

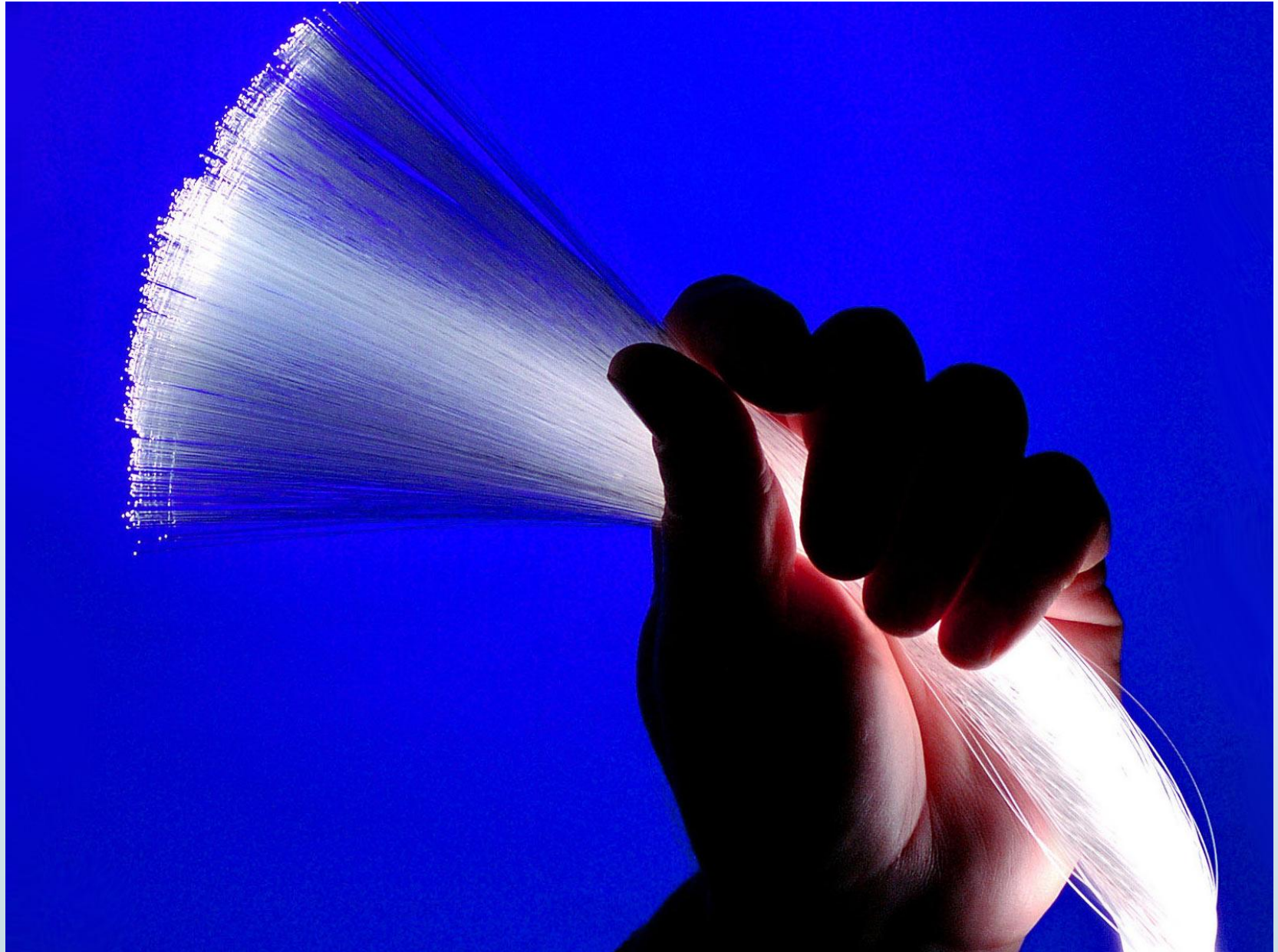


Optical Fiber

by *Vadim Bespalov, Airat Baiburov*

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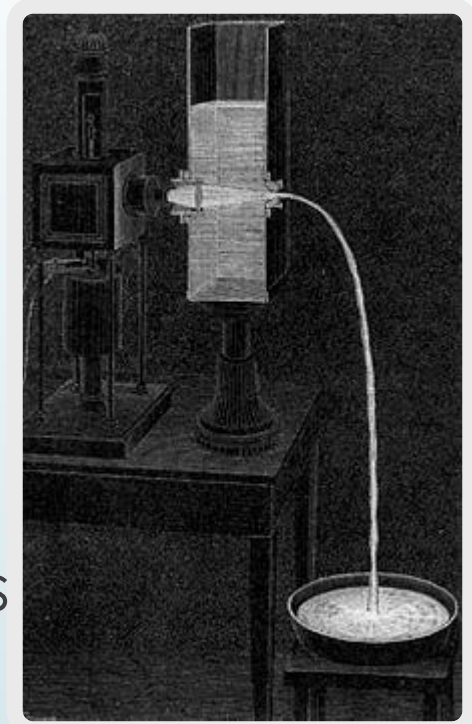
What is Optical Fiber?

- An Optical fiber is a flexible, transparent fiber made of high quality glass (**silica**) or plastic, slightly thicker than a human hair.
- Optical fibers are widely used in fiber-optic communications, which permits transmission over longer distances and at higher bandwidths (data rates) than other forms of communication
- Fibers are used instead of metal wires because signals travel along them with less loss and are also safe to electromagnetic interference.

History of Fiber Optics

Fiber optics is not really a new technology, its fairly old.

Guiding of light by refraction, the principle that makes fiber optics possible, was first demonstrated by Daniel Colladon and Jacques Babinet in Paris in the early 1840s



Uses of Optical Fiber

- Fiber optic can accommodate variety of needs.
