

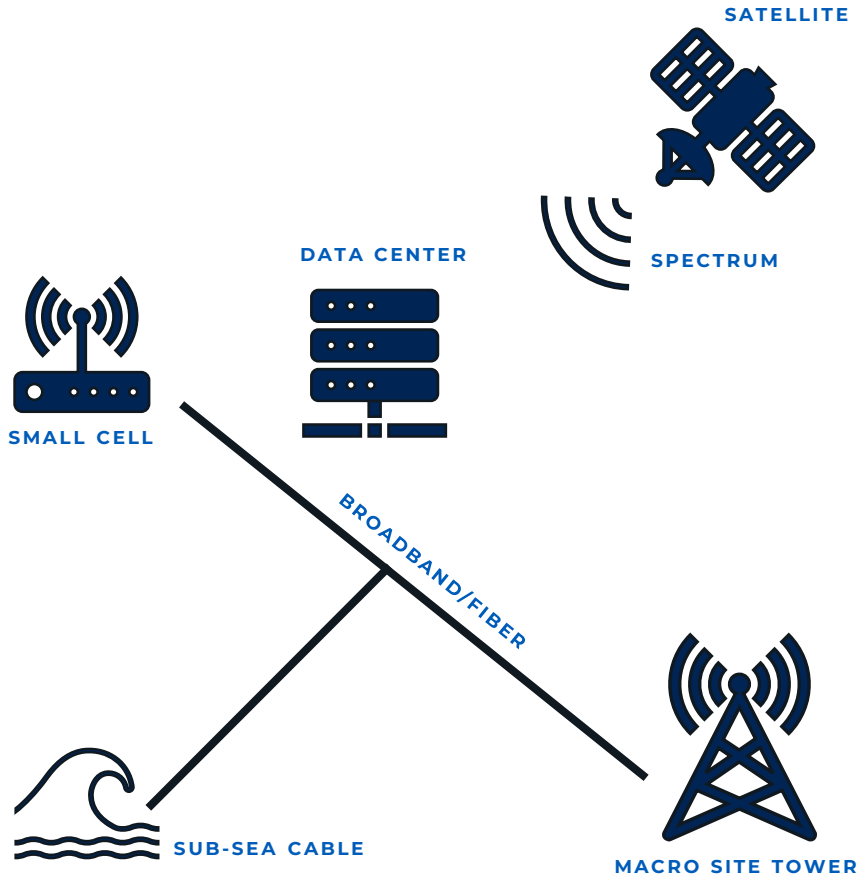


# *Digital Infrastructure Market Overview*

OCTOBER 2024

POWERED BY INNOVATION<sup>SM</sup> | BUILT FOR EVERY GENERATION<sup>SM</sup> | EXPERTLY DELIVERED<sup>SM</sup>

# Digital Infrastructure Ecosystem



## DATA CENTERS

- Centralized warehouse that stores, processes, and distributes information.
- Data centers can be on premise, colocation facilities, or a cloud data centers.
- Data centers are typically locationally advantaged to support AI, cloud, and enterprise workloads.

## TOWERS

- Vertical telecommunication structures that bridge the connectivity of mobile devices to the wider world of the internet.
- Components include small cells, distributed antenna systems, and other next generation solutions for seamless wireless transmission of voice and data signals.

## FIBER & SPECTRUM

- Fiber: thin glass tubes coated in a protective sheath that transmit high speed data used for telecommunications.
- Spectrum: ranges of radio frequencies in the air through which wireless signal travels enabling communication between mobile devices.

## TECH-ENABLED INFRASTRUCTURE & SERVICES

- The integration of technology into traditional infrastructure systems to enhance productivity and cost efficiency.
- The maintenance and servicing of data centers, towers, fiber and spectrum infrastructure to enable the digital transition.

