

AI and Machine Learning for the Connected Home

Stephen Galsworthy, Quby

Session hashtag: #SAISAI4

Quby

Our history in milestones

2004

Home Automation Europe is founded



2006

Home control alternatives are prototyped



2012

Home Automation Europe partners with Eneco to create Toon



2013

Home Automation Europe becomes Quby

Quby

2018

Launch Toon2



2018

launch security service ThuisWacht with Interpolis



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Our partners:



Interpolis.



Launched in 2016

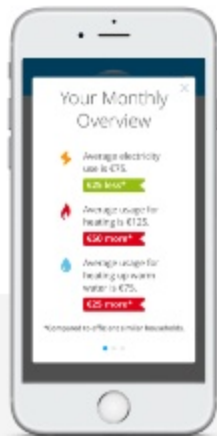
Launched in 2017

Launched in 2012

Testing phase

Toon available Toon in testphase

TOON



ENERGY
INSIGHTS APP



SMART METER
DONGLE & APP



SMART THERMOSTAT &
APP



SECURITY
PACKAGE & APP

DATA SERVICES

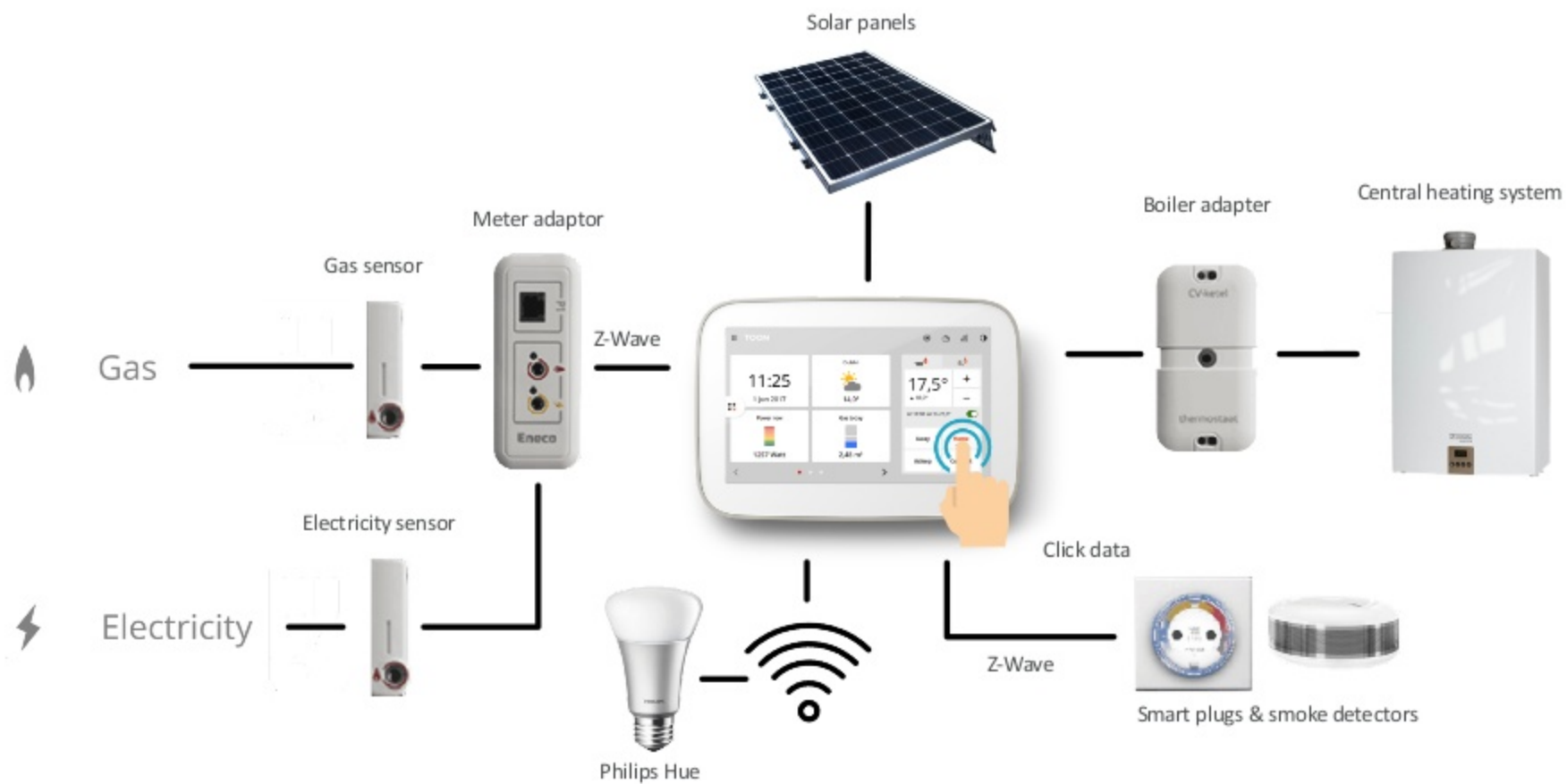
WASTE CHECKER

WATER INSIGHT

MONTHLY ENERGY
INSIGHT

TOON SOLAR

BOILER MONITORING



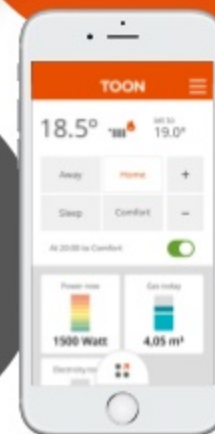
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Over 350,000 displays
installed



