enso
ORIGINS

BUILDING SIMPLICITY

re.tone / Mendix @ SIEMENS

September 19th, 2023

ENSO and Software Development

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ENSO

| We started **10 years** ago with a **group** of **people** that are at their DNA, **tech enthusiasts**

| We aim to **provide simple technology** with a **high** level of **quality** and **without** tech **boundaries**

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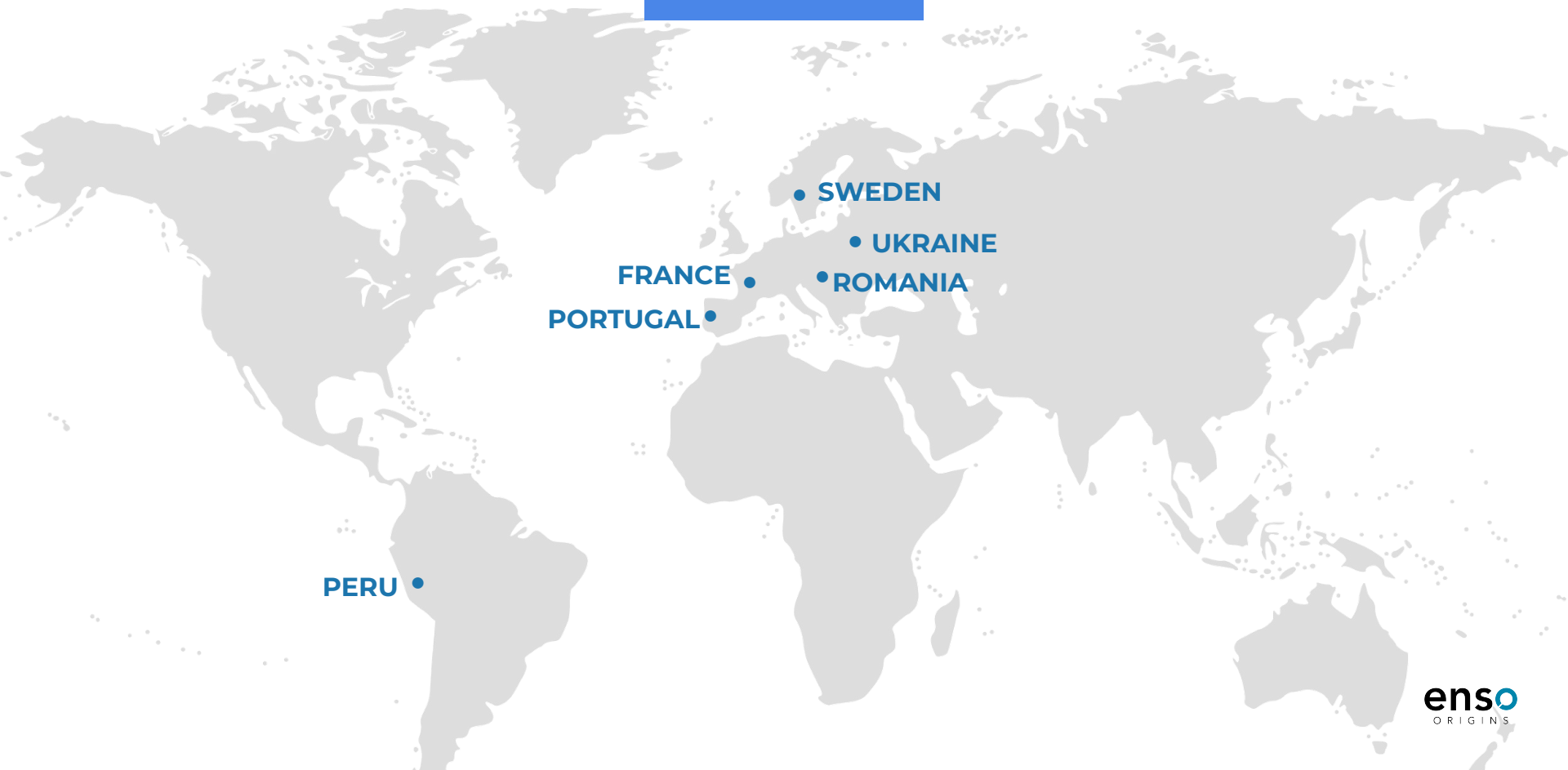
NOT JUST IN OUR INTERNAL MARKET



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THAT LED TO THE CREATION OF 3 CORE STRUCTURES

NETWORK

SOFTWARE

CLEARCODE

NETWORK

| Created with the **main focus** of **designing infrastructures** both for ENSO and for our CUSTOMERS

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NETWORK

Providing services to support our **technology** both **on PREM** and on public **CLOUD providers**

GOOGLE CLOUD
AMAZON
AZURE

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SOFTWARE

| To provide **custom** built **technology** for each project a traditional software **development team** was created

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T E A M

- Counting with **13 developers**

- Most of them **started** their career at **ENSO** and grew to a seniority level with us

- Keeping close with Universities is an advantage like **Universidade de Coimbra** and **ISEC**

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S T A C K

- **JAVA** for mission critical applications
- **REACT JS** for web
- **REACT NATIVE** both Android and Apple IOS
- **NODE JS** for API and backend
- **PostgreSQL** for data storage
- **SQL/NoSQL** several other engines / project needs

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CLEARCODE

And a subset of the software team found a place in the **Low code** environment.

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LOW CODE

Low code **environments** like **Mendix** were a natural and unavoidable evolution that allowed:

| Access to **new markets**
| **Faster delivery** of solutions
| **Easier maintenance** and evolution

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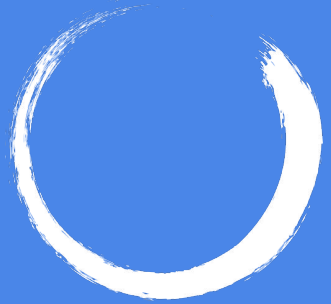
WITH A MAIN DRIVEN VISION



WE BELIEVE IN **SIMPLICITY**

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PRODUCTS

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All of the delloped work led to the arrival of **successful** projects and some **products** that we are going to address on this presentation

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flow

A product used currently by **Civil Protection Services** and **Water Management Entities**

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| Improve **occurrence** control

| Provide permanent **environmental monitoring**.

| Obtain **alarm signals** in alarm or alert situations

Informed and **well-founded decision-making** to enhance the effectiveness of emergency response and prevention measures.

flow enso ORIGINS

360°
PLATFORM

Follow your team wherever they are, from the office to the field

Download on the App Store

ANDROID APP ON Google play

flow

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INCIDENTS AND RESOURCES

SENSING

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INCIDENT AGGREGATOR

| Centralized incident management.

| In different GIS layers.

| Filters for tracking incidents.

| Exporting information for sending and/or archiving.

