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

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See Technologies in the Lenovo booth & Win Big!

Unique Technology

Yoga Tablet 2

Qty 2

WIN BIG!

NVIDIA

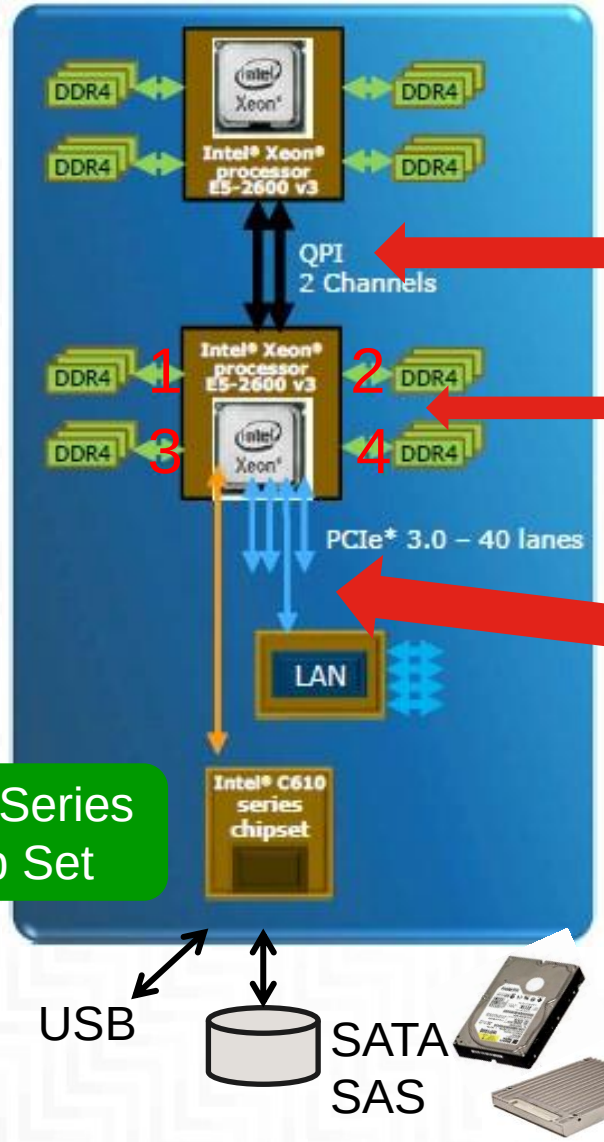
Lenovo

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**

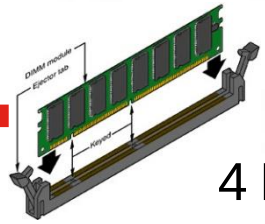
The Basics of How a System Works

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



Quick Path Interconnect

QPI



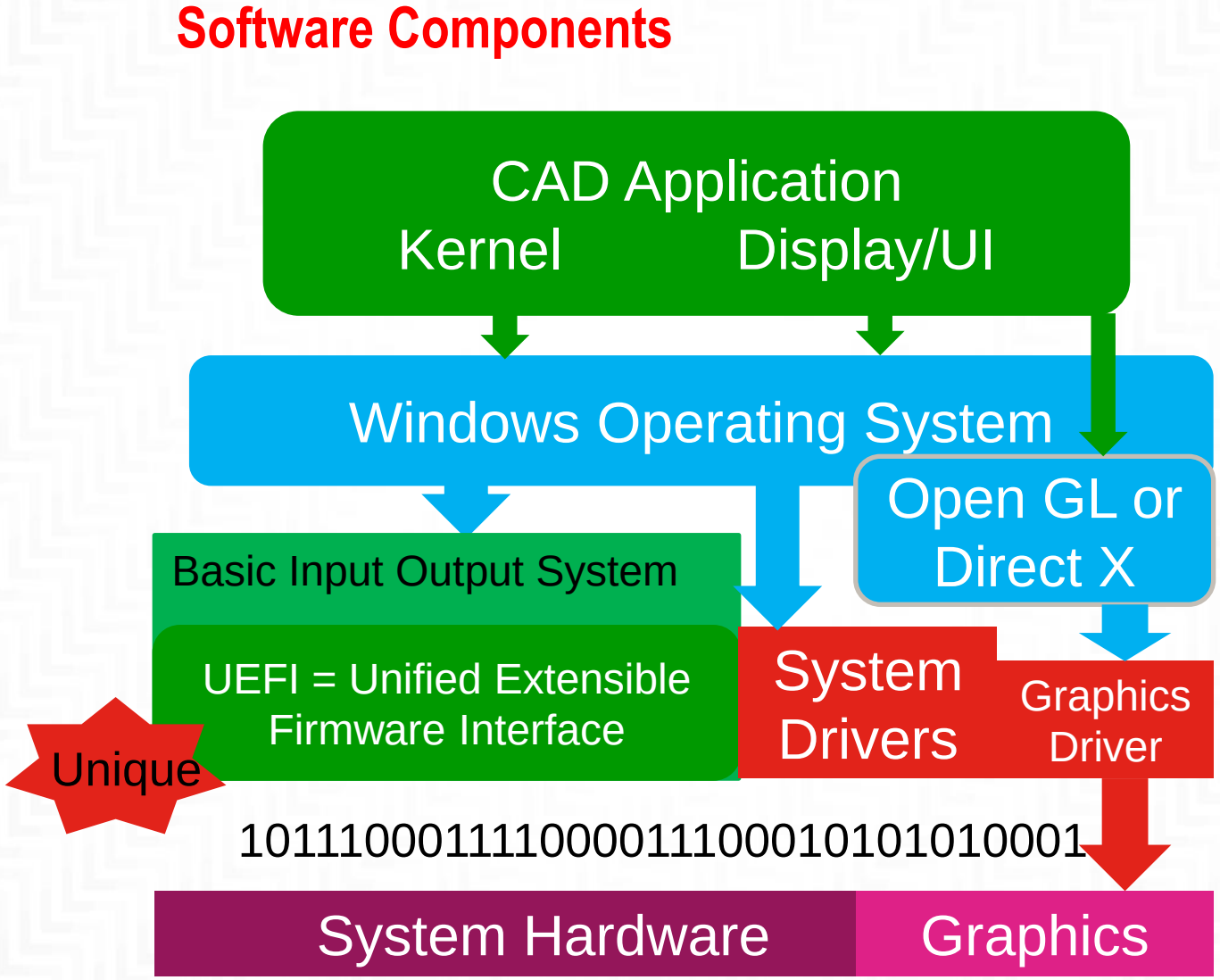
4 Memory Channels/processor

PCIe

M.2 Storage

Graphics

The Basics of How a System Works



Certification Combinations

P300SFF P300 P900 P700 P500

Nvidia Tesla

Nvidia Quadro M6000

Nvidia Quadro M5000

Nvidia Quadro M4000

Nvidia Quadro K2200

Nvidia Quadro K620

P40

P50s

P50

P70

Nvidia Quadro M5000M
Nvidia Quadro M4000M
Nvidia Quadro M2000M
Nvidia Quadro M1000M
Nvidia Quadro M600M
Nvidia Quadro M500M
Intel graphics

Certification Combinations

5 ThinkStations x 5 Graphics Cards x 3 OS = 75 combinations
4 ThinkPads x 3 Graphics Options x 3 OS = 36 combinations

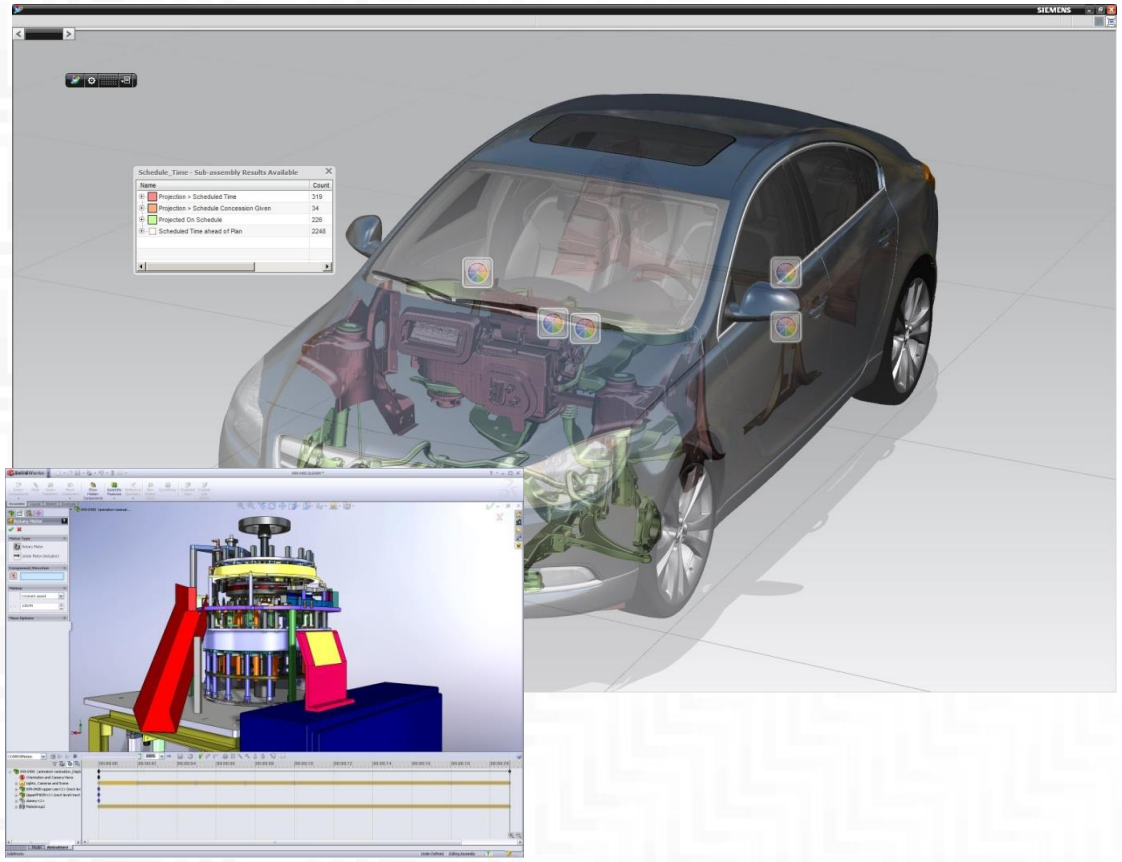
X PTC® Applications & Versions X Graphic Drivers

Processors

Basic Processor Choices

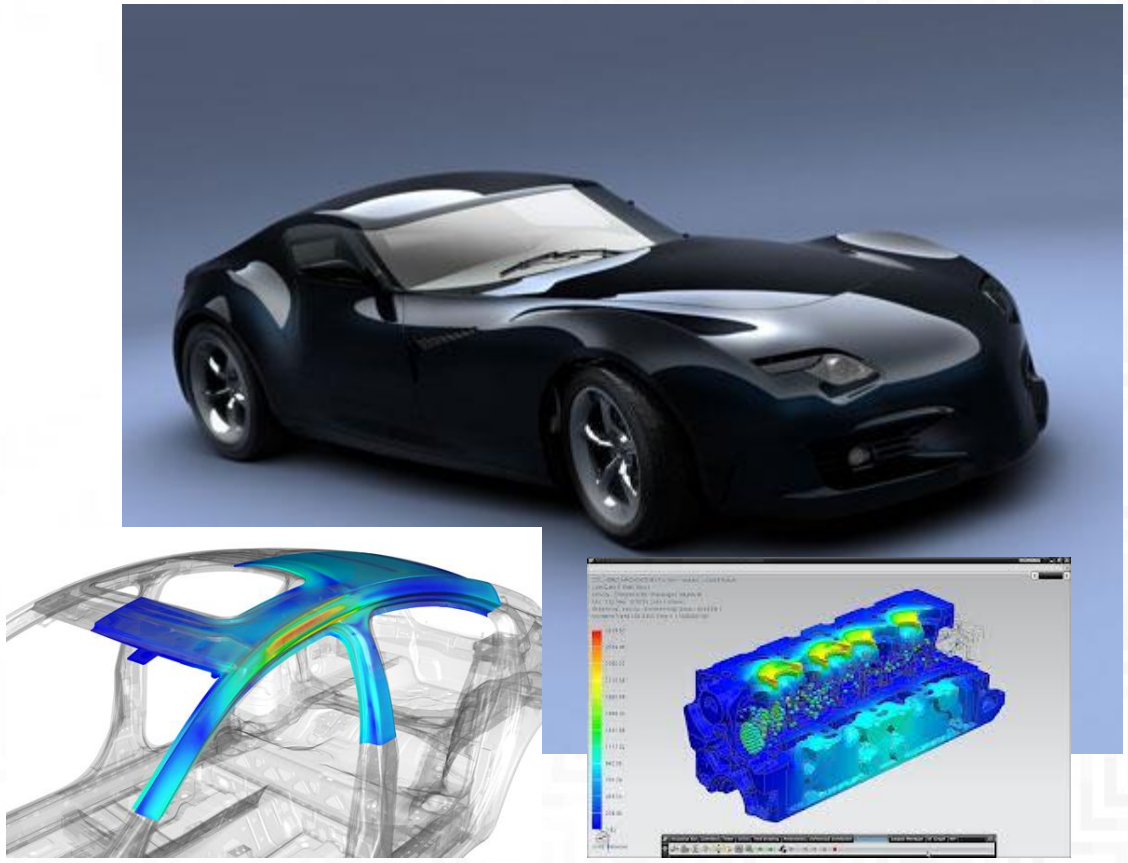
GHz First

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 E3-1280**v5**	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 E3-1285**v4**	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** New for Mobiles	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

