Open Printing Summit Summary
27 September 2007

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Open-Printing-Summit-Summary-20070927.htm
Open-Printing-Summit-Summary-20070927.pdf
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OPS Summary - MONDAY - 24 September 2007

The full agenda of the Open Printing Summit in Montreal (with links to slides from most of the presentations) is at:

```
http://www.linux-foundation.org/en/OpenPrinting/SummitMontreal
```

This summary was originally presented verbally at the PWG/OPS Joint Plenary in Montreal on Thursday morning 27 September 2007.

Part I: Printing System Core and Infrastructure

What is New in CUPS? (Mike Sweet, Apple)

- CUPS Versions in Mac OS X

```
- Jaguar/10.2 - CUPS/1.1.15 - August 2002
- Panther/10.3 - CUPS/1.1.19 - October 2003
- Tiger/10.4 - CUPS/1.1.23 - April 2005
- Leopard/10.5 - CUPS/1.3.2 - October 2007 (tentative)
```

- CUPS 1.3 Features Overview (Mike Sweet)

```
- Kerberos authentication
- More authentication mechanisms for local access
- SNMP printer discovery (now disabled by default)
- DNS-SD/Bonjour/Zeroconf support
- New cupsctl command-line utility (updates cupsd.conf settings)
- Web interface improvements (help, discovery, sharing, etc.)
- Localization (new locales, backends localized, multi-lingual PPDs)
- New side-channel API (for port monitors and backends)
- New cupsPreFilter attribute in PPD file
- New cupsAdminGetServerSettings() and cupsAdminSetServerSettings()
- New cupsRemoveDest() and cupsSetDefaultDest()
- http_t structure is now completely private
```

- CUPS 1.4 Proposed Features (Mike Sweet)

```
- more open-ended - probably one year out as a release
- More performance tuning
- More printer drivers
- Streaming print API (to avoid extra intermediate files)
- Updated web interface (better localization, etc.)
- New PDF filter(s) based on Poppler
- New libusb version of USB backend
- New banner file format for filter-generated banner pages
```

Open Printing US/Europe (Glen Petrie, Epson)

- Introduction and Background on OPWG
- OPWG has identified four principal Printing Environments:

```
- Production Printing
- Office Printing
- Home Printing
- Embedded/Handheld/Mobile/STB Printing
```

- What factors distinguish Printing Environments?

```
- Print Volume (number of sheets)
- Print Job Type
  - Simple
  - Complex but Static
  - Variable Data
  - Incorporate Finishing
- Print Location
  - Attached/Local Printer
  - Network Printer
  - Print Department
  - Print Shop
- Computing System Resources
  - Run-Time Memory
  - Processor Speed
```

- Coherence - Environment Level

```
- Means the Users in all environments can (/will/shall/should??) have
  the same experience
- Differences are mostly artificial
  - Production can request the printing of a single sheet
    - Print a missing or damaged sheet
  - Handheld can request the printing of a 100 copies
    - Kinko's prints 100 sets of presentation downloaded from customer
      PDA
      - Who generated the production job-ticket !!!
      - Could (should?) the PDA do that? - Interesting
- Use a Scaleable Approach
```

- Coherence - Software Level

```
- User Level
  - Print Dialog - Common
  - Print Attributes - Common representation and terminology
- Developer Level
  - Print Attributes - Common representation and terminology
  - Application Programming Interface (API) - Design, Format, Calls,
    Error, etc.
  - Code Module - Coding Style, Coding Structure, Variable Typing, etc.
  - Extension: Planning for Change - Vendor, Code, Attributes, Modules
```

- Coherence Needs - Single Dictionary

```
- Independent of
  - Environment, Print Vendor, Solution Vendor, Operating System &
    Application.
- Defining
  - Terminology, Acronyms, Abbreviations Representation, Relationships,
    Dependencies &, Mathematics (where applicable)
- Defining
  - Code Level Variable, Object(Struct) Members, Range & Scope
```

- Coherence Needs - Common / Extensible Print Dialog

```
- Being worked on ... (Open Usability)
- Request 1: Provides for both GUI and GUI-less API's
```

- Request 2: Scaleable down to Resource Limited Embedded/Handheld Solutions

- Coherence Needs - Software - Application Programming Interface (API)

