

ESTECO
USERS' MEETING
NORTH AMERICA

Reaching for the North Star -
Our model based enterprise
journey from monolith to
microservice, Part 2

um
2023

Daryn Decker
Lockheed Martin Space, Platform Services
- Architecture





Agenda

Lockheed Martin

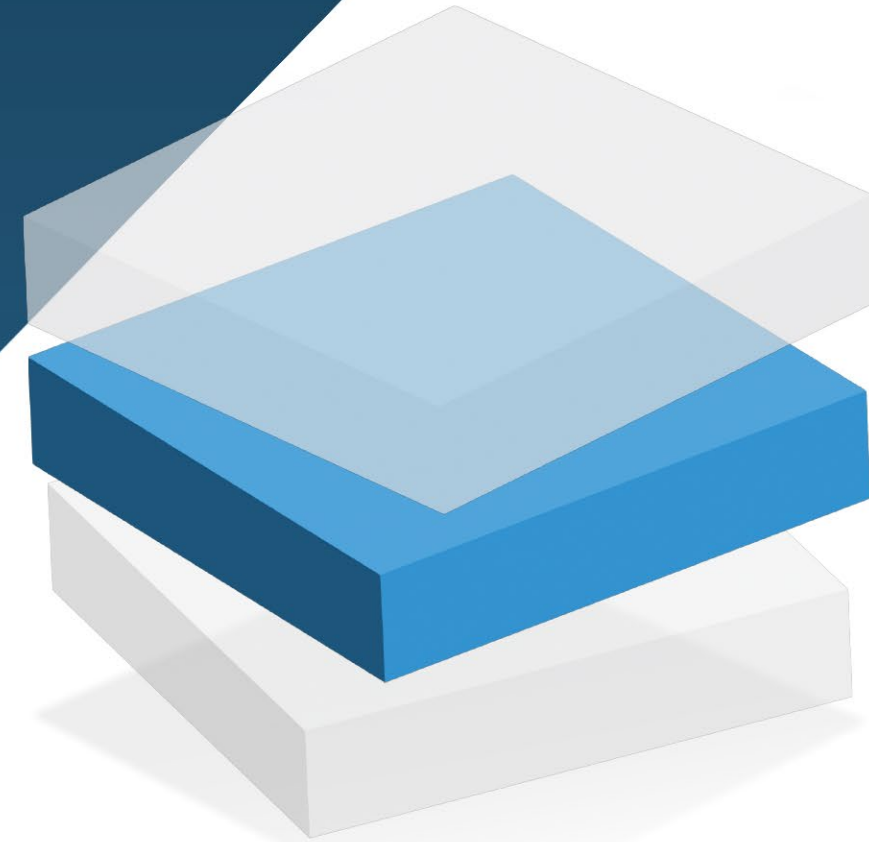
About Me

Start the Journey, Part 1

Current steps, Part 2

Next steps, Part 3?

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Lockheed Martin Overview

Company:

Headquartered in Bethesda, MD.,
Global Security and Aerospace Company

Employees:

116,000 Domestic and International Employees
60,000 Engineers, Scientists and Technologists

Operations:

375+ Facilities Throughout All 50 States and in 33
Nations and Territories

2022 Sales: \$66 Billion

Cash Flow from Operations: \$7.8 Billion

Stock Ticker Symbol: LMT, New York Stock Exchange

Ranked 60th on the 2022 Fortune 500 List of Largest
Industrial Corporations



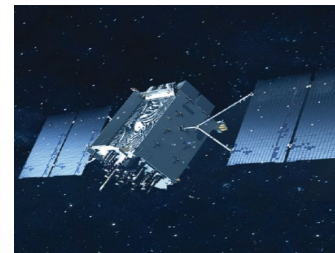
Aeronautics, with approximately \$26.9 billion in 2022 sales which includes tactical aircraft, airlift, sustainment and aeronautical research and development lines of business.



Missiles and Fire Control, with approximately \$11.3 billion in 2022 sales that includes the Terminal High Altitude Area Defense System and PAC-3 Missiles as some of its high-profile programs.



Rotary and Mission Systems, with approximately \$16.1 billion in 2022 sales, which includes Sikorsky helicopters, maritime systems, sensors, radar systems, command and control, combat simulation and training, undersea systems and full-spectrum cyber capabilities.



Space, with approximately \$11.5 billion in 2022 sales which includes development of commercial and government satellites, strategic missiles, mission solutions and the deep space exploration lines of business.

Source: (Who We Are – Lockheed Martin”, 2023)





About Me

Family

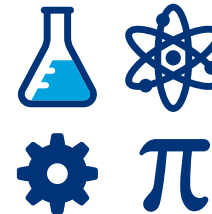
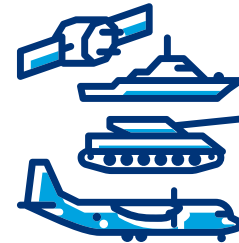


Married to Lynn (29yrs)
Two daughters - Samantha (17), Danielle (~15)



Interesting Facts

- Retired Air Force
- Stationed in Turkey
- Special assignment
 - White House Communications (Patriot Project) , post-9/11
- AFDRP – AFRL/DIA



Interests

- Travel
- Camping, outdoors
- Cooking
- DIY – Lots of DIY!

- Location: Syracuse, NY
- Position: Full Stack Engineer, Sr Staff
- Current Focus Areas: S-MBE Acceleration - Enablement
- Work Experience Summary:
 - ~Thirty years experience in System/Network Design, Engineering, Integration and Maintenance (Leadership, Management, & Technical roles)
 - Twenty years DoD experience in a multitude of IT environments and
 - LM Greenbelt
 - CE and Architecture Pipeline graduate, LM Qualified Architect, Agile Pipeline graduate (Certified PO)
 - RTT Program (Recognized Technical Talent)
- Education:
 - MS – IT Mgmt – TUI University (honors)
 - Concentration - IT Security and Digital Forensics
 - BS – IT Mgmt – TUI University (honors)
 - AAS – Electronics - CCAF





What and When - the journey has started

The Space Model Based Enterprise project is an evolution of the Space Model Based Engineering Acceleration initiative, and it is the Space implementation arm of the broader One LM Transformation (1LMX) Model Based Enterprise initiative. It is a multi-functional effort between Information Technology & Digital Enablement (IT&DE), Engineering & Technology (E&T), and Operations to create a model based enterprise here at Space.

