Basic Approach of 61400-25

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Approach – Key Concepts

- Focus on requirements of monitoring and control functions.
- Numerous wind power plant topologies are supported
- The model for describing information objects and services is independent of the communication protocol and physical media.
- The standard allows mappings to different protocols and implementation on various physical media.
- The communication protocol stack, to the maximum extent possible, should make use of existing standards.

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Clause 5 – Overview of 61400-25

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Objectives of 61400-25

- To be used world-wide by the wind power industry as a communication standard for the monitoring and control of wind power plants.
- To be implemented by vendors (manufactures and suppliers) of wind power plant components and system integrators into their systems to create a standard basis for vendor-independent monitoring and control.
- To be used by operators and owners of wind power plants, as well as utility companies and other parties, to monitor and control the components used for the operation of wind power plants on a standard basis.
- To be as compatible as possible with other utility communications standards such that interoperability with these systems can be achieved with a minimum amount of time, money, and interfacing devices.
- To be considered by planners of wind power plants and designers of wind power plant components in their current and future projects.

Communication Content

- Process information
- Cumulative information
- Historical information
- Setting information
- Meta-information
  - Information about available attributes, types, and other run-time information

Communication Functions

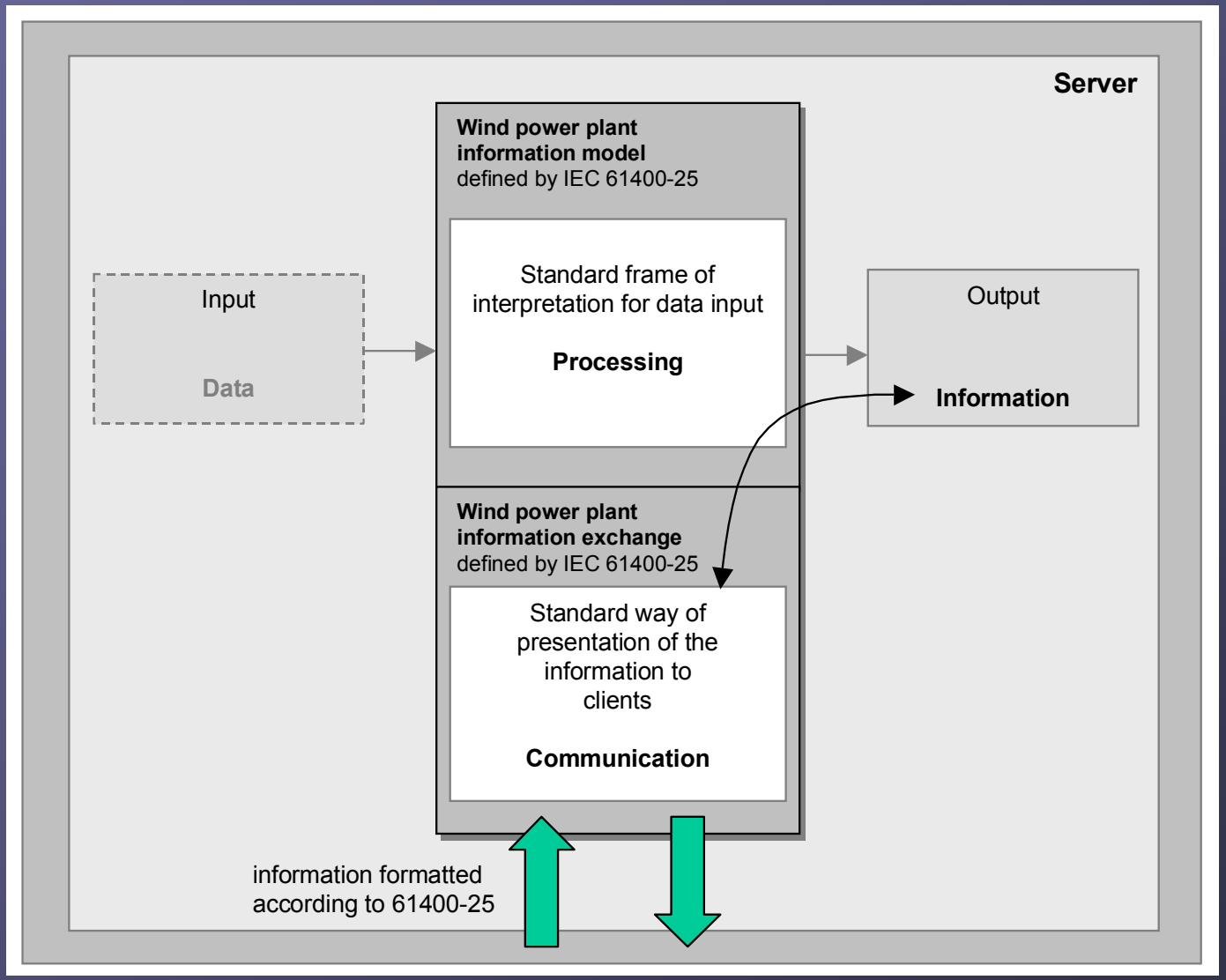
- Operational

Operational functions	Range of application (practical use)
Supervision / monitoring	Local or remote monitoring of the status and changes of states (indications) for wind power plants.
Logging and reporting	Analysing, reporting, evaluating of wind power plants.
Data retrieval	Archiving, exporting, restoring of data.
Control	Changing and modifying, intervening, switching, controlling, parameterising, optimising of wind power plants.

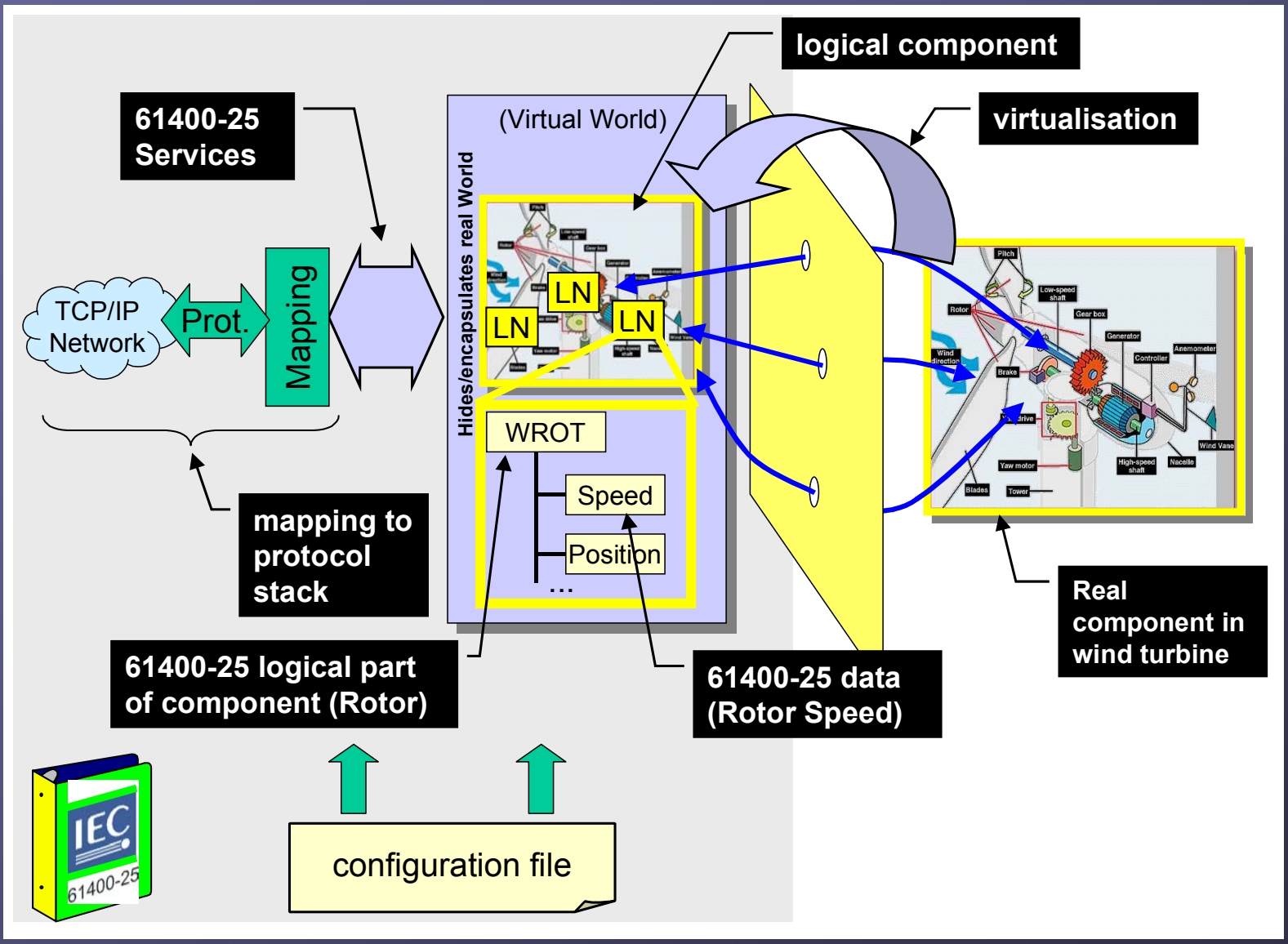
- Management

Management functions	Range of application (practical use)
User / access management	Setting up, modifying, deleting users (administratively), assigning access rights (administratively), monitoring access
Time synchronisation	Synchronisation of devices within a communication system.
Diagnostics (self-monitoring)	This function is used to set up and provide for self-monitoring of the communication system.
Configuration functions	Defining how the information exchange will take place; setting, changing and receiving (retrieval) of configuration data.

