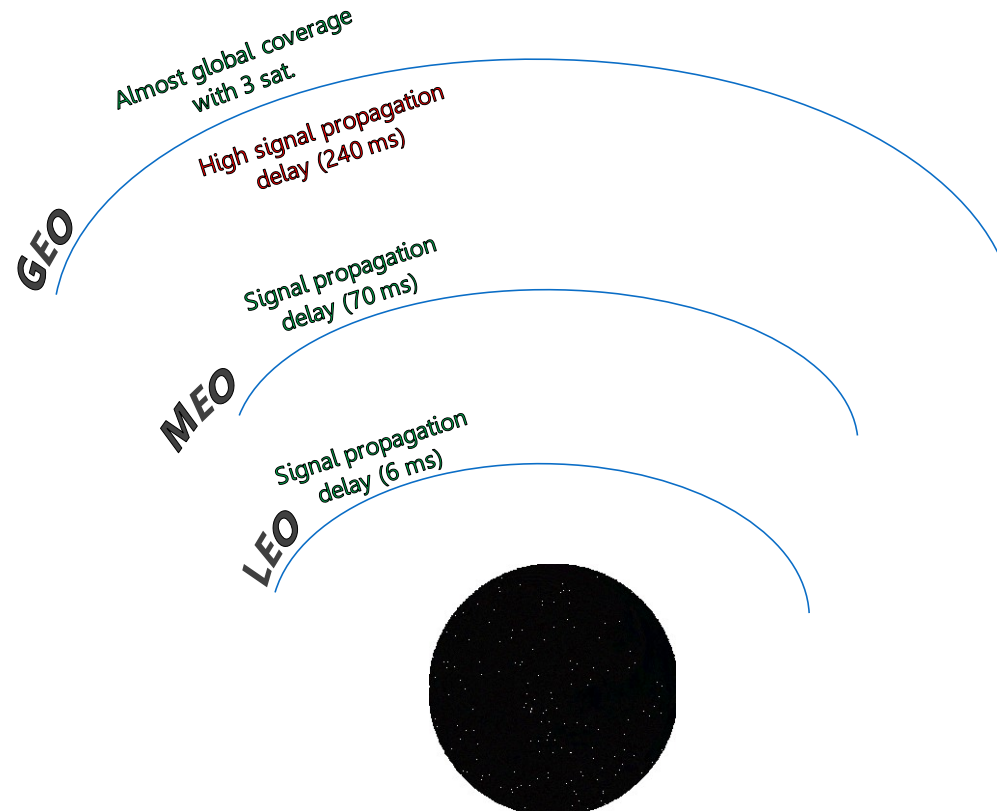# High BDP : focus on SATCOM challenges for QUIC

Characteristics of a SATCOM access

GEO-satellite based systems characteristics:

- Large propagation delay

Almost global coverage with 3 sat.

High signal propagation delay (240 ms)

GEO

Signal propagation delay (70 ms)

MEO

Signal propagation delay (6 ms)

