



Flash Memory Summit

Clustering AV Data For Secure, Reliable Backup

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Types of Data in Autonomous vehicles

- Autonomous Vehicles have lots of sensors capturing
 - Thermal data
 - Location data
 - Complex media captures
 - Images
 - Videos

Storage System of Collected Sensor Data

- This is a cost-efficient system as edge storage is
 - Much more economical than storing these huge volumes of data on the cloud
 - Enables fast data access
 - Better than a RAID 1 physical storage system
- But there is risk of data loss when storing the data on the edge.
 - An accident/theft can cause permanent loss of data stored on edge
- There is a need of data backup on the edge that is
 - Secure
 - Cost efficient
 - Reduces the risk of losing data.



How to avoid data loss ?

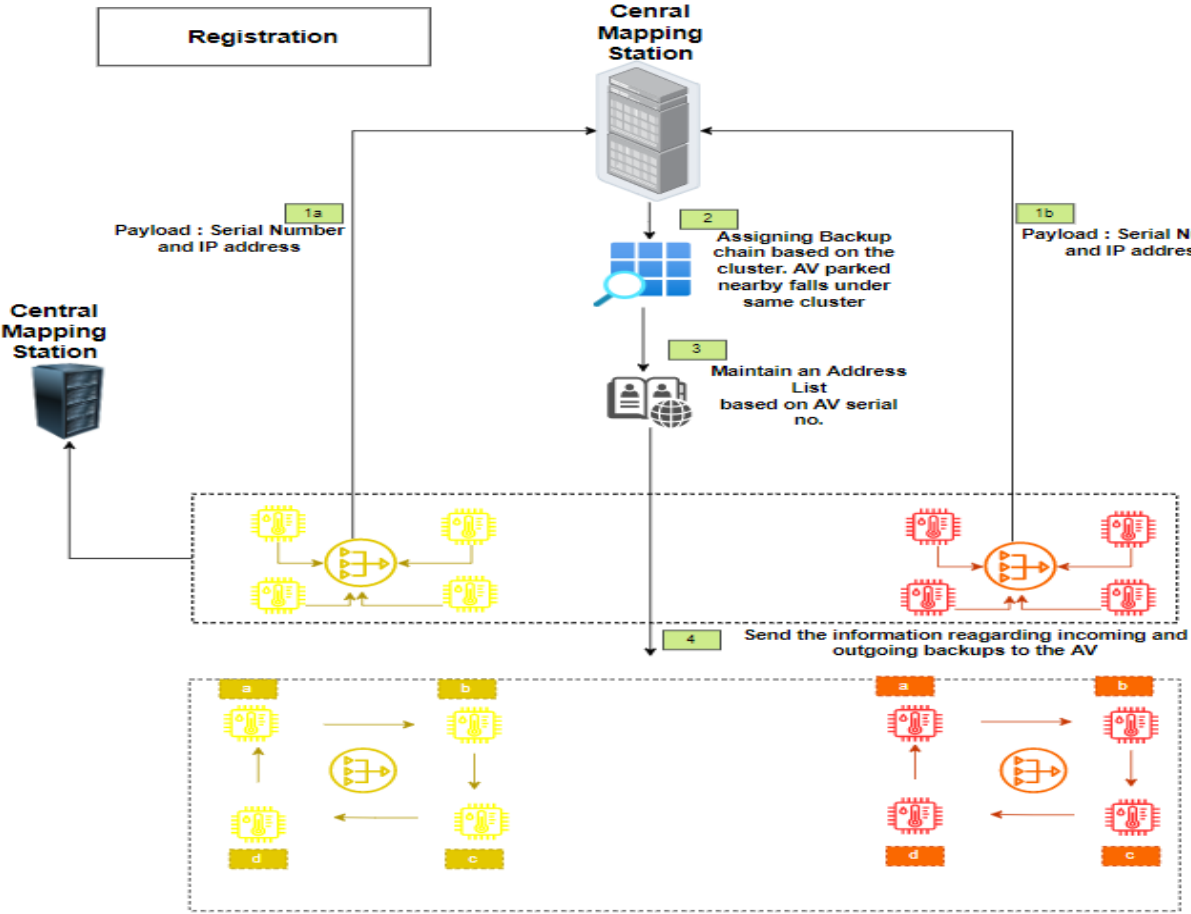
Cluster

- Dynamic cluster of N vehicles which are in a geographical proximity to one another while they are parked for a longer duration (more than an hour)
- Backup policy changes every day to select a new backup AV in the cluster thereby normalizes the backup storage on every AV

Central Mapping Station

- The central mapping system controls the formation of clusters using the cached location data of AVs at specific intervals and thereby determines whether vehicles are in a parked state and are near to the vehicle of interest
- The cluster is used for redundancy as the data of one vehicle is distributed and stored across the other vehicles in the cluster

How Are Clusters Formed ?

