Dev Ops

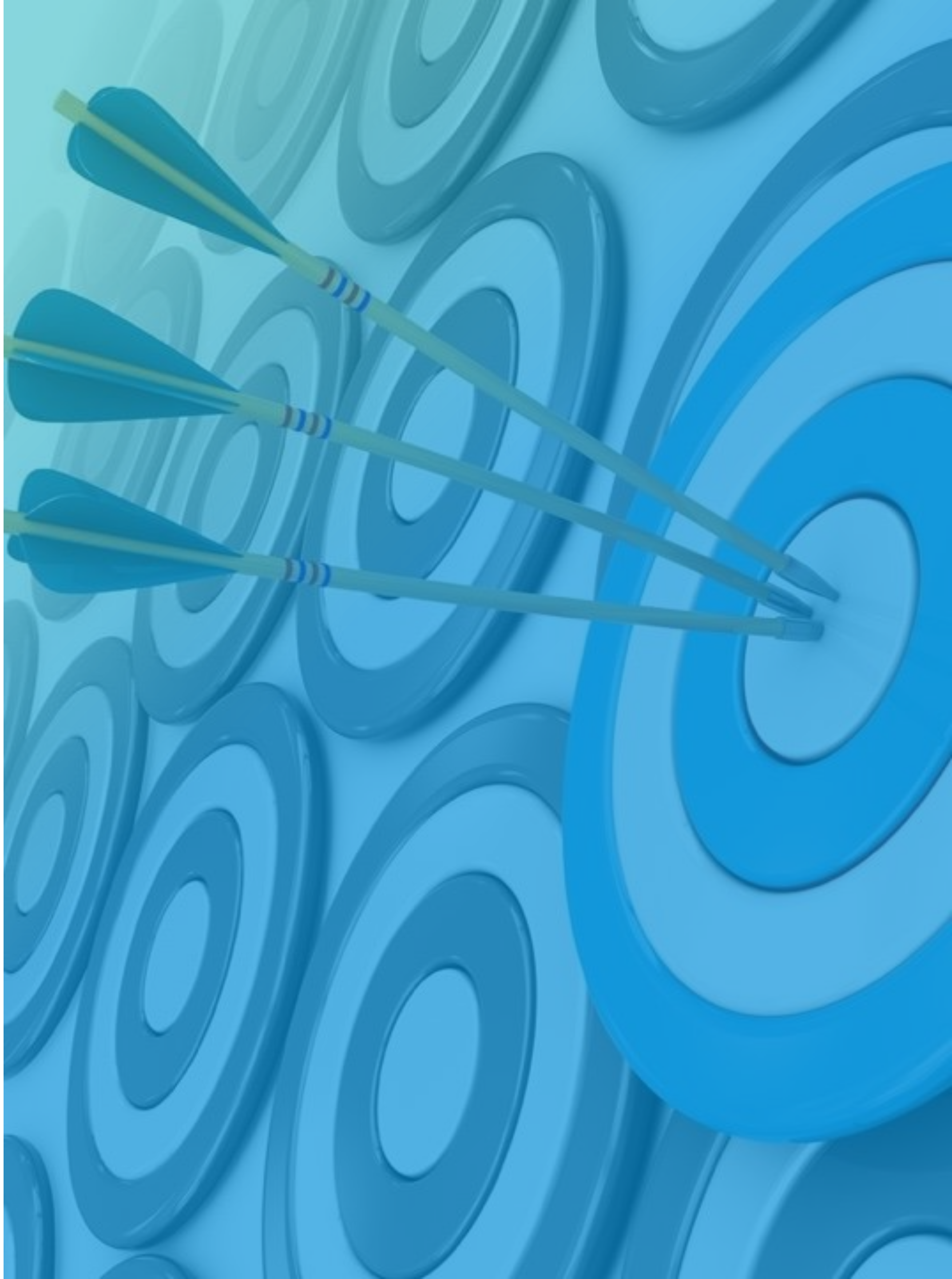
Training for Amazon

CI/CD Pipeline

Training for Amazon

LEARNING OBJECTIVES

- About DevOps
- CI/CD Pipeline
- Version control - Using GIT
- Different concepts of Version Control
- What is GIT?
- GIT Installation
- Pull and Push Code in GIT
- GIT branches release feature
- Hotfix branches
- Branch mistakes
- Planning the Release, Build Pipelines
- Docker Introduction
- Build process - Introduction to Maven
- Automatic Build Process using Jenkins
- Automated Code reviews - Sonar (Introduction only, Configuration of Sonar not covered)



What is DevOps?

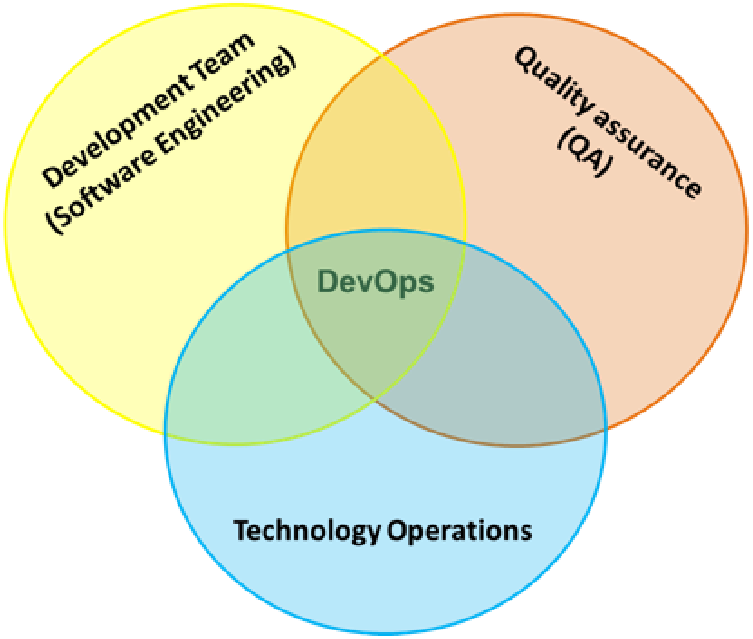
WHAT’S DEVOPS?

DevOps

DevOps is a software development and delivery process that emphasizes communication and collaboration between Product Development Team, QA Team, Operations Team and Business owners to:

Increase organization's ability to deliver application and services at high velocity.

This speed enables organizations to better serve their customers and compete more effectively in the market.



DEVOPS

DevOps building blocks:

Development and QA Team

Code, Build, and Test

Operations Team

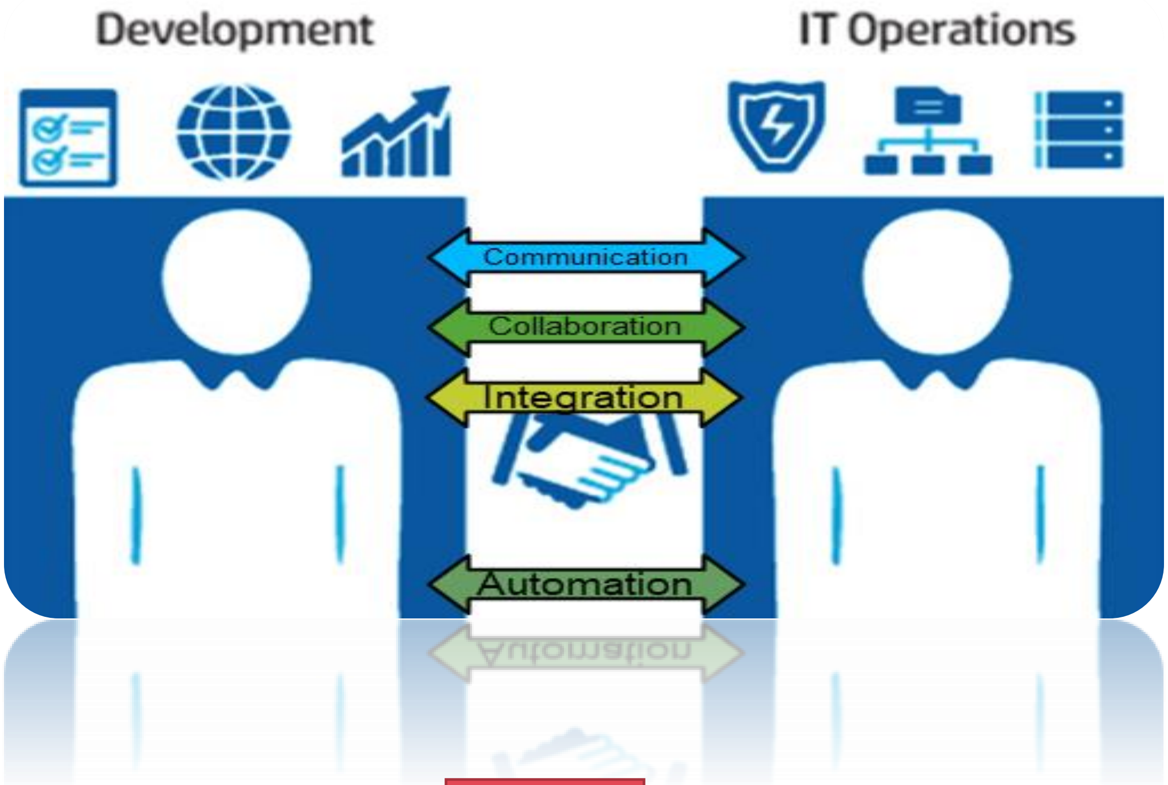
- Packaging
- Release management
- Configuration management
- Application and Infrastructure monitoring

DEVOPS CULTURE

DevOps is more than just a tool or a process change.

