Merkle Tree based Mobile Remote Storage

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Problem

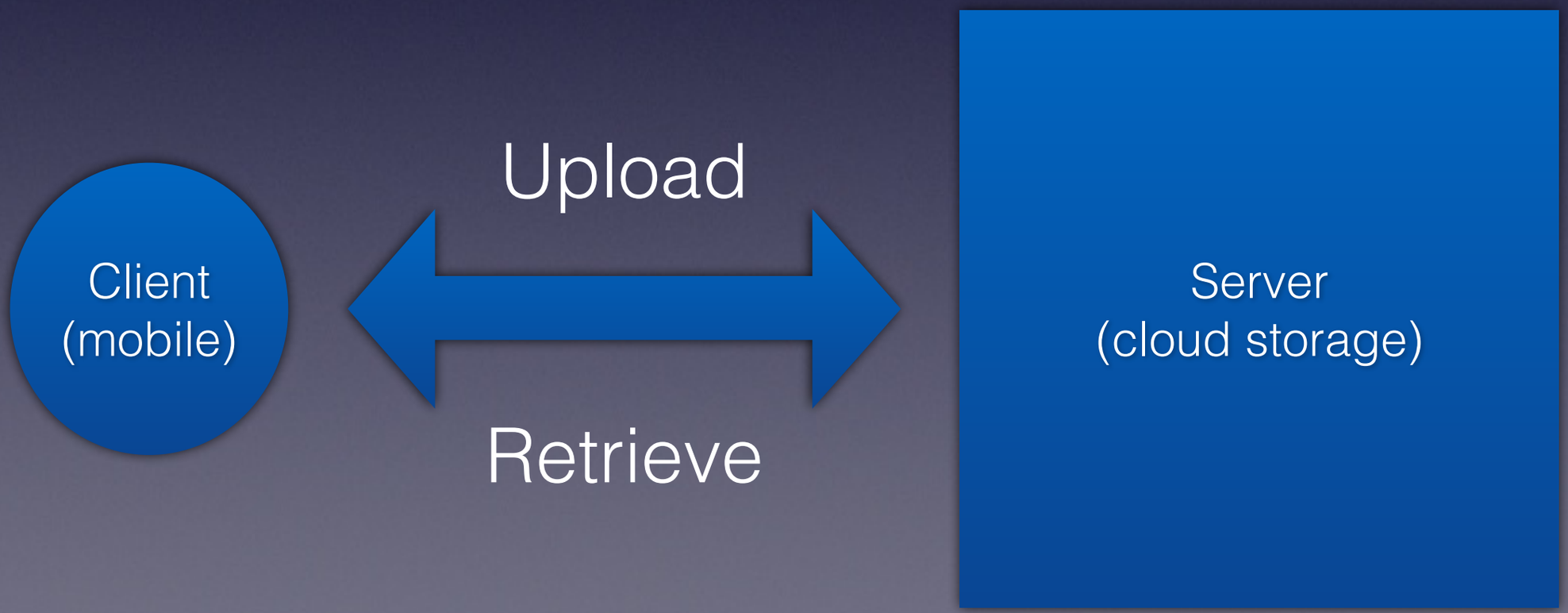
- Mobile Phones are used extensively
- Portable, Mobile
- LIMITED computation power, storage

