



Internet
Society

The Open Fibre Data Standard Shedding Light on Fibre Networks

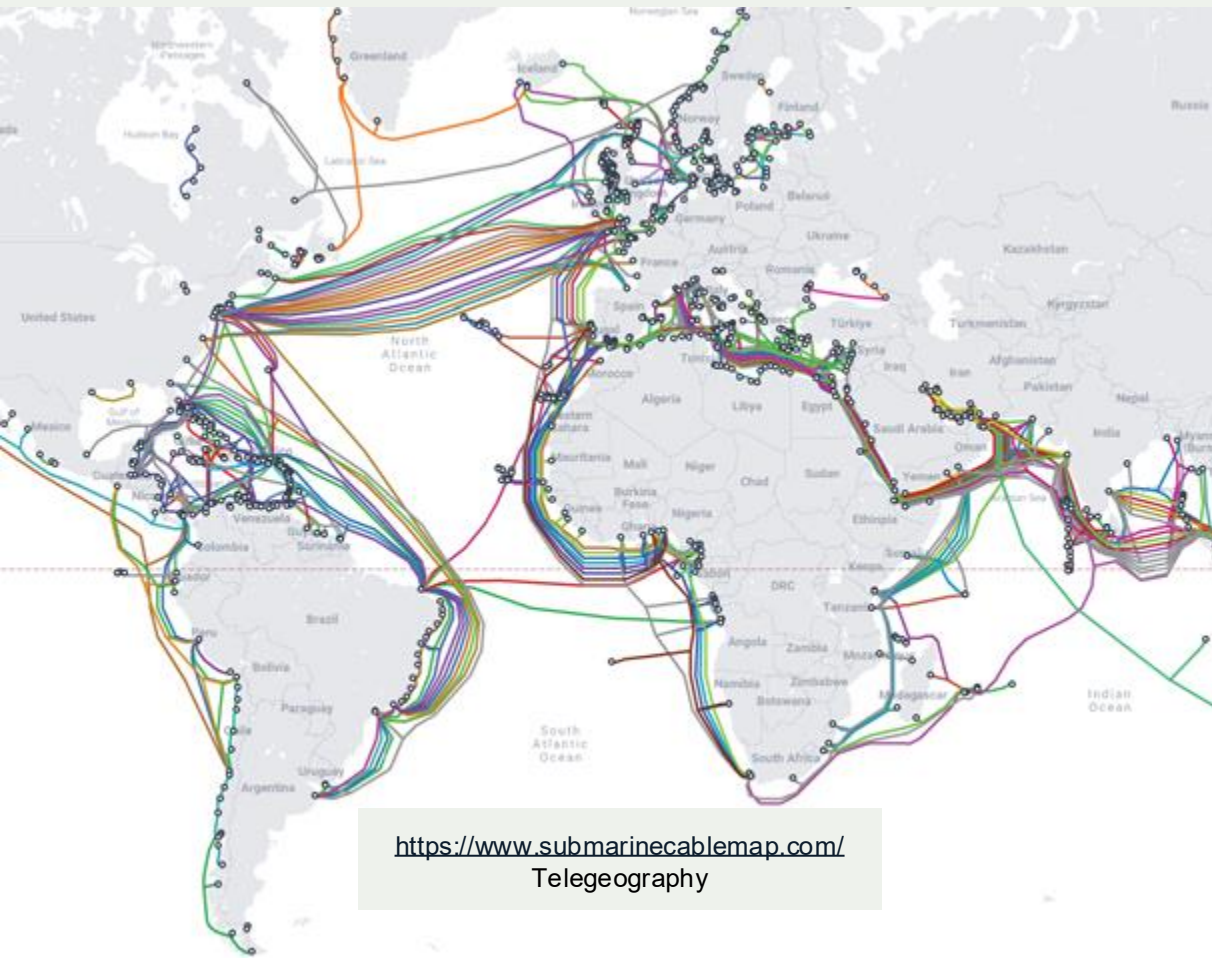
Steve Song
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4 November 2025



© Nyant Quarimye

The Evolution of Fibre Infrastructure



<https://www.submarinecablemap.com/>
Telegeography

- As of 2025, there are more than 600 undersea fibre optic cables, representing nearly 1.4 million kilometres of cable, carrying 97-98% of global internet traffic.
- A single cable can now carry over 300 Tbps.
- Undersea cable maps are readily available.

