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Mapping the Foundations of the Internet with the Open Fibre Data Standard

Steve Song

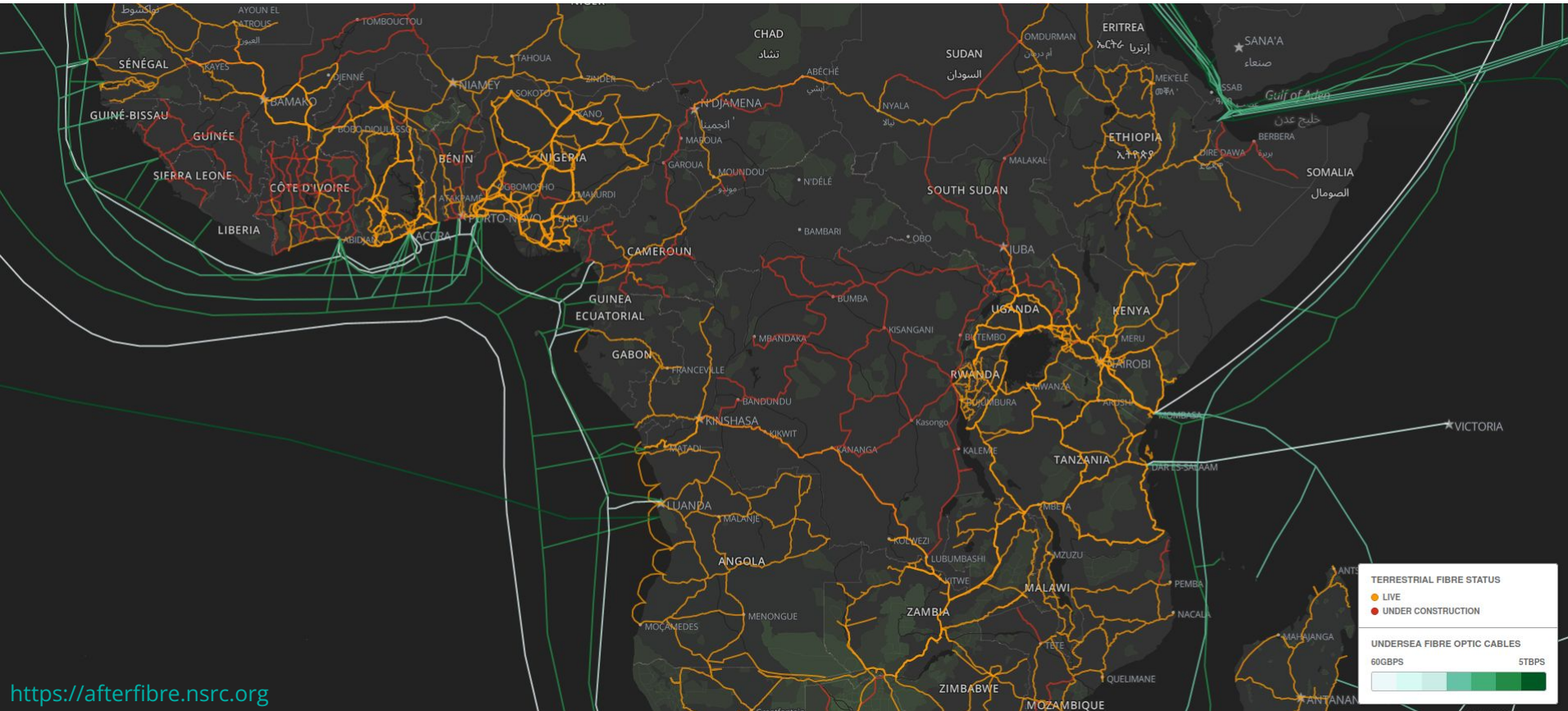
GAIA @ IETF


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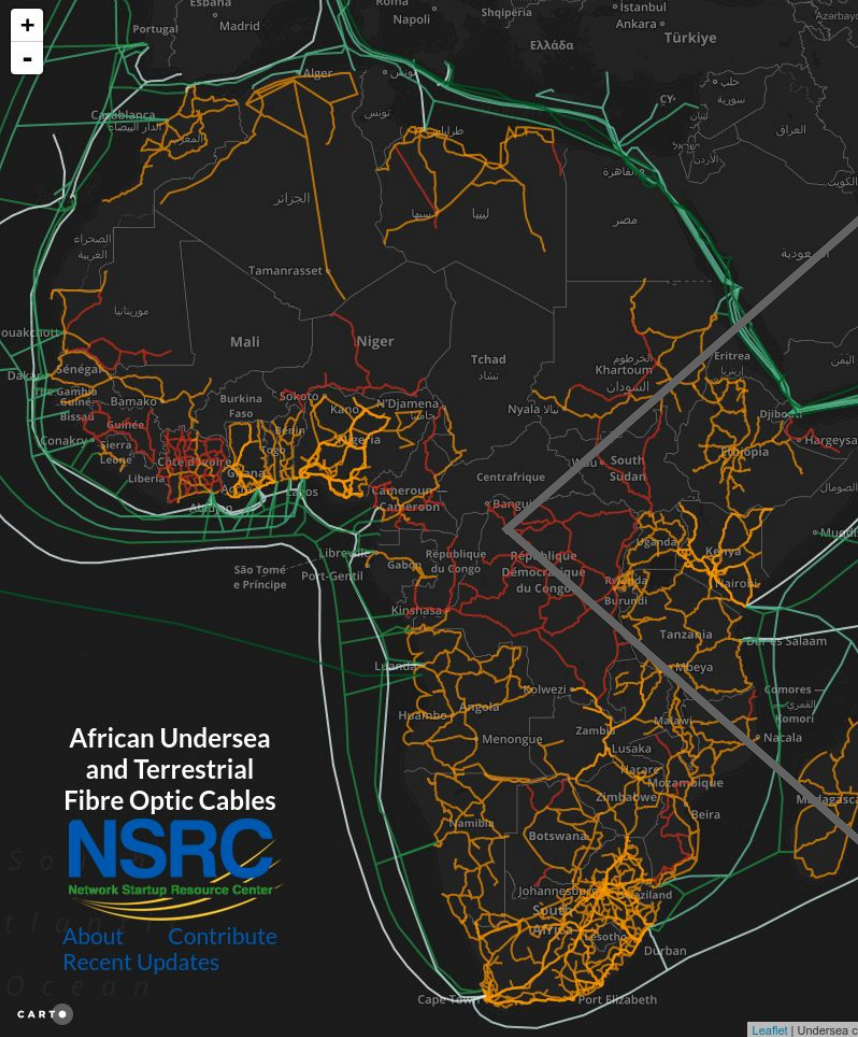
Growth of Terrestrial Fibre



The background features a dark blue field with numerous thin, colorful lines in shades of orange, red, green, and blue. These lines are scattered across the frame, some appearing as straight paths while others curve. Small, glowing dots in various colors are interspersed among the lines, creating a sense of dynamic movement and digital connectivity.

More transparency is needed to understand how physical internet infrastructure is shaping our digital world.

That begins with the foundation on which the modern internet depends, fibre optic infrastructure.



The Arrival of Fast Internet and Employment in Africa

By JONAS HJORT AND JONAS POULSEN

To show how fast Internet affects employment in Africa, we exploit the gradual arrival of submarine Internet cables on the coast and maps of the terrestrial cable network. Robust difference-in-differences estimates from 3 datasets, covering 12 countries, show large positive effects on employment rates—also for less educated worker groups—with little or no job displacement across space. The sample-wide impact is driven by increased employment in higher-skill occupations, but less-educated workers' employment gain less so. Firm-level data available for some countries indicate that increased firm entry, productivity, and exporting contribute to higher net job creation. Average incomes rise. (JEL F14, J23, J24, J63, L86, O15, O33)

Traditional trade theory predicts a decrease in inequality in developing countries during periods of integration in the global economy. The slow economic progress of poor workers in many parts of Africa, Asia, and Latin America during the 1990s and 2000s, however, has raised economic growth to two potential causes: the rapid increase in the global economy and the rapid increase in the global economy. The rapid increase in the global economy and the rapid increase in the global economy. The rapid increase in the global economy and the rapid increase in the global economy.

