

Tips and Tricks on Desktop and Mobile Workstation Selection

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Worldwide Product Development & AEC Segment Mgr.



@SalomoneTom



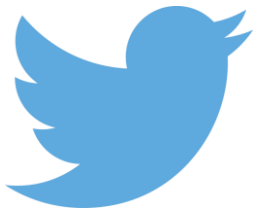
Wed, June 8, 2016

9:15- 10:00 Room 104B





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@ThinkStations
#ThinkPSeries
@SalomoneTom



Lenovo ThinkStation
Tom Salomone

Email

tsalomone@lenovo.com



+ See Technologies in the Lenovo booth & Win Big!

Unique Technology



**Yoga
Tablet 2**

Qty 2

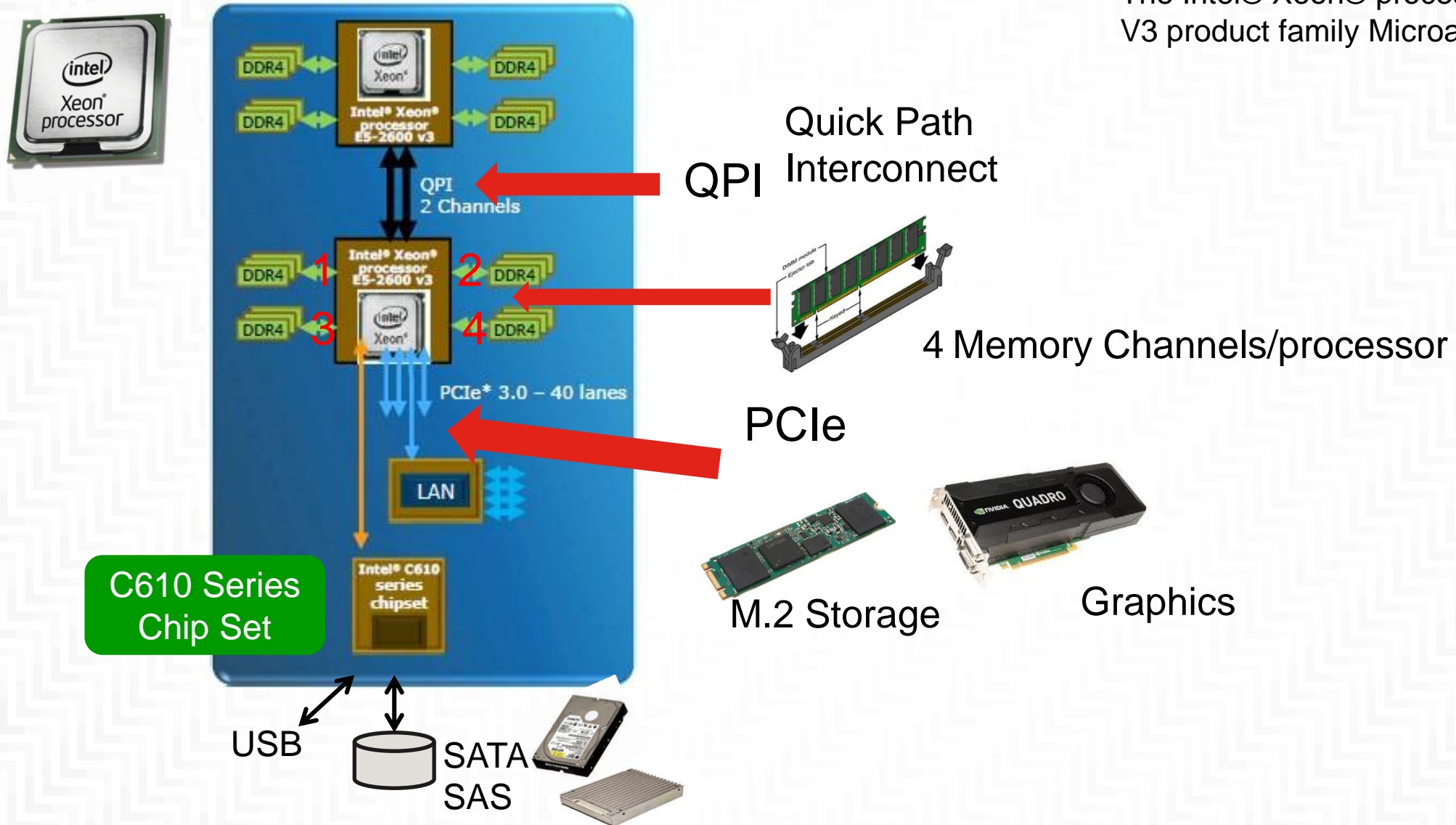
WIN BIG!

Agenda

- **Base Education**
 - **The basics...How a system works with your applications**
 - **The importance of certification**
 - **Processor Selection**
 - **New Mobile Technologies/Dawn of a new Era**
 - **Graphics, Massive Technology Changes**
 - **Desktop Workstations**
 - **Unique Lenovo Advantages**
 - **Understanding graphics, knowing what to choose**
 - **Selecting Storage/ Storage benchmarks**
 - **Summary comments**

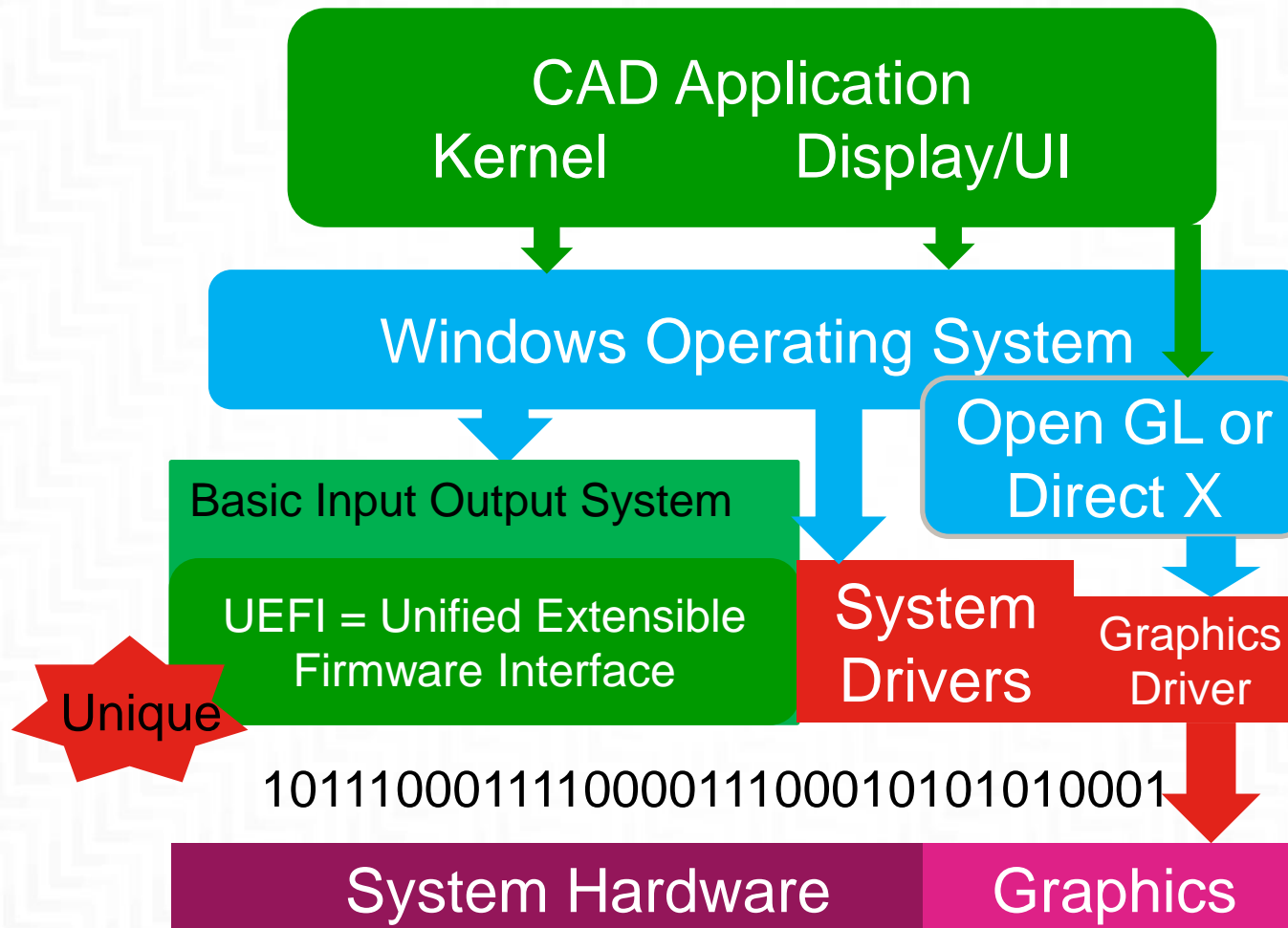
+ The Basics of How a System Works

The Intel® Xeon® processor E5-2600 V3 product family Microarchitecture



+ The Basics of How a System Works

Software Components



+ Certification Combinations



Nvidia Tesla

Nvidia Quadro M6000

Nvidia Quadro M5000

Nvidia Quadro M4000

Nvidia Quadro K2200

Nvidia Quadro K620

Nvidia Quadro M5000M

Nvidia Quadro M4000M

Nvidia Quadro M2000M

Nvidia Quadro M1000M

Nvidia Quadro M600M

Nvidia Quadro M500M

Intel graphics



Lenovo™



+ Certification Combinations

5 ThinkStations x 5 Graphics Cards x 3 OS = 75 combinations

4 ThinkPads x 3 Graphics Options x 3 OS = 36 combinations

X PTC® Applications & Versions X Graphic Drivers

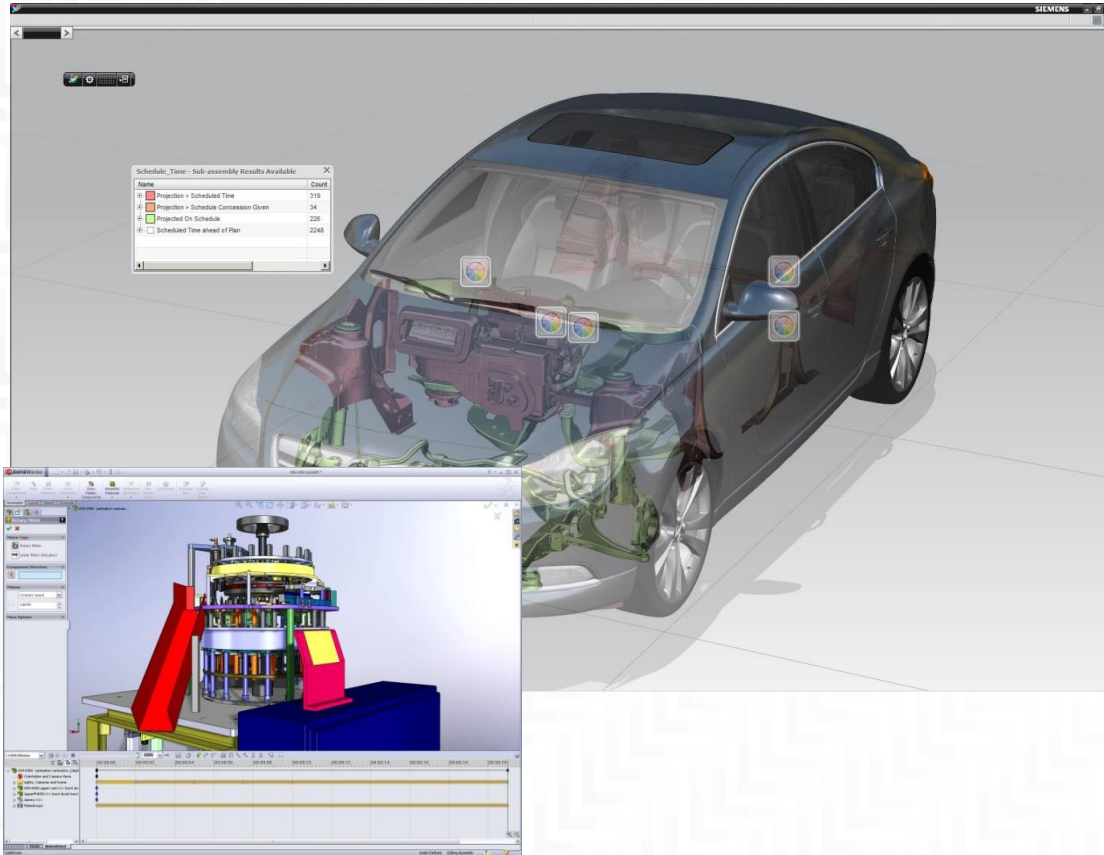
Processors



+ Basic Processor Choices

GHz First

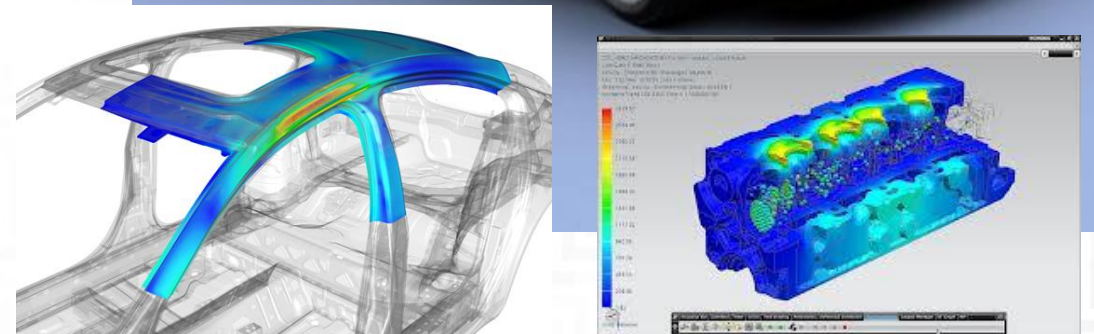
CAD Applications Single Processor -



Cores First

CAE/Simulation/Rendering

Dual Processors -



+ Hasswell -- Broadwell -- Skylake for Desktop

Intel #	Name	process	Cores	Hyper-Threading	Speeds	Turbo boost	Graphics
i7-6700k	Skylake (Gen 6) (Q3 2015)	14 nm	4	Yes	4.0 GHz	4.2 GHz	HD 530
i5-6600k	Skylake (Gen 6)	14 nm	4	No	3.3GHz	3.9 GHz	HD 530
Xeon E3-1280v5	Skylake (Gen 6) Coming	14 nm	4	Yes	3.7 GHz	4.0 GHz	None
i7 -4790c	Broadwell (Gen5) (Q2 2015)	14 nm	4	Yes	4.0 GHz	4.4 GHz	HD4600
I5-4690c3	Broadwell (Gen5)		4	No	3.5 GHz	3.9 GHz	HD4600
Xeon E3-1285v4	Broadwell (Gen5)	14nm	4	Yes	3.5 GHz	3.8 GHz	Iris Pro P6300
i7-4790	Haswell (Gen4)	22nm	4	Yes	4.0 GHz	4.4 GHz	Intel HD Graphics 4600
Xeon E3-1286 v3	Haswell (Gen4) Q2 2014 (refresh)	22nm	4	Yes	3.6 GHz	4.1 GHz	Intel HD P4700

The atoms used in silicon chip fabrication are around 0.2nm.