  - Types: Static Link Library, Dynamic Link Library, Remote Processor Call, Other ??
  - Base Library API's: opInitLib_foo, opSuspendLib_foo, opReleaseLib_foo
  - Base Procedure API's: opInit_foo, opProc_foo, opRelease_foo

- Coherence Needs - Software - Basic Code Modules and Basic Headers

  - Basic Types (OP_INT8, OP_INT32, OP_CHAR, etc)
  - Basic Objects (structs) (OP_RECT, OP_POINT, etc)
  - Basic Errors (OP_ERROR_NONE, OP_ERROR_MEMORY_ALLOCATION, OP_ERROR_INVALID_ARG, etc)

- Coherence Needs - Software - General Code Module

  - Coding Style - Pick one and stay with it!
  - Coding Structure - Pick one and stay with it!

- Coherence Needs - Software - Extension: Planning for Change

  - Vendor, Code, Attributes, Modules

- Scalability - Environment Level

  - Users in all environments can (/will/shall/should??) have the same experience
  - Limitation defined by Available Printer, System and/or Intended Features and Capabilities

- Scalability - Software Level - User Level

  - Print Dialog - Common feature and capability parametrics

- Scalability - Software Level - Developer Level

  - Coding
    - API's ... or
    - Printer/Printing capabilities ... or
    - Attribute properties ...
      - as strings-constants for XML based or resource rich environments
      - as integter-constants for resource limited environments
  - Features and Capabilities
    - The scope, the fidelity and the inclusion based on resources and not necessarily environment !
  - Extension: Planning for Change
    - The scope, the fidelity and the inclusion based on resources and not necessarily environment !

- Models (Architecture and Environments)

  - See slides

- Software - Thin Thread - Overview

  - What is it?
    - Is it a Prototype? Less than but close
    - Is it a Solution? No, not complete.
    - Goal is flush out the architecture, interface and internals
    - We will define it as end-to-end executable that ...
      - follows a single, usually the typically, path through the architecture/design
      - provides only limited error checking (memory allocate but not parameters)
      - assume resources are limited by the software architecture/design not by actual system
      - some functions/processes/procedures provide a single option
  - Start with the ...

  - simplest (feature/capability wise) Environment == Embedded/Handheld
  - API defining features / capabilities == Job Ticketing
  - API managing print == Print Manager
  - API controlling the printer == Printer Driver
  - API supporting printer == Print Channel Manager
  - everything else...

- Software - Thin Thread - Auxiliary Work Products

  - Refining the OpenPrinting Reference Model
  - Refining the OpenPrinting Detailed Architecture
  - Creating an OpenPrinting Dictionary
  - Creating the OpenPrinting Basic Software Header and Source Modules
  - Migrating existing work products to provide coherent, consistent, common
    - Software Elements
    - API
    - Solutions

Printing API (PAPI) (Norm Jacobs, Sun)

- Objectives

  - Provide applications print service or protocol independence
  - Allow a rich, extensible set of information to flow between application and print service
  - Support a rich enough set of operations to be useful to most applications with printing needs

- Not a Print Manager

  - Print service independent
  - Provides available features

- Used by

  - GTK (GNOME)
  - Print commands (lp/lpr...)
  - Mozilla - Bug 317450 - patch submitted

- Works with

  - CUPS (IPP)
  - LP
  - LPD (RFC-1179)

- Capabilities Support

  - in progress
  - integrated solution

- PAPI Source Code - SourceForge

  - http://sourceforge.net/projects/openprinting/
  - openprinting-papi-dev@lists.sourceforge.net

- PAPI Source Code - OpenSolaris

  - http://opensolaris.org/os/community/printing/
  - mailto:printing-spool@linux-foundation.org

- OpenPrinting PAPI mailing list

  - http://linux-foundation.org/mailman/listinfo/printing-spool/
  - printing-spool@linux-foundation.org

- PAPI/1.0 Spec

  - ftp://ftp.pwg.org/pub/pwg/fsg/spool/papi-v1.0-2005-07-15.pdf

Topic - PDF instead of PostScript as standard print job format

Cairo Graphics Library (GNOME) for PS/PDF (Behdad Esfabohd, Cairo)

