

Using samba base libraries

SSSD as an example application

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Introduction

The objective of this talk is to show how some of the samba base libraries can be used and integrated successfully in other projects.

We use SSSD as an example application.

Why samba libraries?

There are a few reasons why I decided to use the samba libraries in this project.

Part of it is because I wanted to use LDB as our internal directory. LDB depends on talloc, tdb and tevent.

Part of it is because I think these libraries are extremely useful and powerful, and has been largely tested within samba.

Also initially SSSD was going to use a process model close to that of samba4. It meant a lot of infrastructure was already in place w/o having to reinvent all from scratch.

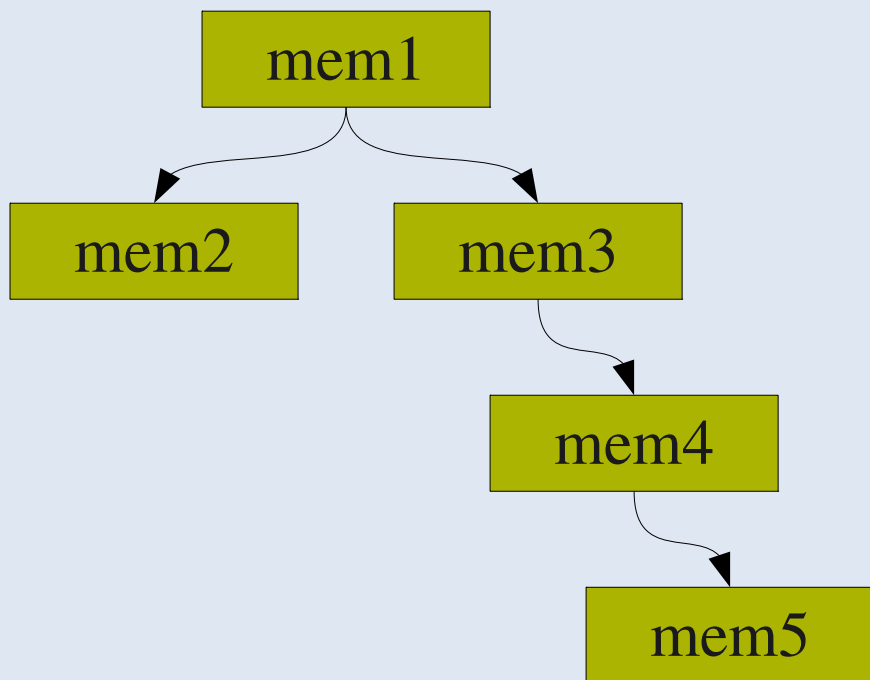
So what is great with these libraries ?

Talloc

Talloc and memory hierarchies

Talloc is samba's memory allocation library.

- Does not replace malloc, but (so far) uses malloc underneath
- Each memory allocation with talloc generates a talloc context
- Each talloc context can be a child of another context
- Each talloc context can be a parent of other contexts

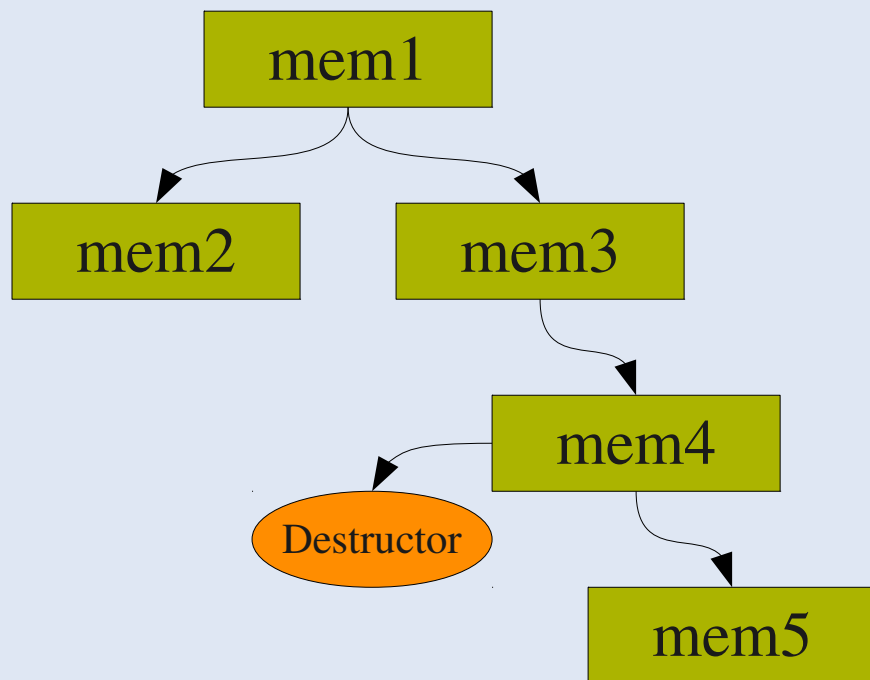


```
mem1 = talloc_new();  
mem2 = talloc(mem1, foo_t);  
mem3 = talloc(mem1, bar_t);  
mem4 = talloc(mem3, baz_t);  
mem5 = talloc_strdup(mem4, "last");
```

Talloc - memory hierarchies

Why are memory hierarchies useful ?

