5G: THE NETWORK FOR THE NETWORKED SOCIETY

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ATU- ARCEP, CAPACITY BUILDING WORKSHOP,
WRC 15 OUTCOMES, BENIN, APRIL 26, 2016

POINT OF DEPARTURE

MUTUAL INTERDEPEDENCE

SPECTRUM IS THE LIFEBLOOD OF ALL THAT IS MOBILE

POINT OF DEPARTURE/2

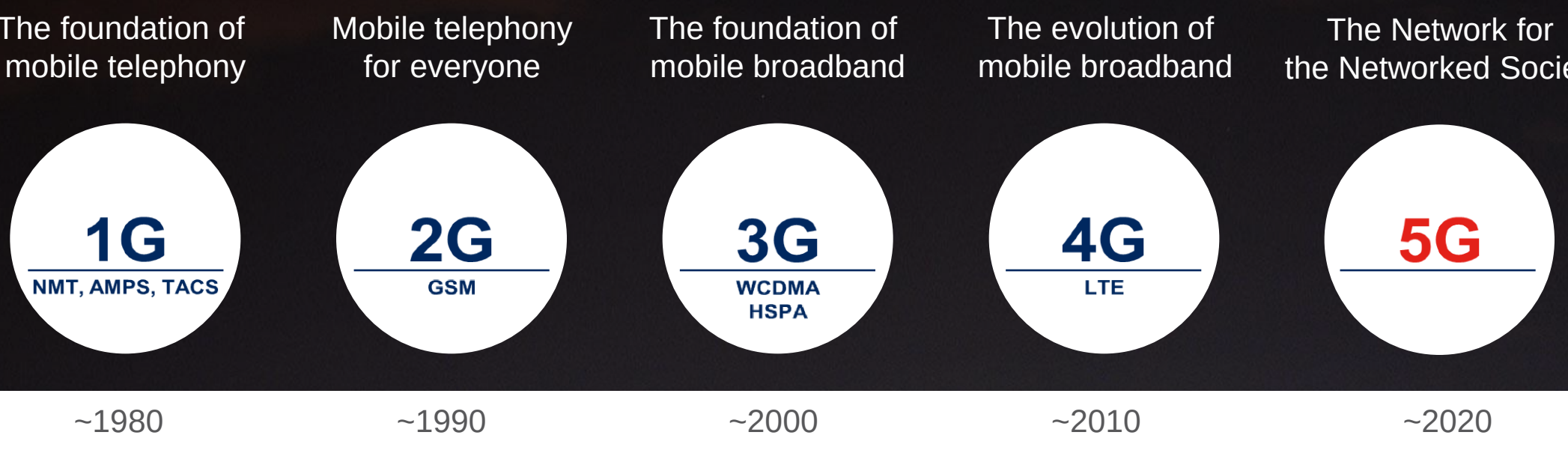
QUANTITATIVE CHANGE
LEADS TO
QUALITATIVE CHANGE

(AND CONCOMITTANT SOCIAL TRANSFORMATION)

CHANGING BEHAVIORS & EXPECTATIONS
OF CONSUMERS
INVITE INDUSTRIES TO TRANSFORM

THE CONNECTIVITY JOURNEY

MOBILE GENERATIONS ACROSS TIME

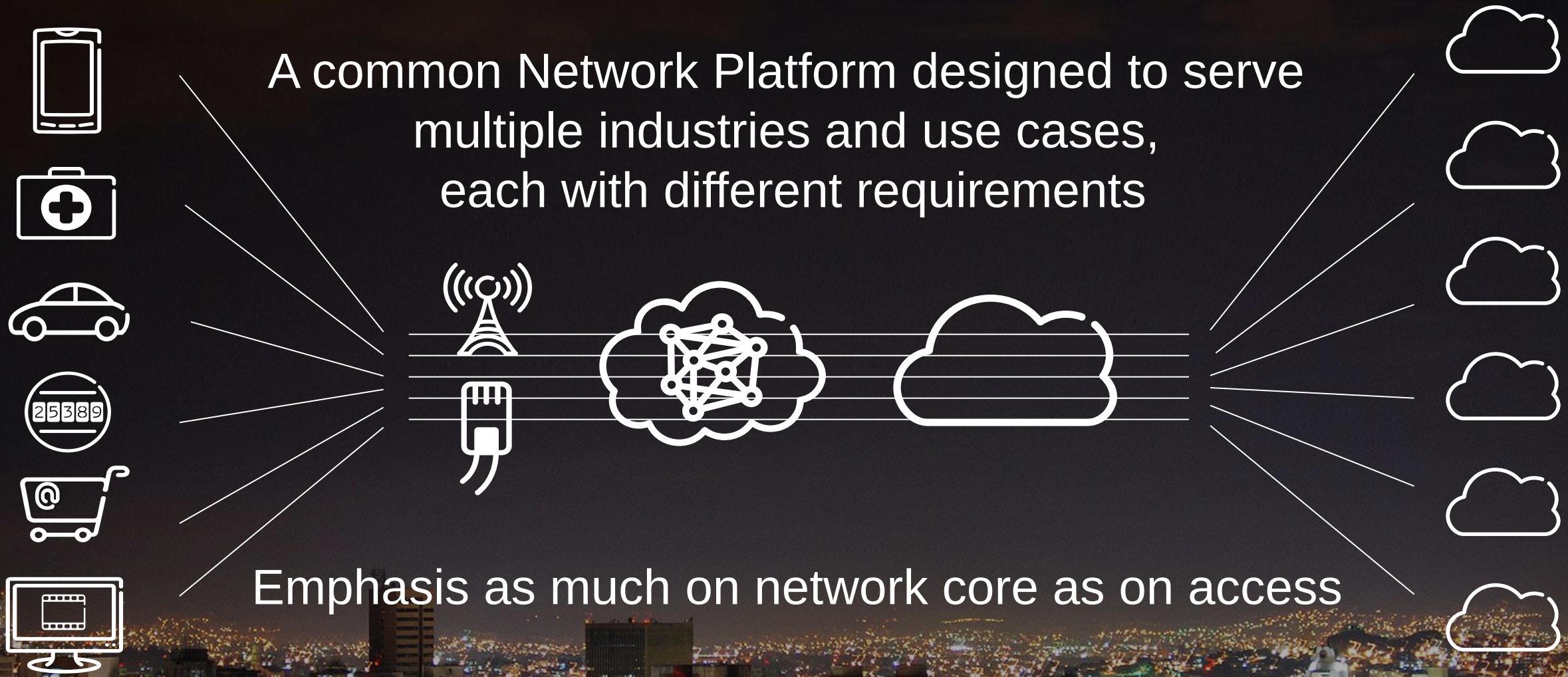


Historically, higher peak data rates, denser infrastructure and more bandwidth have been the hallmark of each mobile technology generation!

Access technologies & new air-interfaces have been the center of attention

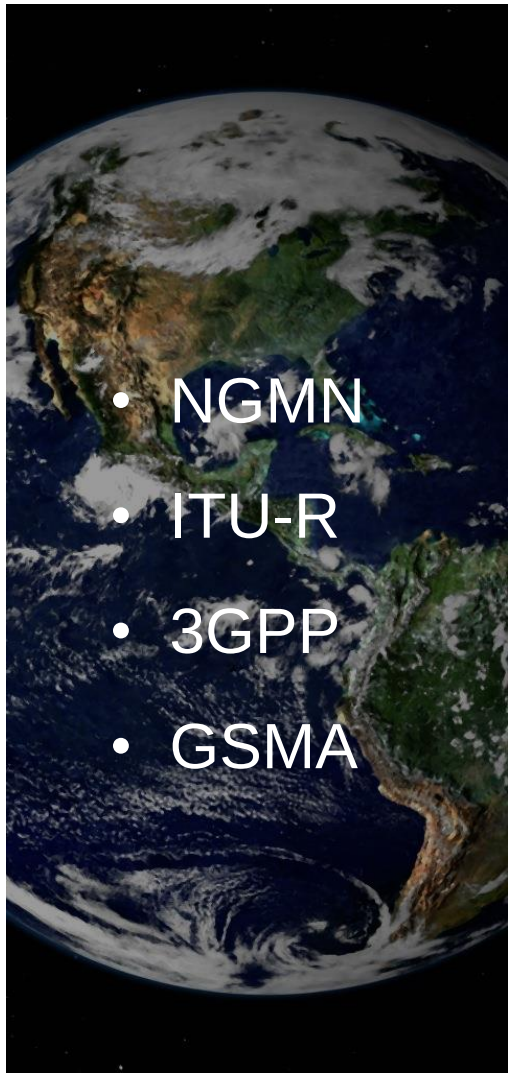
5G IS DIFFERENT: IT'S NETWORK PLATFORM

A common Network Platform designed to serve multiple industries and use cases, each with different requirements

