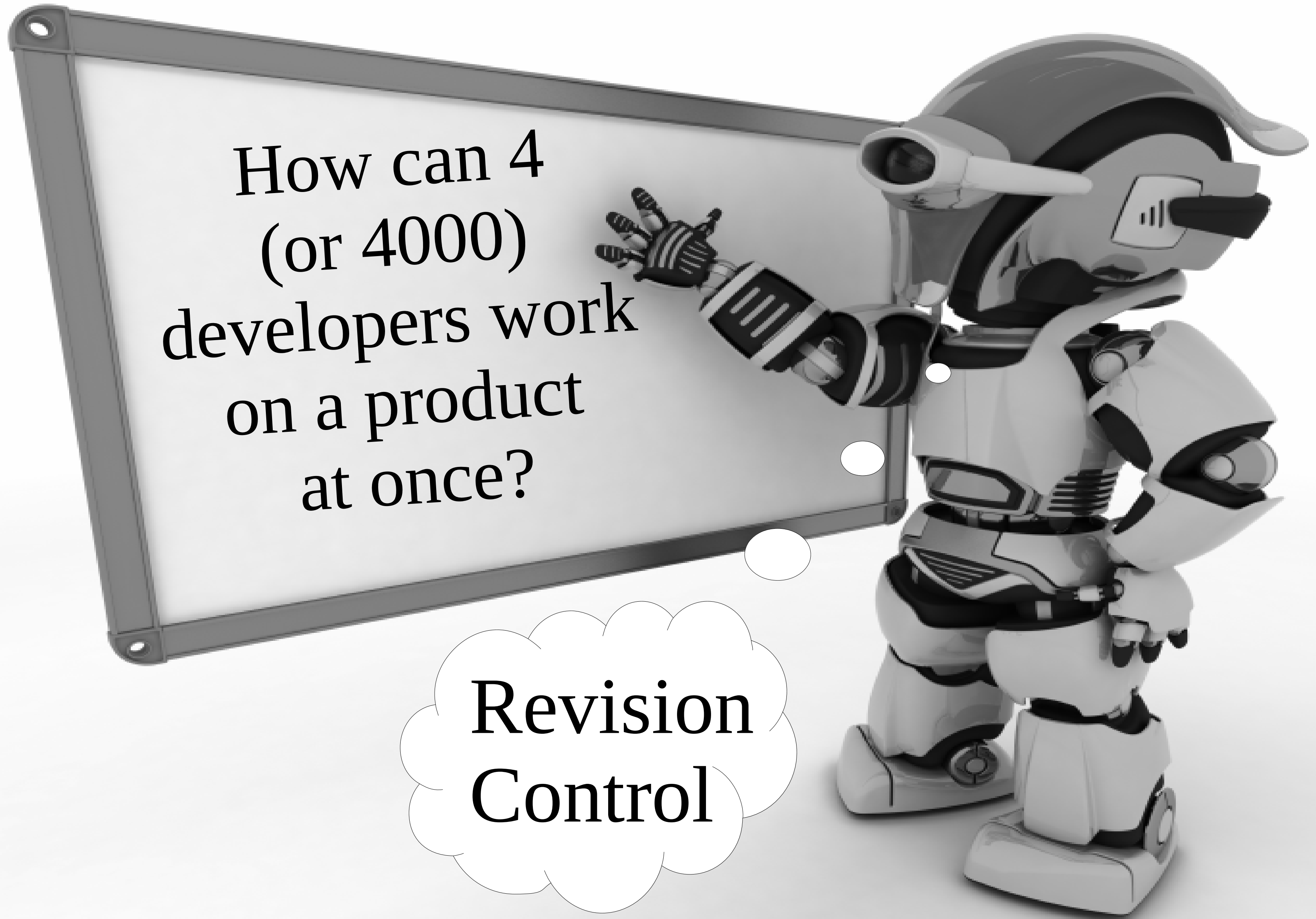


Revision Control

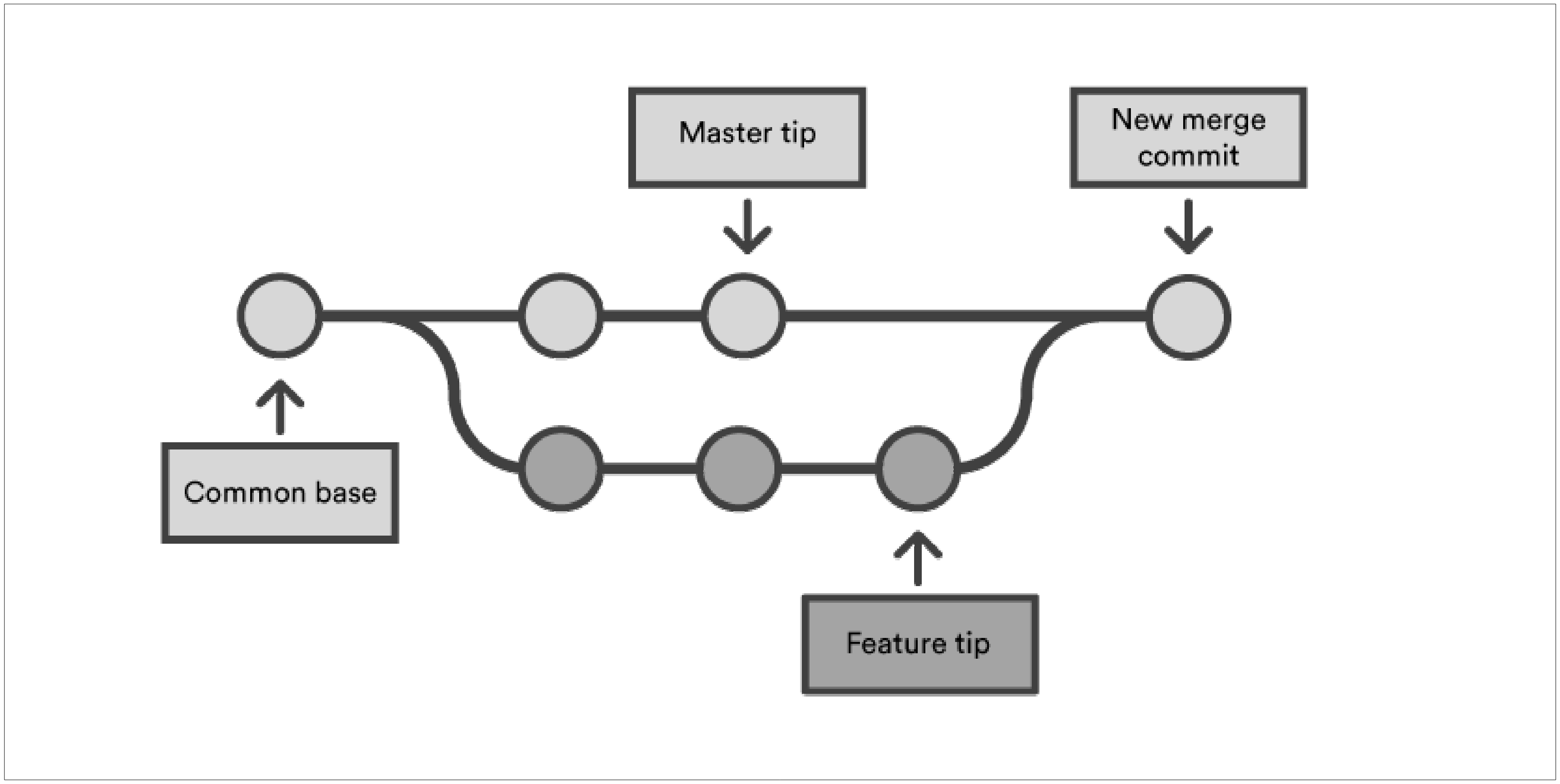
More Info: https://git-scm.com/book/en/v2/Getting-Started-About-Version-Control

Slides #2

Revision Control

- Revision Control:
  -
  - Also called version control, source control, software configuration management.
- Motivation:
  - Need to coordinate changes made by multiple developers.
  - Need a reliable system to ensure changes are ..

