

# Data & Technology Infrastructure: SRVR Index Powering 5G & The Cloud

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New technologies have led to a series of industrial revolutions. The fourth revolution, which Benchmark Investments calls the *Intelligence Revolution*, has just begun. The intelligence revolution will be predicated on complex data flows for **artificial intelligence, augmented reality/virtual reality, blockchain, and the internet of things**. For the revolution to take hold, there will need to be an unprecedented buildout of mission critical technology infrastructure. Trillions of dollars will need to be spent in the next several years as technology solutions **will rely on an increasingly sophisticated foundation of data centers, wireless towers, and fiber optic networks**. Investors should consider positioning their portfolios to capitalize on the buildout of 5G and cloud infrastructure.

# 5G & The Cloud: The Intelligence Infrastructure Path Forward

## What is 5G

5G is the next generation, the fifth generation, of wireless connectivity. 5G is enabled through a combination of technologies including millimeter waves, small cells, and fiber. 5G is not a single innovation, but rather a set of advancements in spectrum usage. Those advancements will enable 5G to be capable of delivering data rates as high as 1 gigabit per second – Approximately 20X faster than current networks - and comparable to the speeds obtained from a wired connection like cable or fiber optic internet service. The wireless speeds of 5G can only work if the cloud is built to process complex data sets.

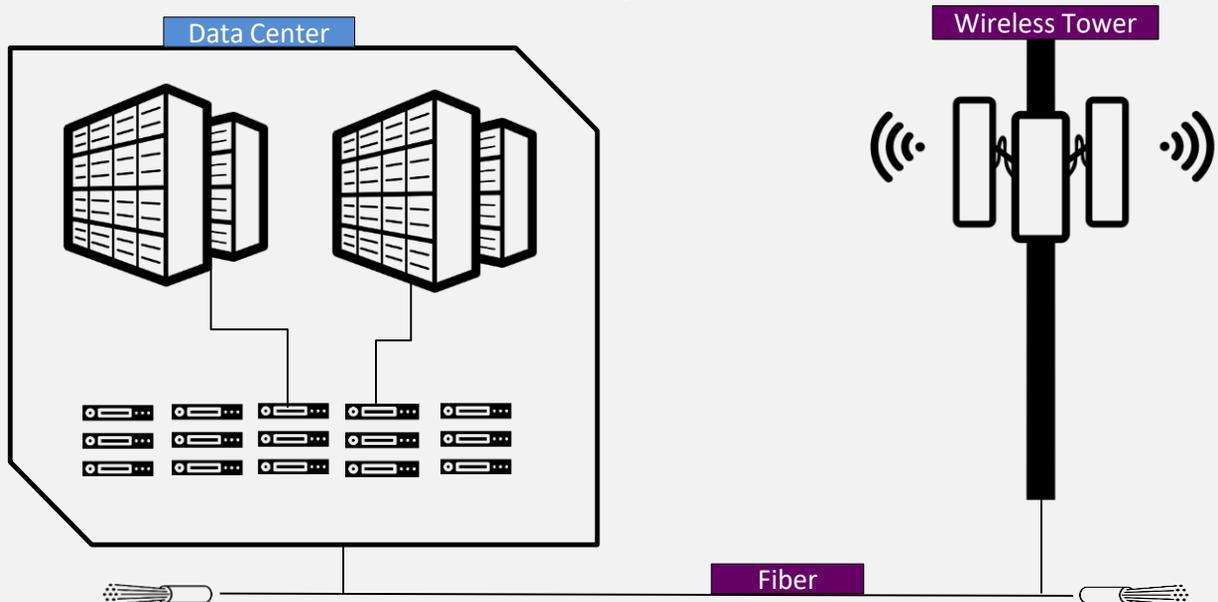
## What is the Cloud

The cloud is a term used to describe a global network of servers, each with a unique function. The cloud is not a physical entity, but instead is a vast network of remote servers around the globe which can connect to each other and are meant to operate as a single ecosystem. These servers are designed to either store and manage data, run applications, or deliver content or a service such as streaming videos, email, productivity software, and even social media. Instead of accessing files and data from a local or personal computer, devices are accessing them online from any internet-capable device.

## What is SRVR Index Infrastructure

### Mission Critical Assets for 5G & Cloud

**5G and Cloud infrastructure are intertwined as both rely on each other's architecture.** Today's digital economy depends on an increasingly sophisticated backbone of data centers, wireless towers, and fiber optic networks to move critical analytics in and out of servers talking to each other. These mission critical assets are the foundational infrastructure of technologies – present and future.