- See slides (very large file) for most details
- Generates PDF/1.4 or earlier versions

```
- Ira - should consider ISO PDF/A and IEEE PDF/is support as profiles
```

Generating perfectly text-extractable PDF (Behdad Esfahbod, Cairo)

- See slides (very large file) for most details
- Cluster analysis is key
- Clusters are uni-directional group of codepoints and glyphs
- Should be implemented by end-of-2007

OP Japan CUPS PDF Filters (Yasumasa Toratani, Canon)

- Format Converter

```
- PostScript - imagetops and texttops
- PDF - imagetopdf and (texttopdf)
```

- Layout Processor

```
- PostScript - pstops
- PDF - pdftopdf
```

- Renderer

```
- PostScript - Ghostscript
- PDF - pdftoopvp (Poppler-based)
```

- PDF Filters: Status and Plan

```
- All PDF CUPS filters at http://opfc.sourceforge.jp
- Reconsider Job Control Info - Modify PDF filters if needed
- texttopdf (utf8topdf?) - Needs comments and VOLUNTEERS
```

Foomatic 4.0: PDF Workflow and XML with DTDs (Till Kamppeter, LF)

- No major changes in Foomatic in several years
- Changes in Printing Infrastructure

```
- PostScript as print job format will be replaced by PDF
- CUPS got new functionality, especially custom option settings
- Automatic printer driver download from the Open Printing web site
```

- Foomatic 4.0 Ideas

```
- DTD/XSD for the XML database, can change database format
- Auto-generate printer XML entries from PPD files
- Easy way to turn user-contributed printer entries into official
  Foomatic entries
```

OPS Summary - TUESDAY - 25 September 2007

Part II: Printing on the Desktop: GUI and Applications

KDE Printing (Cristian Tibirna, Maintainer KDE Print)

- Status quo

```
- Not much changed on the KDE printing front since Atlanta Summit
```

- Last 17 months (since Atlanta Summit)

```
Google Summer of Code:
- 1st topic: openprinting.org on-line driver support - succeeded
- 2nd topic: KDE GUI renovation - not successful
Work on KDE4 started:
- Printing for KDE4 severely lagging
New interest from KDE developers community
- in last 3 weeks
```

- Protocols and technologies

```
- CUPS/1.1 and IPP
- Other protocols very probably will be dropped
- CUPS > 1.1 support still not implemented
- Renovation of CUPS backend required - major rewrite
- PDF printing flux not supported fully
```

- Tools

```
Minimize centralized/shared library
Move tools to optional workspace package
Essential applications:
- kprinter - ESSENTIAL: "lpr with a GUI"
- Printer installation wizard
- Job Viewer (actually very nice job manager - Kurt showed to Ira)
- Dearly needed: better previewer
- Dearly needed: PDF editor
```

- KDE 4 Planning - latest analysis by ad-hoc community group

```
KDE4 4.0:
- KDE3 code porting partially failed { lack of manpower
- Use Qt infrastructure directly
- Regressions and limitations over KDE3
- Very short time for implementation
KDE4 4.1:
- Back to full KDE platform:
  - pre-filter, customizable dialog, printer wizard, etc.
- Using PDF as job format
- New GUI (usability driven)
- Look up wishes (and bugs)
```

- Planning ... concretely

```
- GUI redesign - wait for consensus?
- KDE3 GUI was serving well ("it ain't broken...")
- Pass as much of the job as possible to Qt (natural)
- CUPS 1.3 - Use greedily (PPD parsing?)
- CUPS 1.4 - PDF printing already required by developers
- Take a look at PAPI -> back to supporting many printing backends
```

- Conclusions

```
KDE Printing is no more in acceptable shape
High steam work in progress for KDE4:
```

```
- KDE 4.0 -> placeholder
- KDE 4.1 -> full (best) solution (again)
Acute lack of manpower!
```

GNOME Printing: Behdad Esfahbod (Cairo/Pango)

- See slides (very large file) for most details
- Migration to native OS print dialogs
- No GNOME print team

Common Printing Dialog (Peter Sikking, Open Usability)

