Primer on telecom infrastructure as an asset class for insurance companies and pension funds

Refilwe Modise, Paul O'Mahony, Kumar Sudheer Raj

1. Introduction

This document is a shortened version of a primer on Telecom Infrastructure as a potential asset class for long-term institutional investors. It has been prepared by the Infrastructure Working Party of the IFoA. The full primer is available on the Infrastructure Working Party page of the IFoA website[1].

2. Key Terms in Telecoms

Mitel describes telecommunications, (also known as telecom), as 'the exchange of information over large distances'. Information herein refers to data that is transmitted as voice, text, video or audio data.

The sector, while very broad, includes a variety of industries, where all points of exchange of information include **both** a transmitter and a receiver. There are usually two points of exchange, but sometimes information transfer can occur between multiple stations at once. The medium of transfer of signal can be by various means including but not limited to fibre optics technology, electromagnetic fields, light or cable technology, etc.

Numerous examples of telecommunications comprise this field, such as, the Internet, telephone and cellular communications, Local-Area-Networks (LANs e.g. ethernet) and Wide-Area-Networks (WANs e.g. a bank, its branch offices and ATMs), radio and television media, as well as other less commonly known means, for instance, telegraphy, among many others.

Figure 1 below depicts the history of telecommunications in helping us gain a greater understanding of the industry and how it has evolved over the years across the examples listed above, to today's familiar everyday technologies.

