

Deployment Strategies

CSSE6400

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Definition 1. Deployment Strategy

How a software system is made available to clients.

Deployment Strategies

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

There isn't any one perfect deployment strategy.

Definition 2. 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.

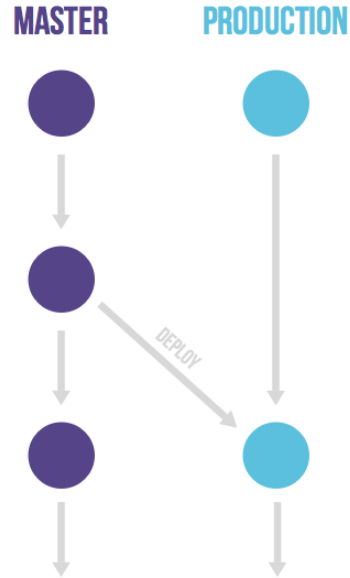
GitHub Flow *[Haddad, 2022]*

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



- Supports CI & CD.
- Expects there is a single deployable version (e.g. cloud / web systems).

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



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

Release Branches^[PRACE,]

- 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.

Recreate Deployment *[Tremel, 2017]*



- 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 *[Tremel, 2017]*



- 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.

Rolling Deployment

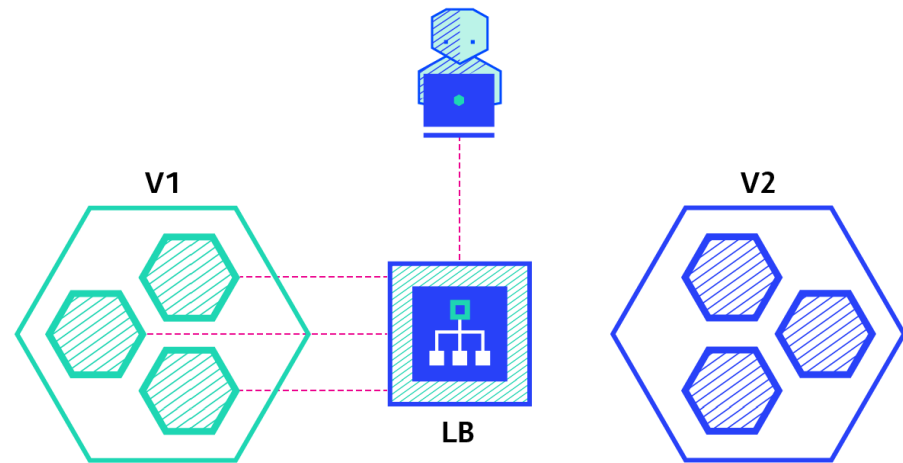
Pros

- 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.

Deployment Strategy Options

- 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 | ✓ | ✓ | ✗ | ■ ■ ■ | □ □ □ | □ □ □ | ■ ■ ■ |

References

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What are the best git branching strategies.

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[Tremel, 2017] Tremel, E. (2017).

Six strategies for application deployment.

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