Today

⇒ * Security implementation in AFS

Wednesday

- Wrap up

Friday

- Townhall

Final Exam

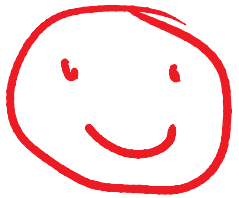
- Wed @ 8 AM (12/9)

C105 Score Card

Spring 2015

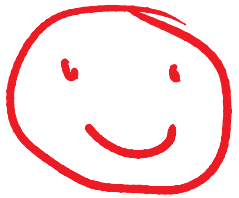
C105 Score Card

Spring 2015 100%.



CIOS Score Card

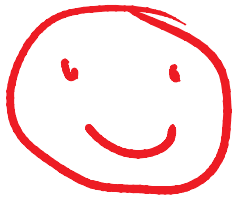
Spring 2015 100%



Fall 2015 33%
(So far)

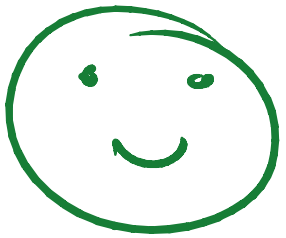
CIOS Score Card

Spring 2015 — 100%



Fall 2015 — 33% (so far)

By next week — 100%



Challenges for Andrew System

Authenticate User

Authenticate Server

Prevent replay attacks

isolate users

Choice in Andrew: private key crypto system
⇒ identity of sender in cleartext

Traditional Unix: username, password
— overuse of Lotk security hole

Dilemma: What to use as identity and Private Key?

Andrew solution

- username and password only for login
- use ephemeral id and keys for subsequent venus-vize communication

Andrew solution

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Three classes of client-server interaction

- login
- RPC session establishment
- file system access during session

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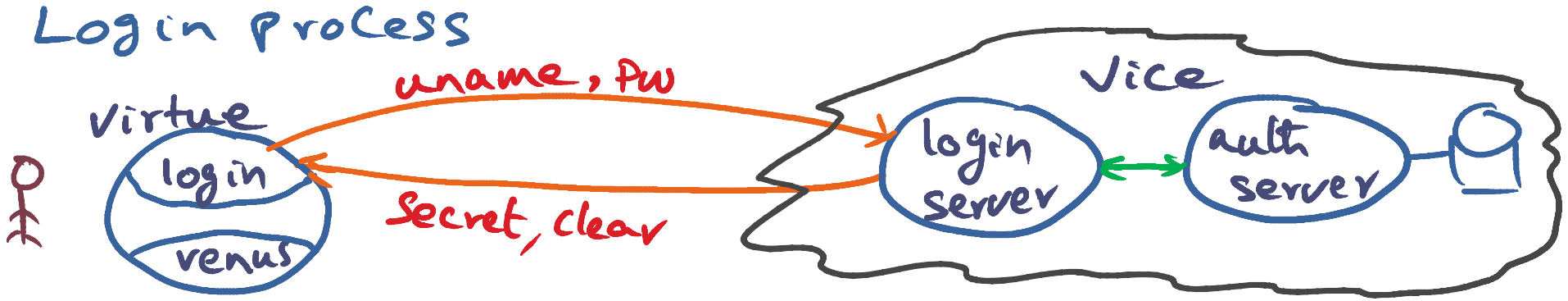
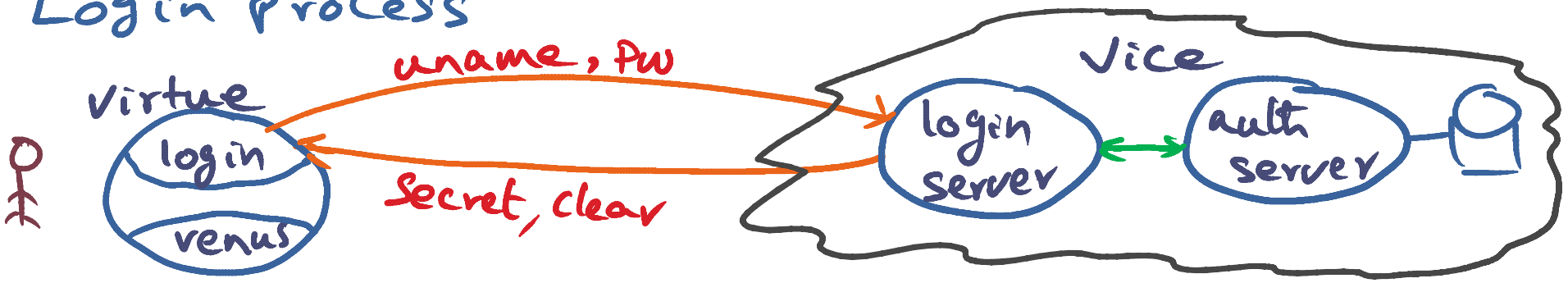
} both use ephemeral id and keys


Login process
Virtue
login
venus
uname, PW
Secret, clear
Vice
login server
auth server

Login process



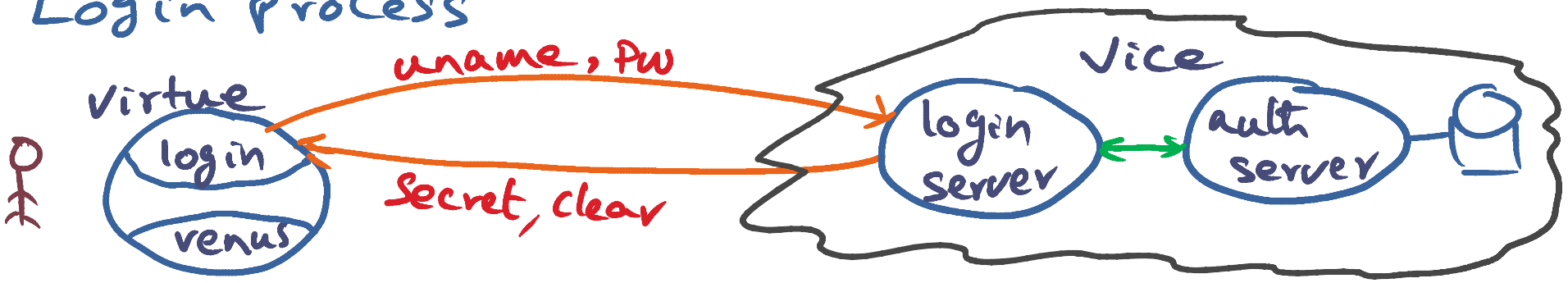
Cleartoken: Data structure

⇒ Extract handshake key client (HKC)

Secrettoken: cleartoken encrypted with key

known only to vice

Login process



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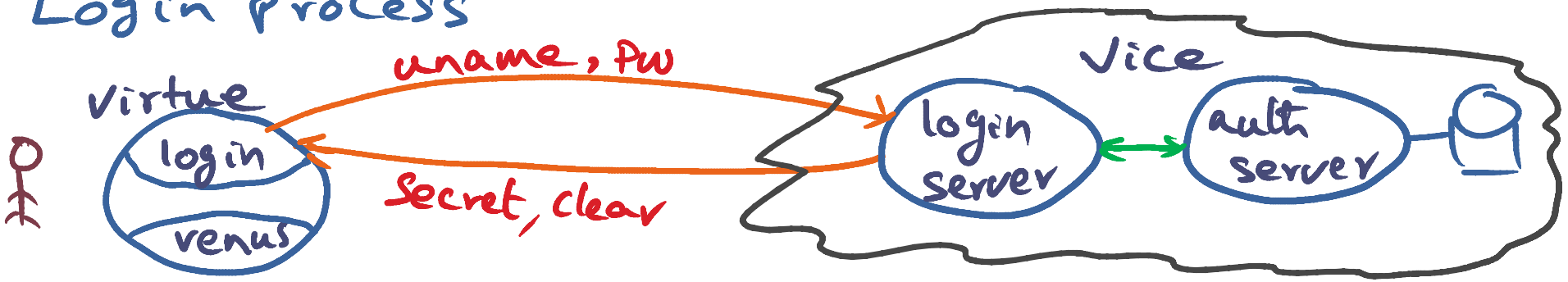

Cleartoken: Data structure

⇒ Extract handshake key client (HKC)

Secrettoken: cleartoken encrypted with key known only to vice

⇒ unique for this login session

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use as ephemeral client-id for this login session

use HKC as private key for establishing a new RPC session

Venus – Vice Communication

Authenticate User

Authenticate Server

Prevent replay attacks

Venus – Vice Communication

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Authenticate Server

Prevent replay attacks

⟹ Bind at Core of this Communication

RPC Session establishment (Bind client-server)

