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TECHNOLOGY IN MOTION

Tech Brief: *Reducing Server Power Consumption by 20%
With Pulsed Air Jet Cooling*

*Transformational electronics cooling:
Small...Powerful...Smart*

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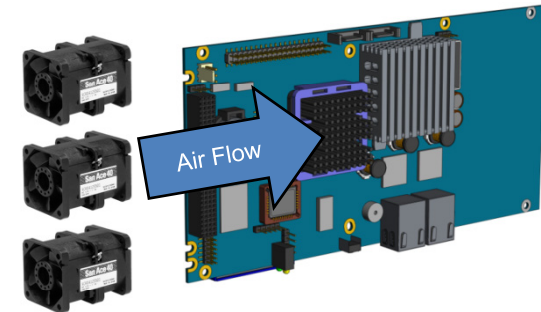
Influent's air cooling breakthrough

- Heat dissipation in high-power products has surpassed the capabilities of traditional fan-driven air cooling systems
- Improvements in fan-driven system performance are constrained by cost, power consumption, size, noise and life requirements
- Influent is developing new pulsed air jet cooling systems that dramatically increase performance within these conflicting constraints
- This tech brief summarizes Influent's CFD server white paper which shows how these new air cooling systems can solve extreme thermal challenges in high density electronics products.
- Please contact Influent Corp for a copy of the supporting white paper:
"Reducing Server Power Consumption by 20% With Pulsed Air Jet Cooling"

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Air cooling systems: Current limitations

- Air cooling in servers has reached its practical limits
- Limitations are with fans and blowers, not due to air itself.
- More cooling power requires higher air velocities
- Why fans and blowers can't deliver more:
 - Must push/pull air through entire enclosure
 - Creating large pressure drops
 - Power increases with the **cube of air flow rate !**
 - Fan size, weight and cost increase with flow rate
- Market need vs. fan / blower behavior (*mirror opposites*):



Market need (↓ Size) =	Flow ↑	Efficiency ↑	Life ↑	Cost ↓
Fan behavior (↓ Size) =	Flow ↓	Efficiency ↓	Life ↓	Cost ↑