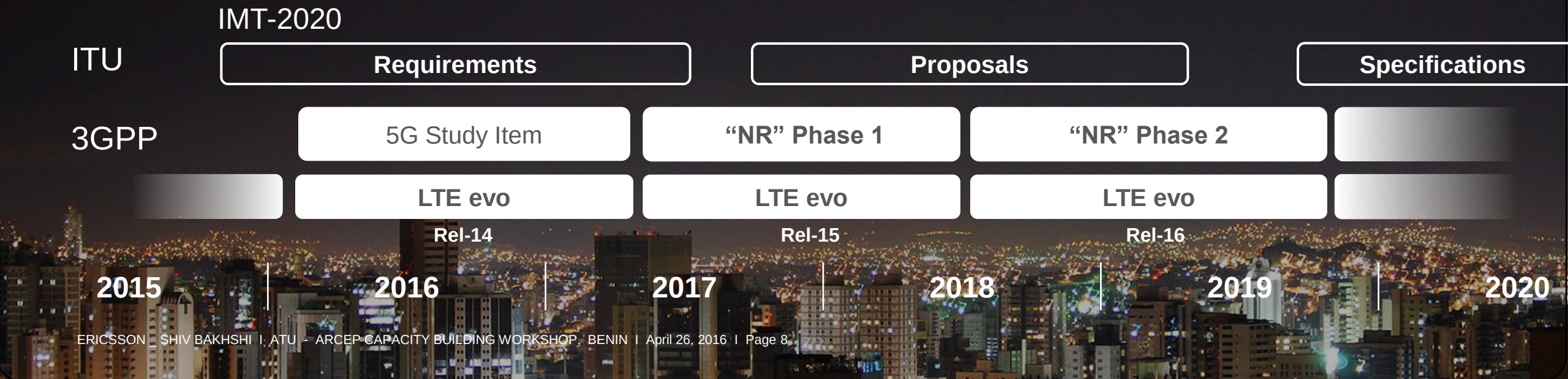


Emphasis as much on network core as on access

5G: GLOBAL INITIATIVE



5G ACCESS TIME PLAN



AGENDA

- WHY 5G : SOME NUMBERS, TRENDS & REQUIREMENTS
- NETWORK AS A PLATFORM & ITS CORE COMPONENTS
- 5G RADIO COMPONENTS
- 5G & FIVE AREAS OF EXTREME IMPORTANCE
- SUMMING UP:

WHY 5G? SOME NUMBERS, TRENDS & REQUIREMENTS

WHY 5G

Technology and society stand in a symbiotic relationship

They feed off of each other in a kind of feedback loop in which they push each other to ever higher planes

WHAT IS CHANGING? IN NUMBERS

What to expect by 2020

11x
growth in smartphone traffic

80%
of mobile data traffic will be from smartphones

60%
Mobile data traffic that will be driven by video

more people will watch streamed on-demand video than linear TV

9.2B
mobile subscriptions worldwide

85%
of all subscriptions will be for mobile broadband

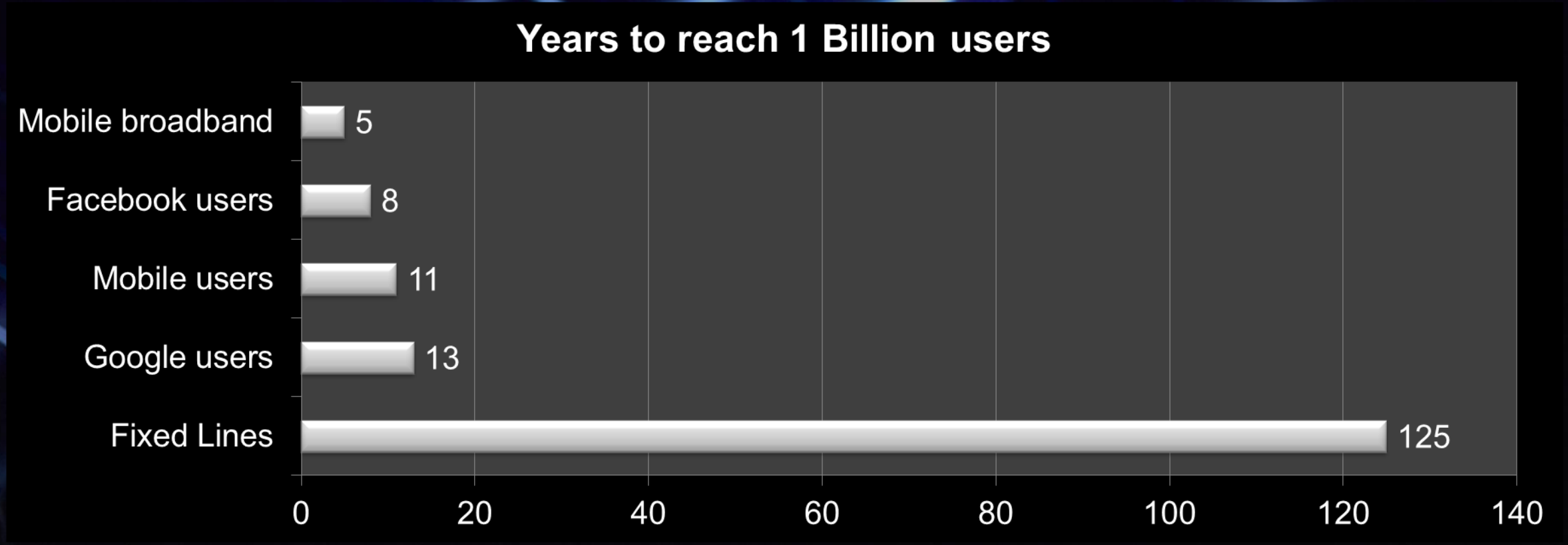
70%
Of the world will have mobile broadband coverage

>90%
global pop will have a mobile phone, 3.7 Bn LTE subscriptions

WHY DO THESE NUMBERS MATTER?

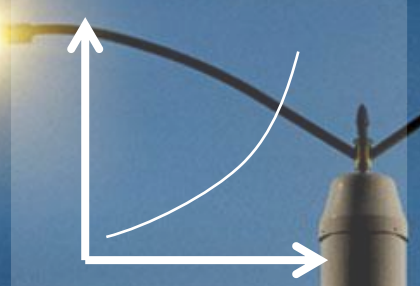
Because all kinds of societal goals – political, economic, developmental – are intrinsically tied to the growth of Mobile Broadband

MOBILE BROADBAND IS THE FASTEST GROWING TECHNOLOGY IN HISTORY



Source: ITU.

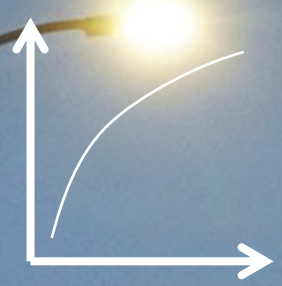
EXPONENTIAL CHANGE



COMPUTATION
DATA
SPEED

Exponential performance

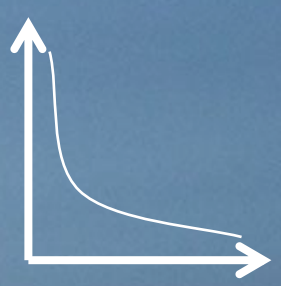
+



PRACTICES
THINGS
PEOPLE

Ubiquitous reach

+



CAPABILITY
TRANSACTION
DISTRIBUTION

New economics

Mobility

Broadband

Cloud

CONSUMER BEHAVIOR EVOLUTION

Enhanced Indoor Coverage

Higher performance, service aware Mobile Broadband

Enriched TV/Media Experience

Augmented Reality

Enhanced Security

. . .

Enterprise Transformation

NEW CONSUMER BEHAVIORS

2,7 BILLION LIKES ON FACEBOOK

$13 MILLION CROWDFUNDING

$2,7 BILLION E-COMMERCE

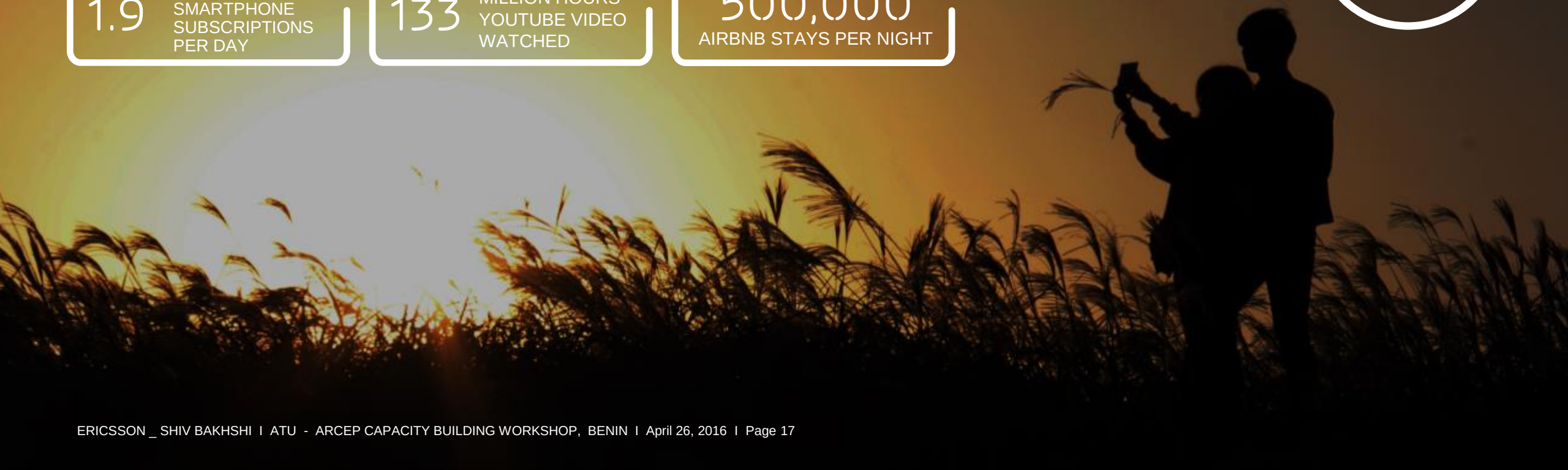
3X UBER REVENUE OVER SIZE OF TAXI MARKET, IN SAN FRANCISCO

