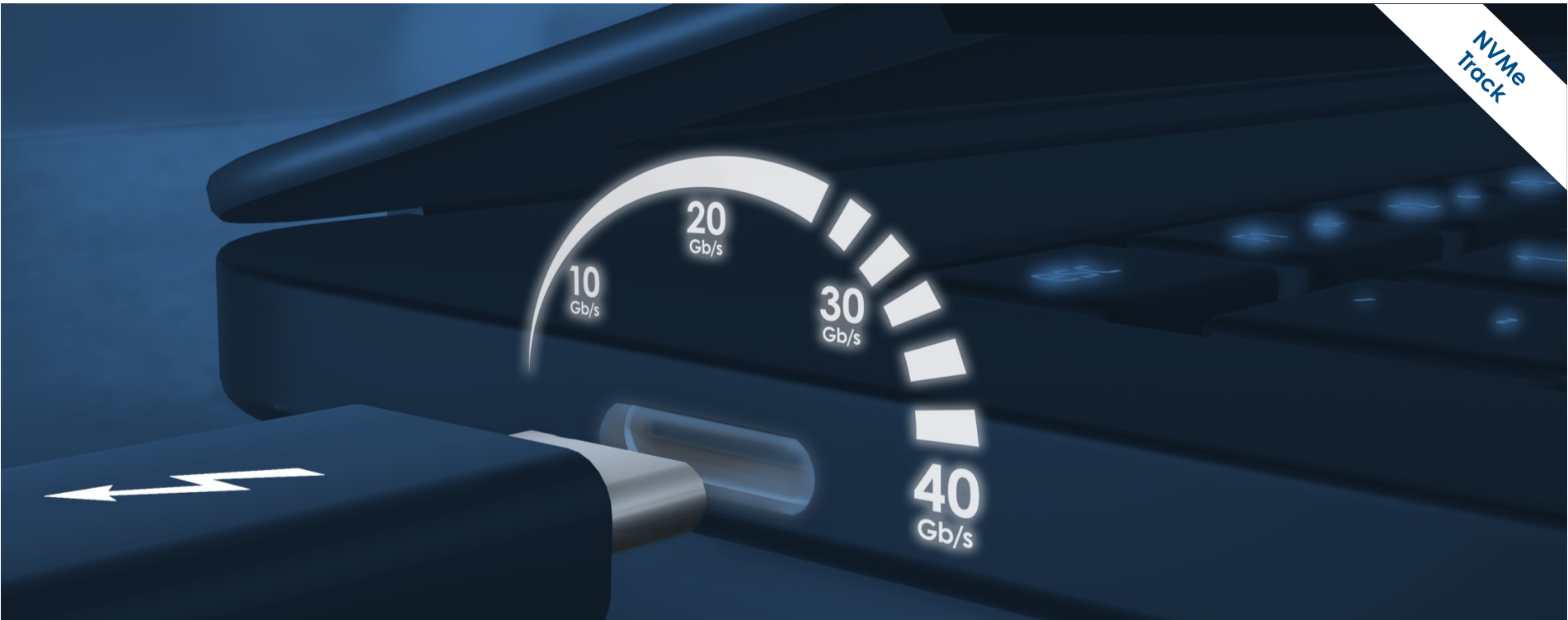


NVMe
Track

A dark blue background featuring a Thunderbolt 3 connector on the left, with a glowing speed gauge in the center. The gauge has markings for 10 Gb/s, 20 Gb/s, 30 Gb/s, and 40 Gb/s. The connector has a white lightning bolt symbol. The overall aesthetic is futuristic and high-tech.

Thunderbolt™ 3 Brings External NVMe Storage to Client Computers

Shailendra Sinha
Sr. Business Development Manager

Agenda

- Thunderbolt Overview
 - Broad Market Adoption
 - Thunderbolt storage benefits for key segments
 - Wrap Up
-



COMPACT THUNDERBOLT™ 3 SSD STORAGE AS FAST AS INTERNAL SSDs



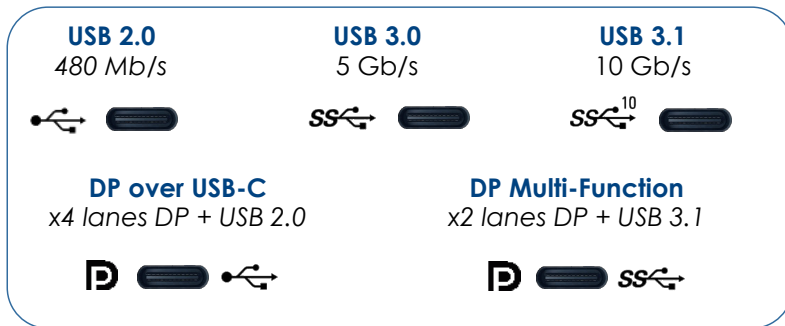
<https://www.youtube.com/watch?v=nNJgzS6vlgQ>

What is USB-C?

