Digitalization in Energy (6 Key Questions)

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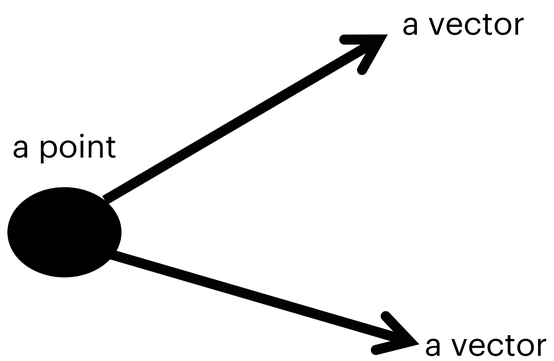
Main Question

What is the vector-direction of digitalization?



6 Questions

- Digital twins
- Digital postoffices
- Beyond AI
- Virtualization
- No consumer disturbance
- Humanless Energy Services

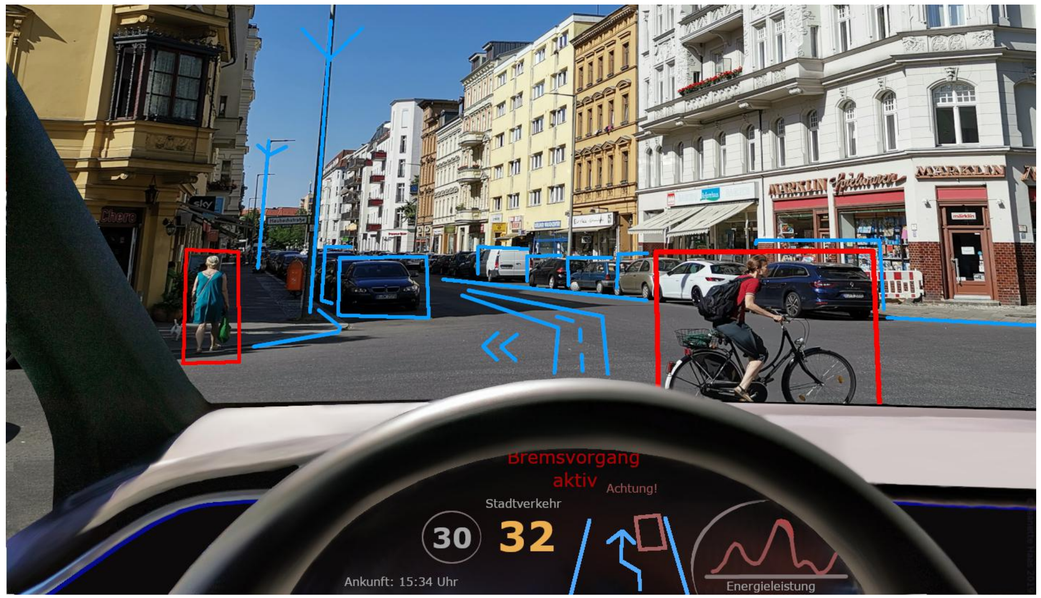
http://barissanli.com/calismalar/2021/20210320-edider.pdf

An example : Private driver

- There are very few people with private “chauffeur”
- You pay
  - Salary
  - Taxes
  - Insurance
- Is it 24/7?
- There are lots of driving jobs (Pandemic)

What if?

- You can rent a service (Taxi/uber)
- Completely software based
- On-demand/within reach 5 minutes
- Autonomous Cars
  - Creates a new business environment
  - You can disaggregate the whole service
  - Create different services
    - Urgent/Vacation/Business
  - Customize it to all levels
  - Remember telephone services? (operator connection etc)



The whole logic

- Human is the most costly element of all systems
- For example energy audits
  - Turkey's case
- What-if “virtual audits”
- Automated virtual audits + drone thermal imaging
- All controlled by software
- Cost decrease
- Service volume
- Cable TV or streaming service

Emerging crossings

- Not only chips & interneet
- More data
- More insight
- More behavioural insight
- More digital=?More behavioural
- Less human=more services
- Gig economy

Case study : Learning from Netflix

- Electricity consumer = Netflix/Streaming service consumer
- Personality and expectations do not change a lot
- So what does the new age consumer expect?
- More custom designed services
- Better insight into consumer feedbacks
- Behavioural and AI methods

http://corpsitedev.bidgely.com/wp-content/uploads/2018/12/Netflix-Bidgely-Parallels.pdf

Clustering

- Netflix has 2000 taste groups
- Billing services
- Avoid “bill shock”s

GOLDILOCKS, DATA SCIENTIST?

Clustering is most effective when it balances personalization with scalability. Enter data scientists, who optimize clusters for size and coverage, just like goldilocks.

PERSONALIZING CUSTOMER SUPPORT

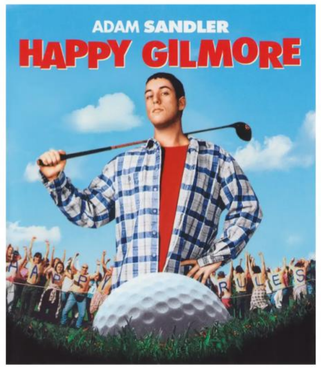
Effective clustering can be used to help utilities handle high bill calls more efficiently. By incorporating income and/or payment history (e.g. customer is typically late in paying their bill) into the clustering analysis, Bidgely can help pre-determine if a customer is more likely to need help setting up payment terms – something that may be automated over the phone or even handled via web. Conversely, by disaggregating appliance consumption data, Bidgely can predict and prepare call center reps for seasonal and/or “bill shock” calls, in which a human is best suited to answer questions.

http://corpsitedev.bidgely.com/wp-content/uploads/2018/12/Netflix-Bidgely-Parallels.pdf

Declared vs Revealed Preferences

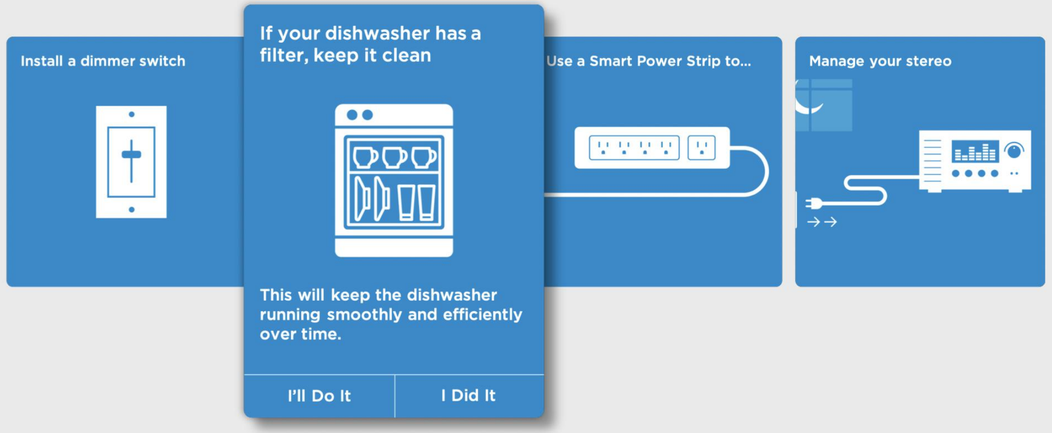
- User feedback is noisy
- Thumbs up/down better than 5 star
- Surveys: Consumer may not remember ...

