Free Your BIM Data

Jeremy Tammik

Forge Program Development

AUTODESK.

AUTODESK®
FORGE DevCon

Summary

Combine the Forge Data Management, Model Derivative and Viewer APIs with REST and socket.io to implement a real-time round-trip BIM editor.

AUTODESK®
FORGE DevCon

Jeremy Tammik
Autodesk Forge Partner Development

- passionate about cooperation and sharing
- The Building Coder and The 3D Web Coder
- support Autodesk APIs and web services
- blog, present, train, developers, community
- KISS!
- I love adventure, survival, problem solving and challenges of all kinds
- fluent in six European languages, vegetarian, kids, grandchildren

AUTODESK®
FORGE DevCon

KISS – keep it simple, stupid

- Lazy
    - … the three great virtues of a programmer: laziness, impatience, and hubris – *Larry Wall*

- Simple
    - Simplicity is the ultimate sophistication – *Leonardo da Vinci*
    - There is no greatness where there is no simplicity – *Leo Tolstoy*

- Perfect
    - Perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away – *Antoine de Saint-Exupéry*

Agenda

- Forge for BIM
- BIM family
- Model Derivative API
- Samples
 - Forge real-time round-trip BIM editor

How Does Forge Help?

- platform! empower developers
- empower users
  - design
  - visualise
  - collaborate
  - make
  - use

AUTODESK®
FORGE DevCon

BIM Roles Collaboration

- Participant counts grow by orders of magnitude

  - design – architect, engineer – Revit
  - visualise – client, everybody – Viewer
  - collaborate – management – Glue + Plan
  - make – construction – Field + Layout
  - use – inhabit, maintain, FM – Building Ops

Free Your BIM Data!

