European High Performance Computing Strategy and Outlook

Towards Exascale

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Key EU developments HPC

European Commission

Communication from the EC "High-Performance Computing: Europe's place in a global race" (2012)

Council Conclusions on High-Performance Computing (Competitiveness Council – 2013)

Establishment of the European Technology Platform on High-Performance Computing (ETP4HPC - 2012) and Strategic Research Agenda on HPC (2013)

Horizon 2020 programme including HPC Calls adopted (end of 2013)

Public-Private Partnership with ETP4HPC (1st January 2014)

Public-Private Partnerships in H2020

Horizon 2020 may be implemented through PPPs where all the partners concerned commit to support the ***development and implementation of R&I activities of strategic importance to the Union****.*

The Union enters a contractual agreement (cPPP) with private partners - commitment for the duration of Horizon 2020 programme

cPPPs launched:

- *Factories of the Future (FoF)*
- *Energy-efficient Buildings (EeB),*
- *European Green Vehicles Initiative (EGVI),*
- *Sustainable Process Industry (SPIRE),*
- *Advanced 5G network (5G)*
- *Robotics,*
- *Photonics*
- ***High Performance Computing (HPC): Public-Private Partnership*** *with ETP4HPC (started 1st January 2014)*
- *Big Data Value Chain (January 2015)*

PPP in HPC: General objectives

- To build a **European world-class HPC technology value chain that is globally competitive** - synergy between the three pillars of the HPC ecosystem (technology development, applications and computing infrastructure)
- To achieve a **critical mass** of convergent resources in order to increase the competitiveness of European HPC vendors and solutions
- To leverage the transformative power of HPC in order to **boost European competitiveness in science and business**
- To **expand the HPC user base**, especially SMEs, and to facilitate the participation of SMEs in the provision of competitive HPC technology solutions
- To develop a **EU leadership and world-wide excellence in key application domains for industry, science and society**
  - provision of innovative solutions for grand societal challenges
  - development of the future applications for the next exascale computing generation

Implementing the HPC strategy in Horizon 2020

An integrated HPC approach in H2020

- HPC strategy combining three elements:

(a) Computer Science: towards **exascale** HPC; *A special FET initiative focussing on the next generations of exascale computing as a key horizontal enabler for advanced modelling, simulation and big-data applications* [HPC in FET]

