D2-01_06

GOOSE MESSAGES BETWEEN SUBSTATIONS USING SDH TRANSPORT

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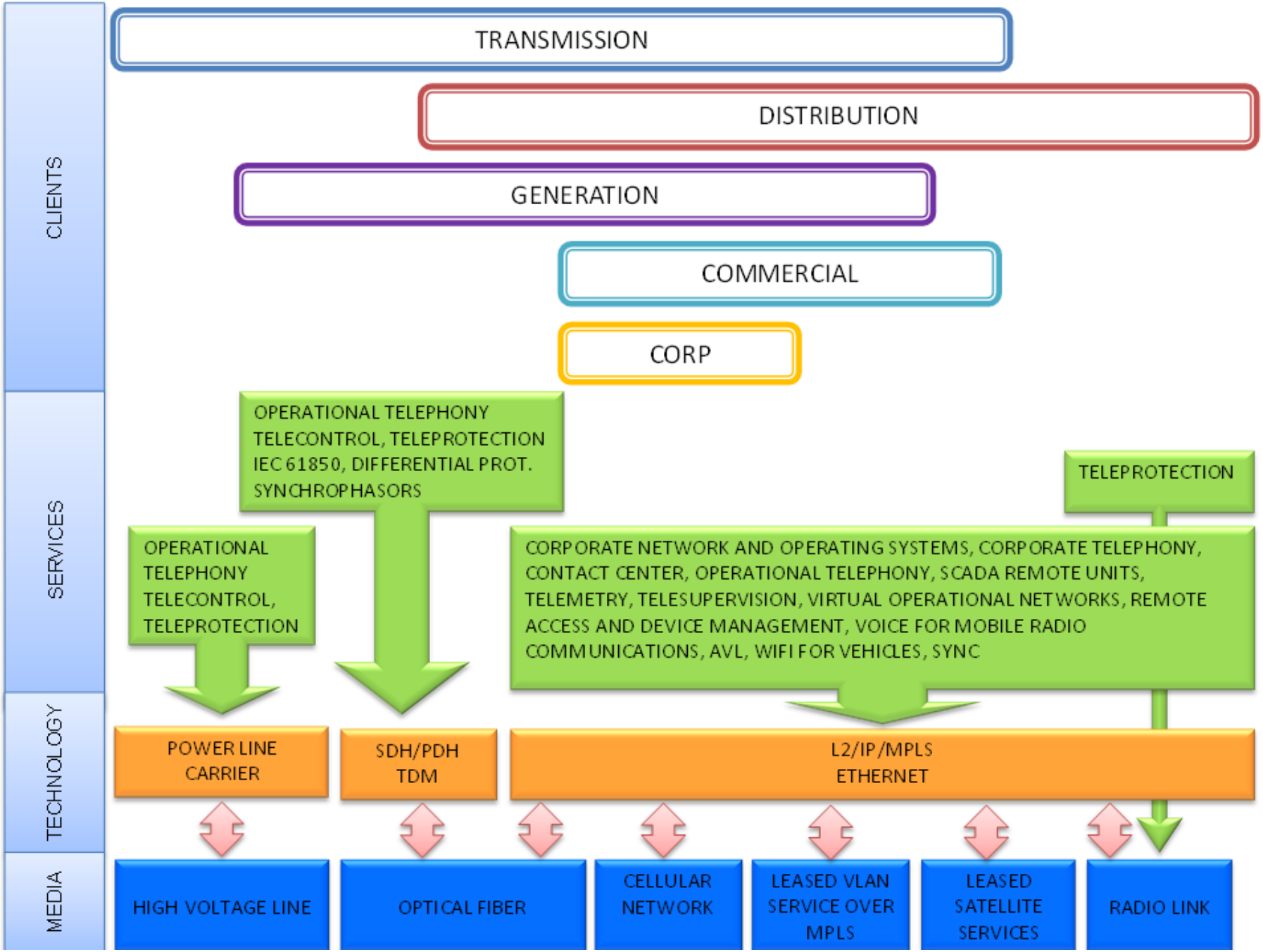
AGENDA

- The context
- The request
- Laboratory Tests
- Getting the bandwith
- Field Test
- Conclusion

