ALMA AOS/OSF-SCO Communication Infrastructure

Update for the SAACC meeting 2017
2017-01-11

G. Filippi[1], J.Ibsen[2], C.Saldias[2], N.Ovando[2]
**1:ESO, 2:JAO/ADC**

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership among Europe, North America and East Asia in cooperation with the Republic of Chile.

PROJECT GOALS

- Provide a long term (>15 years) solution infrastructure

- Cope with projected operations needs (>1Gbps) and scale further

- Minimize latency between the end sites

- Have reasonable upfront CAPEX and very low OPEX

- Take advantage of the existing EVALSO capacity

Architecture of the communication system
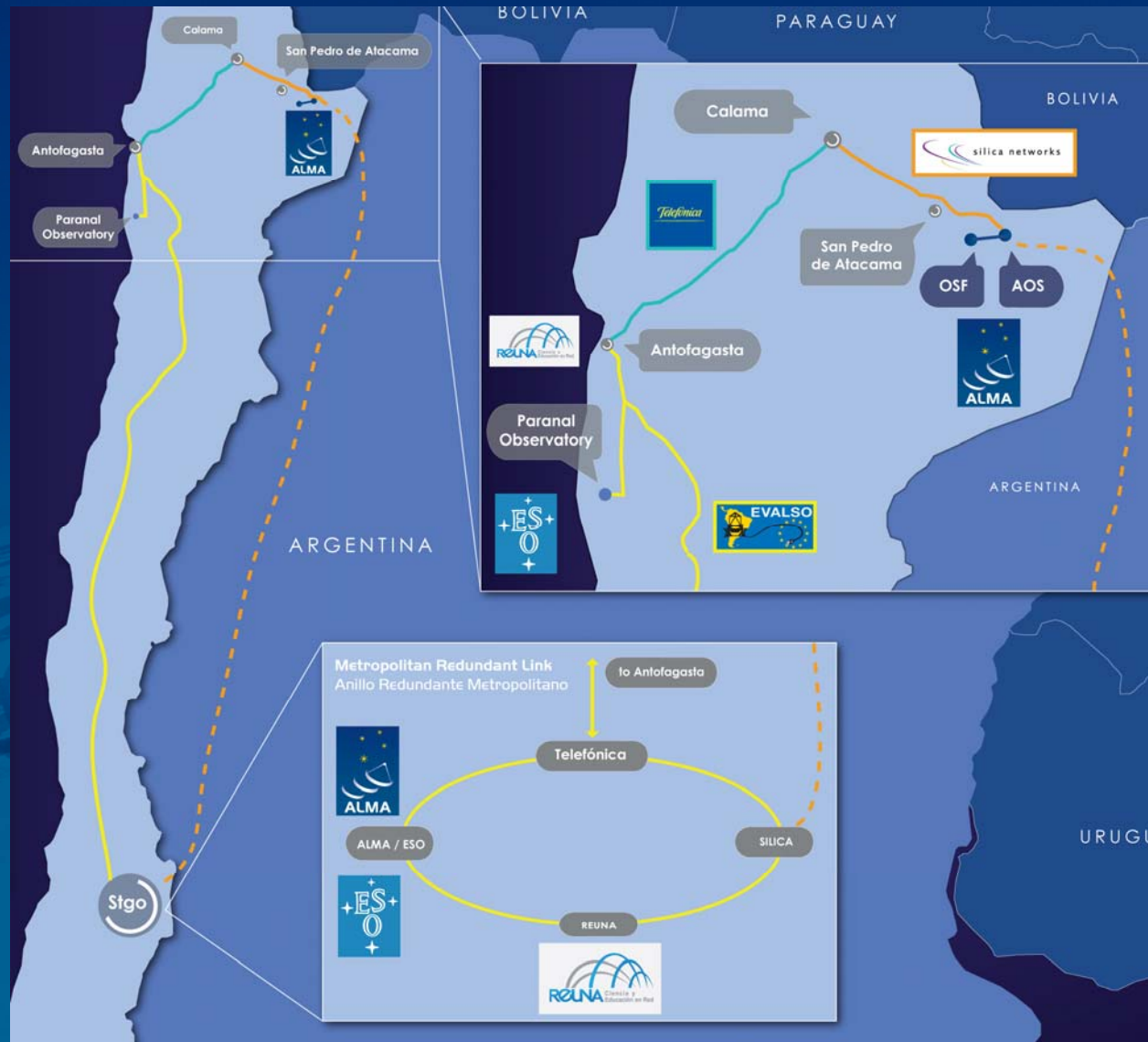
1. A dark fiber pair between AOS and CALAMA (about 150km): this comes from a newly built fiber cable.

