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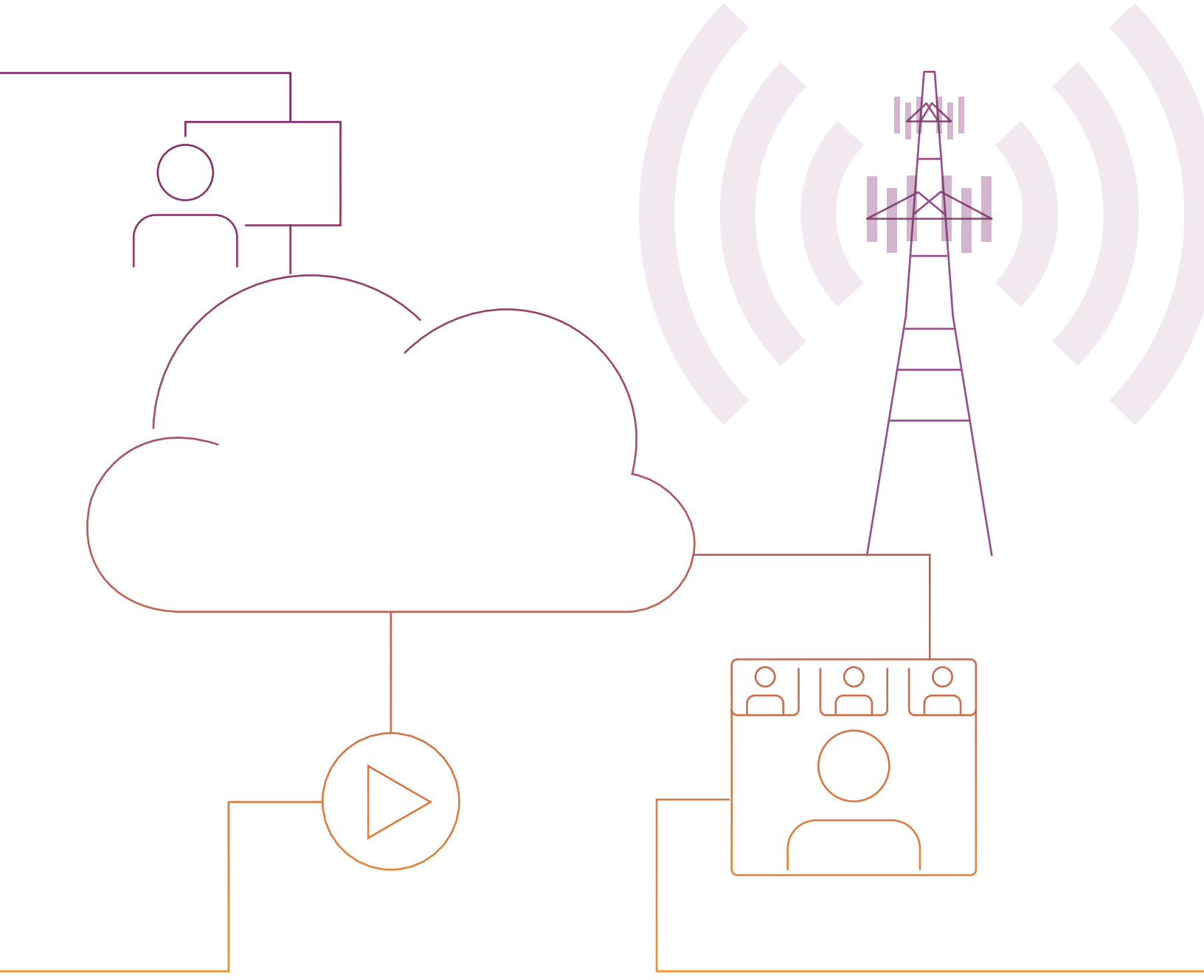
March 10, 2021

Hyperconnectivity Is Here

Introducing the Morningstar Global Digital Infrastructure & Connectivity Index



Andrew Lane
Director of Equity Research—
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Services, LLC

We live in the age of hyperconnectivity. Technological advancements have enabled new communication vectors from human to human, human to machine, and machine to machine. Modern society has grown ever more dependent on the web of digital infrastructure that facilitates countless functions of our daily lives. The networks we rely on have changed how we communicate, how we work, and how we spend our free time. With data traffic growing at an exponential rate, the importance of digital infrastructure will only continue to increase.

Investors have expressed a clear desire to capitalize on this theme, as it will continue to drive rapid, transformational change. However, this objective can prove more challenging than one might suspect. Countless publicly traded companies claim that they will benefit substantially as the world's digital infrastructure and connectivity methods evolve. We contend that exposure to this theme will prove immaterial for many and perhaps even adverse for others. Indeed, many existing thematic indexes fall short in identifying companies that will deliver sufficient exposure to a given theme.

The Morningstar Global Digital Infrastructure and Connectivity Index provides a compelling solution. It offers concentrated exposure to companies that are expected to enjoy significant and growing economic benefits from the development of two promising digital infrastructure technologies—infrastructure as a service and next-generation wireless connectivity (5G). While some indexes focused on cloud computing and 5G connectivity already exist, this index is unique in that it includes only those companies that facilitate the provision of IaaS and 5G technologies rather than also including the adopters of these technologies. This design aims to deliver thematic exposure that is "cleaner" and more concentrated. The index leverages the forward-looking insights of Morningstar equity analysts to provide exposure to companies that will benefit most from the evolution of IaaS and 5G technologies.

Infrastructure as a Service

Infrastructure as a service involves a vendor leasing commodity equipment and services such as servers, storage, switches, and network access. Service agreements can range from on-demand burst capacity or full-time digital infrastructure. IaaS is closely related to platform as a service, which incorporates the core software needed to make hardware usable. PaaS includes the operating system, hypervisor, database, and development tools, among other solutions. Given that IaaS and PaaS are inextricably linked, we include PaaS exposure within the overarching IaaS theme.

