SOLIDWORKS
WORLD 2015
FEBRUARY 8-11
PHOENIX CONVENTION CENTER | PHOENIX, AZ

Achieving Extreme SolidWorks Performance

Hardware/Configuration

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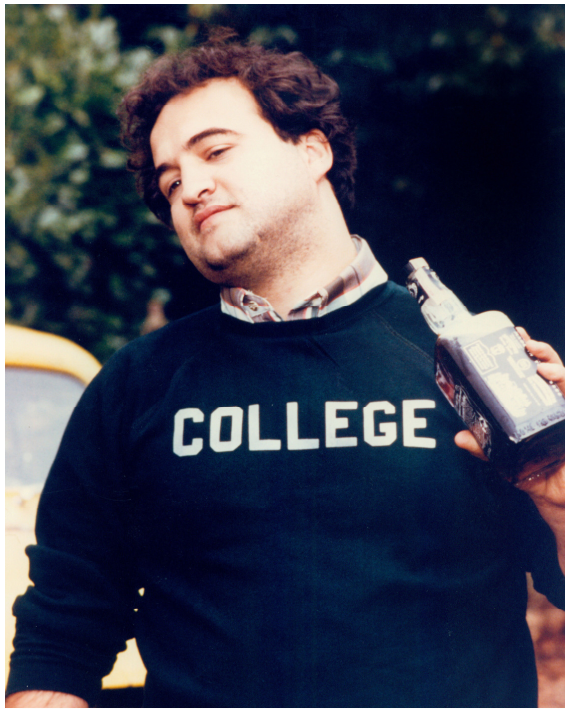
Objective

Better understand the benefits of different hardware investments and learn how to apply performance data to purchasing decisions.

Make the workstation faster than the user!!

Agenda

- Introductions
- Explore results from previous adventures
- New benchmark method
- Hardware comparisons
- Graphics comparisons
- Conclusions

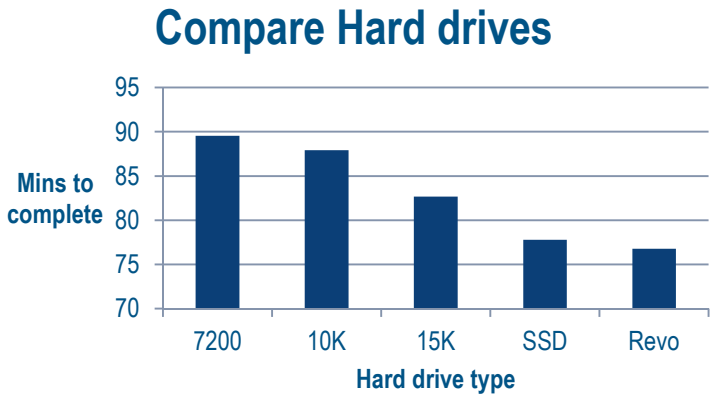


Results from previous adventures

Solid State Hard Drives

- Solid state hard drive are now the standard for operational task
- Large volume local storage is still best served with spinning drives

Switching from 7200 RPM hard drive to an Intel SSD improves performance as much as 15%



Anti-Virus

- Baseline – network storage AV Scanning client and server – 6:52:00
- AV scanning server only – 6:35:00 – 4% improvement
- No AV scanning – 5:49:00 – 15% improvement

Network Storage

- Using local SSD file storage – 2:13:00 – 68% improvement

Multi-Core

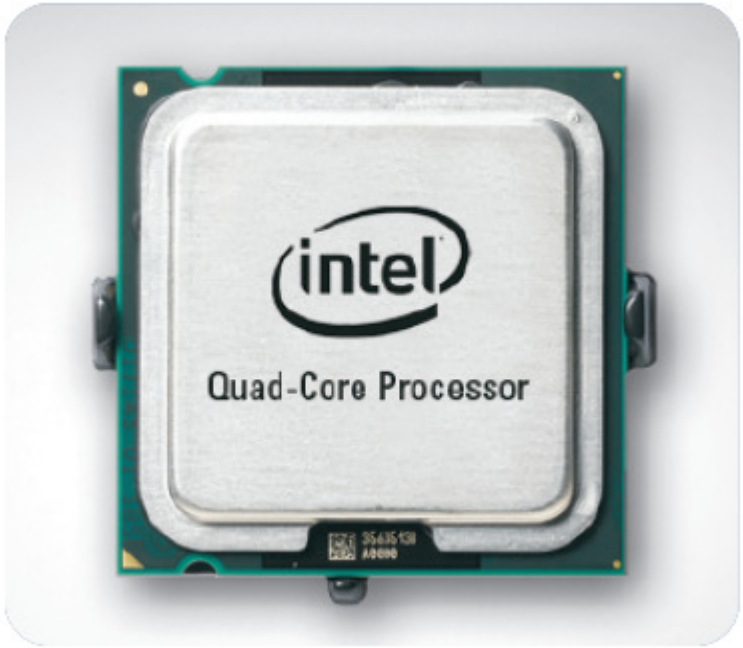
SOLIDWORKS

- SOLIDWORKS uses 2 cores
- OS can use an additional 2 cores
- Other applications will add to the load
- Simulation and Rendering can take advantage of many cores

Multi-Core

SOLIDWORKS

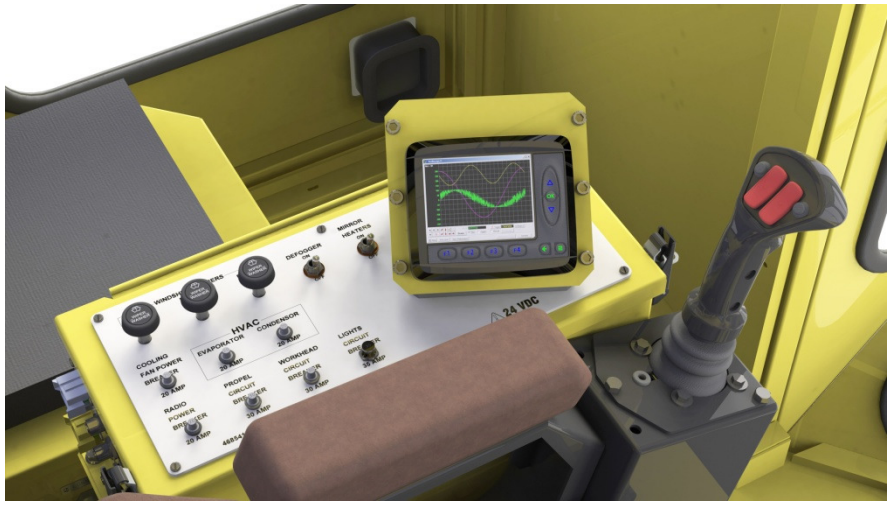
- 1 core – 7:35:41 :: 286% slower
- 2 cores – 1:58:07
- 3 cores – 1:41:47 :: 13.8% faster
- 4 cores – 1:41:08 :: 14.4% faster
- 6 cores – 1:40:40 :: 14.8% faster



Multi-Core

Where more is more

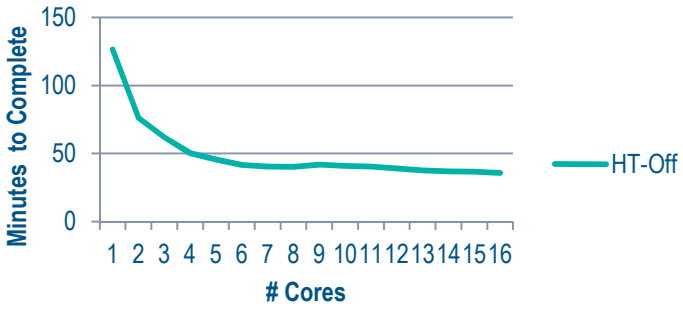
- Simultaneous Applications
  - Outlook
  - ERP
  - Purchasing systems
- Simulation
- Photo-Rendering



