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Going Underground for Data Center Assurance and Security

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We exist in a world today that has witnessed more transformation in the last decade than over this past century. Knowledgeable systems digitally driven by powerful and innovative platforms and next-gen technologies like distributed cloud, Artificial Intelligence (AI) and the all-encompassing Internet of Things (IoT) make up only a partial list. This relentless appetite for innovation and evolution creates a pace for advancement that can present both challenges and opportunities for that measurement called "success."

Consider the market value of AI, which Gartner estimates will reach $3.9 trillion by 2022. Applications of this technology offer an array of potential: to significantly alter operations and their associated costs, open the door to dynamic new revenue sources, simplify customer interaction and make our data-driven ways of working even more efficient. Another advancement, IoT, which boasts an equally impressive valuation from IDC of $1.2 trillion by 2022, has application in virtually every industry sector—manufacturing, retail, healthcare and government can all substantially benefit from the incredible value IoT data brings to daily functions. If you doubt me, check your Fitbit.

These technologies can have profound implications for the business world, as well as for the data centers that power them. Companies that embrace these platforms and next-gen technologies—and use them to their business advantage—drive demand for more powerful networks and secure IT environments. Consider speech recognition: according to Andrew Ng, Chief Scientist at Baidu's Silicon Valley lab, "training just one of Baidu's Chinese speech recognition models requires four terabytes of training data and 20 exaflops of compute." The global AI leader has poured billions into infrastructure investments over the last several years to protect its immense computing requirements.

The data center industry is faced with a radically changing dashboard as organizations plan to meet their growing data requirements, forecast their rate of change, and determine which applications they cannot be without—and therefore must safeguard against both natural and unnatural events.

Enterprises and hosting companies are constantly seeking innovative facilities that better mitigate risks while increasing their performance. They are also rethinking network connectivity to meet the growing and changing compute environment. One of the most important things to consider for long-

term success is location placements. The location of a data center is critical to ensuring the facility runs securely and efficiently. For some, this means at least one of their data centers is up to 150 feet below the earth's surface in an underground facility.

Data Center Trends, Challenges and Opportunities

Let's first consider the state of the global data center industry, both for enterprises and hosting companies' siting facilities. Consider the following insights, supported by findings from IDC:

- By 2020, the heavy workload demands of next-gen applications and IT architectures will force over half (55 percent) of enterprises to modernize their data centers, either through updates to existing facilities or the deployment of new ones. These impending changes to design and placement represent a stellar opportunity for CSPs to differentiate and deliver higher quality of experience.
- Service assurance will increase in complexity alongside evolving digital technologies. IDC expects that, in 2019, 60 percent of digital services will fail to meet desired customer adoption levels because the providers of those services will be unable to effectively monitor and respond to performance and utilization issues. Communications service providers must brace for change as enterprises adopt technologies that require more sophisticated network management. In a recent study from The Thought Leadership Council, for example, half of communications service providers reported needing to supplement their current service assurance tools to support network virtualization.
- Cooling remains one of today's greatest data center operations costs (a separate IDC study polling over 400 enterprise data center managers found "power and cooling costs" to make up nearly 25 percent of operating budgets). As such, IDC predicts that by 2021 the expanded use of power-accelerated computing technologies will force most data center operators to rethink their power and cooling approaches.
- "Natural disasters" and "extreme weather" are cited as the two greatest risks to society in a report from the World Economic Forum (WEF), posing major data center security risks. Consider events like 2012's Hurricane Sandy: while incomparable to the losses of local citizens, the event took down data centers for leading brands like Huffington Post and BuzzFeed. Meanwhile, cyber-attacks—the third greatest risk reported by WEF—also remain a grave issue. It's not a matter of "if" but when natural or unnatural events will affect critical data and infrastructure.

These trends, challenges and opportunities position subterranean data centers as a more secure, cost-effective and adaptable solution. This is becoming an industry paradigm shift as enterprises seek ultra-secure hosting for critical IT functions that support evolving business needs, and CSPs look for more innovative ways to reduce costs, improve quality and capture larger market share.