It inherently requires an organizational culture shift.

This cultural change is especially difficult, because of the conflicting nature of departmental roles:



DEVOPS CULTURE CONTD.

DevOps

Operations

Seeks organizational stability

Developers

Seek change

Testers

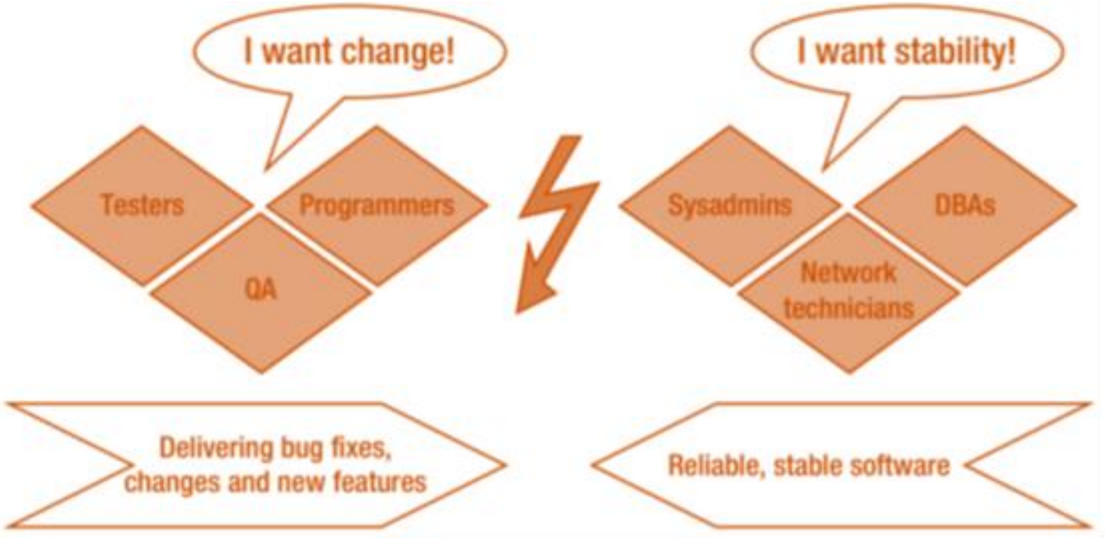
Seek risk reduction

DEVELOPMENT V/S OPERATIONS

DevOps

Developers & development team wants change!

Deliver bug-fixes, changes and new features.



Development Team: Main Goal

To fulfil the customer’s requirements, test the solution, and provide software updates in quick succession.

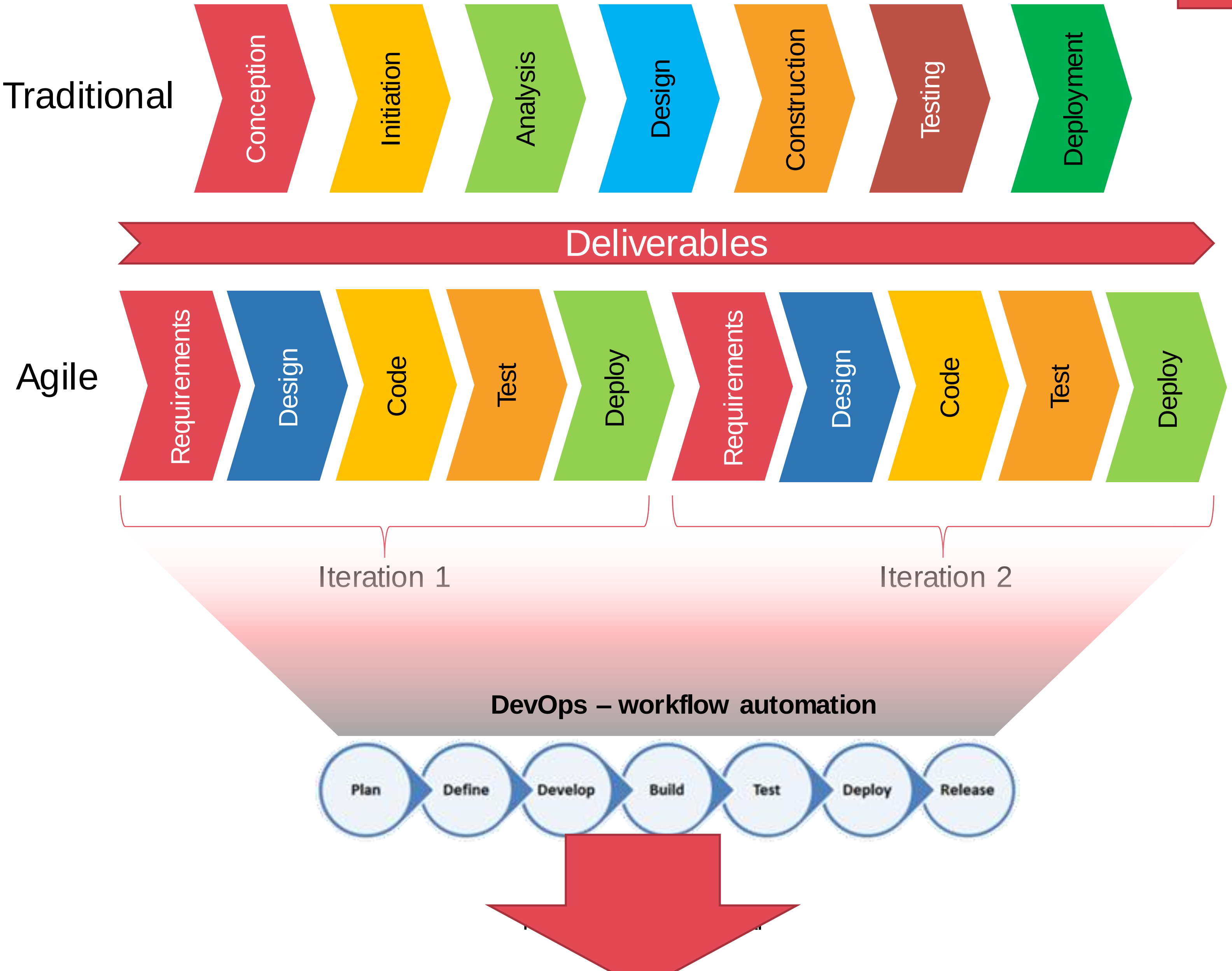
New features that have been implemented and tested by the developers add potential value for the customer.

The operations team is mainly interested in reliable and stable software environment.

Every change forwarded by the development team can endanger the existing reliability and stability of production environment.

DevOps

DEVELOPMENT METHODOLOGIES - COMPARISON



Traditional

Conception
Initiation
Analysis
Design
Construction
Testing
Deployment

Deliverables

Agile

Requirements
Design
Code
Test
Deploy
Requirements
Design
Code
Test
Deploy

Iteration 1

Iteration 2

DevOps – workflow automation

Plan
Define
Develop
Build
Test
Deploy
Release

DEVOPS IN BUSINESS

DevOps Drivers

Market Competition

Ever-changing Business Needs

Quick to Market Requirement

- Tight delivery deadlines
- “The code works on my machine” – blame game
- Disconnect bet’n Development and Operations team.

Conflict Scenarios

- Conflict during deployment
- Conflict after deployment
- Conflict about performance

DEVOPS IN BUSINESS

DevOps

DevOps Drivers

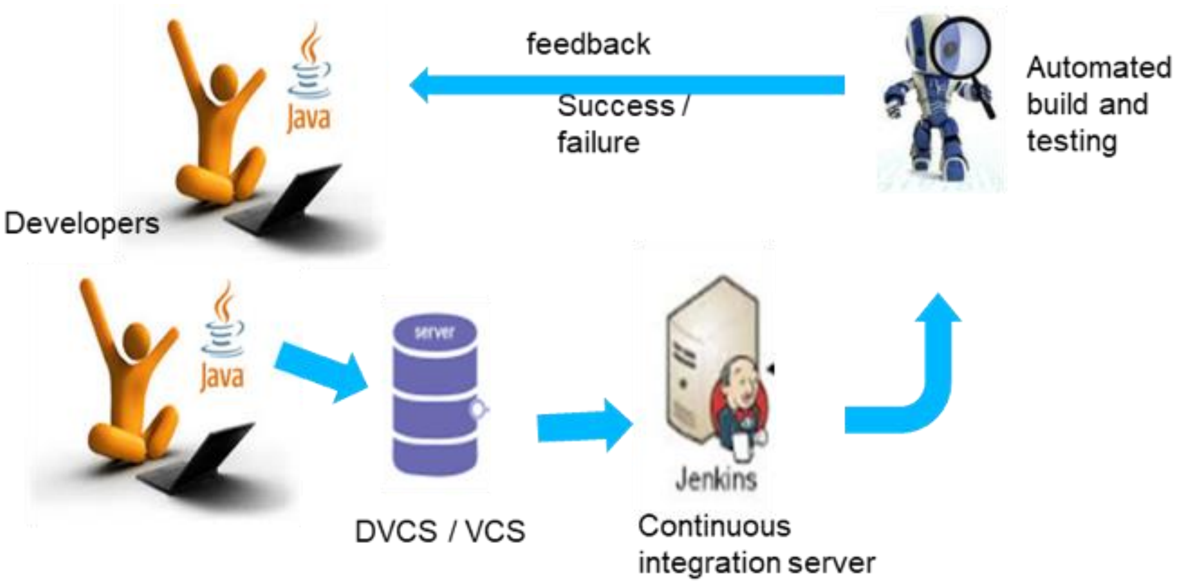
- Advantages of agile processes like Scrum, Kanban are often nullified because of the obstacles to collaboration, processes, and tools that are build up in front of operations.
- Thus, achieving delivery timelines for a sprint becomes challenging.

