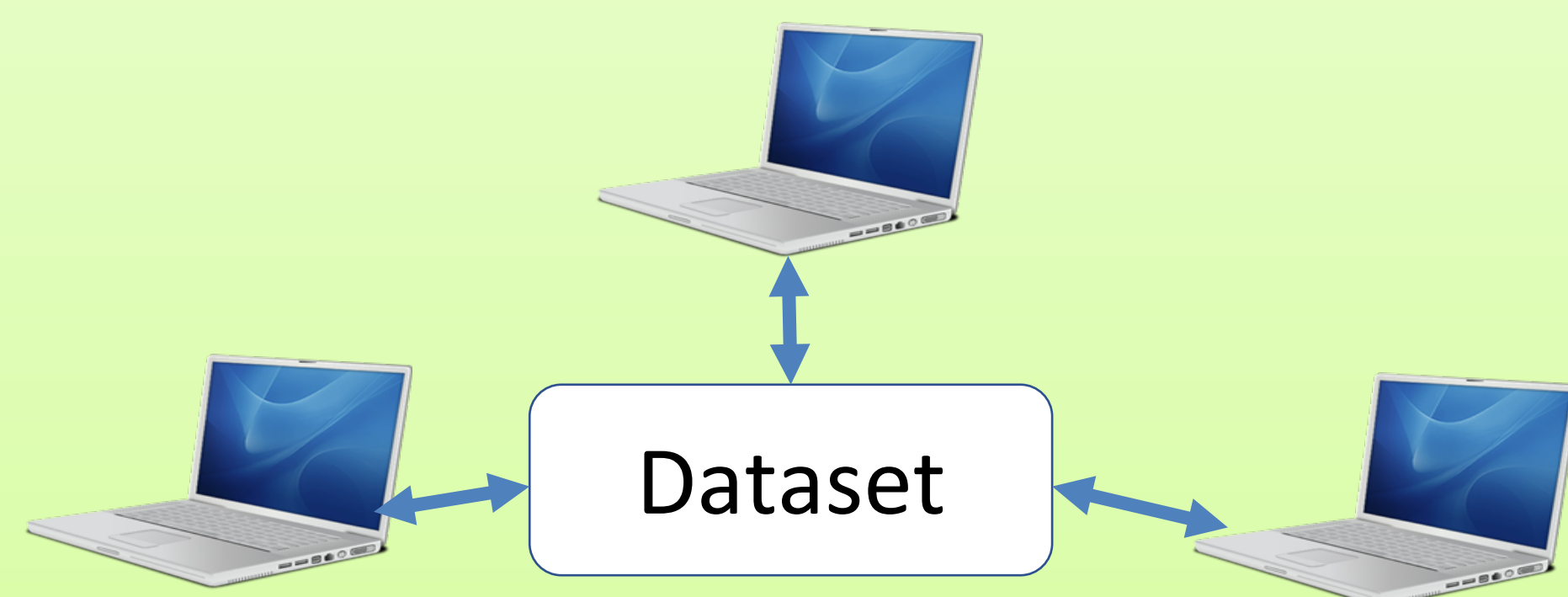


## Internet Research Lab

### Distributed Dataset Synchronization (Sync) in NDN

An abstraction for multi-party data-centric communication:

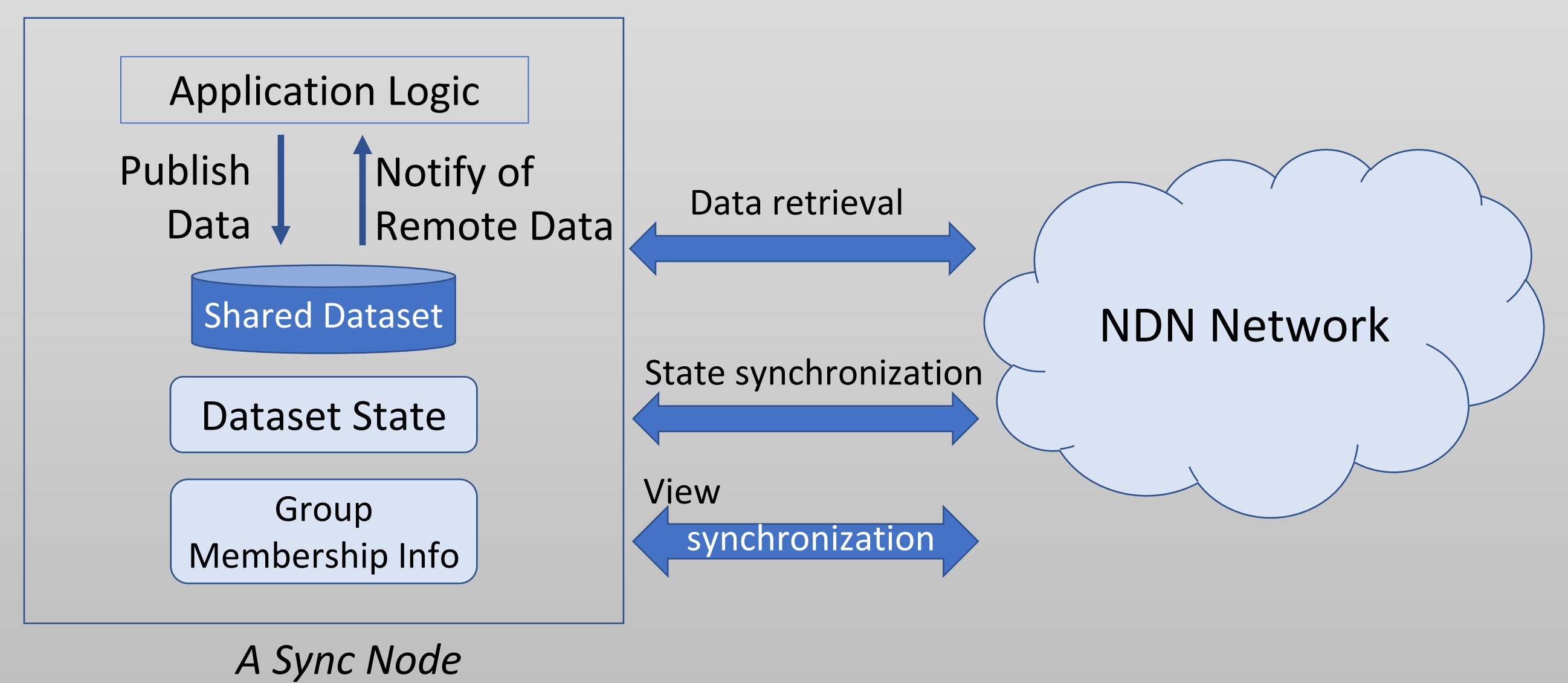
- Each party publishes data in its own namespace and maintains knowledge about other data in the set
- The shared dataset contains data from all parties
- Challenge: how to keep all parties updated on the latest dataset state in an efficient, resilient way with minimal delay
- VectorSync: our latest Sync design based on experience from previous Sync protocols



