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Secure and Efficient Container Image Management for Kubernetes via Harbor

在Kubernetes上采用Harbor高效安全管理镜像

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杜　宁， Caicloud解决方案与交付副总裁

主办： CLOUD NATIVE COMPUTING FOUNDATION caicloud

自我介绍

- VMware中国研发先进技术中心首席架构师、技术总监
- Harbor开源企业级容器Registry项目创始人
- Cloud Foundry中国社区最早技术布道师之一
- 多年全栈工程师
- 《区块链技术指南》、《软件定义存储》作者之一

公众号：亨利笔记

《区块链技术指南》

《软件定义存储》

Agenda

1 Container Image Basics

2 Project Harbor Introduction

3 Consistency of Images

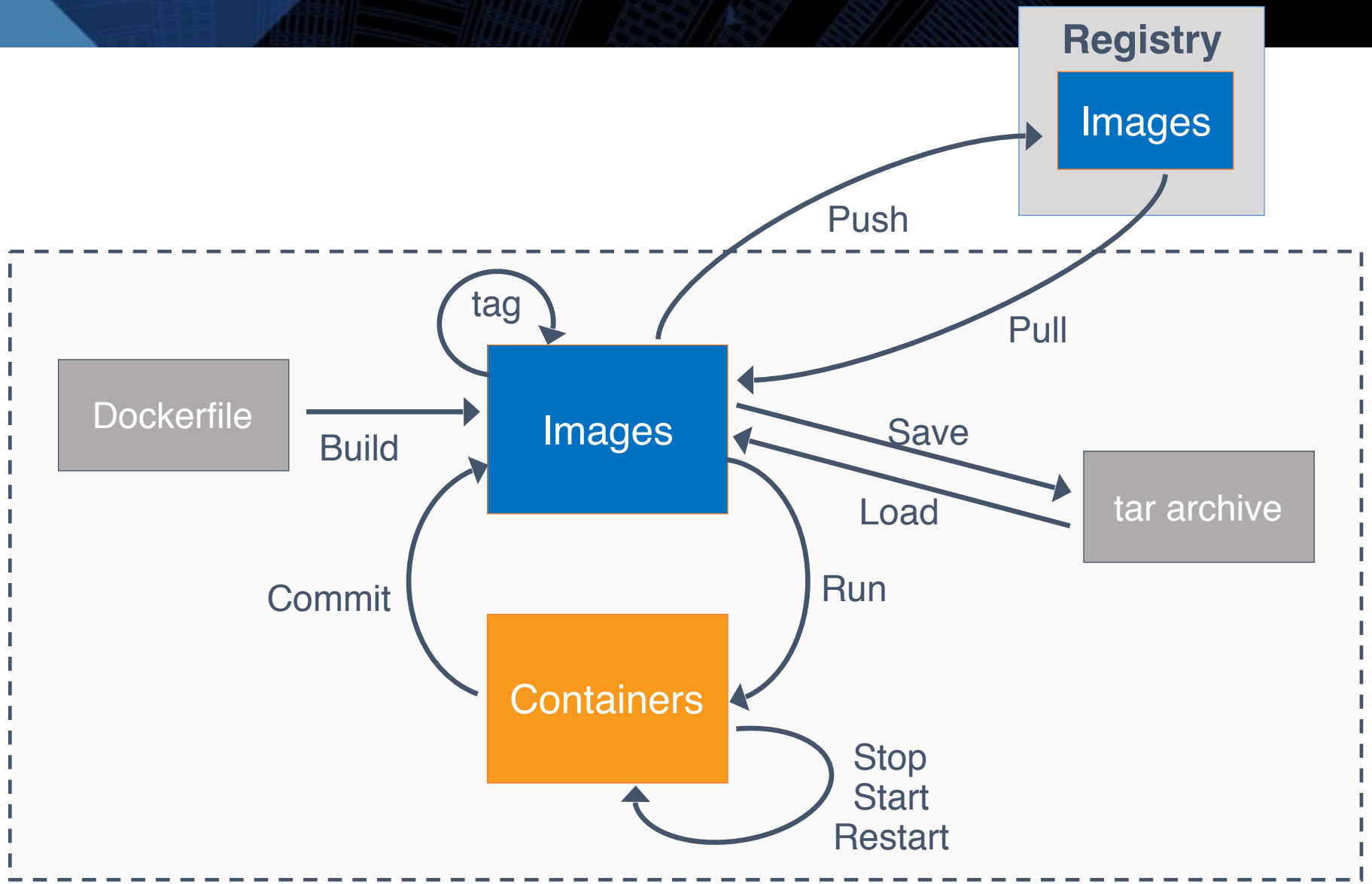
4 Security

5 Image Distribution

6 Integration with Kubernetes

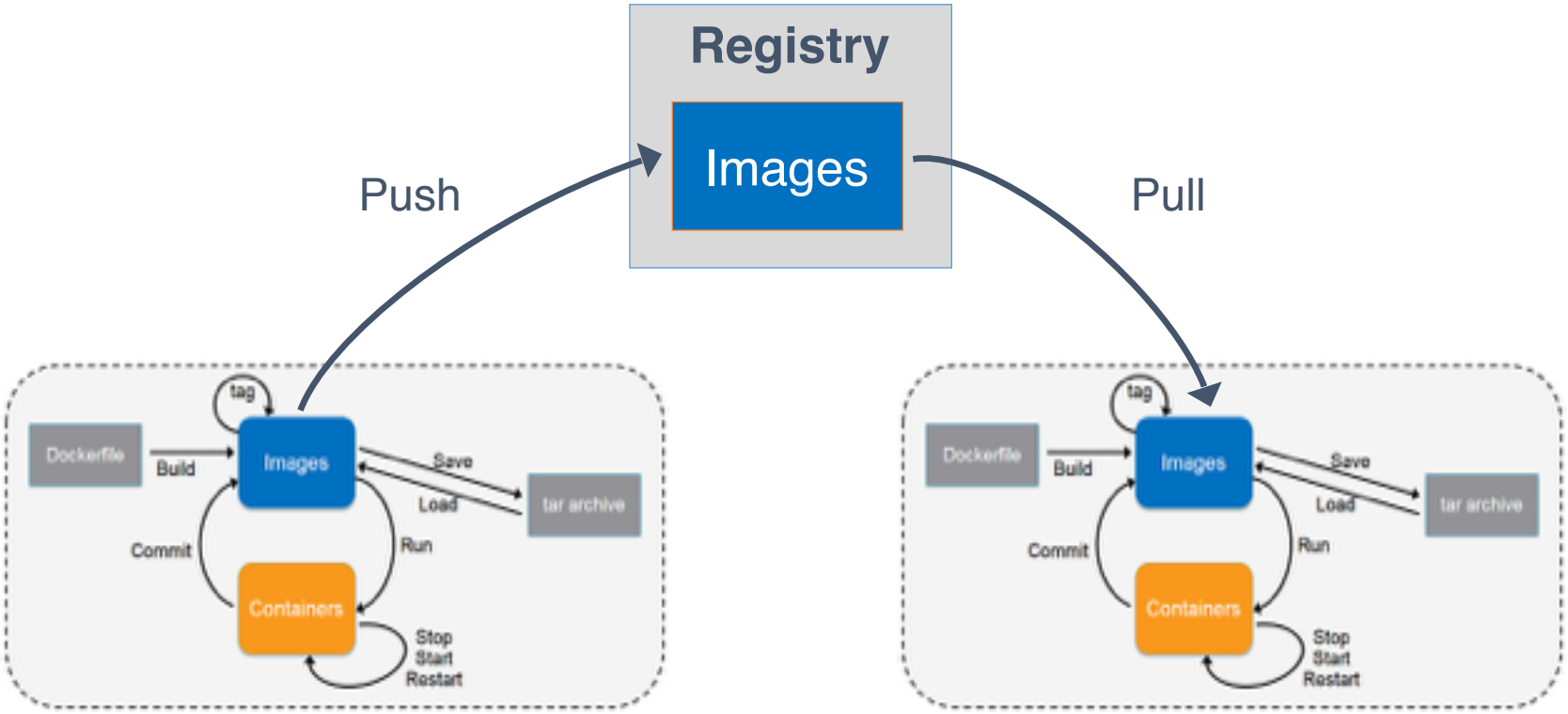
Agenda

Lifecycle of Containers and Images



Registry - Key Component to Manage Images

- Repository for storing images
