Development of Electronic Communication Networks in the Republic of Serbia

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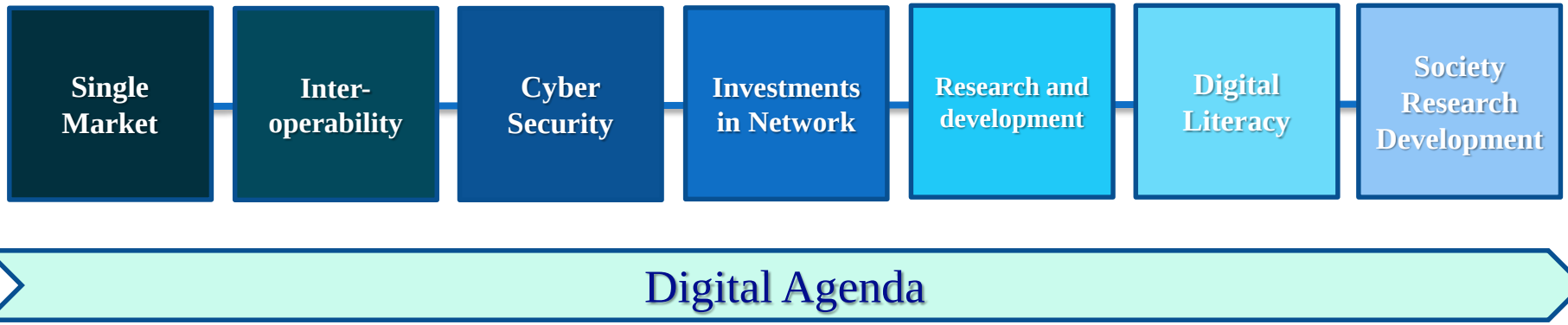
Talk overview

- Trends in ICT policy in EU - Serbian view
- Digital Single Market (Important strategic goals, ICT development indicators, Digital economy, DESI index),
- Digital Single Market Main Technologies (IoT, Cloud Computing, Big Data, Cyber Security, 5G),
- Broadband development in the Republic of Serbia (Strategy of NGA networks until 2023., Broadband Law, Main goals),
- Infrastructure broadband mapping,
- Fixed access networks-challenges in FTTx development,
- Conclusions and future activities .

Digital Agenda until 2020.



The overall aim of the Digital Agenda is
to deliver sustainable economic and social benefits
from a digital single market
based on fast and ultra fast internet and
interoperable applications.

ICT development indicators

Global competitiveness index

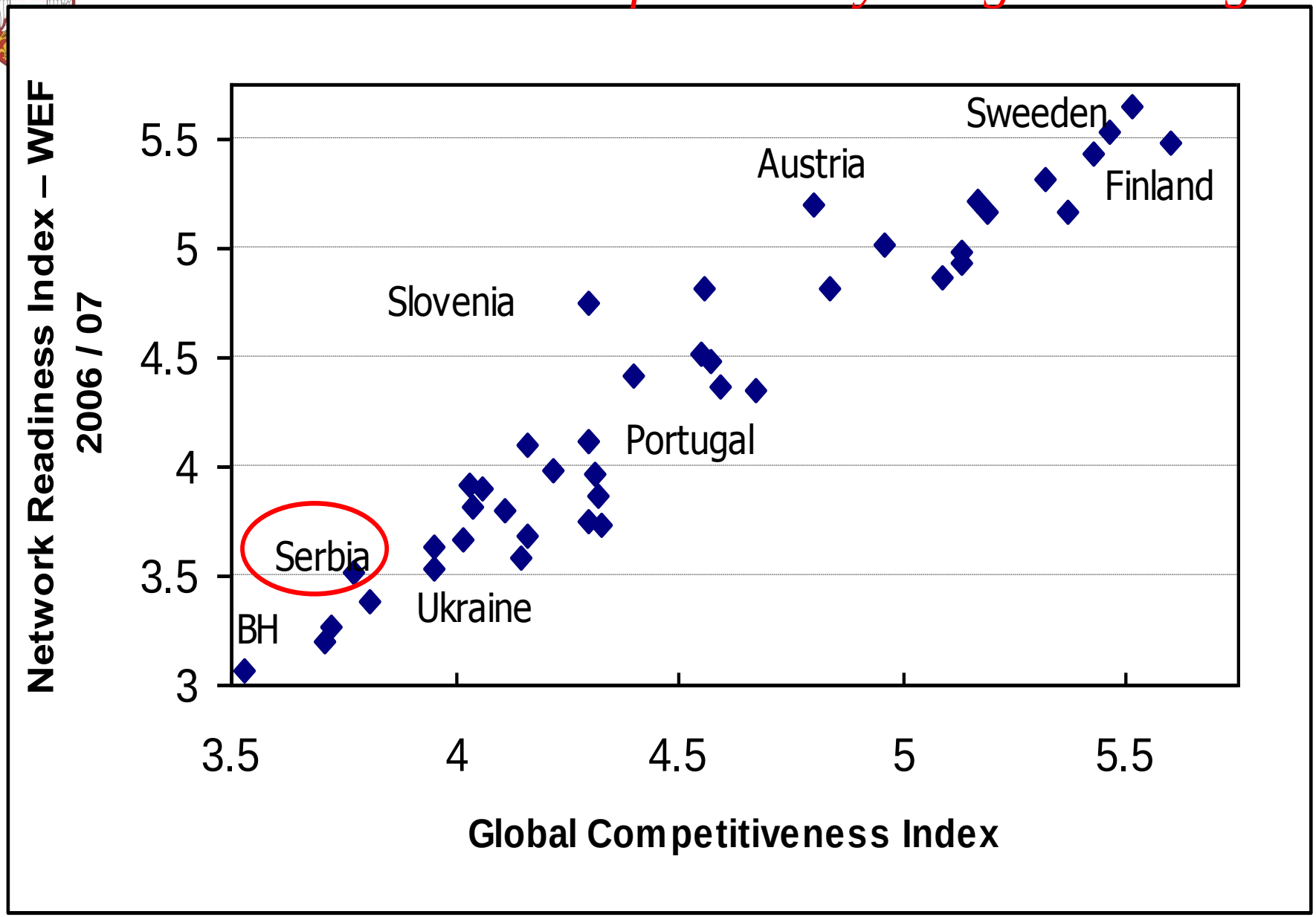
- World bank, International monetary fund Unitated nations - data

- It is being calculated according to 113 variables, within the 12 fields: institutions, infrastructure, macro economy stability, health and education as well as training, stock market efficiency, job market efficiency, sophistication of financial market, technology readiness, market size, business enterprise, innovations.
- The leverage of particular field to competitiveness varies according to level of economical growth of the country.
- Each field has its own scale factor (which may differ from country to country, according to its economical growth).

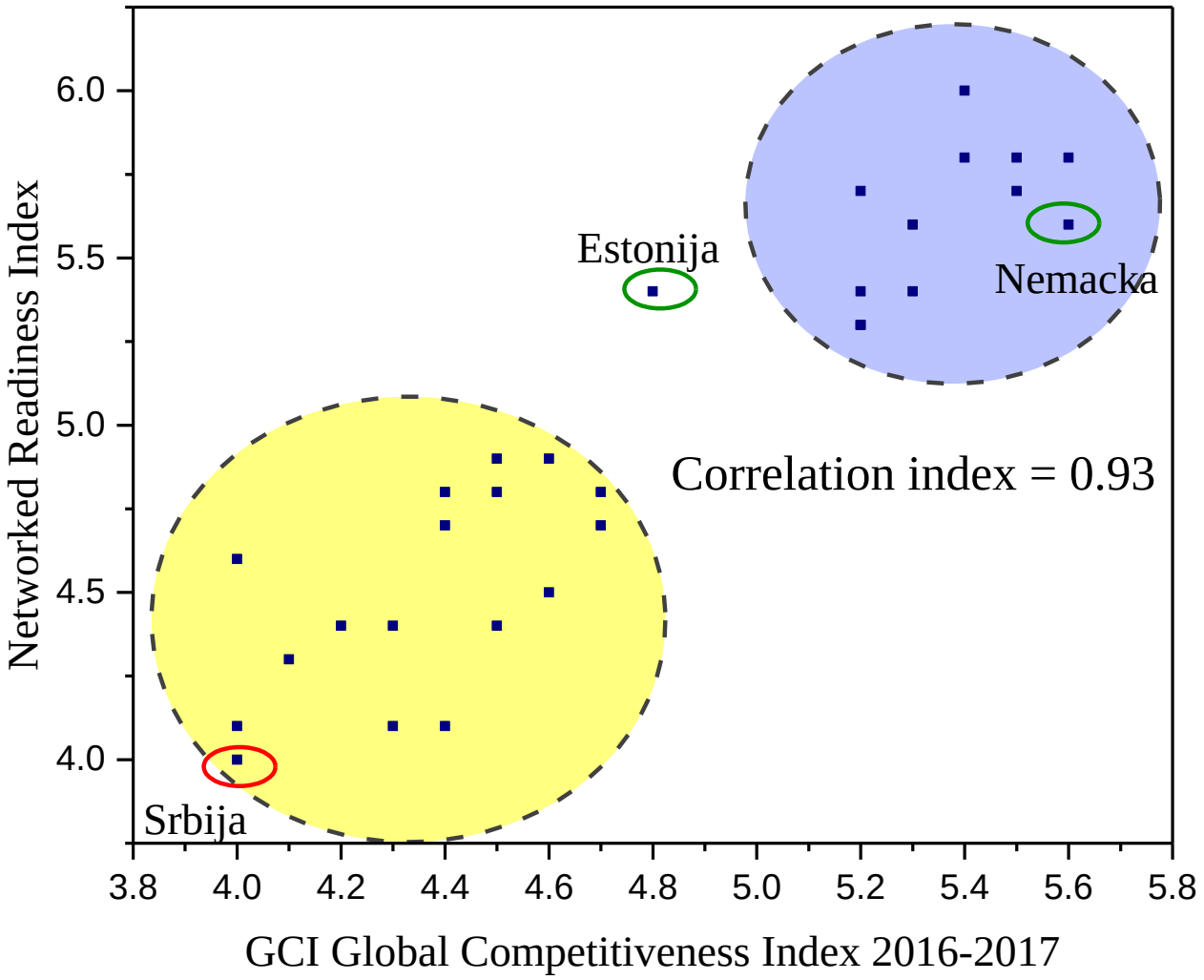
Network readiness index

- Relationship of the stakeholders in development and exploration of the ICTs (single person, enterprise, government),
- The overall macro economy and regulatory environment for ICT in which the stakeholders participate,
- The degree of ICT exploitation which depends on the level of their willingness (or possibilities) to exploit ICTs.

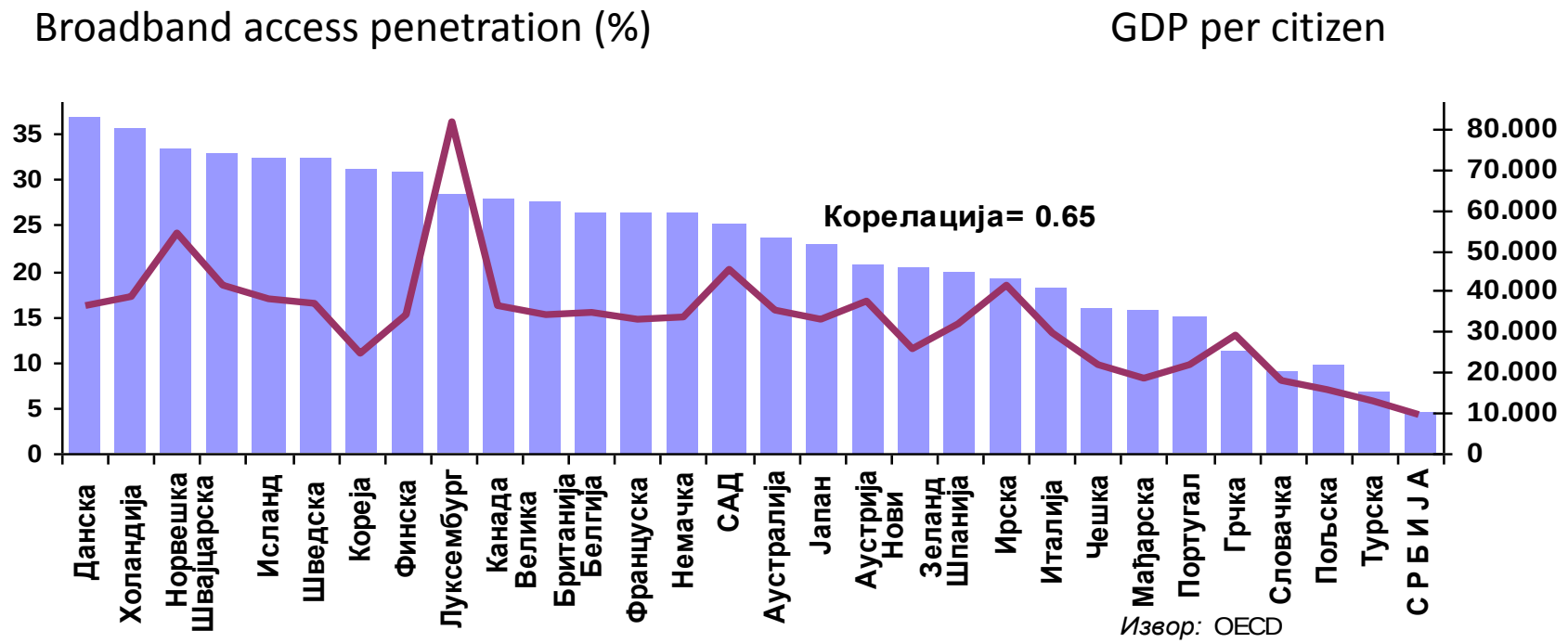
New result is better than same in 2007, unfortunately not good enough



