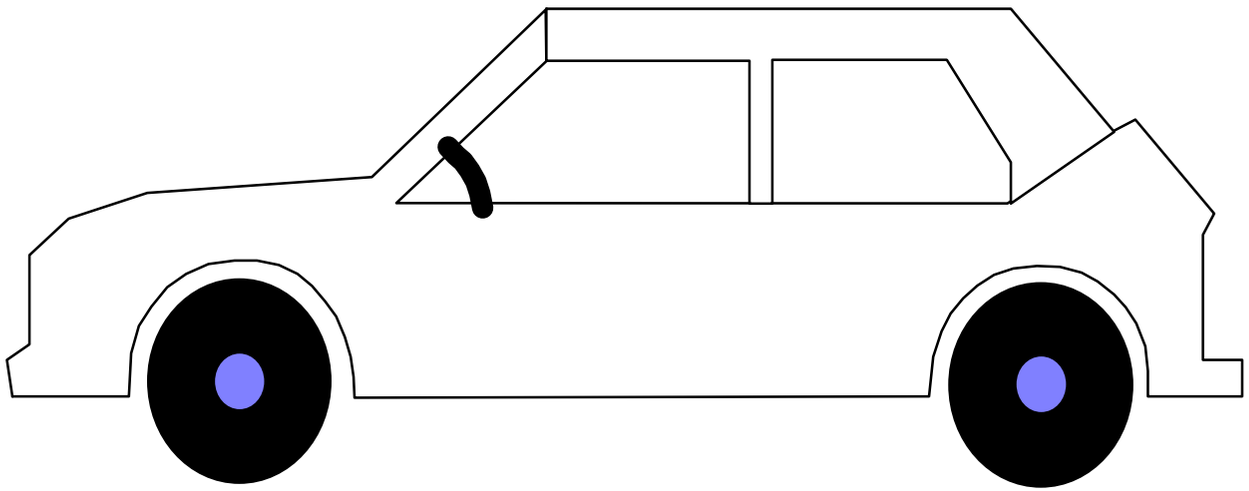
Architectures des Systèmes de Bases de Données

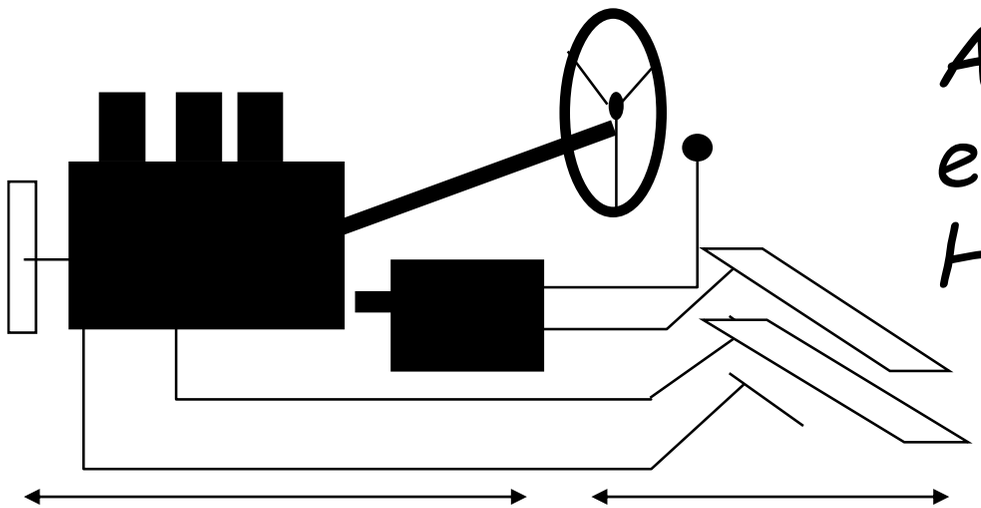
Abstraction Encapsulation

Spaghetti Plate

Traduction en cours

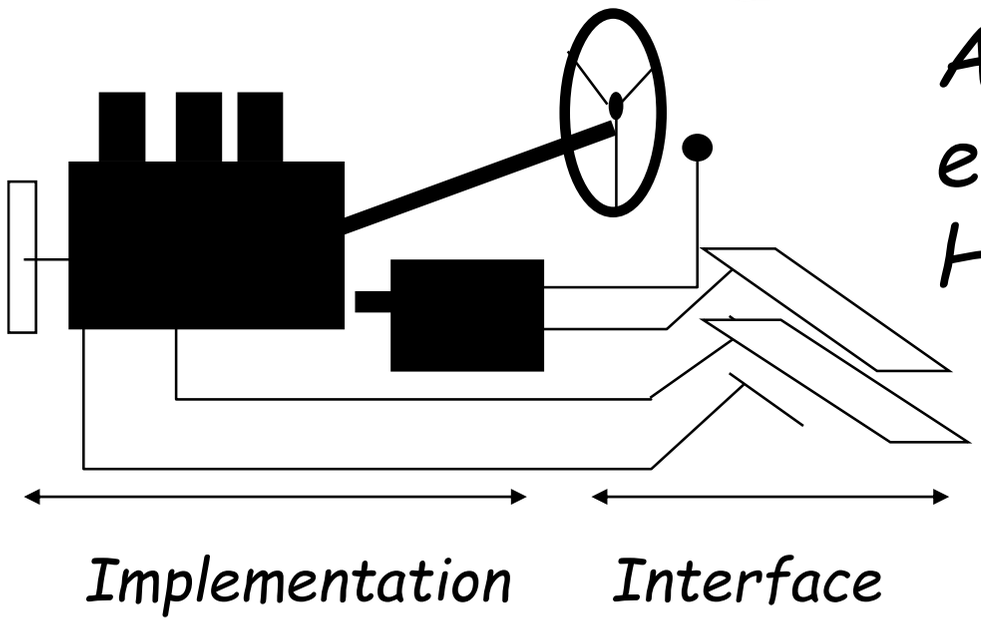
Design By and For Interfaces (GOF)





A driver doesn't care of engine's internal working. He only knows the interface

Design By and For Interfaces



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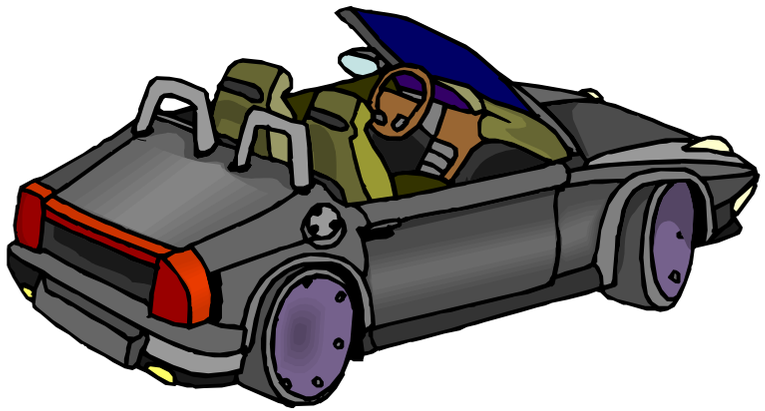

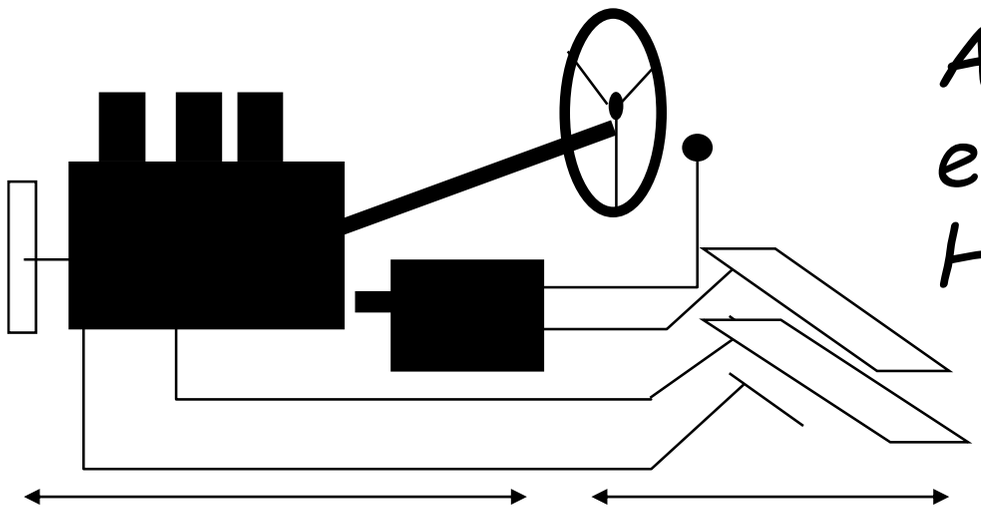

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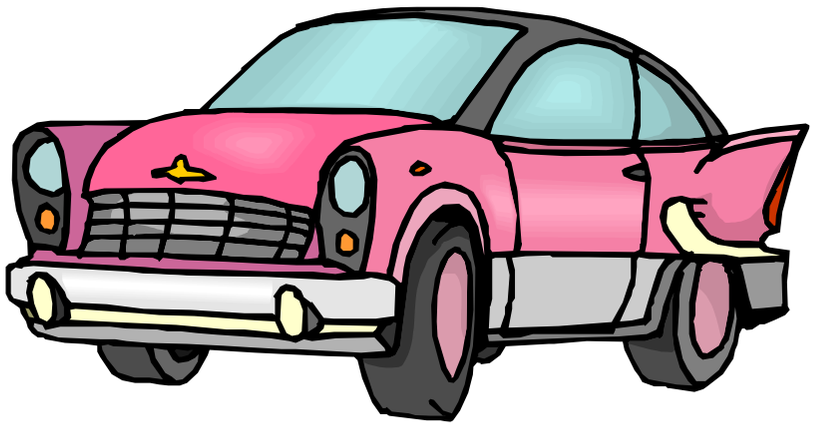

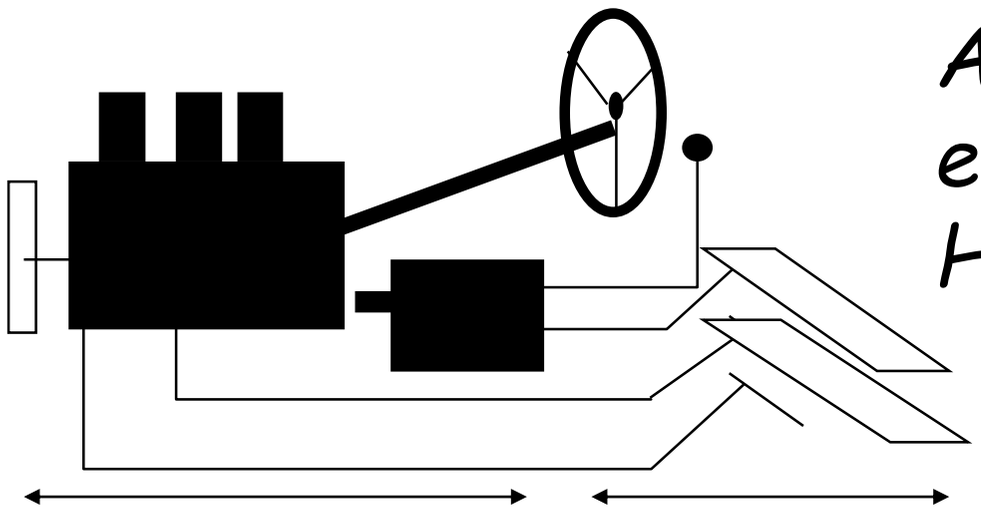

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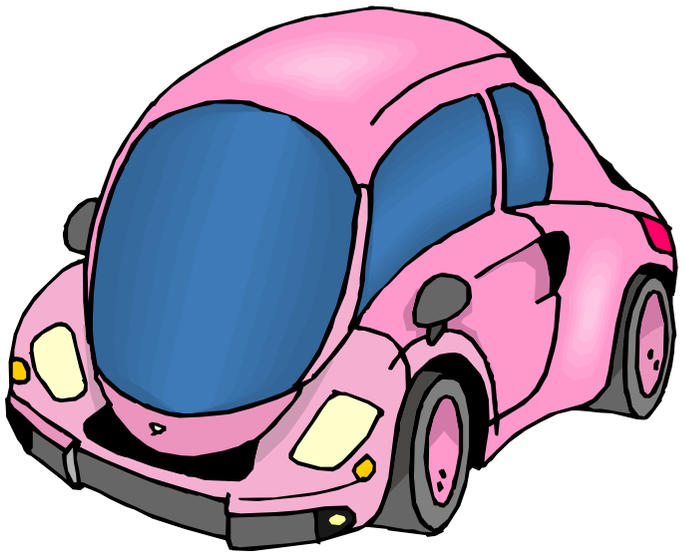

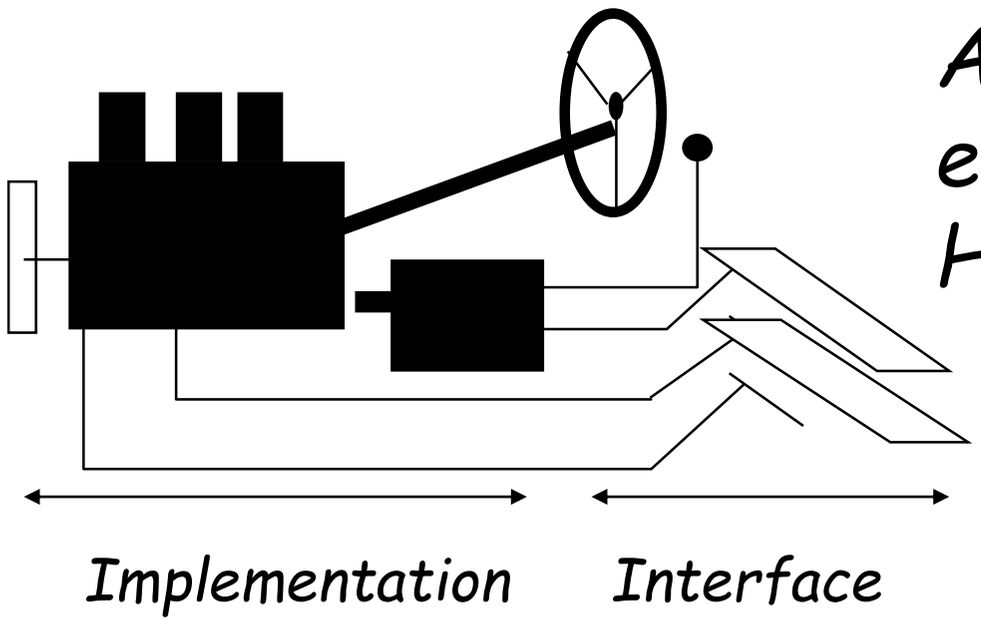

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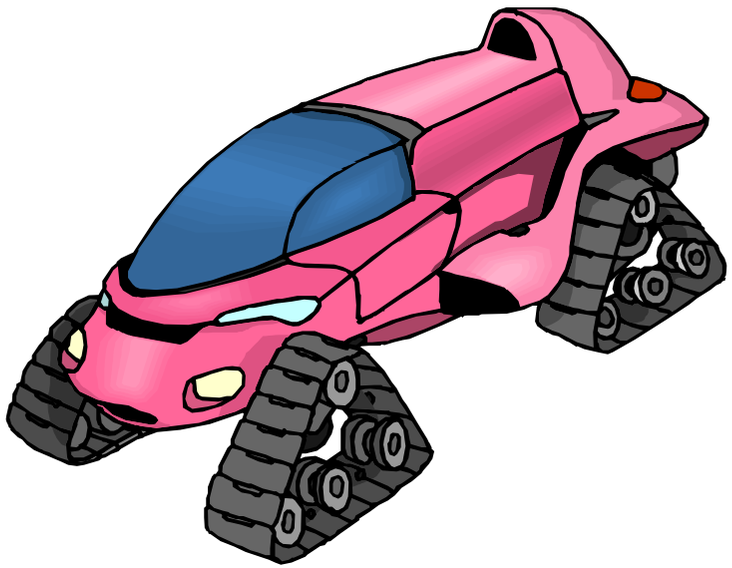

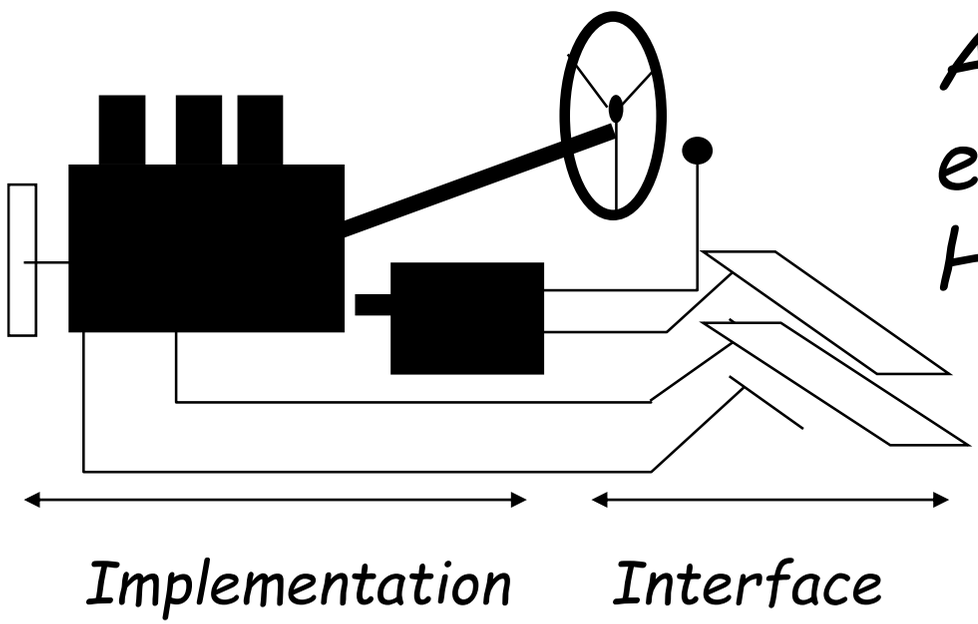

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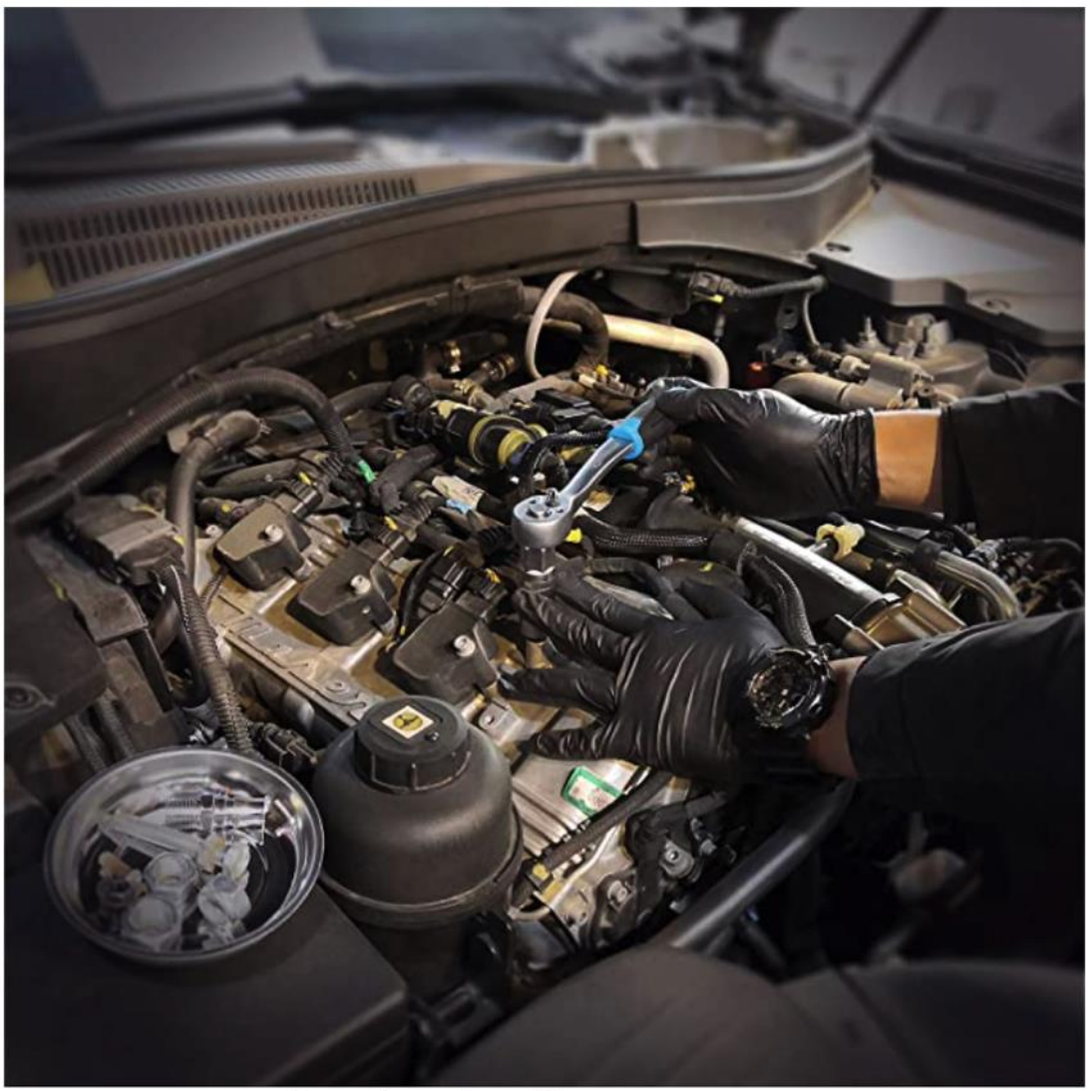

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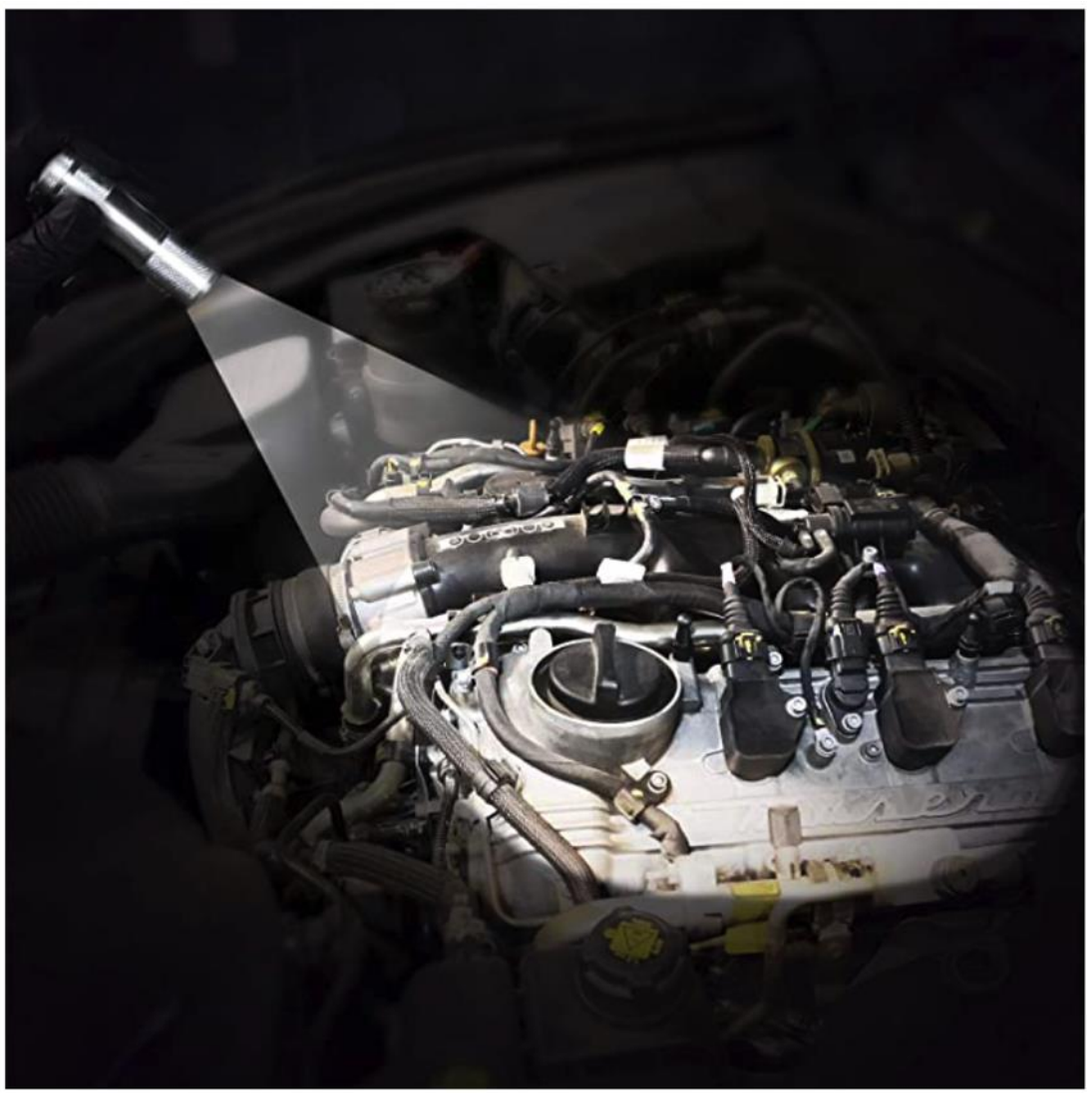

