Google APIs support a variety of features designed to enable state of the art development. In this session, you will learn how to create applications that use performance enhancing features to make your code run faster and use fewer resources. Some features we'll describe include batching, requests for partial response, and efficient ways to handle media

---

About Sven Mawson

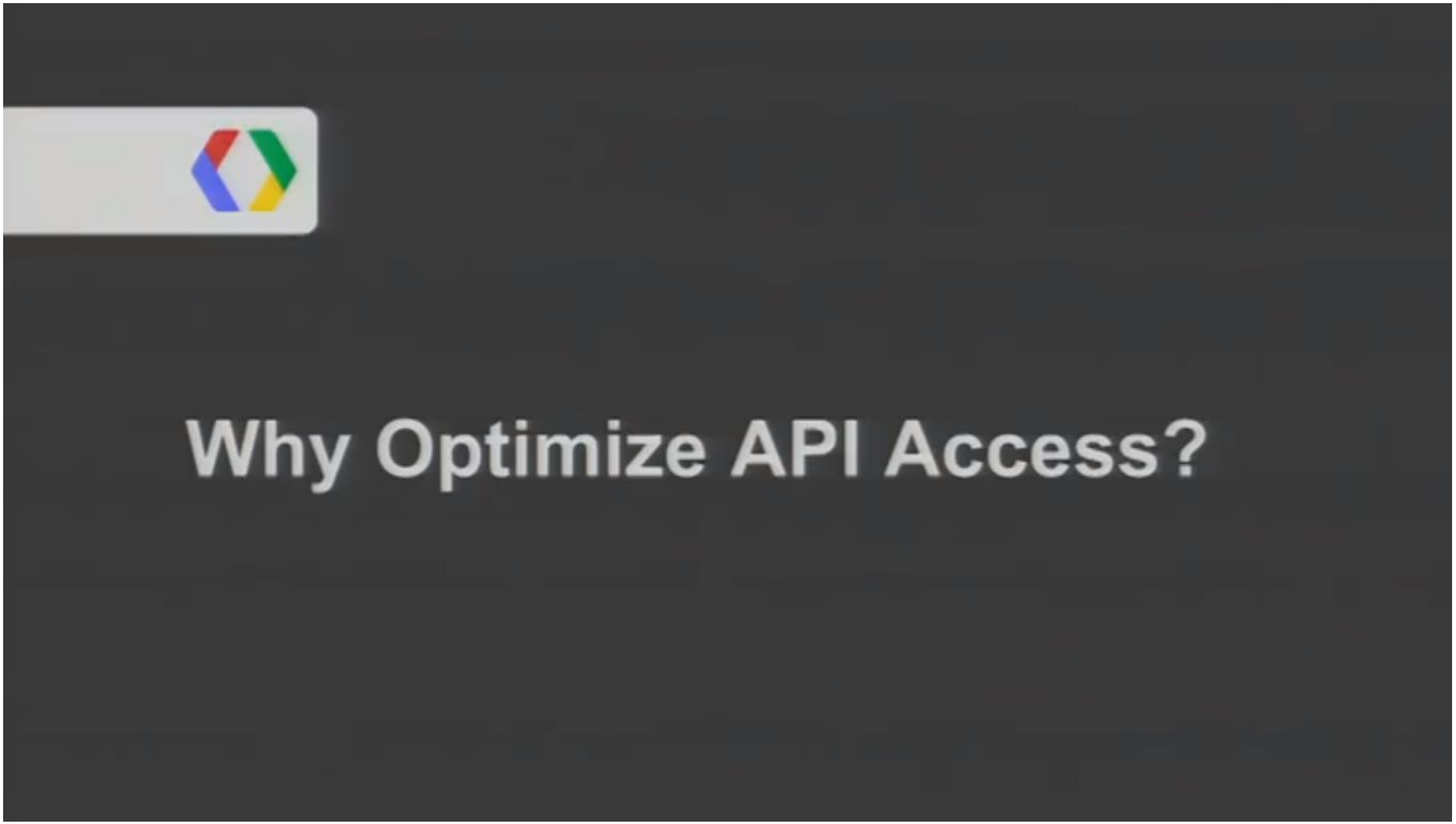
View full profile

Sven joined Google in 2006, between getting his BS from Stanford University and his PhD from UCLA. He currently works on Google's API infrastructure, helping to make Google's APIs stable, fast, and easy to use.

Optimizing Your Code Using Features of Google APIs

Sven Mawson
Staff Software Engineer
#io12

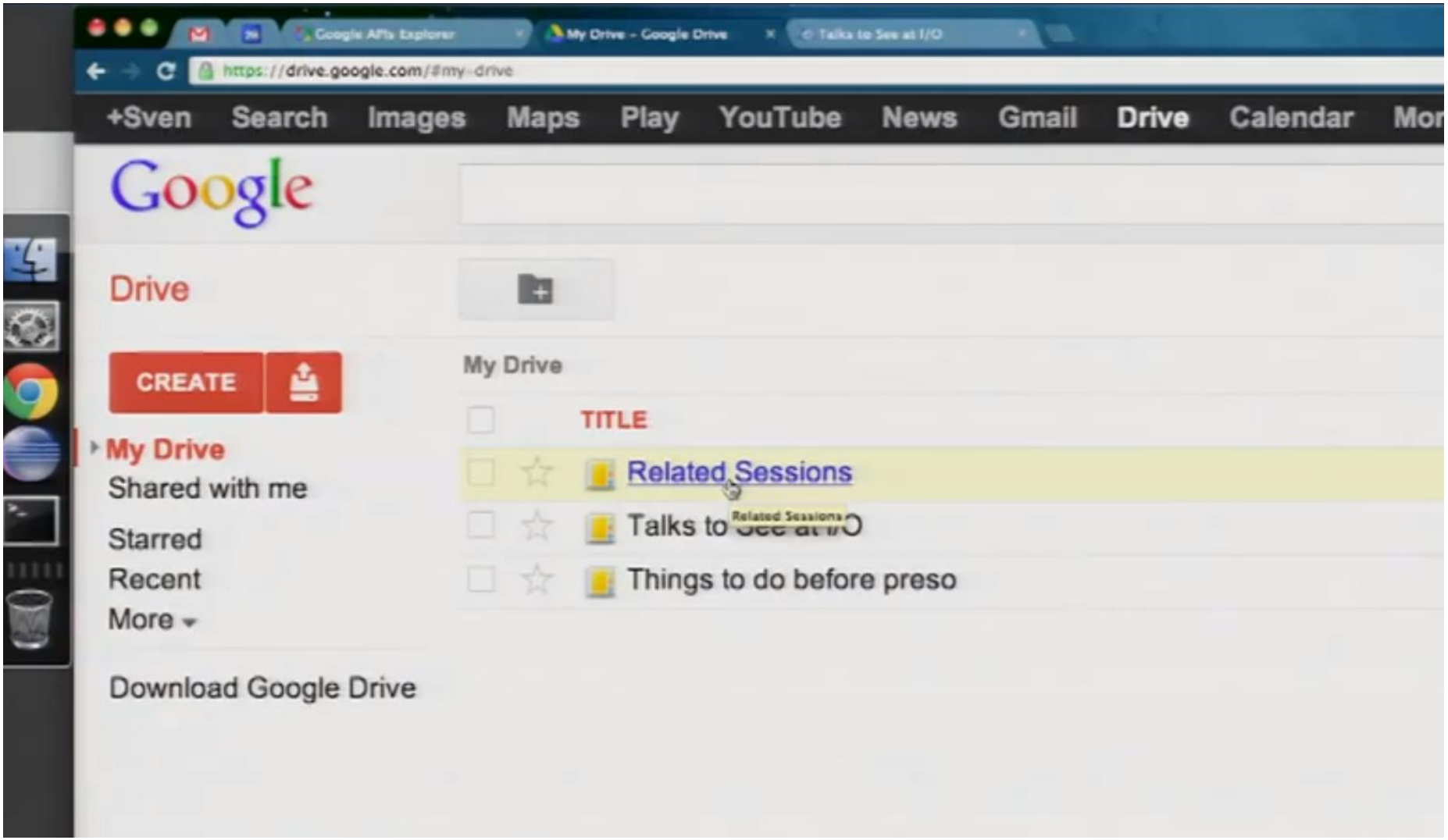
Google I/O 12

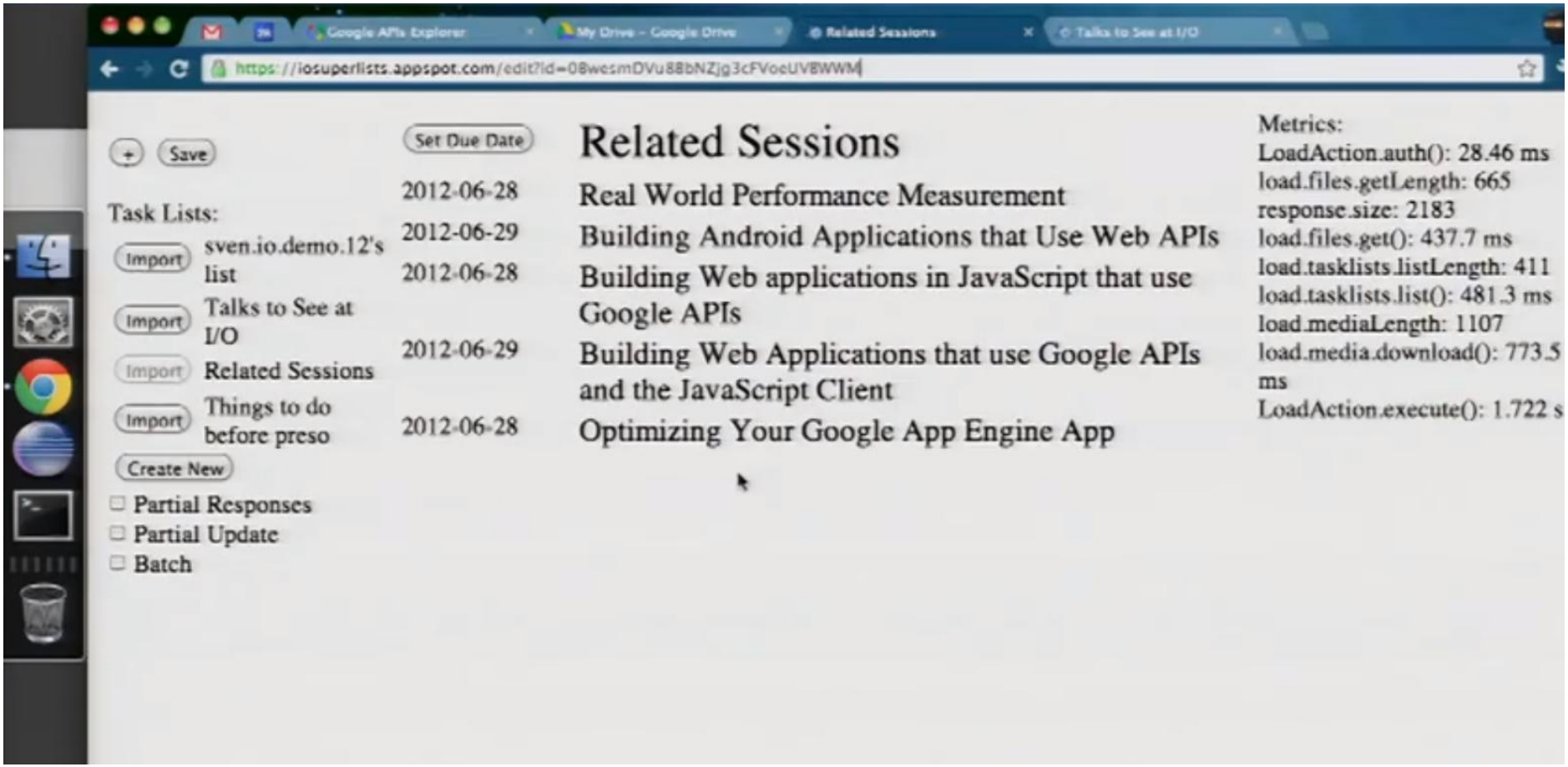

Why Optimize API Access?