24H

1.9 MILLION NEW SMARTPHONE SUBSCRIPTIONS PER DAY

133 MILLION HOURS YOUTUBE VIDEO WATCHED

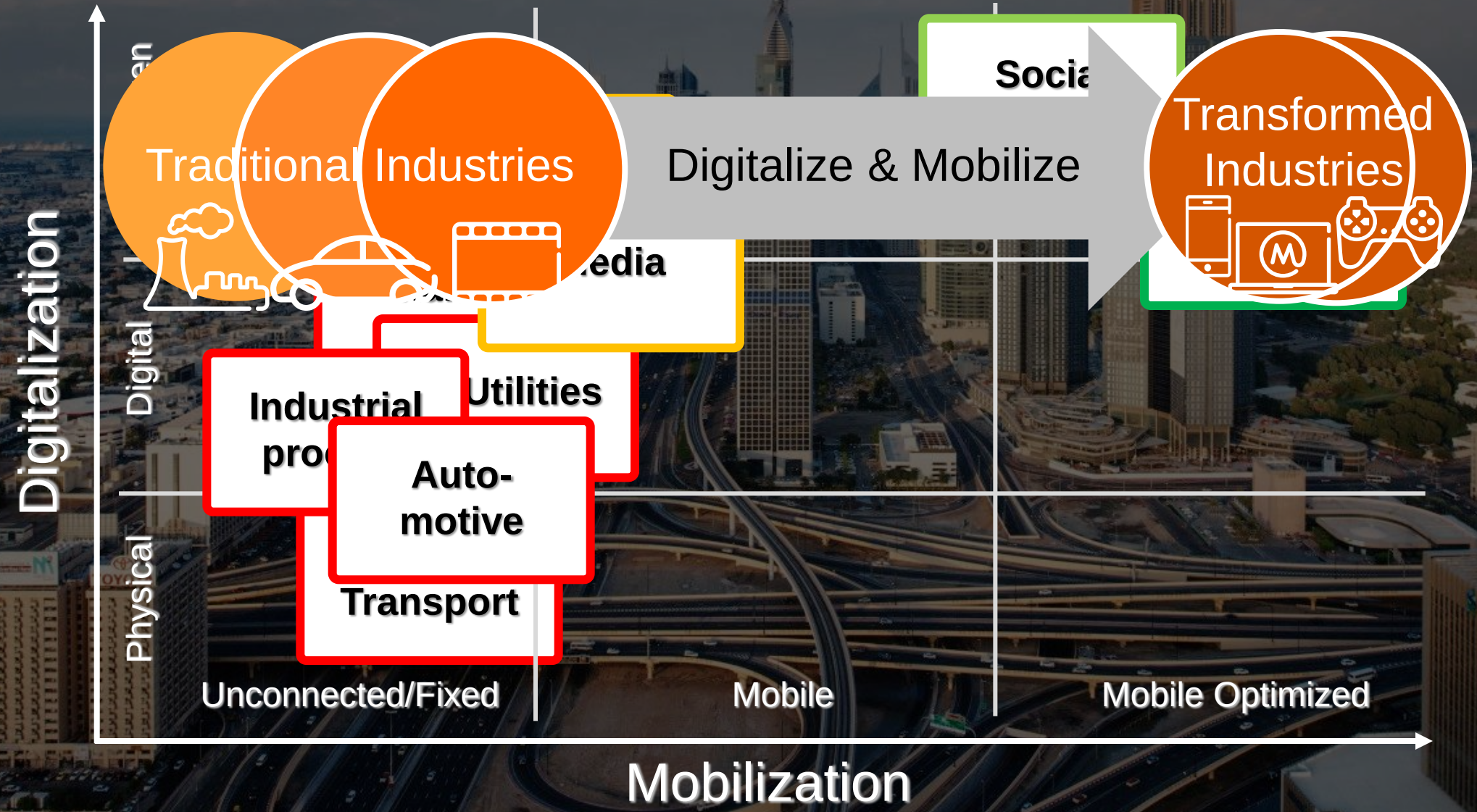
500,000 AIRBNB STAYS PER NIGHT



INDUSTRY TRANSFORMATION

HEALTH	EDUCATION	MEDIA	TRANSPORT	BANKING	UTILITY	RETAIL
WELLNESS	LEARNING	CULTURE	MOBILITY	TRANSACT	FUNCTION	EXCHANGE

INDUSTRIES IN TRANSFORMATION



MEDIA – A FIRST MOVER

ICT MEDIA 50%

Streaming music, on-line games, web & IP TV, web news, media apps, access etc.

MOBILITY - BROADBAND - CLOUD

Media

Transport

Utilities

Health

Etc.

NEW LOGICS / NEW ASSETS

USERS – PARTICIPATING AND ACTIVE

THINGS – CONNECTED AND INTELLIGENT

ANY THING THAT CAN BE CONNECTED WILL BE CONNECTED, SMART AND INTERACTIVE

ANY RESOURCE THAT CAN BE SHARED WILL BE SHARED, ENRICHED AND ABUNDANT

ANY RESHAPING IDEA THAT CAN BE TRIED WILL BE TRIED AND TRIGGER CHANGE

PLATFORMS – ECONOMICS AND SCALE

DATA – OWN, SHARED AND OPEN

NEW CAPABILITIES MADE POSSIBLE BY DIGITALIZATION AND MOBILIZATION

5G

USE CASES

BROADBAND EXPERIENCE
EVERYWHERE, ANYTIME

SMART VEHICLES,
TRANSPORT & INFRASTRUCTURE

MEDIA
EVERYWHERE

CRITICAL CONTROL
OF REMOTE DEVICES

INTERACTION
HUMAN-IOT

KEY TECHNOLOGY TRENDS

Spectrum is the most valuable resource

Programmable & Automated Horizontal Networks

Throughput critical to Customer Experience

New Media Services

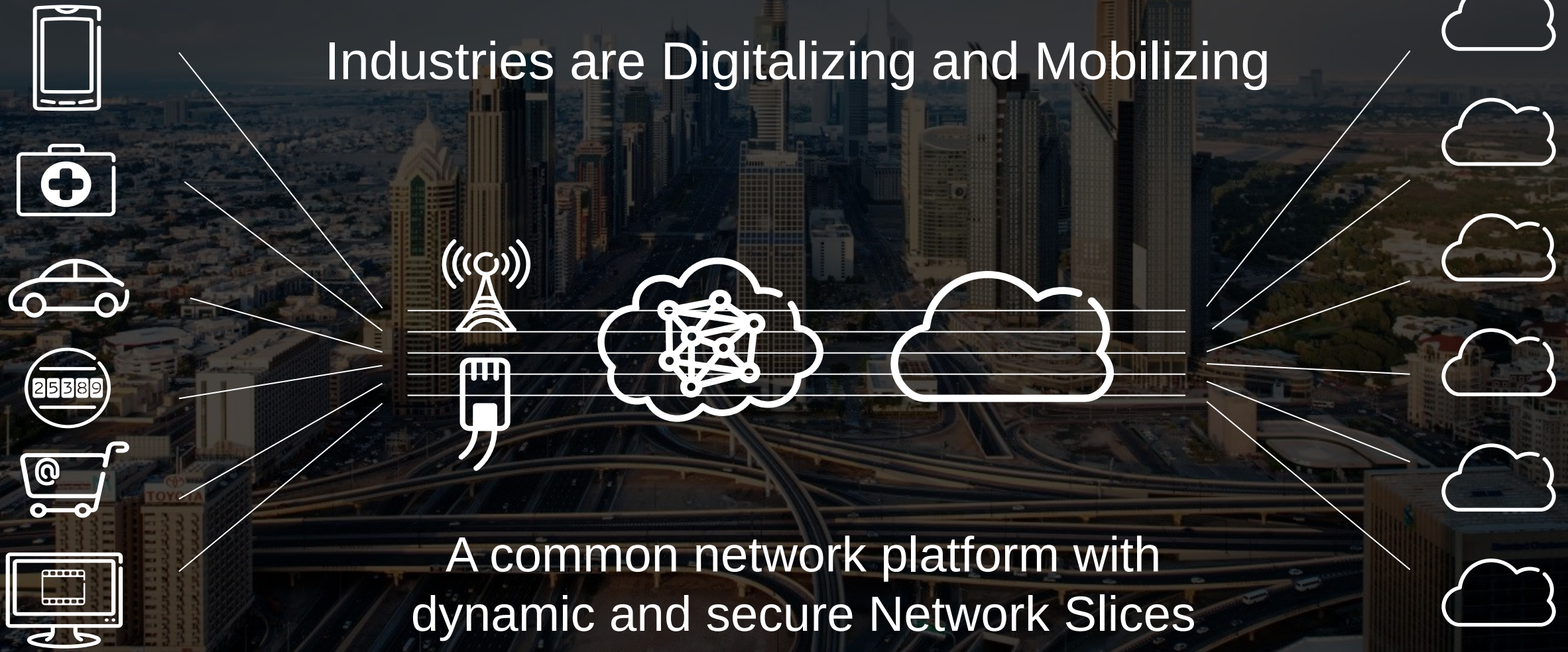
ICT unlocks value & changes business rules

