

Supermicro Liquid Cooling solution

Sr. Principal Solution Architect Junichi Tashiro 11/16/2021



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Together We Are Strong

10	210	\$3,500			Revenue (in millio	ns)						
SUF	ERMICRO	\$2,500			25 Years of Non Revenue Growt	-stop	5					
			- (Profitability	/				FORTU	NE	
	Silicon Valley HQ, USA	\$1,000 \$500 \$- Fy94 Fi	V95 FY96 FY97 FY98 FY	99 FY00 FY	01 FY02 FY03 FY04 FY05 FY06 FY0	17 FY08 FY09 FY	10 FY11 FY12	2 FY13 F	Y14 Fy:	1000	V 917 FY18	
Revenue	\$3.6B (2020)	SUPERMICE	#18 on Fortune	's Top 10 Growing	0 Fastest Companies Worldwide	The 3	rd place	in IDC	Serv	ver ship	ments	
Worldwide Presence	Silicon Valley (HQ), Taiwan, Netherlands, Japan, China	Comparison of the second		Tax SCangaries, Randon Toxicandy Congary	Interst //twowardsic.com/optiolog.jp/locatainen/ther/UR42222837 Bas Schargering, Nicholds Server Uni; Skipenses, Market Kara, and Severh, Third Spanner 27.2017;dx81.44** Nacadry 2017Uniz: 2017Uniz: Versioner 2018 United Stare					nictrons.		
Human Resource	4000+ Worldwide, 50% R&D staff	Wirking Weinig der judit Weine Heisanderstein zum Weine Heisanderstein zum Weine der Standerstein der Wirking der Standerstein der Wirking der Standerstein der Wirking der Standerstein Beiten Weinigerung der Standerstein Weinigerung der Standerstein Beiten Weinigerung de	H ANDER SANDER S	the secon	d year in a row op 100 Fastest Growing Companies in the World	Linite* Linit/SeeHOLOng* Linite*	500 1835 304 1835 1948 875 1981 545		482.5 548.2 206.8 148.2	11.6% 21.2% 54% 45%	1138 -0.76 -0.26 -0.26 -0.276	*
Corporate Growth	#18 Fastest Growing Company (Fortune 2016), #1 Fastest Growing IT Infrastructure Company	Alter and the foreign of the fo	Ang	RANK 2016 2015	COMPANY	3. Soper Stape 3. Human ²⁴ GDM Drivet Others	1867 535 1853 545 9850 2505 486 3626	675	1964 1973 8613 8613	44% 54% 1825 1826	31.46 475 41.76 458	*
Product Volume	3 rd Largest Server System Provider Worldwide (IDC 2018), ~1.2M units annually	 a de la construcción de presentente a de la construcción de la	n Maria	#18 98	SUPERMICRO SAN JOSE	Neal CCs The Covider Questiely	292712 ABBAN Senar Tucker Xovenia	er 280	2,603	10005	875	.,

SUPERMIC

Our Progression







intel Intel Data Center Use case





Configuration

- SBI-6119P/ 6219P with SBE-610J
- CPU: SKL 6136 12C 3.0G
- Memory: 12 x 32GB DDR4-2666
- Storage: 2 x 2.5"1.2TB SAS
- Network: 10G switch module

Intel Data Center Strategy: Leading Intel's Business Transformation

Intel's critical business functions—**Design, Office, Manufacturing, and Enterprise (DOME)**—while operating our data centers as efficiently as possible, Intel IT has engaged in a multiyear evolution of our data center strategy. Sepermicro & Intel IT has developed a disaggregated server architecture. The architecture separates the CPU/DRAM module and the NIC/Drives module on the motherboard.

- the disaggregated design offers the following benefits:
- No need to replace perfectly good components.
- No need to reinstall the OS.
- Cuts refresh costs by a minimum of 44%.
- Reduces technician time spent on refresh by 77%.
- Decreases refresh materials' shipping weight by 82%.



White Paper



https://www.intel.com/content/dam/www/centrallibraries/us/en/documents/intel-it-green-computing-at-scale-paper.pdf



Intel's innovative disaggregated server architecture and data center facilities design and operation reduce e-waste and increase energy efficiency—helping to protect the environment and produce significant cost savings



Liquid Cooling Solution

What's Liquid Cooling









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Liquid Cooling Demand from High-Heat CPU & GPU



1. Intel: 3rd Gen Xeon Scalable Processer (Codename: Ice Lake) released in 2Q 2021, can reach up to 40 Cores, and run at 3.40GHz (Intel[®] Xeon[®] Platinum 8380 Processor), TDP up to 270W per socket.

3. AMD: The current TDP is also as high as 280W

2. NVIDIA: Take the latest Ampere Architecture GPU published in May 2020. TDP of A100 is 400W.



Data Center Power Usage Effectiveness (PUE) Breakdown





Source: The Green Grid, 2012; Zhao et al., 2014; Shehabi et al., 2016



Cold Plate Solution cases



1-Phase Immersion Cooling System







Item

1

2

3

4

5



composition

fluorochemical

vegetable oil

Ethanol (醇)

mineral oil

mineral oil

Manifold Coolant	Pump CDU
	Coolant PHE Cold water

1-Phase Dielectric Coolant

Immersion Liquid Cooling

Facility Water Cooling

Coolant Selections

Coolant

3M FC40 (USA)

Submer (Spain)

Mivolt(UK)

GRC ITRI(TW)

