Raised Floor Data Centers

Prepared for the Future

Tate®

“Raised Floors Protect My Investment by Providing a Foundation for Current and Future Technologies.”

Creating the Future Proof Data Center Environment

The perfect data center environment requires the ability to handle a large number of data cables, the ability to efficiently handle high heat loads that are variable and diverse, and the ability to adapt for future technological and cooling advancements. Tate's system addresses all of these needs in a highly adaptable space that provides the ability to respond quickly and easily to client, organizational and technological changes – all while being cost-effective in both construction and operation. With Tate's access flooring solutions, you'll be able to address all of the demands of a data center while meeting the everyday needs of its users in a secure and reliable environment.

Advantages of a Raised Floor

- Enhanced cooling capabilities and control.
- Ability to accommodate a range of cooling solutions while increasing efficiency and heat load capacities.
- Easily incorporate redundant cooling with a single or multiple cooling strategies.
- Flexibility to incorporate the most energy efficient design opportunities for cooling data centers.
- Easily adapt to technological and client changes over the data center's life-cycle at low cost.
- Offers the best overall solution for distributing water and other liquid cooling agents to row and rack based equipment.
- Water distribution lines placed under a raised floor pose less threat in the event of water leaks or condensation due to system failure.
- Provides the ability to separate water, power and cable.
- Ability to terminate cables wherever you need them with complete flexibility, accessibility, and unlimited capacity.
- Reduced operating costs and lower facility and maintenance costs through accessible, flexible, and adaptable services.
- Underfloor service distribution space keeps the interior space clean and neat for proper air migration in-and-out of equipment.
- Raised floors provide the platform for future scalability.

Raised Floors Compliment Any Data Center Design

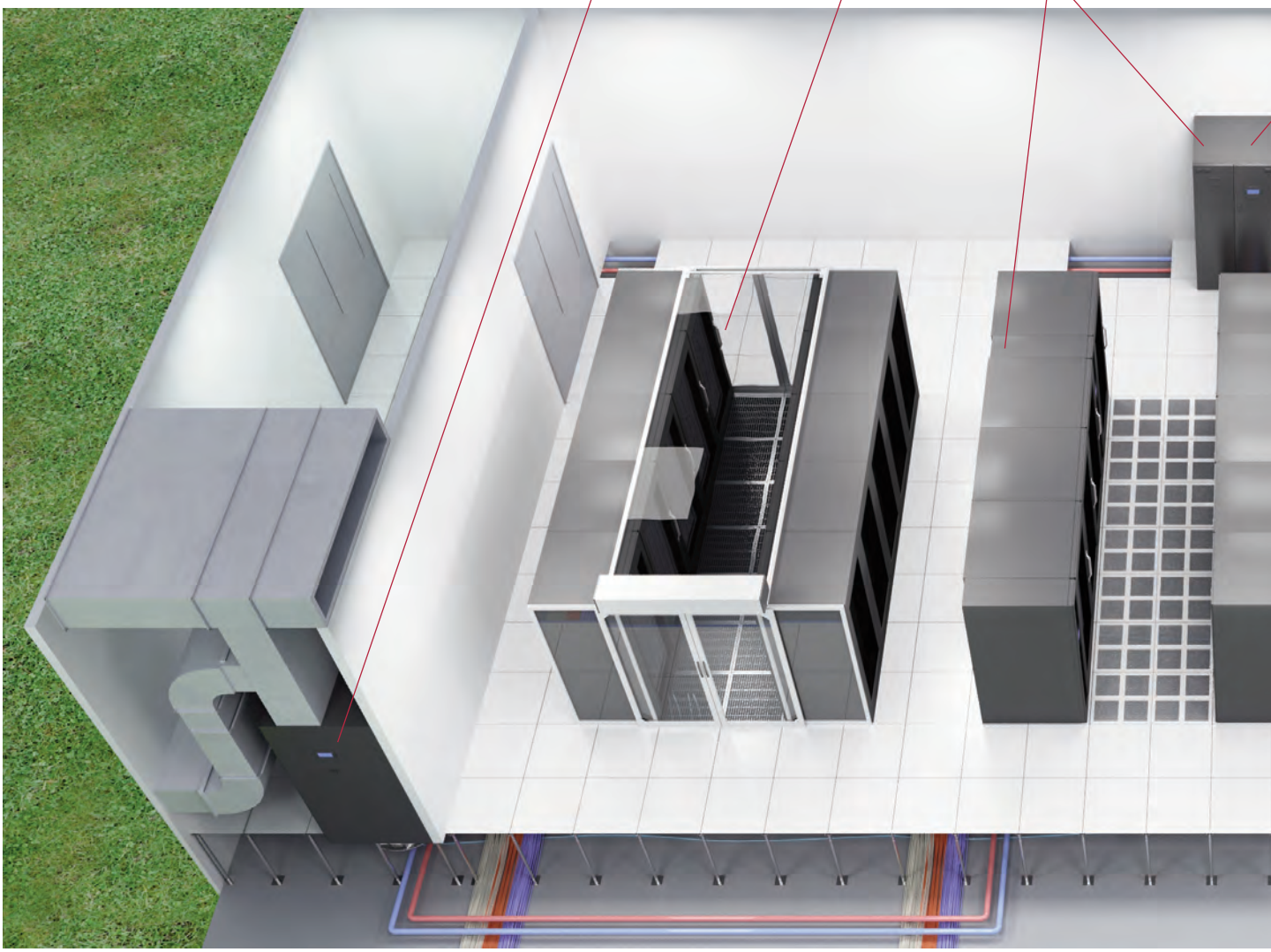
Flexible, Adaptable, Scalable & Efficient

