Internet access service quality: QoS parameters, evaluation methods and practical solutions

What user does in Internet ?

- Searches an information
- Communicates
- Expresses feelings, represents himself, searches like-minded persons
- Plays games, entertains, watches videos, TV, listens radio
- Buys, pays taxes, accesses e - bank, stocks exchange services
- Access e - government services:

Examples of public E- government services

- Access services of any public institution (some services request e- identification, e-signature)
- Annual declaration of incomes and property (upload files of 15-20 kB)
- Declaration of residence
- Registration for a visit to doctor
- Declaration of farmers areas under crops (download speed min600 kb/s is recommended !?)
- Access services of Real property register, Social insurance register, Health insurance register….
- E-voting (up to now is suspended)

What customer would like to obtain and what provider could offer:

Short Internet services access time

High download/upload speed from/to Internet

Rare data transfer/service cut-offs

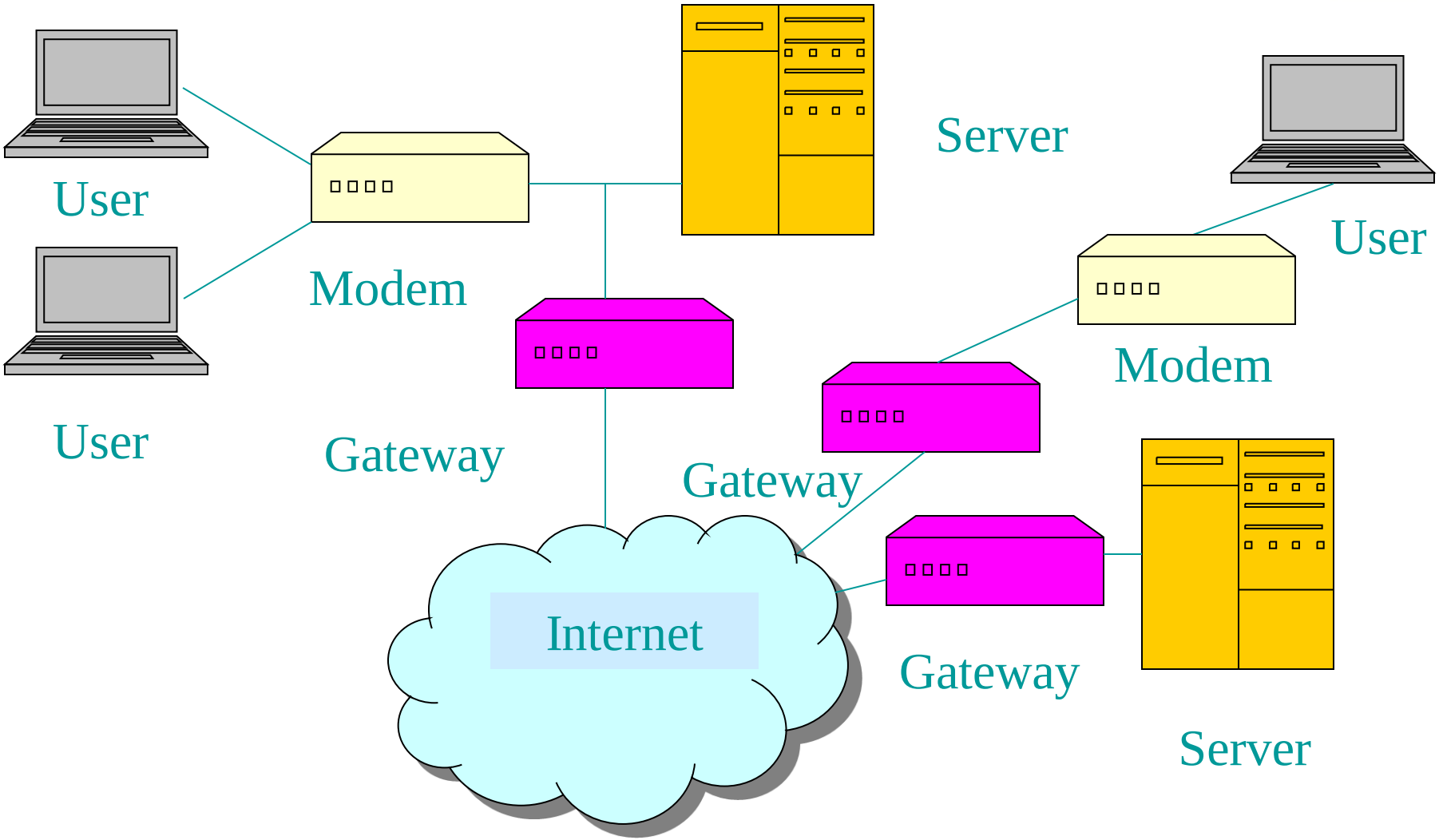
ISPs Internet access services are limited by:

Available interconnections traffic

Peering traffic and diversity limitations

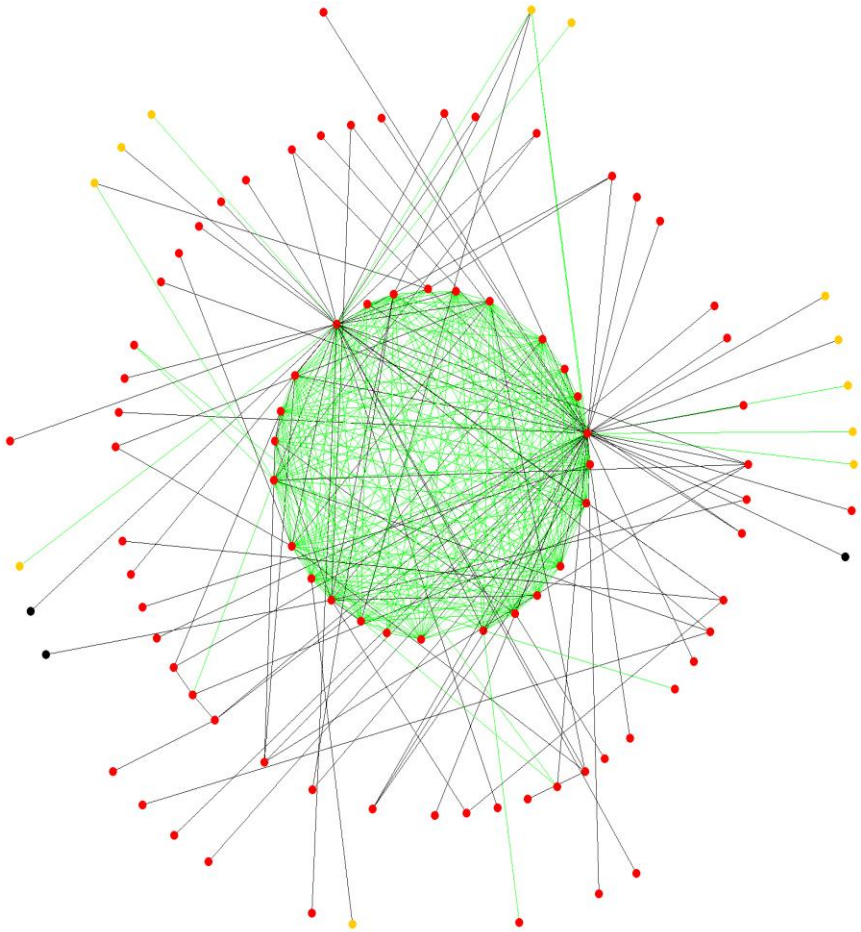
The last mile Internet access technologies

Internet access architecture



LT NET

- ✓ 109 ISPs
- ✓ ~ 600 connections
- ~ 200 transit connections
- ~ 400 peering connections