+ What does this mean

Xeon E3 v5
Core i7, i5, i3 Gen 6

Xeon E5 v4 & v3



+ Hasswell – Skylake-- Broadwell for Mobile

Intel #	Name	Process	Cores	Hyper-Threading	Speeds	Turbo boost	Graphics
i7-6920HQ	Skylake (Gen 6) Q3 2015	14 nm	4	Yes	2.9 GHz	3.8 GHz	HD 530
Xeon Mobile E3-1535M v5	Skylake (Gen 6) Q3 2015	14 nm	4	Yes	2.9 GHz	3.8 GHz	HD 530
i7-5960HQ	Broadwell (Gen5) Q1 2015	14nm	4	Yes	2.9 GHz	3.8 GHz	Iris Pro Graphics 6200
i7-4910MQ	Hasswell (Gen 4) Q1 2014	22nm	4	Yes	2.9 GHz	3.9 GHz	HD4600

New for Mobiles

+ What Does this mean



P40



P50s



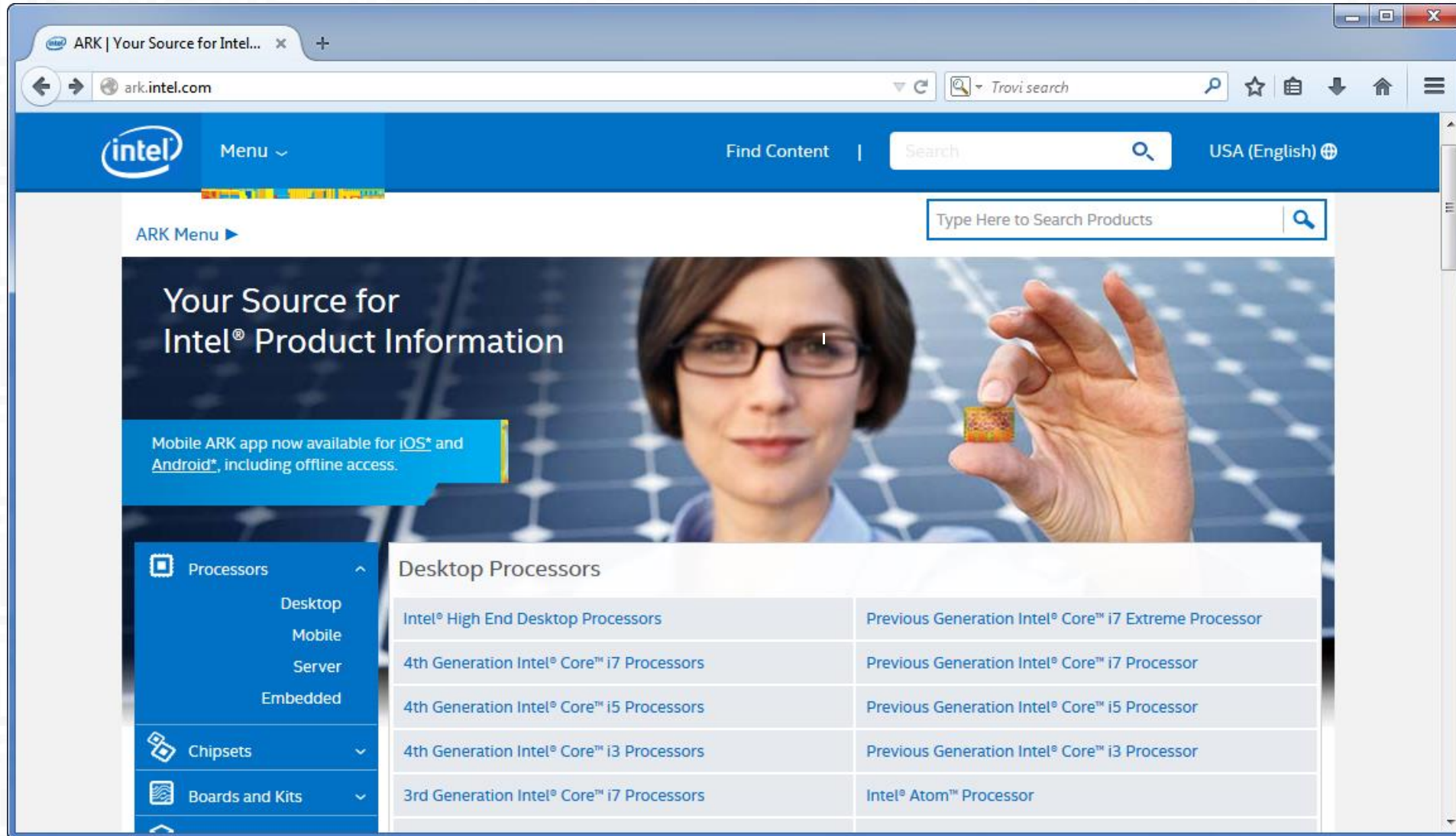
P50



P70

+ Finding Processor Information

Start: <http://ark.intel.com/>



The screenshot shows the Intel ARK website interface. At the top, there is a navigation bar with the Intel logo, a 'Menu' dropdown, 'Find Content', a search bar, and 'USA (English)'. Below this is a secondary search bar with the placeholder text 'Type Here to Search Products'. The main content area features a large banner with the text 'Your Source for Intel® Product Information' and a woman holding a processor chip. A blue notification box states: 'Mobile ARK app now available for iOS* and Android*, including offline access.' On the left, a navigation menu is open, showing 'Processors' selected, with sub-options for Desktop, Mobile, Server, and Embedded. Below the menu, a table lists various processor categories.

Desktop Processors	
Intel® High End Desktop Processors	Previous Generation Intel® Core™ i7 Extreme Processor
4th Generation Intel® Core™ i7 Processors	Previous Generation Intel® Core™ i7 Processor
4th Generation Intel® Core™ i5 Processors	Previous Generation Intel® Core™ i5 Processor
4th Generation Intel® Core™ i3 Processors	Previous Generation Intel® Core™ i3 Processor
3rd Generation Intel® Core™ i7 Processors	Intel® Atom™ Processor

+ Finding Processor Information

Start: <http://ark.intel.com/>

intel Menu USA (Eng)

ARK Menu ▶

Intel® Xeon® Processor E3 v5 Family

All (14) Mobile (2) **Server (11)** Embedded (4)

Compare	Product Name	Status	Launch Date	# of Cores	TDP	Recommended Customer Price	Processor Graphics ‡
<input type="button" value="Compare All +"/>							
<input type="button" value="Compare +"/>	Intel® Xeon® Processor E3-1535M v5 (8M Cache, 2.90 GHz)	Launched	Q3'15	4	45 W	TRAY: \$623.00	Intel® HD Graphics P530
<input type="button" value="Compare +"/>	Intel® Xeon® Processor E3-1505M v5 (8M Cache, 2.80 GHz)	Launched	Q3'15	4	45 W	TRAY: \$434.00	Intel® HD Graphics P530

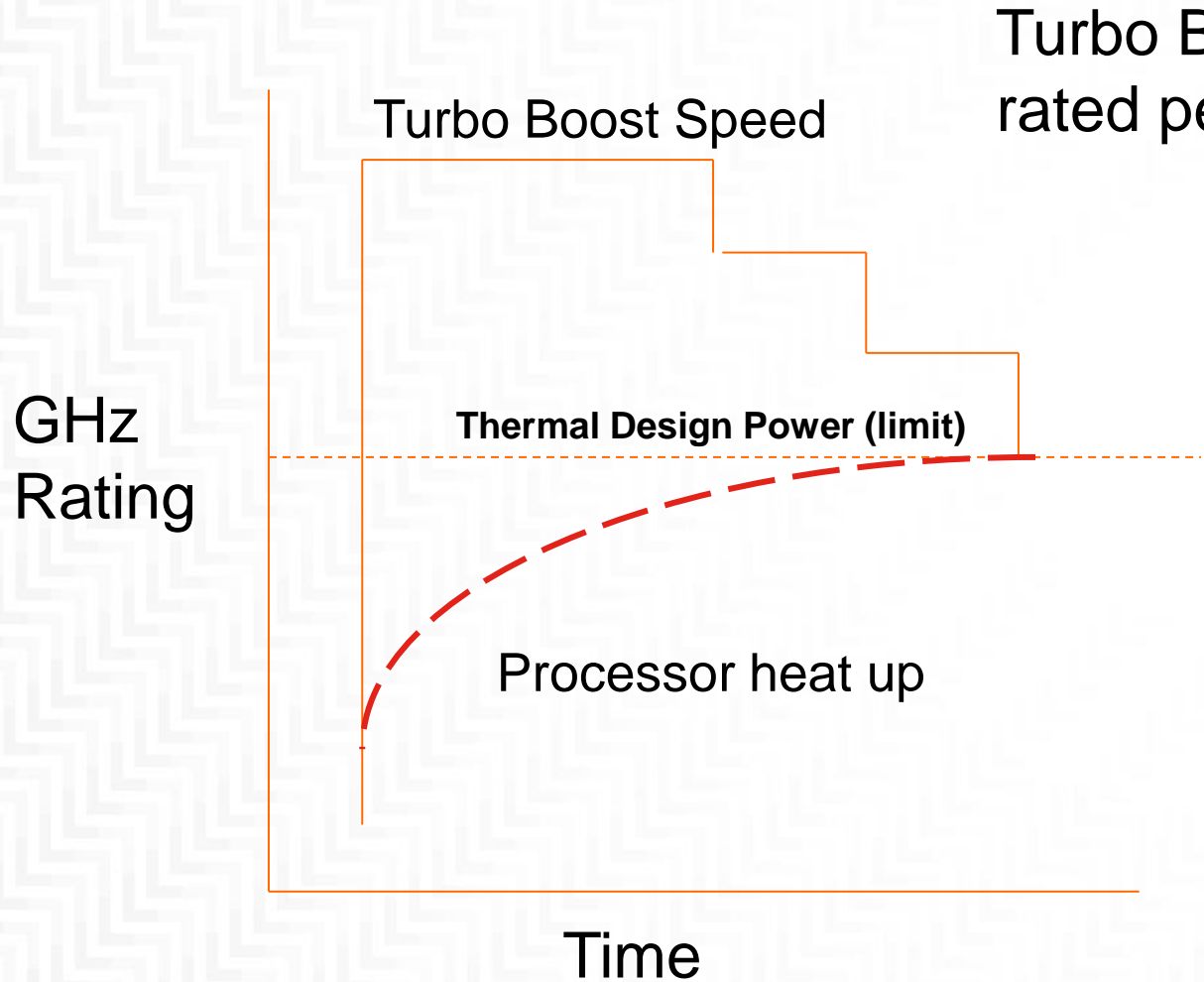
All information provided is subject to change at any time, without notice. Intel may make changes to manufacturing life cycle, specifications, and product descriptions at any time, without notice. The information herein is provided "as-is" and Intel does not make any representations or warranties whatsoever regarding accuracy of the information, nor on the product features, availability, functionality, or compatibility of the products listed. Please contact system vendor for more information on specific products or systems.

"Announced" SKUs are not yet available. Please refer to the Launch Date for market availability.

‡ This feature may not be available on all computing systems. Please check with the system vendor to determine if your system delivers this feature, or reference the system specifications (motherboard, processor, chipset, power supply, HDD, graphics controller, memory, BIOS, drivers, virtual machine monitor-VMM, platform software, and/or operating system) for feature compatibility. Functionality, performance, and other benefits of this feature may vary depending on system configuration.

The Recommended Customer Price ("RCP") is pricing guidance for Intel products. Prices are for direct Intel customers, typically represent 1,000-unit purchase quantities, and are subject to change without notice. Taxes and shipping, etc. not included. Prices may vary for other package types and shipment quantities, and special promotional arrangements may apply. Listing of these RCP does not constitute a formal pricing offer from Intel. Please work with your appropriate Intel representative to obtain a formal price quotation.

+ Turbo Boost 2.0 Manages Processor Speed



Turbo Boost allows faster than rated performance

Dynamically managed:

- Type of workload
- Number of active cores
- Estimated current consumption
- Estimated power consumption
- Processor temperature

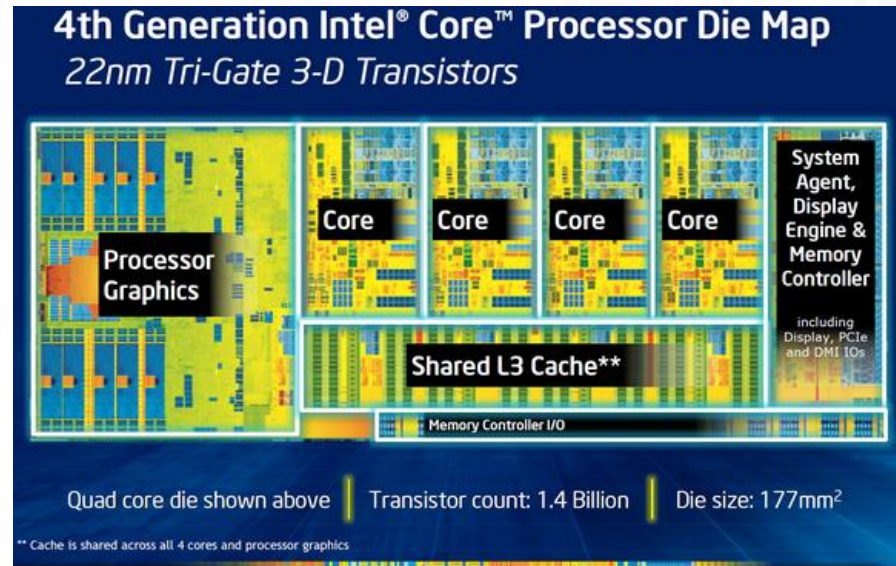
+ Turbo Boost Evolution

Turbo Boost

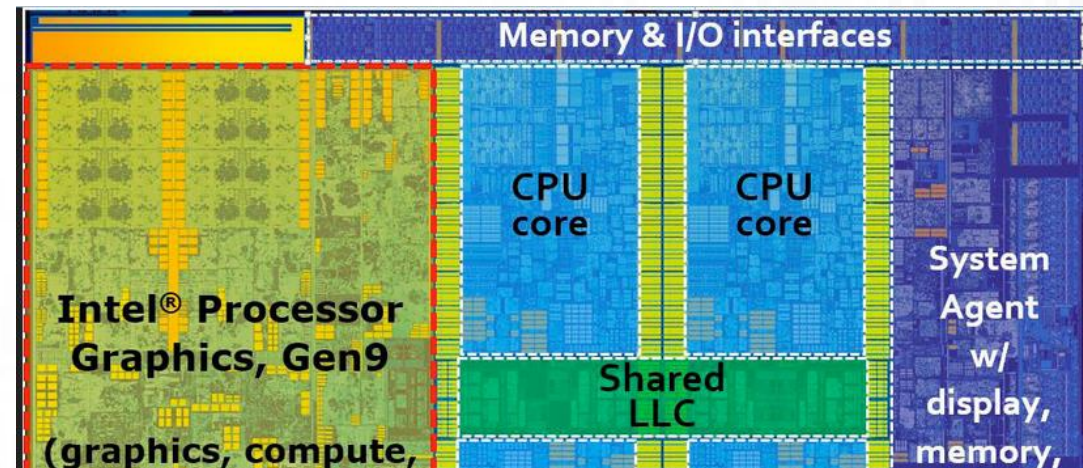
- Nehalem and Westmere
 - Cores Turbo Boost but the noncore regions stayed at a fixed frequency
- Sandy Bridge and Ivy Bridge
 - Core and non-core boost together
- Haswell
 - Energy Efficient Turbo --The two elements of the chip can turbo up and down independently
- Broadwell
 - Turbo Boost 3.0 (Coming)

Turbo Boost 2.0 Monitor

<http://www.techspot.com/downloads/4947-intel-turbo-boost-technology-monitor.html>