Network Readiness Index vs. Global Competitiveness index

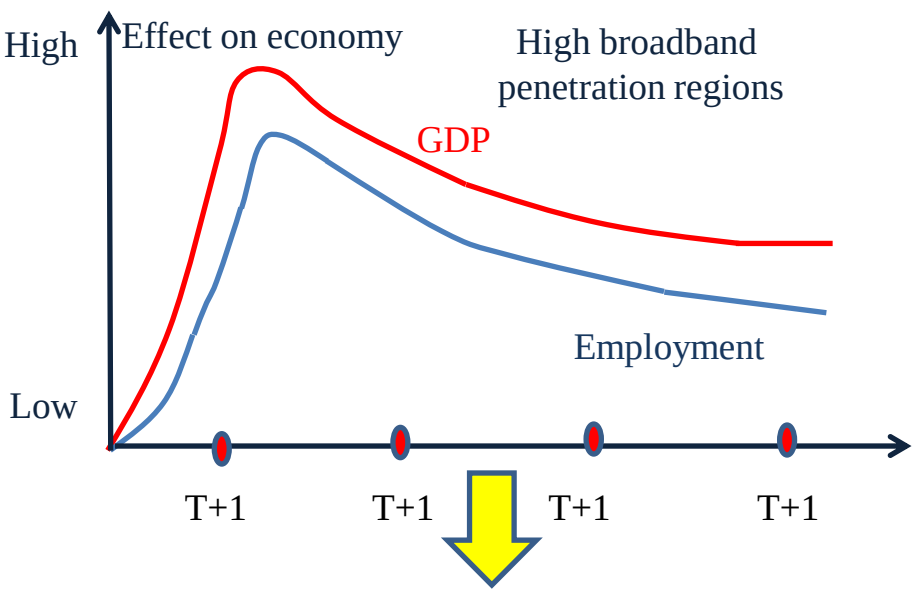


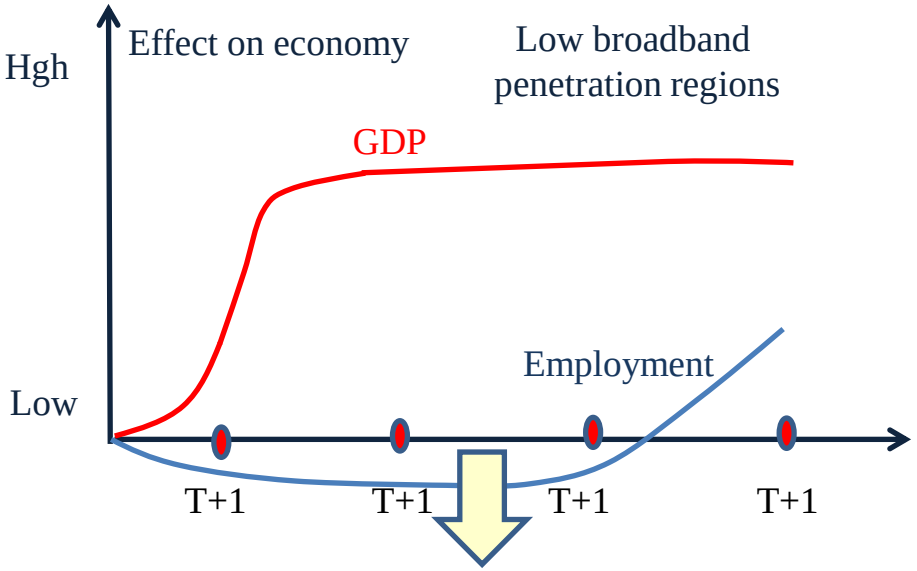
Strategy of Broadband Access



World Bank research in 2009. showed that increase of broadband penetration of 10(%) produces an increase of 1.3% of GDP.

GDP trend

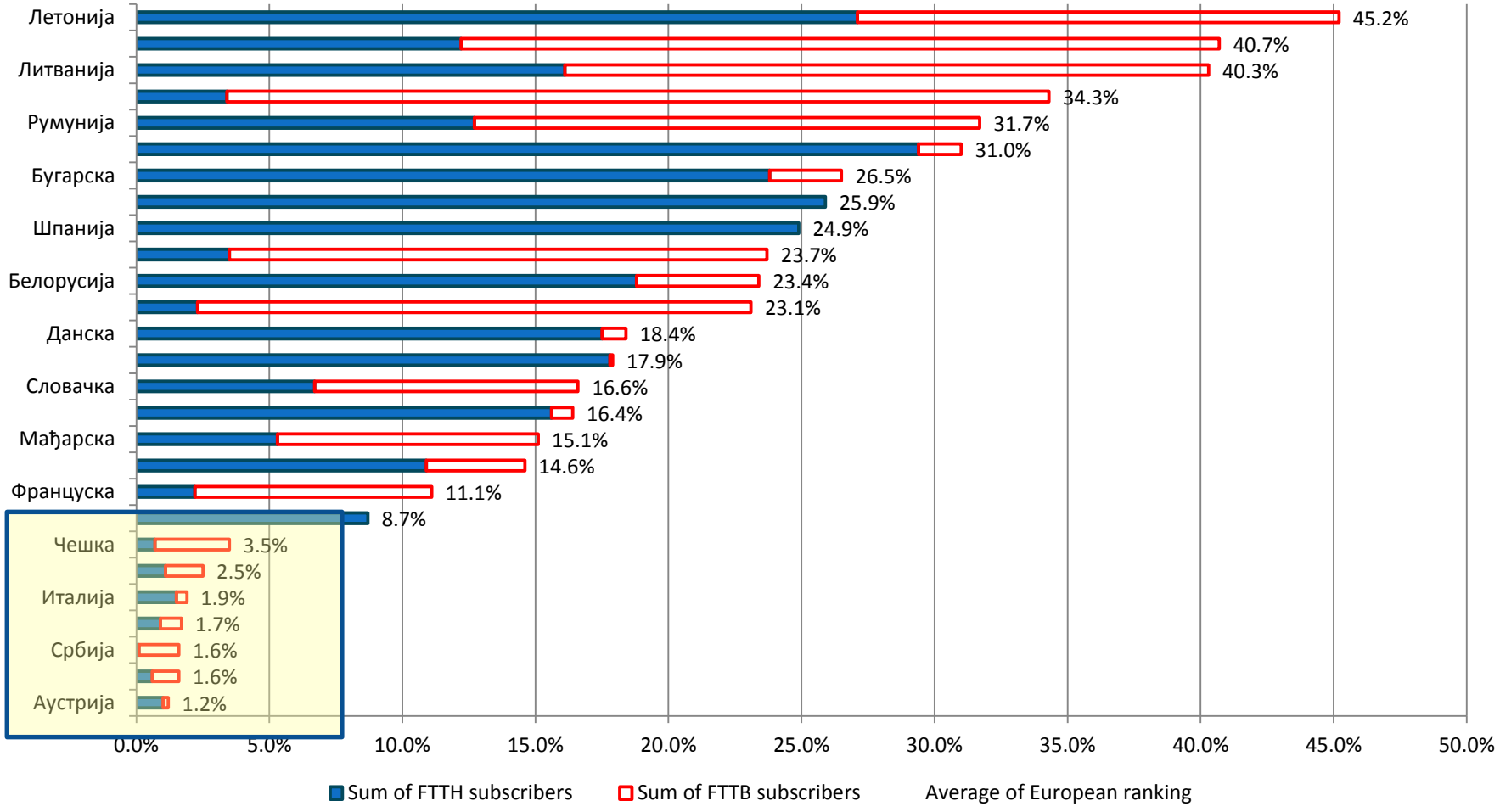




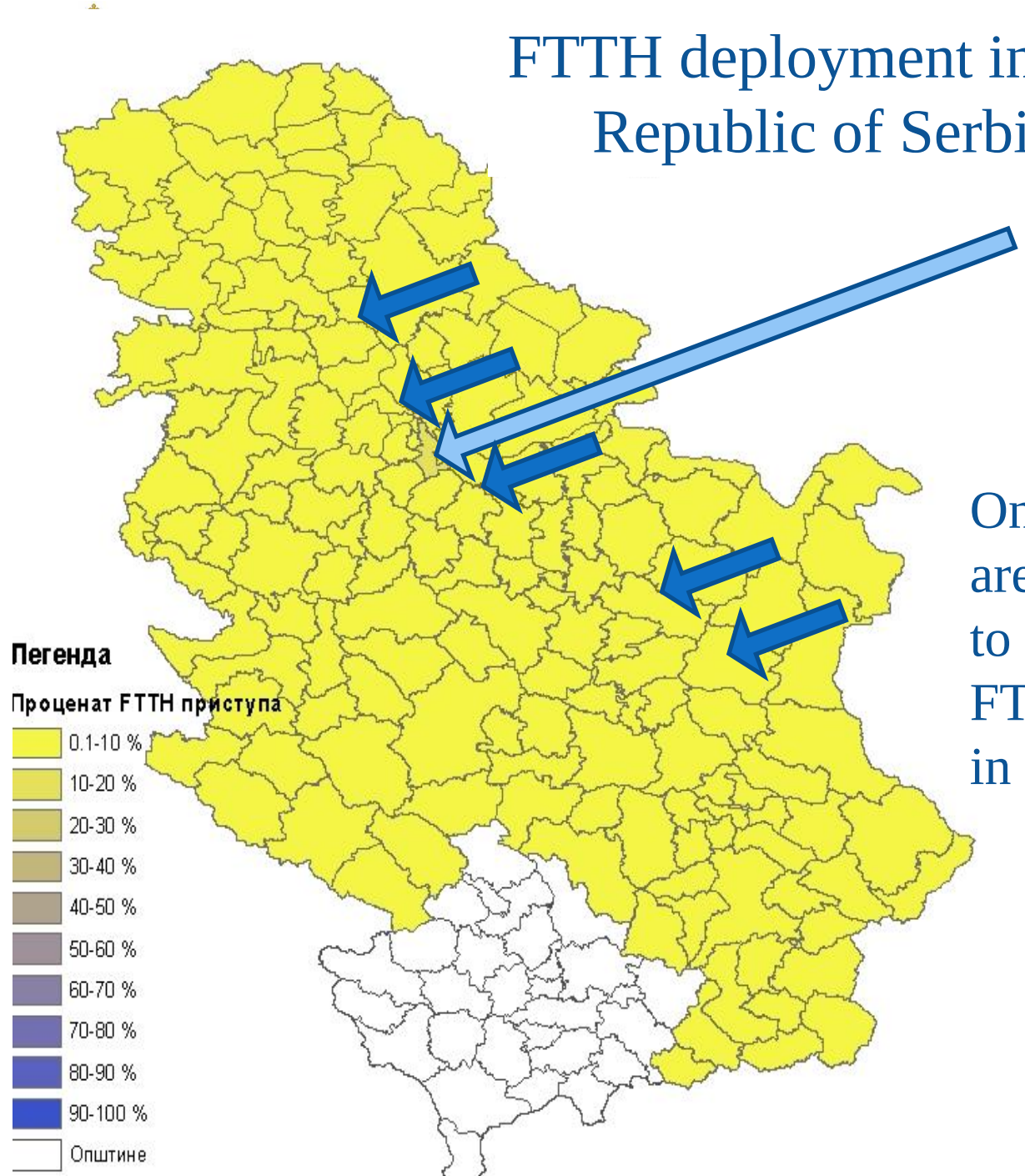
Increase in *broadband* penetration generates:
- High economical increase, that will disappear lately.
- New economical development based on new services.

Increase in *broadband* penetration generates :
- High stability in economical development (reaching the maximum).
- Company owners and employers limit the new employments.

FTTH European Council



FTTH deployment in the Republic of Serbia



One billion of households are going to be offered to subscribe for FTTH services in less than 3 years.

DESI - Digital Economy and Society Index

Digital Economy and Society Index (*DESI*)
collects different indicators
relevant for realization
of digital development in the country.

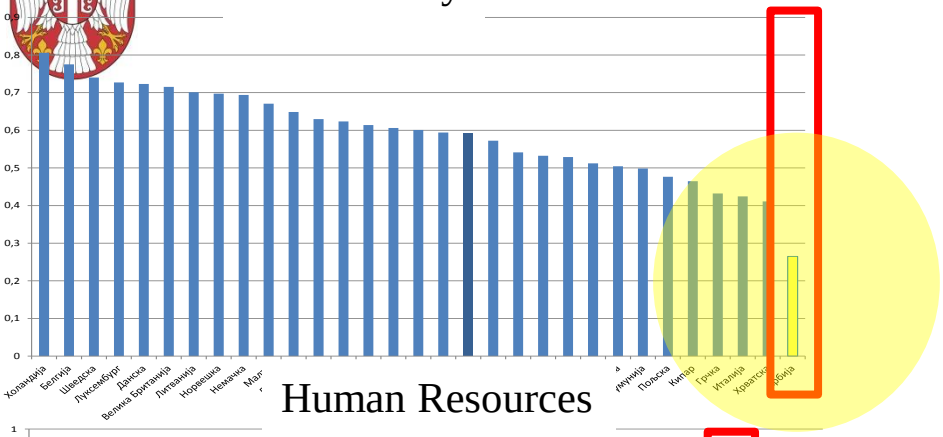
DESI consists of 5 main areas
that are represented by 30 indicators.