LEO

Characteristics of a SATCOM access

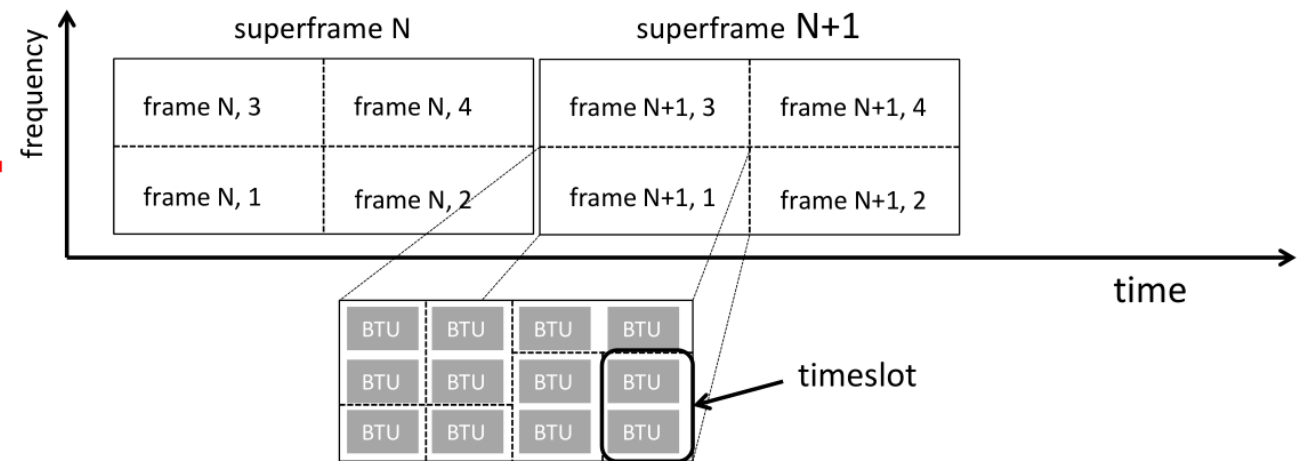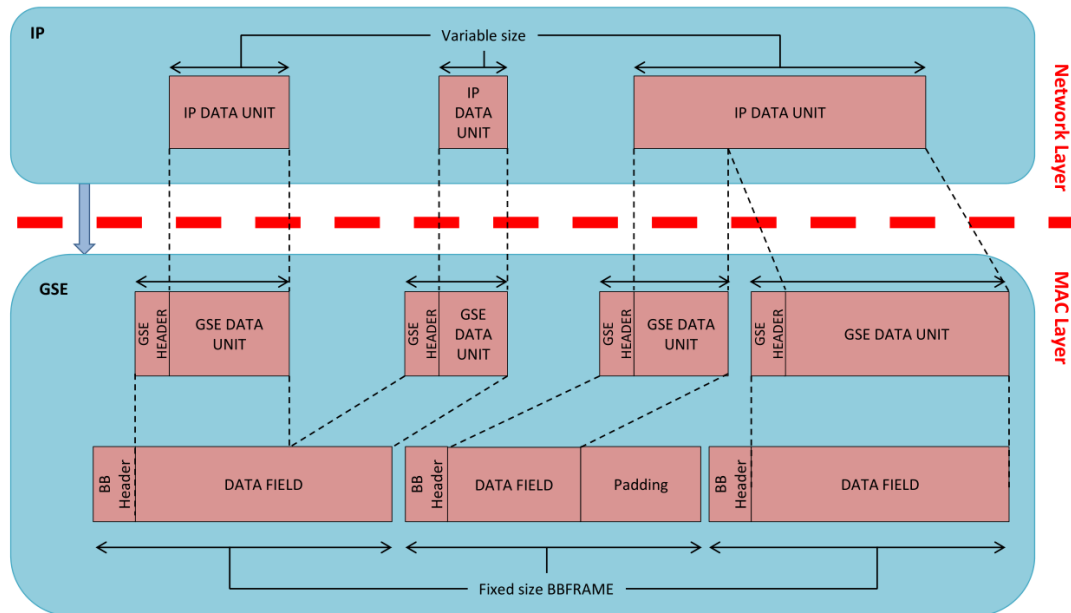GEO-satellite based systems characteristics:

- (sometimes) a high loss-rate (mobile users or users behind a Wi-Fi link)
  - Most SATCOM systems are Quasi-Error Free
  - Rain fades losses happen in very few specific regions
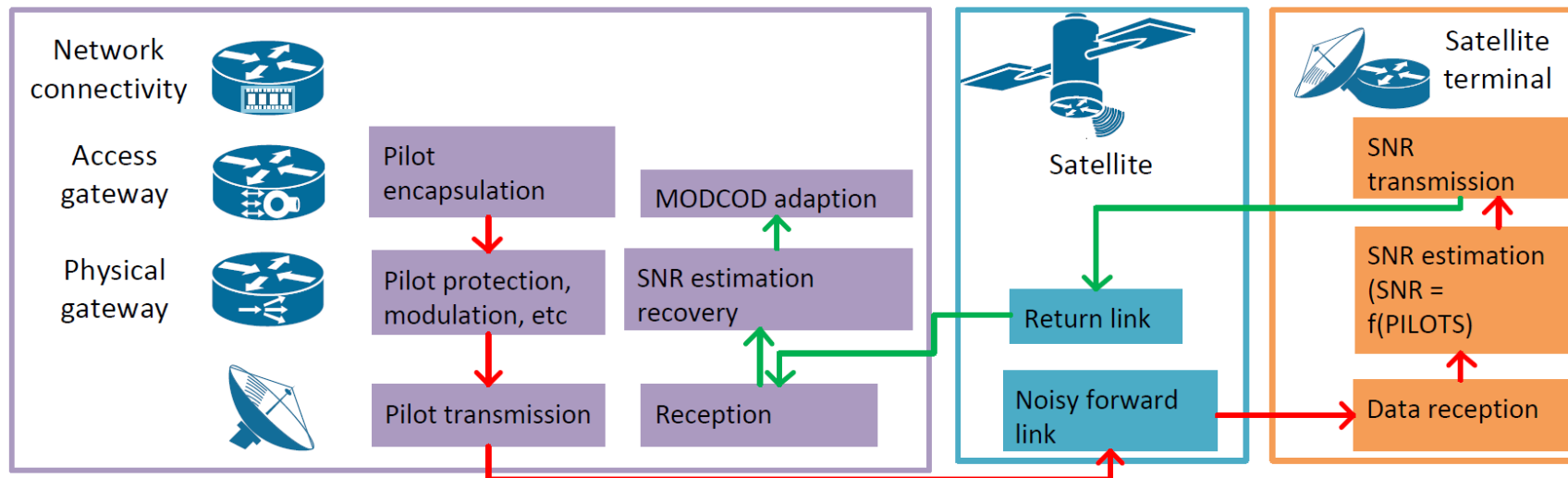
Characteristics of a SATCOM access

GEO-satellite based systems characteristics:

- Radio resource management and asymetry

Other networks with high RTT – fixed access

Latency on fixed access (The RTT Distribution of TCP Flows in the Internet and its Impact on TCP based Flow Control)
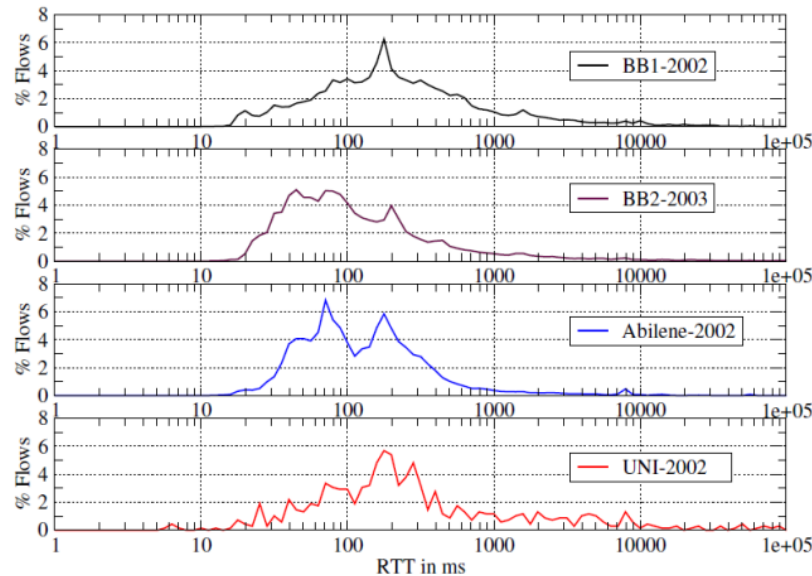
Latency on fixed access (Analysis of Internet Latency : the Reunion Island Case)

