American Airlines

How American Airlines Transformed Legacy Apps and Migrated to OCI

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Kamesh Challa, Oracle Head of Cloud Engineering, Manufacturing

oneworld

Your Presenters

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Topics we'll cover today

- Who we are: American Airlines
- Applications in Scope
- Our OCI Footprint
- Our Migration Journey
- Containerizing Legacy Applications
- Deployment Agility through GitOps
- Cloud Migration Success Factors
- Outcomes and Lessons Learned

Who we are: American Airlines

- The world's largest airline by fleet size: more than 1,300 aircraft in its mainline
- Employs over 100,000 team members
- Operates thousands of flights every day to hundreds of destinations
- …and is a fantastic place to work!

INCLUSION INDEX

HUMAN RIGHTS CAMPAIGN FOUNDATION
BEST PLACES TO WORK
2021 for LGBTQ Equality
100% CORPORATE EQUALITY INDEX

DEI BEST PLACE TO WORK FOR DISABILITY INCLUSION 2021
100% DISABILITY EQUALITY INDEX

American Airlines' Applications in OCI

"SPA" Siebel Platform Applications: 5 Apps

- Siebel CRM: eLoyalty, Loyalty, Call Center, Partner Portal
- Oracle BIP/OBIEE
- Oracle Analytics Cloud
- IBM Middleware
- Database: Oracle 19c on Exadata Cloud Service

Key Facts

- SPA supports important business capabilities for our customers, such as the Admirals Club
- Moved to OCI in May 2020
- OCI Regions: Phoenix (Prod) and Ashburn (DR)

ADMIRALS Club

American Airlines' Applications in OCI

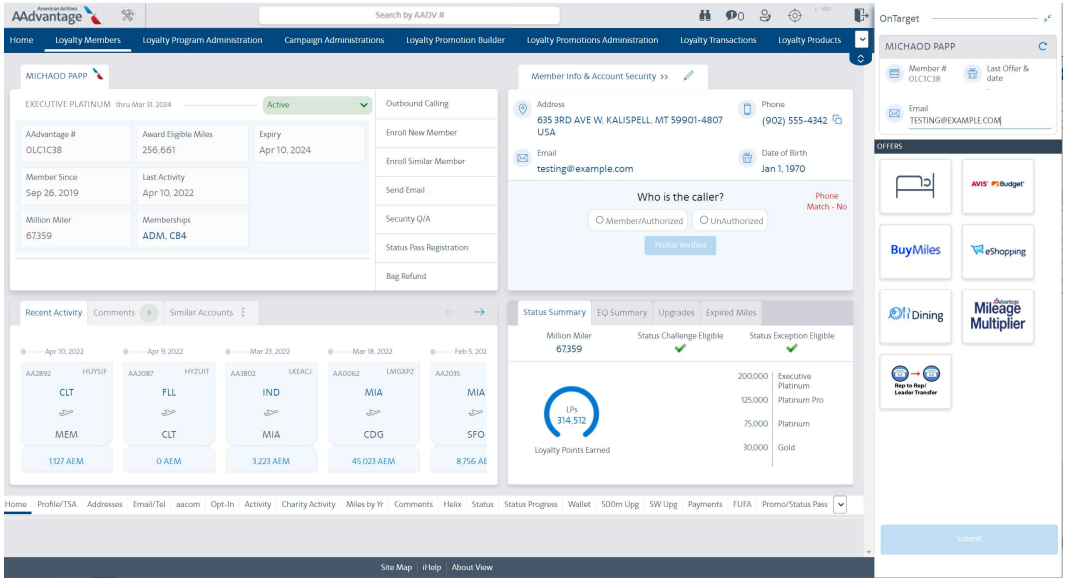
Ventana: American's Loyalty Platform

- Powers the world's largest and oldest airline loyalty program, AAdvantage®
- Processes up to 30 million web service requests daily from AA.com, American's Mobile App, and many other internal and external clients
- Executes 300 daily batch jobs
- Runs on a 16 TB Oracle Database
- Serves as a UI for AAdvantage Customer Service
- 25 large Siebel-based Pods hosted on OKE

Ventana System Composition

- Oracle Siebel CRM 22.8
- IBM Batch and Scheduling software; MQSeries
- Third-Party Proration Engine
- Custom Java for Web Services
- Database: Oracle 19c on Exadata Cloud Service

