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THE LINUX FOUNDATION



AI_dev
Open Source GenAI & ML Summit

China 2024



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SIG Multicluster Intro & Deep Dive

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Welcome!



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We'll cover:

- What this SIG is about
 - Our next problem spaces
- Current activity
 - SIG-MC website
 - ClusterSet / Namespace Sameness
 - About API for storing cluster properties such as Cluster ID / ClusterSet membership
 - Multicluster Services API / Multicluster DNS
 - Building blocks for orchestration
 - ClusterProfile API for centralizing cluster related information
- How to contribute

What this SIG is about



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What this SIG is about



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- Multi-cluster is everywhere
 - Fault tolerance
 - Data locality
 - Policy
 - Capacity
 - Performance
- We need your input!
 - Real user stories and use cases are extremely valuable
 - Tell us what you're working on!

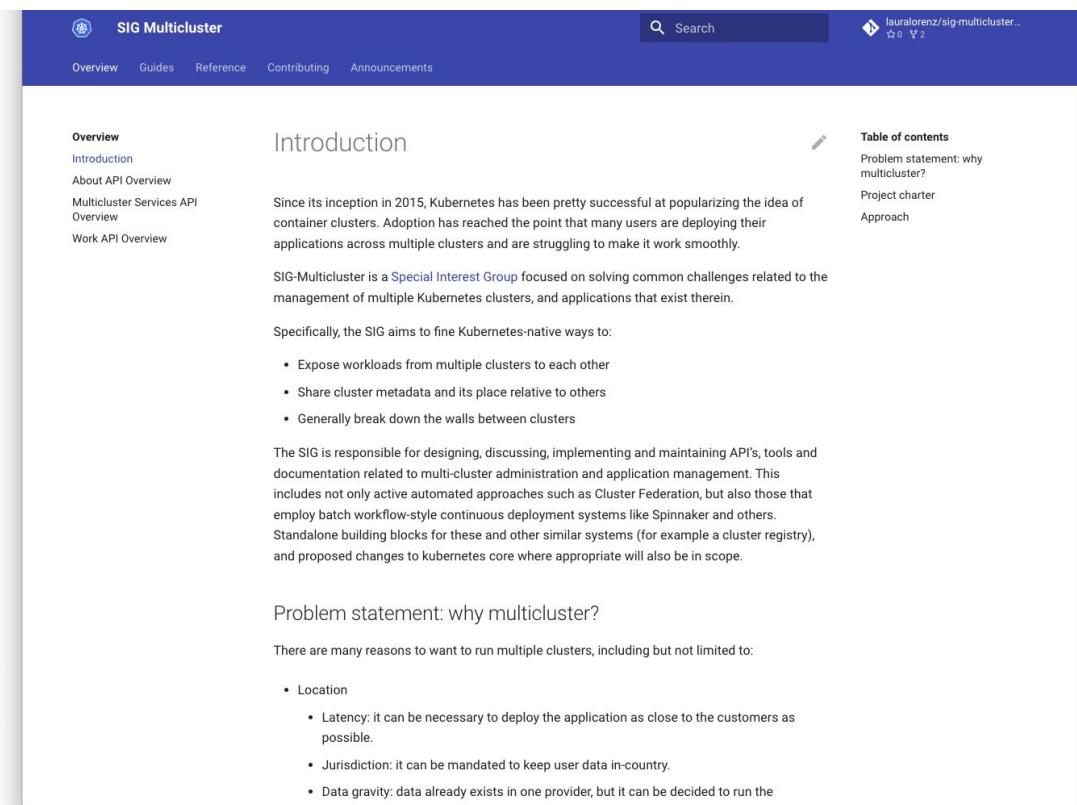
Our approach

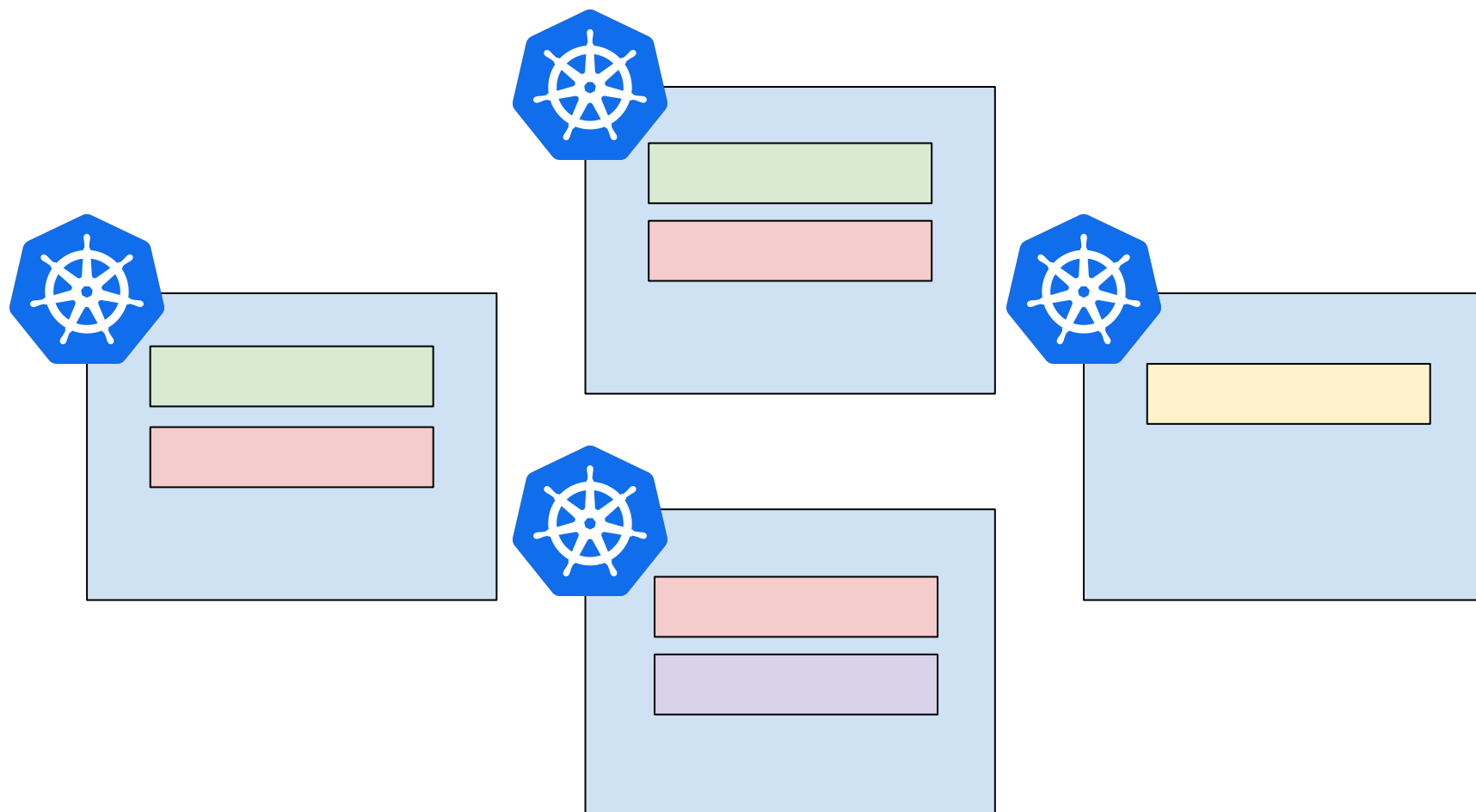


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- Focus on APIs
 - The ecosystem is diverse, make room for customization
- Avoid solving any optional problems
 - “This could be useful” is an engineering fly trap!
- Consistency with existing APIs
- Composable building blocks

- ✨ multicluster.sigs.k8s.io ✨
- Higher level documentation for end users
- Project status updates
- Connect implementers to our APIs and tooling
- Catalogue implementations for end users
- What are we missing?
 - Patterns?
 - Open questions?



