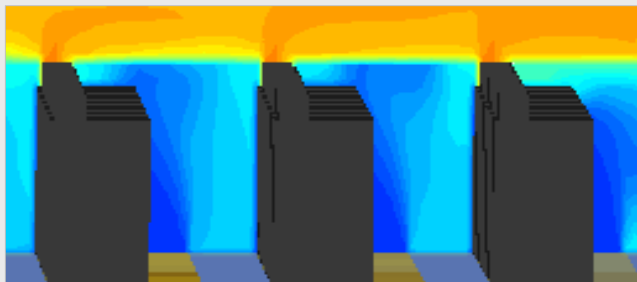


## Application

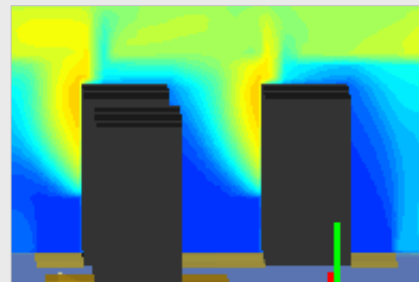
# Create Efficient Data Center Space with Containment Cooling Systems

**APPLICATION | EC7002B**  
**Published August 2010**

**Data center model illustrates Containment Cooling  
stability compared to excessive bypass of cool air**



Full heat return – all cool  
air bypass eliminated



Non-ducted return – allows  
excessive bypass



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### IT Industry Increases Supply Air Temperature

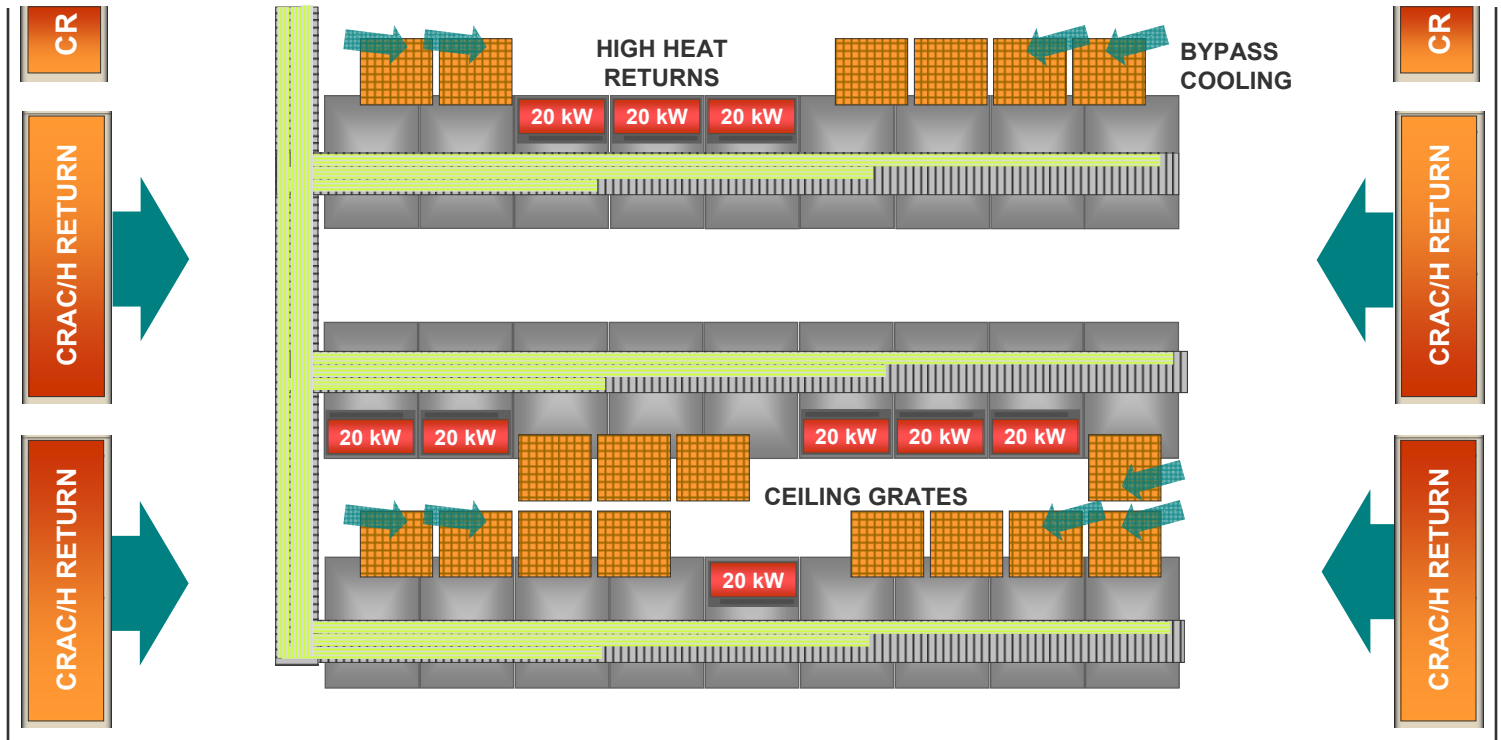
ASHRAE increased the acceptable intake temperature to 80.6 °F (27 °C), specifically for improved data center cooling efficiency. Chillers consume the most energy in a typical cooling circuit and, with raised supply air temperatures, are operational less of the time. The U.S. Army Corp of Engineers, General Dynamics, and Oracle are a few organizations that have selected Opengate systems to automate data center cooling and maximize energy efficiency.

