

Kerberos/Authentication Updates in Samba

Status Update within Samba 4.16

Stefan Metzmacher <metze@samba.org>

Samba Team / SerNet

2022-06-14

Topics

- ▶ SambaXP 2020
- ▶ Security updates
- ▶ Testing improvements
- ▶ MIT KDC improvements
- ▶ Updated Heimdal snapshot
- ▶ Pending Heimdal based Fixes
- ▶ Future Updates
- ▶ How you can reliably change a machine password
- ▶ Questions? Feedback!

- ▶ Also see my SambaXP 2020 Talk
- ▶ <https://samba.org/~metze/presentations/2020/SambaXP/>
- ▶ It explains/shows a lot of details of how Kerberos works

Security updates

- ▶ In November 2021 we fixed a lot security problems
 - ▶ Mostly related to name based races
- ▶ See Andrew's SambaXP 2022 Talk which explains the details

- ▶ In 2020 we introduced python based protocol tests for krb5
 - ▶ We're able to generate any possible request PDU
 - ▶ and verify all fields of the response PDU of the KDC
 - ▶ The initial infrastructure consisted of 3498 lines
 - ▶ (including autogenerated asn code)
- ▶ Now in 2022 these tests have been expanded a lot
 - ▶ We're now at ~ 21k lines!
 - ▶ These new tests helped a lot exploring and fixing the security problems
- ▶ Catching regressions is important when changing the KDC code
 - ▶ The amount of tests should be able to prevent major regressions
 - ▶ However there's still a lot of potential for new/additional tests

MIT KDC improvements

- ▶ The MIT-KDC code for the active directory dc got support for:
 - ▶ PKINIT (certificate/smartcard authentication)
 - ▶ S4U2Self (enable an application service to obtain a Kerberos service ticket on behalf of a named user)
 - ▶ S4U2Proxy (including resource based constrained delegation RBCD)
 - ▶ Propagation of Asserted Identity SIDS: S-1-18-1 vs. S-1-18-2
- ▶ We still hide the MIT-KDC feature behind `'-with-experimental-mit-ad-dc'`
 - ▶ The Heimdal based KDC is still the preferred choice
 - ▶ The new features require MIT krb5 1.20, which got released on 2022-05-26
 - ▶ But the python tests give us an overview what's still missing (and it's getting less and less)

Updated Heimdal snapshot (Part 1)

- ▶ Samba 4.15 had basically the same Heimdal snapshot as 4.0
 - ▶ We did the last import from upstream in 2011
 - ▶ Only fixed important bugs
- ▶ Samba 4.16 imported a fresh Heimdal snapshot
 - ▶ We still have custom patches, but rebased
 - ▶ We try to create upstream pull requests before we integrate patches
 - ▶ But we may not wait for the changes to be accepted upstream
- ▶ The new Heimdal internal APIs are much more flexible:
 - ▶ It's much easier to hook our AD KDC logic into the core code
 - ▶ Hopefully we require less custom changes for future features

Updated Heimdal snapshot (Part 2)

- ▶ Support for Kerberos FAST was added:
 - ▶ This brings Kerberos request armoring
 - ▶ It can tunnel ticket requests and replies that might be encrypted with a weak password inside a wrapper built with a stronger password, say from a machine account.
 - ▶ We don't support Compound Identity with FAST yet
- ▶ FAST is used by Heimdal and MIT by default if possible
 - ▶ But not for Authentication Ticket requests (AS-REQ/REP)
 - ▶ Pre-Authentication with weak passwords is not protected
 - ▶ Only for Service-Tickets requests (TGS-REQ/REP)
- ▶ Windows clients do not use FAST by default
 - ▶ Windows (at least) 2012 DCs, as well as explicit GPO settings, are required
 - ▶ We announce ourselves only as Windows 2008R2

Pending Heimdal based Fixes (Part 1)

- ▶ Usage of previous passwords should not update badPwdCount
 - ▶ It happens when working on multiple hosts with cached passwords
 - ▶ It's already fixed for NTLM authentication
 - ▶ But Kerberos Pre-Authentication results in ACCOUNT_LOCKED_OUT
 - ▶ https://bugzilla.samba.org/show_bug.cgi?id=14054
 - ▶ This merge request has fixes for the problem
 - ▶ https://gitlab.com/samba-team/samba/-/merge_requests/664
- ▶ There are important S4U2Proxy fixes for Windows consumers
 - ▶ We need to use the correct decryption key for enc-authorization-data
 - ▶ https://bugzilla.samba.org/show_bug.cgi?id=13131
 - ▶ We need to use the correct authtime for the PAC
 - ▶ https://bugzilla.samba.org/show_bug.cgi?id=13137
 - ▶ This merge request has fixes for the problem
 - ▶ https://gitlab.com/samba-team/samba/-/merge_requests/2458

