

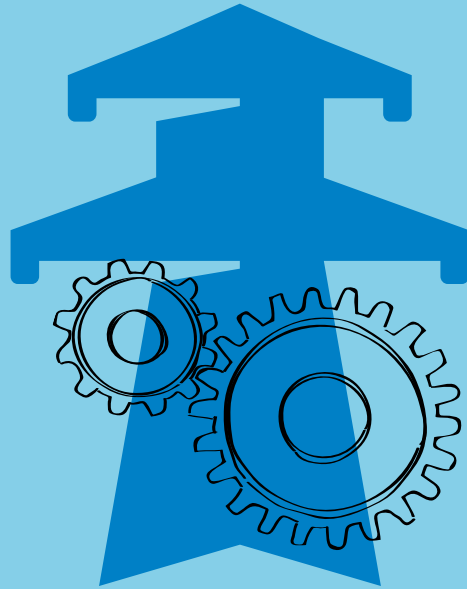


In-House vs External AI&ML

NetIntel@BKW: Why, What and How

AI&ML FOR THE SMART GRID 2020- YAMSHID FARHAT





BKW Energie AG: Who are we?



1893 - Energy for the industrial revolution



1972 - More power for a growing society



Future – Decentralised and fluctuating energy production...

A woman's profile is shown in grayscale, facing right. Overlaid on her head is a complex, glowing white network of lines and dots, resembling a neural network or a digital brain. The background is dark blue.

... and actively managing our digital transition

We identify and develop new solutions

We ensure that we create value from this transition

We protect & expand our know-how

We actively involve our management for a digital transformation

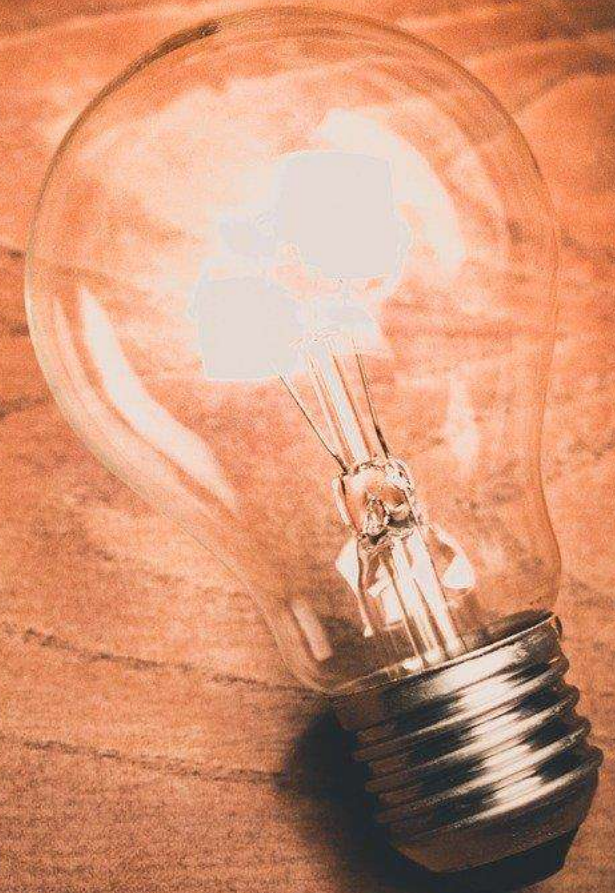
How & when did we start with AI?

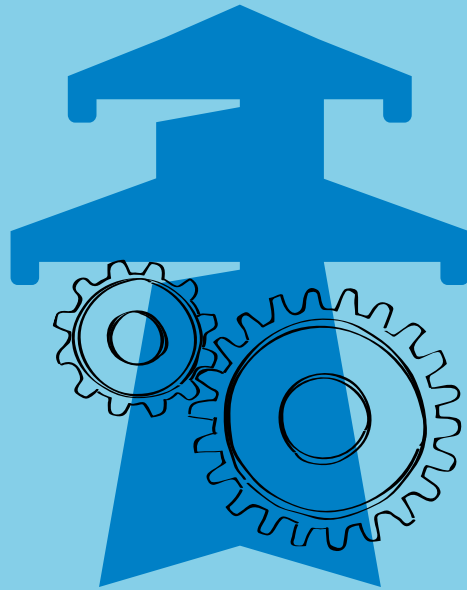
In 2013, we created our Smart Grid department

Focus: Develop new solutions for a more efficient & reliable distribution networks

Potential for providing new services → towards In-House Solutions

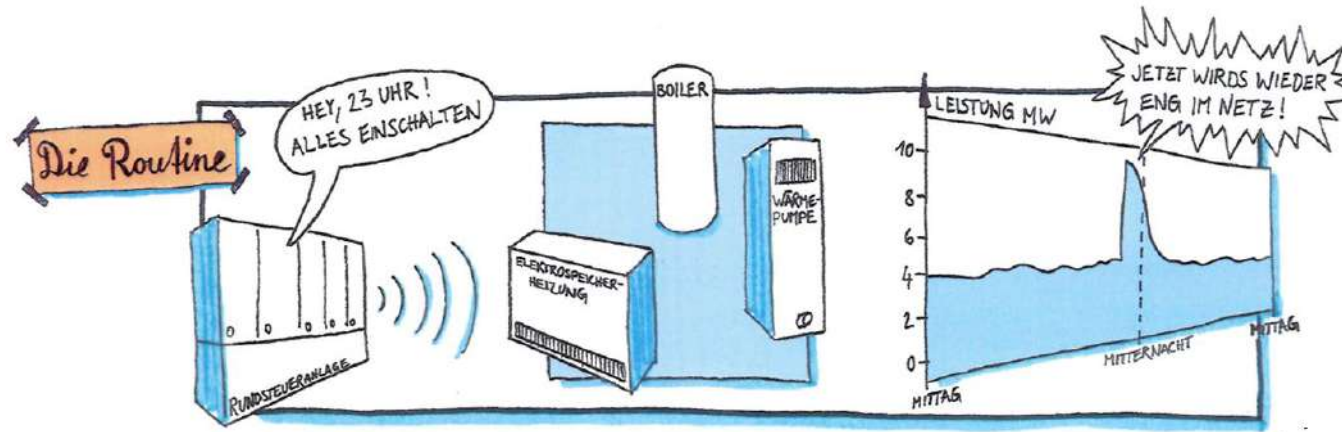
First projects: Demand Side Management & Real-Time Grid Optimization



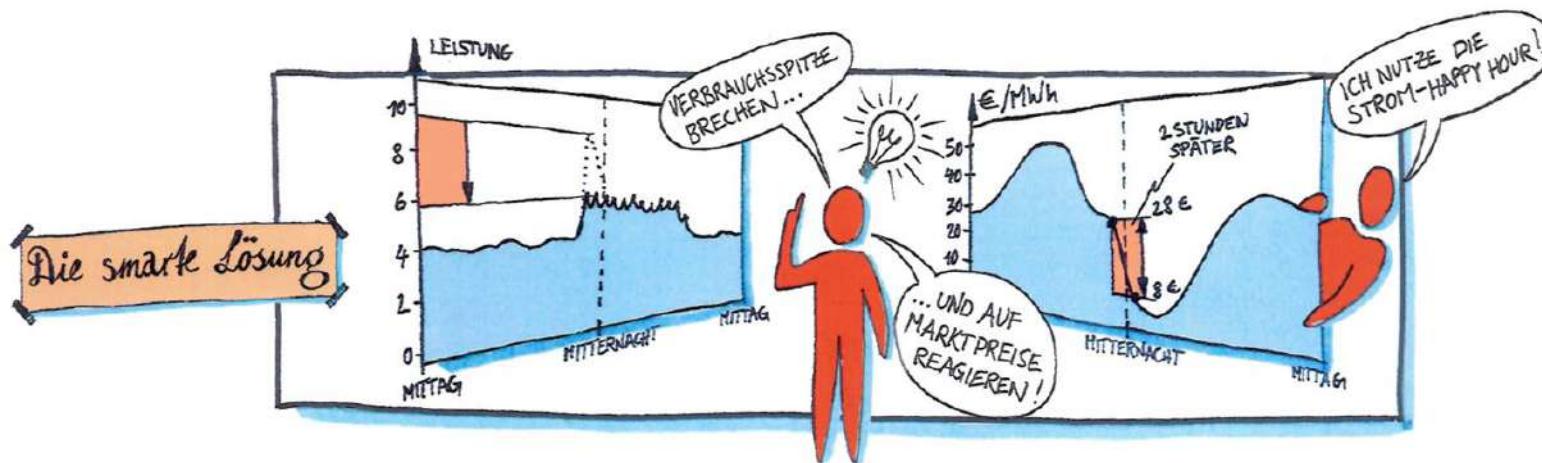


First AI&ML Projects

SmartRSA: Demand Side Management

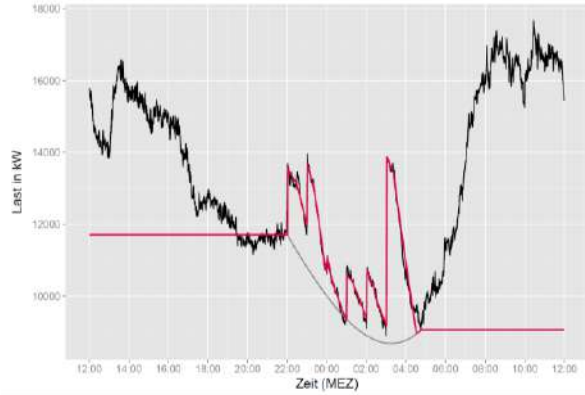


Since 1960, boilers and heat-pumps of **100'000 BKW**-customers are ripple-controlled by static programs



The new **SmartRSA** solution is sensitive to real production on a daily basis, saving more than 100kCHF per year on the day-ahead trading.

