HOW THE INCREMENTAL GROWTH PHILOSOPHY IS CHANGING DATA CENTER DESIGN
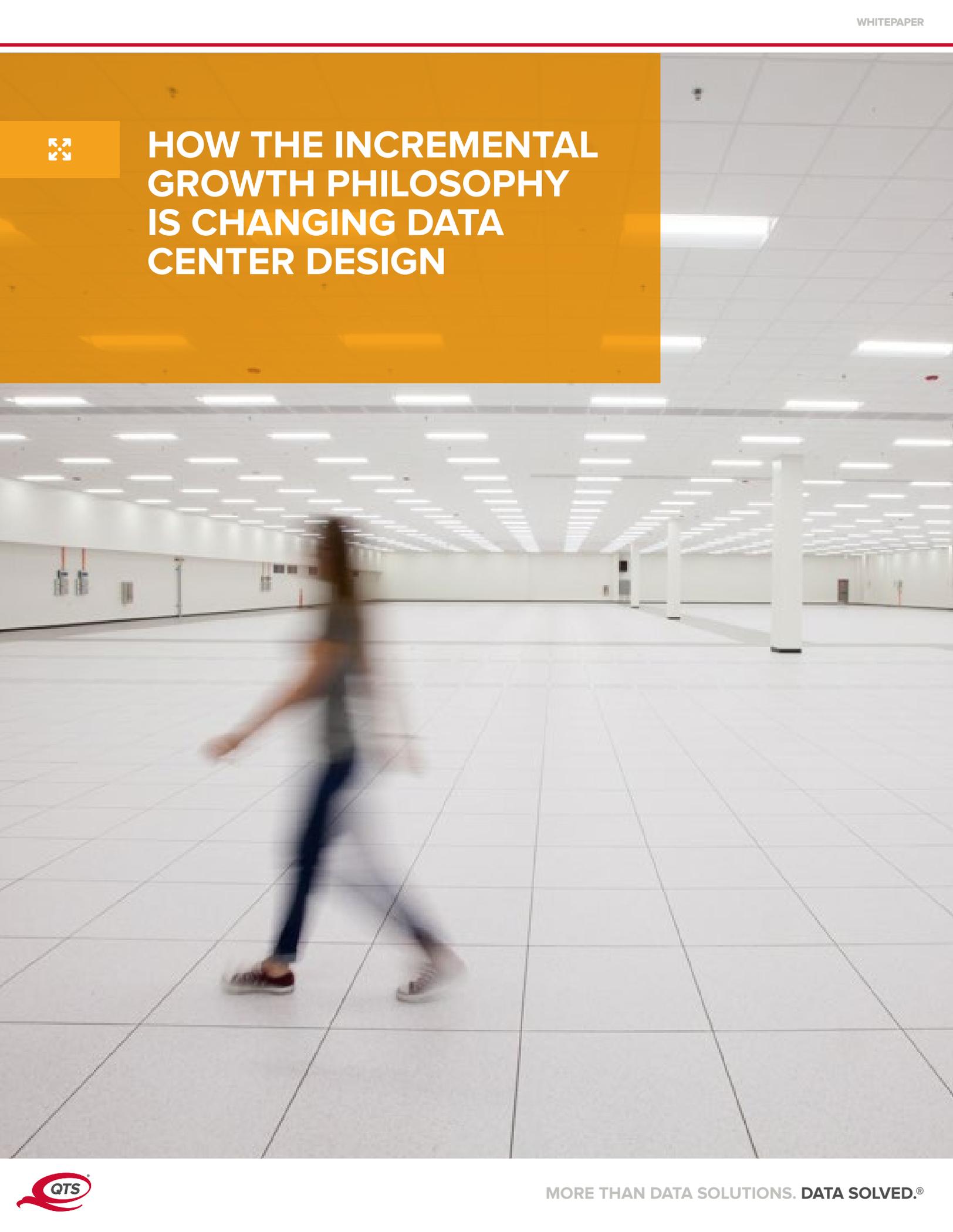
OVERVIEW

As data consumption continues to grow and the expansion of the Internet of Things drives increased demand for data center storage, providers are facing a unique challenge. How can a facility meet the needs of customers today while keeping pace with how those needs will grow in the future?

Data center design and construction are the foundation of providing reliable, scalable service without delay or interruption. A strategy is emerging as the most sustainable and cost-effective approach: **incremental growth**. But this approach presents unique challenges that require innovative construction strategies, specialized expertise and a well-thought-out master plan. Some industry leaders are pioneering the incremental growth philosophy with a constantly evolving approach to better serve customers.

