



Free Your BIM Data

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Forge Program Development



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. Selected data only! Free choice!



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

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

Forge for BIM

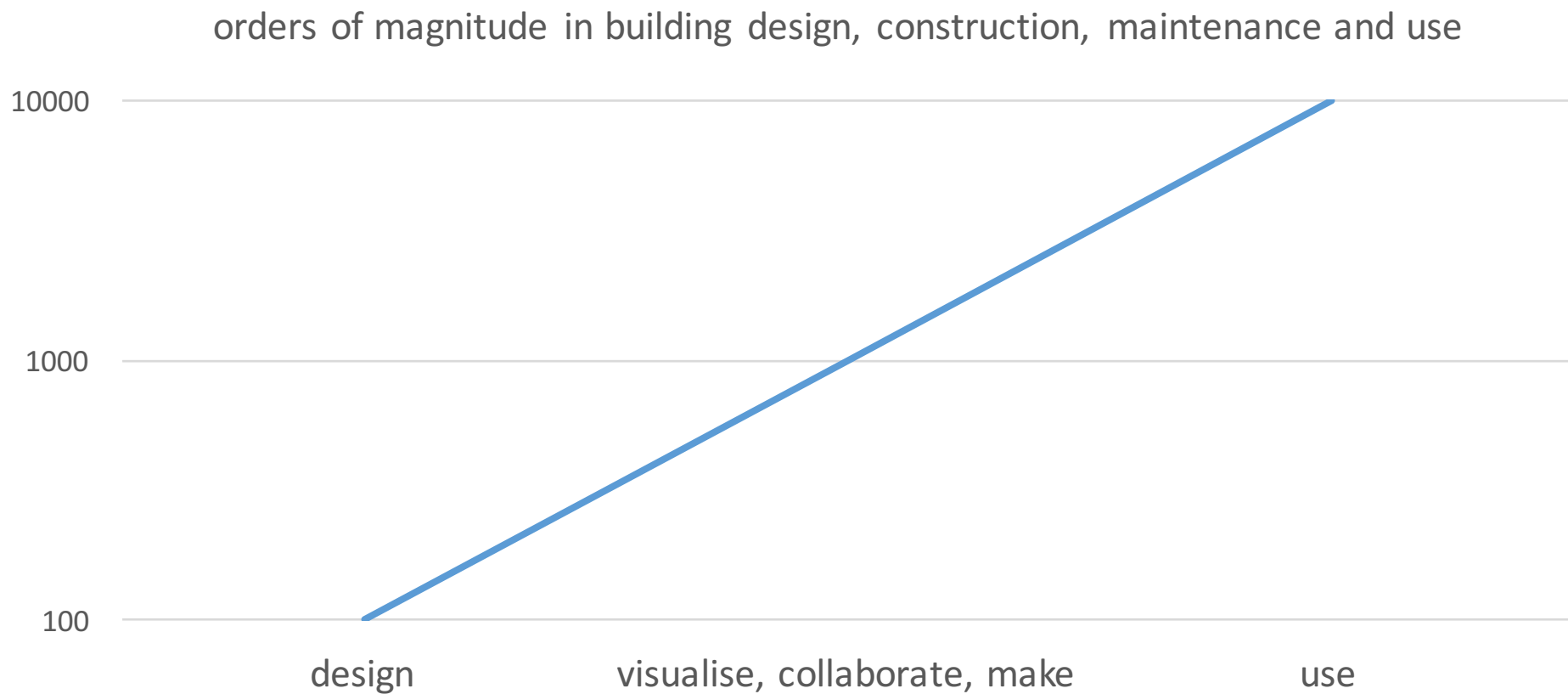
How Does Forge Help?

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

BIM Roles Collaboration

- Participant counts grow by orders of magnitude
 - design – architect, engineer – Revit
 - visualise – client, everybody – Viewer
 - collaborate – BIM management – Glue + Plan
 - make – construction – Field + Layout
 - use – inhabit, maintain, FM – Building Ops

Free Your BIM Data!