# Market Opportunity

- Worldwide data creation is expected to grow at approximately 29% compounded annual growth rate through 2035.<sup>1</sup> This growth is fueling demand for computing power and digital infrastructure such as data centers, towers, and fiber.
- The exponential increase in connected devices and widespread proliferation of data intensive artificial intelligence applications (AI), will continue to drive capital expenditure across the digital infrastructure ecosystem.
- Drivers of opportunity may include, but are not limited to:

**Datacenters** - Lagging data center new construction completions and power constraints may present first mover advantages in less trafficked markets.

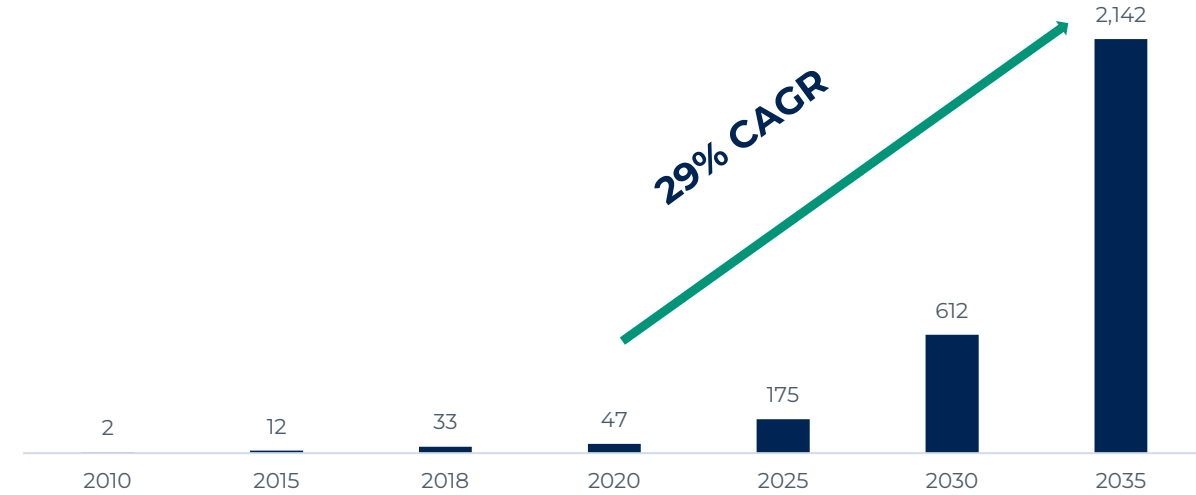
**Towers** - An accelerated shift towards 4G/5G network capacity and high data speeds is driving increased demand for small cells and distributed antenna systems.

**Fiber** - Under penetrated access to broadband fiber to the home. Broadband fiber technology is a requisite for data heavy forms of communication that are growing exponentially.

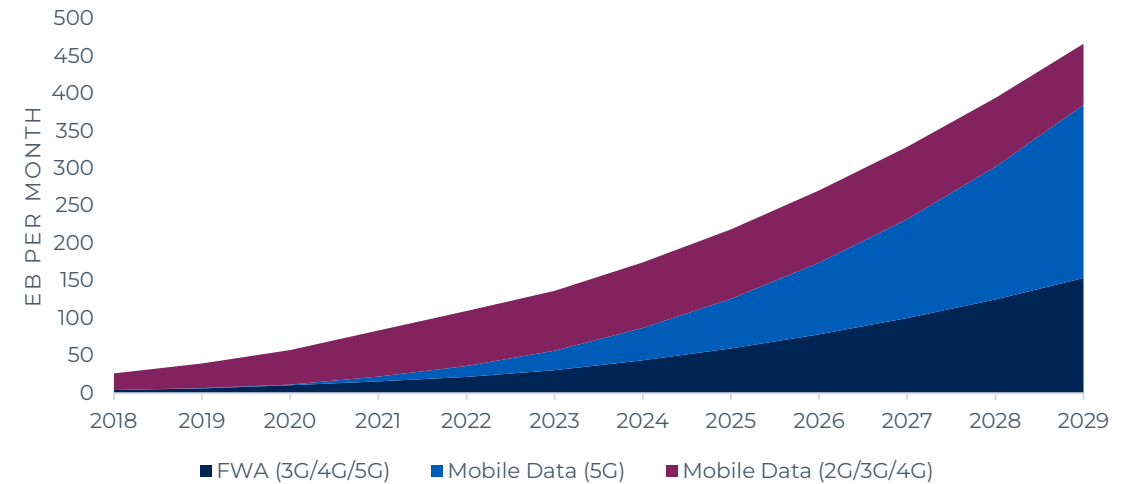
**Spectrum** - An increase in the number of connected mobile devices is propelling spectrum assets that are a critical link in enabling wireless communication.