- Intermediary for shipping and distributing images
- Ideal for access control and other image management



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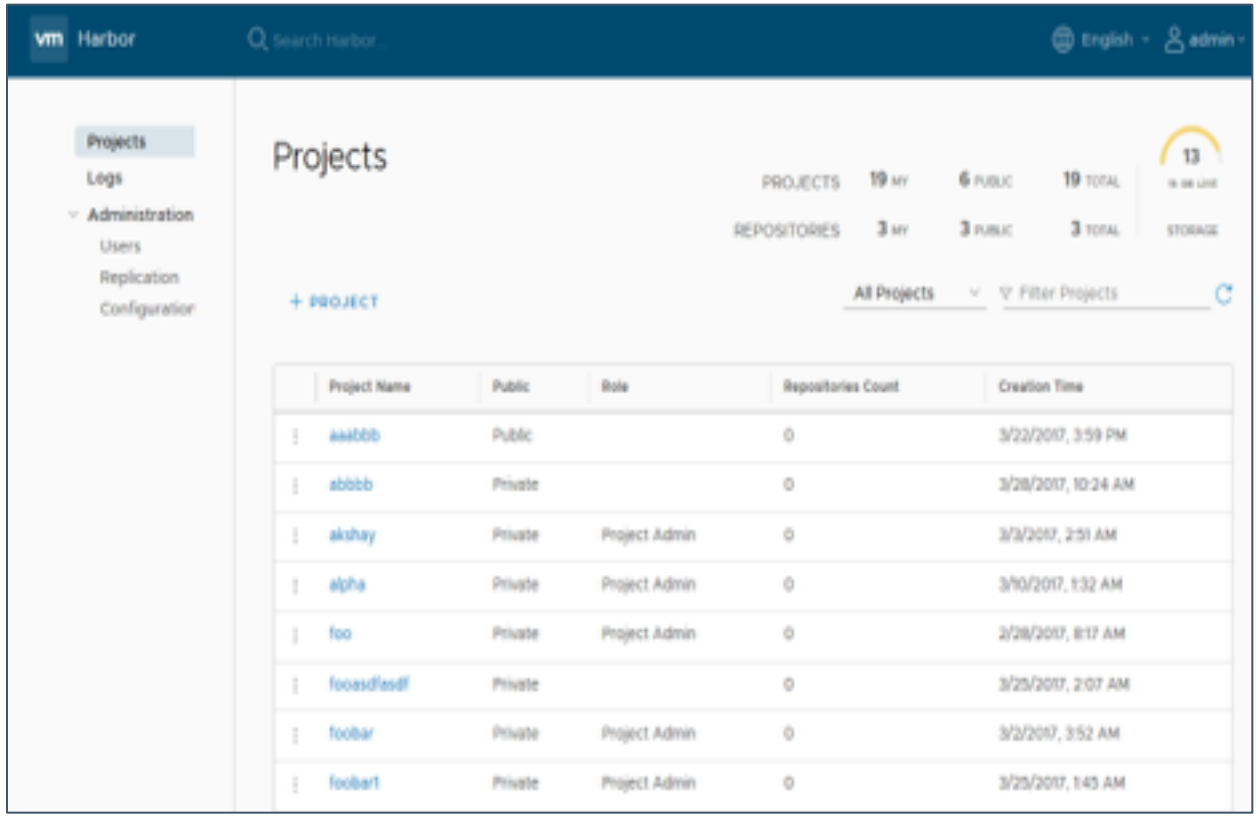
Project Harbor

HARBOR™

- An open source enterprise-class registry server.
- Initiated by VMware China, adopted by users worldwide.
- Apache 2 license.
- https://github.com/vmware/harbor/

Key Features

- User management & access control
  - RBAC: admin, developer, guest
  - AD/LDAP integration
- Policy based image replication
- Vulnerability Scanning
- Notary
- Integrated with Kubernetes
- Web UI
- Audit and logs
- Restful API for integration
- Lightweight and easy deployment



HARBOR™

Harbor Momentum

20K+	2800+	1000+
Downloads	**Stars**	**Users**
800+	58	6
Forks	**Contributors**	**Partners**