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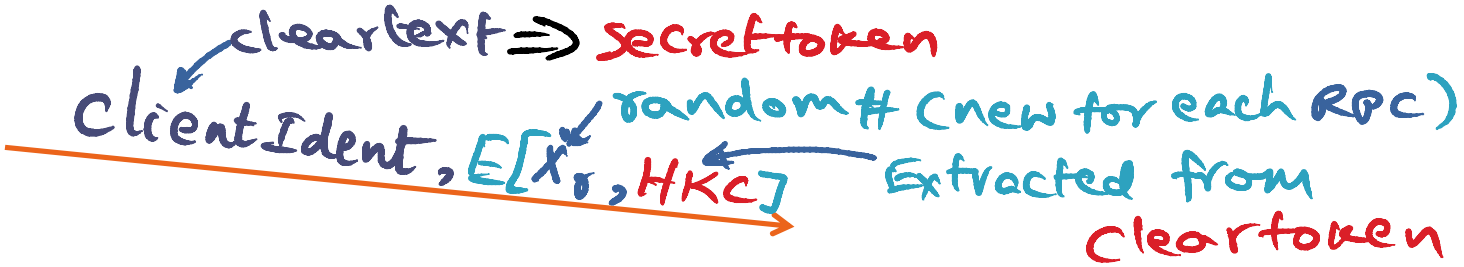
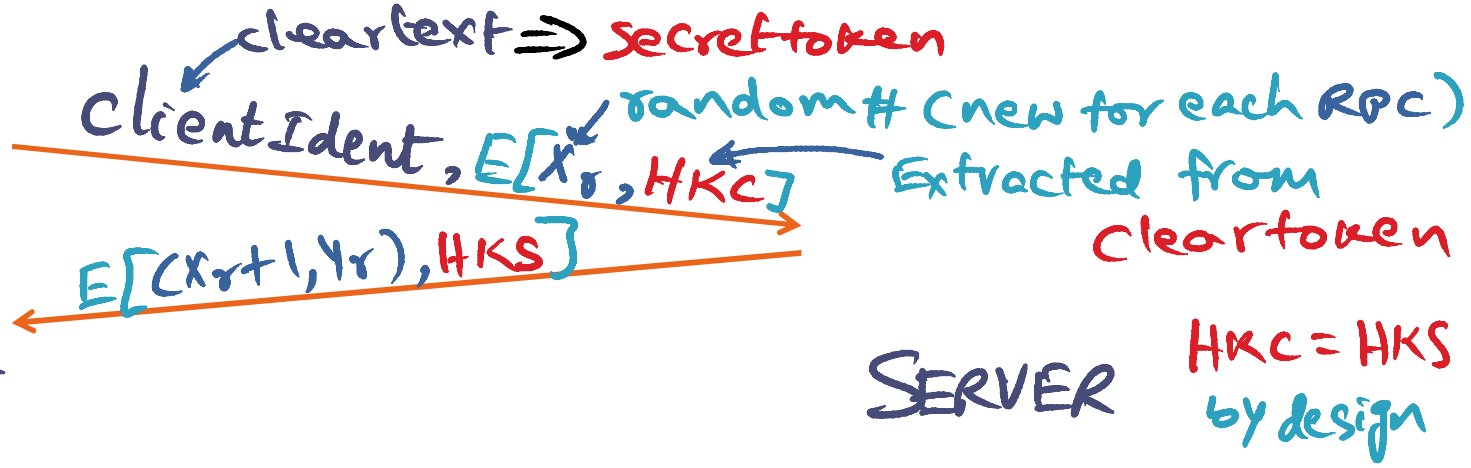


CLIENT

SERVER

RPC Session establishment (Bind client-server)



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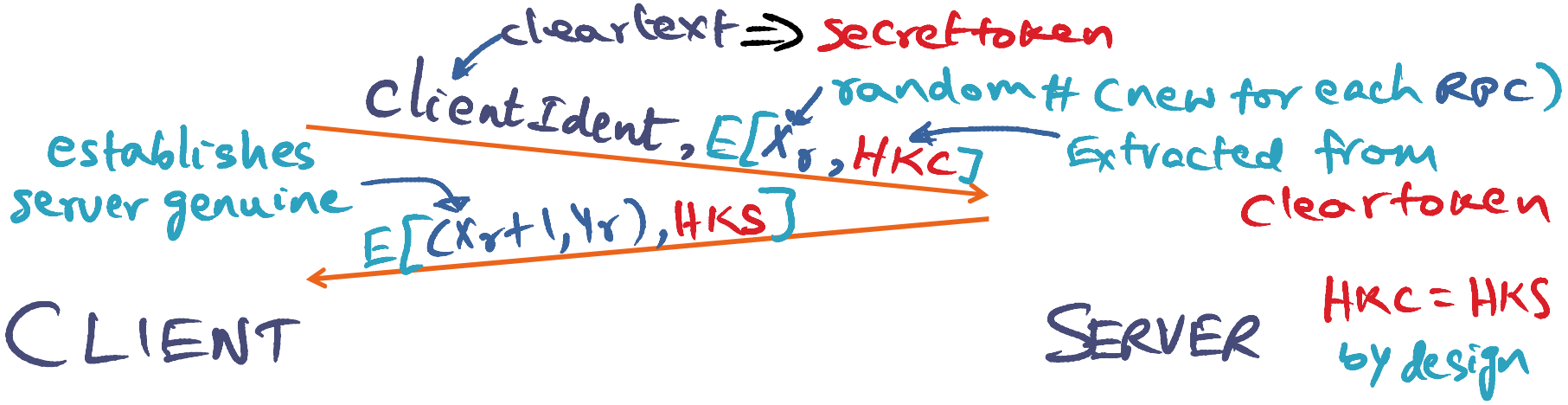

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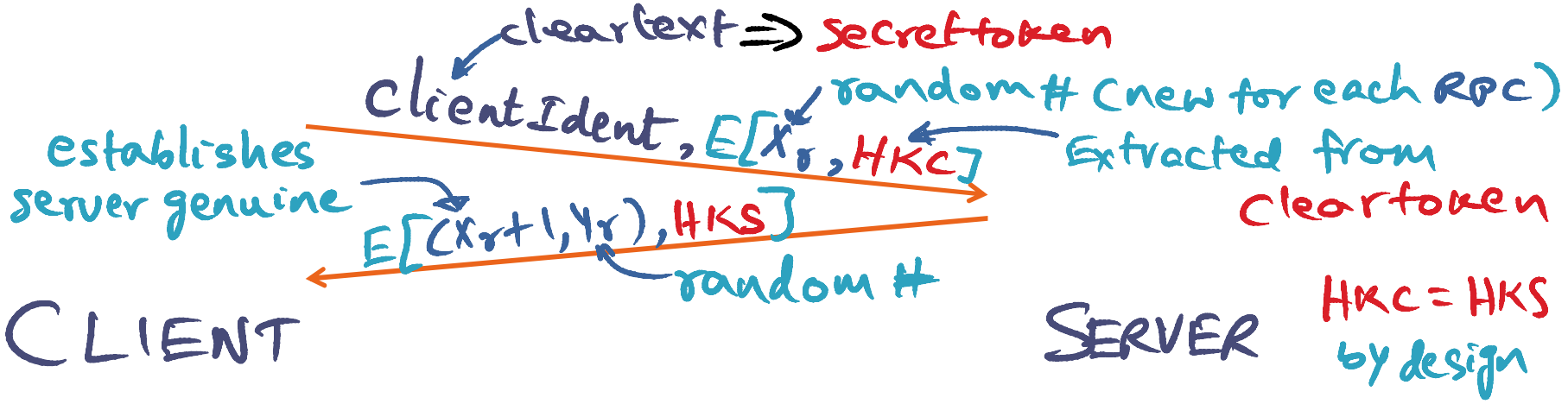

