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Kubernetes SIG MultiCluster Intro + Deep Dive

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Agenda

- Mission
- Active projects
  - Cluster Identity
  - Kubernetes Cluster Federation
- What have we been doing
- Deep dive into Kubernetes Cluster Federation concepts
- Q&A

SIG MultiCluster mission

- Solving common challenges related to the **management of multiple Kubernetes clusters, and applications that exist therein**
- Designing, discussing, implementing and maintaining
  - **API's, tools and documentation**
  - related to multi-cluster administration and application management
- Includes **not only active automated approaches** such as Kubernetes Cluster Federation
  - also those that employ batch workflow-style continuous deployment systems
- Includes:
  - standalone building blocks (for example a cluster registry), and
  - proposed changes to kubernetes core where appropriate
- See more at https://github.com/kubernetes/community/blob/master/sig-multicluster/README.md

Active work efforts

- Cluster Identity
- Kubernetes Cluster Federation (KubeFed)

Sub Project: Cluster Identity

- **Goals**:
  - Develop a cluster identifier concept more durable than API endpoint addresses, certs, etc.
  - Use cases:
    - Identifier that persists longer than currently used identifiers
    - Verify identity of a cluster
- **Status**:
  - Recently started; discussions happening in SIG multicluster biweekly sync

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KubeFed?

Federation v2 is dead; long live KubeFed

We are now officially KubeFed

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- We found federation ambiguous, including references to stuff outside kubernetes.
- **KUBErnetes Cluster FEDeration** established as the official term.
- **kubefed2** tool renamed to **kubefedctl**.
- Project now lives at
  - http://sigs.k8s.io/kubefed

Whats KubeFed for?

- Coordinate configuration in multiple kubernetes clusters from a single API surface.
- Active reconciliation to the desired state of the configuration over the lifecycle of the app.
- To be used as foundation blocks for building higher level multicluster use cases de.g. multi geography applications and disaster recovery.

Where we are at?

- Beta release candidate is out.
  - https://github.com/kubernetes-sigs/kubefed/releases/tag/v0.1.0-rc2
- Few outstanding issues, enhancing documentation before final beta, very soon.

What have we been doing?