The context

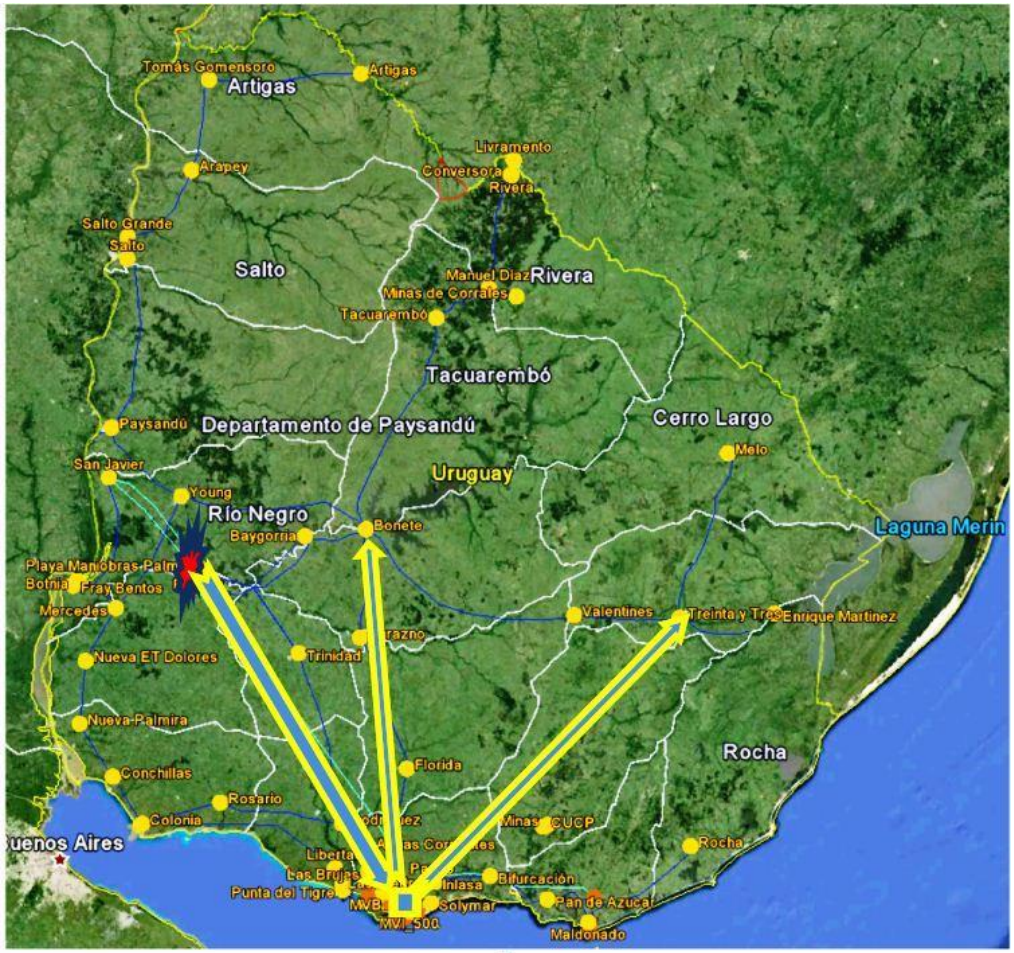
In UTE, the telecommunications network through optical fiber is formed mainly by two separate systems:

- A TDM network with SDH technology
- An operational network that carries services over IP


CLIENTS
SERVICES
TECHNOLOGY
MEDIA
TRANSMISSION
DISTRIBUTION
GENERATION
COMMERCIAL
CORP
OPERATIONAL TELEPHONY TELECONTROL, TELEPROTECTION IEC 61850, DIFFERENTIAL PROT. SYNCHROPHASORS
TELEPROTECTION
OPERATIONAL TELEPHONY TELECONTROL, TELEPROTECTION
CORPORATE NETWORK AND OPERATING SYSTEMS, CORPORATE TELEPHONY, CONTACT CENTER, OPERATIONAL TELEPHONY, SCADA REMOTE UNITS, TELEMETRY, TELESUPERVISION, VIRTUAL OPERATIONAL NETWORKS, REMOTE ACCESS AND DEVICE MANAGEMENT, VOICE FOR MOBILE RADIO COMMUNICATIONS, AVL, WIFI FOR VEHICLES, SYNC
POWER LINE CARRIER
SDH/PDH TDM
L2/IP/MPLS ETHERNET
HIGH VOLTAGE LINE
OPTICAL FIBER
CELLULAR NETWORK
LEASED VLAN SERVICE OVER MPLS
LEASED SATELLITE SERVICES
RADIO LINK

