

# The Internet - PART TWO

# What is the "Ethernet" - I

Ethernet is the most widely installed **local area network (LAN)** technology. Ethernet is a *link layer protocol* in the **TCP/IP stack**, describing how networked devices can format data for transmission to other network devices on the same network segment, and how to put that data out on the network connection.

# What is the "Ethernet" - II

Ethernet was developed at Xerox PARC\* between 1973 and 1974. The idea was first documented in a memo that Metcalfe wrote on May 22, 1973, where he named it after the disproven lumeniferous ether as an "omnipresent, completely-passive medium for the propagation of electromagnetic waves".

\*Xerox PARC = Palo Alto Research Center

# What is the "Ethernet" - III

We now use the term very loosely when referring to Ethernet connections; Ethernet cables, etc

- An Ethernet cable is formed of 8 colour coded wires split into four **Twisted pairs**.
- The pairs are twisted in order to minimise crosstalk between adjacent pairs
- Signal carrying capacity is determined by the technical quality of the cables.
- The specifications refer to **CAT5, CAT6**, which specify if the cables are capable of carrying
  - CAT5 can carry signals up to 100 Mbps**
  - CAT5E will work up to 1,000 Mbps (1 Gigabit)**
  - CAT6 still has four twisted pairs, but they are individually screened, so will work up to 10 Gigabit**

# An RJ45 Ethernet connector



# Packets or “Datagrams”

## TCP/IP

- TCP Transaction Control Protocol
- IP Internet Protocol

## IEEE 802.x

- The international standard for packet switching

# Think of it as sending POSTCARDS

Each individual packet is like a postcard and has:

A **HEADER**, which contains:

- A sender's address
- The recipient's address
- The date it was sent
- A sending number sequence
- Lots of other data about the type of postcard

The header is followed by the **CONTENTS**

- Some information in a standardised format

27 July 2014

My dearest, Aunt Nancy  
You won't believe this but two days ago I tried kangaroo tail, crocodile meat, and a green ant, all in the same day! The kangaroo tail was a bit greasy but the crocodile tasted like--you guessed it!--chicken. But most surprising of all, the green ant tasted like a sour grape! The land down under sure is an interesting place!

Wish you were here!

*Jimmy*



Nancy Nanny  
123 Somewhere Street  
The City, State  
Zip Code



# But each postcard is like an individual page of a novel being sent separately

Random arrivals - the post is often delayed

- The "postcards" can get routed by different paths around the Internet
- That is why each packet has an individual packet number as reference.
- When they are received they are all reassembled in the right order

# But each postcard is like an individual page of a novel being sent separately

Sometimes a packet gets lost - (there is a page missing)

- If page 453 is received followed by page 455 the recipient needs to ask for a retransmission of page 454

Can you please confirm that you have received what I sent?