DEVOPS FOR QA

DevOps

Continuous Testing enabled with, continuous integration.

Continuous integration is software development practice in which team members integrate their work frequently, leading multiple integrations per day.



What Purpose Does This Serve?

1 Each integration helps to reveals integrations errors in build success / failures as quickly as possible.

2 Helps in significantly reducing integration problems and delivery timeline.

DEVOPS FOR IT OPERATIONS

DevOps

Integrated Environment Provisioning

- Dynamic Environment Provisioning
- Containerized App Deployment and Data Center Management

Continuous Application Deployment

Single Click Deployment

Continuous Monitoring

- Performance Monitoring
- System and Application Monitoring
- Log Analysis

DEVOPS FOR BUSINESS OWNERS

Quick to Market

Agility

Environment Stability

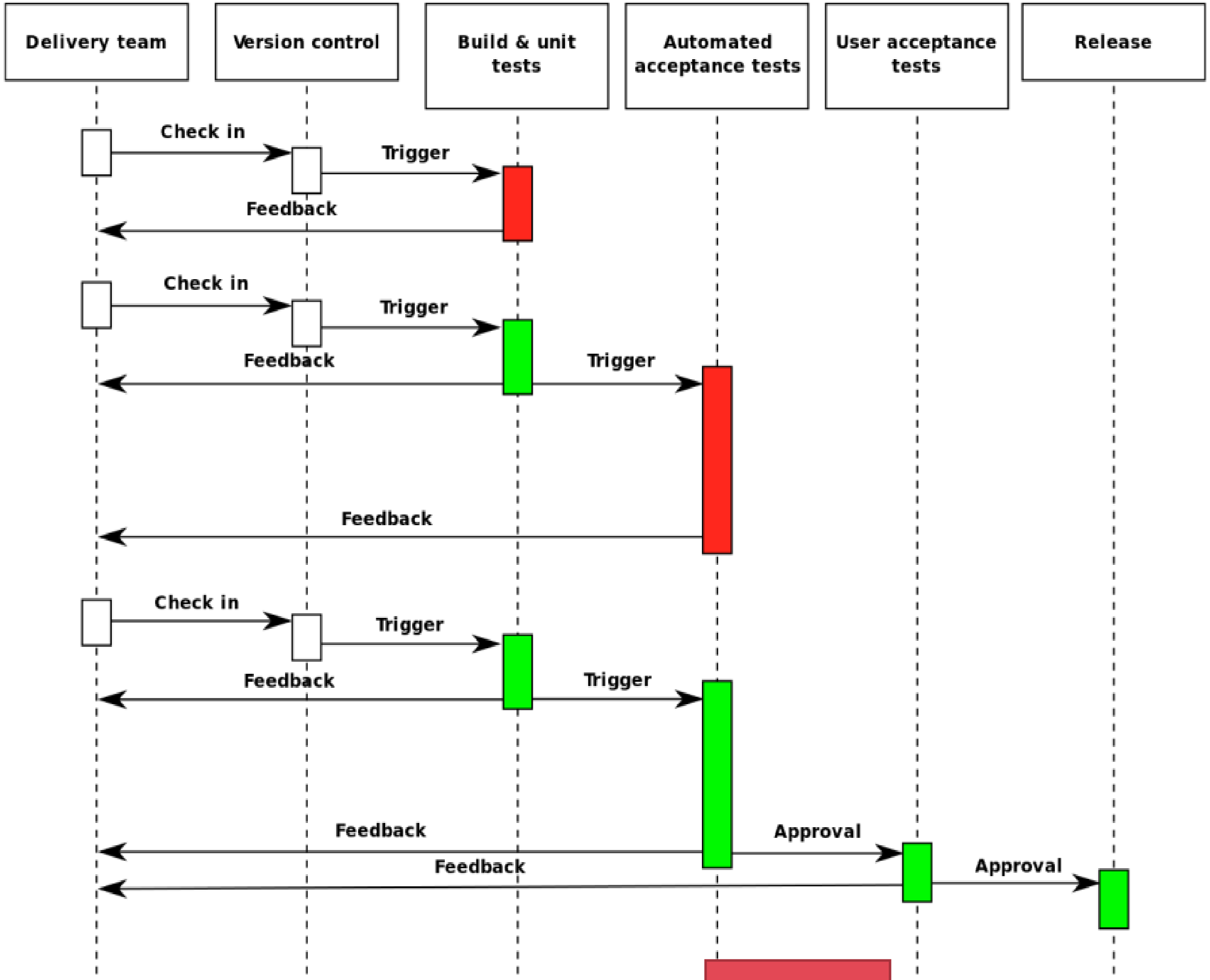
- Fast recovery
- Fully automated deployments

Customer Satisfaction

- Improvement in product quality
- Quick turn around time

CONTINUOUS DELIVERY PIPELINE

DevOps



Delivery team

Version control

Build & unit tests

Automated acceptance tests

User acceptance tests

Release

Check in

Trigger

Feedback

Check in

Trigger

Feedback

Trigger

Feedback

Check in

Trigger

Feedback

Trigger

Feedback

Approval

Feedback

Approval

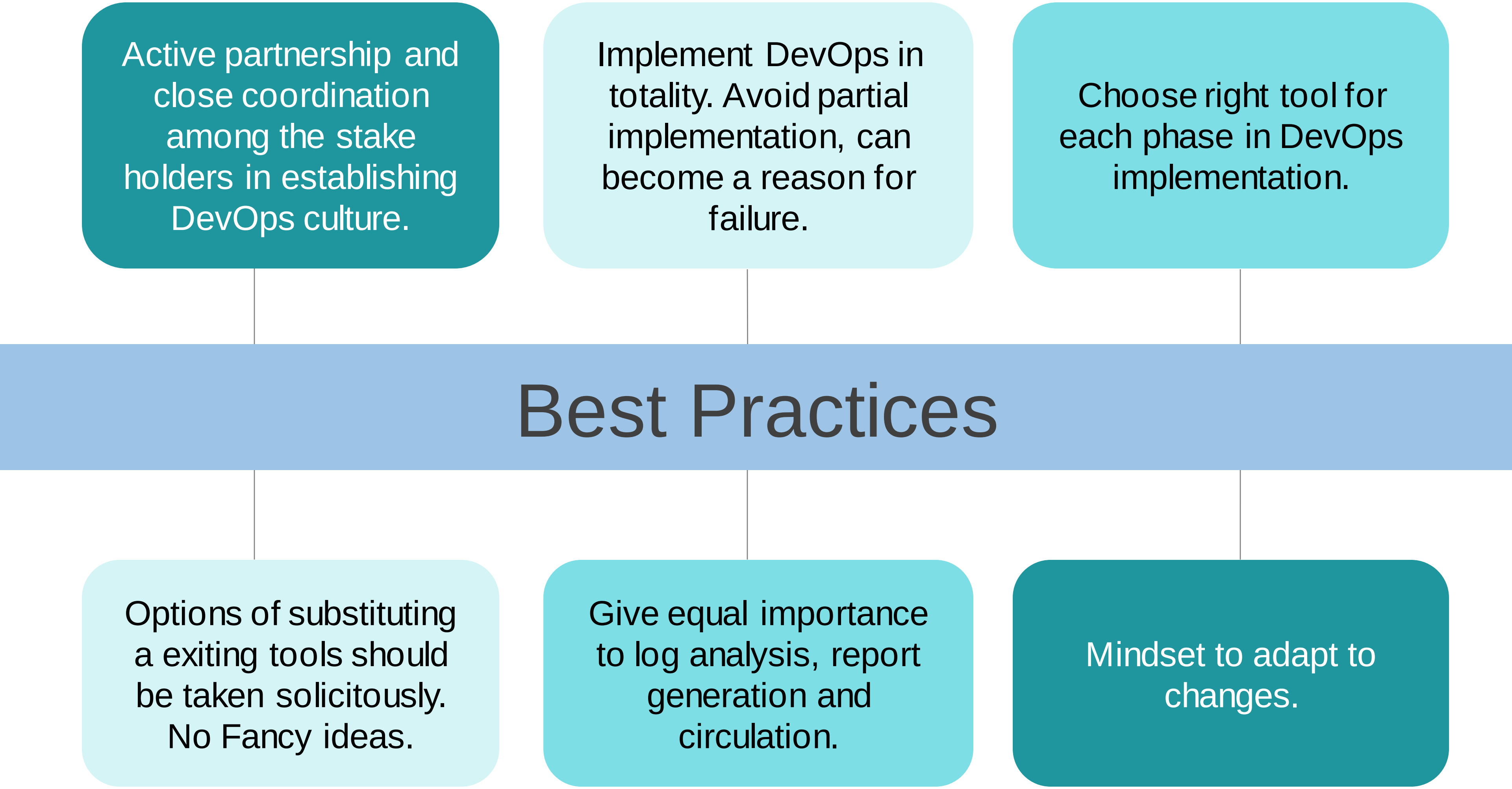
Source: Continuous **Delivery:** Reliable Software Releases through Build, Test, and Deployment Automation

CHALLENGES IN IMPLEMENTING DEVOPS!