Growth of Terrestrial Fibre



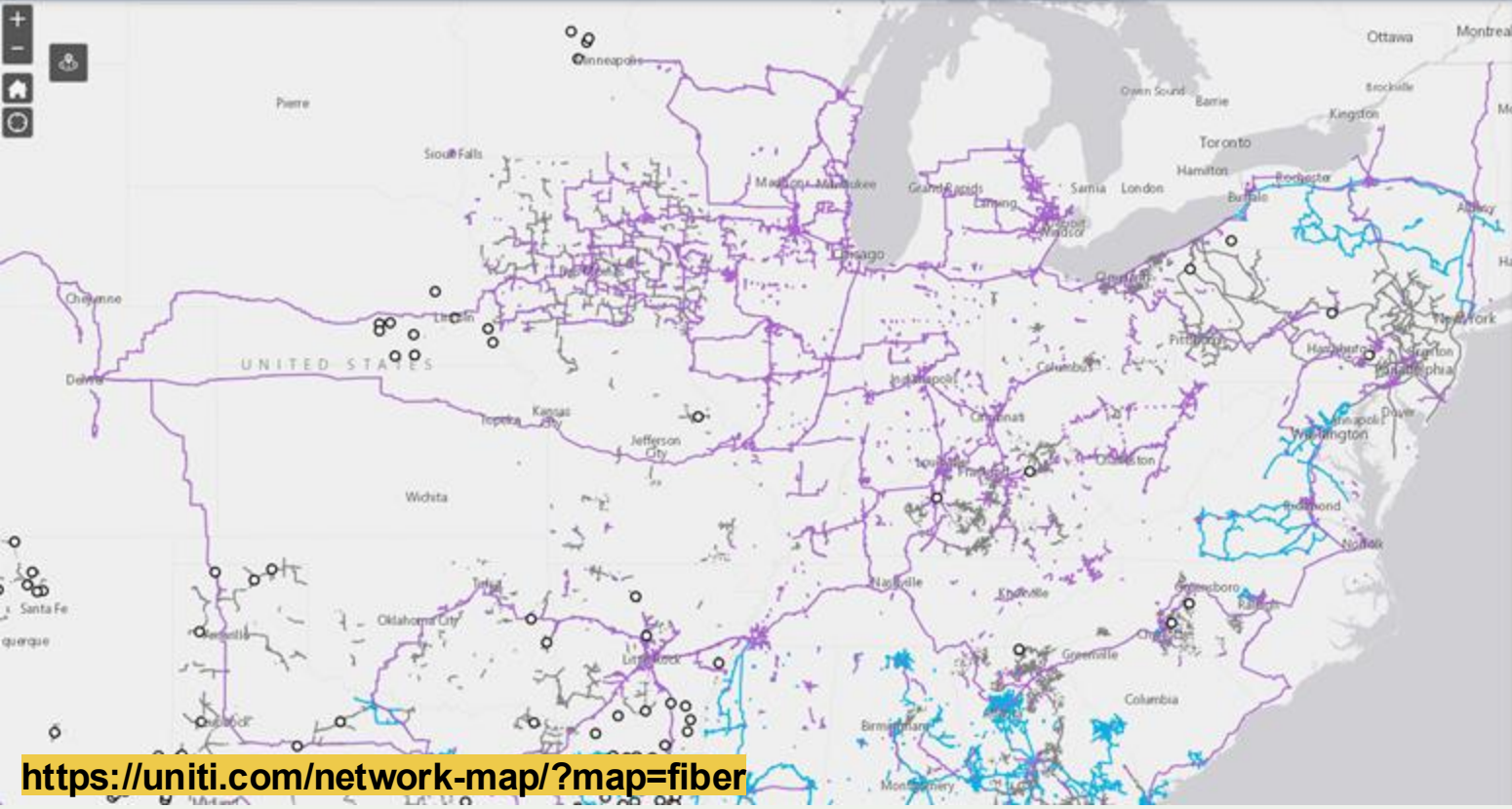
United States: Uniti



About Us Uniti Services Contact Us [Network Map](#) Careers OneView



Uniti Network Map



Layer List

Layers

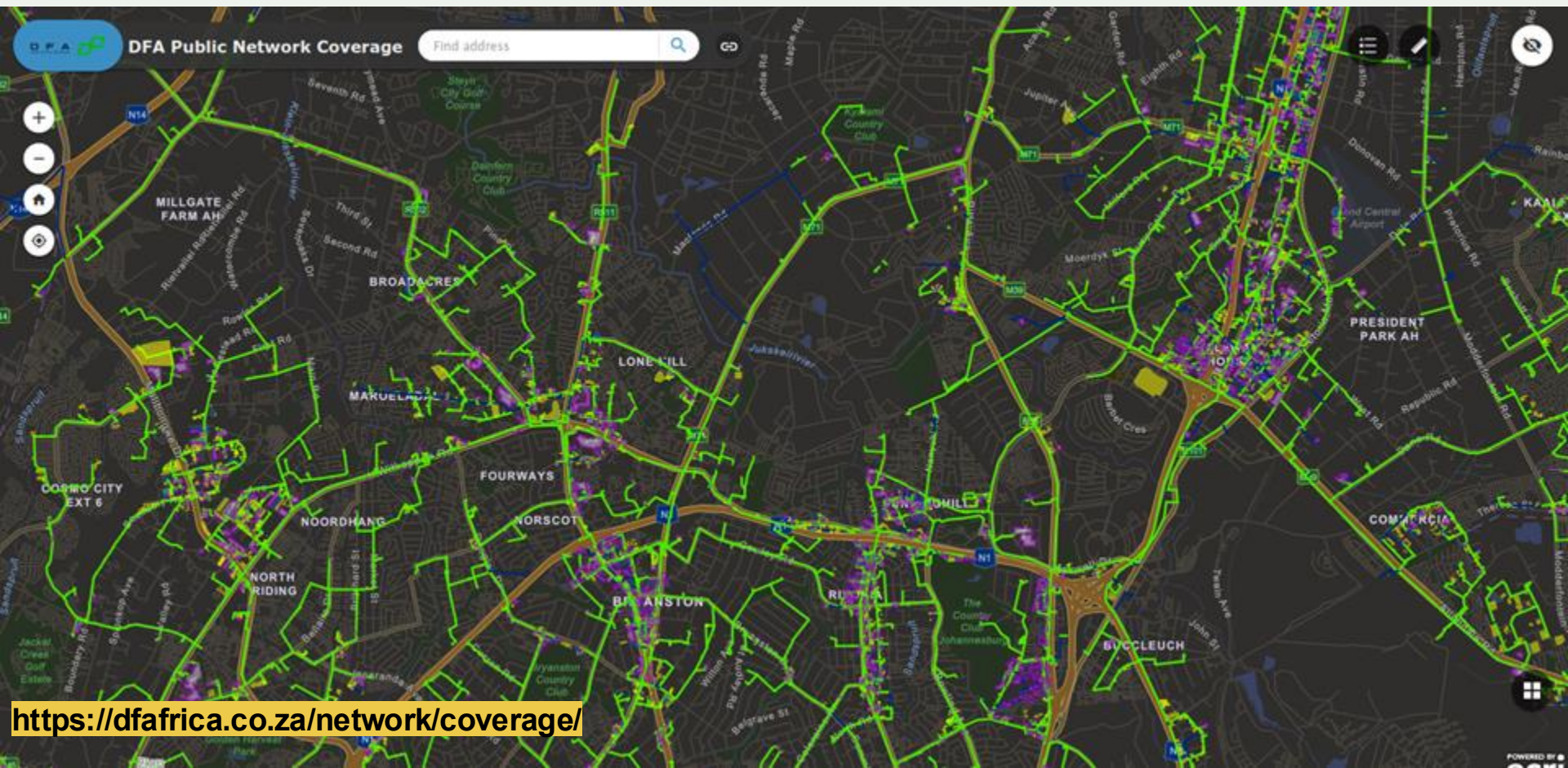
- ☒ Uniti Tower Sites
- ☒ Dark Fiber Available
- ☒ Dark Fiber Fully Leased
- ☒ Network Services



NETWORK MAP
SEE OUR NETWORK

<https://uniti.com/network-map/?map=fiber>

South Africa: Dark Fibre Africa



<https://dfafrica.co.za/network/coverage/>

Ukraine: RETN

RETN®

CUSTOMER PORTAL

EN

Q

=

Search

Q

Network

Long Haul Fibre

Metro Fibre

Leased

Spectrum

Buildings

Data Centers

Business Centers

RETN Offices

Other

Services

Capacity

Internet

Ethernet & VPN

Map of Europe showing RETN network routes and locations. A zoomed-in view of Kyiv, Ukraine, is shown, highlighting the location of RETN LLC and available services.

