DevOps Secrets Management

```yaml
apiVersion: scale/v18
kind: Bio
metadata:
  name: murriel
  labels:
    job: devops
    job: cloud
spec:
  containers:
    - name: orion
      image: russianblue
      command: ["cat"]
spec:
  replicas: 3
    hobbies:
       - name: making
       - name: gardening
       - name: community
```

tell me....

can your systems

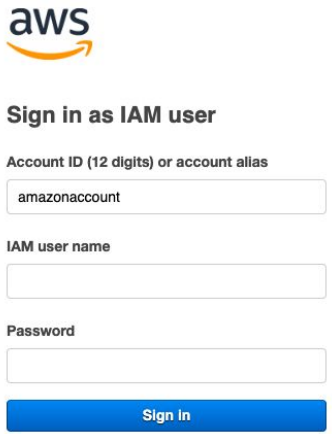
keep a secret?

share a secret?

what are secrets?

personal and team secrets

- Passwords / Passphrases
- Cloud Provider Logins
- Service Provider (SaaS) Logins
- SSH Keys
- Certificates
- Kubeconfigs
- DB Credentials
- App Dashboards and Login



not focusing on email passwords, computer logins, etc managed by IT

system* secrets

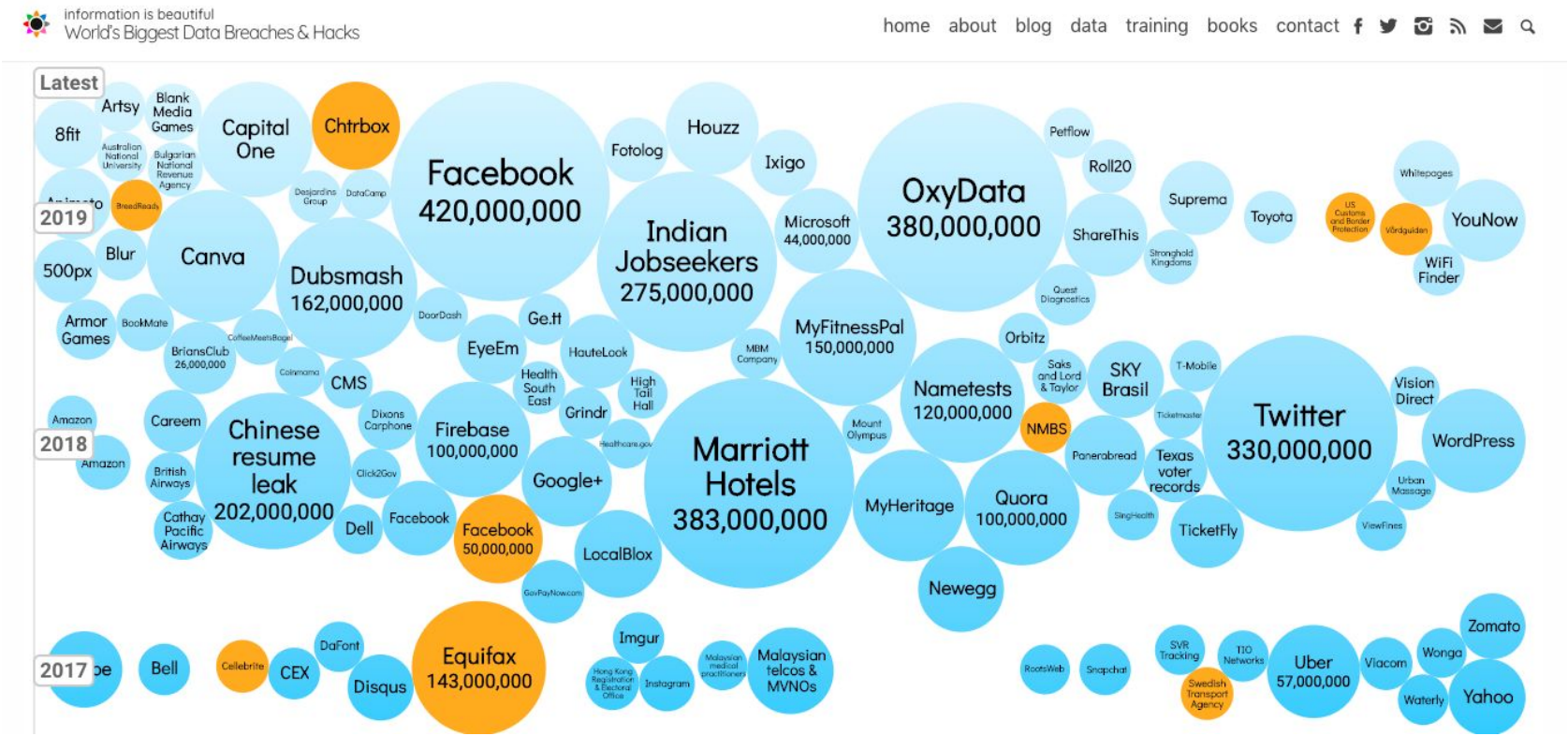
- API Keys
- Certificates
- DB Credentials
- Encryption Keys
- Tokens
- SSH Keys
- System-to-System Authentication Secrets

Systems like...