The request

- The Transmission team is carrying out a draft of Remedial Action Scheme

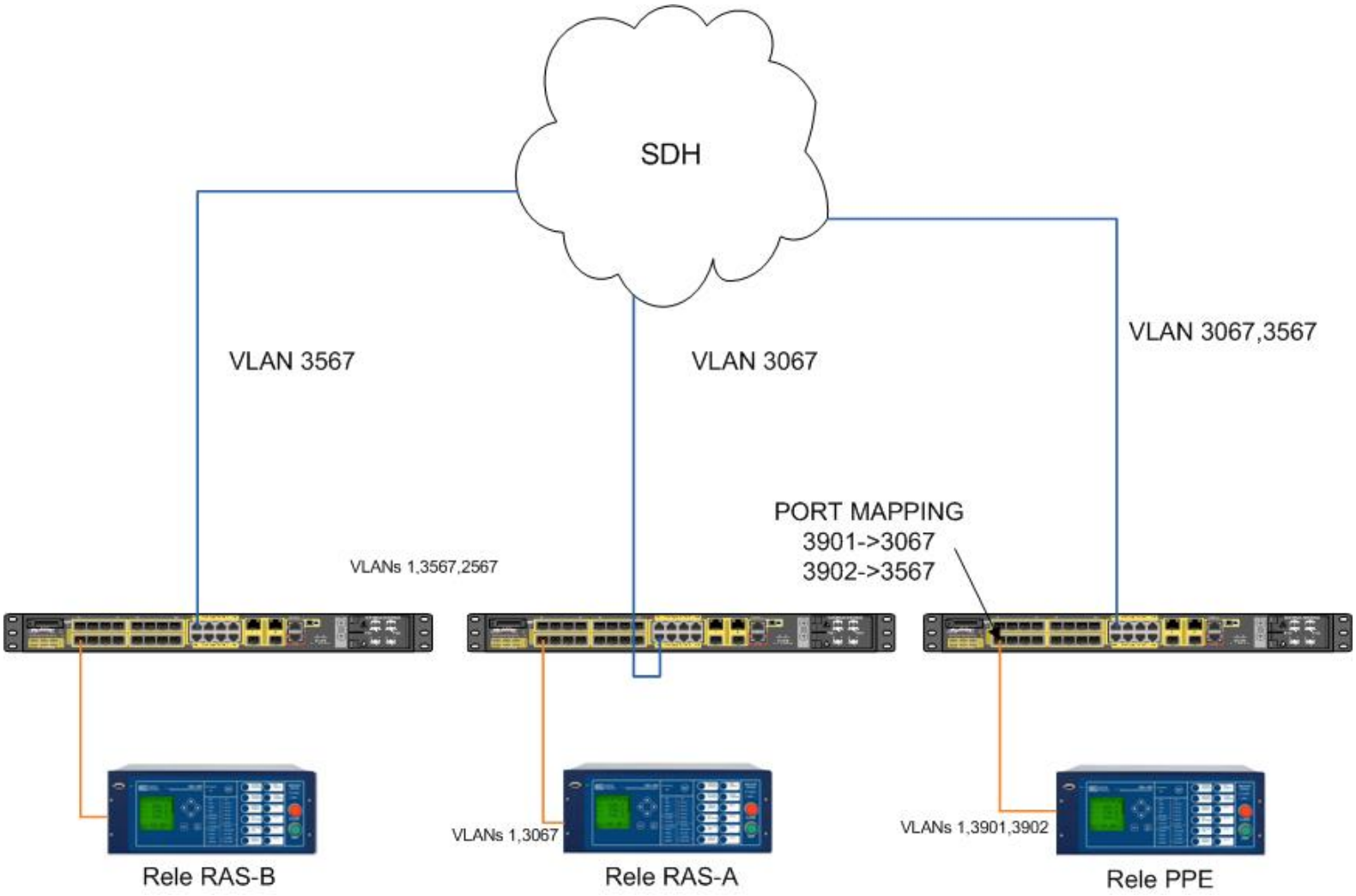


The request

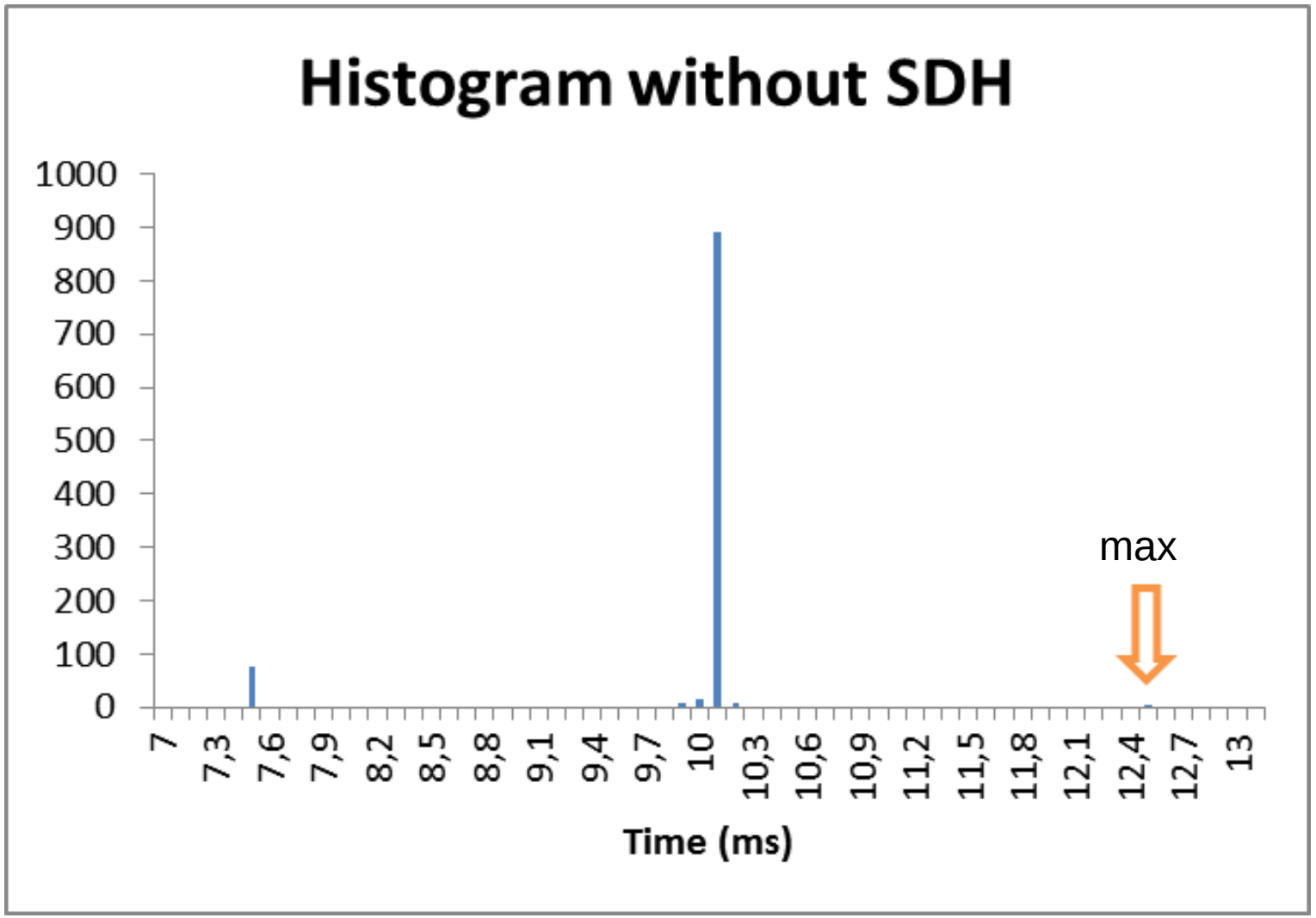
We received the request to transport GOOSE messages between substations.

- The IP network is migrating to MPLS, but this process is just beginning.
- SDH network is mature and formed by New Generation nodes that include a switch capable of transporting Ethernet over SDH.
- To each destination point it was set up a VLAN dedicated to GOOSE messages. The challenge is that messages should arrive in less than 20 ms and get the behavior well characterized to avoid unexpected results.

