

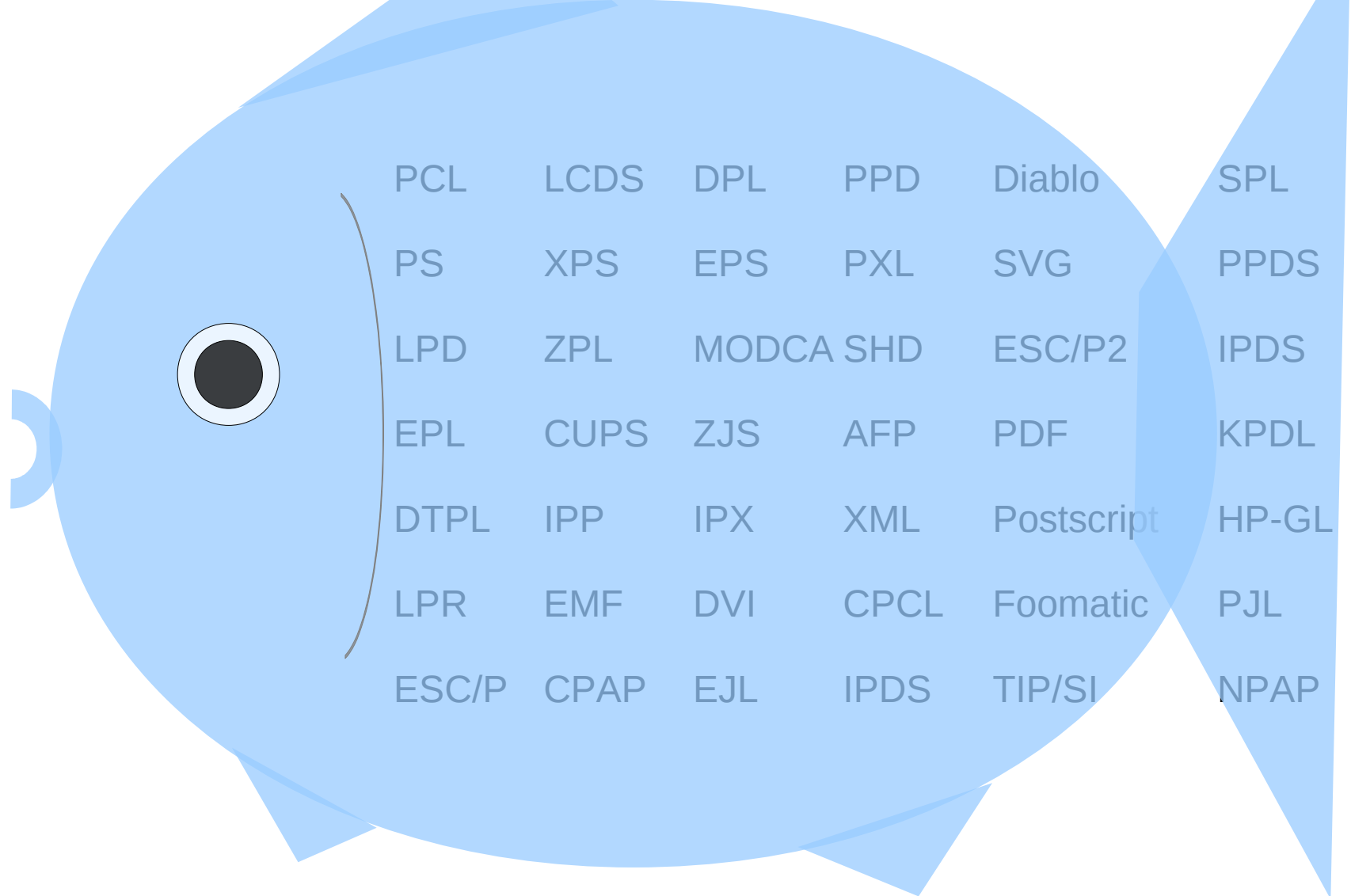
Impression:

Protocoles, Formats, Langages, etc ...

