Kubernetes Basics with IBM Cloud Private

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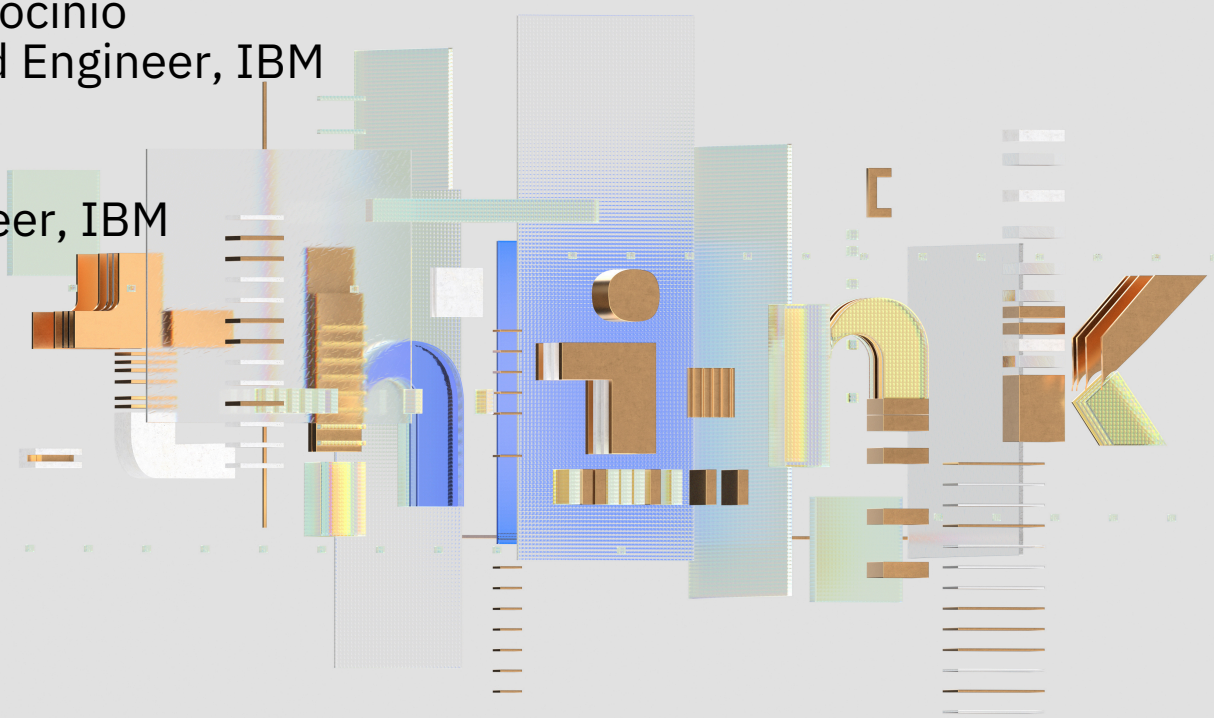

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- Kubernetes
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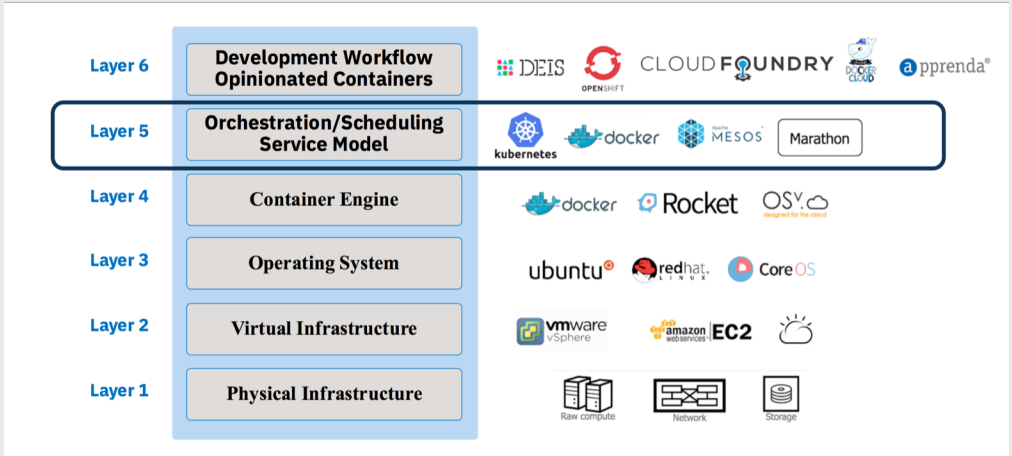
Containers Orchestration

