



SciGRID – Status Quo of an Open Transmission Grid Modelling

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2nd Open Energy Modelling Workshop

14.04.2015

NEXT ENERGY

EWE-Forschungszentrum für
Energietechnologie e.V.

STROMNETZ

Forschungsinitiative der Bundesregierung

SciGRID - Overview

I Aims:

- » Building an open topologically network (transmission grid with 220kV and above)
- » Scientific approach, developing (and publishing) of methods for an automatized evaluation (and abstraction) e.g. from openstreetmap data
- » Evaluating and developing of strategies of comparing network models
- » Organizing an expert workshop and an international conference (at the end of the project)

I Scope:

- » Two funded positions at NEXT ENERGY for 3 years

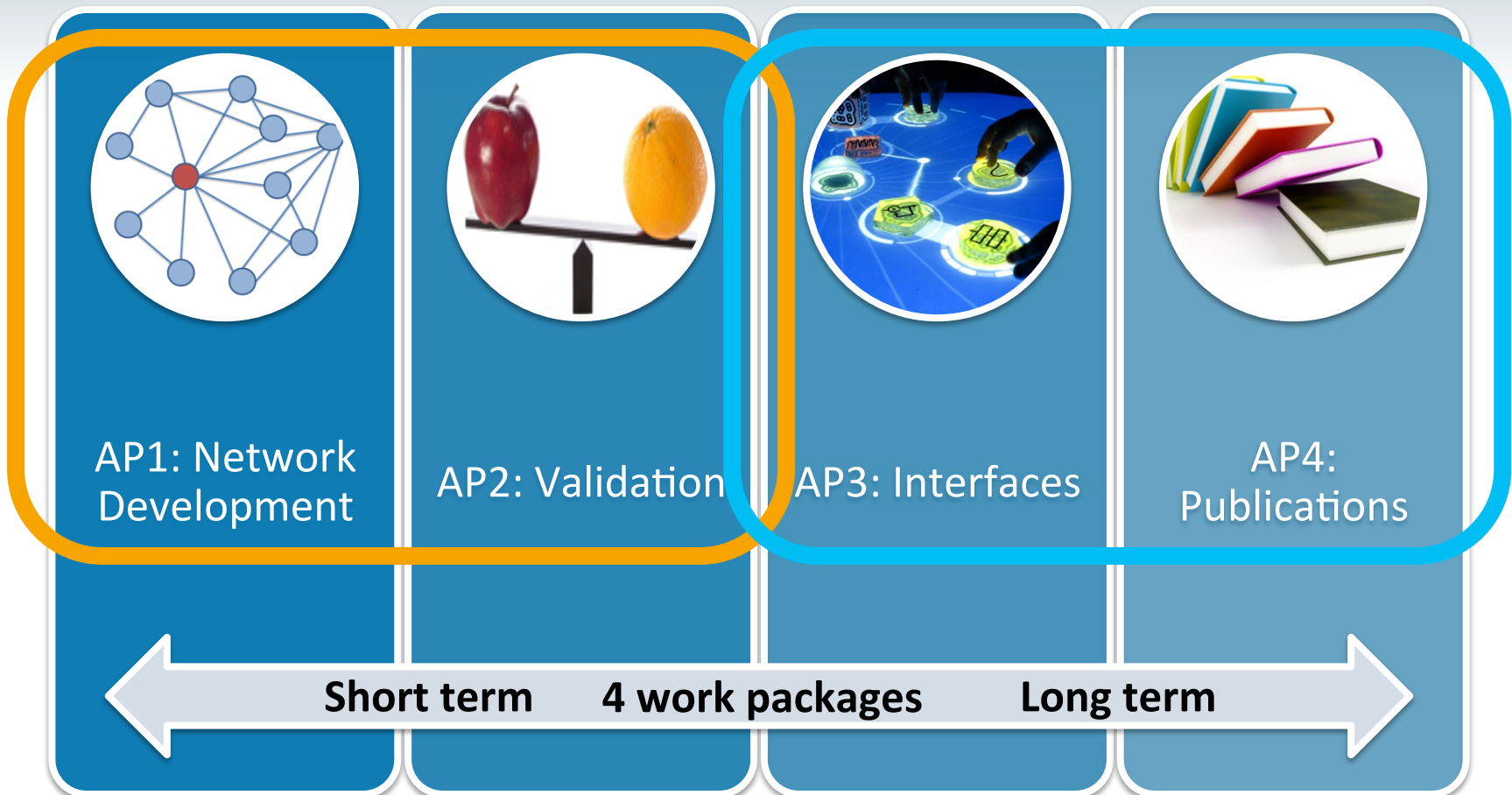
I Status:

- » Project start: 1st of October 2014

SciGRID - Project Plan

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OSM – Data Quantity and Data Quality

mm/yyyy	#OSM User	#circuits	Length of AC 220kV circuits (km)	Length of AC 380kV circuits (km)
01/2010	15	68	820	1536
08/2012	36	476	5295	6686
06/2013	47	497	5302	7122
12/2013	51	520	5464	7274
06/2014	40	664	7169	10303
12/2014	27	771	9987	13890
03/2015	30	773	9997	13915

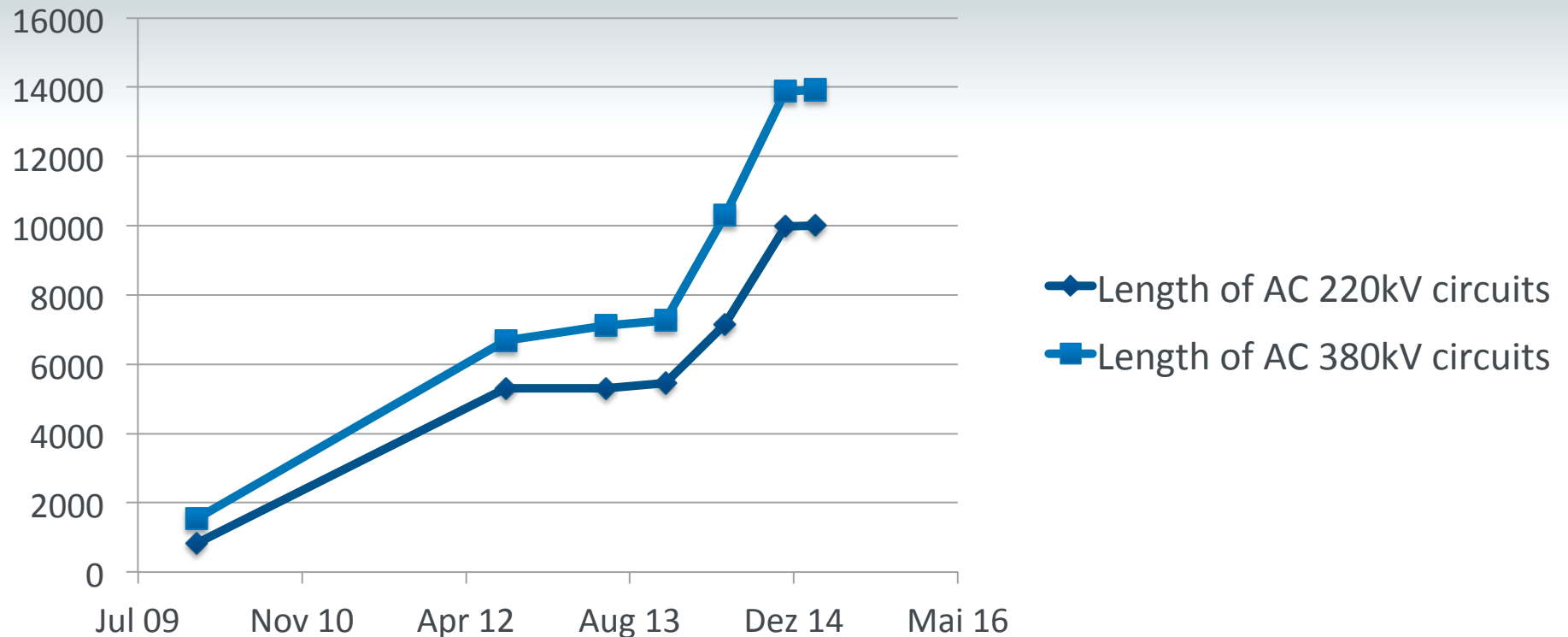
12/2012 ENTSO-E for Germany:

Length of AC 220kV circuits: 14053 km

Length of AC 380kV circuits: 20455 km

Source: <https://www.entsoe.eu/publications/statistics/>

OSM – Data Quantity and Data Quality



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OSM - Data Structure



relation

- ```

<relation id="1560977"
 <member type="way"
 ref="156960646" role="plant"/>
 <member type="way"
 ref="58417796" role="line"/>
 <member type="way"
 ref="23025610" role="substation"/>
 <tag k="route" v="power"/>
 <tag k="type" v="route"/>
 <tag k="voltage" v="380000"/>
 <tag k="cables" v="3"/>
 <tag k="wires" v="quad"/>
</relation>

```

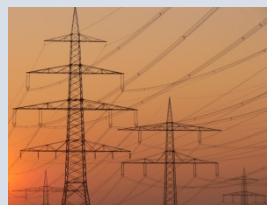


## way

- ```

<way id="58417796"
  <nd ref="2923456189"/>
  <nd ref="2923456185"/>
  <nd ref="724245909"/>
  <nd ref="724245923"/>
  <nd ref="1691982847"/>
  <tag k="power" v="line"/>
  <tag k="voltage" v="380000"/>
</way>

```



node

- ```

<node id="724245909"
 lat="51.8898354"
 lon="14.4283962">
 <tag k="power" v="tower"/>
</node>

```



# OSM - Data Structure



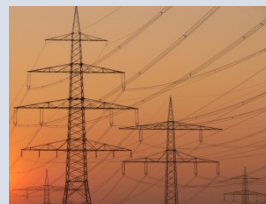
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## node

- ```
<node id="724245909"
  lat="51.8898354"
  lon="14.4283962">
  <tag k="power" v="tower"/>
</node>
```



OSM - Data Structure: Most important „power“ tags



| power=plant, station, substation, sub_station, generator, transformer

» vertices



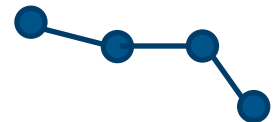
| power=line, cable

» links



| route=power, cables=*, frequency=*, wires=*, voltage=*

» circuits



SciGRID - Abstraction to Topologically Grid Model



 **OpenStreetMap** Bearbeiten Chronik Export

Relation: 302 Marzahn - Thyrow (241441) ×

(kein Kommentar)

Bearbeitet vor etwa ein Monat von [Thomas Plischka](#)
Version #18 · Änderungssatz #29306841

Tags

cables	3
frequency	50
from	Marzahn
name	302 Marzahn - Thyrow
operator	50Hertz
ref	302
route	power
to	Thyrow
type	route
via	Wuhlheide
voltage	220000
wires	double



SciGRID - Transmission Grid Model



Total number of relations with voltage $\geq 220\text{kV}$	779
→ relations to be fixed	34
→ relations with 0 substations	6
→ relations with 1 substation	41
→ relations with 2 substations	623
→ relations with 3 substations	67
→ relations with 4 substations	3
→ relations planned/construction	5

Summary - Building a Topologically Grid Model



Download planet-latest.osm.pbf (27GB)

Extraction of Power Data with Osmosis
(3-4h, ca. 100MB)



Export Power Data with osm2pgsql
(Germany, <2min, ca. 500 MB in
Database)



Abstraction of relations with
route=power and voltage $\geq$
220kV and exactly 2
substations
to
Topological Network
(<2min)

Export
data



For Topologically Analysis, Electricity Flow Model, etc.