2. A dedicated LAMBDA between CALAMA and the REUNA Point of Presence (PoP) in ANTOFAGASTA (about 200 km).

3. A dedicated sub-LAMBDA between the REUNA PoP in ANTOFAGASTA and the SCO at the Vitacura Campus in Santiago: this is indeed configured on the existing EVALSO backbone.

4. A dark fiber pair between AOS and the town of SAN PEDRO (2016).

5. A dedicated LAMBDA between AOS and Santiago via Argentina (2016-2018).

In search of our Cosmic Origins

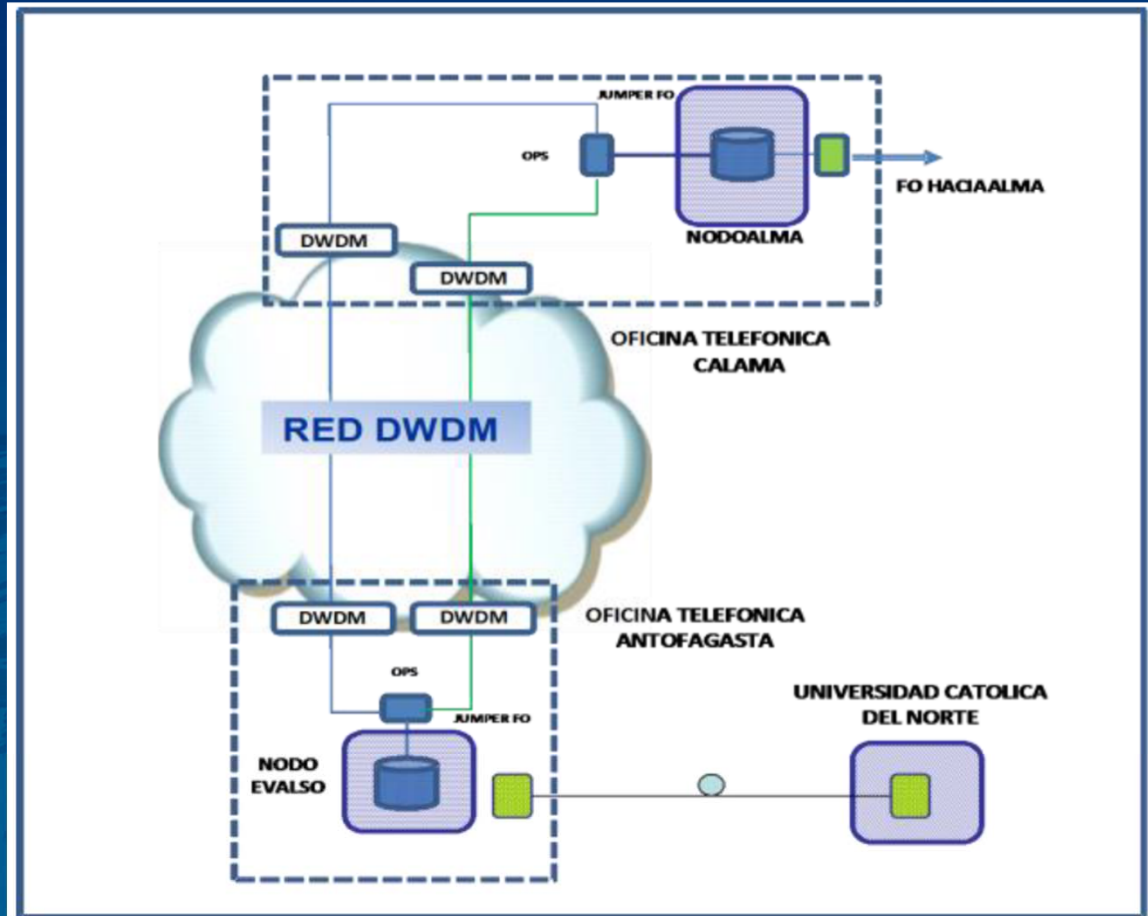| 2011		Feasibility study completed
2012	Mar	Project Plan completed
	Apr	ALMA Board approves the recommendation
	May-Oct	Procurement for AOS/OSF-Antofagasta optical path
	Nov	Contract with Silica and Telefónica signed
2013	Jun	Contract updated with new path and future redundant link
	Aug	Contract with REUNA for equipping & operating AOS-SCO link
	Dec	Fiber AOS-CALAMA: Construction start
	Dec	Lambda CALAMA-ANTOFAGASTA: provisionally accepted
2014	Feb	DWDM equipment selected (PADTEC)
	Sep	DWDM equipment installed
	Nov	Fiber AOS-CALAMA: Construction end (150km of fiber cable)
	Dec 18th	first end-to-end test