orders of magnitude in building design, construction, maintenance and use

AUTODESK®
FORGE DevCon
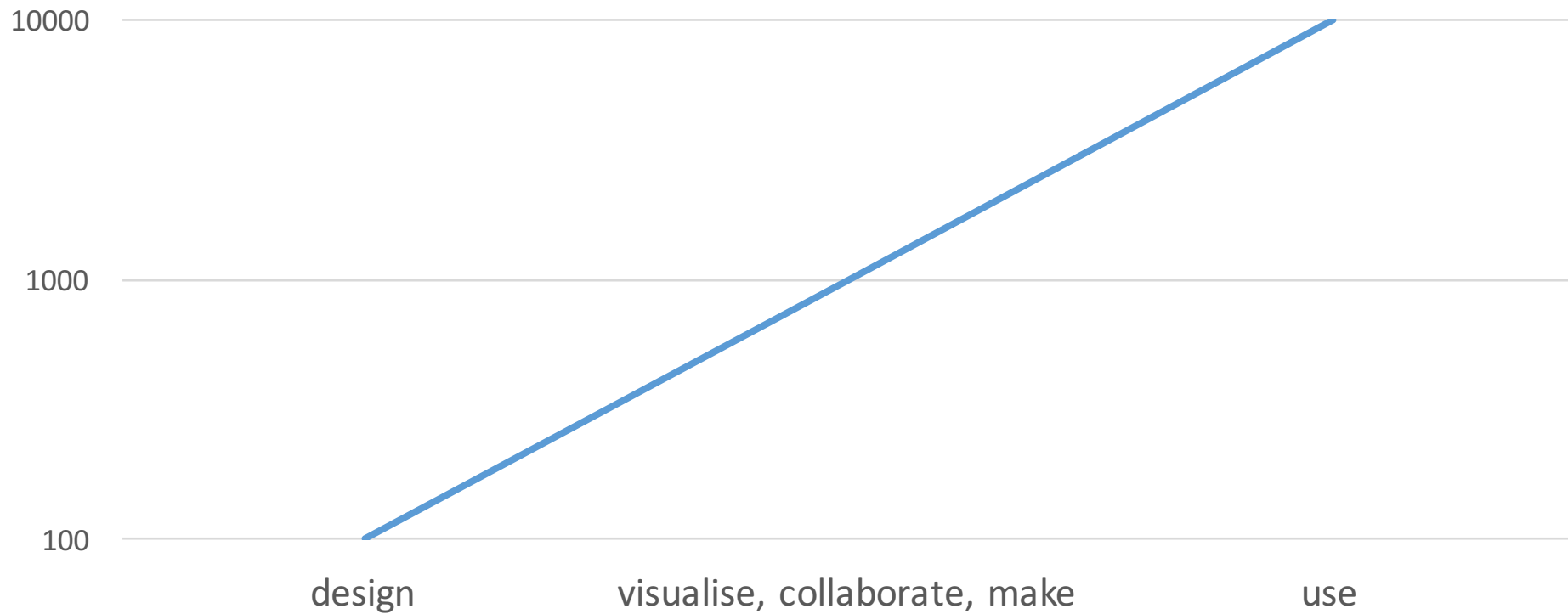
BIM Family

BIM Family

- A360 Collaboration for Revit

  www.autodesk.com/products/collaboration-for-revit

- BIM 360 Family

  www.autodesk.com/products/bim-360/overview

AUTODESK®
FORGE DevCon

A360 Collaboration for Revit

- Connect building project teams
- All participants work on shared BIM
- Visualise, share, coordinate, document
- Communicator chat tool within model
- Stay connected in real time
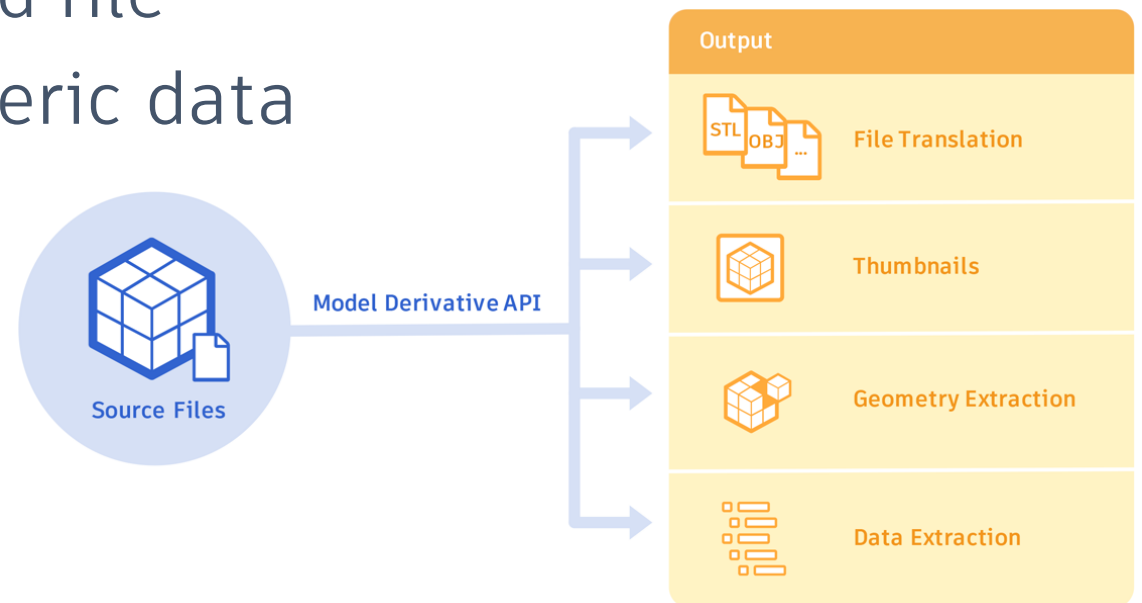
BIM 360 Spanning the Building Lifecyle

PRECONSTRUCTION PHASE	CONSTRUCTION EXECUTION PHASE	COMMISSIONING & HANDOVER PHASE	OPERATIONS & MAINTENANCE PHASE

BIM 360 Glue →

Solution (Cloud and Mobile):
BIM management coordination, collaboration

BIM 360 Layout →

Solution (Mobile):
Construction layout, as-built collection, connects to total-station hardware

BIM 360 Plan →

Solution (Cloud and Mobile):
Visual, short-term project planning, track tasks, commitments and handoffs

BIM 360 Field →

Solution (Cloud and Mobile):
Field data management (issues, tasks, daily project updates and punchlists)

Building Ops →

Solution (Cloud and Mobile):
Streamlines handover, limits warranty expenses, expands service offerings