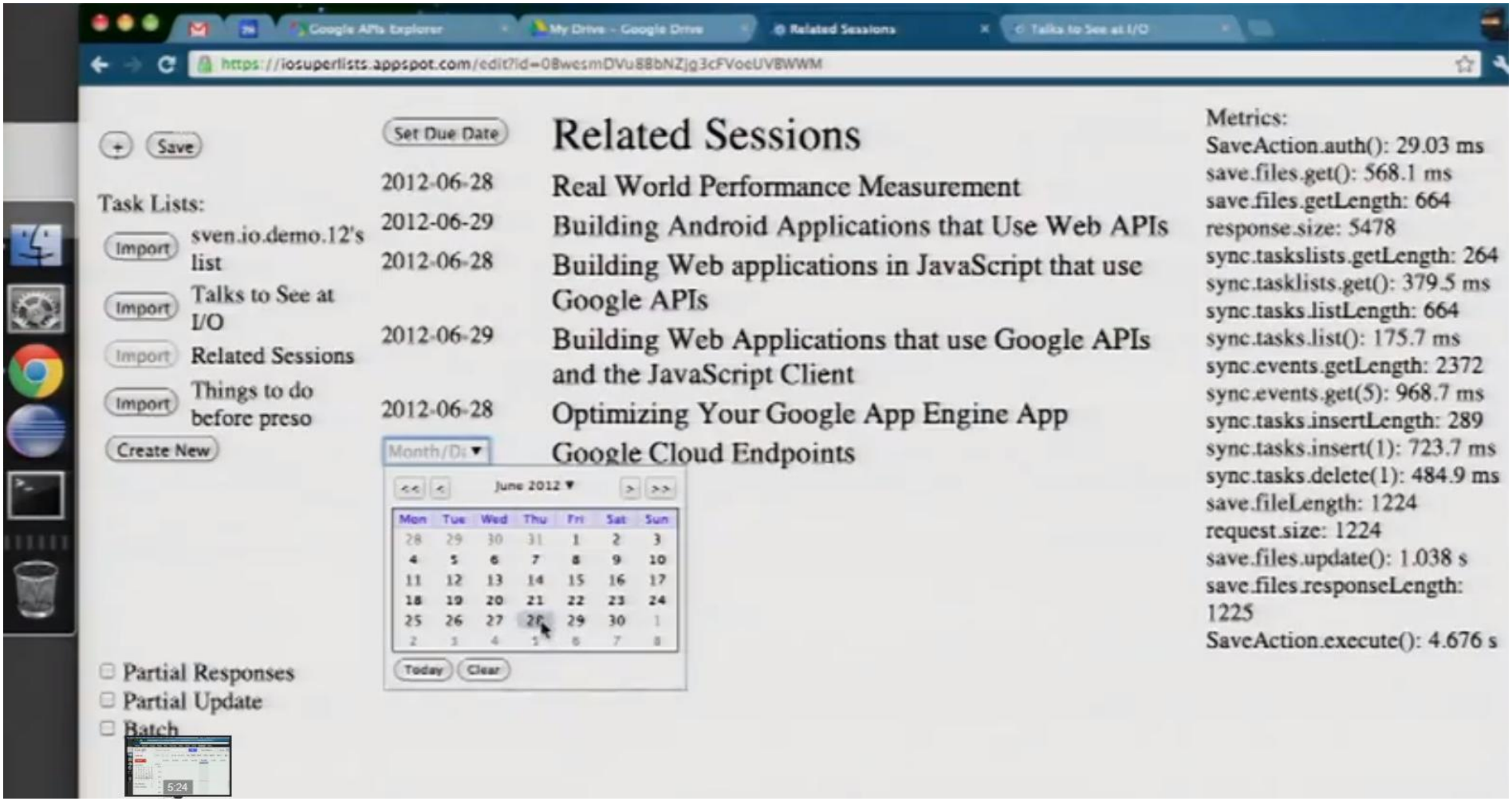

Bandwidth Is Expensive

Example Application

- Built on Google App Engine
- Task Management Application
- Integrated with Google APIs
  - Google Drive SDK
  - Google Tasks API
  - Google Calendar API


My Drive - Google Drive
https://drive.google.com/#my-drive
+Sven
Search
Images
Maps
Play
YouTube
News
Gmail
Drive
Calendar
Google
Drive
CREATE
My Drive
Shared with me
Starred
Recent
More
Download Google Drive
My Drive
TITLE
Related Sessions
Talks to
Related Sessions
Things to do before preso


Google APIs Explorer
My Drive - Google Drive
Related Sessions
Talks to See at I/O
https://iosuperlists.appspot.com/edit?id=08wesmDVu88bNZjg3cFVoeUVBWWM
+
Save
Task Lists:
Import
sven.io.demo.12's list
Import
Talks to See at I/O
Import
Related Sessions
Import
Things to do before preso
Create New
Partial Responses
Partial Update
Batch
Set Due Date
2012-06-28
2012-06-29
2012-06-28
2012-06-29
2012-06-28
Related Sessions
Real World Performance Measurement
Building Android Applications that Use Web APIs
Building Web applications in JavaScript that use Google APIs
Building Web Applications that use Google APIs and the JavaScript Client
Optimizing Your Google App Engine App
Metrics:
LoadAction.auth(): 28.46 ms
load.files.getLength: 665
response.size: 2183
load.files.get(): 437.7 ms
load.tasklists.listLength: 411
load.tasklists.list(): 481.3 ms
load.mediaLength: 1107
load.media.download(): 773.5 ms
LoadAction.execute(): 1.722 s


Google APIs Explorer
My Drive - Google Drive
Related Sessions
Talks to See at I/O
https://iosuperlists.appspot.com/edit?id=08wesmDVu8BbNZjg3cFVocUVBWWM
+
Save
Task Lists:
Import
sven.io.demo.12's list
Import
Talks to See at I/O
Import
Related Sessions
Import
Things to do before preso
Create New
Partial Responses
Partial Update
Batch
5:24
Set Due Date
Related Sessions
2012-06-28
Real World Performance Measurement
2012-06-29
Building Android Applications that Use Web APIs
2012-06-28
Building Web applications in JavaScript that use Google APIs
2012-06-29
Building Web Applications that use Google APIs and the JavaScript Client
2012-06-28
Optimizing Your Google App Engine App
Google Cloud Endpoints
Month/D
<< < June 2012 > >>
Mon Tue Wed Thu Fri Sat Sun
28 29 30 31 1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 1
2 3 4 5 6 7 8
Today
Clear
Metrics:
SaveAction.auth(): 29.03 ms
save.files.get(): 568.1 ms
save.files.getLength: 664
response.size: 5478
sync.taskslists.getLength: 264
sync.tasklists.get(): 379.5 ms
sync.tasks.listLength: 664
sync.tasks.list(): 175.7 ms
sync.events.getLength: 2372
sync.events.get(5): 968.7 ms
sync.tasks.insertLength: 289
sync.tasks.insert(1): 723.7 ms
sync.tasks.delete(1): 484.9 ms
save.fileLength: 1224
request.size: 1224
save.files.update(): 1.038 s
save.files.responseLength: 1225
SaveAction.execute(): 4.676 s


Demo: Super Lists
https://iosuperlists.appspot.com

Code V1

Authentication (using https://developers.google.com/drive/examples/java)

```java
protected Credential getCredential() {
  CredentialMediator mediator = new CredentialMediator(req, getClientSecretStream(), SCOPES);
  return mediator.getActiveCredential();
}
```

Code V1

Loading Metadata and Content from Drive

Java

```
Credentials credentials = getCredentials(req, resp);
Drive service = Drive.builder(TRANSPORT, JSON_FACTORY)
    .setHttpRequestInitializer(credentials).build();
Files.Get getFile = service.files().get(file_id);
File file = getFile.execute();

ByteArrayOutputStream out = new ByteArrayOutputStream();
getFile.getMediaHttpDownloader().download(new GenericUrl(file.getDownloadUrl()), out);
String content = new String(out.toByteArray(), Charsets.UTF_8);
```

Code V1

Creating a New TaskList

Java

```
Tasks tasksService = Tasks.builder(...)...build();
TaskList tasklist = new TaskList().setTitle(list.name);
Tasklists.Insert insertTasklist = tasksService.tasklists().insert(tasklist);
tasklist = insertTasklist.execute();

for (SuperListItem item : list.content.items) {
  Task task = new Task().setTitle(item.name);
  TasksOperations.Insert insertTask = tasksService.tasks().insert(tasklist.getId(), task);
  item.taskId = insertTask.execute().getId();
}
```

Code V1

Syncing Calendar Events

Java

```
Calendar calService = Calendar.builder(...)...build();
List<Event> events = Lists.newArrayList();
for (SuperListItem item : list.content.items) {
  Events.Get getEvent = calService.events().get("primary", item.eventId);
  events.add(getEvent.execute());
}
... // Update events.
for (Event event : events) {
  Events.Update updateEvent = calService.events().update("primary", event.getId(), event);
  Event updated = updateEvent.execute();
}
```

Profiling

- Actions
  - Load
  - Save
  - Sync Tasks
  - Sync Calendar
- Metrics
  - Latency
  - Bandwidth

Profiling - Latency

com.google.base.Stopwatch (http://code.google.com/p/guava-libraries/)

