5toFORO DE TELEVISIÓN DIGITAL

ANALYSIS OF UDP MULTICAST STREAMS USED IN RADIOCUBA TV TRANSMISSION CENTERS

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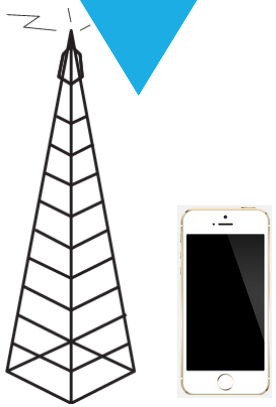
INTRODUCTION

- Guarantying quality of service (QoS) of Digital Terrestrial Television transmitters networks in all country is a priority.
- Deficient delivery of MPEG-2 Transport Stream to the transmission centers could cause degradation on digital signal quality.
- This article verify the fundamental parameters of MPEG-2 TS into UDP multicast streams, to achieve correct delivery with admitted tolerance values.
- UDP and RTP analysis are made with Wireshark, which allows capturing UDP multicast streams and shows required bandwidth, packet loss, buffer requirements, burst, jitter, delta, etc.
- TSReader and PROMAX TS Analyser softwares are used for checking priority 1, 2, 3 errors, PCR accuracy and other fundamental parameters.

The trend is to converge

Satellite Uplinks



Telephony

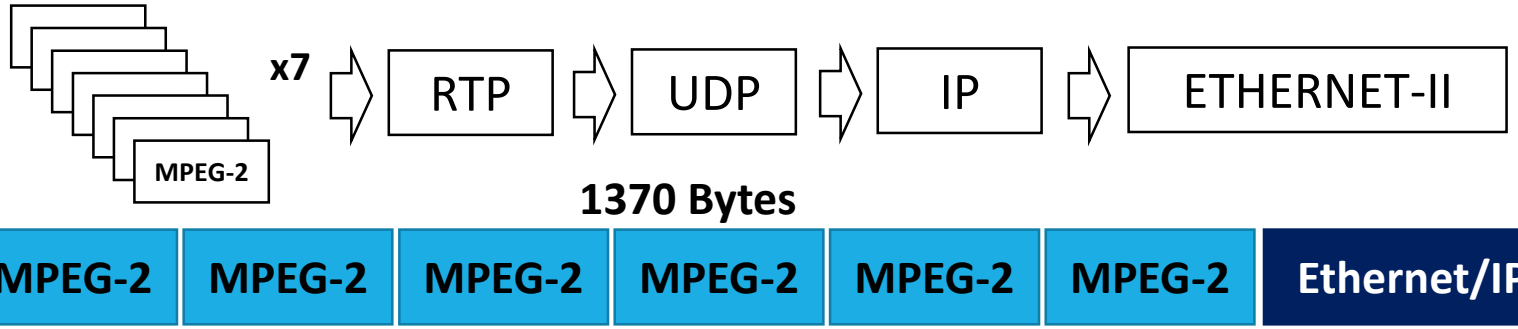
TV Broadcasting

- Voice, data and video services are carried over the IP backbone to the network edge.
- Real time services (voice and video) require Quality of Service.

