# Scalable ESGF Node Manager

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# Background

The current ESGF Node Manager handles:

- Node membership and status
- Capturing metrics
- Sharing node information across federations: certs, endpoints etc
- A mechanism to share common configuration files.

Drawbacks

- Limited scalability.
- P2P file/data exchange could be more secure, particularly configuration files.

# Desirable features for next-gen Node Manager

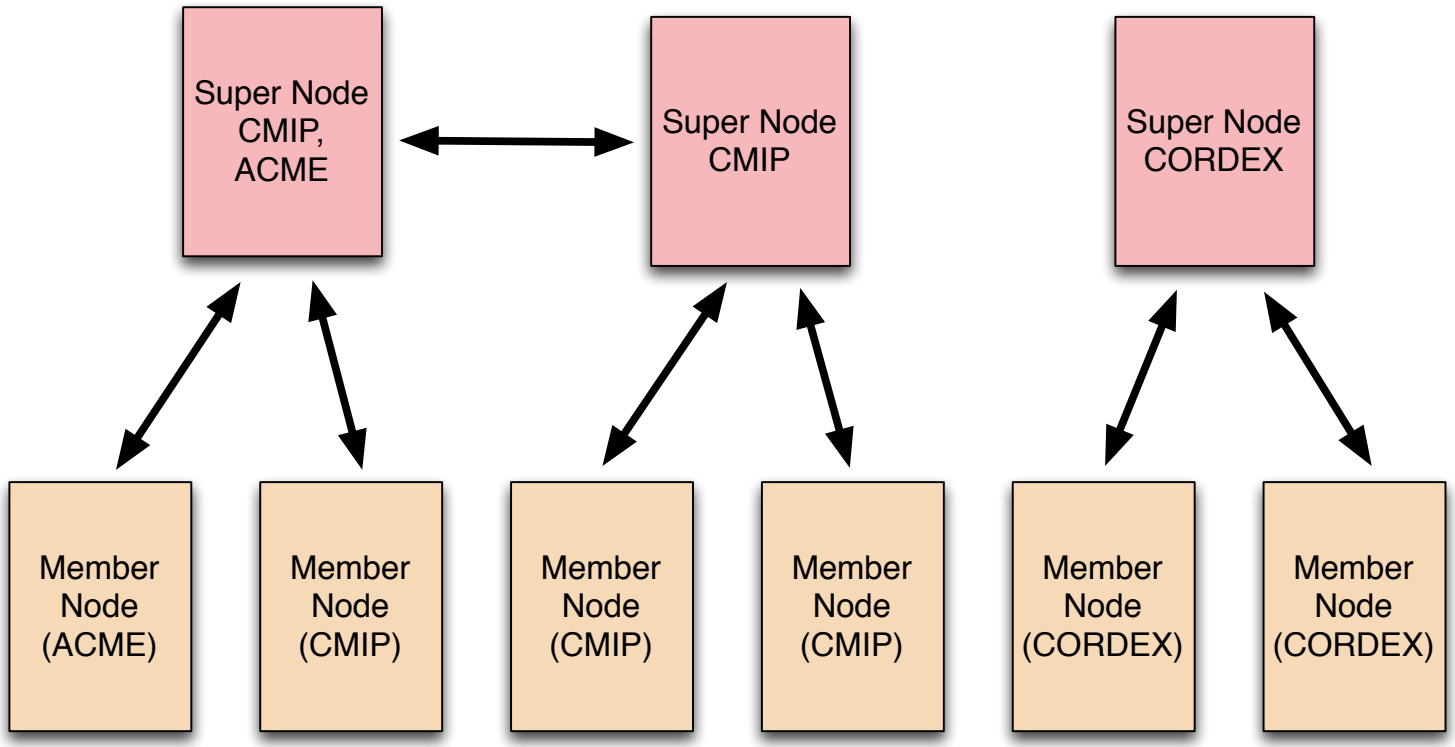
- Fault-tolerant distributed system, without a single point of failure.
- High scalability without overloading resources.
- Minimise communication overheads.
- PAN federation administration: handling cert requests, node memberships etc
- Consistent and highly available common configuration files
- Mechanism to ensure replica consistency across federation.

# Node Manager types

Node managers can be of three different types.