DESI has a tree layers architecture.

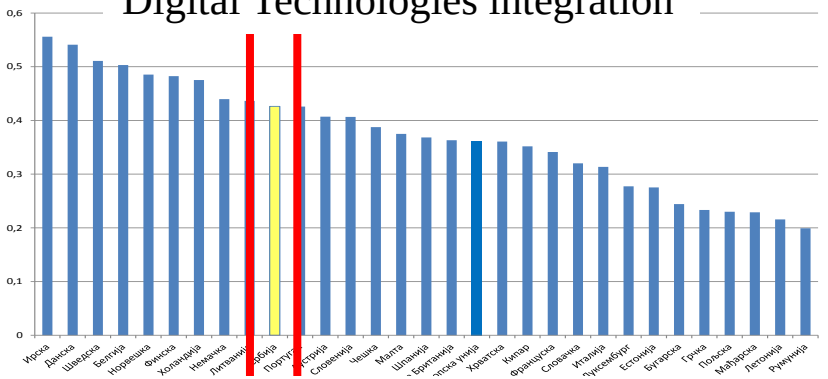
			Serbia	EU 2016	DESI for components	DESI 2016
1 Connectivity	1a Fixed BB access	1a1 BB territory coverage	89,20%	97%	0,264894667 29. The last one	0,360661 28. rank
		1a2 BB population coverage	57,50%	72%		
	1b Mobile BB	1b1 Mobile BB subscribers	76	75		
		1b2 Spectrum	42,50%	69%		
	1c Speeds	1c1 NGA coverage	30%	71%		
		1c2 High speed BB subscribers	18,84%	30%		
	1d Accessability	1d1 Fixed BB price	3,90%	1,30%		
2 Humar resources	2a Basic skills and usage	2a1 Internet users	61,85%	76%	0,403541667 26. rank	
		2a2 Basic computational skills	50%	55%		
	2b Advanced skills and develop	2b1 ICT experts	/	3,70%		
		2b2 STEM diplomas	15	18		
3 Internet usage	3a Content	3a1 News	59,90%	68%	0,349147162 27. rank	
		3a2 Music, video and games	50%	49%		
		3a3 Video on demand	41,00%	41%		
	3b Communication	3b1 Video call	51,30%	37%		
		3b2 Social networks	69,45%	63%		
	3c Transactions	3c1 Banking	12,97%	57%		
		3c2 Shopping	32,20%	65%		
4 Digital technologies integration	4a Business digitalization	4a1 Sharing and trade of electronic information	16,20%	36%	0,426225758 10. rank	
		4a2 RFID	/	3,80%		
		4a3 Social media	31,15%	18%		
		4a4 e-invoice	33%	n.a.		
		4a5 Cloud	9,20%	n.a.		
	4b e-Commerce	4b1 *online* sales	16%	16%		
		4b2 e-commerce exchange	10,00%	9,40%		
		4b3 Cross border *online* shopping	/	7,50%		
5 Digital public services	5a e-Government	5a1 e-government users	15,20%	32%	0,3729 26. rank	
		5a2 Pre filled forms	59	49		
		5a3 Completing the *online* service	35	81		

DESI components for Serbia

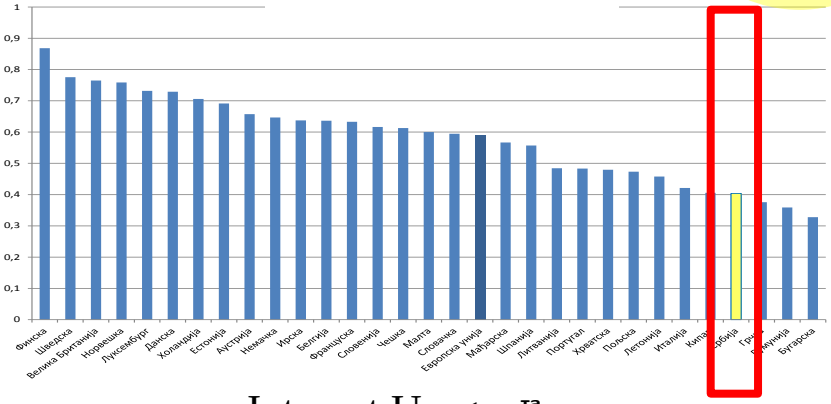
Connectivity



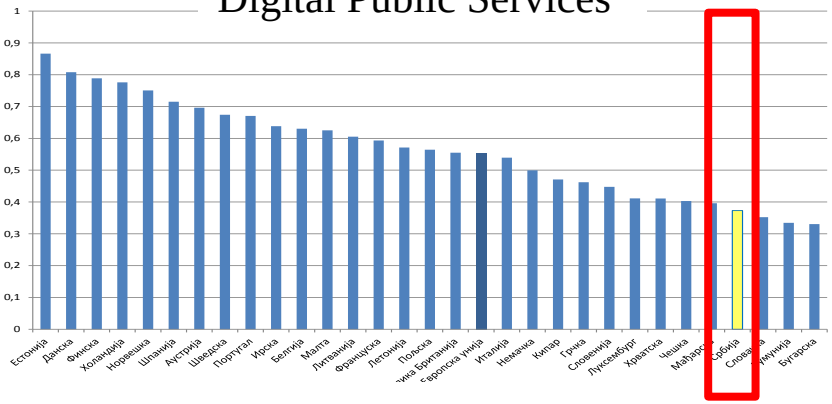
Digital Technologies integration



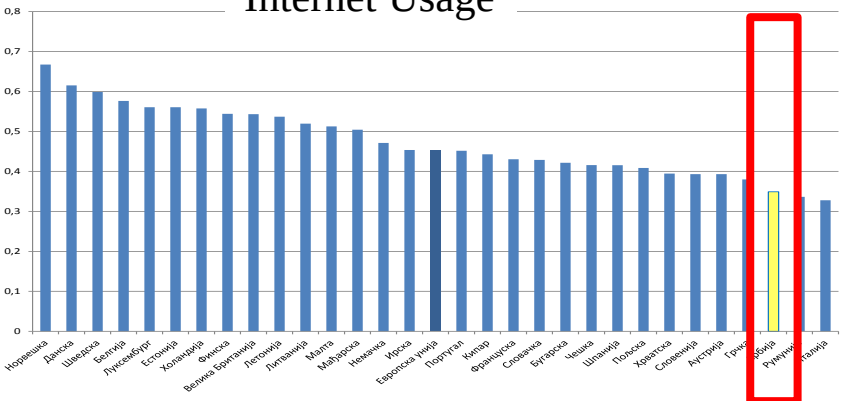
Human Resources



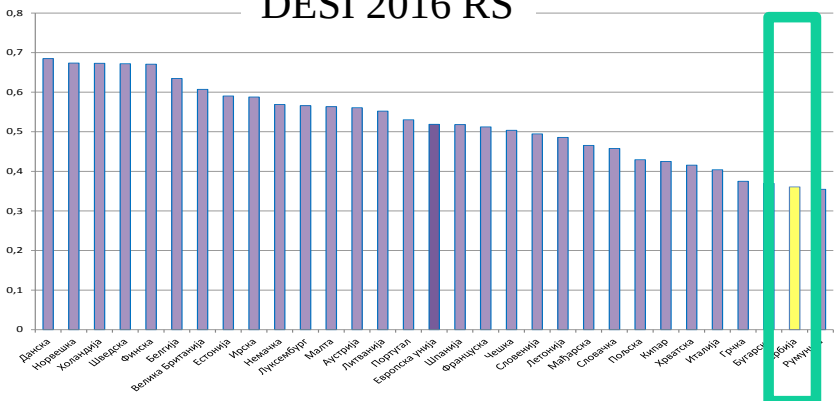
Digital Public Services



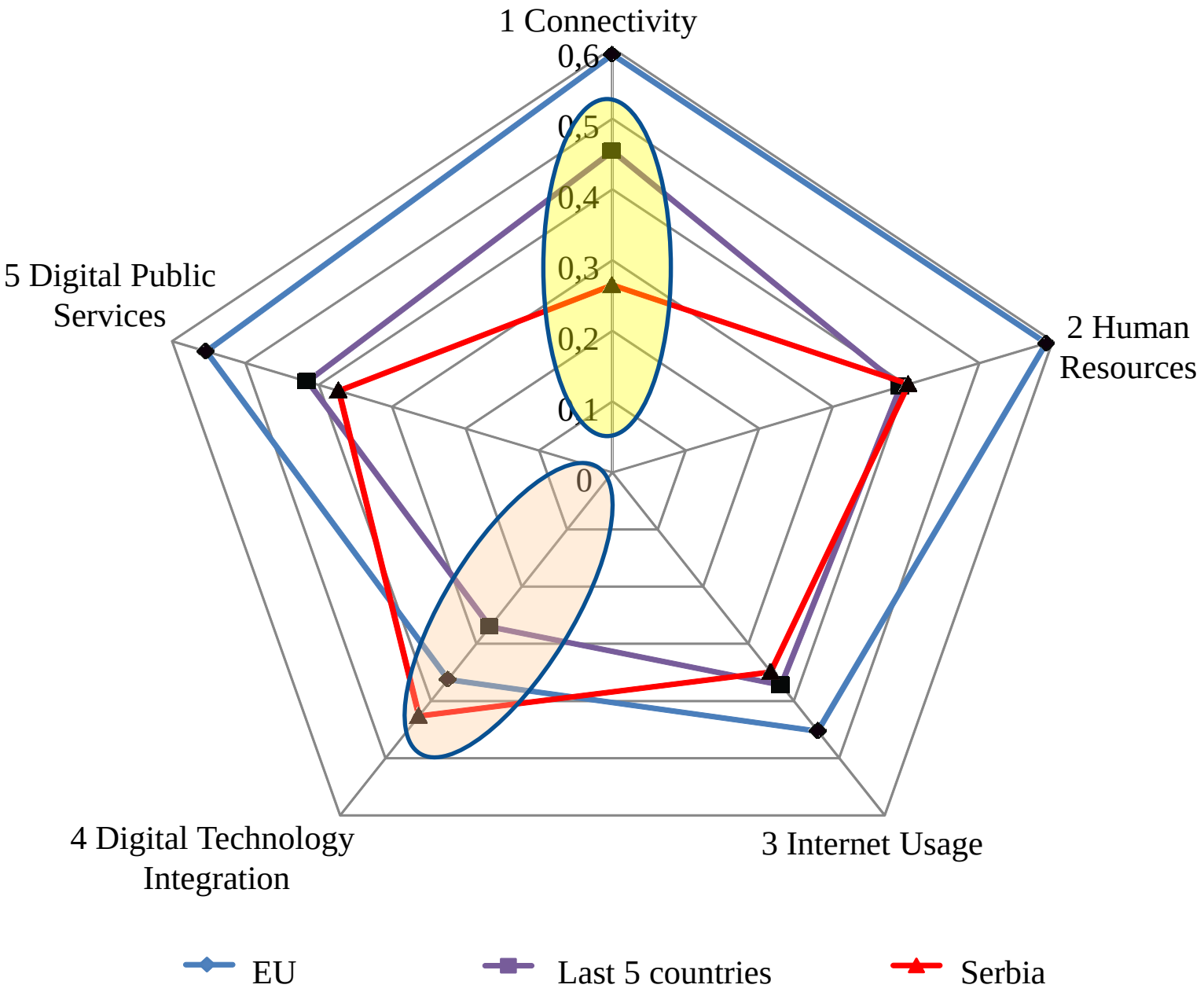
Internet Usage



DESI 2016 RS



DESI components - Serbia vs. EU average



Connectivity?