# 5G & The Cloud:

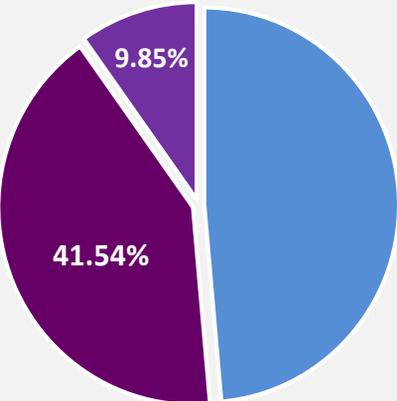
## Foundation of 5G: Communications Infrastructure

### Cell Towers, Small Cells, Distributed Antenna Systems & Fiber

The epicenter of 5G can be found in SRVR Index's physical foundations of wireless connectivity including towers, poles, and even billboards, which allow the transmission of higher frequency 5G signals.

The SRVR Index's sub-sectors provide wireless infrastructure that will be needed to enable a high-speed, connected world. The index's tower companies own the vertical real estate, usually a tower or pole, often with the land parcel underneath and the dark fiber cable underground. Meanwhile, SRVR billboard companies own, permit, and lease real estate to digital media, advertising, and wireless carriers on structures ranging from highway billboards to train platforms. Wireless carriers lease space on towers, small-cell nodes, platforms, and/or billboards to mount equipment such as cell transmitters or antennas designed for short-range, high-frequency 5G signals. Billboard companies, by their very nature, are in highly congested areas and often where no traditional tower is because of zoning. Many billboards legal nonconforming status make them a critical component of the 5G communication ecosystem especially along federal highways. SRVR Index billboard constituents have agreements with wireless operators for their transmitting equipment.

#### Sector Allocations & Company Examples



#### Tech Infrastructure: Telecommunications

41.54% of SRVR Index

- Crown Castle
- American Tower
- SBA Communications

#### Tech Infrastructure: General & Digital Media

9.85% of SRVR Index

- Outfront Media
- Landmark Infrastructure
- Lamar Advertising

#### Tenant Examples

##### Wireless Carriers Broadband Providers & Cable Companies

- Verizon
- AT&T
- Sprint / T-Mobile
- Dish Network

##### Government Agencies

- Police
- Emergency / Medical
- Federal
- Military

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# 5G & The Cloud:

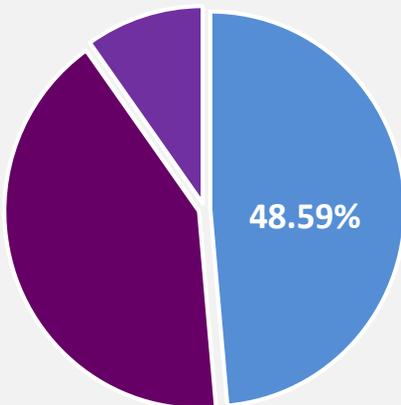
## Foundation of the Cloud: Data Infrastructure

### Data Centers

Data centers are the physical core of the cloud. In its most basic form, a data center is a secure location that houses networking, server and storage equipment. SRVR Index's data centers have high barriers to entry due to their operating expertise. The facilities are often nondescript buildings with strong security and air conditioning systems to support thousands of installed servers that use a lot of power. Many enterprises are moving to data centers for their highly interconnected ecosystems, where they can connect directly, and securely, to the cloud as well as with other important third parties including customers, suppliers, partners, and network providers.

SRVR Index's cloud data centers geographic proximity enables data and applications to be delivered more efficiently as they're located closer to where the data is being generated (known as the edge). Data centers decentralized architecture pushes compute and networking closer to the network edge, users, and devices to enable very low latency. Data is also often collected from multiple sources making cloud data centers the best meeting and distribution location. For the **intelligence revolution**, cloud is the destination, and neutral colocation facilities act as the on-ramp. The strong growth in data consumption and public cloud data storage should continue to drive secular demand for SRVR Index's data centers.