Git Graph / Log / History



source: https://www.atlassian.com/git/tutorials/using-branches/git-merge

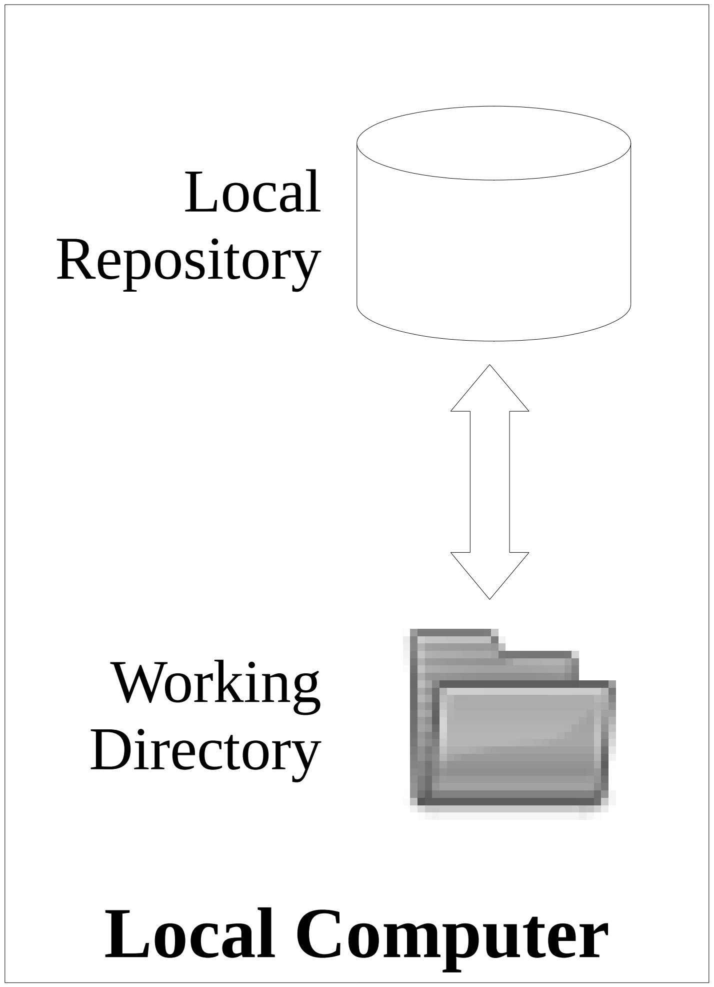
Overview of what we’ll learn in this and later lessons on Git

1. Git Basics
(Good for ~1 person)

2. Merging Conflicts
(Needed for 2+ people)

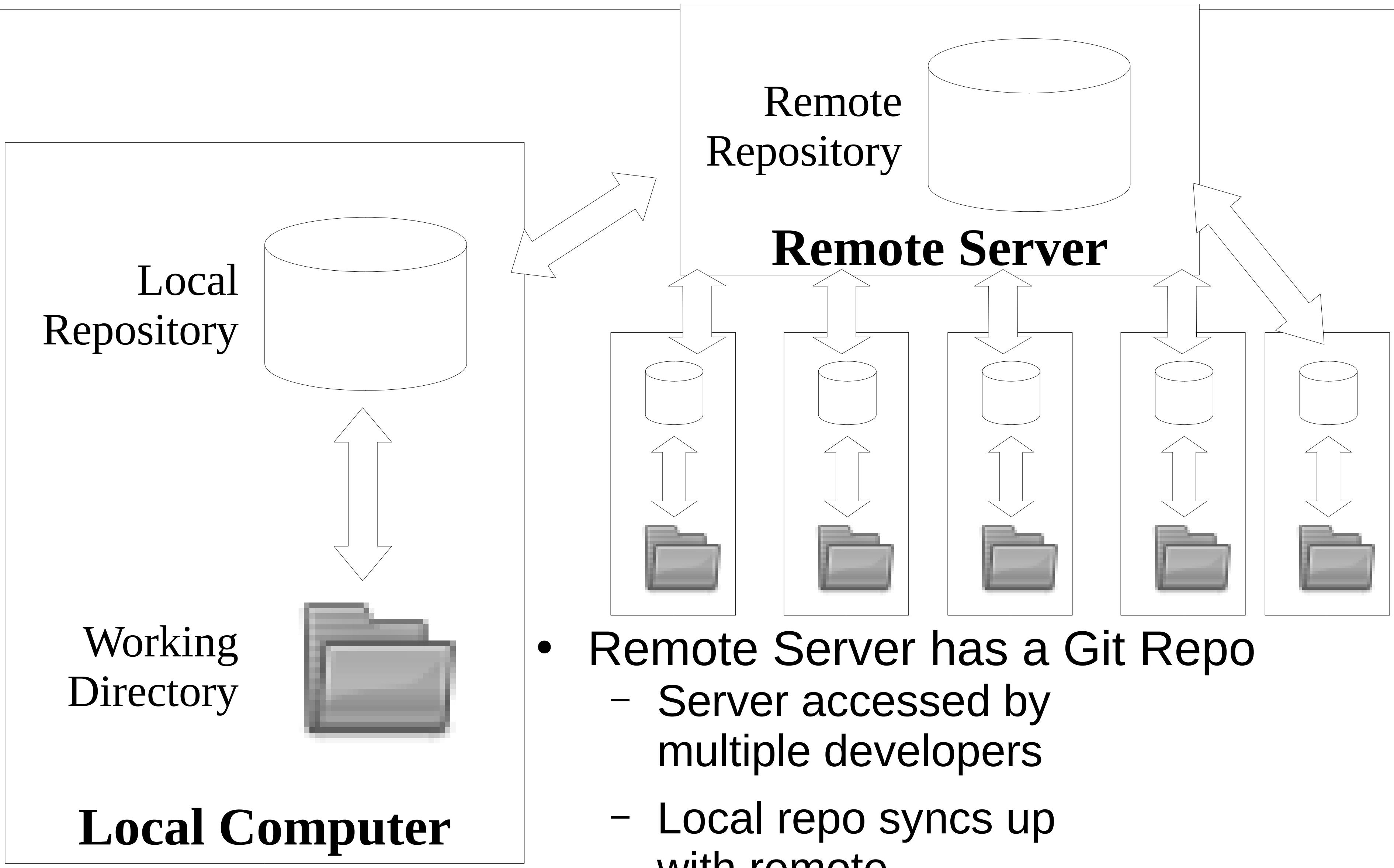
3. Using GitLab
(Managing a team)

