Web Archiving

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LIS Education And Data Science Integrated Network Group (LEADING) Bootcamp
Week 2: June 12, 2023

What We Will Cover

- Archival Crawling
- Access and Replay
- Formats and metadata
- Services
  - Internet Archive
  - Archive-It
  - WebRecorder
- Tools

The Web


Metadata
Research Center
HOME
ABOUT
PUBLICATIONS & SCHOLARLY ACTIVITY
PEOPLE
NEWS & EVENTS
LEADING: LIS Education And Data Science
Integrated Network Group
LEADING Home | People |
LEADING Fellows | Application
LEADING

Our Web


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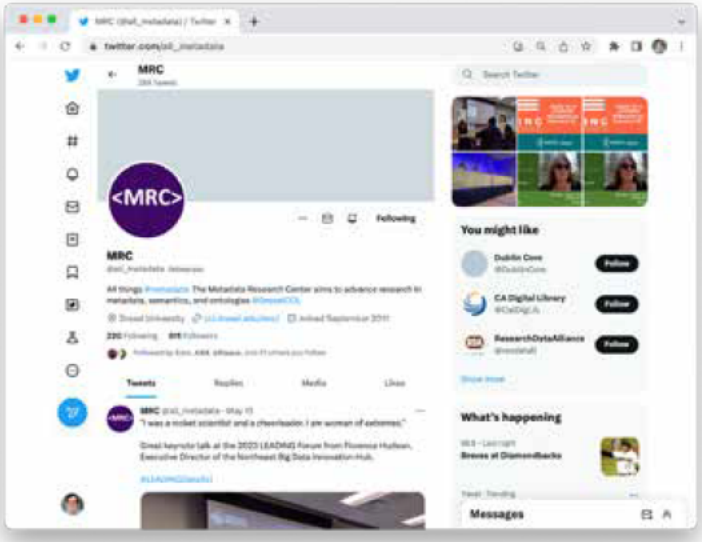
<MRC>
MRC
You might like
What's happening
Messages

My Web


Metadata
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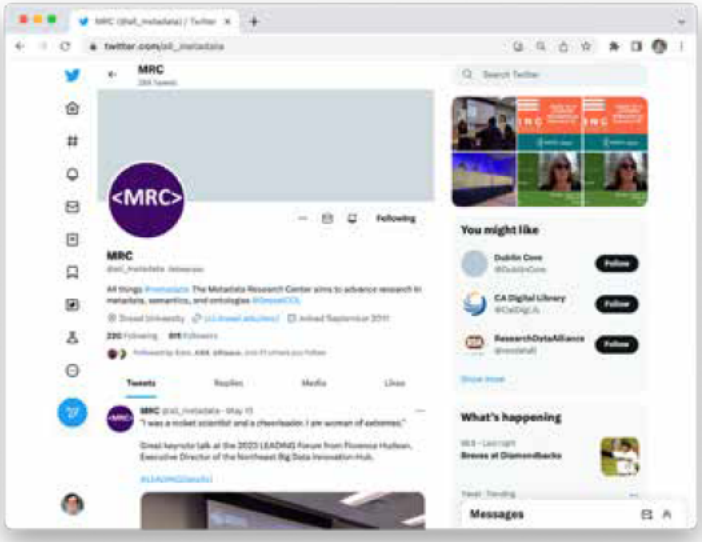
<MRC>
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You might like
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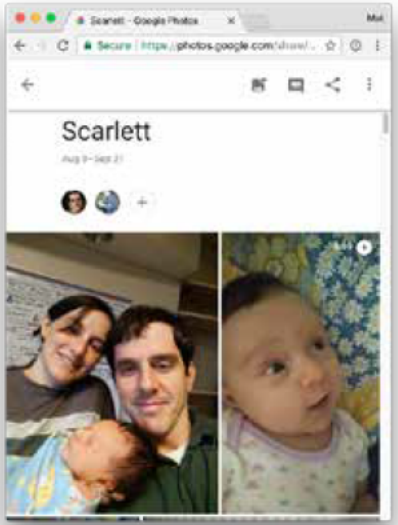
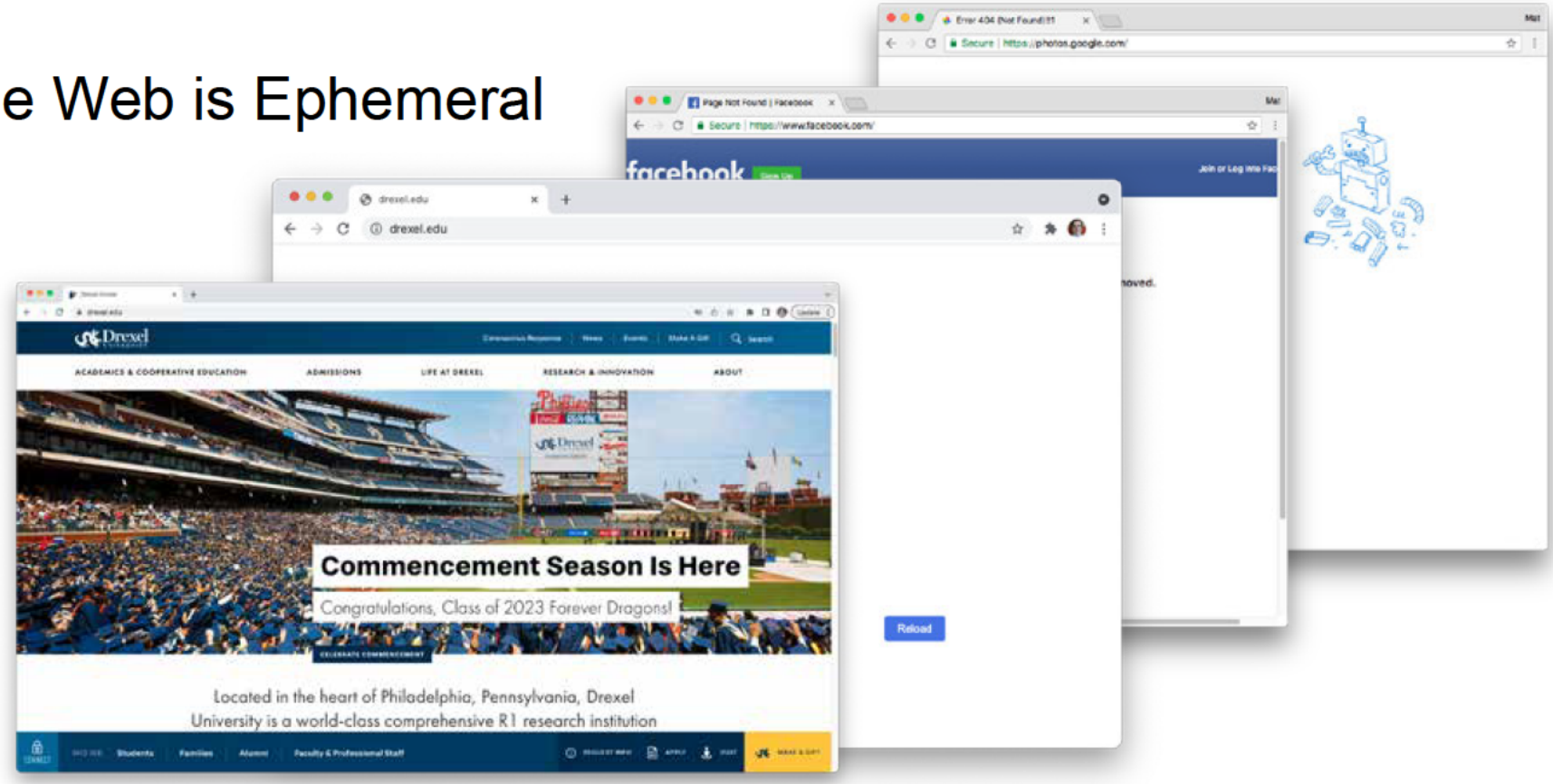
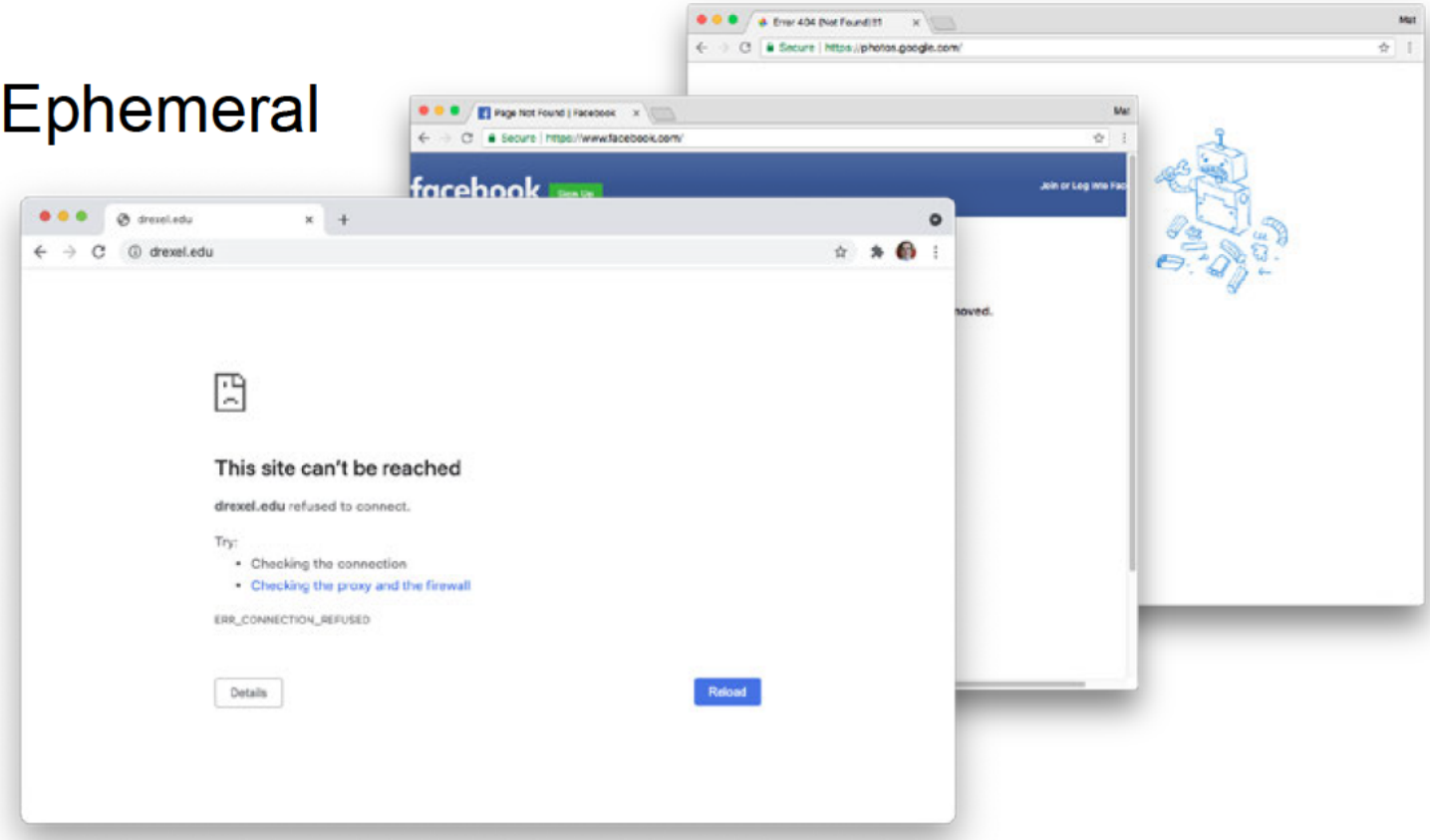

