



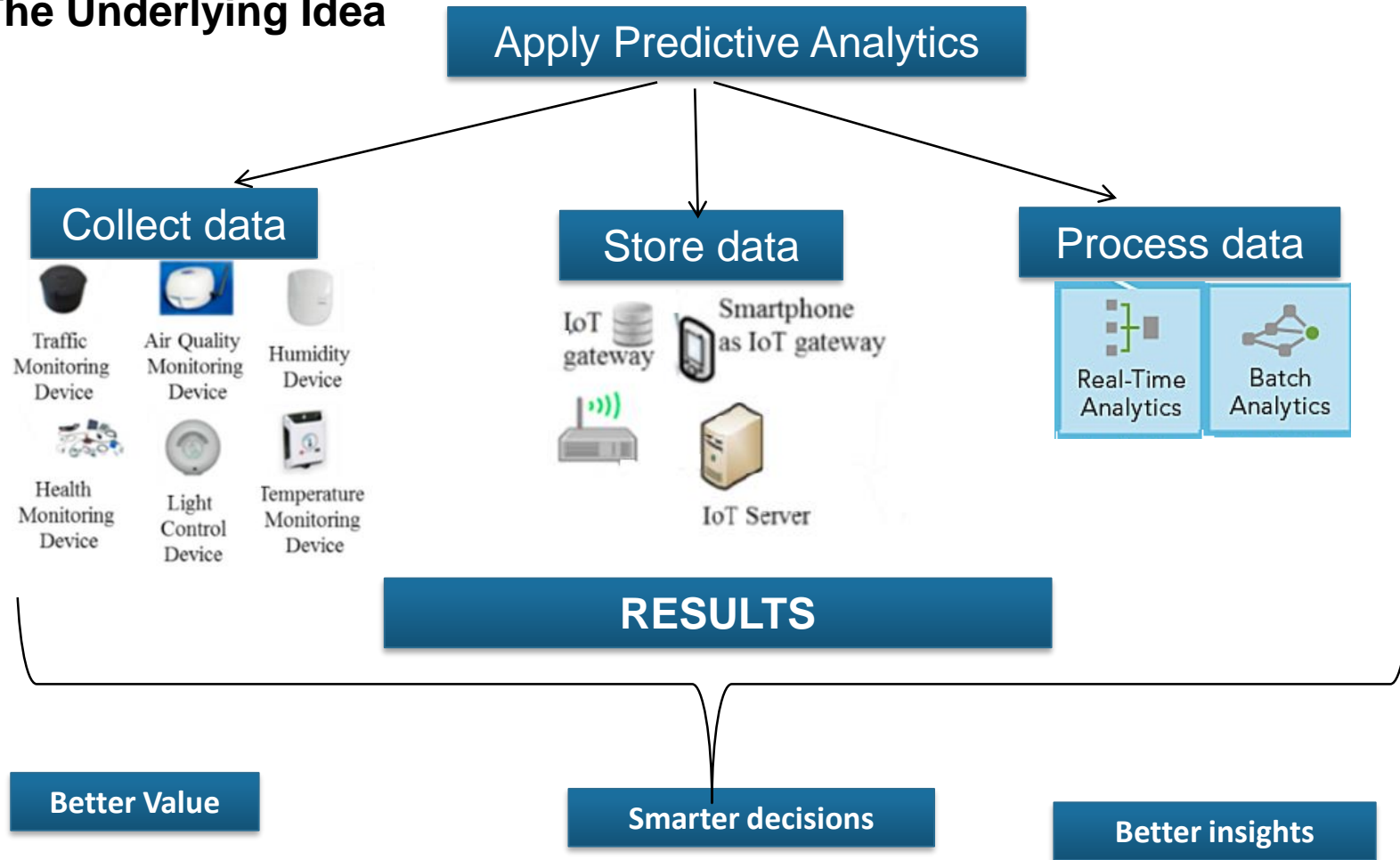
# Internet of Things (IoT)

