



# **Agency for electronic communication Republic of Macedonia QoS Measurement and Reports and future implementation plans**

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# Bylaw and QoS parameters

- Agency for electronic communication adopt Bylaw for quality parameters of public electronic communications services, the manner and procedure for the control and measurement, content, form and manner of disclosure of information about the quality of public electronic communications services, according the law for electronic communications.
- There exist four wireless technologies in Macedonian market, GSM, UMTS, LTE and DVB-T.
- Department for radio frequencies control and monitoring measure and analyze next parameters:
  - Network coverage(signal strength on mobile phones independent from technologies)
  - Network availability(Network availability during drive )
  - Failure calls (Calling IVR number)
  - Dropped calls (Calling IVR number)
  - Call setup time (Calling IVR number)
  - Quality of speech (Calling Voice server)
  - SMS send success rate (Sending SMS to IVR number)
  - Server connection setup success rate (Connection to IP server)
  - Server connection completion rate (Connection to IP server)
  - Speed of data transfer via radio communications network combined by technologies(GPRS, EDGE, UMTS и LTE) (Connection to IP server)
  - Signal strength for DVB-T(Spectrum analyzer)



# Recommendation and measurement equipment

- Agency for electronic communication use Anite equipment for QoS measurements
- For measurement AEC use NEMO OUTDOOR software and NEMO Multilite hardware with six Samsung Galaxy S4 mini phones
- For post processing AEC use NEMO ANALYZE software
- AEC follow ETSI TS 102 250 and ITU-T-P.800 regulation



# Mobile phone dedication and scripts content

VIP 1



T-Mobile 1



ONE 1



VIP 2



T-Mobile 2



ONE 2



## QoS benchmarking report for Skopje, the capital of Republic of Macedonia

National mobile operators in Republic of Macedonia

- ONE.VIP(VIP network)
- T-Mobile Macedonia
- ONE.VIP(ONE network)

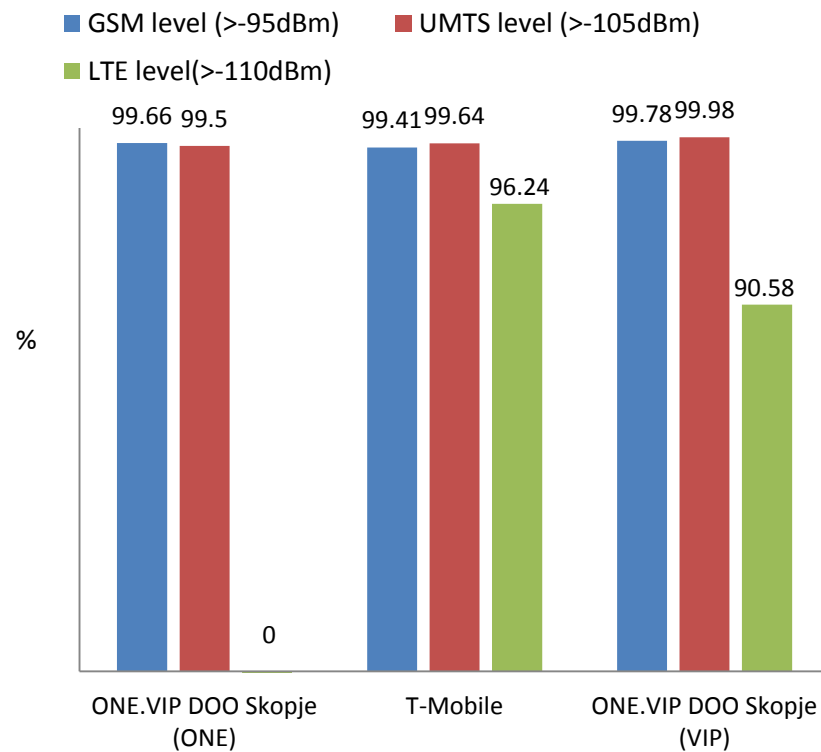


- 
- The period when the measurements were performed :  
23.07.2015 – 17.08.2015
  - The distribution of the number of calls generated in certain municipalities representative is obtained by proportional division in terms of population density in a given municipality according to data taken from data provided by the State Statistical Office of the Republic of Macedonia.