IaaS: What the Future Will Hold

Cloud adoption will continue unabated as companies wrestle with digital transformation and modernization efforts. Gartner estimates that the broader cloud computing market will reach $305 billion in 2021 and grow another 19% in 2022. Morningstar forecasts continued rapid growth thereafter. We drill down within the cloud opportunity to see the IaaS and PaaS markets having nearly reached $100 billion in 2020, growing nearly twice as fast as the broader cloud market. Accordingly, while software-as-a-service companies often dominate headlines as it pertains to the broader theme of cloud computing, this index's more "upstream" exposure to IaaS/PaaS provides even more attractive growth prospects. The Morningstar Global Digital Infrastructure and Connectivity Index includes companies that we expect to contribute meaningfully to this growth trajectory.

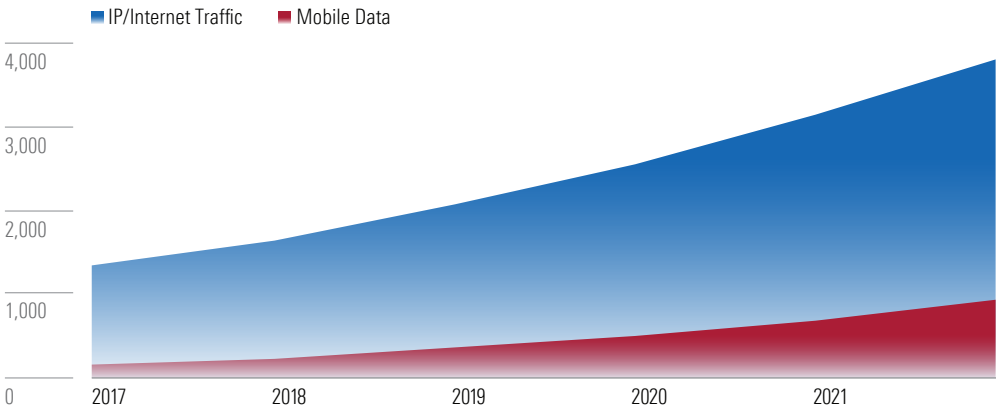
Exhibit 1. **Gartner Worldwide Public Cloud Services End-User Spending Forecast ($ Bil)**

	2019	2020	2021	2022	CAGR (%)	% of 2022 Total Spend
Cloud Application Services (SaaS)	102,064	101,480	117,773	138,261	10.6	38.2
Cloud System Infrastructure Services (IaaS)	44,457	51,421	65,264	82,225	22.7	22.7
Cloud Application Infrastructure Services (PaaS)	37,512	43,823	55,486	68,964	22.5	19.0
Cloud Business Process Services (BPaaS)	45,212	44,741	47,521	50,336	3.6	13.9
Cloud Management and Security Services	12,836	14,880	17,001	19,934	15.8	5.5
Desktop as a Service (DaaS)	616	1,204	1,945	2,542	60.4	0.7
Total Market	**242,696**	**257,549**	**304,990**	**362,263**	**14.3**	—

Source: Gartner

The need for IaaS solutions will be catalyzed by an increasing baseline of global Internet users. Cisco forecasts that there will be 5.3 billion Internet users by 2023, having increased at a 6.3% CAGR from 3.9 billion in 2018. This would imply that the percentage of the global population using the Internet rises to 66% from just 51%. Sliced differently, this represents a staggering increase of 1.4 billion Internet users over just a five-year period. This will continue to spark rapid global data traffic growth, which Cisco estimates will increase at a 26% CAGR from 2017-22.

Exhibit 2. **Cisco Global Data Traffic Forecast (exabytes)**



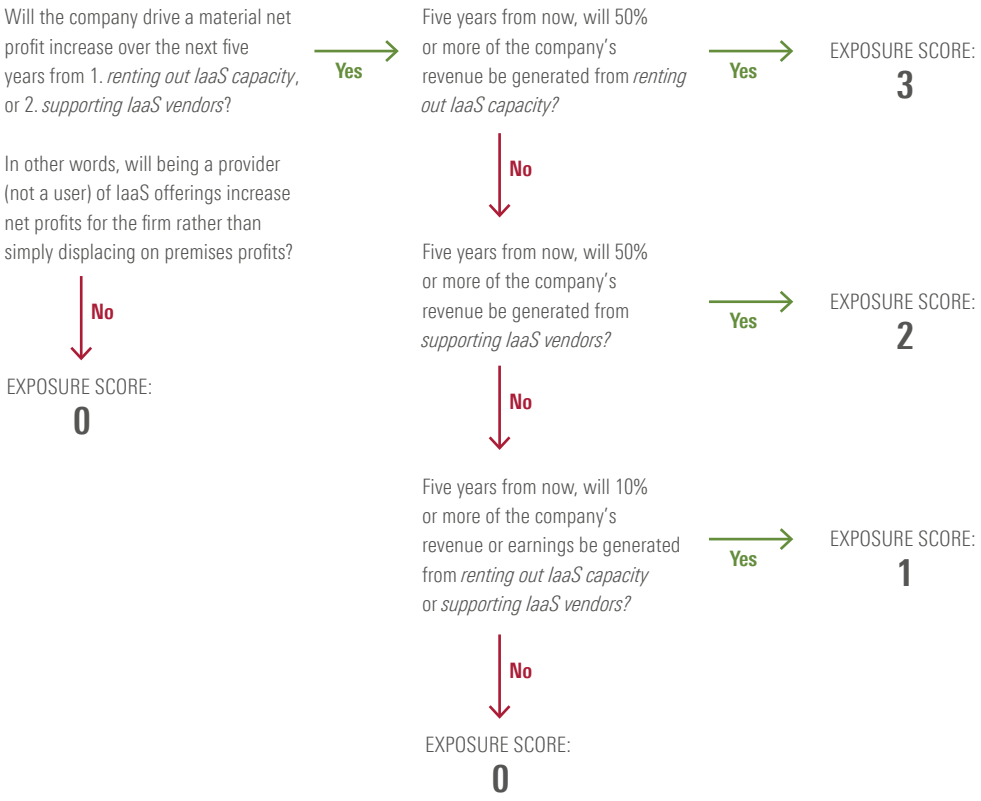
Source: Cisco Annual Internet Report.