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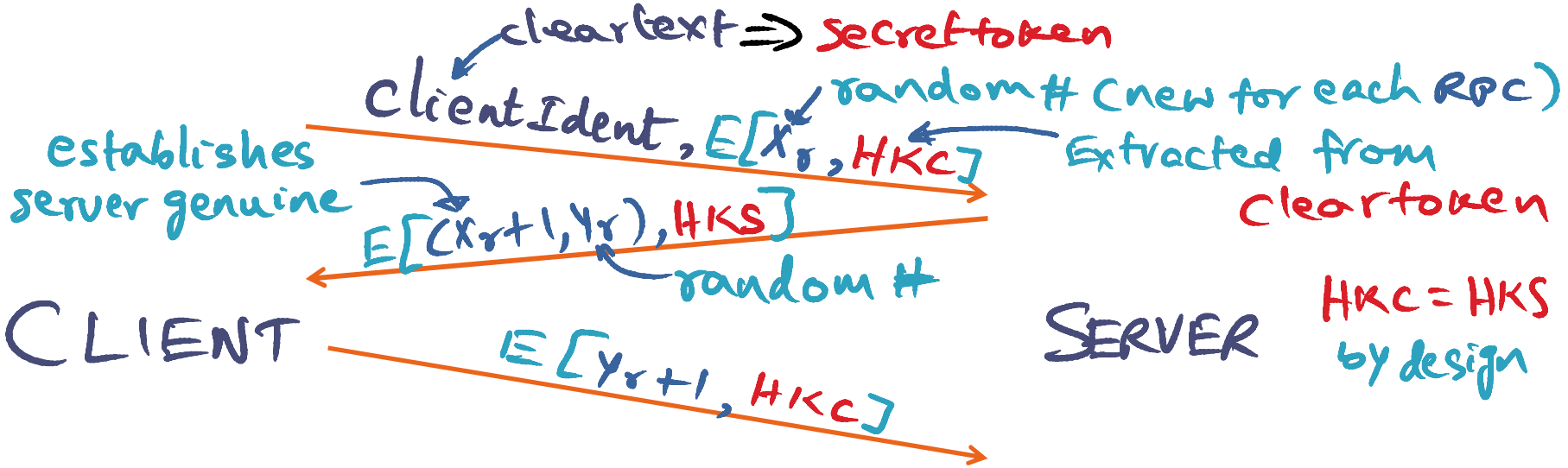

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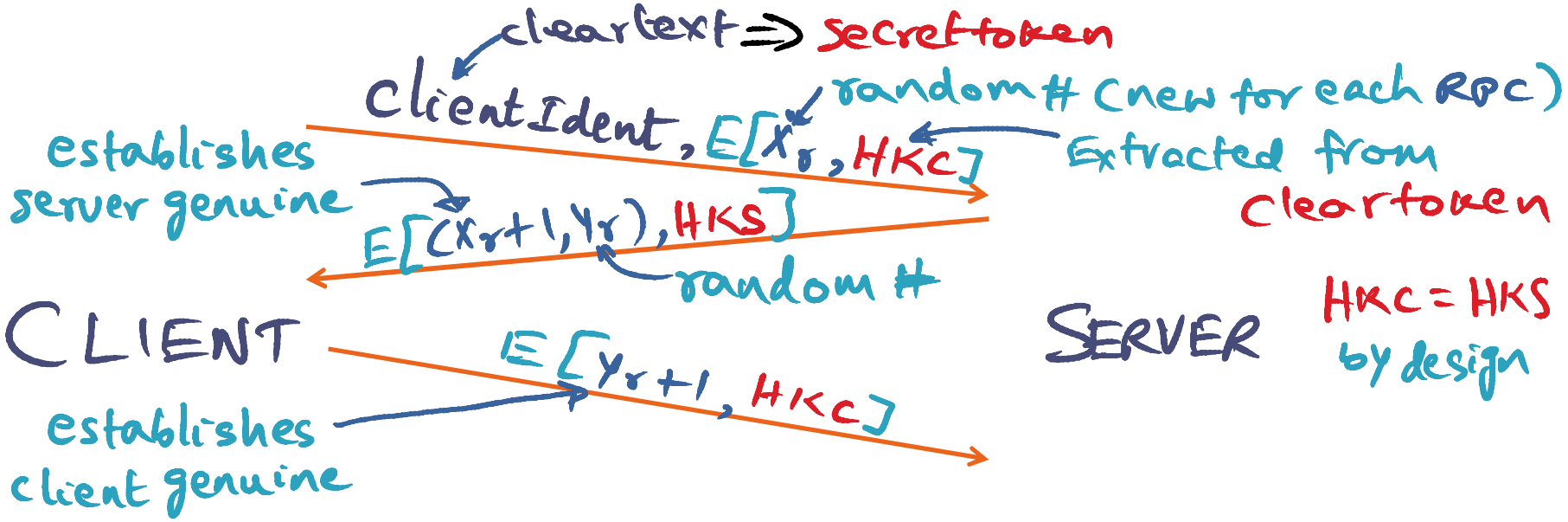

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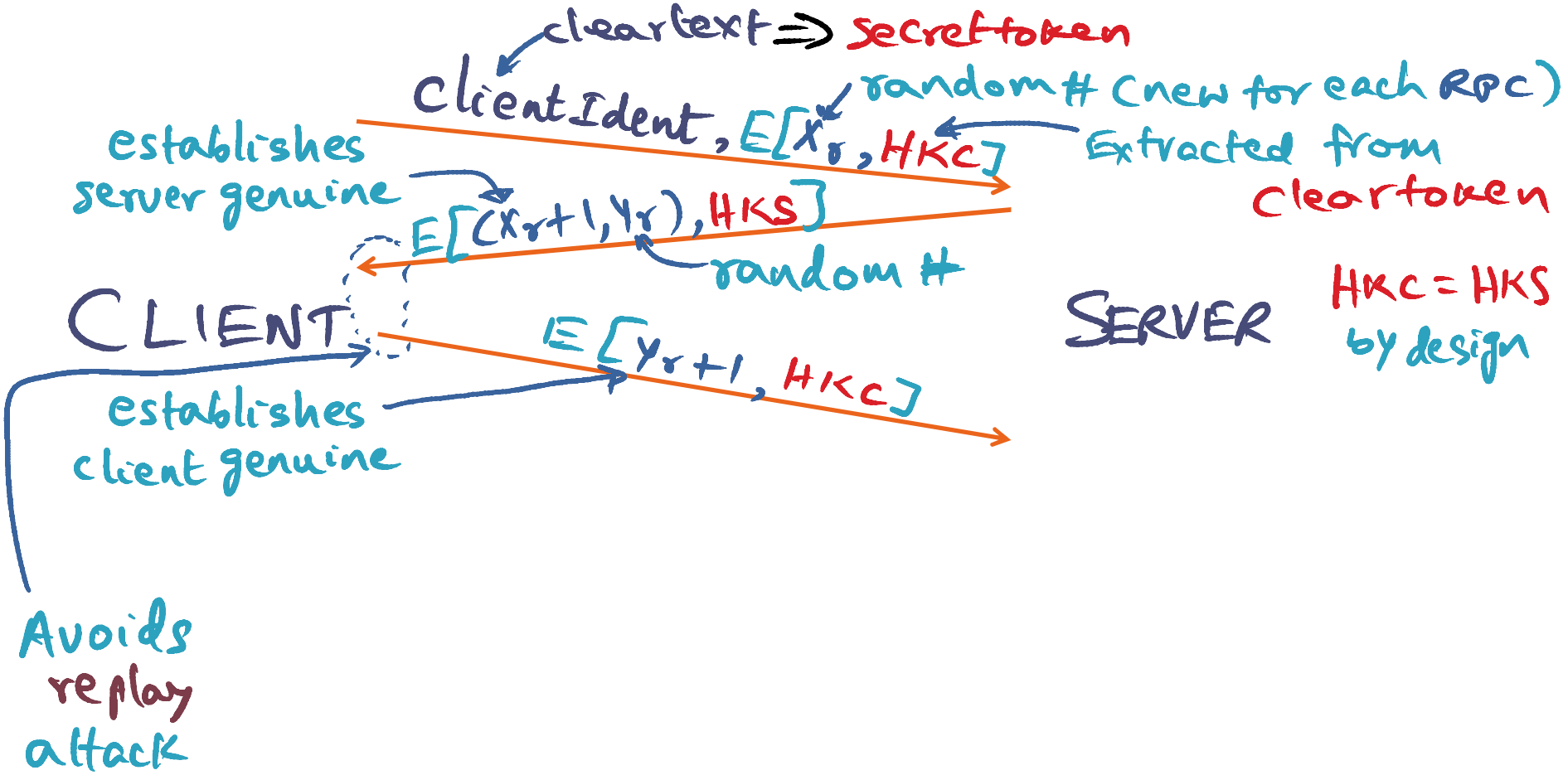

