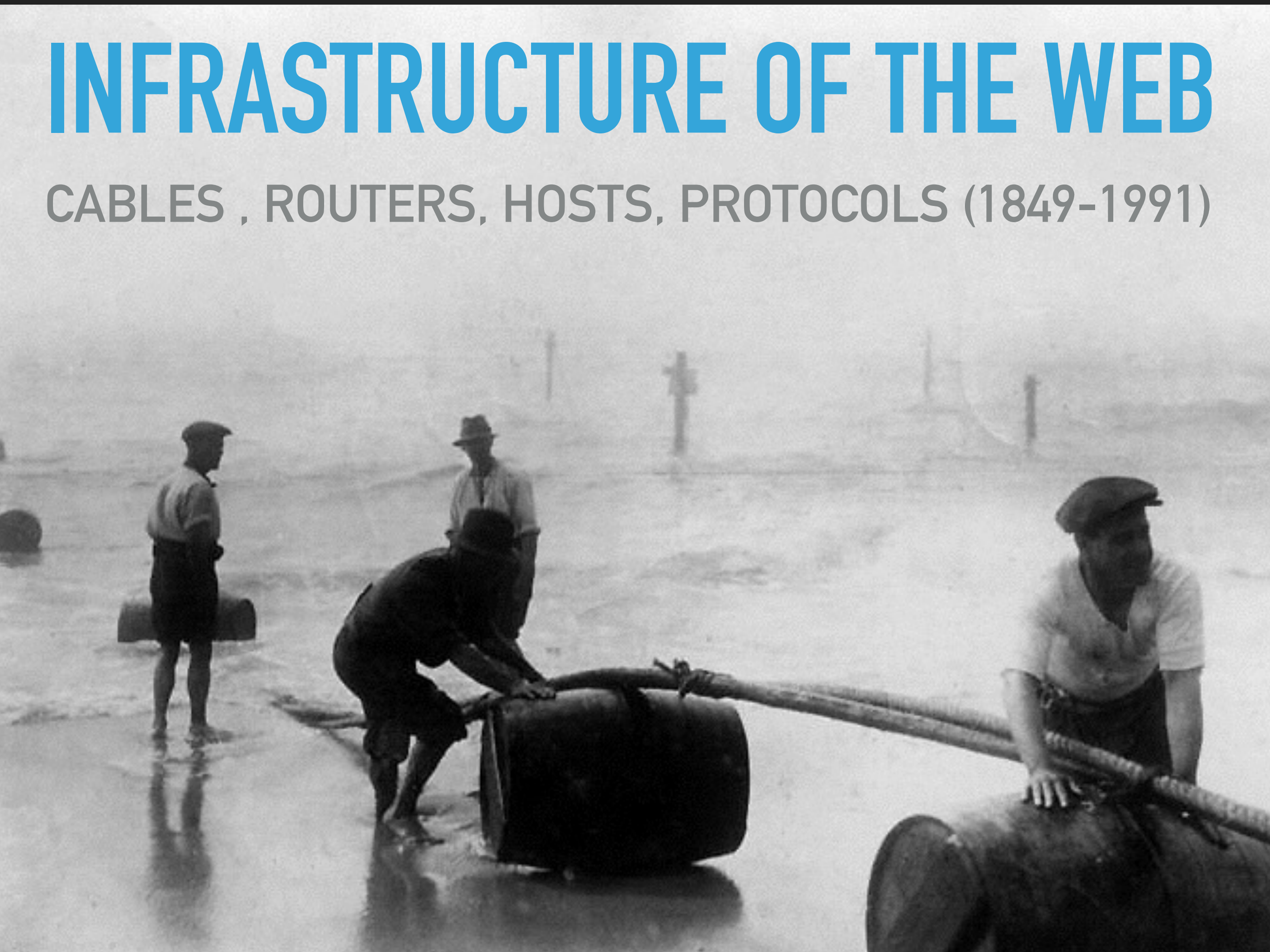
WEB APP ARCHITECTURES

WORSHOP 1/9

INFRASTRUCTURE OF THE WEB

CABLES , ROUTERS, HOSTS, PROTOCOLS (1849-1991)



Machines could communicate remotely before internet !