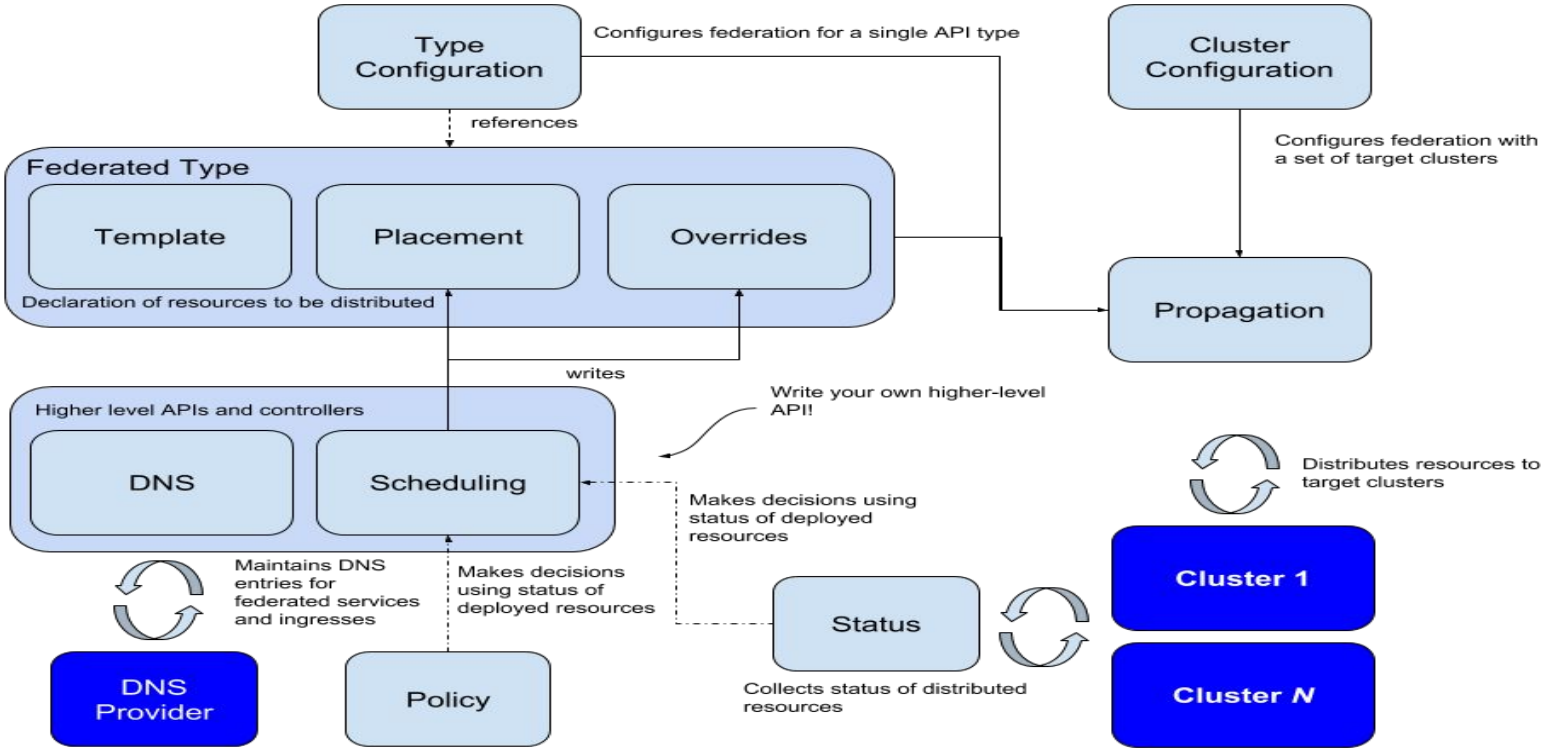
Let's start with a demo

- Run an application/Already have an application

- Deploy KubeFed
- Enable needed types
- Federate application
- Change application in specific clusters
- Control placement of the application in clusters