# Reclaim Wasted Cooling – Use Containment Cooling on Just a Few Racks

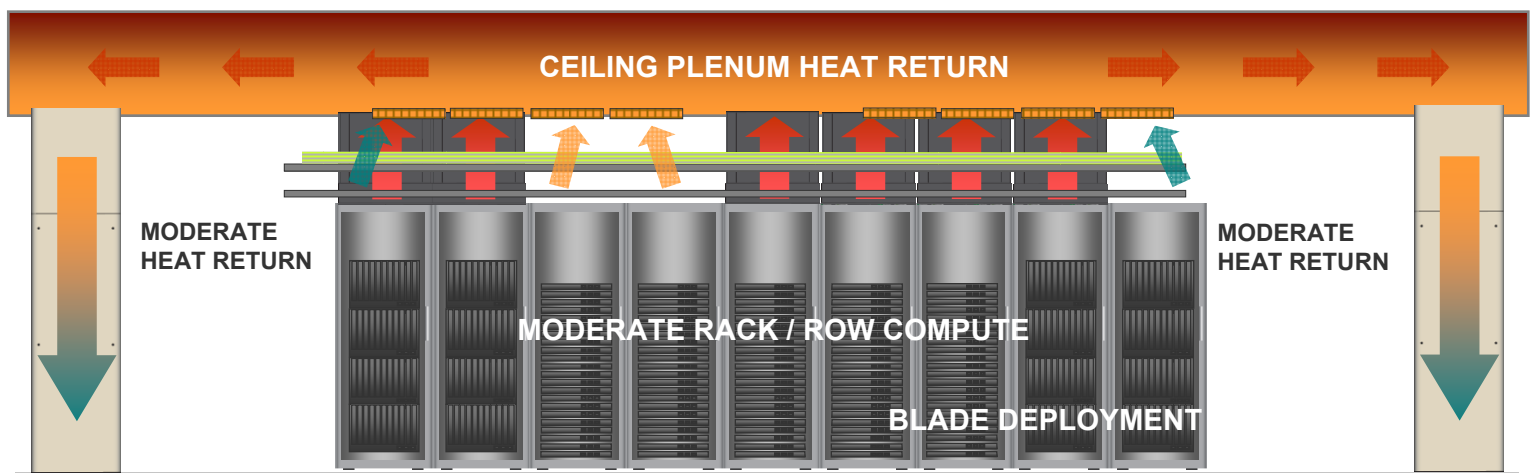
## Add high-density racks with an effectively managed heat containment circuit

Most data centers operate with excessive over-provisioning of cool air. There is typically 2 to 2.5 times the cool air needed being delivered, but hot spots still remain, leaving plenty of opportunity to reclaim wasted cooling. Contain and return the heat from the higher-density rack heat loads directly back to the perimeter cooling units using a ceiling plenum return. This effects a substantial net gain in reclaiming wasted cooling and allows even higher-density rack deployment in the data center space.

