Digital Revolution: ecosistema dell'ingegnere "globale" Testimonianza Alberto Gaibazzi

I- Testimonianza
II – Telecom ecosystem

February 15, 2023

Mi presento

- Laureato in Ingegneria Elettronica (indirizzo Informatica/TLC) a Parma, 1991

- MSc presso UCL (London) e Hirst Resarch Center (GEC-Marconi)

- Ho lavorato presso Italtel, Scientific Atlanta (Ora CISCO), Marconi, Ericsson, NeoPhotonics, E-optolink, ricoprendo diversi incarichi, compreso Direttore R&D, Responsabile Sourcing, Product Application Engineer, Account Manager, Project manager e altri

- Sono autore di pubblicazioni per Riviste internazionali tecniche conferenze del settore

- Ho un brevetto US Patent nel settore CATV

Dopo la laurea – Esperienze all'estero

- 1992- Internship MSc presso UCL (London) e Hirst Resarch Center (GEC-Marconi)
  - Parma University Scholarship
  - Internship UCL
  - Attended MsC Telecom
  - GEC Marconi – Research on coherent systems
  - Published paper on ETT (1993)

Alberto Gaibazzi was born in Parma, Italy on July 5, 1966. He was awarded the «Laurea in Ingegneria Elettronica» by the University of Parma, in 1991. After a short period spent at Parma University, he was seconded to GEC-Marconi Hirst Research Centre in Wembley, UK, where he took part to a joint University of Parma - Hirst Research Centre project on a multichannel FSK coherent system. He also worked on the performance evaluation of Erbium-doped pre-amplifiers in single- and multi-channel IM-DD systems. During the same period he was a «Visiting Fellow» in University College of London (UCL), London, UK. In 1993 he joined the «New Technology» research group of Italtel SIT S.p.A., and he's currently working within the RACE 2028 «Multi-Wavelength Transport Network» project, developing in particular optical Receivers and Transmitters @ 2.5 Gb/s.

- 1997-99 Ho lavorato per Scientific Atlanta (Ora CISCO), ad Atlanta, con contratto americano
  - H1B visa (temporarily employ foreign workers in specialty occupations) 3+3 years
  - Optical systems
  - US Patent on CATV Digital reverse path

Esperienze di lavoro

From	To	City / Country	Employer	Job title	Job description
1991	1993	Parma, London (UK)	University College London (MsC)	Optical/ HW researcher	Photonic system designer
1993	1997	Milano (Italy)	Italtel (IT)	System & Design Engineer	Hardware designer and project manager
1997	1999	Atlanta (USA)	Scientific Atlanta (USA-CISCO group)	Senior Engineer	Design engineer team leader
1999	2007	Genova (Italy)	Marconi (IT/UK)	R&D Director Component Technology manager	HW & optical R&D Labs manager (team of 40+ people over 2 sites), Photonics product Director
2007	2017	Genova (Italy)	Ericsson (SWE)	Sourcing Project Manager (PSM), Component Technology manager, Sourcing Italy Director	Project manager MHL3000, Optics qualification manager globally for Ericsson
2017	2022	Parma	NeoPhotonics (USA)	PAE/ Account Mng. EUR	Sales/ Application Engineer
2022	-	Parma	Eoptolink (CHN)	OEM Sales	Sales/ Customer support

Come negli annunci di ricerca del personale: "seasoned professional"

NeoPhotonics & Eoptolink Case – Remote/Smart-working

- No office in Europe, no Legal Entity
- Contratto italiano mediante Studio partner/intermediario (Employer of Record = International Outsourced Employment Services) oppure rappresentanza italiana
- 4 people in Europe! (remote working)
- Essential "Home Lab" delivered
    - Evaluation kit for customer support
    - Minimal lab kit
- Spend 1-2 weeks in HQ once-twice/year
- Some travelling to meet/support customers (~ 1 week every quarter)
- Everyday job via video/audio call & email

E-optolink

Leading manufacturer of high-speed optical transceivers for:
Datacenter • Telecom • Mobile Networks – Vertical integration

Headquarters in Chengdu, China

Employees:	1000+
Engineers:	300+
Founded:	2008
Stock listed:	2016 300502.SZ
Revenue:	350+ million USD