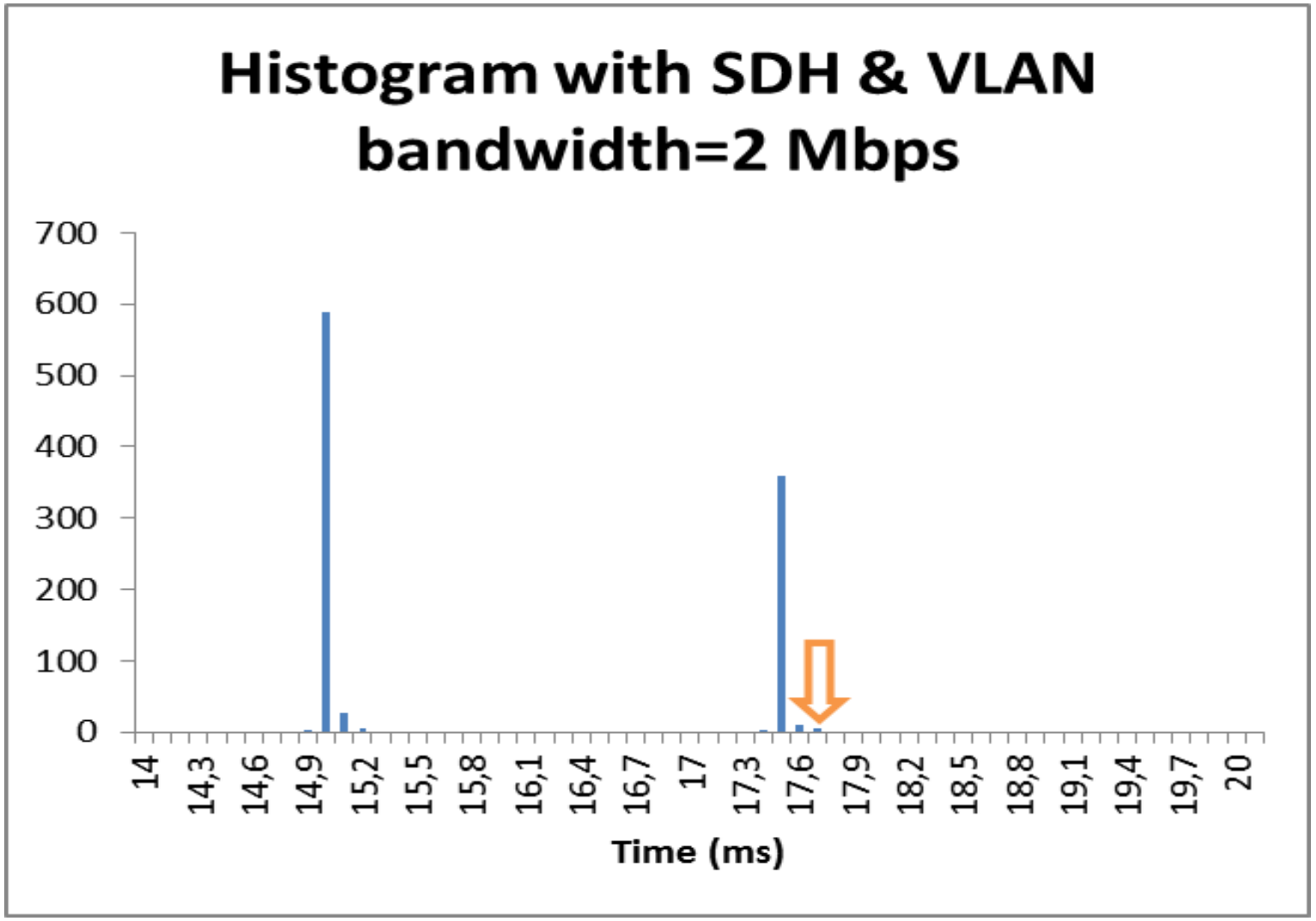
Laboratory Tests



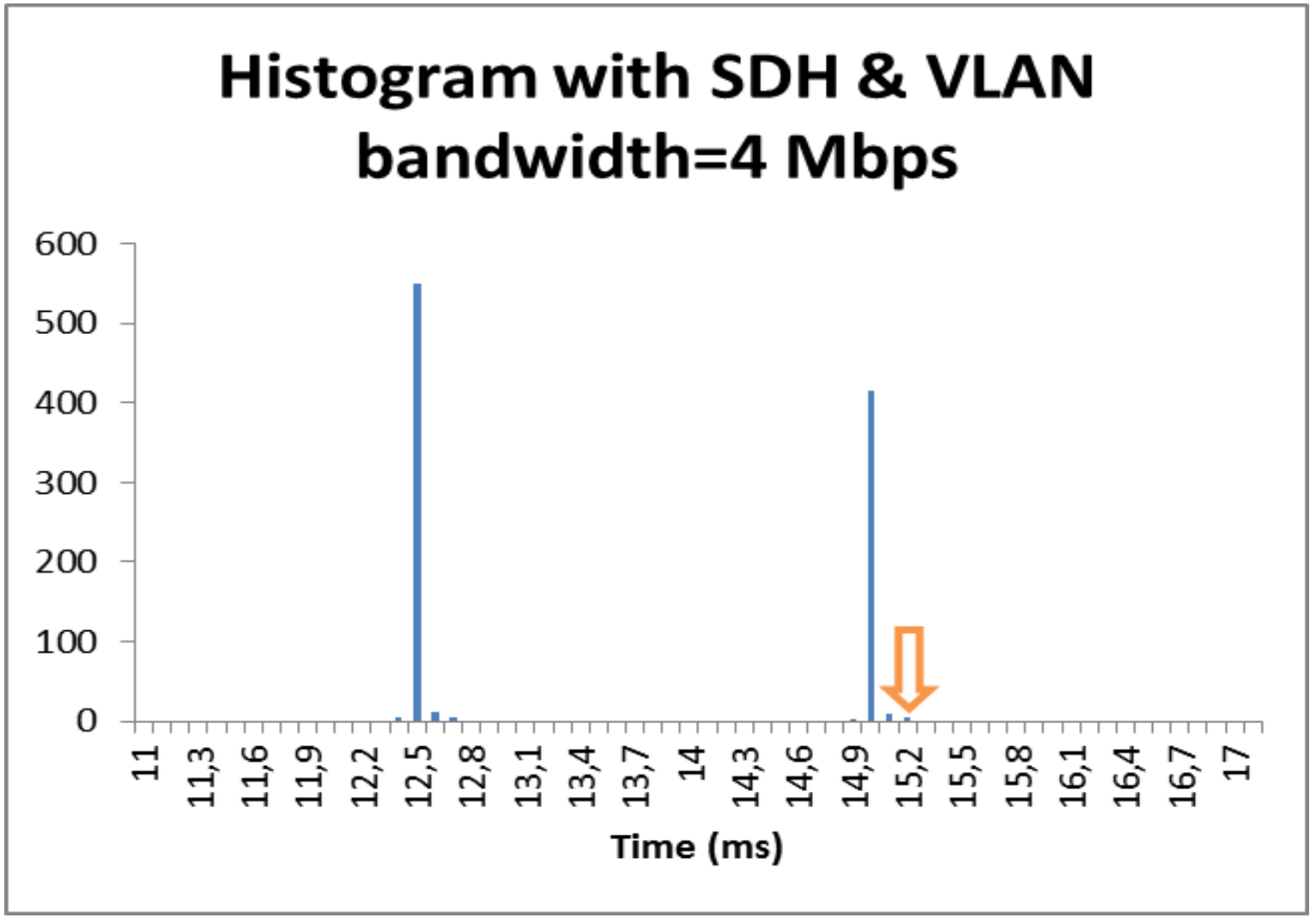
Roundtrip time of a GOOSE message



