Add 3D Photogrammetry to your desktop & mobile applications using ReCap™ Photo API

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Class summary

*The reality capture group at Autodesk is working on new ways to acquire, manipulate and analyze real world data using laser scans or photos through the **ReCap™** technology.*

*This class focuses on how to programmatically access the **ReCap™ Photo Web API** from desktop and mobile applications.*

We start with a quick overview of basic photogrammetry concepts, followed by an introduction to REST-based web-services and finally expose the capabilities of the ReCap Web API, showing what steps you need to take to create a 3D mesh from pictures.

Key learnings

At the end of this class, you will be able to:

- *Understand how ReCap Web API is working and what it can achieve*
- *Consume ReCap REST Web API from desktop & mobile Apps*
- *Get started in no time through the use of API wrappers*
- *Leverage the ReCap technology to create cutting edges applications*

3D Photogrammetry

What is photogrammetry?

Photogrammetry is the science of making measurements from photographs

Photogrammetry output is typically:

- Map
- Drawing
- Measurement
- 3D model

Aerial Photogrammetry

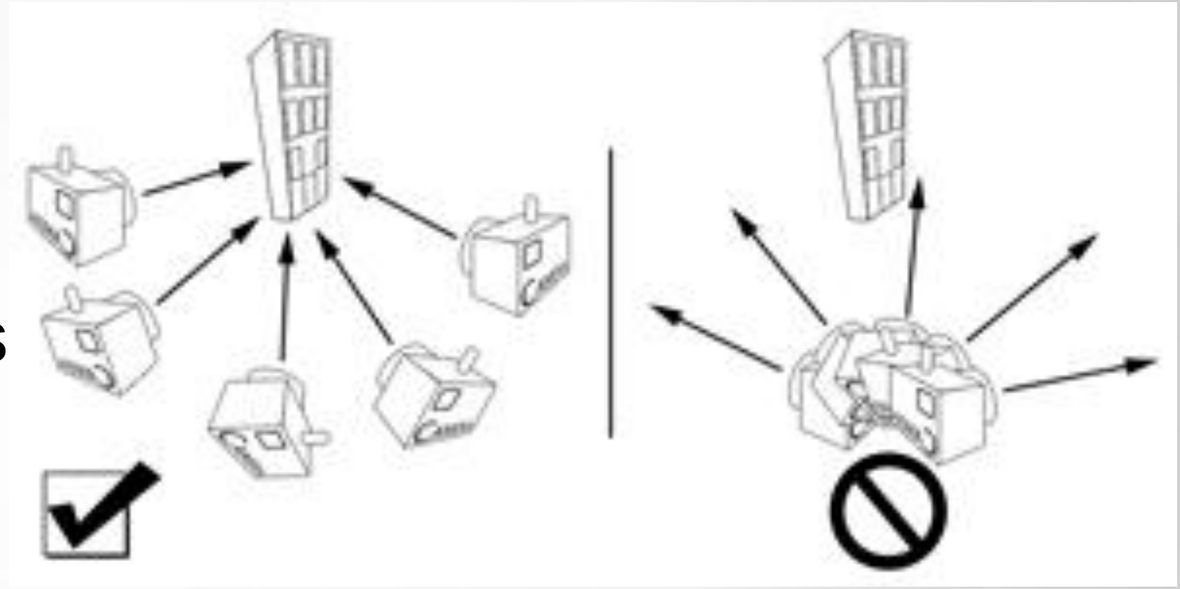
Close-range Photogrammetry

Benefits of photogrammetry

- The technique is non-intrusive to the objects
- A high level of accuracy is achievable
- The digital nature greatly enhances flexibility
- It is cost-effective

How to capture data?

Method used to take pictures has a great impact on the result

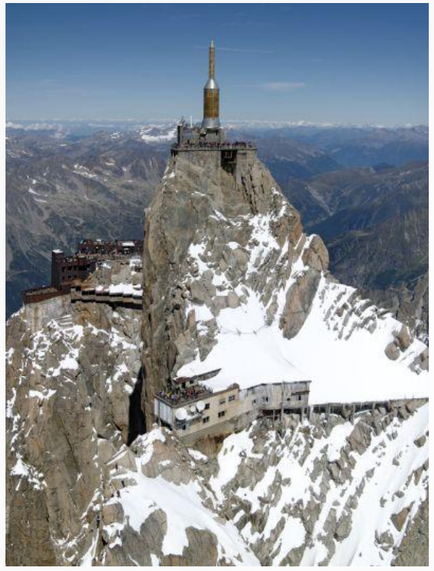


- Need to have views from all angles
- Orbit object or around
- Shoot with 20-40% overlap
- Equal lighting from beginning to end
- Avoid reflection on surfaces
- Between 20 and 100 shots