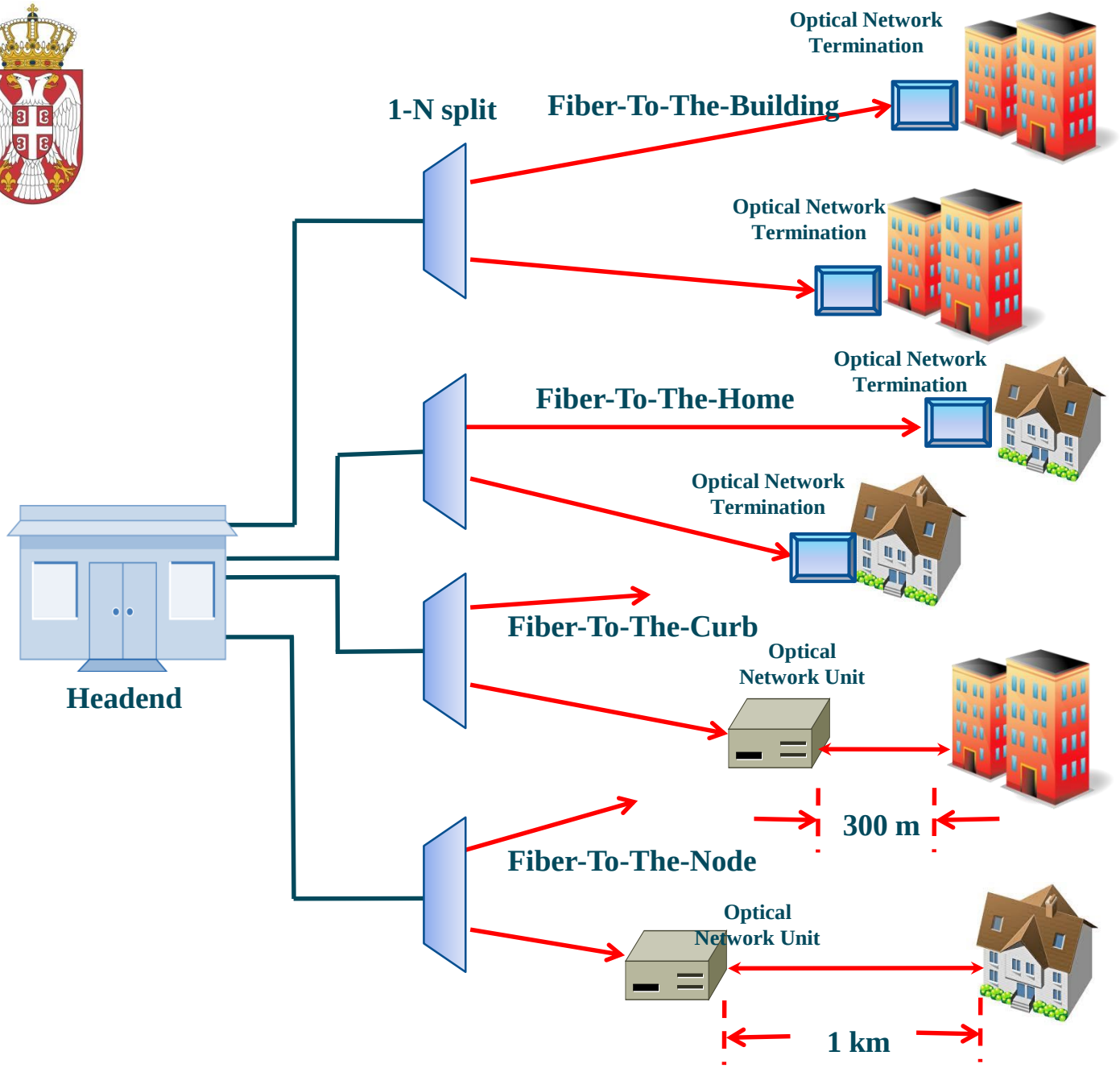
Fixed Access Network:

FTTx – FTTH, FTTC, FTTB, FTTD

Digital Technology Integration?

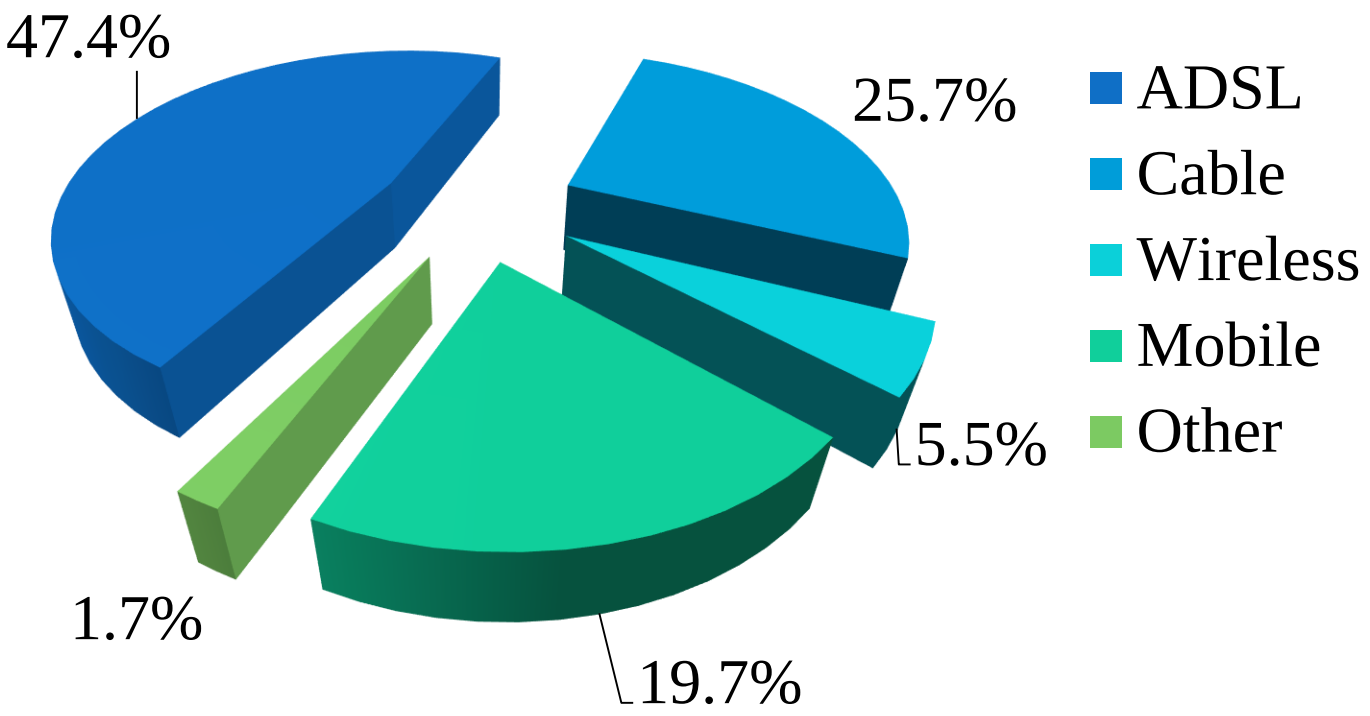
Social networks

Issuing of digital invoices


Optical Network Termination
1-N split
Fiber-To-The-Building
Optical Network Termination
Optical Network Termination
Fiber-To-The-Home
Optical Network Termination
Fiber-To-The-Curb
Optical Network Unit
Headend
300 m
Fiber-To-The-Node
Optical Network Unit
1 km

Broadband technologies in Serbia

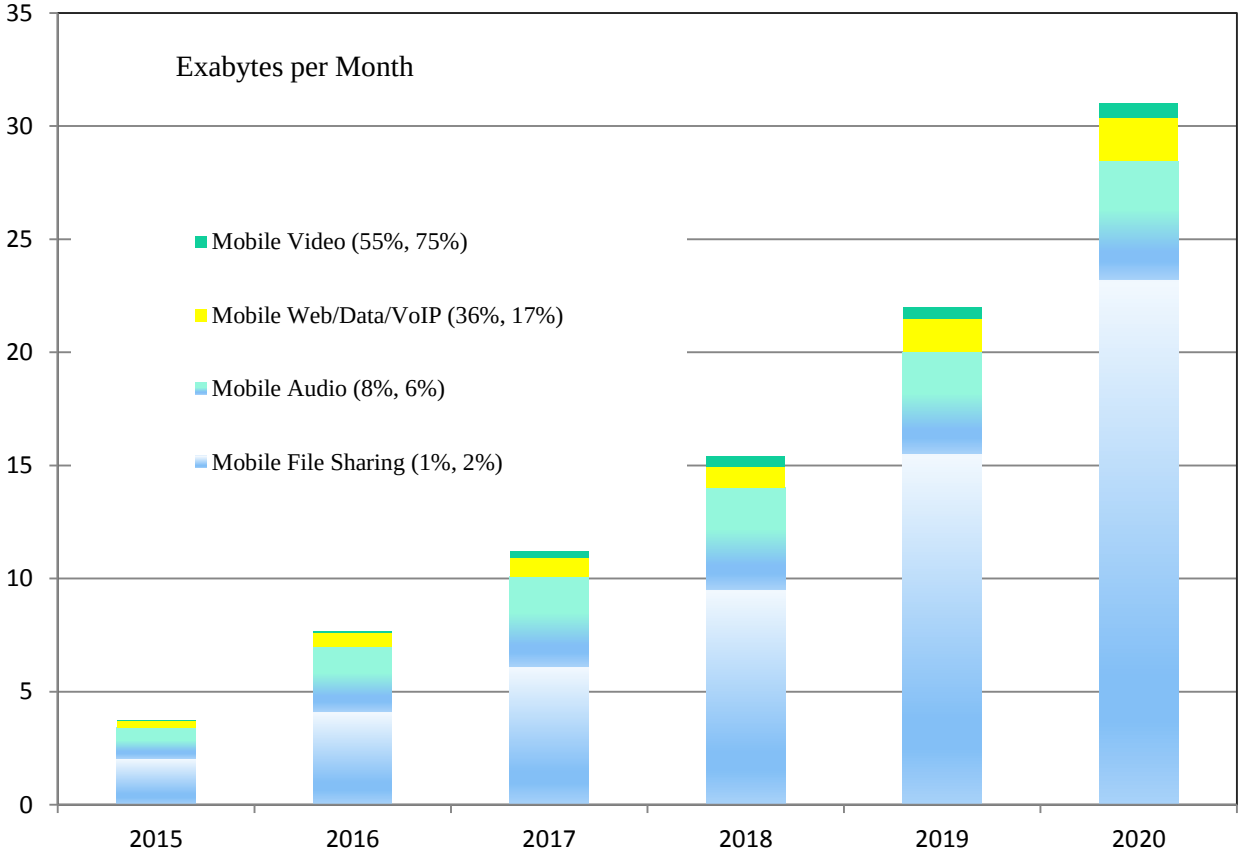
Population – 7.2 mil.
3G subscribers – 4.2 mil.
Broadband subscribers (xDSL, cable, wireless, mobile, FTTx) – 1.46 mil.

