AUTODESK. UNIVERSITY

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Getting Through the Pain to See the Gain

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Learning Objectives

- Learn how to eliminate productivity roadblocks encountered with large models
- Learn about optimal hardware configuration
- Learn about application customizations within Inventor, AutoCAD and Vault
- Learn how to identify system optimizations to prevent system crashes

Description

Learn how to overcome technical hurdles such as large-model rendering. We will provide proven hardware configurations and software customizations for applications. Inventor, AutoCAD and Vault optimizations, eliminating productivity decline and system crashes. Backup solutions outside of the ADMS solution for large database backups in an acceptable timeframe. Customizations, tips and tricks to help reduce resource saturation on your local workstations. This class will focus on maximizing productivity and provide takeaways that you can implement in your environment.

Speaker(s)

Donna is Head of Information and Technologies for Empire Industries and its divisions, the largest being Dynamic Attractions. DA designs and builds amusement park rides and the world's largest telescope structures like those on Mauna Kea in Hawaii. She provides strategic oversight of corporate-wide information technology activities. Donna brings 30+ years of experience in the field of information technology, 21 years at Dynamic Attractions and has a diverse background in a corporate setting with extensive experience in overseeing the Information Services Technology division as well as sets IT direction and coordinates infrastructure and service delivery across the organization. Donna is responsible for supporting enterprise applications, enterprise data, research support, overseeing user support, infrastructure, communications and information security. She has implemented and customized CAD including Autodesk products since 1998.

Craig is the Lead Designer at Dynamic Structures where he is supervising the design team on the Thirty Meter Telescope Enclosure. He is actively involved in developing the company's approach to CAD standards, Integration and Methodologies. He is helping coordinate the move to a Product Based Manufacturer from a Project Based one. He has previously held the positions of Engineering Systems Manager and Drawing Office Manager. With over 40 years of experience in manufacturing everything from bridges and material handling to arenas and telescopes, he has a wide background to call upon when determining the best way forward with a design. Craig works hard to ensure his experience, particularly in the field of astronomical equipment design, is passed on to his younger co-workers in order to preserve it for future projects. An active participant in all things Autodesk, he remains current in the latest software products and willingly shares his views about the appropriate use of the various packages.

Contents:

Part 1: Trouble with large assembly rendering

Hardware specifications

Working with large assemblies in CAD can be very challenging — and even frustrating — if you are not familiar with some basic large assembly performance improvement techniques. If you have worked on large assemblies, you are likely familiar with the software slowdowns and even crashes that can come with these larger assemblies. A solution could be as simple as getting a more powerful computer. Even if you have invested in a top of the line CAD machines eventually your system resource limits will be impacted causing the system to slow down, so be prepared to consistently review your components and configurations. Here are some hardware specifications successfully tested and implemented.

Workstations

HP Z440
CPU Xeon E5-1650
RAM 64GB
GPU NVidia Quadra K4200 or GTX 1080
HD 1TB HDD or 500GB SSD

HP Z420
CPU Xeon E5-1650
RAM 64GB
GPU NVidia Quadra K4200 or GTX 1080
HD 1TB HDD or 500GB SSD

Laptops

Lenovo P50
CPU i7-6700HQ
RAM 16-32GB
GPU NVidia Quadra M1xxx
HD 500GB HDD or 500GB SSD