Servers
Microservices
Serverless functions
Web application
Mobile App
On Premise App
IoT Device Firmware
Other machines

why is this important?

cost of breaches



https://www.informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/

vectors for compromise

- Credentials in Git
- Inadvertently published secrets
  - Artifacts
  - Machine or Container Images
  - Compiled binaries
- Exposed S3 buckets
- Ex-Employees
- Internal unauthorized access
- Unauthorized password use
  - Weak passwords cracked
  - Shared/reused passwords
- Social engineering
- Network sniffing
  - Tokens/Creds sent unencrypted
- Reverse engineering

let’s dream


I THOUGHT OUR SYSTEMS WERE SECURE
I COMMITTED OUR ROOT CREDS TO GITHUB

reality

- Decentralized infrastructure
- Decentralized ownership
- Hybrid Environments
- Inconsistent process and tools
- Path of least resistance
- Legacy code and systems
- Deadlines
- Secret Sprawl
  https://www.hashicorp.com/resources/what-is-secret-sprawl-why-is-it-harmful

anti-patterns

hard-coded secrets

changing history is hard

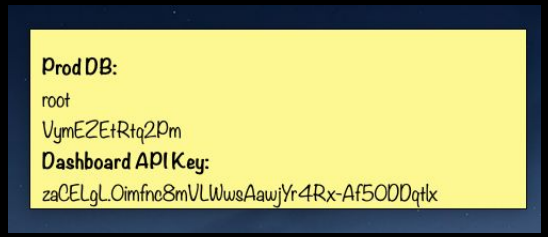
- Secrets in git
  - Application Code
  - Config files
  - Terraform
  - Config Management Files
  - Kubernetes configs
- Secrets in images
  - Machine images
  - Docker/container images
- Plaintext secrets

shared/re-used credentials

- Shared SSH keys
  - *“Can someone Slack me the devops-prod.pem key?”*
- Using master keys or root users
  - Cloud accounts
  - db users
- Creds re-used across environments
  - Dev and Prod share API keys
- Shared kubeconfigs or client certs
- “Default” passwords
- No auth (mongo, elastic, redis...)

insecure sharing methods

- Messaging passwords over chat
- Emailing passwords
- Passwords written publicly
- Passworded Excel sheets
- Passwords in command history
- Passwords saved where they shouldn’t be




```
  503  history
  504  mysql -u root -h db.catschasingdogs.com -pSoTotallySecure
  505  history
bash-3.2$
```

ssh key problems

- Shared keys
- Cloud provider generated keys
- Keys embedded in images
- Jump Box that has ALL the keys
- Key Management
  - Managing personal keys
  - Managing system keys
  - Personal keys as machine keys
  - Global access to machine keys
  - No rotation when employees leave

how can* my systems and i keep secrets?

can and not ***should***

process

plus tools

multi

~~two~~-factor

authentication

we have questions.

where are your secrets?

how to identify secrets?

where are these secrets stored?

when do we need to access them?

how do we update our secrets?

how to revoke secrets?

how is accessing these secrets?

systems for secrets

considerations

- Laws and regulations
- Internal policies and process
- Technical limitations
- Access requirements
- Resources
- Budget

useful considerations

- Human and Infrastructure Resources
  - Team bandwidth and expertise
  - Maintenance overhead
  - Existing tools
  - Buy, build, pay someone to build, or some combination
- (High) Availability and Disaster Recovery
  - Airgapped or segmented networks
  - VPN needed
  - Inter-dependent systems and points of failure
  - Centralization vs distributed
  - Footprint

useful considerations

- AAA: Authentication, Authorization and Accounting
  - Role-Based Access Control (RBAC)
  - Access management
  - Auditing
  - Principle of least privilege
- Updates and Versioning
- Open Source Tools: Maintenance and Updates
- Backups
- Encryption: in rest and in transit
- Ease of use and ease of deployment
- Automation

managing secrets

- Password Managers
- Secrets Storage
  - Jenkins Credentials, Rundeck Secrets, Kubernetes Secrets, Docker Secrets
  - Config Management Secrets
- Secrets Management Tools
- Cloud Provider Secrets

