

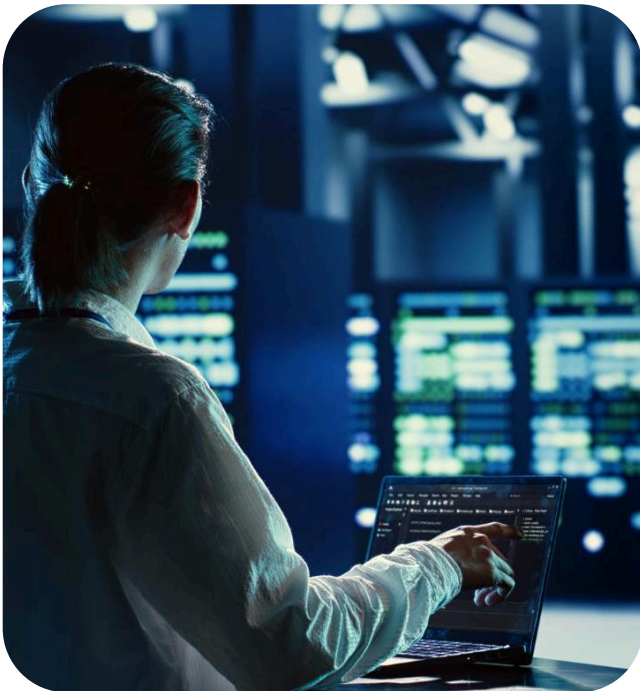
Automated Infrastructure and Compliance-Ready Deployment for Azure Government Cloud

Engineering a custom Python and Bicep automation framework to migrate mission-critical edge AI workloads to a secure, FedRAMP-compliant government environment.

Overview

We engineered a modular automation toolchain—Infra-Deployer and Service-Deployer—using Python, Azure Bicep, and Helm to facilitate seamless Government Cloud migration.

- Achieved full compliance with FedRAMP High, ITAR, and DoD IL5 standards, enabling the client to secure high-value contracts with US federal agencies.
- Reduced manual configuration overhead by 70% and accelerated AKS cluster setup time from several days to just a few hours.



Client Profile

Operating at the frontier of edge computing, this US-based startup delivers a full-stack platform uniting connectivity, compute, and AI. Their technology is specifically designed to operate in rugged, remote, or connectivity-challenged environments where real-time data generation is critical.

Challenges: Regulatory Rigor and Tooling Gaps

Expanding from commercial to government cloud presented significant technical and compliance-related hurdles.

- **Compliance Restrictions:** Standard CI/CD workflows like GitHub Actions were non-compliant, requiring a completely new, isolated deployment mechanism.
- **Manual Bottlenecks:** Managing Helm values, RBAC roles, and secrets for 40+ applications manually led to high error rates and operational lag.

- **Service Parity Issues:** Re-engineering was required to support Azure Government Cloud endpoints and specific service limitations not found in commercial regions.
- **Security Mandates:** Strict requirements for complete network isolation and centralized secrets management without plaintext exposure.

QBurst Solution: Modular Automation Framework

We partnered with the client to implement an extensible Python-based framework that automates the entire lifecycle of infrastructure and Kubernetes services. The solution effectively eliminated manual YAML maintenance by using Jinja2 templates to dynamically generate environment-specific configurations.

The Framework Consists of Two Core Engines:

- **Infra-Deployer:** A Dockerized engine using Azure Bicep and Python to provision core networking, resource groups, and AKS clusters. It applies compliance-driven policies and validations automatically during the provisioning phase.
- **Service-Deployer:** A Kubernetes lifecycle management framework that integrates Helm, Istio, and HashiCorp Vault. It dynamically generates RBAC roles and policies, ensuring secure service mesh operations across more than 40 applications.

Key Features and Technical Highlights

- **Automated Configuration:** Reduced manual YAML maintenance by 70% through dynamic Bicep and Helm value generation.
- **Centralized Secrets Management:** Integrated Azure Key Vault (Gov) and HashiCorp Vault with AES/GCM encryption, reducing security breach risks by 100%.
- **One-Click Rollbacks:** Automated Helm-based operations with built-in atomic updates, reducing potential service downtime by over 90%.

- **Cloud-Native Integration:** Leveraged native Azure CLI and Bicep to reduce reliance on third-party tools, saving an estimated 15–20% in annual licensing costs.

Implementation Approach

The solution follows a "Learning and Detecting" methodology. By using statistical data mining to create empirical profiles, the system detects subtle changes in system behavior weeks before a manual inspection would. This provides the maintenance and procurement teams with more time for corrective action planning.

Impact

- **Zero-Downtime Migration:** Successfully transitioned over 40 mission-critical applications to Azure Government Cloud with no critical service interruptions.
- **Operational Velocity:** Shortened deployment cycles by up to 60%, allowing for rapid onboarding of new government services.
- **80% Error Reduction:** Eliminated manual tasks in RBAC and policy setup, significantly improving system reliability and audit readiness.
- **Market Advantage:** Established a sustainable, audit-ready framework that allows the client to confidently scale within highly regulated US government sectors.