PI System at ENAP: From Information Silos to a Corporate-wide Real-time Data Infrastructure - A Service Model

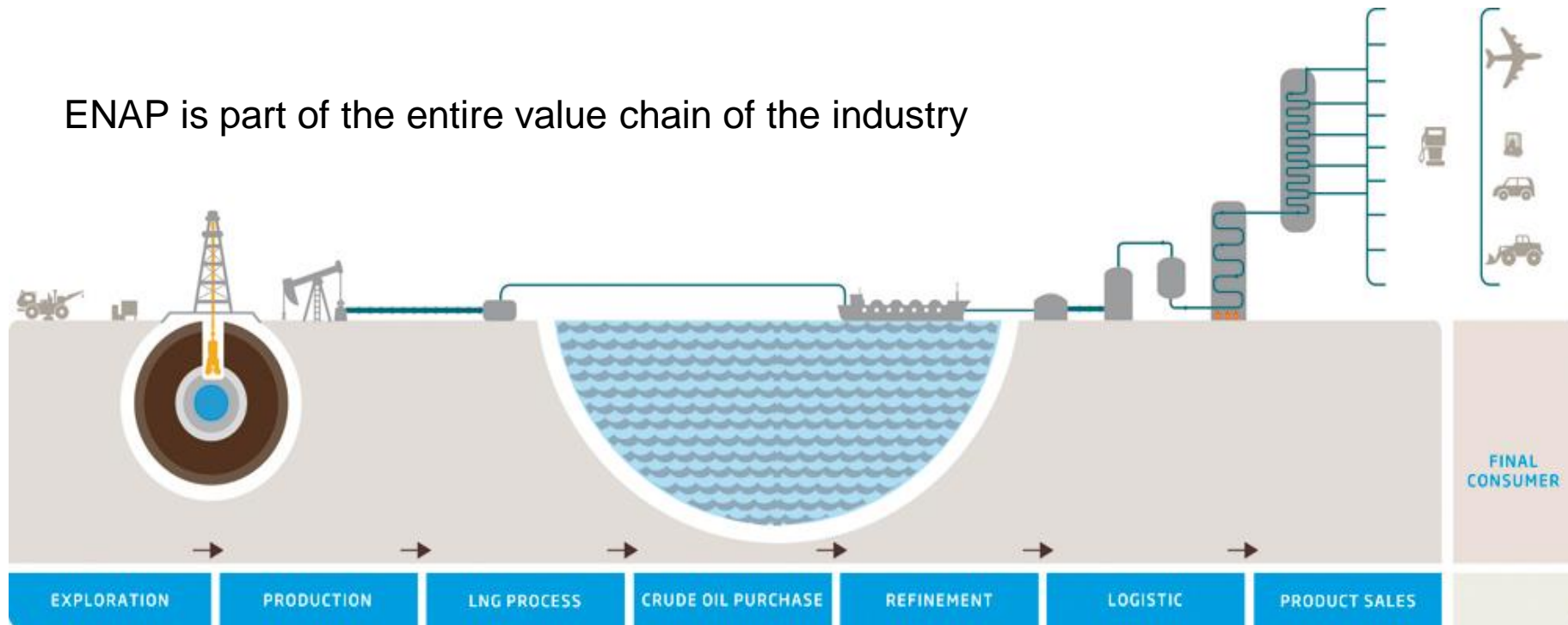Presented by **Sergio Edgardo Garcia Rios**

Agenda

- ENAP at a glance
- Our Business Challenges
- Implementing PI System in a Private Cloud
- Tangible and Other Benefits
- Future Steps
- Summary
- Conclusions

ENAP in the Oil Industry

ENAP is part of the entire value chain of the industry

| EXPLORATION | PRODUCTION | LNG PROCESS | CRUDE OIL PURCHASE | REFINEMENT | LOGISTIC | PRODUCT SALES |

FINAL CONSUMER

ENAP International

Egypt
- East block
  Ras Qattara

Ecuador
- MDC and PBHI block
- 3j block

Chile
- Headquarters in Santiago
- Aconcagua refinery
- Bío Bío refinery
- Maipú, San Fernando
  and Linares terminals
- Magellan ENAP
- Vinapu terminal, Eastern Island

Argentina
- Sipetrol office in Buenos Aires
- Sipetrol office in Rio Gallegos
- Sipetrol office in Comodoro Rivadavia
- Austral basin marina
  - Magellan area block
  - CAM 2-A Sur
  - E2 (ex CAM1 and CAM3)
- Basin San Jorge gulf
  - Campamento central – cañadon perdido block
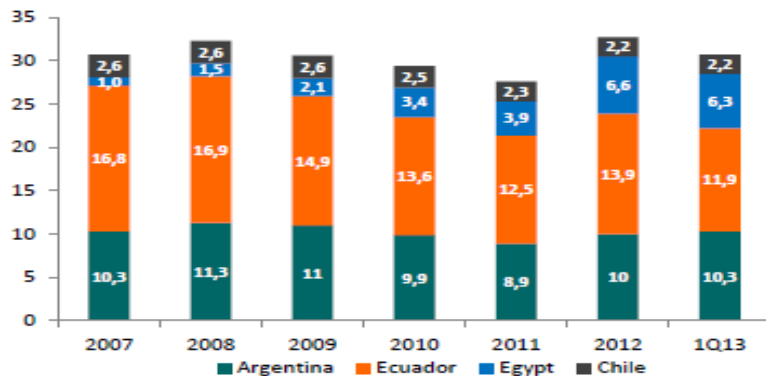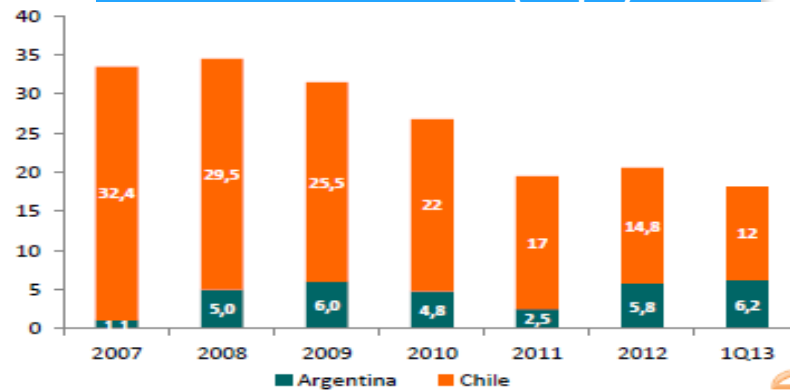 - Pamp del Castillo – La Guitarra block