AUTODESK®
FORGE DevCon

Model Derivative API
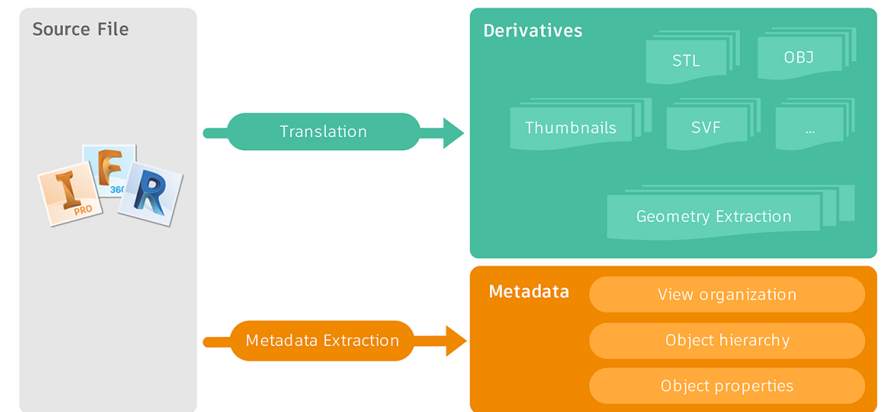
AUTODESK®
FORGE DevCon

Forge Components

- Launched
  - Authentication
  - Data Management API
  - Model Derivative API
  - Viewer
  - Design Automation API
- Review Queue
  - 3D Print API
  - BIM 360 API
  - Issues API
  - Reality Capture API
  - Fusion Connect API
  - A360 API

AUTODESK®
FORGE DevCon

Model Derivative API

- Used to be View and Data API
- Now Model Derivative API and Viewer
- Model: CAD design seed file
- Derivative: extract generic data
  - Object hierarchy tree
  - Thumbnail
  - Properties
  - Geometry

Source Files

Model Derivative API

Output

STL OBJ ... **File Translation**

Thumbnails

Geometry Extraction

Data Extraction

AUTODESK®
FORGE DevCon

Model Derivative Terms

- source file – CAD design source seed file

- derivatives – translated output

- metadata – extracted elements and properties

- manifest – JSON container holding job status and derivative information, e.g. type and URN

- model view – a set of object trees and properties

AUTODESK®
FORGE DevCon

Translation

- Simultaneously into many types of output
- Derivative data stored in one manifest
- Simple to locate translations
- Translate parts of a model into geometry

Derivative Translation Formats

- ## 60+ input CAD formats
  - 3ds, 3dm, asm, asm, cam360, catpart, catproduct, cgr, collaboration, dae, dgn, dlv3, dwf, dwfx, dwg, dwt, dxf, exp, f3d, fbx, g, gbxml, iam, idw, ifc, ifw, ige, iges, igs, ipt, jt, lll, max, mfr, model, neu, neu, nwc, nwd, obj, pdf, prt, prt, rcp, rvt, sab, sat, session, skp, sldasm, sldprt, smb, smt, ste, step, stl, stla, stlb, stp, x_b, x_t, xas, xpr, wire, zip

- ## Autodesk and vendor neutral standards

- ## Output
  - obj, svf and thumbnail – from all input formats afaik
  - iges, step, stl – from cam360, f3d, fbx, iam, ipt, wire

- ## New file formats constantly added

AUTODESK®
FORGE DevCon

Translation Workflow

- Endpoints
    1. GET formats – retrieve list of available translations
    2. POST job – translate source file
    3. GET :urn/manifest – verify job complete, derivatives ready for download, retrieve their URNs
    4. GET :urn/manifest – retrieve derivative URNs
    5. GET :urn/manifest/:derivativeurn – download derivative

Translation Job Status

- POST job is asynchronous
- Returns success on submittal
- Job runs in background
- Check for completion with GET :urn/manifest

Data Extraction

- Extract metadata
- Identify objects in hierarchical tree,
- Retrieve properties and geometries
- Fusion and Inventor – single model view
- Revit – multiple model views

Data Extraction Workflow

- Translate to SVF
- GET :urn/metadata
  - information about metadata
- GET :urn/metadata/:guid
  - object tree for selected metadata
- GET :urn/metadata/:guid/properties
  - list of objects and their properties within the specific metadata view

Getting Started

- Register app
- Acquire OAuth token
- Upload seed file to Object Storage Service OSS