### Plan View – Managed containment working in tandem with best practice cooling



### Elevation View – Managed containment working in tandem with best practice cooling



- Meet aggressive growth demands with Opengate Containment Cooling on only your highest-density racks -

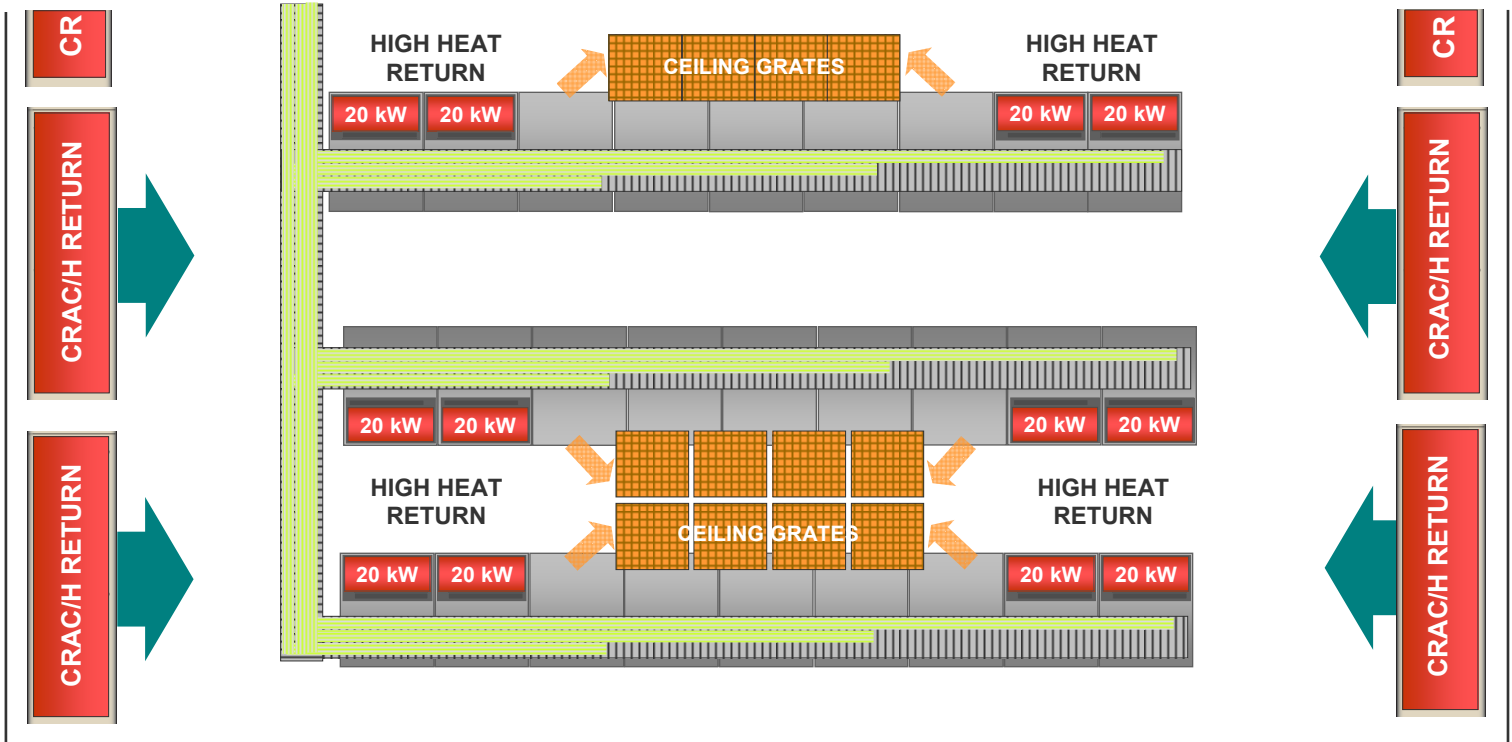


# Reclaim Wasted Cooling – Use Containment Cooling at Row Ends

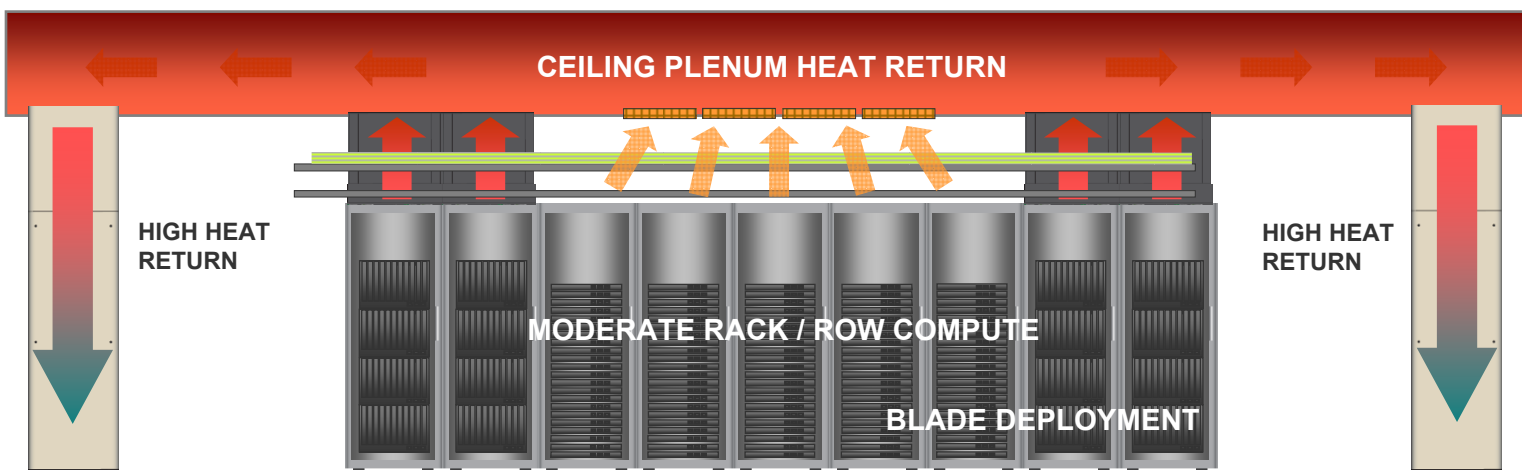
## Add high-density racks with an effectively managed heat containment circuit

Connect CRAC/H returns to the ceiling plenum return and place perforated ceiling grates over low-mid density racks. High-density rack heat is fully contained and sent directly back to the perimeter CRAC/H units. Placing the highest-density racks near the row ends and