## WORLDWIDE DATA CREATION (ZETTABYTES)

1 Zettabyte = 1 trillion Gigabytes



Source: PGIM, Statista, 2019



# Data Centers

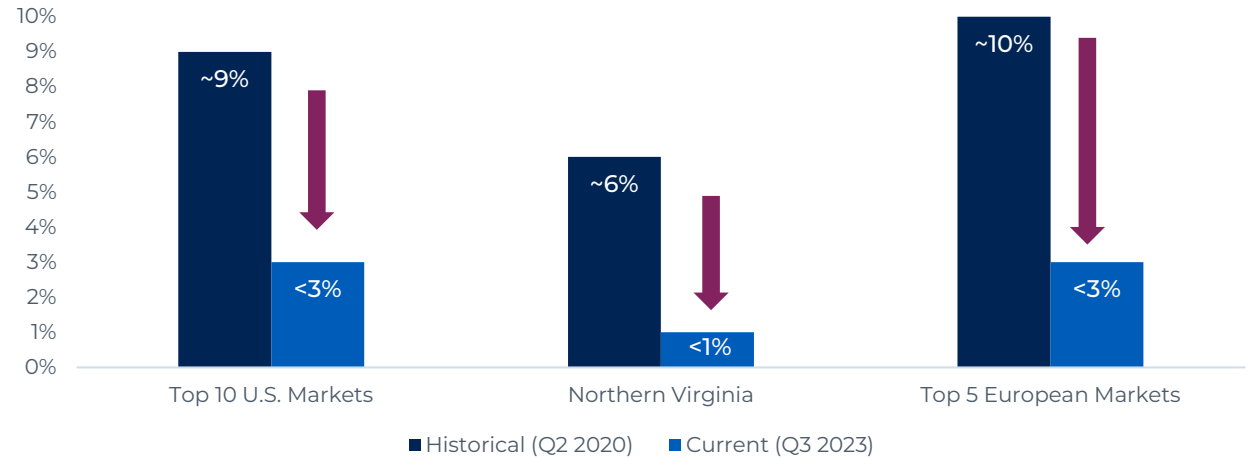
## OPPORTUNITIES:

- Data centers have been utilized as centralized warehouses for processing data for over 50 years. The growth in data consumption driven by AI, cloud, 5G and other next-Gen technology is driving construction and development of data centers.
- Record absorption has led to unprecedented new construction, rising rents and high levels of pre-leasing.

## CHALLENGES:

- The cost and availability of power is a challenge for select high density markets. Access to low-cost power is a priority as data centers grow in megawatts per facility.
- Many municipalities and power providers across the U.S. have announced backlogs in their ability to meet the growing electricity demand by data centers.

## TOP DATA CENTER MARKET VACANCY



Source: IPI Partners, Jefferies, Green Street, Wells Fargo.