- Confirmation of receipt needed

# But each postcard is like an individual page of a novel being sent separately

Maybe there is a blot of ink on the postcard

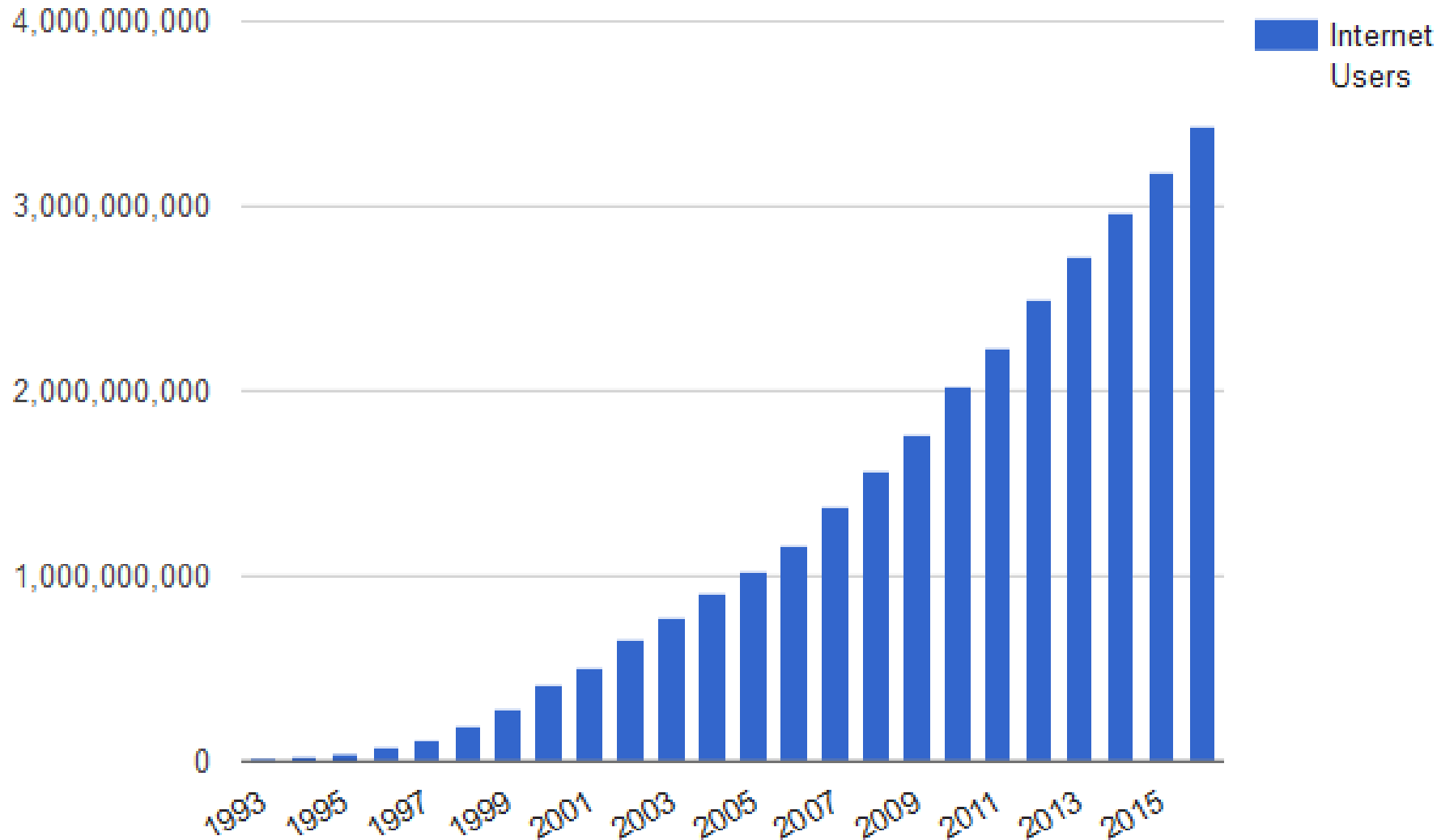
- Page 11 was unreadable. Can you please resend it?

Can we please keep our conversation secure?

- A massive can of worms - literally

# Internet growth - 1993 to 2016

(Worldwide Internet growth)



So much for the structure  
of the Internet

But Tim Berners-Lee made it useful  
for all in 1989

# The Worldwide Web

Conceived by Tim Berners-Lee at CERN in 1989

Free to all. Three key concepts or tools  
Made it all possible

# The three key tools of the WEB

1. **HTML: HyperText Markup Language.** The markup (formatting) language for the web.
2. **URI: Uniform Resource Identifier.** A kind of "address" that is unique and used to identify to each resource on the web. It is now commonly called a **URL or Uniform Resource Locator.**
3. **HTTP: Hypertext Transfer Protocol.** Allows for the retrieval of linked resources from across the web.