Subjects that work

- Natural things
- Living things
- Objects
- Buildings









More Challenging Subjects

Shiny Objects

Texture-less Objects

Hidden Objects

ReCap 360 vs ReCap Web API

- Photo on ReCap 360
  - An existing service that you can access right now
  - Running on Autodesk Secure Cloud **A360**
  - Business model: cloud credits per project

- ReCap Photo Web API
  - **Specific access** to service for **you or your customers**
  - **Volume of content** to be created
  - Business model: cloud credits per project

Photogrammetry Technology @ Autodesk

Brand	Purpose	Business	API
 123D Catch	Low res Photogrammetry For Consumers	Free	No
 ReCap 360 Photo	Full res Photogrammetry for Professionals	Cloud Credits On Autodesk 360	Web API

- **ReCap 360**

https://recap360.autodesk.com

- **123D Catch** - Web and Mobile

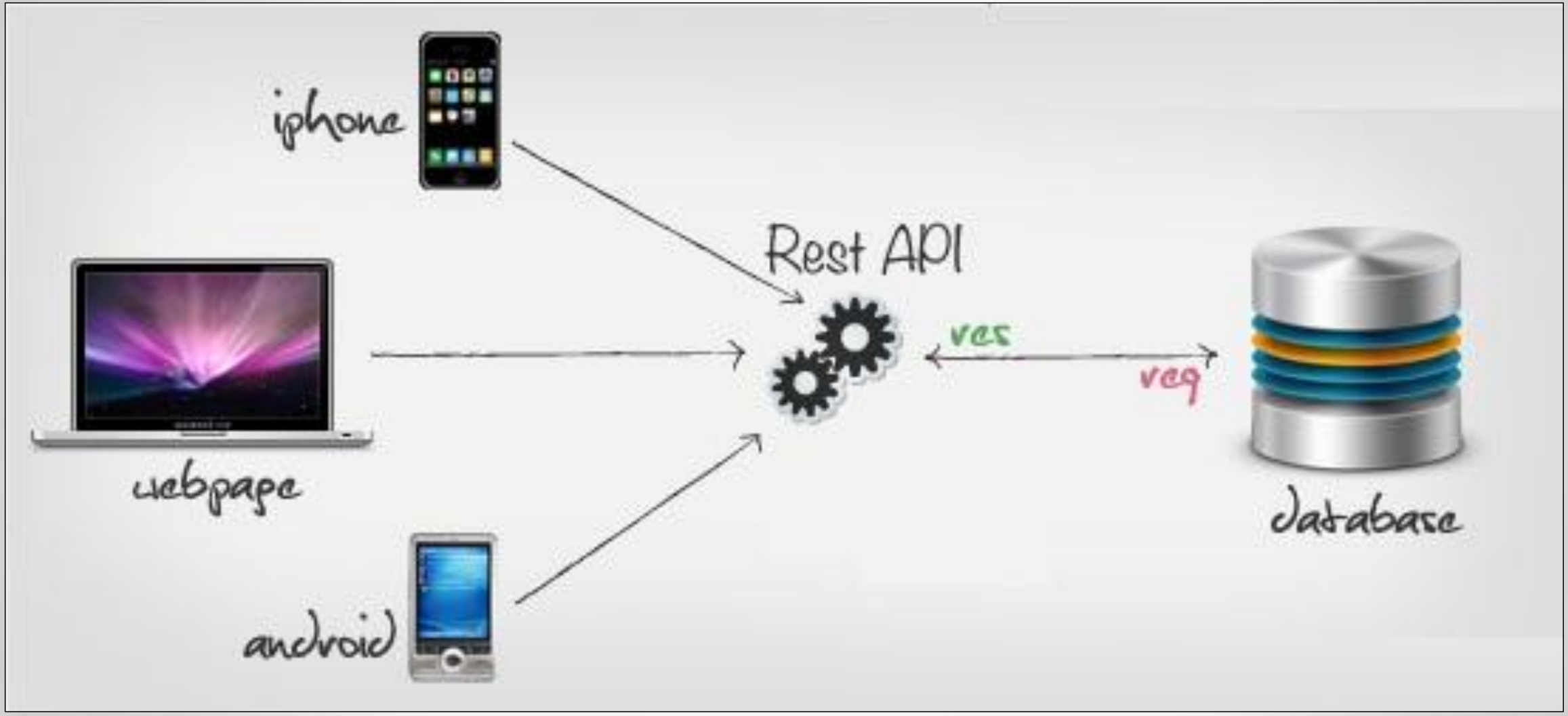
http://apps.123dapp.com/catch

REST API

What is REST?

- **Re**presentational **S**tate **T**ransfer
- **REST** is an architecture style for designing networked applications that relies on a stateless, client-server communications protocol
- In most cases **HTTP / HTTPS** protocol is used