Television Studios

ETECSA Data Network

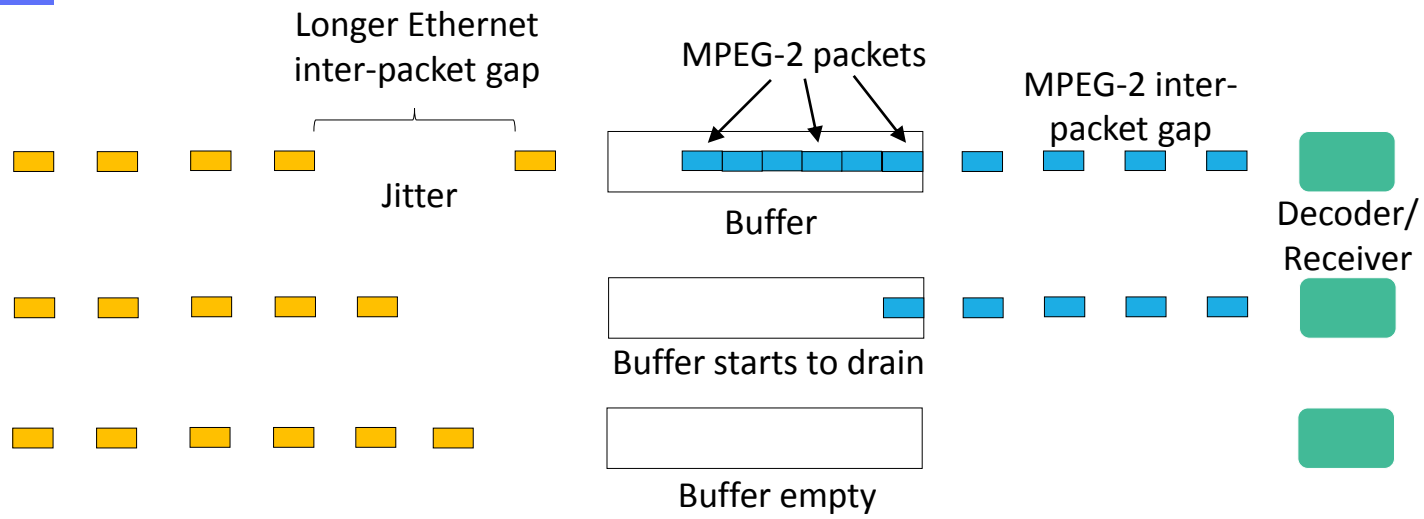
RADIOCUBA Transmission Centers



MPEG-2 uses time stamps called Program Clock References (PCRs), for every program, wich the receiver uses to sync its clock.

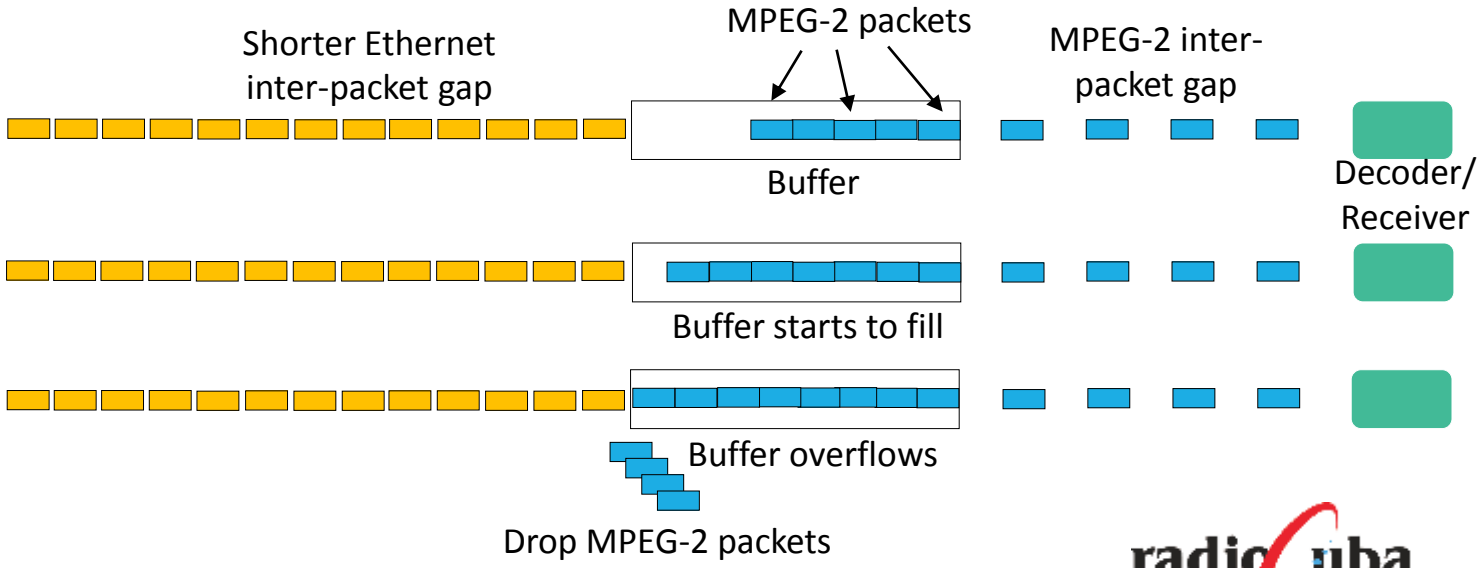
Properties that must be measured and monitored:

- Inter-packet arrival jitter causing delay.
- Inter-packet arrival jitter causing burst.
- Ethernet packet loss.
- Ethernet inter-packet arrival average drift/deviation from the MPEG-2 data transport rate.
- MPEG-2 quality due to packet corruption on the network, MPEG-2 encoding errors, or MPEG-2 packet loss.



Inter-packet arrival jitter causing delay

Inter-packet arrival jitter causing bursts



Softwares and tools

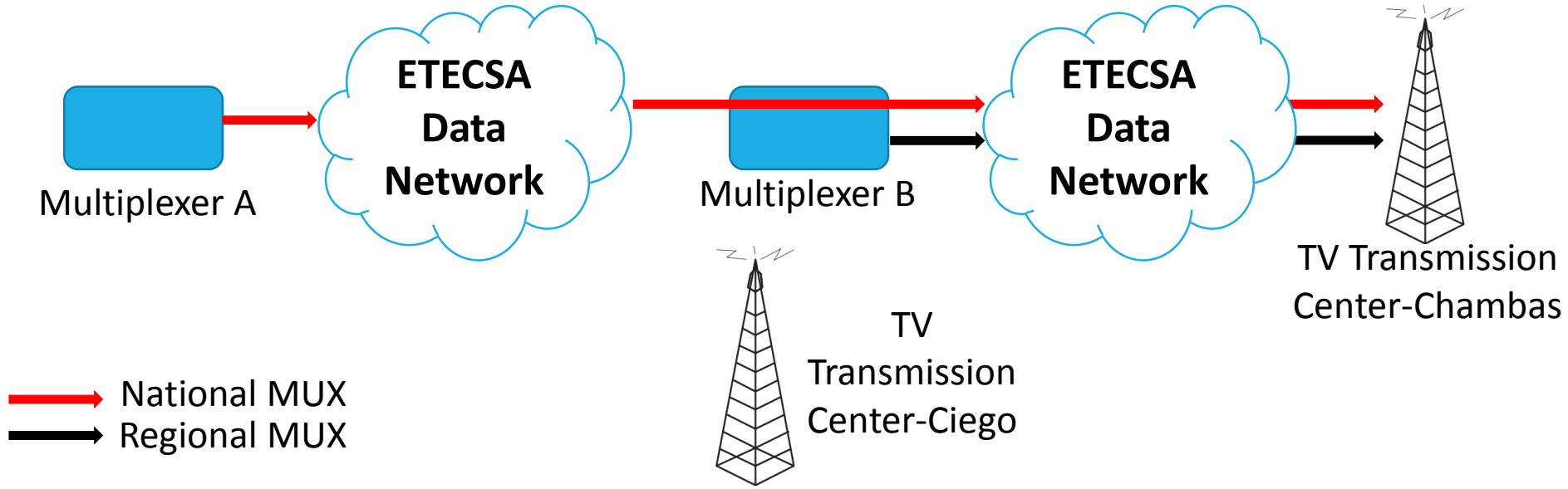
- It is a network protocol analyser.
- It performs RTP analysis for real time applications.
- It calculates UDP statistics for multicast streams.

