PI System as a Foundation for the Implementation of Industry 4.0 at NEXA RESOURCES

Patrick Gobetti, IT Industry Manager, Nexa Resources

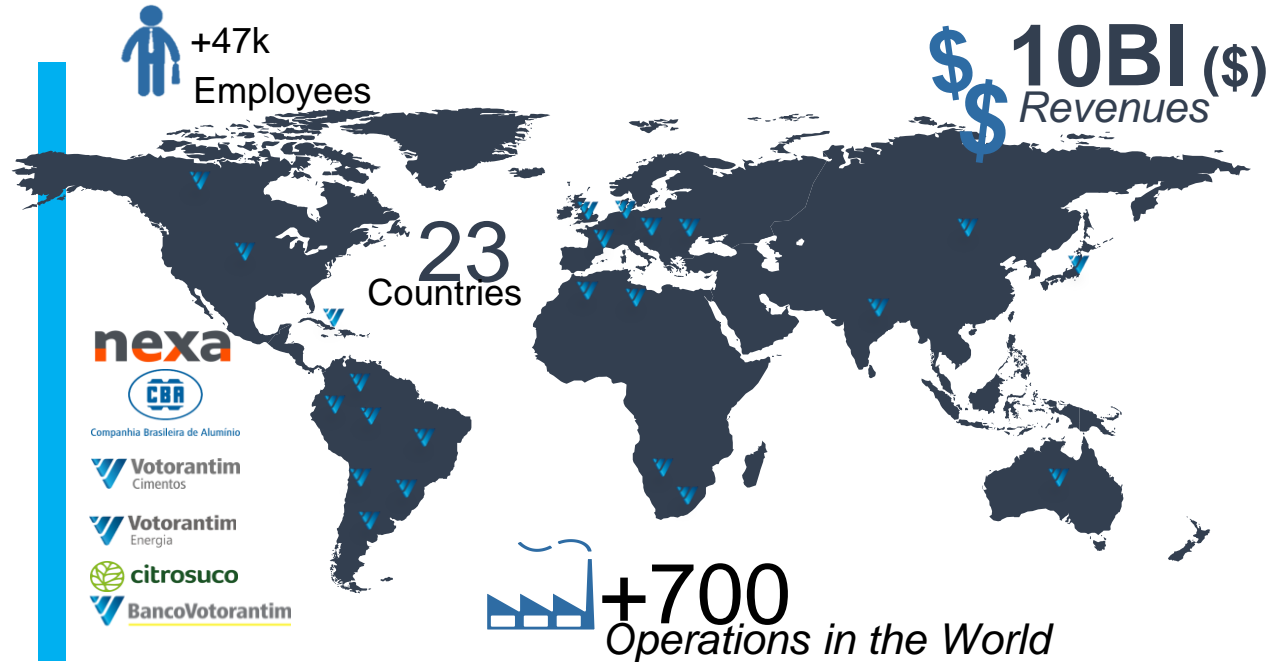Justin Conroy, Program Manager, Radix Engineering and Software

