Questions asked by Pete Beckman

- Overview of activities and investments in exascale
- From your perspective, the key challenges for achieving exascale
- Thoughts on the co-design process
- Important issues for working with open source software community
Roadmap to Exascale

No exactly a roadmap but rather a journey with different issues to be addressed while travelling

No date for achieving the Exaflops but the first milestones are already defined

Challenges are not only technical problems but also economical sustainability
- How to take advantage of investments coming from other markets
- How to reuse high end technologies for value/$ HPC market
- How to increase RoI of high end systems
Technical challenges

- **Power**
  - Bull not involved in nanoelectronics technologies
  - Use or design ASIC with existing technologies
  - Seen as a constraint: never build a more than 20MW system

- **Data movement and handling**
  - Innovation will be key to work around today and upcoming bottlenecks
  - New architectures for both system and IO are required

- **Resilience**
  - Some technologies can help
  - Main difficulty is integration of all aspects (HW+SW) in an efficient way
Welcome to co-design meaning application, algorithm, software, hardware teams working together
- Interaction needed to find the trade-off
- Common understanding help to invest in the right direction for each domain

For the time being, no interest for co-design meaning a specific system for a specific (set of) application(s)
- No valid business model yet found for exascale neither from a custom nor from society demand
- No able to say for one application how much and when for the exaflops
Extreme Computing Lab

Architect of an Open World™
Objective

Master the technologies involved in HPC

Themes
- Large system architecture
- Software scalability
- TCO control
- Interconnect network
- Infrastructure
Collaboration as a key method

- Joint effort of CEA and Bull to develop solutions answering technical challenges of large systems

- Involved in the dynamism of eco-system

- Competitiveness cluster

- Simulation

- Open to collaborative R&D projects
Architecture & packaging

- **System architecture**
  - Integration of standard CPU, hybrid computing, low power options, resilience

- **Interconnect architecture**
  - Low latency, new topology, low power, resilience

- **IO architecture**
  - Architecture, resilience

- **Integration and cooling**
  - Dense packaging, memory stacking, cooling solutions
Software innovations

- Power Mgt
- Reliability of large Clusters
- Complex and large Inter-connect topology mgt
- Scalability
- Performance

Cluster Suite
Bull involved in collaborative R&D initiatives

- Common laboratory
- Projects at European level
- Project in French ecosystem
- Research institutions
- Technology partners: Intel, IBM, Mellanox, Voltaire, DDN, LSI, NEC
Bull SW strategy based on Open Source plus added value

Bull is contributing in numerous communities
(code and test contributions)
- OFED, OpenMPI, Slurm, Lustre, Shine, Papi, HPCToolkit, Perfmon, Kernel.org, ...

Key-points
- Efficient relationship with communities
- Dynamicity of communities
- Governance laws of communities
- In house expertise on components delivered to end users
- In house capability to analyze defects, fix them or back-port existing fixes
- Licenses : BSD, MIT or Apache preferred

Some concerns if
- Communities not concerned by support
- Communities are not quality minded enough