American Airlines AAdvantage



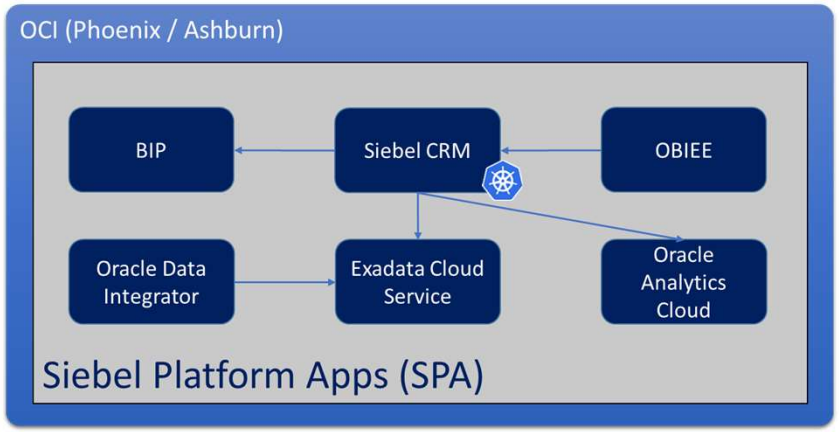
American Airlines' OCI Footprint

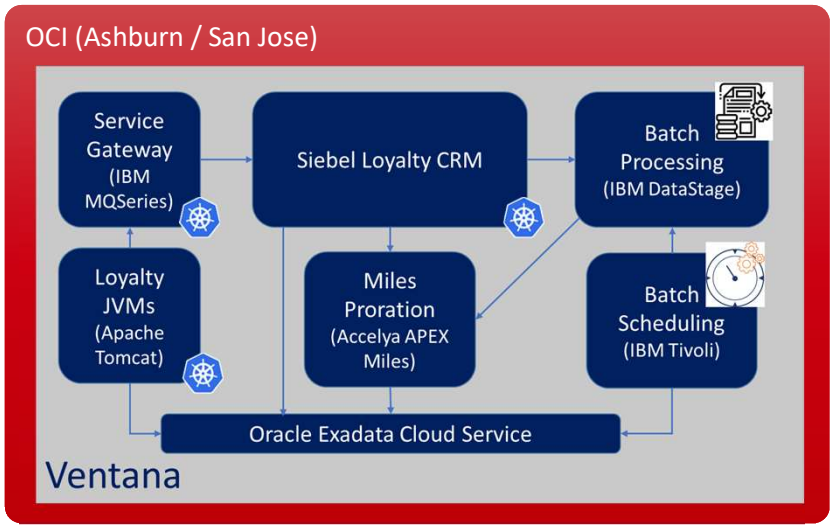
OCI Services Utilized

- Compute
- Oracle Container Engine for Kubernetes (OKE)
- Networking: VCN, FastConnect/Interconnect
- Storage: Block, Object, File
- Exadata Cloud Services (ExaCS) X8M-2
- Load Balancer
- Key Vault
- Analytics (OAC)
- Future: OIC, AI/ML, ATP Database

Supplementary Technologies in OCI

- Palo Alto Firewall
- Security agents
- Multiple open-source technologies supporting monitoring, management, deployment of applications





Our Impetus for Moving Ventana to the Cloud

American's "Cloud First" Direction

- IT Leadership encouraged teams to seek opportunities to migrate to the Cloud
- We considered moving Ventana to the Cloud in 2018/2019 but decided to remain on-premise
- SPA applications were migrated to OCI in 2020 with a Kubernetes go-live completed in November 2021

Data Center Closure

- A Data Center closure impacted Ventana's Disaster Recovery environment
- Migration options included moving to another data center, but carried material risk and cost
- The Data Center closure presented a new opportunity for Ventana to move to the Cloud

Deliver a Platform built for Business Agility and Security

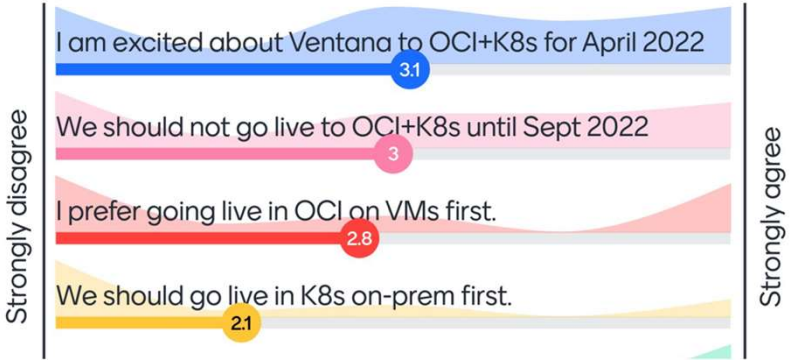
- Build a scalable platform that allows Ventana to grow at the speed of our business
- Prevent security vulnerabilities from being exploited by outside actors
- Meet or exceed enterprise Objectives and Key Results (OKRs) for reliability, security, and performance

Make our Product Awesome!

Weighing multiple migration options

- Move to another on-prem data center
  - Material cost and risk during the migration
  - Unaligned with our “cloud first” direction
- Migrate only our Disaster Recovery Environment to OCI
  - Implies trust in OCI to run Production anyway
  - Would result in two infrastructure platforms to manage
- Migrate all environments to OCI
  - Requires existing hardware disposition
- Lift-and-shift vs. deploy into OKE
  - OKE offered a way to bring traditional apps into a modern architecture
  - A migration + OCI deployment increases risk and time

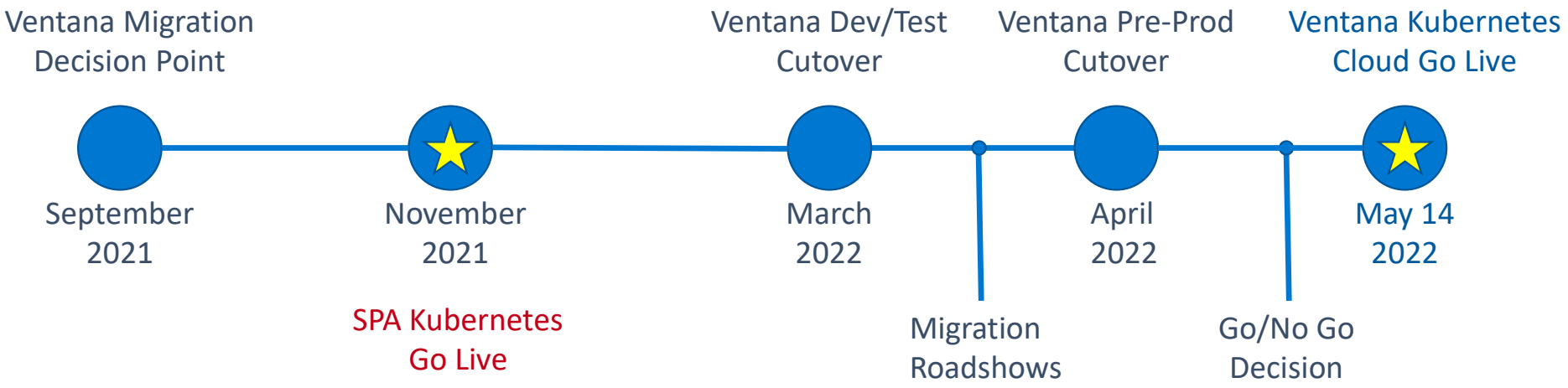
Cloud? On-Prem? VMs? Kubernetes?