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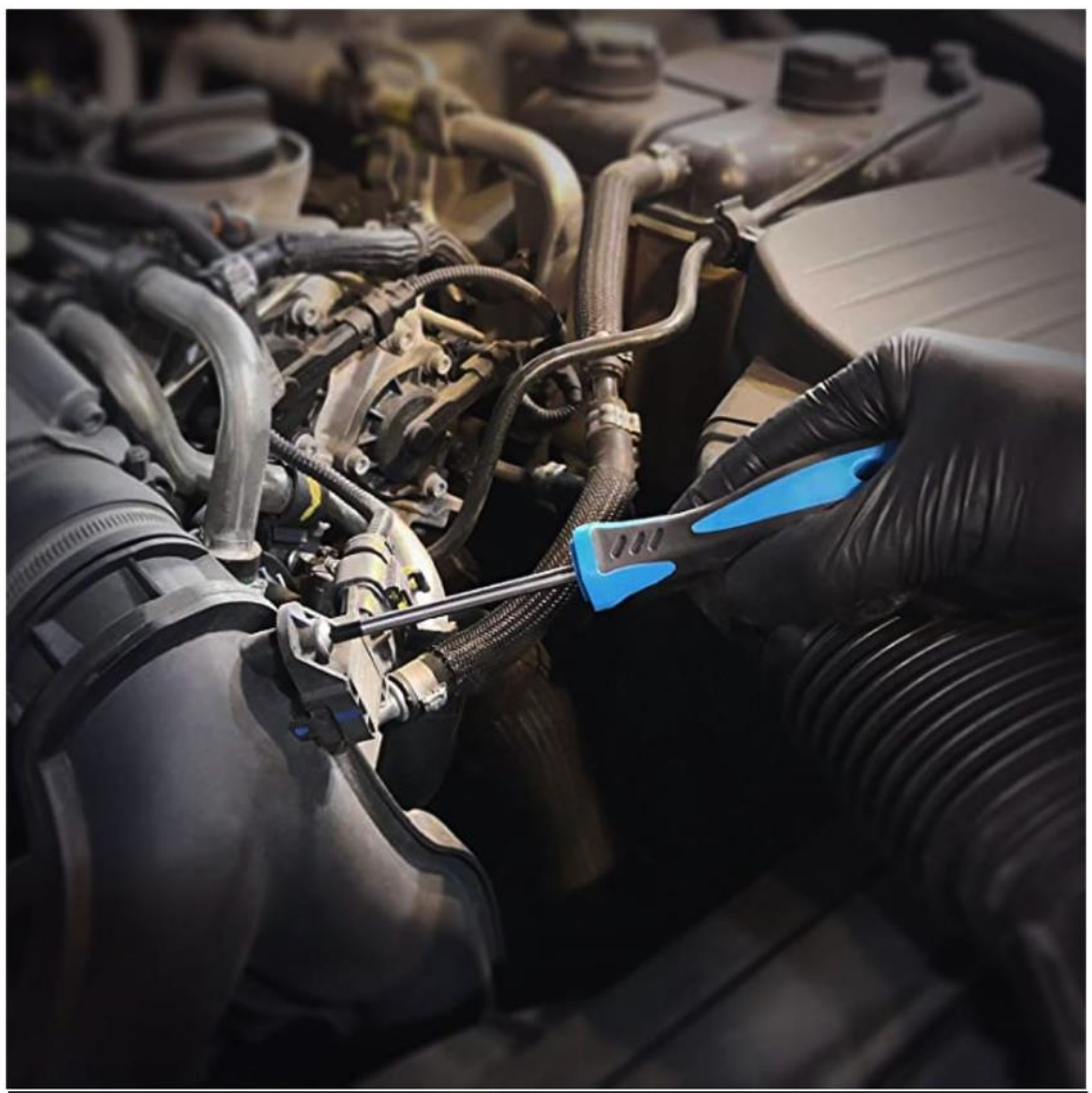

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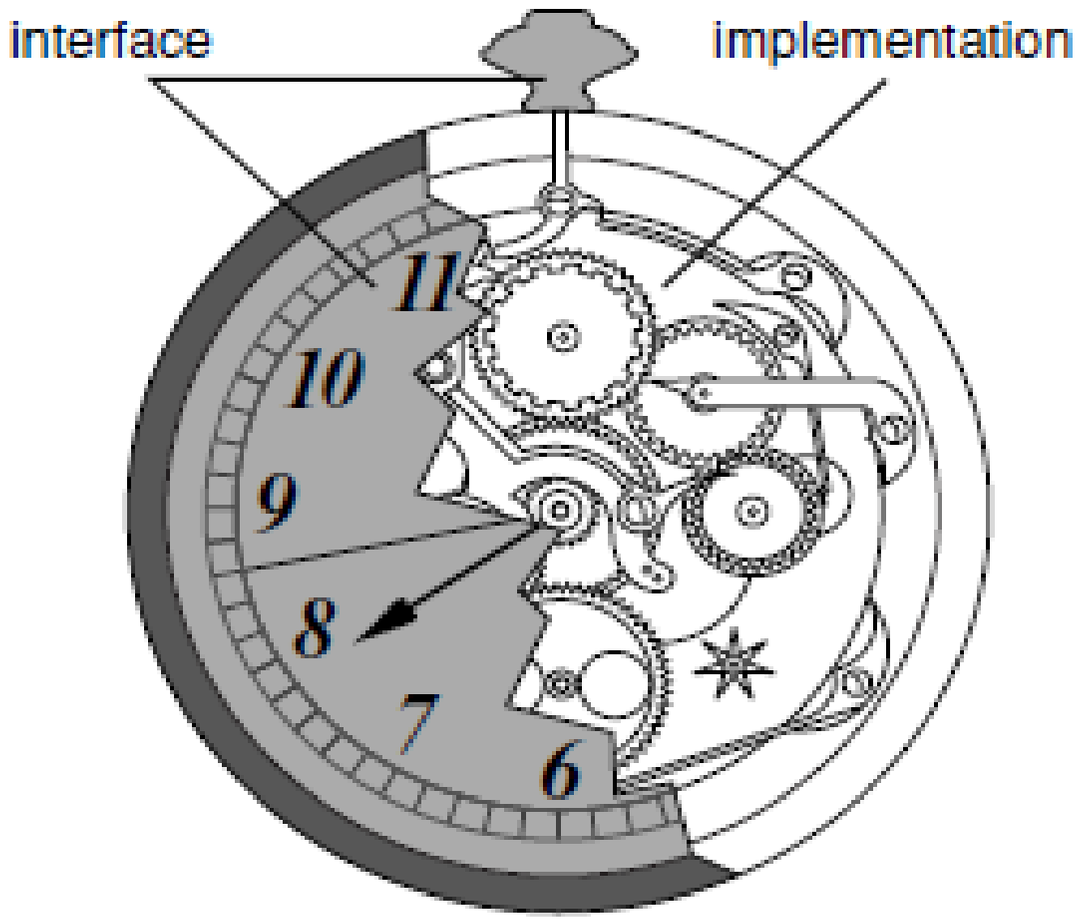
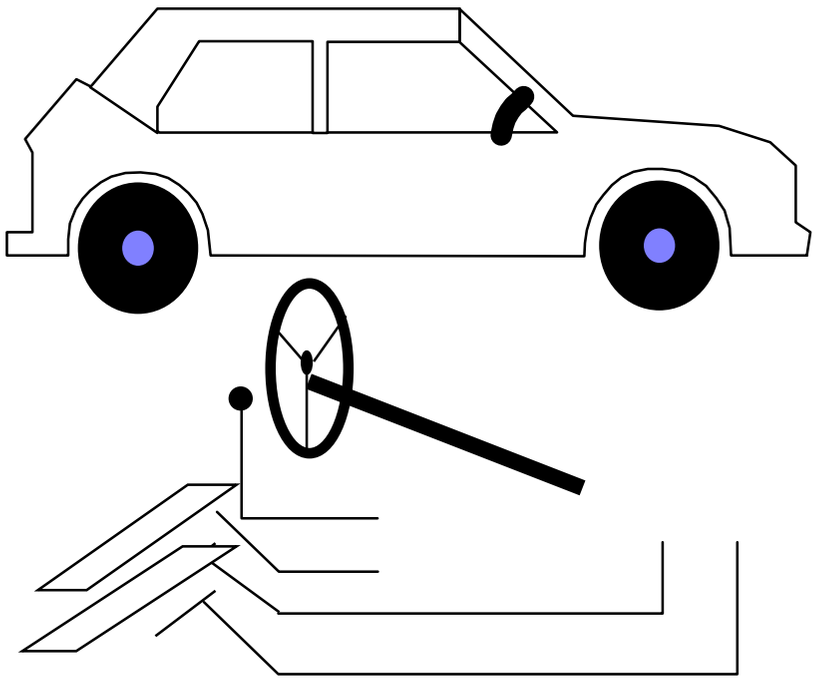
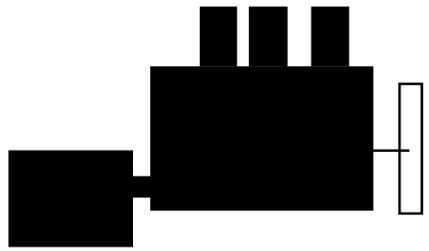
Interface and implementation

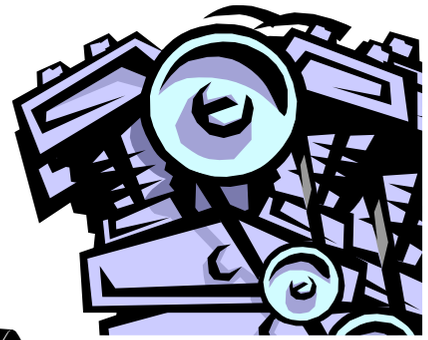


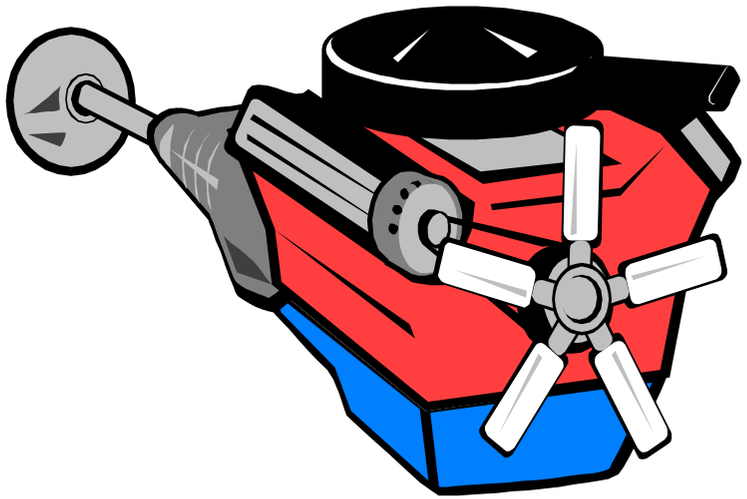
Source : **OBJECT-ORIENTED PROGRAMMING AND THE OBJECTIVE-C LANGUAGE**
NeXT DEVELOPER'S LIBRARY

Interface Versus Implementation









```
00101010001101001
00101111010101010
01001010010101010
01001110110010101
01010001010111111
00001001001001000
```

Interface

(specification)

```
Struct {
        Int field1
        double field2
        abc field3
        xxx field4
}
```

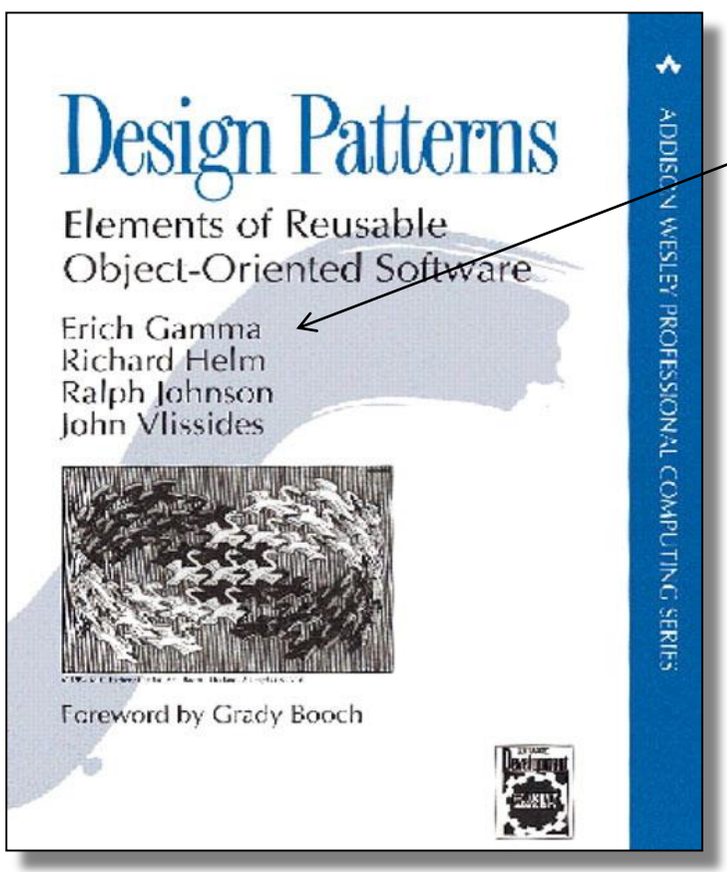
Implementation

(body)

GOF

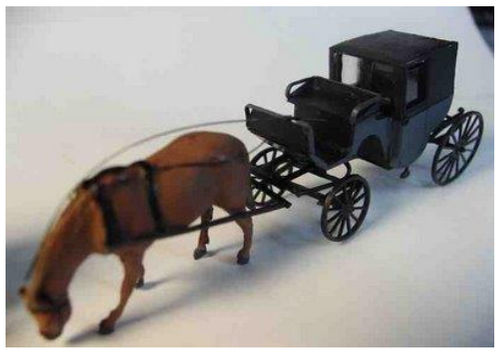
“program to an interface, not an implementation”

http://en.wikipedia.org/wiki/Design_Patterns



Didel ASI

Interface & Encapsulation = New paradigm



Carroserie Hypomobile

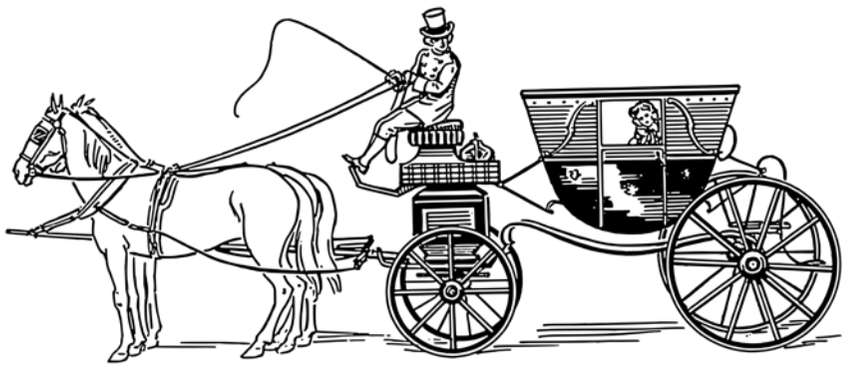
carriage

Shift

Domain Maturity

New paradigm stems from existing

- Starts from the low level
  - Carriage



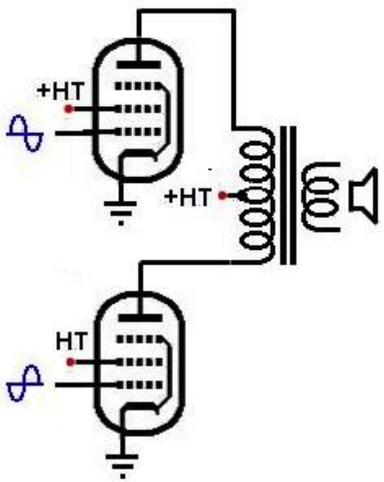
- Starts with what we know so far

- Modeling what we have today helps emmergence of new concepts.

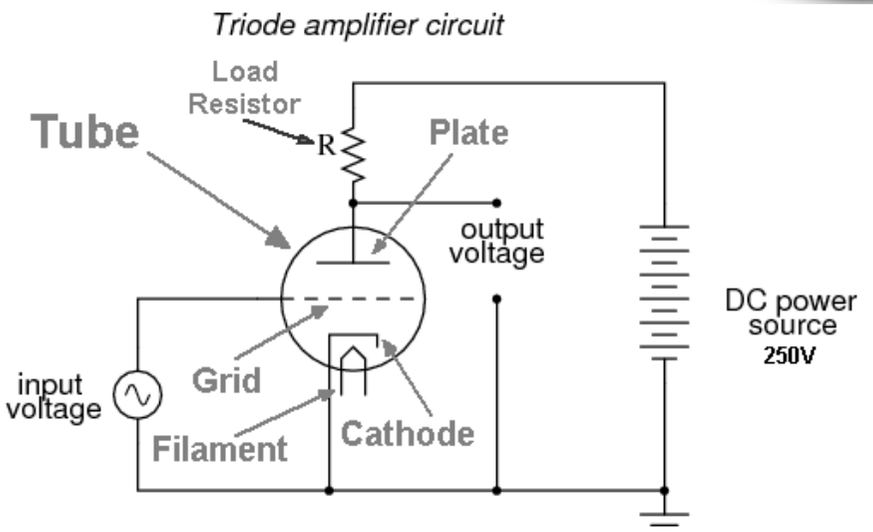
Back to the past !!!

Back to the past !!!

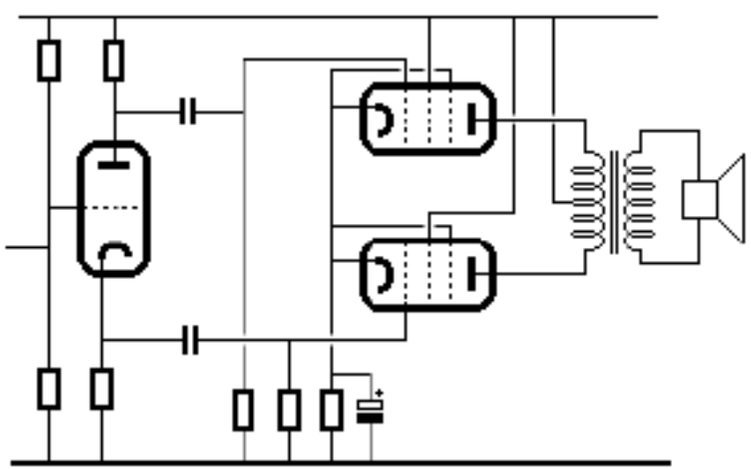
From Vacum Tub to Transistor (solid state)



Simplified Push-Pull tube amp

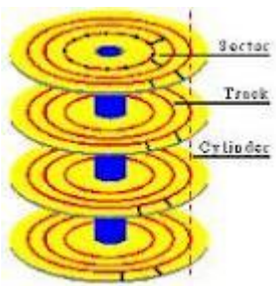


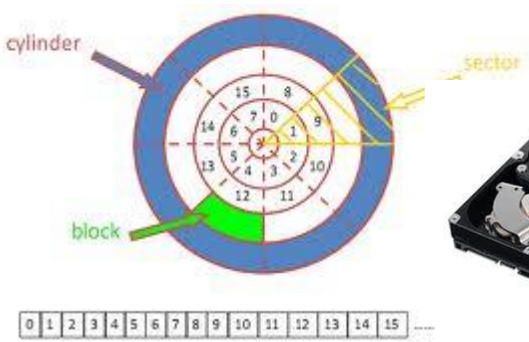
http://surfybear.weebly.com/the-amp.html

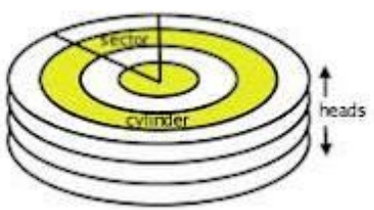


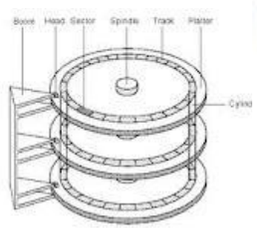
http://www.co-bw.com/Audio_Vacuum_Tube_Amp.htm

Disk physical structure

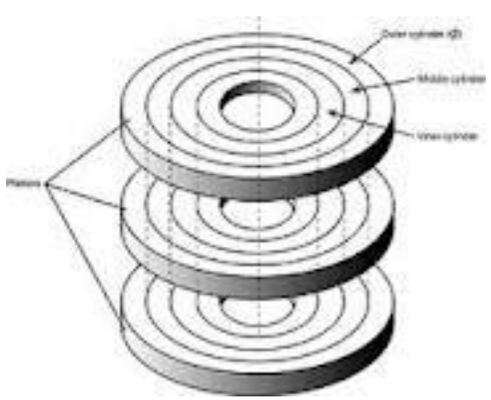


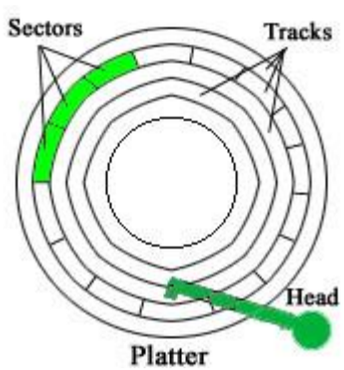






A cylinder is the set of the same tracks across all platters.