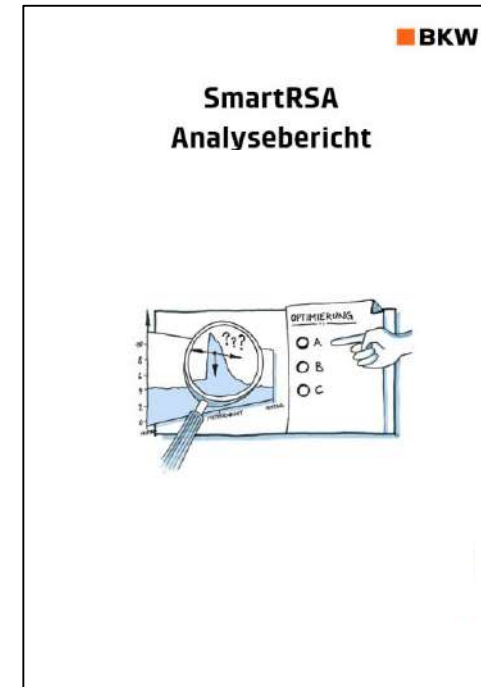
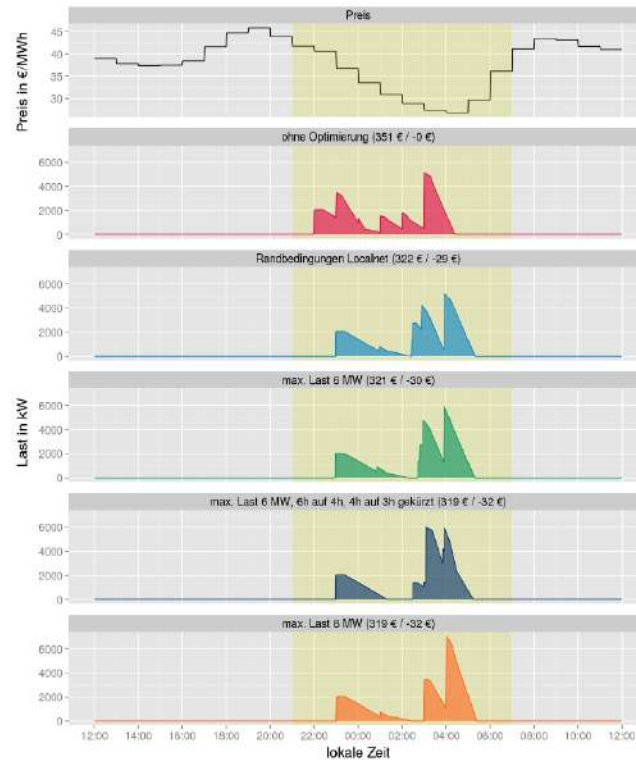
SmartRSA: Prozess



