Software Configuration Management

Kent State University
Prof. Jonathan Maletic

SCM

- Software Configuration Management involves:
- Revision control (version control) and change management
- Build and release management (diff and patch)
- Process and environment management
- Facilitate teamwork and collaboration
- Issue/Defect tracking

Change Management

- Version Control Systems (VCS): git, mercurial, svn, perforce, MS Team Foundation, cvs, rcs

- VCS help developers manage changes made to files (source code, documentation, build files, etc.)

- A revision number is given to each new version (or revision) of a file or set of files

- A commit defines the set of files associated with a new version

- VCS manage the revisions for searching and roll back

Why use Version Control

- Software is really complex and constantly changing.
- Software that compiled and passed tests yesterday may fail today.
- Which change broke the system? Without VCS this is a guessing game.
- VCS records what changes are made, when the change was made, and who made the change - maintains a complete history of changes made to a system

Uses of VCS

- You are working on fixing a bug or adding a new feature
- Can not do this on the “production code” (master copy) - the code that compiles, runs, and passes all the tests
- VCS allows developers to make changes over multiple days on their local copy without modifying the master copy
- After the bug is fixed or feature completed the developer can commit their work to the master copy

Collaboration

- You modify the code in file foo, get it working
- Your team mate modifies the code in file foo and gets it working
- You combine both version and it doesn’t work
- Something in one of the versions broke the other
- Merging can also be supported by VCS
- Version control is essential for coordination of multiple developers

Other Benefits

- Provides a complete time machine for the project - able to roll back to any previous version or examine changes made in the past

- Allows for multiple different variant of the same project - stand alone app, web version, iPhone version, etc

- Greatly simplifies concurrent development and merging of different changes

- Helps define the development workflow and process

Critical Tool

- Version control systems are a critical component in the software engineering process

- Version control systems along with other components of configuration management and team management directly support the quality goal of the project

- By not adopting and correctly using a version control system your project is most likely doomed

How VCS Work

- Versioning at file level
- Text files - diff can be used to determine what changed. This works at the character level (line or word)
- Binary files - at the file level only
- No understanding of syntax or programming language