Upstream

Exploration y Production is responsible for managing the business of hydrocarbon exploration, developing and exploiting the field reserves discovered and producing oil and natural gas. ENAP is active in the whole chain of Exploration and Production business, with operations in Argentina, Ecuador and Egypt, and in the Magellanes Region in Chile, which are managed through Sipetrol.

Crude Oil production (Mbpd)

Year	Argentina	Ecuador	Egypt	Chile
2007	10,3	16,8	1,0	2,6
2008	11,3	16,9	1,5	2,6
2009	11	14,9	2,1	2,6
2010	9,9	13,6	3,4	2,5
2011	8,9	12,5	3,9	2,3
2012	10	13,9	6,6	2,2
1Q13	10,3	11,9	6,3	2,2

Gas Production (Mbpd)

Year	Argentina	Chile
2007	1,1	32,4
2008	5,0	29,5
2009	6,0	25,5
2010	4,8	22
2011	2,5	17
2012	5,8	14,8
1Q13	6,2	12

Downstream

Refining and Marketing Area is responsible for developing the activities related to the production and marketing of fuels and other petroleum products, with the marketing of LNG, in addition to managing the logistics infrastructure for transportation and storage.
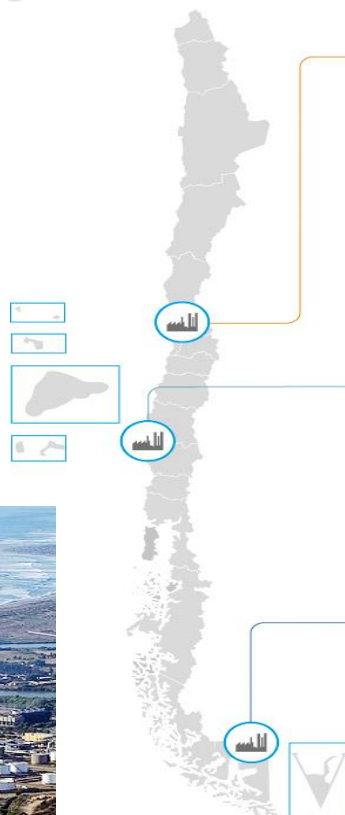
ACONCAGUA REFINERY

|	
Commissioning	November 12th 1955
Location	Concón district, Valparaíso region, Chile.
Products	Liquefied gas, gasolines, kerosenes, diesel, solvent, fuel oils, asphalt, petcoke
Refinery capacity	104.000 barrels of crude oil
Main facilities	• Refinery • Marine terminal in Quintero • Marine Terminal in Eastern Island

BÍO BÍO REFINERY

Commissioning	July 29th 1966
Location	Hualpén district, Biobío region, Chile.
Products	ethylene, propylene, propane, butane, gasolines, kerosenes, diesel, fuel oils, asphalt, petcoke, sodium hydrosulfide, sulphur
Refinery capacity	116.000 barrels of crude oil
Main facilities	• Refinery • Marine terminal in San Vicente

GREGORIO REFINERY

Location	Gregorio district, Magellan region, Chile
Products	kerosenes, diesel, naphta.
Market	Main supplier to Magellan region and supplier to Aconcagua refinery and Bio Bio refinery
Refinery capacity	15.700 barrels of crude oil
Main facilities	• Refinery • Marine terminal