CAD Workstations – workhorse for analysis/renderings

HP Z840
CPU Xeon E5-2650
RAM 128GB
GPU NVidia Quadra K4200
HD RAID5 3TB

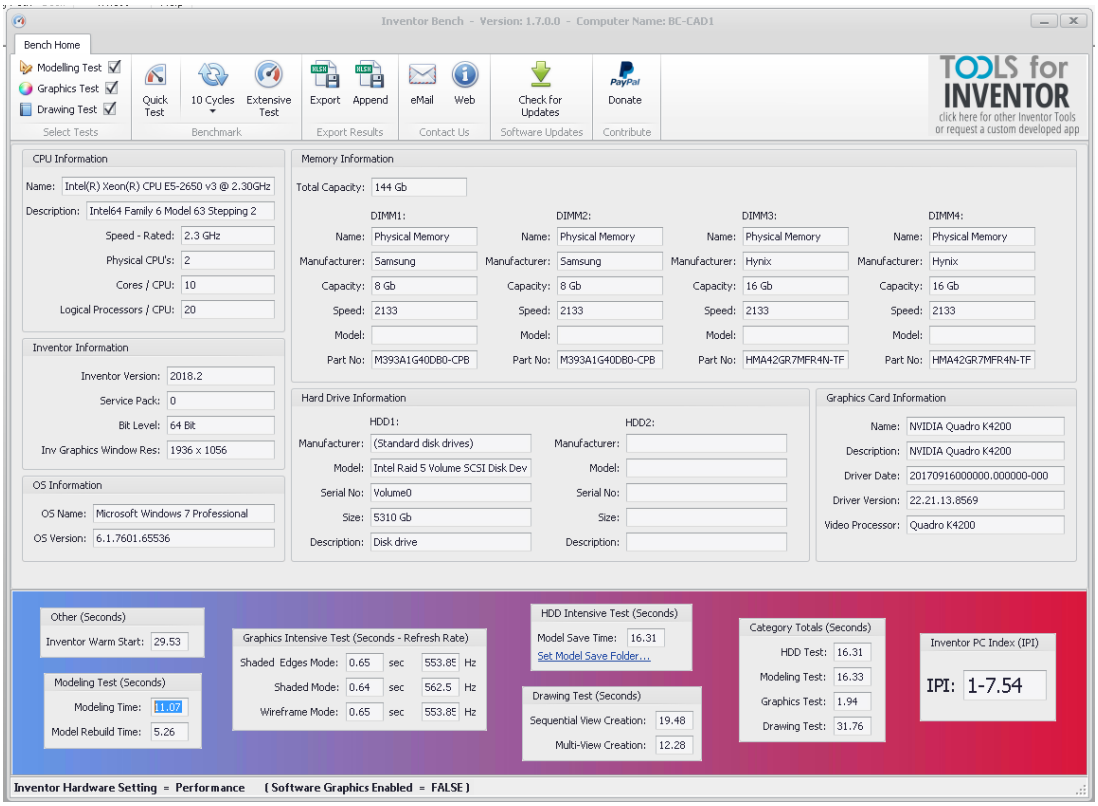
Graphics Cards

In our experiences, the Quadro cards are better for actual renderings, but the GTX series of cards are much more performant for model editing.
An example would be on one machine we changed from a Quadro to a GTX 770. We were able to cut down model opening times dramatically (they were almost quartered).

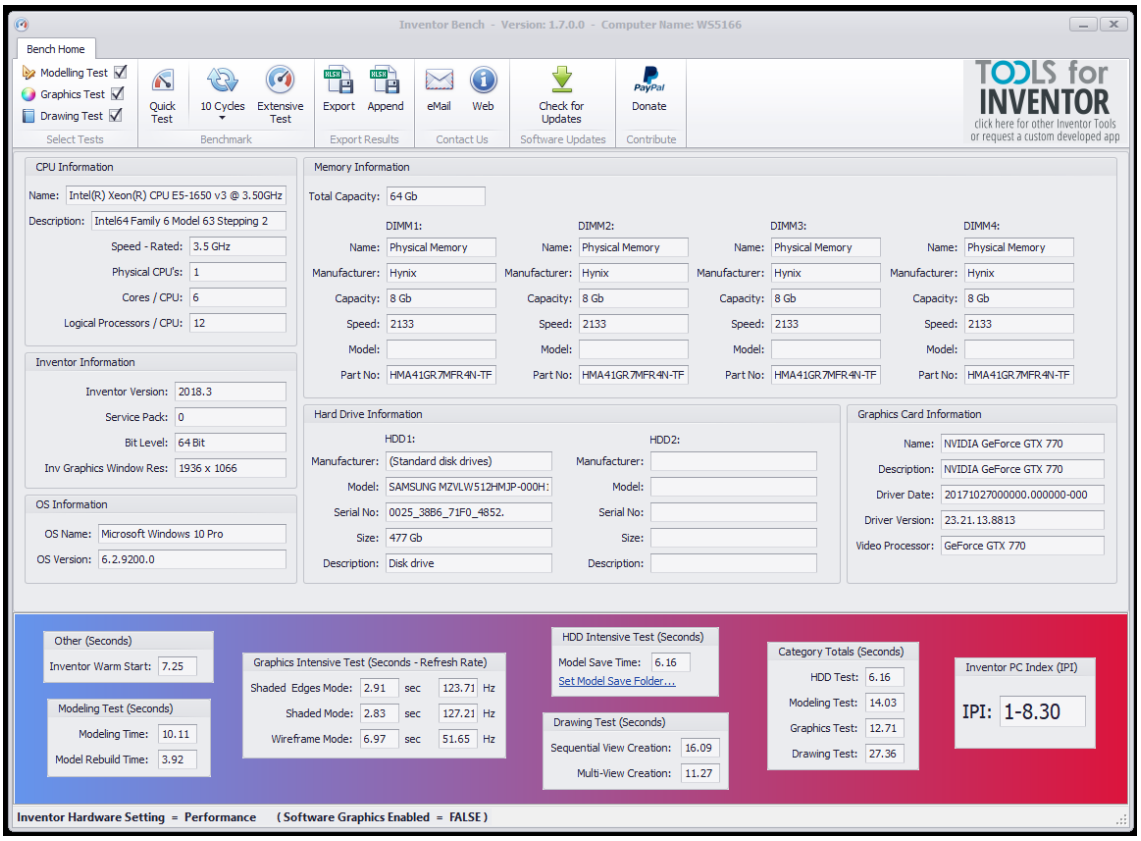
Below are screenshots of performance benchmarking using the Benchmark Tool from Autodesk Exchange.