A rising tide of Internet users, combined with increasing data consumption per user, bolsters our expectations that providers of IaaS solutions will enjoy substantial revenue and profit growth.

IaaS Thematic Exposure Scoring Framework

Our framework to generate IaaS thematic exposure scores relies on forward-looking assessments from Morningstar equity analysts regarding company-specific revenue and net profit impacts tied directly to this theme. This framework assumes that companies renting out IaaS capacity offer greater exposure to this theme than companies that support these IaaS vendors. Ultimately, we believe that companies with the highest thematic exposure scores will offer the greatest exposure to the theme of growing IaaS adoption.

Exhibit 3. **Thematic Exposure Scoring Framework**



Source: Morningstar.

Index Holdings with IaaS Exposure

Arista Networks (ANET)
Sector: Technology
Industry: Information Technology

Arista Networks has solidified its market presence through data center switching and software-based networking innovation, and we believe customers will remain loyal to the firm's Extensible Operating System software and peripheral products. Arista's initial growth came from high-frequency trading firms that found value in its low-latency switches, and then continued growth came from cloud-based data center suppliers yearning for Arista's 100 gigabit hardware, simplified network architecture, and EOS software. Arista is a main player in the upcoming 400 Gb buildout wave within cloud data centers, and the firm is working to diversify its revenue streams with enterprise customers and the campus market.

EOS' novelty lies in its single software image that provides a consolidated view of device activity from end to end and its ability to centrally upgrade the entire network. EOS contains leading software-defined networking features while remaining intuitive, fully programmable, and interoperable across network ecosystems. Arista uses merchant silicon for its hardware, which we believe allows the company to focus on its core competency of software innovation.

Arista works closely with its core customers to optimize their networking ecosystems, which can strengthen its customer switching costs. To expand its customer base beyond the data centers of hyperscale cloud providers, enterprises, service providers, and financial institutions, Arista announced its intention to expand into the campus market. The adjacent move is due to requests from existing customers desiring one software platform across networking locations, and Arista has bolstered its clout with wireless capabilities. Even with current customer concentration risk, we respect that Arista is growing alongside key customers and that new ventures have expanded from core competencies. Our opinion is that Arista is well positioned as a pioneer in the new age of software-defined networking and will continue to be a leader in next-generation switches and routers. Ultimately, the company's revenue and profits are closely tied to customers that provide access to cloud computing.

Intel (INTC)
Sector: Technology
Industry: Semiconductors

Intel is the leader in the integrated design and manufacturing of microprocessors found in PCs and servers. With the rise in interconnectivity of devices, Intel strives to provide the most powerful and energy-efficient silicon solution to any "smart and connected" product. The data centers used to facilitate the information stored, analyzed, and accessed by various front-end devices are mostly run with Intel server chips.

Intel historically differentiated itself first and foremost via the execution of Moore's law, which predicts that transistor density on integrated circuits will double about every two years, meaning subsequent chips have substantial power, cost, and size improvements. This scaling advantage was perpetuated through a higher-than-peer-average R&D and capital expenditure budget that allows it to control the entire design and manufacturing process in an industry where the majority of competition focuses on only one phase.

As cloud computing continues to garner significant investment, Intel's data center group will be an indirect beneficiary. Mobile devices have become the preferred device to perform computing tasks and access data via cloud infrastructures that require large-scale server buildouts. This development has provided strong tailwinds for Intel's lucrative server processor business. Nearly half the company's projected revenue will come from data centers, and IaaS provision will account for a meaningful portion of the associated growth.

Notable IaaS Company Exclusion

Facebook (FB)
Sector: Communication Services
Industry: Internet Content & Information

Facebook offers great expertise in running large data centers. Accordingly, one might surmise that it would garner a high exposure score for the IaaS theme. However, Facebook is not an actual provider of IaaS solutions. Additionally, the company offers very exposure to the specific IaaS theme, as the overwhelming majority of its revenue and profits are tied to advertising. As a result, it was assigned an IaaS thematic exposure score of 0 and is not an index constituent.

5G Connectivity Solutions (Next-Gen)

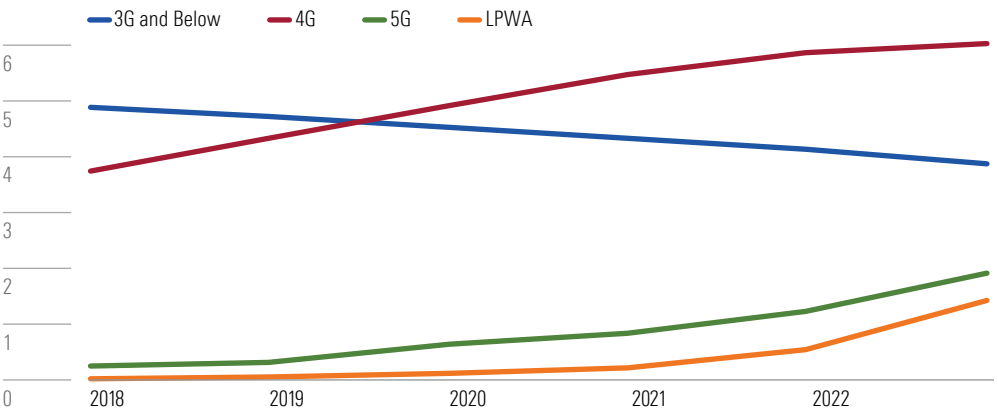
5G refers to the collection of technology standards that forms the foundation of wireless networks under development around the world. The standards seek to enable significant increases in network capacity and speeds, as well as improved network management capabilities. These factors enable the use of millions of devices simultaneously. Future 5G networks will provide critical links for digital infrastructure between consumer devices, sensors, and a host of other users in the field.

5G: What the Future Will Hold

Five years from now, the suite of technologies that fall under the 5G banner will be widely deployed across carrier networks globally, providing most of the capacity in all but the most undeveloped countries. To take full advantage of 5G, carriers will steadily densify their networks, expanding the use of dense fiber systems to deploy small cells and edge-computing solutions. At the same time, alternative providers will emerge to provide both traditional data services (primarily Internet access) and highly specialized offerings. These providers include stand-alone cable companies that possess network management expertise and new entrants (industrial firms, municipalities, and so on) that will require significant consulting help to be successful. For the digital infrastructure index, we look to include companies that will contribute meaningfully to the growth of 5G adoption and benefit in an outsize manner because of it.

