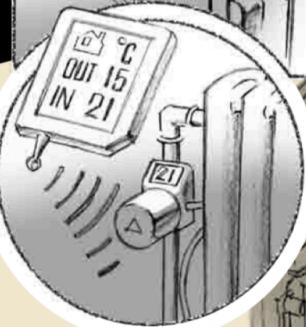
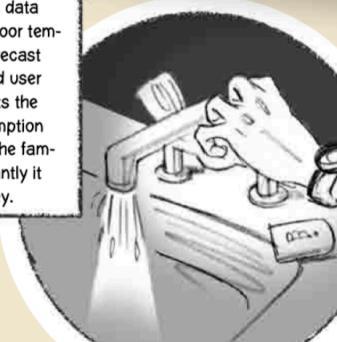


AUTOMATION

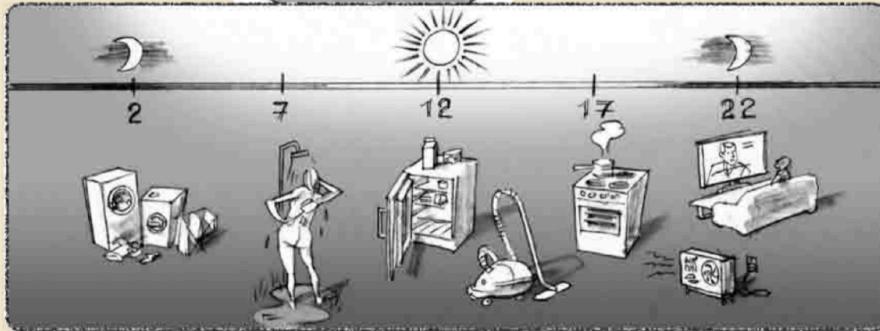
The Home Central Control (HCC) provides the complete control of your house. It controls access, energy, heating according to your profile, environmental conditions and price.



The HCC triggers the heating system by combining data from outdoor and indoor temperature, weather forecast from the Internet, and user preferences. It adjusts the house energy consumption to the real needs of the family, and most importantly it helps you save money.



The HCC recognises which appliances (washing machine, dishwasher, water heater, heating system, etc.) are turned on at a given time and synchronises them to ensure the best energy efficiency taking into account pricing structure of the utility companies.