Local Topology Simplified



- Local Machine has a ..
- The latest code in the repo can be checked-out into the working directory.
  - Head: the latest version of the code.

Remote Topology Simplified

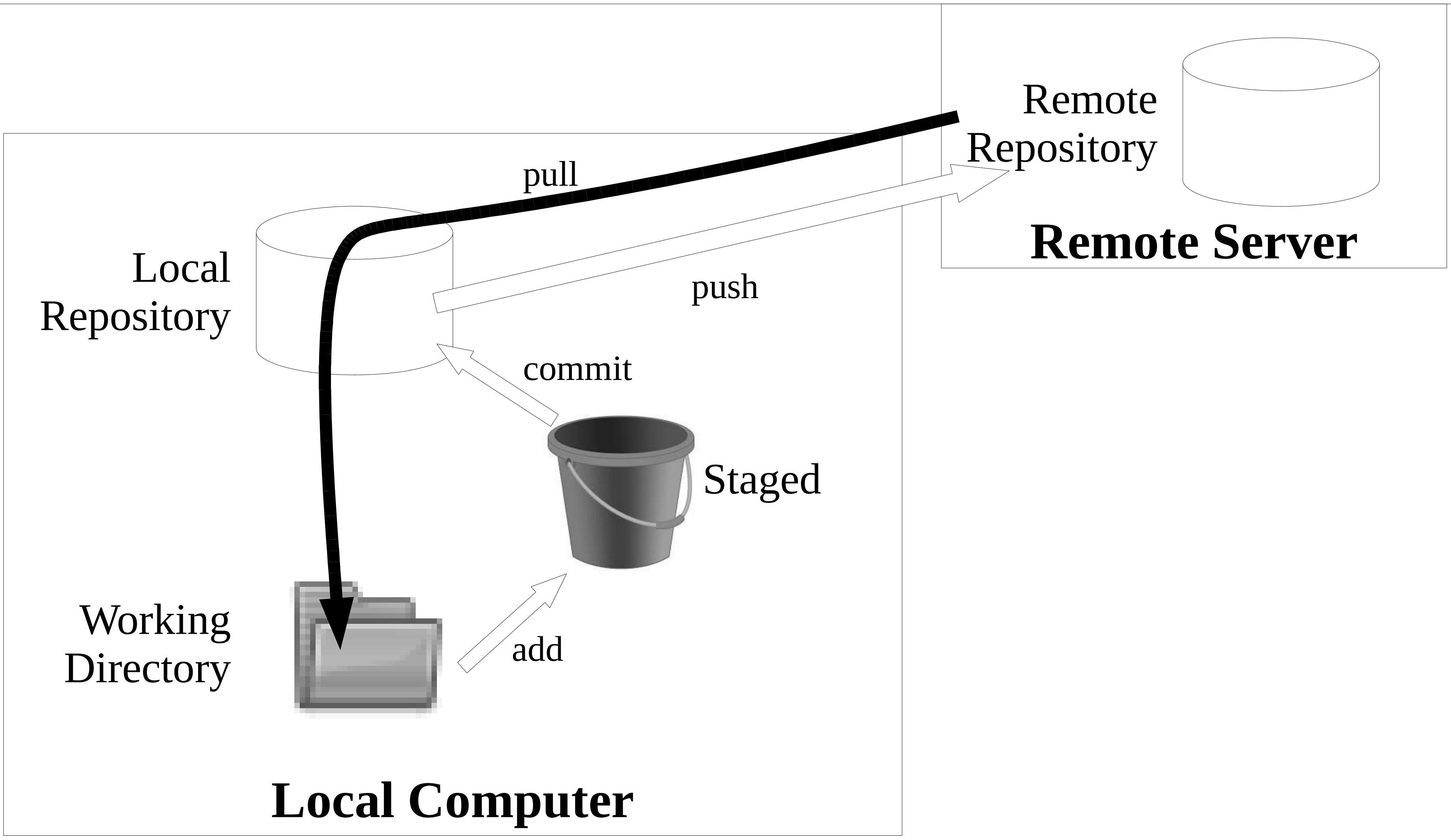


- Remote Server has a Git Repo
  - Server accessed by multiple developers
  - Local repo syncs up with remote

Distributed

- Distributed Version Control
  - Git has..
    each “local repo” is a full and complete repo.
  - Can work off-line (on a plane) and still commit to the local repo. Later sync up with the remote repo.
- Git Servers
  - Often the remote repo is a dedicated Git server such as GitHub or GitLab.
  - These systems add extra team collaboration and discussion tools (more later).

Git Command Diagram



Work Flow 1: Setup

- Associate your local repo to a remote repo by either:
  - Create an empty repo in GitLab (gitlab.cs.sfu.ca) and push some existing code to it; or
  - .. an existing repo to your local PC.

Work Flow 2: Changes

- Do some work in working directory
  - create new files, change files, delete files, etc.
- ..
  - *Stages* the changes as being ready to commit.
  - Also used for adding files to Git (*tracking* them)
- ..
  - Commit all staged changes to local repo.
- ..
  - Send committed changes to remote repo.
- ..
  - View the state of local file changes

Work Flow 3: Other's Changes

- Other team members will push some changes to the repo which you then want
- ..
  - Get changes from remote repo and apply them to local repo and working directory (move to head).
  - If there are any conflicting changes, may need to do a *merge* (more later).
- ..
  - At any time, can view the changes people have made.