Demo

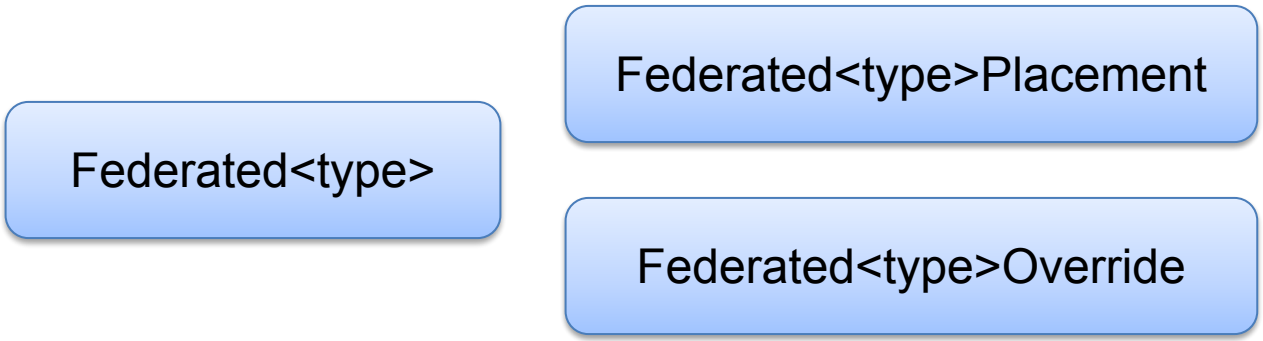
Sub Project: KubeFed



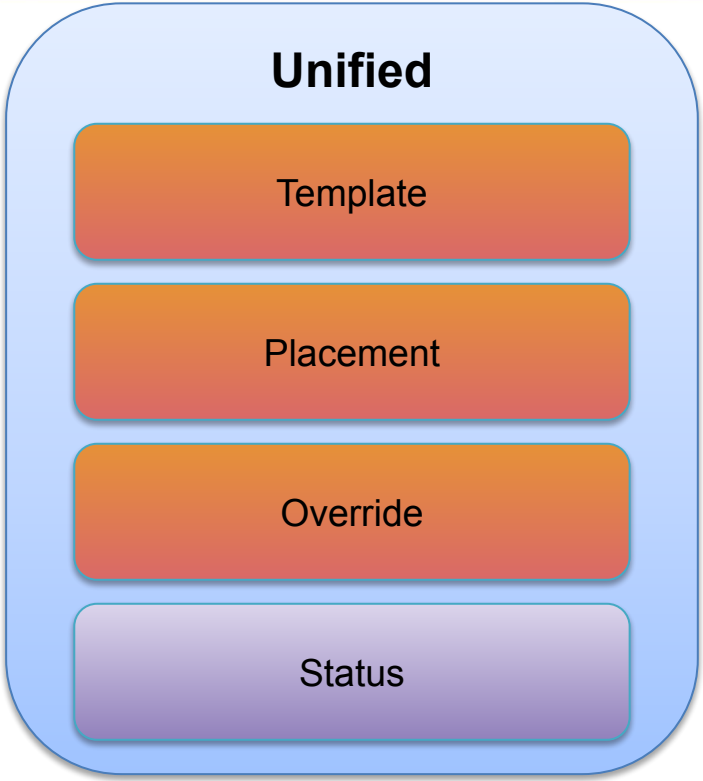
Tooling

- We now have useful tooling via **kubefedctl**
  - **kubefedctl enable** to enable federation of API Types.
  - **kubefedctl federate** to convert kubernetes resources to federated equivalents.

API Overhaul



API Overhaul

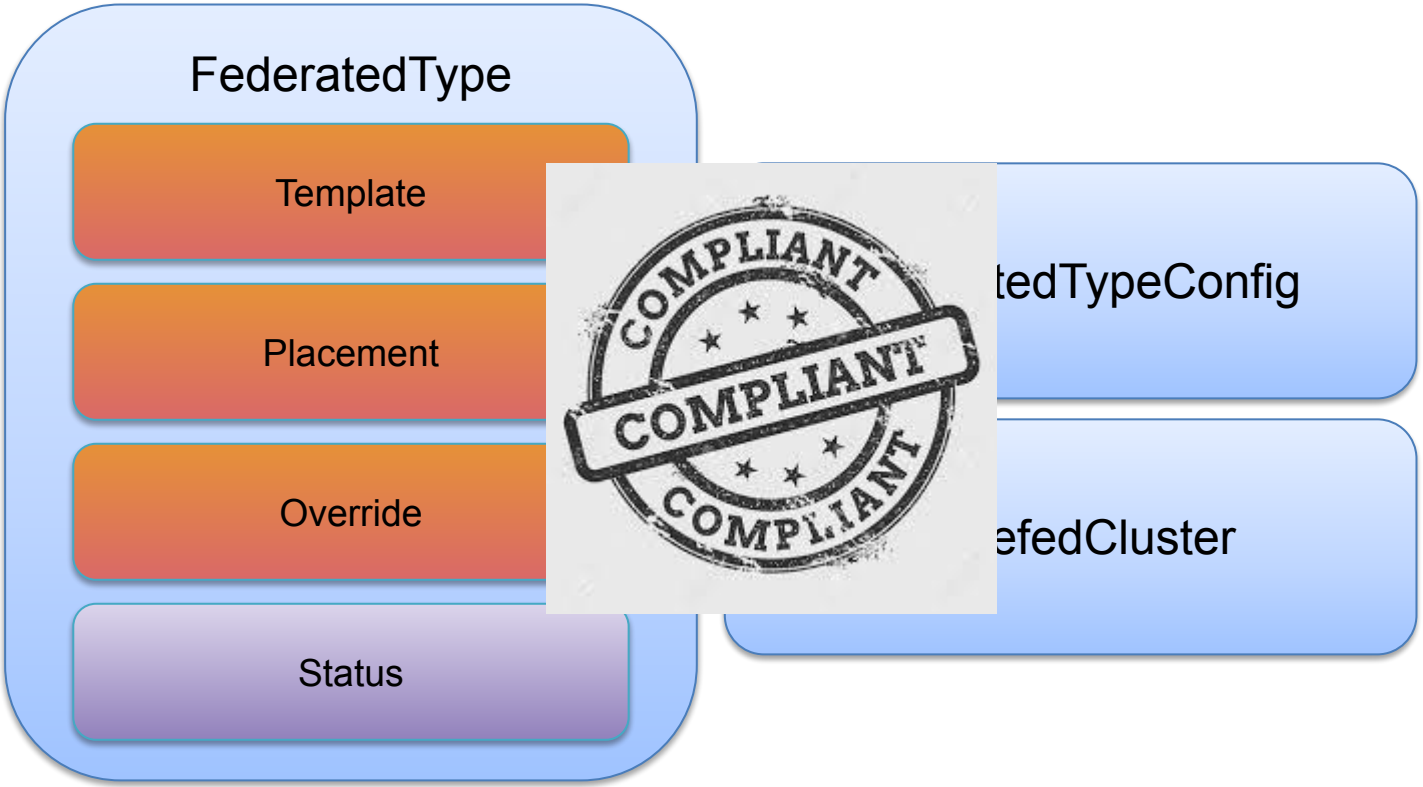


API Overhaul

- Unified **template, placement and overrides**
  - Expressed in a single API resource now.

