



The Power of a Single Integrated Database

Gábor Bús



TSCNET
Services

Connect. Create. Coordinate.

European Power Transmission System



World Largest interconnected grid



About 40 thousand network elements



700 Mio customers



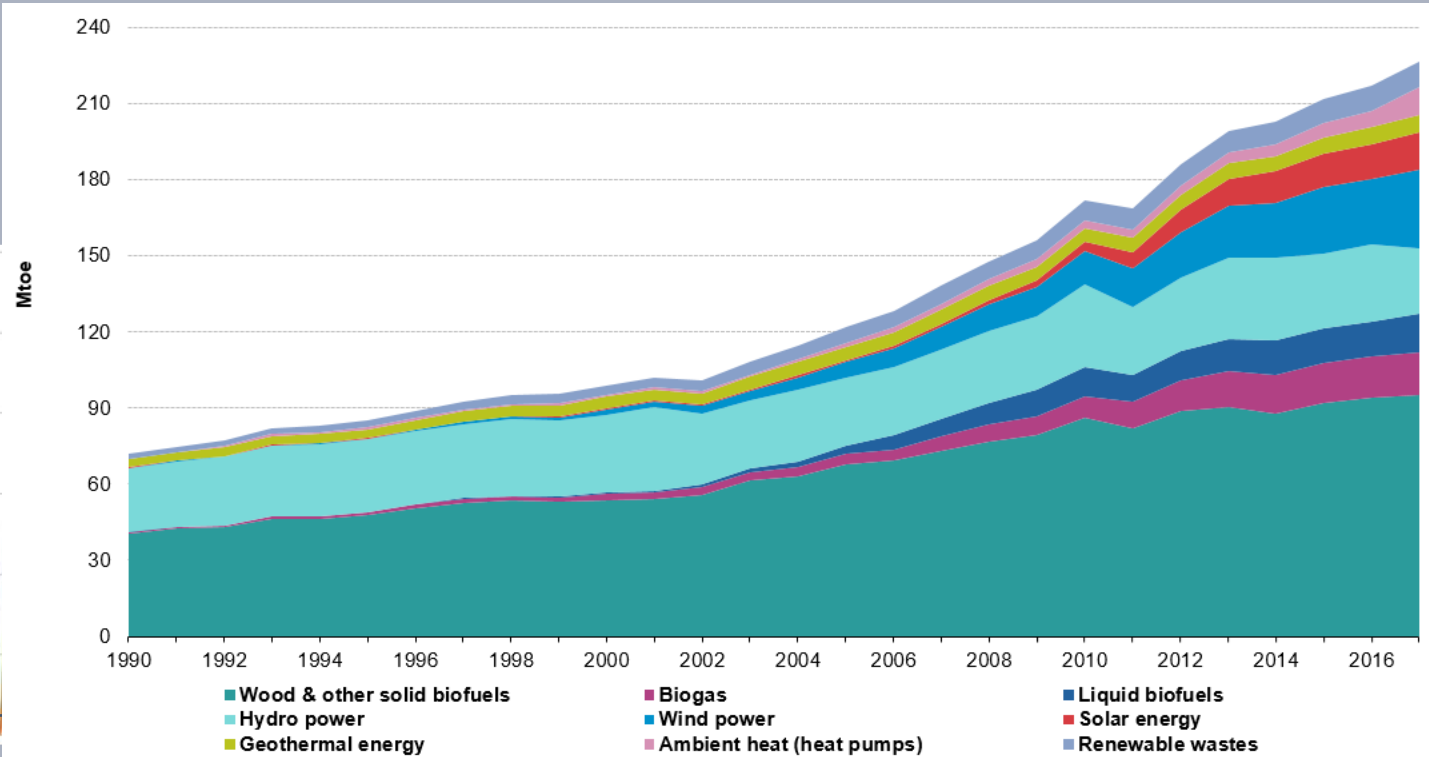
42 TSOs covering 35 countries



Customers and shareholders

Other European countries

European Power Transmission System



12.000

2.000

The main 5 Services



Outage Planning

- More time horizons

3 Applications



Adequacy Assessment

- 1 Time horizon

1 Application



Coordinated Capacity Calculation

- More time horizons

2 Applications



Common grid Merging

- More time horizons

2 Applications



Coordinated Security Assessment

- More time horizons

2 Applications

24/7 shift operation

Challenge #1: Integrate Source Systems



Diverging tools and environments



Uncomfortable access of tools via VPN



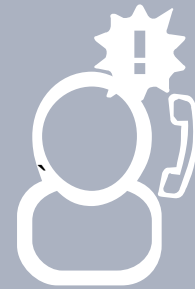
Dynamic IDs of network elements



Overlapping processes during the shifts



Enormous amount of data to process



Solution #1



Pinpoint the what and where needs attention



Integration of relevant data to PI



Standardise network element IDs



Implement intuitive PI Vision Dashboards

Solution #1



Pinpoint the what and where needs attention



Integration of relevant data to PI

- Define the use cases
- Carefully asses the necessary data points (e.g. versions)
- 33 UFL interfaces
- 700k tags

- The diverging identifiers are mapped to a Unique TSCNET ID
- Reference:

Identifier	R (reference)	Y (value)
BZANDV3		
BZANDV3 9		
CALB	1	
CNOS	1	
L0001		



The screenshot shows a list of components and their UIDs. The components are listed in a column on the left, and their corresponding UIDs are listed in a column on the right. A large blue Pi logo is overlaid on the list.

Component	UID
CALB__1_CNOS__1_L0001	...
CALB__1_XAL_DB1_L0001	...
CALB__1_XAL_DB2_L0001	...
CALB__1_XAL_DB3_L0001	...
CALB__1_XAL_DB4_L0001	...
CALB__1_XAL_DB5_L0001	...
CALB__1_XAL_DB6_L0001	...
CALB__1_XAL_DB7_L0001	...
CALB__1_XAL_DB8_L0001	...
CALB__1_XAL_DB9_L0001	...
CALB__1_XAL_DB10_L0001	...
CALB__1_XAL_DB11_L0001	...
CALB__1_XAL_DB12_L0001	...
CALB__1_XAL_DB13_L0001	...
CALB__1_XAL_DB14_L0001	...
CALB__1_XAL_DB15_L0001	...
