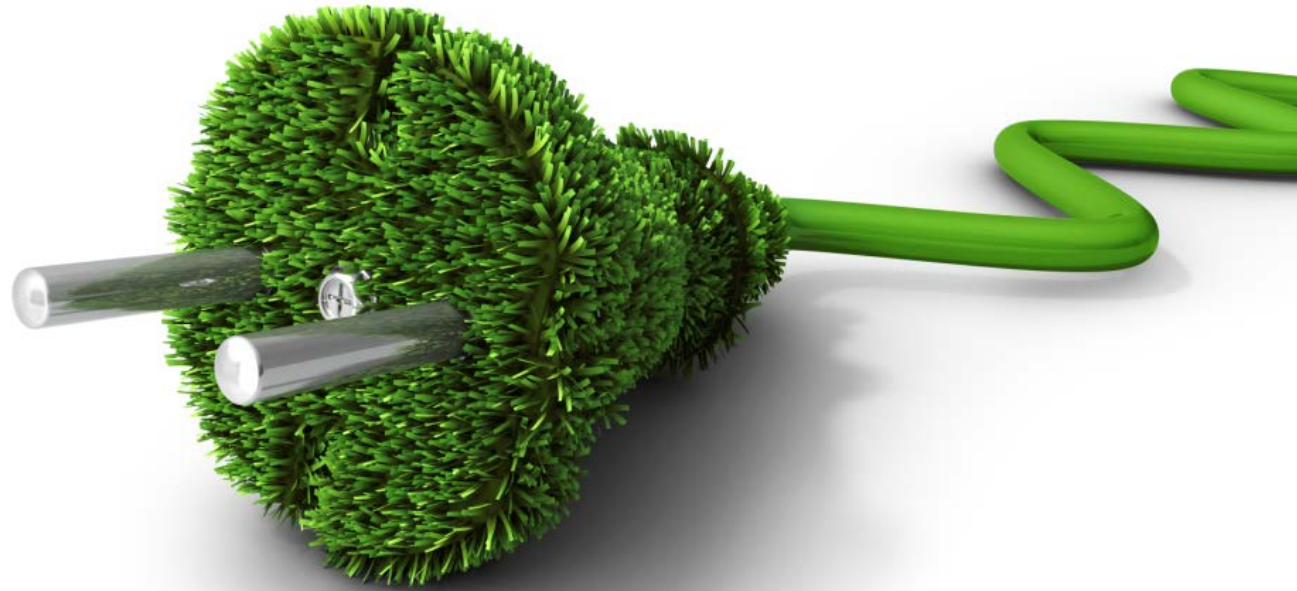




ALCATEL-LUCENT:
Consume less energy?
ICT, we need more of it

Philippe Richard

June 2013

ALCATEL-LUCENT

GETTING TO KNOW US



lightRadio™ a technology breakthrough, the size of a Rubik's cube, delivers lightning fast Internet, consumes less power than a **60W** light bulb and supports **30+** users



80+ power utility networks **WORLDWIDE** use our smart grid solution to save money, prevent outages and decrease their carbon footprint

We have laid **1.284M+** km of **100G** optic fiber- enough to go around Earth **32** times

We have laid **500,000+** km of undersea cable - enough to go around Earth **12.5** times



Our **FP3** and **PSE** chips each support speeds of **400 Gb/s**, equivalent to **70,000** users each watching a HD video **SIMULTANEOUSLY**



80+ railway operators **WORLDWIDE** use our equipment to ensure millions of on-time, safe, connected journeys