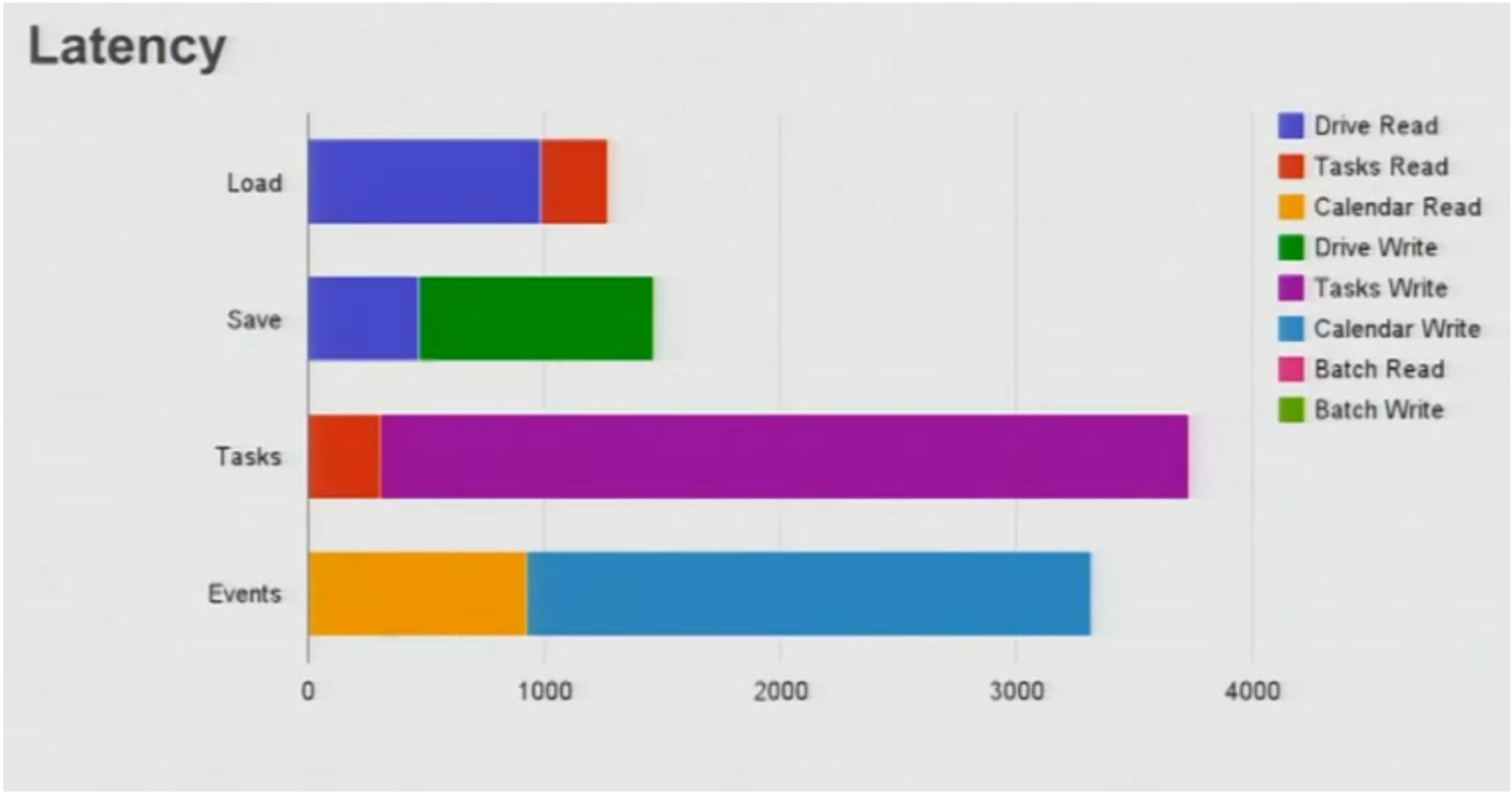
Java

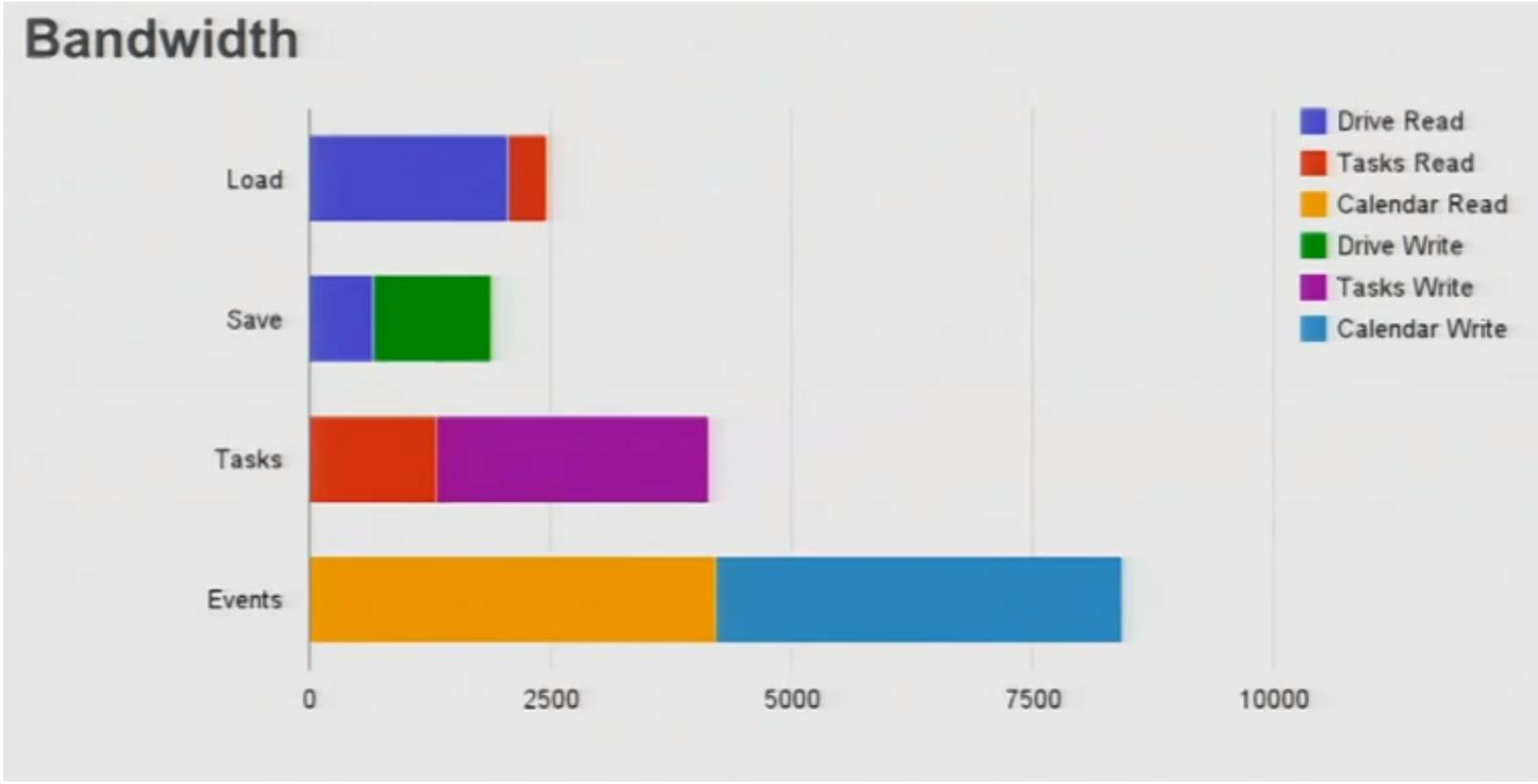
```
Stopwatch loadListTimer = new Stopwatch().start();
...
metrics.put("load.tasklists.list()", loadListTimer.stop().toString(5));
```

Profiling - Bandwidth

com.google.api.client.http.HttpHeaders

```java
TaskList list = listRequest.execute();
metrics.put("load.tasklists.listLength", list.getResponseHeaders().getContentLength());
```


Latency
Load
Save
Tasks
Events
0
1000
2000
3000
4000
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write
Batch Read
Batch Write

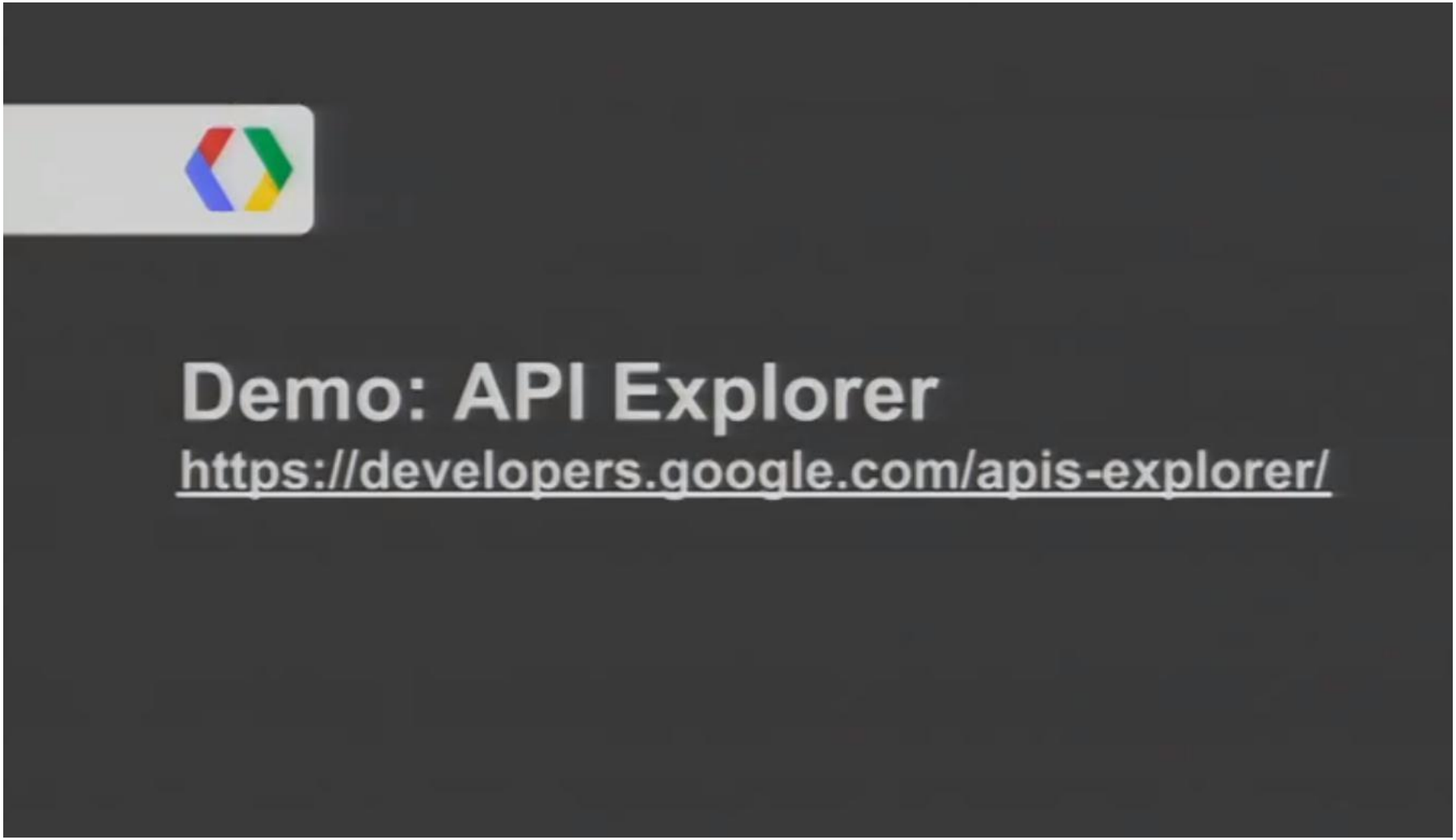

Bandwidth
Load
Save
Tasks
Events
0
2500
5000
7500
10000
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write