We are in the very early stages of 5G adoption, although we expect uptake to grow at an exponential rate in the coming years. Cisco estimates that there will be 1.4 billion 5G devices or connections globally by 2023. However, there were roughly 10 billion devices or connections using 4G or lower connectivity in 2020 that will gradually be displaced by 5G connectivity over the long term.

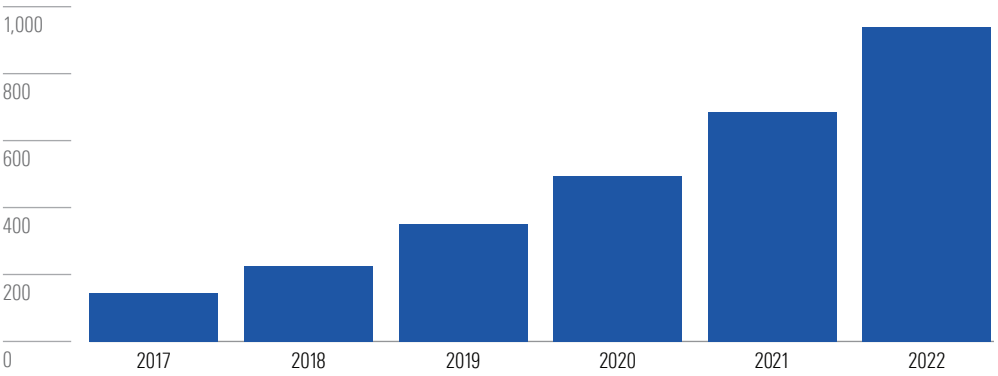
Exhibit 4. **Global Mobile Devices/Connections (billions)**



Source: Cisco Annual Internet Report.

Meanwhile, mobile data traffic overall is slated to grow at a robust 45% CAGR from 2017-22. For any company providing the technology to facilitate 5G connectivity, these outlooks represent the potential for incredible growth.

Exhibit 5. **Global Mobile Data Traffic (exabytes)**

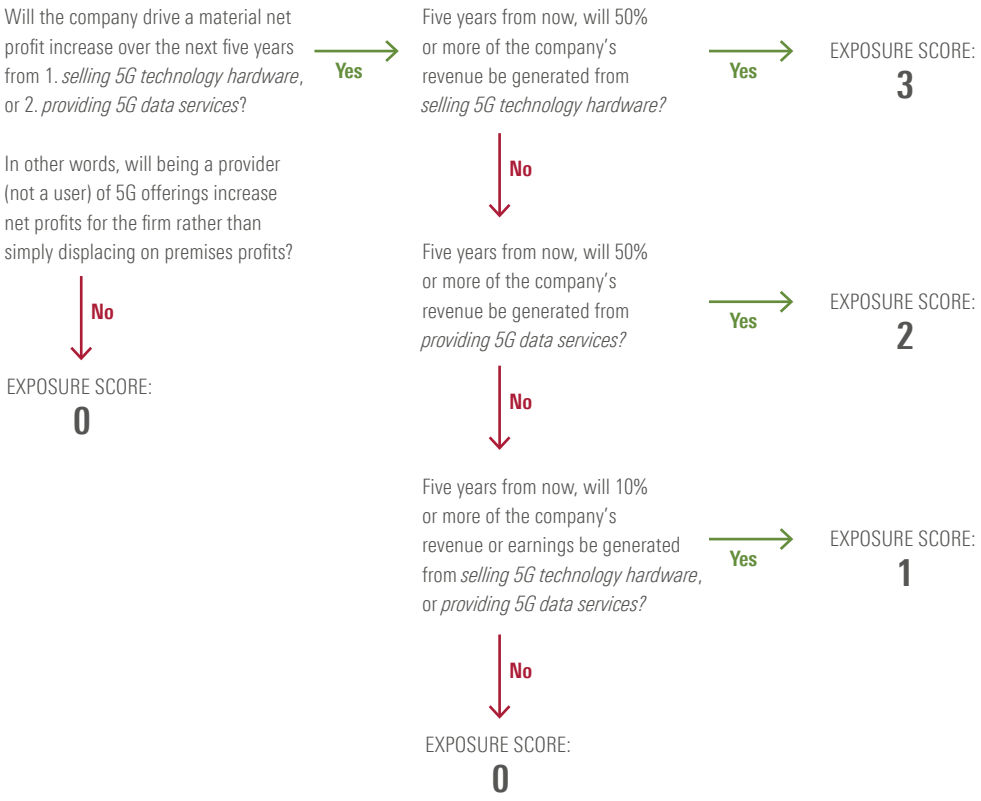


Source: Cisco Annual Internet Report.

5G Thematic Exposure Scoring Framework

Like our IaaS framework, 5G thematic exposure scores use forward-looking assessments from Morningstar equity analysts for company revenue and net profit impacts tied directly to this theme. This framework assumes that companies selling 5G technology hardware offer greater exposure to this theme than companies that provide 5G data services. Ultimately, we believe companies that garner the highest thematic exposure scores will offer the highest exposure to the theme of growing 5G adoption.

Exhibit 6. **5G Thematic Exposure Scoring Framework**



Source: Morningstar.

Index Holdings with 5G Exposure

Qualcomm (QCOM)
Sector: Technology
Industry: Semiconductors

We expect Qualcomm's licensing business, the driver of the firm's narrow moat rating, to see solid growth from the ramp of 5G networks in the coming years. Qualcomm is first and foremost the steward of patents associated with wireless communications technologies, originally in third-generation, or 3G, CDMA networks and, later, in 4G LTE networks commonplace today. Qualcomm's treasure trove of patents allows the firm to charge devicemakers a royalty fee as a percentage of the price of each device sold, especially as devices with new networks like 5G are backward-compatible with most 4G and 3G networks. Qualcomm is also on the forefront in 5G network development and developing enough IP to ensure that it will collect 5G royalties well into the future. In addition to licensing its IP portfolio, the firm designs chips used in smartphones. Qualcomm's high-end Snapdragon application processors are common in high-end Android smartphones, though OEMs have sought to replicate Apple's strategy of developing in-house chips. Despite the threat to Qualcomm's position, the firm has done a solid job of maintaining business at major OEMs such as Samsung, though we think there will be fewer lucrative opportunities going forward.