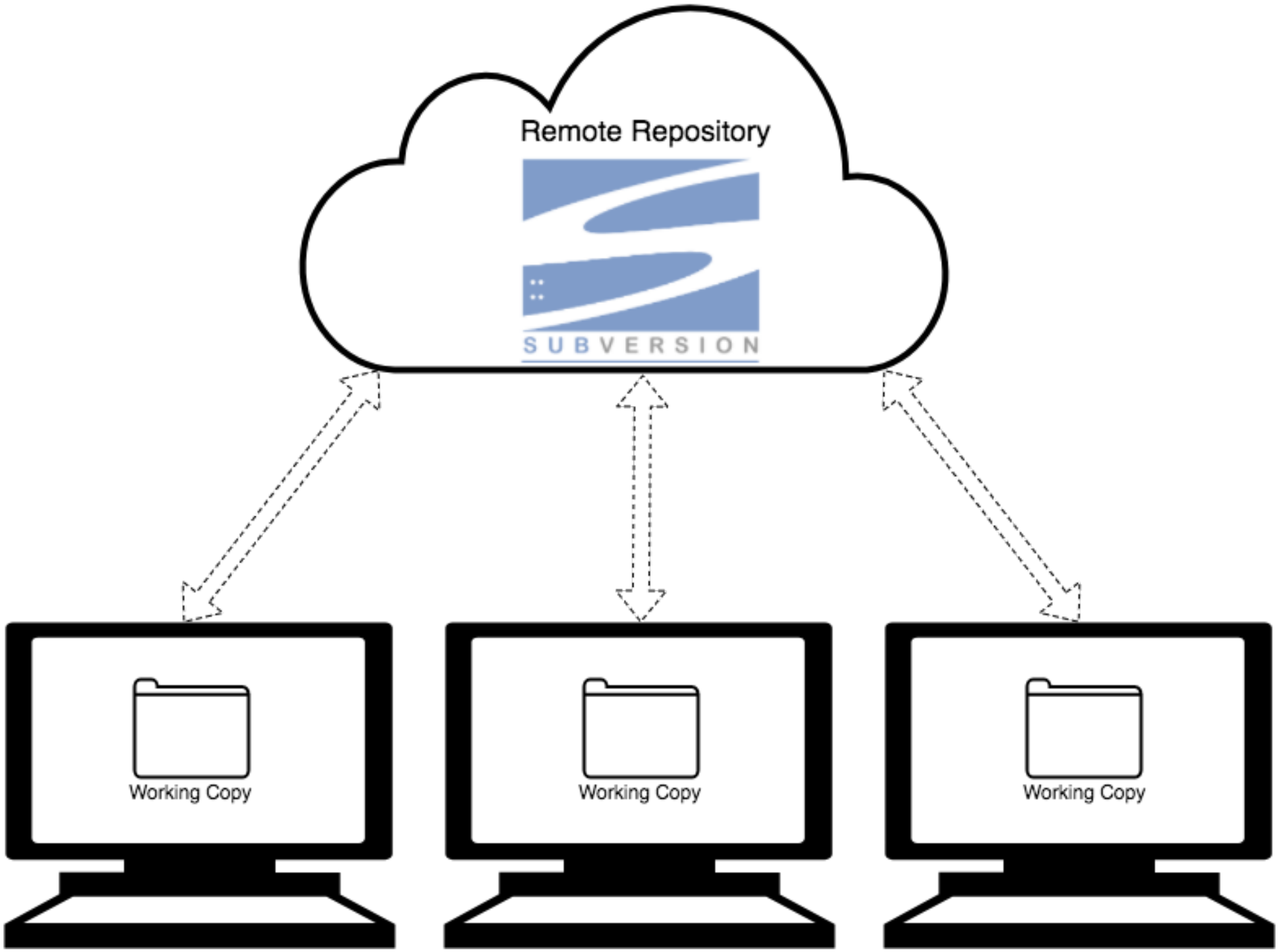
Types of VCS

- There are basically two types of version control systems
  - Centralized: svn, cvs, rcs
    - rcs use file locking
    - svn, cvs use version merging (with diff)
  - Distributed: git, mercurial
    - git uses version merging

Lock vs Merge

- Locking - one developer locks file and only they can modify the file (lock and modify)
    - Advantage is that there is no merging problems
    - Disadvantage is that it slows down development by not allowing others to work on the file (hence they are rarely used anymore)
- Merging has no restrictions on access (copy and modify)
    - Advantage is developers can work in parallel
    - Disadvantage is that there will be merging problems