Integrated Analysis Tool Trade Study ~ Fall of 2021

- Multi-Discipline Engineering Analysis
- Design-of-Experiments Multi-dimensional Analysis



OneLM
Transformation



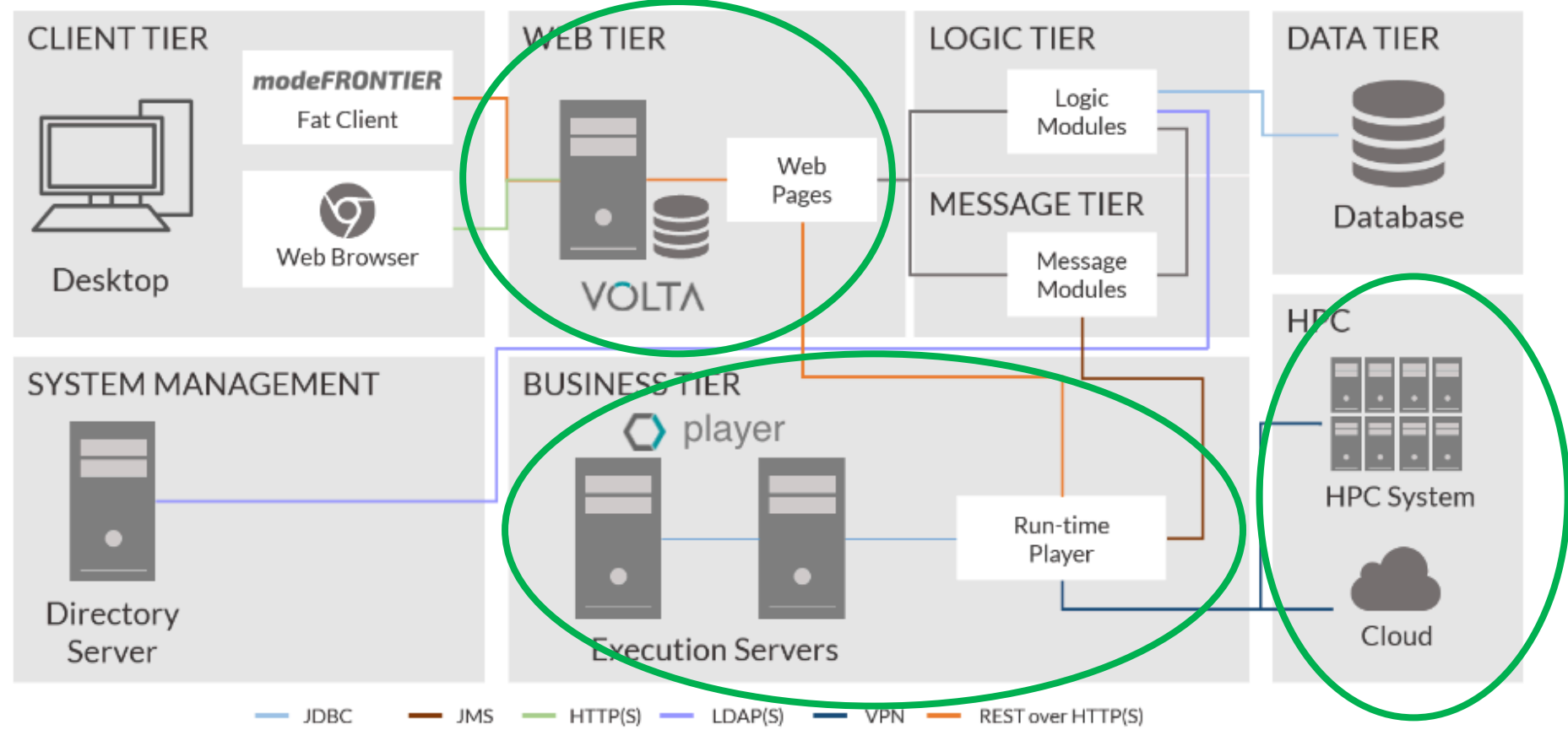
ESTECO VOLTA/modeFRONTIER was selected

- From an IT perspective, particularly drawn to the potential of ESTECO supporting VOLTA in being deployed in a container orchestration environment - Openshift