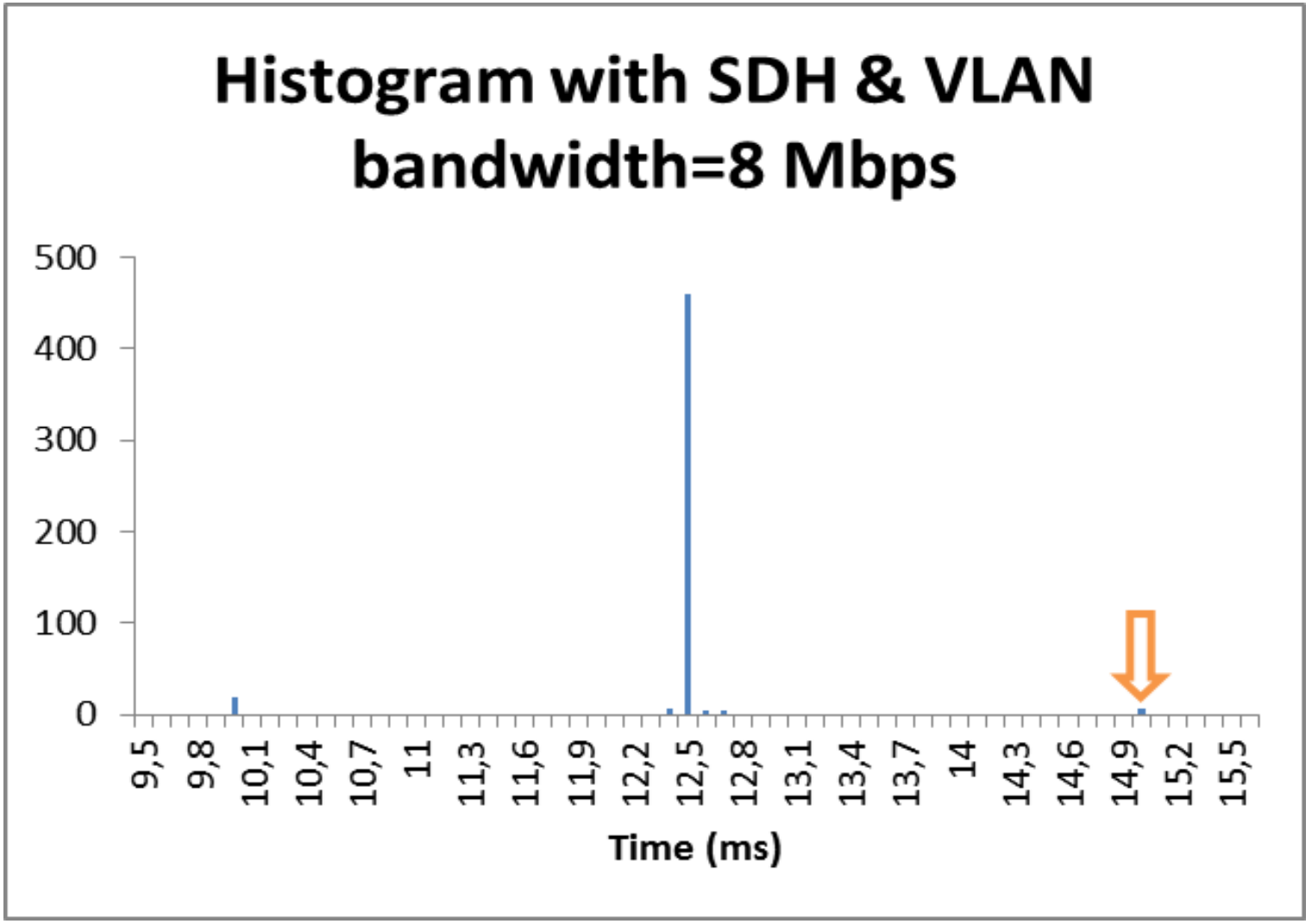
Roundtrip time of a GOOSE message



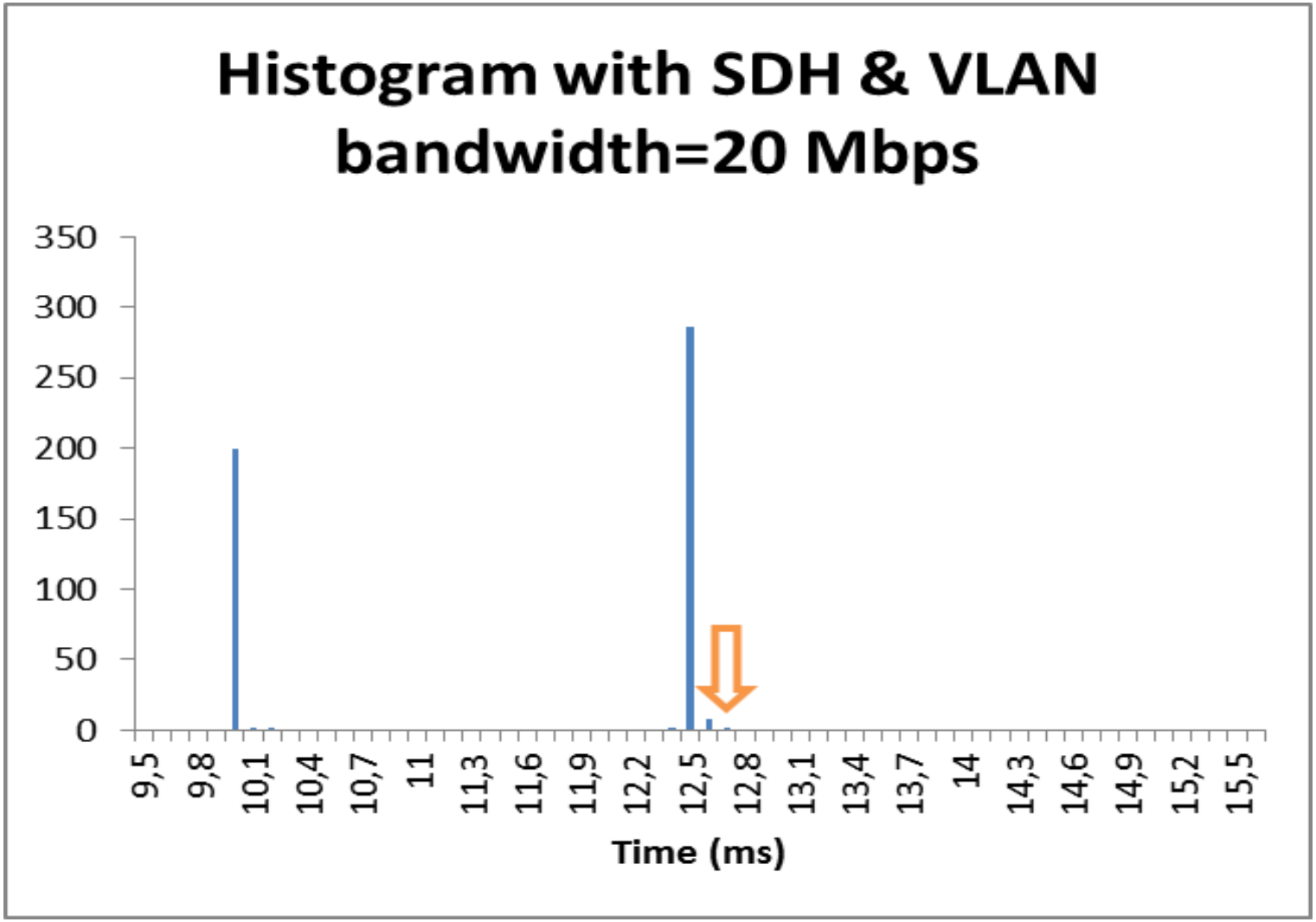