Quelques définitions

PCL	LCDS	DPL	PPD	Diablo	SPL
PS	XPS	EPS	PXL	SVG	PPDS
LPD	ZPL	MODCA	SHD	ESC/P2	IPDS
EPL	CUPS	ZJS	AFP	PDF	KPDL
DTPL	IPP	IPX	XML	Postscript	HP-GL
LPR	EMF	DVI	CPCL	Foomatic	PJL
ESC/P	CPAP	EJL	IPDS	TIP/SI	NPAP

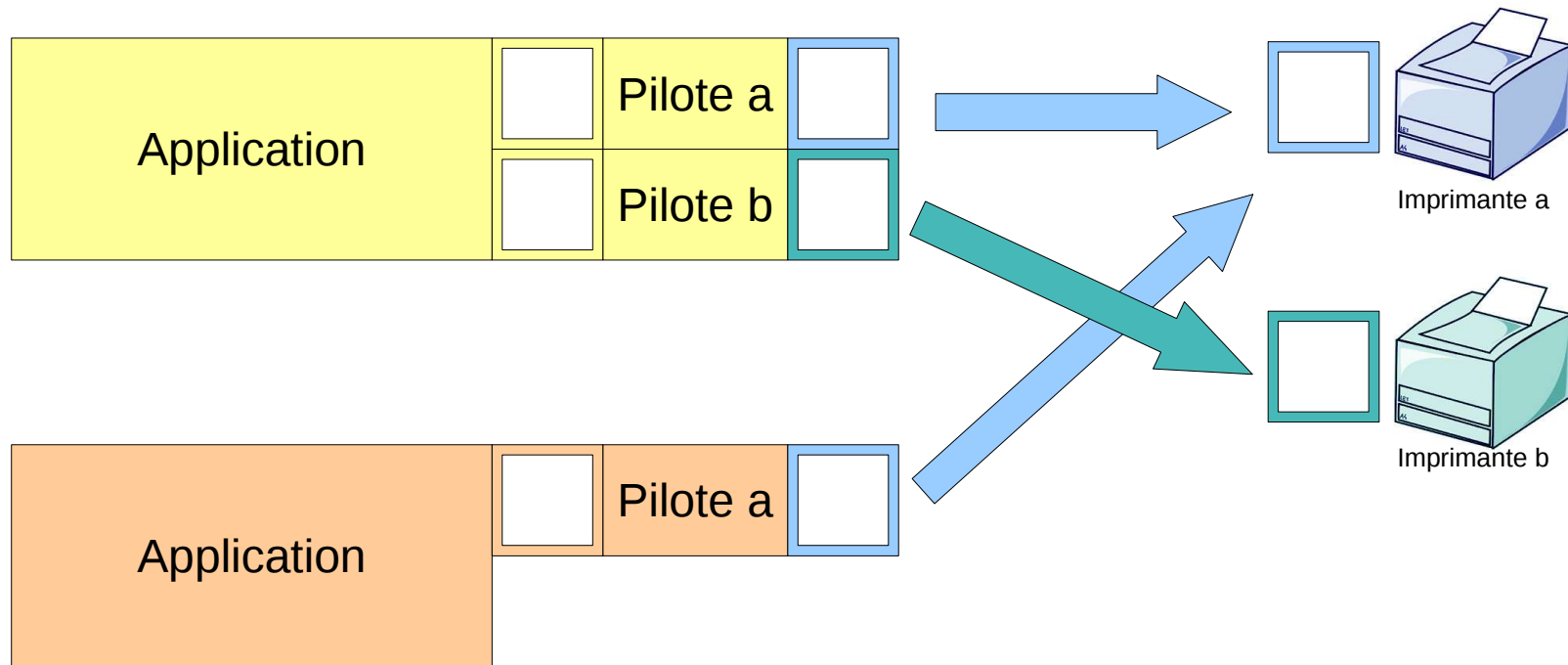
On a eu peur de la noyade...