Integrated Security & Aware Consumers

TELECOM, DATACOM & MEDIACOM

ONE NETWORK – MULTIPLE INDUSTRIES

Industries are Digitalizing and Mobilizing



A common network platform with
dynamic and secure Network Slices

5G PERFORMANCE REQUIREMENTS

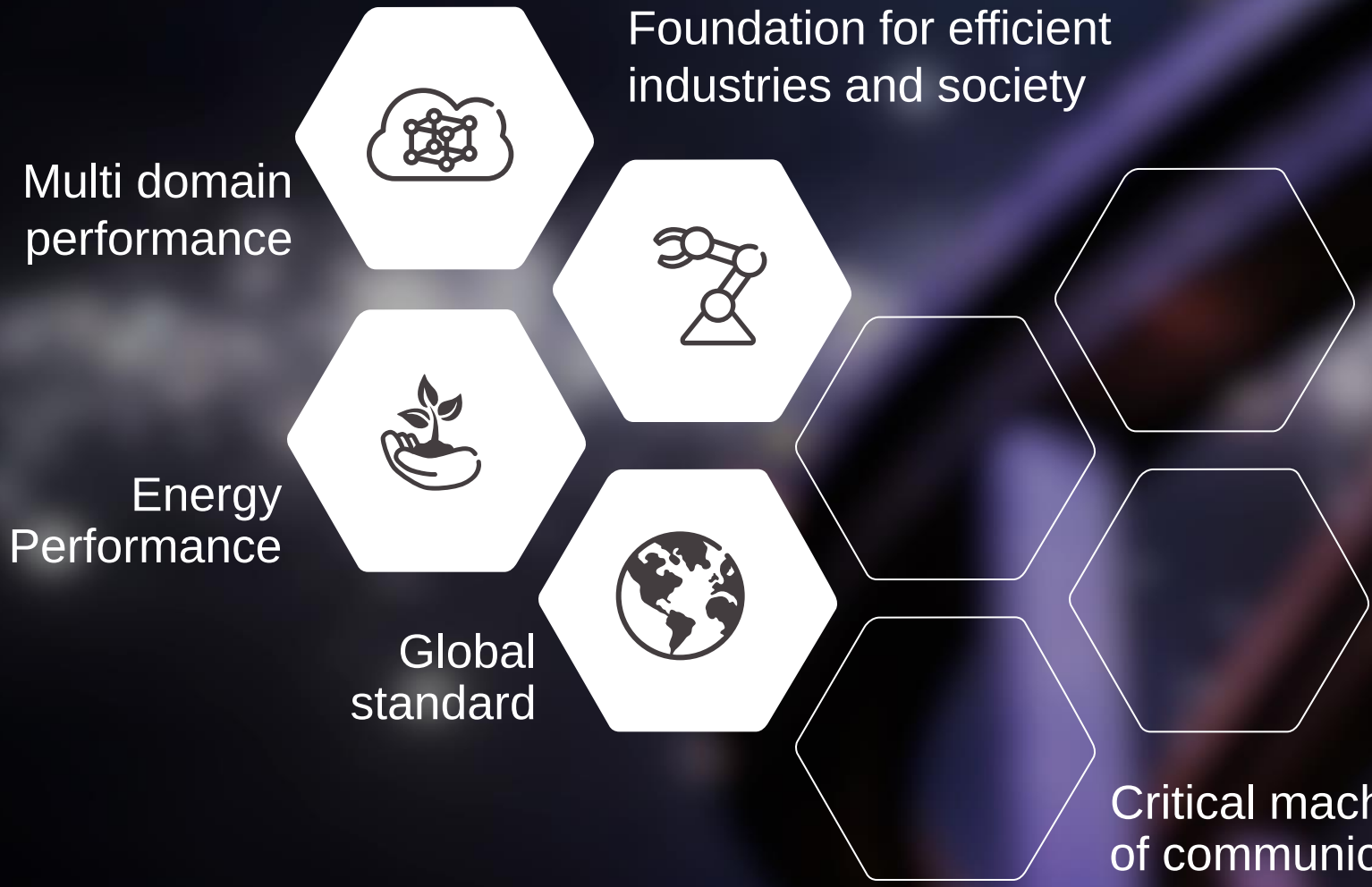
Source: METIS

FLEXIBILITY & ROBUSTNESS

FLEXIBILITY

ROBUSTNESS

WHAT 5G WILL PROVIDE

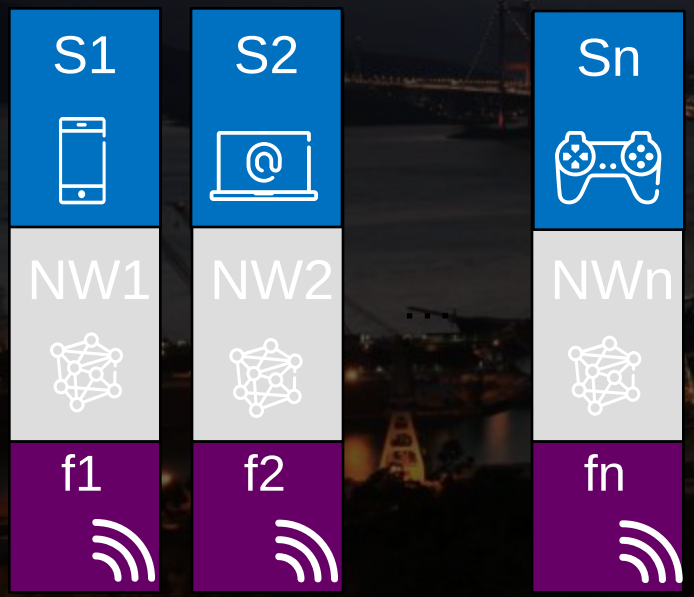


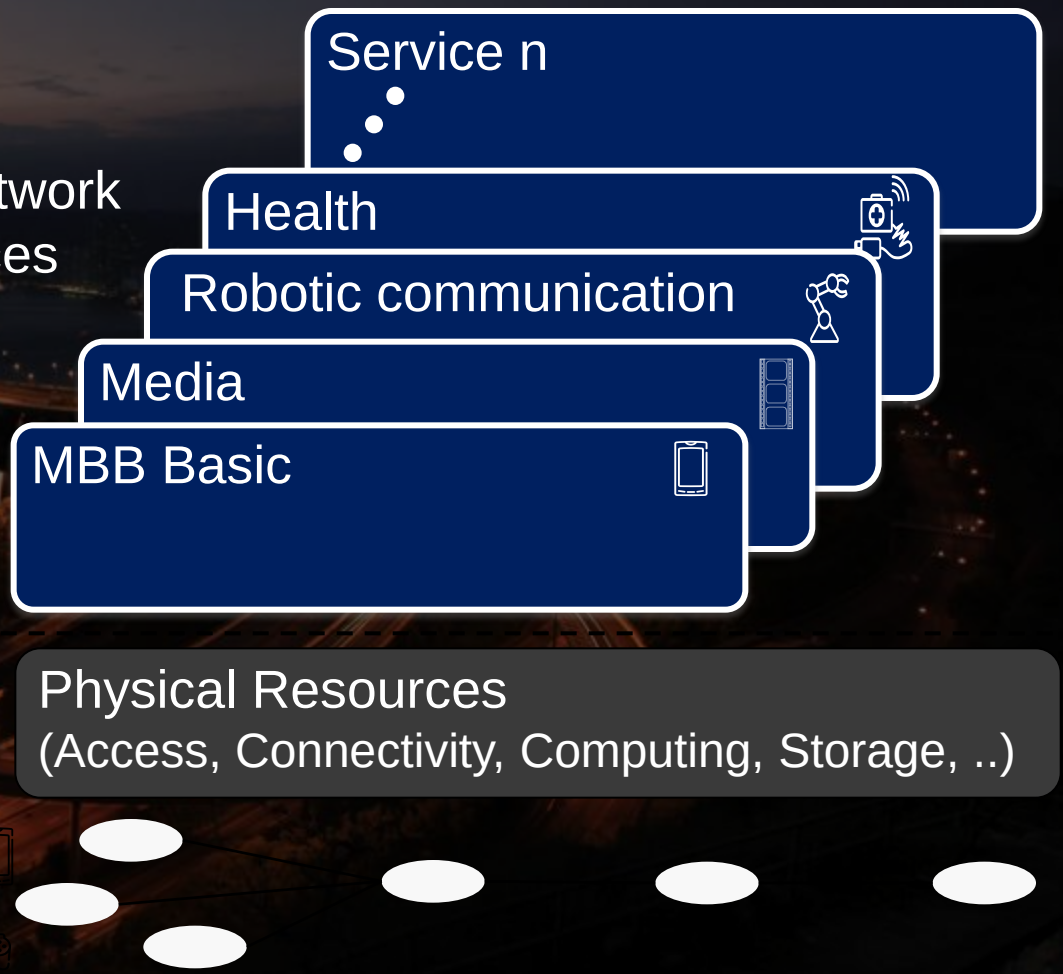
NETWORK AS A PLATFORM & ITS CORE COMPONENTS

5G: THE NETWORK AS A PLATFORM

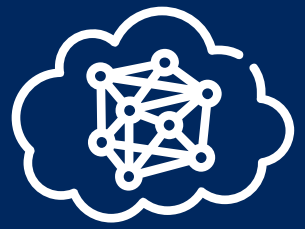
Moving away from dedicated physical networks and resources for different applications

To a “Network Factory” where new networks and architectures are “manufactured by SW”





DRIVERS OF CHANGE IN THE CORE NETWORK



Efficiency & Effectiveness

"Radically simplified network"

