# Comparison of IEC 60870-5-101/-103/-104, DNP3, and IEC 60870-6-TASE.2 with IEC 61850[1]

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## 1 Executive Summary

SCADA protocols have traditionally been designed to **optimize bandwidth** (number of bytes on the wire) and **hardware utilization** (processor speeds, RAM and ROM space). IEC 60870-5 and DNP3 emerged from a broad family of proprietary protocols for **Data Acquisition** (Data Collection) to provide a **first level of Data Acquisition Interoperability**.

Increased numbers of points imply higher costs for system design, engineering, wiring plan, configuration, maintaining databases, commissioning and verifying point lists. More applications are accessing the data and the complexity of the applications is increasing. Deregulation and Smart Grids will add to the complexity through increased information sharing. With traditional SCADA protocols the **meaning of the points** is located in various places: system engineering tools, configuration of RTU and other intelligent electronic devices (IED), configuration of databases, and configuration of applications. The **Management** of this complex information (definition, validation, interpretation, and use) is costly and time-consuming. **Easier Management and Integration of the Information** has become a crucial requirement. **Technology advancements** in hardware, software, and communications have **shifted the focus in SCADA applications** from **Data Acquisition** to **Information Engineering and Management**.

IEC 61850[2] meets the requirements for an **integrated Information Engineering and Management**, providing the user with **consistent Knowledge of the System** on-line – rather than just Gigabytes of raw data values. IEC 61850 defines standardized **Information Models** across vendors and a comprehensive configuration standard (SCL – System Configuration Language). **Self-description** and **Meta-Data** allow for on-line **Validation**. Objects are accessed by **name**, rather than us-

1 This is the 4th version of the comparison; the first (2001-08-28) has been revised and enhanced (DNP3), the third is an update taking more experiences into account. The 4th is a minimal updated version.

2 IEC 61850 is mainly based on UCA™ (IEEE TR 1550). For the purpose of this comparison, UCA is understood as a synonym of IEC 61850. UCA is a Trademark of EPRI, Palo Alto (CA)/USA. In the meantime the name "UCA" is only used in the name of the international users group "UCA International Usersgroup" http://www.ucaiug.org

  

er/vendor/model specific point numbers. Thus **Database Validation** can become highly automated, without vendor configuration files.

**Standardized Information Models**, a set of appropriate **real-time** (GOOSE and Sampled Values) and **SCADA Services**, and the application of advanced communication systems allow for a **high level Application Interoperability** providing application domain specific information models (semantic of data) rather than interoperable data exchange services. In this regard, IEC 61850 goes far beyond the traditional SCADA protocols.

The **specific definitions** in IEC 61850 provide Information Models for substations and feeder applications. The **common parts** are used as a base standard in other application domains, e.g. distributed Energy systems (IEC TC 88 - Wind power plants; IEC 61400-25).

IEC 61850 is the solution for a single IEC TC 57 **Seamless Telecontrol Communication Architecture** for process related information and information exchange.

Substation and many other applications are using IEC 61850 based solutions to exchange useful information between any kind of devices. The standard is accepted globally (mid of 2011). There is no competition known so far.

## 2 Motivation

Users and vendors of RTU and SCADA standards compliant power system products ask more frequently **why** the IEC TC 57 (Power systems control and associated communication) **published a new International Standard** for real-time communication (IEC 61850).

Many experts guess that IEC 61850 is just another IEC SCADA protocol. It seems to be crucial to show the **commonalties** and **what distinguishes IEC 61850 from the traditional approach**.

## 3 Objective

The objective of this analysis is to provide a **comprehensive comparison** of the available IEC standards and DNP3 specification with the **new standard IEC 61850** (see chapter 4 for full titles):

- *IEC 60870-5-101* *Companion standard for basic telecontrol tasks*
- *IEC 60870-5-103* *Companion standard for the informative interface of protection equipment*
- *IEC 60870-5-104* *Network access for IEC 60870-5-101 using standard transport profiles*
- *DNP3* *Distributed Network Protocol (DNP)*
- *IEC 60870-6* *Telecontrol equipment and systems - TASE.2 (synonym ICCP – Inter-control center communications protocol)*

– *IEC 61850* *Communication networks and systems in substations (UCA™)*

– *IEC 61400-25* *Communications for monitoring and control of wind power plants*

The comparison in chapter 6 shows what the solutions have **in common**, how they **distinguish**, and what the **main benefits and advantages** of each solution are. The analysis addresses seven areas of interest:

1. General issues (Table 1)
2. Process data description (Table 2)
3. Operational services (Table 3)
4. Selfdescription services (Table 4)
5. Online configuration (Table 5)
6. Offline configuration (Table 6)
7. Integration into Applications (Table 7)
8. Architecture and communication stacks (Table 8)

Chapter 7 provides a summary.