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TLC ecosystem

Component Manufacturers

NEMs

Operators

Components
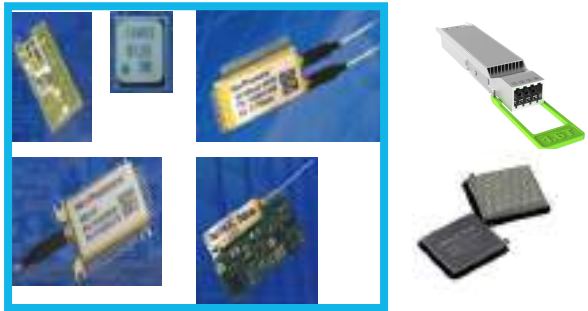
System design

TLC network operators

Opportunita' per L'ingegnere

- L'ingegnere elettronico di oggi si muove all'interno della RIVOLUZIONE DIGITALE, che ha cambiato e cambiera' la vita di tutti e il modo di lavorare

Le sfide del presente e futuro

- ioT
- 5G/6G
- Automotive
- VR (virtual reality)
- Big Data
- AI (artificial intelligence)/ML
- Internet security
- FinTech/Blockchain
- Sustainability (social and environmental): Green economy/EEE, standards

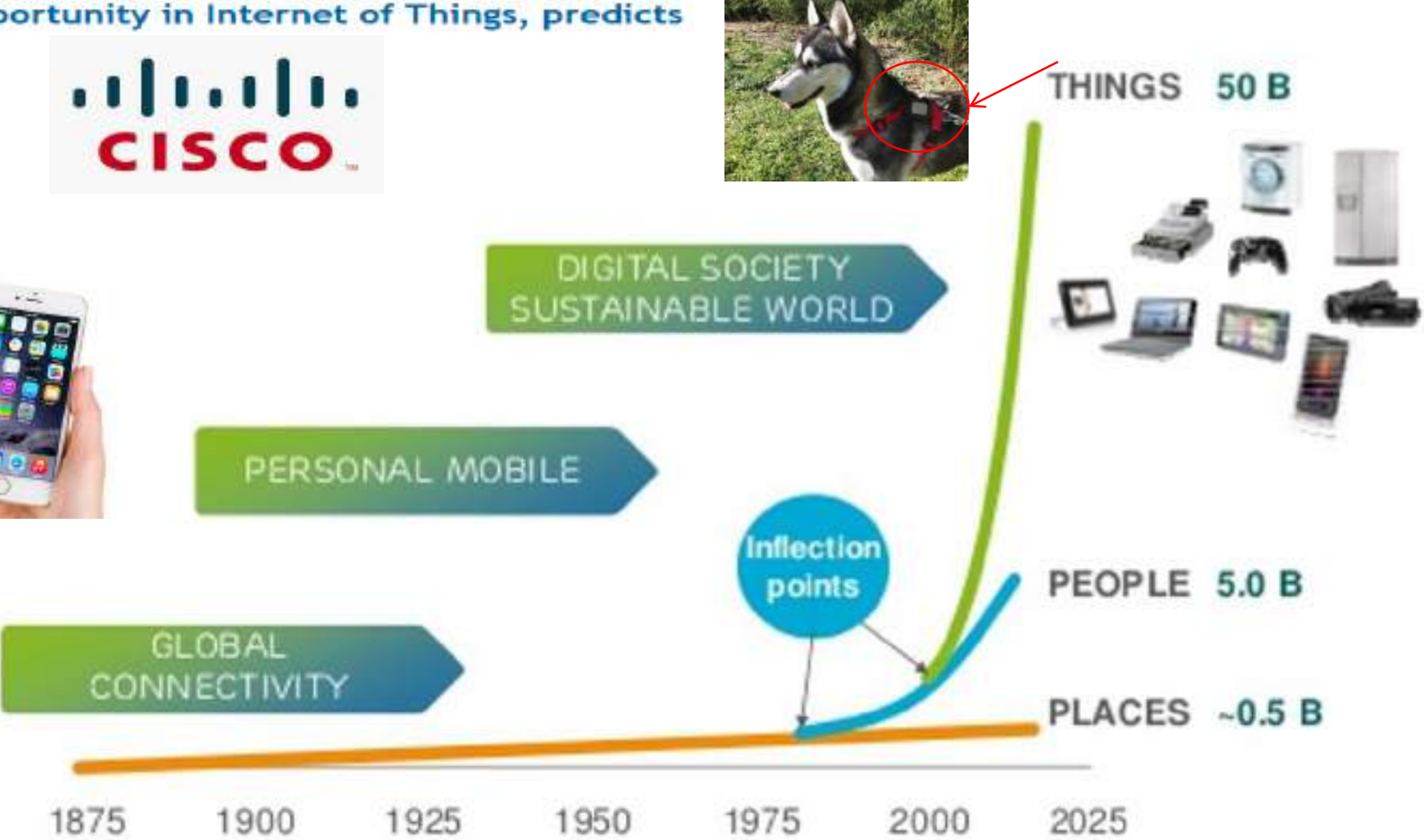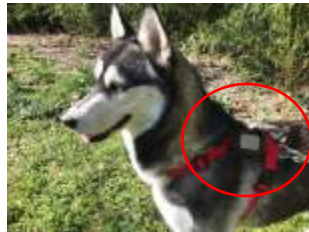# Connections, internet traffic and IoT