### VectorSync: Basic Model

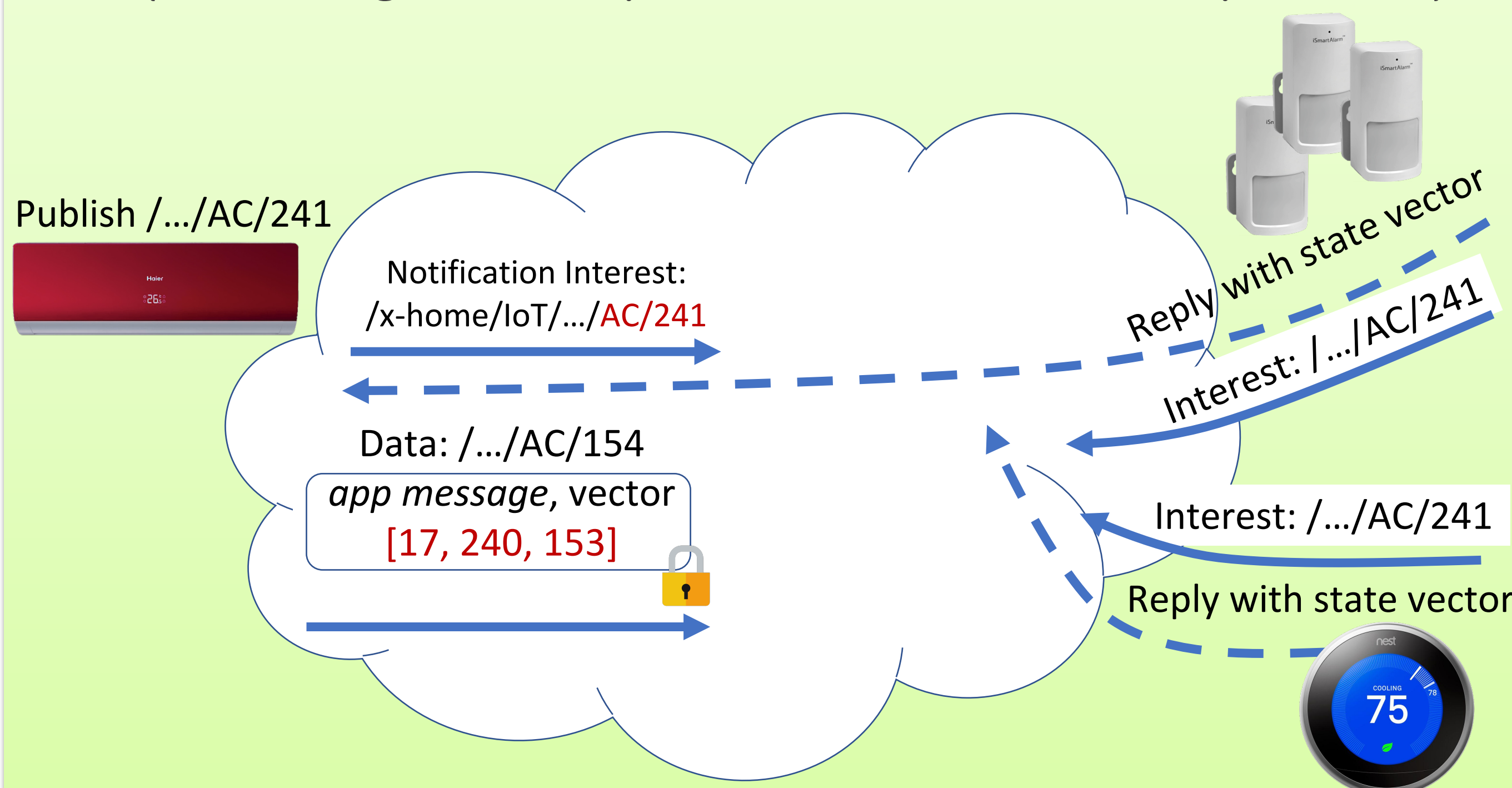
VectorSync maintains two pieces of information:

- Dataset state summarized by the *version vector* [1]
- Group membership information (a.k.a. the *view*)



### Data Synchronization

- **Naming convention:** data name – publisher name || seq#
- A publisher sends notification interests carrying the *full name* (publisher name || seq#) of new data
- Reply data content piggybacks the *state vector* (containing latest sequence number from each producer)