**Acknowledgement**

The following analysis is based on the experience and background information of well-known experts (convenors and other working group members) that have been involved in several IEC TC 57 projects, UCA™, and DNP for many years.

I would like to thank

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– Christoph Brunner, Convenor IEC TC 57 WG 10; (UTInnovation, Zug/Switzerland),
– Grand Gilchrist, Secretary, DNP User's Group Technical Committee and Member of IEC TC57 WG 10; (Enernex, Calgary/Canada),
– Wolfgang Maerz, former speaker of German delegation of IEC TC 57; (former with RWE, Dortmund/Germany), and
– George Schimmel, Member of IEC TC 57 WG 10; (Tamarack, Ann Arbor (MI)/USA),

for their review (of the of the 2001 and 2002 edition[3]) that made this comparison possible.

The 2011-07-19 edition has been provided by Karlheinz Schwarz (SCC) without further assistance of the above listed experts.

[3] The revision 2011-07-19 is an updated and extended version (added more details on configuration, and new information models like for hydro power and DER, and IEC 61400-25 - Communications for monitoring and control of wind power plants)

## 4 References

The following documents – among others – have been considered.

- IEC 60870-5-101 Telecontrol equipment and systems - Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks
- IEC 60870-5-103 Telecontrol equipment and systems - Part 5-103: Transmission protocols - Companion standard for the informative interface of protection equipment
- IEC 60870-5-104 Telecontrol equipment and systems - Part 5-104: Transmission protocols - Network access for IEC 60870-5-101 using standard transport profiles
- IEC 60870-6-503 Telecontrol equipment and systems - Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations - Section 503: TASE.2 Services and protocol
- IEC 60870-6-802 Telecontrol equipment and systems - Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations - Section 802: TASE.2 Object models
- IEC 61850-7-1 Communication networks and systems in substations - Part 7-1: Basic communication structure for substations and feeder equipment - Principles and models
- IEC 61850-7-2 Communication networks and systems in substations - Part 7-2: Basic communication structure for substations and feeder equipment - Abstract communication service interface (ACSI)
- IEC 61850-7-3 Communication networks and systems in substations - Part 7-3: Basic communication structure for substations and feeder equipment - Common data classes
- IEC 61850-7-4 Communication networks and systems in substations - Part 7-4: Basic communication structure for substations and feeder equipment - Compatible logical node and data object addressing
- IEC 61850-7-410 Hydroelectric power plants
- IEC 61850-7-420 Distributed energy resources (DER)
- IEC 61850-7-5 Usage of information models SAS
- IEC 61850-7-500 Use of LN to model functions (SAS)

- IEC 61850-7-510 Use of LN (hydro power plants)
- IEC 61850-7-520 Use of LN (DER)
- IEC 61850-8-1 Communication networks and systems in substations - Part 8-1: Specific communication service mapping (SCSM) - Mapping to MMS (ISO/IEC 9506 Part 1 and Part 2)
- IEC 61850-80-1 Guideline … CDC-based data model using IEC 60870-5-101 or IEC 60870-5-104
- IEC 61850-90-1 Using IEC 61850 for SS-SS communication
- IEC 61850-90-2 Using IEC 61850 for SS-CC communication
- IEC 61850-90-3 Using IEC 61850 for Condition Monitoring
- IEC 61850-90-4 Network Engineering Guidelines
- IEC 61850-90-5 Exchange of synchrophasor information
- IEC 61850-90-6 Use of IEC 61850 for Distribution Automation
- IEC 61850-90-7 Object Models for PV, Storage … inverters, …
- IEC 61850-90-8 Object Models for Electrical Transportation
- IEC 61850-90-9 Object Models for Batteries
- IEC 61400-25-1 Communications for monitoring and control of wind power plants: Overall description of principles and models
- IEC 61400-25-2 Communications for monitoring and control of wind power plants: Information models
- IEC 61400-25-3 Communications for monitoring and control of wind power plants: Information exchange models
- IEC 61400-25-4 Communications for monitoring and control of wind power plants: Mapping to communication profiles (Mapping to XML based communication profile)
- IEC 61400-25-5 Communications for monitoring and control of wind power plants: Conformance testing
- IEC 61400-25-6 Communications for monitoring and control of wind power plants: Logical node classes and data classes for condition monitoring
- DNP3 Distributed Network Protocol (DNP) – V3.0 Basic Document Set
  - DNP V3.0 Data Link Layer