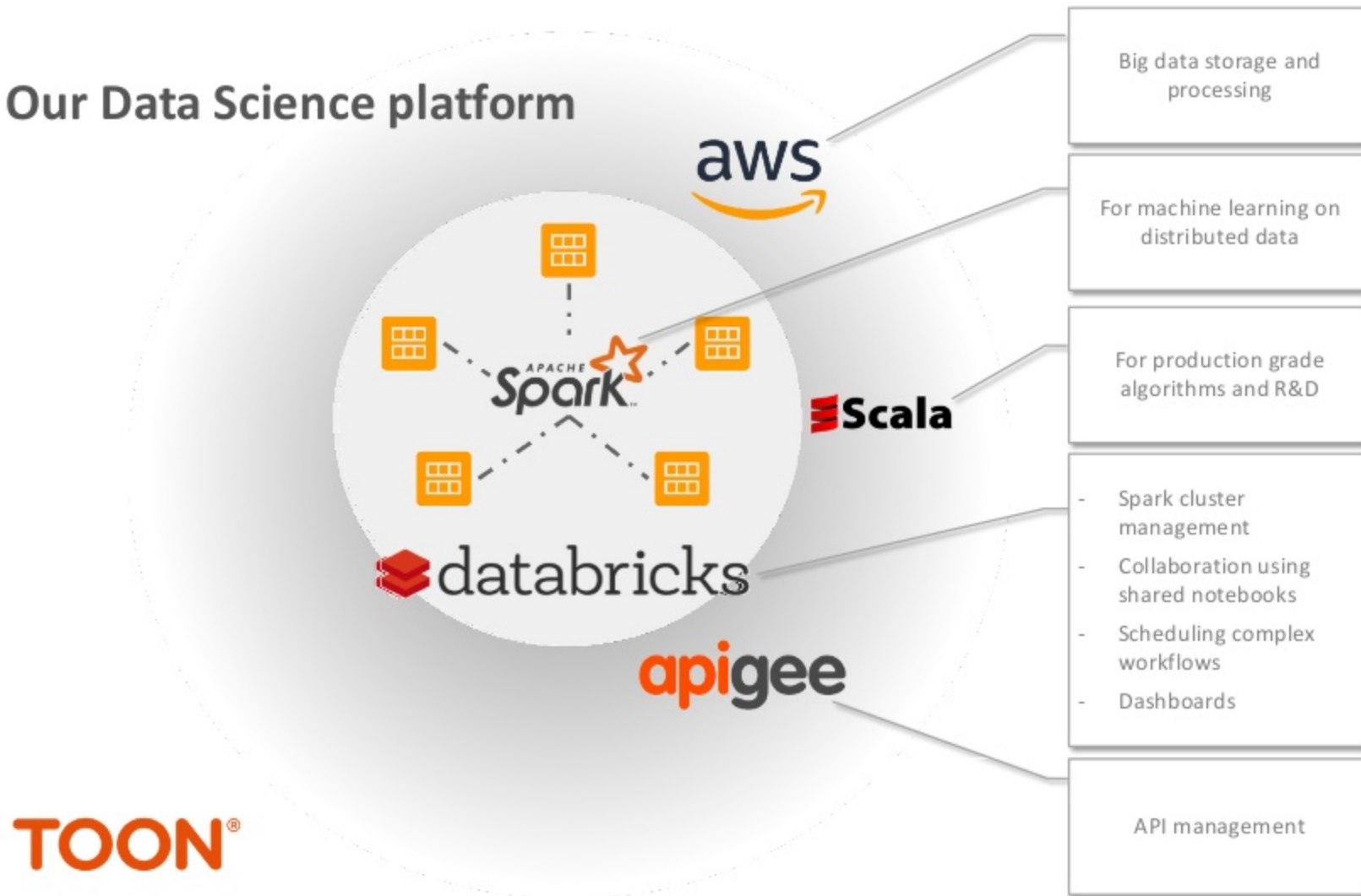
100 MB data
per user
collected per
month

300 types of
sensor and
user
interaction
data



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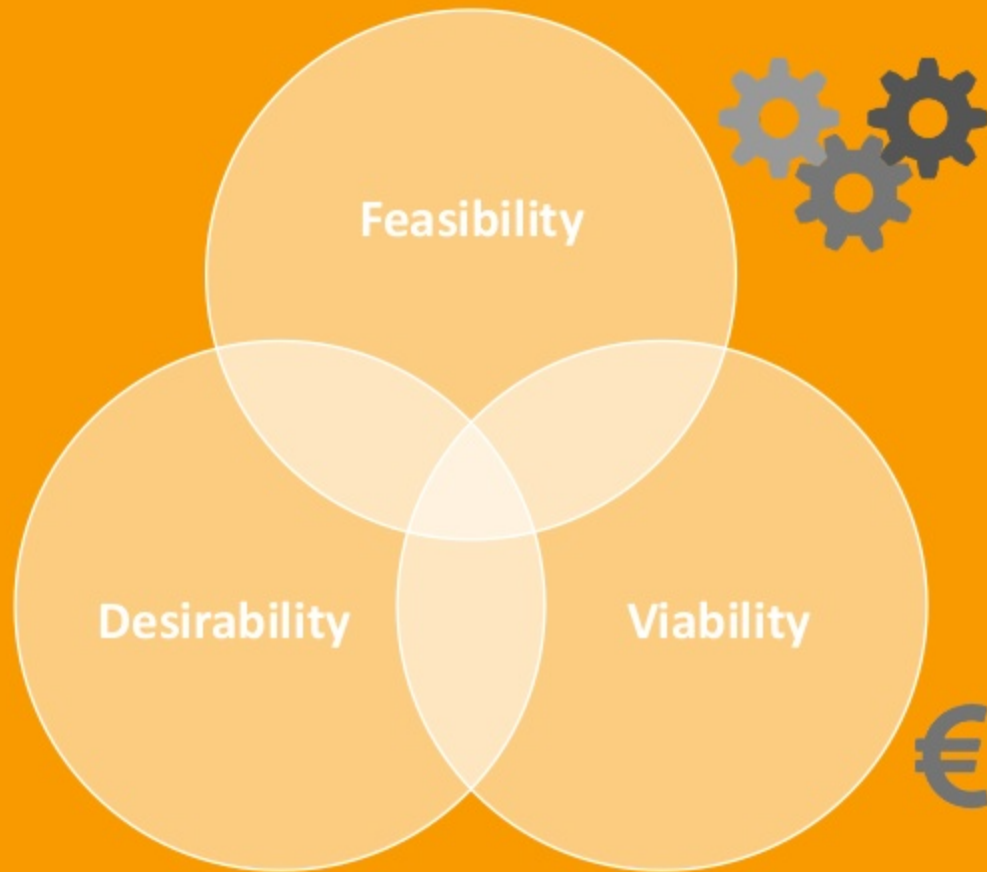
Our Data Science platform



