# **AVEVAWORLD**

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# ISA Intercolombia

Improving Reliability in Electrical Signal Monitoring for ISA and its Companies using AVEVA PI System

Presented By: Maria Angélica Angarita





## Maria Angélica Angarita

#### **Operation Technology Analyst**

- ISA INTERCOLOMBIA
- mangarita@intercolombia.com

## Héctor Mejía

**Operation Technology Specialist** 

- ISA INTERCOLOMBIA
- <u>hfmejia@intercolombia.com</u>



# Agenda

• About ISA and its Companies

- Business Challenge Addressed
   Challenge, Solutions, and Benefits
- Implementation Details
- Conclusion



#### We transmit Electrical Energy throughout Latin America while taking care of what you see least





72.849 Including participation of ISA in other Companies

#### Capacity MVA

110.998

143.730 Including participation of ISA in other Companies

> Indicators 99.77% Availability 99.99%

> > Reliability

Circuit Km
8.151

In construction

Capacity MVA **18.021** 

Information as of 30 June 2024, ISA 2024 Integrated Report

4.700

People

# **Business Challenge Addressed**



CONNECTIONS THAT INSPIRE

**POWER AND UTILITIES | COLOMBIA** 

ISA optimizes its reliability indicator for electrical signals, increasing from 94.74% to 97.09%

#### Challenge

- **Measurement Errors and Communication Latency:** The accuracy of supervision is affected by measurement errors and delays in data transmission, which can compromise the safe and efficient operation of the system.
- Integration and Analysis of Large Volumes of Data: The challenge lies in the precise integration of data from multiple sources and real-time analysis of large volumes of information to optimize maintenance and improve decision-making.

#### Solution

• Deployed AVEVA<sup>™</sup> PI System<sup>™</sup> at ISA and its affiliates for storing and analyzing supervisory data. Using PI AF, a dynamic model was developed that integrates SCADA data to establish reliability indicators in supervision

#### Results

- 12069 of ISA's signals' are monitored by this implementation
- Improves the reliability of monitoring and optimizes the management and maintenance of assets, achieving a more efficient and safe operation of the power system
- Early notification of potential problems, facilitating a quick response from the maintenance team and reducing operational impact



### ISA 2030 Strategy – Four Pillars

#### **Strategy Mobilization Programs**

Asset management, renewal, and maintenance: robotics, advanced O&M.

System security and reliability

Intensified digitalization: implementation of digital solutions supported by big data and Analytics...



GREEN We work to proactively minimize the environmental impact and promote initiatives for its protection.

INNOVATION

Taking advantage of opportunities derived from technological evolution and trends.



CONNECTIONS

**THAT INSPIRE** 

900

COMMITMENTS TO OUR STAKEHOLDERS

All daily actions and decisions are determined by how ISA is

related internally and to the world.

DEVELOPMENT We build capacities to face business challenges and promote entrepreneurship ecosystem.



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IMPLEMENTATION TECHNICAL DETAILS

# Signal Supervision Reliability Model



## Planning Implementation



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### Interfaces and Connectors





**ERP - SAP:** SAP Enterprise resource planning.

AZURE: Microsoft Cloud platform

SCADA: Supervisory Control And Data Acquisition

PMU: Phasor Measurement Unit

SIGO: Operational Information System. Inhouse Software.

Maneuver sequence protocol: web application that allowe maneuver management. Inhouse Software.



## PI System Tags

Standardization and Approval



- Data structure approved for ISA and its companies
- Allows communication between SIGO SAP and PI System
- Facilitates data sharing







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The result of the reliability value calculation for each variable in each component will be stored in a PITAG.