- It can be used in Communication, fiber optic sensors, illumination, medical.
- And also in other places where bright light needs to be shone on a target without a clear line-of-sight path.
- Used in building to route sunlight from the roof to other parts of the building.
- And many more usages but we will only discuss use of optical fiber in communication here.

In Communication

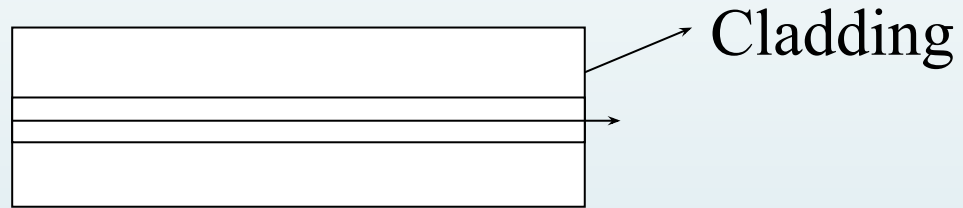
- Optical fiber can be used as a medium for telecommunication and computer networking because it is flexible and can be bundled as cables.
- It is especially advantageous for long-distance communications, because light propagates through the fiber with little attenuation compared to electrical cables.
- The per-channel light signals propagating in the fiber have been modulated at rates as high as 111 gigabits per second (Gbit/s) by NTT, although 10 or 40 Gbit/s is typical.
- In June 2013, researchers demonstrated transmission of 400 Gbit/s over a single channel.

