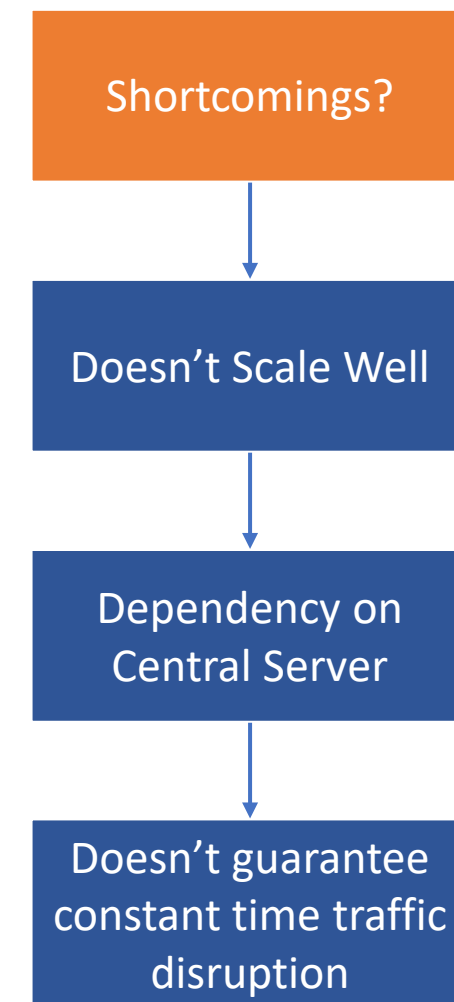
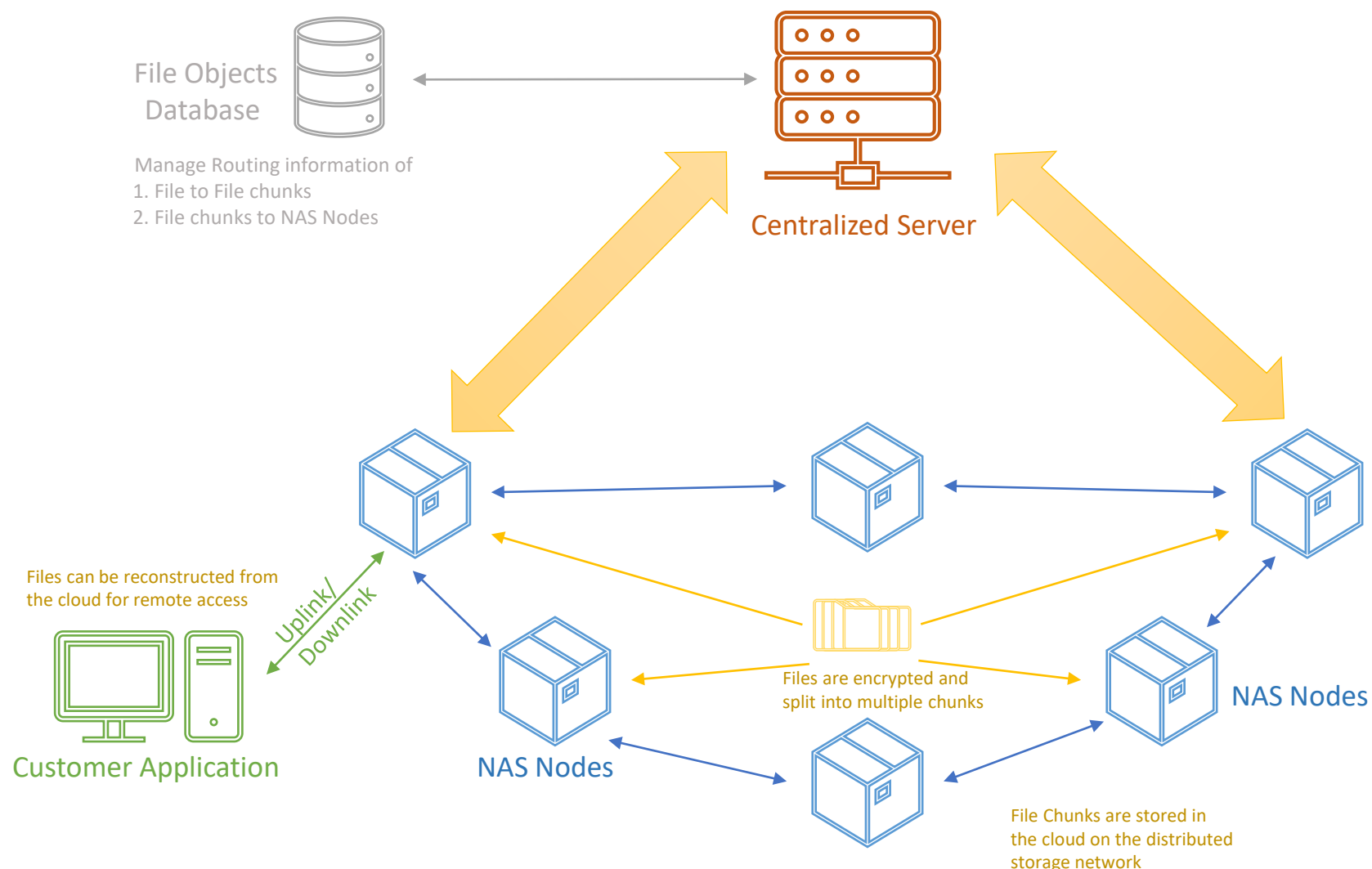