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INCIDENT MANAGEMENT

 # Geo
Reference (GIS)

 # Developments
Photos | Text

 # Categorization
According national categories

 # Alerts
Several alert levels

 # Workflow
Manage each occurrence state

 # Resources
Manage resources

 # Human resources
Human resources management

 # Buildings
Information to support emergency teams

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BUILD DASHBOARDS

| Respond to environmental conditions.

| Collect information 24 hours a day, every day.

| Configure alarms.

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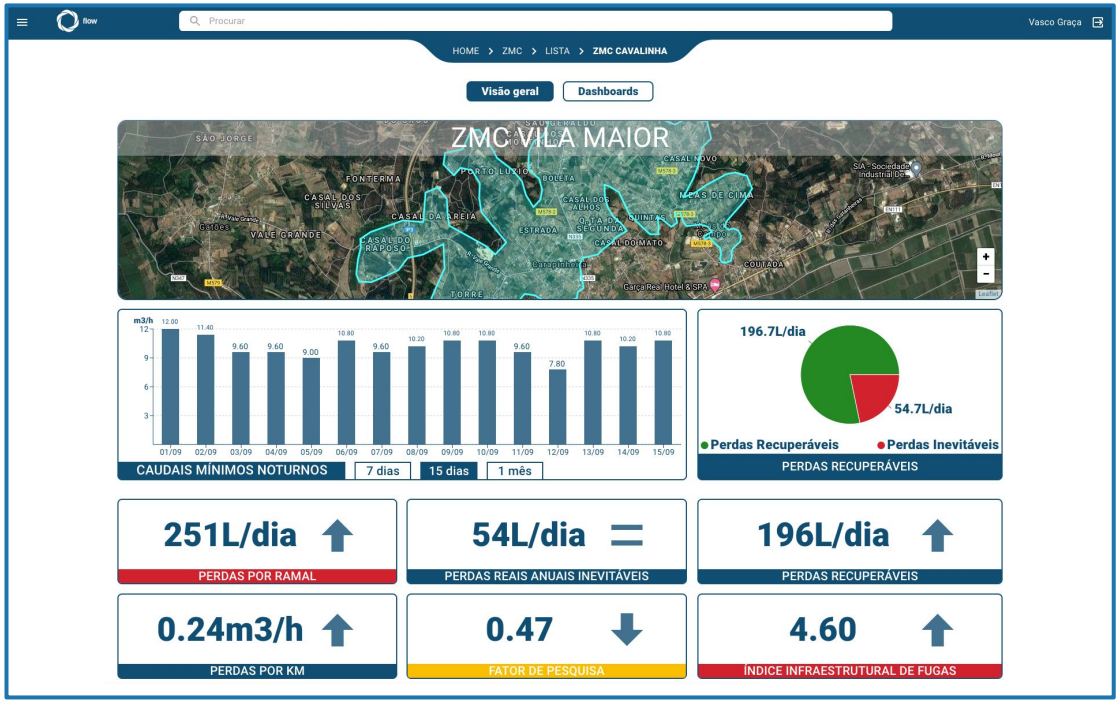

KPI

| Monitor and detect **anomalous situations**

| Various **indicators** calculated 24/7

| Track the **evolution** of your distribution network

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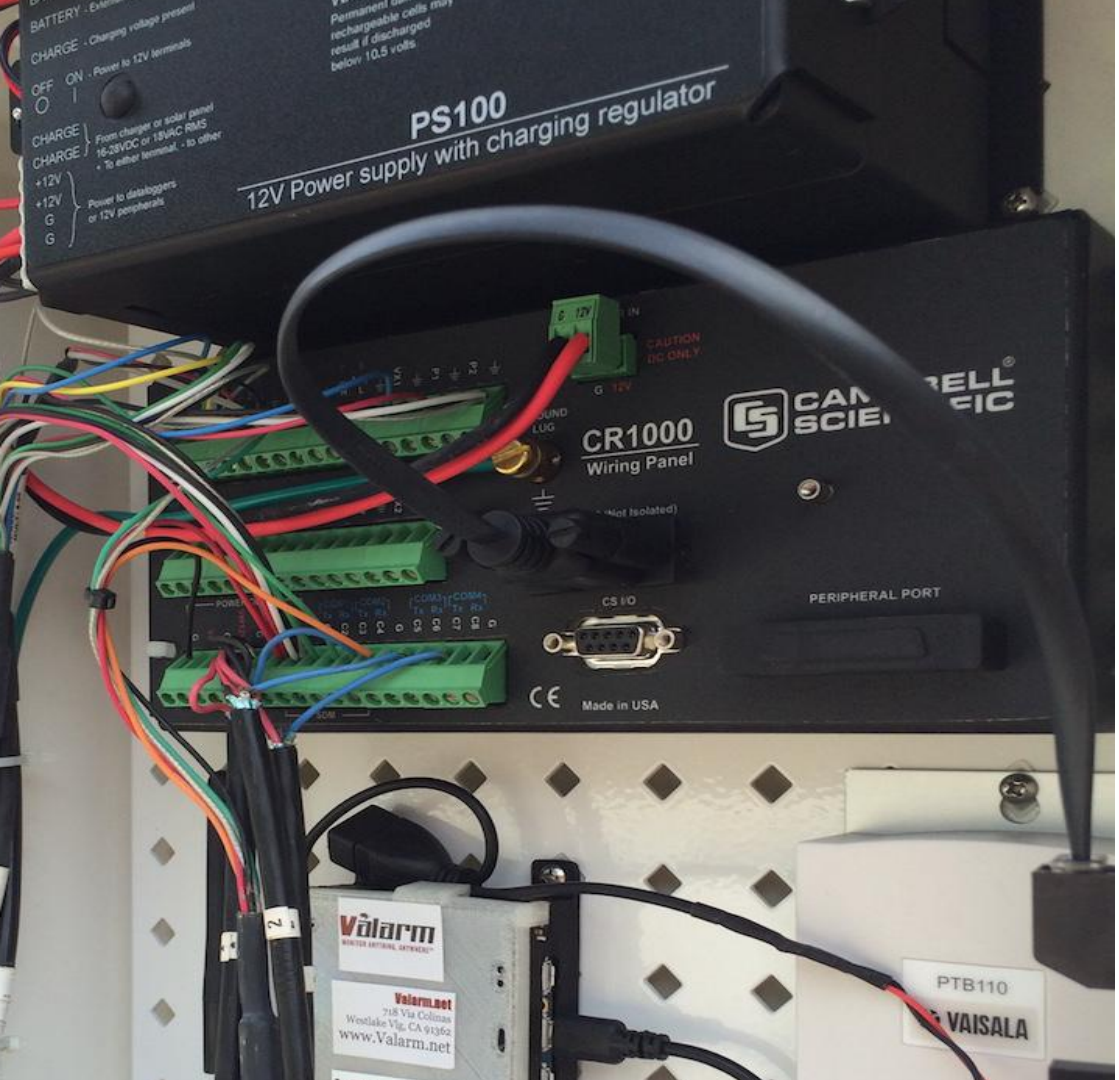