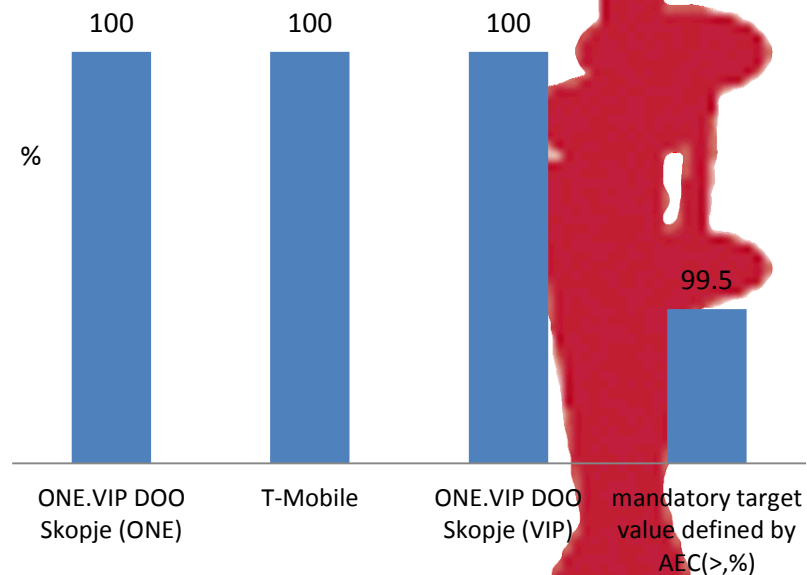
City	Population	Min number of calls	Calls attempts ONE.VIP(ONE)	Calls attempts T-mobile	Calls attempts ONE.VIP(VIP)
Skopje	506926	2028	2095	2172	2338



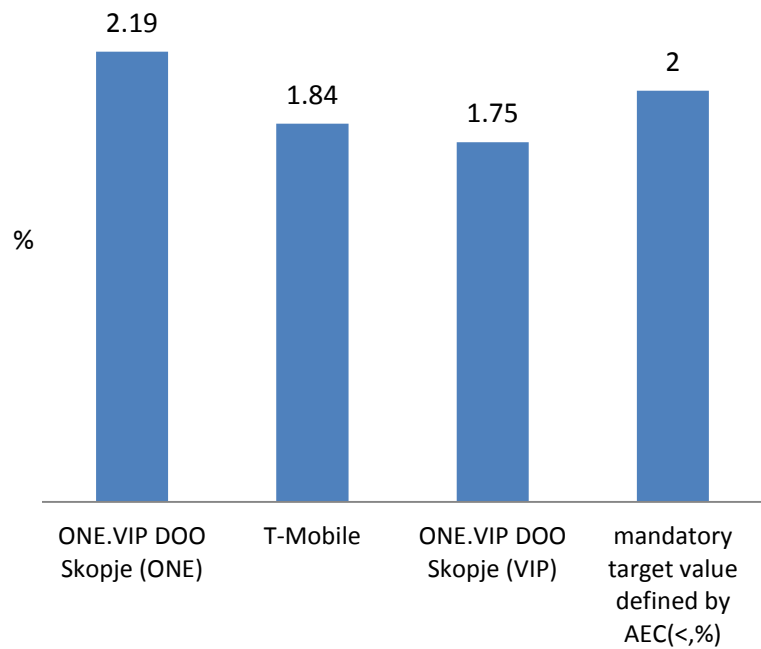
## Network coverage- Level of measurement signal on the phone



