Vanadium (V23) Discussion

Marc Mosko

marc.mosko@sri.com

ICNRG, IETF 119, Brisbane

Wednesday 20, 2024

What? Why?

- It is a secure, distributed, RPC system
- It has distributed naming and discovery
- It uses symmetrical authentication and encryption
- It may use private name discovery with IBE

- It seems interesting for ICN.
- We will do a quick intro to Vanadium, then discuss.

Vanadium has two parts

- Principals and Blessings and Caveats [Security]
  - Use a hierarchical name, e.g. alice:home:tv.
  - Certificate based
  - Blessings are scoped delegations from one principal to another for a namespace (e.g. alice grants Bob “watch” permissions to the TV)
  - Caveats are restrictions on delegations (e.g. Bob can only watch 6pm – 9pm).
  - 3rd party caveats must be discharged before authorization
    - E.g. revocations or auditing
- The RPC mount tables [Object Naming]
  - These describe how to locate RPC namespaces
  - They provide relative naming

How ICN-ish is Vanadium

- The security part is pretty ICN-ish
  - It uses prefix matching and encryption
  - Namespaces work like groups
  - The colon : separates the blesser from the blessed
  - Authorizations match extensions.
    - If Alice authorized “read” to `alice:hometv` to `alice:houseguests`, and if Bob has a blessing for `alice:houseguests:bob`, then Bob has “read” to `alice:hometv`.
  - A special terminator `:$` only matches the exact prefix.
    - A blessing to `alice:houseguest:$` only matches that exact prefix.

Examples from https://vanadium.github.io/concepts/security.html

Examples

- Alice authorizes her TV (Ptv) within her namespace.

P_{alice} using name `alice` says that P_{tv} can use the name `alice:devices:hometv`

- This caveat is valid if `server` has a blessing as `alice:devices:hometv`.

P_{alice} using name `alice` says that P_{bob} can use the name `alice:houseguest:bob` *as long as*

`server` matches `alice:devices:hometv`

Examples from https://vanadium.github.io/concepts/security.html

Root of trust

- Vanadium skirts the issue of root of trust.
- They ran an identity service at https://dev.v.io/auth
  - Based on an initial OAuth2 IDP of an app for an email address
    - User-blessing: `dev.v.io:u:<email>`
    - App-blessing: `dev.v.io:o:<appid>:<email>`
    - Authorizes an app to work on behalf of a user within some context in the blessing
- They ran a Discharge service
  - The identity service offered a revocation caveat at dev.v.io/users/<email_address>
  - Chose a revocation rather than a short-lived authorization.

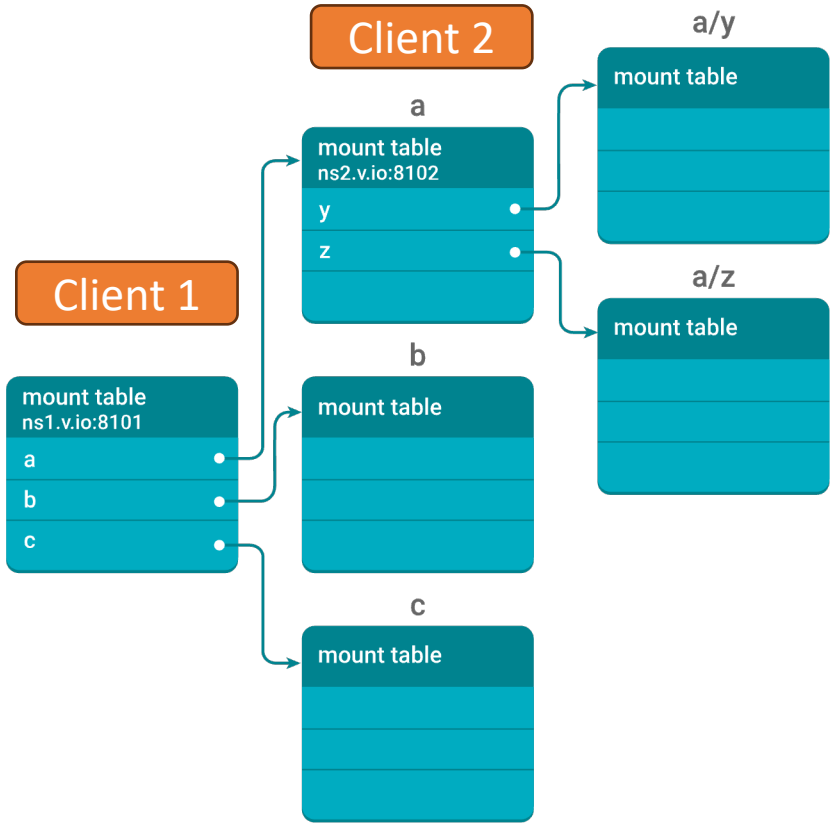
https://vanadium.github.io/designdocs/identity-service.html

Part 2: Object Naming

- An object name facilitates an RPC

If the name /host:8080/a/y/foo.jpg represents a JPEG file,
then /host:8080/a/y/foo.jpg.Get() will return the contents of that file.