Scarlett

The Web is Ephemeral



The Web is Ephemeral



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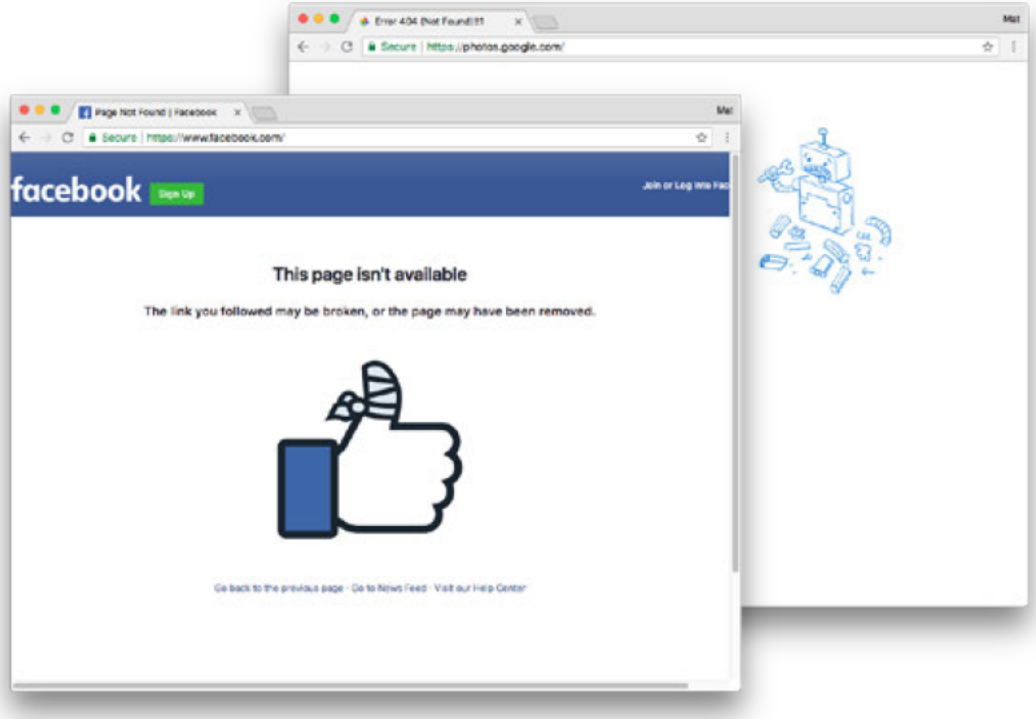