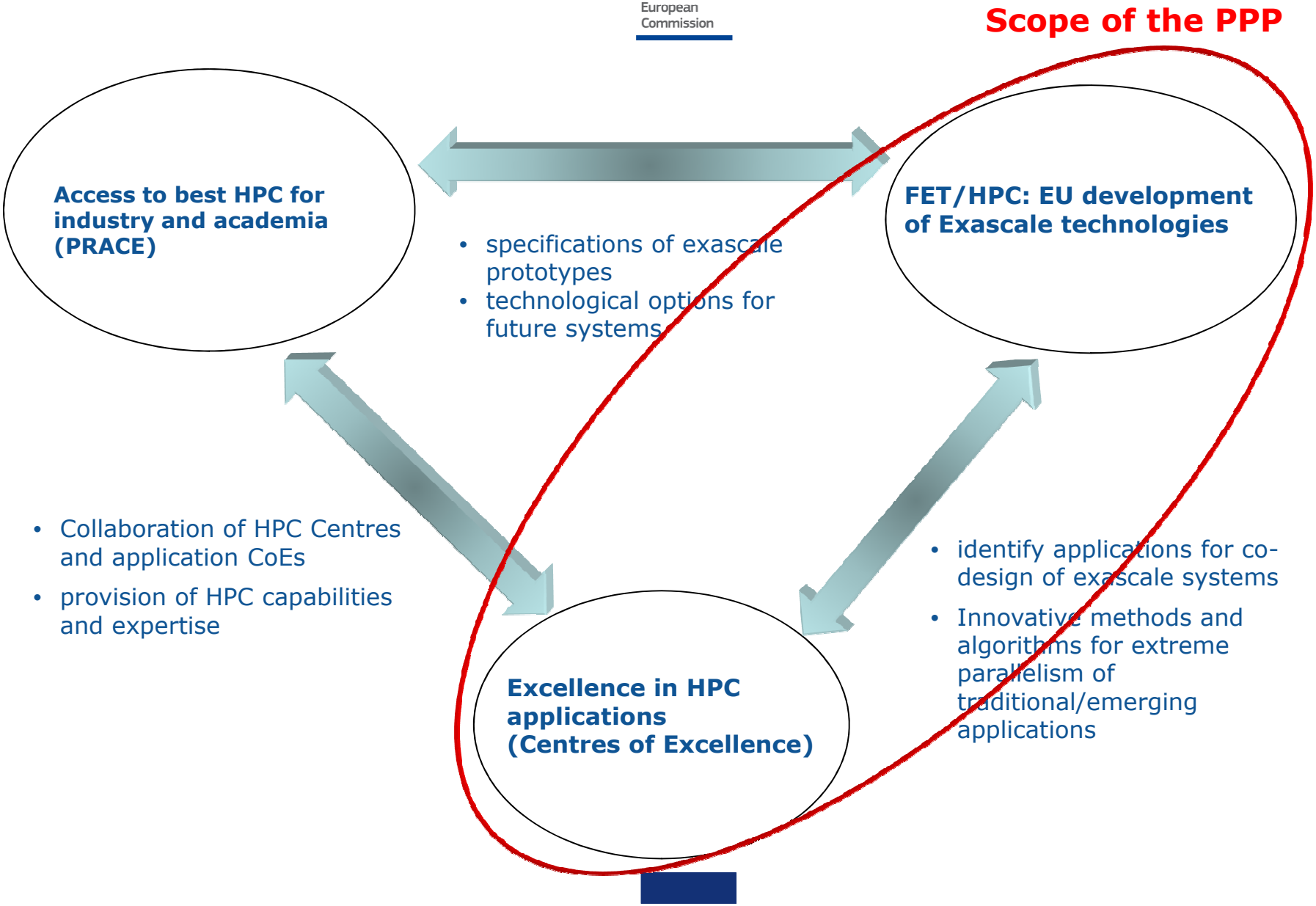
(b) achieving excellence in HPC **applications**; *Centres of Excellence for scientific/industrial HPC applications in (new) domains that are most important for Europe* [e-infrastructures]

(c) providing **access** to the best supercomputing facilities and services for both industry and academia; *PRACE - world-class HPC infrastructure for the best research* [e-infrastructures]

- complemented with training, education and skills development in HPC

Interrelation between the three elements

"Excellent Science" part of H2020



Looking ahead

The market aspect

IDC Top Trends in HPC (HPC = All Technical Servers)

2013 declined overall – by $800 million

- ***For a total of $10.3 billion***
- ***Mainly due to a few very large systems sales in 2012 that weren't repeated in 2013***
- ***Expecting growth in 2015 to 2018 – But 2014 is now looking weak***

