GitHub

Source Control Systems

- A.k.a revision control, source control
- Source control is the management and tracking of changes to source code, documents, data, etc.
- **Allows collaborative development**
- Keeps track of who made a change, when the change was made, and what the change was
- Permits reverting any change and rolling back to a previous state

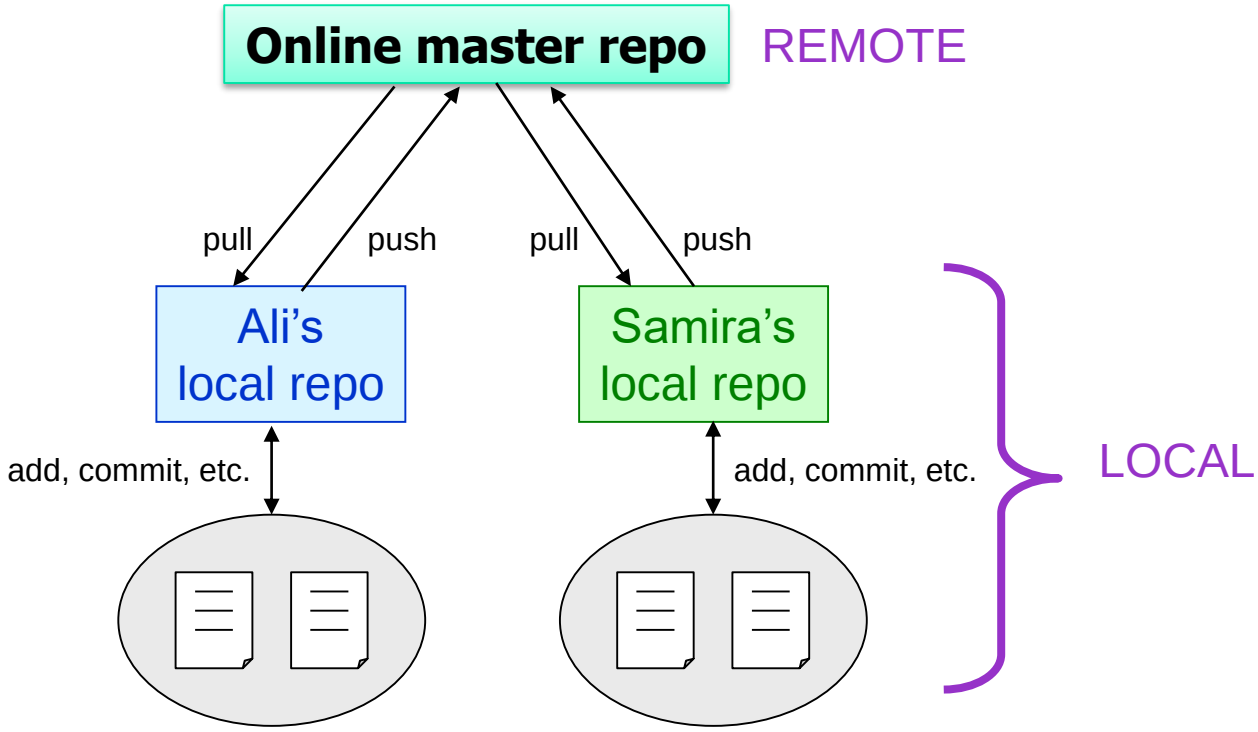
Github

- Github is a distributed source control management system
  - It also provides several collaboration features such as **wikis**, **task management**, and **bug tracking**
- Main characteristics:
  - Entire code and history is kept on the client (user) machine
  - Users can work (make changes to code) even without internet connection
  - Internet connection required only for pushing and pulling from remote repository

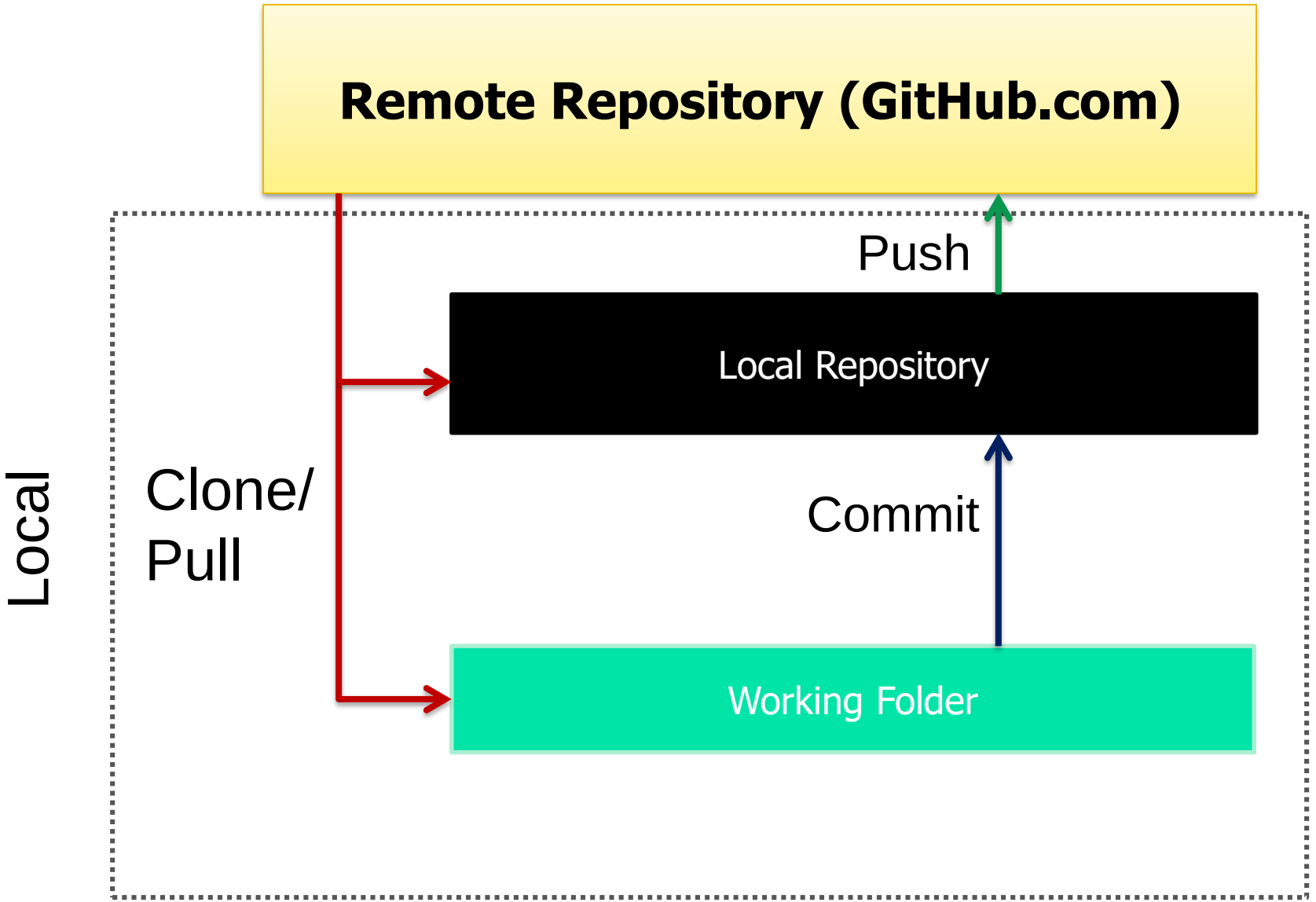
GitHub Basics

- A repository (or 'repo') is a collection of all the files and their commit history
- Copying a repository from a remote server is called **cloning**
  - Cloning allows teams to develop collaboratively
- Pulling: downloading commits that do not exist on the local machine from a remote repository
- Pushing: adding local changes (commits) to a remote repository