What Does this mean

Xeon E3 v5 Mobile Processors

Core i7,i5, i3 Gen 6 Mobile Processors

P40

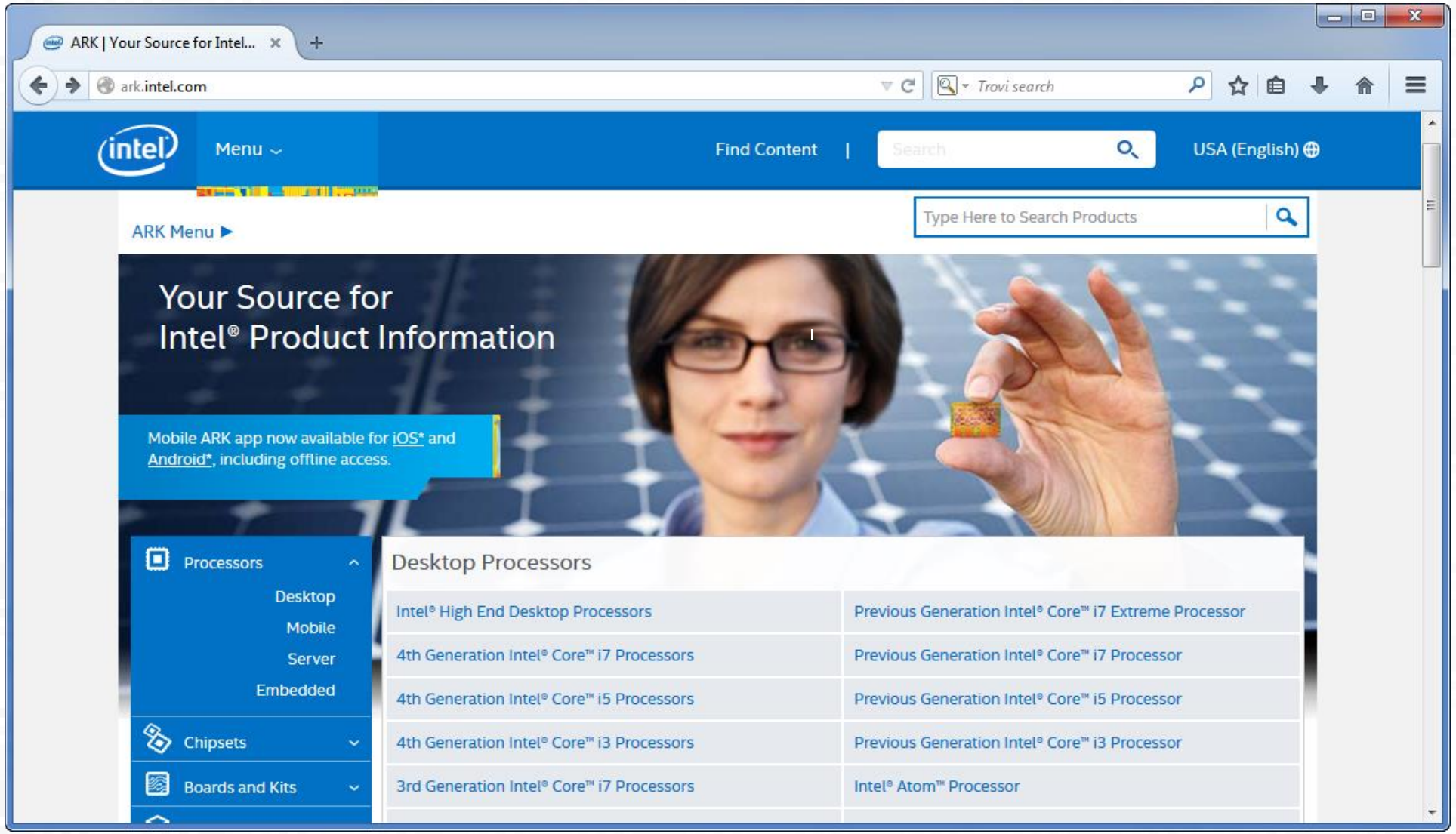
P50s

P50

P70

Finding Processor Information

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



Finding Processor Information

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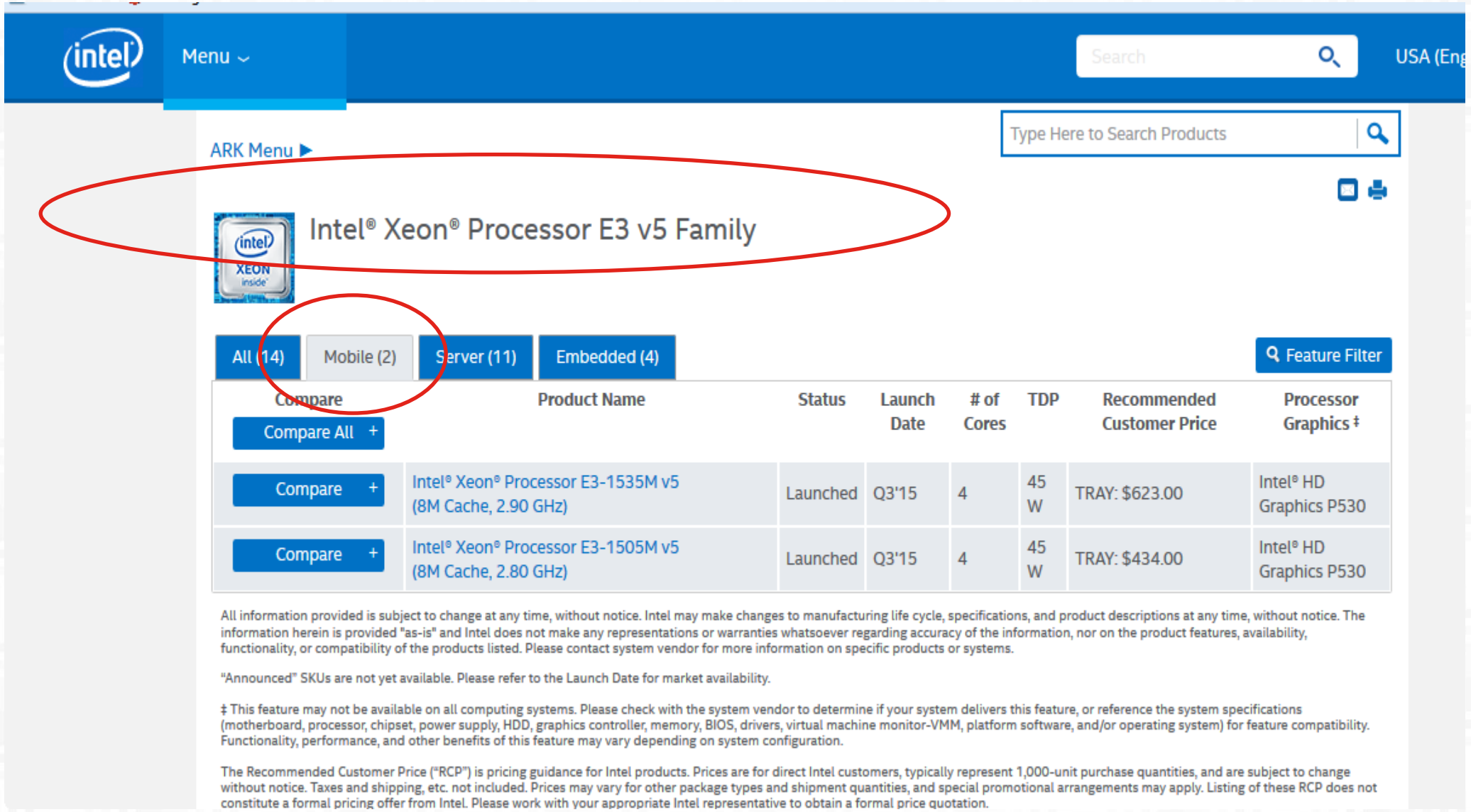
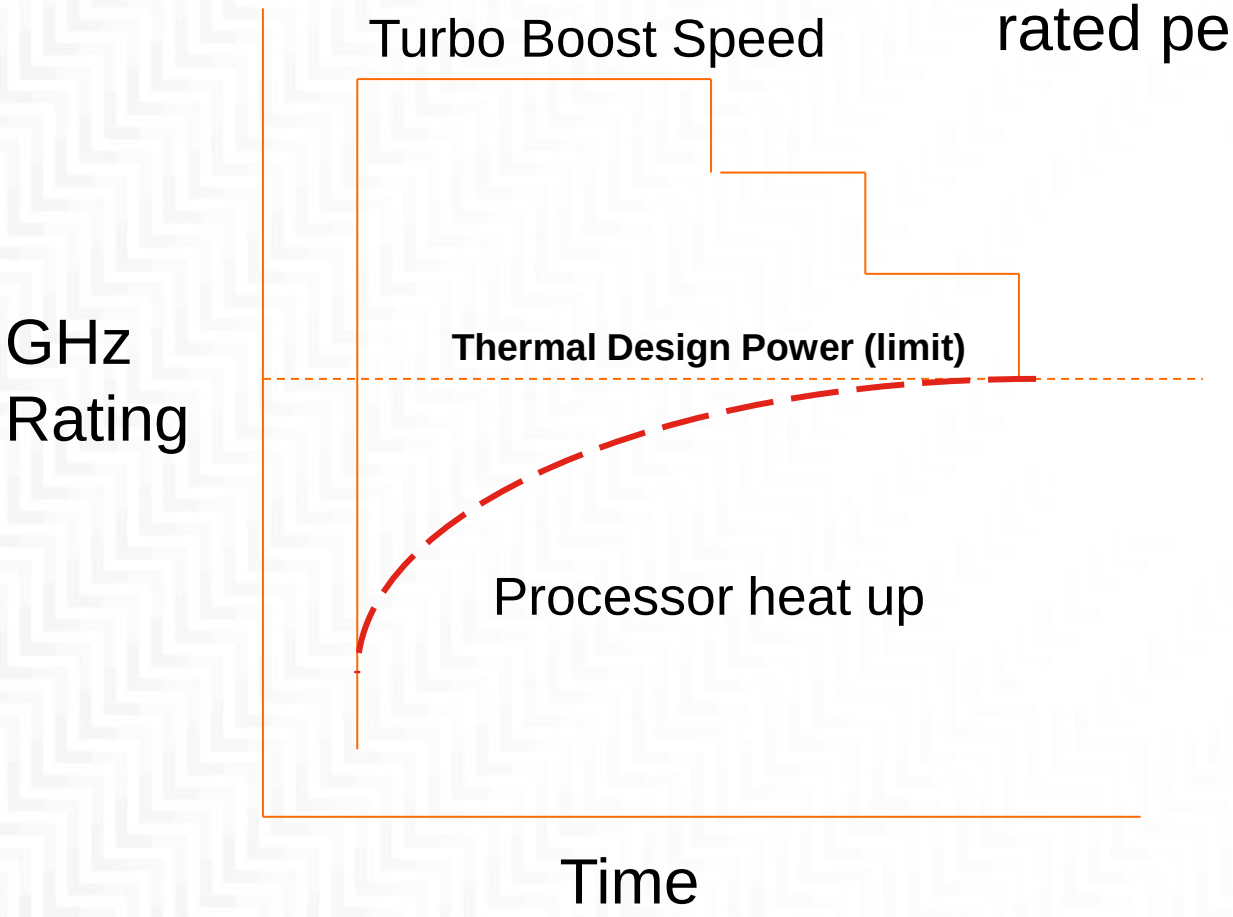


Turbo Boost 2.0 Manages Processor Speed



Turbo Boost allows faster than rated performance

Dynamically managed:

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

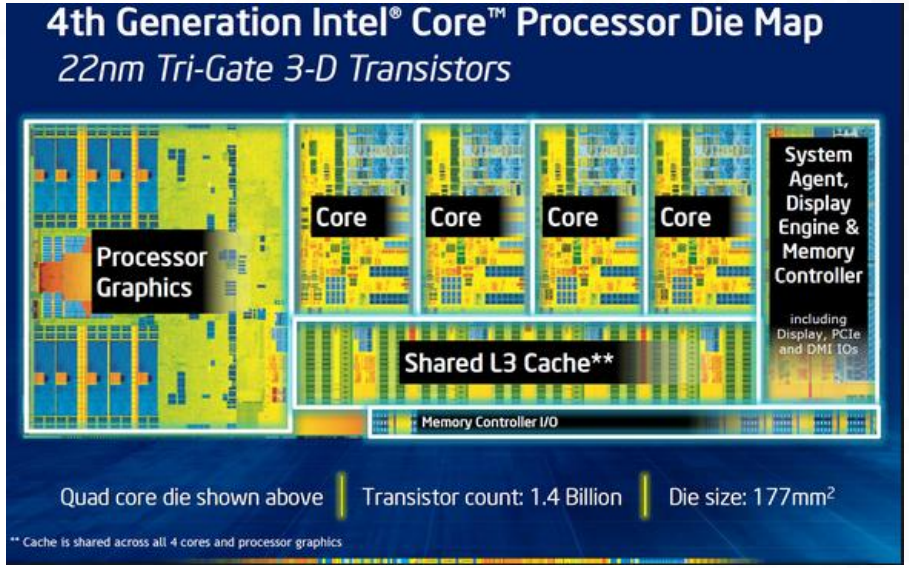
Turbo Boost Evolution

Turbo Boost

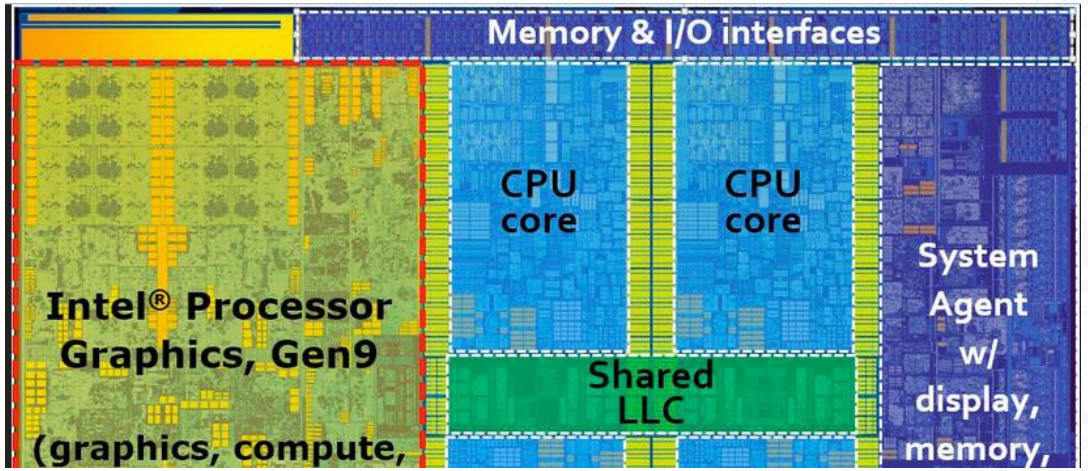
- Nehalem and Westmere
  - Cores Turbo Boost but the noncore regions stayed at a fixed frequency
- Sandy Bridge and Ivy Bridge
  - Core and non-core boost together
- Haswell
  - Energy Efficient Turbo --The two elements of the chip can turbo up and down independently
- Broadwell
  - Turbo Boost 3.0 (Coming)