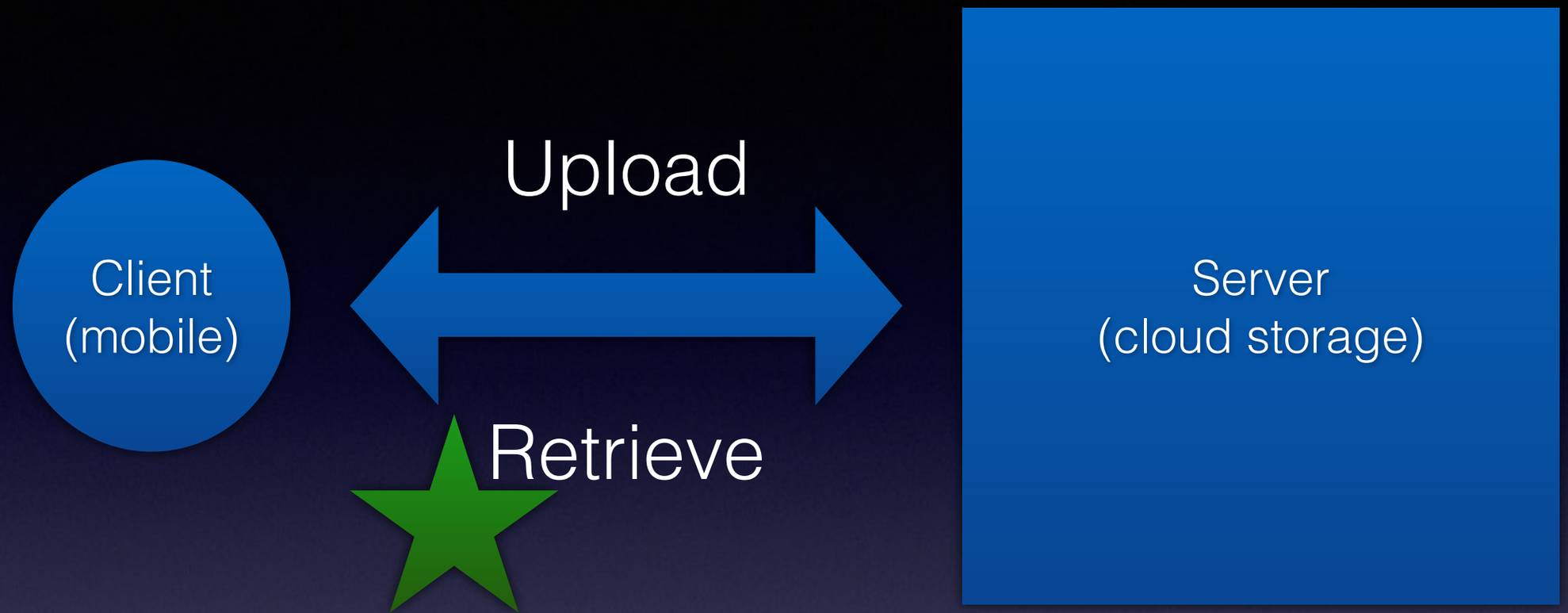
Demand

- People have a lot of files — documents, music, photos, movies, etc.
- People want their files available by hand all the time