Consistent Hashing Powering Distributed Cloud Storage Architecture

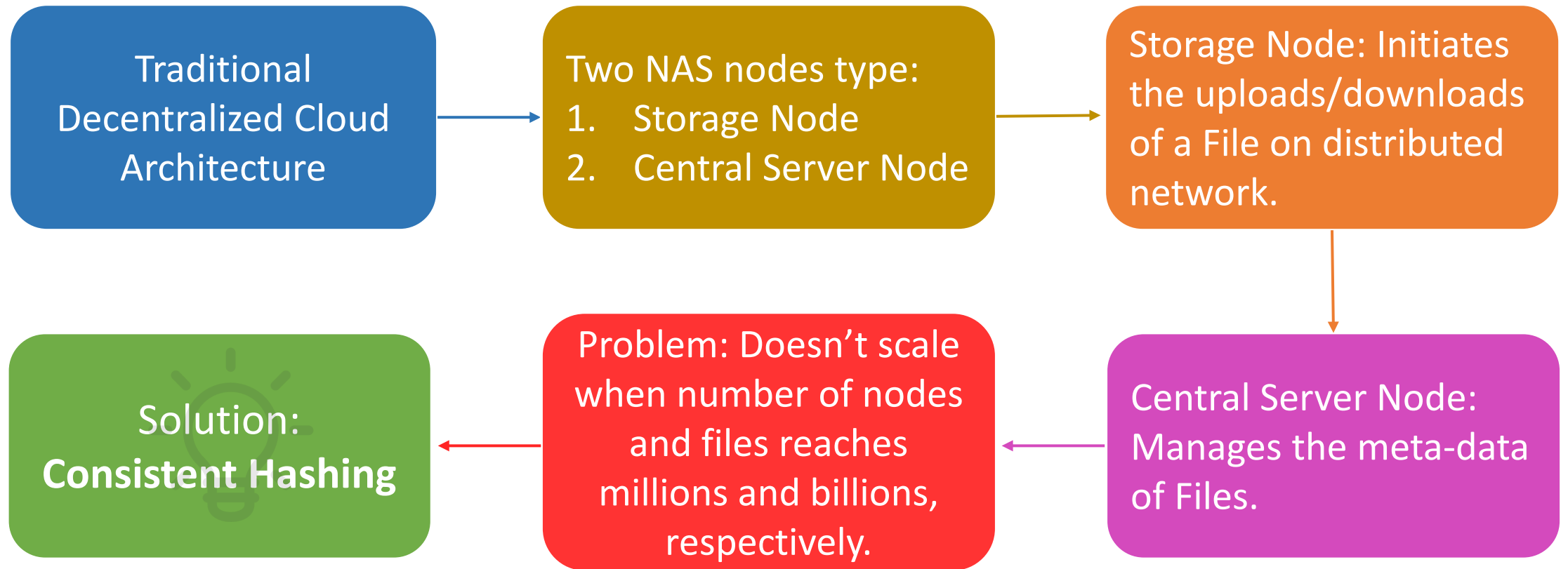
Vishwas Saxena

Senior Technologist, Western Digital

Distributed Cloud Storage Arch

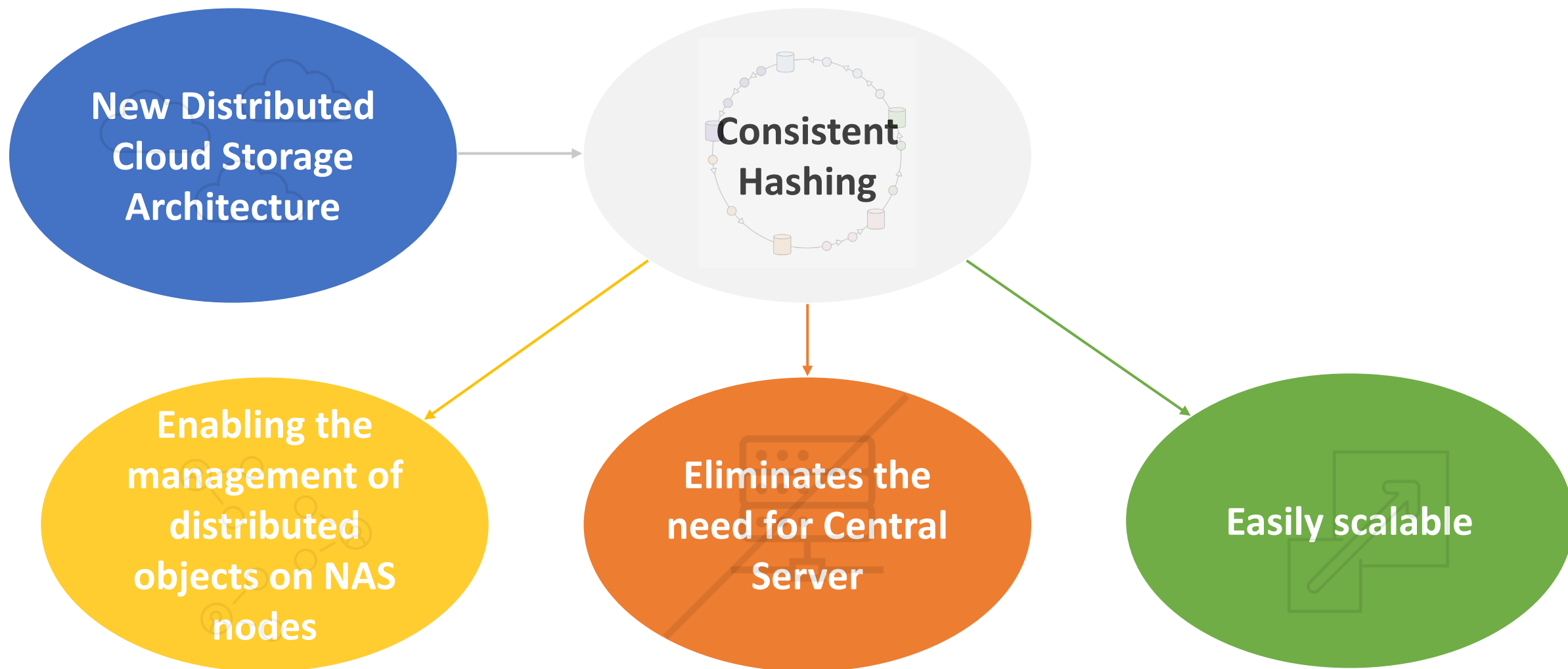


Problem in Distributed Cloud Storage Arch