Products
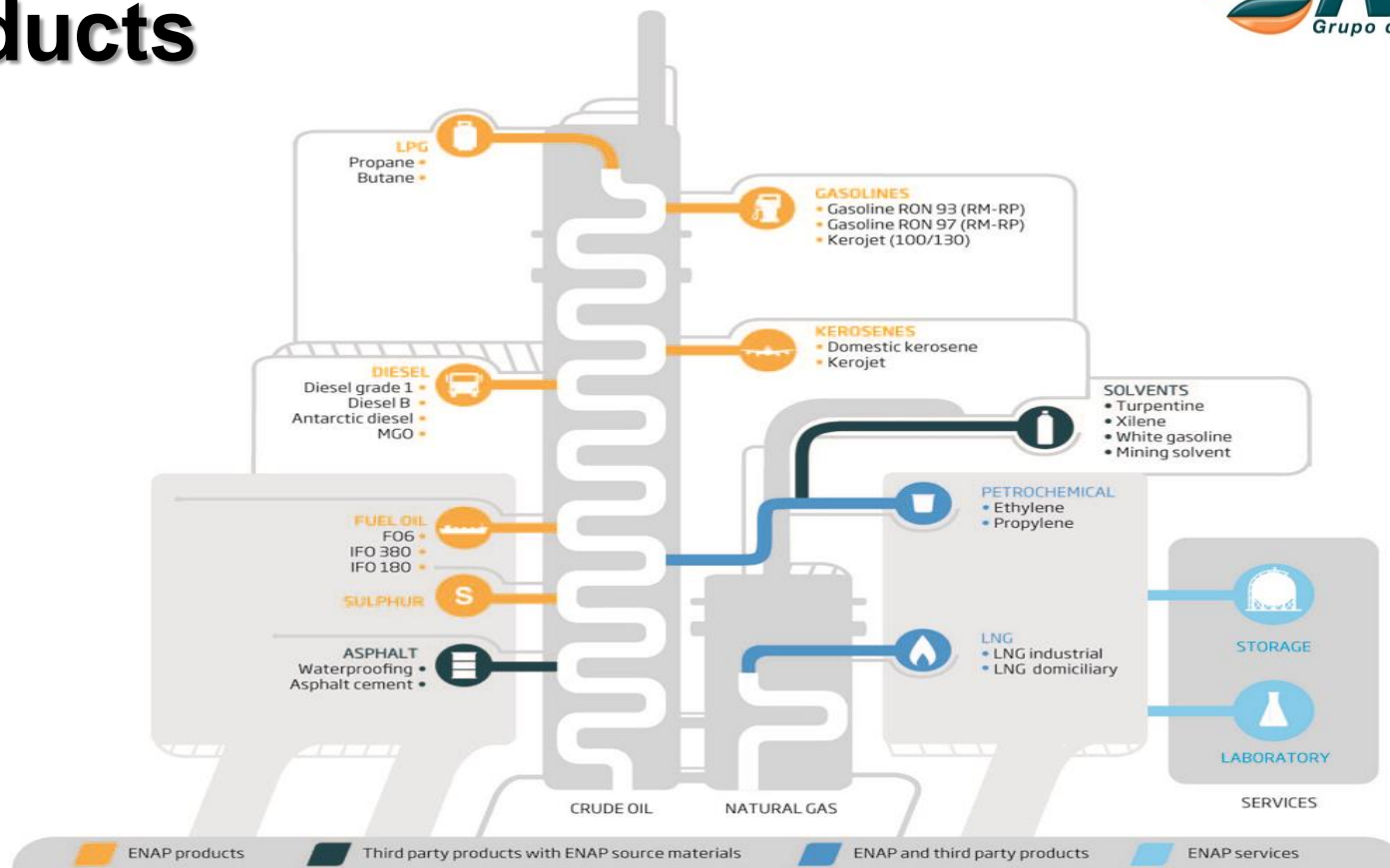
From Information Silos to a Corporate-wide Real-time Data Infrastructure - A Service Model

For many years PI System was used and managed locally at each ENAP site. One and a half year ago we started to change that paradigm and build the basis of a Corporate-wide, Real-time Data Infrastructure, accessible to every person in the company.

Business Challenges

- How to achieve corporate visibility
- How to ensure 100% availability of the data coming from different sites
- How to ensure that the same data generated at a site level is visualized at the corporate level. Data consistency

Solutions

- Basic Infrastructure upgrade
- PI Servers update and expansion
- Work closely with the stake holders
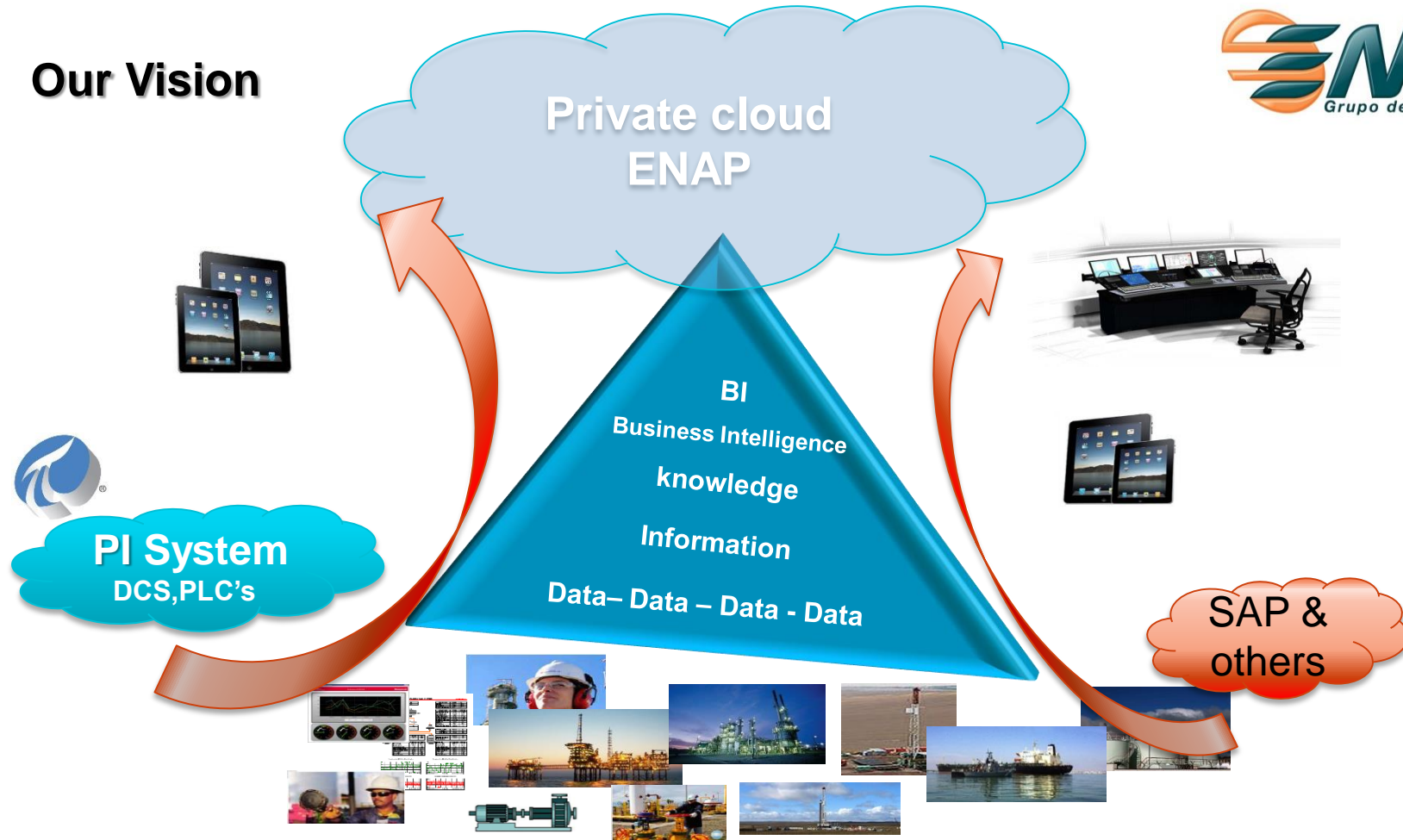- Service Model with SLA
- Data Certification