Git Tools

- Command Line
  - Git is very often accessed via its command-line tools
  - Git commands look like:
    ```
    git clone git@csil-git1.cs.surrey.sfu.ca:myTeam/daProject.git
    git commit
    ```
- GUI Integrated Tools
  - ..
    but low-level understanding is required!
  - Can be inside IDE: Android Studio
  - Can be integrated into file system: TortoiseGit
  - Lecture: command line to understand the tool;
    Assignments: IDE for convenience (likely).

Command-line Demo

- Git Command Demo

  [create repo on csil-git1.cs.surrey.sfu.ca]

  - **`git clone <git@csil-git1.cs....>`**

  [now edit file hello.txt]

  - **`git status`**
  - **`git add hello.txt`**
  - **`git commit`**
  - **`git push`**
  - **`git log`**
  - **`git pull`**

Git Details

1. Git Basics
(Good for ~1 person)

2. Merging Conflicts
(Needed for 2+ people)

3. Using GitLab
(Managing a team)

SSH Key

- GitLab verifies you via an SSH key (no passwords)
  - Generate the key on each machine you use
    (all CSIL machines will share your SSH key)
  - In Linux, open terminal and run:
    ```
    $ ssh-keygen -t ed25519
    ```
    In Windows, follow guide for Git for Windows
  - View key; highlight and copy:
    ```
    $ cat ~/.ssh/id_ed25519.pub
    ```
- On GitLab (gitlab.cs.sfu.ca)
  click avatar (top right) --> Settings --> SSH keys
  - paste SSH key; give title “CSIL”; and add it.
- Now GitLab will allow you access!
  ```
  $ ssh -T git@csil-git1.cs.surrey.sfu.ca
  ```

Basic Git Sequence for Editing Code

0. Have a working directory with no changes

1. ..
   - will "fast-forward" without any conflicting changes

2. ..
   - cannot pull with some uncommitted changes

3. ..

