CUPS Development
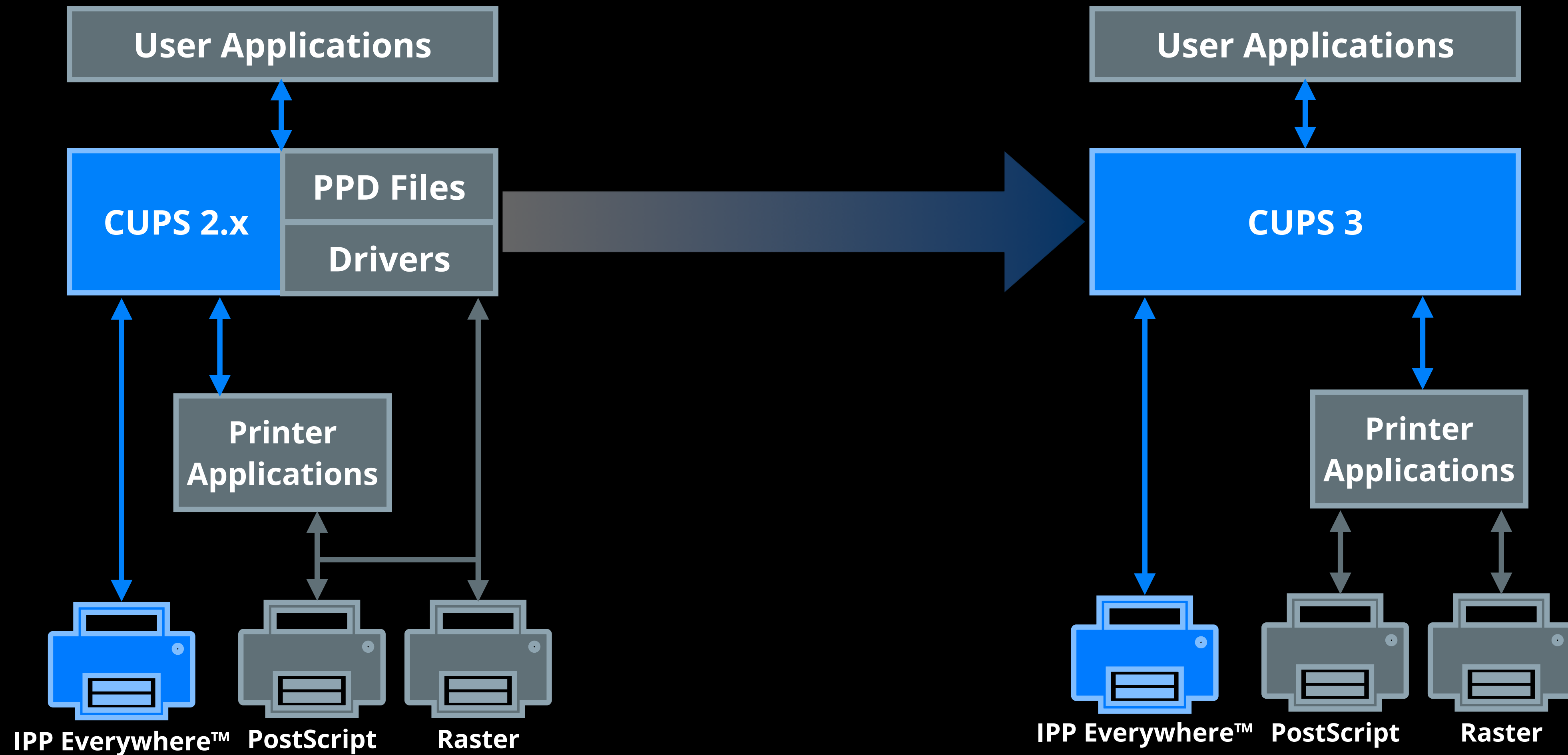
September 8, 2023

Michael R Sweet (Lakeside Robotics)