Why Oracle Cloud Infrastructure?

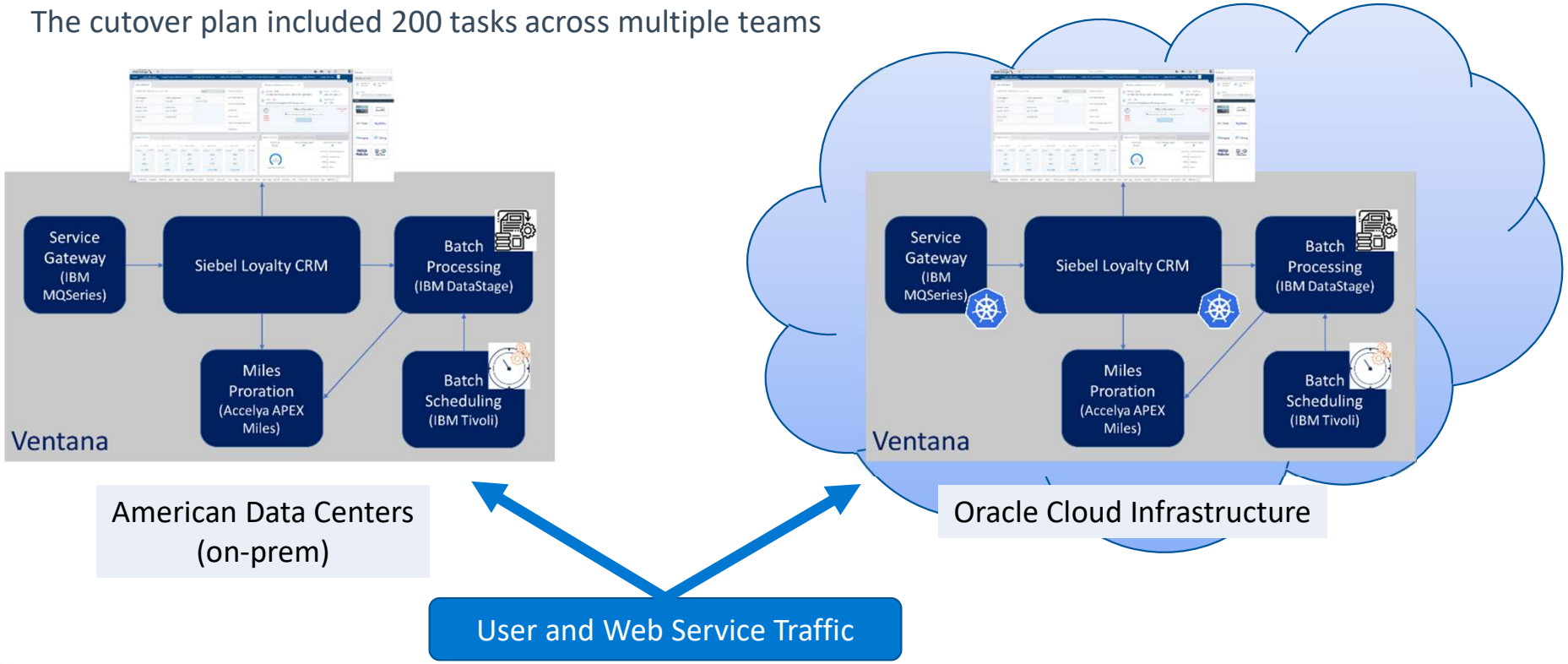
- Ventana's core technologies – Siebel and Oracle Database – are Oracle-based
  - Siebel CRM continues to evolve as an enterprise-grade Loyalty platform
  - Oracle Exadata remains the premier database for Ventana's billions of transactions
- Risk Reduction of our Customers' Data Integrity during the migration
  - Oracle Database on Exadata/ExaCS
  - Oracle GoldenGate, Oracle Active Data Guard
- Alignment to a single platform for all Applications in our care
- Cost efficiencies through a multi-year commitment in OCI
- Low latency, high speed integration with Azure-hosted apps using Interconnect

High-Level Milestones



The Ventana Cloud cutover process

- At 11 PM CDT May 14, 2022, we initiated a cutover of Ventana to Oracle Cloud Infrastructure (OCI)
- Key services were available within 1 hour as planned
- The cutover plan included 200 tasks across multiple teams



