IEA Implementing Agreement on Communications Technologies for Demand Side Management

International Standards Activity for Customer/Utility Communications, Demand Side Management and Related Functions

Final Report

Prepared by Operating Agent
Annex II

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IEA DSM ANNEX II

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Final Report

SUMMARY

In the field of communications, standards play an influential and effective role in guiding designers and manufacturers of communications hardware and networks. Through standards users of such equipment benefit in terms of choice of supplier, competitive pricing and assurance of a degree of quality in the products and services bought.

Following from an interim report, a final assessment has been made of the involvement in international standards of countries participating in the IEA, Annex II project on customer/utility communications. Analysis of replies to a questionnaire developed to collect information on country involvement has highlighted standards and drafting standards bodies and work groups directly relevant to the assessment of communications technologies for DSM.

A conclusion to a portfolio of standards is presented and related to communication structures using each communication medium being considered. A strategy is proposed to enable the work carried out in evaluating consumer and utility requirements and communications media to best benefit work on the international standards scene by analysis of the processes of various international and national standards bodies in producing standards and other related documents. Suitable points in these processes are highlighted where effective lobbying by Annex II may be considered.

International Standards for Customer/Utility Communications, Demand Side Management and Related Functions

Final Report

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1 Introduction to the International Standards Scene

1.1 Aims of Standardisation

1.1.1 General

The broad aims of standardisation can be summarised from a standard of Glossary of Terms for Standardisation and Related Activities, [Section 2 of EN 45020] as follows:

- to promote the quality of products, processes and services by defining those features and characteristics that govern their ability to satisfy given needs, i.e. fit for their purpose;

- to promote improvement in the quality of life, safety, health and protection of the environment;

- to promote the economic use of materials, energy and human resources in the production and exchange of goods;

- to promote clear and unambiguous communication between all interested parties, in a form suitable for reference or quotation in legally binding documents;

- to promote international trade by the removal of barriers caused by differences in national practices;

- to promote industrial efficiency through control of variety .

1.1.2 Specific

Standardisation can be seen to have specific aims to make a product, process or service *fit for its purpose*. These aims include *variety control, usability, compatibility, interchangeability, health, safety, protection of the environment, product protection, mutual understanding, economic performance and trade*. The scope of each of these aims may overlap and definitions of the primary aims are summarised from EN 45020 below :

Fitness for purpose is defined as the ability of a product, process or service to serve a well defined purpose under specific conditions.

Compatibility is the suitability of products, processes or services for use together under specific conditions to fulfil relevant requirements without causing unacceptable interactions.

Interchangeability is the ability of one product, process or service to be used in place of another to fulfil the same requirements.

Variety control is the selection of an optimum number of sizes or types of products, processes or services to meet prevailing needs. It is usually concerned with a reduction in variety.

1.2 Principles of Standardisation

A fundamental principle is that standards should be planned (ref BS0 Part 1 1991). Planning includes an assessment of the social and economic benefits of introducing a standard compared with the cost of its preparation, publishing and maintenance. The committees responsible should consider whether it is feasible to prepare the proposed standard in a technically and commercially acceptable form in time to be of use.

The process involved in writing standards is essentially one of selection. A standard can contain only what the interested parties are prepared to agree on at the time of writing. Thus decisions are needed on when and how it is appropriate to standardise in a rapidly developing technology, or to satisfy new community needs relating to safety or to the environment.

In areas of rapid development such as data communication in DSM, a balance should be struck between inhibiting innovation by standardisation too soon, and proliferating wasteful or mutually incompatible solutions by leaving standardisation too late. If the latter occurs, the cost of subsequent standardisation is likely to be much greater.

Standards should be reviewed at regular intervals and appropriate action taken. A standard that is not kept up to date with changing circumstances in technological advance may become irrelevant or inhibit progress.

1.3 Benefits of Standards to Annex II

Standards are an essential aspect of data communications. Effective communication between two items of equipment succeeds only if both items obey an agreed set of rules or protocols. Although it is possible to formulate such rules in isolation, their use is limited if either item wishes subsequently to communicate with a third. It is more useful if the equipment is designed to conform to protocols agreed by large populations, in other words a standardised set.

Drafting and publication of standards is time consuming and costly. In DA/DSM telecommunications, some primary benefits which would help counterbalance costs are:

- Data communications standards permit systems (computers and terminals) from different suppliers to be interconnected and communicate successfully and allow connection to public communications networks.

- They reduce dependence of customers on particular manufacturers and allow choices from competitive, and hence cheaper, markets which implements standards.

- There is some guarantee of product quality as technical requirements in standards are reviewed thoroughly by experts from differing organisations before approval. Formal specification and verification are used in developing protocols well beyond the resources of most individual companies.

- International or regional standards remove barriers to trade due to differing national practices.