INTEGRATE WITH DATA LOGGERS

| Integration with existing data loggers.

| TCP SOCKET / FTP / API

NEW DATALOGGERS

| Supply
| Installation
| Configuration

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24/7 DATA

| Wind Direction and Speed
| Temperature
| Relative Humidity
| Water Reservoir Levels
| Flow Rates
| Precipitation
| Among others

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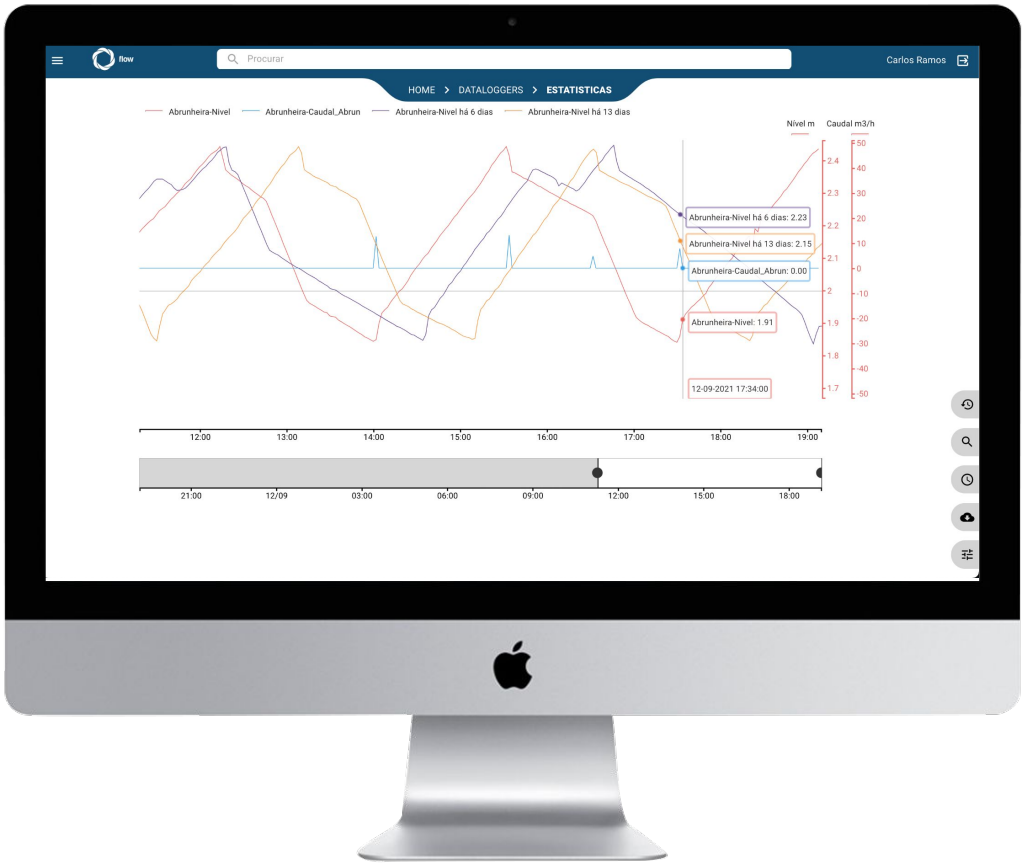

STATISTICS

| **Variable** intersection

| Configuration of variables and **time intervals** for result filtering

| Effective **control** and **audit** of weather conditions' evolution

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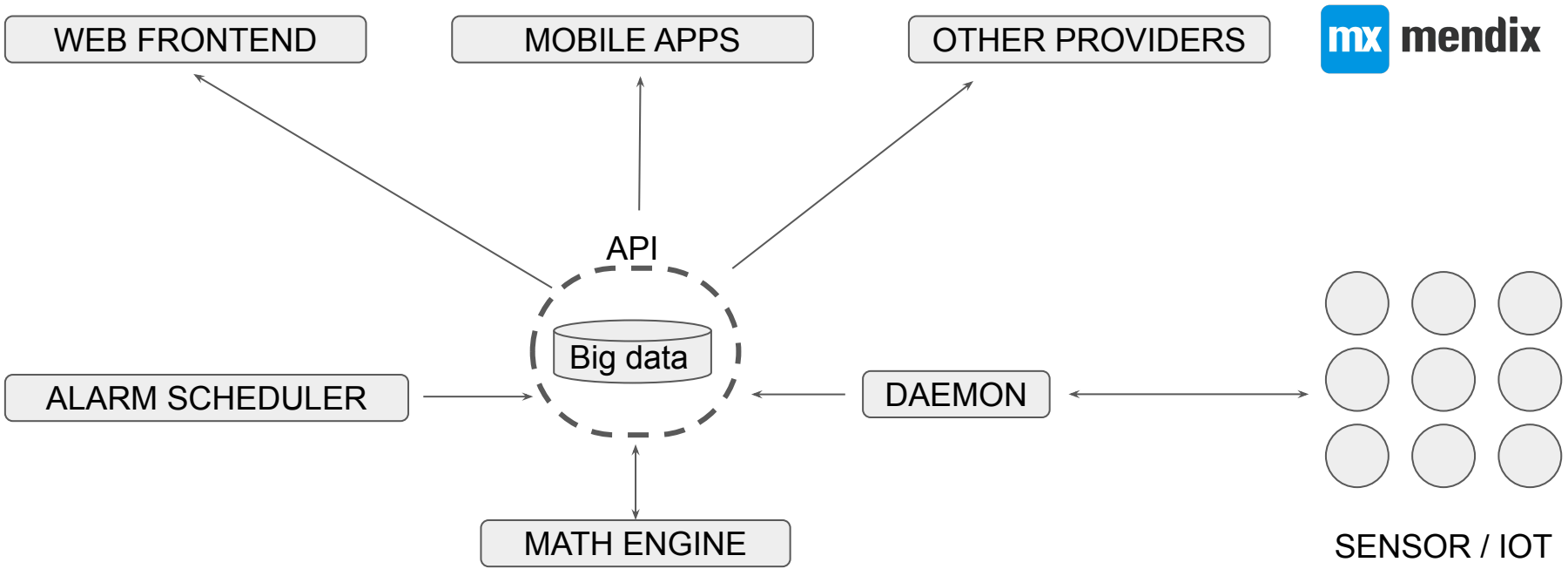
ARCHITECTURE