# What is a BROWSER?

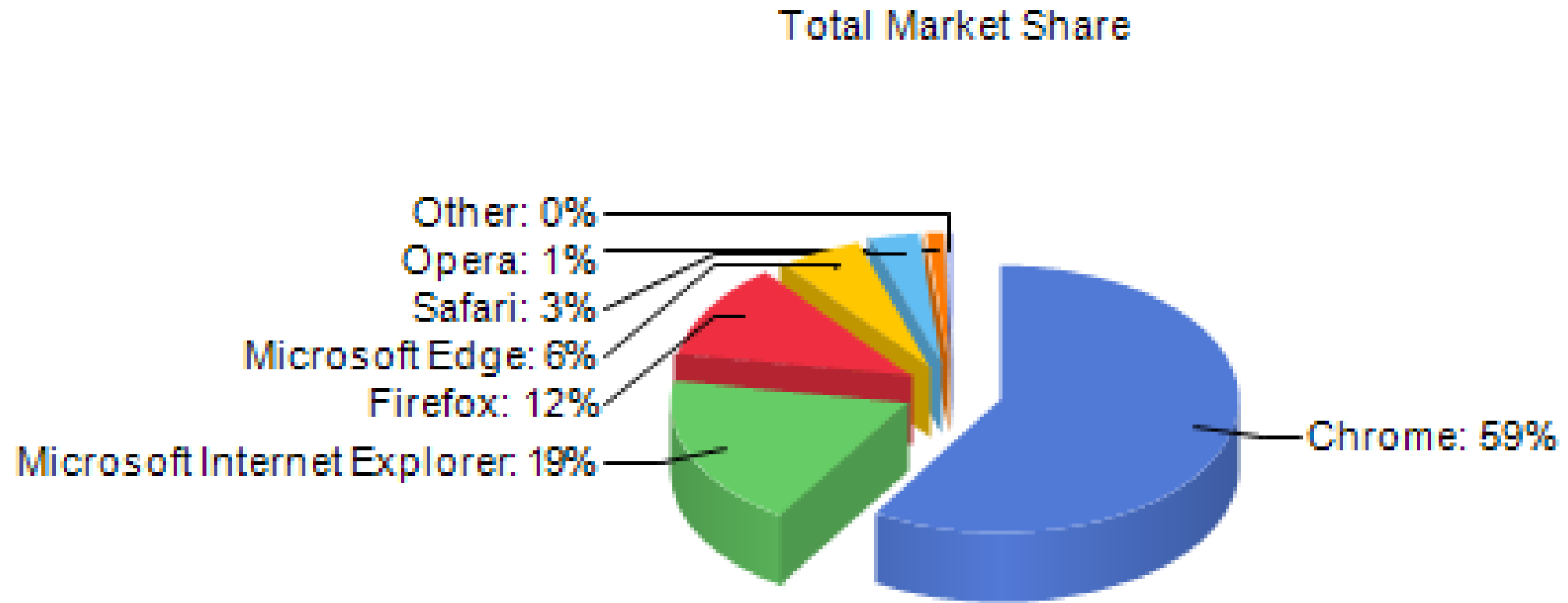
A BROWSER is a software program. It is the entity that connects you to the WEB. You may be familiar with Microsoft's Internet Explorer, but other names may be familiar, such as Chrome; Safari; Firefox; Opera, and Microsoft's Edge.

MS Windows PCs will default to **Edge** with effect from the introduction of Windows 10