KPI

Address

Politekhnicna street, 6, Kyiv, Ukraine, 03056

Available services

CAPACITY

INTERNET

ETHERNET & VPN

SEND A REQUEST

GET IN TOUCH WITH RETN

PDF

Download network map

https://retn.net/en/network/network-map

ITU Infrastructure Connectivity Map



Terrestrial Fibre Mapping Challenges



Accuracy – Existing map sources vary: official maps (from some operators), shareholder reports, World Bank studies, and other ‘informal’ sources.



Completeness - Most maps are not complete and many need updating. Most map data lacks sufficient information to inform policy and development.



Publication Format – Operators that publish map data are limited in the ways that they can publish - interactive webpages, PDF or KML



Validation – Mapping providers have difficulty verifying and keeping their data current.



Multistakeholder initiative

The World Bank, the International Telecommunications Union (ITU), Mozilla Corporation, the Internet Society (ISOC), Liquid Intelligent Technologies, CSquared, and Digital Council Africa are partnering to promote the collaborative development of open data standards for describing telecommunications infrastructure.



The Open Fibre Data Standard (OFDS) is a standard for publishing data on terrestrial fibre optic broadband infrastructure.



Benefits to Governments and Regulators

- More effective network investments by accurately targeting the unserved.
- Improved coordination across infrastructure sectors e.g. road, electricity, rail, oil & gas.
- Reduction of physical network interruption and destruction.
- Opportunity for national and regional benchmarking



Benefits to Governments and Regulators

- Understanding the true extent of national fibre infrastructure
- Benefits to cyber security. Redundancy is key to network resilience.

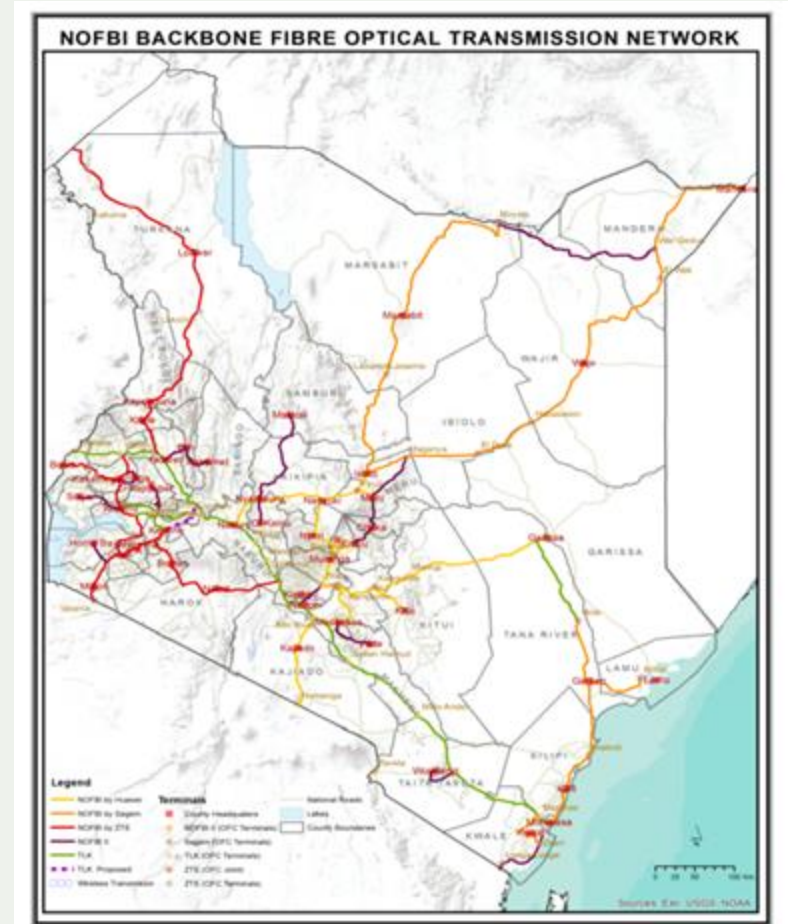
Resilience has less to do with failsafe networks than networks that are safe when they fail.



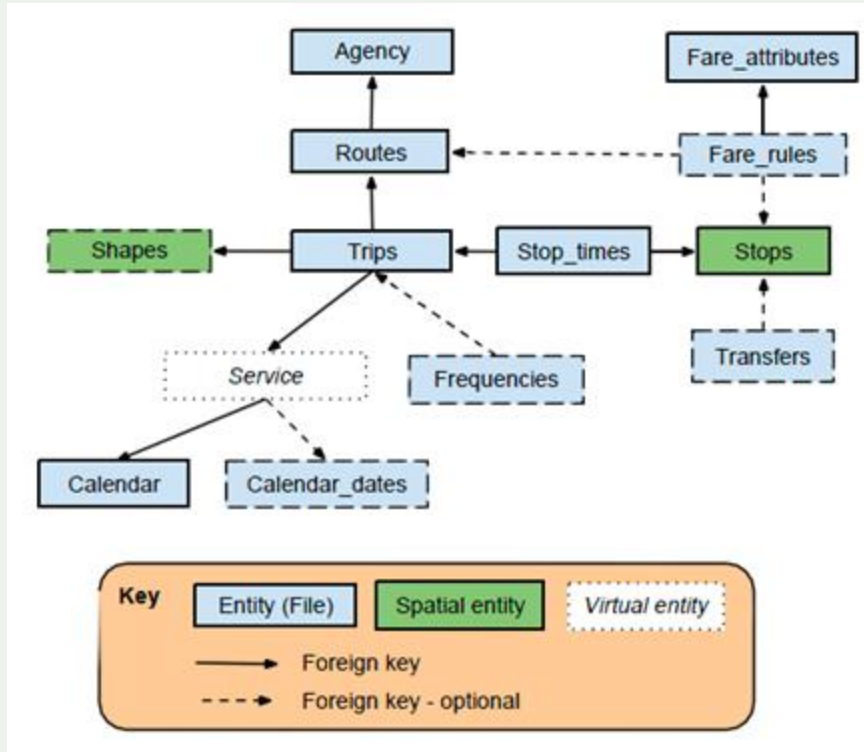
Map of fibre networks from Sao Paulo to Rio de Janeiro

