The DEEP-EST Project.

Viktor Khristenko, Maria Girone (CERN)

Outline

- What is the DEEP-EST / going to be?!

  - How does CERN/CMS participate?!

- What is currently available?!

- CERN/CMS, what benefits for us!?

- Current Ideas

What is the DEEP-EST Project?!

- Dynamical Exascale Entry Platform (DEEP) - Extreme Scale Technologies (EST)

- 3rd generation of the DEEP Project

- EU funded project, which aims to build Modular Supercomputer Architecture (MSA)

- **MSA = Heterogeneity of resources (processors, coprocessors, GPU, FPGA, etc…)**

- **Components:**

  - **Cluster Module - CPUs**

  - **Booster - CoProcessors Intel KNHs**

  - **The Data Analytics Module - CPUs, CPU+FPGA or coprocessors + """"huge amount of (DRAM+non-volatile) memory per core"""""**
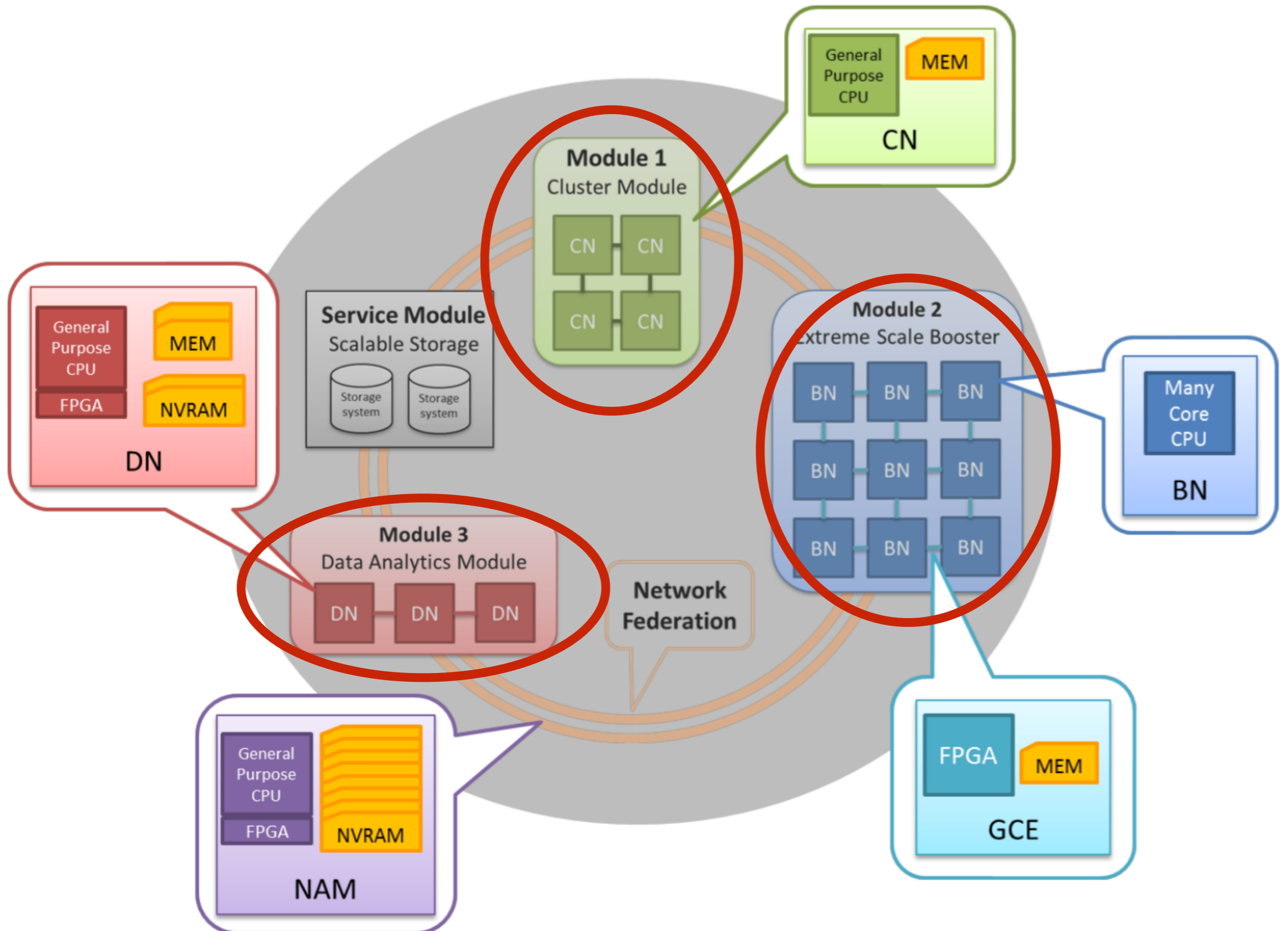
What is the DEEP-EST going to be?