Harbor Users and Partners

caicloud 才云

RANCHER

数人云 shurenyun.com

品高云 BingoCloud

时速云 tenxcloud.com

安吉星 OnStar

TREND MICRO

AXA 安盛天平

TalkingData

通联数据 DATAYES

iFRE

亿阳信通 BOCO Inter-Telecom

Wise2c TECHNOLOGY

慧博云通 HYDSOFT

SLAMTEC

Open EDUTAINMENT 奥鹏教育

BOER 博耳智能 BOER SMART

云星数据

BEYONDSOFT beyond your expectations

主办： CLOUD NATIVE COMPUTING FOUNDATION caicloud 才云

Harbor Architecture

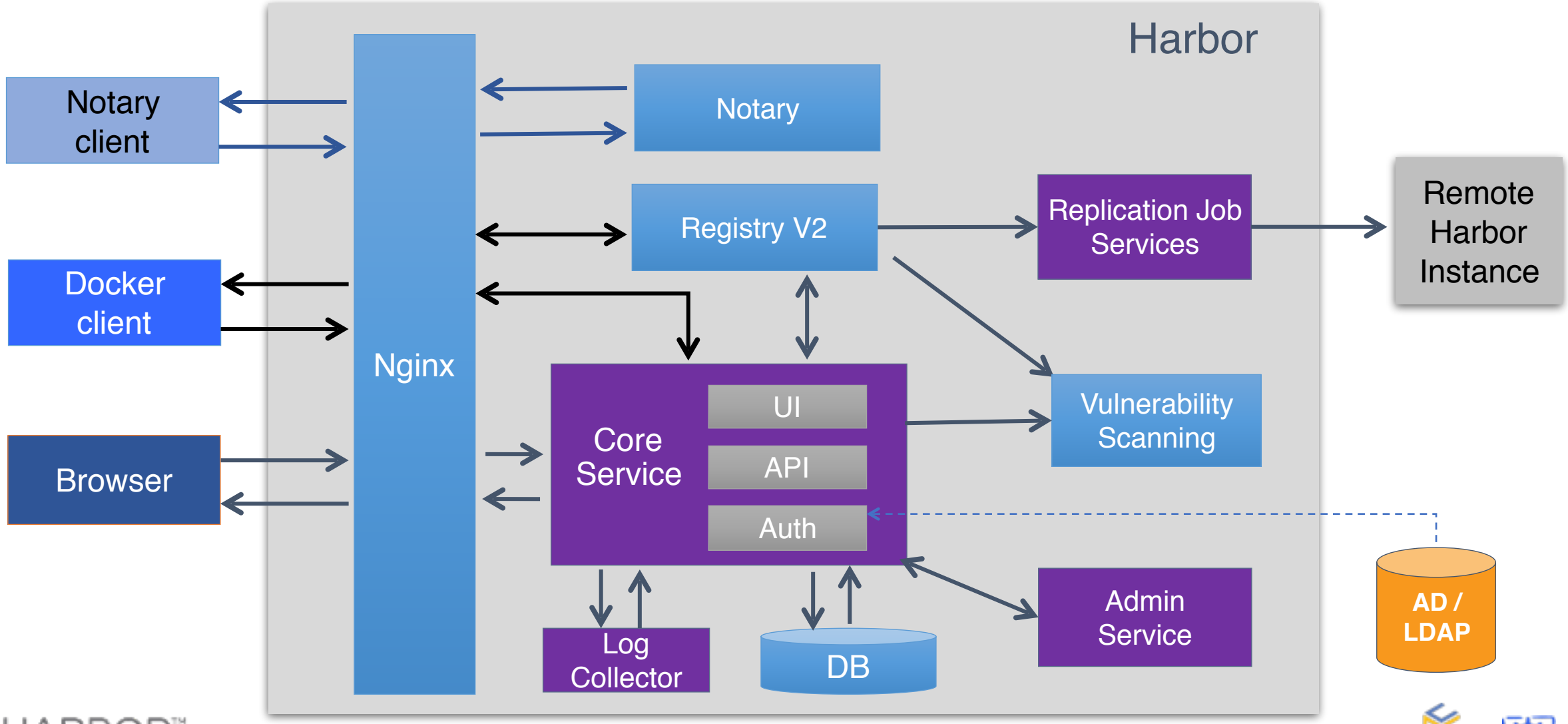
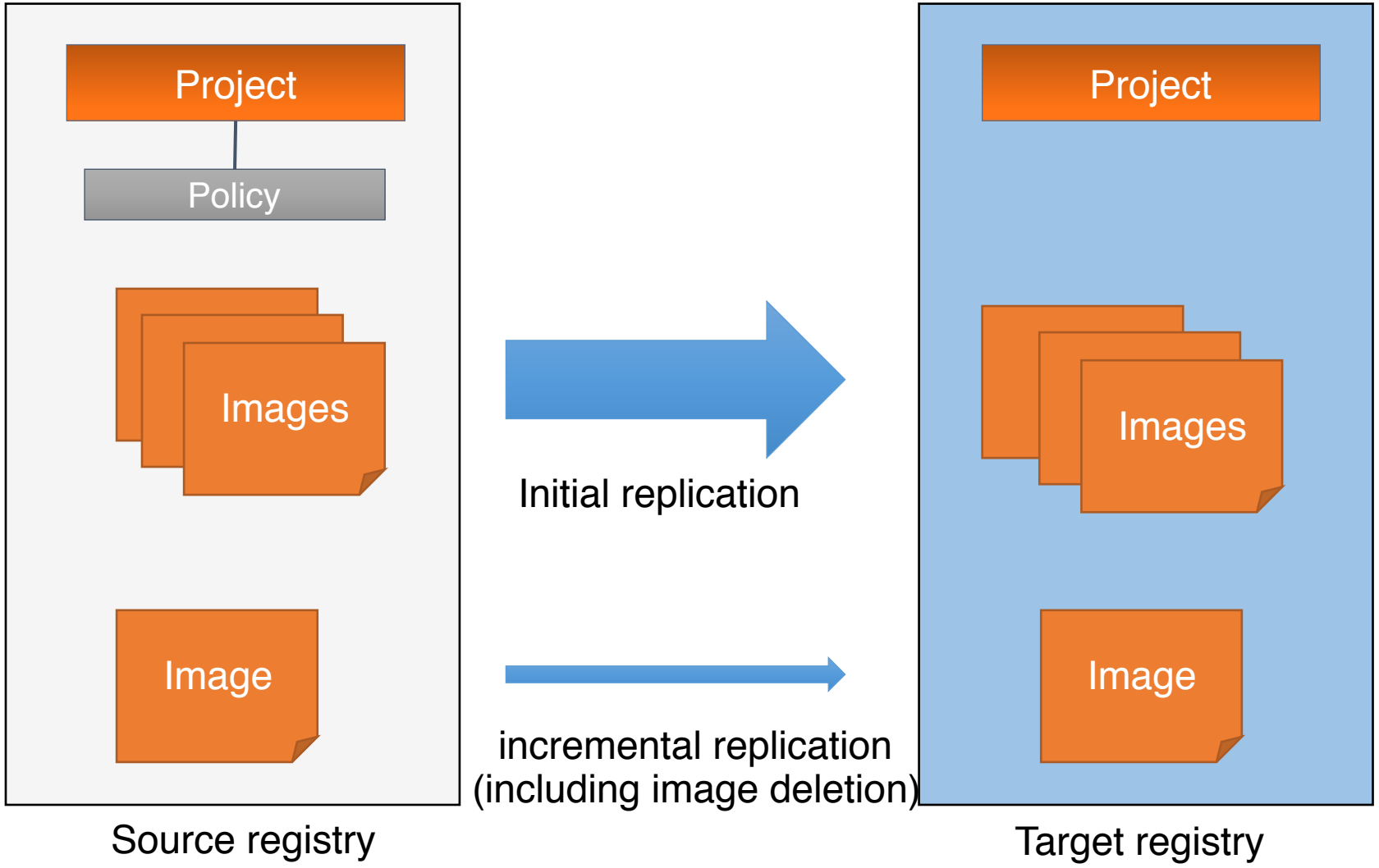


Image Replication (Synchronization)



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Consistency of Container Images

- Container images are used throughout the life cycle of software development
  - Dev
  - Test
  - Staging
  - Production
- Consistency must be maintained
  - Version control
  - Issue tracking
  - Troubleshooting
  - Auditing

