

Here's a little thing  
I call **Zinc.**

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**Zinc** helps you manage  
and **distribute assets**. It  
draws inspiration from  
**Git**, but is designed with  
**mobile clients** in mind.

# The Problem

Mobile apps often need to download stuff. This stuff is usually a group of related files.

Downloading isn't hard.

Efficient updates, however, get a little trickier.

# YUP

- Verifiable content.
- HTTP, CDN friendly.
- Test before pushing to production.
- Simple tools.
- Transparency to client.

# NOPE

- In-place Updates.
- Multiple copies on the client.
- Unnecessary I/O.
- Re-inventing the wheel.

# The Competition

# Timestamped Zips

- Current system based on this
- Problems
  - compress already-compressed files (jpg, mp3, etc)
  - zip slow on iOS\*, requires libarchive
  - download is all-or-nothing

\* I have no data to support this claim

# rsync

- classic \*nix file sync utility
- Problems
  - requires a machine on server, not S3 compatible



# Git

- Essentially a content tracking system
- Problems
  - Requires “checkout”, file duplication
  - blobs are not raw
  - More complex than needed

# Others?

# The **Skinny**

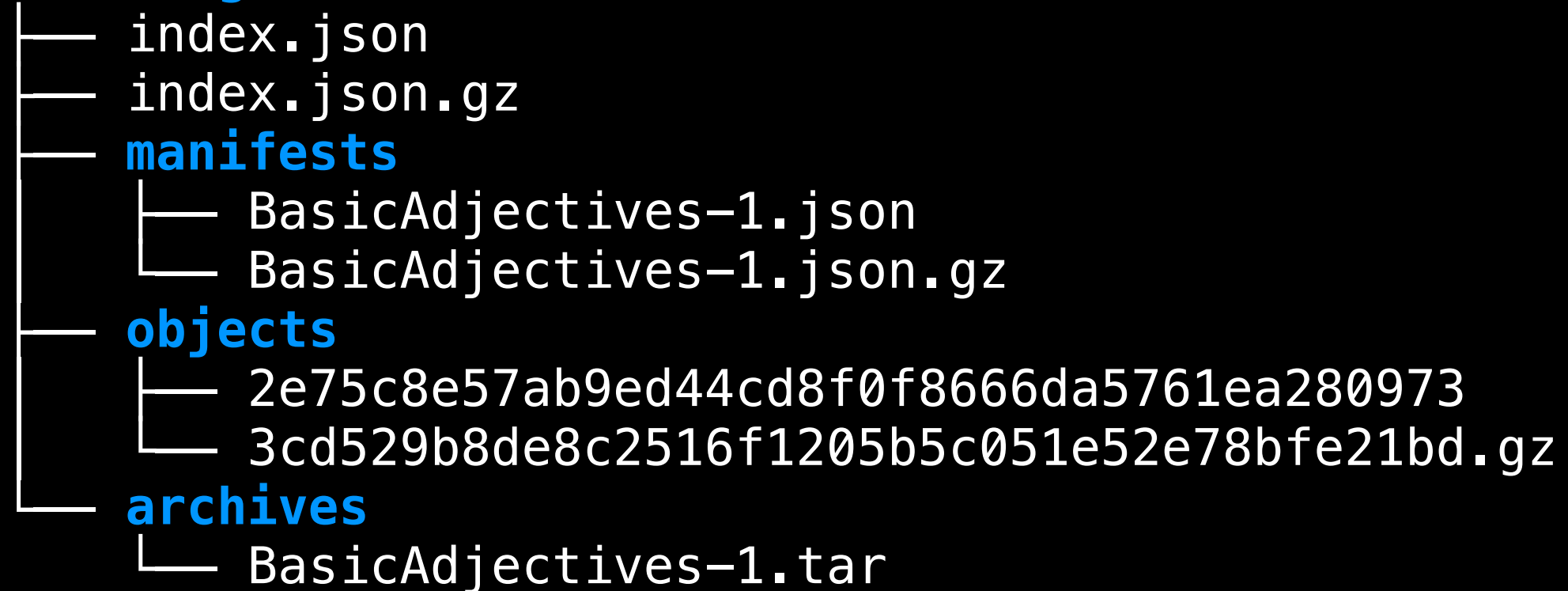
- **Bundle** - a versioned group of related assets
- **Manifest** - a file describing the contents of a bundle
- **Distribution** - a named pointer to a bundle version
- **Catalog** - server side collection of bundles
- **Repository** - client side “checkout” of bundles for one or more catalogs