Lithuanian Internet interconnections

10 LT ISP have interconnections

3 interconnection with TIER-1 ISP

- ✓ 11 interconnection with other ISP
- ✓ International traffic ~ 60 Gb/s

Internet access technologies

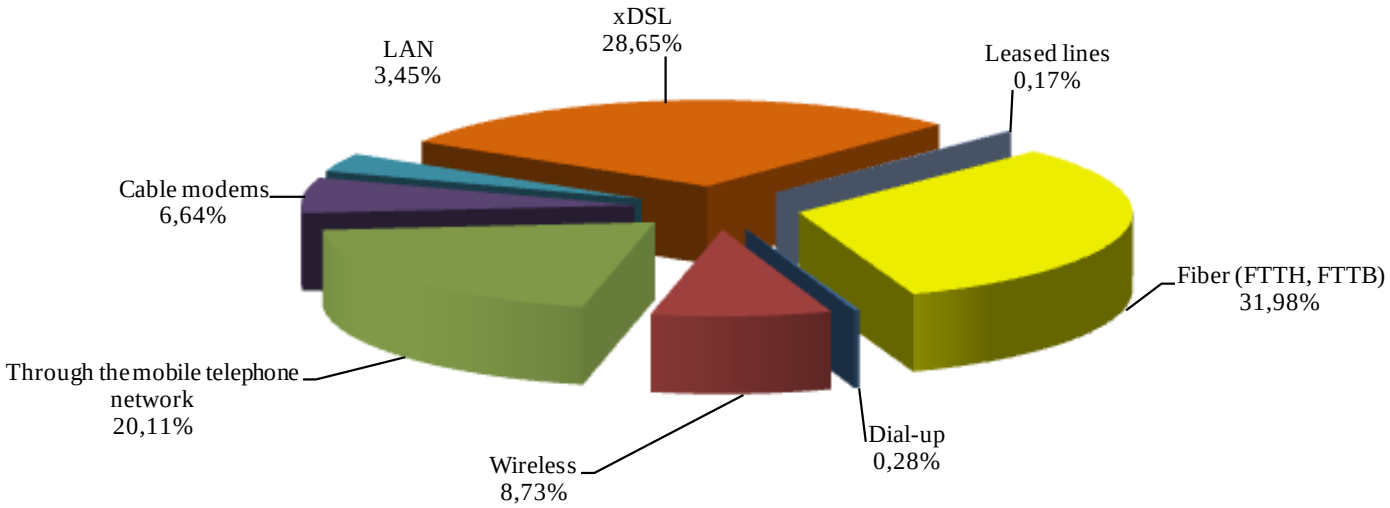
Wired: Power-line, Dial-up, ISDN, DSL, Cable, LAN, Fiber.

Wireless/mobile: GSM-GPRS/EDGE, Wi-Fi, UMTS-HSDPA/HSUPA, WiMAX, LTE

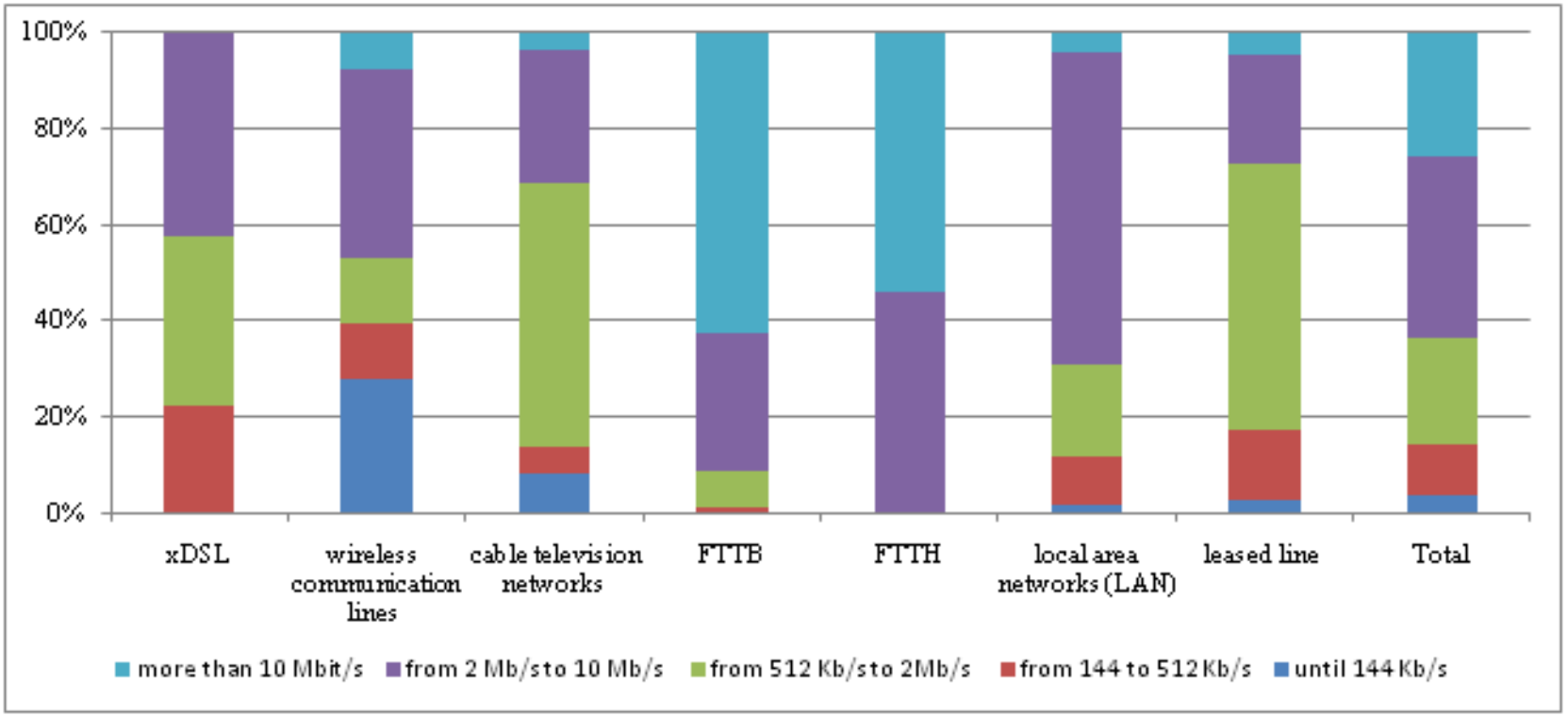
Regardless physical Internet access technology transport layer is the same - IP (TCP/IP, UDP/IP)

Distribution of Internet access services users by the manner of connection IVQ 2009

- 796 thousands of Lithuanian subscribers (23,9 connections per 100 population, 47.7 % households)
- 109 ISPs

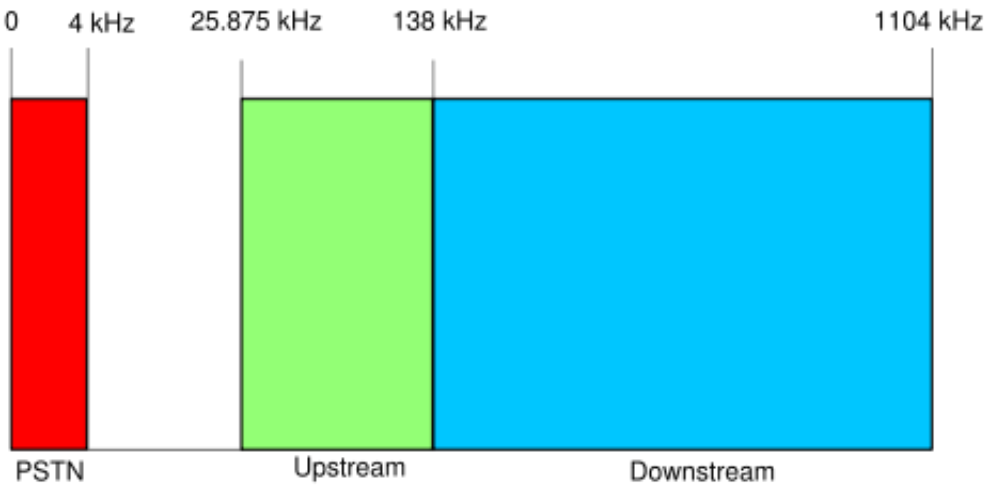


Max downlink data transmission speed defined in contract (IV Q 2009)



ADSL

- ADSL - Asymmetric Digital Subscriber Line utilizes cooper wire for data transmission
- Distance: up to 4 km. ADSL2+M Downstream speed up to 24 Mb/s,
- Upstream speed up to 1 Mb/s
- TEO offers up to 12 Mb/s (ADSL2+)