Application of Predictive Analytics to

Assisted Living

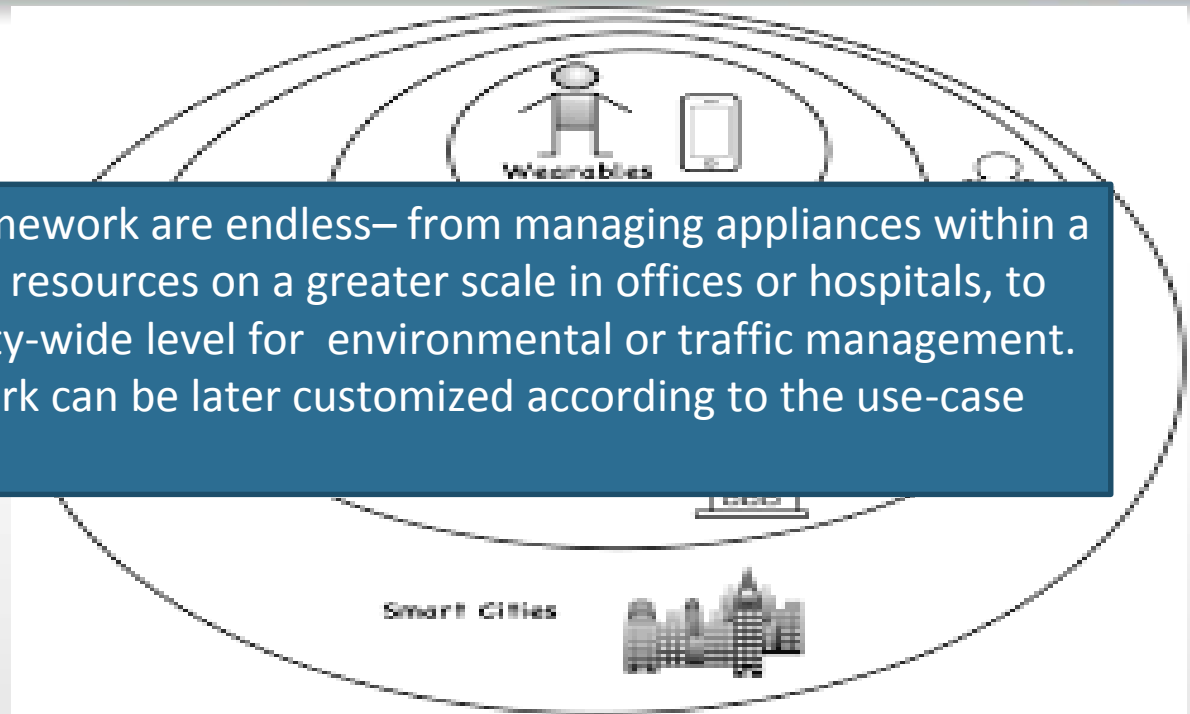
February 10, 2017

## The Underlying Idea

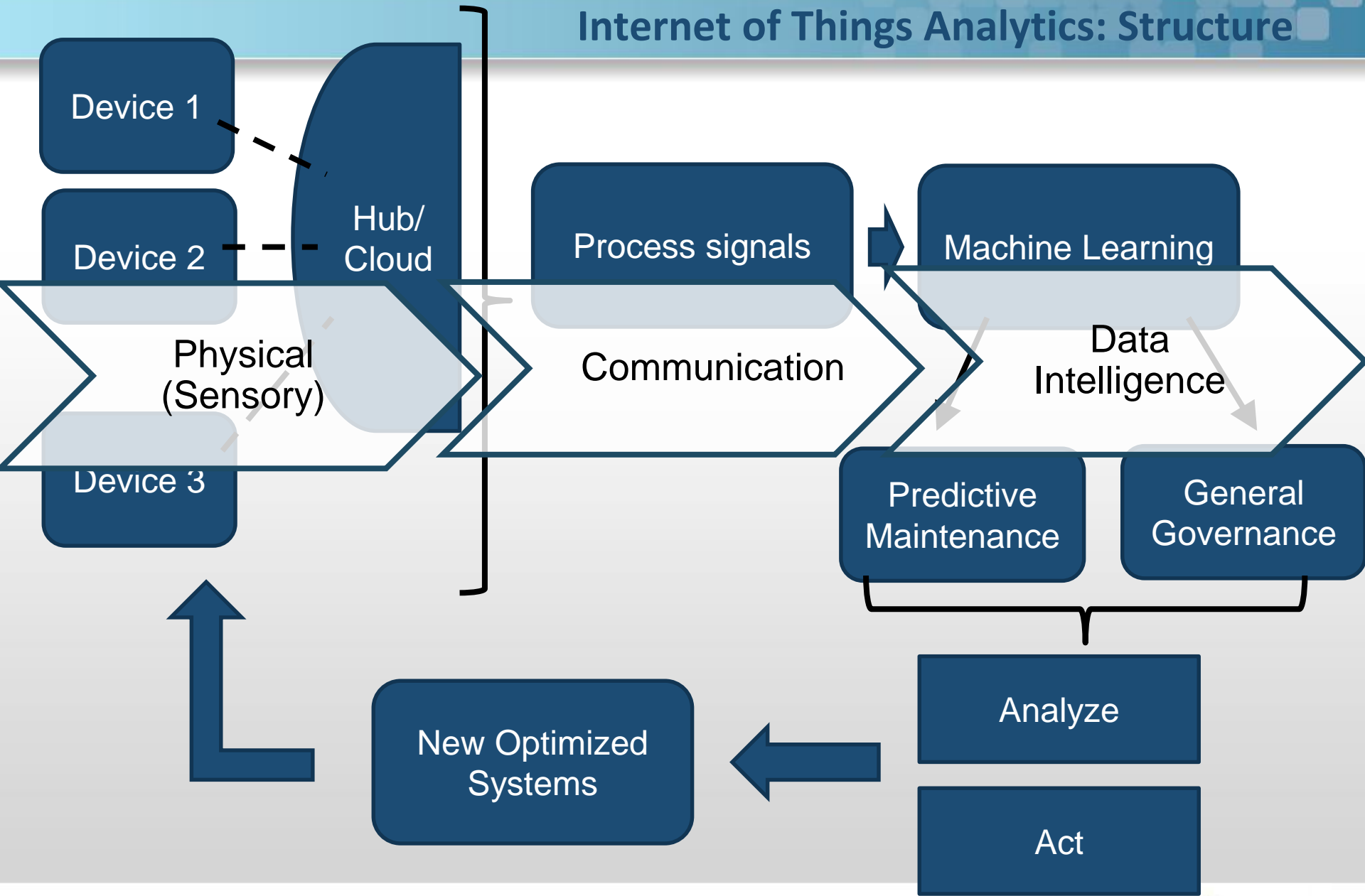


## Business Value

The use cases for such a framework are endless— from managing appliances within a household, to managing resources on a greater scale in offices or hospitals, to even looking at a more city-wide level for environmental or traffic management. A generalized framework can be later customized according to the use-case



# Internet of Things Analytics: Structure





# Assisted Living: The Idea



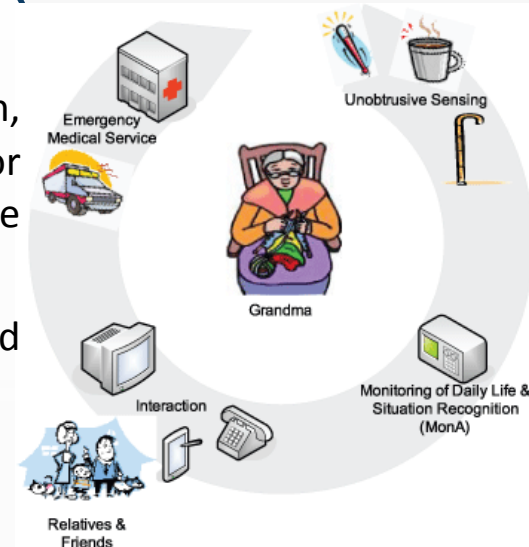
## How It works

Install various sensors around the house to track daily movements. Data collected over a certain time period can be used to determine the “norm.” An outlier detection system can be created for data deterring from this norm.

## Business Value

For elderly care, equipping the home with numerous sensors (e.g., motion, temperature, heating) to provide assistance. Predictive behavior analysis for Assisted Living might determine the probability of falls or the change of care levels.

When movements fall outside of this pattern, an alarm can be sounded depending on how extreme the case is.



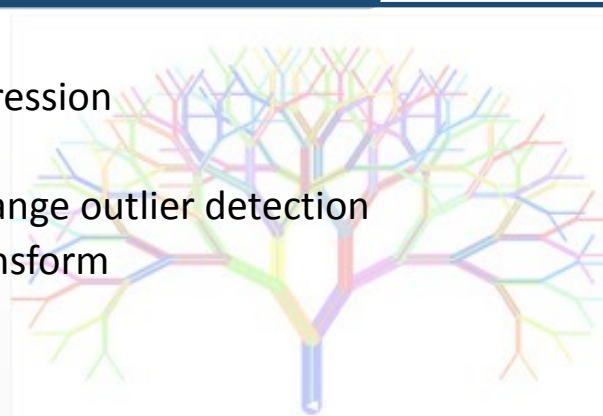


# Assisted Living: The Approach

- **Exploratory analysis** – understand the data and its nuances
- **Data visualization** – what consists of the “norm” within a household and how should the said “norm” be determined