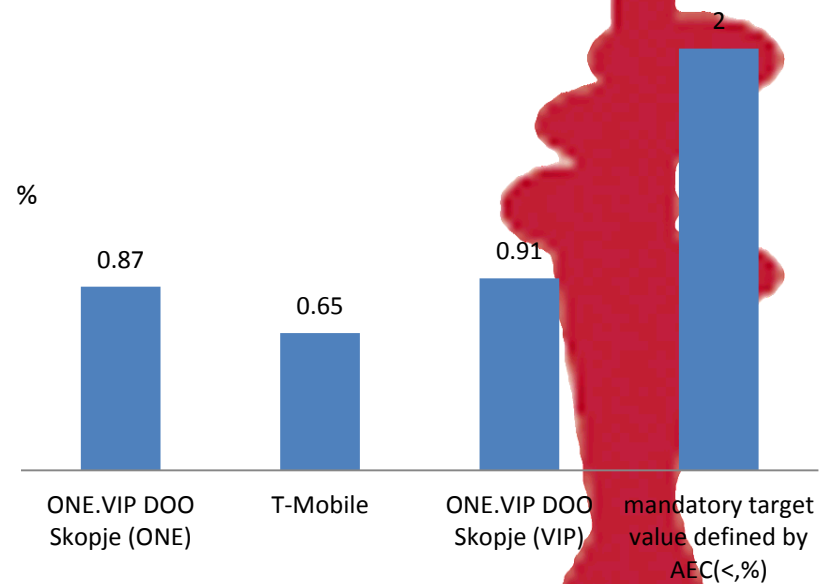
## Network availability



## Failure calls

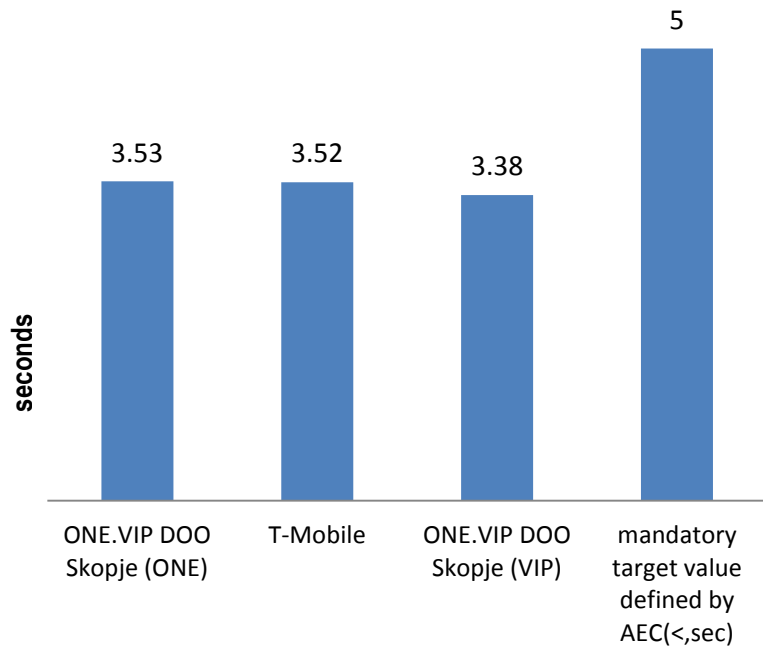


## Dropped calls

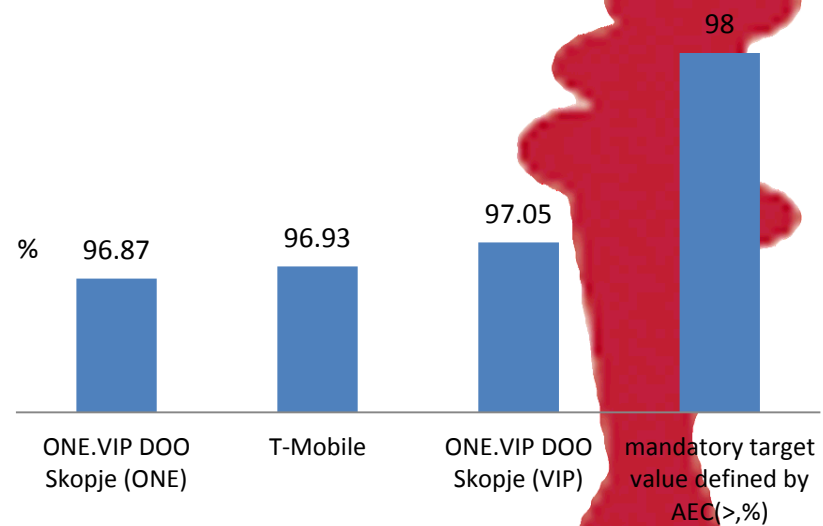




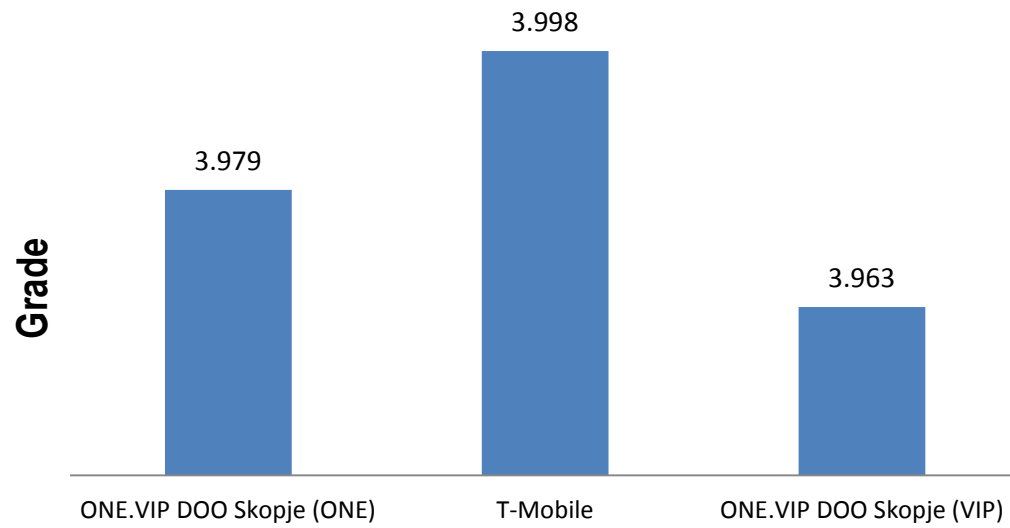
## Call setup time



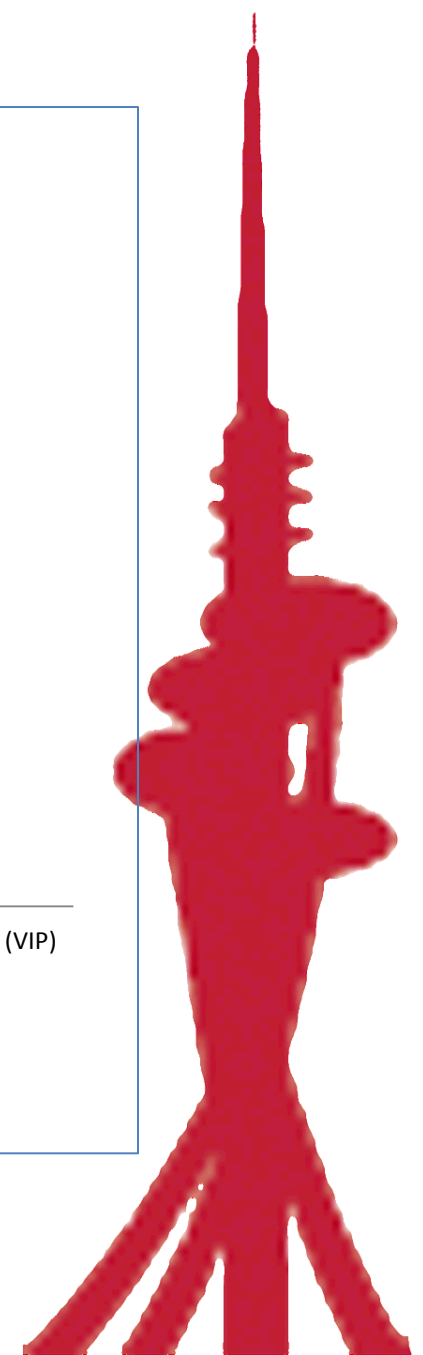