You had to use a dedicated point to point link, meaning a physical copper line going underground between two computers. You could also use a phone line and a modem

But:

- The line is monopolised during the whole communication, even during blanks
- Only two computers are connected at the same time. If you want to reach another computer, you must hang off the phone, and dial another number.

CABLES , ROUTERS, HOSTS, PROTOCOLS (1849-1991)

Image taken from the WarGames movie (1983)

- He is using his phone line and modem to connect to another computer. THIS IS PRE INTERNET, HE IS NOT CONNECTED TO THE INTERNET, just to another computer.

- He can be connected only to one computer at a time.

- The line is monopolised during the whole connection, even during the blanks.

- He will have to hang off and redial to connect to another computer.

Something has been invented to go around these limitations.

?

Packet Switching

- Data split into chunks (packets)
- Each packet has a from address, to address, and payload (data chunk)
- If data requires multiple chunks, then the order of each packet is noted
- Packets sent onto the network, moving from router to router taking different paths (set by the router). Each packet's journey time can, therefore, differ.
- Once packets arrive, they are re-ordered
- Message sent from recipient to sender indicating that the message has been received
- If no confirmation message, sender transmits data again

Many Different Communications can share the same line at the same time

The network is optimised, the line is available for others during blanks

CABLES , ROUTERS, HOSTS, PROTOCOLS (1849-1991)

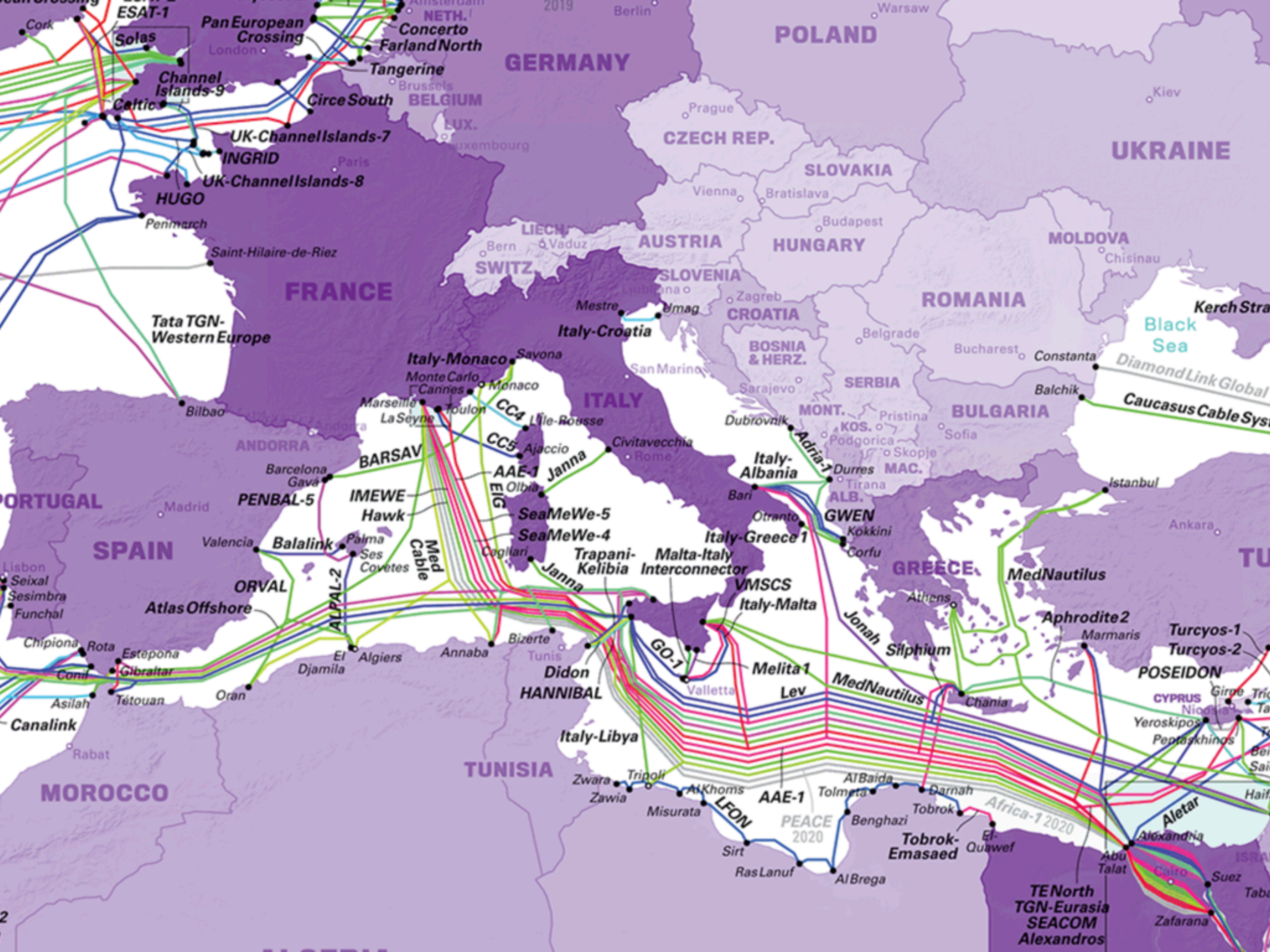
- 1969 : First message exchanged on Arpanet : 4 connected Hosts : UCLA, Stanford, Utah, Santa Barbara
- 1971 : Premier email
- 1973 : 40 hosts
- 1970's : FTP, Email , Usenet
- 1983 : TCP/IP
- 1984 : DNS
- 1987 : 10.000 Hosts
- 1988 : IRC
- 1989 : First ISP for the general public : The World)
- 1991 : Tim Berners-Lee invents the Web

