This presentation premiered at WaterSmart Innovations

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Advance smart metering technologies and software for precise end-use identification

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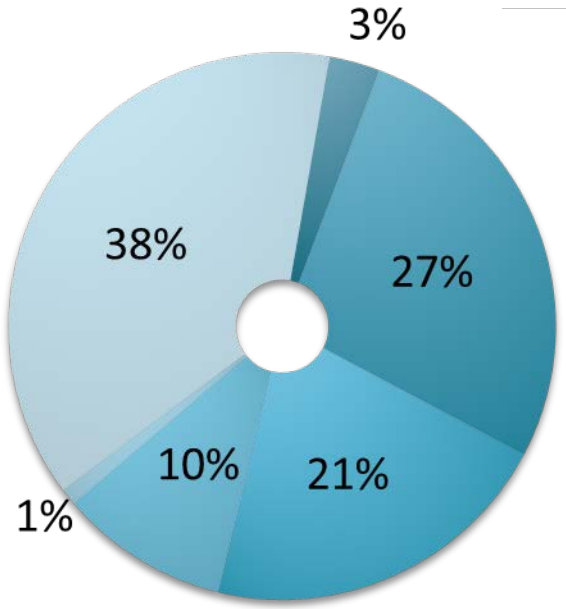
UNIVERSIDAD POLITECNICA DE VALENCIA

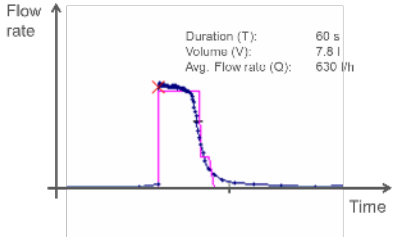
Gestión sostenible del agua urbana

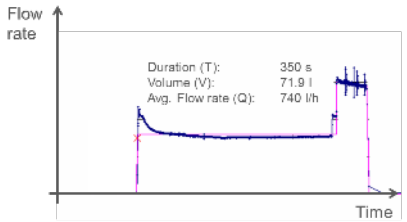
Fundamentals of End-Use analysis

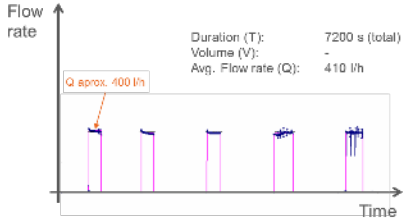
End-Uses analysis disaggregates water consumption into its basic components

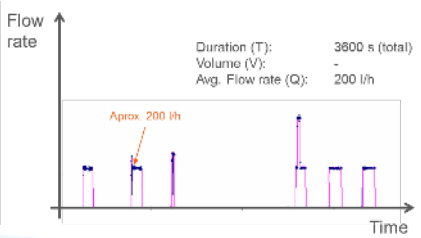


- Leaks
- Showers
- Toilets
- Washers
- Dishwashers
- Faucets









Fundamentals of End-Use analysis

End-Uses disaggregation:

- It is mainly intended for residential users
- It is based on the intrinsic characteristics of water consumption

- Reliability of the results of a study depend on:

Most times limited by budget

Moving from a PILOT to an EXTENDED study

Need for a new hardware and software tools

Pilot study	Extended study
Limited number of users	Large number of users
Limited duration of monitoring period	Unlimited duration of monitoring period
Manual data downloading	Automatic data transmission
Manual processing	Automatic processing
High unitary cost	Low unitary cost

Data quality for End-Use identification

Meter measuring capabilities

Meter to logger comm.

Logger recording capabilities

Software capabilities

Metrology of the meter

- Low flows
- High flows
- Frequency response (how fast the meter responds to changes in flow)

Working principle of the meter

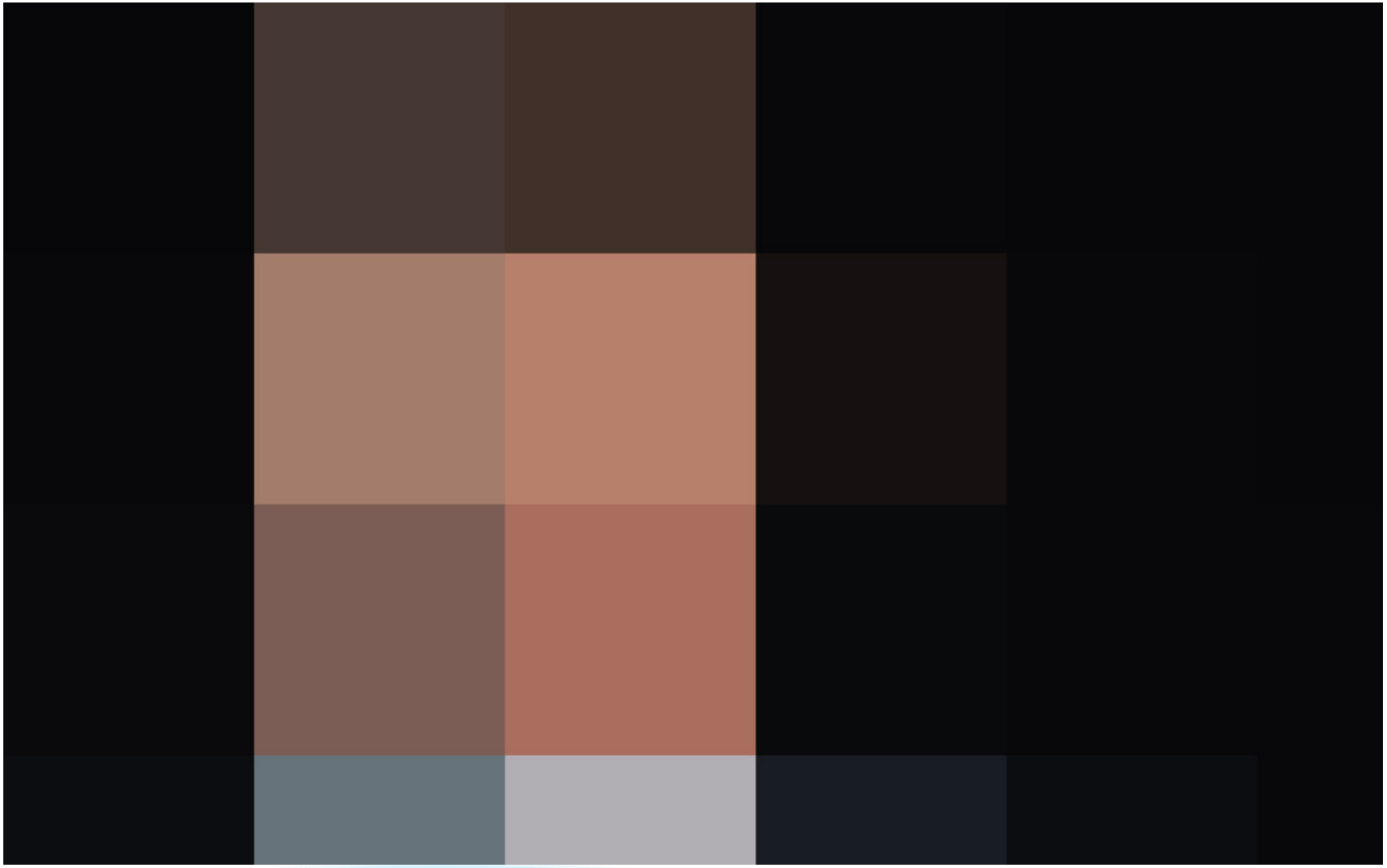
- Mechanical: Velocity – Positive displacement

- Non-Mechanical: Ultrasonic – Electromagnetic

Continuous flow measurement

Flow signal is sampled to save battery

What is this?



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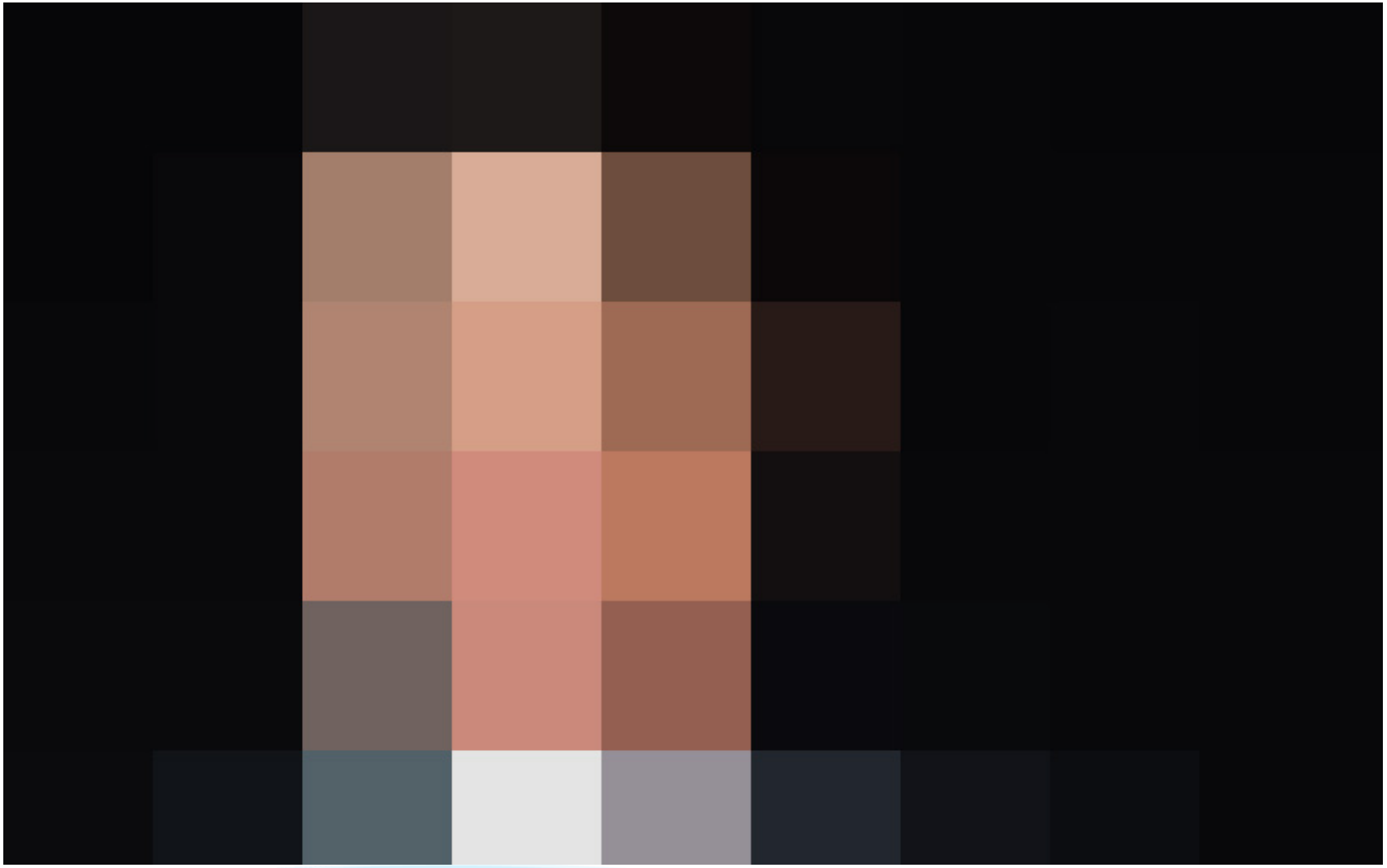