Spaghetti Plate

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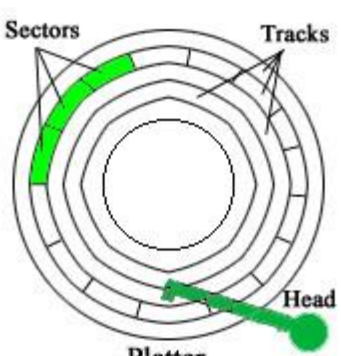
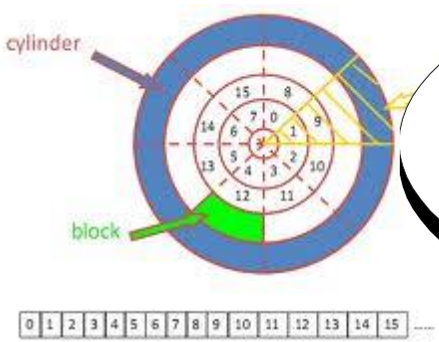
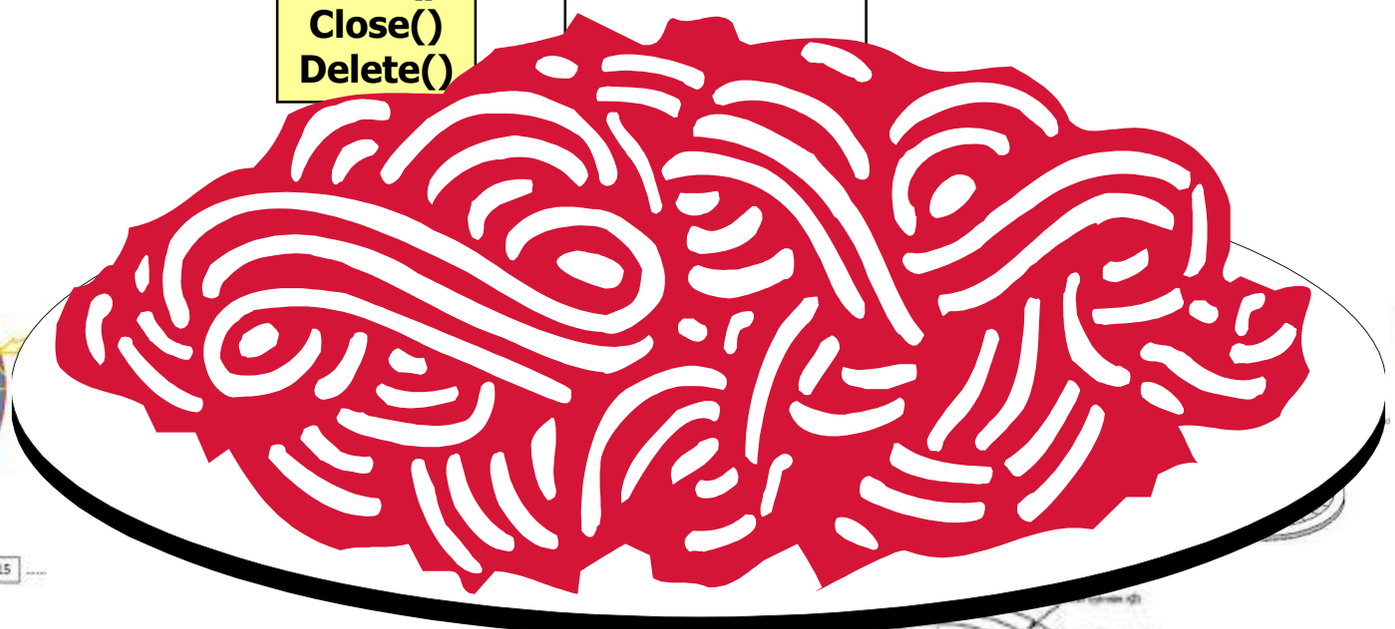
Spaghetti Plate

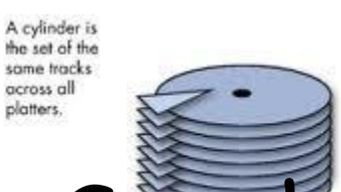


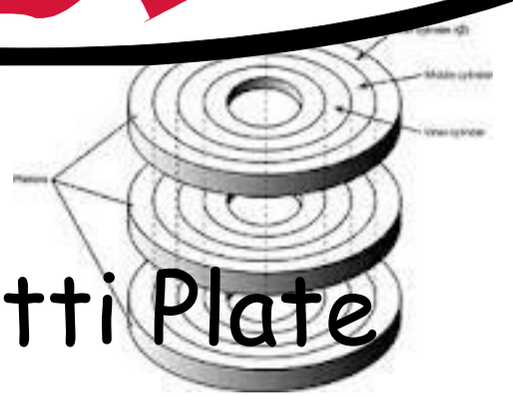
Abstraction Model

Create()
Open()
Write()
Read()
Close()
Delete()

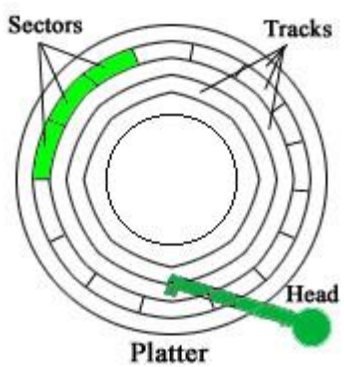




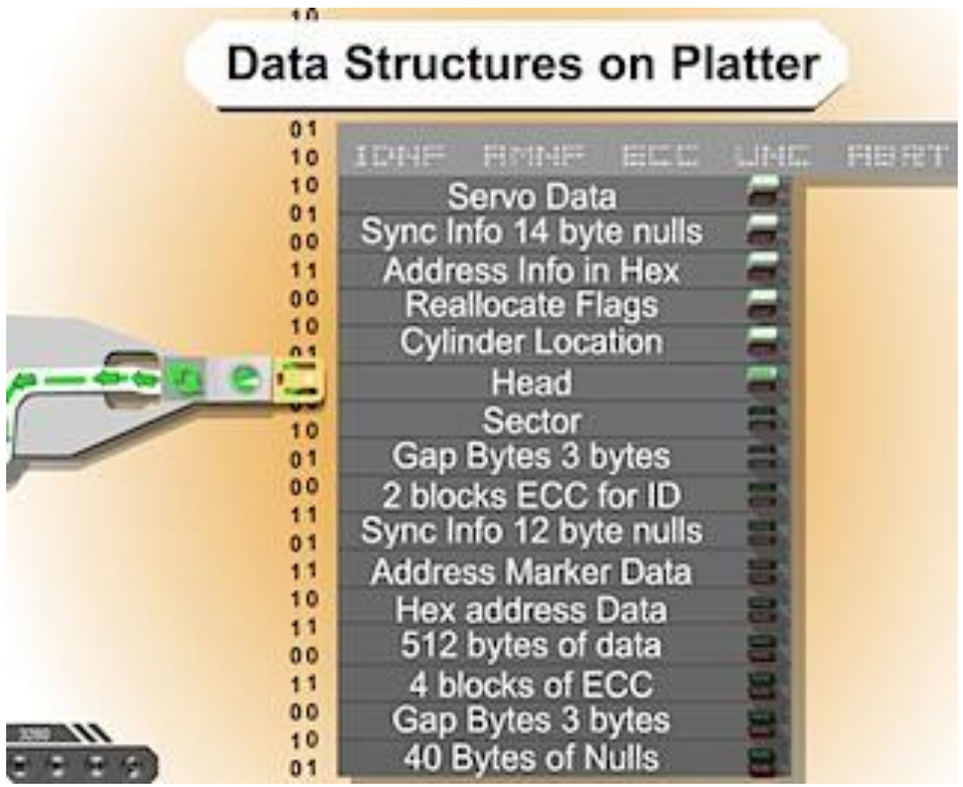




Spaghetti Plate



Disk content



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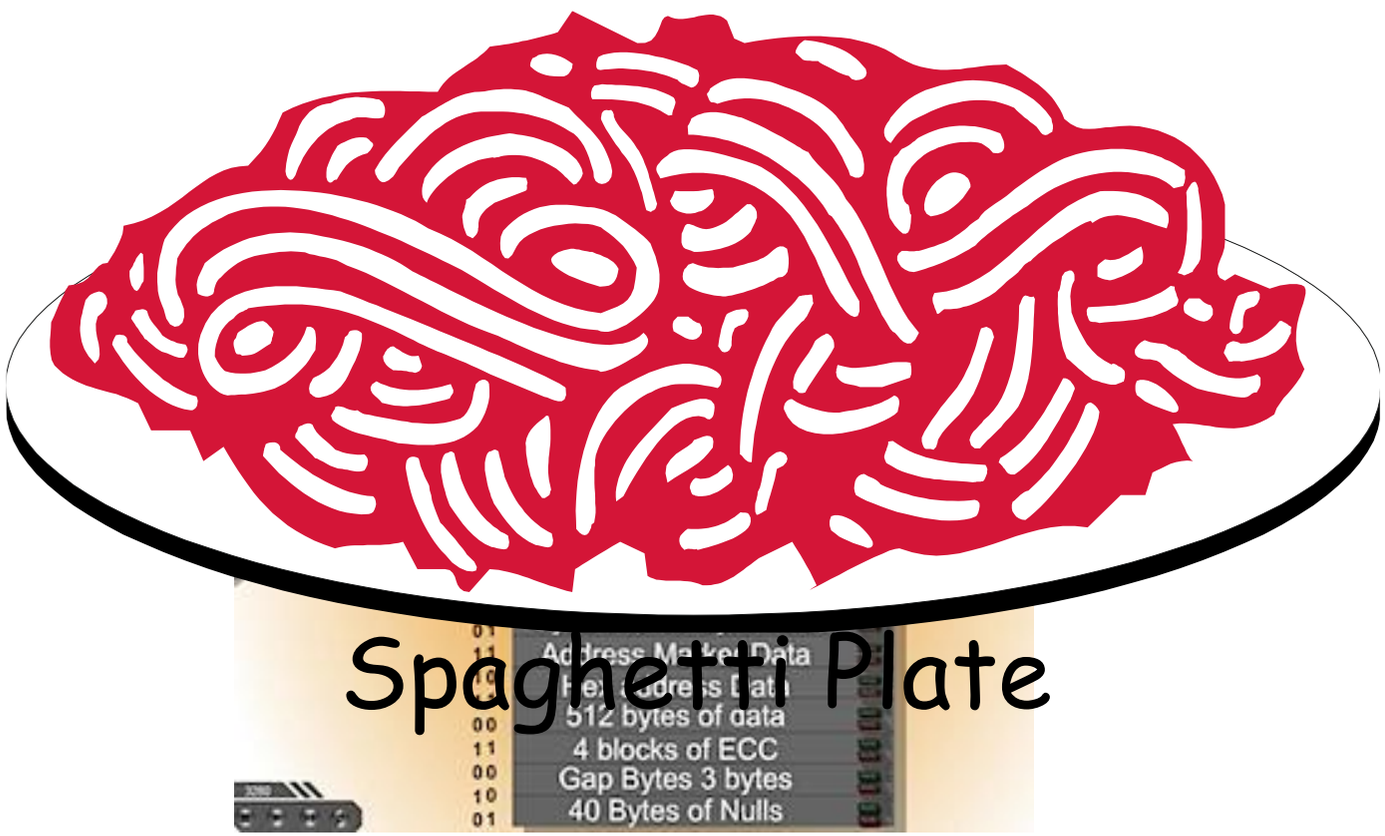
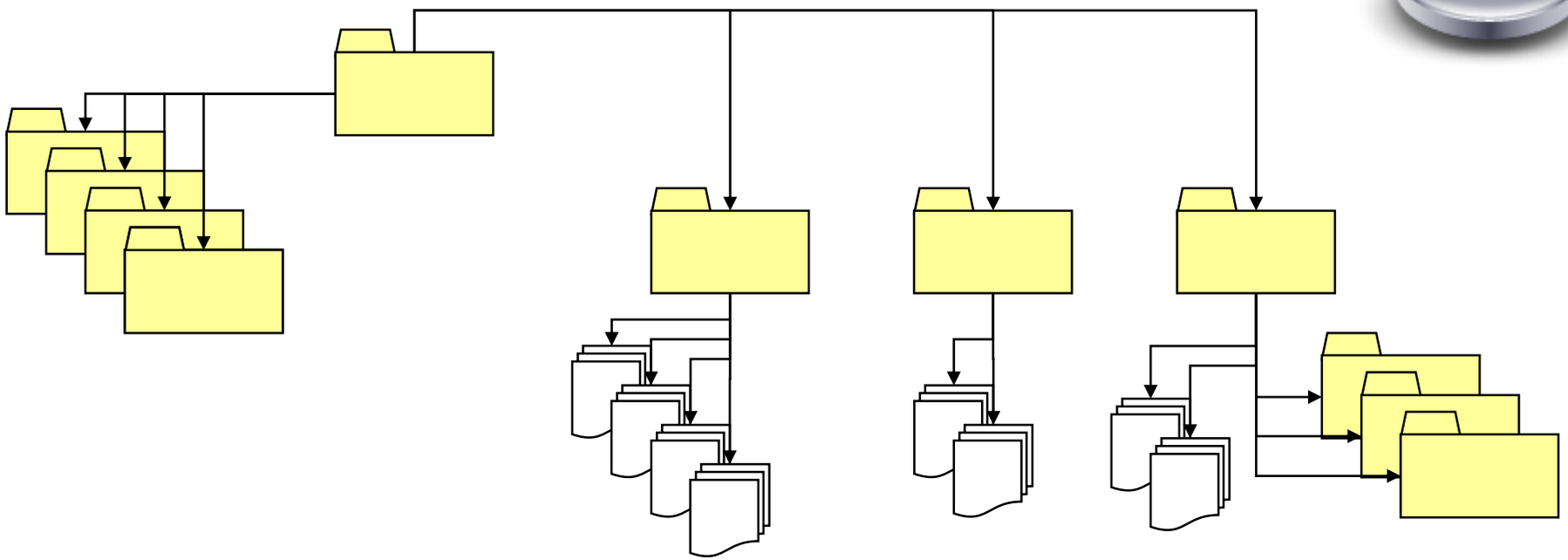
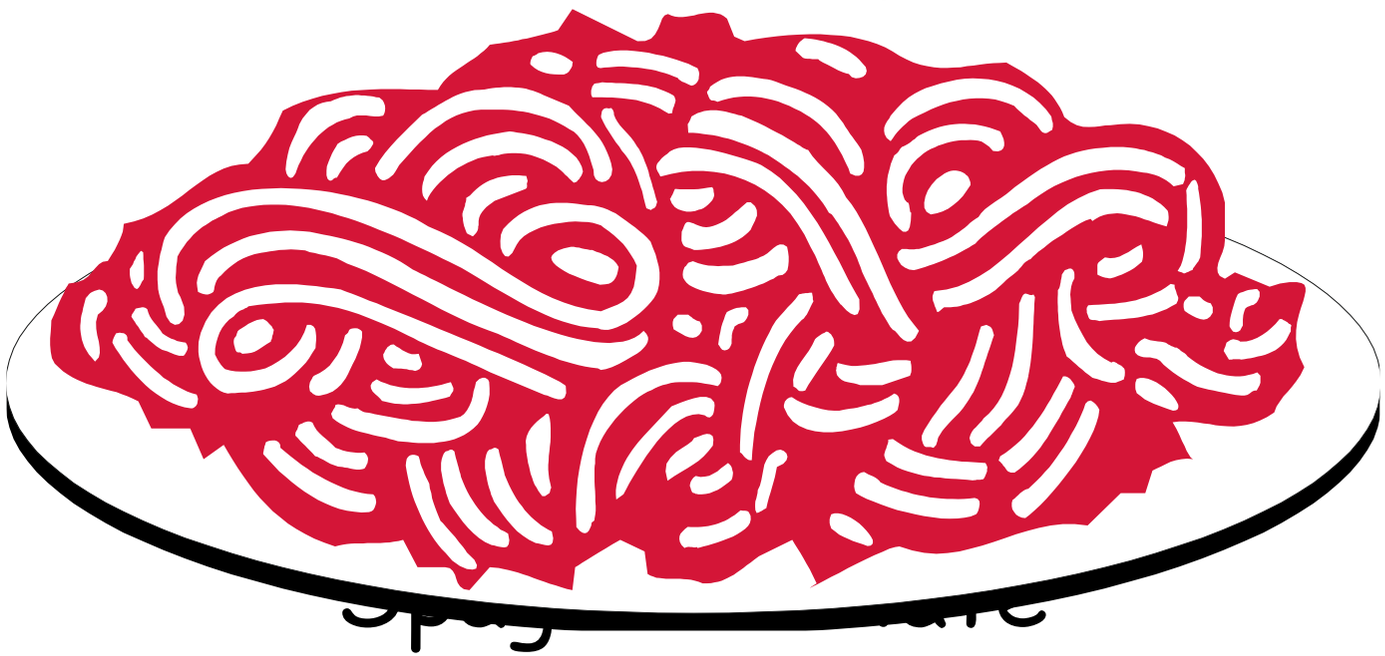


Abstraction Model





File Format

Absolute Sector **0** (Cylinder 0, Head 0, Sector **1**)

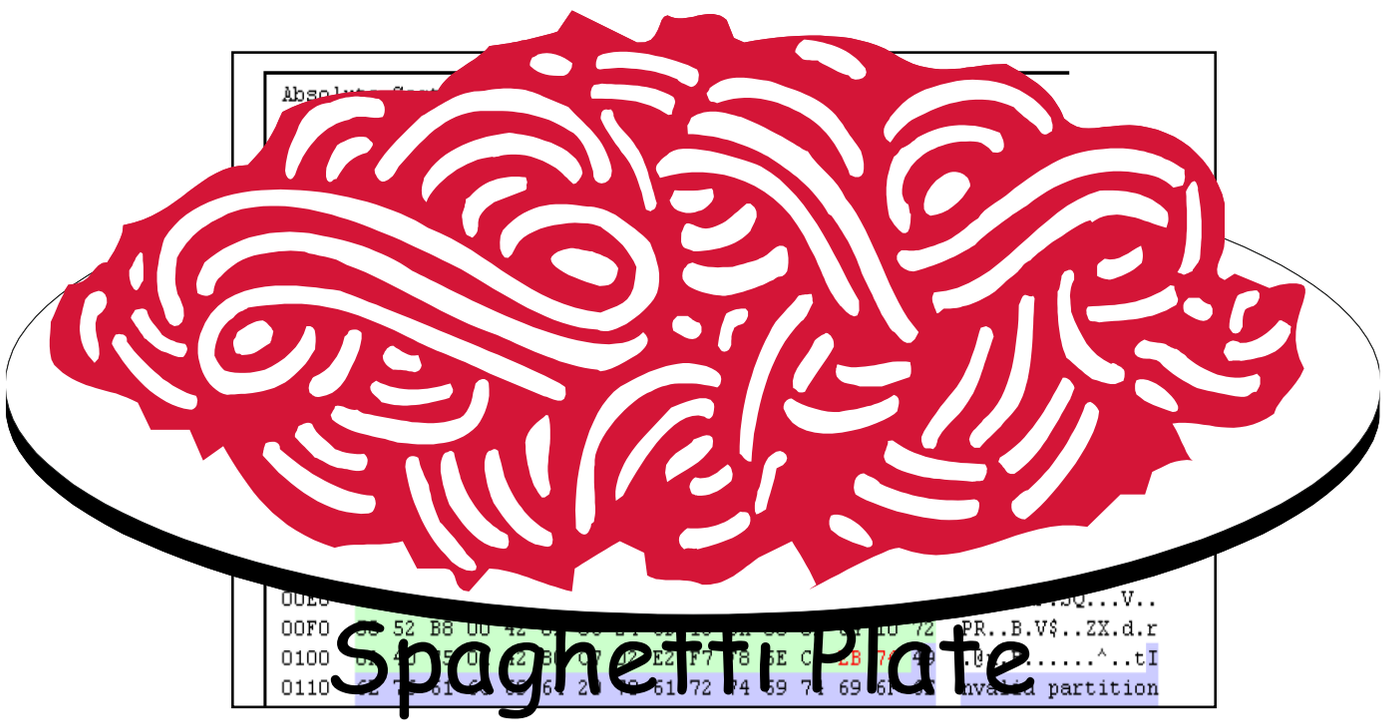
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0000	33	C0	8E	D0	BC	00	7C	FB	50	07	50	1F	FC	BE	1B	7C	3.....|.P.P....|
0010	BF	1B	06	50	57	B9	E5	01	F3	A4	CB	BE	BE	07	B1	04	...PW..........
0020	38	2C	7C	09	75	15	83	C6	10	E2	F5	CD	18	8B	14	8B	8,|.u..........
0030	EE	83	C6	10	49	74	16	38	2C	74	F6	BE	10	07	4E	AC	....It.8,t....N.
0040	3C	00	74	FA	BB	07	00	B4	0E	CD	10	EB	F2	89	46	25	<.t...........F%
0050	96	8A	46	04	B4	06	3C	0E	74	11	B4	0B	3C	0C	74	05	..F...<.t...<.t.
0060	3A	C4	75	2B	40	C6	46	25	06	75	24	BB	AA	55	50	B4	.u+@.F%.u$..UP.
0070	41	CD	13	58	72	16	81	FB	55	AA	75	10	F6	C1	01	74	A..Xr...U.u....t
0080	0B	8A	E0	88	56	24	C7	06	A1	06	EB	1E	88	66	04	BF	....V$.......f..
0090	0A	00	B8	01	02	8B	DC	33	C9	83	FF	05	7F	03	8B	4E	.......3.......N
00A0	25	03	4E	02	CD	13	72	29	BE	46	07	81	3E	FE	7D	55	%.N...r).F..>.}U
00B0	AA	74	5A	83	EF	05	7F	DA	85	F6	75	83	BE	27	07	EB	.tZ.......u..'..
00C0	8A	98	91	52	99	03	46	08	13	56	0A	E8	12	00	5A	EB	...R..F..V....Z.
00D0	D5	4F	74	E4	33	C0	CD	13	EB	B8	**00**	**00**	**00**	**00**	**00**	**00**	.Ot.3..........
00E0	56	33	F6	56	56	52	50	06	53	51	BE	10	00	56	8B	F4	V3.VVRP.SQ...V..
00F0	50	52	B8	00	42	8A	56	24	CD	13	5A	58	8D	64	10	72	PR..B.V$..ZX.d.r
0100	0A	40	75	01	42	80	C7	02	E2	F7	F8	5E	C3	EB	74	49	.@u.B.....^..tI
0110	6E	76	61	6C	69	64	20	70	61	72	74	69	74	69	6F	6E	nvalid partition

File Format

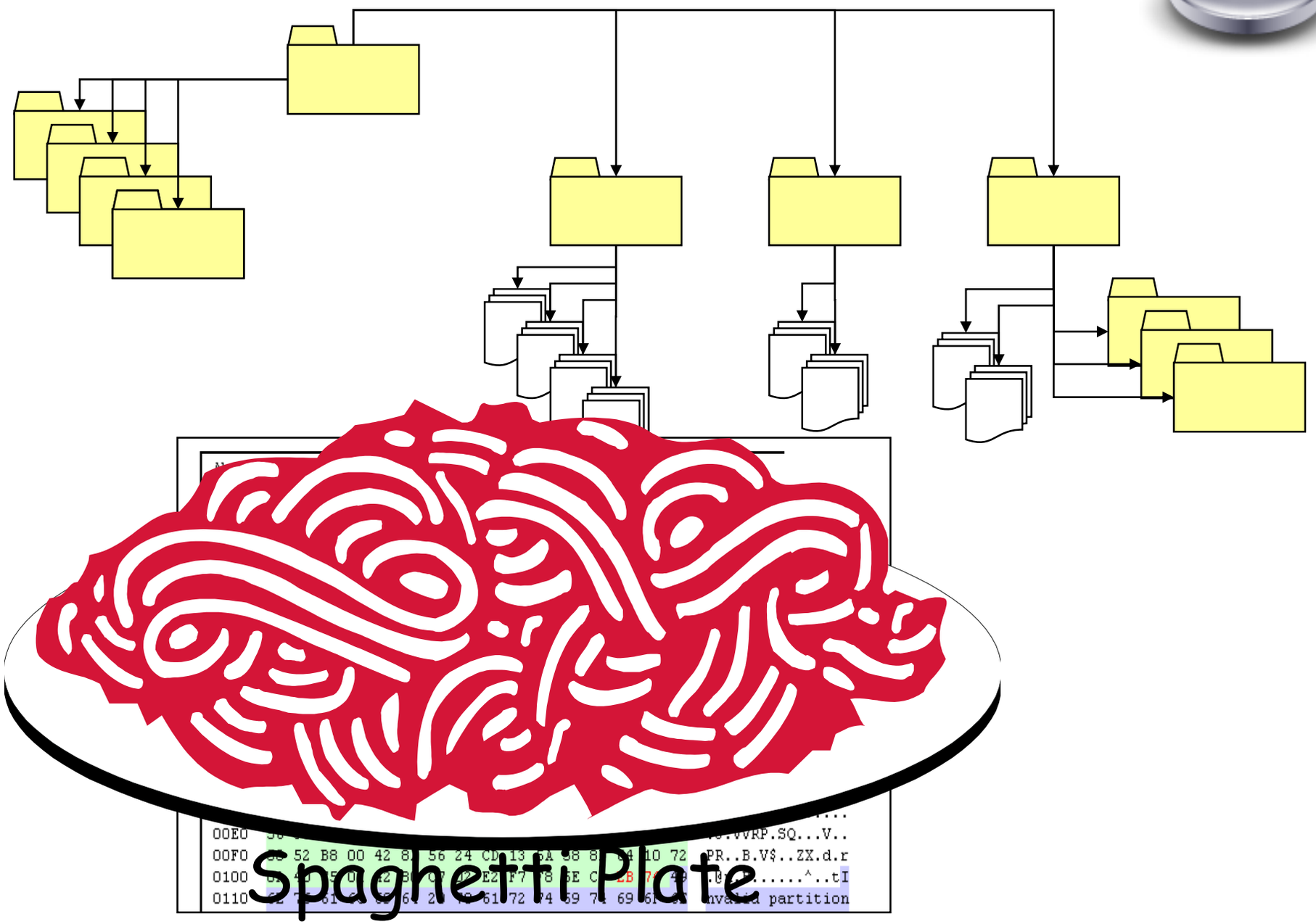
Absolute Sector **0** (Cylinder 0, Head 0, Sector **1**)

```
       0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0000   33 C0 8E D0 BC 00 7C FB 50 07 50 1F FC BE 1B 7C  3.....|.P.P....|
0010   BF 1B 06 50 57 B9 E5 01 F  A4    BF BF 07 B1 04  ...PW...........
0020   38 2C 7C 09 75 15 83                          B  8,|.u...........
0030   EE 83 C6 10                                     It.8,t....N.
0040   3C 00 74                                        .........F%
0050   96 8A                                           <.t...<.t.
0060   3A                                              $..UP.
0070   4                                               ...t
0080   I                                               f..
0090   0                                               ....N
00A0   25 0                                           .F..>.}U
00B0   AA 74 5A 8                                     .........u..'..
00C0   8A 98 91 52 99 03 46 8                  5A EB  ...R..F..V....Z.
00D0   D5 4F 74 E4 33 C                                .Ot.3...........
00E0   56 33 F6 56 56 52 50 06 53 51 BE 10 00 56 8B F4  V3.VVRP.SQ...V..
00F0   50 52 B8 00 42 8A 56 24 CD 13 5A 58 8D 64 10 72  PR..B.V$..ZX.d.r
0100   0A 40 75 01 42 80 C7 02 E2 F7 F8 5E C3 EB 74 49  .@u.B......^..tI
0110   6E 76 61 6C 69 64 20 70 61 72 74 69 74 69 6F 6E  nvalid partition
```