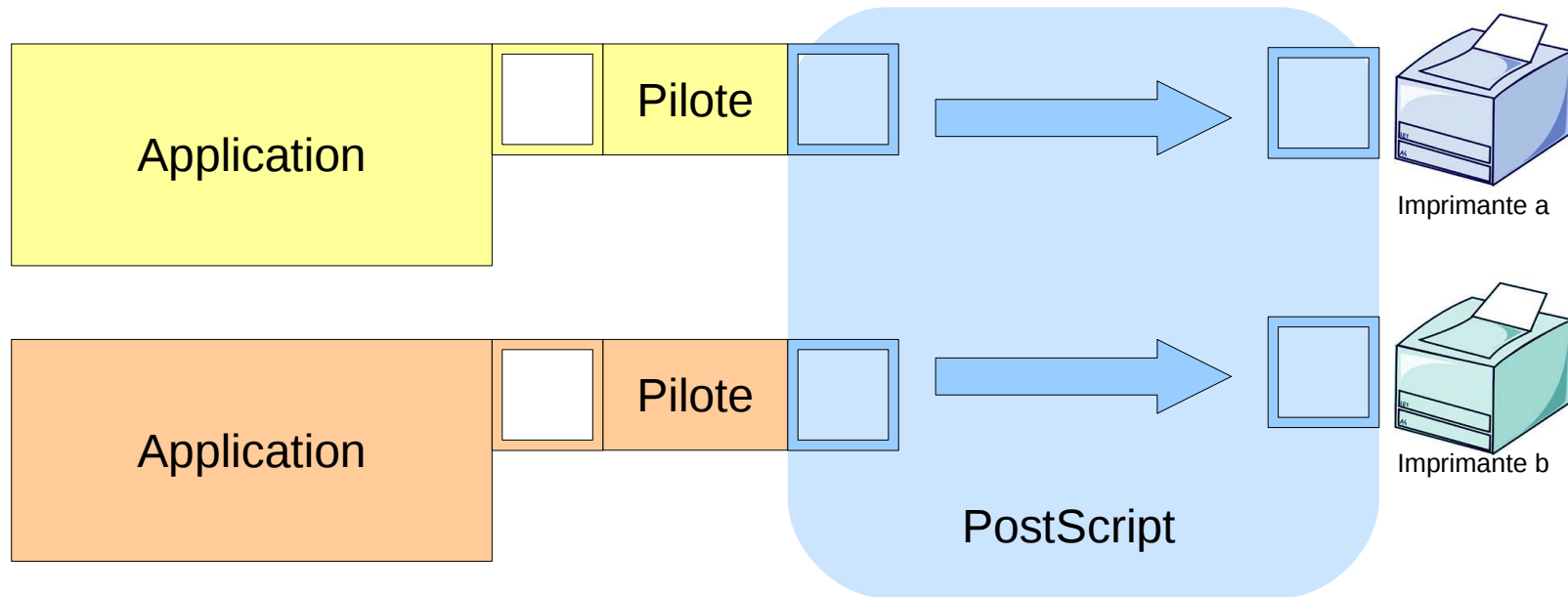
Plan

- Formats, langages de description de page
- Filtres, PPDs
- Protocoles

La préhistoire



L'interface unique!