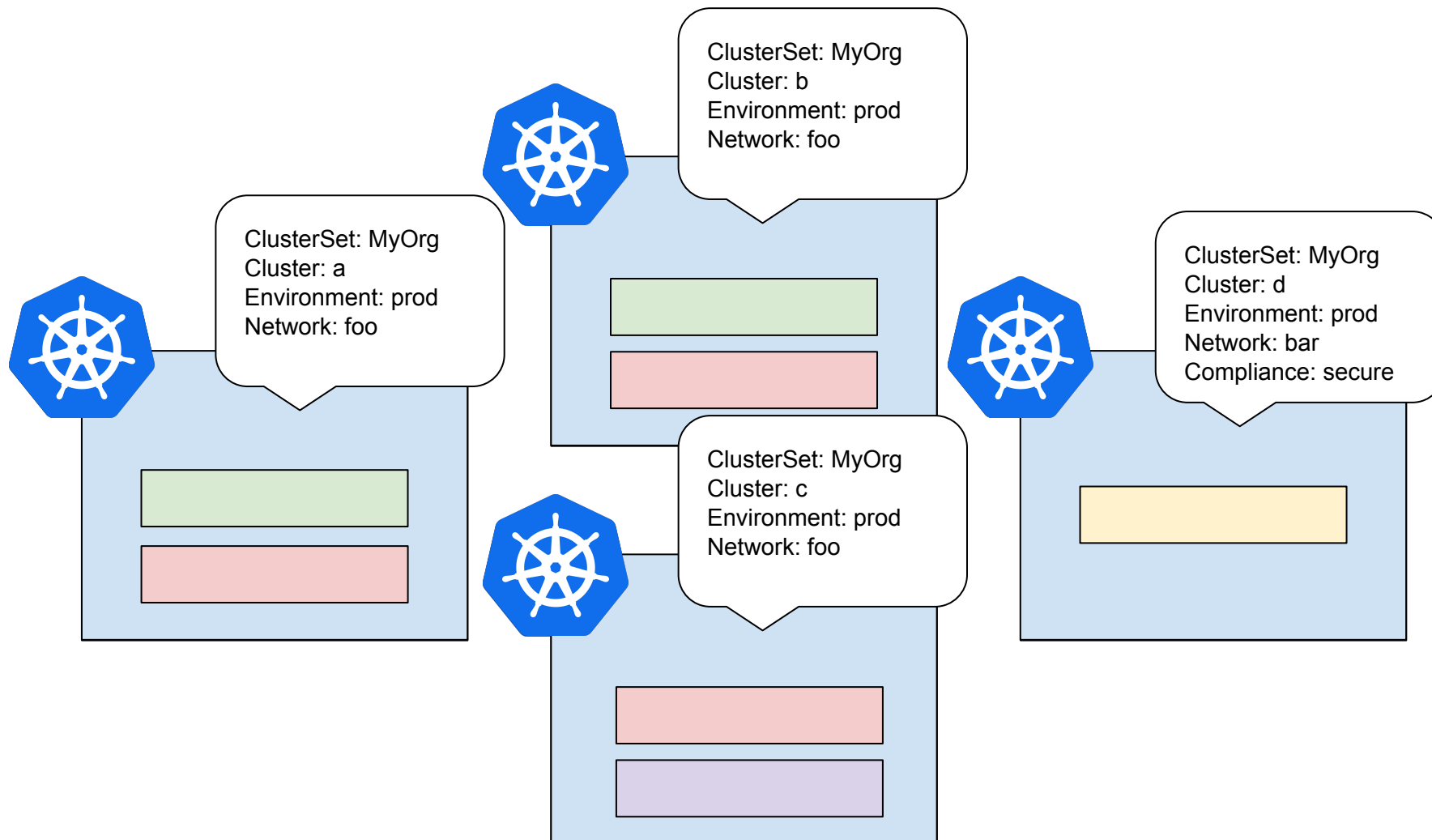


- ClusterSet represents a pattern of use from the field:
 - A group of clusters governed by a single authority
 - High degree of trust within the set
 - [Namespace Sameness](#) applies to clusters in the set
 - Permissions and characteristics are consistent across clusters for a given namespace
 - Namespaces don't have to exist in every cluster, but behave the same across those in which they do
- Now we just need to solve cluster identification
 - See next slide ...

