Moving Day:

Migrating your Big Data from A to B

Laura Thomson
laura@mozilla.com

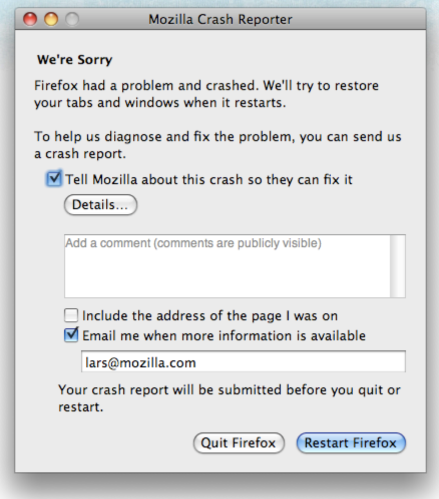
PGCon 2012

Overview

- What is Socorro?
- The problem
- Planning
- Build out and testing
- Troubleshooting
- Moving Day
- Aftermath

Socorro

Very Large Array at Socorro, New Mexico, USA. Photo taken by Hajor, 08.Aug.2004. Released under cc.by.sa and/or GFDL. Source: http://en.wikipedia.org/wiki/File:USA.NM.VeryLargeArray.02.jpg



We're Sorry

Firefox had a problem and crashed. We'll try to restore your tabs and windows when it restarts.

To help us diagnose and fix the problem, you can send us a crash report.

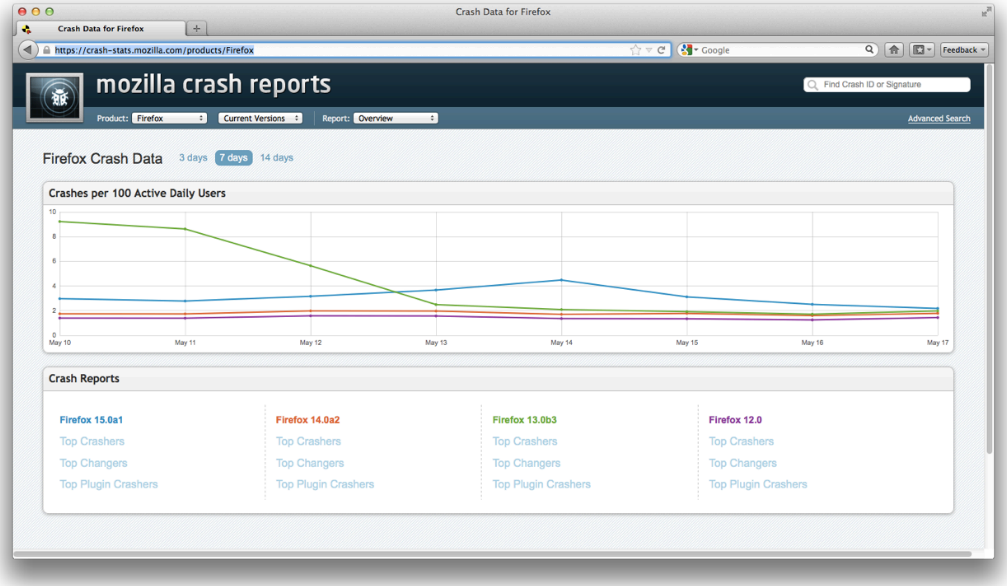
☑ Tell Mozilla about this crash so they can fix it

□ Include the address of the page I was on

☑ Email me when more information is available

lars@mozilla.com

Your crash report will be submitted before you quit or restart.