4. ..
   - automatically merges files without conflicting changes
   - manually merge conflicts when required

5. ..
   - cannot push if others have pushed code:

   “current branch is behind master”, “unable to fast-forward”

Try it yourself (after lecture) :)

1) Create ***empty*** repo on gitlab.cs.sfu.ca
2) Create project in Android Studio; add a Readme.txt
3) Commit to local repo (this adds and commits)
4) Push to remote repo
   Set origin to git@csil-git1.cs.surrey.sfu.ca.____.git
   (get ____ from GitLab repo’s “clone” button)

   If you mistakenly created a non-empty repo, it’s easiest to create a new empty repo (no readme even!) and push to it.
5) Make another change, commit, push

Merge Conflict Demo

- Show demo of conflicting changes being made by two team members at once
  - Pulling with uncommitted conflicts fails
  - Pushing before merging fails
  - Commit my changes
  - Pull to trigger merge
  - When merge done then add/commit/push
- Android Studio has VCS --> Update Project
  - Which works with uncommitted conflicts
  - It automatically stash changes to get around having to do extra commit

.gitignore / delete / add / rename

- .gitignore File
  - Lists file types to exclude from Git:
  - Example:
    Exclude .bak, build products, some IDE files
- Delete / Add / Rename Files
  - Just delete / create the files in working directory
  - Then execute Git commands:
    - “add” changed files
    - “commit”
    - “push”

Commit Messages

- A good commit message is required!
  - Line 1: .. (<70 characters)
    Capitalize your statement
    Use imperative: "Fix bug..." vs "fixed" or "fixes"
  - Line 2: ..
  - Line 3+: .. ; wrap your text ~70 characters

Example:

```
Make game state persist between launches and rotation.

Use SharedPreferences to store Game's state. Serialize
using Gson library and Bundle for rotation.
```

- 276 Pair Programming
  - If pair programming, add pair’s user ID at start:
    “[pair: bfraser] Make game state persist ....”

Reverting Changes

- ‘git checkout’ to revert files
  - ..
  - Overwrite file in working directory with one from local repo.
- Revert with Caution
  - Will lose all uncommitted changes in the file.
  - Normally Git does not let you lose changes.
  - If in doubt, grab a backup copy (ZIP your folder) then revert.
    - Just make sure you don’t commit the backup!

Revision Control Generalities

Merge vs Lock

2 Competing ways revision control protects files:

- Checkout-Edit-Merge
  - Merge support allows concurrent access to a file so multiple developers can work on same code at once
  - But can lead to...
- Lock-Edit-Unlock
  - Locking prevents merge conflicts by..
    - "I can't make any changes until Bob finish!"
  - Adds pressure to make changes quickly..
    "I need that file now!”

Revision Control Features

- Atomic operations
  -
  - Change is applied all at once:
    no other changes applied while you're checking in.
- Tag
  - Mark certain versions of certain files as a group.
    Ex: "Files for Version 1.0 of product".
  - Able to easily..
    of the files later to fix bugs etc.
    - "Get all files exactly as the were in
      Version 1.0 (three year ago)".

Team Work

- Minimum requirement to committing code:
  - When you check in, the full system must compile and run.
  - Only under exceptional circumstances should you ever check in something which breaks the build.

Committing Frequency

- Expected Commit Frequency
  - Commit little changes to local repo very often ..
  - Once some work is more stable, push all the changes at once to remote repo..
- CMPT 276
  - Committing / pushing this frequently gives visibility to your contributions; helps for marking discussions!
  - In a ‘professional’ project, you would tailor your commits/pushes to the work you are doing, and squash small commits together into bigger more meaningful ones.

Coding with Source Control

-
  ```
  // Removed Jan 2002 for V1.01
  // cout << "Dave; I wouldn't do that, Dave.\n";
  ```
  - Put meaningful comments into checkins!

-
  ```
  #if 0
  // Unneeded, but left 'cuz someone may want it...
  ......
  #endif
  ```

-
  ```
  // Written by Dr. Evil
  ....
  ```

Summary

- Revision control a critical tool for development.
  - Git is a distributed revision control system.
- Operations:
  - clone, add, commit, push, pull, merge (later)
- Git Details
  - Merge conflicting changes as needed.
  - .gitignore, revert (git’s checkout)
- Basic Features
  - Atomic operations, tags/Label
- Rules to Code By
  - Commit often, don’t break the build