# Catalog (server)

- Files or “objects” stored by SHA1 of content
- Metadata is JSON (usually gzipped)
- Archives are simple .tar files

# Catalog Structure

## <catalog root>



# Catalog Index

```
{  
  "id": "com.mindsnacks.french",  
  "format": "1"  
  "distributions": {  
    "master": {  
      "BasicAdjectives": 1  
    }  
  },  
  "bundles": {  
    "BasicAdjectives": [1]  
  }  
}
```

# Bundle Manifest

```
{
  "bundle_name": "BasicAdjectives",
  "version": 1,
  "files": {
    "photos/85x85/kind.jpg": {
      "sha": "2e75c8e57ab9ed44cd8f0f8666da5761ea280973",
      "formats": {
        "raw": {
          "size": 8640
        }
      }
    },
    "audio/basic-adj-11.caf": {
      "sha": "3cd529b8de8c2516f1205b5c051e52e78bfe21bd",
      "formats": {
        "gz": {
          "size": 8366
        }
      }
    }
  }
}
```



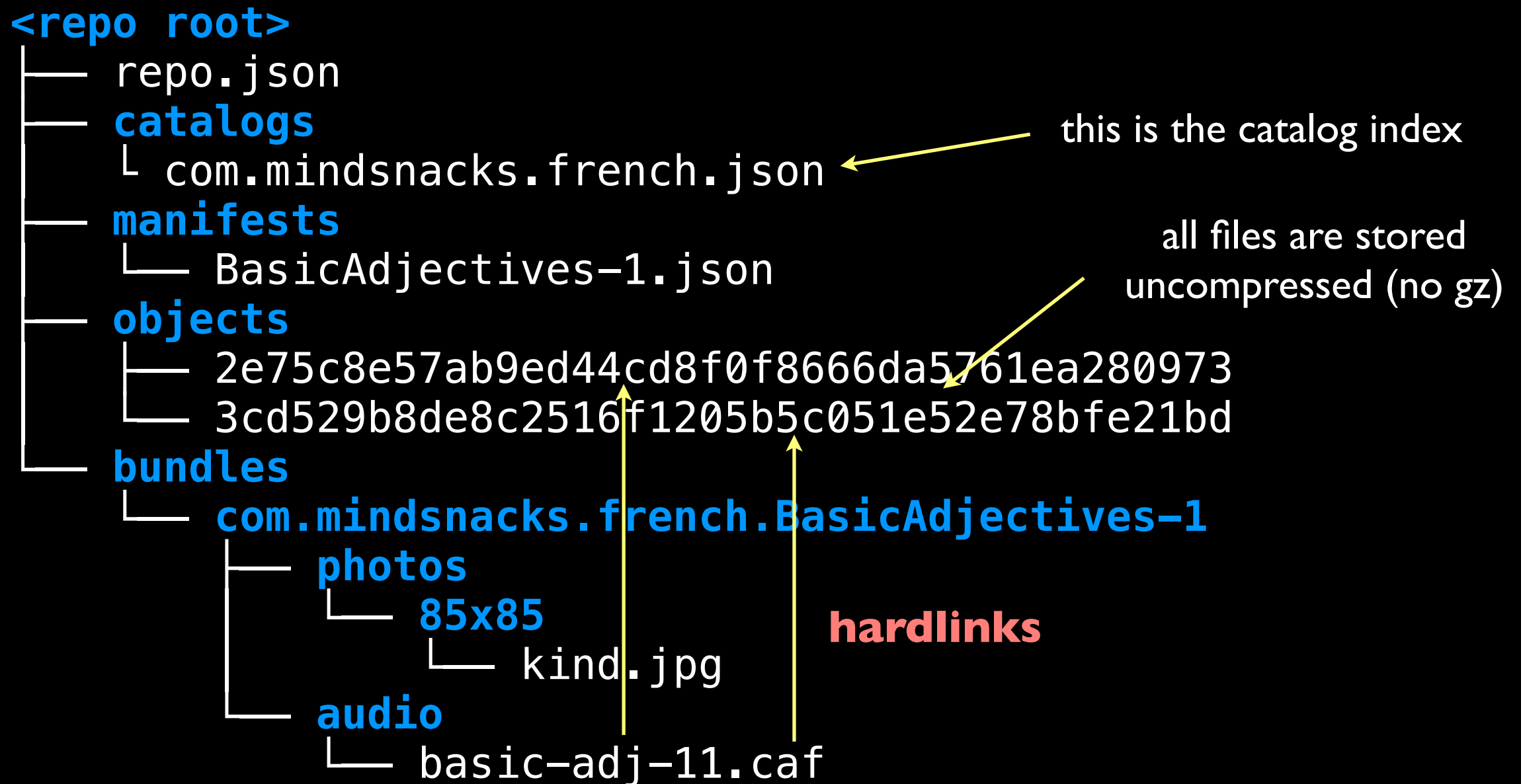
# Why Archives?