Topics

- Transition of Printing
- CUPS 2.4.x
- CUPS 2.5
- CUPS 3

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Transition of Printing

User Applications

CUPS 2.x — PPD Files / Drivers

Printer Applications

IPP Everywhere™   PostScript   Raster

User Applications

CUPS 3

Printer Applications

IPP Everywhere™   PostScript   Raster

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CUPS 2.4.x

- Release manager: Zdenek Dohnal
- Release history:
  - CUPS 2.4.0 - November 29, 2021
  - CUPS 2.4.1 - January 27, 2022
  - CUPS 2.4.2 - May 26, 2022
  - CUPS 2.4.3 - June 1, 2023
  - CUPS 2.4.4 - June 6, 2023
  - CUPS 2.4.5 - June 13, 2023
  - CUPS 2.4.6 - June 22, 2023
- Current Github "2.4.x" branch:
  - Will continue patch updates as needed until 2.5.0 is out

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CUPS 2.5

- Release manager: Till Kamppeter
- Release schedule:
  - CUPS 2.5b1 - November/December 2023?
  - CUPS 2.5rc1 - January/February 2024?
  - CUPS 2.5.0 - February/March 2024?
- Current Github "master" branch:
  - https://github.com/OpenPrinting/cups/milestone/6

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CUPS 2.5 - Overview

- New requirements:
  - C99, DNS-SD (Avahi or mDNSResponder), TLS (GNU TLS, LibreSSL, or OpenSSL), ZLIB, POSIX or Windows threading
- Features:
  - Discovery improvements: "wide-area" DNS-SD lookups and configuration profiles
  - Localization improvements: multiple languages in IPP Everywhere PPDs, centralize localization efforts
  - OAuth 2.0/OpenID authentication: default callback
  - "job-sheets-col" support (banner pages on specific media using standard formats)
- Back-porting of other CUPS 3 APIs as appropriate:
  - Better "media-col" attribute support (`cups_media_t` APIs)
  - HTML form APIs
  - IPP file APIs
  - JSON/JWT support (`cups_json_t` and `cups_jwt_t` APIs)
  - X.509 certificate management improvements (new credentials APIs)

CUPS 2.5 - DNS-SD Discovery

- "Wide-Area Bonjour" (DNS-SD over traditional DNS):
  - https://github.com/OpenPrinting/cups/issues/319
- mDNSResponder code already supports DNS-based DNS-SD
- Avahi code needs to be updated to browse each of the bound domains separately...

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CUPS 2.5 - Profiles

- Configuration profiles provide a way to point clients to known printers/servers:
    - https://github.com/OpenPrinting/libcups/issues/39
- Per-system (`/etc/cups/profiles`, `/usr/local/etc/cups/profiles`, `$SNAP_COMMON/cups/profiles`) and per-user (`~/.cups/profiles`, `$XDG_CONFIG_HOME/cups/profiles`) directories contain files pointing to servers and/or printers
- Proposed format:

```
# comment

# IPP System service implementation
Server {ipp,ipps}://HOSTNAME-OR-IP[:PORT]/ipp/system

# CUPS 2.x server
ServerName HOSTNAME-OR-IP[:PORT]

# IPP Everywhere printer
Printer {ipp,ipps}://HOSTNAME-OR-IP[:PORT]/PATH
```

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CUPS 2.5 - Profiles (con't)

- Additional proposed filter options (also for `client.conf` file):

```
# Don't filter by geo-location
FilterGeoLocation none

# Show printers within distance
FilterGeoLocation 20m

# Show all locations
FilterLocation none

# Show printers with matching location(s)
FilterLocation "Room 1"
FilterLocation "Room 1", "Room 2"
FilterLocation /^Room [1-2]$/
```

```
# Filter printers based on type(s)
FilterType any
FilterType mono
FilterType color
FilterType duplex
FilterType small
FilterType medium
FilterType large
FilterType duplex,color
```

