IEEE BITS Goa, Lumini '21

Green Compute & Storage: Why Does It Matter & What is In Scope?

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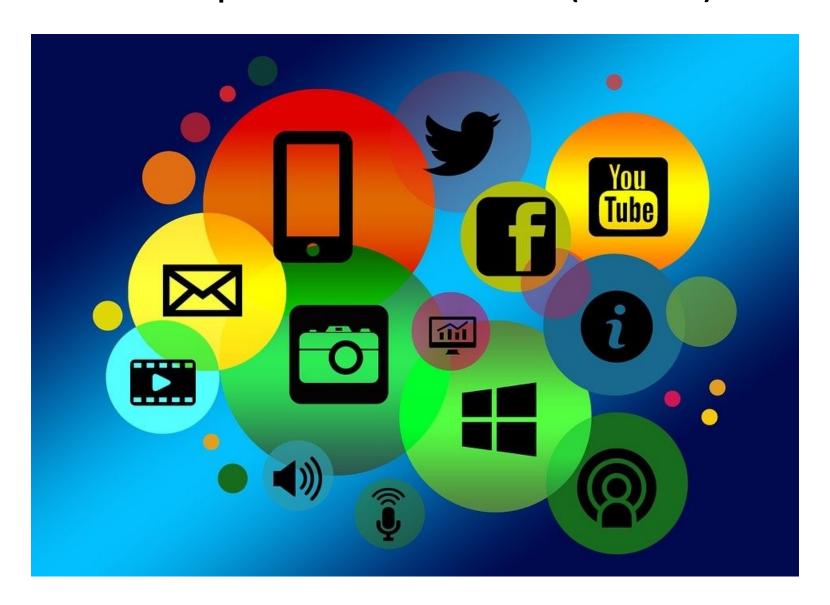
WebSite: http://www.Climate350.com



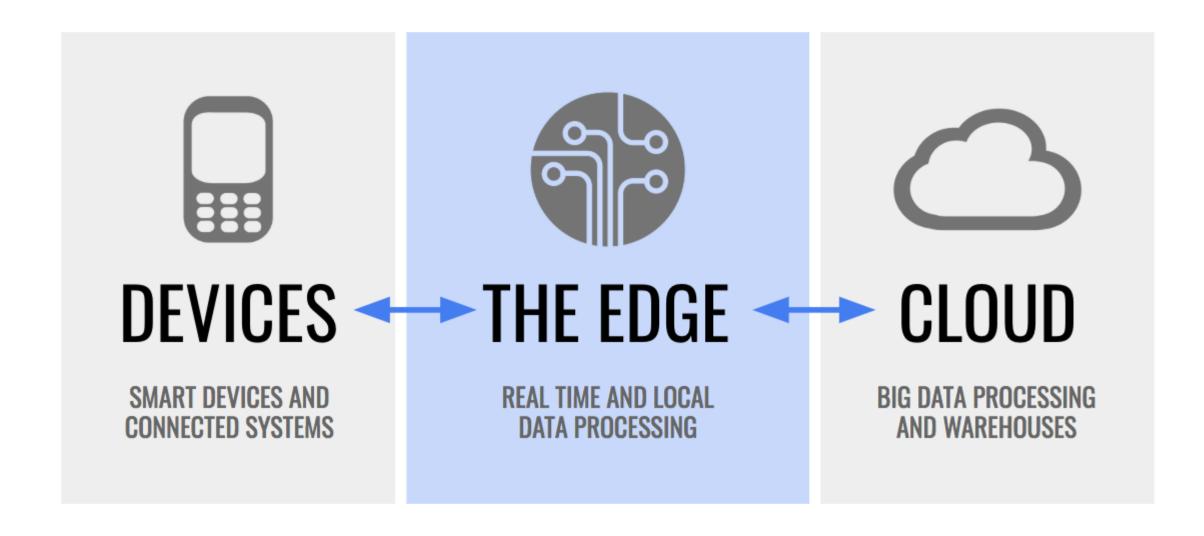
The Internet Data Explosion - Sources



The Internet Data Explosion – Sources (cont'd)



