

# Accelerators – Trends & Ideas

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## Springer Book „Sustained Simulation Performance 2016“

- Dear Editors,
- We are very pleased to inform you that your book has been published and it is available on <http://link.springer.com/book/10.1007/978-3-319-46735-1>.
- Customers can order it via <http://www.springer.com/in/book/9783319467344#>.

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## Outline

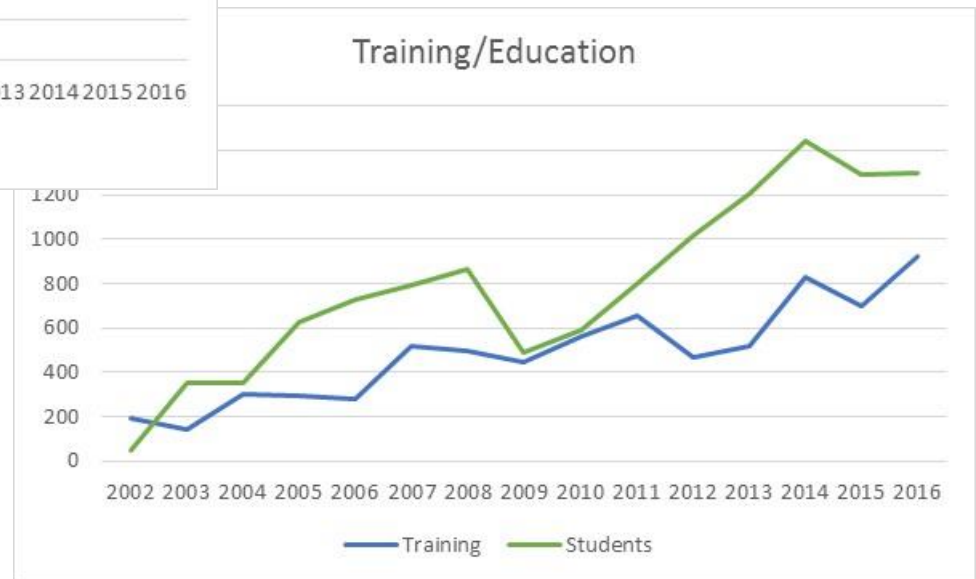
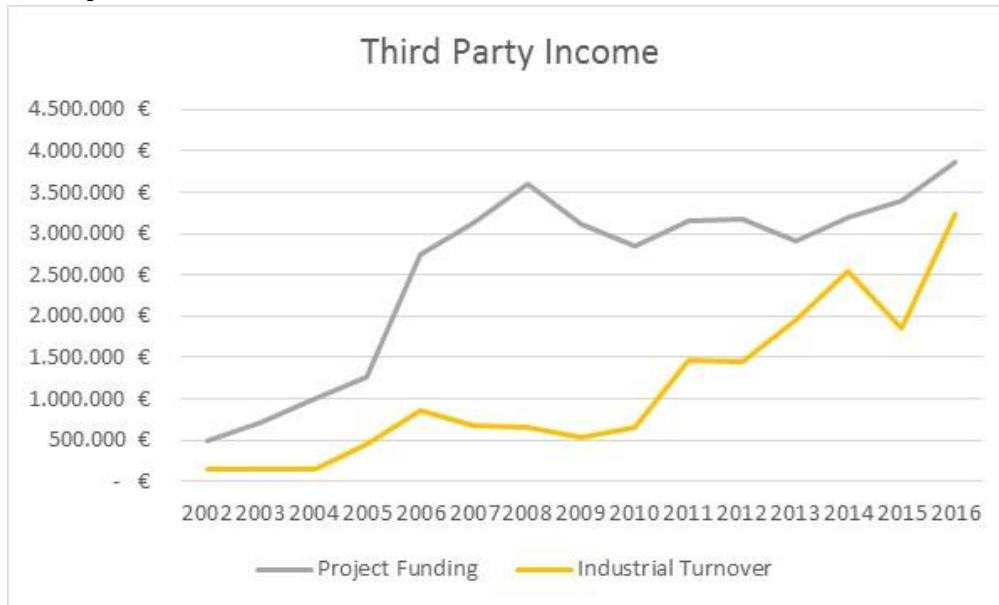
- A few words about HLRS
- A few words about accelerators
- Conclusions