1+ in 3 people **WORLDWIDE** connect to the Internet from home via our equipment



We even have a  **YELLOW SUBMARINE (ROV)!**

LARGEST INSTALLED BASE IN THE WORLD - GROUND, AIR AND SEA

INDUSTRY TRENDS

A FAST-GROWING INDUSTRY

+30%

FIXED BROADBAND
CONNECTIONS

532
Million



2011

691
Million



2015

+32%

MOBILE
CONNECTIONS

5.5 Billion



2011

7.3 Billion



2015

+346%

WI-FI
PUBLIC SPOTS

1.3 Million



2011

5.8 Million



2015

+990%

M2M
DEVICES

1.1
Billion



2011

12
Billion



2015

+129%

APPLICATIONS
DOWNLOADS

18.2
Billion



2011

41.7
Billion



2015

+134%

SMARTPHONE
SALES

428
Million



2011

1
Billion



2015

+100%

ENTERPRISE CLOUD
SERVICES*

12 Billion



2011

25 Billion



2015

+879%

MOBILE VIDEO
CONSUMPTION

429
Million



2011

4.2
Billion



2015

*Source: Yankee

AT THE SPEED OF IDEAS™

3

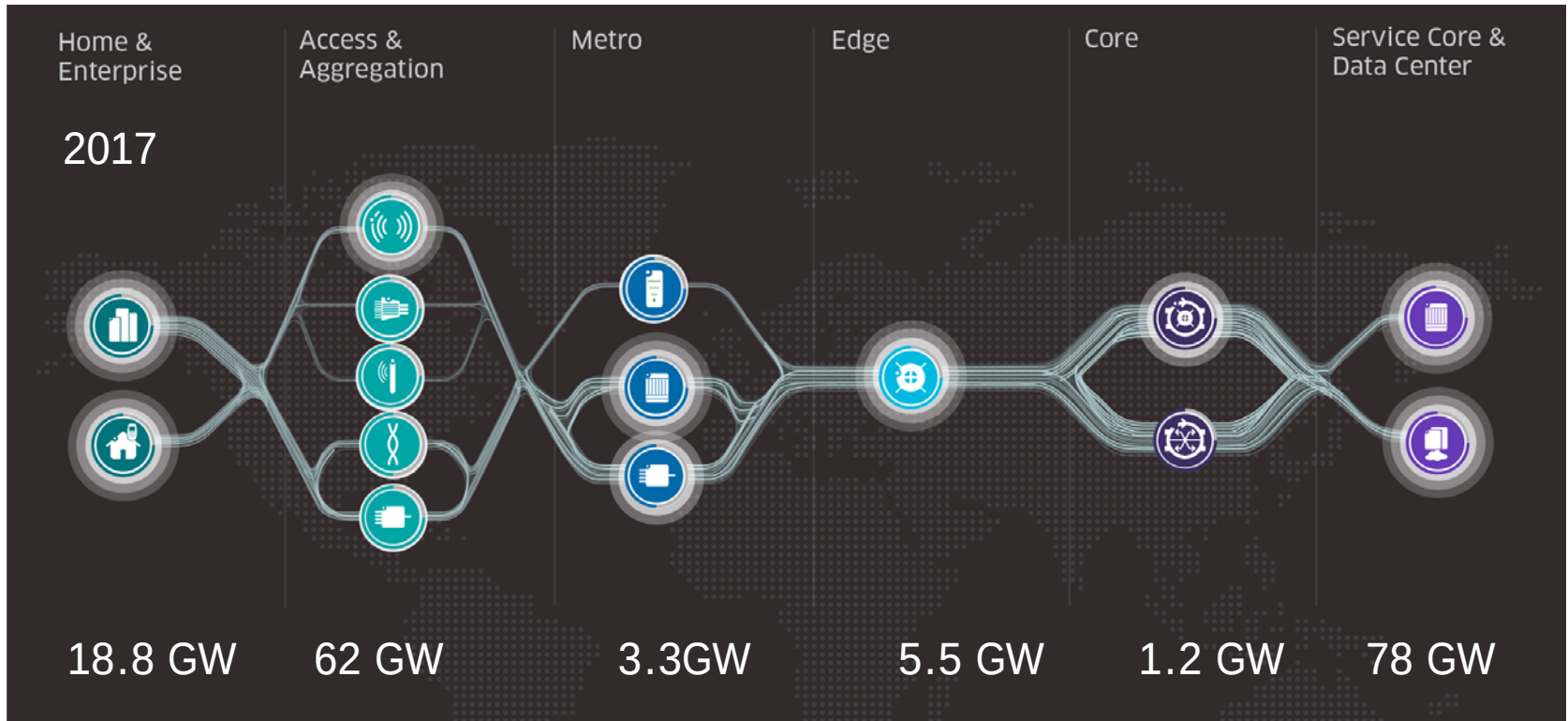
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INDUSTRY TRENDS

