The MDR: A Grand Experiment in Storage & Preservation
Agenda

- Overview of the IA Web Archive
- MDR – What is it and why deploy it?
- Before & After: Philosophy & Best Practices
- Wayback Access Services
- What’s Next?
The Internet Archive is...

A digital library of ~4.5 petabytes of information

- Web Pages
- Educational Courseware
- Films & Videos
- Music & Spoken Word
- Books & Texts
- Software
- Images

The Archive’s combined collections receive over 6 mil downloads a day!

www.archive.org
IA Web Archives

2+ petabytes of primary data (compressed)

- 150+ billion URLs, culled from 200+ million sites, harvested from 1996 to the present
- Includes captures from every domain
- Encompasses content in over 40 languages
- Will add ~2 petabytes of data to these collections each year…
Data Repositories in CA

Fiber - 5.5 Gigabits/sec in SF; scaling to the same in RWC
Plans to scale to 8 Gigabits/sec
Access to Web Collections

The Wayback Machine
- Applied to web.archive.org
  - >20+ million hits per day
  - Avg of 400 requests per second/peak of 600 requests/sec
  - ~100K lookups-by-URL (ie, display dated list of captures) per day
  - ~4 million retrieval requests (URL+exact date) per day (>50/second)

Full-text-search
- R&D service available for 1996 – 1999 (20th century find)
3 Yr strategic project with Sun Microsystems & research community

Goals:

- Reduce costs to power, cool & maintain IA web collections, create a replicable storage solution that is cost effective and scalable

- Experiment with ZFS, novel data organization and compression techniques, Reed Solomon algorithms for replication and restoration

- Deploy researcher APIs & alternative access to collections
MDR – Modular Data Repository

The IA MDR: A shipping container housing ~60, SunFire X4500 servers (each w/4u, 48x1TB drives); hosting ARCs/WARCs; connectivity provisioned = ~300Mb/sec

When was it deployed? March 2009

When will it be filled? As early as Dec 09, but no later than Mar 2010
Comparison: Before & After

**BEFORE**
- 100 Mb ARCs
- Dual core/quad drive, multi generation, storage nodes
- Ubuntu OS
- Proprietary Wayback
- Replicas distributed globally
- Single local replica

**AFTER**
- 1 Gb WARCs, + ARCs
- Sunfire x4500 servers, 4u/48x1TB drives
- Solaris 10/ZFS
- Open Source Wayback*
- 1+ replicas locally; replicas also distributed globally
WARC: Web Archival Data Format

An approved ISO standard: ISO CD 28500

Collaboration of IIPC institutional members
Co-authors: Allan Arvidson, John Kunze, Gordon Mohr, Michael Stack

Builds on ARC/DAT file formats, accommodates related secondary content, such as assigned metadata, abbreviated duplicate detection events, and later-date transformations along with prior contents. No limit to file size.
(W)ARC File Anatomy

(W)ARC File

(W)ARC Record

Text header

Content block

Length, source URI, date, type, ...

E.g., HTTP response headers and length bytes of HTML, GIF, PDF, ...

Append at will
WARC Goals, part 1

- Ability to store arbitrary metadata linked to other stored data (e.g., subject classifier, discovered language, encoding)
- Support for data compression and maintenance of data record integrity
- Ability to store all control information from the harvesting protocol (e.g., request headers), not just response information.
WARC Goals, part 2

- Ability to store the results of data migrations linked to other stored data
- Ability to store a duplicate detection event
- Sufficiently different from the legacy ARC
- Ability to store globally unique record identifiers
- Support for deterministic handling of long records (e.g., truncation, segmentation).
Worldwide Wayback Machine

- Developed by Alexa Internet - 2001
- Written in Perl
- At “End of Life”
  - maintenance problems
  - extension problems
- But Has Scaled Well
  - Over 150 Billion Documents
  - Peaks over 500 requests per second
  - 4 distinct tiers
Wayback Machine

- Minimum 6 month embargo on new content
- Update Cycles
  - Indexed incrementally as ingested, access layer updated manually (usually every 3-6 months)
- Planned Enhancements
  - Migration to open src java implementation
  - Addition of doc titles &/or thumbnails to browse UI
  - “In page” presence
  - “Time based” exclusion policy management
  - Researcher API’s
Thank You!

Kris Carpenter Negulescu
Director, Web Group
Internet Archive
kcarpenter [at] archive [dot] org