The Technical Design of Blockchain Applications in Mobility

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This is a high level talk

Come talk to me later for the engineering

Who Am I?

- I am Sid
- UC Berkeley Computer Science
- Systems Engineering
- Worked in big data systems, networking research, autonomous vehicles research, and blockchain systems
- Working at Facebook
- Currently working on the Vehicle Identity Standards Group

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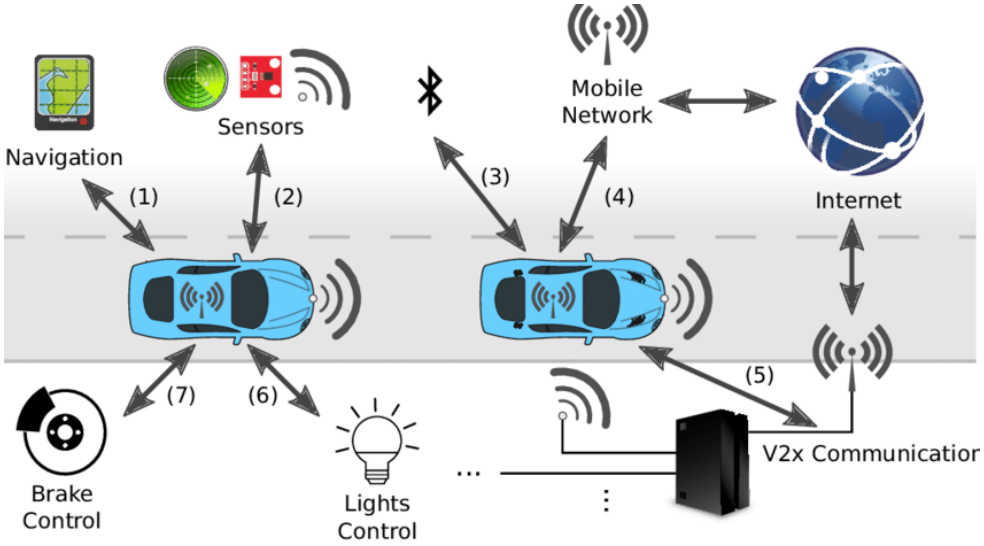
Framing the Problem

The Mobile Environment

- Hyperconnectivity
- Moving actors
- Lossy connections
- Bandwidth



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Blockchain Constraints

Blockchain has important potential drawbacks

- Transaction speeds
- Expensive storage
- Liveness and Synchrony

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A good blockchain system must address these constraints

The Main Blockchain Design Verticals

Scalability

Privacy

Latency and Liveness

Crypto-Economics

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Blockchain Stack

Application Layer

Sybil Control Mechanism

Consensus

Network

Hardware/Infrastructure

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Importance of Scalability

- Cited as the biggest objection to blockchain technology
- Storage
- Throughput
- Duplication of data

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Scalability

Throughput Scalability

- Sharding
- Protocol Design
- State Channels
- Hardware
- Specific Use-Case Chains
- Fewer Nodes

Storage Scalability

- Polynomial Encoding
- State Channels
- Specific Use-Case Chains
- Fewer Nodes

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Importance of Privacy

- Example: Bitcoin
- Natively all information is stored on chain
- Forcing users to put more information of themselves online for public scrutiny
- GDPR
- Recent interest in privacy and online presence (Equifax, Google, Facebook, etc.)

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Privacy

Protocol Privacy

- ZK-Snarks (ZCash, Zexe, etc.)
- Secure Enclaves (SGX-Oasis)
- Usually slow and difficult to understand
- Problems related to proving entities within the system
- Still an active area of research (especially at UC Berkeley)

Other Privacy Techniques

- Private or Semi-Private chains
- Changing on-chain entities
- Token Tumblers

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Bottom Line: Privacy still is not fully solved

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Latency and Liveness

- Latency
- Liveness
- Real time applications
- Example: Access at physical gates
- Example: Payments
- Latency and liveness are critical for network usability

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Latency and Liveness

Content Distribution Networks

Cut through routing/caching

Network protocols like UDP

Fewer validators

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Networks must be active and available

Crypto-Economics

Validators

Privileges

Rewards

Cheating

Tokens ← (not always)

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Example: Vehicle Identity

Vehicle Identity (VID)