CUPS 2.5 - Localization

- Add CUPS project to https://hosted.weblate.org/:
  - https://github.com/OpenPrinting/cups/issues/216
- Update PPD generator to collect all of the supported languages from a printer:
  - https://github.com/OpenPrinting/cups/issues/86
- Update cupsd to generate `.strings` files for all of the supported languages:
  - https://github.com/OpenPrinting/cups/pull/546

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CUPS 2.5 - OAuth 2.0/OpenID

- Replacement for Kerberos SSO:
  - Doesn't require root access or user changing gymnastics like Kerberos
- Many open source solutions available, including my own:
  - https://www.msweet.org/moauth
- SAML and Webauthn authentication backends are commonly available, too
- Support OpenID/RFC 8414 compliant OAuth 2.0 authorization servers:
  - Following in-progress IPP OAuth Extensions v1.0 draft
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippoauth10-20230814.pdf
- Bearer and refresh tokens will be cached per-user/auth-server
- Authorization UI will be presented using embedded web view - only available when printing from system console:
  - Develop separate D-Bus service for this? Or just integrate with common print dialog?
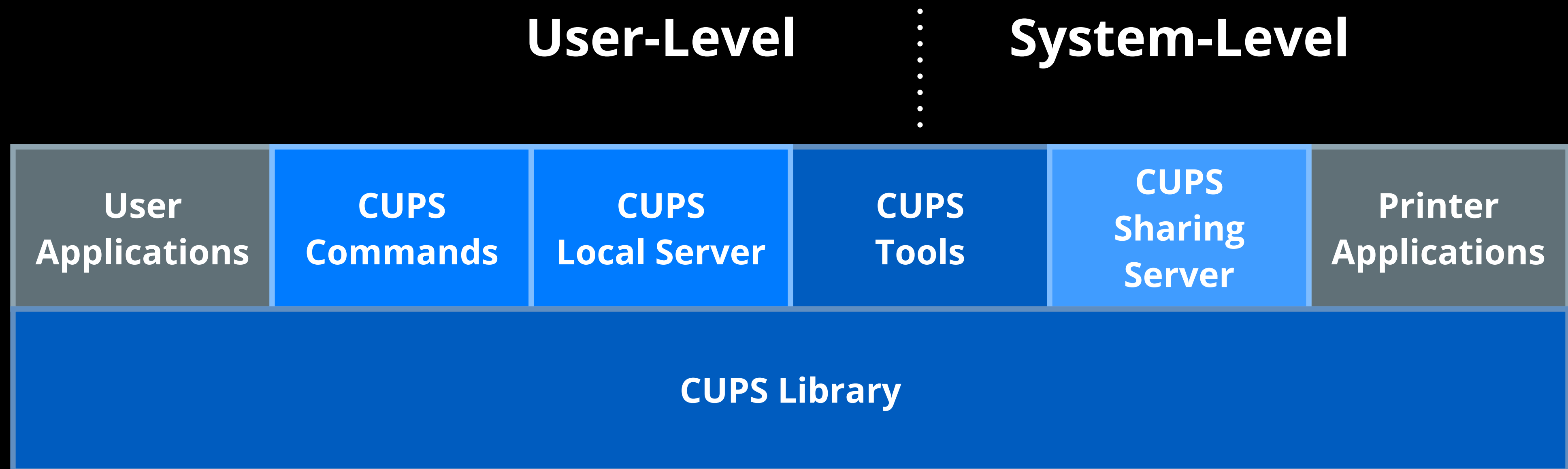 - Command-line tool for registering bearer token, too