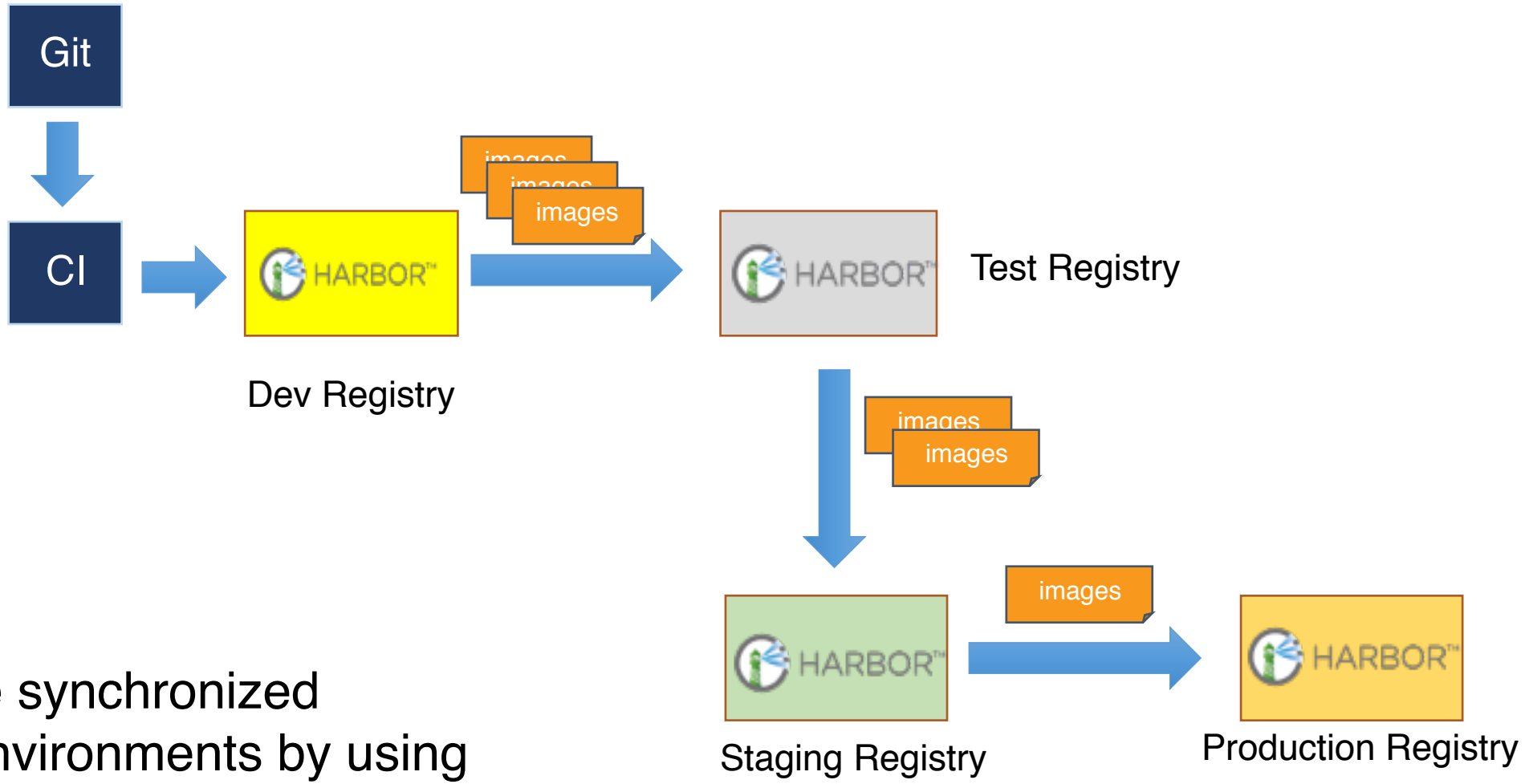
Same Dockerfile Always Builds Same Image?

Example:

```
FROM ubuntu
RUN apt-get install -y python
ADD app.jar /myapp/app.jar
```

- Base image `ubuntu:latest` could be changed between builds
- `ubuntu:16.04` could also be changed due to patching
- `apt-get` (`curl`, `wget`..) cannot guarantee always to install the same packages
- ADD depends on the build time environment to add files

Shipping Images in Binary Format for Consistency



Images are synchronized between environments by using Harbor registry.

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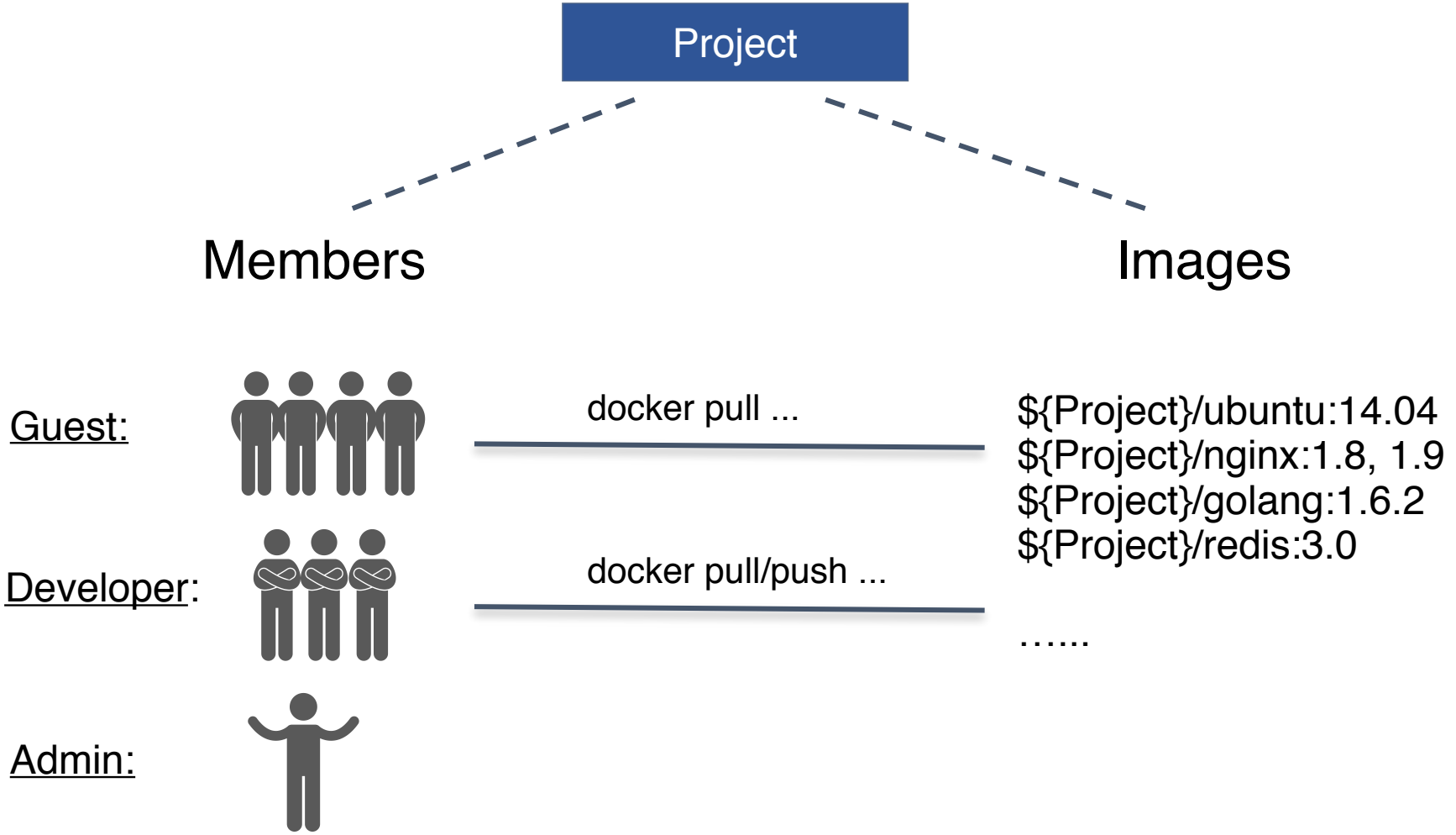
Access Control to Images

