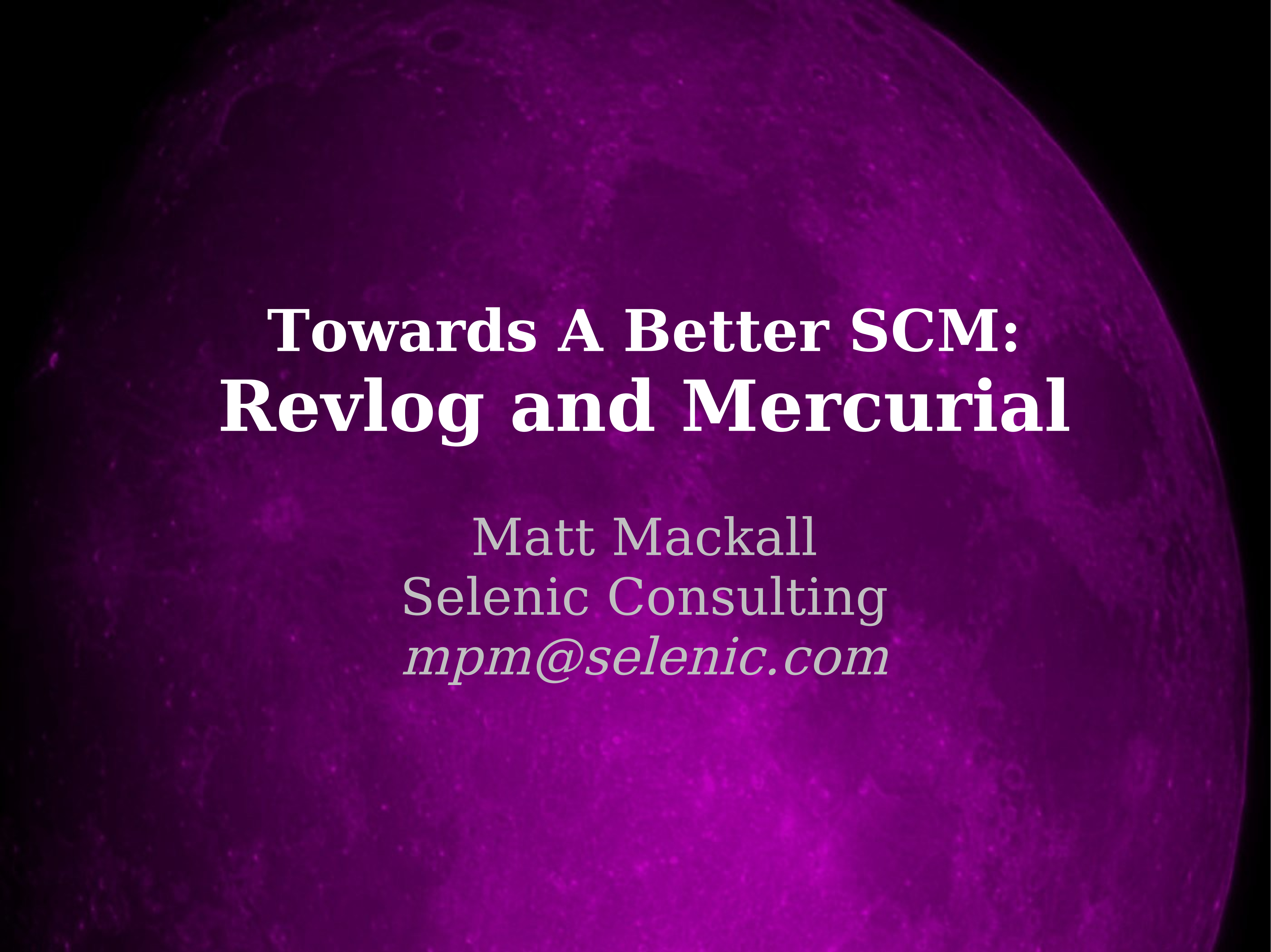


Towards A Better SCM: Revlog and Mercurial

Matt Mackall
Selenic Consulting
mpm@selenic.com

Things To Consider When Building A New SCM

Things To Consider When Building A New SCM

- Scalable

Things To Consider When Building A New SCM

- Scalable
- Atomic

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized
- Convenient Branching

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized
- Convenient Branching
- Repeated Merge