CFD Model: Intel 1-U Server

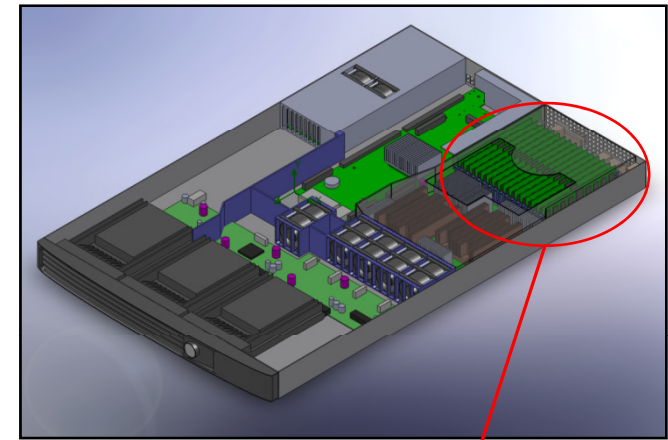
Server DIMMs cooling - CFD Model



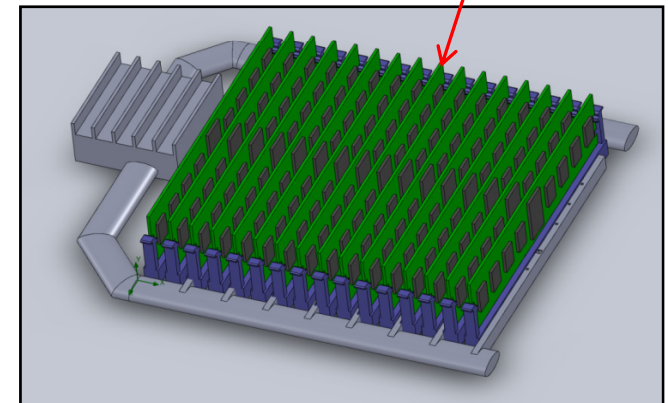
Intel SR1560SFHS 1-U



DIMMs cooled by 4 Sanyo 9CR0412S501 fans



CFD solid model

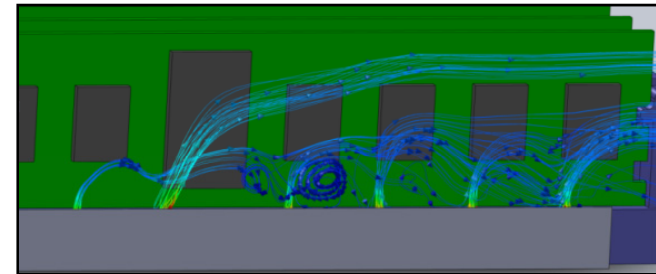


pulsed air jet manifold

- **Problem:**
 - 160W DIMM array exceeding temperature limits
- **Challenge:**
 - Provide additional air cooling without obstructing fan flow
- **Influent's Solution:**
 - Design a retrofit proportional air delivery system (1 actuator, 15 branch manifold, 65 ports)

Performance Results

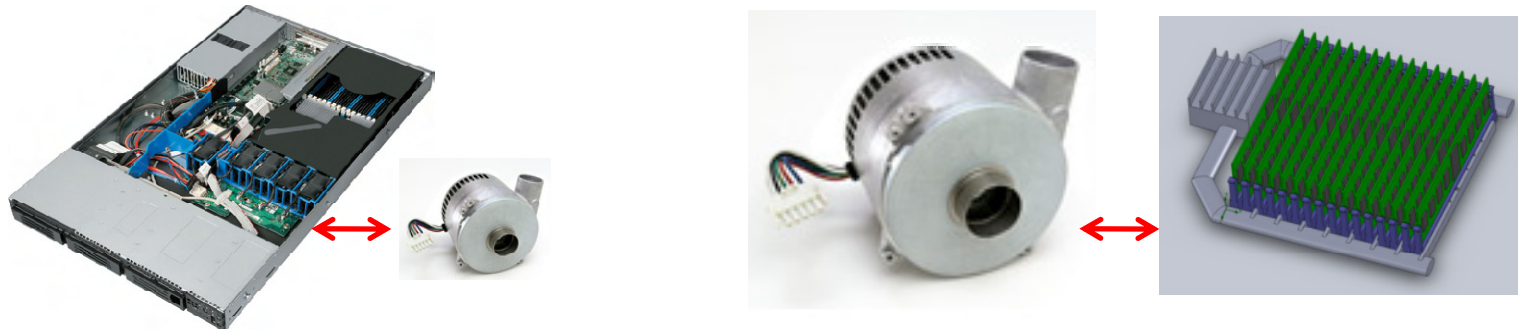
- Jets increase air velocities on chips from 5.5 m/s to 70 m/s (13,800 LFM)
- Provides 20°C drop in DIMM temperature
- Uses 90% less power than fans would use to achieve the same 20°C temp drop
- Delivers a 20% reduction in total server power



CFD Study	Temp. of Hottest DRAM	Fan Flow Rate	Fan Power (20% efficiency)	Jet Power Draw	Total Power Draw
	(°C)	(CFM)	(W)	(W)	(W)
fans only (baseline)	101.6	55.1	19.2	0	19.2
fan + jets	81.5	55.1	19.2	8	27.2
fans only (elevated flow)	81.2	127.1	202.2	0	202.2

Bench Marking

- Blower size required to match jet performance (AMETEK 150446E)



actual size comparisons

	Jet Actuator	Blower
Size (smallest dimension)	0.60 inches	5.8 inches
Weight	0.22 lbs	5 lbs
Power	8 W	400 W (0.53 HP)
Price	\$30 (at low vol.)*	\$209 retail

* Does not include cost reduction of system fans

White Paper Conclusions

- Influent's pulsed air jets overcome the limitations of fan-driven air cooling systems by:
 - Enabling “proportional air delivery” to large arrays of targets (e.g. 65)
 - Accessing space-constrained targets in high-power platforms
 - Transcending the flow³ power consumption limitation of fans
 - Enabling the downsizing and cost reduction of system fans, making Influent's air jet systems highly cost effective.
- Influent's air jets systems are also expected to provide energy savings at the data center level.
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