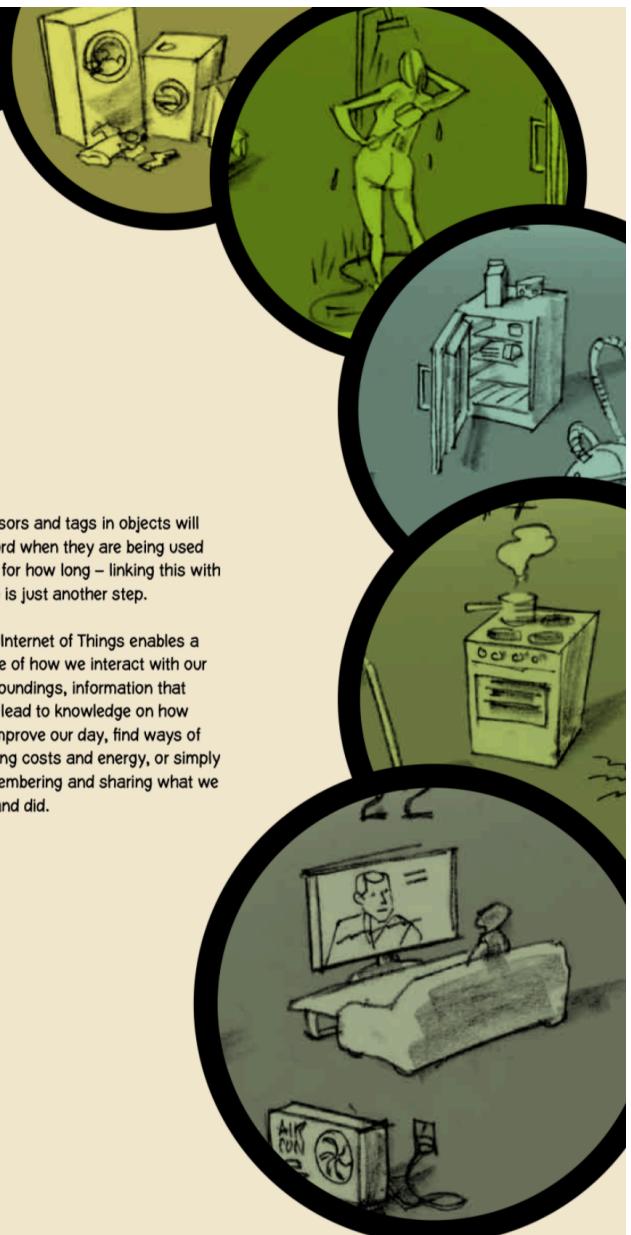
Behaviour

The Internet of Things will show us who we are!

Well, maybe it will not look into our "soul", but it will tell us what we did for how long, where and when. We constantly interact with things – a lot with our mobile phone – and we leave footprints already today with our actions.

How much of this will be recorded and processed is an open question, but Facebook and foursquare for example already provide hints on how much some people are willing to share.

So why not record everyday actions around the house to figure out where our time and money goes – what is a good and what is a bad day.



ORCHARD



Frank is a fruit grower (mixed farming) who cultivates apples, pears, peaches, strawberries, melons, and oranges (greenhouse cultivation and natural fields). Depending on the season, he employs seasonal workers.

Reusable sensor networks

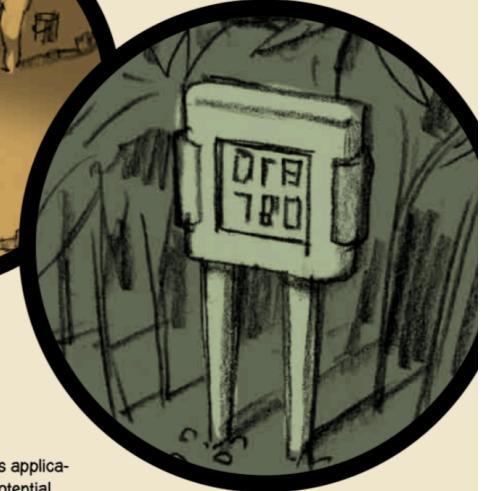
Internet of Things infrastructures can improve farming but their data can also be sold to third parties.

Managing a farm as depicted on the left requires various activities that can be supported by Internet of Things applications.

For example, Frank must always have a detailed picture of weather, crop and soil conditions. This monitoring requires effort and is time-consuming, in particular for a large farm or even in situations where Frank owns fields that are geographically dispersed.

A sensor network allows Frank to get current data about temperature or ground humidity from all of his fields. Based upon this data, he is able to make better decisions in the planning of upcoming activities.

Moreover, data gathered by these sensor networks can also be sold to organisations such as weather agencies, the crop industry or other research communities. Accordingly, investments into sensor networks must not only rely on Frank alone but they might be part-funded by the entire surrounding business ecosystem.



Overall, Internet of Things applications have not only the potential to improve decision-making in a specific sector but they can also be keystones for a service business ecosystem from which various stakeholders benefit.

Ethics versus safety

Internet of Things applications are often a mixed blessing when it comes to benefits and risks.

In the farming scenario, the sensor networks can be used to track the location and even the activities of the workers on the field. This can help Frank to make better decisions regarding the planning and progress of his workforce.

Additionally, this monitoring can be helpful in situations where a worker has a serious accident and needs immediate assistance. In this regard, sensor networks address safety needs in working environments.

But in contrast to these anticipated benefits, sensor networks may also be used for controlling and comparing the workers on the field.

Calculated performance scores could be used as basis for dismissing workers accordingly even though these scores might not reflect the actual working behaviour and performance.