Roundtrip time of a GOOSE message



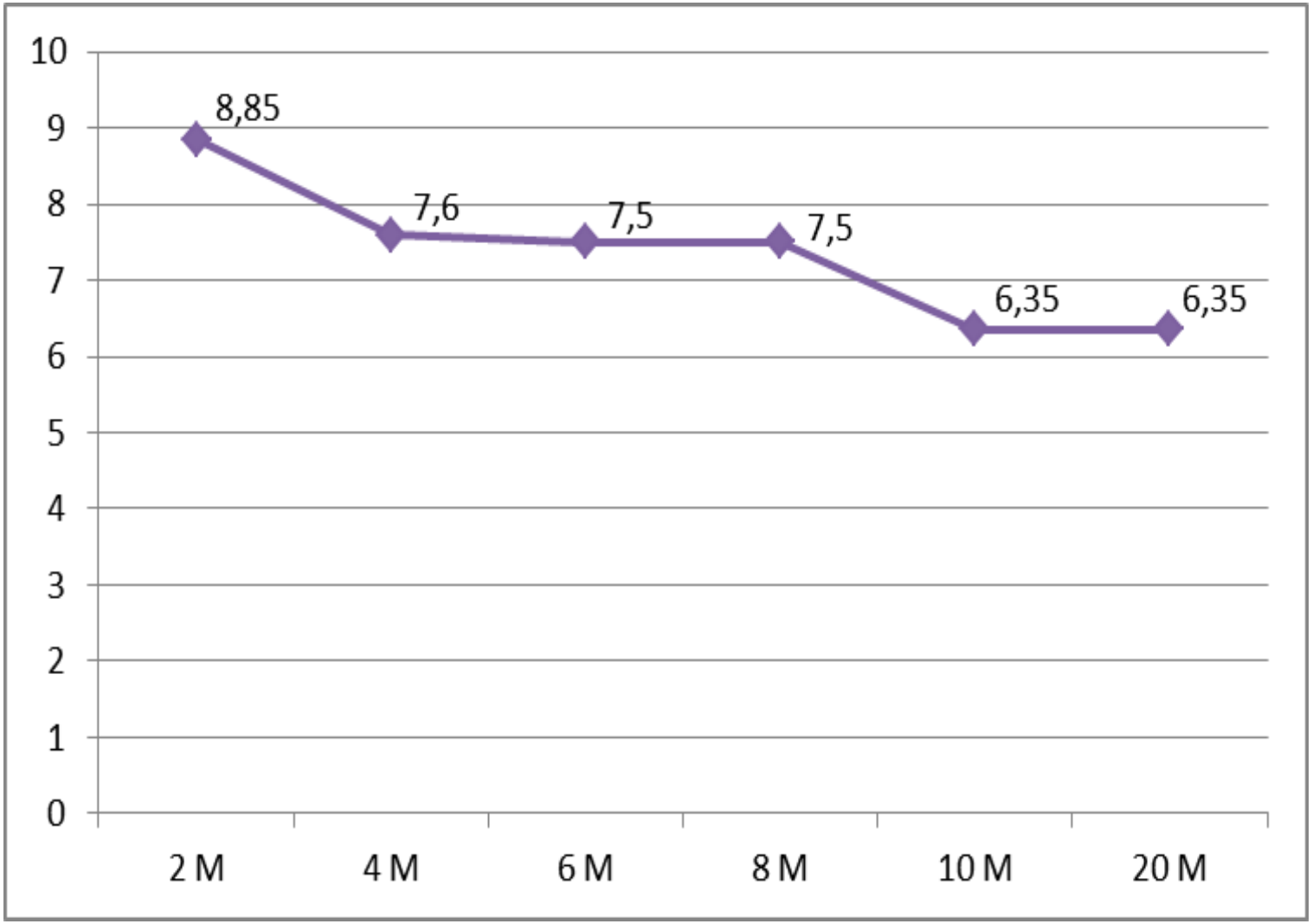
Roundtrip time of a GOOSE message



