Strong Authentication in EOS Shared Fuse Mount

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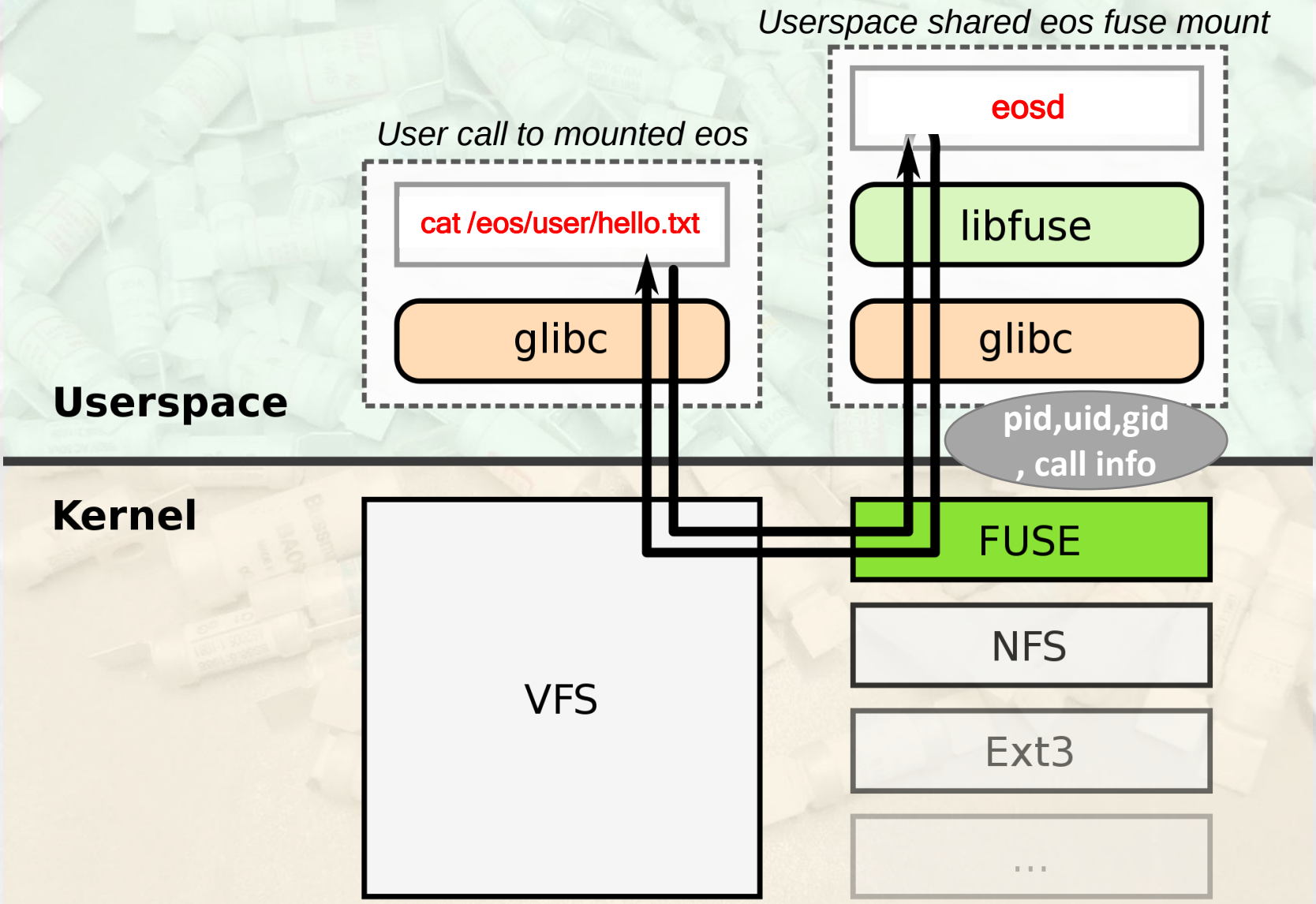
Overview

- Introduction
  - A bit of context
  - Fuse in a sketch
- How it works
  - The new XRootD 4 authentication features
  - Integration into the eos fuse client
  - Getting the (right) users credentials
  - Implementation
- How to use it
  - Configuration
  - eosfusebind and its avatars
- Wrap-up

A bit of context

- Fuse rather than kernel module because much lighter development.
- EOS used to offer two ways to run the fuse mount (it used to be 2 programs):
  - Personal mount : use the krb5 CC or the gsi proxy of the user
  - Shared mount : was using UNIX authentication and had to be granted root access on the mgm
- Important drawbacks
  - Personal mounts are a waste of resource on shared machines
  - Shared mounts are a security threat to the eos instances.
  - Shared mounts have to be manually given special rights on the instance
  - Unix authentication is restrictive in a Grid environment
- One solution : strong authentication in shared fuse mount
  - Prior to XRootd4, the implementation would have been hazardous
  - XRootd4 allows to explicitly pass credentials to be used in urls
  - Let’s do it then!
- Ideally, it should feel like using AFS with kerberos

Fuse in a sketch



The new XRootD 4 authentication features

- Required protocol and credentials can be passed as cgi arguments in the url
  root://eosuser.cern.ch/eos/myfile.txt?xrd.wantprot=krb5&xrd.k5ccname=somefile

…Looks straightforward, easy and great but…

…XRootd client is a smart piece of software:

- It will reuse open connections as much as possible
- Authentication is done when connecting
- It will **not** reconnect to conform to the required authentication. If a connection can be reused, it will **ignore** required authentication.