Centralized Model



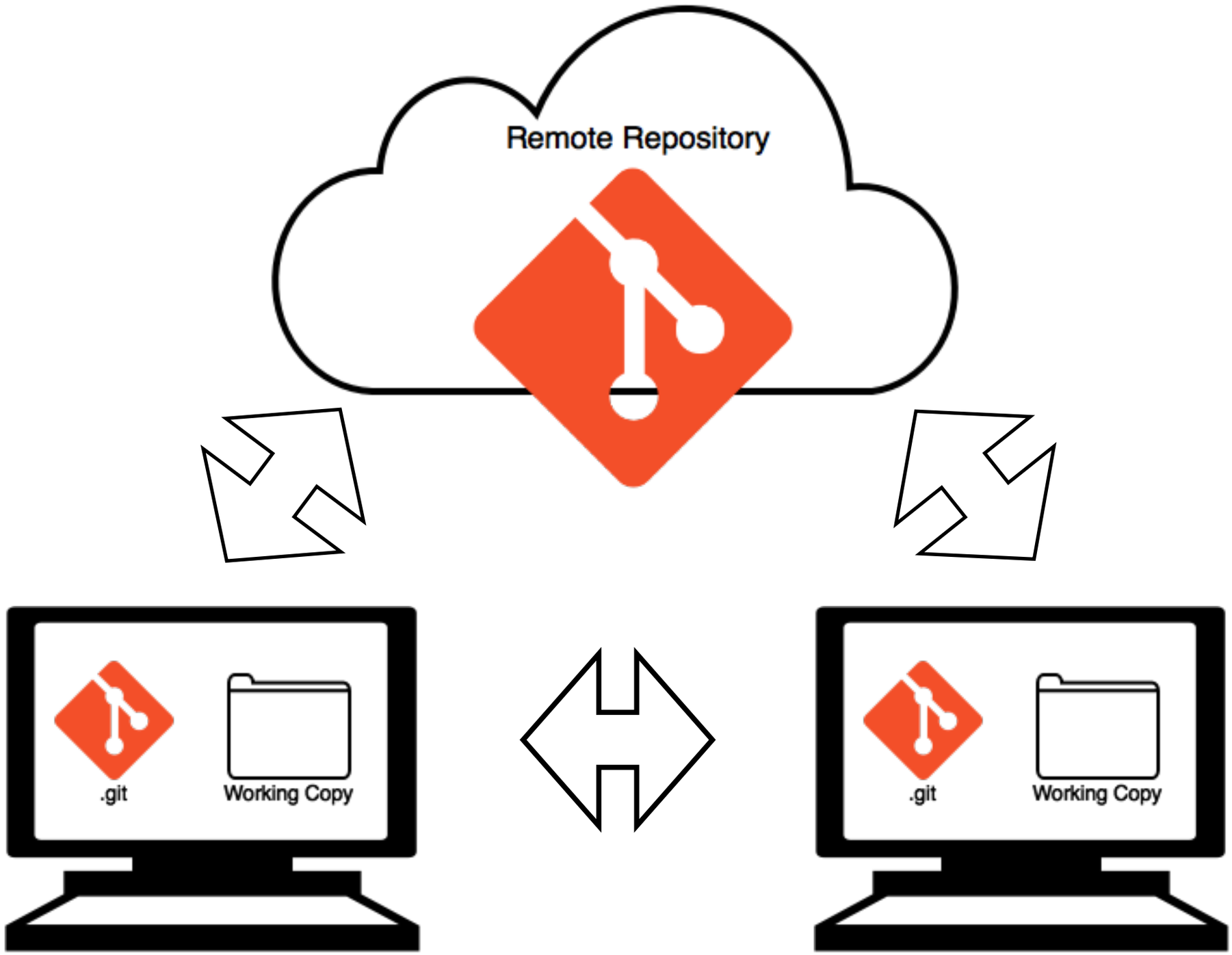
Subversion (svn)

- Subversion uses a centralized repository to store the main copy
- Developers check out a copy of this repo locally on their machine. Changes can be made to this local copy.
- Developers than commit their changes to the main copy
- Other developers must be informed of these changes and either do an update to their local copy or delay the merging process to a later time
- Merge conflicts become a difficult issue to resolve properly
- One sequential sequence of version numbers

svn Workflow

- Update a local working copy
- Perform changes to a local copy of the repo
- Commit changes to central repo
- Need network access to the central server
- Merging is difficult, branching tends to create problems

Distributed Model



Git 

- Git is a distributed version control system (peer-to-peer)
- Git supports the process of branching
- A master branch is maintained - this is the working production code branch
- Developers clone or branch the master as a local copy
- Changes can be pushed into the master. Changes can also be pulled into other developers local copy
- No one sequence of version numbers

