

The NAPI Plugin Guide

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Preface

In the summer of 2005, I was lending my time to the Open-Source community. The project I wound up devoting the majority of my time to was **GPLFlash**, and a big goal for that project was to provide a browser plugin front-end for their Shockwave Flash (SWF) renderer. Unfortunately, the plugin at the time was highly unstable, and prone to crashing the browser whenever any SWF content came up. As part of my work for the project, I was doing a proper design from the ground up — which meant that I would have to be well-acquainted with the plugin interface that we needed to integrate with. As part of that process, I decided to write this guide, in the hopes that it would be useful for many other developers.

Thanks goes out to the folks who made this document possible:

- The Netscape guys, for making the plugin architecture in the first place
- The Internet Archive, for saving things (like the NPAPI docs) that might have otherwise been lost
- The Mozilla organization, for having lots of examples (even if some were broken)
- The Videolan folks, for having an open-source Windows plugin I could learn from
- And everyone else I’ve forgotten. . .

I would also like to point out that I use male forms of pronouns to refer to people of unknown gender; it’s not sexist, it’s proper English. I assume that my audience is both mature and knowledgable enough to know that when I make references like “the Netscape guys,” women can be (and undoubtedly are) a part of that.

1 Introduction

This chapter will cover the general basics of what plugins are, and how they work; it is intended as a primer to the architectural concepts behind the plugin paradigm. Information specific to the Netscape Plugin Application Programming Interface (NPAPI) will be discussed throughout the rest of this manual. Reading this chapter is not strictly necessary in order to use the other chapters, but it may help you to understand and integrate the information at a higher level.

What is a Plugin?

(To be written)

2 Plugin Bootstrapping

When the browser scans its plugin directories and finds a new library, the browser will attempt to see if the library is a plugin. The following things must be able to happen in order for the library to be considered a plugin:

- The browser must be able to tell the plugin the addresses of the browser-side NAPI functions that the browser implements
- The plugin must be able to tell the browser the addresses of the plugin-side NAPI functions that the plugin implements
- The browser must be able to determine what MIME types the plugin handles, along with other metadata about the plugin
- The browser must be able to determine the plugin’s “shutdown” routine

Caution: The directory where plugins should be installed is both browser and platform specific. It will be up to you (and later, your installer) to determine where the plugin should be installed for your target browsers and platforms.

Once these tasks are completed, the plugin should be registered with the browser. In the case of Firefox or Mozilla, this means that the plugin should appear in the “about:plugins” page. The purpose of this chapter is to show how each of the major platforms tries to accomplish these tasks, so that you can create a plugin with the appropriate entry points for your target platform(s). The next chapter, [Chapter 3 \[Registration\]](#), page 7, will cover registration from a platform-independent point of view.

Caution: The entry points in this chapter are expected to be exported as non-mangled names (i.e., C-exported symbols, not C++). Thus, if you are using C++, you will need to wrap these function declarations (and corresponding definitions) in an `extern "C" {}` block.

Windows/OS2

Required entry points

```
NPError WINAPI NP_GetEntryPoints(NPPluginFuncs*)
NPError WINAPI NP_Initialize(NPNetscapeFuncs*)
NPError OSCALL NP_Shutdown()
```

Note: The `OSCALL` in the `NP_Shutdown` signature is not a typo. The `OSCALL` macro is used because the `NP_Shutdown` function can be compiled for and used by more than one platform.

Browser behavior

Browser-Side Addresses

Browser calls `NP_Initialize`

Plugin-Side Addresses

Browser calls `NP_GetEntryPoints`

MIME Types & Metadata

Browser uses file metadata

Shutdown Browser calls `NP_Shutdown`

MIME Types & Metadata

The MIME types and other plugin meta-data are all stored in a resource file that gets compiled into the final DLL. Specifically, the information is stored as strings in the DLL's version information; the browser looks for the following sets of string/value pairs:

ProductName

The name of the plugin

FileDescription

the description of the plugin

MIMEType

A “|” separated list of mime-types, e.g. “text/html|application/x-texinfo|text/xml”

FileExtents

A “|” separated list of filetypes, e.g. “htm,html|tex,txi,texinfo|xml”

FileOpenName

A “|” separated list of human-readable filetypes, e.g. “HTML Document|TexInfo Document|XML File”

Note that in order for the browser to detect them, all of the above strings must be in the “US English” language and use the “Windows Multilingual” encoding.