- Automated deployment, scaling, and management of containerized applications
- Few to thousands of containers
- Kubernetes has emerged as the platform for containers orchestration
- IBM Cloud
  - IBM Cloud Private (ICP)
  - IBM Cloud Kubernetes Service (IKS)
  - Multi Cloud Manager
    - Single dashboard that lets enterprise oversee multiple Kubernetes clusters wherever they are—public cloud or private

Picture courtesy:
https://containerjournal.com/2017/05/25/forrester-rise-containers-forcing-automation/

What is Kubernetes?

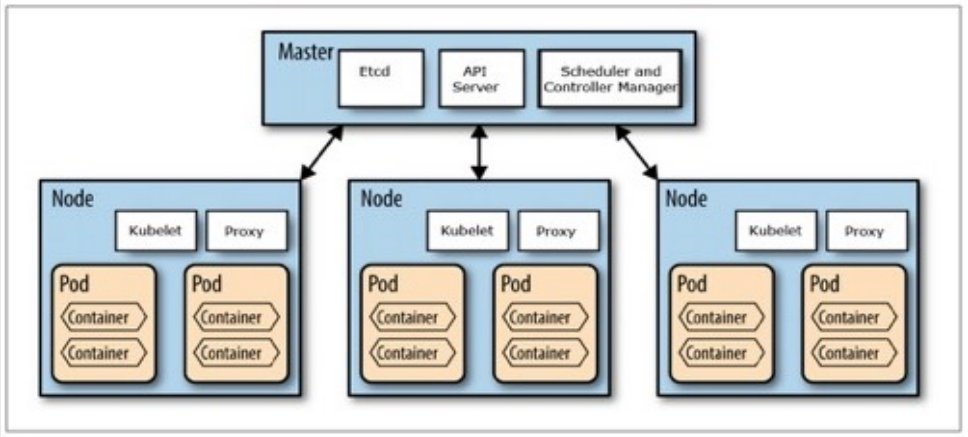
- Enterprise Level Container Orchestration
  - Provision, manage, scale applications (containers) across a cluster
  - Manage infrastructure resources needed by applications
    - Volumes, Networks, Secrets and many more
- Declarative model
  - User provide the "desired state" and Kubernetes will make it happen
- What's in a name?
  - Kubernetes (K8s/Kube): "Helmsman" in ancient Greek



- ✓ High Availability
  - ➢ Multiple replicas of app
- ✓ Portability
  - ➢ Runs across platforms
- ✓ Scalability
  - ➢ Policy (CPU/memory utilization) based scaling
- ✓ Security
  - ➢ TLS enabled endpoints, Secrets

Kubernetes Architecture

- Simple client-server model
- User request a specific state using client like *kubectl* or REST APIs
    - e.g. Deploy some app
- User request is watched and delegated to Controllers to take action
- Controllers take action to achieve the desired state



Kubernetes Resource Model

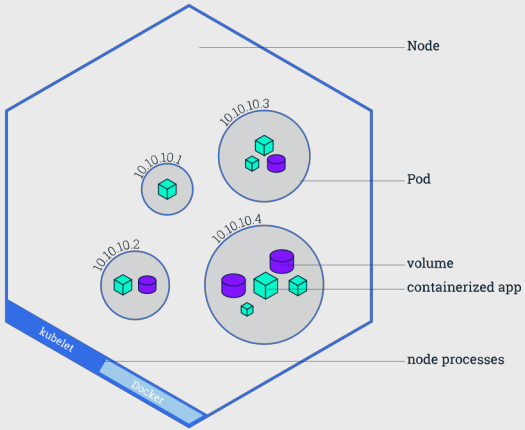
- Config Maps
- Daemon Sets
- **Deployments**
- Events
- Endpoints
- Ingress
- Jobs
- Nodes
- **Namespaces**
- **Pods**
- Persistent Volumes
- **Replica Sets**
- Secrets
- Service Accounts
- **Services**
- Stateful Sets, and more...