- Establishing DevOps Culture
- Implementing Change in Application Development Environment
- Environment Upgradation (standardization)
- Application Complexity
- Budget
- Availability of Skillset

BEST PRACTICES IN DEVOPS

DevOps



Best Practices

Active partnership and close coordination among the stake holders in establishing DevOps culture.

Implement DevOps in totality. Avoid partial implementation, can become a reason for failure.

Choose right tool for each phase in DevOps implementation.

Options of substituting a exiting tools should be taken solicitously. No Fancy ideas.

Give equal importance to log analysis, report generation and circulation.

Mindset to adapt to changes.

DEVOPS OPERATIONAL BENEFITS

DevOps

Increased Agility

To enable instant change deployment

Improved Quality

To improve end user satisfaction

Improve Innovation

To increase innovation cycle

Reduced Outages

Less outages in production (about 80% outages are change related)

WHAT IS A VERSION CONTROL SYSTEM?

VCS

Version control software is an essential part of the every-day of the modern software team's professional practices.

Version control software keeps track of every modification to the code in a special kind of database.

Version control protects source code from both catastrophe and the casual degradation of human error and unintended consequences.

Helps teams to solve problems like, tracking every individual change by each contributor and helping prevent concurrent work from conflict.

Conflicts, if any, should be solved using help of tool or manually.

VERSION CONTROL SYSTEM

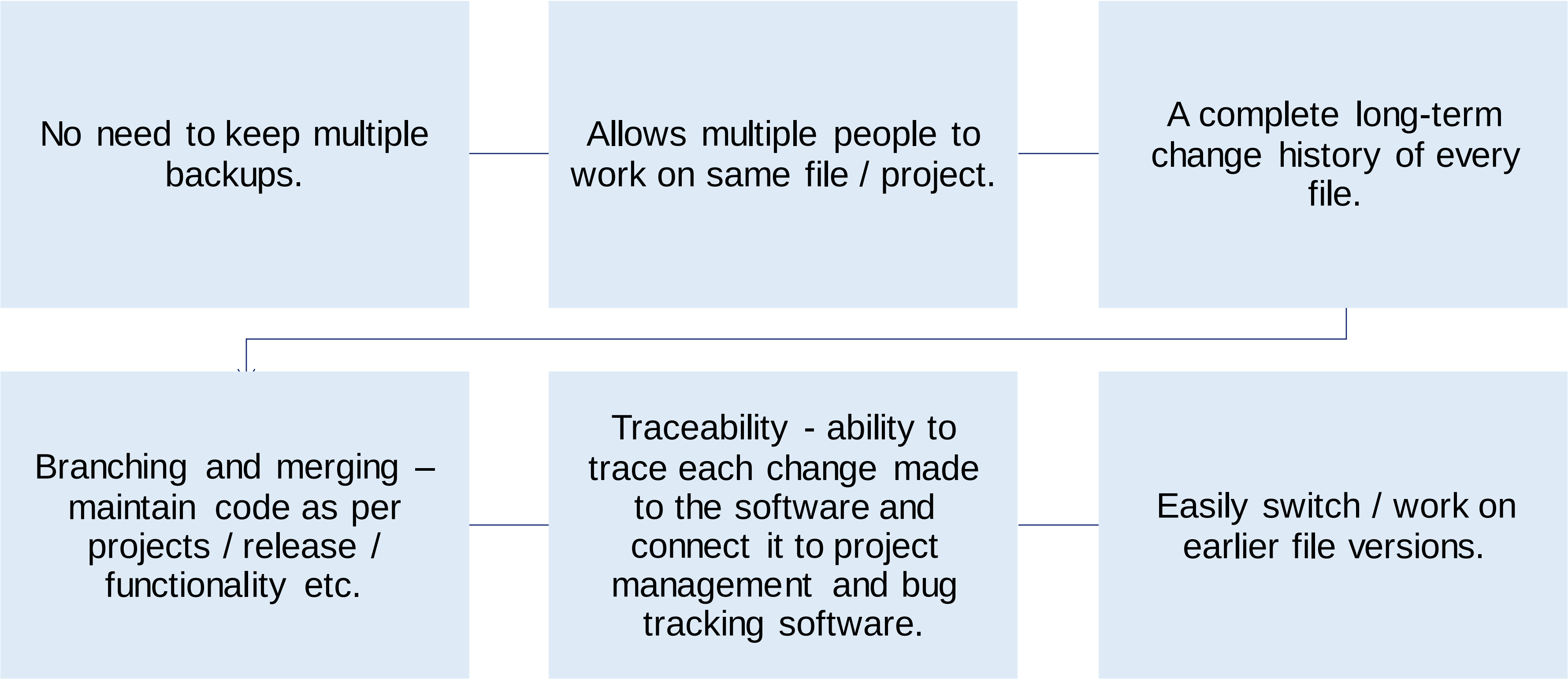
VCS

Version control (or revision control, or source control) is all about managing multiple versions of documents, programs, web sites, etc.

- Almost all “real” projects use some kind of version control
- Essential for team projects, but also very useful for individual projects
- Some well-known version control systems are CVS, Subversion, Mercurial, and Git
- CVS and Subversion use a “central” repository; users “check out” files, work on them, and “check them in”
- Mercurial and Git treat all repositories as equal
- Distributed systems like Mercurial and Git are newer and are gradually replacing centralized systems like CVS and Subversion

VCS

BENEFITS OF VERSION CONTROL SYSTEMS



No need to keep multiple backups.

Allows multiple people to work on same file / project.

A complete long-term change history of every file.

Branching and merging – maintain code as per projects / release / functionality etc.

Traceability - ability to trace each change made to the software and connect it to project management and bug tracking software.

Easily switch / work on earlier file versions.

GIT HISTORY

Came out of Linux development community

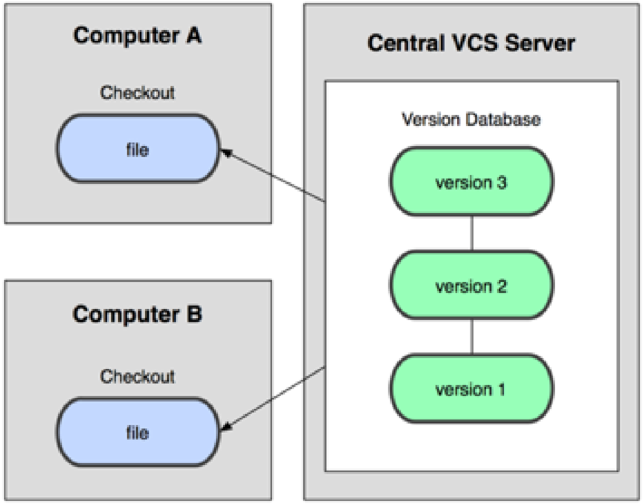
Initial goals:

- Speed
- Support for non-linear development (thousands of parallel branches)
- Fully distributed
- Able to handle large projects like Linux efficiently

Linus Torvalds, 2005

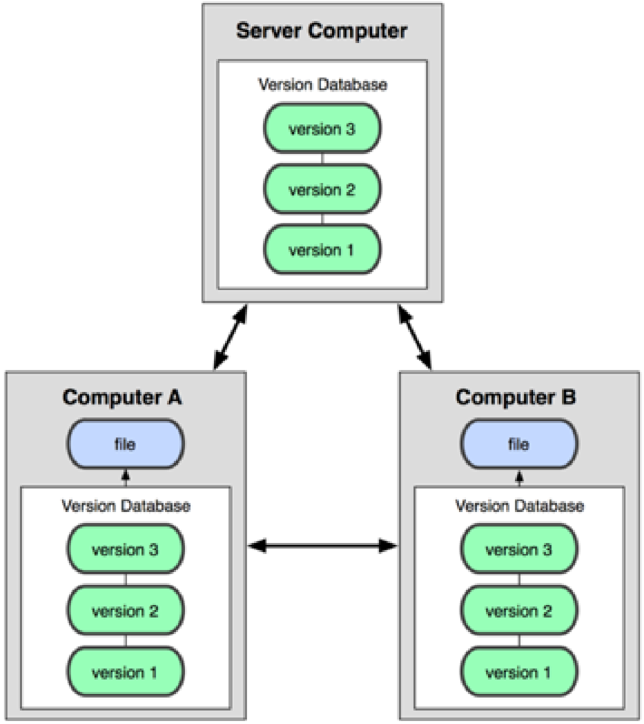
GIT USES A DISTRIBUTED MODEL

Centralized Model



(CVS, Subversion, Perforce)