The Advantages of Going Underground

The underground data center is experiencing rapid growth because of the improvements it offers in risk mitigation, reliability, availability, power efficiencies and lower operational expenses. Facilities once used as military bunkers are being transformed into guarded data center space located deep below the earth's surface. These are some of the world's largest spaces, spanning millions of square feet with multiple story structures inside.

Consider some of today's leading underground facilities:

Swiss Fort Knox, Switzerland: With a history hosting two Cold War bunkers, this site has a prime location near the Swiss Alps, which enables it to pull glacial water from a deep subterranean lake to enhance its cooling systems. The facility features facial recognition surveillance and bulletproof surfaces to resist military and terrorist threats.

The Bunkers, United Kingdom: Originally built to protect British citizens in the event of a nuclear

attack, two former command and control bunkers in Kent and Newbury now operate as colocation data centers. The Kent facility is located 30 meters behind a perimeter fence with three-meter-thick walls. Inside are ex-military and police-grade security, infrared cameras and electromagnetic pulse protection systems.

Bahnhof Pionen, Sweden: Another converted Cold War bunker, this data center site is protected by video surveillance and a 40 cm-thick steel door. The facility is powered by German submarine engines and features stunning aesthetics like underground waterfalls and a 2,600-liter saltwater fish tank. The site, touted as one of the world's most secure data centers, can withstand the force of a hydrogen bomb.

These sites make clear the top perks of going underground:

Natural cooling: With power and cooling costs making up nearly 25 percent of operating budget, the primary reason to migrate data centers underground is natural cooling. While most underground sites still require some form of heat management, operators can maintain a naturally cooler and more consistent temperature as opposed to powering up chillers 24/7.

Former limestone mines particularly help offset temperatures by acting as a heat sink. For example, The Underground, a U.S.-based Iron Mountain facility, claims its limestone can absorb up to 1.5 BTUs per hour per square foot. The cost reductions afforded by naturally-regulated subterranean temperatures are enjoyed by providers and, subsequently, enterprise customers.

Service assurance: The scalable and secure nature of an underground facility enables providers to better deliver on key service assurance efforts—including network quality analytics, operations transformation, and service quality management—to guarantee higher quality of service that differentiates their market positioning and customer appeal. Regardless of what's happening above-ground, providers will maintain real-time visibility into session paths and performance parameters for rapid resolution and recovery.

Physical security: With the ability to withstand a nuclear attack, underground facilities are unquestionably physically secure. Coupled with advanced measures like those enforced above (facial recognition, infrared cameras, military-grade security personnel), underground sites offer unparalleled protection against both natural and unnatural events.

Let's return to the example of Hurricane Sandy: many data centers in the New York tristate area suffered outages because the power was shut off in mandatory evacuation areas. Cooling systems were shut down to keep generators running, leaving some operators no choice but to manually haul diesel fuel up dozens of flights of stairs to backup generators located on the roof. Underground facilities eliminate these possibilities, enabling providers to confidently maintain and secure high-workload requirements 24x7.

Construction costs: An added benefit of going underground is the cost savings associated with construction. According to Architect Kerry Knott of Bell/Knott & Associates, who has worked on several underground data centers, constructing a tornado-proof building above-ground can cost up to $100 extra per square foot. Accelerated permitting for underground construction can also produce 8 to 10 weeks of savings, according to Knott, with the bonus of year-round construction without weather delays.

Other benefits of siting a facility underground include the prevention of satellite imaging, air sampling to detect changes in air ionization, and hot aisle/cold aisle separation to keep equipment even cooler. The competitive advantages are seemingly endless.

Conclusion

As the data center industry shifts in support of these digitally driven technology innovations for business, both enterprises and hosting providers should consider the undeniable benefits of an underground facility. Having said that, it's also important to note that not all underground facilities are created equal. Knott advises potential customers to shop carefully and be mindful of certain considerations. For example:

- Sites must first be mined for commercial development to be considered acceptable data center space
- Limestone must be preserved in proper thickness to ensure structural integrity
- Column size and placement is important, as it impacts the technical space
- Early underground facilities may be risky for siting, as mining techniques have evolved.

An ideal location will offer a safe, natural-weather environment, structurally sound layout, and scalable space for impenetrable protection and sustainable growth.