Turbo Boost 2.0 Monitor

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



6th Generation - 14 nm

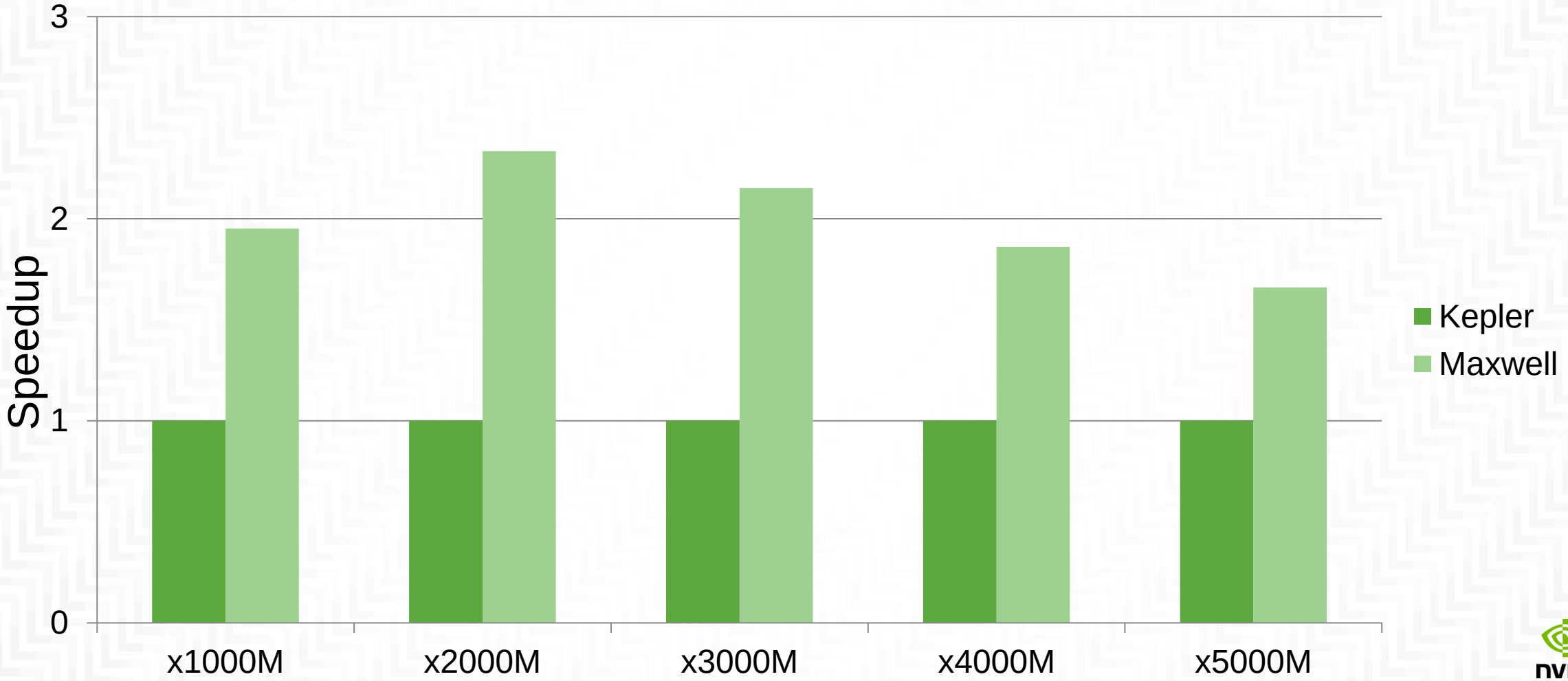


Technology Changes for Mobility

Across the Board Updates – Dawn of a New Era

GPUs for Computer Aided Design

VIEWPERF12 COMPOSITE KEPLER TO MAXWELL PERFORMANCE COMPARISON

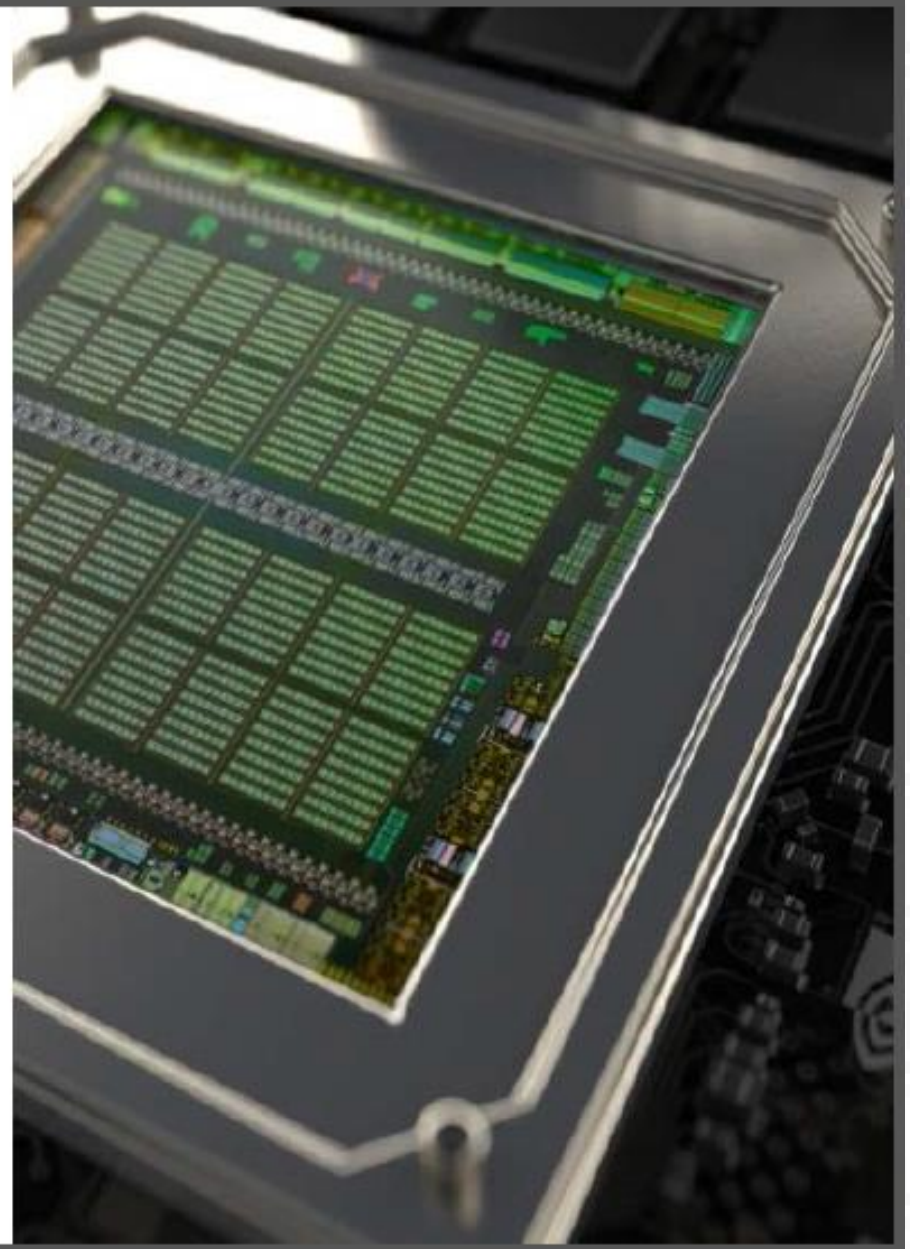


Driver 347.25

New
NVIDIA QUADRO Mobile Products
Powered by NVIDIA Maxwell GPU

Up To **2X** Performance

Energy Efficiency

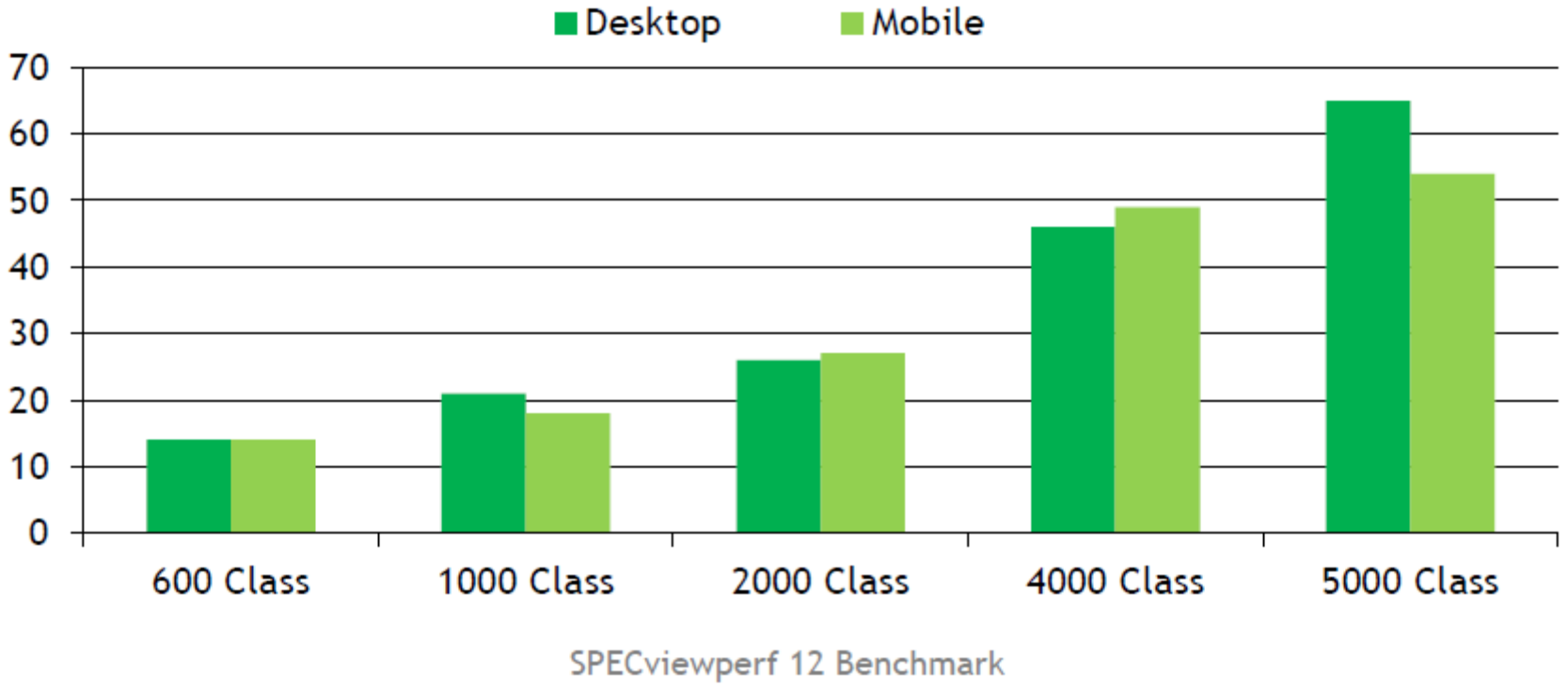


* *Performance and Energy Efficiency measured using SPECviewperf 12 benchmark*

NVIDIA

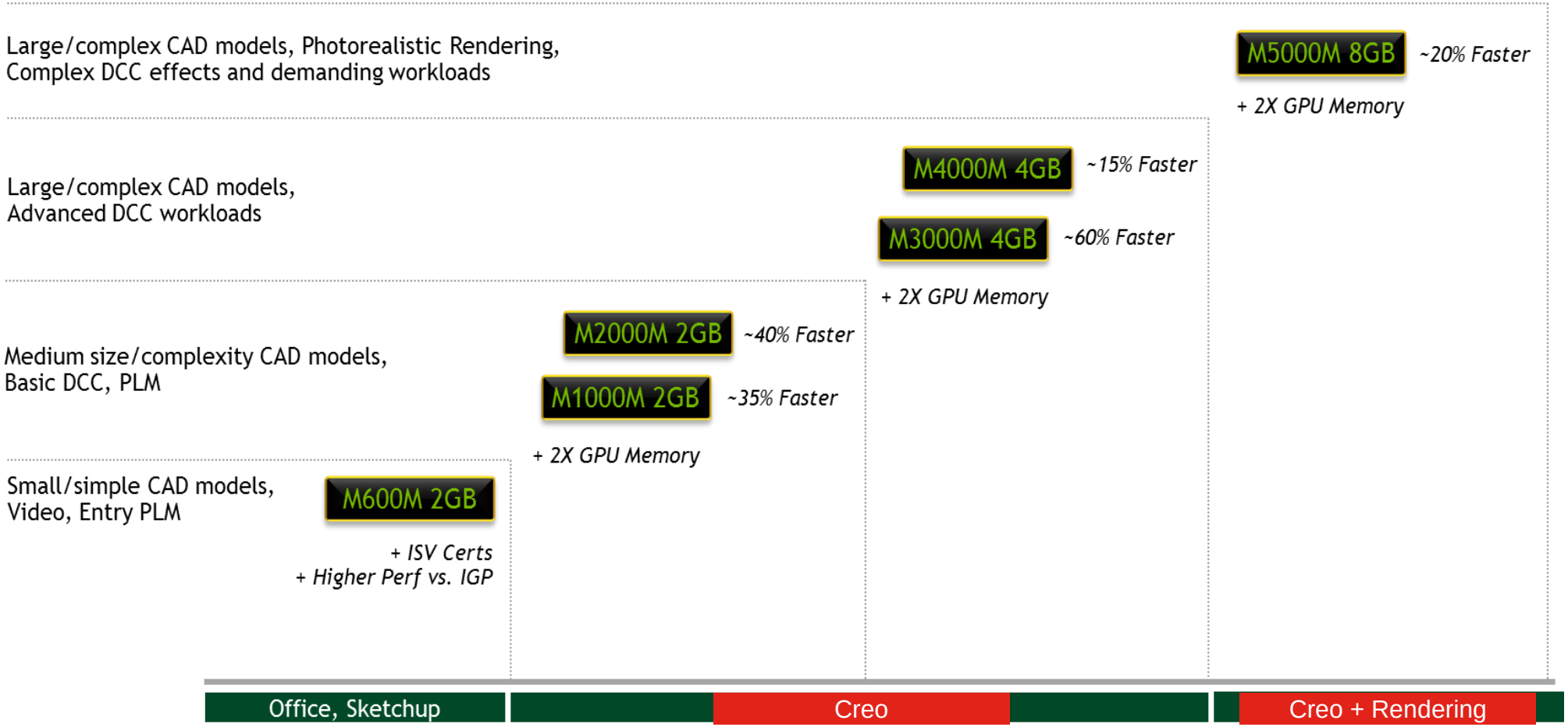
Lenovo

Nvidia Mobile Graphics



Convergence of Desktop and Mobile Performance

