



Petascale Computing in a Cubic Meter by 2015

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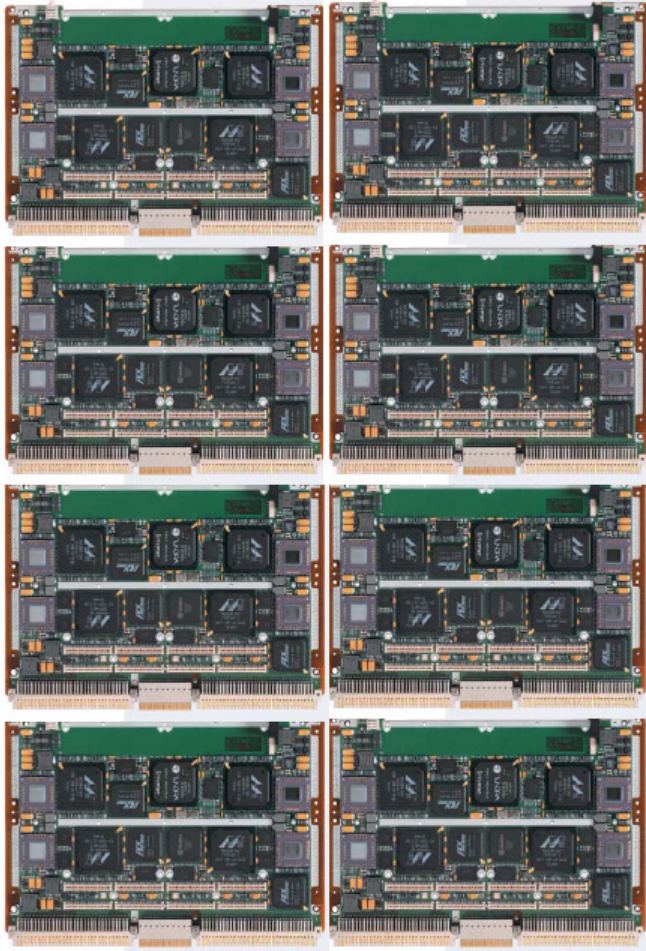


Petascale Computing in a Cubic Meter by 2015

- **Petascale mobile signal processing appears feasible by 2015**
 - One million GFLOPS (10^{15} sustained 32-bit floating point operations per sec) using 20,480 processors
 - 1.28×10^{15} bits/sec simultaneous input & output (bisection bandwidth)
 - 0.1×10^{15} bytes high-speed memory
 - Supports general-purpose signal processing
 - Each compute (CN) node has 10 FLOPS/byte
 - CNs & I/O are rapidly reconfigurable
 - 1m^3 size, 2000 kg weight & 340kW power budgets
 - Modular construction to ease on-site assembly & maintenance
- **Projections based on historical improvement rates for legacy designs**
 - Can demonstrate form & function with today's non-proprietary technologies
 - Required technologies are evolving at different rates
 - Ongoing study to develop system-level technology roadmap
- **High-tech challenges**
 - Microelectromechanical crosspoint switches (size, speed, endurance)
 - Optical crosspoint switches may be needed after 2015
- **Low-tech challenges**
 - Low-voltage DC-to-DC converters with high current, efficiency & density
 - Power bus bar routing: 6.5mm (1/4") diameter wire for 100A = 100W/1V
 - Cost-effective application of heatsink materials having high thermal conductivity (use of highly-oriented pyrolytic graphite or heat pipes to avoid flow-through liquid)

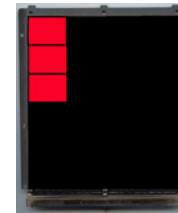
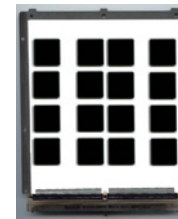
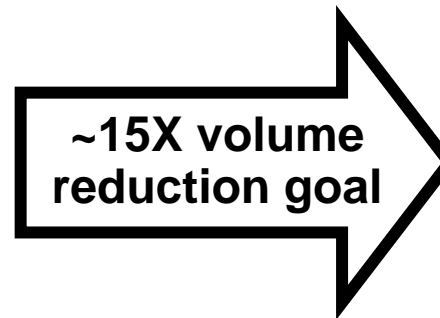


15X Size Reduction vs. COTS by 2015



8 COTS 6U form factor cards @
55W ea (50W processor + 5W
on-board DC-to-DC converter)

Processor SEM-E (standard
electronic module form factor
E) with 16 3D stacks/side
dissipates 375W



1/8 DC-to-DC converter
SEM-E dissipates 47W

Only 11X reduction achievable today
(lack of low-voltage DC-to-DC
converters with necessary current,
efficiency & density)



Figures of Merit for 2005 – 2015