Topics in Agenda

- About Nexa Resources
- Business Challenges
- Technical Challenges
- Work Carried Out
- PI System and the Industry 4.0
- Results Obtained and Business Impact
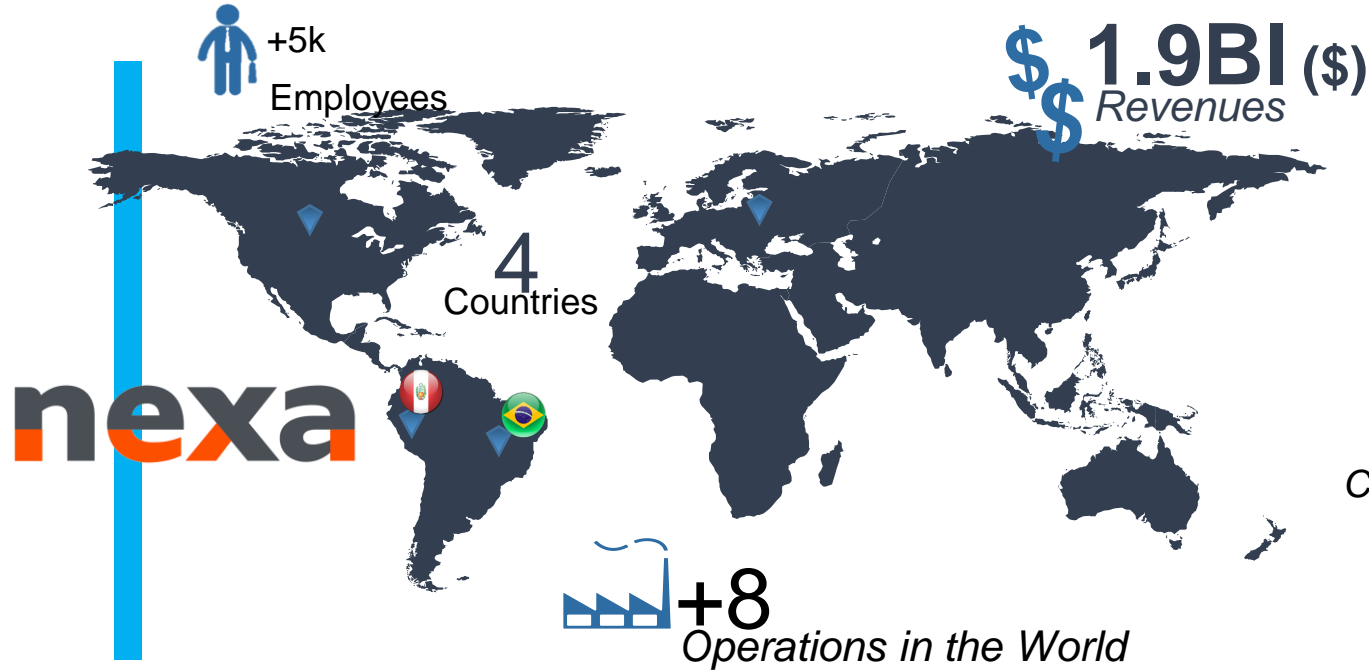- Future Developments Roadmap

ABOUT NEXA RESOURCES

About Nexa Resources: Nexa Resources in Votorantim´s Context

+47k Employees

$$10BI ($) *Revenues*

23 Countries

nexa

CBA
Companhia Brasileira de Alumínio

Votorantim Cimentos

Votorantim Energia

citrosuco

BancoVotorantim

+700 *Operations in the World*

Source: www.votorantim.com.br

About Nexa Resources

+5k

Employees

4
Countries

$$ $ 1.9BI ($)$$
Revenues

+8
Operations in the World

nexa

Mining
Morro Agudo
Vazante
Cerro Lindo
Atacocha
El Porvenir

Smelting
Três Marias
Juiz de Fora
Cajamarquilla

Greenfields
Aripuanã
Caçapava do Sul
Shalipayco
Magistral
Pukaqaqa

Source: www.votorantim.com.br

About Nexa Resources

Mining

Zinc

Copper

Lead

Smelting

SHG Zinc

In the form of granules, ingots or jumbos, it is used to produce alloys such as brass and bronze and in galvanizing processes

Zamac

A highly resistant alloy of zinc-aluminum, magnesium and copper. It is present in the casting of countless industrialized metal products.

Zinc Oxide

Obtained by volatizing zinc metal, it creates products used in rubber, ceramics, chemicals, electronics and agriculture

Zincal 200

An agricultural lime powder, a soil-neutralizing solution used to increase agricultural productivity.

Source: www.nexaresources.com

BUSINESS CHALLENGES

Business Challenges

The main challenge that Nexa intends to overcome with this project is to provide intelligent solutions that allow the business areas to **grow, achieve maximum operating efficiency and reduce costs**.