Internet through TV Cable

- Business users From 3 Mbit/s up to 30 Mb/s.
- For home users up to 6 Mb/s

TELEKOMUNIKACIJŲ BENDROVĖ VINITA

- Up to 4 Mb/s, (Peering 10 Gb/s, Interconnections 2 Gb/s)

Fiber optic

- Theoretically single fiber-optic cable can carry data up to thousands of Tb/s !
- FTTH / FTTB
- TEO offers for home users FTTH up to 200 Mb/s (LT NET) up to 80 Mb/s Internet
- 5C - FTTH up to 100 Mb/s (LT NET) up to 80 Mb/s Internet

- up to 100 Mb/s (LT NET) 15 Mb/s Internet

GPRS/EDGE/UMTS

GPRS - General Packet Radio Service - 2.5 G

EDGE - Enhanced Data rates for GSM Evolution –2.75 G

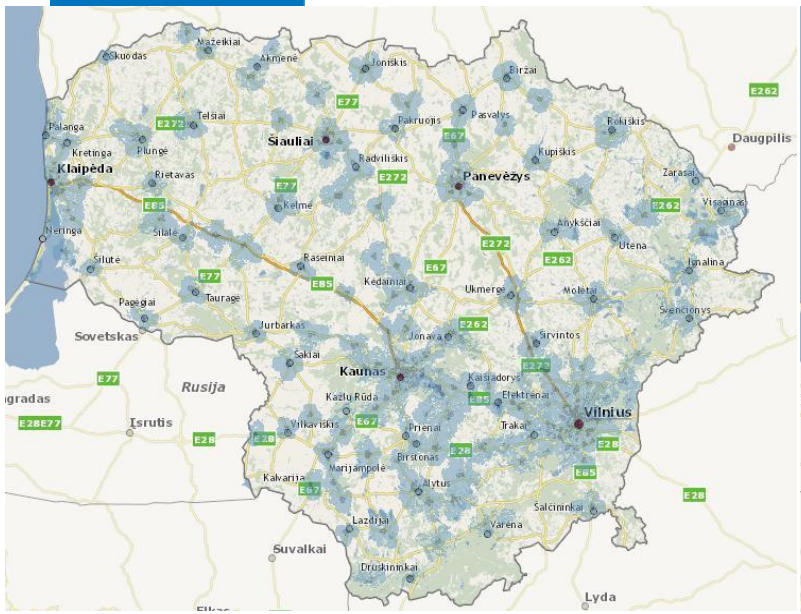
UMTS HSDPA/HSUPA -3.5G

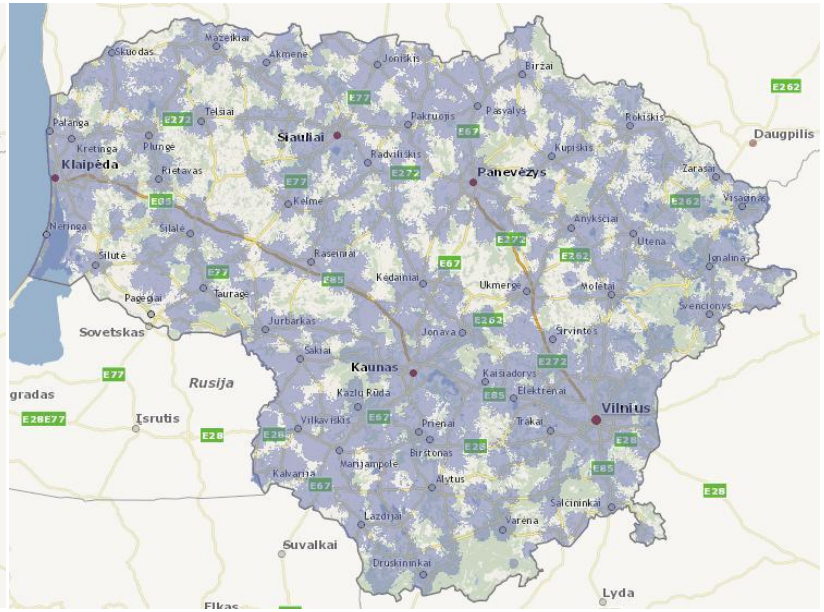
(GPRS up to 85,6 Kb/s, EDGE up to 236,8 Kb/s, UMTS HSDPA up to 7,2 Mb/s, HSUPA up to 2 Mb/s)

OMNITEL
Part of TeliaSonera Group
Žmonės kalba

Offers:

RRT





3G HSDPA in 200 cities and towns

Up to 1 Mb/s, 3 GB/month for 40 LT = 11,6 EUR

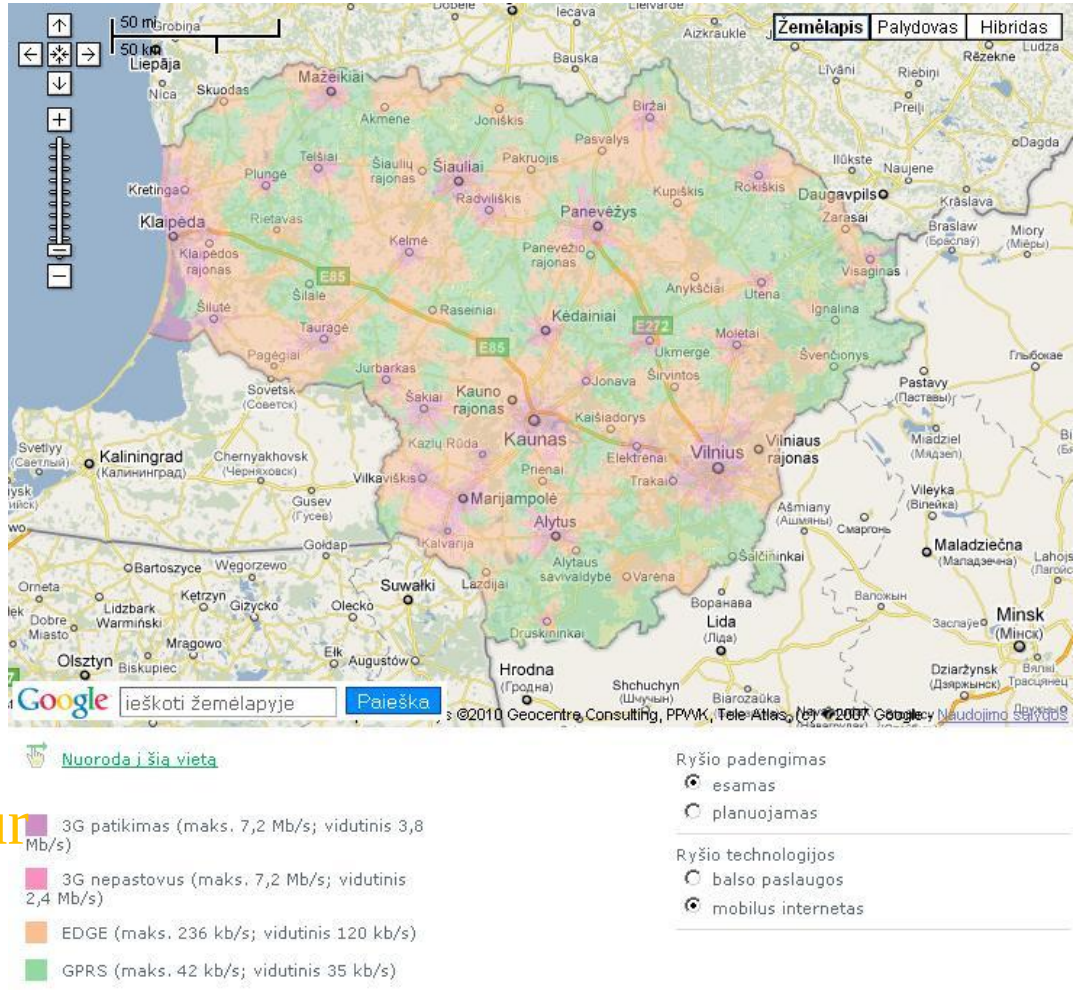
Up to 2 Mb/s 7 GB/month for 70 LT = 20,3 EUR

7,2 Mb/s + 20 LT

Offers:

1 GB/month for 19 LT = 5,5 EUR
3 GB/month for 29 LT = 20,3 EUR
10 GB/month for 49 LT
15 GB/month for 69 LT

PREPAID SERVICES
Up to 0,5 Mb/s,1LT/hour
Up To 7,2 Mb/s, 3,5 LT/hour

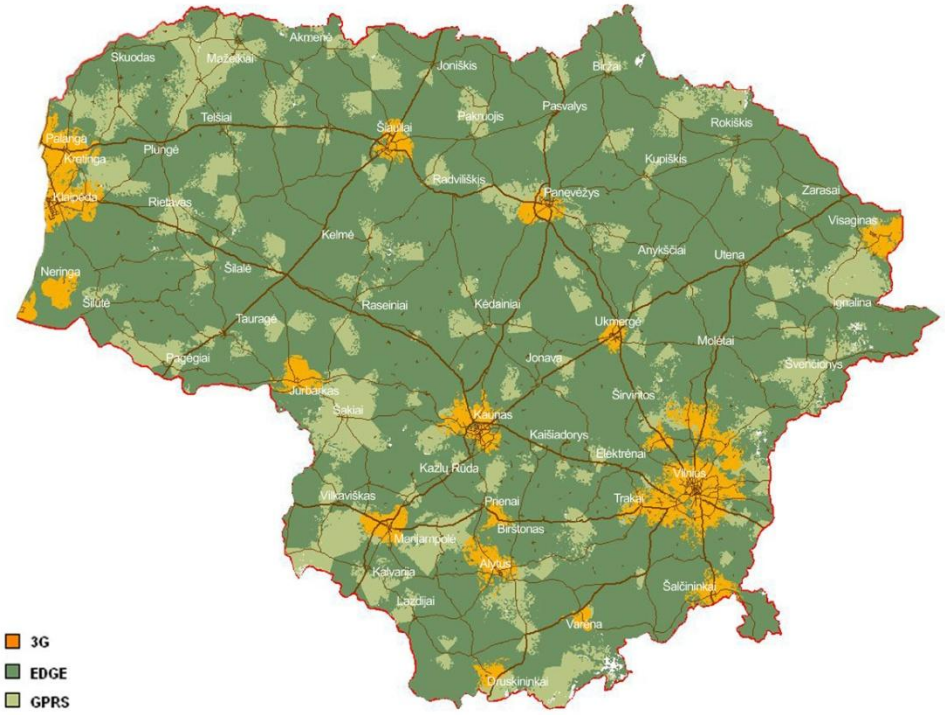


Offers:

1 GB/month , 19 LT = 5,5 EUR

3 GB/month, 29 Lt = 8,4 EUR

Trial period – 2 months !



4G WiMax and LTE

- Wimax; Theoretically up to 70 Mb/s 112 km (in practice 10 Mb/s 2 km in urban area, 10 km in rural area)

Mobilusis 4G internetas

Network is in 20 cities/towns
Download up to 10 Mb/s
From 9 LT to 69 LT
Has prepaid service 2ct/MB

Tikros paslaugos, ne pažadai!

Network is in 5 cities/towns
Download up to 768 Kb/s -2 Mb/s
From 59 LT to 99 LT

Omnitel anounced LTE trial results : up to 52 Mb/s,
Bite- LTE 2011 first Q

Internet access QoS parameters
ETSI EG 202 057-4

Successful log-in ratio [%]

Login time [sec]

Data transmission speed/rate [kb/s] min, max, mean value

Unsuccessful data transmission ratio [%]

Packet loss ratio [%]

Delay [msec]

Jitter/Delay variation [msec]

Targets for QoS parameters to achieve good quality Internet services

- Data transmission (One way)
- Web browsing
- TCP/IP transport, HTTP
- Amount of downloaded data: 10 KB
- Delay < 2-4 s/page
- Information loss 0

- Bulk data transfer
- TCP/IP transport, FTP
- Amount of data: 10 KB – 10 MB
- Delay < 15- 60 s/file
- Information loss 0
- E-mail (e-mail server access – transfer to server2)
- TCP/IP SMTP
- Amount of data 10 KB (with attachment several MB)
- Delay < 4 s minutes
- Information loss 0

- Telephony VoIP: (Symmetrical up/down load)
- UDP/IP
- Data transmission rate: 4 Kb/s – 64 Kb/s
- Delay (one way) < 150 ms
- Jitter < 1 ms
- Packet loss ratio < 3 %

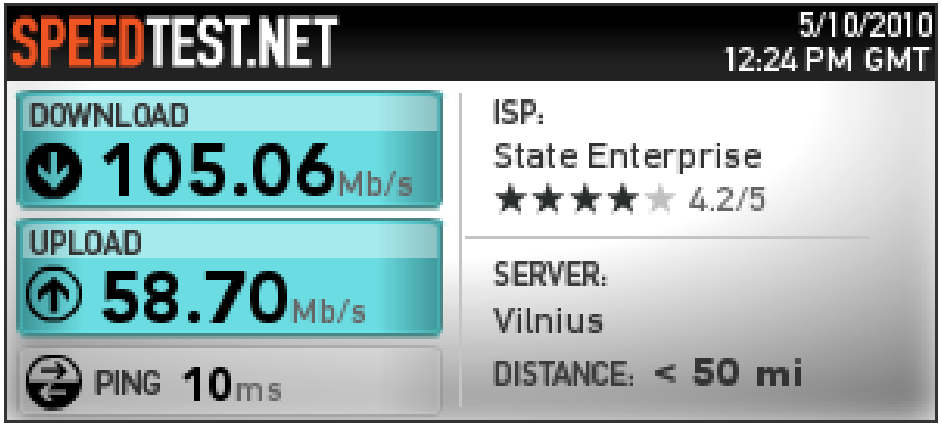
- High quality audio streaming: (one way)
- UDP/IP
- Download rate: 16 Kb/s – 128 Kb/s
- Delay (one way) < 10 s
- Jitter < 1 ms
- Packet loss ratio < 1 %

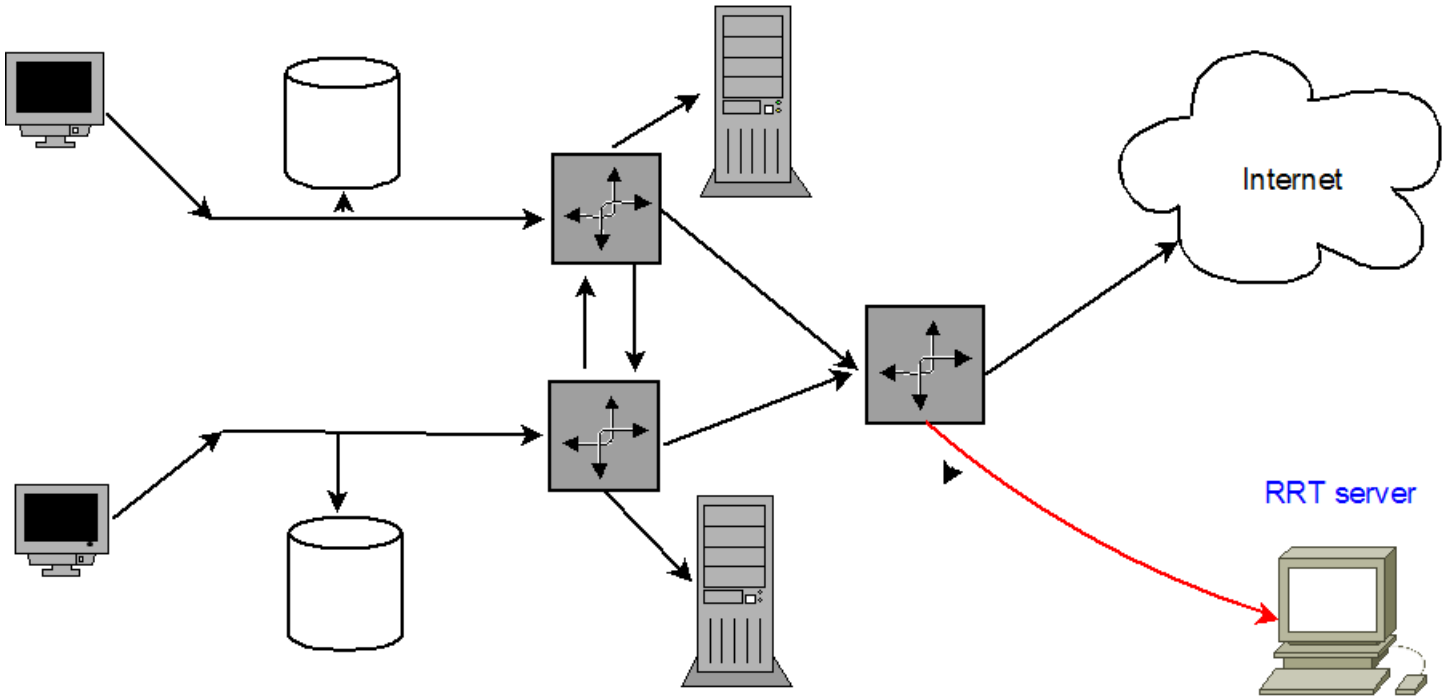
- Videophone: (two way)
- UDP/IP
- Data transmission rate: 16 Kb/s – 384 Kb/s
- Delay (one way) < 150 ms
- Jitter < 1 ms
- Packet loss ratio < 1 %