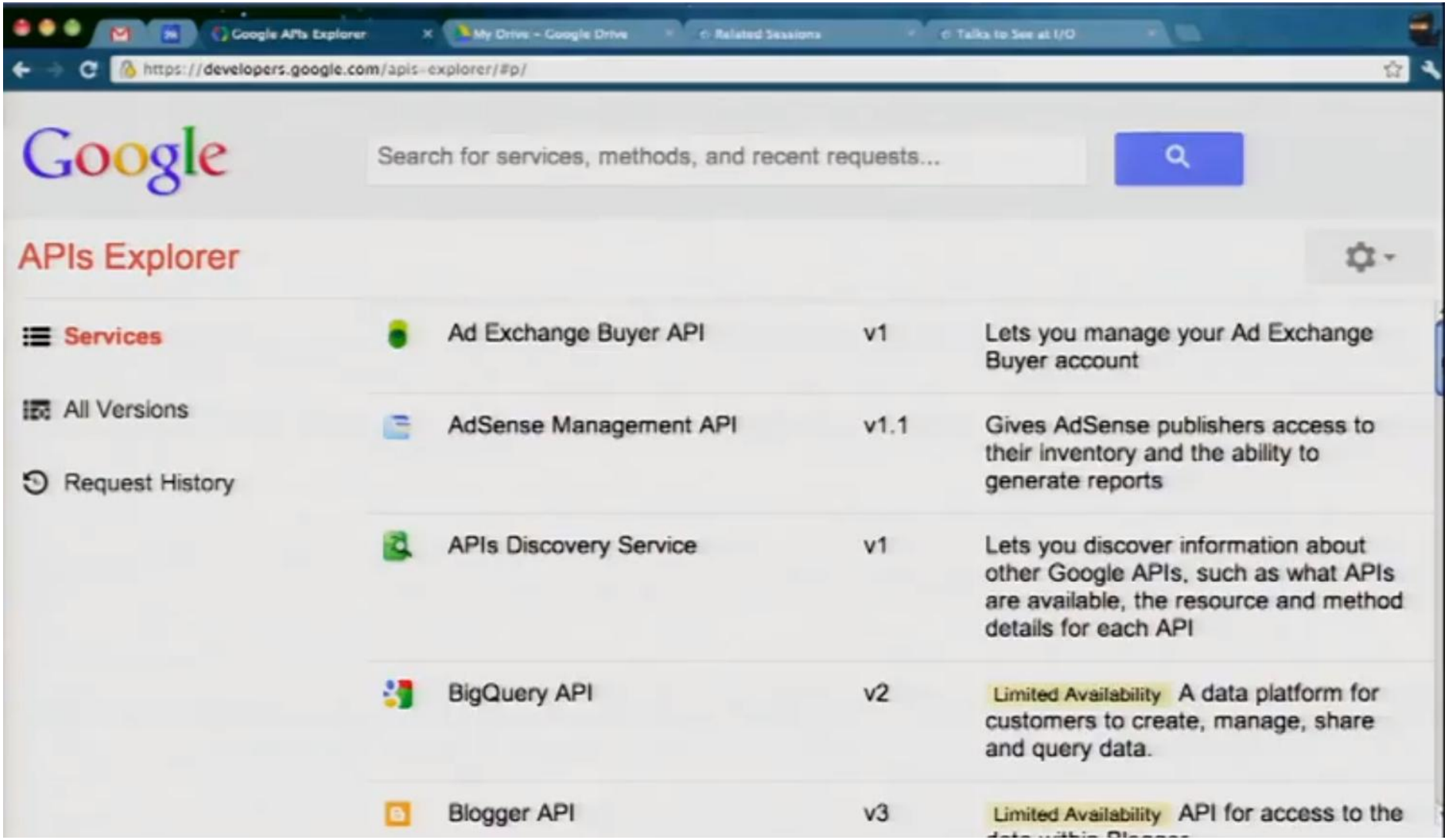
Optimization #0: gzip

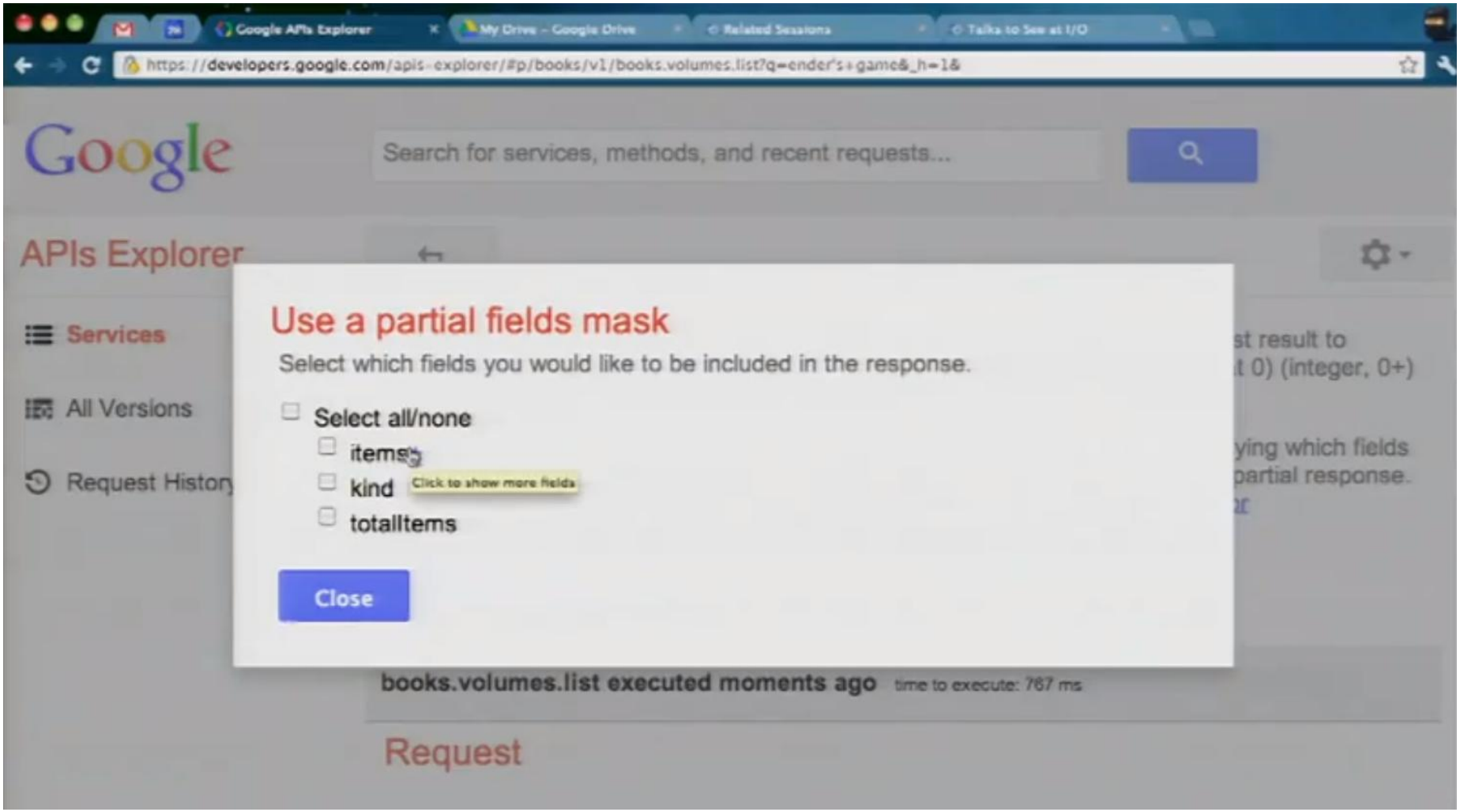
- Goals
  - Save **Bandwidth** and reduce **Latency**
- Solution
  - Send GZipped requests, request GZipped responses
  - Google Client Libraries do this automatically!
- Example:
  - https://www.googleapis.com/discovery/v1/apis
    - Plain: 24877 bytes
    - Gzipped: 2720 bytes (**11%**)

Optimization #1: Partial Response

- Goals
  - Save **Bandwidth** and reduce **Latency**
- Solution
  - Request a subset of the resource using a **fields** mask
- Example:
  - https://www.googleapis.com/discovery/v1/apis
    - 24877 bytes
  - https://www.googleapis.com/discovery/v1/apis?**fields=items/id**
    - 1354 bytes (**6%**)


Demo: API Explorer
https://developers.google.com/apis-explorer/


Google APIs Explorer
My Drive - Google Drive
Related Sessions
Talks to See at I/O
https://developers.google.com/apis-explorer/#p/
Google
Search for services, methods, and recent requests...
APIs Explorer
Services
All Versions
Request History
Ad Exchange Buyer API
v1
Lets you manage your Ad Exchange Buyer account
AdSense Management API
v1.1
Gives AdSense publishers access to their inventory and the ability to generate reports
APIs Discovery Service
v1
Lets you discover information about other Google APIs, such as what APIs are available, the resource and method details for each API
BigQuery API
v2
Limited Availability
A data platform for customers to create, manage, share and query data.
Blogger API
v3
Limited Availability
API for access to the


Google APIs Explorer
My Drive - Google Drive
Related Sessions
Talks to See at I/O
https://developers.google.com/apis-explorer/#p/books/v1/books.volumes.list?q=ender's+game&_h=1&
Google
Search for services, methods, and recent requests...
APIs Explorer
Services
All Versions
Request History
Use a partial fields mask
Select which fields you would like to be included in the response.
Select all/none
items
kind
Click to show more fields
totalItems
Close
st result to
t 0) (integer, 0+)
ying which fields
partial response.
books.volumes.list executed moments ago
time to execute: 767 ms
Request

Optimization #1

Partial Drive Response

```java
Files.Get getFile = service.files().get(file_id);
getFile.setFields("title,downloadUrl,userPermission/role");
File file = getFile.execute();
```