File Format



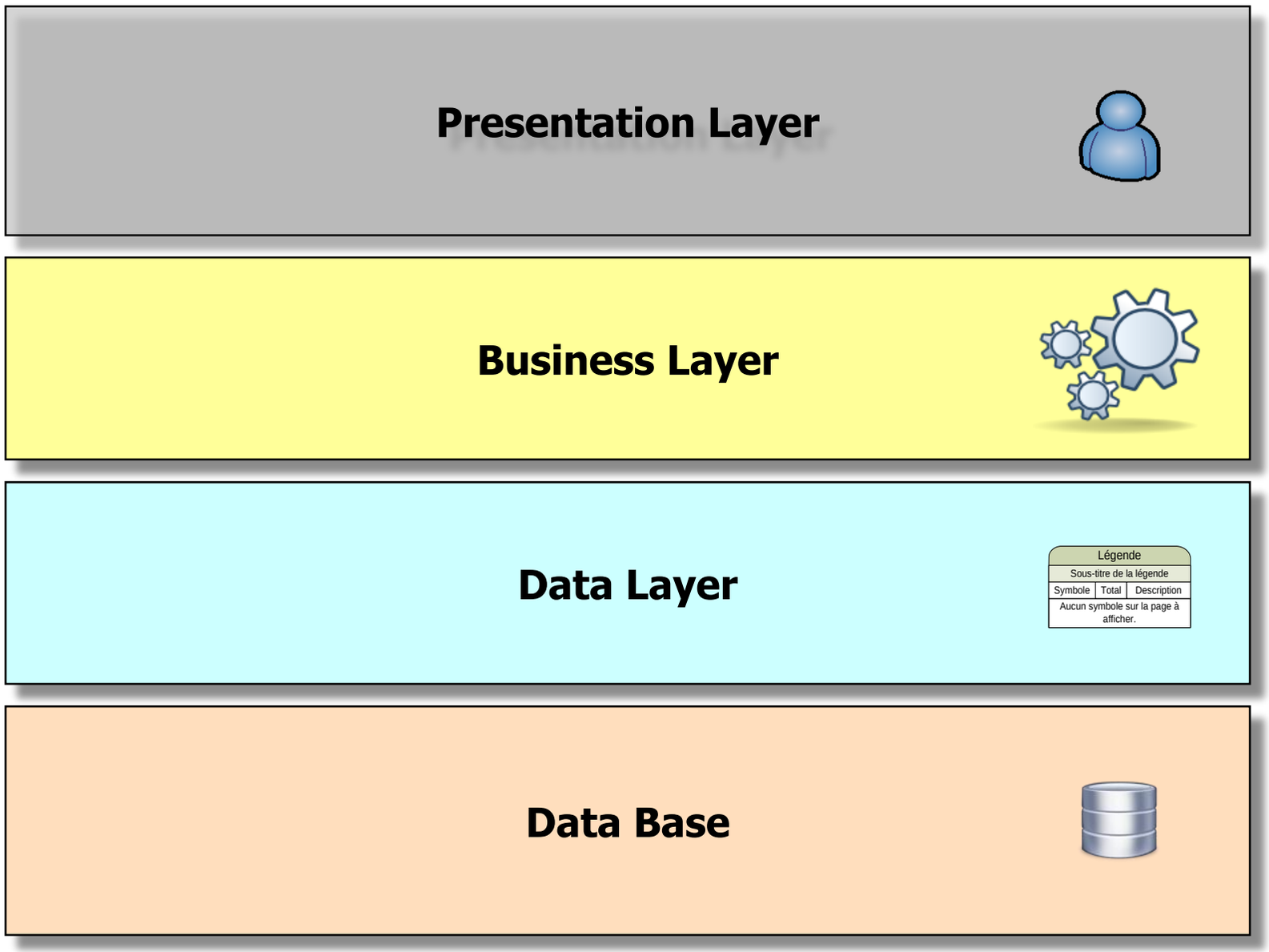
Abstraction Model



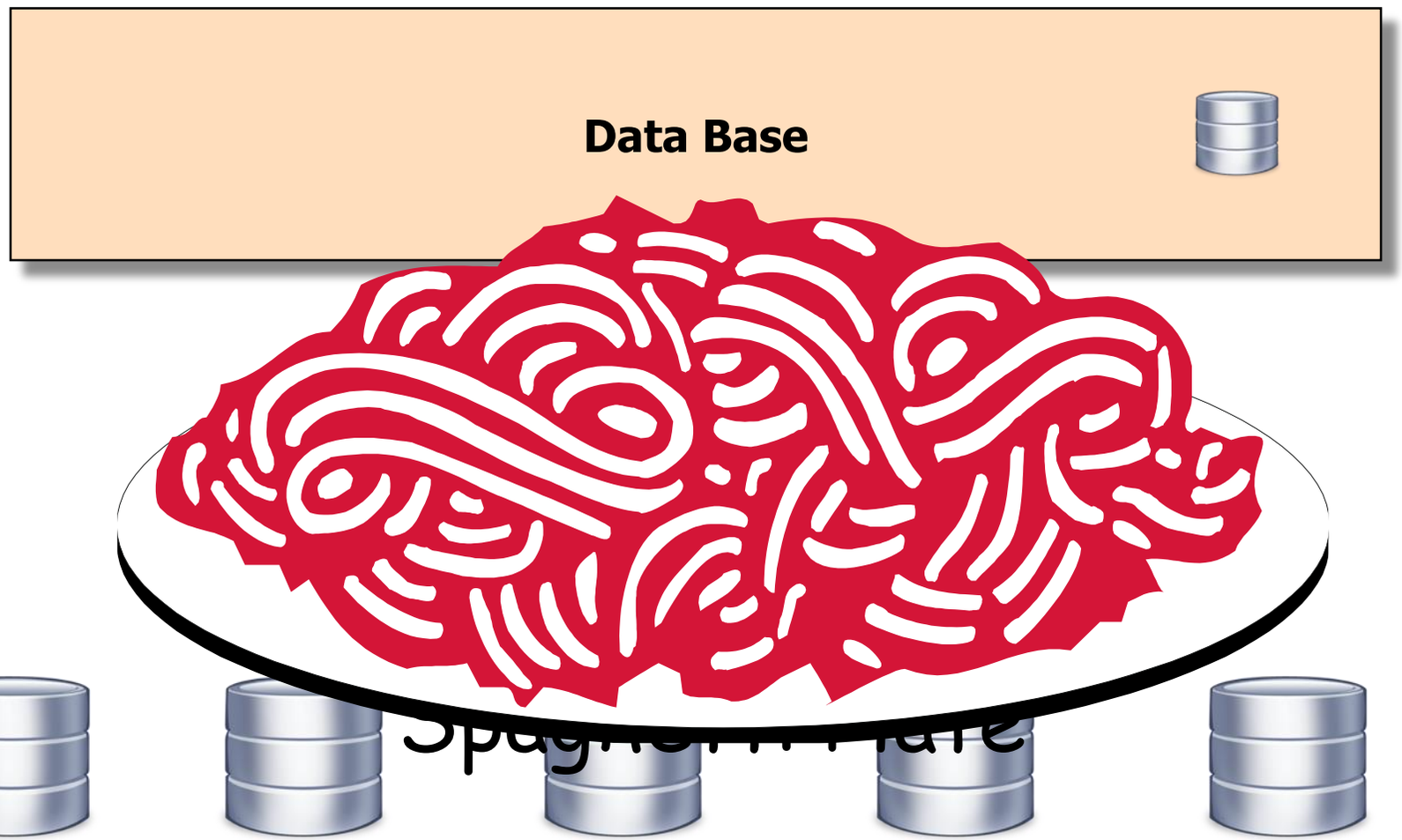
Abstraction Model

ASCII

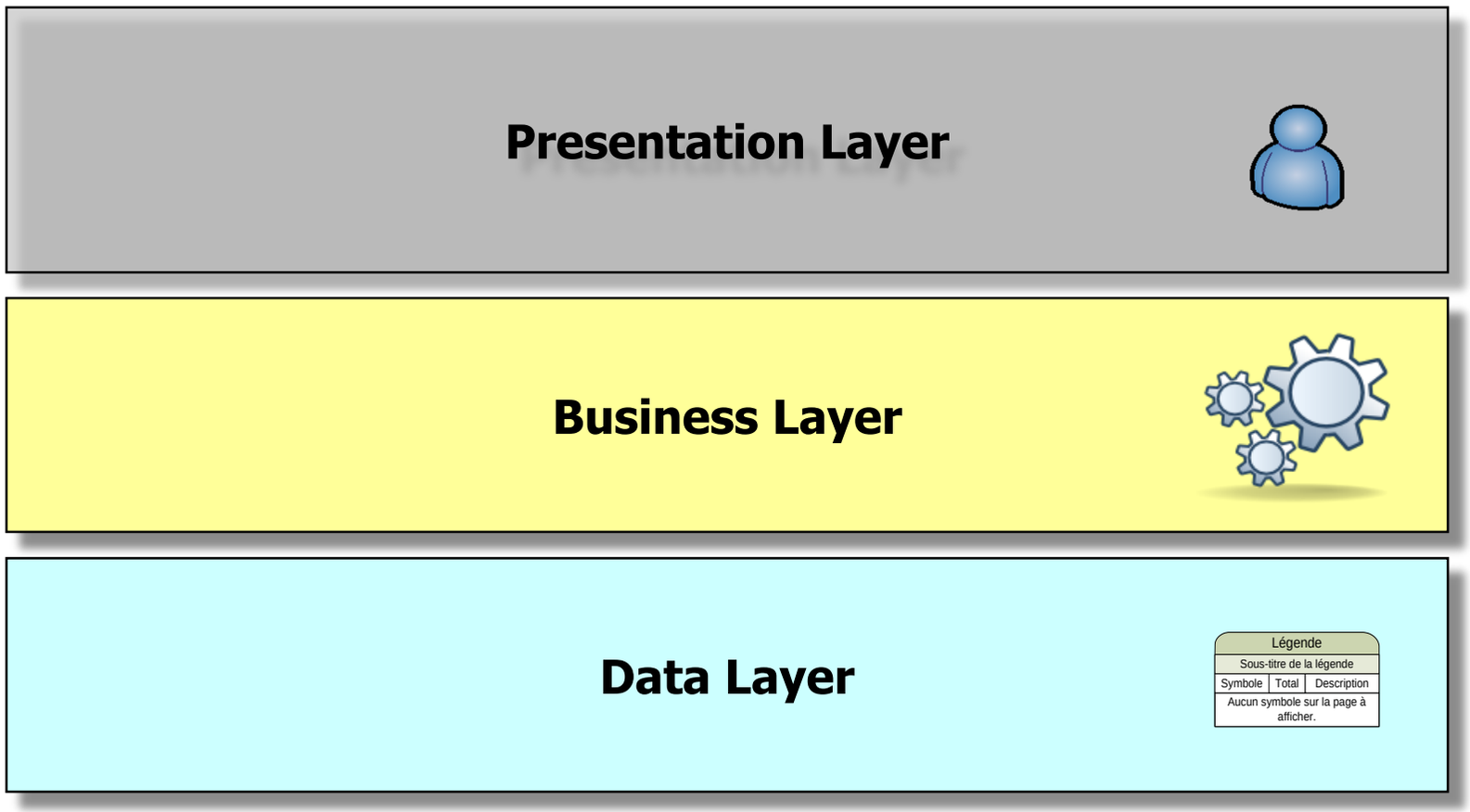
Layered Architecture



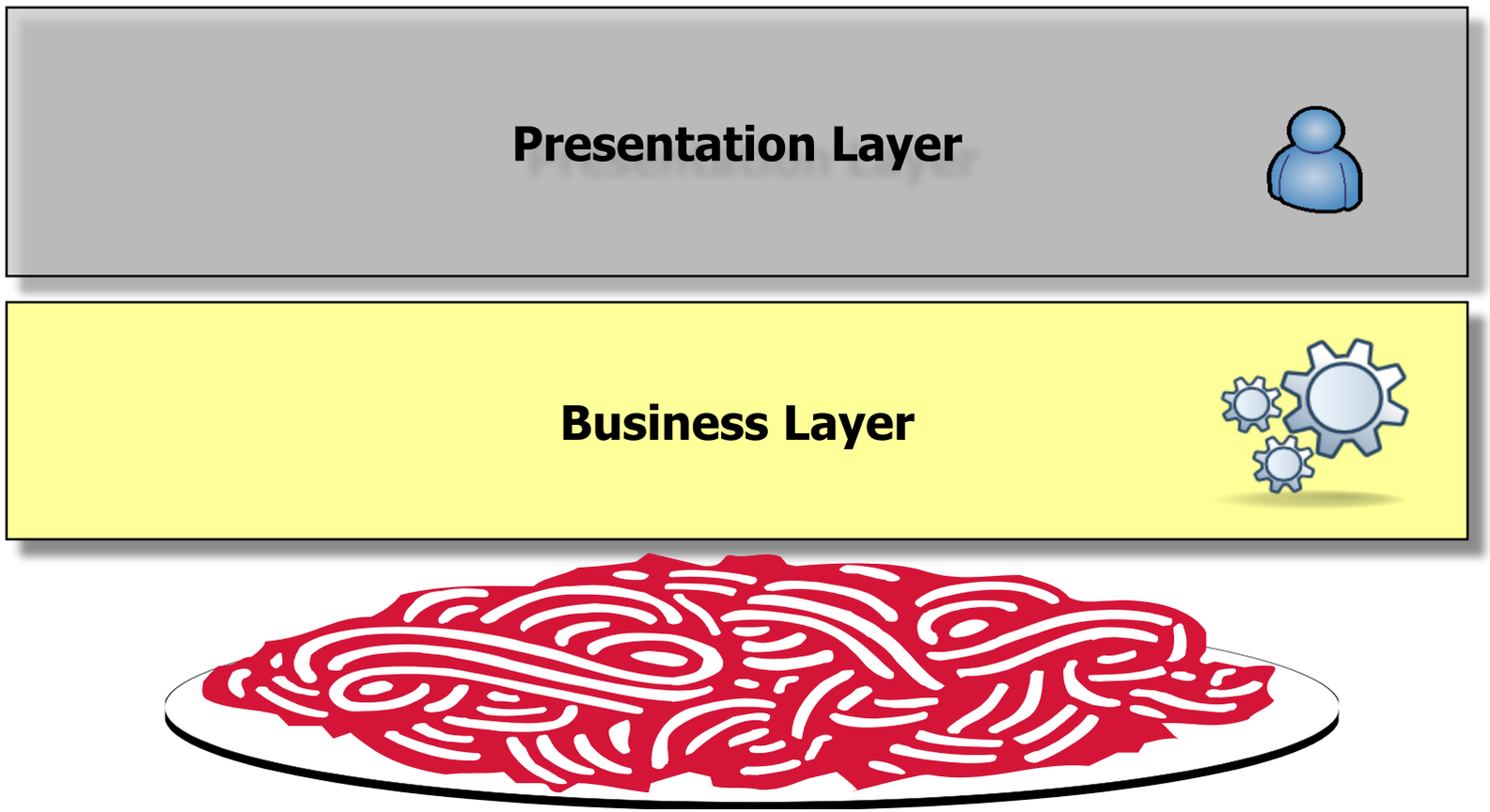
Layered Architecture



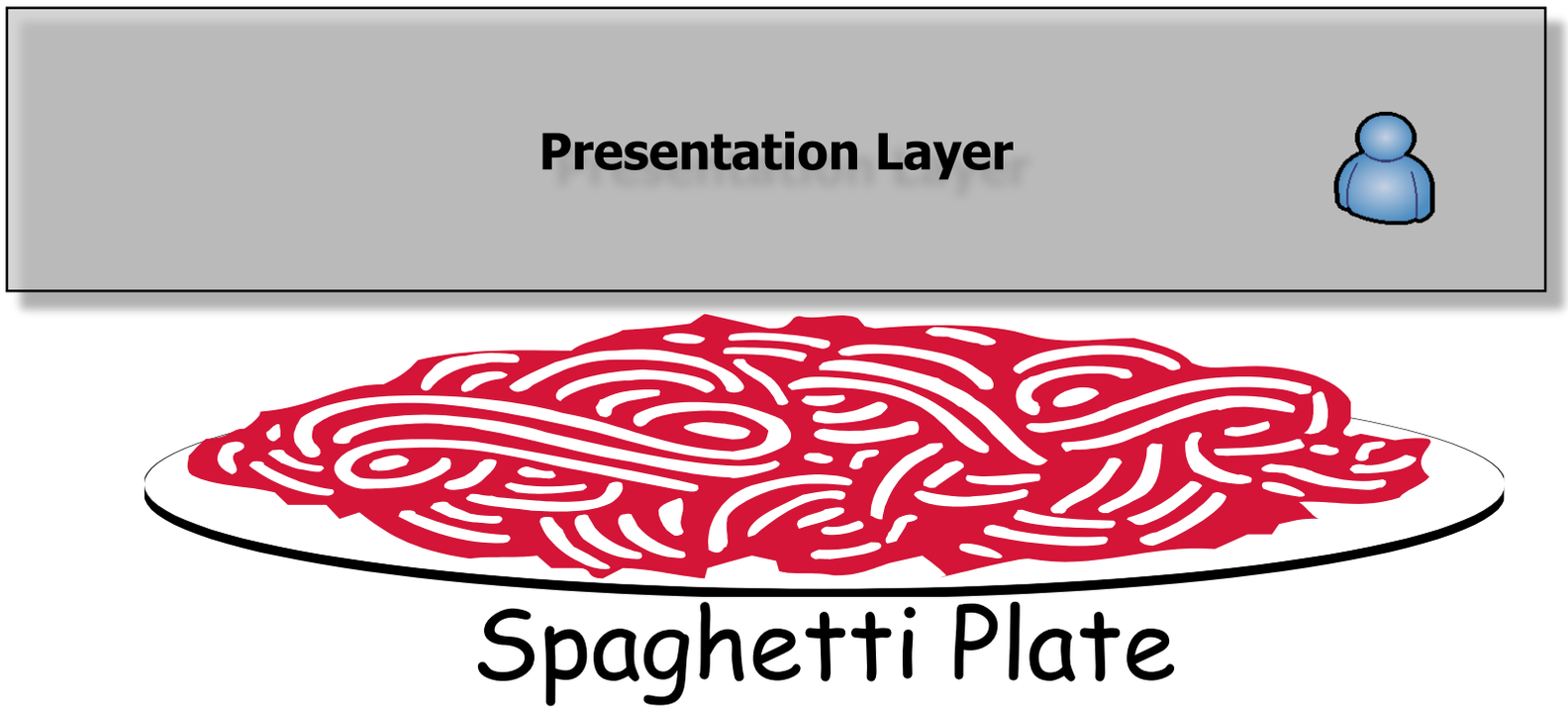
Layered Architecture



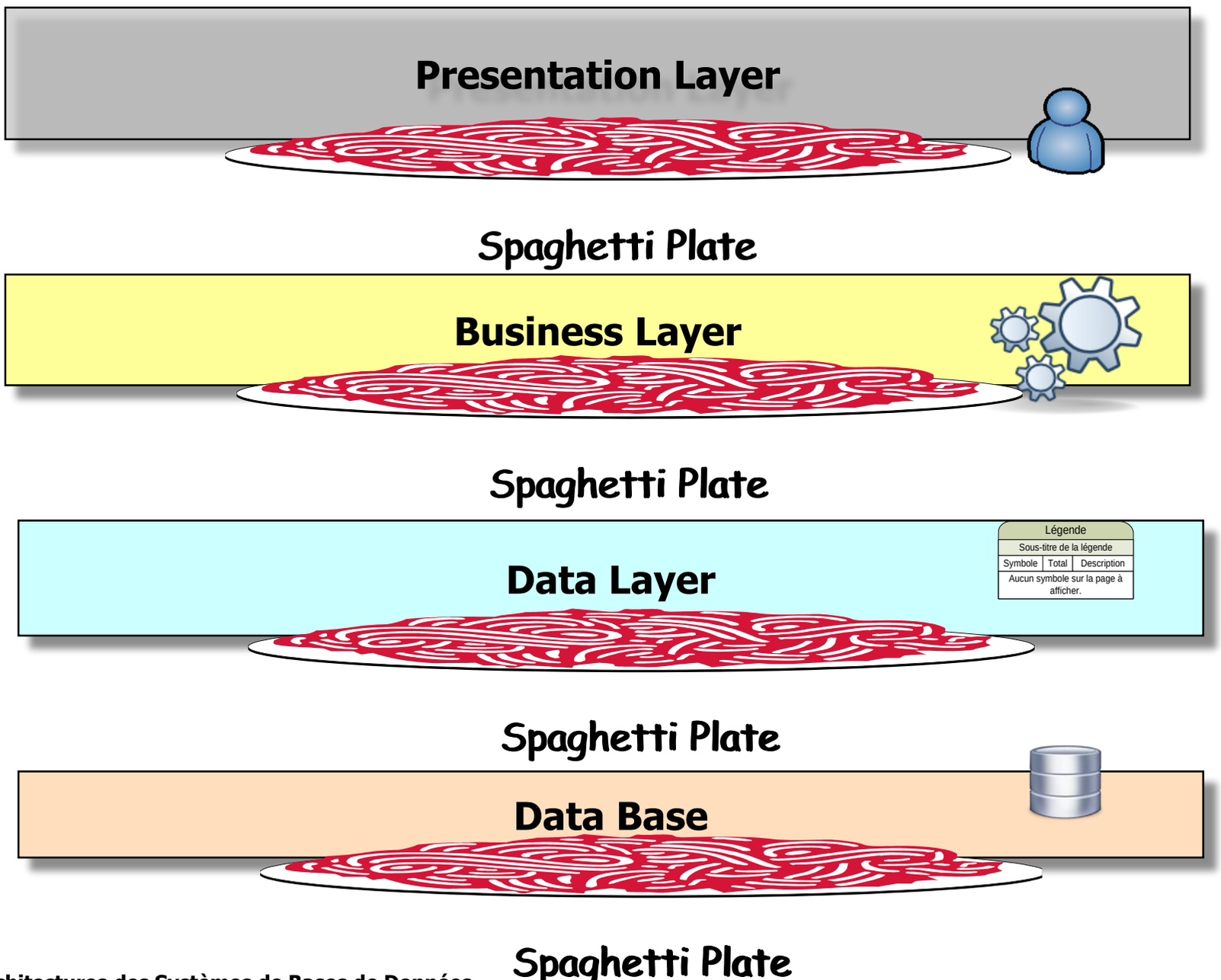
Layered Architecture



Layered Architecture

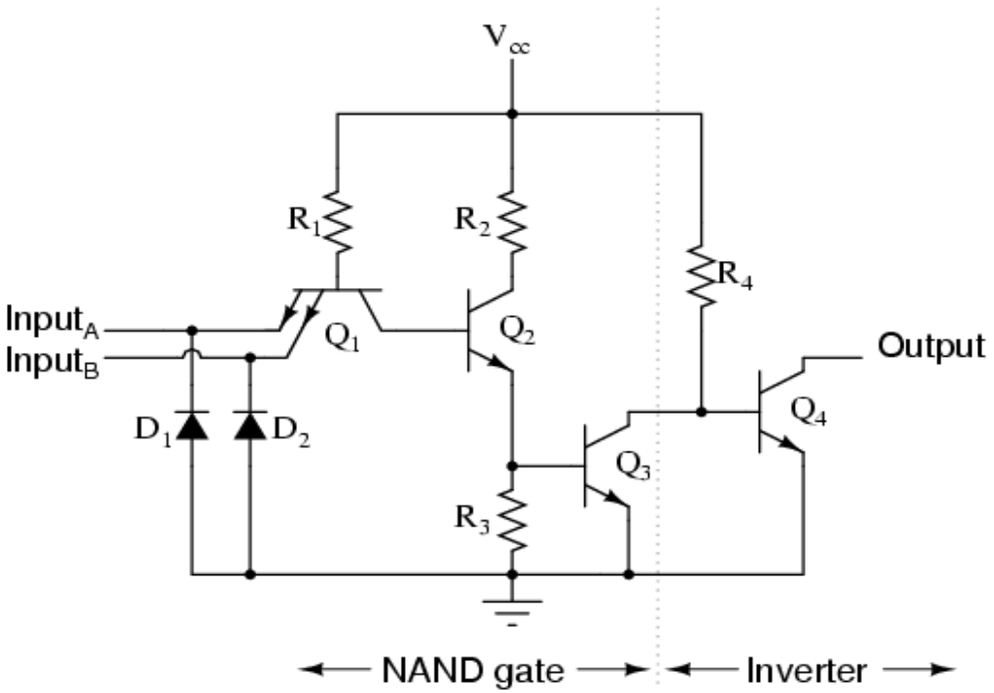


Layered Architecture

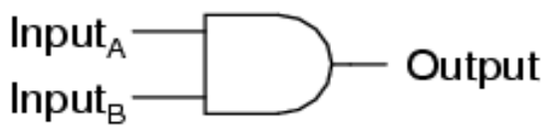


Analogie circuit électronique

AND gate with open-collector output



AND gate

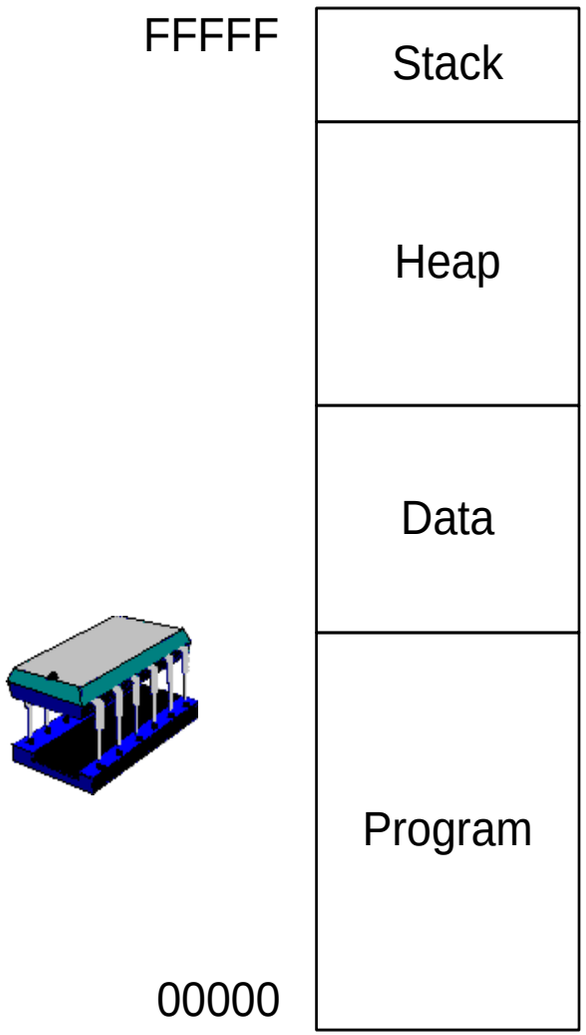


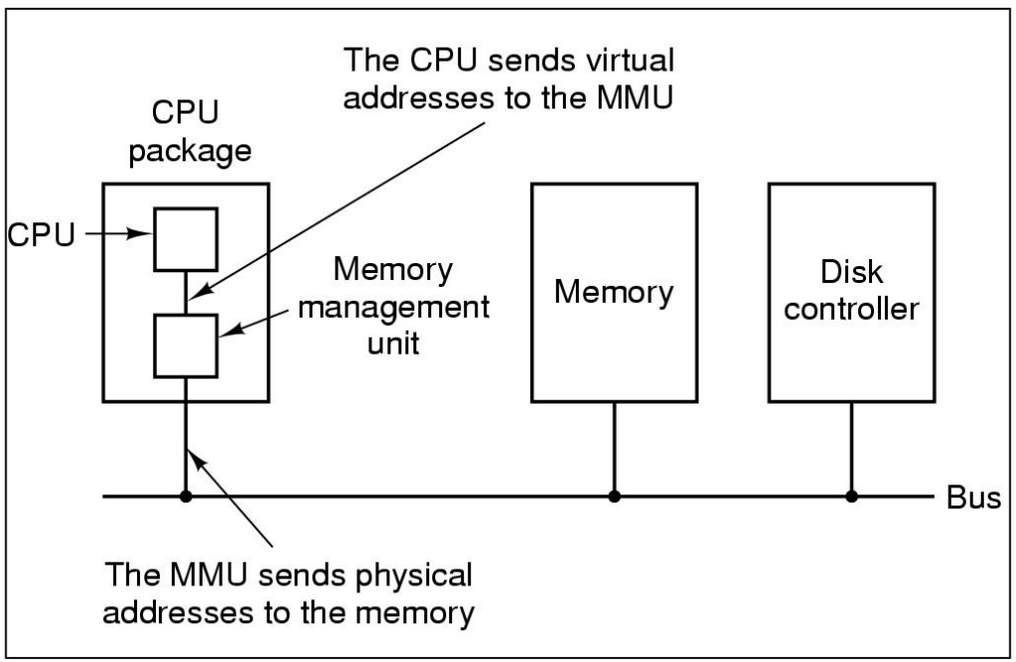
A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

Equivalent circuit

http://www.allaboutcircuits.com/vol_4/chpt_3/5.html

Process and Virtual Memory





Abstraction en couches (vues)

Application

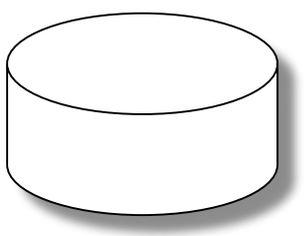
API

Couche Logique

Couche Physique

SQL

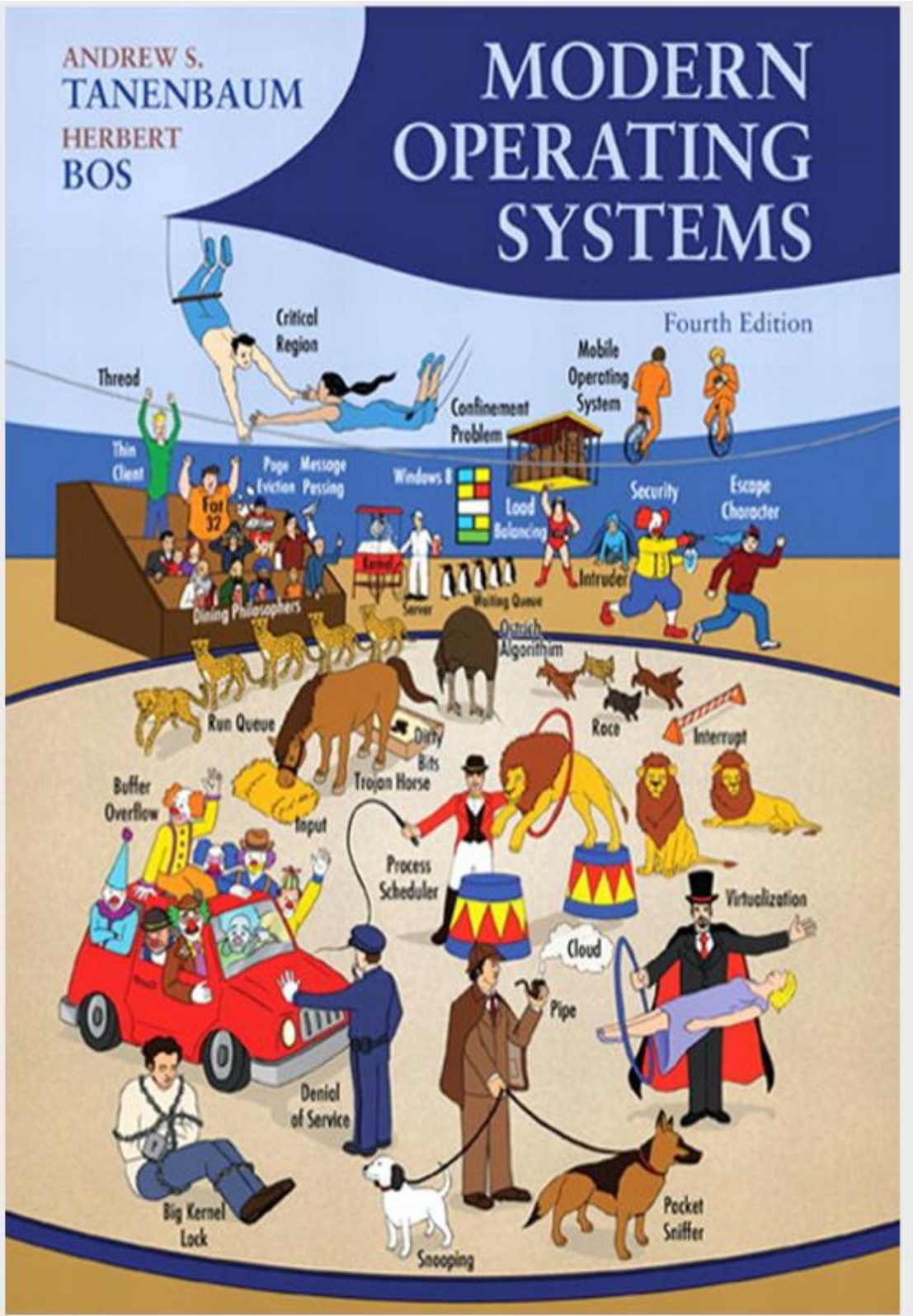
Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
Renault	Kangoo	Vert	RL	56000	1999	Boucher
Renault	Kangoo	Noir	RL	12000	1987	Fayard
Peugeot	106	Grise	KID	75600	2006	Gentil
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard



API : Application Programming Interface

Traduction en cours

A.S.T


ANDREW S.
TANENBAUM
HERBERT
BOS
MODERN