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INTRODUCTION

Data storage and computing needs are not on a linear growth trajectory; they are increasing exponentially on an incomprehensible scale. The internet has grown by a factor of 100 over the past 10 years, driving an increase in data center computing by a factor 1,000.[1] However, the industry is not meeting these needs with *more* data centers, the IT community is building **mega** data centers.

Data Center Dynamics recently highlighted a prediction from the International Data Corporation forecasting that the total number of data centers will cap in 2017.[2] Organizations in the enterprise, financial, healthcare and government sectors are no longer building and managing their own data centers, but instead are moving their data to facilities designed, built and operated by experienced providers. So, how can providers meet these growing needs by expanding their facility and service availability in a sustainable and cost-effective way? In this whitepaper, we will introduce a design philosophy that addresses these challenges and facilitates a more customer-centered design process.

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INCREMENTAL GROWTH PHILOSOPHY

A "build it and they will come" philosophy has dominated data center construction in recent years. Countless providers set out to meet the world's great data boom by launching colossal construction projects with the intent of opening with enough space, equipment and infrastructure to meet demand today and for the next five, even ten years. However, these are white box data centers, pushing customers into rigid categories of facility and solution services. These providers have limited their ability to innovate and customize as the landscape evolves to support each customer's unique vision. Furthermore, these providers are front-loading capital investments and placing substantial strain on their financial and operational resources in an unsustainable business model.

Industry leaders are emphasizing the importance of "right-sizing" a data center to maintain controls on capital investments in property, building space and hardware while simultaneously ensuring that operational costs align with a data center's current customer loads.[3] To accomplish this, providers must approach design with the **incremental growth philosophy.** Incremental growth is characterized by the ability to utilize a master plan and innovative construction strategies that not only keep pace with customer's needs, but also deliver services that streamline the expansion process, improve time to value and offer a more customized solution.

1. Rickman, A., OBE. (2015, September 30). The Future of the Data Center: Reinventing the Network. Retrieved October 28, 2016, from http://www.datacenterjournal.com/future-data-center-reinventing-network/

2. Smolaks, M. (2014, November 11). Number of data centers to decrease after 2017. Retrieved October 30, 2016, from http://www.datacenterdynamics.com/content-tracks/colo-cloud/number-of-data-centers-to-decrease-after-2017/91495.fullarticle

3. Kittila, T. (2016, October 04). "Right-Sizing" The Data Center: A Fool's Errand? | Data Center Knowledge. Retrieved October 19, 2016, from http://www.datacenterknowledge.com/archives/2016/10/04/is-right-sizing-your-data-center-a-fools-errand/

IMPLEMENTING THE PHILOSOPHY

As industry leaders began to realize that building an entire mega data center at once is not just unnecessary, but also risky and inefficient, the challenge arose of how to phase out a construction timeline in a way that avoids operational downtime. However, managing an active construction project adjacent to a delicate data environment comes with a host of considerations that would be irrelevant if a data center was completed prior to offering services. Construction problems, like power outages or water main breaks, can cause catastrophic damage to a data environment. To avoid disastrous disruption, data center design teams must anticipate potential issues, then mitigate the potential for complications. The following are fundamental components of implementing an incremental growth philosophy:

INCREMENTAL GROWTH REQUIRES:

- A Well-Thought Out Master Plan
- Innovative Construction Strategies
- Specialized Expertise in Mega Data Centers Operations

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Master Planning

Building a viable master plan begins with deliberate site selection. Whether building a data center from the ground up, acquiring a purpose-built facility or repurposing an existing building, providers must ensure that the site is conducive to phased expansion. Building a data center from the ground up requires the most time and capital investment, which is not always ideal for incremental growth planning. Renovating infrastructure-rich facilities reduces risk by taking assets through a transformation cycle, without engaging in speculative investment.

Industry leaders are seeing the value of investing in light industrial facilities that can be reimagined as data centers. First, these facilities are built with a greater capacity to withstand extreme weather. Also, these structures are well built with solid infrastructure to support manufacturing operations. They also come with other features necessary for data center operations: large campuses, strong decks, high ceilings, open floor plans and accessibility.

EXPANSION
The data center must have room to grow. The property surrounding the structure should be large enough to accommodate additional data center space. Providers should choose sites with ample acreage or the ability to purchase adjoining property in the future.

RAISED FLOOR SPACE
Next, the team must ensure the facilities deck and ceiling height are conducive to constructing raised floor space, which is vital to a data center's cooling capabilities and network infrastructure. Industrial buildings are some of the few existing structures with the structural ability to support these design elements.

