Video BenchLab Demo: An Open Platform for Realistic Video Streaming Benchmarking

Patrick Pegus II  Emmanuel Cecchet  Prashant Shenoy  Prateek Sharma
University of Massachusetts Amherst
benchlab@cs.umass.edu

ABSTRACT
In this poster and demonstration, we present an open, flexible and realistic benchmarking platform named Video BenchLab to measure the performance of streaming media workloads. While Video BenchLab can be used with any existing media server, we provide a set of tools for researchers to experiment with their own platform and protocols. The components include a MediaDrop video server, a suite of tools to bulk insert videos and generate streaming media workloads, and a client runtime to replay videos in the native video players of real web browsers such as Firefox, Chrome and Internet Explorer. Various metrics are collected to capture the quality of video playback and identify issues that can happen during video replay. Finally, we provide a Dashboard to manage experiments, collect results and perform analytics to compare performance between experiments.

1. Video BenchLab
The BenchLab project seeks to offer an open, freely-available platform for realistic benchmarking of servers applications. While BenchLab was initially designed to support web-based applications [1] and services (e.g., multi-tier web applications accessed from browser-based clients), Video BenchLab [3] is an enhanced platform that provides similar functions for streaming media servers and protocols accessed via browser-based players. Towards this end, Video BenchLab uses real web browsers (Firefox, Chrome and Internet Explorer are supported) running real video players (HTML5 and YouTube players currently supported) to request HTTP streaming content from the server. A key goal of Video BenchLab is to enable automation for running complex experiments where clients, servers, or both may be distributed or running on remote machines such as cloud servers; an experiment comprises a set of clients that are controlled remotely by the platform and provided with a video request trace that they then inject on the specified server or set of servers. The content is streamed to HTML5 players [2] supported by modern browsers and a range of statistics are gathered and uploaded to a central database. Real user behavior when watching video content such as pausing, skipping or clicking on related videos can be simulated as part of the trace replay. BenchLab provides the ability to inject requests onto real servers (e.g., YouTube) and also provides a synthetic server backend based on MediaDrop that emulates a YouTube-like system on small scale. Our MediaDrop server is packaged in a virtual machine (available in VMDK or EC2 AMI formats) with a set of simple and high definition videos of various lengths, ready to use and free to redistribute.

The BenchLab Client Runtime (BCR) that controls the browser records video metadata, including MIME type, resolution and duration, current time, video position, buffer start and end positions, and, if supported by the player, when the video has stalled. This data can be used to extract information about potential lags or skips during the video replay. As the BCR runs on standard Linux or Windows host systems, it can use any wired or wireless network supported by the underlying OS. An Android version of Video BenchLab is in the works for mobile platforms.

The BenchLab Dashboard defines and controls experiments. It stores the traces, configuration and results associated to each experiment. It also provides advanced analytics tools to process video results and help the experimenter detect issues such as network congestions or player side issues (buffer underruns, cpu starvation...).

Our goal is to enable a range of performance evaluation experiments related to server design, streaming protocol performance, network performance and client-side performance. Finally, Video BenchLab includes new tools that permit analysis of results across different runs of an experiment. We believe that the open nature of the BenchLab platform makes it an attractive choice for multimedia systems researchers for use in their own research and experimentation.

2. Implementation and Platform Availability
All components of the Video BenchLab software suite are freely available under an open source license and downloadable from SourceForge at http://sf.net/projects/benchlab. Additional details of our platform are available from the BenchLab project page at http://benchlab.cs.umass.edu/.

Acknowledgements: This research and the development of BenchLab and Video BenchLab is supported in part by a National Science Foundation grant 1339839.

3. References


Motivation
- Lack of streaming benchmarks that are open and freely available to researchers.
- Our goal: an open, flexible benchmarking framework for research use.
- We provide: Streaming server, video datasets, workloads & data analysis tools.

Overall approach and Goals
- Focus on real browsers playing HTTP streaming workloads using HTML5 players
- MediaDrop server with set of free-to-use videos or real web-sites (YouTube,...)
- Can use any network (wired, Wifi, cellular), protocol and Codec
- Programmable video player interactions (pause, seek, skip ad, change quality...)
- Collects advanced metrics from player to detect video skips and lags
- Internet scale experiments and result analysis with friendly Web interface

BenchLab Client Runtime (BCR)
- Replay traces in Web browsers
- Interact with browser to replay inputs
- Collect detailed Web response times
- Collect video player buffer sizes and video position
- GPS coordinates on mobile devices
- Can record HTML and page snapshots
- Easy deployment in the cloud for Internet scale benchmarks

BenchLab WebApp
- JEE WebApp with embedded database
- Repository of Web traces to replay
- Schedule and control experiment execution
- Results repository
- Can be used to distribute / reproduce experiments and compare results

Video BenchLab specifics
- MediaDrop Virtual Machine (VMDK or EC2 AMI)
  - Uses HTML5 video player
  - Includes 33 videos (SD + HD from <1m to >1hour)
  - Related videos for social aspects
- BCR support for Firefox, Chrome and Internet Explorer
  - Video player statistics for YouTube and MediaDrop
  - Relies on Selenium drivers for Linux and Windows
- BenchLab WebApp
  - Web traces with workloads for MediaDrop VM
  - Video player statistic analysis detect skips and lags during replay
  - Network issues detection
  - Result comparison for multi-browser experiments

Future plans
- Explore video player interactions (seek, pause, change quality, ads placement...) and support for multiple buffer regions
- Support for HTTP/2 and video streaming QoE measurements on both desktop and mobiles
- Advanced analytics
  - Automate performance anomaly detection
  - Automatic result clustering for Internet scale experiments

---

Video BenchLab  
Realistic Benchmarking of Streaming Media Wokloads

Emmanuel Cecchet, Patrick Pegus, Prashant Shenoy, Prateek Sharma  
University of Massachusetts Amherst, USA  
benchlab@cs.umass.edu