$14 trillion opportunity in Internet of Things, predicts Cisco

03/15/2013
By Shannon Davis, Web Editor

CISCO

THINGS 50 B

DIGITAL SOCIETY SUSTAINABLE WORLD

PERSONAL MOBILE

Inflection points

PEOPLE 5.0 B

GLOBAL CONNECTIVITY

PLACES ~0.5 B

1875   1900   1925   1950   1975   2000   2025

Big Data/ Analytics (example **ERICSSON** module Network Analyzer)

- Very powerful Tool, gathers data from Millions installed pluggable optics

- Real-time
- Fault prediction
- Shorten Installation time
- Analytics! Lot of room for developing intelligent data correlation engines

TOPOLOGY DISCOVERY

INCLUDING WAVELENGTH MULTIPLEXED LINKS

ANALYZE AND LOCALIZE

Nation-wide in cluster

Regional

Aerial – individual sites

Street view

RX POWER, TX POWER, TEMPERATURE,...

SFP vs. unit temperature (° C)

TIME AND STATISTICAL TRENDS

Cognifiber – Photonics computing at the speed of light (1000x)
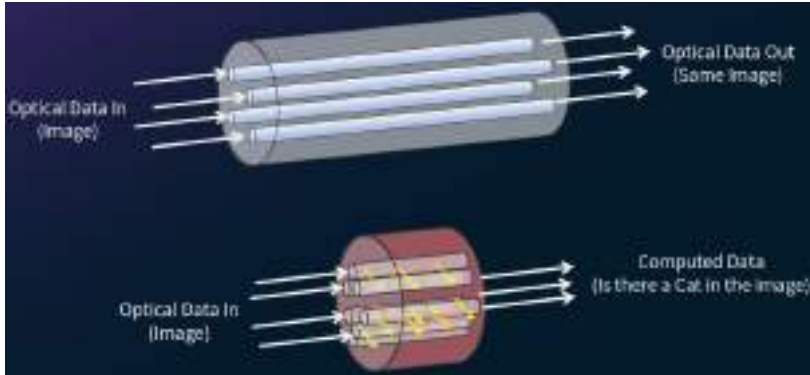
Israel Startup founded: 2016

Deepfiber Aurora system, the first world-wide pure-photonic system demonstrator.
Aurora reaches 100 million machine learning inferences each second, while consuming 270 Watt only, less than a single silicon chip.
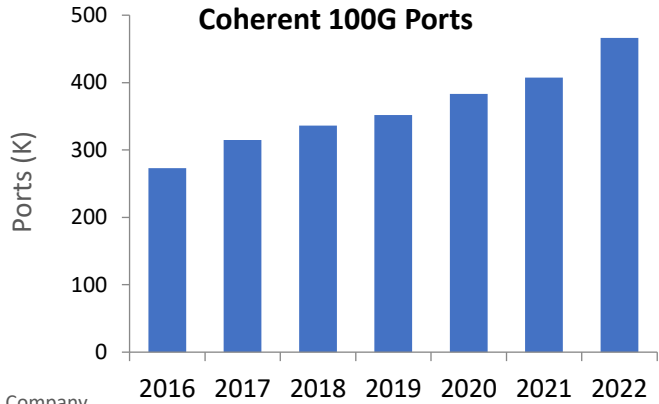
Fiber Multi-cores are pumped with weights to create a Reconfigurable Neural network (written into the fiber itself). The result of this in-fiber processing is to deliver a 100-fold boost in computational capabilities while consuming a fraction of the power of a traditional semiconductor-based solution

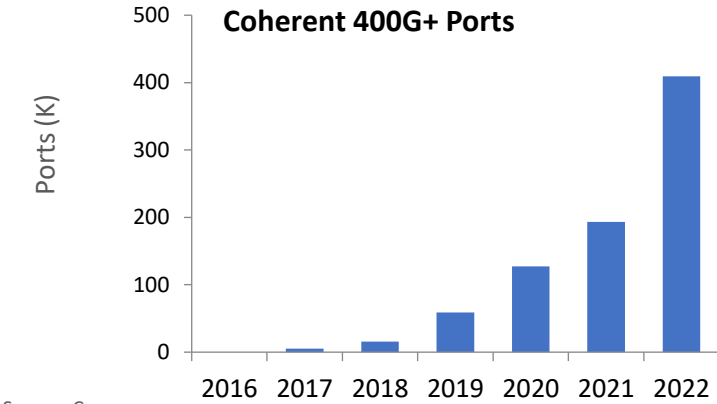Applications:
- AI/ML
- Secure Photon encryption/decryption

