Data Format and Communication Standards to Support Forecasting Services

Forecasting Session 3: IEA Wind Task 36 Joint Session: Updates in Best Practices/Tools

Subtask 2.4: Collaboration on standardization with IEC, standardization needs for forecast vendor / user interaction

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ESIG 2020 Meteorology and Market Design Online Workshop

Data Format and Communication Standards to Support Forecasting Services :: Outline

- What is IEA Task 36, Work Package 2, Subtask 2.4?
- What problem are we trying to solve?
- What has been done to date?
- Examples
- Current approach and work
- Future work and how to participate

What is IEA Task 36 Work Package 2?

Power and Uncertainty Forecasting:

Separated into four sub-tasks:

1. Update of the IEA Recommended Practice on Forecast Solution Selection, including benchmarking.
2. Uncovering uncertainty origins and development through the whole modelling chain.
3. Set-up and dissemination of benchmark test cases and data sets
4. Collaboration on standardization with IEC, discussion of standardization needs for forecast vendor / user interaction

Objectives and description of effort: https://www.ieawindforecasting.dk/work-packages/workpackage-3/task-3-3

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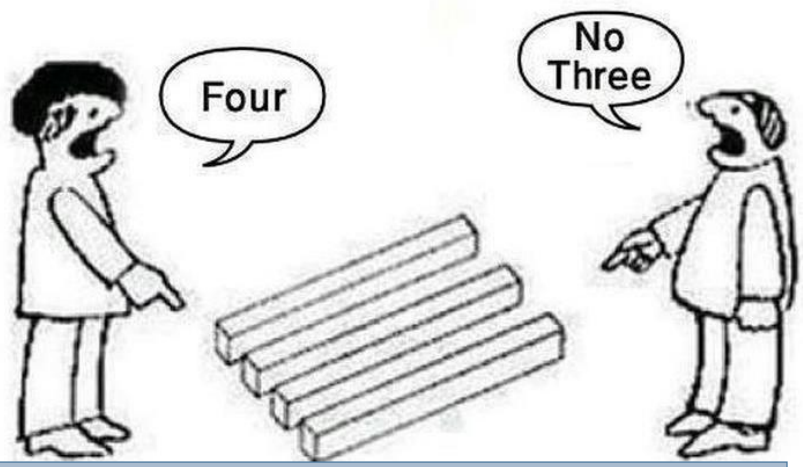
What Problem Are We Trying To Solve?

Current situation between forecast providers and forecast users:

- No clear terminology and definitions
  e.g., Hour-ending, Forecast horizon
- No standard way of exchanging data
  e.g., REST-API, FTP, email, thumb-drive
- Miscommunication and Rework
  Risk: **high**
- Time Consuming



Ultimately, we are trying to reduce bottlenecks so we can further bring down the costs of integrating renewables on the electricity grid

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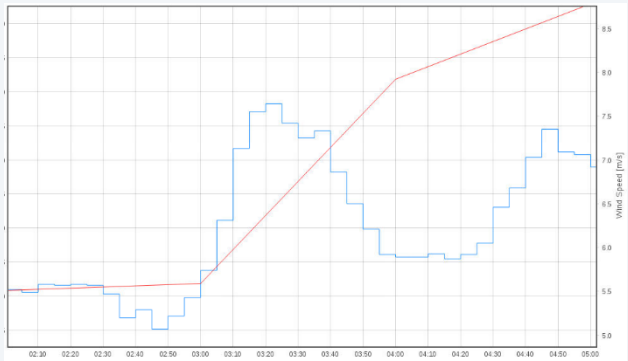
Example of the challenge –

How would you succinctly and effectively describe in words the ***time series date-time interval***?

- Is it indicating the leading- or ending-period?
- Is it the instantaneous or an average value?
- Should the resolution of the interval be articulated the same for measurement and forecast time series?



Enumeration and examples of the product type help define the parameter, but a common information model is required…..

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What has been done to date?

Organization/Effort	Strengths	Weaknesses
ENTSO-E: Weather process and energy prognosis implementation guide	• Very detailed guide for TSOs • Uses IEC standards including Common Information Model (CIM) • Already in use by European TSOs	• Not practical (too expensive) for smaller forecast users to implement • Requires certain level of programming skills to implement
IEC 61400-12: Power performance of wind turbines	• Great model to follow for establishing wind energy industry standard	• Not applicable to renewable energy forecasting (for resource assessment)
IEA Task 36 Phase I: Designing and executing benchmarks and trials	• Applicable to energy forecasting • Provides guidelines for metadata and sample schemas for data exchange	• Lacks details on data structure, definition and units • No link or reference to existing standards (e.g., IEC, ENTSO-E)

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What has been done to date?