Manifest

- JSON container from GET :urn/manifest

- Translated job statuses

- Information about derivatives

  - urn base64 encoded source file URN
  - type type of this JSON object
  - progress overall progress for all translation jobs, complete or %
  - status overall status for translation jobs, pending, success, inprogress, failed or timeout
  - hasThumbnail bool indicateng whether thumbnail has been generated
  - derivatives array of requested output files

Derivative

- Information about requested translations
- Possible types STL, STEP, IGES, OBJ, SVF, thumbnail
  - name
  - hasThumbnail
  - role output file type
  - status pending, inprogress, success, failed or timeout
  - progress complete or percentage done
  - children: array of associated files, each equipped with its own role, mime type, un identifier, progress and status

Metadata

- GET :urn/metadata
  - name of model view
  - guid for the model view

Properties

- GET :urn/metadata/:guid/properties
- Flat collection of application specific object properties
  - type object type 'properties'
  - collection array entries, each with
    - objectid
    - name
    - properties array of the object properties

Extract Data

- Register app, OAuth token, upload seed file
- Step 1: Convert source URN to Base64
- Step 2: Translate source sile to SVF
- Step 3: Verify the job is complete
- Step 4: Retrieve list of model view metadata IDs
- Step 5: Retrieve properties for the model view ID

Forge BIM Samples

Samples

- Forge Sample Collection
  - github.com/Developer-Autodesk
- Connecting desktop and cloud in the past
  - One-off, simplified, hard-coded... security?
- Connecting desktop and Forge
  - More generic, flexible, secure, larger audience
- Future? Pure Forge apps?
 - Complete solution, lower or zero desktop focus?

Forge BIM Samples

- Viewer
  - leefsmp/forge
- Data Management API
  - [data.management.api-nodejs-sample](#)
- Model Derivative API
  - [derivative-service-node.js-sample](#)
- LmvNavTest
  - Extract properties, statistics, dashboard
  - [LmvNavTest](#)

AUTODESK®
FORGE DevCon

DM Basic Sample – Augusto

- Revit model in A360
- Data Management, Model Derivative Service, Viewer
- Hub, project, folder, item, version

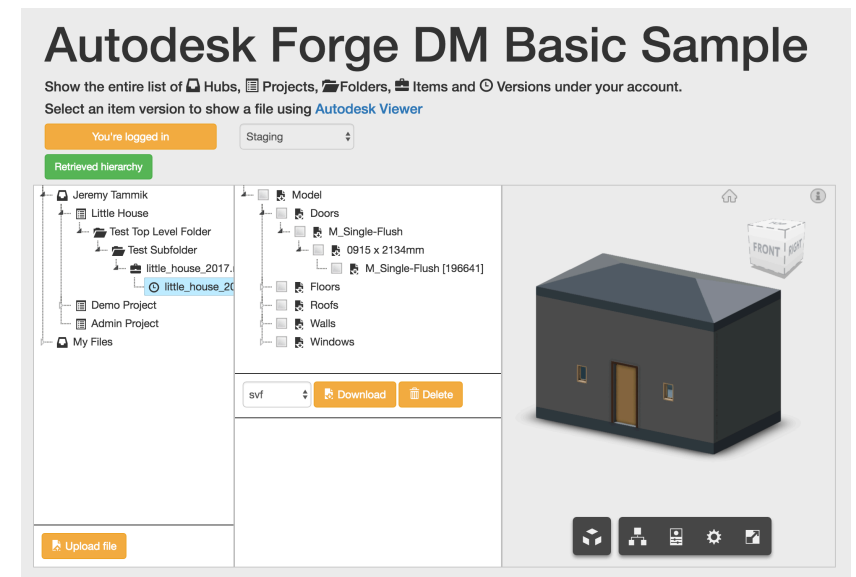github.com/Developer-Autodesk/derivative-service-node.js-sample

