DIGITAL HEALTHCARE ARCHITECTURE

An overview of the current challenges, drivers and opportunities for healthcare digital infrastructure
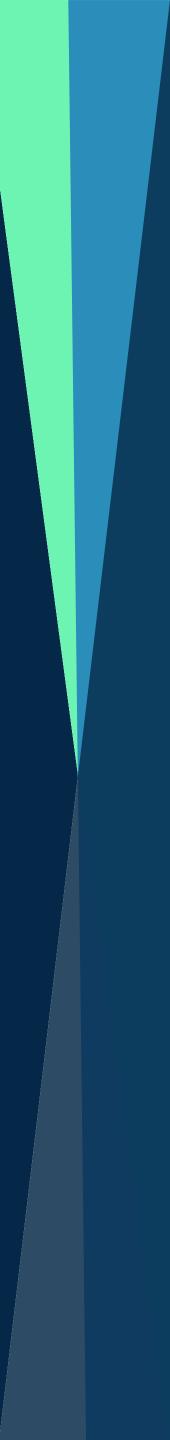
IRON MOUNTAIN®
DATA CENTERS

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SOLUTION SNAPSHOT
This Iron Mountain Data Centers solution overview sets out the key drivers and challenges influencing digital infrastructure strategies for the healthcare industry, with a particular focus on the growth of digital health and the role of colocation.

Introduction

AFTER THE STORM

This has been a hugely challenging decade for global healthcare. Considering the challenges the industry already faced in terms of human resources, funding, built and digital infrastructure, as well as the steep growth in healthcare expectations and demand, it's no wonder that adding a global pandemic to the list, created a perfect storm.

The direct impact of the pandemic was death, suffering and anxiety on a scale unprecedented this century. The indirect effects were more complex and far-reaching. Key among them were mental health issues, the negative impact on the global economy and the generation of massive patient backlogs.

Paradoxically, on the ICT front, the pandemic has been a positive help to digital transformation. It arrived as cloud infrastructure services had matured to the point that significant outsourcing could be contemplated. Cloud services enabled track and trace and effective research collaboration for vaccine development and administration. During Covid, social distancing drove a massive shift to virtual care using cloud-driven services, powering a faster transition than in any other sector.

Digital Healthcare accounts for just a small percent of total healthcare spend currently, but it is the fastest growing segment. At the upper end of the forecasts, Precedence Research predicts that digital health will see a CAGR of 19.2% over the coming years, taking it from $270 billion in 2021 to over $1354 billion in 2030.

Changes have already taken place so swiftly and unevenly that they are still not easy to track, and there are also significant regional and national variations. But broadly speaking, where digital solutions are feasible these are being applied, or development of new solutions is being fast-tracked. Both the challenge and the opportunity are huge; what Deloitte's Stephanie Allen, Global Public Health & Social Services Leader, describes as "predictive, preventative, personalized and participatory medicine" - all built with digital technologies.
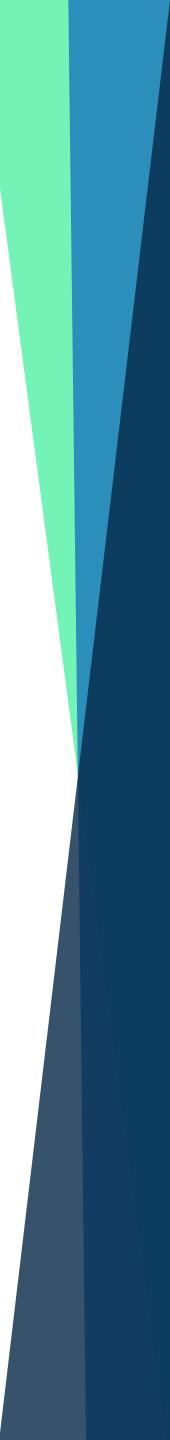
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GLOBAL DRIVERS

RESOURCING

The industry faces huge resourcing issues post-Covid. These require new strategies that are affordable, resilient and scalable. On the digital front, massive investment is required in designing new services around people and their needs, educating patients about digital health opportunities and incentivizing practitioners and their partners to understand, promote and use new tools.