- Kubernetes does not have the concept of an application model, rather it defines a resource for every purpose
- User application is defined in Kubernetes by collection of these resources
- Each resource is monitored and processed by a controller

Pod

- Group of one or more containers, with shared storage/network, and a specification for how to run the containers
  - Smallest deployable unit in K8s
  - Not a durable entity, can die any time
  - User should not create Pod directly but with using resource like Deployment

- Pod always runs on a Node
  - A node is a worker machine in Kubernetes and may be a VM or physical machine

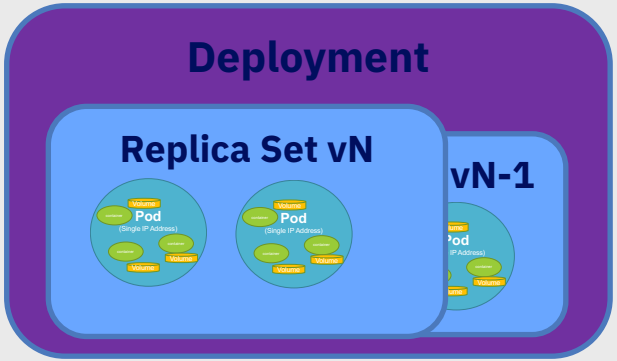



```
apiVersion: v1
kind: Pod
metadata:
  name: guestbook-pod
  labels:
    app: guestbook
spec:
 containers:
   - name: guestbook
     image: ibmcom/guestbook:v1
     ports:
       - containerPort: 3000
```

- Labels are key-value pairs that are attached to each object in Kubernetes
  - *kubectl get pods -l app=guestbook*

Deployment

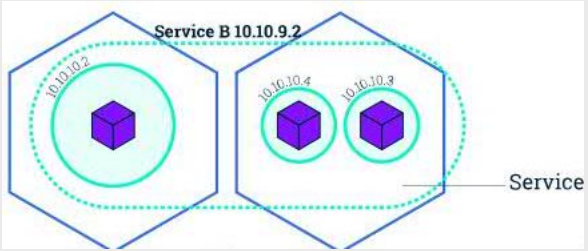
- A Deployment is responsible for creating and updating instances of your application
  - Manages Replica Sets
  - Manages Pods
- Deployment Controller continuously monitors those instances
  - Will create or delete Pods as needed to meet the replica count
- Deployments are also used to manage safely rolling out changes to your running Pods




```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: guestbook-deployment
  labels:
    app: guestbook
spec:
  replicas: 2
  selector:
    matchLabels:
      app: guestbook
  template:
    metadata:
      labels:
        app: guestbook
        version: v1
    spec:
      containers:
      - name: guestbook
        image: ibmcom/guestbook:v1
        ports:
        - containerPort: 3000
```