Optimization #1

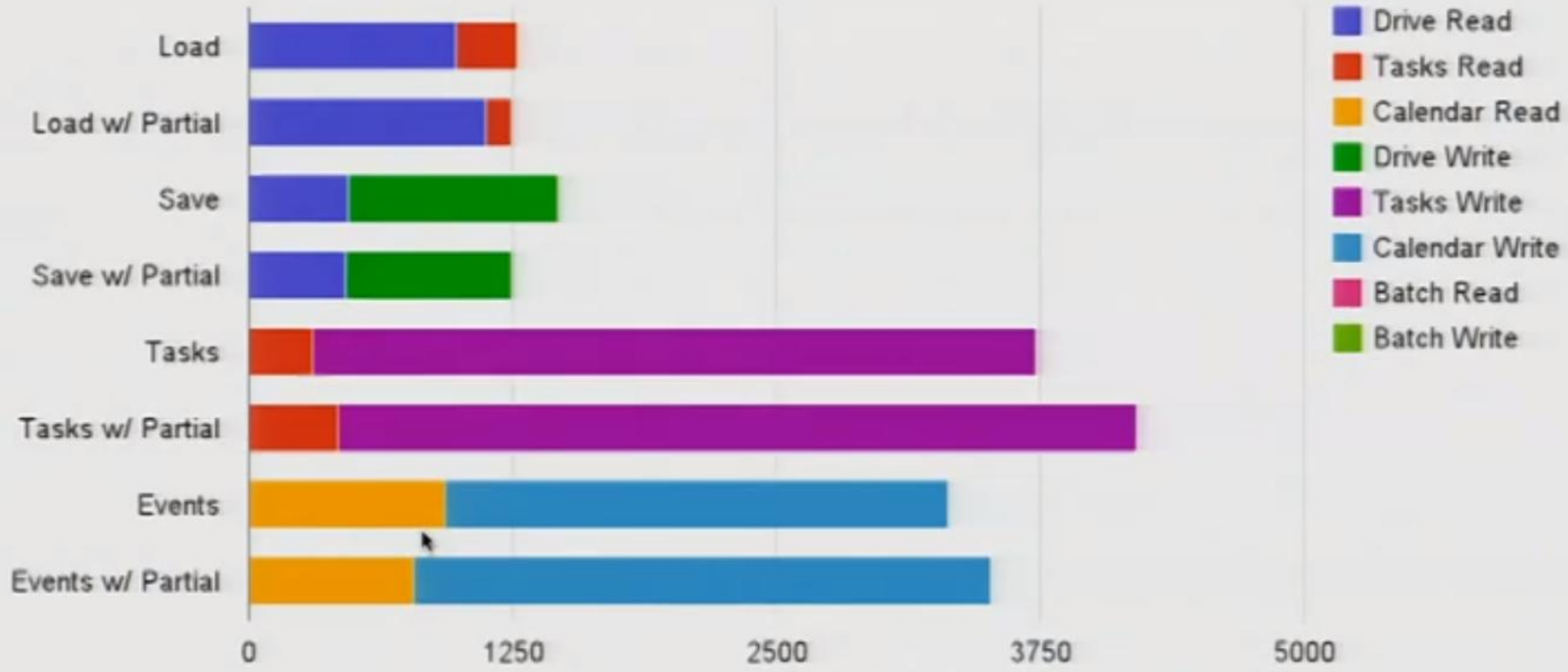
Partial Tasks Responses

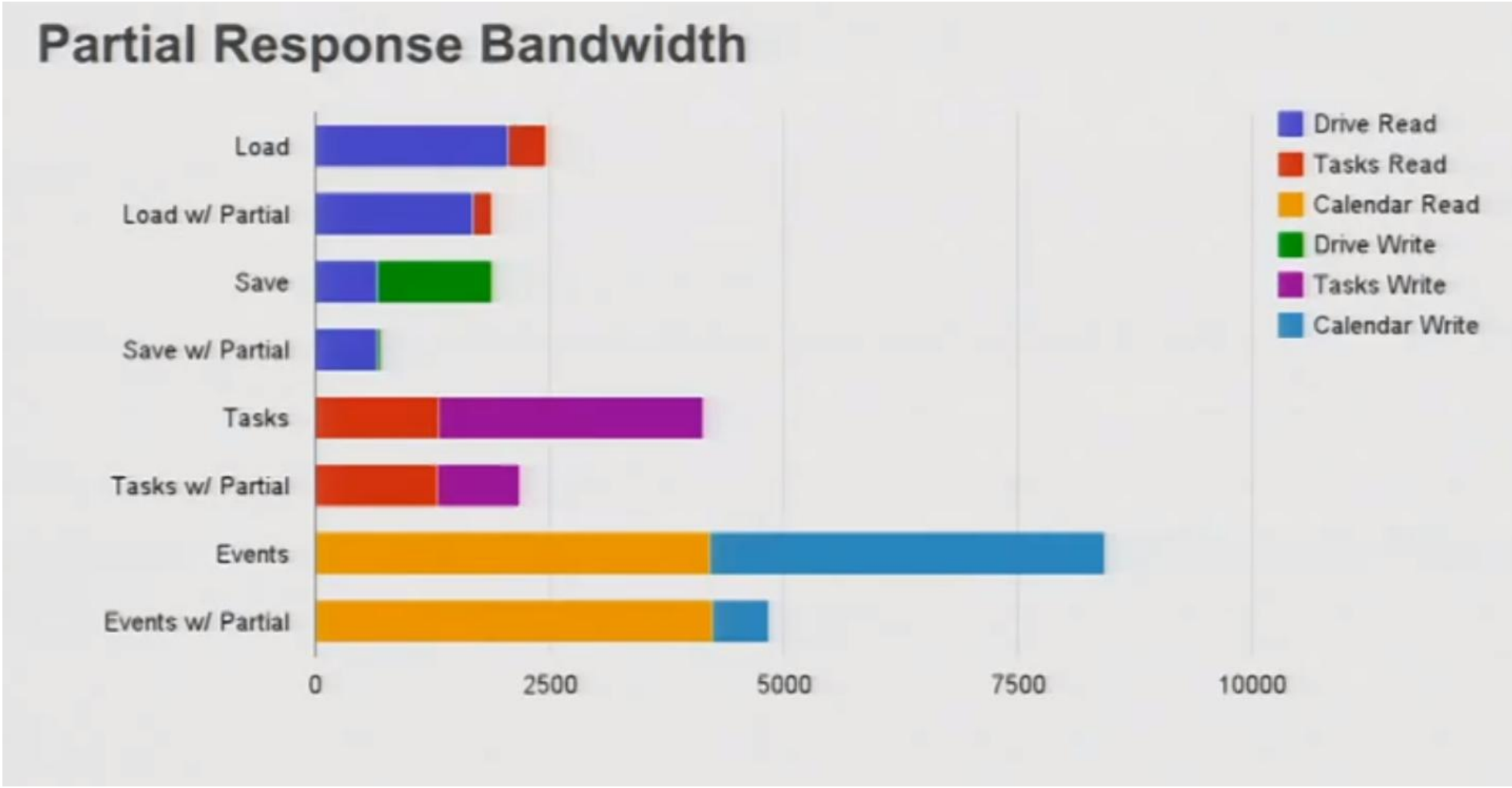
Java

```
Tasklists.Insert insertTasklist = tasksService.tasklists().insert(tasklist);
insertTasklist.setFields("id");
tasklist = insertTasklist.execute();

for (SuperListItem item : list.content.items) {
  Task task = new Task().setTitle(item.name);
  TasksOperations.Insert insertTask = tasksService.tasks().insert(tasklist.getId(), task);
  insertTask.setFields("id");
  item.taskId = insertTask.execute().getId();
}
```

Partial Response Latency




Partial Response Bandwidth
Load
Load w/ Partial
Save
Save w/ Partial
Tasks
Tasks w/ Partial
Events
Events w/ Partial
0
2500
5000
7500
10000
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write

Optimization #2: Patch

- Goals
  - Update resource retrieved using a **fields** mask
  - Save **Bandwidth** and reduce **Latency**
- Solution
  - Send only the updated portions of the resource
  - HTTP **PATCH** instead of **PUT**
- Example:
  - PUT https://www.googleapis.com/tasks/v1/... {"id": "1020931", "title":"My New Title", ...}
    - 415 bytes
  - **PATCH** https://www.googleapis.com/tasks/v1/... {"title":"My New Title"}
    - 30 bytes (**8%**)

Optimization #2

Patch TaskList

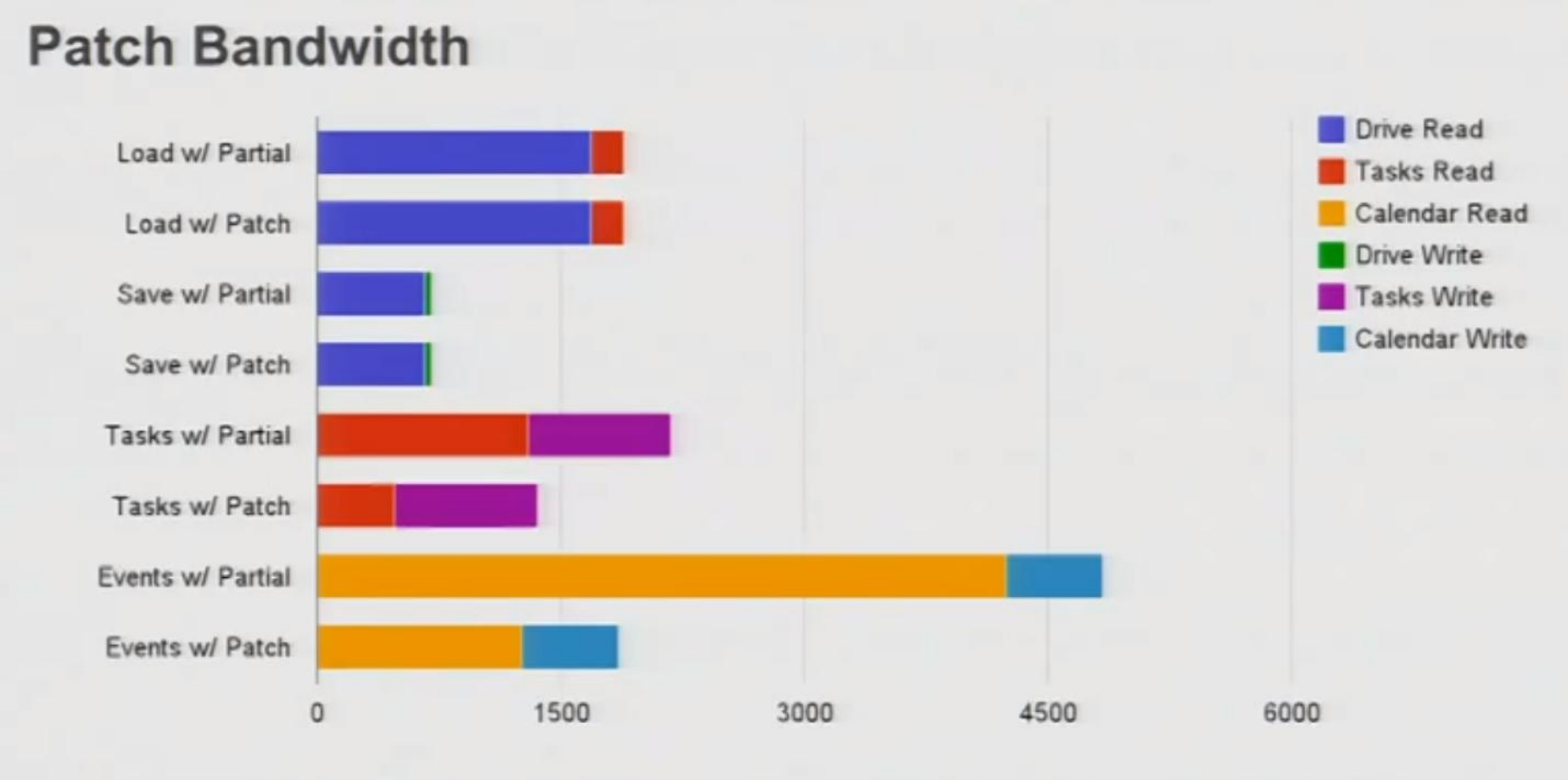
```java
TaskList tasklist = new TaskList().setId(list.taskId).setTitle(list.name);
Tasklists.Patch patchTasklist = tasksService.tasklists().patch(tasklist.getId(), tasklist);
patchTasklist.setFields("id");
TaskList patched = patchTasklist.execute();
```