2011   2012   2013   2014
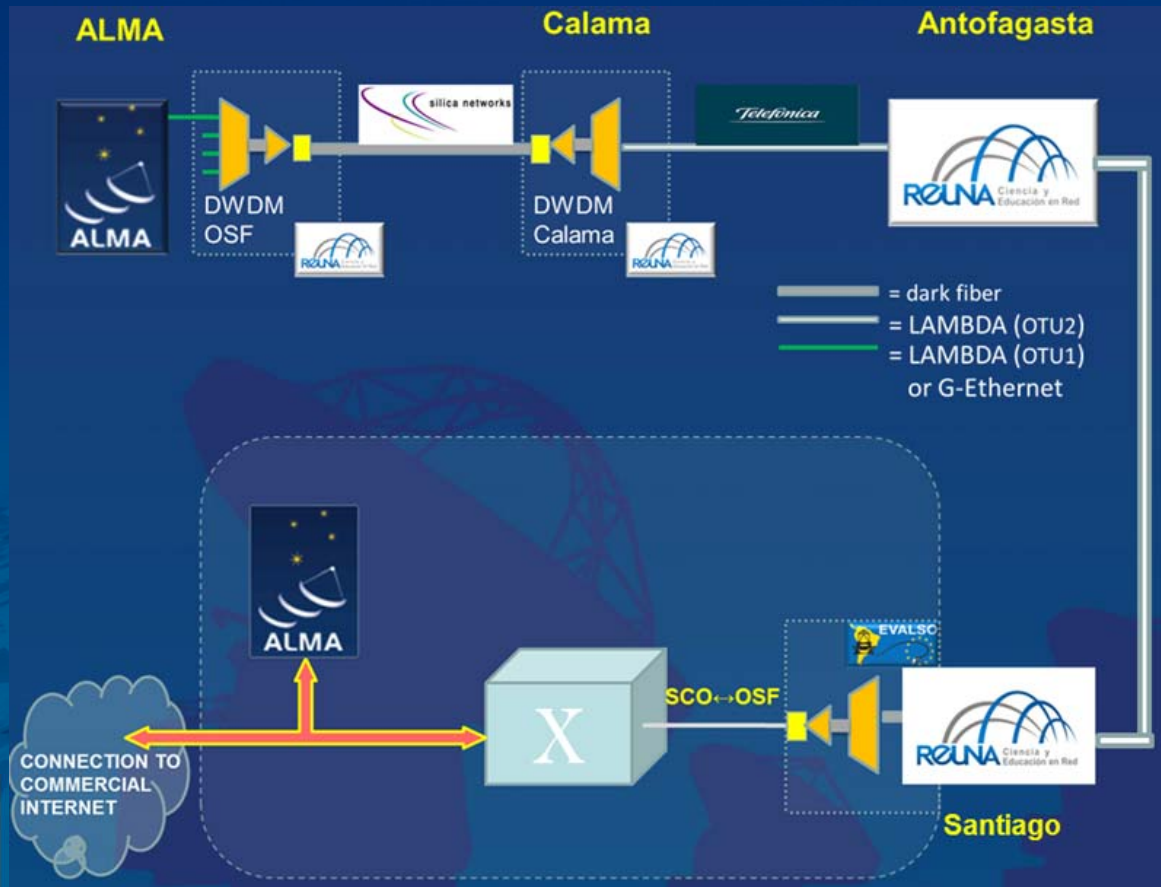
(new) fiber cables AOS – CALAMA

For the transport between Calama and the REUNA PoP in Antofagasta, a dedicated Lambda is provided by Telefonica.