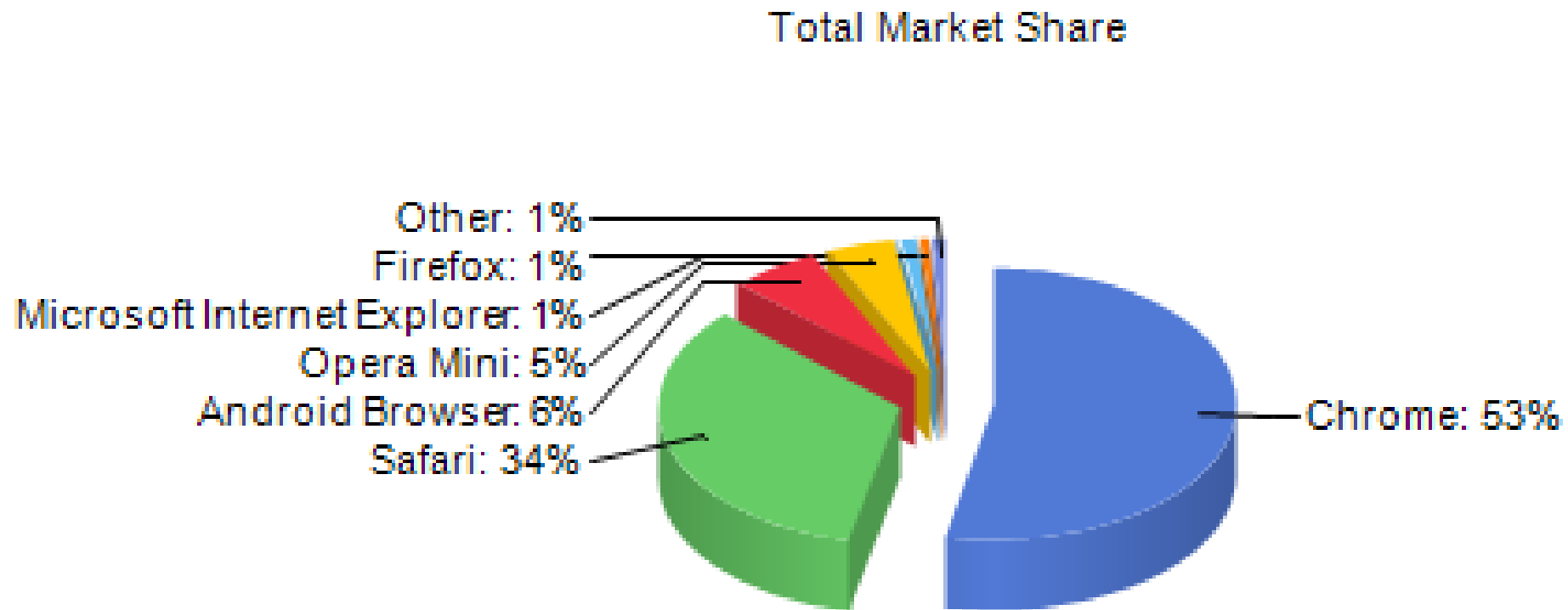
# Desktop Browser Market Share

March, 2017



# Mobile/Tablet Browser Market Share

March, 2017



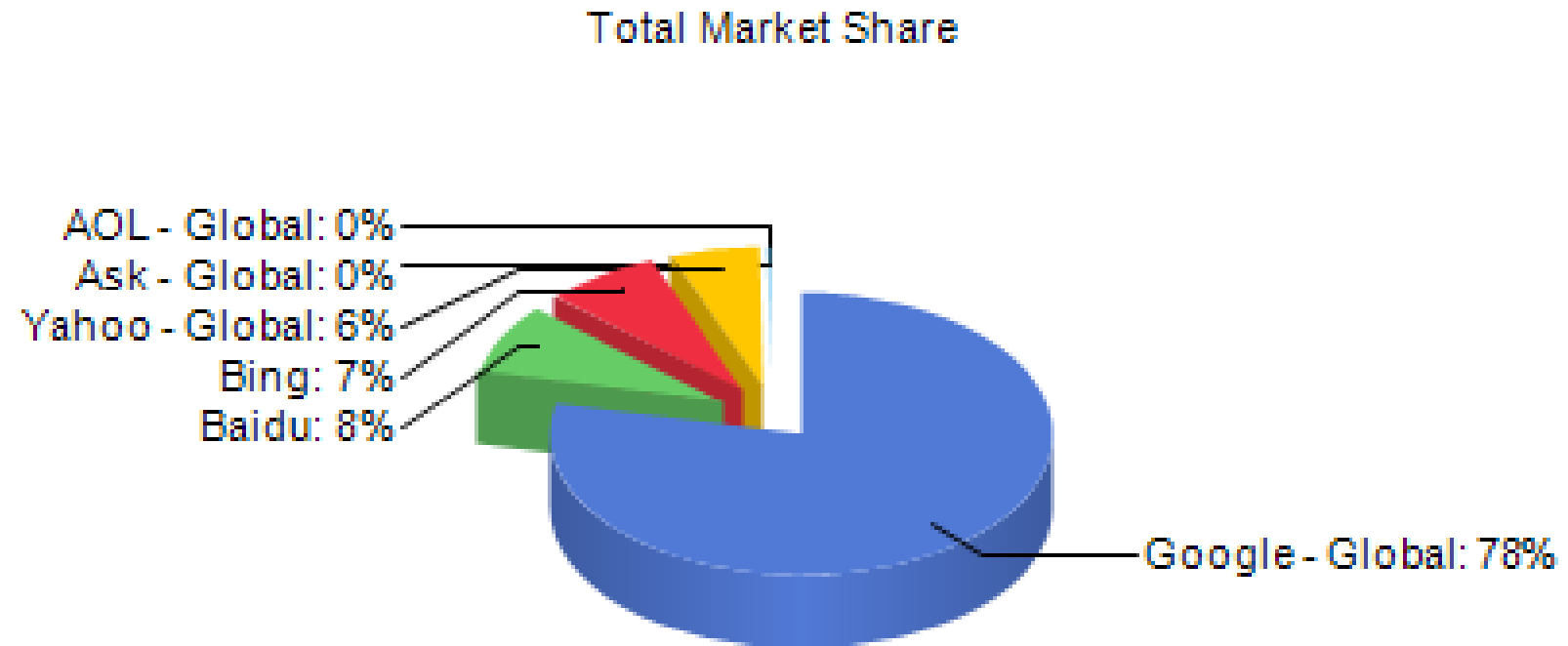
# The SEARCH ENGINE

The SEARCH ENGINE works in tandem with the BROWSER.