Service

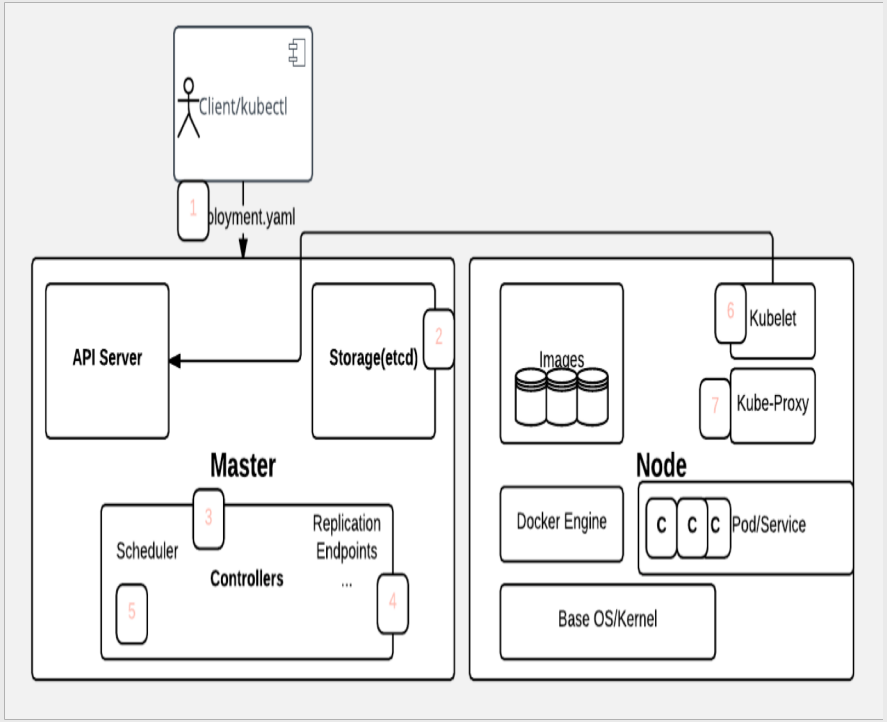
- Pod has unique IP but it’s not exposed outside the cluster, so how to allow your applications running in a Kubernetes cluster to receive traffic?
- A Service is an abstraction which defines a logical set of Pods running in your cluster, that all provide the same functionality
- Service is assigned with a unique IP address, which is tied to the lifespan of the Service
- Expose a Service onto an external IP address using NodePort, Load Balancer, Ingress Controller or Istio.




```
apiVersion: v1
kind: Service
metadata:
  name: guestbook
  labels:
    app: guestbook
spec:
  ports:
  - port: 3000
    targetPort: http-server
  selector:
    app: guestbook
  type: NodePort
```

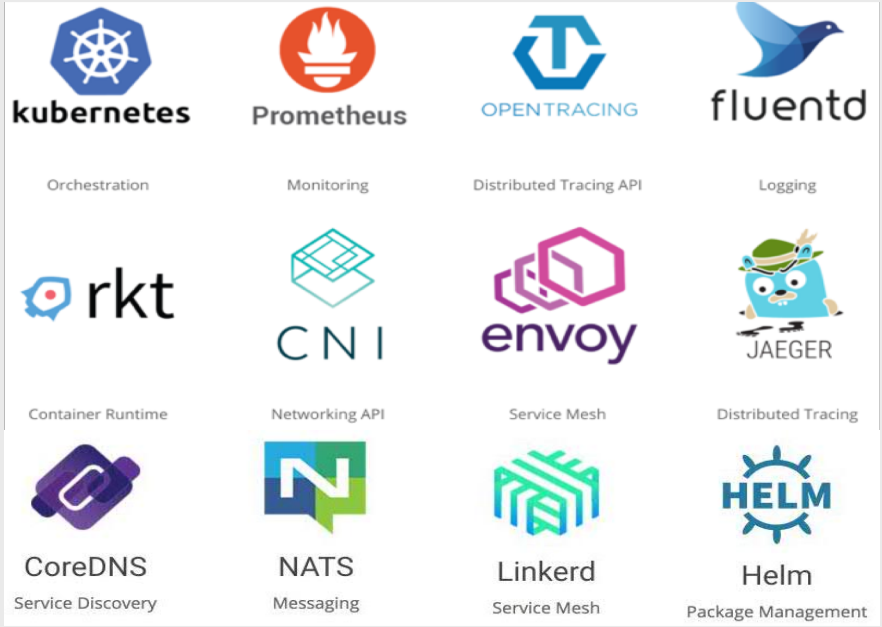
Kubernetes Application Deployment Workflow

- **Kubectl** - user deploys a new application via Kubectl. It sends the request to the API Server.
- **API server** - receives the request and stores it in the data store (etcd). User request is watched and delegated to Controllers to take action.
- **Controllers** - detects the new request and match the desired state.
  - e.g. Scheduler assigns new pod to a Node
- **Kubelet** - takes a set of PodSpecs and
- ensures that the containers described in those PodSpecs are running and healthy.
- **Kubeproxy** - manages network traffic for the pods – including service discovery and load-balancing.