6th Generation - 14 nm

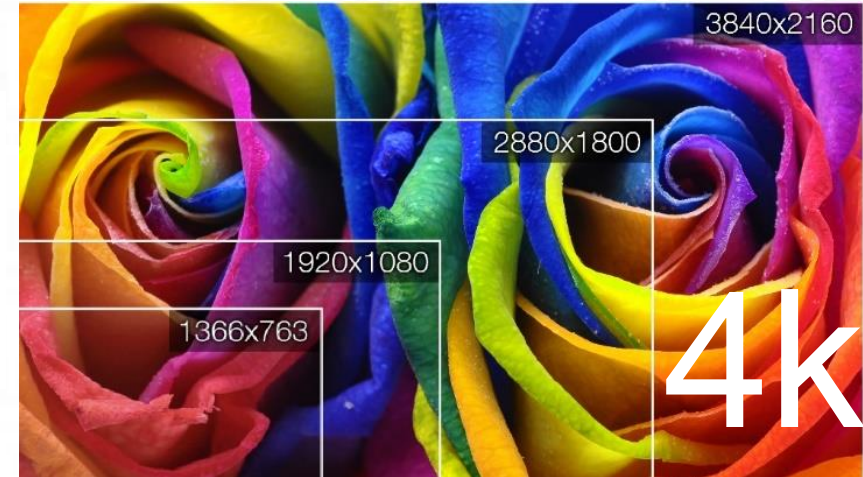




Technology Changes for Mobility



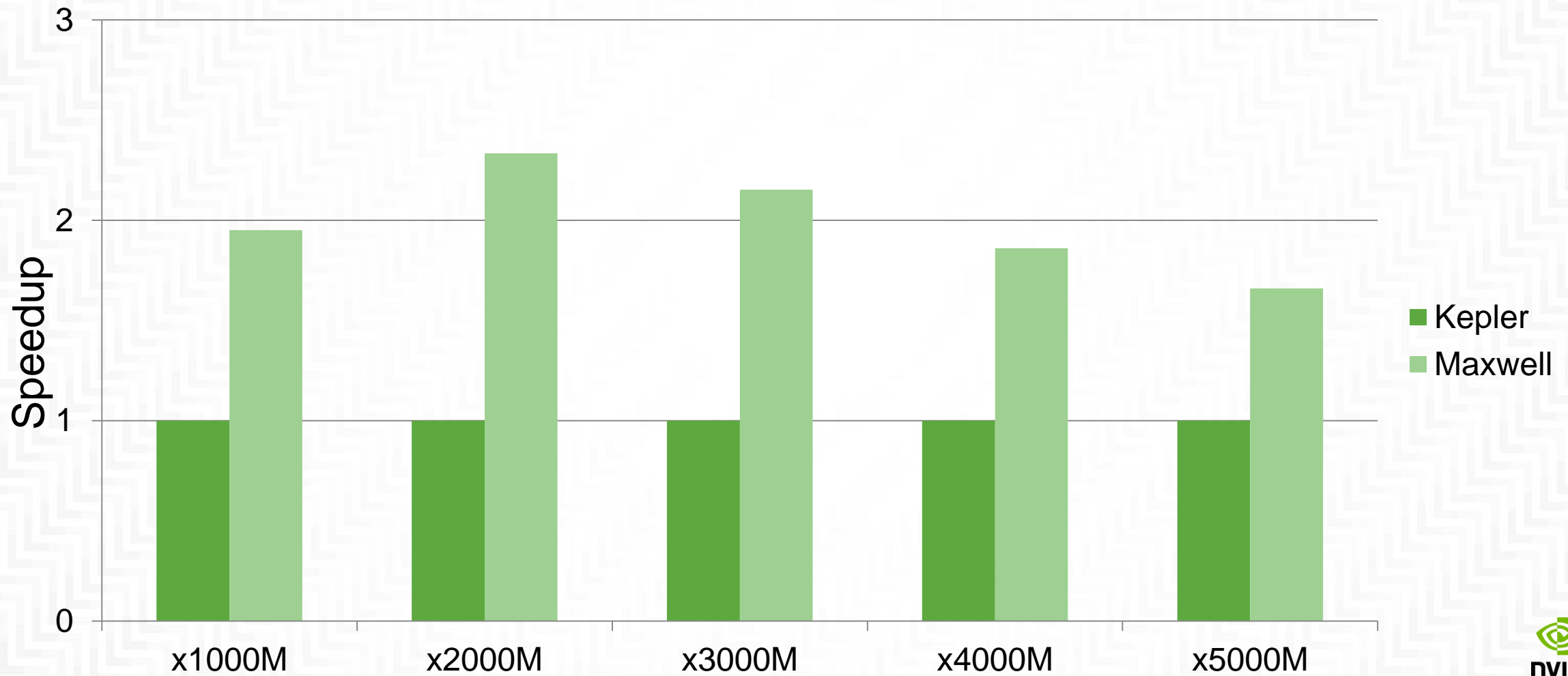
+ Across the Board Updates – Dawn of a New Era



GPUs for Computer Aided Design



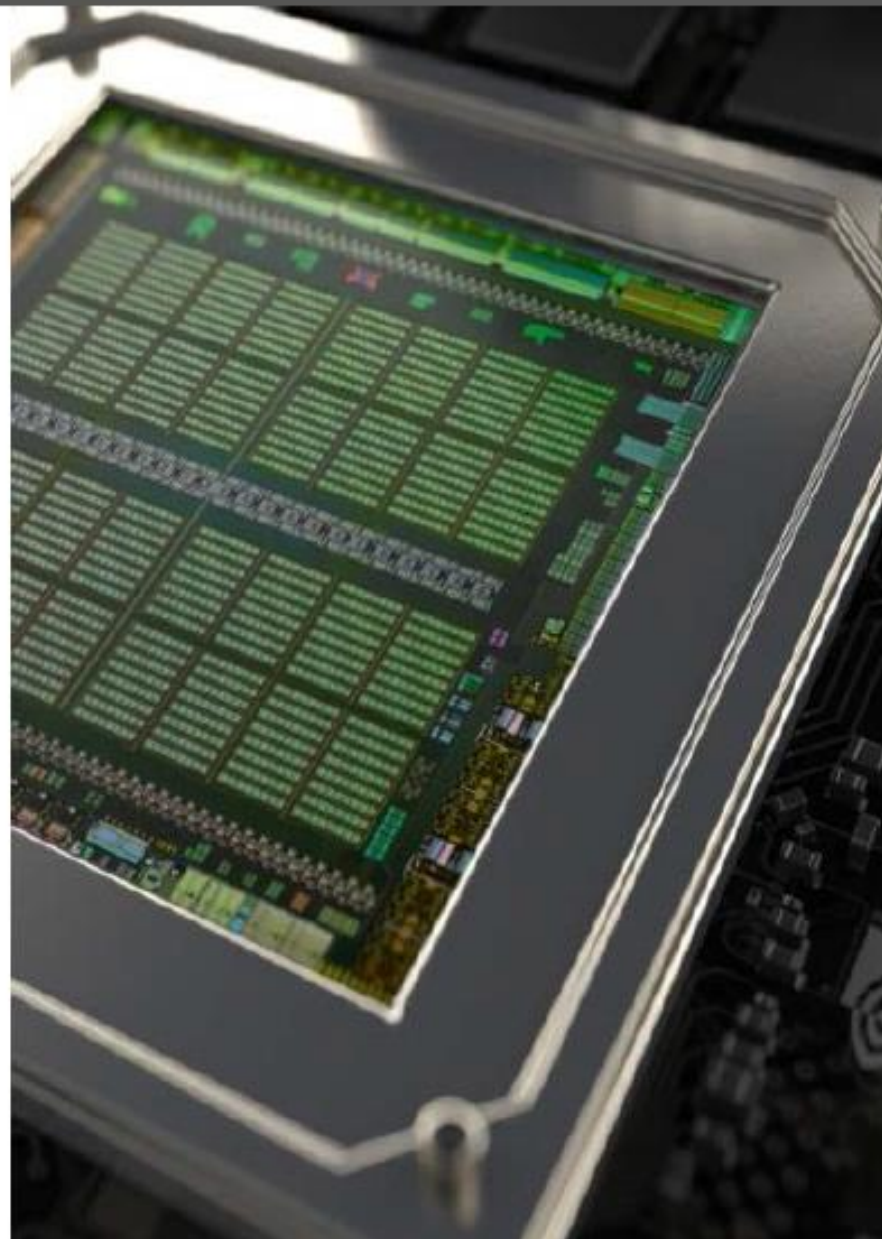
VIEWPERF12 COMPOSITE KEPLER TO MAXWELL PERFORMANCE COMPARISON



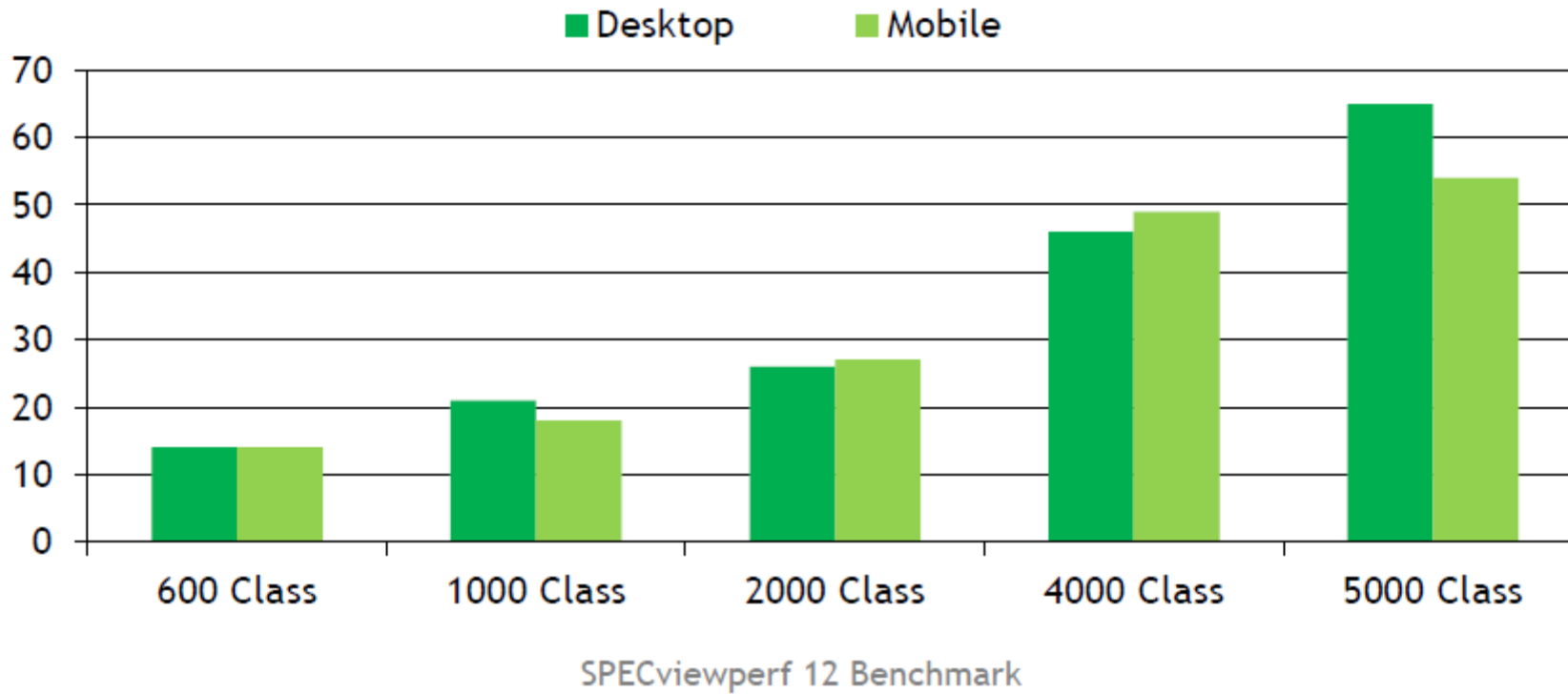
New
NVIDIA QUADRO Mobile Products
Powered by NVIDIA Maxwell GPU