# Model's Components

#### Context

#### 👯 Digital States - PI System Management Tools (Administrator)

<u>File View Tools H</u> elp		
Servers 👔 🗈 🐁 🗙	a   💽   🔄 📮 💷 🔒   🖻	1   🖗
Search P Monarch_S	StatesTable_217    State	State Name
Collective: PI-CO-ITCOTRAL Monarch_S	StatesTable_218	OK
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Monarch_S	StatesTable_224 4	# No Actualizado
Sustem Management Teals	StatesTable_225 5	# No Actualizado Q Cuestionable
System Management Tools Monarch_S	States Lable_226	# No Actualizado S Substituído
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Batch Monarch_S	StatesTable_229	
> Data Monarch_S	StatesTable_230	X No Hazonable
> Interfaces Monarch_S	StatesTable_231 9	X No Razonable Q Cuestionable
> IT Points IT Points	StatesTable_232 10	X No Razonable S Substituido
> Operation Monarch_S	States Table 233	X No Razonable S Substituido Q Cuestionable
Digital States	States Table 235 12	X No Bazonable # No Actualizado
Performance Equations	StatesTable_236	X No Recorded to Actualizado O Questionable
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Monarch_S	StatesTable_242 17	M Manual Q Cuestionable
Monarch_S	StatesTable_243 18	M Manual S Substituido
Monarch_S	States Table_244 19	M Manual S Substituido Q Cuestionable
Monarch_S	StatesTable_55 20	M Manual # No Actualizado
Monarch_S	StatesTable_564 21	M Manual # No Actualizado Q Cuestionable
Monarch_S	States Table_59 22	M Manual # No Actualizado S Substituido
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Phases	26	M Manual X No Razonable S Substituido
pialam33	27	M Manual X No Razonable S Substituido Q Cuestionable
Pielamcont PierfMon	28	M Manual X No Bazonable # No Actualizado
pisqcalam	20	M Manual X Ne Parenable # Ne Actualizade O Cuestionable
SYSTEM	20	M Manual X No Pazonable # No Actualizado & Cuestionable

#### Figure 1: Status codes for signal quality



The conversion of the 8-bit byte from binary to decimal corresponds to the status numbers in the table. Each active bit is added to the final state of the signal. Therefore, multiple states can occur within the same status code.



# Model's Components

#### Reliability of supervision



The status codes identified as recurrent were the following:.

State	State Name
0	ОК
1	Q Questionable
4	Not Updated
5	Not Updated Q Questionable
8	X Not Reasonable
12	X Not Reasonable # Not Updated
16	M Manual
17	M Manual Q Questionable
20	M Manual # Not Updated
64	E Error Estimation
65	E Error Estimation Q Questionable
68	E Error Estimation # Not Updated
69	E Error Estimacion # Not Updated Q Questionable
80	E Error Estimation M Manual
81	E Error Estimation M Manual Q Questionable
84	E Error Estimation M Manual Not Updated
132	F Frozen # Not Updated
	No Data

ConfrabilidadBahiaTrafo\_DT V1.6
General Attribute Templates Ports Analysis Templates Notification Rule Templates

fisa	Conf dia P	$\sim$
f69	Conf_dia_I3	
fø	Conf_dia_12	
160	Conf_dia_I1	

Example Element: TECO-ITCO\TECO-ITCO-SUB\TECO-ITCO-SUB-CEN\BACA\BACA500\BACA500A22BT\Confiab