The firm has historically held a competitive edge in baseband chips, which are critical to devices' inherent ubiquitous connectivity. It has also gained traction in radio frequency front-end modules. Qualcomm had been the sole baseband supplier at Apple for multiple iterations of the iPhone. It lost a portion of this business to Intel in 4G but is now the sole 5G iPhone baseband supplier. However, Apple has acquired Intel's baseband business, and we think Apple will probably use these in-house

chips in future 5G phones. All the while, Qualcomm remains intent on pivoting into nonsmartphone areas such as automotive and "Internet of Things." At least 85% of current revenue is derived from smartphones or licensing that could tie into future 5G connectivity.

Ericsson (ERIC B)
Sector: Technology
Industry: Communication Equipment

Ericsson is a leading provider of hardware, software, and services to communication-service providers. The company is excelling in 5G buildouts and is gaining share. 5G may have a longer spending period than previous wireless iterations, and we believe Ericsson's robust portfolio of hardware and software coupled with its industry-leading services business has it primed to take advantage of 5G network demand.

We expect Ericsson's previous restructuring and strategic development efforts in radio access innovation, combined with 5G demand, to create top-line and operating margin expansion. We believe that Ericsson's software-defined networking will be fruitful as software becomes essential in a 5G world and helps insulate from hardware spending lulls. Our expectation is for Ericsson to gain from 5G networks requiring many small-cell antenna sites to propagate the fastest transmission bands. Ericsson should profit from 5G networks creating more product use cases such as Internet of Things devices within cars and factories. Based on our view that network complexity will increase as firms control and monitor a rapidly growing quantity of Internet of Things devices, we expect Ericsson's software and services to be in high demand. The company also creates revenue from licensing patents that are essential in the production of 5G smartphones (as well as previous generations). We believe Ericsson may find licensing opportunities in nonhandset markets, and that licensing revenue will help bolster operating results. Going forward, the vast majority of Ericsson's revenue and profit will be attributed to 5G connectivity in some way.

Notable 5G Company Exclusion

Verizon (VZ)
Sector: Communication Services
Industry: Telecom Services

Telecoms play a critical role in providing 5G connectivity to network users, so one might expect them to be well represented in an index targeting that theme. However, for most telecoms, 5G profits will largely displace prior 4G profits. Any net profit increase associated with providing 5G connectivity is likely to be less material than one might suspect. This suggests that Verizon, and telecoms more broadly, offer a surprisingly limited degree of exposure to the 5G theme. In turn, the telecoms we cover were assigned a 5G thematic exposure score of 0 and are not index constituents. This serves as a primary example of how our analyst-driven thematic exposure scores can provide more concentrated thematic exposure versus other methods of portfolio construction that employ less-intensive oversight.

The Global Digital Infrastructure and Connectivity Index Offers a Unique Approach to Portfolio Construction

To inform index construction, Morningstar's 100-plus equity analysts provide forward-looking thematic exposure scores across more than 1,500 companies for each of the IaaS and 5G themes. This approach leverages analyst-driven assessments as to how the future revenue and profits of individual companies will be affected by Morningstar's broader outlook for the evolution of these technologies. The thematic scoring process aims to ensure that the index includes not only companies with current exposure to the broader digital infrastructure theme but also those that

will drive future innovation. Too often, thematic indexes use automated keyword searches from filings or historical data points to determine a company's exposure to a theme. However, we'd liken these tactics to performing surgery with a blunt instrument. In this vein, the manual oversight provided by Morningstar equity analysts in developing company-specific, forward-looking thematic exposure assessments represents an attractive value proposition.

We've designed the Morningstar Global Digital Infrastructure and Connectivity Index to include developers of technologies that facilitate the provision of IaaS and 5G connectivity. This index is built around a set of key assumptions:

1. The adoption of IaaS and 5G connectivity solutions represents a long-term theme that will remain highly relevant for many years.

2. The index is able to provide meaningful exposure to each of these two themes.

3. Developers of IaaS and 5G technologies offer a higher degree of thematic exposure than adopters of these technologies.

4. The ability of Morningstar analysts to provide forward-looking judgments regarding the impact these themes will have on specific companies will augment the thematic exposure offered by the index.

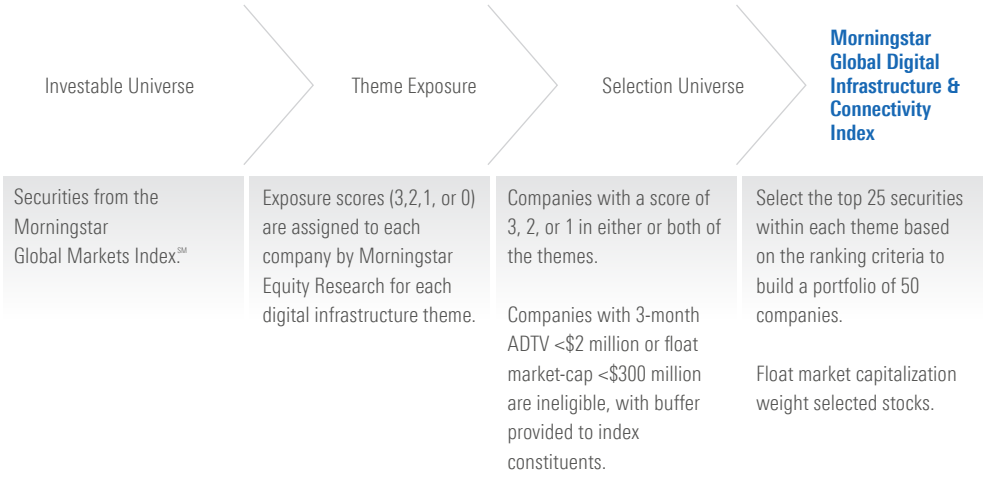
5. Our thematic exposure scoring framework allows for internally consistent analyst scoring that does not imply false precision.

