XY*) TOMBR(FROMMBR)
- CPYF FROMFILE(ITAU1) TOFILE(ITAU2)
FROMMBR(XY1) TOMBR(ABC)



Copy File - Parâmetros CRTFILE e MBROPT



ARQUIVO DE
ENTRADA
(FROMFILE)

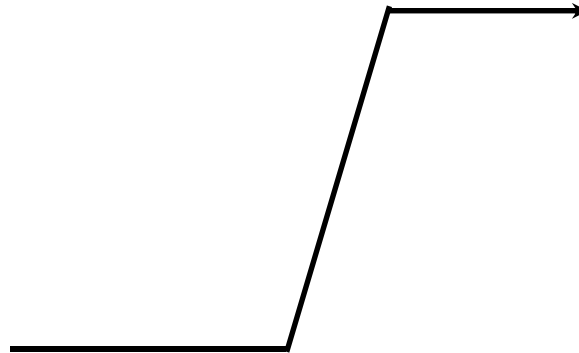
ARQUIVO DE SAIDA (TOFILE)	
ANTES	DEPOIS
NONE	 CRTFILE (*YES)
	 MBROPT(*ADD)
	 MBROPT(*REPLACE)



Copy File

Parâmetros FROMRCD e TORCD

102	
106	
107	
103	
108	
105	



103	
108	
105	

FROMRCD(4)

TORCD(6)

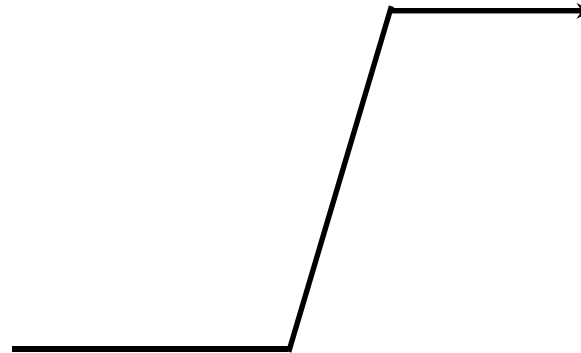




Copy File

Parâmetros FROMKEY e TOKEY

102	
106	
107	
103	
108	
105	



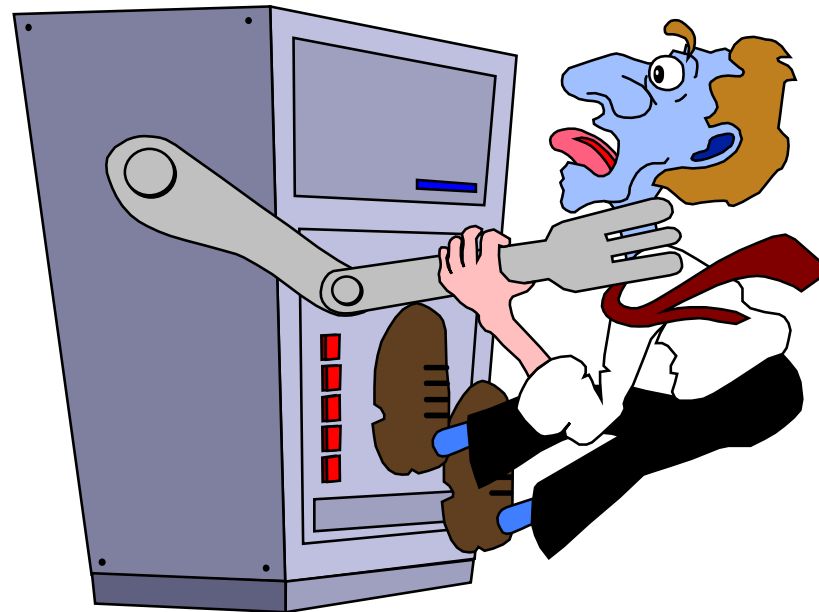
103	
105	
106	

FROMKEY(103)
TOKEY(106)





Laboratórios





Data File Utility (DFU)

Prof. Aparecido V. de Freitas
Doutor em Engenharia da Computação pela EPUSP





DFU

- Gera Programa Interativo
- Adição/Inclusão/Alteração de dados
- Consulta em arquivos de bancos de dados
- Obtenção rápida de resultados
- Não utiliza Linguagem de Programação