Optimization #2

Patch Calendar Events

Java

```
for (SuperListItem item : list.content.items) {
  Events.Get getEvent = calService.events().get("primary", item.eventId);
  getEvent.setFields("id,summary,start,end,sequence");
  events.add(getEvent.execute());
}
... // Patch events.
for (Event event : events) {
  Events.Patch patchEvent = calService.events().patch("primary", event.getId(), event);
  patchEvent.setFields("id");
  Event patched = patchEvent.execute();
}
```


Patch Bandwidth
Load w/ Partial
Load w/ Patch
Save w/ Partial
Save w/ Patch
Tasks w/ Partial
Tasks w/ Patch
Events w/ Partial
Events w/ Patch
0
1500
3000
4500
6000
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write

Optimization #3: Batch

- Goal
  - Minimize HTTP **Requests**
  - Reduce **Latency**
- Solution
  - Send multiple API requests in a single **multipart/mixed** request
- Server-Side Parallelization
- Slight bandwidth cost (envelope)
- Latency variable

Optimization #3

Using a Batch Request

Java

```
Drive driveService = ...
BatchRequest batch = driveService.batch();

Files.Get getFile = ...
FutureCallback<File> getFileCallback = FutureCallback.create();
getFile.queue(batch, getFileCallback);
...
batch.execute();
File file = Futures.getUnchecked(getFileCallback.getFuture());
```

Optimization #3

FutureCallback

```java
public class FutureCallback<T> extends JsonBatchCallback<T> {
  public static <X> FutureCallback<X> create() { ... }

  private final SettableFuture<T> future;
  private FutureCallback(SettableFuture<T> future) { this.future = future; }

  public ListenableFuture<T> getFuture() { return future; }
  @Override public void onSuccess(T result, GoogleHeaders responseHeaders) {  future.set(result); }
  @Override public void onFailure(GoogleJsonError e, GoogleHeaders responseHeaders) { ... }
}
```

Optimization #3

Batching Tasks Updates

Java

```
Tasklists.Insert insertTasklist = tasksService.tasklists().insert(tasklist).setFields(...);
FutureCallback<Tasklist> insertTasklistCallback = FutureCallback.create();
insertTasklist.queue(batch, insertTasklistCallback);
List<FutureCallback<Tasklist> futureTasks = Lists.newArrayList();
for (SuperListItem item : list.content.items) {
  TasksOperations.Insert insertTask = tasksService.tasks().insert(tasklist.getId(), task).setFields(...);
  FutureCallback<Task> insertTaskCallback = FutureCallback.create();
  insertTask.queue(batch, insertTaskCallback);
  futureTasks.add(insertTaskCallback);
}
batch.execute();
```