About API



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About API: cluster metadata



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- [KEP-2149](#)
- Available at sigs.k8s.io/about-api in **Beta**
- Cluster scoped ClusterProperty CRD with a simple schema: just “name” and “value”
- A well-known place to store cluster identification or any other cluster properties that might otherwise be ad-hoc annotations on semantically adjacent objects
 - Cluster ID
 - Ownership information (organizational)
 - Position-in-world - network, environment, purpose
- A building block for higher level orchestration

```
apiVersion: about.k8s.io/v1
kind: ClusterProperty
metadata:
  name: cluster.clusterset.k8s.io
spec:
  value: cluster-1
```

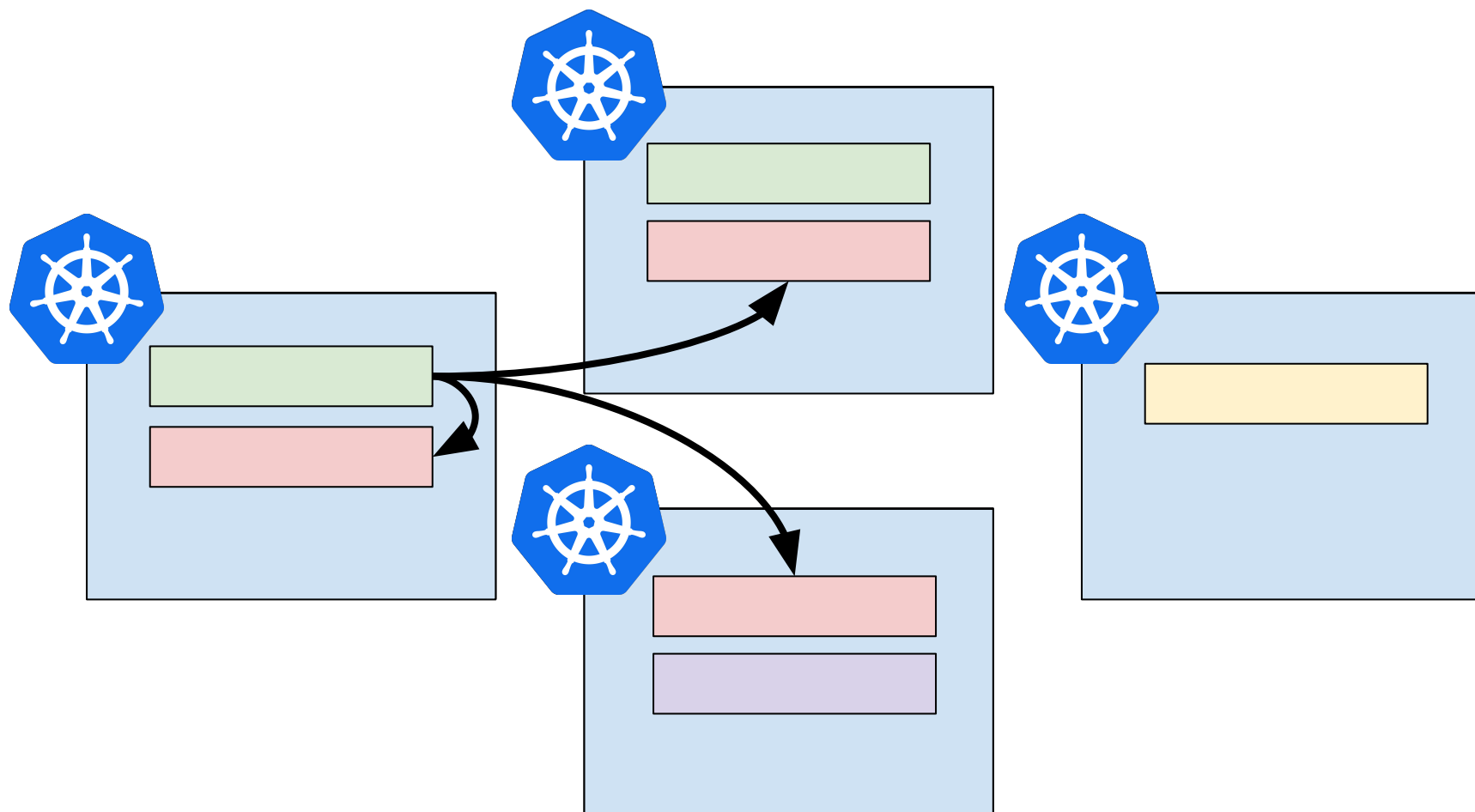
```
apiVersion: about.k8s.io/v1
kind: ClusterProperty
metadata:
  name: clusterset.k8s.io
spec:
  value: mycoolclusterset
```

```
apiVersion: about.k8s.io/v1
kind: ClusterProperty
metadata:
  name: fingerprint.mycoolimplementation.com
spec:
  value: '{"major": "1", "minor": "18", "gitVersion": "v1.18.2", "gitCommit": "52c56ce7a8272c798dbc29846288d7cd9fbae032", "gitTreeState": "clean", "buildDate": "2020-04-30T20:19:45Z", "goVersion": "go1.13.9", "compiler": "gc", "platform": "linux/amd64"}'
```