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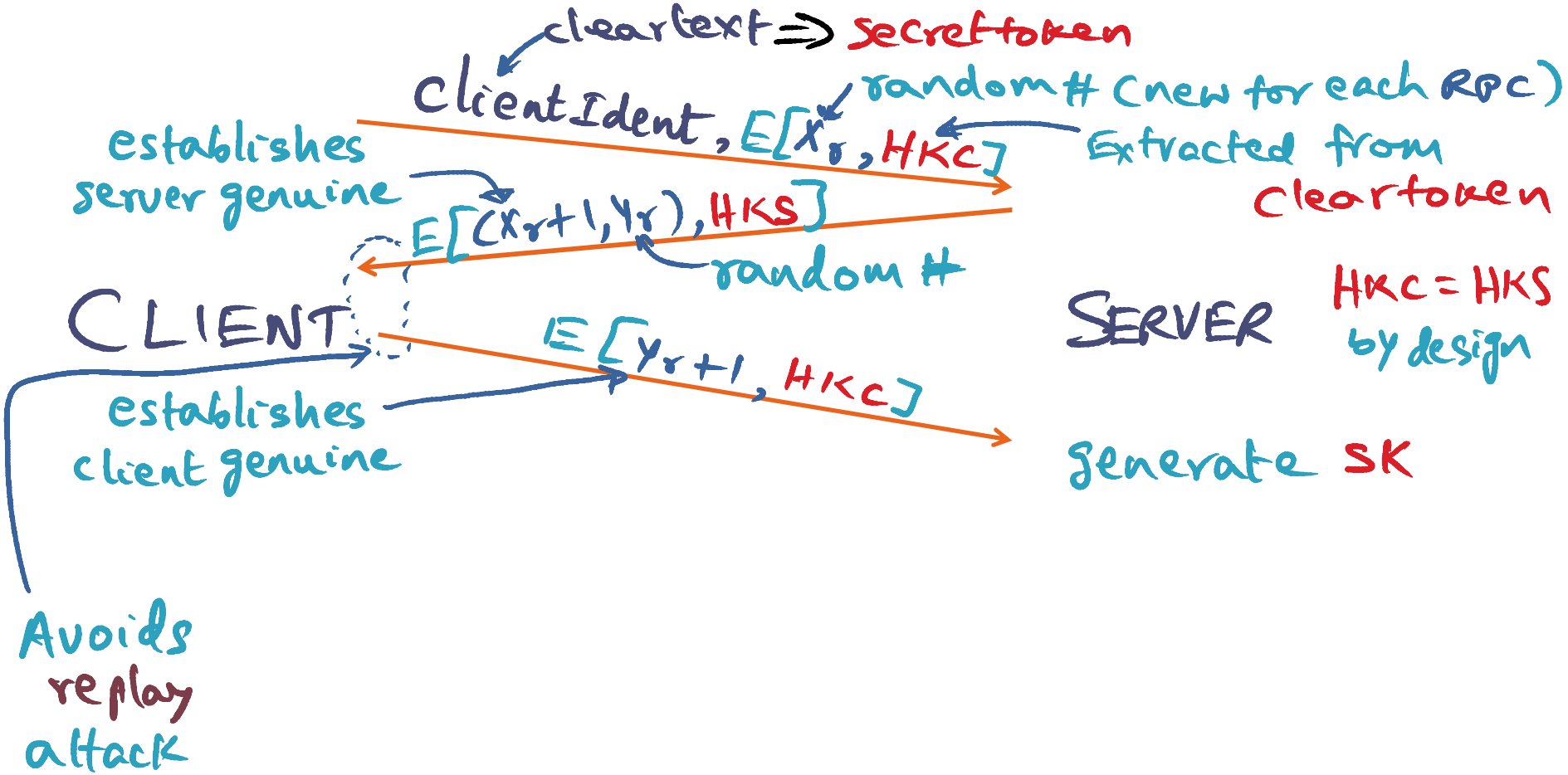

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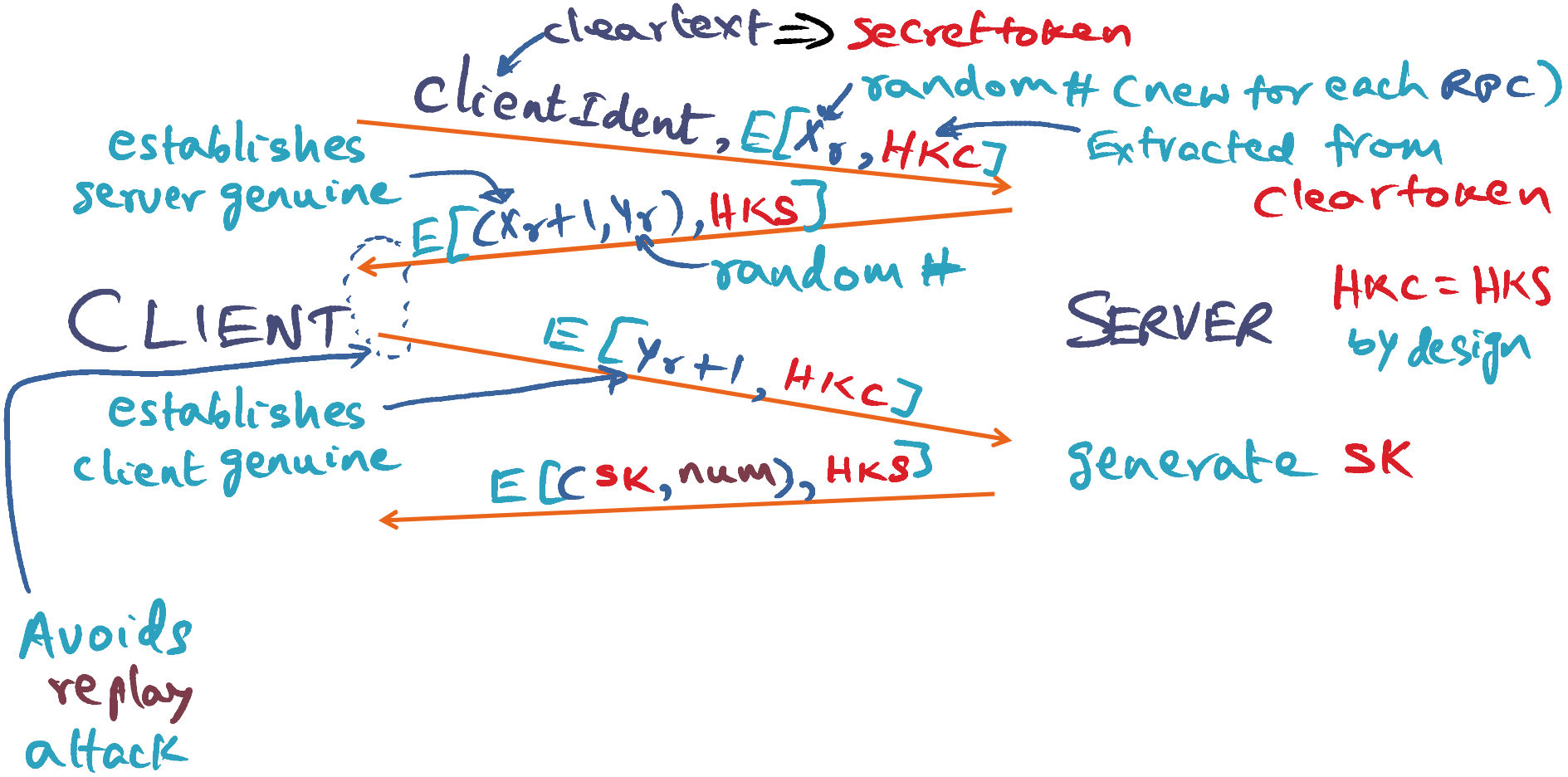