(https://apps.autodesk.com/INVNTOR/en/Detail/Index?id=3667345248776204460&appLang=en&os=Win32_64&autostart=true).

Quadro K4200



GTX 1080


Inventor Bench - Version: 1.7.0.0 - Computer Name: WS5166
Bench Home
Modelling Test
Graphics Test
Drawing Test
Select Tests
Quick Test
10 Cycles
Extensive Test
Benchmark
Export
Append
Export Results
eMail
Web
Contact Us
Check for Updates
Software Updates
Donate
Contribute
TOOLS for INVENTOR
click here for other Inventor Tools or request a custom developed app
CPU Information
Name: Intel(R) Xeon(R) CPU E5-1650 v3 @ 3.50GHz
Description: Intel64 Family 6 Model 63 Stepping 2
Speed - Rated: 3.5 GHz
Physical CPU's: 1
Cores / CPU: 6
Logical Processors / CPU: 12
Inventor Information
Inventor Version: 2018.3
Service Pack: 0
Bit Level: 64 Bit
Inv Graphics Window Res: 1936 x 1066
OS Information
OS Name: Microsoft Windows 10 Pro
OS Version: 6.2.9200.0
Memory Information
Total Capacity: 64 Gb
DIMM1: DIMM2: DIMM3: DIMM4:
Name: Physical Memory
Manufacturer: Hynix
Capacity: 8 Gb
Speed: 2133
Model:
Part No: HMA41GR7MFR4N-TF
Hard Drive Information
HDD1:
Manufacturer: (Standard disk drives)
Model: SAMSUNG MZVLW512HMJP-000H:
Serial No: 0025_38B6_71F0_4852.
Size: 477 Gb
Description: Disk drive
HDD2:
Graphics Card Information
Name: NVIDIA GeForce GTX 770
Description: NVIDIA GeForce GTX 770
Driver Date: 20171027000000.000000-000
Driver Version: 23.21.13.8813
Video Processor: GeForce GTX 770
Other (Seconds)
Inventor Warm Start: 7.25
Modeling Test (Seconds)
Modeling Time: 10.11
Model Rebuild Time: 3.92
Graphics Intensive Test (Seconds - Refresh Rate)
Shaded Edges Mode: 2.91 sec 123.71 Hz
Shaded Mode: 2.83 sec 127.21 Hz
Wireframe Mode: 6.97 sec 51.65 Hz
HDD Intensive Test (Seconds)
Model Save Time: 6.16
Set Model Save Folder...
Drawing Test (Seconds)
Sequential View Creation: 16.09
Multi-View Creation: 11.27
Category Totals (Seconds)
HDD Test: 6.16
Modeling Test: 14.03
Graphics Test: 12.71
Drawing Test: 27.36
Inventor PC Index (IPI)
IPI: 1-8.30
Inventor Hardware Setting = Performance (Software Graphics Enabled = FALSE)

Part 2: Vault and Vault Replication servers

Hardware specifications

Vault Server and Vault Replication Servers

Vault Live Production Server
- Type: Virtual Machine (VMWare)
- Autodesk Data Management Server Console 2018; File Store Size: 3.95 TB
- OS: Server 2016 Datacenter
- Microsoft SQL 2016; Database size: 73 GB
- SQL Management Studio 17.4
- RAM: 150 GB
- CPU: 16X2.10 GHz