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| All the data gathered provides a great database for applying AI / ML methodologies and improve our product

Add **AI capabilities** to existing **products**

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Targeting AI to our customers

| **Selling AI** just for AI **is complicated**

| We **identify** the **value** in **current solutions** and build new value using AI

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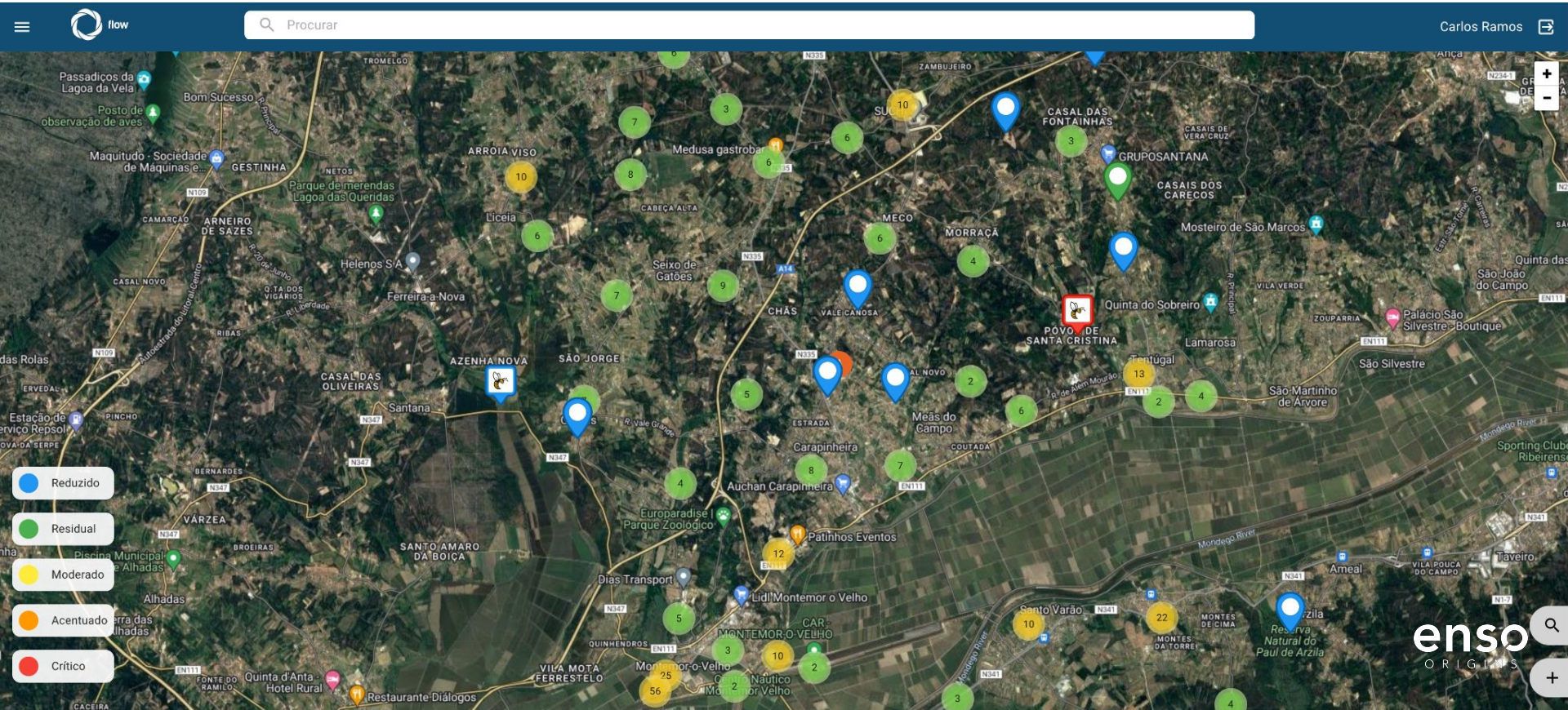
CIVIL PROTECTION INCIDENTS



CIVIL PROTECTION INCIDENTS

TOP 3 DE TIPOLOGIAS

QT.	CÓD.	DESCRIÇÃO	EVOLUÇÃO
163	710	Vespa Velutina	↑
100	3109	Gestão de Combustível	↑
71	4305	Limpeza de Via e Sinaliz...	=

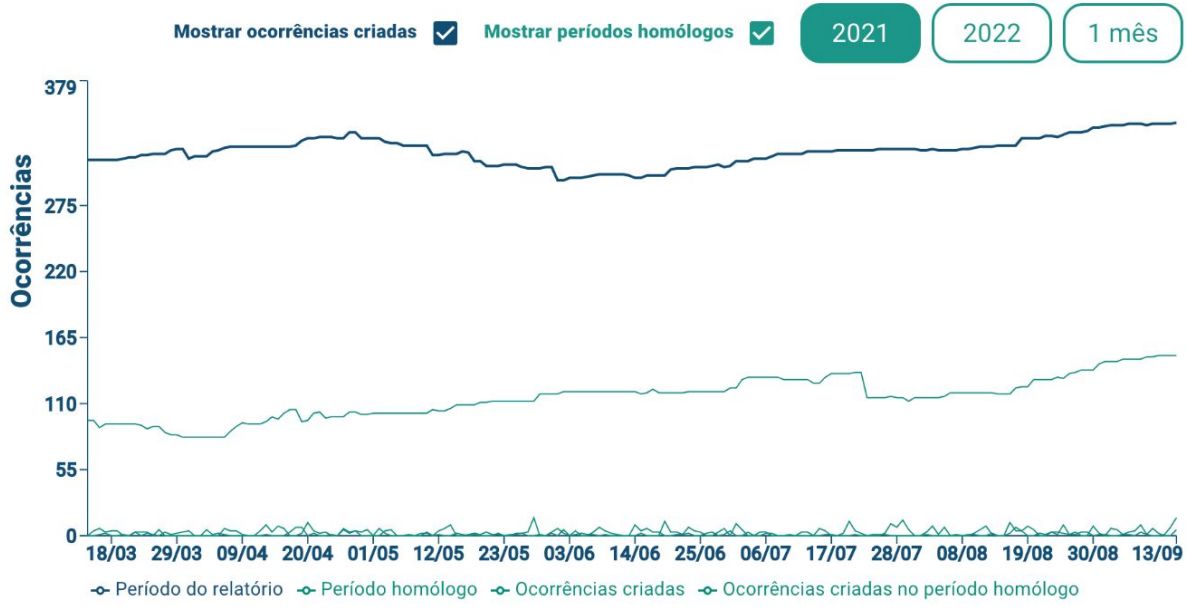
TOTAL OCORRÊNCIAS EXISTENTES

543

225

TOTAL OCORRÊNCIAS CRIADAS

OCORRÊNCIAS EXISTENTES



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OBJECTIVE

| predict probability of occurrences based on **historic** records, cross referencing it with **environment data**