The Monolith



VOLTA Deployment Options



PoC/Standard Environment

Production Environment

Kubernetes Environment

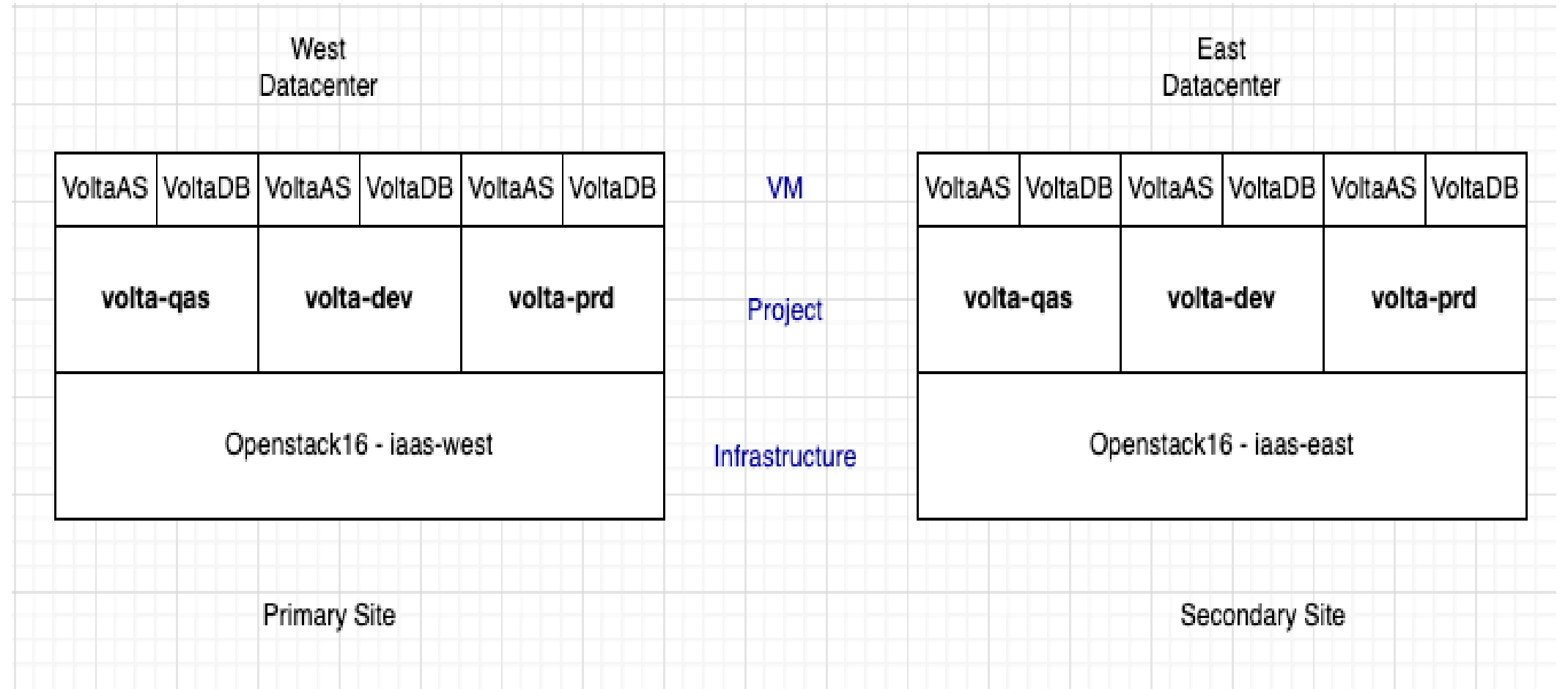
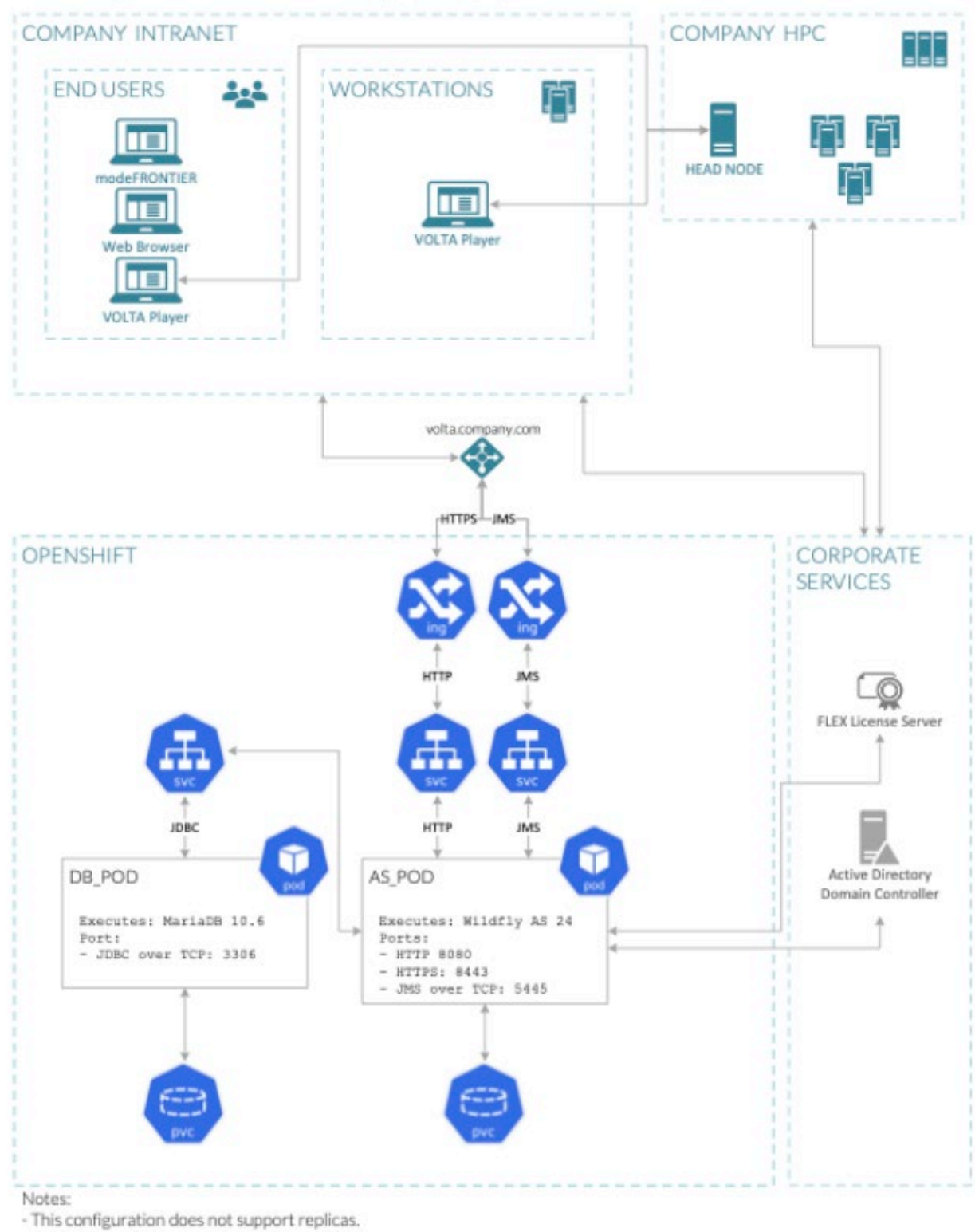
VOLTA Portable Deployment - VOLTA 2021R3





The Monolith and Microservice Pathfinder - Crawl

VOLTA-2021@COMPANY architecture diagram - 15/10/2021



VOLTA Portable Deployment
 - VOLTA 2021R3

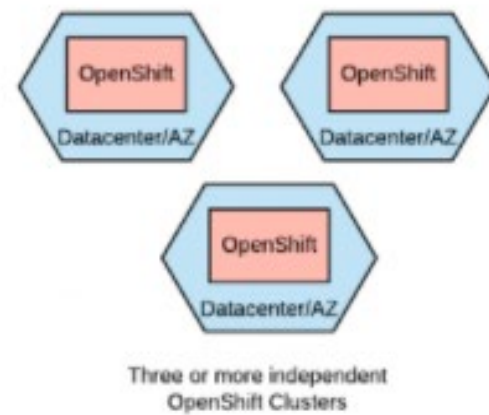
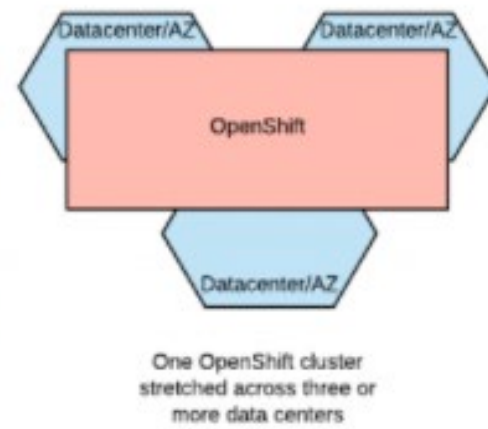
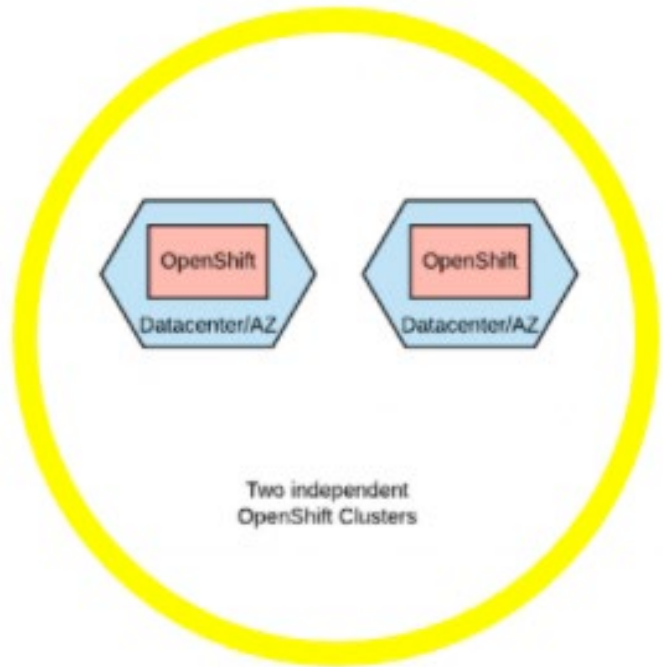
VOLTA Container Deployment
 - VOLTA 2022R1 Preview