OPEN FLOOR PLANS
Data centers require open floor plans free from walls and support columns. Open floor space is key for operational and energy efficiency and allows for flexibility when developing the mechanical and hardware layouts.

ACCESSIBILITY
Convenience, abundant parking and easy loading are all important accessibility considerations when selecting a site. A location near mass transportation and interstates allows your data center to service a larger geographic region. Abundant parking is appealing to colocation customers that will play a role in managing the day-to-day operation of their environments. Lastly, accessible loading can drastically improve the customer experience by creating a seamless process by which to bring equipment and hardware into the facility, increasing speed to market and providing customers with the ability to pivot quickly. Furthermore, adjacencies from loading and test environments to the data center floor also add tremendous value to customers.

Innovative Construction

The driving force behind innovation is building a strong partnership with developers and contractors that have expertise in building critical facilities. These experts have proven records spanning all aspects of data center construction, including architecture, cooling, mechanical and electrical outlay and networking. These relationships must be built on collaborative efforts to define how the master plan will come to fruition and a commitment to a continually evolving process that better serves the data center's customers. Finally, it is critical to bring all your design and construction partners together to vet a design from a holistic perspective and ensure all of a facility's systems are built to integrate with each other.

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Mega Expertise

Specialized expertise is required to manage the operations of a **mega data center.** These facilities house tens of thousands of servers that are supported by complex connectivity networks and power schemes on an expansive campus. As providers build more advanced and robust portfolios that include data center, colocation and hybrid cloud services, they employ progressive operation management strategies that engage state-of-the-art technology and expert personnel.

Another vital aspect of mega data center management is Data Center Infrastructure Management (DCIM). DCIM is an invaluable technology that supports incremental growth by integrating IT and facility monitoring protocols, centralizing efforts to optimize efficiency and providing right-sized strategies to accommodate power, computing and connectivity needs. DCIM is proven to reduce costs and increase operational efficiency. A recent report from Research and Markets forecasts the DCIM market will expand at a compound annual growth rate of 14.68% from 2016 to 2020.[4]

4. Mark, J. (2016, October 4). Data Center Infrastructure Management (DCIM) Solutions Global Market Forecast by 2020. Retrieved October 30, 2016, from https://www.linkedin.com/pulse/data-center-infrastructure-management-dcim-solutions-global-mark?articleId=7656839312908449714

Furthermore, mega data centers are complex entities with personnel focused on continually optimizing operations, security, monitoring and customer service. Providers must take an integrated approach to optimization by creating a central support location connecting all areas of environment management to ensure all departments are in constant communication.

A CUSTOMER CENTERED PROCESS

Cutting-edge providers seek opportunities to improve customer experience and provide a comprehensive services portfolio that scales as a customer's needs and business grow. Incremental growth is the most sustainable method for ensuring data center customers receive a customized solution. When partnering with a provider that utilizes the incremental growth philosophy, **customers enjoy improved Time to Value and a partnership approach from the beginning.**

Time to Value (TtV)

Eliminating constraints that lead to a delayed delivery of services is the first step in improving a customer's time to value (TtV). TtV is a priority when a customer experiences rapid expansion. Any delay can lead to lost financial opportunity and disruption that impacts an organization's ability to perform key business functions.

Adept master planning involves a deep understanding of a customer's expectations for service delivery and how those expectations impact their overall business strategy. Providers must be committed to constantly improving their design and construction methodology to increase speed and flexibility to support rapid growth.

A Partnership Perspective

Earlier, we discussed white box facilities and services. While some off-the-shelf solutions can effectively meet an organization's needs and expectations, custom solutions use a situation-specific approach and provide a more seamless implementation progression, leading to improved long-term operational and energy efficiency. When utilizing an incremental growth philosophy, providers and customers grow synchronously, providing the opportunity to customize solutions and environments to meet a customer's needs during every phase of expansion. Also, in this model, *the provider* delivers cabinet layout, grounding, power, power distribution, testing and compute – saving the customer time, money and resources.

Whether a customer is seeking a new environment in a provider's data center or looking to expand an existing footprint, collaboration is key to ensuring resources are used in the most efficient manner and customers experience a seamless process. Phased data center expansion encourages customers to be actively engaged with designing their data strategy and provides both the customer and the provider the ability to identify opportunities and challenges and plan accordingly.

A CASE STUDY OF INCREMENTAL GROWTH IN 3 UNIQUE MARKETS

Richmond, Dallas and Chicago are hubs for industries with expanding data needs, including the financial, enterprise and government sectors. They are also prime markets for incremental data center growth due to their need for industrial revitalization. These major cities experienced industrial expansion in the 20th century driven by the transportation and communications industries, leading to the construction of complexes built to sustain massive operations for generations. These complexes are often ideal locations for data center locations built with the incremental growth philosophy.