Benefits to Operators

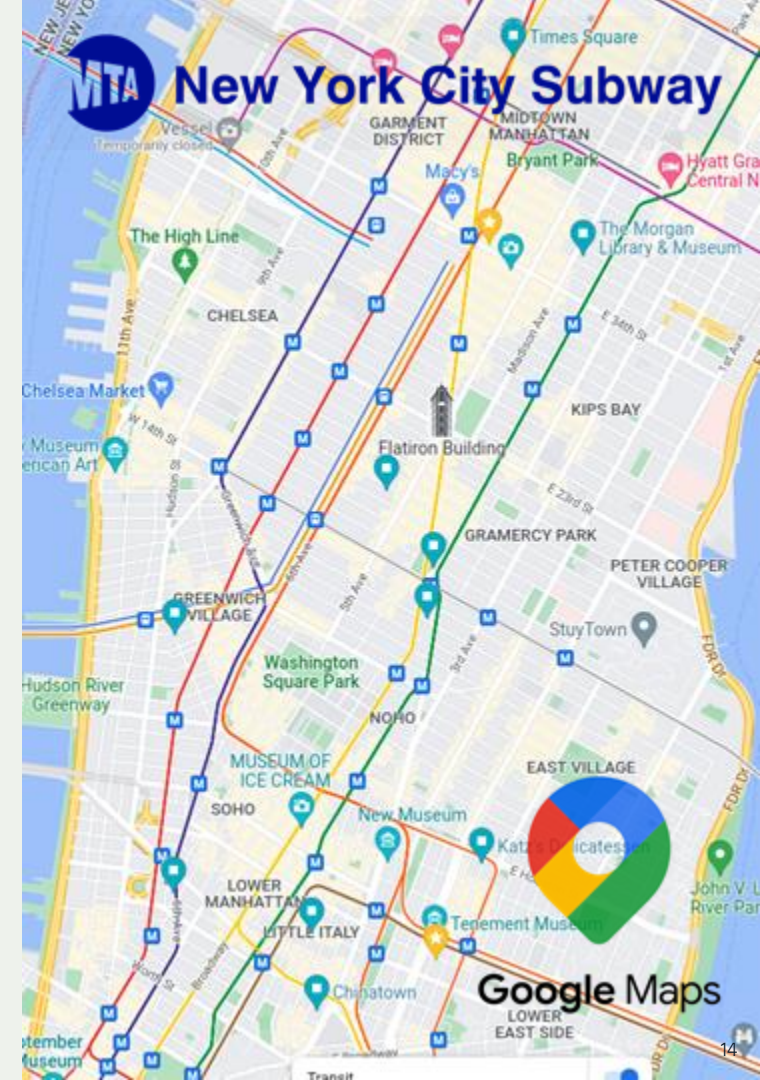
- Opportunities for small ISPs, rural operators in particular.
- More strategic information for investors
- Levelling the playing field in terms of information sharing and building trust
- Better evidence of the socio-economic impact of their networks
- Better network analysis tools



Open Data Standard Example

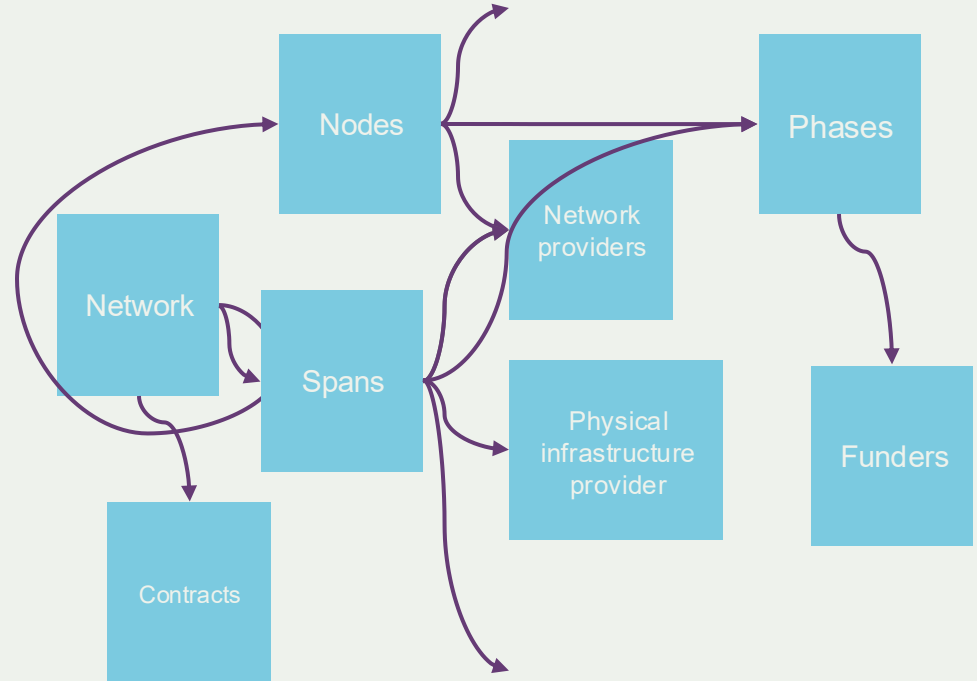


General Transit Feed Specification



Open Fibre Data Standard

- ◆ Describes what data to capture about fibre networks
- ◆ Provides a vocabulary and structure for fibre network data
- ◆ Offers guidance and software tools for publishers and users