- It is a transport stream analyser, decoder, recorder and stream manipulator for MPEG-2 systems.
- It can be very useful for finding errors or inefficiencies (TR 101 290).
- It can use a stream coming from a file, satellite, terrestrial, cable, or IP source.
- It shows an overview of the channels and tables carried in the mux.

TS ANALYSER

- It is a transport stream analyser for MPEG-2 systems.
- It shows detailed information about priority errors (TR 101 290).
- It calculates the TS bitrate and PCR accuracy.
- It shows the video, audio and data usage in the mux.

Distribution of analized MUX:



RTP analysis

Test	Duration (s)	Max. Delta (ms)	Max. Jitter (ms)	Average jitter (ms)	Total RTP packets	Lost RTP packets	Sequence errors
National IP stream-Ciego	198.31	3.31	0.31	0.06	340948	35 (0.01 %)	35
Regional IP stream-Ciego	94.14	1.70	21582096.44	65255.00	161844	8 (0.00 %)	8
National IP stream-Chambas	468.14	68.59	2.10	0.23	800413	154 (0.02 %)	34
Regional IP stream-Chambas	137.45	18.05	22150304.58	58141.23	236311	7 (0.00 %)	7

-Delta=inter-packet gap.

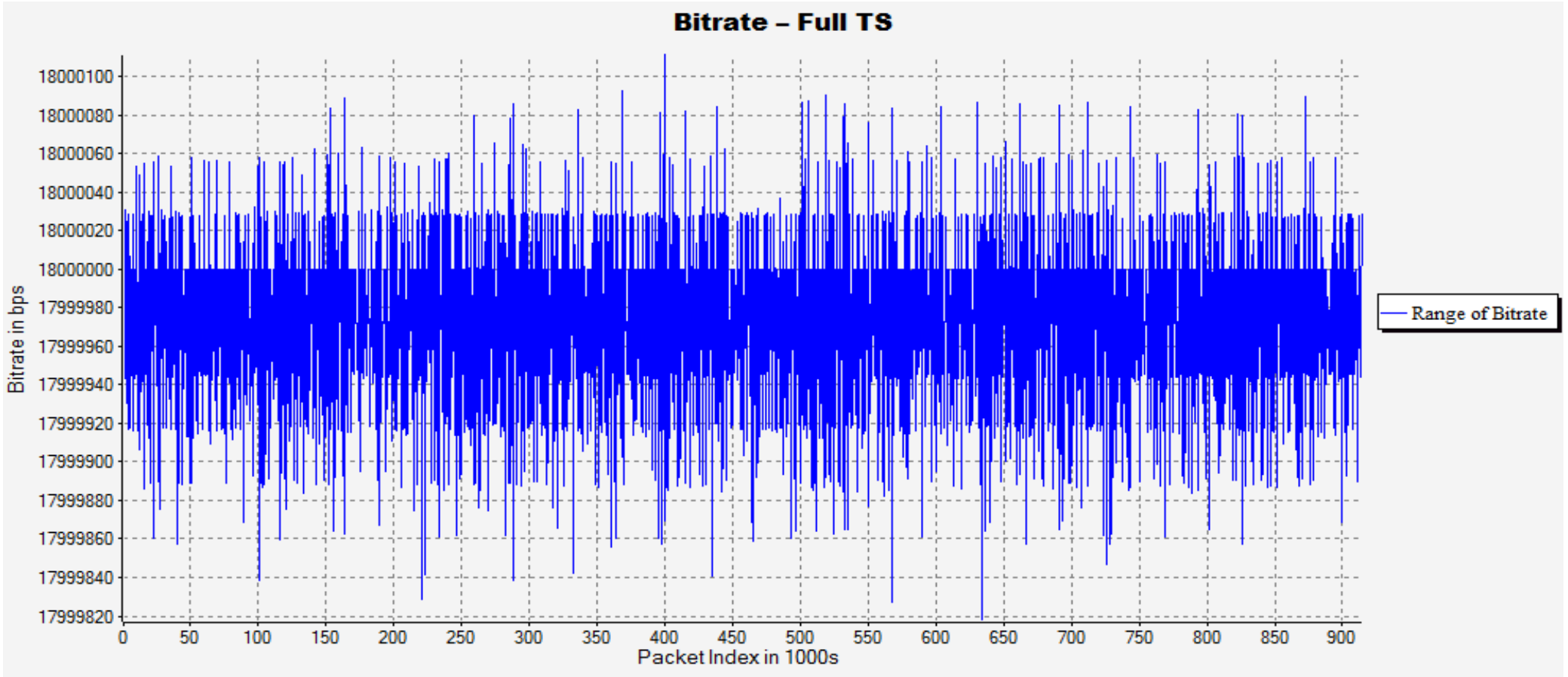
-Values on black background are wrong due to incorrect restamp in multiplexer B.