Benefits of Optical Fiber

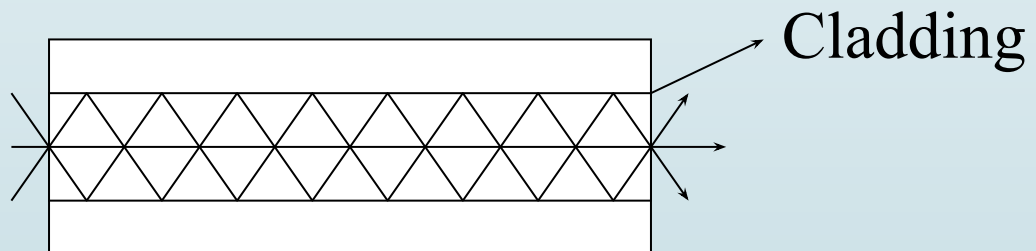
- For short distance application, such as a network in an office building, fiber-optic cabling can save space in cable ducts. This is because a single fiber can carry much more data than electrical cables such as standard category 5 Ethernet cabling, which typically runs at 100 Mbit/s or 1 Gbit/s speeds.
- Fiber is also immune to electrical interference; there is no cross-talk between signals in different cables, and no pickup of environmental noise.
- Non-armored fiber cables do not conduct electricity, which makes fiber a good solution for protecting communications equipment in high voltage environments, such as power generation facilities, or metal communication structures prone to lightning strikes.
- They can also be used in environments where explosive fumes are present, without danger of ignition.

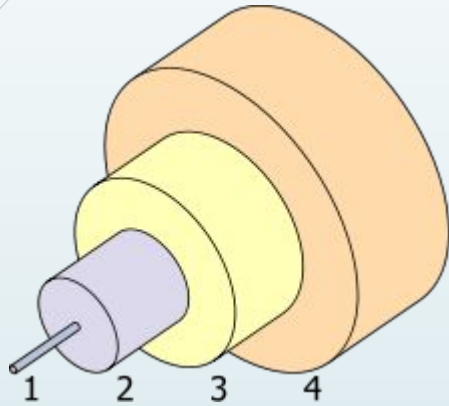
Modes of propagation

- Single mode – there is only one path for light to take down the cable



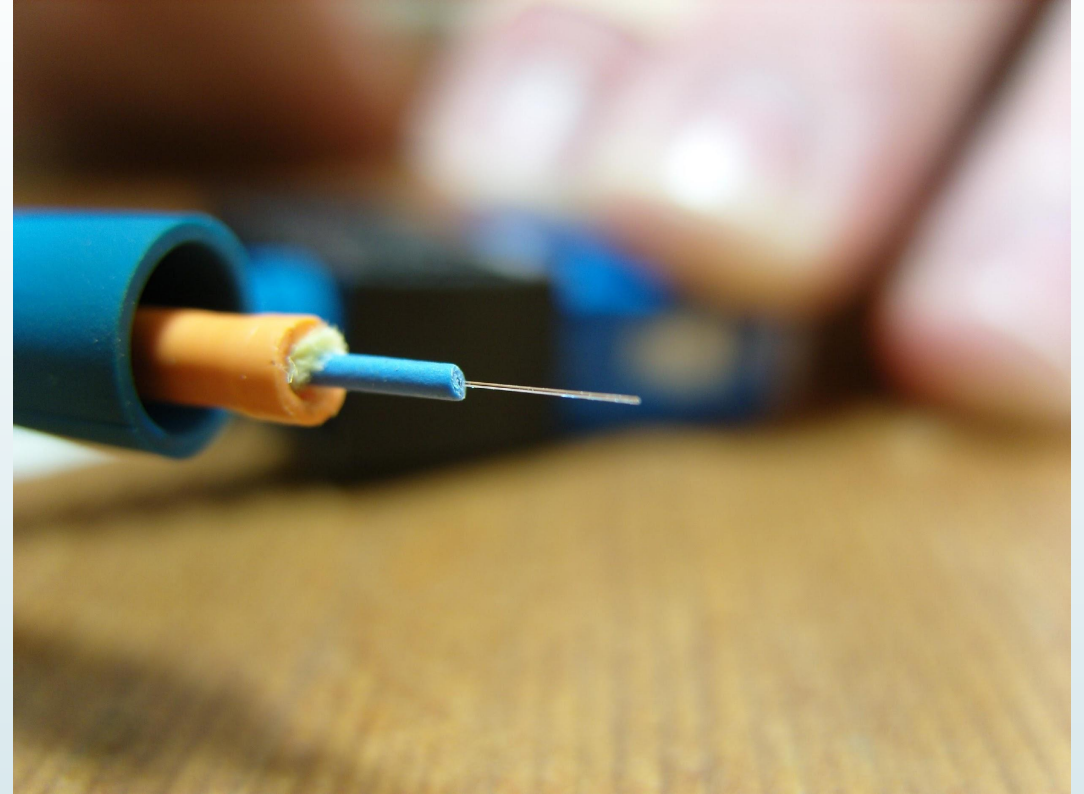
- Multimode – if there is more than one path