- Video streaming: (one way)
- UDP/IP
- Download rate: 16 Kb/s – 384 Kb/s
- Delay (one way) < 10 s
- Jitter < 1 ms
- Packet loss ratio < 1 %
- IP TV MPEG4
- SDTV Download rate: 1,5 – 2 Mb/s
- HDTV Download rate: 7 – 10 Mb/s
- Delay (one way) < 150 ms

RRT speedometer for evaluation of ISP QoS (user oriented)

- Many ISP have own data download speedometers (Unfortunately they provide data speed from their server to user computer.
- There are many speedometers in Internet, but it is difficult to compare their results




Internet
RRT server

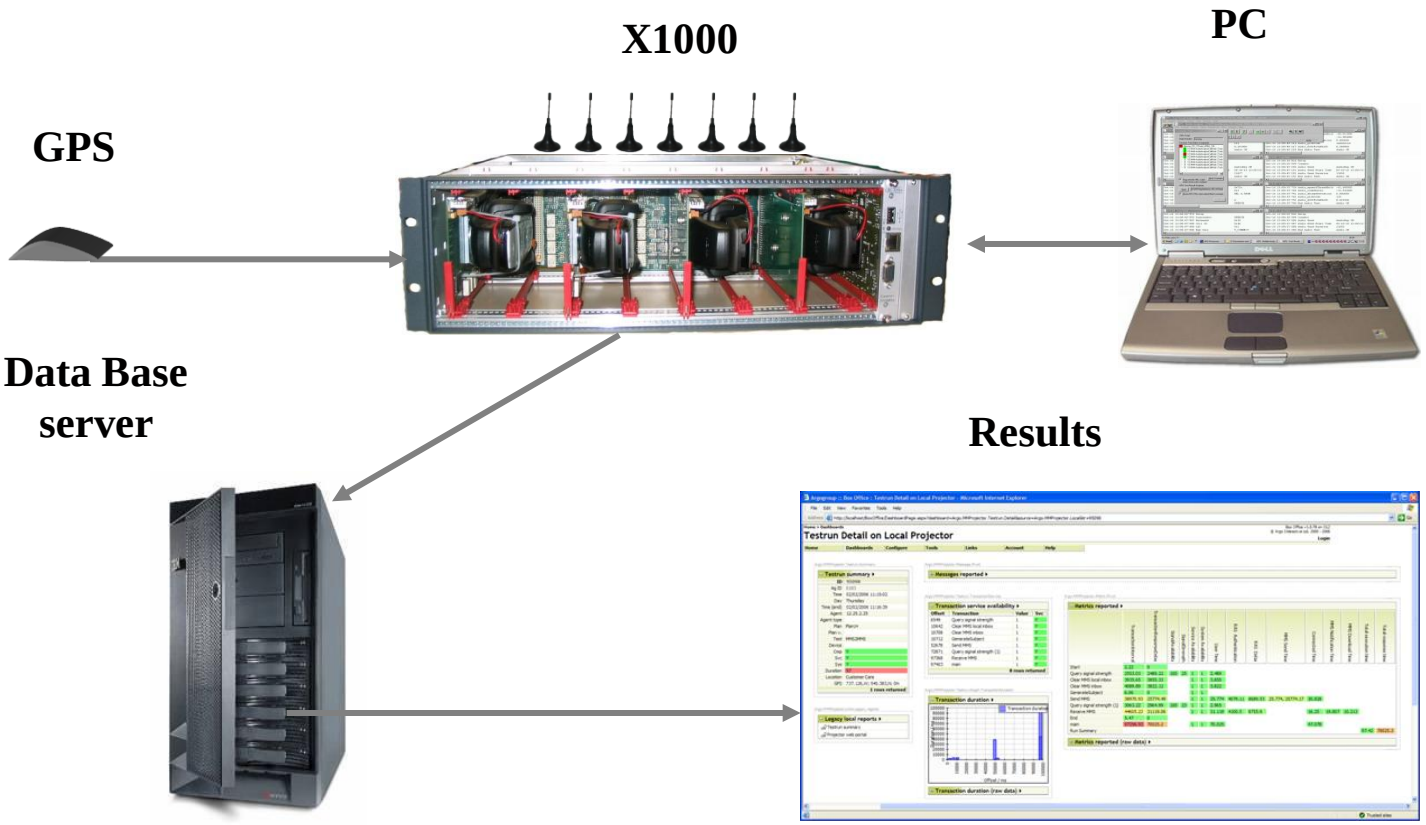
RRT speedometer measures:

- Download rate, kbps
- Upload rate, kbps
- Round trip (both way) delay, ms
- Jitter, ms
- Lost packets, %
- Determines user IP and DNS address
- Selected WebPages download rate
- Provides statistics

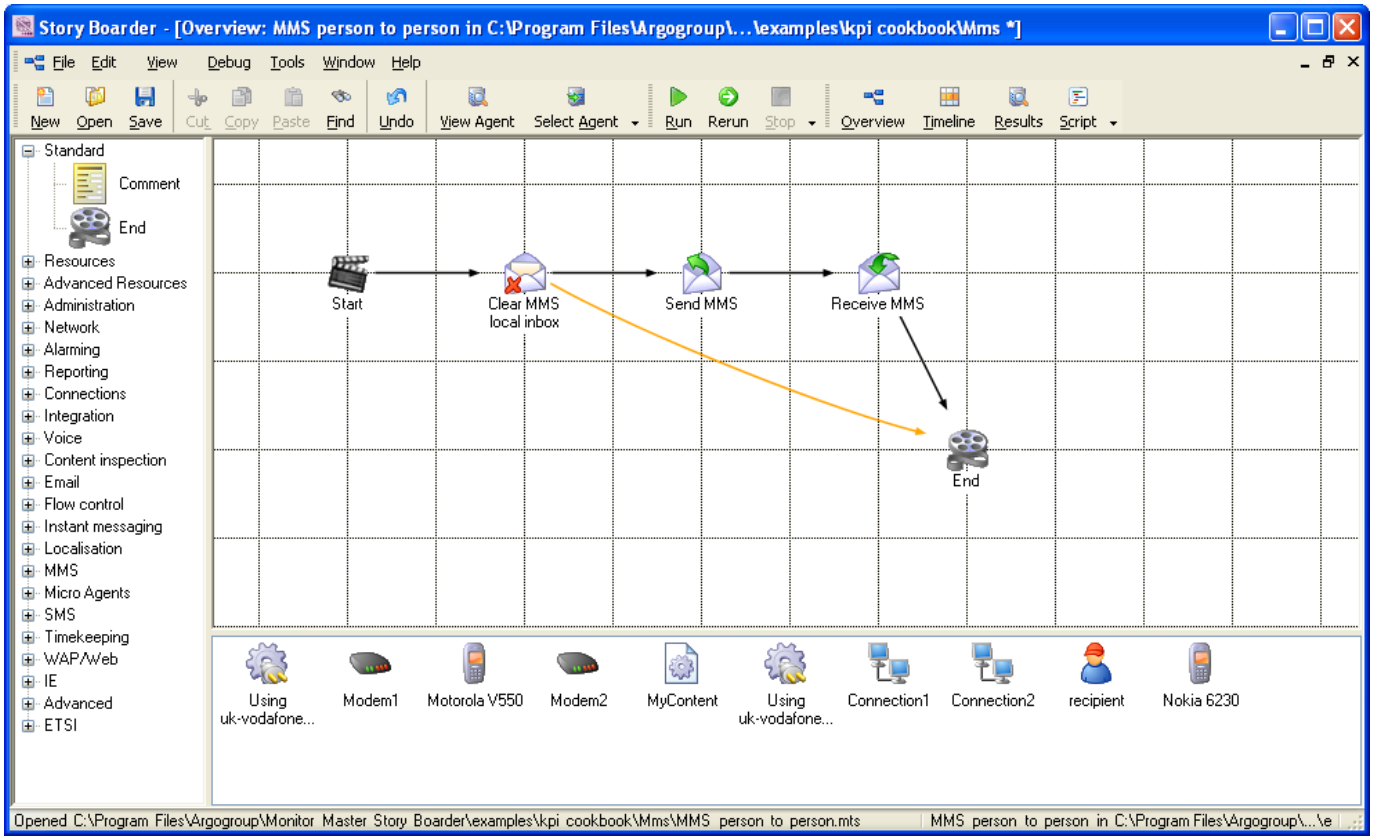
Since 2008 RRT speedometer was launched it was utilized 1,5 mil. times