**Google** is by far and away the most popular search engine

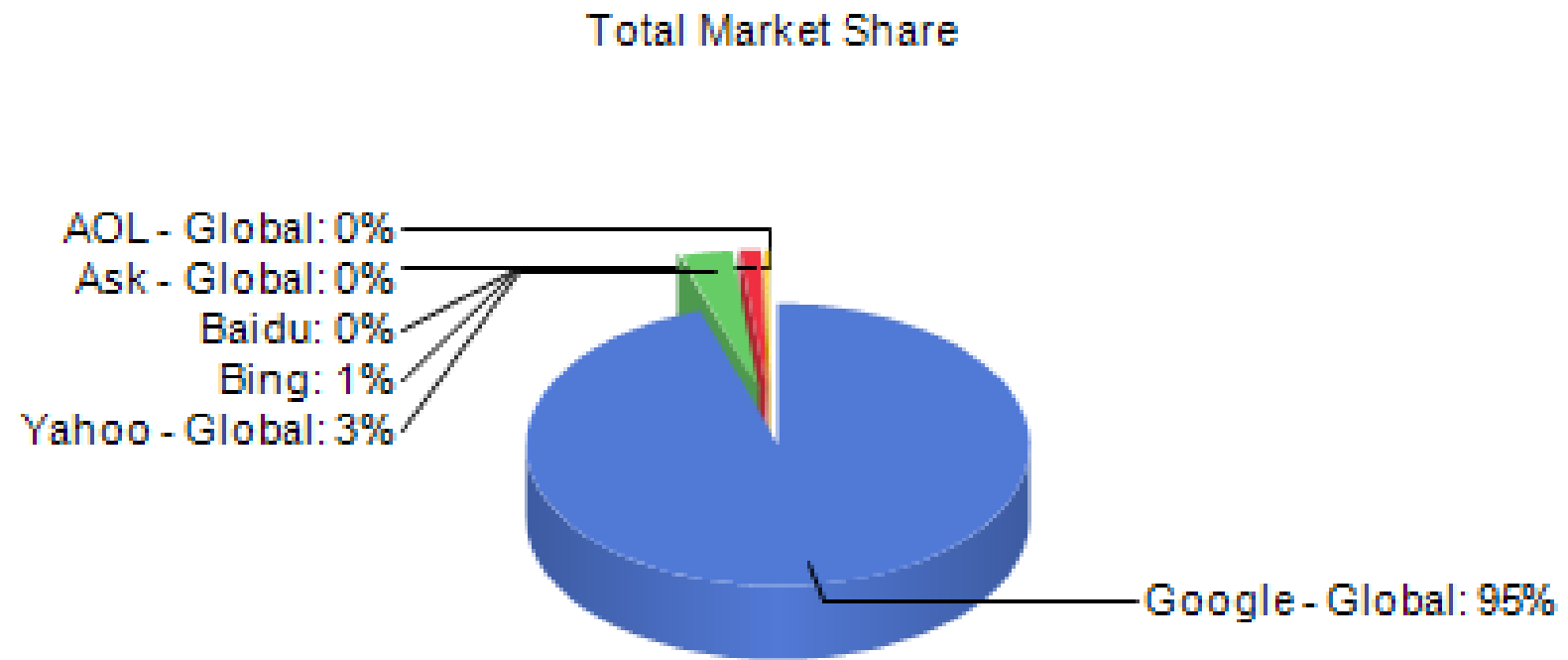
# Desktop Search Engine Market Share

March, 2017



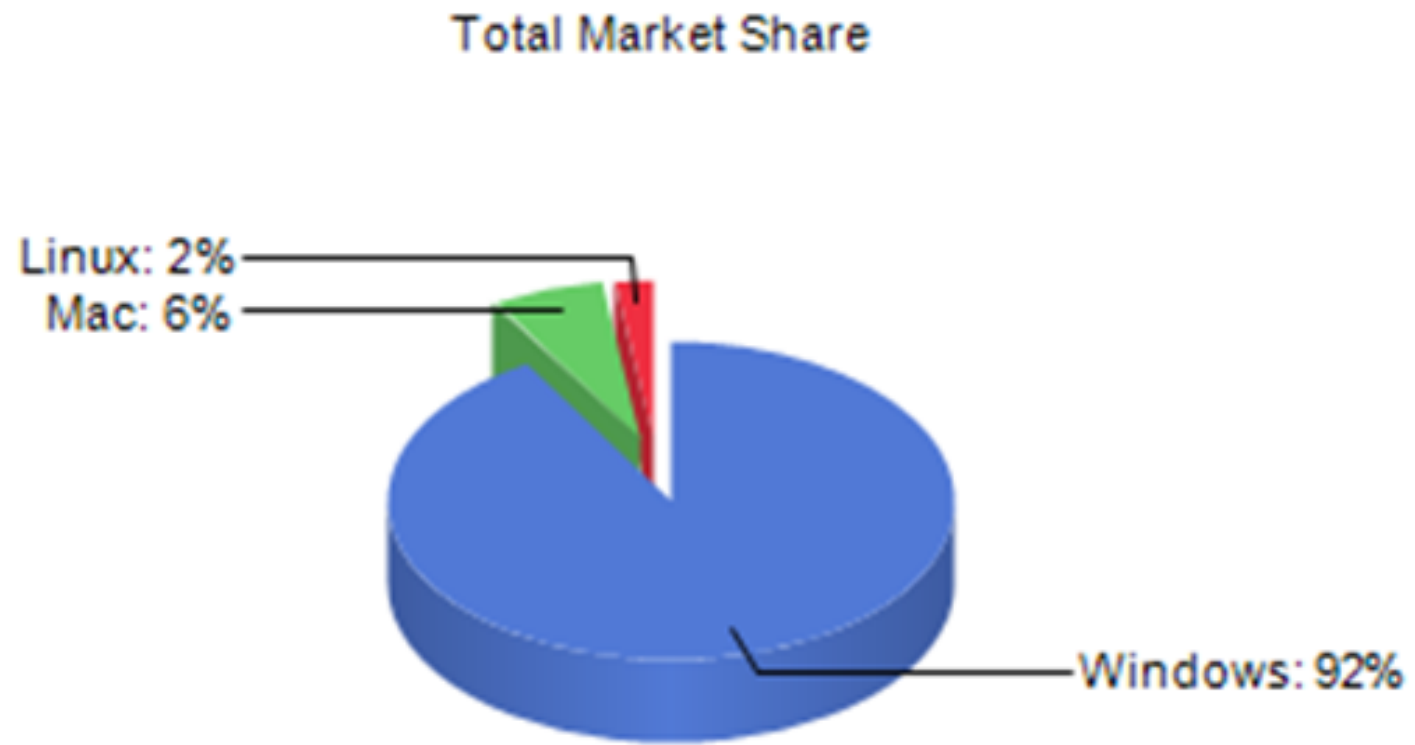
# Mobile/Tablet Search Engine Market Share

March, 2016



# Desktop Operating System Market Share

March, 2017



# Mobile/Tablet Operating System Market Share

March, 2017



# Where is the data stored?

Everything is stored in a DATA CENTRE.