Data Rates Trending – Both Short Reach and Long Haul

Coherent 100G Ports

Ports (K): 0, 100, 200, 300, 400, 500
Years: 2016, 2017, 2018, 2019, 2020, 2021, 2022

Source: Company

Coherent 400G+ Ports

Ports (K): 0, 100, 200, 300, 400, 500
Years: 2016, 2017, 2018, 2019, 2020, 2021, 2022

Source: Company

Coherent 400G+ Revenue

Revenue ($M): 0, 500, 1000, 1500, 2000, 2500
Years: 2016, 2017, 2018, 2019, 2020, 2021, 2022

Source: Company

100G Remains A Substantial Market As Edge 10G→100G

400G+ Port Growth Takes Off As DCI 100G→400G+
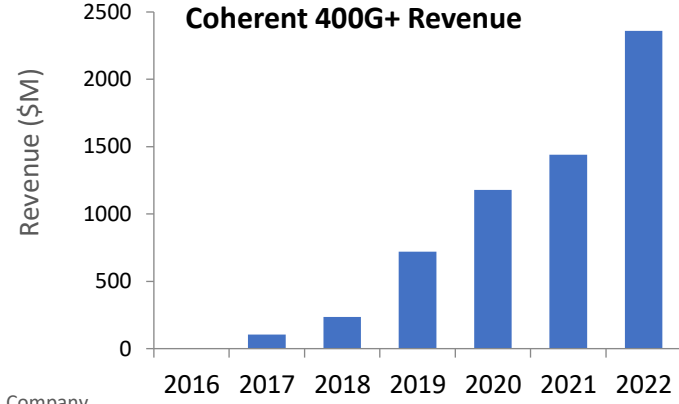
400G+ Transceiver Revenue Grows Rapidly With DCI
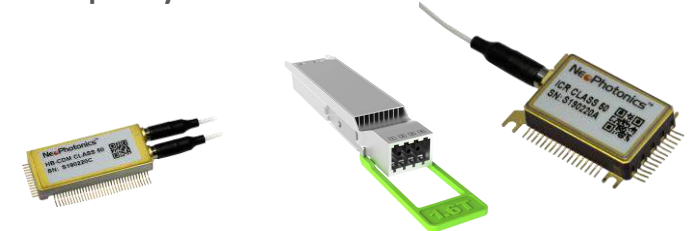
10G ⇨ 100G	100G ⇨ 400G	400G ⇨ 600G ⇨ 800G ⇨ 1.6T

Data Center Interconnection (DCI) - FACEBOOK

"Keep in simple", it's a DC environment:

– shorter reach (500m) ,

– case temperature range,

– lifetime requirements: Don't care about (Telcordia) Reliability...oldest DC rack is 2 years old!

› Showing that >90% of DC traffic is within DC! (<2km)