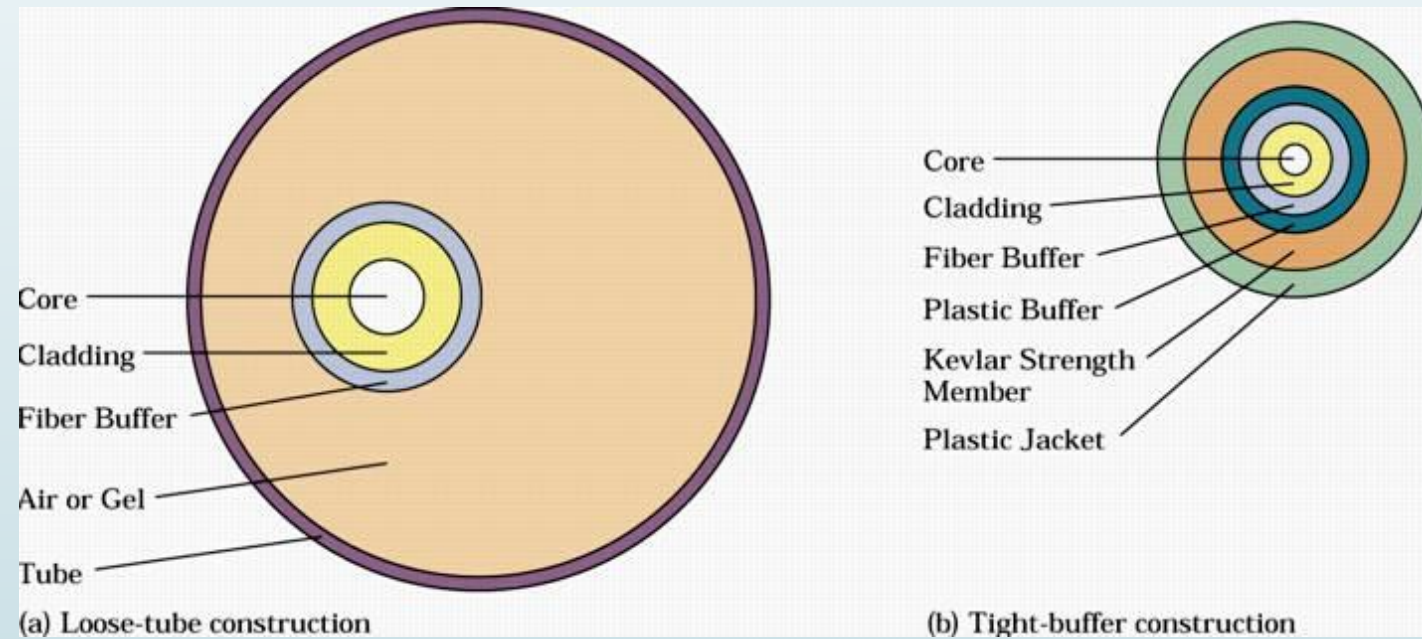


Structure of single-mode fiber

- 1. Core: 8 μm diameter
- 2. Cladding: 125 μm dia.
- 3. Buffer: 250 μm dia.
- 4. Jacket: 400 μm dia.

