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5G and Challenges in Its Support of UHD Media: A View from the WWRF

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Outline

- Vertical industries with UHD media will thrive in 5G networks media
- HD content a natural manifestation of user engagement and +ve experience
- Vertical industries and telecom convergence
- ITU's visions and requirements on 5G
- Introduction of WWRF: : Its role in 5G for vertical industries and UHD media
- VIP(Vertical Industry Platform) at WWRF – A new platform to enable 5G ar content

5G: enabling internet of human and things rich with HQ content

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Internet of Things (IoT):
Personal Area Networks
(PAN)
A Parallel Universe

Vertical industries will thrive in 5G era delivering HQ apps/content with outstanding UX

2G → 3G → 4G → 4.5G → 5G

Voice | Data | Rich data

Machine type communication

Internet of human and things

Human-centric Communications

Human + Machine Communications

5G: convergence of telecom & vertical industries

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5G: Many Vertical Application Areas

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Range of Requirements

Aviation

Banking

Construction

Food & Agriculture

Healthcare

Manufacturing

Mining

Retailing

Port & Shipping

Public Security

Oil & Gas

Transportation

Water Processing

Wearable

Organizations for vertical industries
And fragmentation of requirements

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We still have one thing missing here …

5G KEY TO REVOLUTIONIZING INDUSTRY AND SOCIETY

New research outlines how 5G can transform a broad range of vertical sectors including automotive, transportation, healthcare, manufacturing as well as media and entertainment

BARCELONA - At the Mobile World Congress 2016 in Barcelona, the European Commission and the 5G Infrastructure Association have launched today the 5G Public-Private Partnership whitepaper entitled **“5G Empowering Vertical Industries”**, which outlines how 5G network infrastructures will enable the digitalization of society and economy, leading to the fourth industrial revolution, especially in the automotive, transportation, healthcare, energy, manufacturing as well as media and entertainment sectors.…….

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"Once video gets on the Internet… I'm stunned how people aren't seeing that with TV, in five years from now, people will laugh at what we've had."
–*Bill Gates, Davos Forum January 2007*

"And this is really why YouTube is so important. It was started as a TV channel for everyone…but it has grown into a far more powerful medium where it is now the first port-of-call for anyone seeking video content."
Computer Weekly

Kelsey Group study - *55% of people who view a video visit the company's website, 30% visit a physical store, and 24% make a purchase as a result of watching*

The world has moved on to HDTV and now moving to UHD video, AR, VR, and 3D!

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- Huge flood of online video
  - 36 hours video uploaded to Youtube every minute
  - Cisco predicts by 2016 96% of Internet traffic to be online video

Internet video to surpass broadcast TV by 2020 (Source: Diffusion group)

5G - Main Key Drivers

- IoT
- Big Data
- OTT
- Smart Phones & Tablets
- UHD TV & Virtual Reality
- Cloud Services
- TV Everywhere
- Online Games & Applications
- M2M & D2D
- IPv6
- QoE & QoS
- Ubiquitous

Google

iTunes

NETFLIX

ULTRA HD
Ultra High Definition

YouTube

amazon

5G UHD Everywhere, Paulo Sergio Rufino Henrique, Brunel University, 2015

What is UHD & TV Everywhere

	Compression / Bit Rate		Resolution / Frame Rate	UHD Experience
HD Legacy	H.264 MPEG-4 AVC	6 Mbps	1920 *1080(i)*30fps	Poor Quality
TrueHD	H.264 MPEG-4 AVC	8 Mbps	1920 *1080(p)*60fps	Enhanced Quality
4K	HEVC	10 Mbps	4096 *2160(p)*30fps	4K Quality
Ultra HD1	HEVC	15 Mbps	3840 *2160(p)*60fps	UHD Quality
Ultra HDx	HEVC	20Mbps	3840*2160(p)*120fps	Ultimate Quality

UHD ≠ 4K

5G UHD Everywhere, Paulo Sergio Rufino Henrique, Brunel University, 2015

Major Service Scenarios with 5G

From Samsung 5G Vision white paper, February 2015

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Why bring verticals into telecom ?