The design, deployment and use of such Internet of Things applications must therefore always address ethical principles too. And it must be the first and foremost interest of all stakeholders to discuss these issues in advance of a roll-out because otherwise, user acceptance suffers and expected benefits would not be present.



Smart Urban



Optimisation

The Internet of Things will optimise processes happening in the real world.

Logistics, utilities or event operation are complex tasks that are governed by many parameters that are today estimated or simply unknown.

The IoT enables detailed data gathering of information on a much higher granularity and much better precision than ever before.

In the "Smart Urban Waste Management" application scenario garbage collection can be optimised e.g. in terms of route optimisation based on fill levels. Empty bins are bypassed, full bins are emptied, and broken bins can be repaired quickly. Optimisation saves time and reduces costs – an important factor for today's economically challenged cities.

Optimisation is, however, a challenge in such scenarios. The development of algorithms to find the right patterns out of masses of data and feed the results into reliable business processes will need much experimentation until the right level of confidence is achieved.

Incentives

The Internet of Things will enable a world where we can have more incentives, and not just financial incentives.

Financial incentives have been employed for decades with a moderate degree of success – in some areas they work; in others they have limited impact. It is all about instant feedback.

Computer games are great examples where there is always a task to be performed that is just challenging enough to engage in but easy enough to achieve (maybe after a few tries, but nevertheless).

In the "Smart Urban Waste Management" application scenario citizens get instant feedback in the form of 'green credits' (a virtual currency) for their behaviour – overuse of a resource (in this case the bin space is the resource) is 'punished' by removing credits; and efficient use is rewarded with 'green credits'.

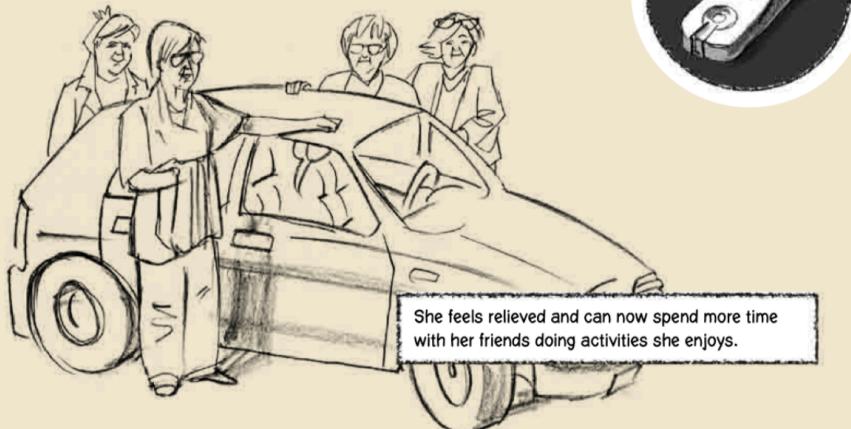
Credits can then be used to gain financial rewards such as tax returns or simply in comparing each other to your friends and fellow citizens in social real-world games.

Experimentation with other than financial incentives is an important area that knowledge from the Internet of Things will enable. But finding out what triggers human behavioural changes, is altogether another area of research.



Continuous Care

The continuous care concept enables patients with chronic diseases or elderly people with health impairments to stay in their own home despite their health constraint, to reduce cumbersome visits to the doctor and to avoid premature relocation to a nursing home.



Saving time

The Internet of Things will save you time and improve your quality of life.

Primary healthcare systems around the world are stretched to a breaking point.

A good indicator of this is the 'waiting time' for treatment. Many of the visits are routine and part of a well-defined set of recommendations to provide the best care for patients. However, this is unsustainable.

The ageing population and an ever-increasing demand for healthcare services are the cause. Telemedicine is a public-private partnership-driven concept that can turn this around.

Telemedicine allows patients to be monitored remotely for routine checkups, using a wearable or portable device at home and on the move. Routine visits become less frequent while treatment can still be adjusted with the information from the telemedicine systems, giving patients more flexibility to enjoy their life.