These four words are the cornerstone of what data center designers, owners and managers strive to create in their facility. The raised floor environment is perfectly suited to provide them all. Managing and segregating large volumes of wires, cables, water lines and other distribution systems is complemented with a raised floor. As equipment is updated and technology changes, additional services can be added or relocated without abandonment or structural changes. The build-out of a raised floor can be easily stopped and started for a phased approach. And raised floors provide the platform to easily implement any current or future cooling strategy for optimal energy efficiency.

Economized Air Handlers pull large volumes of air from outside and pressurizes a raised floor plenum to cool the equipment. *(page 17)*

Full Containment solutions are used to prevent cold air from mixing with hot air. *(page 15)*

Row Based Cooling solutions use a pumping unit to supply water feeds underfloor to in row cooling equipment. *(page 11)*



The Data Center Design is Constantly Changing.

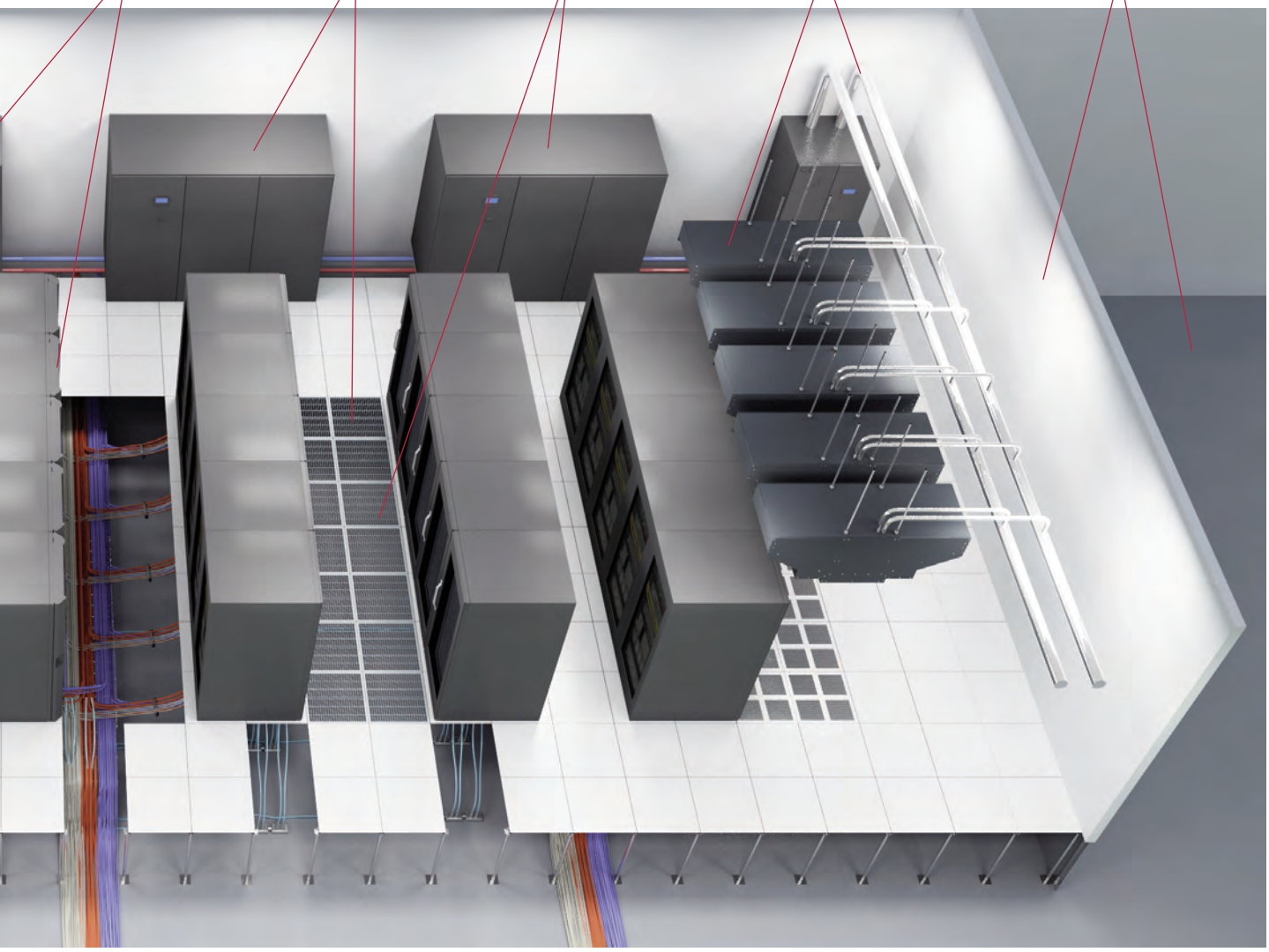
Rear Door Exhaust
Systems use pumping units to supply water feeds under a raised floor to rack mounted equipment. *(page 12)*