The Internet Data Explosion - Key Participants



Internet Compute & Data – Key Design Considerations



Near Real
Time
Processing,
Autonomous
Operations

Cost of Computing, Storage & Connectivity To the Cloud

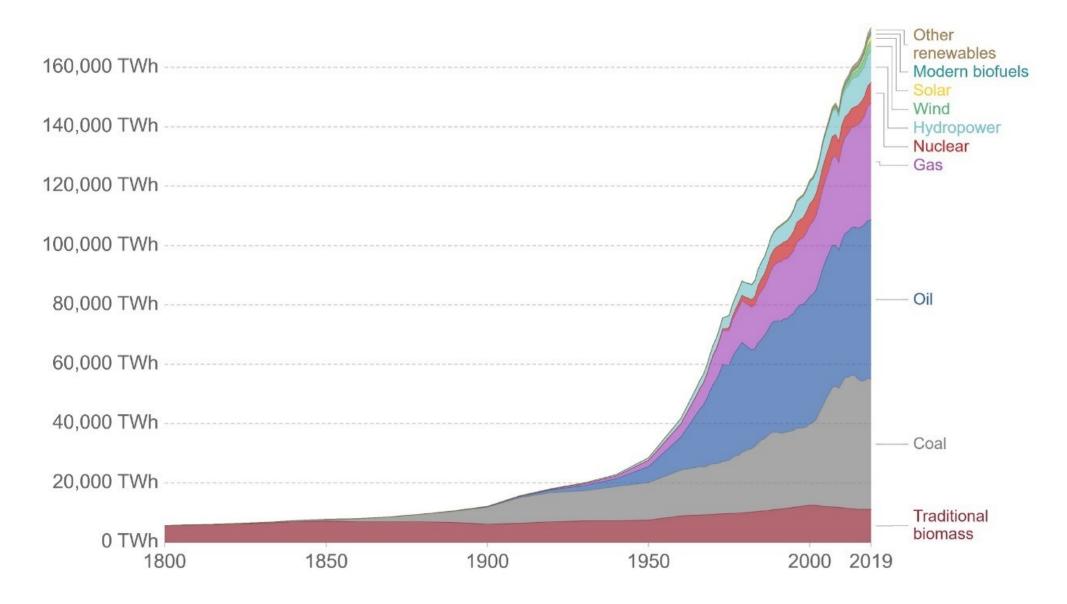


Personal Data

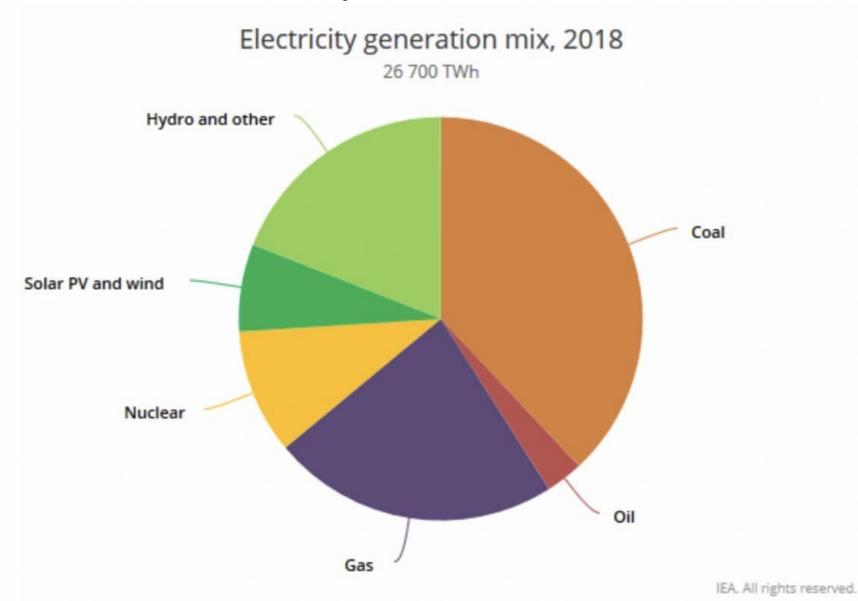
Confidential Data

Data Privacy, Data Retention

Energy Sources to Meet Exponential Human Demands



Energy Sources for Electricity Generation

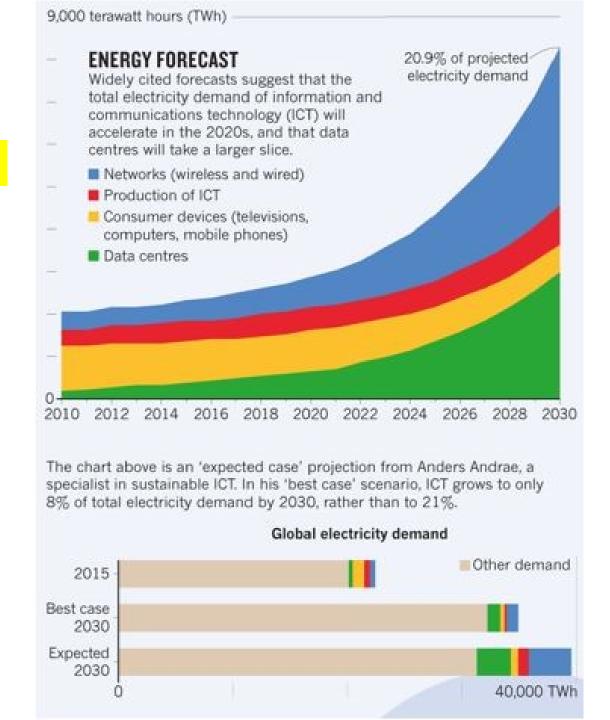


Internet Energy (Imbalance) Forecast

Unsustainable Appetite for Video, Voice,
Images had led to an Explosive (&
Wasteful) Amount of Data being