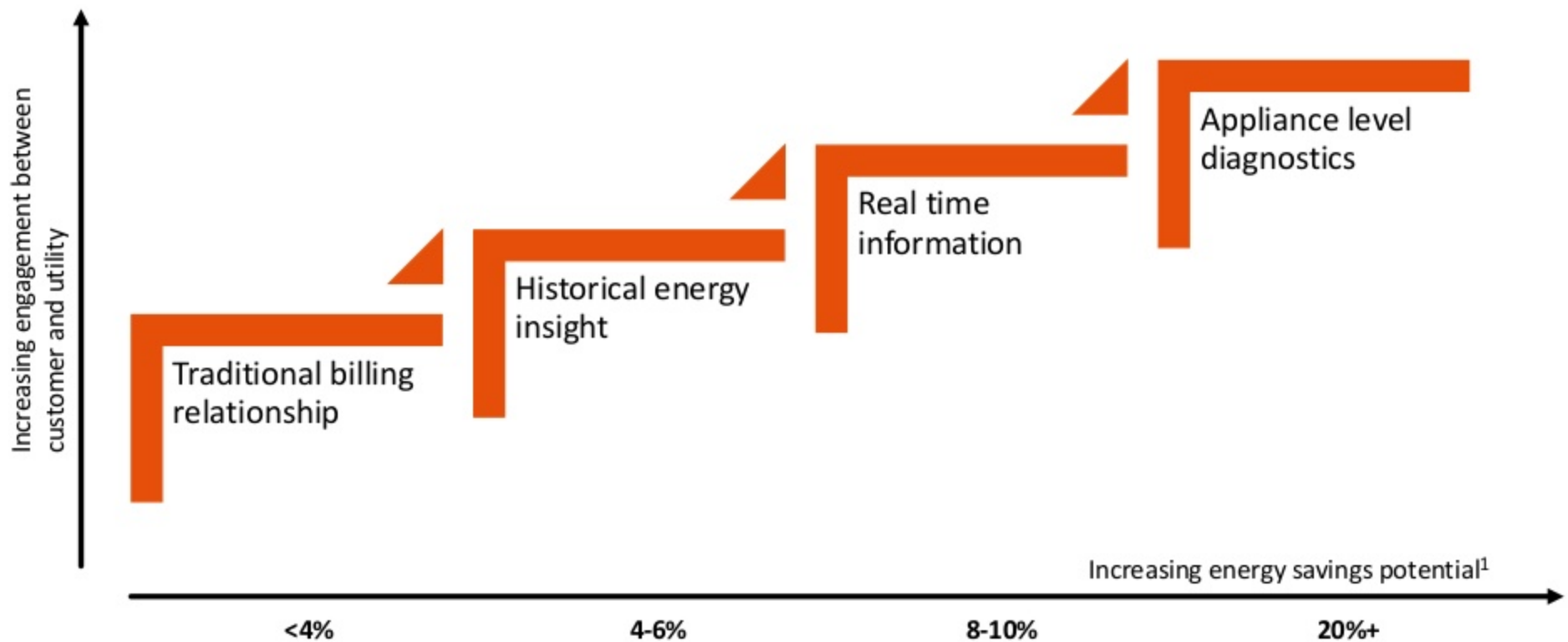
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Creating data driven services





Maximizing energy savings and customer engagement



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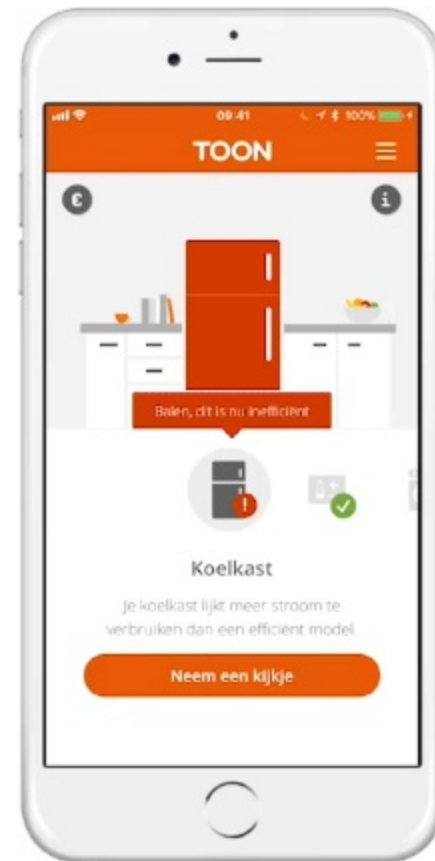
¹Armel et. al., Stanford University (2011)