The index ultimately includes 25 stocks with concentrated exposure to the IaaS theme and 25 stocks with concentrated exposure to the 5G connectivity theme for a total of 50 holdings. The portfolio construction rules will prioritize those stocks we believe to offer the most concentrated thematic exposure within the broader universe of all companies scored.

Portfolio Construction Process

Portfolio construction rules for the Morningstar Global Digital Infrastructure and Connectivity Index aim to ensure that it has a roughly equal thematic exposure representation between the IaaS and 5G themes. This is achieved via the use of two sleeves, one for each of the two themes, that leverage the "primary theme" designation for each company assigned by Morningstar equity analysts. Within each sleeve, the portfolio construction rules are then designed to maximize the portfolio's exposure to each theme by prioritizing companies with the highest analyst-driven thematic exposure scores. Please see the "Ranking Criteria" section of Exhibit 8 for more detail.

Exhibit 7. **Portfolio Construction Process**



Source: Morningstar

Exhibit 8. **Construction Process Parameters**

Parameter	Description
Selection Universe	Morningstar IaaS and 5G scores universe. Only primary share class securities are eligible.
Liquidity Filter	Remove securities with 3-month average daily traded value **<$2 mil USD** ($1.5 mil for buffered securities) or float market cap **<$300 mil** ($200 mil for buffered securities).
Primary Theme Assignment	Primary Theme assigned to each security based on **higher theme exposure** score. Analyst discretion used for securities with the same exposure scores for both themes.
Ranking Criteria	Constituents are ranked in order that emphasizes exposure to Digital Infrastructure themes. **Within each Primary Theme**, securities are ranked based on the descending order of absolute preference: ▸ Exposure score for **Primary Theme** ▸ Exposure score for **Non-Primary Theme** ▸ **Current** index constituents are given preference. ▸ Market capitalization, preferring **smaller** over larger.
Reconstitution Frequency	**Annually** (in December)
Number of Stocks	**50** (25 securities in each Primary Theme)
Weighting Scheme	**Float Market-Cap Weighted** with 50% weight to each Primary Theme
Security Capping	Security weight **capped at 2.5%** Excess weight distributed among other securities in the **same Primary Theme** in proportion of their existing weights

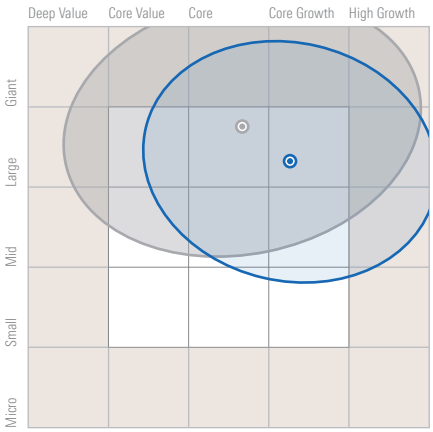
Source: Morningstar

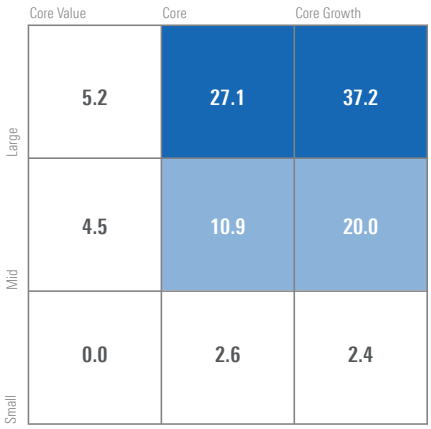
Index Size and Style Analysis

The Morningstar Global Digital Infrastructure and Connectivity Index currently operates in the large-cap growth area of the Morningstar Style Box. The style bias is intuitive, given that its holdings provide exposure to themes that we expect to grow in an exponential manner as society becomes more hyperconnected in the years to come. The large-cap size positioning stems largely from the fact that there are relatively few small- or mid-cap pure plays tied to the IaaS and 5G connectivity themes. Most companies that can be considered market leaders in the provision of associated technologies tend to be quite large. Indeed, establishing and maintaining a widespread IaaS or 5G network requires a significant capital outlay, the likes of which a smaller upstart wouldn't typically have the wherewithal to commit. Relative to its Morningstar Global Markets Index benchmark, the Morningstar Global Digital Infrastructure and Connectivity Index leans more heavily toward growth companies and skews a bit smaller from a market cap perspective. The index's exposure to mid-cap holdings is nearly double that of its benchmark. Looking forward, we do not anticipate any significant changes to the portfolio's broader positioning within the Morningstar Style Box.

Exhibit 9. **Size and Style Positioning**

Holdings-Based Style Map





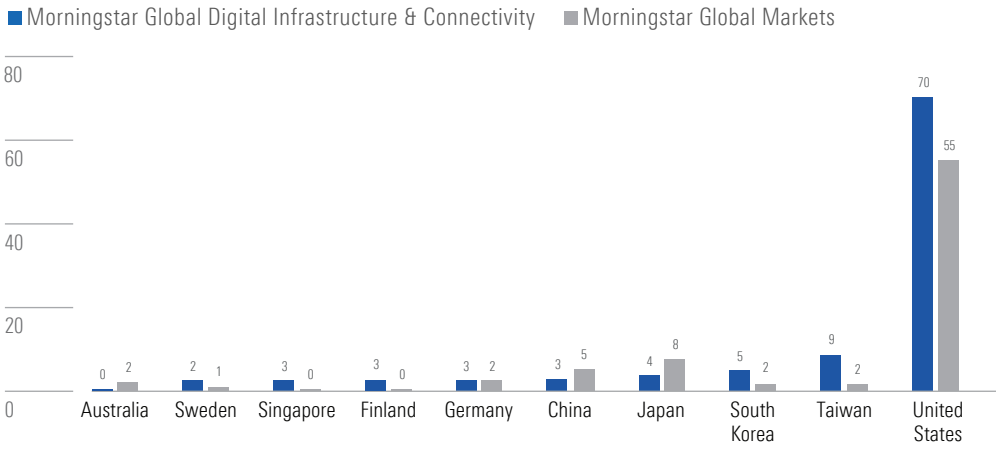
- **Morningstar Global Digital Infrastructure & Connectivity Index**
- Morningstar Global Markets Index

Source: Morningstar Direct. Data as of Dec. 31, 2020.