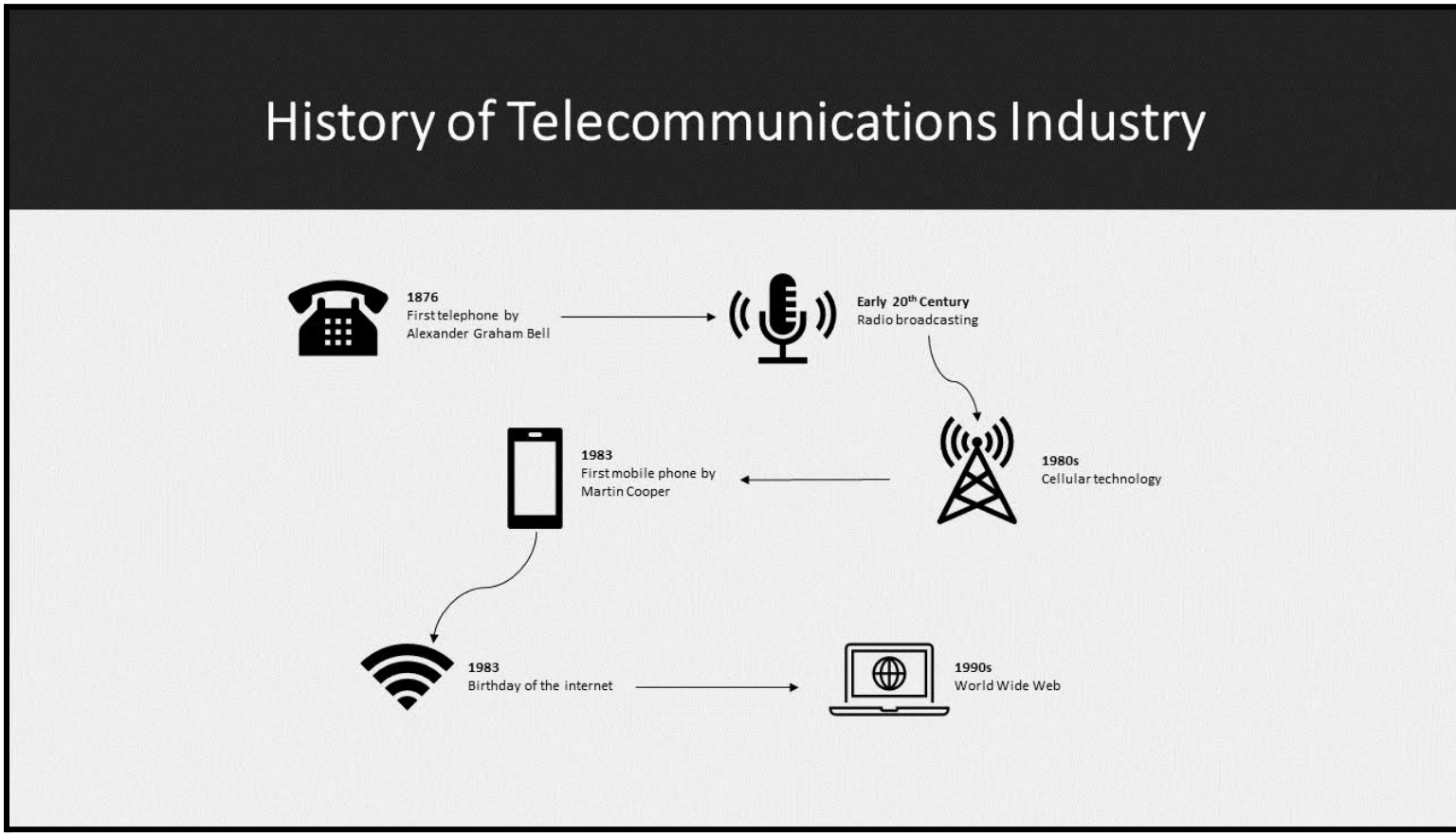

Fig 1: History of Telecommunications industry

[1] https://www.actuaries.org.uk/practice-areas/finance-and-investment/finance-and-investment-research-working-parties/infrastructure-working-party

Telecommunications service providers allow individuals and businesses alike the means to conduct necessary everyday communication. In today's increasingly globalised economy, this demand for reliable connectivity integrated with the described fueling proliferation of the internet, smartphone devices and data intensive applications point to the essential nature of telecom.

In understanding the sector even further, we first dissect it into the three main sub-sectors encompassing it:

1. **Telecommunications Equipment (largest)**
   This refers to the hardwares used in the telecommunications process. These are split into three main segments as follows:

   i. **Public Switching Equipment** e.g. analog switches and digital switches including Voice over IP switches and Virtual Reality (VR).

   ii. **Transmission Equipment** e.g. base transceiver stations, multiplexers, transmission lines satellites, wireless semiconductors, etc.

   iii. **Customer Premises Equipment** e.g. routers, mobile and landline phones, modem, private switches, fax machines, pagers etc.

2. **Telecommunications Services (next largest)**
   Telecommunication Services provide the service of accepting, transmitting and delivering information. Telecommunications services are split into five main segments:

   i. **Cellular Mobile Services** - these are wireless services that allow consumers to use communication devices such as mobile phones (and other devices) to connect to telephone networks. This allows access to all mobile communication services such as voice and non-voice messaging, data and cloud services etc.

   ii. **Radio Paging Services -** these are one-way data communications sent to a mobile device that pings the user on arrival. The communication could consist of a phone number for the user to call, a short message, or an information update, offering a low-cost way to reach people who are on the move e.g. pagers which are commonly used in hospitals.

   iii. **Fixed Line Services -** these refer to wired networks that support fixed broadband and telephone services through *a connection to an end customer using a cable*, through which the user can connect to the internet or make a phone call.

   This involves the use of a variety of technologies for any high-speed data transmission to a residence or a business. Methods of transmission include physical copper, fibre optic cable, and other fixed broadband technology connections.

   An example of this is a landline telephone, or fixed phone line, that transmits signals using metal wire or fibre optic cable, as opposed to wireless transmission as seen in mobile phones.

   iv. **Cable Services -** these are cable connections and switched services that operate media services including internet and television using coaxial cables, which are typically one-way entertainment-related services within a licenced operating area e.g. Virgin Media.

   v. **VSAT (Very Small Aperture Terminal) Satellite Services -** these are satellite-based communications services based on a small-sized earth station used in the transmission/reception of data, voice and video signals over a satellite communication network, excluding broadcast television e.g. critical military communications and logistics systems.

   vi. **DTH Satellite Services -** this is another satellite-based media service provided by cellular providers (Direct to Home). A set-top box and a small dish antenna are installed to receive media services directly from a satellite.

3. Wireless Communication (smallest)

Wireless communication is the transmission and reception of data in free space using electromagnetic fields i.e. devoid of cables or wires. This keeps devices connected to the network without connection by wire, and often involves desktop computers and laptops. There are four main types of wireless connection:

I. **PAN**

A personal-area network consists of a network centralised around the devices of a single person in a single location. It is the smallest network type, covering a maximum distance of approximately 10 metres away from the person/device.

The network could have computers, phones, video game consoles, or other peripheral devices. They can also be wireless, where Bluetooth is the most commonly known wireless PAN. Less commonly known examples of PANs include ZigBee, infrared, wireless printers, game consoles etc.