- DNP V3.0 Transport Functions
- DNP V3.0 Application Layer Specification
- DNP V3.0 Data Object Library

– DNP3 — Distributed Network Protocol (DNP) – Subset Definitions Document (Level 1, 2, & 3)

– IEEE 1379-2000 — IEEE Recommended Practice for Data Communications Between Remote Terminal Units and Intelligent Electronic Devices in a Substation (referencing DNP3 and IEC 60870-5-101)

## 5 Websites

The following websites provide further information.

**Power systems management and associated information exchange**

– http://www.iec.ch/dyn/www/f?p=102:7:0::::FSP_ORG_ID:1273

**DNP**

– DNP users group: www.dnp.org

## 6 Detailed Analysis

The following tables list the details of the analysis. The yellow fields represent support of a specific feature. The "+" signs indicate a tendency of difference in the quantity : "++" means that this solution provides more (functions, comfort, ...) than the other with "+".

**Table 1 General issue**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Application domain** | **Telecontrol (SCADA)** | **Telecontrol (SCADA), intra-substation and control-center to substation** | **Protection (monitoring protection IEDs)** | **Telecontrol (SCADA), intra-substation and control-center to substation** | **Control-center to control-center** | **Substation and feeder automation** (used and extended in many other domains) |
| **Main coverage** | **Application Layer** (Services and Protocol) | **Application Layer** (Services and Protocol) | **Application Layer** (Services and Protocol) and basic **Application Semantic** | **Application Layer** (Services and Protocol) | **Application Layer** (Services and Protocol) and basic **Application Semantic** | **Application Semantic** (models of devices and applications), **Substation configuration language**, and **Application Layer** (Services and Protocol) |
| **Standardization** | **IEC Standard** (1995) Amendments (2000, 2001) | **IEC Standard** (2000) | **IEC Standard** (1997) | **Open Industry Specification (1993),** IEEE 1379 Recommended Practice (2000) | **IEC Standard** (1997) | **All parts are IEC International Standard (IS),** (as per 2004); further extensions published |
| **Standardisation Organization** | **IEC TC 57 WG 03** | **IEC TC 57 WG 03** | **IEC TC 57 WG 03** | **DNP Users Group** (took the specification over in 1993); IEEE | **IEC TC 57 WG 07 (working group is not active any more, 2008)** | **IEC TC 57 WG 10 (former WGs 10, 11 and 12), WG 17 DER, WG 18 Hydro** |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Use in other organizations as base standard | | | | Considered for standardization by Australian water utility industry. | | **Project 25 of IEC TC 88 (Wind Turbine Systems)** uses IEC 61850 as base standard for IEC 61400-25 |
| Crucial design rule used for the development process of the standard | **Optimize use of Bandwidth and hardware** | **Optimize use of Bandwidth and hardware** | **Optimize use of Bandwidth and hardware** | **Optimize use of Bandwidth and hardware** | **Simplify device (data) engineering and integration, supports interoperability** | **Simplify system and device (data) engineering and integration; re-use models; supports interoperability** |
| Further design rules | **Merge the features of earlier proprietary protocols, Push the intelligence in the network toward the remote device** | **Merge the features of earlier proprietary protocols, Push the intelligence in the network toward the remote device** | **Merge the features of earlier proprietary protocols, Push the intelligence in the network toward the remote device** | **Merge the features of earlier proprietary protocols, Push the intelligence in the network toward the remote device** | **Use standard communication protocols. Push the intelligence in the network toward the remote device** | **Use standard communication protocols. Push the intelligence in the network toward the remote device** |
| Crucial Paradigm | **Exchange of numbered lists of simple data points** | **Exchange of numbered lists of simple data points** | **Exchange of numbered lists of simple data points** | **Exchange of numbered lists of simple data points** | **Exchange of named lists of simple and complex data points** | **Modeling and configuration of system, application objects and exchange of I/O and Meta data** (Data Management) |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Application specific information models | A few (3) application specific data types | A few (3) application specific data types | Some application specific data types (protection) | Permits vendors to create application-specific extensions | Some (10+) application specific complex data types; Permits to create application-specific extensions | Some 275 logical node classes with 2000+ data classes; Permits to create application-specific extensions (name space concept) |
| Object-oriented modeling | | | | Under development | Permits object-oriented naming | Supports inheritance, encapsulation, hierarchical models, ... |
| Data Objects and messages are independent of each other? | No | No | No | Yes | Yes | Yes! The information models are independent of the communication and messaging; messaging can be done with web-services (IEC 61400-25-4) |
| Common application layer / encoding independent of data definition | | | | + | ++ | ++ |
| Implementations available | +++ | ++ | +++ | +++ | ++ | +++ |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Implementation for embedded devices | +++ | + | ++ | +++ | + | +++ |
| Dominant market | Europe (South America, Australia, China) | Europe (South America, Australia, China) | Europe (South America, Australia, China) | North America (South America, Australia, China) | All over | All over* |
| Market penetration (2000)* | +++ | + | +++ | +++ | +++ | |
| Market penetration (2008)* | ++ | ++ | + | +++ | ++ | +++ |