Accessing a REST API



HTTP Verbs

VERB	PURPOSE
GET	**Access** a resource
PUT	**Update** a resource
POST	**Create** a resource
DELETE	**Delete** a resource

Basic REST API Demo

- AdnRestAPI sample illustrates how to create a simple REST API using a node.js server:
  - **GET** /products
  - **GET** /product/{id}
  - **POST** /product
  - **PUT** /product/{id}

  - Product:

```
{
    name: 'gold',
    price: 22.5
}
```

ReCap™ API Exposed

ReCAP API – Authentication

- Currently using **OAuth 1.0 a**
  - Samples available on Github:

    https://github.com/ADN-DevTech/AutodeskOAuthSamples
  - Android, iOS, Python, PHP, WinRT, ASP.Net, desktop (.Net)
- Will switch to **OAuth 2.0**

ReCAP API – Authentication

- Example request with OAuth header:

GET http://rc-api-adn.autodesk.com/3.1/API/version?clientID=xxx&json=1

Authorization: OAuth **oauth_consumer_key**=“xxxx",**oauth_nonce**="f0u1cfg0dxq5y6",**oauth_signature**="UOopvAp1IzlE%3D",**oauth_signature_method**="HMAC-SHA1",**oauth_timestamp**="1414152694",**oauth_token**="eyUBkKInCcgBr20%3D", **oauth_version**="1.0“

Accept:
application/json, application/xml, text/json, text/x-json, text/javascript, text/xml