INTERNET EXISTED LONG BEFORE THE WEB !

Can you tell me what type of physical link hold the main part of international internet communications ?

CABLES , ROUTERS, HOSTS, PROTOCOLS (1849-1991)

- 99% of international internet communications goes through submarine cables
- Lay down a submarine cable costs hundreds of millions of dollars
- Putting a satellite on orbit is cheaper, but information flows is slower than in optical fiber. Therefore, the cost per kilobit per second is higher using satellite.
- The deepest cable is 8000m deep (between us and japan)
- Cables are fragile and can be broken
- there was 420 cables on duty in 2019


ESAT-1
Cork
Solas
Pan European Crossing
NETH.
Concerto
Farland North
London
Tangerine
Channel Islands-9
Celtic
Circe South
Brussels
BELGIUM
LUX.
UK-Channel Islands-7
INGRID
UK-Channel Islands-8
HUGO
Penmarch
Saint-Hilaire-de-Riez
FRANCE
Tata TGN-Western Europe
Bilbao
ANDORRA
Barcelona
Gavá
PENBAL-5
IMEWE
Hawk
BARSAV
Madrid
PORTUGAL
SPAIN
Valencia
Balalink
Palma
Ses Covetes
ALPAL-2
ORVAL
Atlas Offshore
Lisbon
Seixal
Sesimbra
Funchal
Chipiona
Rota
Estepona
Conil
Gibraltar
Asilah
Tétouan
Canalink
Rabat
MOROCCO
El Djamila
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Italy-Monaco
Savona
Monte Carlo
Monaco
Cannes
Marseille
La Seyne
Toulon
CC4
Lile-Rousse
CC5
Ajaccio
AAE-1
Olbia
EIG
Janna
SeaMeWe-5
SeaMeWe-4
Cagliari
Trapani-Kelibia
Malta-Italy Interconnector
VMSCS
Italy-Malta
GO-1
Melita 1
Valletta
Lev
Italy-Libya
Zwara
Zawia
Tripoli
Al Khoms
Misurata
LFON
AAE-1
Sirt
Ras Lanuf
Al Brega
PEACE 2020
Al Baida
Tolmeta
Darnah
Tobrok
Benghazi
Tobrok-Emasaed
El-Quawef
Africa-1 2020
Civitavecchia
Rome
Janna
ITALY
Mestre
Umag
Italy-Croatia
San Marino
Italy-Albania
Bari
Otranto
Italy-Greece 1
Adria-1
Durres
Tirana
ALB.
MAC.
GWEN
Kokkini
Corfu
GREECE
Athens
MedNautilus
Jonah
Silphium
Chania
Aphrodite 2
Marmaris
Turcyos-1
Turcyos-2
POSEIDON
CYPRUS
Nicosia
Yeroskipos
Peptaskhinos
Girne
Aletar
Alexandria
Abu Talat
Cairo
Suez
Zafarana
TE North
TGN-Eurasia
SEACOM
Alexandros
Istanbul
Ankara
TU
Black Sea
Diamond Link Global
Kerch Stra
Constanta
Balchik
Caucasus Cable Syst
Dubrovnik
MONT.
KOS.
Pristina
Podgorica
Skopje
Sofia
BULGARIA
SERBIA
Sarajevo
BOSNIA & HERZ.
Belgrade
Bucharest
ROMANIA
CROATIA
Zagreb
SLOVENIA
Ljubljana
AUSTRIA
Vienna
Bratislava
Budapest
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BORIS HORVAT