Results and Benefits

- Information in the cloud
- Reliable and Available Data
- Certified Data

How to achieve corporate visibility of plant real time data, product storage and movements
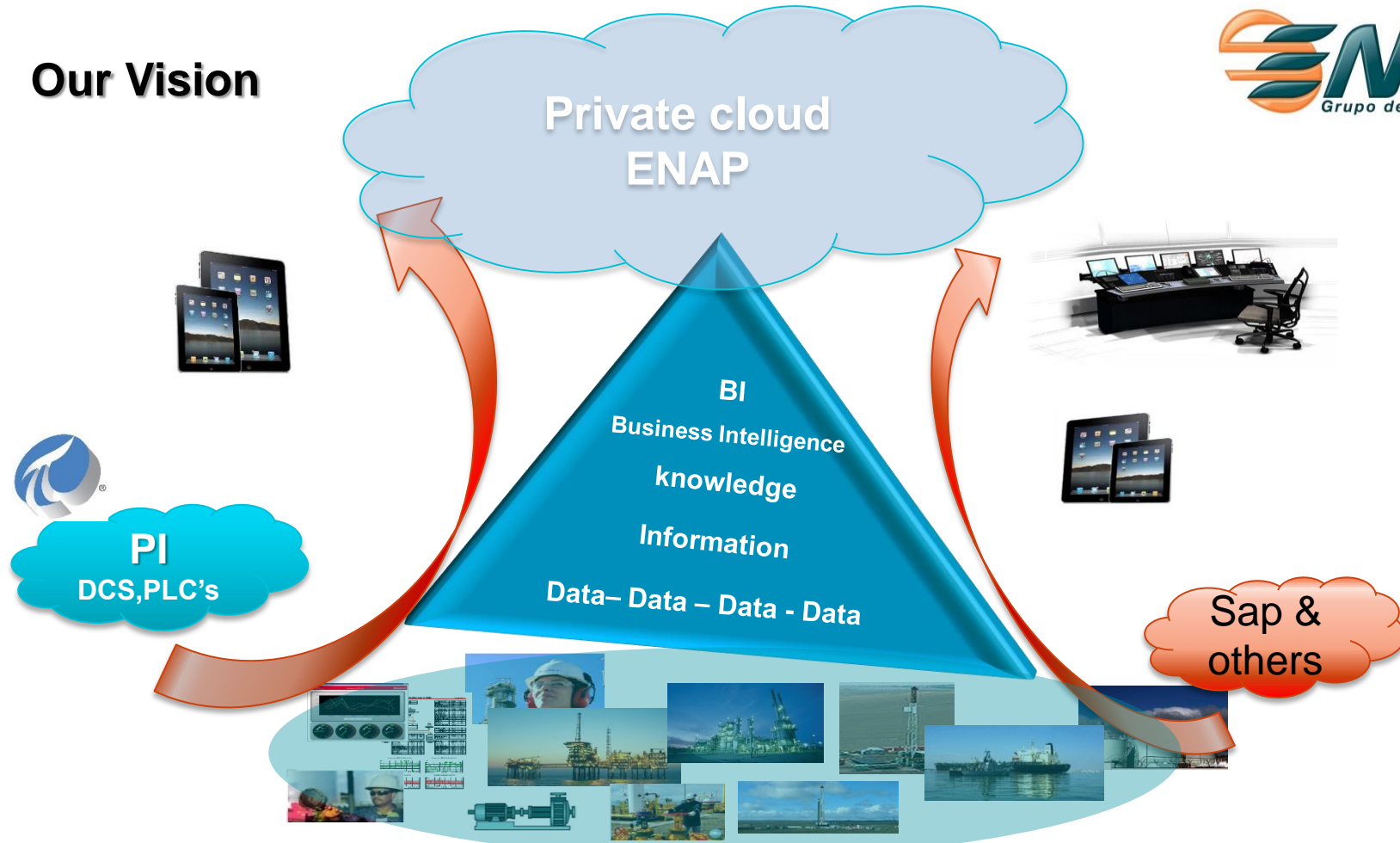
Our Vision

Private cloud ENAP

BI
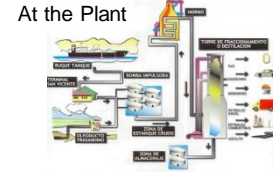Business Intelligence

knowledge

Information

Data– Data – Data - Data

PI System
DCS,PLC's

SAP &
others

How do we get there?