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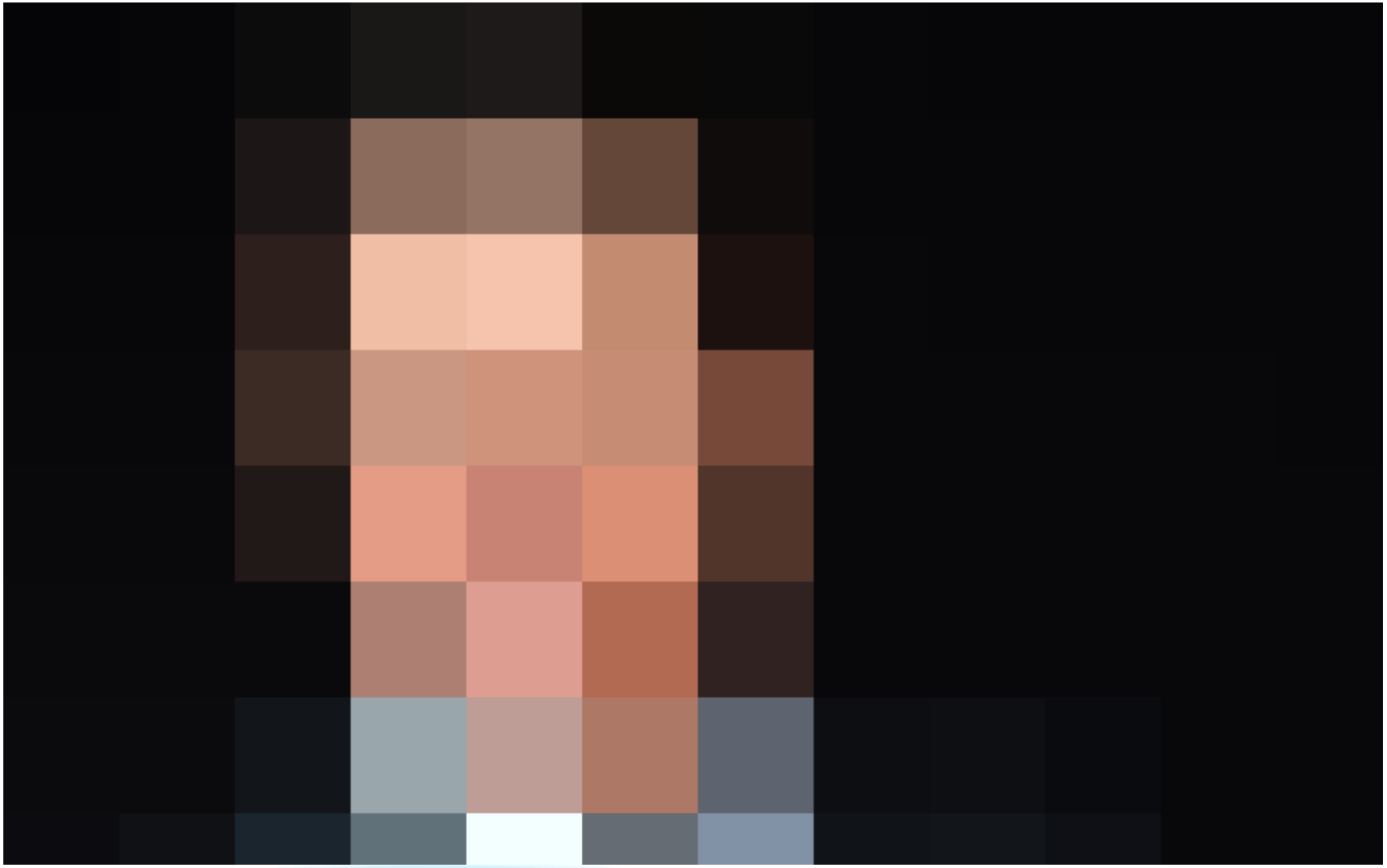
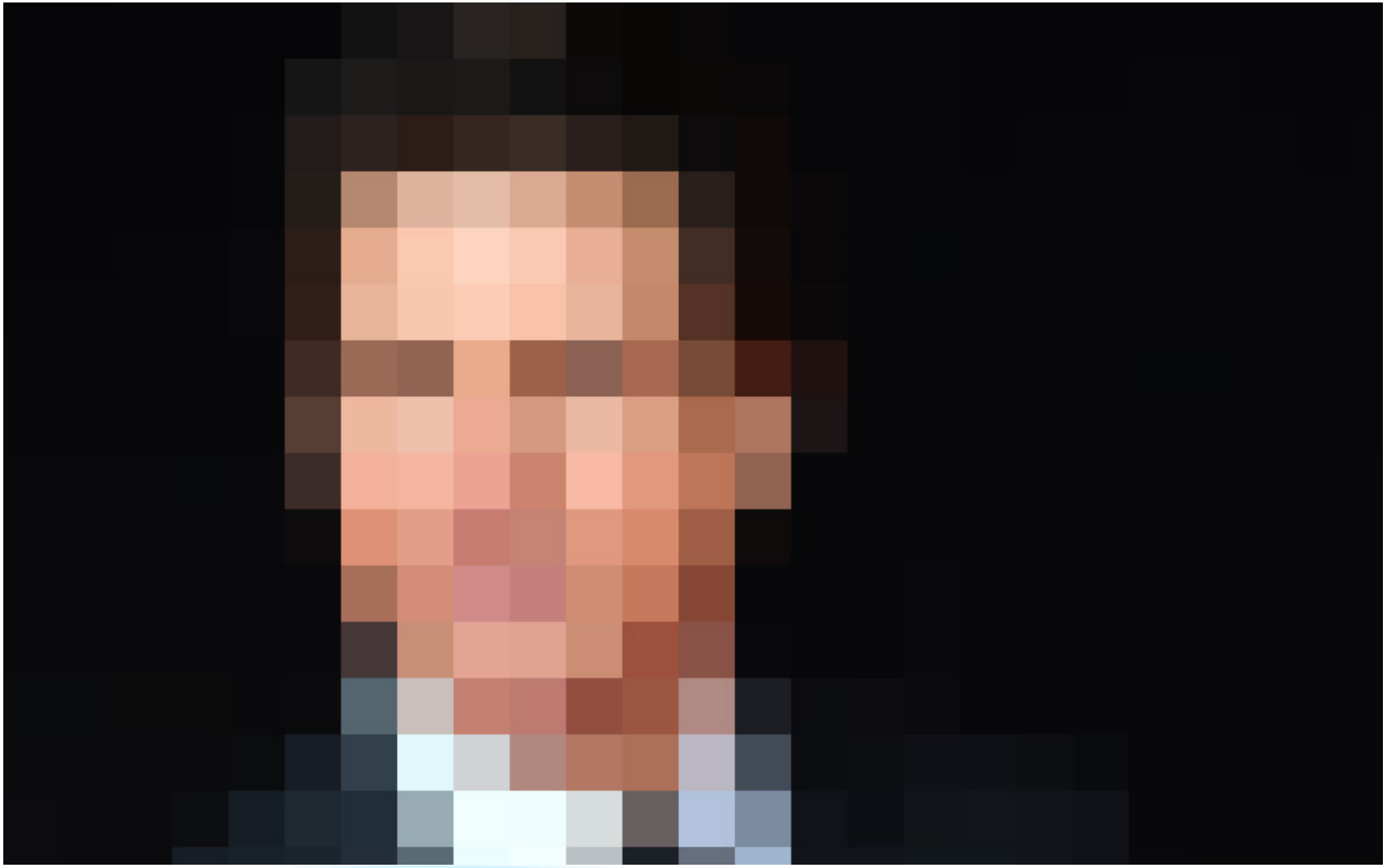
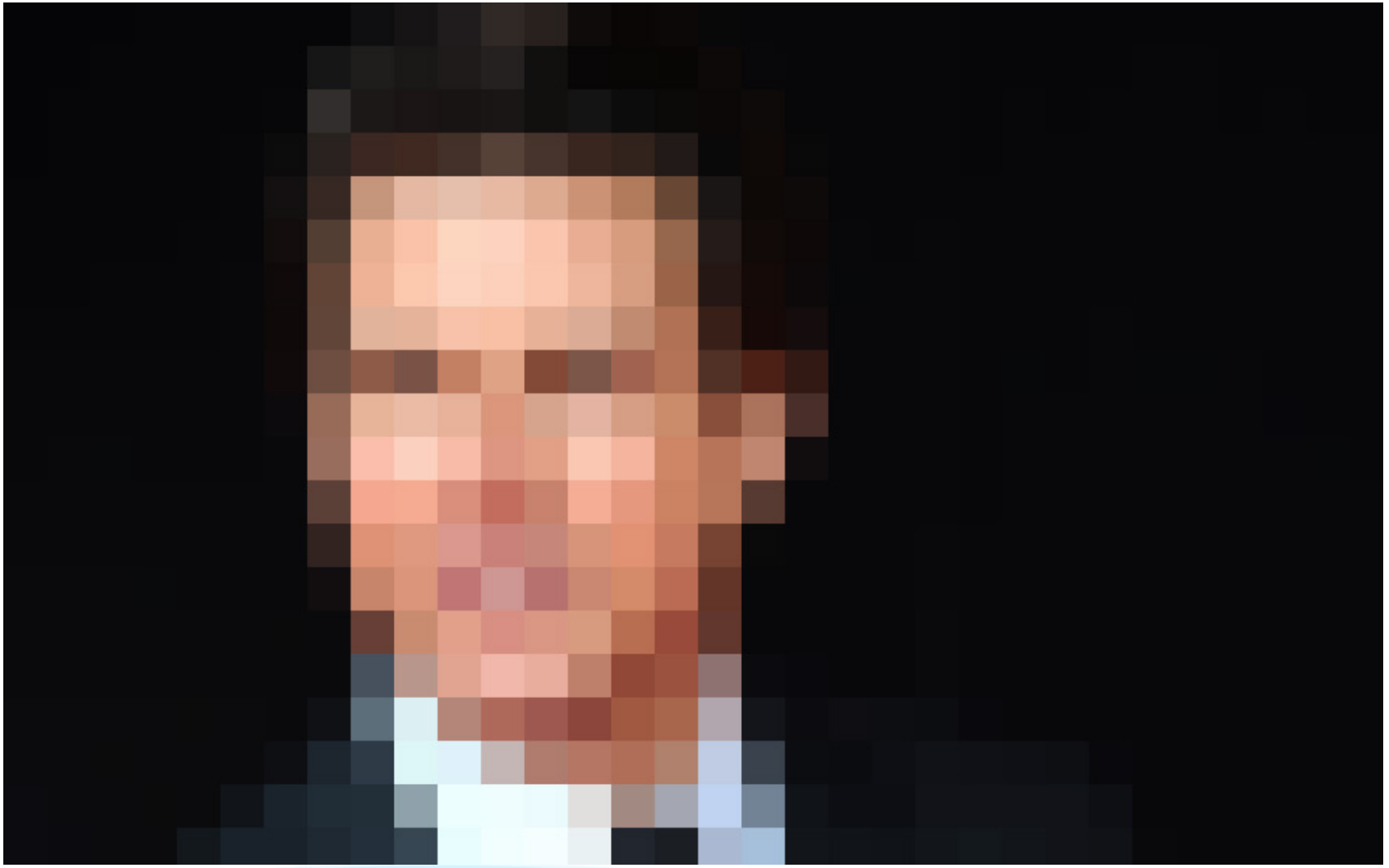