Perimeter CRAC Units
use a pressurized plenum to deliver cool air under the raised floor and to the racks for both primary and back-up cooling. *(page 6)*

In-Floor Cooling Devices
used in conjunction with perimeter CRAC unit or economized solutions to save energy and improve capacity. *(page 8)*

Overhead Heat Exchanger
use refrigerant pumping units which require an open overhead area for airflow, refrigerant lines and equipment. *(page 14)*

Future Unknown Cooling
Temporary walls and Tate's plenum divider can be used to section off space for future expansion. Raised floors provide flexibility to meet unknown future demands.



Will Your Data Center be Ready for What's Next...

Raised Floor Data Centers

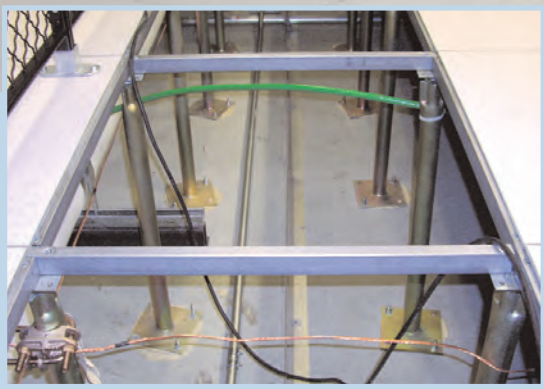
Perimeter CRAC Unit Design

The most common data center design uses a perimeter CRAC or CRAH unit and raised floor to provide the ultimate in air flow distribution flexibility. The under floor plenum space allows the user to selectively distribute air at the volume required so equipment changes can be accommodated more cost effectively.

The use of interchangeable perforated panels, and high air flow grates in both the floor and the ceiling, coupled with the high efficiency down flow CRAC and CRAH units equipped with Tate's CRAC Hood return extension allows the user to realize significant energy savings, while allowing the flexibility that the data center operator has come to expect.

Advantages of a Raised Floor

- Enhanced cooling capabilities and control
- Easily reconfigured to accommodate moves, adds and changes
- Air flow variability from 0-3600 CFM accommodating loads as high as 30kW per rack
- Floor heights over four feet provide virtually unlimited cabling and air flow capacity in easy to access under floor area.
- Reduced operating cost and lower facility and maintenance cost through accessible, flexible and adaptable services
- Removable barriers can be easily installed to divide plenum space for future scalability
- Provides underfloor service distribution path for power and network cabling without the use of a ladder or enhanced structural cable trays and ceilings.