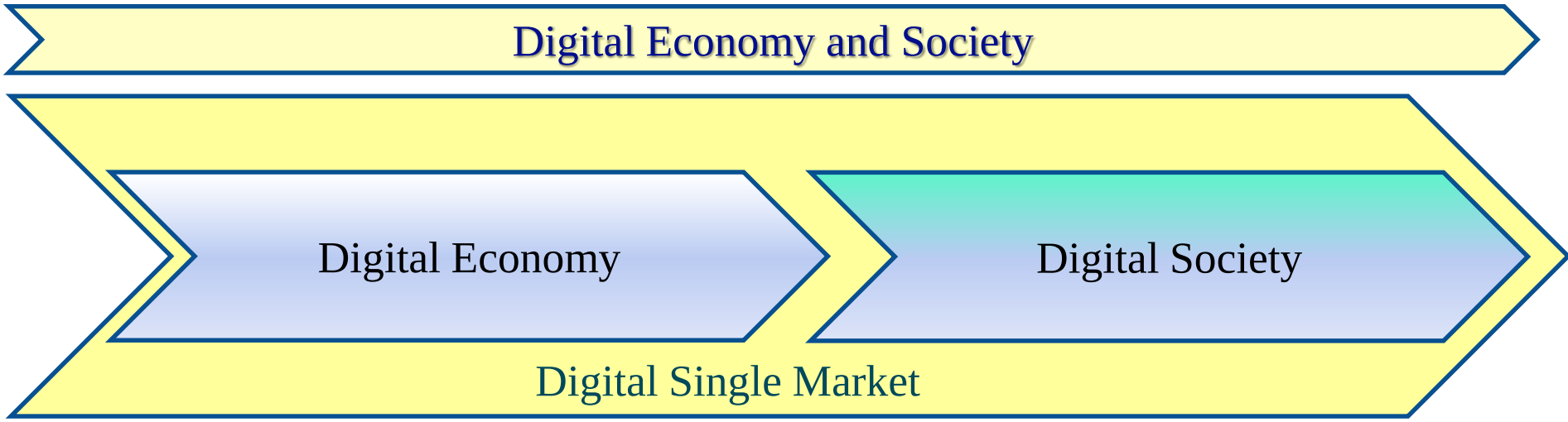


Source: RATEL

Digital Single Market

Participation of Video/Audio Content in Mobile Network Traffic



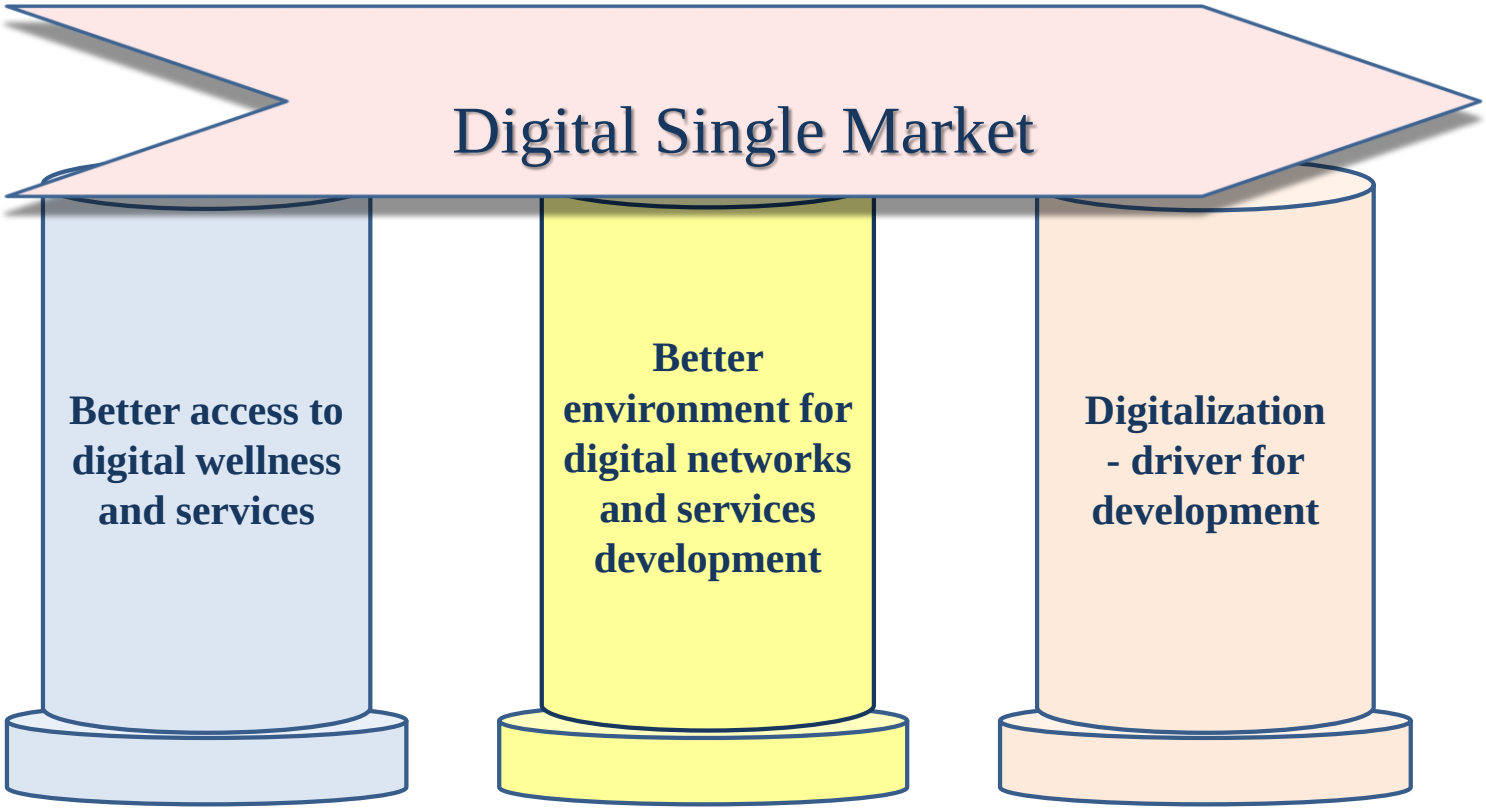


- Digital Single Market (DSM) should enable better exchange of services and goods, developing better environment for overall progress in the EU.

- Republic of Serbia has to be prepared for one of the most complex steps in the process of EU integration, to access more developed DSM.

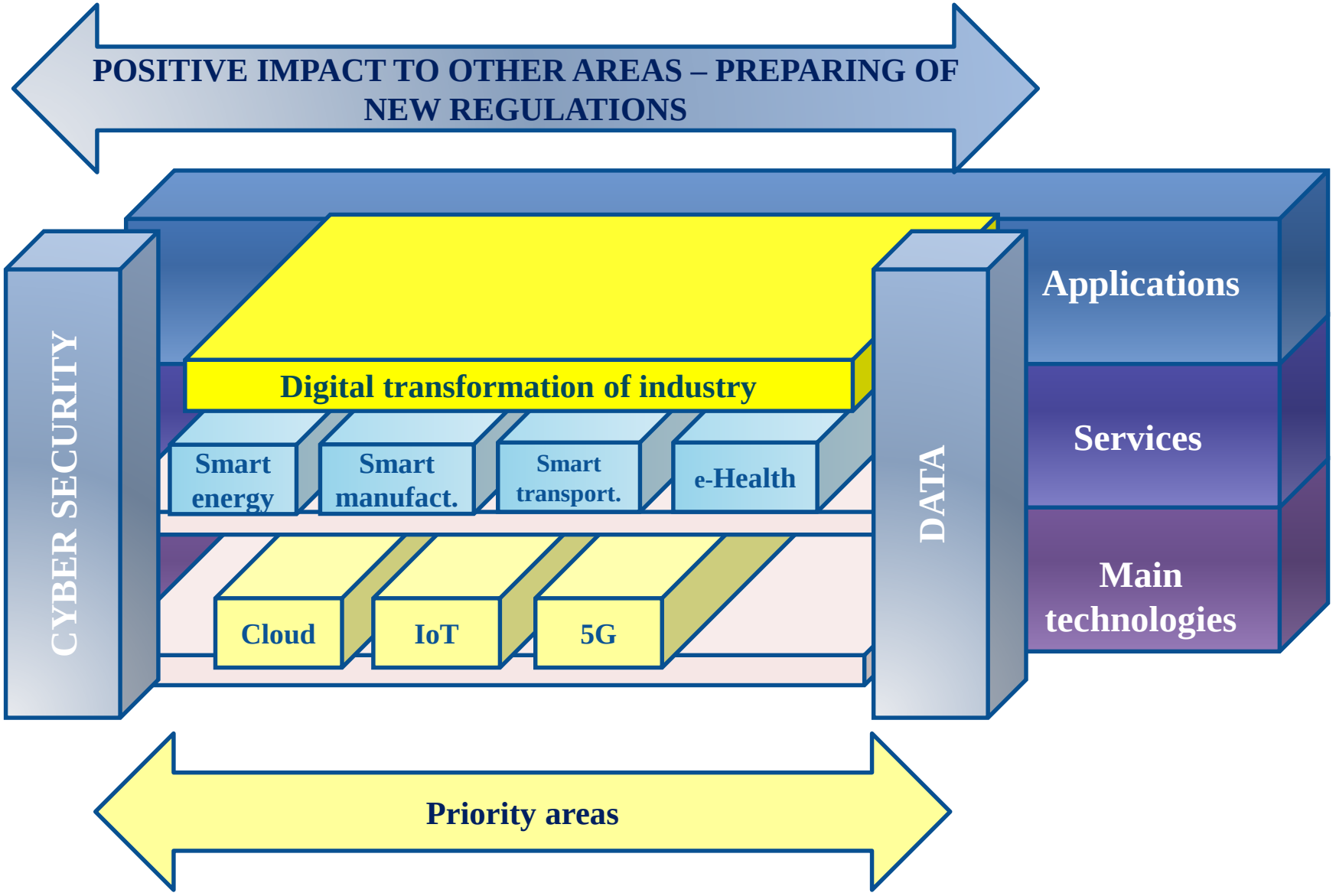
Digital Single Market Services

DSM - pillars or goals?



How to enable the DSM?

DSM layers

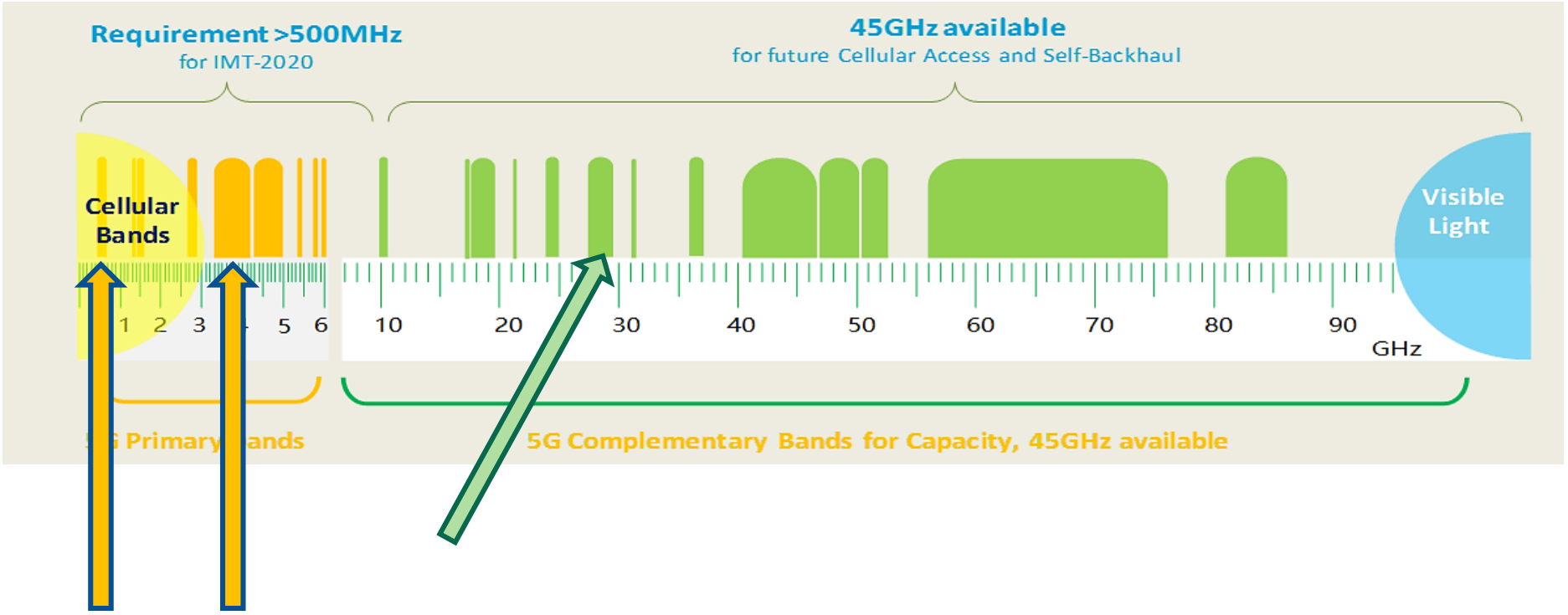

POSITIVE IMPACT TO OTHER AREAS – PREPARING OF NEW REGULATIONS
CYBER SECURITY
Digital transformation of industry
Smart energy
Smart manufact.
Smart transport.
e-Health
Cloud
IoT
5G
DATA
Applications
Services
Main technologies
Priority areas

5G - Spectrum policy

From 5% of radio frequency spectrum - towards 5G

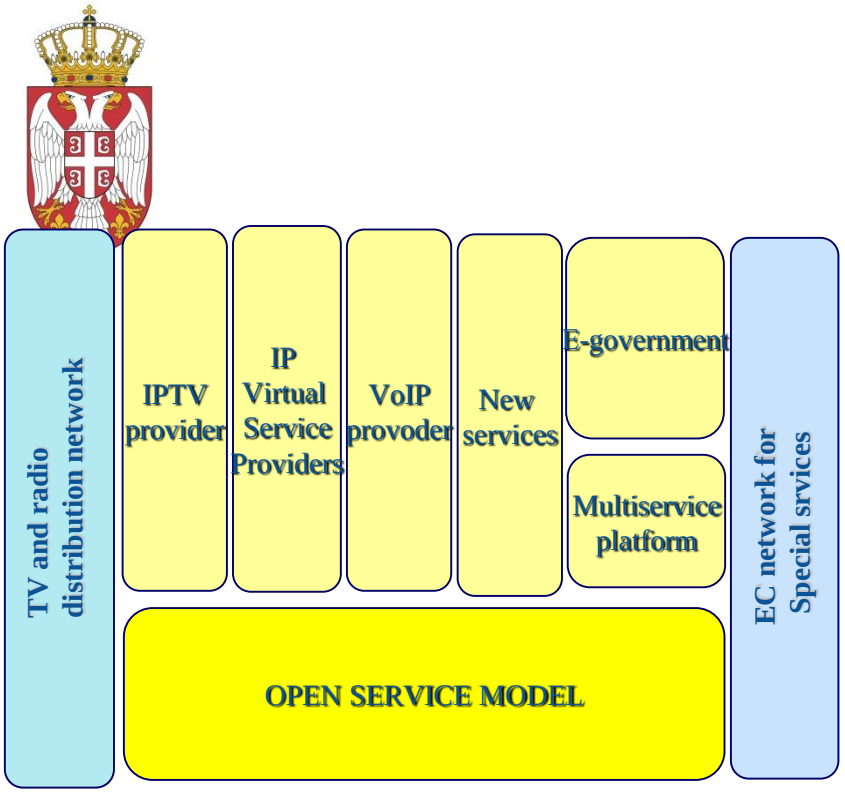
Terrestrial video broadcasting is going to be limited to:
21 - 48 UHF channels and few VHF channels