- Organizations often keep images within their own organizations
  - Intellectual property stays in organization
  - Efficiency: LAN vs WAN
- People with different roles should have different access
  - Developer – Read/Write
  - Tester – Read Only
- Different rules should be enforced in different environments
  - Dev/test env – many people can access
  - Production – a limited number of people can access
- Can be integrated with internal user management system
  - LDAP/Active Directory

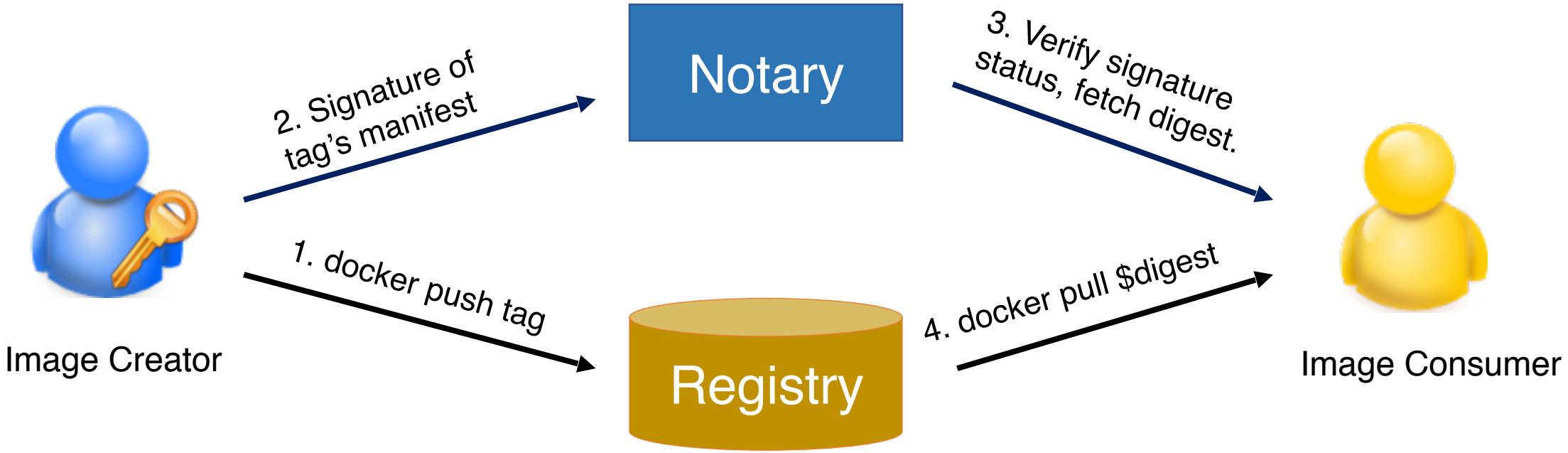
Example: Role Based Access Control in Harbor



Other Security Considerations

- Enable content trust by installing Notary service
  - Image is signed by publisher's private key during pushing
  - Image is pulled using digest
- Perform vulnerability scanning
  - Prevent images with vulnerabilities from being pulled
  - Regular scanning based on updated vulnerability database

Content Trust for Image Provenance



Vulnerability Scanning

- **Static analysis** of vulnerability by inspecting filesystem of container image and indexing features in database.
- **Rescanning** is needed only and only if new detectors are added.
- Update vulnerability data regularly
  - Debian Security Bug Tracker
  - Ubuntu CVE Tracker
  - Red Hat Security Data
  - Oracle Linux Security Data
  - Alpine SecDB

Image Vulnerability Scanning

- **Set vulnerability threshold**
- **Prevent images from being pulled** if they exceed threshold
- **Periodic scanning** based on updated vulnerability database