What is this?

Who is him/her?



Who is him?



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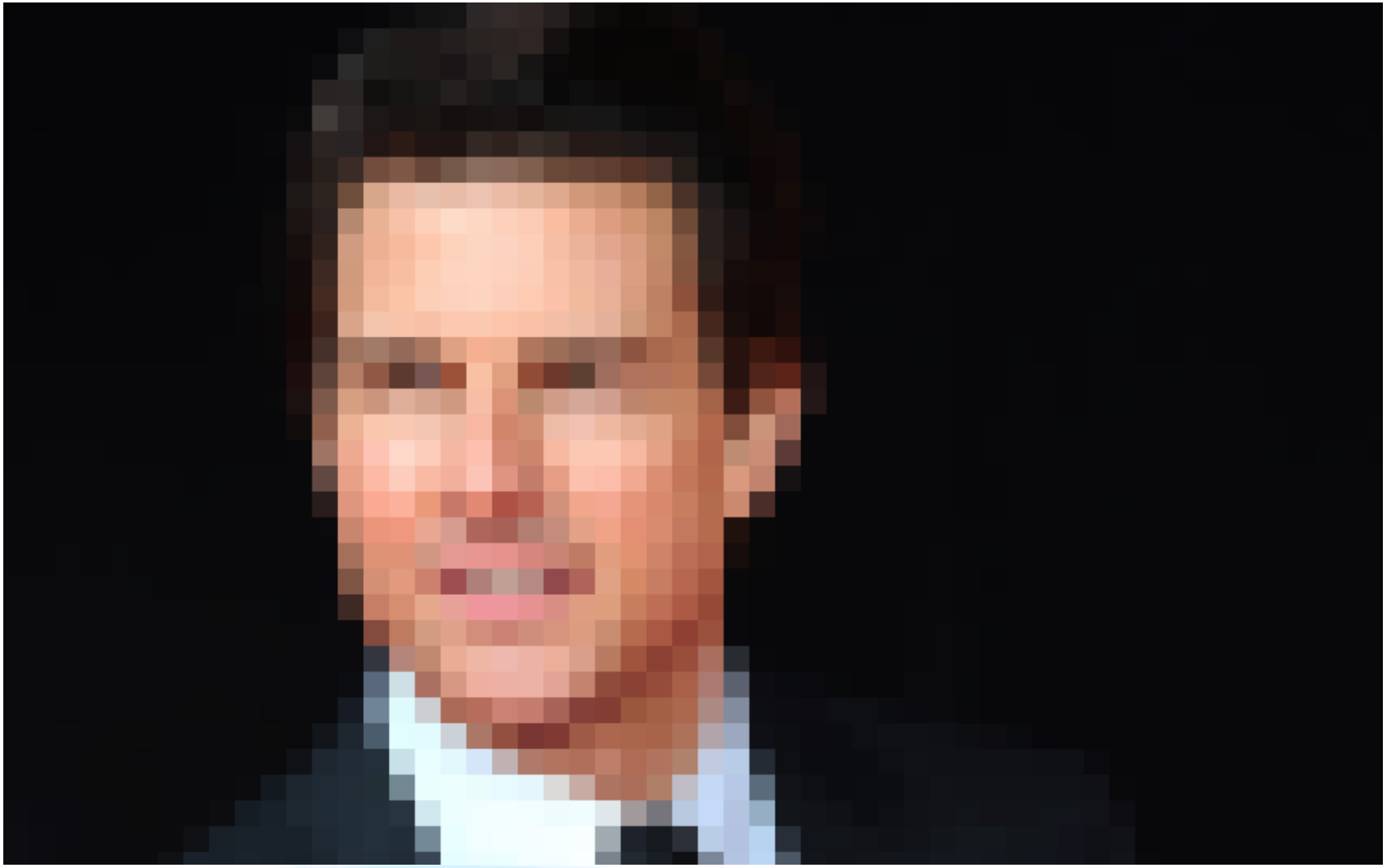
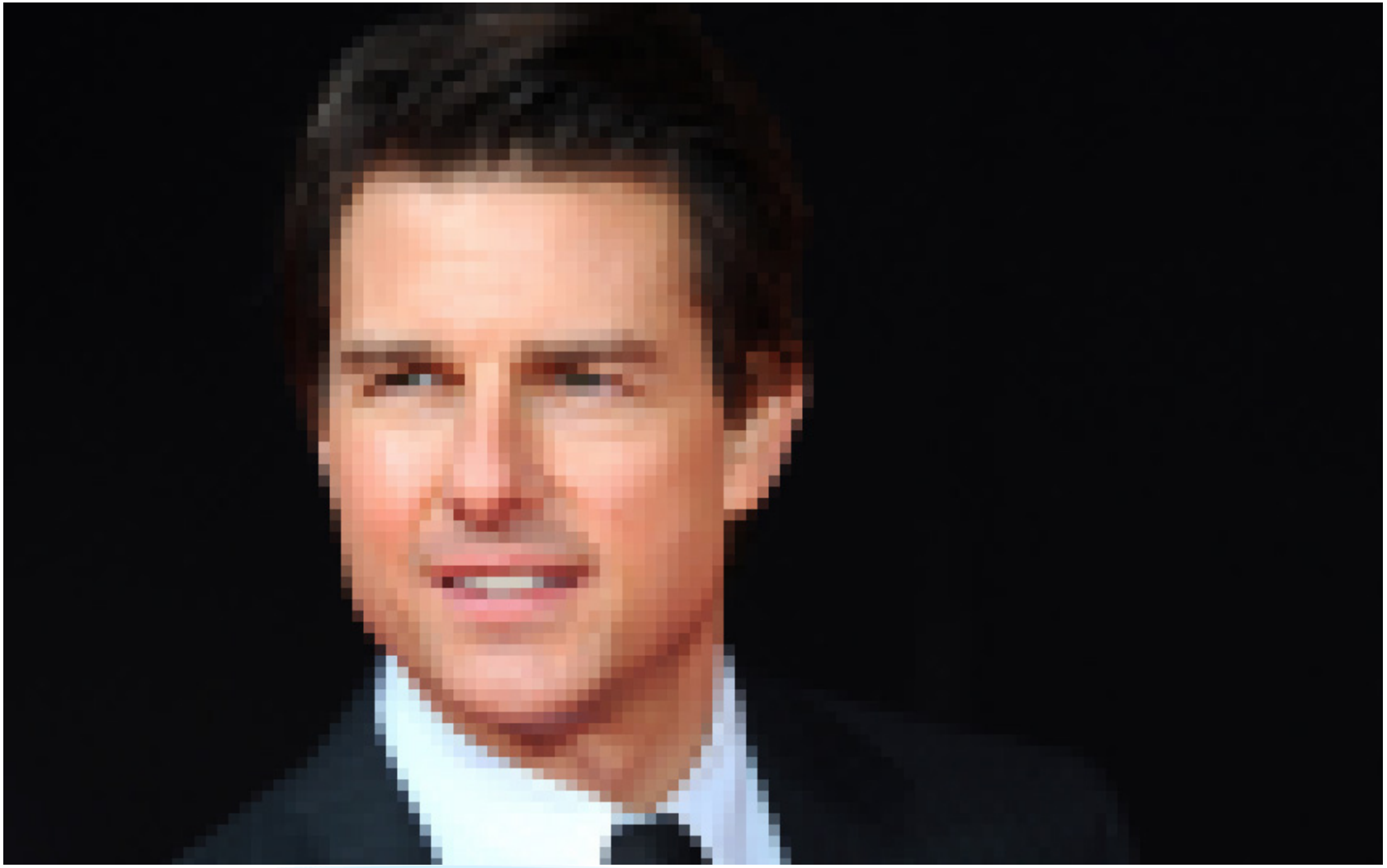


Who is him?

Who is him?



