PAPPL Scanning Support

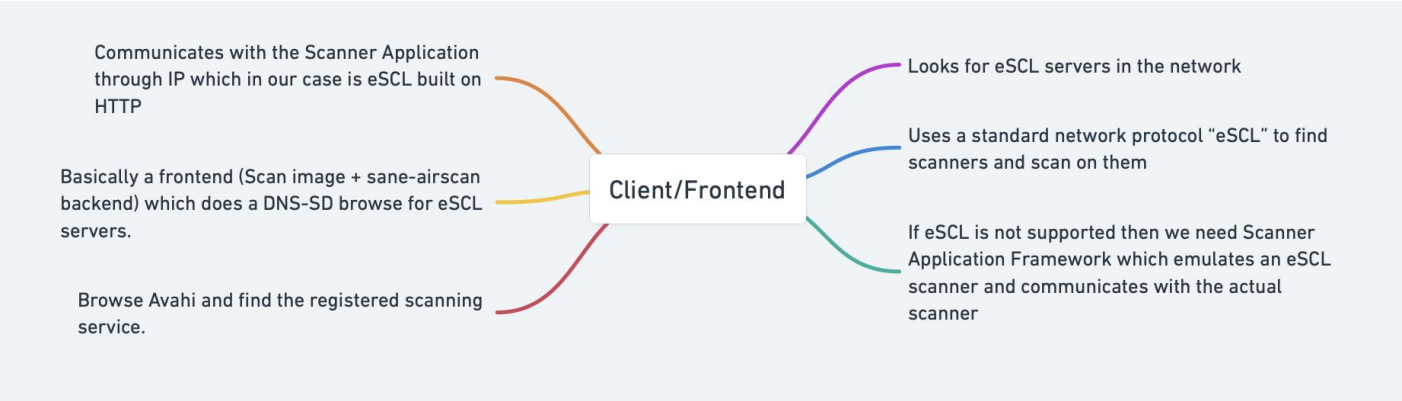
GSoC ‘23 and ‘24

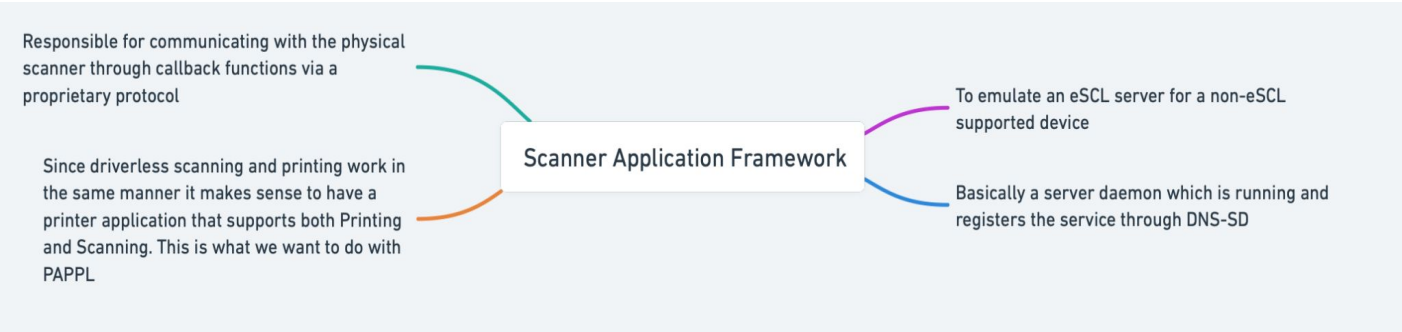
IDEA ??

IDEA : SANE becoming INSANE

- Example: Let’s consider 3 applications and 4 devices
- TWAIN: Needs 12 different programs to work.
- SANE: Reduces the number of programs to 7 but still a lot.
- Driverless Scanning: Reduced to 3.
- PAPPL: Framework for driverless printing through CUPS. Scanning support project being implemented.