- Deep function nesting and cleanup on error conditions
- State/Context based code
- Async code
- Destructors



```
int destructor4(void *mem) {
    struct fid *mem4 = mem;

    close(mem4->file_descriptor);
    Return 0;
}
...
talloc_set_destructor(mem4, destructor4);
...
talloc_free(mem1);
```

Tevent

Tevent

Tevent is a recent addition to the pool of 'T'-libraries.

It is an implementation of an event engine:

- extremely useful in event driven, async programs (such as Samba or SSSD)
- supports different backends for polling file events (based on epoll, or select, or DIY)
- support non-file based events too
 - timers
 - signals
- uses talloc for all memory management

Tevent - The event context

The main actor in tevent is the event context

- holds all references to the currently instantiated events
- returned by the init function:

```
struct tevent_context *tev;  
TALLOC_CTX *mem_ctx;  
...  
tev = tevent_context_init(mem_ctx);
```

It is needed to instantiate new events:

```
/* a new timer event */  
timer = tevent_add_timer(tev, mem_ctx, timeval, callback, private_data);
```

It is normally the key context in the main loop:

```
/* this loops until there are events */  
tevent_loop_wait(tev);
```

Tevent - Events

Tevent supports 3 main events types

file related events (uses epoll/select):

```
void recv_data(struct tevent_context *ev, struct tevent_fd *fde,
               uint16_t flags, void *private_data);
...
fd = socket(AF_UNIX, SOCK_STREAM, 0);
connect(fd, (struct sockaddr *)&namedpipe, sizeof(namedpipe));
fde = tevent_add_fd(tev, mem_ctx, fd, TEVENT_FD_READ, recv_data, pvt);
```

Once you have a file handler you can tell tevent to check if the file descriptor is readable and/or writeable and to call a function when that happens.

Tevent – Events (2)

Timer events:

```
void run_alarm(struct tevent_context *ev, struct tevent_timer *te,  
              struct timeval current_time, void *private_data);  
...  
timer = tevent_add_timer(tev, mem_ctx, timeval, run_alarm, pvt);
```

A timer event lets you tell tevent to run a function after waiting an arbitrary amount.

Very useful to handle situations where you have to wait before retrying an operation over the network

Also extremely useful to schedule task you want to run once in a while (all kind of checks against remote servers, or other resources that cannot be polled through a file descriptor)

Tevent – Events (3)

signals (in a safe way):

```
void my_sighup(struct tevent_context *ev, struct tevent_signal *se,  
              int signum, int count, void *siginfo, void *private_data);  
...  
sig = tevent_add_signal(tev, mem_ctx, SIGHUP, 0, my_sighup, pvt);
```

Signals are normally extremely annoying to deal with.

You can't do many operations within a signal handler (you can't use `malloc()` for example).

With `tevent` it becomes very simple to handle signals as just any other event.

`Tevent` catches and stores the fact that an event has happened and calls your signal handler as soon as control is returned to the main event loop.

TDB

TDB – Trivial/Tiny DataBase

TDB is a very mature component of Samba

- Used in samba to share all kind of information between process

- Used also as storage for data (like accounts, secrets, preinters)

- The API/ABI and file formats are quite stable.

It is a very fast database.

- Uses MMAP (also support file operations)

- It's basically a huge, in memory, hash table.

- Supports multiple write locks on separate records.

- Since some time now it also support transactions.

TDB – Trivial/Tiny DataBase

But this is not a general purpose database

- Similar to BDB

- Supports only single key operations

- Data is treated as a blob.

- The app is responsible for formatting the data records.

Continued development

- Recently there has been interest in making it thread safe

- Some work is being done on supporting nesting transactions

- (Howard Chu (OpenLDAP) sent some interesting patches)

LDB

LDB – Ldap-like DataBase

LDAP-like

- Data stored in entries.

- Entries are organized in a directory.

- Each entry can have any number of attributes.

- Powerful search filters.

- Supports plug-ins to add functionality.

But unlike LDAP

- Can store everything in a single local file
(a tdb for example)

- Does not enforce a schema

- Can work both as a server and as a client library
(EX: against a remote LDAP server)

- Supports transactions

 - (only when a tdb is used for now)

Integration Challenges

Integration challenges

Library API/ABI stability

Interfaces documentation

Libraries packaging

Build system

Mixing std malloc and talloc

DBUS

SSSD

What is SSSD

SSSD stands for System Security Service Daemon.

(Name may still be subject to change)

SSSD is a client agent that implements NSS and PAM (*)

- isolate applications from the network
- implement a better, intelligent caching
- implement offline capabilities for all backends
- hopefully improve authentication configurations

Initial urge was to replace modules like nss_ldap.

Many aspects of SSSD have been **deeply** inspired by Winbindd

But it is **not** a Winbindd replacement

I plan to use libwbclient to use winbindd as a backend in future.

(*) It also implements other interfaces over DBUS but they are not yet stable

Why nss_ldap is bad ?