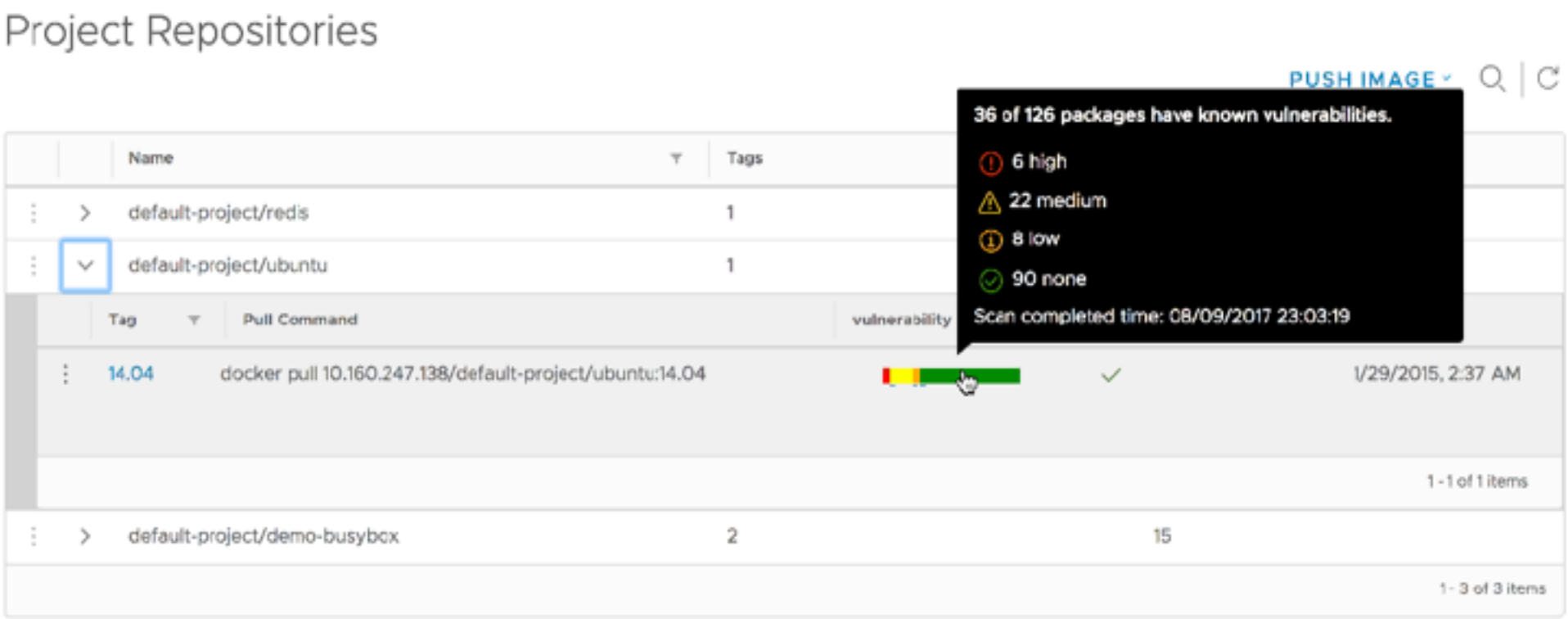


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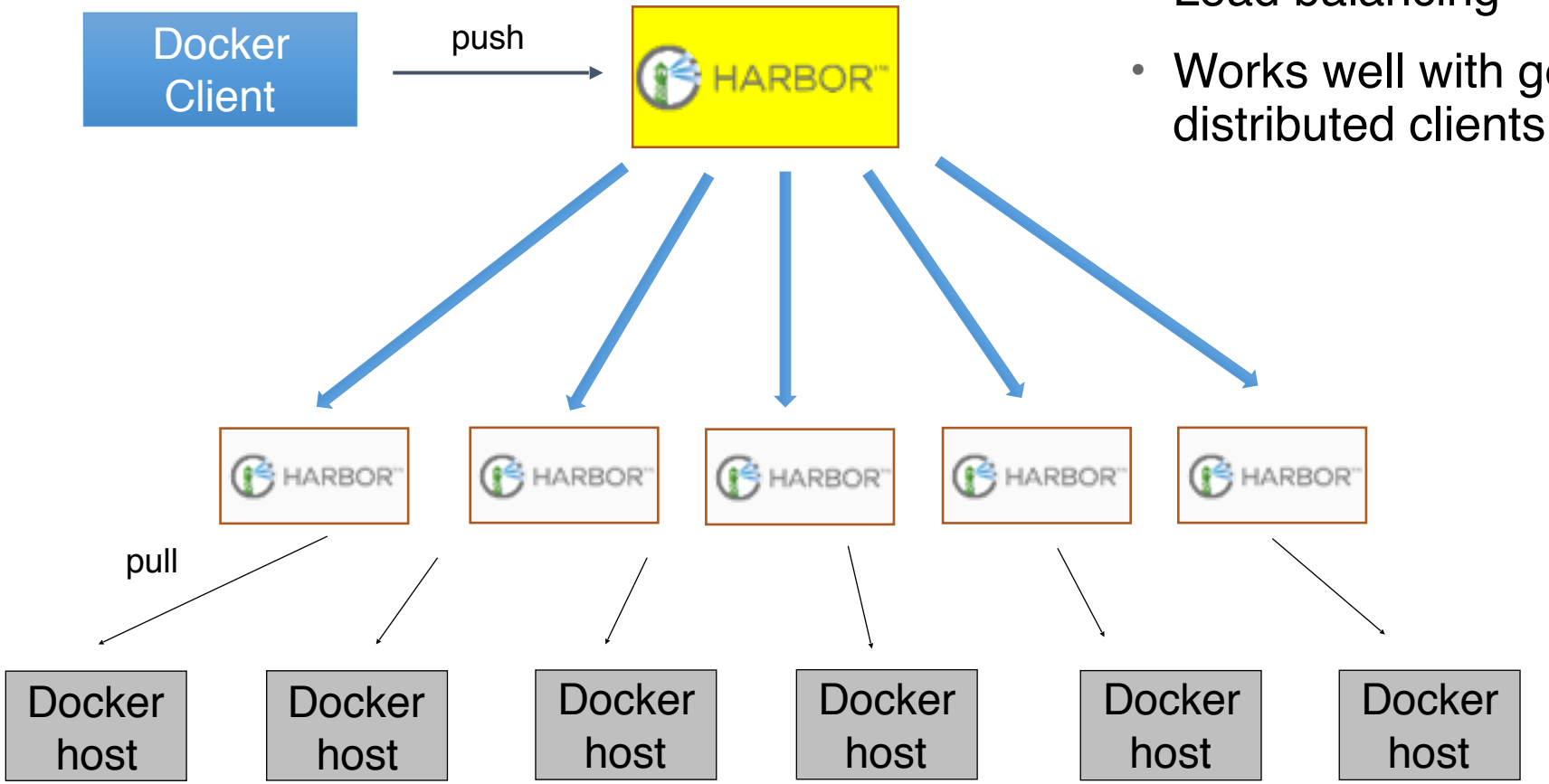
Image Distribution

- Container images are usually distributed from a registry.
- Registry becomes the bottleneck for a large cluster of nodes
  - I/O
  - Network
- Scaling out an registry server
  - Multiple instances of registry sharing same storage
  - Multiple instances of independent registry sharing no storage

Image Distribution via Master-Slave Replication



- Load balancing
- Works well with geographically distributed clients

Master – Slave model

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自我介绍

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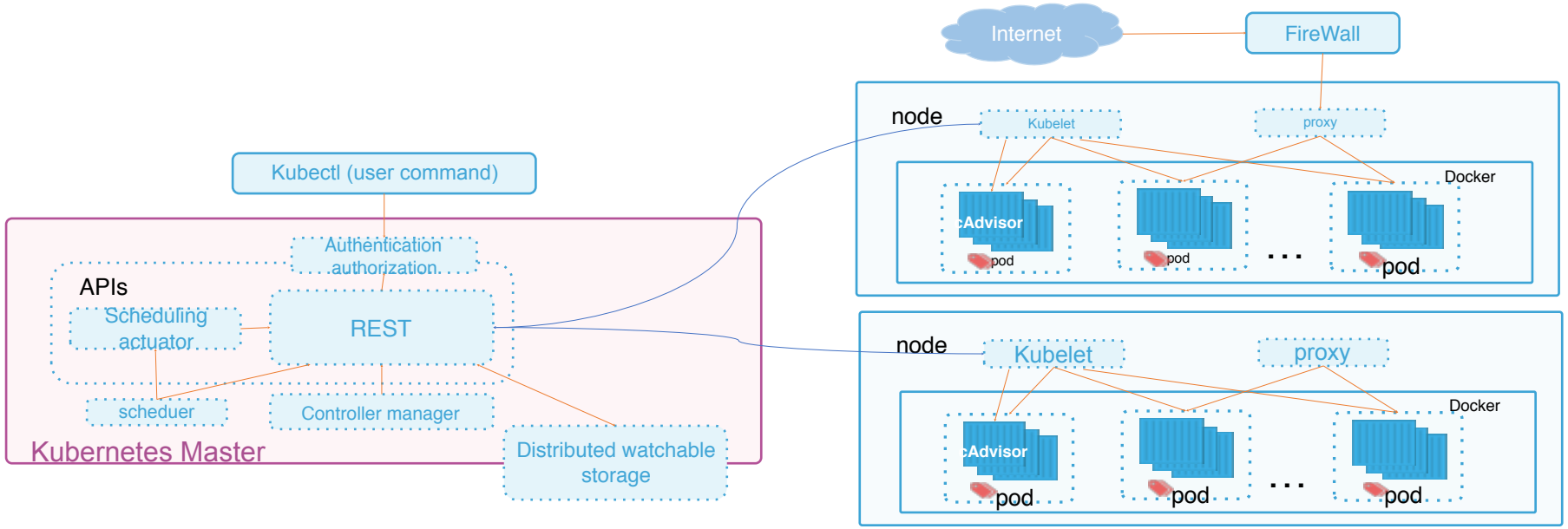
- Email：tony@caicloud.io
- Cell：18610255655