DFU

MAIN

AS/400 Main Menu

SYSTEM: QUALIT

Select one of the following:

1. User Tasks
2. Office Tasks
3. General system tasks
4. Files, libraries, and folders
5. Programming
6. Communiations
7. Define or hange the system
8. Problem handling
9. Display a menu
10. User support and education
11. PC Support Tasks

90. Sign Off

Selection or command

STRDFU

==>

F3=Exit F4=Prompt F9=Retrieve F12=Cancel F13=User support
F23= Set initial menu





DFU

AS/400 Data File Utility (DFU)

Select one of the following:

1. Run a DFU program
2. Create a DFU program
3. Change a DFU program.
4. Delete a DFY program
5. Update adata using temporaty program

Selection or command

===> _____

F3=Exit F4=Prompt F9=Retrieve F12=Cancel





Considerações

DFU x Programação

- Computação em campos selecionados
- Acesso a múltiplos arquivos
- Relacionamento entre campos
- Necessidade de complexos formatos de tela





Query/400





Query/400

- Utilitário para Suporte a decisão
- Permite construção de relatórios a partir de tabelas e visões
- De 1 a 32 arquivos de bancos de dados
- Gera Programas permanentes ou temporários
- Produz Relatórios para:
 - Impressão
 - Visualização na Tela
 - Gravação em arquivos





Query/400

- Ferramenta de Produtividade
- Não utiliza Linguagem de Programação
- Ajuda interativa na montagem da Query
- Pode ser utilizada por Usuários Finais
- Permite a construção de todas as operações relacionais





Query/400

MAIN

AS/400 Main Menu

SYSTEM QUALIT

Select one of the following:

1. User Tasks
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8. Problem handling
9. Display a menu
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11. PC Support Tasks

90. SlgnOff

Selection or command

STRQRY

==>

F3=Exit F4=Prompt F9=Retrieve F12=Cancel F13=User support

F23= Set initial menu





Query/400

Query

Select one of the following:

Query/400

1. Work with queries
2. Run an existing query
3. Delete a query

Query management

10. Work with query management forms
11. Work with query management queries
12. Start a query
13. Analyze a Query/400 definition
14. Start a query allowing Query/400 definitions