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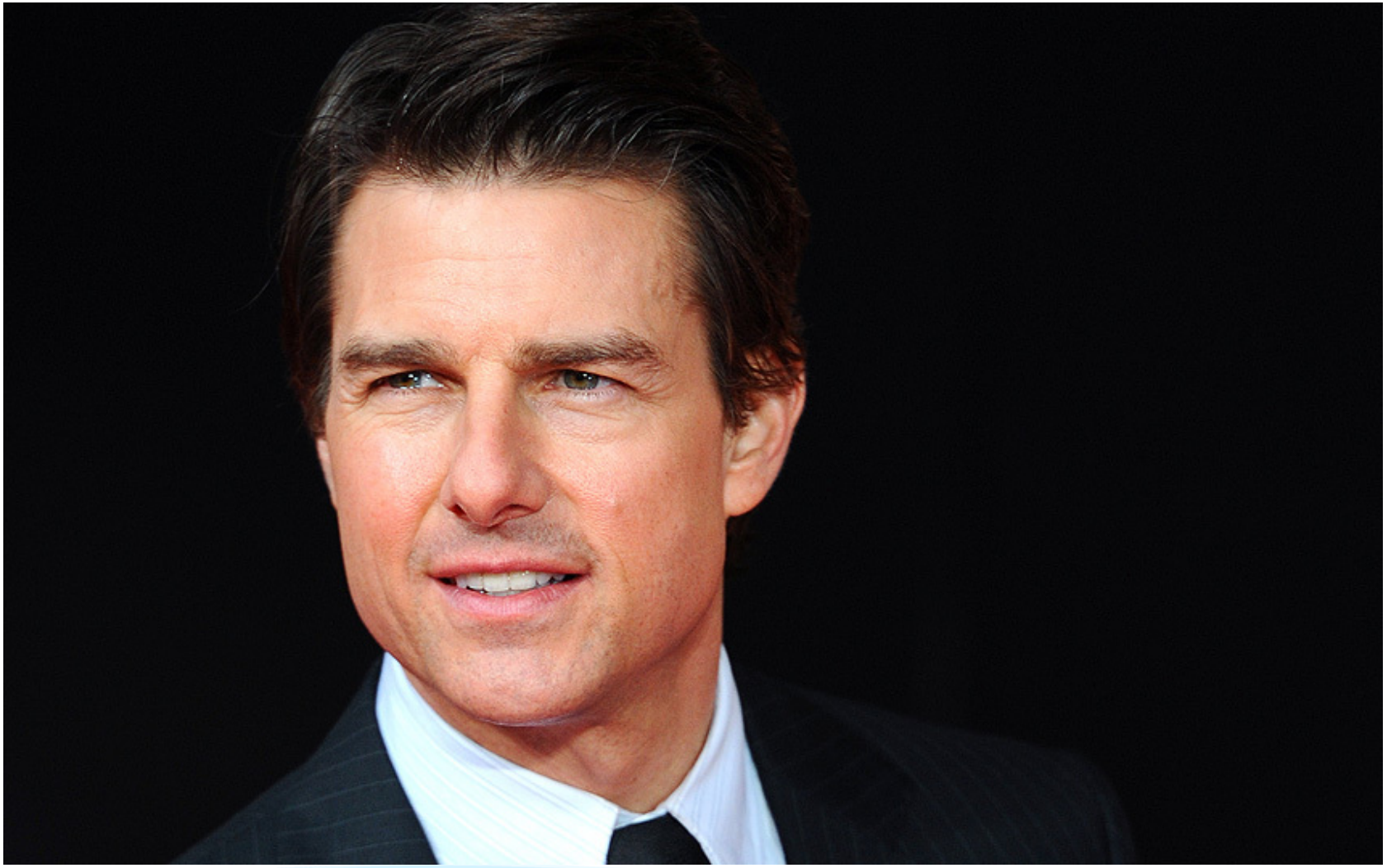
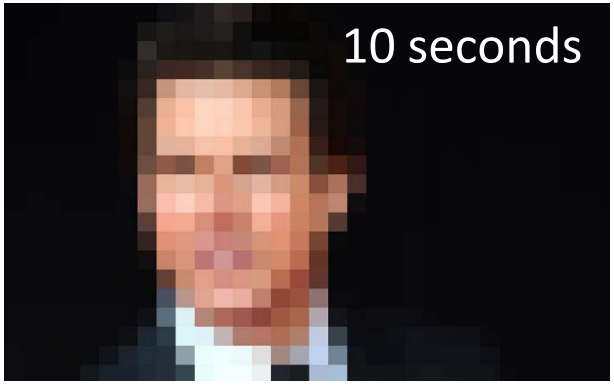


What question do we want to answer?

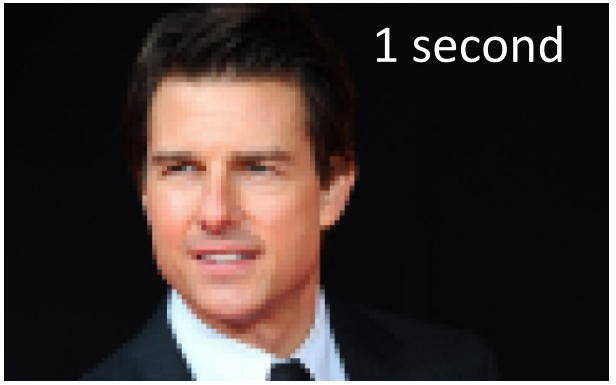
What?

Is it a who?

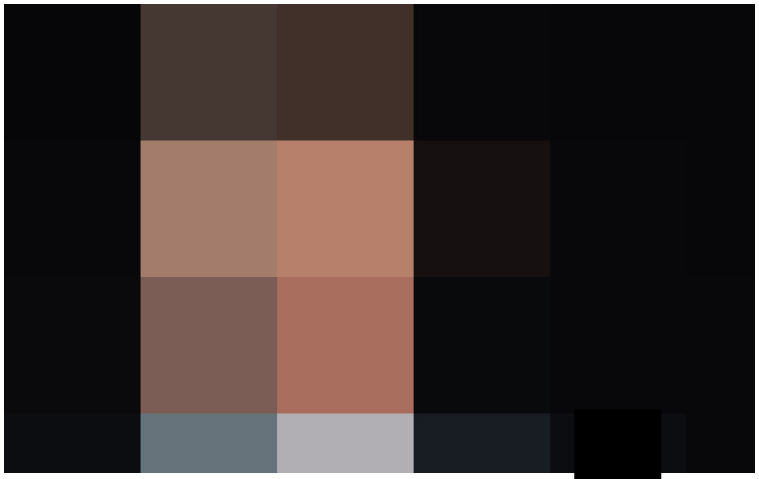
He/She?

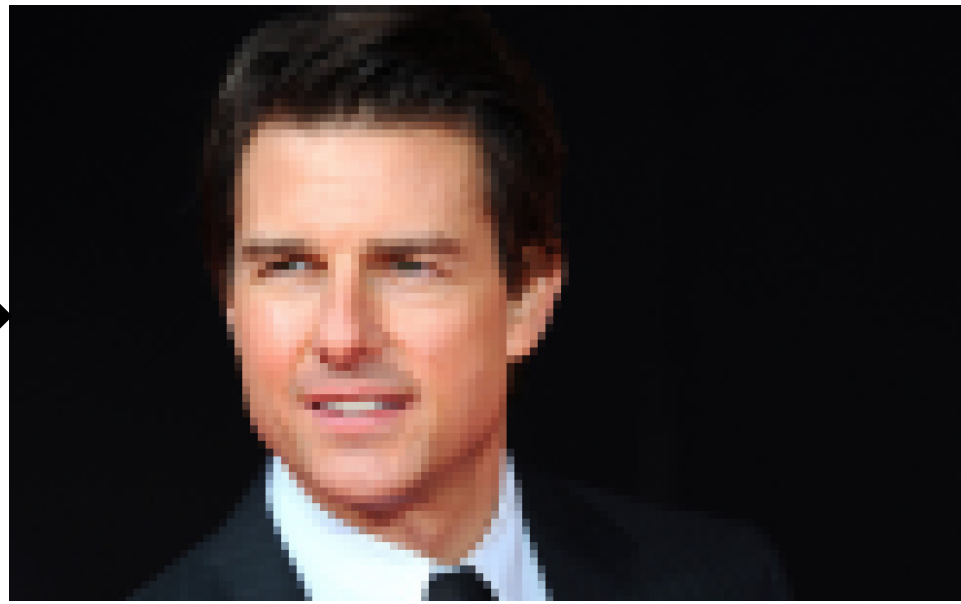


Name?

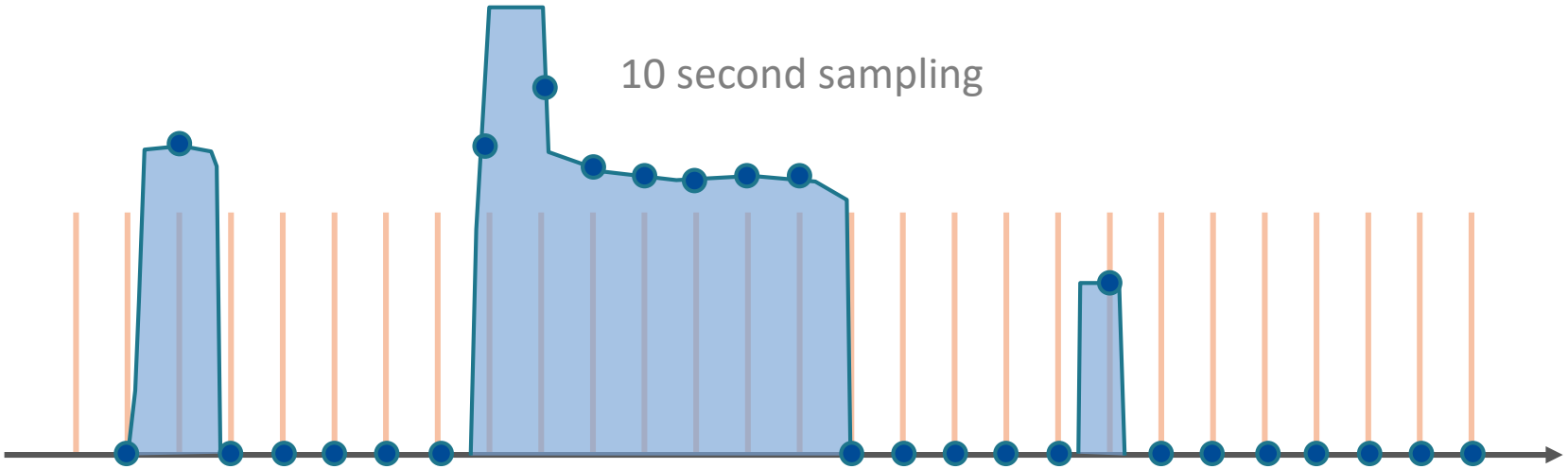


Is it possible….?





Meter measuring capabilities



+

Volume reading resolution

+

Frequency response

How consumption data can be extracted from the meters?