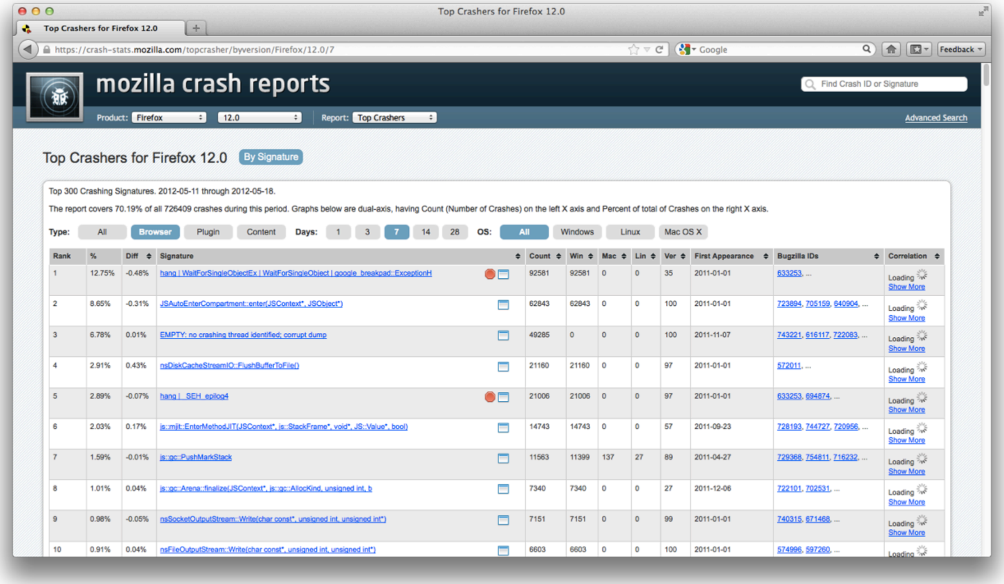


Firefox Crash Data

Crashes per 100 Active Daily Users

Crash Reports

Firefox 15.0a1	Firefox 14.0a2	Firefox 13.0b3	Firefox 12.0
Top Crashers	Top Crashers	Top Crashers	Top Crashers
Top Changers	Top Changers	Top Changers	Top Changers
Top Plugin Crashers	Top Plugin Crashers	Top Plugin Crashers	Top Plugin Crashers



Top Crashers for Firefox 12.0
Top Crashers for Firefox 12.0
https://crash-stats.mozilla.com/topcrasher/byversion/Firefox/12.0/7
Google
Feedback
mozilla crash reports
Find Crash ID or Signature
Product: Firefox
12.0
Report: Top Crashers
Advanced Search

Top Crashers for Firefox 12.0 By Signature

Top 300 Crashing Signatures. 2012-05-11 through 2012-05-18.

The report covers 70.19% of all 726409 crashes during this period. Graphs below are dual-axis, having Count (Number of Crashes) on the left X axis and Percent of total of Crashes on the right X axis.

Type: All [✓ Browser] Plugin Content Days: 1 3 [✓ 7] 14 28 OS: [✓ All] Windows Linux Mac OS X