› Started deploy QSFP28 (100G) SMF (duplex) in 2016

GROWING LARGER

6,400 kilometers of fiber in one building

Facebook Prineville, Oregon, USA Data Center

Figure 3   Topology of Cisco MSDC Design Evolution—Phase 3

SuperSpine

POD B

Spine

POD A

Border Leaf

Leaf

2 X 10 GE

4 X 10 GE

Ixia Servers

Ref Arch Phase 1
Option 3
N7K/N3064
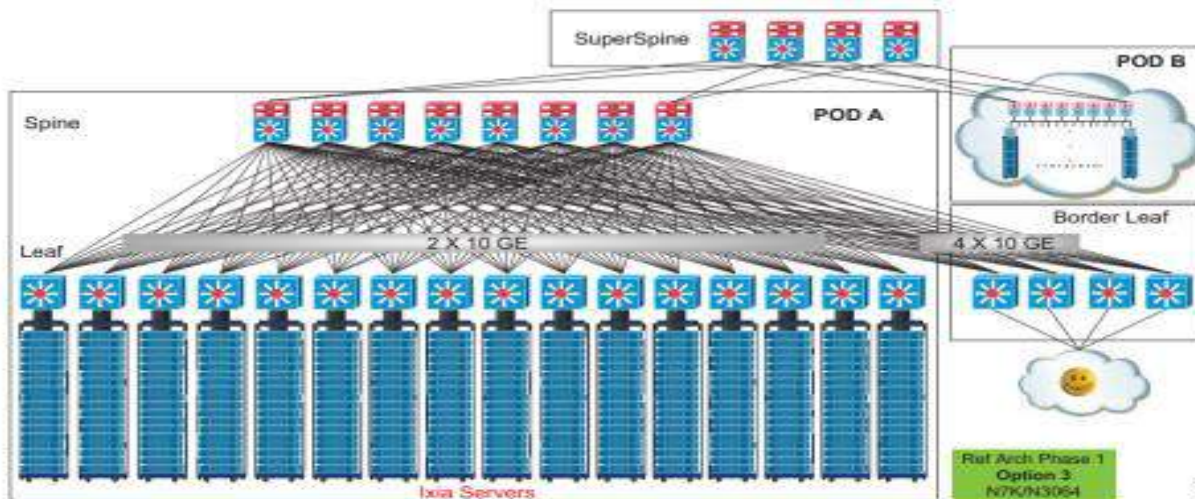
Figure 4   Topology of Cisco MSDC Design Evolution—Phase 4
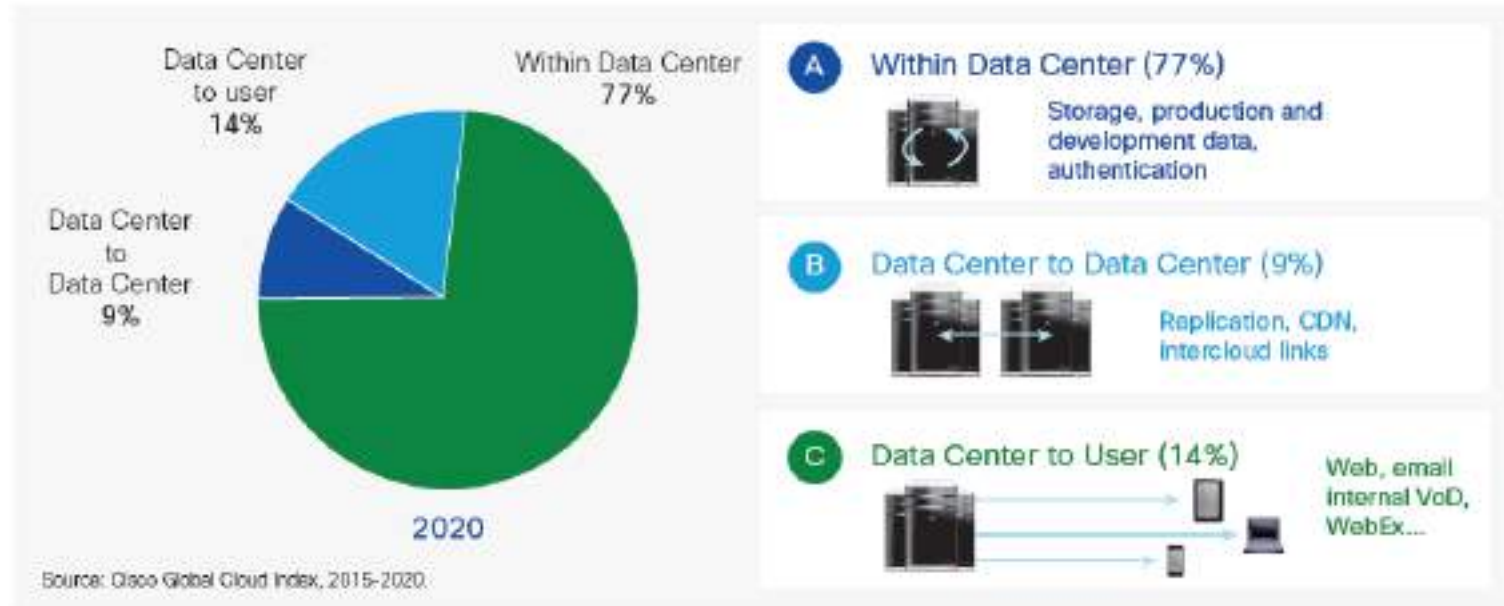
Traffic drives DCI (Data Center Interconnect) demand

Facebook says a 1 Kbyte HTTP request from a user can generate 930 Kbytes of internal data center traffic. Microsoft says data is replicated many times. A Google search may hit 5,000 servers. Cisco reported that East-West traffic made up 76% of all data traffic in 2014. **This has forced a major increase in the number of interconnections in the switching fabric.**