RRT experience and technique applied for evaluation of mobile ISP

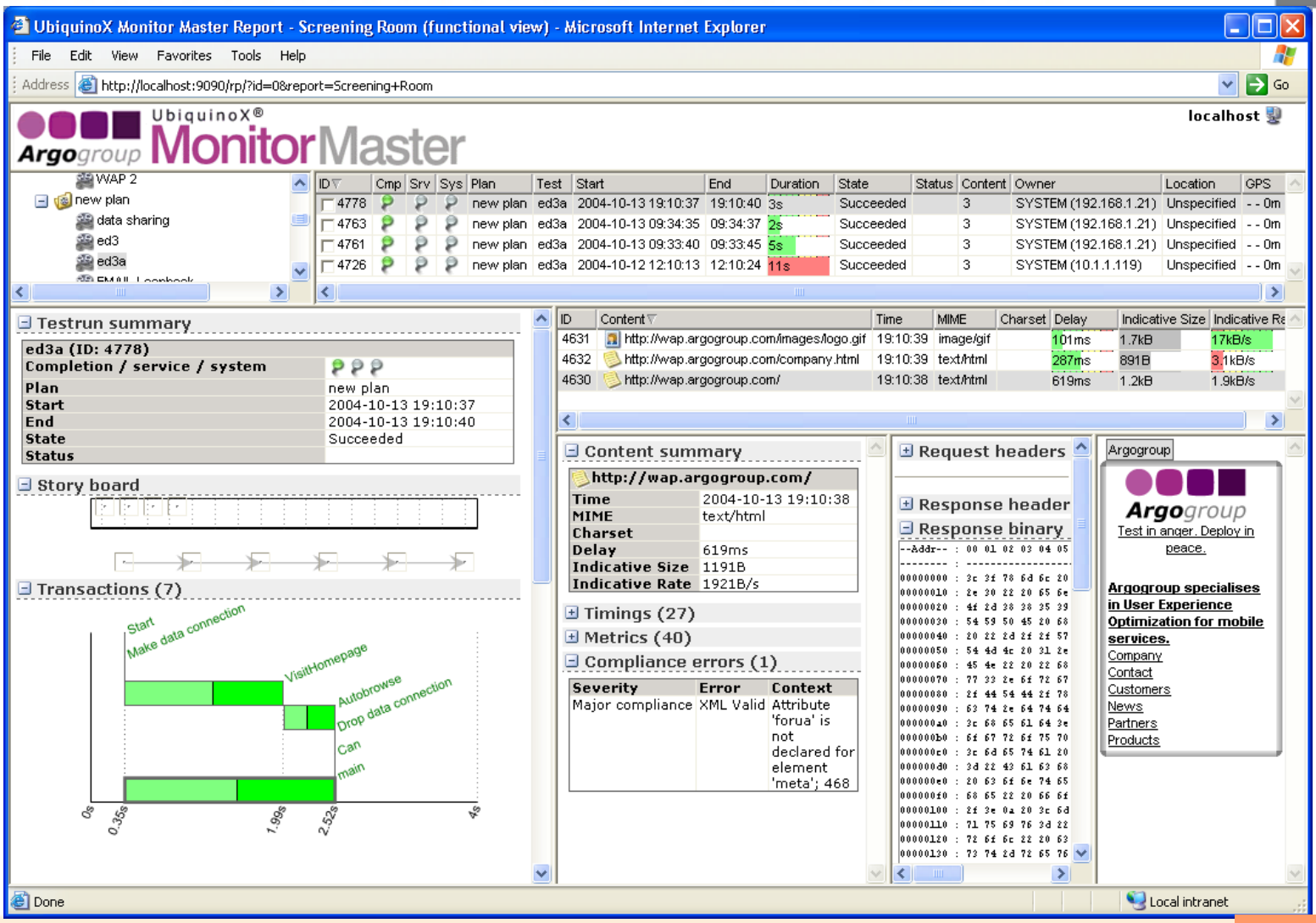
Measurement equipment



Tests scheduler



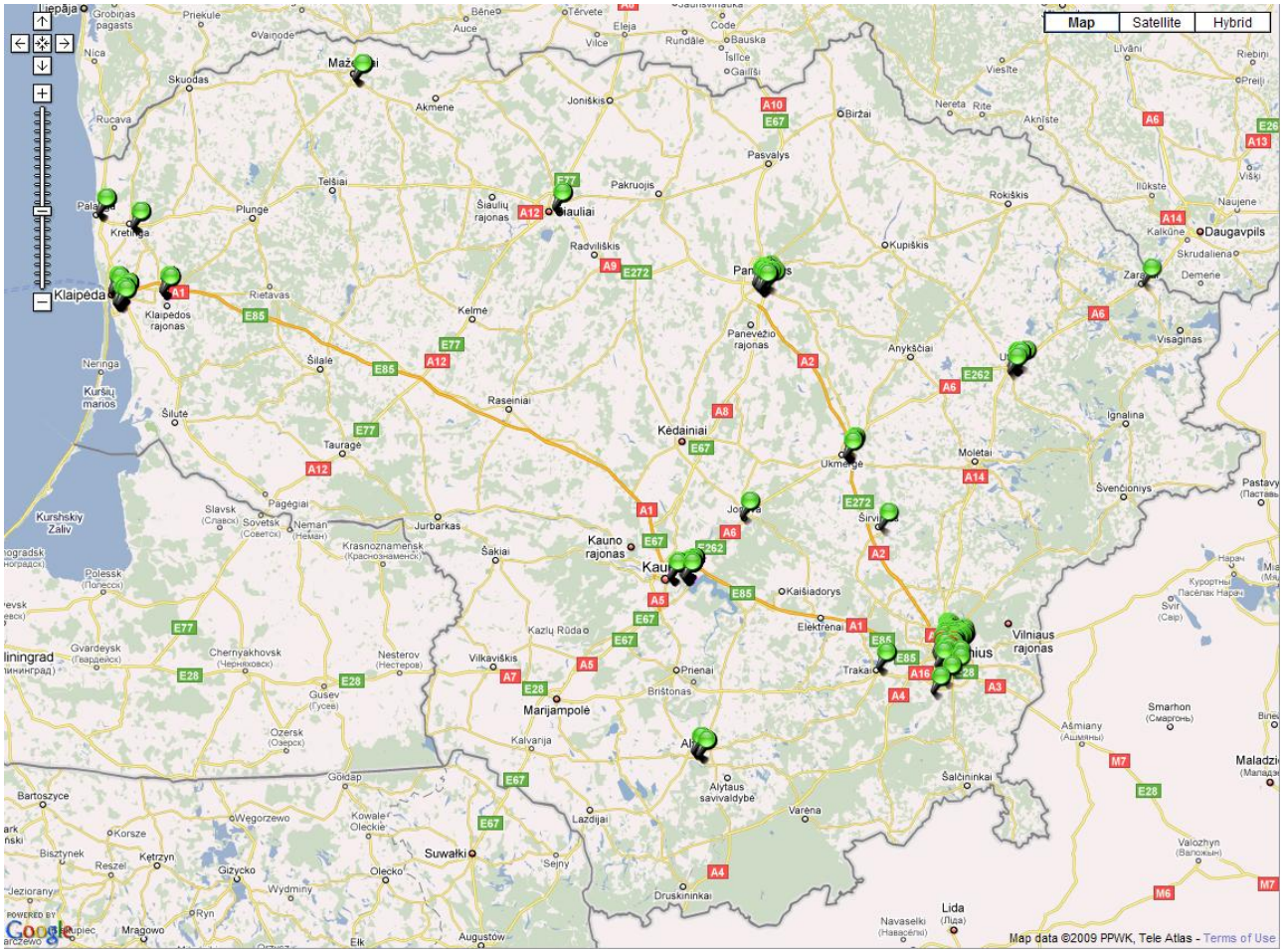
Test


UbiquinoX Monitor Master Report - Screening Room (functional view) - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost:9090/rp/?id=0&report=Screening+Room
Go
UbiquinoX®
Argogroup MonitorMaster
localhost
WAP 2
new plan
data sharing
ed3
ed3a
ID Cmp Srv Sys Plan Test Start End Duration State Status Content Owner Location GPS
4778 new plan ed3a 2004-10-13 19:10:37 19:10:40 3s Succeeded 3 SYSTEM (192.168.1.21) Unspecified - - 0m
4763 new plan ed3a 2004-10-13 09:34:35 09:34:37 2s Succeeded 3 SYSTEM (192.168.1.21) Unspecified - - 0m
4761 new plan ed3a 2004-10-13 09:33:40 09:33:45 5s Succeeded 3 SYSTEM (192.168.1.21) Unspecified - - 0m
4726 new plan ed3a 2004-10-12 12:10:13 12:10:24 11s Succeeded 3 SYSTEM (10.1.1.119) Unspecified - - 0m
Testrun summary
ed3a (ID: 4778)
Completion / service / system
Plan new plan
Start 2004-10-13 19:10:37
End 2004-10-13 19:10:40
State Succeeded
Status
Story board
Transactions (7)
Start
Make data connection
VisitHomepage
Autobrowse
Drop data connection
Can
main
0s
0.35s
1.99s
2.52s
4s