Start our **Digital Transformation** and **Journey to Industry 4.0**, making **right decisions** based on **inteligent, fast and reliable information**
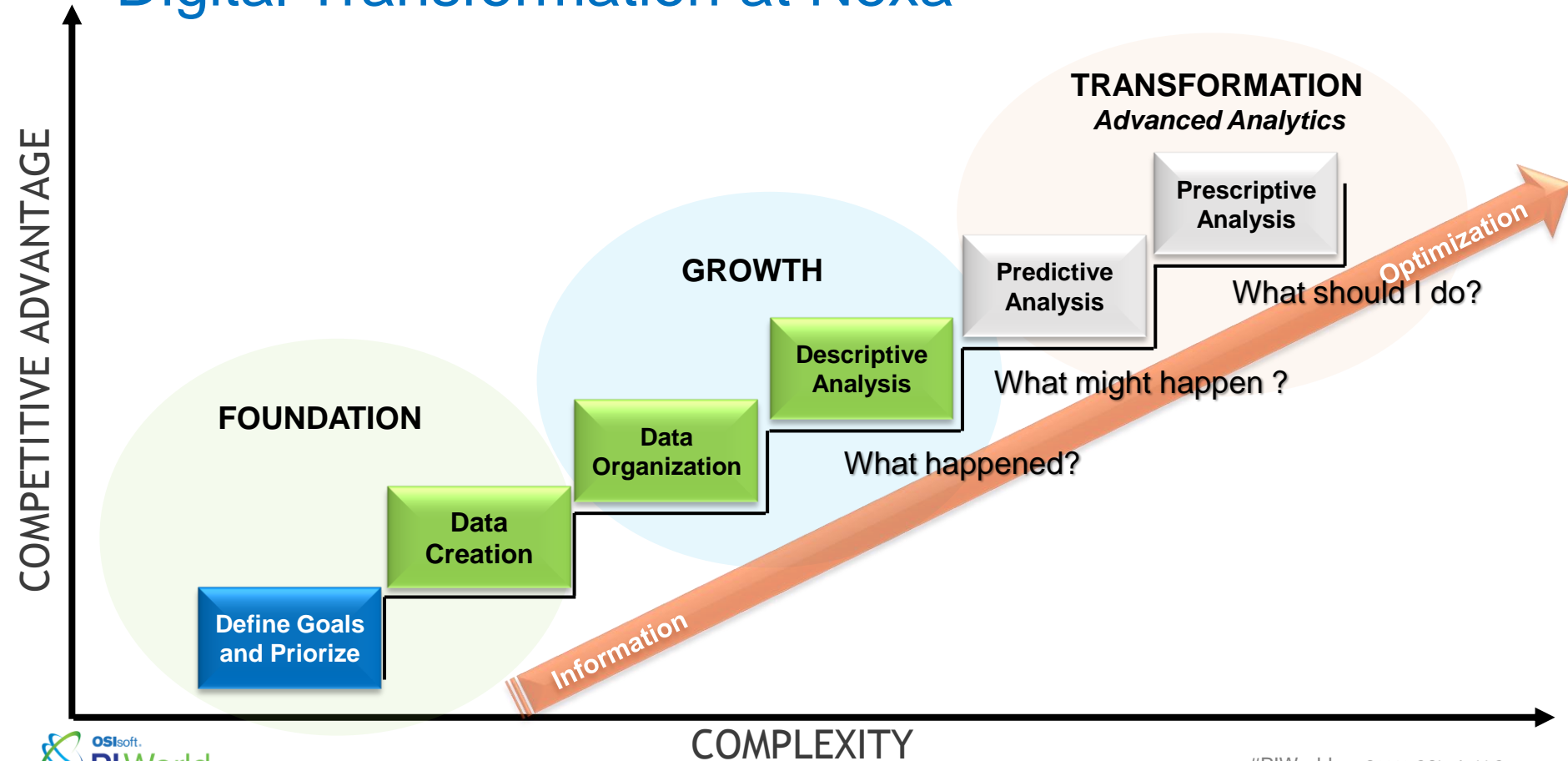
Data Architecture for Nexa´s Business
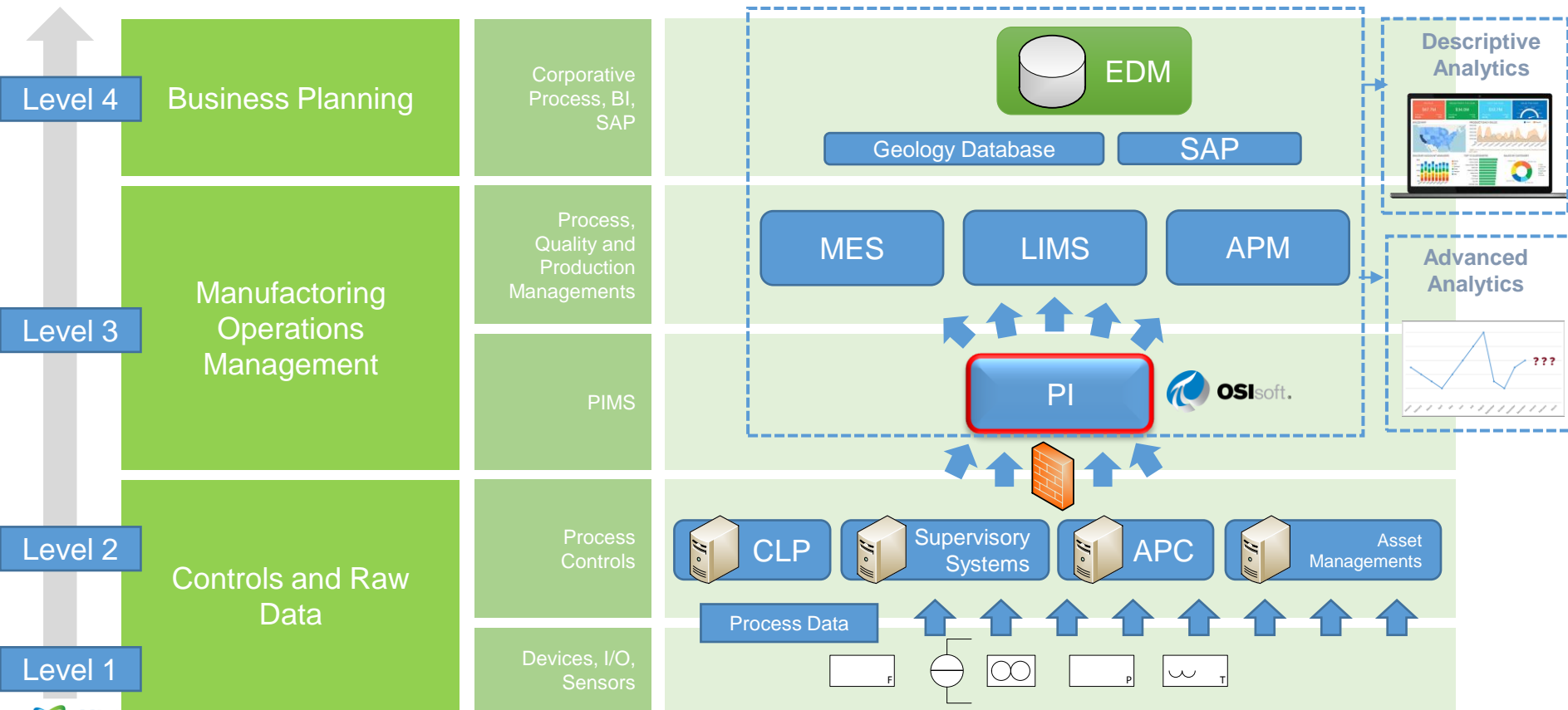
TECHNICAL CHALLENGES