UDP statistics

Test	Packets	Packets/s	Max. Bandwidth (Mbps)	Average Bandwidth (Mbps)
National IP stream- Ciego	340948	1719	19.5	18.8
Regional IP stream-Ciego	161844	1719	19.2	18.8
National IP stream-Chambas	800413	1709	24.6	18.8
Regional IP stream-Chambas	236311	1716	22.9	18.8

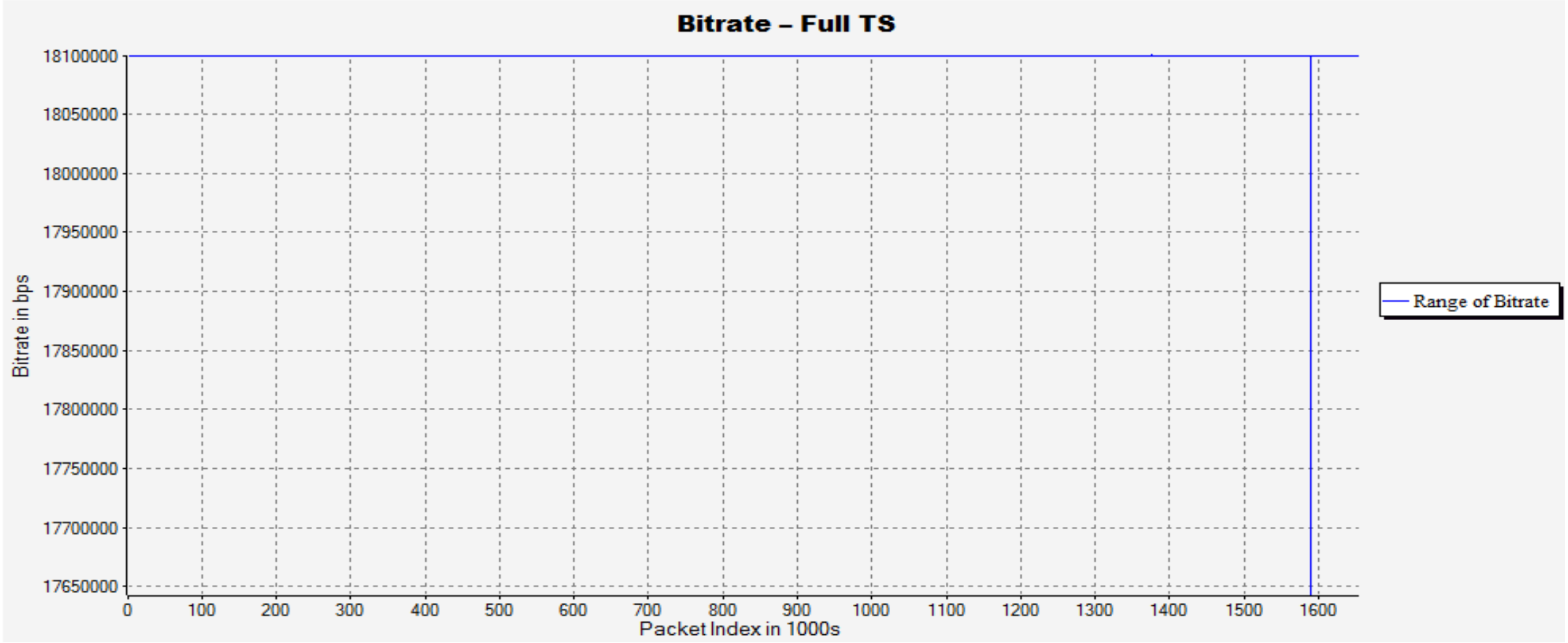
Note: Average window for UDP statistics ⟶ 100 ms (TR 101 290).