ID Content Time MIME Charset Delay Indicative Size Indicative Ra
4631 http://wap.argogroup.com/images/logo.gif 19:10:39 image/gif 101ms 1.7kB 17kB/s
4632 http://wap.argogroup.com/company.html 19:10:39 text/html 287ms 891B 3.1kB/s
4630 http://wap.argogroup.com/ 19:10:38 text/html 619ms 1.2kB 1.9kB/s
Content summary
http://wap.argogroup.com/
Time 2004-10-13 19:10:38
MIME text/html
Charset
Delay 619ms
Indicative Size 1191B
Indicative Rate 1921B/s
Timings (27)
Metrics (40)
Compliance errors (1)
Severity Error Context
Major compliance XML Valid Attribute 'forua' is not declared for element 'meta'; 468
Request headers
Response header
Response binary
Argogroup
Argogroup
Test in anger. Deploy in peace.
Argogroup specialises in User Experience Optimization for mobile services.
Company
Contact
Customers
News
Partners
Products
Done
Local intranet

2009 UMTS QoS tests conditions

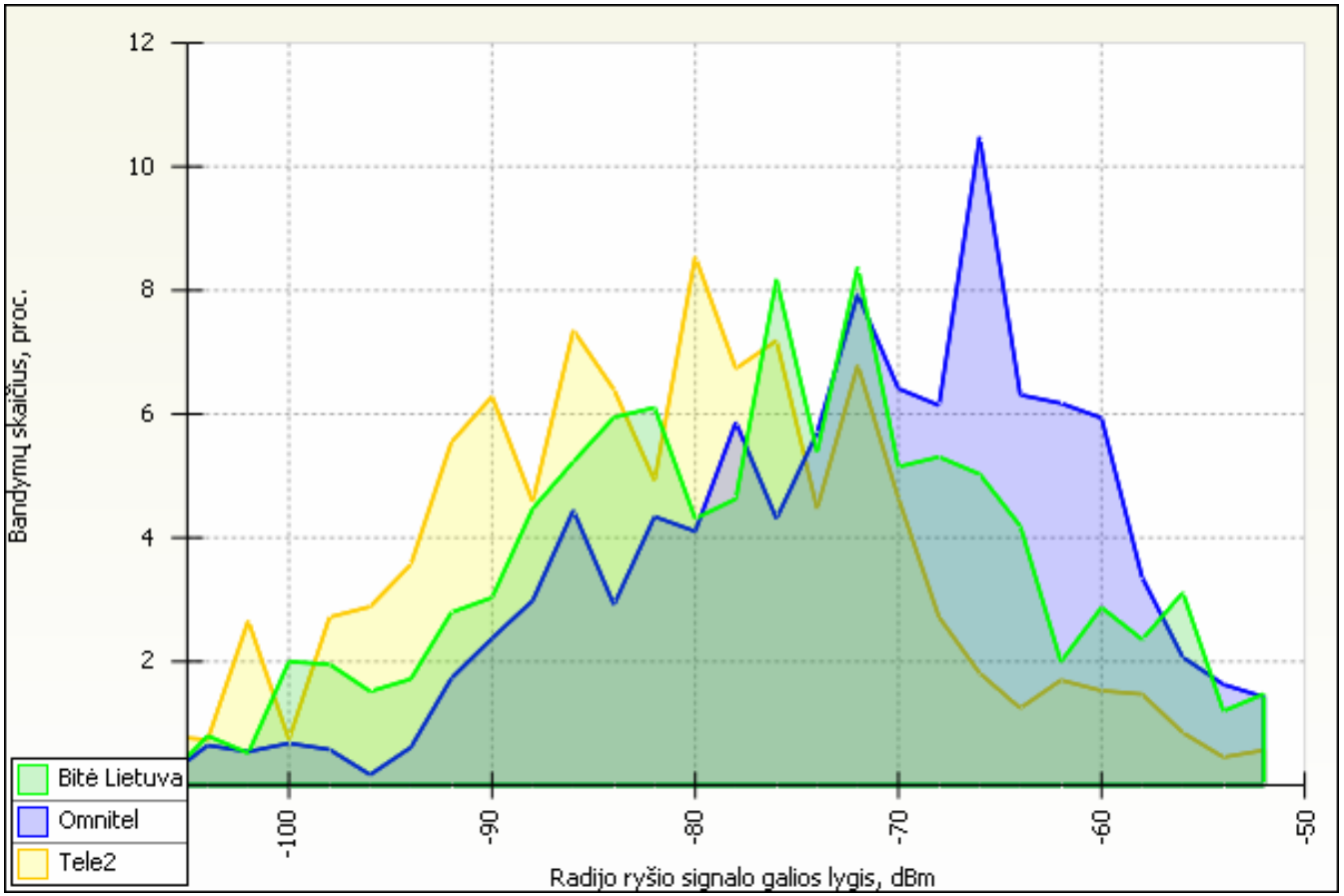
- Tests methods according ETSI TS 102 250-2 v1.6.2 (2008-09)
- In Cities and Towns where 3 operators offer UMTS
- Tests performed during working hours from 8 am to 5 pm
- (Semi) simultaneous tests for all 3 operators
- Sufficient BS signal strength (>-105 dBm)
- Tested HTTP services by downloading uncompressible 1 MB file, placed in RRT HTTP server in IXP

