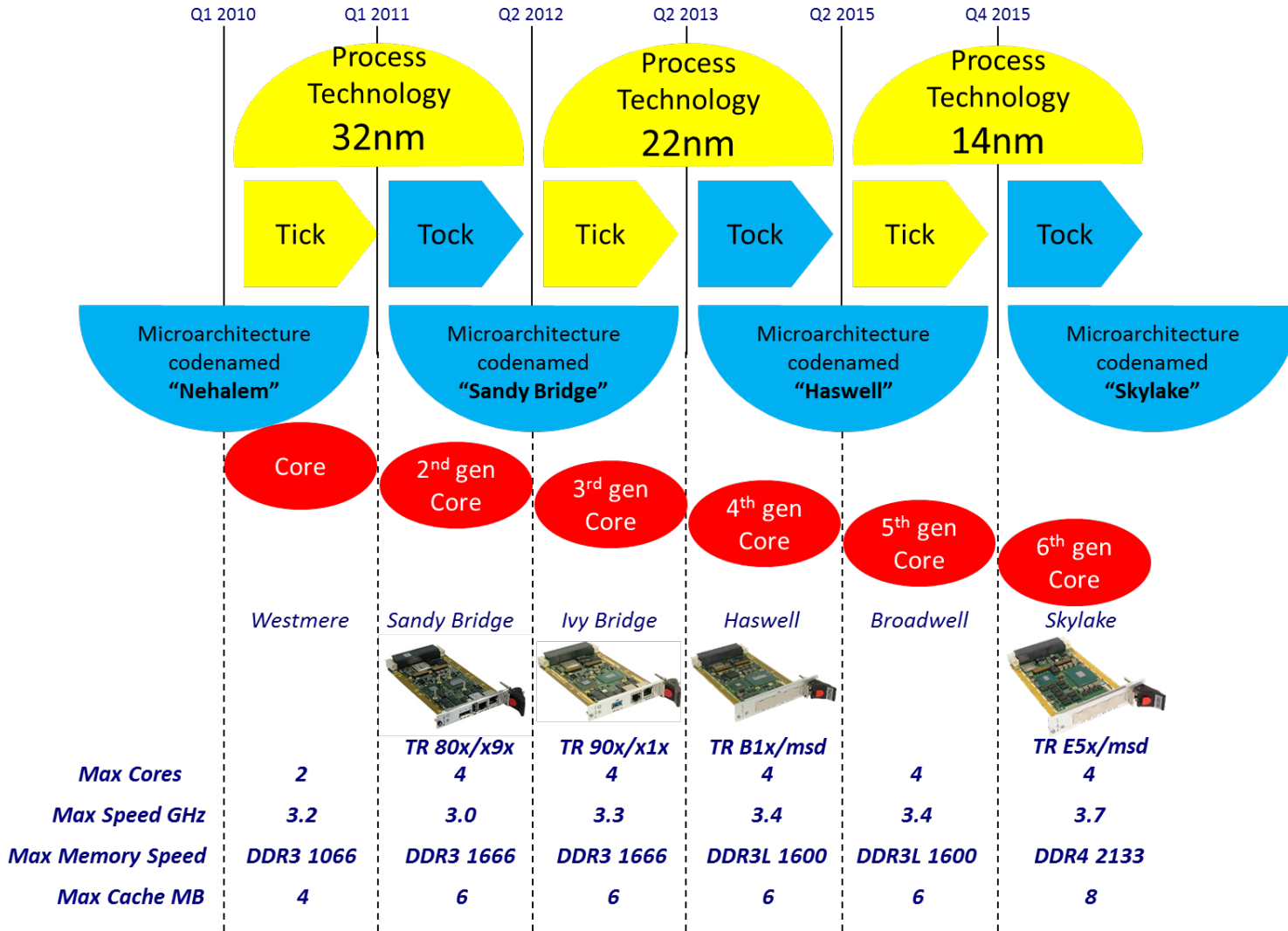


Constructing VPX based rugged micro-servers

Topics

- Intel CPU and GPU processor trends
- Storage improvements
- What does this really mean with reference to 3U VPX micro-servers?
- Conclusions and questions

Intel Technology Cadence



- Metronomic die shrink and micro architecture updates leads to useful CPU performance improvements
- Throw in new instructions, faster memory support and cache upgrades for better real life performance
- Typical Haswell and Skylake comparison:

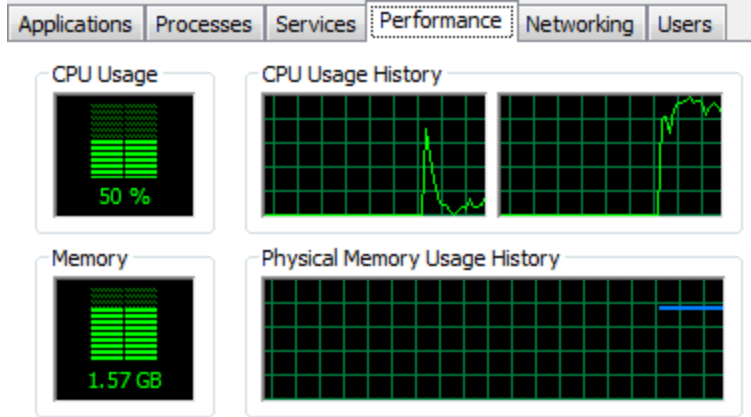
Memory Mark	Result
TRB12 - Core i7 2.4GHz	2429 (-15.4%)
TRE5x_GT2_QC_45W	2871
CPU Mark	Result
TRB12 - Core i7 2.4GHz	7972 (-16.8%)
TRE5x_GT2_QC_45W	9580

Intel GPU – Dramatic Advances

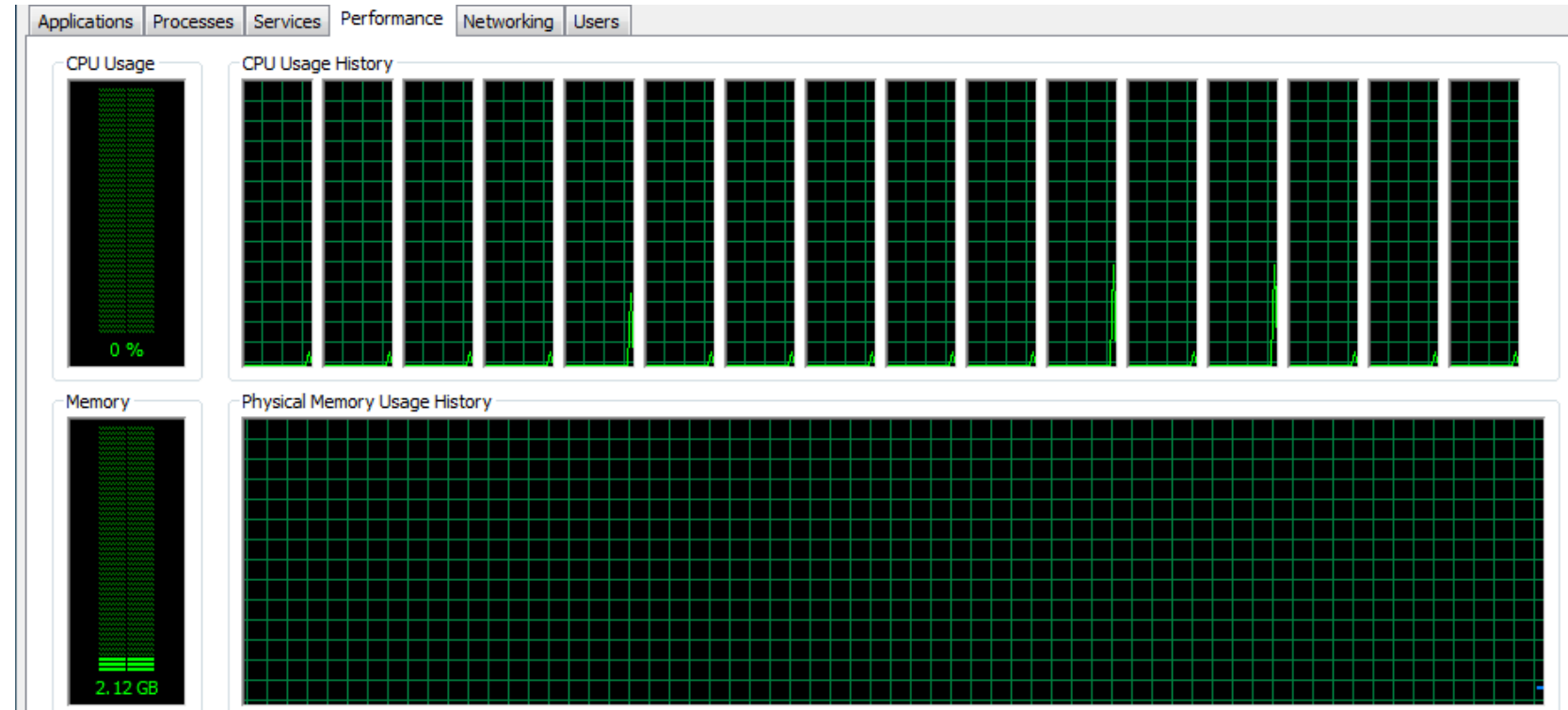
Year	2010	2011	2012	2013	2015	2015
Device	i7-610-UE	i7-2610QE	i7-3610QE	i7-4700EQ	i7-5850EQ	E3 1505M v5
Code	Westmere	Sandy Bridge	Ivy Bridge	Haswell	Broadwell	Skylake
Max GPU Freq	500 MHz	1,300 MHz	1,300 MHz	1,000 MHz	1,100 MHz	1,050 MHz
Execution Units	12	12	16	20	48	24
Designation	HD Graphics	HD Graphics 3000	HD Graphics 4000	HD Graphics 4600	HD Graphics 6200	HD Graphics P530
FLOPS (Single Precision)	24,000	124,000	166,000	320,000	844,800	403,200