Speed & Agility

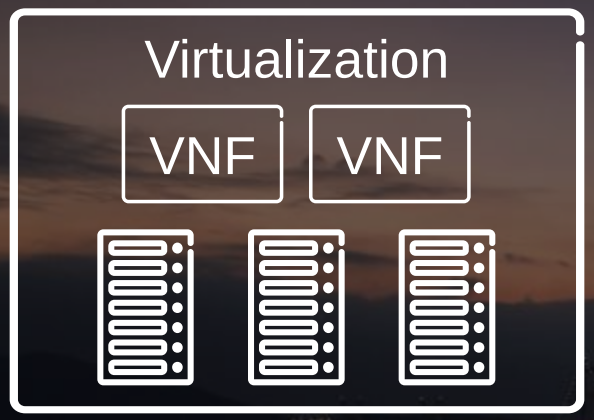
"Bring products to market much quicker"

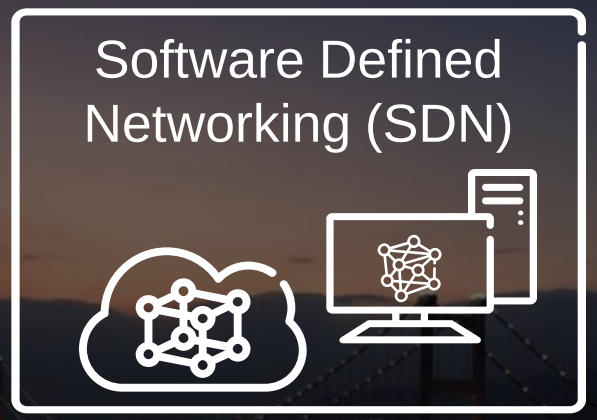
Innovation & Superior performance

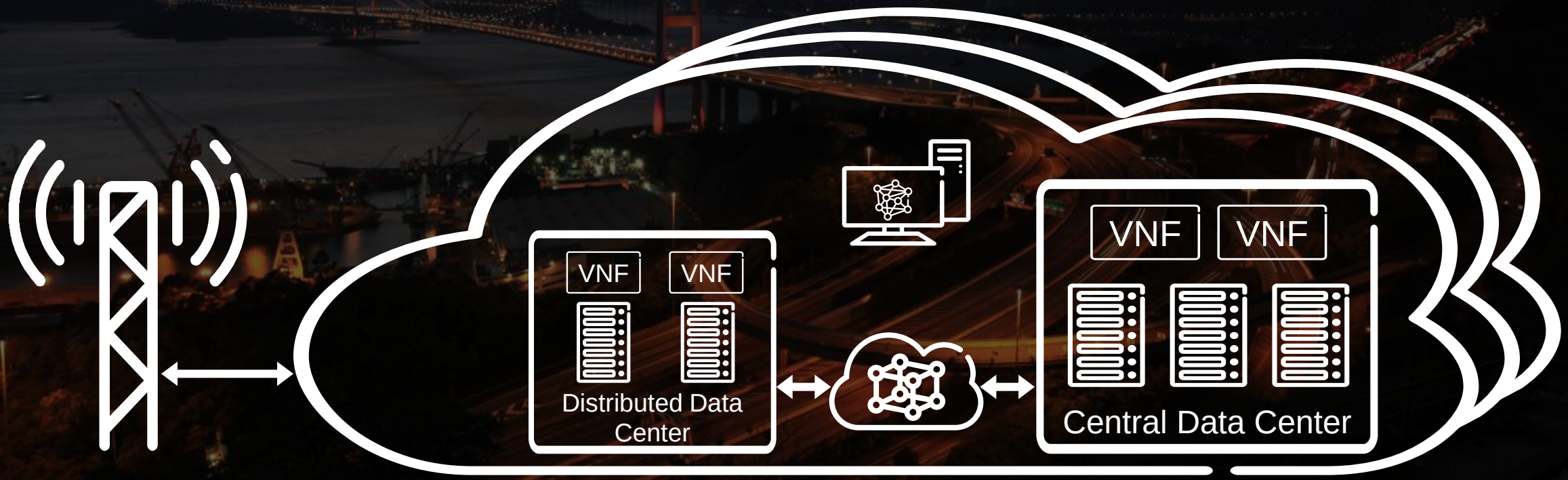
"Providing cloud services to enterprise"