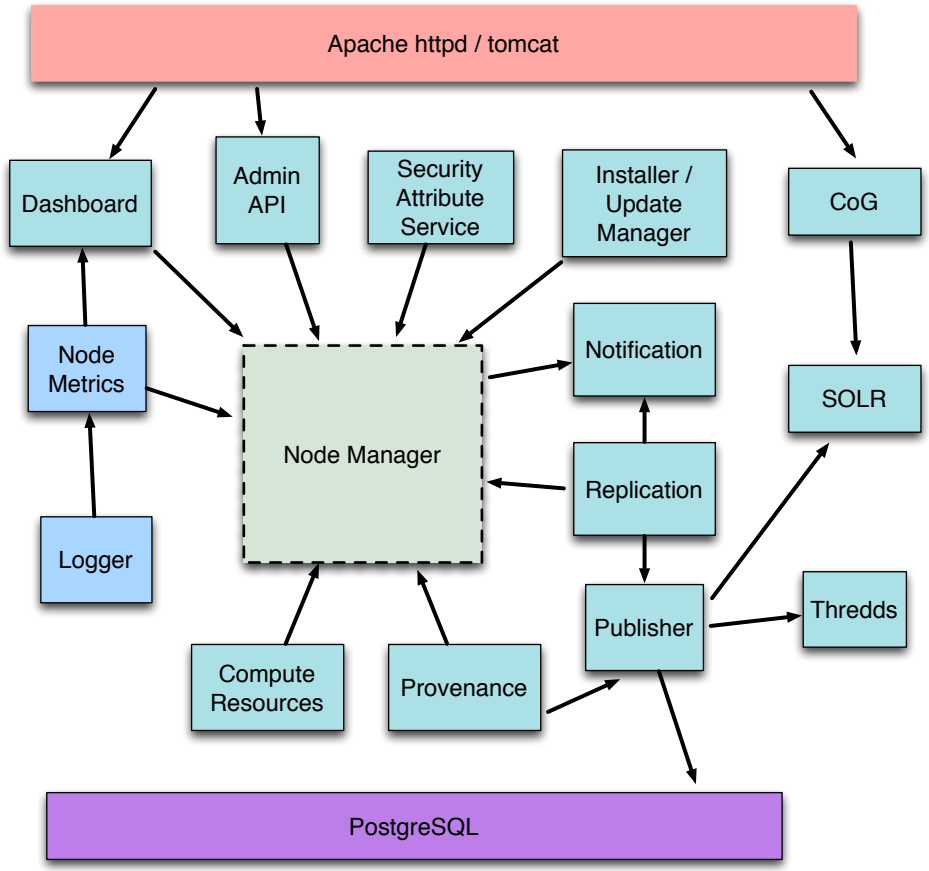
1. Supernodes
   - A validated and reliable source for configuration directives, metrics, information about components etc, at project level.
   - Multiple concurrent supernodes for scalability, fault tolerance and load sharing.
   - Supernodes query other Node Managers for metrics and status.
   - A single Node Manager can serve as supernode to multiple projects or even as supernode to one and membernode to another etc.
   - Administrator action required to add/remove from ESGF
2. Membernodes
   - Default Node Manager configuration
   - Cannot query other Node Managers.
   - May join or leave ESGF "at will"
3. Standby supernodes
   - The Node Managers run as supernodes only when too few supernodes are operational.