We want a unique number that identifies a car

We want that number to map to a certificate

We want to have entities

We want those entities to have permissioned access

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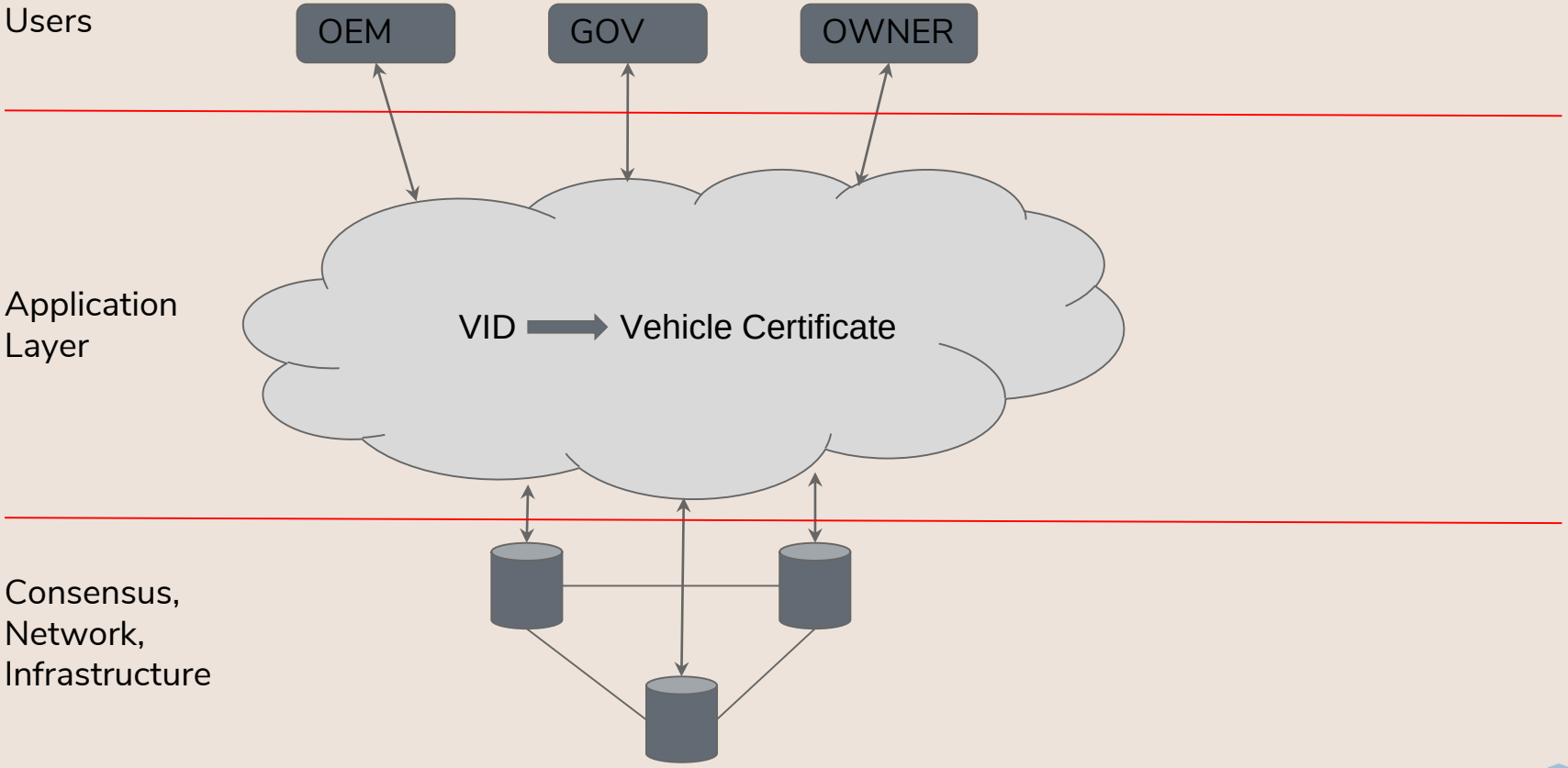
Users
OEM
GOV
OWNER
Application Layer
VID
Vehicle Certificate
Consensus, Network, Infrastructure

Vehicle Identity (VID)

Scalability

Privacy

Latency and Liveness

Crypto-Economics

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We just examined a real project with respect to the four design verticals

Questions?

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