

# HPC challenges

June 25<sup>th</sup> 2013 | Marie-Pierre de Bailliencourt  
SEVP

# What is HPC true measurement?

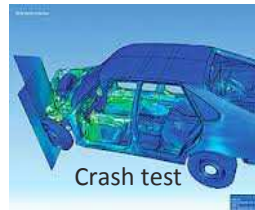
1 000 000 000 000 000 000 operations per second ?

## Sovereignty



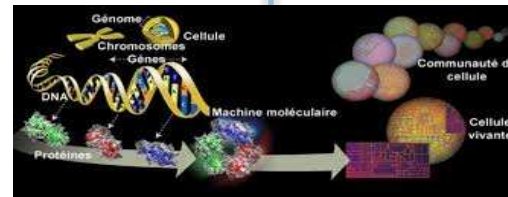
- Reliability of nuclear dissuasion
- Intelligence activities
- Combat environment simulation
- Cyber security

## Competitiveness



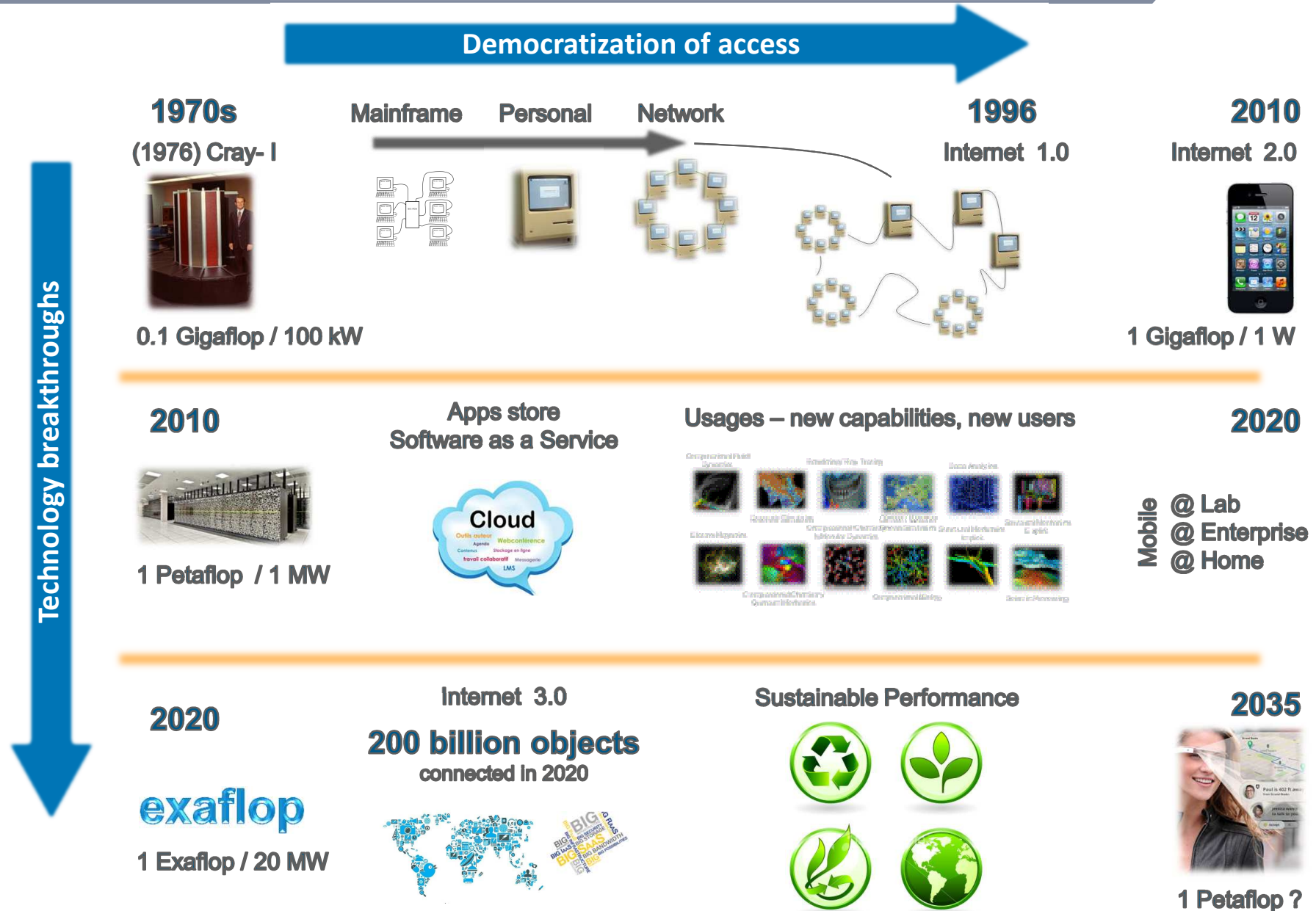
- Innovation
- Time to Market
- Cost Reduction

