Autodesk Revit API How-To and Examples

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  - Training
  - Day to Day Support
  - Planning
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  - Standards
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rug BOSTON

API How-To & Examples

http://www.meetup.com/Boston-Revit-Users-Group/

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API How-To & Examples

Quick Survey

What is the Revit API?

Avatech Solutions - www.avatech.com

- Avatech's Utilities for Revit is probably one of the first API examples many Revit users have seen. These utilities include room renumber, grid select, change case, door mark update, Revit City content browser, space update, earth connection and room phase copy.

Revit Tools - www.revittools.info

- Dr. Angela German created the following tools: to/from room tags, door swing, count elements, manage cad within Revit, update sheet properties, dwg export, excel export, room/area import, renumber elements and room parameters to doors.

Tools 4 Revit - www.tools4revit.com

- Tools for Revit has many tools for the structural side of Revit (Architecture and Structural) as well as a sort & mark tool for elements and a tool that creates legends from different elements. If framing is something that you use frequently, these tools would definitely help increase productivity.

Ideate Explorer - www.ideatexplorer.com

- Ideate Explorer provides an easy way to search, quantify and select the elements within your model or view.

Revit TV - www.revittv.com

- Revit TV has two utilities: Drawing Manager which allows you to update sheet information, various exports, drawing issues/revisions and parameter mapping. Shared Parameter Manager, currently in beta, allows you to update, manage and rename shared parameters.

StrucSoft Solutions - www.strucsoftsolutions.com

- Wall panelize tool for wood and light gauge metal construction that recognizes openings and generates stud arrangements within walls.

CADWERX - www.cadwerx.net

- RevPac 1.0 is a set of productivity tools with the initial focus on user interface enhancements.

CDV Systems, Inc. - www.cdvsystems.com

- CDV Systems put together CodeBook V9 that links a project program and equipment requirements into Revit which is extremely beneficial for healthcare projects.

Emc2 Architects - www.emc2architects.com/revit_tools.html

- Emc2 Architects created Keynote Manager which allows your keynotes to be edited through an interface instead of through the text file.

Trelligence - www.trelligence.com

- Trelligence created Affinity for Revit which brings additional control and abilities to architectural programming in the early phases of a project and the ability to analyze changes to the program in later phases of the project.

BIM jet - www.bimjet.com

- BIM jet is a plug-in tool which allows for the transfer of BIM information into Microsoft Project.

Zach Kron - http://buildz.blogspot.com

- Zach (Autodesk Employee) on his blog shared API created by Harry (API Guru at Autodesk) for use in conceptual massing where there is a direct relationship between an object and the panels. Zach also built a batch rendering utility which utilizes the Revit journaling and VB scripts.

AVATECH UTILITIES
“LIVE DEMO”

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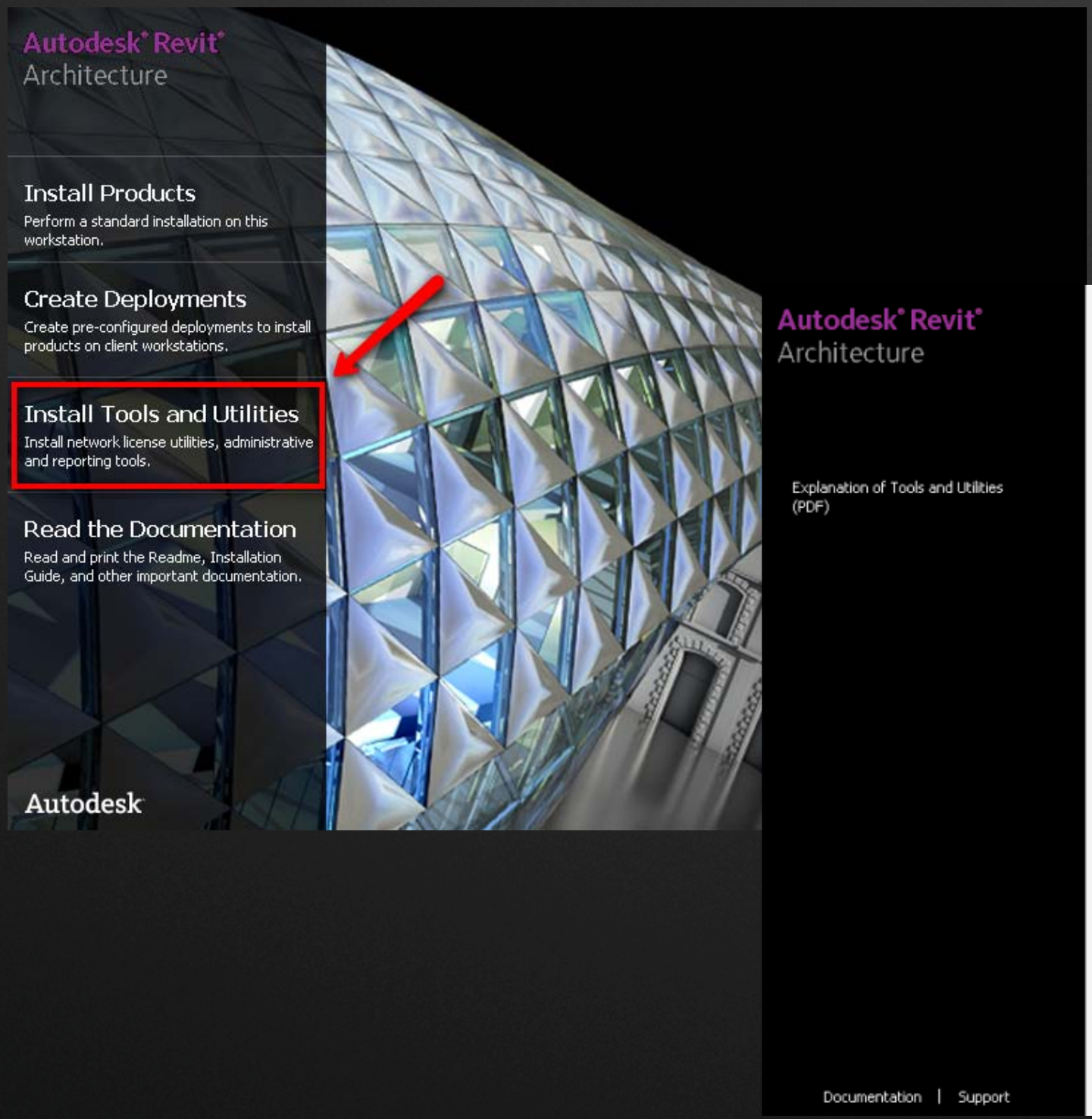
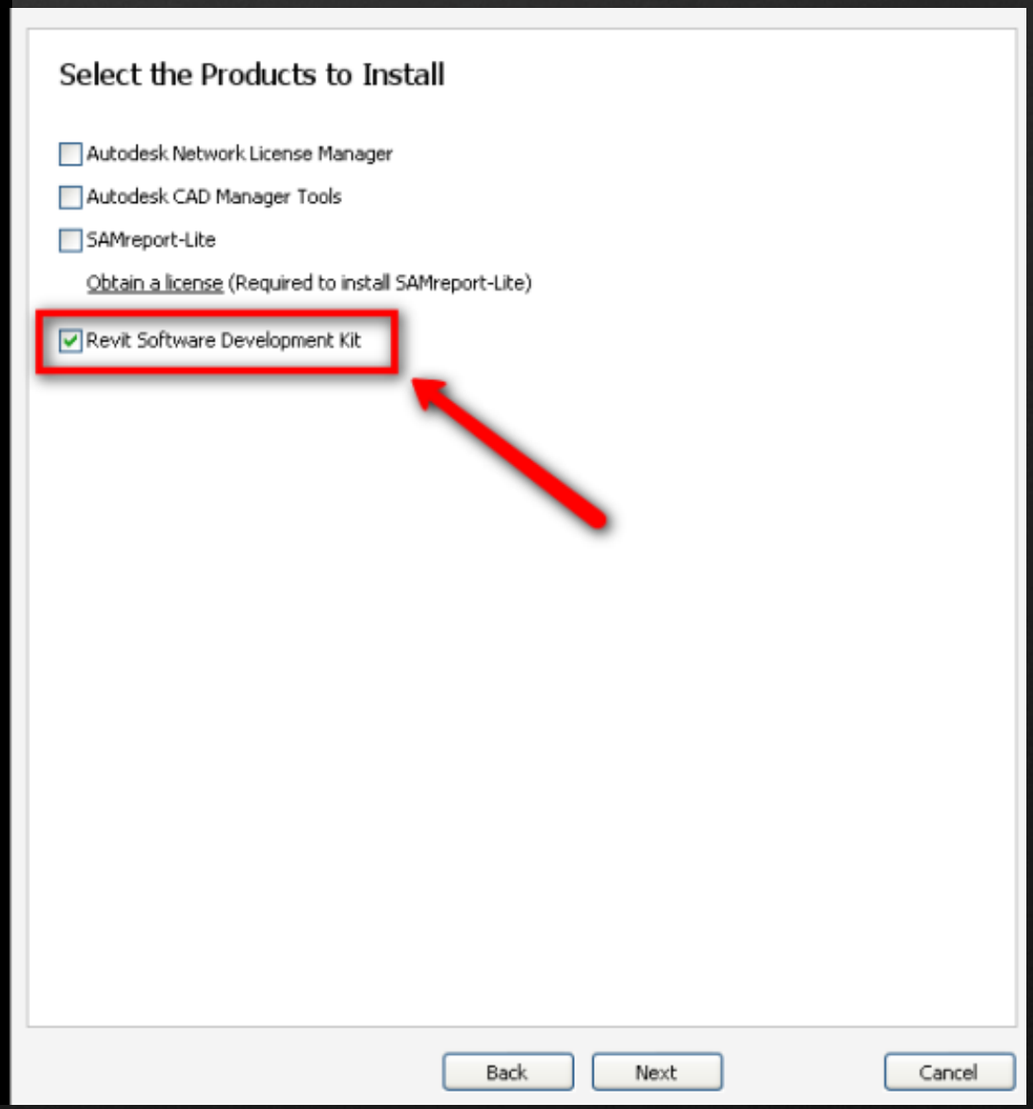
Software Development Kit (SDK)