autodesk-ds.herokuapp.com

AUTODESK® FORGE DevCon
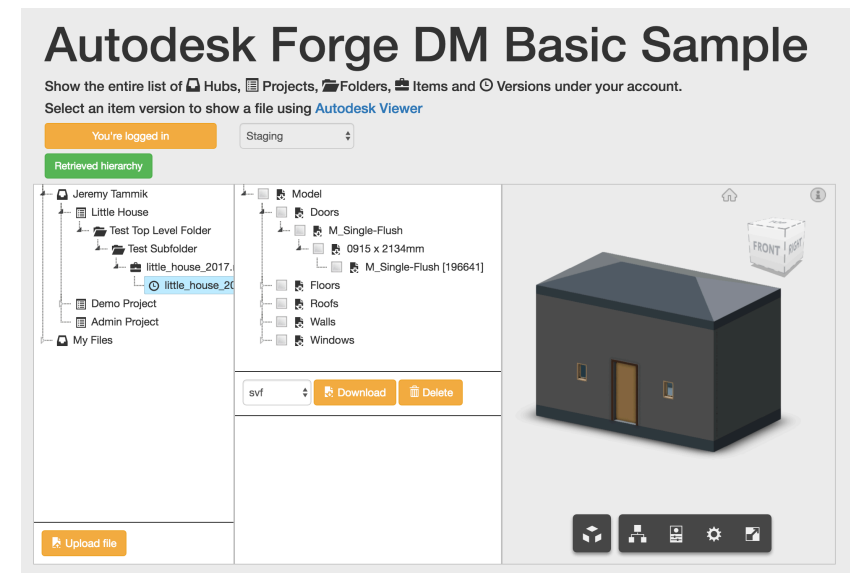
MD Basic Sample – Adam

- Revit model in A360

- Data Management, Model Derivative Service, Viewer

- Hub, project, folder, item, version

github.com/Developer-Autodesk/derivative-service-node.js-sample

autodesk-ds.herokuapp.com

AUTODESK®
FORGE DevCon

LmvNavTest

- Forge Viewer Visual Report
- Pie and bar charts represent model quantites
- Click on chart to highlight model elements
- Select 3D element to highlight on 2D sheet
- Select element in 2D to isolate and fit it in 3D

github.com/Developer-Autodesk/LmvNavTest

calm-inlet-4387.herokuapp.com

AUTODESK®
FORGE DevCon

Real-time Round-trip BIM Editor

AUTODESK®
FORGE DevCon

Real-time Round-trip 3D BIM Editor

- Edit model in viewer
- Transmit real-time update to BIM

Samples Connecting Desktop and Cloud

- It is simple!
  - Tools: REST, HTML, SVG, JavaScript, NoSQL
  - Open source: npm, node, mongo
- Some aspects are hard or complex
  - Choice of web development tool stack
  - Security