* compared with the short time the standards are published

**Table 2 Process data description**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| supported data types | Fixed | Fixed | Fixed | Fexible | Flexible | Flexible, easily extendable |
| Address/Identification | Index (commAddr: 8,16 bits infoObj: 8/16/24 bits) | Index (commAddr:16 bits infoObj: 32 bits) | Index (commAddr: 8Bits function type: 8 bits infoObj: 8 bits) | Index (commAddr: 16 bits Point Index: 8, 16 or 32 bits Naming under development. | Names 32/32 characters | Hierarchical Names 64+64 characters (e.g., AB_E1_Q1/XCBR4.ST.Pos) Index for reporting, logging, GOOSE and SV |
| Quality information | + | + | + | + | + | + |
| Timestamp | + | + | + | + | + | + (utc based) |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Cause of transmission** | + | + | + | + | + | + |
| **> 1 values in one message (data groups, data sets)** | **A few of same type and same COT** | **A few of same type and same COT** | **A few of same type and same COT** | **Several of any type** | **Many of any type** | **Many of any type** |
| **Semantic of data** (meaning of domain specific data like ”time over current”, “PhsA”, “Position of Circuit er”, ... ) | | | **Some** (protection) | | | **Some 5000+ classes** (LN, Data, Data Attr. – for several application domains) |
| **Selfdescription of data (for online retrieval)** | | | | **Some** | **Many** | **Data name, type, functional characteristic, reporting trigger option, deadband, value range, … for any data class defined and accessible** |
| **Open for additional models** | | | | | | **Flexible; any new logical node , data, and common data class can be defined for other application areas** (e.g., wind power plants) |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Configuration of systems and devices | | | | | | Part 6 provides a comprehensive standard for the engineering and configuration of whole systems and devices. Typical substations, bays or devices can be described as types that can easily be reused!<br>Tool support under development … some third-party tools are already available. |

Table 3 Operational services

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Cyclic transmission | + | + | + | Permitted, but interval cannot be remotely adjusted | + | + |
| Spontaneous transmission | + | + | + | + | Flexible | Very flexible |
| Read | Single | Single | Single | Many | Many | Many |
| Write | Single | Single | Single | Many | Many | Many |
| (device) interrogation | + | + | + | + | + | + |
| Clock synchronisation | + | | + | + | | + |
| Control commands | + | + | + | + | + | + |
| Exchange integrated totals | + | + | | + | + | + |
| Remote substitution (online) | | | | | | + |
| Substitution indication | Quality indication | Quality indication | | Quality indication | Quality indication | Quality indication |
| Time series data | + | + | + | + | + | **Any data** (report and logging) |
| Sequence of events | + | + | + | + | | **Status data** (report and logging) |
| Report data values | + | + | + | + | + | **Any data** (with filter) |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Log and retrieve selected data values (historical) at any time** | | | | | | **Any data** (with remote filtering control and other control) |
| **Parameter setting control** | **Few** (measurands) | **Few** (measurands) | **Change predefined protection setting group only** | **Change some communication related parameters; more under development** | **Change of some communication related parameters possible** | **Flexible** (define, change, and edit) |
| **Substation event Exchange (GOOSE, ...)** | | | | | | **+** |
| **Sampled value exchange (for CT and VT)** | | | | | | **+** |
| **File transfer** | **+** | **+** | **+** | **+** | **+** | **+** |