Roundtrip time of a GOOSE message



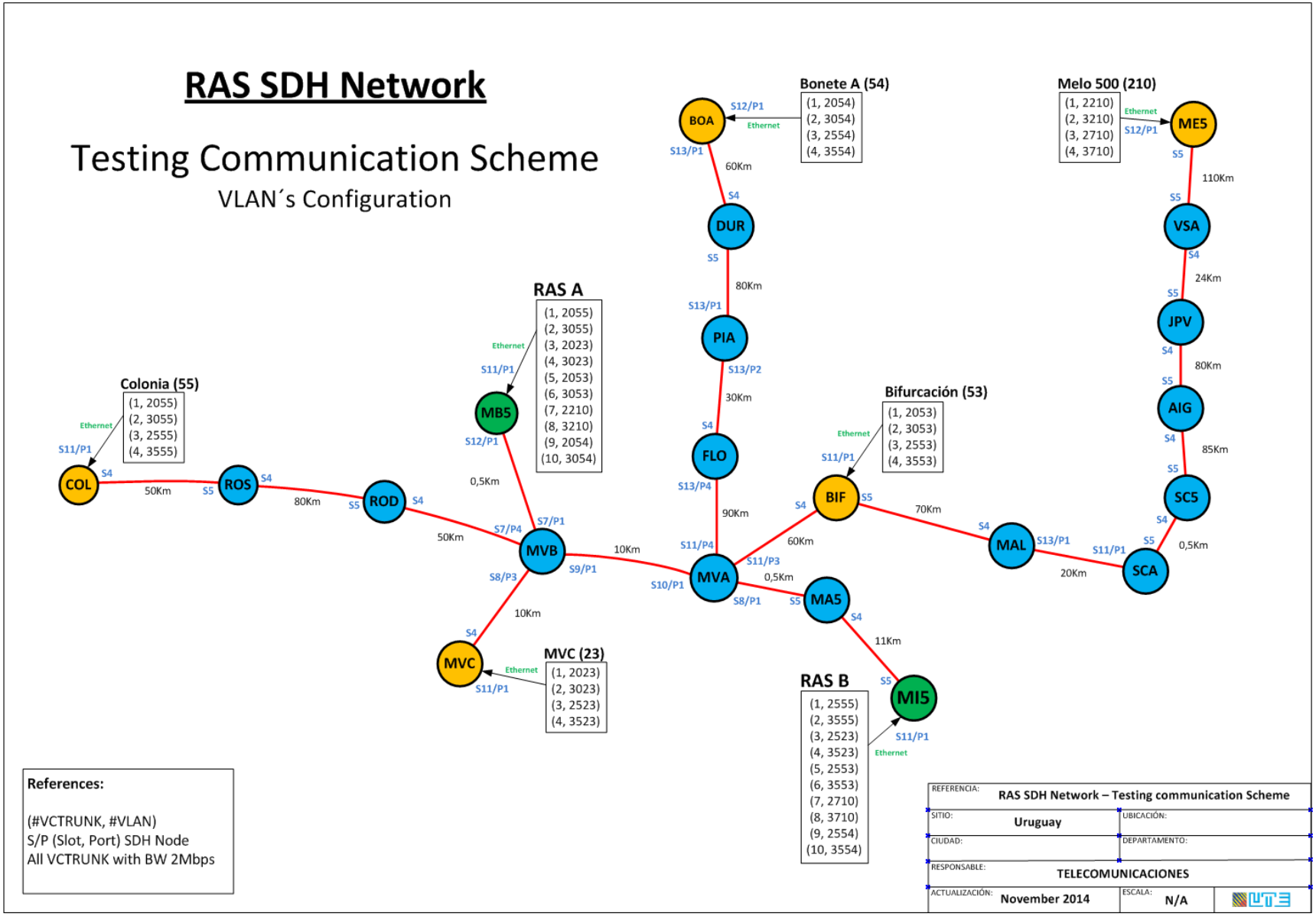
Maximum delay in ms against bandwith (one way)