Figure 8: RTT distribution for the four data sets. The two spikes correspond to coast-to-coast US and Asian/European traffic.
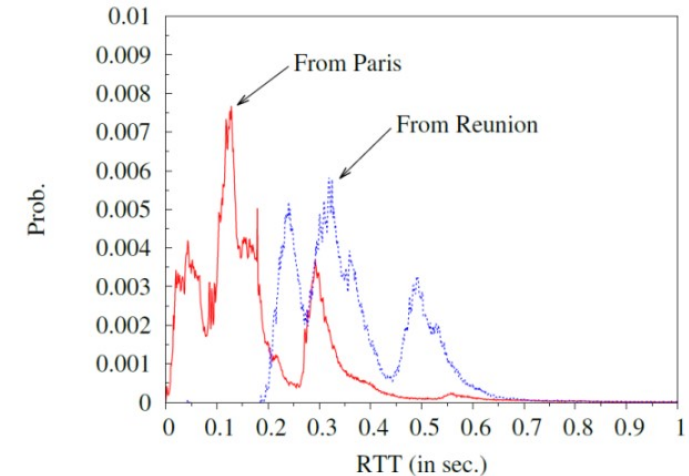

Figure 2: Comparison between Reunion Island access.

Other networks with high RTT – LTE access

Latency on LTE (An In-depth Study of LTE: Effect of Network Protocol and
Application Behavior on Performance – SIGCOM'13)

**Table 1: Comparing with previous measurement studies**

Study	Our Results	3GTest [14]	4GTest [13]		SpeedTest [31]					
Time	October 2012	Aug to Dec 2009	Oct to Dec 2011		February 21 2011 to June 5 2011 (15 weeks)					
Location	One US Metro Area	Across U.S.	Across U.S.		New York City		Madison WI, US		Manchester UK	
Type	LTE Only	Four 3G ISPs	LTE	WiMAX	Cellular	WiFi	Cellular	WiFi	Cellular	WiFi
5% TCP DL*	569	74 – 222**	2112	431	108	404	99	347	28	267
50% TCP DL	9185	556 – 970	12740	4670	1678	7040	895	5742	1077	4717
95% TCP DL	24229	1921 – 2943	30812	10344	12922	17617	3485	14173	3842	15635
5% TCP UL	38	24 – 52	387	172	52	177	55	168	25	180
50% TCP UL	2286	207 – 331	5640	1160	772	2020	478	1064	396	745
95% TCP UL	8361	434 – 664	19358	1595	5428	10094	1389	5251	1659	5589
5% HS RTT	30	125 – 182	37	89	68	21	99	24	98	34
50% HS RTT	70	160 – 200	70	125	159	54	184	69	221	92
95% HS RTT	467	645 – 809	127	213	786	336	773	343	912	313

* TCP DL: downlink throughput (kbps). TCP UL: uplink throughput (kbps). HS RTT: TCP handshake RTT (ms). 5%, 50%, 95% are percentiles.
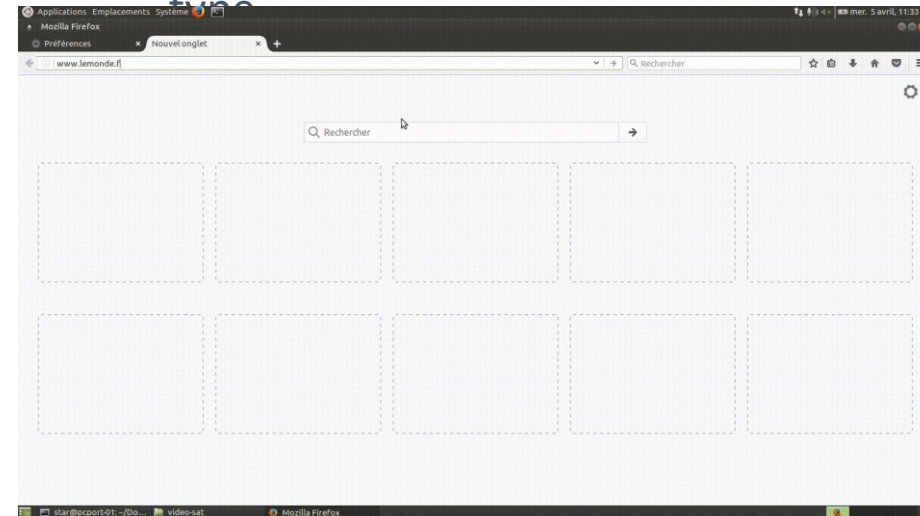** For a range $x - y$, x and y are the result of the worst and the best carriers, respectively, for that particular test.