## Societal improvement



- Life Science progress
- Predictive analysis
- Complex problems resolution
- Entertainment

# Yesterday's challenges are today's standards



# HPC for All – Step 1 enterprise access

## *3 Key requirements to propagate HPC use*

### 1 Technological requirements

- Access & connectivity (4G...)
- IT as a service : Cloud HPC (IaaS/ PaaS)

**extreme factory**  
stay lean: compute smart



### 2 User support

- SaaS (software stack & tools)
- Advisory
- Training



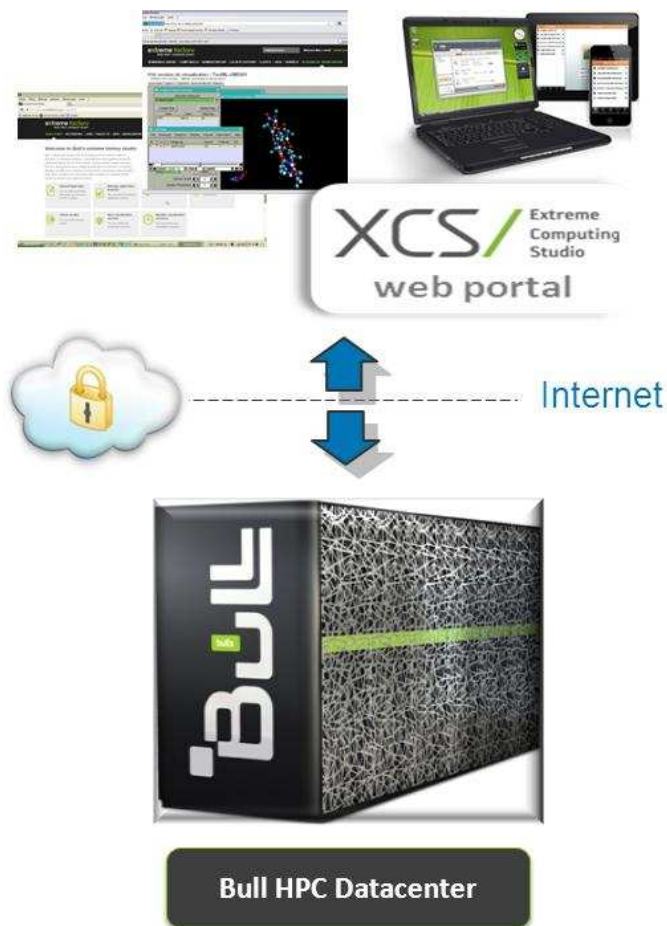
### 3 Financial requirements

- OPEX driven approach  
(ROI of CAPEX too long-term for SMEs)
- Pooling of HPC infrastructure under the sponsorship of dedicated organisms



# HPC technologies available as a service

**extreme factory**  
stay lean: compute smart



## ☐ HPC as a service for

- Remote pre/post processing
- Job submission and management
- 3D remote visualization
- Data management
- License management
- Accounting