Distributed Model

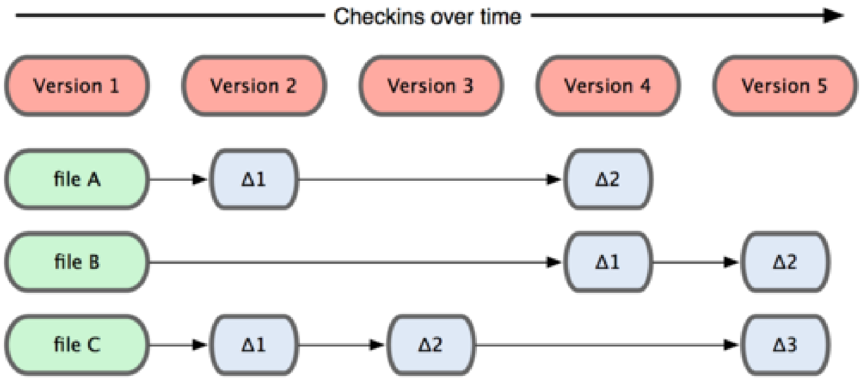


(Git, Mercurial)

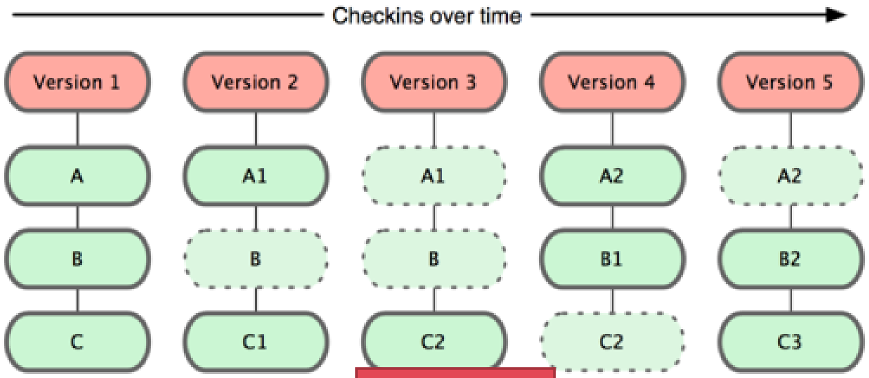
Result: Many operations are local

GIT TAKES SNAPSHOTS

Subversion



Git



GIT USES CHECKSUMS

In Subversion, each modification to the central repo incremented the version # of the overall repo.

How will this numbering scheme work when each user has their own copy of the repo, and commits changes to their local copy of the repo before pushing to the central server?

Instead, Git generates a unique SHA-1 hash – 40 character string of hex digits, for every commit. Refer to commits by this ID rather than a version number.

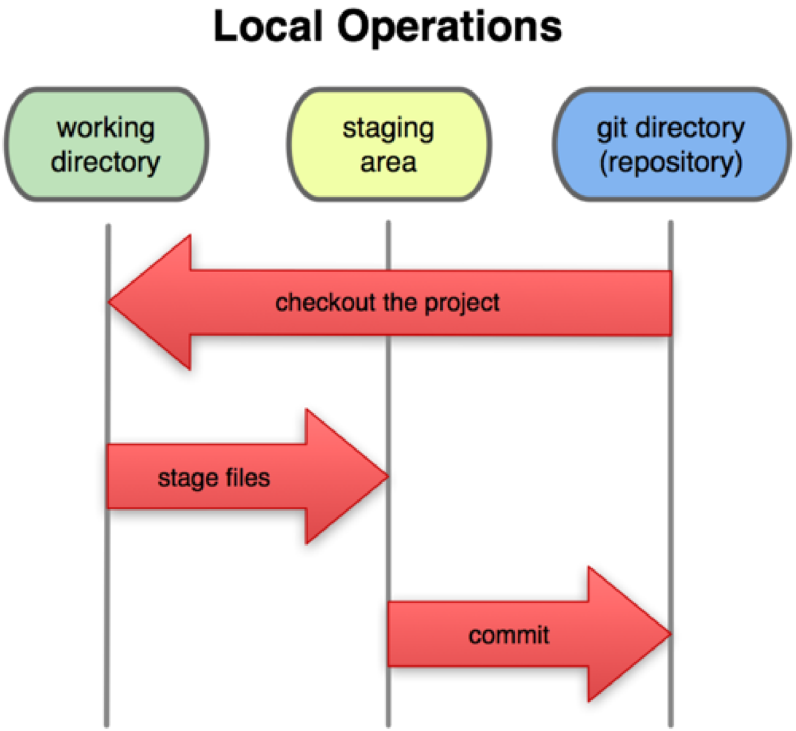
- **Often we only see the first 7 characters:**

1677b2d Edited first line of readme

258efa7 Added line to readme

0e52da7 Initial commit

A LOCAL GIT PROJECT HAS THREE AREAS



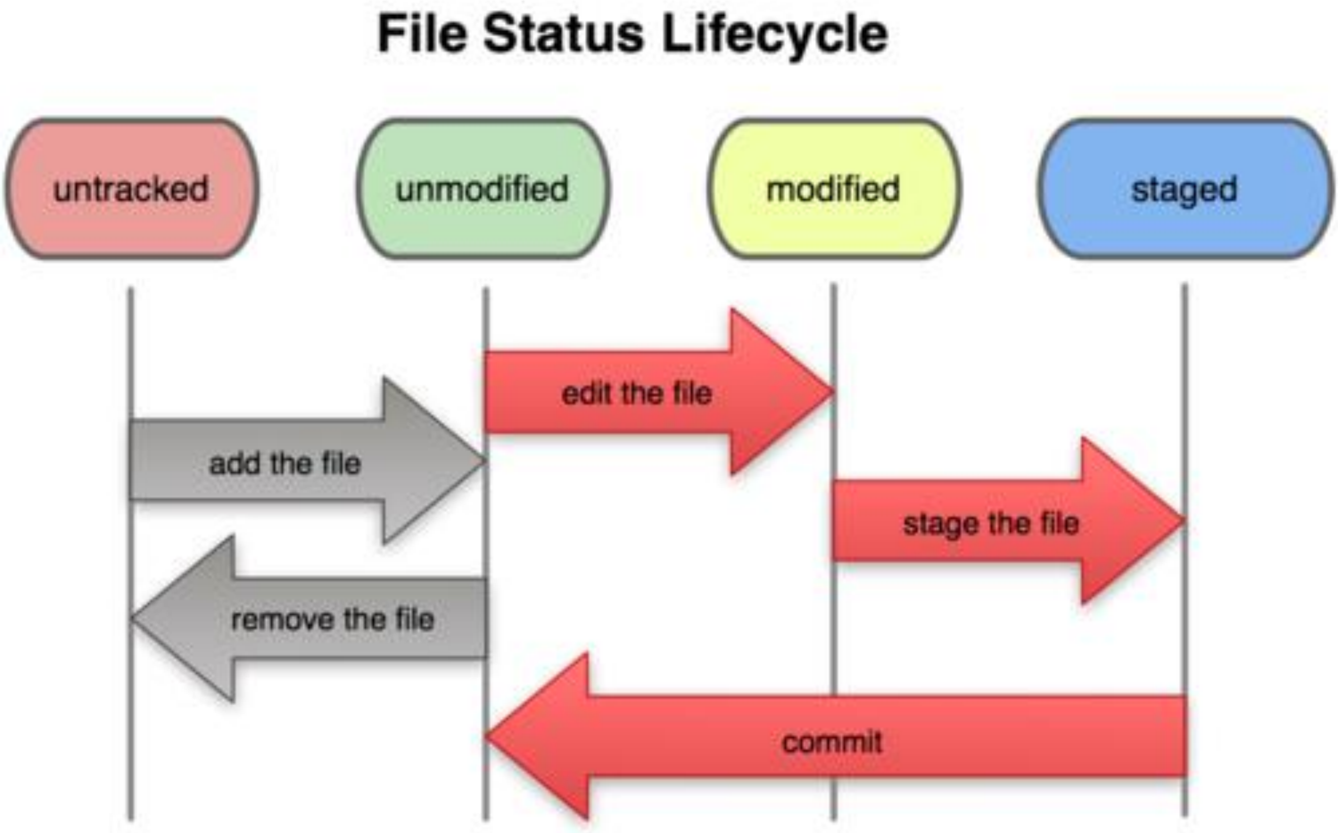
Unmodified/Modified Files

Staged Files

Committed Files

Note: working directory sometimes called the e”, staging area sometimes called the “index”.

GIT FILE LIFECYCLEX



BASIC WORKFLOW

Basic Git Workflow:

1. **Modify** files in your working directory
2. **Stage** files, adding snapshots of them to your staging area
3. Do a **commit**, which takes the files as they are in the staging area and stores that snapshot permanently to your Git directory

- **Notes:**
- If a particular version of a file is in the Git directory, it’s considered committed.
- If it’s modified but has been added to the staging area, it is staged.
- If it was changed since it was checked out but has not been staged, it is modified.

GIT - DVCS

GIT has bash /command-line interface and GUI as well.

- Git is a distributed VCS. Provides extremely fast operation
- Does not need centralized server
- Once the entire repository is pulled on local machine, network / internet connection is not required for most of the VCS operations

WHY GIT?

Git has many advantages over earlier systems such as CVS and Subversion, like:

More efficient, better workflow, etc.

- The literature has an extensive list of reasons.
- Of course, there are always those who disagree.

Best competitor: Mercurial

- Same concepts, slightly simpler to use
- The Eclipse plugin is easier to install and use
- Much less popular than Git

mercurial

DOWNLOAD AND INSTALL GIT

GIT

Online materials:

http://git-scm.com/downloads

Standard one

http://stackoverflow.com/questions/315911/git-for-beginners-the-definitive-practical-guide#323764

From StackExchange

- **Note:** Git is primarily a command-line tool
- GUIs are preferred over command-line tools, but…
- **The GIT GUIs are more trouble than they are worth (YMMV)**

INTRODUCE YOURSELF TO GIT

GIT

Enter these lines (with appropriate changes):

- `git config --global user.name "John Smith"`
- `git config --global user.email jsmith@seas.upenn.edu`

- You only need to do this once.