Up To **2X** Performance
Energy Efficiency

* Performance and Energy Efficiency measured using SPECviewperf 12 benchmark

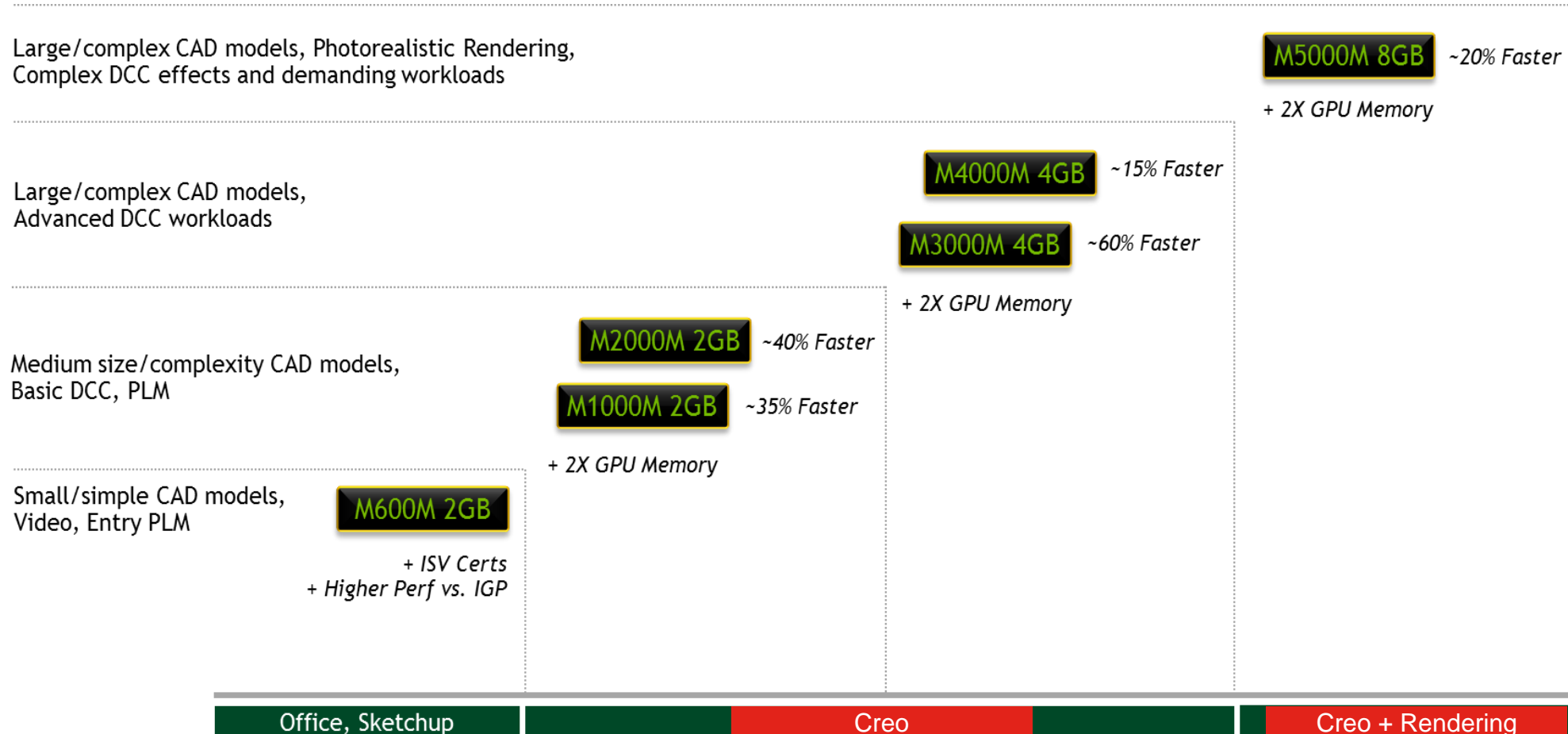


Nvidia Mobile Graphics



Convergence of Desktop and Mobile Performance

+ Mobile Graphics Card Positioning



Perf comparison based on SPECviewperf 12 benchmark

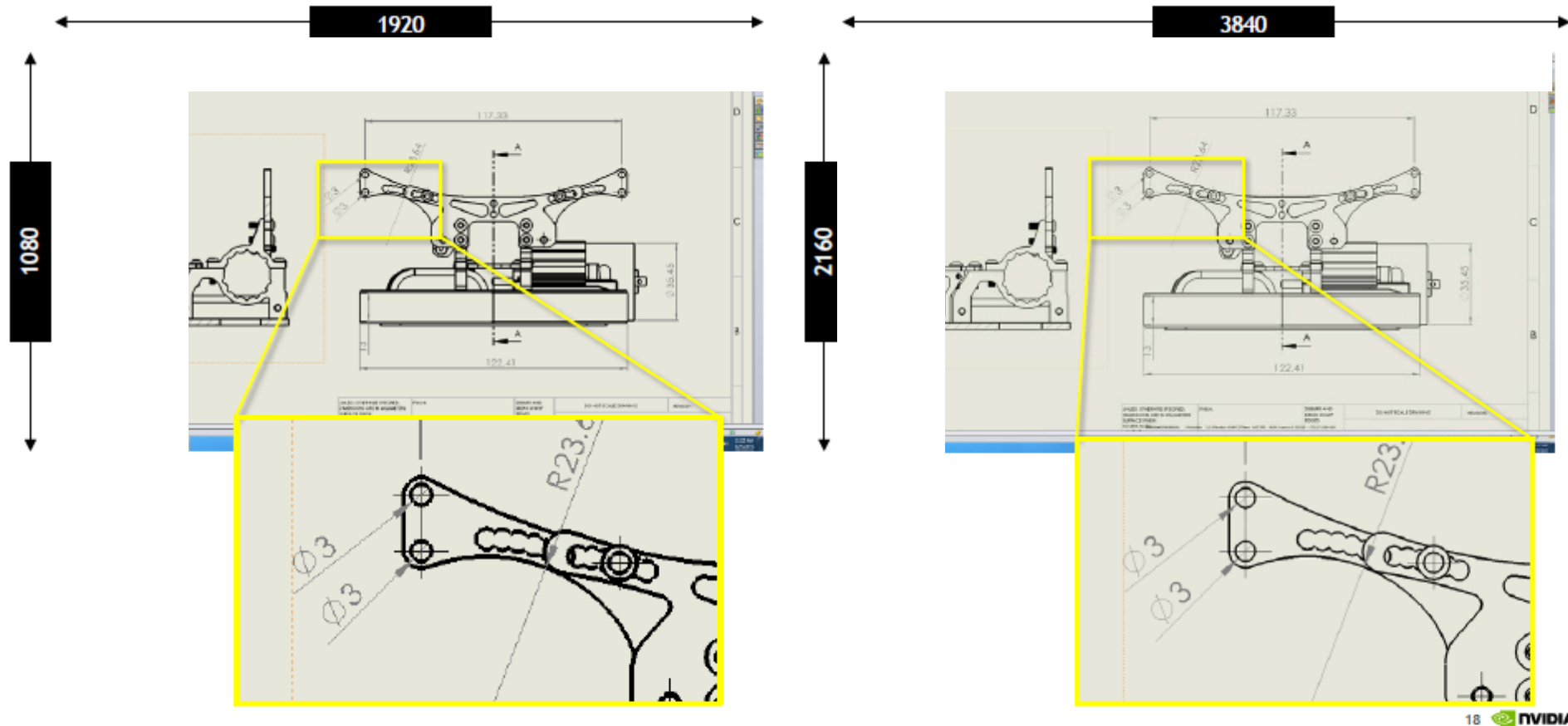


4K Screens



4K with NVIDIA Professional Graphics

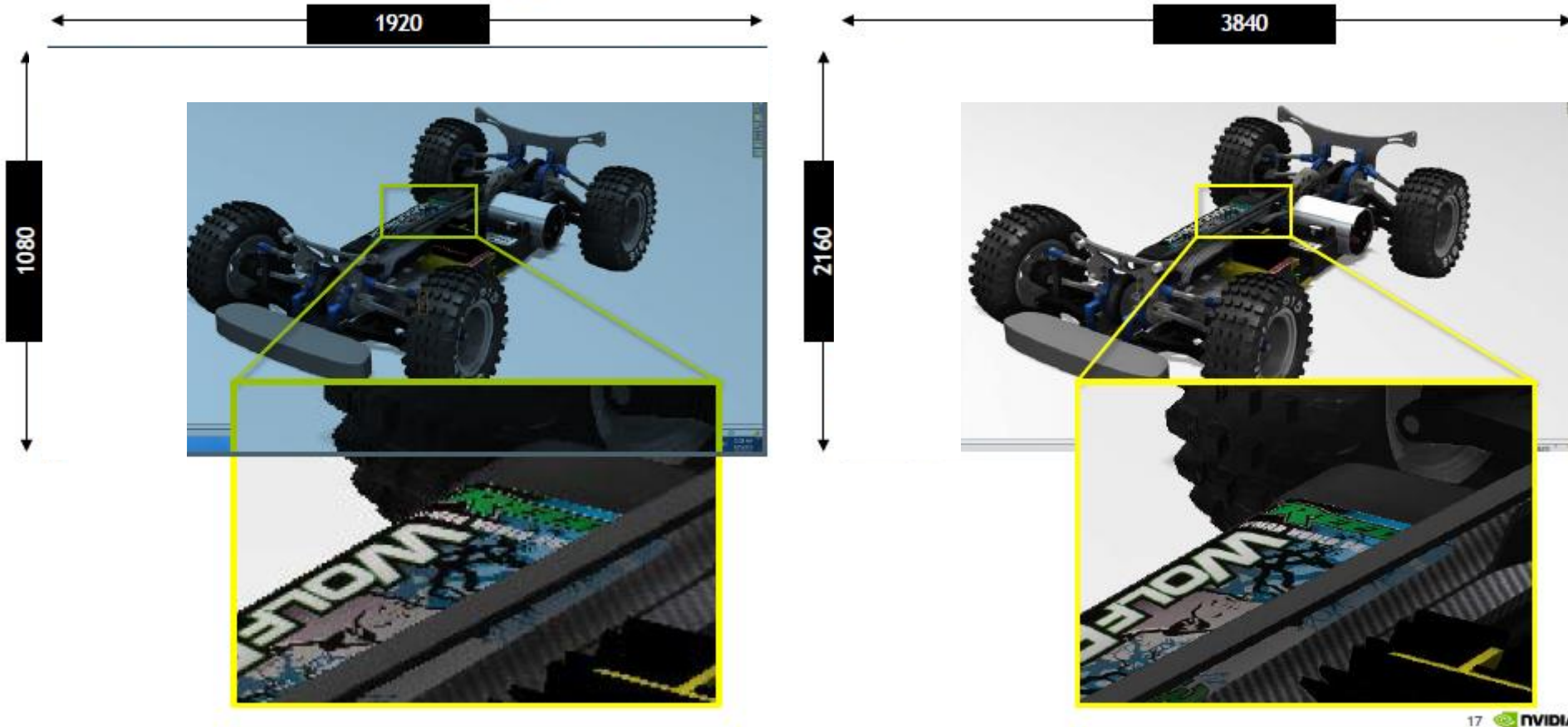
4K - Drawings are especially critical



18 NVIDIA

4K with NVIDIA Professional Graphics

4K - When sharpness matters

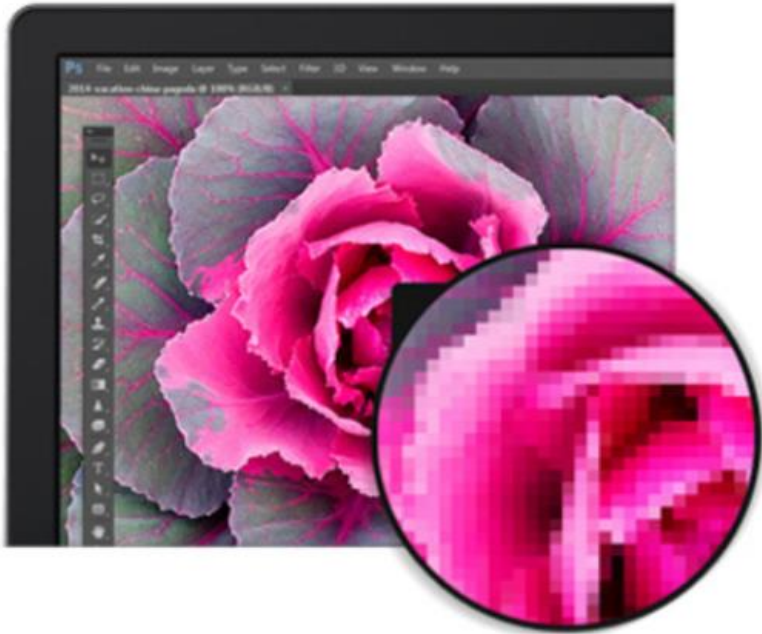


+ Mobility Screens



+ Mobility Screens

2K Full HD
1920x1080



4K Ultra HD
3840x2160



Brilliant Colors and Clarity

Crisp Lines

See more, create better

Image courtesy of PC World April 8, 2015

Unmatched Visuals

**4K UHD IPS screen with
rich, vibrant colors**

Optional touch panel

**100% Color Gamut on
ThinkPad P50**

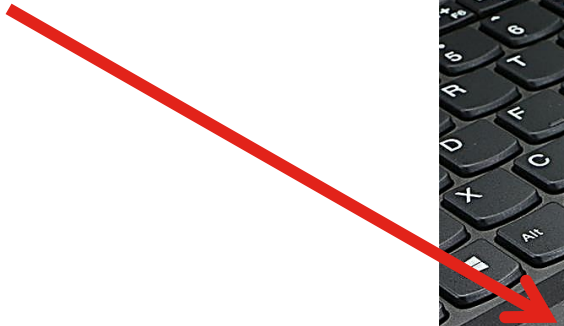


+ Color Calibration

Critical if your job involves color
Calibrate every two weeks

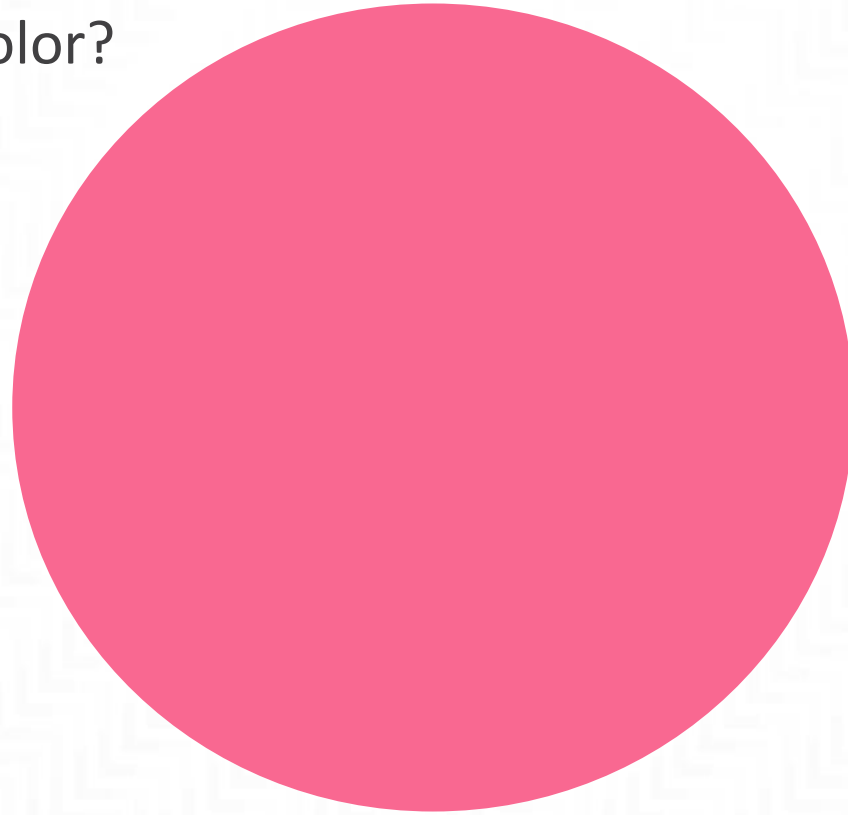


Color Calibrator



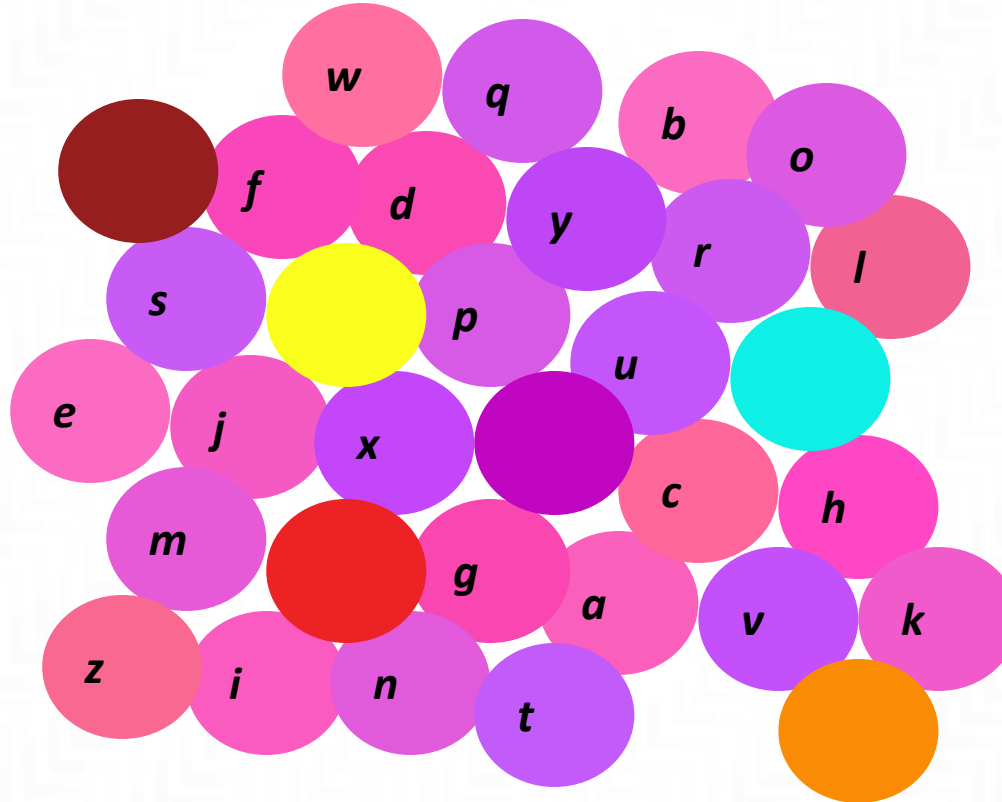
+ X-Rite Panton Color Calibrator

Can you memorize this color?