High Level Orchestration Decision - Walk

Resiliency Decisions

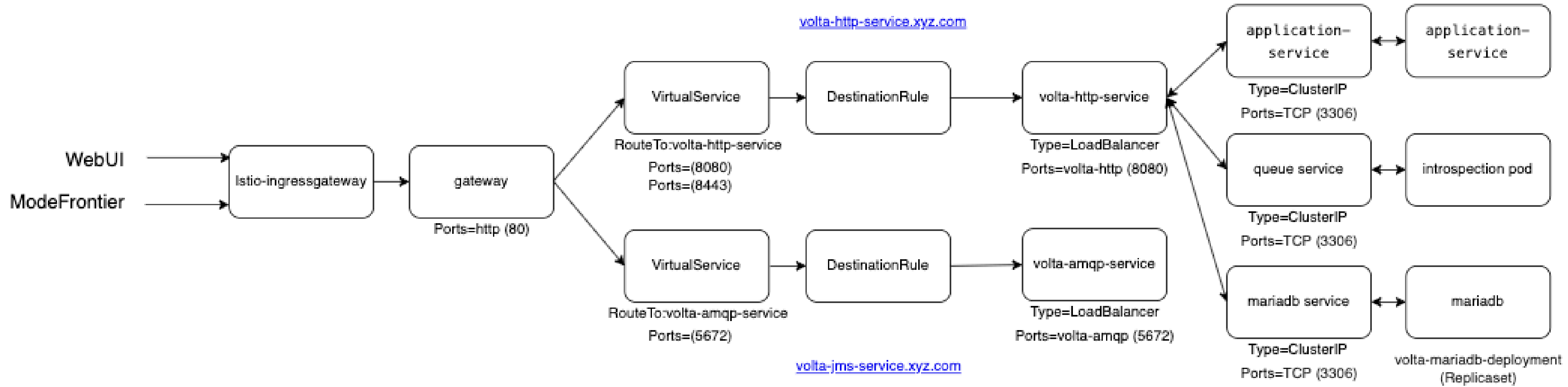


Volta Openshift Ecosystem





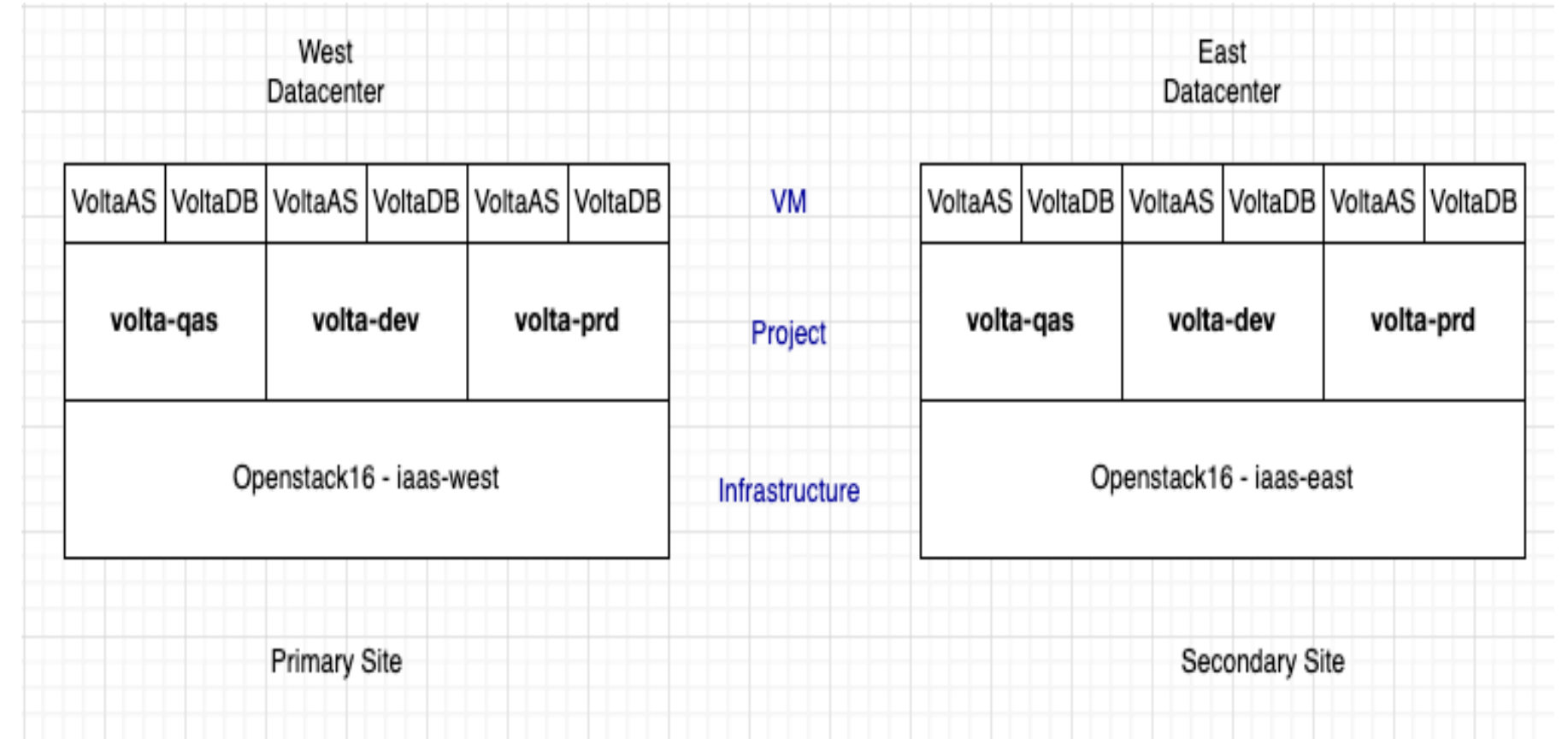
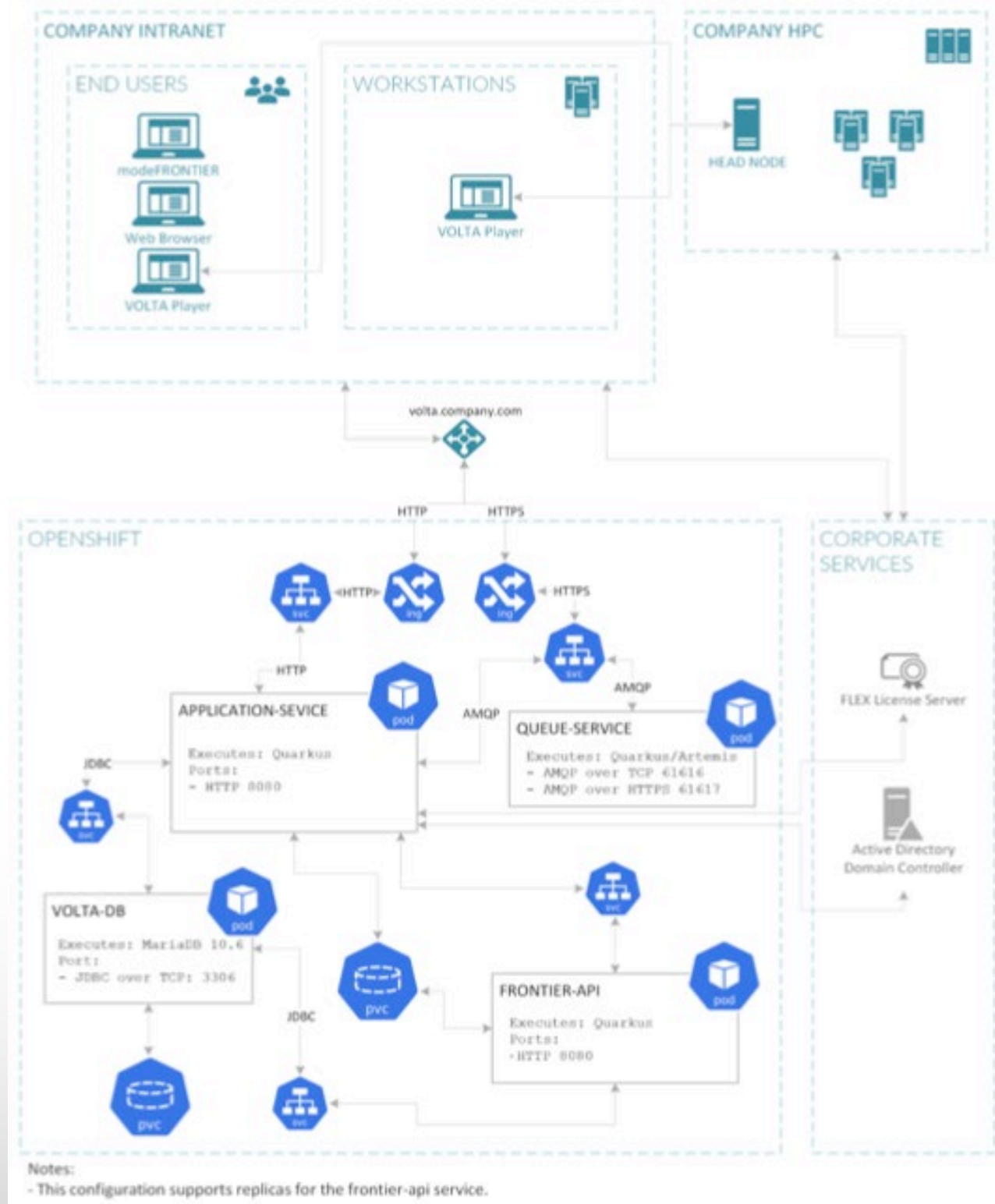
Service Mesh - Walk