Getting the bandwith

- From a baseline of 2 Mbps bandwidth, doubling the bandwidth achieves a 15% reduction in time
- If the bandwidth increase continues, anyway cannot reduce more than 30% of the initial time.
- If the time achieved with 2 Mbps is enough, this is the more efficient configuration in terms of time reduction vs. bandwidth

Field Test


RAS SDH Network
Testing Communication Scheme
VLAN´s Configuration
Colonia (55)
(1, 2055)
(2, 3055)
(3, 2555)
(4, 3555)
COL
ROS
ROD
50Km
80Km
RAS A
(1, 2055)
(2, 3055)
(3, 2023)
(4, 3023)
(5, 2053)
(6, 3053)
(7, 2210)
(8, 3210)
(9, 2054)
(10, 3054)
MB5
0,5Km
MVB
50Km
MVC
MVC (23)
(1, 2023)
(2, 3023)
(3, 2523)
(4, 3523)
10Km
Bonete A (54)
(1, 2054)
(2, 3054)
(3, 2554)
(4, 3554)
BOA
60Km
DUR
80Km
PIA
30Km
FLO
90Km
MVA
10Km
Bifurcación (53)
(1, 2053)
(2, 3053)
(3, 2553)
(4, 3553)
BIF
60Km
0,5Km
MA5
11Km
RAS B
(1, 2555)
(2, 3555)
(3, 2523)
(4, 3523)
(5, 2553)
(6, 3553)
(7, 2710)
(8, 3710)
(9, 2554)
(10, 3554)
MI5
70Km
MAL
20Km
Melo 500 (210)
(1, 2210)
(2, 3210)
(3, 2710)
(4, 3710)
ME5
110Km
VSA
24Km
JPV
80Km
AIG
85Km
SC5
0,5Km
SCA
References:
(#VCTRUNK, #VLAN)
S/P (Slot, Port) SDH Node
All VCTRUNK with BW 2Mbps
REFERENCIA: RAS SDH Network – Testing communication Scheme
SITIO: Uruguay
UBICACIÓN:
CIUDAD:
DEPARTAMENTO:
RESPONSABLE: TELECOMUNICACIONES
ACTUALIZACIÓN: November 2014
ESCALA: N/A

Field Test

- In a real network we must also consider distance and intermediate nodes.
- Measurements between the center and different remote nodes of the SDH network were made.
- After these tests, must add 1 ms every 200 km and the added time to cross a node is almost negligible.

Conclusion

Ethernet over SDH appears to be an suitable solution for transmitting GOOSE messages between substations, because TDM is a mature solution with self healing capabilities in a deterministic context.

Special Report Questions

Q: Could you provide us with more technical details about your method to calculate delay in the two cases: local and field test?

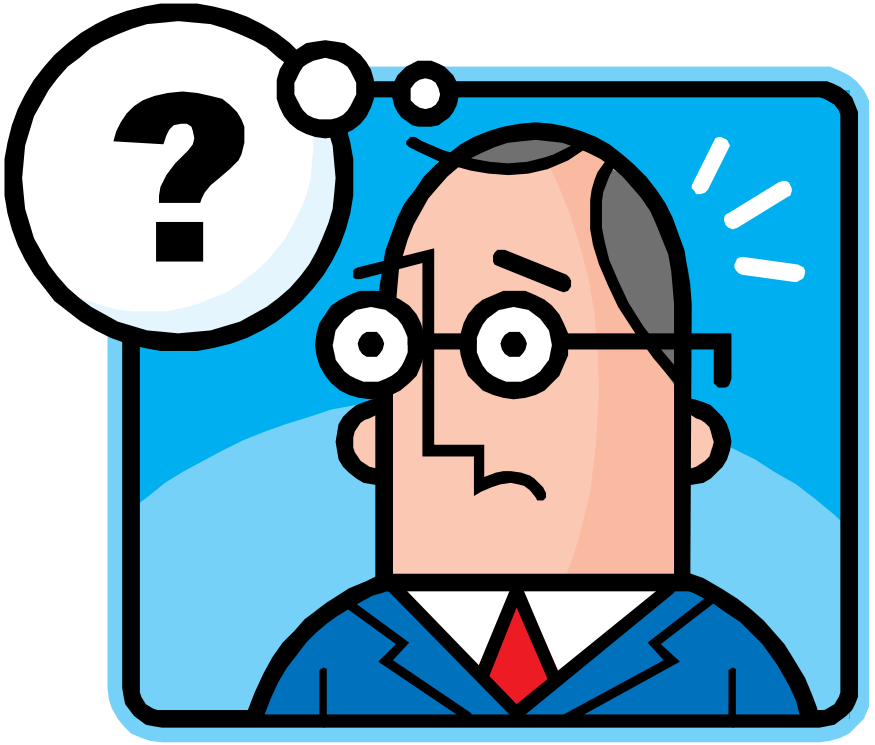
A: In both cases the time is half of the time registered by a relay between the sending of the GOOSE message and the reception of the confirmation message sent by the remote relay

Special Report Questions

Q: Is it possible to use here native Ethernet or IP? What would be the expectations? Do you have any experience with it?

A: Actually this is working on Ethernet over SDH. We are planning to do so soon over MPLS through pseudowire or another similar configuration

Any more questions?



Thank you!