## ☐ Hybrid cloud solutions available

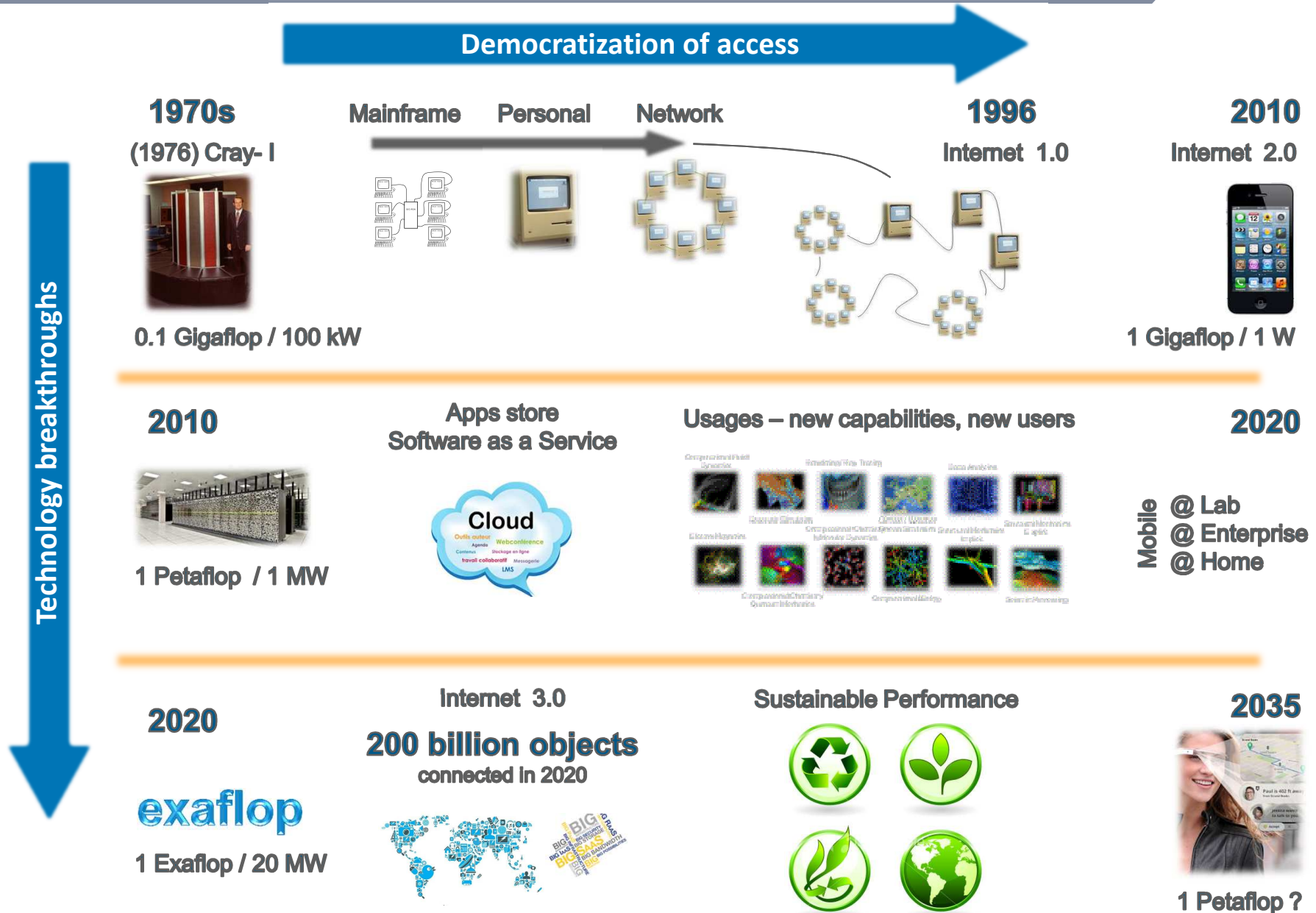
- For customers who want to externalize or burst their HPC hardware and management (BULL HW or tierce)
- Dedicated, shared or on premises (flexible consumption)
- Europe and USA (specially for GPU ISVs)