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- Maximize the value of the telecom networks
  - Monetize the telecom network → **Create new services**
  - Reuse the existing infrastructure as much as possible → **Environment-friendly**
  - Virtualization and resource sharing among different verticals → **Environment-friendly**
  - High quality content/apps productivity and longer sessions -> **Increase UX and revenue streams**

Telecom

Airport

Banking

Construction

Food & Agriculture

Healthcare

Manufacturing

Mining

Retailer

Port & Shipping

Public Security

Oil & Gas

Transport

Water / Wastewater

Wearable

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ITU's visions on 5G (IMT-2020)

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Source: Document 5D/TEMP/625-E, ITU 22nd Meeting of Working Party 5D, San Diego, USA, 10-18 June 2015

ITU's requirements on 5G (IMT-2020)

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Enhancement of key capabilities from IMT-Advanced to IMT-2020

The importance of key capabilities in different usage scenarios

Source: Document 5D/TEMP/625-E, ITU 22nd Meeting of Working Party 5D, San Diego, USA, 10-18 June 2015

A lot of uncertainties in 5G vertical requirements

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Scenario	Enhanced Mobile Broadband			Massive Machine Type Communications	Ultra-Reliable & Low-Latency Communications	
	Seamless Wide-Area Coverage	Hot-spot (high traffic density)			Industry automation	V2X
Key applications	UHD video, AR & VR, etc.	UHD video, AR & VR, etc.		Smart metering, etc.	Tele-surgery, tele-presence, etc.	Self-driving car, etc.
Mobile devices	Smartphones, wearables	Phablets, tablets, laptops		Sensors, wearables	Machines	Vehicles
Requirements						
Data rate (peak)			10~20Gbps	1K~1Mbps	1K~1Mbps	1K~1Mbps
Data rate (cell edge)	100M~1Gbps	100M~1Gbps	100M~1Gbps	1K~1Mbps	1K~1Mbps	1K~1Mbps
Area traffic capacity			10Mbps/m^2	[???]	[???]	[???]
Latency (E2E)	1~10ms	1~10ms	1~10ms	10ms~hours	1ms	1~10ms
Coverage	Large	Small	Small	Very large	[???]	[???]
Power consumption (battery life)	1 day ~ 1 week	1 day ~ 1 week	1 day ~ 1 week	⩽ 10 years	[???]	[???]
Mobile speed	⩽ 500km/h			[???]	[???]	⩽ 500km/h
Connection density				10^6/km^2	[???]	[???]
Cell average spectrum efficiency	[3+]*(IMT-A)			[???]	[???]	[???]
Network energy efficiency	100*(IMT-A)			[???]	[???]	[???]

Vertical Industries

- Requirements for vertical industries are still vague
- That's where ***VIP-WGs*** come in

VIP-WG: Vertical Industry Platform — Working Group

Challenge of 5G Infra:
Building puzzles to deliver end goals and vision

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WWRF (Wireless World Research Forum)

WIRELESS WORLD RESEARCH FORUM®

- Develop future vision of the wireless world
- Enable and facilitate the translation of the vision into reality
- Bring a wide range of parties together to identify and overcome significant roadblocks to the vision
- Inform and educate on trends and developments

- Global operation
- Covers every technical field of wireless communications and mobile networking
- Open to all
- Based on membership

70 member organizations

WWRF to drive 5G via VIPs

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- Bring new members into Steering Board: More key 5G players, vertical industry operators and vendors, auto makers, …

- Create VIP as a pre-standardization platform
- Seed and cultivate new technologies
- Target the convergence of telecom and vertical industries
- Proposal of VIP-WG is open to any company or organization

WWRF publications and activities

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Recent white papers and books

- LTE Small Cell Enhancement
- User 2020 – a vision
- User perspectives on social networking
- Smart cities and ageing populations
- Cybersecurity for the Future Internet
- Mobile in Africa

Work in progress

- 5G Vision
- 5G Radio technologies
- Mobile in India

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Why WWRF for VIP?