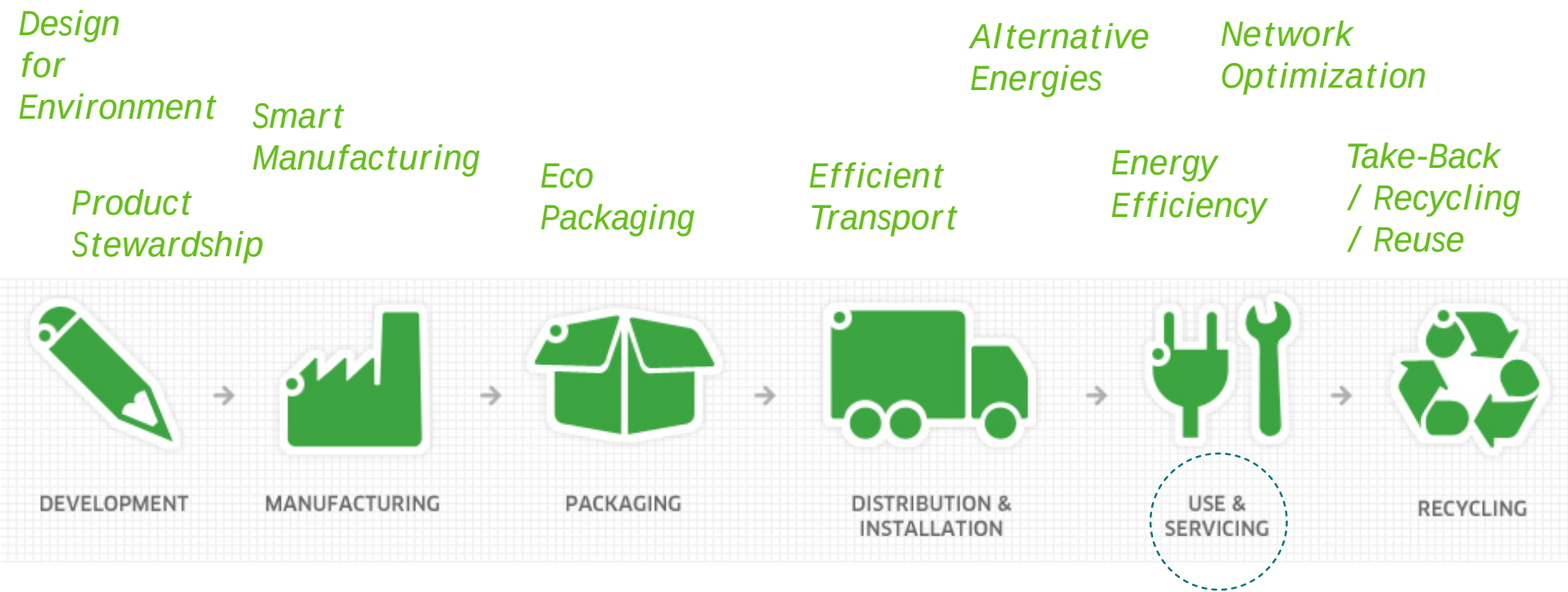
A FAST-GROWING INDUSTRY



If nothing done, the internet would go from 78GW in 2013 to 169 GW with a huge increase in the access domain

DEVELOPING ECO-SUSTAINABLE NETWORKS

HOLISTIC LIFECYCLE APPROACH

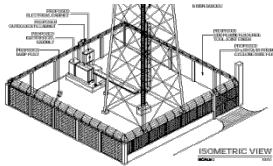


Use & servicing represent 80%-90% of eco impact

DEVELOPING ECO-SUSTAINABLE NETWORKS

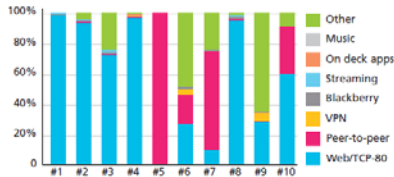
REDUCING POWER CONSUMPTION METHODS

OPTIMIZED ARCHITECTURE / SW



BETTER UTILIZATION

Wireless traffic composition by application for ten heavily loaded base stations measured during the busy hour