- See slides (very large file) for most details
- "One size does not fit all"
- Clusters

```
general inkjet, photo, personal laser workgroup laser,
high volume wide format, impact printers
```

- Siena Workshop (Open Usability sponsored)

```
3 levels of Printing:
- Level 1 - "printing does not exist"
  80% or 90% - "will be OK"
  "just print" - an optional bypass of the dialog
  Print - just print
- Level 2 - quick presets
- level 3 - tweak printing parameters
```

- Tags - many-to-many associations
- Work in progress

```
- Screen shots of version 0.3 common printing dialog
```

- LinuxTag - work with the UI platforms

```
- Gnome + GTK
- KDE + Trolltech
```

LSB 3.2 and 4.0: Printing Infrastructure (Jeff Licquia, LF)

- Background on LSB goals and methodologies - see slides
- Printing in LSB 3.1

```
System V and BSD command-line tools
- Two tools: lp and lpr
- Can print to the default printer or a named printer
- All other details (spooler tech, network support, etc.) are
  implementation-dependent
Generic System V/BSD interfaces are not sufficient
- No way to discover what printers are available
- No standards for discovering or supporting advanced printer
  capabilities
- User interface is necessarily limited
- Lack of backend standardization makes delivering a single driver
  framework nearly impossible
```

- Printing in LSB 3.2

```
System V and BSD command-line tools
- Pretty much unchanged
CUPS/1.1 is now the de-facto standard for printing in Linux
- No other spooler has captured the market
- Newer versions of CUPS have not yet reached everywhere
```

```
ABIs in CUPS
- CUPS Convenience API
- CUPS PPD API
- CUPS Raster API
GhostScript will be required by LSB/3.2
- Must support a standard set of options
- Must support a standard set of drivers
  - CUPS Raster
  - IJS
  - pxlmono, pxlcolor
  - OpenPrinting Vector
foomatic-rip will be required by LSB/3.2
Standard search path for PPDs will be required by LSB/3.2
```

- Printing in LSB/4.0

```
Ideas for LSB 4
- Uplift of CUPS ABIs
- SANE
- PAPI
- Others?
```

Topic - Printer Setup Tools

system-config-printer (Till Kamppeter, LF)

- See slides for most details
- Not presented at OPS due to technical problems

YaST (Johannes Meixner, SUSE/Novell)

- See slides for most details
- Inherent ambiguity of "printer" versus "queue"

```
- hard for end users
```

Printer Drake (Marcelo Leitner, Mandriva)

- See slides for most details
- Impressions

```
- Ira - very nice tool
```

Part III: Printer Drivers and Printer Validation

OP Japan Vector Driver (Yasumasa Toratani, Canon)

- Vector Driver API (PDAPI, aka OPVP)
- Version 0.2 - current spec

```
- API Spec - released in 2003
- HP PCL5, Canon, Epson, and NEC Drivers have been released so far
- Integrated in many distros as "opvp" driver with ESP GS
- CUPS PDF filter "pdftoopvp" in 2006
```

- Version 1.0 - upcoming spec

```
- Current status: RC5 (almost done!)
- ftp://ftp.pwg.org/pub/pwg/fsg/vector/pdapi-spec-1.0rc5.pdf
- Implementation - opvp based on 1.0 is in beta status
- Several vendors are already implemented drivers and testing
  ... so far so good!
```

- Compatibility

```
- New "opvp" code for Ghostscript supports both 0.2 and 1.0 driver
- Automatically detects the API version exported by each printer driver
- Automatically changes the API calling sequence according to the API
  version
- Then both the opvp 0.2 compliant printer driver and the opvp 1.0
  compliant printer driver work under the new opvp 1.0 code w/o any
  modifications!
- Sample driver "opvpnull" is already updated for 1.0
- Driver feasibility test has almost finished (6 months)
  - Soon available at http://opfc.sourceforge.jp
```

Distribution-Independent Driver Packages (Till Kamppeter, LF)

- See slides for most details
- Problems

```
- Distributions do not ship all available printer drivers
- Free drivers from upstream need to be compiled by users
  - Driver installation too complicated for inexperienced users
- Manufacturers make packages only for a few major distributions
- Driver packages often difficult to find on manufacturer's web sites
- Testing/packaging effort for manufacturers and driver developers too
  high to ship binary driver packages for all distributions
```