Mobile Graphics Card Positioning

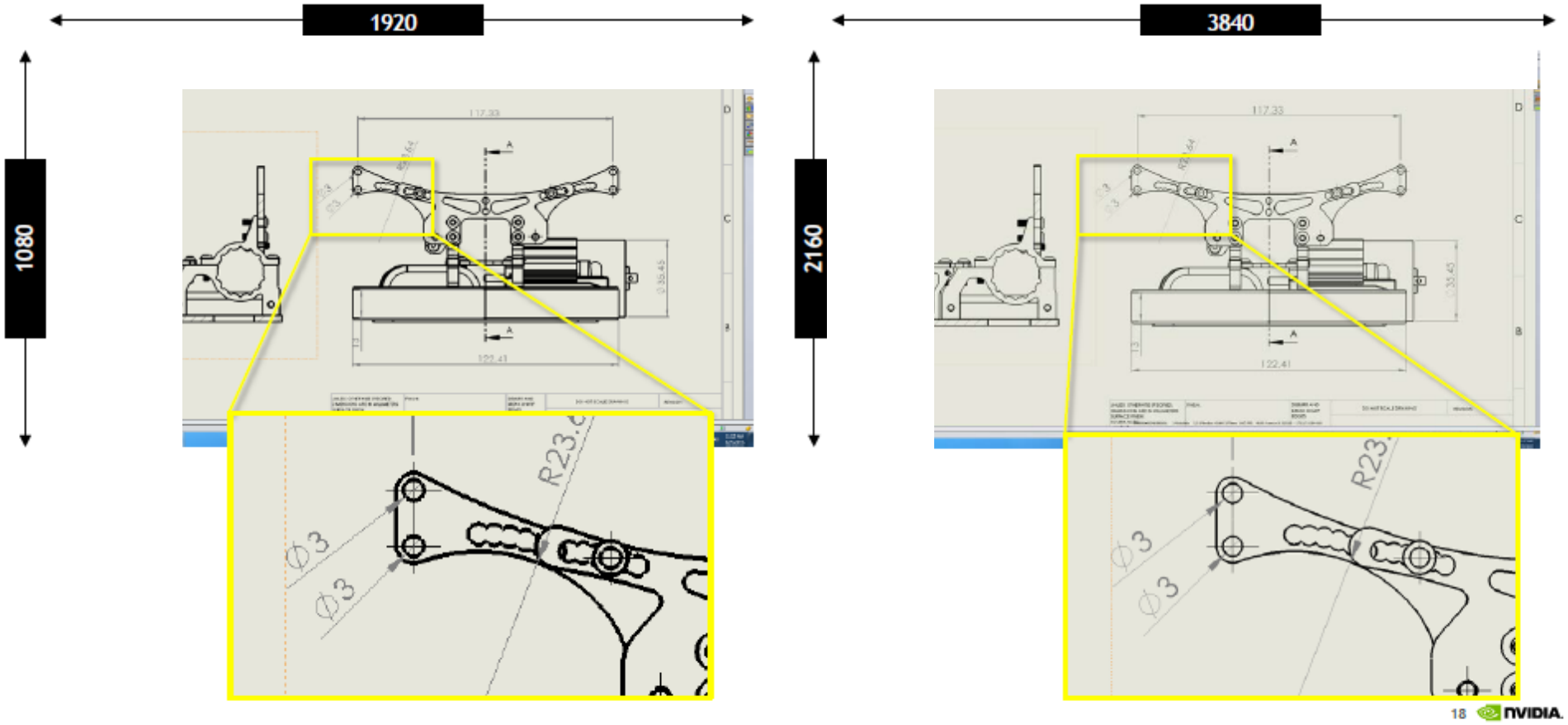


Perf comparison based on SPECviewperf 12 benchmark

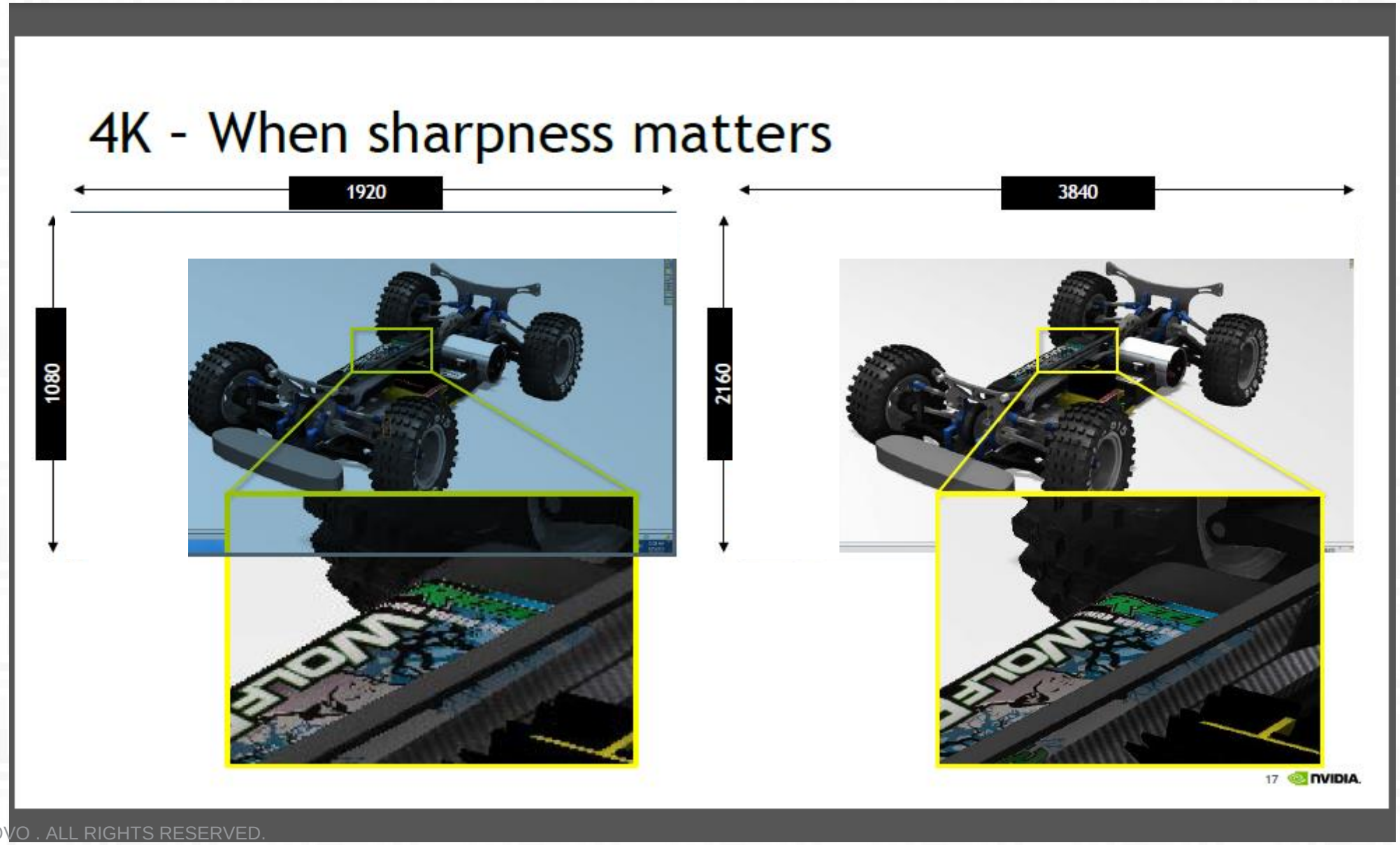
4K Screens

4K with NVIDIA Professional Graphics

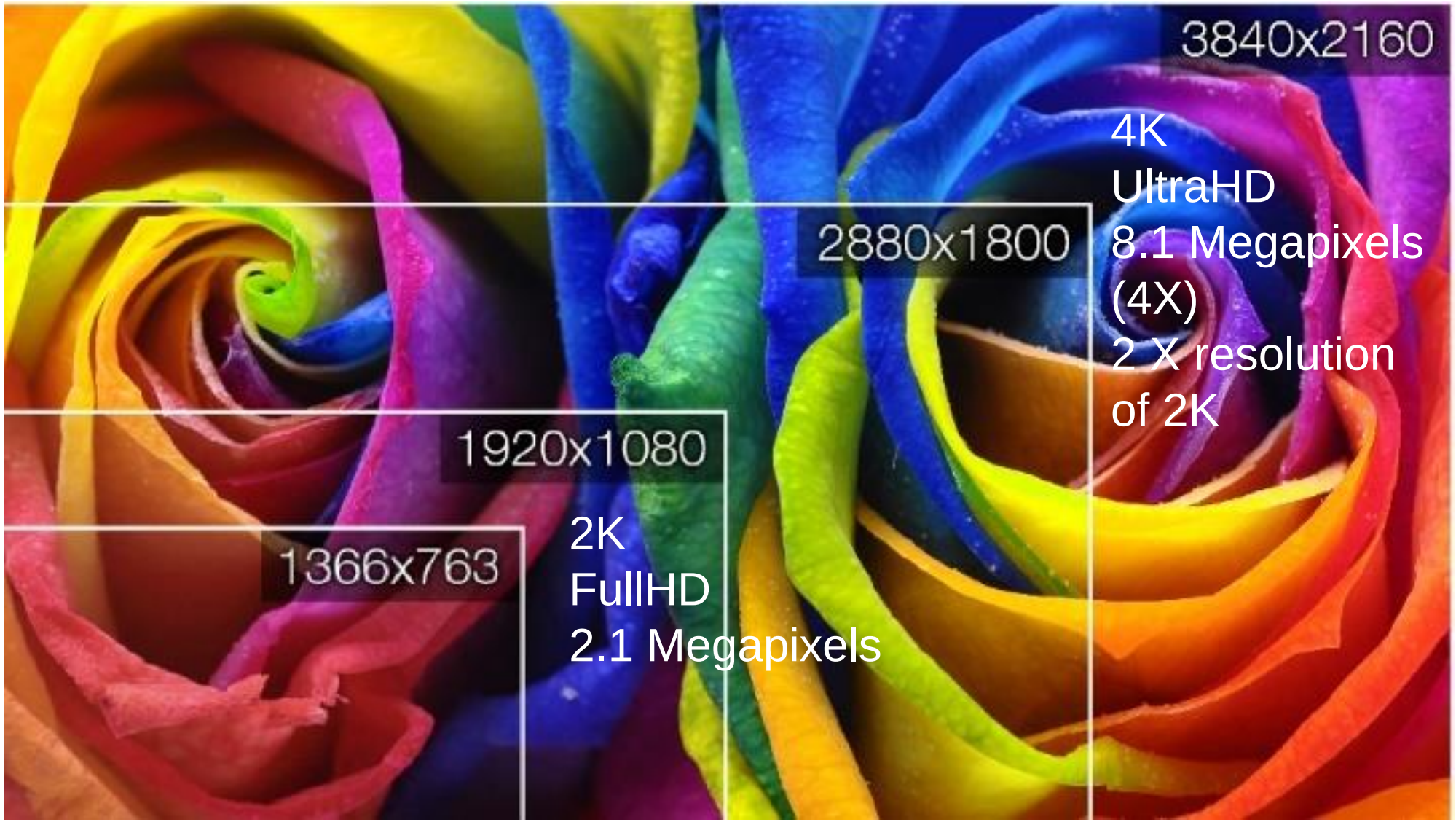
4K - Drawings are especially critical



4K with NVIDIA Professional Graphics

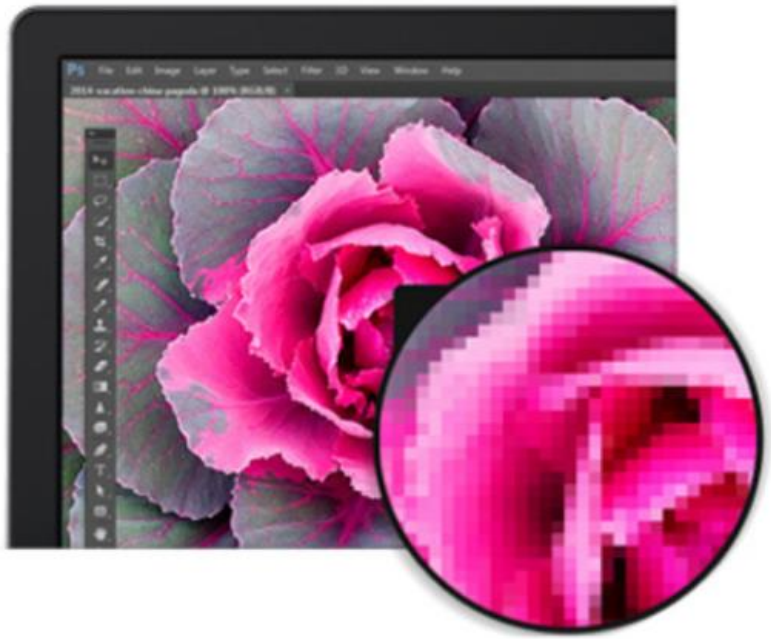


Mobility Screens



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

PANTONE®

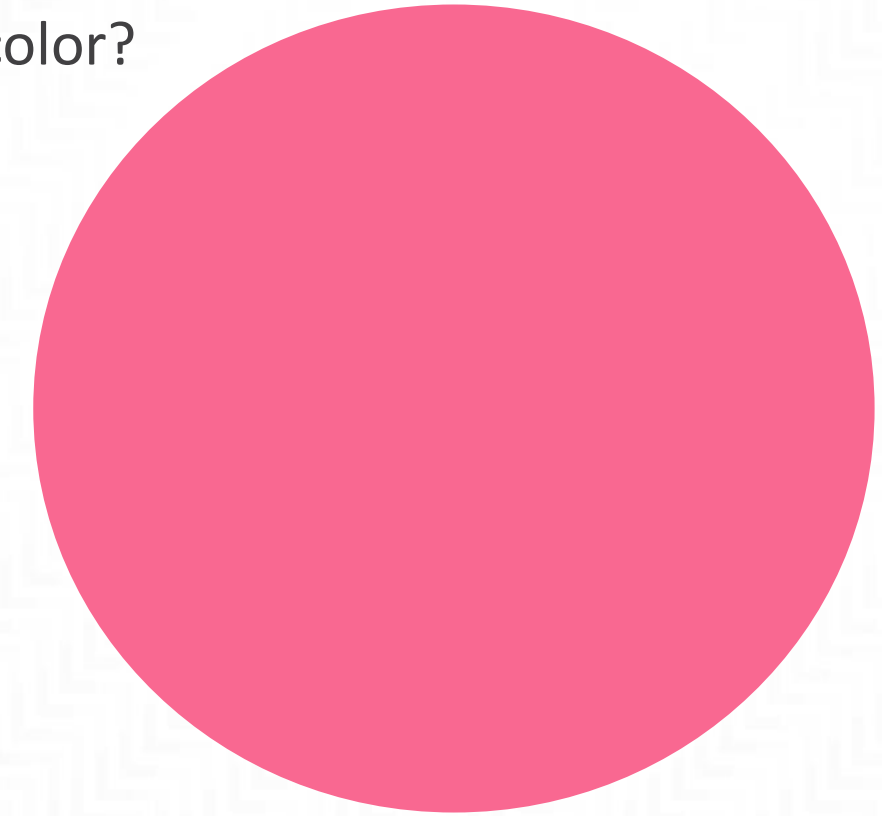
Color Calibrator

NVIDIA.

Lenovo

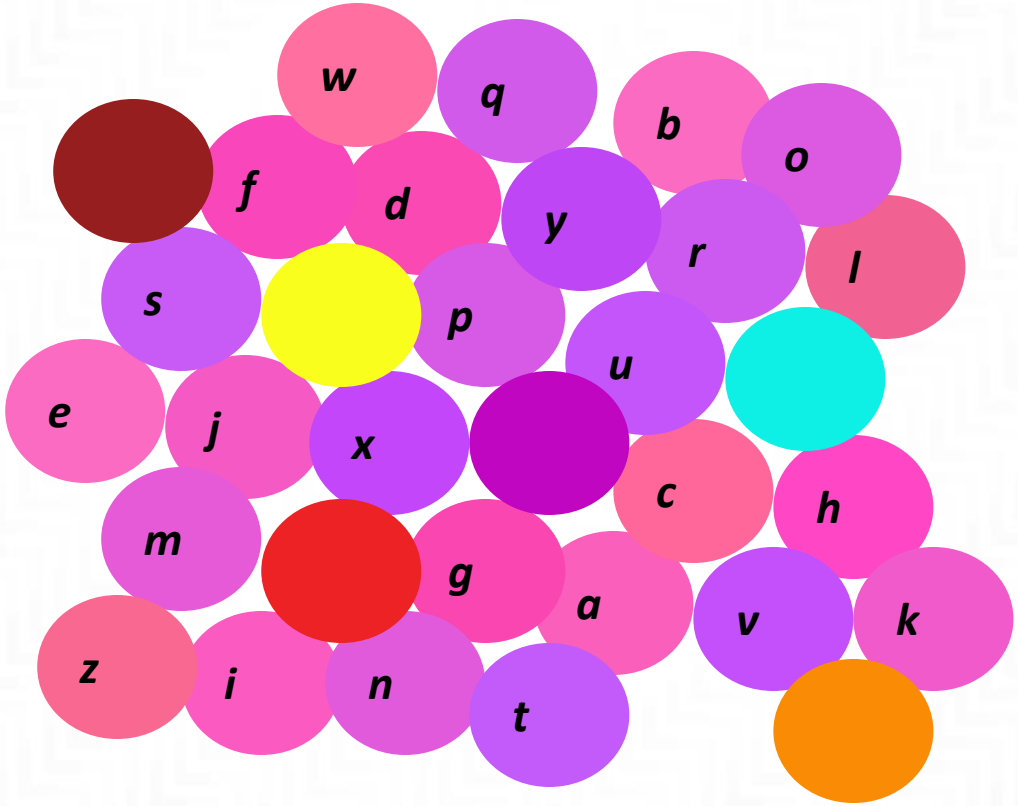
X-Rite Panton Color Calibrator

Can you memorize this color?



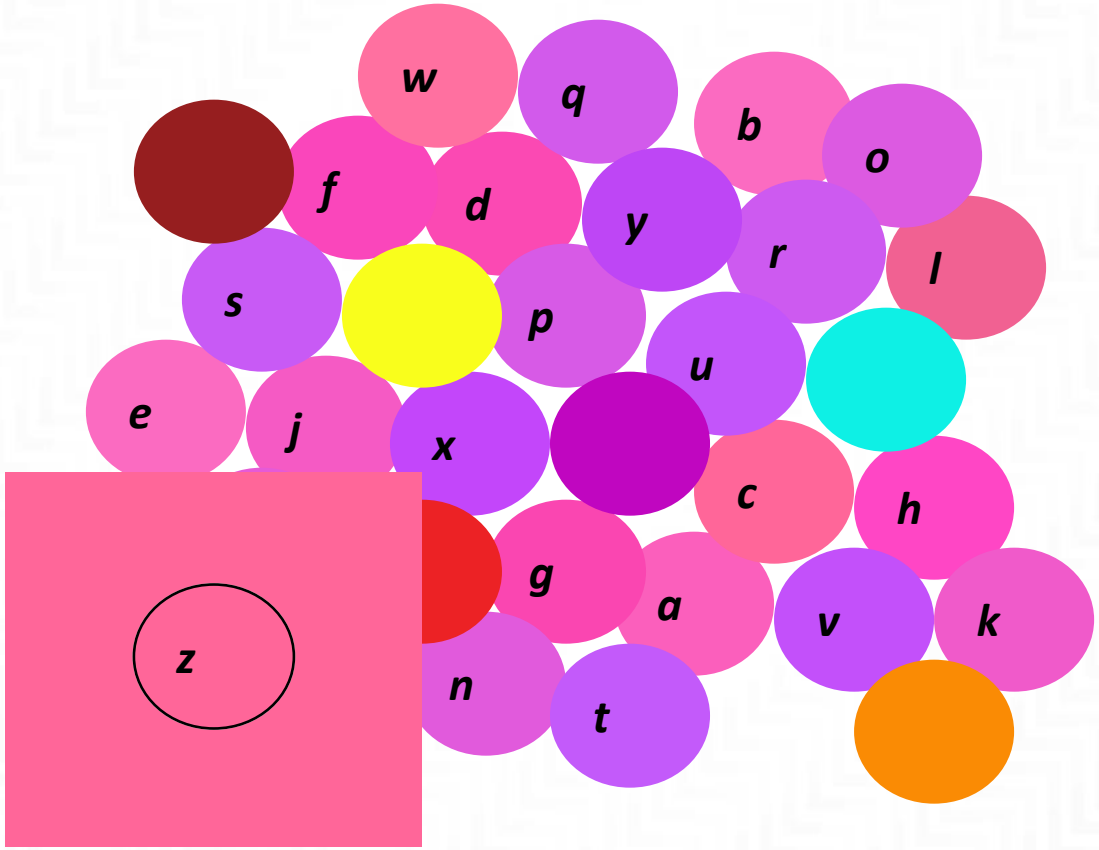
Which Color is it?

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!