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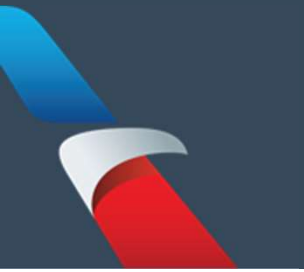
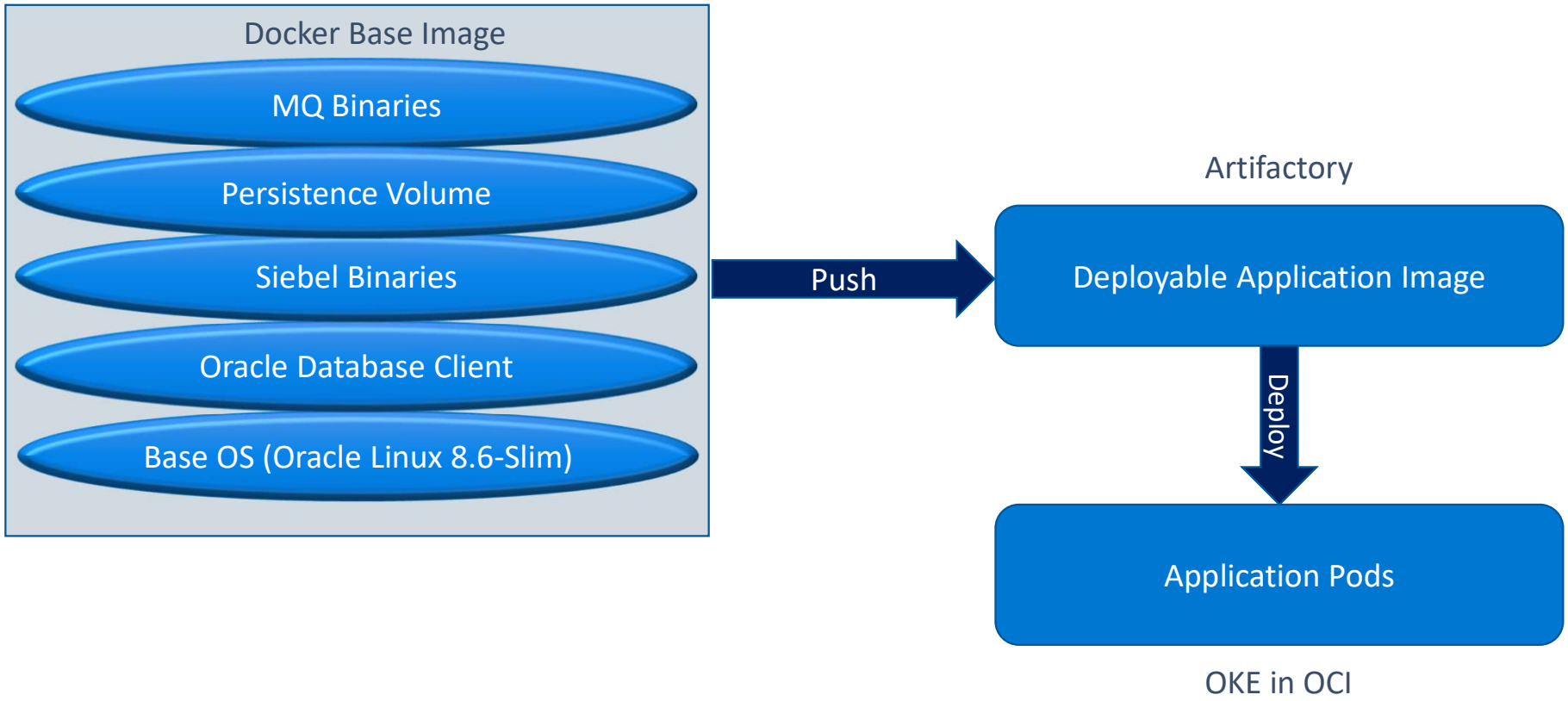
Containerizing Legacy Applications



Legacy Application Images based on multiple layers



Kubernetes Composition of a Legacy App

Kubernetes Deployment Automation

Argo CD

- Declarative GitOps Continuous Delivery tool
- Monitors K8s Apps for version differences

Load Balancer Service

- Exposes Service externally
- Defined by Cloud Provider (e.g., OCI Load Balancer)

NodePort Service

- Exposes Service on a Static Port
- Reliable, consistent service access per Node

Application Installation & Configuration

Helm & Ansible

- Manages Installation & Configuration of K8s Apps

ClusterIP Service

- Enables Inter-Pod communication

Headless Service

- Routes incoming requests directly to Stateful Pods based on Selector Value
- Persistent DNS assignment

StatefulSets

- Deployment Type of the PODs
- Provides ordering and unique assignment

Pod

- Ephemeral instance of a Legacy App Container
- Equivalent to a running instance of Application binaries