Energy Waste Checker

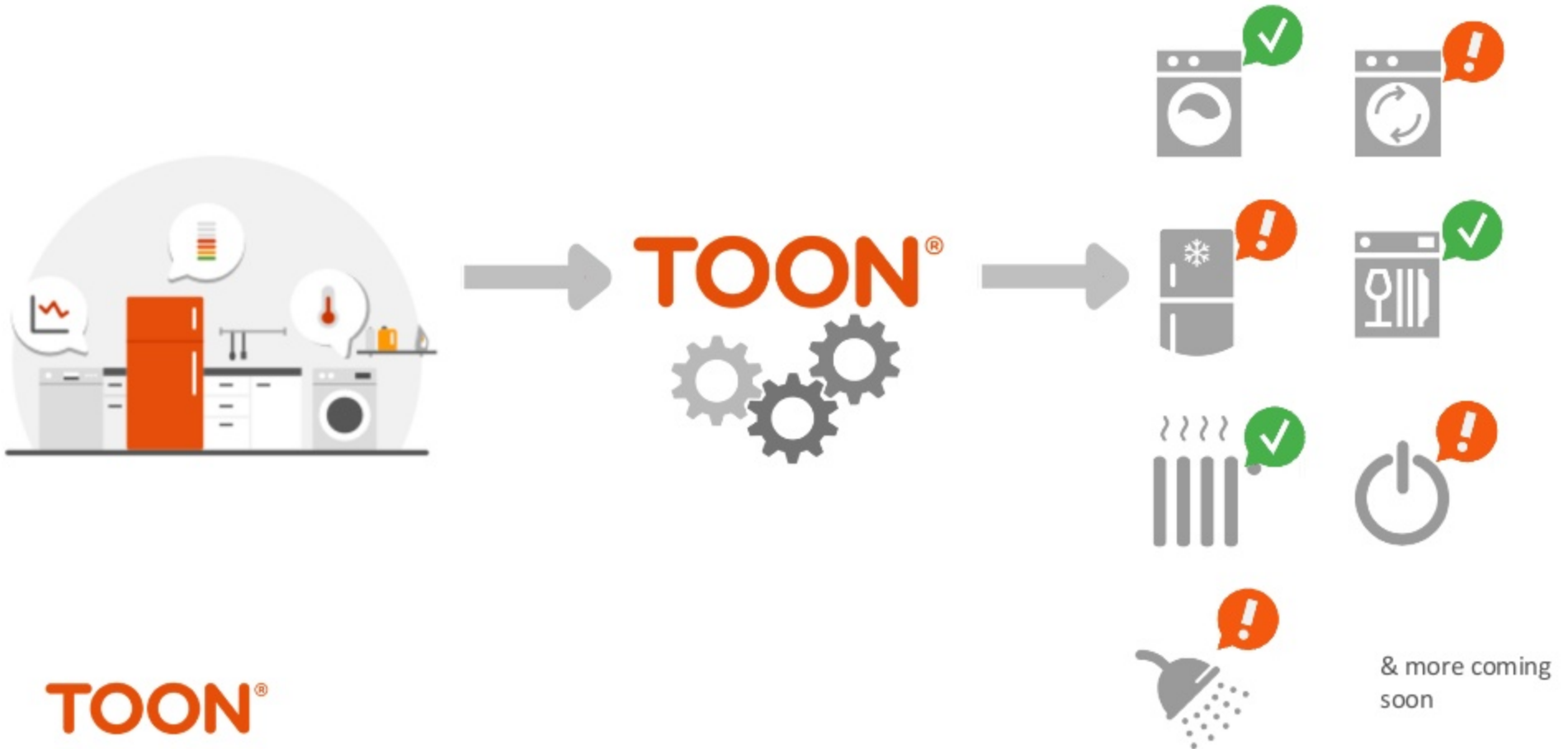
"We don't always notice how much energy we're wasting. Toon can now expose the energy guzzlers in your home."

