



**ZUTACORE™**

UNLOCKING THE POWER OF COOLING

**HYPERCOOL™**

**Direct Contact Evaporative Cooling**

**In-Rack Solution**



# Direct Contact Evaporative Cooling

## *Waterless, Two-Phase, Direct-on-Chip, Liquid Cooling*

Utilizing ZutaCore's Direct Contact Evaporative Cooling (DCEC) technology, the HyperCool™ system is now available as a self-contained, in-rack system, alleviating cooling boundaries at the chip, server, rack, POD and data center levels. The in-rack HyperCool solution uniquely supports up to 20kW computing power with an in-rack air cooled condenser and 70kW computing power with an in-rack water cooled condenser. In-rack units can scale in parallel into multiple rack units, which are then supported by in-row condensers. ZutaCore's waterless DCEC system brings a distinct combination of self-regulated, on-demand, low-pressure cooling in a well integrated, single cabinet. HyperCool is densifying data centers from small to large scale, for both data center retrofits and new builds.

In-rack units combine the hardware system with a Software-Defined-Cooling (SDC) platform. It is a plug-and-play solution that triples computing densities in a fraction of the footprint consistently at the lowest PUE and highest efficiency, in any climate. By reducing the data center design to commissioning cycle and halving costs, ZutaCore empowers data center owners and operators to accelerate return on investments and maximize real estate assets by supporting the proliferation of autonomous and central data centers. With increasingly powerful CPUs and GPUs pushing the envelope into multi-hundred watts, HyperCool addresses chip and server-level hot spots and is well suited for edge computing requirements.



# Solution Overview

At the core of the HyperCool DCEC system is the Enhanced Nucleation Evaporator (ENE), enabling a single, closed-loop, two-phase, liquid cooling solution that yields unparalleled heat dissipation on-chip. Unlike water-based solutions that expose the risk of IT meltdown, HyperCool utilizes a safe, non-conductive, commercially available liquid refrigerant. It is a complete hardware system, enhanced by a Software-Defined-Cooling platform.

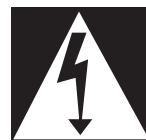
The complete system is comprised of:

- Server-Kit with ENEs
- Smart Refrigerant Distribution Unit (S-RDU)
- Smart Heat Rejection Unit (S-HRU)
- Software-Defined-Cooling Platform (SDC)

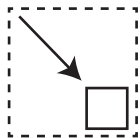
## Technology Differentiators

- Waterless Non-Conductive Liquid Refrigerant
- Two-Phase, Pool-Boiling
- Direct Contact and On Demand Cooling
- Low-Pressure System
- Reduced Boiling Incipient Temperature ( $T_w - T_s \leq 1^\circ\text{C}$ )
- Software-Defined-Cooling (SDC)

