Smart Contracts

(Ethereum 1.0)

PoW Blockchain

- Different puzzle (ethash), ASIC-proof
- ≈12 secs between blocks
- smart contracts

2 types of accounts:

① Normal (public + private key)

→ maintain a balance

Transaction: One payer
One recipient
One amount

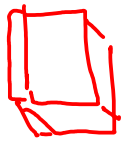
② Bot account

- Controlled by code → on the blockchain
- "Smart contract"

Puzzle

Challenge: Instantaneous transactions

Alice



Bob

$1000

Charlie
- Trustworthy
- Stupid
- Can:
  - Send/receive texts
  - Send/receive $$

1. Alice send book to C
2. C sends picture to B
3. B sends $1K to C
4. C sends $11K to A

book to B

X C can't send/recv book or pic

X B might not be able to verify

1. B sends $1K to C
2. C tells A $1K sent
3. A sends book to B
4. B tells C to release $ to Alice
5. C does it

X 1-sided. B feels good

A can be cheated

B pays half

A sends book

B verifies, pays remaining

X 1-sided, Alice can steal half.

0 A sends $1K to C

1 B sends $2K to C

2 C tells A $1K sent

3 A sends book to B

4 B tells C to release $ to Alice

5 C sends $1K to B
$2K to A

Ethereum Accts

Both types

- Have addresses
- Receive transactions
- Have a balance
- (Send transactions)

Distinction: control

Normal acct: Have private key

Smart contract: Code

Auction

Seller
- Put up good
- Specify deadline
- Reserve price

Buyers
- Submit bids
- Highest bid wins.

Auction S.C.

Highest bid amt
Highest bidder

ctor:
- Good being sold → transfer ownership
- Deadline → contract var
- Reserve price ☆

place_bid:
- Anyone can run
- Payable, ~~any amount~~

Check ~~deadline~~ check amount > highest bid
If highest_bidder != 0: refund them
Set highest_bidder and highest_bid.

end_auction:
- ~~Seller only~~
- No payment

Check reserve price met (otherwise refund)
Check deadline passed
Pay seller
Tranfer good buyer

Next time: gas

↳ fuel to move transactions

What does a miner do?

- Solve proof of work → most expensive
- Share new block to others
- Get txns from pool and create the block
- Verify txns

Bitcoin

variable ← = Run S.C. code. Ethereum

How do BTC fees work?

- Σ inputs $-$ Σ outputs
- Decided by senders

How do they decide

- Look at recent transactions
- More or less depending on prioritization
- Per byte size of txn

What if BTC/USD price suddenly goes up?

(How will txn fees change?)

- Pending txns are paying more!
- Fees should go down
  - Block size doesn't change, so depends on txn demands.
  - Could also go up based on higher demand.

Gas pricing

History: Type 0: old model, simpler gas

Type 2 ("London")

- Gas to run txn itself
  - Normal: 21000
  - S.C.: Price for each executed op.
- How much Gwei per gas?
  - Base price → determined by network
  - Prioritization fee → chosen by submitter

Base price

→ Set algorithmically
to keep blocks ≈ 50% full
(Price matching txn demand)