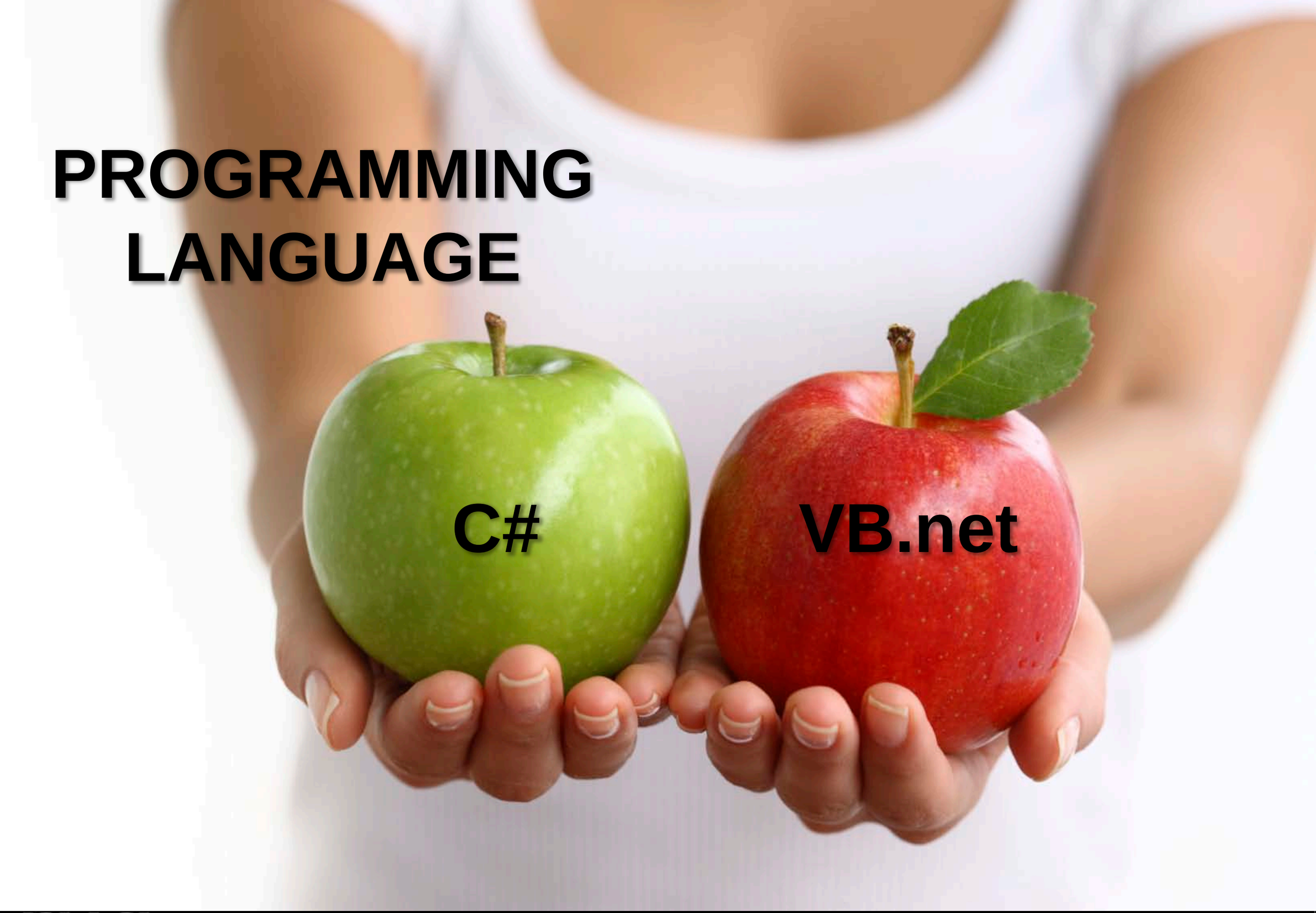
- Getting Started with the Revit API.doc
- Revit 2010 API Developer Guide.pdf
- Revit API Class Diagram.png
- RevitAPI.chm
- Ribbon design guidelines.pdf
- Autodesk Icon Guidelines.pdf
- Add-In Manager