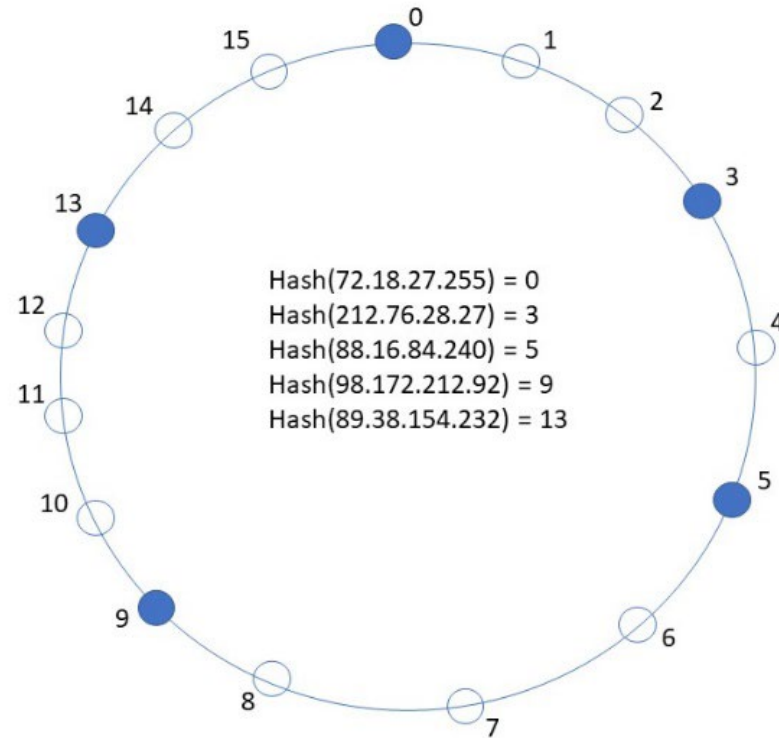


NAS: Network Attached Storage

Idea in a Nutshell



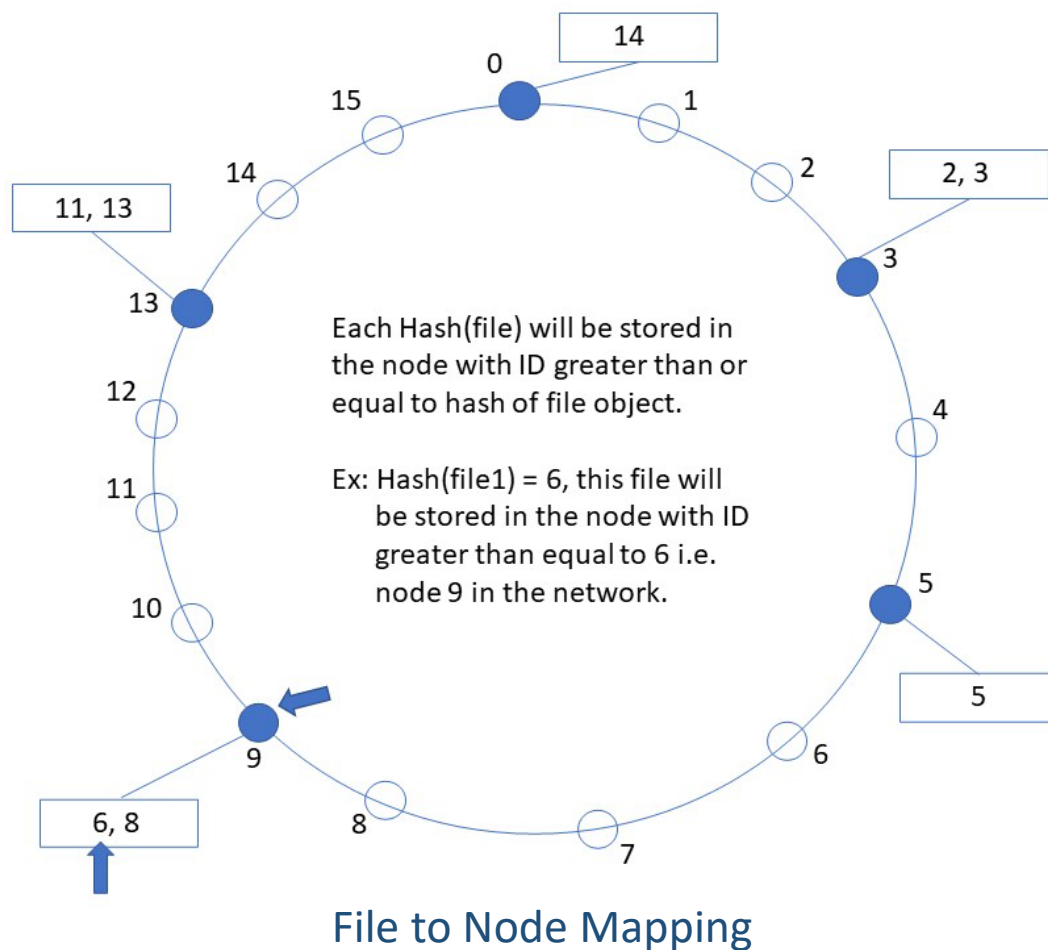
Consistent Hashing example with 4bit n/w



Initial Configuration

- ❖ A 16-node network which is (2^4) node 4-bit network.
- ❖ 5 available IP addresses, which on hashing presents node 0, 3, 5, 9 and 13.
- ❖ Node IP address and file name will be hashed using SHA-512.
- ❖ When a new file object comes into the network, it gets assigned one of these available IP address nodes.