The Architecture





Work / Code
Phase 1

Creating ESCl Endpoints

- Go through the MOPRIA Scan Specifications to know the endpoints.
- HTTPS/eSCL endpoints needed for

  1) /{root}/ScannerCapabilities

  2) /{root}/ScannerStatus

  3) /{root}/ScanBufferInfo

  4) /{root}/ScanJobs and many more

eSCL endpoints

Implemented under pappl/client.c under HTTP_STATE_GET and HTTP_STATE_POST

```
case HTTP_STATE_POST:
  if (strcmp(client->uri, "/eSCL/ScanJobs") == 0)
  {
    // Process the ScanJobs request
    size_t content_length = (size_t)httpGetLength2(client->http);
    char *xml_content = (char *)malloc(content_length + 1);
```

```
 if (strcmp(client->uri, "/eSCL/ScanJobs/"))
   // Check if the requested URI is "/eSCL/ScannerCapabilities"
   if (strcmp(client->uri, "/eSCL/ScannerCapabilities") == 0)
   {
     addOrUpdateIP(&ipList, client->host_field);
```

```
case HTTP_STATE_GET:
  const char *dummyFilePath = "NULL";
  addOrUpdateIP(&ipList, client->host_field);

  // Check if the requested URI is "/eSCL/ScanJobs/JobUri/NextDocument"
  if (isMatchingRequest(client->uri) == 1)
  {
    dummyFilePath = "/DummyDriver/pappl-160.png";

    // Send an external file...
    int fd;            // Resource file descriptor
    char buffer[8192]; // Copy buffer
    ssize_t bytes;     // Bytes read/written
```

Creating XML Parser

- Since eSCL communications is essentially through XML we would have to create a XML Parser that can sort of interpret various details and call the required functions.
- The XML parser is based on regex matching done using patterns as demonstrated in MOPRIA Scan Specifications.
- Divided the main function into many branched out functions for micro features.

XML Parser

Interpret eSCL communications

```
//
// Functions...
//

char *readXmlContent(const char *filePath);

void initScanSettingsXml(ScanSettingsXml *settings, const char *s);

char *getString(const ScanSettingsXml *settings, const char *name, const char *pattern);

double getNumber(const ScanSettingsXml *settings, const char *name, const char *pattern);

bool ClientAlreadyAirScan(pappl_client_t *client);

ScanSettingsXml *ScanSettingsFromXML(const char *xmlString, pappl_client_t *client);
```

```
ScanSettingsXml *ScanSettingsFromXML(
    const char *xmlString,  // I - XML string containing scan settings
    pappl_client_t *client) // I - Pointer to the pappl_client_t structure
{
  ScanSettingsXml scanSettings;
  initScanSettingsXml(&scanSettings, xmlString);

  char *versionPattern = "<pwg:Version>([^<]*)</pwg:Version>";
  char *version = getString(&scanSettings, "Version", versionPattern);

  char *intentPattern = "<scan:Intent>([^<]*)</scan:Intent>";
  char *intent = getString(&scanSettings, "Intent", intentPattern);

  char *heightPattern = "<pwg:Height>([^<]*)</pwg:Height>";
  char *height = getString(&scanSettings, "Height", heightPattern);

  char *contentRegionUnitsPattern = "<pwg:ContentRegionUnits>([^<]*)</pwg:ContentRegionUnits>";
  char *contentRegionUnits = getString(&scanSettings, "ContentRegionUnits", contentRegionUnitsPattern);

  char *widthPattern = "<pwg:Width>([^<]*)</pwg:Width>";
  double width = getNumber(&scanSettings, "Width", widthPattern);

  char *xOffsetPattern = "<pwg:XOffset>([^<]*)</pwg:XOffset>";
  double xOffset = getNumber(&scanSettings, "XOffset", xOffsetPattern);

  char *yOffsetPattern = "<pwg:YOffset>([^<]*)</pwg:YOffset>";
  double yOffset = getNumber(&scanSettings, "YOffset", yOffsetPattern);

  char *inputSourcePattern = "<pwg:InputSource>([^<]*)</pwg:InputSource>";
  char *inputSource = getString(&scanSettings, "InputSource", inputSourcePattern);

  char *colorModePattern = "<scan:ColorMode>([^<]*)</scan:ColorMode>";
  char *colorMode = getString(&scanSettings, "ColorMode", colorModePattern);
```