## SMS send success rate



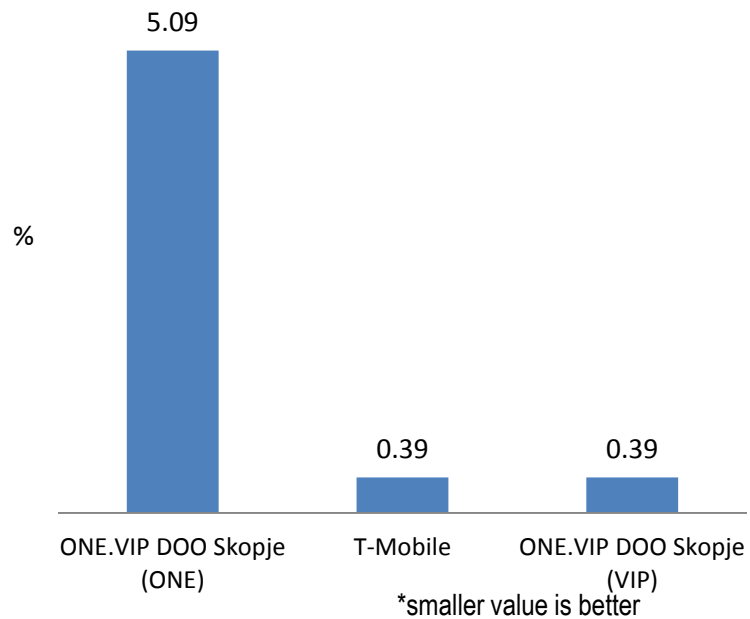
## Quality of speech



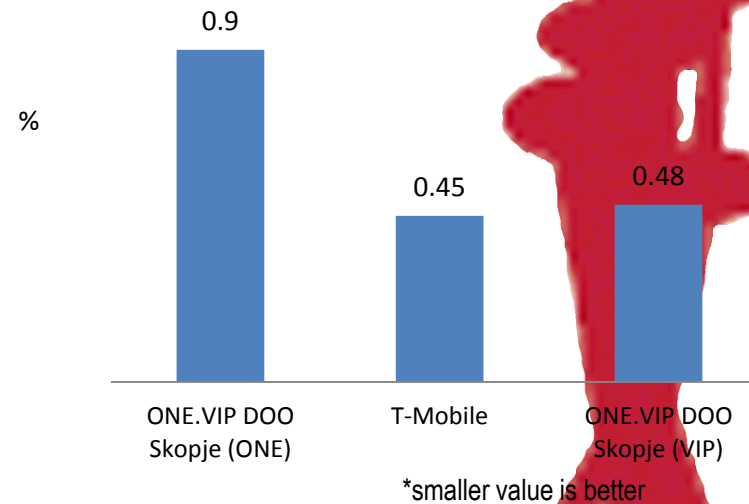
\*bigger value is better



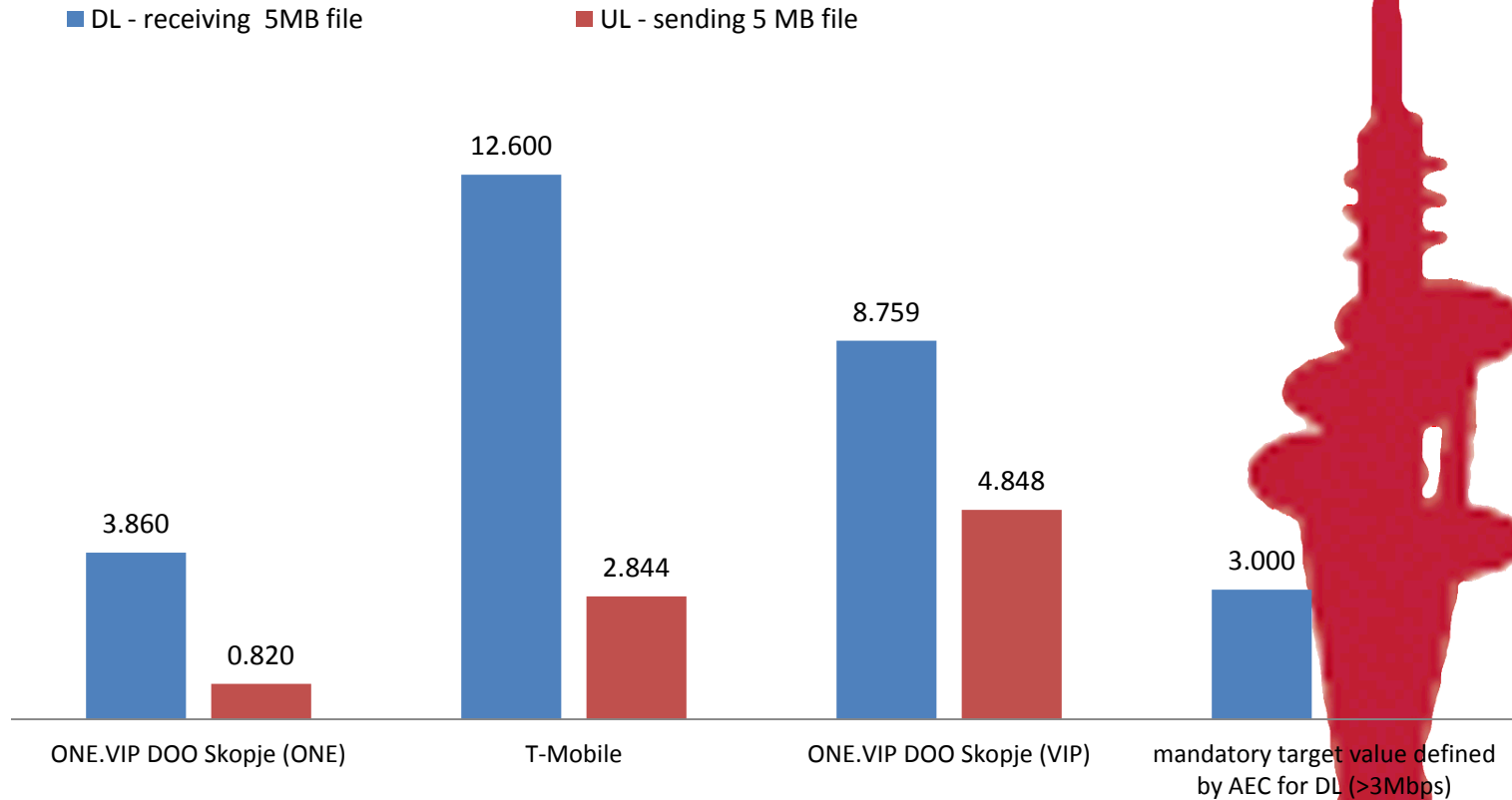
### Server connection setup success rate (failure data attempt)



### Server connection completion rate (drop data session)



## Speed of data transfer via radio communications network combined by technologies(GPRS, EDGE, UMTS и LTE) for cities



# Internet Access Service (IAS) Quality of Service Measuring and Monitoring



# IAS QoS Monitoring

Operators are obliged to prepare Reports containing following parameters:

- Service activation time for fixed (wired)- broadband service
- Network availability ( $> 99.9\%$ )
- Delay
- Delay variation ( $\leq 50\text{ms}$ )
- Bandwidth usage ( $\leq 90\%$ )
- Speed ( $\geq 512$  kbps for Upload and  $\geq 2$  Mbps for Download)
- Packet loss ratio