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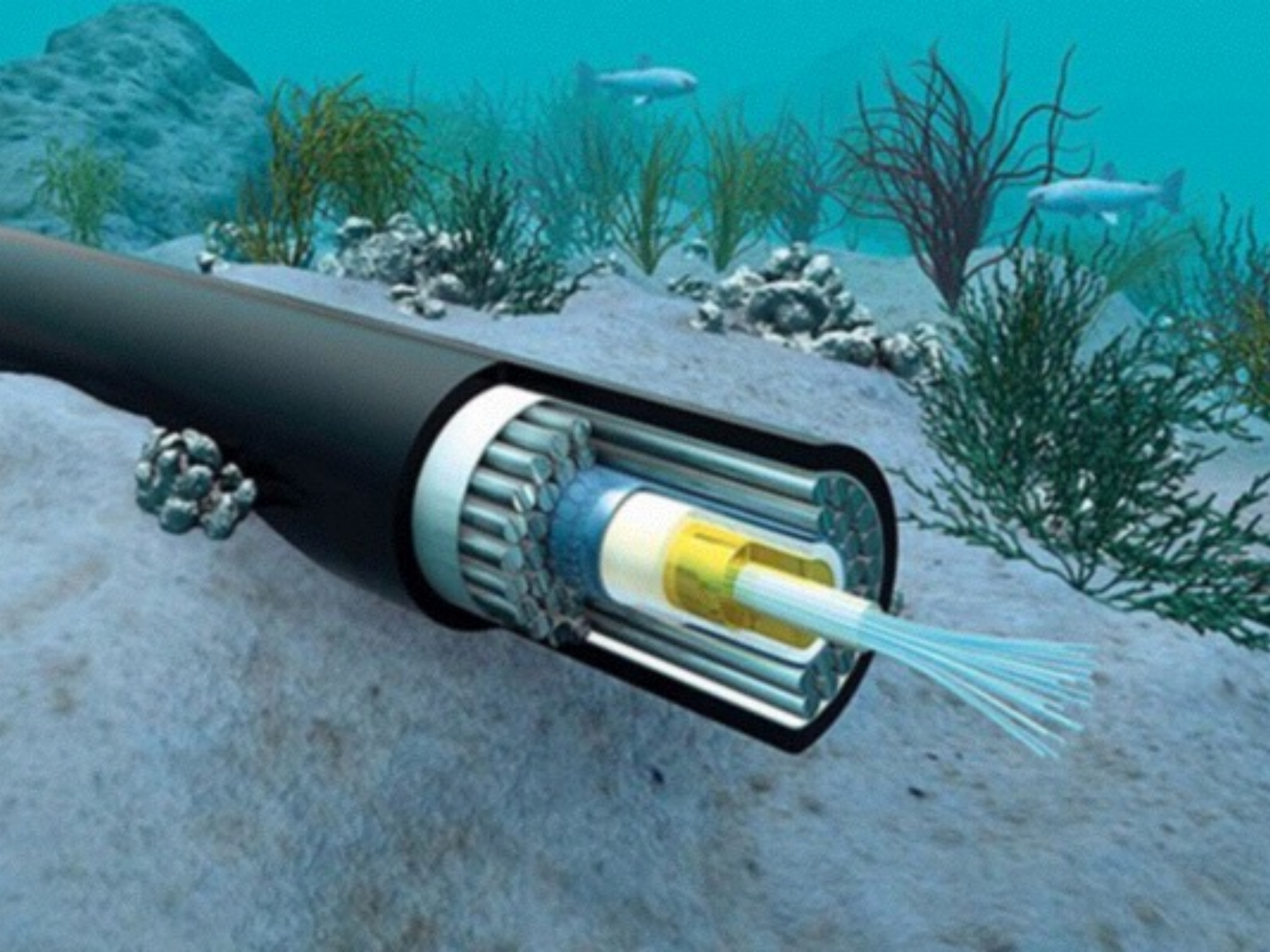
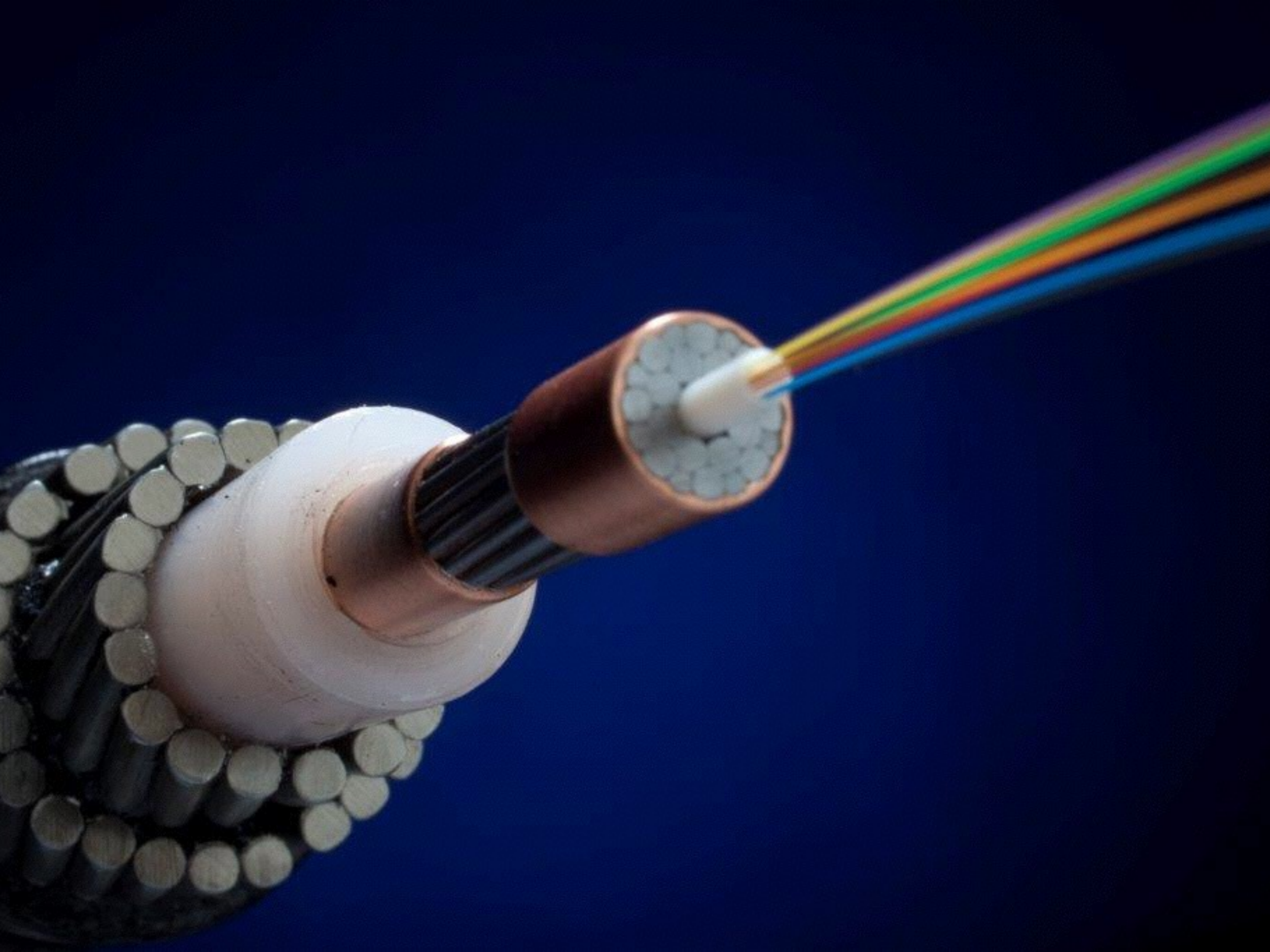