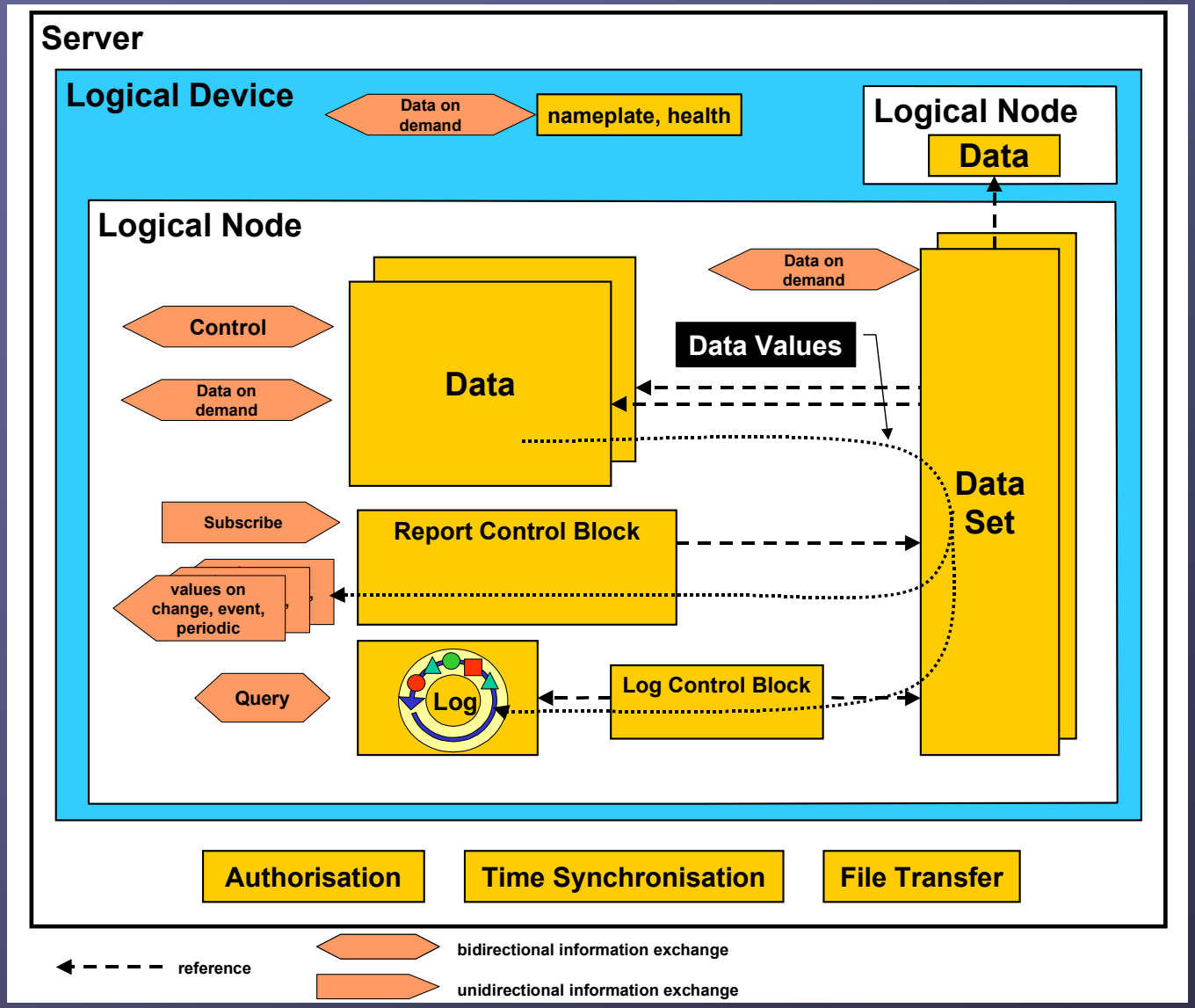
Communications Model



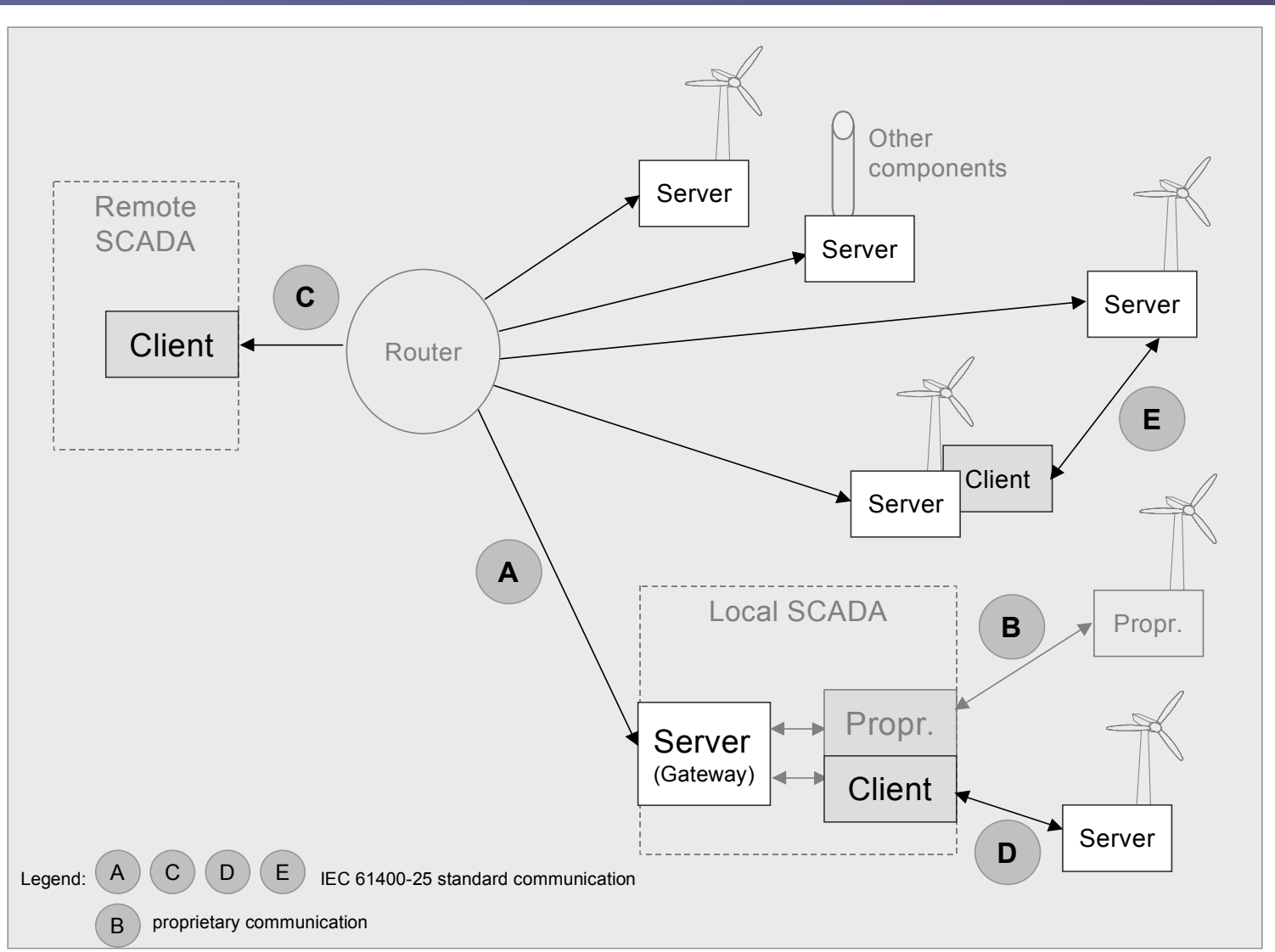
Communication Model



Server View


Server
Logical Device
Data on demand
nameplate, health
Logical Node
Data
Logical Node
Data on demand
Control
Data on demand
Data
Data Values
Data Set
Subscribe
Report Control Block
values on change, event, periodic
Query
Log
Log Control Block
Authorisation
Time Synchronisation
File Transfer
reference
bidirectional information exchange
unidirectional information exchange

Multiple Topologies Supported



Clause 6 – The Good Stuff

- Breaks down a WPP into basic building blocks based on function and real-world realization – Logical Nodes
- For each logical node, defines the equivalent of an old fashioned “points list” only uses names instead of an index or memory offset – standard names for standard things
- Each attribute has a type which can be simple (e.g. REAL4, INT32) or complex (e.g. a structure or array)