As this is part of the provider backbone, the solution include automatic backup at optical level (1+1). The interface complies with the regulations for an OTU2 (10Gbps) link.

DWDM EQUIPMENT

As NEW installations:

- At the ALMA AOS border. This unit manages the traffic that ALMA generates and sends it, using an OTU2 channel, to the Antofagasta node.

- At the Telefónica PoP in Calama. This unit receives the traffic from the Observatory and feeds the OTU2 to the Telefónica Lambda to Antofagasta.

As upgrade of the existing EVALSO:

- In Antofagasta, the lambda coming from AOS via Calama has to be remapped into the EVALSO backbone.

- in Vitacura, the upgrade is minimal and consists in enabling the two 1Gbps ports where the communication is interfaced with the SCO LAN.

The link is operated by REUNA

In search of our Cosmic Origins

(Nearly) OPERATIONAL

Due to administrative hiccups, used in "test mode", but at full functionality.
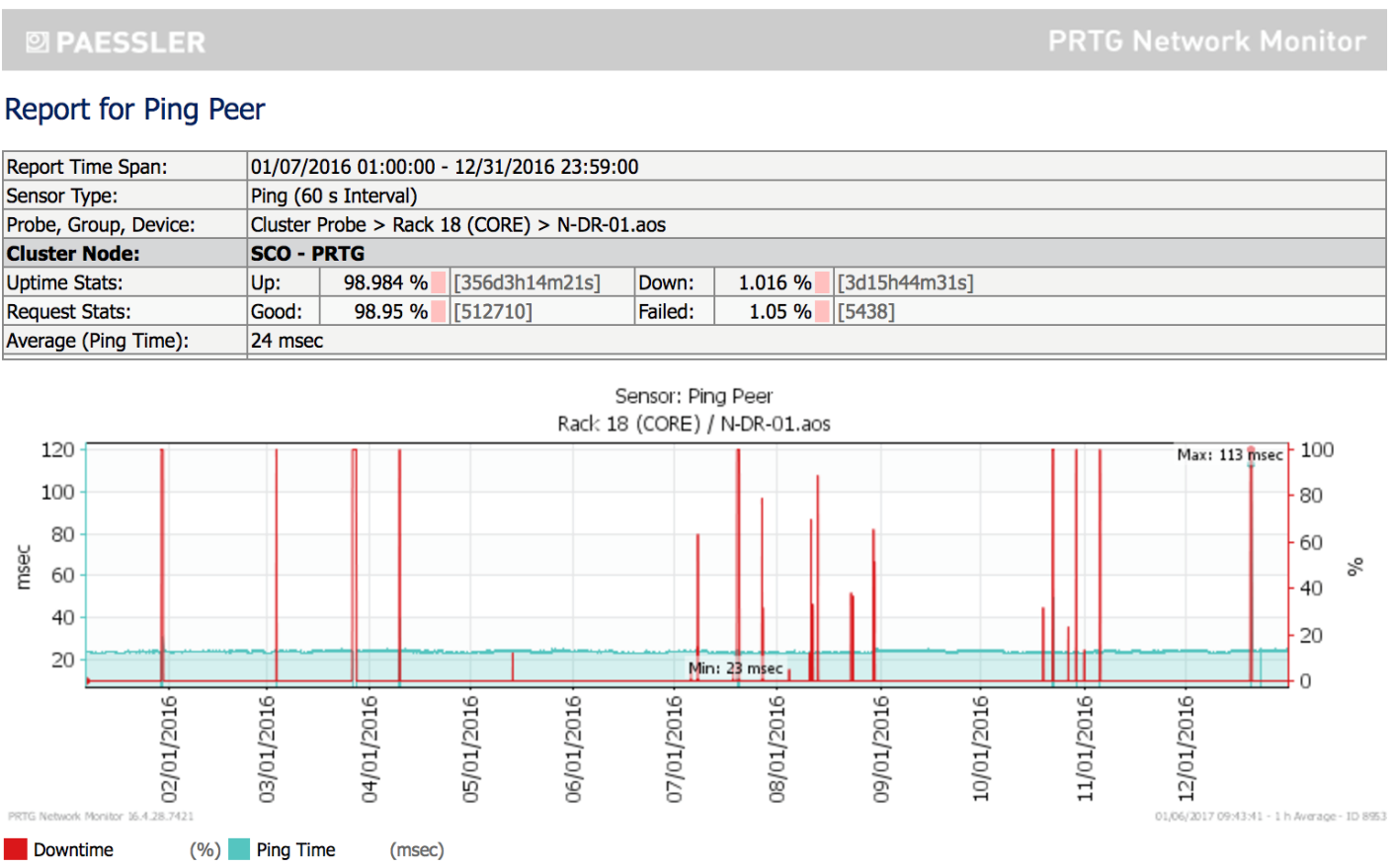
Initial expectations confirmed:

- <u>Delay (PING)</u> between OSF and SCO around 23msec (same for both links).

- <u>Science Data Traffic</u>: between 100 and 200 Mbps, and peaks up to 520Mbps.

- <u>Other ALMA Traffic:</u> between 50 and 100 Mbps, and peaks up to 170Mbps.
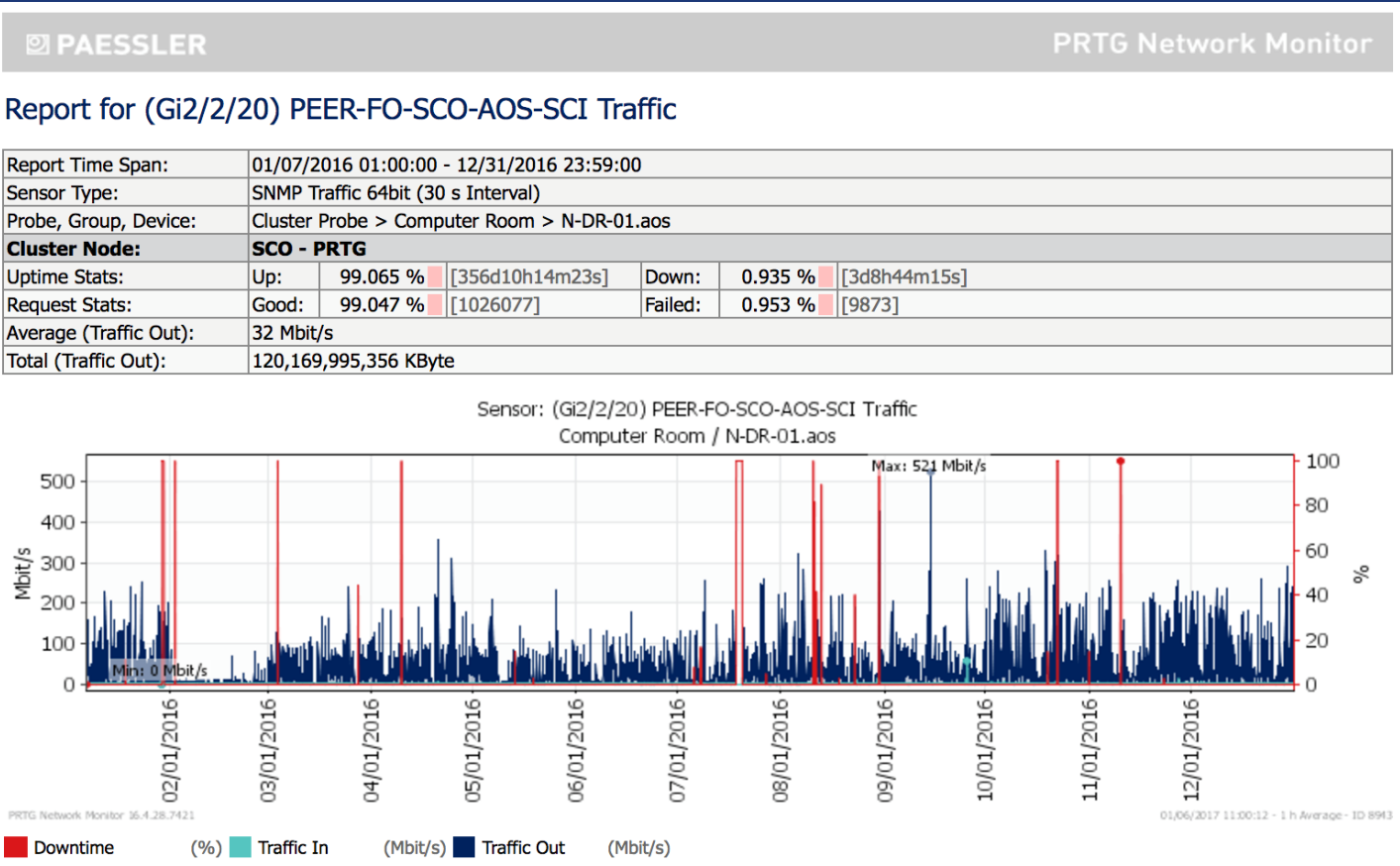
LAST 12 MONTHS (Jan-Dec 2016)
SCIENTIFIC DATA TRANSFER