- Safety and protection of the environment are enhanced through stringent standards for electrical and mechanical safety and electromagnetic interference.

In order to obtain the maximum value from the work carried out within Annex II dealing with communications for DSM and related functions, it is important to identify areas of international standards formation where effective liaison can take place. Through liaison and interchange of information between appropriate standards groups and Annex II, progress can be made towards specifying communication structures which will be targeted to the market needs.

To identify the degree of involvement by participating countries in the formation of international standards and the specific bodies on which they are represented, a questionnaire was produced and completed by participating countries.

From the analysis and overview of the current standards scene, an outline strategy to utilise fully the work produced by Annex II and benefit the participating members is proposed in Section 7.

Access to new communications channels linking utilities and their customers is causing fundamental change in the business processes of utilities. Substantial investment in communications infrastructures, terminal and central units is necessary in order to profit from these changes. Standards provide a means to secure this investment by guaranteeing interoperability of equipment from different manufacturers. The more equipment is interlinked through communications networks, the more the aspects of system management and data access become important. This in turn affects the aim of the standards process in redirection from specifying communications channels to specifying abstract application and device models. These models must be suited to a multi-manufacturer and multi-media environment.

2 Final Review of Standards Information Collected from Participating Countries

Information regarding the involvement of countries participating in the project in international standards activity and the adoption of standards in their countries was collected by means of a questionnaire on standards, Questionnaire IV of Annex II.

The primary aims of the questionnaire were to obtain information from the participating countries on :

- Standards used in DSM and other allied communications systems within the remit of Annex II;

- A world-wide perspective of relevant Committees and Sub-committees in various standards bodies and organisations;

- Information on those people active in the standards drafting process such as convenors, secretaries, and chairmen.

Further to the Interim report which summarised briefly standards documents of interest to participating countries in DSM applications of communications, the table includes an update of all participating countries who expressed interest or involvement in the listed standards and the technical committees which drafted them.

2.1 Classification of Listed Standards

Standards highlighted as of particular interest to the participating countries are listed in Table 2 and have been classified according to **general**, **metering**, and **telemetering** and **telecontrol** functions. Other relevant standards are listed in Section 2.3. All can be related to DSM schemes: general provides a platform of internationally recognised terminology and nomenclature; metering is the data source for most DSM functions considered in Annex II; and telemetering and telecontrol provide means of remote reading and sending of commands or responses, respectively. All these categories of standard can be included in a DSM scheme which may have a variety of media applied to convey information to and from a consumers property to a data collector situated somewhere in the communications infrastructure.

The three categories and a brief description of related standards are given below :

2.1.1 General Standards

IEC 50. ***TC 13***
Is an International Technical Vocabulary with a glossary of technical terms used in electrical engineering. It can be considered an essential basic document for many countries which need to translate technical terms from English, French or Russian to their national languages and provide an aid to clear understanding.

IEC 387 : 1992 Symbols for alternating-current Electricity Meters. *TC 13*
Also EN 60387
Applies to letter and graphical symbols for a.c. electricity meters and their auxiliary devices, independent of induction or static measurement elements. All the symbols included in this standard may be marked on the name-plate, dial plate, external labels or accessories of the meter.

IEC 663 : 1980 Planning of (single sideband) power line carrier systems. TC 57

2.1.2 Metering Standards

IEC 145 : 1963 Var-hour (reactive energy) Meters. *SC 13A*

Applicable to newly manufactured induction type var-hour meters for the measurement of reactive energy of frequency between 40 Hz and 60 Hz, of an accuracy class of 3.0 for ordinary usage, and to their type tests.

IEC 211 : 1966 Maximum Demand Indicators, Class 1.0. *SC 13A*

Applies to indicators Class 1.0 intended to operate as attachments to Watt-hour meters of var-hour meters, coupled mechanically thereto and to indicate the maximum of average power, active or reactive, measured during successive equal intervals of time.

IEC 514 : 1975 Acceptance Inspection of Class 2 alternating-current watt-hour Meters. *TC 13*

Methods for acceptance inspection (100% inspection and statistical sampling inspection) and testing of newly manufactures direct connected induction type watthour meters of Class 2 which are produced and delivered in large quantities. For type tests see below in IEC 521. This publication has the status of a report.

IEC 521 : 1988 Class 0.5, 1 and 2 alternating-current watt-hour meters. *TC 13*

Applies to newly manufactured induction type watt-hour meters of accuracy classes 0.5, 1 and 2, for the measurement of ac electrical active energy of a frequency in the range 45 Hz to 65 Hz and to their type tests only.
This publication supersedes IEC 43 (1960), IEC 170 (1964) and IEC 280 (1968).