Local and Remote Repositories

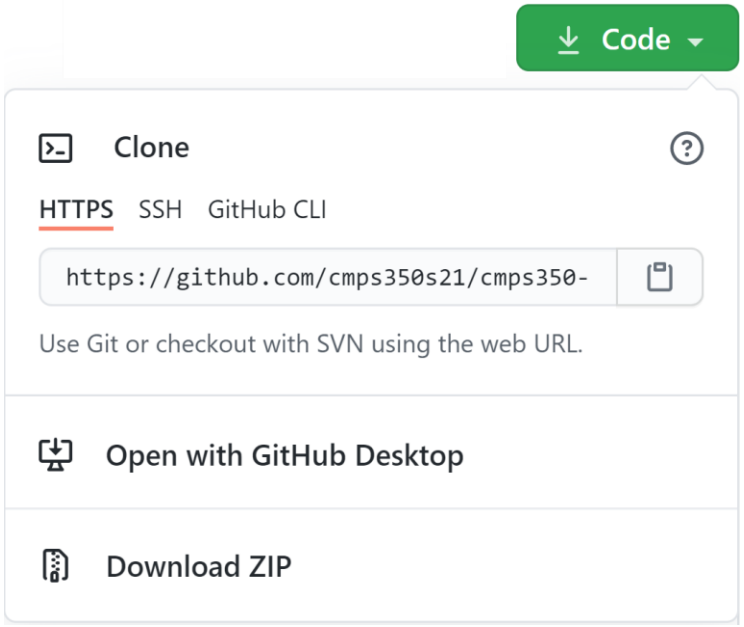


Architecture & Terminology

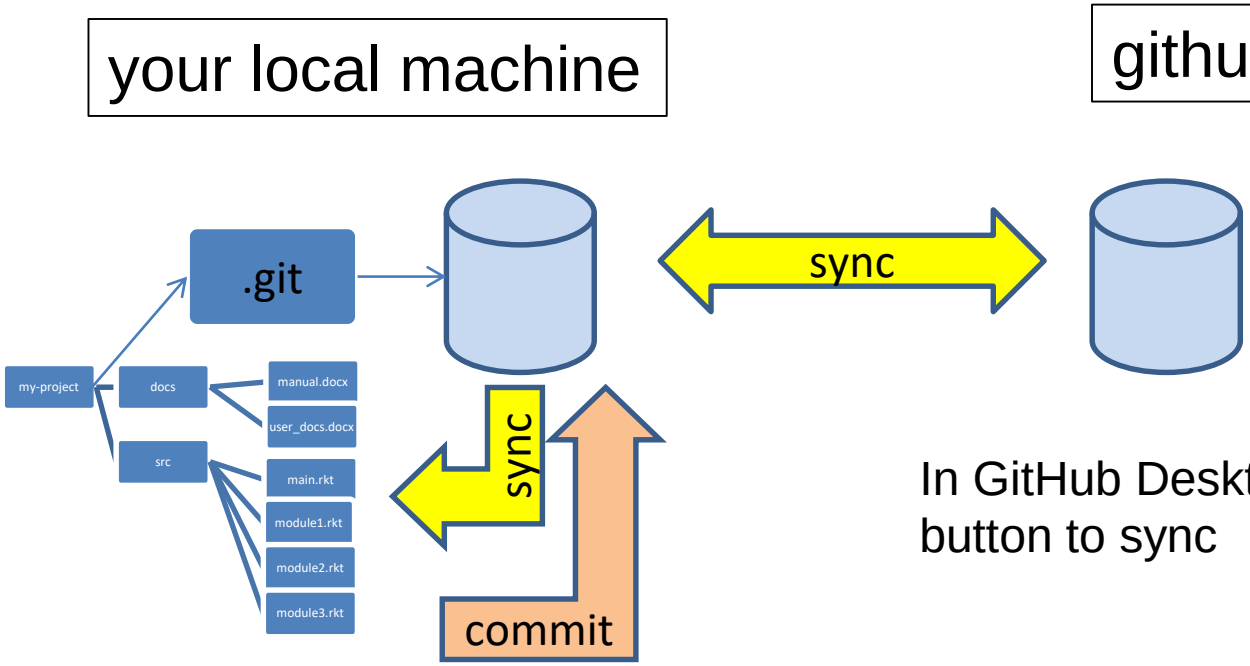


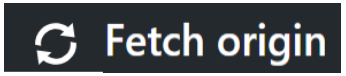
GitHub: Create Local Repository

- Each team member creates local repository that is a clone of the master repository
  - Log into your personal GitHub account
  - Navigate to the team repository
  - Clone the Repository using GitHub GUI or the Command Line



Using GitHub Desktop



In GitHub Desktop, use  button to sync

In this course, we will mainly use GitHub Desktop

Resources

- GitHub Desktop

https://desktop.github.com/

- GitHub foundation short videos

https://www.youtube.com/playlist?list=PLo1o9MOBetEHhfG9vJzVCTiDYcbhAiEqL

- GitHub Help

https://help.github.com/

- Git Book

https://git-scm.com/book/

GitHub: Create Local Repository, *cont'd*

- **`cd`** to the directory where you want the local repository to reside on your local machine.
- Enter the git command

```
git clone URL
```

- Where *URL* is the repository URL
  - Example:

```
git clone https://github.com/cmps356s18/cmps356-content.git
```

Git: Make Local Changes

- Get the status of files in your local repository:

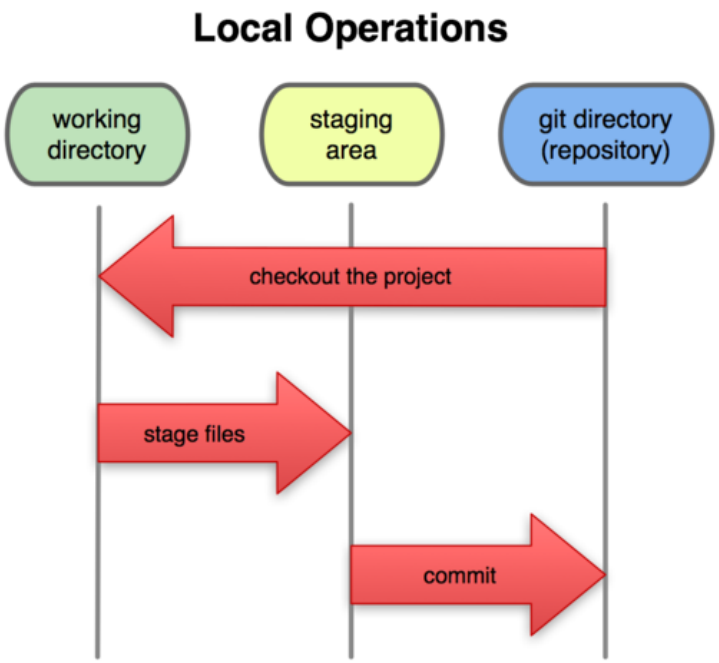
```
git status
```

- After you've updates/created new files on your working directory, first add them to the local staging area:

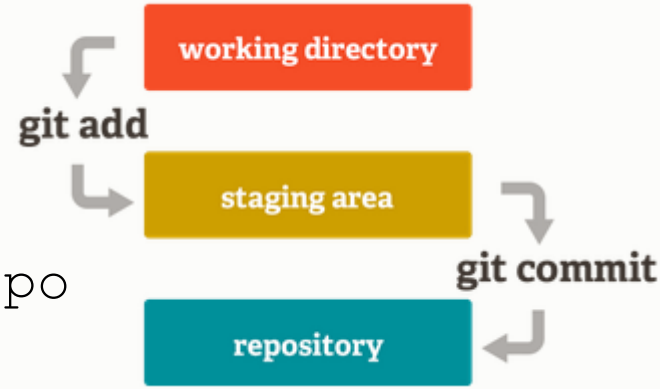
```
git add -A
```

- Commit your staged files to the local repository:

```
git commit –m "commit message"
```



Git Basic Commands Summary



git init //initializes a new git repo

git add -A //adds file to the local staging area

git diff //prints difference made in files

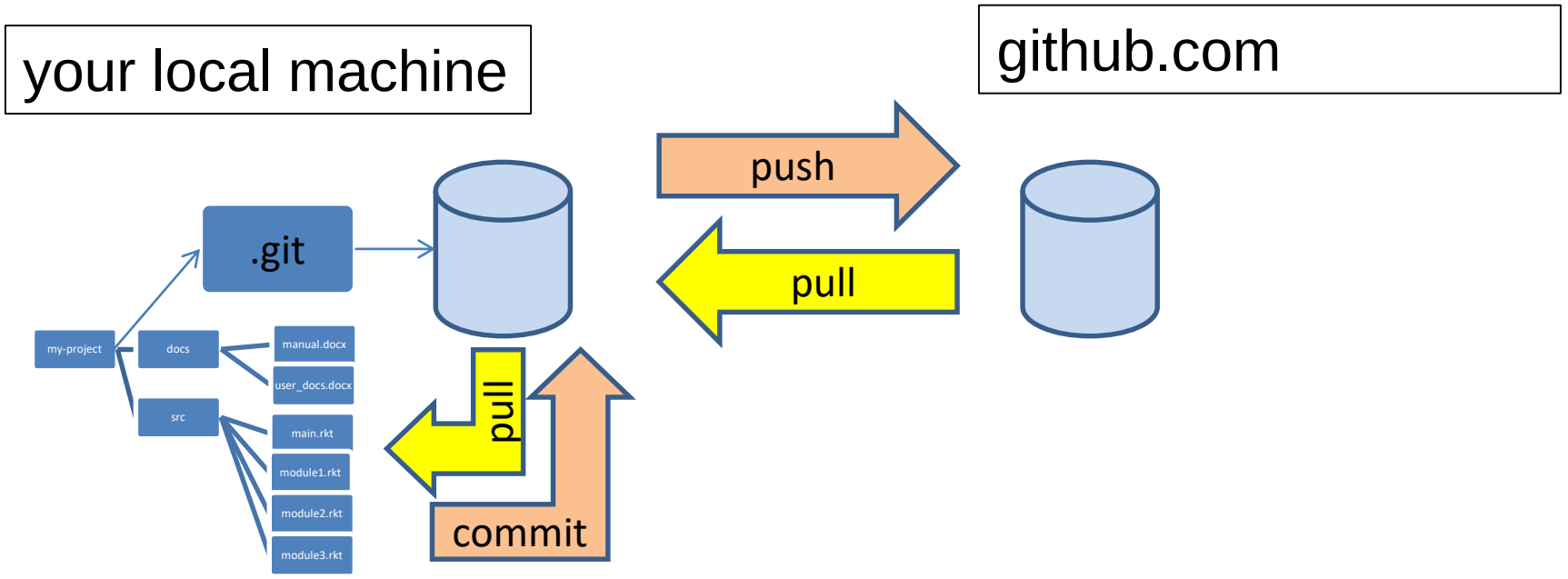
git commit -m "Message here" //save changes to local repository

git status //prints status of current repository

git log //history

git push origin master //push your local changes to your online repository

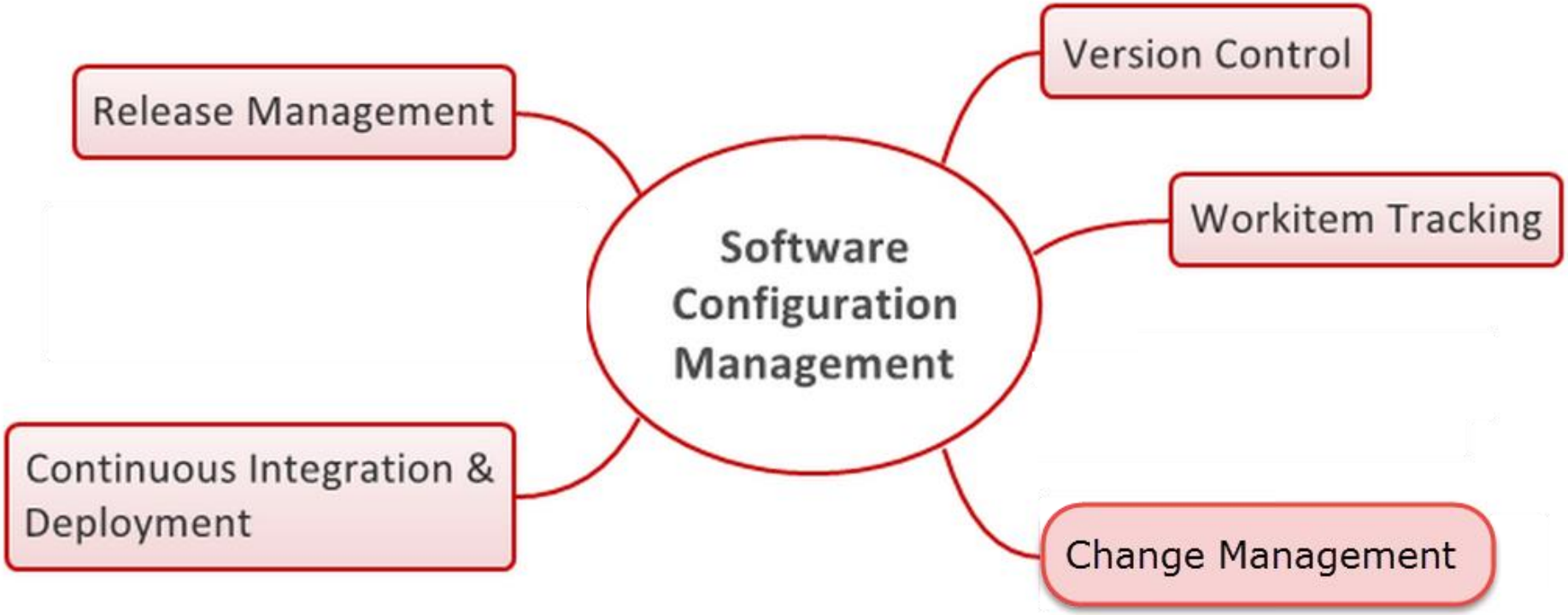
The Whole Picture



Software Configuration Management (SCM)

- Software Configuration Management
  - Techniques, practices and tools to track and **manage changes** throughout the software life cycle
  - Defines the process of change
  - Keeps track of what is happening in the project:
    - Which changes has been made
    - Who did those changes, and
    - Why

SCM Aspects


Release Management
Version Control
Software Configuration Management
Workitem Tracking
Continuous Integration & Deployment
Change Management

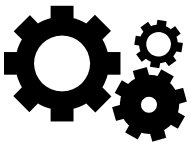
Requirements for SCM

- Repository: shared DB for artifacts with controlled access to prevent overwrites.
- Version management: Maintain history of changes made to each artifact; provide ability to see how version was created.
- Work Item Tracker: To manage tasks, issues and bugs.
- Product build and deployment: Automated build and deployment of the product from artifacts in repository.