1. Build the model



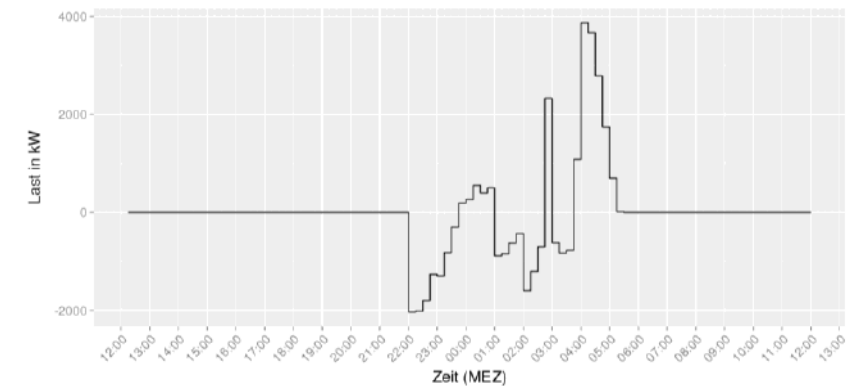
2. Optimize Energy



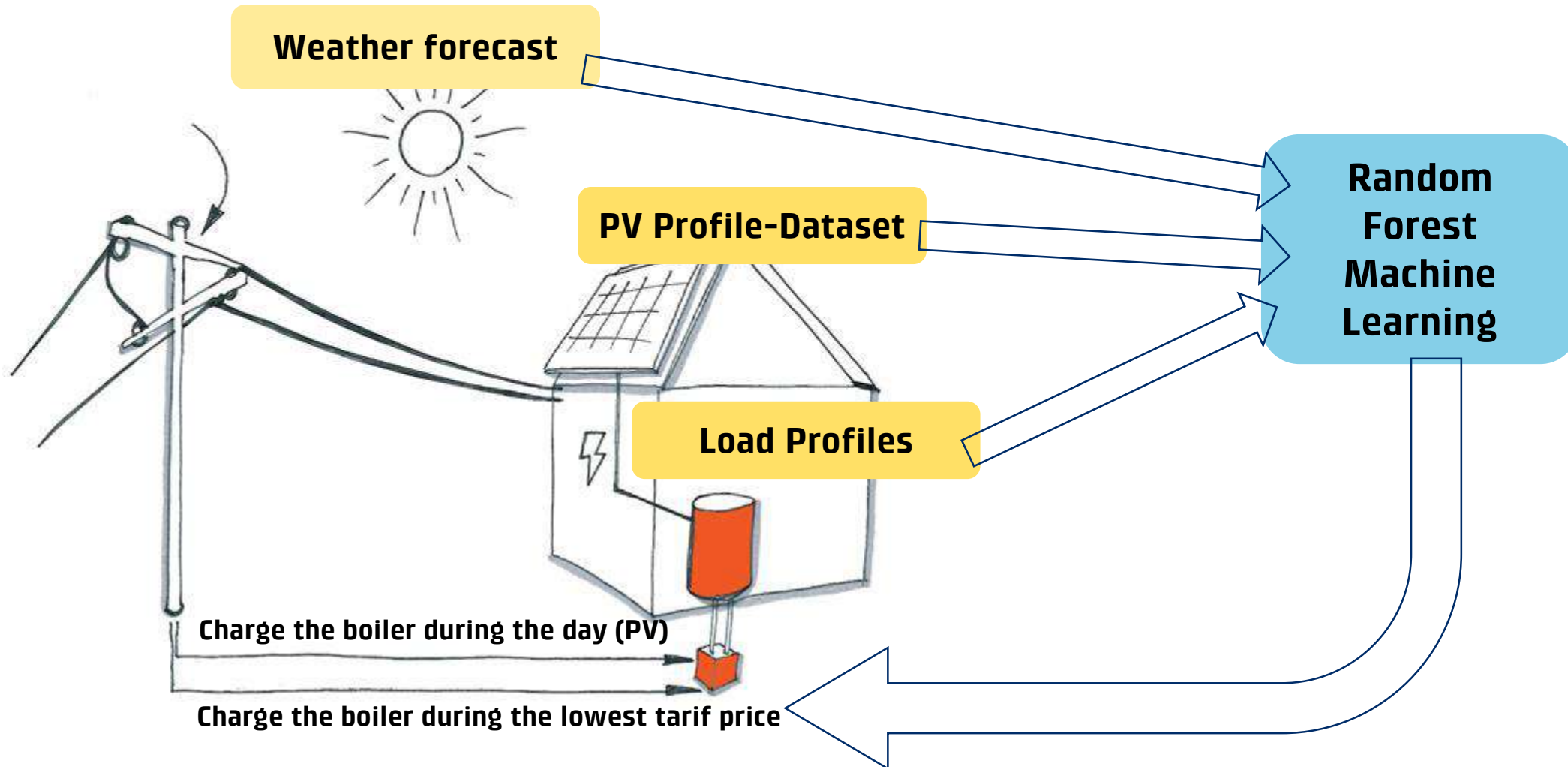
3. Report:
Business
Potential



4. Implementation



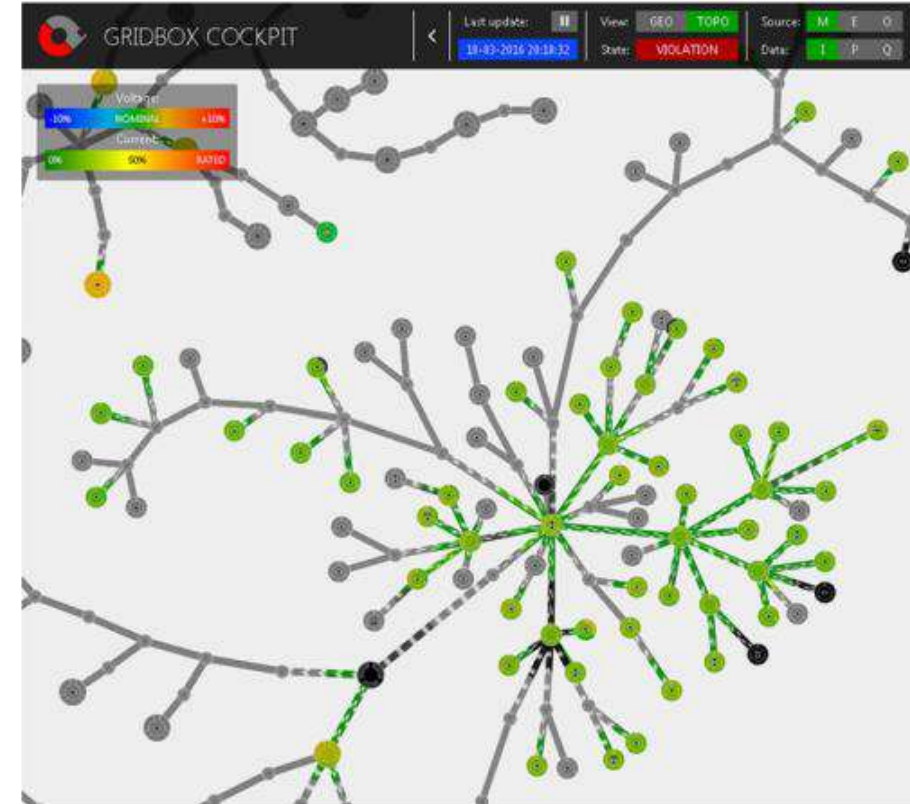
BKW mySun: Optimize Self-consumption



GridBOX: Monitoring and Active Control of Distribution Grids



PMU-Device: Measuring U , I , φ every second



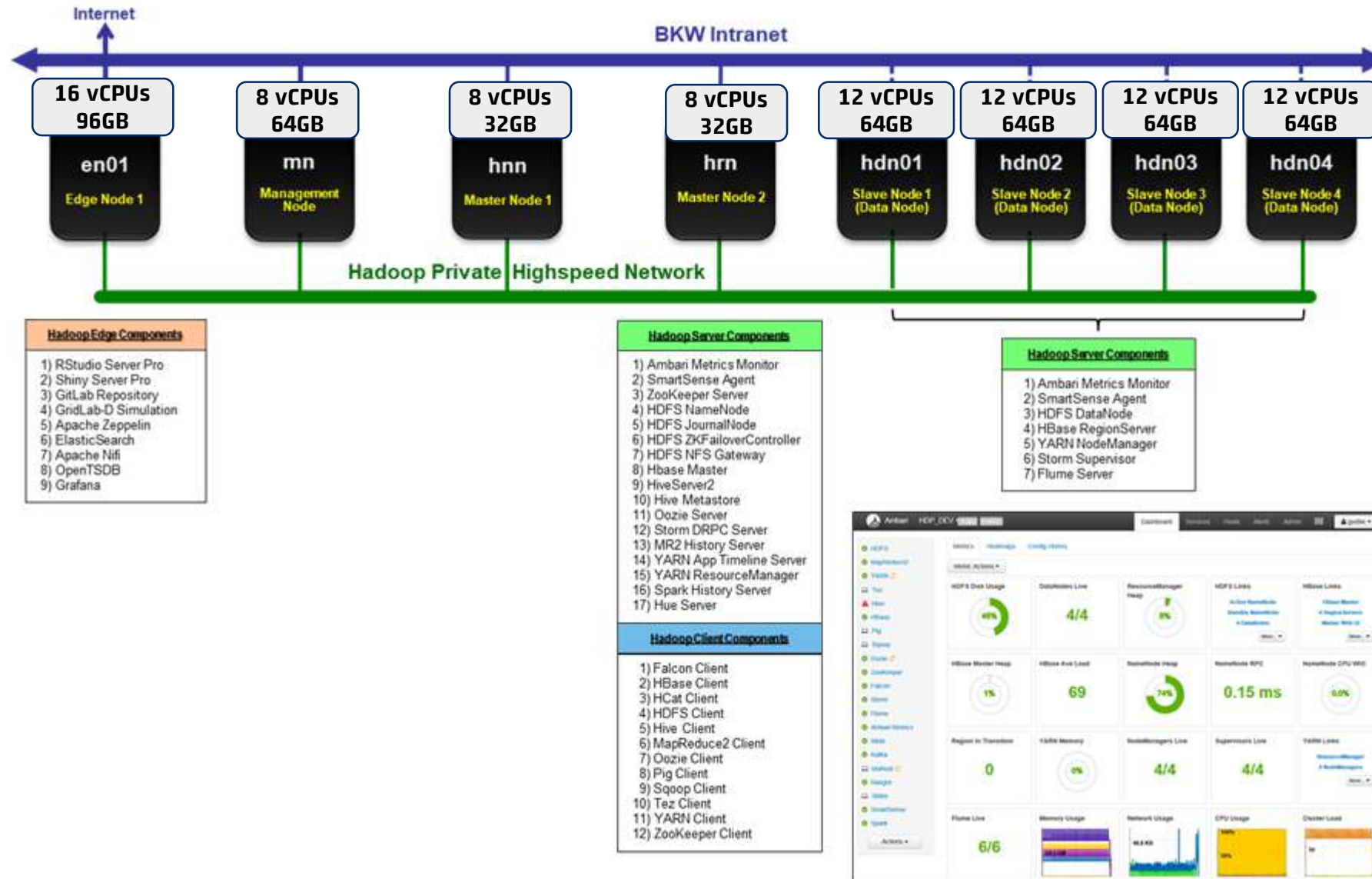
Real-time **observation**
of the **state** of the
distribution grid

Measuring
current and voltage

Applications for an
optimized (active)
operation of the grid
Implemented on a GridBox
Master in the respective regions

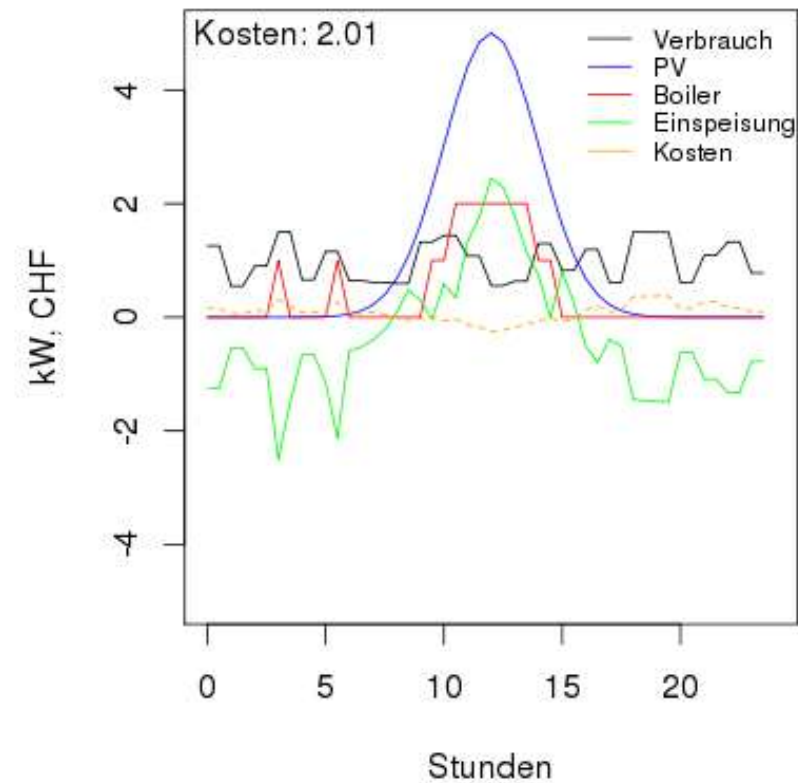
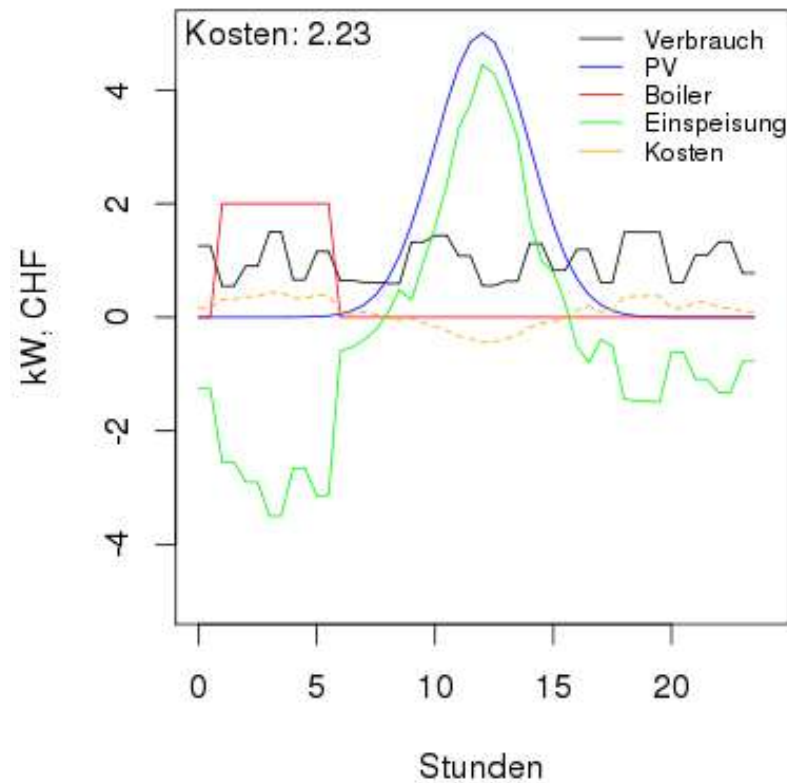
Control
of dispersed generators
and loads