Current Environment – Walk

VOLTA-2022R2



VOLTA Portable (Player) Deployment - VOLTA 2022R2

VOLTA Container Deployment - VOLTA 2022R2





Current Steps – Run (the North Star) – Part 2

Completed experiment, deploying on top of our HADES automated IaaS/PaaS solution

- Custom Rancher, deployed on AWS via CI/CD (can decouple IaaS/PaaS)
- Successfully decoupled from the PaaS (Openshift) layer and deploy in other environments

Upgrade process and SSO – VOLTA 2023R1 Ready to Go

Improve pipeline efficiency, **automation**, adherence to standard strategies and release cadence

Looking at other integration points with VOLTA and “**Design for Classified**”

HPC

Refine our Architecture inter/intra region to enhance resilience and mitigate risk to the Business

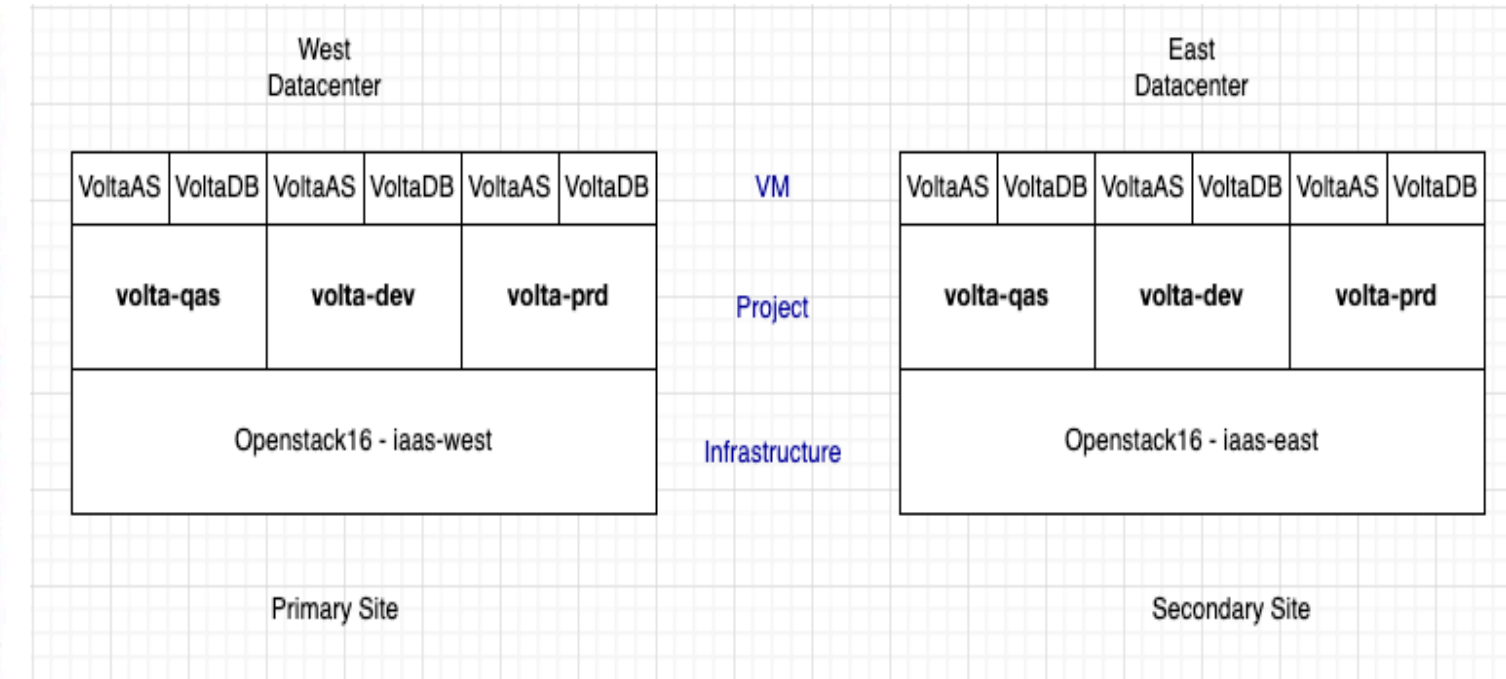
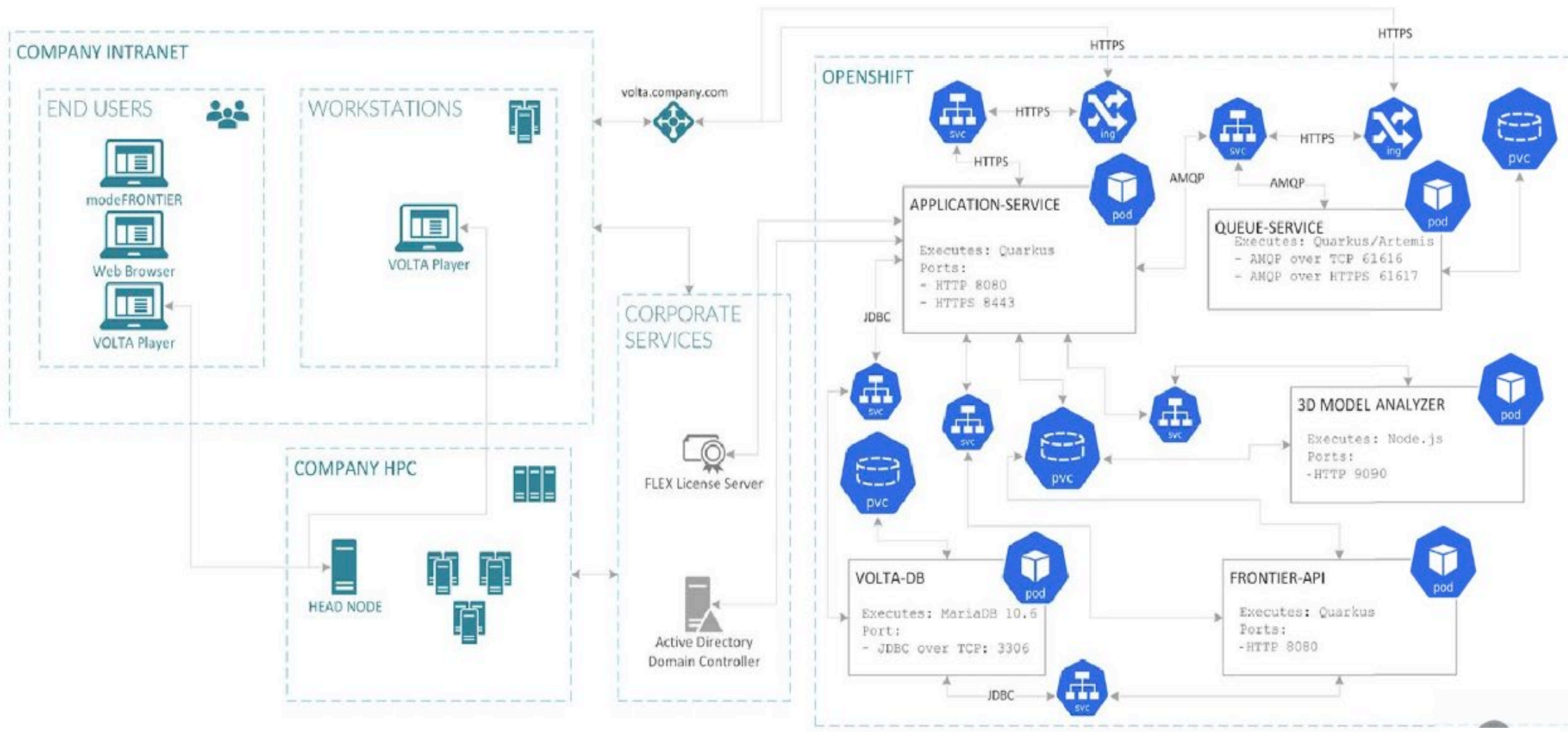
Continuous Limited Scope Disaster Recovery – aka Chaos Experiments that can improve resiliency