# View of federated Node Managers



# Node Manager role in ESGF Node

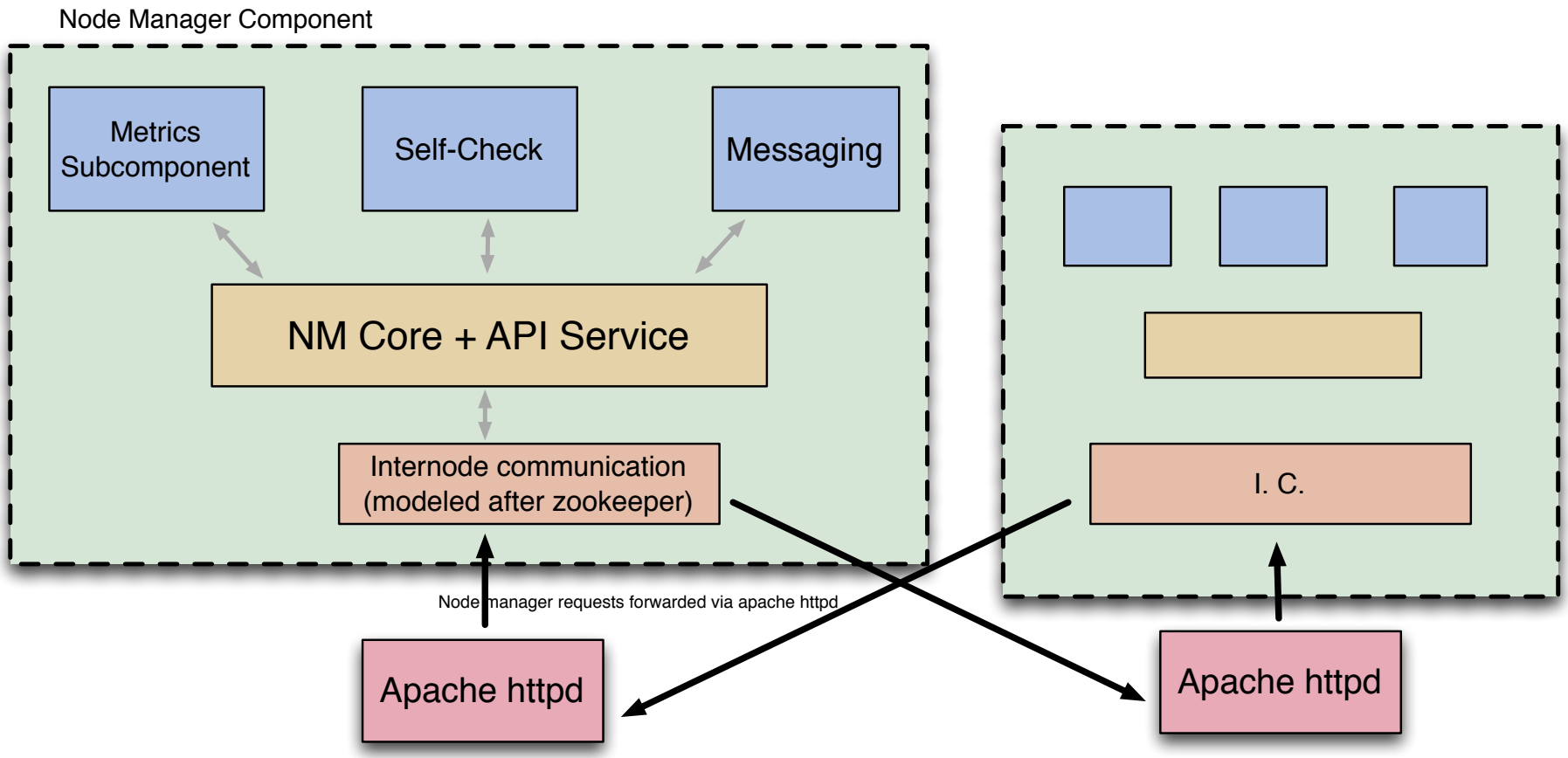
| | |
|---|---|
| Dashboard | Manage consistent updates to registration.xml |
| Metrics | Coordinate metric metadata |
| Compute | Maintain repository of federated compute resources |
| Security | Replication of attributes for service failover |
| Update Manager | Consistent record of component versions |
| Notification | Push alert messages out to administrators / users |
| Replication | Data set version information |
| Publication | Consistent project-based configuration |
| Provenance | Consistent provenance metadata |
| Thredds | ??? |
| SOLR | ??? |
| CoG | ??? |
| Logger | (metadata)? |



# Node Manager components

- **Health Check** Health Check - a heart beat "monituot
- **Communication management**
-
- **ESGF Node Manager API**, to serve as a wrapper,
- **Metric collector**: query member nodes and aggregate them (supernodes)
- **Self-check component**: run sanity checks on self.
- **Admin console (local node)**: submit membership requests, CSRs, volunteer for supernode role etc
- **Admin console (supernode admin mode)**: sign CSRs, manage membership and volunteering requests etc.