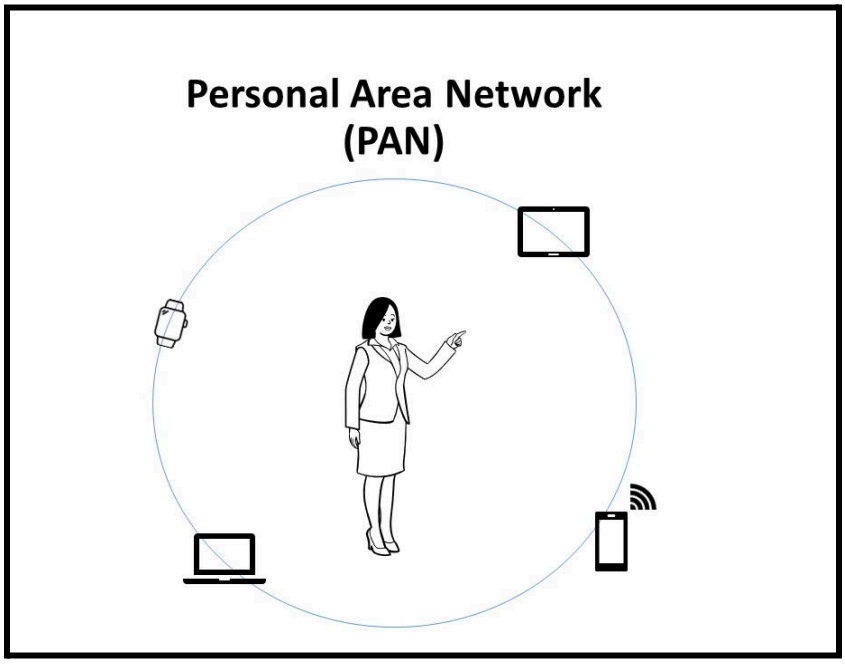

Fig 2: Personal Area Network

II. **LAN**

A local-area-network (LAN) is a type of network that connects devices in a small geographic area, such as a home, office, or school. LANs typically use wired connections, such as Ethernet cables, to connect devices to a central hub or switch. This allows devices to share data, resources, and devices such as printers and storage devices. Examples are joining a home network, work network or a library network etc.

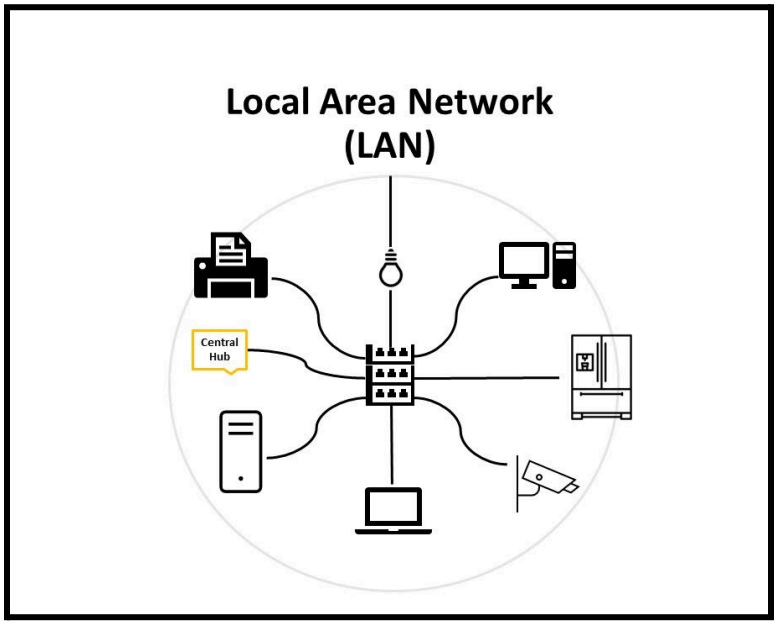

Fig 3: Local Area Network

III. **WLAN**

A wireless-local-area-network works similar to a local area network, however it is completely wireless. Therefore, it connects two or more devices to form a local area network for sharing information in a small geographic area, using entirely wireless communication.

They are common inside homes and small office buildings. Wi-Fi is the most commonly known wireless LAN, followed by mobile phone hotspots.

IV. **MAN**

A metropolitan-area network is a computer network that spans across a city, small geographical area, or business or college campus. One feature that differentiates a MAN from a LAN is its size. A LAN usually consists of a solitary building or area. A MAN can cover several square miles, depending on the needs of the organisation.