Launched in December 2017 to all
Eneco Toon users

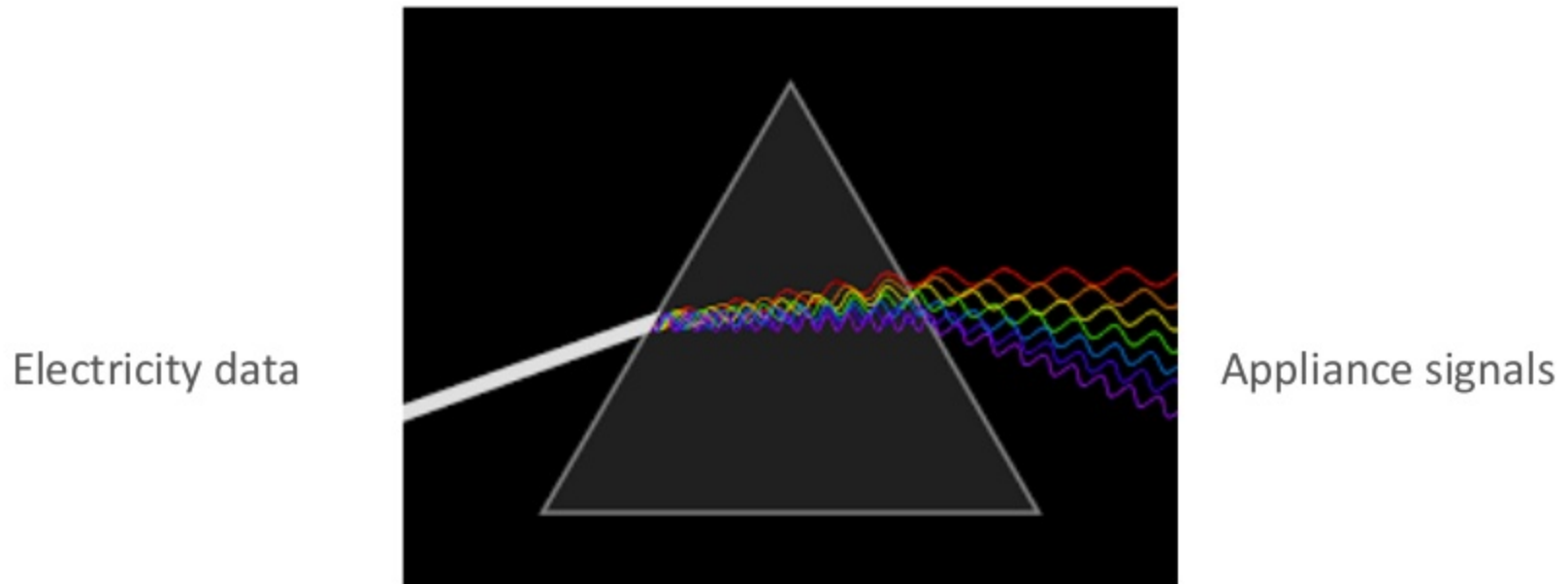
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Toon detects inefficient appliances and behaviours



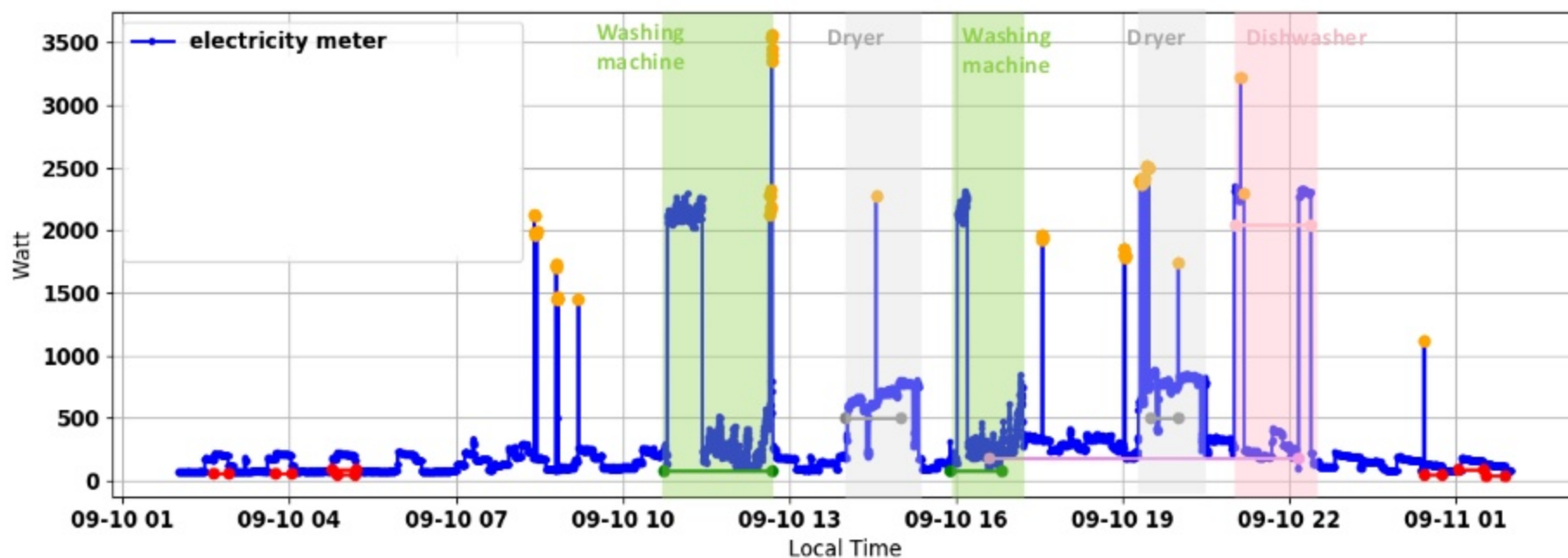
Key technology: **load disaggregation algorithms**



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Quby's disaggregation algorithms