Index Country, Sector, and Industry Weightings

The Morningstar Global Digital Infrastructure and Connectivity Index skews heavily toward U.S.-domiciled technology companies.

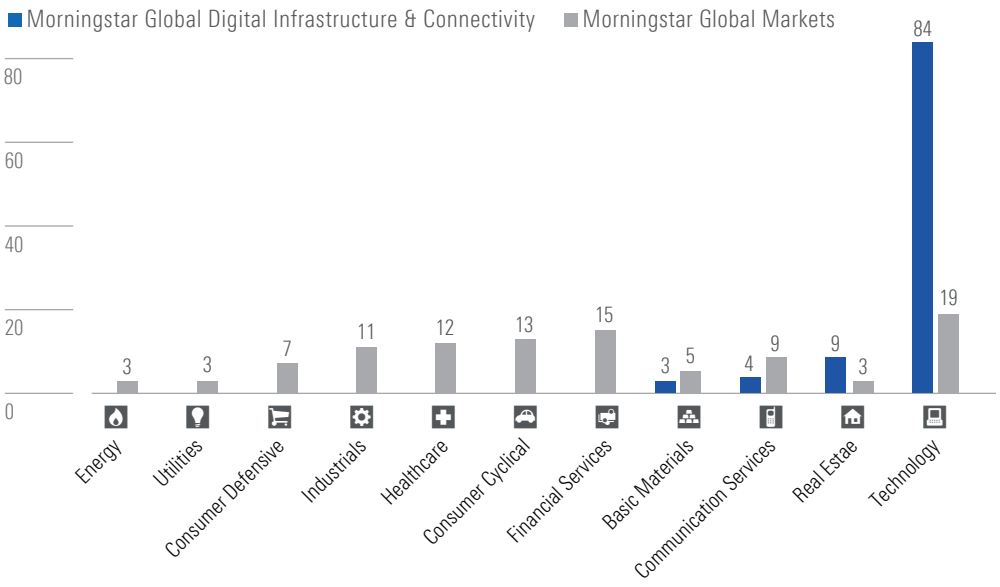
Exhibit 10. **Country Weightings vs. Benchmark (%)**



Source: Morningstar.

The index's elevated exposure to the technology sector comes as no surprise. Its notable real estate exposure stems from the inclusion of data center REITs.

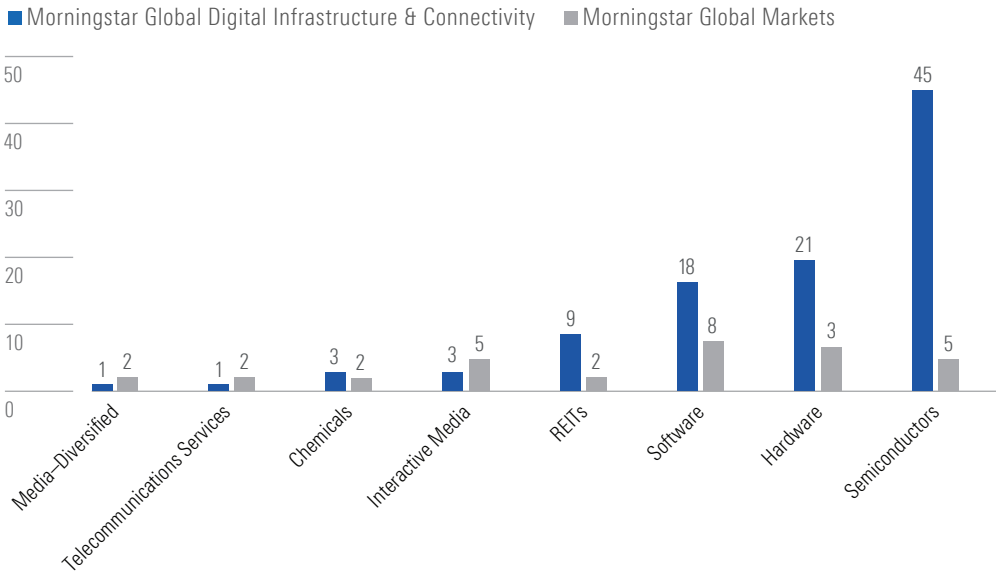
Exhibit 11. **Sector Weightings vs. Benchmark (%)**



Source: Morningstar.

From an industry perspective, the index is heavily weighted toward semiconductors, hardware, software, and data center REITs. Each of these industry weightings is well above that of the benchmark.

Exhibit 12. **Industry Weightings vs. Benchmark (%)**



Source: Morningstar.

