

# Building Analytics Infrastructure for a Distributed Learning Environment

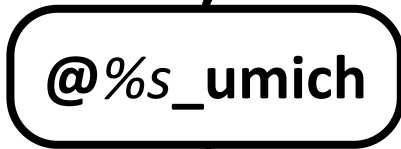


Lance E Sloan

Teaching and Learning,  
Information and Technology Services,  
University of Michigan



# Isloan



# Event Encoding

- xAPI or Caliper
- Why Caliper?
  - Extensible
  - Conformance certification
  - It's new
  - Our colleague Anthony Whyte is very involved with developing the Caliper standard



# Selecting Application

- Which application should we instrument to generate events first?
  - One with many users and content types?
    - LMS?
      - Sakai?
      - Canvas?
  - One with many users and one content type?
  - Problem Roulette?
  - Lecture Capture?



# Application Chosen

- Selected application:
  - Lecture Capture
- Why?
  - Enthusiastic developers
  - LTI provider (local and LMS users)
  - Very active usage
- Why not LMS?
  - Transitioning from Sakai to Canvas
  - Not enough Canvas experience



# Completing Caliper

- Lecture Capture: PHP application
- Problem: caliper-php incomplete
  - Not more than a stub
  - Must complete implementation
  - Use caliper-java as a reference
  - Test with phpunit and caliper-common-fixtures
  - "Certify" with caliper-conformance-tests
  - At release 1.0.0, I had written 90%



# Instrumenting Lecture Capture

- Add Caliper calls to LC to emit select events and actions
  - SessionEvent: LOGGED\_IN, LOGGED\_OUT, TIMED\_OUT
  - MediaEvent: STARTED, ENDED, PAUSED, RESUMED
- Work on Lecture Capture done in parallel of that for completing Caliper
- Caliper events sent to local development tools or simple remote services (<http://RequestB.in/>)



# We're Certifiable

**Product:** Lecture Capture + caliper

**Organization:** University of Michigan

**Registration Number:** IMSk1un2015W1

**Compliance Category:** Classroom Capture/Lecture Tools

**Status:** Caliper Analytics v1.0 Compliant

**Conformance Date:** Monday, August 24, 2015

**Metric Profile Support:** Media Event, Session Event

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Current Registrations:  
[imscert.org](http://imscert.org)



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**Currently one of only fourteen certified applications.**



# Select a Learning Record Store

- An LRS keeps events for later analysis
- 3 or 4 products considered
- OpenLRS (Aperero) was chosen. Why?
  - Open Source
  - U-M is an Aperero member
  - Its two-database architecture is clever
  - Its Caliper support was incomplete; We would have fun implementing it



# Caliper in OpenLRS

- OpenLRS accepts xAPI and Caliper
- When queried for one event type, matching events of the other type are converted
- We had little time and wouldn't use xAPI
- We implemented enough Caliper support to store and retrieve raw events



# Robustness Concern

- Lecture Capture service owners concerned about effects of OpenLRS problems
- My solution, Viadutoo, is a caching proxy endpoint for Caliper events
- Quickly accepts events and closes connection
- Attempts to send events to OpenLRS
- If send fails, store the event
- Stored events may be sent later

# Deployment and...

- With everything ready it was deployed early 2016
- Except for a small problem with unauthenticated users (easy fix), it worked well

**...SUCCESS!**

By July 2016, we'd collected almost ***one million*** events each month

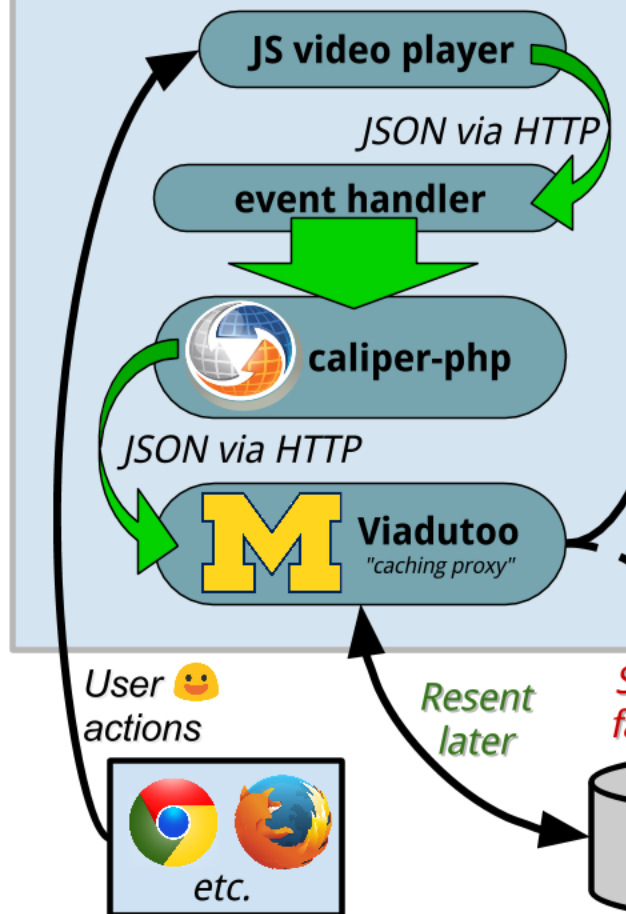
# Next Steps: Analysis

- With sound infrastructure and growing data, we encourage our IT colleagues and Univ. faculty to consider ways to take advantage of it
- A second application, Problem Roulette, was added, so now we plan for growing capacity

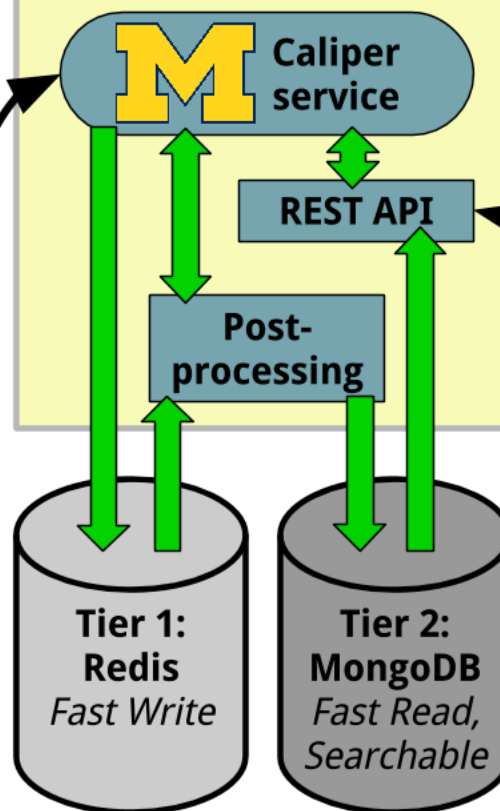
***Now take an aerial view of  
this infrastructure...***



# Lecture Capture



## OpenLRS



## Data Analysis and Viz. Tools

TBD

- Tableau?
- OpenDashboard?
- R + RJSONIO?
- (I)Python/Jupyter + Bokeh?

## Inside a Learning Analytics Infrastructure

# Thank you

We're grateful to the organizations that have created the type of environment needed to encourage the growth of these technologies



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