LWAC: Longitudinal Web as Corpus

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Rationale

- Rationale
- Sample Design

LWAC

- Design
- Properties
- Implementation
- Workflow

Performance & Limits

- Throughput
- Resources/Scalability

Summary

WaC for Language Change

Many ways of measuring change online:

- Crawlers/Revisiting
- Diachronic corpora
- Monitor Corpora
- Subsampling supercorpora
- Feed corpora

ISSUES

- Irregular visits to pages
  "...visiting each website again in the next crawl anticipating for new content is cost-inefficient."
- Manual supervision required
- Lack of detail on network properties
- Non-versioned corpus formats

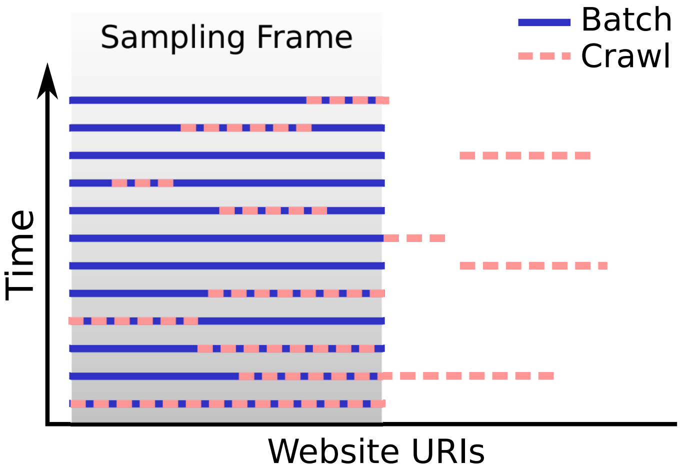
Design Principles

- Reliable, regular sampling strategy
- Set and forget operation
- Vertical and horizontal comparability
- Rigorous & exhaustive data collection
- Integrated corpus format

Cohort Sampling

- Common longitudinal design
- Used elsewhere to disambiguate long- from short-term effects
- Fits with open-source, URL-based corpus model

Cohort Sampling



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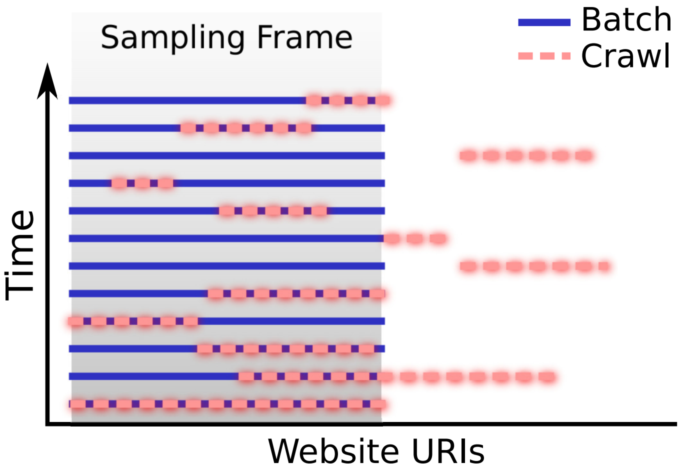

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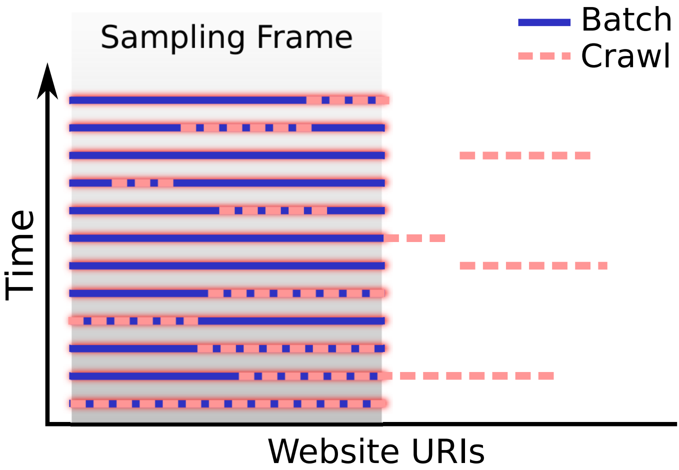