IEC 687 : 1992 Ac static watt-hour meters for active energy (classes 0,2 S and 0,5 S). *TC13*
EN 60687

Applies to newly manufactured static watt-hour meters of accuracy classes 0,2 S and 0,5 S for the measurement of ac electrical active energy of a frequency in the range 45 Hz to 65 Hz and to their type tests only. This standard applies only to transformer operated meters for indoor application consisting of a measuring element and register(s) enclosed in a meter case. Their measuring range and rated current are therefore in accordance with IEC 185.

IEC 736 : 1982 Testing Equipment for Electrical Energy Meters. *TC 13*

Applies to three-phase and/or single phase equipment used for type and acceptance testing of electrical energy meters of Classes 0.5, 1 and 2. Has the status of a technical report.

continued
IEC 1036 : 1990 Ac Static Watt-hour Meters for Active Energy (classes 1 and 2). TC 13

Applies only to newly manufactured indoor or outdoor static watt-hour meters of accuracy classes 1 and 2, for the measurement of ac electrical energy on a frequency in the range 45 Hz to 65 Hz and to their type test only. Does not apply to watt-hour meters where the voltage exceeds 600 V, portable meters or data interfaces to the register of the meter.

2.1.3 Telemetering and Telecontrol Standards

IEC 338 : 1970 Telemetering for Consumption and Demand. ***TC 13***

Applies to new telemetering apparatus, intended to operate in conjunction with electrical integrating meters in particular for billing and statistical purposes. Is applicable regardless of the distance between impulse meters and receiver.

870 Telecontrol Equipment and Systems

Applies to telecontrol equipment and systems with coded bit serial transmission for monitoring and control of geographically widespread processes. All six of the IEC 870 family of standards are listed below with a brief description of each part:

IEC 870-1-1 : 1988 Part 1 : General Considerations
Section 1 General Principles. ***TC57***

Specifies classes for environmental conditions under which telecontrol equipment has to operate. Gives an overall view of the functional elements contributing to basic structures and to the choice of telecontrol systems configurations.
It deals with functions which are typical of any process to be monitored and controlled but emphasises the specific problems which characterise geographically widespread processes, such as the dominant influence of telecommunications links with restricted bandwidth and often low signal-to-noise ratio. However, this report serves only as an introduction to the detailed standards and recommendations laid down in Parts 2-5 of IEC 870.

IEC 870-1-2 : 1988 Part 1 : General Considerations
Section 2 Guide for Specifications. ***TC57***

Presents guidelines but not standards for establishing specifications for telecontrol equipment following the other IEC standards on telecontrol systems and other relevant international standards and recommendations such as those of CCITT. Also facilitates the comparison of equipment produced by different manufacturers.
continued

IEC 870-1-3 : 1990 Part 1 : General Considerations.
Section 3 Glossary. ***TC 57***

Covers all terms necessary for the understanding of telecontrol standards, a certain number of which have not yet been defined in IEC 50 (371). This publication has the status of a report.

IEC 870-1-4 : 1994 Part 1 : General Considerations.
Section 4 : Basic aspects of telecontrol data transmission and organisation of standards IEC 870-5 and IEC 870-6. ***TC57***

This technical report is intended as a brief tutorial on transmission techniques, equipment and protocols in view of their use in telecontrol systems. It is thus intended as a guide to orientate those using the standards defined in the series of IEC 870-5 and 870-6.

IEC 870-2 : 1987 Part 2 Operating Conditions.
Section 1 : Environmental Conditions and Power supplies. ***TC57***

Specifies classes for environmental conditions under which telecontrol equipment has to operate.

IEC 870-3 : 1989 Part 3 Interfaces (electrical characteristics). ***TC 57***

Defines the interface conditions to be fulfilled when connecting together the various elements of equipment needed to constitute a telecontrol system and enabling the user to manage such a system.

IEC 870-4 : 1990 Part 4 Performance Requirements. ***TC 57***

Deals with those characteristics which affect the performance of telecontrol systems and relates the characteristics to the application and processing functions. Establishes a set of rules to assess and specify the performance requirements of telecontrol systems; where feasible, performance classes have been specified for each of the properties covered.

IEC 870-5 : 1990 Part 5 Transmission Protocols
Section 1 Transmission Frame Formats. ***TC 57***
EN 60870-5-1
Covers asynchronous data transmission with half duplex and duplex link protocols operating with window size one for message transfers.
Specifies the basic requirements for services to be provided by the link plus physical layers, for telecontrol applications. In particular, it specifies standards on coding, formatting and synchronising data frames of variable and fixed length which meet specified data integrity requirements.
continued

IEC 870-5-2 : 1992 Part 5 : Transmission Protocols
Section 2 : Link Transmission Procedures. ***TC 57***
EN 60870-5-2
Applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and controlling geographically widespread processes.

IEC 870-5-3 : 1992 Part 5: Transmission Protocols
Section 3 : General Structure of Application Data. ***TC 57***

Applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and controlling geographically widespread processes; specifies rules for structuring application data units in transmission frames of telecontrol systems.