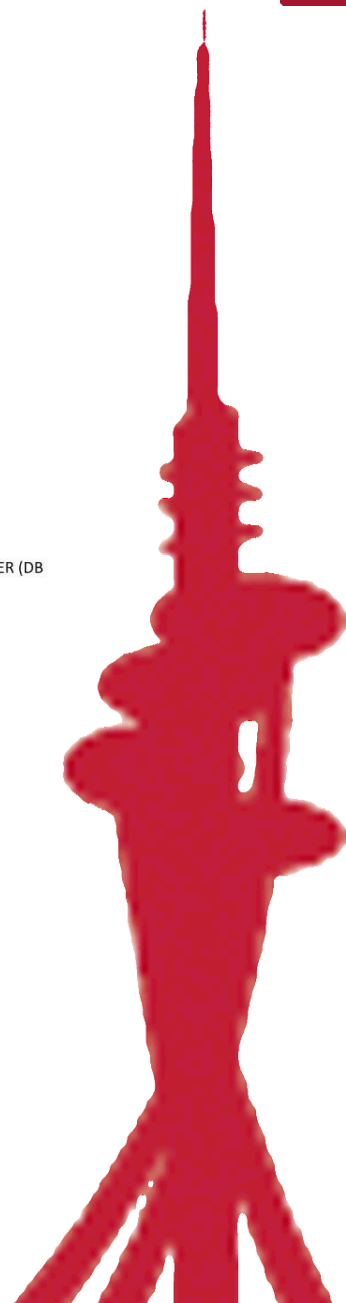
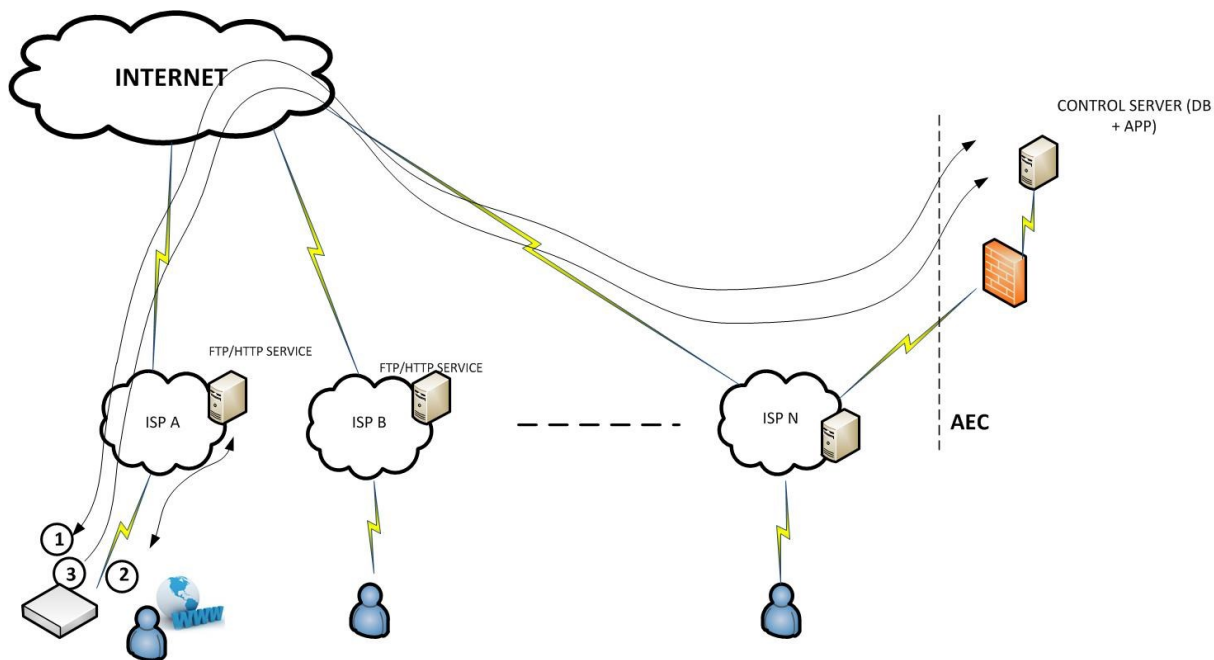
# IAS Measurement System concept

The system should be able to support measurements made by the following terminals:

- Measurements made by web applications for fixed terminal equipment (laptop, PC) at least through two of the most used operating systems (Windows and Mac OS) and adapted to operate at least on two browsers (Internet Explorer, Chrome) ,
  - Measurements made by the application installed in the mobile terminal equipment (smart phones, tablets) adapted to operate at least on two operating systems iOS and Android. The application should be free of charge for installation and use for end users.
  - Measurements made by a hardware component (probe).
- Only measurements made by hardware component (probe) will have legal value

# Measurement process

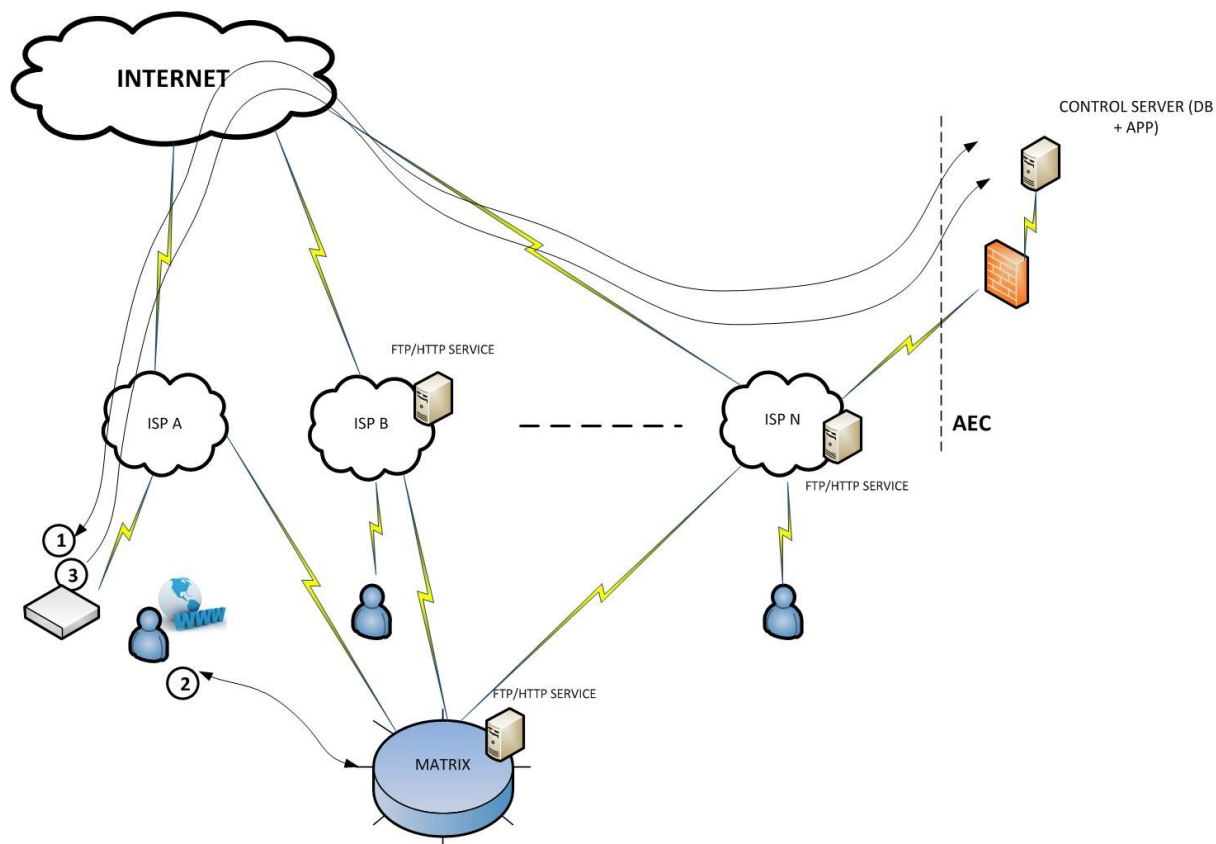
Operator is not connected to the MATR IX (Macedonian Internet Exchange Point)





# Measurement process

Operator is connected to the MATR IX (Macedonian Internet Exchange Point)





**Thank you for attention!**