- Download performance.
- Why .tar? And not .tar.gz?
- And finally? Partial downloads.

# Repo (client)

- Tracks bundles by **id** and **distro**
- Can download from multiple **Catalogs**
- All metadata stored as JSON
- Files stored by SHA1
- Archives are **not** retained

# Repo Structure



# Why Hardlinks?

- Like a real file, but faster and more space efficient than a copy
- Acts as a simple reference count, useful for deleting unneeded files

# The **Implementations**

# Zinc tools

- Open source Python package
- Includes simple API and CLI for working with Zinc Catalogs
- Under heavy development

<https://github.com/mindsnacks/Zinc>

# Zinc-ObjC

- Open source static library for iOS (& Mac?)
- No external dependencies\*
- Simple API for working with Zinc Repos and loading files
- Still **in development**

<https://github.com/mindsnacks/Zinc-ObjC>

# Zinc-ObjC Credits

- AFNetworking (modified and trimmed)
- KSJSON (until iOS 5+ only)
- Light-Untar-for-iOS
- AMFoundation (modified and trimmed)



# The **Walkthrough**

**Act I:**

Set up Catalog with  
zinc cli

# Create a Catalog

```
$ zinc create_catalog  
  --id com.mindnsacks.french  
  --dest file:///french_catalog
```

# Create a Bundle

```
$ zinc update_bundle  
  --catalog file://french_catalog  
  --name BasicAdjectives  
  --source ~/French/BasicAdjectives
```

```
Created bundle 'BasicAdjectives' version 1
```

# Catalog (I)

## french\_catalog

- index.json
- index.json.gz
- **manifests**
  - BasicAdjectives-1.json
  - BasicAdjectives-1.json.gz
- **objects**
  - 2e75c8e57ab9ed44cd8f0f8666da5761ea280973
  - 3cd529b8de8c2516f1205b5c051e52e78bfe21bd.gz
- **archives**
  - BasicAdjectives-1.tar

# Catalog Index (I)

```
{  
  "id": "com.mindsnacks.french",  
  "format": "1"  
  "distributions": {  
  },  
  "bundles": {  
    "BasicAdjectives": [1]  
  }  
}
```

# Create a Distribution

```
$ zinc update_distro  
  --catalog file://french_catalog  
  --id BasicAdjectives  
  --name master  
  --version 1
```

```
Created distribution 'master'  
for 'BasicAdjectives-v1'
```