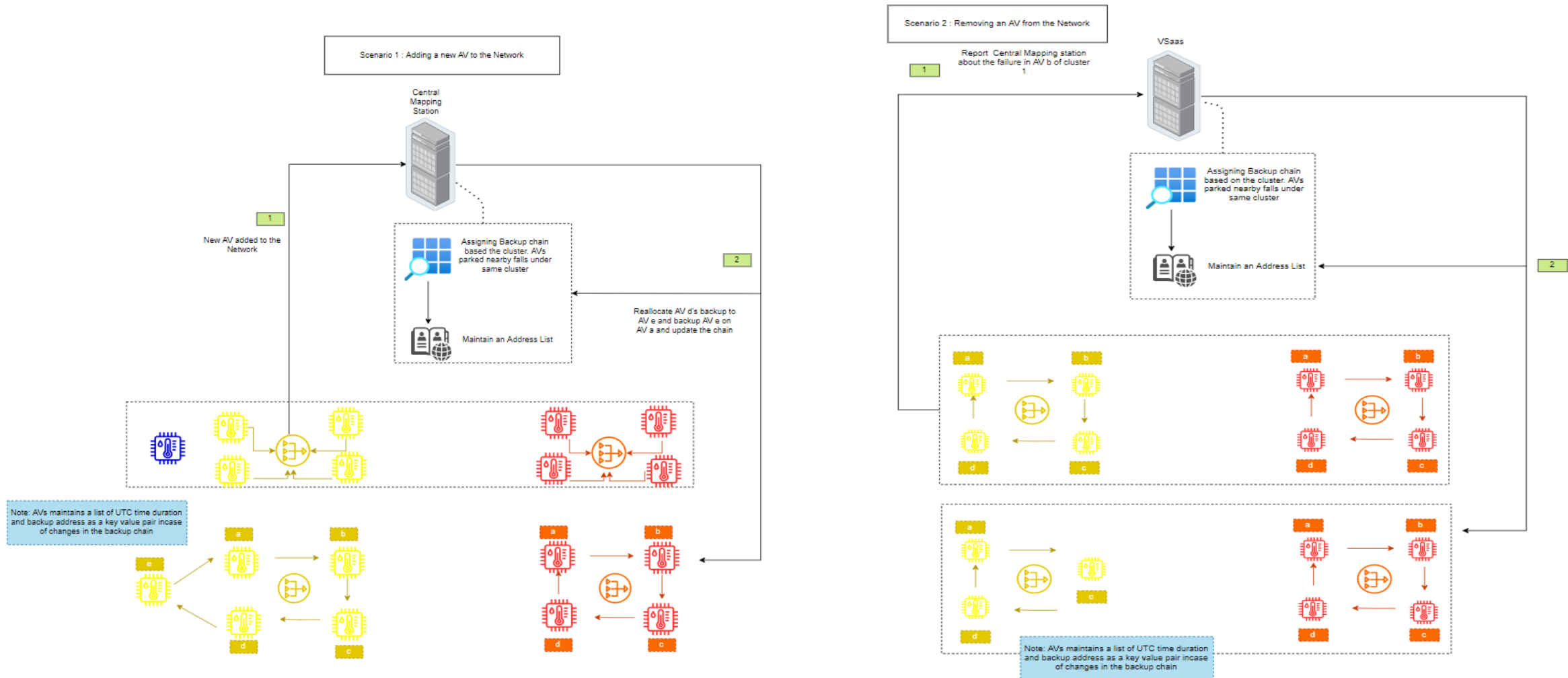


AV Color Coding	
Green	AV1
Blue	AV2
Red	AV3
Yellow	AV4