Facility Solutions:
Digital Realty Trust

Digital Realty Trust recently acquired this 111,000 square foot mission critical data center located in Oakland less than 10 miles from San Francisco, California, just a short walk from the city's financial district. Digital Realty is a developer and operator of the world's finest data centers located across North America and Europe with over 14.9 million rentable square feet of modern data center space under management. Digital Realty's data centers are certified to the highest industry standards and compliance requirements, and feature 24/7/365 power, cooling, connectivity and security capabilities to ensure mission-critical operations and business continuity for over 50 Fortune 500 companies.

Tate Access Floors for Data Centers:

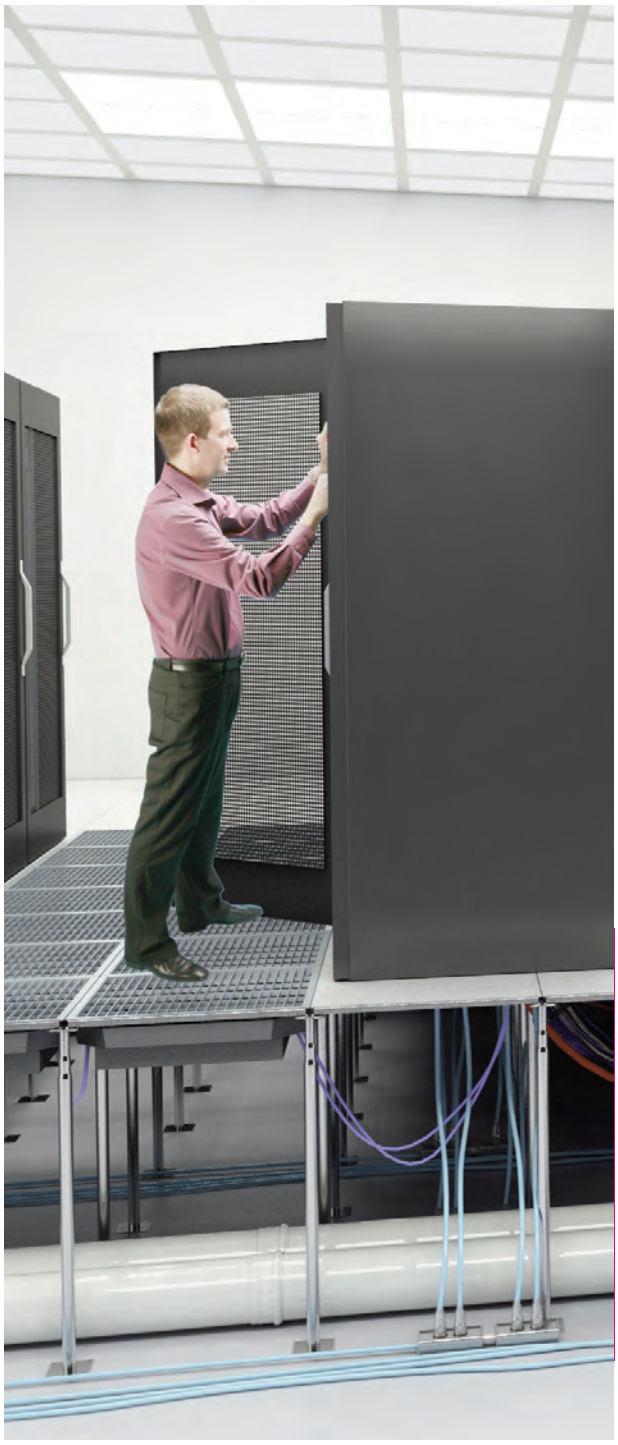
Tate's ConCore panels and seismic pedestals provide the perfect foundation for mission critical facilities. Digital Realty's Oakland Data Center features over 80,000 square feet of usable raised floor. The raised floor environment is ideal for a multi-tenant facility. The flexibility and ease of access to the 30" raised floor is ideal for all kinds of tenant cabling configurations and additions. The ability to swap solid, perforated and GrateAire panels anywhere within the space gives the tenant the ability to deploy high density equipment and the freedom of total configuration flexibility.

Raised Floor Data Centers

In-Floor Cooling Devices

In-floor cooling devices are relatively new and provide a level of control and capacity that was previously unavailable in a traditional CRAC or CRAH unit design. Controlled on a rack-by-rack level these new devices use directionality (DirectAire™), variable air volume dampers (SmartAire™) and floor mounted fans (PowerAire™) to provide exactly the right amount of airflow where it's needed.

The use of rack mounted sensors, and high air flow directional grates, coupled with down flow CRAC and CRAH units using VFD or EC fans allows the user to realize significant energy savings. This savings is gained through several benefits including the ability to deliver higher volumes of air at lower static pressures, the control to deliver exactly the right amount of air needed to cool the equipment, and the significant reduction of by-pass air.