- **Predictive power** – use the past to predict how the next minutes and hours in a house ought to be
- **Value extraction** – what can be learned about a household from their activity patterns?
  - Can energy management be employed?
  - Can generalized fingerprints for certain groups (family size, ages, etc) be determined?

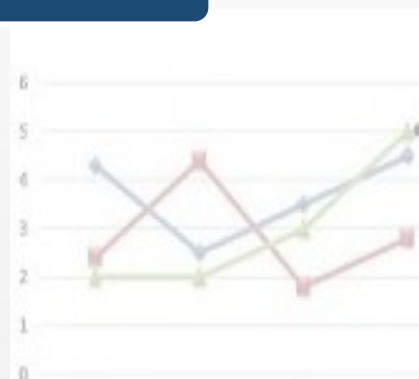
## Visualization Techniques

- Vector autoregression
- Markov chains
- Inter-quartile range outlier detection
- Fast fourier transform
- Random forest



## Modeling Techniques

- Box-and-whisker plots
- Scatter plots
- Line graphs
- Autocorrelation graphs
- Etc.





## Assisted Living: The Outcome

- Insights obtained:

Strong patterns exist within a household, which can be broken down further into patterns by time of day and day of the week. A household's "fingerprint" is determined using about a month's worth of prior activity. This is neither predetermined nor constant – it moves with time.

Visualization of incoming activity compared to the "fingerprint" gives a first cut for any abnormal activity.

More advanced machine learning and modeling methods delve further into the data for patterns indiscernible by the human eye.

- Areas to be further explored:

- Tweaking the prediction methodology for outlier detection
- Use features within data, such as time of day, for increased prediction power
- Further analysis for underlying patterns in the data