Selection or command

====> _____

F3=Exit F4=Prompt F9=Retrieve F12=Cancel F13=User support
F16=AS/400 Main menu

Query Utilities





SQL/400





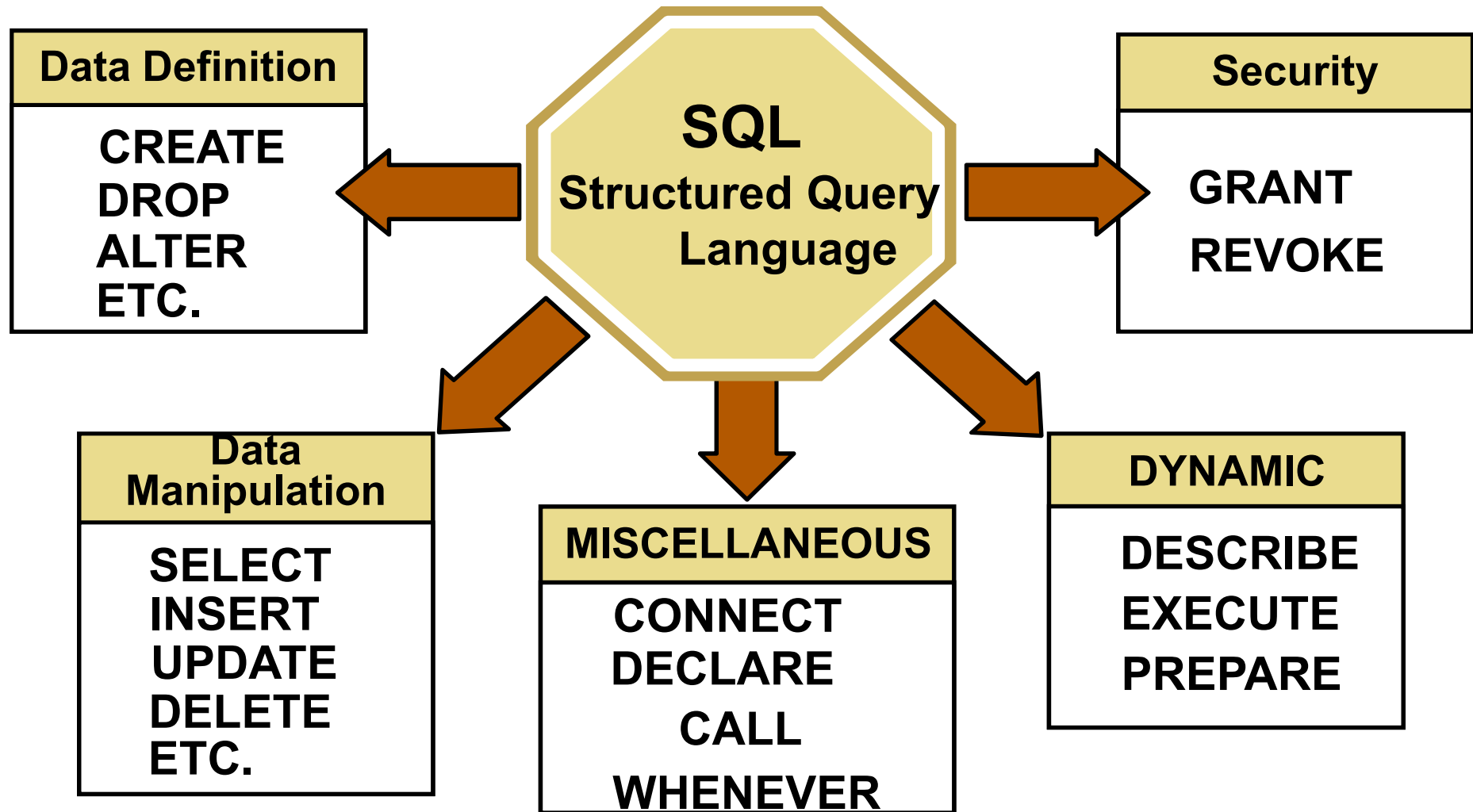
SQL/400



- Execução interativa dos comandos SQL
- Ferramenta de fácil uso por equipes de desenvolvimento e DBA' s
- Criação de Tabelas e Visões (Create)
- Criação de queries (Select)
- Simulação de instruções SQL codificadas nas aplicações
- Suporte às teclas F4 (Prompt) F1 (Help) e F9 (Retrieve)



Tipos de Comandos SQL





5250 Interactive SQL Interface

- **Componente do SQL Development Kit**
- **Execução Interativa e IMMEDIATE de Comandos SQL**
 - SQL entrado a partir de 5250 interactive command interface
 - Statements preparados e executados dinamicamente
 - Resultados exibidos ao usuário
- **Invocado por meio do comando STRSQL**
 - Similar ao comando QCMD
 - Prompting (F4) e help
 - Pode-se salvar statements em um arquivo de fontes
- **Também invocado por meio do comando STRQM**
 - Interface semelhante ao Query/400





SQL/400

MAIN

AS/400 Main Menu

SYSTEM QUALIT

Select one of the following:

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5. Programming
6. Communications
7. Define or change the system
8. Problem handling
9. Display a menu
10. User support and education
11. PC Support Tasks

90. Sign Off

Selection or command

STRSQL

==>

F3=Exit F4=Prompt F9=Retrieve F12=Cancel F13=User support
F23= Set initial menu





Exemplo Query SQL por meio de STRSQL

Session A - [24 x 80]

File Edit View Communication Actions Window Help

PrintScreen Copy Paste Send Recv Display Color Map Record Play Quit Clipboard Support Index

Display Data

Position to line Data width : 27

.....+.....1.....+.....2.....+..

Shift to column

Crs	Course	Ins	Instr
Code	Title	No	Name
L001	ITALIAN	001	DANTE
L103	ENGLISH	002	HIGGINS
L211	SPANISH	003	PICASSO
L214	GREEK	004	HOMER
L303	CHINESE	005	TSUNG

***** End of data *****

F3=Exit F12=Cancel F19=Left F20=Right F21=Split Bottom

MA a 03/032

Connected to remote server/host 9.243.28.50 using port 23

Result Set





Linha de Comandos SQL/400

Enter SQL Statements

Type SQL statement, press Enter.