Advantages of a Raised Floor

- Provides mounting platform for devices to provided airflow control on an individual rack-by-rack basis.
- Significant energy savings when devices are used with CRAC units and air handlers equiped with VFD or EC fans
- Provides effective containment without walls or structures
- Air flow variability from 0-3600 CFM accommodating loads as high as 30kW per rack
- Accessible, flexible and adaptable service distribution platform allows for retrofit of devices into existing data centers
- Provides ability to easily handle diverse and variable heat loads.

In-Floor Cooling Devices From Tate

1. **Sensor Mounted to the Front of the Rack**
2. **Cable Cut-out Seal for Distributing Sensors**
3. **DirectAire, High Volume Directional Grate**
4. **SmartAire, Variable Air Volume Damper**
5. **PowerAire, Fan Assist Module**
6. **SmartAire, Power Distribution Module**
7. **DirectAire Panel Lifter**


1
2
3
4
5
6
7

Facility Solutions:
Row Based Cooling Data Center

When this west coast university rebuilt their data center they had already seen the demand for applications that resulted in high rack level density. They selected a design using a raised floor system coupled with perimeter cooling units to provide the cooling to the standard and medium density IT racks, with rack based cooling units chosen to handle the densities above 25kW. The raised floor environment not only provided a service path for networking cables and a location to safely route the chilled water lines, but provided a critical backup source for cooling the racks utilizing the perimeter CRAC units and the underfloor air during emergency cooling situations.

Tate Access Floors for Data Centers:

The versatility of the raised floor will allow for future expansion and built out of the data center space as demand requires. This customer can feel confident, that regardless of the cooling technology chosen, that the raised floor will adapt to any future needs and provide cooling redundancy through the perimeter CRAC unit regardless of the primary cooling strategy.

Raised Floor Data Centers

Row and Rack Based Water Cooled

Row and Rack based cooling systems provide the ability to bring individual cooling system to the IT load, focusing on meeting the heat rejection requirements directly at the load. The row and rack based units typically are fed from a chilled water source in the data center and reject the heat energy from the IT equipment into the chilled water loop. These systems can be spread over multiple racks on the data center raised floor, or dedicated to specific high density racks as a retrofit or spot cooling solution. Closer proximity of the cooling units to the IT load is intended to reduce hot and cold air mixing, and the typical use of variable speed fans and chilled water throttling also help reduce the energy usage of this type of deployment. Row and rack based cooling is also scalable on the data center floor for future expansion and equipment changes.

Advantages of a Raised Floor

- Open plumbing routing space under the Raised Floor provides an easily scalable cooling infrastructure, systems can be installed when and where required
- Raised Floor provides a safe and convenient location for pipe work, and piping connections
- Underfloor piping mitigates the risks associated with condensation and leaks
- Raised Floor can be utilized for redundant cooling source such as perimeter CRAC units and air side economizers
- Raised Floor provides a path for other service distribution such as power and network cabling in addition to chilled water piping

Raised Floor Data Centers

Rear Door Heat Exchanger

Rear Door heat exchangers replace the standard rear door on the IT rack and provide a direct path for heat rejection from the IT equipment through an air to water heat exchanger. The directly coupled nature, and in some cases the elimination of fans in the door itself can result in significant energy savings compared to other cooling technologies.

Much like Row and Rack based cooling systems chilled water must be ran to each rear door heat exchanger. Chilled water must often be first ran to a coolant distribution unit, and then piped individually out to the rear door heat exchangers. There are many advantages to piping these conections under a raised floor including the use of a CRAC unit for redundant cooling. As shown in the picture below any through floor wire cable and piping connections should be sealed using TateKOLDLOK grommet to eliminate air leakage.

Advantages of a Raised Floor

- Chilled water piping can be safely and conveniently accommodated under the raised floor
- Raised floor with perimeter CRAC unit can serve as a means for redundant cooling
- The raised floor provides a safe and convenient location for pipe work, and piping connections
- Underfloor piping mitigates the risks associated with condensation and leaks
- Raised Floor provides a path for other service distribution such as power and network cabling in addition to chilled water piping
- Easily scalable, offering the user quick access to plumbing below the floor for additional installations

Facility Solutions:
Syracuse University - IBM Data Center

Syracuse University has been named one of the 2010 Green 15 by GDC's InfoWorld for its innovative Green Data Center. The annual Green 15 award recognizes the 15 most innovative IT initiatives of organizations around the world that have embraced green technology to drive projects and develop products aimed at boosting energy efficiency, trimming waste, and reducing or eliminating the use or the production of harmful substances.