## ☐ Extreme Factory 2.0

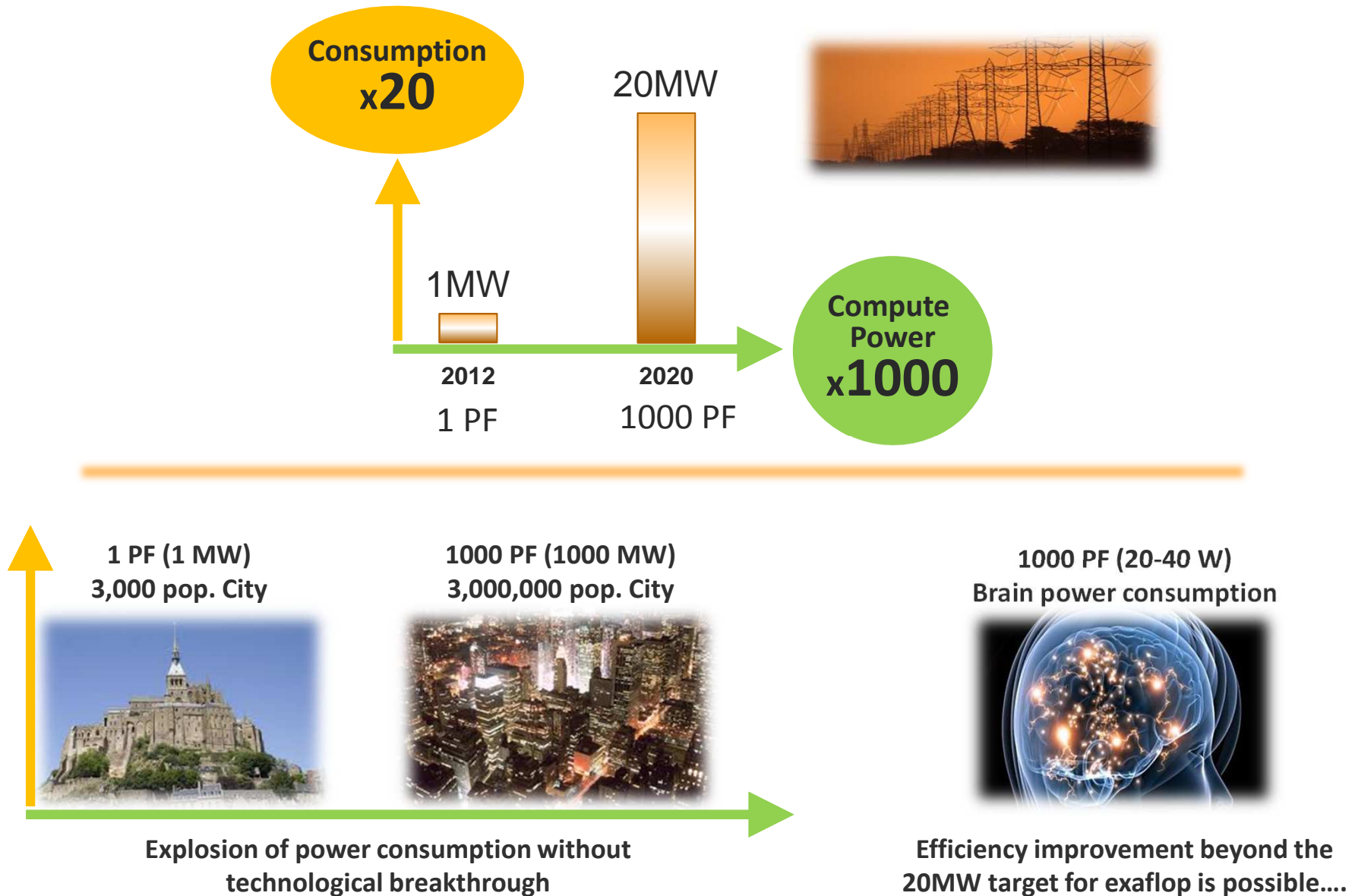
- Partnerships with more than 50 ISVs
- Large spectrum of domains (CAD/PLM, life science, rendering, cloud gaming, VOD etc.)
- Advanced CPU/GPU technologies integration