Install the Software Development Kit (SDK)





PROGRAMMING LANGUAGE



PROGRAMMING REQUIREMENTS

- Created in a language compatible with Microsoft .NET framework 3.5.
- VB.net (Visual Basic) or C# language (Visual C#).
  - The decision between these languages is mostly a personal preference. Most of the samples from the SDK are in C#.
  - If you have someone you work with, a friend or a colleague that may be able to help you with a particular programming language, I would select that one.

PROGRAMMING SOFTWARE

Microsoft Visual Basic 2008 Express Edition

www.microsoft.com/exPress

Microsoft Visual C# 2008 Express Edition

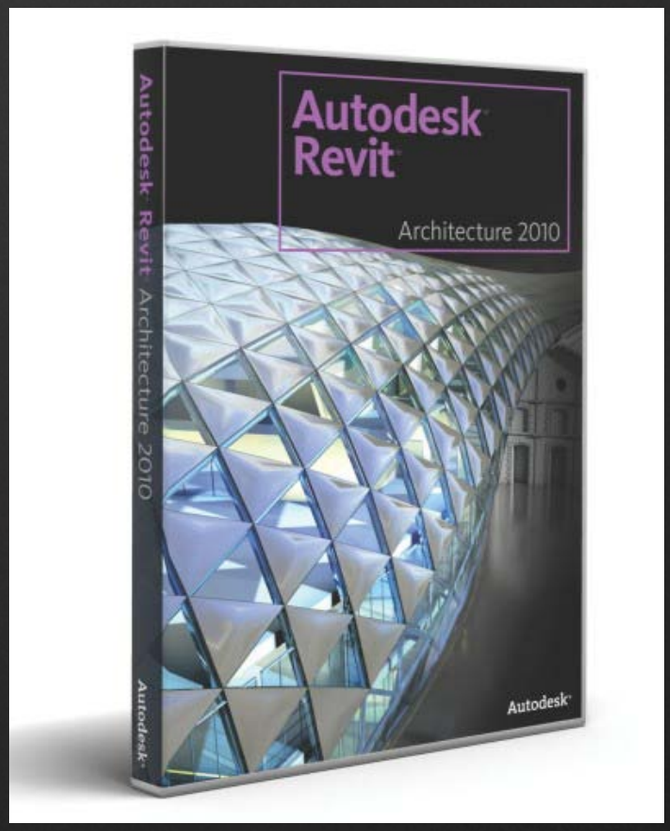
www.microsoft.com/exPress

ic#code develop

www.icsharpcode.net – Select #develop (SharpDevelop)

Microsoft Visual Studio

www.microsoft.com/visualstudio/en-us/default.mspx



VSTA within Revit

REVIT MANAGED DEBUG
(RvtMgdDbg)
“LIVE DEMO”

