

Autodesk AEC Developer's Camp 2010

What's New in the Revit 2011 API

Anthony A. Hauck
Revit Product Line Manager

Agenda

- Who am I?
- Who are you?
- Introduction to the Revit API
- Useful Development Tools
- Revit 2011 API
 - The Rice (must do)
 - The Wine (value add)

Interspersed with Relevant API Demonstrations &
Other Items of Interest to the Developer

Who am I?

Anthony A. Hauck (formerly known as “Emile Kfourri 2.0”)

- 24 years in AEC
 - 10 years as an architect and subcontractor
 - 12 years as Software Developer and IT Director for a large AE firm
- Member of ADN from 1996 - 2007
- Joined Autodesk in November 2007 as **Revit Platform Manager**
- Became **Revit Product Line Manager** in June 2009

Who are you?

- .NET Developers?
- Developed for another Autodesk product?
- Thinking about developing for Revit?
- Developing for Revit?
- Completed one or more Revit applications?
- Commercial developers?
- Corporate developers?
- VSTA Developers?

Revit 2011 API Demo

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Revit API Capabilities

Data Access

- Model Elements
 - Selection Filtering:
 - Create / Add / Delete
- Conceptual Modeling
- Geometry
- Parameters
- Analytic Models

Integration

- Revit User Interfaces
- Respond to Revit Events
- Embedded IDE

Automation

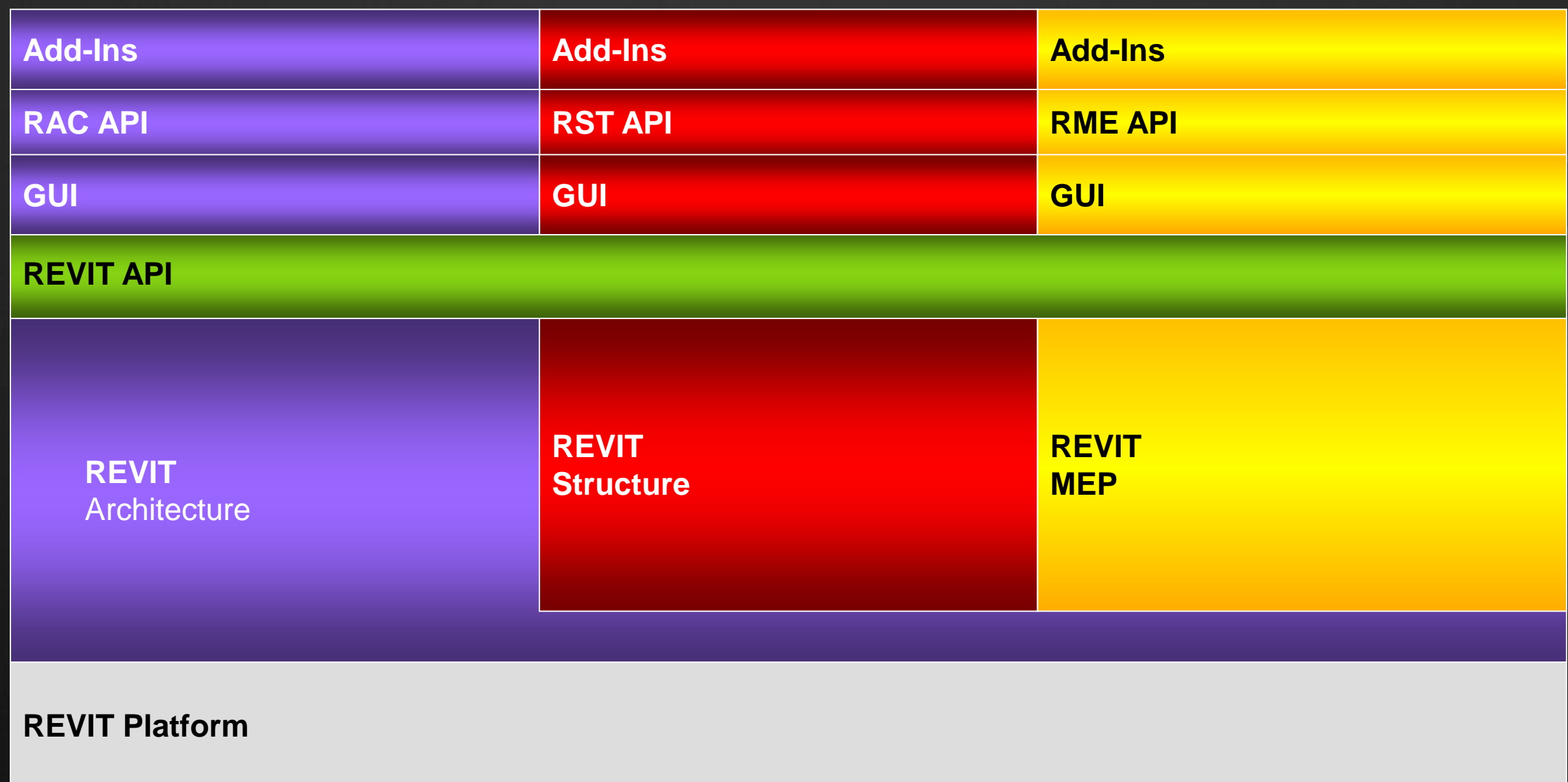
- Project Documentation
- Repetitive or Tedious Tasks
- Model Generation
- Model Analysis