CUPS 3

- Release manager: Michael Sweet
- Release schedule:
  - libcups 3.0b2 - November/December 2023
  - libcups 3.0rc1 + cups-local 3.0b1 - March/April 2024
  - cups-sharing 3.0b1 - September/October 2024
- Current Github "master" branches:
  - https://github.com/OpenPrinting/libcups
  - https://github.com/OpenPrinting/cups-local
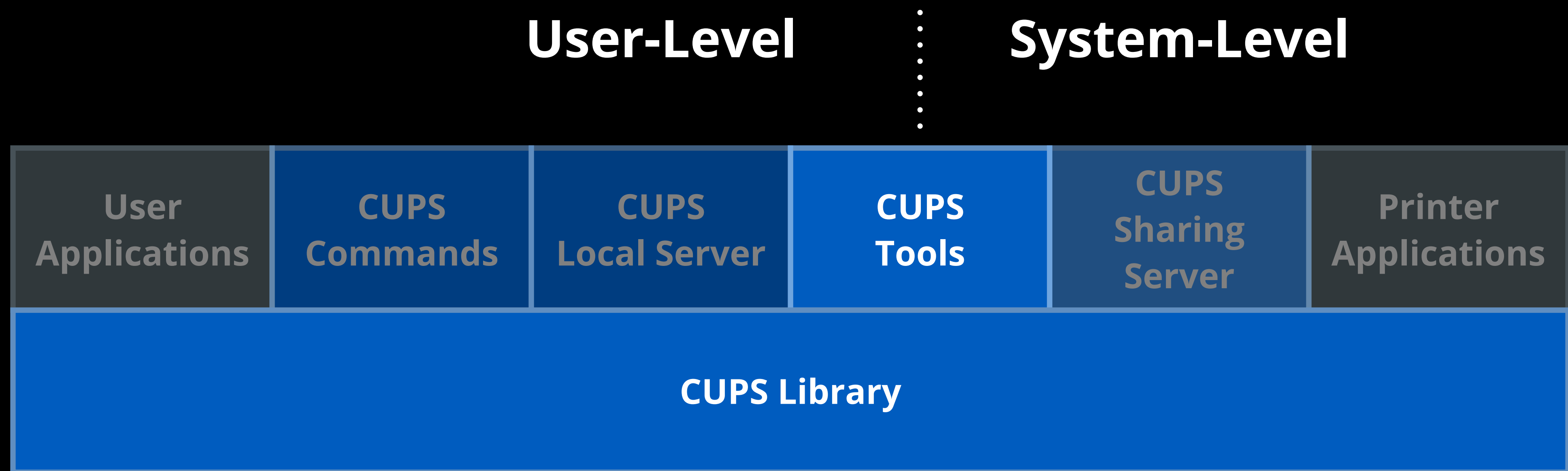 - https://github.com/OpenPrinting/cups-sharing