SCM Tools

- Version control
  - git, github, CVS, Subversion
- Bug tracking
  - Bugzilla, Mantis Bugtracker, Rational ClearQuest

- Automated Build
  - Maven, Ant



- Continuous Integration (build, test and deploy)
  - Jenkins

Version Control

Version Control

- Version control is a system that records changes to a file or set of files over time so that you can recall specific versions later.
- Why?
  - Revert files back to a previous state
  - Compare changes over time
  - See who last modified something
  - Generally, if you screw things up or lose files, you can easily recover

Versioning Models

- **Lock-Modify-Unlock:**
  - Only one user works on a given file at a time → no conflicts
  - Example: Visual SourceSafe, Team Foundation Server (TFS)
- **Copy-Modify-Merge:**
  - Users make parallel changes to their own working copies
  - The parallel changes are merged and the final version emerges
  - Examples: Git, CVS, Subversion

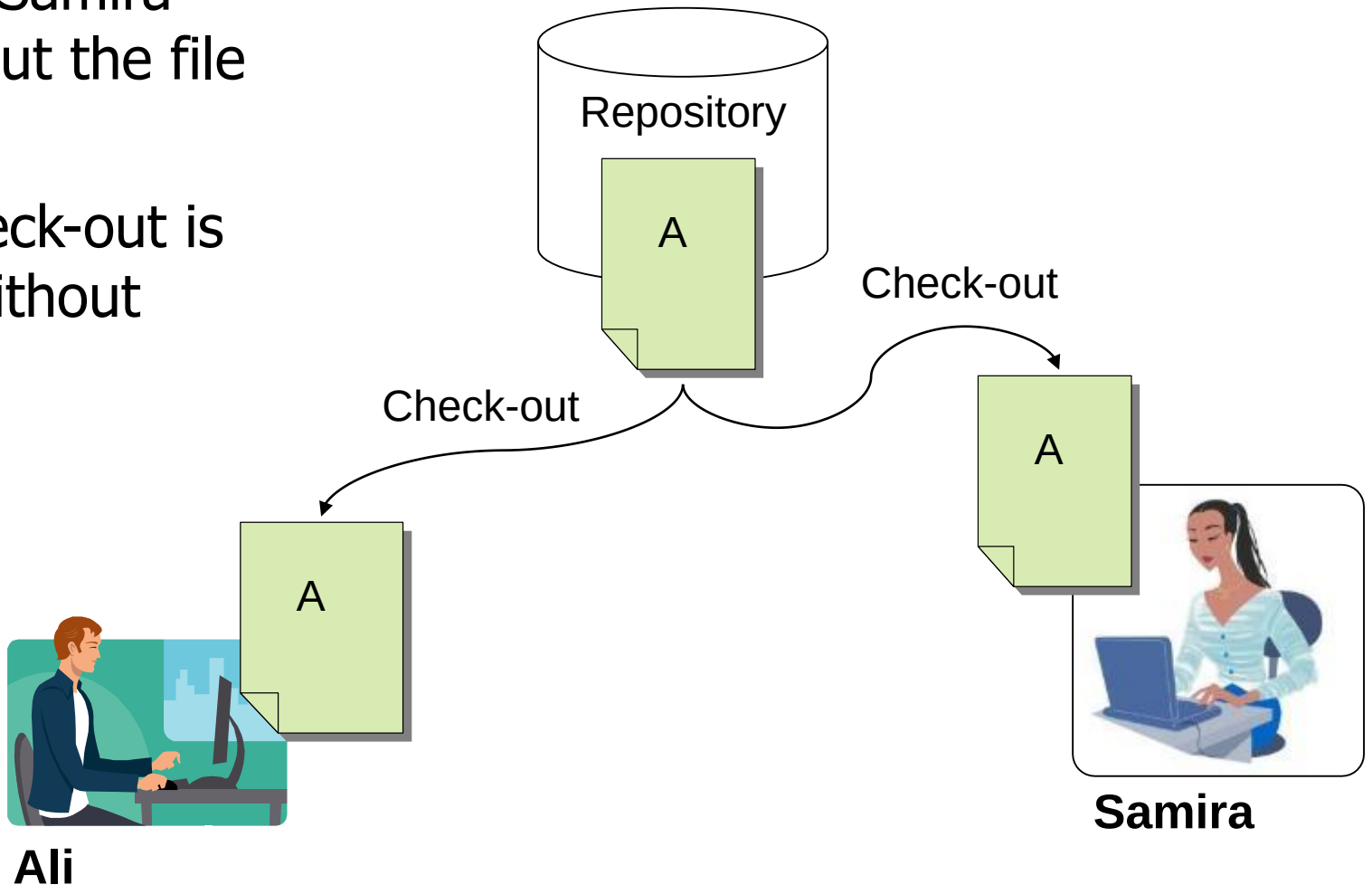
Merging Problems

- If a given file is concurrently modified it is necessary to merge the changes
  - Merging is hard!
    - It is not always possible to do it automatically
- Responsibility and coordination between the developers is needed
  - Commit as fast as you can
  - Do not commit code that does not compile or blocks the work of the others
  - Add comments on commit

The Copy-Modify-Merge Model (1)

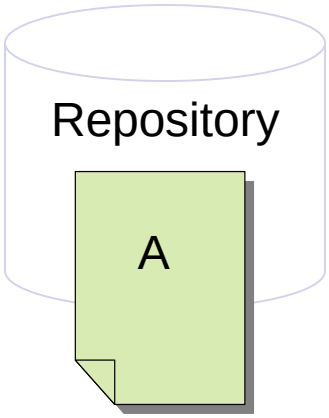
Ali and Samira check-out the file A.

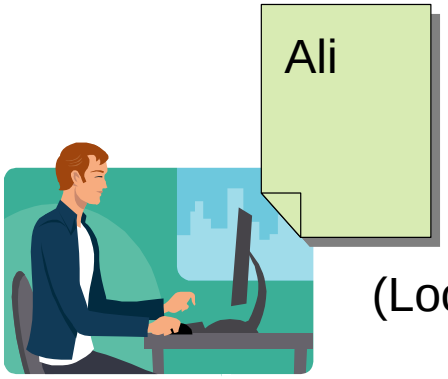
The check-out is done without locking.

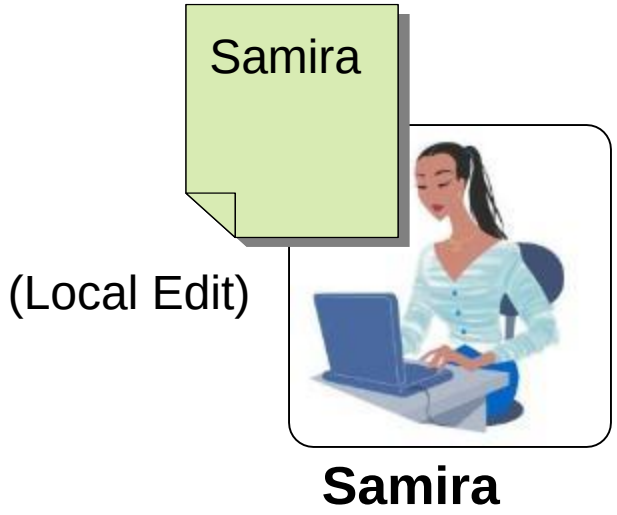


The Copy-Modify-Merge Model (2)

Both of them edit the local copies of the file (in the same time).