Outlook

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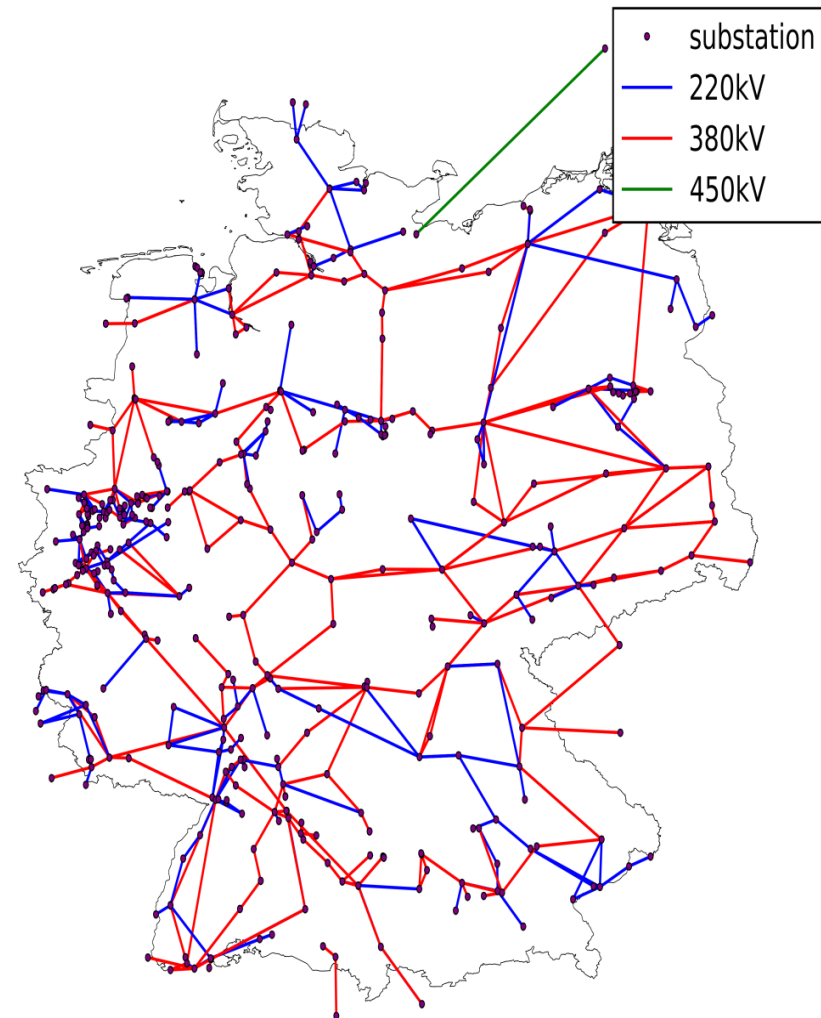
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First release at the end of April
www.scigrid.de

	A	B	C
1	osm_wid	longitude	latitude
2	24799890	6,62582867	51,2606099
3	27867392	1,61188917	49,103754
4	25943440	8,70221849	51,7363526
5	109582315	8,47791063	53,4284855

	A	B	C	D	E
1	from_relation	osm_wid_start	osm_wid_end	length_in_m	voltage
2	67129	28921360	23682013	43379.0	220000
3	67131	27739871	24413992	72685.0	380000
4	67151	24262656	33042984	33942.0	220000
5	67153	24262656	23899043	33471.0	380000