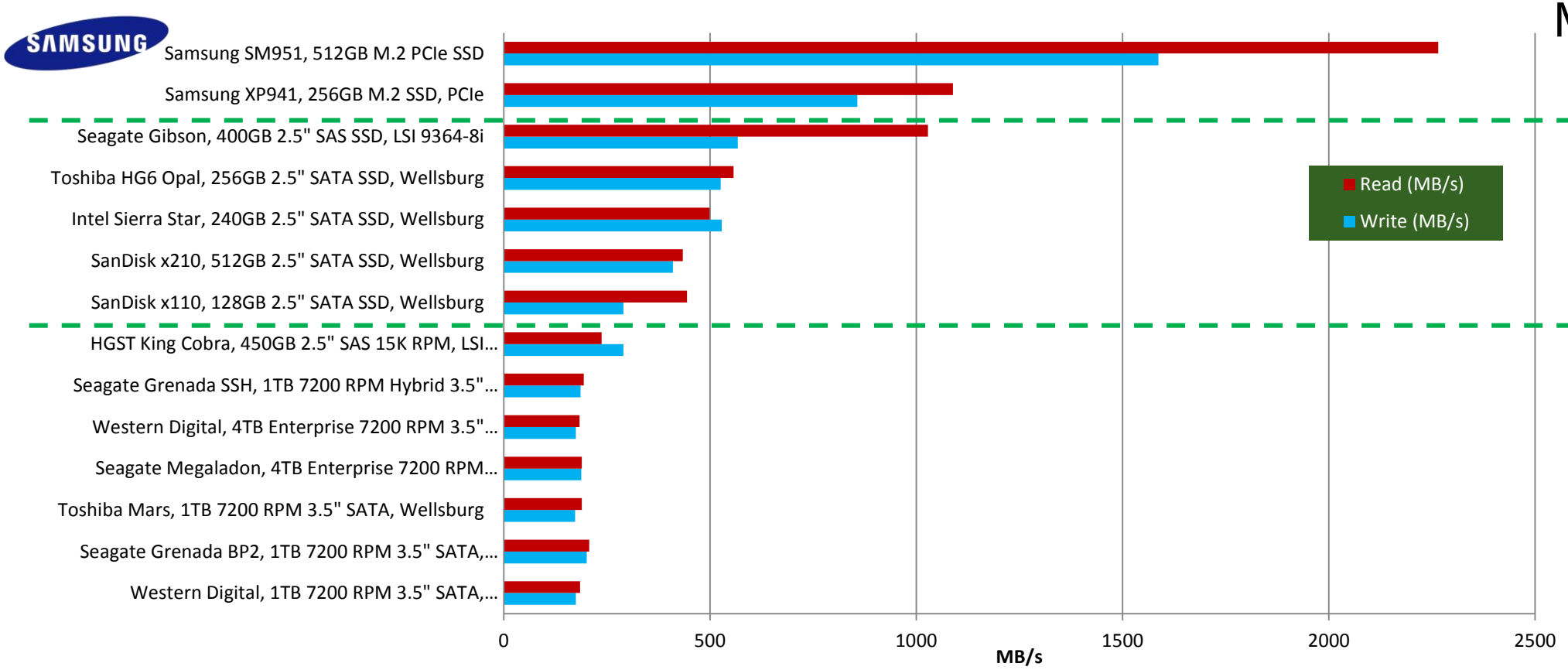
Other Mobile Technologies

UNMATCHED

PERFORMANCE

Storage Speeds you have Dreamed off

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



M.2 NVMe Drives
32 Gb/s

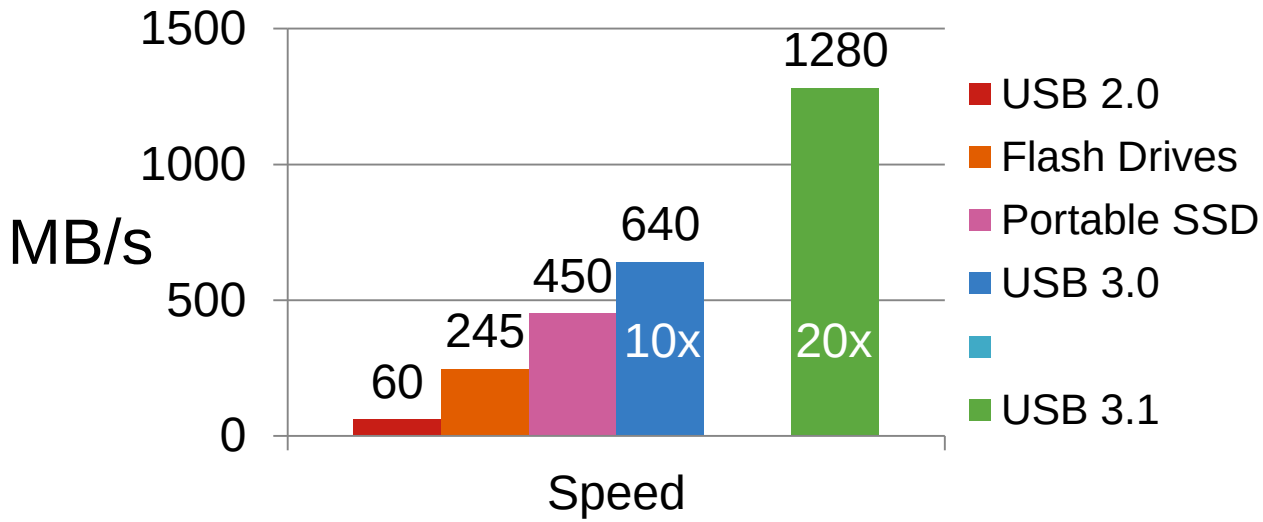
Solid State Drives

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

NVIDIA

Lenovo

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

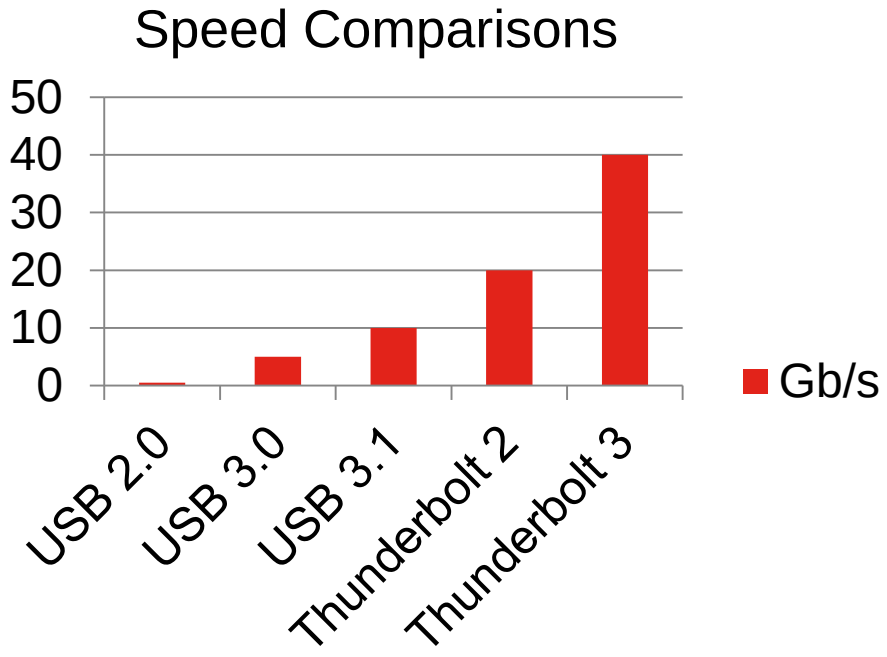
Thunderbolt

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

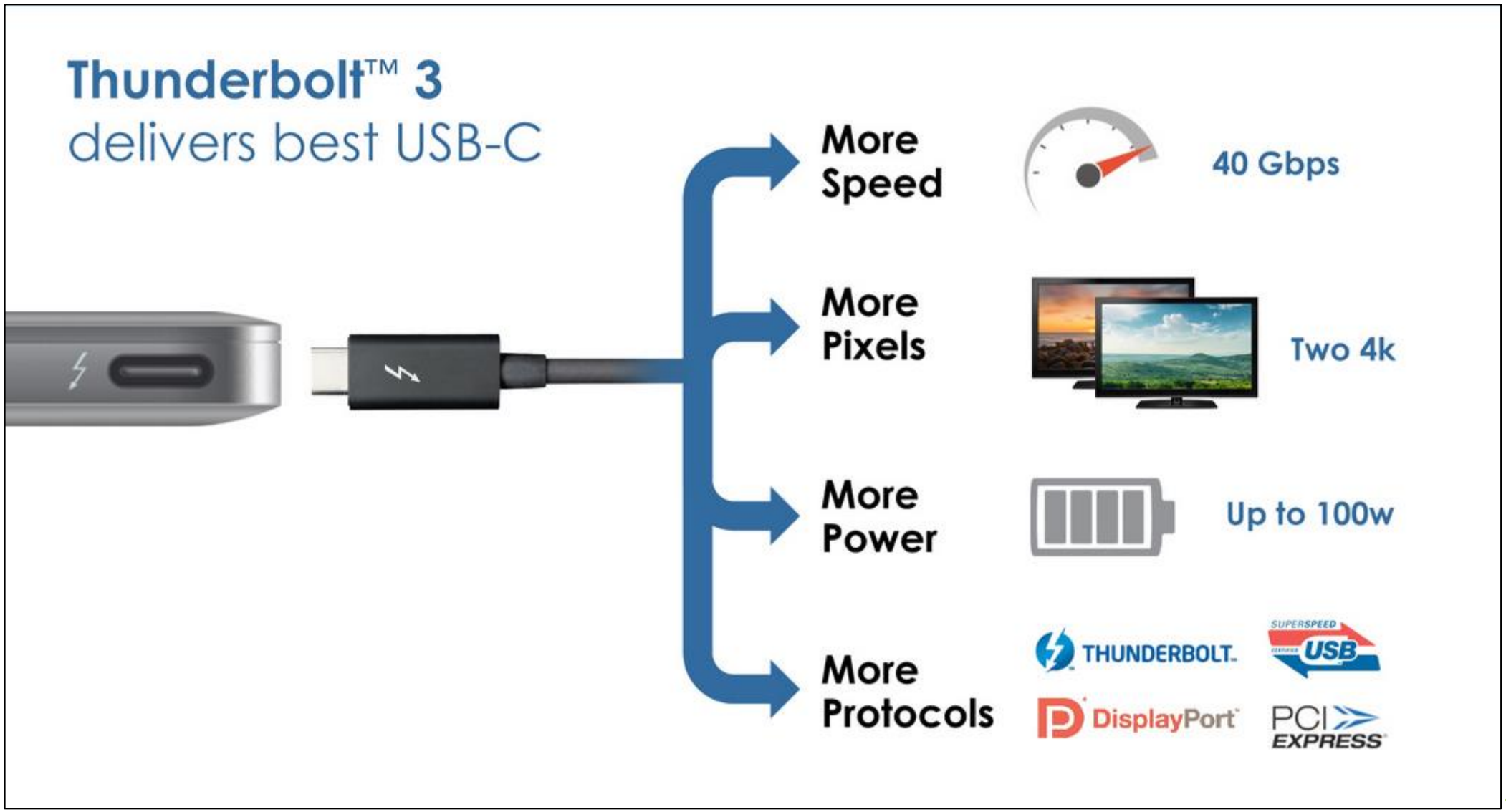
Drives speeds not as fast

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



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			
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

USB3.1

DVDRW

SmartCard

Right

HP/MIC

USB3.1

SDXC

ExpressCard

USB3.1

mDP

Lock slot

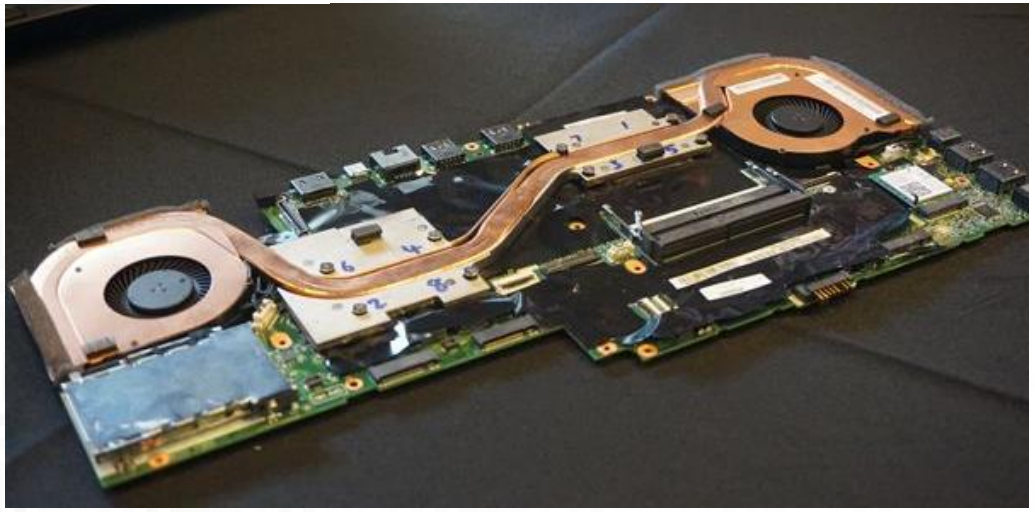
TBT= Thunderbolt 3

SUPERIOR

RELIABILITY

EXCLUSIVE TO LENOVO

FLEX COOLING



Dual Fans

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

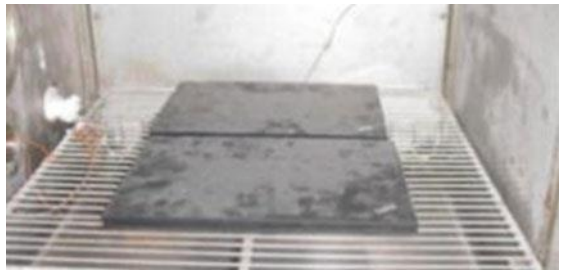
Cool processors enable Turbo Boost

Mobile Workstations -- Mil-Spec Methods & more

HUMIDITY

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

LOW TEMPERATURE



-20℃ for over 72 hours

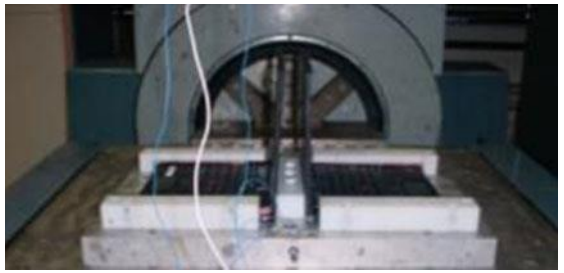
HIGH TEMPERATURE

+30 to +60° C over
7 x 24 hour cycles

SAND

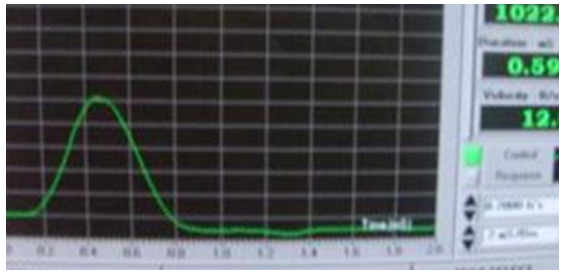
140 mesh silica dust for
6 hour cycles

VIBRATION



Multiple tests while running
and turned off

MECHANICAL SHOCK



High acceleration and repeated
shock pulses over 18 times

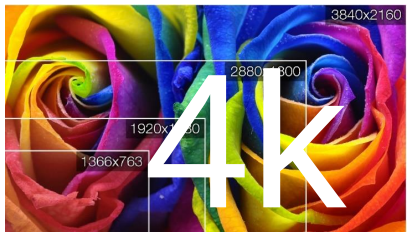
ALTITUDE

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

NVIDIA

Lenovo

Thin & Light

Xeon Power

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

NVIDIA

Lenovo

GPU Power

Best cooling

Analysis and Rendering Power

Lenovo ThinkPad P70 Mobile Workstation

17”