AI, AR & IOMT

> AI-based monitoring tools can now improve patient treatment using real-time reports. AI can interpret medical imaging and make recommendations, follow pharmaceutical purchase patterns and flag side potential effects. Digital Twinning can model treatments for virtual conditions.

> AR apps include patient and doctor education, therapies, surgical visualization and disease simulation.

> The Internet of Medical Things (IoMT) includes medical devices, wearables, ingestible sensors and applications networked to health IT systems. IoMT has the potential to lower the cost of operational and clinical inefficiencies by $100 billion per year.

Smart devices are changing the face of healthcare. A lot of AI, AR and IoMT applications will require high-speed proximate connectivity for data gathering and processing, particularly for wearables, devices and mobile apps running on 5G.

BIG DATA

More data captured from consumer, patient, physical and clinical processes and devices is being processed in the cloud using machine learning algorithms and data visualization tools. Direct benefits include medication correction, preventative care and improvements in resource allocation.

PUBLIC V PRIVATE

While cloud-based processing for big data and new health apps is rising fast, many healthcare organizations prefer to remain with a hybrid architecture due to security concerns or regulations. Hybrid will remain the norm, but public cloud apps and infrastructure will also become more targeted, secure, effective and widespread.

NEW PARTNERSHIPS

New digital models will require a range of new partnerships. These will form the basis of a flexible ecosystem of interconnected practitioners, partners and service providers of all types that can use real-world data to analyze and meet shifting healthcare needs.

NEXT-GEN SECURITY

Data security will continue to be paramount, but new security architectures and access management procedures have the potential to simplify the separation and sharing of relevant data. Blockchain-based EMRs, for instance, can reduce the time needed to access patient information while improving data quality, scalability and interoperability.

DISPERSED CARE

Dispersed health management networks are becoming normal. Key areas are community and home-driven virtual care using IaaS PaaS and SaaS to even out costs and build in resilience. Wearables and mobile apps providing access to healthcare support and monitoring are on the rise. This is particularly true for preventative healthcare and managing long-term, chronic conditions, via heart rate variability, pulse oximeters, electrocardiography and continuous glucose monitoring.

INTEROPERABILITY

Because of the massive amount of data collected from different systems that store and code data differently, data interoperability is an ongoing challenge. New regulations and frameworks are being developed globally to tackle this. Effective interoperability of platforms has the potential to drive deep learning and diagnosis, speeding reaction time to health emergencies like pandemics.

CLIMATE CHANGE

Healthcare accounts for 4% of global CO_2 emissions - more than aviation or shipping. Non-stop health services, refrigeration, air conditioning, machinery, transport, the size and number of facilities all contribute. Climate change also creates new health/respiratory and resilience challenges: More than one-third of global heat-related deaths can now be attributed to climate change. Action needs to be taken now, or healthcare will be a key part of the problems it is trying to solve.

REGIONAL VARIANTS

IMPROVING HEALTHCARE ACCESS

At a global level, the greatest healthcare challenge is to improve access to quality healthcare in areas which have not been adequately covered to date.

While core resourcing to achieve this presents a huge challenge, there is an opportunity for new digital health infrastructure to deliver innovative, easily accessible services that are also significantly more affordable.