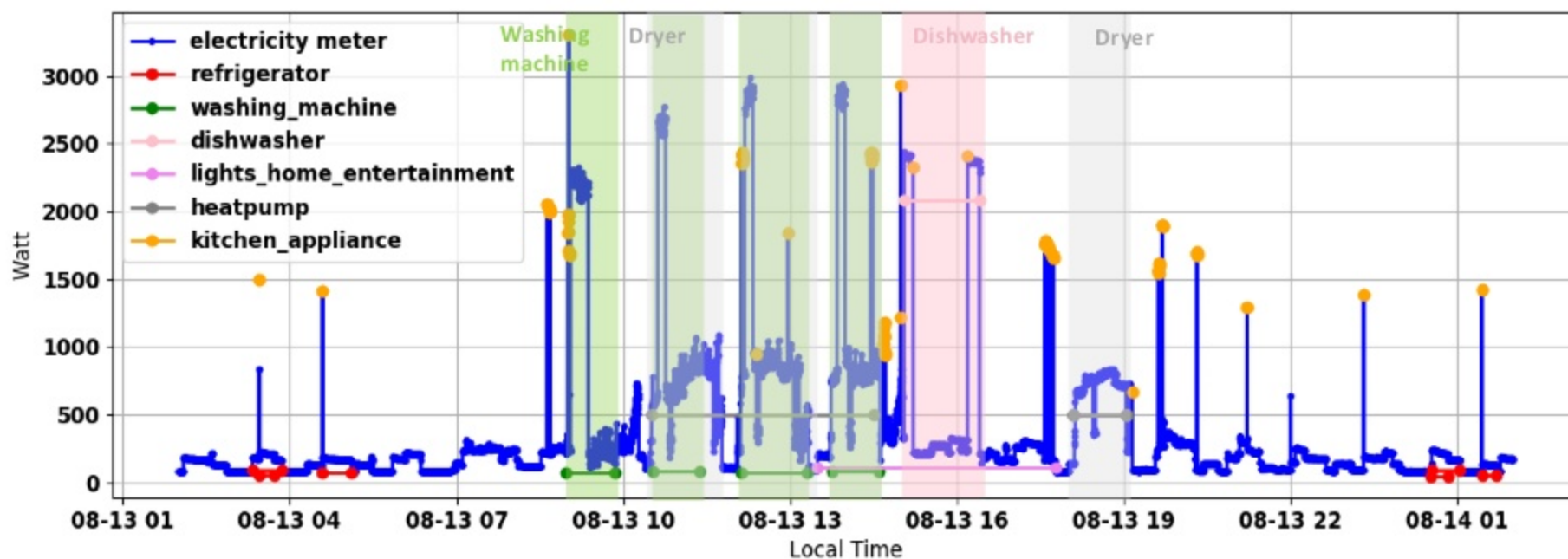
Patent pending algorithms can detect appliances from 10 second resolution electricity meter data



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Quby's disaggregation algorithms

But users try to make it complicated for us...



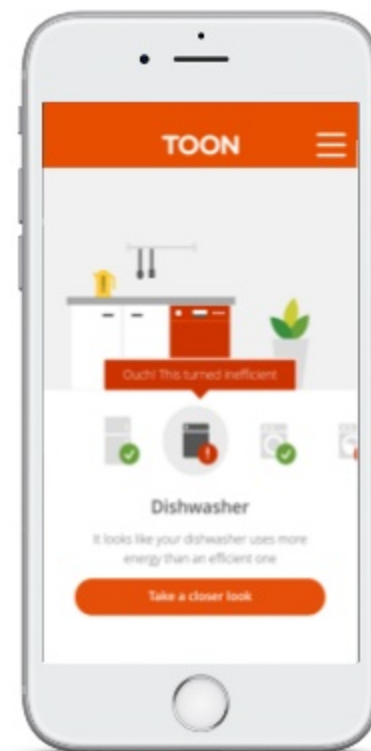
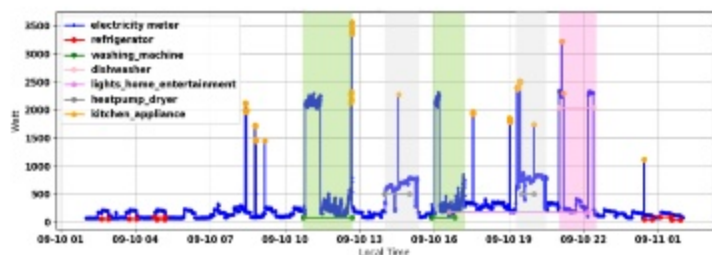
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Use case example: Inefficient dishwasher diagnosis

Disaggregation algorithms run on the 10s electricity meter data

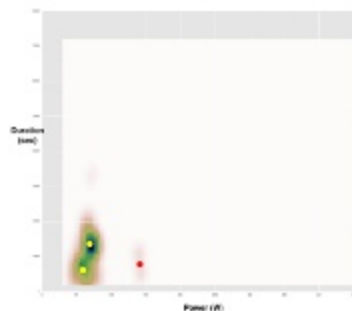
Compared with industry energy consumption standards and peers