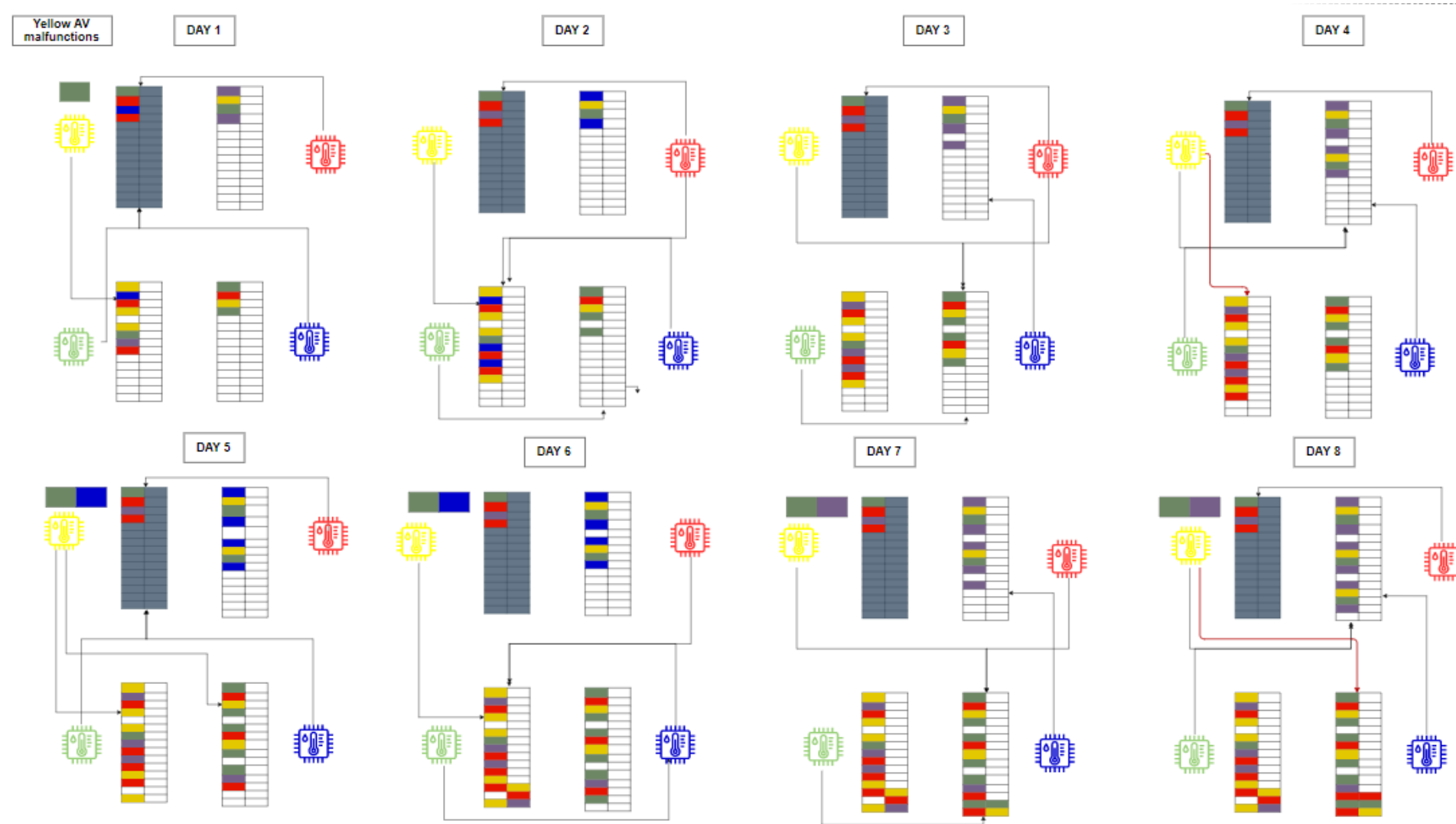
The storage capacity is normalized after 1 cycle (4 days).