# Catalog Index (2)

```
{  
  "id": "com.mindsnacks.french",  
  "format": "1"  
  "distributions": {  
    "master": {  
      "BasicAdjectives": 1  
    }  
  },  
  "bundles": {  
    "BasicAdjectives": [1]  
  }  
}
```



**Act 2:**

Basic iOS client usage

# iOS Basics

```
NSURL* catalogURL = [NSURL URLWithString:  
    @"https://s3.amazonaws.com/zinc-demo/french3/"];  
  
NSString* bundleId = @"com.mindsnacks.french.BasicAdjectives";  
  
ZincRepo* repo = [ZincRepo repoWithURL:repoURL error:&error];  
repo.delegate = self;  
  
[repo addSourceURL:catalogURL];  
  
[repo beginTrackingBundleWithId:bundleId distribution:@"master"];  
  
// (once bundle is cloned...)  
  
ZincBundle* bundle = [repo bundleWithId:bundleId];
```

# Repo (I)

<repo root>

- repo.json
- catalogs
  - └ com.mindsnacks.french.json
- manifests
  - └ BasicAdjectives-1.json
- objects
  - └ 2e75c8e57ab9ed44cd8f0f8666da5761ea280973
  - └ 3cd529b8de8c2516f1205b5c051e52e78bfe21bd
- bundles
  - └ com.mindsnacks.french.BasicAdjectives-1
    - └ photos
      - └ 85x85
        - └ kind.jpg
    - └ audio
      - └ basic-adj-11.caf

# ZincBundle Object

- Acquired from ZincRepo
- Proxy for NSBundle
- Protected from updates while in use  
(i.e., is retained)

```
NSBundle* bundle = [self.zincBundle NSBundle];

NSString* path1 = [bundle pathForResource:
                  @"Basic Adjectives" ofType:@"js"];

NSString* path2 = [bundle pathForResource:@"Basic Adjectives.js"];

NSString* audioPath = [bundle pathForResource:
                      @"audio/basic-adj-11" ofType:@"caf"];
```

# Act 3:

Update a bundle in the  
Catalog

# Update a Bundle

```
$ (hackety hack in ~/French/BasicAdjectives)
```

```
$ zinc update_bundle  
  --catalog file:///french_catalog  
  --id BasicAdjectives  
  --source ~/French/BasicAdjectives
```

```
Created bundle 'BasicAdjectives' version 2
```

# Catalog (2)

## french\_catalog

- index.json

- index.json.gz

### manifests

- BasicAdjectives-1.json

- BasicAdjectives-1.json.gz

- BasicAdjectives-2.json

- BasicAdjectives-2.json.gz

### objects

- ae782445abf8bdc9e3fabfff5d34d1843aef79f8

- 2e75c8e57ab9ed44cd8f0f8666da5761ea280973

- 3cd529b8de8c2516f1205b5c051e52e78bfe21bd.gz

### archives

- BasicAdjectives-1.tar

- BasicAdjectives-2.tar



# Catalog Index (3)

```
{  
  "id": "com.mindsnacks.french",  
  "format": "1"  
  "distributions": {  
    "master": {  
      "BasicAdjectives": 1  
    }  
  },  
  "bundles": {  
    "BasicAdjectives": [1,2]  
  }  
}
```

# Create a Test Distro

```
$ zinc update_distro  
  --catalog file://french_catalog  
  --id BasicAdjectives  
  --name test  
  --version 2
```

```
Created distribution 'test'  
for 'BasicAdjectives-v2'
```

# Catalog Index (4)

```
{
  "id": "com.mindsnacks.french",
  "format": "1"
  "distributions": {
    "master": {
      "BasicAdjectives": 1
    },
    "test": {
      "BasicAdjectives": 2
    }
  },
  "bundles": {
    "BasicAdjectives": [1,2]
  }
}
```

*Testing happens...*

# Make it live!

```
$ zinc update_distro  
  --catalog file://french_catalog  
  --id BasicAdjectives  
  --name master  
  --version 2
```

```
Created distribution 'test'  
for 'BasicAdjectives-v2'
```