CALB__1_XAL_DB16_L0001	...
CALB__1_XAL_DB17_L0001	...
CALB__1_XAL_DB18_L0001	...
CALB__1_XAL_DB19_L0001	...
CALB__1_XAL_DB20_L0001	...
CALB__1_XAL_DB21_L0001	...
CALB__1_XAL_DB22_L0001	...
CALB__1_XAL_DB23_L0001	...
CALB__1_XAL_DB24_L0001	...
CALB__1_XAL_DB25_L0001	...
CALB__1_XAL_DB26_L0001	...
CALB__1_XAL_DB27_L0001	...
CALB__1_XAL_DB28_L0001	...
CALB__1_XAL_DB29_L0001	...
CALB__1_XAL_DB30_L0001	...
CALB__1_XAL_DB31_L0001	...
CALB__1_XAL_DB32_L0001	...
CALB__1_XAL_DB33_L0001	...
CALB__1_XAL_DB34_L0001	...
CALB__1_XAL_DB35_L0001	...
CALB__1_XAL_DB36_L0001	...
CALB__1_XAL_DB37_L0001	...
CALB__1_XAL_DB38_L0001	...
CALB__1_XAL_DB39_L0001	...
CALB__1_XAL_DB40_L0001	...
CALB__1_XAL_DB41_L0001	...
CALB__1_XAL_DB42_L0001	...
CALB__1_XAL_DB43_L0001	...
CALB__1_XAL_DB44_L0001	...
CALB__1_XAL_DB45_L0001	...
CALB__1_XAL_DB46_L0001	...
CALB__1_XAL_DB47_L0001	...
CALB__1_XAL_DB48_L0001	...
CALB__1_XAL_DB49_L0001	...
CALB__1_XAL_DB50_L0001	...
CALB__1_XAL_DB51_L0001	...
CALB__1_XAL_DB52_L0001	...
CALB__1_XAL_DB53_L0001	...
CALB__1_XAL_DB54_L0001	...
CALB__1_XAL_DB55_L0001	...
CALB__1_XAL_DB56_L0001	...
CALB__1_XAL_DB57_L0001	...
CALB__1_XAL_DB58_L0001	...
CALB__1_XAL_DB59_L0001	...
CALB__1_XAL_DB60_L0001	...
CALB__1_XAL_DB61_L0001	...
CALB__1_XAL_DB62_L0001	...
CALB__1_XAL_DB63_L0001	...
CALB__1_XAL_DB64_L0001	...
CALB__1_XAL_DB65_L0001	...
CALB__1_XAL_DB66_L0001	...
CALB__1_XAL_DB67_L0001	...
CALB__1_XAL_DB68_L0001	...
CALB__1_XAL_DB69_L0001	...
CALB__1_XAL_DB70_L0001	...
CALB__1_XAL_DB71_L0001	...
CALB__1_XAL_DB72_L0001	...
CALB__1_XAL_DB73_L0001	...
CALB__1_XAL_DB74_L0001	...
CALB__1_XAL_DB75_L0001	...
CALB__1_XAL_DB76_L0001	...
CALB__1_XAL_DB77_L0001	...
CALB__1_XAL_DB78_L0001	...
CALB__1_XAL_DB79_L0001	...
CALB__1_XAL_DB80_L0001	...
CALB__1_XAL_DB81_L0001	...
CALB__1_XAL_DB82_L0001	...
CALB__1_XAL_DB83_L0001	...
CALB__1_XAL_DB84_L0001	...
CALB__1_XAL_DB85_L0001	...
CALB__1_XAL_DB86_L0001	...
CALB__1_XAL_DB87_L0001	...
CALB__1_XAL_DB88_L0001	...
CALB__1_XAL_DB89_L0001	...
CALB__1_XAL_DB90_L0001	...
CALB__1_XAL_DB91_L0001	...
CALB__1_XAL_DB92_L0001	...
CALB__1_XAL_DB93_L0001	...
CALB__1_XAL_DB94_L0001	...
CALB__1_XAL_DB95_L0001	...
CALB__1_XAL_DB96_L0001	...
CALB__1_XAL_DB97_L0001	...
CALB__1_XAL_DB98_L0001	...
CALB__1_XAL_DB99_L0001	...
CALB__1_XAL_DB100_L0001	...

