Deployment Strategies

CSSE6400

Richard Thomas

May 11, 2026

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

- Branching strategies help manage development activities.
- Deployment strategies help manage releasing / deploying systems.

Definition 0. Branching

Copying the trunk to allow separate and parallel development.

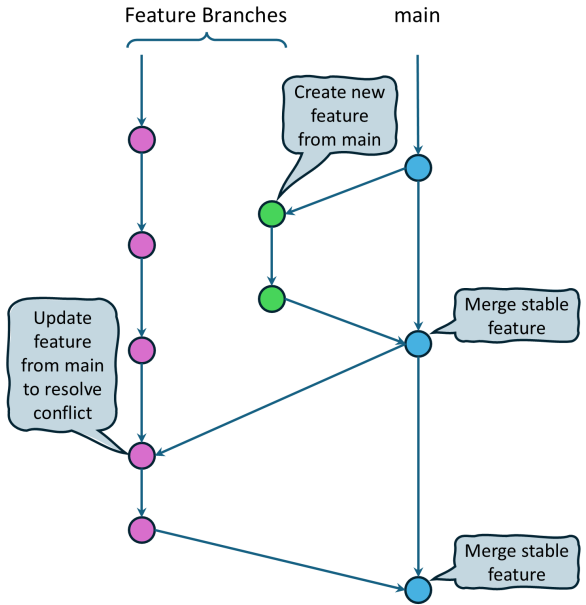
- Branches deviate from the trunk.
- We will look at a few different branching strategies.

- GitHub Flow
- GitLab Flow
- Release Branches

Branching strategies supporting deployment strategies.

GitHub Flow *[Haddad, 2022]*

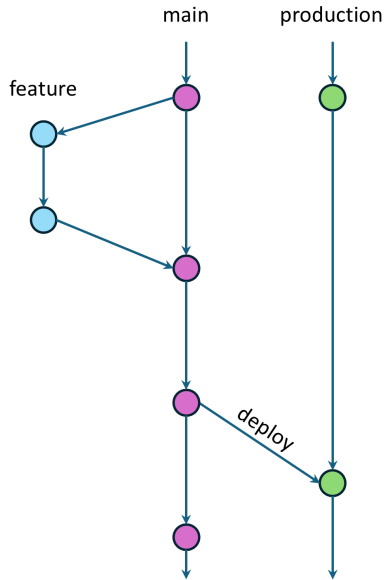
- Main is always *deployable*
- Create branch
- Make changes
- Create pull request
- Resolve issues
- Merge pull request
- Delete branch



- 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]*

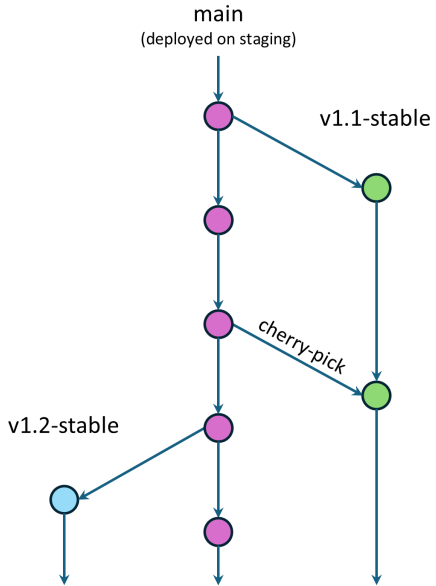
- Supports deployment *windows*
  - Merge to production
  - Deploy when allowed
- Production branch
  - Plus alpha, beta, . . .
- Still have
  - Feature branches
  - Pull requests



- 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

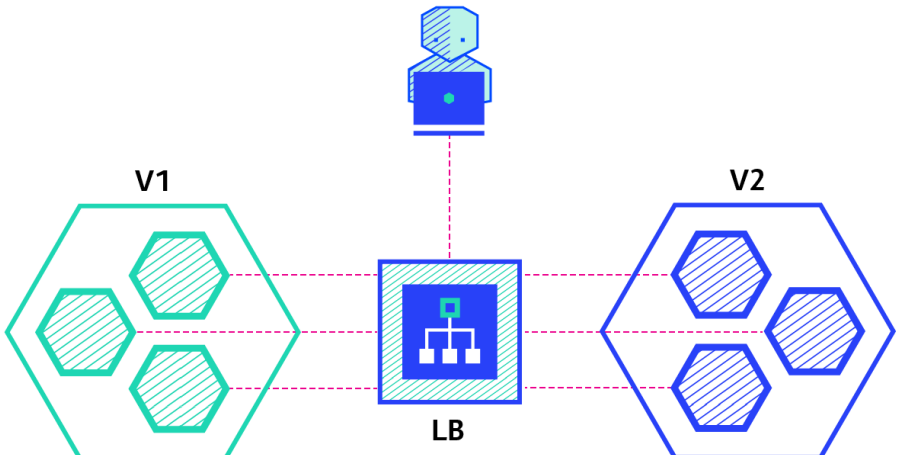


- Cherry-pick: commit is copied from one branch to another, but the branches aren't merged.