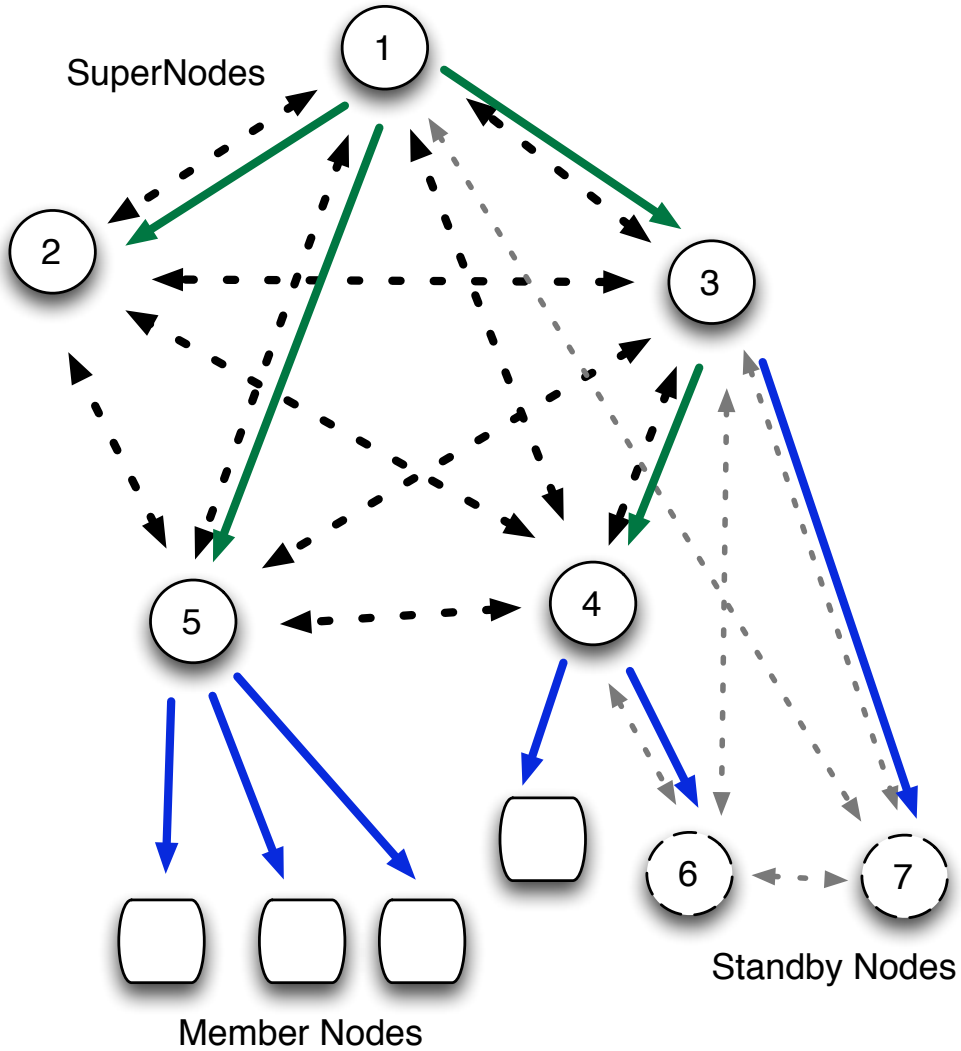
# Node Manager component diagram



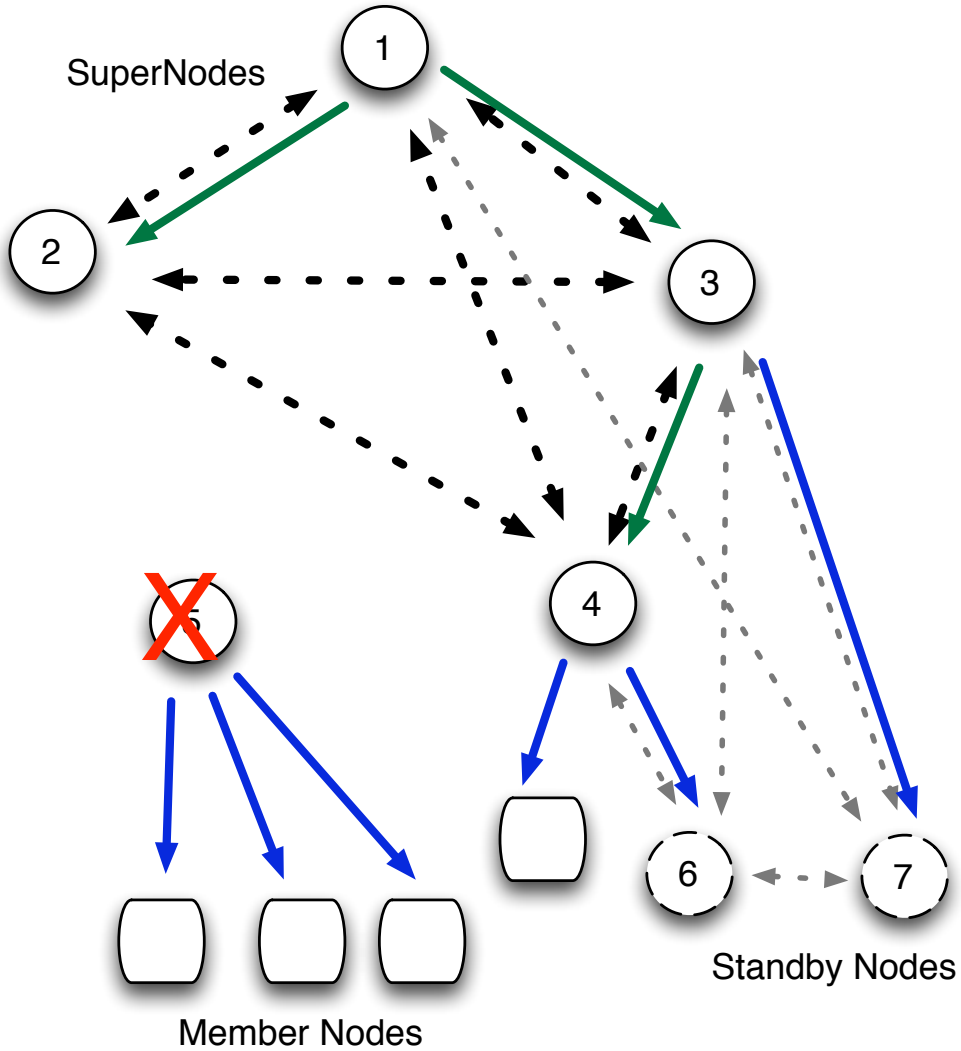
# Supernode failure mitigation

- Member nodes need to be redistributed for node-checks, file distribution in event the assigned supernode fails
- Option 1. Distribute to active super nodes
- Option 2. Promote a standby node. Distribute remaining nodes to "new" supernode, place of promoted node.
- Choice of options depends on setting, resources.