Harbor Integration with Kubernetes

- Harbor作为Kubernetes集群的镜像仓库

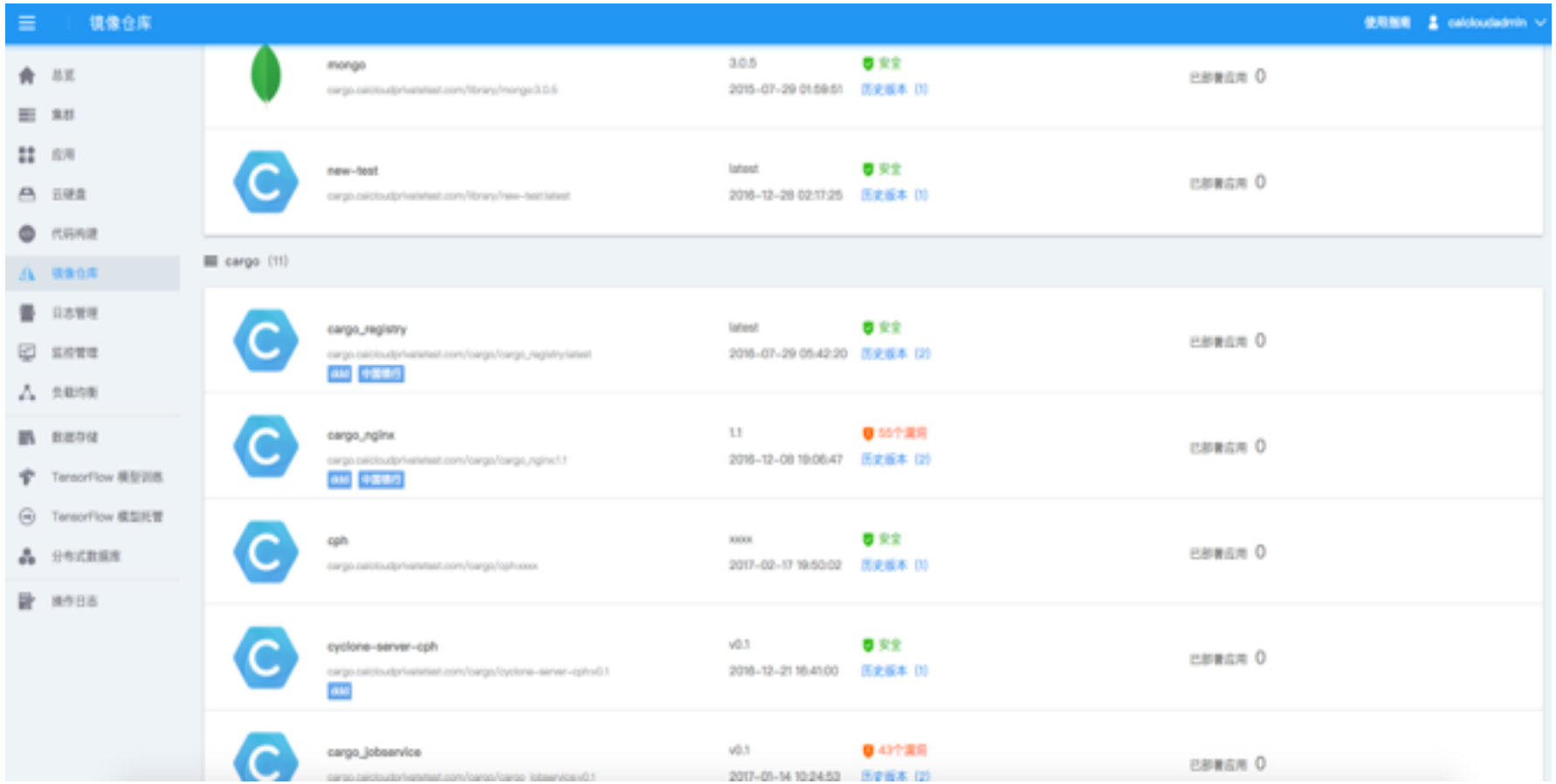


HARBOR™

主办：

Harbor Integration with Kubernetes

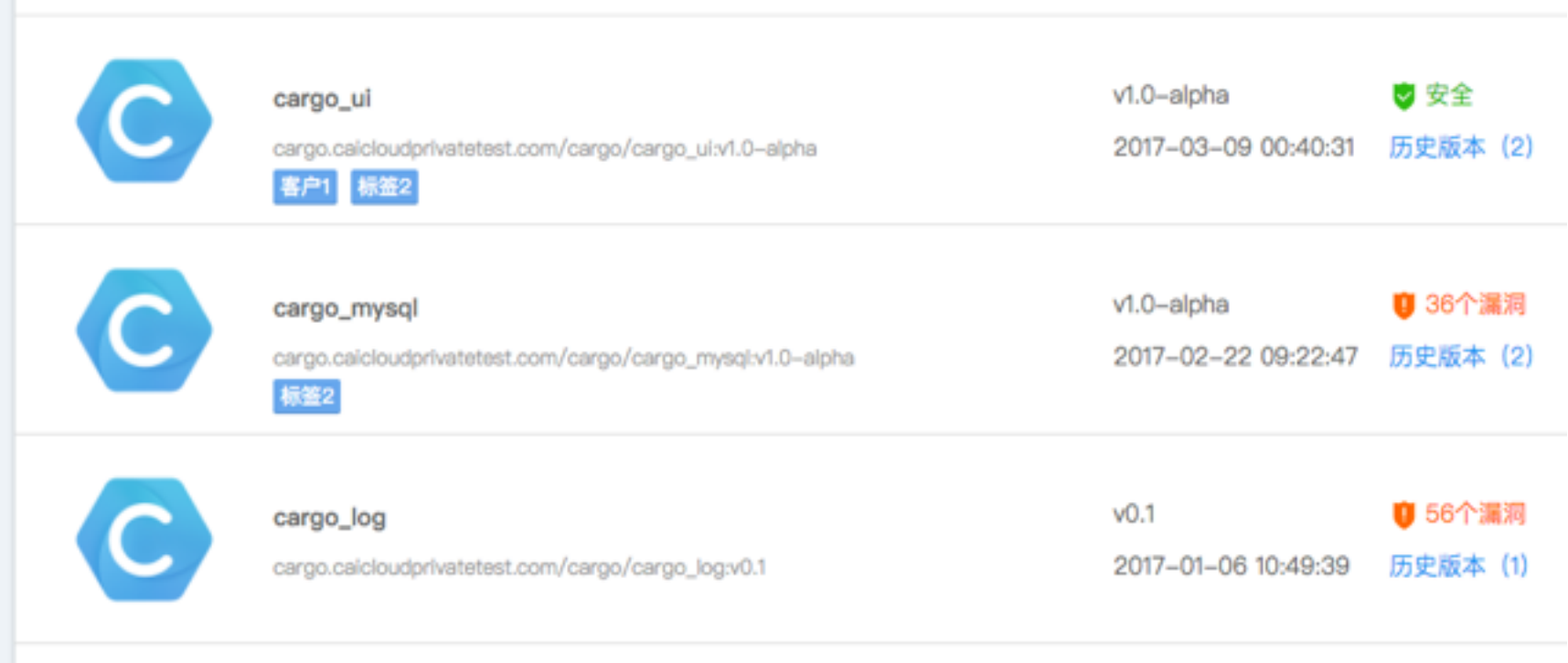
- 界面集成
- 租户
- 权限



主办：

Harbor Integration with Kubernetes

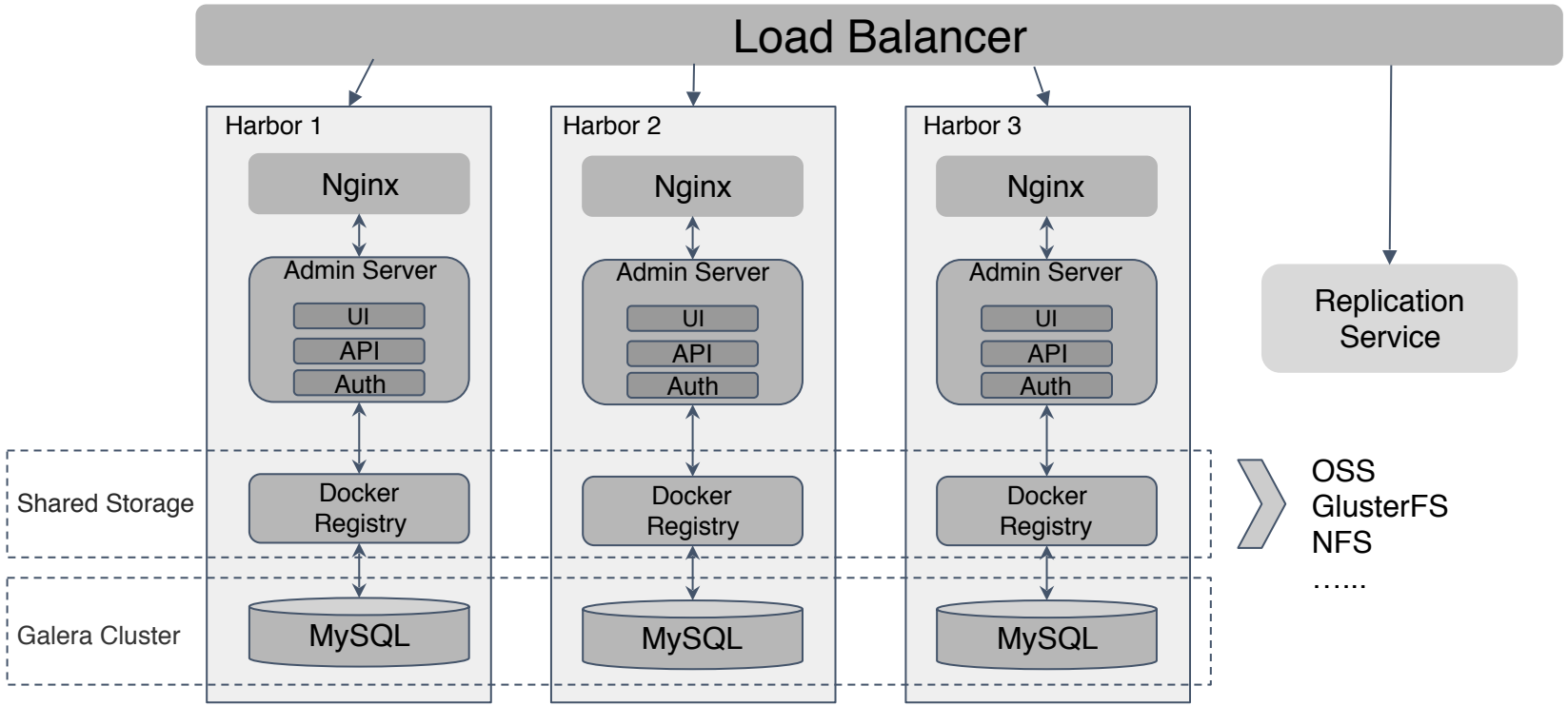