Organization/Effort	Strengths	Weaknesses
DOE SFIP2: Open Source Evaluation Framework for Solar Forecasting ("Solar Arbiter")	• API framework for data format and exchange • Applicable to energy forecasting • Extensible to wind • Publicly available (open source) • Well documented and easy to understand	• Continued support and maintenance uncertain • Data model not mapped to existing standards
SAREF ontology: Smart Appliances REFerence)	• Uses ETSI and EU industry standards for demand-response energy communications • Highly extensible – forward looking • "Interconnect" project funding includes grid interoperability and energy management	• Not as known in the utility, ISO/TSO space • Geared for distributed generation currently

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Example 1: ENTSO-E Weather process and energy prognosis – implementation guide (2017)

Table 1 – Weather configuration document dependency table

Attribute	Value
WeatherConfiguration_MarketDocument	
Type	A95 = Configuration document
sender_MarketParticipant.marketRole.type	A04 = System operator
receiver_MarketParticipant.marketRole.type	A43 = Weather analyser
status	A14 = Creation A15 = Update Note: a document may be either a creation or an update.
Location	
mRID	The identification of the location being described.
coordinateSystem.mRID	A01 = ED50 A02 = OSGB36 A03 = WGS84 A04 = GTRF Refer to ENTSO-E code list for having more description about coordinate syst
start_DateAndOrTime.date Date	The date that the regi tional
end_DateAndOrTime.date Date	The date that the regi sioned.
positionPoints.xPosition	Latitude
positionPoints.yPosition	Longitude
positionPoints.zPosition	Altitude

Attribute type and value maps to codelist definition document

Table 9 - Codelist CoordinateSystemType

Code	Title	Description
A01	ED50	ED 50 (European Datum 1950) is a geodetic datum which was defined after World War II for the international connection of geodetic networks.
A02	OSGB36	Ordinance Survey Great Britain 1936. The Ordinance Survey (OS) devised the national grid reference system, and it is heavily used in their survey data, and in maps (whether published by the Ordinance Survey or commercial map producers) based on those surveys.
A03	WGS84	The World Geodetic System version 1984. for use in cartography, geodesy, and navigation including by GPS. It comprises a standard coordinate system for the earth, a standard spheroidal reference surface (the datum or reference ellipsoid) for raw altitude data, and a gravitational equipotential surface (the geoid) that defines the nominal sea level.
A04	GTRF	Galileo Terrestrial Reference Frame