Definition 0. Deployment Strategy

How a software system is made available to clients.

Recreate Deployment *[Tremel, 2017]*



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

Recreate Deployment

Pros

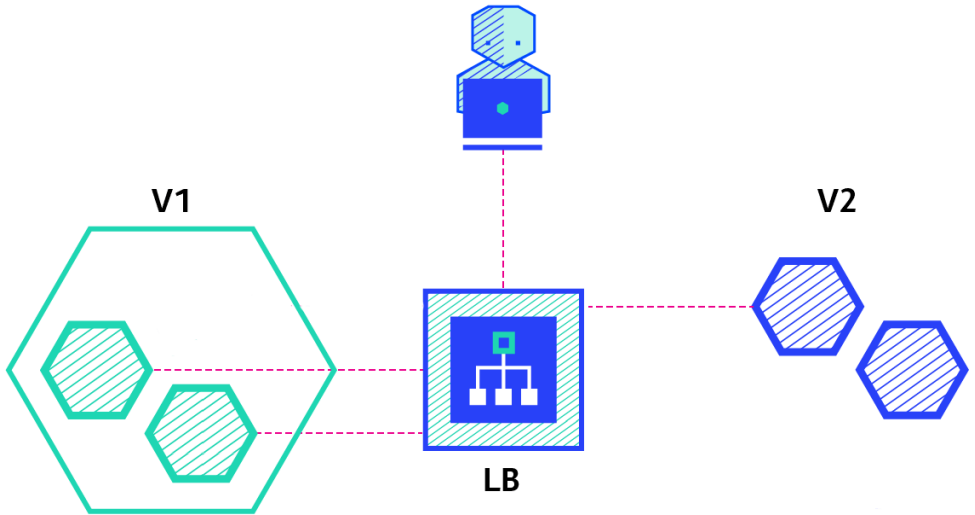
- Easy
- Renewed state
  - App reinitialised
  - Persistent storage consistent with system version

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

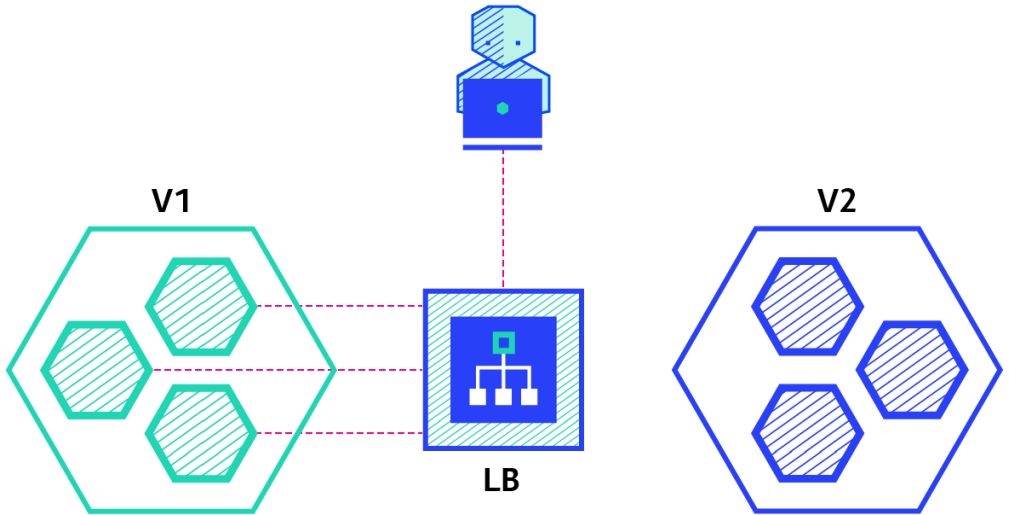
Pros

- 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.