Dummy Driver For Emulation

- Add a dummy driver (initially xml files, later turned to text files) that emulates a driver fetching data from a scanner.
- The following scan driver emulation files had to be added:

  1) ScannerStatus

  2) ScannerCapabilites

  3) ScannerBufferInfo

Dummy Driver

Example of Initial Buffer Info file

```
<?xml version="1.0" encoding="UTF-8"?>
<scan:ScanBufferInfo
xsi:schemaLocation="http://schemas.hp.com/imaging/escl/20
11/05/03 eSCL.xsd"
xmlns:scan="http://schemas.hp.com/imaging/escl/2011/05/03
"
xmlns:httpdest="http://schemas.hp.com/imaging/httpdestina
tion/2011/10/13"
xmlns:pwg="http://www.pwg.org/schemas/2010/12/sm"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<scan:ScanSettings>
<pwg:Version>2.6</pwg:Version>
<scan:Intent>Photo</scan:Intent>
<pwg:ScanRegions>
<pwg:ScanRegion>
<pwg:Height>1200</pwg:Height>
<pwg:ContentRegionUnits>escl:ThreeHundredthsOfInches</p
wg:ContentRegionUnits>
<pwg:Width>1800</pwg:Width>
<pwg:XOffset>0</pwg:XOffset>
<pwg:YOffset>0</pwg:YOffset>
</pwg:ScanRegion> </pwg:ScanRegions>
<scan:DocumentFormatExt>image/jpeg</scan:DocumentFormat
Ext>
<pwg:ContentType>Photo</pwg:ContentType>
<pwg:InputSource>Platen</pwg:InputSource>
<scan:XResolution>300</scan:XResolution>
<scan:YResolution>300</scan:YResolution>
<scan:ColorMode>Grayscale8</scan:ColorMode>
```

Creating SANE Interface for PAPPL Retrofit

- During the later half of GSoC had to understand the working of SANE and how it works.
- Started with understanding the documentation and capabilities of SANE , and finally modelled a PR.
- Independent application completing the SANE driver behaviour already developed and tested.
- Work on combining the SANE Driver from PAPPL Retrofit with PAPPL for creating a Scanner Application still ongoing.

PAPPL Retrofit

SANE Driver Implementation Code Snippet

```c
void initializeSane()
{
  SANE_Int versionCode = 0;
  sane_init(&versionCode, authenticationCallback);
  printf("Version: %d\n", versionCode);
}

SANE_Status getScanningDevices(const SANE_Device ***deviceList)
{
  printf("Getting all Scanning Devices\n");
  SANE_Status status = sane_get_devices(deviceList, SANE_FALSE);
  if (status)
  {
    printf("Could not retrieve devices: %s\n", sane_strstatus(status));
  }
  return status;
}

SANE_Status openScanningDevice(SANE_Device *device, SANE_Handle *handle)
{
  SANE_Status status = sane_open(device->name, handle);
  if (status)
  {
    printf("Scanning device could not be opened %s: %s\n", device->name, sane_strstatus(status));
  }
  return status;
}

void cancelScan(SANE_Handle handle)
{
  sane_cancel(handle);
```

Work / Code
Phase 2

PAPPL API Bridging for Scanner Applications

- Create printer-like class object structures for scanners.
- Add functionalities and data structures for scan job creation and linking with normal job objects.
- Modify the DNS-SD advertisement to support both printing and scanning.
- Merging into Upstream !! 😁