In 2017, Netflix eliminated its long-standing 5-star rating system in order to more accurately capture user feedback. What they had found was that a user might watch a single highly-acclaimed documentary and rate it 5 stars, but watch ten universally-panned Adam Sandler movies and rate them 3 stars. So while user feedback indicated that they rate documentaries higher (perhaps they felt an obligation due to critical acclaim), their actual behavior (that they love watching Adam Sandler movies) differed significantly. By moving to a thumbs up/down rating system, not only was Netflix able to continue capturing actual user behavior (what movies they watch), Netflix also saw an over 200% increase in total feedback, and the feedback has proven more accurate (the user above is more likely to give both the documentary and the Adam Sandler movies thumbs up).



OPTIMIZING WITH FEEDBACK

Bidgely's appliance-level recommendations have an "I did it / I'll do it" feature that serves two purposes for customers: clicking "I'll do it" populates a customer to-do list, while clicking "I did it" removes the recommendation for that customer. At the same time, each click provides the utility with valuable feedback on what recommendations are capturing the most interest, enabling further program optimization.



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Design Matters

- Different groups need different communications

PERSONALIZING ARTWORK

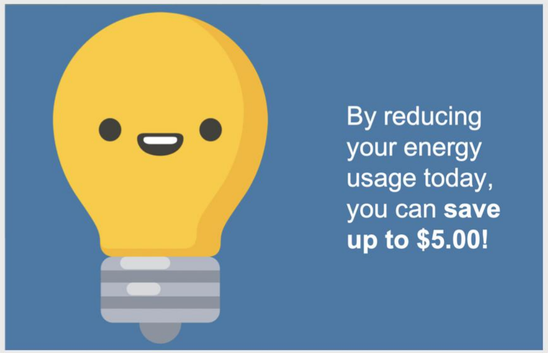
Someone who has watched romantic movies might be shown artwork containing Matt Damon and Minnie Driver, while someone who has watched comedies might be shown artwork containing Robin Williams.

PERSONALIZED EE MESSAGING

Clustering helps Bidgely determine how to best personalize its communications with each customer.

ENVIRONMENTAL CLUSTER

MONETARY CLUSTER



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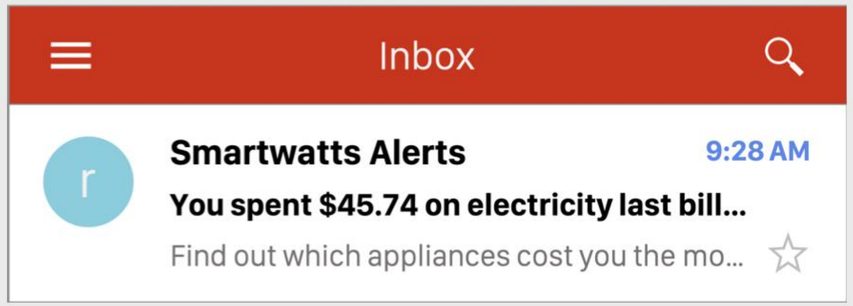
Experimentation and Testing

- Engaging consumers

OPTIMIZING OPEN RATES

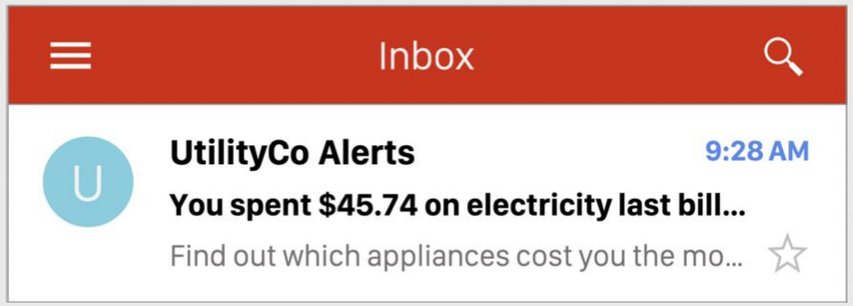
In the example below, a utility was running an EE program and was interested in using the program name as the branding for all communications. However, when Bidgely tested the program name and the utility's name in the email subject line, the utility name showed significantly higher open rates, prompting a course correction towards the utility name.

PROGRAM NAME



29% Open Rate

UTILITY NAME



41% Open Rate

http://corpsitedev.bidgely.com/wp-content/uploads/2016/12/Netflix-Bidgely-Parallels.pdf

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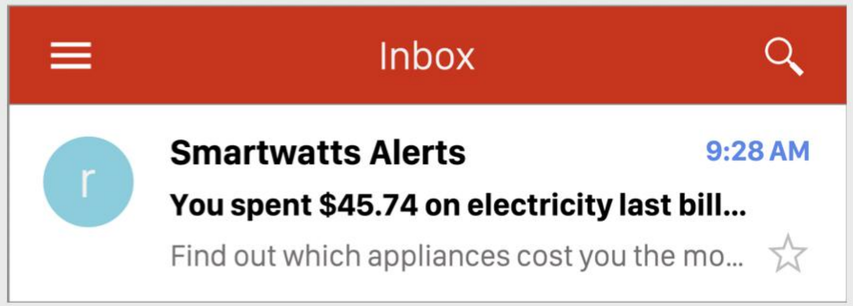

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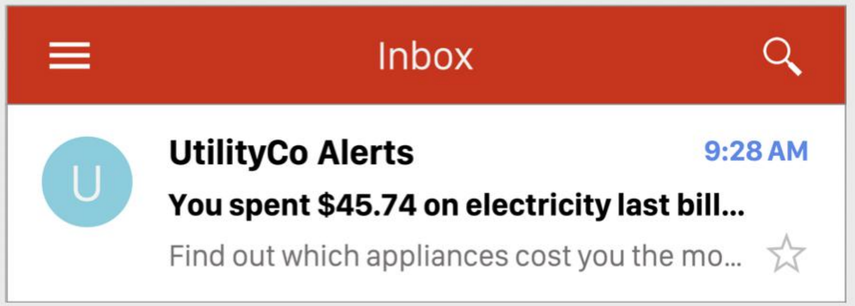

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New Business Models : Bidgely

Customer Experience

- Hyper-Personalization
- AI-Powered Smart Alerts
- Digitalization

Create individual journeys for all your customers powered with energy intelligence from the meter

LEARN MORE

Call Center

- Customer Representative Energy Advisor
- Remote Audit
- High Bill Analyzer

Confidently solve your customer's energy concerns with personalized energy advice generated by UtilityAI

LEARN MORE

Energy Efficiency

- Behavioral Energy Efficiency
- Behavioral Demand Response
- Demand Side Management Targeting & Recruitment

Leading providers are switching to Bidgely to take advantage of energy analytics for all their DSM related programs