EUROPE

Running on top of GDPR, the EU's new Health Data Space framework aims to improve interoperability and access to patient data, including lab results and MRI scans, across all 27 member countries. Effective sharing of anonymized data has particular potential. However, as often happens with new EU frameworks there are potential issues over national sovereignty and it will take until 2025 to bring all member states on board. The UK uses Priority Platform to drive data interoperability. The key information security standard for data storage is ISO 27001 (ISMS) with SOC 2 (SSAE 18) Type II reporting.
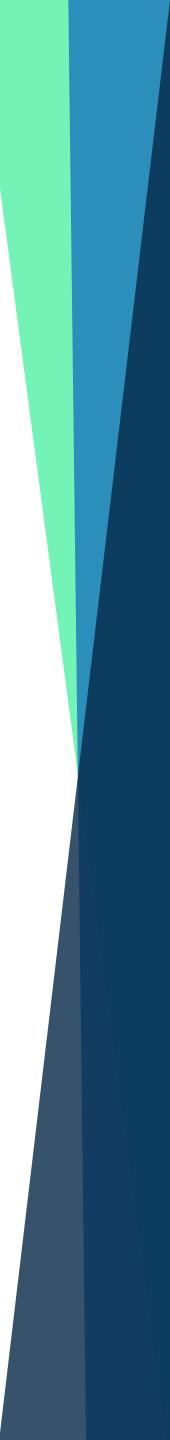
NORTH AMERICA

The USA spends a phenomenal 20% of its GDP on healthcare - over $4 trillion. The sector is complex, with almost 800,000 companies serving it and is experiencing ongoing repercussions from the Affordable Care Act. New legislation and technologies are streamlining/replacing older processes and generating new opportunities across a wider insured base. The region accounts for the majority of the global digital health market due to its rising elderly population, high smartphone penetration and lively investment in new apps and digital healthcare platforms. Healthcare-related emissions are extremely high (7.6 - 10% of total US emissions). Key national data compliance and regulation standards include HIPAA (Type 1),NIST SP 800-53, FedRAMP, and FISMA HIGH.

ASIA PACIFIC

With deep mobile penetration, a strong innovation track record, and half of the world's internet users, digital health ecosystems are already being applied across Asia Pacific. 28% of China's population uses connected health devices, the highest number in the world. India's UHI (Universal Healthcare Initiative) is creating an open network, aggregating current apps, adding new ones and assimilating electronic patient records. Healthcare-related emissions are generally lower here. The widest-spread data security standard for storage is also ISO 27001 (ISMS) with SOC 2 (SSAE 18) Type II reporting.

INFRASTRUCTURE CONSIDERATIONS

There are a number of issues to be taken into account when designing or outsourcing future-proof infrastructure:
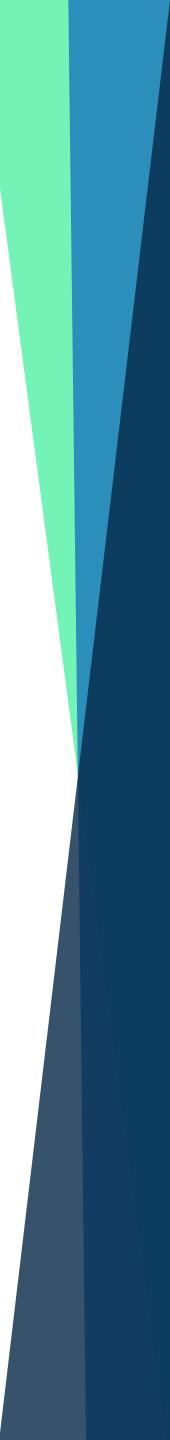
HYBRID FLEXIBILITY

Considering the sensitive and highly regulated nature of patient data, moving away from provider-owned infrastructure will not happen overnight. A colocated hybrid design, in which workloads can be moved to and from the cloud, will offer the access management and security the industry is used to while increasing scalability and access to the cloud and new partners and service providers. New colocation customers also typically reduce their total cost of ownership by more than 30% when compared to previous in-house solutions.