CUPS 3 - Overview

- New modular architecture
  - Common library/tools (libcups)
  - Local printing (cups-local)
  - Shared printing (cups-sharing)
- "Native" IPP implementation
  - Printer applications to support legacy printers
- Removal of deprecated APIs/features
  - Printer drivers/PPDs
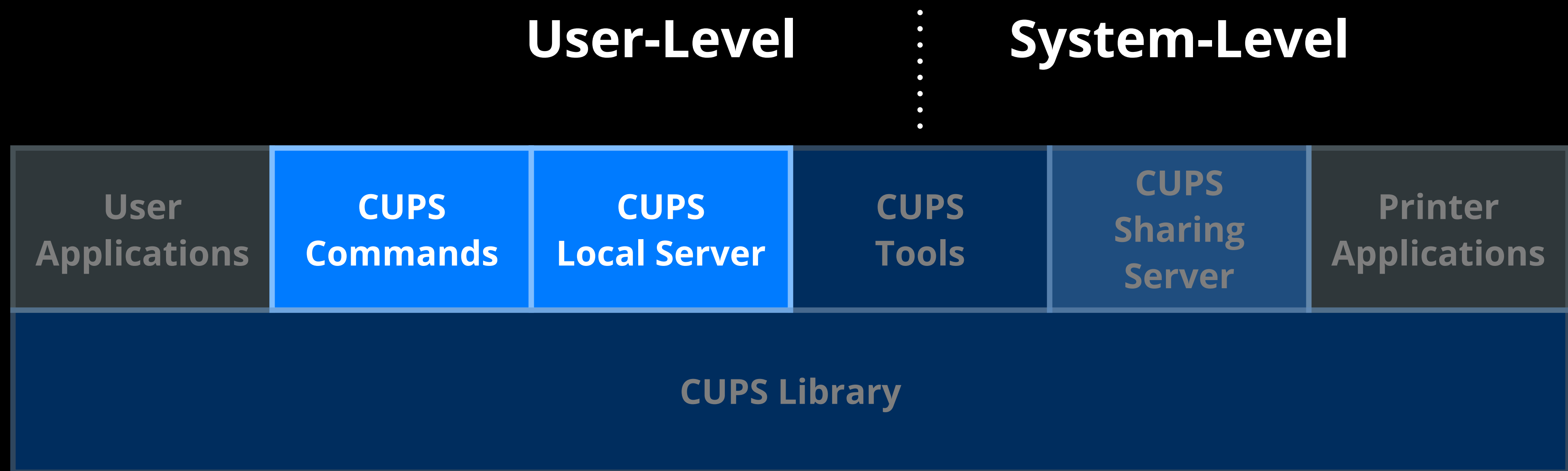 - Kerberos
- General cleanup

CUPS 3 - Architecture

User-Level · System-Level

User Applications	CUPS Commands	CUPS Local Server	CUPS Tools	CUPS Sharing Server	Printer Applications
CUPS Library					

CUPS 3 - libcups

User-Level ⋮ **System-Level**

User Applications	CUPS Commands	CUPS Local Server	CUPS Tools	CUPS Sharing Server	Printer Applications

