ARM + DSP Supercomputer
Modular HPEC Architectures

nCore
System Overview

The **nCore BrownDwarf Y-Class** system unifies **COTS technologies**, **high performance SoCs**, **advanced low latency interconnects**, and **optimized software** to create a supercomputer delivering **exceptional performance**, **reliability**, **power telemetry**, **reconfigurability**, and **programmability** at significantly reduced power levels.

The modular architecture lends itself well to design, development and deployment of **HPEC** systems for **military and aerospace applications**, **medical imaging**, **biomedical & genomic research**, **oil & gas exploration**, **physics simulations** and **power vs. performance research**.

More information can be found here: [http://ncorehpc.com/browndwarf/](http://ncorehpc.com/browndwarf/)
Y-Class AMC Block Diagram

- TI 66AK2H12 “Keystone 2”
- 4 x ARM A15 @ 1.4GHz
- 24 x C66 DSP @ 1.2GHz
- 51.2GB/s Total Memory Bandwidth
- 26GB ECC Memory
- 2TB/s Internal Bus
- 100Gb/s Hyperlink
- 20Gb/s SRIO Compute Fabric
- 10Gb Ethernet System Fabric
- 3 x 1Gb Ethernet OBM Fabric
BrownDwarf Y-Class System Cabinet

Applications can use a single AMC node or scale to hundreds of nodes while interfacing with any ATCA or uTCA component.

- **Y-Class AMC Node**
  - 2TFLOPS SP / 2TOPS Integer
  - 104GB ECC Memory

- **Carrier Blade**
  - Compute Processors [ARM/DSP]: 92/1152
  - Accelerator Performance (SP/DP): 23.1/6.1TFLOPS
  - Aggregate Switching Capacity: 2.2Tb/s
  - Aggregate Memory Bandwidth: 2.4TB/s
  - Maximum ECC Memory: 1.2TB
  - Power Telemetry Measurement Points: 1632

- **Switch Blade**

**Calculation:**

\[ x \ 4 \ + \ x \ 12 \ = \]
Military/Aerospace/Data Acquisition Architecture

- **BrownDwarf Y-Class**
- **11 TFLOPS**
- **624GB ECC**
- **1.2TB/s MBW**
- **380Gbps SRIO**
- **576 DSP Cores**

**Backplane**

- **A/D FPGA**
- **Video**
- **Storage Blade**
- **10GbE Switch**
- **SRIO Switch**

**Sensors**

- **Video**
- **Radar**

**Networks**

- **SRIO - 80Gbs**
- **10GbE**
- **1GbE**

**Storage**

- **6TB SSD**
- **120Gbps SRIO**

**Other**

- **sFPDP 1553 Etc.**
DPI and Big Data Architecture

BrownDwarf Y-Class

BrownDwarf Y-Class

BrownDwarf Y-Class

BrownDwarf Y-Class

BrownDwarf Y-Class

BrownDwarf Y-Class

11 TFLOPS
624GB ECC
1.2TB/s MBW
480Gbps SRIO

40GbE Packet Processor Blade
2 x Cavium Octeon II CN6880

40GbE Packet Processor Blade

Storage Blade

Storage Blade

40GbE Switch

SRIO Switch

1200b SRIO

n x 10GbE

10GbE span/inline/tap

SRIO - 800bs
10GbE
1GbE

Backplane

120Gb SRIO

6TB SSD

6TB SSD

SAS

SAS
## H.264 Transcoding Architecture - 6 Slot Variant

### H.264 BP
- **Encoding**: 8 x C66 DSP Cores
- **Decoding**: 8 x C66 DSP Cores
- **Encoding**: 1 x BrownDwarf Blade
- **Decoding**: 1 x BrownDwarf Blade

<table>
<thead>
<tr>
<th>H.264 BP</th>
<th>Encoding</th>
<th>Decoding</th>
<th>Encoding</th>
<th>Decoding</th>
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<td>CIF/30</td>
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<td>104</td>
<td>576</td>
<td>1248</td>
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<tr>
<td>D1/30</td>
<td>12</td>
<td>24</td>
<td>144</td>
<td>288</td>
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<tr>
<td>720p30</td>
<td>4</td>
<td>8</td>
<td>48</td>
<td>96</td>
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<tr>
<td>720p60 or 1080p30</td>
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<td>24</td>
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<tr>
<td>1080p60</td>
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<td>2</td>
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<td>24</td>
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### H.264 HP
- **Encoding**: 8 x C66 DSP Cores
- **Decoding**: 8 x C66 DSP Cores
- **Encoding**: 1 x BrownDwarf Blade
- **Decoding**: 1 x BrownDwarf Blade

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H.265 Transcoding Architecture - 6 Slot Variant

**H.265 (Standard Quality)**

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<td>720p30</td>
<td>8 x C66 DSP Cores</td>
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<td>3 x BrownDwarf Blade</td>
<td>9 x BrownDwarf Blade</td>
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**H.265 (High Quality)**

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**Specifications**

- 4.6 TFLOPS
- 312GB ECC
- 1.2TB/s MBW
- 240Gbps SRI0
- 6TB SSD
- 120Gb SRI0
- 1.2TB/s MBW
- 240Gbps SRI0

** Hardware Features**

- Storage Blade
- Backplane
- SRI0 Switch
- 10/40GbE Switch
High Performance Computing Architecture

65 TFLOPS
3.3TB ECC

9.7kw / 110v
nCore Lithium Suite

- nCore Lithium Suite is the fastest way to performance and productivity on TI Keystone II and BrownDwarf
- Ubuntu ARM HPC centric server distribution enables access to 6.5k Linux Packages
- Native development environment on Keystone II for ARM & DSP using optimizing compilers
- Offload computations to C66x DSP cores using OpenMP 4.0 with accelerator model and OpenCL
- OpenMPI over SRIO, Optimized IPP replacement library for C66x, Advanced DMA library for C66x
- Performance Optimization Tool Layers (PAPI for A15 and C66x DSP), BLAS (ATLAS)
- Industry Leading Commercial Support

Currently Supported Platforms:
- nCore BrownDwarf YCNODE
- nCore BrownDwarf MBLADE
- TI’s XTCIEVMK2X EVM
- Others to follow

nCore is the worldwide leader in TI Keystone software technologies