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized
- Convenient Branching
- Repeated Merge
- Robust Storage

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized
- Convenient Branching
- Repeated Merge
- Robust Storage
- Easy to Use

Things To Consider When Building A New SCM

- Scalable
- Atomic
- Decentralized
- Convenient Branching
- Repeated Merge
- Robust Storage
- Easy to Use
- Portable

Early History Of Mercurial

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives
  I start working on Mercurial

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives
  I start working on Mercurial
  Linus starts working on Git

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives
  I start working on Mercurial
  Linus starts working on Git
- April 8: Linus releases initial nearly useless Git snapshot

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives
  I start working on Mercurial
  Linus starts working on Git
- April 8: Linus releases initial nearly useless Git snapshot
- April 19: Mercurial 0.1 released
  features: familiar interface, efficient storage, commit/checkout/clone/pull/merge

Early History Of Mercurial

- April 6, 2005: Bitmover announces end of gratis version of Bitkeeper
  Linus mentions he's looking at alternatives
  I start working on Mercurial
  Linus starts working on Git
- April 8: Linus releases initial nearly useless Git snapshot
- April 19: Mercurial 0.1 released
  features: familiar interface, efficient storage, commit/checkout/clone/pull/merge
- April 20: Linus fails to destroy Git in a timely fashion

Desirable Properties For Revision Storage

Desirable Properties For Revision Storage

- O(1) addition and retrieval

Desirable Properties For Revision Storage

- O(1) addition and retrieval
- immutable or append-only

Desirable Properties For Revision Storage

- O(1) addition and retrieval
- immutable or append-only
- decent compression

Desirable Properties For Revision Storage

- O(1) addition and retrieval
- immutable or append-only
- decent compression
- strong integrity checks

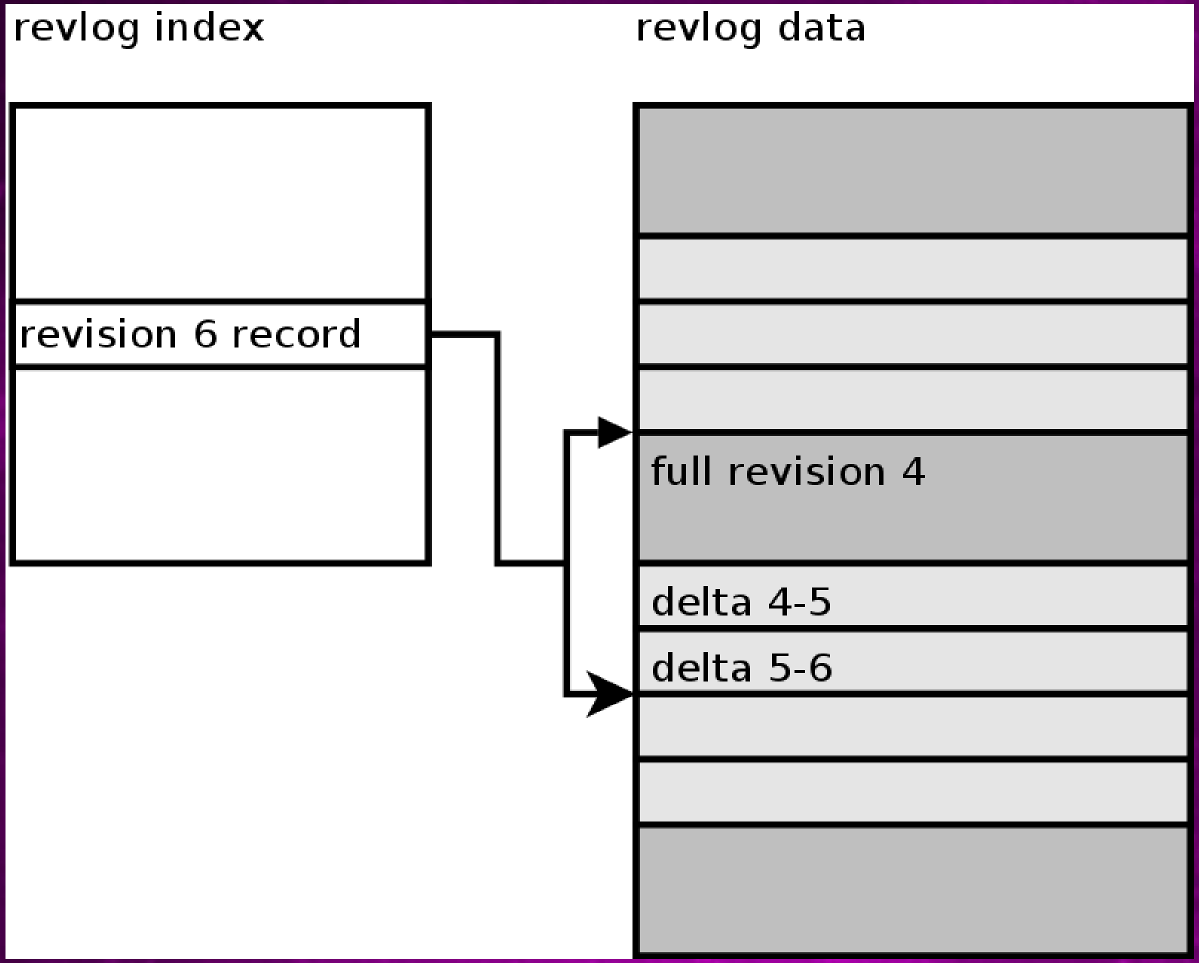
Desirable Properties For Revision Storage