# Yesterday's challenges are today's standards



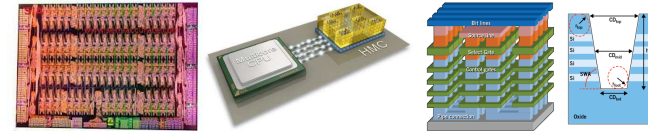
# The challenge of power consumption



## Main technological breakthroughs

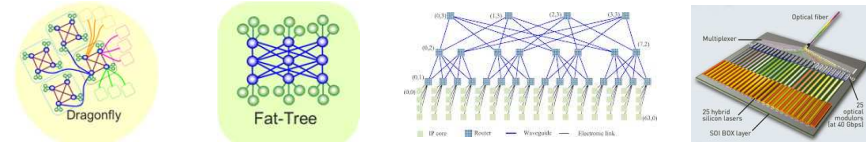
- New architectures

- xeon phi, next gen GPU,
- 3D memory, nodes, storage...



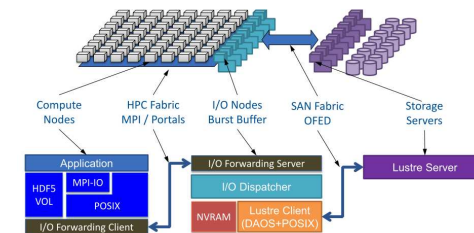
- High performance Interconnect

- ASICs of NIC and switches including HW optimizations, Optics, SW for orchestration & routing



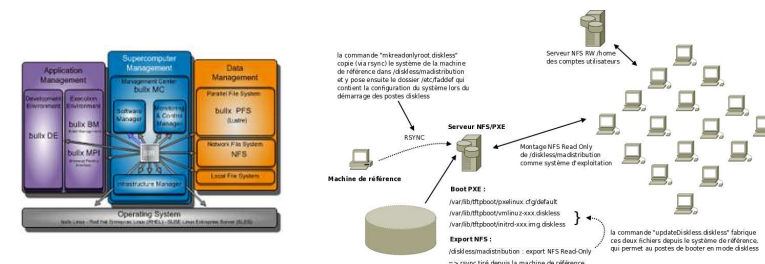
- I/O: performance, scalability & flexibility

- Proxy, I/O forwarding, diskless...