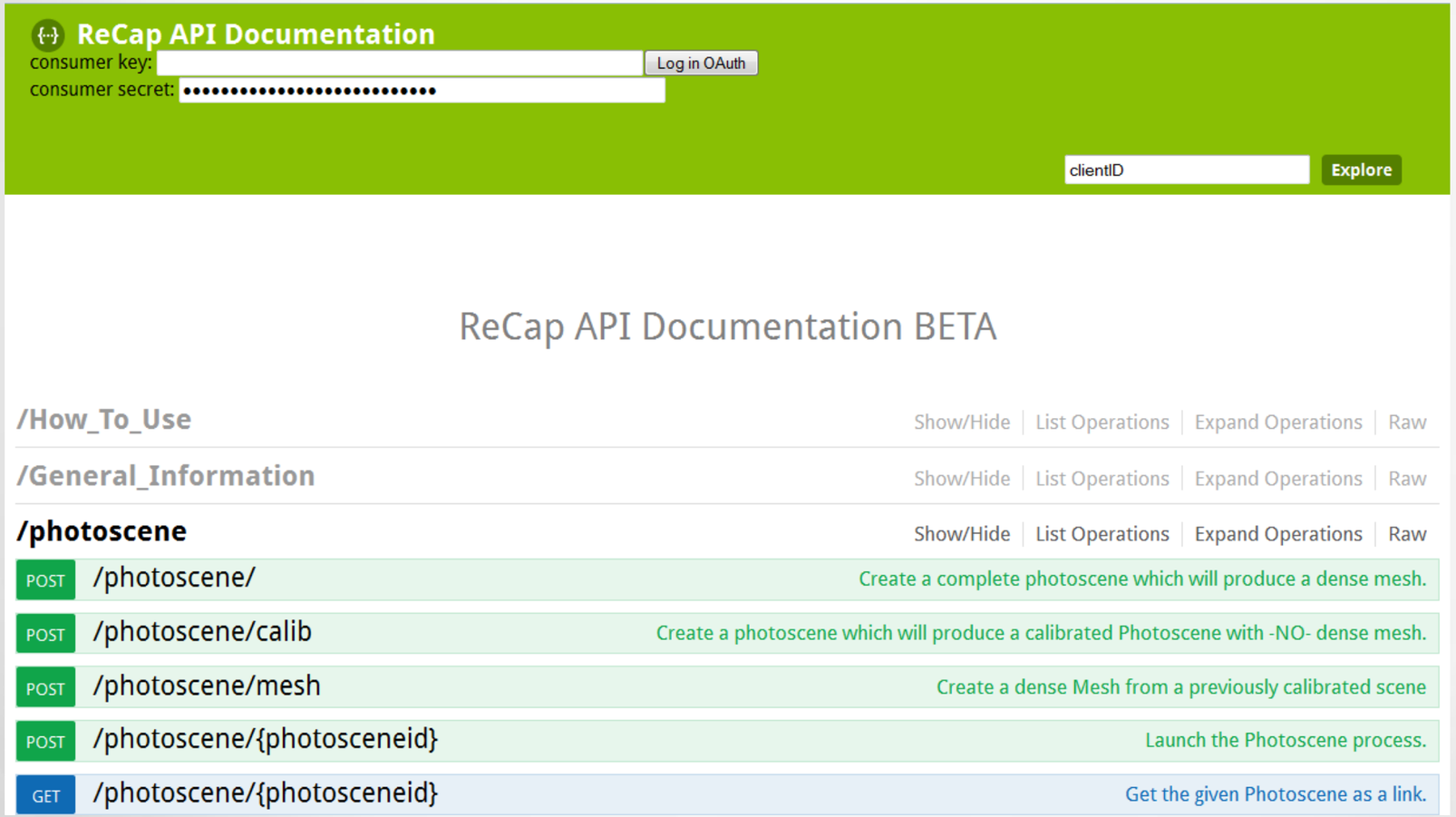
User-Agent: RestSharp/104.4.0.0

Host: rc-api-adn.autodesk.com

Accept-Encoding: gzip, deflate

ReCAP API – Using the documentation

- http://rc-api-adn.autodesk.com/3.1/api-docs



ReCAP API – Basic workflow

- Create a new photoscene:
  POST /photoscene
- Upload files for given photoscene:
  POST /file
- Trigger processing for given photoscene:
  POST /photoscene/{photosceneId}
- Monitor photoscene progress (optional):
  GET /photoscene/{photosceneid}/progress
- Get URL to photoscene result & download the data:
  GET /photoscene/{photosceneid}

ReCap API - Overview

/photoscene Show/Hide | List Operations | Expand Operations | Raw

POST	/photoscene/	Create a complete photoscene which will produce a dense mesh.
POST	/photoscene/calib	Create a photoscene which will produce a calibrated Photoscene with -NO- dense mesh.
POST	/photoscene/mesh	Create a dense Mesh from a previously calibrated scene
POST	/photoscene/{photosceneid}	Launch the Photoscene process.
GET	/photoscene/{photosceneid}	Get the given Photoscene as a link.
DELETE	/photoscene/{photosceneid}	Delete the given photoscene and all the associated assets (images, output files, ...)
GET	/photoscene/{photosceneid}/progress	Returns the current progress percentage of a photoscene
GET	/photoscene/{photosceneid}/processingtime	Return time in second to calculate the given photoscene.
GET	/photoscene/{photosceneid}/filesize	Return the size on disc for all documents used to or created by given photoscene.
GET	/photoscene/{photosceneid}/properties	Return a photoscene properties and images information
POST	/photoscene/{photosceneid}/cancel	Set the Photoscene status to CANCEL for no further processing.
PUT	/photoscene/{photosceneid}/error	Set an error code to a photoscene.