- By type
  - Pulse output

  - Communication protocol

- By medium of communication
  - Wired
  - Wireless

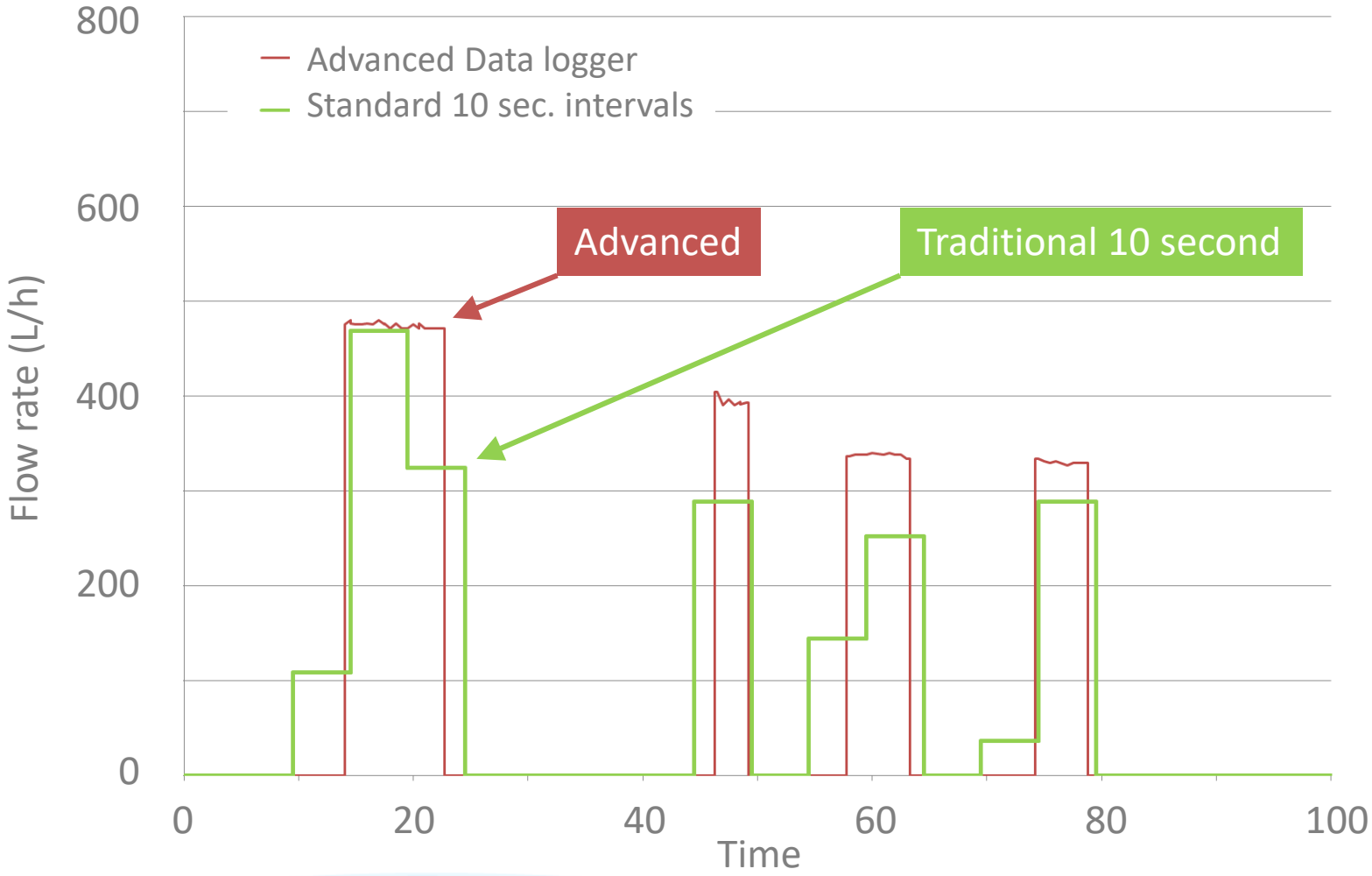
	Advantages	Disadvantages
Pulse output	Low cost	Reliability
	Volume reading resolution	Limited amount information
	Availability & flexibility	Inverse flow
Protocol comm.	Absolute readings	Slow communications
	Additional information	Poor volume reading resolution
		Battery consumption

Memory capacity → Not a problem anymore!

How consumption data is stored in the logger

- At fix intervals of time
- Recording the time of occurrence of the pulses

Flow traces distortion caused by data acquisition equipment



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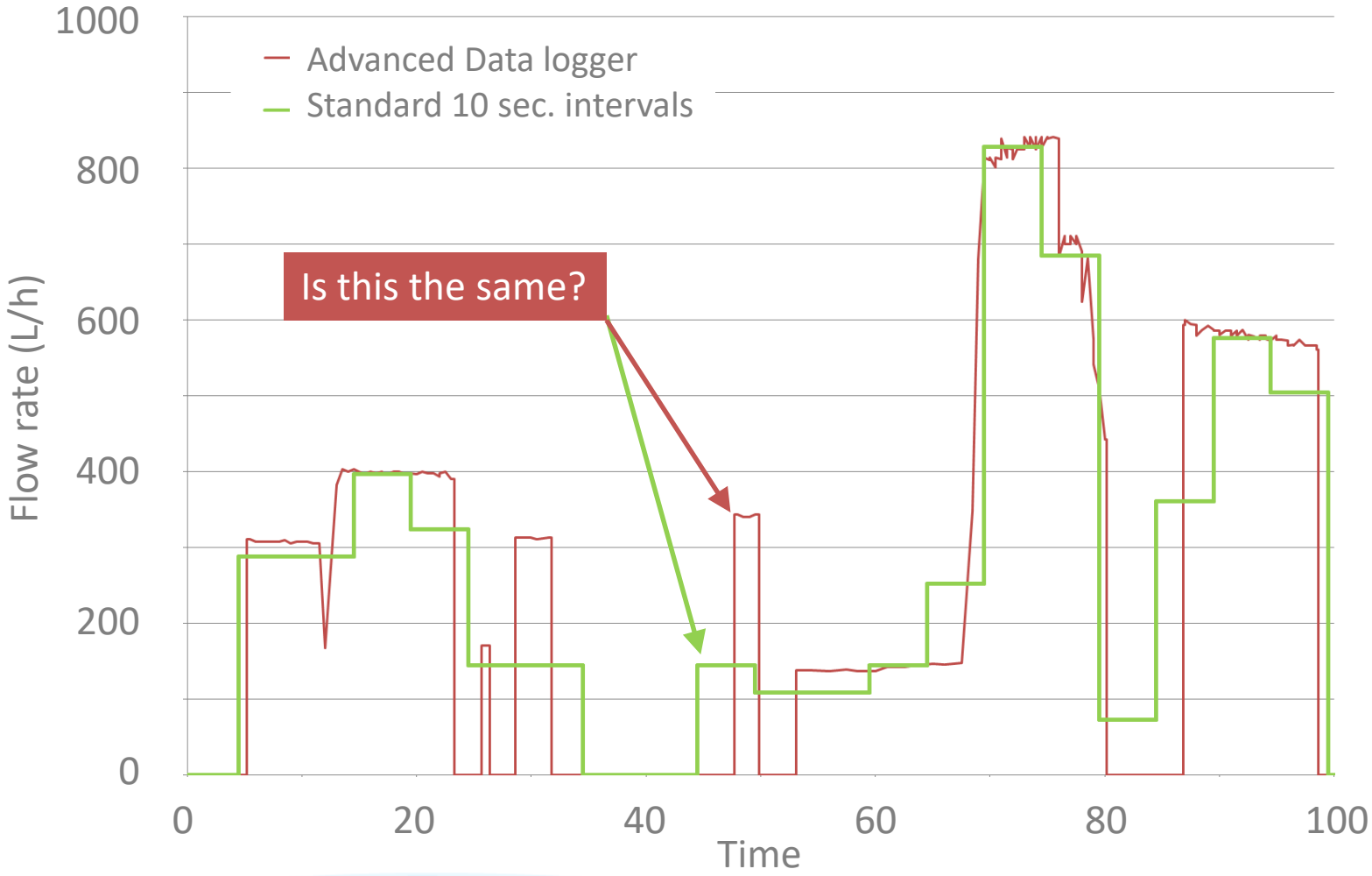


