

pShare: A Peer-to-Peer Storage Framework

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Motivation

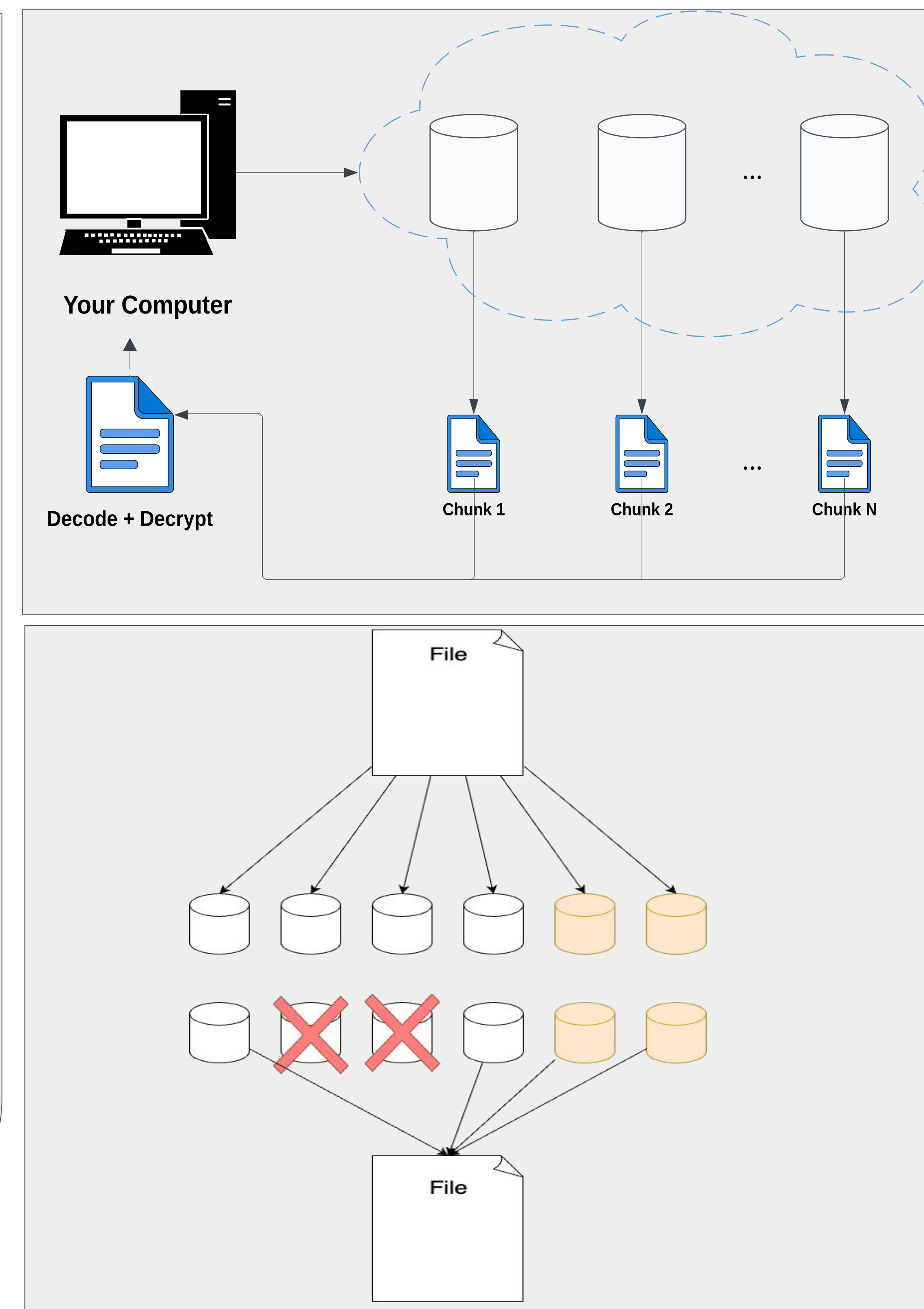
- Storing private data on the cloud exposes client data to the infrastructure weaknesses of cloud providers, as demonstrated in recent data breaches.
- Cloud providers have an incentive to use consumer data for profit, such as to train AI models or distribute portfolios to third parties. Many cloud business models operate with hidden fees, such as by making it difficult to retrieve data once it's been uploaded, or making terms and conditions difficult for consumers to understand.
- Traditional consumer-grade backups stored on external drives can be damaged, destroyed, lost, or compromised more easily than with our product.

pShare

A secure, redundant, and decentralized file storage solution without relying on traditional cloud service providers. pShare enables individuals and organizations to utilize idle storage space on local computers in the same network, while ensuring privacy and file integrity through chunking, encryption, erasure coding, and file distribution between these computers.

System Design & Components

- **Registry Node:**
Acts as central coordinator for encryption, chunking, and file tracking. Can perform: upload / download / delete on files on storage nodes (permission restricted to application folder).
- **Storage Node:**
Store encrypted file chunks, respond to discovery broadcasts, download/delete/upload GRPC calls, and disconnect requests from the registry node.
- **Auto-balancer concept:**
pShare automatically handles the creation of the number of chunks generated from erasure coding, and manages where the chunks are distributed to, failure via decay (computers exiting the network over time)



How It Works

- **File Upload:**
 - File encrypted
 - File is split into m chunks and k parity chunks using Reed-Solomon erasure coding, with $(m - k)$ of them required to reconstruct it: up to k can be lost
 - Chunks are distributed across available storage nodes using gRPC calls
- **File Download:**
 - Registry node retrieves min number $(m - k)$ chunks from storage nodes
 - Chunks are decrypted and reassembled
 - Checksums validates file integrity
- **Storage nodes (n) to parity (k)**
 - $n < 3$: $k = 1$
 - $4 < n < 10$: $k = n / 2$
 - $n > 10$: $k = \lceil \sqrt{n} \rceil + 1$
 - 17: 12/5, 100:89/11, 1000:967/33

pShare

Home

Storage Nodes

Cloud

Upload a File

Choose File

Your Files

Filename	Size (KB)	Actions
family_photo.jpg	1050	  
pic2.jpg	1050	  
key.json	1	  



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Home

Storage Nodes

Cloud

Connected Storage Nodes

Device	Usage (MB)	Action
computer1	5.3 / 15.0	
computer2	5.2 / 15.0	

Available Storage Nodes

Device	Capacity (MB)	Action
computer15	15.0	