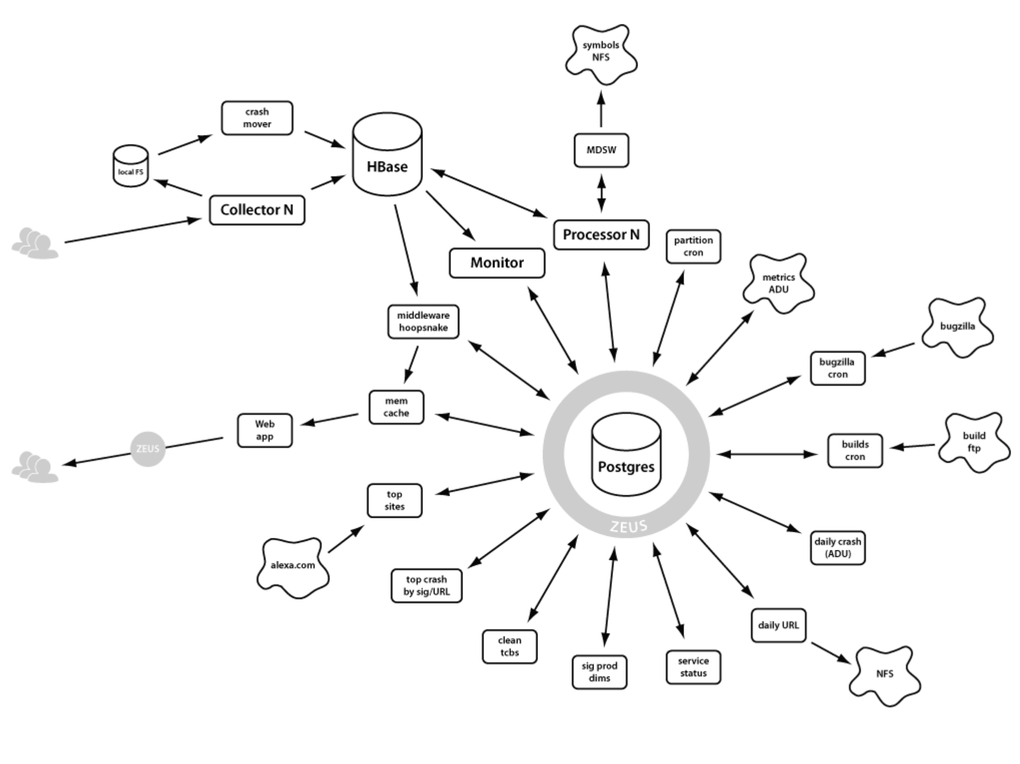
Rank	%	Diff	Signature	Count	Win	Mac	Lin	Ver	First Appearance	Bugzilla IDs	Correlation
1	12.75%	-0.48%	hang | WaitForSingleObjectEx | WaitForSingleObject | google_breakpad::ExceptionH	92581	92581	0	0	35	2011-01-01	633253, ...	Loading Show More
2	8.65%	-0.31%	JSAutoEnterCompartment::enter(JSContext*, JSObject*)	62843	62843	0	0	100	2011-01-01	723894, 705159, 640904, ...	Loading Show More
3	6.78%	0.01%	EMPTY: no crashing thread identified; corrupt dump	49285	0	0	0	100	2011-11-07	743221, 616117, 722083, ...	Loading Show More
4	2.91%	0.43%	nsDiskCacheStreamIO::FlushBufferToFile()	21160	21160	0	0	97	2011-01-01	572011, ...	Loading Show More
5	2.89%	-0.07%	hang | _SEH_epilog4	21006	21006	0	0	97	2011-01-01	633253, 694874, ...	Loading Show More
6	2.03%	0.17%	js::mjit::EnterMethodJIT(JSContext*, js::StackFrame*, void*, JS::Value*, bool)	14743	14743	0	0	57	2011-09-23	728193, 744727, 720956, ...	Loading Show More
7	1.59%	-0.01%	js::gc::PushMarkStack	11563	11399	137	27	89	2011-04-27	729368, 754811, 716232, ...	Loading Show More
8	1.01%	0.04%	js::gc::Arena::finalize(JSContext*, js::gc::AllocKind, unsigned int, b	7340	7340	0	0	27	2011-12-06	722101, 702531, ...	Loading Show More
9	0.98%	-0.05%	nsSocketOutputStream::Write(char const*, unsigned int, unsigned int*)	7151	7151	0	0	99	2011-01-01	740315, 671468, ...	Loading Show More
10	0.91%	0.04%	nsFileOutputStream::Write(char const*, unsigned int, unsigned int*)	6603	6603	0	0	100	2011-01-01	574996, 597260, ...	Loading

Typical use cases

- What are the most common crashes for a product/version/channel?
- What new crashes / regressions do we see emerging? What's the cause of an emergent crash?
- How crashy is one build compared to another?
- What correlations do we see with a particular crash?

What else can we do?

- Does one build have more (null signature) crashes than other builds?
- Analyze differences between Flash versions x and y crashes
- Detect duplicate crashes
- Detect explosive crashes
- Find “frankeninstalls”
- Email victims of a particular crash
- Ad hoc reporting for e.g. tracking down chemspill bugs

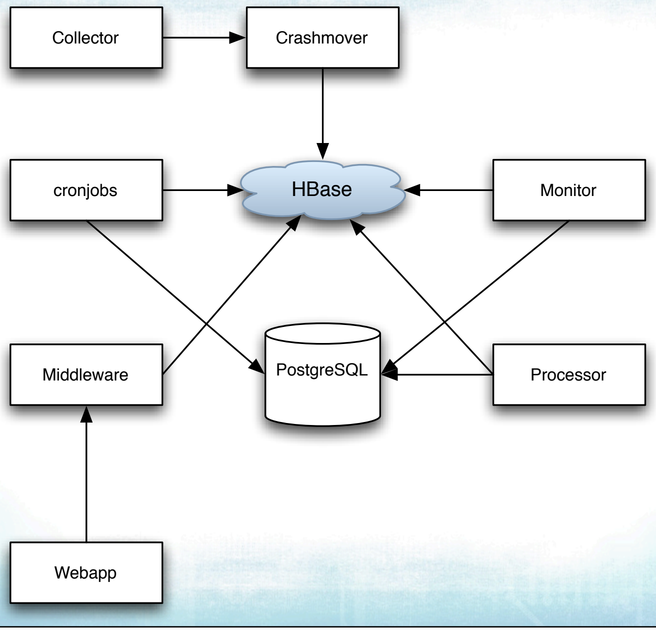

symbols NFS
MDSW
crash mover
HBase
local FS
Collector N
Processor N
Monitor
partition cron
metrics ADU
bugzilla
middleware hoopsnake
bugzilla cron
mem cache
Web app
ZEUS
Postgres
ZEUS
builds cron
build ftp
top sites
alexa.com
top crash by sig/URL
daily crash (ADU)
daily URL
clean tcbs
sig prod dims
service status
NFS