USES

Observing network properties over time:

- Link rot/document attrition
- Latency
- Server properties, headers, protocol support

Observing user's experience of common websites/links:

- Editorial policy
- Page revisions
- "live" page content

LWAC

- Download/Sampling tool for longitudinal use
- Suitable for long- or short-term samples
- Reliable
- Scalable
- Hard to detect
- Records network and content related variables

DATA

- Vertical and horizontal comparability of samples
- Configuration, network properties and data recorded for later use
- ‘No data left behind’ policy: $\approx$ 120 variables stored on each request
- Format, size filters to exclude unwanted data
- Charset normalisation

IMPORT / EXPORT

- Import URL lists
- Export to CSV, XML or arbitrary templates
- Export using filters and data normalisation scripts
- Live export supported

User Model

LWAC can imitate real users or crawlers:

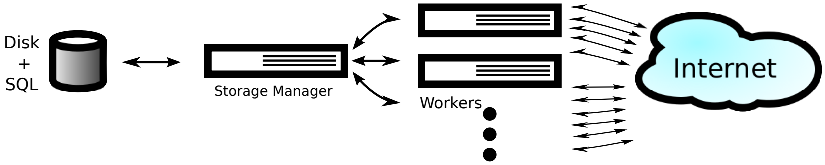
- Realistic redirect handling
- Timeouts at all stages of URL lookup
- Spoofing of user-agent
- Realistic request headers, cookie use

RELIABILITY

- No skew on sampling intervals
- Data security across crashes/restarts (atomicity)
- Error reporting, detailed logging
- Stability for long-term runs

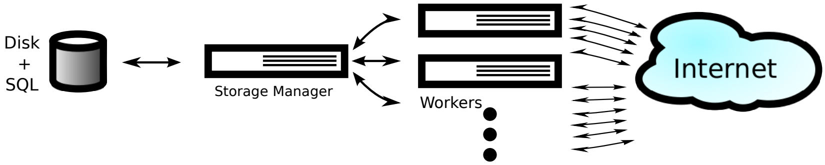
Overview

- UNIX-model tool set
- Written in Ruby using cURL
- Distributed client-server design
- Central control of sampling policy



Basic Workflow

1. Find links of interest ([Web]BootCaT)



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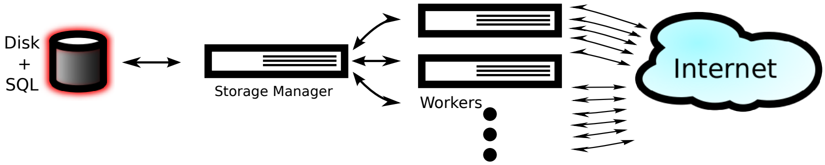

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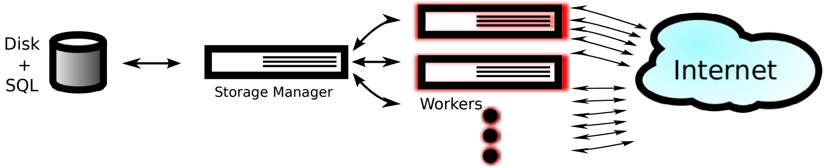

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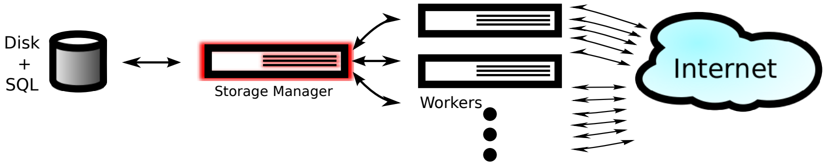