AND, THE ECONOMIES OF SCALE AND SCOPE

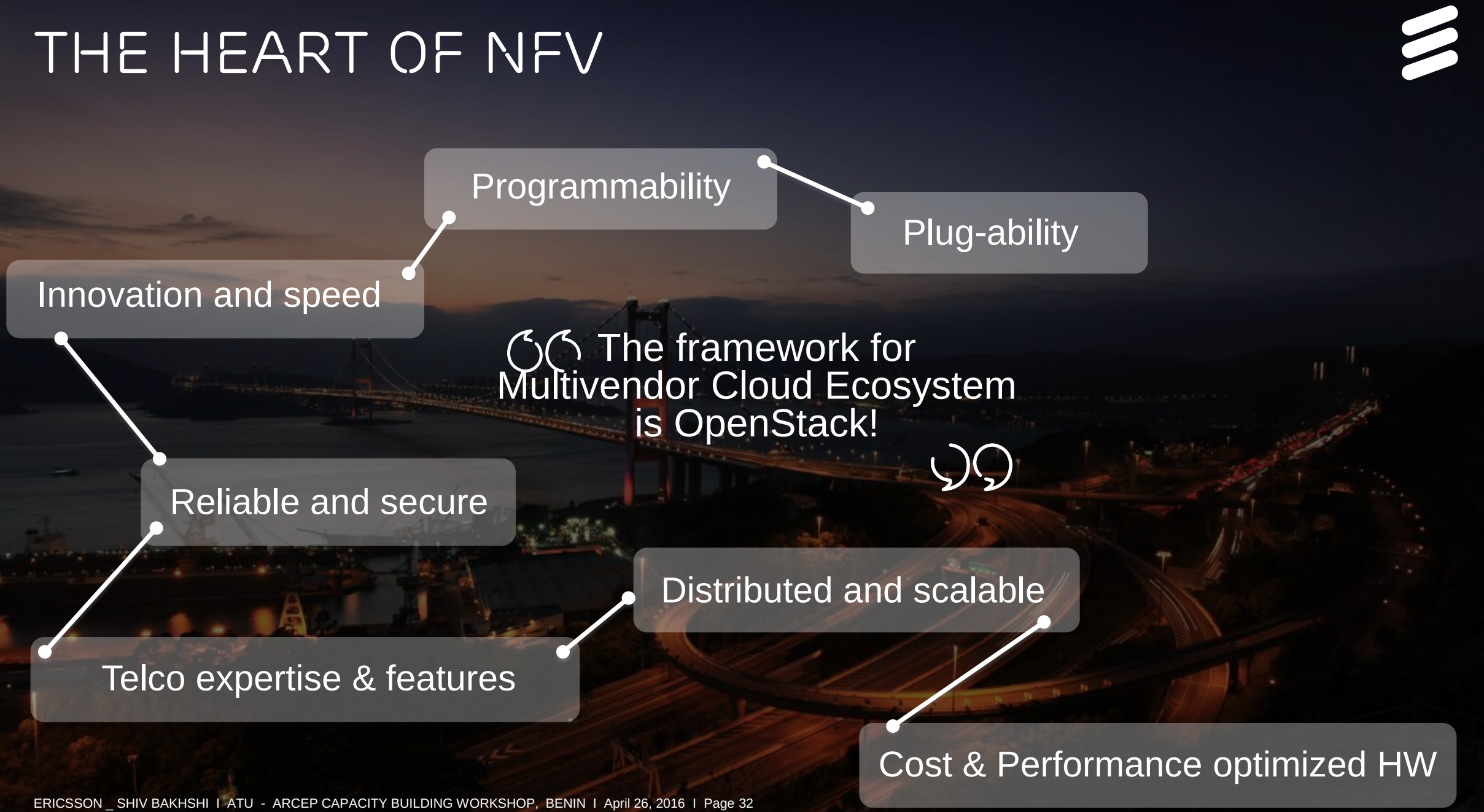
THE KEY CORE COMPONENTS







THE HEART OF NFV



SDN: KEY CHARACTERISTICS

New Capabilities

API / Exposure

Split Control

& Data plane

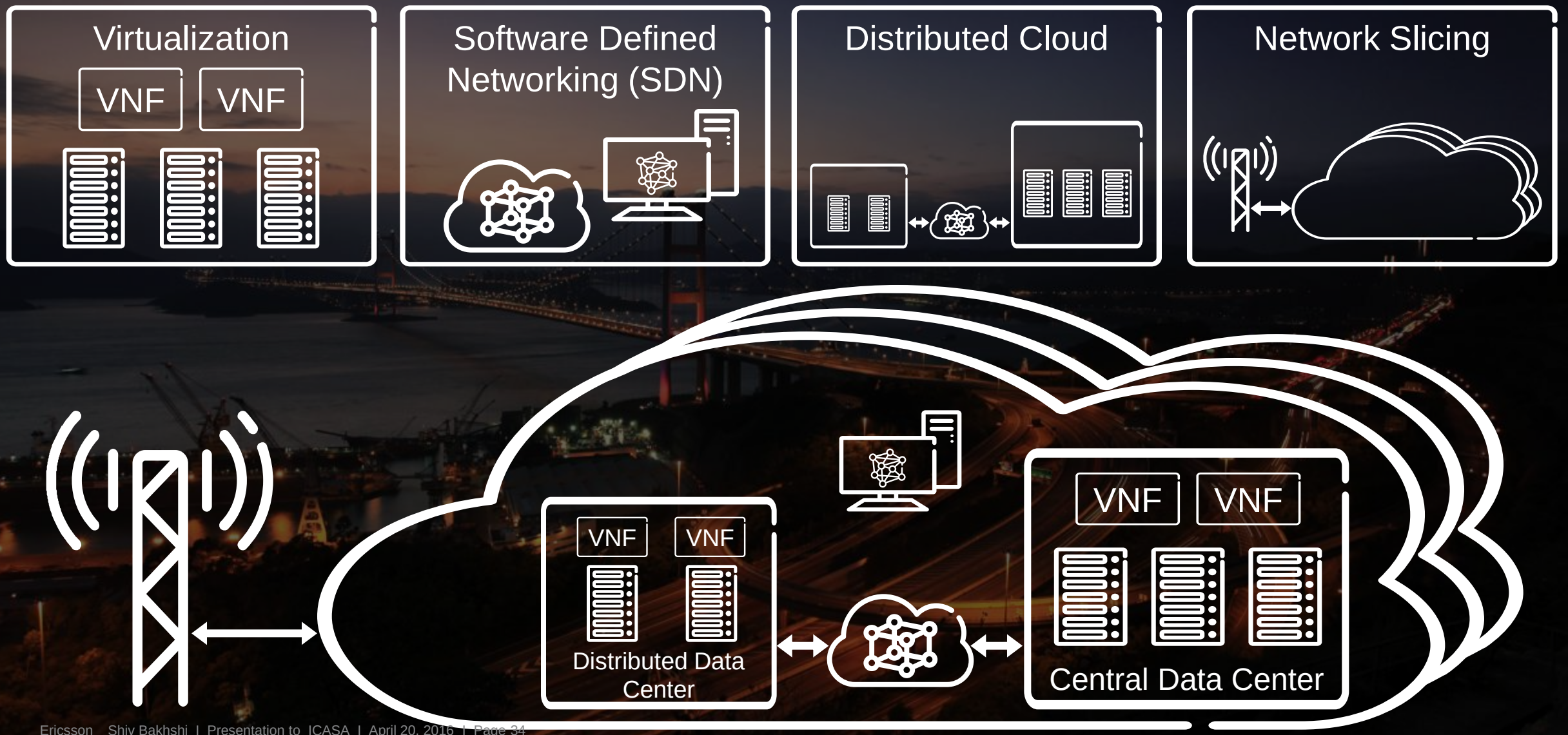
Network Function

Virtualization Enablement

Rigid, inflexible (wireline) networks with manual provisioning, static configuration and massive TTM for new services

“Software driven” programmable, agile networks with capacity sharing, RT configuration/provisioning and on-demand service creation (without truck rolls)

THE KEY CORE COMPONENTS/RECAP



5G RADIO COMPONENTS

THE KEY RADIO COMPONENTS

Flexible and scalable design

Spectrum

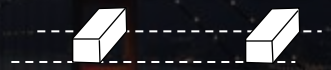
Deployment

Use cases

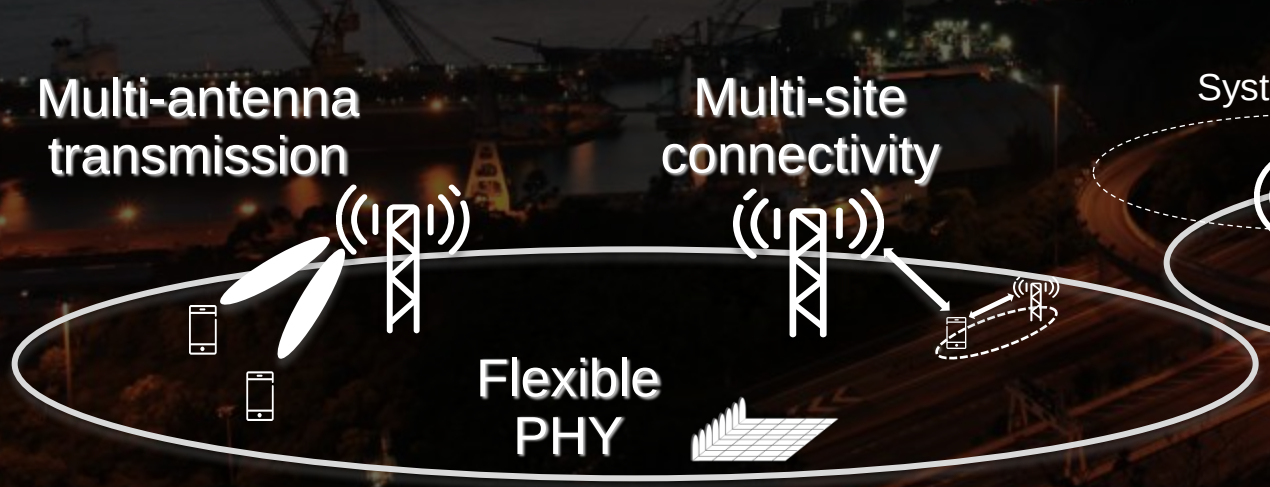
Extension to higher frequencies

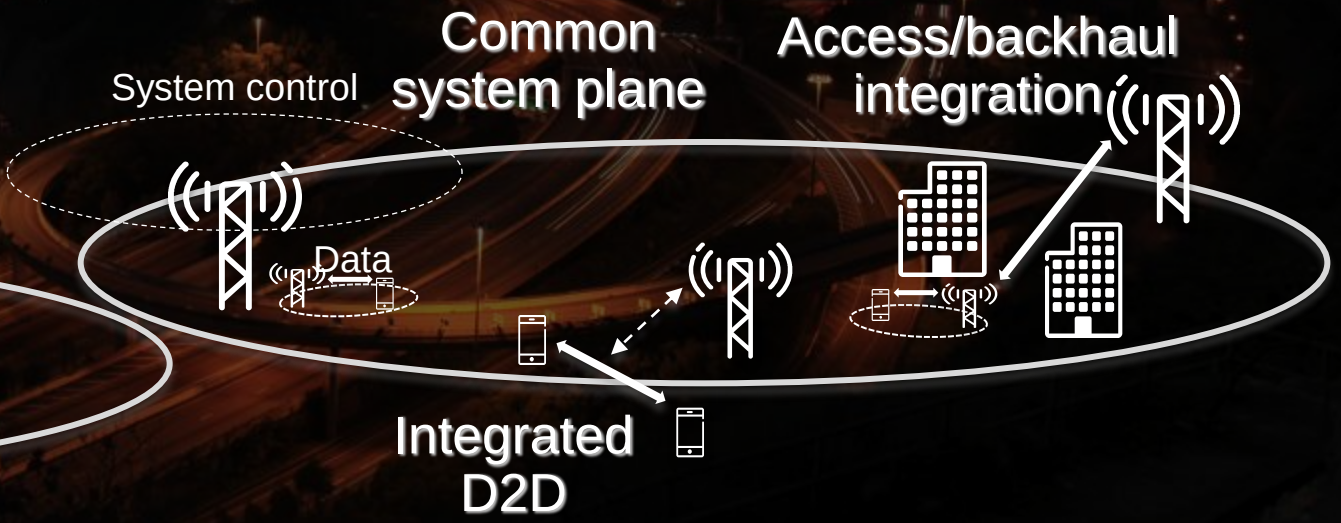
Licensed and unlicensed spectrum

Ultra-lean design



Minimize network transmissions
not directly related to user data delivery

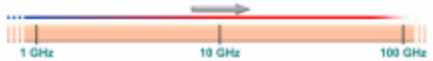




5G KEY RADIO TECHNOLOGY AREAS

Extension to higher frequencies

Complementing lower frequencies for extreme capacity and data rates in dense areas



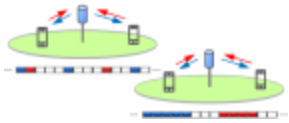
Spectrum flexibility

Spectrum sharing

- ***Unlicensed***
- ***Shared licensed***
- ***Network sharing***

Complementing dedicated licensed spectrum

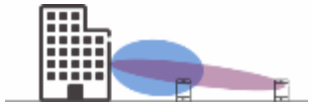
Duplex Flexibility



Multi-antenna technologies

For higher as well as lower frequencies

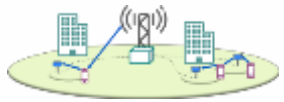
Beam-forming for coverage



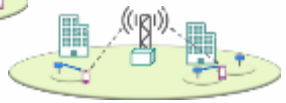
Multi-user MIMO for capacity

Multi-site coordination

Multi-site transmission/reception



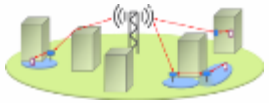
Multi-layer connectivity



Access/backhaul integration

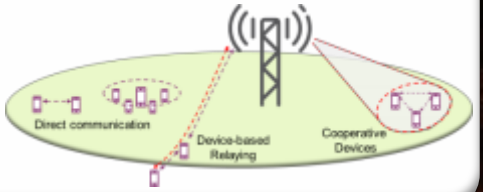
Same technology for access and backhaul

Same spectrum for access and backhaul



Device-to-device communication

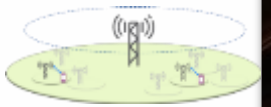
Direct communication
Device-based relaying
Cooperative devices