Regional IP stream-Ciego



Values are right, in correspondance to MPEG-2 TS bitrate (17.99 Mbps).

Regional IP stream-Chambas



Inter-packet arrival jitter causing bursts ⟶ MPEG-TS Bitrate increases and decreases.

PROMAX

TS ANALYSER

Service List

- TSANALYSER(captura 01 chambas 17 05 17.ts)
  - Cubavisión(PMT_PID= 0x1001)
  - Tele Rebelde(PMT_PID= 0x1002)
  - Educativo(PMT_PID= 0x1003)
  - Educativo 2(PMT_PID= 0x1004)
  - Multivisión(PMT_PID= 0x1005)
  - Infantil/CHab(PMT_PID= 0x1007)
  - CVI(PMT_PID= 0x1008)
  - Clave(PMT_PID= 0x1009)
  - Radio Rebelde(PMT_PID= 0x100A)
  - Radio Progreso(PMT_PID= 0x100B)
  - Radio Taíno(PMT_PID= 0x100C)
  - Radio Enciclopedia(PMT_PID= 0x100D)
  - CMBF(PMT_PID= 0x100E)
  - Radio Reloj(PMT_PID= 0x100F)
  - RHC(PMT_PID= 0x1010)
  - Habana Radio(PMT_PID= 0x1011)
  - Rebelde AM(PMT_PID= 0x1012)

TS ID :	0x0001
Network ID :	0x0064
Original NID :	0x0064
Network Name :	Radiocuba
Packet Length :	188
Total TS Packet :	1654170
Type :	DVB (TS)

TR 101 290

Select Source

PSI Info | TR 101 209 | PCR | ES Info | Bitrates | PID Dispersion | T2-MI

Priority1 ○ Priority2 ● Priority3 ○ Clear All

No.	Indicators	Errors	Alarm
2.1	Transport Error	>1000	YES
2.2	CRC Error	0	NO
2.3	PCR Interval Error	1	YES
2.4	PCR Accuracy Error	16	YES
2.5	PTS Error	53	YES
2.6	CAT Error	1	YES

Clear selected Alarms

S.No.	Description	Error
2.3	PCR_error in total	1
2.3.1	Time interval between two consecutive PCR values more than 40 ms	0
2.3.2	PCR discontinuity of more than 100 ms occurring without specific indication	1
2.3.3	Referred PCR_PID is missing	0

View Error Info

Conclusions

- Wireshark, TSReader and PROMAX TS Analyser are useful tools for UDP multicast streams and MPEG-2 TS analysis.
- Efficient delivery to Radiocuba Centers is a requirement for insuring QoS.
- Jitter and packet loss are fundamentals parameters in real time applications and services, so they must be measured and monitored for avoiding degradation on digital signal quality.
- Inter-packet arrival jitter causing delay or UDP packet bursts (and its effects on MPEG-2 TS) could cause pixelation on Digital Terrestrial Television signal.

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THANK YOU

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