Memory capacity

How consumption data is stored in the logger

- At fix intervals of time
- Recording the time of occurrence of the pulses

Battery duration → Thinking on the long term

- Lithium batteries
- Rechargeable batteries + solar panel

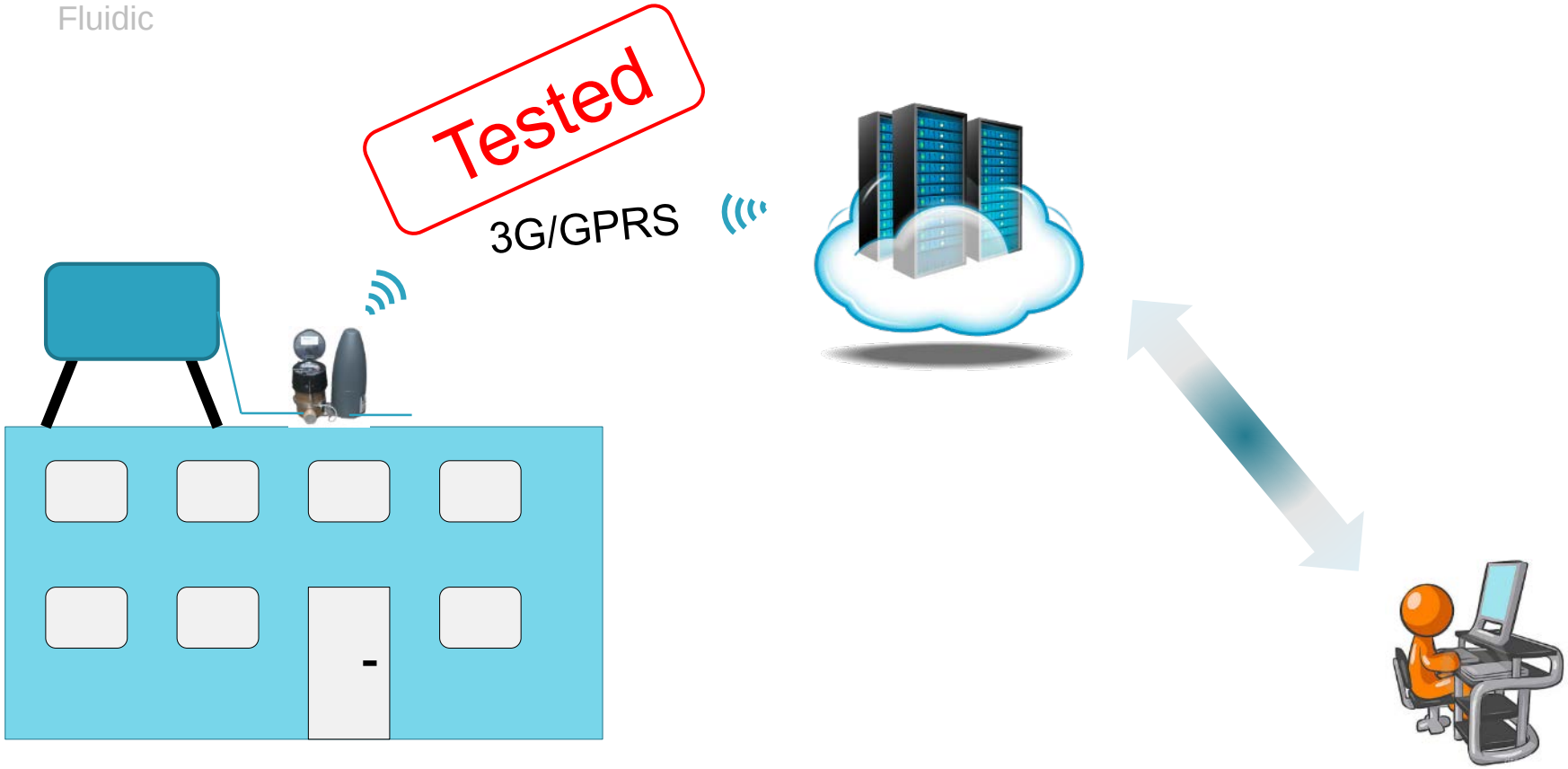
3G/GPRS communication

- More data –higher transmission costs and battery consumption

Remote configuration capabilities

Option 1

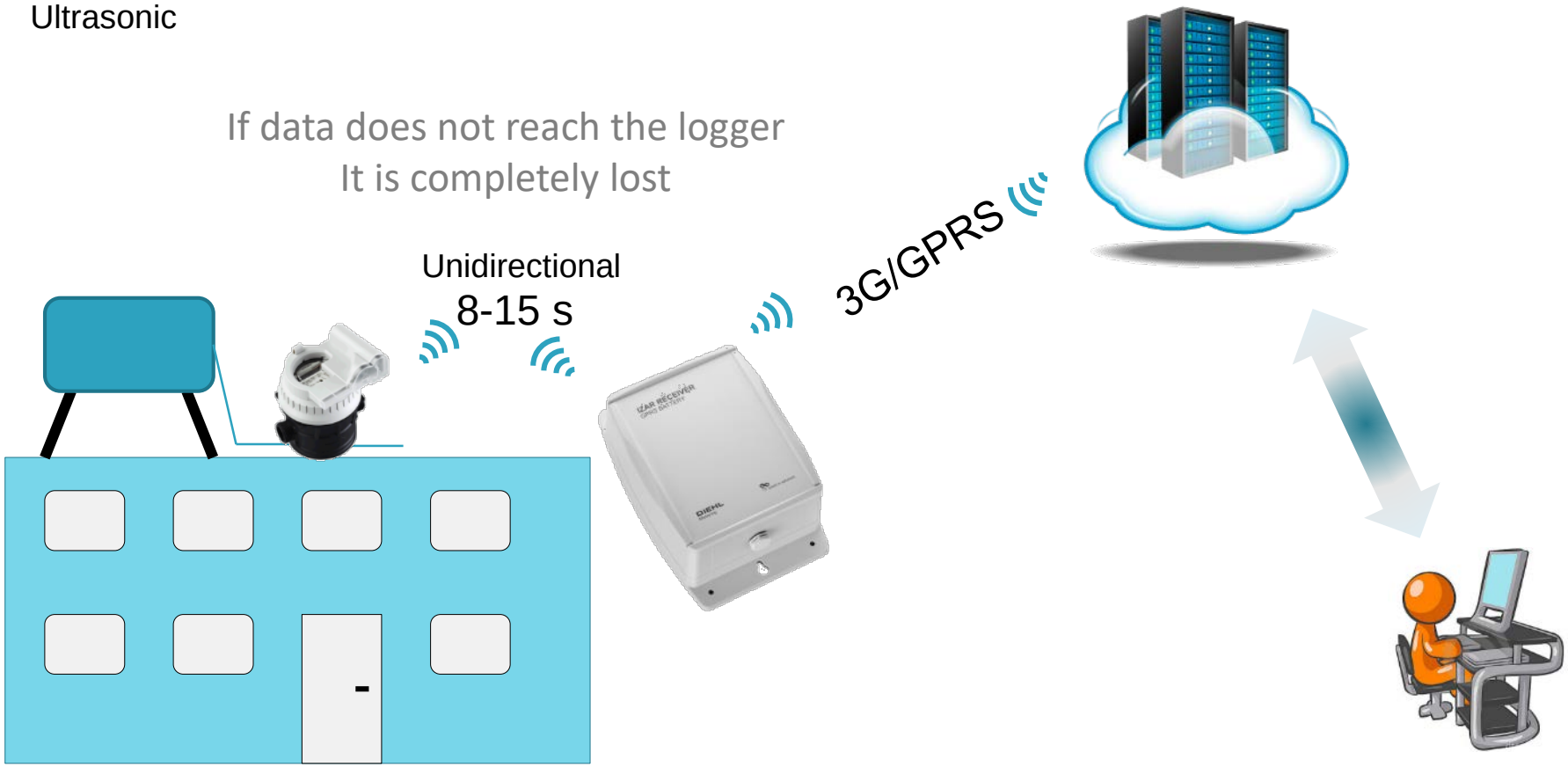
Meter	Reading	Comm. to logger	Recorder	Comm. to server
Mechanical	Pulse emitter	Wired connection	Data logger	3G/GPRS
Ultrasonic				
Electromagnetic				
Fluidic				



Option 2

Meter	Reading	Comm. to logger	Recorder	Comm. to server
Mechanical meter Electromagetic Ultrasonic	Protocol comm.	Wireless	Concentrator	3G/GPRS

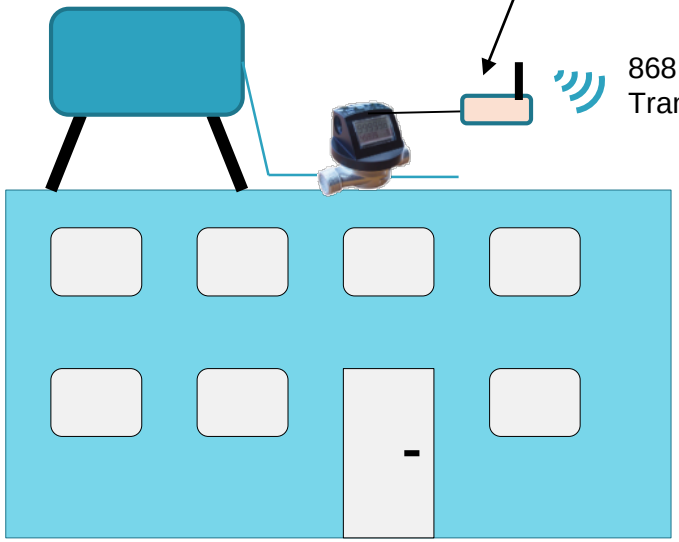
If data does not reach the logger
It is completely lost



Option 3

Meter	Reading	Comm. to logger	Recorder	Comm. to server
Mechanical meter Electromagnetic Ultrasonic	Pulse emitter	Wireless module	Concentrator	3G/GPRS

Radio module:
Internal memory greater than 4 Mb
No data is lost if transmission fails



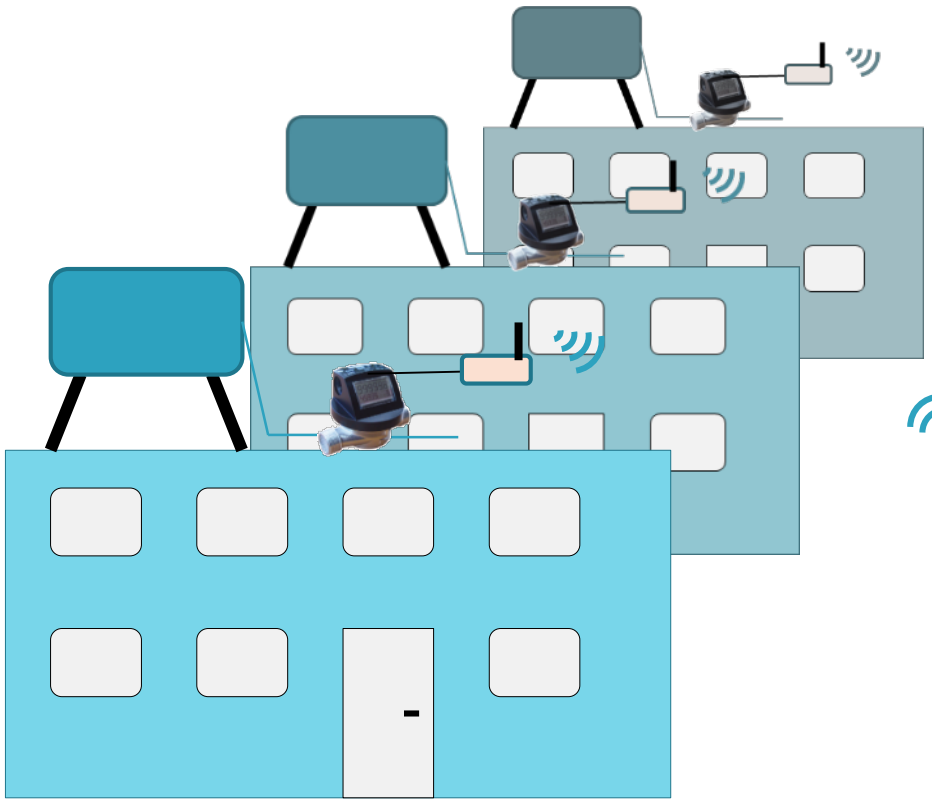
868 or 433 MHz
Transmission time configurable

3G/GPRS

This can be powered by solar panel, power supply, batteries.
It has a configurable internal memory (SD card)

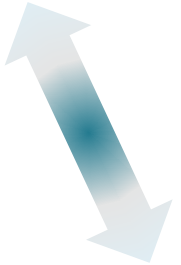
Option 3-bis

Meter	Reading	Comm. to logger	Recorder	Comm. to server
Mechanical meter Electromagnetic Ultrasonic	Pulse emitter	Wireless module	Concentrator	3G/GPRS



3G/GPRS

Concentrator can manage more than 1 radio module



Applications

Option 3

- Residential buildings meters installed in apartments
- Residential areas
- Studies on hot-cold End-Uses of water
- Studies for various utilities at once (water + electricity + gas)
- Analysis of non-residential users
  - Flow switches + wireless transmitters
  - Meters at strategic locations
  - Loggers

Conclusions on hardware technologies

Non-mechanical meters commercially available today are not suitable for End-Use studies

Protocol communications cannot be used

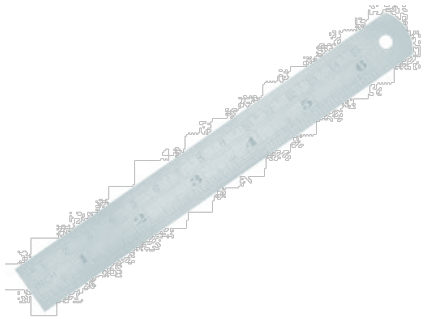
- Slow
- Reading volume resolution
- Battery consumption

Not designed for such frequent readings!!