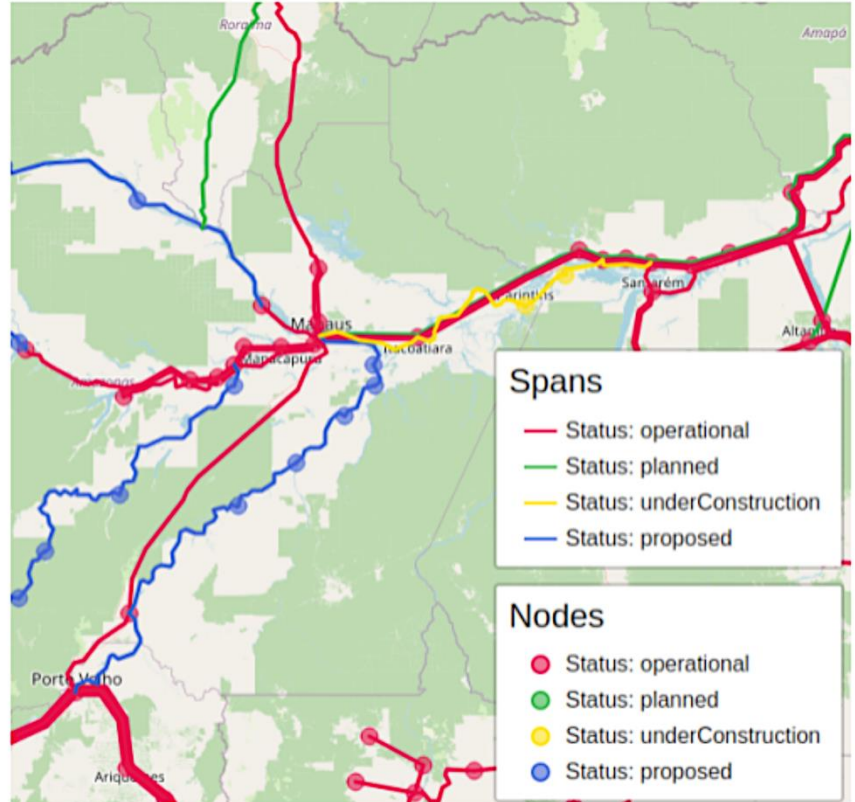


Spans

- Status: operational
- Status: planned
- Status: underConstruction
- Status: proposed

Nodes

- Status: operational
- Status: planned
- Status: underConstruction
- Status: proposed



Components

Schema and codelists	Documentation	Open source tools
Define the structure and format of OFDS data, the meaning of each field, and the rules that must be followed to publish OFDS data.	A primer, guidance and reference documentation covering how to publish and use OFDS data.	Software tools for converting, validating and exploring OFDS data. CoVE (Convert, Validate, Explore)

Network
A telecommunication network. A network consists of a set of nodes interconnected by spans.

id `string (format: uuid)`
A universally unique identifier for this network, as defined by [RFC 4122](#). For more information, see the [identifier reference](#).

name `string [1..]` A name for this network.

nodes `array [1..] Node`
Information about the nodes that belong to this network. Information about nodes should be embedded in this field unless:

- The network is too large to load in to memory, in which case a link to a streamable bulk nodes file may be provided in `.links`.
- The data is published via an API and the network is too large to return in a single API response, in which case a link to a paginated nodes endpoint may be provided in `.links`.

For more information, see [how to format data for publication](#).

<https://open-fibre-data-standard.readthedocs.io/en/latest/reference/schema.html>

Open Fibre Data Standard

0.2.0 release

Welcome to the Open Fibre Data Standard 0.2.0 release.

We want to hear your feedback on the standard and its documentation. For general feedback, questions and suggestions, you can comment on an existing [discussion](#) or start a new one. For bug reports or feedback on specific elements of the data model and documentation, you can comment on the issues in the [issue tracker](#) or you can [create a new issue](#).

To comment on or create discussions and issues, you need to sign up for a free GitHub account. If you prefer to provide feedback privately, you can email info@openfibredata.net.

Fibre optic networks are approaching the status of essential

<https://open-fibre-data-standard.readthedocs.io/en/latest/>

Open Fibre Data Standard

CoVE Convert, Validate, Explore | Standard Documentation

[Load New File](#)

Schema Version
Your data was checked against schema version: 0.2

Data Conversion
Download the data that you submitted in either its original format or in alternative formats. For more information, see the [publication format reference](#). If you are investigating an error, you might find the alternative formats easier to use.

[JSON \(original\)](#)

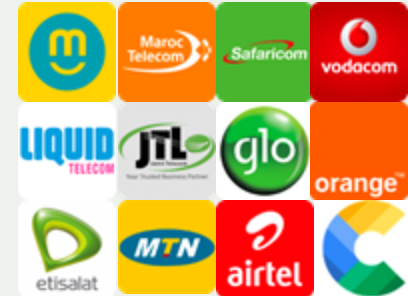
[network package \(json \(9.2 KB\)\)](#)

<https://ofds.cove.opendataservices.coop/>



Categories of Data

Location data	Technical data	Administrative data
The route of fibre cables, the coordinates of PoPs, towers and IXPs.	Capacity, ITU fibre standards, power availability.	The organisations that own and operate infrastructure, the status of infrastructure, dark fibre availability.