AUTODESK®
FORGE DevCon

Connecting Desktop and Cloud in the Past

- Round-trip Revit BIM, CouchDB, node.js, MongoDB
  - RoomEditorApp – roomedit
    - github.com/jeremytammik/RoomEditorApp
  - FireRatingCloud – fireratingdb
    - github.com/jeremytammik/FireRatingCloud
- Three.js viewer
  - vA3C
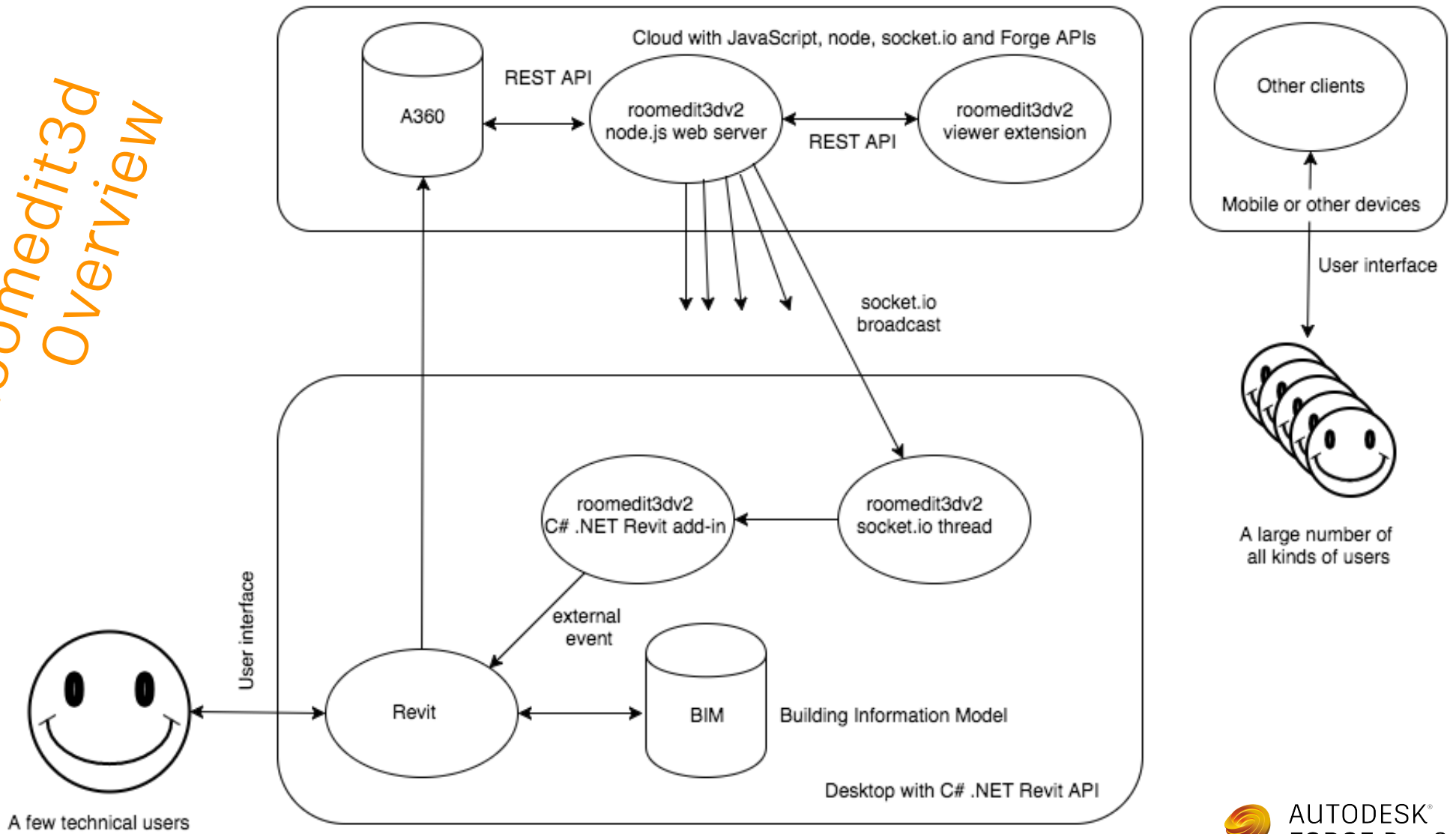   - va3c.github.io

AUTODESK®
FORGE DevCon

Connecting Desktop and Forge Today

- Roomedit3dV2
- Edit BIM in Forge viewer
- Load extension
- Move element
- Log translation in web client and server
- Broadcast via socket.io
- Revit add-in subscribes to broadcast
- Update BIM in real time

roomedit3dv2.herokuapp.com

AUTODESK®
FORGE DevCon

How can you edit in the viewer?

- No way!
  - Viewer is viewer, read-only!
- Oh yes!
  - Translation is one-way, but...
  - Viewer is three.js open source JavaScript
  - Data is open source JSON stream
 - Edit to your heart's content

Roomedit3d Overview

Cloud with JavaScript, node, socket.io and Forge APIs

A360 ←REST API→ roomedit3dv2 node.js web server ←REST API→ roomedit3dv2 viewer extension

socket.io broadcast

Other clients

Mobile or other devices

User interface

A large number of all kinds of users

roomedit3dv2 C# .NET Revit add-in ← roomedit3dv2 socket.io thread

external event

User interface

Revit ↔ BIM — Building Information Model

Desktop with C# .NET Revit API

A few technical users

AUTODESK® FORGE DevCon

Todo – Save Changes

- Real-time socket broadcast
- No add-in listening? Changes lost!
- Alternative, todo item:
  - Store pending modifications in database
  - Add-in retrieves change and marks it done