transmitted, stored and processed
increasingly by energy hungry AI/ML
algorithms

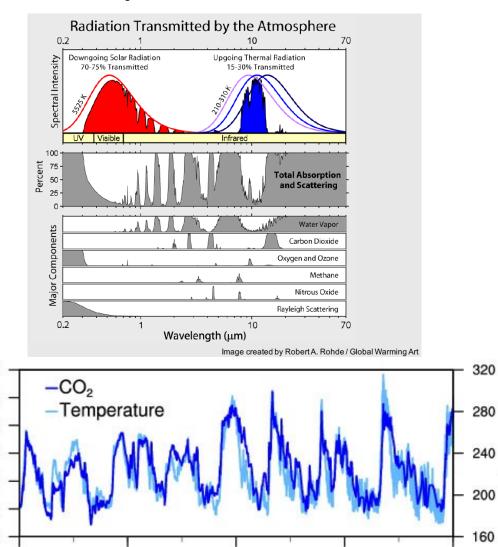
Imagine the future with 5G, IoT, Always
Connected Devices Everywhere

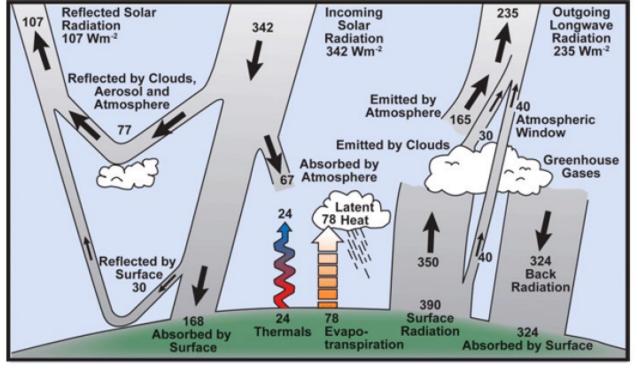
WE NEED TO ADDRESS THIS GROWING ENERGY IMBALANCE IN THE INTERNET



The Disruption: Earth's Overall Energy Balance

CO₂ (ppm)





GHG	GWP for 100 years
CO ₂	1
CH_4	23
N_2O	296
HFC - 23	12 000
HFC – 134a	1 300
SF_6	22 200

GWP == Global Warming Potential

Source: IPCC Third Assessment Report (2001).

600000

400000

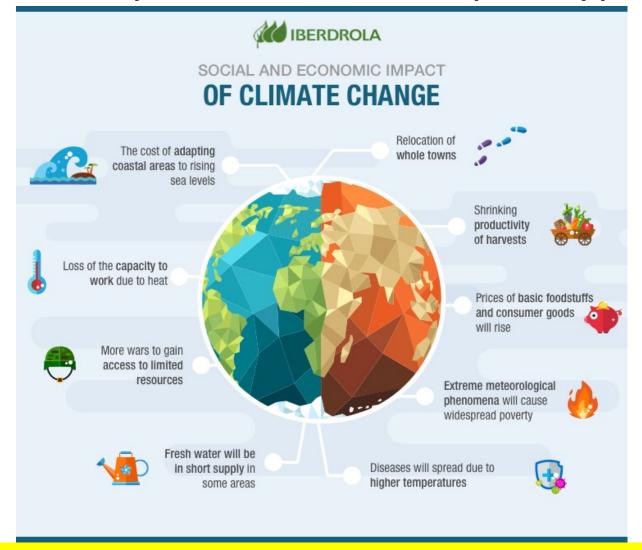
Age (years before present)