- O(1) addition and retrieval
- immutable or append-only
- decent compression
- strong integrity checks
- cluster file changes together on disk

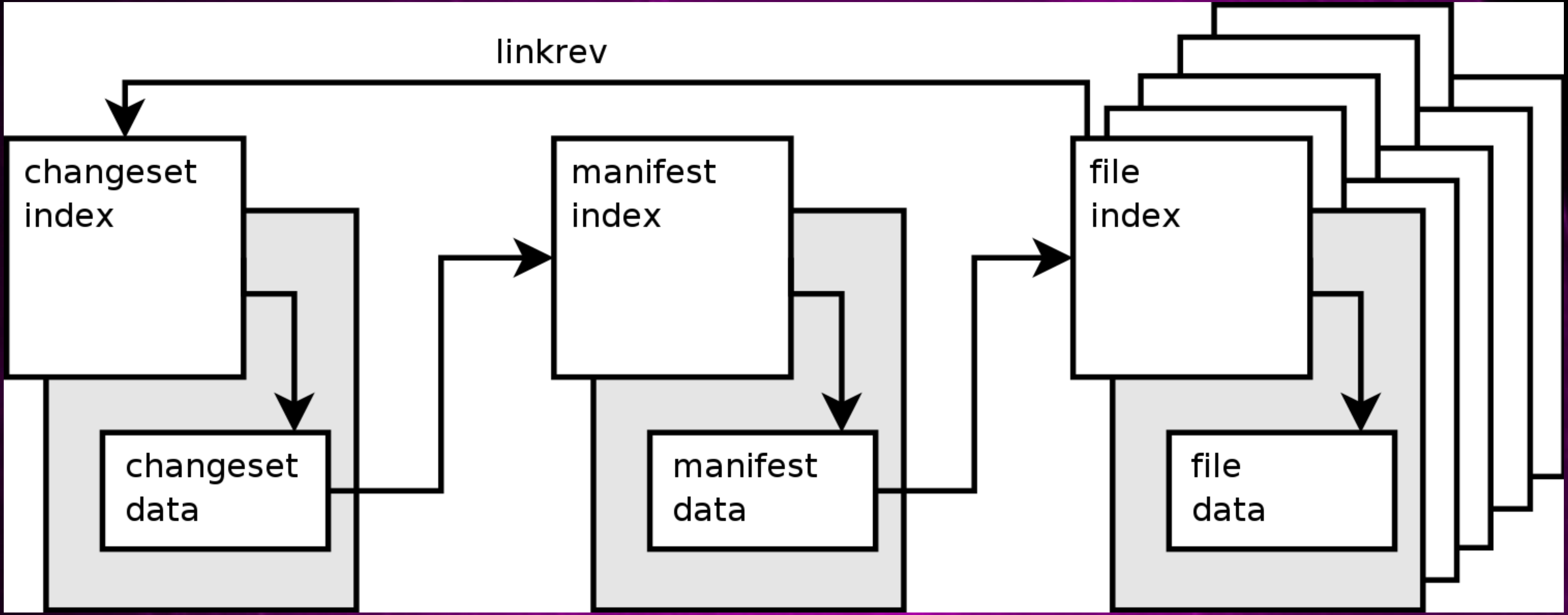
Desirable Properties For Revision Storage

