



Future Optical Networks post 5G

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Investing in Research & Development

4th

Highest number of patents filed with the European Patent Office of UK-based companies

2nd

In the fixed line telecoms sector over past ten years

£2.5

billion

Spent on R&D over the last five years

30+

Direct university research relationships

1,027

Graduates and Apprentices recruited by BT in 2019

103

Number of inventions filed in 2019/20

5,000+

Patents in our portfolio

Fibre – a 21st century global mega project

19th / 20th Century saw massive world-wide infrastructure projects

Railways, electricity grids, water supplies, telephone networks based on copper

21st Century is also seeing massive world-wide build

High bandwidth wireless access
Optical Fibre to billions of homes and small cells

The fibre already installed is a small fraction of what is to come

World-wide project will take decades
Cost \$100s bns
Will have to endure for ~100 years or more

Optical technology underpins the future

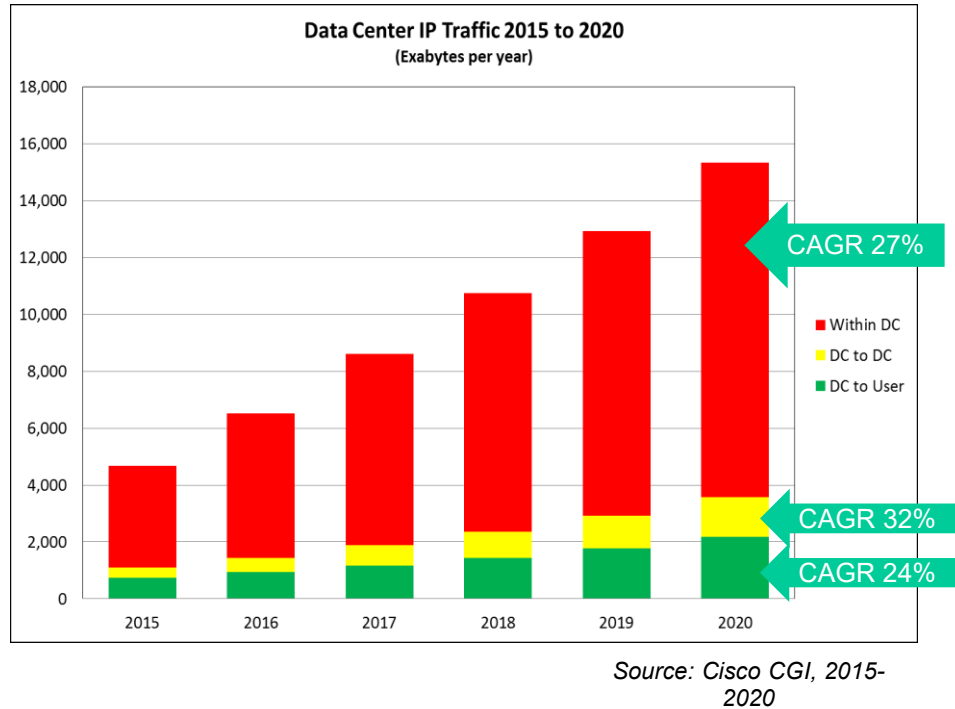
Essential for all future 5G++ networks
Essential for all consumer internet
Essential for all future smart cities, IoT
Essential to maintain EU leadership

Fibre to homes / 5G cells is a century-scale investment with century-scale impact