## TYPES OF DATA CENTERS

	RETAIL COLOCATION	WHOLESALE/ENTERPRISE	HYPERSCALE
<b>Target Customers</b>	Small & Medium companies	Content providers, cloud companies, large enterprises	Large cloud and content providers like Microsoft, Amazon, Meta, etc.
<b>Customers per Data Center</b>	100+	5-10	1-2
<b>Owner Pricing Power</b>	High	Moderate	Low
<b>Customer Retention</b>	Limited Relocation: typically due to M&A or consolidation	Moderate: Low for cloud/content; high for enterprise	High: long term leases (10 years+)

Source: Grain Management, Pathstone Research

# Towers

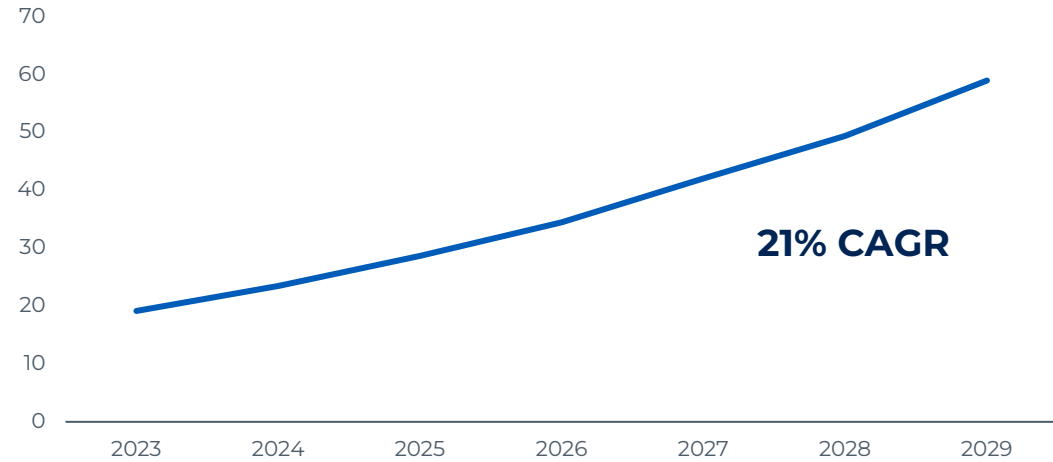
## OPPORTUNITIES:

- Capital expenditure for cell towers that are critical infrastructure for mobile network operators (Verizon, AT&T, etc.) in enabling the transmission of data over wireless spectrum.
- As smartphone market penetration continues and data consumption rises, densification of the existing tower network will be required to maintain adequate coverage for seamless data usage.

## CHALLENGES:

- Antiquated tower portfolios require significant capital investment to maintain competitive coverage and processing of high volumes of data.
- For example, AI enabled mobile applications like Google Maps require real time connectivity to analyze traffic conditions and provide users with the fastest routes.

## NORTH AMERICAN MOBILE DATA TRAFFIC PER DEVICE PER MONTH



Source: Ericsson Mobility Report, June 2024

## TYPES OF TOWERS

MACRO AND ROOFTOP TOWERS	SMALL CELLS	DISTRIBUTED ANTENNA SYSTEMS
Large structures on which multiple mobile carriers lease space to deploy antennas for lower frequency spectrum.	Small antennas used to increase network capacity in dense urban areas for higher frequency spectrum e.g., for 5G.	Small networks of antennas, strategically deployed through a building to bring consistent coverage and increase capacity.

Source: Grain Capital Management

# Fiber

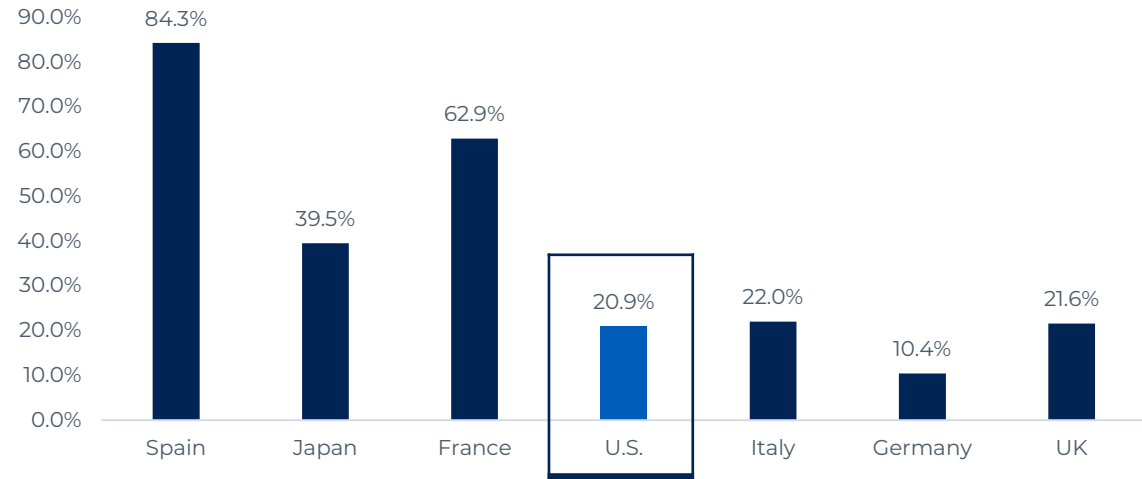
## OPPORTUNITIES:

- Fiber in the U.S. is underpenetrated. In 2023 fiber subscriptions represented roughly 21% of all fixed broadband subscriptions, lagging other developed countries.<sup>1</sup>
- Over half of U.S. homes do not have access to broadband fiber. With increased work from home and remote learning trends there is an accentuated need for high-speed connectivity that fiber provides.

## CHALLENGES:

- With many of the larger providers focusing on Tier 1 markets there is the potential for overbuild. Tier 2 and 3 markets have largely been underserved and potentially present green space opportunity.
- Large mobile providers expanding footprint. However, fiber footprint continues to be focused on Tier 1 markets, for example recent acquisitions like Verizon's purchase of Frontier.

## BROADBAND ACCESS



Source: Grain Capital Management; TeleGeography

## TYPES OF FIBER

FIBER TO THE HOME/ENTERPRISE	LONG HAUL FIBER	DARK FIBER	SUB SEA CABLE
End to end fiber optic connection directly to individual homes/businesses allowing for faster data transmission.	Fiber optic cables used to transmit data over long distances connecting cities and regions.	Fiber optic cables that have been laid but remain “unlit/dark” that are used as backhaul for future data transmission.	Fiber optic cables laid across the ocean floor used to connect countries and continents.

Source: Pathstone Research

<sup>1</sup>Source: Grain Capital Management; TeleGeography

# Spectrum

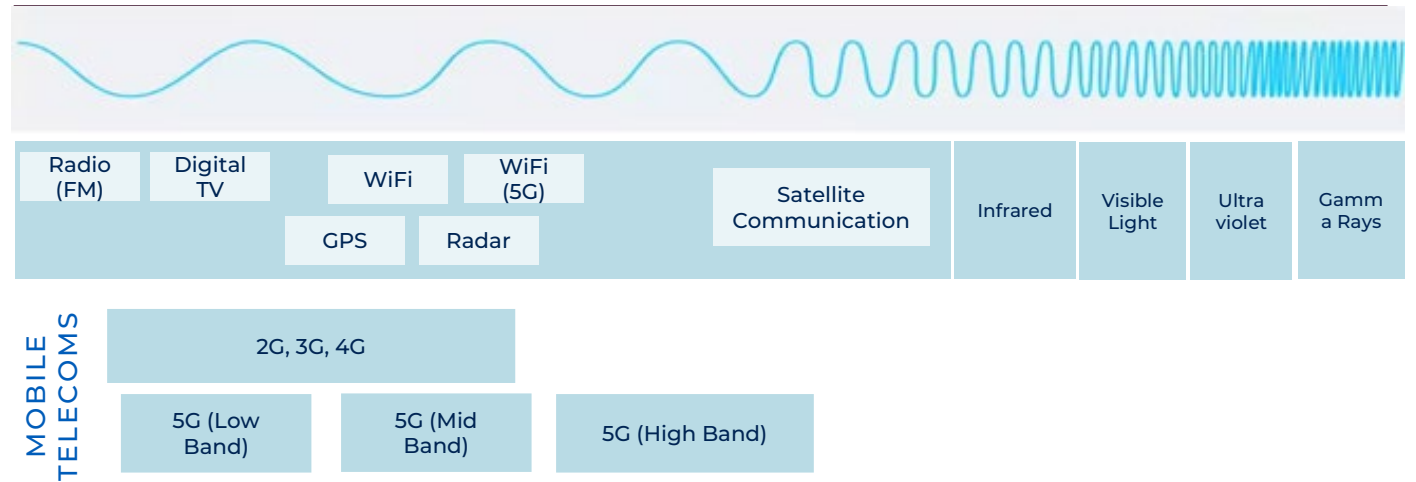
## OPPORTUNITIES:

- 5G deployments require a mixture of low-, mid-, and high-band spectrum ranges for faster mobile broadband speeds and improved quality of service.
- Historically there has been supply/demand imbalance and the proliferation of connected devices creates tailwinds for high quality assets.

## CHALLENGES:

- Spectrum is a finite resource on which wireless signal travels and is essential for mobile communications. Governments oversee the allocation of spectrum licenses and occasionally make spectrum available via auction.
- Low to mid frequency spectrum is a competitive space. Mobile carriers like Verizon and AT&T have aggregated low and mid band assets for 4G deployments.

## WAVELENGTH BANDS



Source: Nokia

## EXIT OPTIONS FOR SPECTRUM INVESTMENTS

LEASE	SELL OUTRIGHT	CONTRIBUTE TO JV	SPECTRUM BUILD OUT
Lease to major wireless carriers with long term contracts.	Sell the asset on the secondary market.	Contribute assets to a wireless JV entity.	Partner with a carrier to build out spectrum and offer wholesale capacity.

Source: Grain Capital Management

# Digital Infrastructure Opportunity Risk vs Return Profile



Source: Grain Management, Pathstone Research



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# Contact Us

888-750-PATH(7284)  
contact@pathstone.com



## Arizona

15169 N Scottsdale Rd  
Suite 205  
Scottsdale, AZ 85254

## California

1900 Avenue of the Stars  
Suite 970  
Los Angeles, CA, 90067

## Boulder CO

1048 Pearl St  
Suite 450  
Boulder, CO 80302

## Denver CO

255 Fillmore St  
Suite 600  
Denver, CO 80206

## Lakewood CO

13949 W Colfax Ave  
Building 1 – Suite 105  
Lakewood, CO 80401

## D/C Metro Area Alexandria

201 N Union St  
Suite 300  
Alexandria, Virginia 22314

## D/C Metro Area Potomac

12505 Park Potomac Ave  
Suite 400  
Potomac, MD 20854

## Naples FL

999 Vanderbilt Beach Rd  
Suite 200  
Naples, FL 34108

## Winter Park FL

145 Lincoln Ave  
Suite A  
Winter Park, FL 32789

## Georgia

3344 Peachtree Rd NE  
Suite 1550  
Atlanta, GA 30326

## Massachusetts

24 Federal St  
8th Floor  
Boston, MA 02110

## New Jersey HQ

10 Sterling Blvd  
Suite 402  
Englewood, NJ 07631

## New York

410 Park Ave  
Suite 930  
New York, NY 10022

## Philadelphia Metro Area

6022 West Chester Pike  
Newtown Square, PA 19073

## Rhode Island

50 Park Row West  
Suite 113  
Providence, RI 02903

## Austin TX

3160 Bee Cave Rd  
Suite 304  
Austin, TX 78746

## Austin TX

300 W 6th St  
Suite 1530  
Austin, TX 78701

## Bellevue WA

225 108th Ave NE  
Suite 400  
Bellevue, WA 98004

## Seattle WA

920 5th Ave  
Suite 415  
Seattle, WA 98104

## Our Sister Companies:

### Advisor Partners

2185 N California Blvd  
Suite 290  
Walnut Creek, CA 94596

### Willow Street

255 Buffalo Way  
Jackson, WY 83001