SEVENTH FRAMEWORK PROGRAM
RESEARCH INFRASTRUCTURES

GRANT AGREEMENT 212891


**E**nabling
**V**irtual
**A**ccess to
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Nature[1]: **REPORT (R)**

Dissemination Level[2]: **PP**

**Abstract**

This document reports on the deployment of the DWDM Equipment.

[1] nature of the deliverable: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

[2] Dissemination level **PU** = Public
**PP** = Restricted to other programme participants (including the Commission Services).
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**CO** = Confidential, only for members of the consortium (including the Commission Services).

AUTHOR

| Name | Affiliation[3] |
|---|---|
| Sandra Jaqye | REUNA |

Co-AUTHOR(s) LIST

| Name | Affiliation |
|---|---|
| Albert Astudillo | REUNA |
| | |
| | |
| | |
| | |
| | |

[3] Project Members

| | | |
|---|---|---|
| Università degli Studi di Trieste (Coordinator)<br>http://www.units.it/ | UniTs | Italy |
| European Organisation for Astronomical Research in the Southern Hemisphere<br>http://www.eso.org/ | ESO | International |
| Ruhr-Universität Bochum<br>http://www.astro.ruhr-uni-bochum.de/ | RUB | Germany |
| Consortium GARR (Gestione Ampliamento Rete Ricerca)<br>http://www.garr.it/ | GARR | Italy |
| Universiteit Leiden<br>www.leidenuniv.nl/ | UL | The Netherlands |
| Istituto Nazionale di Astrofisica<br>http://www.ts.astro.it/ | INAF | Italy |
| Queen Mary and Westfield college, University of London<br>http://www.qmul.ac.uk/ | QMW | United Kingdom |
| Cooperación Latino Americana de Redes Avanzadas<br>http://www.redclara.net/ | CLARA | Uruguay |
| Red Universitaria Nacional<br>http://www.reuna.cl/ | REUNA | Chile |

# Contents

# 1 Overview

The equipment deployed over the link infrastructure, dark fiber and fixed wavelength, were acquired through a procurement process developed by REUNA on behalf of EVALSO project. The procurement process was run from January to May of 2010. The equipments awarded were CIENA brand model CN4200 represented by the company Adexus.

**Relevant Activities:**

- Procurement Process: January-May/2010
- Installation Planning Activities: May-July/2010
- Equipment Reception: July/2010
- Equipment physical installation:
  - 2/August: REUNA node
  - 3/August: ESO/Vitacura node
  - 4/August: Santiago/Telefonica node
  - 16/August: Antofagasta node
  - 17/August: Paranal node
- Circuits activation: During September and beginning of October.
- OCA set-up: 27/October

# 2 Equipment Specification[4]

Equipments manufacturer: CIENA (www.ciena.com)

Company giving the services: ADEXUS (www.adexus.cl)

**Equipments Family:** CN 4200

**Chassis:** There were selected two kind of chassis, classic one (4 slots) and RS (17 slots).

In the sites of Antofagasta and Paranal there is also an additional small no active chassis (CN 2110) to host the module of Chromatic Dispersion Compensation.

**Interfaces**: The interface facing the network is an F10A model and the interface facing the client side is an M3 or a G10 interface. The F10A in the case of EVALSO will be used as 1xOTU-2 and 2xSFP at GEth, the M3 2xSFP at GEth and the G10 10xSFP at GEth.

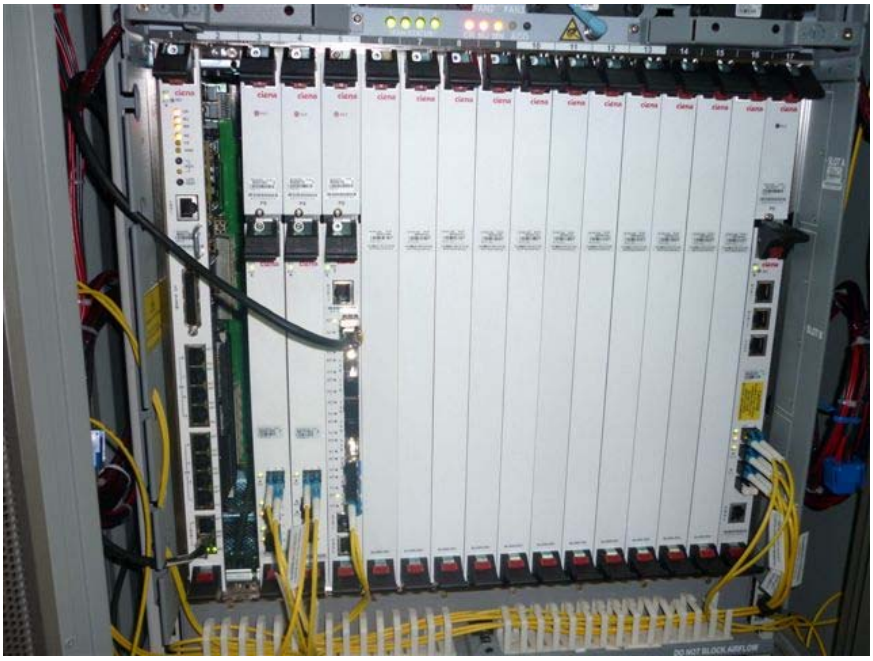
[4] Detail information is contained in the "SA1-2.2 Tender Result – DWDM Equipment" document

**Additional equipment:** The link Antofagasta-Paranal is 130Kms so was necessary to add an amplifier specifically a Variable optical amplifier and a Chromatic Dispersion Compensation module.