Events Timeline for PI

Juiz de Fora

Três Marias

Vazante & Morro Agudo

Cajamarquilla

| 2002 | 2003 | 2004 TO 2017 | 2018 | 2019 | FUTURE |

TODAY

OSIsoft.
PI World SAN FRANCISCO 2019
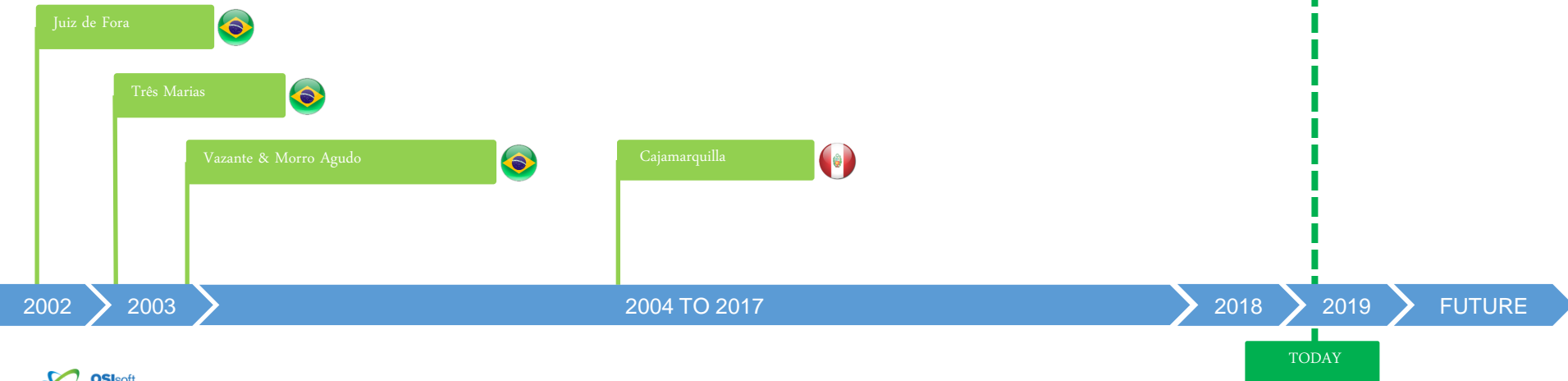
Technical Challenges

