GreenTouch Consortium: Overview and Green Meter Research Study

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Energy Efficiency is a Necessity for the ICT Industry

Global aviation industry

50 million cars

Global ICT Emissions: 2.3%, Growing at 4% YoY

GeSI "SMARTer 2020: The Role of ICT in Driving a Sustainable Future", 2012

NETWORK ENERGY USE
+27%
INCREASE
2012 to 2106

INTERNET
=5th
HIGHEST COUNTRY
If the internet was a country: energy consumption is higher than Russia and a little less than Japan

NETWORK
~75%
ENERGY BILL
70 to 80% overall energy bill of an operator
➢ RAN: +70% of network electricity cost

ENERGY BILL
7-20%
OPERATORS OPEX
From 7% in mature countries to +20% in emerging countries

Fundamental question:

Support the traffic growth in a sustainable and economically viable way throughout the world
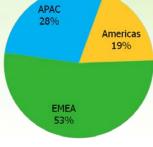
GreenTouch
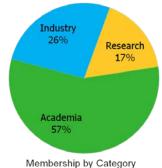
GreenTouch™ (www.greentouch.org)

Deliver by 2015 Architectures, Specifications and Solutions and Demonstrate Key Technologies to Increase Network Energy Efficiency by a Factor 1000 Compared to 2010

- **Bell Labs Initiated Global Research Consortium** representing industry, government and academic organizations

- Launched in May 2010 with focus on energy efficiency, sustainability and growth

- Holistic and ambitious goal of 1000x

- 53 member organizations with 350+ leading scientists

- New innovation model for sustainability

- Recognized by the World Economic Forum as an industry-led best practice toward sustainability

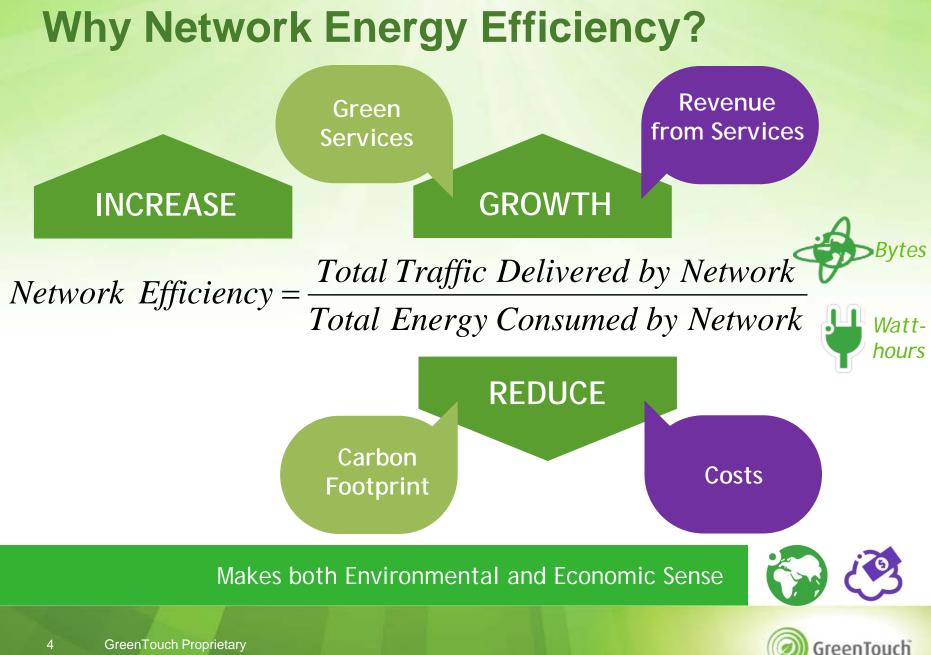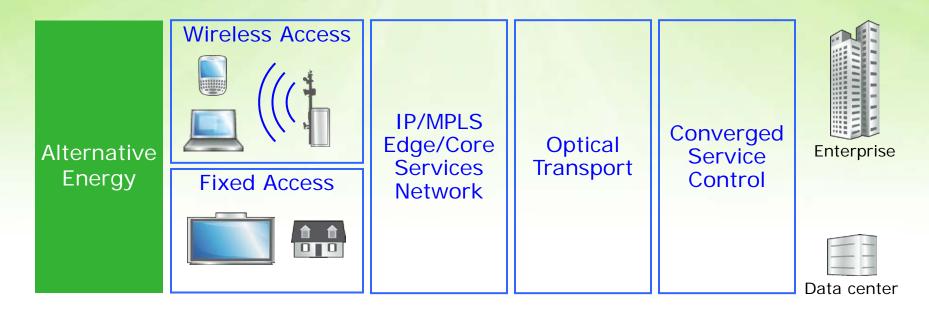- Leading Green ICT: cooperation with other NGOs such as GeSI, ITU-T, GreenGrid, Carbon Trust, ITRS

APAC 28%
Americas 19%
EMEA 53%

Membership by Region

Industry 26%
Research 17%
Academia 57%

Membership by Category

GreenTouch Overview Video

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Why Network Energy Efficiency?