- 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

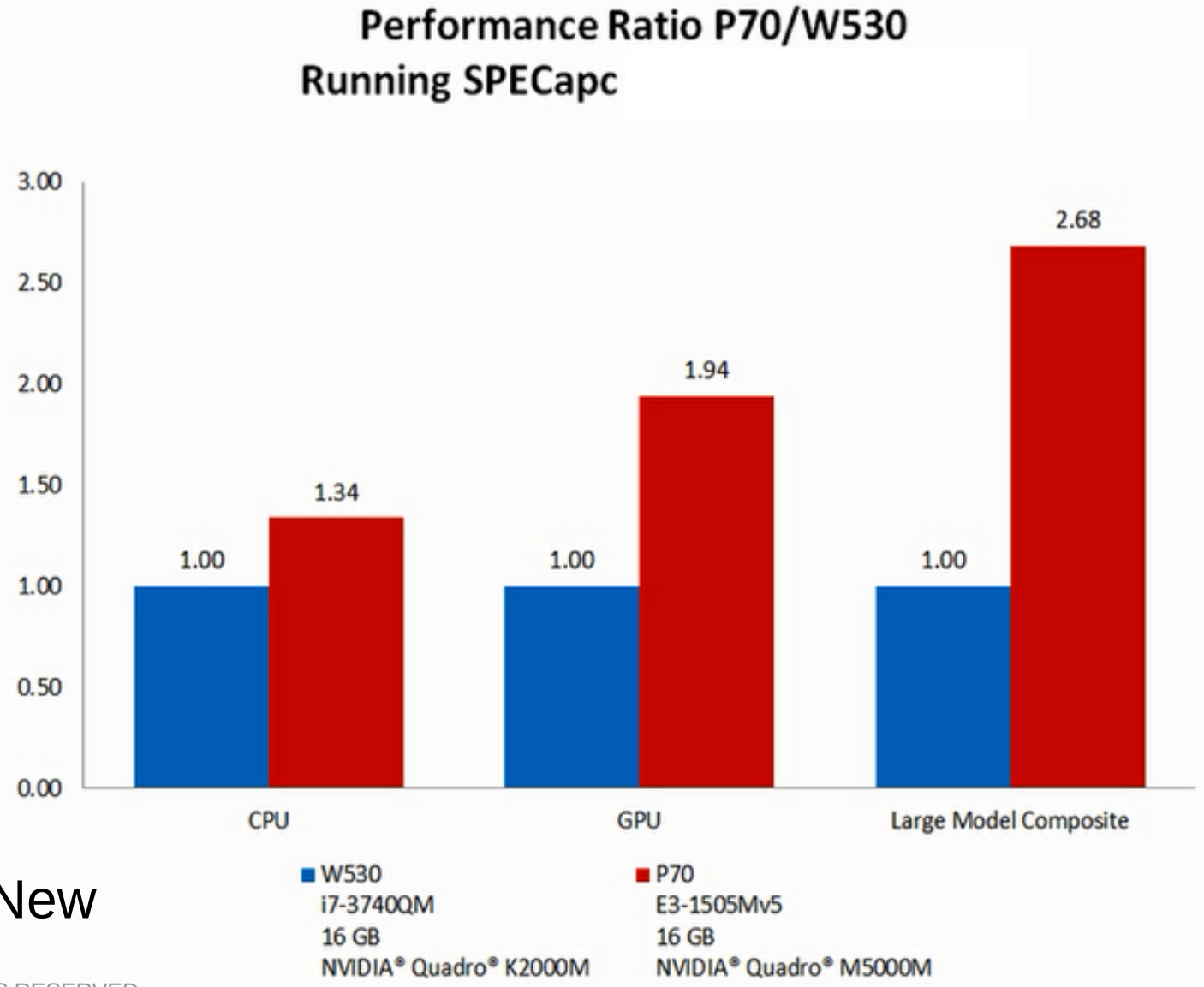
Cooling design exclusive to Lenovo

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

NVIDIA

Lenovo

Results – Higher is Better



GPU Power makes and Enormous Difference with Rendering

Old vs New

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

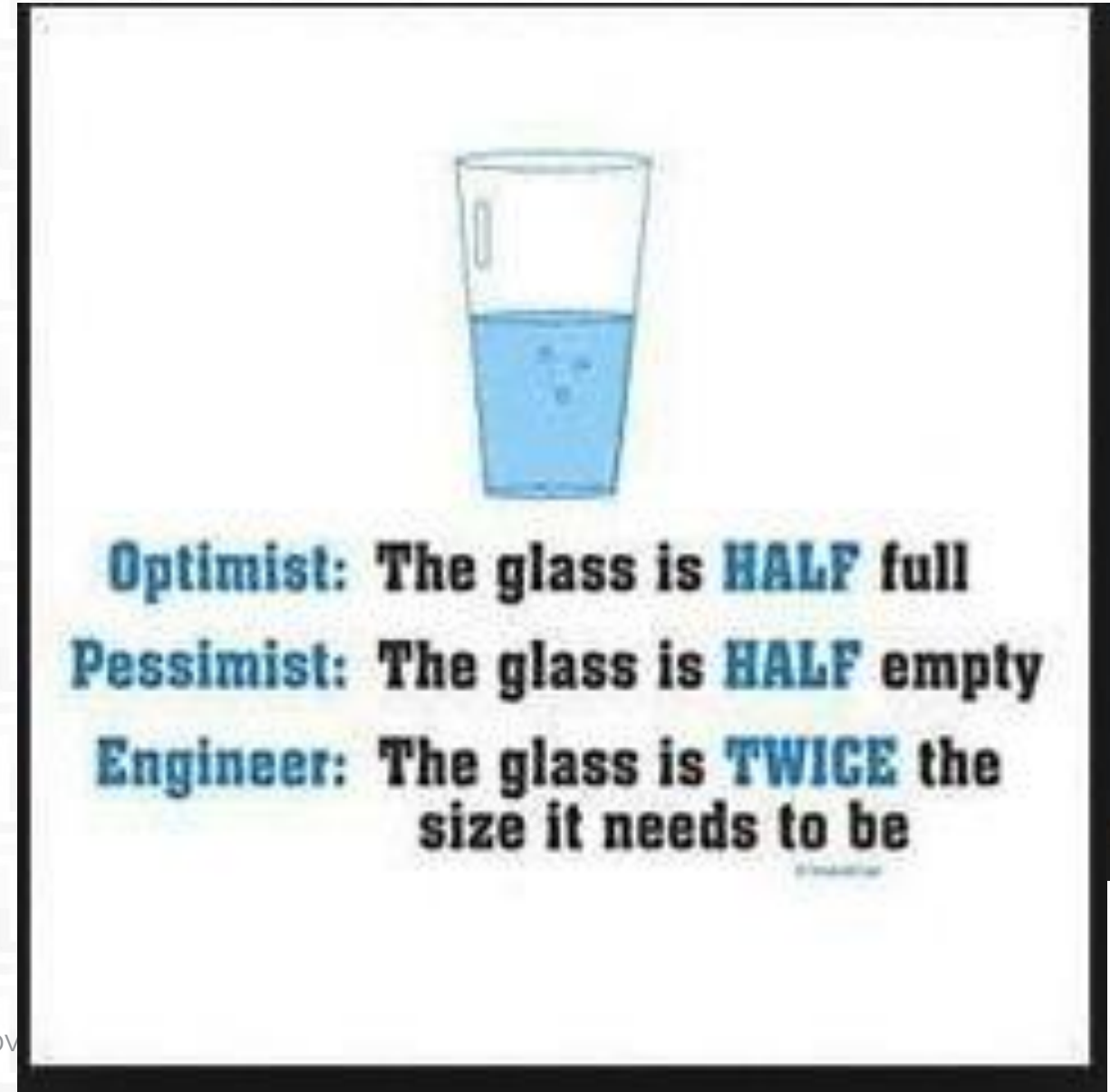
More Done in Less Time

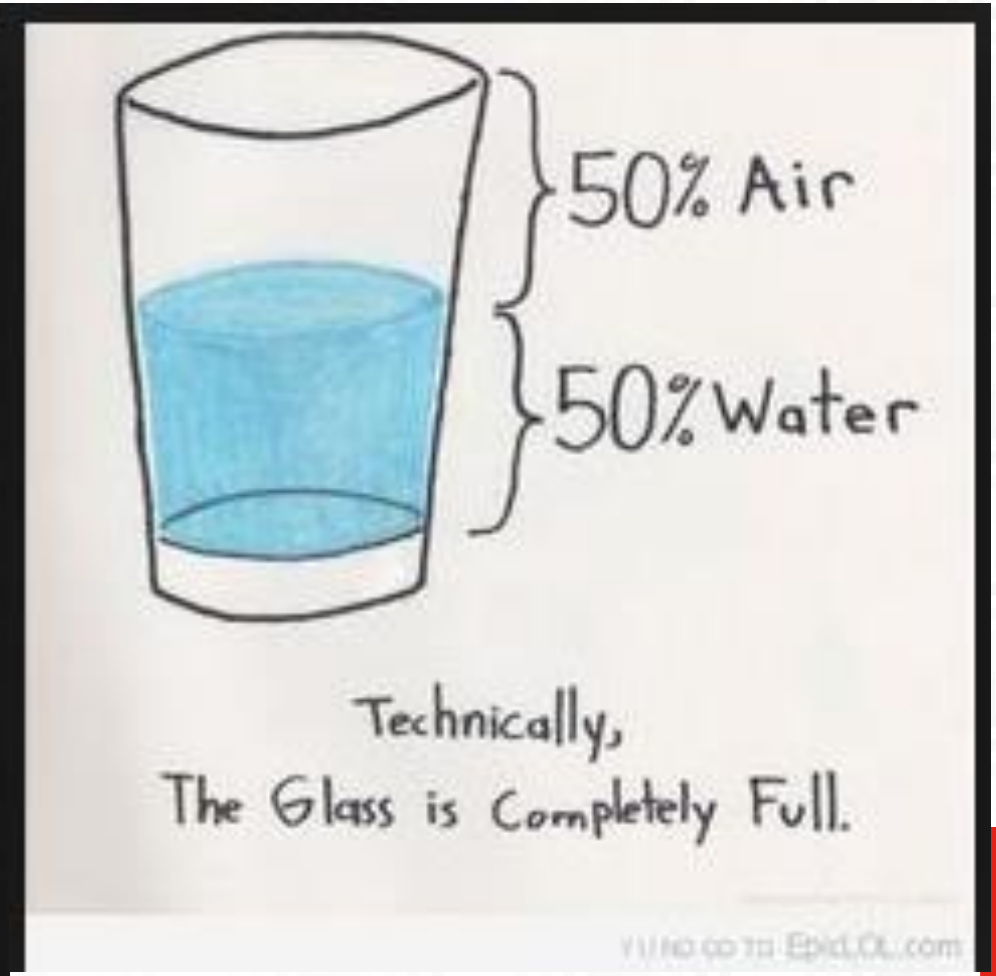
- Usability -- 4K display clarity, Keyboard/Mouse Pad, Touch
- Reliability history, testing, cooling leadership, ECC memory
- Performance – i7 or Xeon, CUDA, 64 GB DDR4, PCIe drives, Cooling
- Latest – mobile processors, graphics and storage

Productivity/usefulness

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

Engineering View





Desktop Workstations

Desktop Workstations

SUPERIOR

RELIABILITY

RELIABILITY MORE IMPORTANT THAN EVER

EXCLUSIVE TO LENOVO

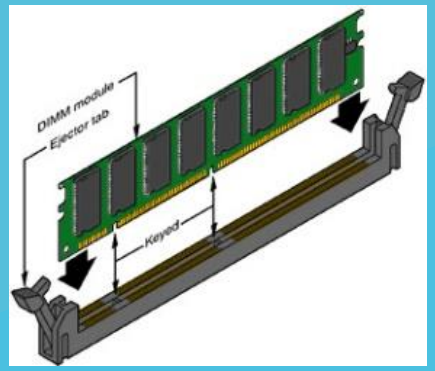
COOLEST IN THE INDUSTY

TRI-CHANNEL COOLING

The patented tri-channel architecture ensures each component receives cool air.

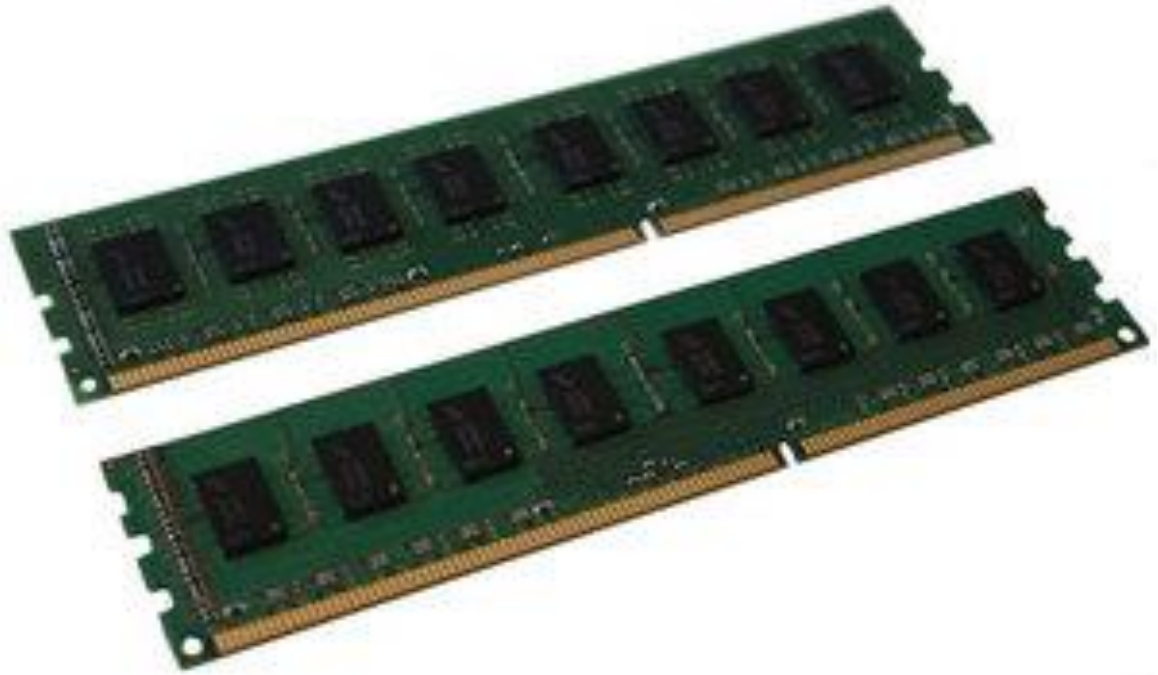
LONGER TURBO BOOST

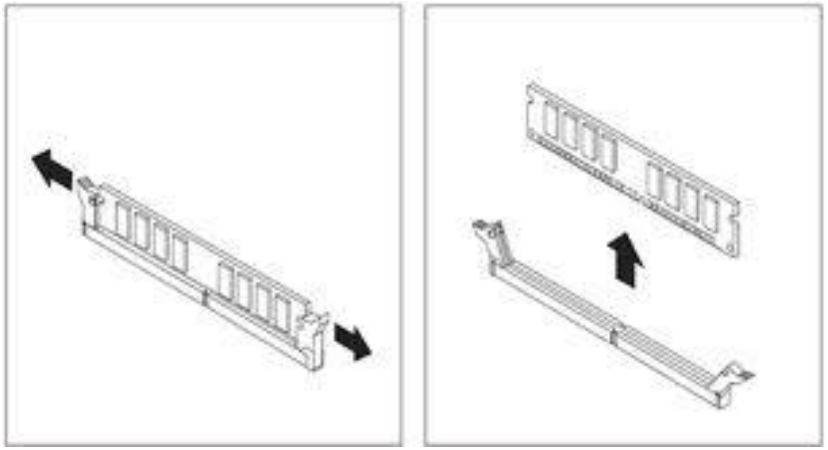
Memory



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 is16 GB
- ECC improves dependability/recommended