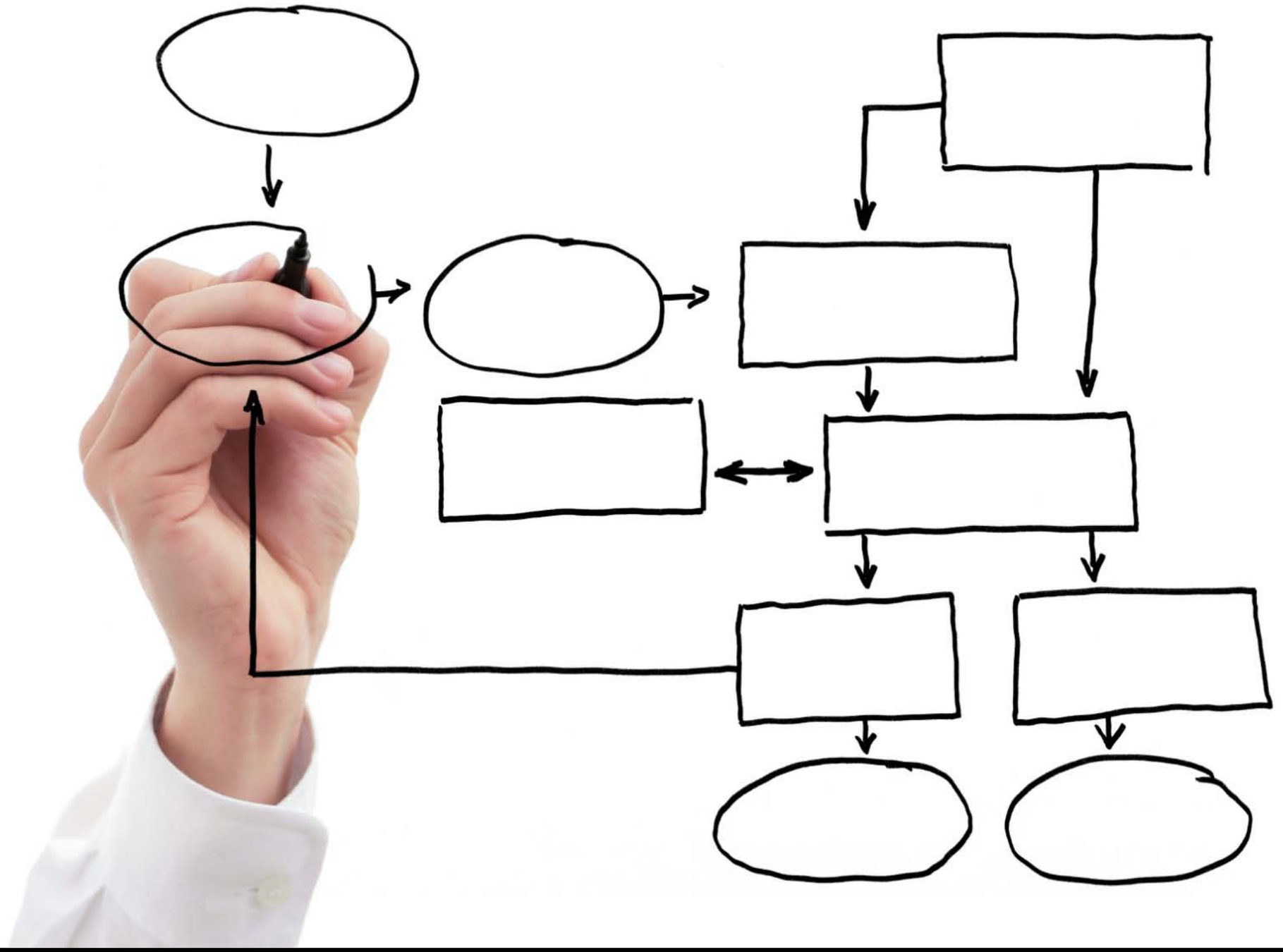
Start API work
and go from

STRUGGLE

to

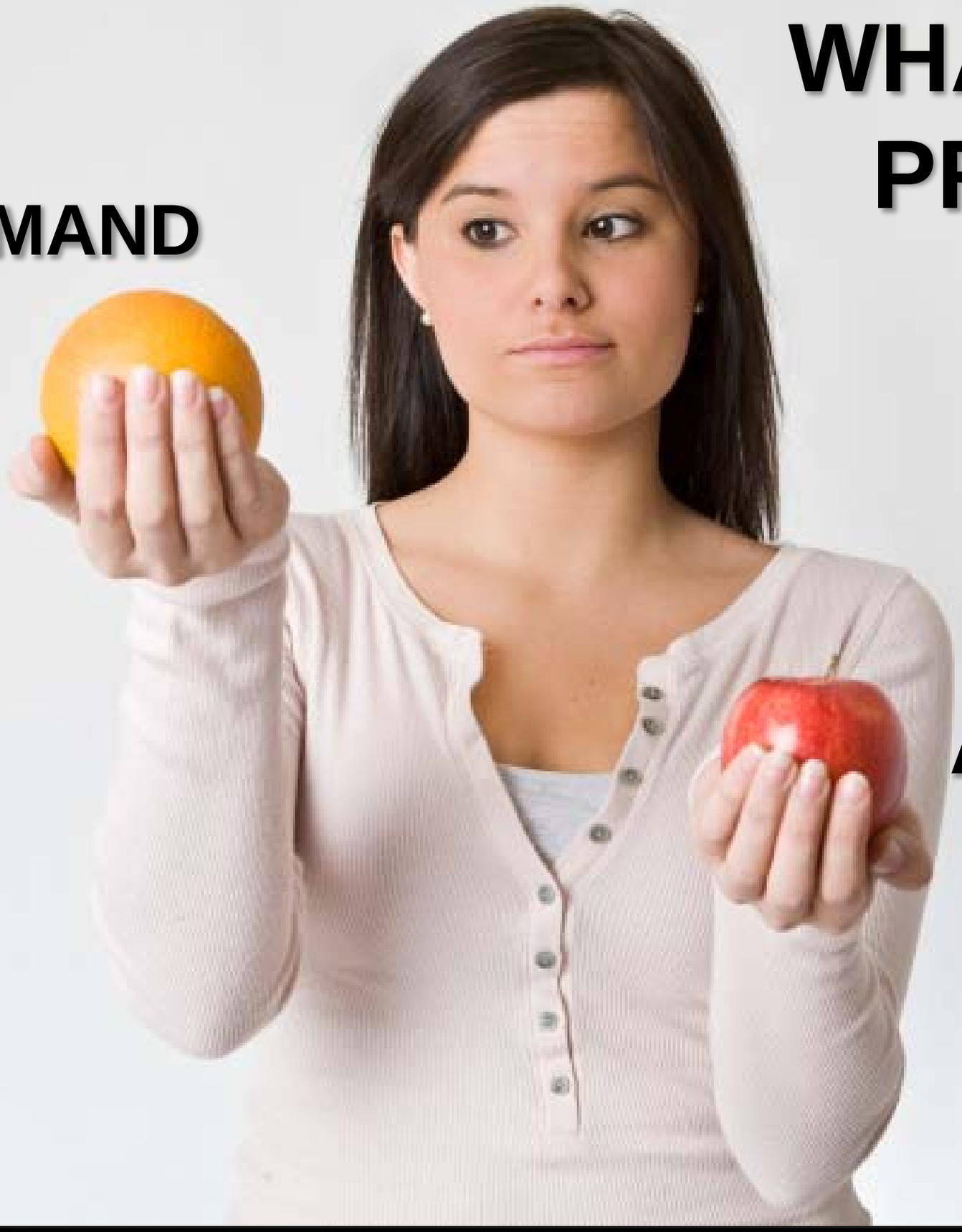
SUCCESS

PLAN
your project



WHAT TYPE OF PROGRAM?

COMMAND



APPLICATION

Predictability and Efficiency

- BENEFICIAL

Not just to you –
but to the project team

Courtesy of Phil Read - HNTB

Predictability and Efficiency

- BENEFICIAL
- EFFICIENT

Implementation and changes are fast and predictable

Courtesy of Phil Read - HNTB

Predictability and Efficiency

- BENEFICIAL
- EFFICIENT
- ELEGANT

Understood by the team and
any last minutes new members

Courtesy of Phil Read - HNTB

Predictability and Efficiency

- BENEFICIAL
- EFFICIENT
- ELEGANT
- REPETITIVE

Can be used on
many projects

Courtesy of Phil Read - HNTB

Predictability and Efficiency

- BENEFICIAL
- EFFICIENT
- ELEGANT
- REPETITIVE

Courtesy of Phil Read - HNTB

REVIT INI FILE EDIT
“LIVE DEMO”

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API How-To & Examples

External Commands

- **ECCount=(#Total Commands)**
  - This line should equal the total number of commands
- **ECClassName(# sequentially listed 1,2,3…)=AssemblyName.ClassName**
  - This is used to provide the name of your command object that supports the IExternalCommand interface.
- **ECAssembly(# sequentially listed 1,2,3…)= C:\(Tool Location)\Project.dll**
  - This is the location of the compiled .dll for use by Revit to run the command. The name of the .dll will match the name of your project which is the AssemblyName as shown above in the ECClassName. The location can be anywhere (local or network) as long as Revit can reconcile the location. Performance and access speed should be considered when deciding on a location.
- **ECName(# sequentially listed 1,2,3…)= “ProjectName”**
  - This name is what appears in the Revit Add-In Panel, External Tools menu.
- **ECDescription(# sequentially listed 1,2,3…)= “Extended Project Tool Name”**
  - This description is displayed in the status bar when you mouse over the menu item.

External Applications

- **EACount=(#Total Commands)**
  - This line should equal the total number of commands
- **EAClassName(# sequentially listed 1,2,3…)=AssemblyName.ClassName**
  - This is used to provide the name of your command object that supports the IExternalCommand interface.
- **EAAssembly(# sequentially listed 1,2,3…)= C:\(Tool Location)\Project.dll**
  - This is the location of the compiled .dll for use by Revit to run the command. The name of the .dll will match the name of your project which is the AssemblyName as shown above in the ECClassName. The location can be anywhere (local or network) as long as Revit can reconcile the location. Performance and access speed should be considered when deciding on a location.