Our Vision

Private cloud ENAP

BI
Business Intelligence

knowledge

Information

Data– Data – Data - Data

PI
DCS,PLC's

Sap & others

How to ensure 100% availability of the data coming from different sites
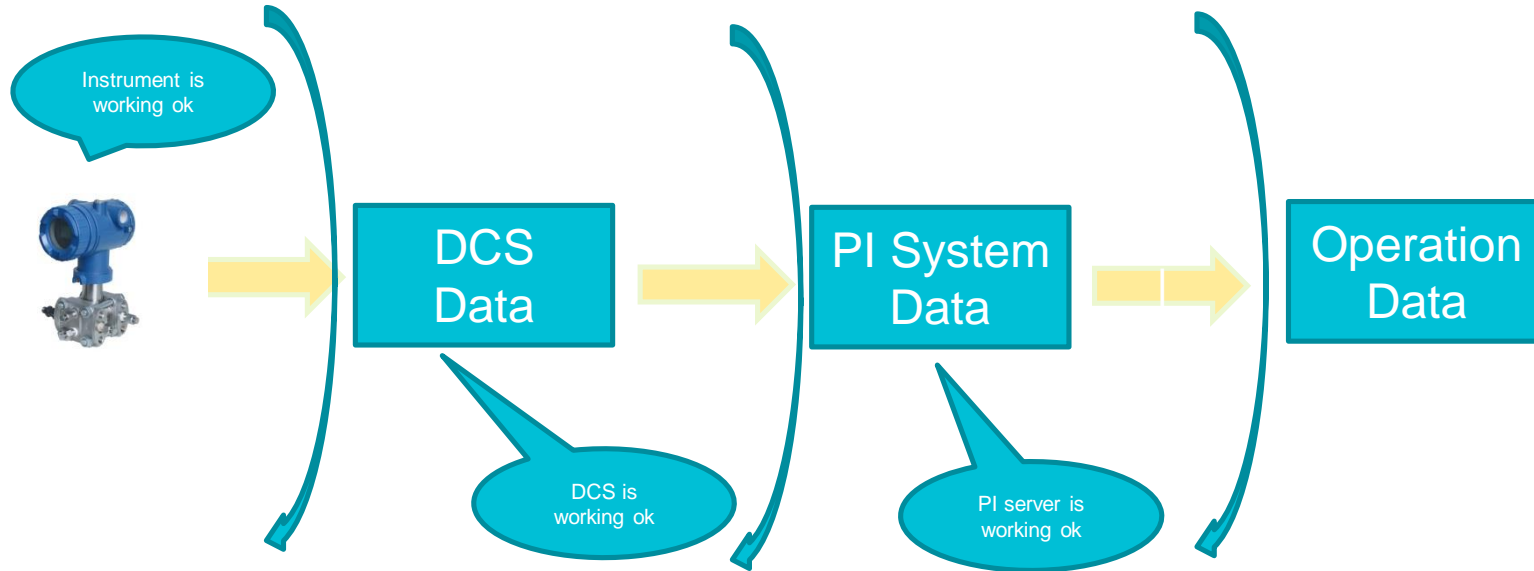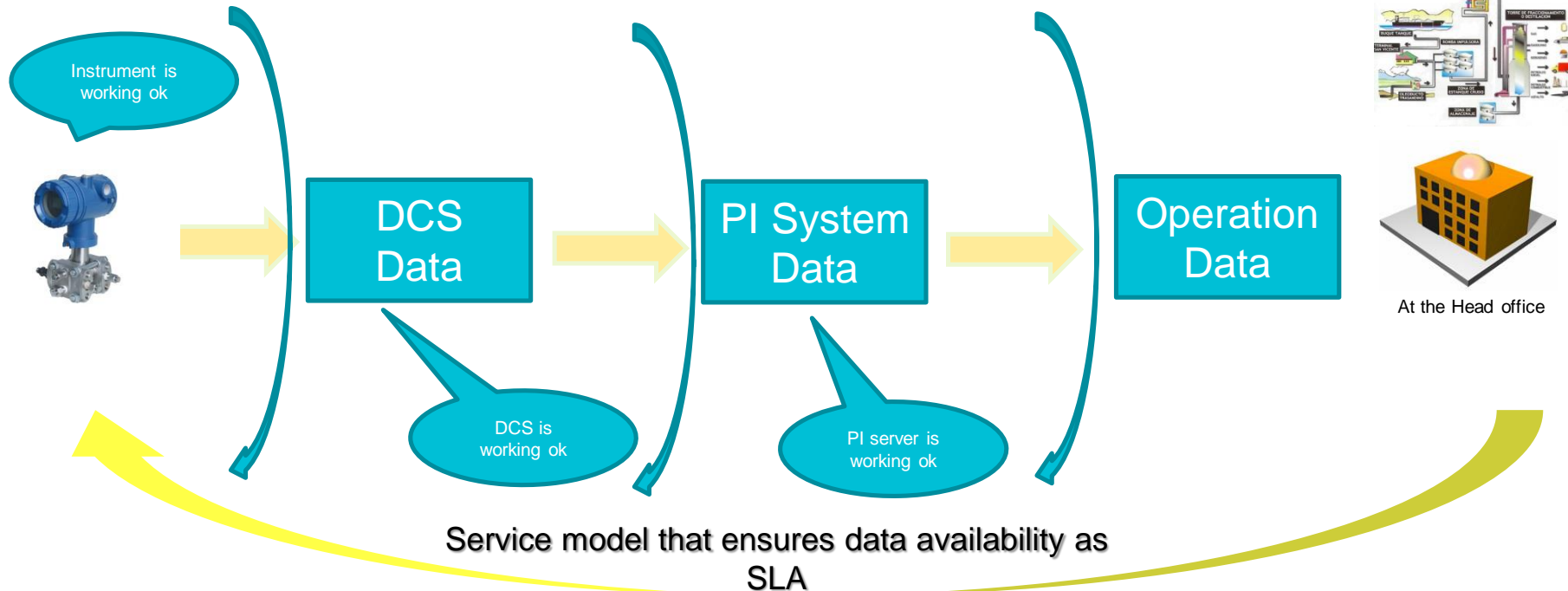
How to ensure that the same data generated at a site level is visualized at the corporate level.
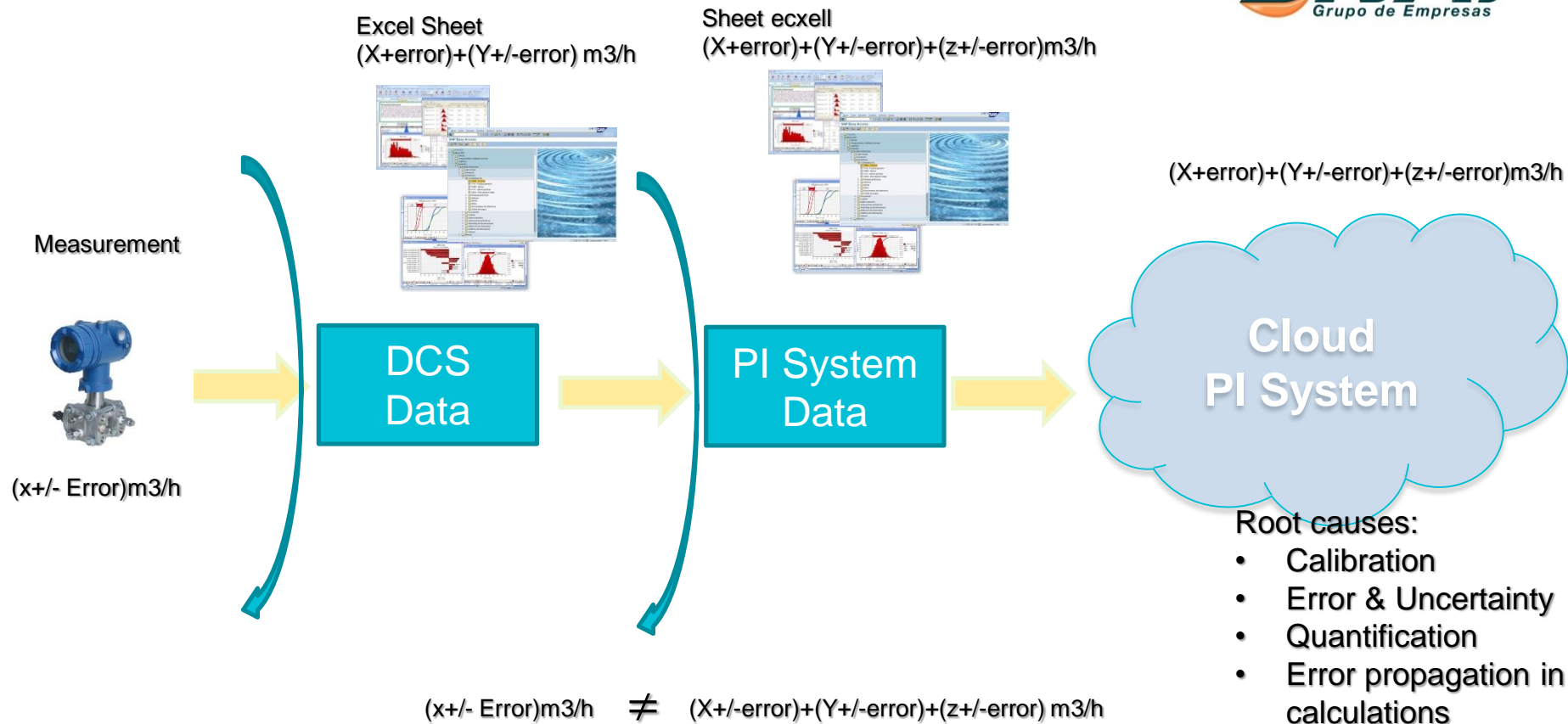
Data consistency – Data Certification