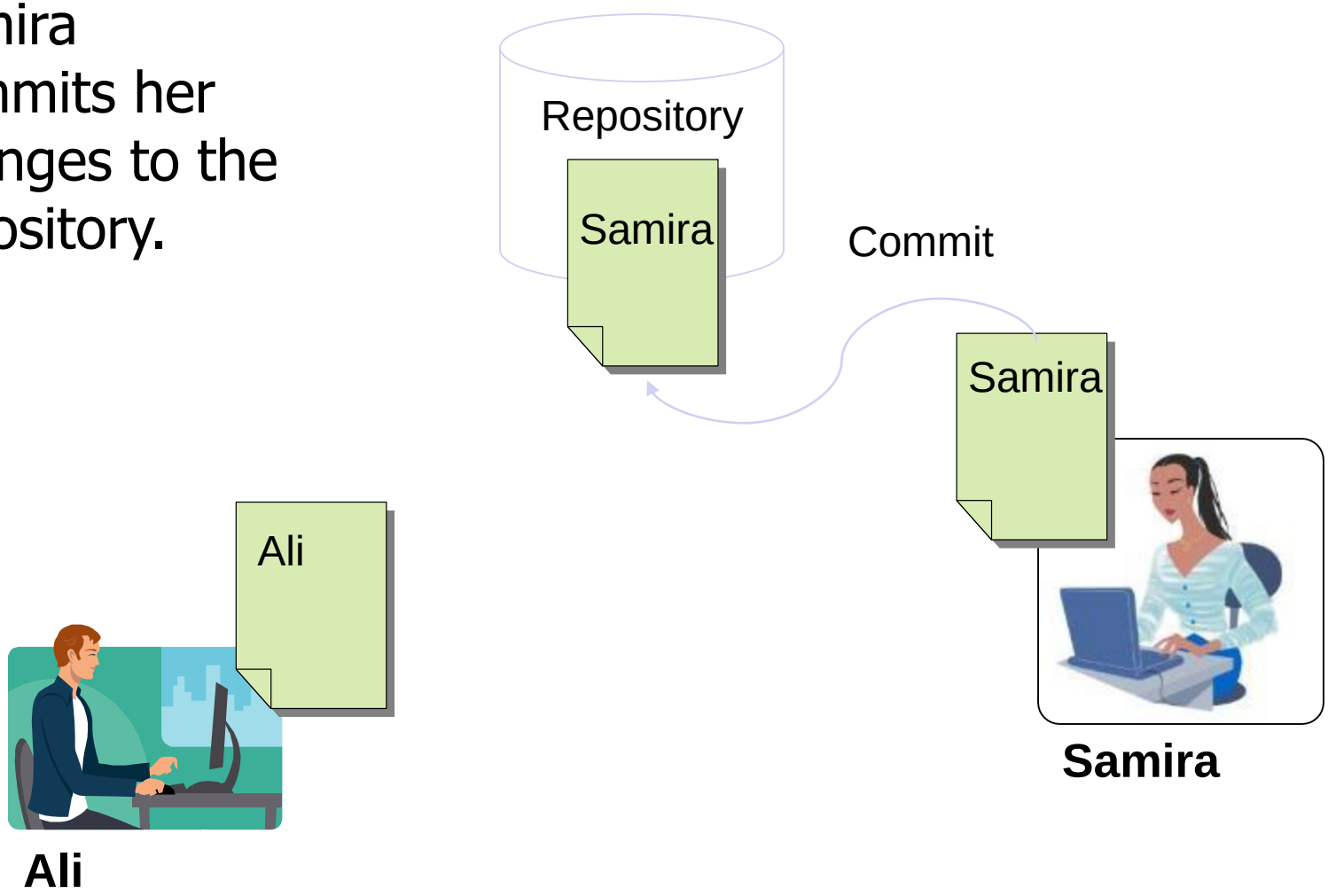






The Copy-Modify-Merge Model (3)

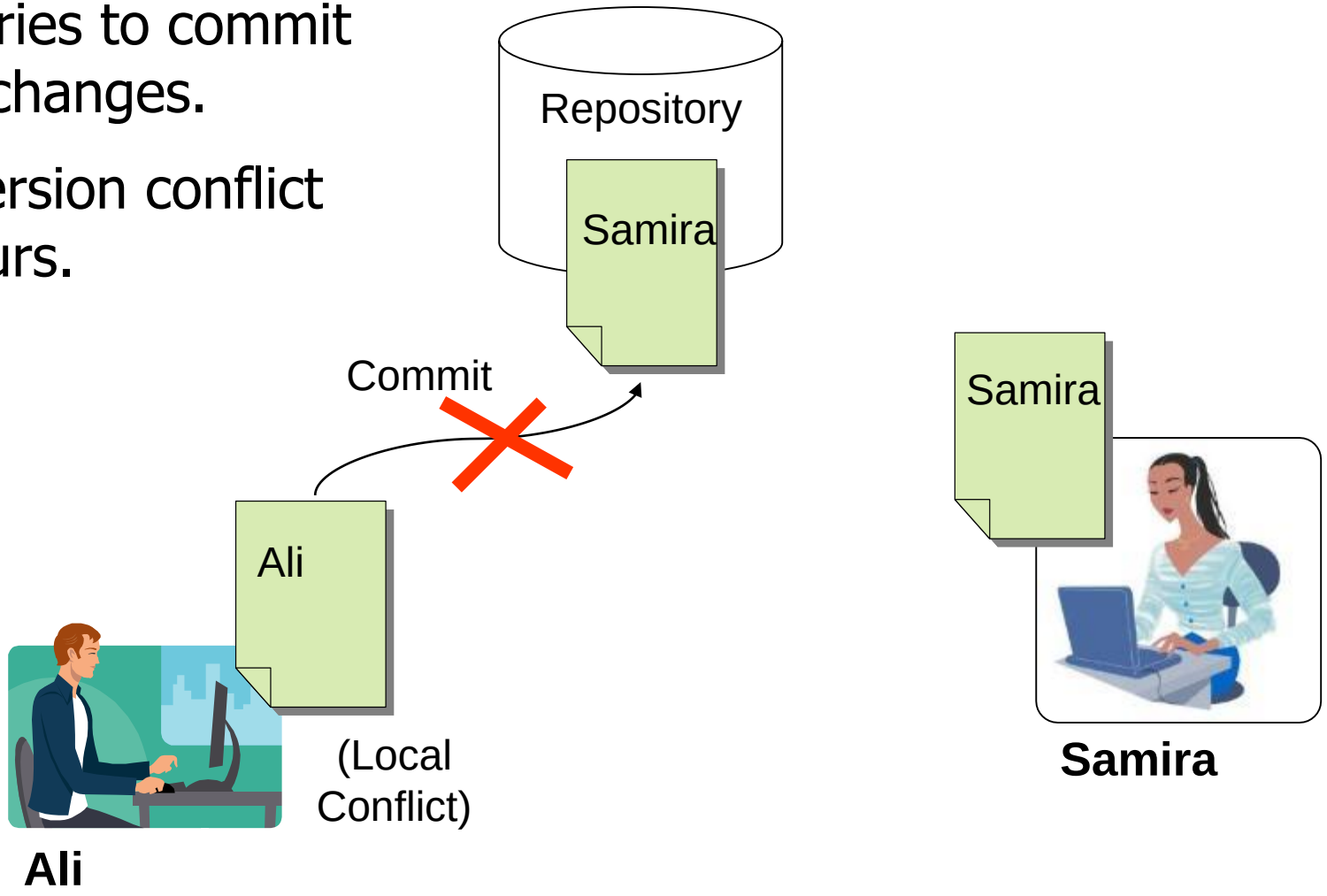
Samira commits her changes to the repository.