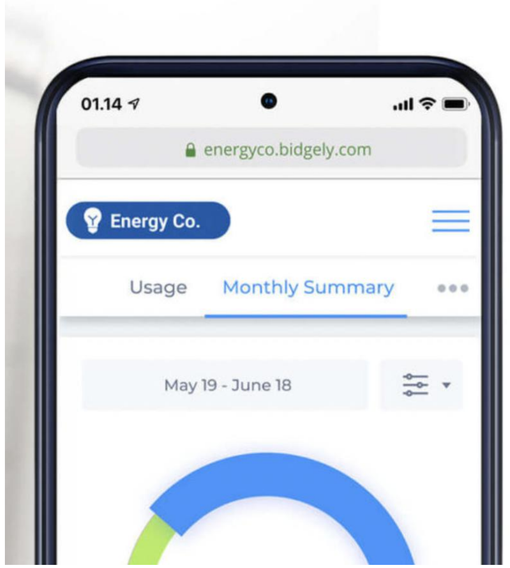
LEARN MORE

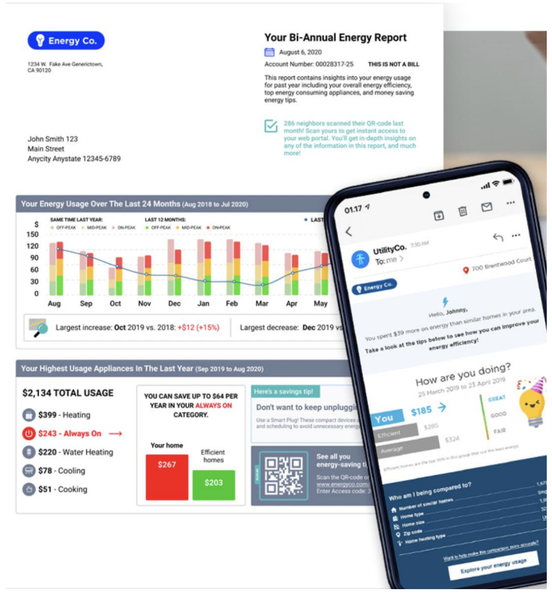
Smart Shop™

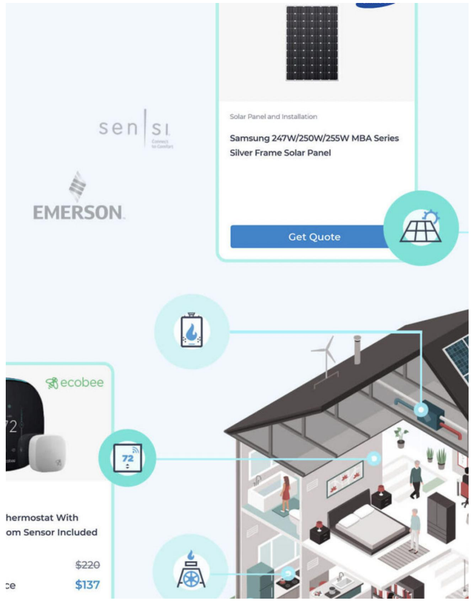
- Personalized Product & Service Offerings
- Exclusive Manufacturing Discounts
- Near Real-Time Rebate Processing

Reimagine your Marketplace with personalized marketing built in

LEARN MORE







SOLUTIONS

Digital Customer Experience

HER 2.0

Virtual Energy Assessment

Gas

Enterprise Analytics

EV Solution

Small Medium Business

Smart Shop Marketplace

Call Center Customer CARE

CX TRANSFORMATION

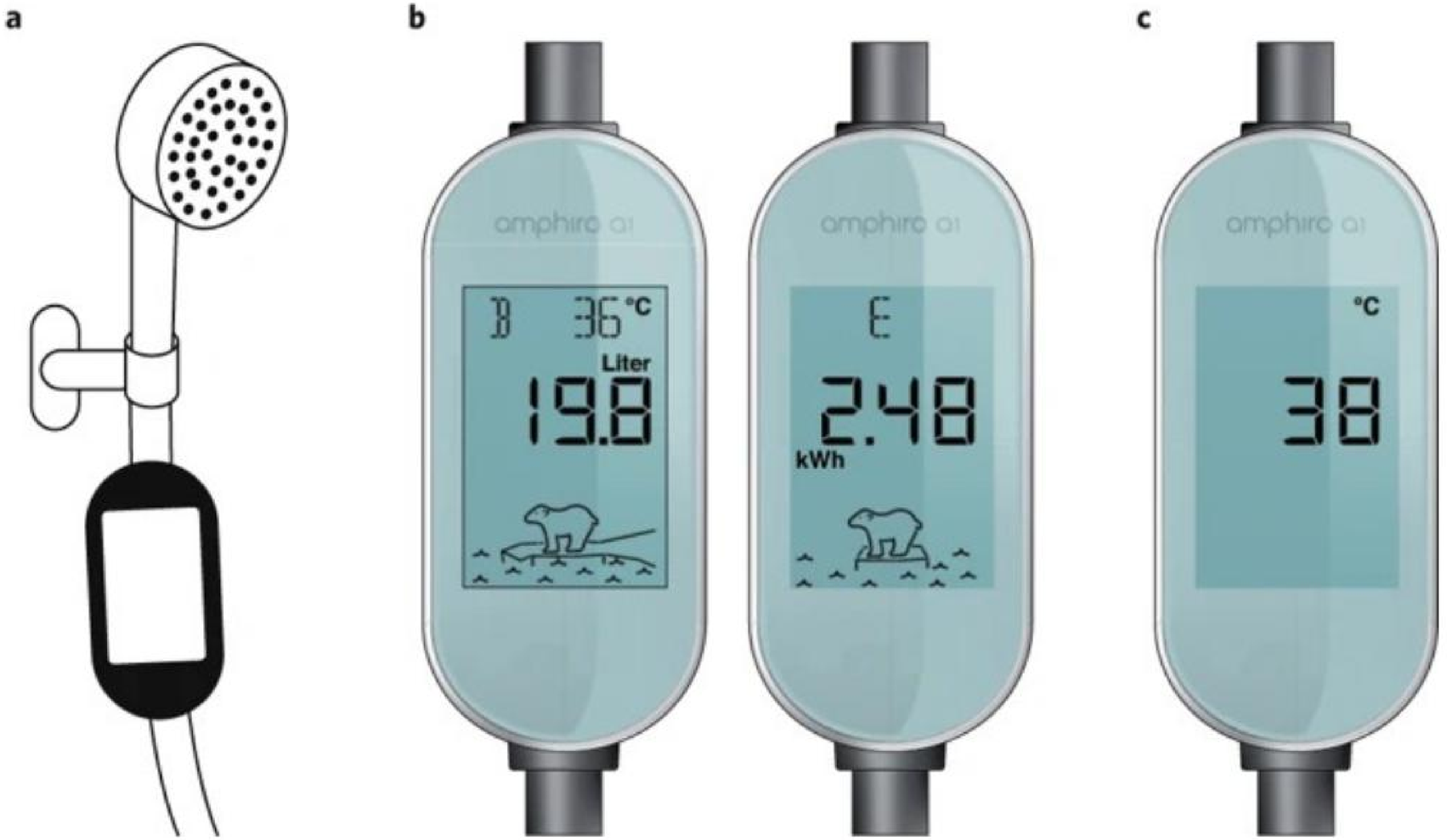
Digital HER

Paper HER

AI-Powered Alerts (Web, Email, SMS & Mobile)

