Deployment Strategies

CSSE6400

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- Branching Strategies

- Deployment Strategies
  - Recreate Deployment
  - Rolling Deployment
  - Blue/Green Deployment
  - Canary Deployment
  - A/B Deployment
  - Shadow Deployment

There isn't any one perfect deployment strategy.

> **Definition 0.** Branching
>
> Copying the trunk to allow separate and parallel development.

- Branches deviate from the trunk.
- A few different branching strategies.

Branching Strategies

- GitHub Flow

- GitLab Flow

- Release Branches

Branching strategies supporting deployment strategies.

GitHub Flow [Haddad, 2022]

- Main is always deployable
- Create branch
- Make changes
- Create pull request
- Resolve issues
- Merge pull request
- Delete branch

- CSSE3200 Feature Branches are a variant of this.
- Supports CI & CD.
- Expects there is a single deployable version (e.g. cloud / web systems).

GitLab Flow [Saavedra, 2023]

- Supports deployment windows
  - Merge to production
  - Deploy when allowed
- Production branch
  - Plus alpha, beta, …
- Still have
  - Feature branches
  - Pull requests

MASTER **PRODUCTION**
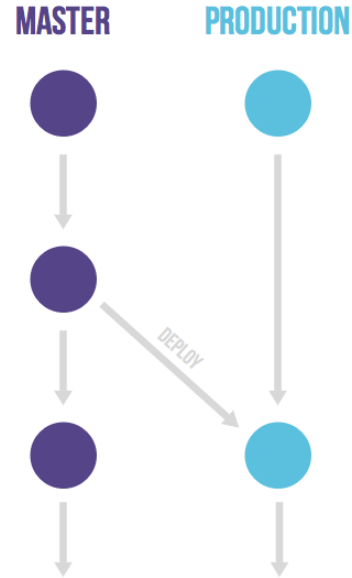
DEPLOY

- Deployment windows examples
  - App store approval
  - Server availability
  - Support availability

Release Branches[Saavedra, 2023]

- Supports multiple versions of system
- Feature development in main
- Released versions are branches
- Bug fixes in main
  - Cherry-pick into branches
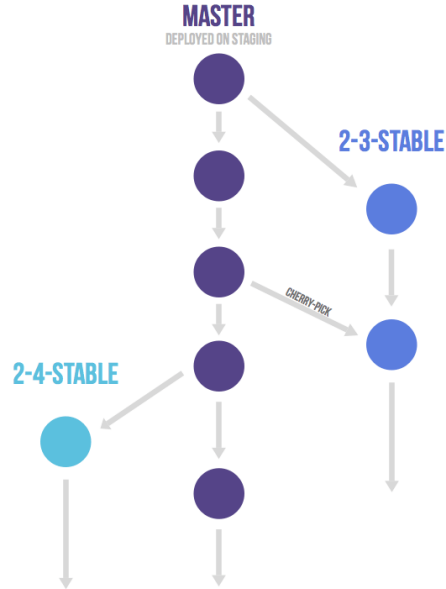
- Cherry-pick: commit is copied from one branch to another, but the branches aren't merged.

Definition 0. Deployment Strategy

How a software system is made available to clients.

Recreate Deployment [Tremel, 2017]

V1 **LB** **V2**

- Shutdown version 1.
- Deploy version 2.
- Requires downtime.

Recreate Deployment

Pros

- Easy
- Renewed state
  - App reinitialised
  - Persistent storage consistent with system version

Cons

- Downtime

Renewed state means app is reinitialised and db table structure is consistent with system version.

Rolling Deployment<superscript>[Tremel, 2017]</superscript>

- Slowly roll out new version.
- Pool of instances of **V1** behind load balancer.
- Deploy an instance of **V2**.
- Add **V2** instance to pool.
- Remove one **V1** instance from pool.
- Continue until **V2** is fully deployed, replacing **V1**.