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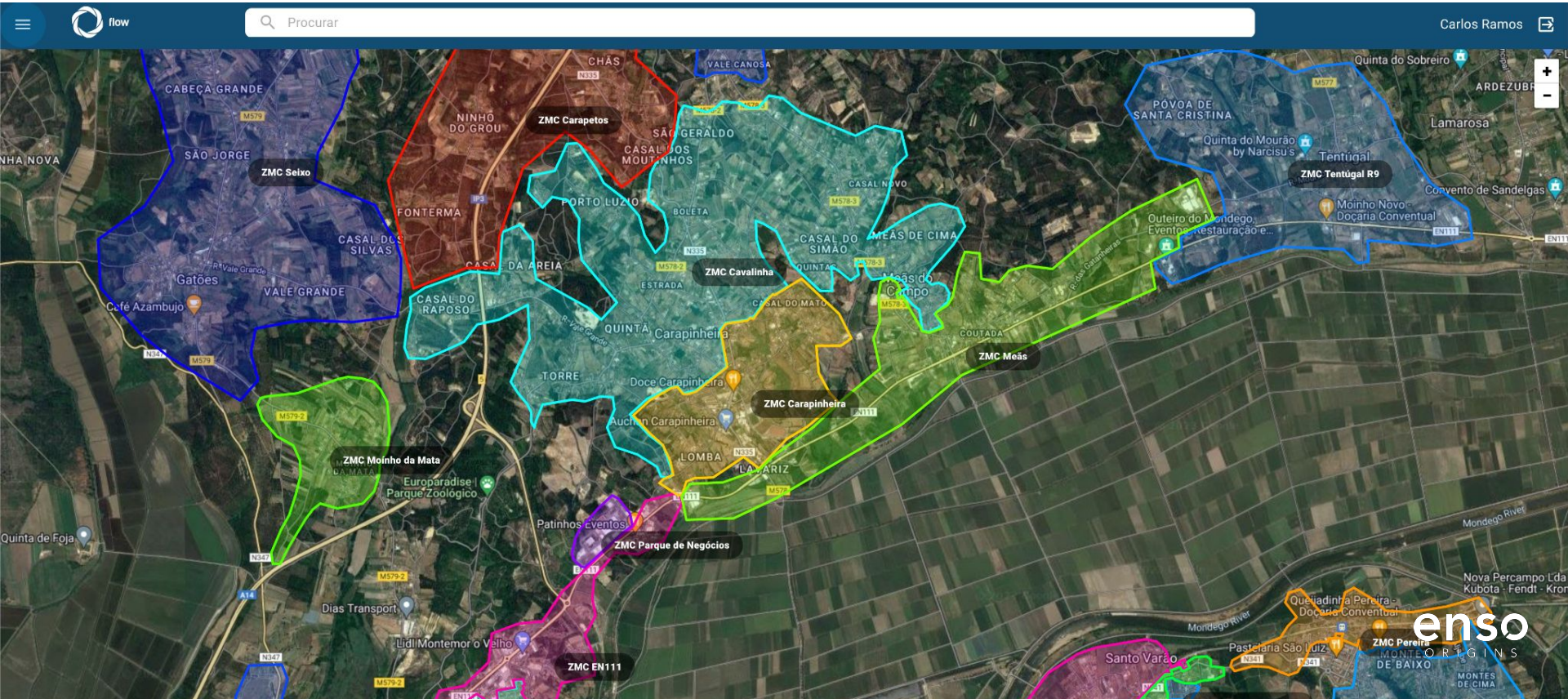
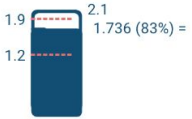
WATER MANAGEMENT



WATER TANKS

PINHAL DAS AREIAS

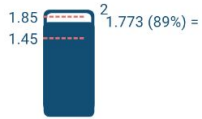
Nivel



Reportado: 17/09/23 22:24

ARAZEDE R17

Nivel



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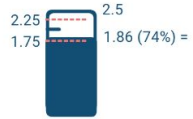
GORDOS R40

Nivel



Reportado: 17/09/23 22:18

PLIA

Nivel

Reportado: 17/09/23 22:24

MECO R1

Nivel R1

Reportado: 17/09/23 22:20

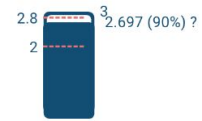
MECO RA

Nivel

Reportado: 17/09/23 20:00

MECO R2

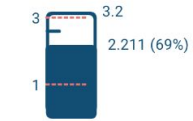
Nivel



Reportado: 17/09/23 20:00

GATÕES

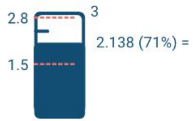
Nivel



Reportado: 17/09/23 20:00

SARGAÇO

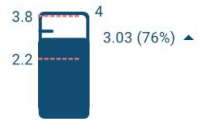
Nivel reservatorio



Reportado: 17/09/23 22:20

CAVALINHA

Nivel



Reportado: 17/09/23 22:24

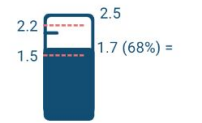
S. GENS

Nivel

Reportado: 17/09/23 22:28

TENTÚGAL R7

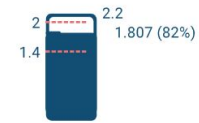
Nivel



Reportado: 17/09/23 22:24

TENTÚGAL R8

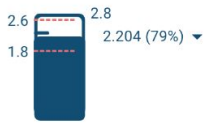
Nivel Reservatorio



Reportado: 17/09/23 21:50

TENTÚGAL R9

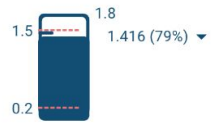
Nivel R9



Reportado: 17/09/23 22:18

TENTÚGAL R9 - LABIRINTO

Nivel Labirinto R9



Reportado: 17/09/23 22:18

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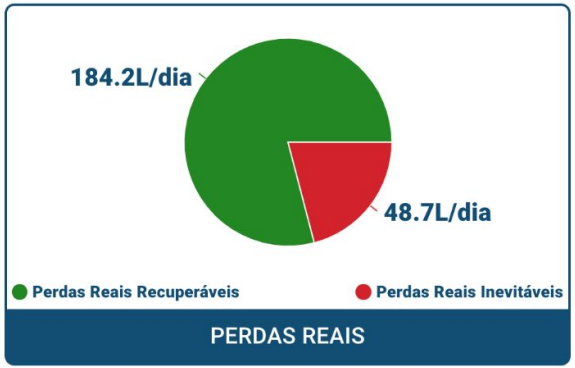
MANAGEMENT INDICATORS