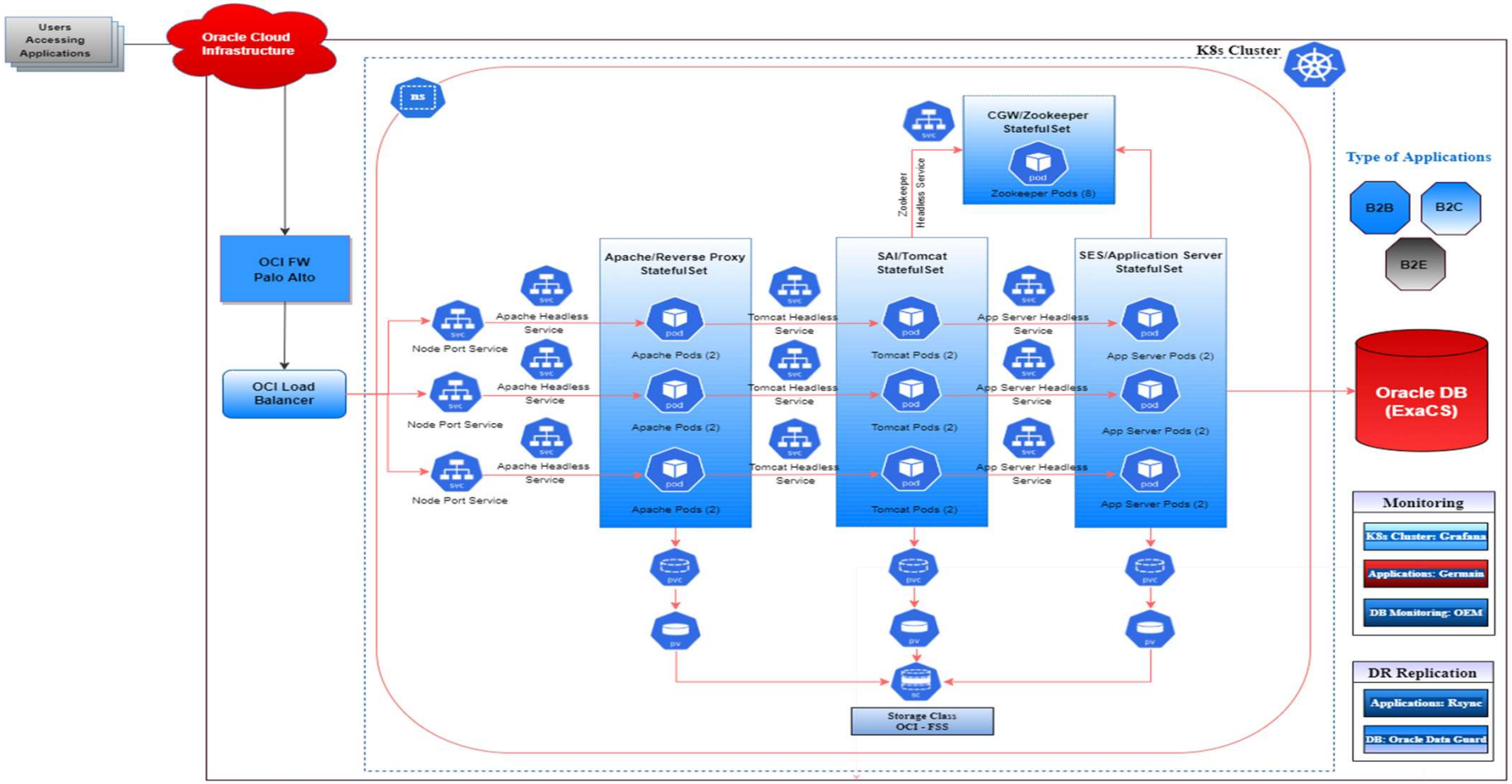
Persistent Volume

- Provisioned storage used by Pods
- Retains data even after Pod restart
- Uses OCI's FSS storage driver