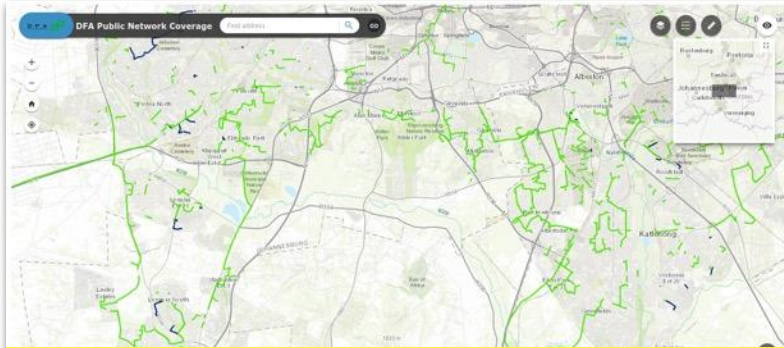
2019

Acemoglu 2003; Attanasio, Goldberg, and Pavcnik 2004; Burstein, Cravino, and

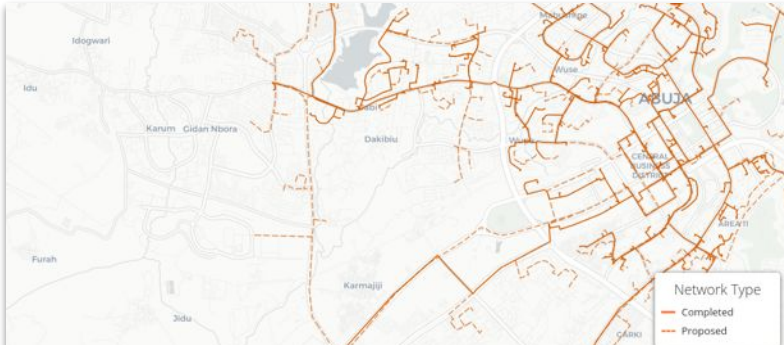
*Hjort: Columbia University, Uris Hall 622, 3022 Broadway, New York, NY 10027, BREAD, CEPR, and NBER (email: hjort@columbia.edu); Poulsen: Uppsala University, Box 514, 751 20 Uppsala, Sweden (email: jonas.poulsen@fek.uu.se). This paper was accepted to the AER under the guidance of Marianna Berman, Coeditor. We are grateful to five anonymous referees for insightful comments that significantly improved the paper. We also thank Adrian Adermon, Sebastian Ashband, Niklas Bengtsson, Martina Björkman-Nyqvist, Greg Bruih, Esther Duflo, Ray Fisman, Oded Galor, Francois Gerard, Amit Khandeal, Erik Lindqvist, Mushiq Mobarak, Kalle Moene, Iva Mork, Anders Olovsgård, Michel Serafinelli, Kjell Storesletten, Eric Verhoogen, Tim Waters, Frank Windmeijer, Chris Woodruff, and especially Henrik Sjöstal and Mathias Teuchost for many helpful conversations, and seminar participants at the Barcelona Summer Forum, Bocconi, Brown, Columbia, Harvard, IGC Growth Week, NBER Summer Institute, Oslo, Oxford, Stockholm School of Economics, UBC, and Uppsala for comments and suggestions. Sawal Acharya, Patrick Kennedy, and Roxanne Rahnama provided great research assistance. We thank Akamai, Steve Song, and the World Bank for data access. Hjort thanks the Center for Development Economics and Policy at Columbia University for financial support. Any errors are our own. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

†Go to <https://doi.org/10.1257/aer.20161385> to visit the article page for additional materials and author disclosure statement(s).

Good Practice in Sharing Exists Today

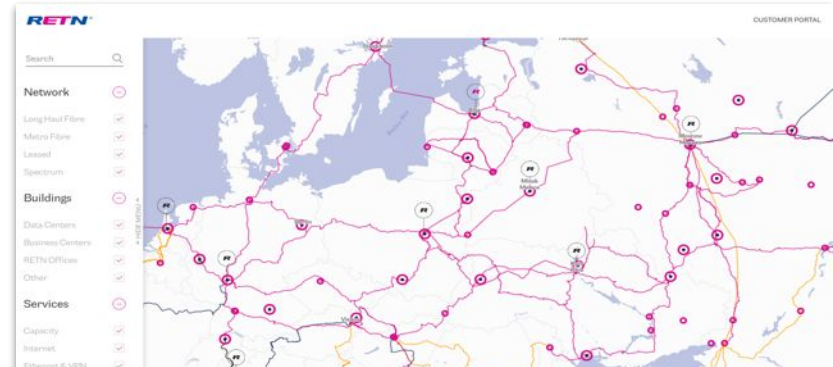


South Africa: <https://dfafrica.co.za/network/coverage/>



Nigeria: <https://bcnnigeria.net//index.php/our-network/>

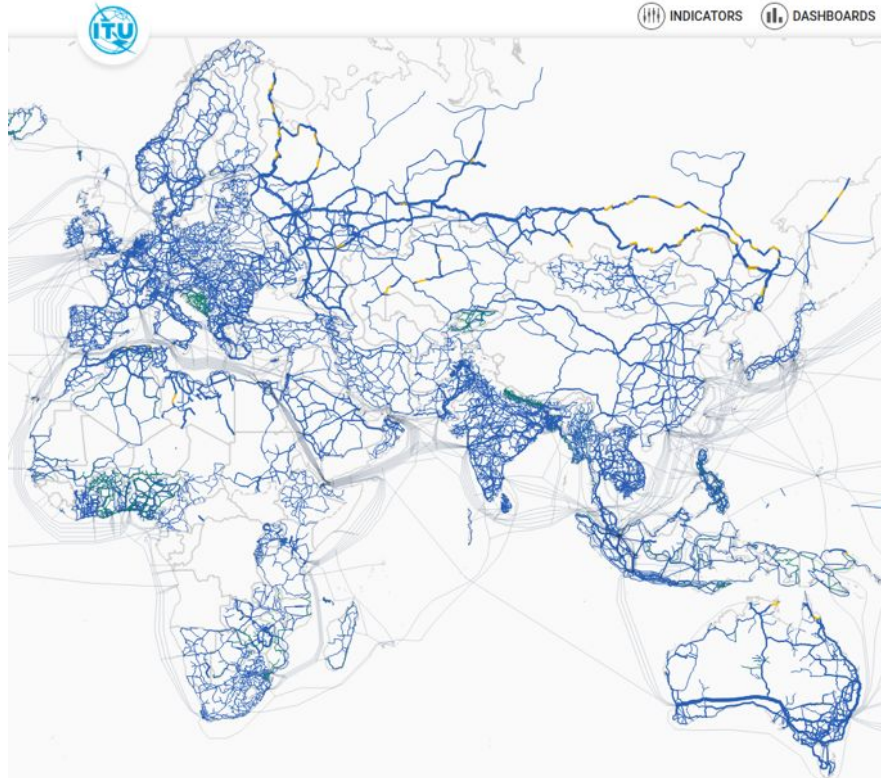
Many fibre network operators around the world share their network maps, although they are still in the minority. There is no normalised practice of network information sharing.



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



ITU Transmission Map



<https://www.itu.int/itu-d/tnd-map-public/>

ITU has maintained a global map of terrestrial fibre optic network infrastructure through its partnership with regulators and operators around the world.