In the following pages, we will examine how QTS employed the three pillars of the incremental growth philosophy (master planning, innovative construction strategies and mega data center expertise) when planning, designing and building their Richmond, Dallas and Chicago facilities.

Master Planning

	SITE SELECTION AND ABILITY TO EXPAND	EXISTING INFRASTRUCTURE STRENGTHS	ACCESSIBILITY
QTS RICHMOND	**Former Semiconductor Plant** • 210 acre campus • Ability to triple in size	• 22,000 tons of on-site chiller capacity • Outside of 50-mile blast zone for Washington, DC	• Conveniently located near Richmond International Airport • Easy access to I-95 and 1-64
QTS DALLAS	**Former Semiconductor Plant** • 54 acre campus • Ability to double in size	• Built with 240 million pounds of concrete • Column-free, uninterrupted space • Support piers that extend 90ft into bedrock • Built to withstand hurricane and tornado strength winds	• Conveniently located near Dallas-Fort Worth Airport • Abundant parking • Easy access to I-635 and I-35E
QTS CHICAGO	**Former Printing Press** • 30 acre campus • Ability to double in size	• High ceilings • Strong deck • Located in 500-year floodplain	• Convenient to Chicago Central Business District • Large and small truck loading docks • Abundant parking

Innovative Construction Strategies

	COOLING	MECHANICAL/ ELECTRICAL	CONNECTIVITY
QTS RICHMOND	• 25,000 tons of chiller capacity with the ability to scale • Redundant cooling	• 2 on-site substations deliver 110 MVA to facility, scalable to 220 MVA • Redundant power • On-site fuel storage	• Carrier-neutral facility with access to a broad range of global and national providers • 3 distinct fiber paths out of the facility
QTS DALLAS	• Air-cooled and water-cooled chillers • 48 hour makeup water storage • 100,000 gallon chilled water storage • Water-side economization	• 2 separate 138kV feeds • On-site redundant substation (140MVA total) • Parallel redundant N+1 generator farm • 48 hour on-site diesel fuel storage with multiple refueling contracts	• Carrier-neutral facility with diverse building entrances • Access and redundancy to all regional carrier hotels and long-haul carrier POPs • Convenient in-building access to multiple providers
QTS CHICAGO	• Highly efficient systems utilize cool outside air without contaminants • Automatically accommodates load variations 0-4 MW in 30 minutes • Real-time economization, less engineering planning, and intake planning	• 24 MW of gross power capacity • All power cabling below floors installed in either conduit or seal-tight flexible conduit • Complete flexibility in design with the 2 MW block solution	• Carrier-neutral facility • Fiber ring options to 350 E. Cermak Street • Access to 100+ network carriers and partners

Mega Data Center Expertise

	DESIGN AND MANAGEMENT EXPERTISE	STATE-OF-THE-ART SECURITY	OPERATIONS SUPPORT CENTER
THE QTS DIFFERENCE	• DCIM • Expertly trained engineers, technicians, managers and operators	• 24x7x365 on-site security teams • Advanced CCTV video surveillance systems • Card access, biometric fingerprint and iris scan identification	• Centralized location for all customer service comprised of expert team leads, engineers and customer support representatives to address incidents, inquiries and issues

PIONEERING INCREMENTAL GROWTH

QTS is one of the industry leaders not just defining the value of the incremental growth philosophy, but also employing this strategy when building mega data centers around the country. At the heart of this philosophy is the desire to constantly innovate, evolve and provide the best possible customer experience.

QTS is also committed to the broader impact an incremental growth strategy can have on cities, pioneering how the data center industry can continue to improve and expand sustainability initiatives. QTS seeks opportunities to utilize cutting-edge green technologies and energy-efficient strategies to improve the viability and sustainability of a community.

ABOUT QTS | 877.QTS.DATA | QTSDATACENTERS.COM

QTS Realty Trust, Inc. (NYSE: QTS) is a leading provider of secure, compliant data center, hybrid cloud and managed services. QTS features the nation's only fully integrated technology services platform providing flexible, scalable solutions for the federal government, financial services, healthcare and high tech industries. QTS owns, operates or manages more than 5 million square feet of data center space and supports more than 1,100 customers in North America, Europe and Asia Pacific. In addition, QTS' Critical Facilities Management (CFM) provides increased efficiency and greater performance for third-party data center owners and operators. For more information, please visit www.qtsdatacenters.com, call toll-free 877.QTS.DATA or follow us on Twitter @DataCenters_QTS.