MC Services API



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MC Services API



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- [KEP-1645](#) and sigs.k8s.io/mcs-api
- Services are a multi-cluster building block
- Allows a single service to span and/or be consumed by multiple clusters
- Focused only on the API and common behavior, leaving room for various implementations
 - Submariner, GKE, Istio, AWS
- Consumers only ever rely on local data
- ClusterIP and headless services just work as expected across clusters.

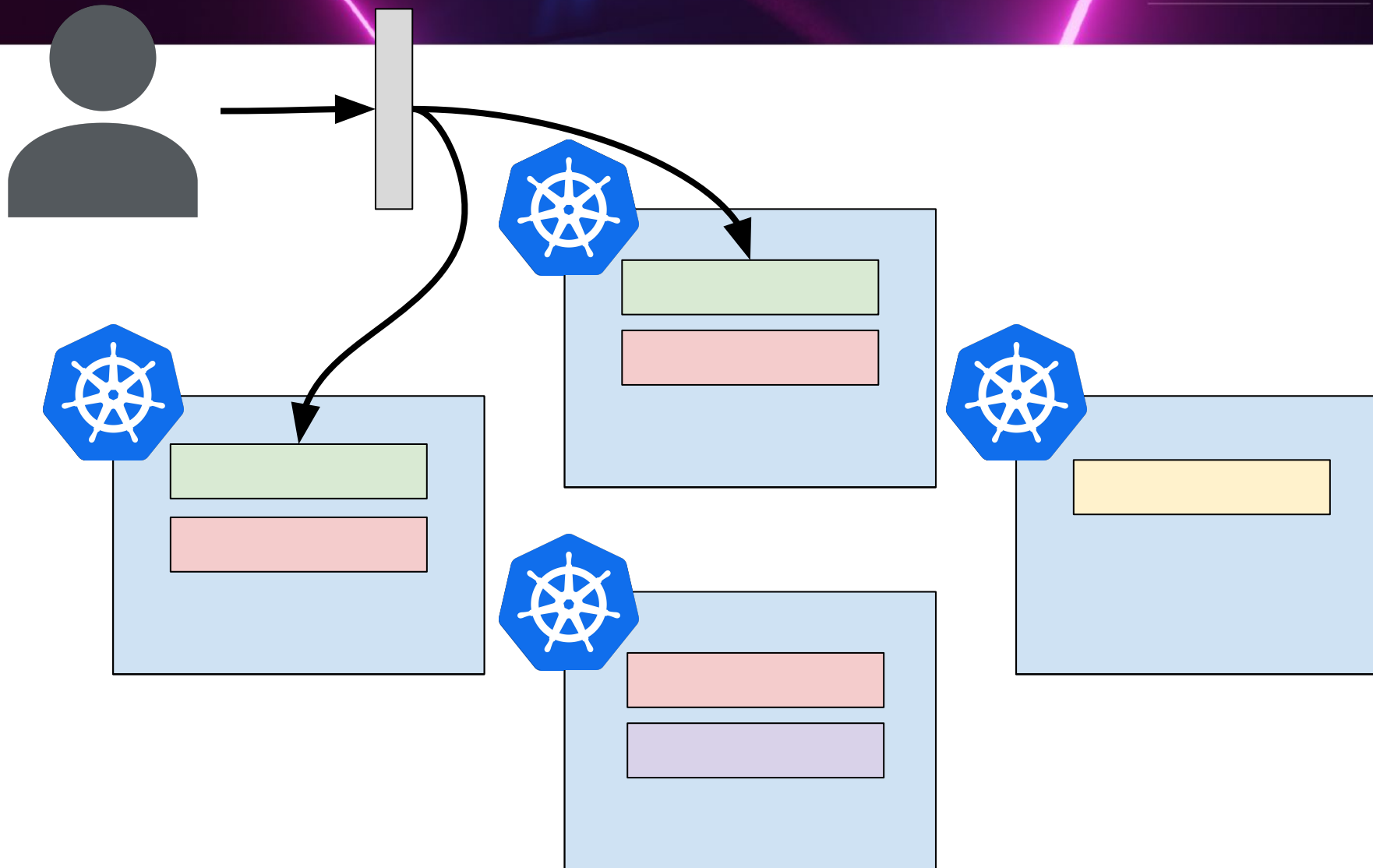
```
apiVersion: v1
kind: Service
metadata:
  name: foo
  namespace: bar
spec:
  ports:
    - port: 80
  selector:
    app: foo
---
apiVersion: multicluster.x-k8s.io/v1alpha1
kind: ServiceExport
metadata:
  name: foo
  namespace: bar
```