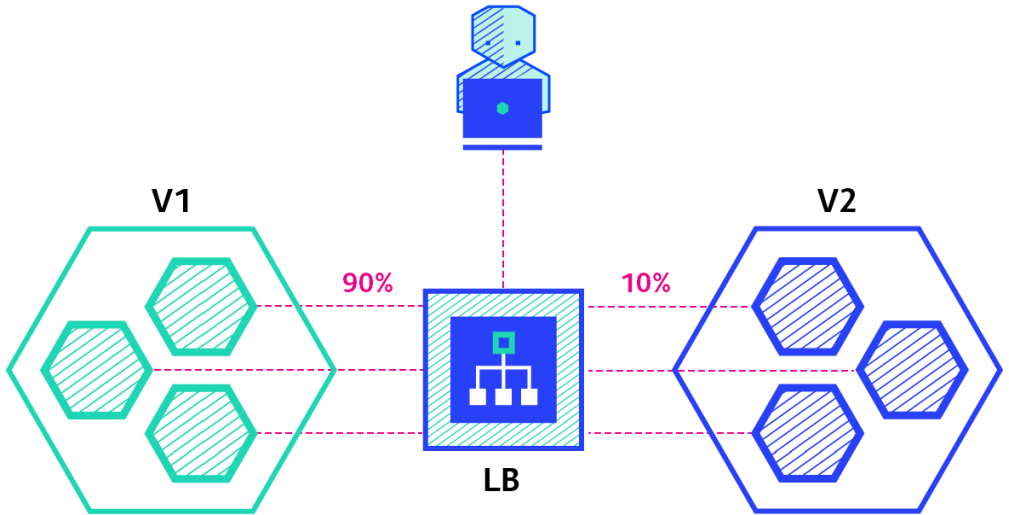
Pros

- 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

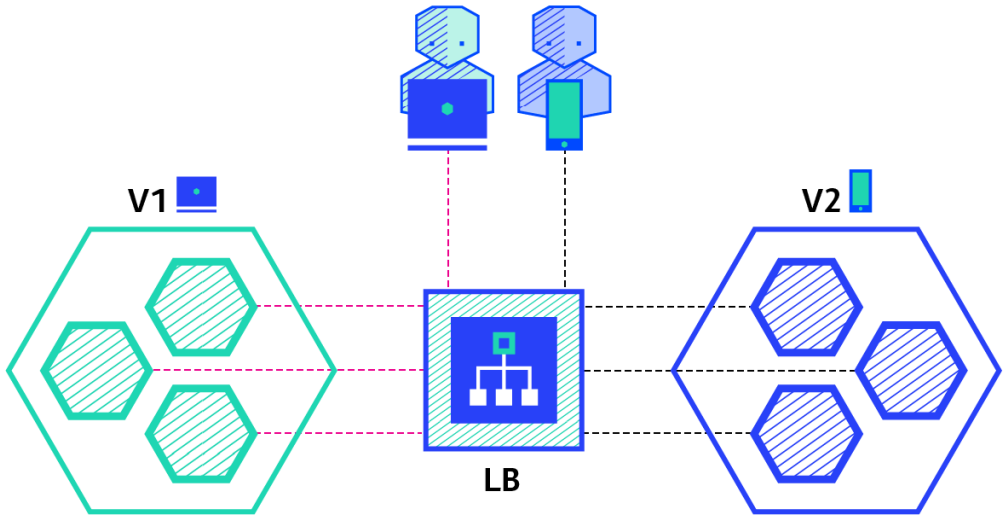
- New version released to subset of users
- Can monitor performance and error rates
- Easy and fast rollback

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.

Pros

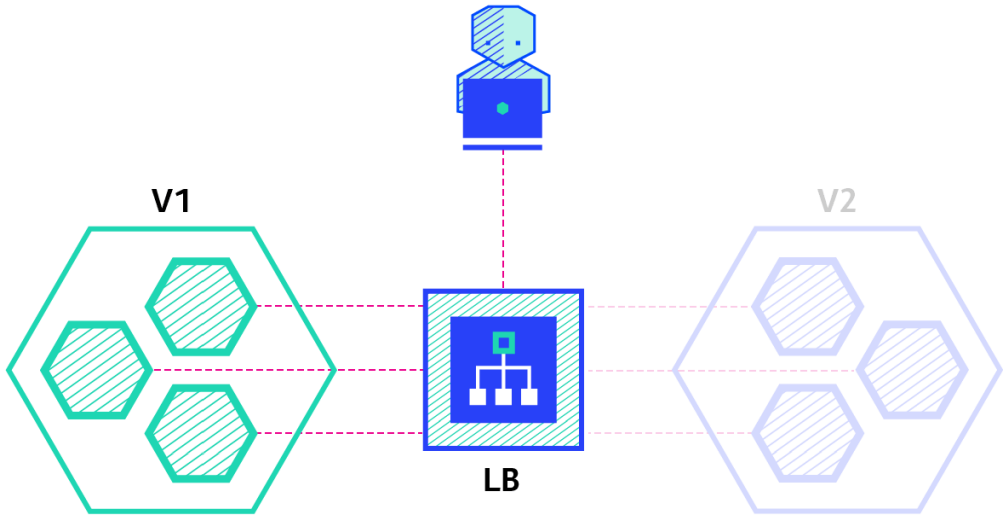
- Multiple versions run in parallel
- Full control over traffic distribution

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 impact the response	✓	✓	✗	■■■	□□□	□□□	■■■

- Modification of original diagram at https://thenewstack.io/deployment-strategies/.
- Cloud Cost for Canary & A/B *increased* to *medium*.
- Rollback Duration for Ramped *decreased* to *medium*.

References

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https://about.gitlab.com/blog/2023/07/27/gitlab-flow-duo/.

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