IEC 870-5-4 : 1993 Part 5: Transmission Protocols
Section 4 : Definition and Coding of Application Information Elements. ***TC57***

Gives rules for defining information elements and presents a set of information elements, in particular of digital and analogue process variables frequently used in telecontrol applications.

870-6 Telecontrol Protocols compatible with ISO and ITU-T recommendations

No information available currently from IEC publications.

IEC 1037 : 1990 Electronic Ripple Control Receivers for Tariff and Load Control. ***TC 13***

Specifies the requirements for the type test of indoor self-contained static ripple control receivers for the reception and interpretation of a single audio frequency superimposed on the voltage of the electricity distribution network and for the execution of the corresponding switching operations.
Requirements for constructional details internal to the receivers are not specified.

IEC 1038 : 1990 Time Switches for Tariff and Load Control. ***TC13***

Specifies requirements for the type test of newly manufactured indoor self-contained time switches with operation reserve that are used to control electrical loads, multi-tariff registers and maximum demand devices. Does not cover the acceptance tests and conformity tests.

IEC 1107 : 1992 Data Exchange for Meter Reading, Tariff and Load Control - Direct Local Data Exchange. ***TC 13***

Specifies hardware and protocol specifications for local systems. Deals with direct local systems in which the hand-held unit is connected to one tariff device only at a time. Connection can be permanent or disconnectable through an electrical or optical coupling. The protocol took as its basis the basic reference model for communication between open systems (OSI).

continued

IEC 1142 : 1993 Data Exchange Meter Reading, Tariff and Load Control - Local Bus Data Exchange. ***TC 13***

Describes a method for local bus data exchange where a number of tariff devices in a given local area are connected by a dedicated bus; all of these tariff devices may then be read by connection of a hand-held unit to a central magnetic plug. Presents hardware and protocol for local systems, while specifications for a remote system falls within the scope of a future standard.

IEC 1334 : Part 1 General Considerations, Distribution Automation using distribution line carrier systems.

IEC 1334-1-1 : 1995 Part 1 General Considerations - Section 1: Distribution Automation Architecture. ***TC 57***

Describes the structure of distribution networks for both medium and low-voltage levels and presents the architecture of a distribution automation system using distribution line carrier systems. This publication has the status of a Technical Report - type 3.

IEC 1334-1-4 : 1995 Section 4 : Identification of data transmission parameters concerning medium and low-voltage distribution mains. ***TC 57***

Assesses the ability of MV and LV distribution power networks to be used as a data transmission medium suitable to support applications related to distribution automation systems. This publication has the status of a Technical Report - type 3.

IEC 1334-3-21 : 1996 Part 3 : Mains Signalling requirements Section 21 : MV Phase to phase isolated capacitive coupling device ***TC 57***

IEC 1334-4-1 : 1996 Part 4 : Data Communications Protocols Section 1 : Reference Model of the Communication system

IEC 1334-4-41 : 1996 Part 4 : Data Communications Protocols Section 41 : Applications protocols - Distribution line message specification

IEC 1334-5-1 : 1996 Part 5 : Lower layer profiles section 1 : Spread Frequency Shift Keying (S - FSK) Profile

ary of Received Replies to Questionnaire IV on Standards

	Details of Document		
	Technical Committee	**Title**	**Interested Participating Countries**
	TC13	Chapter 691 (International Electrotechnical Vocabulary) Tariffs for Electricity Supply	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
	SC13A	Var-hour (Reactive Energy) Meters	**Spain, Netherlands, Switzerland, Japa**
	SC13A	Class 1 Overload Indicators for ac Meters	**Spain, Netherlands, Switzerland, Japa**
	TC13	Telemetering for Consumption and Demand (to be cancelled)	**Spain, Netherlands, Switzerland, Ja**
	TC13 & CLC TC13	Symbols for Alternating Current Electricity Meters	**Spain, Netherlands, Switzerland, Fir Japan, UK, Norway.**
	TC13 & CLC TC13	Acceptance Inspection of Class 2 ac Current Watt-hour Meters	**Spain, Netherlands, Australia, Switze Japan, Norway.**

Details of Document		
Technical Committee	**Title**	**Interested Participating Countries**
TC13 & CLC TC13	Class 0.5, 1 and 2 ac Watt-hour Meters.	**Spain, Netherlands, Australia, Switze Japan. UK, Norway.**
TC57	Planning of (single sideband) power line carrier systems	**Netherlands, Norway.**
TC13 & CLC TC13	Ac Static Watt-hour Meters for Reactive Energy (classes 0.25 & 0.5S)	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
TC13	Testing Equipment for Electrical Energy Meters.	**Spain, Netherlands, Switzerland, Ja**
TC57	Telecontrol Equipment and Systems Part 1 : General Considerations	**Netherlands, Norway.**
TC57	Telecontrol Equipment and Systems Part 2 : Operating Conditions.	**Netherlands, Norway.**
TC13	Telecontrol and Systems Part 3 : Sec 1: Interfaces (General Considerations) Sec 2: General Requirements for dlc Equipment Sec 3: Mains-borne Signalling Requirements Sec 4: Data Communications Protocol	**Spain, Netherlands, Japan.**
TC13	Part 4: Performance Requirements.	**Netherlands.**