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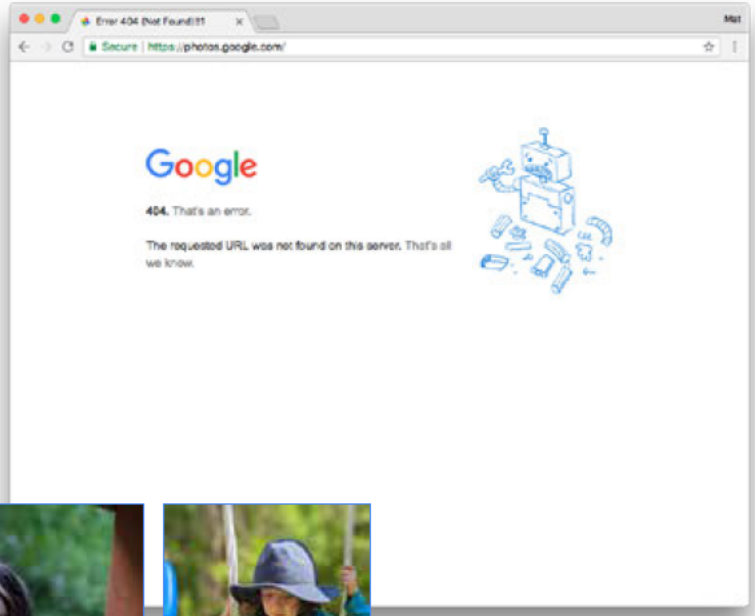
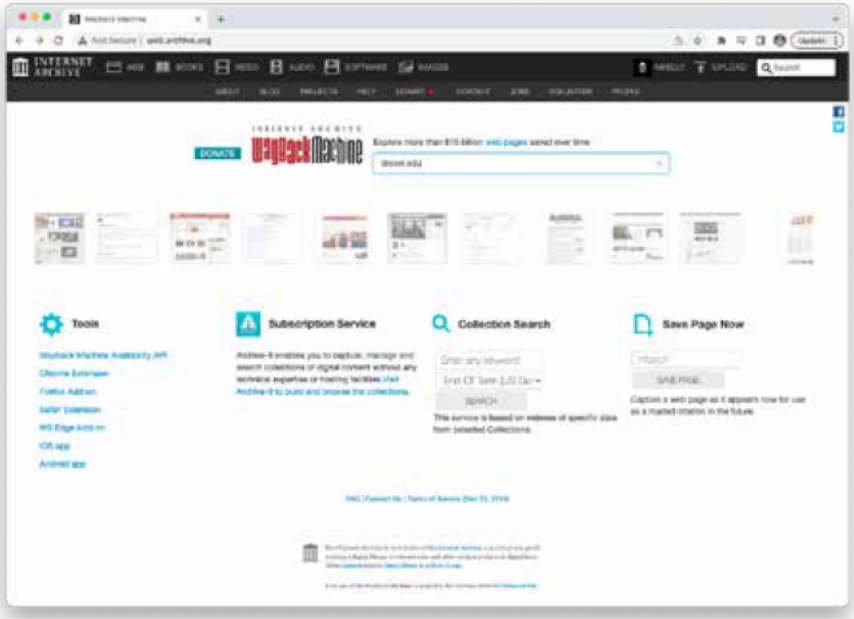
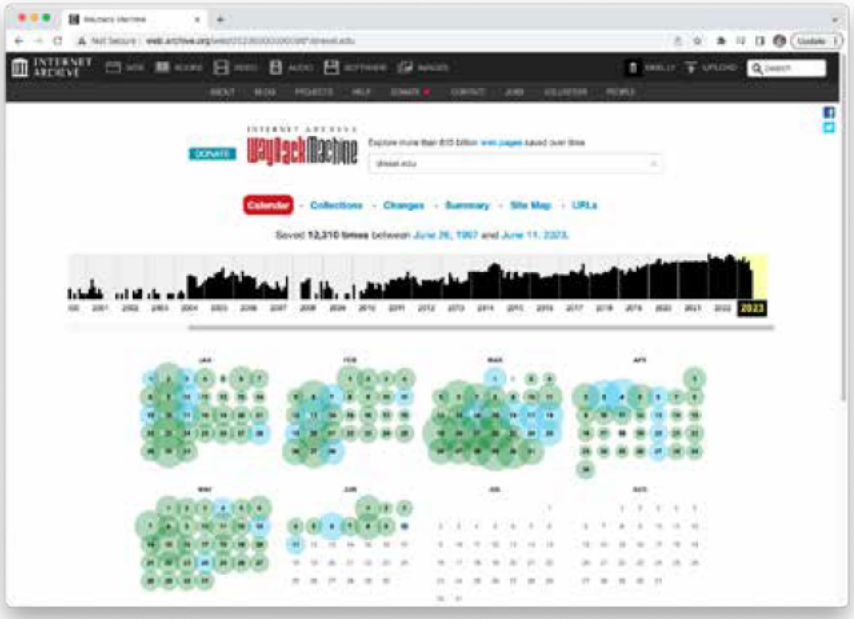


Web Archives to the Rescue: Typical Access



1. Go to `archive.org` in your browser
2. Enter the URL you want to see in the past in the form field
3. Submit your query

Web Archives to the Rescue: Typical Access

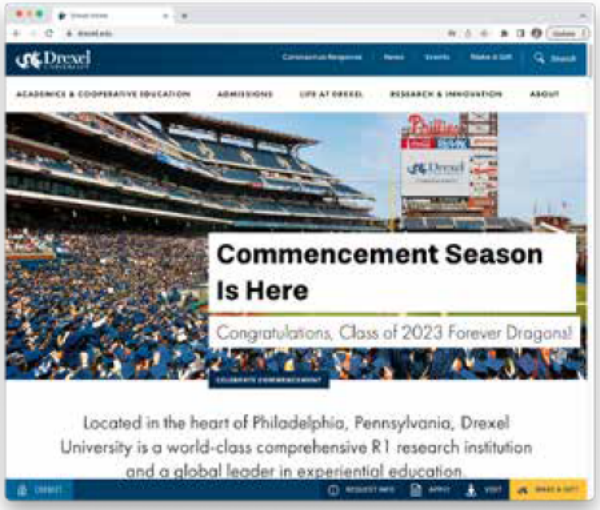


4. Locate the archived Web page on the calendar or histogram view

5. Select the year/selection for the day

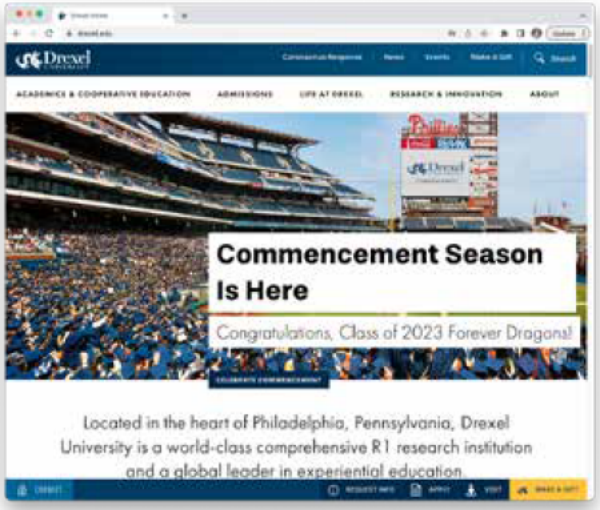
6. Repeat until you find the closest date and time