OPERATING
SYSTEMS
Fourth Edition
Critical Region
Thread
Thin Client
Page Eviction
Message Passing
Confinement Problem
Mobile Operating System
Windows 8
Load Balancing
Security
Escape Character
Intruder
Dining Philosophers
Server
Waiting Queue
Kernel
Dijkstra's Algorithm
Run Queue
Race
Interrupt
Dirty Bits
Trojan Horse
Buffer Overflow
Input
Process Scheduler
Virtualization
Cloud
Pipe
Denial of Service
Big Kernel Lock
Snooping
Pocket Sniffer

Abstraction en couches (vues)

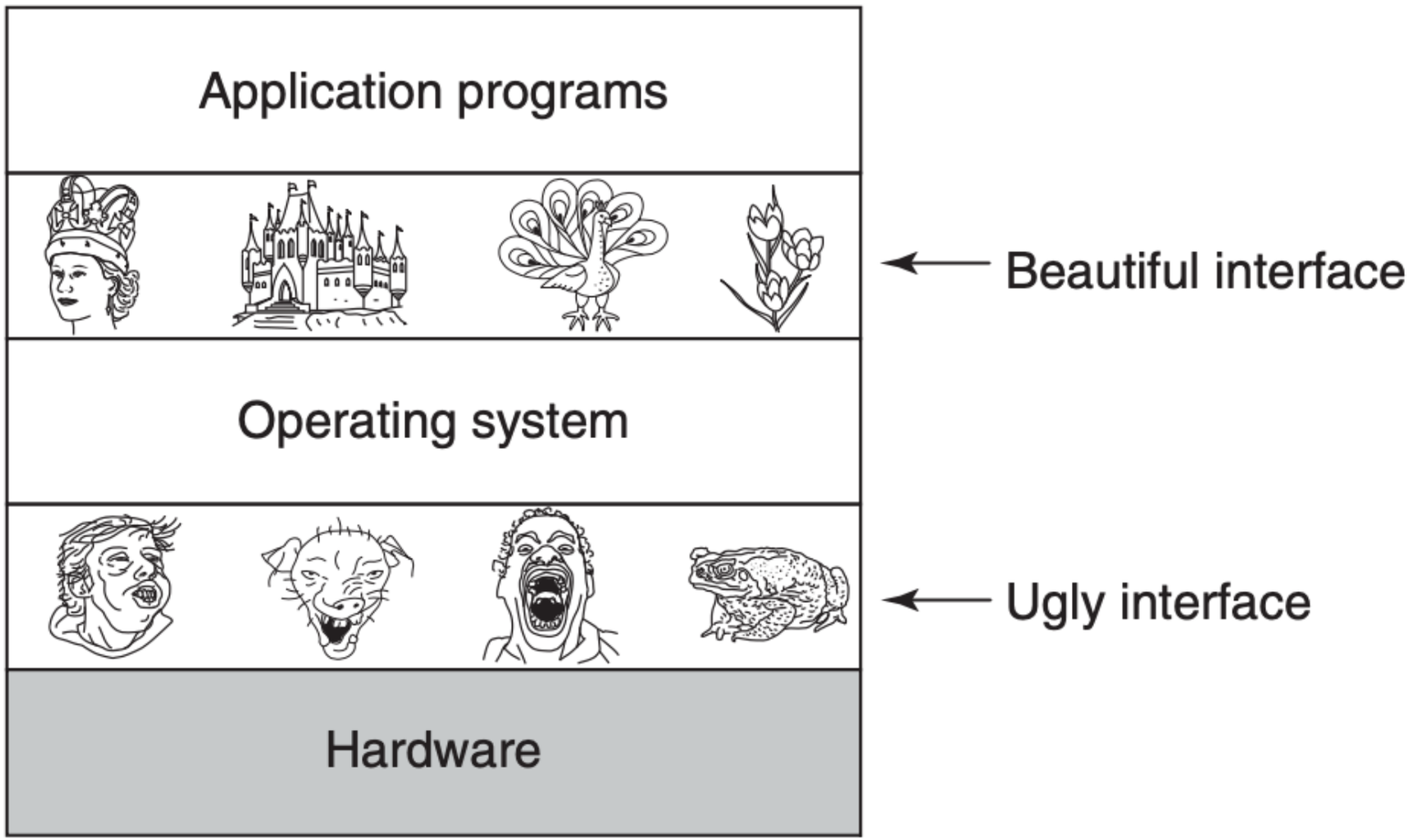
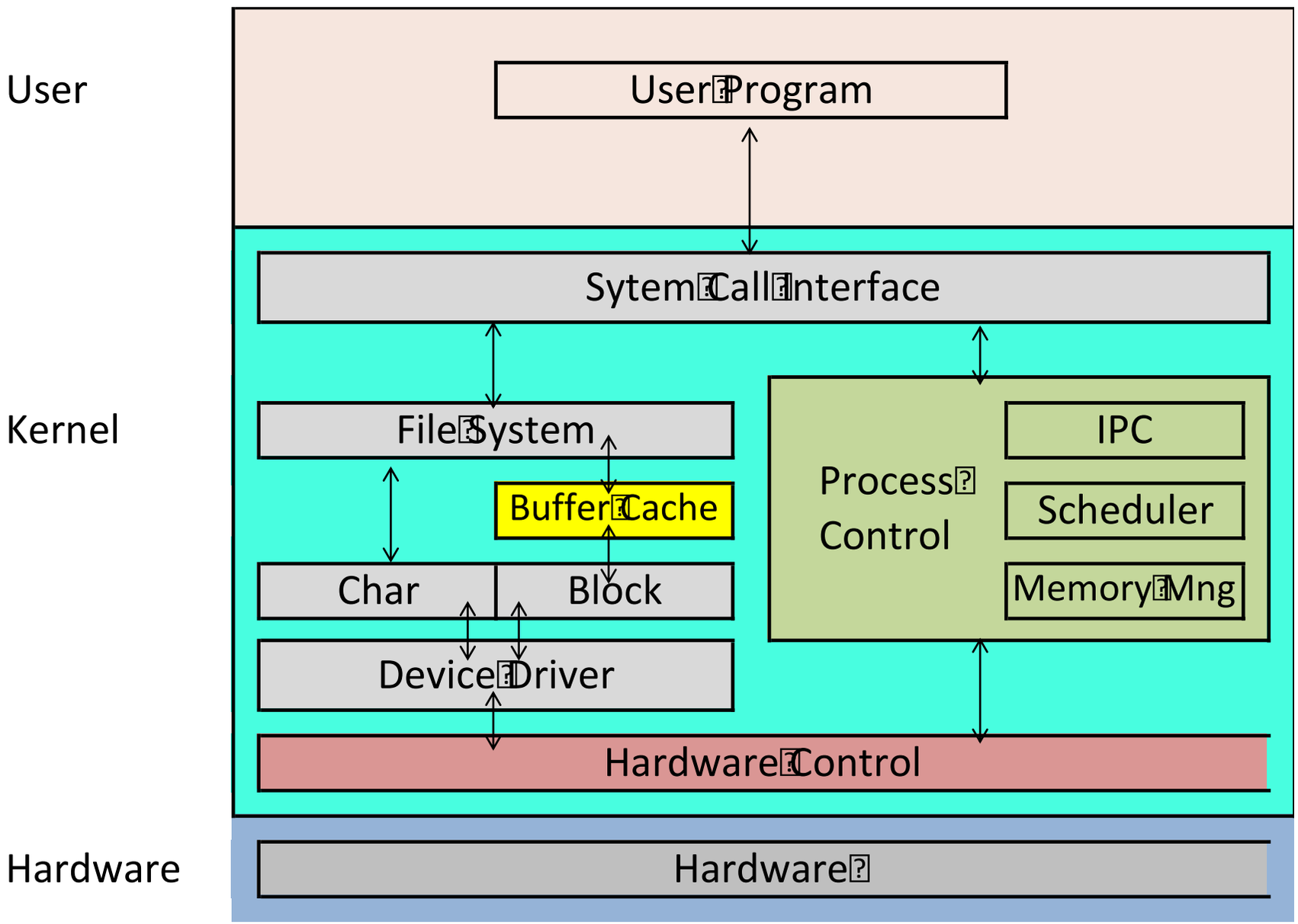


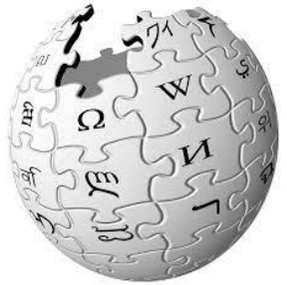
Figure 1-2. Operating systems turn ugly hardware into beautiful abstractions.

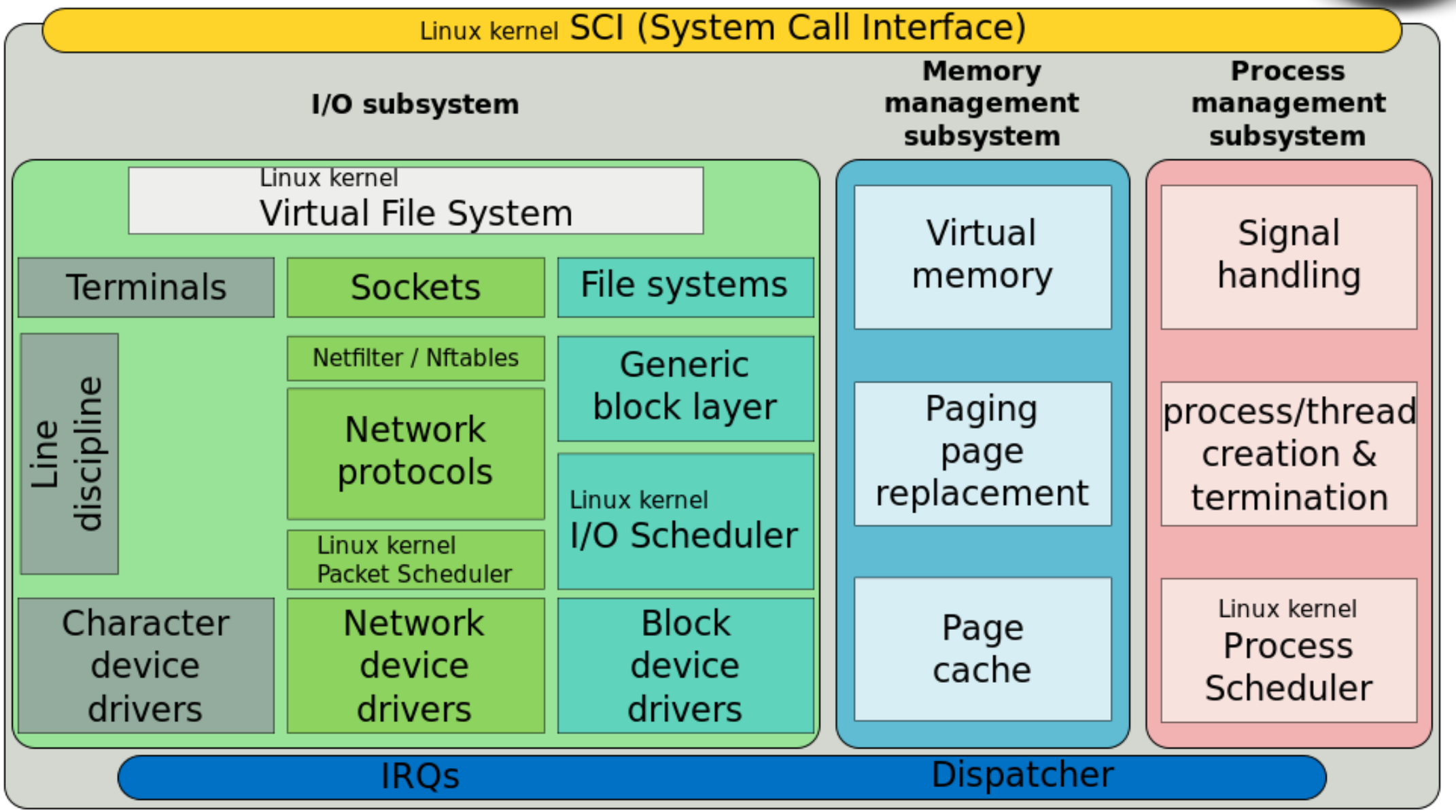
Traduction en cours

Operating System

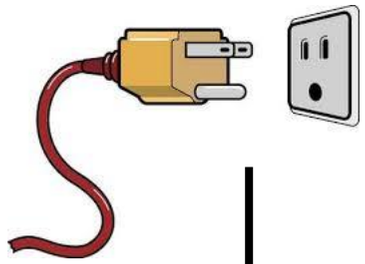


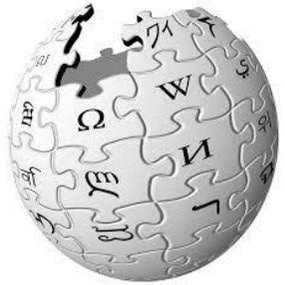
Linux




Linux kernel SCI (System Call Interface)
I/O subsystem
Memory management subsystem
Process management subsystem
Linux kernel
Virtual File System
Terminals
Sockets
File systems
Line discipline
Netfilter / Nftables
Network protocols
Linux kernel
Packet Scheduler
Generic block layer
Linux kernel
I/O Scheduler
Character device drivers
Network device drivers
Block device drivers
Virtual memory
Paging page replacement
Page cache
Signal handling
process/thread creation & termination
Linux kernel
Process Scheduler
IRQs
Dispatcher