Ultra-lean design

Minimize transmissions not related to user data

Separate delivery of user data and system information



Higher data rates and enhanced energy efficiency

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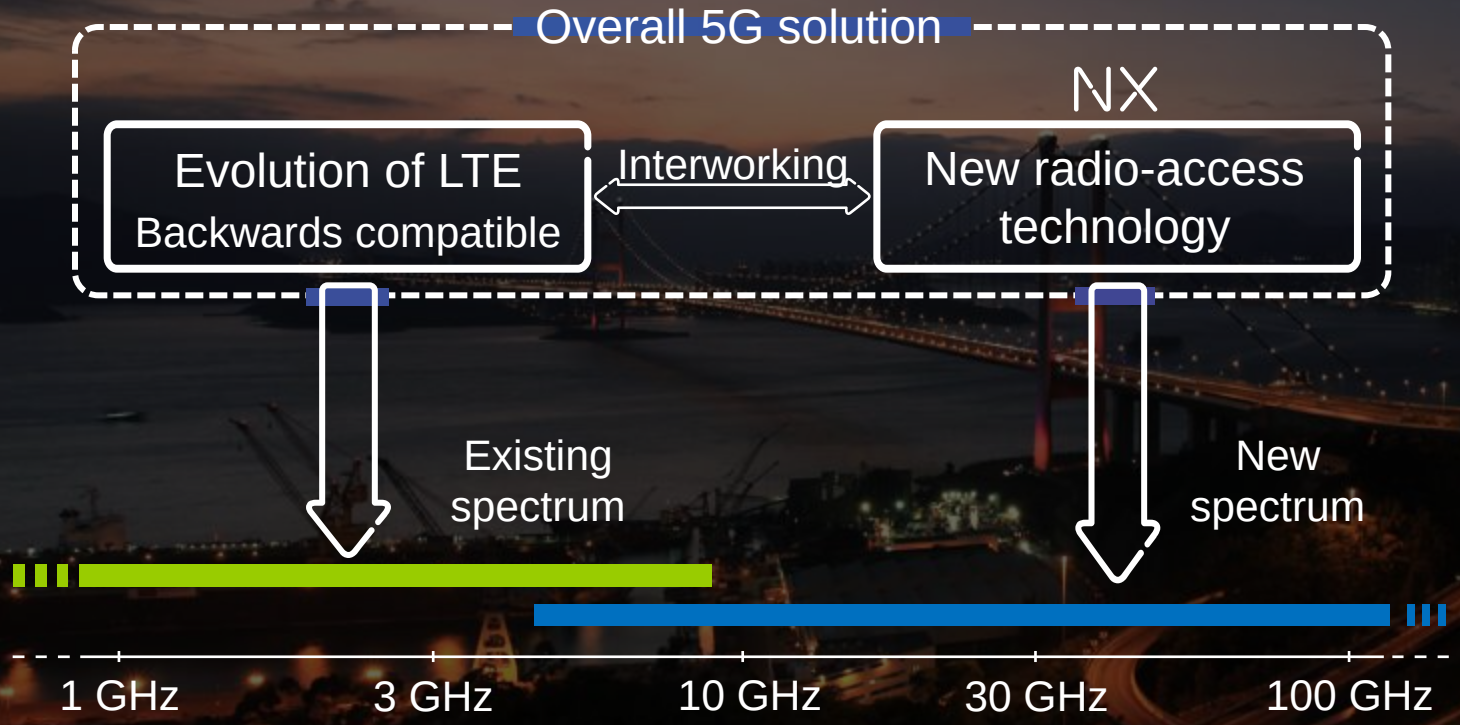
5G & FIVE AREAS OF EXTREME IMPORTANCE

WIRELESS ACCESS & SPECTRUM



Spectrum flexibility

Flexible duplex	Dedicated Licensed Spectrum
FDD and TDD	Complimented with spectrum sharing
Dynamic TDD	Unlicensed
Full Duplex	Shared licensed

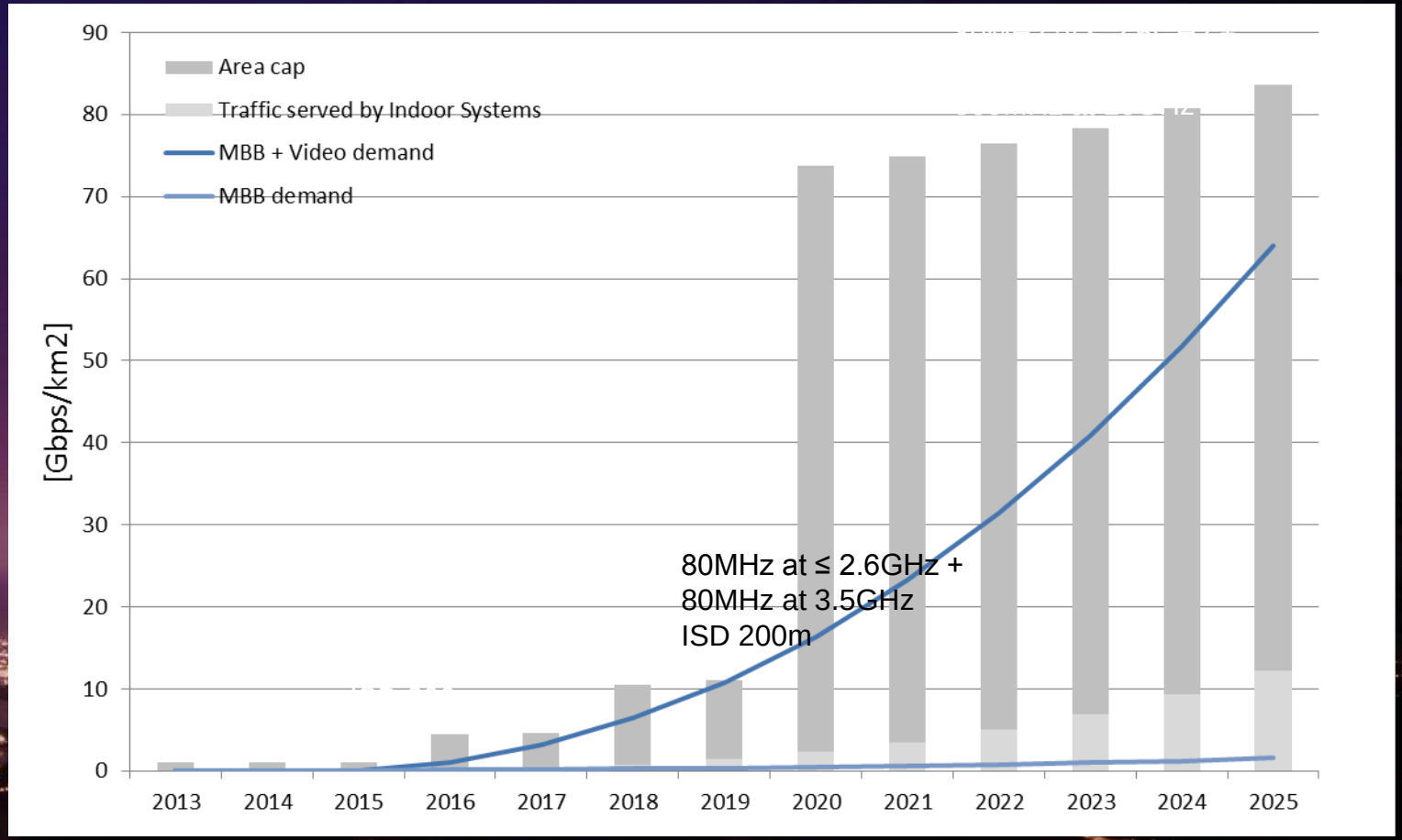
Significant effort required regionally and globally for the required New Spectrum

SPECTRUM APPROACH

- Global & regional harmonization of spectrum is key
- More licensed spectrum bands to be added
- Capacity and Coverage considerations for bands eg. LTE-A vs NB-IoT
- Complement licensed (anchor) with unlicensed bands eg. LAA
- Bring 3GPP radio technology into unlicensed bands eg. MuLTEfire
- Multi access connectivity across 3GPP & Non-3GPP
- Performance (Interference, capacity, coverage etc) key driver
- Device ecosystem influences deployment

EXTREME NETWORK CAPACITY

- Demand
  - Mobile broadband plus 25% penetration for 4k video 3hrs per evening*
  - 10Mbps with 95% probability
- Met with
  - Refarming < 3GHz
  - 80MHz at 3.5GHz
  - 500 MHz at ~10GHz
  - Carrier aggregation
  - Densification x4.25



Low-rise, European scenario with 10 000 subscribers/km2, baseline ISD 425m, 1500subs/site
Note: all spectrum below 2.6GHz modeled at 2.6GHz
*) 4k usage increasing from 0 to 100% from 2015 to 2025