Solution #1



Imple

- An
- No
- 8 F



Challenge #2: ML with clean data



Explore Machine Learning potentials



Maintain clean & complete data source



Solution #2



Restore the data



Introduce regular, automatic data check



Pilot project for ML

Solution #2



Restore the data

PIDATA

Drive D:

Capacity: 2499 GB

Used space: 325 GB

Free space: 2174 GB

Historic Future

Review and update parameters

#	Start Time	End Time	Duration	Size (MB)	% Full	Compt	Archive File	Last Modified Time	Backup Time
0	8/1/2018 12:00:00 AM	10/1/2018 12:00:00 AM	30d 00:00:00	836	99.9		D:\P\arc\Future\PIDATA_2018-09-01_00-00-00.arc	9/3/2019 10:09:04 PM	9/3/2019 3:15:15 AM
1	8/1/2018 12:00:00 AM	9/1/2018 12:00:00 AM	31d 00:00:00	3911	99.9		D:\P\arc\Future\PIDATA_2018-09-01_00-00-00.arc	9/3/2019 9:38:58 PM	9/3/2019 3:15:15 AM
2	7/1/2018 12:00:00 AM	8/1/2018 12:00:00 AM	31d 00:00:00	3683	99.9		D:\P\arc\Future\PIDATA_2018-07-01_00-00-00.arc	9/3/2019 8:53:49 PM	9/3/2019 3:15:15 AM
3	6/1/2018 12:00:00 AM	7/1/2018 12:00:00 AM	30d 00:00:00	3837	99.9		D:\P\arc\Future\PIDATA_2018-06-01_00-00-00.arc	9/3/2019 9:43:59 PM	9/3/2019 3:15:15 AM
4	5/1/2018 12:00:00 AM	6/1/2018 12:00:00 AM	31d 00:00:00	2970	99.9		D:\P\arc\Future\PIDATA_2018-05-01_00-00-00.arc	9/3/2019 8:08:40 PM	9/3/2019 3:15:15 AM
5	4/1/2018 12:00:00 AM	5/1/2018 12:00:00 AM	30d 00:00:00	2530	99.9		D:\P\arc\Future\PIDATA_2018-04-01_00-00-00.arc	9/3/2019 8:13:41 PM	9/3/2019 3:15:15 AM
6	3/1/2018 12:00:00 AM	4/1/2018 12:00:00 AM	31d 00:00:00	2507	99.9		D:\P\arc\Future\PIDATA_2018-03-01_00-00-00.arc	9/3/2019 4:32:55 PM	9/2/2019 3:15:13 AM
7	2/1/2018 12:00:00 AM	3/1/2018 12:00:00 AM	28d 00:00:00	2314	99.9		D:\P\arc\Future\PIDATA_2018-02-01_00-00-00.arc	9/3/2019 8:06:08 AM	9/1/2019 3:15:15 AM
8	1/1/2018 12:00:00 AM	2/1/2018 12:00:00 AM	31d 00:00:00	2961	99.9		D:\P\arc\Future\PIDATA_2018-01-01_00-00-00.arc	9/3/2019 6:53:25 PM	9/3/2019 3:15:15 AM
9	12/1/2018 12:00:00 AM	1/1/2019 12:00:00 AM	31d 00:00:00	3173	99.9		D:\P\arc\Future\PIDATA_2018-12-01_00-00-00.arc	9/3/2019 8:18:42 PM	9/3/2019 3:15:15 AM
10	11/1/2018 12:00:00 AM	12/1/2018 12:00:00 AM	30d 00:00:00	2913	99.9		D:\P\arc\Future\PIDATA_2018-11-01_00-00-00.arc	9/3/2019 8:23:43 PM	9/3/2019 3:15:15 AM