Digital Thread/Digital Twin – Cradle to Grave





VOLTA Cloud Deployment



VOLTA Portable (Player)
 - VOLTA 2023R1

VOLTA Server Container
 - VOLTA 2023R1





Automation Vision

Vision: ability to continuously deliver common, software-defined capabilities that support autonomous operations to realize rapid time to value, resiliency and differentiation for the business.



Mission: evolve the business and technology models to support implementation of a well-architected automation framework that delivers software-defined capabilities. establish modular technology building blocks that are orchestrated and automated and that can be assembled in various configurations to quickly support business requirements and production operations.



- api-driven and software-defined
- leverage existing knowledge and assets
- well-defined building blocks and modules
- autonomous self-healing operations (HA/DR)
- distributed configuration management

- enterprise collaboration
- infrastructure as code / solution automation
- inner-source community development
- standard tools, platforms and processes
- agile, devops, gitops



Collaboration Accelerates Value

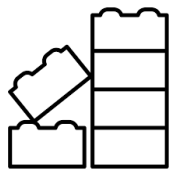




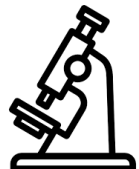
Automation Strategy



Agile



Modular

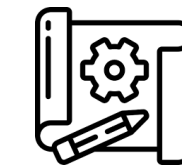


Validated



Prioritized

1. Establish automation vision, scope, concept and objectives
2. Identify, assess and catalog existing automation assets
3. Define automation standards, guardrails and governance
4. Define automation architecture and building blocks
5. Establish automation **testbed** and validate concepts
6. Define use cases, blueprints and best practices
7. Execute pilots and early adopters
8. Develop automated, resilient production capabilities