On-Premise Big Data Architecture 2015



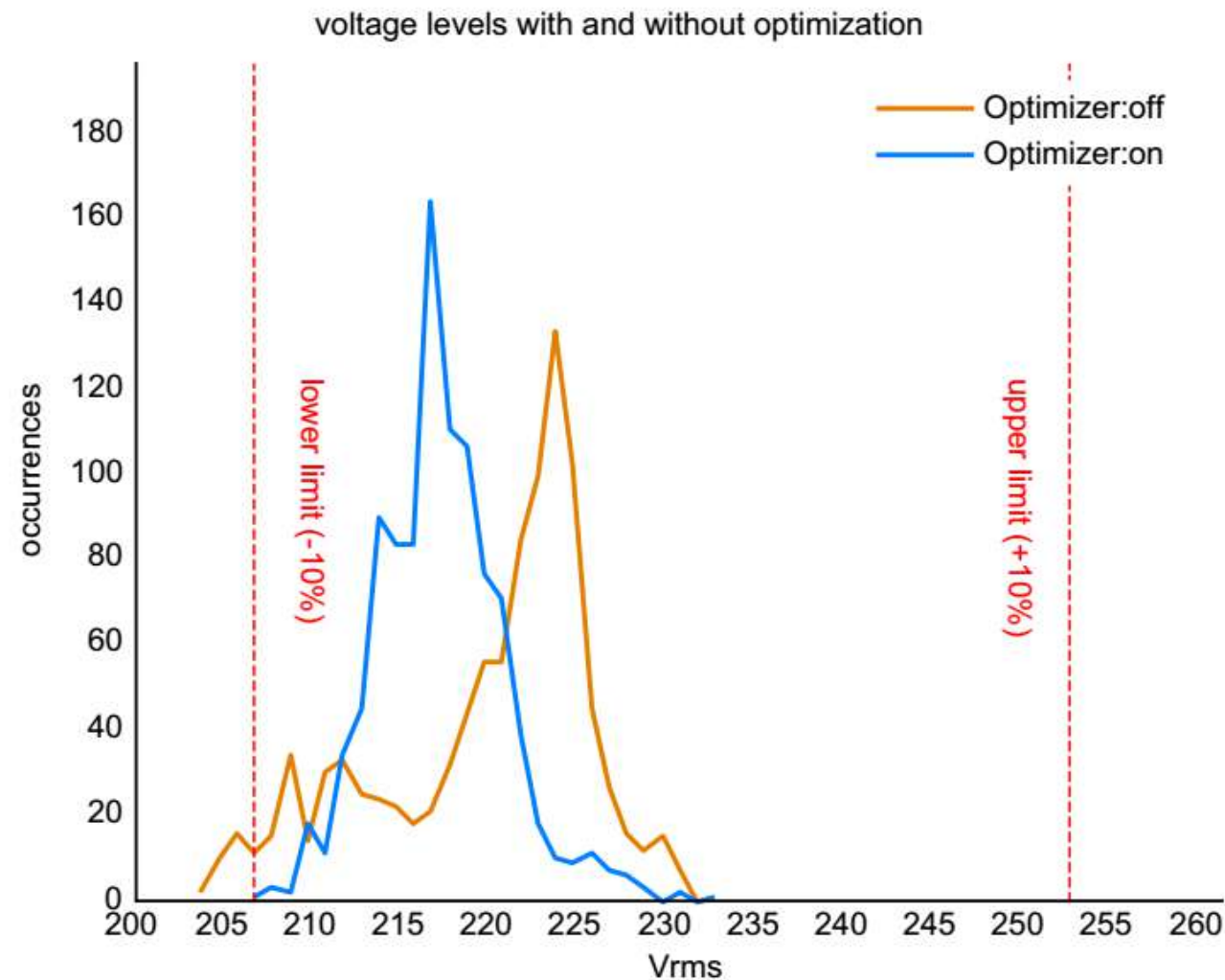
Results: BKW mySun

The boilers will be charged during the day if enough PV-Production is expected. No additional operation costs are required



Results: GridBox

The real-time control using our Optimization algorithms ensures an optimal Power Quality



Expectations vs Reality

On Premise:

- Build Know-How
- Data Compliance
- Flexible
- Potential consultancy services

On Premise reality:

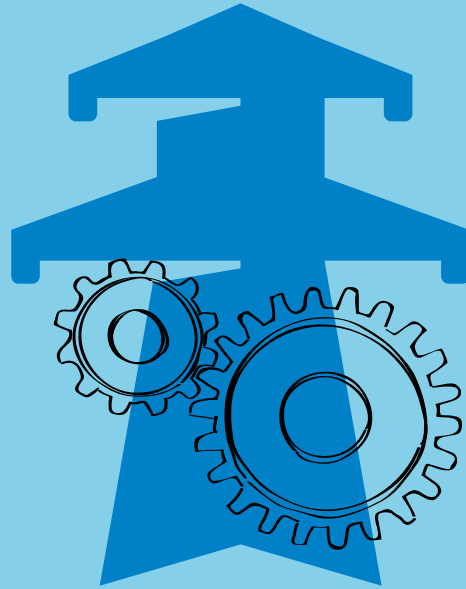
- High operational costs
- Just specialists can run the platform
- Updates & Modifications are not easy implemented (no flexible)

Innovative Applications:

- Smart Solutions for the Grid of the future
- Build Know-How
- Develop new products

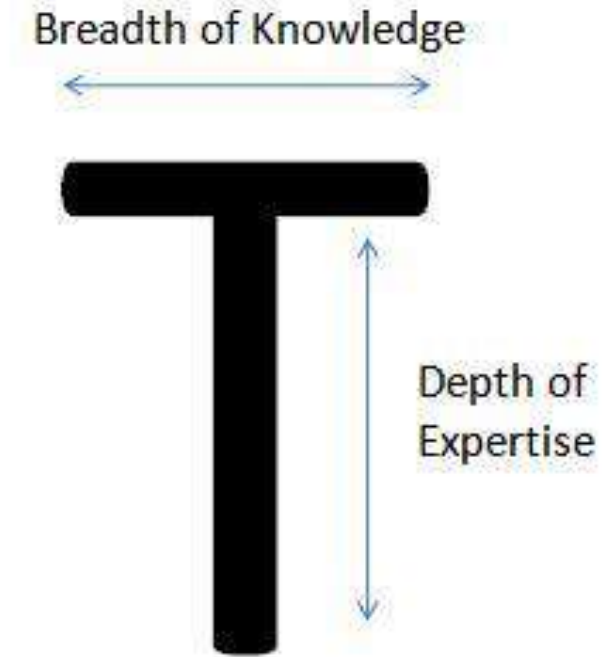
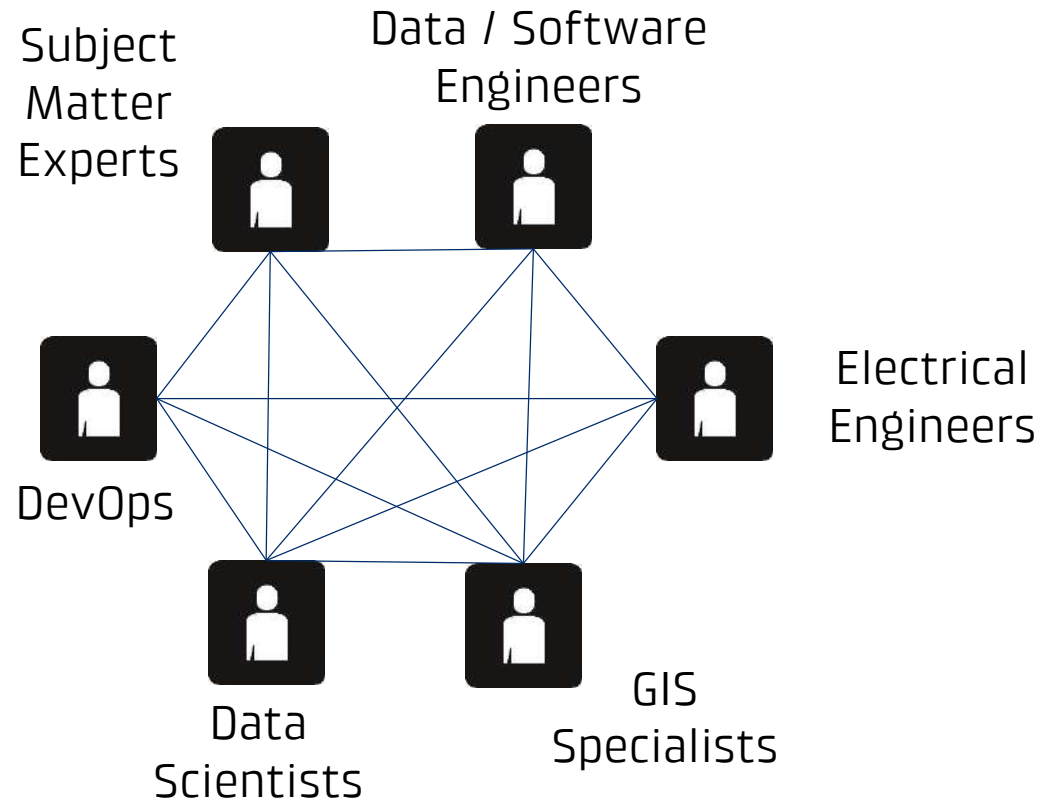
Innovative Applications reality:

- No Business Case with actual regulation
- Products were not developed (or are no longer available)