Trivial Solution

- 4G, LTE technology
- Dump the files to a server, and retrieve them when needed

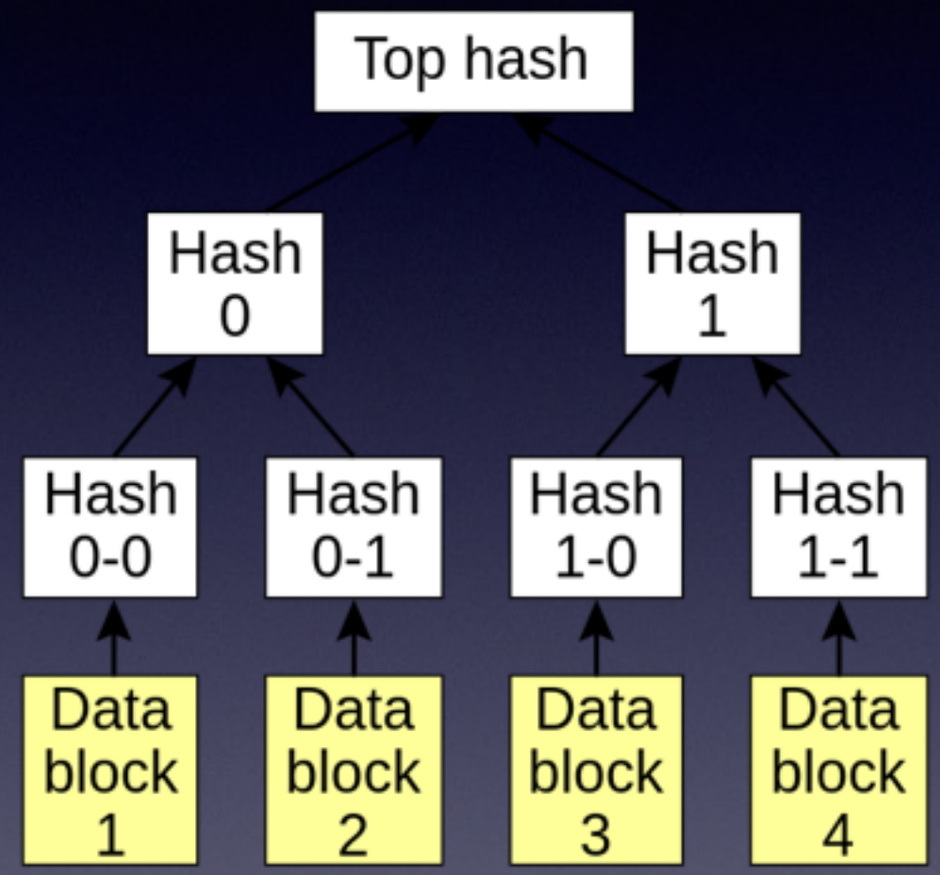




- Security concern
- Verification of retrieved files

Verification

- Hash?
- Merkle Tree



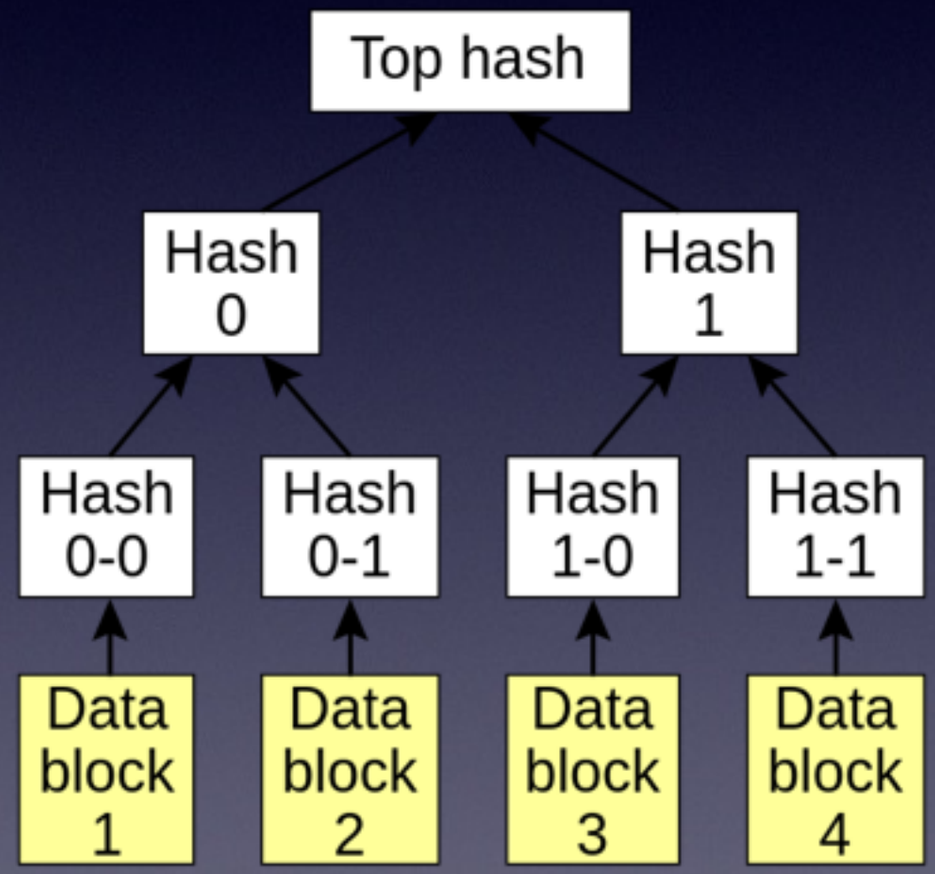
My Project

Merkle Tree Verification

- Phone — Upload/ Retrieve
