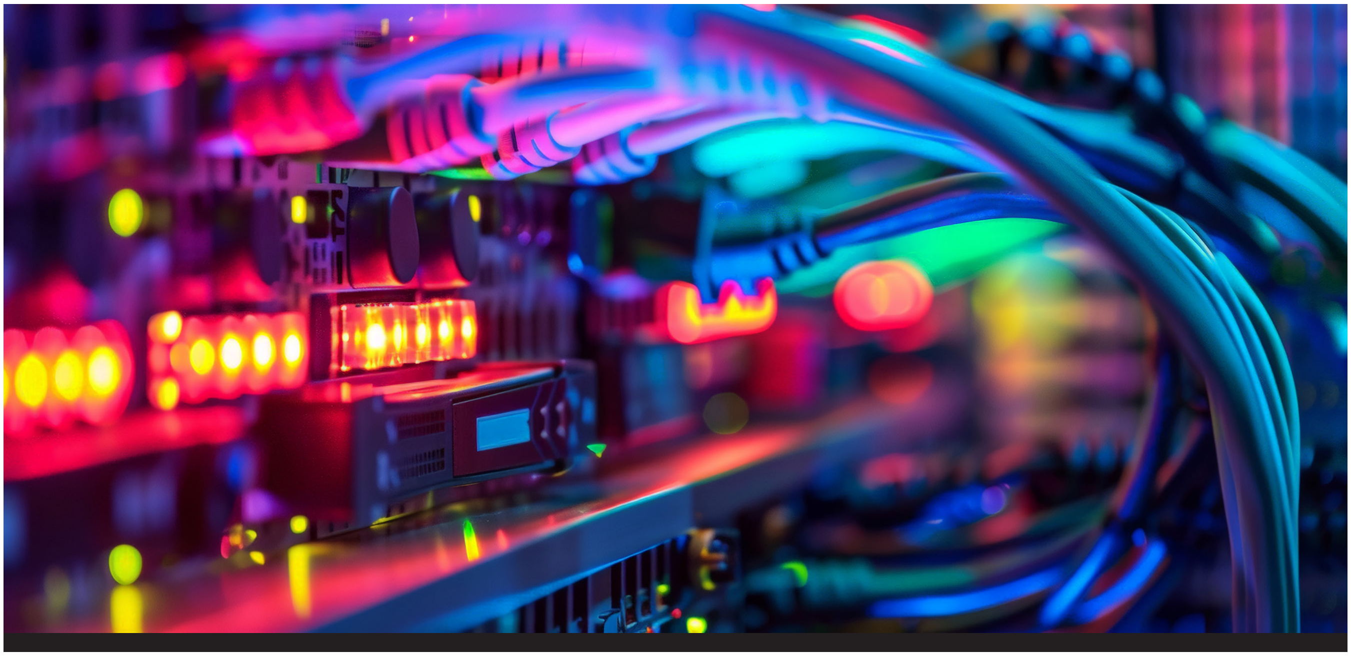


introduction

Data centers are foundational to the digital infrastructure of the modern world. They support cloud computing, data storage, business operations, and are essential for connectivity across industries. From enabling work-from-home setups to providing storage for vast amounts of data for global corporations, these facilities are integral to virtually every aspect of modern society. Here, we'll provide an overview of the types of data centers, followed by planning and design considerations for your data center project.

DATA CENTER CLASSIFICATIONS

Managed. The day-to-day function of the data center equipment is operated by a an entity other than the user, either within the owner's facility or in a data center owned and operated by a data center provider in a colocation data center.

Colocation Center or Colo. The customer's IT equipment is hosted in a data center owned and operated by another entity. The data center operator provides the physical infrastructure.

Micro Center. The micro center has the components of a traditional data center (electrical power with UPS & PDU, in-rack cooling, and remote operations) but is scaled down into a single cabinet. Micro Centers can be used in remote locations where there is a need for network connectivity.

Enterprise Center. This is a traditional data center owned and operated by the same entity, usually on-site or adjacent to the devices it is serving. This classification is popular in industries where data privacy or security is a prime concern.

Cloud Data Center. Also known as "someone else's data center." Here, the customer's data is stored on "public" servers that are owned by the data center operator. These are large scale facilities which host data equipment in remote locations to support users 24/7/365.

Edge Center. This is a data center close to the devices it serves and is usually a smaller footprint than a Cloud or Enterprise facility, but larger than a Micro Center. The Edge Center is often located on the periphery of metropolitan areas to connect devices for 5G and telecommunications, digital streaming services, internet of things (IoT), autonomous vehicles, and more.

Hyperscale Center. This data center is an extra-large cloud data center of 500,000 SF to 1,000,000 SF+ in size and have grown to dominate the data center market in the last ten years. These facilities typically use 100-1,000+Mega watts and can be in a campus-like environment with multiple buildings. Amazon Web Services, Microsoft, Google, and Meta “The Big Four” operators of Hyperscale Centers and dominate the hyperscale market.