"Socorro has a lot of moving parts"

…

"I prefer to think of them as dancing parts"

Basic architecture (simplified)

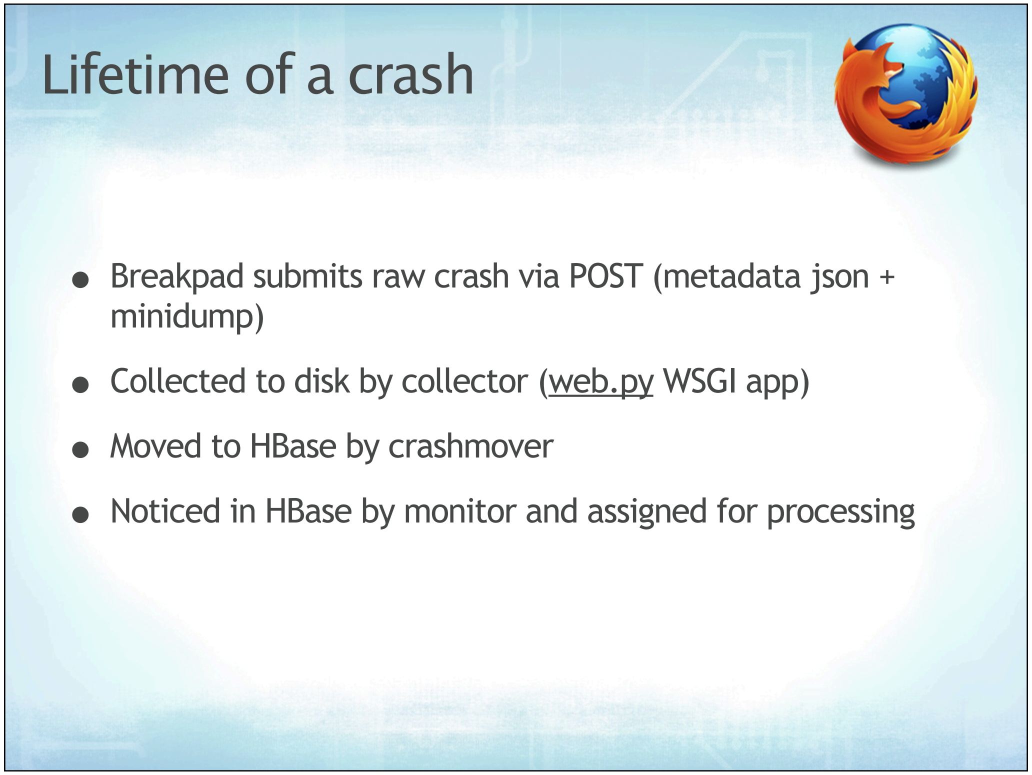


Firehose engineering

- At peak we receive 2300 crashes per minute
- 2.5 million per day
- Median crash size 150k, max size 20MB (reject bigger)
  - Android crashes a bit bigger (~200k median)
- ~500GB stored in PostgreSQL - metadata + generated reports
- ~110TB stored in HDFS (3x replication, ~40TB of HBase data) - raw reports + processed reports

Implementation scale

- > 120 physical boxes (not cloud)
- ~8 developers + DBAs + sysadmin team + QA + Hadoop ops/ analysts
- Deploy approximately weekly but could do continuous if needed