Linkages

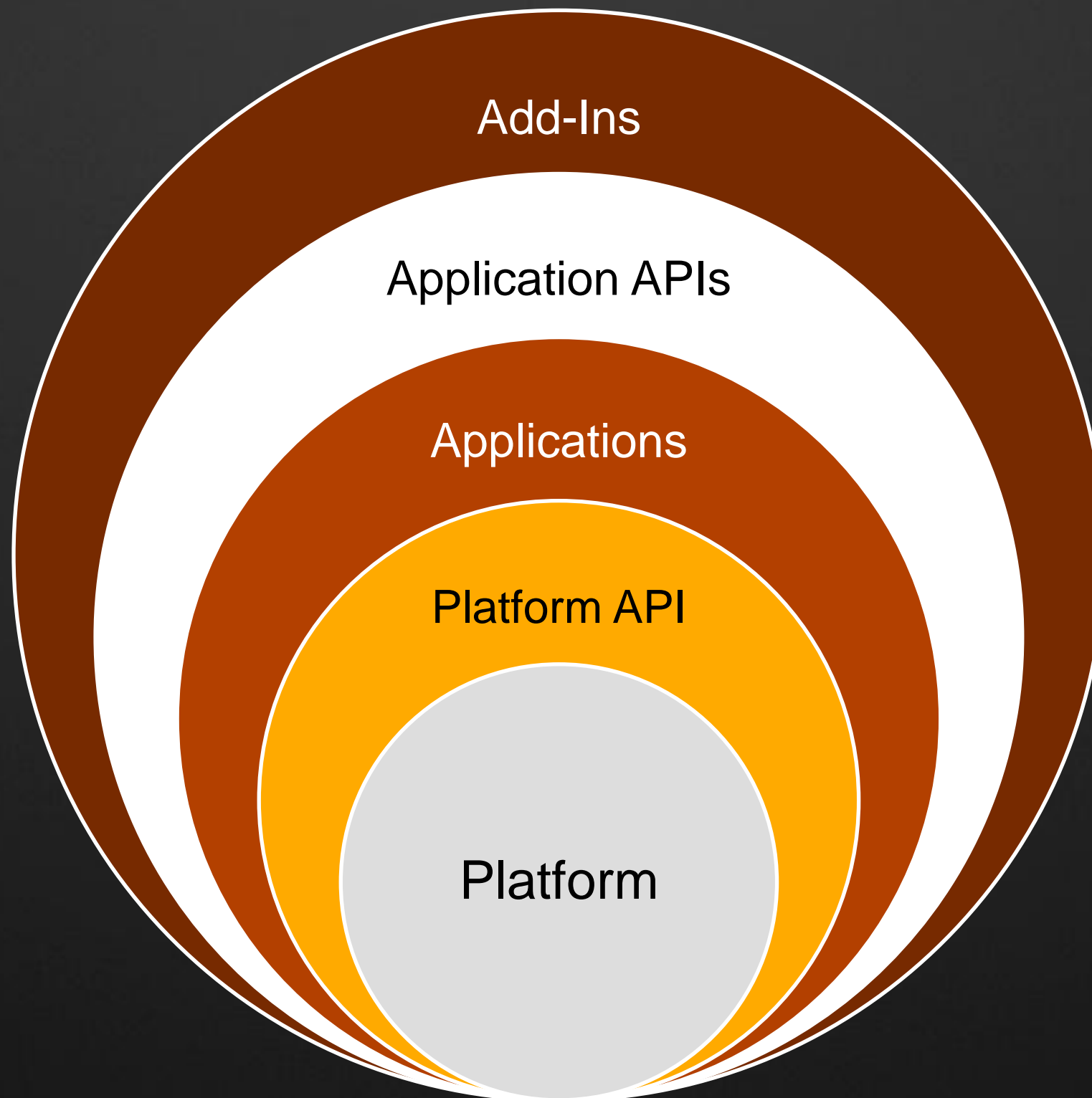
- Analysis Applications
- External Databases

Revit API Design Transition

- API Applied to Products
- GUI Rooted in Products



Revit API Design Concept



Revit API Design Goal

- API-Centric Development
- API Indistinguishable from GUI
- All Verticals Using the API

GUI	Add-Ins	GUI	Add-Ins	GUI	Add-Ins
Revit Architecture API		Revit Structure API		Revit MEP API	
REVIT Architecture		REVIT Structure		REVIT MEP	
Platform API					
REVIT Platform					

Revit API Development

Five Rules:

- Learn Revit
- It's not AutoCAD
- Spend the Time: 2 weeks to begin
- Start Early: 90% is better than 0%
- Never Give Up, Never Surrender!



Revit API Development: **Getting Started**

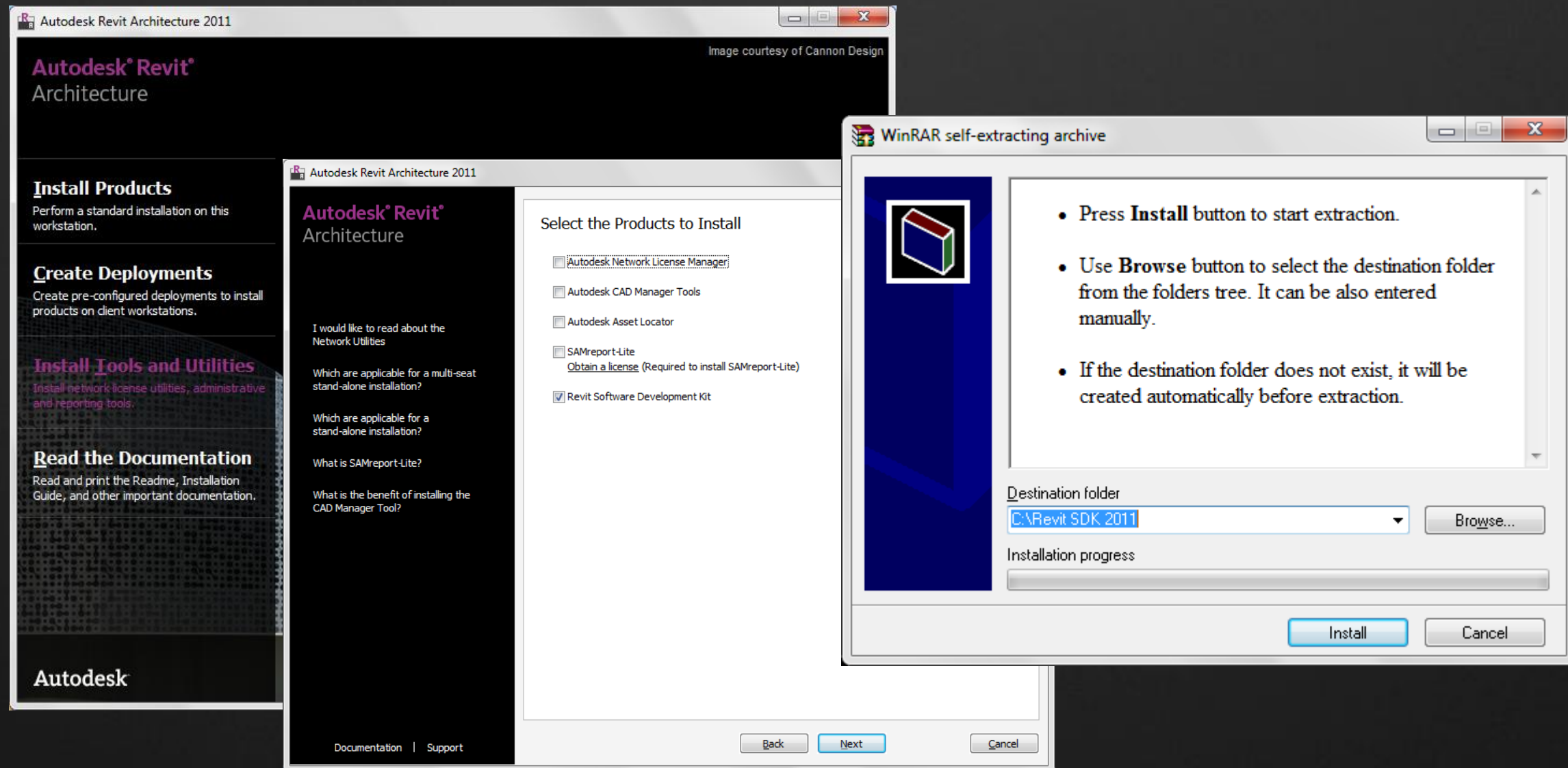
- Revit Architecture, Revit Structure or Revit MEP
- Familiarity with the target Revit application