Git Workflow

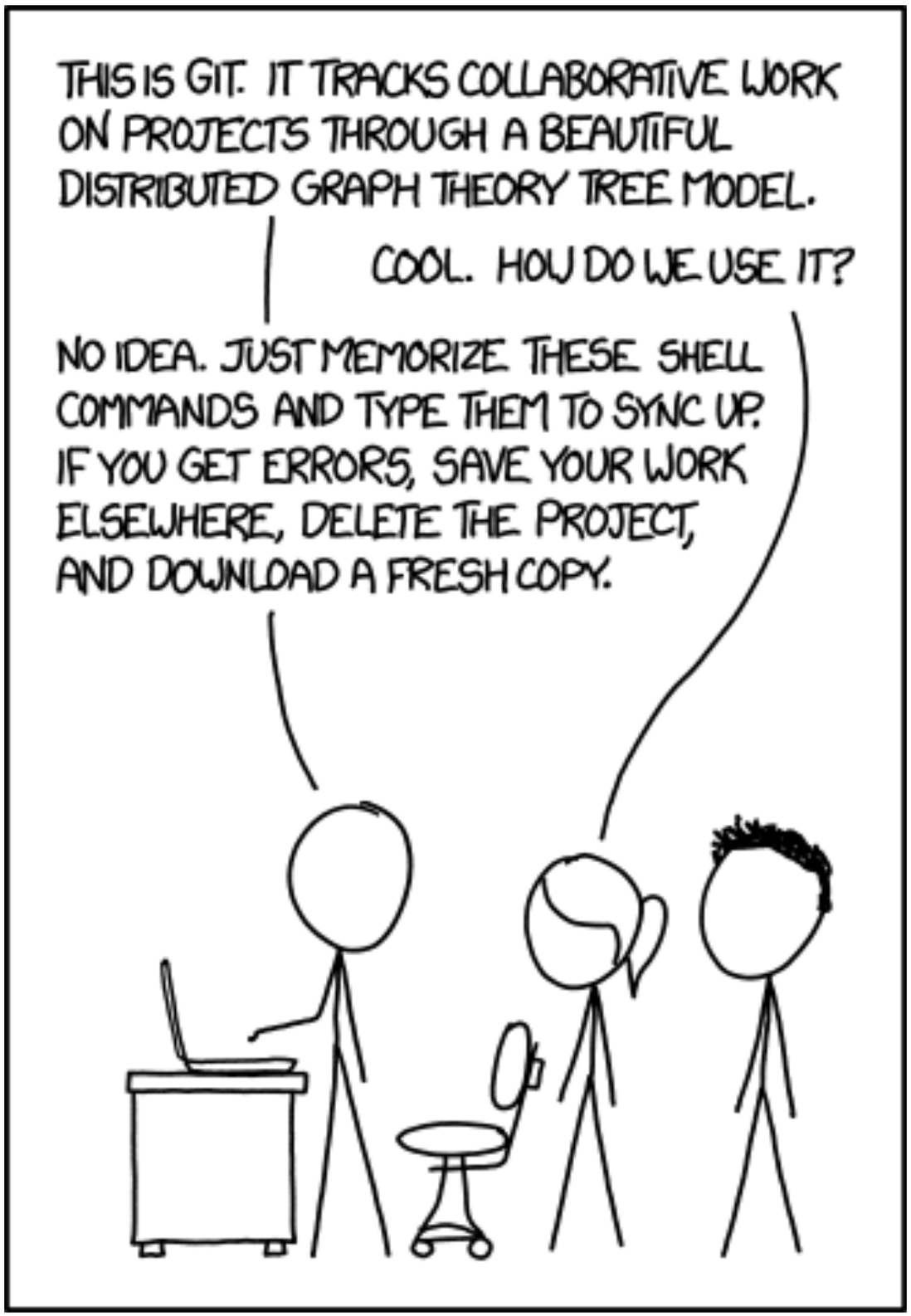
- Versions are identified by a SHA1 id (160 bit Hex decimal number) - Secure Hash Algorithm - gives a unique id. Records changes not versions

- Each local copy is a full fledged repo that can be worked on without a network connection

- Developers clones a repo and make changes, then pushes to others using the repo. Tracks merge data

- Advantage: fast, flexible, multiuser, very powerful

- Disadvantage: Complex and difficult to learn (over 160 commands)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