EDGE OUTPOSTS

The massive data demands that new health technologies create will require faster and higher density processing and sizable amounts of data will need to be accessed and processed at the edge, closer to the point-of-care. To reach patients via VR, AR and IoMT devices, healthcare providers and their partners will increasingly need to deploy via 5G. This will require edge micro-facilities. Where no locations currently exist, provider capability in location-sourcing, capacity and power planning must be up to providing timely space and operational support for core
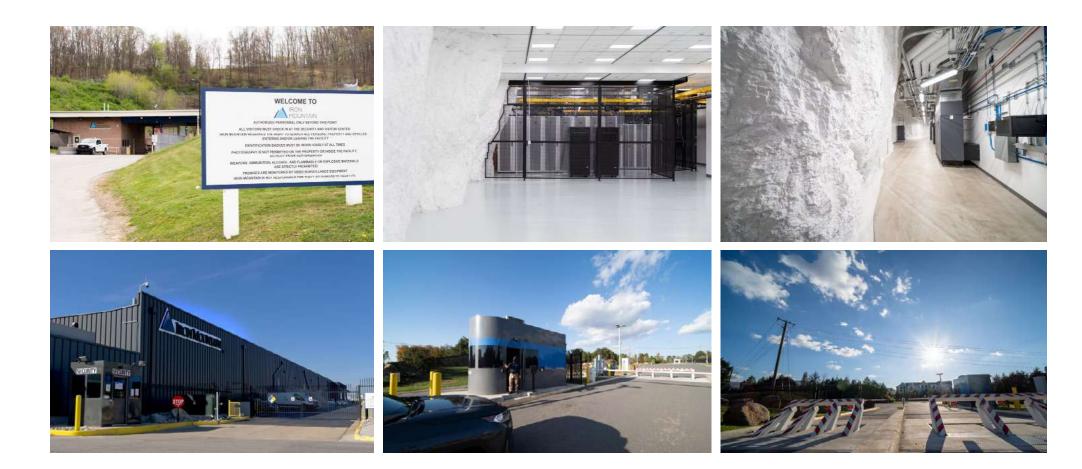
In addition to 20 core data centers in North America, EMEA and APAC, Iron Mountain has, over the past 70 years, built a portfolio of 1400+ facilities world-wide. 695 of these facilities are located close to city centers or airports in the sub-5ms latency zone – the Metro Edge. Spread across 50 countries, they provide a valuable source of potential Network Edge and Metro Edge PoPs for local zones. Where customers express a need, IMDC has a proprietary highly secure and customizable modular edge solution to leverage these sites.

and partner servers and connections. For edge developments, expertise on the ground and access to space are critical in working with utilities, regulators, logistics, contractors and staff. Security must be as comprehensive as in core facilities.
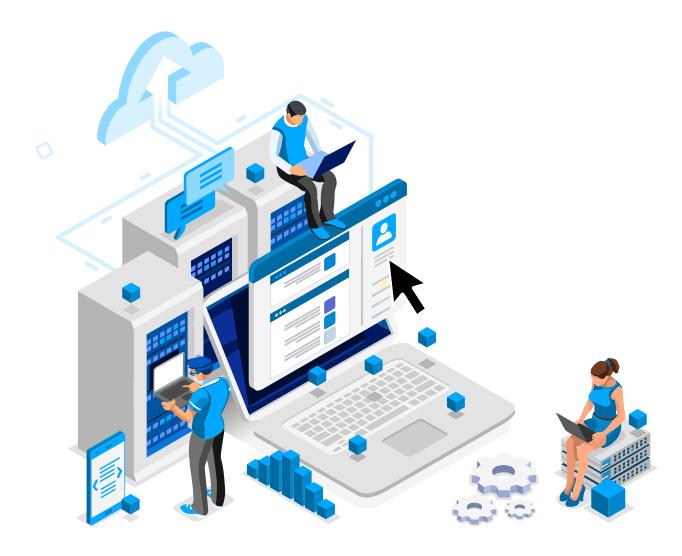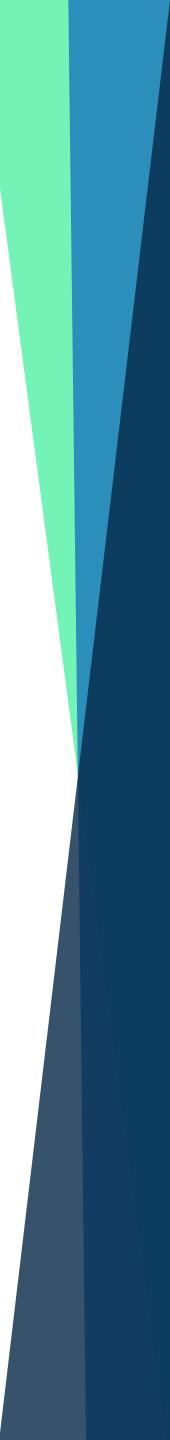
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UPTIME & PHYSICAL SECURITY