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- WWRF is a ***mature*** international organization
  - Full-fledged charters and bylaws
  - Diversified members from both industry and academia
  - … …
  - In a nutshell, ***a platform with very good infrastructure !***

- WWRF's targets
  - where new ideas / concepts are announced to the world → **World leading forum**
  - where industry meets academia → **5G pre-standardization platform**
  - where telecom industry meets vertical industry → **5G pre-standardization platform**
  - where CT (communication tech) meets IT (information tech) → **Convergence of IT and CT**

- On the ***5G pre-standardization platform (WWRF VIP)***
  - The telecom and vertical industries need to sit down to talk
  - New scenarios, use cases, requirements and technologies need to be discussed
  - Consensus needs to be built
  - …
  - Necessary preparation needs to be done before going to SDOs like 3GPP

VIP (Vertical Industry Platform): Bring needs of verticals into 5G

VIP-WGs are open to all parties that will be involved in the specification of IoT in 5G

ORGs (IT)

AIOTI ALLIANCE FOR INTERNET OF THINGS INNOVATION

oneM2M

Service / Applications

VIP-WGs

WWRF

Use cases, Requirements, Tech Analysis

SDOs (CT)

3GPP A GLOBAL INITIATIVE

ETSI World Class Standards

Visions, Scenarios & Technologies

Telecom Industry | **Vertical Industries** | **Academia**

V2X (vehicle-to-anything) - VIP

Self-driving car is NOT accident-free …
(11 accidents in 6 years for Google's self-driving car)

Safety of Transportation

An OS for cars ?

Huge demands for data

V2X
(vehicle-to-anything)

Auto and telecom engineers have different knowledge sets

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Auto Engineer:
What the heck is modulation, channel coding, TTI, … ?

?

Telecom Engineer:
I don't understand the mechanics, radar or sensors built in the car.

?

V2X Project
How to pull it off ?

V2X: vehicle-to-anything
(vehicle, infrastructure, pedestrian, …)

?

Professor:
I'm not familiar with either engineering or standard issues.

VIP-WG will bridge automotive and telecom industries

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Auto Engineer:
The response time of auto-brake has to be less than 1ms to avoid crash.

3GPP
A GLOBAL INITIATIVE

Study Items (scenarios, requirements, tech trends)

Telecom Engineer:
Well, I think we can help by shortening the TTI to 0.1ms …

VIP-WG on V2X

Professor:
Didn't you know that I have invented a ground-breaking technology?

VIA-WG

- Pre-standardization platform prior to SDOs
- Consensus building for different industries
- Sort out scenarios / requirements
- Boil down scenarios to technologies
- Seed & cultivate new technology
- Identify future trends

e/m-Health VIP WG - The Vision

Develop an e/m-Health vertical industry paradigm to expose the requirements of such systems to be 5G enabled. Get the experts from this vertical industry involved in the WWRF VIP and beyond.

- 5G networks will target:
  - low power consumption
  - cost efficiency
  - flexibility for future evolutions
- But healthcare use cases will require:
  - homogenous experience from outdoor to deep-indoor
  - higher typical throughput per user/ application
  - Smart IoT
  - High security
  - Ultra Low Cost deployments
  - Emergency management

5G timeline

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Notes:

* Proposal submission to ITU no later than June 2019
* Spec submission to ITU no later than February 2020

Upcoming WWRF major events in 2016

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WWRF #36 Meeting
June 2-3, 2016
Beijing, China

5G Huddle 2016
September, 2016
Frankfurt, Germany

WWRF #37 Meeting
September, 2016
Kassel, Germany

Join us in VIP!
Thank you !

http://www.wwrf.ch/

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