Pros

- Fairly easy
- Slow release of new version
  - Observe issues
  - Rollback
- Stateful instances can finish gracefully
  - Instance is killed when inactive

Cons

- Time
- Support multiple APIs
- Support different versions of persistent data structure
- No control over traffic to different versions

Blue-Green Deployment[Tremel, 2017]

- **V2** deployed alongside **V1**, including same number of instances.
- **V2** tested in production environment.
- Load balancer switched to use **V2** instances
- Shutdown **V1** instances.

Blue-Green Deployment

Pros

- Instant release of new version
- Fast rollback if necessary
- Only one version 'live' at any time
  - No versioning conflicts

Cons

- Expensive
  - Double the infrastructure
- Stateful instance version switch difficult
  - Can't kill instance in middle of a transaction

Canary Deployment[Tremel, 2017]

- Gradually shift traffic from **V1** to **V2**.
- Traffic usually split by percent (e.g. 90/10, 80/20, ...).
- Allows a trial deployment to see what happens.

Canary Deployment

Pros

- New version released to subset of users
- Can monitor performance and error rates
- Easy and fast rollback

Cons

- Slow
- Implies poor testing

Canary is commonly used to see if something works or will fail in production.

A/B Deployment[Tremel, 2017]

- Actually it's A/B Testing.
- Both versions are deployed and usage evaluated, usually via analytics.
- Long Term: Deploy version that has best usage result.

A/B Deployment

Pros

- Multiple versions run in parallel
- Full control over traffic distribution

Cons

- Needs intelligent load balancer
- Debugging a version is difficult
  - Need good logs & tools

A/B testing & deployment requires sophisticated infrastructure and analytics to do well.

Shadow Deployment [Tremel, 2017]

- Complex to setup.
- **V2** deployed alongside **V1**.
- All traffic is sent to **V1** & **V2**.
- Tests **V2** ability to handle production load.
- Doesn't impact on production traffic or user experience.
- **V2** rolled out when it demonstrates it is stable.
- Need to manage interactions with external services (e.g. payment gateway).
- When customer checks out their shopping cart, you don't want to send two payment requests from **V1** & **V2**.
- Mock external services.
- Persistent data from **V1** (production data) needs to be copied to **V2** when it's deployed as production, with any data migration.

Shadow Deployment

Pros

- Performance testing with production traffic
- No impact on users

Cons

- Expensive
  - Double the infrastructure
- Complex to setup
  - Need mocks for external services

Performance testing may give false confidence.
  - It's not user testing.

- Staging or beta testing
  - Recreate or Rolling
- Production (Live)
  - Rolling or Blue/Green
- Uncertain of system stability
  - Canary
- Evaluation
  - A/B or Shadow

There isn't any one perfect deployment strategy.

Deployment Considerations [Tremel, 2017]

Strategy	ZERO DOWNTIME	REAL TRAFFIC TESTING	TARGETED USERS	CLOUD COST	ROLLBACK DURATION	NEGATIVE IMPACT ON USER	COMPLEXITY OF SETUP
RECREATE — version A is terminated then version B is rolled out	✗	✗	✗	■□□	■■■	■■■	□□□
RAMPED — version B is slowly rolled out and replacing version A	✓	✗	✗	■□□	■■■	■□□	■□□
BLUE/GREEN — version B is released alongside version A, then the traffic is switched to version B	✓	✗	✗	■■■	□□□	■■□	■■□
CANARY — version B is released to a subset of users, then proceed to a full rollout	✓	✓	✗	■□□	■□□	■□□	■■□
A/B TESTING — version B is released to a subset of users under specific condition	✓	✓	✓	■□□	■□□	■□□	■■■
SHADOW — version B receives real world traffic alongside version A and doesn't impact the response	✓	✓	✗	■■■	□□□	□□□	■■■

References

[Haddad, 2022] Haddad, R. (2022).
What are the best git branching strategies.
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`git-branching-strategies-in-2022/`.

[Saavedra, 2023] Saavedra, C. (2023).
Combine gitlab flow and gitlab duo for a workflow powerhouse.
`https://about.gitlab.com/blog/2023/07/27/gitlab-flow-duo/`.

[Tremel, 2017] Tremel, E. (2017).
Six strategies for application deployment.
`https://thenewstack.io/deployment-strategies/`.