Large companies, for example, may use a MAN if they have a spacious campus and need to manage key components, such as HVAC and electrical systems.

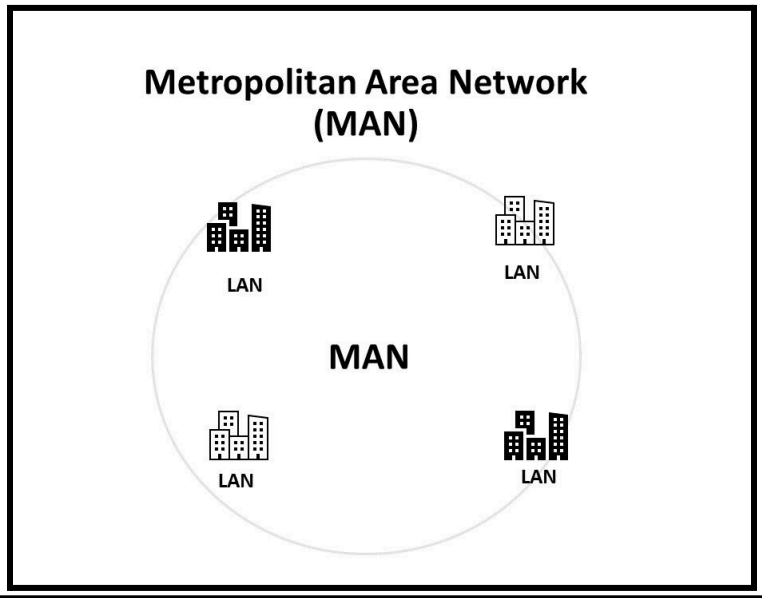

Fig 4: Metropolitan Area Network

V. **WAN**

A wide-area network covers a very large area, like an entire city, state, or country. In fact, the internet is a WAN. Like the internet, a WAN can contain smaller networks, including LANs or MANs. Cellular services are the most commonly known wireless WANs.

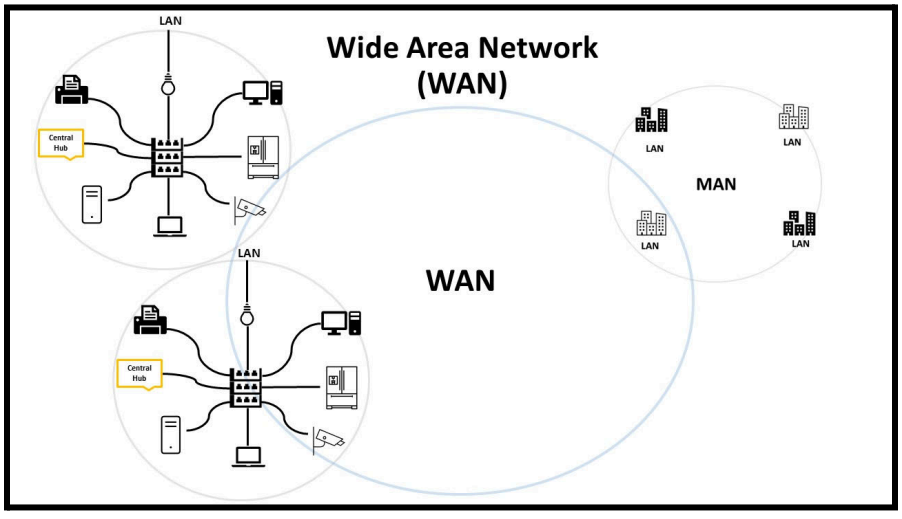

Fig 5: Wide Area Network

The main difference between the different types of networks lies mainly in the distance range offered by each network for a connection to be established. This is illustrated below:

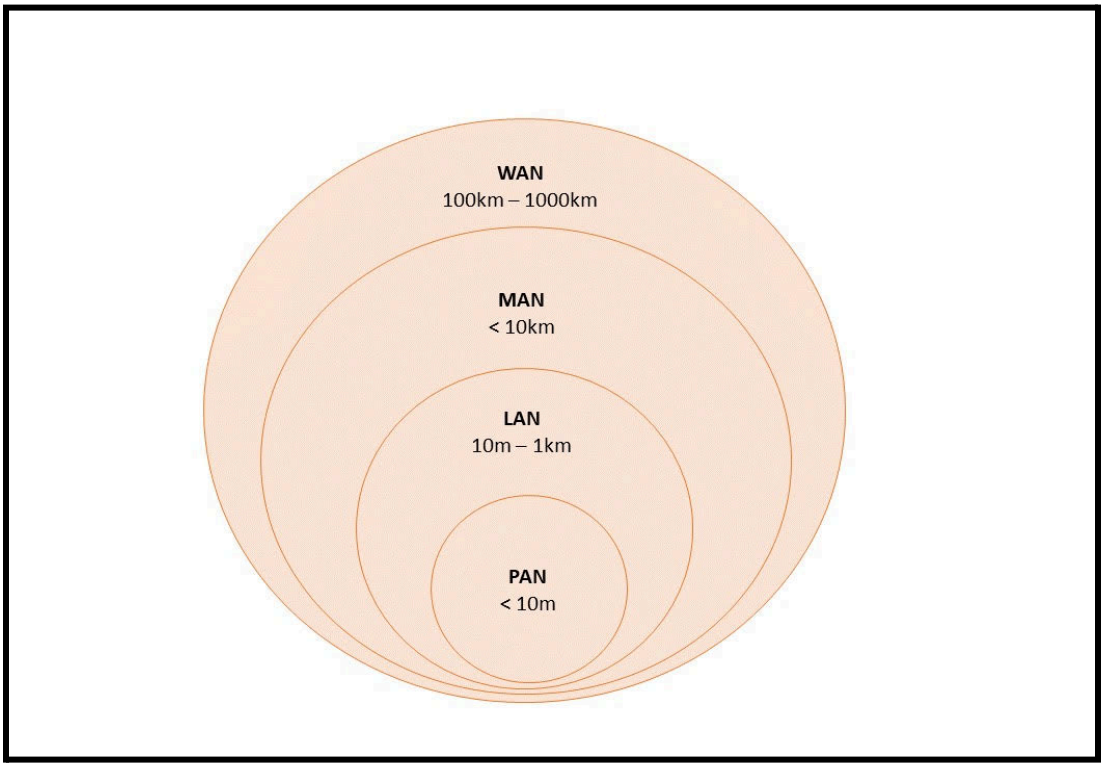

Fig 6: Range of distance offered by each network

A more extensive glossary of key terms in telecoms, both in layman and technical terms, is provided in Appendix I of the full primer.

3. Overview of the Broader Telecom Sector

The telecom sector is a dynamic and ever-evolving industry that encompasses a wide range of activities, technologies, and services aimed at facilitating global communication and connectivity. In this section we provide an overview of the telecom sector beyond just telecom infrastructure, shedding light on its key components, market dynamics, and trends that impact the industry.

Services

Telecom services form the backbone of the sector, encompassing voice calls, messaging, data services, internet access, and multimedia content delivery. Telecommunication service providers, both mobile and fixed-line operators, play a central role in delivering these services to consumers and businesses. They establish and maintain extensive networks of communication infrastructure, enabling seamless connectivity across vast distances.

Mobile telecommunications, in particular, has witnessed tremendous growth and innovation over the years. The advent of wireless technology and the widespread adoption of smartphones have transformed the way people communicate, access information, and conduct business. Mobile operators deploy and manage networks that allow users to connect on the move, providing voice and data services through cellular towers and base stations.

Fixed-line telecommunications, on the other hand, relies on wired infrastructure to deliver services. This includes copper-based telephone lines, fibre-optic cables, and broadband networks. Fixed-line operators provide voice, internet,

and digital TV services to homes, businesses, and institutions. With the increasing demand for high-speed internet and data-intensive applications, the deployment of fibre-optic networks has become crucial in ensuring reliable connectivity.

Infrastructure

In addition to telecommunications services, the telecom sector encompasses several other important components. Equipment manufacturers and technology providers play a pivotal role in developing and deploying the infrastructure and devices that power the industry. They design and manufacture a wide array of telecommunications equipment, including smartphones, network routers, switches, and transmission equipment.

Digital infrastructure is another key aspect of the sector. Data centres, cloud computing services, and content delivery networks (CDNs) form the backbone of digital connectivity and storage. Data centres house servers and storage systems that store and process vast amounts of digital information, while cloud computing enables on-demand access to computing resources. CDNs ensure the efficient delivery of digital content, such as videos, websites, and applications, by distributing it across multiple servers geographically.