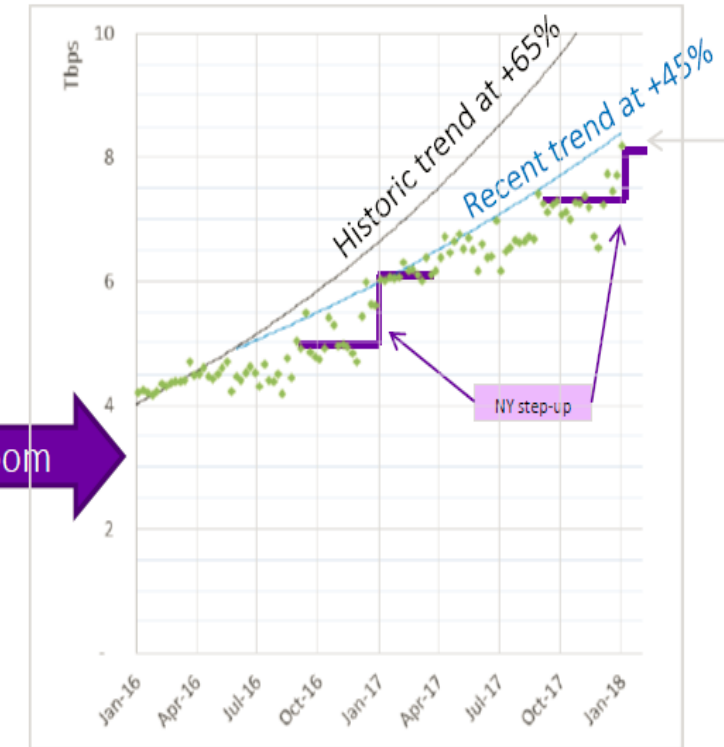
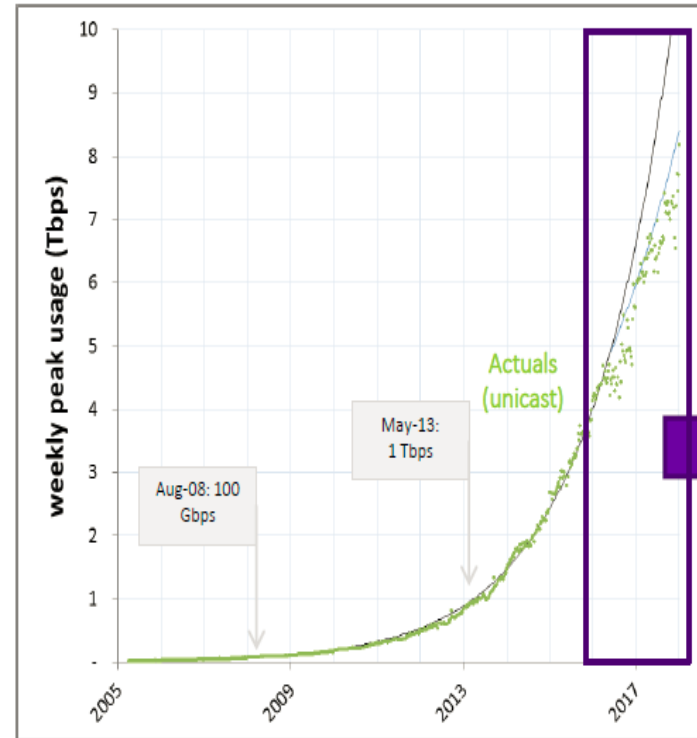


Network traffic growth

Global averages



A BT central core router



Strong, exponential traffic growth for many many years – continual requirement for new optical technology

Shannon and Moore – not long for this world....

- Shannon's law defines total capacity in a channel.
- Optical transmission is nearing this capacity limit
- Higher data rates = shorter distances
- We can no longer simply increase the data rate



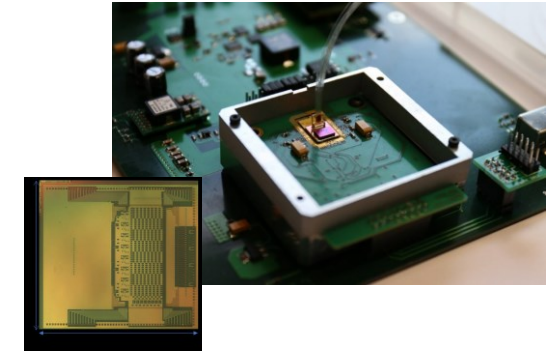
- Moore's law predicts silicon speed doubling every 2 years
- But this is slowing down
- And associated power dissipation has become a huge problem in Data Centres and networks

How do we continue to provide 30% annual traffic growth when both our fibre and electrical switching are hitting limits?

Key areas to focus on

Data centre technologies

Volume and scale = low cost
But reduced performance specs

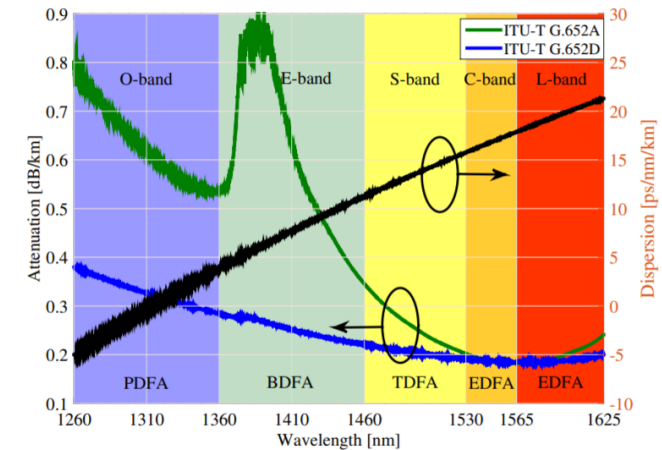


Photonic Integration

Will provide increased optical functionality at cost-effective price point

Overall fibre capacity

Shannon limit reached for C band optical transmission
Explore other bands?
Or new fibres types such as Hollow Core or Multicore



New architectures needed

Distributed data centre including local telecom exchanges – “EDGE”
Less optical network switching in the core