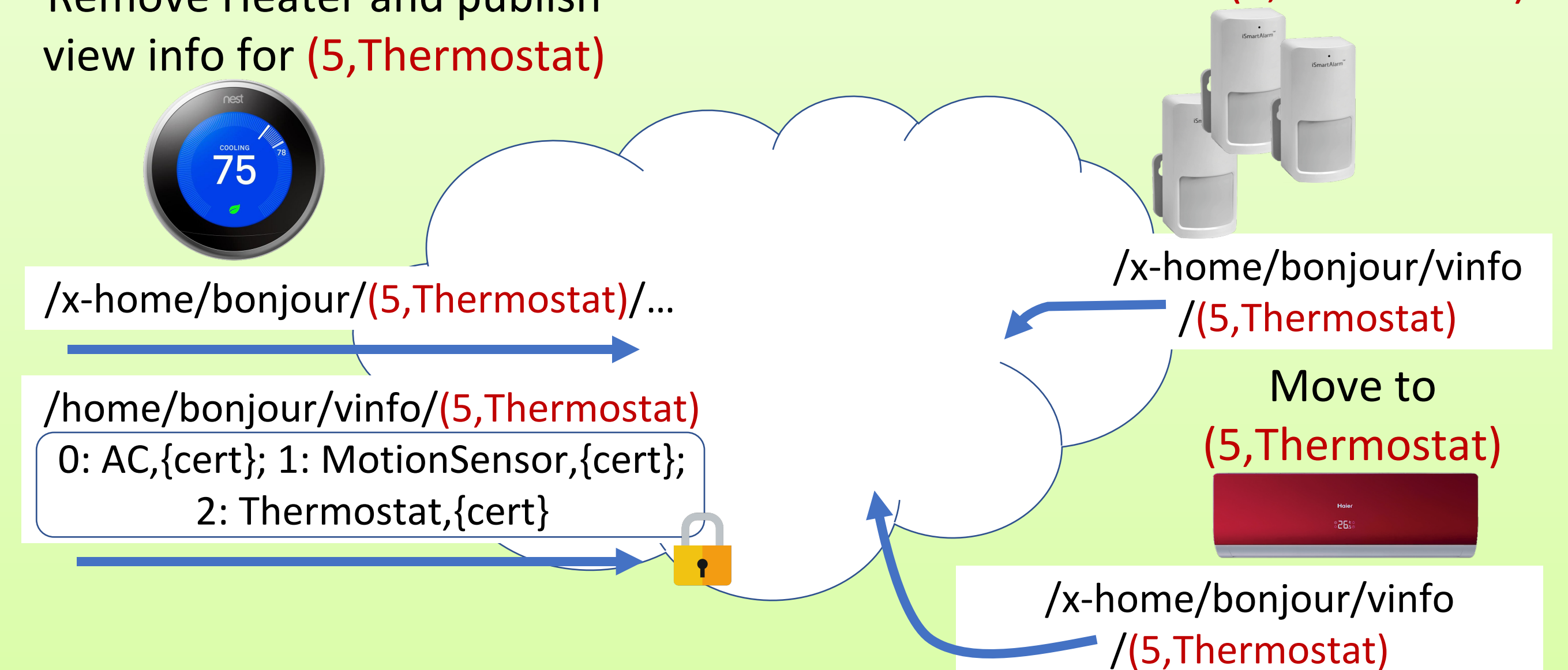
### Synchronizing Group Membership by Views

- An elected leader defines the view and assigns a *view number*, publishes group membership as a Data packet
- Notification interest carries the current view number and leader's name to announce the view

View (4,Thermostat): {0:AC; 1:MotionSensor; 2:Thermostat; 3:Heater}

Remove Heater and publish view info for (5,Thermostat)

Move to (5,Thermostat)



### Comparing with Previously Proposed Sync Protocols

	Sync state representation (and size)	Interest frequency	Factors affecting Interest size	Data dissemination delay (without loss)
CCNx Sync [3]	Name tree (large)	Periodic	Node hash	Depending on Interest period + tree walk
iSync [2]	Invertible Bloom Filter (large)	Periodic	IBF digest	Depending on Interest period + 3.5 RTT
ChronoSync [4]	"prefix+seq#" list (small)	Long-lived Interest	State digest (with exclude filter)	1.5 RTT (+ additional RTT to fetch simultaneous data)
VectorSync	State vector (small)	One per data (with heartbeat)	View ID + full data name	1.5 RTT

### References

1. Parker, et al., Detection of Mutual Inconsistency in Distributed Systems, 1983
2. Fu, et al., Synchronizing Namespaces with Invertible Bloom Filters, 2015
3. CCNx 0.8.2 Synchronization protocol, 2012
4. Zhu, et al., Let's ChronoSync: Decentralized Dataset State Synchronization in Named Data Networking, 2013
5. Zhang, et al., Named Data Networking, 2014
6. Shang, et al., A Survey of Distributed Dataset Synchronization in Named Data Networking, 2017