Name	Expression	Output Attribute
ti	Bod('y')	<u>Map</u>
tf	Bod('*')	<u>Map</u>
Ttotal	tf-ti	<u>Map</u>
Tcues1	TimeEq('\ Corriente-I1 Q',ti,tf,1)	<u>Map</u>
Tcues2	<pre>TimeEq(' Corriente-I1 Q',ti,tf,17)</pre>	<u>Map</u>
Tcues3	TimeEq('\ Corriente-I1 Q',ti,tf,81)	<u>Map</u>
Tcues4	TimeEq('\ Corriente-I1 Q',ti,tf,5)	Map
Tcues5	TimeEq('\ Corriente-I1 Q',ti,tf,65)	Map
Tnoact1	TimeEq('\ Corriente-I1 Q',ti,tf,4)	<u>Map</u>
Tnoact2	TimeEq('\ Corriente-I1 Q',ti,tf,132)	Map
Tnoact3	TimeEq('\ Corriente-I1 Q',ti,tf,68)	Map
Tnoact4	TimeEq('\ Corriente-I1 Q',ti,tf,20)	Map
Tnoraz1	TimeEq('\ Corriente-I1 Q',ti,tf,8)	<u>Map</u>
Tnoraz2	<pre>TimeEq('\ Corriente-I1 Q',ti,tf,12)</pre>	<u>Map</u>
TManu1	<pre>TimeEq('\ Corriente-I1 Q',ti,tf,16)</pre>	<u>Map</u>
TManu2	TimeEq('\ Corriente-I1 Q',ti,tf,17)	Map
Tnodata	TimeEq('\ Corriente-I1 Q',ti,tf,"No Dat	TNoDat dia I1
Terrest1	TimeEq('\ Corriente-I1 Q',ti,tf,64)	Map
Terrest2	TimeEq('\ Corriente-I1 Q',ti,tf,80)	Map
Terrest3	TimeEq('\ Corriente-I1 Q',ti,tf,84)	Map
Terrest4	TimeEq('\ Corriente-I1 Q',ti,tf,69)	Map
Tmalacalidad	Tcues1+Tcues2+Tcues3+Tcues4+Tcues5+Tnoact	Tmalacalidad dia 11

Scheduling: O Event-Triggered O Periodic								
	Run every day at 12:00 a.m. Configure							
	T\ITCO3943							