Multi-Core

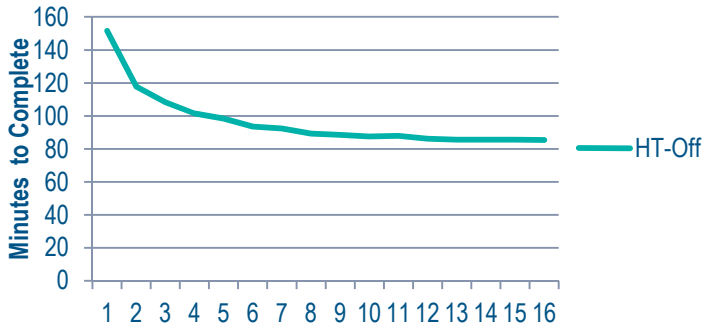
Simulation Flow

- 4 – 6 cores 17% faster
- 4 – 8 cores 20% faster
- 4 – 16 cores 29% faster



Static Simulation

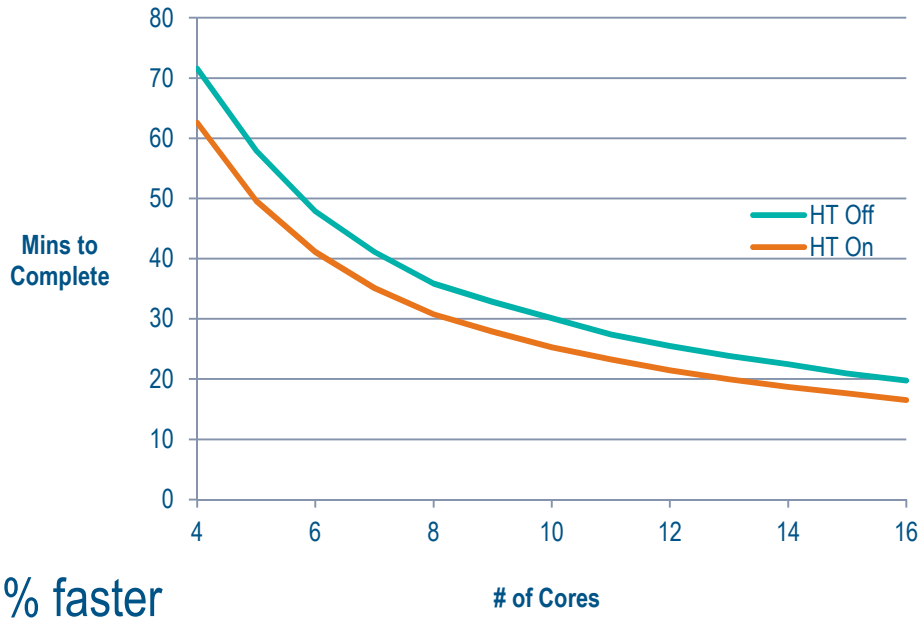
- 4 – 6 cores 7.7% faster
- 4 – 8 cores 12% faster
- 4 – 16 cores 16% faster



Multi-Core

Photo-Rendering

- 4 – 6 cores 17% faster
- 4 – 8 cores 51% faster
- 4 – 16 cores 74% faster



Hyper-Threading is as much as 16% faster

Other Settings and Options

- RAID 0 and RAID 1 – little to no effect
- Optimizing OS Visual Settings – little to no effect
- Using SWAP for RAM – Dramatic effect (BUY MORE RAM)
- Add-ins – Impact depends on what is turned on
- Optimized SOLIDWORKS Options – Up to 16% faster

The Benchmark

The Hardware

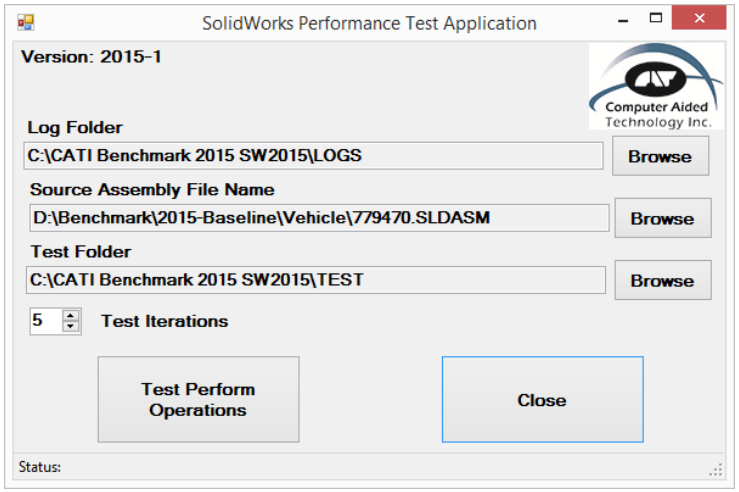
APEX 2 from BOXX Technologies, Inc.

- i7-4790K
  - 4 Core
  - 4.0 GHz overclock to 4.5GHz
- 32GB RAM
  - Dual Channel DDR3 @ 800MHz
- Solid State Hard Drive
  - SSDSC2BW180A4
  - 180GB
- Nvidia Quadro K2200 Graphics Card

The Benchmark

Previous versions

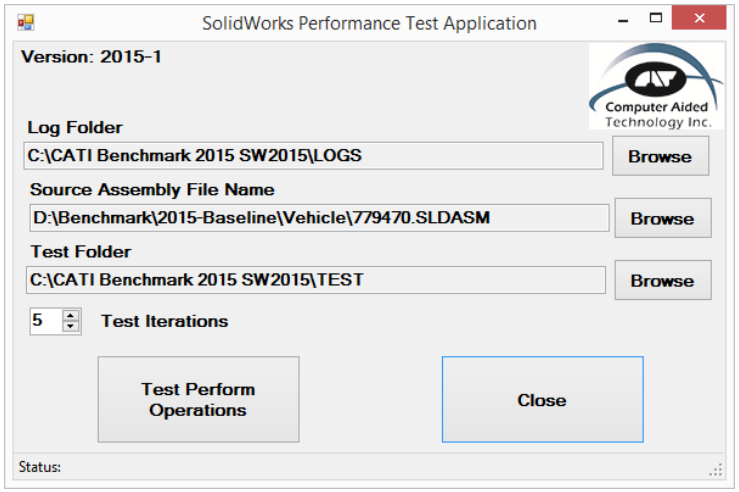
- Simulates many aspects SOLIDWORKS use
- Long run time
- Locked into testing with graphics manipulation
- Works with only one model



The Benchmark

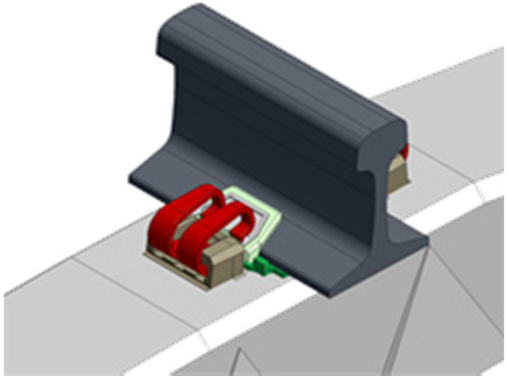
Current version

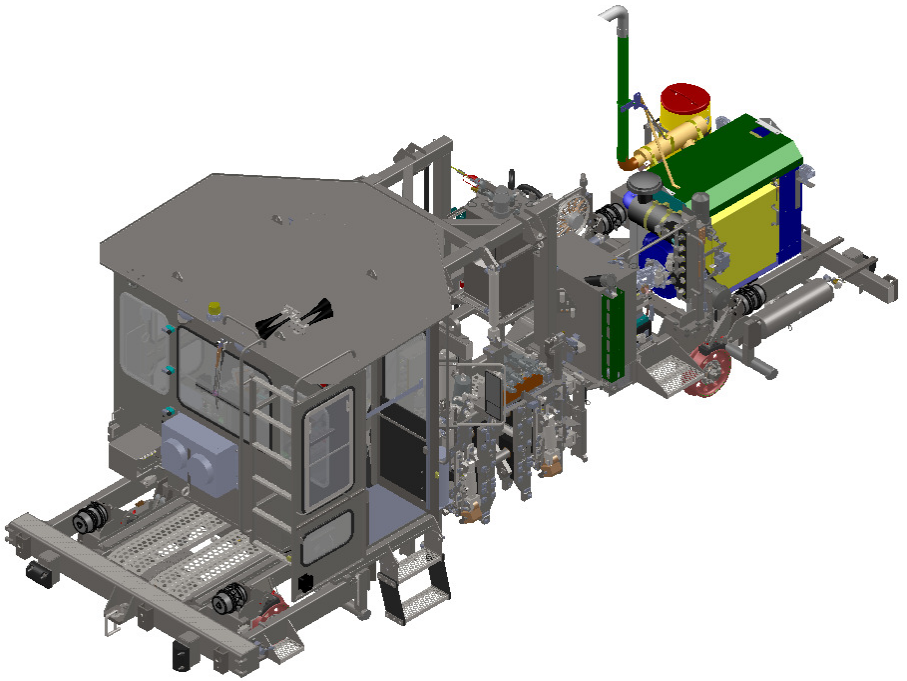
- Currently simulated fewer aspects of SOLIDWORKS use
- Shorter run time
- Option to run with or without graphics manipulation
- Works with virtually any SOLIDWORKS model