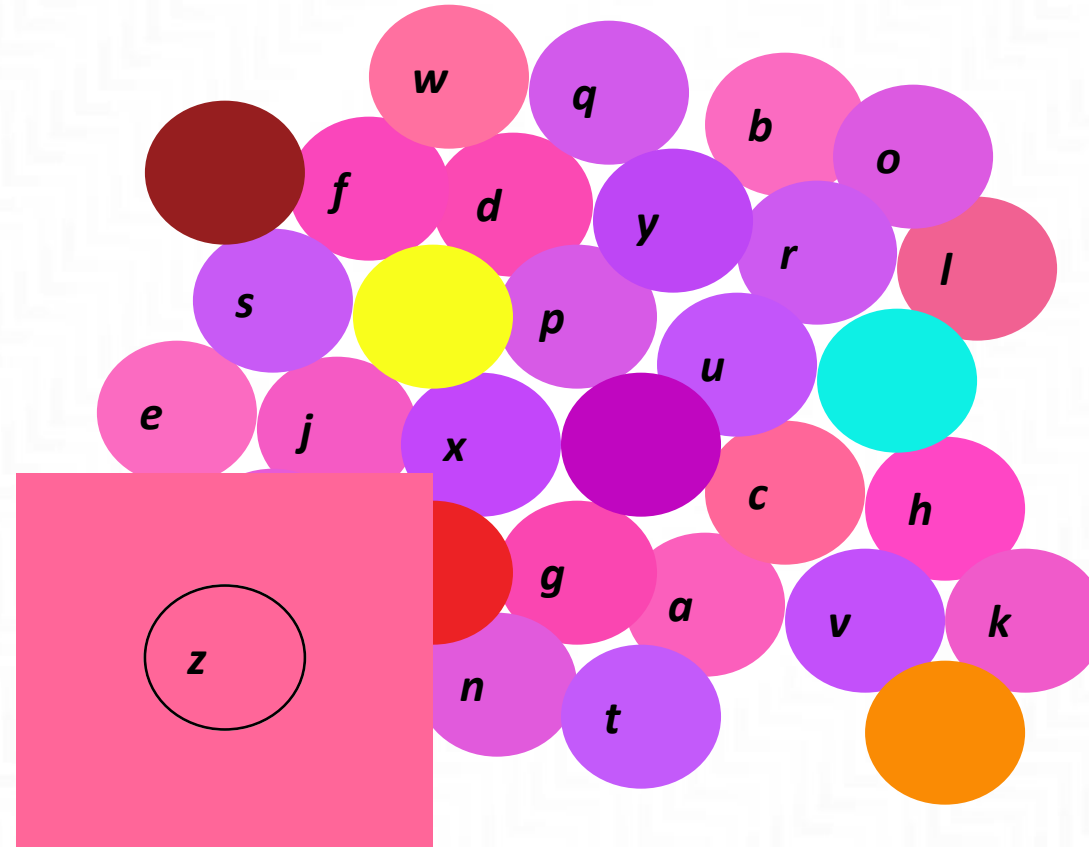
+ Which Color is it?

Can you find the color that you memorized?



+ I didn't get it right either

If you picked 'z' than you have better color memory than most!





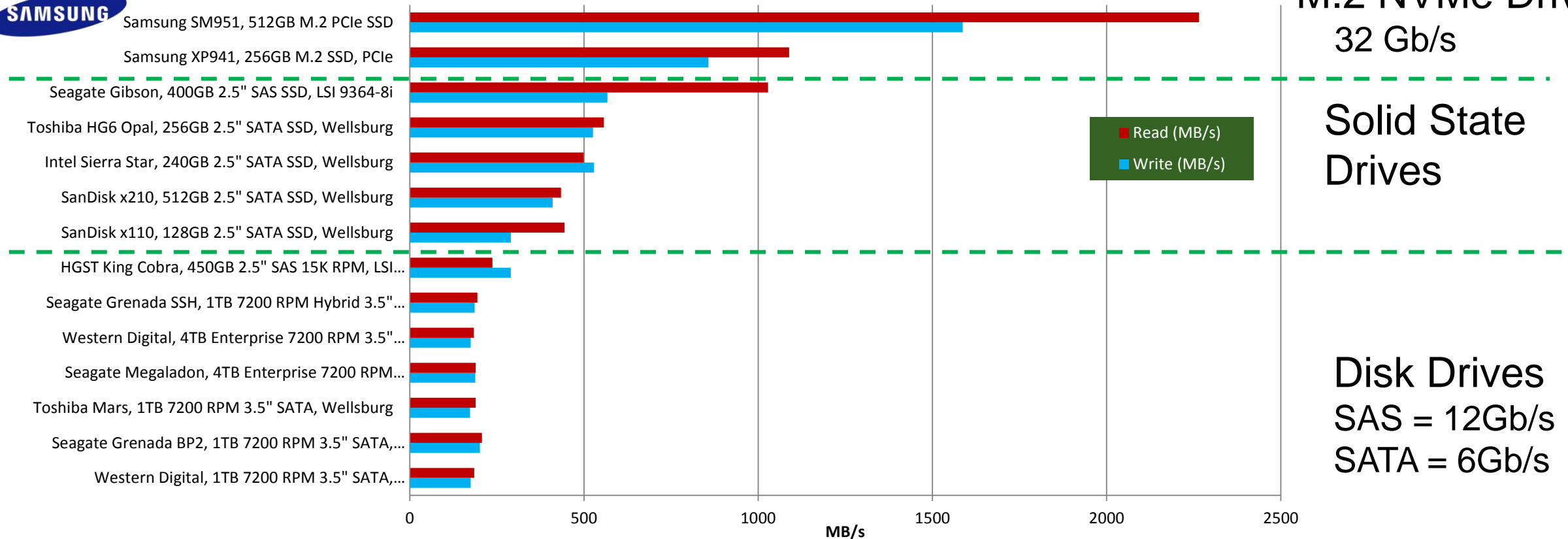
Other Mobile Technologies



+ Storage Speeds you have Dreamed off

Storage Device Sequential Read/Write Performance Based on ATTO Benchmark, 8192KB Transfer size

SAMSUNG



M.2 NVMe Drives
32 Gb/s

Solid State
Drives

Disk Drives
SAS = 12Gb/s
SATA = 6Gb/s

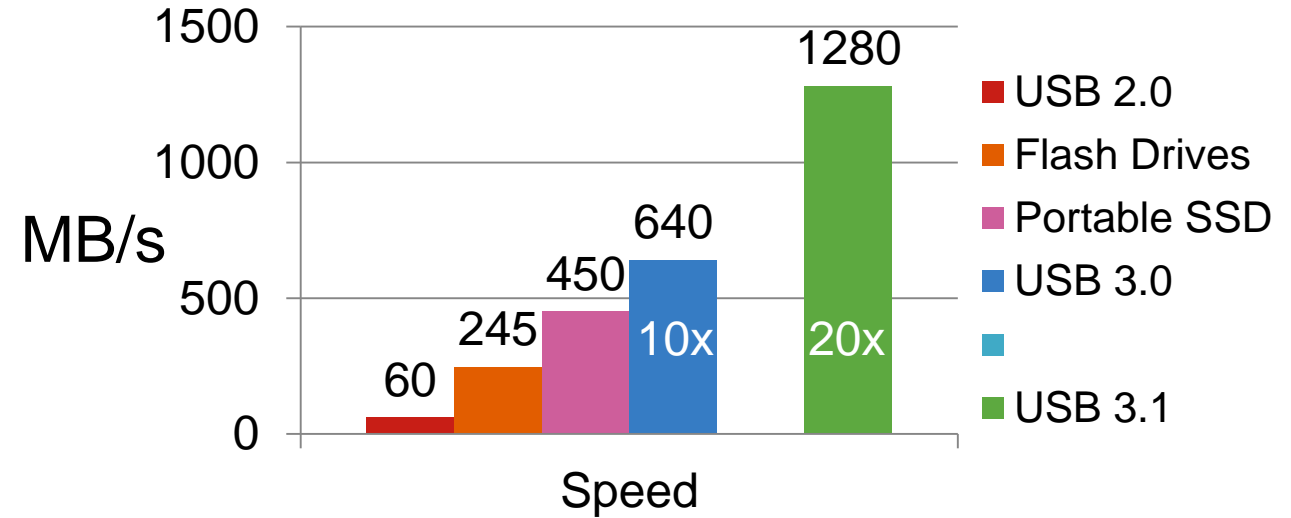
+ USB 3.1



USB 3.0/3.1 color code blue

Backward compatible

3.0/3.1 USB Flash drives speeds vary



Samsung portable SSD T1
1TB USB 3.0 drive

+ Thunderbolt

Thunderbolt Version 3 = 40 Gbits/second
(4x USB 3.1 Gen 2)
(faster than M.2 NVMe 32 Gbits/second)

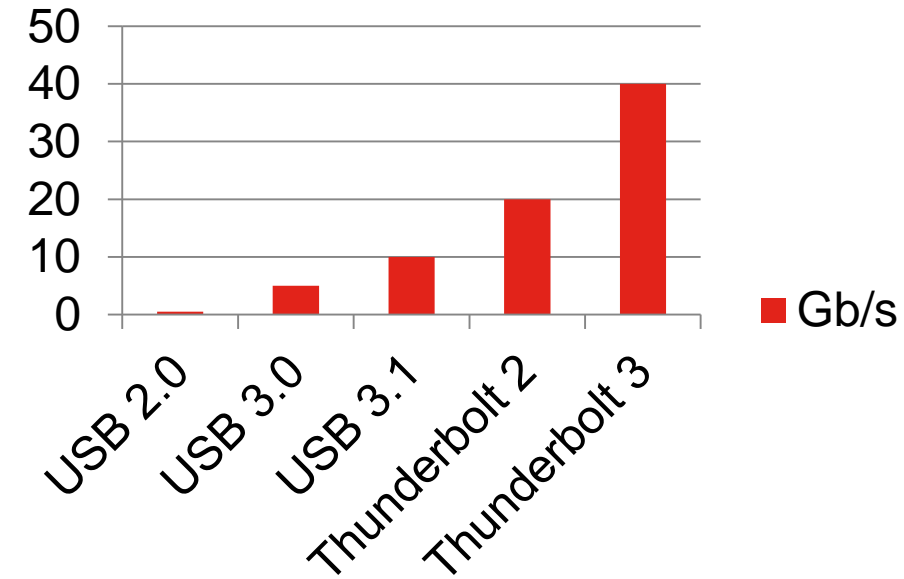
Drives speeds not as fast

USB C – connector

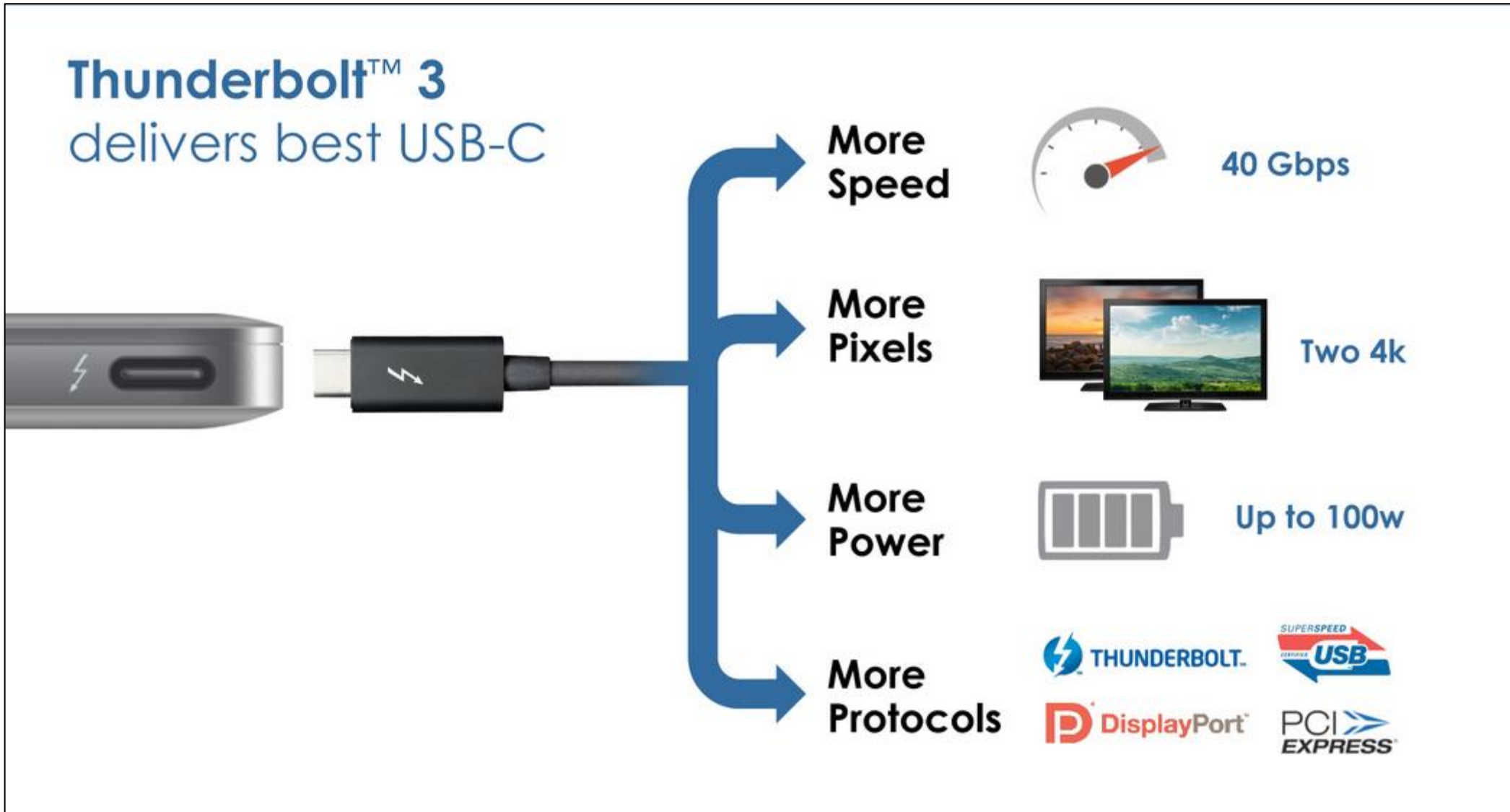
- Black with bent arrow Connector

- Passive cables 20 Gb/s
- Active cable 40 Gb/s
- Cooper – limited to 6 ft
- Optical cables coming

Speed Comparisons



+ Thunderbolt Possibilities



+ Networking



Wi-Fi

802.11 ac (second generation) – faster speed (dual band 2.4 GHz, 5.0 GHz)
more range . Compatible with n/g/b/a (n is next newest)

Feature	802.11ac Wave 1	802.11ac Wave 2			
		1.3 Gbps	1.73 Gbps	2.6 Gbps	3.5 Gbps
PHY Rate	1.3 Gbps	1.3 Gbps	1.73 Gbps	2.6 Gbps	3.5 Gbps
# of Spatial Streams	3	3	4	3	4
Modulation	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Channel Width	20, 40, 80 MHz	20, 40, 80 MHz	20, 40, 80 MHz	20, 40, 80, 80+80, 160 MHz	20, 40, 80, 80+80, 160 MHz
MIMO	Single User	Single User Multi User	Single User Multi User	Single User Multi User	Single User Multi User
802.11 protocol support	a, n, ac	a, n, ac	a, n, ac	a, n, ac	a, n, ac



Ethernet 1 Gb/s (Max 10 Gb/s)