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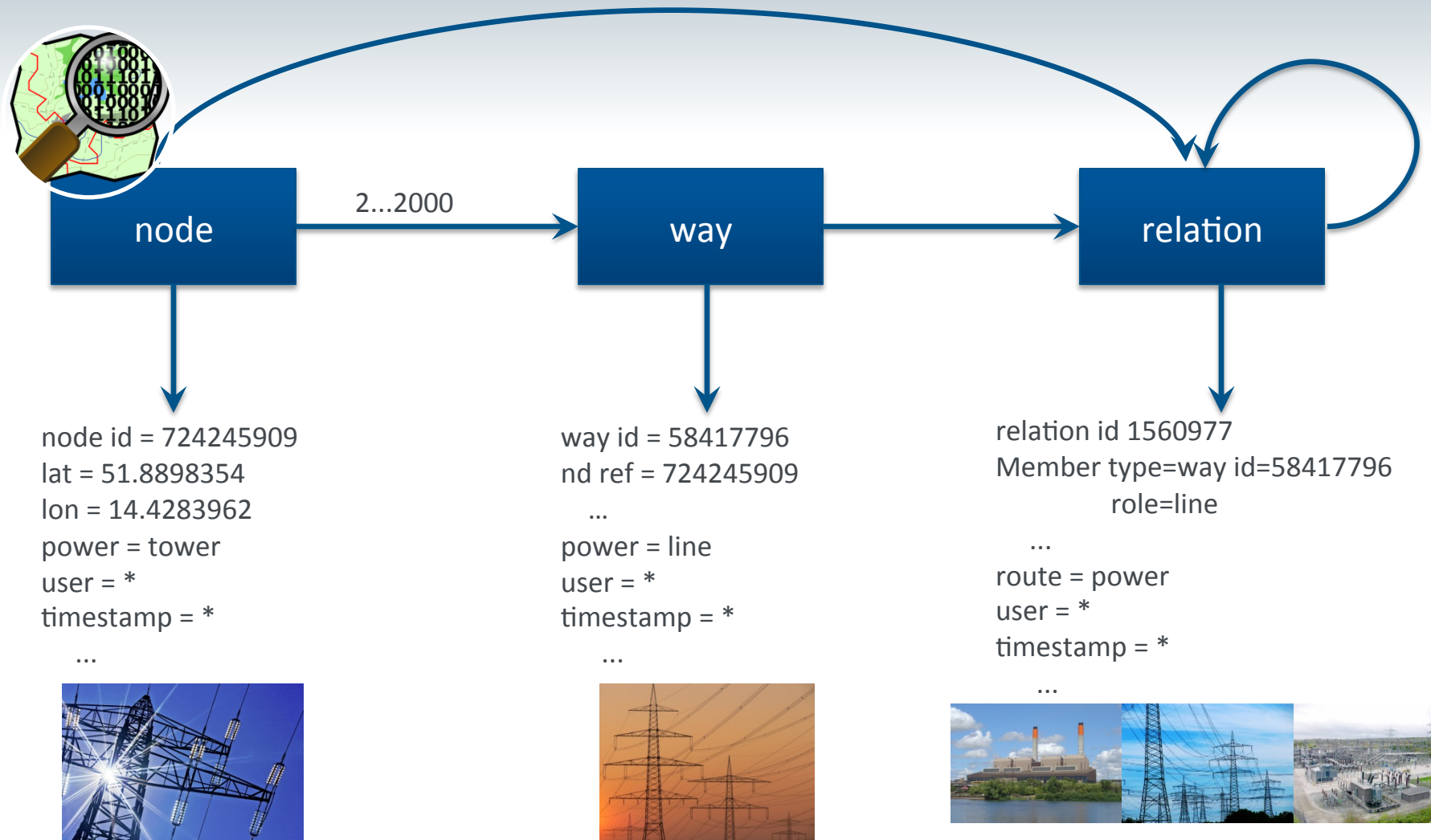
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Thank you for your attention



OSM Data Structure: Example



OSM Data Structure: Distribution of „power“ tags



power=plant

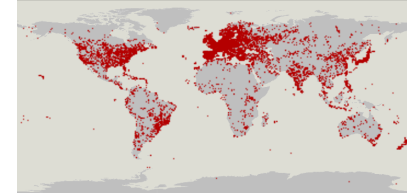
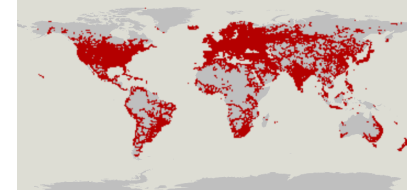
» power=line

» power=generator

- anything that converts energy of one source to electrical energy



Source:
<https://wiki.openstreetmap.org>



Source: <https://taginfo.openstreetmap.org/keys/power>

238 different values → not all of them are relevant
„tower;substation“, “1“, “grounding_electrode“, “2x400“...