- PostScript (Adobe 1985, Apple LaserWriter)
- PCL,PCL-XL (HP)
- ESC/P (Epson) et plein d'autres
- PDF

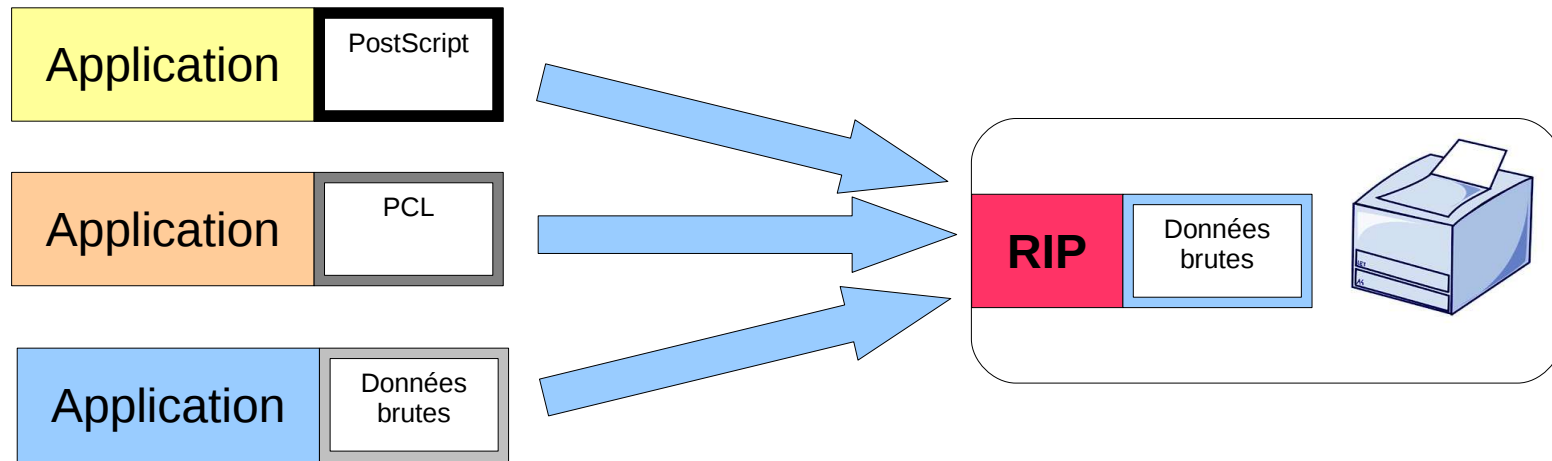
PDL

Page Description Language

- Metadonnées
 - Données
 - Instructions pour les imprimantes (couleurs, polices, ...)
 - Formalisation vectorielle des éléments
- Méthode de description de page **indépendante** du matériel

RIP

Raster Image Processor



- Module dans l'imprimante (en hard et/ou en soft)
- Interprète le PostScript (ou autre PDL)
- Calcule l'image tramée (bitmap)
- CPU + RAM

PostScript

- Vrai langage de programmation

```

1  %!PS                % First 2 characters need to be '%!' (magic numbers).
2  % two boxes         % '%' introduces comments. The virtual PS-pen is asked
3  100 100 moveto       % to move to coordinate (100,100), then draw a
4  0 50 rlineto         % relative line 0 units to the right and 50 to the top,
5  50 0 rlineto         % go on with 50 to the right (0 to the top
6  0 -50 rlineto        % now 50 units straight down,
7  closepath           % close the "path",
8  .7 setgray          % switch to 70% gray value for the color to use and
9  fill                % fill the box with this color..
10 %                   % First box is finished; next figure
11 160 100 moveto       % is constructed in an analogous way.,
12 0 60 rlineto         % but this time not just with horizontal
13 45 10 rlineto        % and vertical lines, but also with lopsided ones..
14 0 -40 rlineto        % (yes, 20% in PostScript stands for a more
15 closepath           % dark value than 70%).
16 .2 setgray          %
17 fill                % The closing command "showpage" tells
18 showpage            % the printer to eject the page...
```



```

%!PS
100 100 moveto 0 50 rlineto 50 0 rlineto 0 -50 rlineto closepath
.7 setgray fill 160 100 moveto 0 60 rlineto 45 10 rlineto 0 -40 rlineto
closepath .2 setgray fill
showpage
```