USB-C is a connector and cable

- Small and flippable
- USB 2.0 data (only requirement)
- Video, charging, alternate modes (optional)

More than 10 configurations available
5 examples shown below



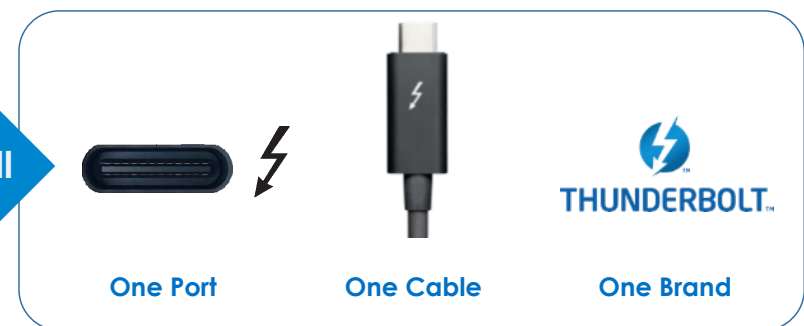
Does it All

What is Thunderbolt 3?

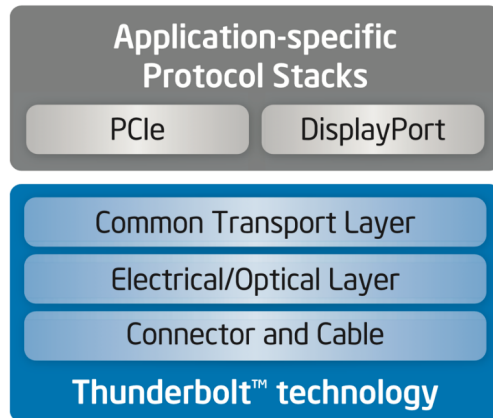
TBT3 supports all USB-C configurations

- 40Gb/s (supports DP, USB, and PCIe)
- 2 video streams, up to x8 lanes DP 1.2
- USB 3.1 (10Gb/s), up to PCIe Gen 3 x4
- Supports Native USB and DisplayPort

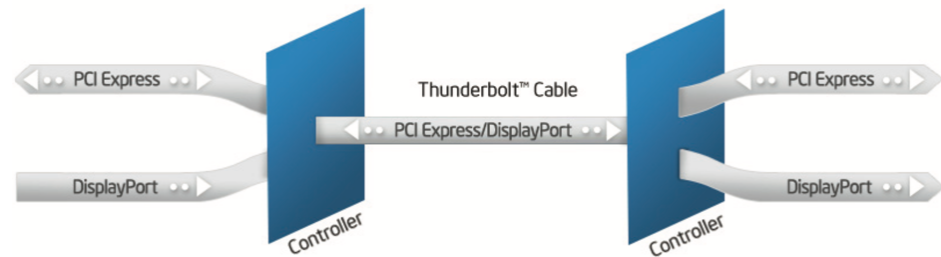
Universal for PC/Mac, cables, devices
The USB-C that does it all



How Thunderbolt Protocol Works



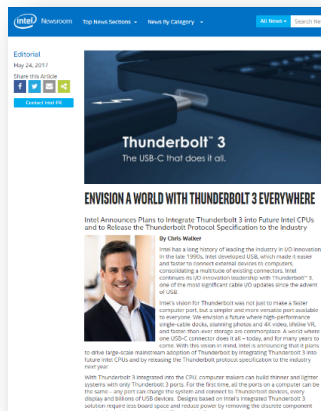
DisplayPort and PCIe are **tunneled** over a **40Gb/s bi-directional Link**



PCI Express and **DisplayPort** transported between Thunderbolt™ controllers over a **Thunderbolt cable**

Thunderbolt 3 controllers have integrated USB 3.1 (10Gb/s) **XHCI host controller** to support USB - not a device side controller

Envision a World with Thunderbolt™ 3 Everywhere



“Intel plans to drive large-scale mainstream adoption of Thunderbolt by **integrating** Thunderbolt 3 into future Intel CPUs, and by **releasing** the Thunderbolt Protocol specification to the **industry** next year”