Standardized



Supportable



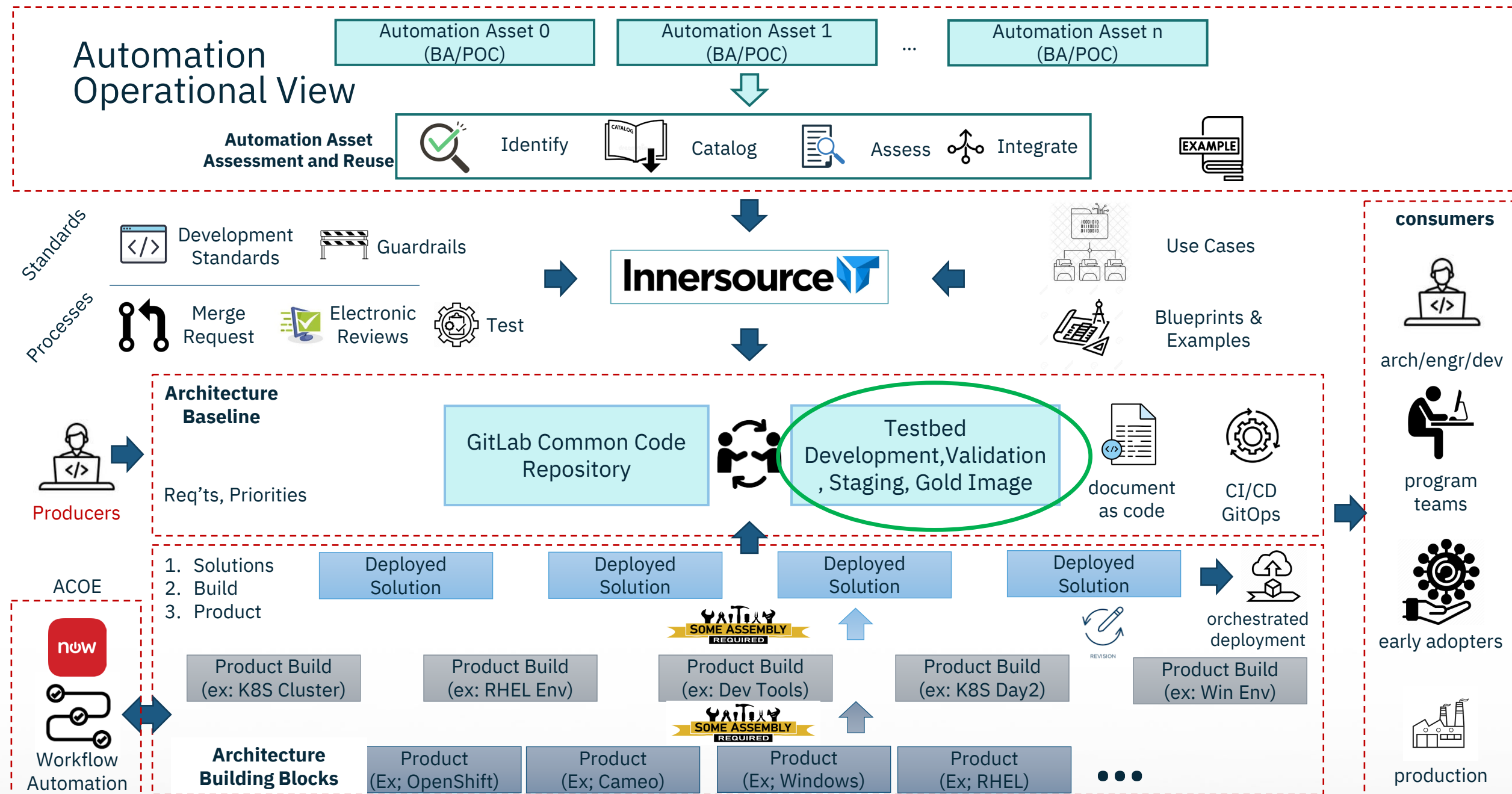
Applicable



Repeatable

Leverage Existing Automation Assets, Standards, and Collaboration







ACTION Testbed/Staging Product Concept

BLUF – “**Design for Classified**”, will require focused attention on enabling capabilities and FSE/FSD/SRE/Cyber skills that benefit the business (mentoring, training, execution – crawl, walk, run)

Space **Advanced Classified Capabilities, Test, Integration** and **Operations Network**

- Offer IT and Cyber guardrails (highly opinionated DevSecOps) and levels of expertise, but otherwise open the door for customers to kick the tires on various aspects of the tech stack (IaC and 100% automated - desired).
- Facilitate quick turnaround standup, adaptation, and tear-down of resources to save cost and time where possible – classified Lines of Business unique requirements.
- Also onboard personnel to Full Stack Principles (DevSecOps) - similar to other rotational process pioneered in xSolutions.
- Partner with 1LMX Classified IT Infrastructure Transformation (CAT/COT) and our internal Automation team to support development, testing and common staging for classified





ACTION Organizational Model

FSE Classified Product Enablement and Integration

Focus on **FSE/FSD/SRE/Cyber** for both **Classified** and **Unclassified** A&E

- Possess experience and expertise to bridge that gap
- Bring needed **parity** between the two domains while connecting architectures, platforms and applications that align to the needs of the business “Ahead of Ready” with a “Design for Classified” focus
- **Fail-fast**, then triage a workable solution (xSolutions - 30 days)

Establish ACTION and Integration COE, partner with 1LMX and all LM Business Areas, collaborate and produce positive results





VOLTA Player Containerization at Scale Project

Project description: Collaboration between Lockheed Martin Space, ESTECO, and Purdue University to explore containerization at scale of the VOLTA Player with Kubernetes. It also explores the cost/benefit trade-off of leveraging elastic cloud resources versus HPC to perform MDO analysis and exposes learners to the foundational principles of Full Stack Engineering, DevSecOps, and the ability of IT to partner with the Business to solve real-world Engineering challenges.

Keywords: Kubernetes, elasticity, high-performance compute, scalability

Tools/Skills that will be used/learned: Azure, AWS, containerization, orchestration platforms

Citizenship status: US Citizens and permanent residents required

Relevant information:

- <https://www.esteco.com/>
- https://engineering.esteco.com/volta/?_ga=2.141143090.148993064.1679593552-876850635.1653395907





VOLTA Player Containerization at Scale Project - Challenge

Is **containerizing** the VOLTA player a viable technical option?

Will containerizing VOLTA player (versus a virtual machine deployment) result in an ability of Model Based Enterprise (MBE) resources (and potentially others) to be delivered in a more infra/platform **decoupled** manner, thereby offering program **flexibility**?

Is there a **cost/benefit** of deploying VOLTA player in an orchestration environment backed with elastic cloud resources **versus** High Performance Compute (HPC) to perform multi-discipline optimization (MDO) analysis?

Will containerizing VOLTA player result in **savings** to the business, both in **cost of IT resources** (personnel, infrastructure, platforms – complexity of solution, Day2 ProdOps), as well as **time** to deliver a solution?





VOLTA Player Containerization at Scale Project - Goals

Deploy a **completely containerized** ESTECO VOLTA solution (VOLTA Server and VOLTA players) to an Orchestration (Kubernetes/OpenShift) Platform (leveraging any aspects of automation, DevSecOps/GitOps is a bonus).

- GitOps/DevSecOps consists of container/code scans, CI/CD pipelines, etc

Integrate GPU-based Infrastructure as part of the Orchestration Platform.

- Deploy VOLTA player as a container leveraging the CPU and GPU-backed nodes and determine whether there are any **performance gains** in doing so.

Identify a representative **MDO workflow** that can be utilized for these comparison experiments.

Deploy VOLTA player on **HPC** and connect to VOLTA Server running on an Orchestration Platform.

Compare, and contrast performance and capacity characteristics as well as pertinent **non-functional requirements** and characteristics when choosing an Orchestration Platform with that of VOLTA Player running on an HPC environment.

Compare, and contrast cost, schedule, and pertinent **functional requirements** when choosing an Orchestration Platform running in a cloud provider with that of VOLTA Player running on an HPC environment.

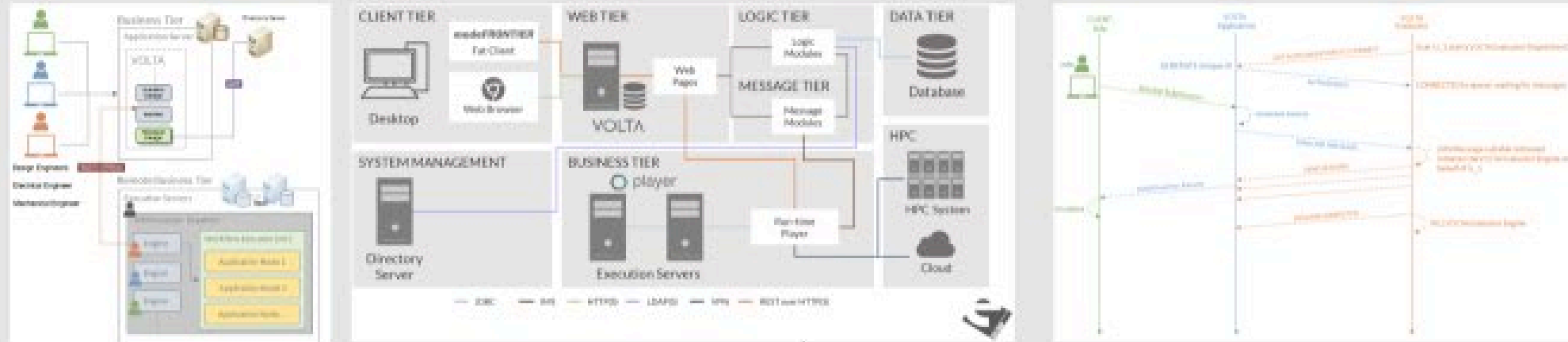
Identify programmatic characteristics and additional factors that may impact the results of the experiments such as Capital versus Expense outlays, **technical expertise** required, **day 2 Ops**, functional and/or non-functional requirements that need to be documented and considered as part of the **decision-making** process.