A collaboration of SU, IBM and New York State, the GDC has been hailed as one of the world's greenest computer centers, designed to use about 50 percent less energy than a typical data center. The $12.4 million, 12,000-square-foot facility (6,000 square feet of infrastructure space and 6,000 square feet of raised-floor data center space) was completed in early December 2009 and became fully operational in April 2010.

The GDC is used by SU as its primary computing facility and by IBM as a showcase to demonstrate how energy-efficient technologies can reduce energy costs and environmental impact.

Tate Access Floors for Data Centers:

The Syracuse University Green Data Center is equipped with 40" floor heights to provide the necessary space for multiple functions. The primary cooling method used in the data center is rear door heat exchangers mounted to each rack. These units directly cool the hot air from the IT equipment, and return it into the space at the required temperature for equipment to take back in reheat, and pass back again through the rear door heat exchanger. The raised floor is used to route the chilled water lines from the facility to the rear door units in a safe manner. The racks in the space are also a large consumer of electricity, and the power cabling is passed from the power distribution unit, via power whips under the floor to each rack. Finally the raised floor space is also used as a means of backup cooling. CRAH units are installed around the perimeter of the facility, and can provide additional or redundant cooling to the mission critical IT hardware in case of other cooling system loss of capacity.

Tate

Raised Floor Data Centers

Overhead Heat Exchanger

Overhead and above rack cooling systems have quickly become an accepted method for adding additional cooling capacity to high density rows of equipment. These systems are meant to compliment perimeter CRAC and CRAH unit designs to provide additional air delivery to the cold aisle. Refrigerant piping is routed overhead to a pumping unit which handles the exchanges from refrigerant to chilled water or outdoor air.

Since these systems are design to add capacity where perimeter CRAC and CRAH units can no longer supply adequate cooling, the raised floor area is often utilized in the same way. Air is still delivered under the raised floor to the equipment in the low, medium and high density zones, and additional cold air is delivered where it is needed in those zones, allowing for a precisely provisioned data center. Raised floors further complement this design by proving a distribution path for wires and cables that do not obstruct the distribution of cooling lines and overhead equipment.

Advantages of a Raised Floor

- Dual airflow paths allow for redundancy in mission critical locations
- Raised floor space is used for power and cabling distribution to allow for overhead design of equipment and refrigerant lines
- Separation of chilled water lines feeding the pumping unit, power cables, networking infrastructure and air flow is all possible

Raised Floor Data Centers

Full Containment Solutions

Total containment systems such as Tate's ContainAire™ prevents the cold supply air from mixing with the hot exhaust air prior to being ingested by the data center equipment. This is accomplished through several variations that contain either the hot or cold air while allowing the other to flow freely throughout the space. Hot or cold aisle containment typically features side wall barriers mounted to the racks at each end of a row with a roof that is either mounted to the top of the racks or extending from the top of the rack to the ceiling. Exhaust chimneys are a common variation of hot aisle containment where chimney structures are attached directly to the back of the racks to allow the hot air to move to the ceiling plenum without mixing with the cooler space air. This system allows the aisles to remain free of obstructions.

Since these systems are design to add capacity and energy efficiency by eliminating mixing, the raised floor area is often utilized as a supply plenum to deliver the air directly to the cold aisle. Raised floors further complement this design by proving a distribution path for wires and cables that do not obstruct or penetrate the containment system walls.

Advantages of a Raised Floor

- Enhanced cooling capabilities, control and efficiency
- Easy supply source for air flow variability from 0-3600 CFM to accommodate virtually any high density heat load
- Raised floor space is used for power and cabling distribution to allow for air tight aisle containment without penetrations