# HLRS

# HLRS Roadmap

	H1/'12	H2/'12	H1/'13	H2/'13	H1/'14	H2/'14	H1/'15	H2/'15	H1/'16	H2/'16	H1/'17	H2/'17	H1/'18	H2/'18	H1/'19	H2/'19	H1/'20	H2/'20	H1/'21	H2/'21	H1/'22	H2/'22								
<b>Infrastructure &amp; Buildings</b>																														
							Training Building				Adaptations										Extension									
<b>Systems &amp; Storage</b>	NEC SX-9		Sandybridge Cluster						NEC SX-ACE				Cluster										xxx PF		xxx PF					
	Cray XE6		1 PF		Cray Aries						3,8 PF				Cray Extension 7,4 PF															
	HPSS/Lustre				10 - 20 PB				30 - 40 PB																					
<b>Research</b>	DFG CoE Extension																													
	DFG SPEXXA										SPPEKA Extension																			
	2nd Nat. HPC Initiative						3rd Nat. HPC Initiative																							
	PRACE 2IP		PRACE 3IP				PRACE 4 IP				PRACE 5 IP				Data Analytics Project										Scalability					
	European Project CRESTA						MontBlanc II				Exascale Demonstrator (Proposed)										Interactivity									
	European CoE for Global Systems Science										New User Communities (humanities, politics, ...)																			
<b>Industry</b>	HWW Cloud										HWW NEW																			
	SICOS for SME				FORTISSIMO Project						SICOS continued																			
	ASCS		ENSOC						FORTISSIMO II				ASCS				Consolidated Solution Centers													
									Media Solution Center																					
											Medical Solution Center																			
<b>Outreach Edu / Train</b>	Outreach Project						Outreach continued																							
					Training Project								European Training Project																	
											New WG on PR & Industrial training																			
<b>Sustainability</b>															Philosophy of Science															
							Sustainability Project						Sustainability II																	
	H1/'12	H2/'12	H1/'13	H2/'13	H1/'14	H2/'14	H1/'15	H2/'15	H1/'16	H2/'16	H1/'17	H2/'17	H1/'18	H2/'18	H1/'19	H2/'19	H1/'20	H2/'20	H1/'21	H2/'21	H1/'22	H2/'22								