Software issues continue to grow

The worldwide Petascale Race is at full speed

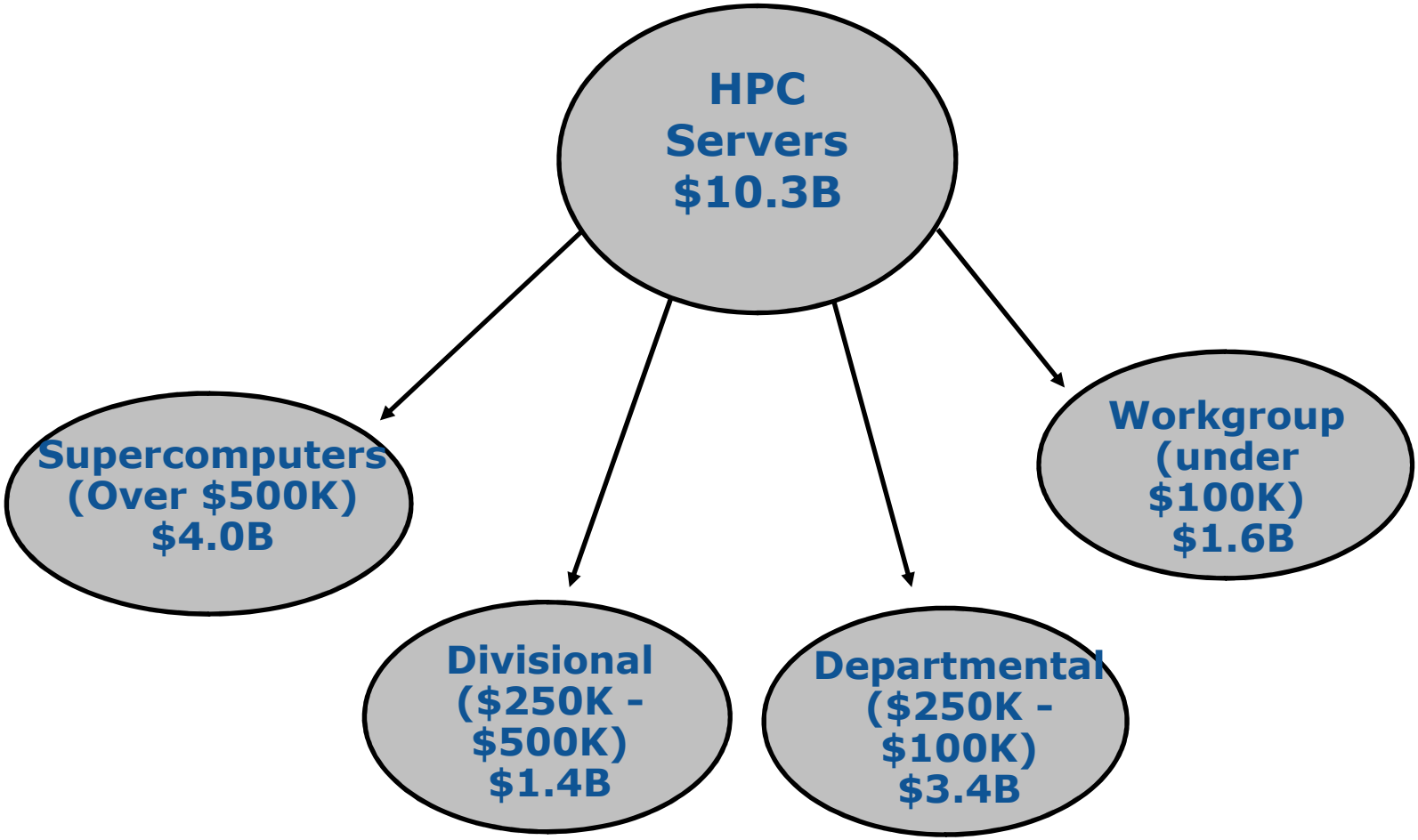
GPUs and accelerators are hot new technologies