BIM Family

BIM Family

- A360 Collaboration for Revit

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

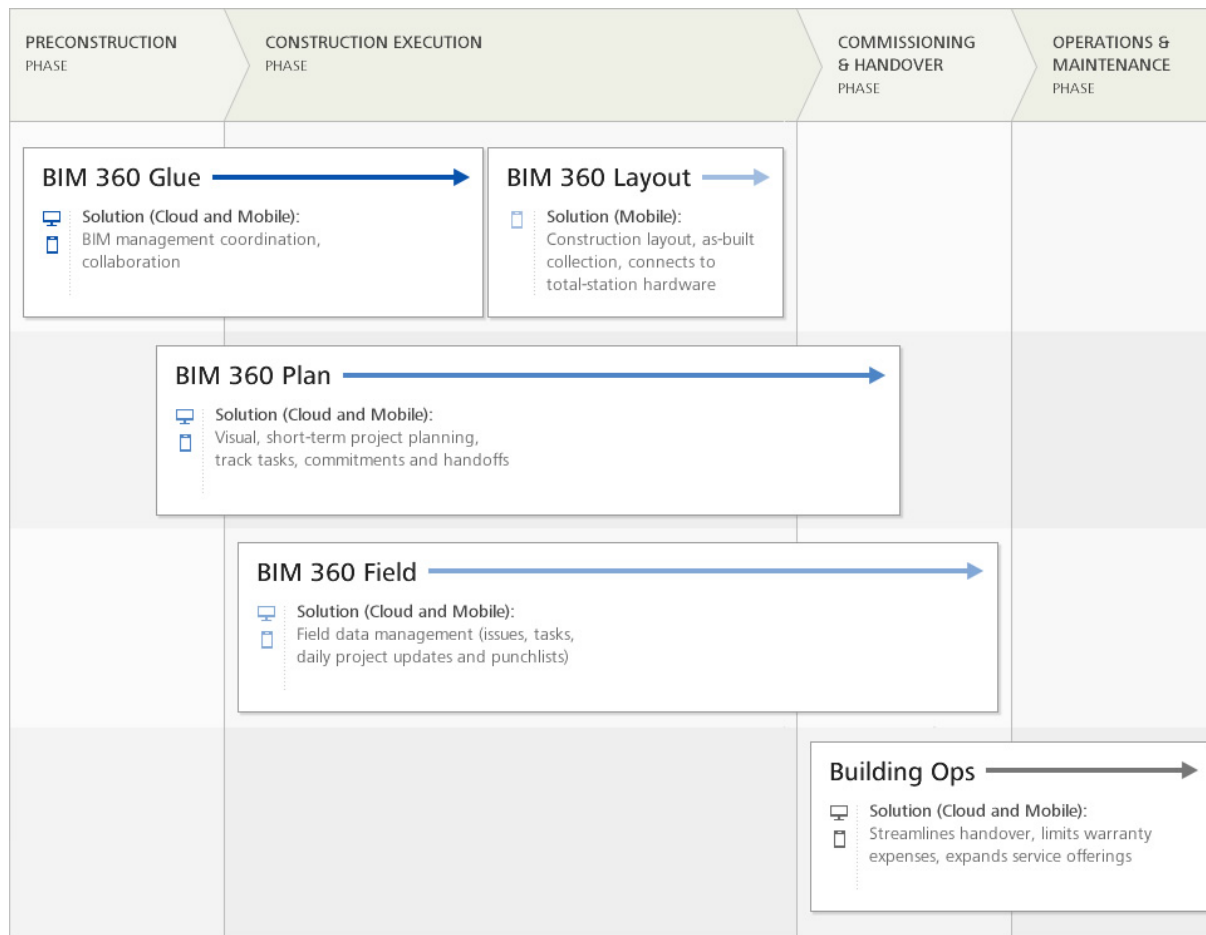
- BIM 360 Family

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

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 Lifecycle



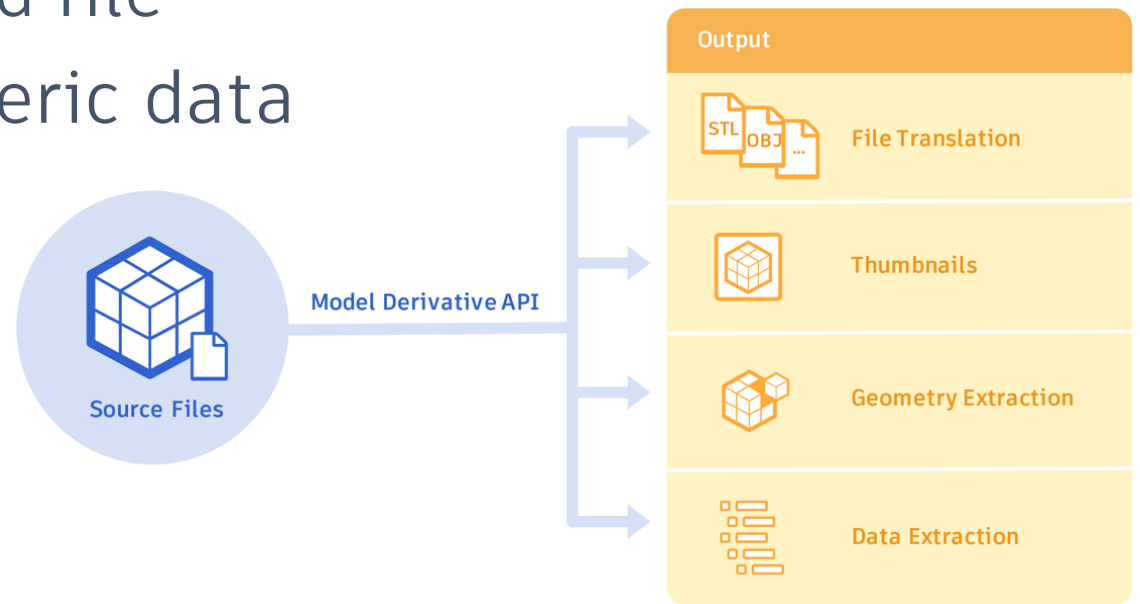
Model Derivative API

Forge Components

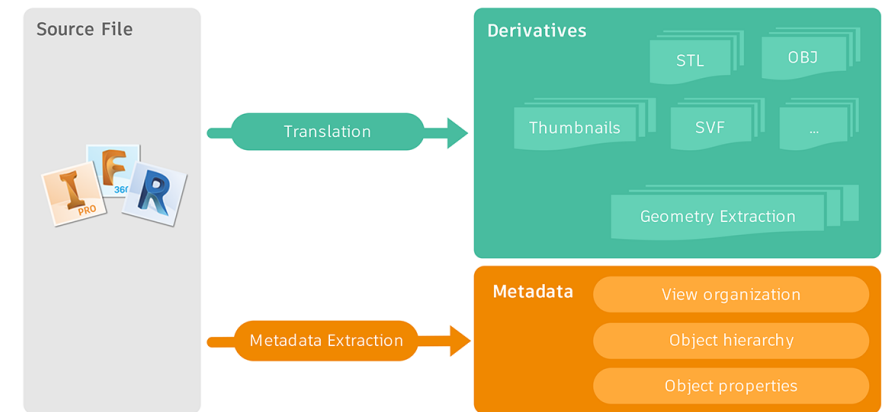
- Launched
 - Authentication
 - Data Management API
 - Model Derivative API
 - Viewer
 - Design Automation API
- Review Queue
 - 3D Print API
 - BIM 360 API
 - Issues API
 - Reality Capture API
 - Fusion Connect API
 - A360 API

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



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

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

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 indicating 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 file 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

Try it out using Paw and Postman

- Postman for Chrome or Mac
 - www.getpostman.com
- Paw for Mac
 - luckymarmot.com/paw