http://www.bidgely.com/

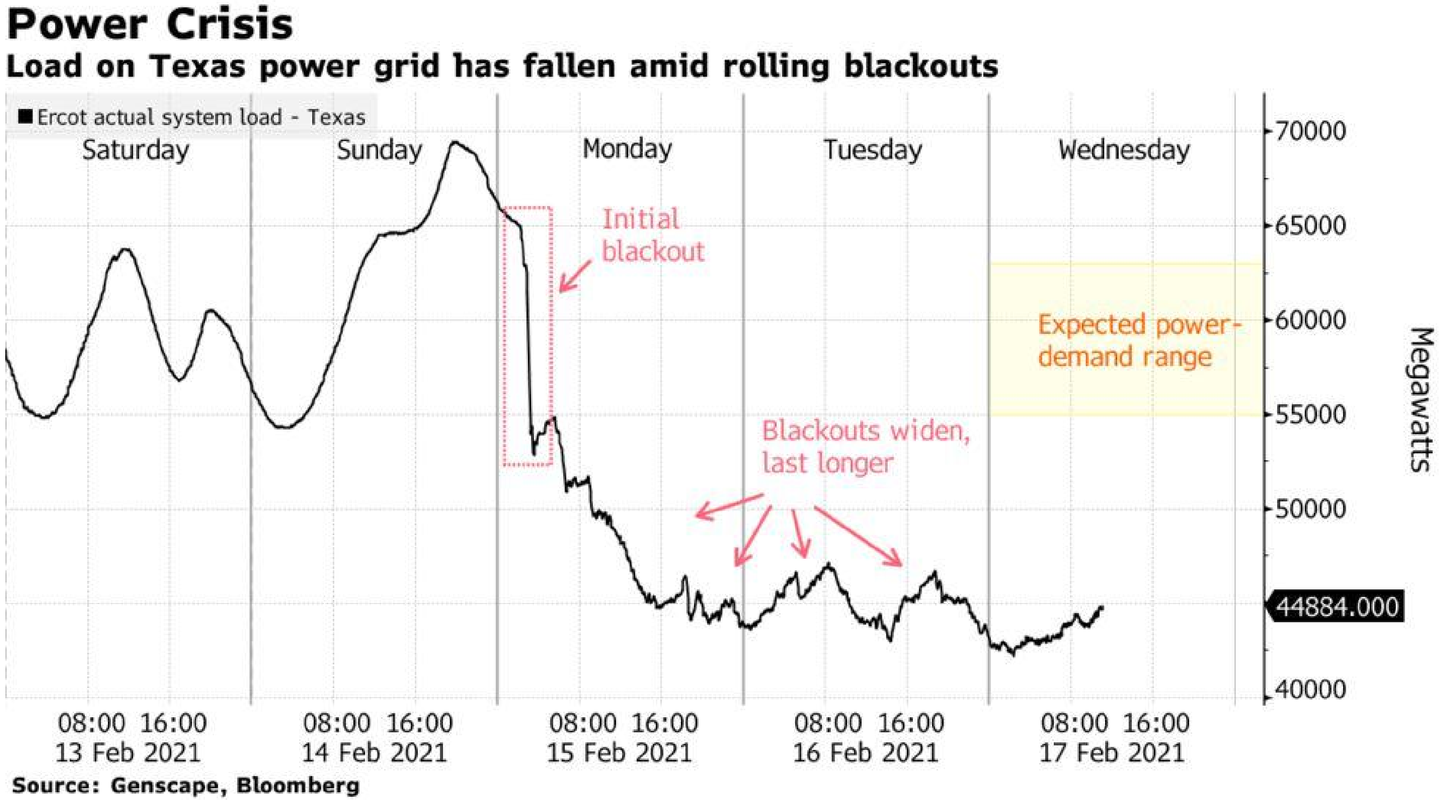
Case Study - New Business Models



Real-time feedback reduces energy consumption among the broader public without financial incentivesVerena Tiefenbeck, Anselma Wörner, Samuel Schöb, Elgar Fleisch & Thorsten Staake Nature Energy volume 4, pages831–832 (2019) https://www.nature.com/articles/s41560-019-0480-5