232L/dia ↓
PERDAS POR RAMAL

48L/dia =
PERDAS REAIS INEVITÁVEIS

184L/dia ↓
PERDAS REAIS RECUPERÁVEIS

0.26m3/h ↓
PERDAS POR KM

0.52 ↑
FATOR DE PESQUISA

4.78 ↓
ÍNDICE INFRAESTRUTURAL DE FUGAS

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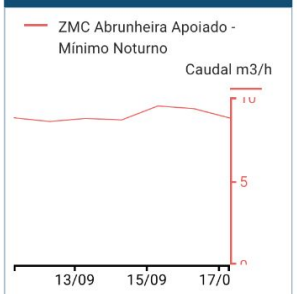
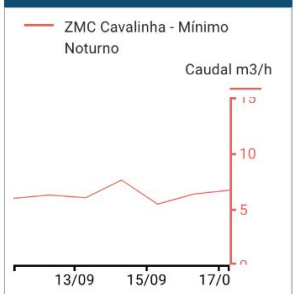
FLOW MEASURING

ZMC ABRUNHEIRA APOIADO



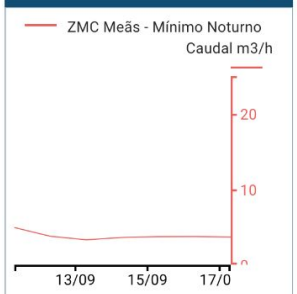
Reportado: 17/09/23 08:00

ZMC CAVALINHA



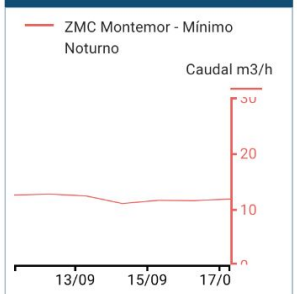
Reportado: 17/09/23 08:00

ZMC MEÃS



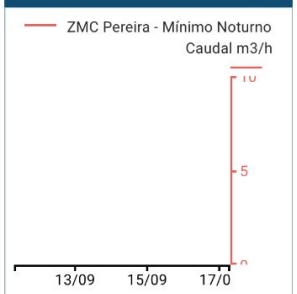
Reportado: 17/09/23 08:00

ZMC MONTEMOR



Reportado: 17/09/23 08:00

ZMC PEREIRA



Reportado: 17/09/23 08:00

ZMC SANTO VARÃO

Reportado: 17/09/23 08:00

ZMC SANTO VARÃO E FORMOS ELHA

Reportado: 17/09/23 08:00

ZMC SÃO TIAGO

Reportado: 17/09/23 08:00

ZMC TENTÚGAL R8

Reportado: 17/09/23 08:00

ZMC TENTÚGAL R9

Reportado: 17/09/23 08:00

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OBJECTIVE WATER LOSS

Using data from the monitoring of the water distribution infrastructure we **cross reference incidents versus** the evolution of several significant variables like

- Minimum **night** water **loss**
- Average **pressure**
- Evolution of **water flow**

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OBJECTIVE FOR WATER LOSS

Present during the next 12 months a **differentiated solution** that, through A.I. delivers a service that can:

| Anticipate scenarios that represent failure prone infrastructures nodes

| Effectively **provides recommendations** and maintenance plans for operation teams

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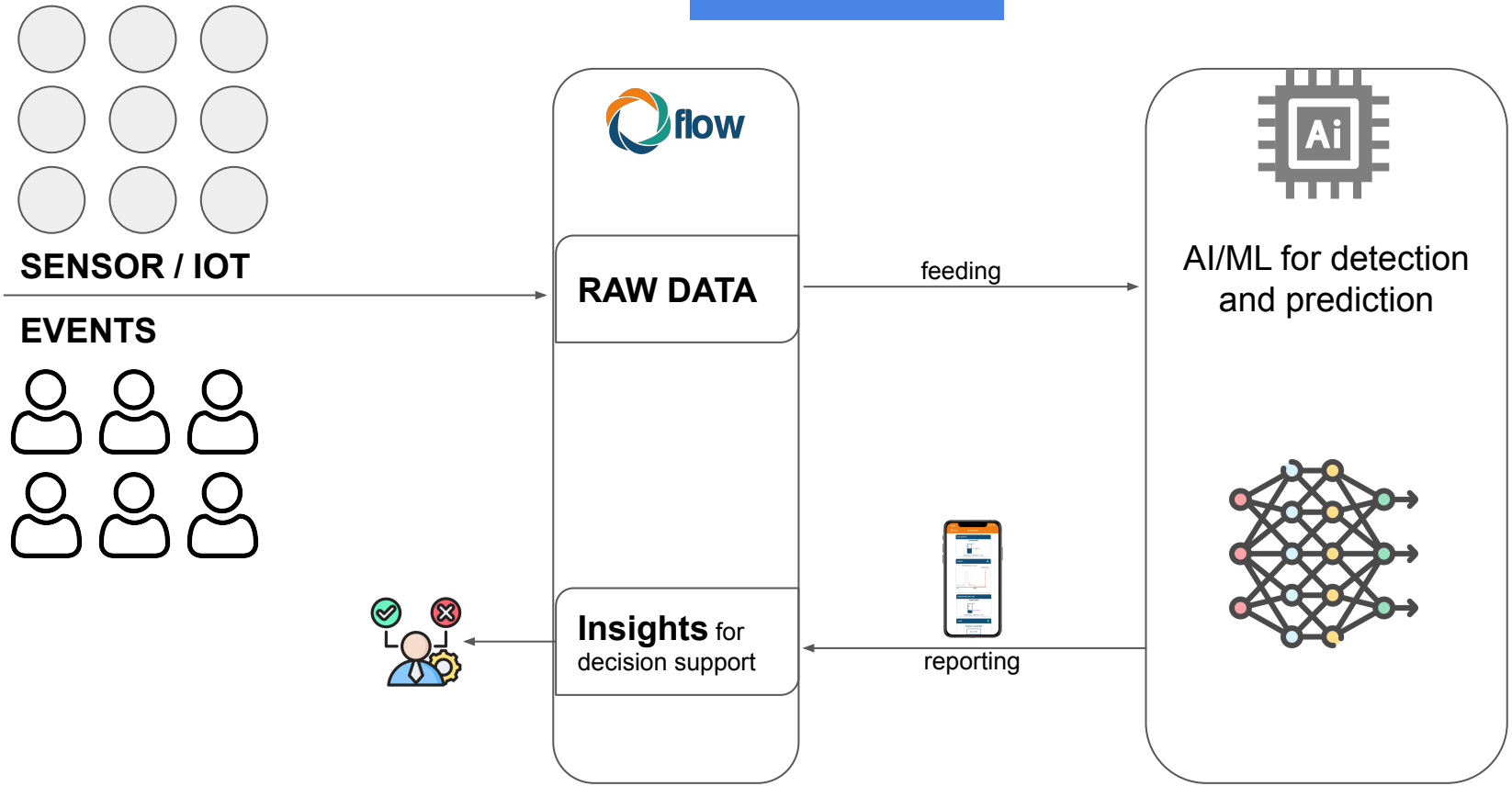
METHODOLOGY