Low cost solutions are becoming available for long term monitoring

Data quality for End-Use identification

Meter measuring capabilities ▷ Meter to logger comm. ▷ Logger recording capabilities ▷ Software capabilities

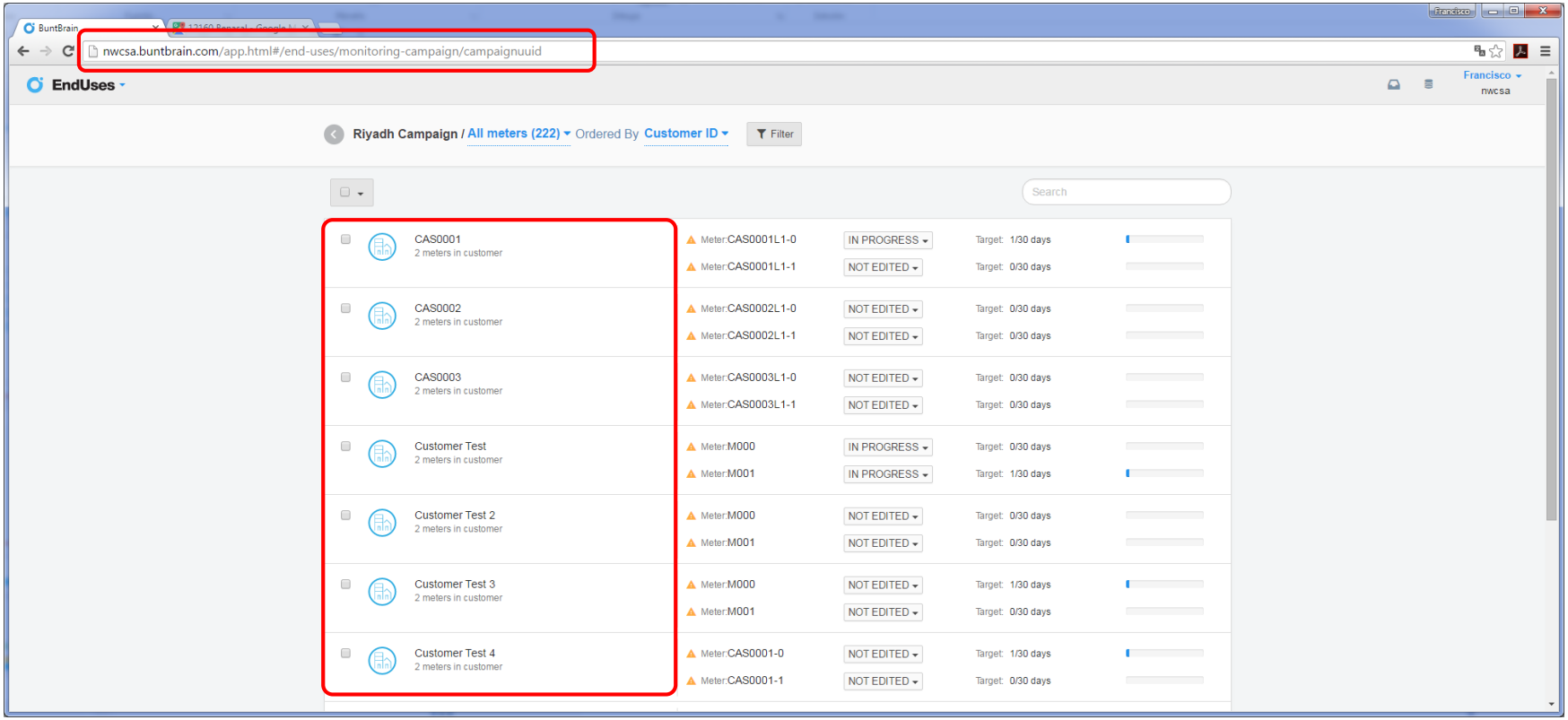


Need for new software tools

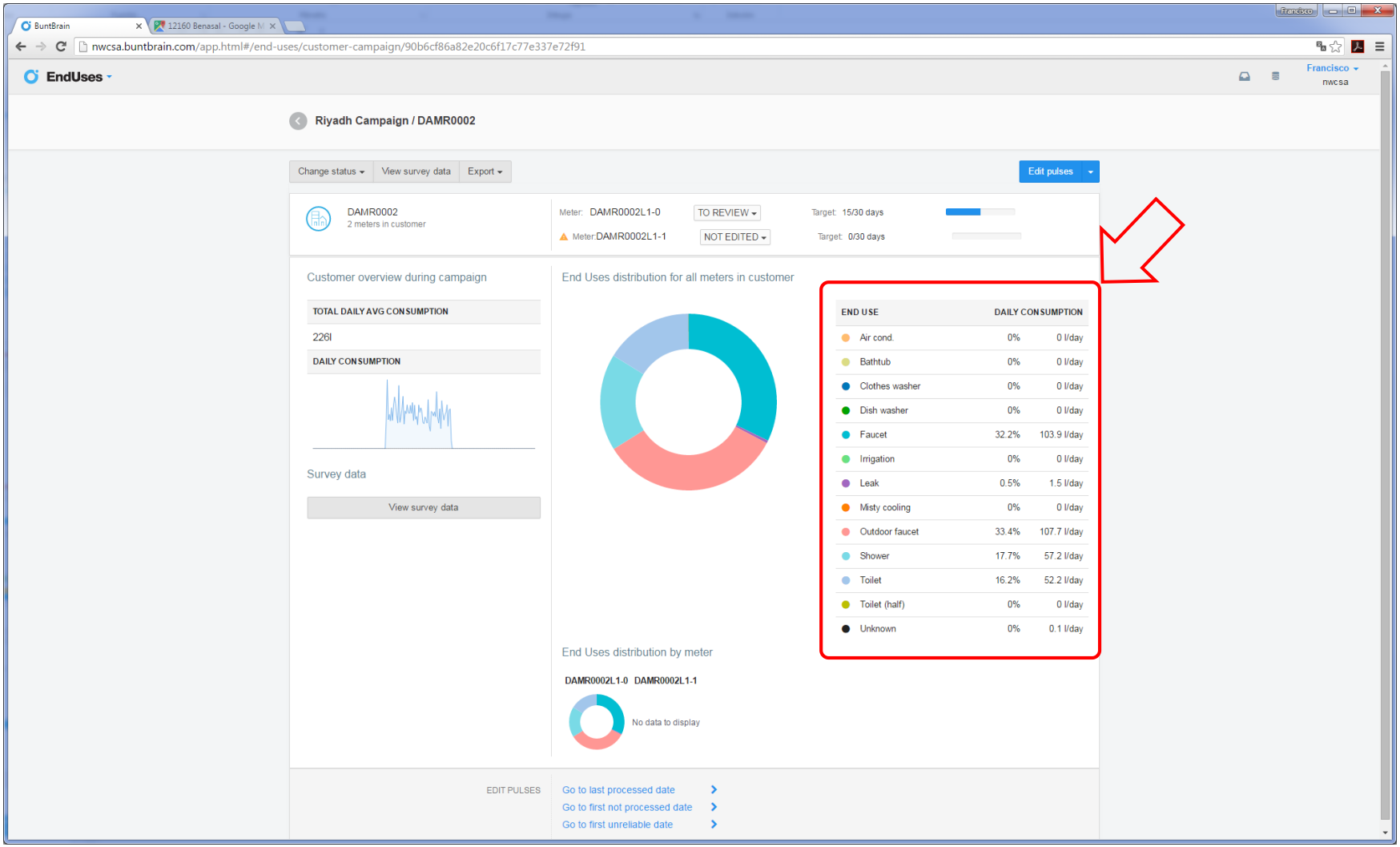
New requirements moving from a PILOT to an EXTENDED study

- Improved data base structure
- Precise identification of water End-Uses
- Multi user web-based software
- Automatic processing of flow traces
- Automatic reporting