- O(1) addition and retrieval
- immutable or append-only
- decent compression
- strong integrity checks
- cluster file changes together on disk
- efficient logging and annotate

Revlogs


revlog index
revlog data
revision 6 record
full revision 4
delta 4-5
delta 5-6

Changesets, Manifests, and Files



Transactions and Rollback

Transactions and Rollback

- Every repository write is protected by a simple transaction log

Transactions and Rollback

- Every repository write is protected by a simple transaction log
- The log records the starting length of each revlog touched

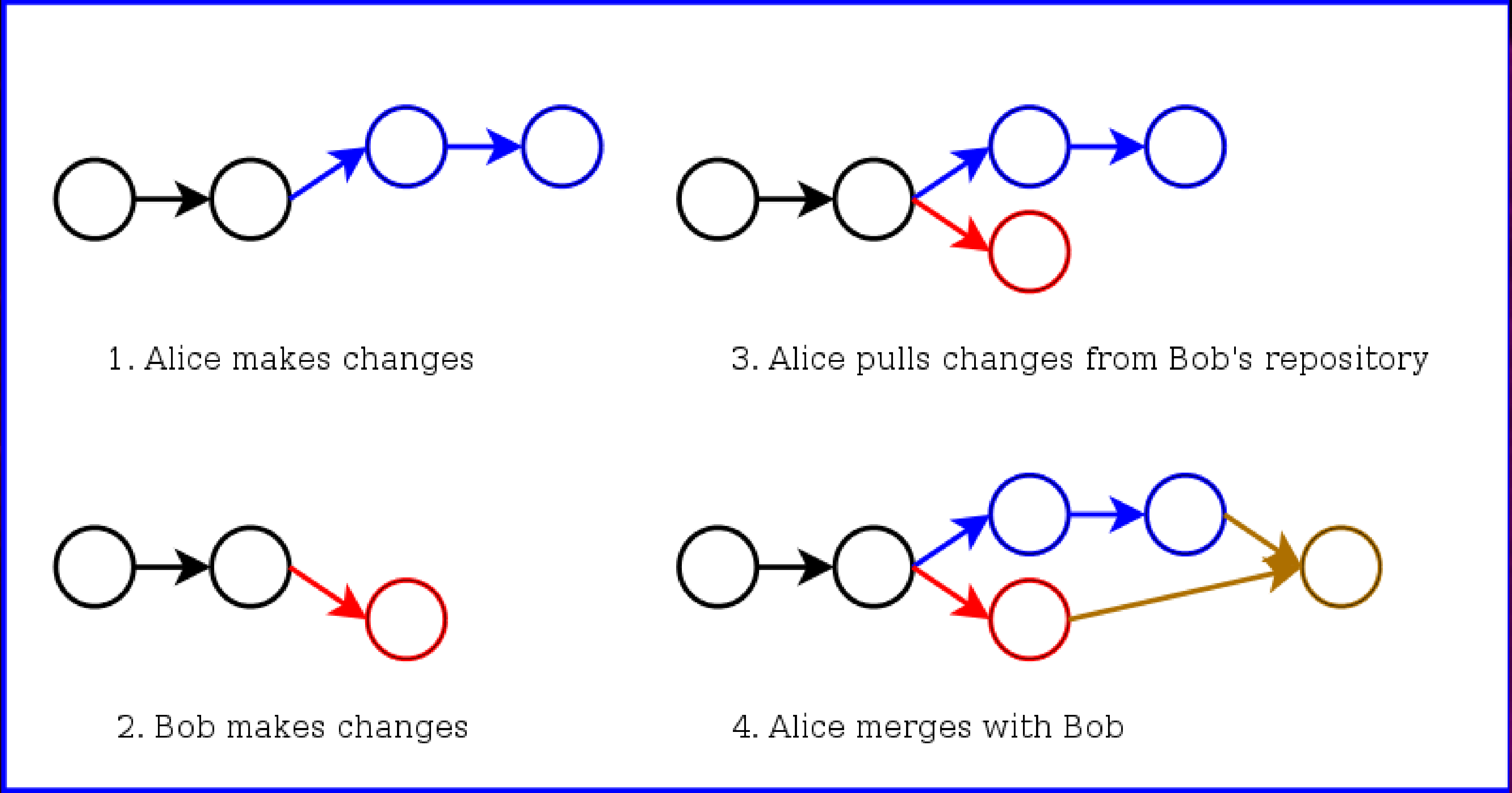
Transactions and Rollback

- Every repository write is protected by a simple transaction log
- The log records the starting length of each revlog touched
- On abort, each revlog is truncated to its original length

Transactions and Rollback

- Every repository write is protected by a simple transaction log
- The log records the starting length of each revlog touched
- On abort, each revlog is truncated to its original length
- We save the most recent transaction log to allow manual rollback (“undo”)

Synchronization and Merging



Taking Advantage of the FS

Taking Advantage of the FS

- Avoiding seeks is critical for performance

Taking Advantage of the FS

- Avoiding seeks is critical for performance
- Traversal order matters!

Taking Advantage of the FS

- Avoiding seeks is critical for performance
- Traversal order matters!
- Ordering by hash means random seeking in the working directory and degrades to random seeking on copy

Taking Advantage of the FS

- Avoiding seeks is critical for performance
- Traversal order matters!
- Ordering by hash means random seeking in the working directory and degrades to random seeking on copy
- Ordering by modification time degrades to random seeking over time

Taking Advantage of the FS

- Avoiding seeks is critical for performance
- Traversal order matters!
- Ordering by hash means random seeking in the working directory and degrades to random seeking on copy
- Ordering by modification time degrades to random seeking over time
- Ordering by pathname is stable and gives largely monotonic head movement

Some Other Optimizations

Some Other Optimizations

- Mercurial uses a custom delta algorithm

Some Other Optimizations

- Mercurial uses a custom delta algorithm
- Applying long chains of deltas is clever

Some Other Optimizations

- Mercurial uses a custom delta algorithm
- Applying long chains of deltas is clever
- Careful ordering avoids locking for most operations