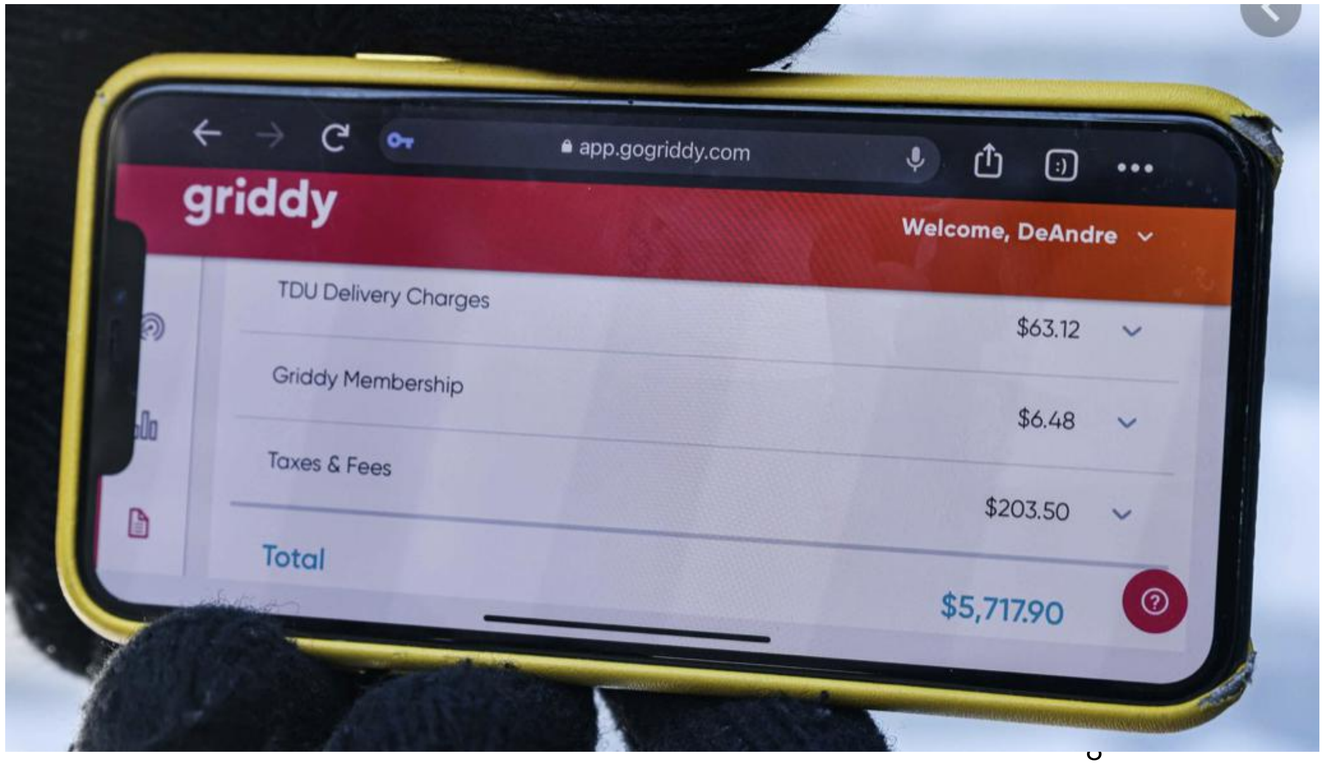
Case Study - Texas Energy Crises

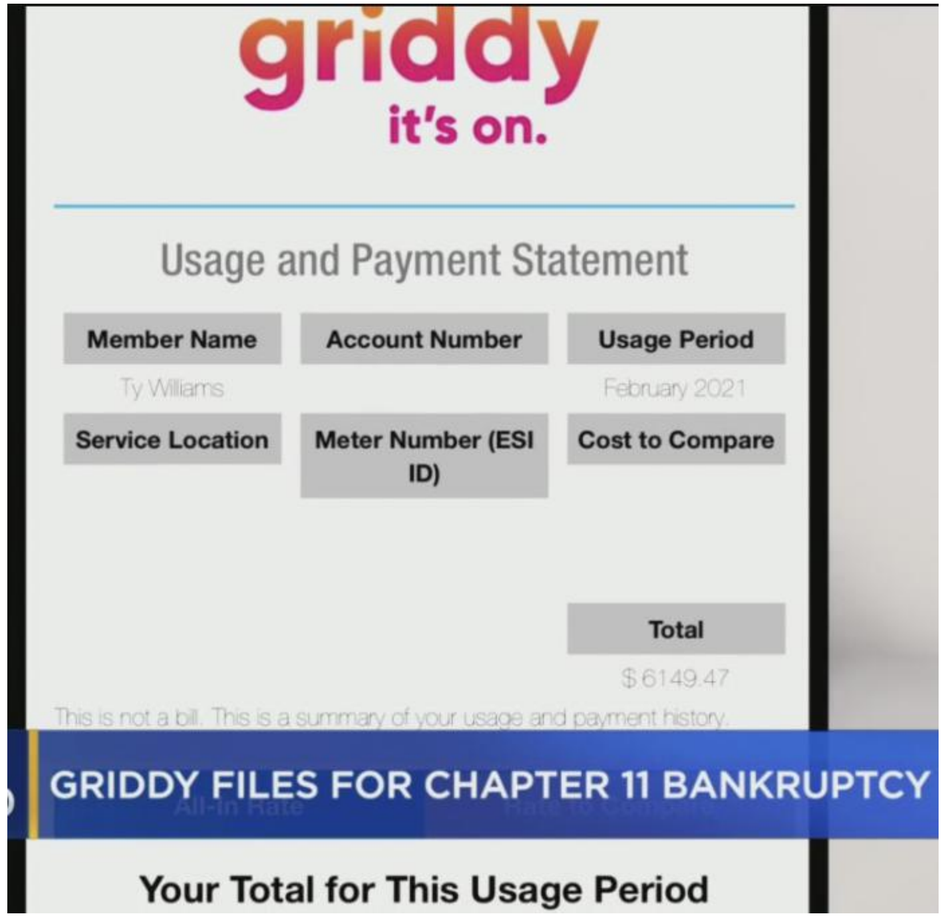
- Polar Vortex
- Wind turbines
- Natural gas transportation
- Blackouts
- Limits of computer software



Griddy

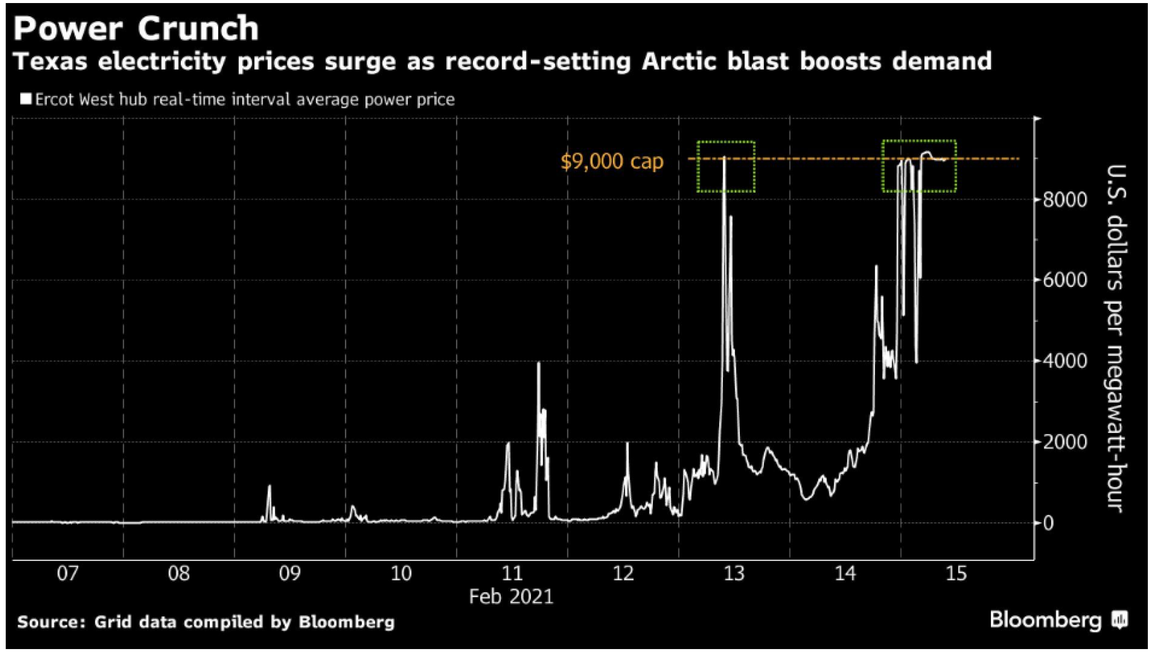
- 10 $ monthly subscription
- Wholesale prices





Wholesale price peak

- What has happened?
  - Trying to bring more reserve
  - Computer program decrease price
  - Skip the program and declare 9000$/MWh

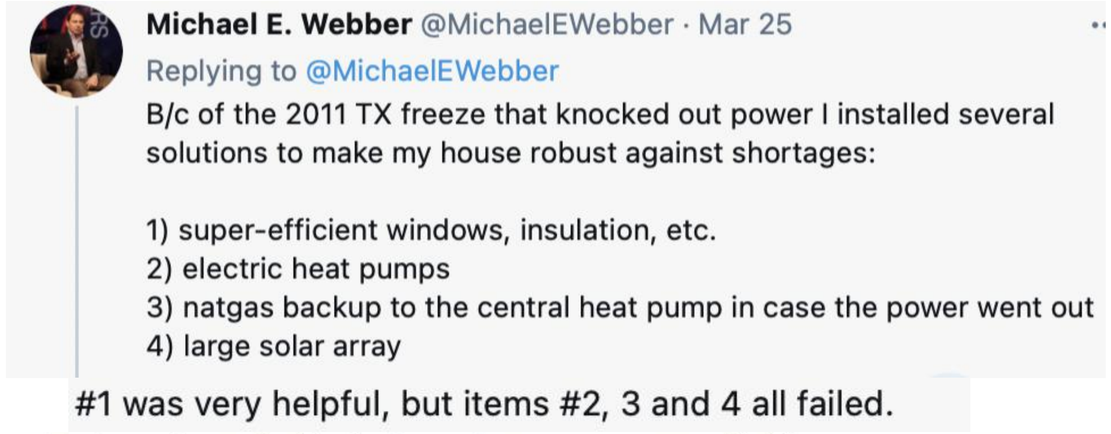


- Griddy consumers

- Little time to warn consumers
- Consumers are not that flexible
- not protected from wholesale price fluctuations

A consumer perspective

- Remote control's disadvanteges



Michael E. Webber @MichaelEWebber · Mar 25

Replying to @MichaelEWebber

B/c of the 2011 TX freeze that knocked out power I installed several solutions to make my house robust against shortages:

1) super-efficient windows, insulation, etc.
2) electric heat pumps
3) natgas backup to the central heat pump in case the power went out
4) large solar array

#1 was very helpful, but items #2, 3 and 4 all failed.