Web Archiving: View The Web of the Past



Now

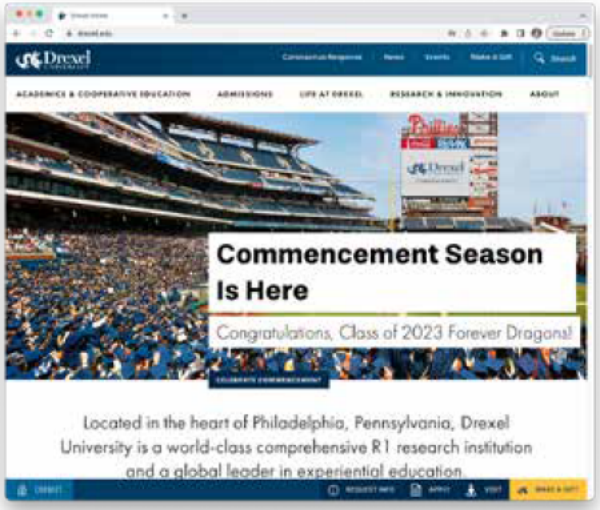
Web Archiving: View The Web of the Past



Now

June 14, 2011

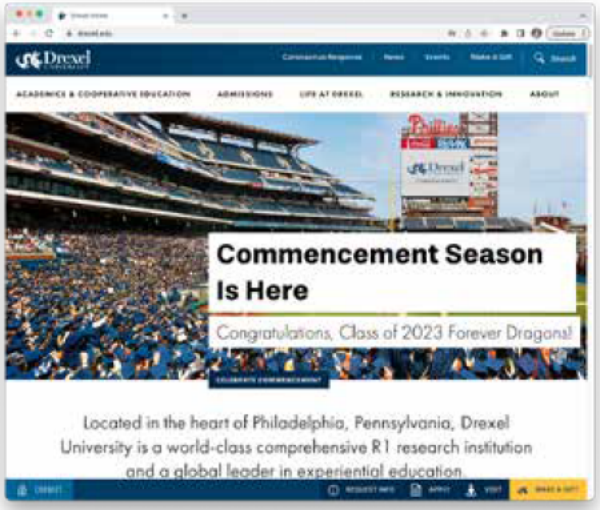
Web Archiving: View The Web of the Past



Now

March 10, 2006

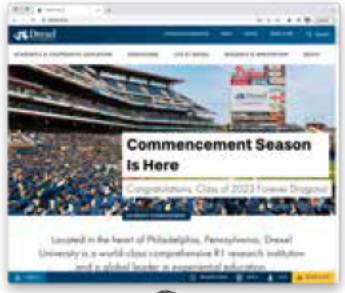
Web Archiving: View The Web of the Past



Now

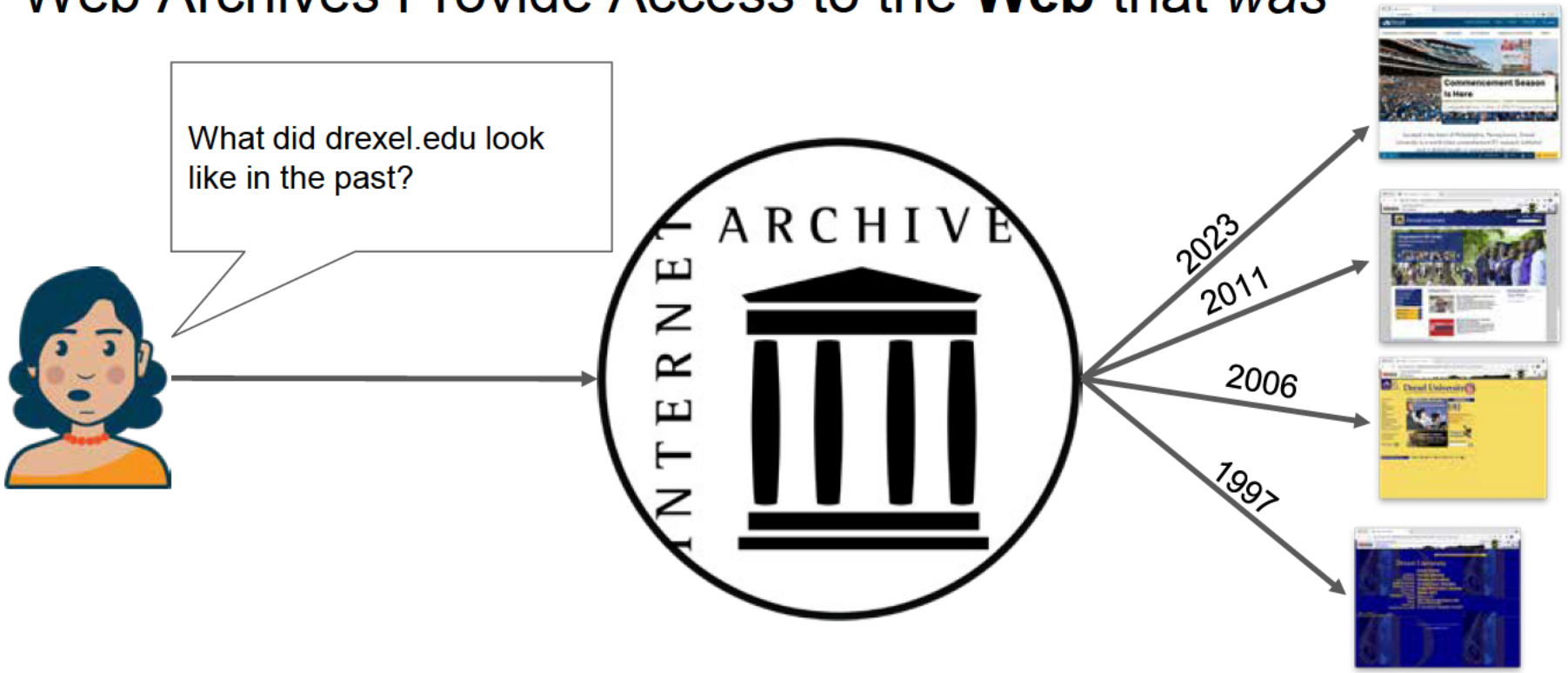
March 26, 1997

Web Archiving

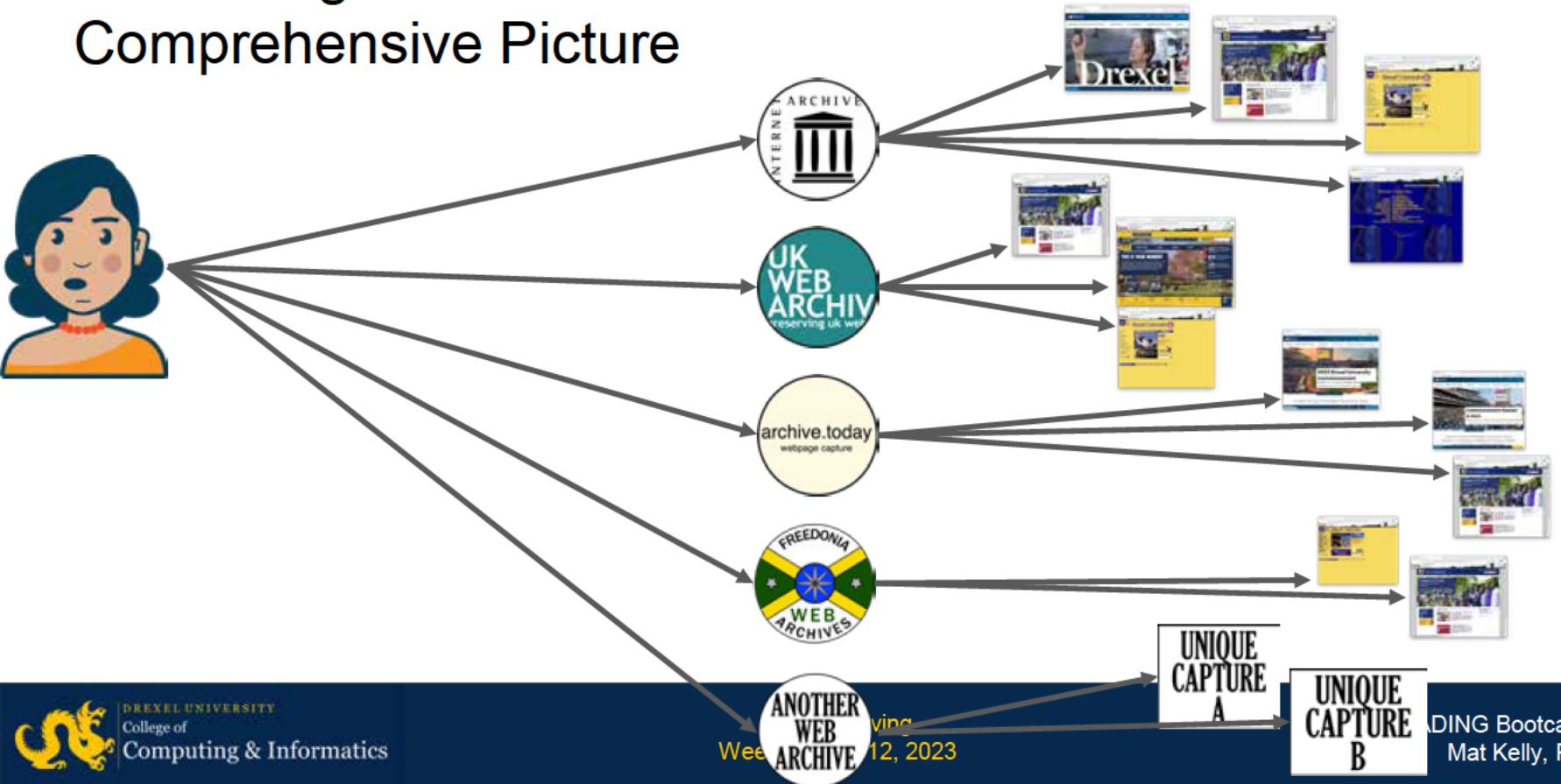