The Models

Racine Railroad Products

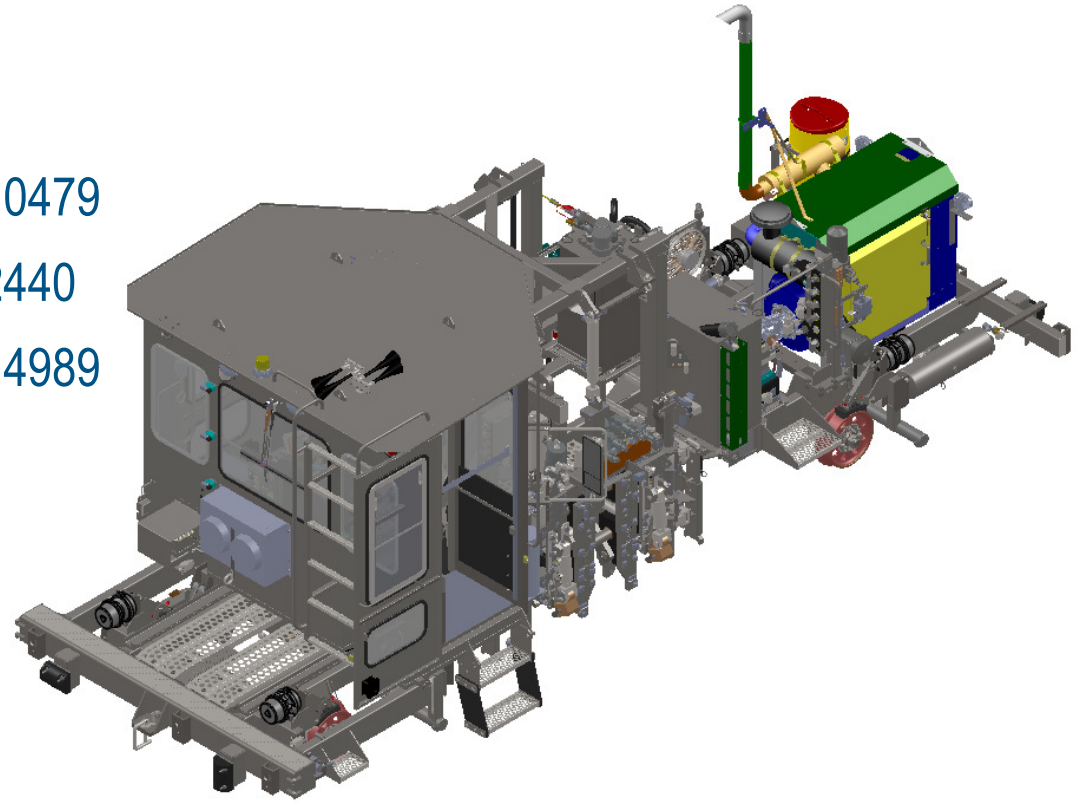




The Models

2440

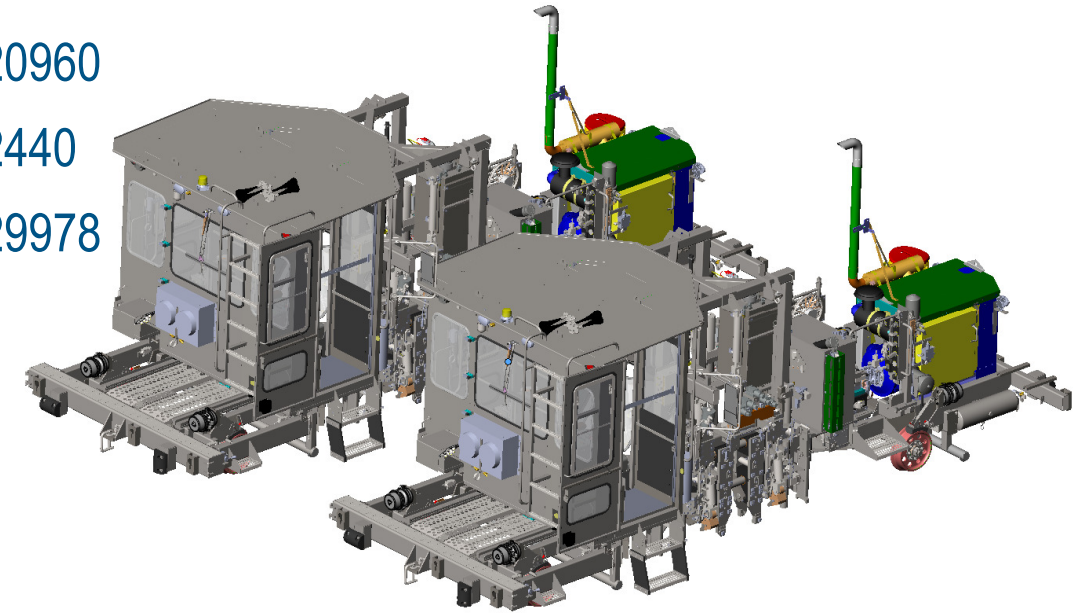
- Components 10479
- Unique components 2440
- Number of bodies 14989



The Models

2440 2X

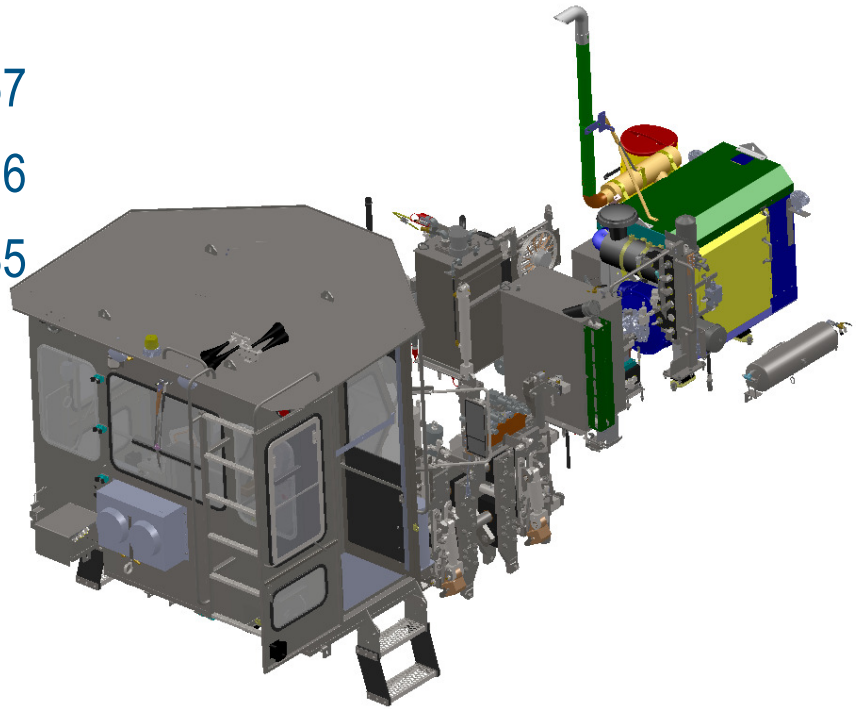
- Components 20960
- Unique components 2440
- Number of bodies 29978



The Models

1900

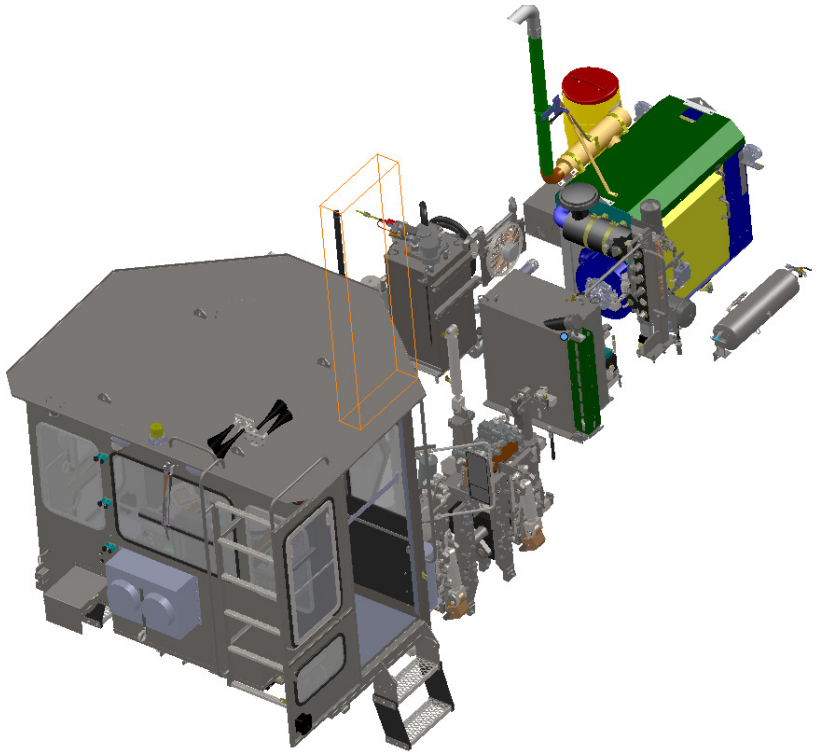
- Components 8067
- Unique components 1916
- Number of bodies 9935