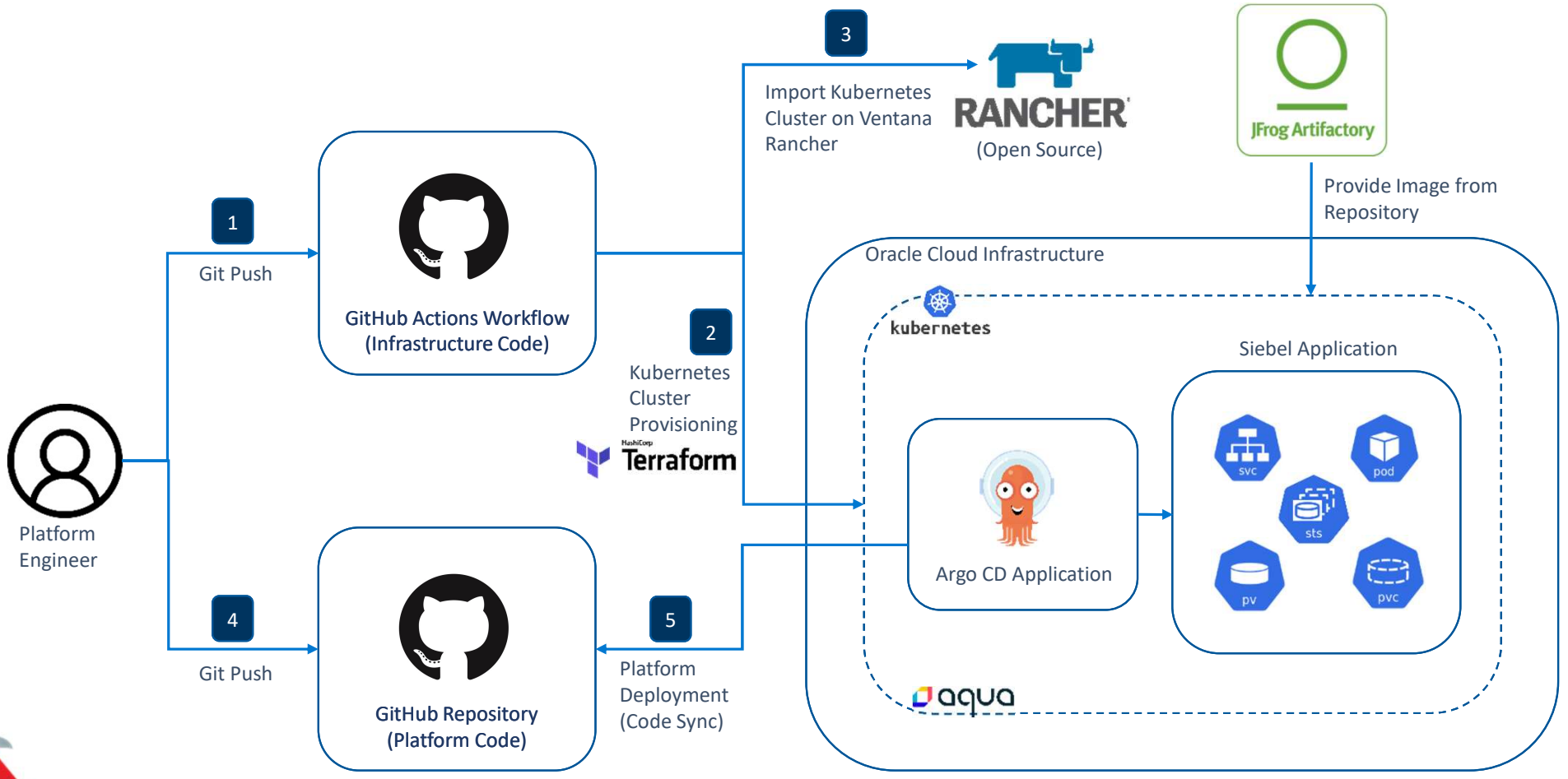
Persistent Volume Claim

- Binds the Persistent Volume to the Pod

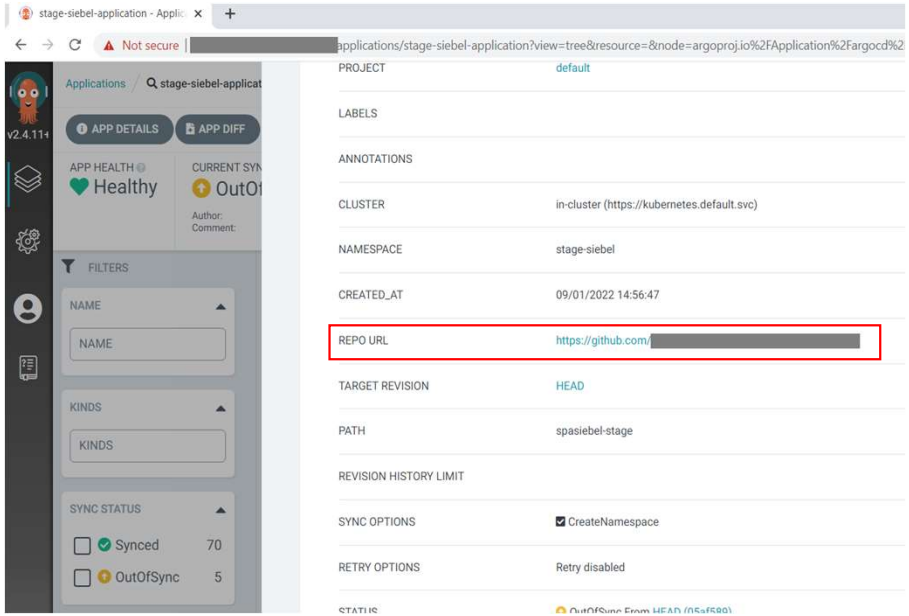
Logical Kubernetes Architecture



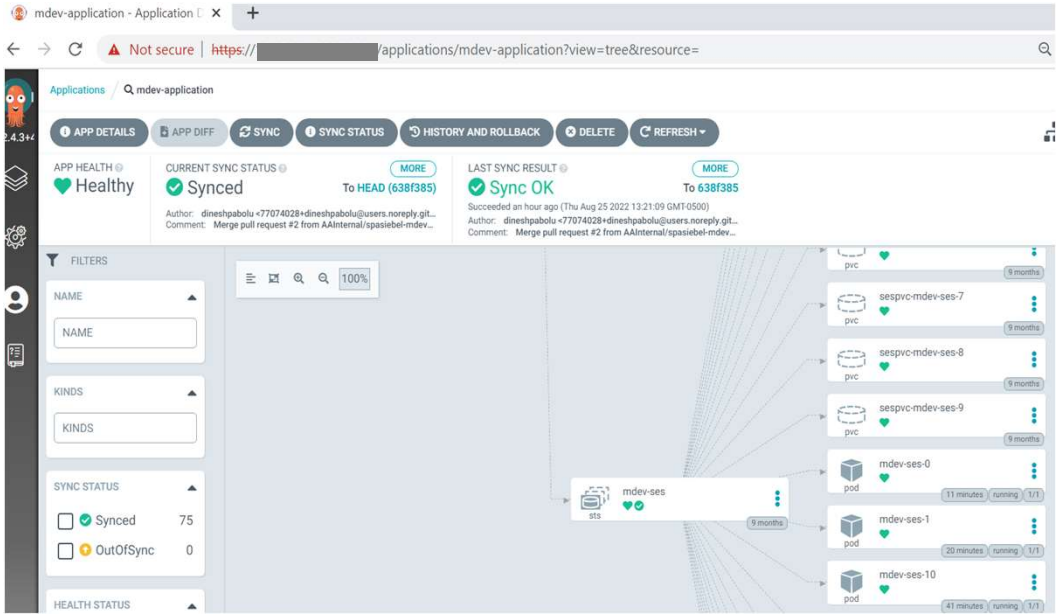
GitOps Infrastructure Automation



Deploying Kubernetes Pods through Argo CD



Argo CD Monitors the specified GitHub Repo for changes



38 minutes to update Pods via Automated Rollout

New Environments can be deployed in a single day

Simplified Upgrades and Rollbacks

Patch Update Process
1. Upgrade the Siebel Image
2. Upload it into Artifactory and run the Security Scan (aquasec)
3. Update the values.yaml file with latest Image details
4. Push the yaml files to Git Repo
5. Approval on Git Pull request
6. Trigger the deployment through Argo CD
7. Leverage the existing configuration using Persistence volume

Patch Rollback Process
1. Update the values.yaml file with previous Image details
2. Push the yaml file to Git Repo
3. Approval on Git Pull request
4. Trigger the deployment through Argo CD
5. Leverage the existing configuration using Persistence Volume

Application Upgrade Stats in K8s
• 50% reduction in effort to upgrade and deploy the application
• Continuous Deployments through Argo CD
• Easy to scale up and scale down of resources at Pod level
• Easy Rollback mechanism of Application versions
• Easy to scale down Application Pods whenever required

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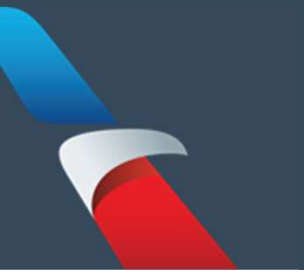
Cloud Migration Success Factors