- Dramatic performance increase per generation from Sandy Bridge
- OpenCL has the advantage of being supported across architectures
- Integrated GPU potential still largely untapped

Intel Xeon D-1500 processor family – disruptive technology

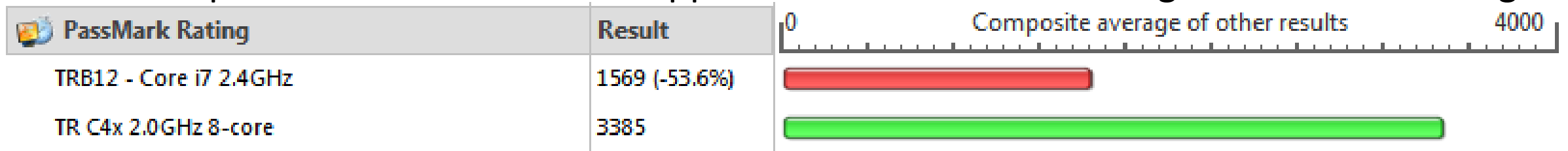


Core 2 Duo Circa 2009



Xeon D-1548 2015, 8 cores, 16 threads

- Dramatic performance increase for applications that take advantage of multi-threading



Storage Advances

- Steady interface progression SATA → SATA300 → SATA600 and PCIe happening
- The read/write speed and capacity of Solid State Drives is also disruptive



2.5-inch

- Available up to 2TB for mass storage
- A lot more robust than physical drives



Embedded

- Shipping 64GB, 128GB in 2016
- Conformal coating
- Highly Robust



What does this mean?



For the sort of applications we are targeting:

- C4ISR
- Image processing
- Encryption/Decryption
- Electronic Warfare
- Signals Intelligence

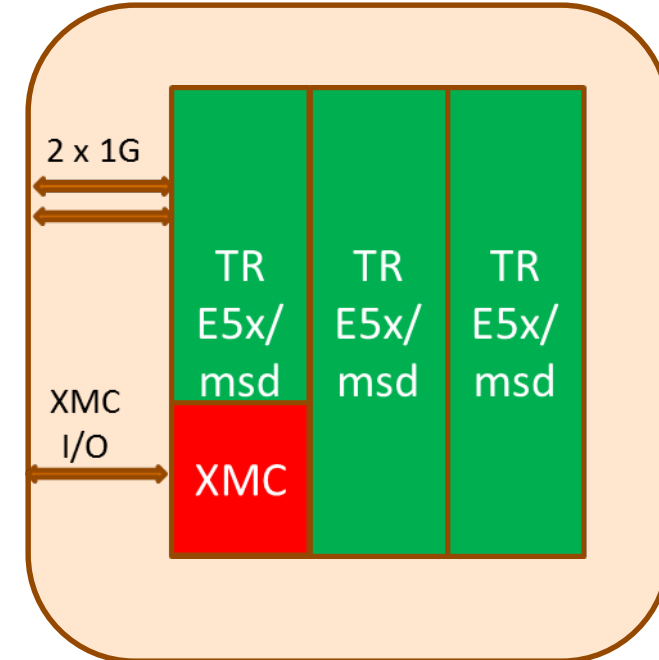
within the same SWAP envelope it's possible to fit significantly more and faster CPU, GPU and storage capabilities

Image processing example

- 3 Skylake image processing resources
- Meshed via 3.9 GB/s PCIe gen 3 links using non-transparent bridge capability
- CPU: 3 x 4 = 12 cores / 24 threads
- GPU: 3x24 cores (today) → >1 TFLOP
- Ethernet or XMC for external connectivity

- Enables single product to be used instead of a traditional CPU and GPU combination