Install from Revit DVD: Install Separate IDE:

Macros Visual Studio Tools for Applications	External Applications & Commands MS Visual Studio 2008 or Express
REVIT SDK	
VSTA Documentation	API Documentation
VSTA Samples	API Samples

Revit API Development: Getting Started

Revit SDK:



<http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=2484975>

Revit API Development: Getting Started

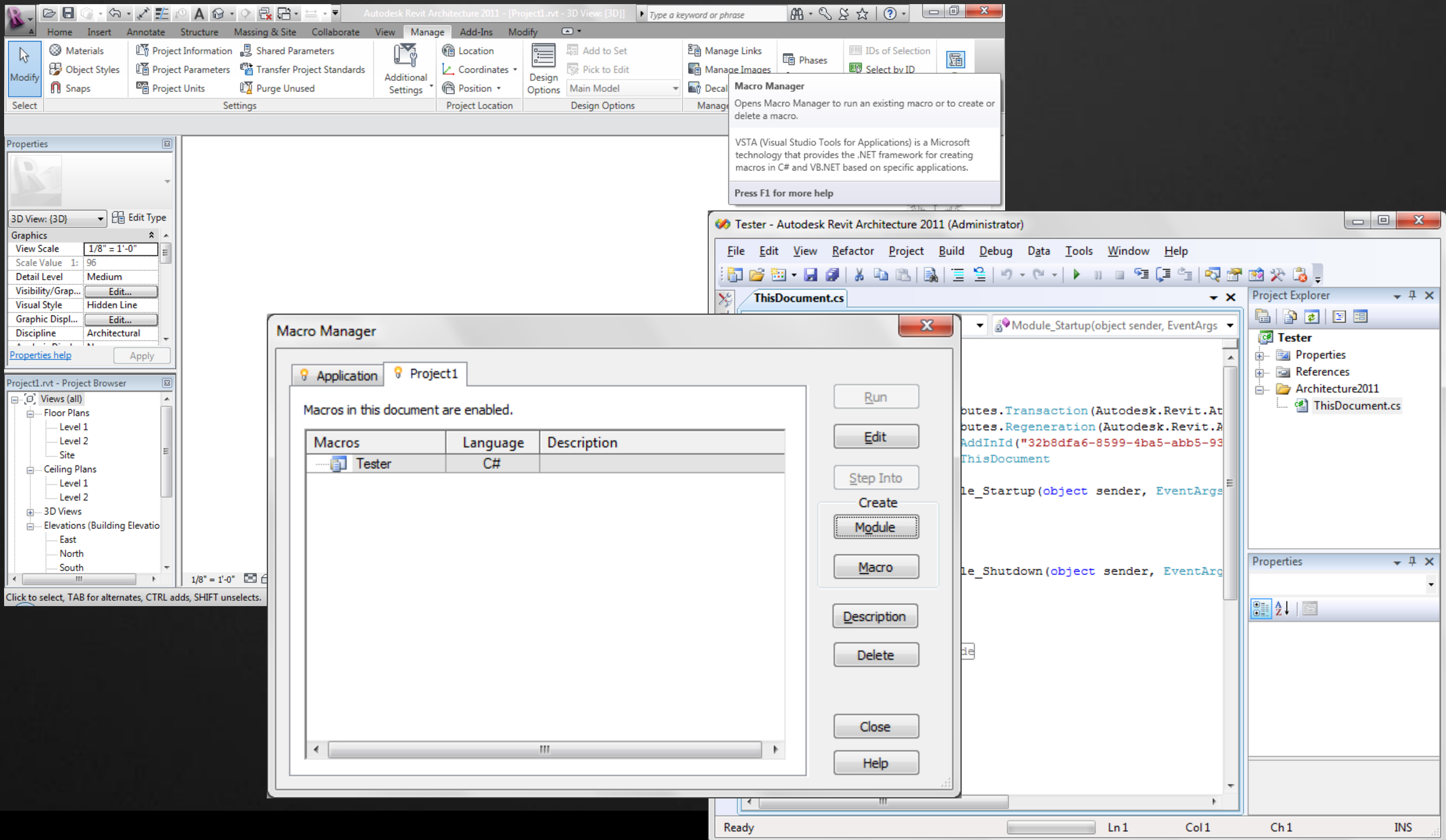
- .NET 3.5
 - Reference:
 - \<Revit Folder>\Program\RevitAPI.dll
 - \<Revit Folder>\Program\RevitUIAPI.dll
- All Revit products expose the same .NET object model
 - Identical DLLs
 - Application-Specific Functionality
- Documentation:
 - Revit SDK Folder
 - [The Building Coder](#)