PostScript / PCL

	PostScript	PCL (Printer Control Language)
Matériel	Très répandu dans le monde des imprimantes Préfér� dans le monde professionnel de l'imprimerie	Egalement tr�s r�pandu (pas que HP)
OS	Tr�s bien int�gr� au monde Unix	Plut�t Windows et Mac Filtres PS -> PCL sous Unix
Fichiers	Texte	Binaire
Pr�visibilit�	PS ind�pendant du mat�riel -> impression identique	PCL d�pendant en partie du mat�riel
Textes et graphiques simples		Plus rapide (jet d'encre)
Graphiques complexes	+ rapidit� + qualit� + bande passante	- rapidit� - qualit� - bande passante
RIP	M�moire n�cessaire importante	

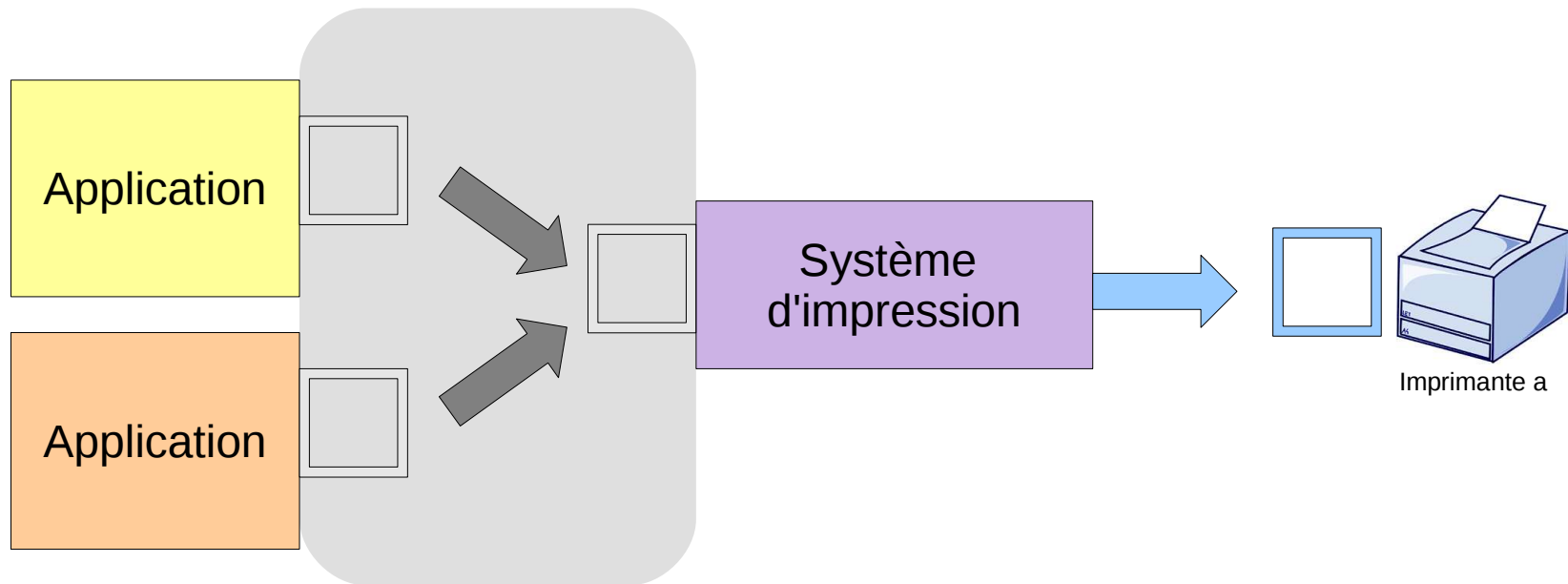
PostScript / PCL

- Imprimante Laser PostScript
 - construction de l'image complète de la page en RAM par l'imprimante
 - rendu bitmap d'une page A4 à 600 dpi => 4 Mo
 - compression des rendus
 - Plusieurs exemplaires => 1 seul transfert
- Imprimante jet d'encre
 - construction de l'image finale dans l'ordinateur par le pilote
 - envoi ligne par ligne au fur et à mesure que la feuille sort.