## 2.1 Equipment in the field

### 2.1.1 ESO PARANAL


### 2.1.2 ANTOFAGASTA (TELEFONICA PoP)



### 2.1.3 SANTIAGO TELEFONICA PoP

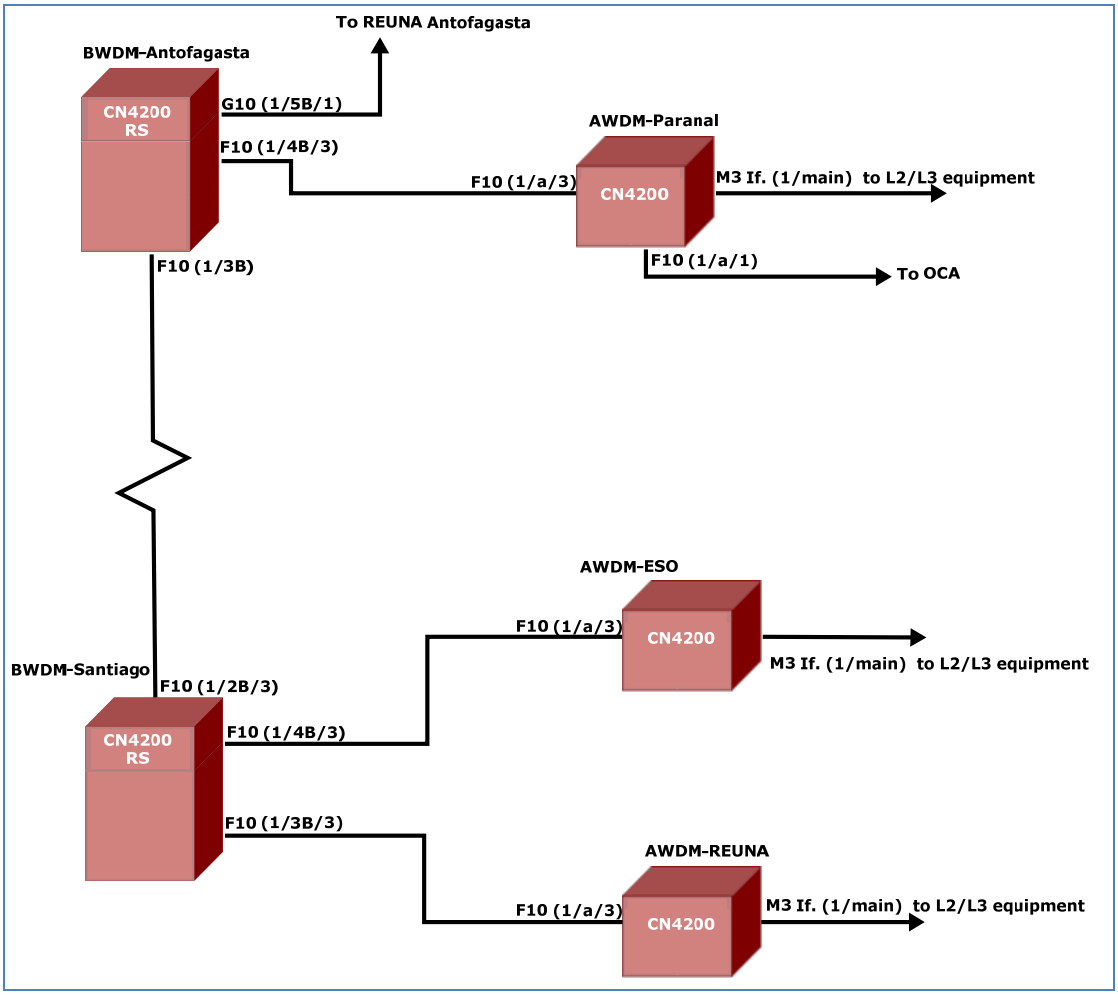

Comment: This picture was taken before the missed blank card were installed in the equipment

### 2.1.4 REUNA/Santiago

### 2.1.5 ESO/Vitacura

# 3 Equipment Configuration

A topology diagram of the EVALSO network is shown in the following picture:

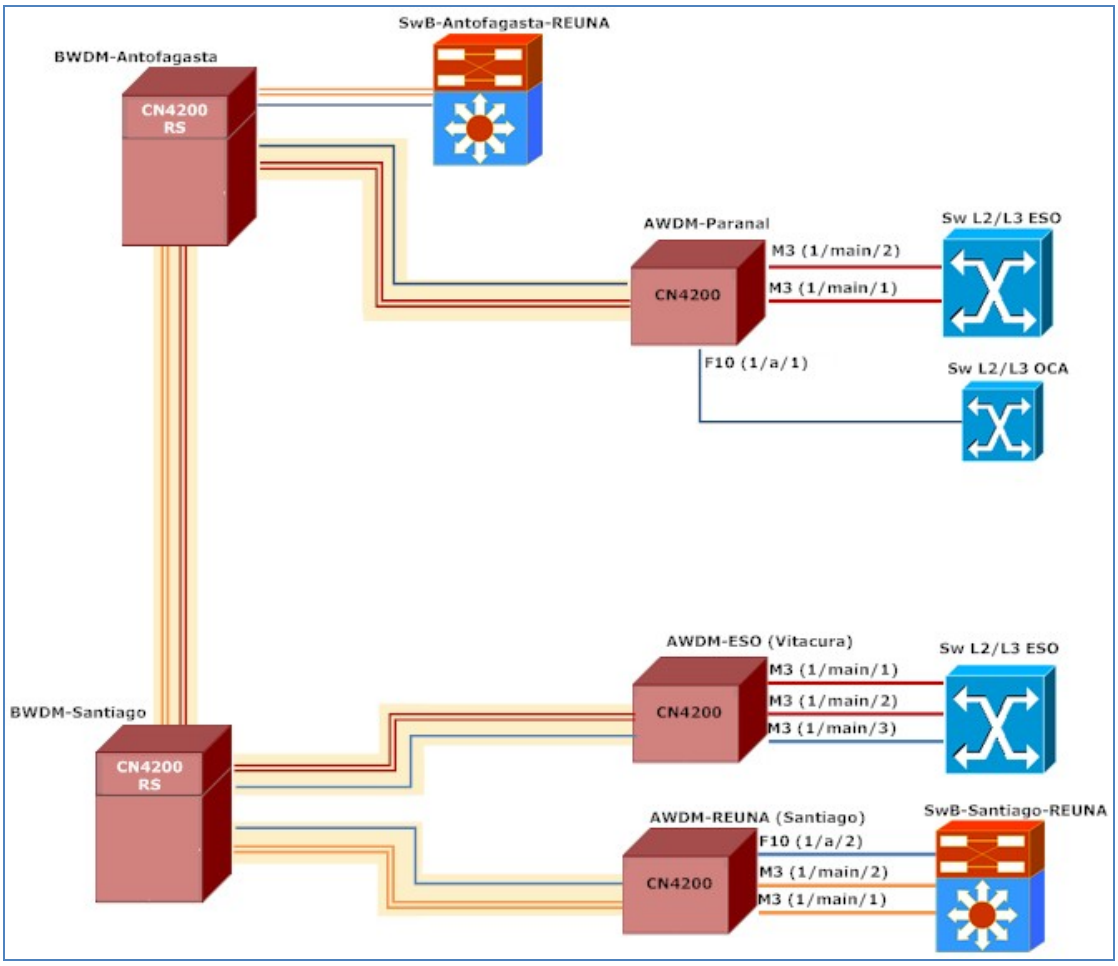



The figure shows it is physically connected the CIENA in Paranal to the CIENA in Antofagasta, the CIENA ESO/Vitacura and REUNA/Providencia to the CIENA Santiago/Telefonica and the CIENA in Antofagasta to the Santiago/Telefonica. The nodes in Antofagasta and Santiago/Telefonica are called backbone nodes (BWDM-node) and the other end terminal or access nodes (AWDM-node).

The equipments are configured so to established circuits or path at 1GEth between the nodes as follows:

- ESO/Paranal to ESO/Vitacura 2x1Gbps circuits are configured
- REUNA/Antofagasta to REUNA/Santiago 2x1Gbps circuits are configured
- ESO/Vitacura to REUNA/Providencia 1x1Gbps circuit is configured

Next diagram shows graphically the circuits between the nodes:

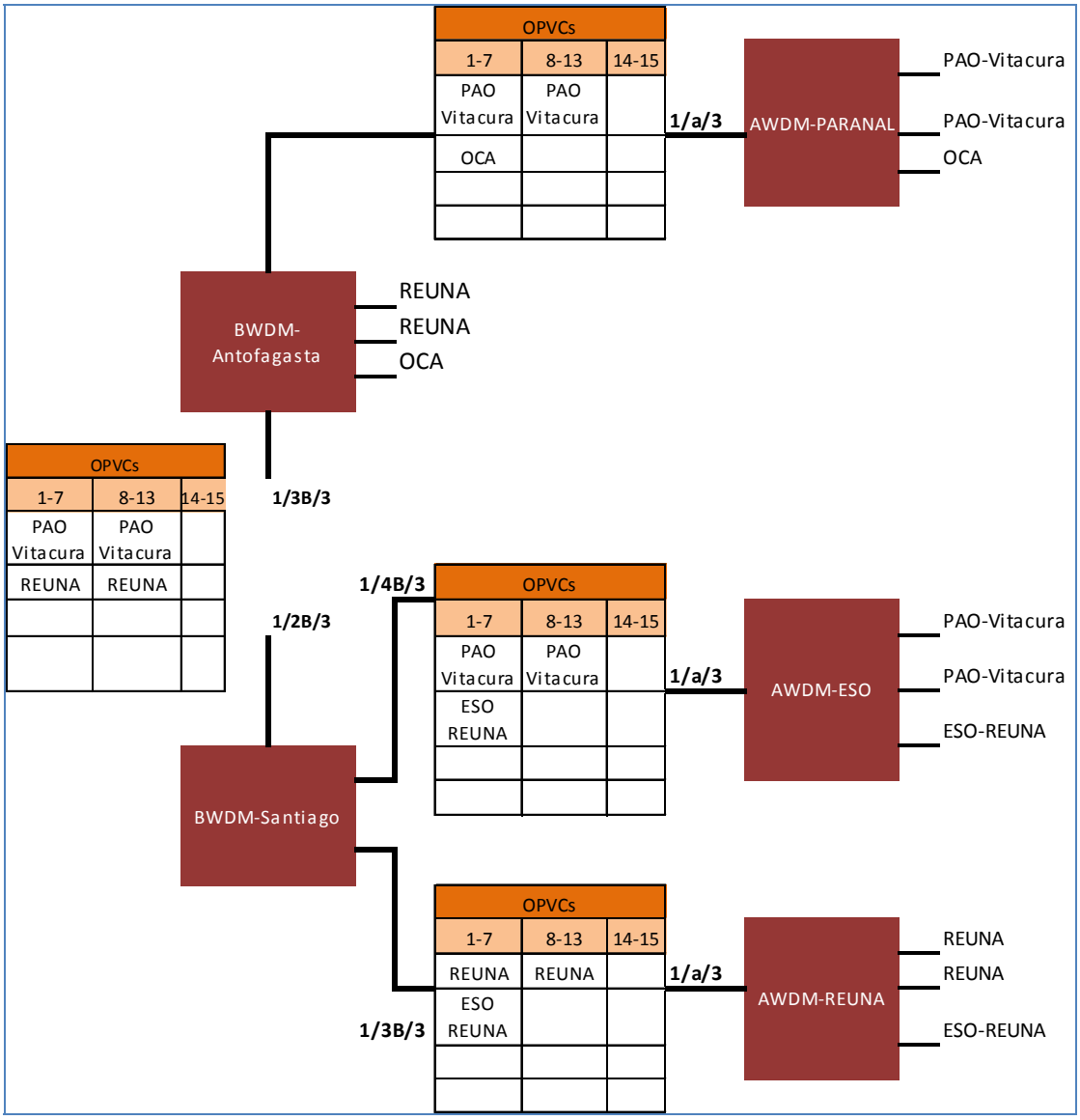



More in details the circuits are also configured in groups of OPVCs, as explained below:

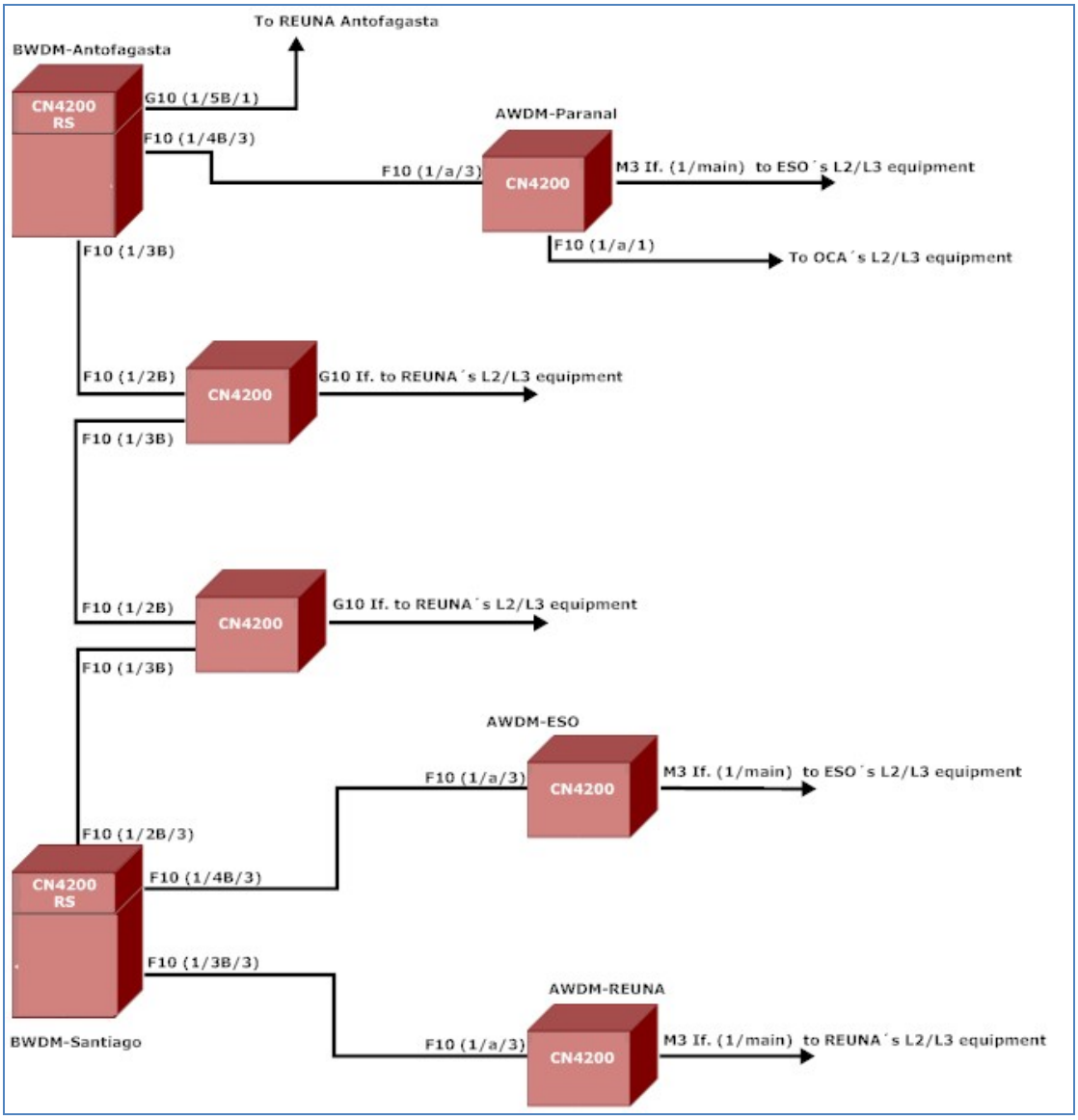
An OTU-2 (10Gbps) is composed of 4 ODU1 (2,5Gbps) each of them is composed by 16 OPVCs (155Mbps). Also is relevant to mentioned, to transport a GEthernet is needed 7OPVC. Following picture shows this graphically.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ODU1 | | | | | | | | | | | | | | | | |
| ODU1 | | | | | | | | | | | | | | | | |
| ODU1 | | | | | | | | | | | | | | | | |
| ODU1 | | | | | | | | | | | | | | | | |

Considering the above explanation following picture shows the transport of each Giga Ethernet over EVALSO infrastructure:



EVALSO project allows the add and drop of the lambda in the two backbone nodes of REUNA´s network along the path, making the following the final topology diagram




In terms of configuration, the circuits from Paranal to ESO/Vitacura run transparently in the Copiapo and La Serena nodes, they are not turn off to the L2/L3 REUNA´s equipment in each site.

# 4 Measurement

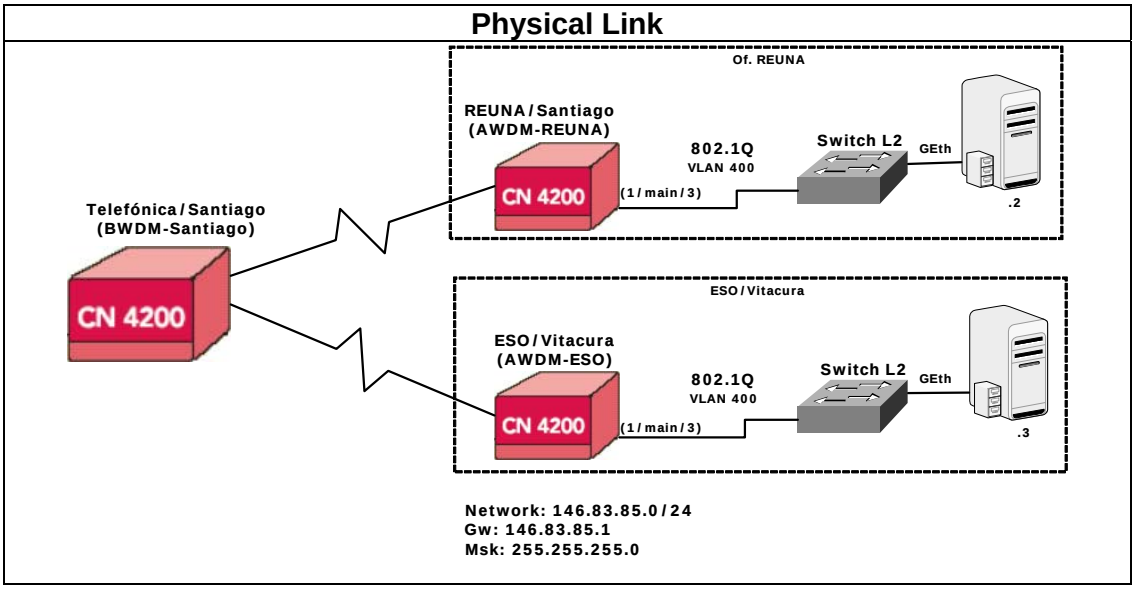
**Circuits performance measurement:**

To measure the capacity of each circuit it was used iperf tool running in servers at both end of the circuits to be measures. The measures done were:

- Circuit between ESO/Vitacura and Paranal: 2x1Gbps
- Circuit between REUNA/Antofagasta and REUNA/Santiago : 2x1Gbps
- Circuit between ESO/Vitacura and REUNA/Providencia:1x1Gbps
- Circuit between OCA and REUNA node in Antofagasta: 1x1Gbps

In the measures an average of 920Mbps was obtained.

It is depicted the configuration used to measure the circuit between ESO/Vitacura and REUNA[5]:

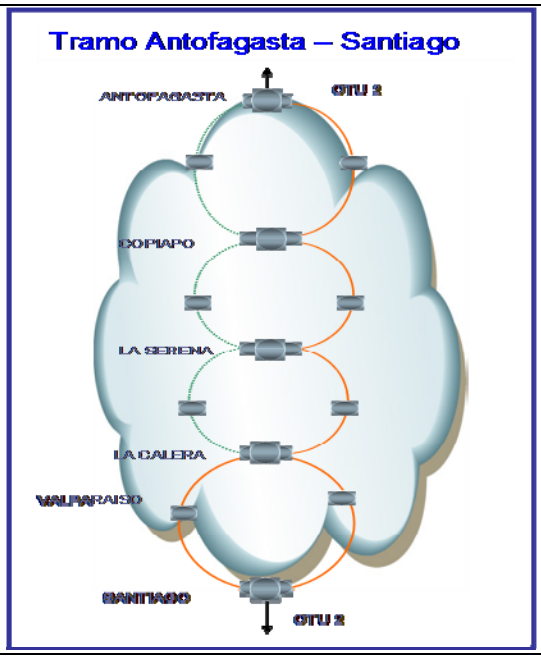



| Server | Client | Bw |
|---|---|---|
| REUNA (146.83.185.2) | ESO (146.83.185.3) | 925 Mbits/sec |
| ESO (146.83.185.3) | REUNA (146.83.185.2) | 904 Mbits/sec |

[5] For mode details see document “Bandwidth Measures REUNA-ESOVitacura”

**Redundancy Test**

The lambda solution from Antofagasta to Santiago is a 1+1 configuration, this means the link has a primary path and a backup one as shows the following diagram.




The test was run to prove the 1+1 solution as well to understand the impact of the switch over when this occurs in the operational status of the link. The test was done making a real interruption of the main path in each segment of it, this is: Antofagasta-Copiapó, Copiapó-La Serena, La Serena-La Calera y La Calera-Santiago as seen in the above figure.

Comments:

The CIENA equipment doesn´t detect the interruption at the OTU-2 level in any of the cut mades, this prove the switch over is transparent for the EVALSO optical network.

To “see” the interruption an extended ping was run from the next L3 equipment attached to the CIENA in Antofagasta and Santiago. The ping result was an interruption of 36 seconds each time.

# 5 ANNEX1: Hardware configuration by node

## 5.1 Paranal

| Group Id | Description | Q | S/N |
|---|---|---|---|
| | CN4200 Chassis | 1 | 50176 |
| CN-M3-FLEX-F | CN-M3-FLEX-F-FLEXIPORT MULTISERVICE MODULE W/3 SFP PORTS;INTEG CPU,COMPACT FLASH MEM/CONF BACKUP | 1 | M5968989 |
| F10E-A90-TN | F10E-A90-TN - AGG MOD;UNPROT; OTU2 ENH FEC NTWK;ITU 100 GHZ TUNABLE DWDM;DIST:95KM,DISP:90KM;XFP REQ | 1 | M5818383 |
| OAV-0S-U-C | OAV Optical Amplifier | 1 | M5992933 |
| CN4200-FDF-H-EW | CN4200-FDF-H-EW -CN4200,FRONT EXH,FULL D&C SLOT. INCL HIGH SPEED FANS,FILTER. REQ PWR,ALM,BLKS | 1 | M6000891 |
| | Chassis para Compensador | 1 | NO SERIADO |
| CN 2110-CHS | CN 2110 CHASSIS WITH MOUNTING KIT | 1 | M5971607 |
| CN-PSM-DC400 | CN4200, CN-PSM-AC600T | 2 | M5685553 - M5685591 |
| CN 4200-MNT-19-ETSI | CN 4200-MNT-19-ETSI - 19 INCH / ETSI MOUNTING BRACKET | 1 | NO SERIADO |
| CN-ALM-STD | CN-ALM-STD - Alarm Mod - Standard with Critical, Major, Minor LED indicators | 1 | M5844212 |
| CN-FULL-BLK | CN-FULL-BLK - BLANK CARD FOR FULL LENGTH SLOTS | 2 | NO SERIADO |
| OPT-LX | OPT-LX - Optical Plug-in: 1310nm 1000BASE-LX pluggable optical transceiver (up to 10km) Medium Reach | 2 | PGB20SG - PGB20SH |
| OPT-nn | CWDM 1471nm to 1611nm, 100km ETHP, FCHP, STM-4/16 | 1 | PHB18TT |
| | ATTENUATOR | 2 | NO SERIADO |
| S/W Media R6.2 | SW (MEDIA), CN4200, R6.2 | 1 | NO SERIADO |