### Sector Allocations & Company Examples



#### Data Infrastructure: Data Center & Management

48.59% of SRVR Index

- Equinix
- Digital Realty
- CyrusOne
- Interxion
- GDS
- QTS Realty
- Iron Mountain

### Tenant Examples

#### Hyperscale Cloud Providers

- Amazon Web Services
- Microsoft Azure
- Google Cloud Platform
- Oracle Cloud

#### Internet

#### Media & Communications

- Facebook
- IBM
- Netflix
- Hulu
- AT&T
- Verizon
- Telefonica
- Telstra

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# 5G & The Cloud: Changing the Future of Computing & Communications Enabling Intelligence Architectures

## Going from Smartphones to Smart Cities

The mission critical assets of cell towers, fiber, and data centers may need to be in place if economies are going to transition from smartphones to smart cities. SRVR Index's decentralized architecture pushes compute and networking closer to the edge to enable very low latency. Smart cities may feature ubiquitous interconnected infrastructure making everything a "device" connected to 5G and cloud networks including streetlights, traffic systems, and parking meters. Infrastructure could potentially sync with citizens' devices, including vehicles, in order to optimize traffic flow of citizens cars with autonomous capabilities. City life will become permanently altered and will result in the emergence of the "smart city" built on the foundation of 5G & Cloud infrastructure and enabled by new technologies.

## New Technologies Enabled: Lower Latency & 10X More Capacity

The unparalleled buildout of SRVR Index infrastructure is leading the advent of new technologies. The **'Future Four Horsemen'** are four key technologies that may eventually permeate many aspects of our daily lives in the future because of the SRVR Index constituents. Significant investment is taking place to build out the technological infrastructure for:



1. Internet of Things (IoT)
2. Artificial Intelligence (AI)
3. Augmented Reality / Virtual Reality (AR/VR)
4. Blockchain / Private Distributed Ledgers

These new technologies can enable the efficient collection, storage and processing of immutable data. Businesses may want to move their data securely from on-premise to cloud, where they can apply cloud solutions, and tools, to uncover new trends and insights.

The data boom could also create a surge in demand for 5G network infrastructure which can provide a means to capture data traffic, especially from the new wave of IoT devices. The compute networking equipment will likely operate in a highly interconnected third-party data center space with the data volumes providing the fuel for artificial intelligence. These advancements, in turn, could lead to further enterprise deployments of IoT, cloud adoption, and AI spend.

## 128

### The Amount of Antennas Needed for 5G

“But when the road has too many cars, the only way to prevent traffic jams - network congestion, in the telecom analogy - is to add more lanes. Today, most cell towers have between 3 and 15 antennas. With 5G, ‘you will gain, easily, 10 times more capacity,’ [...] as towers will have as many as 128 antennas.”

Flore, D. Qualcomm's Vice President of Technology (2019). 'The Yeoman Work Behind 5G Wizardry.' *Wall Street Journal*. 11 May 2019

# 5G & The Cloud: Changing the Future of Computing & Communications Enabling Intelligence Architectures (Cont.)

## Internet of Things (IoT)

SRVR Index constituents – tower and data centers – could play a vital role globally in enabling greater connectivity between people, things, and infrastructure. New generations of technology, including 5G, are expected to help facilitate the increasing proliferation of the “internet of things” and more advanced machine-to-machine technologies. The number of IoT devices is exploding, with Intel predicting that it will grow to 200 billion connected devices in 2020, up from 15 billion in 2015. Gartner conservatively estimates 75 billion IoT devices by 2025. Regardless, each device will be collecting and transmitting data back to the cloud and through 5G infrastructure. The amount of data these connected devices are generating is staggering. More data usage requires improvements to existing network infrastructure, and this feeds growth into both the cell tower and data center industries.

## Artificial Intelligence (AI)

**Cloud Providers Enable Easy Enterprise AI Adoption** by leveraging in place cloud infrastructure. Cloud platforms cultivate an ecosystem of shared collaboration on AI projects, including open-source, with massive research and development (R&D) budgets. Enterprises are now using cloud AI tools and services to rapidly integrate intelligence in every application or device. The expanding integration of AI in business-to-business as well as business-to-consumer products and services will increase data usage exponentially requiring more SRVR Index infrastructure.

“What we’re seeing is a transition, the beginning of an S curve of growth for the data center industry.”