FireRatingCloud Architecture
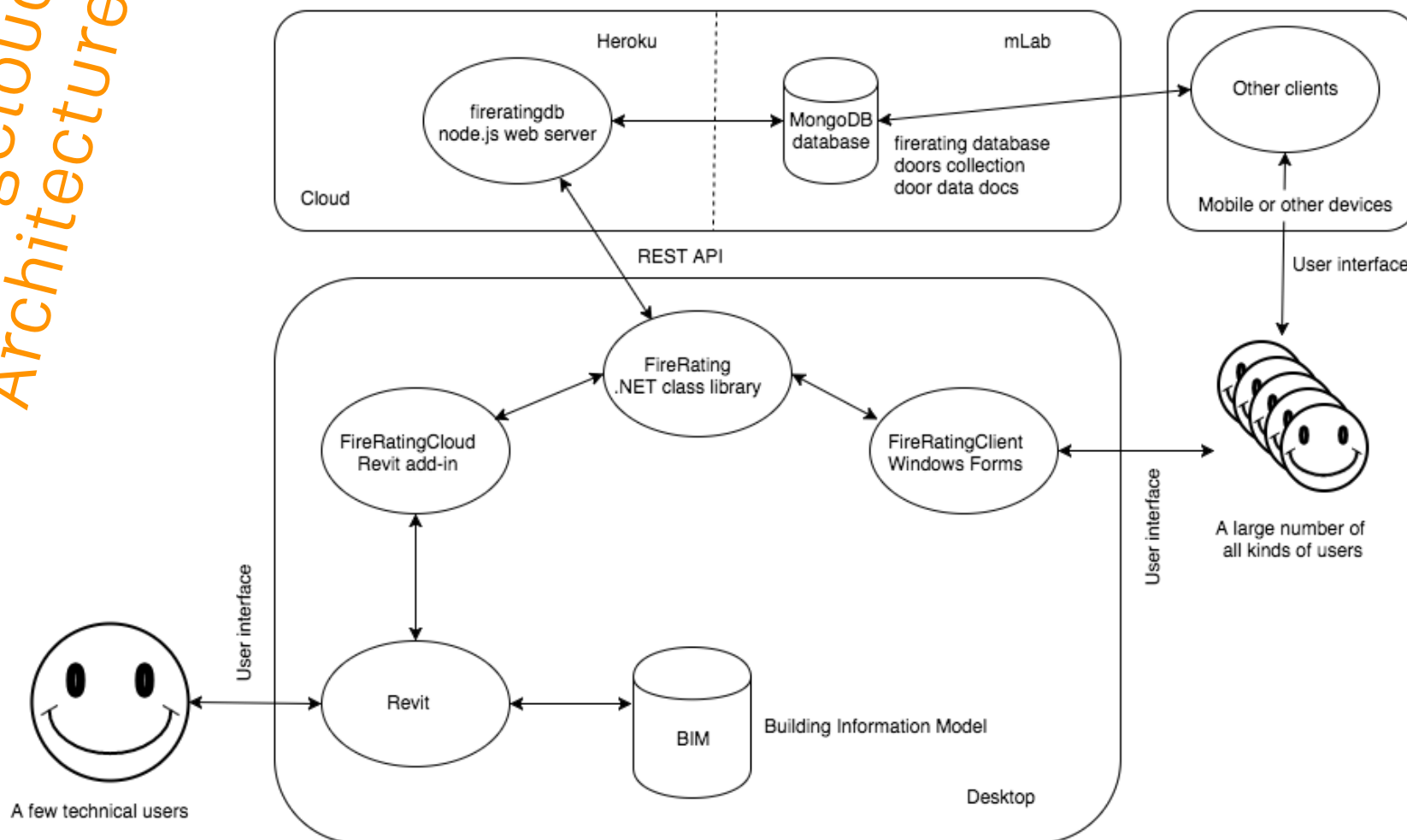
Cutting the String

- Revit is a heavy duty design tool
  - Used to create CAD seed file
- Forge provides
  - Full access to design data on the cloud
  - Meta data, element hierarchy, geometry
- Cut the string to Revit?
  - Liberate Revit data
  - Combine with other sources
- Where do you want to take this?

AUTODESK®
FORGE DevCon

Revit I/O

- Forge Design Automation API
  - Currently supports DWG read-write
  - Max, Maya, Inventor coming soon
  - What do you need from Revit in the cloud?
  - Requesting your input!