directing this heat with the Opengate system further reduces cool air bypass, resulting in higher-density IT deployments and lower data center temperatures. With a 1:1 supply and return of air at the row ends, minimal-bypass cool air enters the ceiling grate return.

Plan View – Managed containment working in tandem with best practice cooling



Elevation View – Managed containment working in tandem with best practice cooling



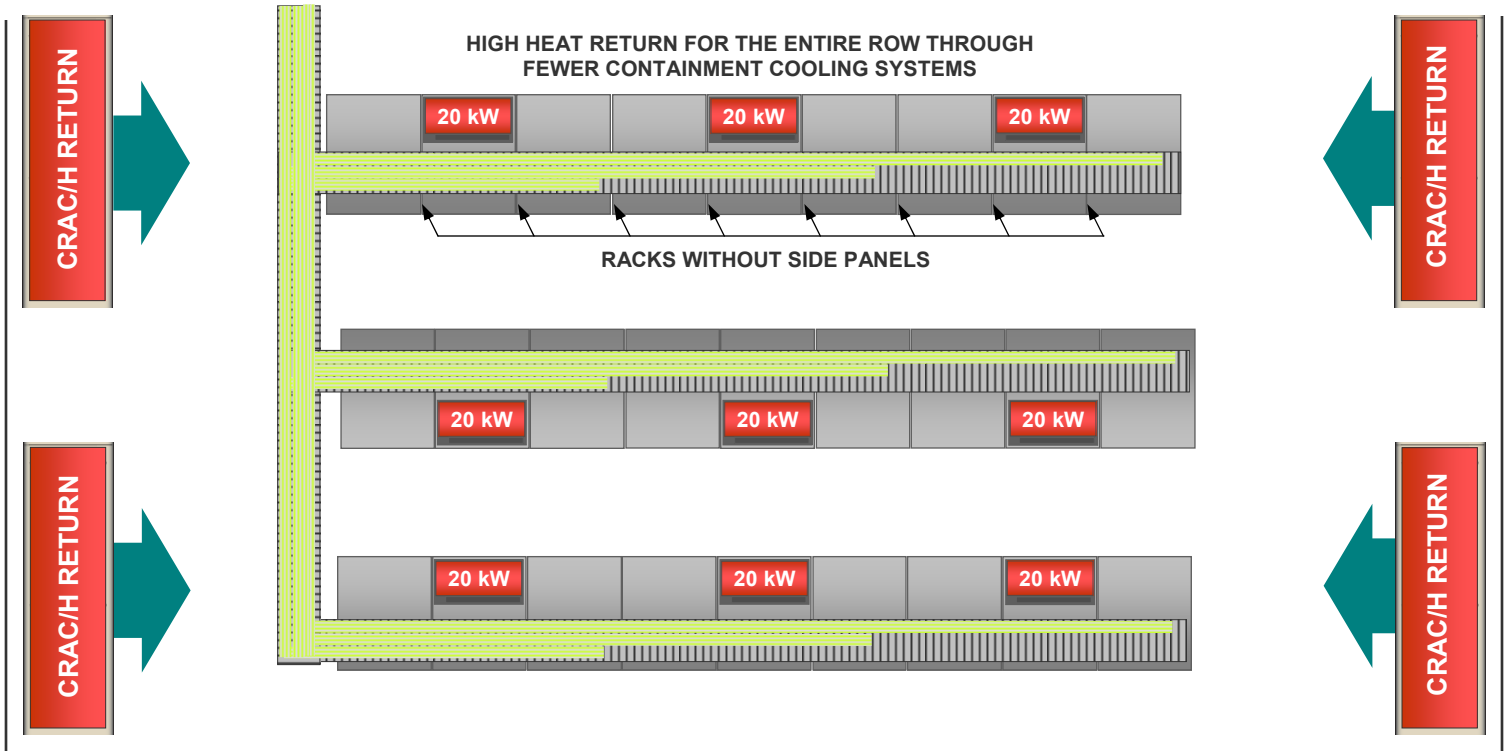
- Prevent end-of-row bypass and hot air recirculation using containment cooling at row ends -  
Minimal height is required in the ceiling plenum as the air uniformly pulls around objects and through tight gaps. Refer to the Husky case study where a 15-inch plenum had obstructions to 4 inches in many areas.