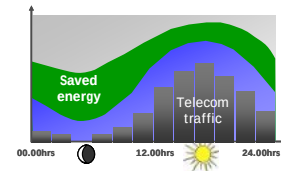
INTELLIGENT THERMAL / COOLING



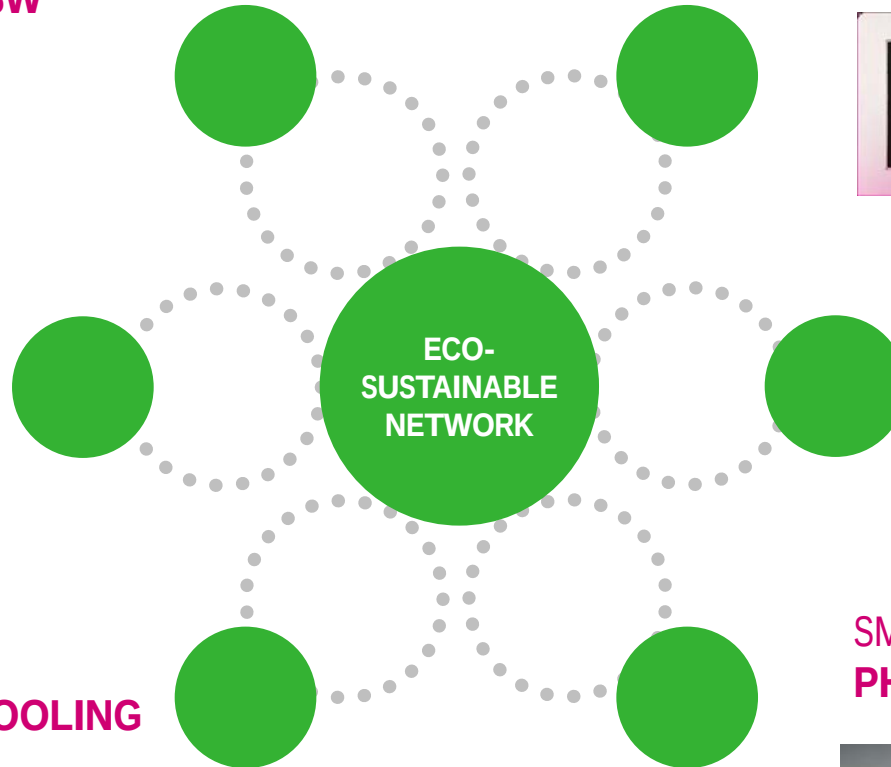
NEW HARDWARE



BETTER CONTROL



SMART PHYSICS



NETWORK DESIGN FOR ENERGY EFFICIENCY

SAVE

69%

POWER

Due to increased **density** and **efficiency** at the **packet transport layer**
+ Remote OA&M at the optical and IP layers: reduce truck rolls and site visits

SAVE

75%

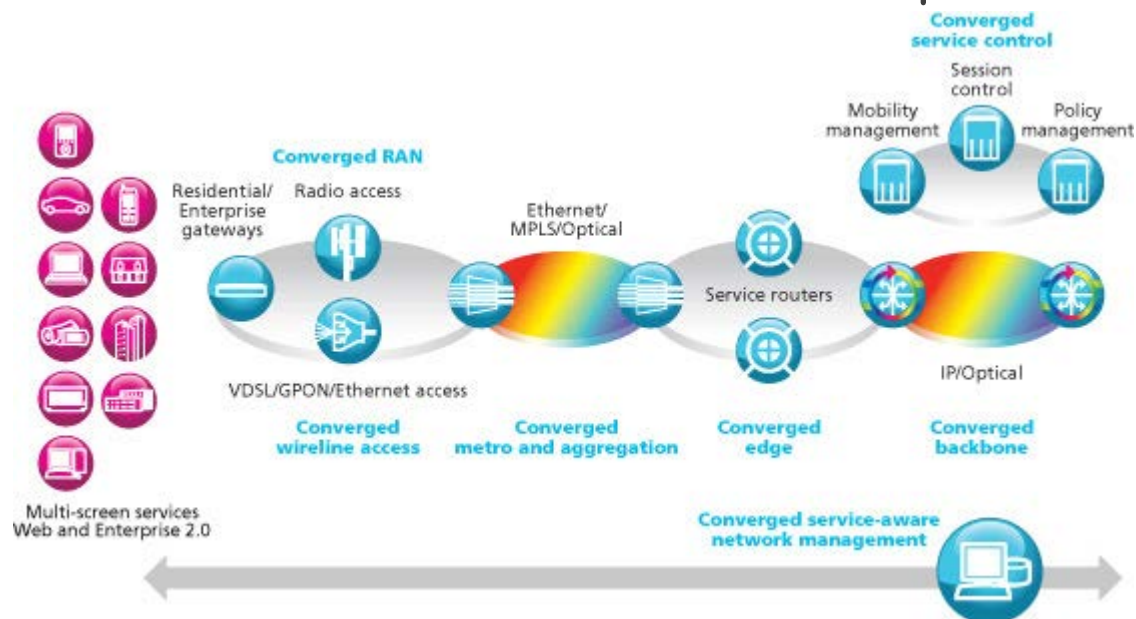
FLOOR SPACE

SAVE

1.1M

KILOWATT-HOURS

Bell Labs study of a typical HLN approach
566 metric tons of CO2 per year
1.6 million km in an economy class car