Nexa Resources had the **PI System installed on 5 out of their 6 major units**, but we were facing problems such as:

- **Low security and reliability of data infrastructure**
- **Dealing with different OsiSoft's contracts**
- **Outdated installations of PI System (2010 version)**
- **Inexistent asset management**
- **Lack of corporate standards and processes for PI**
- **Plenty of reports in excel and Processbook being shared across common network folders**
- **Few PI System specialists on the unities, and for most employees the PI System was a <u>black-box</u> which had the sole purpose of delivering data to their reports.**
- **Some unities in Peru did not have PI System (Cerro Lindo, El Porvenir and Atacocha)**

WORK CARRIED OUT

Work Carried Out: Corporate Contracts

175k Tags, PI Vision, Pi Integrator, PI Combopack ...

Juiz de Fora	Três Marias
Morro Agudo	Vazante
Cerro Lindo	Cajamarquilla
El Porvenir	Aripuanã **NEW**
	Atacocha **NEW**

Work Carried Out: Architecture Improvements
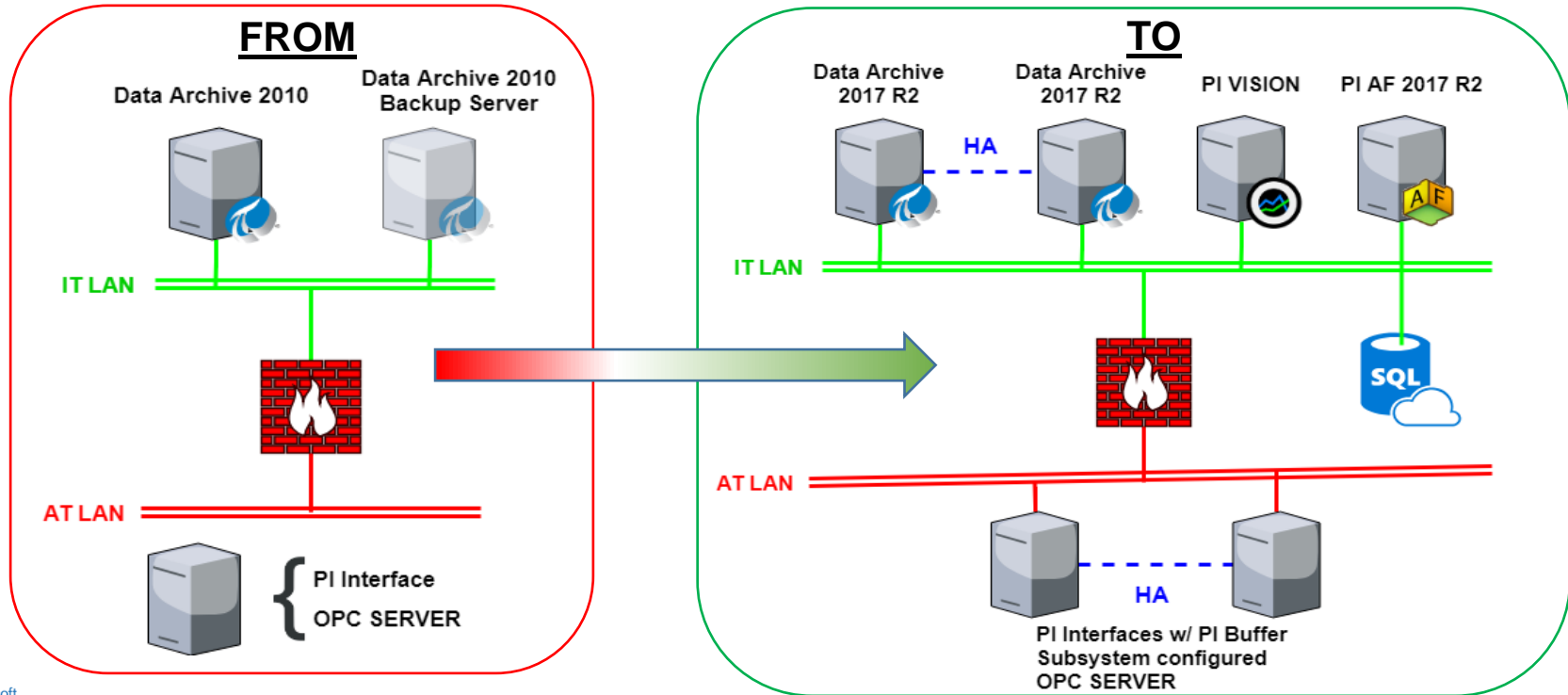
Work Carried Out : PI AF Configured For Process And Maintenance Views.