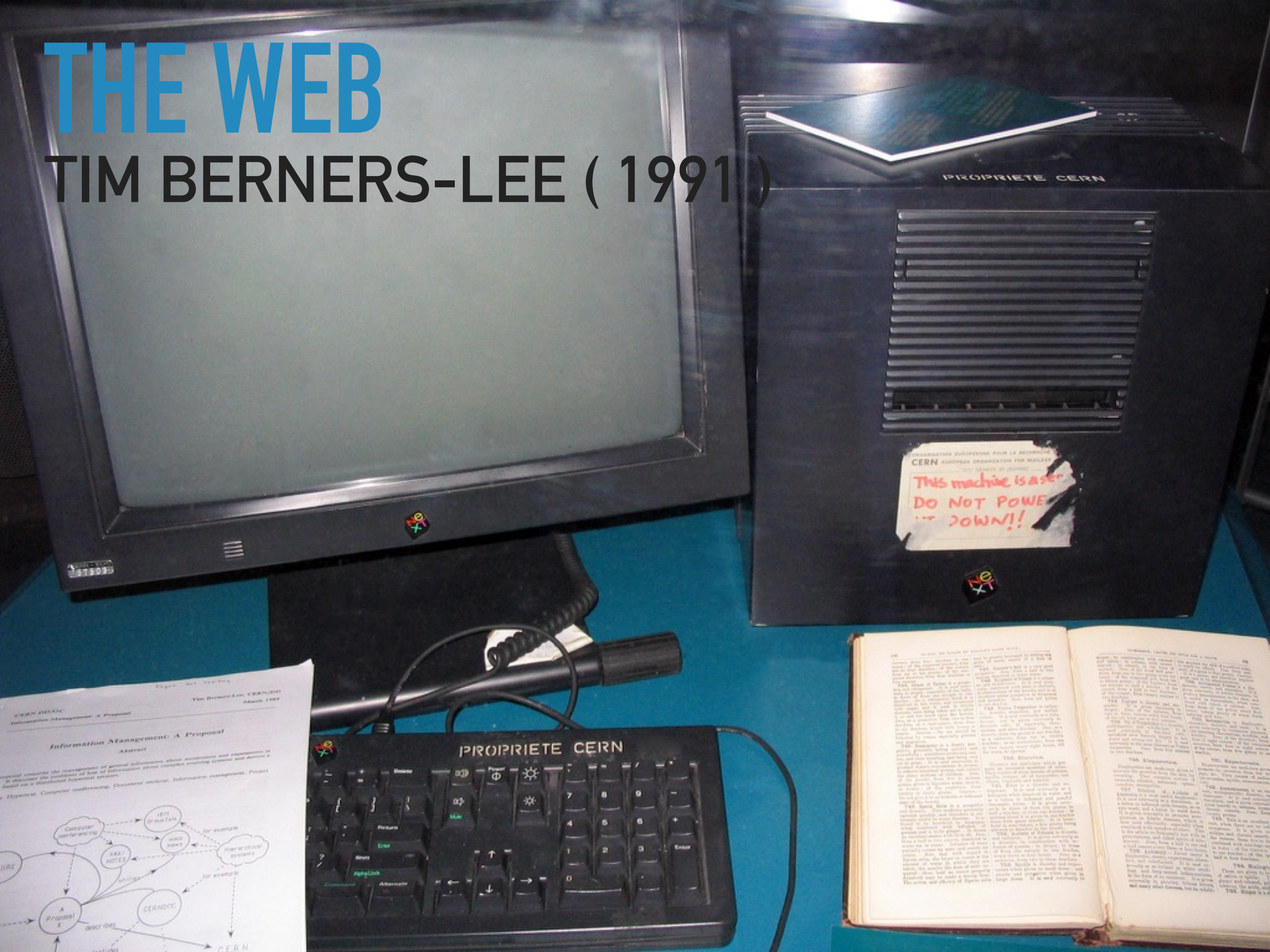