Details of Document		
Technical Committee	**Title**	**Interested Participating Countries**
TC57	Telecontrol Equipment and Systems Part 5 : Transmission Protocols	**Netherlands, Switzerland, Japan. U Norway.**
TC57	Telecontrol Equipment and Systems Part 6 : Telecontrol Protocols Compatible with ISO Standards and ITU-T Recommendations	**Netherlands, Switzerland, Japan, U Norway.**
TC13	Ac Static Watt-hour Meters for Active Energy (Classes 1 & 2)	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
TC13	Electronic Ripple Control Receivers for Tariff and Load Control	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
TC13	Time Switches for Tariff and Load Control.	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
TC13	Data Exchange for Meter Reading, Tariff and Load Control. Direct Local Exchange	**Spain, Netherlands, Australia, Switzerland, Finland, Japan, UK, No**
TC 57	Distribution Automation using Distribution Line Carrier Systems	**Australia**
TC 13	Data Exchange for Meter Reading, Tariff and Load Control. Local bus Data Exchange.	**Netherlands, Switzerland, Finland, (J UK, Norway.**
TC 57	Distribution Automation using Distribution Line Carrier Systems	**Norway.**

	Details of Document		
	Technical Committee	**Title**	**Interested Participating Countries**
	CLC TC13	Signalling on Low Voltage Electrical Installations in the Frequency Range 3kHz to 145.5 kHz. Part I General requirements, Frequency Bands and Electromagnetic Disturbances.	**Spain, Netherlands, Switzerland, Fin UK.**
	CLC TC13	Class 0.5, 1 and 2 Meters (IEC 521 equivalent)	**Netherlands, Switzerland.**
	CLC TC13	Acceptance Inspection of Class 2 Meters (IEC 514 equivalent).	**Switzerland.**
	CEN TC 176	Heat Meters	**Finland, Norway.**

2.3 Additional standards relevant to customer/utility functions and communications

1. **TC57 WG07: 1776**
   Telecontrol application service elements based on the manufacturing messaging specification and associated functional profiles.

2. **TC13 1068: Amendment No. 2 to IEC 1036**
   Alternating current static watt-hour meters for active energy (Classes 1 and 2).

3. **TC13 1085:**
   Power consumption and voltage requirements for multi-energy and multi-function static energy meters.

4. **TC13 1009: Amendment to IEC 1036**
   Clauses related to physical protection of the meter.

5. **TC13 1070:**
   Data exchange for meter reading, tariff and load control - Direct local data exchange (Revision of IEC 1107).

6. **TC13 1055:**
   Acceptance inspection for direct connected of alternating current static watt-hour meters for active energy (Classes 1 and 2).

7. **TC13 1071:**
   User requirements for local and remote meters data exchange - Applications and performance.

8. **TC13 1043:**
   Glossary of Terms.

9. **TC13 1086:**
   Pulse devices for induction or static meters.

10. **TC13 1011**
    Pre-payment electricity metering systems.

11. **TC13 1082:**
    Tele-reading of large industrial and commercial customers meters (Trim+) using the PSTN (architecture and protocols).

12. **TC13 1083:**
    Application layer protocols for remote reading of meters (detailed specifications).

13. **TC13 1084:**
    TRIM/EURDIS+ protocolsÆ management DLMS server (companion specification).

14. TC13 1073:
Immunity requirements for IEC Publications of static watt-hour meters and associated equipment.

15. TC13 1074:
Alternating current static volt - ampere - hours meters for apparent energy (Classes 1 and 2).

16. TC13 1087: Revision No. 1 of IEC 1142 (1993):
Data exchange for meter reading, tariff and load control - Local bus data exchange.

17. TC13 1088:
Reliability of static electricity meters and supplementary devices.

18. ISO 9000-3/9001

19. CEN EN 29001/29003/45001

20. ANSI/IEEE 829/830/730/983

3 A Model for Representation of Standards in Communications Systems

In the context of DSM functions and supporting communications media infrastructures, standards can be listed by application to media, hardware or communications protocol or a combination thereof. Standards relating to combinations of media, hardware and protocols of those highlighted by the participating countries in section 2 are chosen to provide a useful view of how standards can assist in systems engineering of suitable media infrastructures to support any given DSM functions.