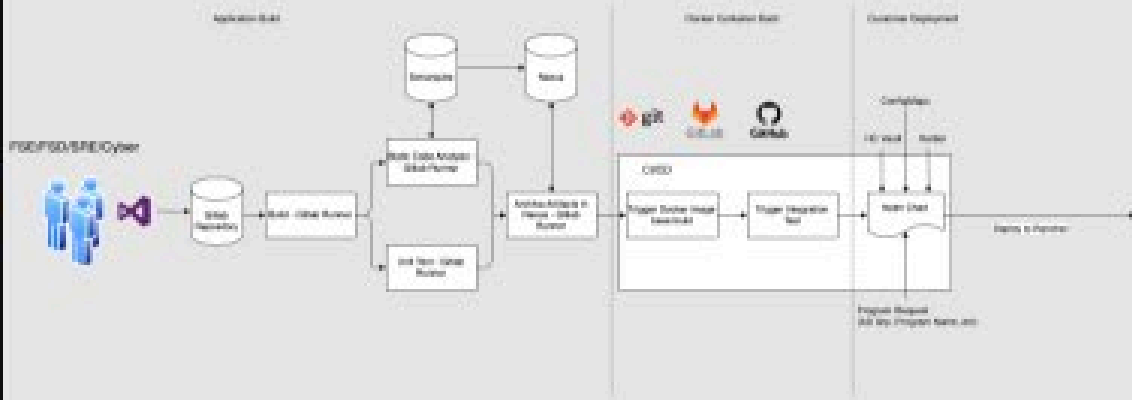


Project Architecture

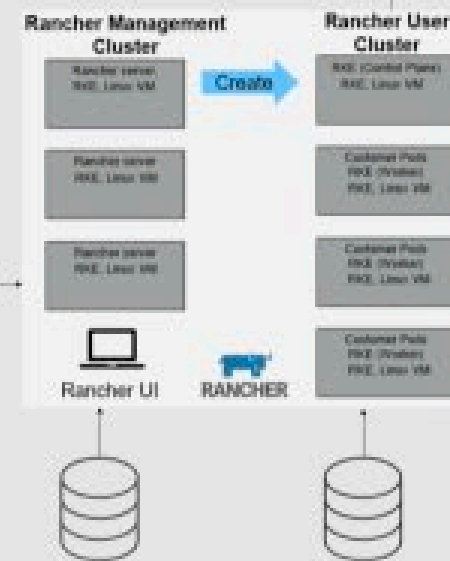
Functional Architecture



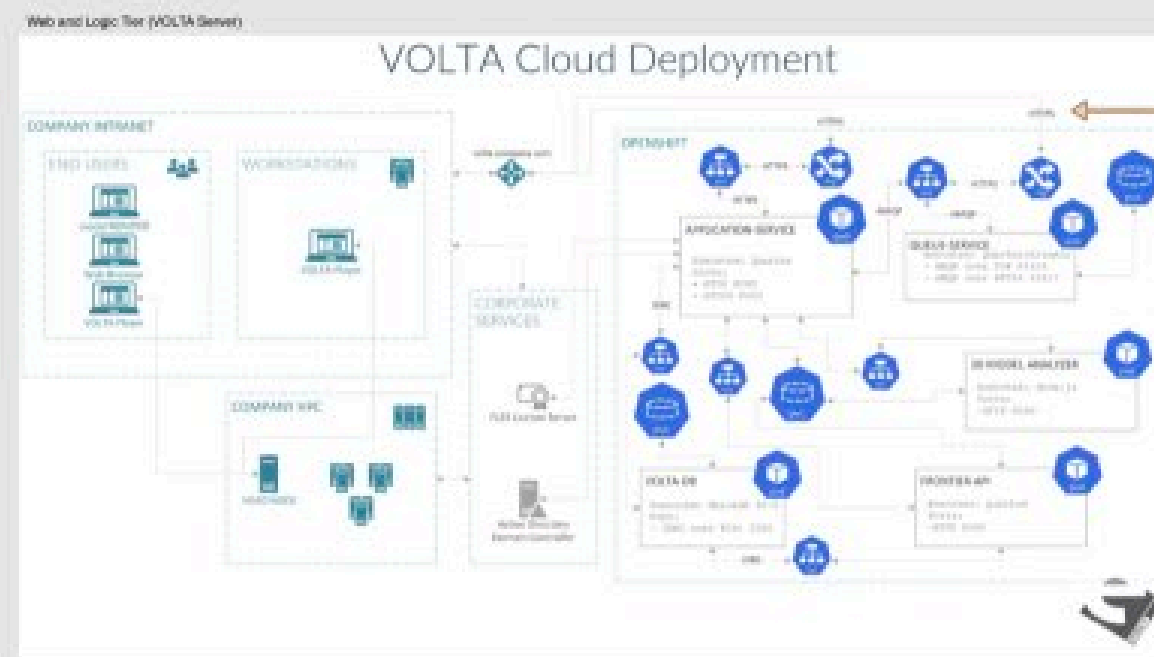
Sample Purdue Environment



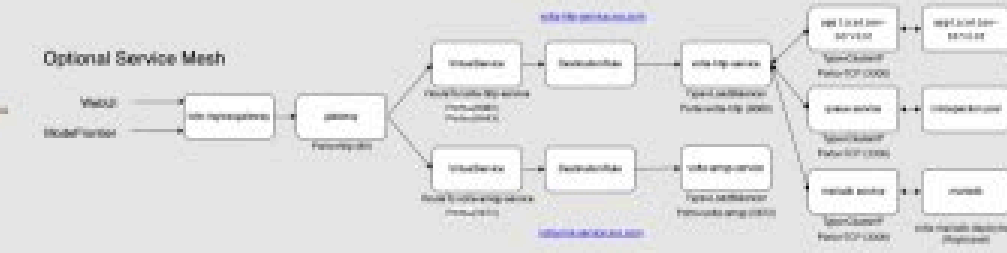
Existing Purdue Environment



ESTECO Deployment Architecture



Optional Service Mesh



Business Tier (VOLTA Player)





ACTION – Next Steps (Part 3?)

- Work with ESTECO to productionalize volta-player as a OCI container
 - Simplify, decouple, and run anywhere
- Finalize LM-ESTECO-Purdue project – communicate results
- Evaluate volta-player running in AWS Parallel Cluster Service
 - Evolution of Purdue effort and focus on commodity hardware
- Evaluate newest ESTECO VOLTA S/W Pre-Release – Functional/NF
- Automate, Automate, Automate!



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Transformation





Contact Info

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