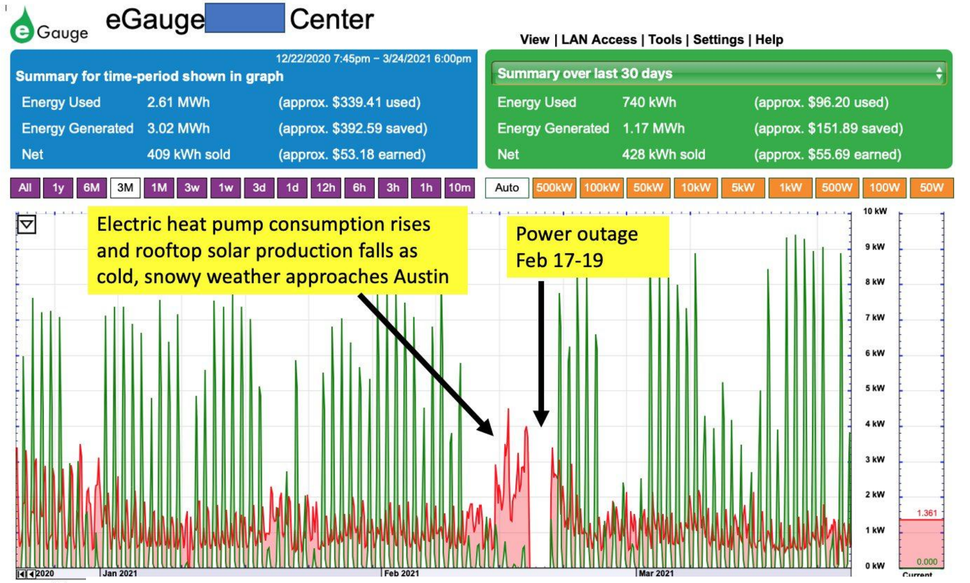
My house is enrolled in the Power Partners program, which lets @austinenegy cycle my A/C on/off in the summer for a few minutes at a time to reduce peak demand. Across all the city's air conditioners, it saves 50+ MW of peak demand, which is significant.

savings.austinenergy.com/rebates/reside...

2 1 19

Michael E. Webber @MichaelEWebber · Mar 25

I had no idea that they would also use that ability to cycle my heat pump (essentially a reversed A/C) on/off. In the summer they might turn off my A/C a few mins/hour. But the depth of the energy crisis was so bad the situation was reversed: I only had heat a few mins/hour.



Unfortunately, solar panels don't work when the power is out unless the home has a battery (for safety reasons: if solar panels send power back onto the wires, it can electrocute line workers making repairs). I don't have a battery so my house lost power despite the solar panels.

2 2 25

Michael E. Webber @MichaelEWebber · Mar 25

But what about the gas backup for my heating system?

The gas backup (and gas water heater) have electronic controls, ignition, blower, etc. When the power went out, I also lost my gas heat.

The house got even colder. Not quite life-threatening, but we were headed that way.

https://twitter.com/MichaelEWebber/status/1374922246783971332

Case Study:How to use daily Covid data?

```
# 5. Now get the google mobility report in CSV then filter TR part
googleurl="https://www.gstatic.com/covid19/mobility/Global_Mobility_Report.csv"
googledata=pd.read_csv(googleurl)
trdata=googledata[(googledata.country_region_code=="TR") & (googledata.sub_region_1.isna())]
```

- Covid and Electricity Consumption
- EEPS520 course
- Full code available
- Covid mobility data from Google/Apple
- Electricity data from EPİAŞ
  - Simple Linear regression
- Residential vs Total consumption

```
# 10. now we initiate the whole dataset with columns work, commercial etc maxrows of 284
# number of columns
# make sure that the row numbers for each data is same
maxrows=284
totaldata=pd.DataFrame({'date':dates[0:maxrows],
              'work': work[0:maxrows],
              'commercial':commercial[0:maxrows],
              'residential':residential[0:maxrows],
              'retail':retail[0:maxrows],
              'transit':transit[0:maxrows],
              'parks':parks[0:maxrows],
              'electricity':dailyelectricity.values.flatten()[0:maxrows] })
```

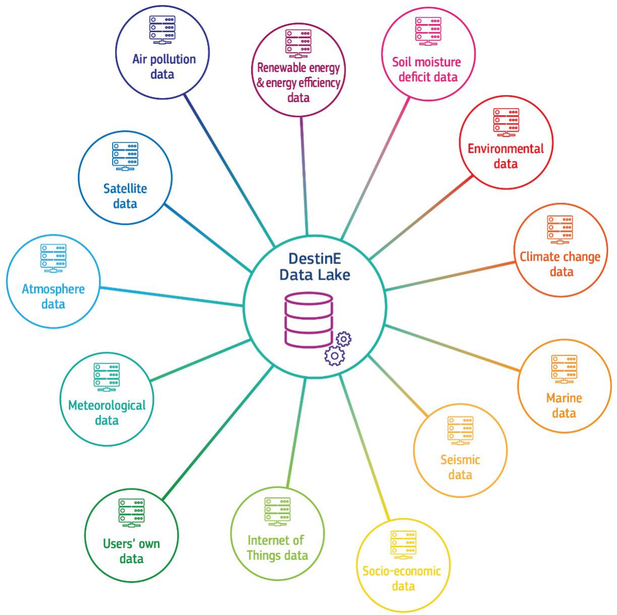
```
# 11. Correlation data from correlogram
totaldata.corr()
```

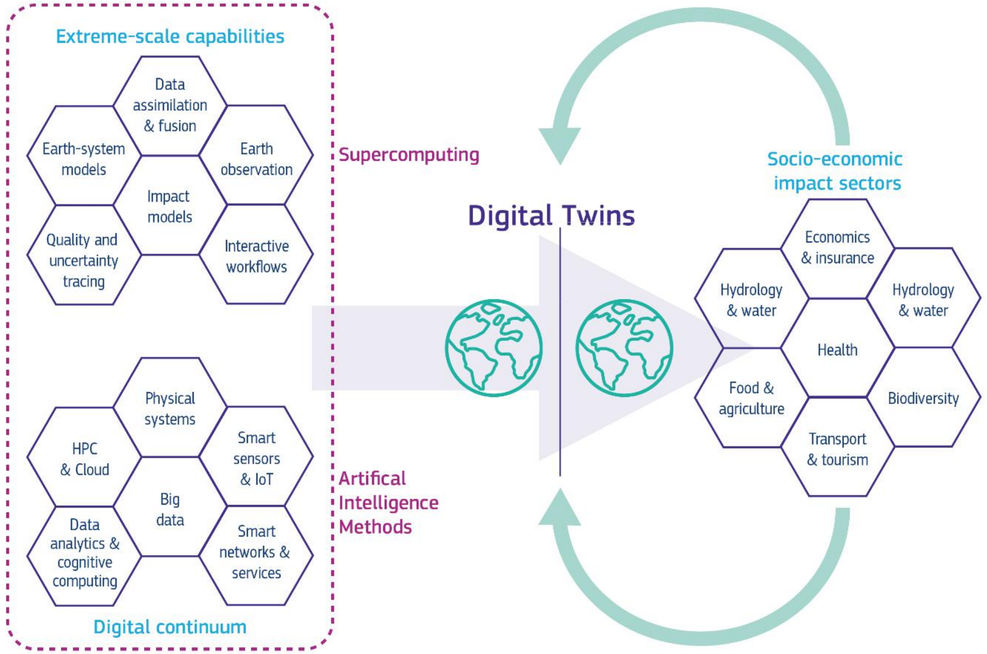
	work	commercial	residential	retail	transit	parks	electricity
work	1.000000	1.000000	-0.882489	0.872141	0.885866	0.631478	0.584756
commercial	1.000000	1.000000	-0.882489	0.872141	0.885866	0.631478	0.584756
residential	-0.882489	-0.882489	1.000000	-0.918531	-0.943874	-0.889814	-0.728920
retail	0.872141	0.872141	-0.918531	1.000000	0.974035	0.802017	0.742920
transit	0.885866	0.885866	-0.943874	0.974035	1.000000	0.829138	0.738101
parks	0.631478	0.631478	-0.889814	0.802017	0.829138	1.000000	0.703587
electricity	0.584756	0.584756	-0.728920	0.742920	0.738101	0.703587	1.000000

http://barissanli.com/calismalar/dersler/eeps520-2020/lecture11_covid.html

Q1 - Digital Twins

- A digital twin of all the electric system
  - Why?