11	10/1/2018 12:00:00 AM	11/1/2018 12:00:00 AM	31d 00:00:00	2272	99.9		D:\P\arc\Future\PIDATA_2018-10-01_00-00-00.arc	9/3/2019 8:03:39 PM	9/3/2019 3:15:15 AM
12	9/1/2018 12:00:00 AM	10/1/2018 12:00:00 AM	30d 00:00:00	3871	99.9		D:\P\arc\Future\PIDATA_2018-09-01_00-00-00.arc	9/3/2019 8:18:42 PM	9/3/2019 3:15:15 AM
13	8/1/2018 12:00:00 AM	9/1/2018 12:00:00 AM	31d 00:00:00	3767	99.9		D:\P\arc\Future\PIDATA_2018-08-01_00-00-00.arc	9/3/2019 12:11:59 PM	9/3/2019 3:15:15 AM
14	7/1/2018 12:00:00 AM	8/1/2018 12:00:00 AM	31d 00:00:00	3672	99.9		D:\P\arc\Future\PIDATA_2018-07-01_00-00-00.arc	9/1/2019 11:59:23 PM	9/2/2019 3:15:13 AM
15	6/1/2018 12:00:00 AM	7/1/2018 12:00:00 AM	30d 00:00:00	3604	99.9		D:\P\arc\Future\PIDATA_2018-06-01_00-00-00.arc	8/30/2019 8:16:28 PM	8/31/2019 3:15:16 AM
16	5/1/2018 12:00:00 AM	6/1/2018 12:00:00 AM	31d 00:00:00	3728	99.9		D:\P\arc\Future\PIDATA_2018-05-01_00-00-00.arc	9/3/2019 6:40:50 AM	9/3/2019 3:15:15 AM
17	4/1/2018 12:00:00 AM	5/1/2018 12:00:00 AM	30d 00:00:00	3740	99.9		D:\P\arc\Future\PIDATA_2018-04-01_00-00-00.arc	9/3/2019 6:40:50 AM	8/30/2019 3:18:08 AM
18	3/1/2018 12:00:00 AM	4/1/2018 12:00:00 AM	31d 00:00:00	3393	99.9		D:\P\arc\Future\PIDATA_2018-03-01_00-00-00.arc	9/2/2019 1:44:44 AM	9/2/2019 3:15:13 AM
19	2/1/2018 12:00:00 AM	3/1/2018 12:00:00 AM	28d 00:00:00	3445	40.1		D:\P\arc\Future\PIDATA_2018-02-01_00-00-00.arc	9/3/2019 8:08:40 PM	9/2/2019 3:15:13 AM
20	1/1/2018 12:00:00 AM	2/1/2018 12:00:00 AM	31d 00:00:00	3906	67.7		D:\P\arc\Future\PIDATA_2018-01-01_00-00-00.arc	9/1/2019 8:13:36 PM	9/2/2019 3:15:13 AM
21	12/1/2017 12:00:00 AM	1/1/2018 12:00:00 AM	31d 00:00:00	3120	99.9		D:\P\arc\Future\PIDATA_2017-12-01_00-00-00.arc	9/1/2019 8:18:37 PM	9/2/2019 3:15:13 AM
22	11/1/2017 12:00:00 AM	12/1/2017 12:00:00 AM	30d 00:00:00	3688	74.9		D:\P\arc\Future\PIDATA_2017-11-01_00-00-00.arc	9/3/2019 8:53:49 PM	9/2/2019 3:15:13 AM
23	10/1/2017 12:00:00 AM	11/1/2017 12:00:00 AM	31d 00:00:00	3453	78.1		D:\P\arc\Future\PIDATA_2017-10-01_00-00-00.arc	9/2/2019 1:39:43 AM	9/2/2019 3:15:13 AM
24	9/1/2017 12:00:00 AM	10/1/2017 12:00:00 AM	30d 00:00:00	3906	99.9		D:\P\arc\Future\PIDATA_2017-09-01_00-00-00.arc	9/3/2019 8:13:36 PM	9/3/2019 3:15:13 AM