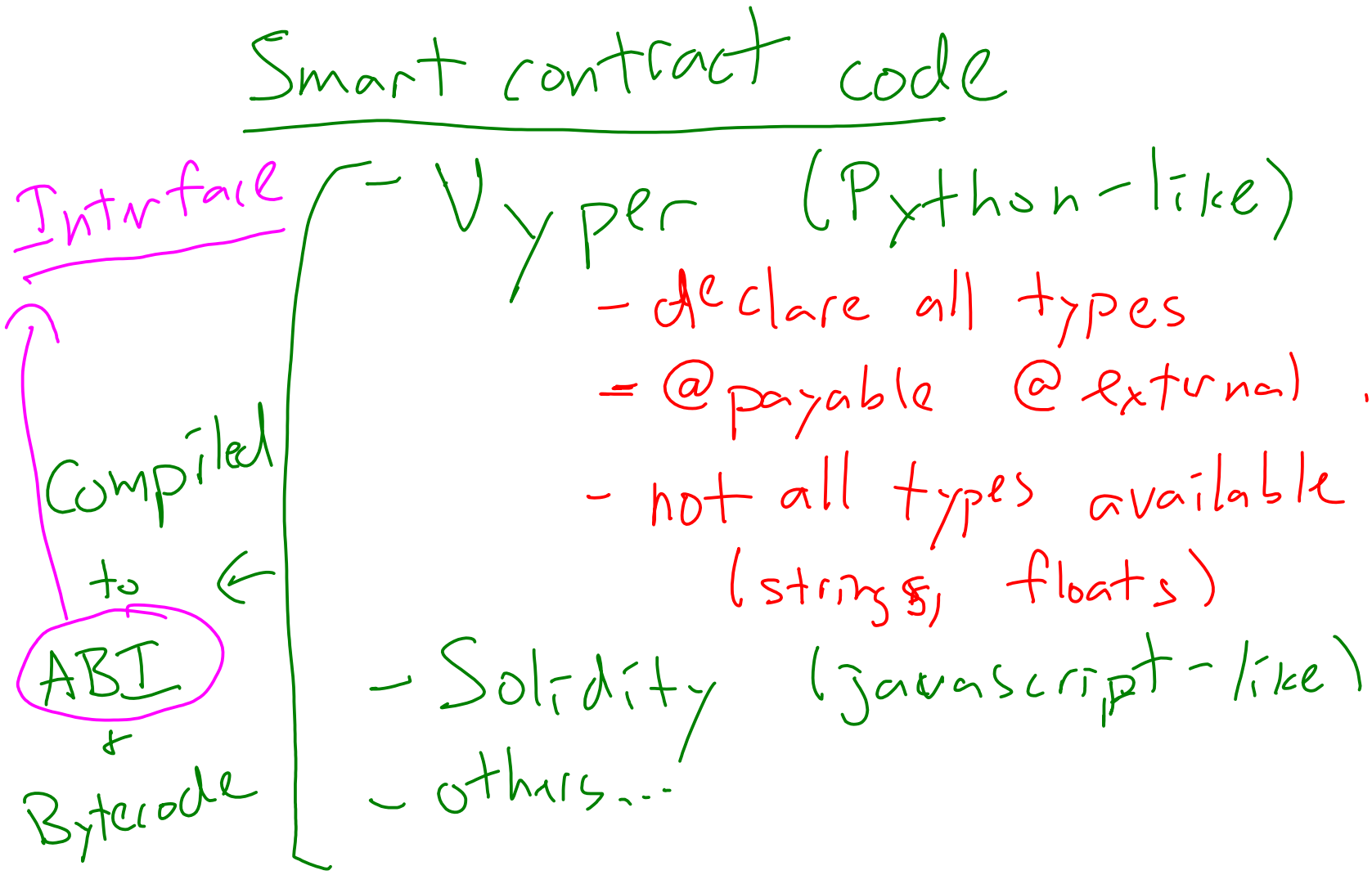
→ Burned (no one gets it)

Prioritization fee

- Decided by sender
- Miner gets it.

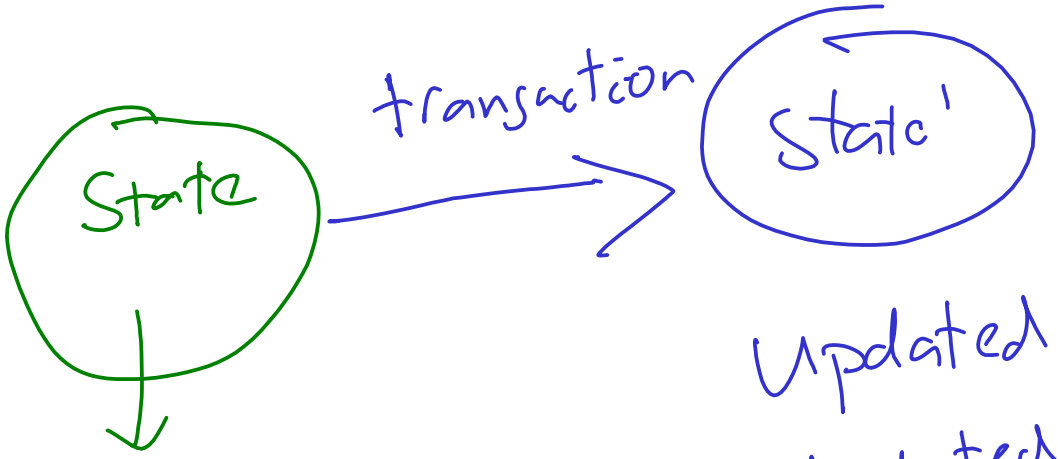
Gas: fees to make txns happen

Smart contract code



Ethereum Virtual Machine

Big state machine



Updated balances
Updated storage

account balances
data storage

Gas depends on cost to make the transition

EVM Bytecode

- Few hundred instructions ("Opcodes")
- Each has a price
- Stack-based virtual machine
  - ↳ temporary