Traffic: Santiago ←out   in→ ALMA site

In search of our Cosmic Origins
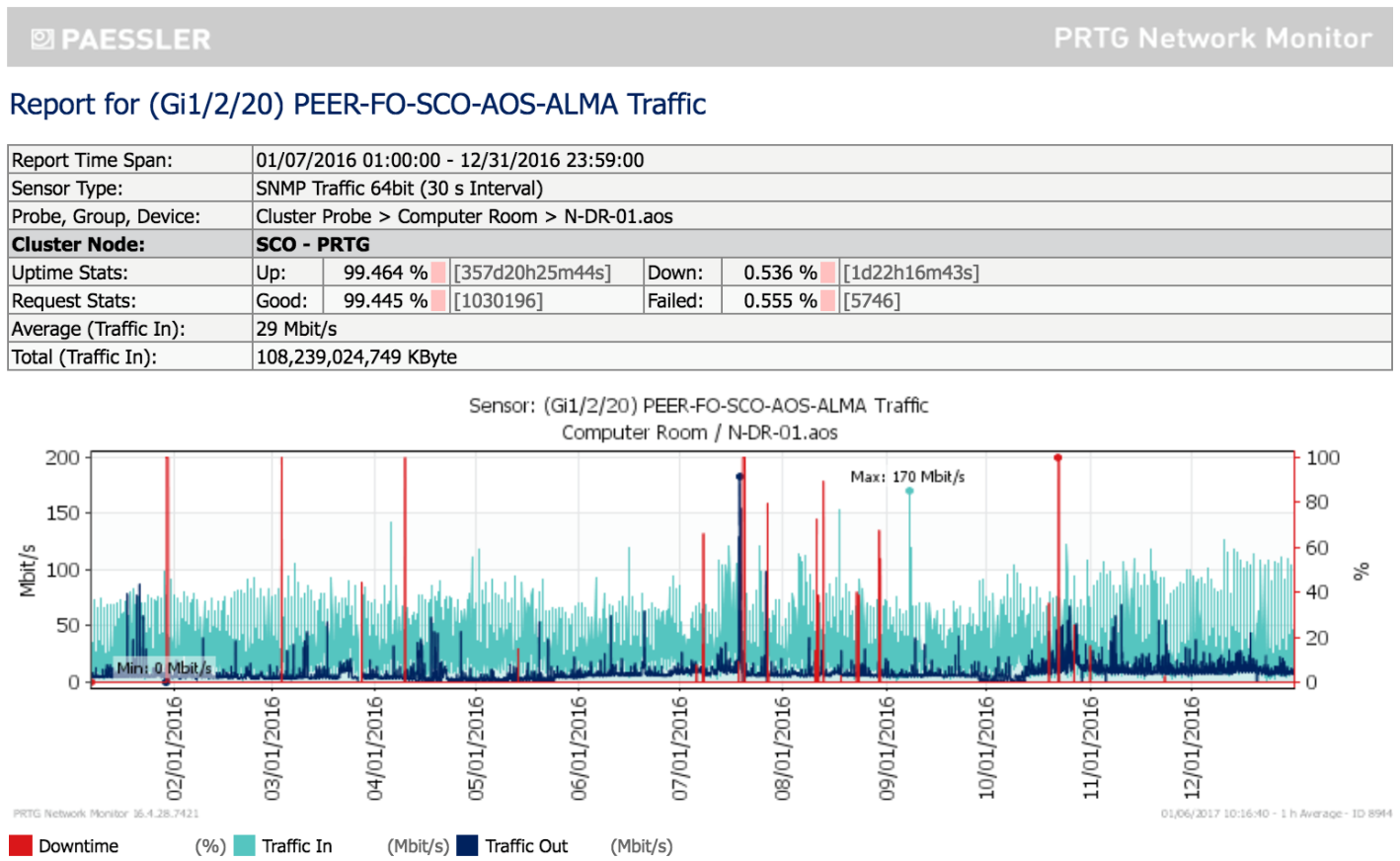
LAST 12 MONTHS (Jan-Dec 2016)