Uptime and physical security are still critical. Tier 3 facilities with redundant and resilient infrastructure and failproof configuration are non-negotiable. Comprehensive physical and data security layers should guard your vital assets. In some cases extreme security is required: for maximum physical security underground facilities offer even greater protection from intrusion and natural disasters. Security features and uptime numbers are just as critical at the edge as at the core.

REMOTE MANAGEMENT

Colocating infrastructure increases speed and taps into valuable skills and ecosystems. By moving to a full-service colocation model which offers cross connects, builds and installs, smart hands and migration management via a web interface, healthcare providers can become more location independent, freeing up more resources for primary care or core admin. Operators can also use virtualized control surfaces with distributed monitoring from satellite or home locations, features which were critical to continued operation during the Covid-19 outbreak.

MORE SECURITY, MORE STANDARDS

Regulatory compliance remains most readily achieved in a dedicated environment. Healthcare enterprises are subject to a wide range of international regulations. The cost of non-compliance is heavy, both financially and in terms of reputation. Infrastructure providers should be expected to do more than simply provide highly reliable data center services. They need to offering healthcare organizations flexibility in tailoring the environment to meet their particular compliance requirements

Build, ethical and operational standards need to be consistent across continents. From ecosystems to uptime, sustainability to edge expansion, the key to making data center decisions that will power the next generation of services is the mix of reliability, reach, and investment in growth which make for a productive long-term partnership. A broad checklist of third party certifications is a good indicator of quality. Look for ISO 27001, SSAE18 SOC 2 (Type II)/SOC 3*, PCI-DSS, ISO -50001. Region-specific certifications are also key; in North America, NIST SP 800-53*, FISMA HIGH, FedRAMP and HIPAA (Type I); OSPAR in Asia; ISO 450001 and 9001 in EMEA.
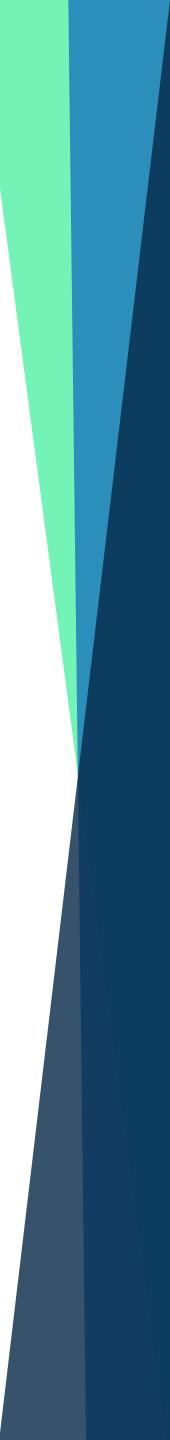
DECARBONIZING THE INDUSTRY

Because healthcare is one of the world's largest emitters, digital transformation should also contribute to emission and environmental impact reduction. While emissions emanating directly from health care facilities make up 17% of the sector's footprint, indirect emissions from purchased electricity, steam, cooling, and heating comprise another 12%. ICT will comprise a significant part of this. Every participant in the healthcare industry needs to take responsibility for mitigating climate change. Considering the growth of digital health services, this is a major opportunity in infrastructure design and outsourcing.