# Reclaim Wasted Cooling – Use Containment Cooling at Row Level

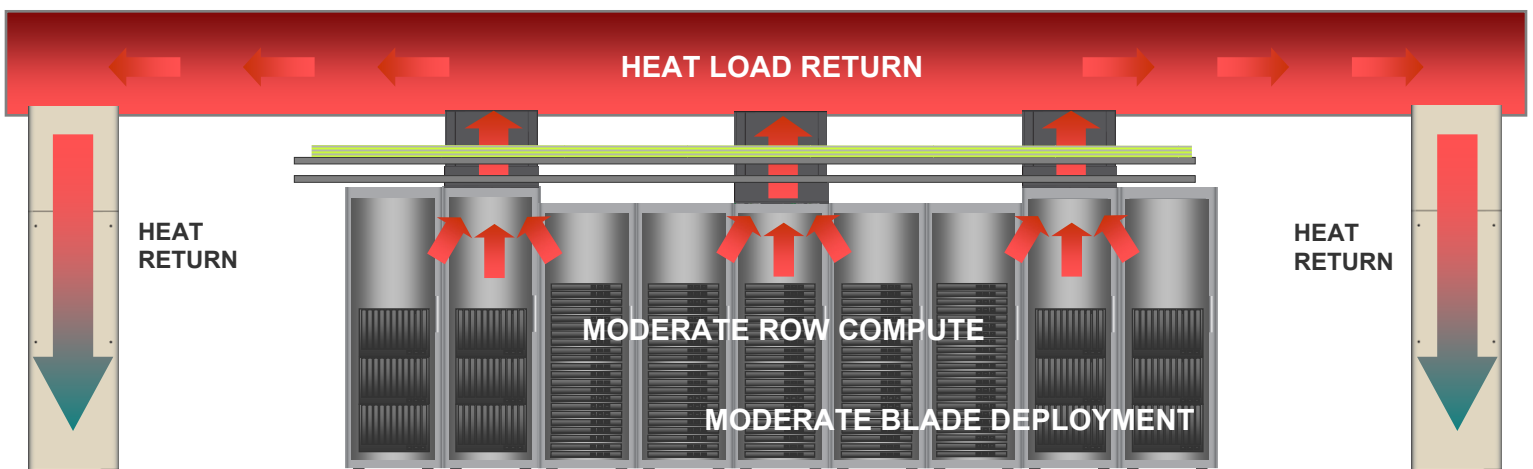
## Achieve medium density at the row level for racks without side (divider) panels

Connecting CRAC/H unit returns to the ceiling plenum return and deploying the appropriate number of **Opengate Containment Cooling systems** satisfy the IT load for the entire row. Open rack sides (no divider panels) between racks and the IT load stacked with a few U-spaces at the rack top is required. Deploy Containment Cooling systems to handle the row load and add additional capacity as needed.