The Models

1530

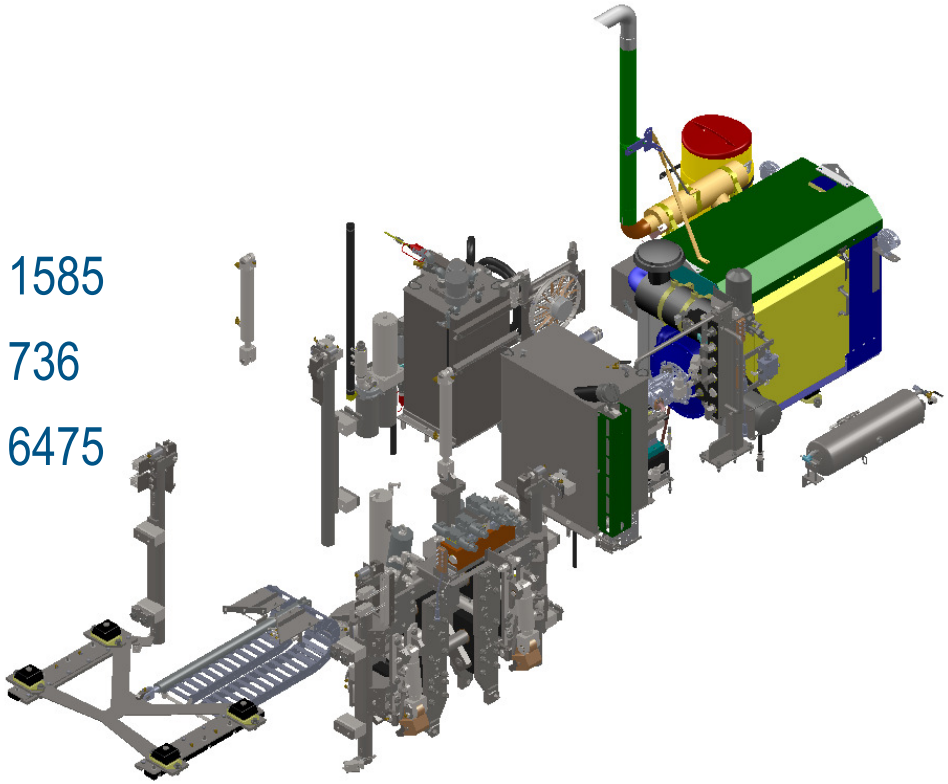
- Components 5468
- Unique components 1530
- Number of bodies 10356



The Models

735

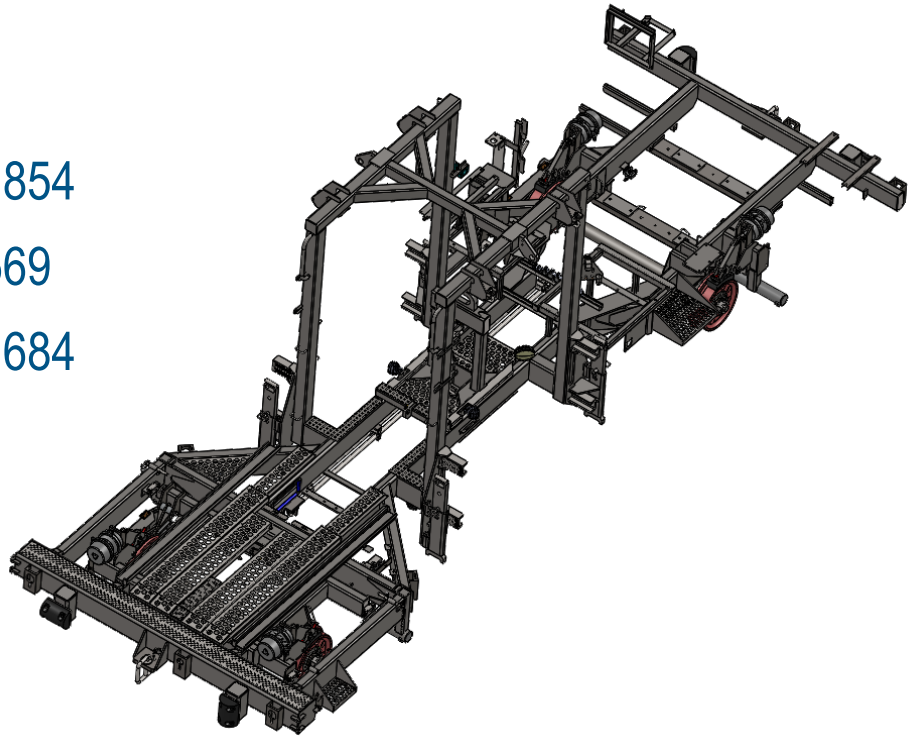
- Components 1585
- Unique components 736
- Number of bodies 6475



The Models

570

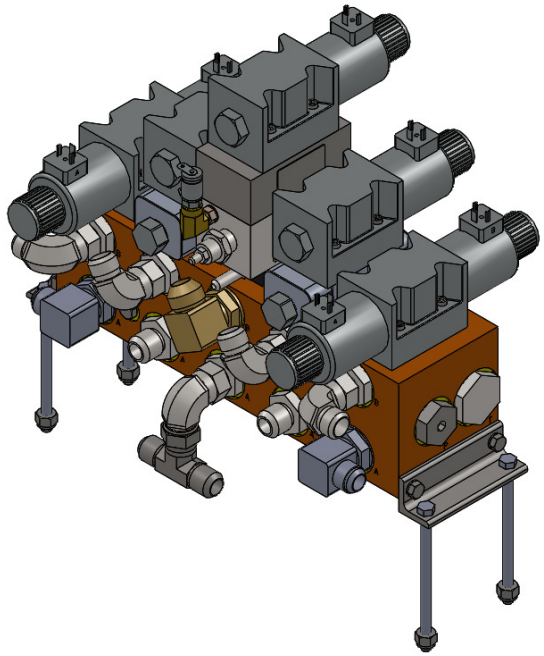
- Components 1854
- Unique components 569
- Number of bodies 1684



The Models

35

- Components 94
- Unique components 34
- Number of bodies 90



Hardware Results

RAM

Is there such thing as too much?

- RAM is critical
- Every assembly has a threshold
- Without enough RAM
  - Hard Drive becomes hyper-critical
    - Used for SWAP simulating RAM
  - Everything is slower
  - OS struggles as well
  - Stability can become an issue as well

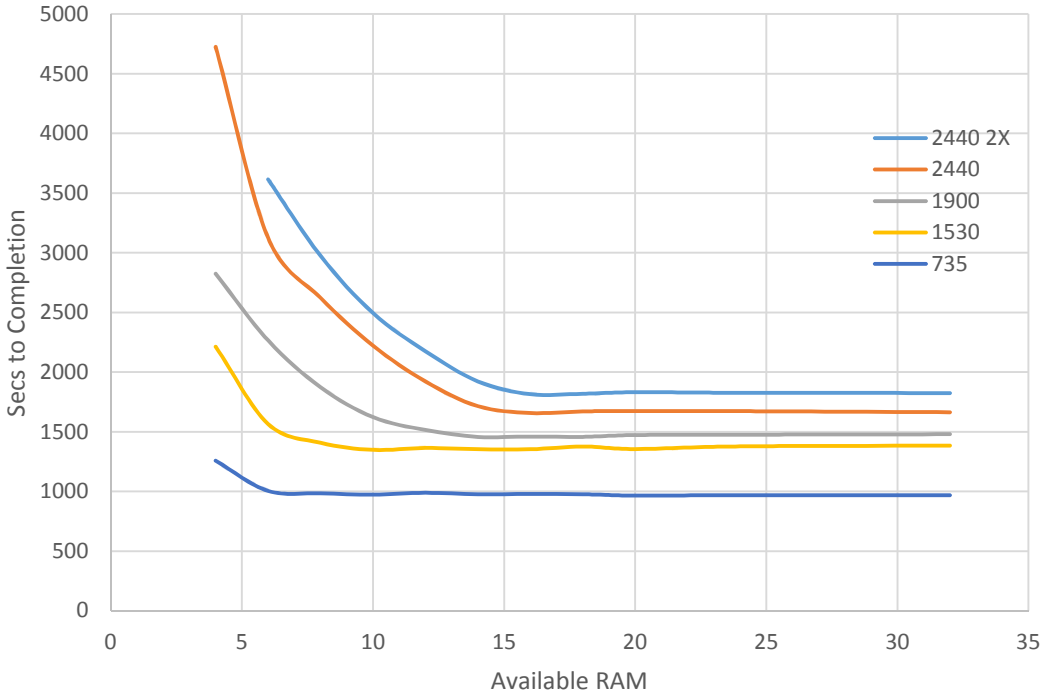
RAM

Is there such thing as too much?

- Benchmark was run with:
  - 5 different assemblies
  - 11 different RAM configurations
  - No graphics manipulation
  - 4 Cores 4.5GHz
  - SSD for operation and storage

RAM

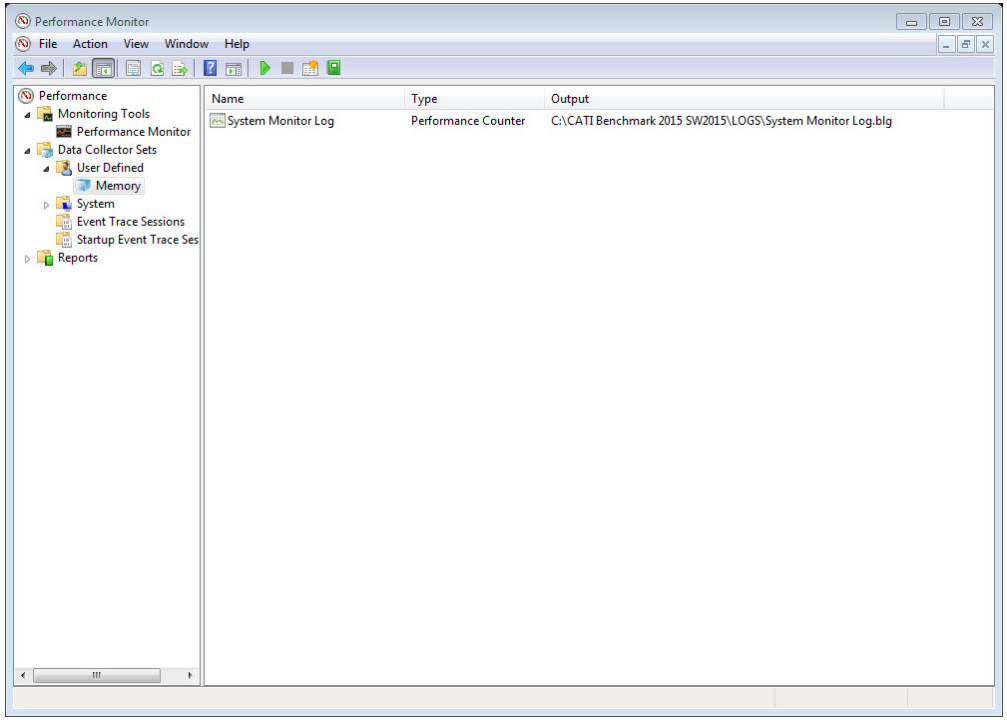
- 2440 and 2440 2X end up very close
- The point of flat line is close to the amount of RAM required for a specific Assembly
- RAM beyond the required for an assembly has virtually no impact