RIP software

- Ghostscript (Unix)
- Wysiwig
- autres RIP software intégrés aux applis PAO (InDesign)

L'interface unique côté application



- Unix: Postscript, PDF
- Windows:
 - EMF (GDI, Graphics Device Interface)
 - XPS (XML Paper Specification)

Ghostscript

- Unix
- Interpréteur Postscript libre (Gnu GPL)
- Capable de générer le bitmap correspondant à une imprimante non PostScript à partir d'un fichier PostScript
- `gs -h`
- ESP Ghostscript 7.05.4 => 300 filtres
- Amélioration de la qualité (Gimp Print Project)

Autres filtres Unix

- CUPS raster
 - Filtres basés sur Ghostscript
 - `rasterto...` (`/usr/lib/cups/filter`)
 - Utilisation de fichiers PPD
- Binaires spécifiques sous MacOSX

PPD

Postscript Printer Description

- fichier texte qui décrit les capacités (recto-verso, choix du bac, résolution,...) des imprimantes et les commandes pour utiliser ces capacités
- version 4.0, 1992; version 4.3, 1996
- Le document de référence est sur le site de Adobe

PPD

- Utilisé par CUPS pour construire les pages de configuration dans l'interface web
- Et les outils (ex: lpoptions, foomatic,...) qui vont avec

PPD: exemple

```
*%===== Installable Options =====
*%===== & System Management =====
*OpenGroup: InstallableOptions/Installable Options

*OpenUI *Option21ExternalTray/External Tray: PickOne
*DefaultOption21ExternalTray: False
*Option21ExternalTray False/Not Installed: ""
*Option21ExternalTray True/Installed: ""
*CloseUI: *Option21ExternalTray

*OpenUI *Option20InternalTray2/Internal Tray 2: PickOne
*DefaultOption20InternalTray2: False
*Option20InternalTray2 False/Not Installed: ""
*Option20InternalTray2 True/Installed: ""
*CloseUI: *Option20InternalTray2

*OpenUI *Option30Finisher/Finisher: PickOne
*DefaultOption30Finisher: None
*Option30Finisher None/Not Installed: ""
*Option30Finisher FinKING/Finisher 1000: ""
*Option30Finisher FinLAWC/Finisher 2250: ""
*Option30Finisher FinTONEC/Booklet Finisher: ""
*CloseUI: *Option30Finisher

*OpenUI *Option2LargeCapacityTray/Large Capacity Tray: PickOne
*DefaultOption2LargeCapacityTray: False
*Option2LargeCapacityTray False/Not Installed: ""
*Option2LargeCapacityTray True/Installed: ""
*CloseUI: *Option2LargeCapacityTray

*OpenUI *Option1LowerPaperTrays/Lower Paper Trays: PickOne
*DefaultOption1LowerPaperTrays: False
*Option1LowerPaperTrays False/Not Installed: ""
*Option1LowerPaperTrays True/Installed: ""
*CloseUI: *Option1LowerPaperTrays

*CloseGroup: InstallableOptions
```