- When a new connection is needed, there is no way to force a reconnection, a new one has to be made.
- Use xrootd login as connection id (root://a23FIPk0@eosuser.cern.ch/eos…..)
  - 1 connection per (xroot login,server)
  - xrootd login is 8 characters, if using base64 encoding: 2^{48}.
    Enough to avoid reusing connections.
  - Connections left behind will timeout and get closed.

Getting the (right) user credentials

- Using user's environment to specify the credentials to use seems intuitive
  - Implemented! Almost working.
  - **Deadlock** with the kernel…… find something else…..
- Using symlinks created by the user to point to the credentials to use
  - Security to be explicitely taken care of.
  - Implemented!
  - Working .. after some bug fixing
- We call this credentials binding
- Two types of credentials binding
  - User binding : bind a user to default credentials
  - Session binding : allow a user to use specific credentials in a given (linux) session
- Credentials resolution in the daemon
  - Try to find a session binding, if success, done.
  - Try to find a user's binding , if success, done.
  - Optionally : fallback as being nobody , if success, done.
  - Fail

Implementation

- Coarsely, that is it. A few points had to be watched carefully
- Speed and concurrency:
  - Credentials have to be resolved and checked for any call from any user from any process accessing the fuse mount
  - Several levels of caching
  - Finely crafted locking and mappings
- Security:
  - Credentials safety check is deferred to the underlying library (GSI, Kerberos)
  - Security of symlinks to credentials have to be checked
- OS interaction:
  - Heavy use of proc files
  - All the pid, ppid, sid stuff
- Integration:
  - Tool for the users to create the bindings **eosfusebind**
  - Integration with sshd via pamd, jobs systems and a few servers

Configuration

- If GSI or KRB5 is enabled, Unix authentication is **disabled**
- GSI and KRB5 **can** be used together
- Using GSI authentication:
  - Grid security should be properly configured on the box i.e. a user should be able to authenticate to eos using the client.
    XrdSecPROTOCOL=gsi eos whoami should authenticate the user with gsi
  - *Export EOS_FUSE_USER_GSIPROXY=1* should be added to /etc/sysconfig/eos
  - Users should create a proxy with **grid-proxy-init**
- Using KRB5 authentication:
  - Kerberos should be properly configured on the box i.e. a user should be able to authenticate to eos using the client.
    XrdSecPROTOCOL=krb5 eos whoami should authenticate the user with krb5.
  - *Export EOS_FUSE_USER_KRB5CC=1* should be added to /etc/sysconfig/eos
  - *If in-memory krb5 tickets are to bused, Export EOS_FUSE_USER_**UNSAFEKRB5**= 1* should be added to /etc/sysconfig/eos
  - Users should create a ticket with **kinit**

eosfusebind and its avatars

- The script manages symlinks of the form:
  /var/run/eosd/credentials/u<uid>.<protocol>
  /var/run/eosd/credentials/u<uid>_sid<session_id>_sst<session_startuptime>.<protocol>
- For user bindings, eosfusebind copies (and cleans-up) the credentials to:
  /var/run/eosd/credentials/store/
- For session bindings, eosfusebind just symlinks the credentials in-place.
- Every time it's called, the script cleans-up the unused symlinks for the user.
- There is locking mechanism for concurrent calls
- The script allows to display the binding for the current session, for the user and for all the other sessions of the same user.
- The script is integrated with pamd for ssh and co.
- The script is also integrated with the wrapping script of kinit
- For very specific symlinks can be created by hand (or should we evolve eosfusebind?)

eosfusebind -h

Wrap-up

- Features
  - Shared fuse mount with krb5 and gsi authentication
  - No measurable impact on performance
  - No deployment overhead on eos administration
  - No security risk
  - Easy to use and to integrate **eosfusebind** tool to bind credentials to users/sessions
- Operational experience
  - Running for a **few months** on lxplus (interactive use)
  - Running for a few weeks on lxbatch (bath systems)
  - After many iterations of bug fixing/evolution, the authentication is **now very stable**.
  - Today, most major eos instances are automatically available on lxplus on login.
- Perspectives
  - Long run and expiring credentials
  - Upcoming new fuse implementation does not require high performance. Rewriting without all the caching?