Global DC traffic growth
Source: Cisco Global Cloud Index, 2013-2018
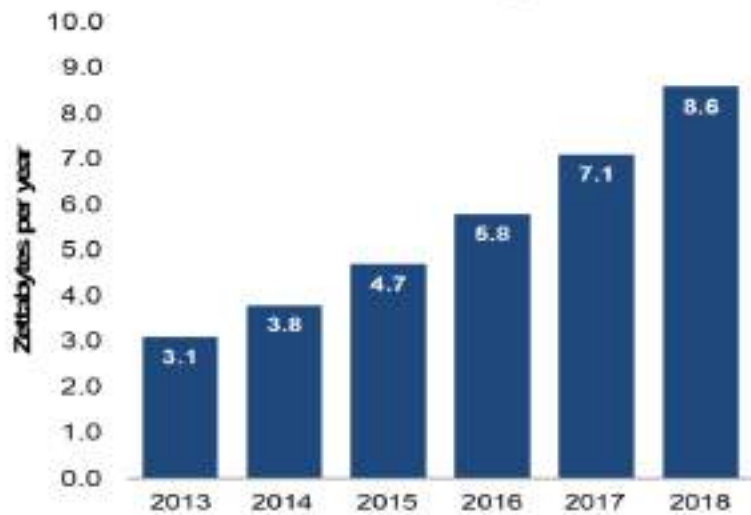
Data Center to user 14%
Data Center to Data Center 9%
Within Data Center 77%
2020
Source: Cisco Global Cloud Index, 2015-2020.

A — Within Data Center (77%) — Storage, production and development data, authentication

B — Data Center to Data Center (9%) — Replication, CDN, intercloud links

C — Data Center to User (14%) — Web, email internal VoD, WebEx...

Market focus - INTEL

Significant data center interconnect demand coming

Webscale	City	2014	2015	2016
Amazon	Dublin, Ohio			500,000
Apple	Maiden #2	500,000		
Apple	Prineville		676,000	
Apple	Mesa			1,300,000
Apple	Athenry			1,800,000
Apple	Viborg			1,800,000
Facebook	Altoona #2			465,000
Facebook	Forest City #2	370,000		
Facebook	Lulea #2			300,000
Facebook	Prineville #2	350,000		
Google	Eemshaven			500000
Google	Lenoir #2		500000	
Google	Council Bluffs #3		500000	
Microsoft	Boydton #1		316300	
Microsoft	Boydton #2			316300
Microsoft	Dublin #2		169000	
Microsoft	Quincy #2		300000	
Microsoft	San Antonio #1	470000		
Microsoft	San Antonio #2			256000
Square footage published and estimates.				
Source: Ovum Global Data Center Analyzer, web scale and 3rd party press releases				

Over $4.5 billion in planned & current data center projects in the US (2022)

Google DC case – Medium reach

SanFrancisco area:

› 8 interconnected DC via 10Tb/s connections (day1!), 100Km

› Need 100 λ WDM @100Gb each: SiPho only way to provide integration for 100+ chan.

Hundreds of thousands of optical ports to bring a web scale DC online

ovum

Ovum's model results assuming:

- 500,000 square foot data center

- Leaf and spine architecture

- 10G servers and 40G switches

- Fully loaded DC **results** in:
  - 800,000 servers
  - 50,000 Top of Rack switches
  - 4,167 fabric and spine switches
  - **>200,000 connections to 2,000 meters**
  - **One fully loaded 100G WDM system (i.e. 96 wavelengths or 9.6 Tbps) for every data center connection**

The data center is the ICP's "revenue factory". They want to deliver the most competitive and cost effective offering.
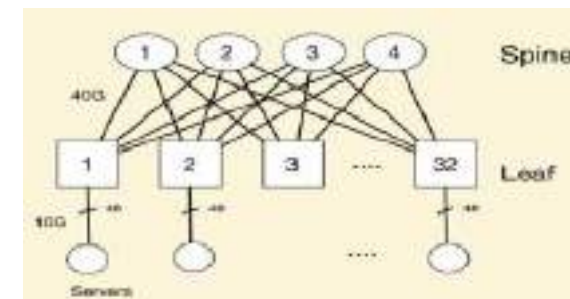
Source: Gazettabyte