THE WEB

TIM BERNERS-LEE (1991)



Tim Berners Lee identifies information sharing difficulties at the CERN, where he works. Different systems exists, and publishing and accessing documents between them is complicated. He designs a new way to share documents, that will comply with these requirements :

* NON CENTRALISATION (every computer can share documents)

* HETEROGENEITY (Must work on different systems)

* REMOTE ACCESS

* HYPERTEXT (display document from another server in just one click)

30 years later, the principles he proposed still rule the Internet !

WorldWideWeb
Info
Navigate
Document
Find
Edit
Links
Style
Print... p
Page layout...
Windows
Services
Hide h
Quit q

Links
Mark all A
Mark selection M
Link to marked L
Link to New N
Unlink Z
Link to file...
Help

Tim's Home Page

My home page

altas

The World-Wide Web Virtual Library: Subject Catalogue

The WWW Virtual Library

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Mail to ma
to add po
administra

See also

Aeronaut

Agricultu

Anthropology

Archaeology

Asian Studies

Astronomy and

Bio Sciences

Separate list.

Separate list .

High-Energy Physics Information

CERN Welcome

CERN

European Laboratory for Part

Geneva, Switzerlan

About the Laboratory:

- on CERN info ,
- General information, divisions, groups and activities , scientific committees

CERN Experiments

Experiments

WWW Support for Experiments

ALEPH	LEP experiment
ALICE	A Large Ion Collider Ex LHC
ATLAS	A Toroidal LHC Appar
CHORUS	WA95 - Neutrino oscill CERN
CMS	Compact Muon Solenc

Atlas

THE WEB

- WEB SERVER : software waiting for request and sending content.
- WEB CLIENT (or BROWSER) : software requesting content and displaying it nicely.
- HTTP : The language between them
- URL : Allows to identify a resource on the network
- HYPERTEXT : clickable links to access other documents instantly
- HTML : Language to describe document.

http://www.example.com/dossier/page.htm

LAB 1
SPEAKING HTTP

HTTP COMMUNICATION

On the web, the client asks for something , the server answers. HTTP is the language of this exchange. if you type www.example.com/ in your browser this is what happen backstage :

GET / HTTP/1.1

Host: www.example.com

Connection: keep-alive

...

HTTP/1.1 200 OK

Content-Type: text/html;

...

<html>

...

- first block is client request : Request line and request headers.

- second block is server response : Status line, Response headers.

- third block is server response content.

  see the two line breaks between reponse headers and content

HTTP HEADERS :

Information exchanged between client and server during a http request, in the form of name:value pairs. They include : name and version of the browser, cookies, Last modification date, duration of the cache, accepted languages, accepted file formats .... They are never displayed in the browser.

Install netcat (nc on mac)

In a shell, run netcat in listen (server) mode on port 9502 and leave it open

Open another terminal window, run netcat in client mode and connect to localhost on the same port, now type some text and press enter. Do the same on the other window.

You’ve just understood client / server basic principles:

1 server, 1 client, 1 port number

Of course, this would work the same way if the server were on the other side of the earth. just use his ip address instead of localhost.

In a shell, run netcat in listen mode on port 9572 and connect with your computer browser to

http://localhost:9572

to display how your browser is speaking when he makes a request (= client http headers)

(Windows : WSL !)

your browser now leaves the connection open and is waiting for the answer from the server. do ctrl-c in netcat.

what happens ?

run netcat again, as server on port 9503, connect to it with your browser, and this time, once the browser made his request, type this text into the shell. DO NOT FORGET THE EMPTY LINE BETWEEN HEADERS AND CONTENT. See what happens in the browser.

```
HTTP/1.1 200 OK

Content-Type: text/html;



Hi Bro
```

Do the same with a request from your mobile phone (same wifi connection) using your local server ip address

how to find it ?

MOBILE FIRST ! Mobile >50% of worldwide web traffic

Due to low infrastructure and financial restraints, many emerging digital markets skipped the desktop internet phase entirely and moved straight onto mobile internet via smartphone and tablet devices.

By contrast, mobile only makes up around 40 percent of online traffic in the United States.

in a shell, use netcat as a client connect to google and get homepage. Read and understand server headers.

```
echo -n "GET / HTTP/1.0\r\n\r\n" | nc www.google.com 80
```

exercice :