+ P70 Mechanical



TBT
HDMI
Ethernet
Power

Left

Right



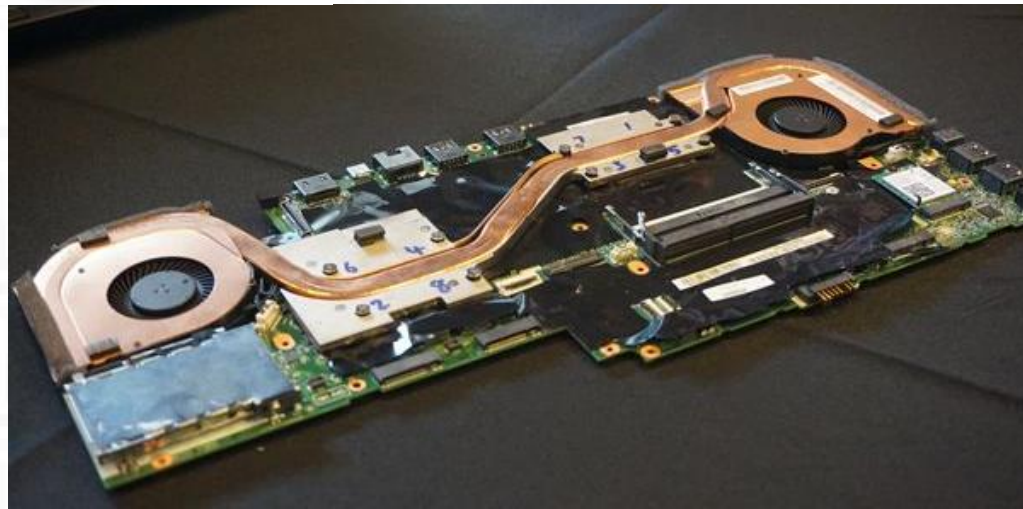
USB3.1
DVD/Blu-ray
SmartCard



HP/MIC
USB3.1
SDXC
ExpressCard
USB3.1
mDP
Lock slot

TBT= Thunderbolt 3

FLEX COOLING



Cool processors enable Turbo Boost

SUPERIOR

RELIABILITY

EXCLUSIVE TO LENOVO

Dual Fans

Connected by a heat pipe
Located by CPU and GPU
Shares the cooling load

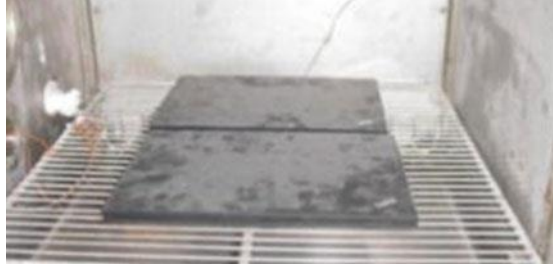
+ Mobile Workstations -- Mil-Spec Methods & more

HUMIDITY



Relative humidity of 91-98% at 20 to 60° C

LOW TEMPERATURE



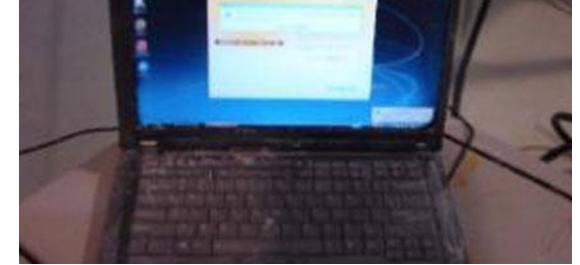
-20°C for over 72 hours

HIGH TEMPERATURE



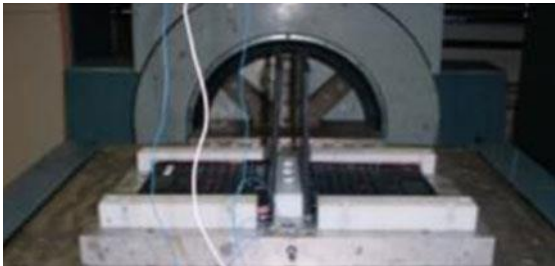
+30 to +60° C over 7 x 24 hour cycles

SAND



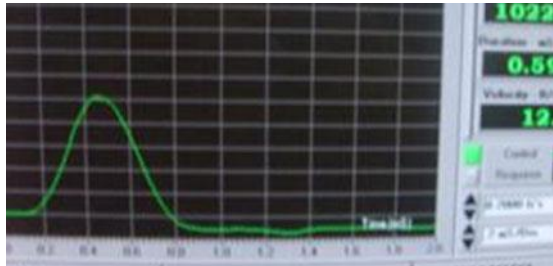
140 mesh silica dust for 6 hour cycles

VIBRATION



Multiple tests while running and turned off

MECHANICAL SHOCK



High acceleration and repeated shock pulses over 18 times

ALTITUDE



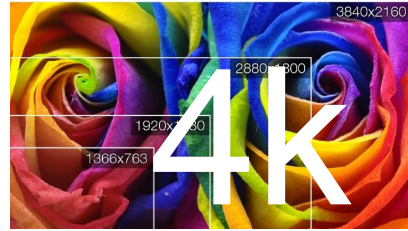
Tests operation at 15,000 feet while running

EXTREME TEMPERATURES



-20° C to 60° C over 3 cycles of 2 hour duration

+ What Does This Mean? Dawn of a New Era



P40



P50s



P50



P70



- Awesome Performance
- Clarity/ Brilliant screens
- Blazingly fast storage
- Faster connectivity – ahead of availability
- Highly Reliable with Lenovo design

MAINSTREAM CAD USER

Lenovo ThinkPad P50 Mobile Workstation

- NVIDIA Quadro Maxwell graphics
- Intel® Core™ and mobile Xeon Skylake processors (6th generation)
- Thinnest and lightest in it's class
- Memory: DDR4 up to 64 GB with ECC option
- Unique FLEX dual fan cooling
 - Enables Turbo Boost
- 15.6 inch 4K IPS Display, touch option
- Exclusive X-Rite Pantone® integrated color calibrator

15.6"

Cooling design
exclusive to
Lenovo



*New Use Cases – Xeon, 64 GB ECC Memory,
New Nvidia graphics, PCIe drives, 4K display
= Much larger 3D models, faster*

+ Analysis and Rendering Power

Lenovo ThinkPad P70 Mobile Workstation

- NVIDIA Quadro M graphics with GPU power
- Intel® Core™ and mobile Xeon processors – 6th generation
- Memory: up to 64 GB with ECC option
- Unique FLEX dual fan cooling
 - Enables Turbo Boost
- 17 inch 4K IPS Display, touch option
- X-Rite Pantone® integrated color calibrator
- Three button Touchpad

New Use Cases – Xeon, 64 GB Memory, ECC, same high end graphic power as a desktop, GPU Power - faster performance, rendering, analysis

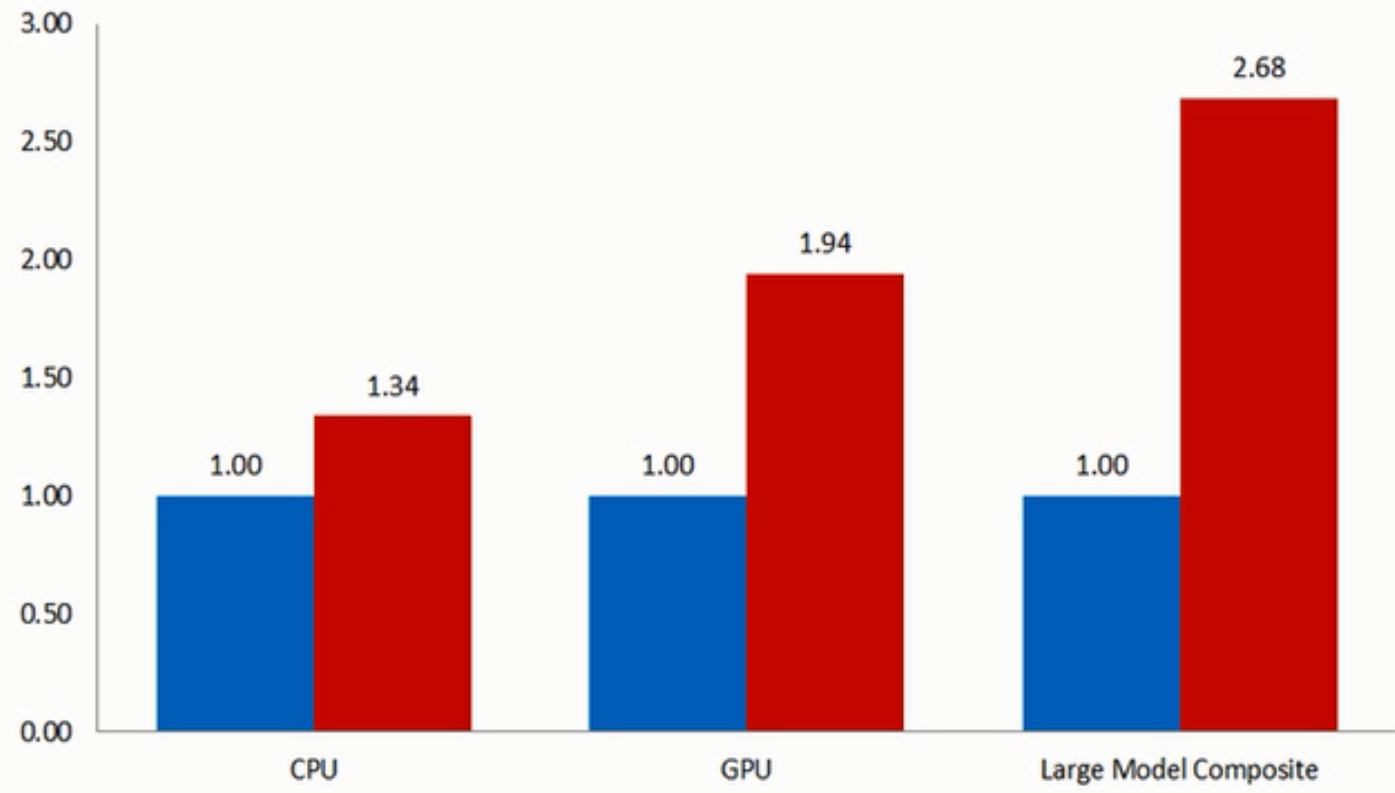
17"



Cooling design exclusive to Lenovo

+ Results – Higher is Better

Performance Ratio P70/W530
Running SPECapc



GPU Power makes and Enormous Difference with Rendering

Old vs New

- W530
i7-3740QM
16 GB
NVIDIA® Quadro® K2000M
- P70
E3-1505Mv5
16 GB
NVIDIA® Quadro® M5000M

+ ThinkPad P40 Yoga Mobile Workstation

Sketch/ Create



Wacom
Pen
Technology



Design/ CAD



Collaborate/Review



+ ThinkPad Mobile Workstation Summary

Easier Mobility

- Lightest in its class, longer battery life, smaller power brick, fewer dongles

More Done in Less Time

- Usability -- 4K display clarity, Keyboard/Mouse Pad, Touch
- Reliability history, testing, cooling leadership, ECC memory
- Performance – i7 or Xeon, CUDA, 64 GB DDR4, PCIe drives, Cooling
- Latest – mobile processors, graphics and storage

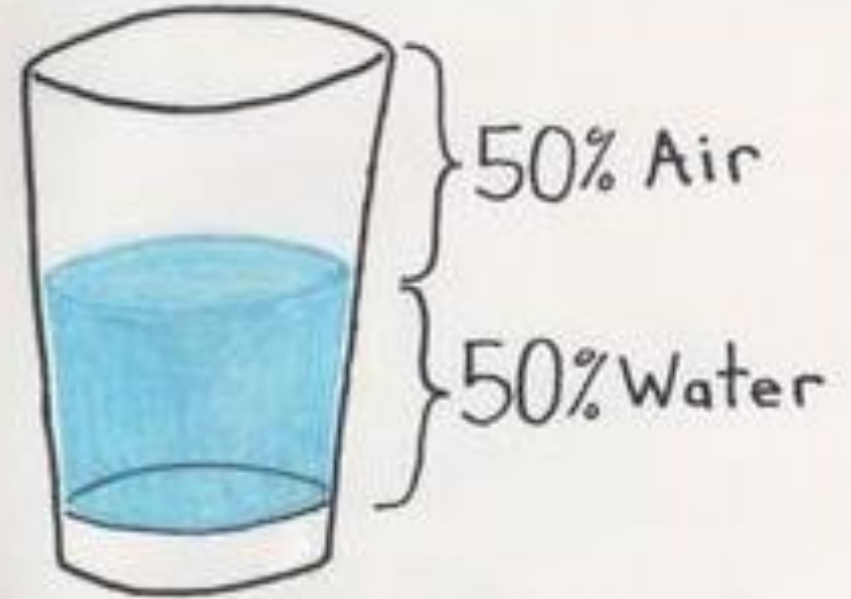
Productivity/usefulness

- Pen and Sketching
- Environment – docking station, connections, features
- Color calibration

+ Engineering View



- Optimist:** The glass is **HALF** full
- Pessimist:** The glass is **HALF** empty
- Engineer:** The glass is **TWICE** the size it needs to be



Technically,
The Glass is Completely Full.

www.epicfail.com

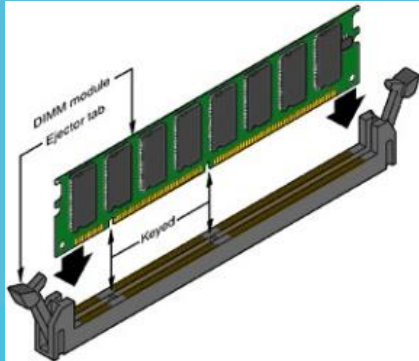
Desktop Workstations



+ Desktop Workstations

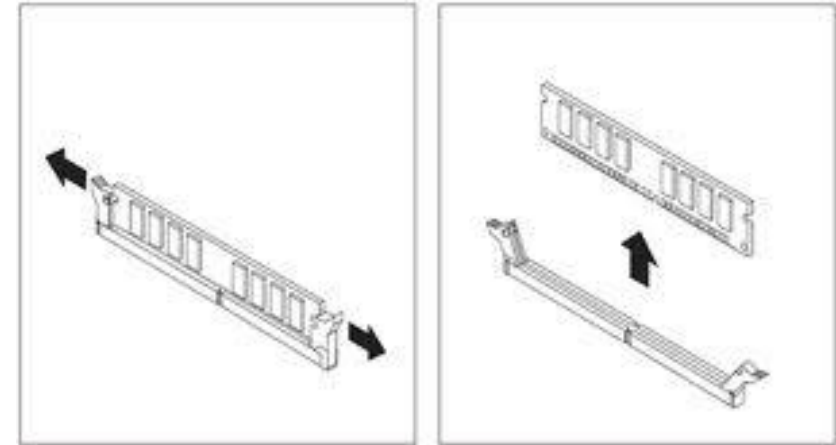
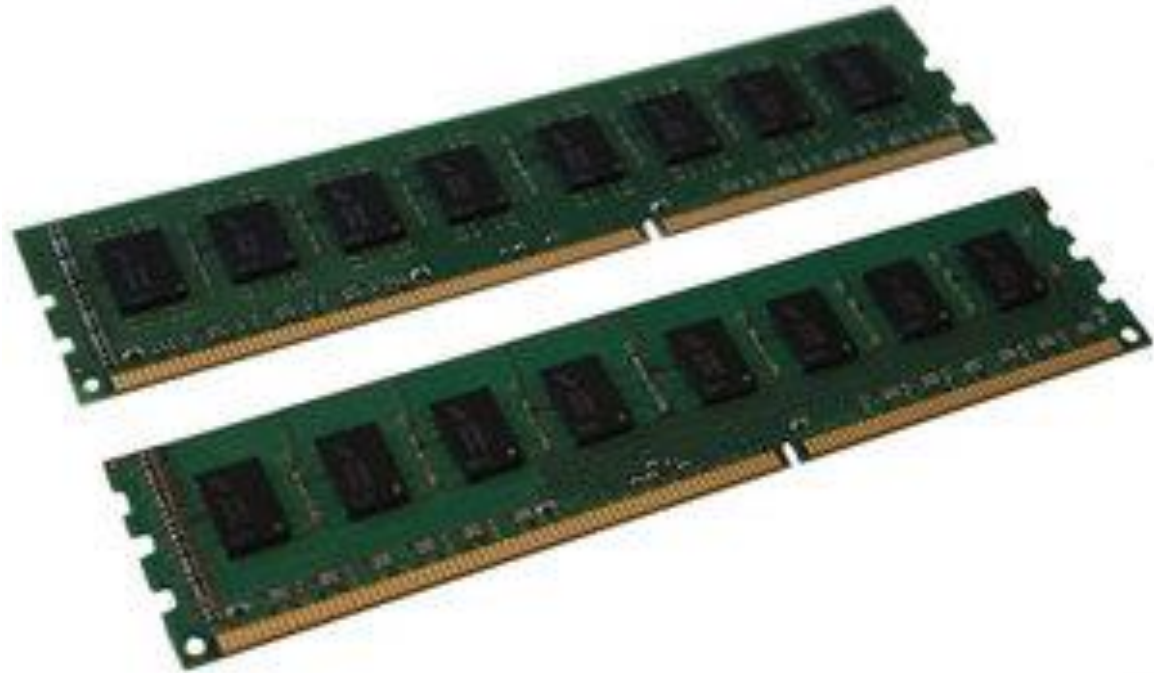