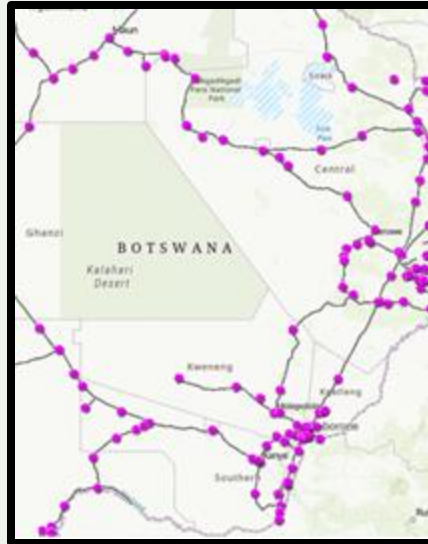


Reach

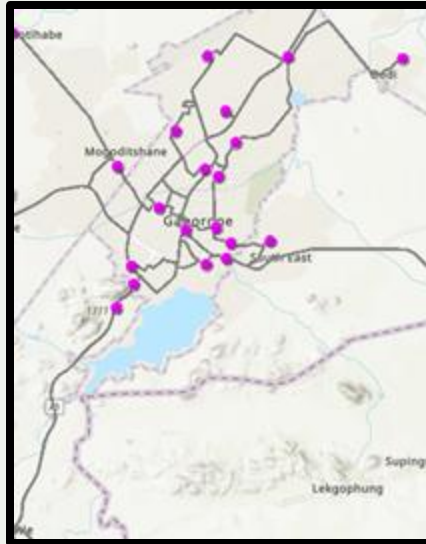
The initial focus of OFDS lies in describing **national and middle mile** networks but will ultimately encompass **last mile** networks.



Undersea



National



Middle mile

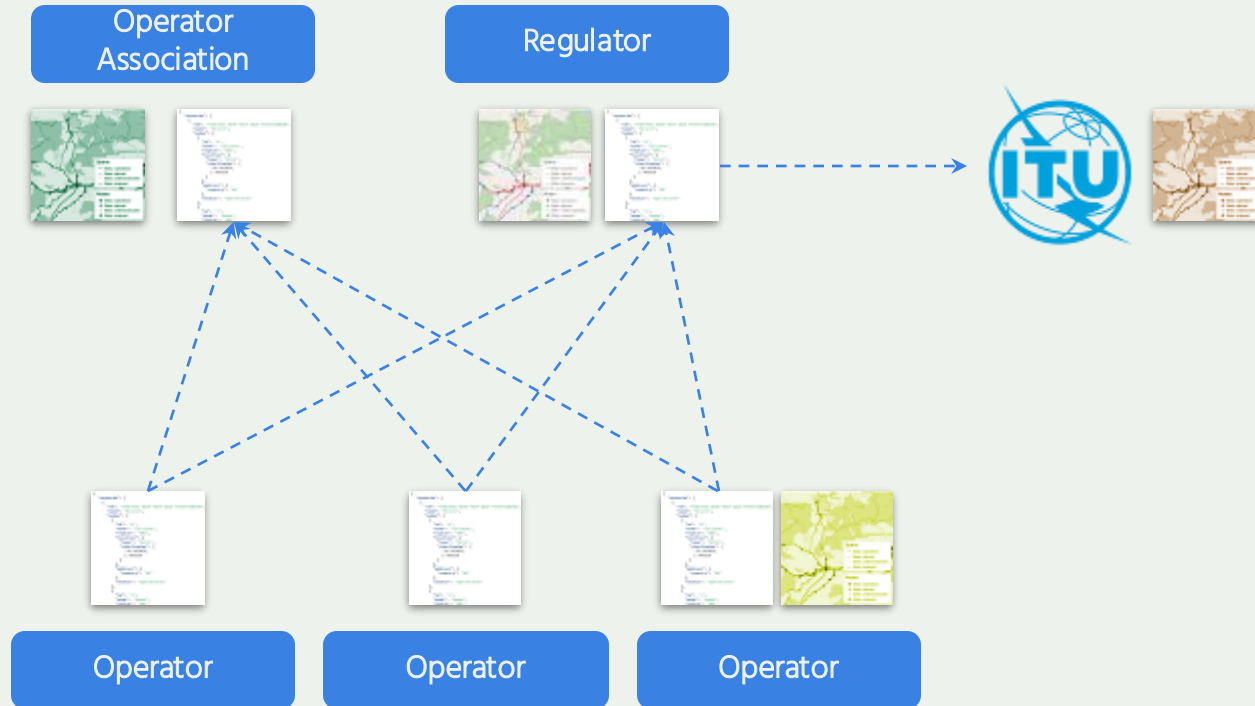


Last mile



Sources: submarinecablemap.com, [BoFiNet GIS portal](http://BoFiNet.org)

Data sharing possibilities



Different organisations may combine Open Fibre Data with various data sources to serve their individual missions.

Work in 2025



WORLD BANK GROUP



COMMUNICATIONS
AUTHORITY OF KENYA

- Development of standard governance
- Development of software tools for OFDS – QGIS plug-in
- Collaboration with World Bank support for OFDS in East Africa
- Collaboration with Africa BB Maps initiative
- Advocacy for OFDS in Latin America and Asia Pacific