These data centres are all over the planet

They will typically be in a highly secure building

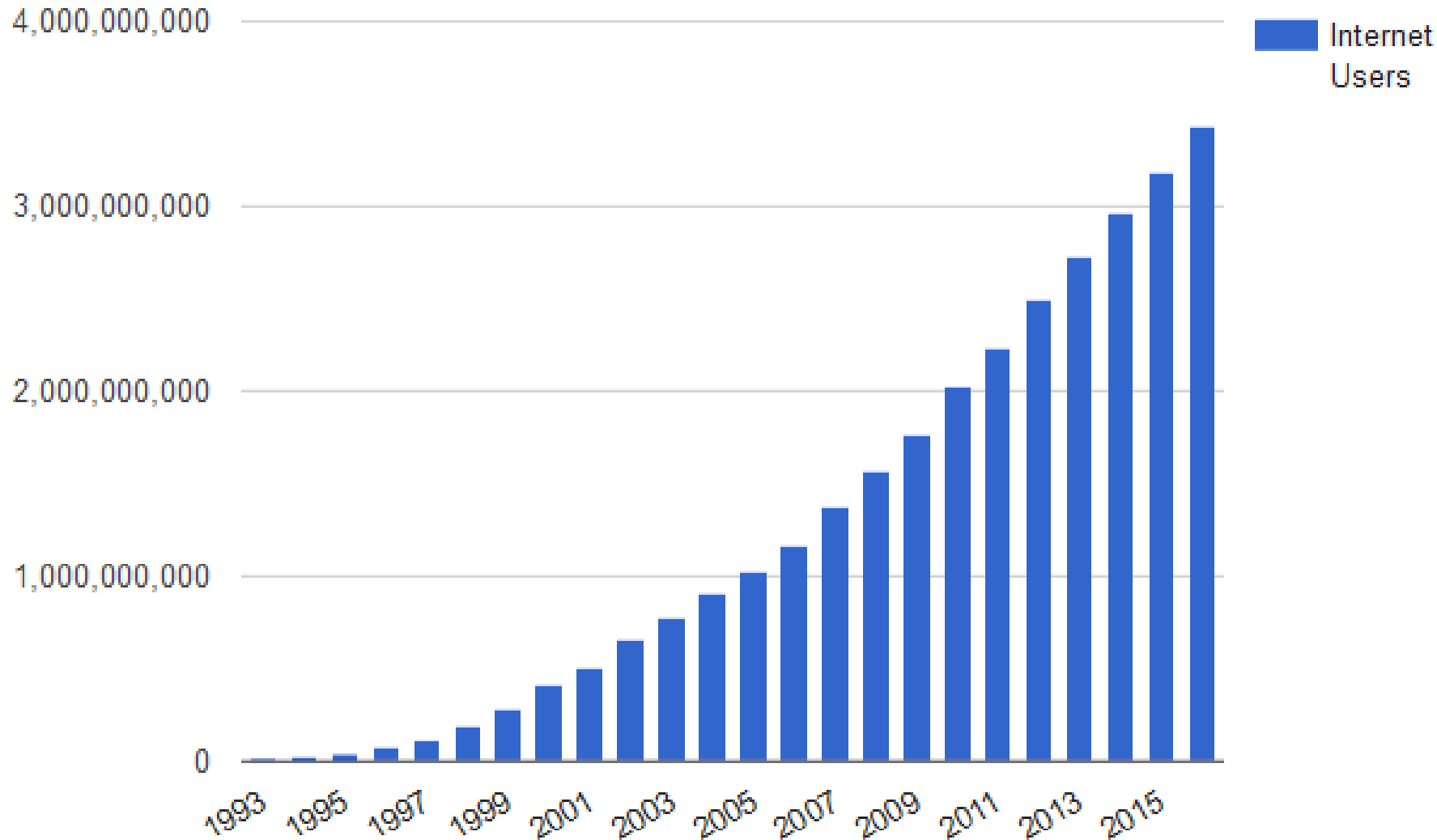
They consume an enormous amount of electricity

**Google** has by far and away the largest number of data centres. Then there's Facebook, Amazon, Apple etc



# Internet growth - 1993 to 2016

(Worldwide Internet growth)



**The Cloud aka many  
Data centres**



THUNDER AND LIGHTNING  
ISN'T GOD BEING ANGRY! IT'S  
MICROSOFT AND GOOGLE  
FIGHTING IN THE CLOUDS.



# Save it to the cloud



# But at a cost!


**No such thing as a free lunch!**



A photograph of a large elephant standing in a modern boardroom. Several people are seated around a large conference table, looking at the elephant. The room has large windows and a circular skylight on the ceiling. The elephant is positioned on the right side of the frame, facing the group of people.

The elephant in the room?

Data centres are consuming  
2% of **global electricity**

A photograph of a large elephant standing in a modern conference room. Several people are seated around a large wooden table, looking at the elephant. The room has large windows and a circular skylight on the ceiling. The elephant is positioned on the right side of the frame, facing towards the left. The text "The elephant in the room?" is overlaid in white at the top.

The elephant in the room?

Internet connectivity is now becoming a significant contributor to global climate change



Google being cool. . .