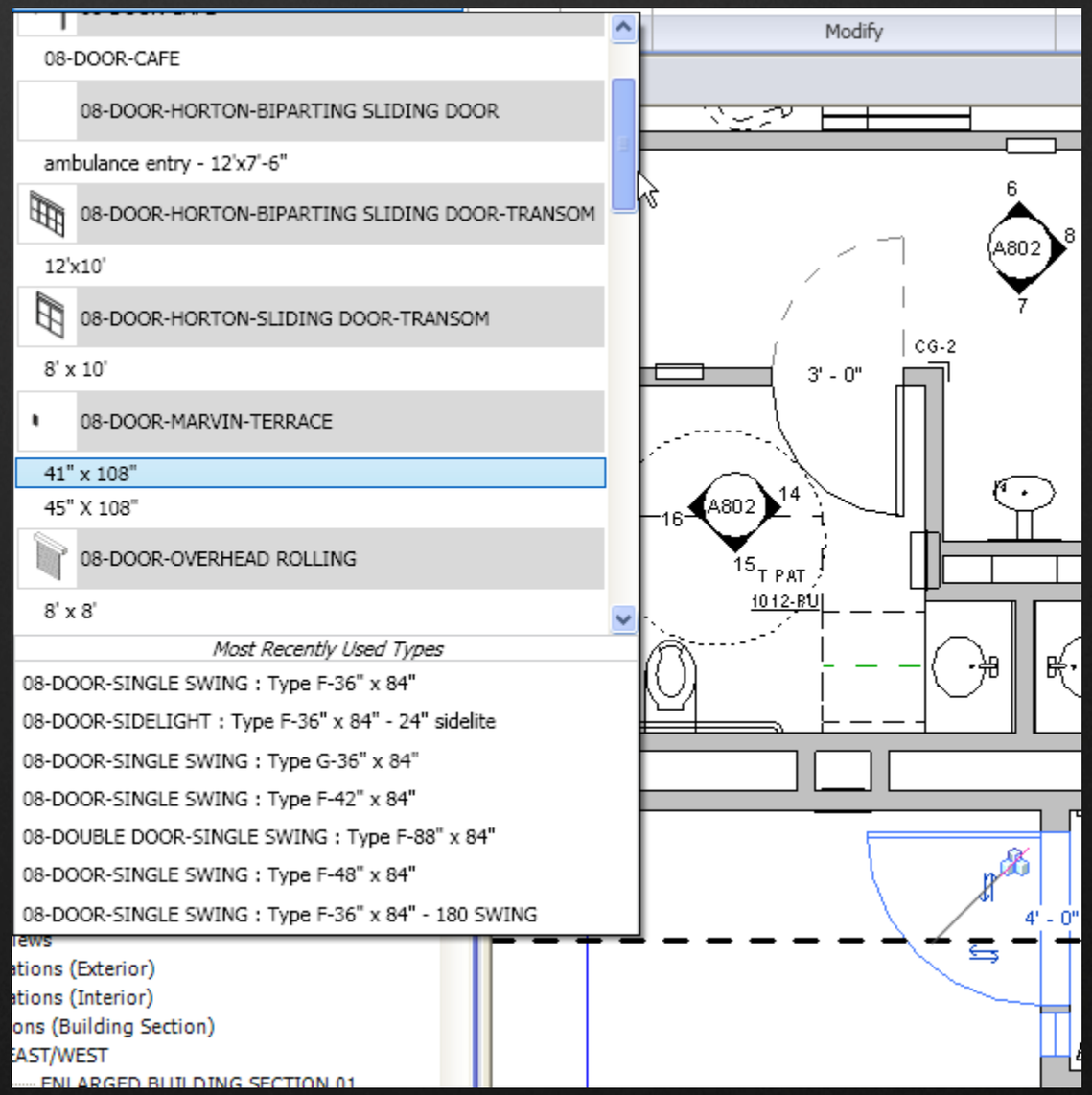
What have we done?

Example 1 – Family Naming Convention

- Purpose: *Control family names when multiple people are generating content.*

  - Organization by CSI Major Division

DIVISION 01	GENERAL REQUIREMENTS/GENERAL DATA
DIVISION 02	SITE CONSTRUCTION
DIVISION 03	CONCRETE
DIVISION 04	MASONRY
DIVISION 05	METALS
DIVISION 06	WOOD AND PLASTICS
DIVISION 07	THERMAL AND MOISTURE PROTECTION
DIVISION 08	DOORS AND WINDOWS
DIVISION 09	FINISHES
DIVISION 10	SPECIALTIES
DIVISION 11	EQUIPMENT
DIVISION 12	FURNISHINGS
DIVISION 13	SPECIAL CONSTRUCTION
DIVISION 14	CONVEYING SYSTEMS
DIVISION 15	MECHANICAL
DIVISION 16	ELECTRICAL



Example 2 – STC & OpenSavePage

PAYETTE

OPEN / SAVE PAGE

File Management Post

SAVE TO CENTRAL (STC)

- The more often you STC the less time it will take each time. This will also reduce the possibility of not having enough memory to STC.
- STC operations can be accelerated by pressing "Relinquish Latest" before the STC.
- If someone is STC and you attempt to STC you will be placed in a que. The last person to be placed in the que is the last that Revit selects to STC. Therefore, it is best if you continue working and try to STC in a few minutes.
- To improve model size and STC time it is best to have one team member "Compact File" on a regular basis. It is best if this individual is usually the last team member to leave each day.

AUDIT

It is best that at a minimum one team member Audit the Central File to check for and repair any errors that are in the file. Revit files are essentially a database and can become corrupt if not maintained.

SUPPORT

For the most efficient support it is best if you email the Helpdesk _Helpdesk@payette.com. We can also assist with any questions that you have about the Revit Best Practices.

Team Post

DEADLINES

SD (for estimate)	*11/07/2007 - complete*
DD (for estimate)	*09/17/2008 -complete*
25% CD (progress)	01/15/2009
50% CD (progress)	02/16/2009
75% CD (progress)	03/15/2009
90% CD (for estimate)	04/13/2009
CD (for bid)	05/15/2009

REVIT ISSUES

PLAN COORDINATION

- Review basement level walls / structure with SGH. Coordinate concrete wall locations on Wall Sections [A8.xx], then fix wall locations in South Wing Basement and East Wing Basement in Revit.
-

RCPs

- Review Electrical lighting drawings and coordinate
- A10 to provide an A08 in a dimmable version for Laser Lab and L2 Chemistry labs.(A08-D)
- A10 provided an A30 fixture, but none is located in Revit
- A10 provided an A35 fixture, but none is located in At research lab entrances in the south and east wings: In some A07 fixtures are located in some places and • A07-A fixtures in others. (South wing, L2 vs. south wing L3 for instance). Is this intentional?
- A10 to review 170 person auditorium; layout has changed [A6.04]
- A10 to review West wing chemistry labs, L1 & L2 and confirm that 3 will give us proper light levels. [A6.05 & A6.09]
- A10 to review Mini-connector, L1 design and comment on number of lights required [A6.05]
- A10 to review 65 person classroom layout [A6.06]
- A10 to review Connector L1 layout [A6.07]

Project Client
PROJECT NAME

Revit Best Practices

GENERAL GUIDELINES

In general, the following characteristics can affect performance:

- Complex Geometry
- Multiple Parametric Relationships
- Multiple Constraints
- Linked Files

ARRAYS

Arrays can be used to copy and associate objects together. After the array is deployed, performance may be improved by ungrouping the arrayed, removing the parametric association of the copied objects.