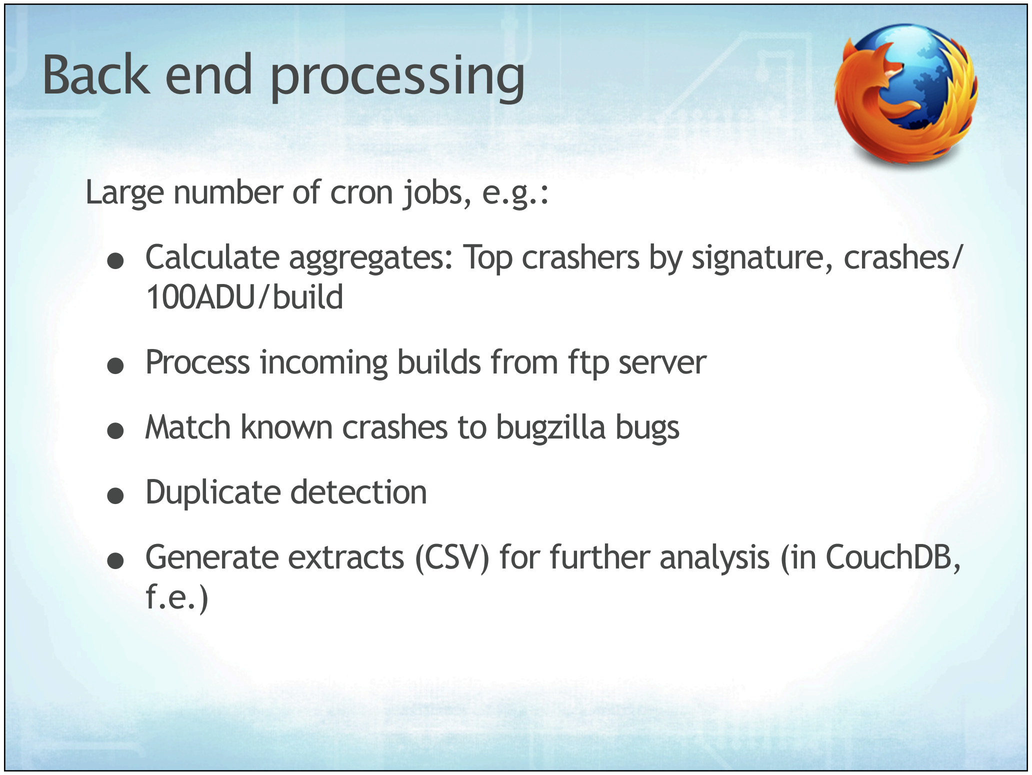


Lifetime of a crash

- Breakpad submits raw crash via POST (metadata json + minidump)
- Collected to disk by collector (web.py WSGI app)
- Moved to HBase by crashmover
- Noticed in HBase by monitor and assigned for processing

Processing

- Processor spins off minidump stackwalk (MDSW)
- MDSW re-unites raw crash with symbols to generate a stack
- Processor generates a signature and pulls out other data
- Processor writes processed crash back to HBase and metadata to PostgreSQL



Back end processing

Large number of cron jobs, e.g.:

- Calculate aggregates: Top crashers by signature, crashes/100ADU/build
- Process incoming builds from ftp server
- Match known crashes to bugzilla bugs
- Duplicate detection
- Generate extracts (CSV) for further analysis (in CouchDB, f.e.)

Middleware

- All data access through REST API (new)
- Enable other apps against the data platform and allow the core team to rewrite webapp more easily
- In an upcoming version each component will have its own API for status and health checks