Logical Nodes

LN classes	Description	M/O
WTUR	Wind turbine general information	M
WROT	Wind turbine rotor information	M
WTRM	Wind turbine transmission information	O
WGEN	Wind turbine generator information	M
WCNV	Wind turbine converter information	O
WGDC	Wind turbine grid connection information	M
WNAC	Wind turbine nacelle information	O
WYAW	Wind turbine yawing information	M
WTOW	Wind turbine tower information	O
WMET	Wind power plant meteorological information	M
WALM	Wind turbine alarm information	M
WSLG	Wind turbine state log information	O
WALG	Wind turbine analogue log information	O
WREP	Wind turbine report information	O

Standard Names for Standard Things

WTUR class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/C/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
General information				
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see **Error! Reference source not found.**)		M
TurAvlTm	TMS	Turbine availability time		M
TurOpTm	TMS	Turbine operation time		O
TurStrCt	CTE	Number of turbine starts		O
TurStpCt	CTE	Number of turbine stops		O
State information				
TurSt	STV	Windturbine status		M
Analogue information				
TotEgyAt	AMV	Total active energy generation		M
TotEgyRt	AMV	Total reactive energy generation		O
TotPwrAt	AMV	Total active power production		M
TotPwrRt	AMV	Total reactive power production		O
Control information				
SetTurOp	CMD	Windturbine operation command: Str | Stp | Auto		M
Setpoint information				
DmdPwrAt	SPV	Turbine active power production setpoint		O
DmdPwrRt	SPV	Turbine reactive power production setpoint		O
DmdPwf	SPV	Turbine power factor setpoint		O

Basic Types

Attribute type	
Name	**Range / explanation**
BOOLEAN	True | False
INT8	-128 to +127
INT16	-32.768 to +32.767
INT24	-8.388.608 to 8.388.607
INT32	-2**32 to (2**32)-1
INT128	-2**127 to (2**127)-1
INT8U	0 to 255
INT16U	0 to 65.535
INT24U	0 to 16 777 215
INT32U	0 to 4.294.967.295
FLOAT32	single precision floating point, range and precision as specified by IEEE 754 single precision floating popint.
FLOAT64	double precision floating point, range and precision as specified by IEEE 754 double precision floating popint.
ENUMERATED	Ordered set of values dependent of information to be modeled; custom extensions are allowed
CODED ENUM	Ordered set of values, defined once; custom extensions are not allowed. Type shall be mapped to an efficient encoding in the mappings
VISIBLE STRING	ASCII string

More Complex Types

Like a C Language Structure or a C++ Language Class

TimeStamp type definition			
Attribute name	**Attribute type**	**Value/value range/explanation**	**M/O**
SecondSinceEpoch	INT32	(0...MAX)	M
FractionOfSecond	INT24U	Value = SUM from i=0 to 23 of bi*2**–(i+1); Order = b0, b1, b2, b3, ...	M
TimeQuality	TimeQuality		M

AnalogueValue Type Definition			
Attribute Name	**Attribute Type**	**Value/Value Range**	**M/O/C**
i	INT32	integer value	GC_1 a)
f	FLOAT32	floating point value	GC_1 a)
a) GC_1 = At least one of the attributes shall be present for a given instance of DATA.			

Clause 7 – Information Model

- This clause describes the information modeling approach. It borrows heavily from IEC 61850 and is compatible with it. It is included/repeated in the standard so that the document can be more useful as a “stand alone” document.

Clause 8 – Protocol Mappings

- The logical model is independent of the underlying protocol used to transport the data.
- The underlying protocol is generally independent of the physical media used to provide connectivity of the devices
- 61850 formally defines one mapping – ISO 9506 – MMS. 61400-25 defines 4. 61850 could and should utilize the additional mappings and immediately make it a more flexible standard
- Additional mappings are possible but maybe not desirable for simplicity of interoperability
- Protocol mapping flexibility is best used to track communications industry technological advancement rather than the ability to support your favorite protocol

Annexes

- The annexes contain a bunch of information that software developers need to know to implement the standard
- Mainly describes the gritty details for the protocol mappings – geeks only please!

Conclusion

- The standard document must balance several factors:
  - Two audiences
    - Electric power engineers with a specialty in wind
    - Communication & information engineers & software developers
  - The desire for a stand-alone document with enough information to implement the standard versus the desire for a document with only the wind industry specific information and references to all other standards and other documents necessary to use the standard – tough call
- Approach based on modern object oriented communications modeling approach and standards
- Independent of specific protocols and physical media
- Extensible without obsolescence as new capabilities required and technology advances
- Supports continuum of simple, bandwidth constrained devices/systems to extensive, high point count devices, systems and gateways connected to high speed networks