Solution #2

VM health

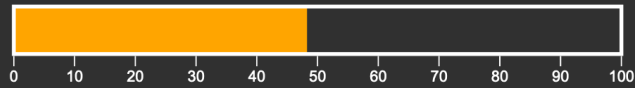
Asset: 10.61.131.142 PI SQL ▼

Ad Hoc Display



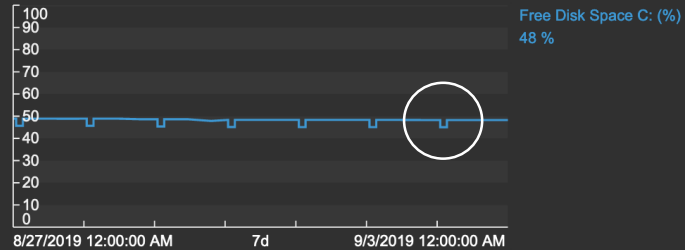
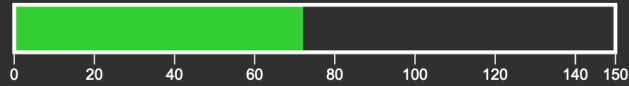
10.61.131.142 PI SQL|Free Disk Space C: (%)

48 %



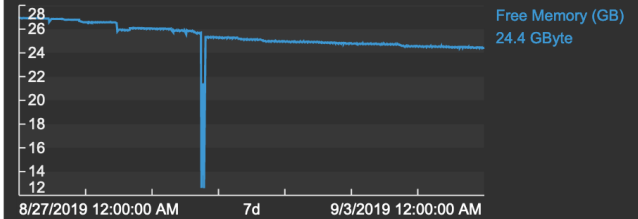
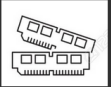
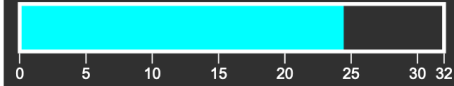
10.61.131.142 PI SQL|Free Disk Space C: (GB)

72 GByte



10.61.131.142 PI SQL|Free Memory (GB)

24 GByte



Solution #2



Pilot project for ML

- Aim: Detect possible overloads without forecast data from TSOs
- Input data: Calendar, Weather forecast, (weekly outage information)
- Model training: Historical congestion forecast results
- Result: Good approximation on country and Time Stamp resolution

Benefits #2



Lessons learned: clean data is 80% of ML or data analyses



It is proved that ML can be potentially used for enhanced services

Single Integrated Database

CHALLENGES

- Diverging source systems and IDs
- Too much data for human processing
- Historize and save data in a secure manner
- Potential in ML?

SOLUTION

- Integrated source system to a single database based on pre-defined use cases
- Run automatic analyses
- Inform operational staff via visualization and notification
- Maintain database health

BENEFITS

- Less time and effort in analyses and reporting
- Higher level of database maintenance
- Proven ML concept for future services

Thank you for your attention



- Gabor Bus
- Lead Data Visualization and Analyses
- TSCNET Services GmbH
- g.bus@tscnet.eu

Questions?

Please wait for
the **microphone**

State your
name & company



Please remember to...

Complete Survey!

Navigate to this session in
mobile agenda for survey