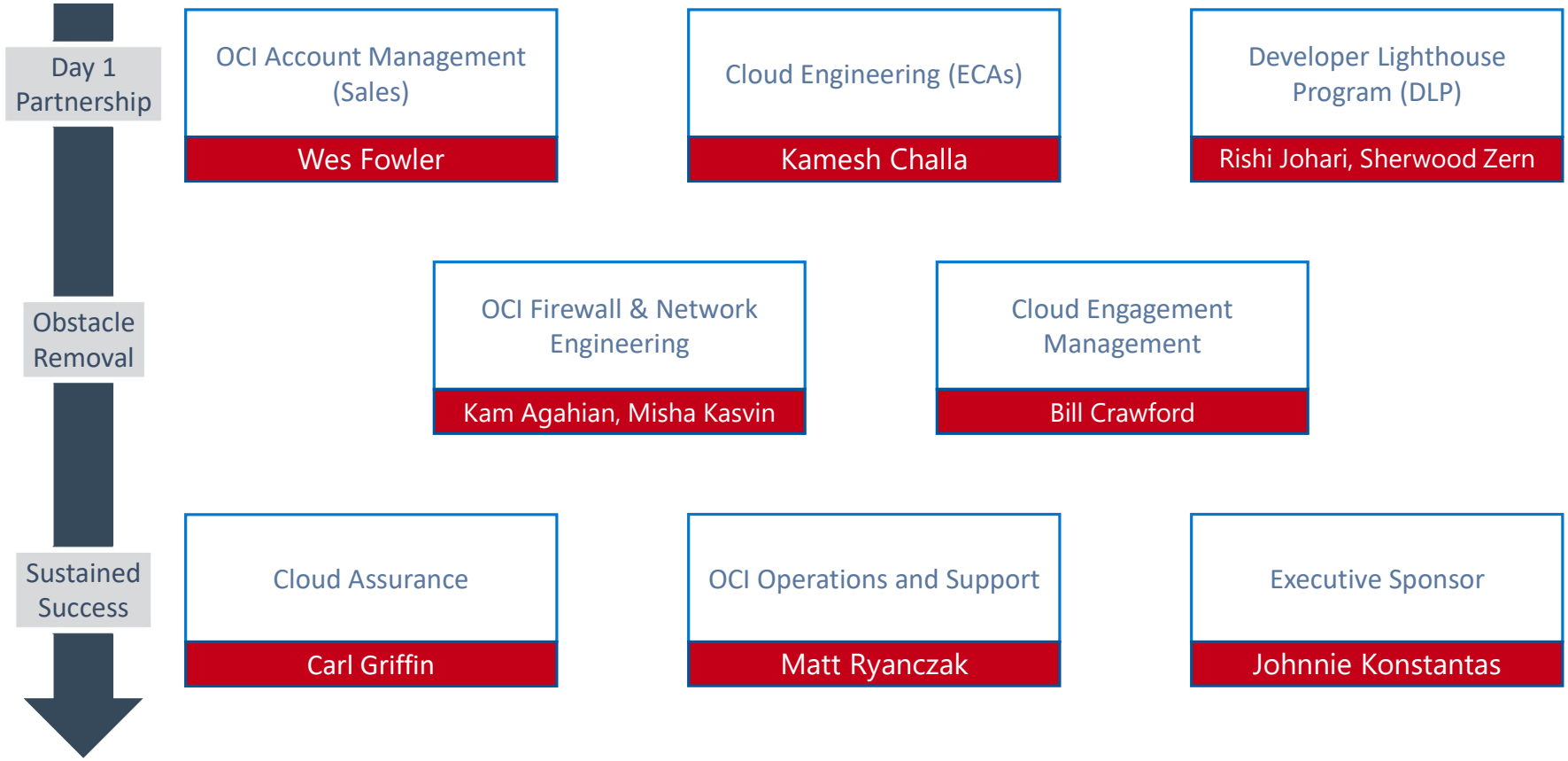
Key Success Factors

Two key factors played a critical role in our migration success:

Partnering with Oracle
• Cloud Sales • Cloud Engineering & DLP • Cloud Engagement Management • Cloud Assurance • Operations & Support • Executive Sponsorship

Empowering the Team
• Certifications • Upskilling • Leadership Support • Persistent Team • Track record of success

Partnering for Customer Success: Key Oracle Teams



Upskilling and Certifications

This badge was issued to
[redacted] 07 December 2021 by Oracle

ORACLE Certified Associate Oracle Cloud Infrastructure Cloud Operations 2021

Oracle Cloud Infrastructure 2021 Certified Cloud Operations Associate

Issued by Oracle

An Oracle Cloud Infrastructure 2021 Certified Cloud Operations Associate has demonstrated hands-on experience and knowledge required to Automate Cloud tasks, Tune Performance, Troubleshoot, manage cost, manage security and compliance policies, Monitor and Alert OCI, Implement Data Retention and Archival, create shell scripts with the Command Line Interface (CLI) and design Cloud-scale Agility on OCI. Up-to-date training and field experience are recommended.

View Requirements

This badge was issued to
Tim Tsao 20 October 2021 by Oracle

ORACLE Certified Foundations Associate Oracle Cloud Infrastructure 2021

Oracle Cloud Infrastructure Foundations 2021 Associate

Issued by Oracle

The Oracle Cloud Infrastructure (OCI) Foundations certification is intended for individuals looking to demonstrate fundamental knowledge of public cloud services provided by Oracle Cloud Infrastructure. This certification is targeted towards candidates with non-technical backgrounds such as those involved in selling or procuring cloud solutions, as well as those with a technical background who want to validate their foundational-level knowledge around core OCI services. This exam does not require any hands-on technical experience and is not a prerequisite for taking any other OCI certifications.