CORPORATE BASE-TEMPLATES

SITE-SPECIFICS DERIVED TEMPLATES

| T | Hydrometallurgy |

| T | Flotation | - - - - - | T | Flotation Pb/Ag |

| T | Filter | - - - - - | T | Rotation Filter |

| T | Conveyor | - - - - - | T | Screw Conveyor |

Elements
- Elements
  - Cerro Lindo
    - Mina
    - Planta
      - Chancado
        - Chancado Primario
          - Balanzas
            - BL0002
          - Detector de Metales
          - Eletroimas
          - Faja Transportadora
          - Stock
        - Chancado Secundario L1
        - Chancado Secundario L2
      - Espesamiento
      - Filtrado Concentrado
      - Filtrado Relaves - Disposicion de Relaves
      - Flotacion
      - Molienda
      - Reactivos
      - Relleno en Pasta
      - Suministro Agua Industrial
      - Suministro Agua Tratada
    - Servicios Tecnicos
    - Utilidades
  - Reports Cerro Lindo
- Element Searches

Asset Framework (AF) Structure in Nexa

AF - CERRO LINDO
89 Element Templates
815 Elements in AF tree
6.976 tags

AF – CAJAMARQUILLA
142 Element Templates
4.190 Elements in AF tree
9.824 tags

AF - VAZANTE
77 Element Templates
615 Elements in AF tree
1.477 tags

AF – TRÊS MARIAS
155 Element Templates
3.730 Elements in AF tree
5.781 tags

AF – MORRO AGUDO
39 Element Templates
245 Elements in AF tree
569 tags

AF – JUIZ DE FORA
98 Element Templates
1.898 Elements in AF tree
4.798 tags

Work Carried Out : Corporate Governance for PIMS

NEXA Business And Process Knowledge
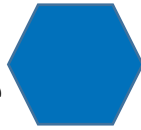
OSISOFT Best Practices and Recommendations

RADIX Methodology and Industry Knowledge

9 **ITIL PROCESS DEFINITIONS**

4 **PI MANAGEMENT PROCEDURES**

6 **SUPPORT CONTENT DOCUMENTS**

INCLUDING:

INCIDENT MANAGEMENT
CHANGE MANAGEMENT
HARDENING
DEVELOPMENT STANDARDS
SERVICES CATALOG
AND OTHERS...

Work Carried Out: Staff Training

Determined User Profiles   **Mapped Desired Skills**   **Custom Training**

PI USERS

PI POWER USERS

PI ADMINISTRATORS

PI DEVELOPERS

TRAINING COVERING PI USERS CONTENT

TRAINING COVERING PI POWER USERS CONTENT

TRAINING COVERING PI ADMINISTRATORS CONTENT

TRAINING COVERING PI DEVELOPERS CONTENT

PI SYSTEM AND THE INDUSTRY 4.0

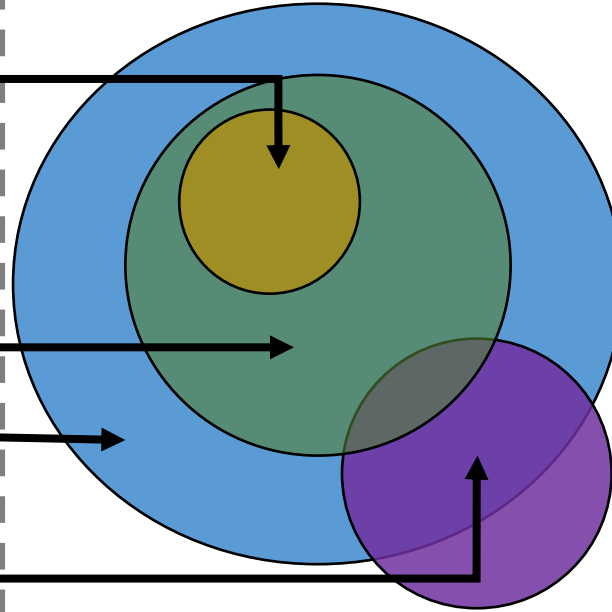# PI System And The Industry 4.0

Nexa Resources is attentive to market trends, including the technological and cultural transformations brought by the industry 4.0.
The PI System plays an important role in this transformation on NEXA:

- The structuring of data in **PI AF allows NEXA to easily feed analytics tools** with relevant structured information.

- **PI Analysis allows end-users to create calculated data that, upon creation, are already related to an element** and all its other information.

- **PI Notifications allows the machines and devices to "talk" to their users**, delivering important alarms in their phones.

- **PI Vision makes it possible to access plant information at anytime, anywhere from any device.**

RESULTS OBTAINED AND BUSINESS IMPACT

Results Obtained and Business Impact

The **corporate agreements** with OsiSoft and Radix provide **security and assurance** that NEXA's future needs and plans for PI will be met in the best way, with **standards, velocity and smaller cost**.

NEXA is operating with a much more **robust PI architecture** with high **reliability and security** in data collection and storage.

PI VISION* and **PI AF** have made data much more **accessible to users**, where information is structured in a way familiar to the users.
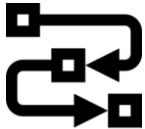
The procedures and processes are well defined in the PI Governance, ensuring **uniformity at the corporate level**.

*Cerro Lindo

Results Obtained and Business Impact

The PI System is no longer seen as a black-box by the end-users. Instead, the users are trained and motivated to create and share their own reports, using the PI System as a valuable work tool.

Furthermore, PI Consultants from Radix visited every Nexa plant, **seeking improvement opportunities in production, quality and security, to be achieved with improved usage of the PI System and its tools.** At first, they were able to identify:

70+ **IDENTIFIED OPORTUNITIES**

18M+ **ESTIMATED ANNUAL RETURN (USD) *Future**

Error de certificado https://pecrlwvpiap01nx.vm.votorantim.grupo/PIVision/#/Displays/152/Relleno-en-Pasta-N%C2%B01---Filtro-Banda

OSIsoft
PI Vision

New Display   VID_VMETAIS\jfleon

Relleno en Pasta N°1 - Filtro Banda (read-only)

Ad Hoc Display

nexa

Relleno en Pasta N°1 - Filtro Banda

Presion Aire Instrumentos
70.7 psi

A Trasvase Camion y Bomba de Pasta
0 psi

Nível Relave en Filtro
42.225 %

Filtro Delkor
M_82512   Corriente
0 A

Presion Agua de Lavado
0 psi

Out
14.0 L/min
Caja de Vacio

Espesador de
8 Metros

Flujo de Alimentacion M_82502
Valor Actual   Totalizado
4.7 m3/h   656,952.1 m3

De Planta de
Tratamiento de
Agua

XV_82504

De Planta de
Tratamiento de
Agua

Humedad Relave en Filtro
11.933 %

Soplador

Faja Transportadora Descarga F

M_82510

M_82511

De Bombas Sumideros

De Bombas de Filtrado

De TK Agua de Presa

Trampa
de Humedad

M_82512

FIT_82504
23.1 gal/min

XV_82501

Tanque de Agua de Sello

Tanque de Proceso
Nivel
68.615 %

M_82504
Bomba
de Vacio

Tanque
Alimentacion a
Pasta

M_82501

Nível
82.605 %

Densidad Linea M_82502
1,000 kg/m3

100
80
60
40
20
0

100
80
60
40
20
0

Tanque
de Filtrado

Tanque Barometrico

100
80
60
40
20
0

Tanque de Lavado d

100
80
60
40

M_82502

Tanque de
Agua de Procesos

Presion Agua de Proceso
0 psi

M_82566

09/04/2019 06:28:10 p.m.

◄   1h   ►

Now   09/04/2019 07:28:10 p.m.