- Server — Storage

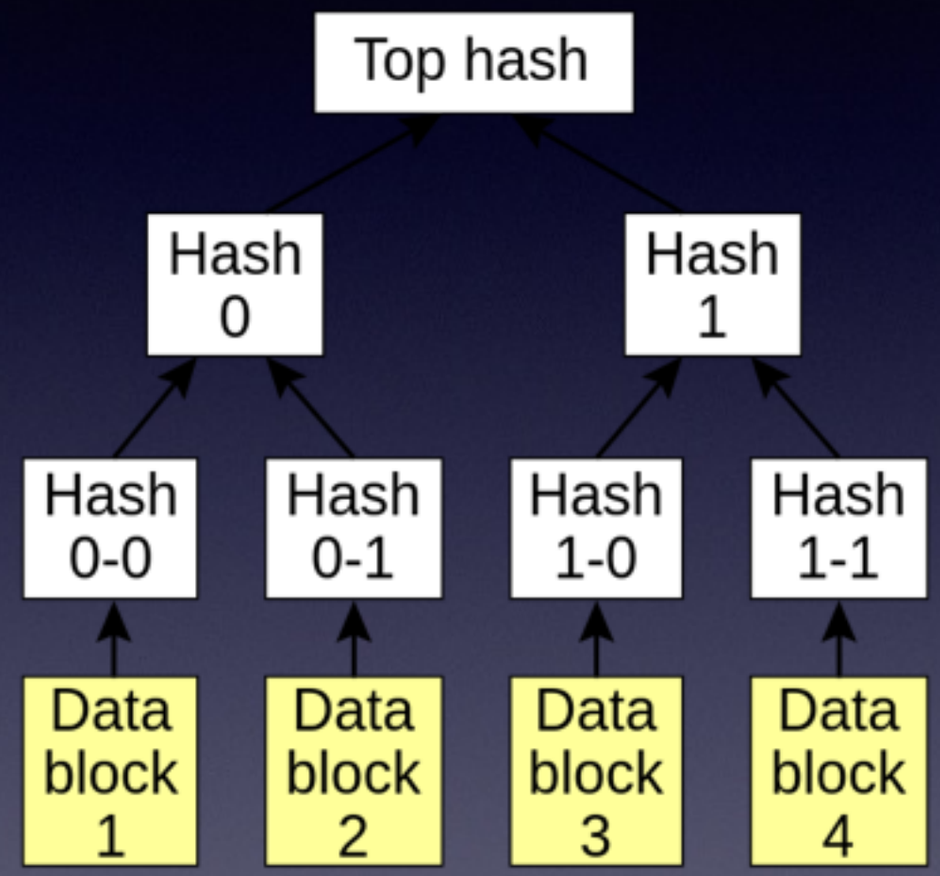
Merkle Hash Tree

- Balanced binary tree defining a hierarchical hashing schemeover
- Root hash is a hierarchical digest of the entire set



Proof of Membership

- Path from the item to the root hash + hashes of the sibling nodes
- Example: block 2
- (Hash 0-0, Left), (Hash 1, right)