RAM

Performance Monitor

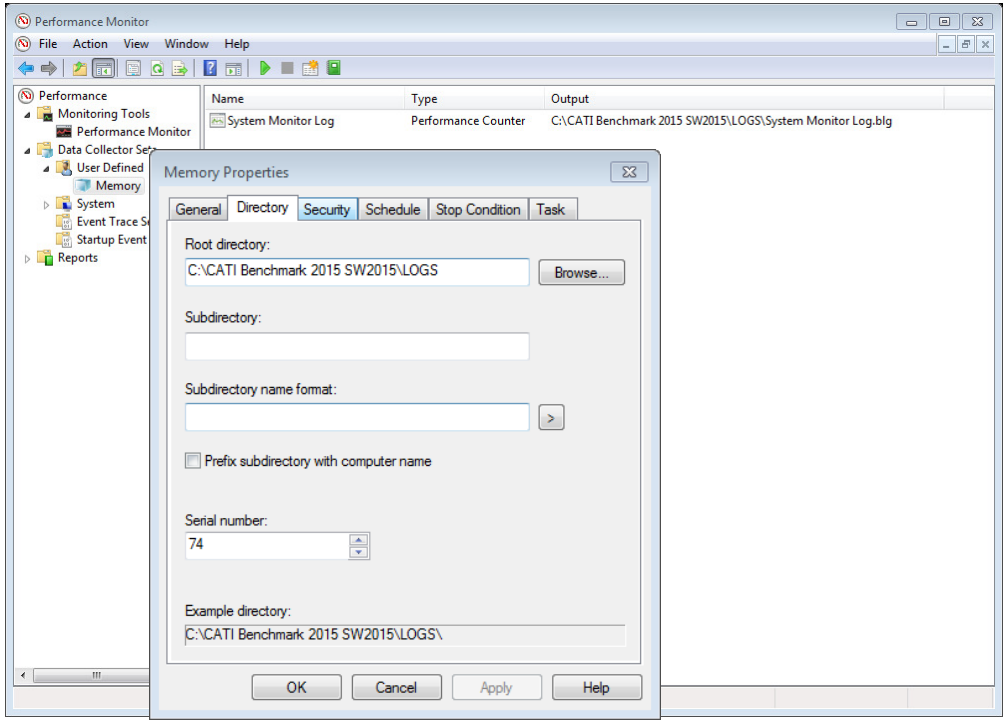
- perfmon



RAM

Performance Monitor

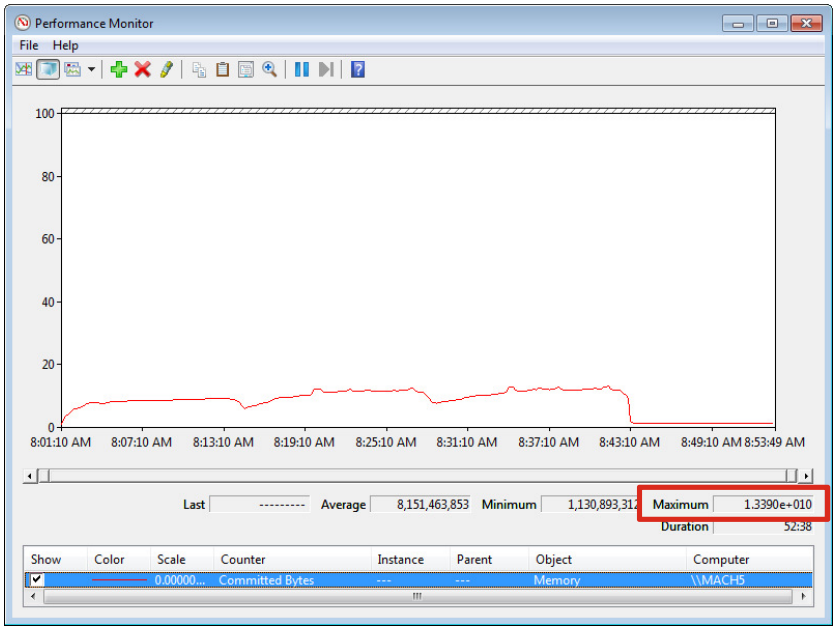
- perfmon



RAM

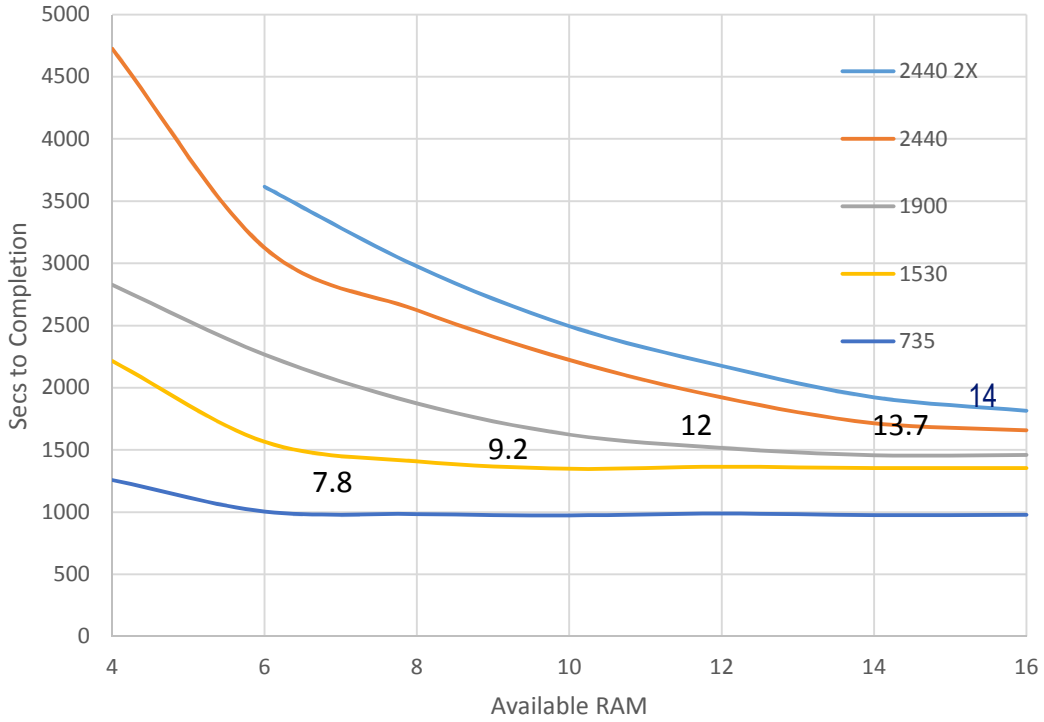
Performance Monitor

- perfmon



RAM

- It's better to over buy than under buy
- Modeling methodology is huge



Processor Speed

- SolidWorks uses no more than 2 cores
- The OS can use another 2 cores
- Anything more that 4 is overkill

Can your processor be too fast?