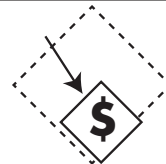
## Data Center Operator Benefits



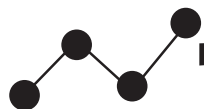
**0%** Risk of IT Meltdown



**10x** Densification



Up to  
**50%** Reduction in CAPEX/Footprint



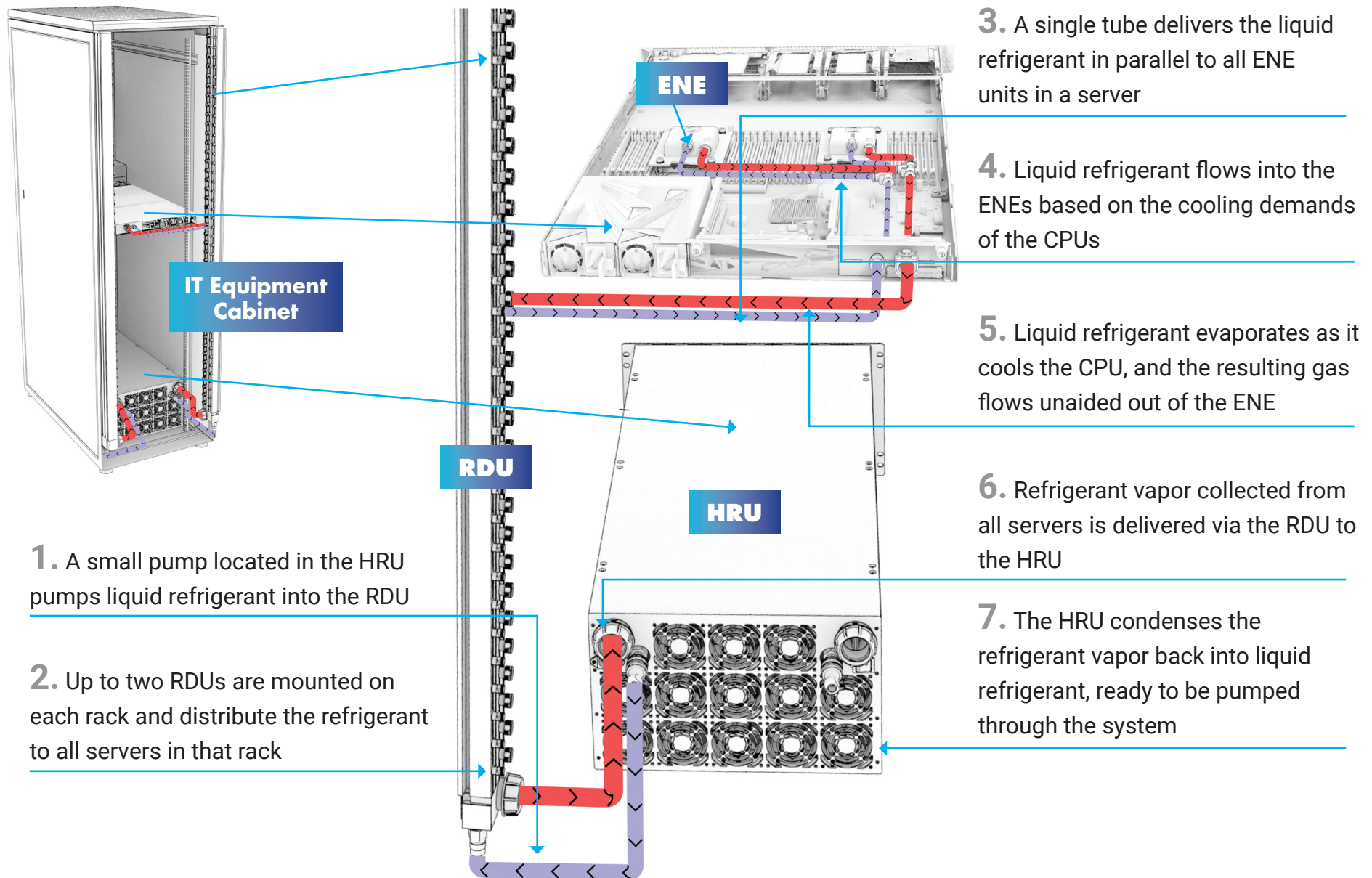
**10x** Direct-on-Chip Cooling Efficiency



Up to  
**70%** Reduction in OPEX



# Principal System Overview





# HyperCool In-Rack System Overview

## Server-Kit with Enhanced Nucleation Evaporator (ENE)

ZutaCore HyperCool uses dielectric refrigerant that boils at 34°C in atmospheric pressure, (3M™ Novec™ 7000) and leverages a latent heat phenomenon to provide 90% reduction in liquid pumping, providing superior heat transfer performance. At the heart of this process is the ENE, a pool-boiling evaporator device, which provides on demand response and enables the scalability of HyperCool to parallel cool all chips in the data center, switching instantly from idle to turbo mode. The ENE's self-regulation supplies exactly the amount of refrigerant needed to cool the heat generated by each component. The thermal energy is efficiently removed from the devices through the generation of vapor, which then transports the energy to the condenser where it is removed from the rack via a flow of air or water.