ECO-SUSTAINABLE NETWORKS: WIRELESS

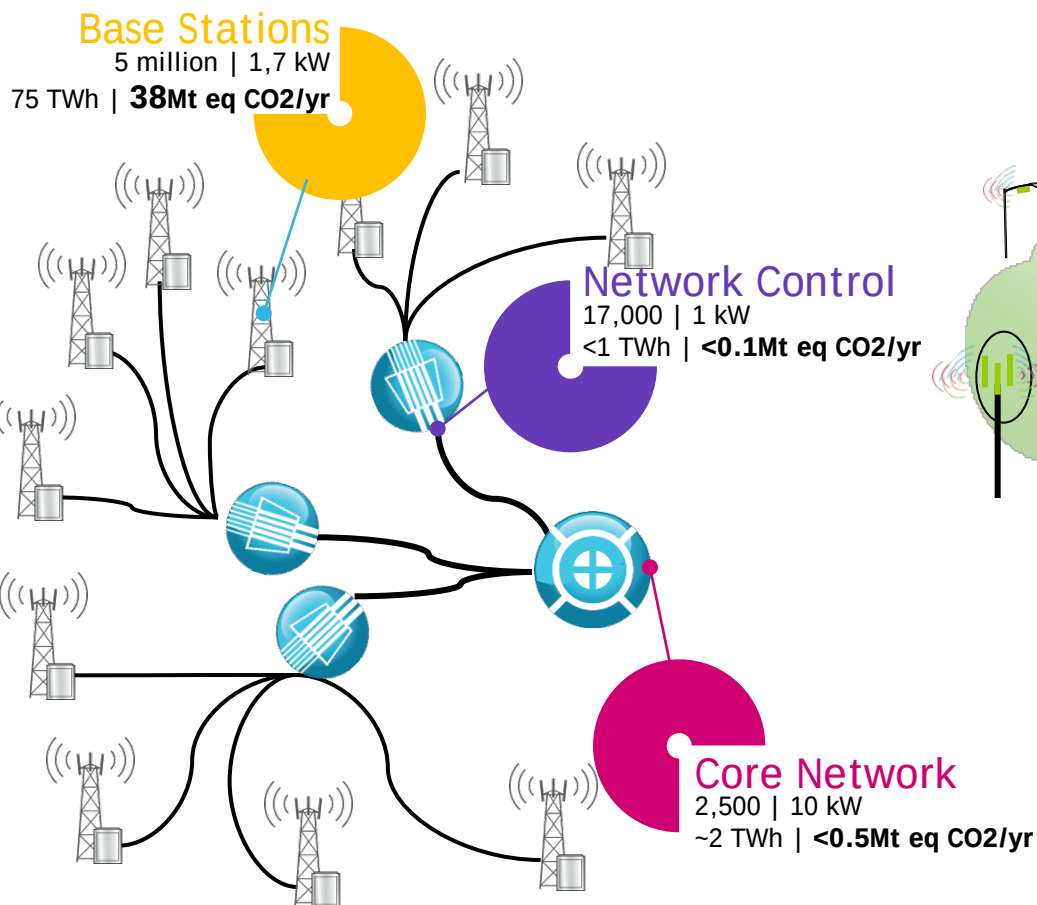
NETWORK DESIGN RADICAL CHANGE

9768 METRO RADIO
OUTDOOR LTE



TODAY

ENERGY DISTRIBUTION



TOMORROW

EFFICIENT NE TECHNOLOGY & C-RAN



AT THE SPEED OF IDEAS™

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Alcatel-Lucent



ECO-SUSTAINABLE NETWORKS: WIRELESS

Green Air Interface

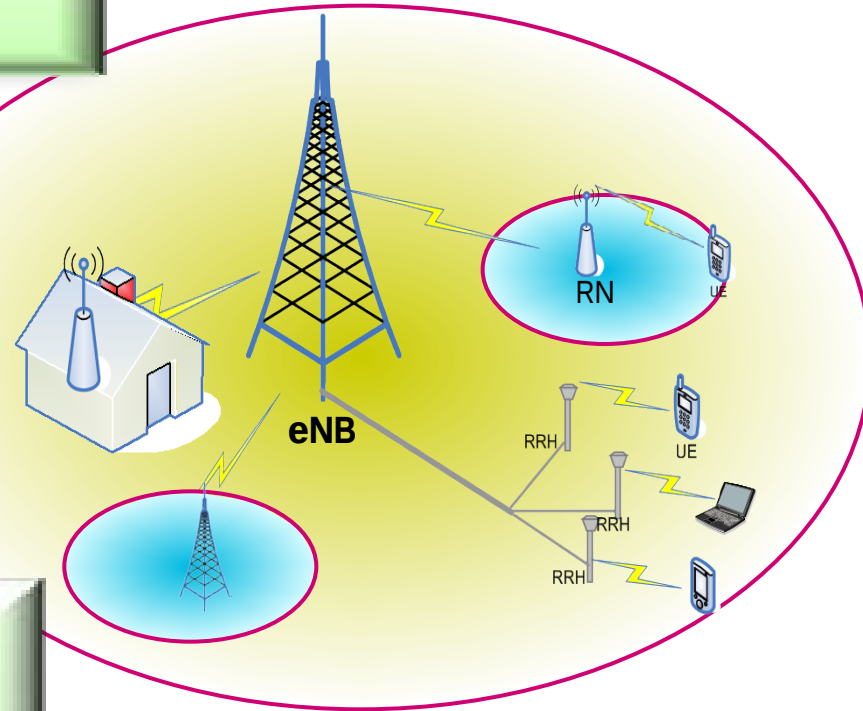
- Large Scale Antenna Systems
- Very High Bandwidth
- Bandwidth and Capacity Adaptation

Network Architecture & Mgmt

- Dynamic Management for Energy Efficiency
- Small Cells, Relays and Repeaters, HetNets
- Beyond Cellular Green
- New BS Architecture – Cloud Computing for Signal Processing
- Energy Efficiency Evaluation Framework

Base Station Hardware

- Ultra Low-Power Base-Station on a Chip
- Load Adaptive Transceivers
- High Efficiency RF-Power Amplifiers
- Renewable Energy Powering
- New Architectures such as lightRadio™



ECO-SUSTAINABLE NETWORKS: WIRELESS

Base station level

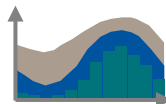


Hardware
integration



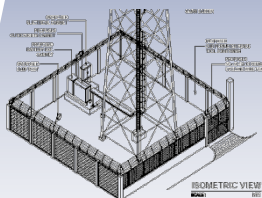
Multi-carrier power
amplifier

Dynamic
software



Dynamic power
save

Site level



No air
conditioning
outdoors



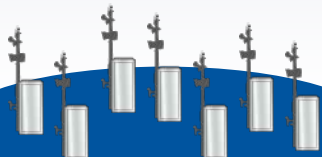
Direct cooling

No feeder



Remote radio
head

Network level



High and
focused
coverage



Smart antenna

earth

Energy Aware Radio and network technologies

15 Partners from 10
European countries

Funding Scheme: Large scale
Integrating Project (IP)