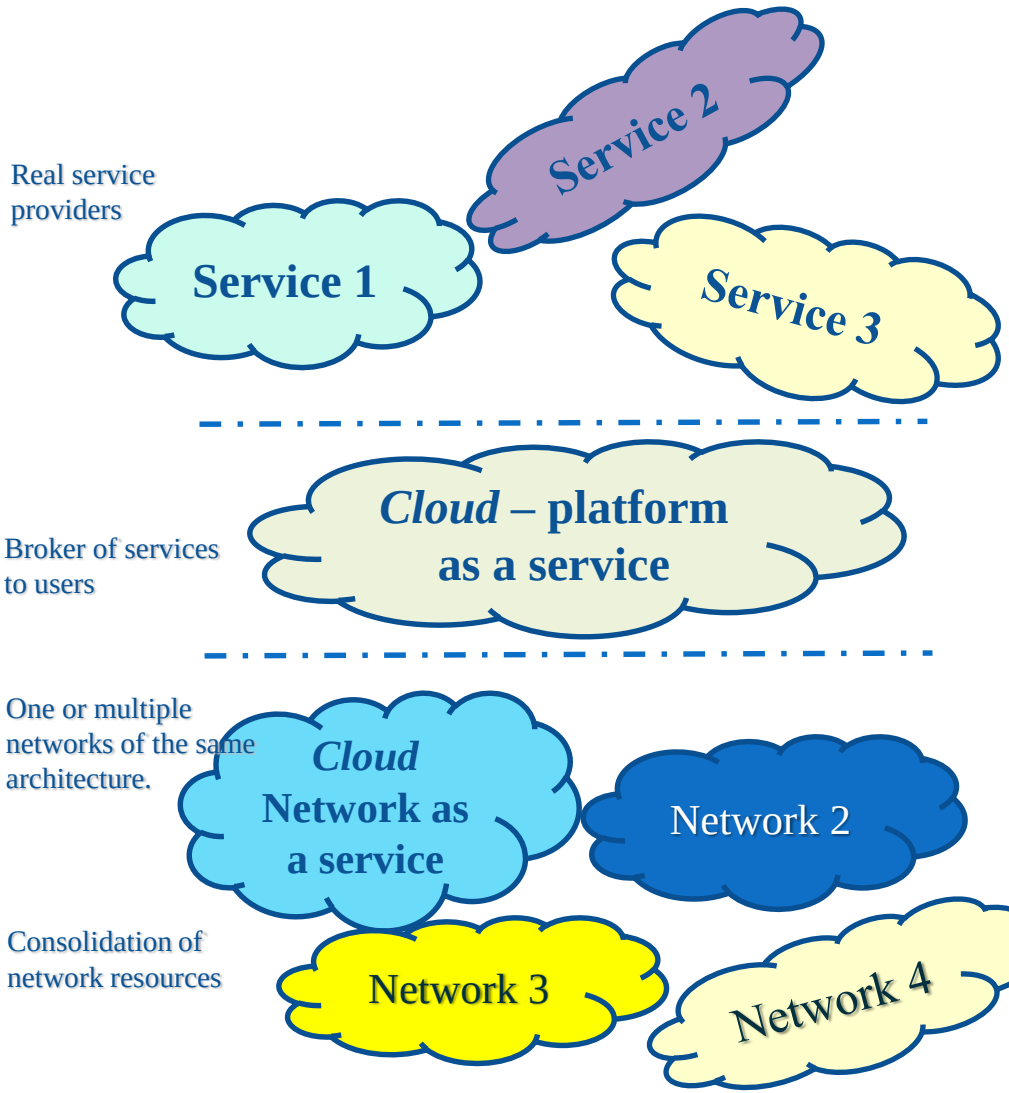
5G spectrum


Requirement >500MHz
for IMT-2020
45GHz available
for future Cellular Access and Self-Backhaul
Cellular Bands
Visible Light
1 2 3 5 6
10 20 30 40 50 60 70 80 90
GHz
5G Primary Bands
5G Complementary Bands for Capacity, 45GHz available

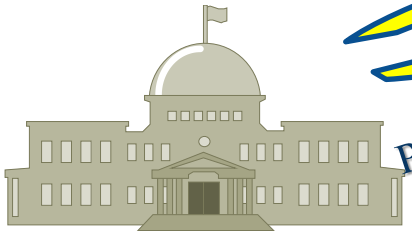
Cloud services

Computer cloud





Рачунарски облак



Public systems

Service 1

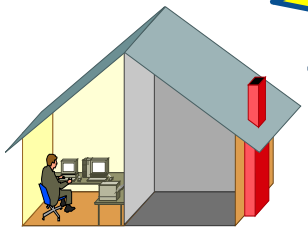
Service 2

Service 3

SaaS *- Software as a Service*

Cloud – platform as a service

PaaS *- Platform as a Service*



Small an medium enterprises - Digital entrepreneurship

Cloud Network as a service

Network 2

Network 3

Network 4

IaaS *- Infrastructure as a Service (storage*, network,…).

Internet of Things (IoT)

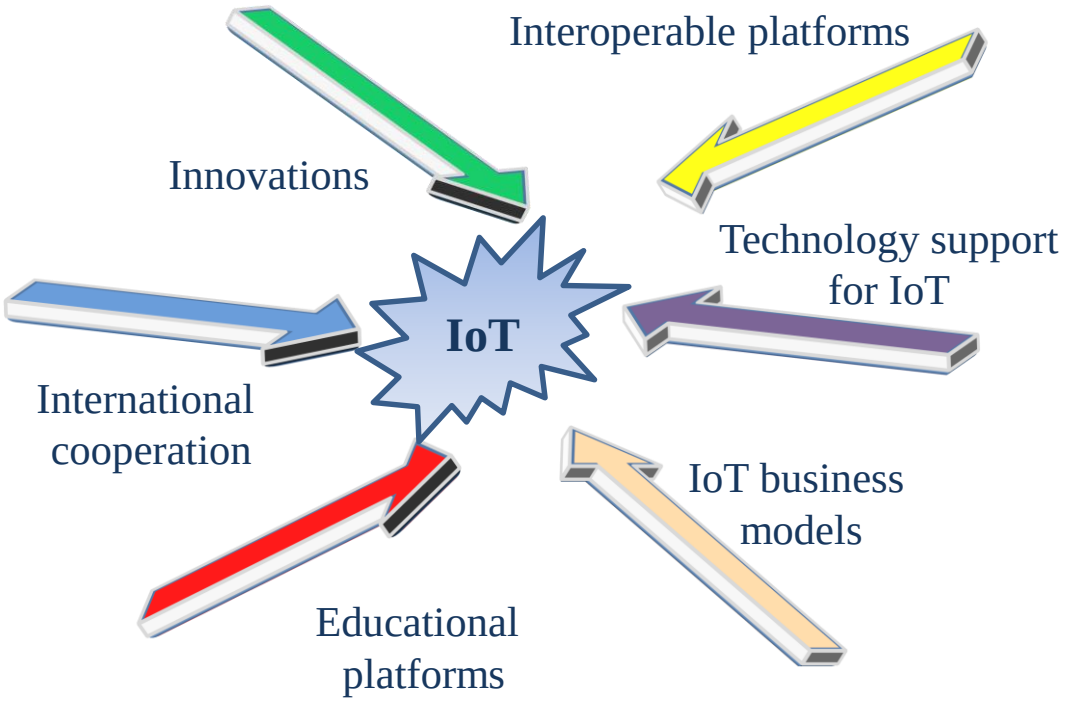
IoT

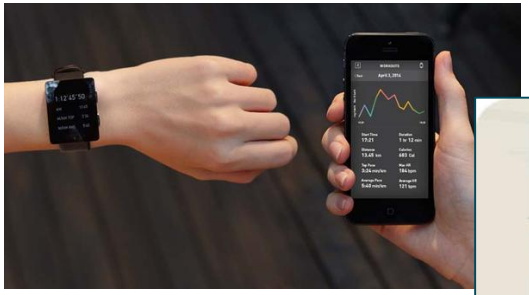
- *IoT* represents the state of the art communications technology connecting huge number of objects - household equipment, wearable devices as body are networks (BAN), transport vehicles and sensors,

- It is expected that more than 20 billion of connected devices will be present before 2020,

- Main goal: *IoT* should help in solving the challenges such as climate changes, energy efficiency increase, better resources usage producing the overall human wellness.

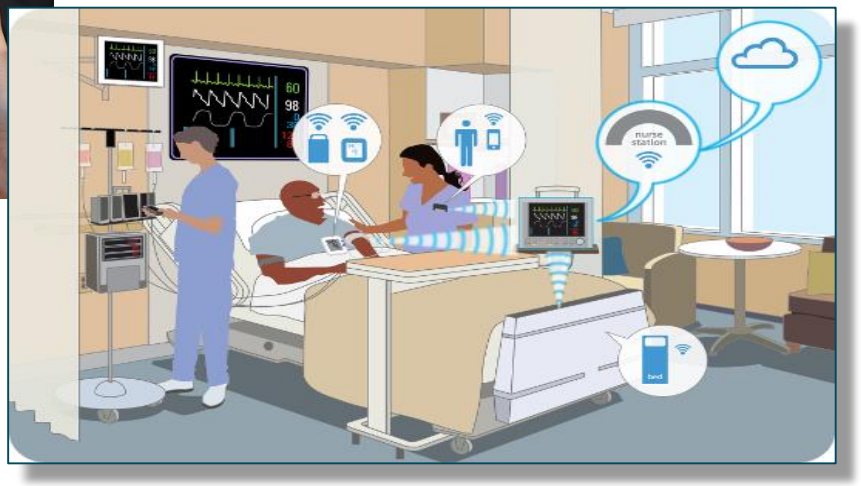
How to develop IoT?





Wearable Tech

Healthcare



Smart Appliances

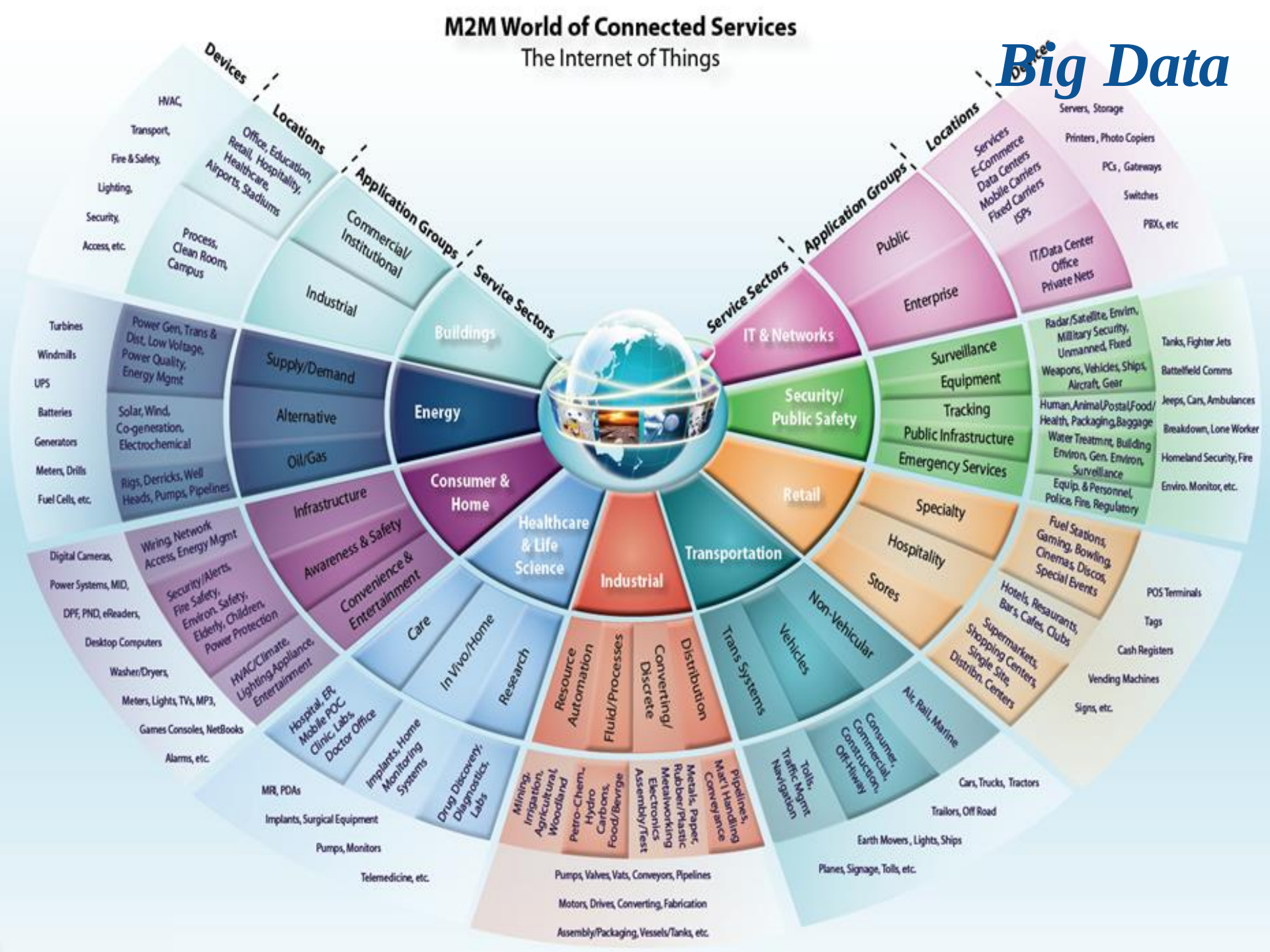
- IoT equipment interoperability,
- Trusted services,
- Privacy,
- End-to-end Security,
- Open systems for object identification and authentication,
- IoT for public procurement