- Direct-On-Chip Cooling
- On Demand, Immediate Response
- Two-Phase Heat-Exchange
- Pool-Boiling
- Self-Regulated

ZutaCore offers multiple ENEs for various CPUs and GPUs including an ENE for Intel's Skylake and an ENE for Intel Xeon's with LGA2011 sockets. These provide:

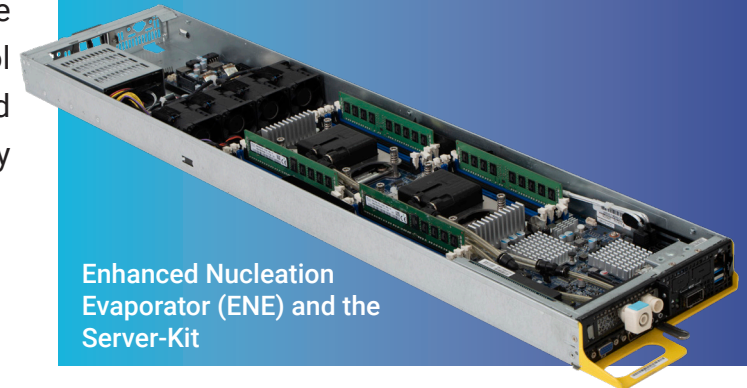
- The only LOW-PRESSURE, two-phase, ON DEMAND cooling technology
- ENE's Thermal resistance:  $< 0.035^{\circ} \text{C/W}$
- Boiling Incipience:  $\Delta T < 0.5^{\circ} \text{C}$
- Max tested heat flux:  $90\text{W/cm}^2$
- Parallel & self-regulated delivery to multiple chips
- Standard: quick & easy, typically <4 minutes any market server retrofit



ENE for Skylake



ENE for LGA2011

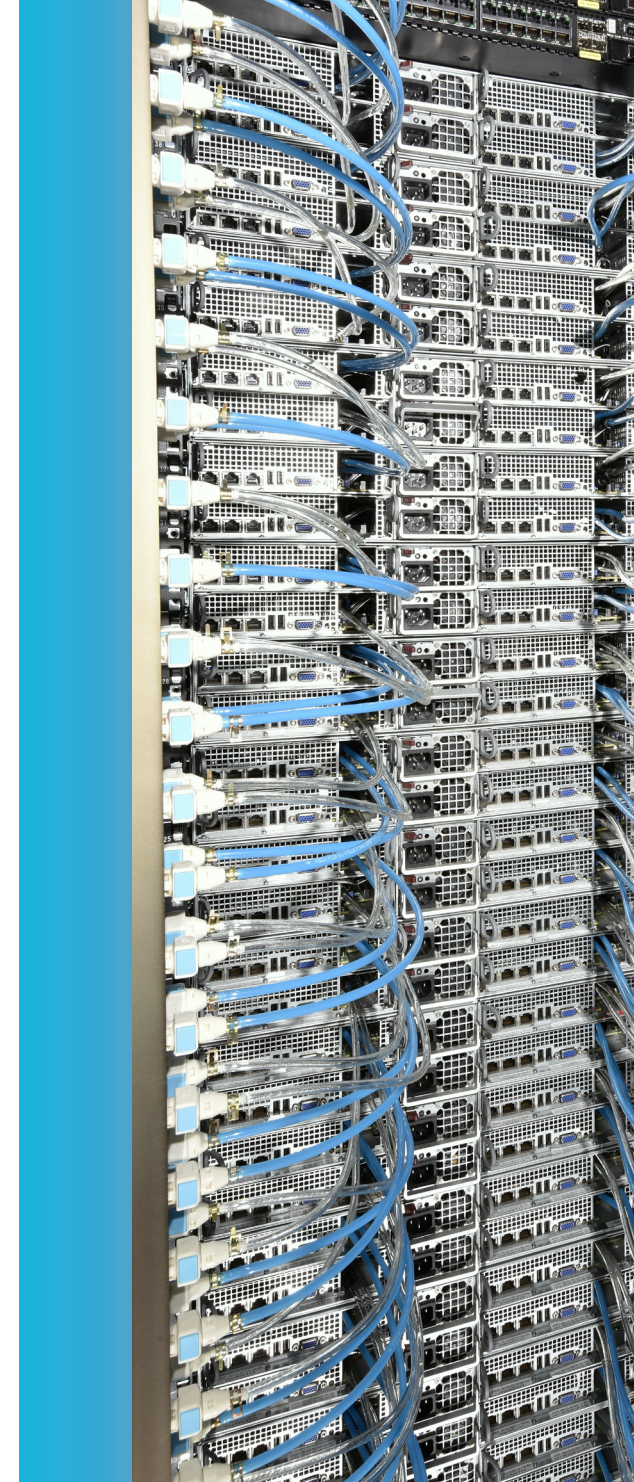


Enhanced Nucleation Evaporator (ENE) and the Server-Kit

# Smart Refrigerant Distribution Unit (S-RDU)

- Self-contained
- Fits into standard racks
- Seamless integration
- Enabling hot installation and swapping of servers
- 3-level leak detection & prevention
- Insulation & heat containment