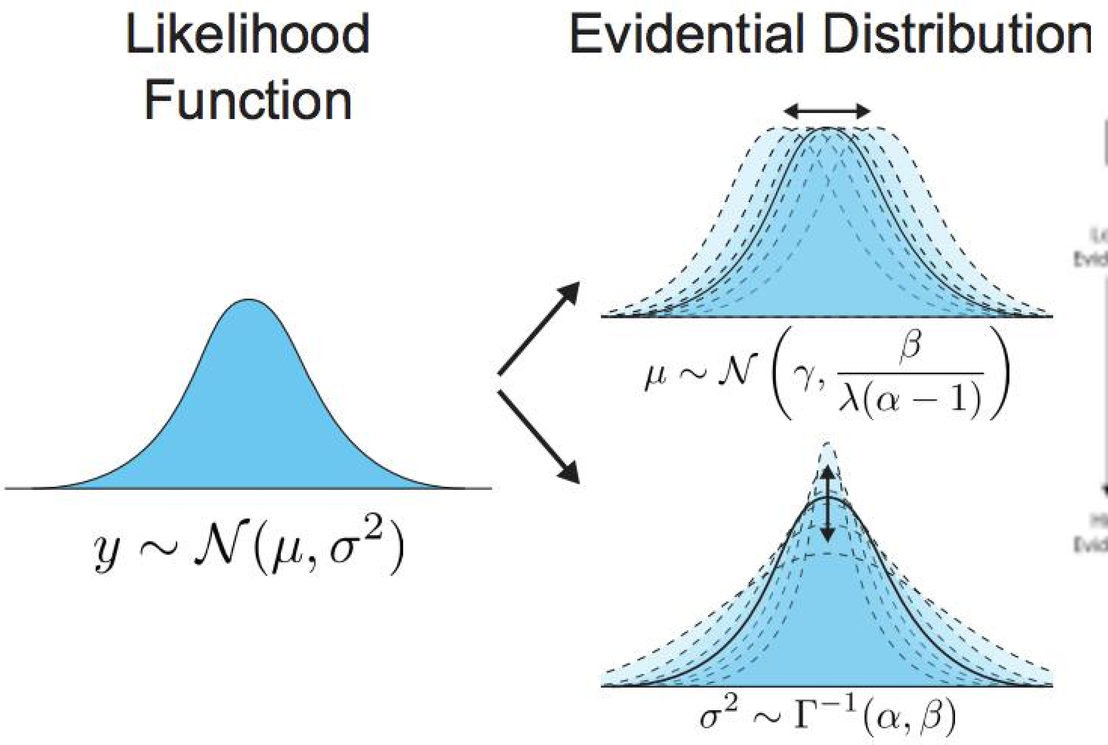
https://digital-strategy.ec.europa.eu/en/library/destination-earth

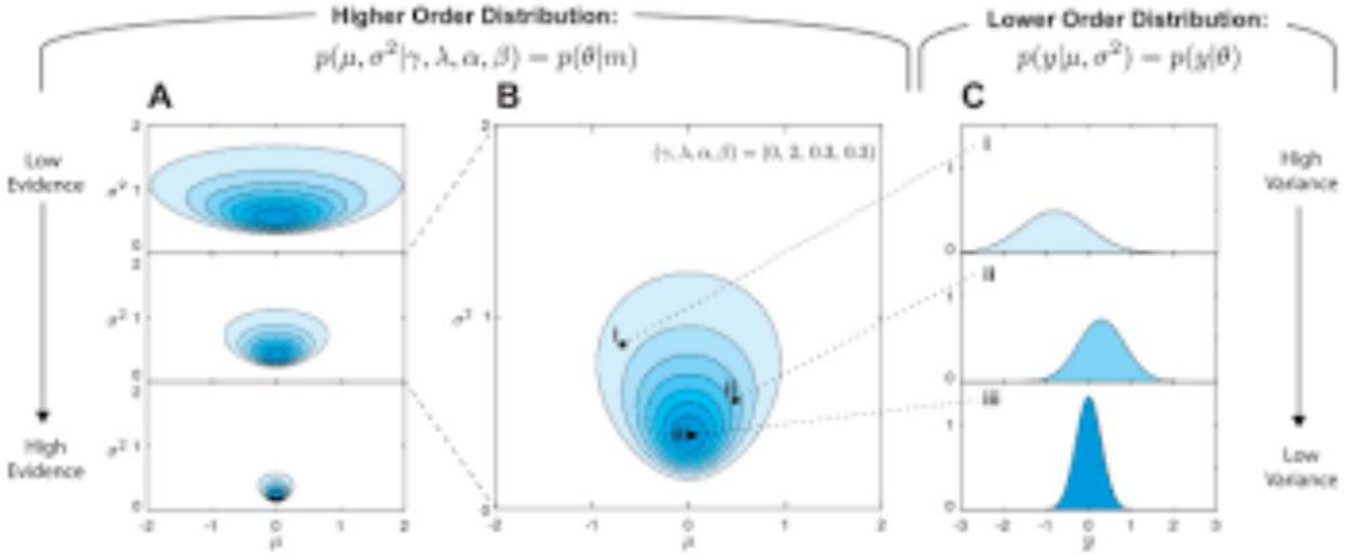
Q2 - Digital Postoffice

- Age of digital identity
- Digital & lots of data related to identities
- The deeper the data = finger print
- Protection of digital identities = a public good?

Q3 - Beyond AI

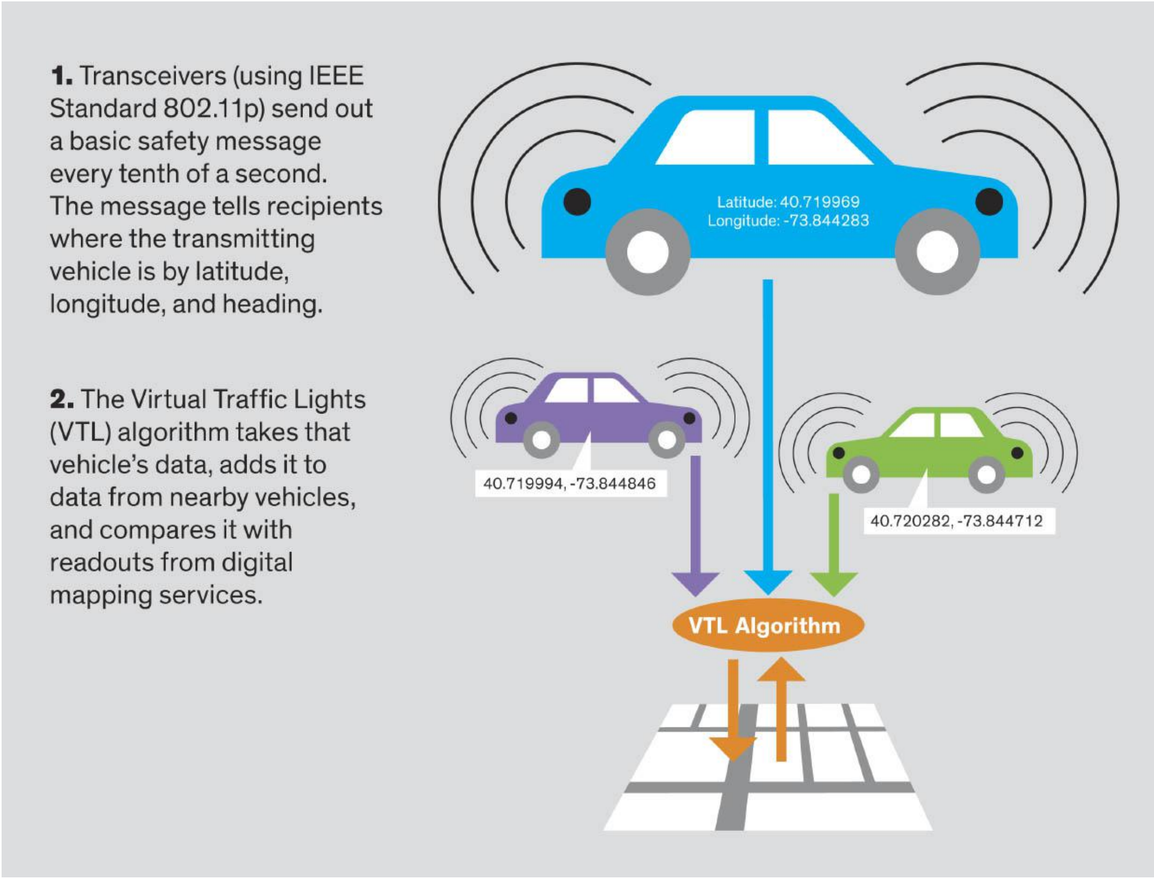
- Weights and Matrices
  - What if instead of numbers, probability curves rule