Associate a live Web URI
with their **archived representations**

Web Archives Provide Access to the **Web** that *was*

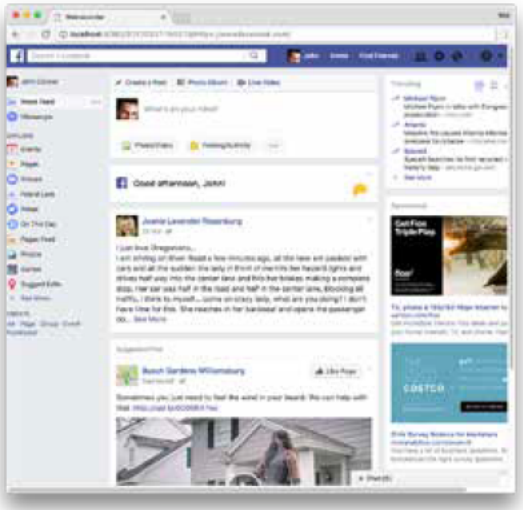


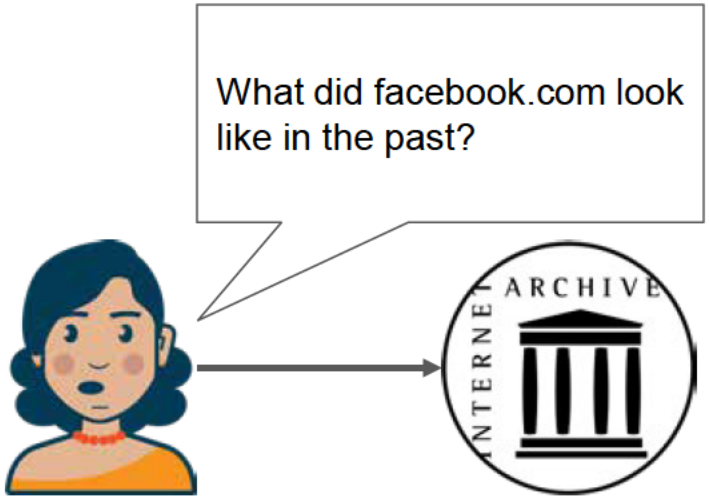
Consulting More Archives Produces a More Comprehensive Picture



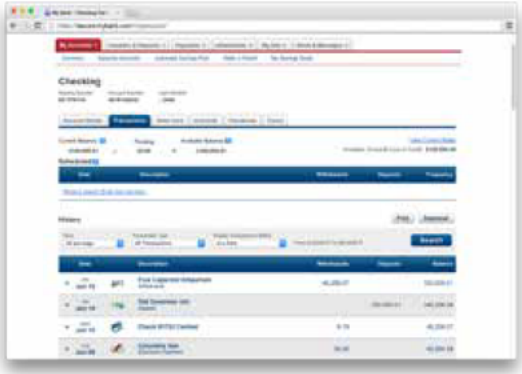
Even Then, Not Everything is Preserved

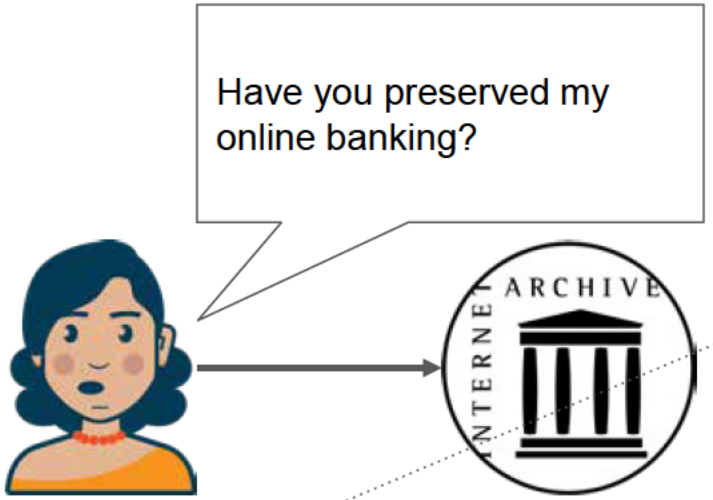
User Sees on Live Web May Not Be What is Captured