Vault Legacy Server
- Type: Virtual Machine (VMWare)
- Autodesk Data Management Server Console 2018; File Store Size: 275 GB
- OS: Server 2016 Datacenter
- Microsoft SQL 2016; Database size: 7.2 GB
- SQL Management Studio 17.4
- RAM: 48 GB
- CPU: 16X2.10 GHz

Vault Replication Server
- Type: HP Z840
- CPU: Xeon E5-2650
- Autodesk Vault File Server Console 2018; File Store Size: 3.95 TB
- OS: Server 2016 Datacenter
- RAM: 128 GB
- CPU: 4X2.2 GHz
- GPU: NVidia Quadra K4200

Part 3: Backup specifications for large datasets

100+ TB databases do exist, and surprisingly, there are quite a few such Very Large Databases (VLDB). Most are Oracle and some are Microsoft SQL Server based. Applications with such large databases are mission critical to the enterprise.

Below are specifications on Vault as well as our steps to complete backups.

Live Production and Legacy server backups

Daily backup

- Veeam - Nimble to Exagrid- 5 AM with SQL Application-aware Processing enabled moving data from Nimble storage to Exagrid backup storage then upload to cloud repository (AWS)
- Nimble to Nimble - 14 points of daily backup at midnight

Hourly Backup

- Nimble only - 48 restoration points of hourly backups from 7AM to 5 PM (3.5 business days)

ADMS:
The major issue we have using the ADMS backup feature is it will take over 3 days and eventually freezes after 18 hours.

To bypass this issue:

- We are using the “Obackup” command to run the backup job, which is still taking about 3 days, 54 hours to be precise.
- Once backup is complete, we create a snapshot of the volume, clone it, make it offline, attach it to another vm, restore, make it online and connect with iSCSI initiator for verification that the backup is completed successfully by random file verifications.

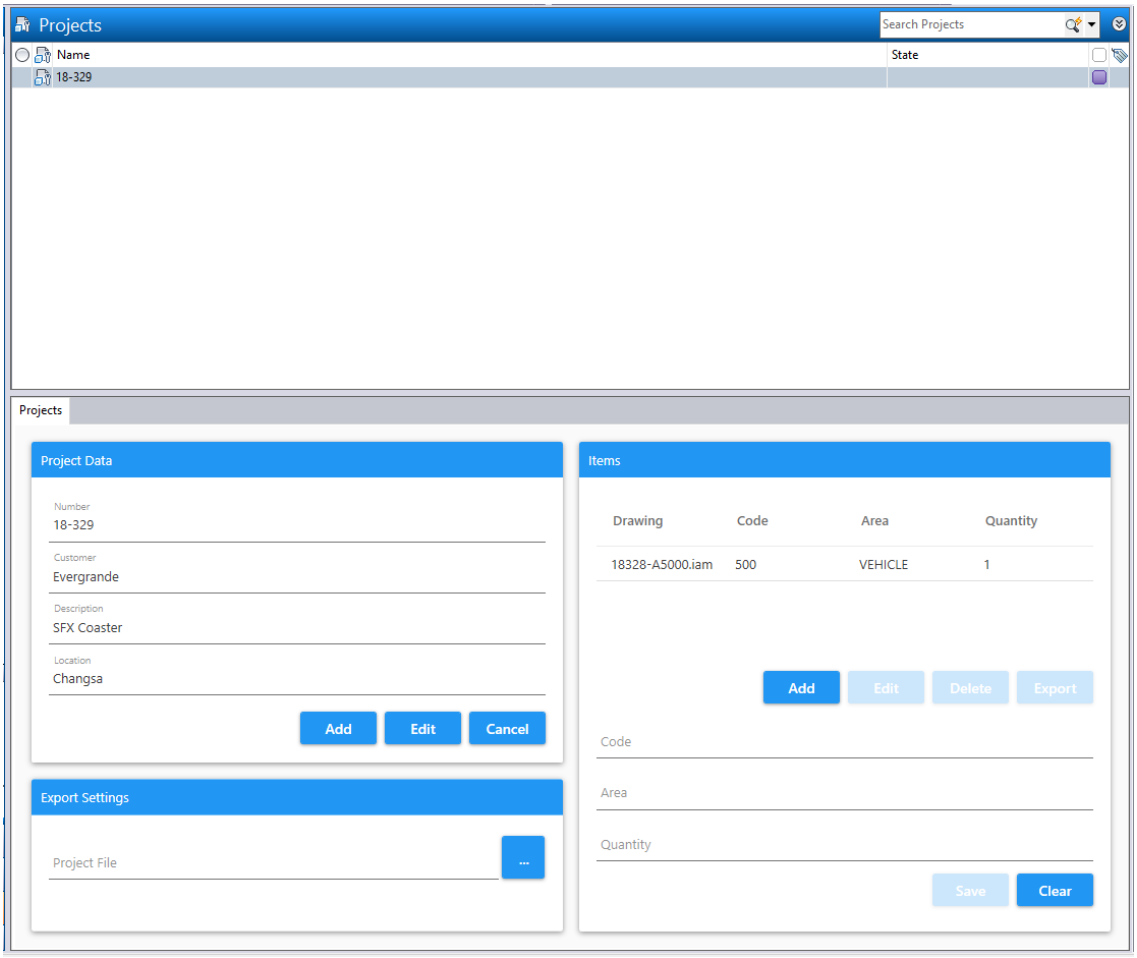
The size of our SQL database is 79 GB, the size of library in SQL is 8.5 GB and total file store is 4 TB.