IoT obstacles - IPv6 implementation

Country	%
Belgium	50.4
Greece	33.16
Germany	30.8
Switzerland	27.54
UK	18.83
France	18.15
Finland	16.56
Hungary	10.68
Slovenia	7.51
Bosnia	3.46
Serbia	0.04
Croatia	0.02

Data

Cyber Security


M2M World of Connected Services
The Internet of Things
Big Data
Devices
Locations
Application Groups
Service Sectors
HVAC,
Transport,
Fire & Safety,
Lighting,
Security,
Access, etc.
Office, Education, Retail, Hospitality, Healthcare, Airports, Stadiums
Process, Clean Room, Campus
Commercial/ Institutional
Industrial
Buildings
Energy
Supply/Demand
Alternative
Oil/Gas
Power Gen, Trans & Dist, Low Voltage, Power Quality, Energy Mgmt
Solar, Wind, Co-generation, Electrochemical
Rigs, Derricks, Well Heads, Pumps, Pipelines
Turbines
Windmills
UPS
Batteries
Generators
Meters, Drills
Fuel Cells, etc.
Consumer & Home
Infrastructure
Awareness & Safety
Convenience & Entertainment
Wiring, Network Access, Energy Mgmt
Security/Alerts, Fire Safety, Environ. Safety, Elderly, Children, Power Protection
HVAC/Climate, Lighting,Appliance, Entertainment
Digital Cameras,
Power Systems, MID,
DPF, PND, eReaders,
Desktop Computers
Washer/Dryers,
Meters, Lights, TVs, MP3,
Games Consoles, NetBooks
Alarms, etc.
Healthcare & Life Science
Care
In Vivo/Home
Research
Hospital, ER, Mobile POC, Clinic, Labs, Doctor Office
Implants, Home Monitoring Systems
Drug Discovery, Diagnostics, Labs
MRI, PDAs
Implants, Surgical Equipment
Pumps, Monitors
Telemedicine, etc.
Industrial
Resource Automation
Fluid/Processes
Converting/ Discrete
Distribution
Mining, Irrigation, Agricultural, Woodland
Petro-Chem., Hydro Carbons, Food/Bevrge
Assembly/Test Electronics
Metalworking Rubber/Plastic
Metals, Paper,
Pipelines, Mat'l Handling Conveyance
Pumps, Valves, Vats, Conveyors, Pipelines
Motors, Drives, Converting, Fabrication
Assembly/Packaging, Vessels/Tanks, etc.
Transportation
Trans Systems
Non-Vehicular
Vehicles
Tolls, Traffic Mgmt Navigation
Consumer, Commercial, Construction, Off-Hiway
Air, Rail, Marine
Cars, Trucks, Tractors
Trailors, Off Road
Earth Movers , Lights, Ships
Planes, Signage, Tolls, etc.
Retail
Specialty
Hospitality
Stores
Hotels, Resaurants, Bars, Cafes, Clubs
Supermarkets, Shopping Centers, Single Site, Distribn. Centers
Fuel Stations, Gaming, Bowling, Cinemas, Discos, Special Events
POS Terminals
Tags
Cash Registers
Vending Machines
Signs, etc.
Security/ Public Safety
Surveillance
Equipment
Tracking
Public Infrastructure
Emergency Services
Radar/Satellite, Envirn, Military Security, Unmanned, Fixed
Weapons, Vehicles, Ships, Aircraft, Gear
Human,Animal,Postal,Food/ Health, Packaging,Baggage
Water Treatmnt, Building Environ, Gen. Environ, Surveillance
Equip. & Personnel, Police, Fire, Regulatory
Tanks, Fighter Jets
Battelfield Comms
Jeeps, Cars, Ambulances
Breakdown, Lone Worker
Homeland Security, Fire
Enviro. Monitor, etc.
IT & Networks
Public
Enterprise
Services
E-Commerce
Data Centers
Mobile Carriers
Fixed Carriers
ISPs
IT/Data Center
Office
Private Nets
Servers, Storage
Printers , Photo Copiers
PCs , Gateways
Switches
PBXs, etc

Data,... data

- Data analysis,
- Feature extraction:

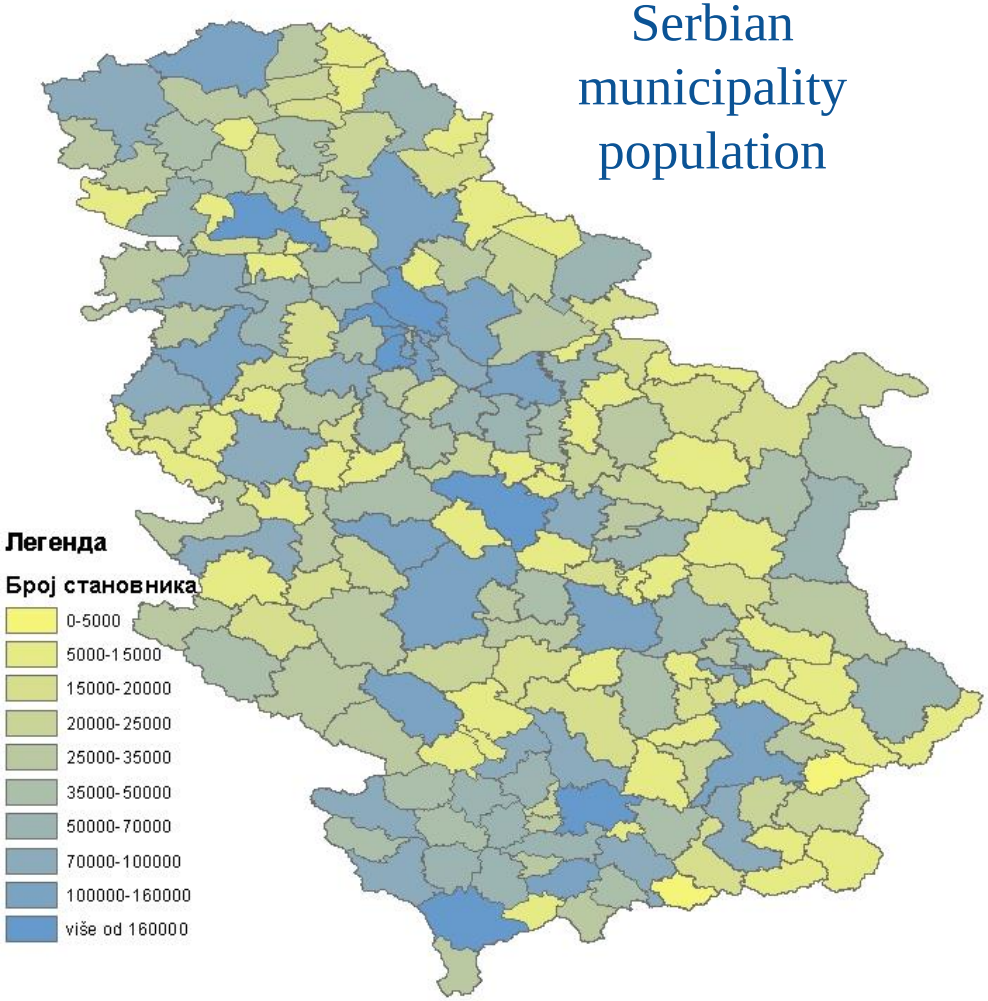
  image, video, audio applications,…,

  other data.
- Processes control.

Broadband Infrastructure Availability

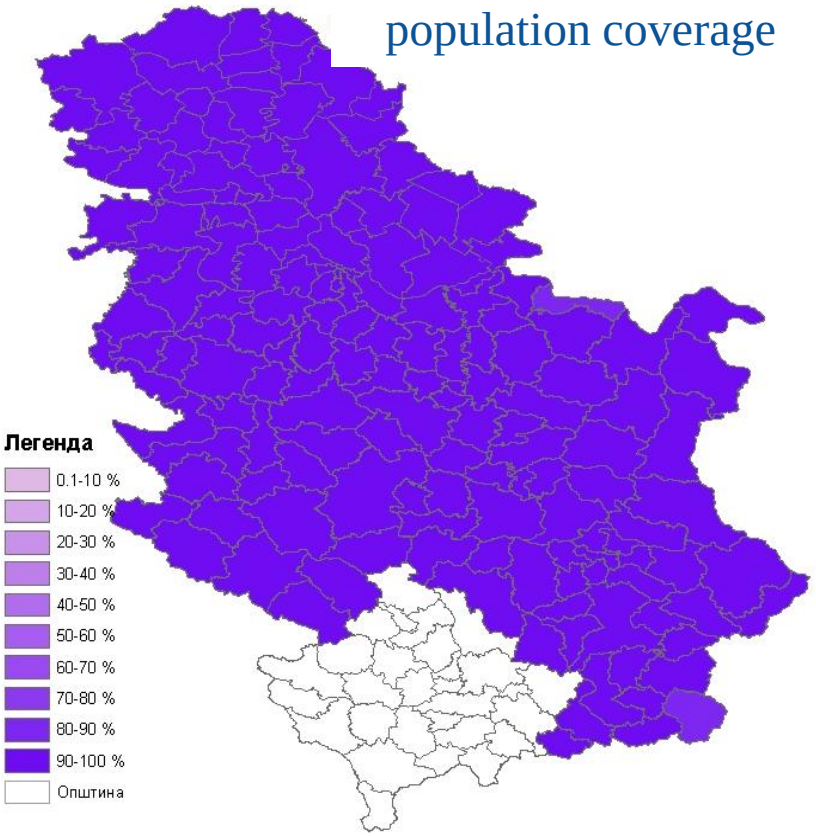
Population in Serbia

Serbian municipality population

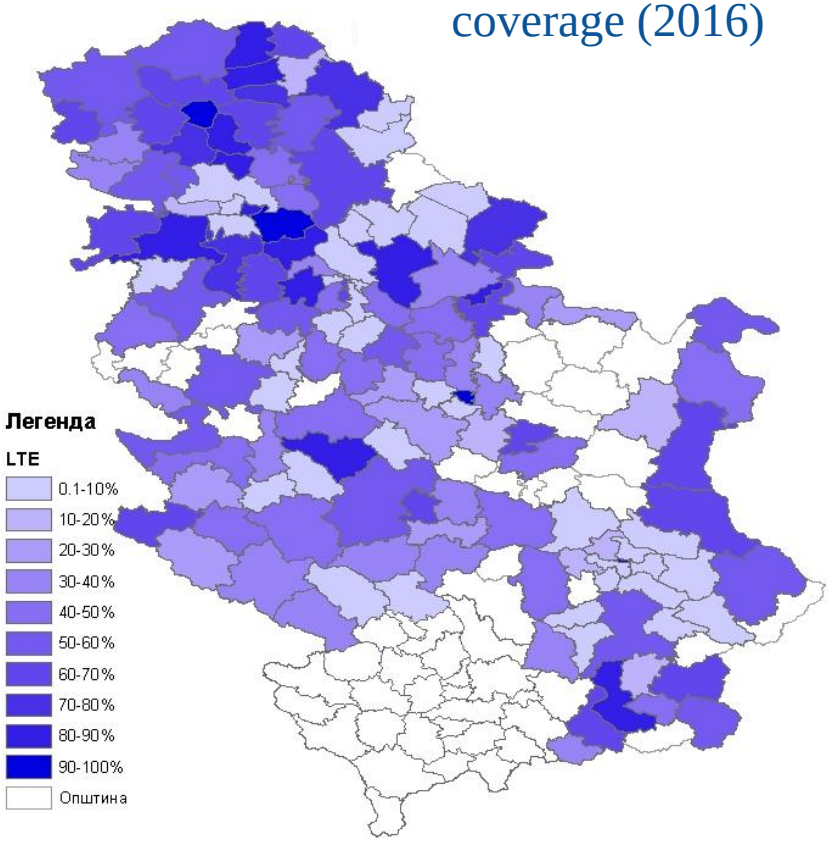


Mobile – Population Coverage

UMTS signal population coverage

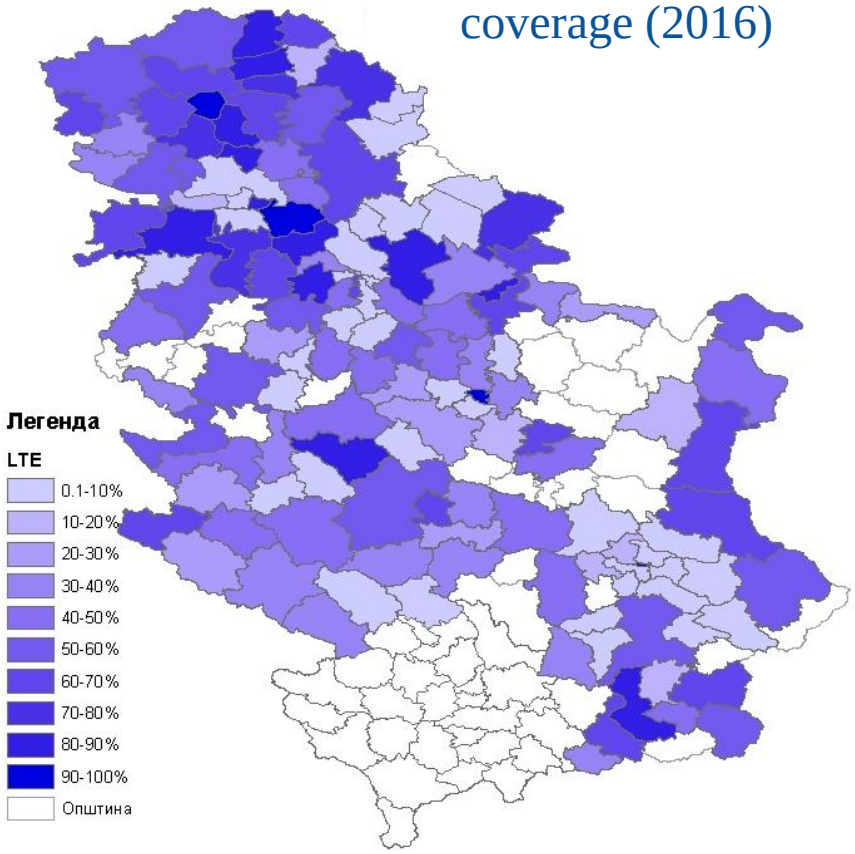


LTE signal population coverage (2016)

