



Unique Cooling Solutions for Dense HPC Systems (PMBP)

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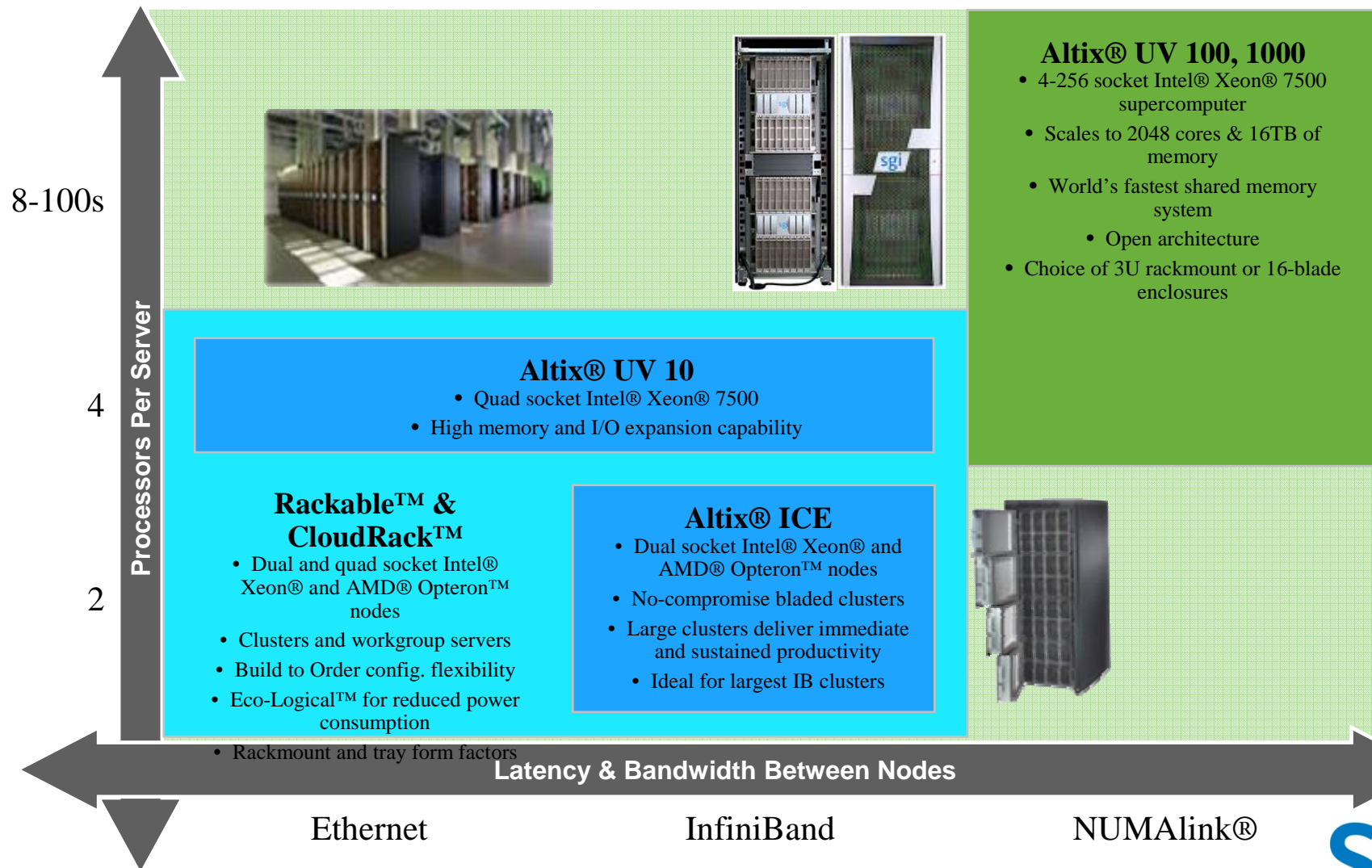
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Agenda

- SGI Platforms Today
- Electrical Power
- Liquid Cooling
- Containers
- Comments

SGI Server Solutions

Best Value, Performance, Fit



SGI® Altix® ICE 8400 & UV 1000 Platforms



**SGI Altix
ICE 8400**

- Air-Cooled
 - Available Water Cooling
- 34.5kVA Platforms
 - Varies with configuration
- 31.28-in W x 48.20-in D
(795mm W x 1229mm D)
- 2560 Lb (1161 kg)
- Multi-Rack Cabling
 - Down-Row & Across-Aisle



**SGI Altix
UV 1000**



SGI® 34.5kVA 3-Phase AC Rack Feeds

- North America & Japan
 - 180 to 264VAC Range
 - (2) 60A, 3-pole, 4-wire, IEC 60309 receptacles
 - 1-phase power supplies operated line-to-line
 - 456 to 504VAC Range (available)
 - (1) 60A 4-pole, 5-wire, IEC 60309 receptacles
 - 1-phase power supplies operated line-to-neutral
- International
 - 312 to 457VAC Range
 - (2) 32A 4-pole, 5-wire, IEC 60309 receptacles
 - 1-phase power supplies operated line-to-neutral