Choice and acceptance

Consumers want to choose their products, and choice makes the world a better (acceptable) place.

The "Continuous Care" application scenario illustrates the patient choosing a telemedicine device. This is an important action for the acceptance of new technology in a very personal and intimate part of people's lives.

It is an iterative process of end user engagement in experimental living labs that get us to the point where good products are created.

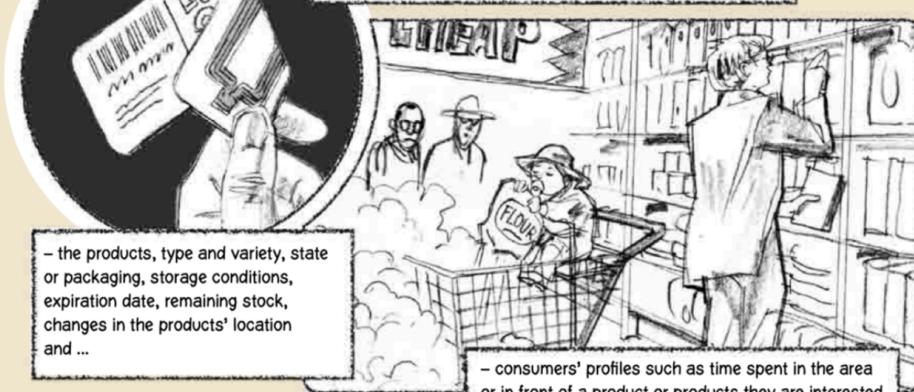
Understanding what the user wants is a key issue for the Internet of Things not to become a 'Big Brother' or a 'Damocles Sword'.



Smart

PRODUCT Management

Tom is working in a supermarket. He is in charge of the management of a beverages department.



In this way, I can conclude the flow of the goods in the department, the efficiency of my marketing strategy in the department, and I learn about the behaviour and satisfaction of the consumers according to the supply.



Optimised product management

The Internet of Things will allow for extreme streamlining of all processes related to product management in logistics, such as to be found in supermarkets.

By employing different technologies such as RFIDs, sensor networks and intelligent accounting software, a supermarket manager will be able to keep track of his inventories without having to count manually – everything will be automated. In addition, the software will be able to produce statistics on which products are favoured by the customers – for instance by just counting how much of a product has been sold, but also by monitoring customers' behaviour in front of the shelves. It is then much easier for the manager to decide where to place which products on the shelf in order to optimise the offer – and certainly the sales.

With such up-to-date information available, a manager can react much more quickly to important events or changes in current situations, such as low inventory or changing customer needs and wishes – and all this without any manual work, just through automatic monitoring.

RFID

Radio Frequency Identification (RFID) is probably the most important basic technology for the Internet of Things.

Based on so-called RFIDs, all kinds of things – in this example products in a supermarket – can be first uniquely identified, and second their location can be precisely determined.

RFIDs can take different forms. The best known is probably the one you can see in this comic book: here, it is a kind of electronic label or tag which can be attached to basically any item or group of items. But there are also RFIDs which have the size and form of a grain of rice and can be implanted under the skin of an animal or a human.

The most common form of RFIDs (and the one relevant here) is passive: whenever they receive a certain signal from an RFID reader, they send back a signal to this reader. This signal is unique for this tag, so the reader can uniquely identify the tag – and thus the product attached.

RFID tags do not need energy supply – the energy of the incoming signal is sufficient to produce the outgoing one, at least for a distance of typically a few centimetres, which is usually sufficient.

In combination with a reader and a product information system (a piece of software), RFIDs show their extreme power: it becomes very easy to count huge amounts of products by just moving the reader in front of them.

When a customer takes a product from the shelf and puts it into his cart, the shelf reader will take note of this by reducing the amount of that product in the repository. The reader in the cart can automatically register the product so that payment at the cashier can be done in zero time.

It should not go unmentioned that many people have some fears concerning their privacy – they think that with RFIDs, everything they do can be taken note of and accounted to them.