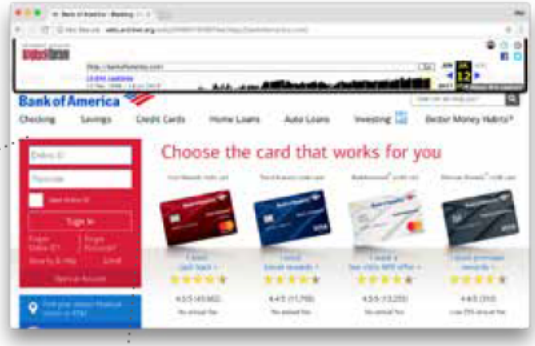


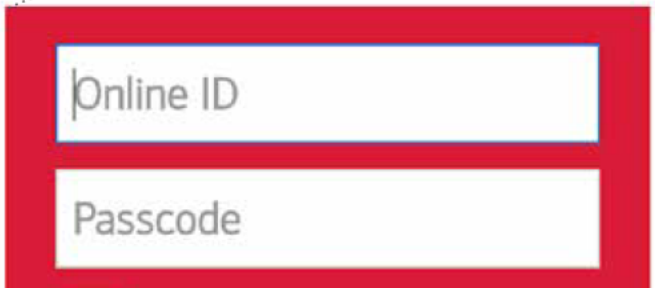


...And Oftentimes That is For the Best

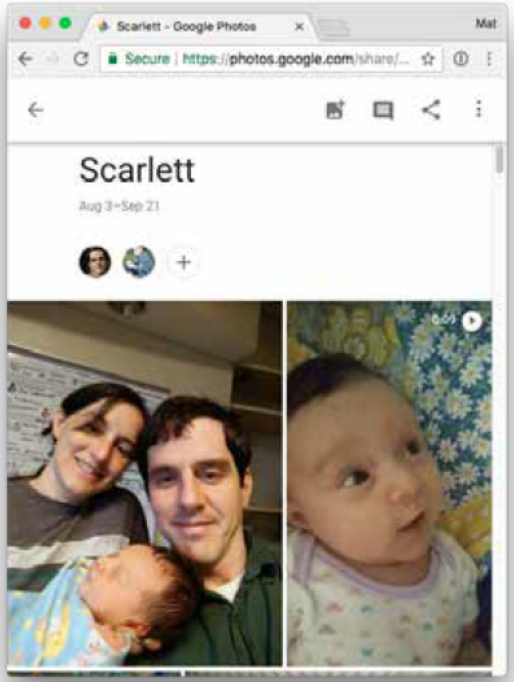


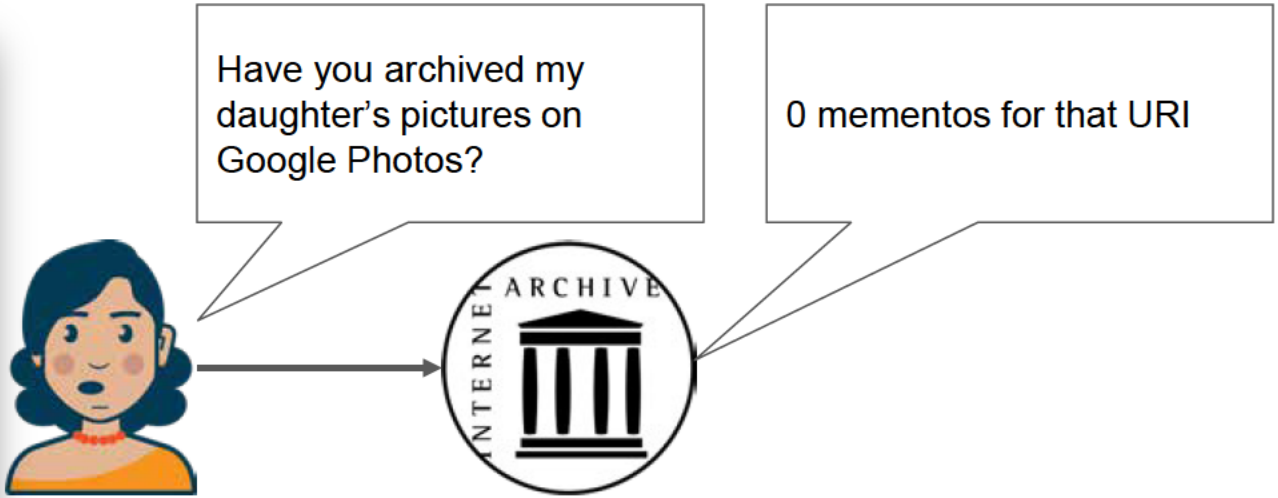




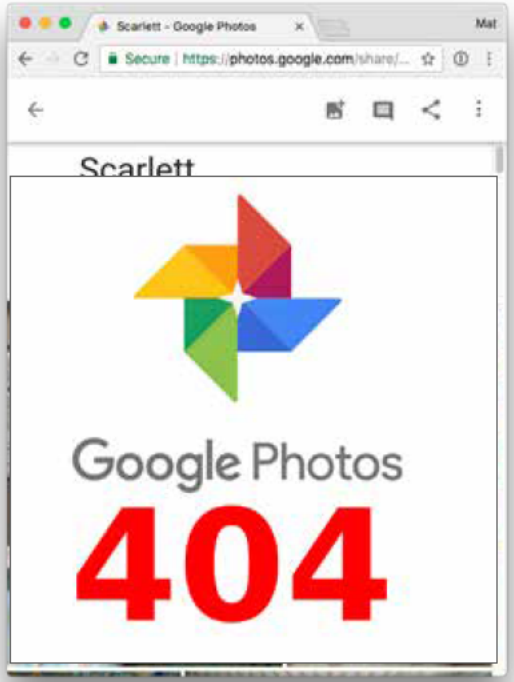


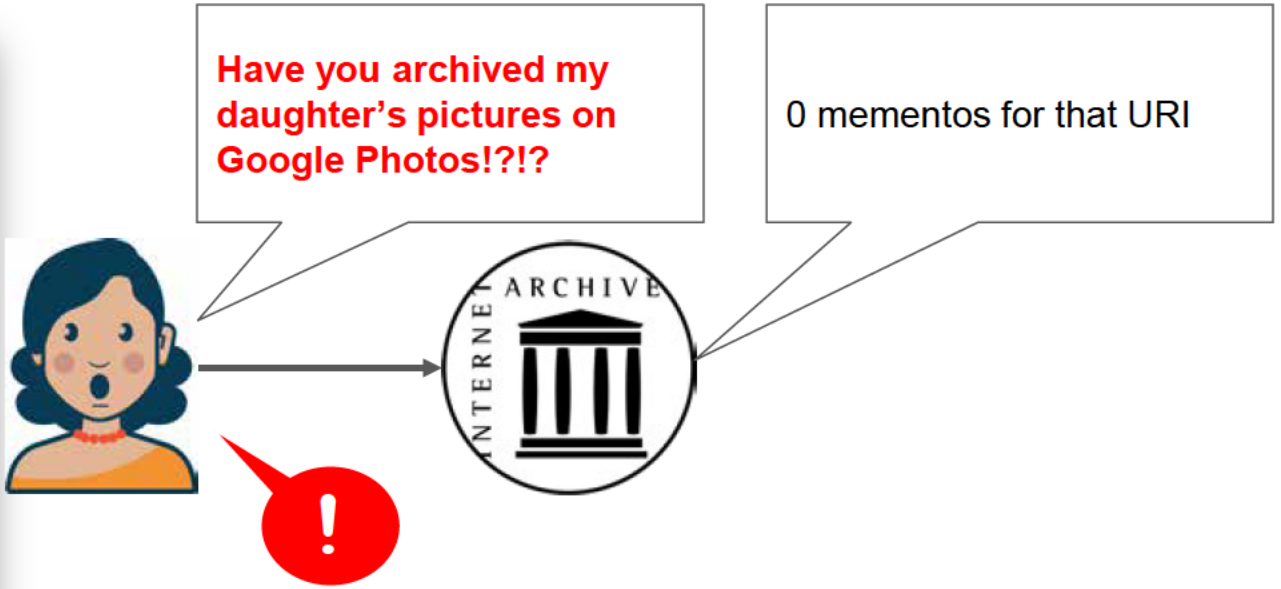
Other Times, We May Want Our Content Archived





...Especially When It Has Disappeared





Approaches Toward Archiving the Web

- Crawling
- Page-at-a-time Web Archiving
- Proxy-style Web archiving

Crawlers, in General

- Originally intended for search engines
  - Googlebot
  - Alexa
- Follow links, add to queue until exhausted (never)
- Custom scripts (Python, Perl, etc.) for ad hoc applications
  - Intent must be known prior to crawling
  - Can be temporally and spatially expensive