Example Load Variability

- 34.5kVA Rack Nameplate
 - Used for facilities wire-sizing
 - 33kW to 25kW Range Running Linpack
 - 33kW = Highest TDP sockets, full memory
 - 25kW = Mid TDP sockets, half memory
 - 24.8kW to 18.8kW Estimate Running Applications
 - Used for energy consumption planning (kWh)
 - ~75% of Linpack is a reasonable estimate of applications
 - Estimated application power is 72% to 54% of nameplate

SGI[®] Altix[®] ICE 8400 Water-Cooled Coils

Shipping Rear-Door Water-Cooled Coils since 2004

**Target Heat Rejection
95% water / 05% air**

**(4) Individual Coils
w/Condensate Drain Pans**

**Chilled-Water Supply
45°F to 60°F (7.2°C to 15.6°C)
14.4 gpm (3.3 m³/hr) Max.
UV 1000 up to 65°F (18.3°C)**

**100 psig (690kPa) max supply pressure
up to 30% glycol or inhibitors by volume**



3/4" (1.91 cm) Coupling

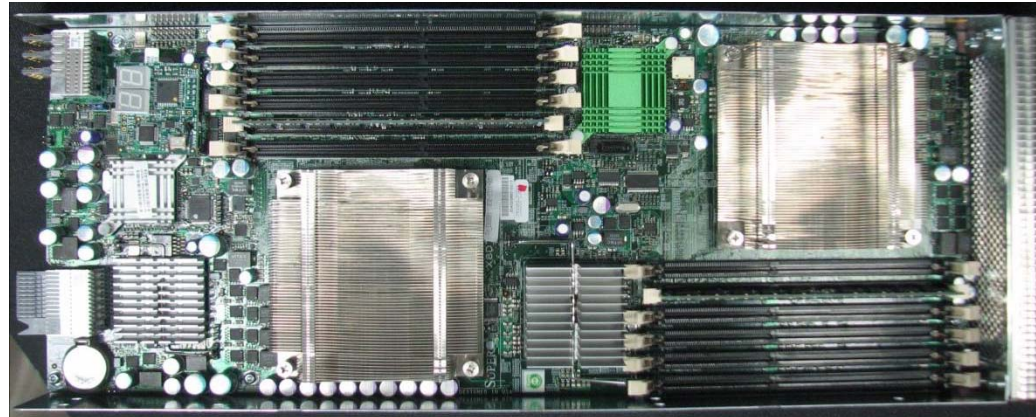


Warm Water Cooling

- Some customers interested in providing water by dry and/or evaporative cooling (no chiller)
 - 75°F (24°C) and 86°F (30°C) Water Supply Temp.
- Also interest in providing water by dry-cooling only (no evaporation or chiller)
 - Up to 100°F (38°C) Water Supply Temp.

Liquid Cooling

- “Closely-coupled” cooling offerings available
- Use of liquid-cooled heatsinks and coldplates starting to emerge
- Commodity components are air-cooled today
 - DIMMs, VRMs, I/O add-in cards, HDDs and other LOM items challenging to liquid-cool