Consistent Hashing

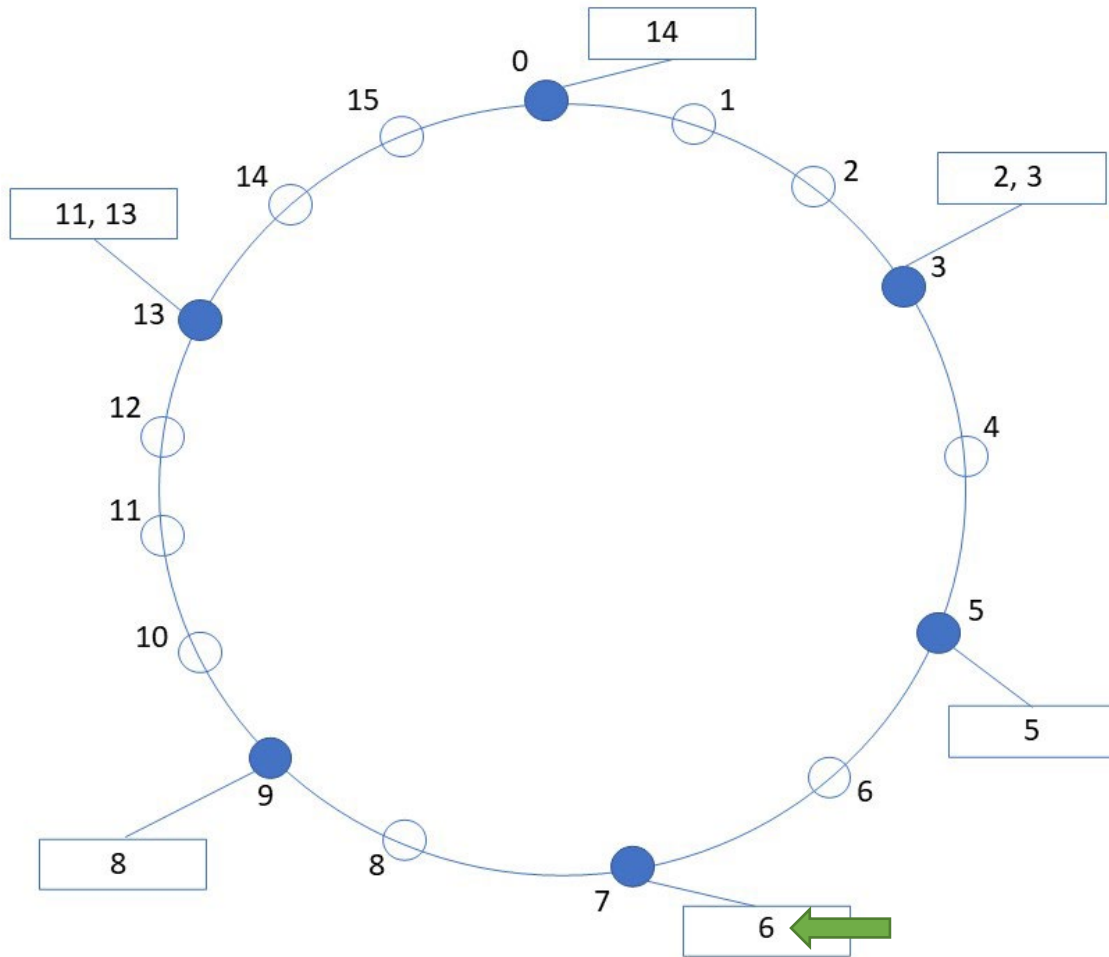


Finger Table

- ❖ Each available node in the network has finger table which stores the information about the successor nodes.
- ❖ Each node N contains information about successor node which succeeds node N by $(2^i + N) \bmod 2^m$, where $0 \leq i < m$.
- ❖ A node only stores routing information about at most m nodes in the network, because variable i is in the range of 0 to m .