Initially standards relating to data transmission over networks referred to methods of interfacing devices to the networks. More recently operators or public carriers for example have begun to provide extensive distributed information services such as exchange of electronic messages (Teletex) and access to public databases (Videotex). To cater for these emerging services standards bodies associated with the telecommunications industry have formulated standards not only for interfacing to such networks but also so-called higher level standards concerned with the format (syntax) and control of the exchange of information (data) between systems. Open systems can be achieved where equipment from one manufacturer can be interchanged with equipment from another. Another term used in this context is Open Systems Interconnection Environment (OSIE).

3.1 An Open Systems Interconnection Environment

The potential advantages of OSIE were formally recognised in the mid 1970's as different proprietary systems became more common. As a result a range of standards began to be introduced. The first was concerned with the overall structure of the complete communication subsystem within a computer. This was produced by the International Standards Organisation (ISO) and is known as the ISO Reference Model for **Open Systems Interconnection (OSI).**

3.2 The 7-Layer Open Systems Interconnection Model

The aim of the ISO Reference Model is to provide a framework for the co-ordination of standards development and to allow existing and evolving standards activities to be set within a common framework. The aim should also allow an application process in any computer that supports a particular set of standards to communicate freely with an application process in any other computer that supports the same standards, irrespective of its origin of manufacture. The term, computer, can be taken in its broadest sense to cover any device capable of data processing, storage or forwarding.

An example of an application process (i.e. a layer 7 activity) relevant to DSM that may wish to communicate in an open way is that of a process in an instrument (e.g. data logging in a meter) receiving commands and returning results to a supervisory system (e.g. utility data collector).

Open systems interconnection is concerned with the exchange of information in such a process with an aim to carry out a particular information processing task irrespective of the hardware on which it is running.

The ISO has adopted a layered approach to modelling communications subsystems. The subsystem is broken down into layers each of which performs a well defined function. Conceptually these can be considered as performing one of two generic functions which are either network dependent or application oriented. In DSM this could relate to systems engineering to support solutions of suitable media infrastructures, and required DSM, DA and SCADA functions, respectively.

3.3 An Enhanced Performance Architecture Variation

Various models to assist in creating satisfactory communications protocols have been devised and recorded in documents by the ISO. The most common of these involves the concept of Layers which deal with different facets of the communications process such as encoding of data or actions performed, i.e. ***applications***. A 7 layer model allows representation of interconnectivity between a variety of sending and receiving devices but at some cost in the overhead required per layer for the control and addressing of packets of information at each layer. A background to, and a brief tutorial on, the ISO reference model (first detailed in the Interim report on Standards, sec. 3.1 & 3.2.) is included here in Secs 3.1 -3.2 as an aid to review.

In suitable cases, some layers of the model may be ignored to improve efficiency in terms of the data to overhead ratio but there is a corresponding reduction in flexibility. One such reduced model is the **Enhanced Performance (or Collapsed) Architecture** model specified in ISO 7498 which has 3 layers only, with the missing specifications either being unnecessary for the system concerned, or having essential elements covered in another layer. The layers specified in this model are known as **Physical (P), Data Link (DL)** and **Application (A)**. The data link is often split further into **Medium Access Control (MAC)** and **Logical Link Control (LLC)** sub-layers. See Figure 3.1 below:

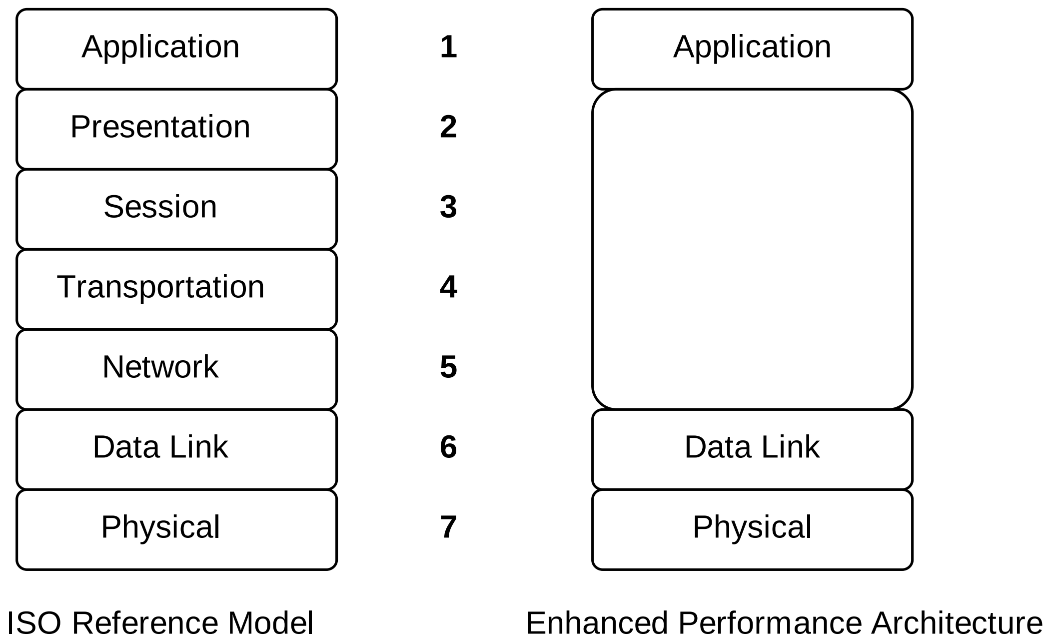

Figure 3.1

3.4 Standardised Testing of Communications Protocols

Any communication protocol required for use in a DSM system should pass a test of conformity if it is to communicate readily with other communications systems using different protocols. A test implementation of a communications protocol can be made with reference to layers 1 - 7 of the ISO reference model and a procedure for testing is described in document ***ISO 9646, OSI Conformance Testing Methodology and Framework***. It contains procedures that must be followed during the design of a protocol, details the conformance tests, and how to perform them. Note that ISO 9646 describes protocol conformance tests for ISO standards only, and de-facto protocols such as TCP/IP, WSCC and ELCOM-90 are excluded.

3.5 Functional Models related to OSI

Various functional reference models have been proposed which can be applied to DSM applications such as remote meter reading (RMR). These models allow the functionality of RMR applications to be defined independently of the communication medium, (Figure 3.2). Models suitable to the work of Annex II focus on information flows which aids analysis of traffic levels for given DSM functions and consumer profiles. Communications infrastructures used to support these flows of data may be of mixed or single types.

Of particular relevance to Annex II is an interface, called GS1 in this reference, between Network Owner and Consumer where many standards relating to protocols and data flows in this region exist for a variety of media and applications.

For data exchange between software modules within a utility and between actors in the energy market, the Norwegian Electric Power Research Institute (EFI) has developed a library of objects called GS2. The library is developed by using the programming language C++ and works on top of the application layer in the ISO Reference model, but can be transformed to lower levels (e.g. the communication protocols between customer and utility).

The authorities' requirements are that customers above 500 MWh must have two way communicating meters. For customers below 500 MWh, load profiles may be used. Both metered values and load profiles shall be made available in GS2 format for all actors in the energy market.

The nature of work programmes in standards bodies with well defined goals and specified deadlines often leads to providing documentation to cover specific tasks and functions at the expense of standards at system level. For utilities therefore, integration of communications systems with differing applications can be hindered by established standards which may conflict when an attempt is made to include several within a single communications structure. Meter reading, for example, can be implemented according to guidelines from standards bodies ISO, IEC, CEN, or representative groups like EPRI UCA and EurUCA, and dominant manufacturers with their proprietary solutions such as LONworks and CEbus. All these documents and products may address portions of OSI layers and the relevant interface, but few have an overview or strategy for integration with other standards to provide a complete solution to a systems designer in DSM. A main conclusion therefore is to form a distinction between media-specific and function-related standards with regard to DSM solutions.

In applying RMR, for example, a range of media may be required to carry a message to and from source to destination which could relate to a suite of standards developed in isolation. It is therefore unlikely that an harmonious set of standards describing the data path can be formed. At the higher levels of the OSI stack, functional specifications may achieve harmony with each other, but a demanding requirement is for them to relate in a uniform way to the lower, dissimilar, and possibly conflicting, set of media based standards.

This can be readily shown in figure 3.2 below which relates function and media standards both to the OSI stack and each other. For differing media, several fundamentally different standards at the physical layer are shown which may well be used on an RMR data path. At the upper, more abstract (in the sense of distance from transporting data bits) layers, meter functions such as modem and internal data storage appear. The aim is to achieve a uniform interface between these and the lower physical media layers for a transfer of information between meter source and its destination which is defined fully by a set of non-conflicting standards. A principle requirement of implementors of DSM/DA systems then is the OSI physical layer can represent all media choices and have well defined standards describing their access and operation, but to achieve global (in terms of DSM/DA systems) standards at higher OSI layers, protocols must be able to interface correctly with the lower layers regardless of media. The difficulty in smooth implementation is compounded in DA/DSM where a greater requirement is placed on these higher OSI level standards as placement of terminals and their associated interfaces, which operation would be described by these standards, may vary depending on function.