## 5.2 Antofagasta

| Group Id | Description | Q | S/N |
|---|---|---|---|
| | CN4200RS-CTL, 17-SLOT CONTROLLER SHELF, 16 FULL / 0 HALF SLOTS, CN 4200RS | 1 | M5762519 |
| F10E-A90-TN | F10E-A90-TN - AGG MOD;UNPROT; OTU2 ENH FEC NTWK;ITU 100 GHZ TUNABLE DWDM;DIST:95KM,DISP:90KM;XFP REQ | 2 | M5757802 - M5897260 |
| CN-G10 | CN-G10, L2 ETHERNET SWITCH MODULE W/10 SFP PORTS (10/100/1000 ETH, 1 OTU1), CONTROLLER CAPABLE W/CF | 1 | M6000039 |
| | KIT, PDU-80, ETSI CABINET, FRONT POWER, CN 4200XC | 1 | NO SERIADO |
| CN 2110-CHS | CN 2110 CHASSIS WITH MOUNTING KIT | 1 | M5960121 |
| | Attenuator | 2 | NO SERIADO |
| | MAN-NC, NODE CONTROLLER, CN4200 | 1 | M5931548 |
| | INSTALLATION KIT - FAN MODULES, ETSI 300MM DEEP RACK/CABINET ASSEMBLIES, CN 4200RS | 1 | NO SERIADO |
| | INSTALLATION KIT - SHELF, ETSI 300MM DEEP X 600MM WIDE RACKS/CABINETS, CN 4200RS | 1 | NO SERIADO |

| | | | |
|---|---|---|---|
| | INSTALLATION KIT, POWER HARNESS, ETSI 300MM X 600MM APPLICATIONS, CN 4200 RS | 1 | NO SERIADO |
| | INSTALLATION KIT, GENERIC CABINET HARDWARE, ETSI CABINET APPLICATIONS, CN 4200 RS | 1 | NO SERIADO |
| | KIT, PDU-80, ETSI CABINET, FRONT POWER, CN 4200XC | 1 | NO SERIADO |
| | INSTALLATION KIT, POWER ADAPTER, CN4200RS | 3 | NO SERIADO |
| OAV-0S-U-C | OAV Optical Amplifier | 1 | M5992937 |
| OPT-LX | OPT-LX - Optical Plug-in: 1310nm 1000BASE-LX pluggable optical transceiver (up to 10km) Medium Reach | 7 | PG71JTM - PGS5V7T - PGS5V7U - PGS5V7V - PGS5V7W - PGS5V7X - PGS5V7Y |
| | Chassis para Compensador | 1 | NO SERIADO |

## 5.3 Santiago (at TELEFONICA PoP)

| Group Id | Description | Q | S/N |
|---|---|---|---|
| | CN4200RS-CTL, 17-SLOT CONTROLLER SHELF, 16 FULL / 0 HALF SLOTS, CN 4200RS | 1 | M5879139 |
| F10E-A90-TN | F10E-A90-TN - AGG MOD;UNPROT; OTU2 ENH FEC NTWK;ITU 100 GHZ TUNABLE DWDM;DIST:95KM,DISP:90KM;XFP REQ | 3 | M5818491 - M5826391 - M5859389 |
| | MAN-NC, NODE CONTROLLER, CN4200 | 1 | M5858900 |
| | INSTALLATION KIT - FAN MODULES, ETSI 300MM DEEP RACK/CABINET ASSEMBLIES, CN 4200RS | 1 | NO SERIADO |
| | INSTALLATION KIT - SHELF, ETSI 300MM DEEP X 600MM WIDE RACKS/CABINETS, CN 4200RS | 1 | NO SERIADO |
| | INSTALLATION KIT, POWER HARNESS, ETSI 300MM X 600MM APPLICATIONS, CN 4200 RS | 1 | NO SERIADO |
| | INSTALLATION KIT, GENERIC CABINET HARDWARE, ETSI CABINET APPLICATIONS, CN 4200 RS | 1 | NO SERIADO |
| | KIT, PDU-80, ETSI CABINET, FRONT POWER ENTRY, CN 4200XC | 1 | NO SERIADO |
| | INSTALLATION KIT, POWER ADAPTER MODULE, CN4200RS | 4 | M5859723 - M5834045 - M5834064 - M5898998 |
| 166-0082-150 | RECTIFIER, 3RU SHELF, 2.50KW SYSTEM, CN4200 | 1 | M5979931 |
| CN-FULL-BLK | CN-FULL-BLK - BLANK CARD FOR FULL LENGTH SLOTS | 13 | NO SERIADO |
| Node License R6.2 | LWOS, CN 4200, NODE LICENSE RTU, R6.2 | 1 | |