### Plan View – Managed containment at the row level for racks without side panels



### Elevation View – Managed containment at the row level for racks without side panels



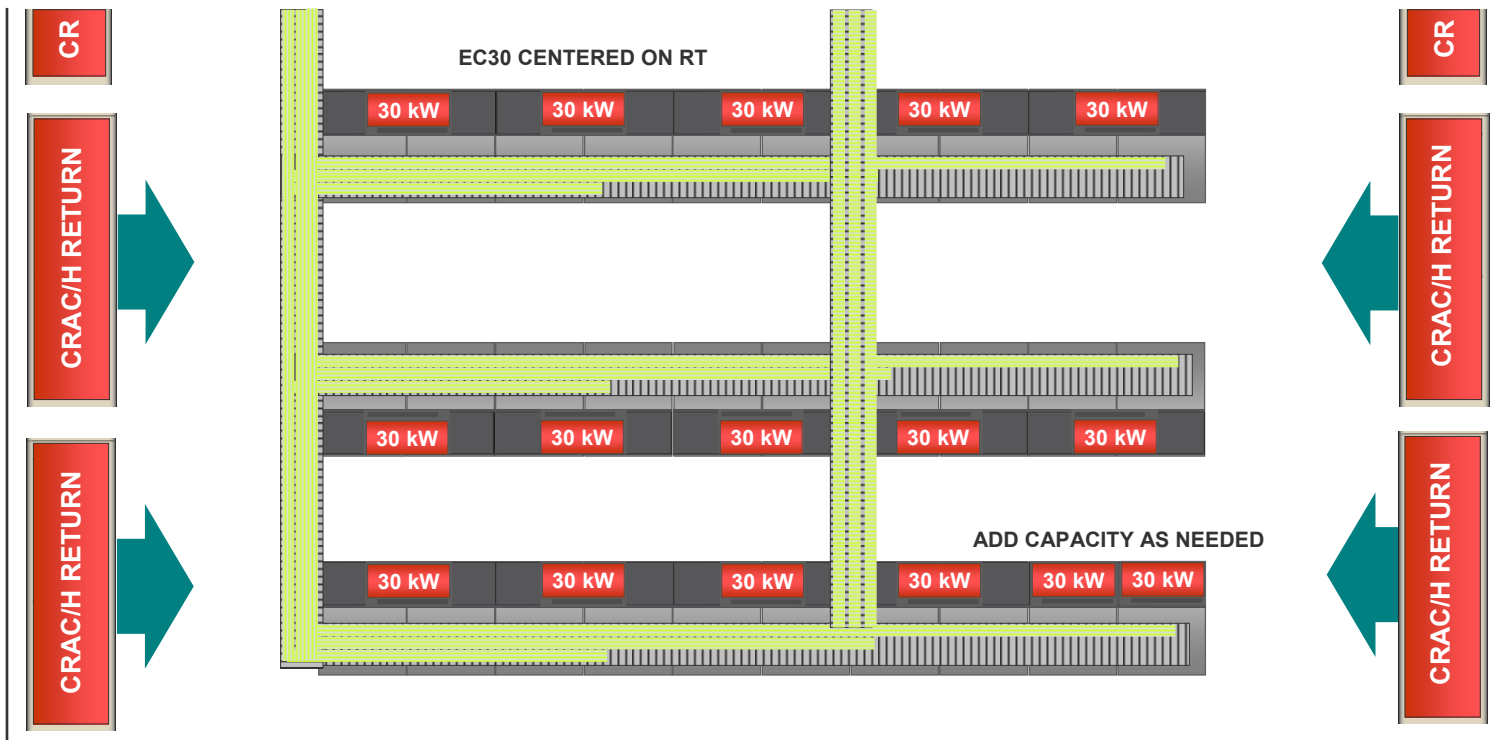
- Racks of varying height in the same row are easily accommodated in this Containment Cooling scenario -