- Existing Infrastructure

```
- OpenPrinting database (former linuxprinting.org) - central database
  for printer/driver info
- LSB provides tools and infrastructure to create
  distribution-independent binary packages
```

- Solution - Distribution-independent printer driver packages

```
- Based on LSB 3.1 for binary format (later LSB 3.2)
- Using CUPS, Ghostscript (with IJS, CUPS Raster and OpenPrinting Vector
  interfaces), Perl, and foomatic-rip which is in any distribution (and
  will be required by LSB 3.2)
- Installing everything in /opt/<supplier>/ to avoid conflicts with
  distribution
- Linking PPDs to /usr/share/ppd/
- Discovering system directory/file locations at install time
  - maintainer scripts:  pre/post (un)install) and symlinking system
    files appropriately
- Make packages part of OpenPrinting database, so that they can be
  easily found
- Infrastructure for automatic package lookup, download, and
  installation through the internet by printer setup tools
```

OPS Summary - WEDNESDAY - 26 September 2007

Topic - Driver Development Reports since last OPS

HP Linux Drivers (Shiyun Yie and Raghothama Cauligi, HP)

- Hp Is Committed to Open Source Printing Software

```
- Currently Provide Completely Open Source Software
  - Support over 1,200 Printer models with Connectivity Software
```

```
    - Driver
    - Toolbox
    - Scan
    - Fax
    - Photocard
    - Installer
```

- What's New in HP Linux Software?

```
- HPLIP Localized and adding Languages
  - Current languages:
    EFIGS
    Braziliaan Portuguese
    Simplified Chinese
    Russian
- HP Adding Binary Plug-Ins to HPLIP
  - HPLIP will continue to provide Open Source Code as we do now
  - Some HP Printers require proprietary software technologies to allow
    full access to printer features and performance
  - These technologies cannot be open sourced
  - Binary Plugs work in Conjunction with HP Open Source HPLIP
  - Delivered via binary library
  - Proprietary license between HP and customer
```

HP Linux Binary Plug-Ins (David Welch, HP)

- HPLIP 2.7.9 Plug-In Design

```
- Supported by HP Device Manager for Linux
  - PPDs
  - Firmware
  - Plug-Ins
  - Rules
  - License
```

Canon Printer Driver for Linux (Yasumasa Toratani, Canon)

- History

```
- When Started?
  - First Linux Printer Driver developed by Canon was released in
    March 2001 (Ver.1.00)
- Inkjet Printers as well as Laser Printers
  - Laser Printer Driver Ver.1.00 released in August 2003
  - Cooperate with open source activities boosted by Japanese Agency
- For Overseas Market (outside Japan)
  - Today, releasing from Europe, Australia sales companies for each
    region market
  - Study for the US market
```

- Latest Printer Drivers

```
- Color/Monochrome Laser Printers and Multifunctionals
  - Ver.1.50 (Released on May 22nd, 2007)
  - Over 140 models Color and Monochrome - imageRUNNER, imagePRESS,
    LaserBase, and LaserShot series supported
  - PostScript, UFR II, CAPT, LIPS IV(Japanese) and LIPS LX (Japanese)
    models
  - "x86" as well as "x86_64" supported
  - Both "rpm" and "deb" packages released
- Photo Inkjet Printers and Multifunctionals
  - Ver.2.70 (Released on Apr. 26th, 2007)
  - Scanner driver Ver.1.00 for MFPs also released
- Download Sites:
  http://cweb.canon.jp/drv-upd/lasershot/drv_linux.html
  http://www.canon.com.au/drivers/index.html
  http://software.canon-europe.com/
```

SUSE Print Management (Johannes Meixner, SUSE/Novell)

- No slides posted - see Till's photo of whiteboard
- For print management, need *DEVICE* info (not just queue info)
- For supplies, lifetime, etc, need *DEVICE* info

Third-Party Printing Driver Development (Hin-Tak Leung)

- Recent Trends

```
- Larger Multi-function devices - scanner, fax modems
- Smart handhelds
- PictBridge
```

- How People Do It?

```
- How we did it:
  - print to FILE:
  - USB snoop
- How others do it:
  - Guest OS in Boch/VMware virtualization
  - Hardware signal analyzer
```