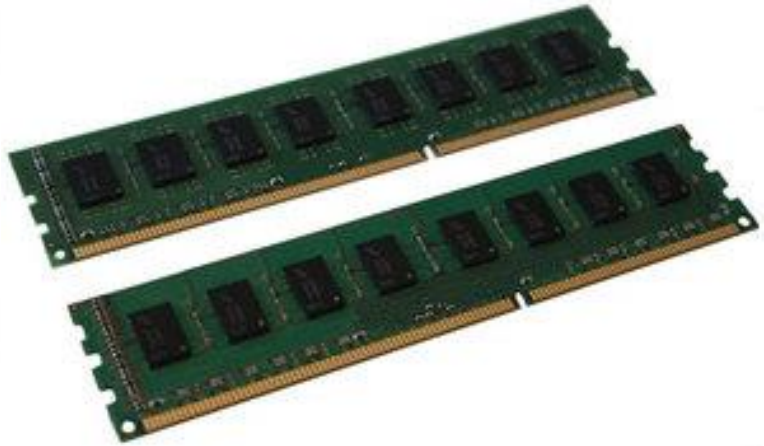
ECC MEMORY IS A KEY TO DEPENDABLE USE

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

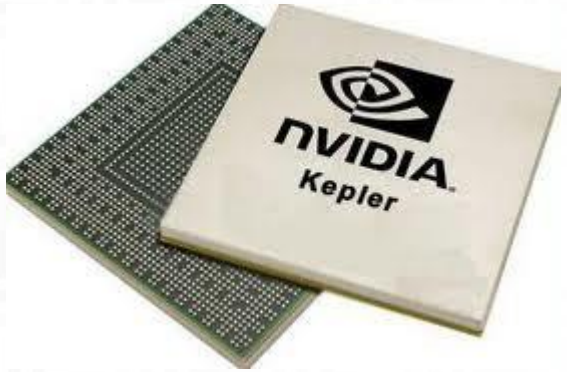


BAD DAY FOR A CIVIL ENGINEER

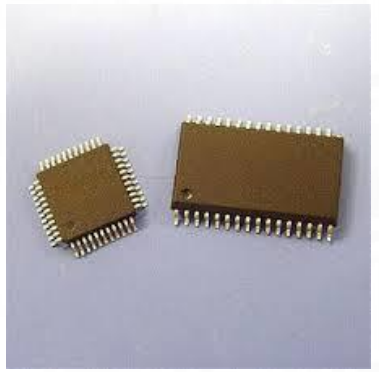
Graphics

Graphics Card Considerations

Processor



Memory



Driver

10111000111100001110001010101010001

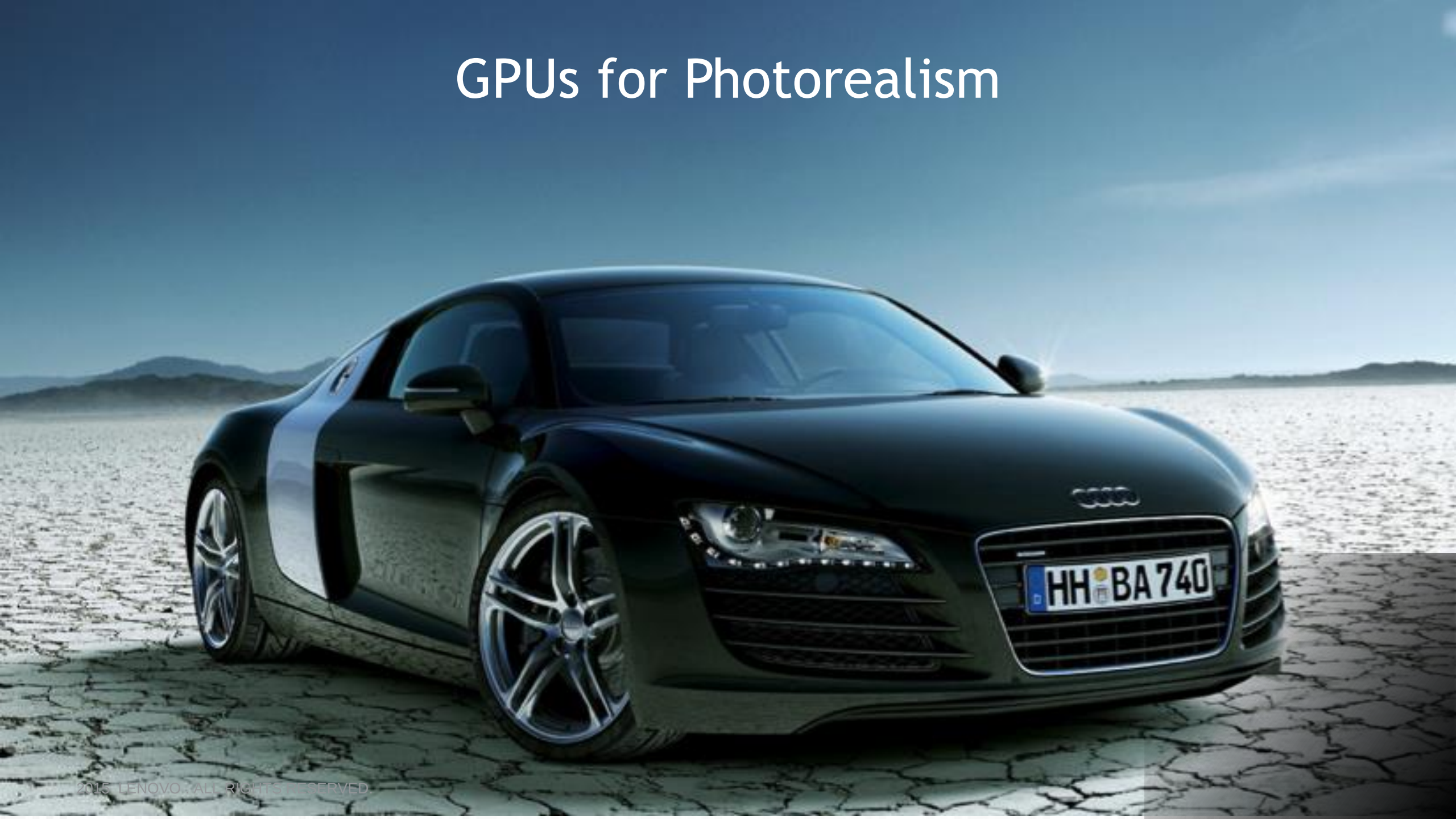
Graphic Card Sizing is Usage Dependant

Things that affect the sizing

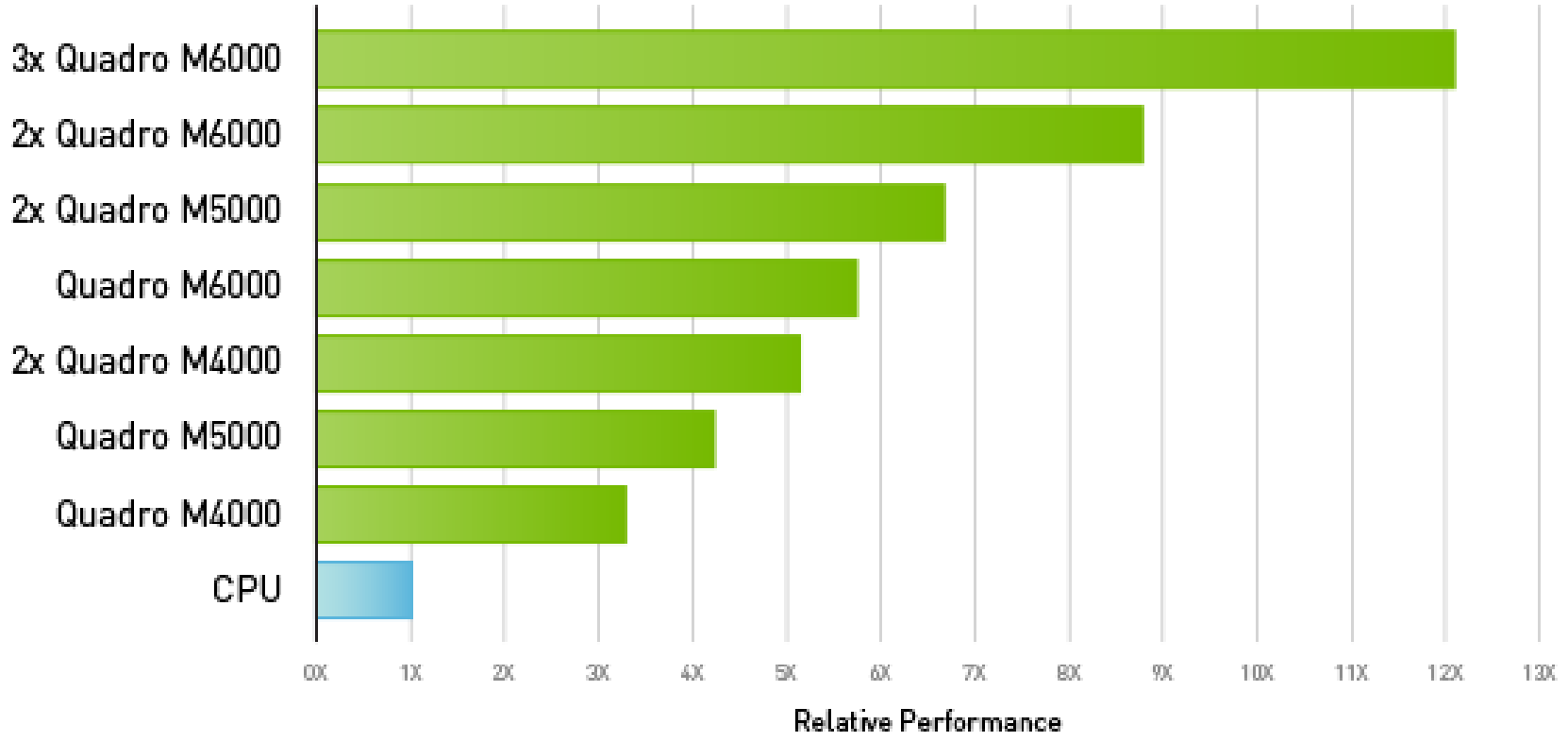
1) 3D Model size- number of surfaces
   - (number of polygons and textures)
2) Number of pixels/monitor size/screen resolution
3) Need for movement
   - High frame rates (i.e. Virtual Reality)
4) Ray tracking/lighting affect
   - Advanced lighting techniques

Need Certified Drivers

GPUs for Photorealism



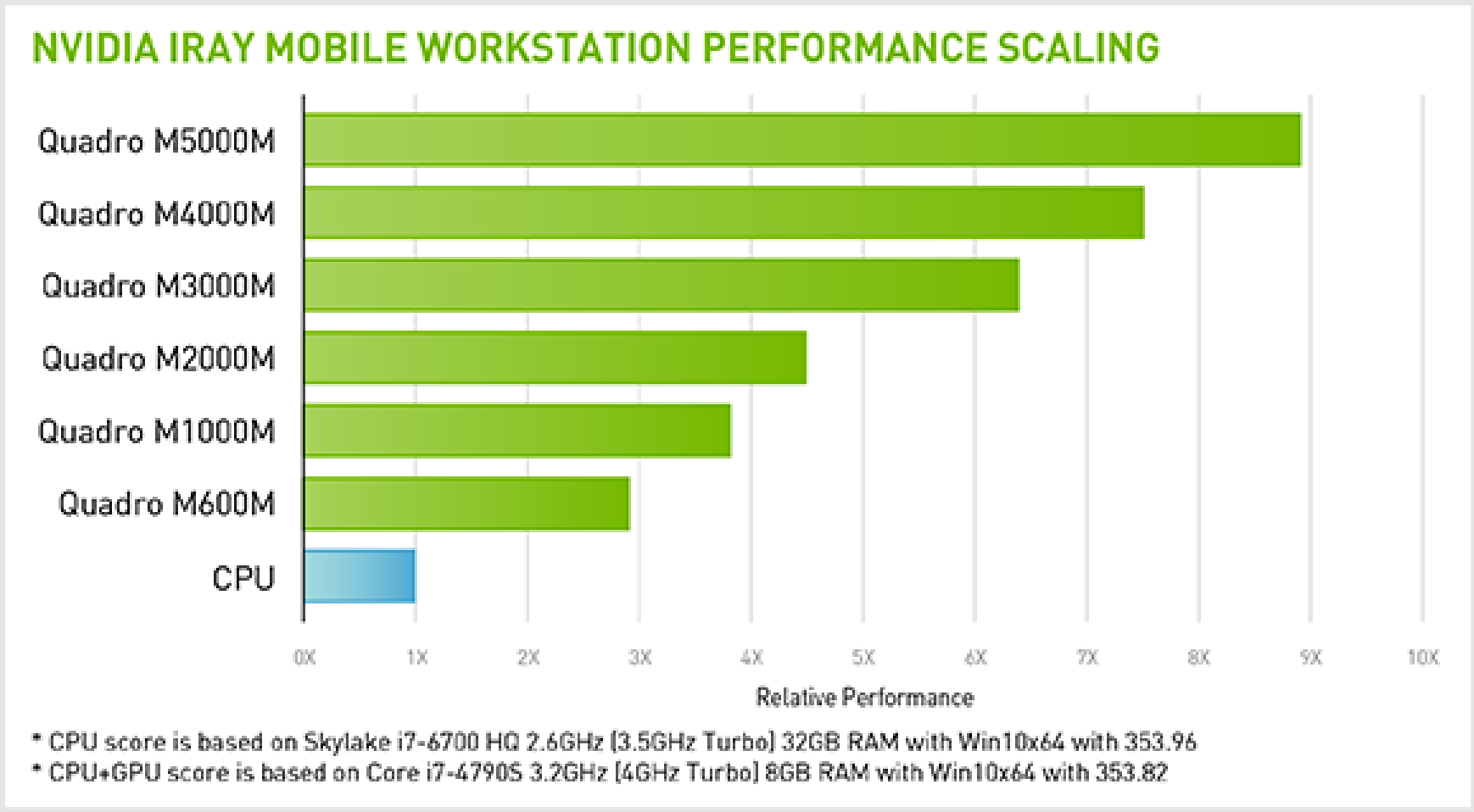
NVIDIA IRay Desktop



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.

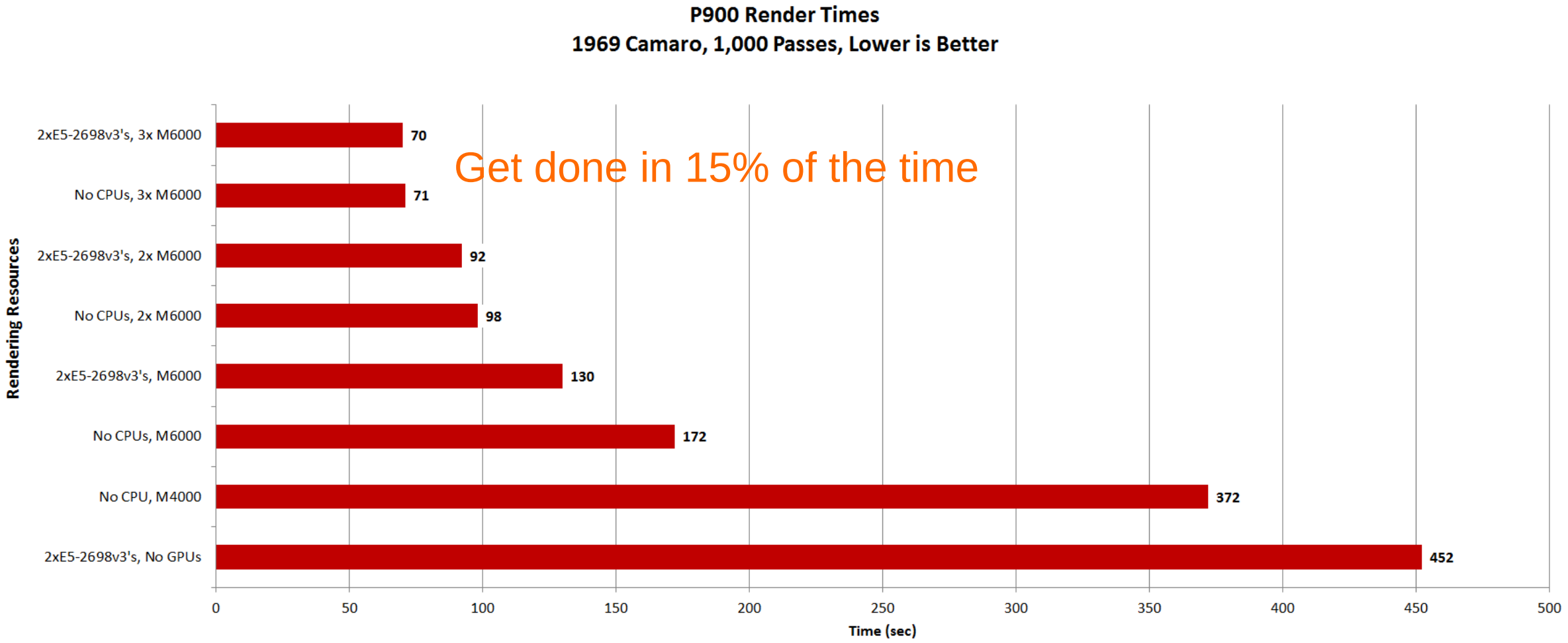
The more GPU power, the faster it goes

NVIDIA IRay Mobile

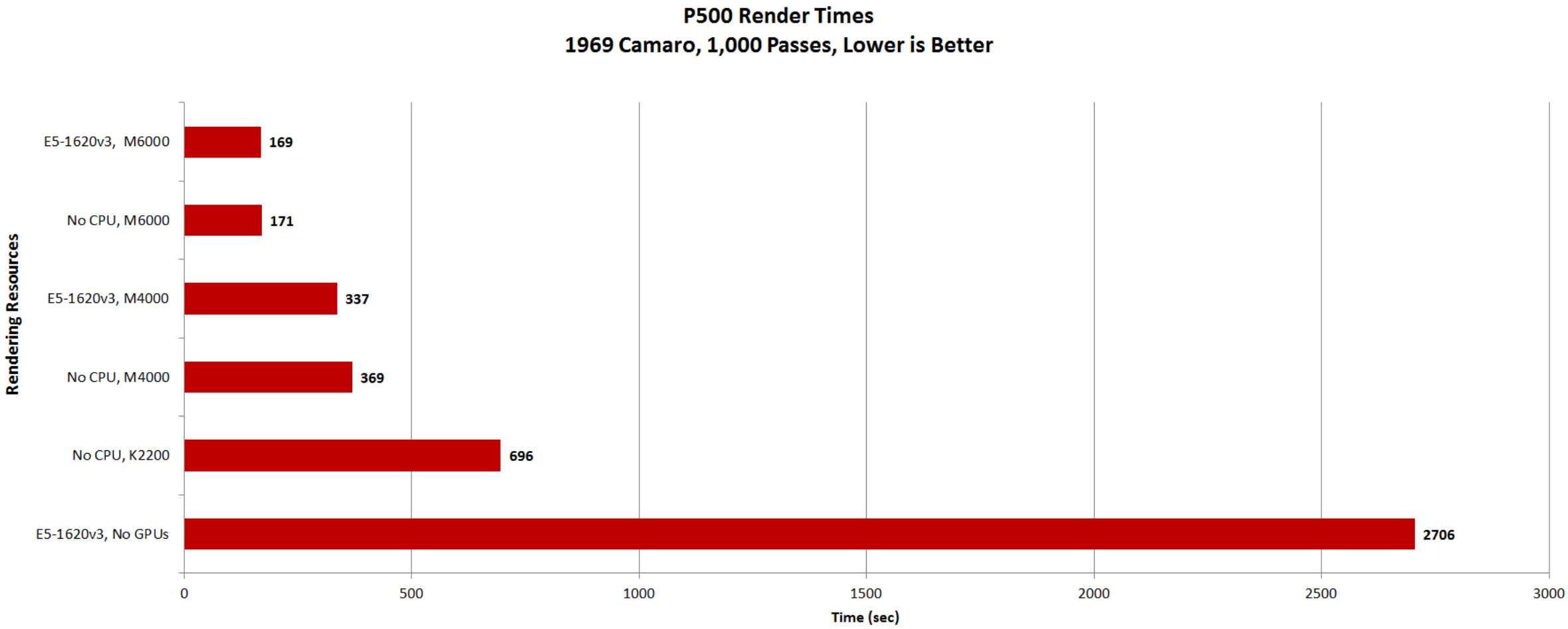


The more GPU power, the faster it goes

P900 Render Times



P500 Render Times



Ease of Deployment and Support

Some specific Lenovo features

DESIGNED FOR EASE OF USE

MODULAR DESIGN

TOOL-LESS ACCESS

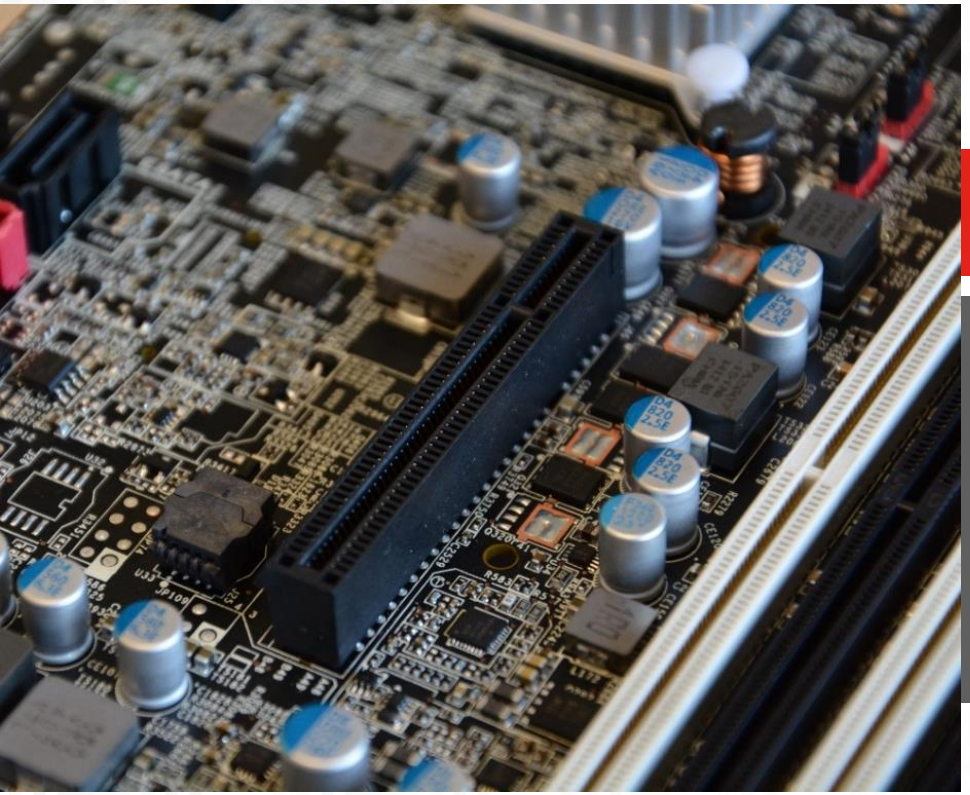
INTEGRATED HANDLES
92% EFFICIENT POWER SUPPLY
SNAP IN PARTS

UNMATCHED

PERFORMANCE

EXCLUSIVE TO LENOVO

MORE STORAGE, WITHOUT COMPROMISE



FLEX CONNECTOR

Maximum Storage Speeds

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

NVIDIA.