The Copy-Modify-Merge Model (4)

Ali tries to commit his changes.

A version conflict occurs.

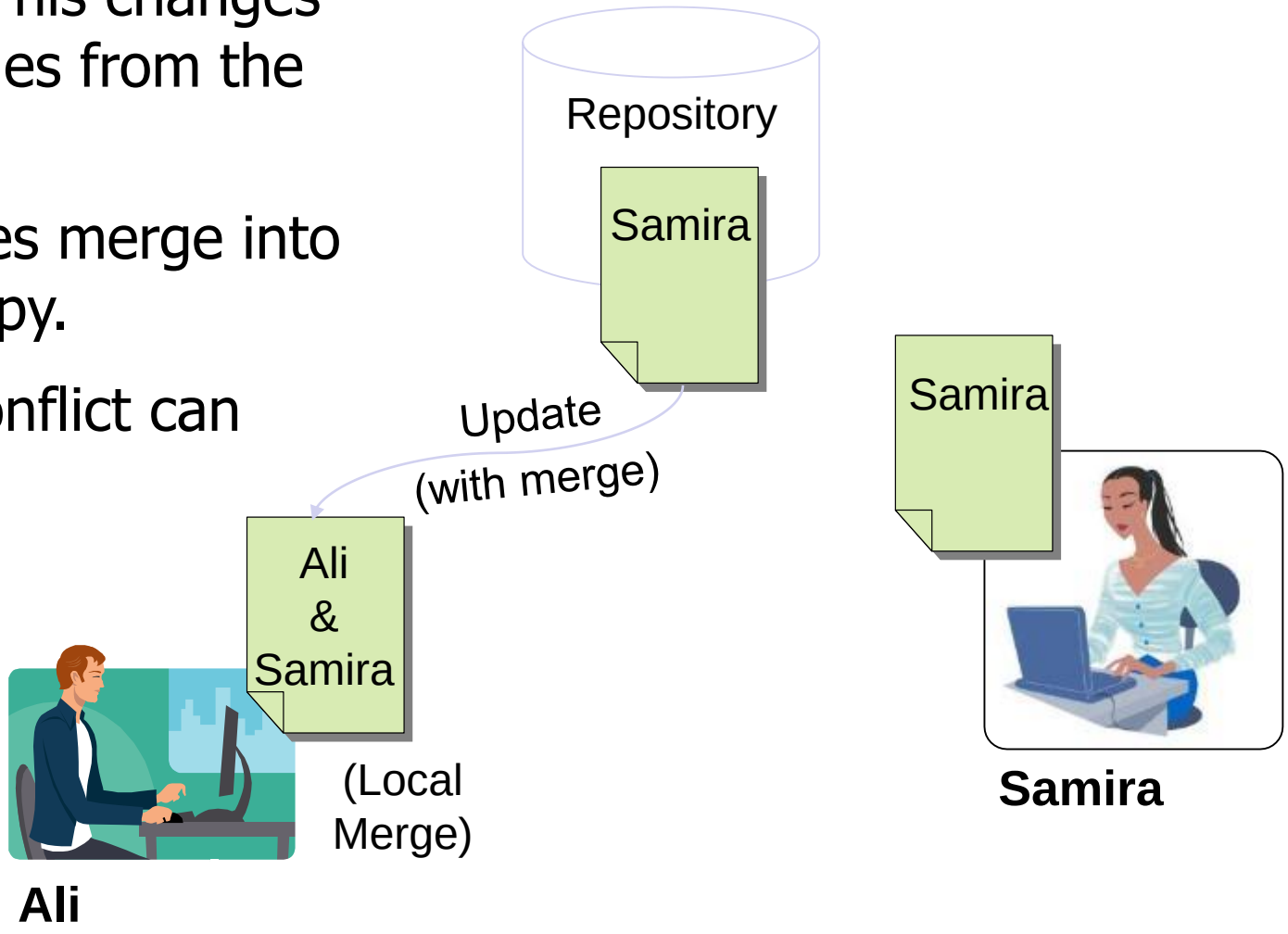


The Copy-Modify-Merge Model (5)

Ali updates his changes with the ones from the repository.

The changes merge into his local copy.

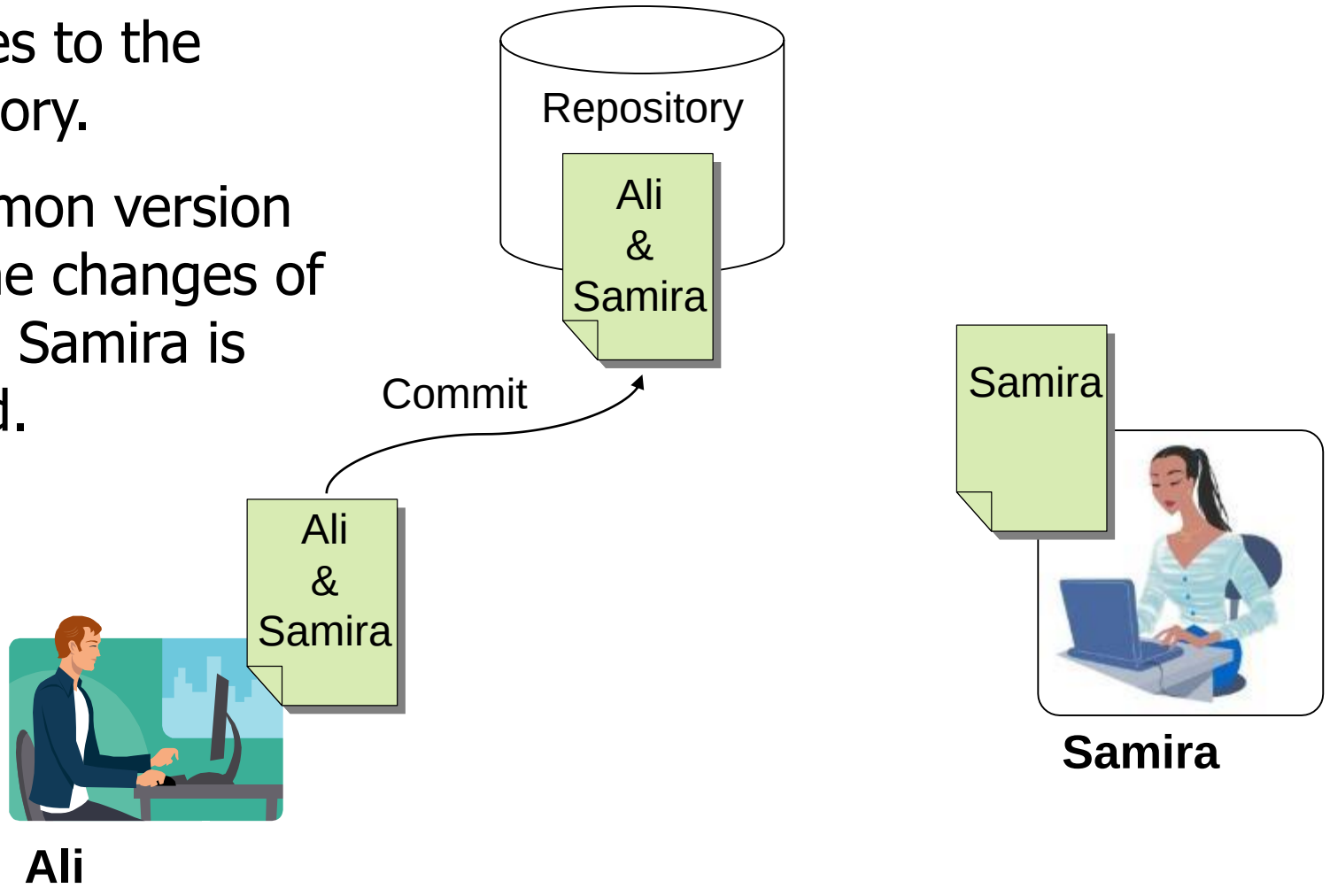
A merge conflict can occur.