DESIGN OPTIONS

- Limit the use of rooms in design options to necessities to avoid additional processor time spent on detecting rooms option conflicts.
- Use separate models for variations of whole building setups.
- Preserve design options only as long as they are useful to the project. Even though options may not be active and visible, when changes are made within the main model all design options will update to maintain the model's consistency.
- Consider whether options should be presented long term in separate models which can be linked as needed.

DWG FILES

- Minimize the number of linked or imported DWG files.
- Avoid importing unnecessary data like hatching or AutoCAD specific linework such as construction lines. Delete unnecessary parts and layers of the DWG file within AutoCAD, run the overkill command to reduce lines and import only the cleaned DWG.
- Avoid exploding the geometry imported from DWG files. The exploding operation within Revit can change a DWG from a single managed element to thousands of additional elements.
- Only link essential DWG files into necessary views.
- Switch off visibility of 2D AutoCAD DWGs in perpendicular views. A 2D AutoCAD file linked into a plan view will show as cutback lines in elevation, causing performance degradation.

FAMILY CREATION

- Create a family component instead of in-place families for repetitive components. When an in-place family is copied (which may itself be problematic), it makes an entirely new entity each time.
- Limit the use of detailed nested parameterized families to necessities.
- Families require fewer resources than groups. Use families instead of groups, where possible. Groups are very powerful, but updating large quantities of group instances consumes significant computing resources.
- Where possible, avoid widespread use of voids in family geometry.
- Where possible, avoid arrays and formulas.
- Use symbolic lines and masking regions instead of geometry in plan views.
- Parametric families place a greater computational burden on the model than static families. Consider whether a family needs parametric flexibility and combine that flexibility to necessary adjustments.

IMPORTING & LINKING

- Unload links of all types if not used. Temporarily unload links if not needed in the view and reload them as required to limit memory resources necessary to open a project file.
- Large projects may benefit from breaking the model into separate project files and linking them into a single central file and assigning each model to a worker. Some typical options to divide a model include:
  - Separate Buildings
  - Building Shell
  - Building Core
  - Interiors

MODELING ECONOMICALLY

- When creating detail views, model hatches with filled regions not lines.
- Limit joined geometry to necessities.
- Remove unneeded area schemes.
- Avoid maintaining unnecessary groups. Delete unused groups from the project browser.
- Purge unused objects. Purged objects can not be recovered so confirm that families are saved or will not be needed in future phases before purging.
- Regularly review and fix warnings.

RASTER IMAGES

- Remove unneeded raster images and renderings. Raster images represent a performance and file size cost which should be minimized.
- Monochrome raster images are smaller than color images. Save black and white raster images as 1 bit per pixel format instead of JPG or TIF.
- Large raster images such as logos scaled down to fit into title blocks still retain the original file size. Consider creating a smaller, simplified image for import into Revit.

VIEWS

- Minimize view depth where possible in elevation, plan and section views.
- Consider back clipping 3D views to reduce the quantity of geometry maintained in active. "Off" for view properties, For Clip Offset and set the distance from the view camera to the desired view depth.
- Use section boxes to limit the visible geometry when working in a 3D view.
- Use "Wire frame" display mode when working in a linked file environment. "Wireframe" mode can be 3 times faster than "Hidden Line" or "Shading with Edges" modes.
- Avoid hiding large quantities of individual elements in views.
- Zoom in to speed up drawing and snapping.
- Close unnecessary views when working in a 3D view.
- Revit will update all currently open views affected by the changes to the model. It is recommended to close unneeded views to improve performance.

WORKSETS

- Use selective workset opening when opening a Revit Workshared Project.
- Close worksets not required for a given editing session.

Purpose: *Synchronize with Central cancels unless view is on Open/Save Page.*

Example 2 – STC & OpenSavePage

This example utilizes C#

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Windows.Forms;
using Autodesk.Revit;
using Autodesk.Revit.Events;

namespace Payette.Revit.SDK
```

Example 2 – STC & OpenSavePage

```
{
    public class OpenSaveCheck : IExternalApplication

    {

        public IExternalApplication.Result
     OnShutdown(ControlledApplication application)
    {
        return IExternalApplication.Result.Succeeded;
    }
```

Example 2 – STC & OpenSavePage

```
public IExternalApplication.Result OnStartup(ControlledApplication application)
        {
            try
            {
            // Registering Events
           application.DocumentSynchronizingWithCentral += new EventHandler
          <Autodesk.Revit.Events.DocumentSynchronizingWithCentralEventArgs>
       (app_SWC);
            }
            catch (Exception)
            {
                return IExternalApplication.Result.Failed;
            }
            return IExternalApplication.Result.Succeeded;
        }
```

Example 2 – STC & OpenSavePage