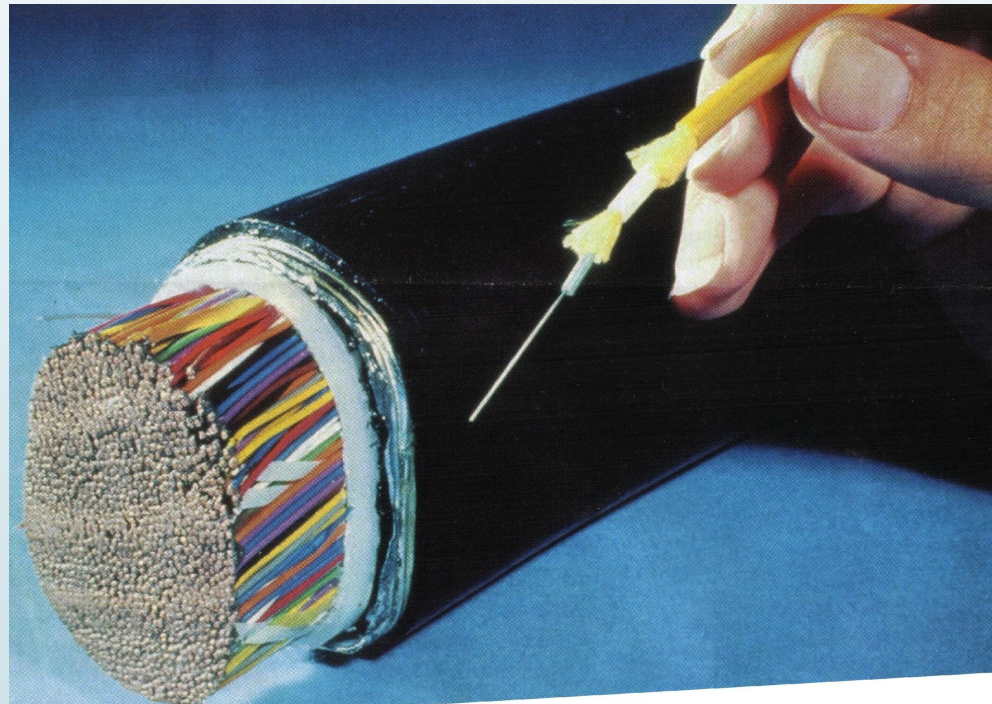


Types of Optical fiber cable



Did you know?

- A small optical fiber can carry more data than a large copper cable.



- It is a unidirectional technology.

Advantages of Optical Fiber over Conventional Copper System

□ **Broad Bandwidth**

- Broadband communication is very much possible over fiber optics which means that audio signal, video signal, microwave signal, text and data from computers. It is possible to transmit around 3,000,000 full-duplex voice or 90,000 TV channels over one optical fiber.

□ **Electrical Insulator**

- Optical fibers are made and drawn from silica glass which is nonconductor of electricity and so there are no ground loops and leakage of any type of current. Optical fibers are thus laid down along with high voltage cables on the electricity poles due to its electrical insulator behavior.

□ **Immunity to Electromagnetic Interference**

- The optical fiber is electrically non-conductive, so it does not act as an antenna to pick up electromagnetic signals which may be present nearby