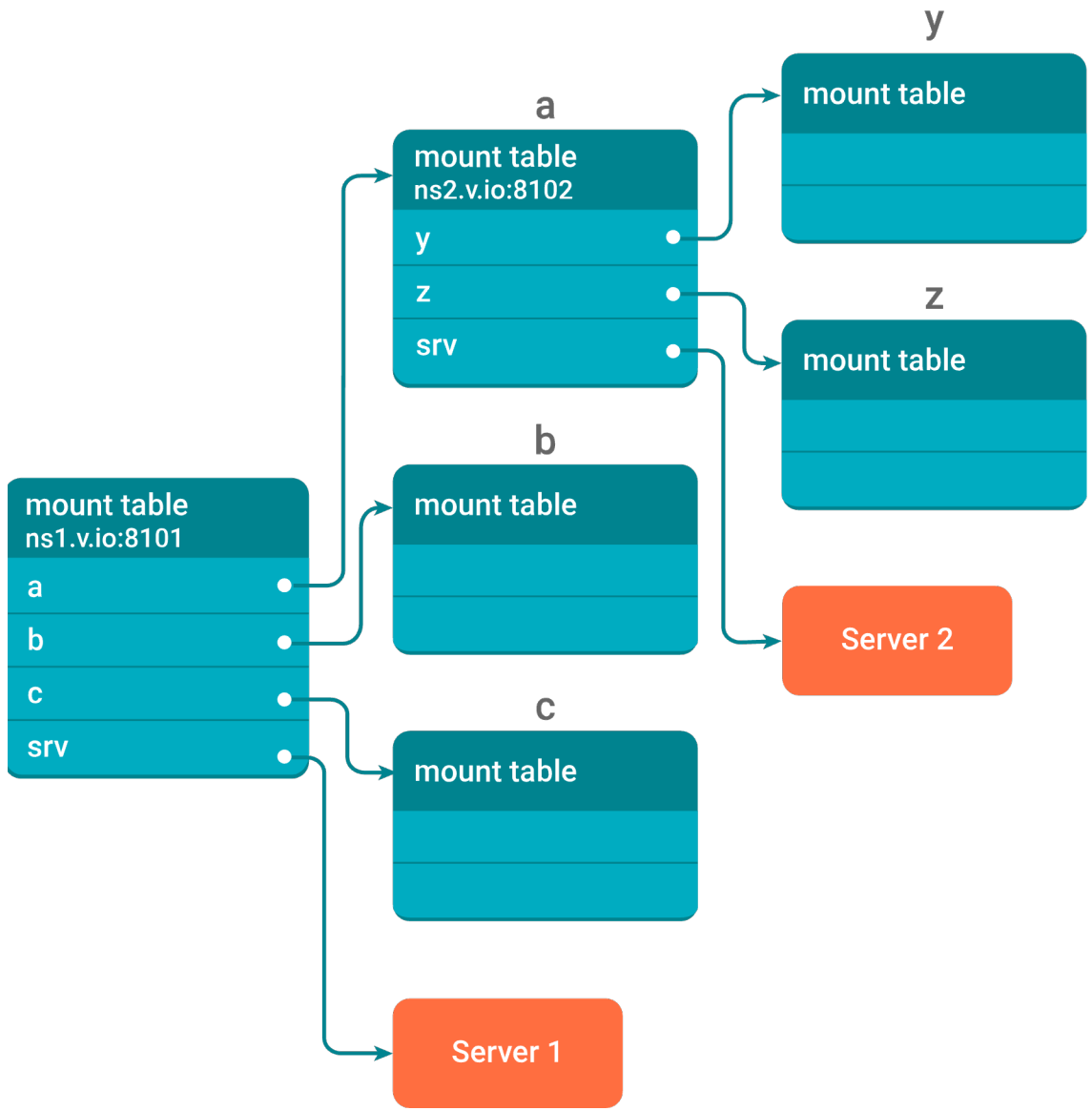
- Note that Object names are/
- A *Mount Table* maps an endpoint to object name components.
- Resolving an object name is a recursive walk.
- It is relative. Client 1 sees /ns1.v.io:8101/a/y, client 2 sees /ns2.v.io:8102/y



https://vanadium.github.io/concepts/naming.html

Entity resolution

- The devices that execute an RPC name are also listed in the mount table.
- E.g. /ns1.v.io:8101/a/srv.Get()
- Extensions are passed
  - /ns1.v.io:8101/a/srv/foo/bar.Get() calls Server 2 with foo/bar.Get()
- Cycles are permitted



https://vanadium.github.io/concepts/naming.html

More on names

- A mount table is a service that maps an object name to an (endpoint, suffix) pair.
- A mount table is itself an RPC, so you can mount tables on tables.
- A rooted name begins with an Endpoint
  - <ipv4:port>,
  - <ipv6:port>,
  - <dns:port>, or
  - <macaddr> (for BT)

Summary

- Vanadium is a permissioned RPC service
- A name encodes the endpoint plus name suffix
- The endpoint does not need to resolve to a single mount table server, it could be any server that possesses an appropriate blessing.
- Authentication is done via pair-wise key exchange and blessing validations. It can be private if using IBE, otherwise server name leaks.
- Authorizations and Blessings and Caveats use hierarchical, prefix-matching names.

What does it mean for ICN?

- The security piece is interesting.
  - Blessings and Caveats and discharges and namespaces as groups.
  - How does it differ from SDSI co-signings?
- Vanadium identity service
  - Interesting mapping of OAuth2 app:email tokens to PKI and blessings.
- The RPC piece needs a bit of finessing
  - Embedding an endpoint in the name is not ICN.
  - Embedding a root of trust could be.
  - CCNx [1] uses public-key scoped names.
  - NDN uses schematized-trust key anchors.

[1] Ghali, Cesar, Gene Tsudik, and Ersin Uzun. "In content we trust: Network-layer trust in content-centric networking." *IEEE/ACM Transactions on Networking* 27, no. 5 (2019): 1787-1800.