Figure 2: High level hardware configuration of the DEEP-EST prototype

How does CERN/CMS participate?!

- 6 applications participate in the DEEP-EST Project

  - Neuroscience / Weather Analytics / Biology Simulations / Astronomy / High Energy Physics

- CMS is a new member of this set!

- DEEP-EST wants CMS to provide various workflows to run on their system

- DEEP-EST does not know about what kind of physics workflows we run!

- Simulations -> Reconstruction -> Particle Flow -> Data Analysis -> anything!

What is currently available?!

- knc1:
    - 2 Xeon CPUs
    - 64 GB memory
    - 4 KNCs (named knc1-mic[0-3]) with 61 cores and 16 GB each
- knc2:
    - 2 Xeon CPUs
    - 64 GB memory
    - 2 KNCs (named knc2-mic[0-1]) with 57 cores and 6 GB each

DEEP:

- Cluster:
    - 2 Xeon CPUs per node
    - 32 GB memory per node
    - 128 nodes
- Booster:
    - 2 KNCs per BNC (Booster Node Card)
    - 16 GB per KNC
    - 192 BNCs

SDV:

- Cluster:
    - 2 Xeon Haswell CPUs per node
    - 128 GB per node
    - plus 1 NVMe with 400 GB per node
    - 16 nodes
- KNLs:
    - 8 KNLs
    - 4 with EXTOLL
    - 2 with NVMe
    - 96 GB per KNL

DEEP-ER prototype (it is planned like this):

- Cluster Nodes:
    - The nodes from the SDV will be used as Cluster Nodes.
- Booster Nodes:
    - 3-4 chassis with 18 KNL boards each
    - 1 KNL per board
    - 96 GB per KNL
    - plus 1 NVMe with 400 GB per KNL

Xeon CPUs +
KNC coProcessors

Xeon CPUs +
KNC coProcessors

Cluster: Xeon Haswell CPUs

Booster: KNLs
EXTOLL - network

How does CERN/CMS benefit from the DEEP-EST Project

- We do not want to just benchmark CMSSW against the DEEP-EST system. We want to contribute!

- 1 Fellow working full-time on the R&D of the CMS Software eco-system targeting HL-LHC!

- DEEP-EST is agnostic about the HEP workflows -> advantage for us in terms of what we want to test out/run.

- A bunch of hardware (promised to be) that we can test against!

- A collaboration with sciences outside of HEP

Ideas

- CMS Big Data Project

  - Low weight ROOT I/O (spark-root) + Apache Spark for Physics Data Analytics

  - Physics ML Pipelines with Apache Spark + …

- DEEP-EST is about heterogeneity => heterogeneity for CMS software framework?!

- Distributed Processing (MP) for TDataFrames with HPX

- Data Transformation

- For applications/workflows to run on the DEEP-EST system, standard CMS sequences (reco, tracking, sim, PF) + analytics.