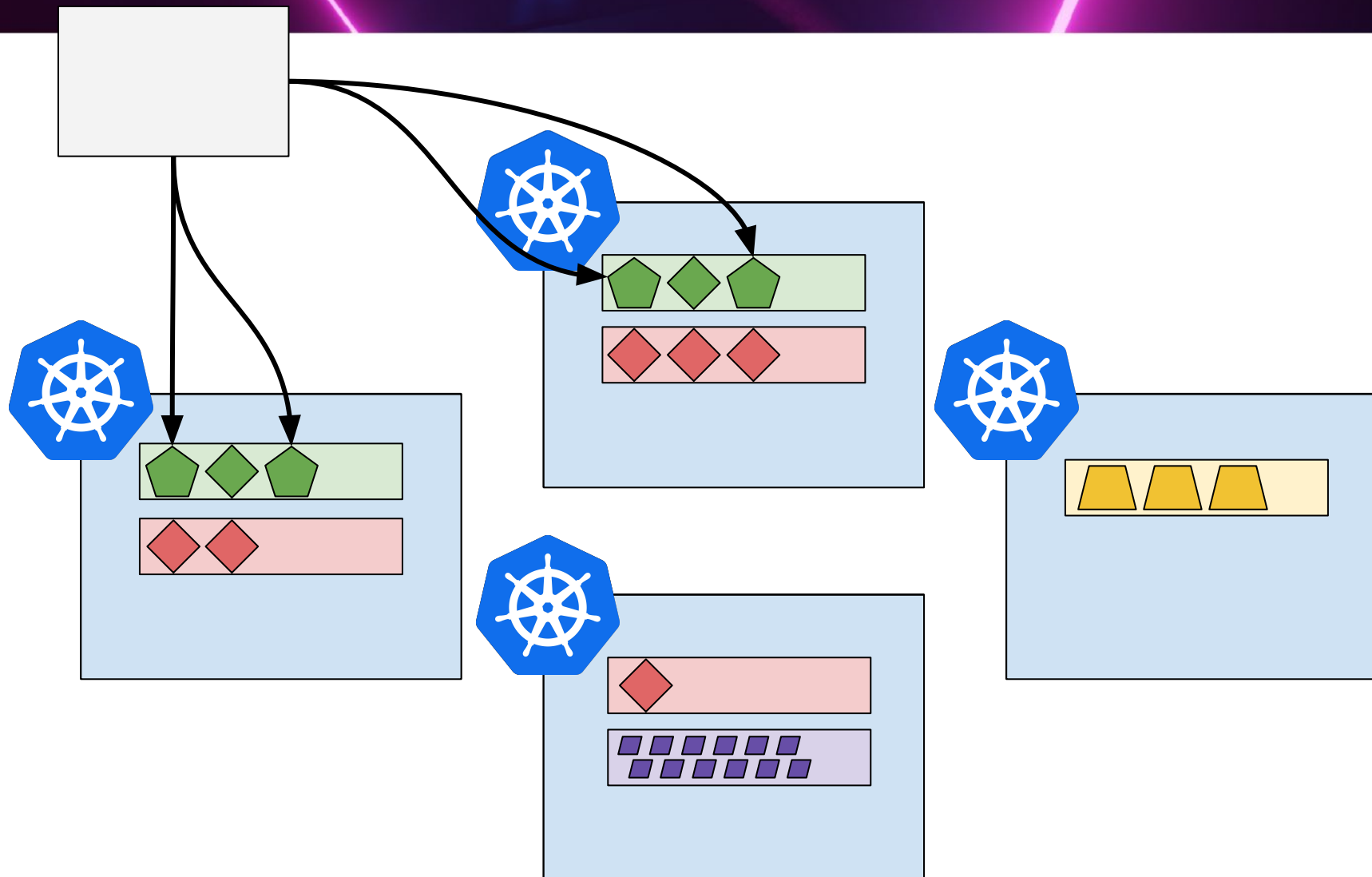
MCS + Gateway



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Orchestration



- History from different angles:
 - Cluster-registry
 - Early attempt, lack of clear use case
 - Kubefed
 - Some use, too broad, development stalled
- Clear demand exists for multi-cluster orchestration, but what comes next?
- **Cluster Inventory API** (*new*)
 - New proposal from several groups/projects
 - Opportunity to help steer — come work with us!

- [KEP-4322](https://kep-4322.sigs.k8s.io/cluster-inventory-api) and sigs.k8s.io/cluster-inventory-api
- Cluster Inventory allows multi-cluster applications to dynamically discover available clusters and respond to various cluster lifecycle events.
- A Cluster Profile is essentially an individual member of the Cluster Inventory that details the properties and status of a cluster.

```
apiVersion: multicluster.x-k8s.io/v1alpha1
kind: ClusterProfile
metadata:
  name: generated-cluster-name
  labels:
    x-k8s.io/cluster-manager: some-cluster-manager
spec:
  displayName: some-cluster
  clusterManager:
    name: some-cluster-manager
status:
  version:
    kubernetes: 1.28.0
  properties:
    - name: clusterset.k8s.io
      value: some-clusterset
    - name: location
      value: apac
  conditions:
    - type: ControlPlaneHealthy
      status: True
      lastTransitionTime: "2023-05-08T07:56:55Z"
      message: ""
    - type: Joined
      status: True
      lastTransitionTime: "2023-05-08T07:58:55Z"
      message: ""
```