```
public void app_SWC(object sender,
  DocumentSynchronizingWithCentralEventArgs swcArgs)
      {
          Document doc = swcArgs.Document;
          Autodesk.Revit.Elements.View m_view = doc.ActiveView;
      {
          if (m_view.Name != "OpenSavePage")
          {
            //cancel the Synchronize With Central process
            swcArgs.Cancel = true;
            MessageBox.Show("Synchronize With Central Cancelled -
            Activate the OpenSavePage to Synchronize With the Central
            Database.");
          }
```

Example – KR+H Cabinet Makers

www.cabinetmakers.com

VIDEO

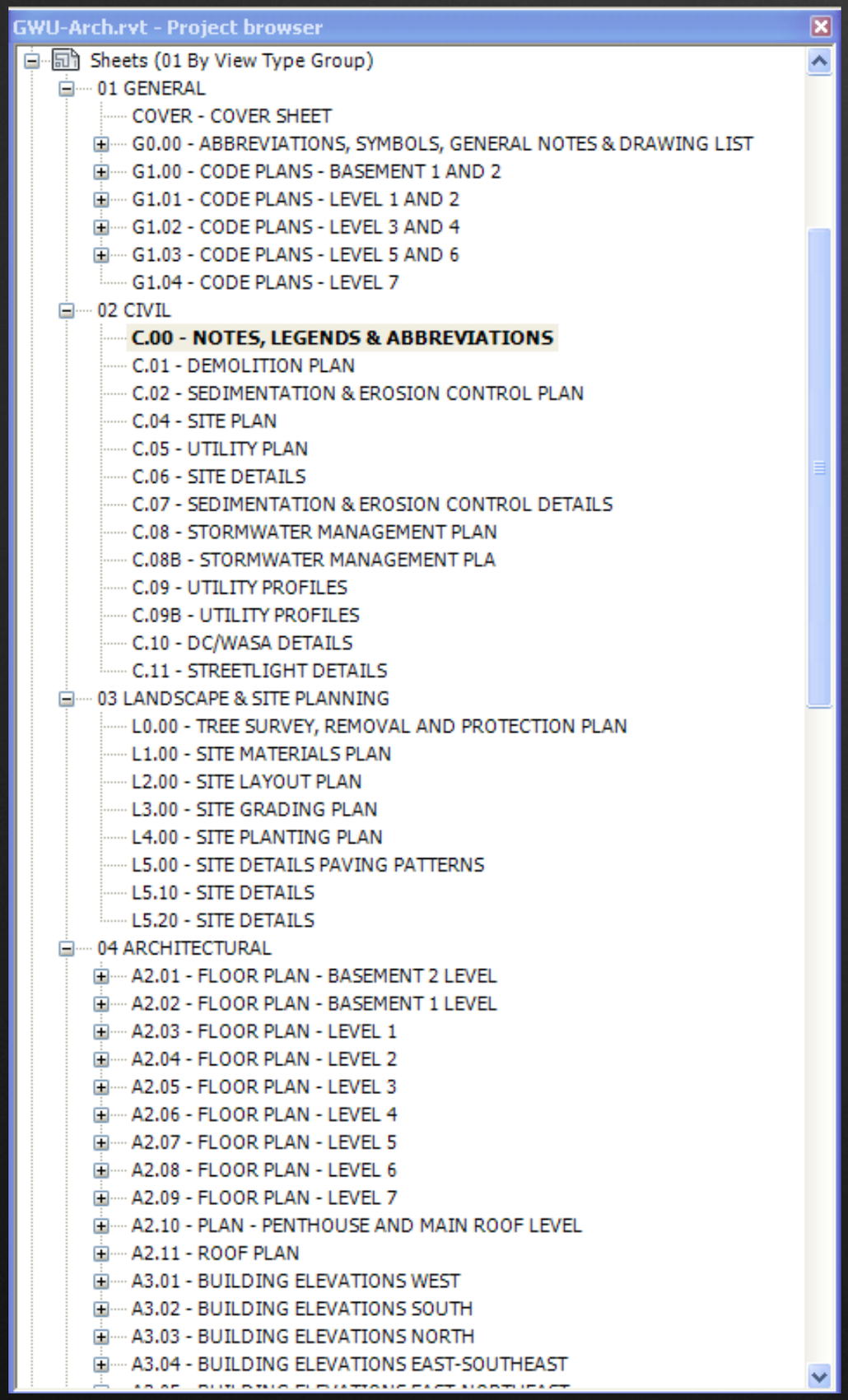
Example 3 – Door/Wall Fire Rating

- Purpose: *Set a doors fire rating based on the hosting walls Fire Rating*
- Rule of Thumb for a doors fire rating applies to ~95% of instances
  - Based on 2006 International Building Code®

Wall Fire Rating	Door Fire Rating
3 Hour	120 Minute
2 Hour	90 Minute
1 Hour	45 Minute
Smoke Partition	20 Minute

TABLE 715.4
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4 3 2 1½	3 3[a] 1½ 1½
Fire barriers having a required fire-resistance rating of 1 hour: Shaft, exit enclosure and exit passageway walls Other fire barriers	 1 1	 1 ¾
Fire partitions: Corridor walls Other fire partitions	 1 0.5 1 0.5	 1/3[b] 1/3[b] ¾ 1/3
Exterior walls	3 2 1	1½ 1½ ¾
Smoke barriers	1	1/3[b]



Example 4
Create Sheets

Purpose: *To reduce the time, frustration and clicks required to create numerous View Sheets.*

Additional API Ideas

- Add Fire Rating Line
- Export Settings
- Revisions on Sheets
- Room Data Sheets (RDBLink)
- All Elements in a Room
