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Kubernetes in Highly Restrictive Environments

Oleg Chunikhin | CTO, Kublr

Introductions

Oleg Chunikhin
CTO, Kublr

- ✓ 20 years in software architecture & development
- ✓ Working w/ Kubernetes since its release in 2015
- ✓ Software architect behind Kublr—an enterprise ready container management platform
- ✓ Twitter @olgch; @kublr

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What's Kublr?

OPERATIONS

Automation | Infrastructure

Logging | Monitoring

Observability | Custom Clusters

API | Usage Reporting

Ingress | Storage | Networking | Container Registry | CI / CD | App Mgmt

Container Runtime

Kubernetes

Infrastructure

SECURITY & GOVERNANCE

RBAC | IAM

Air Gap | TLS

Certificate Rotation | Audit

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Creating a Production-Grade Kubernetes Cluster

1. Install with kubeadm/other tools[1,2]
2. ...installer works its magic...
3. Done?

kubernetes

[1] https://kubernetes.io/docs/setup/independent/install-kubeadm/
[2] https://kubernetes.io/docs/setup/

Creating a Production-Grade Kubernetes Cluster

Unfortunately, it’s not that easy!

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What We'll Discuss Today

1. Cloud native, Kubernetes, and Enterprise
2. Enterprise Restrictions and Requirements
3. Kubernetes enterprise deployment patterns
4. Kubernetes solution categories and their limitations
5. On-premises struggles

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Cloud Native and Enterprise

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Cloud Native

- ✓Cloud Native Precursors
  - ✓SRE, DevOps, 12factor app
  - ✓API (management), Microservices
  - ✓Containers, Cloud, Virtualization
- ✓Empower IT teams to respond to business requirements quickly, reliably, and predictably
- ✓Larger Enterprises can benefit most, but adoption is lagging behind

Cloud Native Attributes

- ✓Lightweight containers
- ✓Language agnostic
- ✓Microservices
- ✓API
- ✓Stateless/stateful separation
- ✓Self-service infrastructure
- ✓Isolated from OS/server deps
- ✓Agile DevOps processes
- ✓Highly automated
- ✓Declarative resource mgmt

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Enterprise Requirements

- ✓Multiple/complex environments (On-prem, Clouds, Hybrid)
- ✓Centralized management and governance
  - Provisioning, Monitoring, Log Collection, IdM/AAA, Cost
- ✓Integration with existing tools
- ✓Security (Infrastructure, OS, IdM/AAA)
- ✓Software management (Patches, Packages, Images)

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Enterprise Constraints

- ✓Separation of Responsibilities
  - Infrastructure, Operations, Security, Legal
- ✓Network Access (white/black-listing, air gap)
- ✓Security Tools and Processes (infra, OS, platform, apps)
- ✓OS, Platform, and Software Practices and Standards
  - Vendor and version certification; configuration practices; custom package repositories; etc

Cloud Native Enterprise Requirements and Patterns

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Cross-Team Responsibilities

- ✓Large organizations often separate teams by:
  - Compute
  - Network
  - Traffic ingestion
  - Storage
  - Security
- ✓“Cloud native” paradigm shift is necessary

Centralized Management

- ✓Unification, standardization, governance
  - ✓Centralized vs distributed management
- ✓Management API
- ✓RBAC and IdM/AAA; integration

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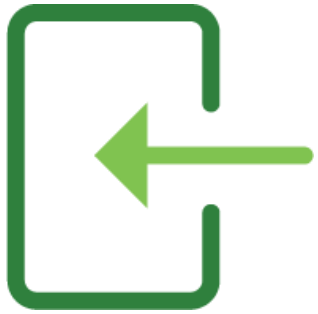
Logging and Monitoring



- ✓Centralized collection and analysis
- ✓Integration with existing solutions
- ✓RBAC for logs and metrics across teams
  - per project
  - per team
  - per environment

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Security

- ✓Identity Broker
- ✓Fine-grained role-based access control (RBAC)
- ✓IdM/AAA
- ✓Secret management and support for external secret storage
- ✓Cluster secrets storage/rotation
- ✓Internal CA
- ✓Support for external CA
- ✓Infrastructure mgmt integration