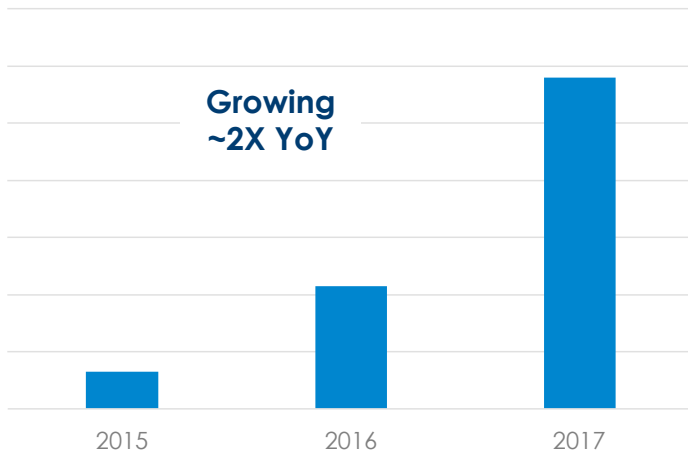


Thunderbolt 3 Windows OS support

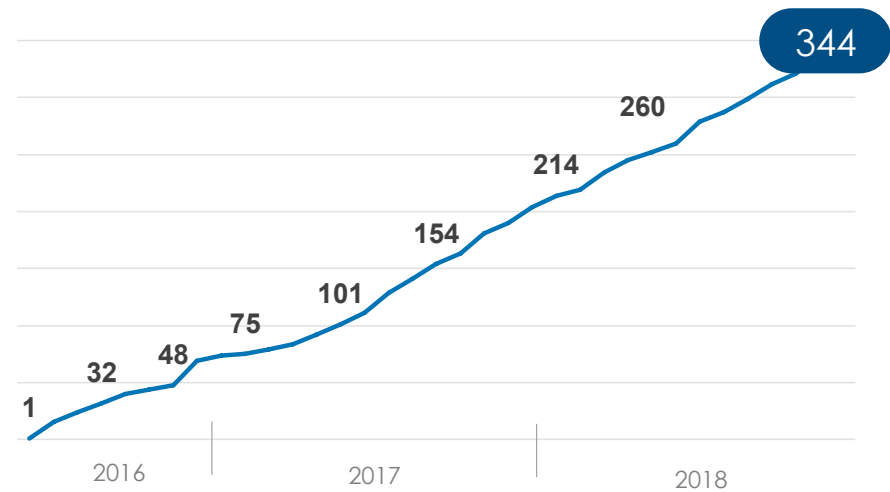
- Windows inbox driver support
- RS3 Native, RTD3 & UCSI support
- Native OS security

Thunderbolt™ 3 PC Snapshot

Windows PC Volume



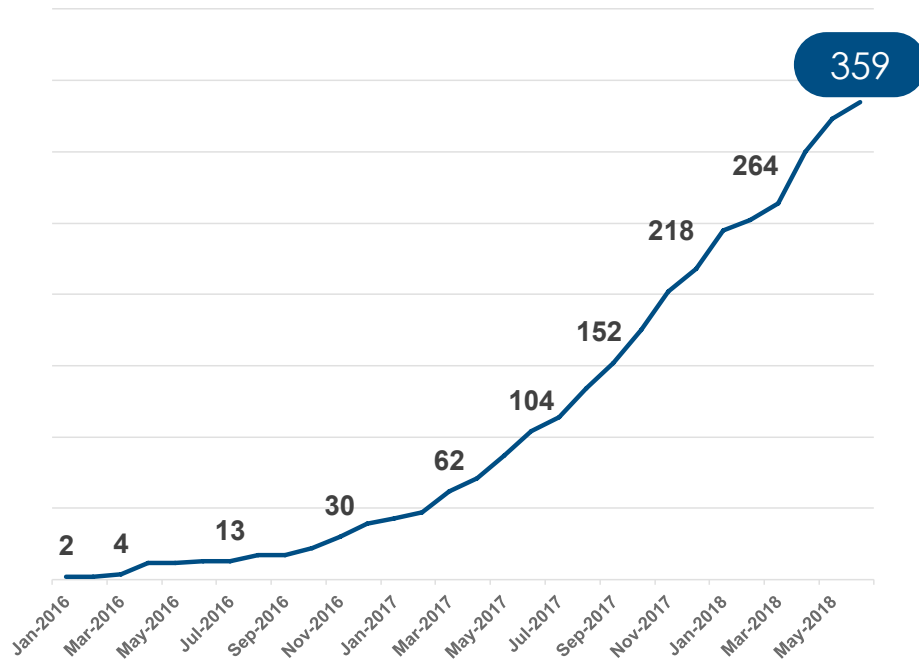
Certified PCs



Integration expected to push Thunderbolt™ 3 computer volumes into the **hundreds of millions** over the next 2-3 years