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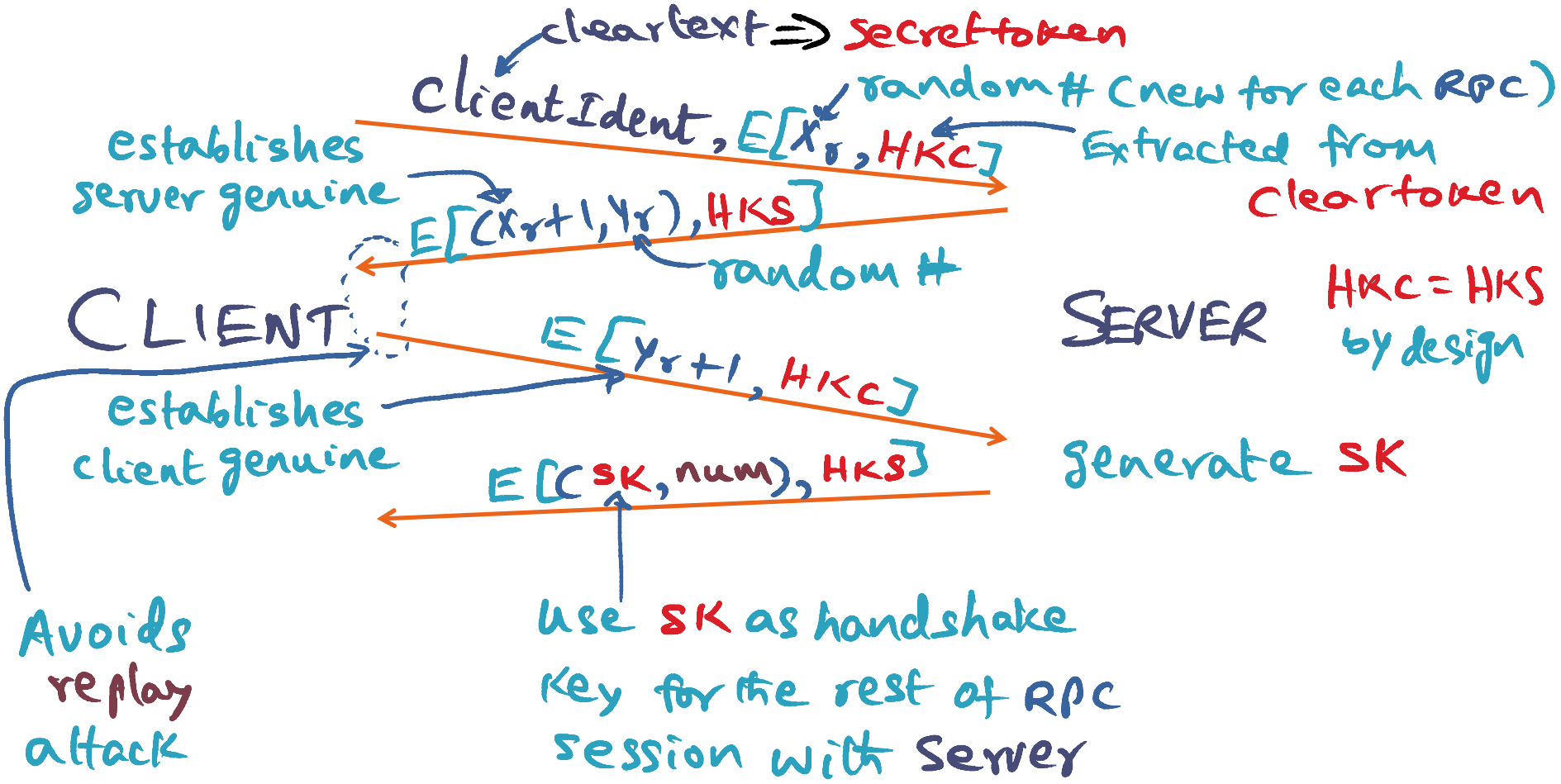

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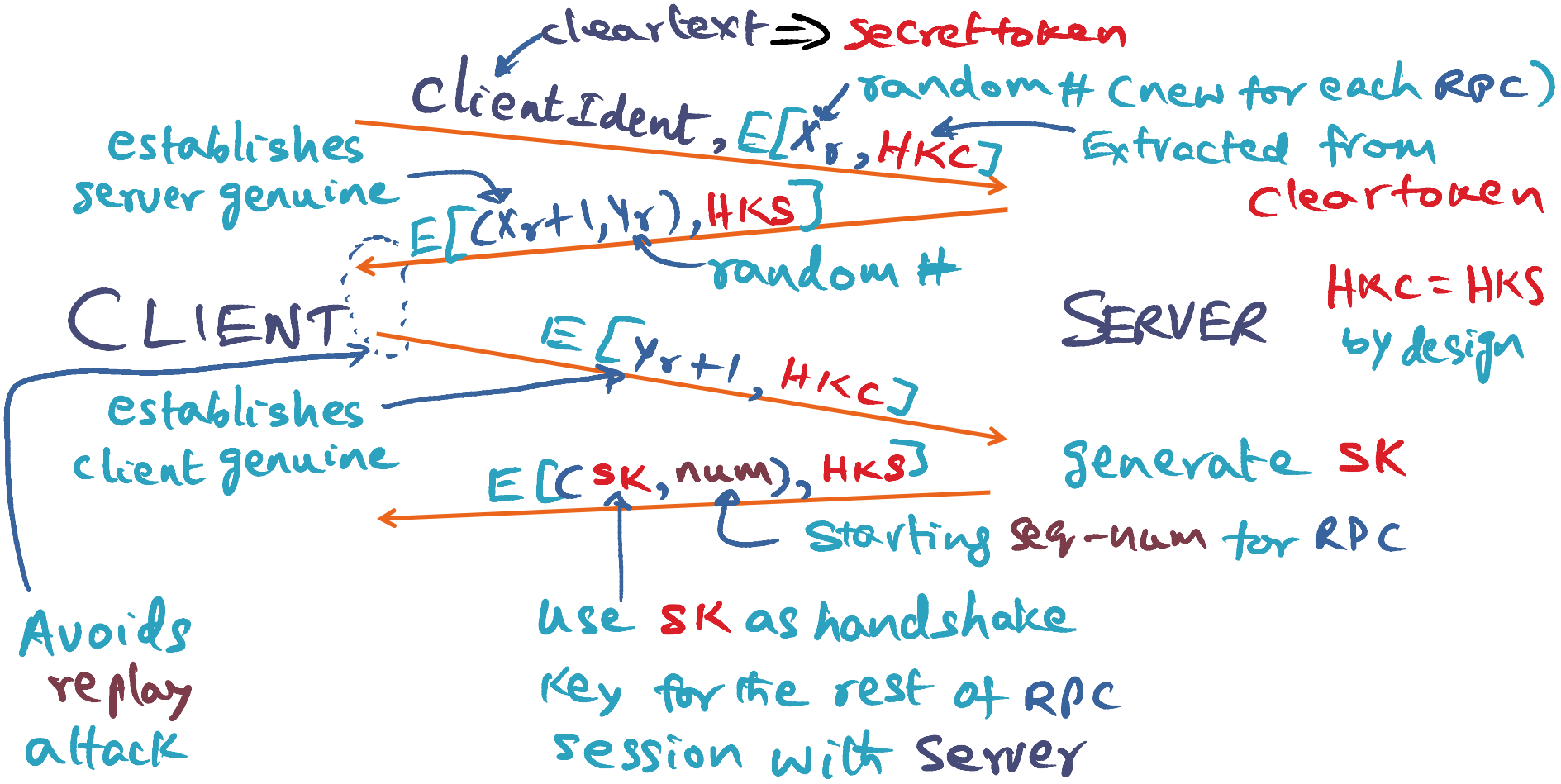