Related Sessions

- Integrate and Extend Your Construction Ecosystem with BIM360 HQ APIs and Forge
 - Unified account administration and data across BIM 360. Single point of integration for customer accounts, projects, partner companies, user management, and other account level information – Manu Venugopal, Saikat Bhattacharya, Keith White
- Extend BIM 360 Docs with the Issues Service API
 - Create issues related to Forge documents incl. BIM360 Docs – Galia Traub, Mikako Harada
- Collaborating with Design Data
 - Combine the Forge Model Derivative, Viewer, Markup, Commenting and Data Management APIs to create powerful review and collaboration workflows around your design – Augusto Goncalves, Phaneendra Kumar Divi
- Free Your Design Data
 - Model Derivative API, translate design files to different formats, extract data to use anywhere – Shiya Luo, Adam Nagy, Autodesk

Mainstage Keynotes

- JeDunn Dashboard
 - BIM, Oracle, Excel, SharePoint, etc.
 - Forge
- Ben Cochran
 - Drilling down into individual Forge API calls

Forge BIM Samples

Samples

- Forge Sample Collection
 - github.com/Developer-Autodesk
- Connecting desktop and cloud in the past
 - One-off, simplified, hard-coded, no security
- Connecting desktop and Forge
 - More generic, flexible, secure, larger audience
- Future? Pure Forge apps?
 - Complete solution, lower desktop focus

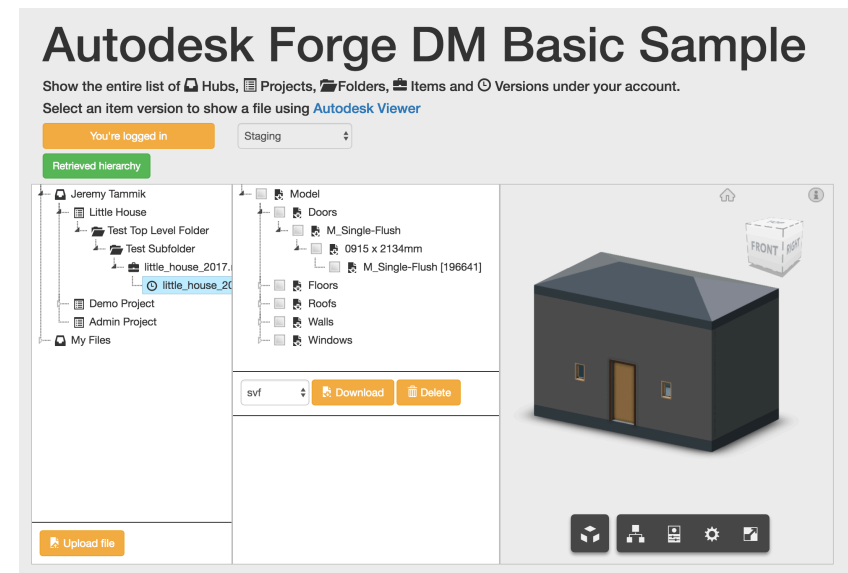
Forge BIM Samples

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

DM Basic Sample – Augusto

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

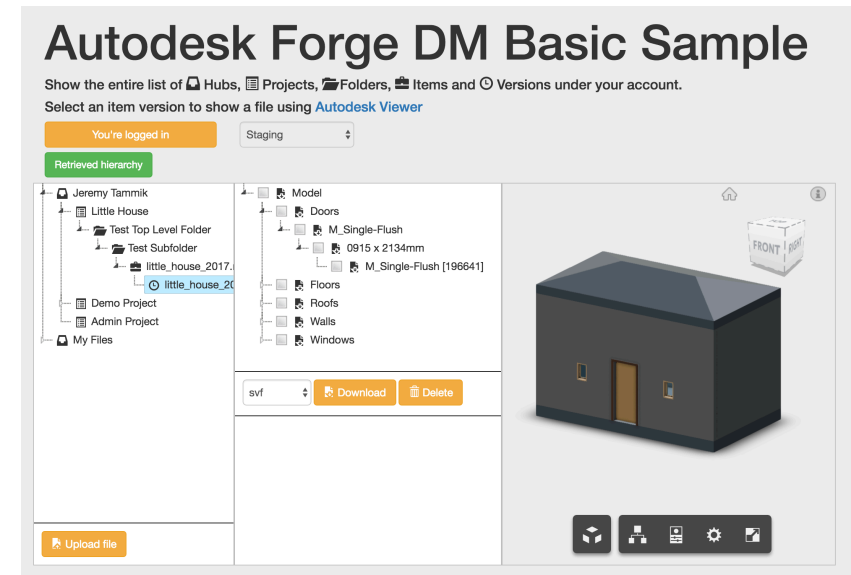
github.com/Developer-Autodesk/derivative-service-node.js-sample
autodesk-ds.herokuapp.com