**Table 4 Self description services**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Get Directory of All Objects** (Names and types of Data of Logical Nodes, ...) | | | **Limited** (generic services only) | | + (only flat point lists) | ++ (complete information hierarchy) |
| **Get Definition of operational Objects** (Name, Type, range, unit, deadband for reporting, scale, description, ... of process data) | + (deadbands only) | + (deadbands only) | + (generic services only) | + (deadbands only, more under development) | ++ | +++ |
| **Get Definition of communication service related objects** (Report/log control attributes, Control attributes, Setting group attributes, ...) | + | + | + | + | ++ | +++ |

**Table 5 Online configuration**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Define groups of data | | | | + | + | + |
| Select data for reporting | | | | + | + | ++ |
| Enable/disable communication control objects | + | + | | + | ++ | +++ |
| Change reporting/logging behavior | + | + | | + | ++ | +++ |
| Load configuration | + | + | | + | + | + |

**Table 6 Offline configuration**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Complete description of device configuration** | **Paper document only** | **Paper document only** | **Paper document only** | **Paper document only;** Online Document under Development | **Paper document only** | **XML / XML Schema** specifies the semantic of devices, logical devices, logical nodes, data in the context of the real substation (describing the optional information and private information) |
| **Support for vendor independent engineering systems** | | | | | | Supports the development of **vendor independent** engineering tools based on the comprehensive list of classes for LNs. Data, and CDC |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Location of configuration** | Configuration of **RTU** and/or **IED**, configuration of **databases**, and configuration of **applications** | Configuration of **RTU** and/or **IED**, configuration of **databases**, and configuration of **applications** | Configuration of **RTU** and/or **IED**, configuration of **databases**, and configuration of **applications** | Configuration of **RTU** and/or **IED**, configuration of **databases**, and configuration of **applications** | Configuration of **RTU** and/or **IED**, configuration of **databases**, and configuration of **applications** | Part of the **configuration is in the IED** → at any time consistent; additionally in the **XML file** of the configuration.<br>It could be expected that a SCL file for the configuration will soon be made available as a downloadable file from the device. |
| **Automatic verification of online and offline configuration** | | | | | | **The complete information model can be retrieved online and automatically compared with the offline configuration file.** |

**Table 7 Integration into Applications**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Data integration** | Mapping (1) of indexed **communication objects** to **application objects** and (2) **application objects** to the variables of the appplication database or programs | Mapping (1) of indexed **communication objects** to **application objects** and (2) **application objects** to the variables of the appplication database or programs | Mapping (1) of indexed **communication objects** to **application objects** and (2) **application objects** to the variables of the appplication database or programs | Mapping (1) of indexed **communication objects** to **application objects** and (2) **application objects** to the variables of the appplication database or programs | Direct mapping of **named objects** to the **variables of the application database or programs.** | Direct mapping of **named STANDARD objects** to the **variables of the application database or programs.** |
| **Application Programmers Interface (API)** | **No standard API** | **No standard API** | **No standard API** | **No standard API** | **No standard API** | **No standard API** |

**Table 8 Architecture and communication stacks**

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| Data model independent of services | | | | + | + | + |
| Services independent of communication networks | | | | | | + |
| Communication systems supported | V.24/V.28 or X.24/X.27 | TCP/IP over Ethernet 802.3 or X.21 (any linkt that supports TCP/IP) | RS 485/Fiber | V.24/V.28 or X.24/X.27; TCP/IP over Ethernet 802.3 or X.21 | TCP/IP and OSI over Ethernet 802.3 or X.21 (any linkt that supports TCP/IP) | TCP/IP (IPv4 and IPv6) and OSI over Ethernet 802.3 or X.21serial (any link that supports TCP); Ethertype for GOOSE and Sampled Values; VPN, … |
| Layering | 3 layer | 7 layer (TCP/IP) | 3 layer (PHL, DLL, AL) | 4 layer (serial) or 7 layer (TCP/IP or UDP/IP | 7 layer and Object Library | 7 layer (TCP/IP and OSI) and Logical Node (Data and Common Data) and object Library; 3 layer possible |
| Mode | (Un)balanced | Balanced | (Un)balanced | Balanced | Full duplex | Full duplex |
| Routing | | IP | | IP if TCP/IP or UDP is supported | IP, OSI NP | IP, OSI NP |