4. Global Telecom Market Summary

Telecoms is a global industry. The sector's largest players typically tend to display characteristics of defensive stocks, emphasising it as a good investment choice for investors seeking steady earnings and consistent dividends. The below table, based on a Mobile Magazine online article, gives the top 10 telecommunications companies globally, arranged in order of annual revenue:

Rank	Company	Primary Location	Revenue (USD Billions)	Primary subsector
1	AT&T	USA	168.9	Wireless (MNO)
2	Verizon	USA	133.6	Wireless (MNO)
3	Deutsche Telekom	Germany	122.8	Wireless (MNO)
4	Comcast	USA	116.4	Fixed
5	Nippon	Japan	113.5	Fixed
6	China Mobile	China	109.2	Wireless (MNO)
7	China Telecom	China	59.8	Fixed
8	Vodafone	Germany	53.2	Wireless (MNO)
9	Orange	France	49.9	Wireless (MNO)
10	Telefonica	Spain	49.2	Wireless (MNO)

Table 1: Largest telecom companies globally by annual revenue.
Source: https://mobile-magazine.com/articles/top-10-largest-telecommunications-companies-2023

Many of the major players listed above have expanded beyond their home country to host operations in different markets.

5. Overview of the Telecom Infrastructure Sector

As a critical component of the telecom industry, telecom infrastructure serves as the foundation for communication networks, enabling the seamless transmission of voice, data, and multimedia content.

Telecom infrastructure comprises both physical and digital components. Physical infrastructure includes a diverse range of assets, such as towers, antennas, fibre-optic cables, satellite systems, and data centres. These assets are strategically deployed to ensure widespread coverage, efficient data transmission, and reliable connectivity across various geographic areas.

Connectivity Infrastructure

Towers and antennas form the backbone of wireless communication networks, providing the infrastructure for mobile operators to transmit signals to and from mobile devices. These structures are strategically located to optimise coverage and network capacity. As the demand for mobile data continues to surge, the deployment of additional towers and small cell sites becomes crucial to meet the increasing capacity requirements.

Fibre-optic cables play a vital role in the transmission of high-speed data over long distances. With its ability to carry vast amounts of data at lightning-fast speeds, fibre-optic infrastructure has become essential for delivering broadband internet services and supporting the growing demand for data-intensive applications. Telecom companies and infrastructure providers invest in the deployment of fibre-optic networks, either underground or overhead, to connect homes, businesses, and institutions.

Satellite systems offer an alternative means of communication, particularly in remote or geographically challenging areas where traditional terrestrial infrastructure may be limited. Satellites enable global coverage and facilitate various applications, including telecommunication services, television broadcasting, and internet connectivity. Satellite operators and manufacturers play a crucial role in launching, maintaining, and operating these systems.

Data Infrastructure

Data centres are fundamental to the digital infrastructure of the telecom sector. These facilities house servers, storage systems, and networking equipment that store and process vast amounts of data. Data centres support critical operations such as cloud computing, content delivery, and data storage for telecommunication services, online platforms, and businesses relying on digital operations. As the volume of data continues to grow, data centres are constantly evolving to meet the increasing demands for storage, processing power, and network connectivity.

Technological advancements are shaping the telecom infrastructure sector, enhancing its capabilities and opening new opportunities. The deployment of next-generation networks, such as 5G, promises faster speeds, lower latency, and improved connectivity. 5G infrastructure involves a combination of upgraded towers, small cells, and advanced network architecture, enabling innovative applications like Internet of Things (IoT), smart cities, autonomous vehicles, and immersive multimedia experiences.

Another key trend in telecom infrastructure is the convergence of telecommunications and IT infrastructure. The rise of cloud computing, virtualization, and software-defined networking has led to the emergence of network function virtualization (NFV) and software-defined networking (SDN). NFV allows network services to be virtualized and run on commodity hardware, while SDN separates the network control and data plane, providing greater flexibility and agility in managing network resources.

The telecom infrastructure sector presents attractive opportunities for long-term institutional investors seeking stable and predictable cash flows. Telecom infrastructure assets often offer long-term contractual agreements and stable revenue streams, making them an appealing investment avenue for insurance companies, pension funds, and other institutional investors. The essential nature of telecom infrastructure and its role in enabling connectivity positions it as a resilient asset class that aligns with the investment objectives of long-term investors.