## ■ HW & SW architectures

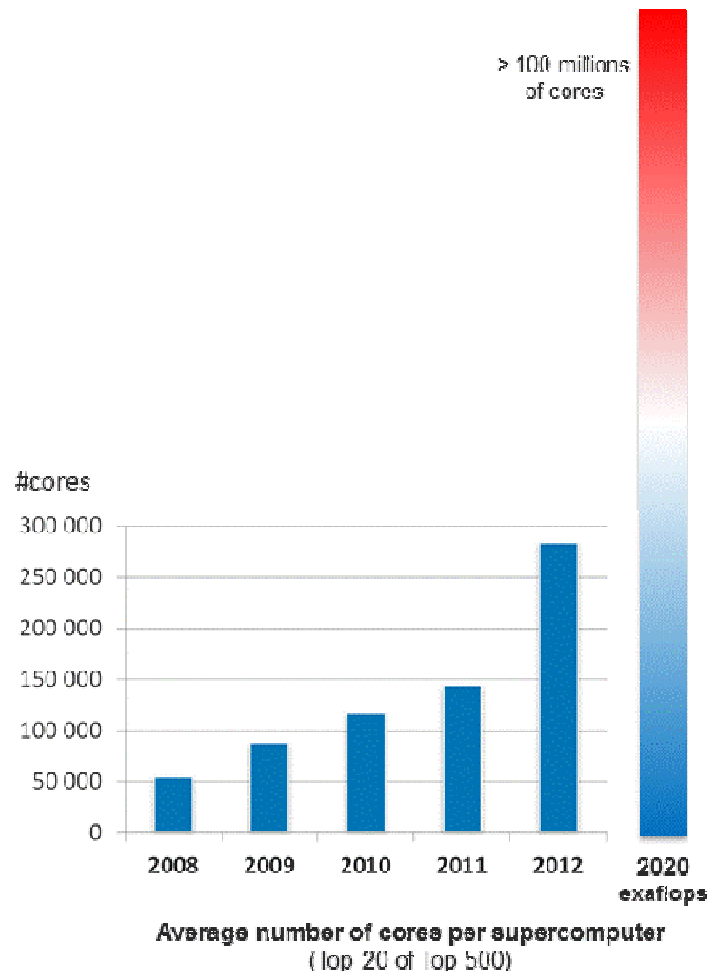
- Middleware (development and execution environment) designed for application scalability and resilience
- Highly scalable management center





# Meeting the Application challenges with parallelism

## EXAFLOP: Number of cores increases exponentially



### The Current Situation:

- Only 1% of SW are capable to exploit 10 000 processors
- It takes 5 to 10 years in average to rewrite an application
- 50% of IT managers said that their applications scaled at a maximum of 120 cores (2011 survey, Addison Snell)

### The two-fold Challenge:

1. Keep the early adopters on path  
(capture the full benefits of the performance from thousands of processors to millions of cores)
2. Bring all the others in the game

# Meeting the Application challenges with parallelism

## TOOLS TO MEET THE CHALLENGE:

- New numerical algorithms
- New programming languages & new paradigms
- Administrative, development and debugging tools