Big data combined with HPC is creating new solutions in new areas

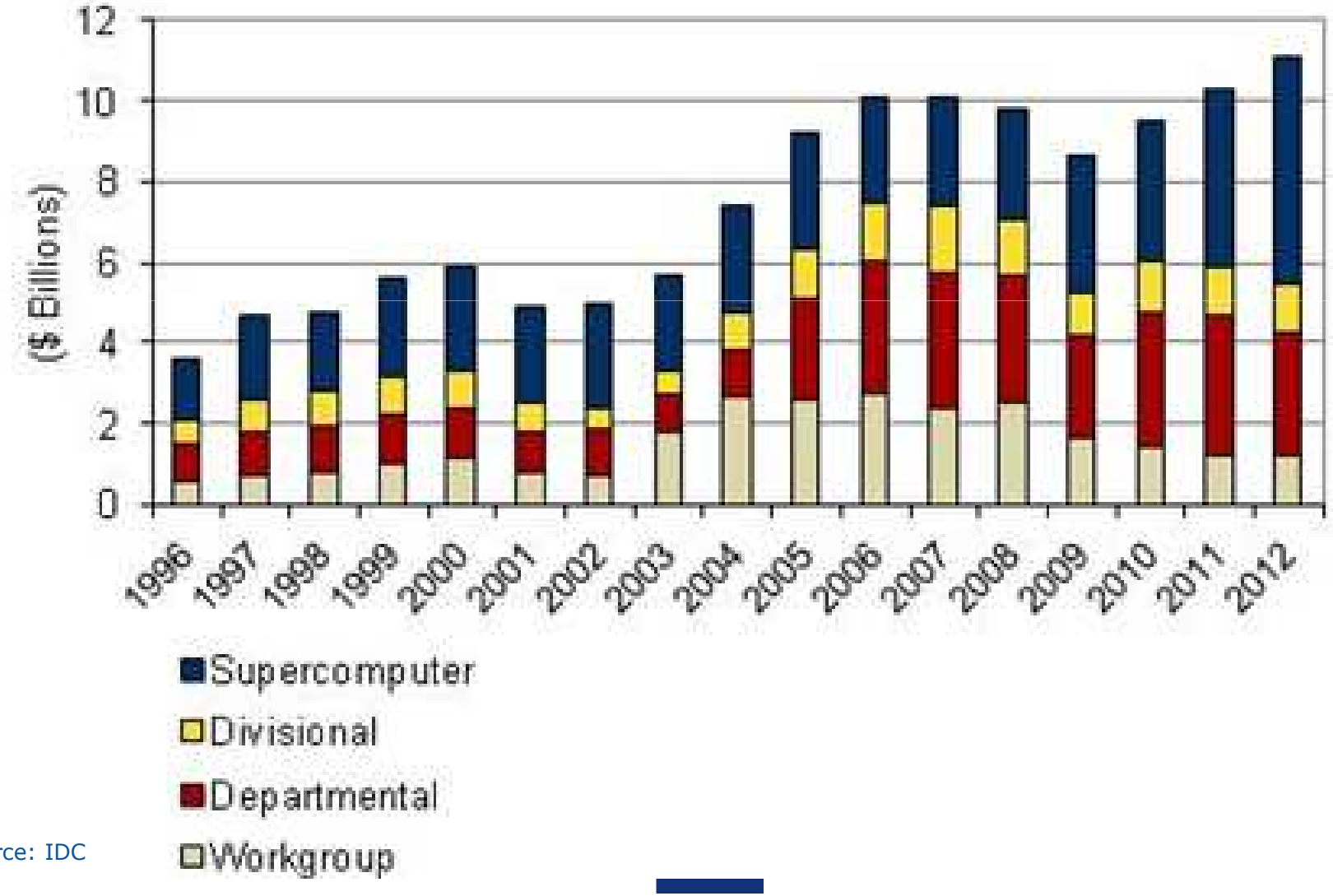
Source: IDC

Initial data from an on-going study with IDC.

IDC HPC Competitive Segments: 2013



Source: IDC


IDC HPC Worldwide Technical Server Sales: 1996 to 2011
($ Billions)
0
2
4
6
8
10
12
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Supercomputer
Divisional
Departmental
Workgroup

Source: IDC

HPC Forecasts

Forecasting a 7.4% yearly growth from 2013 to 2018

2018 should reach $14.7 billion

Worldwide Total Technical Computer Market			
	2013	2018	CAGR 13-18
Supercomputer	3,994,740	5,661,830	7.2%
Divisional	1,355,097	1,845,090	6.4%
Departmental	3,363,263	4,657,390	6.7%
Workgroup	1,585,666	2,545,416	9.9%
Total	10,298,766	14,709,726	7.4%
Source: IDC 2014			

The HPC servers Market By Region

HPC Server Sales By Region				
	2010	2011	2012	2013
North America	4,200,521	4,644,549	4,827,543	4,516,404
EMEA	3,027,000	3,209,455	3,327,475	3,101,954
Asia/Pacific w/o Japan	1,213,827	1,525,193	1,591,304	1,912,454
Japan	573,362	783,154	1,247,371	663,301
Rest-of-World	101,514	137,708	104,050	104,653
Total	9,116,225	10,300,058	11,097,743	10,298,766
Source: IDC 2014				