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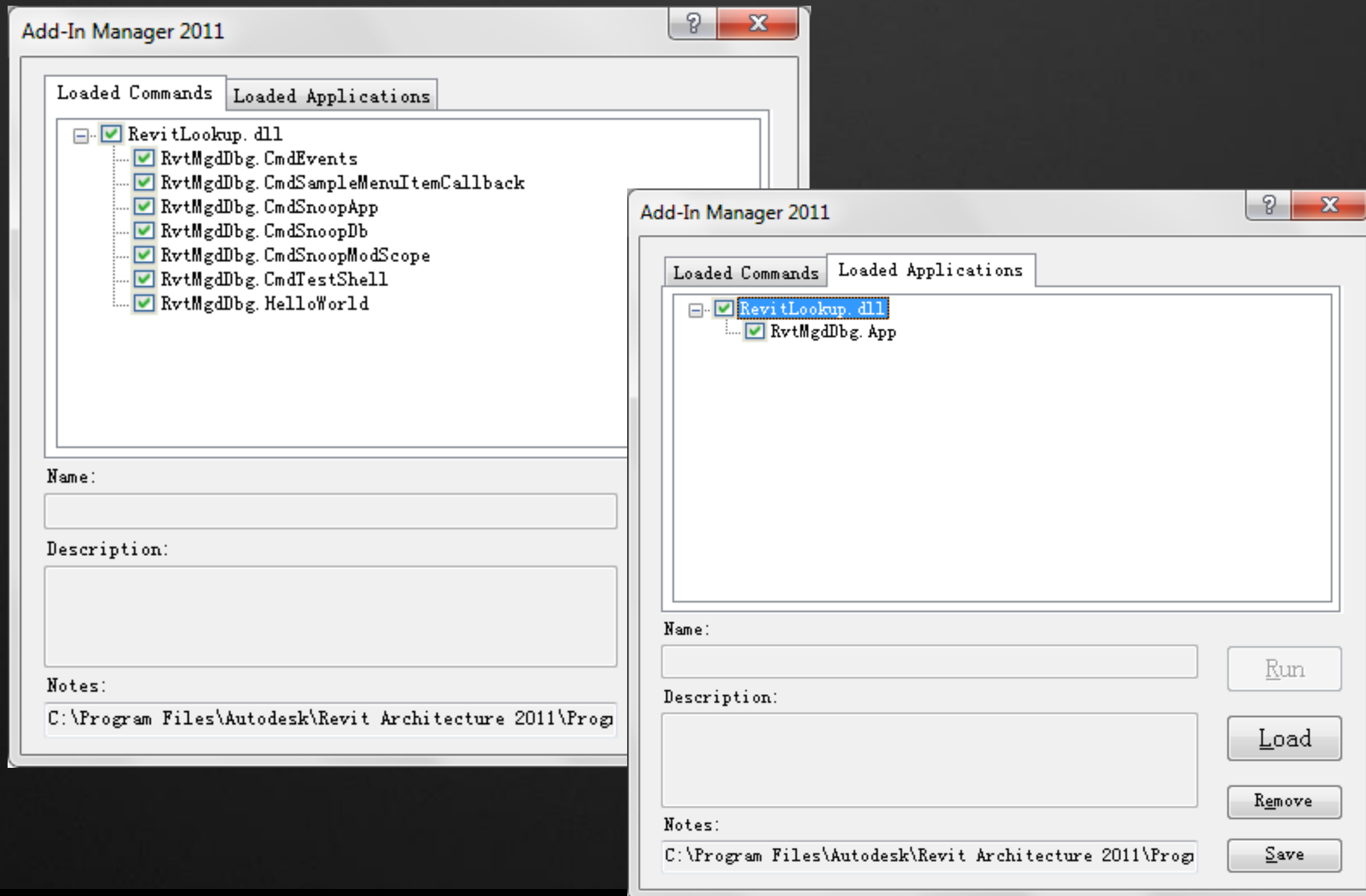
Interspersed with Relevant API Demonstrations &
Other Items of Interest to the Developer

VSTA is *your* friend:



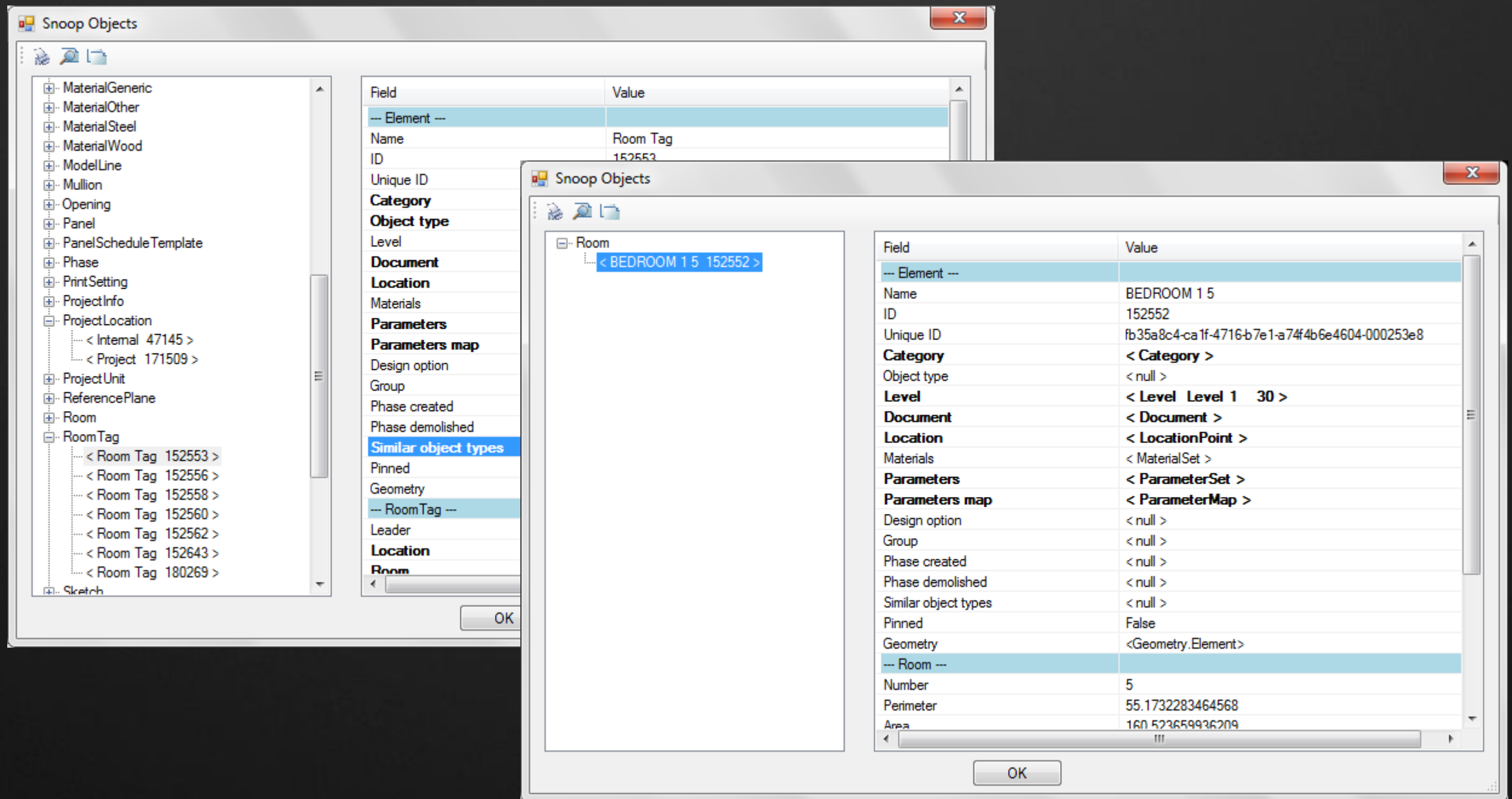
Revit API Development: Useful Development Tools