In the absence of Open Data norms for network information sharing, operators often default to sharing under an NDA.

As a result the network map data is typically restricted from being downloaded, presenting an barrier to researchers who might leverage this resource.



Multistakeholder Initiative

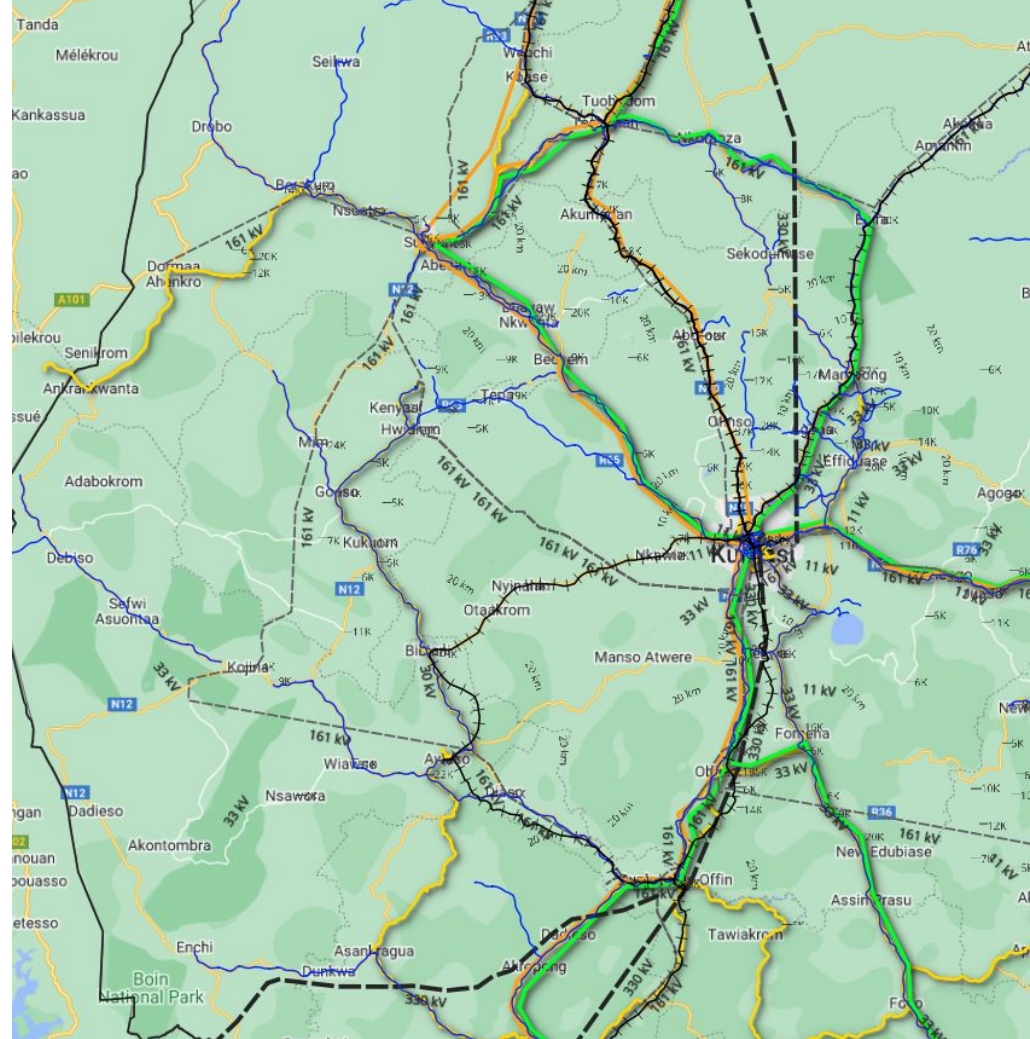
The World Bank, the International Telecommunications Union (ITU), Mozilla Corporation, the Internet Society (ISOC), Liquid Intelligent Technologies, CSquared, and Digital Council Africa are partnering to promote the collaborative development of open data standards for describing telecommunications infrastructure. The first challenge we have taken on is that of terrestrial fibre optic infrastructure.