The Copy-Modify-Merge Model (6)

Ali commits the changes to the repository.

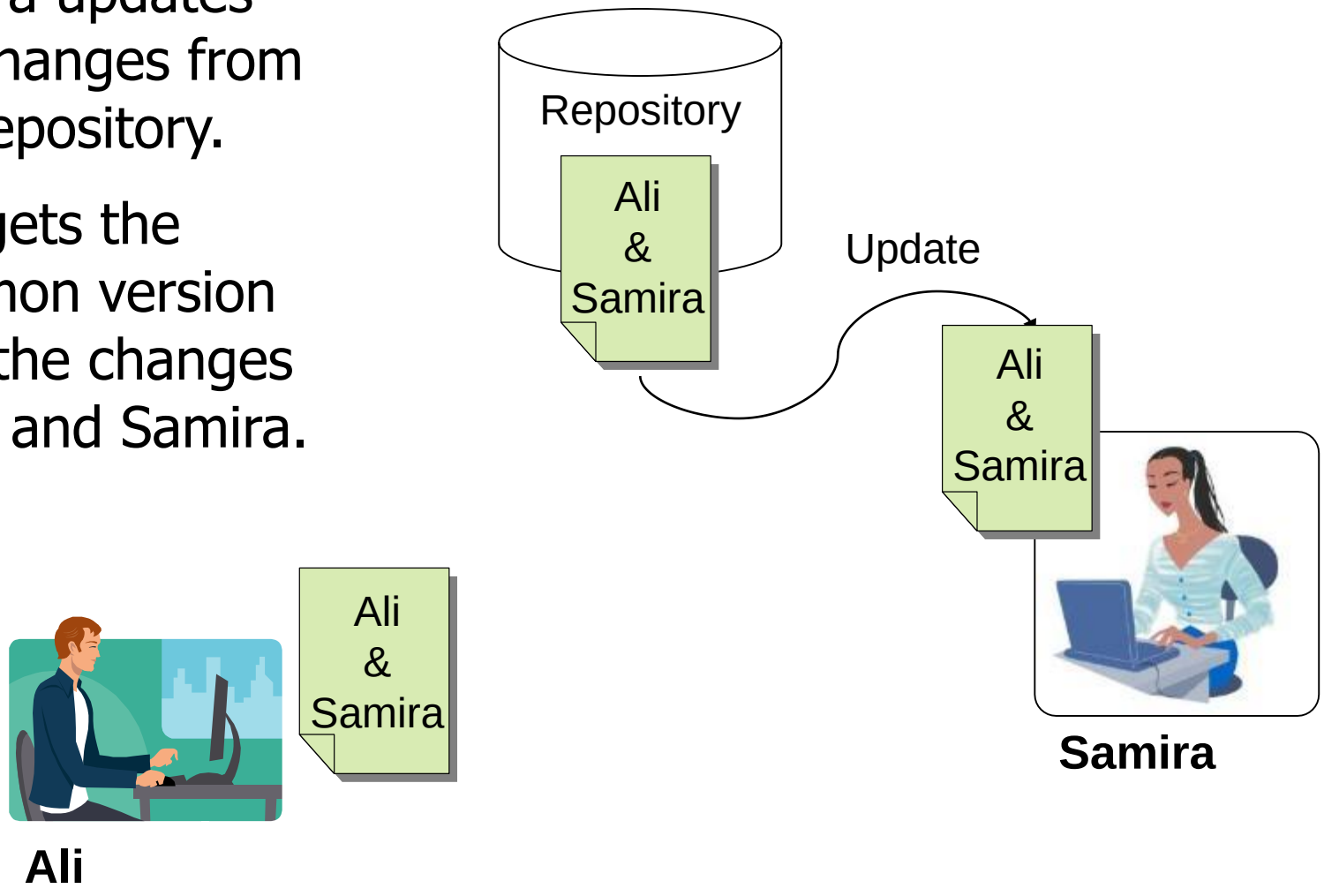
A common version with the changes of Ali and Samira is pushed.



The Copy-Modify-Merge Model (7)

Samira updates the changes from the repository.

She gets the common version with the changes of Ali and Samira.