CUPS Library

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CUPS 3 - libcups

- Repository:
  - https://github.com/OpenPrinting/libcups
- Commands:
  - ippevepcl, ippeveprinter, ippeveps, ippfind, ipptool, ipptransform (pending)
- Library:
  - Added new APIs (most also provided in CUPS 2.5):
    - IPP test file, HTML form, JSON, JWT, and X.509 APIs
  - Removed all deprecated APIs
  - Naming and calling conventions have been normalized - see "MIGRATING.md" document
  - New shared library major version - not binary compatible with CUPS 2.x and earlier
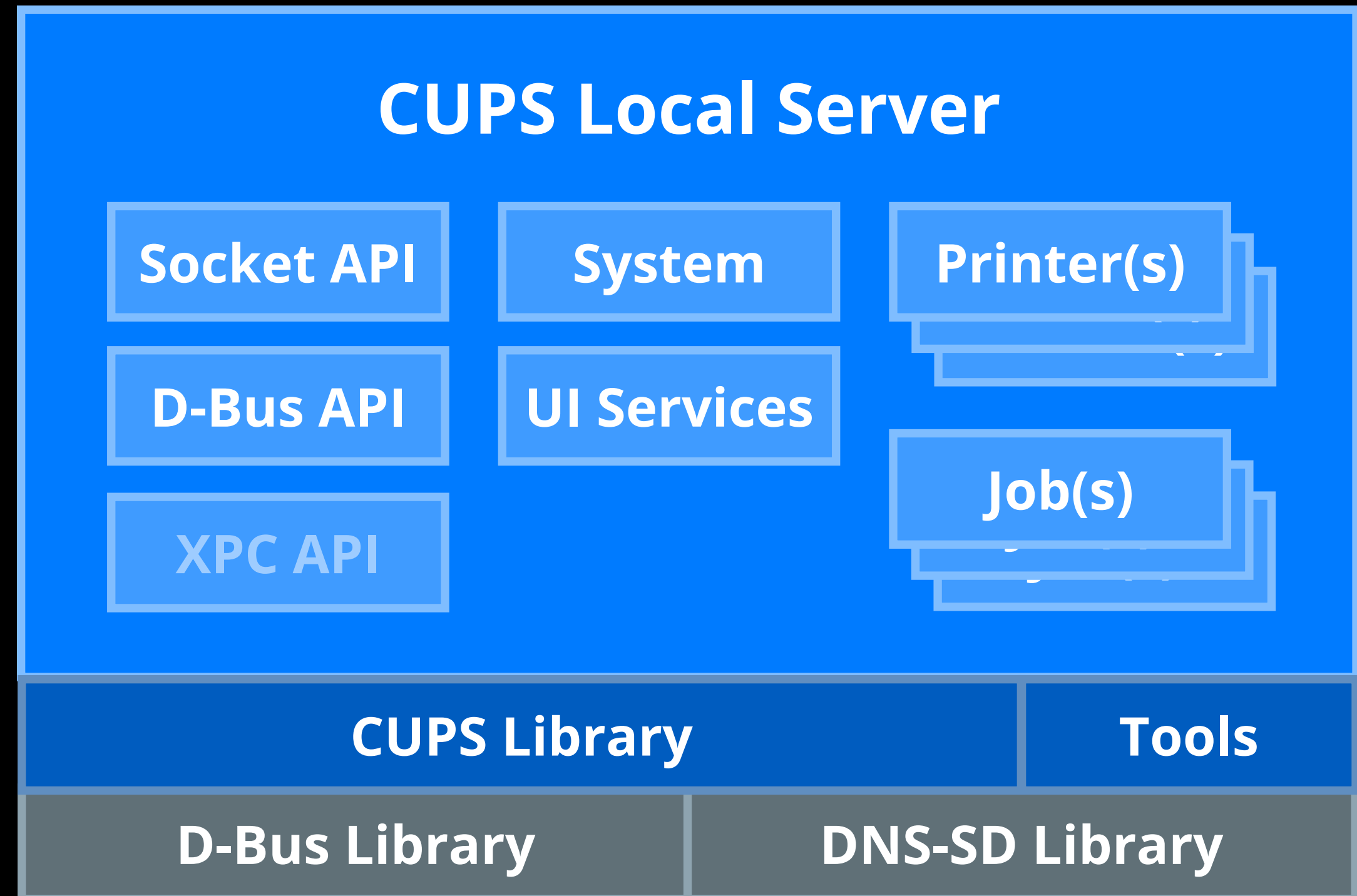- Status: Nearly feature complete

CUPS 3 - cups-local

User-Level ⋮ **System-Level**

User Applications	CUPS Commands	CUPS Local Server	CUPS Tools	CUPS Sharing Server	Printer Applications
		CUPS Library			

