1. **Data Synchronization**
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2. **What is Synchronization?**
   - Data synchronization ("syncing" for short) is the copying of data from one computer to another so the computers share the same data
   - Things that may be copied/replicated are new data, updated data, data deletion, and the renaming of files and other data objects
   - The two computers may be referred to as the "source" and the "target" (see next slide)
   - Usually faster, more efficient, and less error-prone when performed by software on a recurring schedule

3. **Why Synchronize?**
   - Ubiquity: You need access to your data regardless of where you are or which computing device you are using
   - Consistency: You need for your data to be up-to-date whenever and wherever you access it
   - You use multiple devices in any given day—desktop computers, laptops, tablets, smartphones, etc.
   - Backing up your data

4. **Two Types of Synchronization**
   - One-way synchronization "mirrors" data, copying it from the source to the target, but not the reverse
   - Two-way synchronization copies data from one computer to the other and vice versa; both serve as the source for each other

5. **How Synchronization is Performed**
   - The implementation details will vary according to the particular service/software, but some basic principles apply
   - First, the data to be synchronized is compared between the two computers
   - Second, any differences in the data are noted, such as a file that exists on only computer, or is an older version of what exists on the other
   - Third, the data is copied with the goal of ensuring the data on one computer is the same as what is on the other

6. **Simple Example: One-way (Mirroring)**
   1. Before synchronization
   2. After synchronization

7. **Simple Example: Two-way Synchronization**
   1. Before synchronization
   2. After synchronization

8. **Two-way Example: Whispersync for Amazon Kindle**
   - A user may have multiple Kindle devices and/or computers for reading Kindle books
   - Whispersync synchronizes your bookmarks, notes, and furthest page read across your devices
   - The process is enabled by default and takes place silently without the your interaction
   - Amazon's server acts as the intermediary for the data transfer

9. **Two-way Example: Google Bookmarks**
   - Google Bookmarks allows you to save and access the very same set of Internet bookmarks on multiple computers
   - No need to go back to another computer on which you bookmarked a useful site, nor to try to remember what the site was named
   - Includes organizational aides such as adding searchable labels and notes to your bookmarks

- Get started by creating a Google account

10   **Two-way Example: Microsoft SyncToy**
- May be used in multiple modes
  - Synchronize: new and updated files are copied both ways; renames and deletes are replicated
  - Echo: new and updated files are copied one direction; renames and deletes are replicated
  - Contribute: new and updated files are copied one direction; renames are replicated, but not deletes
- Advanced options allow you to exclude certain folders and file types
- The third option is useful if you wish to keep a historical archive of old files that you have deleted from the target PC
- Faster and more efficient than manual drag-and-drop in Windows Vista and later
- I use the first option most often, as when I need to keep updated copies of the CUGG web files on my laptop and a flash drive

11   **Two-way Example: Dropbox**
- Install the Dropbox app on your computer, smartphone, and tablet
- Create an account
- Add files to the Dropbox folder on your computer
- Once the app is installed on each device, it will watch for changes and sync them with your other devices

12   **One-way Example: Apple iCloud**
- Music, movies, and TV shows purchased on any Apple device are accessible on other Apple devices
- The content is synced down to the devices from Apple's servers
- Unlike Amazon's Whispersync, data is not copied back (upstream) from the devices, so the syncing is one-way