Problems with nss_ldap:

- includes ldap libraries
 - Requires to link them statically to avoid symbol issues
 - Requires a rebuild when there is an issue with ldap libraries
- lives within the process space
 - Very complex code, a bug means we can crash the app.
- no pooling of connections
 - A server with many processes may end up with **many** connections to the remote LDAP server unnecessarily
- access credentials
 - nss_ldap lives in the user process space, any credential needed to access the ldap server is exposed to all users

Nsswitch.conf is never reloaded, requiring a restart of all applications on configuration changes or modules updates

What is “wrong” in nsswitch ?

Things nsswitch gets wrong in today's networked computing:

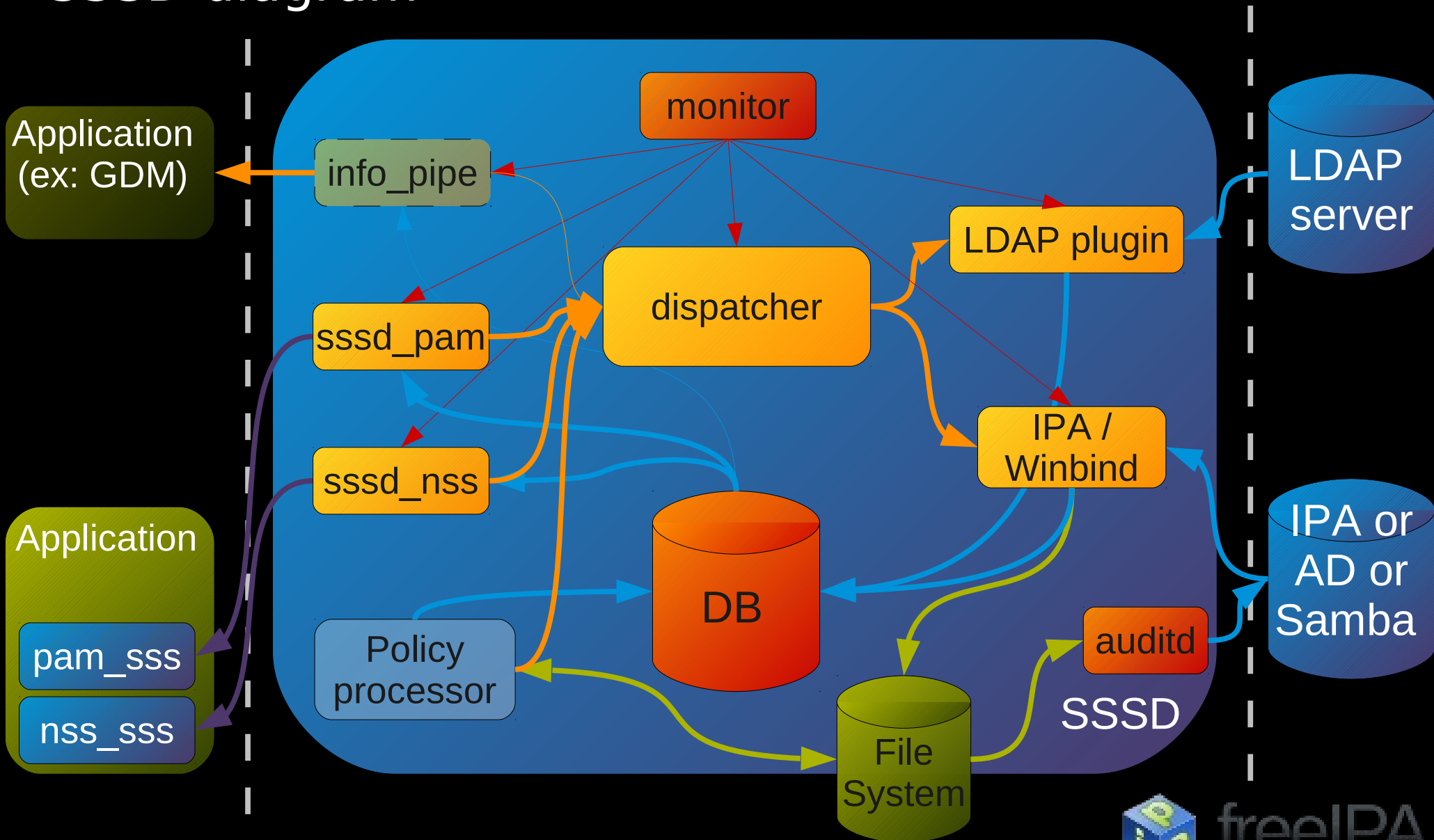
- assumes data is always present, available, and reachable without significant delays.
- no concept of identity domains, all users/groups are stored in a single name space.
- assumes enumerating users/groups is possible/desirable

What is “wrong” in PAM ?

Things PAM gets wrong:

- assumes a text interface and basically a login/password access scheme
- no concept of identity/authentication domains.
- Static interface, does not cope with dynamic environments
- Too complex and yet no ideal to configure “stacks”

SSSD diagram



Thank you!

Thank YOU for attending this talk.

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My opinions do not necessarily reflect the opinions of organizations I am connected with or the companies I work or worked for.