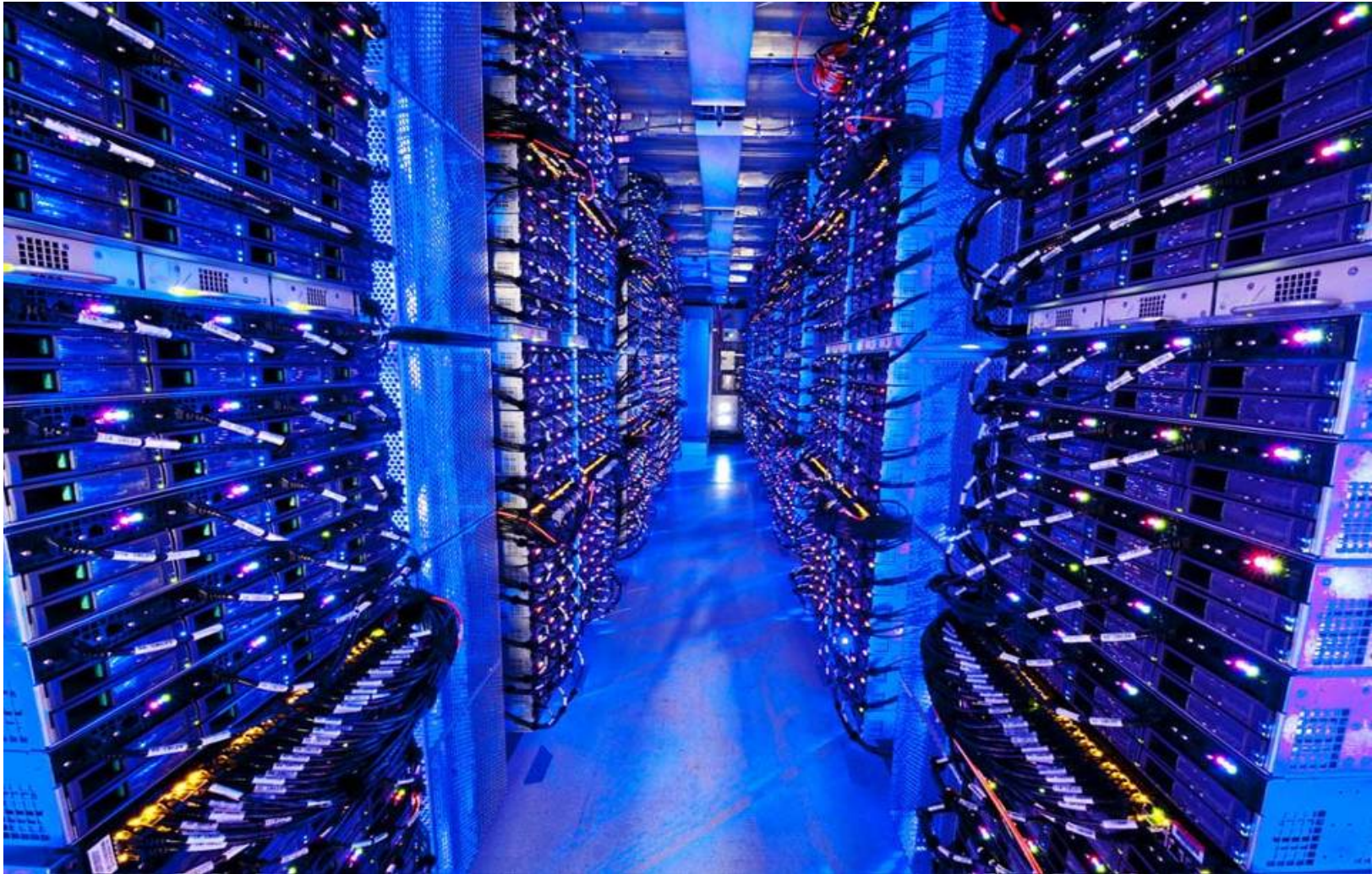


SGI® ICE Cube™ Modular Data Centers



- High Value: Lowers Total Cost of Ownership
- Eco-Logical™: Leading PUE <1.12
- Flexible: Full Support for all SGI Servers, Storage and Networking Solutions and third party gear
- Wide-Ranging Deployment Scenarios

Dual Row ICE Cube™ in Production



SGI® ICE Cube™ Models Compared

Model	IC2012DR	IC4028DR	IC4032DR	IC2010HY	IC4026HY	IC4018UR	IC4016UP	IC4024UD	IC2008UA
Container Class	Dual Row	Dual Row	Dual Row	Dual Row (Hybrid)	Dual Row (Hybrid)	Universal	Universal	Universal	Universal (Air)
Container Length	20'	40'	40'	20'	40'	40'	40'	40'	20'
Half-Depth 19" Racks	12 x 55U	28 x 55U	32 x 60U	8 x 60U	24 x 60U	0	0	0	0
Standard-depth 19" Racks	0	0	0	2 x 44U roll-in	2 x 44U roll-in	18 x 44U roll-in	16 x 60U fixed	24 x 49U fixed	8 x 44U roll-in
Total Rack U	660	1540	1920	480 + 88	1440 + 88	792	960	1176	352
Max. Cores*	14,832	34,608	43,392	15,072	36,768	27,528	46,080	27,540	16,896
Max. Storage (PB)**	6.2	14.5	16.6	6.6	16.0	17.9	23.8	29.8	7.9
Max. Power (kW)	260	600	1200	540	1000	350	700	350	280
Cooling Design	Water	Water	Water	Water	Water	Water	Water	Water	Air
PUE <1.12	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Based on max. 305W power per node. **With 2TB SATA II drives.

Additional 40' dual-row model: IC4024DR (24 x 55U half-depth racks + vestibule)

Universal Air Cube IC2008UA



- 20' unit ships whole or in modular pieces for local assembly
- Up to (8) 34.3kW Roll-In 44U racks (280kVA)
 - 5000 CFM (8500 m³/hr) maximum airflow per rack
- 3-Stage Adiabatic Cooler (20%, 40%, or 60%)
 - Outdoor air conditions determine cooler operation (3 of 7) zones wetted
 - Cold aisle: 23.3°C (74°F) to 32.2°C (90°F) dry-bulb temp & 22.5% to 70% RH
- Fully Loaded - PUE < 1.07

Comments

- 50kW and greater racks on the horizon
- 480VAC racks gaining popularity
- Commodity systems are air-cooled today
 - Are these O (50kW) racks air or liquid cooled?
- Warm water cooling is desired
 - No chiller and no evaporation
 - Reuse of waste heat
- Rack weights are significant
- New paradigms like containers available

Comments

- Holistic view of infrastructure to minimize TCO
 - Compute, network, storage, software; apps
 - Data center size, energy cost, climate, HVAC, security
 - Redundancy, maintainability
 - Just to name a few.....
- TCO models may need to span across multiple departments and budgets
 - E.g. System Procurement and System Operation

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