The replications from our live production server to our replication server is happening every 4 hours from 11AM. Usually the differential is 24,000 objects to replicate which is around 20 GB each time, the first one in the morning and last one after working hours are usually the largest. In average, it will take between 2 - 3 hours to sync the data, so we run it every 4 hours.

Part 4: Customizations, Tips, Tricks and Tools

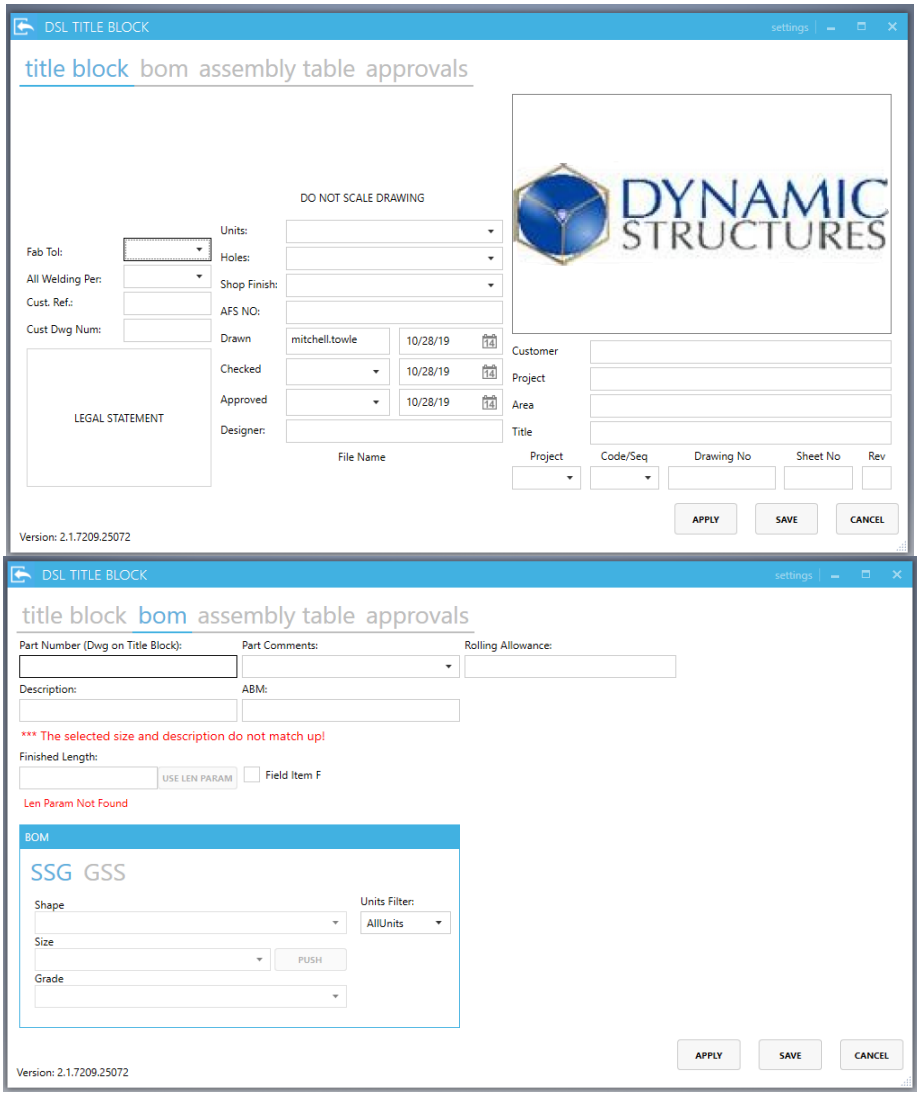
Data Exporter:

We created a custom data exporter to export our CAD data in to a data transfer format that our ERP/MRP understands (KSS). Rather than creating a separate program for people to use we created a GUI inside of vault that then uses Inventor Apprentice to generate this export. We are using a custom object inside of Vault as a container for this data, and link properties for the individual items that are in this container. There is also room for improvement by making this data exporter use Vault Items instead of file references, we can then remove the dependency to Inventor Apprentice and use the Job Processor to automatically generate these files.



iProperty Manager:

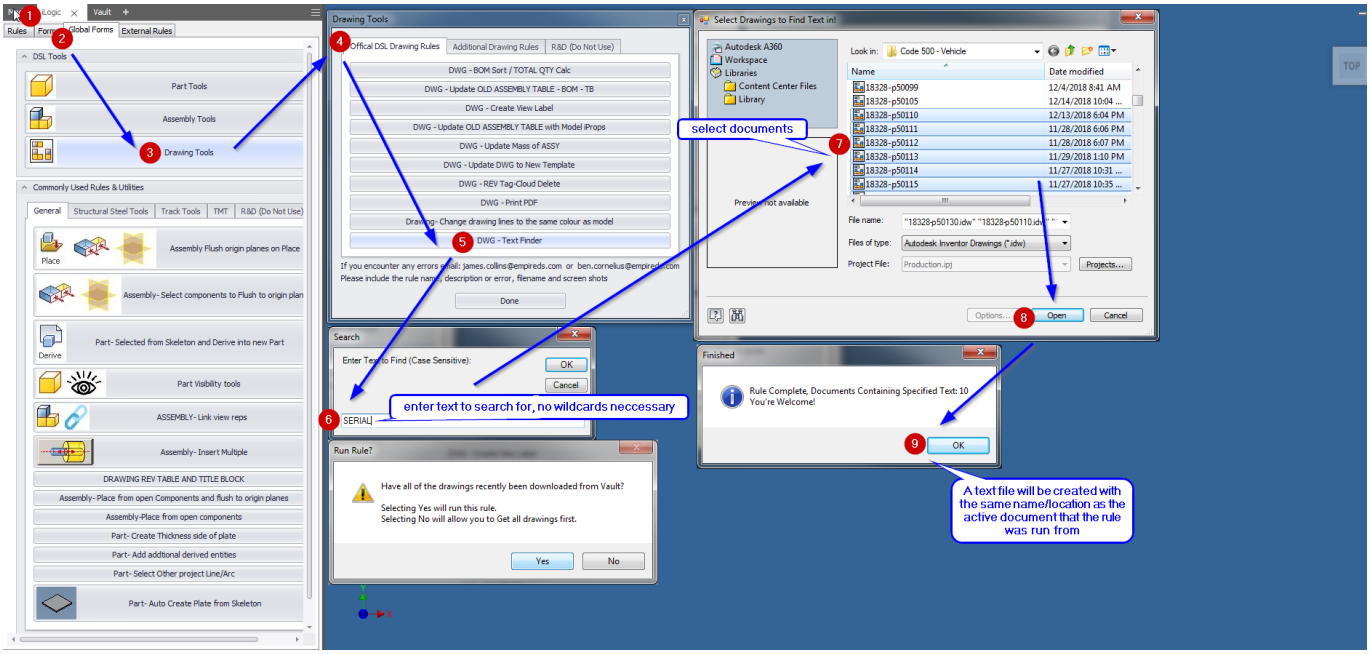
One of the issues that we came across with the project data exporter utility is inconsistency in descriptions of items in the models. Every designer likes to call up material or items in an ever so slightly different syntax. When then importing to our ERP/MRP software there would be many errors because of the unknown items. To mitigate this we created an Inventor add-in with a GUI for editing the properties. This allowed us to provide selection sets to the designers of approved materials and items, increasing the amount of consistency in our meta-data. Some of these selection sets are looked up directly in our ERP/MRP database via SQL, while others are maintained in an Excel lookup file that is version controlled in vault. This add-in was created by Brain Bucket Software
Exchange: https://apps.autodesk.com/en/Publisher/PublisherHomepage?ID=5GEJP3FL7SDQ
Website: https://www.brainbucketsoftware.com/



