

### Knots concept – yet another computing solution

- 1) knots computer is an internal network-based fat client computer architecture for GPGPU computing with practical aspects in mind. It is designed for small Research & Development up to 10 people teams. It consists of a single fully operational workstation and a background distributed computing architecture,
- 2) It is based on Linux operating system and C/CUDA GPU technology provided independently of single user Personal Computer workloads,
- 3) single knot ( from overall recommended 10 knots ) proposition:
  - Motherboard: FM2A88X Extreme6 ( 2xPCIe 3.0 x8; 1xPCIe 3.0 x4; ATX format ),
  - CPU: AMD A10 7850k,
  - RAM: 2x8GB 1333MHz ( majority of users seldom exceeds 6GB of used RAM ),
  - HDD: 4x120GB SSD Goodram CX 300 in RAID 0 configuration,
  - NET: 1port 10GbE PCIe adapter ( SR SFP+ GBIC ),
  - GPGPU: user-independent **GTX 1070 8GB** + ordinary GT730,
  - MONITOR: 2x23.8" HP 24er connected to GT730,
  - HEADSET: Sennheiser HD280,
  - KEYBOARD: Lenovo Combo,
  - shiny case with at least 500W power supply; pendrive; mobile phone: myPhone Hammer,
  - uSD card; comfortable seat,
- 4) server supervisor:
  - Dell R720xd; 2x CPU's,
  - 24x2.5" CX300 SSD 120GB ~2TB current problem data,
  - 3x 4ports 10GbE PCIe adaptor ( theoreticall no of connected 12 knots ),
  - network drives on ancient MD1000 with new 30TB accessible via server 8GFC,
- 5) internet connection at least 300Mbps on 24ports FE switch via 2 firewalls cascade ( bought from different manufacturers ),
- 6) each knot is connected to supervisor server via 1x 10GbE internal network,
- 7) programs development:
  - single GPGPU efficient kernel program development at first step,
  - data distribution from server supervisor to RAM shared memory ( #shmget ) via Samba file server, GPGPU works from/to shared memory on its host,
  - background Operating System service for shared memory handling,
  - GNU Parallel (please cite) package functionality on server supervisor work deployment,
  - background service for turning off unused knots and Wake on LAN's magic packets,
- 8) 10GbE is less problematic and much more popular than some exotics like Infiniband and Fibre Channel network devices but yes – it is slower with higher connection latency,
- 9) R720xd file server capabilities are slightly too small – there should be two such servers, but with practical data loads in mind it could be quite functional anyway in my personal opinion,
- 10) data distribution via network is ~8 times slower than RAM shared memory access – computational problems should be assymetric in read-write to computation time comparisons,
- 11) there are 4ports GbE PCIe adaptors which could be connected to switch ( for example 52 ports GbE + 4 ports 10GbE server uplinks ) via knot 4xGbE aggregated link in more economical designs,
- 12) please note some custom cases filled with vaseline oil providing significant heat distribution efficiency increase. Long term computations should be provided on the basis of two GTX 1080ti's,
- 13) knots concept does not require devices airconditioning,
- 14) above mentioned design might provide practical peak ~34TFLOPS computational capabilities for 30k\$. Annually it consumes 18k\$ of current at full load.

Post Scriptum: please note, that knots capabilities could be easily extended with Volta microarchitecure devices in future.