Some Other Optimizations

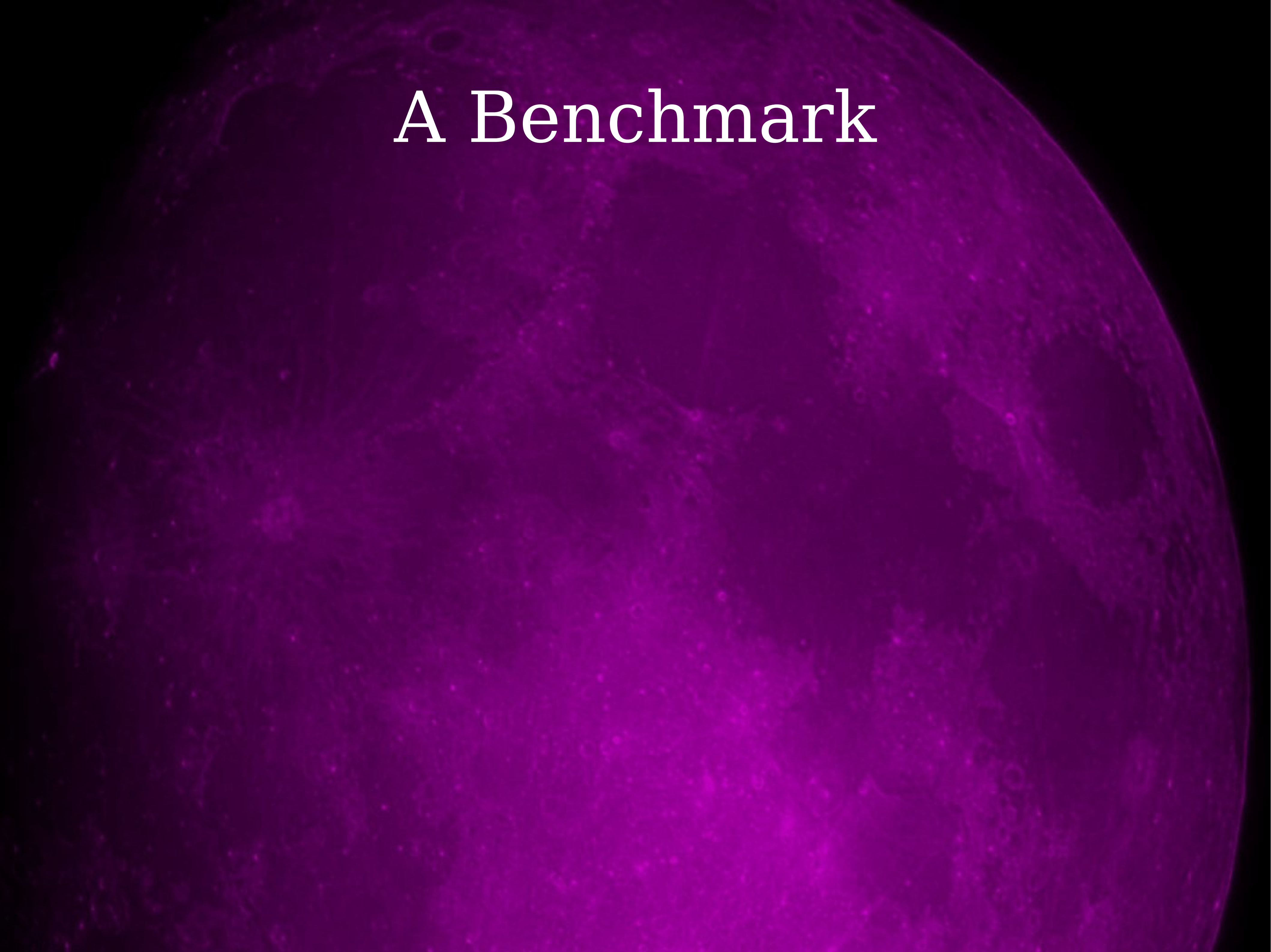
- Mercurial uses a custom delta algorithm
- Applying long chains of deltas is clever
- Careful ordering avoids locking for most operations
- Local clones use copy-on-write

Some Other Optimizations

- Mercurial uses a custom delta algorithm
- Applying long chains of deltas is clever
- Careful ordering avoids locking for most operations
- Local clones use copy-on-write
- Remote clone uses recompression for WAN transmission

Some Other Optimizations

- Mercurial uses a custom delta algorithm
- Applying long chains of deltas is clever
- Careful ordering avoids locking for most operations
- Local clones use copy-on-write
- Remote clone uses recompression for WAN transmission
- Network protocol uses graph discovery algorithm for efficiency



A Benchmark

A Benchmark

- commit 773 patches (20MB) for 2.6.18-rc1 to -mm2

A Benchmark

- commit 773 patches (20MB) for 2.6.18-rc1 to -mm2
- 1.8GHz AMD64 laptop, 1.2GB of RAM freshly formatted ext3 filesystem, data=writeback,noatime

A Benchmark

- commit 773 patches (20MB) for 2.6.18-rc1 to -mm2
- 1.8GHz AMD64 laptop, 1.2GB of RAM freshly formatted ext3 filesystem, data=writeback,noatime
- Git 1.4.1:

```
$ git-quilt-import 2.6.18-rc1-mm2
real: 2m7.701s user: 1m15.953s sys: 0m30.186s
```

A Benchmark

- commit 773 patches (20MB) for 2.6.18-rc1 to -mm2
- 1.8GHz AMD64 laptop, 1.2GB of RAM freshly formatted ext3 filesystem, data=writeback,noatime
- Git 1.4.1:

```
$ git-quilt-import 2.6.18-rc1-mm2
real: 2m7.701s user: 1m15.953s sys: 0m30.186s
```

- Mercurial:

```
$ hg qpush -a 2.6.18-rc1-mm2
real: 1m18.398s user: 0m42.511s sys: 0m10.105s
```

Mercurial Wiki:
http://selenic.com/mercurial