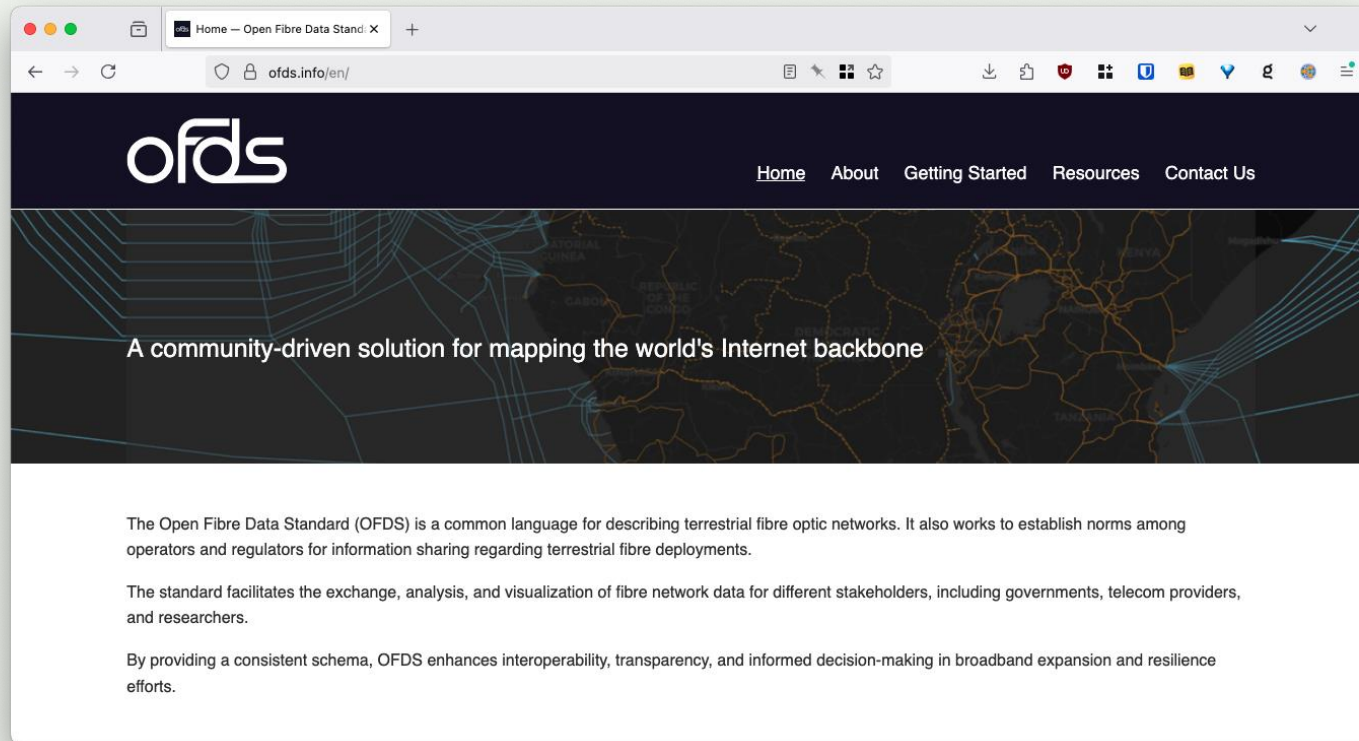


Africa BB Maps

<https://africabbmaps.itu.int/>



Find out more at...



<https://ofds.info>



Supplemental slides for a discussion
on transparency and cyber security

The Cost of Obscurity

The risks of economic costs from obscurity are significant:

- A 2021 study with MTN Ghana estimated the cost of cuts like this would amount to a loss of USD750,000 in the 5 month period.
- This does not include the economic losses from the cut to enterprises that depend on that infrastructure.

[BUSINESS](#) [POLITICS](#) [EDUCATION](#) [ENTERTAINMENT](#) [SPORTS](#) [TECHNOLOGY](#) [INTERNATIONAL](#) [AUDIO ON DEMAND](#)

MTN suffers 939 fibre cuts in five months

By Starrfm.com.gh - July 18, 2022

[f Facebook](#) [Twitter](#) [WhatsApp](#) [in LinkedIn](#) [Email](#) [+](#)



MTN Ghana suffered nine hundred and thirty-nine (939) incidents of fibre cable cuts between January to May 2022, an increment of 14.65% compared to 819 cuts recorded same period last year.

[LISTEN LIVE](#)



Starr1035

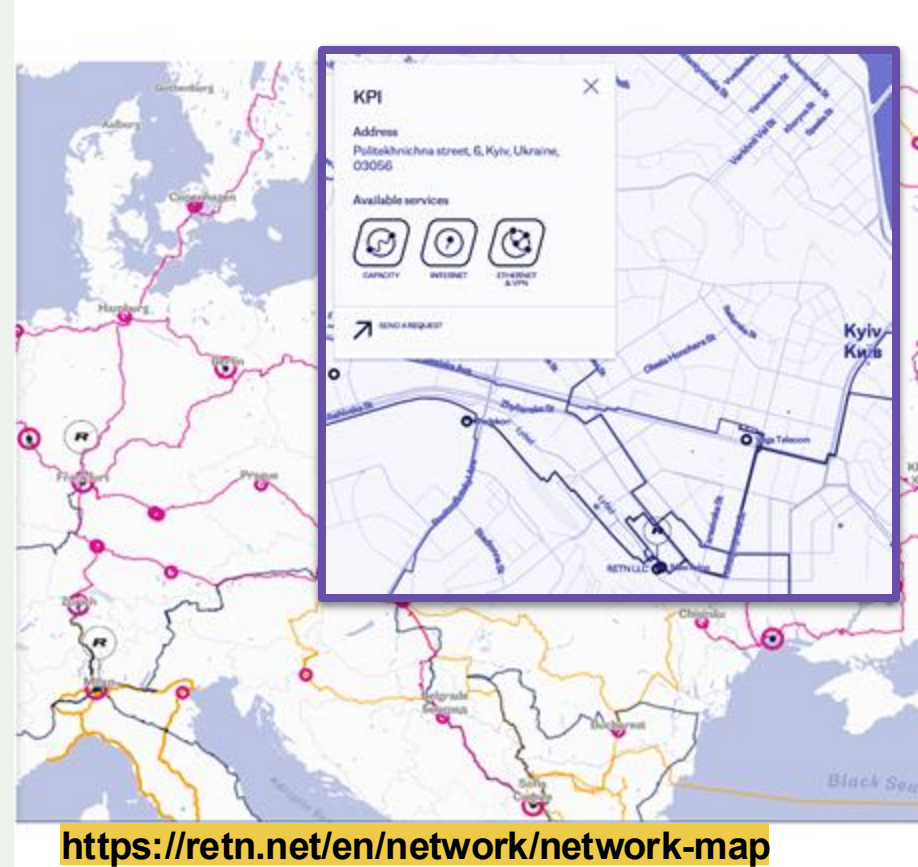
MORE NEWS

- Actress Mercy A 'Pressure'
- Agyeman Manu MoH authorized
- A-G Report: Poo cover-up - Agye
- Outgoing law sc at University of I
- 51yr old goldsm their baby for Gh
- Trump's Truth S

Evidence from Existing Operators

Evidence from operators who currently share detailed maps of their fibre network infrastructure suggest that publicly available maps are not a critical point of security vulnerability.