CUPS 3 - cups-local

- Repository:
  - https://github.com/OpenPrinting/cups-local
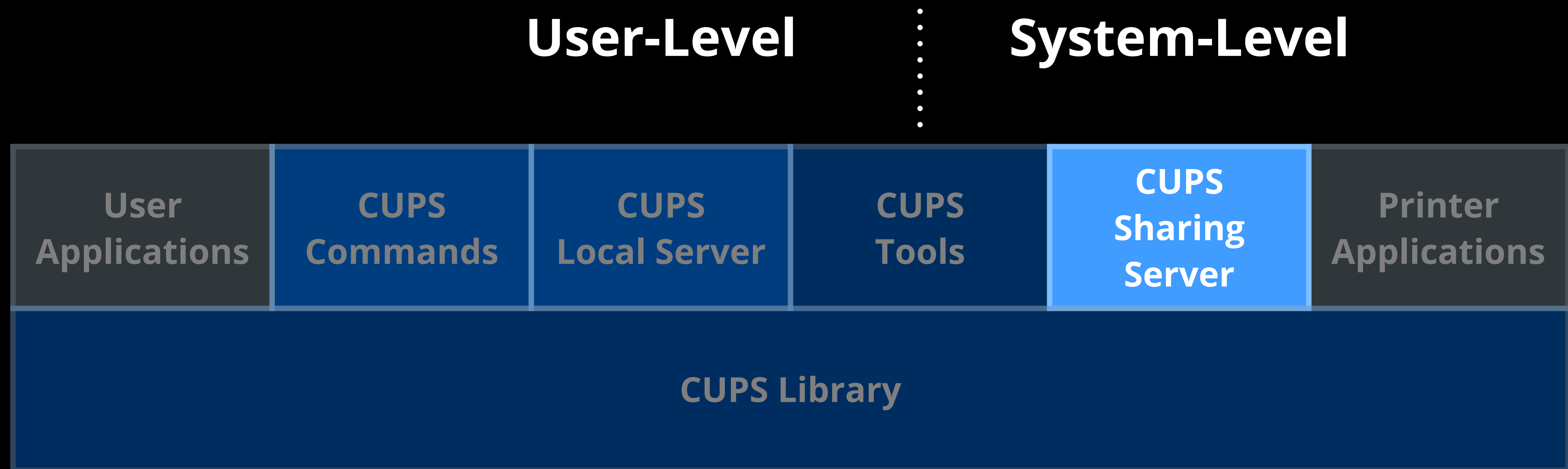- Commands:
  - cancel, lp, lpq, lpr, lpstat
- Local Server (cups-locald):
  - Handles local print requests for desktop/mobile devices
  - Only temporary IPP Everywhere print queues
  - Runs as user
  - UNIX domain socket and/or D-Bus API and/or XPC API
- Status: Barely started

CUPS 3 - cups-locald

- Handles all discovery and communications with printers
- Handles authentication, authorization, consent, and notification UI
- Converts to/from PDF/raster as needed for printers
- Job history is limited to the current session/login
- No web interface
- Configuration limited to listing specific printers or servers that cannot be discovered via DNS-SD ("profiles")
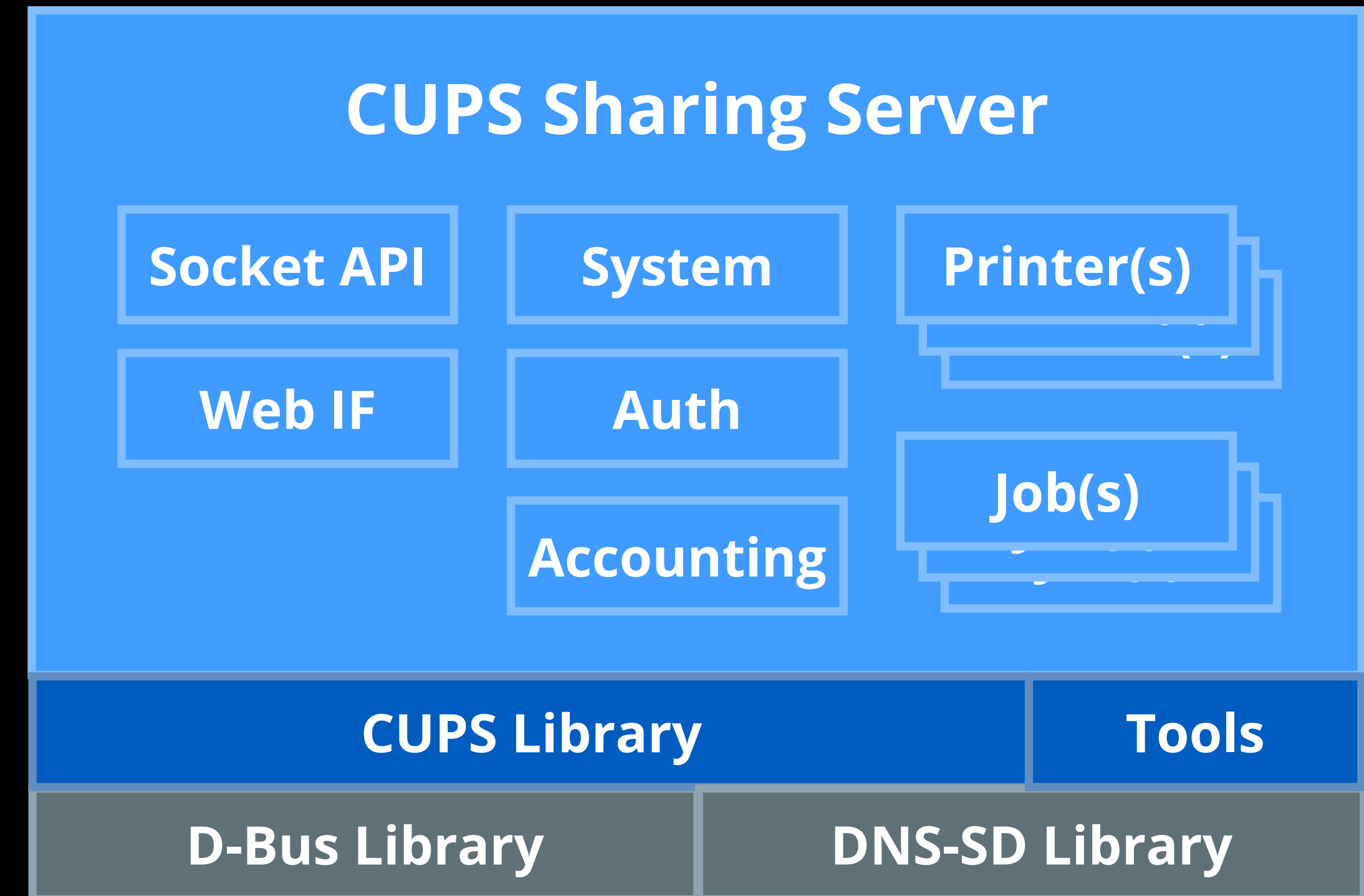
CUPS Local Server