19:28
9/04/2019

FUTURE DEVELOPMENTS ROADMAP

About Nexa Resources
Events Timeline

Cerro Lindo

Governance Model Design

PI AF Implementation

Infrastructure and Software Improvements

Global Contract w/ OSI

Juiz de Fora

Três Marias

Vazante & Morro Agudo

Cajamarquilla

Partnership w/ Radix

ROADMAP

El Porvenir

Aripuanã

| 2002 | 2003 | 2004 TO 2017 | 2018 | 2019 | FUTURE |

TODAY

OSIsoft.
PI World SAN FRANCISCO 2019
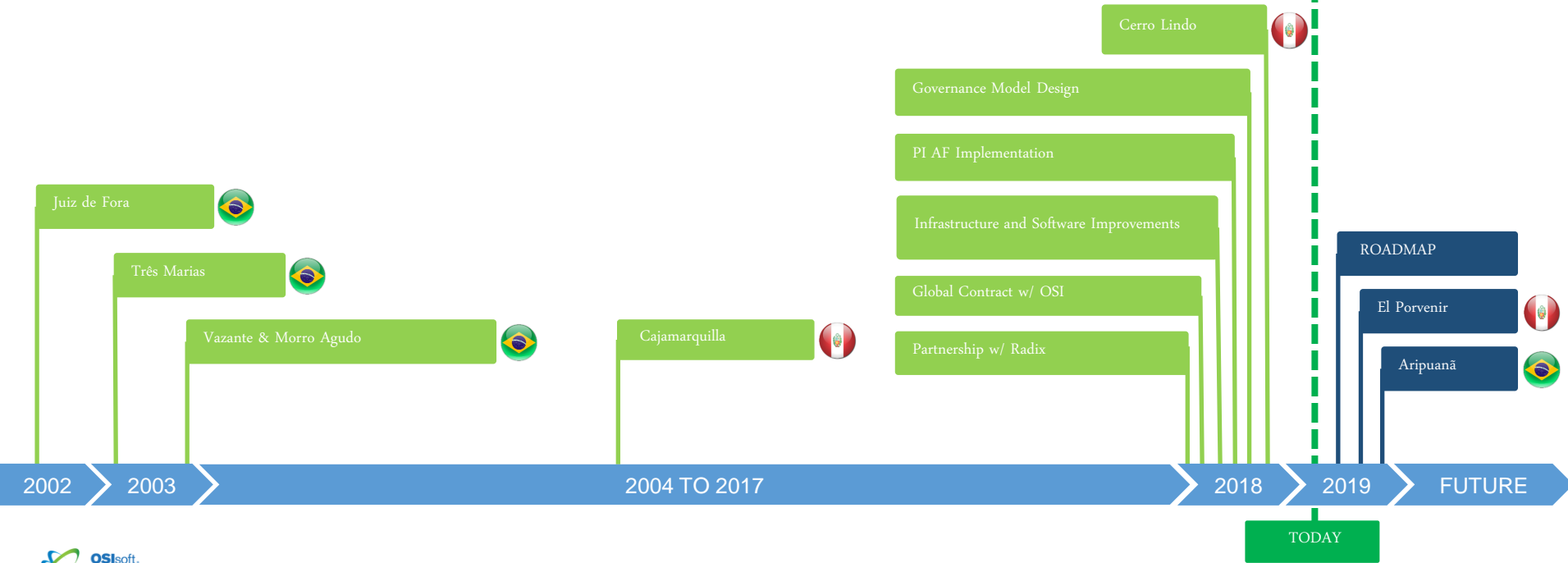
What´s Next ?

J F M A M J J A S O N D

QUICK WINS

REPORT CRITICAL OCCURENCES
(**PI NOTIFICATION**)

STANDARDIZE AND DEMOCRATIZE INFORMATION
(USING **PI VISION + MOBILITY**)

PI Processbook Reports Migration to PI Vision

IMPLEMENTATION OF **GOVERNANCE MODEL**

MID TERM

IMPROVE RESULTS AND PROVIDE MORE PROCESS AND ASSETS INFORMATIONS
(**NEW PI VISION SCREENS AND APLICATIONS**)

LONG TERM

DAILY WORK ROUTINE MANAGEMENT
(IMPLEMENT PROCESS MANAGEMENT SYSTEM WITH PI DATA)

NEW

PI SYSTEM ROLLOUT
(**EL PORVENIR AND ARIPUANA**)

ADVANCED ANALYTICS CASES IN JUIZ DE FORA AND TRES MARIAS

Questions?

Please wait for
the **microphone**

State your
name & company

Please remember

TO DOWNLOAD APP, SEARCH OSISOFT

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