## 5.4 ESO Vitacura

| Group Id | Description | Q | S/N |
|---|---|---|---|
| | CN4200 chassis | 1 | 50178 |
| CN-M3-FLEX-F | CN-M3-FLEX-F-FLEXIPORT MULTISERVICE MODULE W/3 SFP PORTS;INTEG CPU,COMPACT FLASH MEM/CONF BACKUP | 1 | M5968978 |
| F10E-A90-TN | F10E-A90-TN - AGG MOD;UNPROT; OTU2 ENH FEC NTWK;ITU 100 GHZ TUNABLE DWDM;DIST:95KM,DISP:90KM;XFP REQ | 2 | M5897264 - M5859314 |
| CN4200-FDF-H-EW | CN4200-FDF-H-EW -CN4200,FRONT EXH,FULL D&C SLOT. INCL HIGH SPEED FANS,FILTER. REQ PWR,ALM,BLKS | 1 | M6000893 |
| CN-PSM-AC450T | CN-PSM-AC450T -450W AC POWER SUPPLY MODULE, 115/220VAC -SUPPORTS UP TO A FULLY LOADED CN 4200 SYSTEM | 2 | M5685562-M5685544 |

| | | | |
|---|---|---|---|
| CN 4200-MNT-19-ETSI | CN 4200-MNT-19-ETSI - 19 INCH / ETSI MOUNTING BRACKET | 1 | NO SERIADO |
| CN-ALM-STD | CN-ALM-STD - Alarm Mod - Standard with Critical, Major, Minor LED indicators | 1 | M5844221 |
| CN-FULL-BLK | CN-FULL-BLK - BLANK CARD FOR FULL LENGTH SLOTS | 1 | NO SERIADO |
| OPT-LX | OPT-LX - Optical Plug-in: 1310nm 1000BASE-LX pluggable optical transceiver (up to 10km) Medium Reach | 3 | PGE3KD6 - PGE3KCL - PGE3KD1 |
| Node License R6.2 | LWOS, CN 4200, NODE LICENSE RTU, R6.2 | 1 | NO SERIADO |

## 5.5 REUNA Santiago

| Group Id | Description | Q | S/N |
|---|---|---|---|
| | CN4200 chassis | 1 | 50180 |
| CN-M3-FLEX-F | CN-M3-FLEX-F-FLEXIPORT MULTISERVICE MODULE W/3 SFP PORTS;INTEG CPU,COMPACT FLASH MEM/CONF BACKUP | 1 | M5968966 |
| F10E-A90-TN | F10E-A90-TN - AGG MOD;UNPROT; OTU2 ENH FEC NTWK;ITU 100 GHZ TUNABLE DWDM;DIST:95KM,DISP:90KM;XFP REQ | 2 | M5897309 - M5826392 |
| CN4200-FDF-H-EW | CN4200-FDF-H-EW -CN4200,FRONT EXH,FULL D&C SLOT. INCL HIGH SPEED FANS,FILTER. REQ PWR,ALM,BLKS | 1 | M6000894 |
| CN-PSM-AC450T | CN-PSM-AC450T -450W AC POWER SUPPLY MODULE, 115/220VAC -SUPPORTS UP TO A FULLY LOADED CN 4200 SYSTEM | 2 | M5685563-M5685560 |
| CN 4200-MNT-19-ETSI | CN 4200-MNT-19-ETSI - 19 INCH / ETSI MOUNTING BRACKET | 1 | NO SERIADO |
| CN-ALM-STD | CN-ALM-STD - Alarm Mod - Standard with Critical, Major, Minor LED indicators | 1 | M5844223 |
| CN-FULL-BLK | CN-FULL-BLK - BLANK CARD FOR FULL LENGTH SLOTS | 1 | NO SERIADO |
| OPT-LX | OPT-LX - Optical Plug-in: 1310nm 1000BASE-LX pluggable optical transceiver (up to 10km) Medium Reach | 5 | PFR124H - PGE3KDD - PGE3KB2 - PGE3KCE - PGE3KCH |
| Node License R6.2 | LWOS, CN 4200, NODE LICENSE RTU, R6.2 | 8 | NO SERIADO |