S- RDU	Imperial	Metric
Length (in., mm.)	78.0	1981
Width (in., mm.)	3.7	95
Depth (in., mm.)	2.0	50
Weight (lb., Kg.)	18.1	8.2
Mounting type	Tool-less Buttons	
Number of connections	1 per Supply & Return RU	





# Heat Rejection Unit – Air and Water

- Multiple connection options to RDU or blind mate connectors, pre-assembled for easy installation
- Easy access and no refrigerant piping above or below the racks

- Full redundancy of Novec™ pumps
- 19" rack mountable unit 6U by 40" depth form factor

## Available in air-cooled and water-cooled solutions

### 20kW A-HRU

- Air cooled condenser (single loop, 1.03 pPUE),
- Newest version of the technology
- The ONLY completely waterless solution available to the market
- Enables implementation of HyperCool in facilities without access to water

### 70kW W-HRU

- Water cooled condenser (double loop, 1.1 pPUE)
- Enables industry's highest density solutions leveraging existing water to HRU infrastructure

\*In-row and external HRUs are available

## Air and Water Technical Specifications

Attribute	A-HRU		W-HRU	
	Imperial	Metric	Imperial	Metric
Nominal CPU/GPU Cooling Capacity	20kW	20kW	70kW	70kW
Height (in., mm.) 6U	14.4"	266mm	14.4"	266mm
Weight	66lbs	30kg	176lbs	80kg
Length (in., mm.)	39"	1000mm	39"	1000mm
Width (in., mm.) 19"	17"	436mm	17"	436mm
Electrical Requirement	0.93kW	0.93kW	0.8kW	0.8kW
Voltage/Amperage	100VAC - 9.3A 240VAC - 3.9A	100VAC - 9.3A 240VAC - 3.9A	100VAC - 8A 240VAC - 3.3A	100VAC - 8A 240VAC - 3.3A



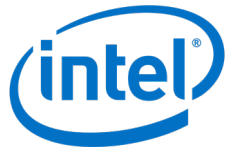
# Software-Defined-Cooling Platform (SDC)

HyperCool is a complete hardware system, enhanced by a software-defined-cooling platform, for cooling assets virtualization, predictive operations and optimization.

- System performance optimization
- Automates resource provisioning & management
- Increases system resiliency and redundancy
- Provides cooling resources modularity
- Big data collection and analysis



Intel and ZutaCore have strategically integrated Intel® Data Center Manager (Intel® DCM) into ZutaCore's HyperCool SDC platform. Intel Data Center Manager offers enterprise and service providers real-time power and thermal monitoring for servers, racks, and groups of servers in the data center. Together, ZutaCore's SDC platform enhanced with Intel DCM's suite of tools increases SDC functionality by helping data center operators gain visibility into computing power assets and opportunities for increased rack density. Ultimately, it answers the increasing demand from data center operators for innovative strategies to leverage software for predictive cooling schemes for maximum utilization of resources at the highest power efficiencies.





# HyperCool - Unlocking the Power of Cooling

The ZutaCore HyperCool waterless DCEC based system provides a unique combination of benefits that directly addresses today's computing density needs and the future cooling demands of the world's computing infrastructure. Mechanically self-regulated, HyperCool provides on demand capabilities simply and reliably for high performance computing applications requiring high densities in new design and retrofits such as artificial intelligence (AI), machine learning (ML), autonomous vehicles and 5G networks.

With global data center infrastructure partners, ZutaCore is ready to scale and provide customers with a trusted pathway to adoption. Through the HyperCool system, ZutaCore empowers customers to accelerate return on investments and maximize real estate assets with future-proof technology, redefining what is possible in data center design and operations.