Kubernetes Community Overview

- Kubernetes is a CNCF project
- What is CNCF?
  - **C**loud **N**ative **C**omputing **F**oundation
- Various Repositories
  - main - github.com/kubernetes/Kubernetes
  - doc - github.com/kubernetes/website
  - community - github.com/kubernetes/community
- Issues https://github.com/kubernetes/kubernetes/issues
- Pull Requests https://github.com/kubernetes/kubernetes/pulls



Where is the Kubernetes Community?

- Special Interest Groups (SIGs)
  - Domain specific group
    - Examples: ContribEx SIG, Networking SIG, Testing SIG, Doc SIG, **SIG IBM Cloud** etc.
    - https://github.com/kubernetes/community/blob/master/sig-list.md
  - Meet every week or bi-weekly
    - Typically zoom video call
    - Similar to OpenStack IRC project meetings
- Slack channels
  - https://kubernetes.slack.com
  - Several channels for users, developers, SIGs
- Weekly Community Meeting
- Conferences (CloudNativeCon + KubeCon) / Meetups
- Mailing list / google groups:
  - Devs: kubernetes-dev@googlegroups.com
  - Users: kubernetes-users@googlegroups.com

Helm

- How to deploy your app without managing the individual manifest files/resources?
- How to update it without having to update manifest files and redeploy?
- How to share deployment artifacts with others?
- Helm can answer these questions
  - Helm is a package manager that streamlines installation and management of Kubernetes applications.
  - Think of it like apt/yum/homebrew for Kubernetes.
  - It is a CNCF project and its development is backed by a strong open community.

Create and Manage Kubernetes Resources with *kubectl*

Inline

- *kubectl run guestbook --image=ibmcom/guestbook:v1*
- kubectl expose deployment guestbook --type="NodePort" --port=3000