- Developing a Standard Multi-Cluster Inventory API
 - Speakers:
 - Zhiying Lin(Microsoft)
 - Chen Yu(Microsoft)
 - Hongcai Ren(Huawei)
 - Di Xu(Xiaohongshu)
 - JianQiu(Red Hat)
- Time: Friday August 23, 2024 14:10~14:45 HKT
- Location: Level 1, Hung Hom Room 1

What's Next?



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- Canonical patterns?
 - We've got tools, how do you use them?
 - Are there patterns or workflows we should recommend?
- Leader election across clusters
 - Global controller management needs coordination
- What else do we need to start operating above the cluster?



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Get Involved

Be part of the SIG



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- What are you working on?
 - Tools you're building, tools you're missing
- What problems do you or your customers have?
- Do you have unique needs that have been overlooked?
- Do you need help, or want to help?

How you can help the SIG



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- Add information to the web site
- Contribute to the test suite

Be part of the SIG



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Share your use cases, problems, and ideas

- Home page: <https://multicluster.sigs.k8s.io>
- Slack channel:
<https://kubernetes.slack.com/messages/sig-multicluster>
- List:
<https://groups.google.com/forum/#!forum/kubernetes-sig-multicluster>
- Meetings are biweekly Tuesdays, 12:30 eastern, 9:30 pacific, 16:30 UTC



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Thanks!