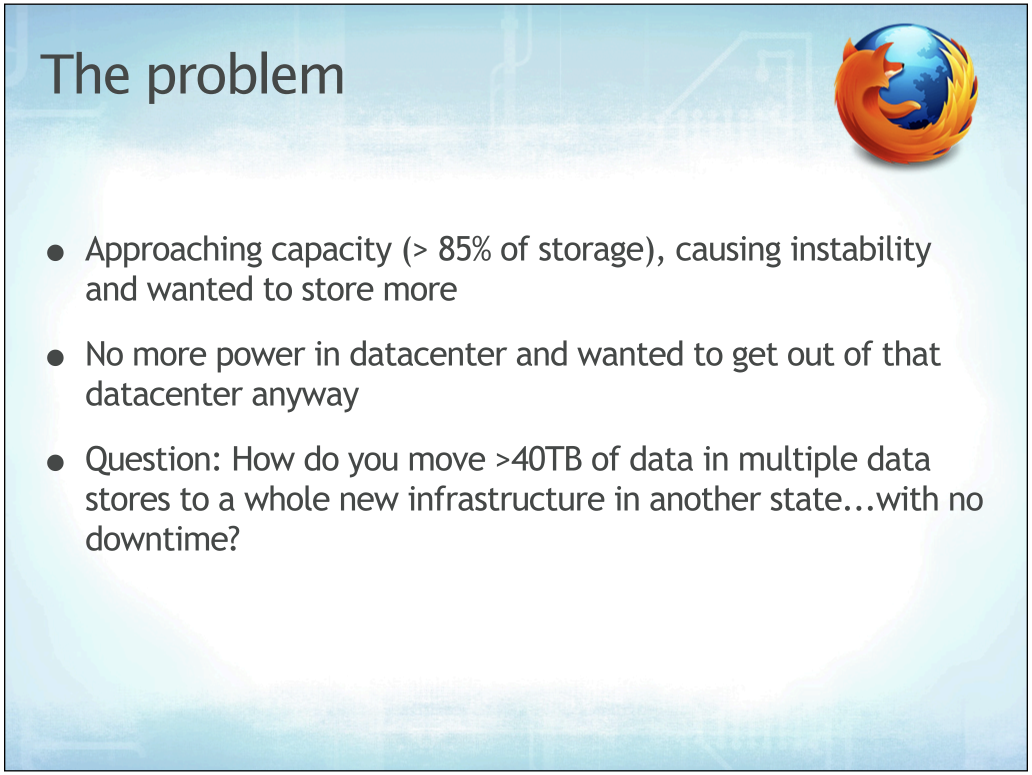
Webapp

- Hardest part is sometimes how to visualize the data
- Example: nightly builds, moving to reporting in build time rather than clock time
- Code a bit crufty: rewriting in 2012
- Currently KohanaPHP, will be Django (playdoh)

Other implementation details

- Python 2.6 mostly
- PostgreSQL9.1, stored procs in pgpl/sql
- memcache for the webapp
- Thrift for HBase access
- HBase (CDH3)
- Rolling out ElasticSearch for fulltext indexing of crashes

The problem



The problem

- Approaching capacity (> 85% of storage), causing instability and wanted to store more
- No more power in datacenter and wanted to get out of that datacenter anyway
- Question: How do you move >40TB of data in multiple data stores to a whole new infrastructure in another state...with no downtime?

Complication: Fragility

- Ongoing stability problems with HBase, and when it went down, everything went with it
- Releases were nightmares, requiring manual upgrades of multiple boxes, editing of config files, and manual QA
- Troubleshooting done via remote (awful)
- If we were going to do it over, we were going to do it right.

Analyzing uptime

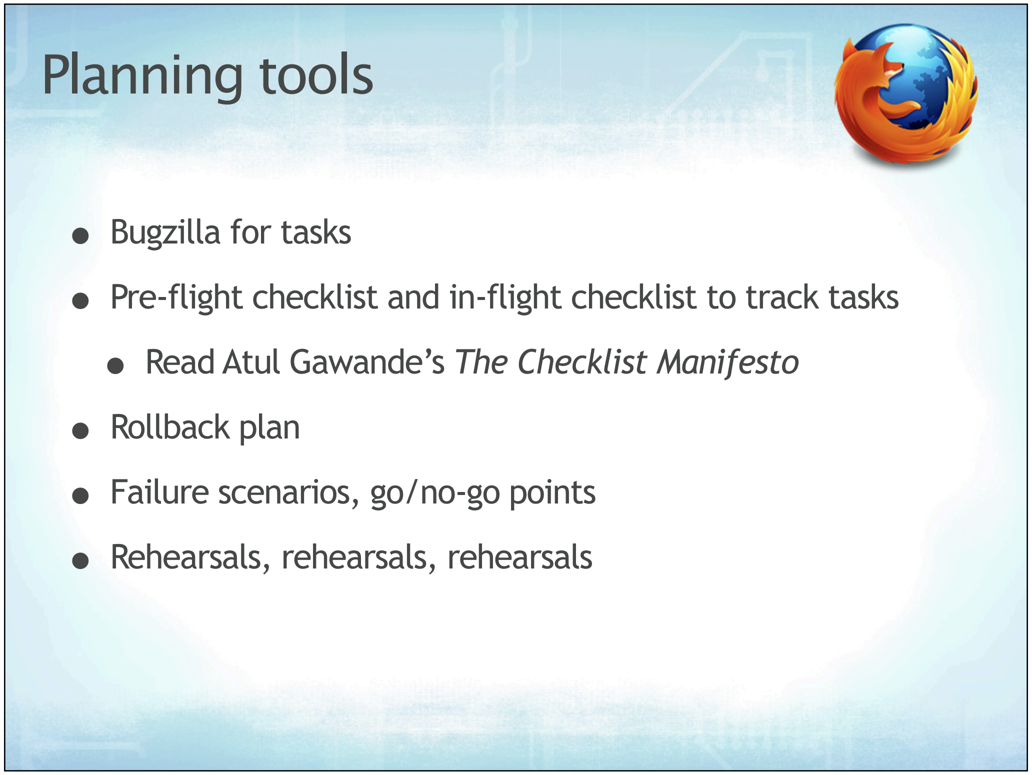
- Not all parts of a system have the same uptime requirement
- As long as we had zero downtime on data collection, the rest could be offline for a short period (hours, not days).
- This reduces the problem to a tractable one:
    - Collect data to temporary storage (disk) during the migration, and recommence processing once migration complete
- Rewrote crash storage to use a pluggable primary/secondary