ReCap API - Limitations

- Maximum size of a single file
  - **128 MB**
- Maximum number of simultaneous uploaded files
  - **20**
- Maximum size in memory allocated for an image
  - **512 MB**
- Maximum number of images processed for a scene
  - **250**

ReCap API - Formats

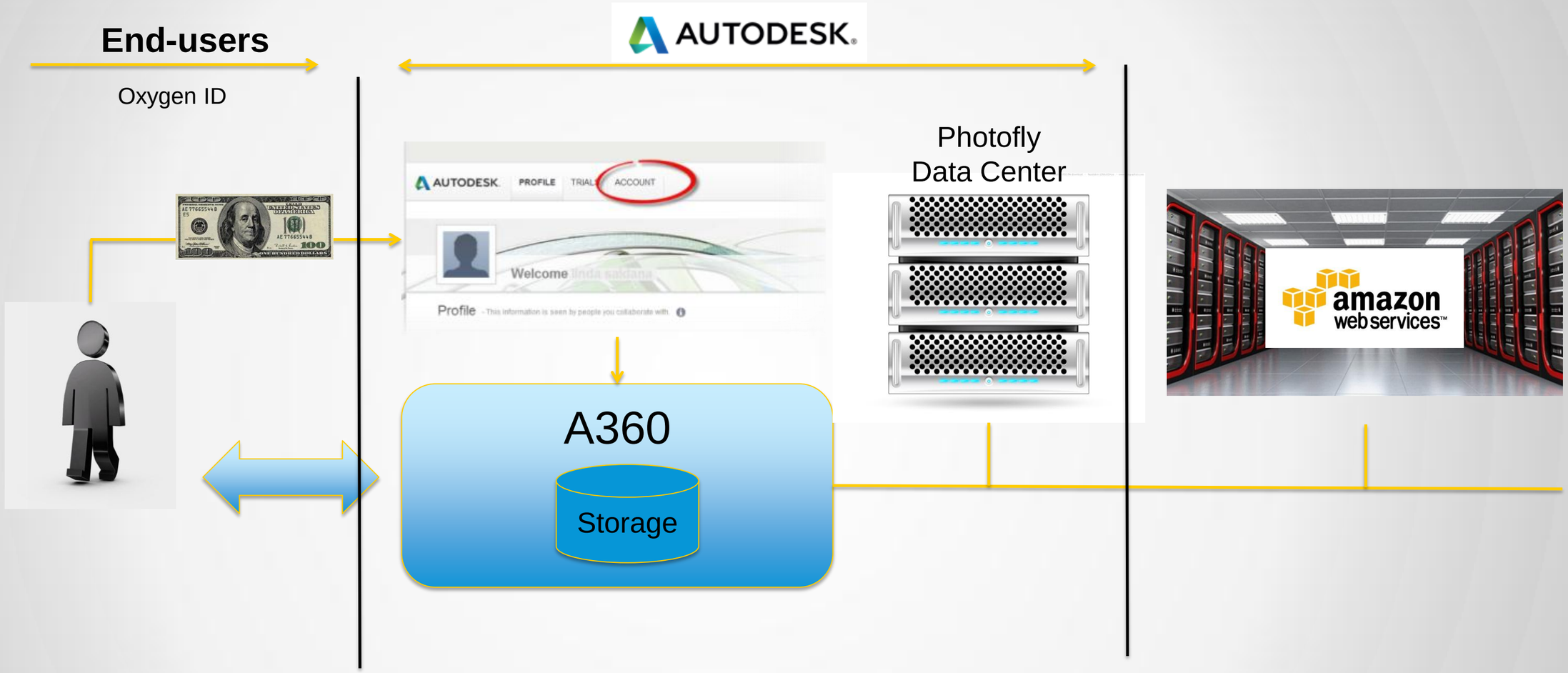
- Source photos
  - Jpegs or Tiffs; No limit in resolution
  - Supports GoPro Hero 3
- Optional data
  - Scale and/or Survey points
- Mesh density
  - Draft or Ultra
- Output
  - Photo-textured 3D model
  - 3D cameras
  - Undistorted images

	OBJ	RCM	FBX	RCS	IPM
3D point cloud				X	
3D mesh	X	X	X		X
Textures	X	X	X		X
3D cameras			X		