Linux





Linux kernel SCI (System Call Interface)

I/O subsystem

Memory management subsystem

Process management subsystem

Linux kernel
Virtual File System

Terminals

Sockets

File systems

Line discipline

Netfilter / Nftables

Network protocols

Linux kernel
Packet Scheduler

Generic block layer

Linux kernel
I/O Scheduler

Character device drivers

Network device drivers

Block device drivers

Virtual memory

Paging page replacement

Page cache

Signal handling

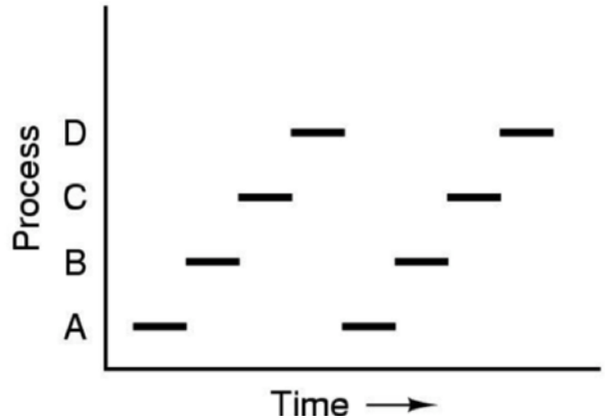
process/thread creation & termination

Linux kernel
Process Scheduler

IRQs

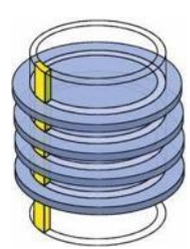
Dispatcher

I/O



User Mode

Kernel Mode



A File

User Mode

Kernel Mode

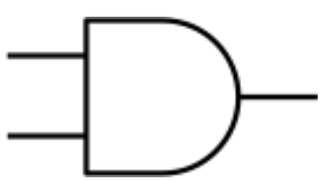
A File

User Mode

Kernel Mode

File

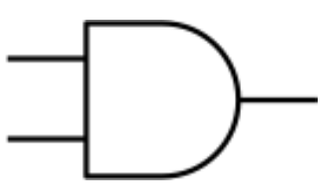
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24

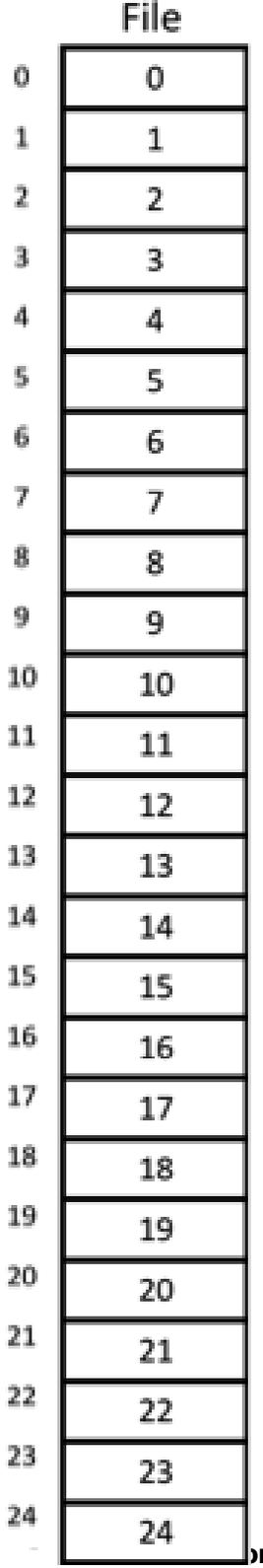


A File

User Mode

File



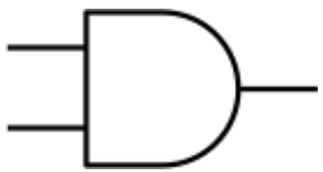


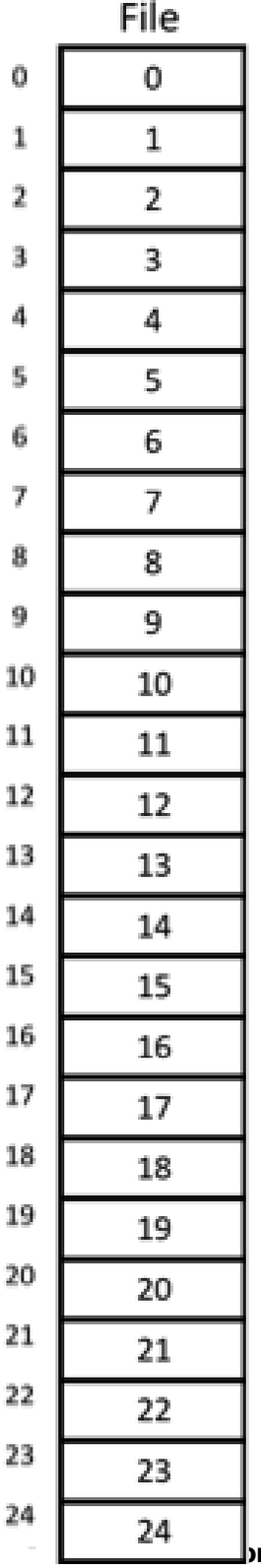
Kernel Mode

A File

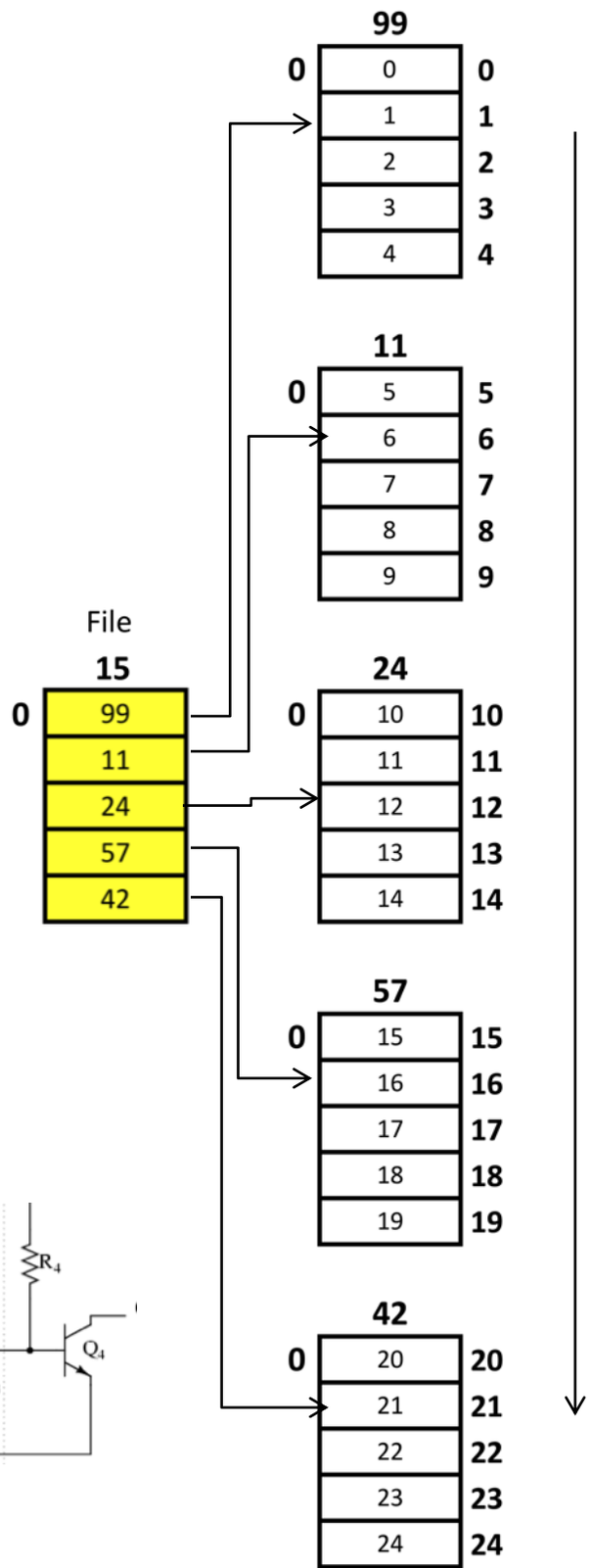
User Mode

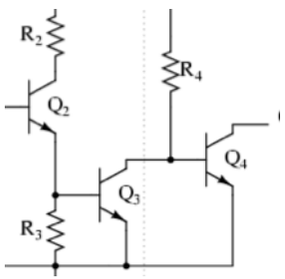
File





Kernel Mode

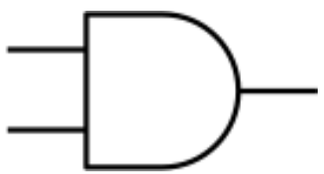


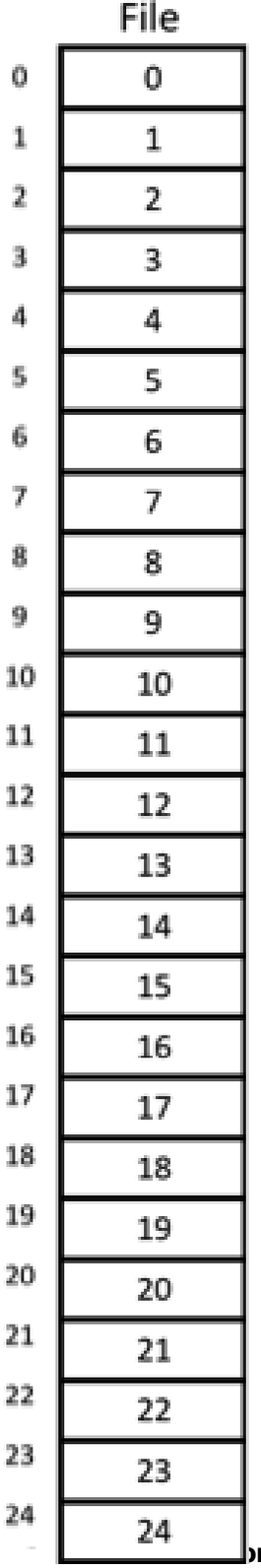


A File

User Mode

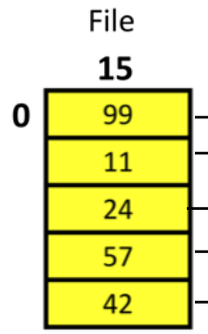
File

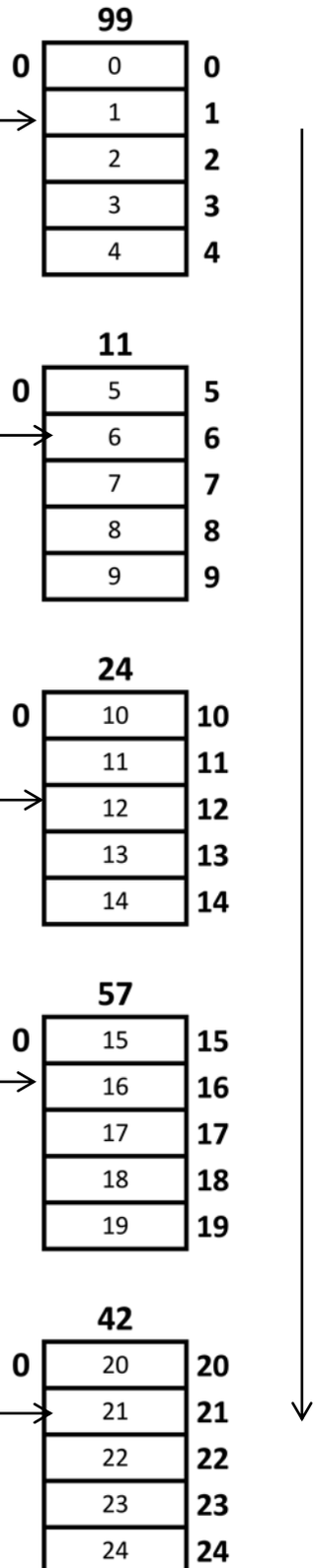


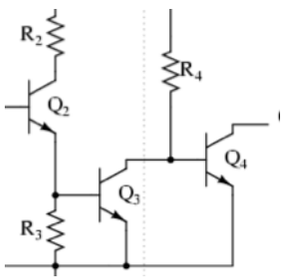


Kernel Mode

File Descriptor



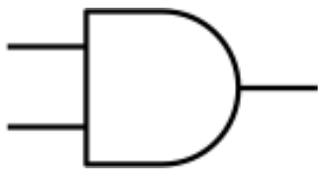


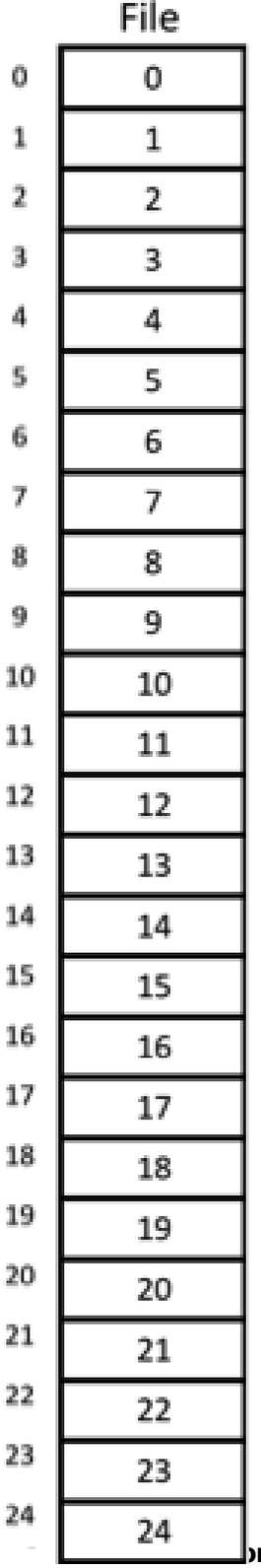


A File

User Mode

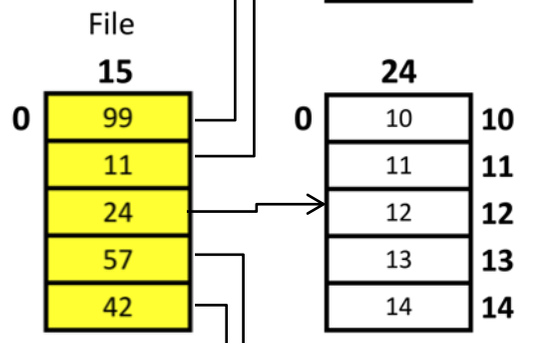
File

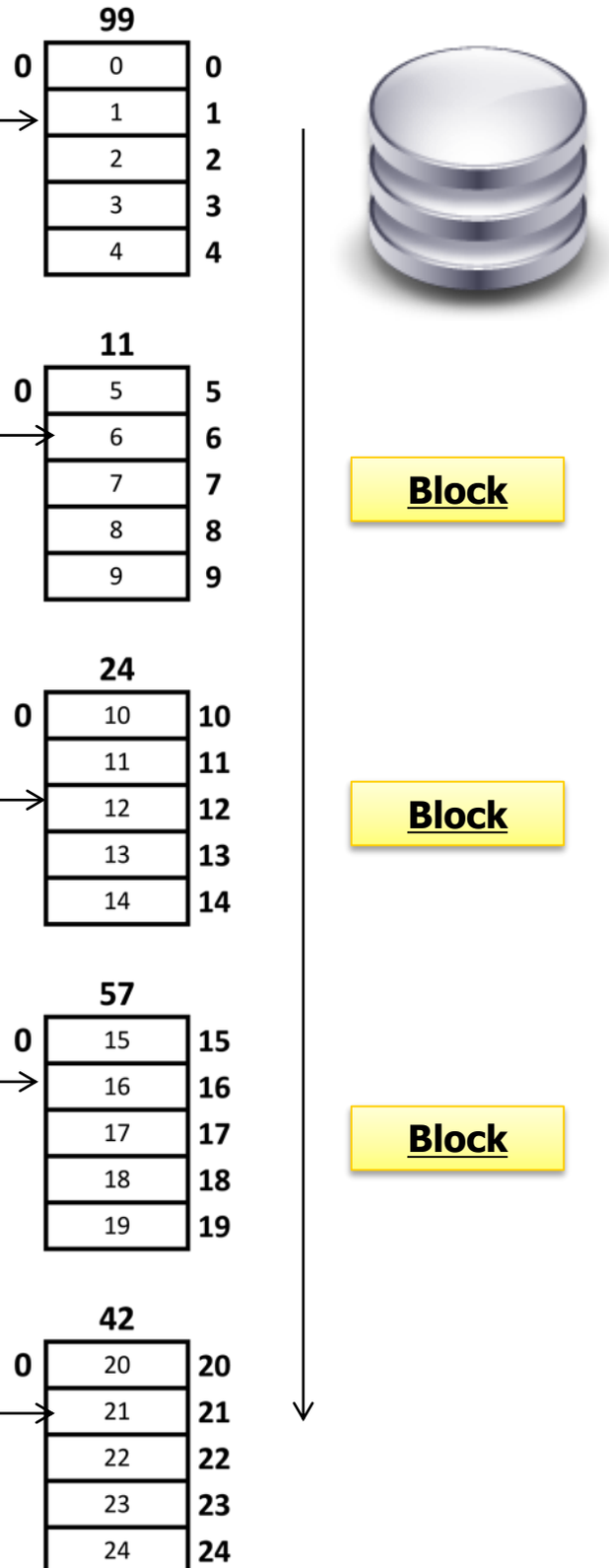


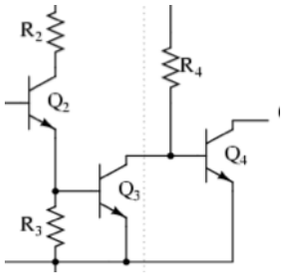


Kernel Mode

File Descriptor







Block

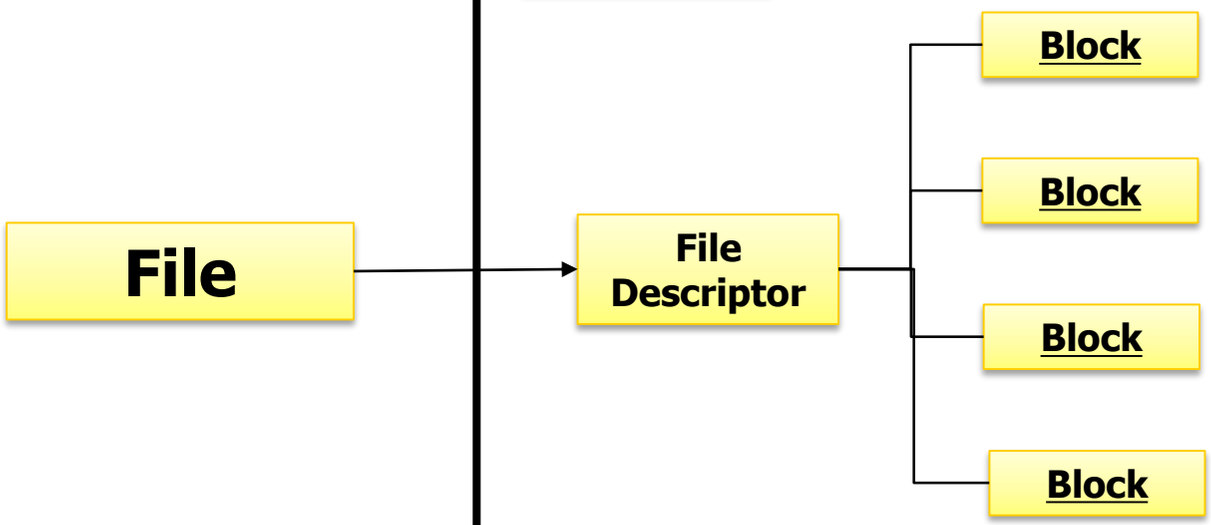
Block

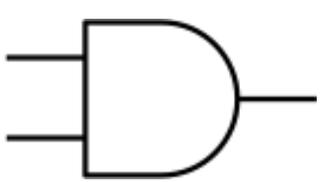
Block

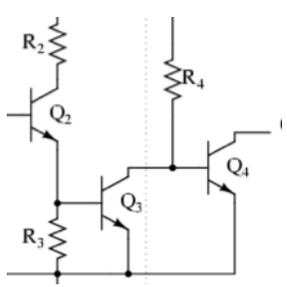
A File

User Mode

Kernel Mode







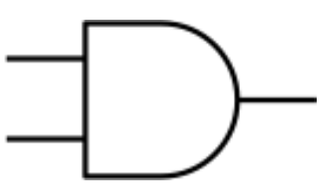
A File

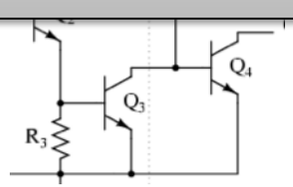
User Mode

Kernel Mode

File → **File Descriptor** → **Block**, **Block**, **Block**, **Block**

To indicate an instance of a class its name must be underlined.