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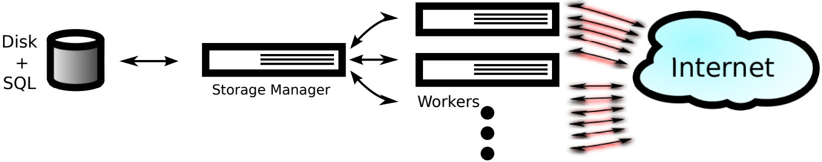

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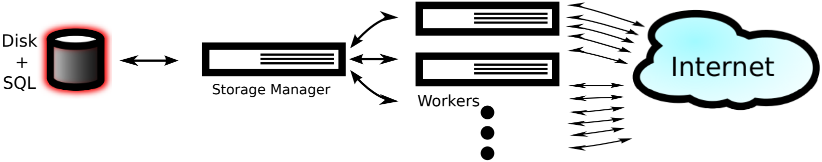

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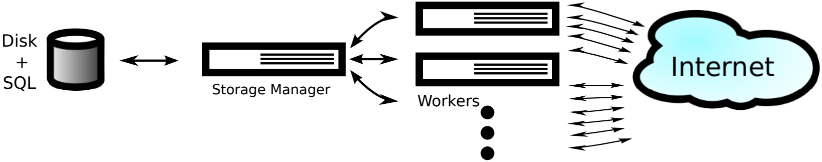
7. Do science

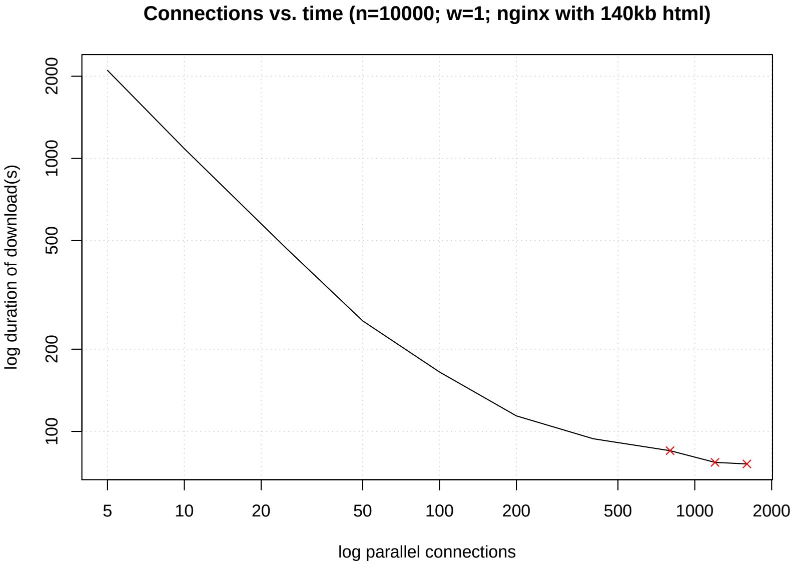


PERFORMANCE

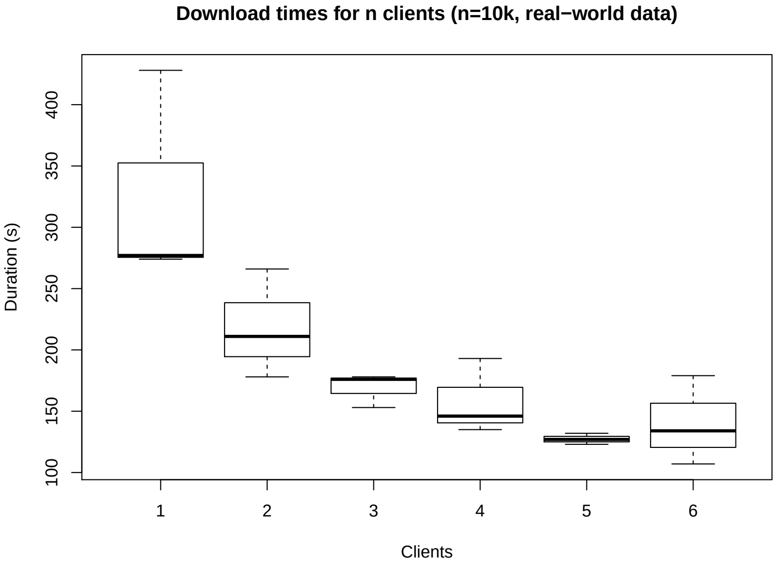
Dependent on:

- Number of clients
- Number of connections per client
- Client-server network speeds
- Latency/speed of DNS, web servers

THROUGHPUT (1 CLIENT)



THROUGHPUT (N CLIENTS)



THROUGHPUT (REAL-WORLD)

Corpus:

- BootCaT-derived URL List
- 228k URLs: 4600 requests, 50 links/call

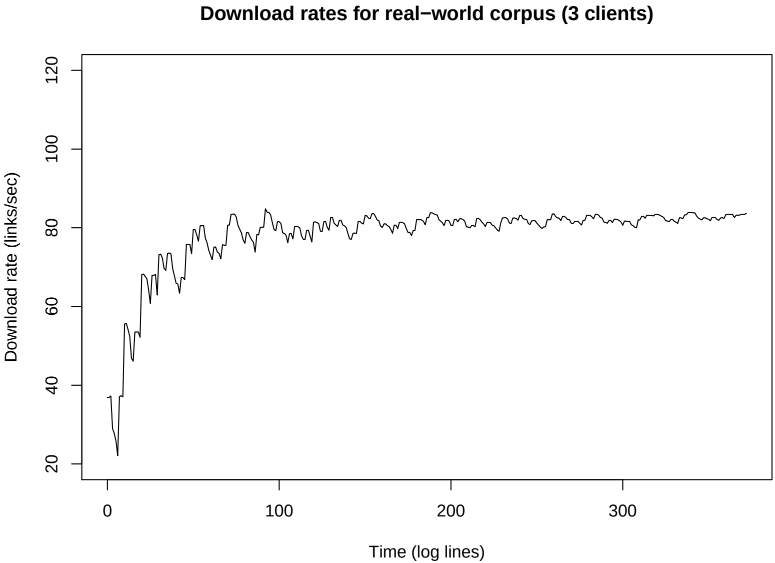
System:

- 3 clients, 400 connections/client

Throughput:

- 14.9GB in 45 minutes (5.6MBps, 300k links/hour)
- ≈ 588 million words after cleaning

THROUGHPUT (REAL-WORLD)



Download Times (Corpora)

Using my 3-client deployment:

- BE06: a few seconds
- BNC: 8 minutes
- ukWaC: 2.5 hours (or 17 hours before filtering)
- DECOW2012: 12 hours (words); 24 hours (documents)

RESOURCES/SCALABILITY

- Memory usage $O(1)$ for client and server
- Memory usage defined by batch size:
  - Server: $(clients \times batch\_size \times link\_size) + (batch\_size \times max\_resource\_size)$
  - Client: $in\_progress \times max\_resource\_size$ (using disk cache)
- Disk usage $O(N)$ for server, $O(1)$ for client.
- Practically around 120-200MB for the application, 1-200MB for data.

ETIQUETTE

- LWAC is capable of DDOS-style throughput
- Normally lists of links contain references to each server a few times
- Within-sample rate controlled by the parallel connection limit
- Between-sample rate defined by sample period

SUMMARY

- LWAC makes longitudinal sampling easy (ish!)
- Records many more variables than most download systems
- Modest resource requirements
- Fast and scalable
- Fully documented, open source

The Last Slide

`http://ucrel.lancs.ac.uk/LWAC/`

Suggestions/comments/bug reports welcome!
`s.wattam@lancaster.ac.uk`