MD Basic Sample – Adam

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

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autodesk-ds.herokuapp.com



LmvNavTest

- Forge Viewer Visual Report
- Pie and bar charts represent model quantities
- 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

Real-time Round-trip BIM Editor

Real-time Round-trip 3D BIM Editor

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

Samples Connecting Desktop and Cloud

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

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

Connecting Desktop and Forge Today

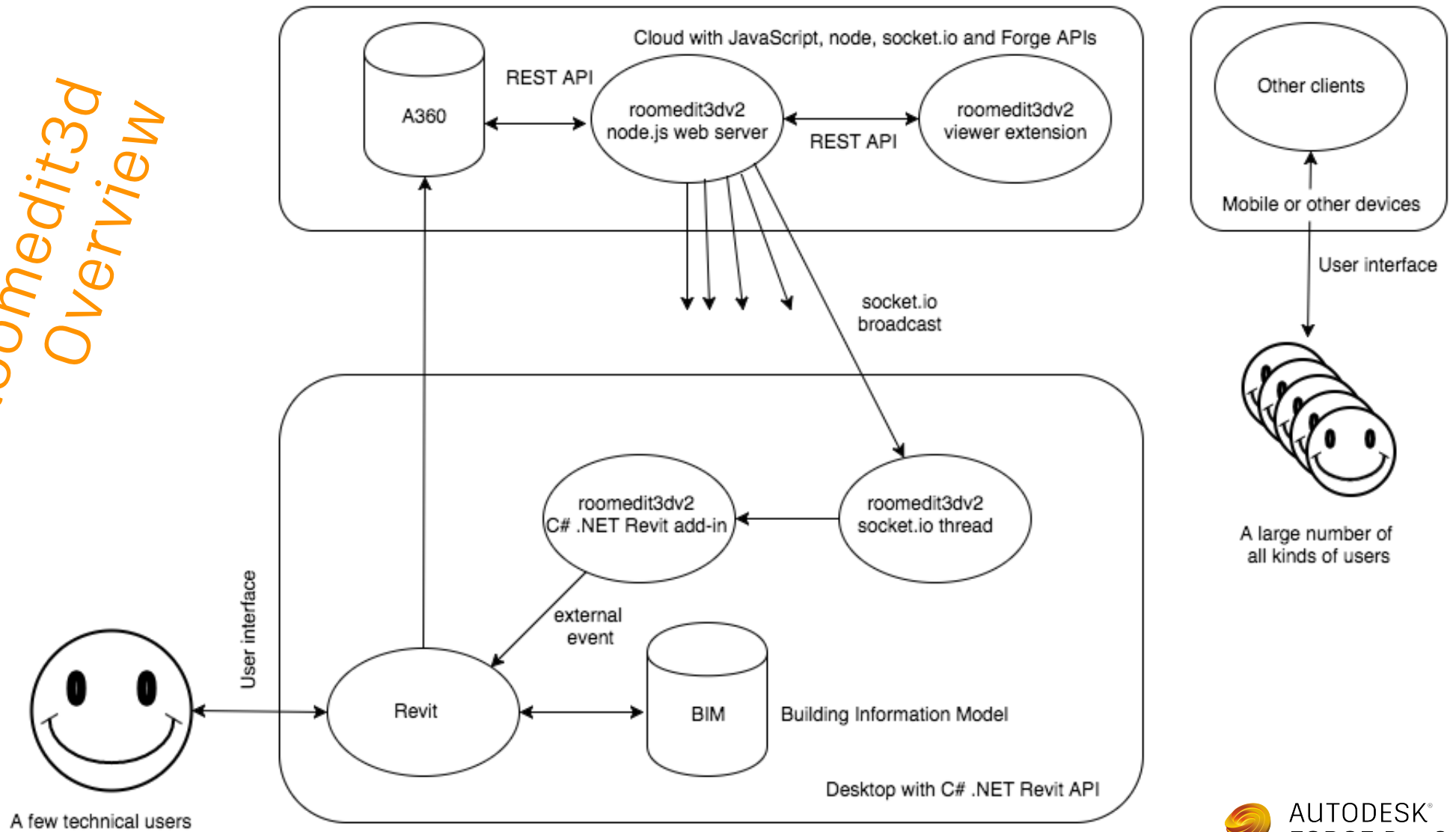
- Roomedit3dV2
- Edit BIM in Forge viewer
- Load extension
- Move element
- Log translation in web client and server
- Broadcast via socket.io
- Revit add-in subscribes to broadcast
- Update BIM in real time