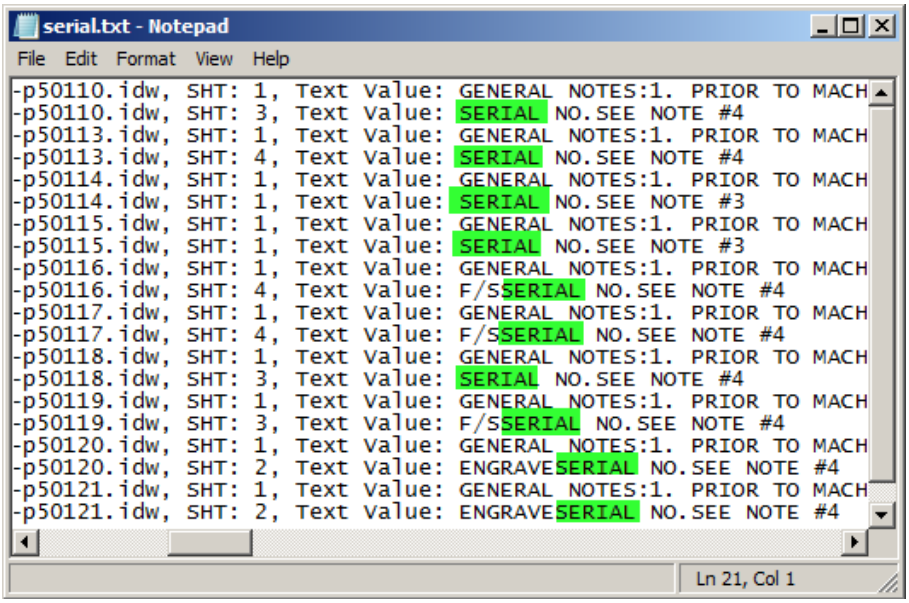
Customizations for Inventor:

Drawing – Text Finder:

Searches through drawings to find a user defined text string and outputs a text file showing the results, which is great when you do not want to open each drawing individually