Q4 - Virtualization

- Virtualization assets
  - Virtual inertia
  - Virtual powert plants
  - Virtual consumers?
    - each plugs
  - Virtual transformers & lines
  - Virtual capacities?
- Why? Flexibility & security



https://spectrum.ieee.org/transportation/infrastructure/how-vehicletovehicle-communication-could-replace-traffic-lights-and-shorten-commutes

Q5 - No consumer hustle

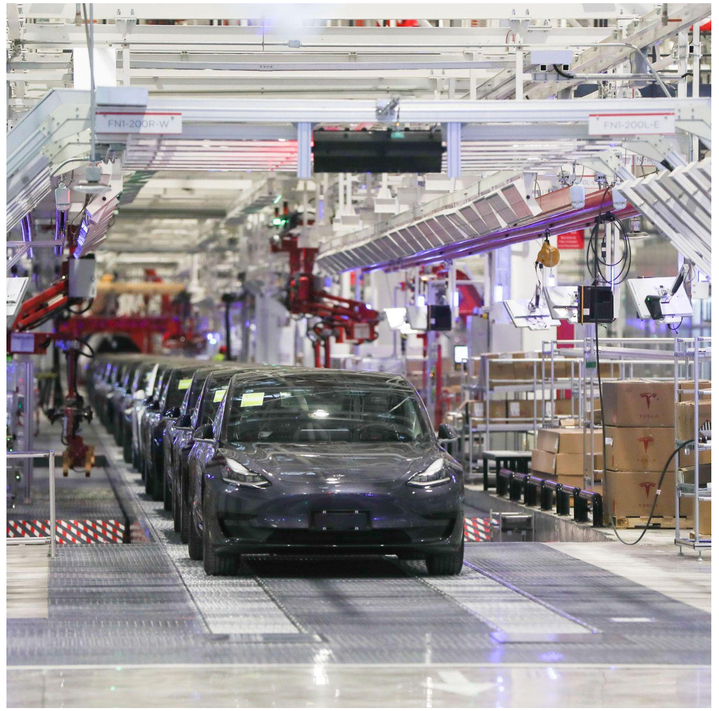
Objective function

- What is the optimal duration for consumer to think about DisCo/services?
  - **ZERO**
- How to enable it?

- More powerful but less visible services (integrating to Siri?)

Q6 - Humanless Energy Services

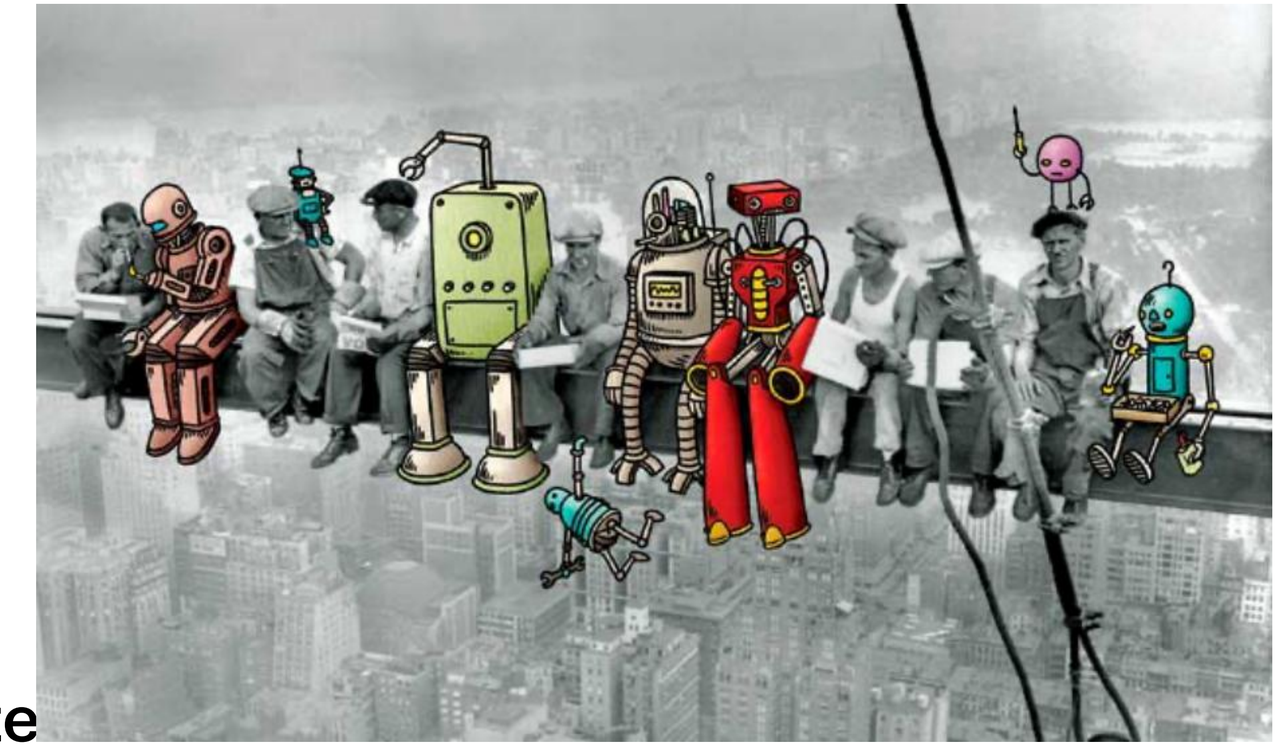
- Automobile revolution
  - T Model to Tesla
- Textials -> Human to Machine
- Telecom infrastructure
  - Switchboards



  - Energy services? Why do we need humans? How to eliminate it?
    - If there is a pattern?
    - Virtual assistants to field services

Conclusion

- Future is an ongoing discussion
- Identify the vectors
  - But they mutate with new tech
- Which generation of AI is it?
  - 4th or 5th?
- How to eliminate human factor?
  - Why? cost, speed, copy
  - How? Identify patterns & disaggregate
- Virtualization of assets
  - Inevitable
  - Creates new market models



thank you

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