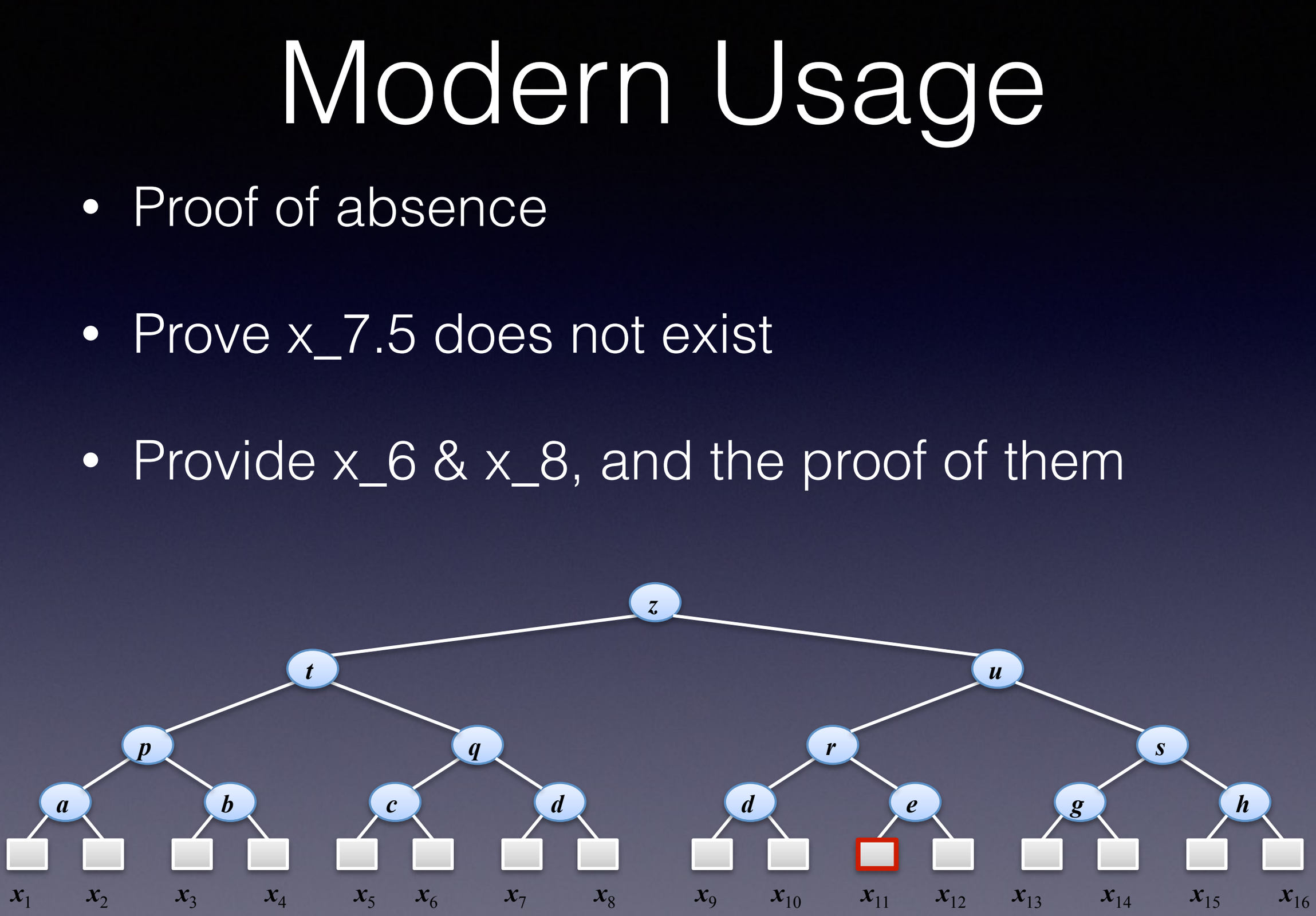


Advantage

- Client need root hash only, O(1)
- Verification takes log(n), n is # of files despite the file size

Modern Usage

- Proof of absence
- Prove x_7.5 does not exist
- Provide x_6 & x_8, and the proof of them



Industry Use Cases

- Version Control — Git
- Secure File Synchronization — FileRock
- Transaction History — Bitcoin Protocol
- Streaming Data — Netflix

Demo

- Server: django w/ mysql on heroku
- Client: iOS