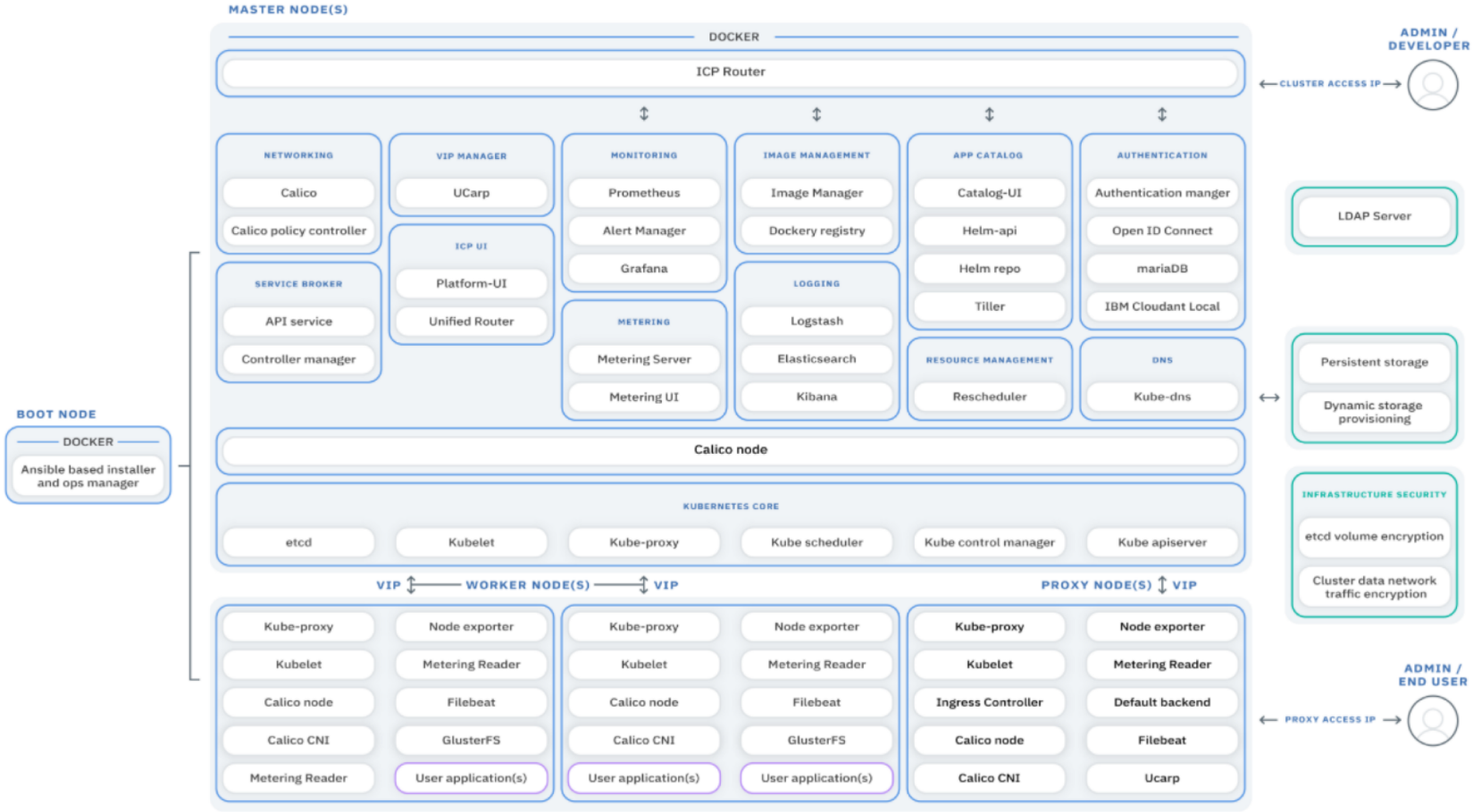
➢ Simple and quick but doesn’t give much control
➢ OK for playing but not for production
  - Commands do not provide a source of records except for what is live.
  - Commands do not provide a template for creating new objects
  - etc.

Using YAML manifest

- *kubectl create -f guestbook-deployment.yaml*
- *kubectl create -f guestbook-service.yaml*

➢ Requires basic understanding of the object schema and the additional step of writing a YAML file but,
  - Allows you to have more fine-grained control over all of resources being created within the Kubernetes cluster
  - Reusable and easy to share
➢ **This is what we will use for labs** except Lab1 where we will create namespace to show inline command usage.

IBM Cloud Private (ICP)



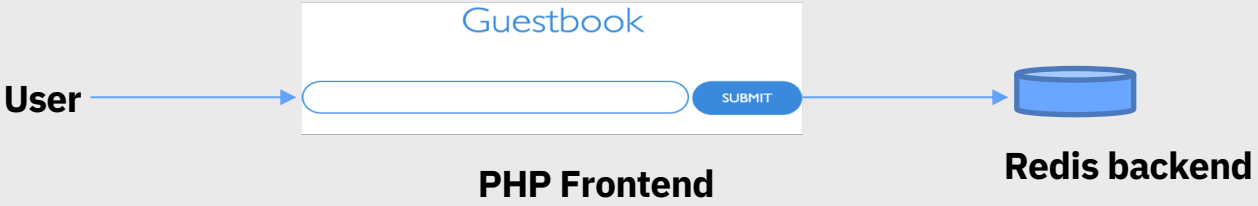
Lab Structure

- Namespace and Context
- Create Deployment
- Scale the Deployment
- Create Service
- Expose Service externally
- Run Troubleshooting Commands
- Deploy App using Helm
- Create Environmental Variable to use in the container
- Create ConfigMap
- Create Secret

Follow the instructions provided here:
http://ibm.biz/icpkube

We will use guestbook app

- Sample multi-tier web application which stores guest entries
- Make sure you look into the lab files and understand what's going on