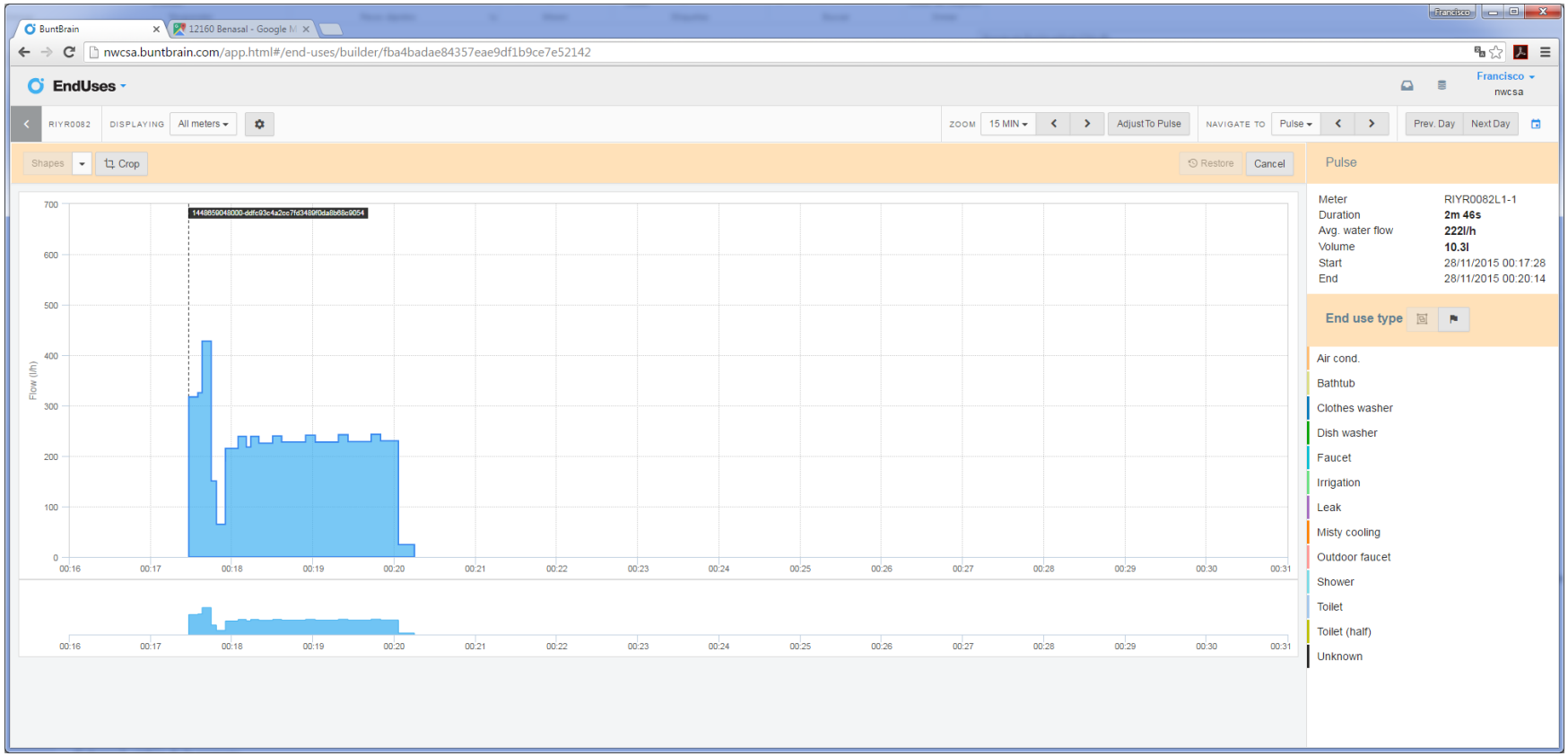
Multi-user on-line platform



Automatic reporting



Example:
Manual flow trace disaggregation



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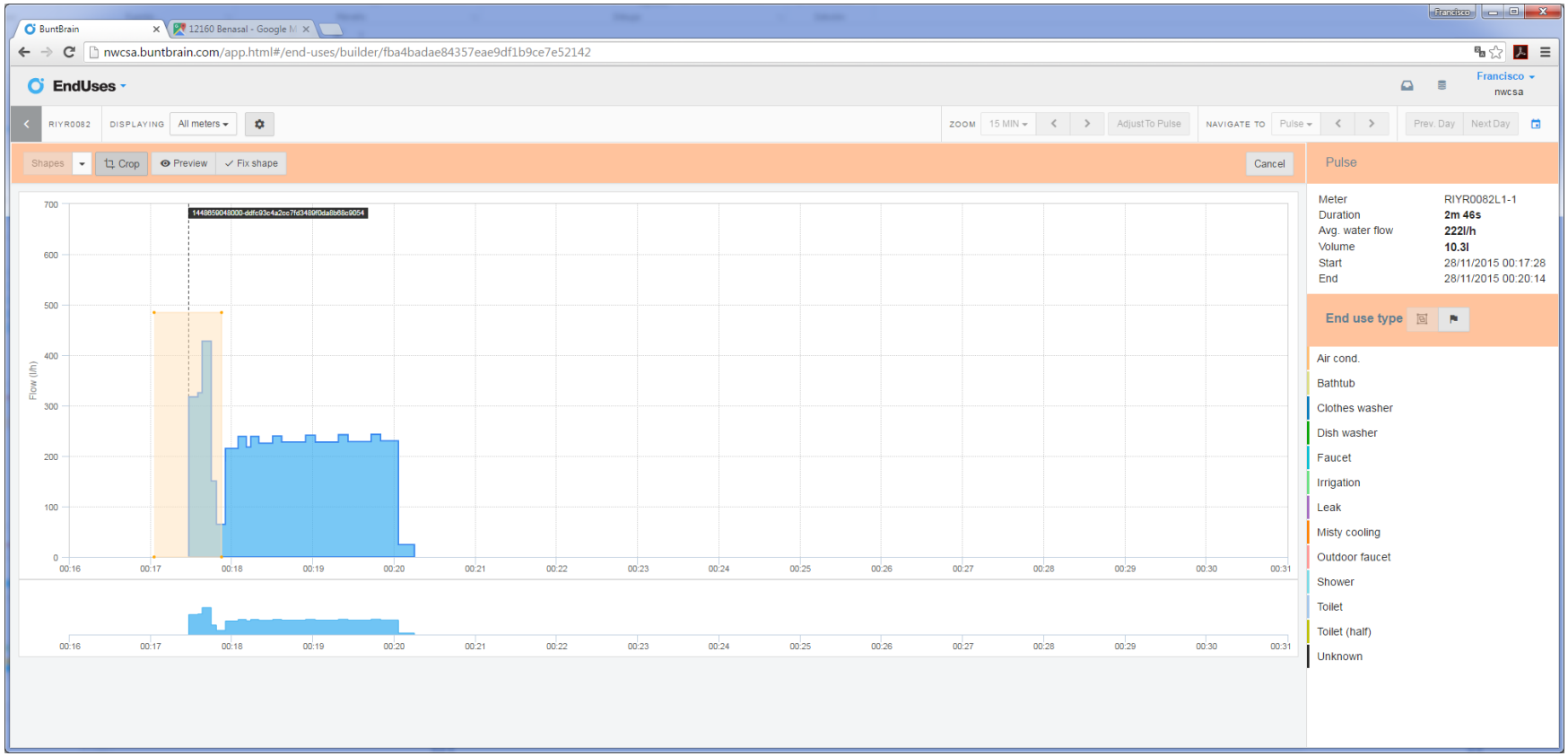

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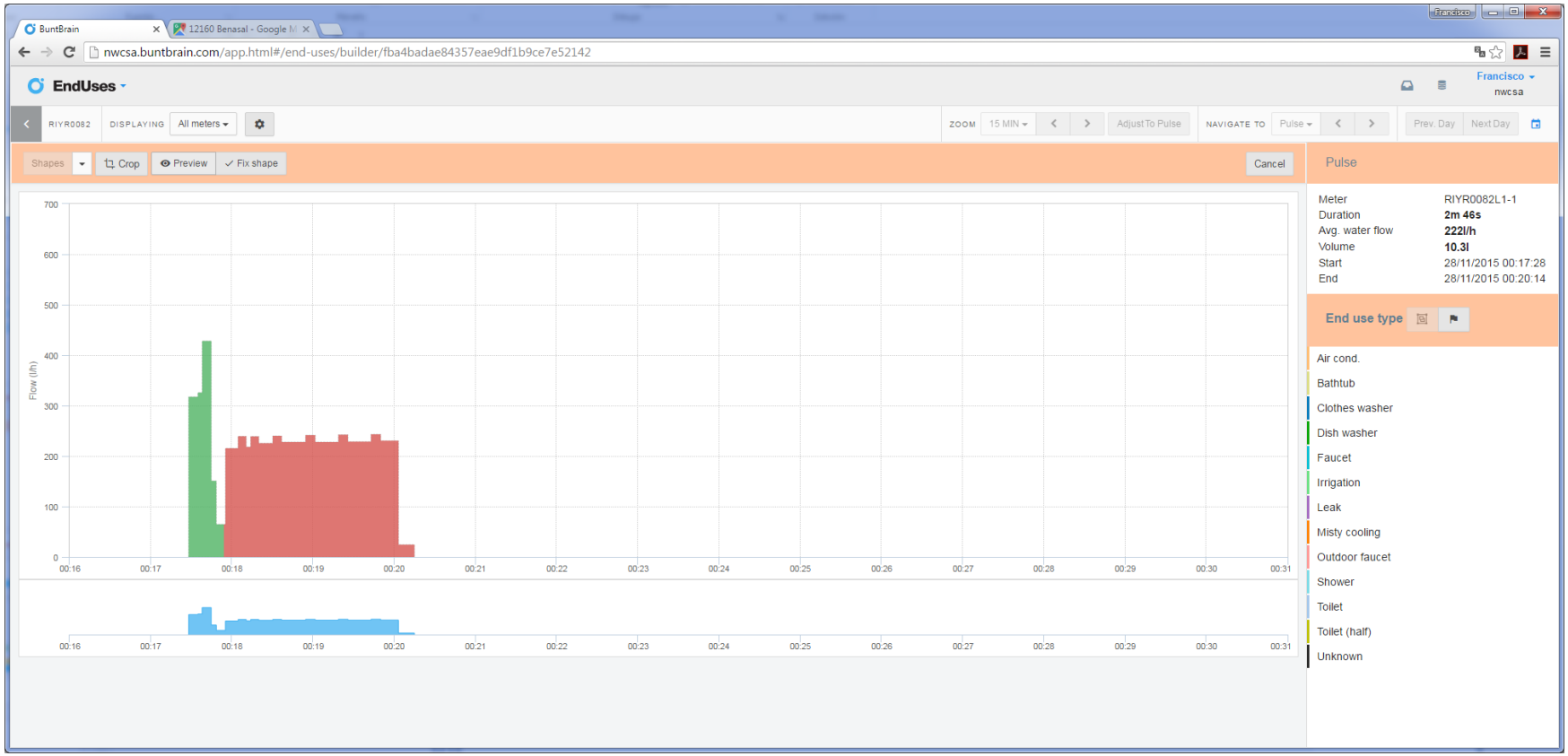
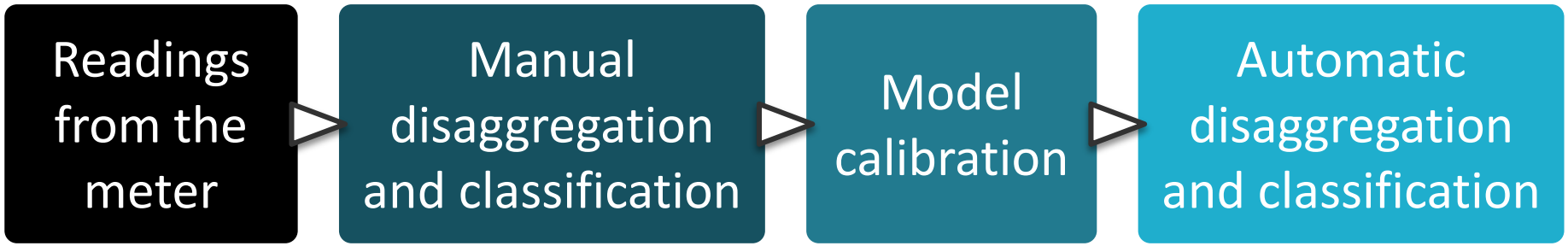


Data processing flowchart



Additional required features

The software should be capable of simultaneously working with several signals per customer:

Hot and Cold water

Water, gas and electricity

Non-residential users with several meters

Additional required features

Pulses are not recorded as simple rectangular pulses

More sophisticated identification methods can be developed

More accurate results

More storage space is needed

Larger processing capacity

Conclusions

Technology has made possible continuous monitoring of customers

New software tools are needed to process the huge volume of data collected

Advance smart metering technologies and software for precise end-use Identification

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