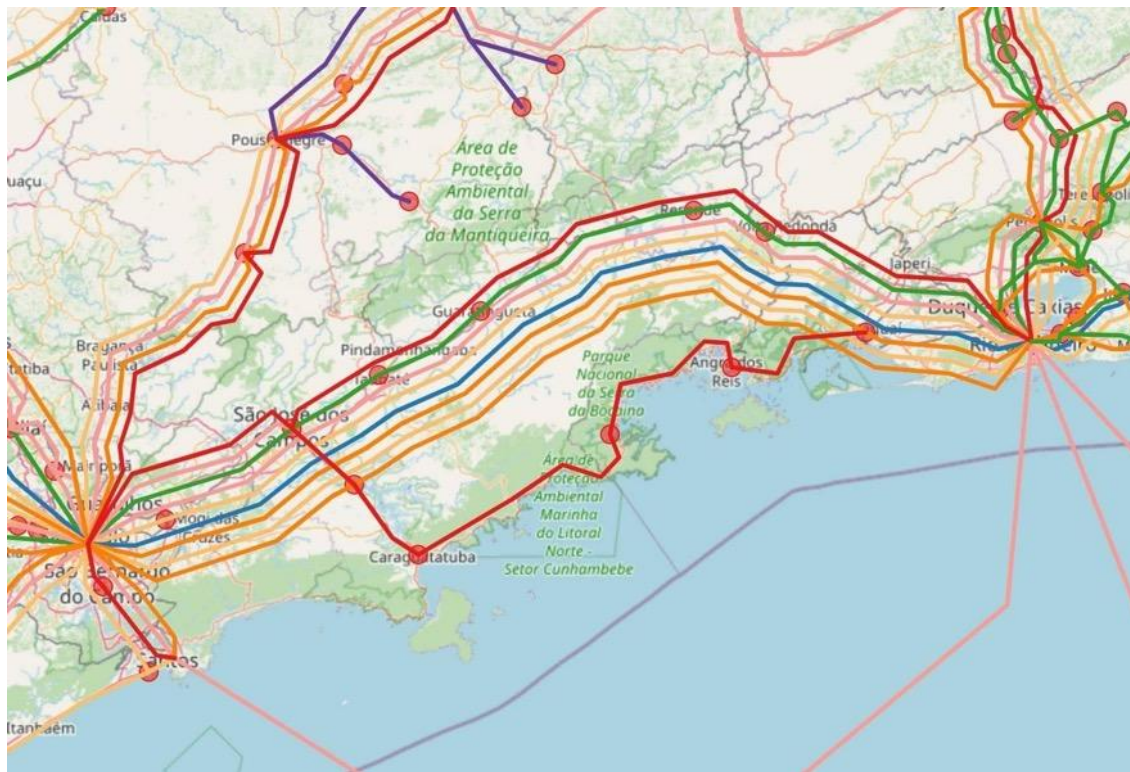
Benefits of Open Fibre Data

- 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





- Understanding the true extent of national fibre infrastructure
- If 8 operators report fibre along a route such as that to the right, does that represent 8 unique fibre networks?



Map of fibre networks from Sao Paulo to Rio de Janeiro





BENEFITS TO OPERATORS

Benefits to operators

- Reduction of physical network interruption and destruction.
- 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

MTN suffers 939 fibre cuts in five months

By Starrfm.com.gh - July 18, 2022



LISTEN LIVE



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.

The telecom giant experienced a monthly average of 11% traffic affected cuts during the first quarter of this year.



Starr1035F

MORE NEWS

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



ITU Partner2Connect Pledge



Open Data in Telecommunications Pledge

We believe that trusted open data is essential in order to extend affordable, high-quality broadband to all. Accordingly we pledge to:

- promote the **collaborative development of open data standards** in the ICT infrastructure sector in order to better understand the challenges and opportunities of providing affordable access to communication for all;
- begin by developing open data standards for describing **terrestrial fibre** optic networks;
- develop sustainable mechanisms for promoting **public input, management, and adoption** of these standards; and,
- promote a culture of **openness and trust** among regulators, infrastructure owners and operators.



Partnership with Open Data Services

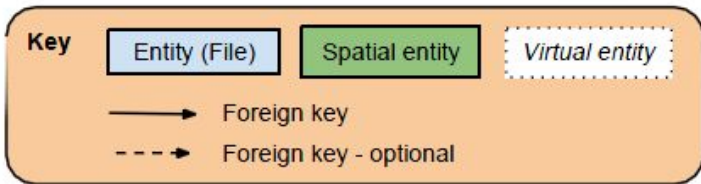
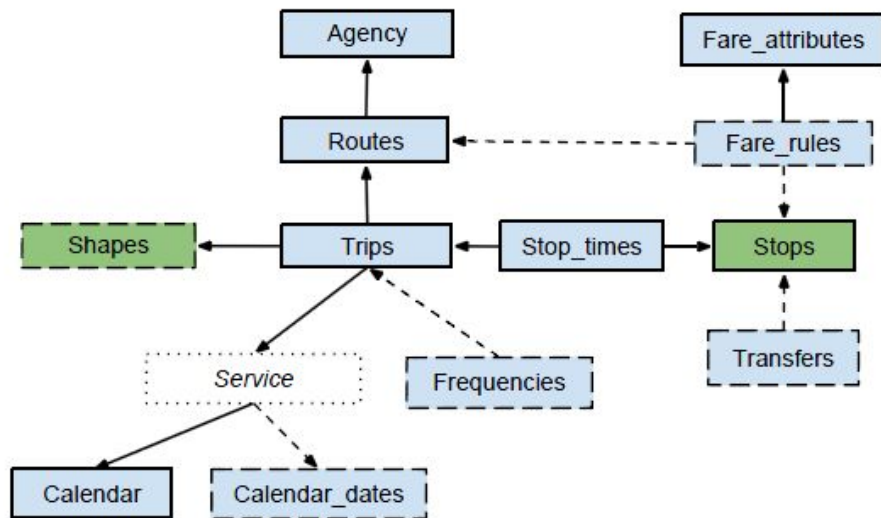
- Leading experts in open data standards who have worked on:
 - Beneficial **Ownership** data standard
 - International **Aid** Transparency Initiative (IATI) data standard
 - Open **Contracting** Data Standard
 - Among others...