Moving data: PostgreSQL

- Theoretically easy!
- Only about 300GB at the time
- Sync from SJC->PHX
- Done in a maintenance window beforehand to reduce downtime on the day, and repeated on migration day
- At this stage we did *not* have replication set up in the old location

Moving data: HBase

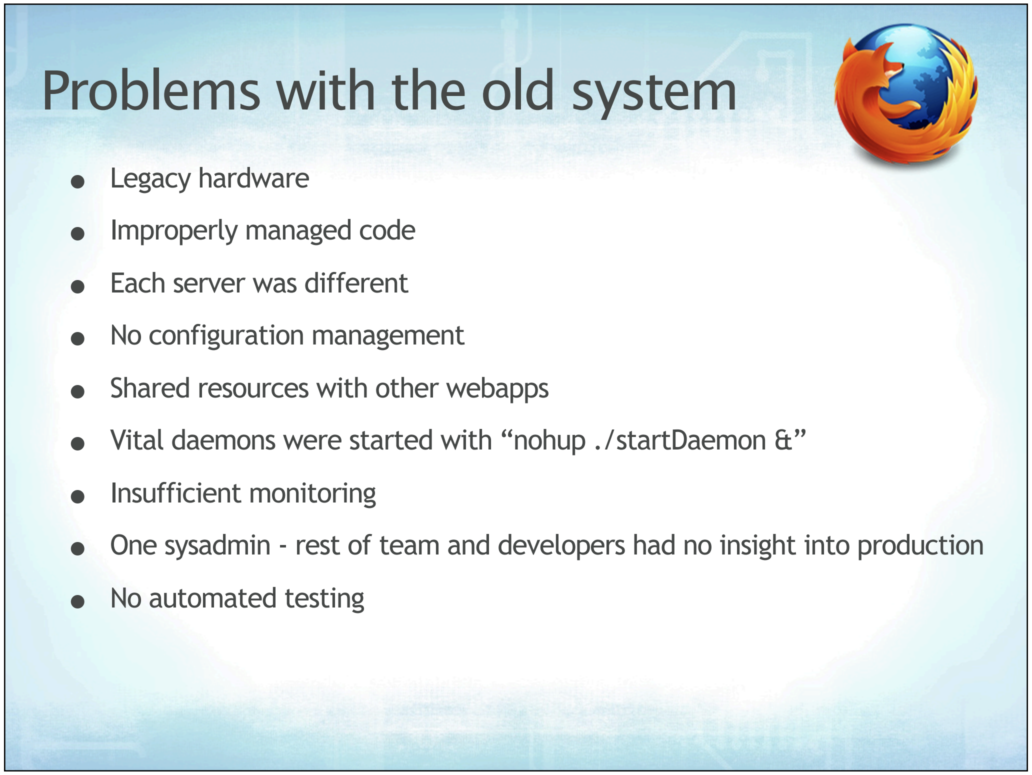
- Originally intended to use distcp, an HBase sync utility
- Couldn’t use this on a running system, and we couldn’t afford the downtime needed (24 hours+)
- Solution: Wrote a dirty copy tool: copy data while running and then use distcp to reach consistency