### Indicator Notifications



### PI Vision Dashboard – Data Reliability Indicator

۲	Confiabilidad de datos - ISA INTERCOLOMBIA																	
Regional	Regional % Confiabilidad Confiabilidad Total: 94,9 %																	
CEN	94,2 %	BACA034 100,0 %	BACA230 93,0 %	BACA500 98,0 %	BETA034 100,0 %	BETA115 95,1 %	BETA230 96,8 %	CHIV115 99,6 %	CHIV230 95,8 %	IBAG230 97,6 %	LMES230 83,2 %	LREF115 97,6 %	LREF230 83,3 %	MIEL230 98,5 %	PURN230 99,0 %	SANA230 99,9 %	SFEL23 95,7 %	0 SOCH230 99,5 %
CON	95,0 %	BOLI220 93,5 %	BOLI500 96,8 %	CCOL220 94,7 %	COPE220 99,6 %	COPE500 96,3 %	CUES230 100,0 %	EBOS220 96,3 %	ERIO220 99,7 %	SABA034 100,0 %	SABA220 99,1 %			TCOL220 97,7 %			TIUM034 100,0 %	VALL220 94,2 %
NOR	95,8 %	ANCO230 93,2 %	ANTI500 98,2 %	ASUR230 92,9 %	CERR034 95,4 %	CERR110 98,7 %	CERR230 96,6 %	CERR500 96,3 %	CHIN110 100,0 %	CHIN230 99,4 %	CHIN500 91,1 %	GECE110 100,0 %	GTPE230 95,7 %	HEL1230 96,0 %	HEL1500 99,6 %	JAGU230 97,2 %	MRIA23 99,8 %	0 PLAY230 85,8 %
ORI	96,8 %	BANA115 99,9 %	BANA230 99,9 %	CARI004 99,9 %	CARI034 99,9 %	CLIM034 99,9 %	CLIM230 100,0 %	0 COMU2 97,3 %	30 GUAT2 95,8 %	30 LCIR03 99,9 %	34 LCIR2 99,9 %	30 LLOM 90,2 %	500 LPAL2 99,0 %	30 LSIE ; 99,0	230 OCAJ % 100,0	V013 OCA % 95,0	N230 OC % 96,	AN500 PRIM 7 % 95,5
SUR	92,7 %	ALFE230 91,2 %	CART2 77,4 %	30 ES 89,	ME230 5 %	JAMO115 99,8 %	JAMO2: 99,2 %	30 LEN 98,3	E230	LHER230 98,1 %	LMR034 92,7 %	LVIR 99,8	15 L\ % 8!	/IR230 5,9 %	LVIR500 87,1 %	PAEZ: 97,5 %	230 P	ANA034 00,0 %
Regional	% No Dat	a			No	o Dat	a To	tal:0	,13 %	, 0								
CEN	0,00 %	BACA034 0,00 %	BACA230 0,00 %	BACA500 0,00 %	BETA034 0,00 %	BETA115 0,00 %	BETA230 0,00 %	CHIV115 0,00 %	CHIV230 0,00 %	IBAG230 0,00 %	LMES230 0,00 %	LREF115 0,00 %	LREF230 0,00 %	MIEL230 0,00 %	PURN230 0,00 %	SANA230 0,00 %	SFEL23 0,00 %	0 SOCH230 0,00 %
CON	0,00 %	BOLI220 0,00 %	BOLI500 0,00 %	CCOL220 0,00 %	COPE220 0,00 %	COPE500 0,00 %	CUES230 0,00 %	EBOS220 0,00 %	ERIO220 0,00 %	SABA034 0,00 %	SABA220 0,00 %	SABA500 0,00 %	TCAR220 0,00 %	TCOL220 0,00 %	TEBS220 0,00 %	TFLO220 0,00 %	TIUM034 0,00 %	VALL220 0,00 %
NOR	0,00 %	ANCO230 0,00 %	ANTI500 0,00 %	ASUR230 0,00 %	CERR034 0,00 %	CERR110 0,00 %	CERR230 0,00 %	CERR500 0,00 %	CHIN110 0,00 %	CHIN230 0,00 %	CHIN500 0,00 %	GECE110 0,00 %	GTPE230 0,00 %	HELI230 0,00 %	HEL1500 0,00 %	JAGU230 0,00 %	MRIA23 0,00 %	0 PLAY230 0,00 %
ORI	0,48 %	BANA115 0,00 %	BANA230 0,00 %	CARI004 0,00 %	CARI034 0,00 %	CLIM034 0,00 %	CLIM230 0,00 %	0 COMU2 0,00 %	30 GUAT2 7,51 %	30 LCIR03 0,00 %	34 LCIR2 0,00 %	30 LLOM 0,00 %	500 LPAL2 0,00 %	30 LSIE 6 0,00	230 OCAJ % 0,00	N013 OCA % 0,00	N230 OC % 0,0	CAN500 PRIM 0 % 0,00 %
SUR	0,15 %	ALFE230 0,00 %	CART2 0,00 %	30 ESI 0,0	ME230 0 %	JAMO115 0,00 %	JAMO2: 0,00 %	30 LEN 0,00	E230   % (	LHER230 0,00 %	LVIR034 0,00 %	LVIR 0,00	15 L\ 6 0,	/IR230 00 %	LVIR500 0,00 %	PAEZ2 0,00 %	230 P 5 0	ANA034 ,00 %

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## PI Vision Dashboard – Data Reliability Detail (Substation)





### Conclusion

- 12069 of ISA's signals are monitored by this implementation
- Improves the reliability of monitoring and optimizes the management and maintenance of assets, achieving a more efficient and safe operation of the power system
- Early notification of potential problems, facilitating a quick response from the maintenance team and reducing
  operational impact
- The model provides results on the reliability of supervision, covering not only each substation but also each zone or region, as well as an overall value for each company in the group. This makes it easy to identify the elements or substations where the quality of supervision is inadequate, thus optimizing the implementation of corrective actions and contributing to operational safety.
- The goal of developing the following steps is to enhance the analytical model, enabling a comprehensive evaluation of the reliability in the supervision of all electrical signals from ISA and its companies.

# **Questions?**

Please wait for the microphone. State your name and company.



## Please remember to...

Navigate to this session in the mobile app to complete the survey.



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# Thank you!



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