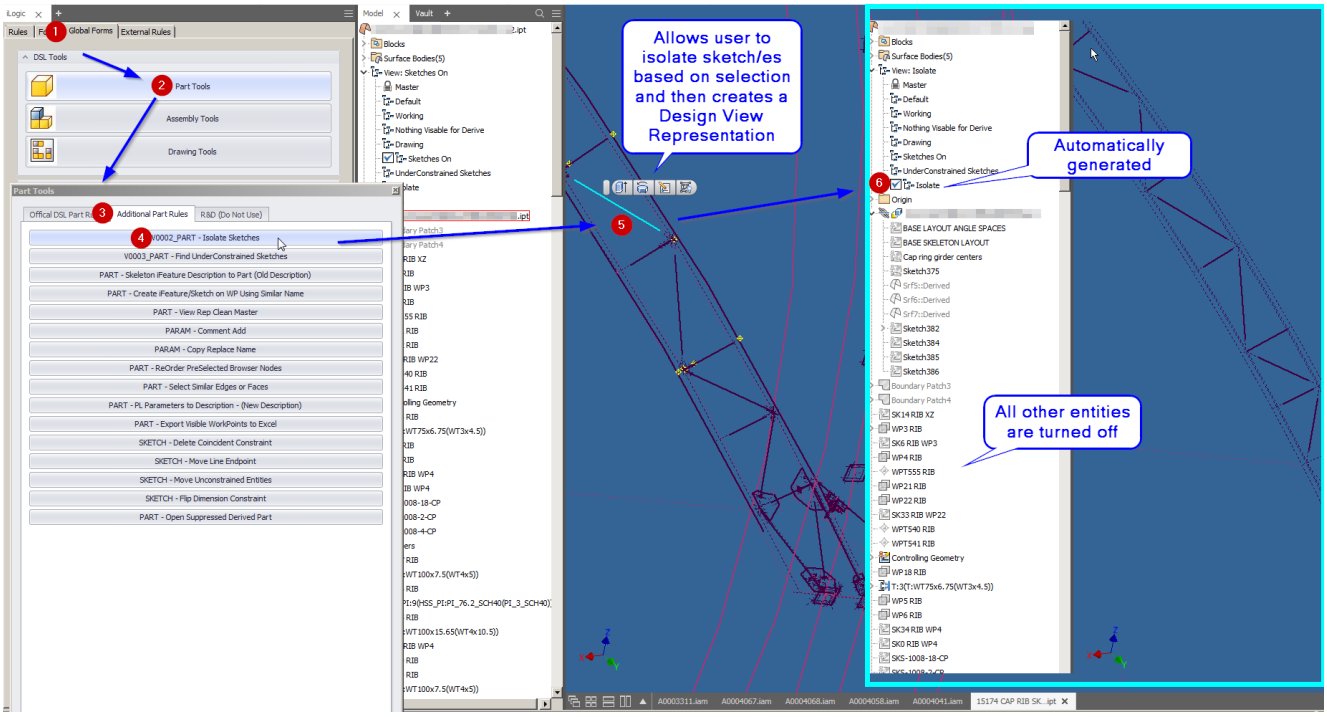


Output file



Part – Isolate Sketches:

Great for skeletal modelling as there is not an existing solution this allows the user to isolate a sketch and generates a Design View Representation, similar to isolating a layer in AutoCAD



Skeletal Modeling:

Skeletal modeling in Inventor is a method of creating many associated parts using one sketch to drive them. The basic workflow would be:

1. Create a single part model, your skeleton, on a common logical origin. Depending on the complexity of your end model, this could contain many different sketches inside this one part file. They can be on different planes and in different XYZ positions. Locate these sketches to show how your assembly would look in its finished state.
2. If the end model is extremely complex, or a modular component, it might make more sense to create multiple separate skeletons that have a common origin.
3. Ensure all critical parameters are defined in your skeleton. It is often handy to create named custom parameters for dimensions that can change.
4. Once your skeleton is defined, you then create a new part file, and derive your skeleton file into it. Find the appropriate sketch within your skeleton that you want to create your first part from by extruding or whatever feature(s) are needed for your end result.
5. Continue making your parts as needed and once complete create a new assembly file. Start placing your parts, which in most cases can be simply “grounded in place” as they are linked to your origin from the skeleton. For instances where this doesn’t apply, use a new view representation where your skeleton is visible and use the skeletons features to constrain your parts as needed.
6. There are other variations to the workflow outlined above, but the end result is the same. Any changes to your parts can be done in the original skeleton file and if done correctly, associated parts will adjust automatically to suit your changes.

Some useful basic tips:

ALWAYS use parameters or driven equations to describe your parts. This will ensure your part is always described correctly after any changes occur.

Skeletal modeling is a more efficient way of creating parts for assemblies as they are always parametrically linked. If one part changes, related parts will change automatically to suit that change. One does have to be careful and be aware of unintended design changes, but overall it is a much quicker and safer method then modeling parts individually and then constraining them individually in an assembly.

Shrinkwraps:

For large models, the best method we have found so far is to use “shrinkwraps” as much as possible. Shrinkwraps are a separate copy of an assembly file that “dumb” it down to one part file.

There are options when creating your shrinkwrap file to simplify it by removing holes, filling voids, removing chamfers/fillets etc, or greatly simplify complex shapes by replacing them with a basic cylinder or square.

Take this method one-step further by creating simplified views within your assembly files that will not show parts you do not need to see at a higher level; such as fasteners, electrical sensors, brackets, internal components, small parts, etc. then use this simplified view to create your shrinkwrap making it an even smaller file size.

There is more to making a file easier to handle than just part and instance count; if you can reduce the number of surfaces and constraints Inventor needs to calculate you will have much more success with larger models.

Once created, your shrinkwrap will be linked to your original model and will update if the source changes (unless you select the “break link” option, which has its uses as well, but the shrinkwrap will need to be re-created if the source changes).

Once you have created your shrinkwrap, you will give it the same PART NUMBER as the source file and place it in an upper level assembly, usually at the “E” (installation) level to greatly reduce resources. You will typically place several different shrinkwraps in a file using this method.