Optical Fiber in Sea

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Submarine Cable Map

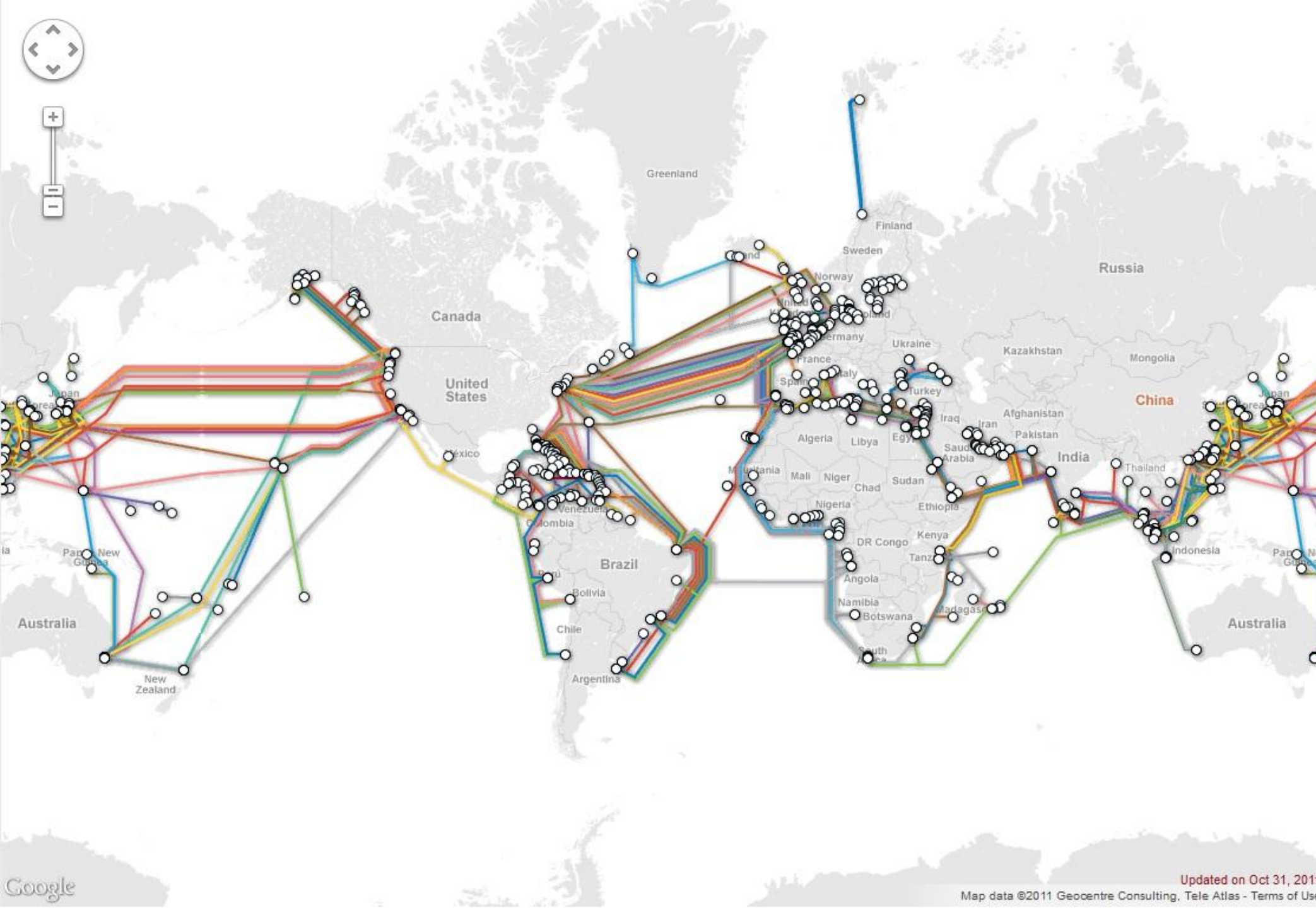
The [Submarine Cable Map](#) is a free resource from TeleGeography. Data contained in this map is drawn from Global Bandwidth Research and is updated on a regular basis.

To learn more about TeleGeography or this map, please click [here](#).

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Submarine Cables

- ACS Alaska-Oregon Network (AKORN)
- Aden-Djibouti
- Africa Coast to Europe (ACE)
- Alaska United East
- Alaska United South East
- Alaska United West
- ALBA-1
- Aletar
- Algeria-Spain
- ALPAL-2
- America Movil-1 (AM-1)
- American Samoa-Hawaii (ASH)
- Americas-I North
- Americas-II
- APCN-2
- Apollo
- ARCOS
- Argentina-Uruguay
- Asia Submarine-cable Express (ASE)
- Asia-America Gateway (AAG) Cable System
- Atlantic Crossing-1 (AC-1)
- Atlantis-2
- Atlas Offshore
- Australia-Japan Cable (AJC)
- Australia-Papua New Guinea-2 (APN-2)
- Australia-Singapore Cable (ASC)
- Axin
- Bahamas 2
- Bahamas Domestic Submarine Network (BDSNi)
- Bahamas Internet Cable System (BICS)
- BalaLink
- Balkans-Italy Network (BIN)
- Baltic



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Thank You

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