- You can have more than enough RAM
- You can have more than enough Cores

Processor Speed

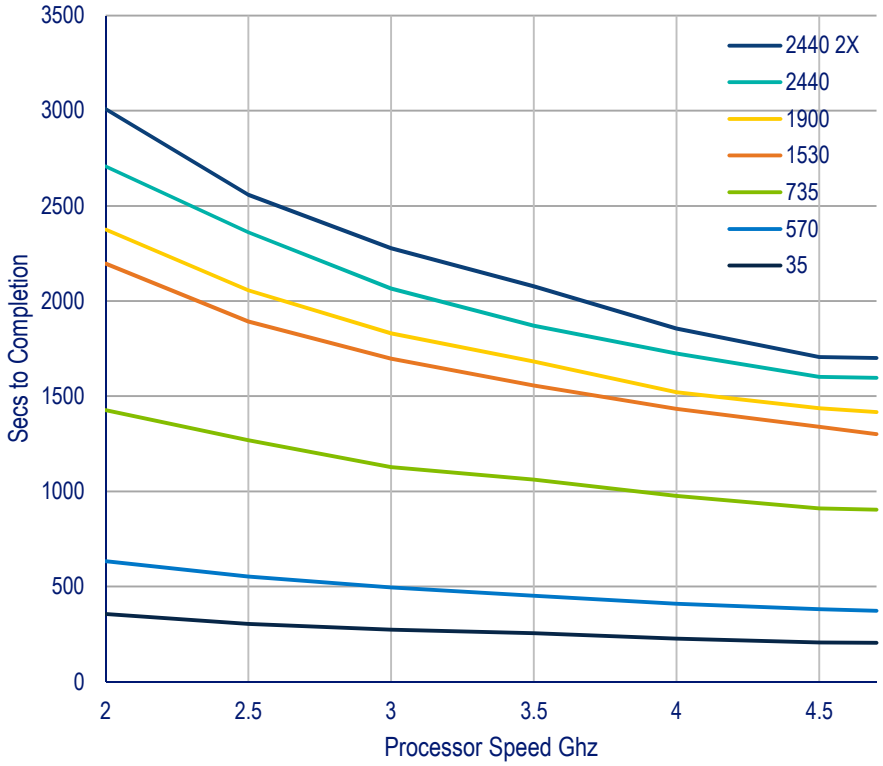
Is there such thing as too much?

- Benchmark was run with:
  - 7 different assemblies
  - 7 different processor speeds
  - No graphics manipulation
  - 32 GB RAM
  - SSD for operation and storage

Processor Speed

Expectations

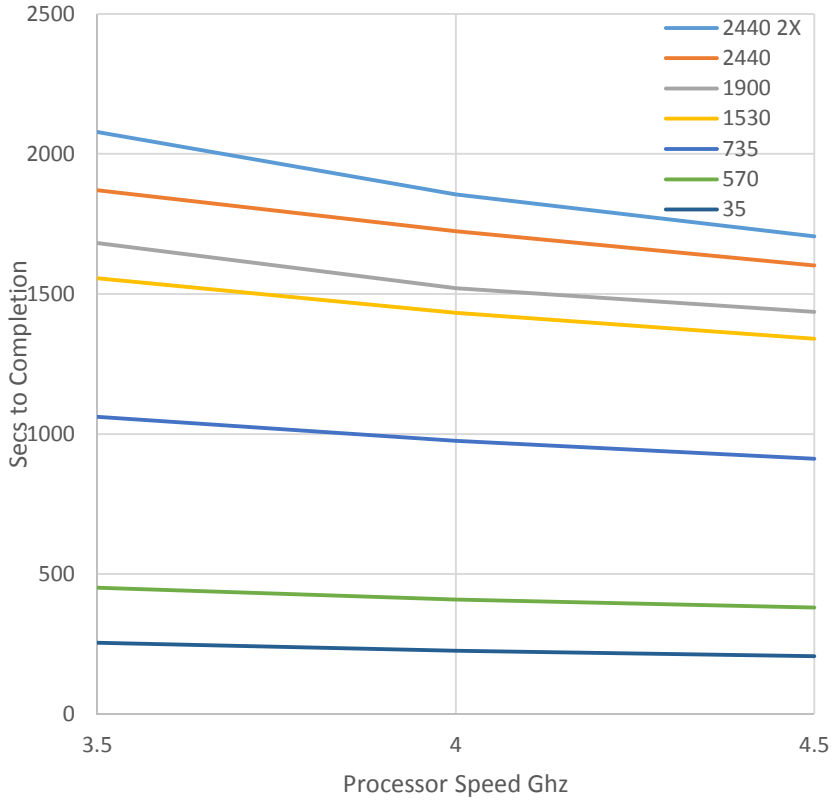
- Between 7.5% and 9.0% performance increase per ½ GHz
- No discernable difference between small and large assemblies



Processor Speed

The Practical Zone

- 3.5 – 4.5 Ghz
  - Largest Assembly – 18% faster
  - Smallest Assembly – 19% faster
  - Least Improved 1530 – 14% faster



Graphics

NVIDIA®

Graphics

What Affects Graphics Performance?

K620

K2200

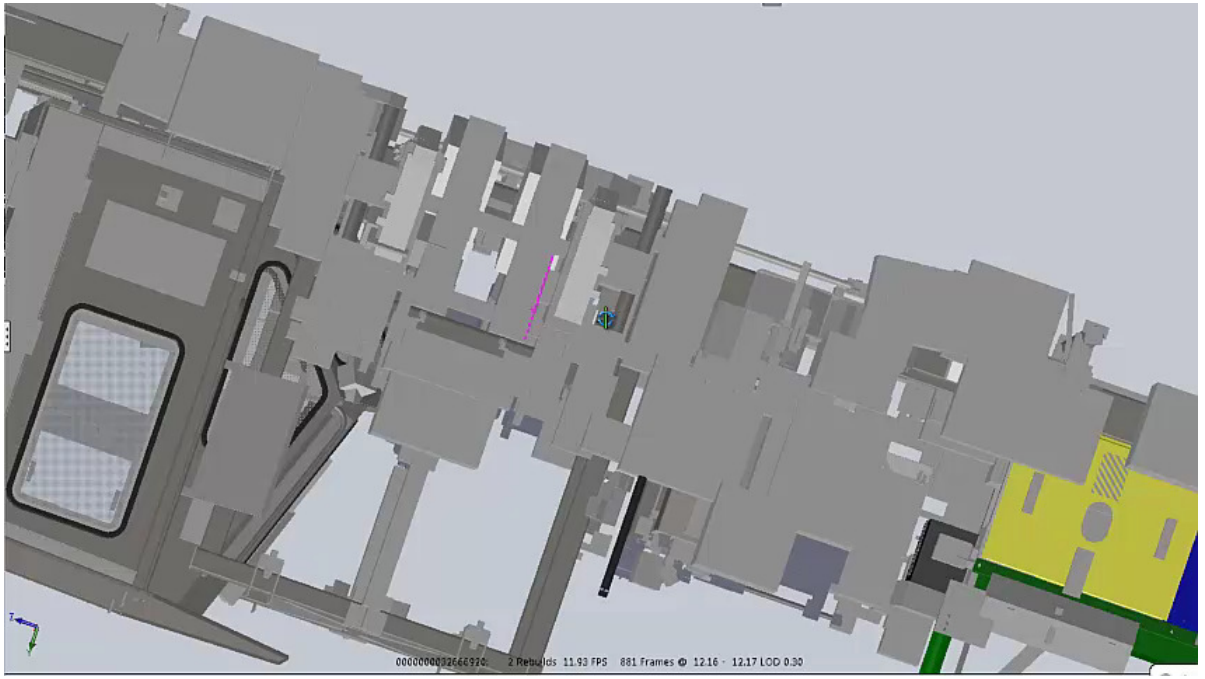
K4200

- Graphics card
- Driver
- CPU
- RAM
- Assembly size
- Complexity of geometry
- Level of Detail

- Curvature Generation
- Lightweight Mode
- Realview and Shadows
- Software OpenGL
- Image Quality
- Display Style
- More…..

Graphics

How do we measure performance?



- FPS
- The “Response”
- The “Feel”
- Image Quality (while in motion)

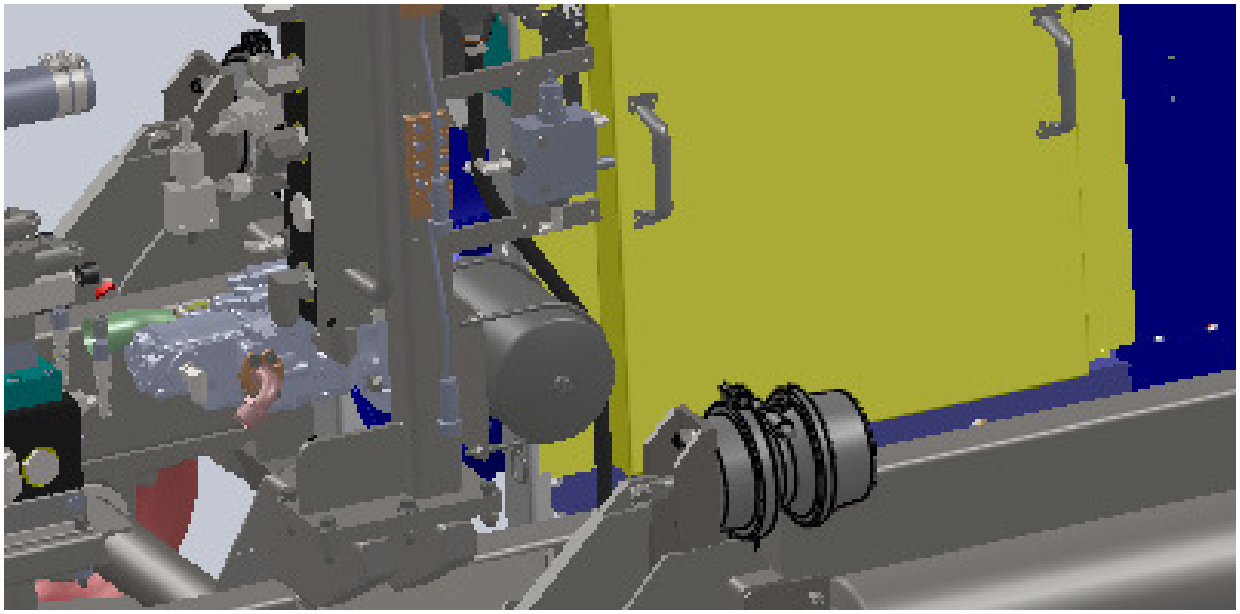
Graphics

How many frames per second can a human perceive?