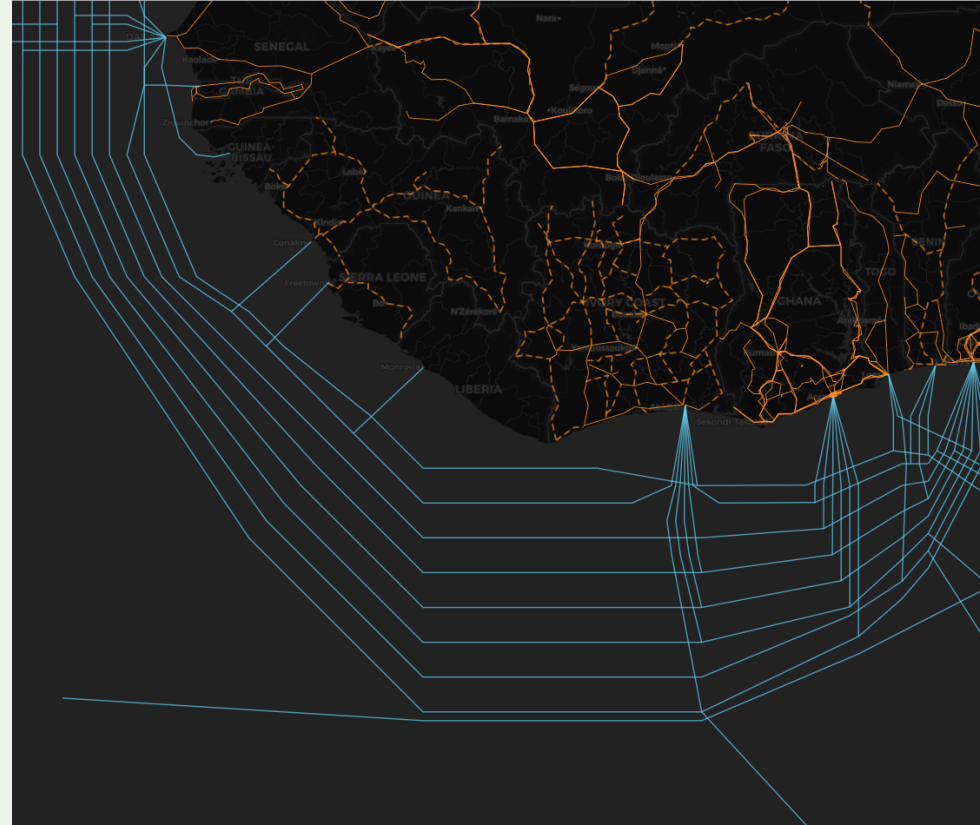
The case of operators in Ukraine are a dramatic case in point.



<https://retn.net/en/network/network-map>

Undersea and Terrestrial Interdependence

- Undersea cable cuts in 2024 exposed Africa's connectivity risks
- ITU has convened an international group to consider undersea cable resiliency
- In the 2024 disruption off Côte d'Ivoire terrestrial fibre played a critical role in recovery
- We need to consider undersea and terrestrial fibre infrastructure together to form a true picture of resilience



Public Data Obfuscation is an Option

Terrestrial fibre network maps can be published in a manner that is useful to researchers, but which also provides sufficient obfuscation of map data to allay operator concerns regarding security.

There are a number of technical approaches to achieving this.

Bokeh: Obfuscating Physical Infrastructure Maps

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ABSTRACT

Physical infrastructures that facilitate e.g., delivery of power, water and communication capabilities are of intrinsic importance in our daily lives. Accurate maps of physical infrastructures are important for permitting, maintenance, repair and growth but can be considered a commercial and/or security risk. In this paper, we describe a method for obfuscating physical infrastructure maps that removes sensitive details while preserving key features that are important in commercial and research applications. We employ a three-tiered approach: tier 1 does simple location fuzzing, tier 2 maintains connectivity details but randomizes node/link locations, while at tier 3 only distributional properties of a network are preserved. We implement our tiered approach in a tool called *Bokeh* which operates on GIS shapefiles that include detailed location information of infrastructure and produces obfuscated maps. We describe a case study that applies *Bokeh* to a number of Internet Service Provider maps. The case study highlights how each tier removes increasing amounts of detail from maps. We discuss how *Bokeh* can be generally applied to other physical infrastructures or in local services that are increasingly used for e-marketing.

CCS CONCEPTS

• Security and privacy → Data anonymization and sanitization.

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<https://doi.org/10.1145/3356994.3365501>

KEYWORDS

Geographic Information System; Shapefile Obfuscation; Network Map Obfuscation; Internet Physical Infrastructure Maps

1 INTRODUCTION

Accurate maps of the geographic characteristics and features of physical infrastructures such as power, water and communication systems are routinely generated and maintained by both public and private entities. These maps are important for a wide range of applications including inventory management, risk assessment, permitting, maintenance, repair and growth. These maps are also important in a wide variety of research contexts that seek to assess complex combinations of characteristics or capabilities and/or make fundamental and longer term improvements to infrastructure.

Our study is concerned with maps that convey characteristics of physical infrastructure. Such maps typically include details of locations of key components (e.g., buildings), which we refer to as *nodes*, and connectivity between components (e.g., various forms of rights of way, wires, conduits, etc.), which we refer to as *links*. Representations of such infrastructure appear as a graph or network on a map. Moreover, they are often instantiated in a standard GIS format such as ESRI's shapefile or Google's KML/KMZ so that they can be easily visualized, analyzed and combined with other data. We argue that there are two fundamental features of such maps that define their accuracy. *Location accuracy* is the correspondence between the represented geographic locations of individual nodes/links in a map with their actual (ground truth) locations. *Graph accuracy* is the correspondence between individual nodes and links in a map and their actual physical connectivity in the network. In each case an exact match between the map and the true physical infrastructure would mean the map is 100% accurate.

Unfortunately, there are risks in publishing 100% accurate physical maps. First is the risk of attack on the physical infrastructure locations identified in the maps. These attacks seek to damage nodes and/or links causing outages that could have broader impact. Examples of such attacks (which were

A Common Language

OFDS is both an Open Data and an Open Standards initiative.

Having a common language through an Open Standard for describing terrestrial fibre optic network is essential to understanding network resilience and regulatory compliance. This is true whether the data is made public or kept to a limited group.

Regulators and operators can choose together the level of transparency that is appropriate.

Open Data
+
Open Standard