Lecture #39: Compression

Announcements

- HKN surveys Friday in class. Extra points awarded to those who participate!

- Changes (simplifications?) to Project 3 spec:

  - Last two parts of 'gitlet status" are extra-credit. Leave empty (just the headers) if you don't want to do them.
  - Specified what happens to staging area for checkout and reset.
  - Change error messages for checkout to make more sense.

Compression and Git

- Git creates a new object in the repository each time a changed file or directory is committed.

- Things can get crowded as a result.

- To save space, it *compresses* each object.

- Every now and then (such as when sending or receiving from another repository), it packs objects together into a single file: a "packfile."

- Besides just sticking the files together, uses a technique called *delta compression.*

Delta Compression

- Typically, there will be many versions of a file in a Git repository: the latest, and previous edits of it, each in different commits.

- Git doesn't keep track explicitly of which file came from where, since that's hard in general:

  – What if a file is split into two, or two are spliced together?

- But, can guess that files with same name and (roughly) same size in two commits are probably versions of the same file.

- When that happens, store one of them as a pointer to the other, plus a list of changes.

Delta Compression (II)

- So, store two versions

V1	V2
My eyes are fully open to my awful situation. I shall go at once to Roderick and make him an oration. I shall tell him I've recovered my forgotten moral senses,	My eyes are fully open to my awful situation. I shall go at once to Roderick and make him an oration. I shall tell him I've recovered my forgotten moral senses, and don't give twopence halfpenney for any consequences.

as

V1	V2
[Fetch 1st 6 lines from V2]	My eyes are fully open to my awful situation. I shall go at once to Roderick and make him an oration. I shall tell him I've recovered my forgotten moral senses, and don't give twopence halfpenney for any consequences.

Compression Techniques

Slides from Josh Hug

LZ77 and DEFLATE

- Git Actually uses a different scheme from LZW for compression: a combination of LZ77 and Huffman coding.

- LZ77 is kind of like delta compression, but within the same text.

- Convert a text such as

```
One Mississippi, two Mississippi
```

  into something like

```
One Mississippi, two <11,7>
```

  where the <11,7> is intended to mean "the next 11 characters come from the text that ends 7 characters before this point."

- We add new symbols to the alphabet to represent these (length, distance) inclusions.

- When done, Huffman encode the result.