Translated to personalised advice for the end user



Toon determines the "fingerprint" of the appliance through features

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Scale of the Waste checker



Each day we detect over
75,000 dishwasher
cycles

That's
13 years
of dishwashers running
continuously

and over
25% are
used
inefficiently

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POP QUIZ

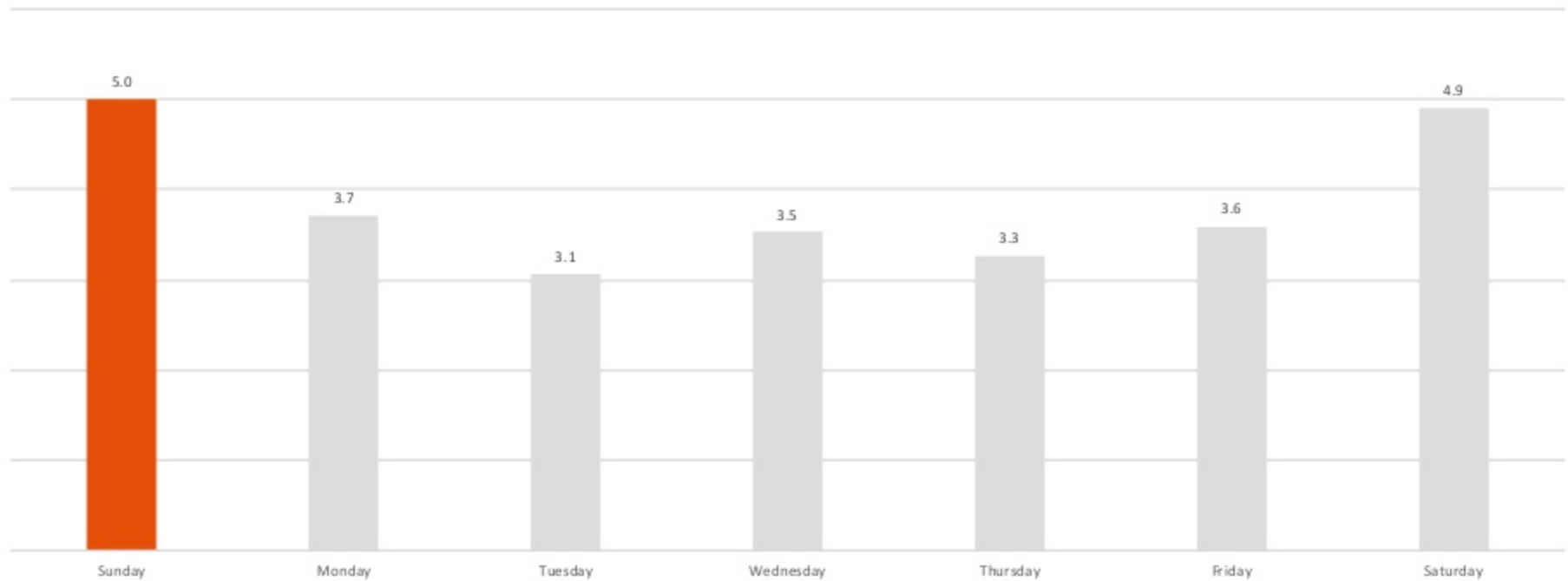
Which is the most popular day of the week to do the laundry?



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It's Sunday!

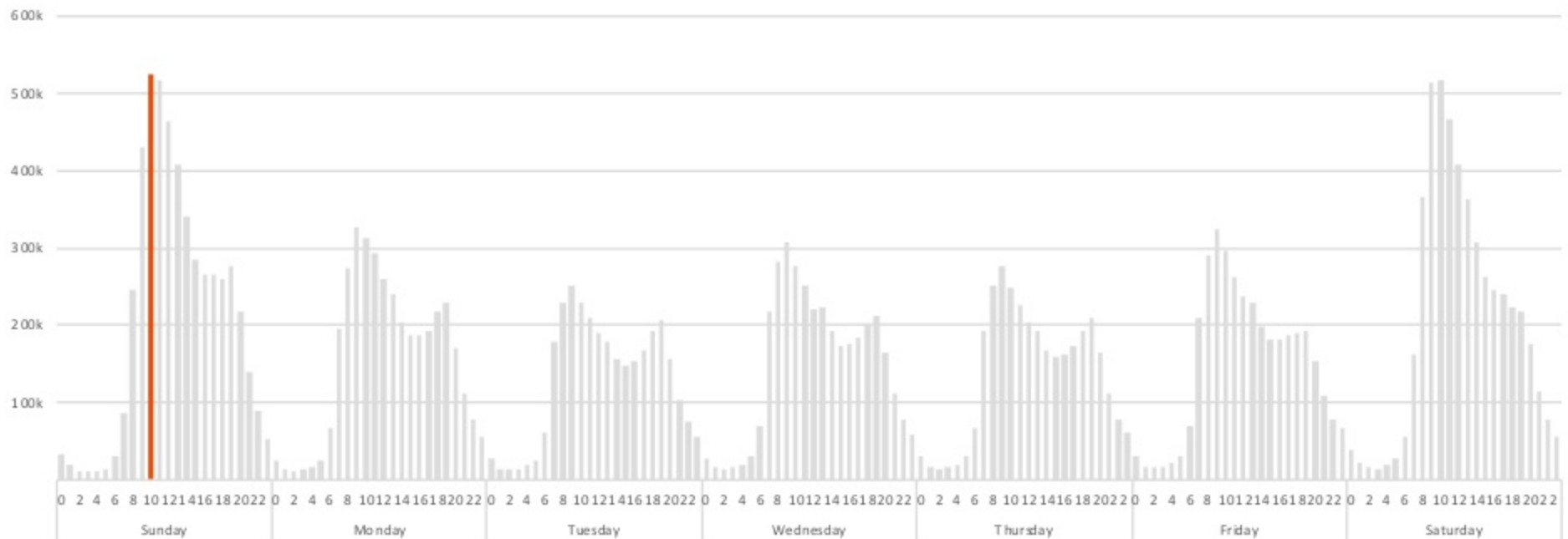
with 5.0 million of the 27 million washing machine detections we've made in 2018 so far



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It's Sunday!

with 5.0 million of the 27 million washing machine detections we've made in 2018 so far



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Heating system anomaly detection



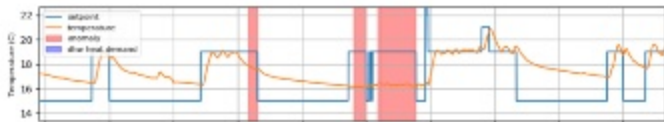
Enhancement to our existing Boiler
Monitoring service

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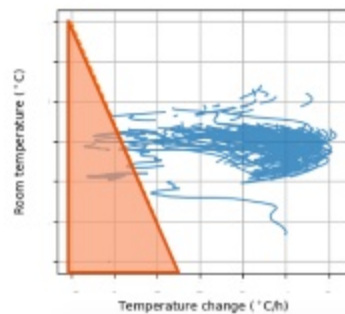