Day	Source				Destination				Storage (GB)			
									1	2	3	4
1	1, 2, 3			4	4			1	1	0	0	3
2	2, 3, 4			1	1			2	4	1	0	3
3	3, 4, 1			2	2			3	4	4	1	3
4	4, 1, 2			3	3			4	4	4	4	4
N	1	2	3	4	2	3	4	1	N	N	N	N

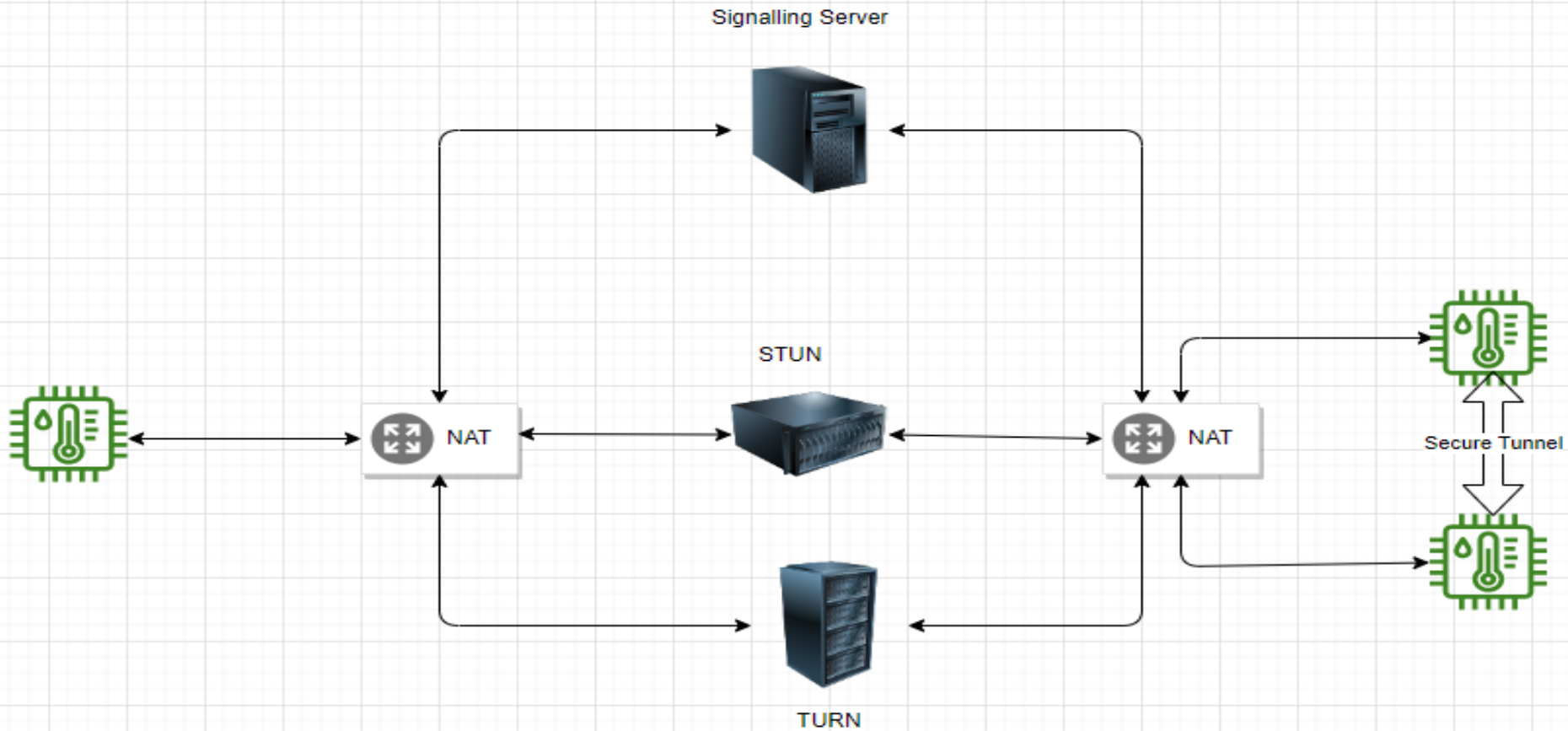
Adding/Delete An AV To Cluster



What If One Autonomous Vehicle Fails ?



Secure P2P Tunnel Of Autonomous Vehicles



- Security
 - Data privacy is intact as data is not stored on cloud
 - AVs create secure P2P tunnel for backing up data
- Reliability
 - There is no single point of failure
 - No manual data intervention is required to setup backup cluster
- Cost
 - Eliminates cloud cost for data backup
 - Minimal network and bandwidth cost



Thank You

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