ARM Cluster: A Research Tool

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ODROID vs Raspberry Pi

The ODROID XU4 and the Raspberry Pi 2B were benchmarked by running math equations and were compared on speed and power.

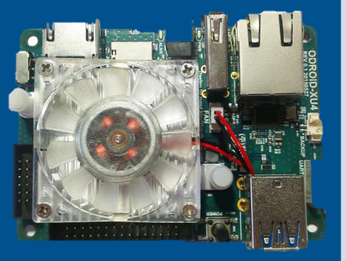
LENGTH OF TIME (SECONDS)				
DEVICE	**Addition**	**Multiplication**	**Division**	**Sine**
ODROID-XU4	29.925	31.341	37.032	227.40
RASPBERRY PI 2B	221.645	221.034	29.204	1468.63

GIGAFLOPS				
DEVICE	**Addition**	**Multiplication**	**Division**	**Sine**
ODROID-XU4	0.311	0.297	0.251	0.0410
RASPBERRY PI 2B	0.0420	0.0421	0.0313	0.00634

GIGAFLOPS PER DOLLAR PER WATTS				
DEVICE	**Addition**	**Multiplication**	**Division**	**Sine**
ODROID-XU4	0.00028	0.000268	0.000226	0.0000369
RASPBERRY PI 2B	0.0003	0.0003	0.000224	0.0000453

ODROID XU4

2 x USB 3.0 Host
1 X USB 2.0 Host
Gigabit Ethernet Port
2 GB RAM
Added 16 GB Storage
7.4 x faster than Pi 2B
8 cores: 4 x a15, 4 x a7

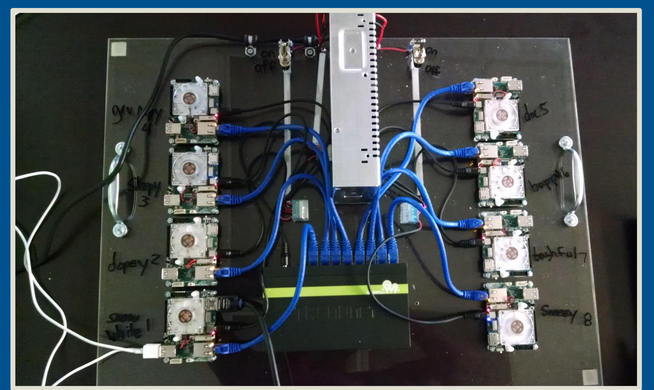


HPLinpack Benchmark

LINPACK measures the computing power by solving linear in parallel on the system. It was used to benchmark the cluster in the star topology.

Mission

To build the fastest, most efficient cluster of single-board computers.



Cluster in Star Topology

Communication

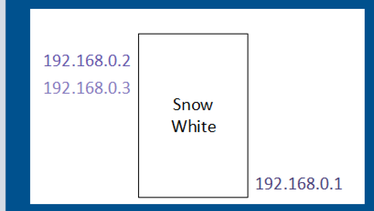
USB and GPIO connections were tested. Currently, there's no way to connect through USB, and GPIO was slower than Ethernet.

```
# interfaces(5) file used by ifup(8) and ifdown(8)
# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto eth0
iface eth0 inet static
    address 192.168.0.11
    netmask 255.255.255.0
    up route add -net 192.168.0.10 netmask 255.255.255.255 gw 192.168.0.11
    up route add -net 192.168.0.9 netmask 255.255.255.255 gw 192.168.0.11
    up route add -net 192.168.0.8 netmask 255.255.255.255 gw 192.168.0.10
    up route add -net 192.168.0.7 netmask 255.255.255.255 gw 192.168.0.10

auto eth2
iface eth2 inet static
    address 192.168.0.12
    netmask 255.255.255.0
    up route add -net 192.168.0.13 netmask 255.255.255.255 gw 192.168.0.12
```

Routing Table

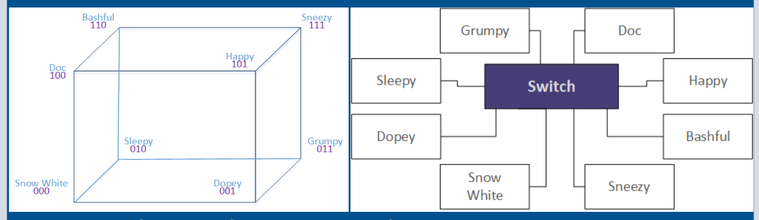


IP Addresses

Three IP Addresses were assigned to each ODROID: one for Ethernet and one for each USB 3.0 port. Routing tables were created for each ODROID

Topology

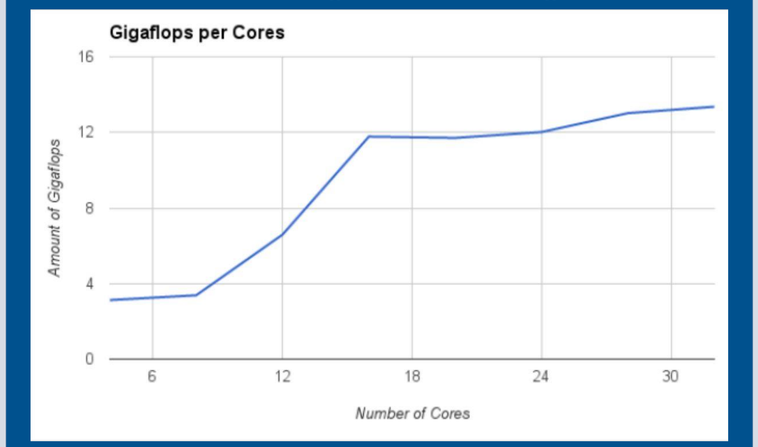
The 8 ODROIDS were connected into a Star Topology; each connected to a switch via Ethernet. Ring and Hypercube were connected using an Ethernet-to-USB cord.



Hypercube and Ring Topology

Results

Using four a7 cores per node, all eight nodes, produced 13.36 Gigaflops. Using two a15 cores per node on all eight nodes produced 26.23 Gigaflops. An i7 device using four cores gave 61.3



LINPACK results for star topology on a7's

Tools LINPACK | C/C++ | WiringPi | GPIO | USB | Ethernet | USB to Ethernet | Python | OpenMPI | MPICH | Ubuntu Linux | Bash