# Catalog Index (5)

```
{
  "id": "com.mindsnacks.french",
  "format": "1"
  "distributions": {
    "master": {
      "BasicAdjectives": 2
    },
    "test": {
      "BasicAdjectives": 2
    }
  },
  "bundles": {
    "BasicAdjectives": [1,2]
  }
}
```

**Act 4:**

Update a bundle in the  
client Repo

# Client Update

1. Periodically download index.json
2. Compare local and remote distributions  
versions of tracked bundles
3. If necessary, clone new Bundle



# Bundle Clone

1. Download manifest
2. Determine count and total size of changes
3. Download and unpack files/archive\*
4. NOT made active if old version of Bundle is still in use

# Sidebar: Download Performance

- Individual files might too much overhead
- Entire archive might be wasteful
- HTTP 1.1 pipelining? Good in theory, tricky in practice
- rsync? Not a "dumb" server.
- zsync? Need to retain or reconstruct archive on client.
- patches/diffs? A lot more info to maintain.

# Last Modified, First Out Archive

- New files are written to beginning of archive
- Existing files are written in the same order as in previous archive
- If client knows how many bytes missing, can easily calculate range it needs from

# LMFOA Example

## Archive v1

7199f – 100 bytes  
08b34 – 150 bytes  
37dc6 – 200 bytes  
ae782 – 300 bytes

## Archive v2

36e31 – 210 bytes  
7199f – 100 bytes  
08b34 – 150 bytes  
ae782 – 300 bytes

## Archive v3

aeba7 – 100 bytes  
36e31 – 210 bytes  
7199f – 100 bytes  
08b34 – 150 bytes

- Client has v1, current is v3
- Download v3 Manifest
- Calculates missing bytes via Manifest:  
 $\text{size}(\text{aeba7}) + \text{size}(\text{36e31}) = 310$
- Download bytes (0–310) of archive

# Repo (2)

```
<repo root>
├── repo.json
├── catalogs
│   └── com.mindsnacks.french.json
├── manifests
│   ├── BasicAdjectives-1.json
│   └── BasicAdjectives-2.json
├── objects
│   ├── ae782445abf8bdc9e3fabfff5d34d1843aef79f8
│   ├── 2e75c8e57ab9ed44cd8f0f8666da5761ea280973
│   └── 3cd529b8de8c2516f1205b5c051e52e78bfe21bd
└── bundles
    ├── com.mindsnacks.french.BasicAdjectives-1
    │   └── ...
    └── com.mindsnacks.french.BasicAdjectives-2
        └── ...
```

*If/When old version  
is released...*

# Repo (3)

```
<repo root>
├── repo.json
├── catalogs
│   └── com.mindsnacks.french.json
├── manifests
│   └── BasicAdjectives-2.json
├── objects
│   ├── ae782445abf8bdc9e3fabfff5d34d1843aef79f8
│   └── 3cd529b8de8c2516f1205b5c051e52e78bfe21bd
├── bundles
│   └── com.mindsnacks.french.BasicAdjectives-2
│       ├── photos
│       │   ├── 85x85
│       │   │   └── kind.jpg
│       └── audio
│           └── basic-adj-12.caf
```

# The **Demo**



**Thanks.**



*We're hiring!*

<http://www.mindsnacks.com/careers/>

# *MindSnacks Engineering*



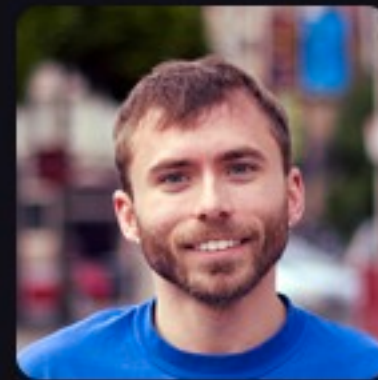
**Nacho Soto**  
@nachosoto



**Andy Mroczkowski**  
@amrox



**Karl Stenerud**  
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**Ryan Balfanz**  
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