Memory



+ Memory-DDR4

New Speed = 2133 MHz & 2400 MHz



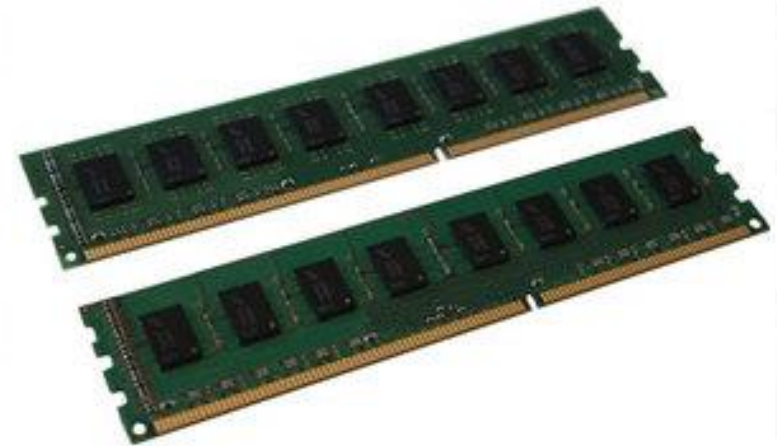
+ Memory Sizing

- Enough memory to store your model and application in memory
 - Typical 10 - 16x saved
- Avoid relying on storage devices, will be significantly slower
- Model sizes grow – double every 2-3 years
- Minimum in CAD today is 16 GB
- ECC improves dependability/recommended

ECC MEMORY IS A KEY TO DEPENDABLE USE

ECC Memory corrects single digit errors

- Single digit errors go undetected
- A single digit change is significant
 - 4800mm = 1001011000000
 - 5824mm = 1011011000000
- Errors caused by Gamma Rays



BAD DAY FOR A CIVIL ENGINEER

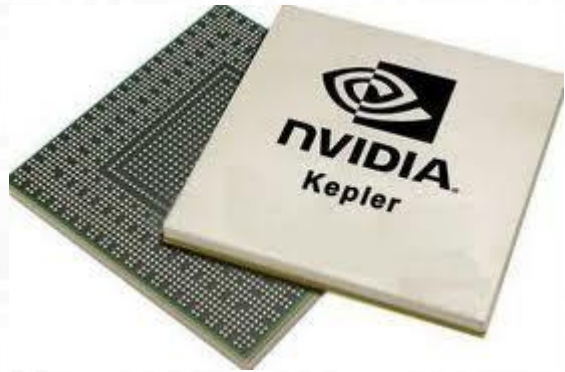


Graphics

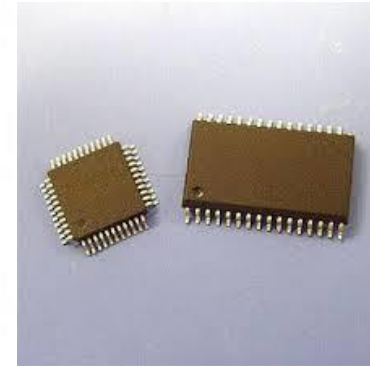


+ Graphics Card Considerations

Processor



Memory



Driver

101110001111000011100010101010001

+ Graphic Card Sizing is Usage Dependant

Things that affect the sizing

- 1) 3D Model size- number of surfaces
 - (number of polygons and textures)
- 2) Number of pixels/monitor size/screen resolution
- 3) Need for movement
 - High frame rates (i.e. Virtual Reality)
- 4) Ray tracking/lighting affect
 - Advanced lighting techniques

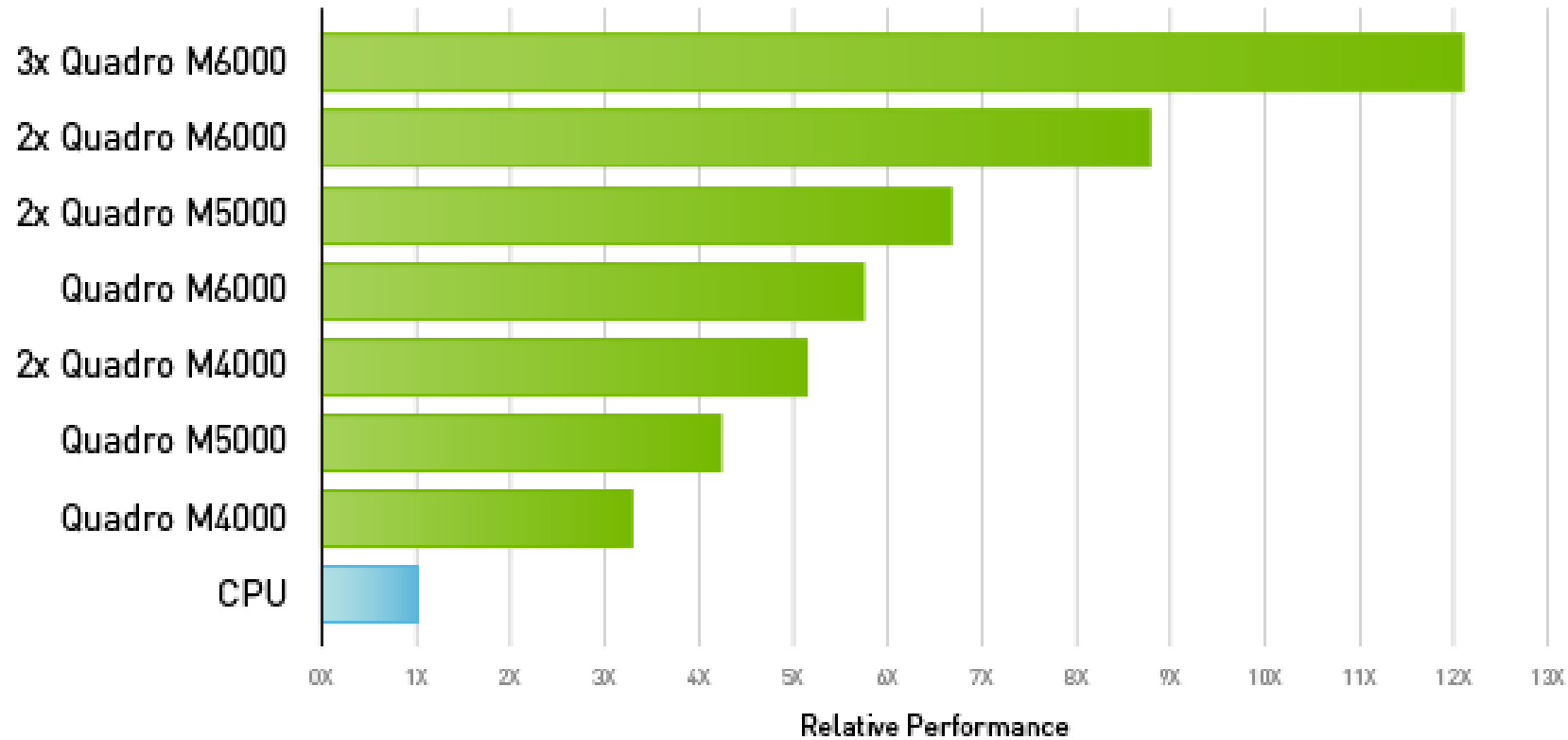


Need Certified Drivers

GPUs for Photorealism



+ NVIDIA Iray Desktop

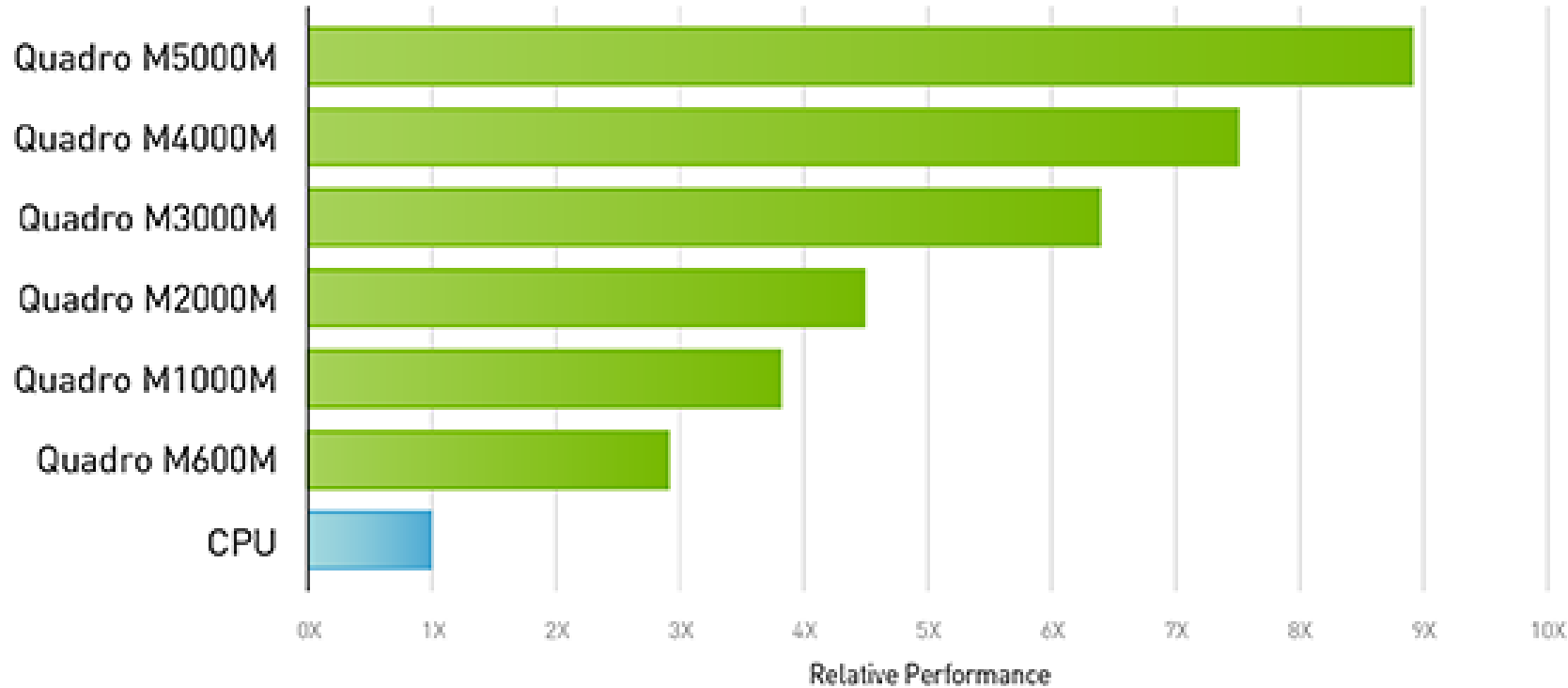


Tests run on a workstation with Intel Xeon E5-2697 V3, 14 cores, 2.6GHz, 32GB RAM, running Win 7 64-bit SP1, using NVIDIA Iray technology and driver version 361.75. Performance testing completed with NVIDIA's internal benchmark.

The more GPU power, the faster it goes

+ NVIDIA Iray Mobile

NVIDIA IRAY MOBILE WORKSTATION PERFORMANCE SCALING



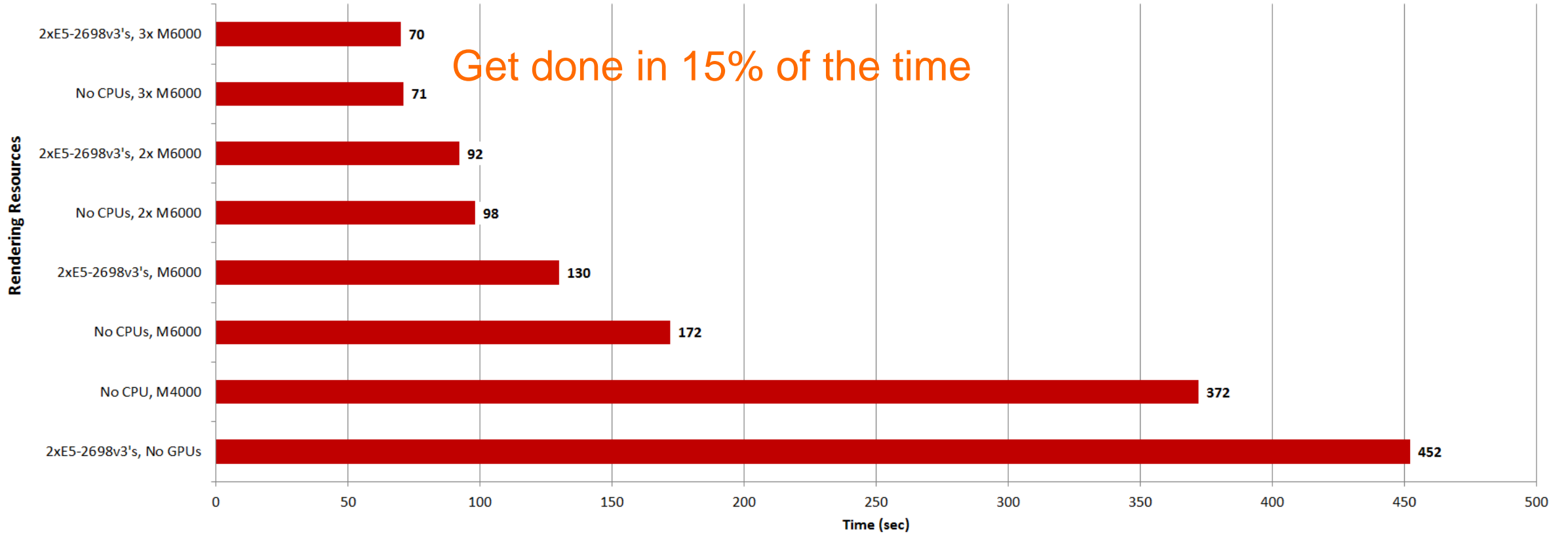
* CPU score is based on Skylake i7-6700 HQ 2.6GHz [3.5GHz Turbo] 32GB RAM with Win10x64 with 353.96

* CPU+GPU score is based on Core i7-4790S 3.2GHz [4GHz Turbo] 8GB RAM with Win10x64 with 353.82