2009 UMTS QoS tests results
Tests geography

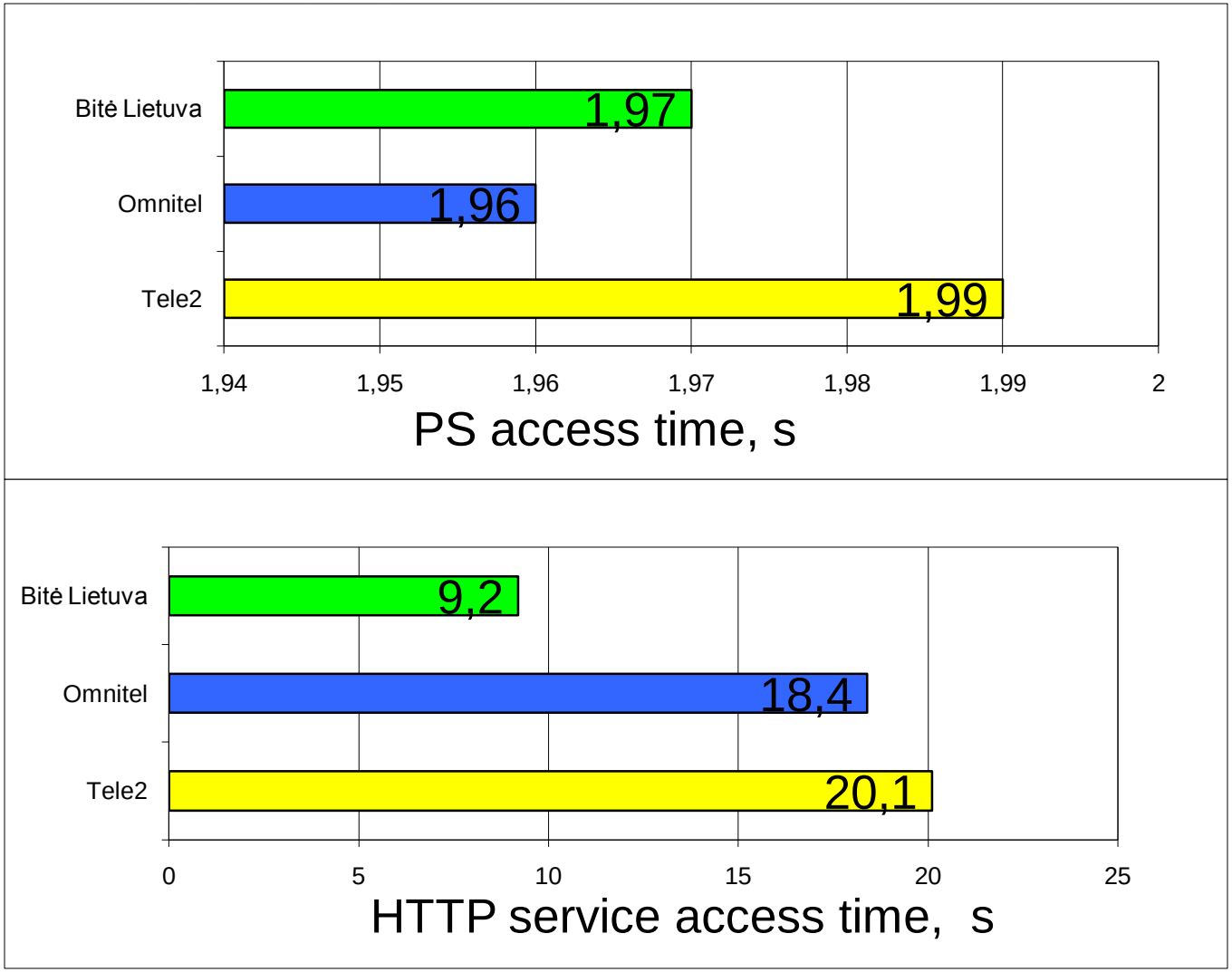


2009 UMTS QoS tests results

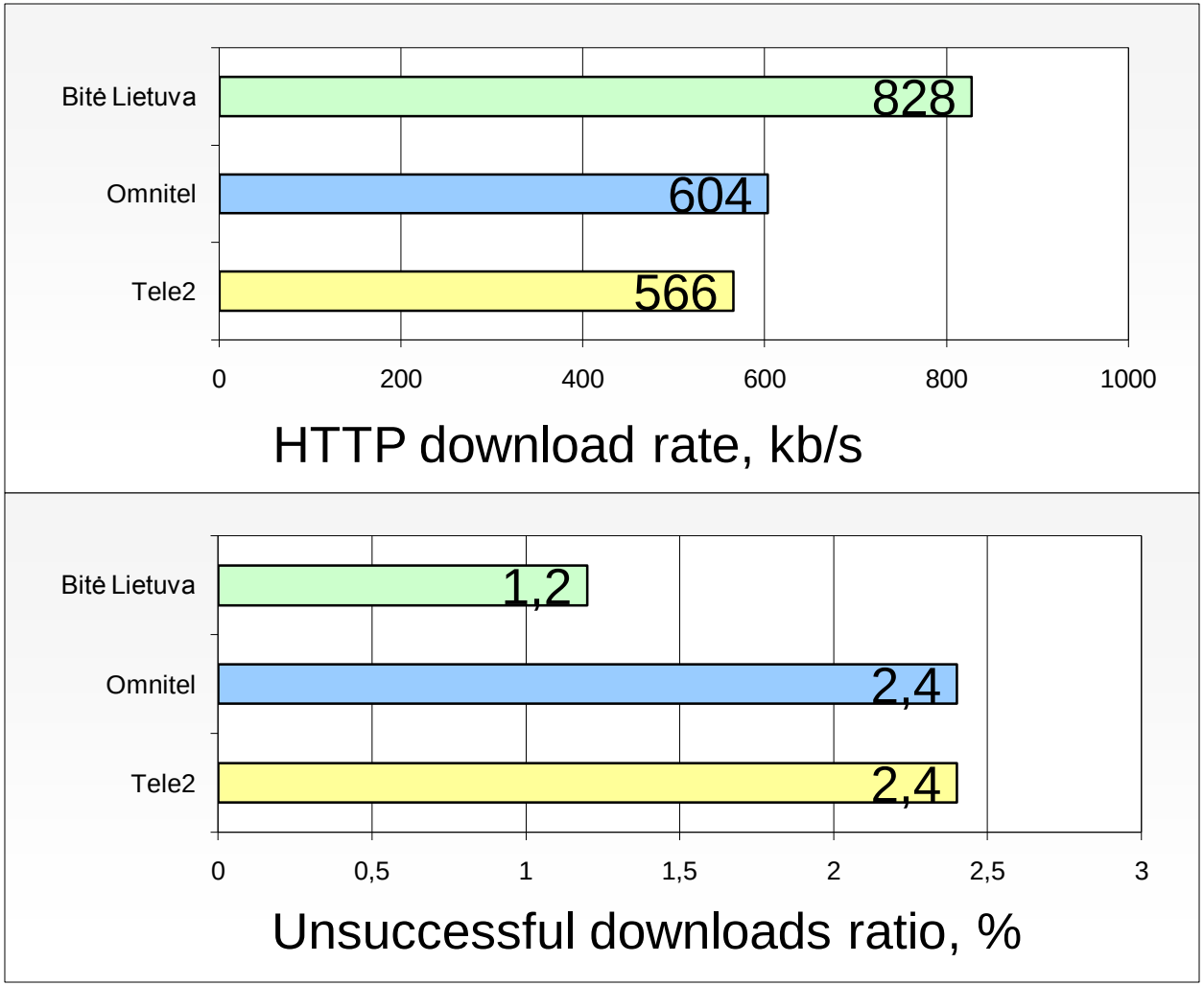
BS radio signal power > -105 dBm



2009 UMTS QoS tests results



2009 UMTS QoS tests results



Customers complains on ISP QoS

- Since 2007 RRT has been judged up to 50 complains on ISP QoS (technical)
- The most of them were on mobile internet access GPRS/EDGE/ UMTS QoS
- One of the main issue- weak radio signal
- Worse data rates than expected, cut offs...
- After emerging new technologies complains on older technologies increase...

Customers complains on ISP QoS

- RRT performs evaluation tests in user defined location
- Preferably RRT uses its equipment (not users)
- Take into account contract defined QoS limits
- Evaluates general Internet access QoS parameters

Conclusions

- More information about Internet access QoS should be provided for customers (Obligations for ISPs and reliable info from third party)
- Internet access QoS parameters should be customer oriented and exactly defined
- Regulator should be technically competent to evaluate ISP QoS

Спасибі !
Thank You !

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