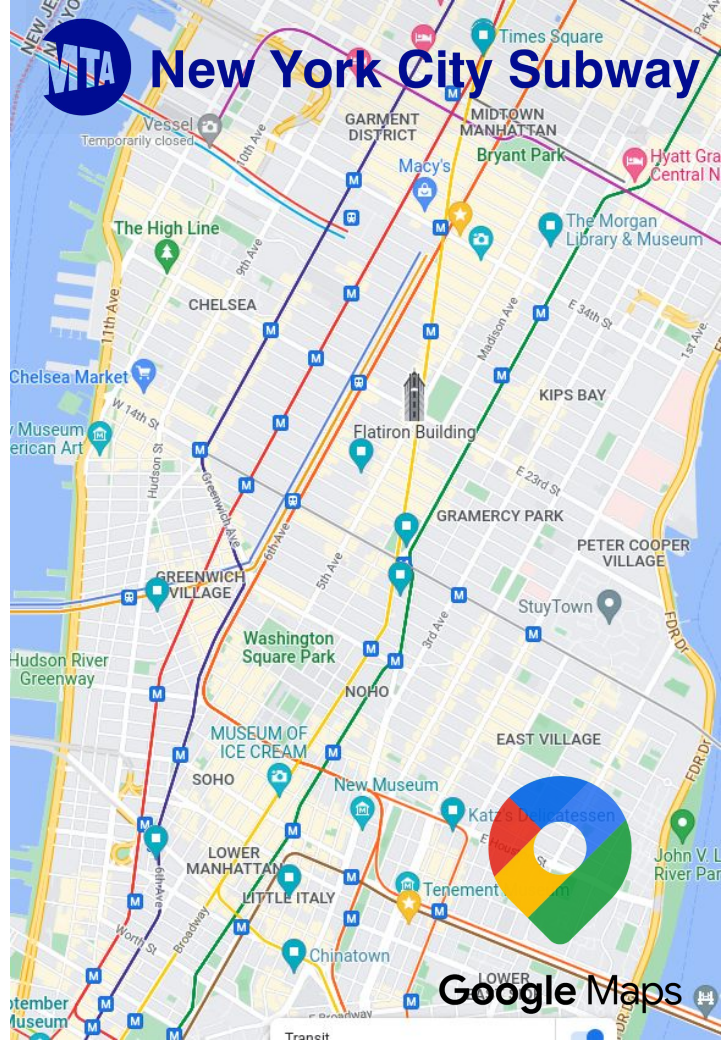
open data
services



Open Data Standard Example

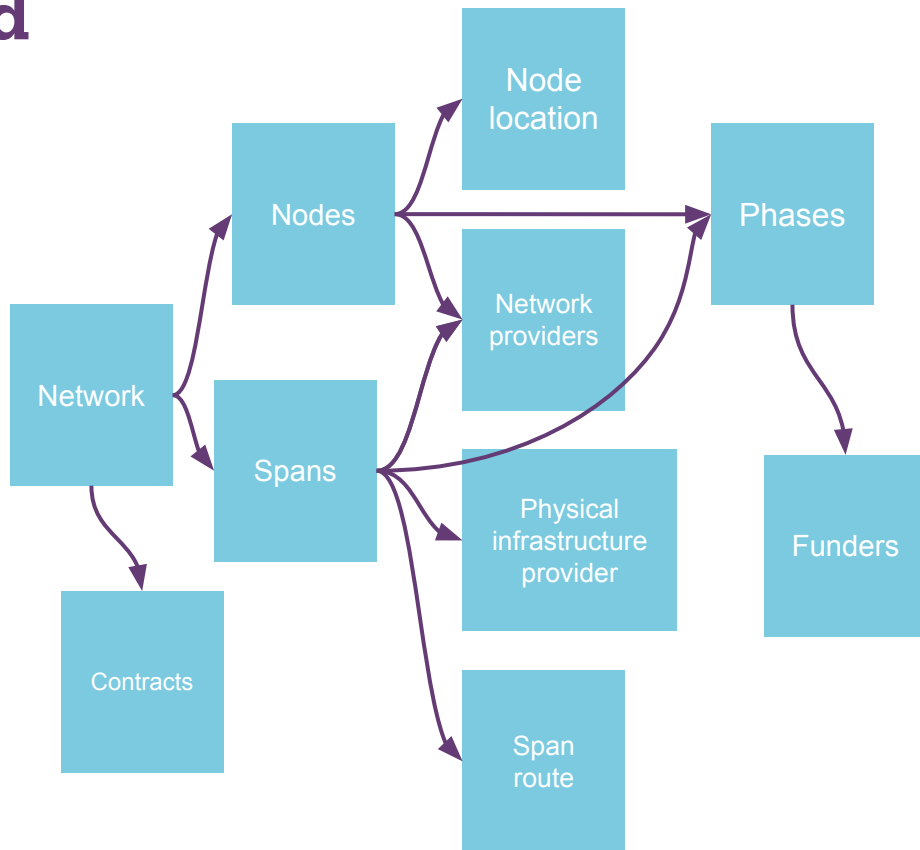


Public Transit



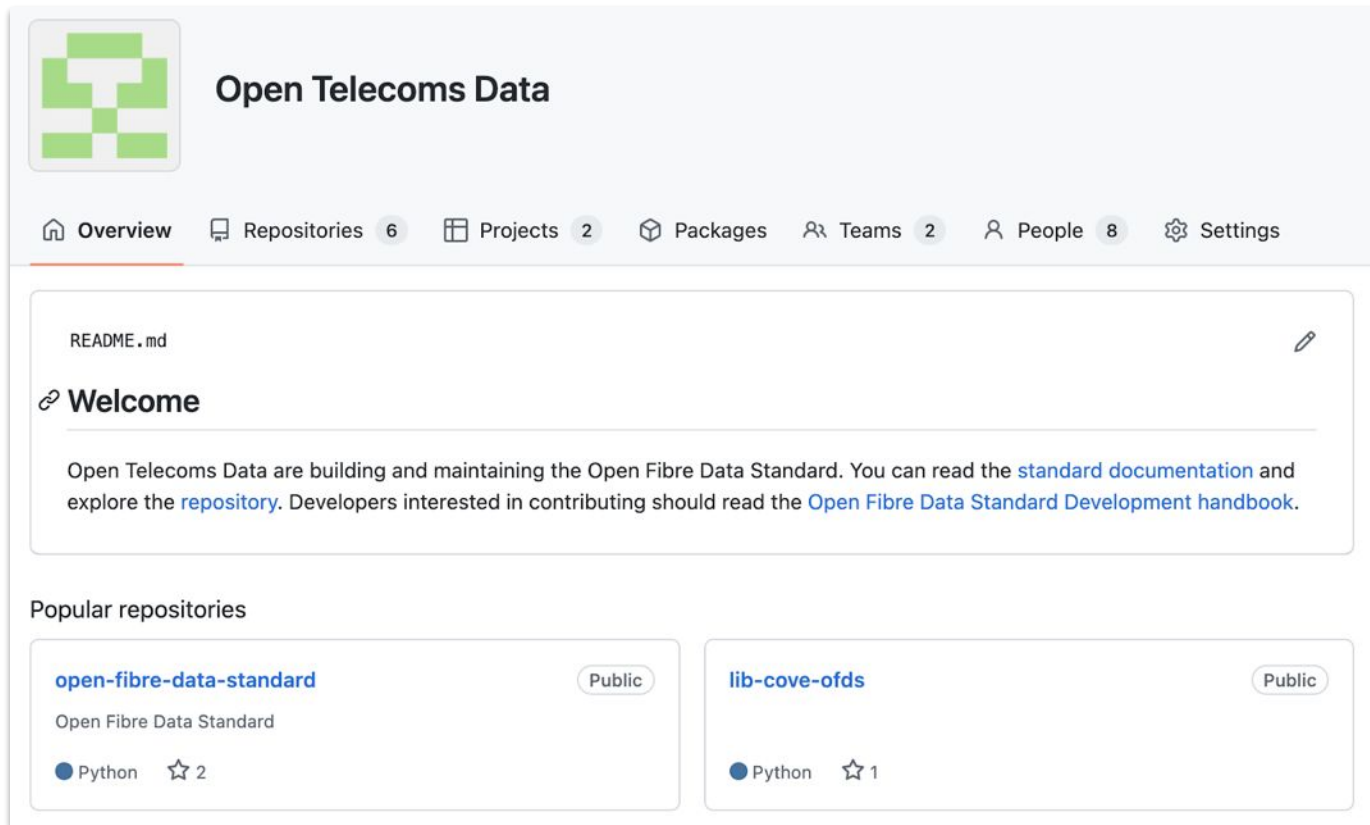
Open Fibre Data Standard

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







A version of the standard is publicly available




The image shows a screenshot of the GitHub repository page for 'Open Telecoms Data'. At the top left is a green and white pixelated logo. The repository name 'Open Telecoms Data' is displayed in a large, bold font. Below the name is a navigation bar with links for 'Overview', 'Repositories 6', 'Projects 2', 'Packages', 'Teams 2', 'People 8', and 'Settings'. The main content area shows a 'README.md' file with a 'Welcome' section. The welcome text states: 'Open Telecoms Data are building and maintaining the Open Fibre Data Standard. You can read the [standard documentation](#) and explore the [repository](#). Developers interested in contributing should read the [Open Fibre Data Standard Development handbook](#).' Below this, there is a 'Popular repositories' section with two cards. The first card is for 'open-fibre-data-standard', which is public, has 2 Python packages, and 2 stars. The second card is for 'lib-cove-ofds', which is public, has 1 Python package, and 1 star.

 **Open Telecoms Data**

[Overview](#) [Repositories 6](#) [Projects 2](#) [Packages](#) [Teams 2](#) [People 8](#) [Settings](#)

README.md 

 **Welcome**

Open Telecoms Data are building and maintaining the Open Fibre Data Standard. You can read the [standard documentation](#) and explore the [repository](#). Developers interested in contributing should read the [Open Fibre Data Standard Development handbook](#).

