An Overview of the Common UNIX Printing System, Version 1.1

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This whitepaper describes the Common UNIX Printing System™ ("CUPS™"), a portable and extensible printing system for UNIX®. CUPS is being developed by Easy Software Products, a software firm located in Hollywood, Maryland that has been selling commercial software for UNIX since 1993 through more than 40 distributors serving over 80 countries worldwide.

Additional information on CUPS is available on the World Wide Web at "http://www.cups.org".

Background

Printing within UNIX has historically been done using one of two printing systems - the Berkeley Line Printer Daemon ("LPD") [RFC1179] and the AT&T Line Printer system. These printing systems were designed in the 70's for printing text to line printers; vendors have since added varying levels of support for other types of printers.

Replacements for these printing systems have emerged [LPRng, Palladin, PLP], however none of the replacements change the fundamental capabilities of these systems.

Over the last few years several attempts at developing a standard printing interface have been made, including the draft POSIX Printing standard developed by the Institute of Electrical and Electronics Engineers, Inc. ("IEEE") [IEEE-1387.4] and Internet Printing Protocol ("IPP") developed by the Internet Engineering Task Force ("IETF") through the Printer Working Group ("PWG") [IETF-IPP]. The POSIX printing standard defines a common set of command-line tools as well as a C interface for printer administration and print jobs, but has been shelved by the IEEE.

The Internet Printing Protocol defines extensions to the HyperText Transport Protocol 1.1 [RFC2616] to provide support for remote printing services. IPP/1.0 was accepted by the IETF as an experimental Request For Comments [RFC] document in October of 1999. Since then the Printer Working Group has developed an updated set of specifications for IPP/1.1 which have been accepted by the IETF and are awaiting publication as proposed standards. Unlike POSIX Printing, IPP enjoys widespread industry support and is poised to become the standard network printing solution for all operating systems.

CUPS uses IPP/1.1 to provide a complete, modern printing system for UNIX that can be extended to support new printers, devices, and protocols while providing compatibility with existing UNIX applications. CUPS is free software provided under the terms of the GNU General Public License and GNU Library General Public License.

History

The first production release of CUPS (based on IPP/1.0) was released in October of 1999. Since then, we have released several patch updates to the original CUPS 1.0 release that addressed security, portability, and bugs found, but no new functionality was added to improve the stability of the CUPS code.

CUPS 1.1 is based on IPP/1.1 and adds many of the functional enhancements that have been requested by our users. As with 1.0, CUPS 1.1 will be followed by patch releases that address any problems found with the software but add no new features.

Design Overview

Like most printing systems, CUPS is designed around a central print scheduling process that dispatches print jobs, processes administrative commands, provides printer status information to local and remote programs, and informs users as needed. Figure 1 shows the basic organization of CUPS.

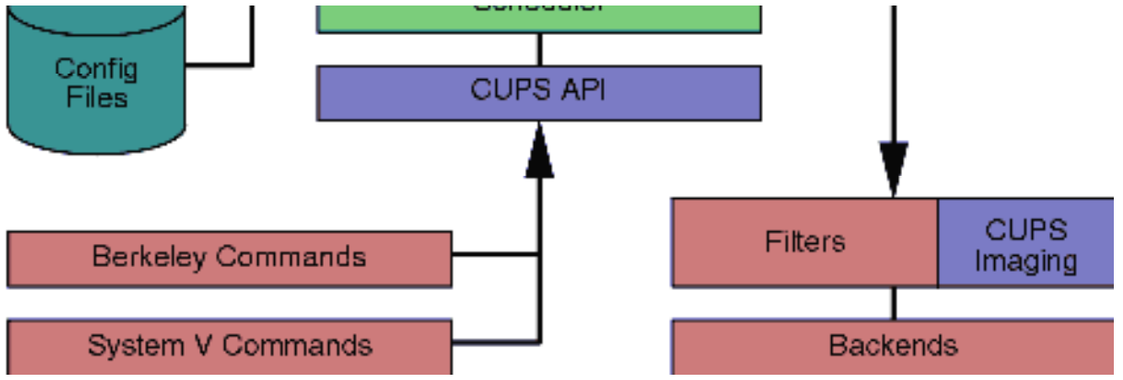

Figure 1 - CUPS Block Diagram

Scheduler

The scheduler is a HTTP/1.1 server application that handles HTTP requests. Besides handling printer requests via IPP POST requests, the scheduler also acts as a full-featured web server for documentation, status monitoring, and administration.

The scheduler also manages a list of available printers on the LAN and dispatches print jobs as needed using the appropriate filters and backends.

Configuration Files

The configuration files consist of:

- The HTTP server configuration file.
- Printer and class definition files.
- MIME type and conversion rule files.
- PostScript Printer Description ("PPD") files.

The HTTP server configuration file is purposely similar to the Apache server configuration file and defines all of the access control properties for the server.

The printer and class definition files list the available printer queues and classes. Printer classes are collections of printers. Jobs sent to a class are forwarded to the first available printer in the class, round-robin fashion.

The MIME type files list the supported MIME types (text/plain, application/postscript, etc.) and "magic" rules for automatically detecting the format of a file. These are used by the HTTP server to determine the *Content-Type* field for *GET* and *HEAD* requests and by the IPP request handler to determine the file type when a *Print-Job* or *Send-File* request is received with a *document-format* of *application/octet-stream*.

The MIME conversion rule files list the available filters. The filters are used when a job is dispatched so that an application can send a convenient file format to the printing system which then converts the document into a printable format as needed. Each filter has a relative cost associated with it, and the filtering algorithm chooses the set of filters that will convert the file to the needed format with the lowest total "cost".

The PPD files describe the capabilities of all printers, not just PostScript printers. There is one PPD file for each printer. PPD files for non-PostScript printers define additional filters through *cupsFilter* attributes to support printer drivers.

CUPS API

The CUPS API contains CUPS-specific convenience functions for queuing print jobs, getting printer information, accessing resources via HTTP and IPP, and manipulating PPD files. Unlike the rest of CUPS, the CUPS API is provided under the terms of the GNU LGPL so it may be used by non-GPL applications.

Berkeley and System V Commands

CUPS provides the System V and Berkeley command-line interfaces for submitting jobs and checking the printer status. The **lpstat** and **lpc status** commands also show network printers