As data levels rise, sustainability is critical to long-term value and should be integral to standards. ISO 50001 Energy Management and ISO 14001 Environmental Management certifications should be non-negotiable. These standards should be extended to cover all new builds; both core and edge.

Demand 100% renewable power. And go a step further if possible. Look for a carbon credit scheme like IMDC Green Power Pass for CSR reporting, and, if the site is suitable, renewable generation as close as possible to the point of use. It should also soon be possible to match site by site electricity use with local clean power generation every hour, every day to achieve 24/7 clean power. For both efficiency and impact reduction, also check that IT asset lifecycle optimization and recycling, remarketing and secure disposal are available.

Iron Mountain Data Centers leads the global colocation industry in sustainability implementation.

> Iron Mountain Data Centers has maintained 100% renewable electricity supply for our global data center business since 2017, and will continue to do so.

> Our goal is to power our facilities with 24/7 clean electricity, every hour of every day and work toward zero waste across operations. So far IMDC hourly tracking covers 75% of the company's annual electricity consumption.

> Iron Mountain provides a complete IT Asset Lifecycle Management (ALM) portfolio via ITRenew, including cleaning, certifying and remarketing used equipment.

> By 2030, all Iron Mountain Data Centers worldwide will be Climate Neutral, as part of our commitment as a signatory to the EU Climate Neutral Data Centre Pact.

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SMART HEALTH ARCHITECTURE

API-driven health apps require low or no latency access between providers, insurers, payment processors, retail networks, research partners and others. Directly connecting to partners and providers within the same data center eliminates latency and increases efficiency, cutting a huge amount off network costs and accelerating connections to new services. Global interconnections and direct cloud connections will support data transit and core flows. A range of network, SDN, and internet exchange services will also help keep data costs competitive.

Healthcare's digital infrastructure has traditionally been both centralized and specialized. This is changing fast. To enable resilience, support new dispersed health networks and drive consumer-style health apps, healthcare providers will need a more enterprise-style infrastructure.