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K8S Security Tools and Best Practices

- ✓Utilize RBAC
- ✓SELinux/seccomp
- ✓PodSecurityPolicies
- ✓NetworkPolicy
- ✓Authentication and Authorization Integration
  - ✓OIDC, Web Hooks, Authenticating Proxy
- ✓Admission Web Hooks

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Audit

- ✓Kubernetes API server audit
- ✓Audit support for the logging and monitoring dashboards
- ✓Audit support in the cluster provisioning tool (cluster install, update, upgrade, delete)

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Complex Environment
Heterogeneous/Hybrid/On prem

- ✓Infrastructure management differences
- ✓Infrastructure automation
- ✓Network connectivity and protection

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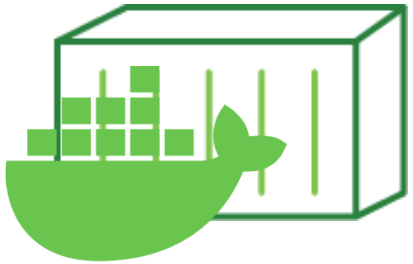
Complex Environment
Isolated/Air Gap



- ✓Where to get the required OS packages?
- ✓How to provide the required container images?
- ✓Binary repository (for helm and agents)?

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Requirements | Support Existing Tooling

- ✓Integration with existing processes and tools for deployment, logging and monitoring, security, software management etc

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Requirements | Cloud Native Platform

- ✓Kubernetes
- ✓Cloud native storage
- ✓Cloud native DB
- ✓Network policy
- ✓Image management
- ✓Backup and DR
- ✓Integrated CI/CD

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On Premises Struggles

- ✓Pure bare metal limitations
- ✓vSphere API interactions
- ✓Realizing HA for Kubernetes
- ✓Disaster recovery
- ✓OS upgrades
- ✓Security updates
- ✓Kubernetes upgrades
- ✓Air-gap/offline mode

What are Your Options?

- ✓Cloud provider managed Kubernetes
- ✓Home grown solution
- ✓3rd party vendors

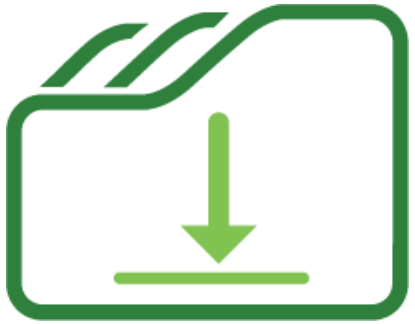
Cloud Provider Managed Solution

- ✓Quick, easy, integrated, managed

but

- ✓May not meet your requirements and/or regulations
- ✓Access to masters and Kubernetes components in general
- ✓No or limited K8S configuration customizations
- ✓Support for on-prem / hybrid installations

Home Grown Solution



- ✓Will cover your needs

but

- ✓Requires extra time and efforts that could be spent on innovation
- ✓With 4 major releases per year, it may be hard to keep up with upstream Kubernetes

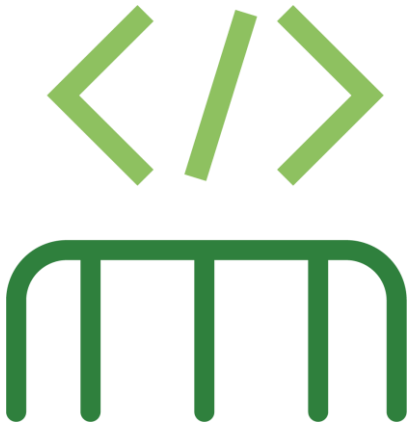
Vendor Solution

- ✓Will cover your needs

but

- ✓Careful requirement definition and feature analysis is necessary; choose wisely!
- ✓Custom development and integration may still be required

What's Next?



- ✓Infrastructure as a code
- ✓Immutable Infrastructure
- ✓CI/CD for infrastructure
- ✓GitOps

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Q&A

Take Kublr for a test drive!
kublr.com/deploy

Free non-production license

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