Heating system anomaly detection

1. Boiler and thermostat data are constantly monitored by Toon



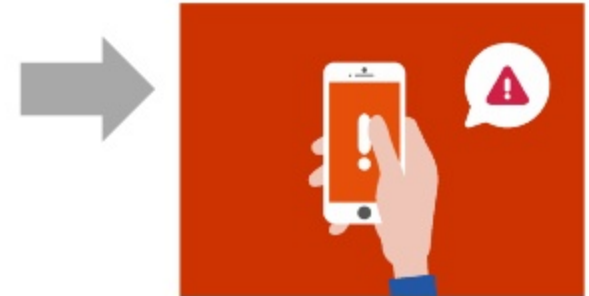
2. Toon determines when the system leaves its normal operating range



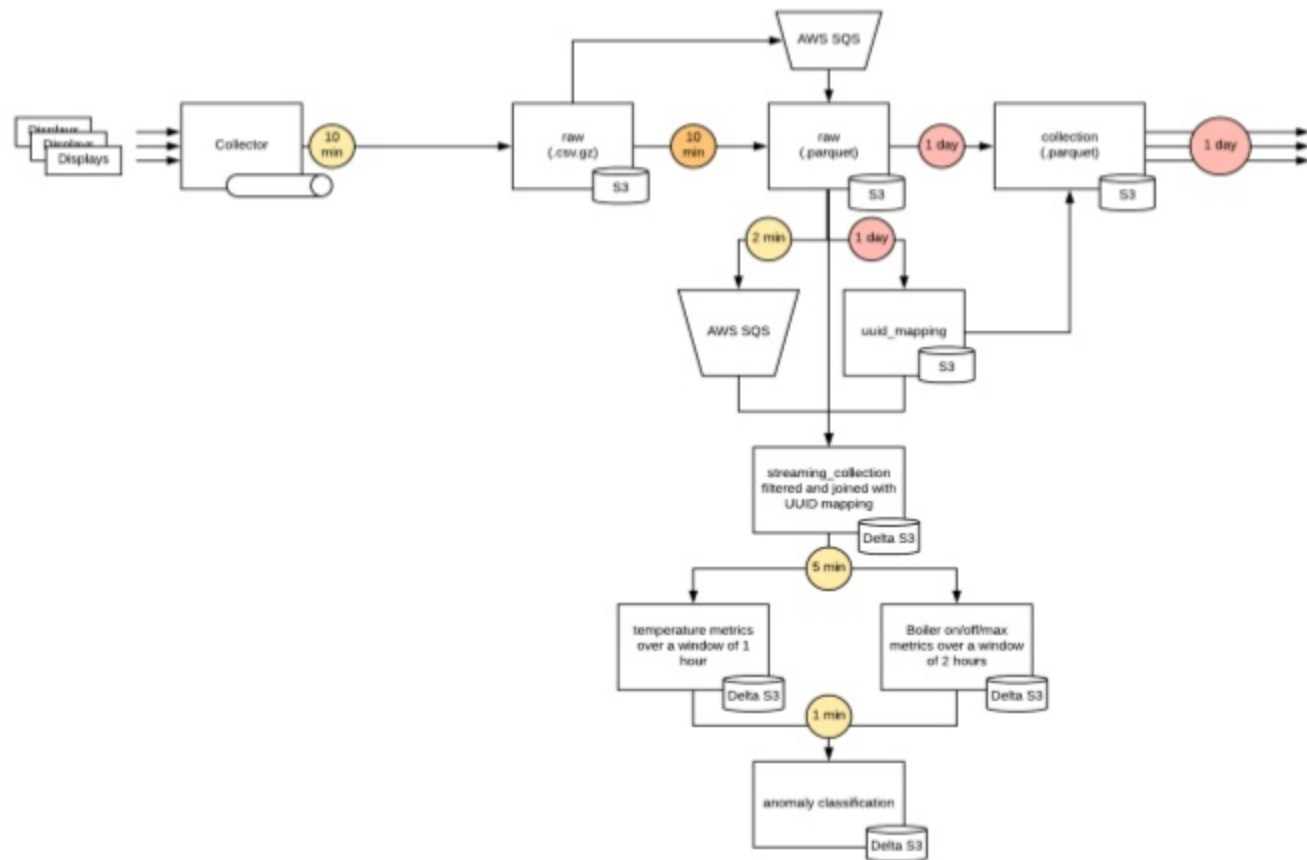
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3. Severity and user preferences taken into account

4. Toon user is alerted



Heating system anomaly detection



5 things we learned



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#1: We love Spark

Machine learning on distributed data is key to all of this working at scale.

An example: Spark's window functions work great for time series data.

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#2: We prefer Scala now

Moving from Python to Scala takes effort but it's worth it.

An example: We define our dataset schemas statically. Static typing and type inference in Scala helps enforce these schemas.

#3: We live in the cloud

Rather than taking care of the infrastructure, data engineers can concentrate on how to make data available to the business.

The Databricks platform gives us cluster timeouts, autoscaling, spot instances...all without the need for additional FTEs.

#4: 'In production' is not the end

Continuous feedback from hundreds of thousands of users means there's always improvements to make.

An example: Our users told us that they wanted more information about their efficient appliances, such as heat pump dryers. We productionized a **deep learning** model to give them this info.

#5: Full-stack data science rocks!

Build and run, from initial concept to end result. Making services that our end users will love.

Working together we deliver state-of-the-art algorithms operating at scale in production.

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