# Key Performance Indicators



# ACCELERATORS

# Accelerators in the TOP500

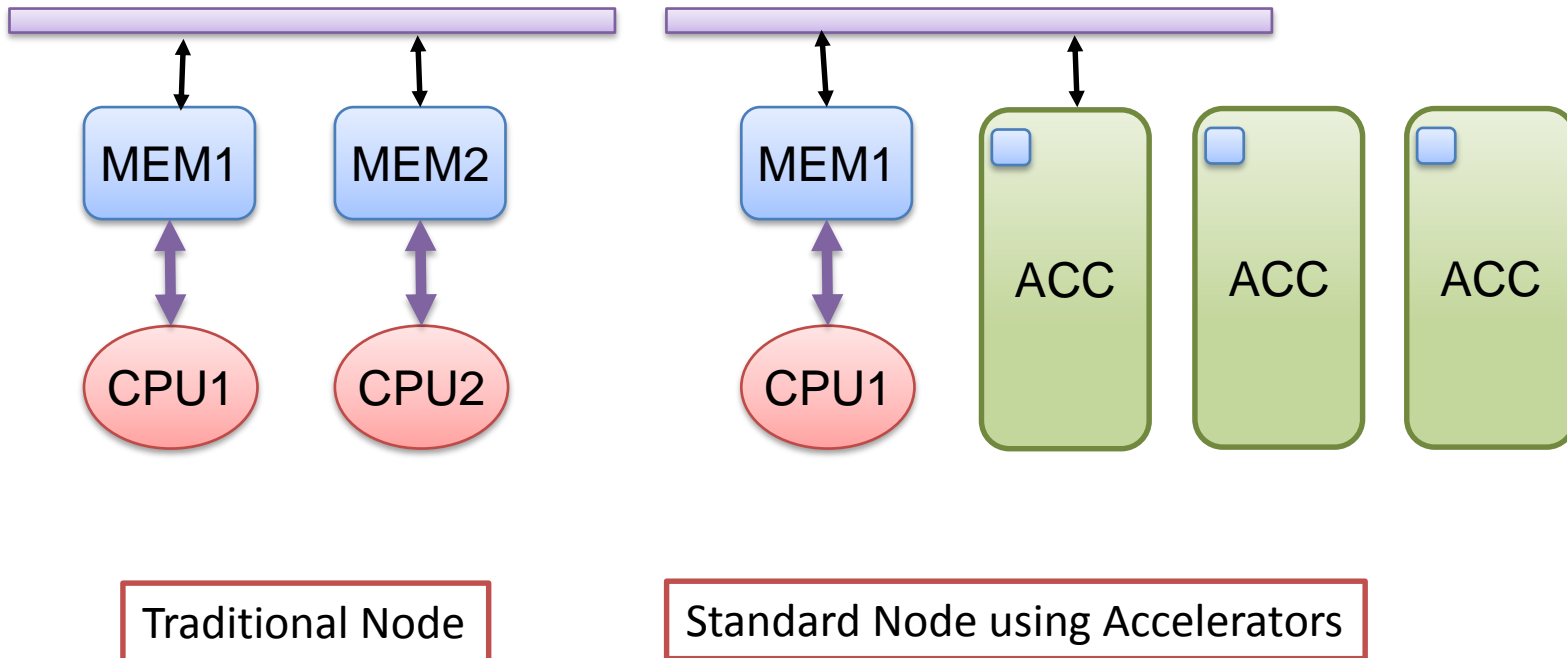
Name	Computer	Total Cores
Sunway TaihuLight	Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway	10649600
Tianhe-2 (MilkyWay-2)	TH-IVB-FEP Cluster, Intel Xeon E5-2692 12C 2.200GHz, TH Express-2, Intel Xeon Phi 31S1P	3120000
Titan	Cray XK7 , Opteron 6274 16C 2.200GHz, Cray Gemini interconnect, NVIDIA K20x	560640
Sequoia	BlueGene/Q, Power BQC 16C 1.60 GHz, Custom	1572864
Cori	Cray XC40, Intel Xeon Phi 7250 68C 1.4GHz, Aries interconnect	622336
Oakforest-PACS	PRIMERGY CX1640 M1, Intel Xeon Phi 7250 68C 1.4GHz, Intel Omni-Path	556104
K Computer	SPARC64 VIIIfx 2.0GHz, Tofu interconnect	705024
Piz Daint	Cray XC50, Xeon E5-2690v3 12C 2.6GHz, Aries interconnect , NVIDIA Tesla P100	206720
Mira	BlueGene/Q, Power BQC 16C 1.60GHz, Custom	786432
Trinity	Cray XC40, Xeon E5-2698v3 16C 2.3GHz, Aries interconnect	301056



## Theoretical Advantages

- SIMD style architecture
- Higher number of cores
- Higher peak performance
- Higher potential for future improvement
- Not only made by Intel
- Easy to plug in (even into your local workstation)