- Disassembling

```
- IDA Pro
- .NET : Reflector
- Java : ??
```

- Manufacturer: Linux driver, why not?

```
- Fact: Manufacturers are out for making money
  - hardware
  - consumables e.g. ink/toner cartridges
  - support contracts
```

- Manufacturer: Linux driver, why not?

```
- Fact: Manufacturers are out for making money
- Question: Does it make financial sense?
  - IP, Patents, business advantage, 3rd party sub-contract/licensing
  - Justifying up-front business cost, and subsequent revenue projection
  - Hardware/software co-developed at close proximity - i.e., no specs
  - Cannot admit to hardware design faults and subsequent software work
    arounds, etc.
```

- Manufacturer: Linux driver, why?

```
- Sale opportunities: print servers
- New emerging market segments:
  - Commodities- tied-in with Bluetooth, mobile+phone, embedded devices,
    PDA, WebPAD
  - PictBridge
- Product/Market Differentiator - same product class, more OSes
  supported
```

- Manufacturer: Linux driver, how?

```
- Hardware/Consumables
- Funding
- Specs
- Engineering resources/contacts
- Source code
```

- Interesting technologies

```
- Wine - native bridge?
- XEN
- Mingw
```

- Just to use printer?

```
- Cups
- Samba
- Redmon
- Gsprint (Win32 ghostscript mswinpr2 driver)
```

Topic - Printer Driver Validation

Printer Driver Validation (Yasumasa Toratani, Canon)

- Discussion Members

```
- Mihara<osamu.mihara@fujixerox.co.jp>
- Miyata<akiyoshi.miyata@avasys.jp>
- Nagasaka<nagasaka.fumio@exc.epson.co.jp>
- Ogasawara<naruoga@nts.ricoh.co.jp>
- Sekiguchi<atsushi.sekiguchi@konicaminolta.jp>
- Shida<shida.keisho@canon.co.jp>
  - drafting/arrangement
- Toratani<toratani.yasumasa@canon.co.jp>
```

- Discussion

```
- Collected each member's comment about the Linux printer driver
  validation from the view point of:
  - What kind of things should be validated
  - Who validate
  - How to validate a printer driver
  - Validation cost
```

- Conclusion of the Discussion

```
- Too early to start the Linux printer driver validation
  - We need more discussion first...
```

- Validation Item

```
- First, discussion for defining the validation items should be started
  - Printing result?
  - Printing performance?
  - Printing options?
  - Printing from particular applications?
  - Language?
  ---> Test cases for printing validation
```

- Validation Tool and Data

```
- Next, the validation tool, data and environment should be discussed,
  for instance:
  - OS and Application
  - Test Print Data (text? photo? graph?)
  - Languages
  - and more...
```

- Validation by Driver Developer

```
- Depending on the printing use cases...
- In many cases, whether the driver works correctly or not can be
  validated only by the driver developer (printer vendor)
---> Self Validation
```

- Validation Cost

```
- On the other hand, we should also consider that the Linux desktop
```

```
  market is still smaller than that of the major Desktop OSs
---> Validation is good, but the balance between the test cases and
     testing/validating cost should be considered
```

- Let's start the discussion (in Montreal)

```
- Multiple test case clusters
- Multiple validation tools for test case clusters
- And further discussion is being considered at The Linux Symposium
  Tokyo in November, 2007
```

Part IV: The OpenPrinting Summit 2007 is Over - Final Thoughts

OPS Wrap-up

- Best Quotes:

```
- "There is no such thing as printing" - Peter Sikking
- "There is no printer in the printing system" - Johannes Meixner
```

- Above are the various OPS topics reviewed during our wrap-up session on Wednesday afternoon 26 September 2007.
- Below are the various OPS messages to manufacturers discussed during our wrap-up session on Wednesday afternoon 26 September 2007.