30% of world market

The Broader HPC Market

Worldwide

Revenues by the Broader HPC Market Areas			
	2013	2018	CAGR 13-18
Server	10,298,766	14,709,726	7.4%
Storage	3,841,141	5,898,600	9.0%
Middleware	1,122,052	1,587,179	7.2%
Applications	3,305,216	4,854,210	8.0%
Service	1,690,499	2,235,878	5.8%
Total Revenue	20,257,674	29,285,594	7.6%
Source: IDC 2014			

The Projected HPC Market In EMEA: Beyond The Base Servers

EMEA

Revenues by the Broader HPC Market Areas			
	2013	2018	CAGR 13-18
Server	3,101,954	4,433,856	7.4%
Storage	1,164,773	1,727,754	8.2%
Middleware	355,157	488,013	6.6%
Applications	1,039,935	1,419,563	6.4%
Service	550,568	669,118	4.0%
Total Revenue	6,212,388	8,738,305	7.1%
Source: IDC 2014			

The Projected HPC Market In EMEA: By Industry/Application Areas

HPC Industry/Application Segments for EMEA			
	2013	2018	CAGR 13-18
Bio-Sciences	343,563	450,944	5.6%
CAE	405,305	605,833	8.4%
Chemical Engineering	11,294	16,346	7.7%
DCC & Distribution	11,152	15,851	7.3%
Economics/Financial	71,038	101,238	7.3%
EDA	99,385	142,919	7.5%
Geosciences	305,308	436,059	7.4%
Mechanical Design	4,180	3,787	-2.0%
Defense	296,584	416,102	7.0%
Government Lab	829,111	1,207,690	7.8%
University/Academic	584,618	839,067	7.5%
Weather	86,456	127,694	8.1%
Other	53,961	70,325	5.4%
EMEA Total	3,101,954	4,433,856	7.4%
Source: IDC 2014	-	-	

The Projected HPC Market In EMEA: By Industry/Application Areas

HPC Industry/Application Segments for EMEA		
Application	2013	2018
Bio-Sciences	11.1%	10.2%
CAE	13.1%	13.7%
Chemical Engineering	0.4%	0.4%
DCC & Distribution	0.4%	0.4%
Economics/Financial	2.3%	2.3%
EDA	3.2%	3.2%
Geosciences	9.8%	9.8%
Mechanical Design	0.1%	0.1%
Defense	9.6%	9.4%
Government Lab	26.7%	27.2%
University/Academic	18.8%	18.9%
Weather	2.8%	2.9%
Other	1.7%	1.6%
Total	100%	100%
Source: IDC 2014		

Preliminary forecasts

European Commission

HPC is still expected to be a strong growth market

- **Growing recognition of HPC's strategic value is helping to drive high-end sales**
- **Low-end buyers are back into a growth mode**

HPC vendor market share positions will likely shifted greatly in 2014 and 2015

Recognition of HPC's strategic/economic value will drive the exascale race, with 100PF systems in 2H 2014/2015

- **20/30MW exascale systems will wait till 2022-2024**

The formative HPDA market will expand opportunities for vendors

Source: IDC

Initial data from an on-going study with IDC

Preliminary forecasts

Software is the #1 roadblock

- **Better management software is needed**
- **Parallel software is lacking for most users**

  Many applications will need a major redesign

Clusters are still hard to use and manage

- **System management & growing cluster complexity**
- **Power, cooling and floor space are major issues**
- **Third party software costs**
- **Storage and data management are becoming new bottle necks**
- **Lack of support for heterogeneous environment and accelerators**

ROI is becoming a requirement, especially as system costs escalate

… Some good news in that there are new technologies in Big data, accelerators, clouds, etc.

Source: IDC

Initial data from an on-going study with IDC.

Headline research challenges towards exascale (FETHPC)

- ***Co-design*** *of HPC systems and applications*
- ***Exascale transition*** *of the whole compute stack (system software, tools, programming, mathematics, algorithms, applications)*
- *Extreme Computing with* ***Extreme Data***
- *Exascale* ***Ecosystem Development***
- *International collaboration*


European Commission

Thank you for your attention!

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