- 漏洞检测



主办：

Harbor Integration with Kubernetes

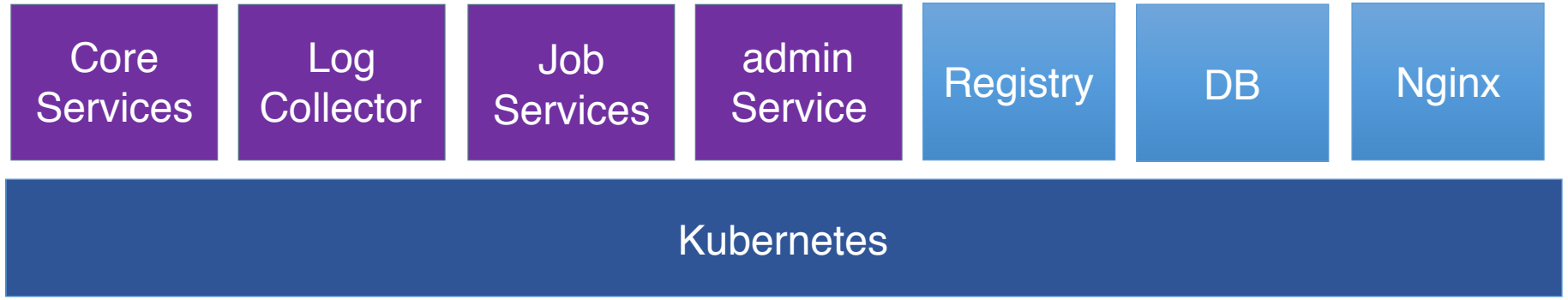
- 高可用性



主办：

Harbor Integration with Kubernetes

- 以Pod的形式部署到Kubernetes上



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Thank you for your time

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