====>

**CREATE
TABLE + F4**

Selection or command

====>

F3=Exit F4=Prompt F6=Insert line F9=Retrieve F18=Copy line
F12=Cancel F13=Services F24=More keys



Criando uma Query

Enter SQL Statements

Type SQL statement, press Enter.

==>

SELECT + F4

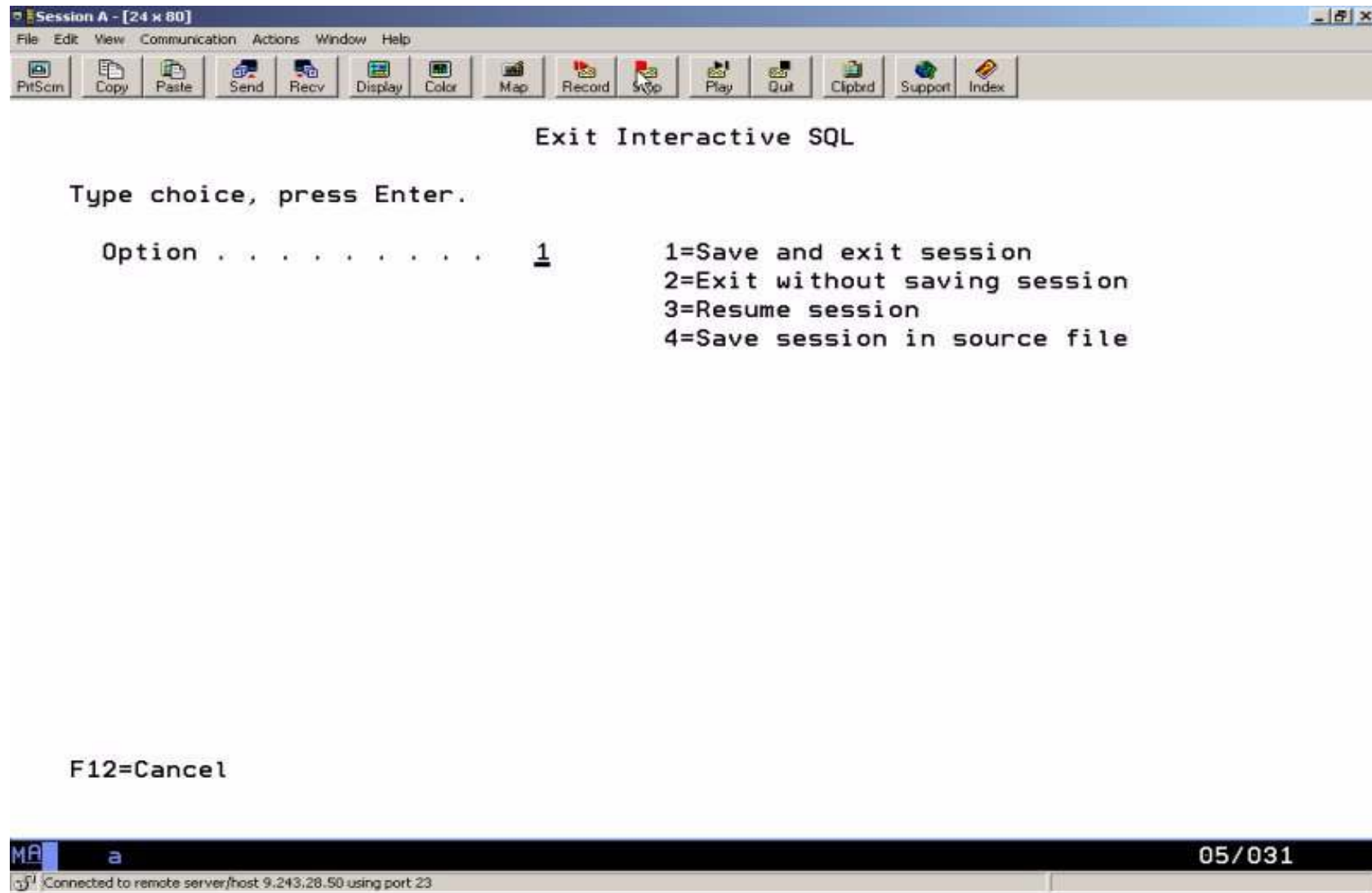
Selection or command

==>

F3=Exit F4=Prompt F6=Insert line F9=Retrieve F18=Copy line
F12=Cancel F13=Services F24=More keys