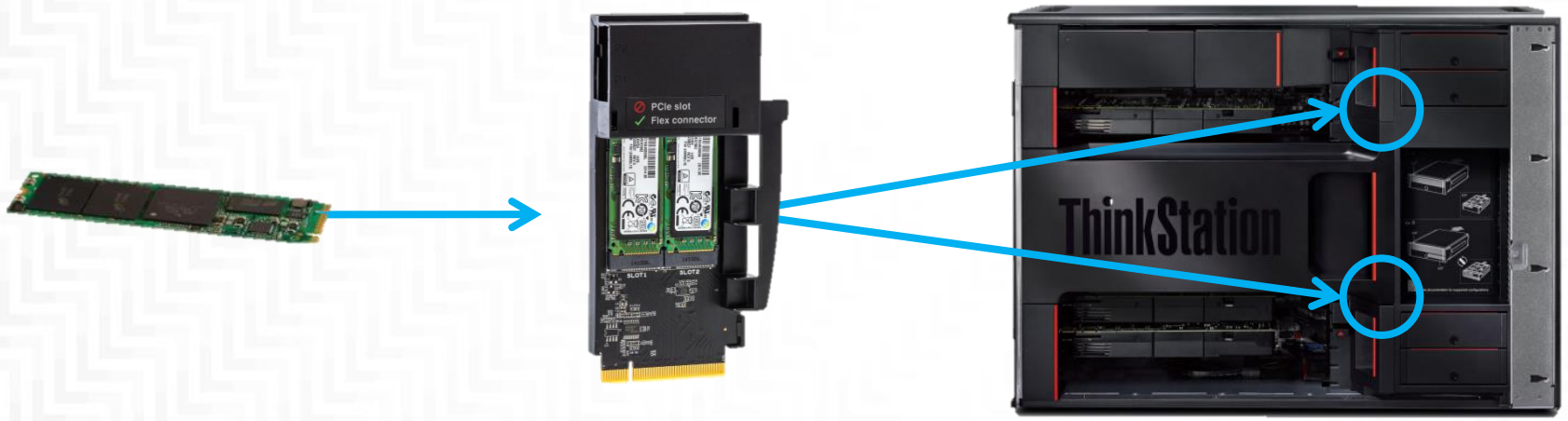
Lenovo

UNMATCHED PERFORMANCE

EXCEPTIONAL STORAGE PERFORMANCE

EXCLUSIVE TO LENOVO

FLEX DRIVES FLEX CONNECTOR



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

FLEX Drive
* * * * * * *

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

Diagnostic Port

No Troubleshooting

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

P Series Summary

Much Easier for IT

- Deploy, Install, Solve, Replace quicker than before

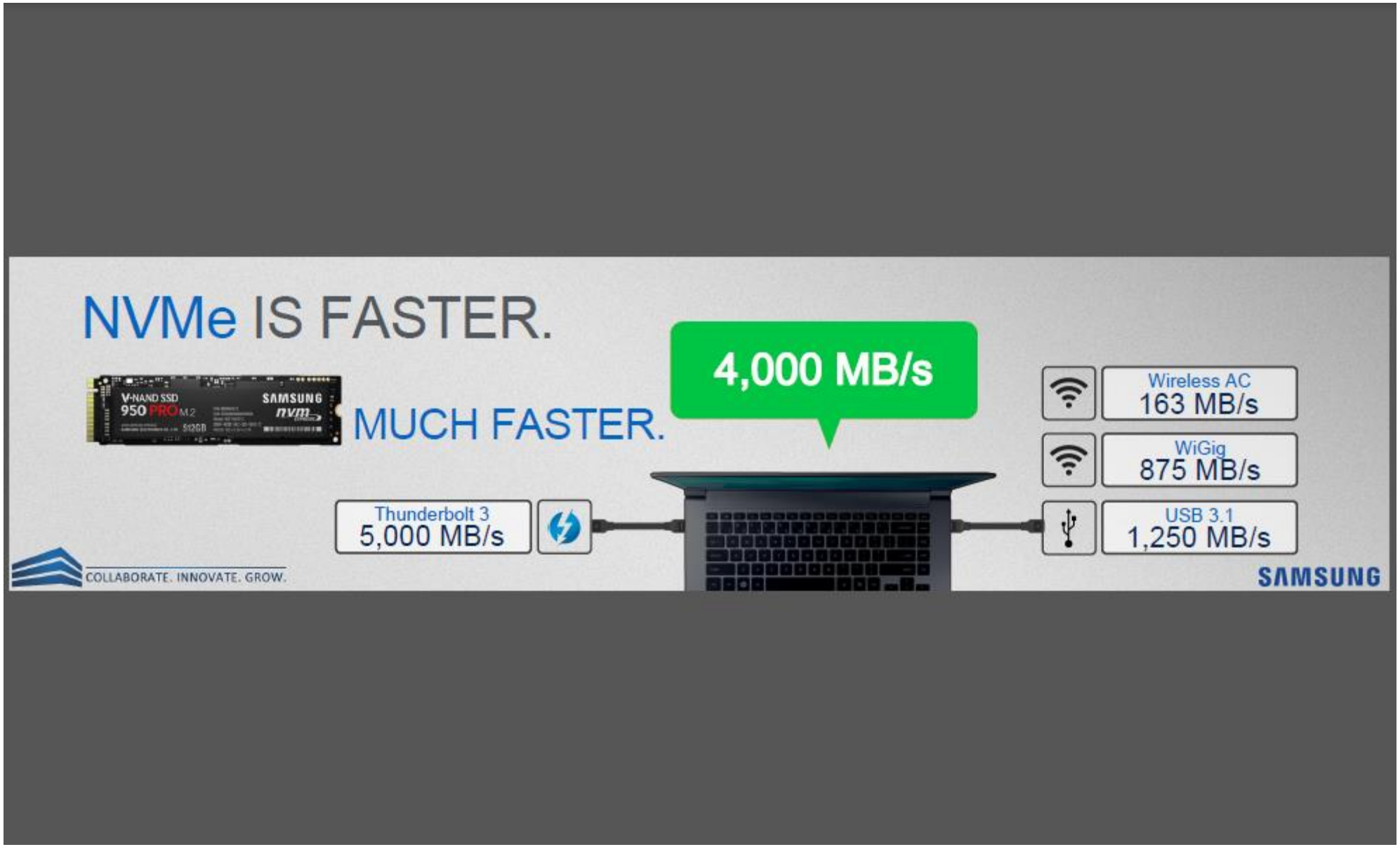
More Done in Less Time

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

Save $$

- Most energy efficient workstations on the market

Samsung Technology



SATA vs NVMe

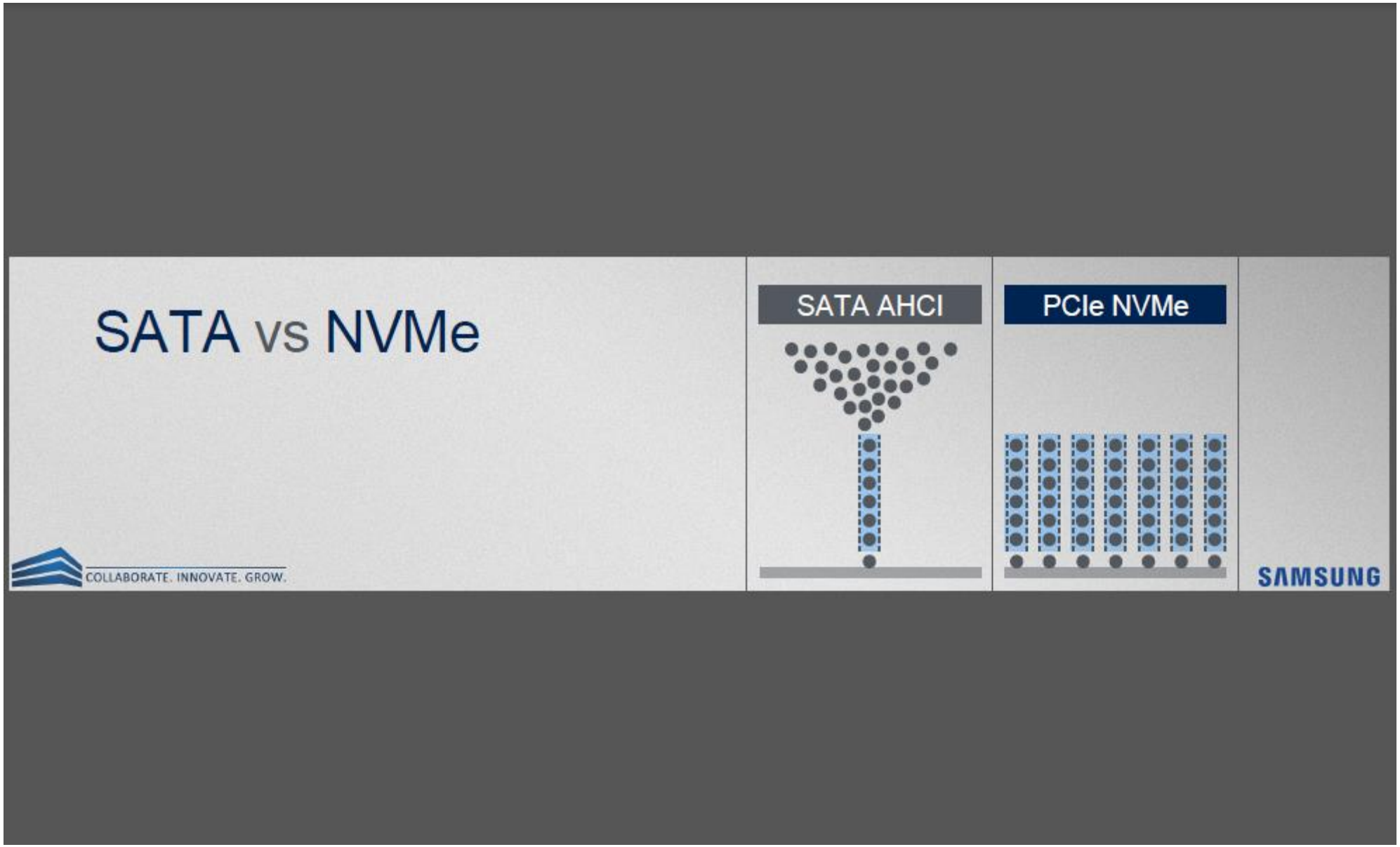
	SATA AHCI	PCIe NVMe
#of Queues	1	64,000
#of CMD/Queue	32	64,000

COLLABORATE. INNOVATE. GROW.

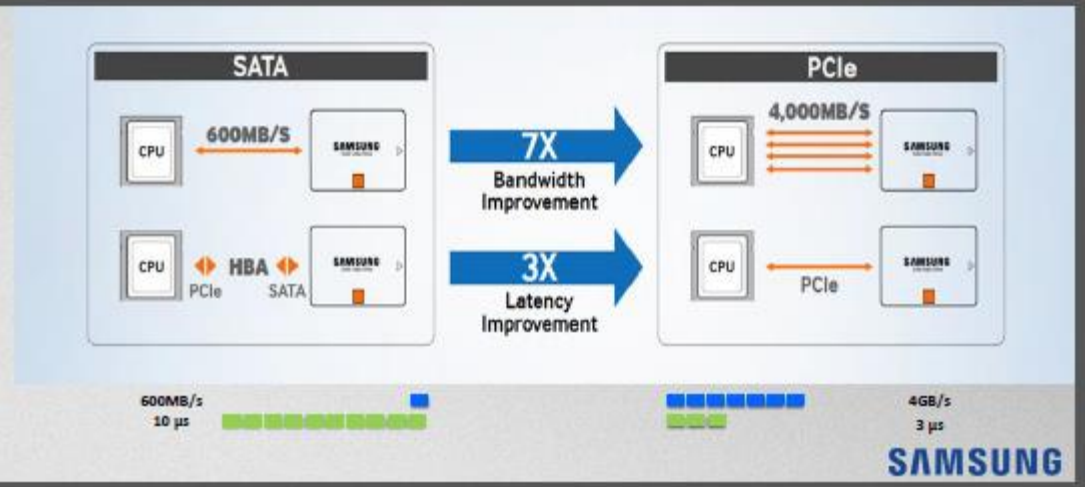
SAMSUNG

NVIDIA.

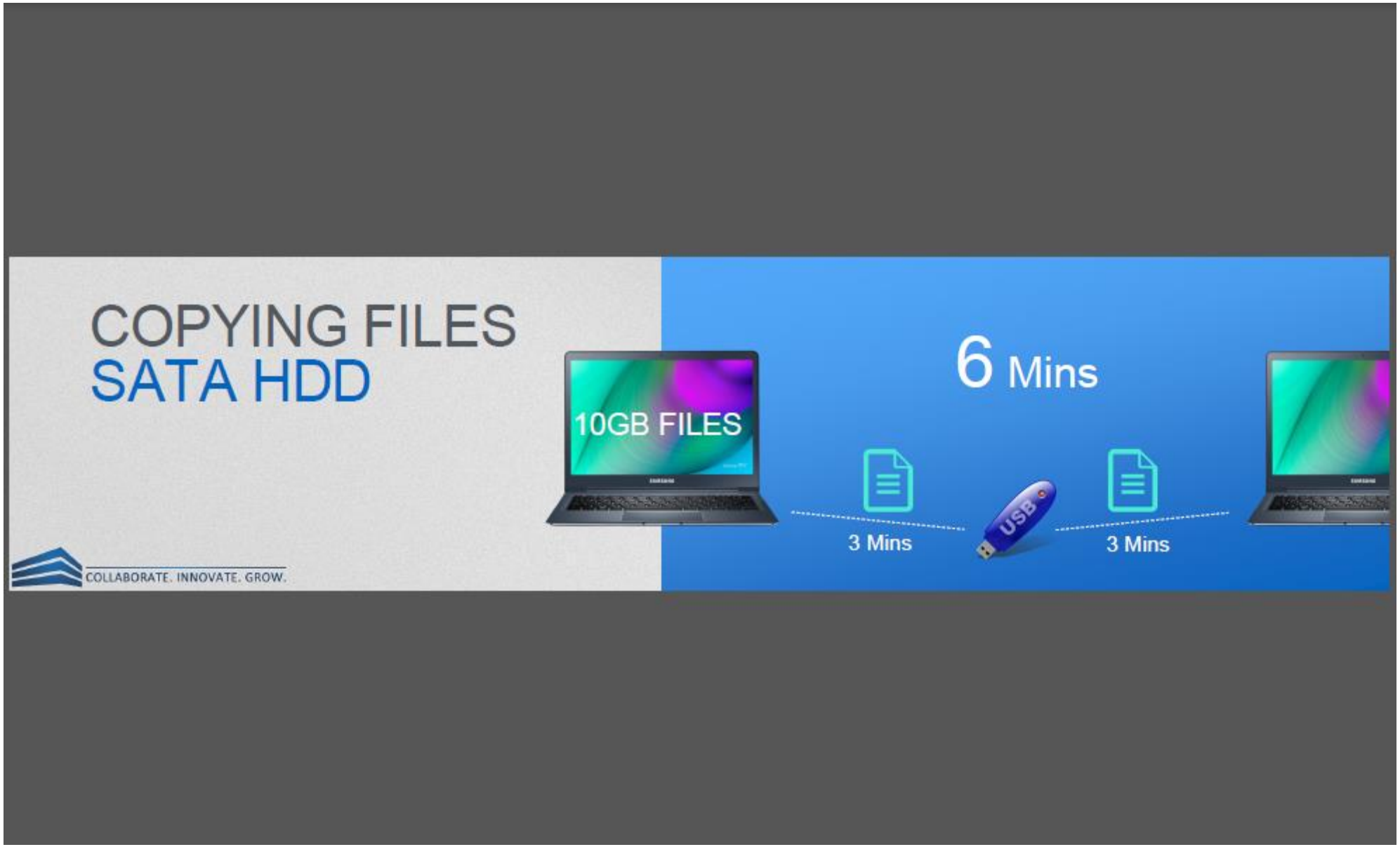
Lenovo



SATA vs NVMe

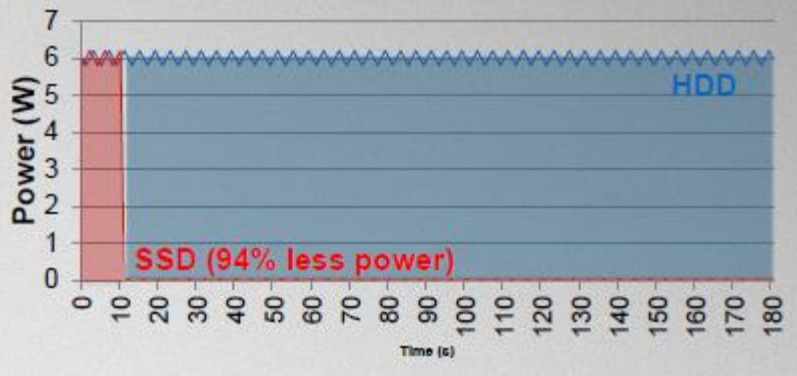


COLLABORATE. INNOVATE. GROW.



TRANSFERRING DATA

FASTER = MORE BATTERY LIFE



COLLABORATE. INNOVATE. GROW.

SAMSUNG

26.67 x 6.46 in

NVIDIA.

Lenovo

LENOVO WORKSTATIONS

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

COLLABORATE. INNOVATE. GROW.

SAMSUNG

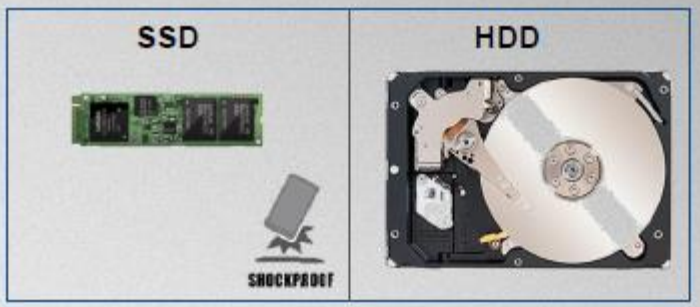
26.67 x 6.46 in

NVIDIA.

Lenovo

DURABILITY

- SSDs are 4x more resistant to shock[1]
- 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.

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

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#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!

NVIDIA

Lenovo

P50 Mechanical

Left

Right

TBT= Thunderbolt v3