| Feature | 60870-5-101 | 60870-5-104 | 60870-5-103 | DNP3 | 60870-6-TASE.2 | 61850 |
|---|---|---|---|---|---|---|
| **Transport protocol** | | **TCP** | | **Pseudo Transport over serial. Pseudo Transport, encapsulated Data Link Layer, and either TCP or UDP over IP** | **TCP, OSI TP** | **TCP, OSI TP** |
| **Addressing** | **Link: 0, 1, or 2 octet**<br>**AL: 2 to 5 octets** | **Stack specific** (several address fields for DLL, Network, Transport, ...);<br>**AL: 5 octets fixed** | **Link: 0, 1, or 2 octet**<br>**AL: 3 octets fixed** | **Source and destination 16-bit over serial. Add stack-specific addresses for each layer of IP implementation. TCP/UDP port reserved and fixed.** | **Stack specific** (several address fields for DLL, Network, Transport, ...); **application objects** are named (... 64 char) or bit mapped in some cases | **Stack specific** (several address fields for DLL, Network, Transport, ...); **application objects** are named (... 128 char) or bit mapped in some cases |
| **Configuration of communication stack** | **Several attributes** | **Some attributes of each layer** | **Several attributes** | **A few attributes** | **Some attributes of each layer** | **Some attributes of each layer** |
| **Open for other encoding solutions (e.g., XML)** | | | | Under Development" for DNP3. | | **+** (products are available that provide HTML and XML coded messages) |
| **Open for future service (middle ware) systems (HTTP, CORBA, SOAP, ...)** | | | | | | **IEC 61400-25-4 defines a webservice protocol for IEC 65180-7-2 (ACSI)** |

## 7 Summary

The following list gives a brief interpretation of the comparison.

- **All** solutions provide services to exchange the **basic real-time information** (e.g., single point status and control, cyclic and spontaneous reports, interrogation) for SCADA related requirements,
- **One** provides the real-time information exchange for **sampled values** and **trip** commands (61850).
- Most have **mainly fixed functionality** (101, 103, 104, DNP, TASE.2), one supports **broad applicability** covering **data modeling, self-description services, configuration service, and advanced communication models and services** (61850),
- All are **available** in many products and applied all over (101, 103, DNP, TASE.2, 61850), products are available and applied in several application (104)
- Some use **many main-stream technologies** (61850, TASE.2, 104/DNP partly) or use **proven (restricted)** solutions (101, 103, 104/DNP partly),
- **DNP3** and **IEC 60870-5-101/104** have basically the same functionality.
- All solutions provide a **first level of Data Acquisition Interoperability**
- **One** (**61850**) has become the **preferred IEC solution** for the process information, information exchange and configuration within the future IEC TC 57 seamless Telecontrol Communication Architecture (sTCA), applications of the other solutions will **migrate to the use of 61850** step by step.
- **One (61850)** has the potential to be used as an **integrated Information Management** in almost all utility applications domains (electric, distributed electric, gas, water), providing the user with **consistent Knowledge of the System** on-line.
- **One (61850)** allows for a **high level Application Interoperability** providing application domain specific information models (semantic of data) rather than interoperable data exchange services only.
- **One (61850)** provides a **comprehensive system configuration language** – the crucial part of IEC 61850.

## Additional information

Please visit the following web sites for further information:
http://www.nettedautomation.com
http://www.scc-online.de
http://blog.iec61850.com
http://dispowergen.com

I would appreciate receiving your comments.

Best Regards,

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SCC Supplier Information [pdf, 300 KB]

**Karlheinz Schwarz** received in 2007 the IEC 1906 Award "for his strong involvement in the edition of the IEC 61850 series, its promotion inside and outside IEC, and specifically its adaptation for wind turbine plant control".