# Reclaim Wasted Cooling – Use Containment Cooling at Row Level

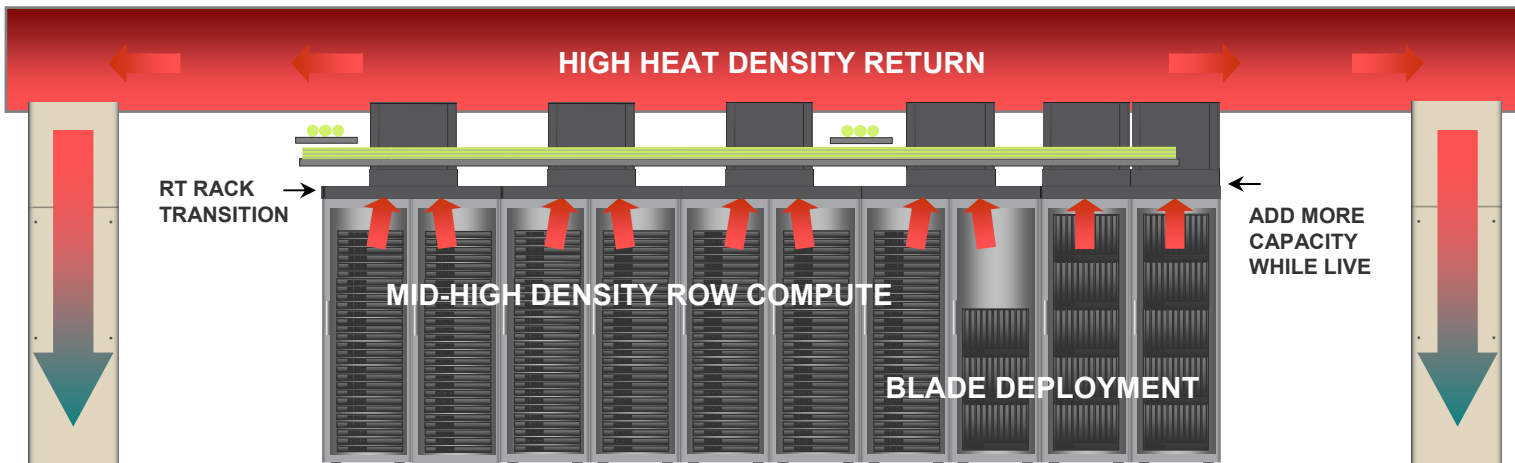
## Achieve medium to high-density managed containment using Opengate 2 Rack Transition

The Opengate Rack Transition allows you to use one Containment Cooling unit across 2-3 racks. Effectively cool up to 15 kW per rack and scale up to 30 kW per rack by simply moving and adding additional capacity when needed. This deployment works with or without divider panels between racks. You can stack IT load to the top of the rack.

### Plan View – Managed containment at the row level using Opengate RT



### Elevation View – Managed containment at the row level using Opengate RT



- Avoid crossing cable trays and add Containment Cooling systems as needed -

Move Containment Cooling systems in 6-inch increments left to right along the 2-Rack Transition. Variable positioning avoids over-rack obstructions such as cable trays and sprinkler heads, and allows you to add more managed heat containment capacity as needed.



*“Opengate exceeded expectations—a seamless effort from specifying to start-up. We’re now placing high-density racks wherever we need to and we never receive temperature alarms.” – Steve Hawley, Medical College of Wisconsin*

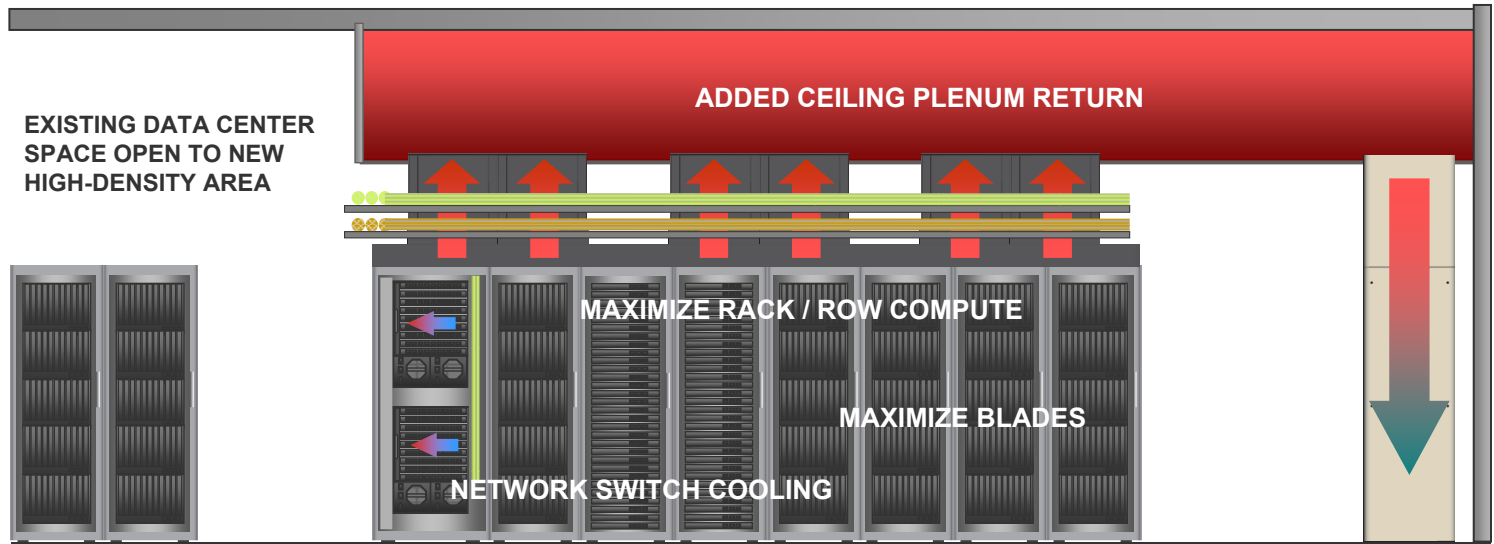
# Deploy a New Ceiling Plenum and Reclaim Wasted Cooling