Fechando uma sessão SQL interativa





Membro fonte SQL

```
Session A - [24 x 80]
File Edit View Communication Actions Window Help
[Icons: Print, Copy, Paste, Send, Recv, Display, Color, Map, Record, Stop, Play, Quit, Clipboard, Support, Index]

Columns . . . : 1 71 Browse OL38V3COL/QSQLSRC
SEU==> REFTABLE
FMT ** ...+... 1 ...+... 2 ...+... 3 ...+... 4 ...+... 5 ...+... 6 ...+... 7
0009.00
0010.00 - drop table OL38V3COL.CL_SCHED;
0011.00 drop table OL38V3COL.DEPARTMENT;
0012.00 drop table OL38V3COL.EMP_ACT;
0013.00 drop table OL38V3COL.EMPLOYEE;
0014.00
0015.00 /*****
0016.00 /* Create the table DEPARTMENT. */
0017.00 /*****
0018.00
0019.00 create table OL38V3COL.department
0020.00         (deptno char(3) not null with default,
0021.00          deptname varchar(29) not null with default,
0022.00          mgrno char(6) not null with default,
0023.00          admrdept char(3) not null with default);
0024.00
0025.00 /*****

F3=Exit   F5=Refresh   F9=Retrieve   F10=Cursor   F11=Toggle   F12=Cancel
F16=Repeat find       F24=More keys

MA a 04/009
Connected to remote server/host 9.243.28.50 using port 23
```





Exemplos de Comandos SQL

- **INSERT, CREATE, UPDATE - Rows in a table**

```
insert into OL38V3COL.EMP_ACT values(  
'000010', 'AD3100', 10, 0.50, '1982-01-01', '1982-07-01');
```

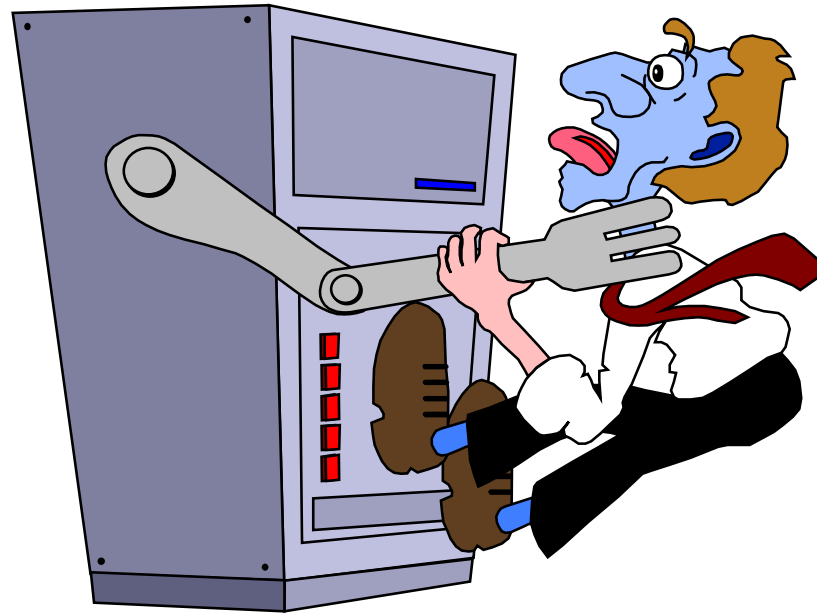
- **DROP - Schema, table, view**

```
drop table OL38V3COL.DEPARTMENT;
```

- **ALTER - Add, change, or delete a column definition**

```
alter table equipment  
alter column equip-desc  
set data type varchar(60)
```





Laboratórios