Archival Crawler

HERITRIX

- Record HTTP transactions
- Associate metadata with crawls
- Links extracted from web page are added to queue (frontier) and subsequently processed
- Store in a portable, standard format
  - e.g., WARC

Crawler Output: Web Archive (WARC) file

- As compared to...
  - raw collection of files
  - screenshots
- ISO-backed (28500:2017)
- Checksums/Fixity
- Metadata
- Extensible

WARC response record

- warc-response header
- HTTP response header
- HTTP response payload

Access

- Files readable but “replay” required
  - Reassembles resource representations captured
  - Allow one to experience as if a web page
- Account for “rewriting” or “redirecting” links back to the archive
  - Does this compromise the integrity of the record?
  - Some advanced (reconstructive) approaches mitigate this

Circling back: Crawling the Dynamic Web

- Crawlers should be fast, often written as scripts
- Typically are not functionally complete to modern web techs
  - Lag behind in some newer features of the web
  - This is problematic! Resources are missed
- Other approaches: leverage a “headless” browser
  - A lot slower but crawls are higher fidelity -- more accurate record

More info:
Justin F. Brunelle, Mat Kelly, Michele C. Weigle and Michael L. Nelson, “The Impact of JavaScript on Archivability,” International Journal on Digital Libraries (IJDL), 17(2), pp. 95-117. January 2016.

Access beyond Replay

- Captures may be distributed between archives
  - Different accounts of the same web page over time can be aggregated
- Aggregation assists in revolving temporal voids
  - Higher temporal granularity is proportional to a more complete record
  - Sources should be trusted/vetted, else the record is questionable
- An archive likely does not have the precise time requested
  - Datetime negotiation assists in resolving the closest

Memento (RFC7089)

- Specification for temporal negotiation on the web
- Provides *syntax* and *semantics* for representing archival captures
- Concepts like TimeMaps and TimeGates allow for representation of captures' identifiers from a single or multiple sources
- Most web archives implement Memento
  - including WayBackMachine
- Provides an alternate means of access beyond simply replaying the archived web page.

https://datatracker.ietf.org/doc/html/rfc7089

TimeMap

Live web URL

Original URI (URI-R)

Note "last" here, providing temporal context

Relative Relations

Same representation in other formats

Other TimeMaps (URI-Ts)

Access point for temporal negotiation

TimeGate (URI-G)

```
<https://drexel.edu>; rel="original",
<https://aggregator.matkelly.com/timemap/link/https://drexel.edu>;
rel="self"; type="application/link-format",
<http://web.archive.bibalex.org:80/web/19970626040823/http://www.drexel.
edu/>; rel="first memento"; datetime="Thu, 26 Jun 1997 04:08:23 GMT",
<https://web.archive.org/web/19970626040823/http://www.drexel.edu:80/>;
rel="memento"; datetime="Thu, 26 Jun 1997 04:08:23 GMT",
<https://web.archive.org/web/20060615011116/http://www.drexel.edu:80/>;
rel="memento"; datetime="Thu, 15 Jun 2006 01:11:16 GMT",
<https://wayback.archive-it.org/all/20210611040826/https://drexel.edu/>;
rel="memento"; datetime="Fri, 11 Jun 2021 04:08:26 GMT",
<https://web.archive.org/web/20210614165405/http://drexel.edu/>;
rel="last memento"; datetime="Mon, 14 Jun 2021 16:54:05 GMT",
<https://aggregator.matkelly.com/timemap/link/https://drexel.edu>;
rel="timemap"; type="application/link-format",
<https://aggregator.matkelly.com/timemap/json/https://drexel.edu>;
rel="timemap"; type="application/json",
<https://aggregator.matkelly.com/timemap/cdxj/https://drexel.edu>;
rel="timemap"; type="application/cdxj+ors",
<https://aggregator.matkelly.com/timegate/https://drexel.edu>;
rel="timegate"
```

Link (RFC 7089) TimeMap

Memento is Extensible — e.g., other TimeMap formats

```
<http://matkelly.com>; rel="original",
<http://localhost:1208/timemap/link/http://matkelly.com>;
rel="self"; type="application/link-format",
<http://web.archive.org/web/20060514123511/http://www.matkelly.com:8
0/>; rel="first memento"; datetime="Sun, 14 May 2006 12:35:11 GMT",
<http://web.archive.org/web/20060516213852/http://www.matkelly.com/>
; rel="memento"; datetime="Tue, 16 May 2006 21:38:52 GMT",
...
<http://web.archive.org/web/20180128152125/http://matkelly.com>;
rel="memento"; datetime="Sun, 28 Jan 2018 15:21:25 GMT",
<http://web.archive.org/web/20180319141920/http://matkelly.com/>;
rel="last memento"; datetime="Mon, 19 Mar 2018 14:19:20 GMT",
<http://localhost:1208/timemap/link/http://matkelly.com>;
rel="timemap"; type="application/link-format",
<http://localhost:1208/timemap/json/http://matkelly.com>;
rel="timemap"; type="application/json",
<http://localhost:1208/timemap/cdxj/http://matkelly.com>;
rel="timemap"; type="application/cdxj+ors",
<http://localhost:1208/timegate/http://matkelly.com>; rel="timegate"
```

Link (RFC 7089) TimeMap

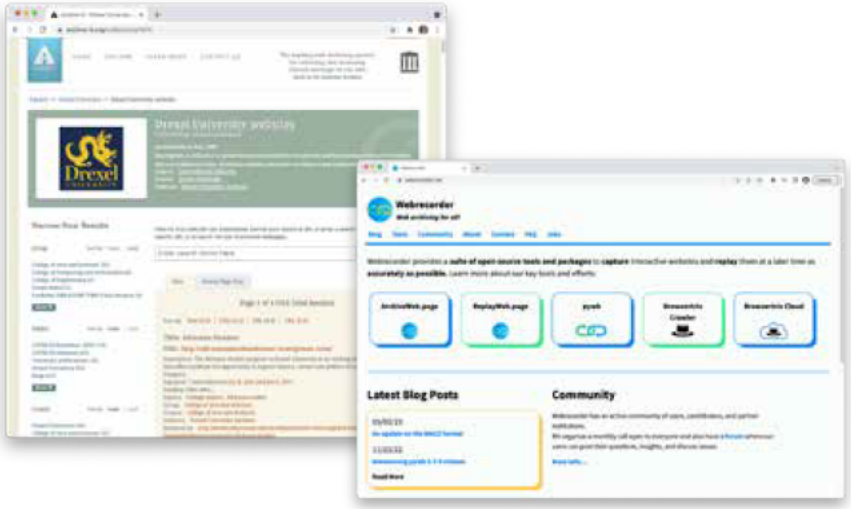
```
!context ["http://tools.ietf.org/html/rfc7089"]
!id {"uri": "http://localhost:1208/timemap/cdxj/http://matkelly.com"}
!keys ["memento_datetime_YYYYMMDDhhmmss"]
!meta {"original_uri": "http://matkelly.com"}
!meta {"timegate_uri": "http://localhost:1208/timegate/http://matkelly.com"}
!meta {"timemap_uri": {"link_format":
"http://localhost:1208/timemap/link/http://matkelly.com", "json_format":
"http://localhost:1208/timemap/json/http://matkelly.com", "cdxj_format":
"http://localhost:1208/timemap/cdxj/http://matkelly.com"}}
20060514123511 {"uri":
"http://web.archive.org/web/20060514123511/http://www.matkelly.com:80/",
"rel": "first memento", "datetime": "Sun, 14 May 2006 12:35:11 GMT"}
20060516213852 {"uri":
"http://web.archive.org/web/20060516213852/http://www.matkelly.com/", "rel":
"memento", "datetime": "Tue, 16 May 2006 21:38:52 GMT"}
...
20180128152125 {"uri":
"http://web.archive.org/web/20180128152125/http://matkelly.com", "rel":
"memento", "datetime": "Sun, 28 Jan 2018 15:21:25 GMT"}
20180319141920 {"uri":
"http://web.archive.org/web/20180319141920/http://matkelly.com/", "rel":
"last memento", "datetime": "Mon, 19 Mar 2018 14:19:20 GMT"}
```