ReCap API - Advanced workflows

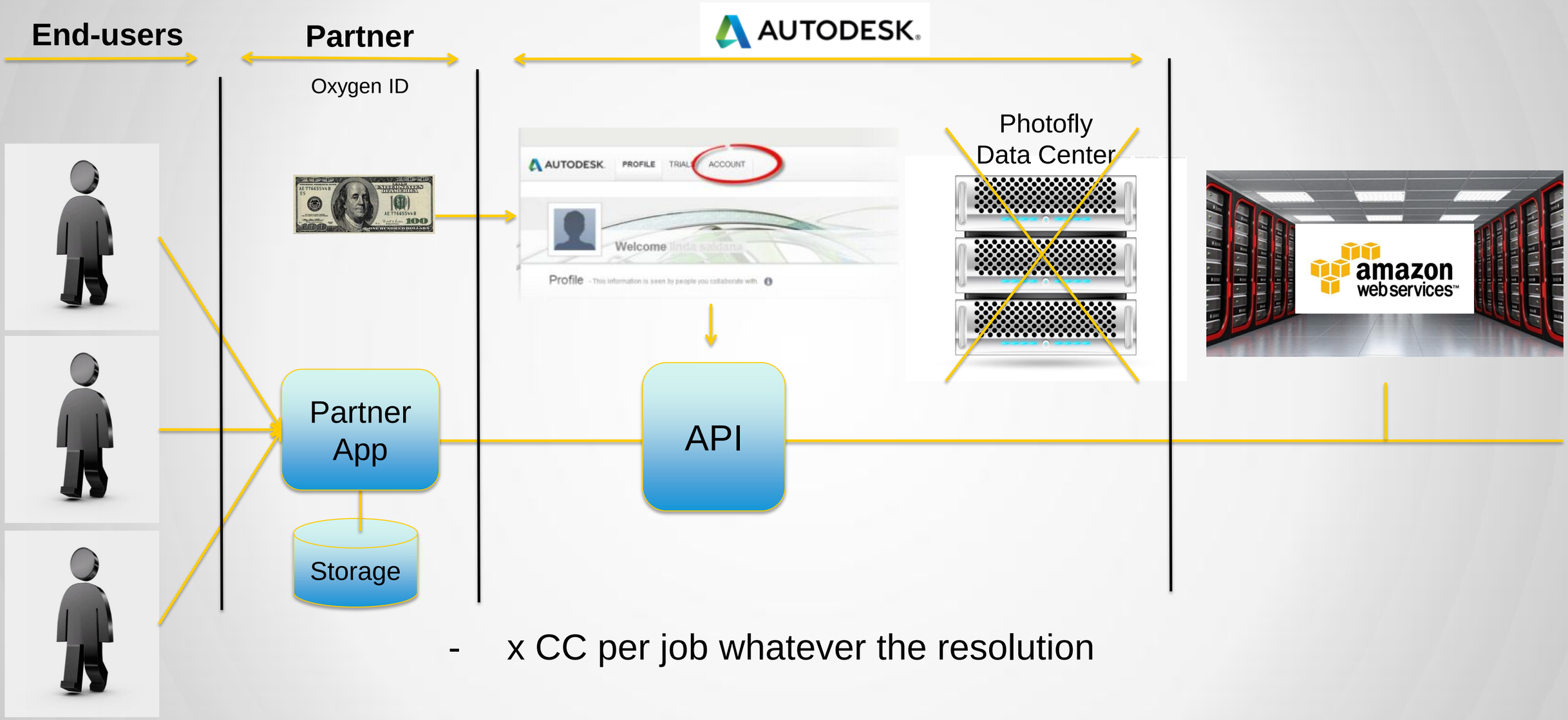
- Change the mesh quality
- Set notifications
- 3DP master
  - Add/remove images
  - Add manual points
  - Add survey points
- Control the 3D processing box
  - Define bounding box
- Meta-data
  - Set the initial camera parameters
  - Advanced control on mesh post processing (cleaning, healing, …)