roomedit3dv2.herokuapp.com

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

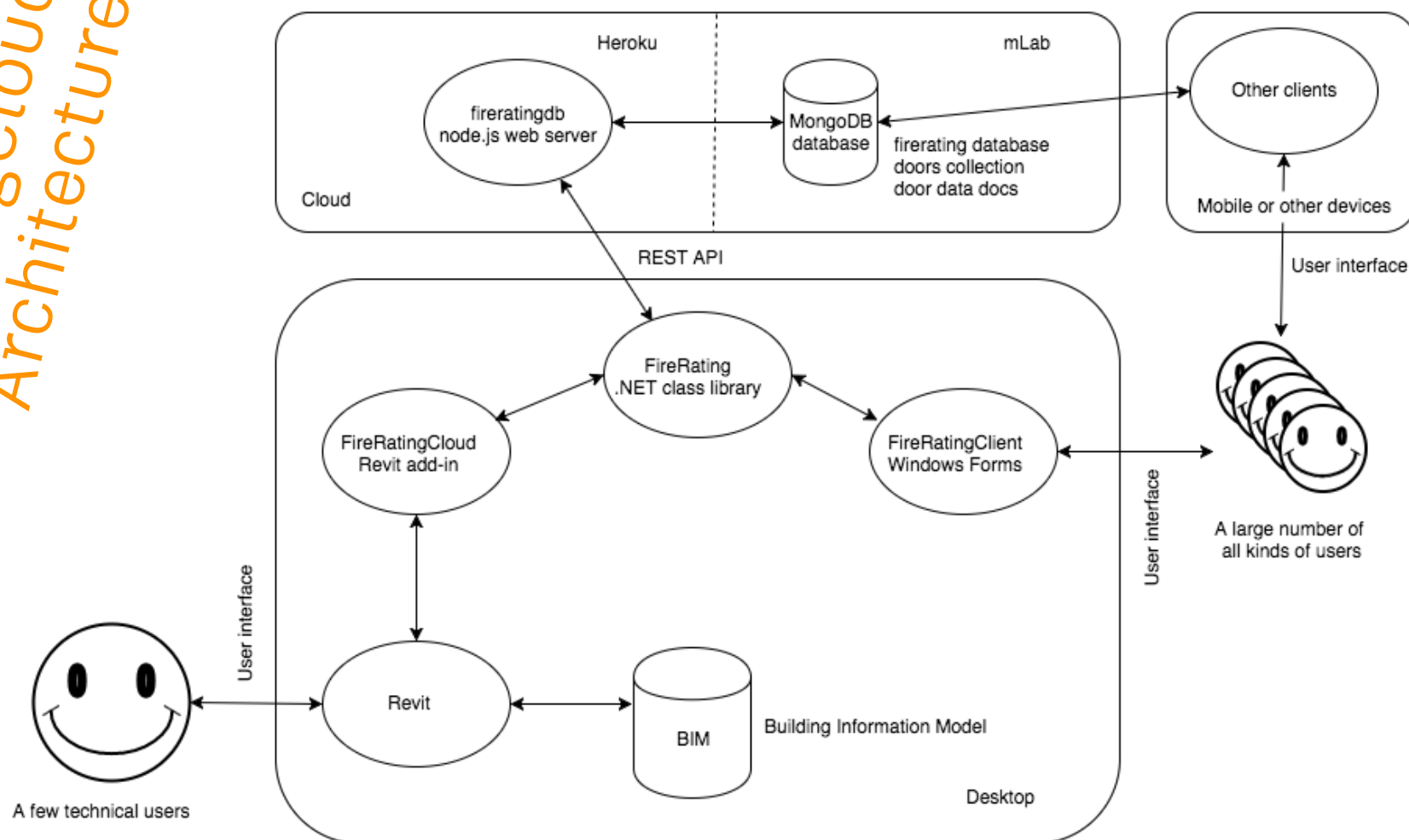
Roomedit3d Overview



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 tool
 - Create CAD seed file
- What can you now?
 - Design data on the cloud
 - Full access to meta data plus geometry
- Cut the string attached to Revit
 - Liberate Revit data
 - Combine with other data
- Where do you want to take this?

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?

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

Technologies

- SVG
- NoSQL