Appendix

Appendix Exhibit A. **Current Holdings**

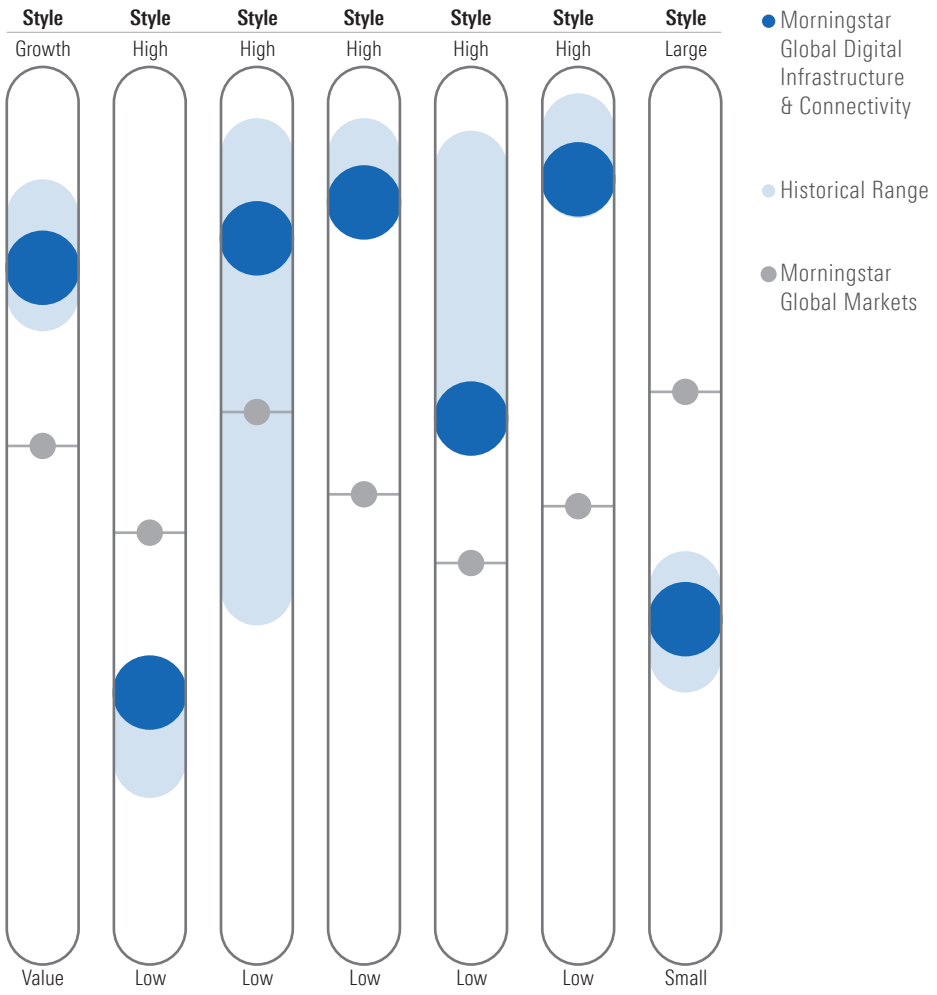
Name	Ticker	Sector	Country	Portfolio Weighting (%)
Marvell Technology Group Ltd	MRVL	Technology	CHN	2.77
MediaTek Inc	2454	Technology	TWN	2.76
DuPont de Nemours Inc	DD	Basic Materials	USA	2.70
Fortinet Inc	FTNT	Technology	USA	2.65
Monolithic Power Systems Inc	MPWR	Technology	USA	2.64
Twilio Inc A	TWLO	Communication Services	USA	2.64
F5 Networks Inc	FFIV	Technology	USA	2.64
Nokia Oyj	NOKIA	Technology	FIN	2.63
Taiwan Semiconductor Manufacturing Co Ltd	2330	Technology	TWN	2.63
Skyworks Solutions Inc	SWKS	Technology	USA	2.62
Infineon Technologies AG	IFX	Technology	DEU	2.57
STMicroelectronics NV	STM	Technology	SGP	2.56
Murata Manufacturing Co Ltd	6981	Technology	JPN	2.56
Digital Realty Trust Inc	DLR	Real Estate	USA	2.55
Intel Corp	INTC	Technology	USA	2.54
Arista Networks Inc	ANET	Technology	USA	2.54
Micron Technology Inc	MU	Technology	USA	2.51
Microsoft Corp	MSFT	Technology	USA	2.51
Equinix Inc	EQIX	Real Estate	USA	2.50
Broadcom Inc	AVGO	Technology	USA	2.48
Samsung Electronics Co Ltd	005930	Technology	KOR	2.47
Datadog Inc Class A	DDOG	Technology	USA	2.46
Qorvo Inc	QRVO	Technology	USA	2.44
Akamai Technologies Inc	AKAM	Technology	USA	2.44
Analog Devices Inc	ADI	Technology	USA	2.38
Telefonaktiebolaget L M Ericsson Class B	ERIC B	Technology	SWE	2.34
NVIDIA Corp	NVDA	Technology	USA	2.30
Qualcomm Inc	QCOM	Technology	USA	2.30
SK Hynix Inc	000660	Technology	KOR	2.26
VMware Inc	VMW	Technology	USA	2.24
Inphi Corp	IPHI	Technology	USA	2.17
CyrusOne Inc	CONE	Real Estate	USA	2.16

Appendix Exhibit A. **Current Holdings**

Name	Ticker	Sector	Country	Portfolio Weighting (%)
Xilinx Inc	XLNX	Technology	USA	2.12
Juniper Networks Inc	JNPR	Technology	USA	1.91
Cree Inc	CREE	Technology	USA	1.55
Dropbox Inc Class A	DBX	Technology	USA	1.48
CoreSite Realty Corp	COR	Real Estate	USA	1.42
Largan Precision Co Ltd	3008	Technology	TWN	1.39
Ciena Corp	CIEN	Technology	USA	1.16
Pure Storage Inc A	PSTG	Technology	USA	1.13
Taiyo Yuden Co Ltd	6976	Technology	JPN	1.13
DISH Network Corp Class A	DISH	Communication Services	USA	1.06
Lumentum Holdings Inc	LITE	Technology	USA	1.05
Yageo Corp	2327	Technology	TWN	1.03
New Relic Inc	NEWR	Technology	USA	0.89
Win Semiconductors Corp	3105	Technology	TWN	0.76
Teradata Corp	TDC	Technology	USA	0.66
Cogent Communications Holdings Inc	CCOI	Communication Services	USA	0.56
MACOM Technology Solutions Holdings Inc	MTSI	Technology	USA	0.36
Megaport Ltd	MP1	Technology	AUS	0.32

Source: Morningstar.

Appendix Exhibit B. **Factor Exposures**



Source: Morningstar.

About Morningstar Indexes

Morningstar Indexes combine the science and art of indexing to give investors a clearer view into the world's financial markets. Our indexes are based on transparent, rules-based methodologies that are thoroughly back-tested and supported by original research. Covering all major asset classes, our indexes originate from the Morningstar Investment Research Ecosystem—our network of accomplished analysts and researchers working to interpret and improve the investment landscape. Clients such as exchange-traded fund providers and other asset management firms work with our team of experts to create distinct, investor-focused products based on our indexes. Morningstar Indexes also serve as a precise benchmarking resource.

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