200000

Temperature change from present (°C)

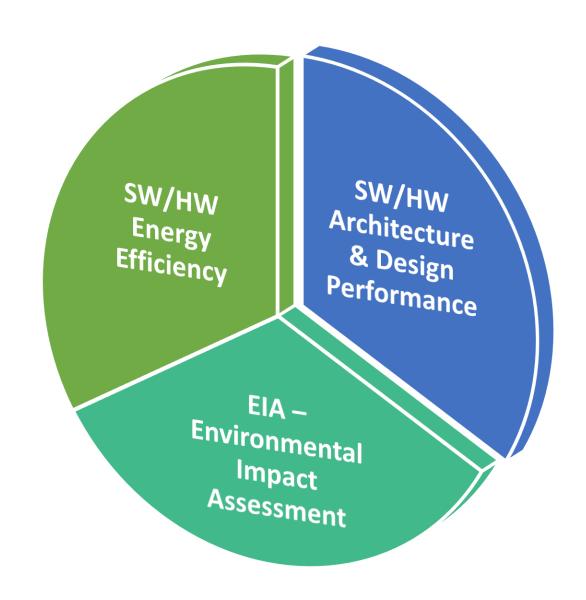
800000

The Disruptive Consequence: Climate Apocalypse



Climate Change: Globally Pervasive, owing to Human Induced Energy Imbalance, resulting in the Unnatural Extinction of Species with Unnatural "Landscaping" of the Environment

Green Compute & Storage



Green Compute & Storage (cont'd)

Programming Languages – C/C++, Go native efficiency in **Protocols and Connectivity –** relation to richness of Java, gRPC, HTTP/2, MQTT/Zigbee **Python Energy Efficiency** Data Design – Volume, Variety, Frequency

Green Compute & Storage (cont'd)

Microservices & Kubernetes,
Cloud Services & APIs –
balance the ease of
orchestration versus energy
overhead

DevOps to evolve to Climate Energy Operations through a metrics based SW design feedback lifecycle

SW/HW
Architecture &
Design
Performance

3-Tier Compute, Network
Storage versus Energy
Efficient HCI (Hyper
Converged Infrastructure)

Green Compute & Storage (cont'd)

Data Energy Characterization KWh per GB of Data for Renewable Energy To Power Compute, Network and **Data Centers (Solar, Wind)** Storage EIA -**Environmental Impact** Assessment **ASSESS THE IMPACT OF THE SW YOU ARE CREATING AND** ITS NET IMPACT ON THE **ENVIRONMENT/NATURAL WORLD**

An Engineer's Ethos: Ethics, Ethics and Ethics

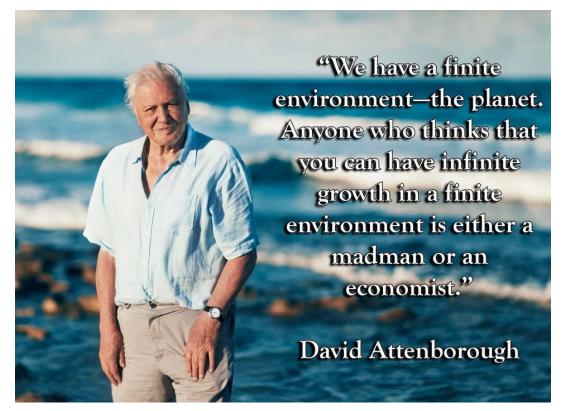


IEEE Code of Ethics

(https://www.ieee.org/about/corporate/governance/p7-8.html)

1. to hold paramount the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices, to protect the privacy of others, and to disclose promptly factors that might endanger the public or the environment;

Lumini '21: A Call for Technology In Harmony with the Planet





Hope and Consequent Action is a Great Thing. Let Us Get to Work!

THANK YOU!

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