Popular repositories

open-fibre-data-standard Public
Open Fibre Data Standard
Python ☆ 2

lib-cove-ofds Public
Python ☆ 1

Documentation and digital tools are available

The screenshot shows the 'Open Fibre Data Standard' documentation browser. The top navigation bar includes a search box and a 'latest' indicator. A left sidebar contains a menu with categories: Primer, Guidance, Reference, Schema reference, Codlists reference, Publication formats reference, Identifiers, History, and Governance. The main content area is titled 'Browser' and provides instructions on how to interact with the schema tree. Below this, the 'Network' schema element is detailed, including its description, required fields (id, name, nodes, spans, phases), and explanatory text for each field.

Browser

Click on schema elements to expand the tree, or use the '+' icon to expand all elements. Use {} to view the underlying schema for any section. Required fields are indicated in **bold**.

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](#).

spans array[1..*] **Span**
Information about the spans that belong to this network. Information about spans 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 spans 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 spans endpoint may be provided in `.links`.

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

phases array[1..*] **Phase**
Information about the phases in which this network is deployed.

open-fibre-data-standard.readthedocs.io/

The screenshot shows the 'Open Fibre Data Standard' CoVE interface. The top navigation bar includes the 'CoVE' logo and the text 'Convert, Validate, Explore'. A 'Standard Documentation' link is visible in the top right. A 'Load New File' button is present. The main content area is divided into sections: 'Schema Version' (with a message 'Your data was checked against schema version:'), 'Download Data' (with a message 'For more information, see the publication format reference.'), and a list of download options. The 'JSON (original)' section shows a file 'network-package.json (9.1 KB)'. The 'GeoJSON' section shows 'Nodes GeoJSON (12.7 KB)' and 'Spans GeoJSON (11.2 KB)'. The 'CSV' section lists various CSV files, including 'contracts.csv (333 bytes)', 'contracts_documents.csv (316 bytes)', 'contracts_relatedPhases.csv (141 bytes)', 'links.csv (198 bytes)', 'main.csv (756 bytes)', 'nodes.csv (876 bytes)', 'nodes_internationalConnections.csv (291 bytes)', 'organisations.csv (1.5 KB)', 'phases.csv (168 bytes)', 'phases_funders.csv (141 bytes)', and 'spans.csv (1.2 KB)'.

Open Fibre Data Standard

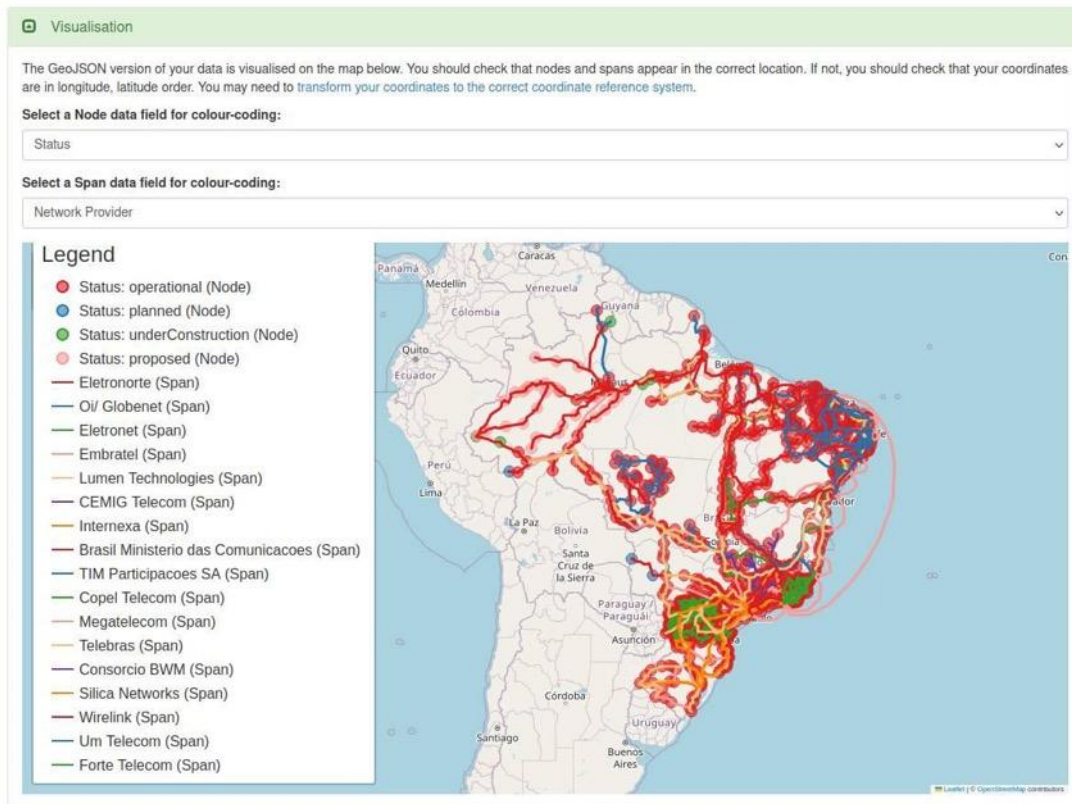
CoVE

 Convert, Validate, Explore Standard Documentation

ofds.cove.opendataservices.coop/

Action has already begun

- In November 2022, the Brazilian government released network fibre optic infrastructure data using the draft Open Fibre Data Standard.
- Pilots are currently underway in Ghana and Kenya





moz://a

Thank You

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