Dave Crowley, Chief  
Technical Advisor, Microsoft

**Bisnow Data Center  
Investment Conference,  
June 2018**

### Artificial Intelligence – Enabled by Cloud Datacenters



Eight-Rack Pod of Google’s Liquid-Cooled TPU Version 3 Servers for AI Workloads

**SRVR Index’s cloud data centers are at the heart of AI architectures.** Providers house their servers which include their own customized chips as exemplified by the picture above of Google’s AI servers. The large providers, from Amazon to Microsoft, have the scale to build their own customized chips which they believe can work substantially better for their proprietary solutions. ASICs, or application-specific integrated circuits, have been custom-built for artificial intelligence, including Google’s Tensor Processing Unit (TPU). TPU chips were found to increase compute performance while being more energy efficient. Designing custom chips and hardware for AI is expensive but demonstrates how the cloud providers are disrupting the traditional semiconductor space. It is indicative of the mutually assured disruption taking place in the nascent field of AI.

# 5G & The Cloud: Changing the Future of Computing & Communications Enabling Intelligence Architectures (Cont.)

## Augmented Reality / Virtual Reality (AR/VR)

AR/VR are fast moving environments with stringent reliability and availability requirements that might not exist without SRVR Index's mission critical infrastructure. Augmented reality devices and applications are emerging technologies that are being deployed in almost every sector of the economy, including the military for education and training purposes. Cloud service providers are essential to delivering the AR/VR experience. For example, processing the rendering that creates the 3D images which is at the very heart of AR/VR technology.

**Companies can create a hybrid cloud model in SRVR Index's data centers** that directly connects them to cloud based rendering services, while keeping their assets securely on a private cloud, **lending credence to the invaluable nature of SRVR Index infrastructure.** Real time responsiveness is absolutely critical to many of the industry's latency-sensitive applications. Even a few milliseconds of lag between a user action and an application response can ruin the experience, whether it's gaming or interactive viewing. Augmented reality and virtual reality cannot look like actual reality without high-performance and low-latency connections.

## Private Blockchain / Distributed Ledgers

**Cloud Providers Driving Blockchain Ecosystems.** Amazon Web Services, Microsoft Azure, and IBM are the leading enterprise blockchain providers, offering tools and managed services that simplify blockchain provisioning and back-office functions. Cloud providers solutions allow users to focus on business value creation. They build these applications on their existing infrastructure leveraging massive storage and processing with artificial intelligence. This can only occur on the cloud, and blockchain is one of the best ways to ensure that this data is immutable. Due to its speed, flexibility, and scale, private blockchain technology could benefit any industry requiring fast, secure transactions across multiple cloud data centers.

The emergence of blockchain cloud technology is no surprise. Blockchain solutions for secure key management and cryptography service offered on cloud neutral platforms could simplify data protection across any cloud architecture. Solutions include cloud data center key storage, encryption and tokenization while simultaneously addressing performance and GRC (governance, risk and compliance) requirements. Security at the digital edge is of particular importance for enterprises, and counterparties, and SRVR Index infrastructure can restrict key access to unauthorized users. The goal of all of these cloud services is to simplify development and ease experimentation with prebuilt models and architecture. Enterprises may not have the wherewithal and blockchain technology experts on staff to pursue proof-of-concepts on their own; they may need a trusted service provider that supplies the tools to build on top of blockchain platforms.

“When it comes down to Equinix, the way that we think about ourselves is our goal is to protect, connect, and power the digital world. And with that, we're structured as a real estate investment trust, because we are stewards of some of the most important internet infrastructure assets in the world.”

Chip Newcom  
Director of Investor Relations and  
Sustainability, Equinix

**Nasdaq & Benchmark Investments,  
Investing in 5G & Cloud Infrastructure  
Webinar, August 2019**

# 5G & The Cloud: The Investment Case

## Mission Critical Idiosyncratic Growth

### Unprecedented Demand

The intelligence revolution will command an unprecedented build out of technological infrastructure much like the industrial revolutions before it. Trillions of dollars will need to be spent over the next several years alone to support innovative solutions. Initial demand indicates:

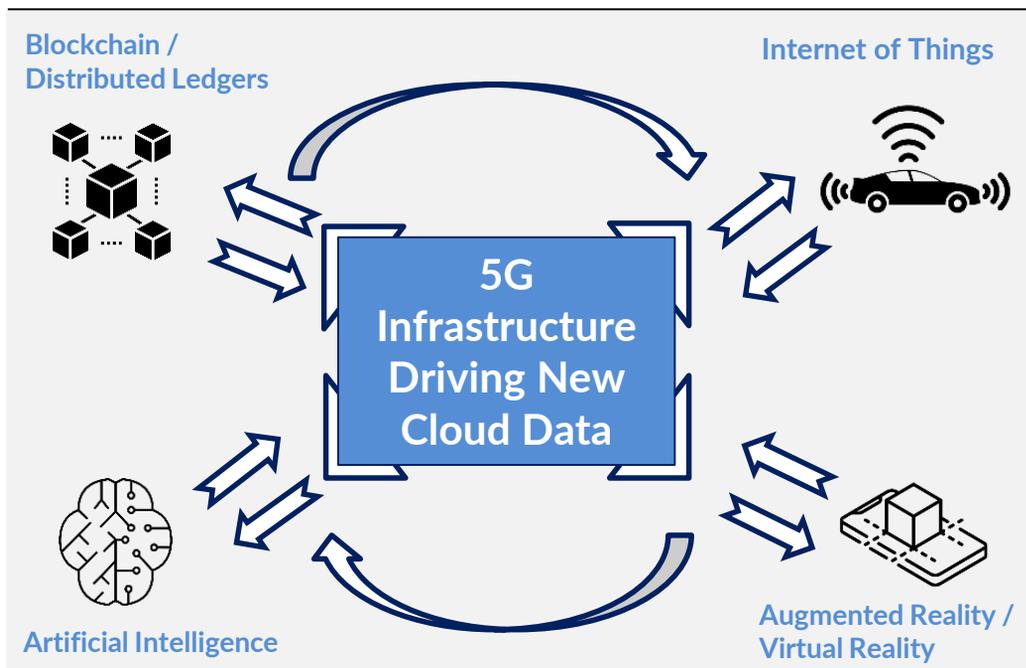
- **75 Billion** Internet of Things Devices by 2025 – Gartner
- **95%** of workloads and compute instances estimated will be processed by cloud data centers by 2021 – Cisco Global Cloud Index
- **11X Growth - 65% CAGR** – Estimated total IoT traffic between 2018 – 2023 – AV & Co. Research and Analysis
- **71.5%** of global data center traffic within the data center itself - Cisco Global Cloud Index

Data is a precious commodity. The proliferation of computing devices that permeates every aspect of our lives creates demand for data, software, and services.

**The next evolution of big data is capturing output from smartphones, IoT, and devices through the SRVR Index.** Data can now be captured as communications, compute, entertainment have all become over the top applications on the internet and now in the cloud.

### The Virtuous Cycle Enabled by 5G & Cloud Mission Critical Assets: Two-Way Data Collection and More Edge Services

Data collection from applications and devices on the internet and through the cloud have enabled cloud providers to collect and monetize data easily which in turn drives more data. SRVR Index constituents facilitate providers in securing data with blockchain, monetizing with AI, and rendering augmented reality while transmitting with the internet of things.



# 5G & The Cloud: The Investment Case

## Mission Critical Disruption Avoidance

### Tech Infrastructure: Avoiding Mutually Assured Disruption

Mutually Assured Disruption (“MAD”) is where the advent of new technologies could lead to constant investment and disruption with no clear path to success or market share. There will be winners and there will be even more losers in a field of hopeful disruptors and incumbents. MAD happens when the field of ‘disruptors’ becomes crowded and each enterprise risks spending as much time thwarting one another as well as taking on the established players they mean to displace. Furthermore, when disrupters fight, they can burn through a lot of investors’ cash while making limited progress toward becoming entrenched and profitable. In the technology field it is known as the dual disrupter dilemma. It is currently happening in the technology fields below.

SRVR Index infrastructure removes the crystal ball of investing in the new 5G & Cloud economy.

The SRVR Index enables exposure to capitalize on the growth of the intelligence revolution without having to predict winners where constant disruption is rampant.

### 5G & Cloud Technology Industries Ripe for Disruption and Obsolescence:

- Semiconductors
- Telecommunications Equipment
- Computer Services & Software
- Computer Hardware & Electronics

In the intelligence revolution, traditional semiconductor, software, and hardware companies can come under pressure not only to disrupt, but to also use technology to create better consumer and enterprise outcomes or to improve efficiency.

It should become increasingly important for investors to pay attention to how the companies they own are disrupting, adapting, and using technology. Investors seeking to benefit from innovation should be aware that in past revolutions, there were periods of disruption after new technologies were introduced, that made it unclear which companies would adapt and which start-ups would become tomorrow’s fast-growing companies.