- If you want to use a different name/email address for a particular project, you can change it for just that project
  - `cd` to the project directory
  - Use the above commands, but leave out the `--global`

GIT

GIT - DVCS

Working Area

Similar to work area, development environment.

Staging Area

Where you store a place a snapshot before committing changes to the local repo.

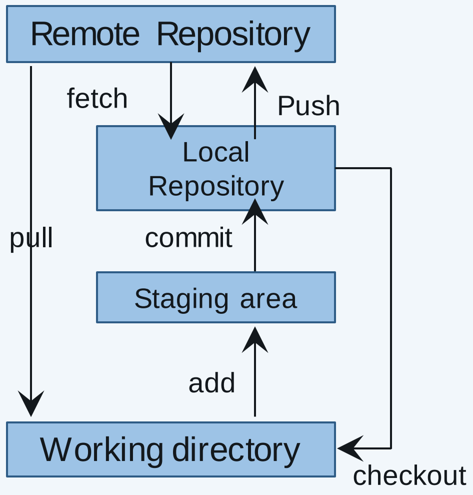
Local Repo

- Is a copy of remote repository.
- Has all versioning of data/code/artifacts maintained.

Remote Repository

This can be the GitHub repository or a remote repository maintained on a server on intranet.

GitHub



Download 'git' from, http://git-scm.com

GIT – DVCS Contd.

GIT works on most of the OS platforms (OSx, Windows, Unix / Linux).

- On installation, the GIT config should be run to configure user name, email ID, etc.
- In order to start using the VCS, the folder that you want to version control, run the command ‘git init’.
- This enables the VCS and tracking of file changes in the folder.

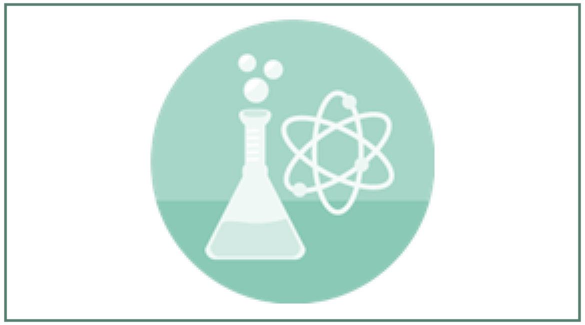
SPRINT GOAL

GIT

A short statement of what the work will be focused on during the sprint:

Database Application

Make the application run on SAP HANA Server in addition to SQL.



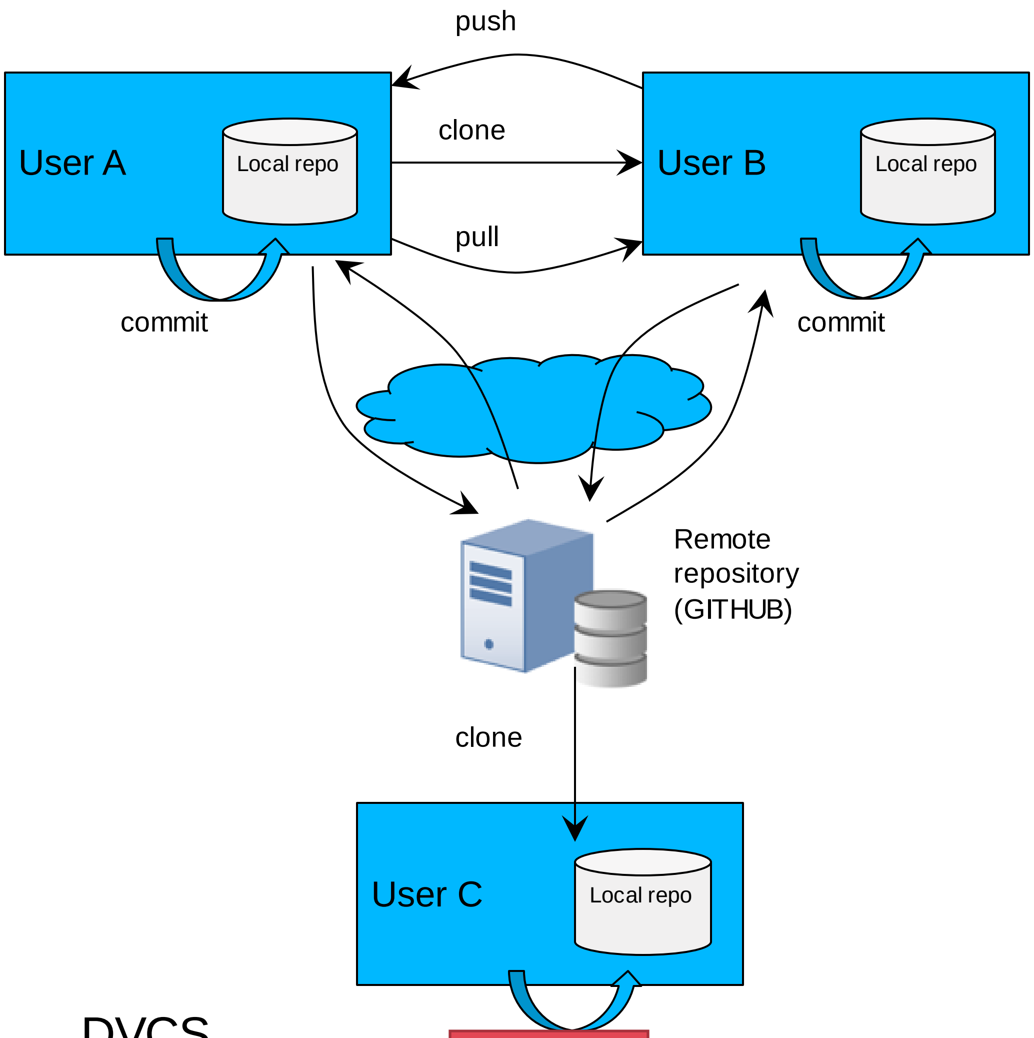
Life Sciences

Support features necessary for critical ailments relation to genes studies.

Financial Services

Support Interfaces rather than streaming real time data.

DISTRIBUTED VCS & CENTRALIZED VCS



DVCS

GIT COMMON COMMANDS

GIT

Below are certain commands that are used often while we use ‘GIT’.

```
git status

git add

git rm –cached  -- to remove file added to staging area

git commit –m “comment”

git log  --- use ‘shift+z’ to come out of the log

git diff  -- provides info about what has changed in the file

git diff –cached   --- diff for the files in the staging area.

git branch  -- provides list of all branches

git branch <branch name> -- create a branch

git remote add <name> <url>  -- to add remote repo.

git checkout  <branch name> -- switch to mentioned branch

git clone <https://remote repo>  -- clone from remote repo.

git pull <repo name> <branch name>
```

Always perform a ‘Pull’ action before ‘pushing’ the code to remote repo.

GIT Commands

command	description
git clone ***url [dir]***	copy a git repository so you can add to it
git add ***files***	adds file contents to the staging area
git commit	records a snapshot of the staging area
git status	view the status of your files in the working directory and staging area
git diff	shows diff of what is staged and what is modified but unstaged
git help ***[command]***	get help info about a particular command
git pull	fetch from a remote repo and try to merge into the current branch
git push	push your new branches and data to a remote repository
others: init, reset, branch, checkout, merge, log, tag	

CREATE AND FILL A REPOSITORY

1

cd to the project directory you want to use

2

Type in git init

- This creates the repository (a directory named .git)
- You seldom (if ever) need to look inside this directory

3

Type in git add **.**

- The period at the end is part of this command!
- Period means “this directory”
- This adds all your current files to the repository

4

- Type in git commit –m "Initial commit"
- You can use a different commit message, if you like

CLONE A REPOSITORY FROM ELSEWHERE

- git clone URL
- git clone URL mypath
- These make an exact copy of the repository at the given URL
- git clone git://github.com/rest_of_path/file.git
- Github is the most popular (free) public repository

All repositories are equal, but you can treat some particular repository (such as one on Github) as the "master" directory.

Typically, each team member works in his/her own repository, and "merges" with other repositories as appropriate.

THE REPOSITORY

Your top-level working directory contains everything about your project.

The working directory probably contains many subdirectories—source code, binaries, documentation, data files, etc.

One of these subdirectories, named .git, is your repository.

At any time, you can take a “snapshot” of everything (or selected things) in your project directory, and put it in your repository. This ”snapshot is called a commit object.

The commit object contains (1) a set of files, (2) references to the “parents” of the commit object, and (3) a unique “SHA1” name. Commit objects do not require huge amounts of memory.

You can work as much as you like in your working directory, but the repository isn’t updated until you commit something.

INIT AND THE .GIT REPOSITORY

GIT

- When you said `git init` in your project directory, or when you cloned an existing project, you created a repository.
- The repository is a subdirectory named .git containing various files.
- The dot indicates a “hidden” directory.

Do Not

You do *not* work directly with the contents of that directory; various git commands do that for you

Do

You *do* need a basic understanding of what is in the repository

MAKING COMMITS

You do your work in your project directory, as usual.