password managers

- KeePass (open source)
  - KeePass, KeePassXC, ~~KeePassX~~
- LastPass
- 1Password
- Dashlane
- Keeper
- Password Safe
- Roboform

secret storage

kubernetes

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: mysecret
type: Opaque
stringData:
  config.yaml: |-
    apiUrl: "https://my.api.com/api/v1"
    username: {{username}}
    password: {{password}}
```

- Secrets API object
- Separate secrets from configmaps, pod definitions, image
- Base 64 **encoded** not encrypted
- Encrypted in etcd
- Accessible with cluster access*
- Role-based control
- https://github.com/bitnami-labs/sealed-secrets
- Helm Secrets
- Kamus

https://kubernetes.io/docs/concepts/configuration/secret/#risks

pipeline

Jenkins Secrets

- Credentials plugin
- https://github.com/jenkinsci/hashicorp-vault-pipeline-plugin

Rundeck Secrets

Travis CI Secrets

encrypted git

encrypt secrets before commiting

- git-crypt
- git-secret
- keybase
- StackExchange BlackBox
- LockGit

github secrets

Code | Issues 0 | Pull requests 0 | Actions | Projects 0 | Security | Insights | Settings

- Options
- Manage access
- Branches
- Webhooks
- Notifications
- Integrations & services
- Deploy keys
- **Secrets**
- Actions

Secrets

Secrets are environment variables that are **encrypted** and only exposed to selected actions. Anyone with **collaborator** access to this repository can use these secrets in a workflow.

Secrets are not passed to workflows that are triggered by a pull request from a fork. Learn more.

secret_cat — Remove

Add a new secret

Name

YOUR_SECRET_NAME

Value

ALSO: https://github.com/apps/secret-audit

config management

Ansible Vault

Saltstack Pillars

Chef Vault

Puppet - hiera-yaml and hiera-gpg

secret management

stackshare

Vault

Secrets Management

+ Follow

Stacks
320

I Use This

- 12 Secure
- 8 Very easy to set up and use
- 8 Dynamic secret generation

AWS Secrets Manager

Secrets Management

+ Follow

Stacks
34

I Use This

- 0 Managed Service

Docker Secrets

Secrets Management

+ Follow

Stacks
29

I Use This

- 2 Secure
- 2 Multi-Host aware

Keywhiz

Secrets Management

+ Follow

Stacks
10

I Use This

- 1 Fuse FS

Torus CLI

Secrets Management

+ Follow

Stacks
8

I Use This

Learn more

generic secrets management pipeline

- Substitute secret with a parameter
- Secret is injected
  - at build time
  - at deploy time
  - dynamically at run-time
- Encryption at rest and in transit
  - *Depending on when they are injected they may live unencrypted somewhere*
- Determine threat model and access requirements
- Varies depending on type of application
- Sufficient encryption/obfuscation required for secrets embedded in shipped software

open source

- Hashicorp Vault
  - Open Source
  - Enterprise
- SecretsHub
- Mozilla SOPS
- Torus
- CyberArk Conjur
- Square Keywhiz
- Lyft Confidant
- Pinterest Knox

Closed Source / SaaS

- BeyondTrust
  - Password Safe
  - Cloud Vault
  - DevOps Secrets Safe
- Thycotic
  - Secret Server
  - DevOps Secrets Vault
- CryptoMove Key Vault

hashicorp vault

- robust
- rotation and expiration
- integrations
- community support
- documentation
- professional services

- management complexity
- production requires consul and clustering and approles and policies and integrations and configuration and...

Notes on Vault Implementations

- AppRoles and Policies + Rotation and Expiration considerations
- Kubernetes Vault operators
  - https://github.com/coreos/vault-operator
  - https://github.com/banzaicloud/bank-vaults
- Jenkins plugins
- API-driven
- Many integrations with config management or other systems
- https://github.com/bruj0/vault_jenkins
- https://www.hashicorp.com/resources/how-to-share-secrets-pipeline

cloud providers

amazon web services

- Secrets Manager
- Key Management System (KMS)
- Amazon Certificate Manager
- Security Token Service (STS)

google cloud

- Secret Manager
  - New! (Beta Release)
- Cloud Key Management System
- Berglas

microsoft azure

Azure Key Vault

- Secrets Management
- Certificate Management
- Key Management

https://letsencrypt.org/
https://certbot.eff.org/

addressing anti-patterns