OTHER IP TRAFFIC

Traffic: Santiago ←out   in→ ALMA site

OPERATIONAL REPORTS

- Provided by REUNA since September 2015.
- Report on system performance, single downtime events, both planned and unplanned.
- Provides statistics on availability

Periods:

- Month: December 2016, 31 days, 744 hours
- Trimester: October 2016 to December 2016
- Year: January to December 2016, 366 days, 8784 hours

Availability	Monthly			Yearly		
	Uptime [hours]	Downtime [hours]	Availability [%]	Uptime [hours]	Downtime [hours]	Availability [%]
Planned	744	0	100%	8776,46	7,54	99,91%
Unplaned	734,72	9,28	98,75%	8679.6	104,41	98,81%
Total	734,72	9,28	98,75%	8672.6	111,95	98,73%

Table 3: Availability

AVAILABILITY 2016 (1/2)

	2016												jan-dec
	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	
total hours in the month	744	696	744	720	744	720	744	744	720	744	720	744	8784
AOS-CALAMA fiber	0	0	0	0	0	0	0	0	0	0	0	0	0
Lambda Calama-Antofagasta	0	0	2.43	0	0	0	0	0	0	0	0	0	2.43
Lambda Antofagasta-Santiago	12	0	29.63	2.26	0	0	4.35	0	0	0	0	0	48.24
Santiago-ESO(Vitacura) fiber	0	0	0	0	0	0	0	0	0	5.28	0	9.28	14.56
Santiago-REUNA fiber	0	0	0	0	0	0	0	0	0	0	0	0	0
DWDM Equiment (PADTEC)	0	0	0	0	0	0	43.85	2.87	0	0	0	0	46.72
downtime ALMA (new part)	0	0	2.43	0	0	0	43.85	2.87	0	0	0	0	49.15
downtime EVALSO (existing part)	12	0	29.63	2.26	0	0	4.35	0	0	5.28	0	9.28	62.8
total downtime (as total)	12	0	32.06	2.26	0	0	48.2	2.87	0	5.28	0	9.28	111.95
available hours	732	696	711.94	717.74	744	720	695.8	741.13	720	738.72	720	734.72	8672.1
monthly availability	98.39%	100.00%	95.69%	99.69%	100.00%	100.00%	93.52%	99.61%	100.00%	99.29%	100.00%	98.75%	
average last 3 months	99.29%	99.29%	97.98%	98.41%	98.45%	99.90%	97.82%	97.69%	97.69%	99.63%	99.76%	99.34%	98.73%
average last 12 months	99.49%	99.57%	99.01%	99.09%	99.20%	99.27%	98.74%	98.82%	98.82%	98.79%	98.79%	98.73%	

Two major events in April and July account for 65% of the total downtime.

Without those, the availability would have been >99.5%

AVAILABILITY 2016 (2/2)

Availability Total
Jan 2016 - Dec 2016