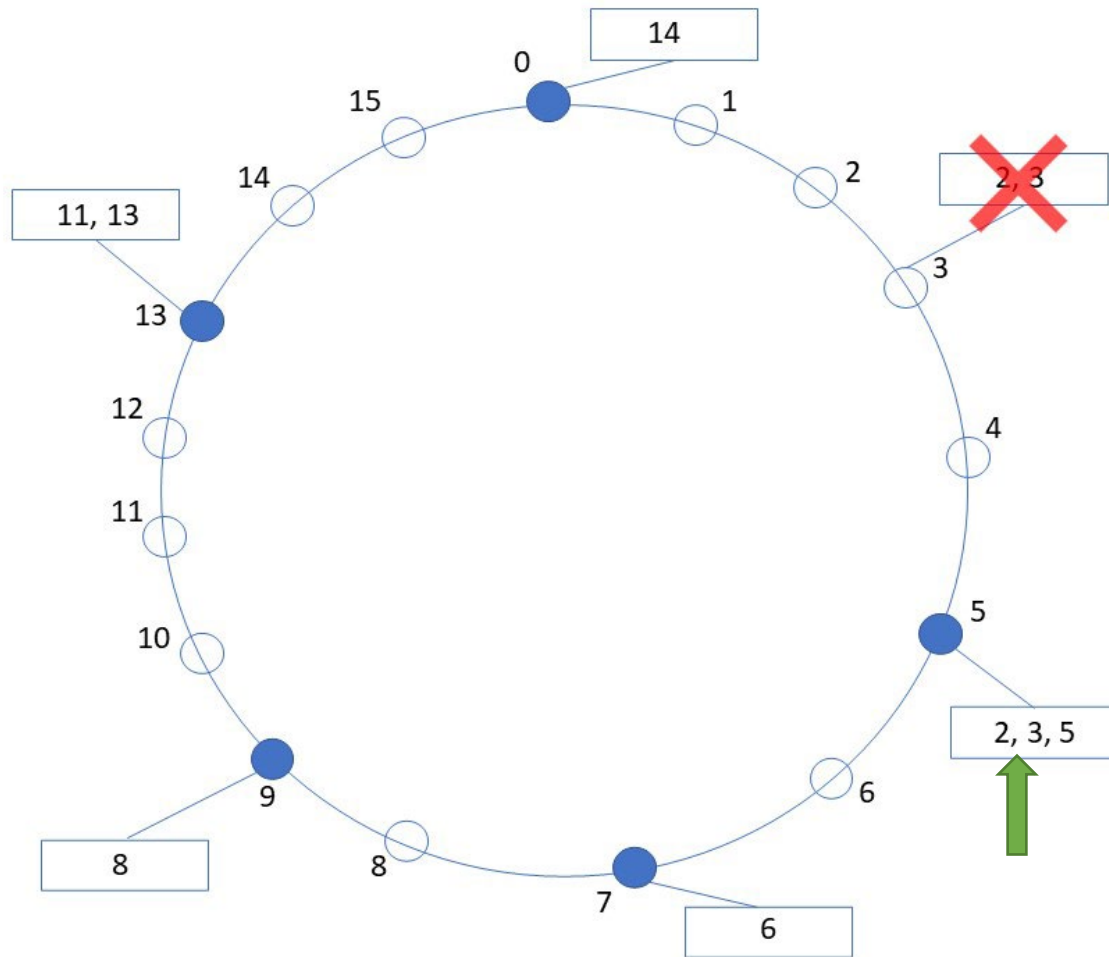


New Node Joins the Network



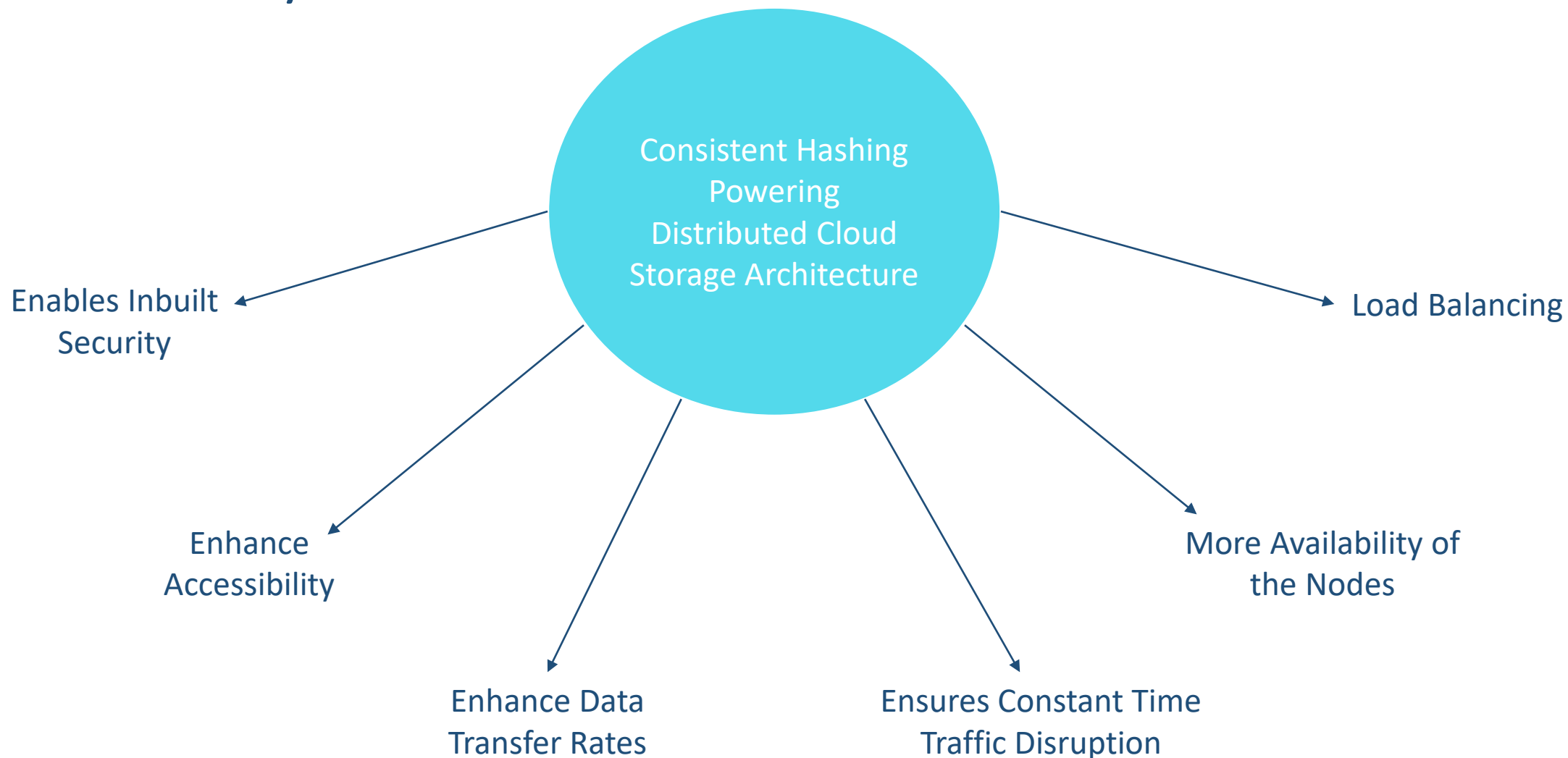
- ❖ A new node with $ID = 7$ joins the network.
- ❖ Only the successor node will reassign its files to newly added node.
- ❖ In this case, successor node is $ID = 9$.
- ❖ File with hash 6 will be reassigned to node with $ID = 7$.
- ❖ Also, the successor of node 5 will be changed from node 9 to newly added node 7.

Node Leaves the Network



- ❖ A node with $ID = 3$ leaves the network.
- ❖ Only the successor will be assigned all files of the exit node.
- ❖ In this case, successor node is $ID = 5$.
- ❖ All files of node 3 will be assigned to node 5.
- ❖ Also, the successor of node 0 will be changed from node 3 to node 5.

Summary



Summary

- ❖ Guarantees architecture scalability when number of Files and NAS Nodes reaches billions and million, respectively.
- ❖ Minimum disruption of existing file objects distributed across NAS nodes. Typically, only one node's file objects moved when new node joins or leaves the network.
- ❖ The ring structure ensures that the data is evenly distributed among the storage nodes, as data items are placed on the nodes closest to their hash values. This load balancing property enables efficient utilization of storage capacity across the distributed cloud storage system.
- ❖ Constant sized Finger Table enhance the searching time and accessibility.

Thank You