Add-In Manager is *your friend*:



Revit API Development: Useful Development Tools

Revit Lookup is *your friend*:



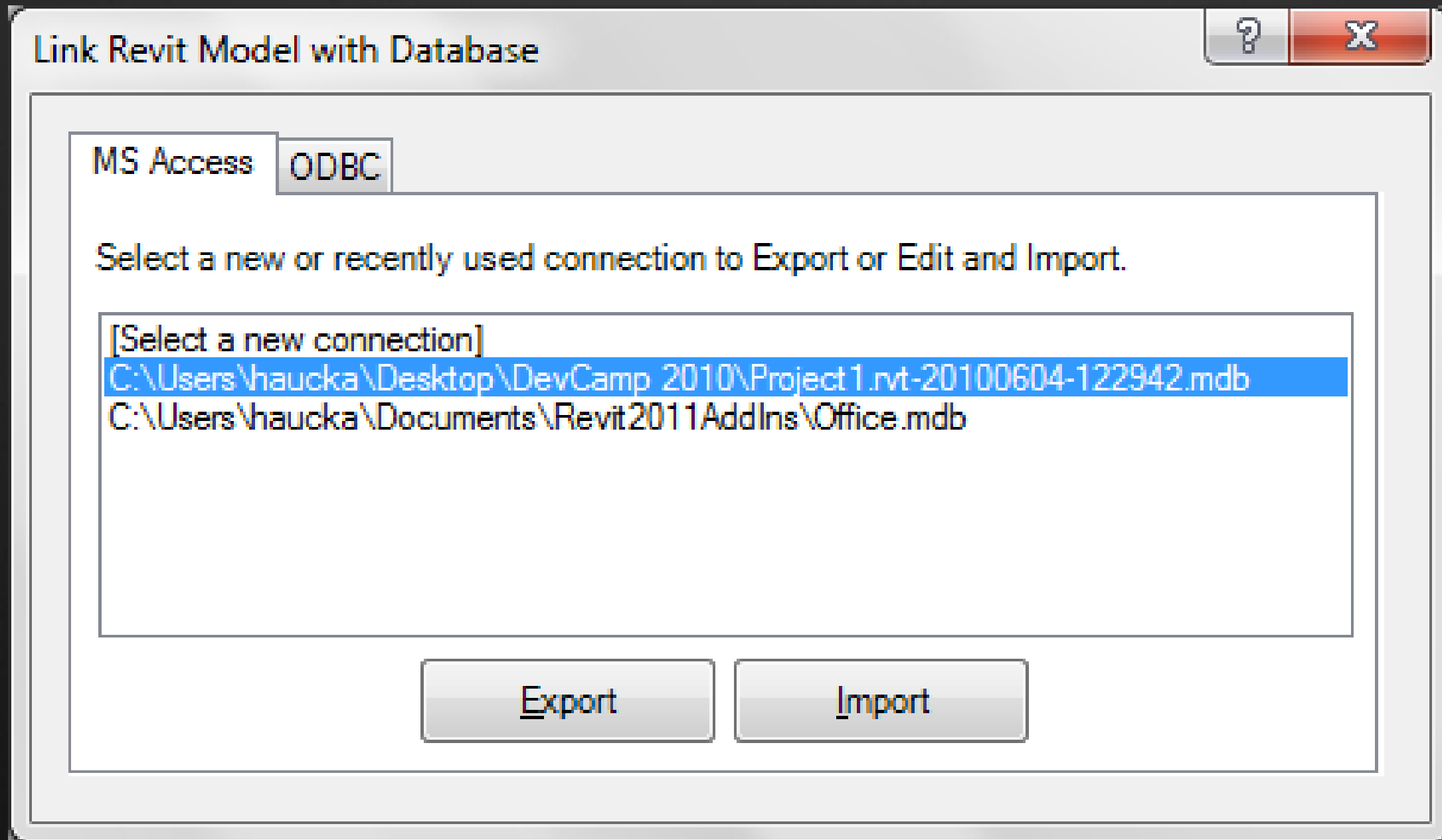
Revit API Development: Useful Development Tools

Events Monitor is *your friend*:

Events History		
Time	Event	Type
6/4/2010 9:44:07 AM	DocumentCreating	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:44:12 AM	ViewActivating	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:44:12 AM	ViewActivated	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:44:42 AM	ViewActivating	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:44:42 AM	ViewActivated	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:45:12 AM	DocumentSaving	Autodesk.Revit.ApplicationServices.A...
6/4/2010 9:45:16 AM	DocumentSaving	Autodesk.Revit.ApplicationServices.A...

Revit API Development: Useful Development Tools

Revit DB Link is *your friend*:



Revit 2011 API Demo

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Developer Reaction

“YEEEEEE HHHAAAAAA!!!!!!!”

... For now I just want to congratulate the Factory and in particular the API team for a massive, exciting and compelling release. And those words don't do it justice.”

- Guy Robinson

<http://redbolts.com/blog/post/2010/03/25/Yeah-Baby!!-Revit-2011-API-e28093-the-unofficial-4th-Discipline.aspx>

APIs and Porting



The Rice

- Making sure your application runs
- Steps to support the next release



The Wine

- Opportunities to add value
- Using the new features and APIs to increase the value of your products.

APIs and Porting



The Dog Food

- Eating our own API changes
 - **Revit Extensions Team:**
 - 36 extensions
 - Pure migration = 42 person/days
 - Estimated 4 person/days testing
 - **Robot Structural Analysis Team :**
 - Link to RSA
 - Pure migration = 2 person/days
 - Estimated 1 person/days testing
 - **RSA Concrete Team :**
 - 3 extensions
 - Pure migration = 5 person/days
 - Estimated 1 person/day of testing

**1 to 2 days to migrate
an Extension**

**Your mileage
may vary**

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What's with all the Rice?