View Requirements

CERTIFIED kubernetes ADMINISTRATOR

The Cloud Native Computing Foundation hereby certifies that

Krishnam Raju Bhattu

has successfully completed the program requirements to be recognized as a

Certified Kubernetes Administrator

PRIYANKA SHARMA, GENERAL MANAGER, CLOUD NATIVE COMPUTING FOUNDATION

April 25, 2021 — DATE OF COMPLETION

LF-mmggdqnnns — CERTIFICATE ID NUMBER

To verify the status of this Certificate, please visit http://training.linuxfoundation.org/certification/verify

ORACLE PartnerNetwork Solution Engineering Specialist

Oracle Application Integration Cloud Platform

Additional Details

Oracle Application Integration Cloud Platform Solution Engineer Specialist

Issued by Oracle

The Oracle Application Integration Cloud Platform Solution Engineer Specialist badge is intended for professionals within partner organizations who specialize in designing and configuring Oracle Application Integration Cloud Platform to their customer base. The recommended online training sessions provide more in-depth information to help the presales teams, including an assessment to demonstrate their knowledge and be recognized by Oracle.

Skills

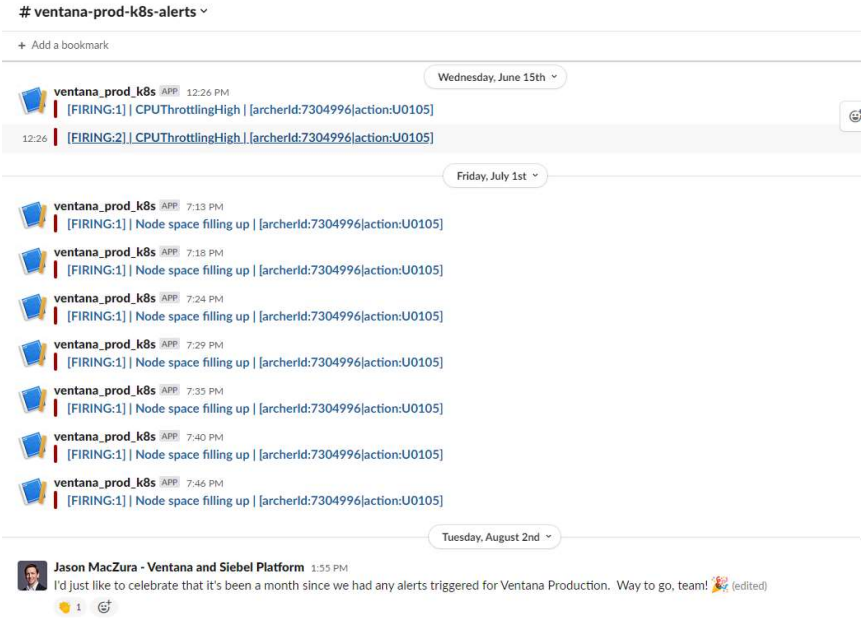
INT - App Integration | Solution Engineering

Outcomes and Lessons Learned

Operational Outcomes since Ventana Go Live

- **Excellent operational reliability** for our Critical application
  - ***ZERO*** customer-impacting incidents have occurred in Oracle Cloud Infrastructure
  - ***ZERO*** automated warnings triggered in the Kubernetes monitoring Slack channel since July 1, 2022

A recent 7-day report on Pod metrics



Operational Outcomes since Ventana Go Live

- **Performance**: Acceptable ~40ms additional latency increase on web services from on-prem end points
- **Improved Scalability**: Fast scaling to react to spikes in website traffic load from promotions, seasonal peaks etc.
- **Improved Resiliency**: Automatic Pod restarts when pod crashes or memory limits are exceeded
- **Optimized Infrastructure expenses**
  - Avoids large capital spend for new hardware refreshes
  - Open-source software alternatives save significant license costs
- **Simplified Infrastructure Management**: 60% reduction in the number of Compute instances
- **Improved Security:** 50% faster patch deployments

Operational Outcomes since Ventana Go Live

4 days post-Ventana Go Live

Lessons Learned for a successful cloud migration

Technical Lessons and Findings

- Not all COTS applications can be migrated to containers
  - Technical limitations due to image size
  - Vendor support (or lack thereof!)
- Issues may need to be replicated in a VM footprint
- Running Kubernetes requires another technology stack to manage and upgrade
- Kubernetes upgrades of legacy apps require additional care to avoid/minimize downtime
- Large Node and POD sizing required
- File Storage Service cost considerations

Leadership Lessons

- Partner with teams within Oracle
- Gain team buy-in before moving forward
- "Operationalize" Learning Journeys
  - Schedule daily learning sessions as a team
  - Build in time to experiment with new technologies
- Demonstrate trust and support – celebrate both success and failure

Key Takeaways

- **OKE and Open-source can support Critical applications:** Open-source technologies can support the deployment, configuration, management, and monitoring of critical applications while optimizing costs
- **Legacy Application Modernization is Possible:** With Ventana's recent deployment to OCI, American Airlines is running the largest "Siebel implementation on Kubernetes" in the world
- **Empower your team:** Set high standards for your team… empower them to skill up… and they will meet them!
- Thanks to OCI, we now run our core Loyalty system in a scalable, self-healing cloud architecture that positions us to take advantage of cloud services such as real-time AI and modern data integration technologies

LRN3714:
How American Airlines Moved Mission-Critical Apps to Kubernetes

- Learn more about the technologies and solutions we implemented to move into OKE
- Deeper technical dives into open source technologies running in OCI
- Tomorrow @ 2:30 PM

Vijay Krishnaswamy
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Sherwood Zern
Cloud Solutions Architect
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American Airlines
You are why we fly™