EVENTS TYPOLOGY RISK

...MOS ANORMAIS 2023

	Variação	Dias em alerta ↓
...e Vila Maior	188%	12
...e Montemor-oVelho	171%	7
...e Barca	117%	3
...e Abrunheira	105%	3

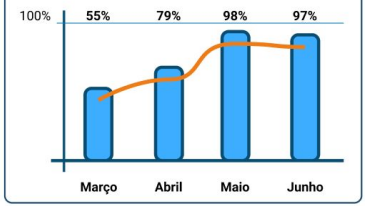
CLIENTES COM CONSUMOS ANORMAIS 2023 > IA 2024

Contrato	Contador	ZMC	Variação	Dias em alerta ↓
C44219940	JJFK485YH	ZMC de Vila Maior	188%	12
C83362154	NNVI44HD9	ZMC de Montemor-oVelho	171%	7
C09884657	HD67763FK	ZMC de Barca	117%	3
C005339509	144KJHF37	ZMC de Abrunheira	105%	3

CONTADORES SEM COMUNICAÇÃO

ZMC	Contadores sem comunicação
ZMC de Vila Maior	45%
123123123	37%
123123123	37%
123123123	21%

Leituras recebidas



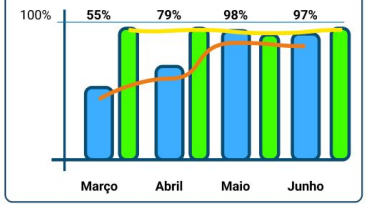
CONSUMOS ANORMAIS POR ZMC >

ZMC ↓	Alertas		
ZMC de Vila Maior	19 ↘	31 ↗	
ZMC de Montemor-o-Velho	12 ↘	2 ↘	
ZMC de de Barca	7 ↘	31 ↗	
ZMC de Vila Abrunheira	5 ↗	31 ↗	

CONTADORES SEM COMUNICAÇÃO >

ZMC	Contadores sem comunicação	
ZMC de Vila Maior	45%	9%
ZMC de Monte...	37%	7%
ZMC de de Barca	37%	4%
ZMC de Vila Abru...	21%	1%

Leituras recebidas



2023 → **2024**

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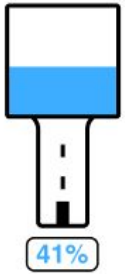
PLANNED MAINTENANCE

VERIFICAÇÃO DE RESERVATÓRIOS



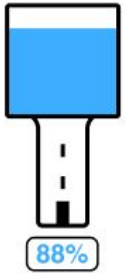
Reservatório de Vila Maior

Capacidade: 150.000 litros

Data última limpeza: 5 junho 2023

Data próxima limpeza: 5 junho 2025

17 maio 2024



Reservatório de Vila Barca

Capacidade: 210.000 litros

Data última limpeza: 25 agosto 2023

Data próxima limpeza: 25 agosto 2025

2 abril 2025

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How **AI** can **predict** businesses and people's **behaviors**

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Case Study

- **Transport** and **networks** (people, freight, services, mobility, etc.)
- **Systems** overwhelmingly **complex**
- **Simulation** approaches often **employed**
- **Simulation** (conceptual) <> **Simulator** (implementation)

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Problem

| **Simulator** can become computationally **heavy**

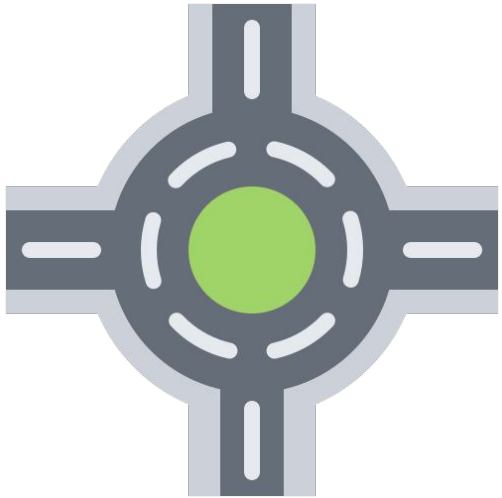
| **Single run**: 5min, 10min , 20 min, 1 hour, 1 day...

| **Output** behaviour **hard to explore**

Simple Example

Simulator with **5** discrete **input dimensions**:

top speed:	[40, 50, 60, 70, 80]
inflow:	[0 100, 500, 1000, 2000 ,3000]
entries/exits:	[1, 2, ..., 10]
max accel:	[0.3, 0.5, 1, 1.5, 3, 3.5, 4]
lanes:	[2, 3, 4, 5, 6, 7]



Full behaviour exploration: 5 x 6 x 10 x 7 x 6 = 12600

Single run = 20 min

Full time = 12600 x 20 min = 252k minutes = 175 days!