### Mutually Assured Disruption – Apple, Qualcomm, Intel 5G Modem Semiconductor Example

**Investment Thesis:** Apple was reportedly planning to use Intel’s 5G chips for its 2020 iPhone models.

**Event:** Intel abandoned the development of modems for 5G smartphones, an effort it had spent a decade and billions of dollars on, citing no clear path to profitability. The news that Intel had exited the 5G modem business came just hours after the Apple / Qualcomm settlement agreement was announced.

**Cause:** Apple and Qualcomm settled their multi-year long, patent and antitrust lawsuit ceasing all litigation. Apple signing a six-year licensing deal with Qualcomm and also agreeing to buy Qualcomm chips. Qualcomm, on the other hand, is preparing to ship its second generation 5G chip and can meet Apple’s needs with its current products.

**Result:** Apple bought Intel’s 5G smartphone chip business which became the embodiment of the mutually assured disruption that will take place during the intelligence revolution. For Intel’s part, the deal would allow the company to shed a business that had been weighing on its bottom line: The smartphone operation had been losing about \$1 billion annually, a person familiar with its performance has said, and has generally failed to live up to expectations according to the Wall Street Journal.

**Further Disruption:** While Apple and Qualcomm signed a supply agreement, Apple is working on developing its own modems and disclosed in court earlier this year that it has held talks with MediaTek and Samsung around modems. Apple also builds its own graphics engines, wireless chips and is exploring custom batteries and screens.

# 5G & The Cloud: The Investment Case

## Mission Critical Risk / Reward Attributes

### Portfolio Diversification Effects

The core principles of investing may not change as the **intelligence revolution** could disrupt many sectors of the financial markets. Investors seeking to benefit from innovation should be aware that in past industrial revolutions, there were periods of disruption after new technologies were introduced that made it unclear which companies would adapt and which start-ups would become tomorrow's fast-growing companies.

It will be important for investors to pay attention to how the companies they own are investing in, adapting and using technology. The intelligence revolution is an exciting, and potentially a high growth area but separating reality from hype is going to be difficult. Investors should consider investing in the broader technology ecosystem with the SRVR Index as the constituents are set to benefit from the shift to emerging solutions.

*SRVR Index is an asset class that investors should consider owning as part of a well-diversified portfolio. A key benefit of diversification is the potential to increase long-term returns without taking on additional risk.*

### Differentiated Exposure - Uncorrelated Asset Class

SRVR Index's mission critical infrastructure assets have shown relatively low sensitivity to macro factors, such as economic cycles and interest rates, while concurrently offering relatively attractive cash flow growth profiles, making them a particularly appealing and critical element of a diversified portfolio. *SRVR Index members provide diversification to portfolios because their price movements, during most periods, are not correlated with the rest of the market.*

## SRVR Index Risks

SRVR Index constituents are publicly traded in the United States and are subject to the risks of the public equities markets. The biggest risk for equities is market risk where investors can experience losses due to factors that affect the overall performance of the financial markets. Market risk, also called "systematic risk," cannot be eliminated through diversification. Sources of market risk include recessions, political turmoil, changes in interest rates, natural disasters and terrorist attacks. Systematic, or market risk, tends to influence the entire market at the same time. Furthermore, real estate ownership and management, like any other business or commercial endeavor, is subject to all sorts of risks. SRVR Index members could be subject to three principal risks aside from market risk:

#### Real Estate Risks

- Interest Rate Sensitivity
- Supply / Demand Conditions
- Competition from Nearby Sites
- Property Expenses
- State & Local Permitting

#### 5G Infrastructure Risks

- Technology Obsolescence
- Land Ownership vs. Leases
- Tenant Consolidation
- International & Currency Risks
- Carrier Cost Reduction

#### Cloud Infrastructure Risks

- Competition from Hyperscale Users
- Supply Growth Pressure
- Public Cloud vs. Hybrid / Multi
- Higher Utilization
- Reduced CapEx

# 5G & The Cloud: The Investment Case

## Mission Critical Risk / Reward Attributes

### Differentiated Risk / Reward Metrics

SRVR Index gives exposure to the build out of cloud, 5G, and edge computing infrastructures without exposure to traditional semi-conductor, software, and hardware companies which could demonstrate performance dispersion as they spend trillions on capital expenditures over the next decade.