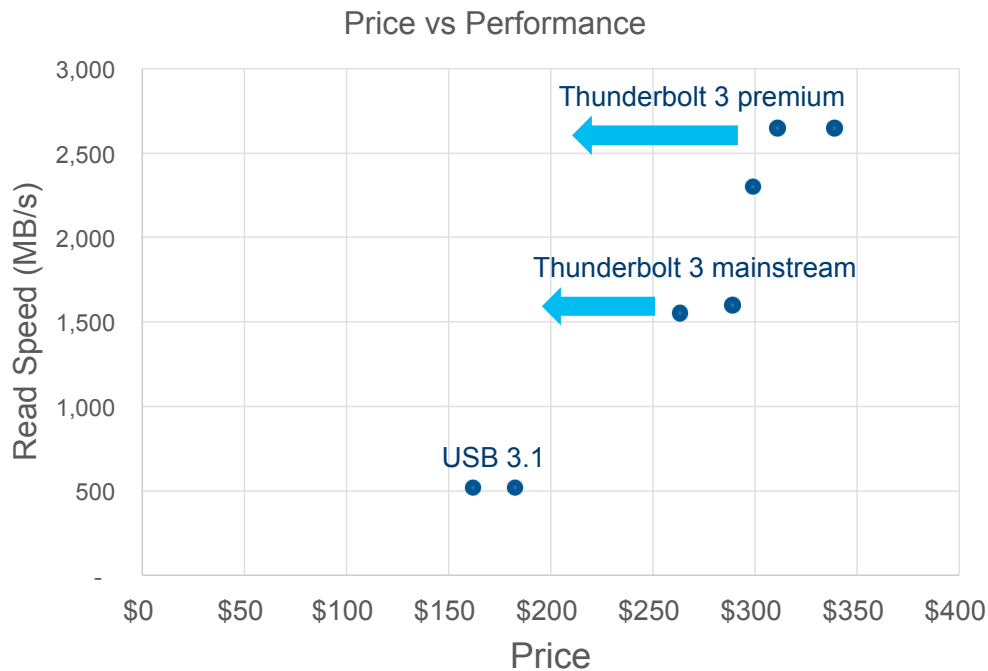
Thunderbolt™ 3 Ecosystem Snapshot

Certified Thunderbolt™ 3 Devices



	Adapters (81)		Networking (15)
	Display (7)		AV / Other (17)
	Docks (79)		PCI Expansion (30)
	Card Reader, Hub (4)		Storage (110)
	eGfx (32)		

Thunderbolt 3 vs. USB 3.1 Portable NVMe SSD



Thunderbolt 3 offers 3-6x more performance for **small** cost adder

We expect the cost of PCIe NVMe based SSDs to become comparable with SATA SSDs in future.

Standard 15W of bus power for larger capacity drives

Thunderbolt™ 3 Storage Benefits for Key Segments

Business

Media

Gaming

On the Go

Speed

Speed up to **2,850MB/s** (PCIe Gen 3x4)

Capacity

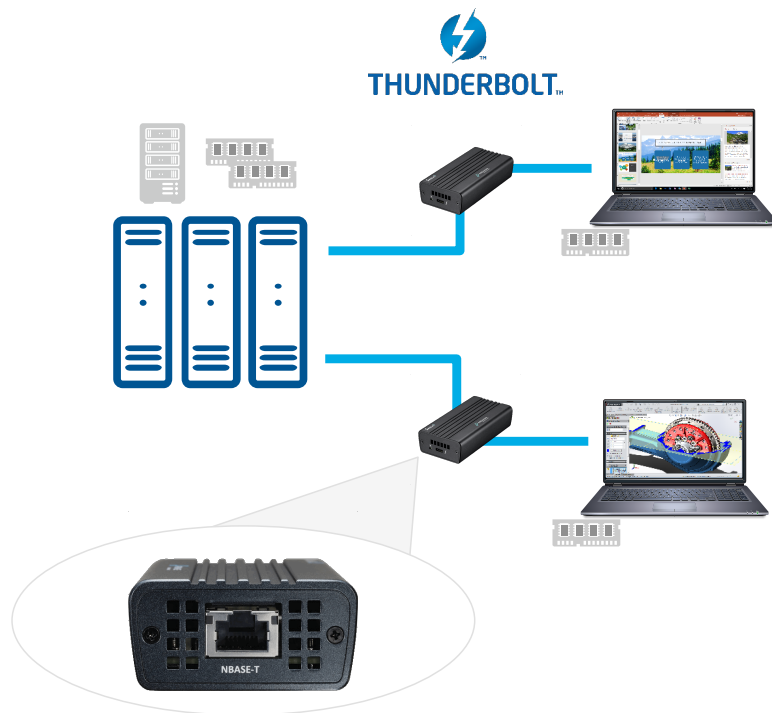
Standard 15W of bus power for larger capacity drives
Thunderbolt SSDs offer real-time extension to capacity limited PC