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Example 2: IEA Task 36 WP 2, Sub-Task 2.1 recommended best practice document

```
<xs:element name="WindSCADA">
  <xs:complexType>
    <xs:sequence>
      <xs:element maxOccurs="unbounded" name="WindPark">
        <xs:complexType>
          <xs:attribute name="ID" type="xs:string" use="required" />
          <xs:attribute name="Time" type="xs:dateTime" use="required" />
          <xs:attribute name="Mw" type="xs:decimal" use="required" />
          <xs:attribute name="Availabilty" type="xs:decimal" use=" optional" />
          <xs:attribute name="CurrentActivePower" type="xs:decimal" use=" optional"/>
          <xs:attribute name="Curtailment" type="xs:string" use="optional" />
          <xs:attribute name="WindSpeed" type="xs:decimal" use="optional" />
          <xs:attribute name="WindDirection" type="xs:decimal" use="optional" />
          <xs:attribute name="AirTemperature" type="xs:decimal" use="optional" />
          <xs:attribute name="AirPressure" type="xs:decimal" use="optional" />
          <xs:attribute name="Outage" type="xs:decimal" use="optional" />
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

XML Schema Definition Example from forecast trial and benchmark execution

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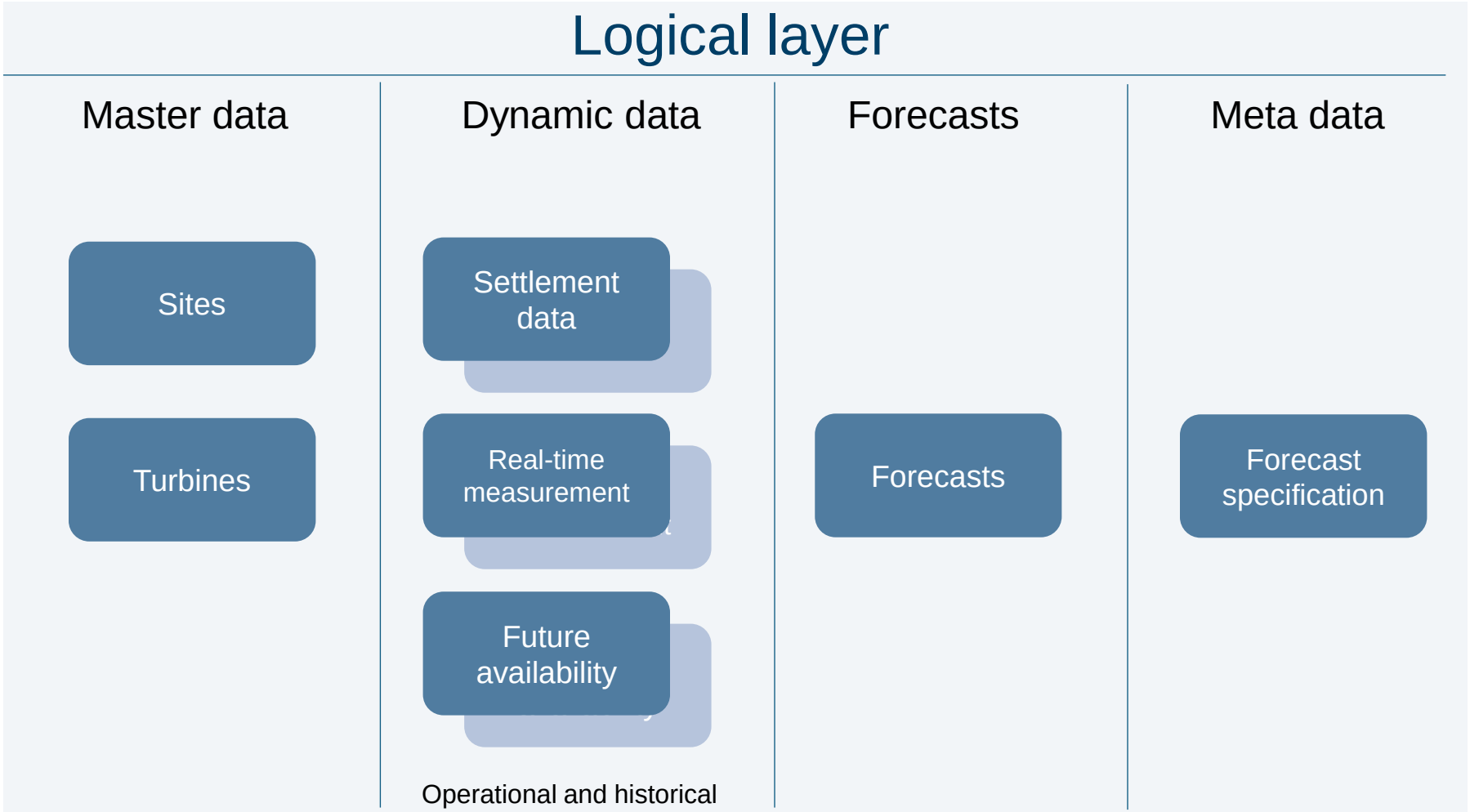

There has to be a clear delineation between different data layers since similar data parameter will appear in multiple layers (e.g., weather measurement <u>and</u> forecast)

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Current Approach and Work

Two levels of standardization

Level 1: High Level / Std terms

- ✓ Detailed documentation
- ✓ Data type definitions (e.g., metadata, dynamic data)
- ✓ Data Exchange Options

Level 2: Repeatable / Scalable

- ✓ Level 1 + ….
- ✓ Units defined and articulated
- ✓ Attribute / Value tables are extensible to other renewables
- ✓ Will use IEC 63235 Energy market CIM standard

1. Forecast System Specifications			
Data field	**Description**	**Value**	**Example**
Power unit	Which power unit do you want for the forecasted values?		…V,…
Time zone	What should be the time zone of the forecasted values?		…EST,…
Forecast update frequency	How frequent do…		…n …very every 4 hours)
Forecast granularit…			60 min (one prediction every hour)
Forecast horizon	What is the maximum horizon you want us to forecast? In hours.		168 hours (predictions up to 168 hours ahead)

EXAMPLE – Level 1 Data Standard

Two-level approach captures most renewable energy forecast consumers and establishes or borrows from common industry terminology

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Current Approach and Work – Development

- ✓ Forecast providers and forecast users (utilities, market participants) are invited to contribute knowledge, use cases, recommendations
- ✓ Core working group as well as reviewers and followers
- ✓ Structured process for developing, reviewing and releasing new best practice version
- ✓ Further review of existing and related standards
- ✓ IEA Task 36 review process
- ✓ Coordinate with other relevant groups and initiatives (e.g., IEC 63043, SFIP2, ETSI, ESIG)

Success will be measured by the adoption of recommended practices by Forecast Providers which will trickle to Consumers

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Future More "Ideal" Scenario

- Well defined terminology and definitions
- Standard way of exchanging data that is adaptable/abstracted from existing and dynamical systems (e.g., agnostic to changing IT security constraints)
- Publicly available practices / standards easily discoverable
- All parties more satisfied with outcomes
- Free up time for Forecast Providers to focus on:
  - Modeling and accuracy improvements
  - More complex and atypical business requirements
- Forecast Consumers can easily test and determine value of forecast product

Ultimately, improved forecast quality and lower costs can be achieved through recommended practices and standards