Facility Solutions:
Manassas Colocation Facility

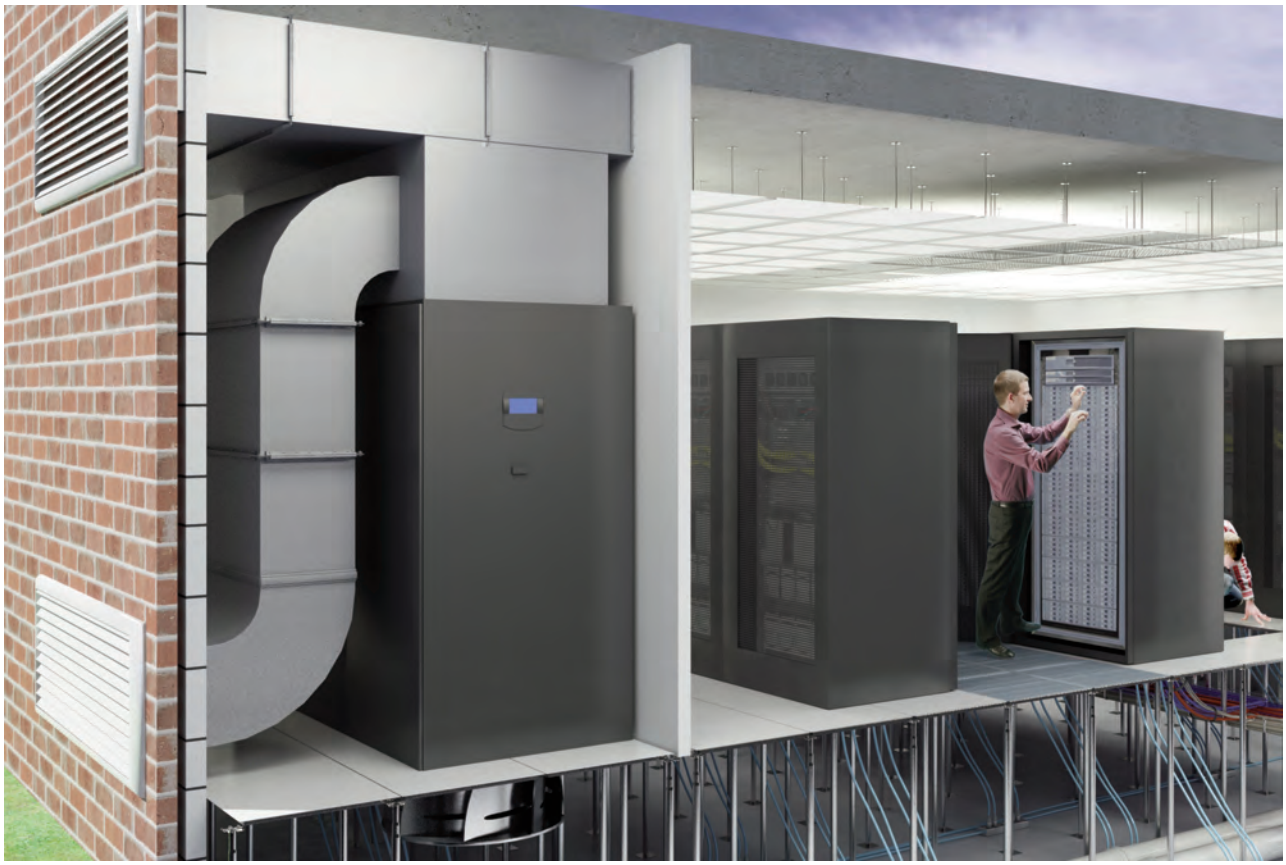
The 220,000 sqft facility is located just 30 miles outside of Washington DC is designed to meet Defense Threat Reduction Agency (DTRA) standards for security. The two-level building features 100,000 sqft of raised floor area which is scalable from 120 to 300 watts per square foot. The data center consists of two 50,000 sq.ft. rooms subdivided into eight 6,250 sq.ft. modules. The upper level houses one room and 6,000 sq.ft. of office space while the lower level houses the second room and 50,000 sq.ft. of mechanical and electrical equipment. The flywheel design of the UPS system and energy-efficient electrical infrastructure help achieve a PUE of 1.28. The modular and scalable facility can be customized to suit the diversity, reliability and capacity requirements of any client allowing them to adapt thier investment to the size of thier business with lower risk and capital exposure.

Tate Access Floors for Data Centers:

Instead of conducting chilled water to each client's rack area, the facility uses an evaporative cooling system that delivers cool air to the IT equipment. The cooling system delivers air through grates installed in the raised floor. Unlike conventional facilities the system is powered by six 180-ton commercial air handlers with variable-frequency drives that do the work of 9 20-ton CRAC units. They are rated to be 25% more efficient and provide clients with 33% more rack capacity.

Raised Floor Data Centers

Economizer Design



The use of air side economizing in the data center space has come into its own in recent years as one of the key ways to reduce the energy usage in the data center space. Historically deployed with containment methods and raised access floor, the overall impact on the data center energy bill is significant.