# Architectures (schematic)



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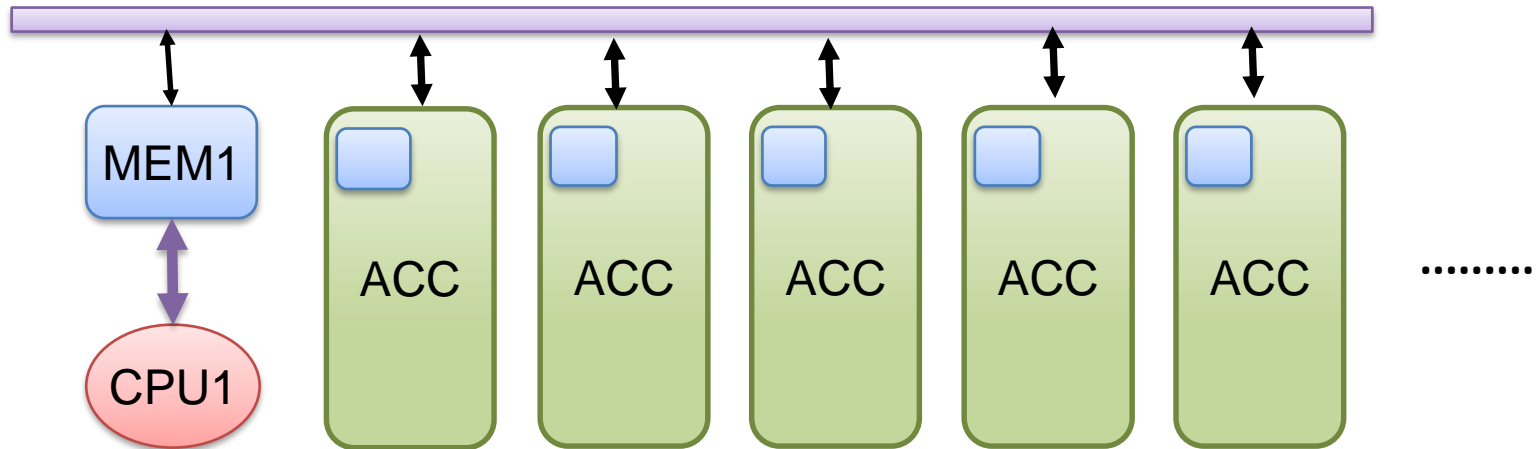
## Practical Challenges

- Slow connection to memory
- Small local memory
- Non-standard programming

My favorite accelerator concept



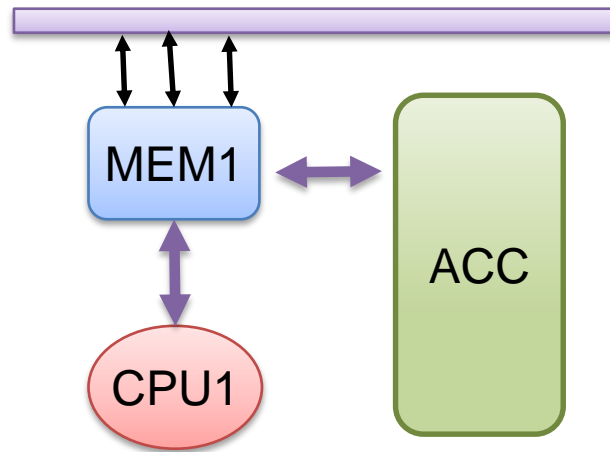
## What we can expect to see



- Somewhat faster path to memory
- Somewhat bigger local memory
- Non-standard programming

## An option for a compromise

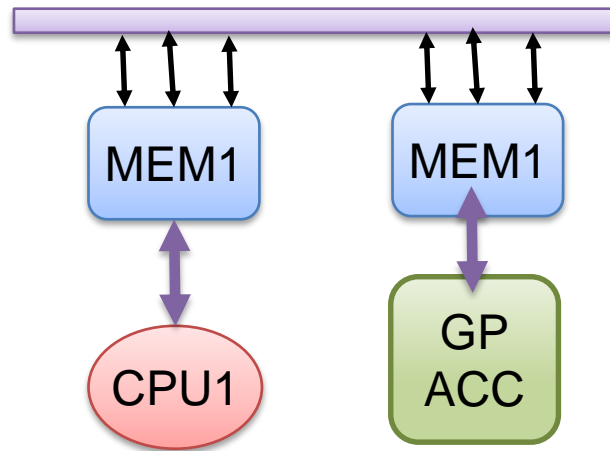
Hybrid node using an accelerator that can access the same memory



- **Less slow** connection to memory
- **Big** memory
- **Non-standard programming (there are ways to overcome this)**

## Another option for a compromise

Hybrid node using a general purpose accelerator that has its own big/fast memory



- **Fast** connection to memory
- **Big** memory
- **Standard programming**

# CONCLUSIONS



## My 5 cent

- Architectures are driven by accelerator technology
- There is limited hope for accelerators that can solve real world engineering problems easily
- There is ample room for better solutions
- The laws of the market suggest that someone will fill this niche

# Questions