Terabits being demanded for Metro DCI

Purported Google bay area mesh demand

- Fully-meshed network

- Virtualizing servers across the WAN

- All 8 data centers behave as one

- 100 x 100G wavelength cross sections on each link

- 10Tbps per link

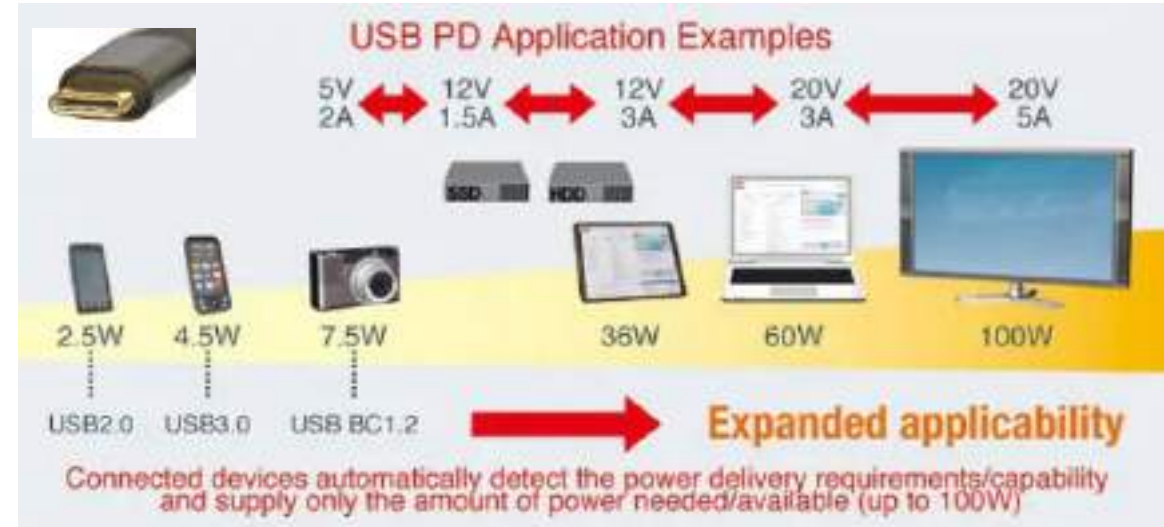- Full 96 wavelength equipped Day 1

- 250Tbps metro network

Standards' Engineer – USB-C PD (Power Delivery)

International Telecommunication Union

Optical Internetworking Forum

USB PD Application Examples

Connected devices automatically detect the power delivery requirements/capability and supply only the amount of power needed/available (up to 100W)

Si afferma sempre piu' la figura dello "Standard Engineer" in grado di partecipare ai lavori di standardizzazione globale – per conto delle Compagnie medie/grandi.
Contribuisce alla "Sustainability"

The EU has published its new 'Common Charger' directive in its Official Journal:Starting on December 28, 2024, every phone, tablet, camera, device sold in the EU will have to have a USB Type-C port. Good for the environment: Disposed of and unused chargers account for about 11 000 tonnes of e-waste annually in the EU.

Energy-Aware IP NETWORKS - MOTIVATION

Sustainability Targets

The massive increase in usage of telecommunication services, impose to the industry CO2 emissions reduction
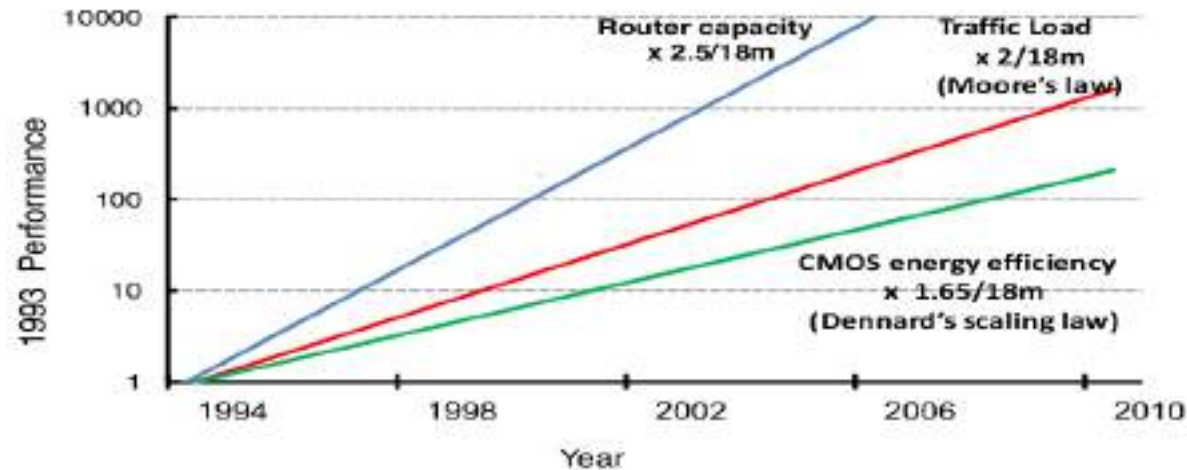
Evolution from 1993-2010 of Routers capacity vs. Traffic volume and Energy efficiency in Silicon technology. Source: CISCO systems 2006

Higher capacity always comes with higher power requirements, irrespective of whether the devices are used to their full capacity or not.

Static Energy efficiency enhancement is not sufficient

Dynamic power management is required

EEE IEEE 802.3 AZ

**[Q] What is IEEE 802.3az/ Energy Efficient Ethernet?**

- It is an international standard (since September 2010)

- Originally proposed by INTEL (then supported by Cisco)

- IEEE 802.3az/ Energy Efficient Ethernet is a symmetric protocol that enables network ports to switch between higher power state (data mode) / lower power state (LPI mode) in response to whether data is flowing through them (Active state) / Not (Idle state).