Successful PoC for KDDI project at ITRI (GRC solution)







2-Phase Immersion Cooling System





Air Cool vs. Liquid Cool Power Efficiency



SMC 4U 8 GPUs servers x9 (72 GPUs/ Rack)	x9 In Row Air Cooling (pPUE:1.6~1.4)			×9	ex ex ex ex ex ex ex ex ex ex ex ex ex e			
			Cold Plate		Immersion Cooling			
			(pPUE:1.4~1.15)		(pPUE: <1.1)			
IT Equipment Energy (W)	1 server	1 Rack	1 server	1 Rack	1 server	1 Rack		
11 Equipment Energy (W)	3,600	32,400	3,300	29,700	3,200	28,800		
Non-IT Facility Energy (W)	1 server	1 Rack	1 server	1 Rack	1 server	1 Rack		
[Chillers, CRACs, pumps, etc…]		14,580		4,780	_	2,100		
Total Rack-Level Power (W)		46,980	-27% 🔶	34,480	-34% 🔶	30,900		
pPUE = Total power in one section of a data centre Total power of the IT devices in this section		1.45		1.16		1.07		

Comparison of Liquid Cooling and Air Cooling



	Liquid Cooling	Air Cooling
Advantage	 Lower OPEX (OPerating EXpense) Quieter Lower PUE (Power-Saving) 	 Lower CAPEX (Capital Expenditure) Easy Deployment Easy to Install
Disadvantage	 Higher CAPEX Coolant / Water Needed Leakage Concern 	 Higher OPEX Air Flow Mixing

Where is the Demand of Liquid Cooling



- Solution for high-density/high-heat device
 - GPU server, high-density server, ...
- Energy saving requirement
 - Low PUE/Low power consumption
- Field with water-cooling tower facility
 - General industrial plant, LAB, ...
- Low-noise demand sites
 - Clean room, laboratory, office, ...



Liquid Cooling Rack & Configuration

Blade Server Advantages



- Resource savings
 - Reusable of management module, chassis enclosure and switch module
- Space Savings
 - Up to 65% rack space saving
- Power Savings
 - Up to 20% energy cost savings
- Maintenance savings
 - Hot swap blades, PWS, CMM, switch
- TCO, TCE savings
- Cabling savings with blade-switch
- Refresh cost savings
 - Reusable enclosure
 - Operation Resources
 - Rack and stack
 - Network engineering
 - OS configuration engineering





SBI-420P-1T3N/1C2N

SBI-4119SSG/4114S/SG



8U SuperBlade[®] 820H Enclosure

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Liquid Cooling Rack Solution (I)





Per Rack Including

Rack dimension: 1991mm(H) x 750mm(W) x 1200mm(D) Net weight(including all parts): 1104 kg





Facility Hose Pairs Camlock



CONFIDENTIAL

Liquid Cooling Rack Solution (II)







Per Rack Including



1U PassThrough Tray (support 10 blades)



10 PassThrough Tray(support 20 blades)





CDM 42U 76-node

Hot Liquid



Cold Liquid

CDM: Coolant Distribution Module

Liquid Cooling Rack Solution (III)





Per Rack Including

Blade Server System* 4pcs

- SBE-820H-822: Enclosure for 20 Blades w/ 8x2200W
- SBM-IBS-H4020: HDR 200G InfiniBand Switch
- MBM-CMM-FIO-V: CMM
- MBM-XEM-002: Blade 10G Ethernet Broadcom switch with 2xQSFP and 4xSFP+, up to 2pcs
 - **PWS-DF005-2F**: 12Vdc input redundant FAN module power *3pcs
 - AOC BBP card: Blade Battery back up control module

Server Blade *76pcs

- SBI-420P: ICX Blade SFT-DCMS and SN on Asset tag for RMA
- Cold Plate: 1U Liquid Cooling Module for Blade B12DPT 8U20N

RMA: Return Merchandise Authorization

8U SuperBlade ICX DP Blade with Passive Cooling Loop





Performance, Power, and Cost Comparison



8U 820H Enclosure	Air Cooling	Liquid Cooling	Improvement		
СРИ	8352Y	8368			
MSRP(\$)	3450	6302			
TDP (W)	205	270			
Cores	32	38	MA		
Base Frequency (GHz)	2.2	2.4			
Cache/core (MB)	1.5	THE J.SULES			
GFLOPS per CPU	2252.8	2918.4	Up 29.55%		
Nodes per enclosure	20	20			
16G@3200 RDIMM	320x	320x			
Power Consumption (W)	13,672	16,922	Up 23.77%		
GFLOPS per enclosure	90,112	116,736	Up 29.55%		
GFLOPS/Per 42U rack	360,448	466,944			
Power/Per 42U rack (W)	54,688	67,688			
GFLOPS/Watt	6.59	6.9	Up 4.7%		

1. 90% heat can be recovered by liquid cool.

2. Air condition efficiency: consume 18KW per 40KW power

REDUCE



Blade Server Advantage @ Data Center



Multi-generation infrastructure for up to 65% CAPEX Savings

REUSE REFRESH (45% ~60% save in Hardware Refresh Costs)

Modular upgrades for maximum performance and efficiency

REDUCE (June 2018 White Paper)

Optimized shared resources for up to 50% reduction in Power and Cooling TCO



Disaggregated Server Architecture



Multi-Node Power and Cooling



Resource Pooling



Rack Scale Management

REFRESH

Thank You



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