The SRVR Index strategy aims to cut the risk of a portfolio and improve its long-term risk-return profile by optimizing the weights of the asset classes with regards to the overall risk of the portfolio. By adding the SRVR Index to portfolios, investors should experience much lower risk levels without compromising the growth of technology. From a risk budgeting perspective, this means that investors could “spend” less of their tech risk allowance on this portion of their asset allocation while still maintaining access to returns.

There is a predictability and steadiness to most SRVR Index companies operating and financial performance from quarter to quarter and from year to year. The stability and predictability of SRVR Index’s rental revenues, occupancy rates, and operating costs reduces the risk of negative surprises and volatility. Real estate and technology are cyclical industries, and there will be down years. However, rental rates, and technology infrastructure cash flows, tend to grow over time. Long-term leases enjoyed by SRVR Index constituents provide earnings stability making the asset class act more like fixed income.

*Stock exchange traded SRVR Index members may provide investors an efficient way to diversify their technology investments to reduce risk and potentially increase long-term returns.*

Owning exposure to the SRVR Index lowers the vexing issues raised by other non-listed investment vehicles:

- Offers diversification and liquidity
- Provides expert and experienced management teams and investor transparency
- Avoid conflicts of interest between management teams and their investors

### SRVR Total Return Index Against S&P500 Total Return Index May 15, 2018 – September 30, 2019

Metric	SRVR <sup>SM</sup> Index	S&P 500 Index	Potential Portfolio Result
Annual Return	24.65%	8.64%	Higher Absolute Returns
Upside Capture	94.36%	100%	Comparable Upside
Downside Capture	23.29%	100%	Less Downside
Beta	0.64	1.00	Lower Beta
Alpha	16.03	0.00	Higher Alpha
Sharpe Ratio	1.63	0.58	Higher Risk-Adjusted Returns

Time Period from 5/15/2018 to 9/30/2019

Source: Benchmark Investments, Bloomberg LP, Morningstar. Nasdaq is the independent index calculation agent. The Index was released on 12/28/2017. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS. YOU CANNOT INVEST DIRECTLY IN AN INDEX.

# 5G & The Cloud: The Investment Case

## Mission Critical Risk / Reward Attributes

### Investment Performance

SRVR Index constituents are professionally managed, publicly traded companies, that are the leaders in **5G & Cloud mission critical infrastructure**. They attract tenants and earn income by building value throughout long-term investment cycles with their specialized business models. SRVR Index constituents drive total return performance for technology infrastructure investors, who could benefit from strong, reliable annual dividend payouts and the potential for long-term capital appreciation.

*SRVR Index constituents' track record of reliable and growing dividends, combined with long-term capital appreciation through stock price increases, could have provided investors with attractive total return performance for many periods over the past 10 years. Performance dispersion can be significant when compared to the broader stock market, broad based real estate, fixed income indices, and other major indices, as well as the rate of inflation.*

### Portfolio Positioning Rationale

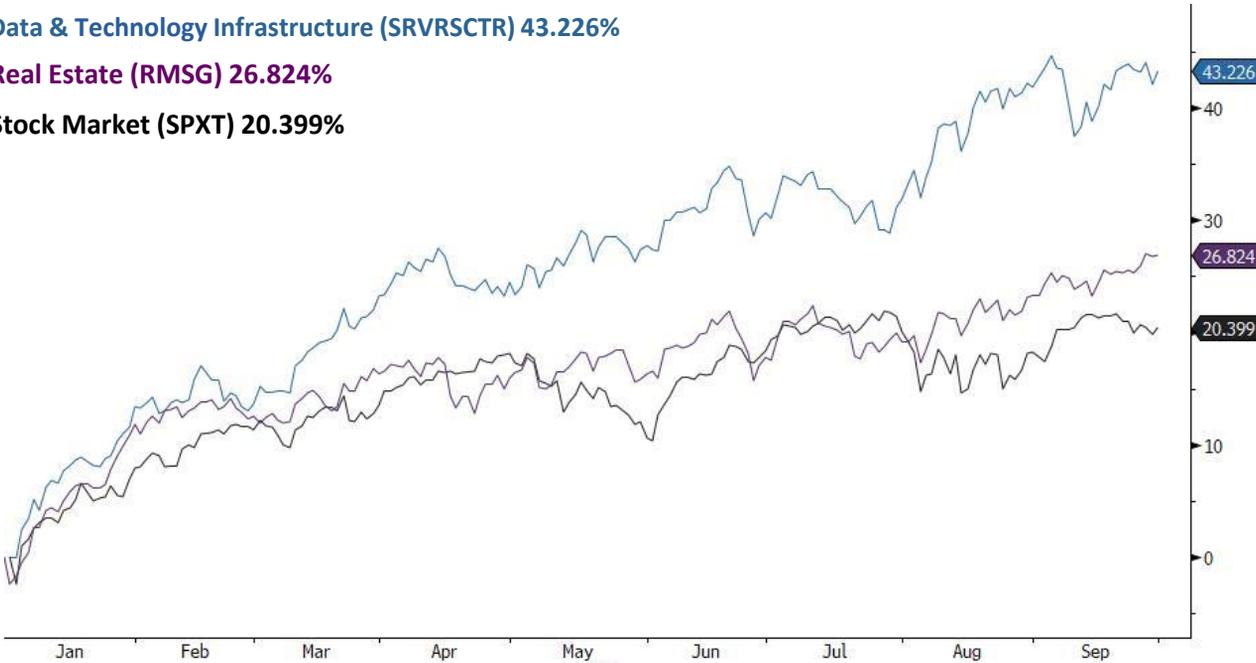
- Significant outperformance of the S&P 500 over most periods
- Better returns versus broad based infrastructure and real estate
- Delivers growth of technology with the safety and security of income assets

