

# 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.

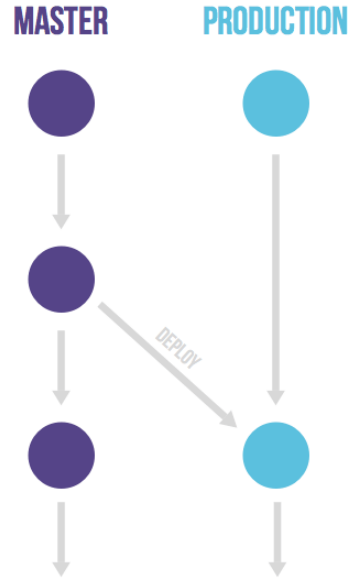
## GitHub Flow *[Haddad, 2022]*

- 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<sup>[PRACE, ]</sup>

- 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

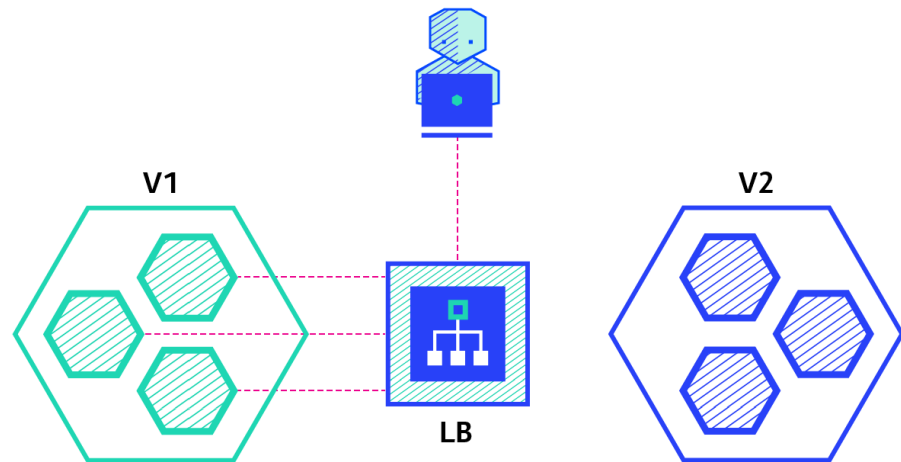
### Pros

- 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 <sup>[Tremel, 2017]</sup>



- 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
<b>RECREATE</b> version A is terminated then version B is rolled out	✗	✗	✗	■□□	■ ■ ■	■ ■ ■	□ □ □
<b>RAMPED</b> version B is slowly rolled out and replacing version A	✓	✗	✗	■□□	■ ■ ■	■ □ □	■ □ □
<b>BLUE/GREEN</b> version B is released alongside version A, then the traffic is switched to version B	✓	✗	✗	■ ■ ■	□ □ □	■ ■ □	■ ■ □
<b>CANARY</b> version B is released to a subset of users, then proceed to a full rollout	✓	✓	✗	■□□	■ □ □	■ □ □	■ ■ □
<b>A/B TESTING</b> version B is released to a subset of users under specific condition	✓	✓	✓	■□□	■ □ □	■ □ □	■ ■ ■
<b>SHADOW</b> version B receives real world traffic alongside version A and doesn't	✓	✓	✗	■ ■ ■	□ □ □	□ □ □	■ ■ ■

## References

[Haddad, 2022] Haddad, R. (2022).

What are the best git branching strategies.

<https://www.flagship.io/git-branching-strategies/>.

[PRACE, ] PRACE.

Introduction to gitlab flow.

[https://repository.prace-ri.eu/git/help/topics/gitlab\\_flow.md](https://repository.prace-ri.eu/git/help/topics/gitlab_flow.md).

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

Six strategies for application deployment.

<https://thenewstack.io/deployment-strategies/>.