DYNAMIC ADAPTATION - motivation

Traffic level hugely varies over time (working days/week-ends, day/night)

- During harsh hours may run at full performance
- Interesting dynamic Power Management Modes can be applied by means of actual traffic load measurement and prediction, slowing-down resources or shutting-down unnecessary resources without affecting QoS at slack hours
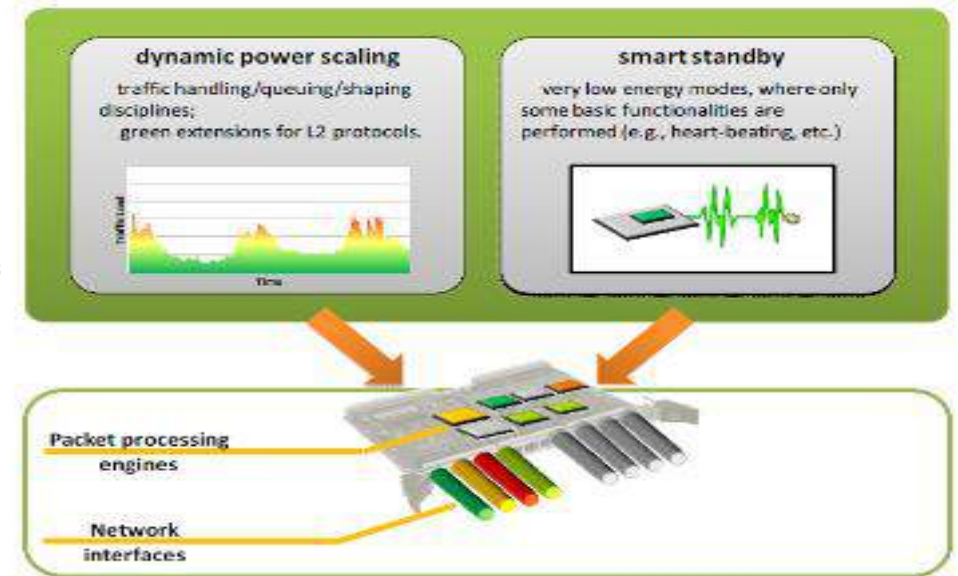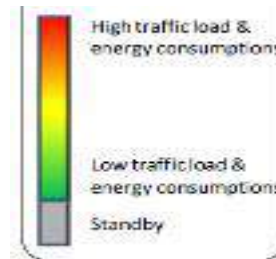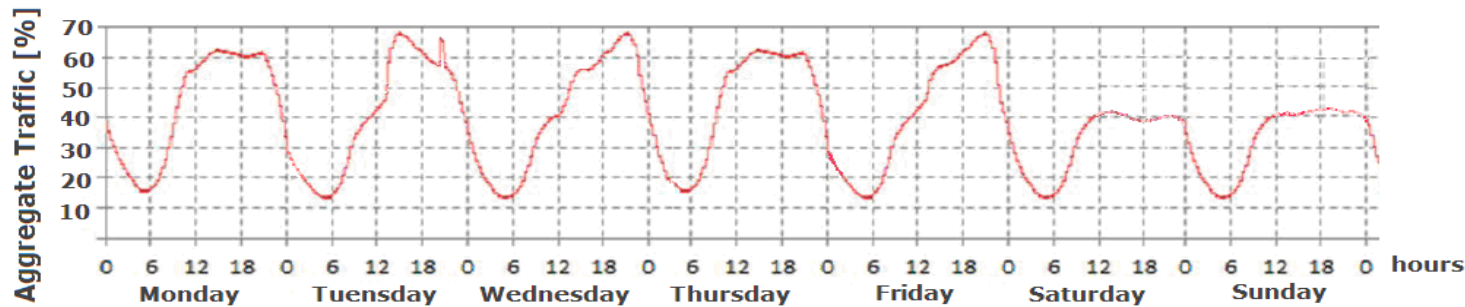
Takeaways

- ! Esperienze all'estero importanti per l'ingegnere "globale": Fluent in English!

- Remote Working: opportunita' anche se employer non ha Legal Entity e Non solo per sviluppatori Software

- Digital revolution: ecosistema dell'Ingegnere e opportunita'
  - Esplosione Traffico internet (ioT, AI/ML…)
  - Data Centers & interconnections, power management
  - Sustainability (Energy-aware IP networks + Standards' Engineer)

Libri che consiglio sulla Digital revolution

Steve Jobs
by Walter Isaacson

ALESSANDRO BARICCO
THE GAME