A File

User Mode

Kernel Mode

I/O

File

File Descriptor

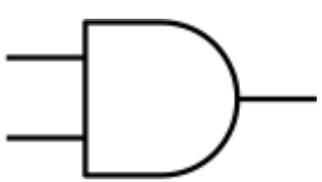
Block

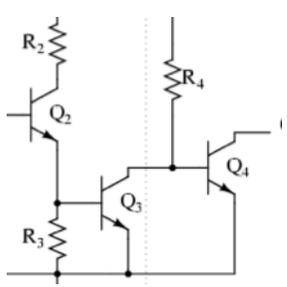
Block

Block

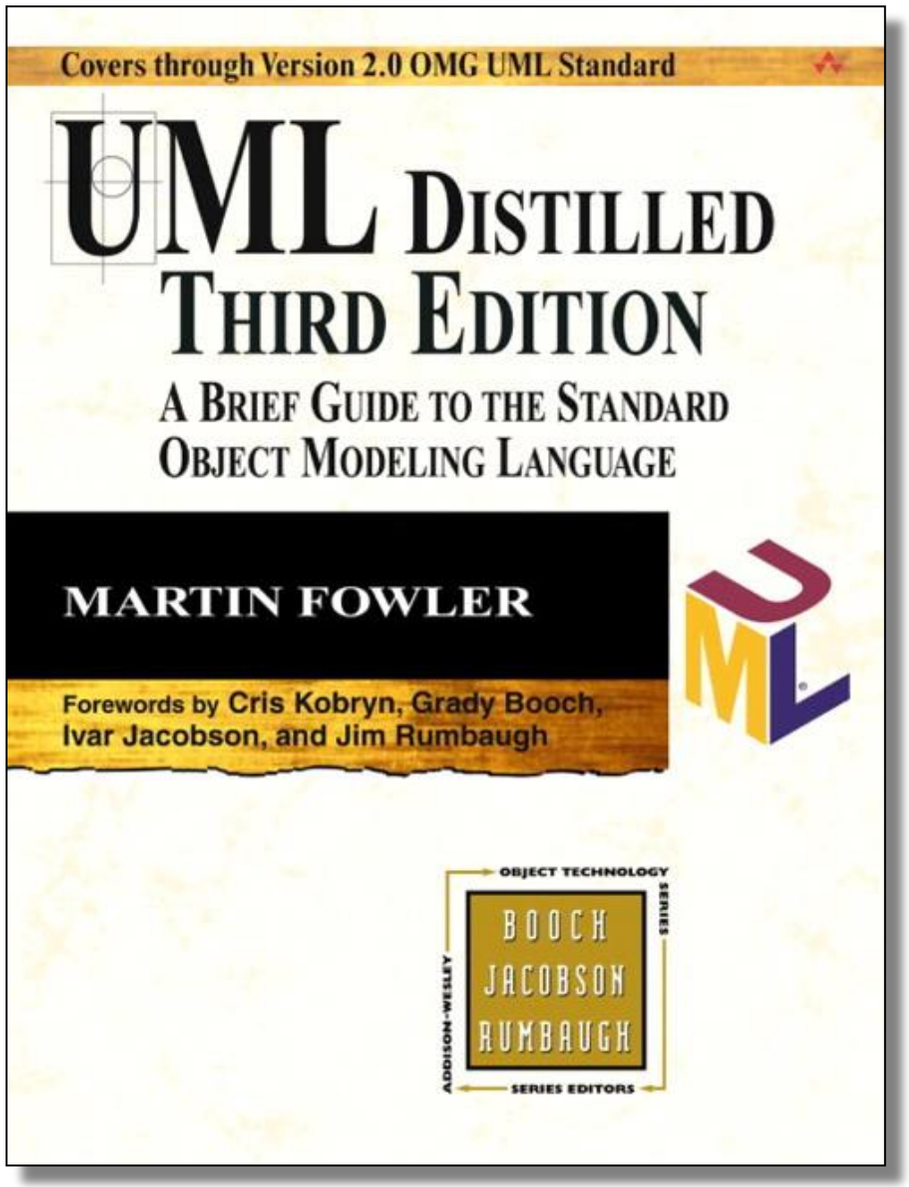
Block

Disk





Martin Fowler (1997)



A File

User Mode

Kernel Mode

I/O

File

File Descriptor

Block

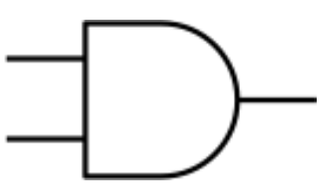
Block

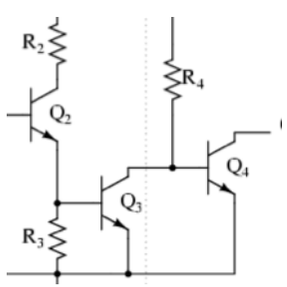
Block

Block

Disk

Join





A Query

User Mode

Kernel Mode

I/O

File

File Descriptor

Block

Block

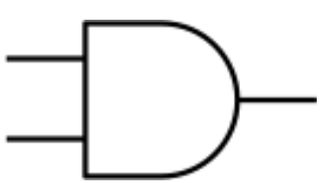
Block

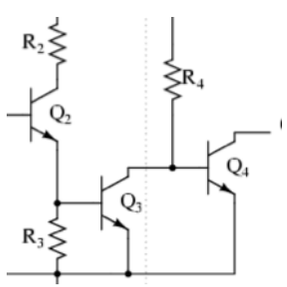
Block

Disk

Query

Join





A Query

User Mode

Kernel Mode

I/O

File

File Descriptor

Block

Block

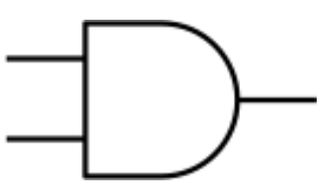
Block

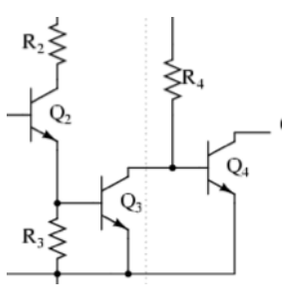
Block

Disk

Query

Join





A Query

User Mode

Kernel Mode

I/O

File

File Descriptor

Block

Block

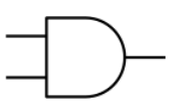
Block

Block

Disk

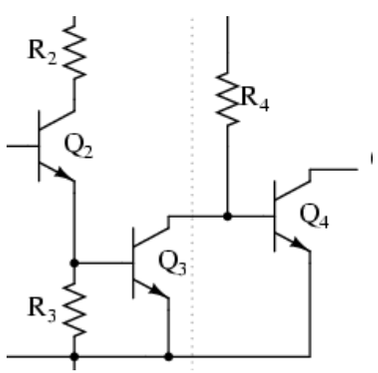
Query

Join

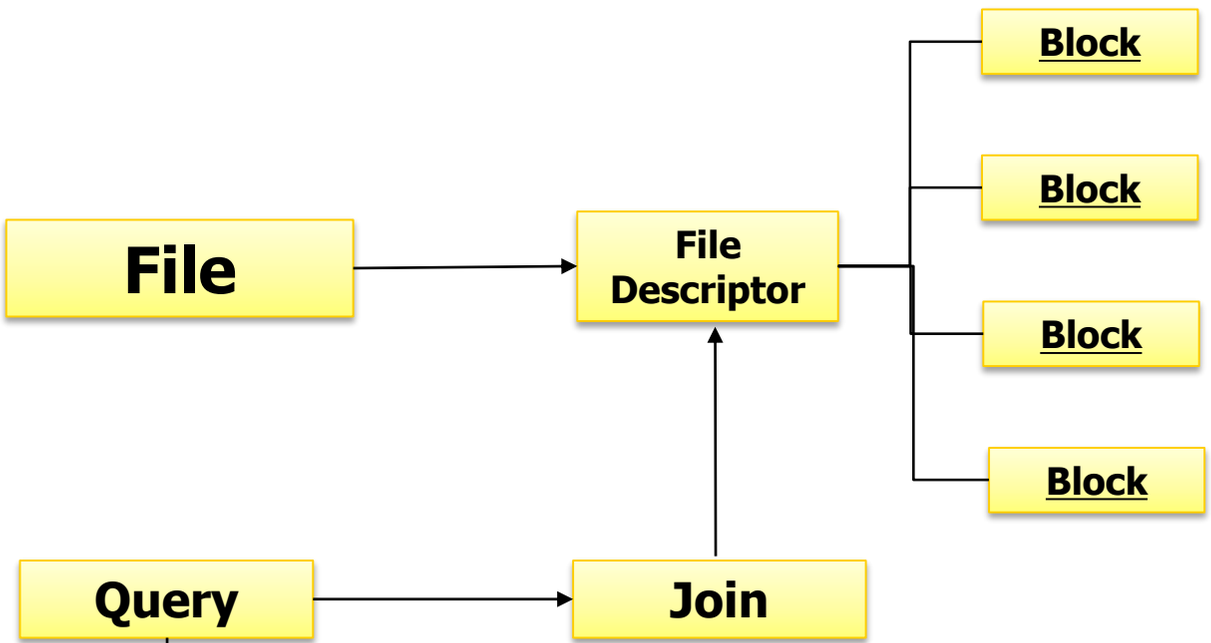


Table

Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
Renault	Kangoo	Vert	RL	56000	1999	Boucher
Renault	Kangoo	Noir	RL	12000	1987	Fayard
Peugeot	106	Grise	KID	75600	2006	Gentil
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

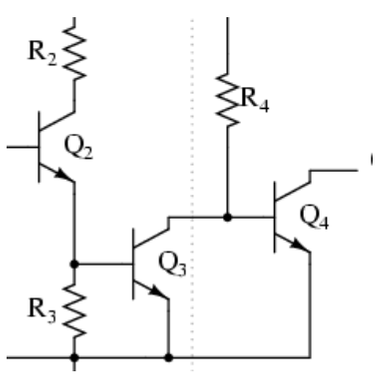


A Query



Disk

Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
Renault	Kangoo	Vert	RL	56000	1999	Boucher
Renault	Kangoo	Noir	RL	12000	1987	Fayard
Peugeot	106	Grise	KID	75600	2006	Gentil
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard



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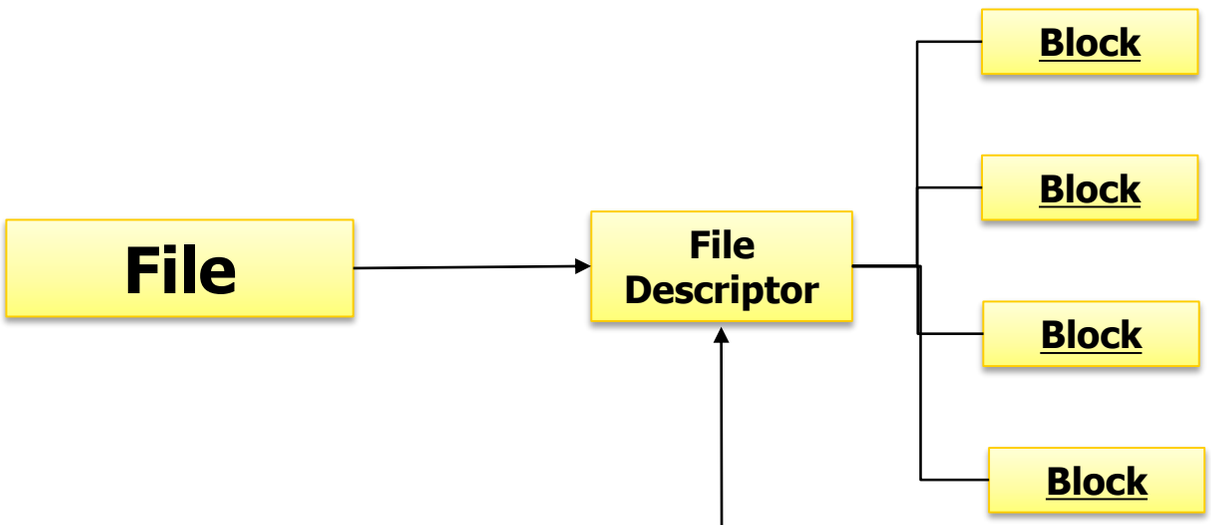
A Query



Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
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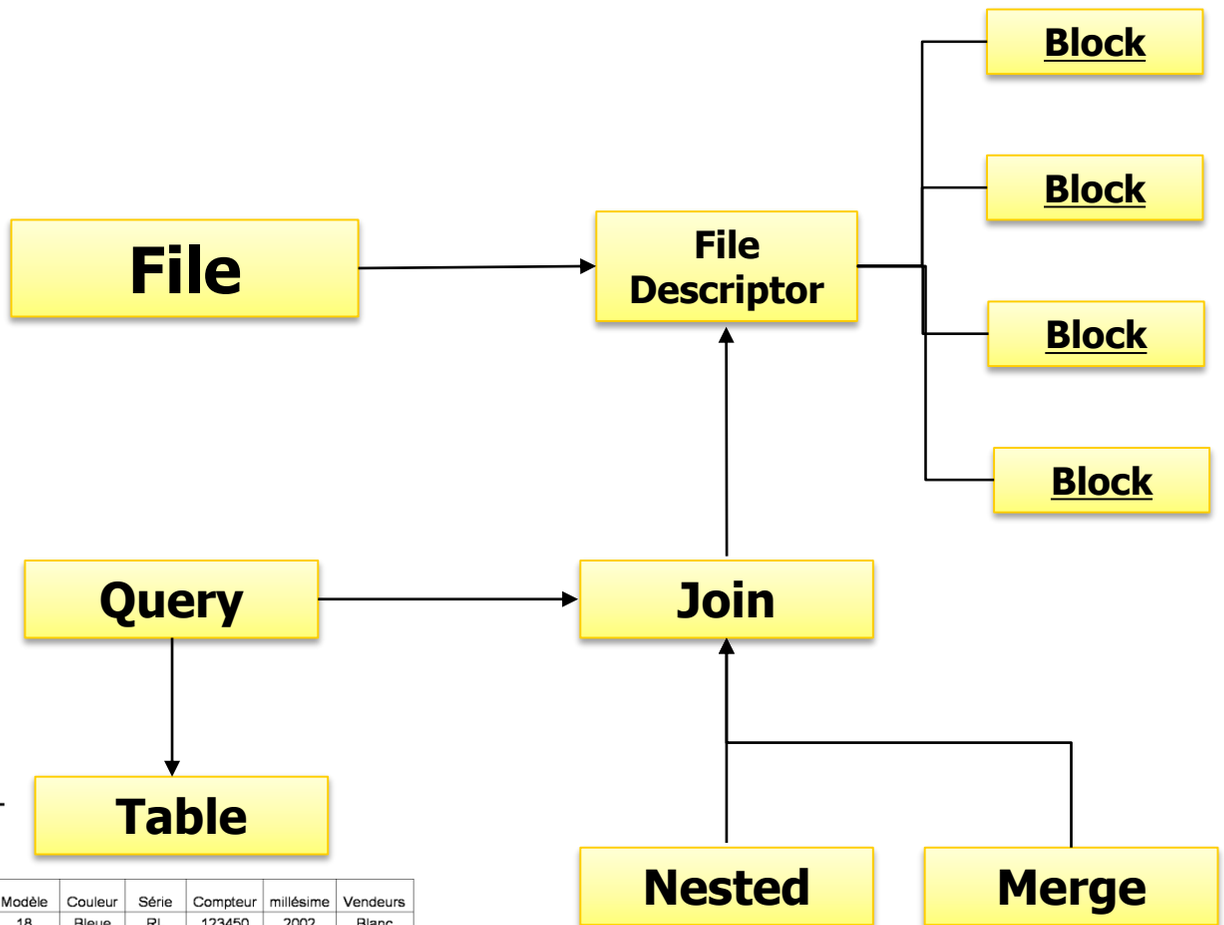
Peugeot	106	Grise	KID	75600	2006	Gentil
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

A Query



Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
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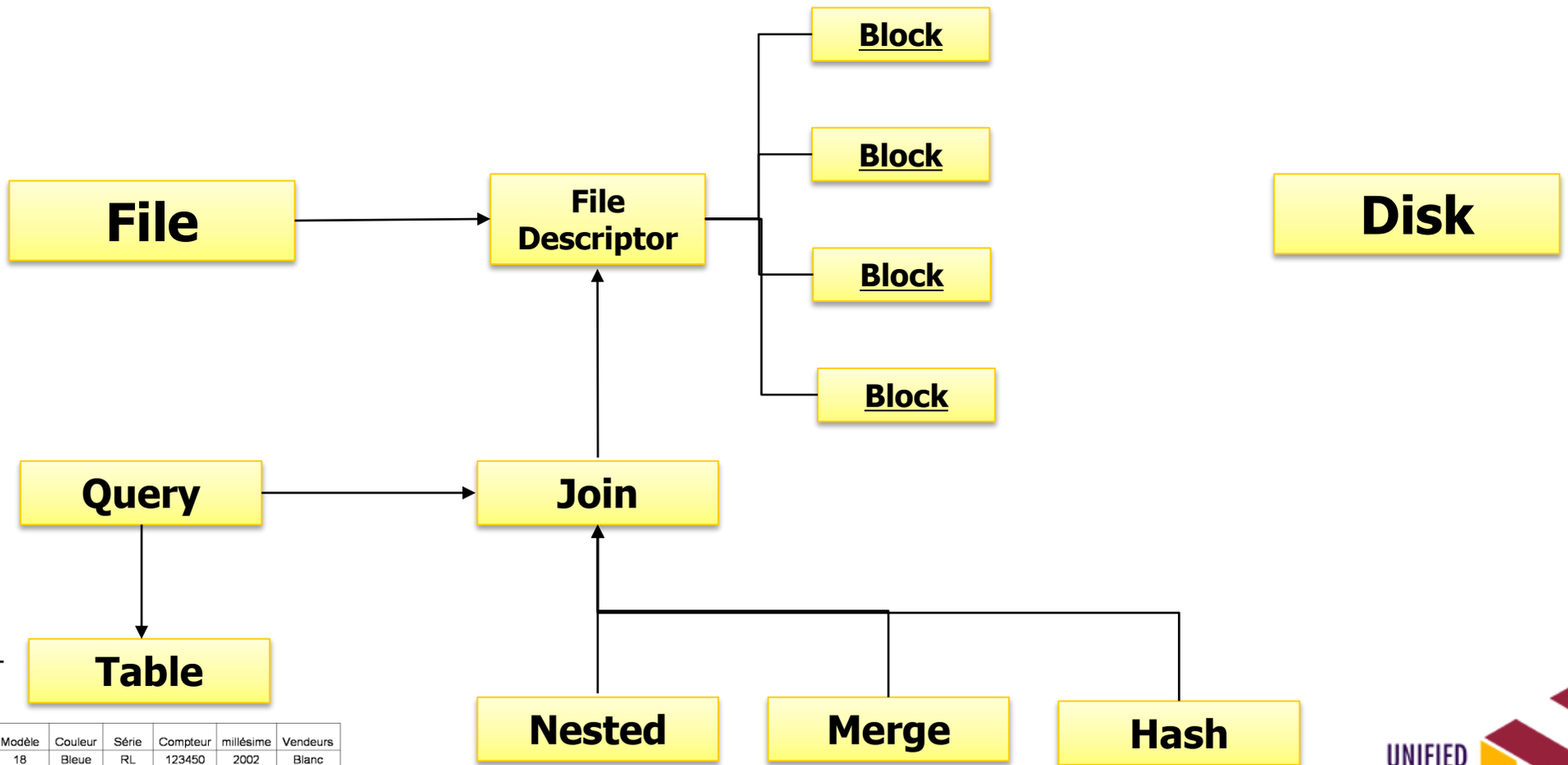
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

A Query



Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
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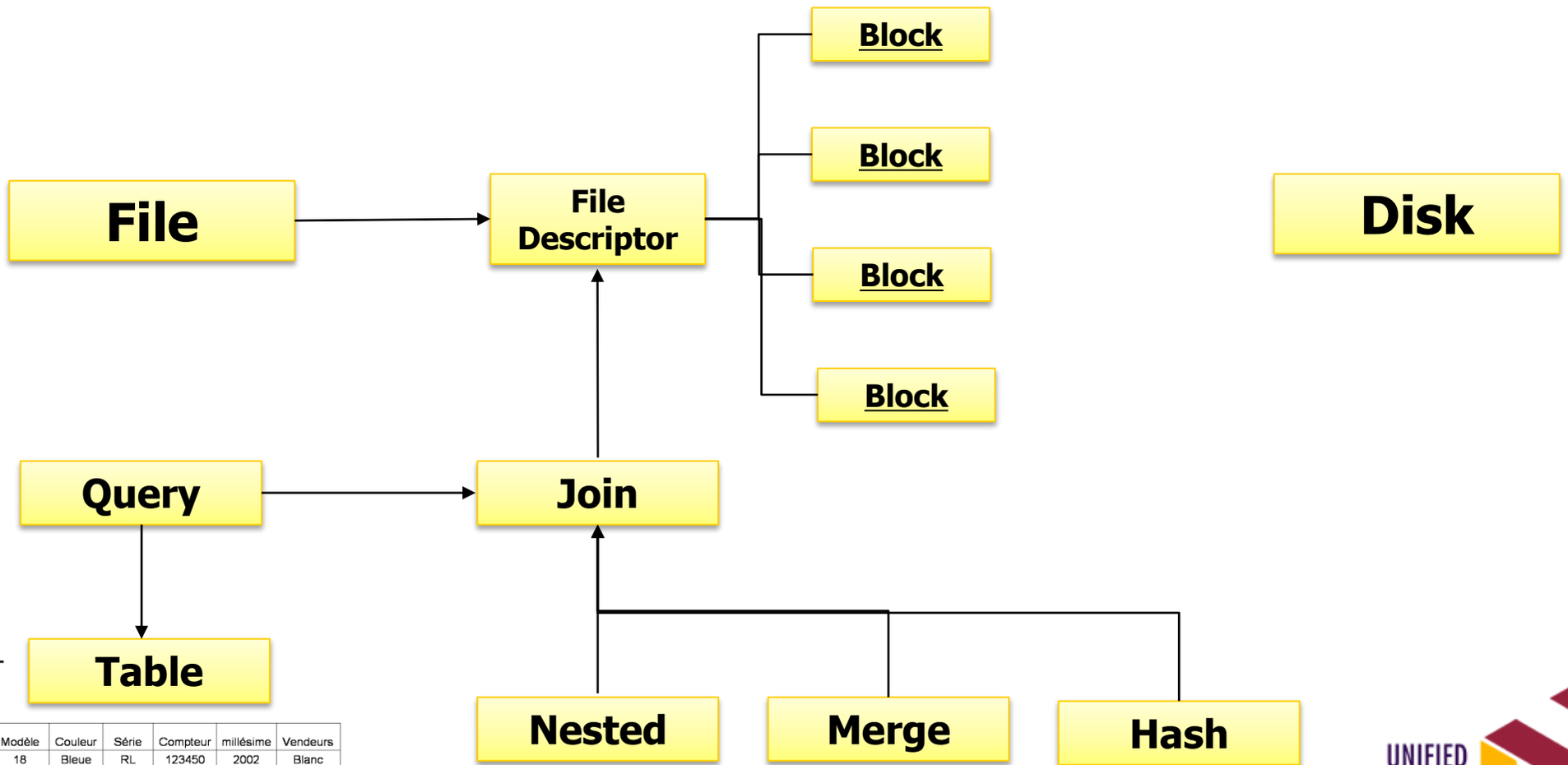
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

A UML Class Diagramm



Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
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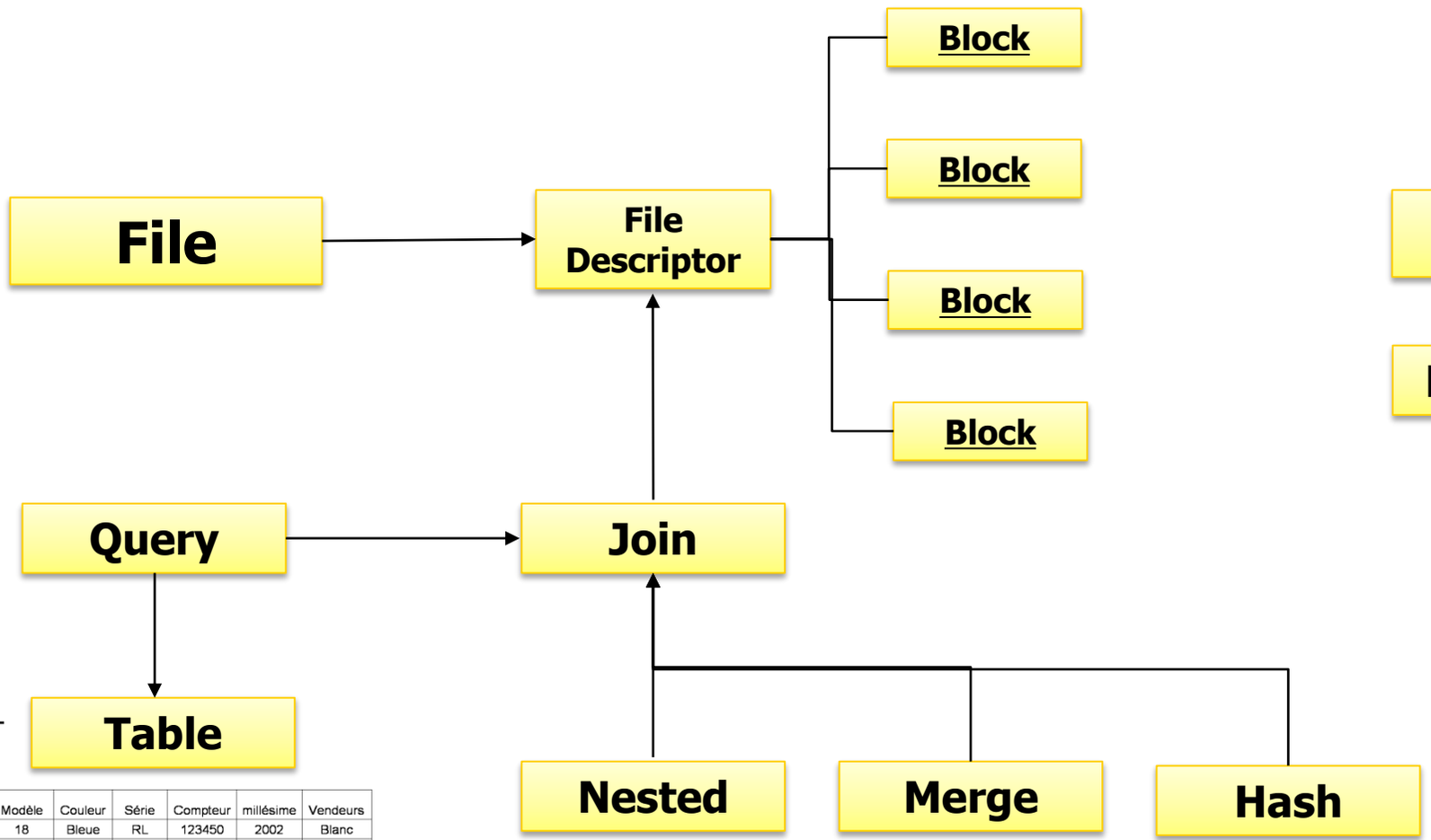
Renault	Kangoo	Noir	RL	12000	1987	Fayard
Peugeot	106	Grise	KID	75600	2006	Gentil
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