Set Printer Options

Home Administration Classes Doc

dsm645: Options Installed

External Tray: Not Installed ▼

Internal Tray 2: Not Installed ▼

Finisher: Not Installed ▼

Large Capacity Tray: Not Installed ▼

Lower Paper Trays: Not Installed ▼

Set Printer Options

PPD: exemple

```
*%===== Installable Options =====
*%===== & System Management =====
*OpenGroup: InstallableOptions/Installable Options
```

```
*OpenUI *Option21ExternalTray/External Tray: PickOne
*DefaultOption21ExternalTray: False
*Option21ExternalTray False/Not Installed: ""
*Option21ExternalTray True/Installed: ""
*CloseUI: *Option21ExternalTray
```

```
*OpenUI *Option20InternalTray2/Internal Tray 2: PickOne
*DefaultOption20InternalTray2: False
*Option20InternalTray2 False/Not Installed: ""
*Option20InternalTray2 True/Installed: ""
*CloseUI: *Option20InternalTray2
```

```
*OpenUI *Option30Finisher/Finisher: PickOne
*DefaultOption30Finisher: None
*Option30Finisher None/Not Installed: ""
*Option30Finisher FinKING/Finisher 1000: ""
*Option30Finisher FinLAWC/Finisher 2250: ""
*Option30Finisher FinTONEC/Booklet Finisher: ""
*CloseUI: *Option30Finisher
```

```
*OpenUI *Option2LargeCapacityTray/Large Capacity Tray: PickOne
*DefaultOption2LargeCapacityTray: False
*Option2LargeCapacityTray False/Not Installed: ""
*Option2LargeCapacityTray True/Installed: ""
*CloseUI: *Option2LargeCapacityTray
```

```
*OpenUI *Option1LowerPaperTrays/Lower Paper Trays: PickOne
*DefaultOption1LowerPaperTrays: False
*Option1LowerPaperTrays False/Not Installed: ""
*Option1LowerPaperTrays True/Installed: ""
*CloseUI: *Option1LowerPaperTrays
```

```
*CloseGroup: InstallableOptions
```

```
dbonnafo@pcfontan:~$ lptions -l -d dsm645
Option21ExternalTray/External Tray: *False True
Option20InternalTray2/Internal Tray 2: *False True
Option30Finisher/Finisher: *None FinKING FinLAWC FinTONEC
Option2LargeCapacityTray/Large Capacity Tray: *False True
Option1LowerPaperTrays/Lower Paper Trays: *False True
ColorModel/Color Mode: *Grayscale
Resolution/Resolution: *600dpi
PageSize/PageSize: A3 *A4 A5 Legal Letter 11x17
PageRegion/PageRegion: A3 A4 A5 Legal Letter 11x17
InputSlot/InputSlot: MultiTray 1Tray 2Tray 3Tray 4Tray 5Tray *Auto
Duplex/Duplex: *None DuplexNoTumble DuplexTumble
MediaType/Paper Type: *Plain Recycled Special Colored Letterhead Pre
OutputBin/Destination: *Default Standard Bin1 External FinProof FinS
RIS Staple/Staple: *None UpperLeft UpperRight LeftW RightW UpperW
RIPunch/Punch: *None LeftJP2 LeftUS2 LeftUS3 LeftEU4 LeftNEU4 RightJ
RIPrintMode/Toner Saving: *Orhit 5rhit
JobType/JobType: *Normal SamplePrint LockedPrint DocServer
Password/Locked Print or Doc Server Password (4 digits): *None 4001
UserCode/User Code (up to 8 digits): *None 1001 1002 1003 Custom
dbonnafo@pcfontan:~$
```

PPD: exemple

```
*UIConstraints: *Option21ExternalTray True *Option30Finisher FinKING
```

- Les développeurs de PPD peuvent créer leurs propres mot-clés. Ex:

```
*FoomaticRIPOptionSetting OutputBin=External: "SET OUTBIN=LOWER"
```

- Les fichiers PPD peuvent contenir la définition de filtres pour transformer le PS et le PDF en PCL et les commandes PJP propres à l'imprimante

PPD: les filtres

- CUPS définit de nouveaux mots clés, voir <http://www.cups.org/documentation.php/spec-ppd.html>, beaucoup pour Mac OS X

*cupsFilter: "application/vnd.cups-raster 50 rastertohp"

*cupsFilter: "application/vnd.cups-pdf 0 foomatic-rip"

PJL, Printer Job Language

- Développé par HP
- Permet d'envoyer des commandes aux imprimantes avant d'envoyer les documents PCL, PS, PDF, etc.
- Exemple: dans le chapitre 9 « PJL File System Commands »