- If you create new files and/or folders, they are not tracked by Git unless you ask it to do so

```
git add newFile1 newFolder1 newFolder2 newFile2
```

- Committing makes a “snapshot” of everything being tracked into your repository
- A message telling what you have done is required

```
git commit –m “Uncrevulated the conundrum bar”
git commit
```

  - This version opens an editor for you the enter the message
  - To finish, save and quit the editor
- Format of the commit message
- One line containing the complete summary
- If more than one line, the second line must be blank

COMMITS AND GRAPHS

A commit is when you tell git that a change (or addition) you have made is ready to be included in the project.

- When you commit your change to git, it creates a commit object.
- A commit object represents the complete state of the project, including all the files in the project.
- The *very first* commit object has no “parents”.
- Usually, you take some commit object, make some changes, and create a new commit object; the original commit object is the parent of the new commit object. Hence, most commit objects have a single parent.
- You can also merge two commit objects to form a new one. The new commit object has two parents. Hence, commit objects form a **directed graph**
- Git is all about using and manipulating this graph.

WORKING WITH YOUR OWN REPOSITORY

GIT

A head is a reference to a commit object.

The “current head” is called HEAD (all caps).

Usually, you will take HEAD (the current commit object), make some changes to it, and commit the changes, creating a new current commit object.

- **This results in a linear graph:**

- **A → B → C → …→ HEAD.**

- You can also take any previous commit object, make changes to it, and commit those changes.
- This creates a branch in the graph of commit objects.
- You can merge any previous commit objects.
- This joins branches in the commit graph.

COMMIT MESSAGES

In git, “Commits are cheap.” Do them often.

When you commit, you must provide a one-line message stating what you have done

Terrible message	Better message
“Fixed a bunch of things”	“Corrected the calculation of median scores”

- Commit messages can be very helpful, to yourself as well as to your team members.
- You can’t say much in one line, so commit often.

CHOOSE AN EDITOR

When you “commit,” git will require you to type in a commit message.

- For longer commit messages, you will use an editor.
- The default editor is probably `vim.`

- To change the default editor:
  - `git config --global core.editor /path/to/editor`

- You may also want to turn on colors:

```
git config --global color.ui auto
```

WORKING WITH OTHERS

All repositories are equal, but it is convenient to have one central repository in the cloud.

Here’s what you normally do:

- Download the current HEAD from the central repository
- Make your changes
- Commit your changes to your local repository
- Check to make sure someone else on your team hasn’t updated the central repository since you got it
- Upload your changes to the central repository

If the central repository *has* changed since you got it:

- It is *your* responsibility to **merge your two versions.**

This is a strong incentive to commit and upload often!

- Git can often do this for you, if there aren’t incompatible changes.

TYPICAL WORKFLOW

```
git pull remote_repository
```

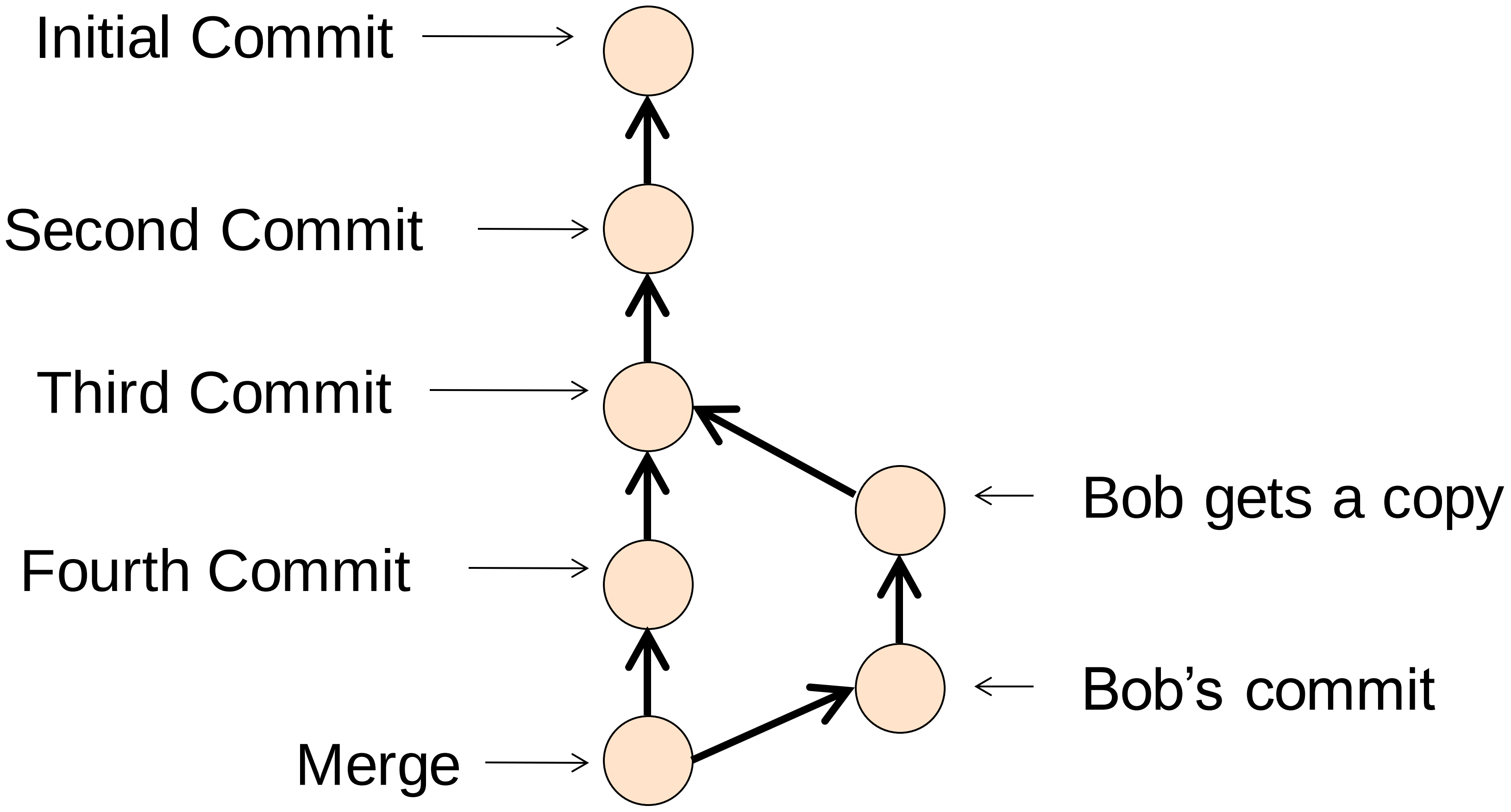
- Get changes from a remote repository and merge them into your own repository

```
git status
```

- See what Git thinks is going on.
- Use this frequently!
- Work on your files (remember to `add` any new ones)

```
git commit -m “What I did”
git push
```

MULTIPLE VERSIONS



Initial Commit

Second Commit

Third Commit

Fourth Commit

Merge

Bob gets a copy

Bob’s commit

ACTIVITY

GIT

- Run common commands on Git
- Understand the output

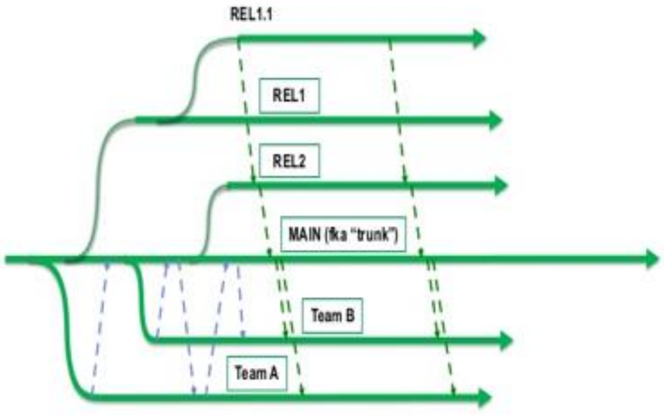
BRANCHING AND MERGING STRATEGIES

1. Branch by release, “staircase model”
2. Branch by feature. Each distinct branch
3. Hotfix branch

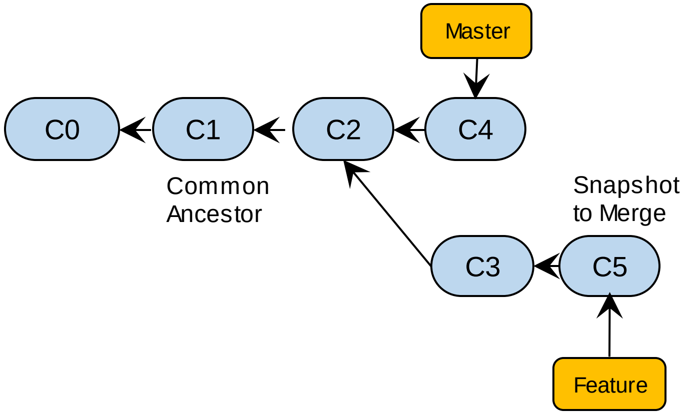
Best Practices:

- Keep option of branching only if required, keep it simple.
- Incase of centralized VCS, merging should be done frequently / sooner (daily recommended)
- Use tagging as and when required.
- Delete unwanted branches.
- Identify shared components in details and in advance.

Merge only when your branch is compliable and stable.