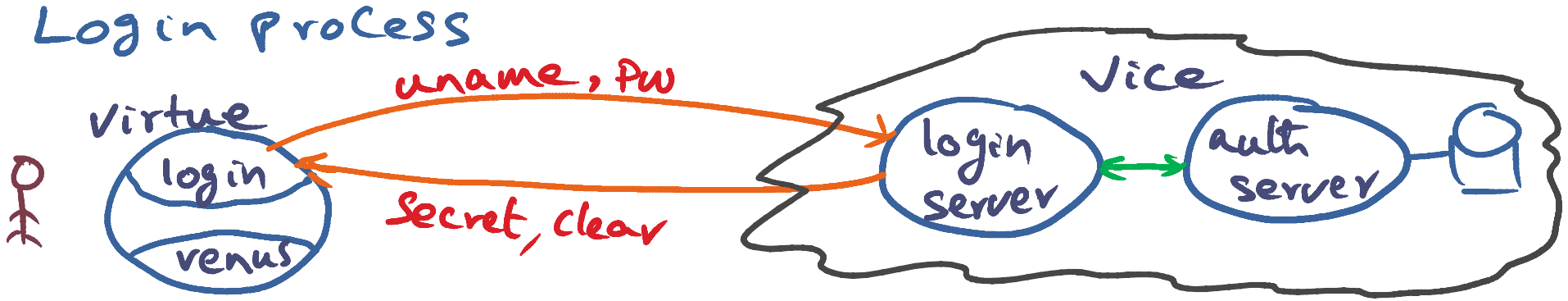
Login process
Virtue
login
venus
uname, PW
Secret, clear
Vice
login server
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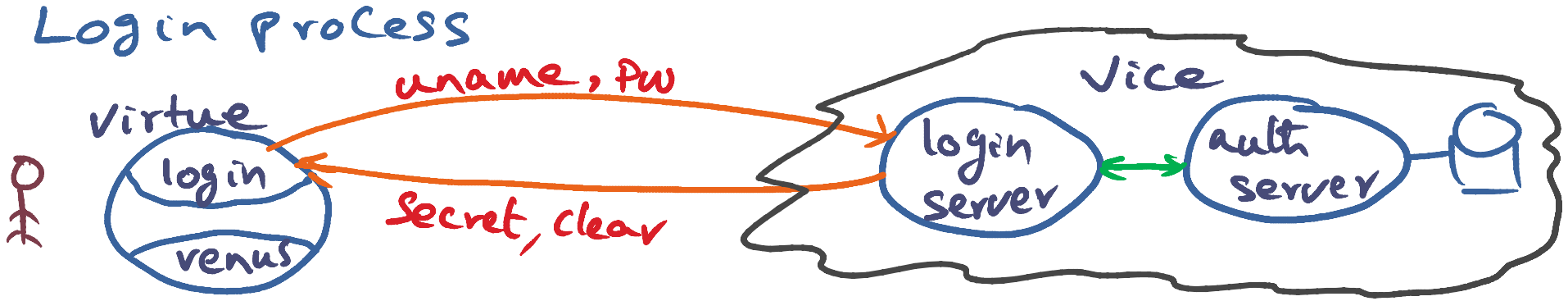
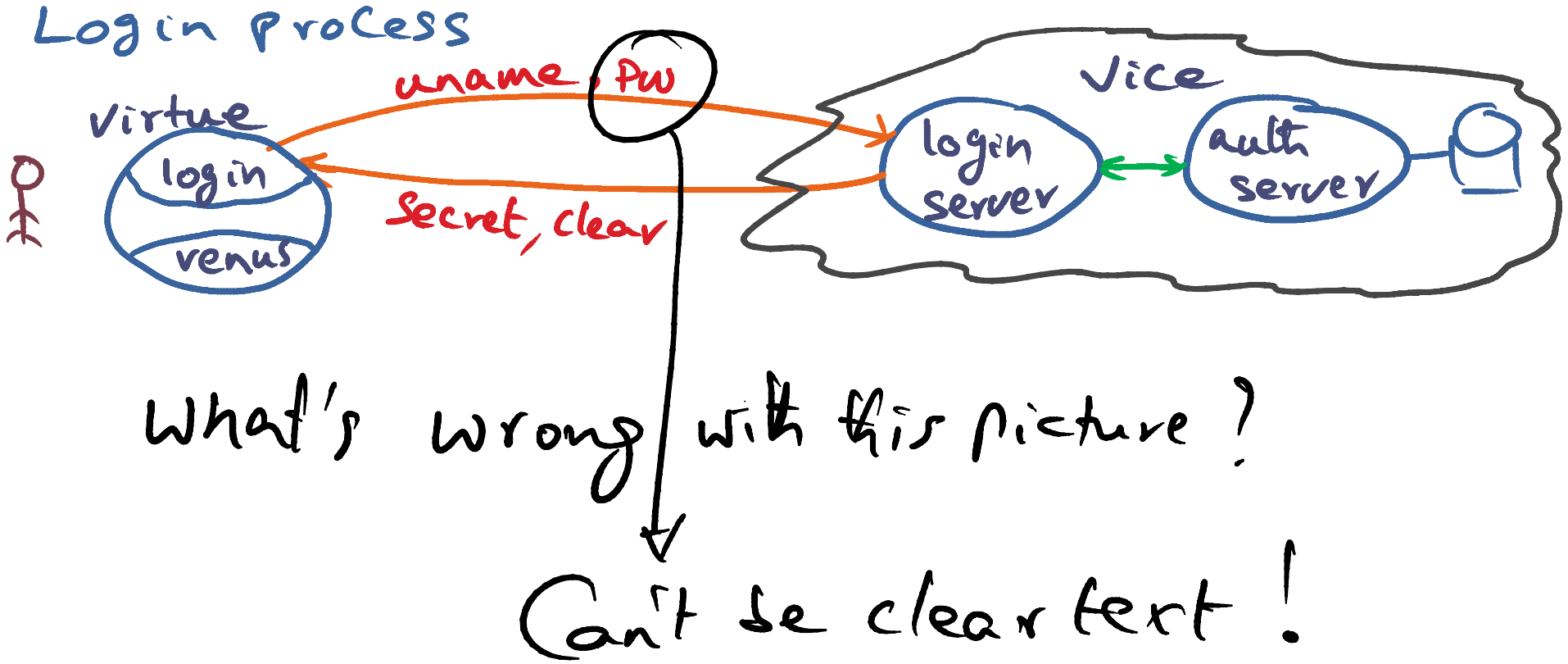


What's wrong with this picture?


Login process
uname, PW
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What's wrong with this picture?
Can't be clear text!

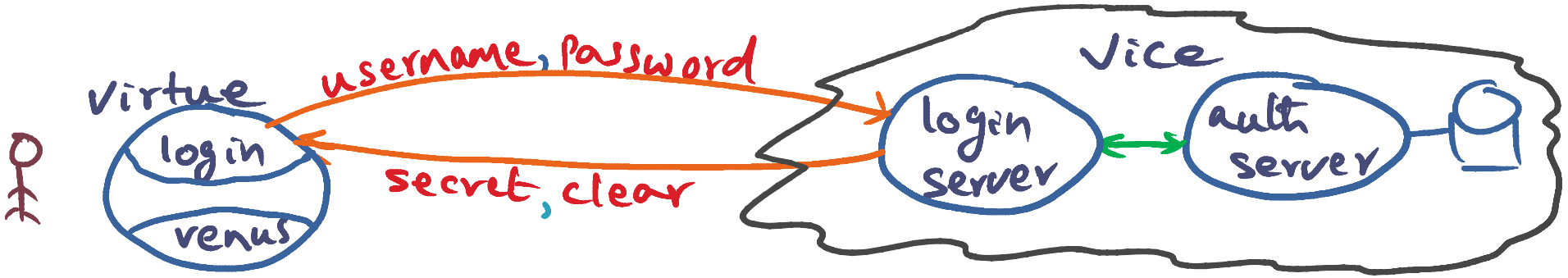
Login is a special case of Bind

- Password used as HKC
- username used for ClientIdent

Login is a special case of Bind

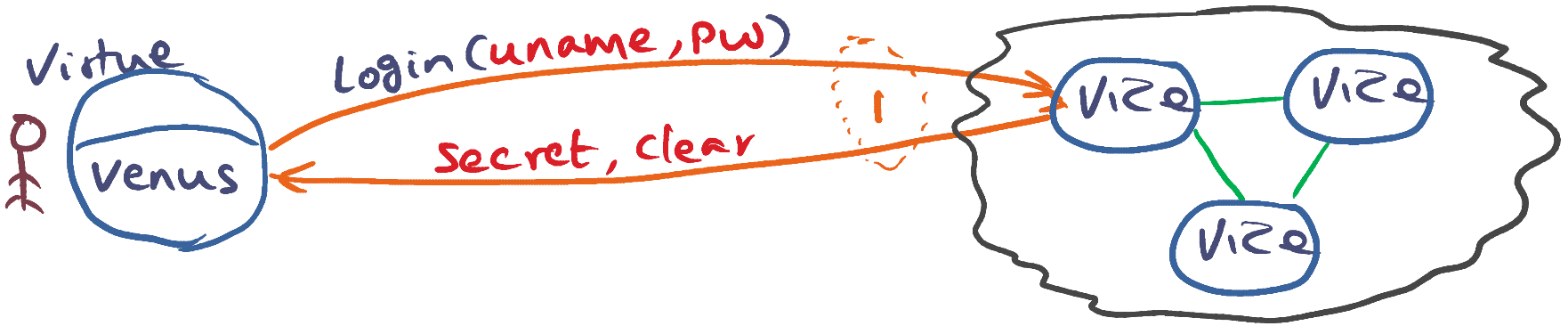
- Password used as HKC
- username used for ClientIdent
- get back two tokens