Pending Heimdal based Fixes (Part 2)

- ▶ We should announce PA-SUPPORTED-ETYPES like windows:
 - ▶ We should announce strong encryption types, even if no related key is stored
 - ▶ It means a ticket can have a stronger session key type than decryption key type
 - ▶ https://bugzilla.samba.org/show_bug.cgi?id=13135
 - ▶ This merge request has fixes for the problem
 - ▶ https://gitlab.com/samba-team/samba/-/merge_requests/2459

- ▶ Compound Identity Support together with Claims Support
 - ▶ The new Heimdal KDC APIs will make it easy to add new PAC buffers
 - ▶ It's also easy to check with PA-Data elements are used by the client
- ▶ Given the client support for FAST in Heimdal and MIT
 - ▶ winbindd could be changed to use armoring krb5 auth for pam_winbind
 - ▶ It would prevent krb5 pre-auth with weak passwords on the wire

How you can reliably change a machine password (Part 1)

- ▶ Windows passwords are UTF-16 with up to 255 characters
 - ▶ From there the UTF-8 version is calculated for Kerberos
 - ▶ It's also the input for MD4() in order to generate the NTHASH
 - ▶ Machine passwords should be as strong as possible
- ▶ First we tried completely random passwords:
 - ▶ The length is random between 128 and 255 characters
 - ▶ Each character is a random 32-bit codepoints
 - ▶ =>https://bugzilla.samba.org/show_bug.cgi?id=12262
 - ▶ After a password change Kerberos may no longer work
 - ▶ The conversation of passwords was wrong depending on 'unix charset'
 - ▶ As Heimdal/MIT libraries don't support compound UTF-16
- ▶ Then we limited the characters to 16-bit codepoints
 - ▶ This avoids compound UTF-16 characters
 - ▶ We also verify all conversations and may fallback to ascii for invalid characters

How you can reliably change a machine password (Part 2)

- ▶ We tried to store the new password locally first
 - ▶ In the past we had problems with ctdb failing to store the password after the remote change
 - ▶ =>https://bugzilla.samba.org/show_bug.cgi?id=12782
 - ▶ There are DCs with RefusePasswordChange=1 returning WRONG_PASSWORD
 - ▶ That way we destroyed the join
- ▶ We now store 3 or 4 password generations
 - ▶ older, old, current and optionally next
 - ▶ Before trying a remote change we store the 'next_change' password (if not already existing)
 - ▶ Then we check which password the remote DC currently holds
 - ▶ If the server already knows about the 'next_change', we just finish the pending change.
 - ▶ If the server only knows about our old or older password, we abort the change, in hope replication latency will fix things up later.
 - ▶ We try the remote change and store the result

How you can reliably change a machine password (Part 3)

- ▶ Even with only validated 16-bit codepoint passwords we are not safe
 - ▶ =>https://bugzilla.samba.org/show_bug.cgi?id=14984
 - ▶ Changing the password via an RODC we likely destroy the join
 - ▶ RODC/RWDC PasswordUpdateForward handling via NetrLogonSendToSam ignores errors
 - ▶ Passwords longer than ~ 127 characters get INVALID_PARAMETER, most likely 256 bytes vs. 256 (UTF-16) characters
- ▶ We now finally match Windows
 - ▶ We're using a fixed length of 120 characters
 - ▶ It means password changes work against RODCs now
- ▶ It is so important to match Windows as close as possible
 - ▶ This is just one example
 - ▶ But we had a lot of similar cases in the last 20 years
 - ▶ It's really important otherwise we're constantly hitting untested code
 - ▶ In Windows itself
 - ▶ Other vendors are only testing against Windows

- ▶ Stefan Metzmacher, metze@samba.org
- ▶ <https://www.sernet.com>
- ▶ <https://samba.plus>

Slides: <https://samba.org/~metze/presentations/2022/SDC-EMEA/>