Compatibility

Hundreds of millions of Thunderbolt™ 3 PCs in the next 2-3 years
Pro level quality - due to **required** host, device, and cable cert

Cost

USB PD controllers and 40Gb/s cable **costs continue to drop**
Small cost adder when compared to the SSD cost

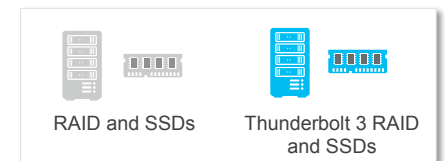


Thunderbolt™ 3 to 10GbE adapter

Business and Large Enterprise

Thunderbolt™ 3 to 10GbE adapter ~\$100 may accelerate 10GbE transition

Mainstream 10GbE for thin-and-light laptops can drive client and data center refresh for faster SSDs

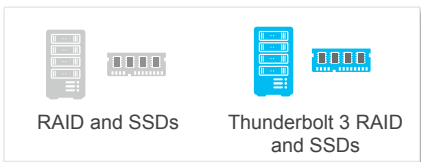
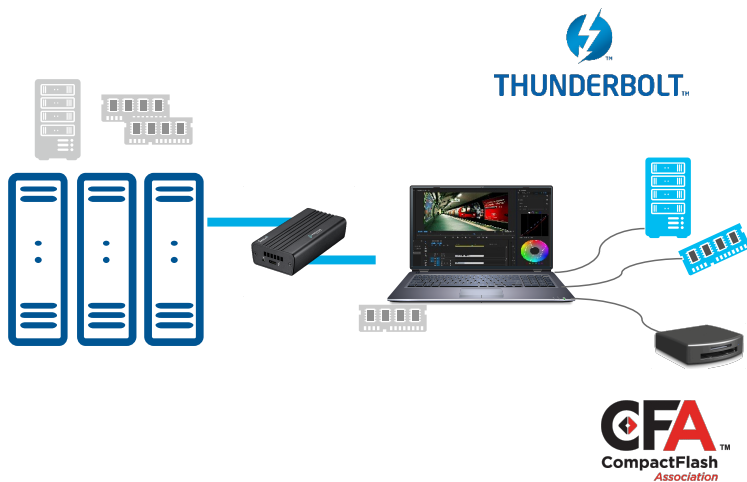


Media Creation

Portable, desktop, compact flash, and NAS storage innovation is happening on Thunderbolt™ 3 and PCIe

Manage large photo library created by widely available 4K phone cameras

Quickly ingest and edit multi-stream uncompressed HD and 4K video



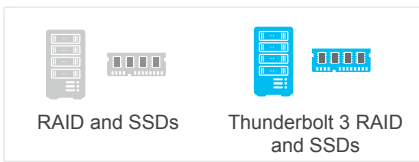


Gaming

Keep entire gaming library on Thunderbolt™ 3 external SSD

Expand capacity of PC or Mac with Thunderbolt 3 external SSD, while maintaining the same performance as an internal SSD.

Record game play in 4K then post to Twitch or YouTube



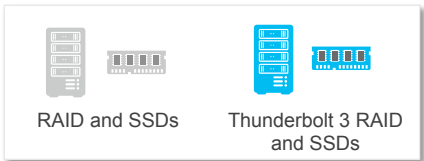


On the Go

Offer lower bin SSDs focused at mainstream segment, offering 3x SATA performance (1,500MB/s)

Drive brand awareness for your SSDs in mainstream channels

Convenient small form factor



Next Steps

- Become a Thunderbolt developer
 - Contact Shailendra Sinha at Intel shailendra.sinha@intel.com
- Work with existing Thunderbolt 3 ODM to improve time to market <https://thunderbolttechnology.net/tech/odms>
- Collaborate with industry on optimal M.2 configurations
 - Performance up to PCIe Gen 3 x 4 and Bus Power up to 15W

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