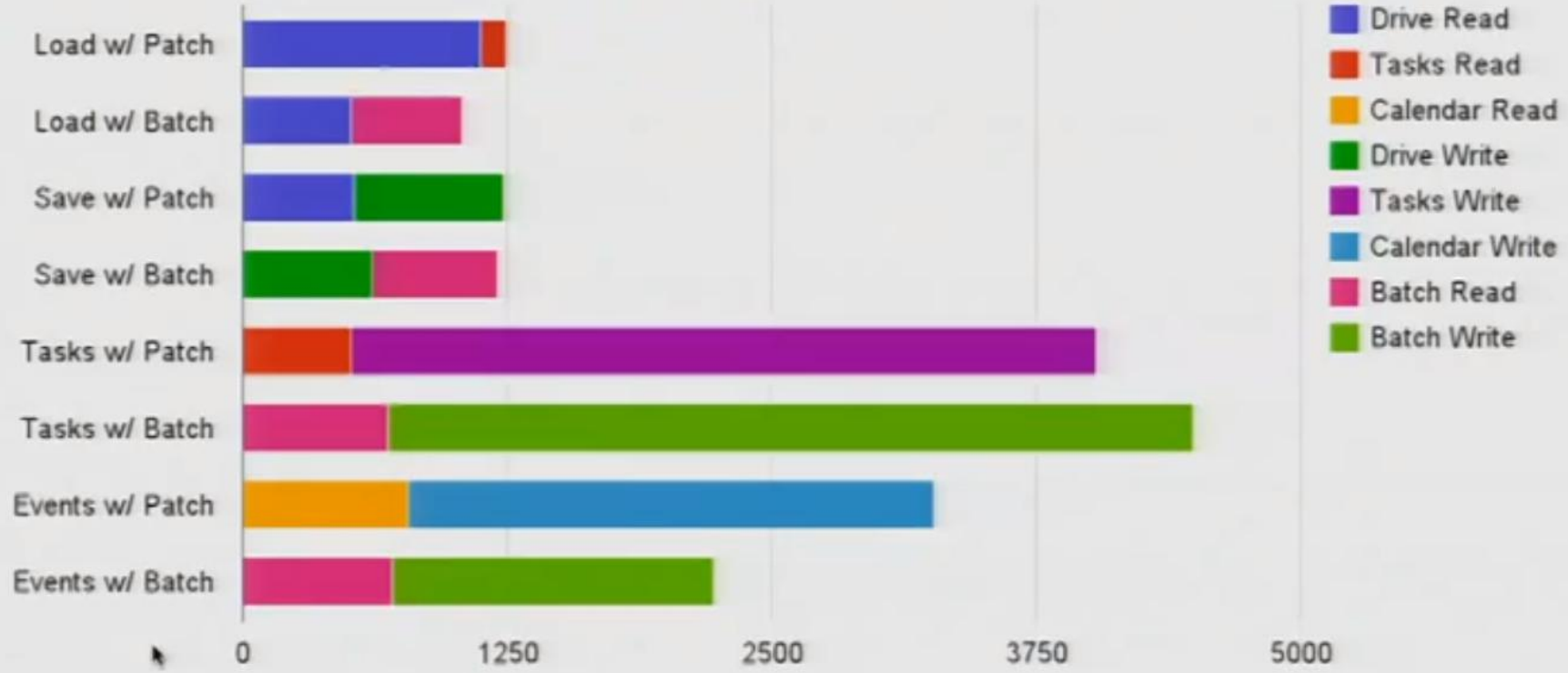
Optimization #3

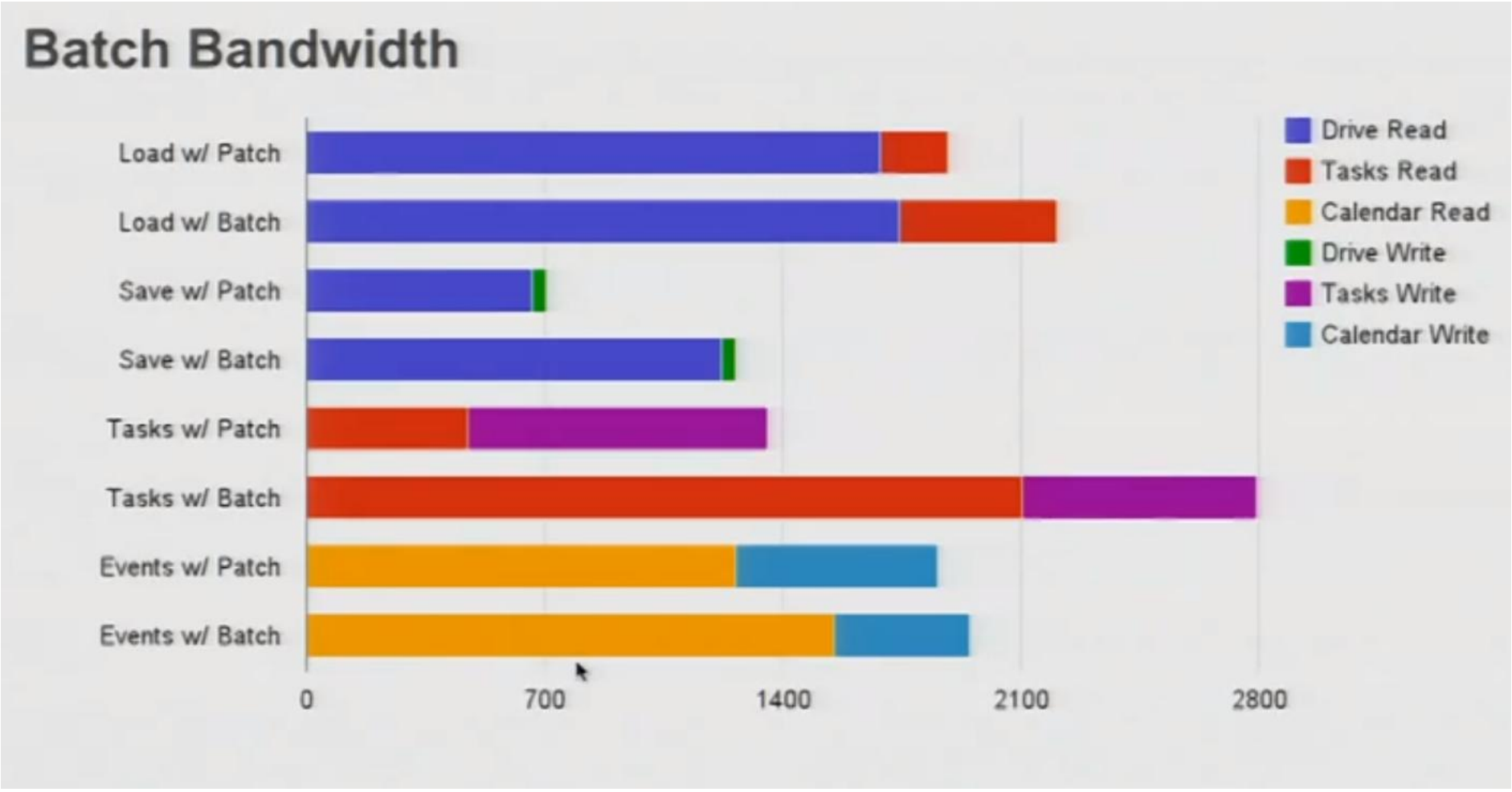
Batching Calendar Events

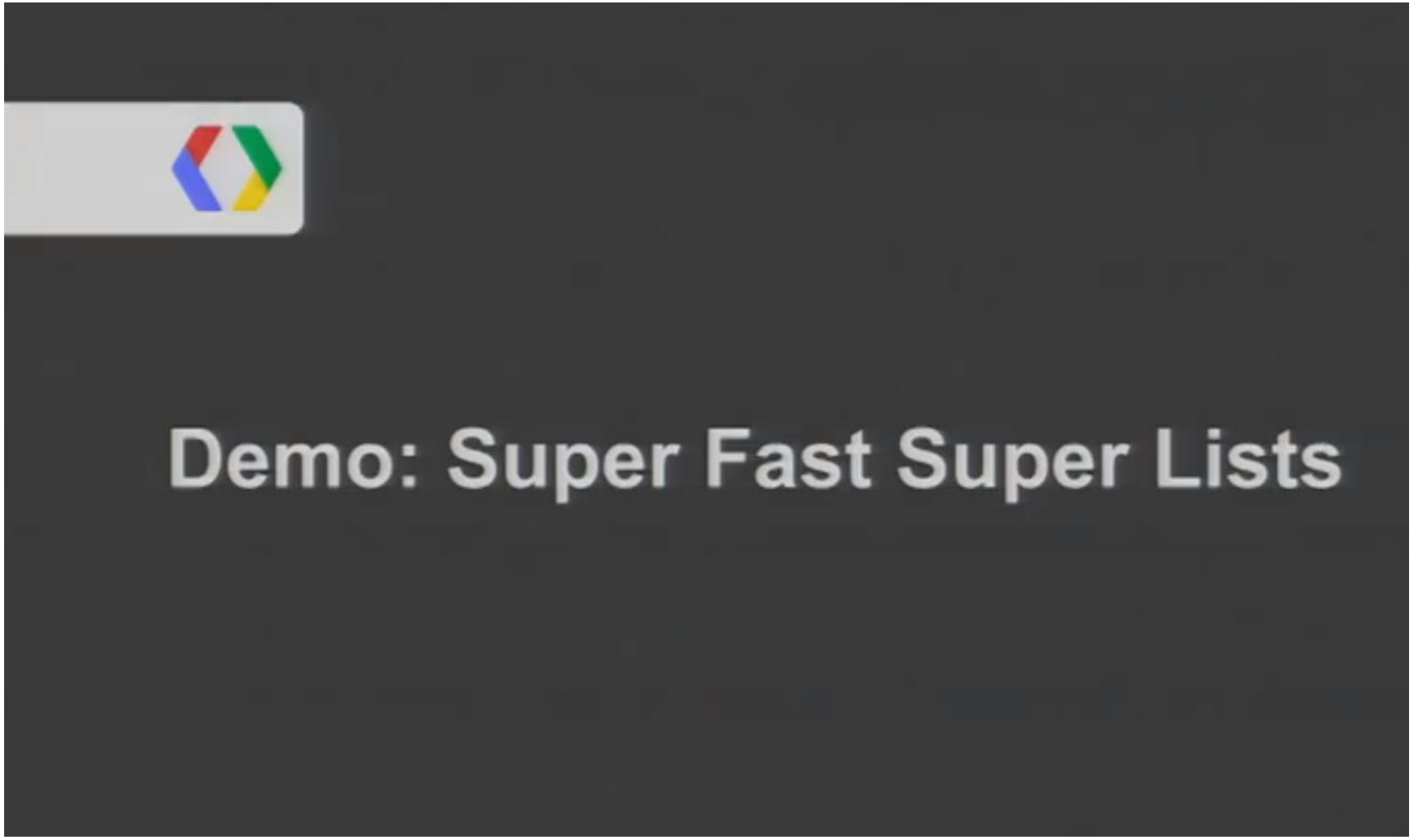
Java

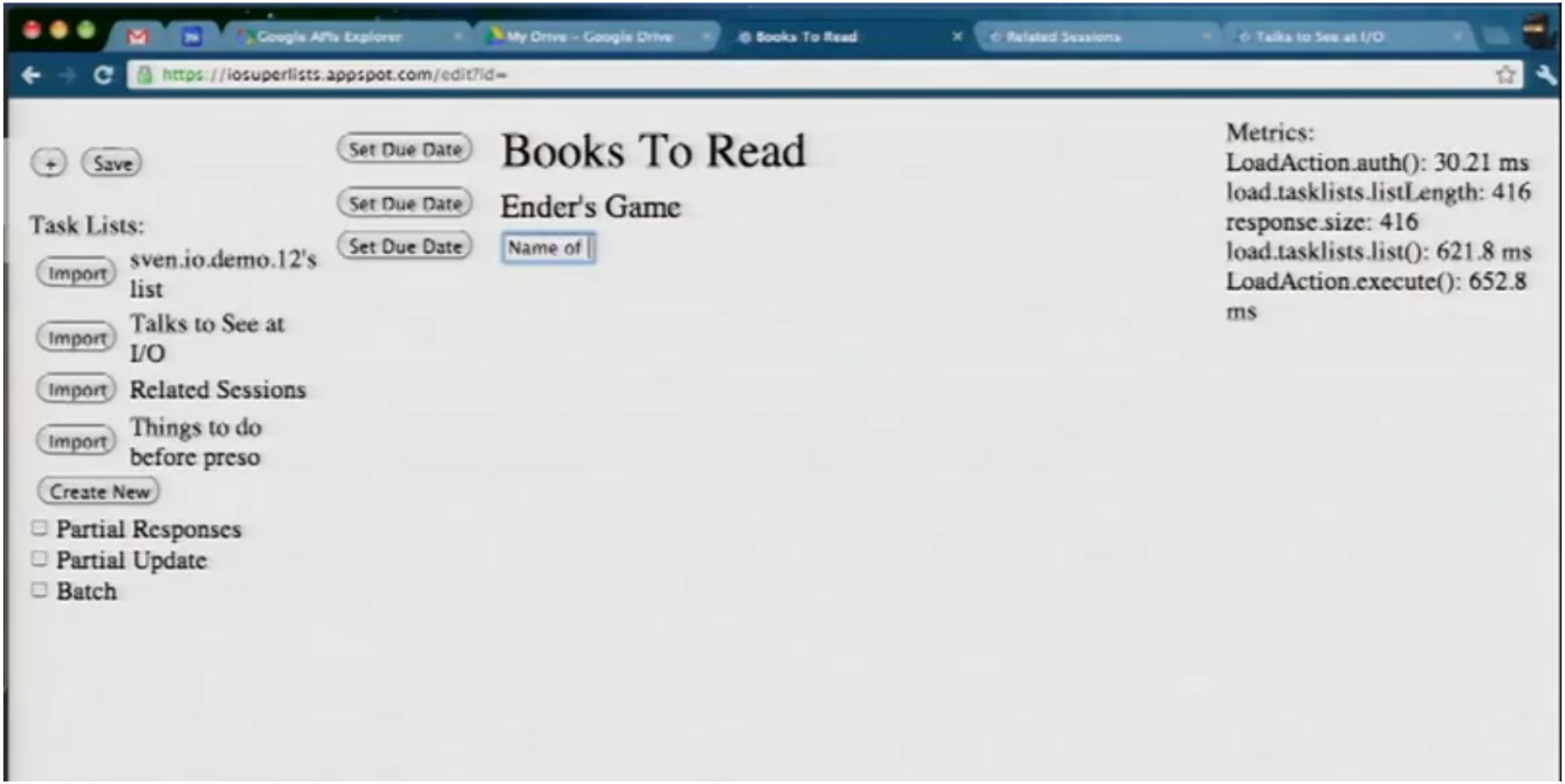
```
List<FutureCallback<Event>> eventFutures = Lists.newArrayList();
for (SuperListItem item : list.content.items) {
  Events.Get getEvent = calService.events().get("primary", item.eventId).setFields(...);
  FutureCallback<Event> callback = FutureCallback.create();
  getEvent.queue(batch, callback);
  eventFutures.add(callback);
}
batch.execute();
batch = calService.batch();
...
```