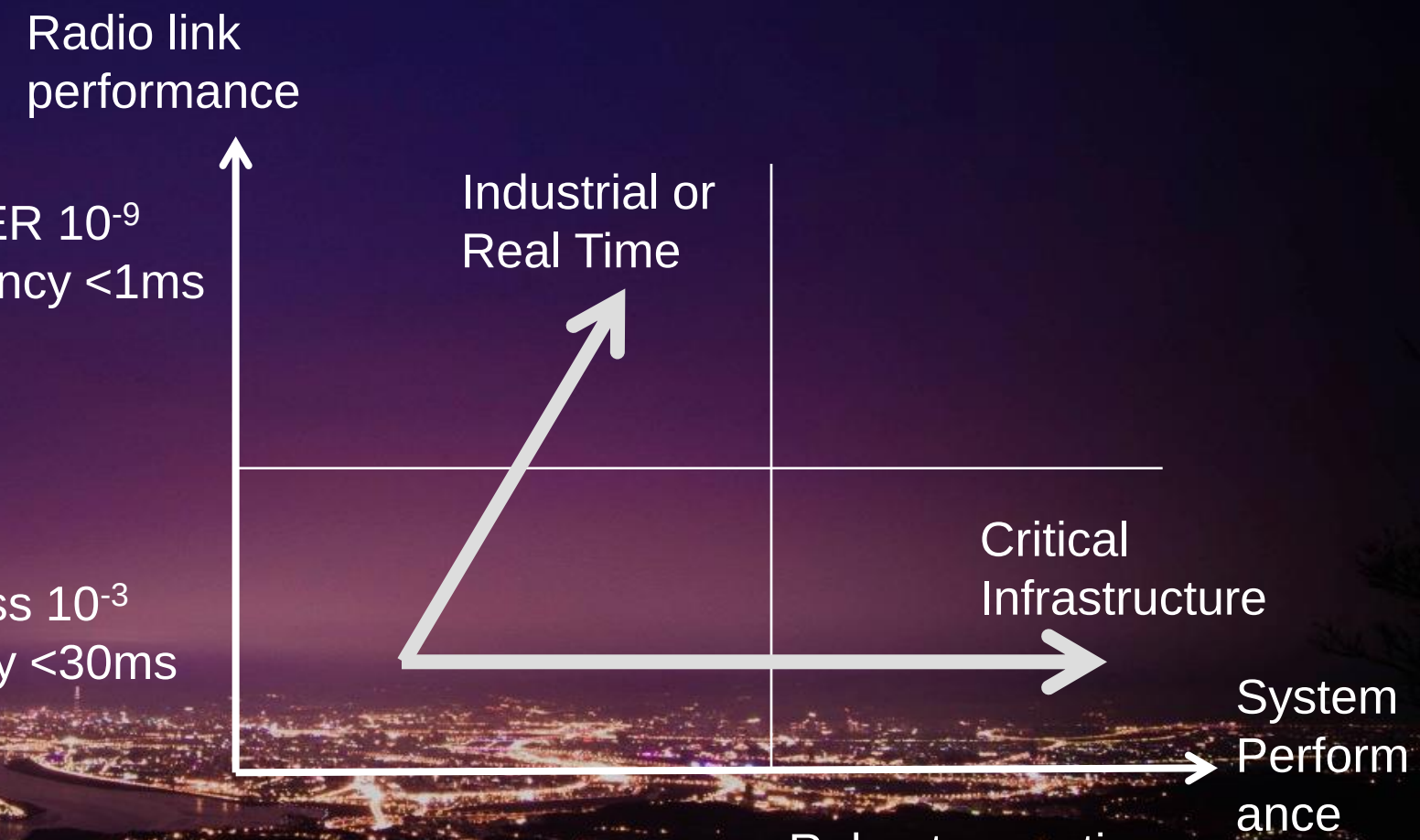
EXTREME NETWORK COVERAGE

Outdoor and indoor, Wide area and venues, Public and private

- 99% global population coverage
- Full indoor coverage
- Coordinated heterogeneous networks
- Flexible deployments; macros to picos stationary and moving platforms
- M2M control in factories
- 1 msec latency
- No reliance on ARQ
- Spatial and frequency diversity

EXTREME RELIABILITY

- Coordination
  - Spatial diversity
  - Multi-hop/Mesh
  - Network coding
  - D2D
  - Interference cancellation
  - Spectrum use
  - Channel coding



MACHINE TYPE COMMUNICATIONS

Critical Communications

<5ms e2e delay
99.999% transmission reliability
500Kmph relative velocity

Extreme availability

Massive Communications

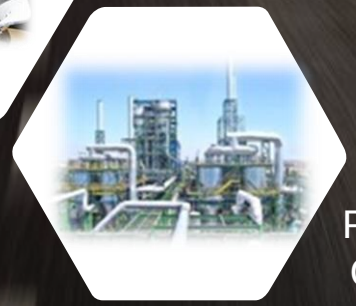
>10yrs battery lifetime
>80% cost reduction
20dB better coverage

Scalability and flexibility

Intelligent Transport Systems

Connected Sensors

Autonomous Cars



Process Control

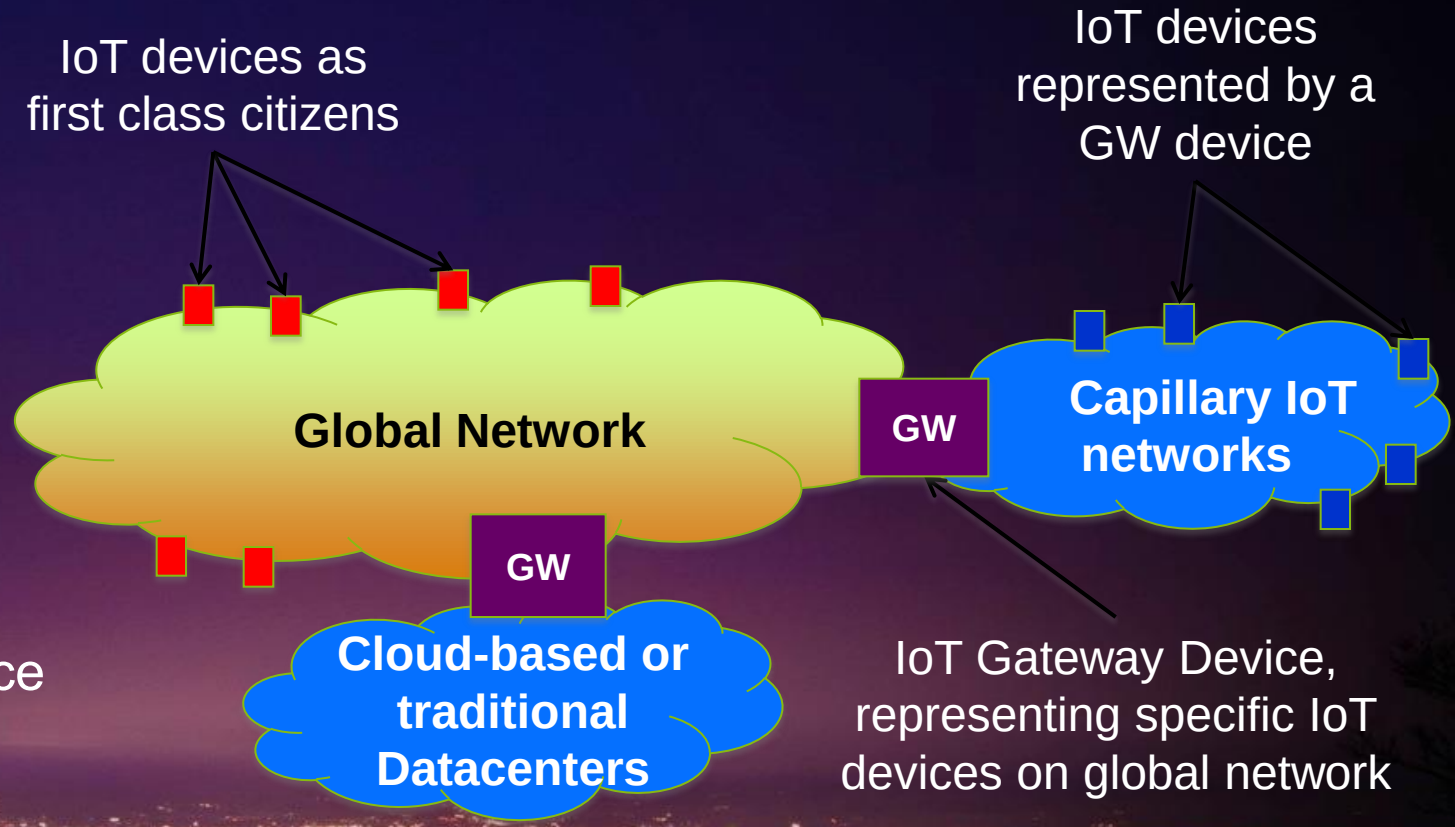
Energy Meters

Logistics Tracking

IoT SECURITY

- Layered identification
- Communication security
- Security policy

- IoT Ecosystem interaction
  - Processors, OS's, Platforms, Device types, Communication/Security Protocols, APIs, Interoperability



5G: SUMMING UP

5G Network Evolution to Meet Expectations

Sustainability

Management & Orchestration

Radio Access

Applications

Cloud Infrastructure

IP Infrastructure

Security

Scope for 5G

5G JOURNEY IN THE INDUSTRY

Builds on LTE and previous experiences

Global efforts for a global standard in 2020

Challenging 5G system requirements

Open platform for industry eco-system to leverage

AND, NEW SPECTRUM WILL BE KEY

DRIVING 5G FORWARD

5G PARTNERING ANNOUNCED WITH 21 OPERATORS. OVER 50 ECOSYSTEM PARTNERS

DRIVER OF GLOBAL STANDARDIZATION INITIATIVES: METIS I+II AND INDUSTRY ALIGNMENT

15 INDUSTRY PILOTS FOR DIGITALIZATION OF INDUSTRIES

5G

5G TECHNOLOGY FIRSTS: 5 GBPS THROUGHPUT – JUNE 2014

5G RADIO TEST BED FIELD TRIALS 2016 - DELIVERING 25 GBPS WITH BEAM FORMING AND MIMO

5G TECHNOLOGIES ARE ALREADY IMPROVING 4G NETWORKS

5G READY CORE TEST BED: NETWORK SLICING IN TRIAL


"A VISION IS NOT JUST A PICTURE
OF WHAT COULD BE;
IT IS AN APPEAL TO OUR BETTER SELVES,
A CALL TO BECOME SOMETHING MORE."


THE FUTURE DOESN'T JUST HAPPEN
PEOPLE HAVE TO BELIEVE IN IT
AND WORK TO MAKE IT HAPPEN
IT'S TIME TO LIGHT UP AFRICA


ERICSSON