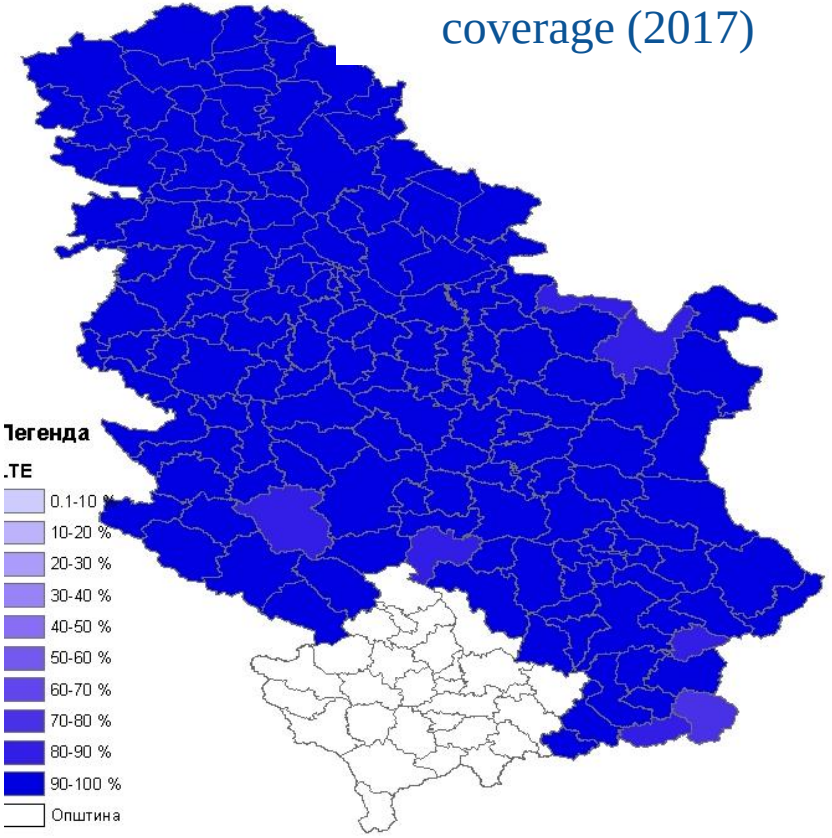


LTE - Population Coverage in Serbia

LTE signal population coverage (2016)

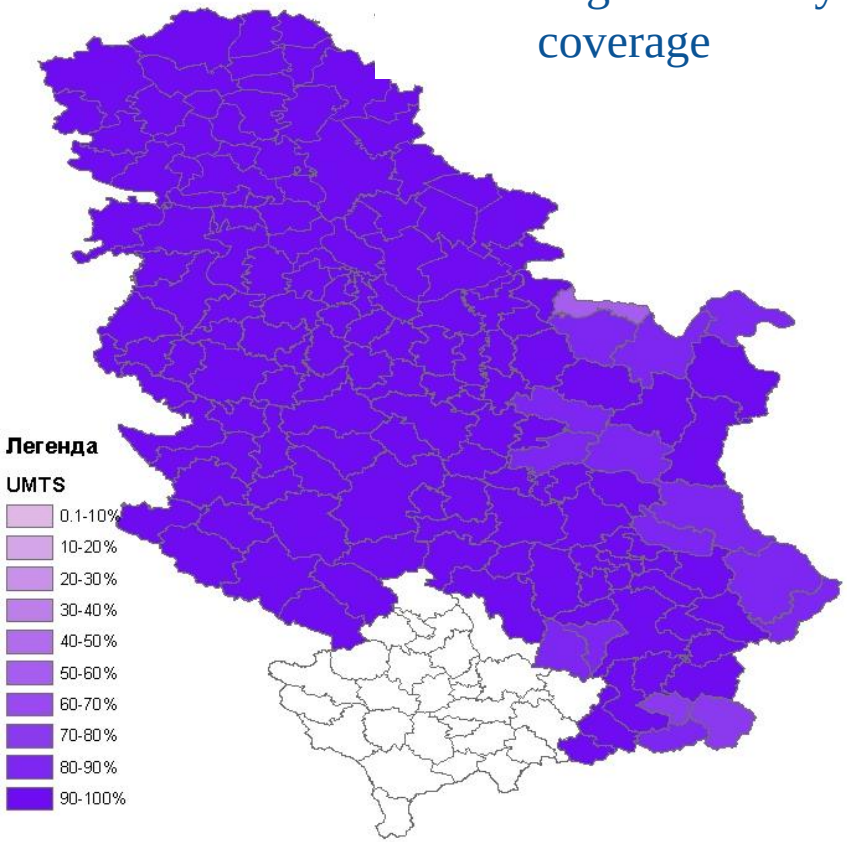


LTE signal population coverage (2017)

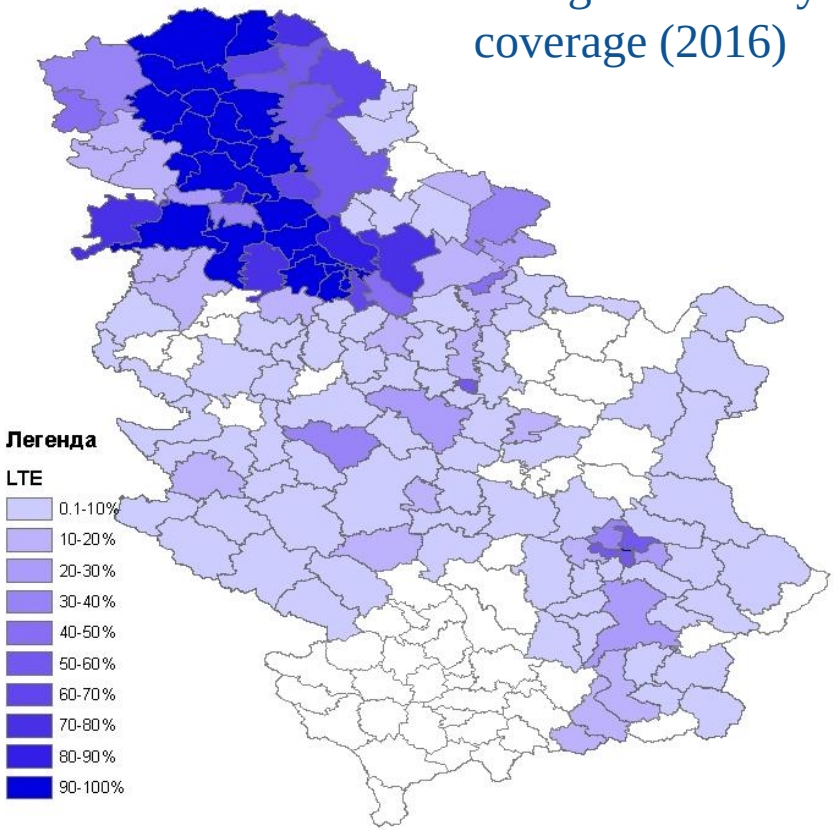


Mobile – Territory Coverage

UMTS signal territory coverage

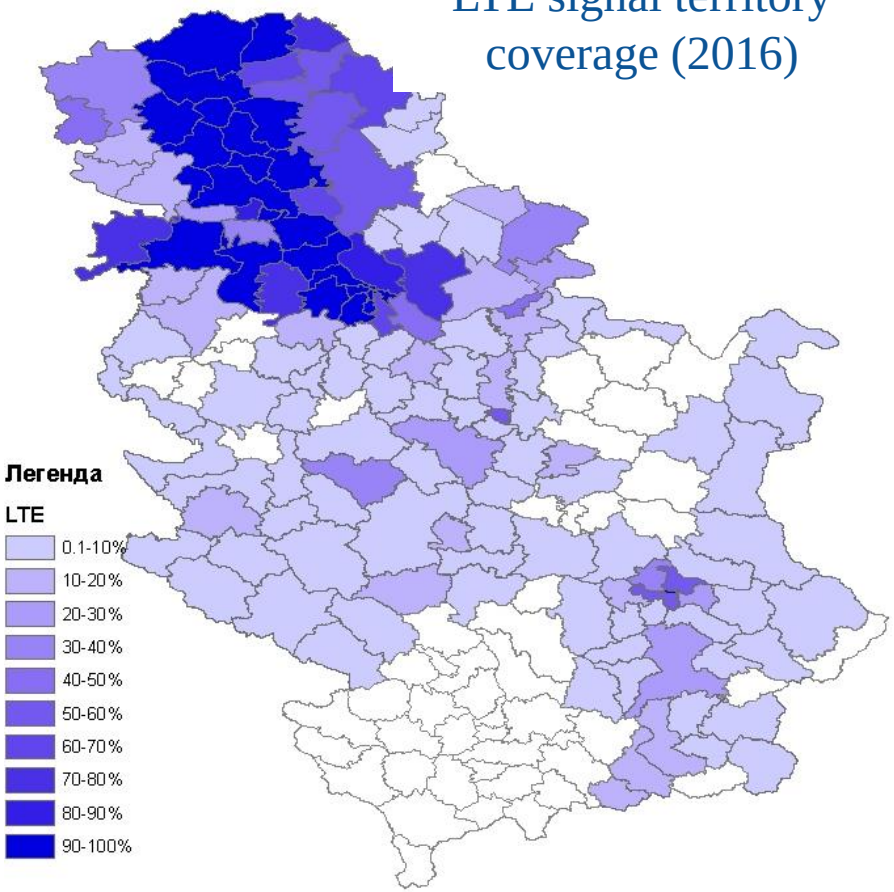


LTE signal territory coverage (2016)

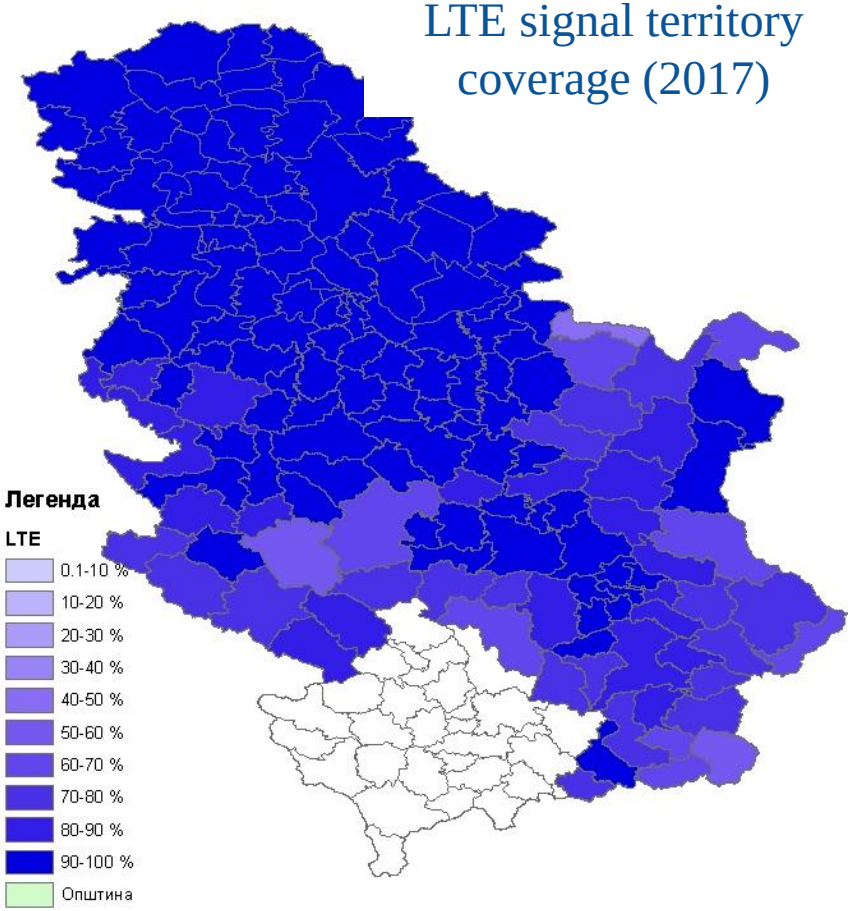


LTE - Territory Coverage in Serbia

LTE signal territory coverage (2016)



LTE signal territory coverage (2017)



Future plans?

- Development of the interoperability standards
- Huge data base processing
- Open data
- Cyber Security
- Spectrum policies …5G …
- Forcing of the IPv6 implementation

Thank you for the attention!

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