- This API resource now has a meaningful **status**
  - Provides consolidated propagation status.
  - Lists propagation problems, if any.

API Overhaul



API Overhaul

- Core APIs are now compliant with kubernetes API conventions.

Future work

- Improve usability and documentation.
  - Further easing API translation from kubernetes resources to KubeFed resources.
  - Helm plugin to auto-convert manifests while installing.
- Higher level user facing API, akin to Apps CRD in kubernetes.
- Pull reconciliation

Deep dive

- How does KubeFed manage resources in multiple clusters?

KubeFed Beta Features

- Register a cluster to KubeFed control plane
  - **kubefedctl join**
- Enable management of a type of resource
  - **kubefedctl enable**
- Convert resources to federated form
  - **kubefedctl federate**
- Manage member cluster API state
  - Control plane + federated resources

Registering a cluster

- **kubefedctl join**
  - Registers a cluster as a ‘member’ cluster
- Creates service account (**SA**) in member cluster
- Creates a **KubeFedCluster** in the host cluster
  - API endpoint of member cluster
  - CA bundle of member cluster
  - Reference to secret containing **SA** token

Enabling federation of a type

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- **kubefedctl enable**
- Creates the federated type CRD
  - e.g. **FederatedDeployment**
- Creates a **FederatedTypeConfig**
  - Includes group, version, resource name (**GVR**) for 2 API types
  - Target type (e.g. **Deployment**)
  - Federated type (e.g. **FederatedDeployment**)

Federated Types

- A federated type defines how a resource should appear in multiple clusters
  - e.g. **FederatedDeployment**
- 3 fields:
  - template: common form of the resource
    - Embeds the target resource
  - placement: the clusters it should appear in
  - overrides: per-cluster variation

FederatedNamespace

- Namespaces are special (only container)
  - So is the federated equivalent!
- **FederatedNamespace**
  - is namespace-scoped (simpler permissioning)
  - Placement for a contained federated resource is the intersection of the federated resource and federated namespace placement

Converting existing resources

- **kubefedctl federate**
- Converts Kubernetes resources to their federated equivalent
- Resources can exist in API or be provided via yaml
- **kubefedctl federate ns my-ns --contents**
  - Convert the namespace and its contents to federated equivalents

Configuring propagation

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- **propagation**: reconciling resources in member clusters with a federated resource
- **FederatedTypeConfig** (**FTC**) configures propagation for a federated type
- For each **FTC**, a ‘sync’ controller is launched:
  - Watches federated resources in host cluster
  - Watches target resources in member clusters
  - Ensures target state matches federated state

Sync controller: API interaction

- No explicit type support compiled in
- **FTC** provides *group*, *version*, & *resource name* (**GVR**) for target and federated API types
- **GVR** enables API calls (e.g. Get, Watch)
- **unstructured** (maps of interfaces) used in place of golang structs
  - No type safety
  - But federated resources are consistent

Sync controller: Updates

- Sync controller lacks type details
- How to decide if a target resource is up-to-date?
- Track what was used as input
  - Record hashes of the template and overrides fields
- Track the version of the resulting resource
  - Record resource version or generation

Enough detail?

Q&A

- Common questions
  - Is it necessary to grant KubeFed cluster-admin in member clusters?
  - What happens when KubeFed goes down?
  - How do I enable cross-cluster service discovery?
  - How would I decide between KubeFed and gitops?

Getting involved

- Github:
  - https://sigs.k8s.io/kubefed
- Kube Slack:
  - #sig-multicluster on https://kubernetes.slack.com/
- Mailing list:
  - https://groups.google.com/forum/#!forum/kubernetes-sig-multicluster
- Community page:
  - https://github.com/kubernetes/community/tree/master/sig-multicluster