UNIX

Required entry points

```
char*      NP_GetMIMEDescription()
NPError    NP_GetValue(void*, NPPVariable, void* out)
NPError    NP_Initialize(NPNetscapeFuncs*, NPPluginFuncs*)
NPError    OSCALL NP_Shutdown()
```

Browser behavior

Browser-Side Addresses

Plugin-Side Addresses

Browser calls `NP_Initialize`

MIME Types & Metadata

Browser calls `NP_GetMIMEDescription` for MIME types, and calls `NP_GetValue` to get the plugin name and description.

Shutdown Browser calls `NP_Shutdown`

MIME Types & Metadata

The MIME types are returned by the `NP_GetMimeDescription` as a string of the format “mime/type:ext,ex2,ex3:Human-Readable Description;mime/type2:ext3:Another description”. Thus, the MIME types from the Windows example would be represented as follows:

```
"text/html:htm,html:HTML Document;"
"application/x-texinfo:tex,txi,texinfo:TexInfo Document;"
"text/xml:xml:XML File"
```

The plugin name and description are extracted through the `NP_GetValue` interface, which is very similar to the `NPP_GetValue` interface (FIXME: add cross-reference to the section discussing `NPP_GetValue`). `NP_GetValue` is concerned with only two values of `NPPVariable`: `NPPVpluginNameString` and `NPPVpluginDescriptionString`. A typical implementation of `NP_GetValue` could look like this:

```
NPErr NP_GetValue(void* reserved, NPPVariable var, void* out)
{
    NPErr ret = NPERR_NO_ERROR;
    char** val;

    if(out == NULL)
        { return NPERR_INVALID_PARAM; }

    val = (char**)(out);

    switch(var)
    {
        case NPPVpluginNameString:
            *val = "Example Plug-In";
            break;
        case NPPVpluginDescriptionString:
            *val = "A plug-in that demonstrates how NP_GetVal is implemented";
            break;
        default:
            ret = NPERR_INVALID_PARAM;
            break;
    }

    return ret;
}
```

Mac

Required entry points

```
DEFINE_API_C(NPErr) main(NPNetscapeFuncs* nsTable,
                        NPPPluginFuncs* pluginFuncs,
                        NPP_ShutdownUPP* unloadUpp)
```

Browser behavior

Browser-Side Addresses

Plugin-Side Addresses

Browser calls main

MIME Types & Metadata

Browser uses file metadata

Shutdown Browser calls the *NPP_ShutdownUPP* function pointer that main returns

Caution: I don't have access to a Mac, nor do I know how to program on one. If someone with more Mac development experience could write this section, I'd be much obliged.

MIME Types & Metadata

The MIME types and metadata for the plugin are stored in the resource fork of the final plugin library file. On OSX, the information from *NP_GetMIMEDescription* will override any information coming from the resource fork. Anyone who wants to flesh this out can start working from the [NPAPI documentation](#).

3 Registration

After the platform-specific parts from [Chapter 2 \[Plugin Bootstrapping\]](#), page 3 are taken care of, registration becomes fairly straightforward. There are two major structures involved in registration: *NPPluginFuncs* and *NPNetscapeFuncs*. The former is passed from the plugin to the browser, and declares what functions the plugin has implemented. The latter is passed from the browser to the plugin, and declares what functions the browser makes available.

NPNetscapeFuncs

```
typedef struct _NPNetscapeFuncs {
    uint16 size;
    uint16 version;
    NPN_GetURLUPP geturl;
    NPN_PostURLUPP posturl;
    NPN_RequestReadUPP requestread;
    NPN_NewStreamUPP newstream;
    NPN_WriteUPP write;
    NPN_DestroyStreamUPP destroystream;
    NPN_StatusUPP status;
    NPN_UserAgentUPP uagent;
    NPN_MemAllocUPP memalloc;
    NPN_MemFreeUPP memfree;
    NPN_MemFlushUPP memflush;
    NPN_ReloadPluginsUPP reloadplugins;
    NPN_GetJavaEnvUPP getJavaEnv;
    NPN_GetJavaPeerUPP getJavaPeer;
    NPN_GetURLNotifyUPP geturlnotify;
    NPN_PostURLNotifyUPP posturlnotify;
    NPN_GetValueUPP getvalue;
    NPN_SetValueUPP setvalue;
    NPN_InvalidateRectUPP invalidaterect;
    NPN_InvalidateRegionUPP invalidateregion;
    NPN_ForceRedrawUPP forcedredraw;
    NPN_GetStringIdentifierUPP getstringidentifier;
    NPN_GetStringIdentifiersUPP getstringidentifiers;
    NPN_GetIntIdentifierUPP getintidentifier;
    NPN_IdentifierIsStringUPP identifierisstring;
    NPN_UTF8FromIdentifierUPP utf8fromidentifier;
    NPN_IntFromIdentifierUPP intfromidentifier;
    NPN_CreateObjectUPP createobject;
    NPN_RetainObjectUPP retainobject;
    NPN_ReleaseObjectUPP releaseobject;
    NPN_InvokeUPP invoke;
    NPN_InvokeDefaultUPP invokeDefault;
    NPN_EvaluateUPP evaluate;
```

```

    NPN_GetPropertyUPP getproperty;
    NPN_SetPropertyUPP setproperty;
    NPN_RemovePropertyUPP removeproperty;
    NPN_HasPropertyUPP hasproperty;
    NPN_HasMethodUPP hasmethod;
    NPN_ReleaseVariantValueUPP releasevariantvalue;
    NPN_SetExceptionUPP setexception;
} NPNetScapeFuncs;

