National Federated Compute Services NetworkPlus

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Evaluation of Secure Federated Kubernetes Storage for Trusted Research Environments

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This project will explore and evaluate a federated, secure storage solution, enabling researchers to make use of national research infrastructure without losing control of their own security boundaries.

Key Objectives

- Exploration and Evaluation of automated encryption solutions for Kubernetes block storage in TREs, utilising technologies such as Linux Unified Key Setup (LUKS), HashiCorp Vault.

- Evaluate federated key ownership solutions, ensuring each institution maintains exclusive control over its encryption keys

- Evaluate compliance, auditability, and operational security frameworks for encrypted storage, aligning with data security standards such as ISO27001, CAF, SATRE

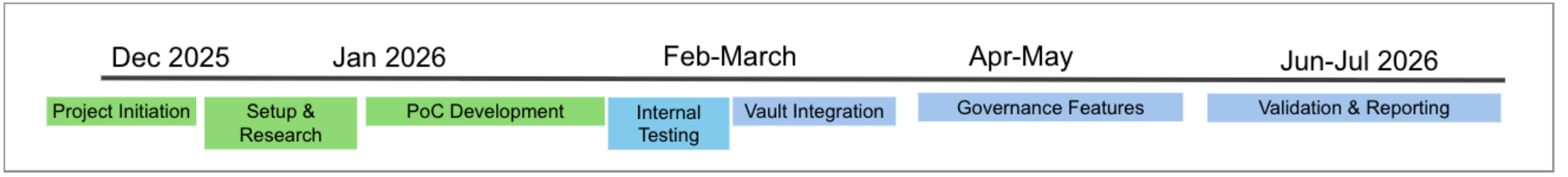
- Drive adoption and knowledge transfer through open-source deliverables with the wider TRE community.

Technical Evaluation and Implementation

- Technologies: Python (Kopf), LUKS/dm-crypt, Kubernetes, CSI, HashiCorp Vault, OpenBao, OpenStack Cinder
- CRD & Operator: Custom Resource triggers orchestration of volume encryption
- Vault Integration: Keys securely generated, stored and retrieved per-volume.

Status and road map

- Prototype Operator developed using the Kopf farmwork to automate block cinder storage.
- Successfully integrated with OpenStack Cinder CSI for dynamic encryption of volumes.
- Custom Resource Definitions (CRDs) designed to declaratively trigger encrypted volume creation via kubectl workflows.
- Operator orchestrates LUKS encryption on the worker nodes ensuring volumes are securely mapped and formatted before use.
- Initial tests confirm encrypted volumes are mounted and usable by pods with no input from users.
- Vault integration with key management is planned for next phase.



Key Benefits and Impact

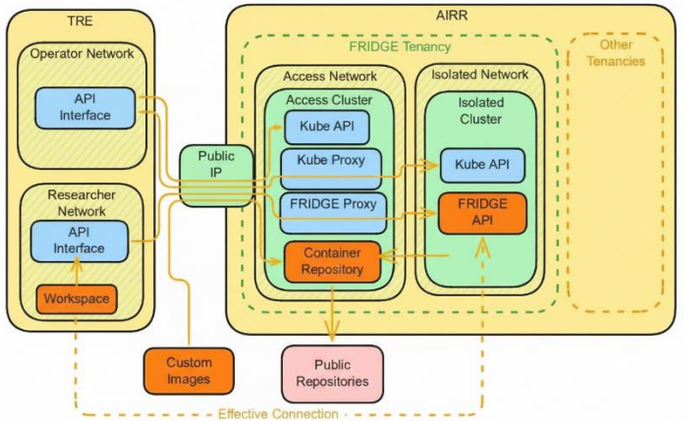
- Transparent and seamless for users and researchers
- Aligned with ISO27001, CAF and SATRE guidance and standards
- Policy enforcement and encrypt volume by default
- TRE operators manage encryption keys
- Suitable for national TRE federation

Use cases

- Federated Research Infrastructure by Data Governance Extension (FRIDGE)
- Pharos AI project – accelerate AI powered cancer care

PharosAI

FRIDGE
A DARE UK PROJECT



UK TRE

Project team

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