Lab

http://ibm.biz/icpkube

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How a 225-Year-Old Bank is Transforming with Enterprise Design Thinking

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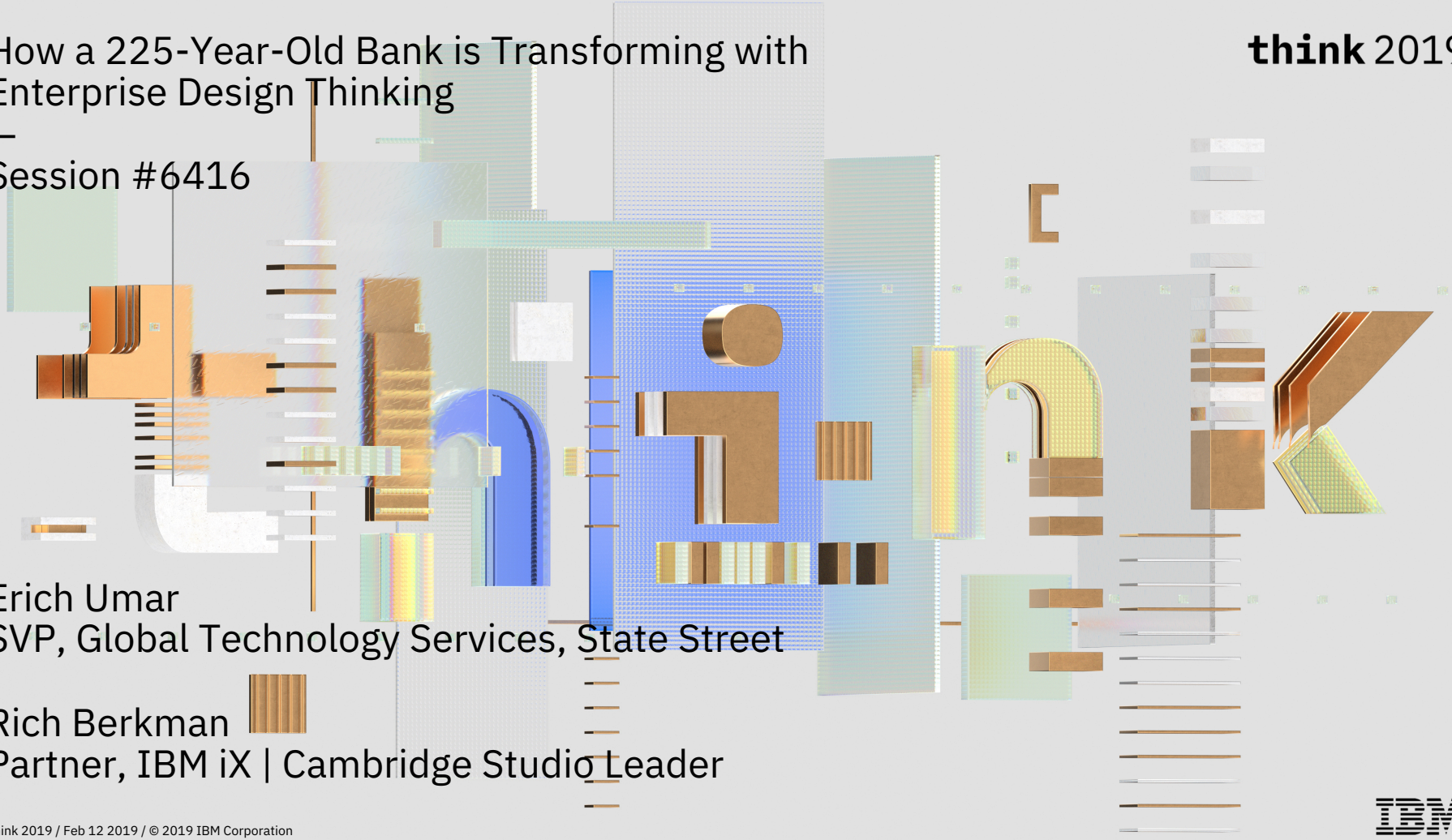

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Thank you

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