FEATURES WILL INCLUDE

> Hybrid cloud hosting for workload shifting workloads
> On-site network service and partner ecosystems
> Dispersed architecture extending to the edge
> Data-hungry IoMT devices
> AI/ML cloud services for big data projects
> AR/VR edge apps
> Regulated interoperability
> Redundant direct connects to multiple clouds
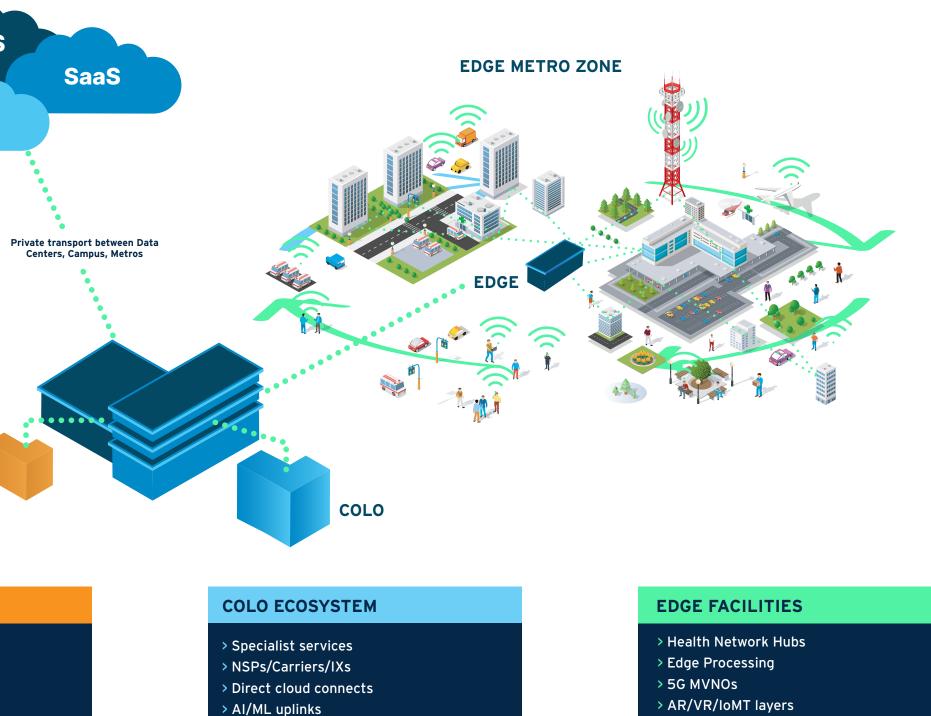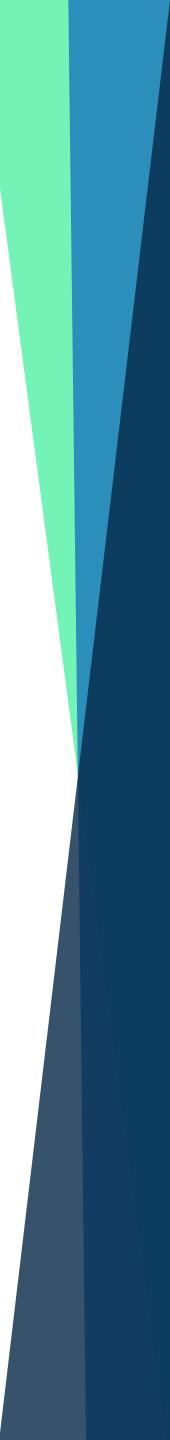> Improved PUE/WUE
> 24/7 renewable power

PaaS

SaaS

IaaS

EDGE METRO ZONE

Private transport between Data Centers, Campus, Metros

EDGE

CORE

COLO

CORE DATA CENTER
> Legacy apps
> Image archiving
> Segregated data
> Core hub

COLO ECOSYSTEM
> Specialist services
> NSPs/Carriers/IXs
> Direct cloud connects
> AI/ML uplinks
> App API connects
> Partner connects

EDGE FACILITIES
> Health Network Hubs
> Edge Processing
> 5G MVNOs
> AR/VR/IoMT layers

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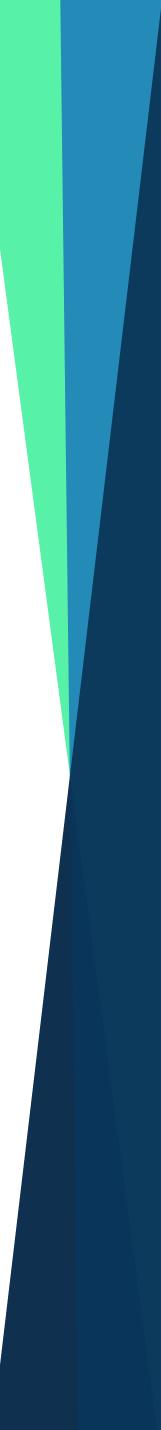
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ABOUT

Iron Mountain Data Centers operates a global colocation platform that enables customers to build tailored, sustainable, carrier and cloud-neutral data solutions. As a proud part of Iron Mountain Inc., a world leader in the secure management of data and assets trusted by 95% of the Fortune 1000, we are uniquely positioned to protect, connect and activate high-value customer data. We lead the data center industry in highly regulated compliance, environmental sustainability, physical security and business continuity. We collaborate with our 2,000+ customers in order to build and support their long-term digital transformations within our 3.5M SF global footprint spanning 3 continents. For more information, visit www.ironmountain.com/data-centers

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