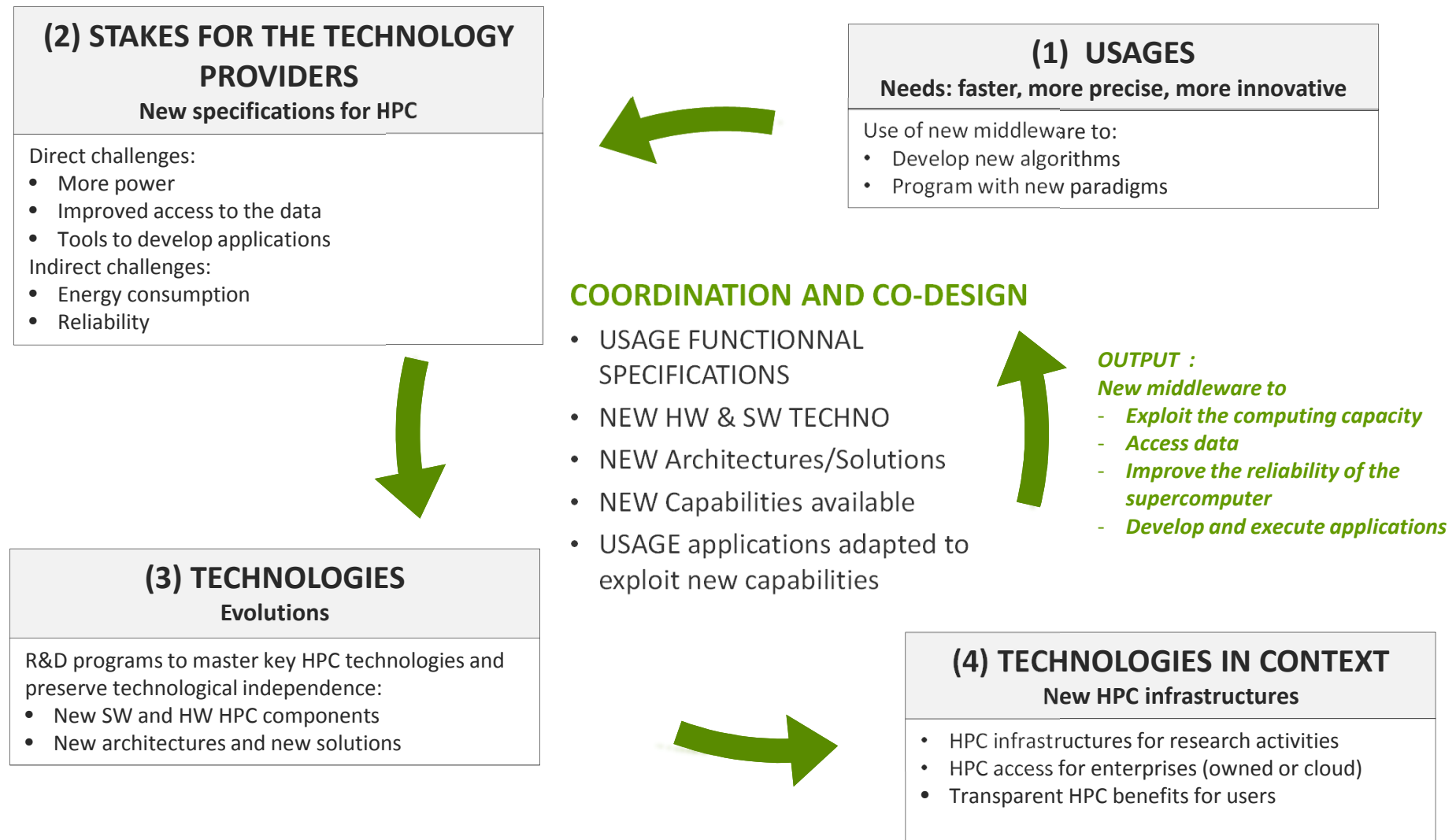


## BENEFITS:

- Proof of Concept to demonstrate gains in performance
- Workshops to optimize & speed-up simulations
- Benchmark of applications & solutions
- Learning & training
- Access to computing resources

# Usages-techno virtuous circle

*Take-away : iterations between usages, middleware and technologies each time breakthrough occurs*

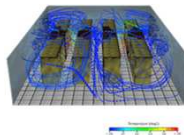


# Yes, we can Design, Build, Run ... exaflop !

## CAPABILITIES

### DESIGN & BUILD:

- Architecture
- Complete, open, scalable & reliable SW suite
- End to end development (ASICs, cards, blades, racks)
- Data Center conception
- Mobile Data Center
- Cooling technologies



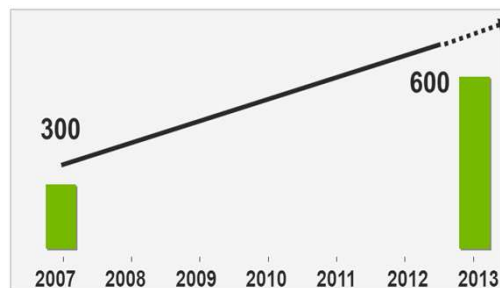
### RUN:

- Benchmarking & optimization
- Large deployment
- Expertise and services (from advisory to maintenance, including PaaS access and training)



## TRACK RECORD

### Largest team of HPC experts in Europe



### Historical position in the top 500 HPC



- June 2012, Curie, n°9, 1.4 Pflops
- June 2012, Helios, n°12, 1.2 Pflops
- Nov. 2010, Tera100, n°6, 1 Pflops
- June 2013, Météo Fr, n°54, 0.5 Pflops
- June 2006, Tera10, n°5, 42 Tflops



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