- Room/Area Creation
- Timer
- Write Errors to Journal
- Straighten lines off Axis
- Get Room Dimensions
- Reset Mark Values
- Center Room Object Tag
- Levels and Objects

AUGI Wish List 2009

- Advanced Text Editor
- Non-Vertical Walls
- Select All Instances in View
- Custom Elevation Tags
- Print Window Options
- Adjust Material Layer
- Hide Element in All Views
- Tagging Elements in Revit Link
- Photo Backgrounds in Rendering
- Automatic Consultant Sheets

AUGI Wish List 2009

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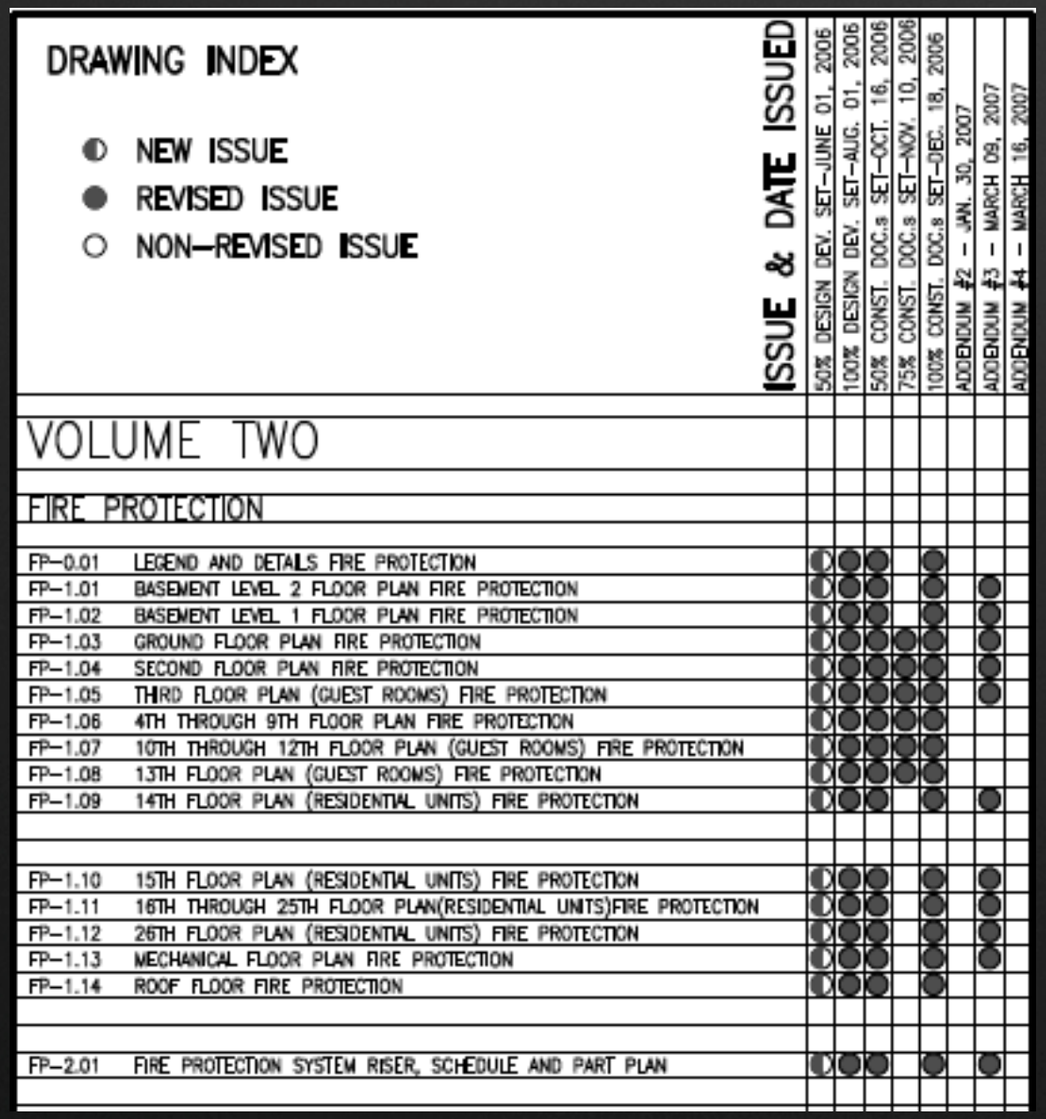
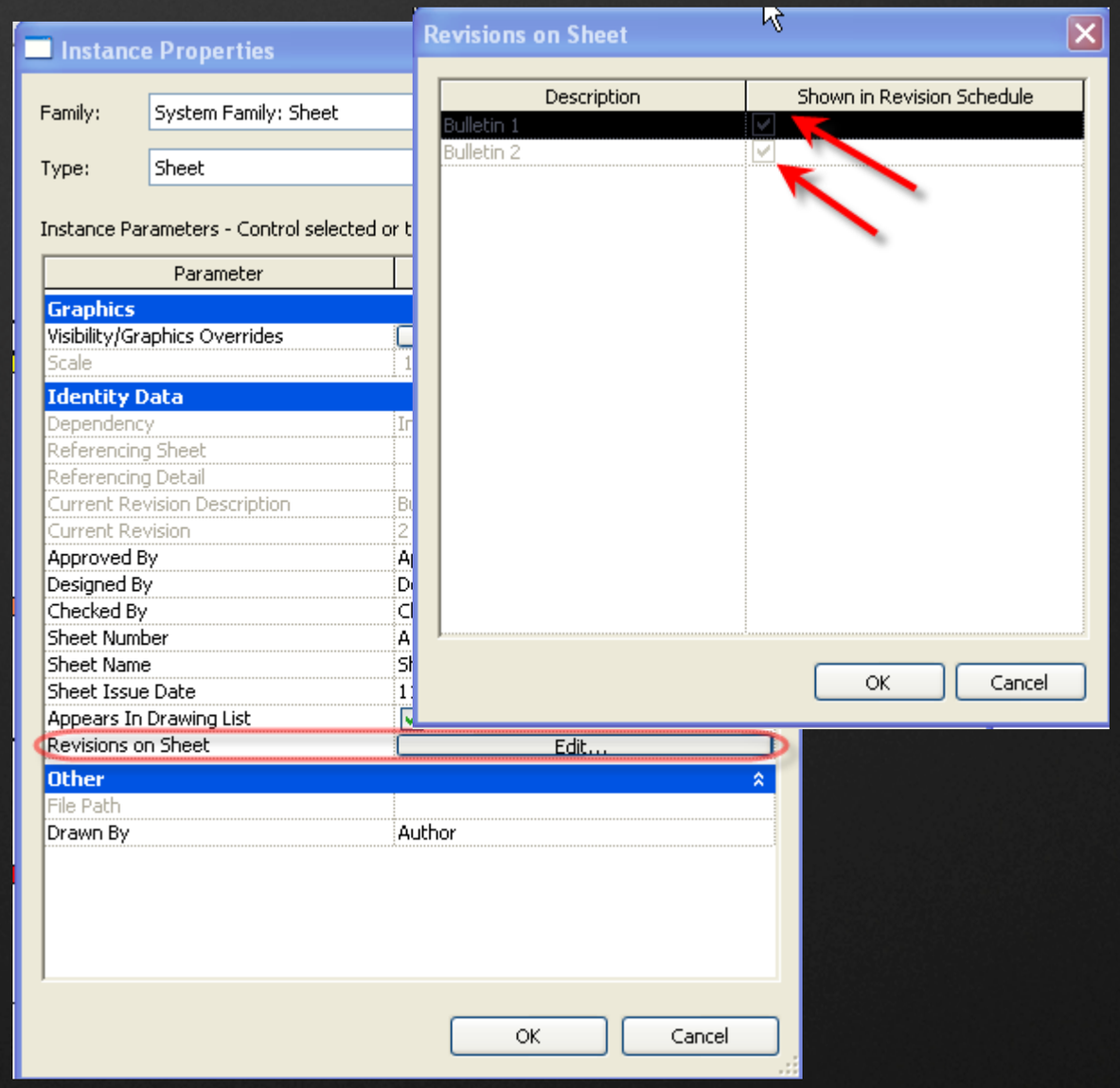
- Tagging Elements in Revit Link
- Photo Backgrounds in Rendering
- Automatic Consultant Sheets

Additional Ideas

- Graphic Revision Schedule





Additional Resources

- **Blogs**
  - The Building Coder by Jeremy Tammik
    - http://thebuildingcoder.typepad.com
  - Bolt out of the Red by Guy Robinson
    - http://redbolts.com/blog/
  - CAD Application Development by Matt Mason
    - http://cadappdev.blogspot.com/
  - Revit Programming by Ed Pitt
    - http://revit-programmer.blogspot.com

- **Forum**
  - Autodesk Users Group International – Revit API Forum
    - http://forums.augi.com/forumdisplay.php?f=218

I will also be posting information and downloads on the AU site and at http://jasongrant.squarespace.com/

API FUN
HARRY MATTISON
EXAMPLES
“LIVE DEMO”

Announcements

- **Next Meeting**
  - Mid March

  - Topics being Discussed
    - Revit 101
    - What’s New in 2011
    - Revit Templates
    - Revit in the Construction Process
    - Sharing Models among Consultants