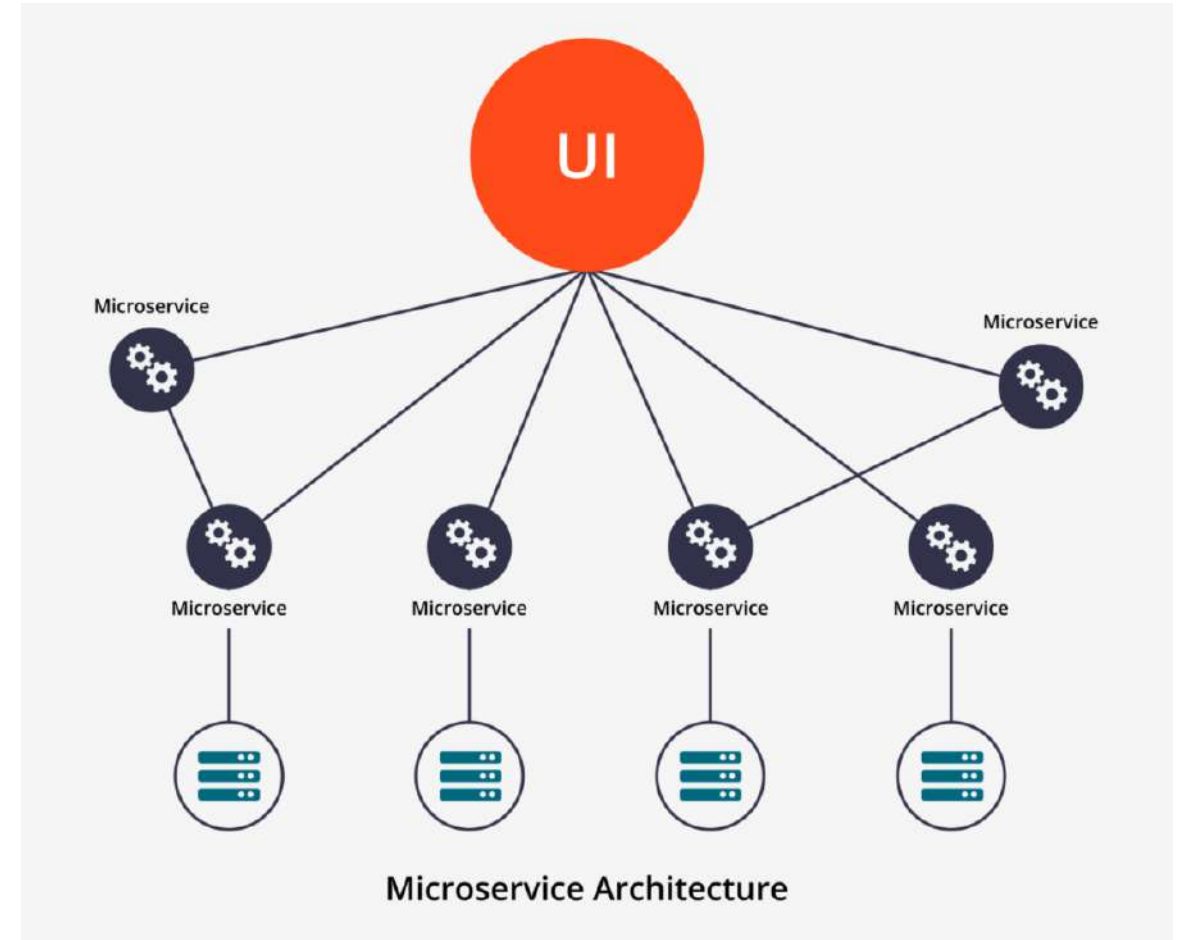
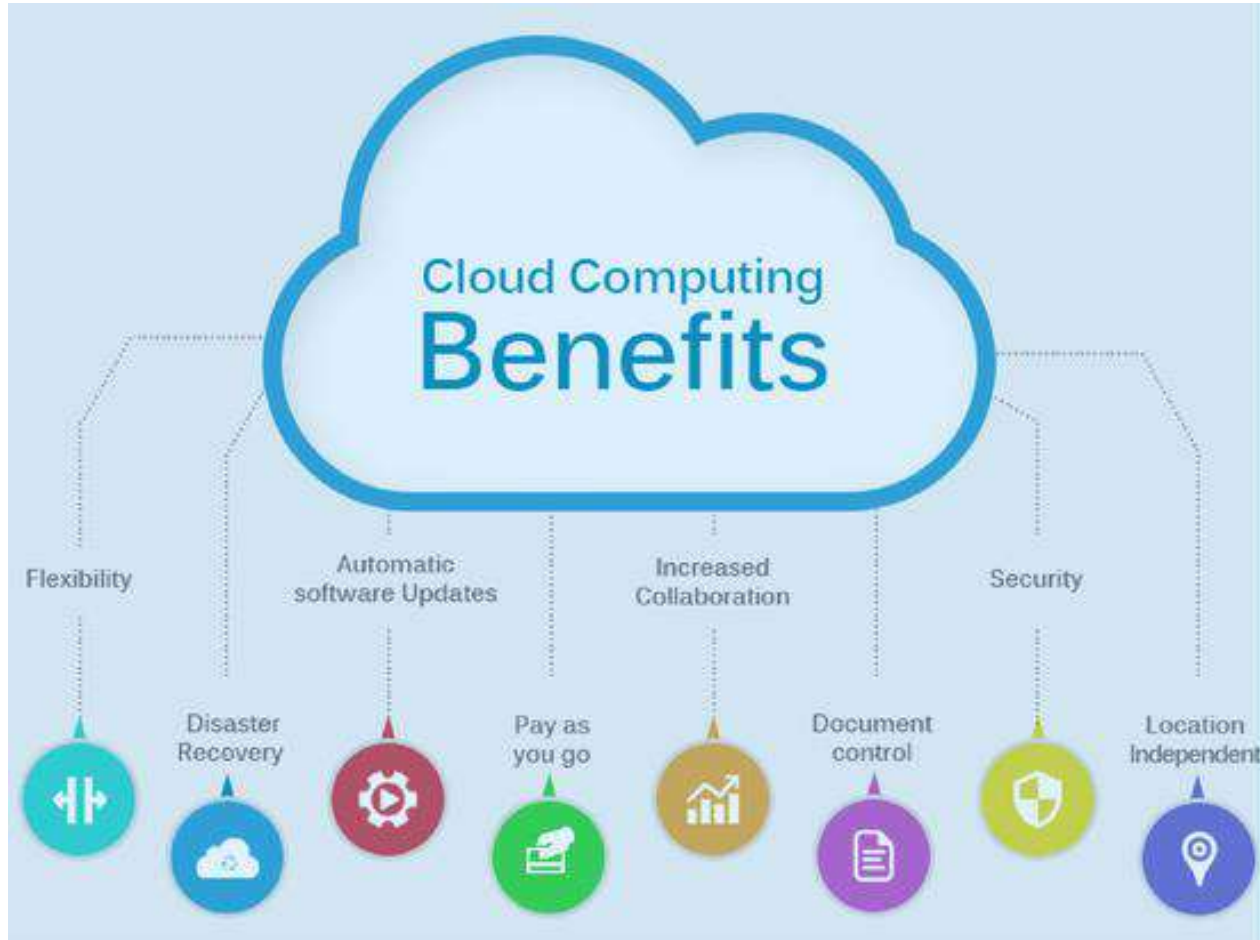
Lessons learned:
What we have learnt and implemented

Be Flexible & Work together

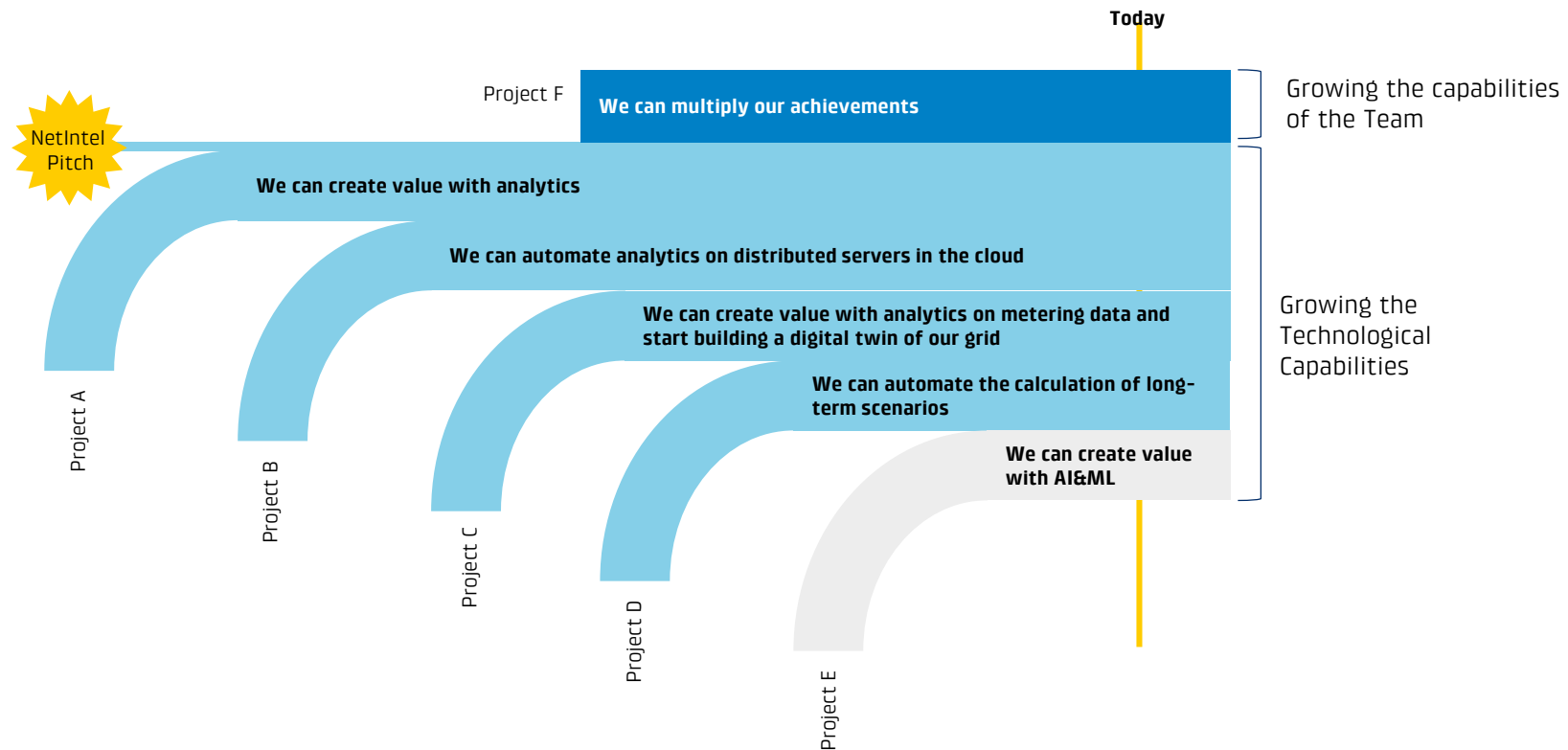


An interdisciplinary and agile cell (that survives)

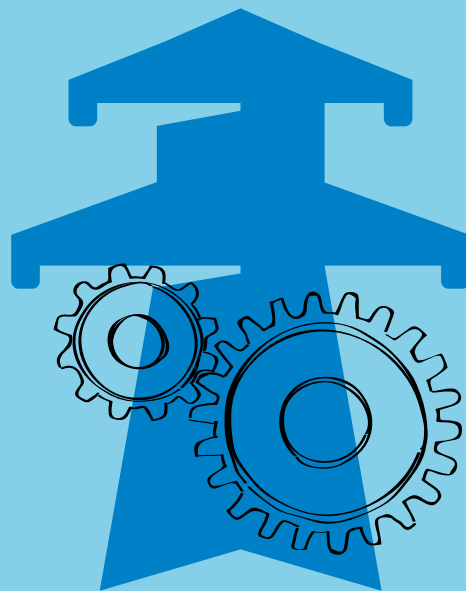
IT-Flexibility: Cloud & Microservices



Focusing on the return of investment while improving the capabilities of the platform and the team