OPS Messages to Manufacturers

- From Open Source Developers

```
- Please publish specifications (not for the proprietary features)
```

- From Linux Distributions

```
- Please make Linux drivers easy to package
- Distribution-independent drivers
- Distribution-friendly driver installation
- CUPS-friendly drivers (for Linux environments)
```

- From All (OPWG, Developers, Distributions)

```
- Please implement Port Monitor MIB (PWG 5107.1) - IEEE 1284 Device ID
- Please implement coherent printer metadata (USB, parallel, network)
- Please use standard tokens for languages (PDF, etc.) - action to OP
```

OPS Summary - Open Printing Project Status for 2007

This section updates last year's presentation at the PWG/OPS Joint Plenary in Lexington in October 2006.

OP Reference Model - stable

- OP Reference Model Diagram is archived at:

```
ftp://ftp.pwg.org/pub/pwg/fsg/architecture/Reference-Model
```

  in the file:

```
FSG-OpenPrinting-Reference-Model-Diagram-20060410.pdf
```

OP DSH (Directory Structure and Hierarchy) - completed

- OP DSH standardizes locations of PPD files and print drivers
- OP DSH has been adopted in FHS (Filesystem Hierarchy Standard), LSB/3.2, and CUPS 1.3

OP PAPI (Print API) - completed

- OP PAPI/1.0 currently in Open Solaris and four Linux distros
- OP PAPI/1.0 reference implementation posted on Source Forge
- OP PAPI/1.0 may be included in LSB/4.0
- OP PAPI/1.0 formally approved by OP in July 2005:

  ```
  ftp://ftp.pwg.org/pub/pwg/fsg/spool
  ```

  in the file:

  ```
  papi-v1.0-2005-07-15.pdf
  ```

OP JTAPI (Job Ticket API) - completed

- OP JTAPI/1.0 UML diagrams and C headers are stable and aligned with spec
- OP JTAPI/1.0 reference implementation - work-in-progress in Thin-Thread
- OP JTAPI/1.0 may be contributed into CUPS for LSB/4.0 inclusion
- OP JTAPI/1.0 formally approved by OP in July 2005:

  ```
  ftp://ftp.pwg.org/pub/pwg/fsg/jobticket/JTAPI_Spec
  ```

  in the file:

  ```
  fsg-openprinting-job-ticket-api-v0100-20050315.pdf
  ```

OP PDAPI (Print Driver API, aka OPVP) - nearly complete

- OP PDAPI/0.2 implemented in Ghostscript in all Linux distributions with drivers for several printer models from multiple manufacturers
- OP PDAPI/0.2 has been adopted in LSB/3.2 (with required PWG UPDF namespace and excluded Text/Font API support)
- OP PDAPI/1.0 now technically complete and scheduled for formal approval by OP before end-of-2007
- OP PDAPI/1.0 Release Candidate 5 spec is archived at:

  ```
  ftp://ftp.pwg.org/pub/pwg/fsg/vector
  ```

  in the files:

  ```
  pdapi-spec-1.0rc5.pdf
  pdapi-changes-0.2to1.0rc5.pdf
  ```

OP PCMAPI (Print Channel Manager API) - work-in-progress

- OP PCMAPI supports management of communications channels (USB, Parallel, etc.) to local or network printers
- OP PCMAPI design and implementation work continues
- Current OP PCMAPI draft is NOT posted

OP SMAPI (Status Monitoring API) - work-in-progress

- OP SMAPI prototyped in 2004
- OP Steering Committee requested that communications channels be broken out separately (to PCMAPI)
- After OP PCMAPI is complete, OP SMAPI spec will be updated to use OP PCMAPI
- Obsolete OP SMAPI draft is archived at:

  ```
  ftp://ftp.pwg.org/pub/pwg/fsg/status_monitoring
  ```

  in the file:

  ```
  SMAPI_draft_20040522.pdf
  ```

OP PCAPI (Printer Capabilities API) - proposed

- OP PCAPI should at least support Adobe PPD and PWG UPDF namespaces for properties (in an abstract manner analogous to OP JTAPI)
- OP PCAPI is currently being designed by Wendy Phillips (Sun)

OP DDAPI (Device Discovery API) - proposed

- OP DDAPI should support multiple discovery methods (SNMP, DNS-SD, LDAP, etc.)

OP TFMAPI (Transform API) - proposed

- OP TFMAPI should support format-neutral API for conversion of print document formats (source, intermediate, or print-ready) for use by OP PAPI implementations and applications