(robust and reliable)

Data consistency & Data Certification

Measurement

(x+/- Error)m3/h

Excel Sheet
(X+error)+(Y+/-error) m3/h

Sheet ecxell
(X+error)+(Y+/-error)+(z+/-error)m3/h

(X+error)+(Y+/-error)+(z+/-error)m3/h

DCS Data

PI System Data

Cloud PI System

Root causes:
- Calibration
- Error & Uncertainty
- Quantification
- Error propagation in calculations

(x+/- Error)m3/h ≠ (X+/-error)+(Y+/-error)+(z+/-error) m3/h

Loop calibration Task

Work Order Nro.23-245 FI54567
Loop Calibration

Meas

(x+/- Error)m3/h

Instrument Data sheet
With ISO17025

(x+error) m3/h

DCS Data

PI System Data

Cloud PI System

Fi: 10% of range

Fi: 50% of range

Fi: 10% of range OK

Fi: 50% of range OK

Fi: 10% of range OK

Fi: 50% of range OK

Tangible Benefits

- Information available in the private cloud with access for every person in the company
- Service model focused on the availability, reliability and robustness of the data
- Different areas work together in Data production
- Access to information via mobile devices

Other Benefits

- PI System, process data repository for:

  - Refinery mass balance system at site level
  - Products movement system at site level
  - Mass balance and product movements through the entire value chain
  - Inventory and product storage systems
  - Plant Simulation system

Future steps

- Add Exploration and Drilling information from other international subsidiaries

- Asset Management of mechanical rotating equipment

- Environmental management KPIs for refineries

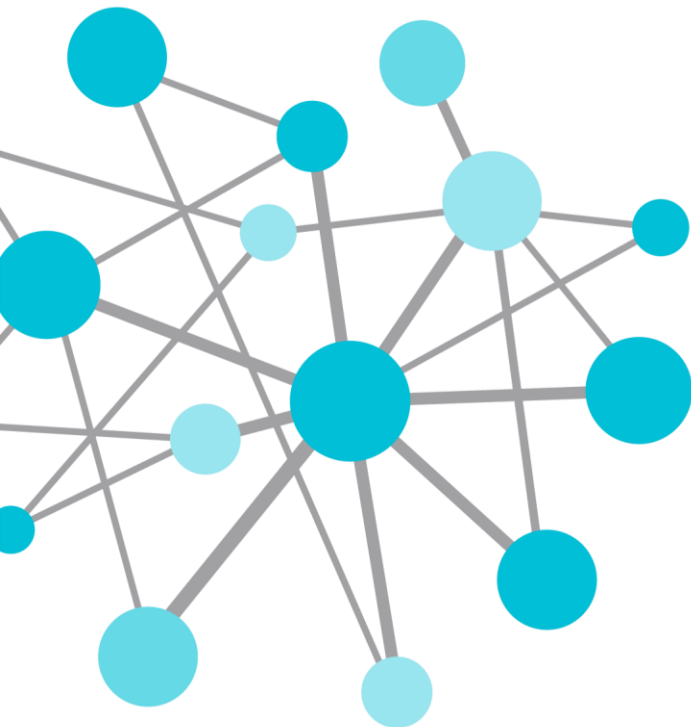- Explore Enterprise Agreement with OSIsoft
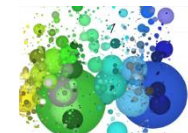
Conclusions

- The PI System Infrastructure allows us to have the information available throughout to entire company with a high rate of availability and certainty of "only one truth"