The more GPU power, the faster it goes

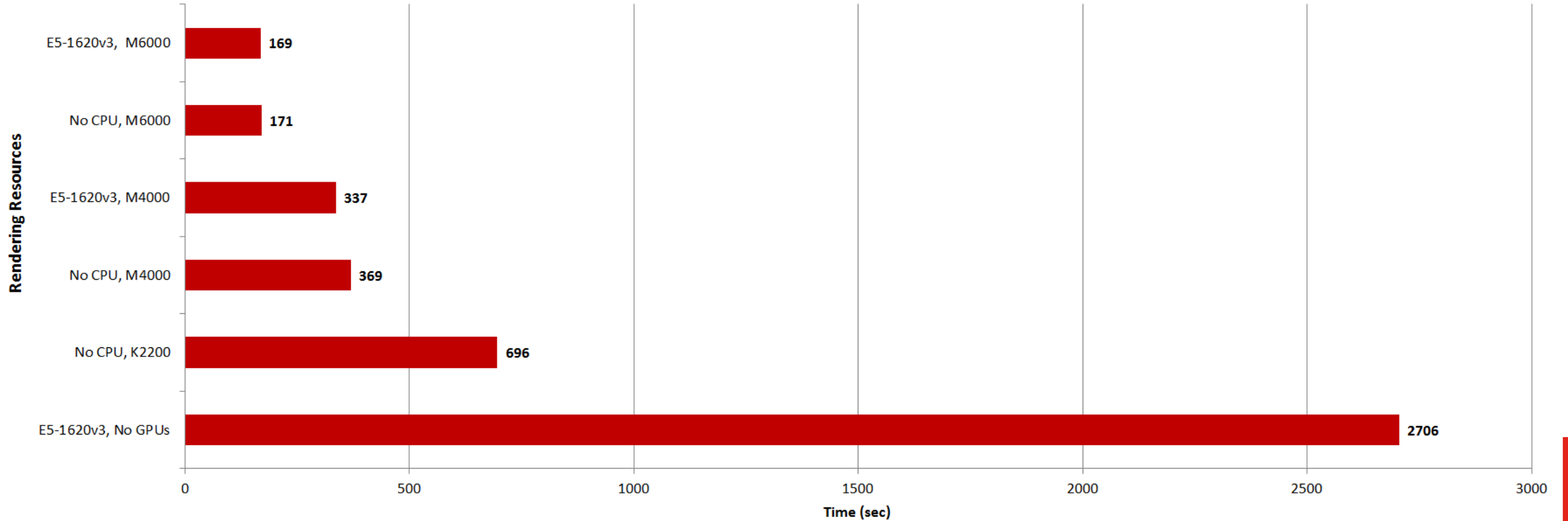
+ P900 Render Times

P900 Render Times
1969 Camaro, 1,000 Passes, Lower is Better



+ P500 Render Times

P500 Render Times
1969 Camaro, 1,000 Passes, Lower is Better





Ease of Deployment and Support

Some specific Lenovo features



DESIGNED FOR EASE OF USE

MODULAR DESIGN

TOOL-LESS ACCESS

INTEGRATED HANDLES
92% EFFICIENT POWER SUPPLY
SNAP IN PARTS



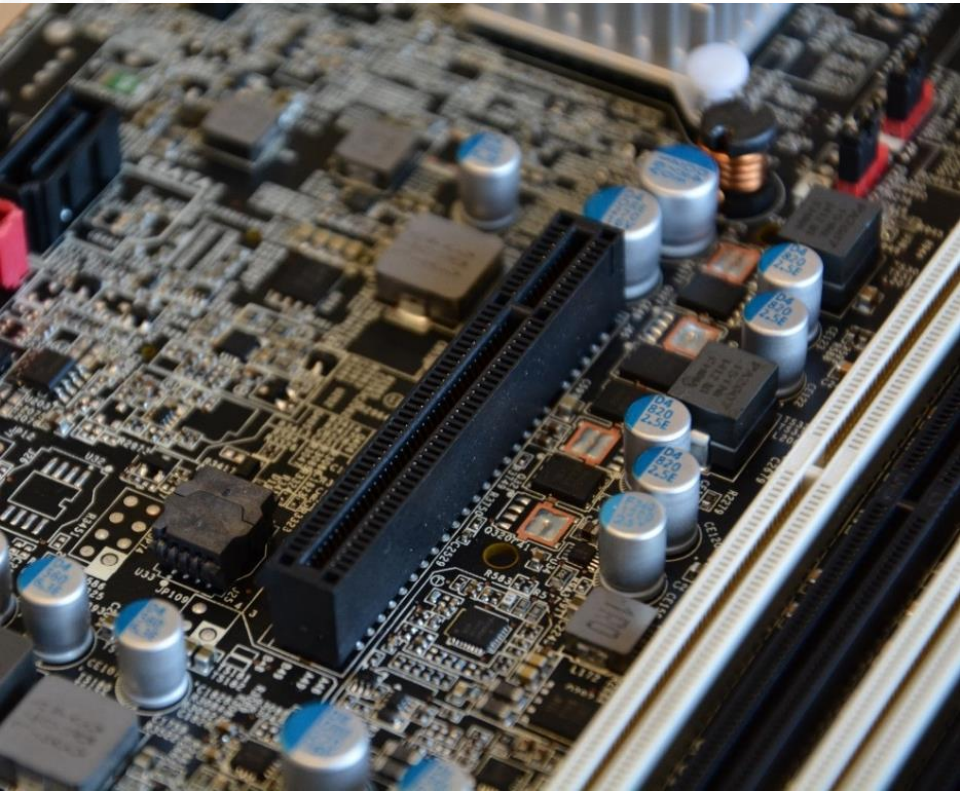
MORE STORAGE, WITHOUT COMPROMISE

UNMATCHED

PERFORMANCE

EXCLUSIVE

TO LENOVO



FLEX CONNECTOR

Maximum Storage Speeds

- SATA Drives – 6Gb/s
- SAS – 12Gb/s
- PCIe/FLEX Drives – 32Gb/s

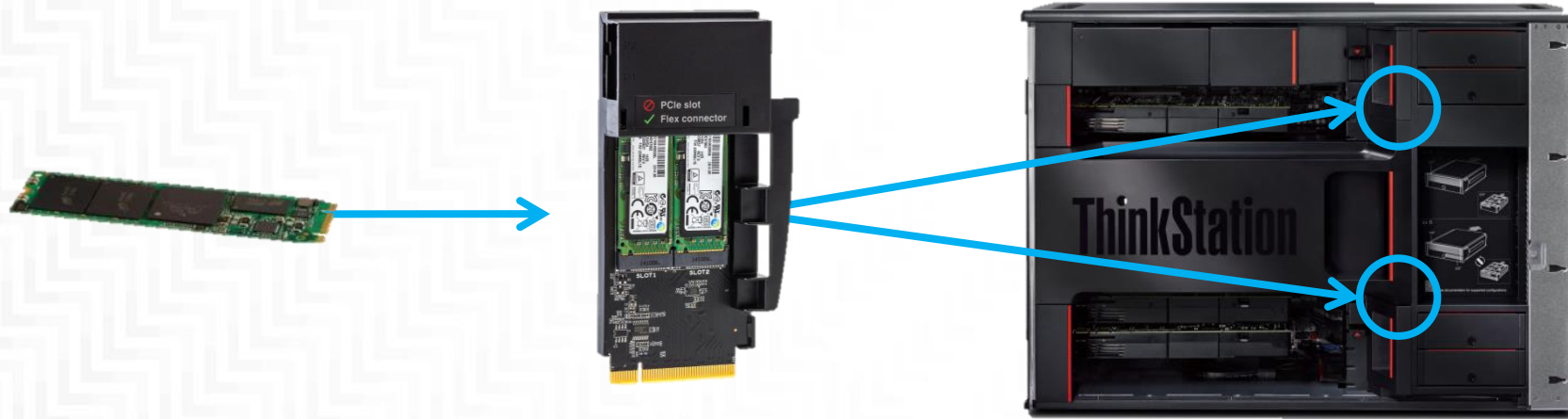
EXCEPTIONAL STORAGE PERFORMANCE

UNMATCHED

PERFORMANCE

EXCLUSIVE TO LENOVO

FLEX DRIVES
FLEX CONNECTOR



M.2 PCIe SSD + FLEX Adapter + FLEX Connector =

FLEX Drive

Lenovo



READ AND CALL DIAGNOSTICS

EXCLUSIVE TO LENOVO

FRONT-PANEL DIAGNOSTICS

- Designed into the Mother board
- Captures events – not just failures
- Failure shown as dashboard light, and/or on the monitor
- Can choose phone plug-in application

No Troubleshooting

- Quickly determine a hardware or software failure
- Self diagnose
- Reboot check later
- Event history



Diagnostic Port



+ P Series Summary



Much Easier for IT

- Deploy, Install, Solve, Replace quicker than before

More Done in Less Time

- Usability improves Productivity
- New levels of Reliability
- New/Unique levels of performance designed in

Save \$\$

- Most energy efficient workstations on the market



Samsung Technology





DAWN OF A NEW ERA



SATA HDD
WAS FAST ENOUGH



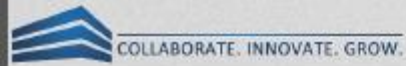
125 MB/s



Wireless N
75 MB/s



USB 2.0
60 MB/s



SAMSUNG



THE SATA HDD IS NOW THE BOTTLENECK



125 MB/s

Thunderbolt 3
5,000 MB/s



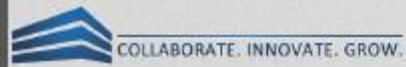
Wireless AC
163 MB/s



WiGig
875 MB/s



USB 3.1
1,250 MB/s



SAMSUNG



SATA SSD
WAS FAST ENOUGH

550 MB/s

Thunderbolt 3
5,000 MB/s



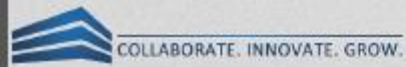
Wireless AC
163 MB/s



WiGig
875 MB/s



USB 3.1
1,250 MB/s



SAMSUNG





NVMe IS FASTER.



MUCH FASTER.

4,000 MB/s

Thunderbolt 3
5,000 MB/s




Wireless AC
163 MB/s



WiGig
875 MB/s



USB 3.1
1,250 MB/s

 COLLABORATE. INNOVATE. GROW.

SAMSUNG



SATA vs NVMe

	SATA AHCI	PCIe NVMe
#of Queues	1	64,000
#of CMD/Queue	32	64,000

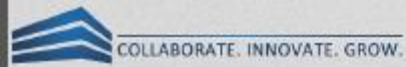


SAMSUNG

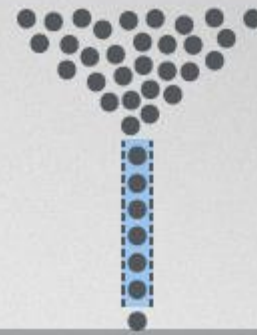




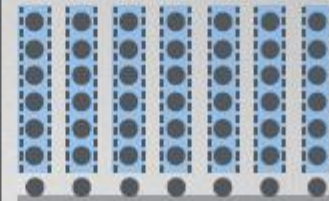
SATA vs NVMe



SATA AHCI



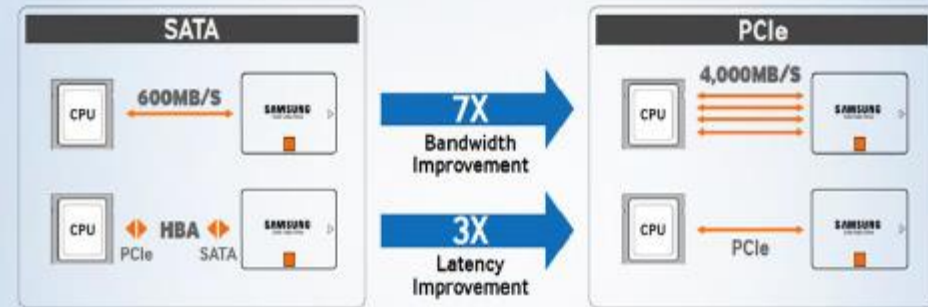
PCIe NVMe



SAMSUNG



SATA vs NVMe



600MB/s
10 μ s

4GB/s
3 μ s

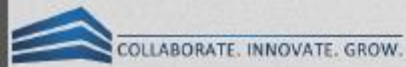




PC IMPACT



COPYING FILES SATA HDD



3 Mins

6 Mins



3 Mins

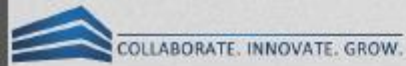




COPYING FILES NVMe SSD

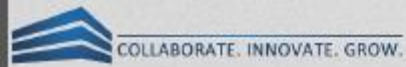
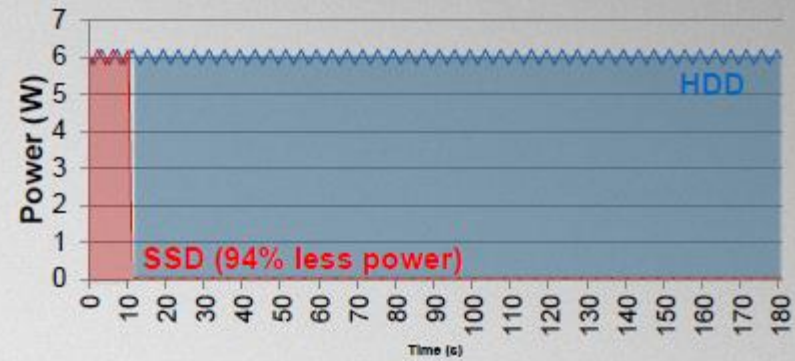


10 Secs
Thunderbolt + NVMe





TRANSFERRING DATA FASTER = MORE BATTERY LIFE



SAMSUNG

26.67 x 6.46 in





Samsung M.2 Storage

26.67 x 6.46 in



LENOVO WORKSTATIONS



M.2 SSD
NVMe PCIe Gen3 x4
32Gbps host interface



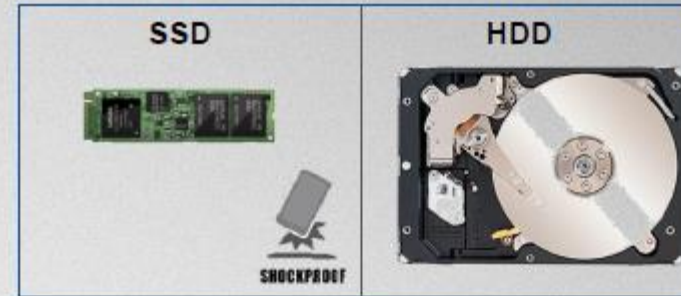
SAMSUNG

26.67 x 6.46 in



DURABILITY

- SSDs are 4x more resistant to shock¹
- SSDs use NAND flash mounted on circuit boards, and are shock resistant up to 1500G/0.5ms
- HDDs consist of various moving parts - making them susceptible to shock and damage (typically rated at 350G/2ms)



COLLABORATE. INNOVATE. GROW.

¹Based on Seagate Momentus HDD datasheet compared to Samsung SM951 datasheet

SAMSUNG



RELIABILITY

No Wear-out issues

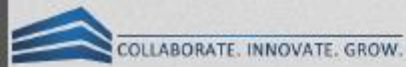


No Failure issues

Industry leading Annualized Return Rates (ARR)



Sources: SSD: Sample set of 3 million SSD shipments, HDD: Google, Carnegie Mellon



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@ThinkStations
#ThinkPSeries
@SalomoneTom



Lenovo ThinkStation
Tom Salomone

Email

tsalomone@lenovo.com



+ See Technologies in the Lenovo booth & Win Big!

Unique Technology



**Yoga
Tablet 2**

Qty 2

WIN BIG!

Lenovo™

+ P50 Mechanical



USB3.1

Ethernet

TBT

HDMI

Power

Left

Right



SDXC

ExpressCard

SmartCard



HP/MIC

USB3.1

mDP

Lock slot

TBT= Thunderbolt v3