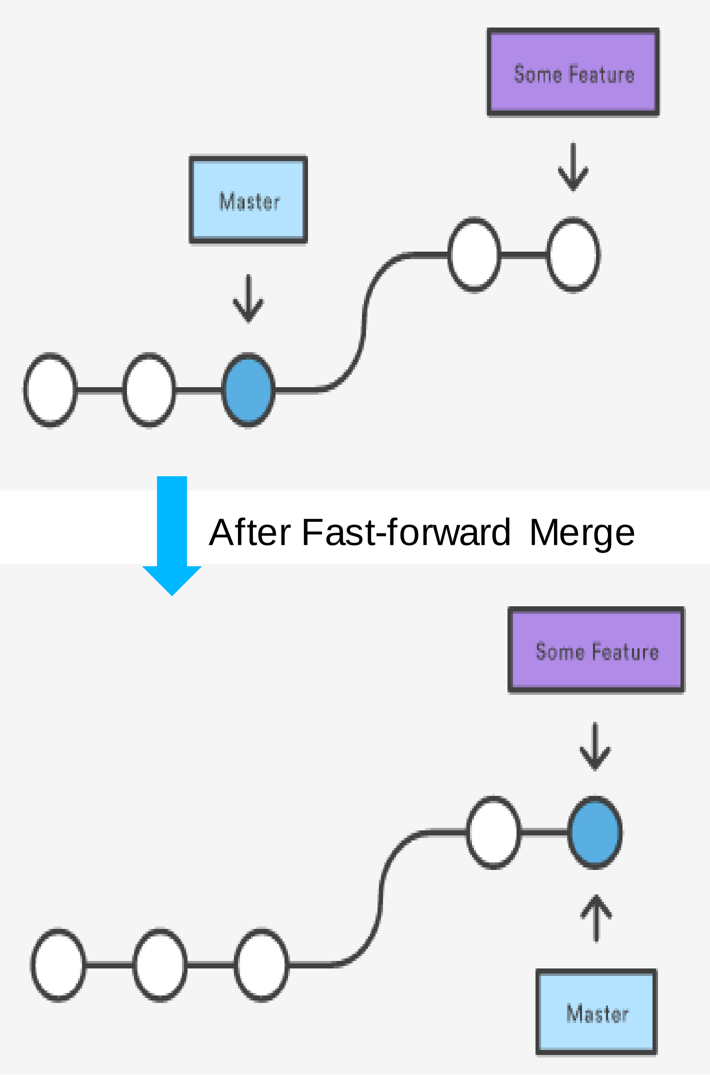


Branching and merging scenario

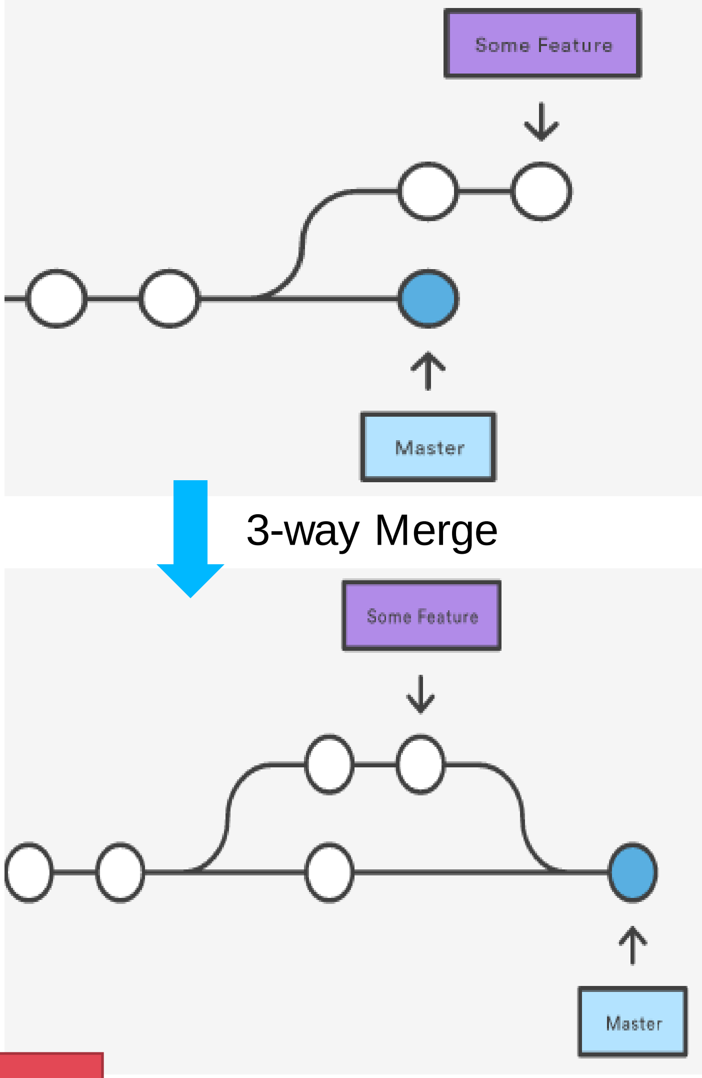


Simple Branching and merging in GIT project

GIT MERGE OPERATIONS



After Fast-forward Merge



3-way Merge

QUESTIONS FOR YOU

GIT

What is the difference between pull and a check out?

Who originally wrote git and why?

What process should be done before each check-in?

What types of file should NOT be included in source control?

GIT RESOURCES

- At the command line: (where verb = config, add, commit, etc.)
- $ git help <verb>
- $ git <verb> --help
- $ man git-<verb>

- Free on-line book: http://git-scm.com/book
- Git tutorial: http://schacon.github.com/git/gittutorial.html
- Reference page for Git: http://gitref.org/index.html
- Git website: http://git-scm.com/

- Git for Computer Scientists (http://eagain.net/articles/git-for-computer-scientists/)

KEEPING IT SIMPLE

If you:

- Make sure you are current with the central repository
- Make some improvements to your code
- Update the central repository before anyone else does
- Then you don’t have to worry about resolving conflicts or working with multiple branches
- All the complexity in git comes from dealing with these

Therefore:

- Make sure you are up-to-date before starting to work
- Commit and update the central repository frequently

- **If you need help:** https://help.github.com/

ASIDE: WHAT IS GITHUB?

GitHub.com is a site for online storage of Git repositories.

- Many open source projects use it, such as the Linux kernel.
- You can get free space for open source projects or you can pay for private projects.

Question: Do I have to use GitHub to use Git?

Answer: No!

- You can use Git completely locally for your own purposes
- You or someone else could set up a server to share files
- You could share a repo with users on the same file system, such as we did for homework 9 (as long everyone has the needed file permissions).

What is Docker & Container

Docker

Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly. With Docker, you can manage your infrastructure in the same ways you manage your applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.

Lifecycle of Docker

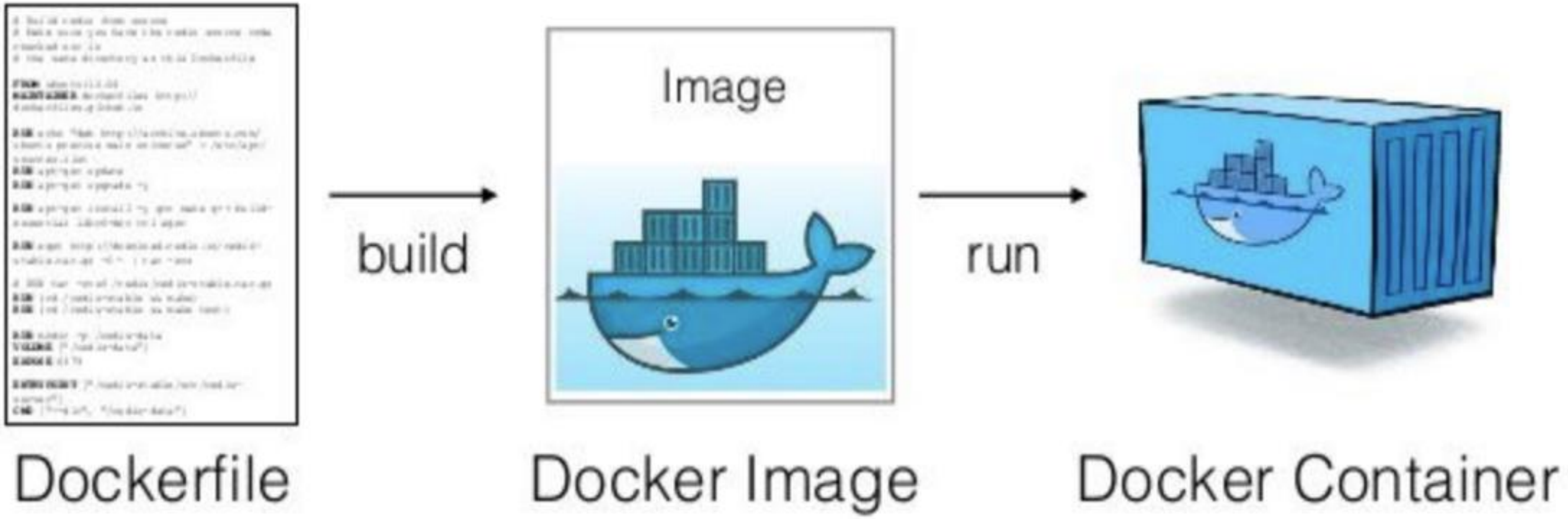


Image
build
run
Dockerfile
Docker Image
Docker Container