In conclusion, the telecom infrastructure sector is a critical component of the broader telecom industry, providing the physical and digital infrastructure necessary for seamless communication and connectivity. From towers and fibre-optic

cables to data centres and satellite systems, telecom infrastructure plays a pivotal role in meeting the increasing demands for high-speed data transmission and reliable connectivity. Understanding the evolving technologies, trends, and investment potential within the telecom infrastructure sectors allows potential investors to make informed decisions and capitalise on the long-term value this asset class can offer.

6. Methods of Institutional Investment in Telecom Infrastructure

Some routes to introduce telecoms into a portfolio are given below:

Public-Private Partnerships

Historically, investment in infrastructure such as for telecoms was done through collaborations between private and public sector entities called Public-Private Partnerships. These schemes are set up to finance, develop and eventually deploy and operate a set of infrastructure and associated services, combining efforts and resources of both parties.

They are usually associated with projects involving a large capital outlay. They may also be deployed via any one of the following models in which the private company conducts any one of the following:

Fig 7: PPP Delivery Models spider chart

Equity

The telecom sector is made up of (i) telecom equipment, (ii) telecom services, and (iii) wireless communication. Additionally, many different types of telecom products and services are in deployment, as explained in further detail elsewhere in this primer.

Therefore companies may buy equity listed from any of these various listed companies. Unlisted equity may also be sought, but may prove a challenge to both buy and sell due to its illiquidity.

Valuations and dividend yields vary depending on the maturity level of the geographic market in question. Companies in markets with more potential for growth are typically less likely to pay out dividends (although this is not always the case). The table below shows average Price to Earnings ratios and dividend yields for telecom companies across a range of geographies.

Region	Average PE ratio	Average dividend yield
Asia Pacific Emerging Markets	29.1x	1.2%
USA	22.4x	0.4%
Europe	13.2x	2.0%
Middle East and Africa	11.1x	3.5%
Latin America and Caribbean	10.1x	0.9%

Table 2: Telecom equity valuation multiples and dividend yields
Source: Bloomberg.com

Corporate Bonds

Companies could alternatively purchase bonds issued by the various types of telecom companies. Infrastructure projects tend to be highly leveraged and therefore debt financing may be the more accessible route to telecom investments.

These provide both a steady income and less risk of default than most corporate bonds due to the defensive nature of telecom companies to the economy.

The yield curve of investment grade corporate bonds from telecom companies as at the end of November 2023 is shown below. These bonds are from companies across the world. The trendline in red shows a relatively flat term structure.

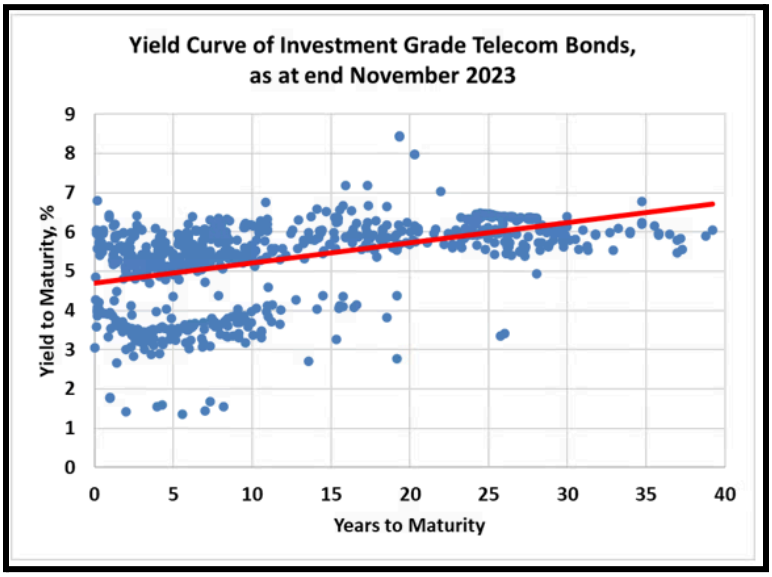

Fig 8: IG telecom bonds yield curve
Source: Bloomberg.com

Alternative Debt Securities

Since debt tends to dominate the leveraging of infrastructure projects, besides corporate bonds, other forms of debt have emerged over the years. Examples are listed below:

- **Telephone Bonds:** Over the last four decades, there has been an emergence of a particular type of bond issued mainly by telephone companies. These bonds behave more like commodity bonds than utility bonds depending on the level of competition that exists between telephone companies in the region/country.