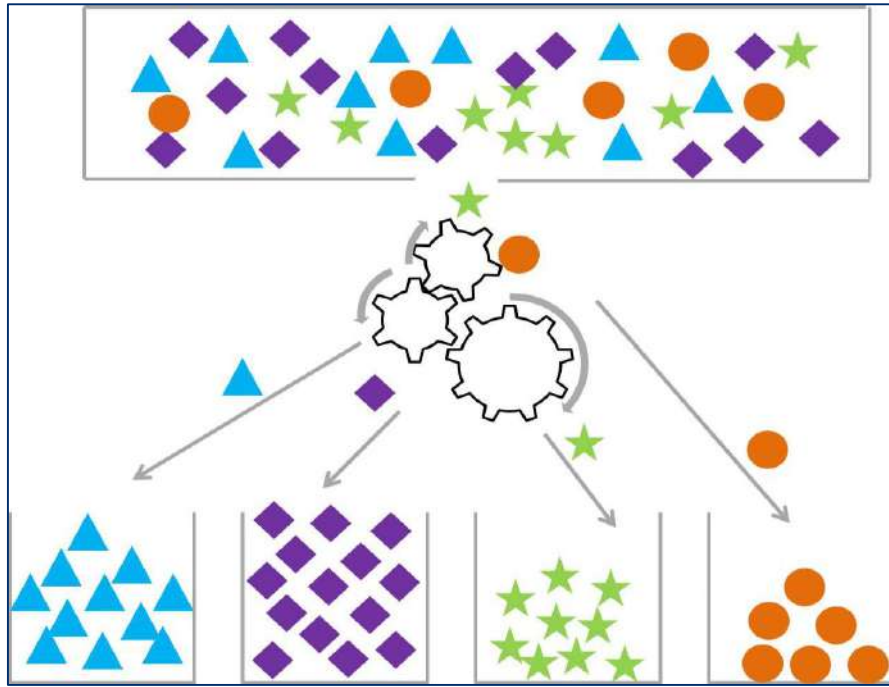
No big budget up front, but small steps with a good ROI



NetIntel: Where are we today?

We build our own Models (In-House)

Standard Load Profiles for Network Planning

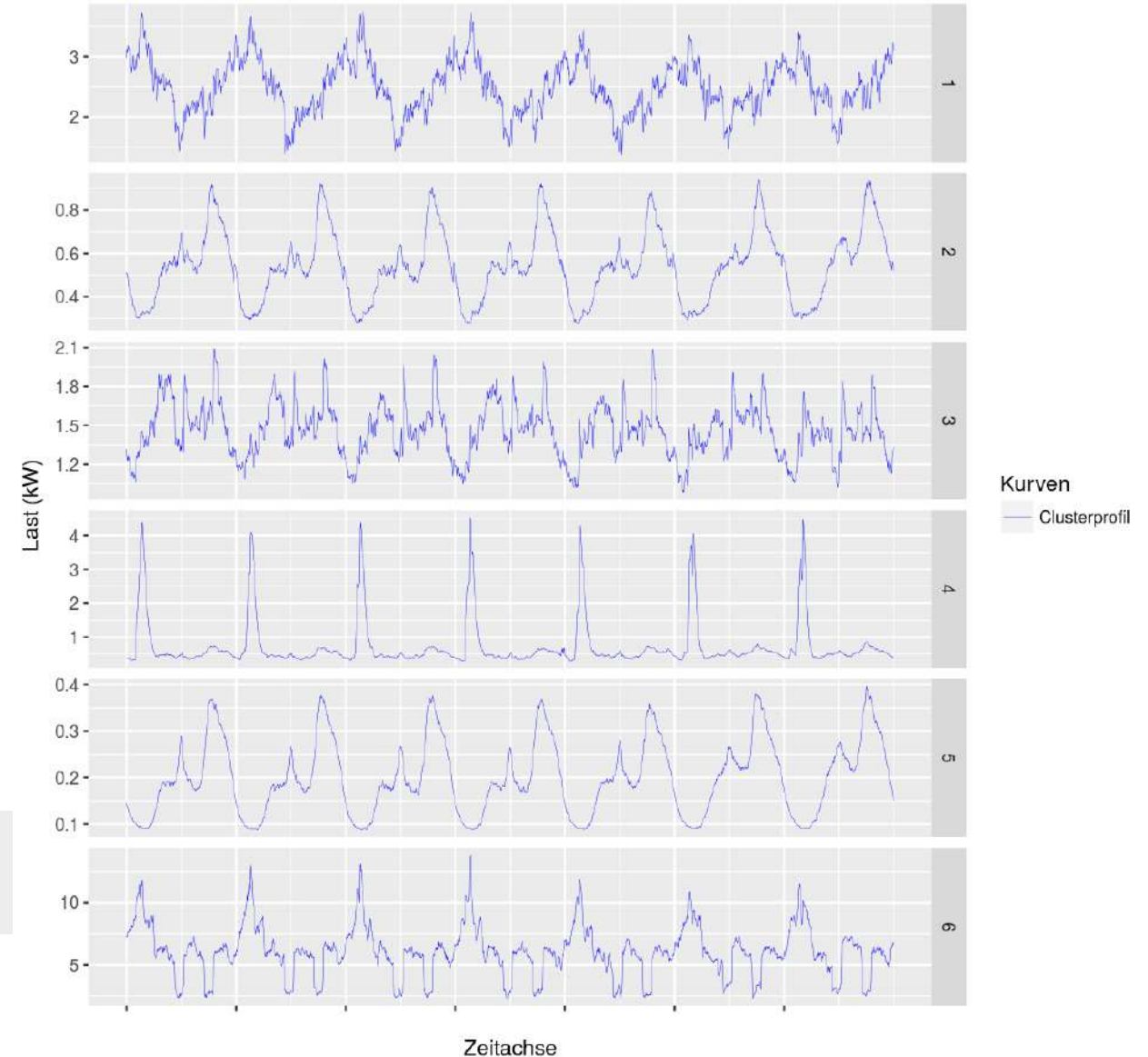


Clustering with K-Means Algorithm

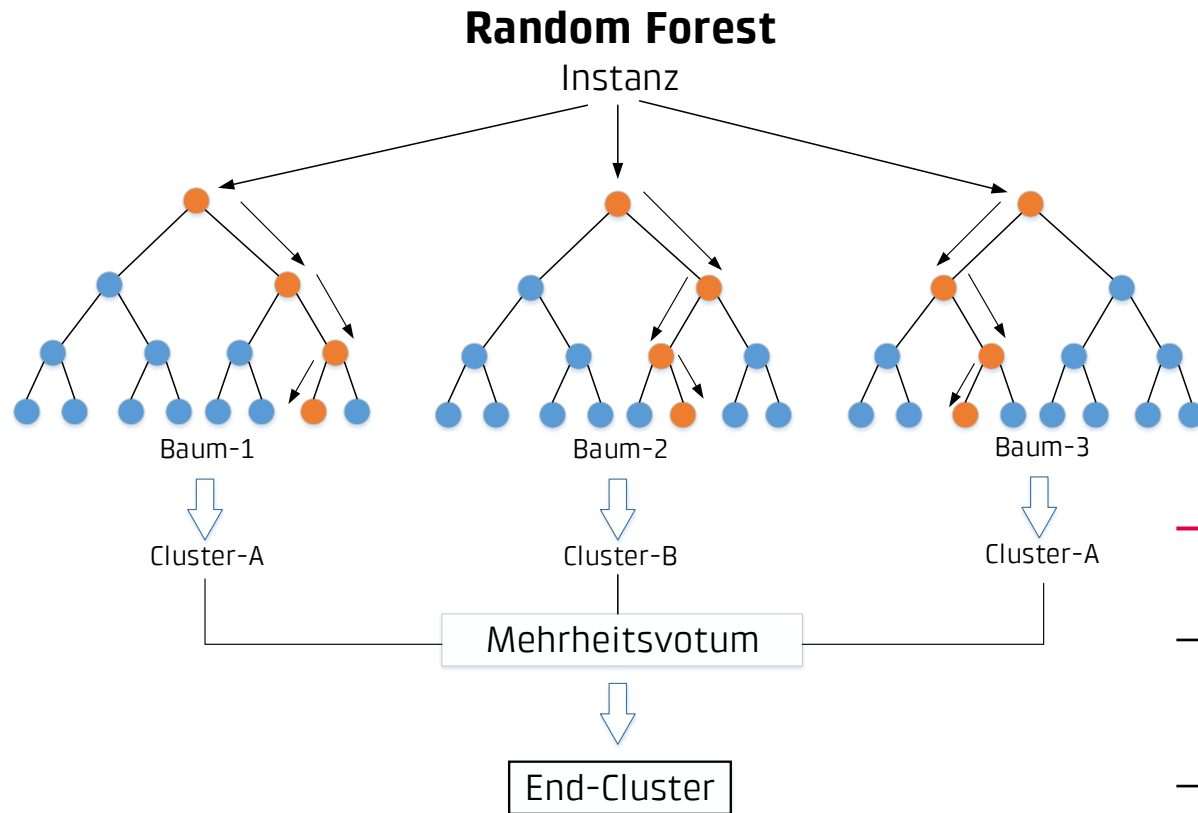
Our goal is to categorize our customers for "realistic" network calculations

Clusterprofile

Anzahl Profile pro Cluster: 17 - 136 - 47 - 70 - 426 - 4



ML-Load Profile classification



Customer Input Data:

1. Energy consumption per year (E_{year})
2. Number of rooms
3. Type of warming water system
4. Type of Heating system
5. Maximum Power (P_{max})

Parameter	4 Cluster	5 Cluster	6 Cluster	7 Cluster
Building information	83 %	81 %	67 %	69 %
All Data except energy	90 %	84 %	73 %	73 %
All Data except Pmax	90 %	90 %	88 %	91 %
All Parameters	96 %	94 %	92 %	94 %