Green Services

Revenue from Services

INCREASE

GROWTH

$$Network\ Efficiency = \frac{Total\ Traffic\ Delivered\ by\ Network}{Total\ Energy\ Consumed\ by\ Network}$$

Bytes

Watt-hours

REDUCE

Carbon Footprint

Costs

Makes both Environmental and Economic Sense

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End to End Network Perspective

Alternative Energy

Wireless Access

Fixed Access

IP/MPLS Edge/Core Services Network

Optical Transport

Converged Service Control

Enterprise

Data center

Thermal Management and Cooling

Eco-Sustainable Services
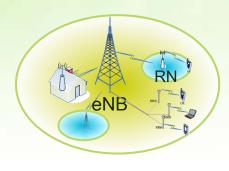
GreenTouch Proprietary

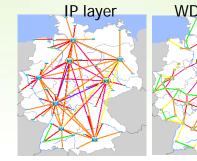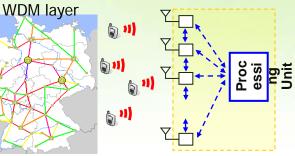GreenTouch

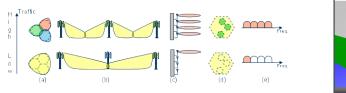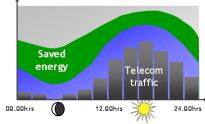# New Approaches Focused on Energy

Components and Hardware

Network Architecture
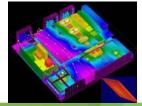
Management and Control
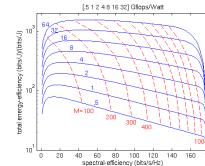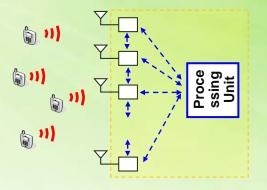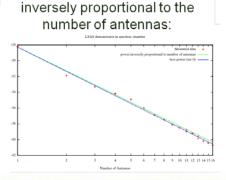
Thermal Management

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Large Scale Antenna System

- Use many more service-antennas than terminals with data beams directed towards the terminals

- Increased spectral efficiency (bits/s/Hz) and radiated energy efficiency (bits/Joule)

- Technological advantages:
  - Only needs cheap, single-antenna terminals
  - All complexity at the base station
  - Expensive power amplifier amplifiers replaced by many low-power low-precision units

- Important to consider total system energy consumption and energy efficiency:
  - Radiated power
  - LSAS-critical computing processing power
  - Internal per-antenna power consumption (RF chains, analog blocks, A/D)
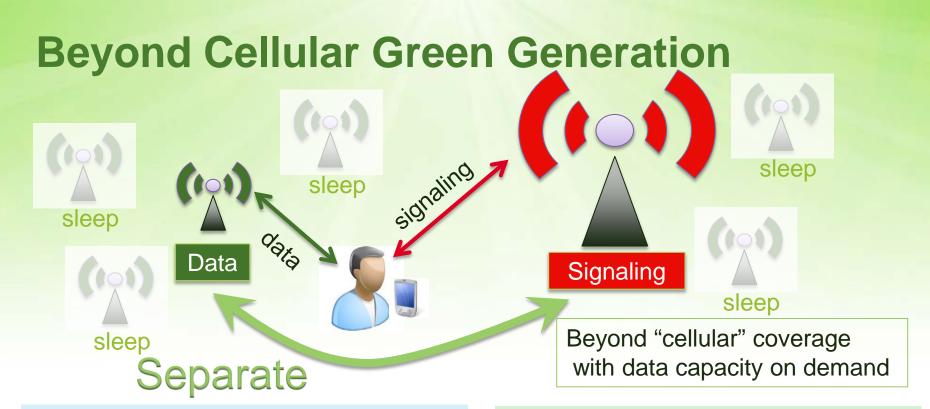

Measured transmit power is inversely proportional to the number of antennas:

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Beyond Cellular Green Generation

sleep · sleep · sleep · sleep · sleep

Data — data — signaling — Signaling

Separate

Beyond "cellular" coverage with data capacity on demand
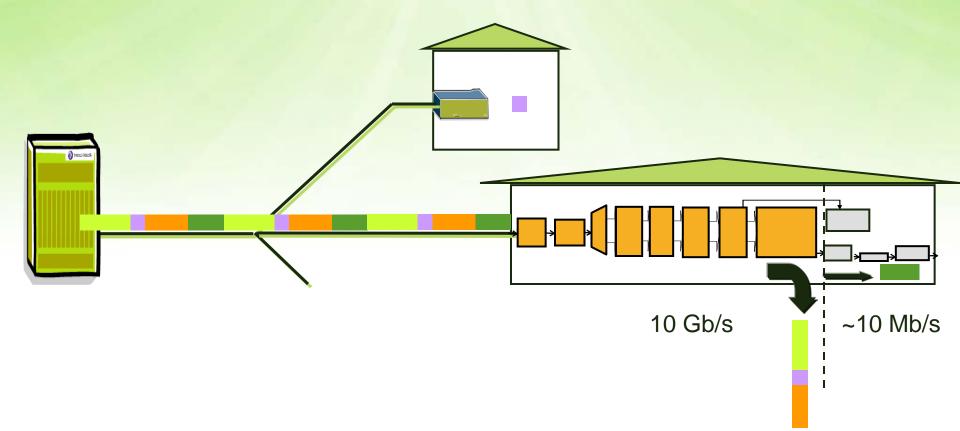
Opportunities for sustainability:

- System designed for energy efficiency
  - Separate capacity from coverage
  - Optimise signalling transmission
  - Lean access to system
- Cope with massive amount of low data rate services

Challenges:

- New system architecture
- Re-invent mobility management
- Agile management, context aware, network with memory
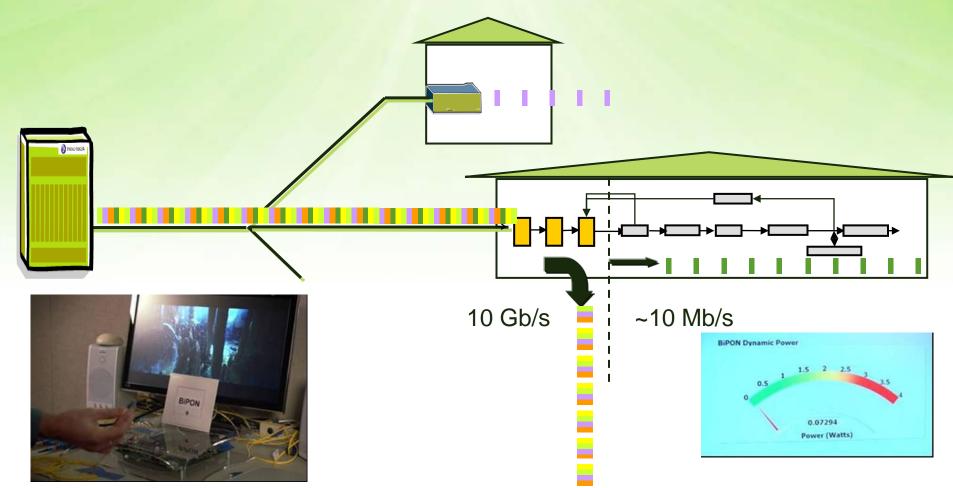- Hardware for fast reconfiguration

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Standard Transmission Protocol in FTTH Networks (XG-PON)

10 Gb/s

~10 Mb/s

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Bit-Interleaved Passive Optical Networks

10 Gb/s ~10 Mb/s

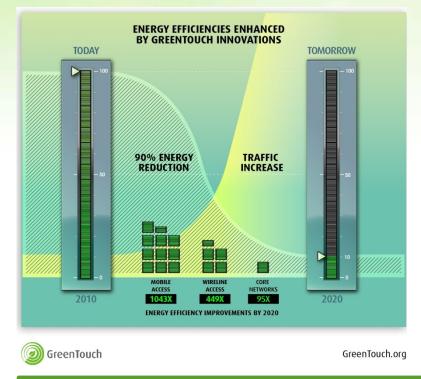BiPON Dynamic Power

0.07294
Power (Watts)

Bit-Interleaved Passive Optical Networks (Bi-PON) provides better than 10x energy efficiency improvement

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Real Overall Progress and Results

Research study shows net energy consumption in networks can be reduced by up to 90% by 2020 while taking into account traffic growth

- Significant impact for service provider
- Technology assets for future networks
- Economic impact
- Environmental sustainability
- Live webcast on May 13 with announcement of results and green meter research study

Green Meter Webcast: http://www.mediaserver.com/m/p/jcczhxay.
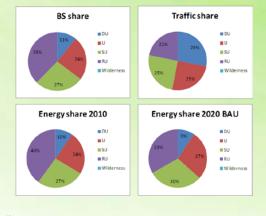
Some Key Technologies

- **Mobile:**
  - Small cells deployment in dense urban environments
  - Infrastructure sharing across operators
  - Discontinuous transmissions during periods without traffic
  - Base station power models
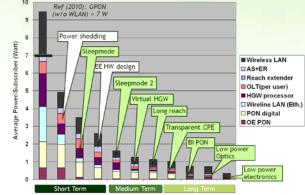 - All-optical backhaul

- **Wireline:**
  - Bit interleaved passive optical networking (Bi-PON)
  - Power shedding and sleep modes
  - Energy efficient hardware

- **Core:**
  - Optical bypass and optimum use of mixed line rates
  - Dynamic allocation of resources to diurnal traffic fluctuations
  - Low power electronics and photonics

Conclusion: Where Do We Go From Here?

16 RESEARCH PROGRAMS and PROJECTS

NEW APPROACHES BEING TAKEN

TWO MAJOR PUBLIC DEMONSTRATIONS

COMMON REFERENCE ARCHITECTURE & ROADMAP

ADDITIONAL DEMOS TO VALIDATE KEY TECHNOLOGIES

ONGOING RESEARCH ACTIVITIES AND UPDATES TO GREEN METER

BRAINSTORMING ON NEW IDEAS

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