Latency and webbrowsing on SATCOM

Light page – Wikipedia type
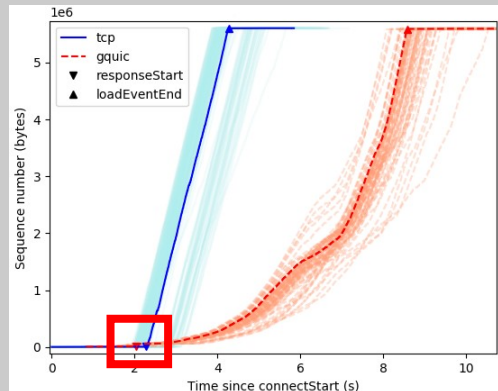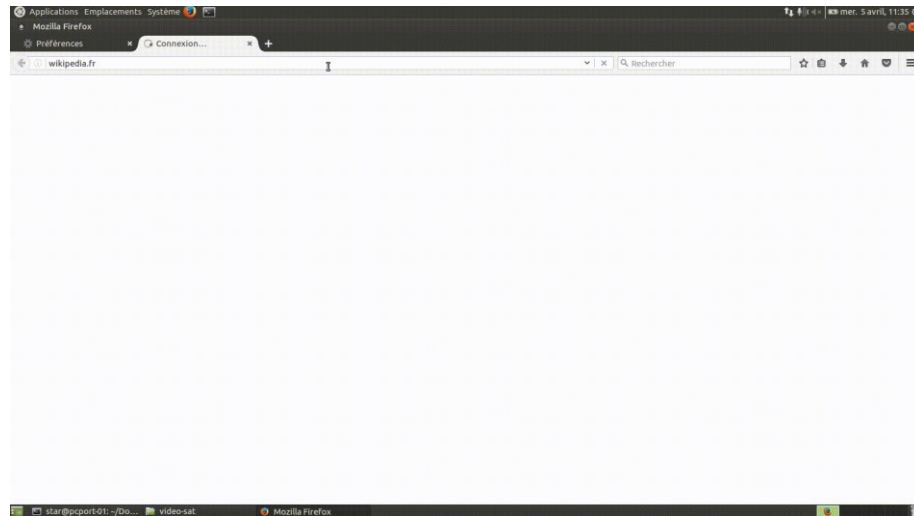
Heavy page – news media type

TOOWAY satellite Internet access :
- Solution furnished by ISP ALSATIS with EUTELSAT operator
- 20Mbps download / 6 Mbps upload

Challenge : SWOT analysis of QUIC in SATCOM

SWOT analysis of QUIC in SATCOM

Strength	Weakness	Opportunity	Threat
0-RTT handshake TLS handshake	Loss impact on large file transfers	More integrated SATCOM systems Cheaper ground segments	Lack of control on evolution of the protocol Potential QoE reduction

Loss ratio	Goodput (Mbps)
0	10
0.0001	8.5
0.0005	5.2
0.001	4.2
0.005	1.1

Questions ?

500 Gbps in Ka-band