PPD, PJJL

```
*OutputBin External/External Tray: "%% FoomaticRIPOptionSetting:  
OutputBin=External"
```

```
*FoomaticRIPOptionSetting OutputBin=External: "SET OUTBIN=LOWER"
```

(capture du spooler cups)

```
ESC%-12345X@PJJL SET RENDERMODE=GRAYSCALE
```

```
@PJJL SET RESOLUTION=600
```

```
@PJJL SET ECONOMODE=OFF
```

```
@PJJL SET DUPLEX=OFF
```

```
@PJJL SET MEDIATYPE=PLAIN
```

```
@PJJL SET OUTBIN=LOWER
```

```
@PJJL SET STAPLE=OFF
```

```
@PJJL SET PUNCH=OFF
```

```
@PJJL ENTER LANGUAGE = PCLXL
```

```
) HP-PCL XL;1;1;Comment Copyright Artifex Software, Inc. 2005^@
```

```
<D1>X^BX^B<F8><89><C0>^@<F8><86><C0>^C<F8><8F>A<C0>^
```

PPD: résumé

Les fichiers PPD contiennent:

- Les options disponibles
- Les valeurs par défaut
- Les filtres à utiliser
- Les commandes PjL

Foomatic

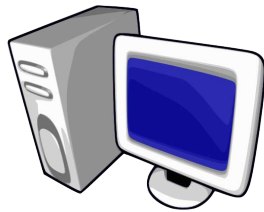
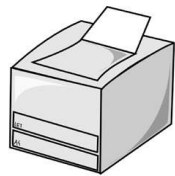
foomatic-db / foomatic-rip

Universal print filter/RIP wrapper

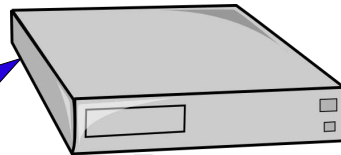
- Foomatic-db: collection de fichiers PPD
- Foomatic-rip: Utilise le fichier PPD pour connaître les « vrais filtres » nécessaires (souvent GhostScript) pour transformer le document à imprimer dans le langage de l'imprimante (PS, PCL, etc.)

foomatic-rip

HP LaserJet 2055dn



Serveur CUPS



openprinting.org

hp-laserjet_p2055dn-hpijs-pcl3.ppd

cupsFilter?

FoomaticRIP?

```
*cupsFilter: "application/vnd.cups-postscript 0 foomatic-rip-hplip"
```

```
*FoomaticRIPCommandLine: "gs -q -dBATCH -dPARANOIDSAFER -dQUIET -dNOPAUSE  
-sDEVICE=ijs -sIjsServer=hpijs%A%B%C -dIjsUseOutputFD%Z -sOutputFile=- -"
```

IPP, Internet Printing Protocol

- RFC 2910, 2911 pour la version 1.1
- CUPS et Windows ("Effectively Using IPP Printing". Microsoft. April 8, 2003)
- Utilise http/https (transport, authentication, chiffrement)

? que font les imprimantes avec IPP ?

LPR et direct socket printing

- Line Printer Remote, RFC1179
 - LPRng, <http://www.lprng.com/>
 - Port TCP 515
-
- Raw TCP/IP ou direct socket printing (port 9100)

```
@inproceedings{,
  author = {Parviainen, Jaakko and Haataja, Keijo and Mielik\"{a}inen, Jarno and Toivanen, Pekka},
  title = {Comparative efficiency analysis of LPR and raw TCP/IP printing protocols},
  booktitle = {WOCN'09: Proceedings of the Sixth international conference on Wireless and Optical
Communications Networks},
  year = {2009},
  isbn = {978-1-4244-4704-6},
  pages = {434--439},
  location = {Cairo, Egypt},
  publisher = {IEEE Press},
  address = {Piscataway, NJ, USA},
}
```