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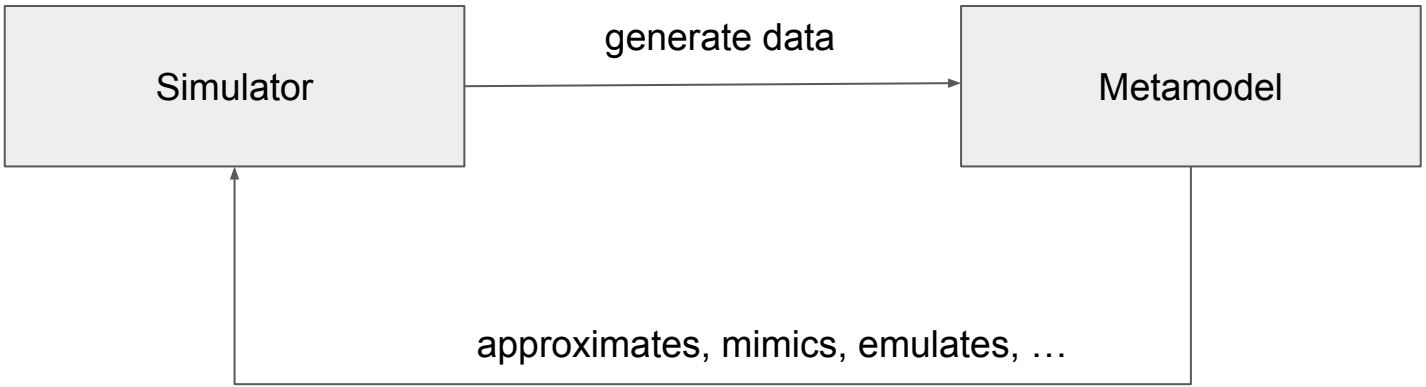
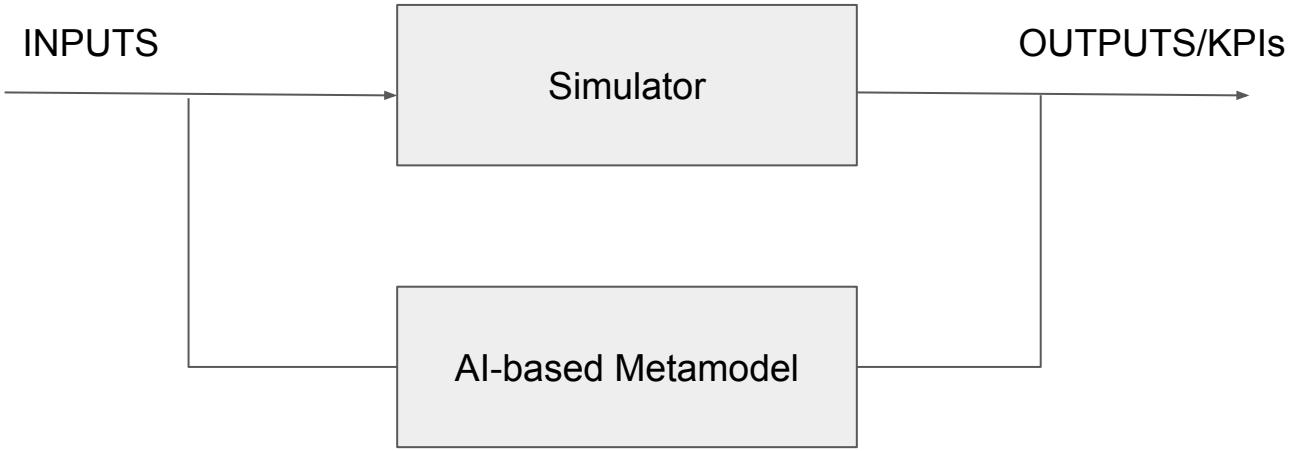
Solution

Build a simulation AI/ML-based **metamodel**

Metamodel = **model of a model**





Simulator: more accurate, but slower, unknown function

Metamodel: less accuracy (10% error), but faster (1/10th), explicit function

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Simple Example

Simulator with **5** discrete **input dimensions**:
[10, 20, 30, 40, 50]
[-6 -5, -4, -3, -2 , -1]
[1, 2, ..., 10]
[0, 0.5, 1, 1.5, 2, 2.5, 3]
[-3.4, -1, 3, 10, 50, 100]

Full behaviour exploration: 5 x 6 x 10 x 7 x 6 = 12600

Single run = 20 min
Single metamodel run = 2 min

Full time = 12600 x 20 min = 252k minutes = 175 days ~6 MONTHS
Full time = 12600 x 2 min = 25200 minutes **~18 days**

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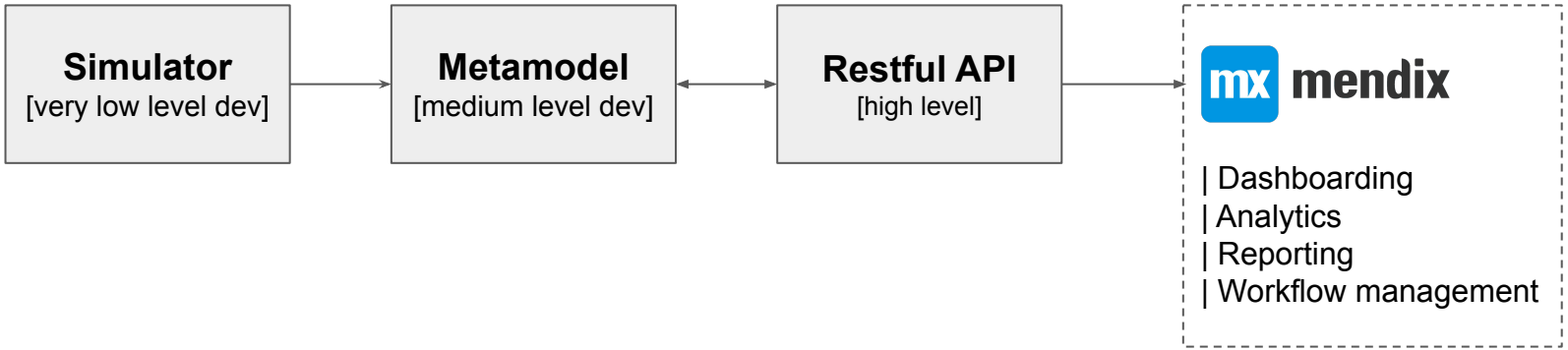
MODEL ACCESS AND INTEGRATION

| **AI/ML-based metamodel** can be hard to interact with

| There is **no** universal **plug-and-play** metamodel

| **Highly tailored** to each individual simulator

| **Low-level** implementation and domain knowledge required



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USING TECHNOLOGIES LIKE **MENDIX** WILL PROVE EACH TIME MORE A VALUABLE SOLUTION, AND **AI** WILL BECOME EACH TIME **MORE** AND MORE **ACCESSIBLE**

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BUILDING SIMPLICITY