CDXJ TimeMap

Original URI (URI-R) | Other TimeMaps (URI-Ts) | TimeGate (URI-G) | Relative Relations

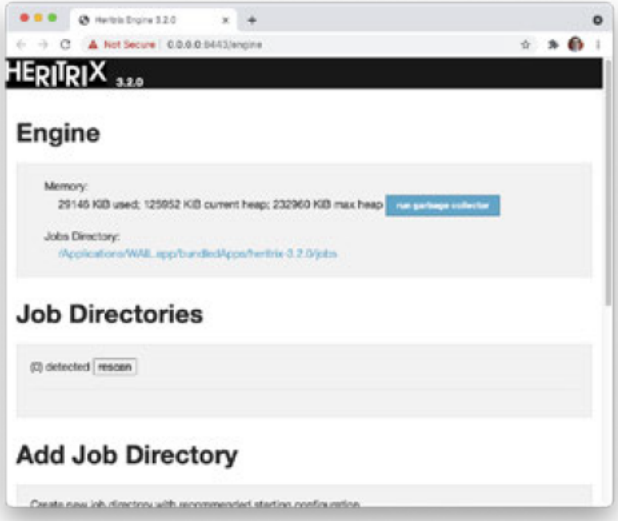
Archival Institutions and Web Services

- Internet Archive (IA): https://web.archive.org
  - Mostly automated crawling but now allows one-off user-supplied URI-specification
- Archive-It: https://archive-it.org
  - Subsidiary of IA
  - $-based subscription service
  - Introduces curated “collections”
  - Allows metadata association
- Webrecorder: https://webrecorder.net
  - Newer technologies, higher-fidelity captures
  - Collection-based organization
  - Free and Open Source, actively developed
  - Web service (Conifer) and suite of tools



Web Archiving Tools

- Capture
  - Heritrix (institutional grade crawler)
  - Proxy-style capture
    - Webrecorder's pywb
    - Warcprox
  - Browser-based capture: WARCreate
- Replay
  - OpenWayback
  - Webrecorder's pywb

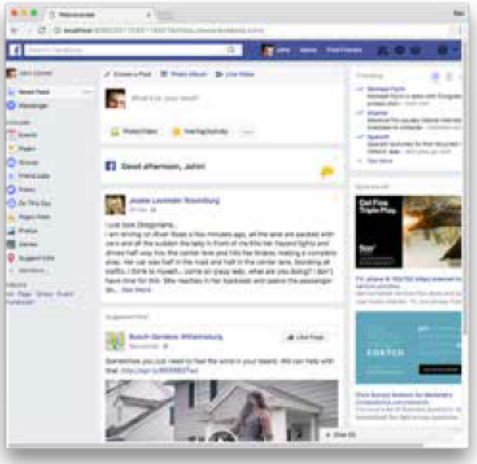


Heritrix web interface
For control control - not definition

Using Web Archives beyond simply Re-experiencing Web pages

- Historical research
- Technologies over time
- Recent discourse
- Fact-checking

Personal Web Archiving?



- Archives provide a representation of past web
  - Correct representation?
  - Verifiable?
- Personalization, authenticated representations allow for a custom experience on the web
  - Archivable?
  - Does it matter?

Personal Web Archiving?

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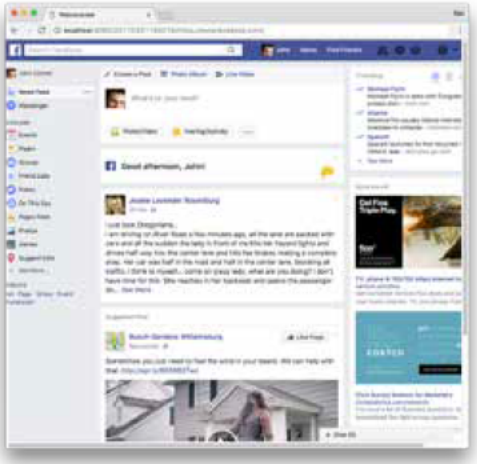
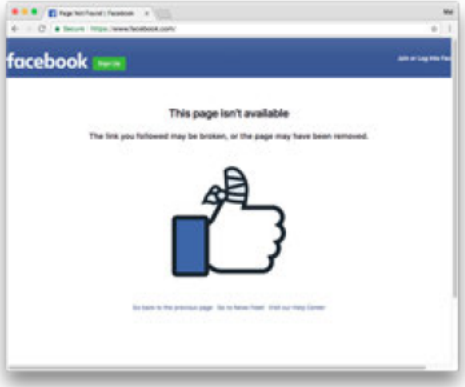




Beyond Replay

- What if the computer with my WARCs dies?
  - InterPlanetary Wayback: peer-to-peer distributed integration of WARCs and IPFS
- While on the live web, how do I know how well this page has been preserved?
  - Mink: browser extension, view archival prevalence while browsing live web
- Archival tools are hard to manage and require CLI interaction, ugh!
  - WAIL: packages Heritrix, OpenWayback, other archiving tools into a native, desktop-based app

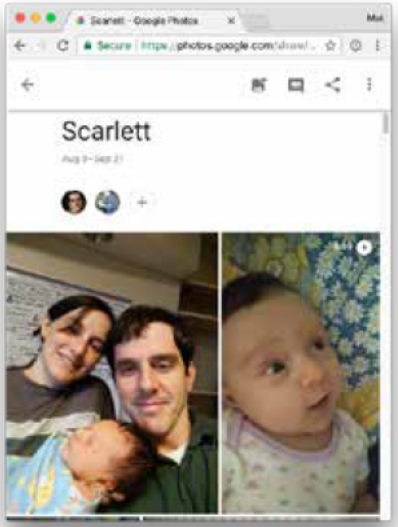
https://github.com/oduwsdl/ipwb

https://github.com/machawk1/mink

https://github.com/machawk1/wail

Open Questions

- Capturing content behind authentication
  - Large part of the problem
  - What many think is important on the web requires credentials to access
  - PII
- Trusting institutions' captures as true
- Distributed web archives / aggregation
- Vetting captures over time
  - An approach: distributed archival fixity
  - See:



Aturban M, Klein M, Van de Sompel H, Alam S, Nelson ML, et al. (2023) Hashes are not suitable to verify fixity of the public archived web. PLOS ONE 18(6): e0286879. https://doi.org/10.1371/journal.pone.0286879

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Archiving the Web is not a Solved Problem

- Web pages are culturally significant, should be preserved
- Contemporary archival tooling is always catching up to browsers' functionality
- Some web content should only reside in personal/private captures
- There is lots more to do regarding tooling, formats, verification, validating, etc.