 - CAP theorem

Resources


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

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](https://twitter.com/AutodeskForge)

Free your BIM data!

Jeremy Tammik, Forge Partner Development
 [@jeremytammik](https://twitter.com/jeremytammik)

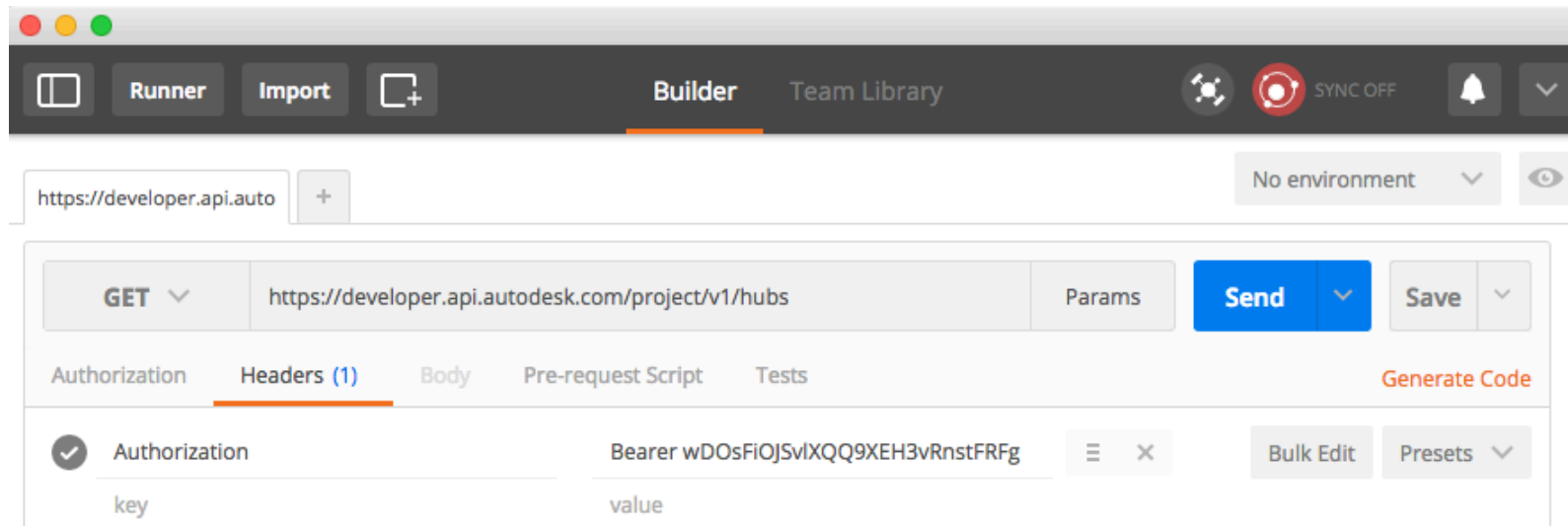


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Play with Postman



- <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`

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](https://stackoverflow.com/questions/tagged/autodesk-data-management)