```

The *NPNetScapeFuncs* provides the plugin with the browser’s NPAPI version, as well as pointers to the NPAPI functions that the browser has implemented. When the plugin receives this structure from the browser, the plugin will need to do two things: verify that the browser is compatible with the plugin, and if so, make the browser’s NPAPI functions available to the rest of the plugin.

Checking binary compatibility

When an *NPNetScapeFuncs* structure is passed to the plugin, the plugin must first check the *version* field to ensure that the structure the browser is using is binary-compatible with the structure that the plugin was compiled with. The code to do this check is as follows (assuming *browser_data* is the *NPNetScapeFuncs** that is passed to the plugin):

```

// NULL pointers are invalid
if ( browser_data == NULL )
    { return NPERR_INVALID_PARAM; }

// Ensure that the browser’s major NPAPI version is not greater than the
// plugin’s major NPAPI version
if( (browser_data->version >> 8) > NP_VERSION_MAJOR )
    { return NPERR_INCOMPATIBLE_VERSION_ERROR; }

```

The *version* field is a 16-bit number that represents the union of two unsigned 8-bit numbers. The most significant byte is the major version of the NPAPI that the browser or plugin was compiled against, while the least significant byte is the minor version. The plugin can access the version of the NPAPI it is compiled with through the *NP_VERSION_MAJOR* and *NP_VERSION_MINOR* macros.

Copying the data

Because the data structures must be monotonic (i.e., they may only have new things added to the end) to ensure backwards-compatibility, two *NPNetScapeFuncs* that aren’t the same size can still be used with one another — which is why there was no *size* check in the previous section. The code for copying the browser’s *NPNetScapeFuncs* data to the plugin’s local data is as follows (assuming *g_browser_data* is a globally-scoped *NPNetScapeFuncs* in the plugin):

```

size_t copyCount = sizeof(g_browser_data);

// Initialize the plugin’s NPNetScapeFuncs structure
memset(&g_browser_data, 0, copyCount);

// Determine the amount of data that needs to be copied

```

```
copyCount = (browser_data->size < copyCount)?browser_data->size:copyCount;

// Do the copy
memcpy(&g_browser_data, browser_data, copyCount);
g_browser_data.size = sizeof(g_browser_data);
```

This code results in the plugin receiving as much data from the browser as possible. In the case where the browser's structure is greater than or equal to the size of the plugin's structure, the plugin's structure is completely filled. In the case where the browser's structure is smaller, the plugin's structure is filled with the contents of the browser's structure, and the left-over fields are filled with NULL values.

Logical Compatibility Check

Once the browser's data has been copied over, the plugin should verify that the browser provides all of the functionality that the plugin requires. For example, if your plugin uses the *NPN_ForceRedraw* function, you would want to check that the *forcedredraw* variable of the *NPNetscapeFuncs* structure is non-NULL:

```
NPError error = NPERR_INVALID_FUNCTABLE_ERROR;
if(g_browser_funcs.forcedredraw == NULL)
    {;}
else if(g_browser_funcs.invoke == NULL)
    {;}
// ...
else
    { error = NPERR_NO_ERROR; }
```

Since browsers could provide pointers to stubbed functions, this is not a foolproof method for ensuring compatibility. However, it is a good first line of defense.

NPPluginFuncs

To be written

4 Instantiation

To be written

5 Managing the Screen

To be written

6 Receiving Streams

To be written

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If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the “with...Texts.” line with this:

```
with the Invariant Sections being list their titles, with  
the Front-Cover Texts being list, and with the Back-Cover Texts  
being list.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

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