**We use AI for Document classification
(In-House + Expert Support)**



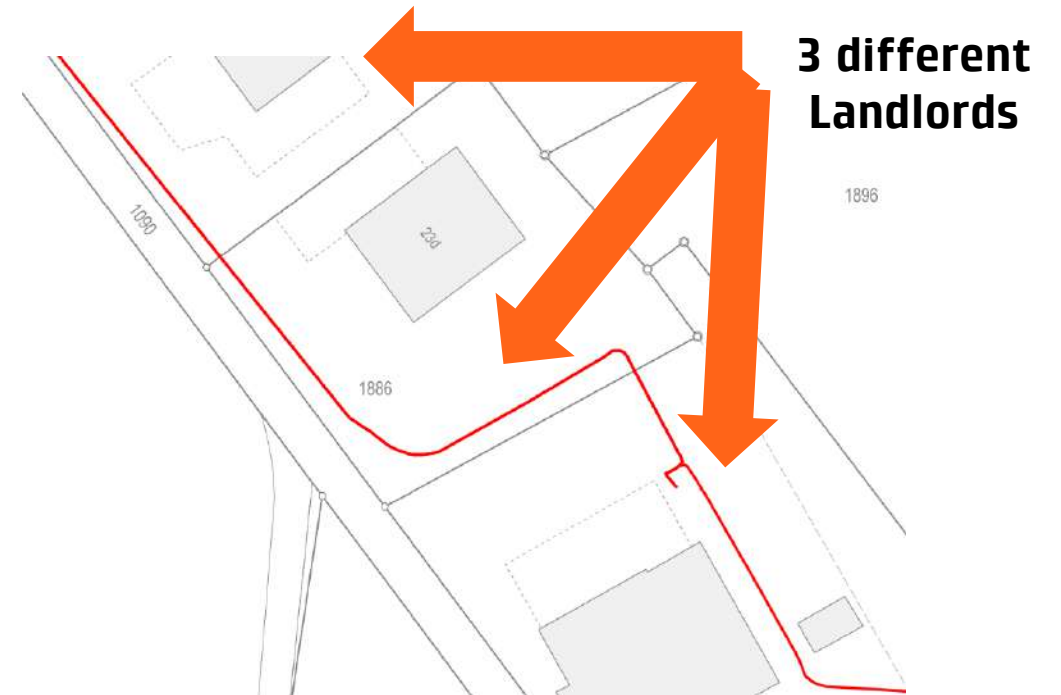
VISION

Digitalization of existing processes: Contracts

- First Case: Easement Contracts (Dienstbarkeitsverträge)

- When we require to install our assets (ie. Cable-lines, transformers), we must make a contract with each landlord.
- Our assets have an average life of 40 years (or more!), therefore we should track the contracts for renewal or regular payment purpose

Underground
Cable



Digitalization of existing processes: Contracts

- Documents need to be digitalized
- How? The important information needs to be extracted
- The non-valid contracts need to be sorted
- **Most important:** An added-value needs to be generated

PDF != Digital

- Landlord
- Address
- Contract-type
- Relevant dates

ie. Asset no longer exists

- Access to the data
- Increase quality
- Reduce costs

First approach: Digitalize the contracts manually

- $\pm 10\%$ of the contracts have been scanned and loaded into our systems
- Experts have also extracted the information and analyzed the validity of the contracts

First estimations show that digitalizing 100% of the contracts require...

>5 years

Investment is not feasible

Second approach: AI Solution

Challenges:

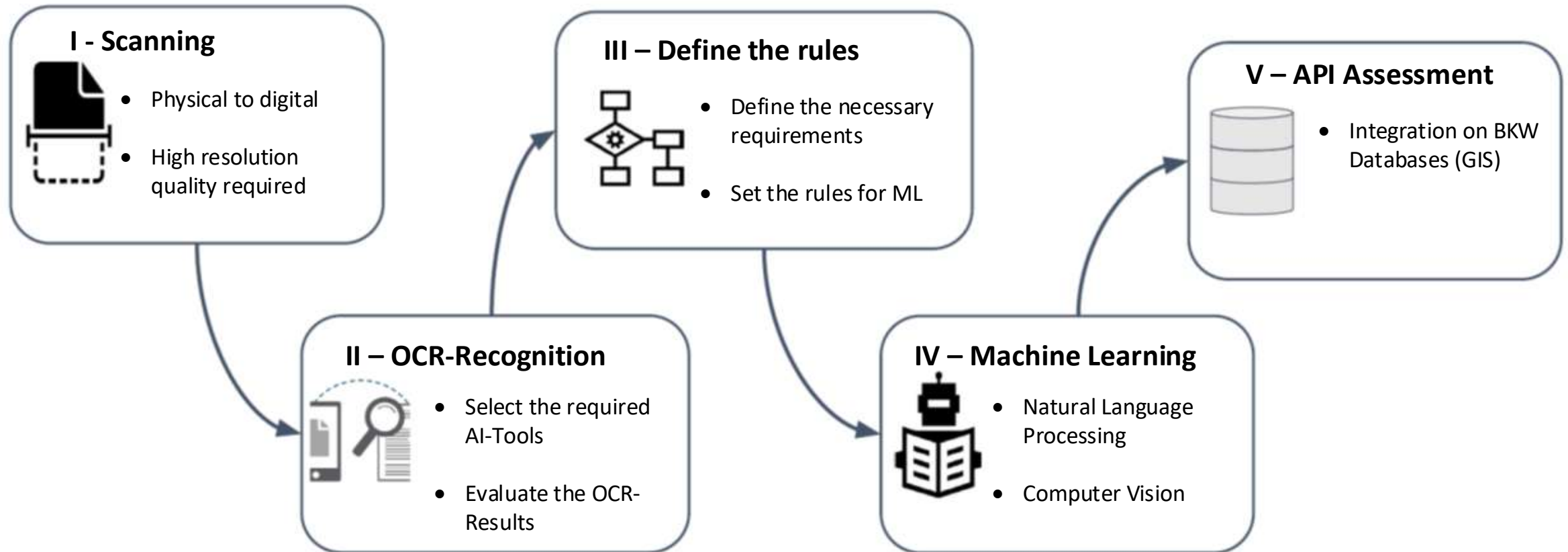
- Up to 200k Contracts for the last +100 years
- Two different languages, more than 100 different contract-types
- Some documents include hand-writting or remarks
- Some contract owners, addresses or lot numbers no longer exist
- No AI (Text-recognition) Experience within our company

Expectations:

- We want to build Know-How for further similar Use-Cases
- We want to operate our solution for further development

**Development of an In-House
Solution with an external Expert
Partner**

Digitalization of the Easement Contracts



Generating value from AI

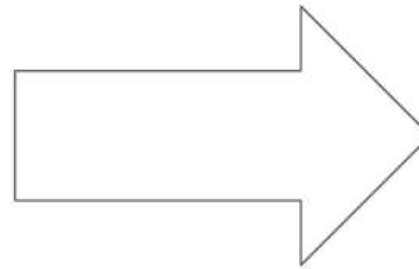
Unstructured Data

Antrag ZANIT
Der Bittsteller ist Leistung oder bei späteren Arbeiten an der Leitung eine Kontrolle, Unterbaue und Reparatur versuchte
zu leisten.
Art. 5
Die Grundbesitzer Grundbesitzer gegenüber dem Grundstück für den Schaden, der durch den Bau oder
Betrieb der elektrischen Leitung entstehen sollte.
Art. 6
Der Grundbesitzer ist dafür berechtigt, Bäume und Äste, welche die Leitung gefährden können, nach Rücksprache mit der BKW
entfernen zu lassen.
Für Bäume, welche der Grundbesitzer nach Entfall der
Zurückgefahren werden müssen, zahlt die BKW keine Ent-
Art. 7
Sollte eine spätere Überleitung oder sonstige notwendige
Veränderungen erforderlich sein, so ist der
Grundbesitzer verpflichtet, die Kosten zu tragen.
Für die Verlegung der Leitung (Hohlröhre) auf einen anderen Fuß-
zu zahlen. Eine zusätzliche Entschädigung hierfür wird ge-
leistet. Wird die Verlegung von den zuständigen Bediensteten
möglich, so sind die BKW wegen einer notwendigen Ver-
schiebung der Leitung zur Hälfte zu zahlen. Schädigung
Art. 8
Der Grundbesitzer verpflichtet sich, bei einer Verletzung
Rechtsansprüche zu übernehmen für sämtliche Kosten, in F-
Art. 9
Jeder Partei erhält ein Exemplar des Vertrags.
Art. 10
Die BKW und berechtigt dessen Vertrag auf dem Boden
ausdrückliche Genehmigung.

1426

Vollstreckungs-
E-117-Forderung, Hausnummer: Vertrag Nr. 1.74214.000
Büroexemplar

Dienstbarkeitsvertrag
zwischen der
BKW FMB Energie AG
Betreiber BKW genannt
und
Betreiber Grundbesitzer genannt
betreffend
Recht auf Duldung einer elektrischen Freileitung
Art. 1
Der Grundbesitzer, für sich und seine Nachkommen, erteilt der BKW und deren ständigen Rechtsnachfolgern oder Makulanten das
einstufige Recht, eine elektrische Niederspannung-Freileitung für die Dauer der Existenz und nach den gesetzlichen Vorschriften
durch seine nachfolgenden Grundbesitzer zu ziehen. Zu diesem Zweck sind die BKW ersichtlich berechtigt, die notwendigen
Ingenieur- und Anlagen- sowie Grundstücke zu ziehen und letztere zwecks Bau, Leitung, Kontrolle und Unterhalt der Leitung durch die
Personen oder ihre Beauftragten jederzeit zu betreten, zu betreten und wenn nötig in Anspruch zu nehmen.
Art. 2
Der Grundbesitzer, über welche die Leitung führt, sind wie folgt angegeben:
Grundbesitzer: Grundbesitzer Lokations: Grundbesitzer
Art. 3
Der BKW für die Errichtung der Dienstbarkeit in beschränkter Anzahl Entschädigungen betragen für
3. Stange: 400,- Fr. 1.200,-
Stange: 400,- Fr. 1.200,-
Stange: 400,- Fr. 1.200,-
Stange: 400,- Fr. 1.200,-
Veränderung an Stange: 400,- Fr. 1.200,-
Kontrollier: 400,- Fr. 1.200,-
Erlauben und Aussehen
von Entschädigungen soll
entsprechend sein.
Total: 1.600,-
Die Entschädigungen sind zahlbar bei Errichtung der Leitung auf
Bau: 40-23.018-0 Konto-Nr. 40-23.018-0
Postkassen-Nr. 40-23.018-0 Postkassen-Nr. 40-23.018-0