## ASHRAE award-winning 12K sq-ft, high-density computing area expanded from one wall

Add a ceiling plenum to part of or the entire data center for a very reasonable investment, and without the disruption caused by adding supplemental cooling systems. <sup>1</sup>Oracle converted 12K sq-ft within an existing space of 82K sq-ft at their main data center in Austin, Texas (ASHRAE Journal Dec 2008 or ASHRAE HD Data Centers Case Study Book). Oracle received a National ASHRAE Award for this High-Density Rack Heat Containment method in January 2010.

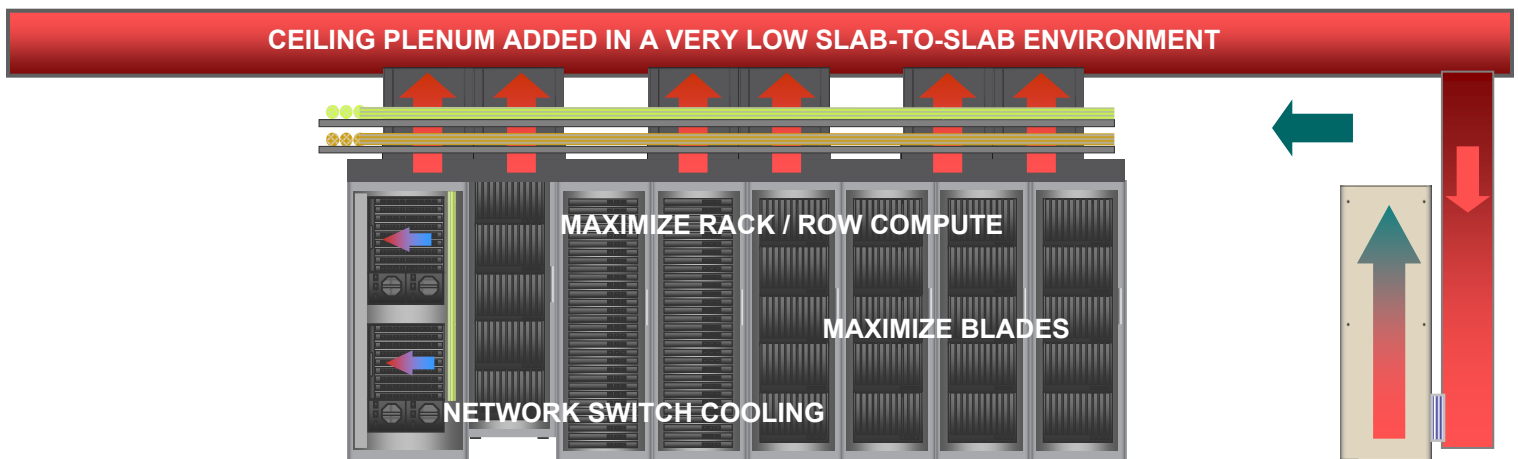
*"We're putting Opengate on all new racks coming into our high-density area." – Mitch Martin, Oracle Chief Engineer*

### Quickly deployed & ultra-efficient, high-density computing area



### High-density computing area in a low slab-to-slab environment using upflow units

You can fully utilize existing upflow-type AC units (as shown below). This configuration may require you to move units forward to allow rectangular ducting to be placed behind the AC unit for a direct return air path from above.



- Fully utilize available cooling -

Add a ceiling plenum with a height as low as 9 inches and create an entire cooling circuit with upflow or downflow units.