- Common thought is 60 fps
- Some experiments show at least 220 fps
- Most monitors only go to 60Hz
- Monitors can be found at 120Hz and even 240Hz
- What your graphics card can do beyond the refresh rate is overkill.

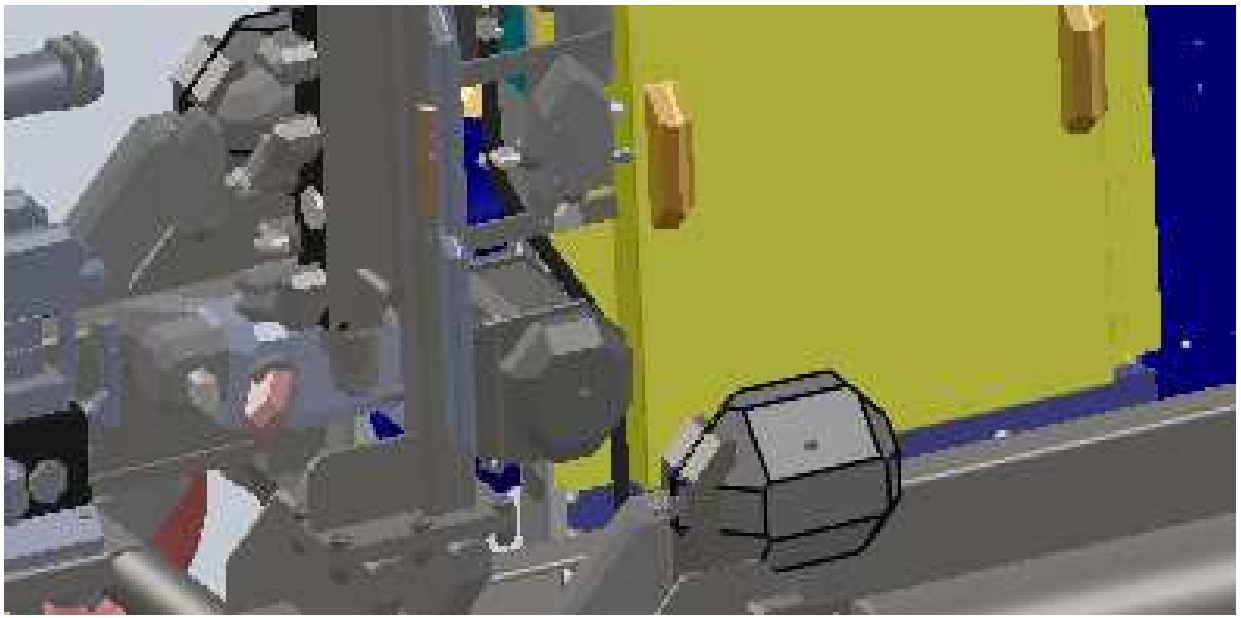
Graphics

Level of Detail



Graphics

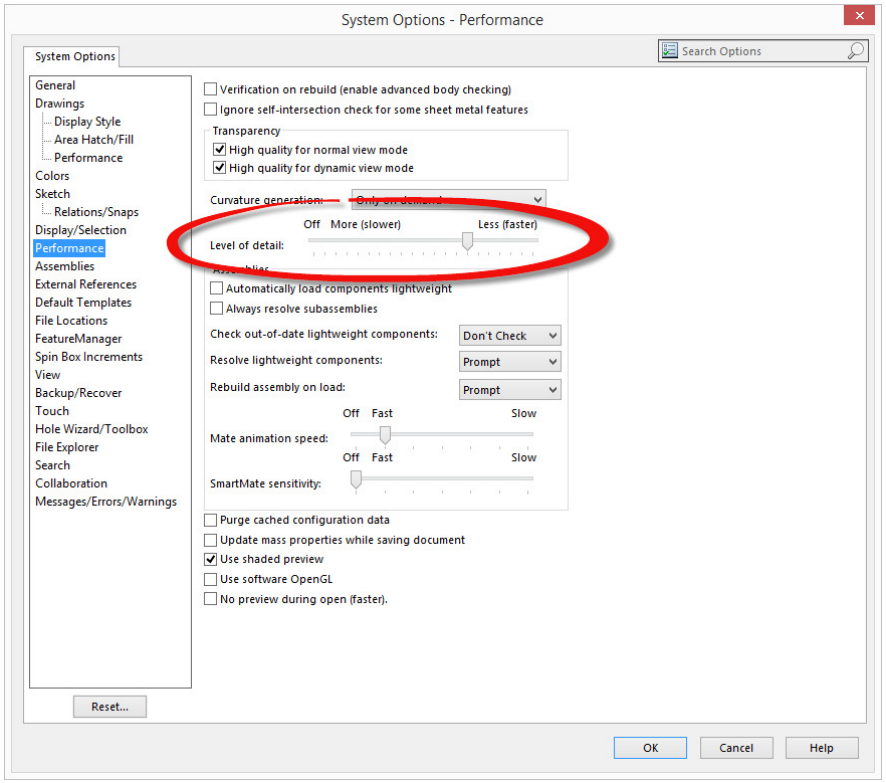
Level of Detail



Graphics

Level of Detail

- Limits image quality while panning, zooming, and spinning
- Allows a model to translate more smoothly with less visible detail
- Left = More detail fewer fps
- Right = Less detail more fps



Graphics

Level of Detail

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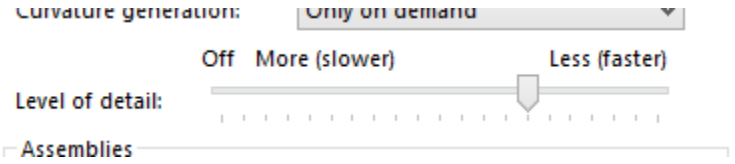
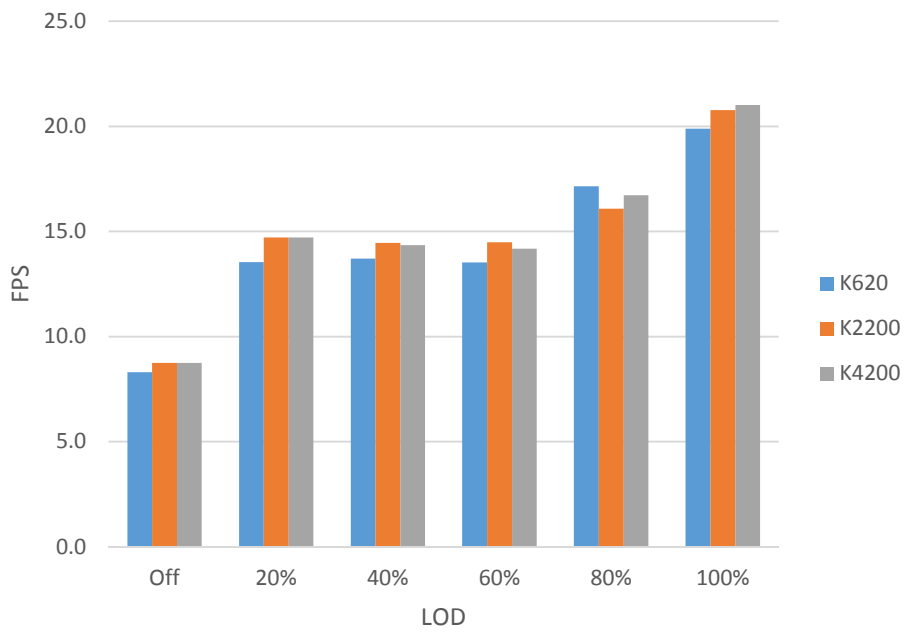


Graphics

Large Assemblies

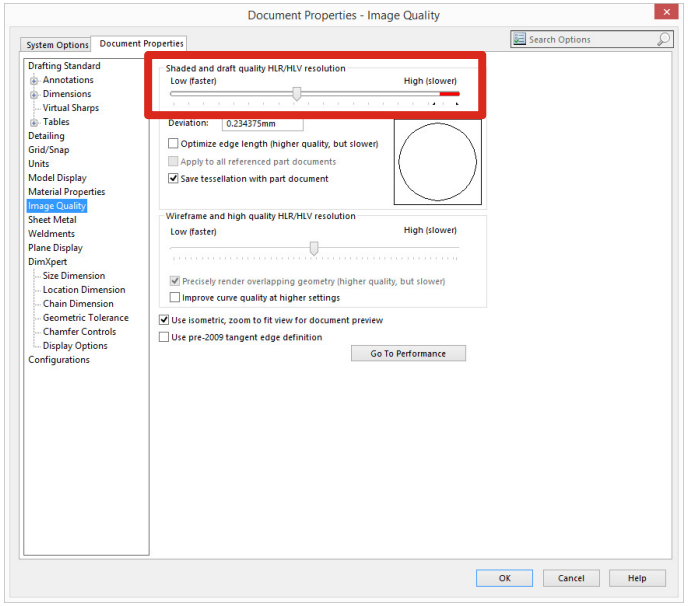
- % Difference extremely small
  - Off – 5.0%
  - 20% -- 8.0%
  - 40% -- 5.2%
  - 60% -- 6.6%
  - 80% -- 6.2%
  - 100% -- 5.3%



Graphics

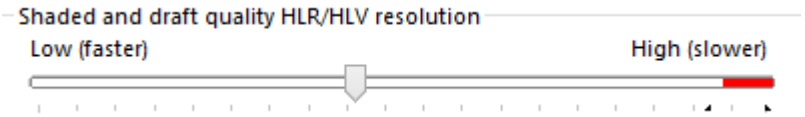
When do better graphics cards make a difference?