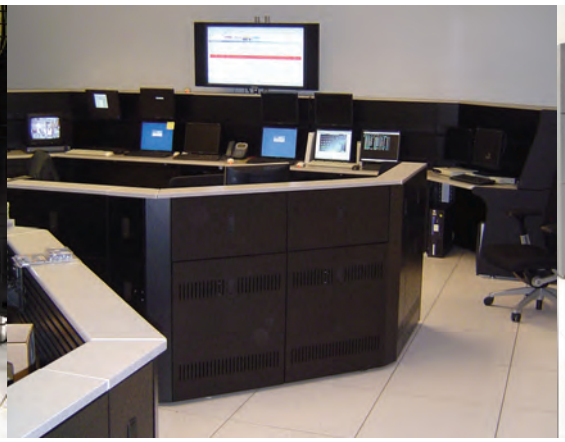
The raised floor plenum provides the ideal initial pathway from the economizing system. Now when the system is deployed using Tate's DirectAire to deliver air precisely where it is needed; containment systems can be eliminated ensuring that the outdoor air does not mix with the hot exhaust air prior to entering the rack.

Advantages of a Raised Floor

- Varied raised floor heights can accommodate the required air flow volumes for any desired capacity
- Raised floor space can accommodate cabling for network and power for ease of deploying containment strategies
- Back-up cooling equipment can easily be added to the same air distribution system
- Deploying with Tate's DirectAire grate eliminates the need for a full containment system

Prepare Your Data Center for the Future

With the ever increasing requirements for flexibility, capacity, and efficiency in the data center, the raised floor environment will continue to provide a key platform to deliver critical services. Recent years have brought dramatic changes in the way data centers are built and operated, everything from the infrastructure and cooling to computing equipment and management have undergone significant adaptations. Most notably, we have seen the raised floor data center environment transform from a traditional perimeter CRAC or CRAH only approach to a multifaceted array of solutions applied on the raised floor to accommodate both capacity, efficiency and redundancy requirements.


The need for scalability, modularity, and flexibility coupled with the array of solutions available on the market make the need for a raised floor in a data centers easy to understand. New technologies are adopted and implemented very quickly in the data center. This requires facilities to be built so they can accommodate current systems while being flexible enough to protect the investment and remain reliable and competitive in an unknown future.

With raised floors in your data center the future is bright.

- Enhanced cooling capabilities and control.
- Ability to increase efficiency and heat load capacities.
- Adapt to technological changes over the life of the data center.
- Easily distribute & segregate water, power and cable.
- Terminate services in a flexible and adaptable platform.
- Clean & neat interior space to ensure proper air migration in-and-out of equipment.
- The platform for know & unknown future scalability.

“Raised Floors Provide My Data Center the Flexibility, Capacity and Energy Efficiency to Operate Successfully.”

Data Center Products

Visit www.tateaccessfloors.com for more information

SmartAire

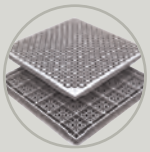
VAV damper to automatically control airflow at the rack level improving energy efficiency.

DirectAire

68% open area all steel panel that angles airflow to achieve a 93% TAC rate.

PowerAire

Fan assisted airflow at the rack level for handling extremely high & diverse heat loads.



GrateAire

56% open area aluminum grate capable of delivering 2100 CFM @ .1" H2O.

Corporate Headquarters:
7510 Montevideo Road, Jessup, MD 20794
Tate Hotline: 1-800-231-7788
Tel: 410-799-4200 Fax: 410-799-4207

Production Facilities:
7510 Montevideo Road, Jessup, MD 20794
52 Springvale Road, Red Lion, PA 17356

tateaccessfloors.com
kingspan.com

Tate Access Floors, Inc. components are proudly made in the U.S.A.

International Sales & Support Office:
169 Jalan Jurong Kechil
#7-011, Sherwood
Singapore 598669
Tel: 65-6468-1332 Fax: 65-6468-6681

tateglobal.com
kingspan.com

Canadian Office & Production Facilities:
880 Equestrian Court, Oakville, ON L6L 6L7 Canada
Tate Hotline: 1-800-231-7788
Tel: 905+847-0138 Fax: 905+847-0141

tateasp.com
kingspan.com

For a white paper on Long Term Flexibility – Raised Access Floor and the Future of Data Center Cooling visit www.tateaccessfloors.com/resources/white_papers.aspx

A member of Kingspan.