DATA CENTER TIERS

emersion has experience in the hierarchy of data centers as defined by TIA-569 standard including Tier I, Tier II, Tier III, Tier IV.

planning

Key data center planning considerations include:

Zoning. Municipalities often allow data centers within commercial, industrial, and minimal agricultural developments. The preference is for sites not adjacent to residential areas or institutions due to the scale of the facilities, the generator and chiller noise, and light pollution.

Site. Appropriate topography is essential to a data center’s operation. The current generation of colo/hyperscale facilities have reached a size that require the site to be as flat as possible while maintaining acceptable stormwater drainage. Consideration should be given to site circulation to allow access for emergency vehicles and semi-truck deliveries.

Hazards. Due to the massive investment of the physical infrastructure and IT equipment, the site should be evaluated for risk. Insurance providers have specific requirements that need to be met for policy coverage. It is wise to locate data centers in regions that mitigate the risk of natural hazards.

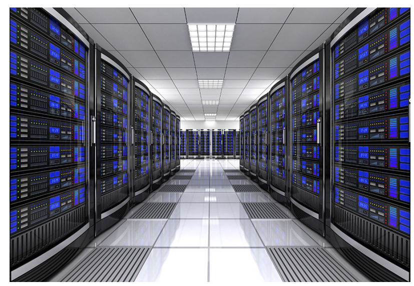
Power. This represents the single largest operating expense of data centers. Regions with abundant power have historically offered cheaper electric rates to industry users. Ideally, data centers should have connections to multiple utility substations in order to provide redundancy in the event of a shutdown at one substation. Backup power is also required in the event of an outage. The industry standard is to achieve redundancy with large diesel generators located in an exterior generator yard.

Due to power restraints and community concerns, the largest data center installations are developing their own utility-scale power generation plants. The generation energy source is typically diesel or natural gas with a growing interest in onsite nuclear plants.

Cooling. Computer chips in server blades generate a significant amount of heat that require cooling during their operation. The method of cooling is dependent on the climate zone, the size of the facility, water availability, and the power density of the server cabinets in the data halls.

Connectivity. A data center cannot operate without a connection to fiber optic communications. Pre-planning efforts with telecommunication providers will help owners identify acceptable fiber optic routes.

SPEED TO MARKET



Data center users put an emphasis fast-track design to get their facilities up and running as soon as possible. The design process should follow an integrated project delivery method where the typical data hall footprint and supporting mechanical/electrical spaces are programmed in a way that allows construction of the building's core and shell to begin immediately.

The fit-out of the individual data halls should have a phased approach and will follow in a separate design package. It isn't unusual for the largest data centers to have a fit-out schedule of 2-3 years after the completion of the building envelope.

Design & Construction Delivery Methods

The traditional **design-bid-build** method is widely used across the industry. Some providers have elected to utilize the **design-build** method and engage design-build firms in order to speed project delivery. Project delivery methodology includes an integrated design process or phased construction with core+shell first and data hall fit-out to follow.

THE ROAD AHEAD

The future of data centers is tied closely to the rise of Artificial Intelligence (AI), which is pushing the limits of existing infrastructure. Operators will need to adapt to higher power demands, more sophisticated cooling methods, and longer construction timelines.

Communities that support the development of AI-specific infrastructure through smart policies, incentives, and workforce development will be better positioned to capitalize on this growth.

The intersection of AI and data center technology is reshaping the landscape of digital infrastructure. The combination of increased demand for computational power, the need for advanced cooling systems, and shifting market dynamics in real estate and labor will define the next phase of data center development. Communities and operators that are proactive in addressing these challenges will have a competitive edge as they build the digital infrastructure of the future.

PROJECT EXAMPLE

Information Technology Center (Phase I), U.S. Air Force

The 106,000 SF Information Technology Center is an internationally recognized center of excellence for the Air Force. The first phase is a $100+ million, multi-building complex providing a state-of-the-art computer center, with collaborative modeling and simulation. There are 2,000 Department of Defense users across the world with access to the Center's computing capabilities. Researchers from every branch of the military and other federal agencies use it to explore and solve critical problems.

The facility is a 3-story, secure building that is programmed, designed, and constructed to integrate leading edge simulation facilities with supercomputing resources. The facility consolidates critical computing and workspace for modeling, simulation, analysis, and design. The data hall provides computer racks in a hot isle/cold isle arrangement.

Future phases will continue the consolidation by providing space for a large computing center, learning and engineering spaces, and new state-of-the-art modeling and simulation spaces.

The lowest level houses mechanical equipment, an assembly shop, and major computing equipment. The first floor provides space for simulation and analysis; the second floor provides open and closed offices, software development space, and conferencing capabilities. The building's core is offset to maximize the floorplate's openness to accommodate the large computing and mechanical spaces, with future flexibility for the simulation and administration floors.

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Steve has over 40 years' experience with business leadership and project management. Prior to co- founding emersion DESIGN, he was the President and CEO for a 100-person A/E firm with offices in Ohio and Florida.