Planning tools

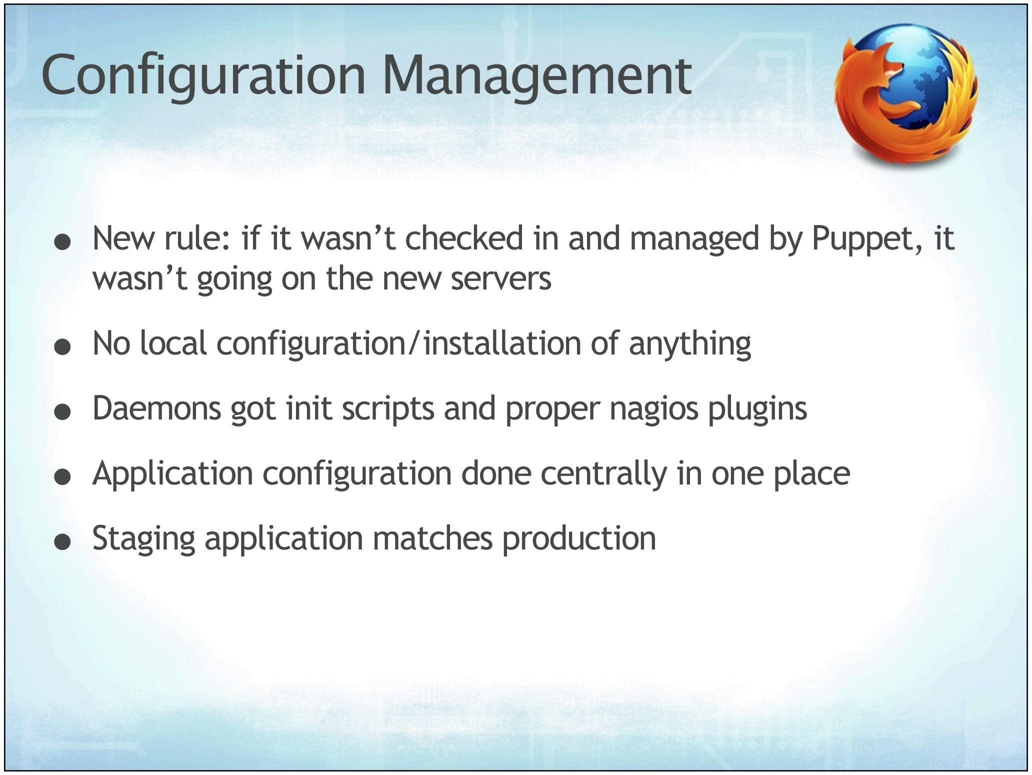
- Bugzilla for tasks
- Pre-flight checklist and in-flight checklist to track tasks
  - Read Atul Gawande’s *The Checklist Manifesto*
- Rollback plan
- Failure scenarios, go/no-go points
- Rehearsals, rehearsals, rehearsals

Build out



Problems with the old system

- Legacy hardware
- Improperly managed code
- Each server was different
- No configuration management
- Shared resources with other webapps
- Vital daemons were started with “nohup ./startDaemon &”
- Insufficient monitoring
- One sysadmin - rest of team and developers had no insight into production
- No automated testing



Configuration Management

- New rule: if it wasn’t checked in and managed by Puppet, it wasn’t going on the new servers
- No local configuration/installation of anything
- Daemons got init scripts and proper nagios plugins
- Application configuration done centrally in one place
- Staging application matches production

Packages for production

- 3rd party libraries and packages pulled in upstream
- IT doesn’t need to know/care how a developer develops. What goes into production is a tested, polished package
- Packages for production are built and tested by Jenkins the same way every time
- Local patches aren’t allowed. A patch to production means a patch to the source upstream, a patch to stage and a proper rollout to production
- Every package is fully tested in a staging environment

Load Testing

- Used a small portion (40 nodes) of a 512-node Seamicro cluster
- Simulated real traffic by submitting crashes from the test cluster
- Tested system as a whole, under “real” production load

Troubleshooting

- New data center, new load balancers, new challenges
- Tested and tuned various configurations
- Network misconfigurations reduced performance: discovered and resolved in smoke testing

Migration day

- Flew the team in
- Migration day checklist: http://tinyurl.com/migrationday
- Went remarkably smoothly due largely to good co-operation between teams

Aftermath

- Backfilling the data collected during the outage window turned out to be tricky for several reasons:
  - Network flow issues from SJC -> PHX
  - Old submitter in the old datacenter: retroactively upgraded the code to the new multithreaded version to solve that
- Outage in our external ADU data (Vertica failure) the day after made it hard to be sure the data “looked right”

Postmortem

- Postmortem to learn what we did right and wrong
- (Really important to do this, even - especially? - when things go well)

Everything is open (source)

Site: https://crash-stats.mozilla.com

Fork: https://github.com/mozilla/socorro

Read/file/fix bugs: https://bugzilla.mozilla.org/

Docs: http://www.readthedocs.org/docs/socorro

Mailing list: https://lists.mozilla.org/listinfo/tools-socorro

Join us in IRC: irc.mozilla.org #breakpad and #it

Hiring: http://mozilla.org/careers

Questions?