- Single part
- Complex geometry
- Large amount of tessellation



- We tested a single part
- Ran the image quality up in steps

  25% : 50% : 75% : 95% : 100%

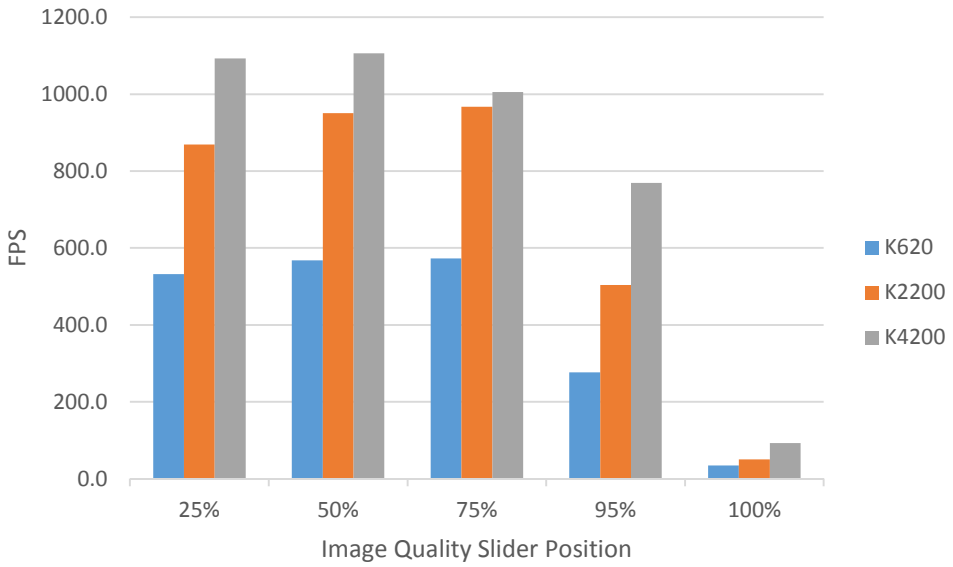


Graphics

When do better graphics cards make a difference?

- Going from a K620 to a K2200
  - 69% more fps on average
- Going from a K2200 to a K4200
  - 22% more fps on average

Most of the improvement occurs beyond the monitor's ability to display.

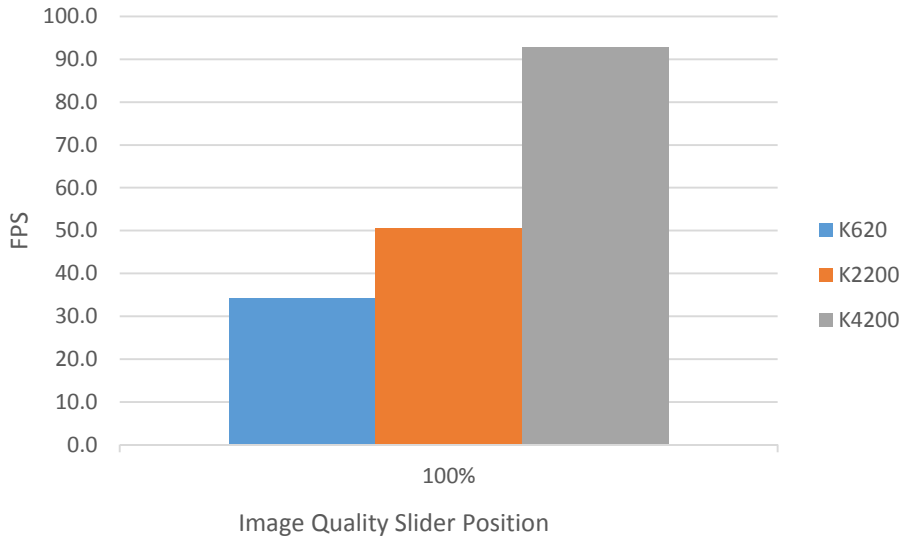


Graphics

When do better graphics cards make a difference?

- Going from a K620 to a K2200
  - 48% more fps on average
- Going from a K2200 to a K4200
  - 83% more fps on average

This improvement is very noticeable especially with 120Hz monitors.



Graphics

What is the large assembly threshold?

At some point SolidWorks determines that an assembly is too big for the graphics card

K620

	LOD 0%	LOD 20%	LOD 40%	LOD 60%	LOD 80%	LOD 100%	RV & Shdw	Curve	Always
1530	19.4	21.9	21.5	21.9	21.2	23.7	7.4		18.8
735	25.7	33.3	33.9	32.7	33.8	31.8	10.1		25.9
570	359.8	335.4	339.4	325.3	327.8	334.8	206.0		261.5
35	318.8	325.9	324.7	327.2	324.7	325.3	202.0		317.0

Graphics

What is the large assembly threshold?

Oddly, it happens at roughly the same spot regardless of what card you're working with

		LOD 0%	LOD 20%	LOD 40%	LOD 60%	LOD 80%	LOD 100%	RV & Shdw Curve	Always
K2200	1530	20.6	23.9	22.9	22.7	22.6	24.2	9.0	20.0
	735	23.8	35.2	32.5	32.1	34.3	33.6	10.4	25.0
	570	275.6	356.1	353.2	357.6	368.2	351.8	256.4	398.8
	35	319.3	328.4	320.5	328.4	326.6	321.1	234.8	320.5

Graphics

What is the large assembly threshold?

Up to the point of SolidWorks redirecting the graphics operation; the more powerful cards seem to perform, on average, faster.

		LOD 0%	LOD 20%	LOD 40%	LOD 60%	LOD 80%	LOD 100%	RV & Shdw	Curve Always
K4200	1530	19.4	22.7	22.8	22.6	23.1	25.0	8.8	19.8
	735	25.5	35.0	33.9	33.5	34.6	34.4	10.5	25.4
	570	403.5	356.9	352.5	356.9	359.1	361.3	278.3	405.3
	35	328.4	326.6	320.5	321.7	326.6	323.5	237.1	327.8

Summary

What is practical for me?

- Solid state hard drive
- 16GB RAM (Actually dependent on your specific needs)
- Nvidia K2200 graphics card
- Single 4 core processor (more cores if sim or photo-rendering is to be done)
- Processor clock speed as fast as you can afford
- Local working directory (EPDM)
- Optimized SolidWorks Options (details in Wednesday's presentation)

Questions

For a copy of this and all other presentations

http://www.cati.com/sww2015/

For more information visit

blog.cati.com

Racine Railroad Products

Thank You

CATI and InFlow Presentation Schedule

Monday February, 9th

- **Discovering and Understanding SOLIDWORKS Dismissed Messages** - 1:30pm-2:30pm - Room North 229, Bryan Pawlak and Phil Whitaker
- **SOLIDWORKS Composer: As Easy as Building with Legos** - 1:30pm-2:30pm – Room North-225B, Brian Reel
- **Achieving Extreme SOLIDWORKS Performance: Hardware/Configuration** - 2:45-3:45pm - Room North-121A-C, Adrian Fanjoy and Josh Altergott
- **Configuring SOLIDWORKS Toolbox** - 2:45-3:45pm - Room North-124A/B, John Van Engen
- **Successfully Prepare for Your EPDM File/Data Migration** - 2:45-3:45pm - Room North-120B-C, Jeff Barker

Tuesday February, 10th

- **SOLIDWORKS Duct Tape & Bailing Wire: Creative Solutions to Everyday Problems**- 1:30-2:30pm - Room North 129A/B, Josh Altergott and Adrian Fanjoy
- **Drawings: Setup of Templates and Sheet Formats**- 1:30-2:30pm - Room North-221, Jim Krivoshein
- **EPDM Web: Implementing and Configuring** - 1:30pm-2:30pm - Room North-121A-C, Justin Webster
- **How to Build and Maintain Effective Design Tables** - 2:45-3:45pm - Room North-120D, Josh Altergott
- **DriveWorksXpress Essentials Hands-On Lab** – 4:30pm-6:00pm - Room North-227C, Ryan Dally

Wednesday February, 11th

- **Achieving Extreme SOLIDWORKS Performance: Modeling Methodology** - 2:45-3:45pm - Room North-120D, Josh Altergott, and Adrian Fanjoy
- **Sharing Assemblies—Without Giving It All Away**- 2:45-3:45pm - Room North-221, Jim Krivoshein

For a copy of all CATI and InFlow presentations please go to http://www.cati.com/sww2015