The Rice



- Changes to Revit API Namespaces
- New Classes for XYZ, UV, and ElementId
- Replacement for Symbol
- New Transaction Interfaces
- New Element Iteration Interfaces
- Replacement for AnalyticalModel
- Replacement for gbXMLParamElem
- Revit Exceptions
- Removed Deprecated Events
- VSTA Proxy Removal
- Some Function Signature Changes

The Rice – Changes to Revit API Namespaces



Revit 2011 divides the API into three primary namespaces:

- Autodesk.Revit.ApplicationServices
 - Classes accessing application settings and options
- Autodesk.Revit.DB
 - Classes accessing file data
- Autodesk.Revit.UI
 - Classes accessing or customizing the user interface

The Rice – DLL Split



- RevitAPI.dll (DB)
- RevitAPIUI.dll (UI)

The Rice – Changes to Revit API Namespaces



Each namespace has discipline subdivisions, e.g:

- Autodesk.Revit.DB.Architecture
- Autodesk.Revit.DB.Structure
- Autodesk.Revit.DB.Mechanical
- Autodesk.Revit.DB.Electrical
- Autodesk.Revit.DB.Plumbing
- Etc.

The Rice – Set Regeneration Option



Registered Commands and Applications must explicitly set a Regeneration Option:

- `RegenerationOption Automatic`:
 - The API framework will regenerate after every model level change. **It is obsolete and will be removed in a future release.**
- `RegenerationOption Manual`:
 - Regeneration may be triggered by your application. **SuspendUpdating blocks are unnecessary and should not be used.**

Revit 2011 API Code

The Rice – New classes for XYZ, UV, and ElementId



- Autodesk.Revit.DB.XYZ
- Autodesk.Revit.DB.UV
- Autodesk.Revit.DB.ElementId
 - Implemented in managed code
 - Suitable for properties
 - API methods have been converted to accept
 - Methods now take .NET collections interfaces containing these types:
 - Autodesk.Revit.ElementIdSet -> ICollection<Autodesk.Revit.DB.ElementId>
 - Autodesk.Revit.Geometry.XYZArray -> IList<Autodesk.Revit.DB.XYZ>
 - Autodesk.Revit.Geometry.UVArray -> IList<Autodesk.Revit.DB.UV>
- ElementId is now **a class instead of a struct** and should not be passed by reference.

The Rice – Replacement for Symbol



- The Symbol class has been renamed to:
 - **ElementType**
- New methods to identify and find similar types that can replace the element.

The Rice – New Transaction Interfaces



- Transaction – no nesting
- Subtransaction – can be nested
- TransactionGroup – treat several transactions as one
- Transaction Control:
 - Start
 - Commit
 - RollBack
 - GetStatus
 - Uninitialized
 - Started
 - Committed
 - RolledBack
 - Pending

The Rice – New Element Iteration Interfaces



- Iterate and filter elements from a document, or only elements from a list of element ids
- High performance filters which do not expand the element in memory for evaluation
- Chained shortcuts which apply common filters
- Group more than two filters.
- Match derived types automatically with the type filter
- Iterate elements from all design options or from specific design options.
- Use foreach on the collector element
- LINQ query compatible.

Revit 2011 API Demo

The Rice – Changes to AnalyticalModel



The following AnalyticalModel subclasses have been removed:

- AnalyticalModel3D
- AnalyticalModelFloor
- AnalyticalModelFrame
- AnalyticalModelLocation
- AnalyticalModelWall
- Replacement functions can now be found on the base class AnalyticalModel.

The Rice – Changes to AnalyticalModel



- AnalyticalModel offers:
 - Manual and automatic adjustments
 - Projection, hard points, approximation, and rigid links
 - Analytical offset
- AnalyticalModelProfile has been replaced by AnalyticalModelSweptProfile
- AnalyticalSupportData and AnalyticalSupportInfo are now collections of AnalyticalModelSupport objects.
 - Support priority
 - Curve, point, and face providing support
- GetAnalyticalModel() on Element.

The Rice – Replacement for gbXMLParamElem



gbXMLParamElem property

BuildingService
BuildingType
ExportComplexity
GroundPlane

ProjectLocation

ProjectPhase

EnergyDataSettings property

ServiceType
BuildingType
ExportComplexity
GroundPlane

ProjectGeographicLocationString

ProjectPhase

The Rice – Revit Exceptions



- API methods throw subclasses of Autodesk.Revit.Exceptions.ApplicationException.
- Similar to .NET System Exceptions:
 - ArgumentException
 - InvalidOperationException
 - FileNotFoundExceptions
- Some subclasses unique to Revit, e.g:
 - AutoJoinFailedException
 - RegenerationFailedException
 - ModificationOutsideTransactionException
- InternalException:
 - Contains extra diagnostic information which can be passed back to Autodesk for diagnosis.

The Rice – Deprecated Event Removal



- `Application.OnDocumentSaved`
- `Application.OnDocumentSavedAs`
- `Application.OnDocumentOpened`
- `Application.OnDocumentClosed`
- `Application.OnDocumentNewed`
- `Application.OnDialogBox`
- `Document.OnSaveAs`
- `Document.OnSave`
- `Document.OnClose`

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The Wine – New APIs



- Selection
- Dynamic Update
- OnIdle Event
- Command Registration
- Error Handling
- Analysis Visualization
- Conduit & Cable Tray
- UI API Enhancements
- Task Dialogs
- ...and more!

The Wine – Selection



Selection.PickPoint()

- Select a point on the active sketch plane
- Snap overrides

View.SketchPlane

- Set the active sketch plane

Selection.PickObject

Selection.PickObjects

- Users can make one or multiple selections
- Users can make multiple selections via box select
- Custom status prompt
- Custom selection filter

The Wine – Dynamic Model Update



Element Events

- Track by type, or particular elements
- Added
- Changed
- Deleted

Model Edit on Event

- Within the same regeneration cycle
- Undo with triggering operation

Revit 2011 API Demo

The Wine – OnIdle Event



Application.Idling

- Raised when the API application can safely access the active document between user interactions.
- Allows changes to the document if a new transaction is opened.
- User perception of Revit responsiveness will be improved by splitting tasks across multiple event calls

Revit 2011 API Demo

The Wine – Command Registration



- The Revit API now offers the ability to register API applications via a .addin manifest file.
- Multiple AddIn elements may be provided in a single manifest file.
- The new mechanism currently offers the following XML tags:
 - Assembly
 - ClientId
 - Text
 - Description
- The Revit.ini registration mechanism remains in place for the 2011 release but will be removed in the future.