fixing hard-coded secrets*

Fixing Committed Secrets

- https://securitytrails.com/blog/github-dorks
- https://github.com/awslabs/git-secrets
- https://github.com/dxa4481/truffleHog
- https://github.com/awslabs/git-secrets

Clean Up Repos

- git-filter-branch https://help.github.com/en/github/authenticating-to-github/removing-sensitive-data-from-a-repository
- BFG Repo Cleaner https://rtyley.github.io/bfg-repo-cleaner/

Rotate Published Creds

Testing

Refactor

fixing shared credentials

Implement RBAC where possible

Databases:

- tiered creds
- root, read only, read-write

Evaluate scope

- some secrets should be “shared team” secrets
- user license limitations

Refactor

fixing insecure communications

- define securer* communications channels
- enforce first-time reset if possible
- use your password manager
- encrypt and send
- secure shared location

ssh key solutions

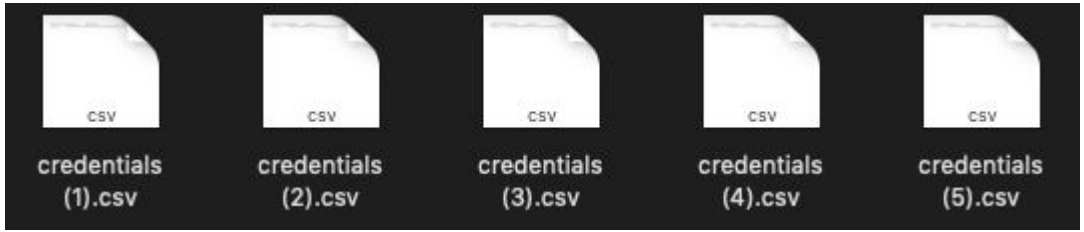
- methods for rotation
- store / manage public keys
- config management
- audit images
- audit auto-generated keys
- use a secret manager/vault
- remove keys when not needed
  - employee leaves
  - access no longer needed
- limit shared keys, or access to shared keys

personal and team strategies

- audit local workstation or shared systems/filesystems
- limit password re-use or password sharing
- use a password manager
- use temporary / time-limited tokens*
- avoid root users/accounts
- USE MULTI-FACTOR

personal and team policies

- awareness of secrets (visibility)
- secure sharing methods
- limit access
- password policies
  - expiration (does not necessarily work)
  - complexity
- onboarding and offboarding
  - Remove access and secrets when people leave
- password storage policies
- secret storage



closing thoughts

- ★ knowable process
- ★ team buy-in and education
- ★ reduce barriers to usage
- ★ auditing, rotation, encryption
- ★ manage access to master keys
- ★ plaintext is bad
- ★ parameters and dynamic secrets
- ★ roles and least privilege
- ★ iterate, monitor, review

designing secure systems

- NIST 800-63B - Digital Identity Guidelines
  https://pages.nist.gov/800-63-3/sp800-63b.html
- Google Cloud - User Account Management
  https://cloud.google.com/blog/products/gcp/12-best-practices-for-user-account
- Kubernetes Security/Secrets
  https://github.com/kubernetes/community/blob/master/contributors/design-proposals/auth/secrets.md
- 12-factor patterns
  https://12factor.net/

resources & references

Secrets Management Articles

- https://www.hashicorp.com/resources/eliminating-secret-sprawl-in-the-cloud
- https://techbeacon.com/security/top-resources-cloud-native-secrets-management
- https://www.beyondtrust.com/resources/glossary/secrets-management
- https://dzone.com/articles/devops-and-the-proliferation-of-secrets
- https://techbeacon.com/security/top-resources-cloud-native-secrets-management
- https://blog.cryptomove.com/secrets-management-guide-approaches-open-source-tools-commercial-products-challenges-db560fd0584d
- https://www.hashicorp.com/resources/how-to-share-secrets-pipeline
- https://docs.cloudposse.com/secrets-management/anti-patterns/
- https://medium.com/slalom-technology/secret-management-architectures-finding-the-balance-between-security-and-complexity-9e56f2078e54
- https://www.praetorian.com/blog/secure-and-scalable-secret-management-in-the-cloud

resources & references

Cloud Providers

- https://cloud.google.com/blog/products/identity-security/introducing-google-clouds-secret-manager
- https://github.com/GoogleCloudPlatform/berglas
- https://aws.amazon.com/secrets-manager/
- https://azure.microsoft.com/en-us/services/key-vault

Config Management

- https://docs.ansible.com/ansible/latest/user_guide/vault.html
- https://docs.saltstack.com/en/latest/topics/tutorials/pillar.html
- https://github.com/voxpupuli/hiera-eyaml
- https://docs.chef.io/chef_vault

Password Management

- https://www.beyondtrust.com/blog/entry/top-15-password-management-best-practices
- https://hackernoon.com/we-reverse-engineered-16k-apps-heres-what-we-found-51bdf3b456bb#.io6e11q6n

share your secrets management

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