Structured data

Type	0.4 kV-Freileitungsvertrag
Municipality	Oberburg
Lot Number	48
Date	03/1999
Signatures	OK
Validity	OK



Integrated with
internal DMS
e.g. SAP S/4HANA

VISIUM

**We use AI for Visual Recognition for
our Asset Management**

(External AI Solution)



Current inspection methods are labour intensive, expensive and dangerous

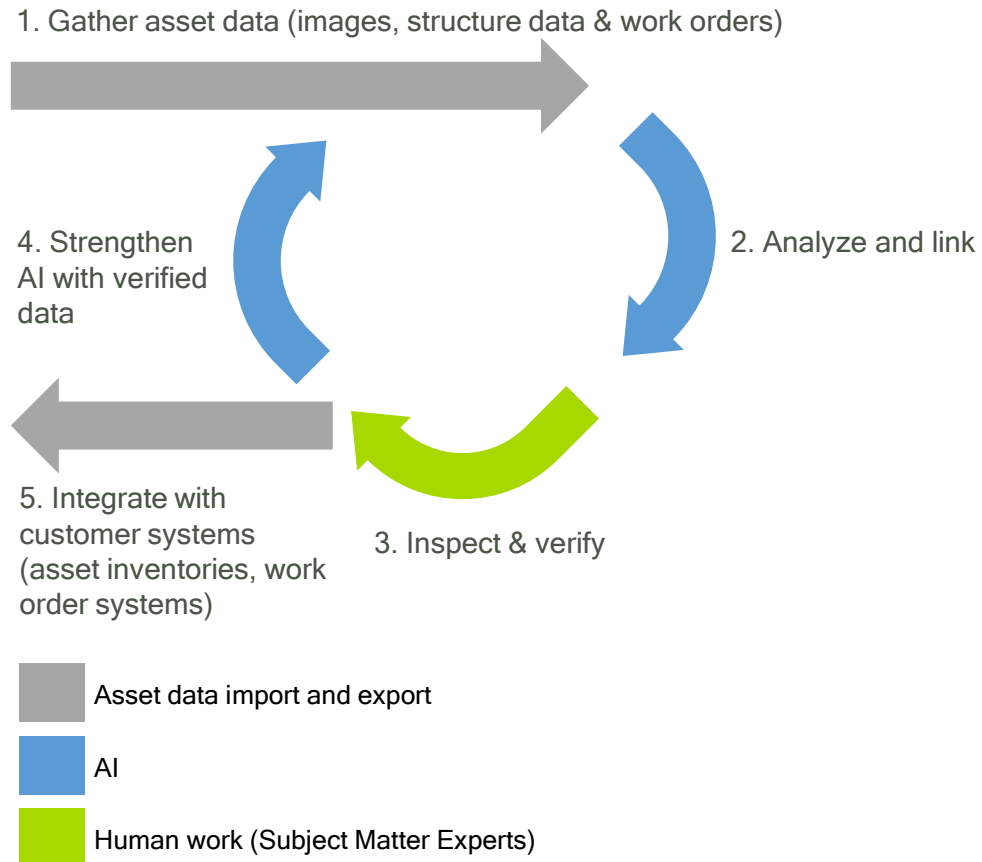


Current inspection methods are manual,
dangerous, slow and costly

Data is manually processed - defects are not detected in a
timely manner

Turning inspection data into asset insight

How?



Why?



1. **Improve the efficiency of inspection work** by facilitating the ability to turn image data into annotated asset records



2. **Enhance reliability** by acting on a problem before it causes issues



3. **Improve safety** by keeping people out of harms way



4. **Optimize capex** through more targeted capex spend



5. **Easily comply with regulatory requirements** through extensive documentation of the grid

Why using an external AI-Solution?

- AI Solutions based on Visual recognition require big datasets
- Required resources for picture classification & Model development are too high
- We profit from the development done together by eSmart with other utilities
- We can still shape & strengthen the AI with our Expert's classifications

What it is important for us:

- We can export & use the predictions for other purposes and in other environments
- We can build additional services & interfaces on top of this solution

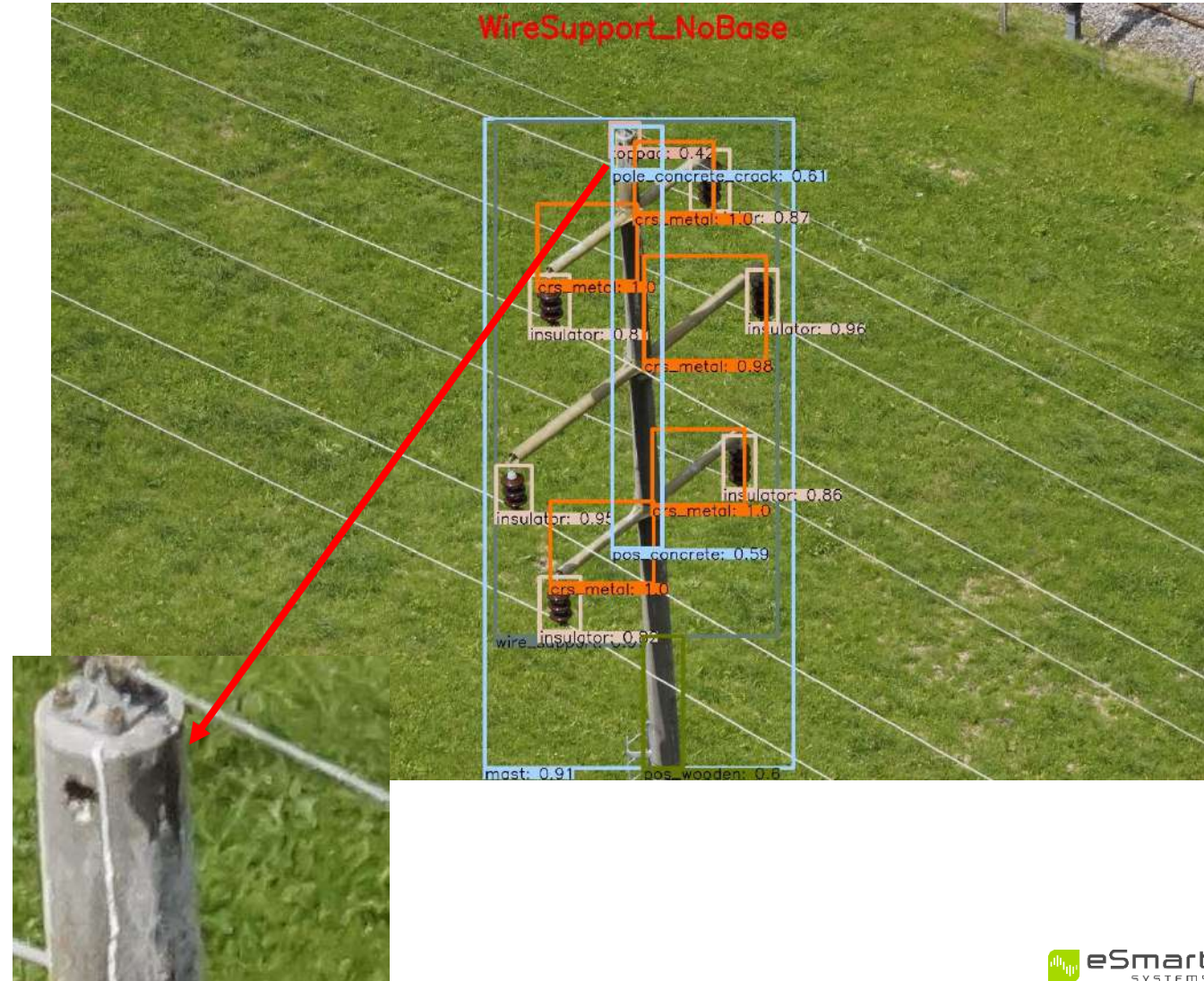
But we can & will challenge them

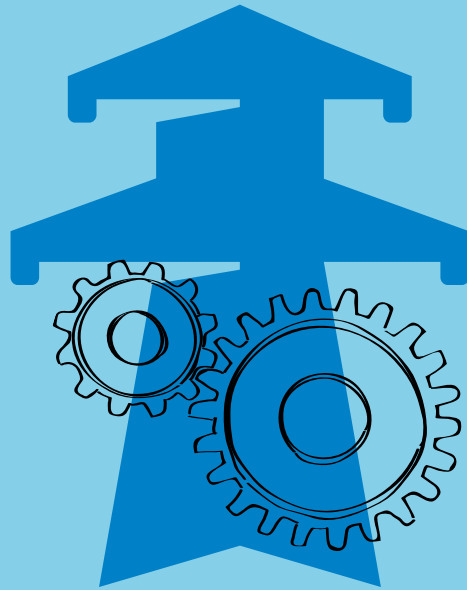
Actual state of the collaboration

- We ran the AI-Solution on a first small dataset
- Assets are correctly identified & classified
- Potential defects are identified

Next Steps:

- Our Experts will classify a training set using the Grid Vision™ manual inspection feature
- AI-Model will be improved and tested on a new Test data set
- Business Case analysis for the integration of the Grid Vision™ software in our process





Conclusions

Conclusions

- Accept your company culture and strategy, don't try to reshape the future alone
- Be flexible & agile. Requirements will change, try to understand them
- Main focus with AI should always be generate value
- In-House & External AI&ML solutions can be successful, try to define your strategy for each case
- Nobody better than ourselves to understand and fullfill our requirements
- Share success, involve rather than convince stakeholders. Being right is not enough!

Thank you for your attention

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