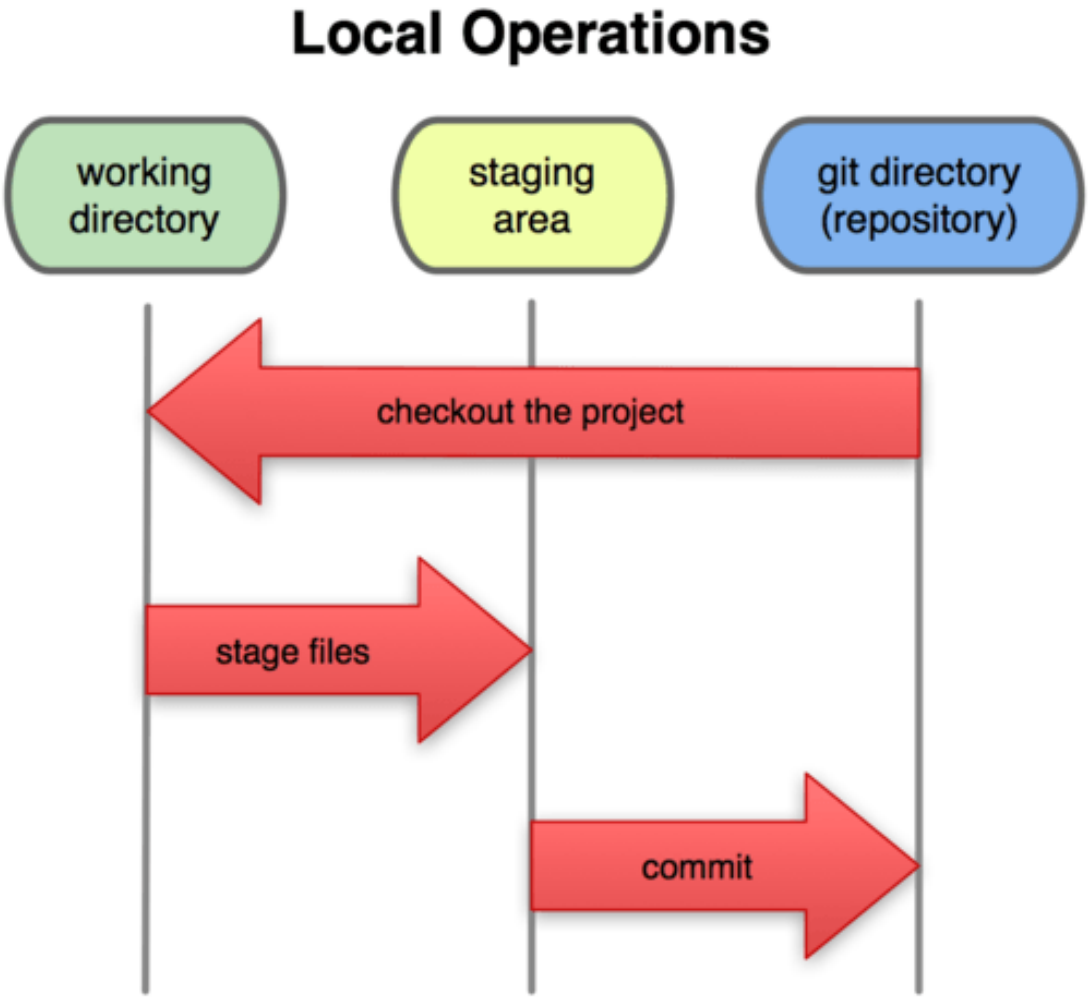


Git Basics

- The 4 States of a file
  - Modified
    - File has changed but not committed
  - Staged
    - Marked to go to next commit snapshot
  - Committed
    - Safely stored in local database
  - Untracked!
    - Newly added or removed files

Git Basics (Cont.)

- Three Main Section of a Git Project



Git: Local Operations

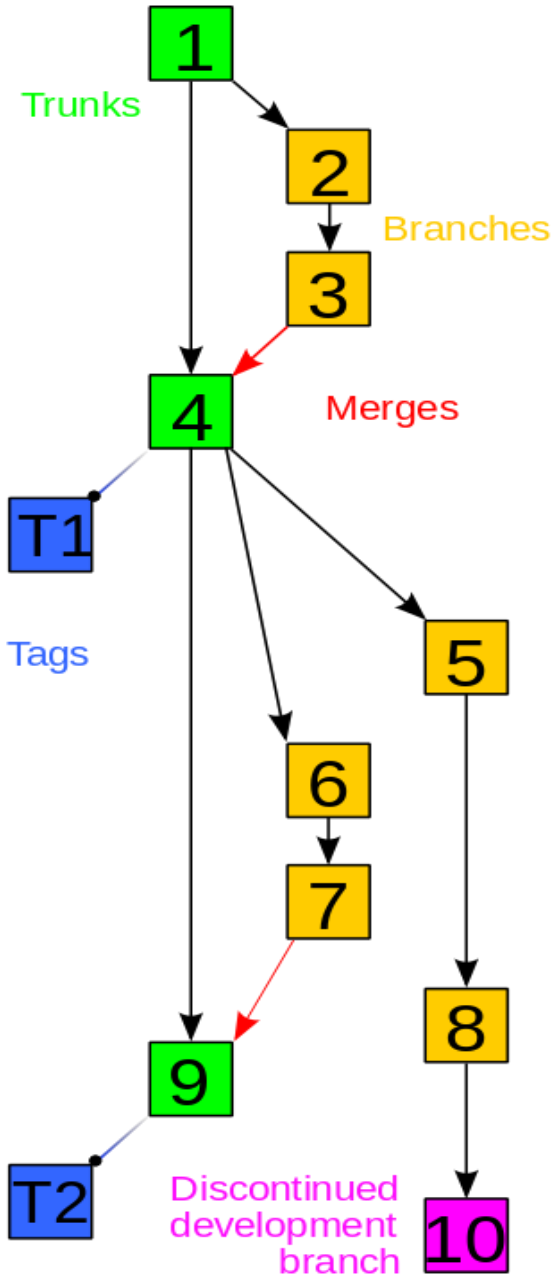
- Each developer has a complete local copy of the repository on his or her workstation
- Local operations
  - add
  - commit
  - check in
  - check out
  - status
  - differences
  - etc.

Git: Remote Operations

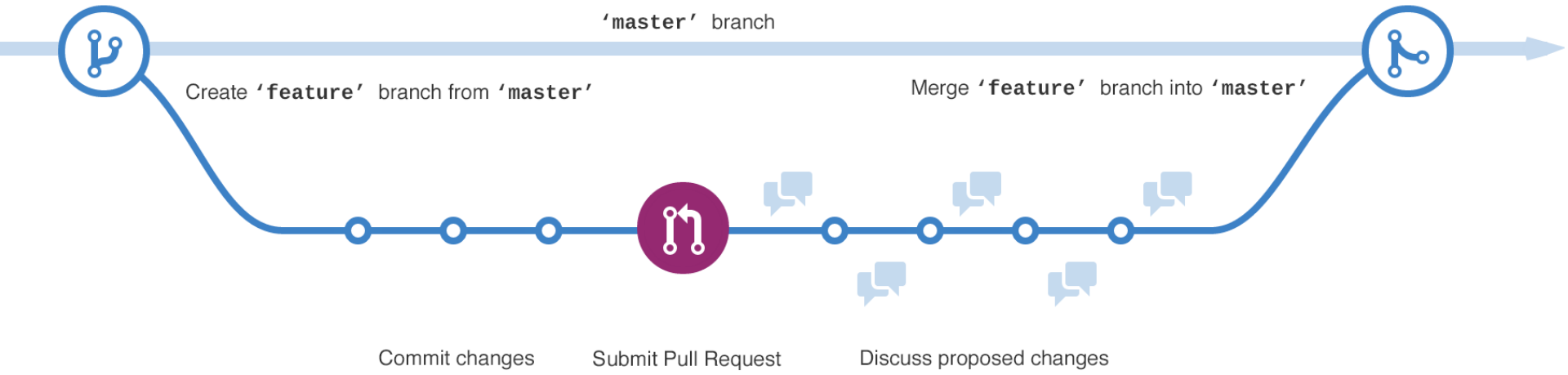
- Do remote operations only when necessary to the master repository on the server.
  - Clone the master repository into a local repository
  - Push (and merge) a local repository up to the master repository
    - If another team member had pushed the same files since you last obtained them from the master repository, or added new files, you'll have to pull down the changed or new files in order to merge them into your local repository before you can push
  - Pull (and merge) files from the master repository down to a local repository

History Tree

- Trunk is in green is the master branch that has the production version
- Branches are in yellow
- A need of branching arises in the following situations:
  - Developing a new feature or fixing a bug
  - **Variant:** functionally equivalent versions, but designed for different settings, e.g. hardware and software



Branches using GitHub



- Developers use branches for keeping bug fixes and feature work **separate** from the ***master*** (production) branch. When a feature or fix is ready, the branch is merged into master.
- Before merge you may make a **pull request**, to start a discussion about commits (code review) and get feedback

Branches

- **Isolating** new development from finished work
- New development (new features, non-emergency bug fixes) are built in **feature branches.**
  - They are only **merged** back into master branch when ready for release

GitHub basics – pull requests