Total Cost: € 14.8 m
EC Contribution: € 9.5 m

Duration:
January 2010 - June 2012

Project Coordinator:
Dietrich Zeller, Alcatel- Lucent

Technical Manager:
Magnus Olsson, Ericsson



ECO-SUSTAINABLE TECHNOLOGIES

7950 XRS CORE ROUTER FAMILY

UNPARALLELED SCALE & EFFICIENCY, WITH FULL FLEXIBILITY
TO HANDLE BROAD RANGE OF CORE NETWORKING NEEDS



-66 %
ENERGY
CONSUMPTION

5X

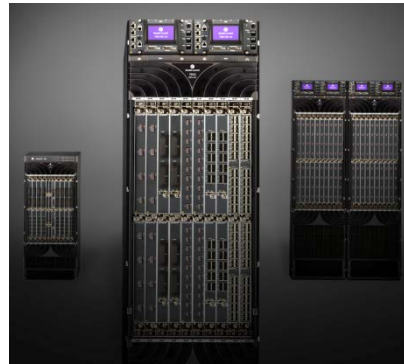
MORE DENSITY

66%

LESS ELECTRICITY
CONSUMPTION

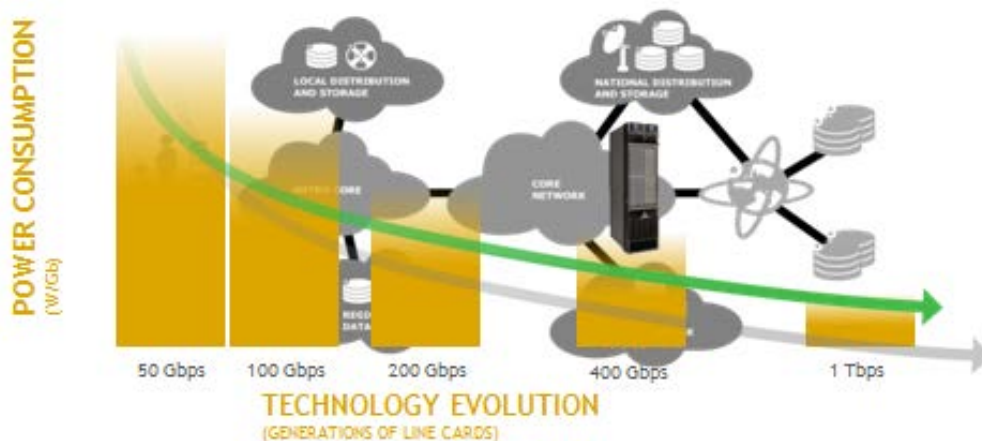
1

PLATFORM,
NO COMPROMISES



“Our routing systems sit at the massive intersections of the Internet, where billions of individual messages are directed every second. Our technology provides more capacity and more flexible traffic management with reduced energy consumption, helping to ensure better performance from global broadband networks.”

Basil Alwan
President, IP Division



ECO-SUSTAINABILITY

ACHIEVEMENTS & COMMITMENTS

KEY ACHIEVEMENTS

+25% INCREASE IN ENERGY EFFICIENCY
OF KEY PRODUCTS

-24% DECREASE IN CARBON FOOTPRINT VS 2008

Eco-innovations

- LIGHTRADIO™ : reduce energy consumption of mobile networks by **50%**
- FP3 PROCESSOR: **50%** less power
- 7950 EXTENSIBLE ROUTING SYSTEM (XRS): **66%** less power to reduce the eco impact of IP networks

Bell Labs

GreenTouch™, making networks **1,000** times more energy efficient

PERFORMANCE TARGETS

-50%
DECREASE IN CARBON FOOTPRINT BY 2020



Eco-innovations

+75%
INCREASE IN ENERGY EFFICIENCY FOR LIGHTRADIO™ BY 2015



The Greenhouse Gas Protocol Initiative
The foundation for sound and sustainable climate strategies

INNOVATION CHALLENGES

Lower relative VENTURE CAPITAL investments in Telecom

Telecom operators desire to minimize number of suppliers while maintaining innovation

FEWER PLAYERS
FUNDING BY LARGE SUPPLIERS

innovacom

Partnerships with startups
and with customers

Direct and indirect funding

Annualized metrics:

500 startups evaluated

100 met and reviewed in detail

15 actions

AT&T
FOUNDRY
WHERE IDEAS ARE MADE



“open innovation” and “co-creativity” are key

CONCLUSIONS

ICT NETWORKS ARE GROWING RAPIDLY

- Scaling networks is becoming more difficult
- Bringing focus to energy efficiency

TRANSFORMING
ICT NETWORKS
FOR A
SUSTAINABLE
FUTURE

ICT AND RESEARCH COMMUNITIES ARE ORGANIZING TO ADDRESS CHALLENGES

- Dramatic, holistic change, but over long term evolution
- Cooperative organizations such as GreenTouch guiding (re)evolution

SEVERAL PROMISING RESEARCH DIRECTIONS AND INITIAL RESULTS HAVE BEEN OBTAINED

MORE WORK REMAINS!

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AT
THE
SPEED
OF
IDEAS™

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ECO-SUSTAINABLE TECHNOLOGIES

FP3 400G NETWORK PROCESSOR



-50 %
ENERGY
CONSUMPTION

FASTER, SMARTER AND GREENER



FP3 | *latest silicon design techniques reducing power consumption by 50% or higher for every packet processed*

4X

THE SPEED
OF TODAY'S NETWORKS

REDUCES THE IMPACT ON
ENVIRONMENT

up to **50%** less power than
equivalent chips in use today