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- TICA Manager
- ENAP
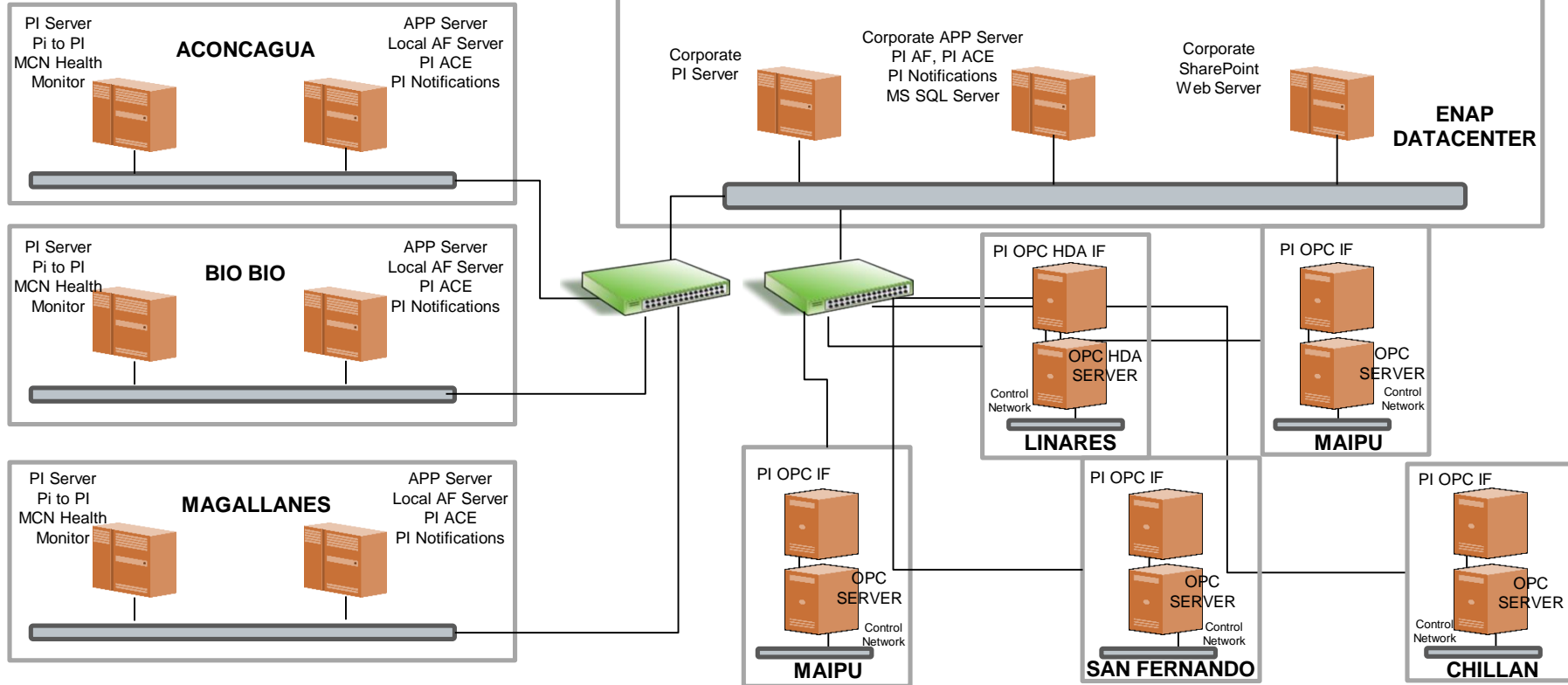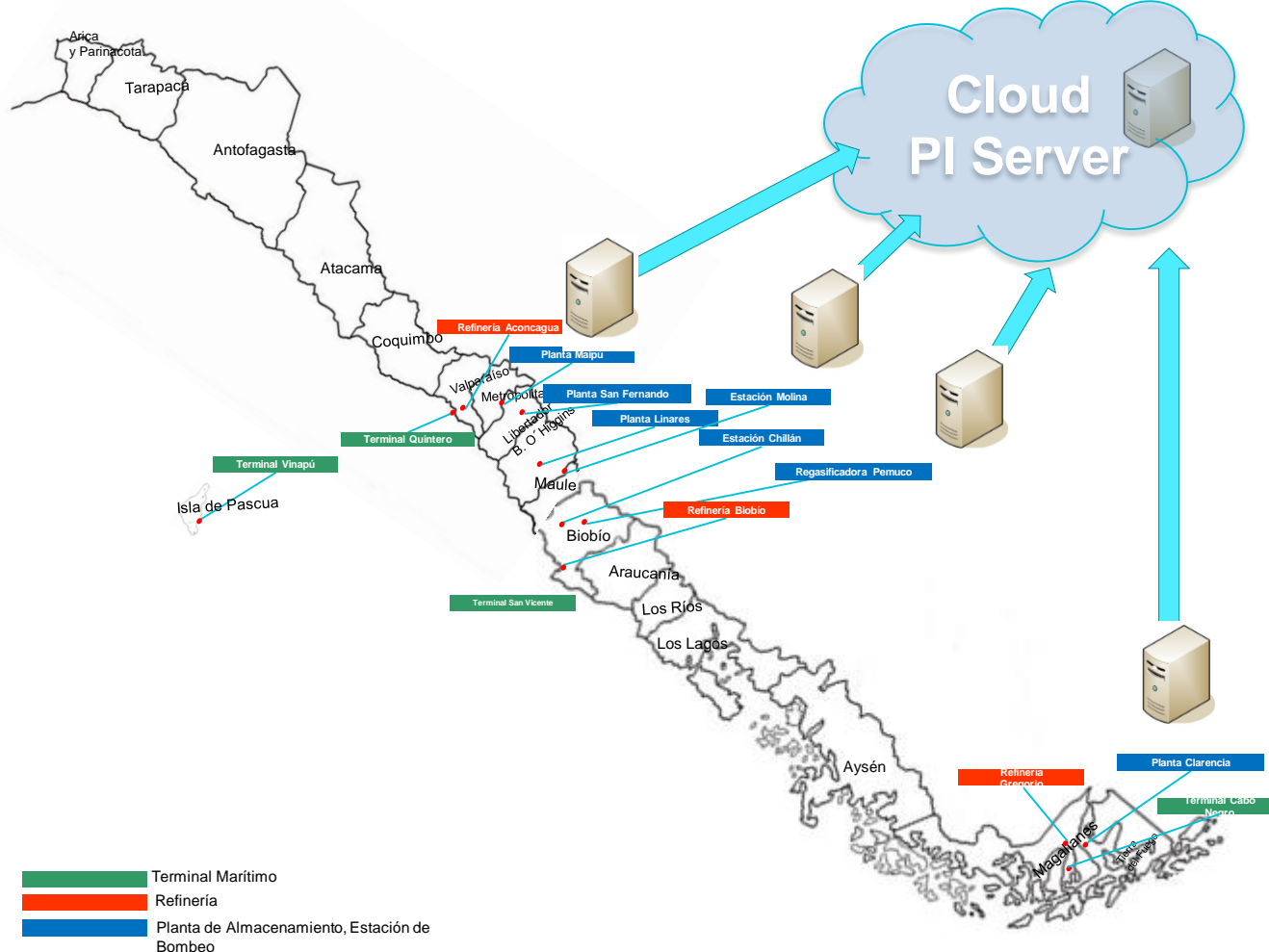
THANK
YOU

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Strengthen the platform & Update each PI Server

PI Server corporate architecture at ENAP

ACONCAGUA

PI Server
Pi to PI
MCN Health
Monitor

APP Server
Local AF Server
PI ACE
PI Notifications

BIO BIO

PI Server
Pi to PI
MCN Health
Monitor

APP Server
Local AF Server
PI ACE
PI Notifications

MAGALLANES

PI Server
Pi to PI
MCN Health
Monitor

APP Server
Local AF Server
PI ACE
PI Notifications

ENAP DATACENTER

Corporate
PI Server

Corporate APP Server
PI AF, PI ACE
PI Notifications
MS SQL Server

Corporate
SharePoint
Web Server

LINARES

PI OPC HDA IF

OPC HDA
SERVER

Control
Network

MAIPU

PI OPC IF

OPC
SERVER

Control
Network

MAIPU

PI OPC IF

OPC
SERVER

Control
Network

SAN FERNANDO

PI OPC IF

OPC
SERVER

Control
Network

CHILLAN

PI OPC IF

OPC
SERVER

Control
Network