Standard socket based application using FIN-S abstraction



Micro-server examples

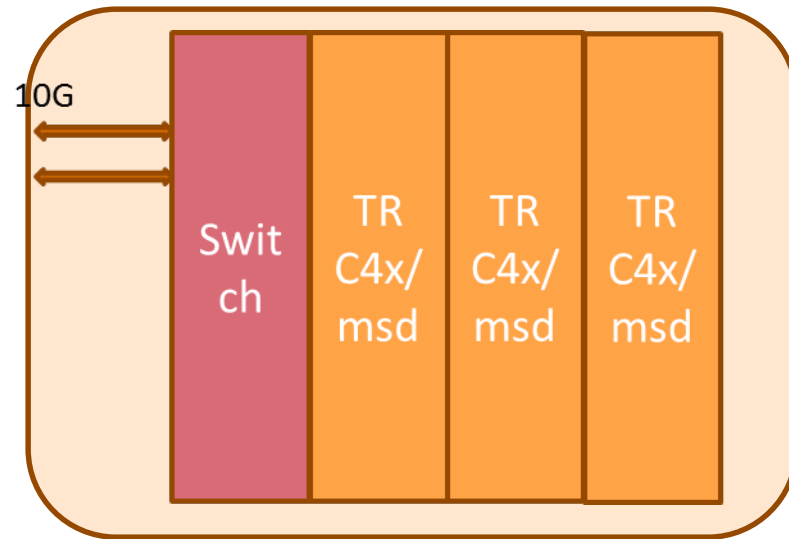
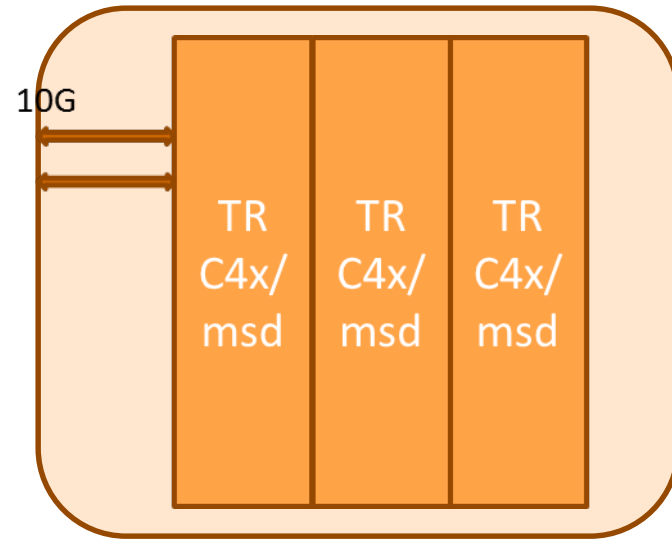
- 3 Xeon D-1500 processing resources
- CPU: 3 x 8 = 24 cores / 24 threads (today)
- 2 x 10G Ethernet for external connectivity

Example 1:

- Meshed via 3.9 GB/s PCIe gen 3 links using non-transparent bridge capability

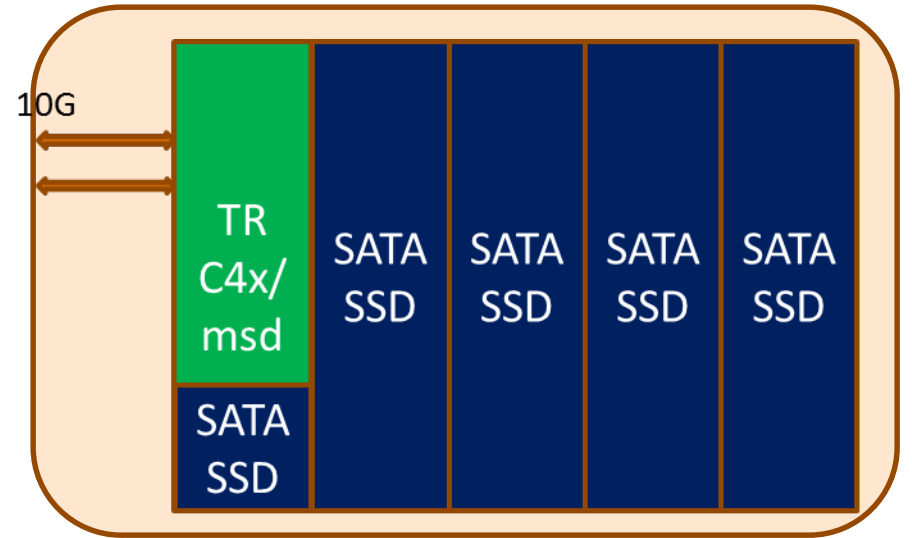
Example 2:

- Switched 10G Ethernet backplane
- Improves multi-threaded application throughput



Server with Storage

- 1 Xeon D-1500 processing resources
- CPU: 1 x 8 = 8 cores / 16 threads (today)
- Up to 64GB rugged module for OS and application storage
- Up to 8TB storage with RAID configuration options
- 2 x 10G Ethernet for external connectivity
- Enables higher performance embedded storage applications



Conclusions and questions

- Whilst it's taken a few generations the:
 - choice of processor and increase in core count,
 - ability to use built-in GPU offload engines,
 - mated with improved storage capabilitieshave all enabled more powerful 3U VPX rugged micro-server solutions
- These have sufficient performance for many target applications
- Watch this space for more announcements