  SecretToken } encrypted with
  ClearToken } Password



- tokens kept by venus for this login session

Putting it all together



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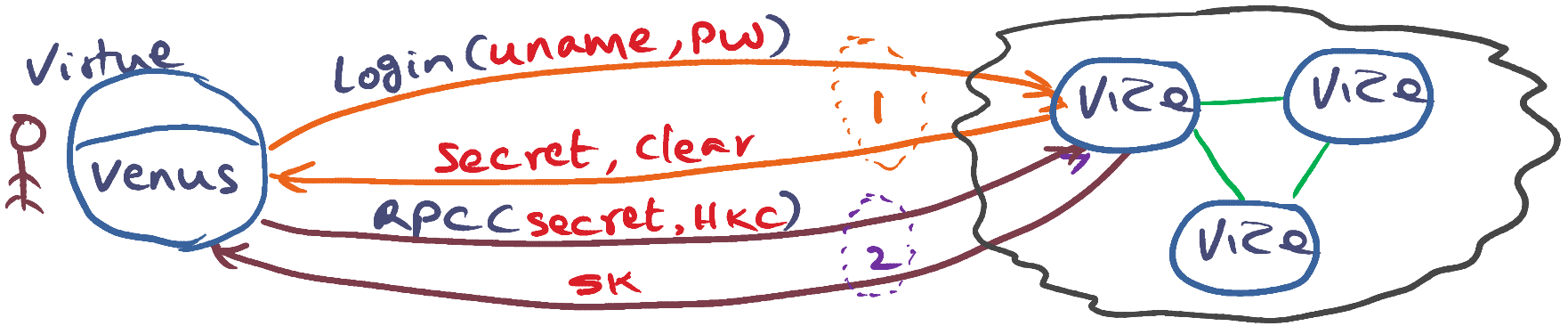

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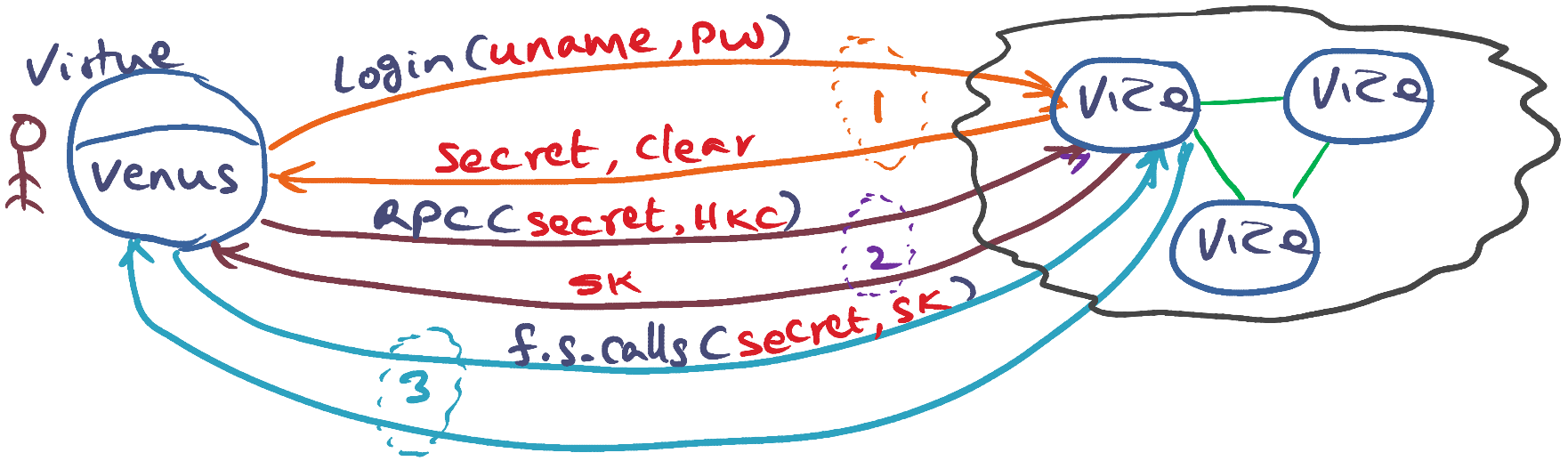

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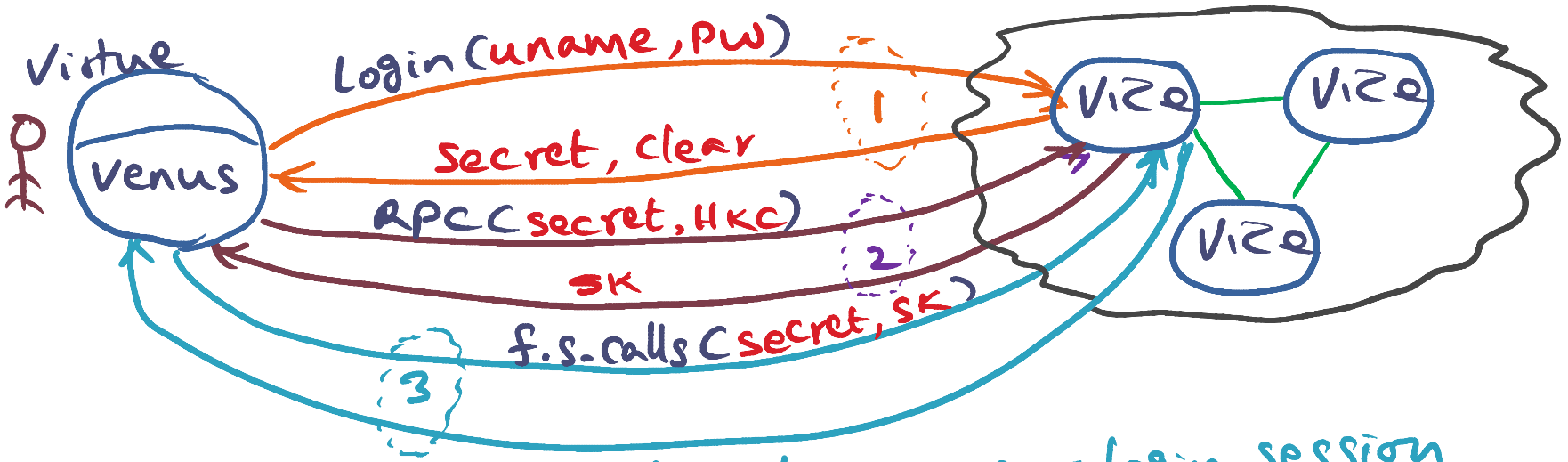

– (uname, PW) exposed only once per login session

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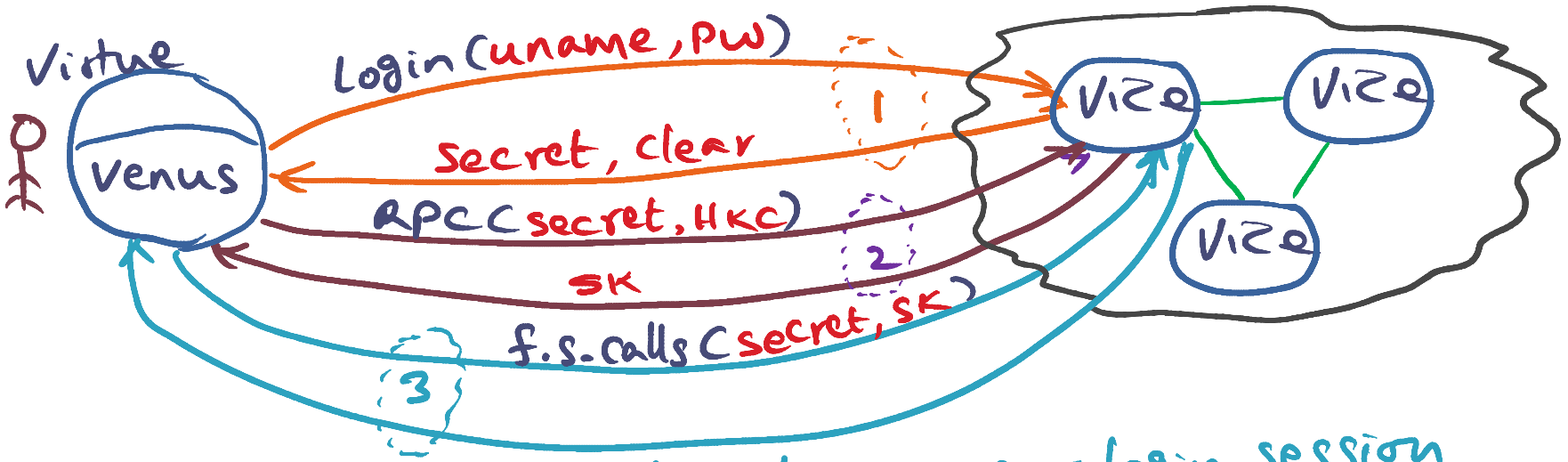

- (uname, PW) exposed only once per login session
- HKC used only for a new RPC session