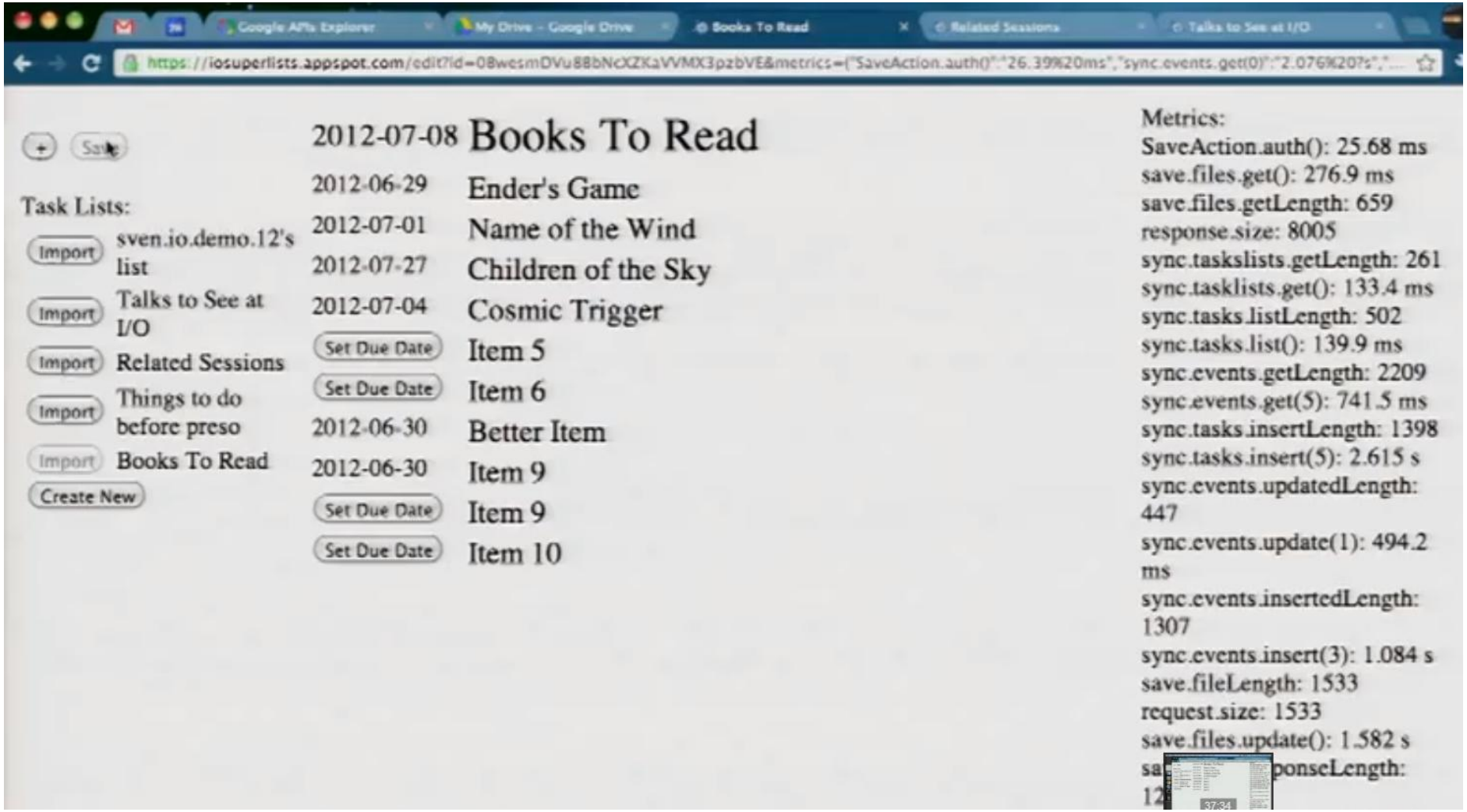
Batch Latency



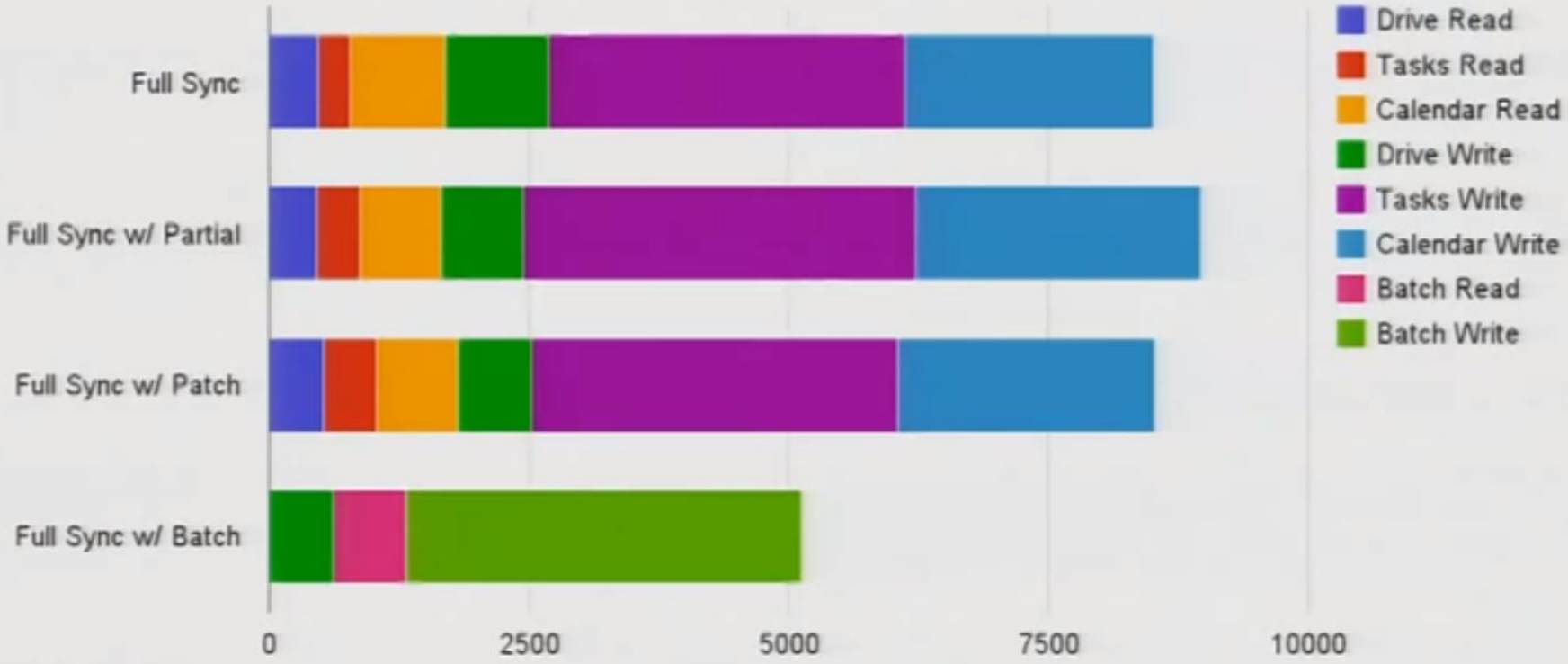

Batch Bandwidth
Load w/ Patch
Load w/ Batch
Save w/ Patch
Save w/ Batch
Tasks w/ Patch
Tasks w/ Batch
Events w/ Patch
Events w/ Batch
0
700
1400
2100
2800
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write

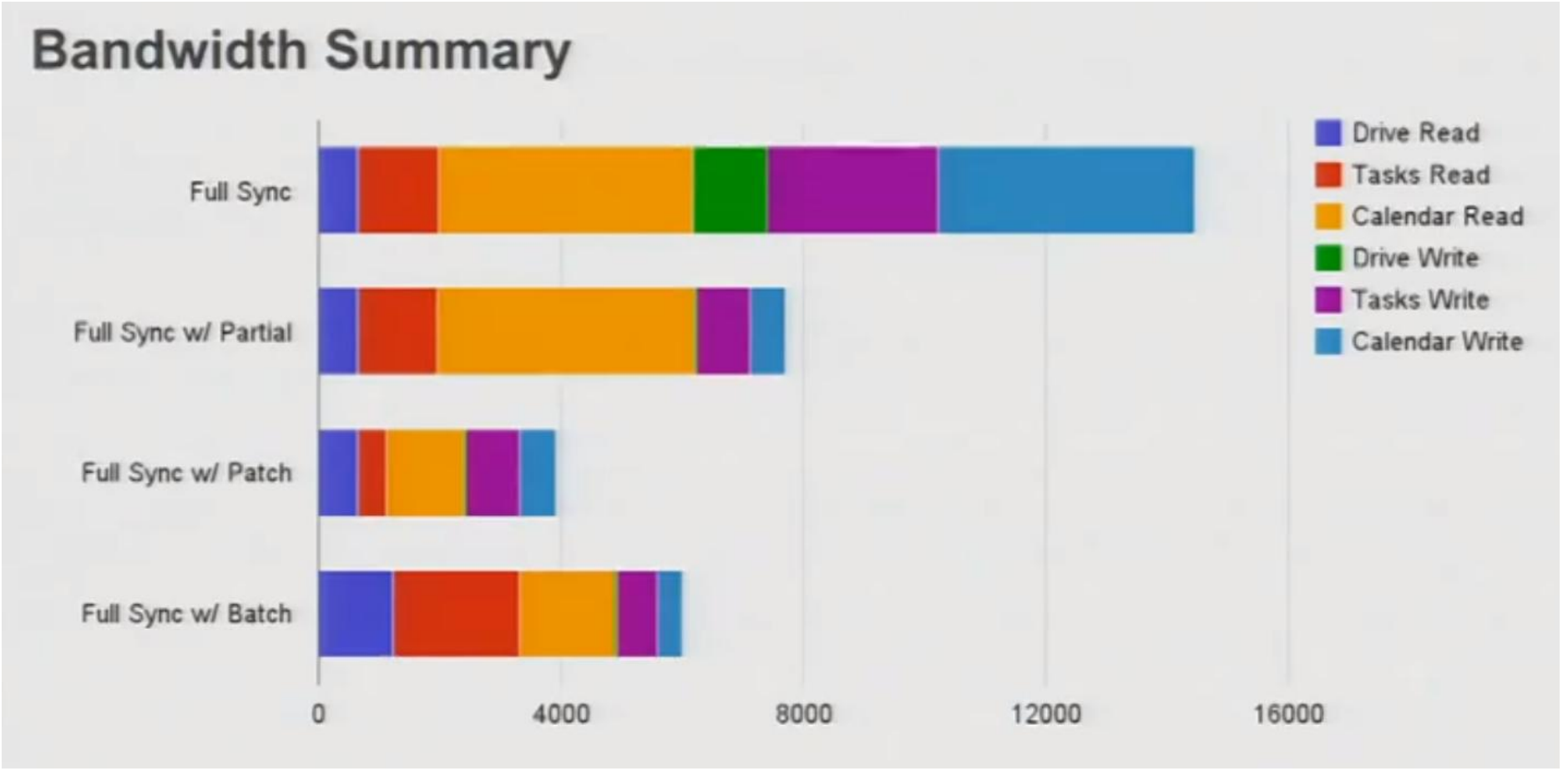

Demo: Super Fast Super Lists


Google APIs Explorer
My Drive - Google Drive
Books To Read
Related Sessions
Talks to See at I/O
https://iosuperlists.appspot.com/edit?id=
+
Save
Task Lists:
Import
sven.io.demo.12's list
Import
Talks to See at I/O
Import
Related Sessions
Import
Things to do before preso
Create New
Partial Responses
Partial Update
Batch
Set Due Date
Set Due Date
Set Due Date
Books To Read
Ender's Game
Name of
Metrics:
LoadAction.auth(): 30.21 ms
load.tasklists.listLength: 416
response.size: 416
load.tasklists.list(): 621.8 ms
LoadAction.execute(): 652.8 ms


Google APIs Explorer
My Drive - Google Drive
Books To Read
Related Sessions
Talks to See at I/O
https://iosuperlists.appspot.com/edit?id=08wesmDVu88bNcXZKaVVMX3pzbVE&metrics={"SaveAction.auth()":"26.39%20ms","sync.events.get(0)":"2.076%20?s",",...
Save
Task Lists:
Import sven.io.demo.12's list
Import Talks to See at I/O
Import Related Sessions
Import Things to do before preso
Import Books To Read
Create New
2012-07-08 Books To Read
2012-06-29 Ender's Game
2012-07-01 Name of the Wind
2012-07-27 Children of the Sky
2012-07-04 Cosmic Trigger
Set Due Date Item 5
Set Due Date Item 6
2012-06-30 Better Item
2012-06-30 Item 9
Set Due Date Item 9
Set Due Date Item 10
Metrics:
SaveAction.auth(): 25.68 ms
save.files.get(): 276.9 ms
save.files.getLength: 659
response.size: 8005
sync.taskslists.getLength: 261
sync.tasklists.get(): 133.4 ms
sync.tasks.listLength: 502
sync.tasks.list(): 139.9 ms
sync.events.getLength: 2209
sync.events.get(5): 741.5 ms
sync.tasks.insertLength: 1398
sync.tasks.insert(5): 2.615 s
sync.events.updatedLength: 447
sync.events.update(1): 494.2 ms
sync.events.insertedLength: 1307
sync.events.insert(3): 1.084 s
save.fileLength: 1533
request.size: 1533
save.files.update(): 1.582 s

Latency Summary




Bandwidth Summary
Full Sync
Full Sync w/ Partial
Full Sync w/ Patch
Full Sync w/ Batch
0
4000
8000
12000
16000
Drive Read
Tasks Read
Calendar Read
Drive Write
Tasks Write
Calendar Write

Summary

	Latency Savings	Bandwidth Savings
Gzip	N/A	70-90%
Partial	N/A	40-80%
Patch	N/A	40-70%
Batch	30-60%	-10-20%

More Information

Helpful Links

- https://developers.google.com/discovery/v1/performance
- https://developers.google.com/drive/performance
- Google APIs: Getting Started Quickly

Related Sessions

- Real World Web Performance Measurement
- Building Android Applications that Use Web APIs
- Building Web applications in JavaScript that use Google APIs
- Building Web Applications that use Google APIs and the JavaScript Client
- Building REST APIs for Mobile with App Engine
- Optimizing Your Google App Engine App

Thank You!

sven@google.com
+SvenMawson
#io12