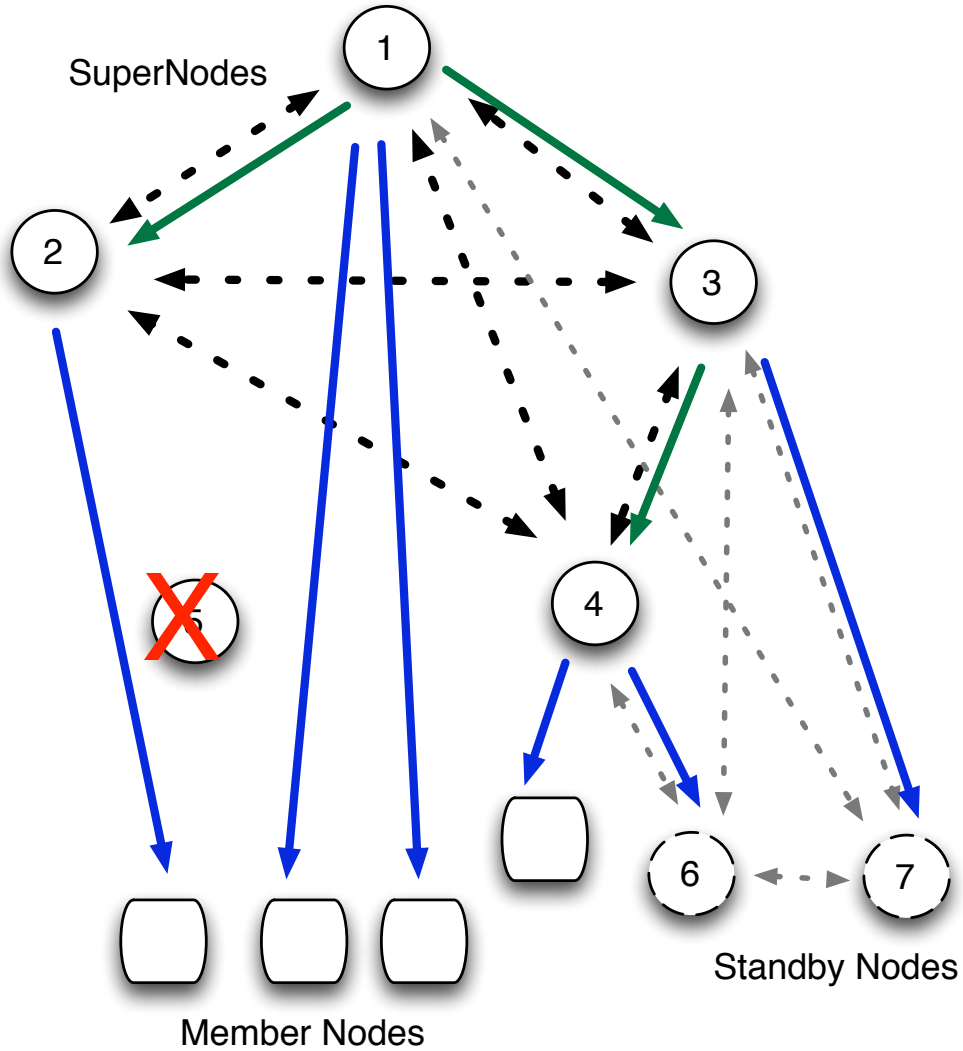
# Supernode failure mitigation



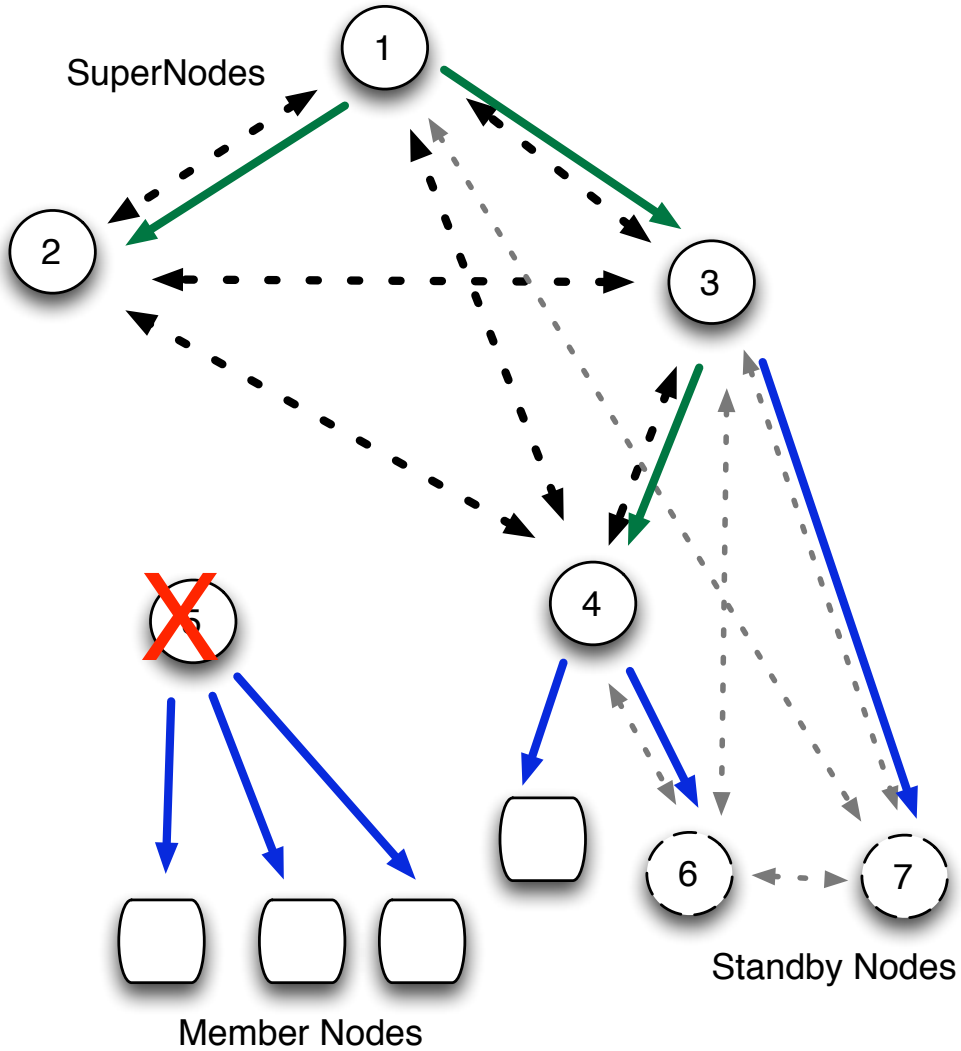
# Supernode failure mitigation



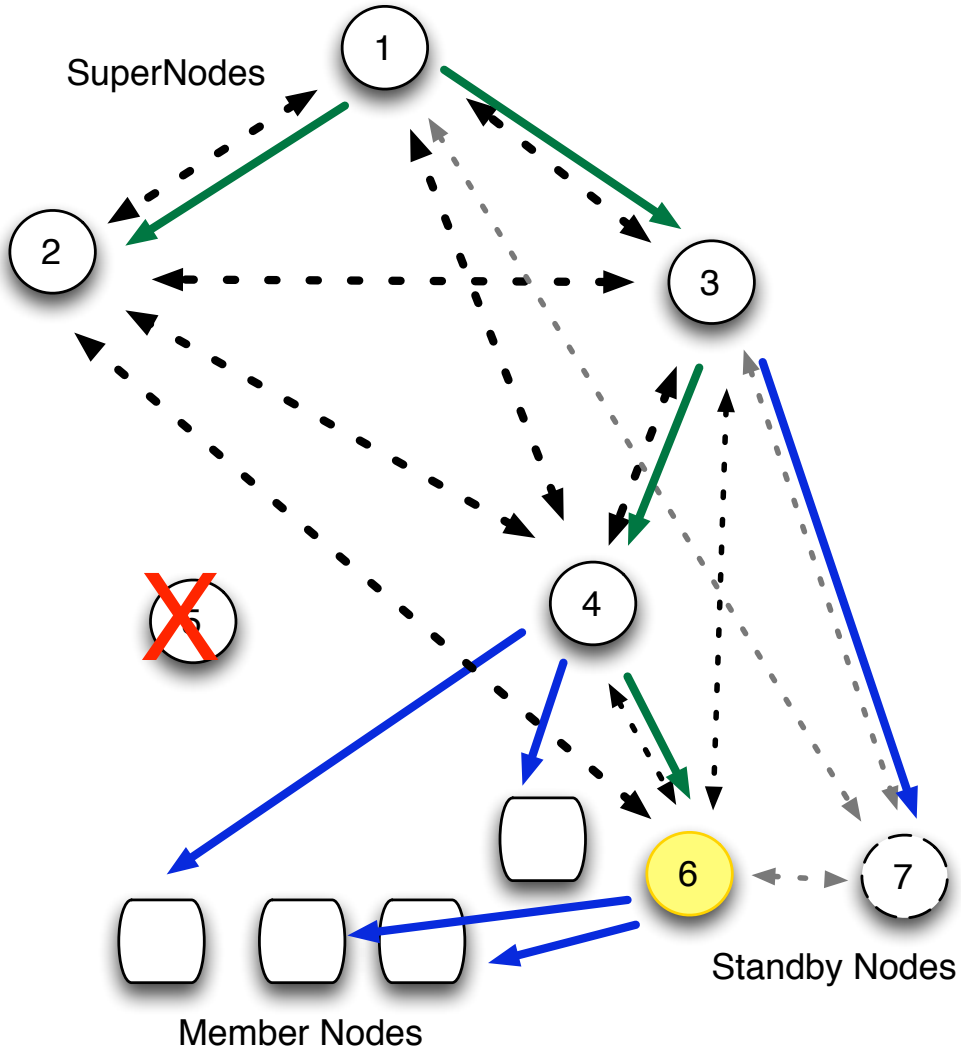
# Supernode failure mitigation - Option 1



# Supernode failure mitigation - Option 2



# Supernode failure mitigation - Option 2



# Conflict resolution

- Modeled on git principles
- Changes are like commits with timestamps (supernode id becomes the "tiebreaker")
- Deterministically ordered and replayed - all nodes get the same answer.
- Example: "race condition" of multiple member nodes joining in close succession.

# Prototype of the Node Manager

- **API** Django
  - Supports node map distribution, member node join / self-removal.
  - Passes work items (changes) to task queue
- Task queue - process changes. Single worker handles updates synchronously
- Communication set up asynchronously. Responses added to queue.

# Node Manager design considerations

- Security: factor for both user/machine executed elevated privilege operations.
- Design to guard against spoofing of membernodes/supernodes etc.

# Implementation Status

Federation prototyping ongoing. single source health check complete
TODO - node reassignment
multiple source health check
conflict resolution
dashboard support
Summer - start testing in wide-area environment - will need your help!