A UML Class Diagramm



Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
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Renault	Kangoo	Noir	RL	12000	1987	Fayard
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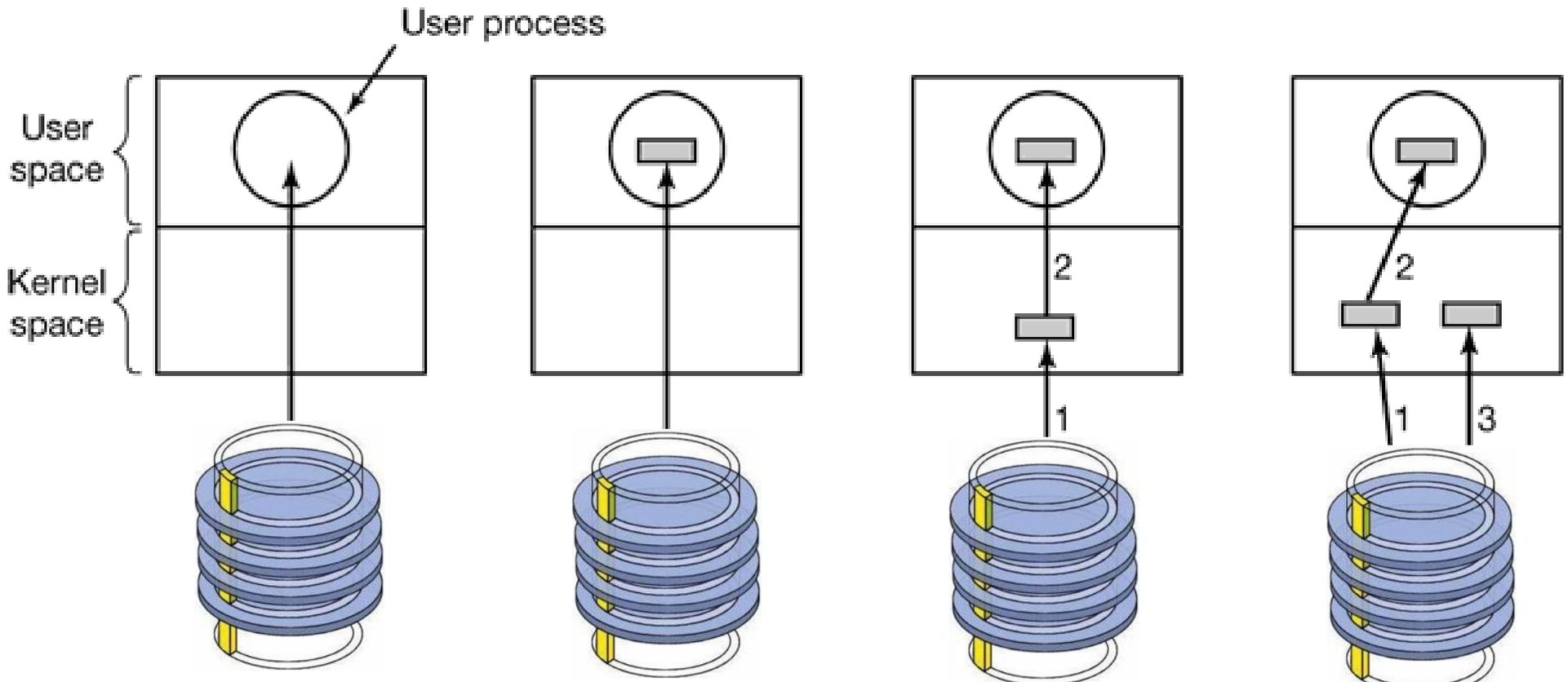
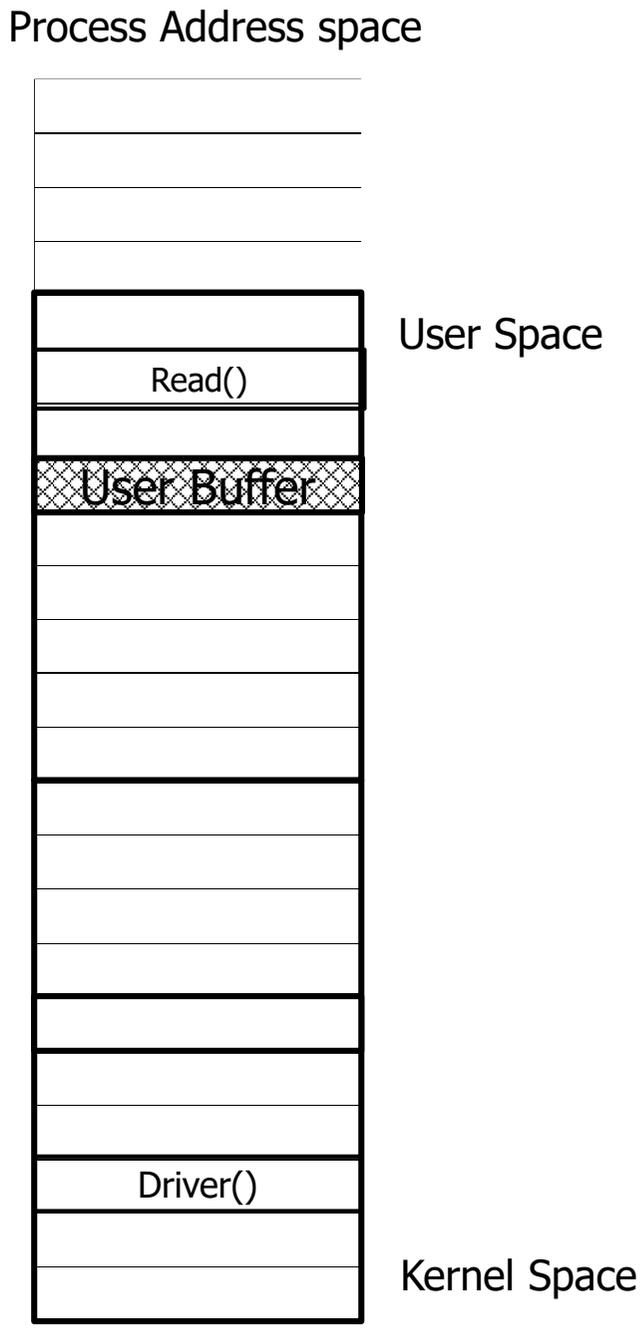
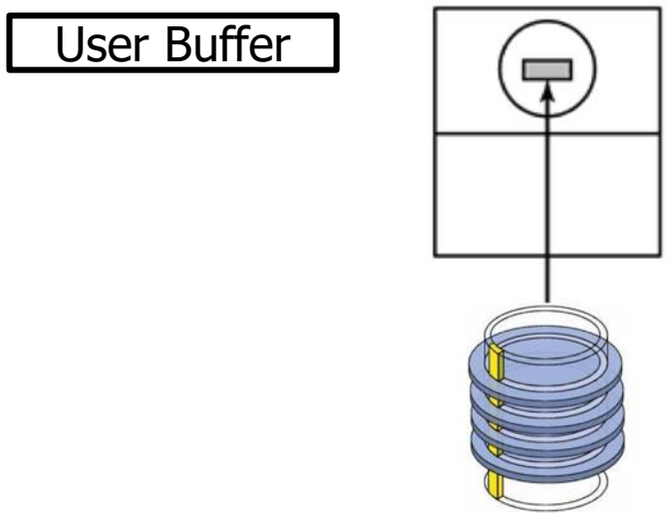
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

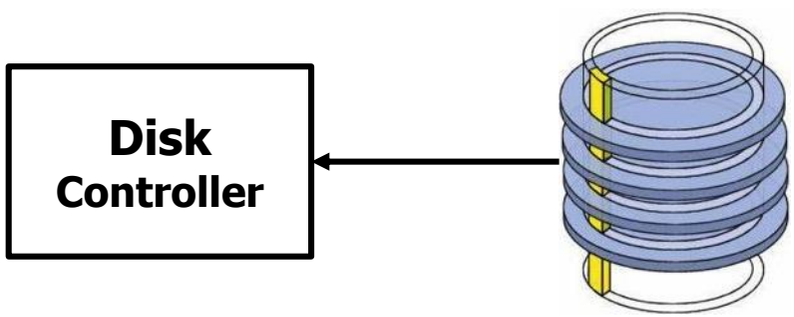
A.S.T : Buffer



I/O


Process Address space
User Space
Read()
User Buffer
Driver()
Kernel Space


User Buffer


Disk
Controller

A UML Class Diagramm

Buffers

Free Buffers

File

File Descriptor

Block

Block

Block

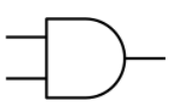
Block

Disk

Free Blocks

Query

Join



Table

Nested

Merge

Hash

Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
Renault	Kangoo	Vert	RL	56000	1999	Boucher
Renault	Kangoo	Noir	RL	12000	1987	Fayard
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Peugeot	309	Jaune	chorus	189500	2007	Germain
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Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

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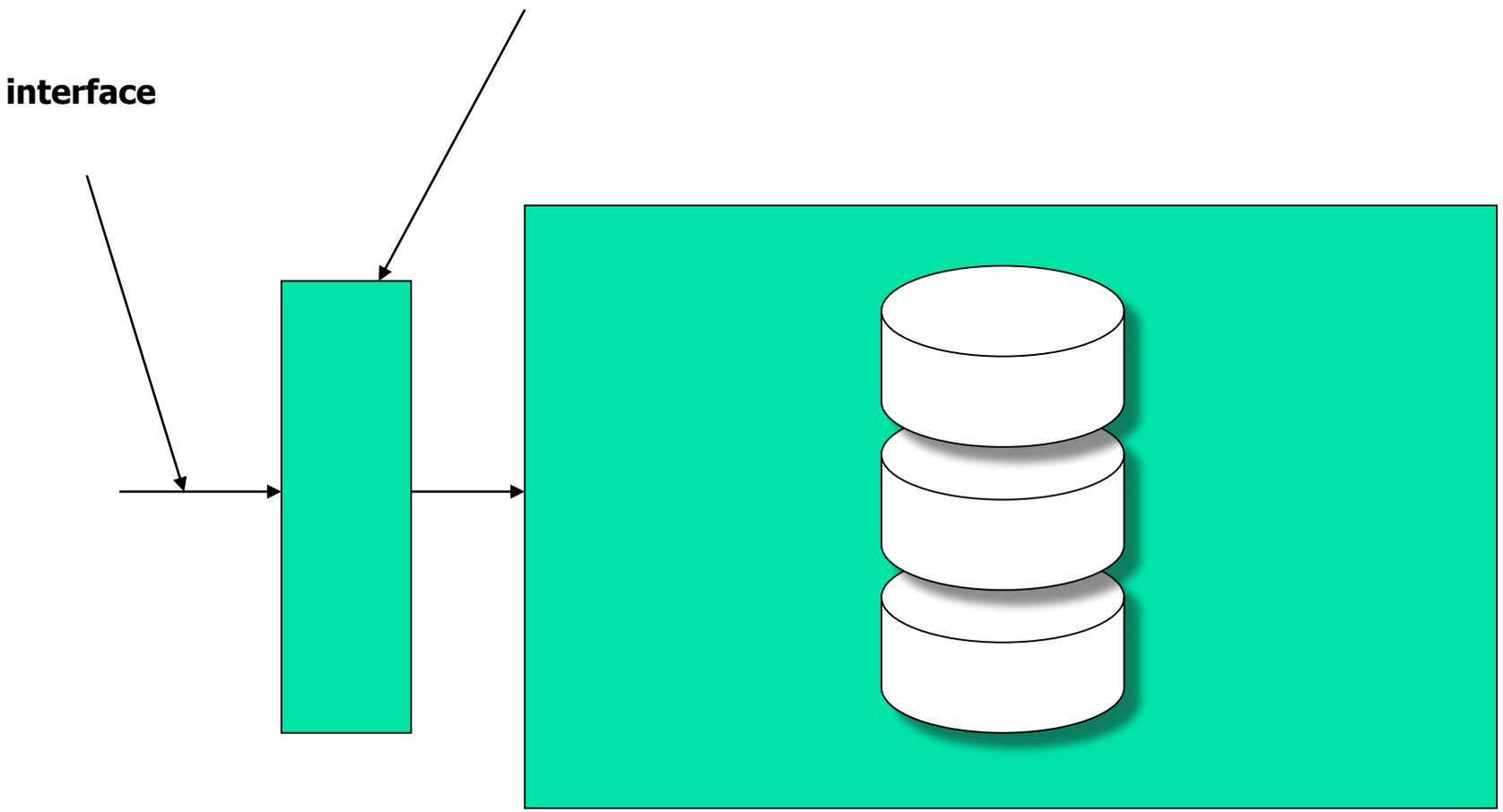
Encapsulation

Modèle = vue simplifiée



Traduction en cours

Encapsulation

Tables

Marque	Modèle	Couleur	Série	Compteur	millésime	Vendeurs
Renault	18	Bleue	RL	123450	2002	Blanc
Renault	Kangoo	Vert	RL	56000	1999	Boucher
Renault	Kangoo	Noir	RL	12000	1987	Fayard
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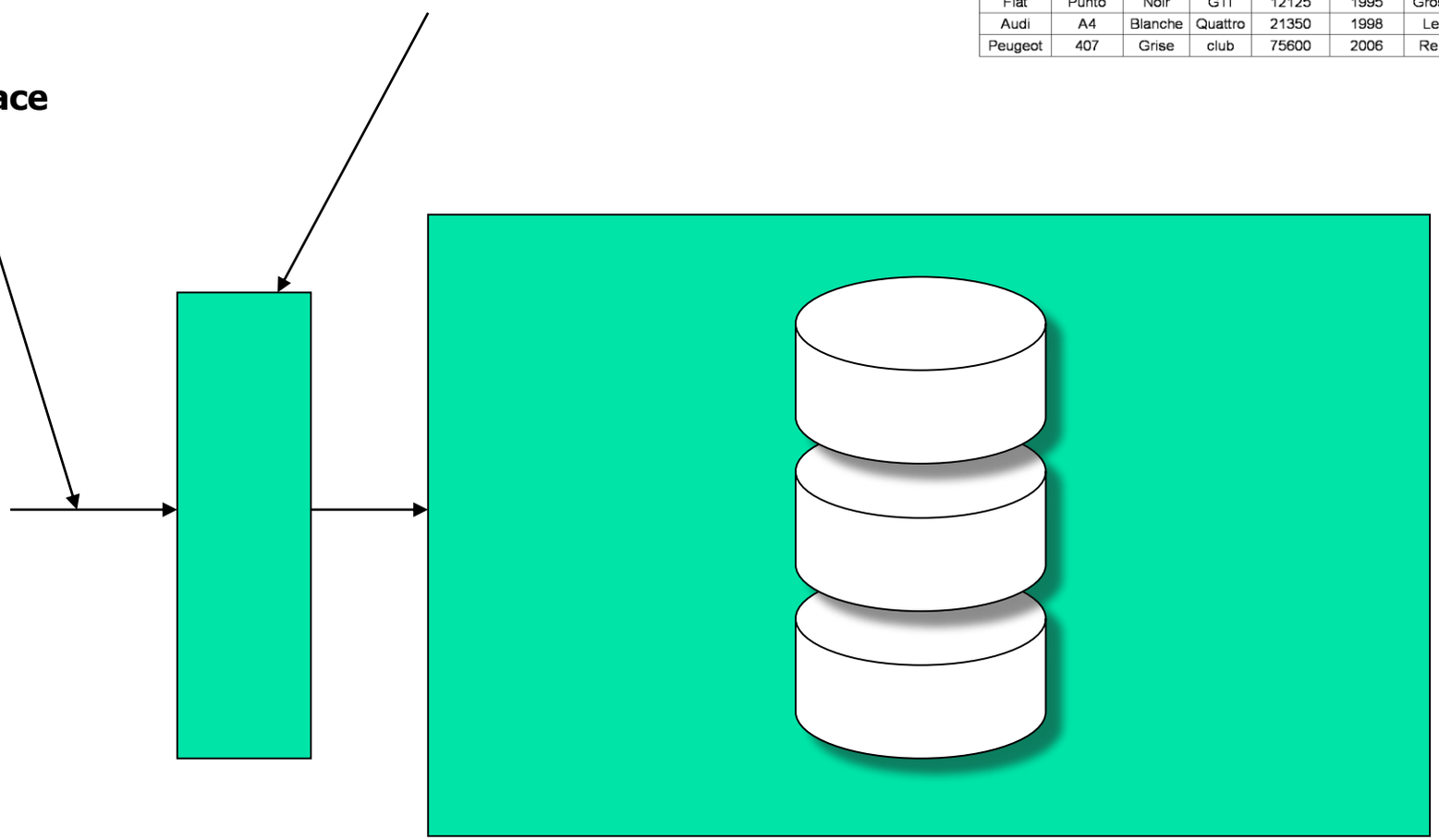
Peugeot	309	Jaune	chorus	189500	2007	Germain
Ford	Escort	Blanche	Match	225000	2002	Girard
Fiat	Punto	Noir	GTI	12125	1995	Grosjean
Audi	A4	Blanche	Quattro	21350	1998	Legoff
Peugeot	407	Grise	club	75600	2006	Renard

Modèle = vue simplifiée

interface



Fichiers

Traduction en cours

A File

User Mode

Kernel Mode

I/O

File

File Descriptor

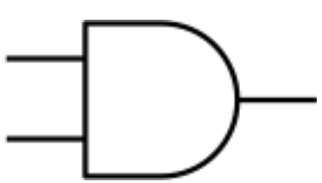
Block

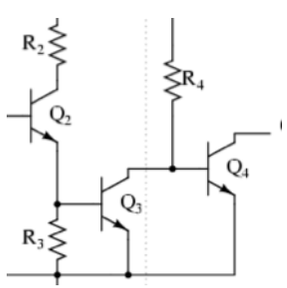
Block

Block

Block

Disk





A File

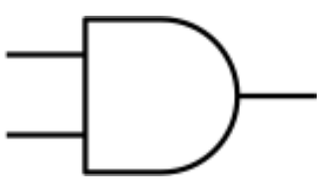
User Mode

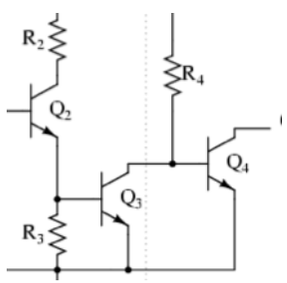
Kernel Mode

I/O

File → **File Descriptor** → **Block** | **Block** | **Block** | **Block**

Disk





A File

User Mode

Kernel Mode

I/O

File

File Descriptor

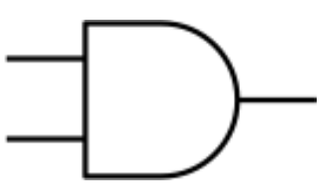
Block

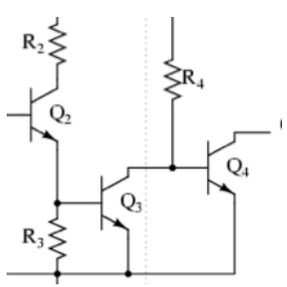
Block

Block

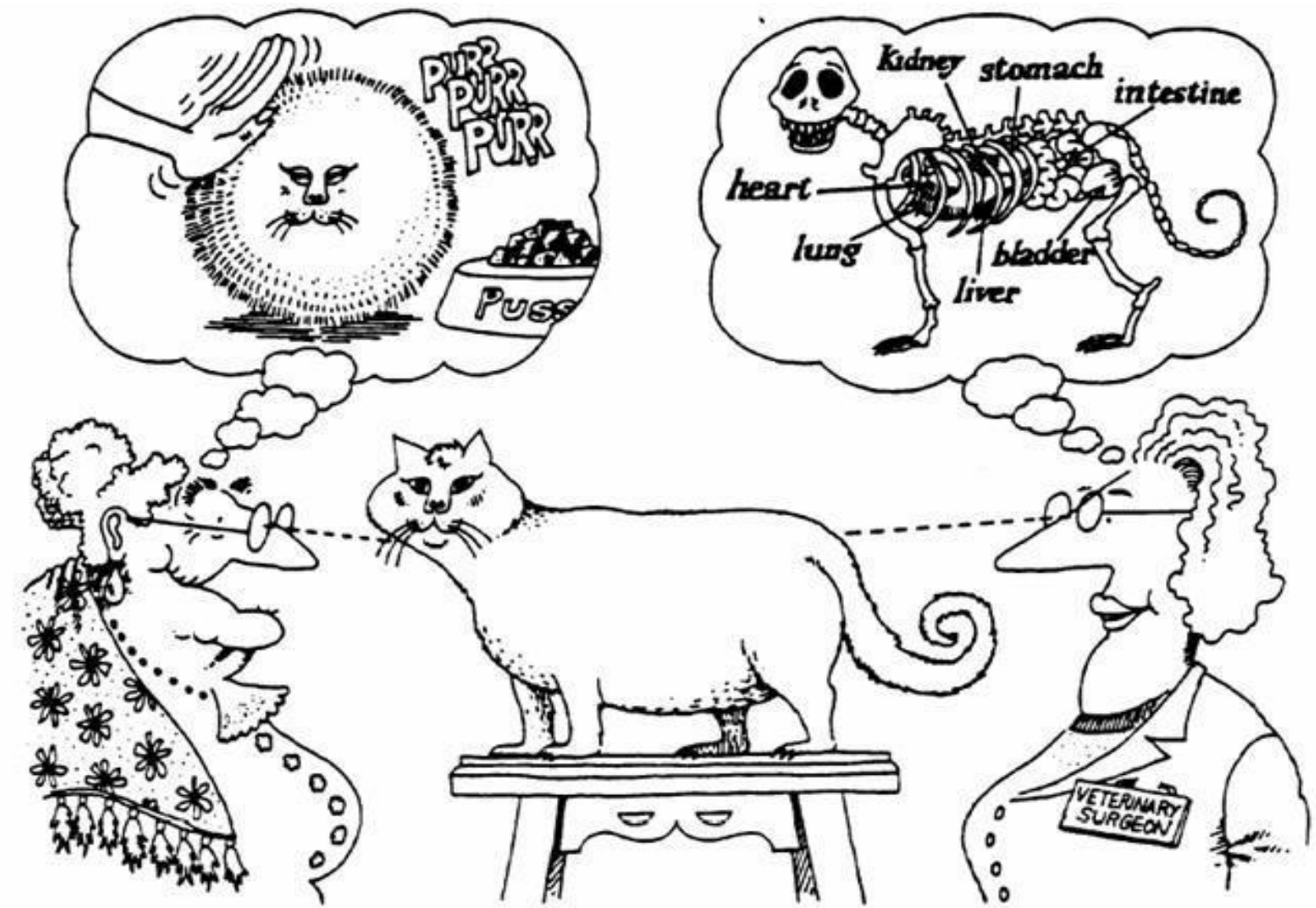
Block

Disk

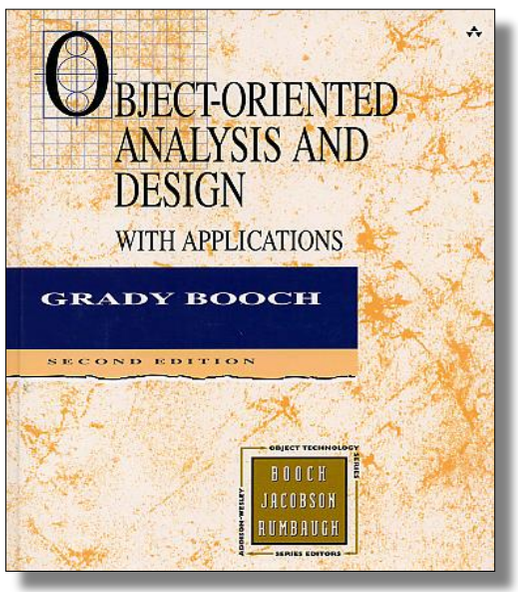




Grady BOOCH OOAD



Abstraction focuses upon the essential characteristics of some object, relative to the perspective of the viewer.



Architecture Framework