### 2019 Year-to-Date Total Return Index Percentage Performance

Data & Technology Infrastructure (SRVRSCTR) 43.226%

Real Estate (RMSG) 26.824%

Stock Market (SPXT) 20.399%



Date: 01/01/2019 – 9/30/2019

Source: Benchmark Investments and Bloomberg LP. Nasdaq is the independent index calculation agent. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS. YOU CANNOT INVEST DIRECTLY IN AN INDEX.

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## Index Versions

Symbol	Index Name
SRVRSCTR	Benchmark Data & Infrastructure Real Estate SCTR <sup>SM</sup> Total Return Index
SRVRS CPR	Benchmark Data & Infrastructure Real Estate SCTR <sup>SM</sup> Price Return Index
SRVRS CNR	Benchmark Data & Infrastructure Real Estate SCTR <sup>SM</sup> Net Total Return Index

Index Provider **Benchmark Investments**  
Calculation Agent **Nasdaq Global Markets**



## Index Statistics

Index Symbol	<b>SRVRSCTR</b>
Reconstitution	<b>Quarterly</b>
Rebalance	<b>Quarterly</b>
Weighting	<b>Modified Market Cap</b>
Components	<b>18</b>
Calculation Date	<b>12/28/2017</b>
Inception Date	<b>3/16/2007</b>
Base Value	<b>1000</b>

## Index Definitions

**Annualized Returns:** Return is the amount of money an investment made for a portfolio. Return is given as a percentage.

**Upside / Downside Capture Ratios:** Upside/downside capture ratio show whether a given strategy has outperformed, gained more or lost less than, a broad market benchmark during periods of market strength and weakness, and if so, by how much. Upside capture ratios for strategy's are calculated by taking the strategy's monthly return during months when the benchmark had a positive return and dividing it by the benchmark return during that same month. Downside capture ratios are calculated by taking the fund's monthly return during the periods of negative benchmark performance and dividing it by the benchmark return.

**Beta:** Beta is a measure of a strategy's sensitivity to market movements. It measures the relationship between a fund's excess return over T-bills and the excess return of the benchmark index. Equity funds are compared with the S&P 500 index. Morningstar calculates beta using the same regression equation as the one used for alpha, which regresses excess return for the fund against excess return for the index. This approach differs slightly from other methodologies that rely on a regression of raw returns.

**Alpha:** A measure of the difference between a strategy's actual returns and its expected performance, given its level of risk as measured by beta. A positive alpha figure indicates the strategy has performed better than its beta would predict. In contrast, a negative alpha indicates the strategy's underperformance, given the expectations established by the strategy's beta.

**Sharpe Ratio:** This risk-adjusted measure was developed by Nobel Laureate William Sharpe. It is calculated by using standard deviation and excess return to determine reward per unit of risk. The higher the Sharpe ratio, the better the fund's historical risk-adjusted performance. It is calculated for the past 36-month period by dividing a portfolios' annualized excess returns over the risk-free rate by its annualized standard deviation. The Sharpe ratio can be used to compare directly how much risk two funds each had to bear to earn excess return over the risk-free rate.

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