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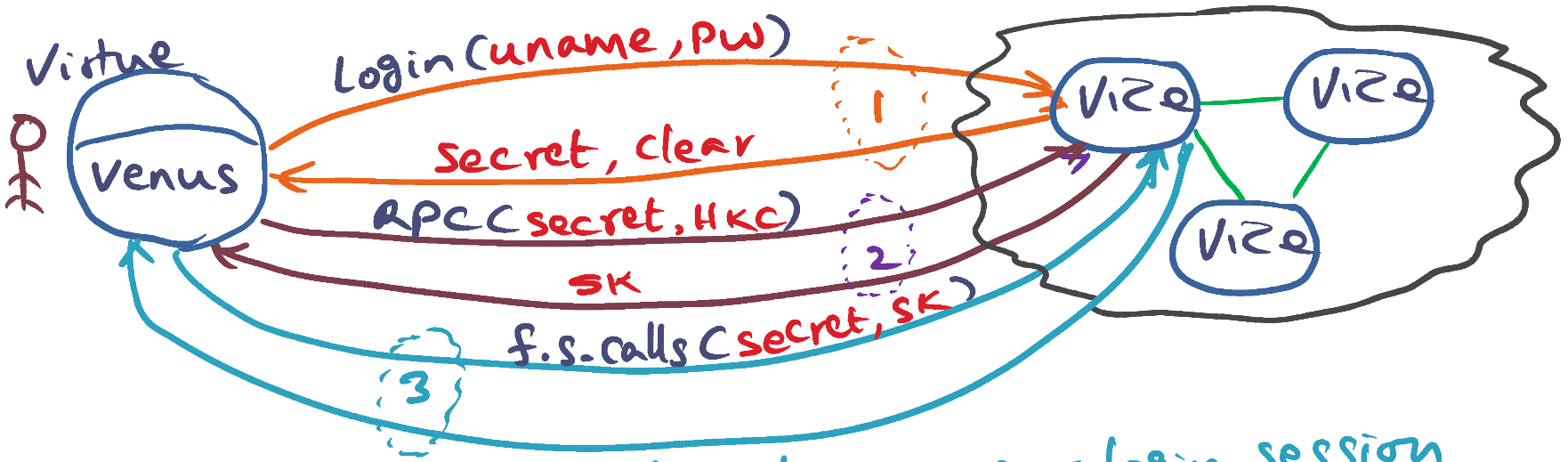

- (uname, PW) exposed only once per login session
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duration of login session validity

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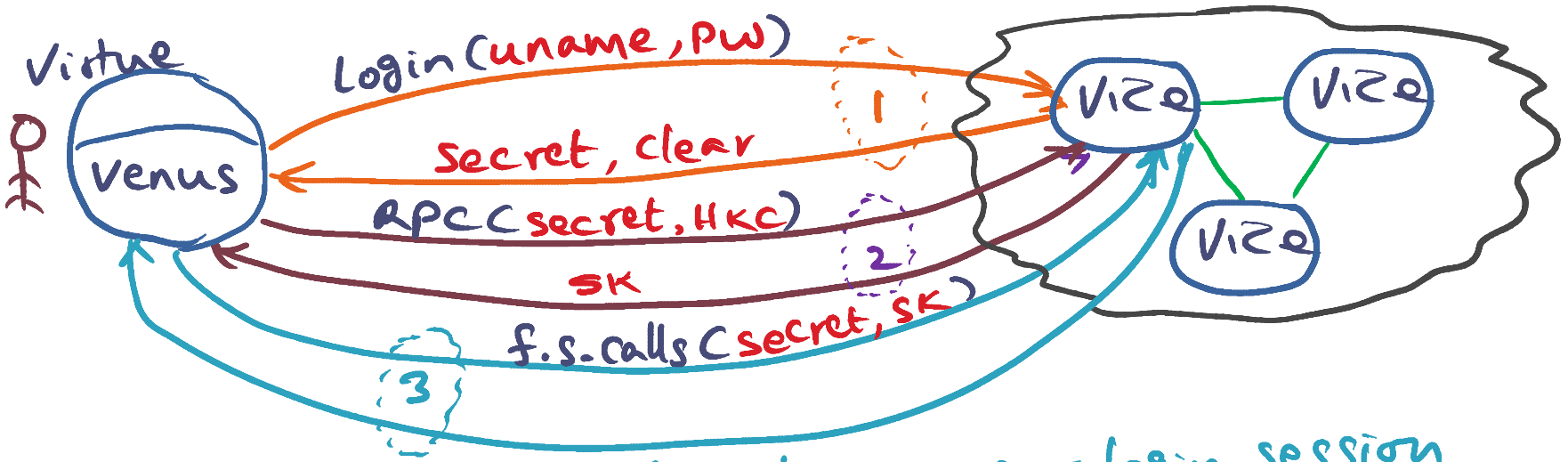

- (uname, PW) exposed only once per login session
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- SK for all Rpc calls to file System

↳ duration of login session validity

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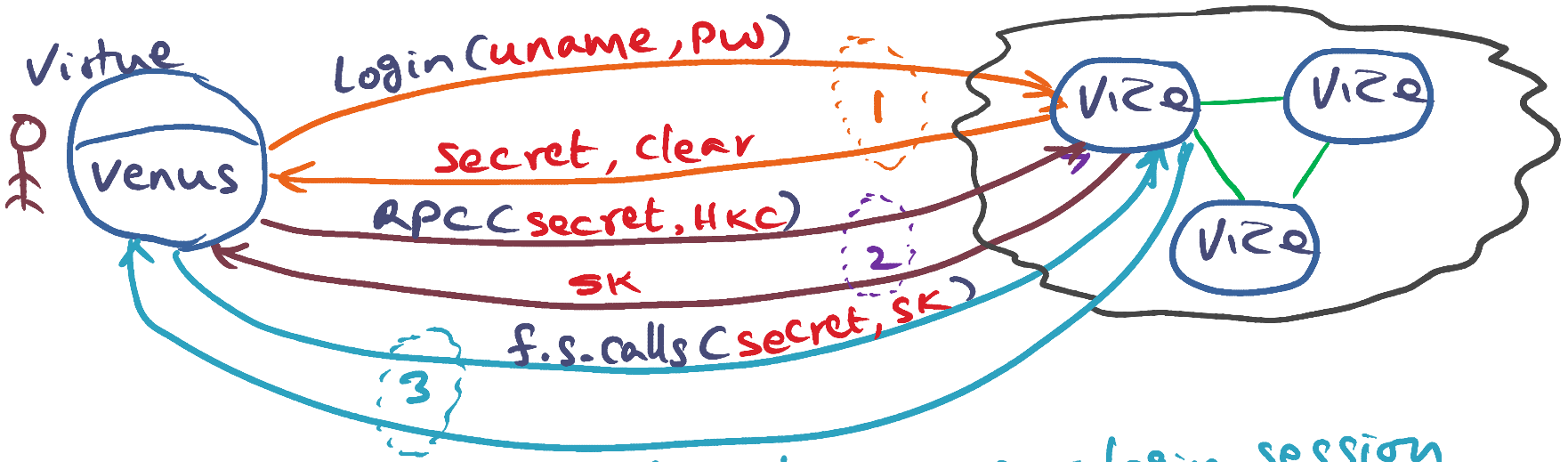

- (uname, PW) exposed only once per login session
- HKC used only for a new RPC session
- SK for all Rpc calls to file System
  - → duration of RPC session validity

→ duration of login session validity

Group Activity : AFS security Report Card

Mutual Suspicion

☐ yes ☐ NO

Protection from System for Users

☐ yes ☐ NO

Confinement of resource usage

☐ yes ☐ NO

Authentication

☐ yes ☐ NO

Server integrity

☐ yes ☐ NO

AFS security Report Card

Mutual suspicion
- [x] yes
- [ ] NO

} yes from fellow users

Protection from system for users
- [ ] yes
- [x] NO

} gotta trust!

Confinement of resource usage
- [ ] yes
- [x] NO

} NW BW DOS attacks

Authentication
- [x] yes
- [ ] NO

} validation of client-server

Server integrity
- [ ] yes
- [x] NO

} Physical + social moves

Another group Activity

Features of AFS Compared to Vanilla NFS ??

Key takeaways

- Andrew file system has features that extend the vanilla privilege levels provided by the Unix file system semantics.
- Further it also introduces the notion of audit trail for system administrators modifying the system.
- OS designers we can take the "best solution" that is out there for information security and implement a secure and usable distributed system.
- benchmark solution against the design principles laid out by Saltzer for information security