    The Building Coder Topics "Revit I/O"

    thebuildingcoder.typepad.com/blog/about-the-author.html#5.28b

Resources

- Live on **HEROKU**
  - roomedit3dv2.herokuapp.com
- Code on **GitHub**
  - model.derivative.api-nodejs-sample-roomedit3d
- Demo on **YouTube**
  - www.youtube.com/watch?v=bDI5YX7PDP8
- Documented by The 3d Web Coder
  - Roomedit3d Thee-legged OAuth Access to Forge

AUTODESK
FORGE DevCon

Now it's up to you...

- What is your client's ultimate effective BIM use?
- Which Forge platform components fit the bill?
- Let us know what you need!

forge.autodesk.com – @AutodeskForge

Free your BIM data!

Jeremy Tammik, Forge Partner Development
@jeremytammik

AUTODESK®
FORGE DevCon

AUTODESK®

Play with Postman
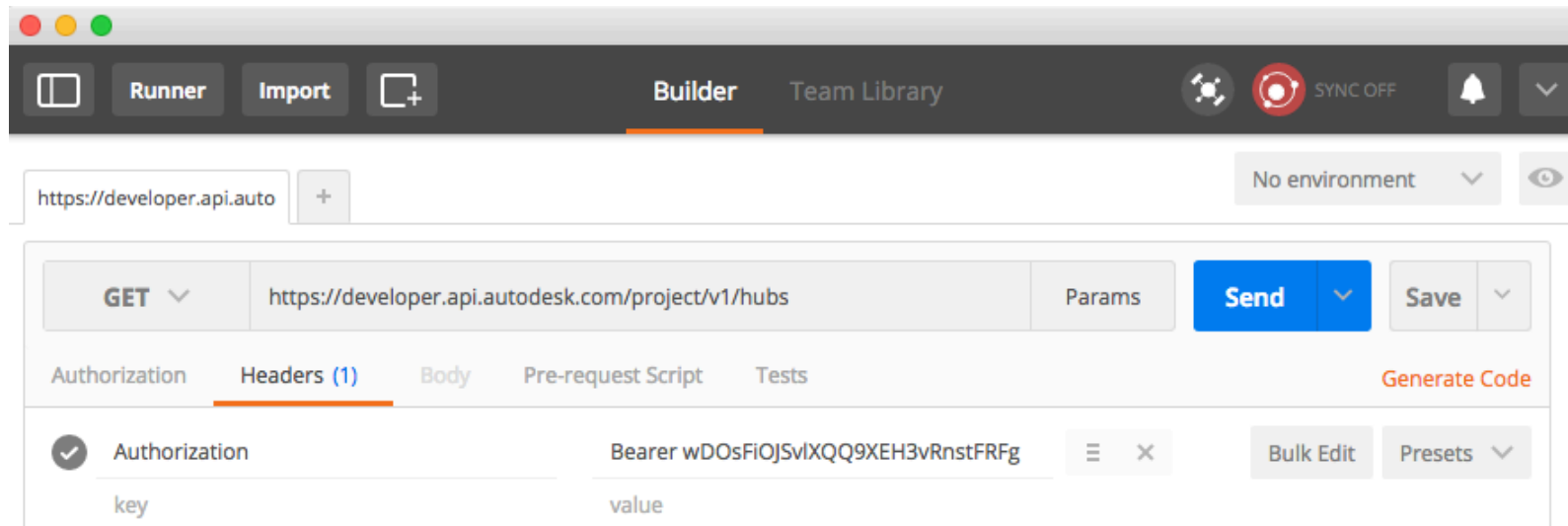
- http://developer.api.autodesk.com

- JSON API format

Interesting Data Management API endpoints

- List of project
  /project/v1/hubs/::hubid::/projects
- Project
  /project/v1/hubs/::hubid::/projects/::projectid::

- Folder contents
  /data/v1/projects/::projectid::/folders/::folderid::/contents

AUTODESK®
FORGE DevCon

Interesting A360 endpoints

- List of comments
/a360/v1/items/::itemid::/comments

- Add a comment
/a360/v1/comments

Next Steps

- Register your app and get your key
  developer.autodesk.com

- See documentation & tutorials
  developer.autodesk.com/en/docs/data/v2
  Reuse code
  github.com/Developer-Autodesk

- Ask questions
  TAG: autodesk-data-management

GitHub

stack**overflow**

AUTODESK®
FORGE DevCon