Photo on ReCap 360 - Monetization



- $ 50 / year for storage (25GB)
- 5 CC per job in « ultra » resolution

ReCap API Partners – Monetization

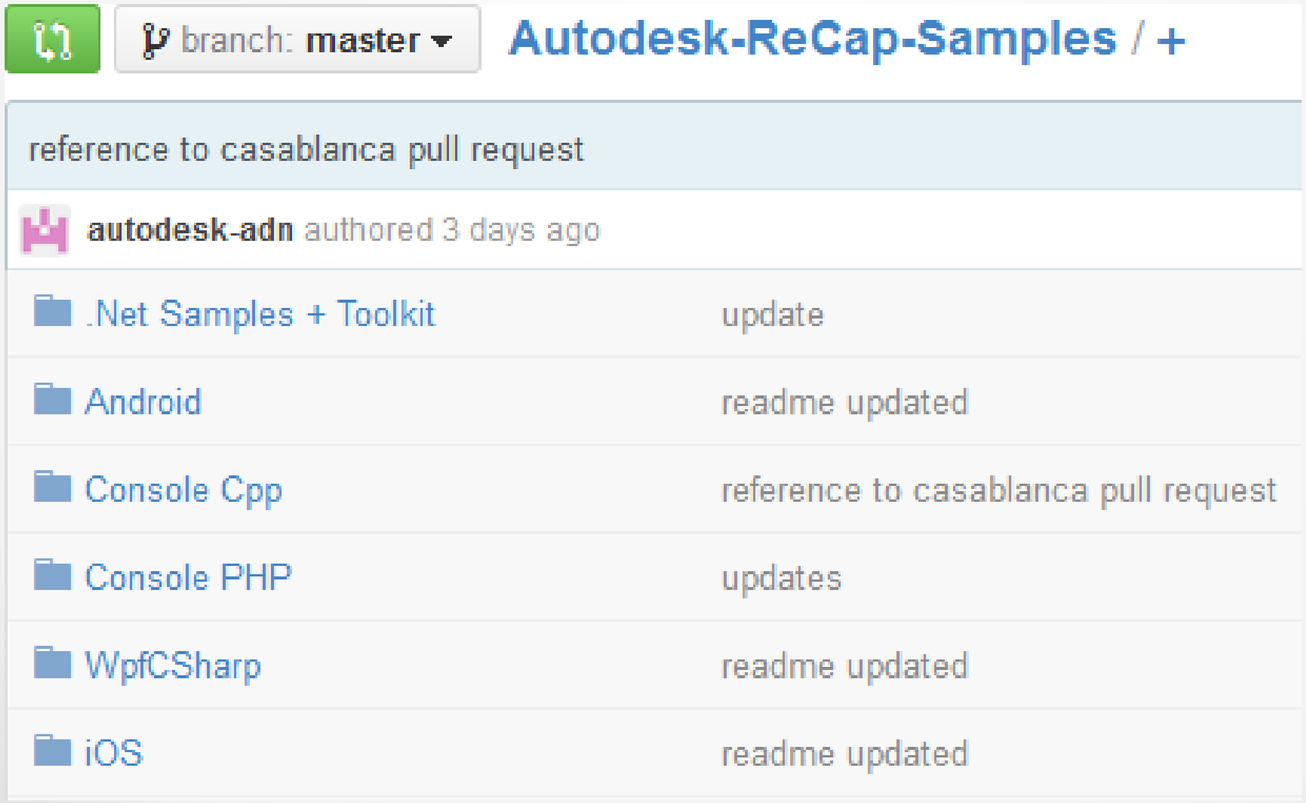


- x CC per job whatever the resolution

ReCap API - Samples

- ADN ReCap Samples:

  https://github.com/ADN-DevTech/Autodesk-ReCap-Samples



ReCap API - C# Toolkit Demo

```
async private void bTest_Click(object sender, EventArgs e)
{
    AdnOAuthConnector connector = new AdnOAuthConnector(
        UserSettings.OAUTH_URL,
        UserSettings.CONSUMER_KEY,
        UserSettings.CONSUMER_SECRET);

    connector.LoginViewMode = LoginViewModeEnum.iFrame;

    if (await connector.DoLoginAsync())
    {
        AdnReCapClient reCapClient = new AdnReCapClient(
            UserSettings.RECAP_URL,
            UserSettings.RECAP_CLIENTID,
            connector.ConsumerKey,
            connector.ConsumerSecret,
            connector.AccessToken,
            connector.AccessTokenSecret);

        var listResponse = await reCapClient.GetPhotosceneListAsync();

        if (listResponse.IsOk())
        {
            foreach (var photoscene in listResponse.Photoscenes)
            {
                WriteLine(photoscene.SceneName);
            }
        }
    }
}
```

Resources

- Documentation/test client
  - http://rc-api-adn.autodesk.com/3.1/api-docs/
- Mailing list
  - Get credentials: api.key.request@autodesk.com
  - Comment/question: recap.api@autodesk.com
- Links
  - ReCap 360: https://recap360.autodesk.com
  - 123D App: http://apps.123dapp.com/catch
  - Samples: https://github.com/ADN-DevTech/Autodesk-ReCap-Samples