- **Green/Sustainability Bonds:** A newer type of bond emerging is known as green bonds. These support more stringent action being taken towards net zero, with investments funnelled into sustainable projects. Funds could invest in these types of infrastructure green bonds to ensure their own efforts towards sustainability are also covered.

REITs

Other channels of investment could be in telecom infrastructure REITs. These offer the chance to own and operate telecom infrastructure assets, such as telecommunications towers, fibre cables and wireless infrastructure, as well as data centres.

REITs benefit from relatively steady demand for their assets. For example, telecom companies need communications towers to support mobile networks, therefore requiring companies to typically sign long-term leases with REITs to guarantee access to essential infrastructure. This guarantees consistent long term income.

Specialist ETFs

These ETFs generally hold a diversified portfolio of telecom related stocks which may also reduce company specific risks. The yield obtained will depend on the performance of underlying stocks in the ETF.

7. 2023 Trends in Telecoms

To conclude we look at two hot topics in the telecom industry at the time of writing in 2023.

Convergence Wars in Mature Markets

A typical consumer in developed markets have become accustomed to ultra fast internet wherever they go:

a. At home, they enjoy an excellent wired broadband connection from their fixed or cable service provider.
b. On the move, they connect to their mobile network operator's (MNO) wireless data connection (e.g. 4G or 5G).

The providers of each of these services have tended to differ in most countries. However, as high speed internet service becomes more and more of a commodity (at least in urban areas), companies in each market are looking to extend their share of the overall connectivity pie. In the long-run, this should increase competition and be good for consumers[2].

Broadband providers such as Charter Communications in the US currently have mobile virtual network operator (MVNO) contracts in place with MNOs like Verizon. Charter now wants customers to get their entire connectivity from Charter: broadband from Charter at home and wireless data (via Charter's cable and Verizon's wireless network) on the move. Broadband providers like Charter can offer relatively cheap wireless service to the customer as they can use their own vast cable infrastructure to transfer data for most use cases, and only pay to use Verizon's wireless infrastructure in the limited cases when needed.

MNOs eg. T-Mobile in the US are hoping users notice that their 5G connection is now fast enough for almost all internet use cases. The user might then stick with T-Mobile for its wireless data offering. But as importantly, they could cut their broadband connection at home. Instead moving to a fixed wireless home internet offering. Fixed wireless internet is cheaper than traditional wired broadband. However, it is naturally constrained in the volumes of customers it can serve successfully by the capacity of the wireless networks. For example, T-Mobile may only be able to offer sufficiently fast fixed wireless internet to 3 houses on a particular street before it would run into capacity issues.

The ultimate winners of the convergence wars in the US remain to be seen - but the outcome will be telling for markets around the world. To date, MNO's have been winning significant broadband market share through their cheaper price point fixed wireless offerings. This has been reflected in the stock market outperformance of MNOs versus cable companies during 2022 and 2023. However, some industry experts maintain that the capacity constraints described above will soon slow the rapid growth of fixed wireless, and that the more interesting long-term trend to keep an eye on is cable companies winning wireless market share.

[2] https://www.fiercewireless.com/wireless/2022-year-telecom-convergence-moore

Telecom Companies spinning out their Physical Infrastructure Assets

Telecom companies had long viewed their tower assets as a capital intensive cost centre. Stock investors prefer capital light businesses that pay for the use of infrastructure such as the towers as an operating expense rather than through hefty capex up front. This has led to many of these tower assets being spun off into separate tower specialists eg. American Tower. These tower companies have enjoyed incredible multiples. Investors view them as a steady stream of cash flows into the future. They will benefit from increasing digitalisation over time, regardless of the particular trend or device that wins popularity. They also have low operating expenses.

Telecom companies themselves have not enjoyed such love from the stock market. They are seen as capital intensive businesses that are beholden to both the demands from consumers for constant connection and no drops in coverage, as well as internet content providers hoovering up more and more of the public's attention span to data rich video each year. This has left them in precarious finance positions - high leverage has left them extra exposed in a rising interest rate environment. Making the prospect of immediate cash in exchange for selling infrastructure assets in order to reduce debt even more appealing. Eg. Millicom is considering a spin off of its tower assets across different geographies in Latin America through carving out a new towers-only subsidiary to IPO - "Lati"[3]. This tower company would win business from other wireless providers in these regions who would avoid the need for capex to build out their network.

[3] https://www.millicom.com/2022annualreport/unlocking-the-hidden-value-of-our-towers-infrastructure/