The Wine – Command Registration



- Create entries in the Revit journal
 - **JournalMode.UsingCommandData**
Uses the “StringStringMap” supplied in the command data. Hides all Revit journal entries in between the external command invocation and the StringStringMap entry.
 - **JournalMode.NoCommandData**
Does not write contents of the ExternalCommandData.Data map to the Revit journal. Allows Revit API calls to write to the journal as needed. This option should allow commands which invoke the Revit UI for selection or for responses to task dialogs to replay correctly.

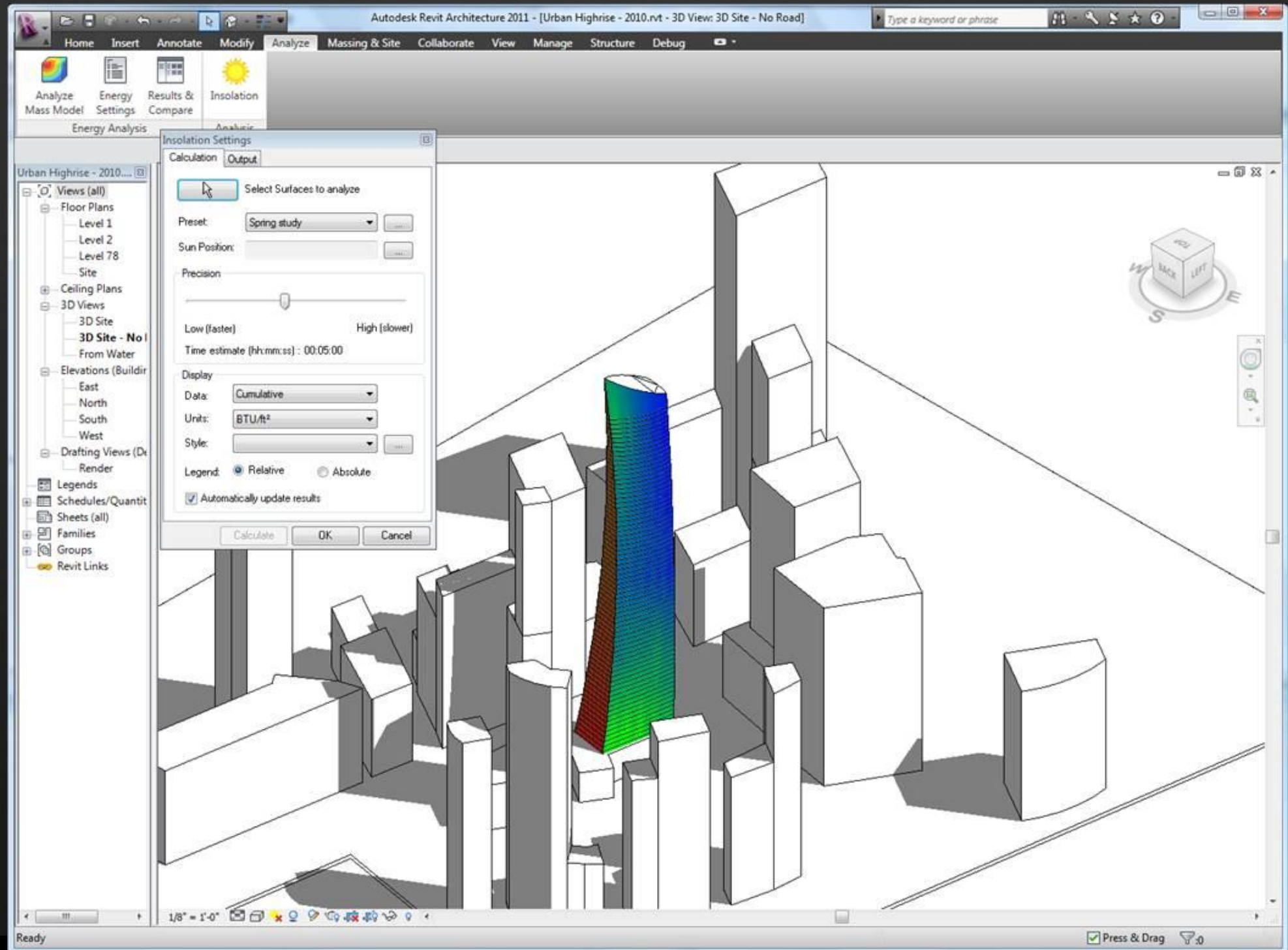
Revit 2011 API Demo

The Wine – Error Handling API



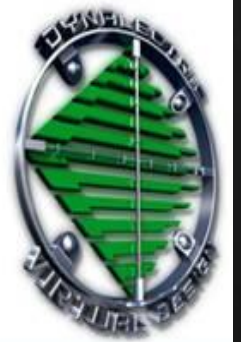
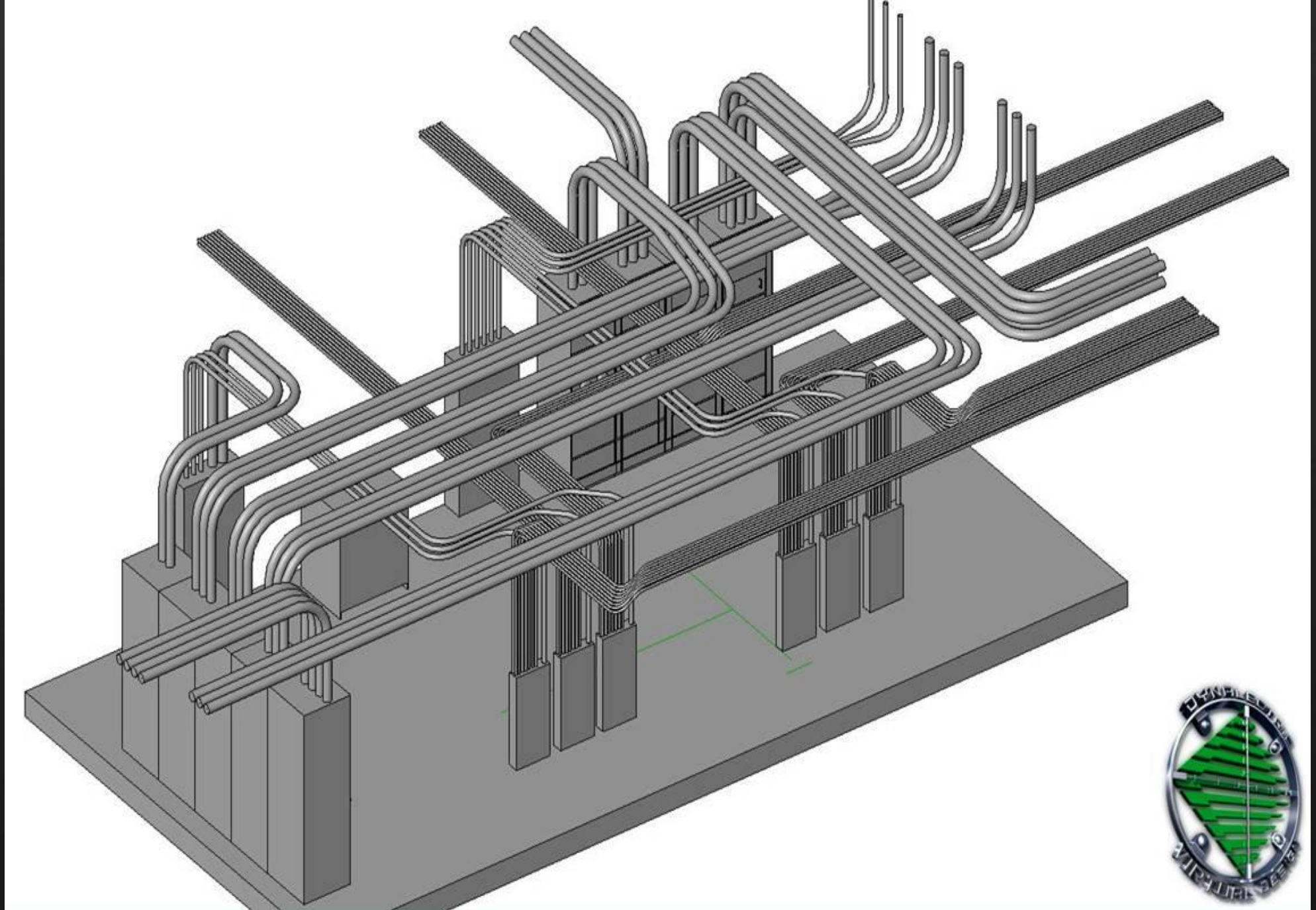
- Define Posted Errors
- Custom Messages
- Error Resolution Callbacks
- Filter Revit Errors
- Resolve Errors
- Suppress Warnings

The Wine – Analysis Visualization



Revit 2011 API Demo

The Wine – MEP Conduit and Cable Tray

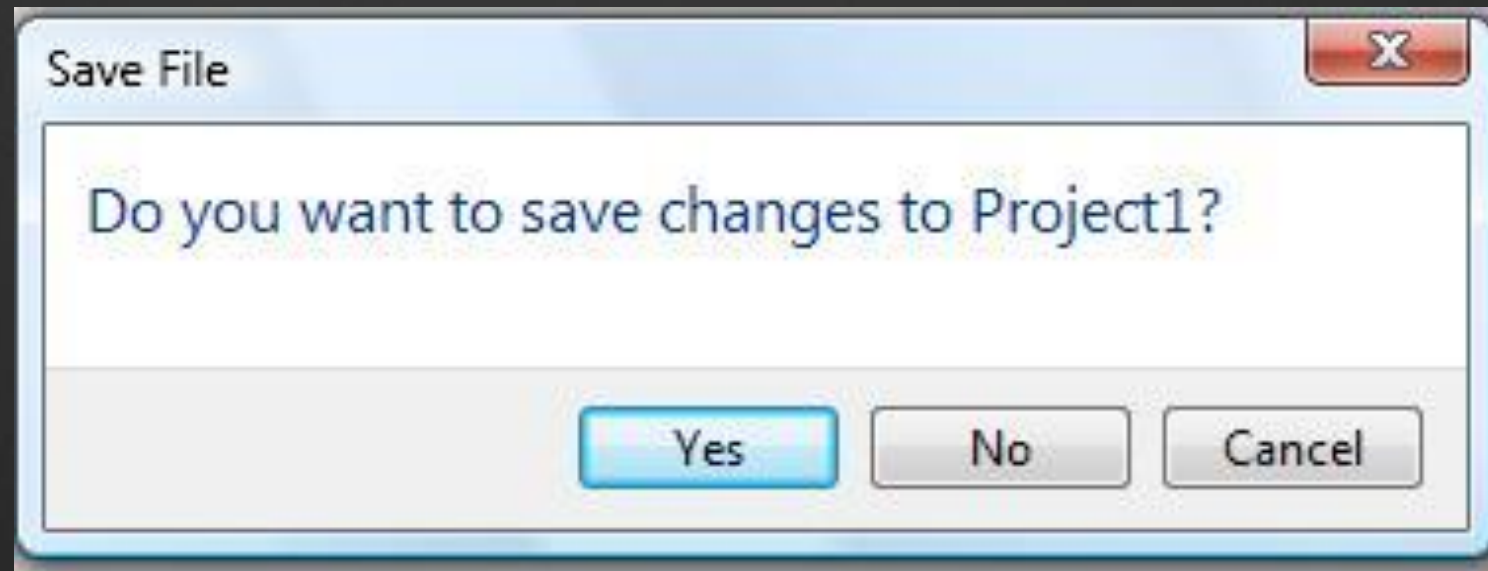


The Wine – UI API Enhancements



- SplitButton - a pulldown button with a default pushbutton attached
- RadioGroup - a set of ToggleButtons, where only one of the set can be active at a time
- ComboBox - a pulldown containing a set of selectable items, which can be grouped optionally
- TextBox - an input field for users to enter text
- SlideOut panel - an extra panel can optionally slide down from a Ribbon panel; this panel can contain any of the standard Ribbon components

The Wine – Task Dialogs



- Instructions
- Detailed Text
- Icons
- Buttons
- Command Links

The Wine – And More!



- Obtain point placement references from a family
- Import DWG as link
- Identify if import instance is linked
- Rehost a form
- Rebar API changes
- Associate array dimension to label in families
- Refresh active view
- Create sloped wall on mass face
- Rename and replace a family parameter
- Reporting parameters
- Extract GUID from a Parameter

The Wine – And Even More!



- SuspendUpdating applies to Parameter.Set
- Export option for color mode
- Export model to IFC
- Floor slope and elevation
- NewTruss() in Revit Architecture
- Validation in ElectricalSystem properties
- Convert between Model Curves and Detail Curves
- WireMaterialType, InsulationType, TemperatureRatingType
- DuctConnector, PipeConnector, ElectricalConnector
- Truss - attach and detach chord
- Drop truss and beam systems

Questions?