Socket API	System	Printer(s)
D-Bus API	UI Services	
XPC API		Job(s)

| CUPS Library | Tools |
| D-Bus Library | DNS-SD Library |

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CUPS 3 - cups-sharing

User-Level ⋮ **System-Level**

User Applications	CUPS Commands	CUPS Local Server	CUPS Tools	CUPS Sharing Server	Printer Applications

CUPS Library

CUPS 3 - cups-sharing

- Repository:
  - https://github.com/OpenPrinting/cups-sharing
- Commands:
  - cupsaccept, cupsdisable, cupsenable, cupsreject, lpadmin
- Sharing Server (cups-sharingd):
  - Handles network print requests and local printing on headless servers
  - Full print accounting/ACLs/pre-processing of documents
  - OAuth 2 and PAM-based authentication/authorization
  - IPP Shared Infrastructure Extensions/System support
- Status: Barely started

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CUPS 3 - cups-sharingd

- Handles all communications with printers
- Authorization/consent/notification UI needs to be handled by client
- Converts to/from PDF/raster as needed for printers
- Job history is configurable
- Web interface
- Configuration similar to existing cupsd
- OAuth token introspection (RFC 7662) or JWT inspection and scopes for ACLs

CUPS Sharing Server

Socket API	System	Printer(s)
Web IF	Auth	
	Accounting	Job(s)

CUPS Library | **Tools**

D-Bus Library | **DNS-SD Library**

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CUPS 3 - Challenges

- Much broader scope and integration than the original CUPS work
- Desktop support - need to uplift GNOME/KDE/XFCE desktops to new D-Bus API for printing, authorization, consent UI
- Need developers to work on the local and sharing servers, desktop UI/ services
  - Can probably use/adapt PAPPL code for the core server bits
  - Much of the print dialog work can be repurposed
  - Probably have existing authorization/notification UI we can use
- Graphics libraries - current PDF tools/libraries have problematic licenses or other limitations

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