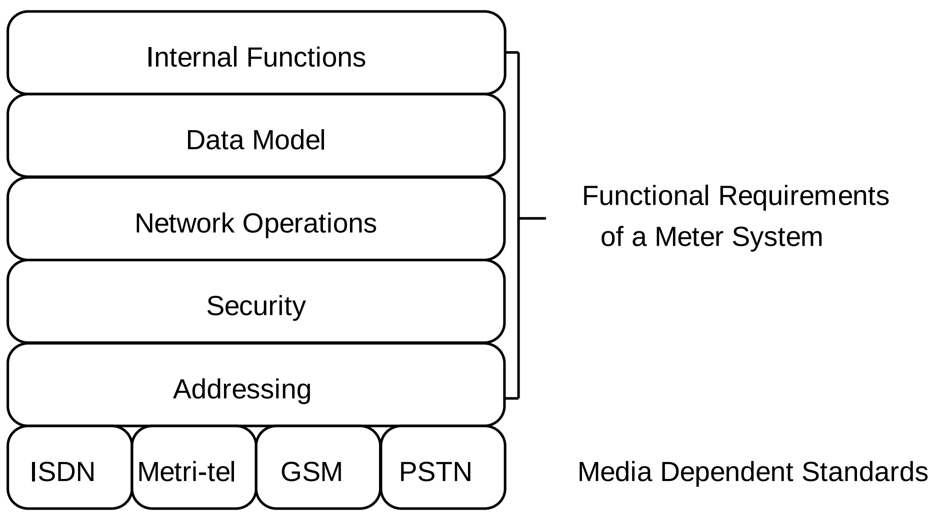

Figure 3.2

3.6 Data Models

A common approach to analysing data exchange and the elements associated with it is to construct data models. Object oriented methodologies are well suited to this form of analysis In concept, an example of object orientation for a DSM function applied to a given population type requires definition of typical function message packets and the types of consumer they serve. These definitions are fundamental to a data model and should be simple in form with attributes or additional features being added when required to form basic objects. Combinations of these objects are built up as a scenario is developed. Well defined communications functions can be created to act on the objects thereby providing any level of scenario complexity from a simple modelling base. Annex II work which uses an object oriented model is therefore an appropriate tool to offer to standards committees and work groups once suitable work programmes are identified.

4 Communications Media in DA/DSM Applications and Relevant Standards

The following diagrams show communications infrastructures for each medium considered in the IEA DSM Annex II with associated standards taken from the preceding tables in section 2. Each figure therefore shows a portfolio of standards for each communications medium used in an international or national format by the participating countries.

4.1 Layout of a PLC/DLC Communications Network with Relevant Standards

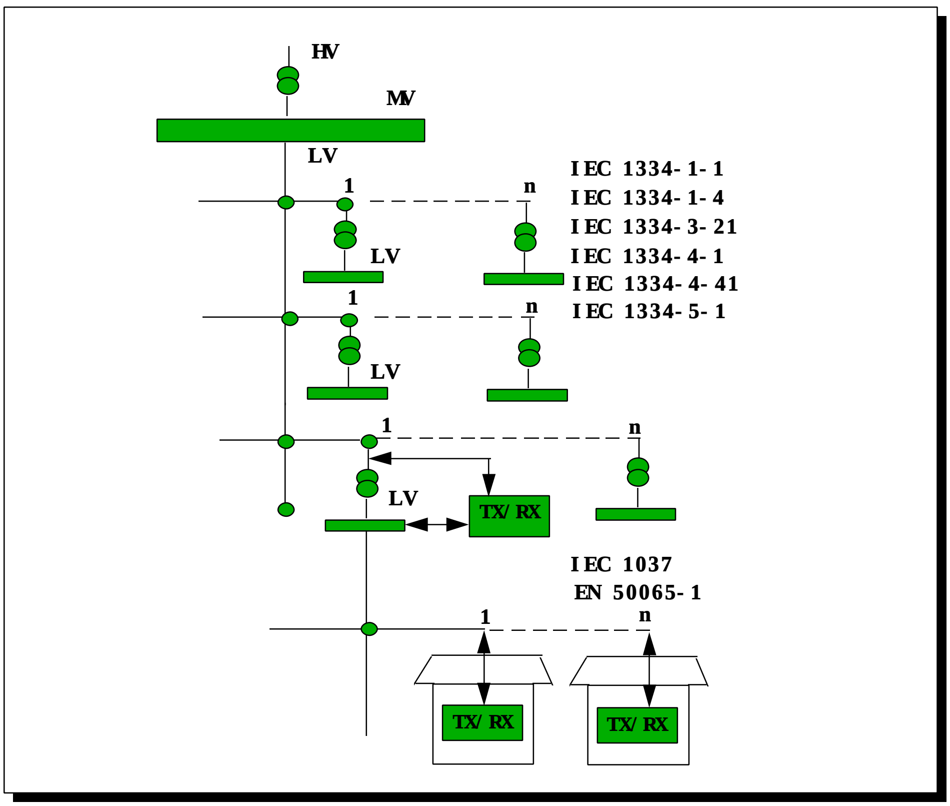

Figure 4.1

Comments on Figure 4.1

Standards IEC 1334 series and EN 50065-1 are listed with descriptive titles in section 2.

A set of the family of 1334 standards describing distribution using dlc is included in the portfolio of Figure 4.1. Other parts of the family can be included as providing background information and tutorials on telecontrol systems in general. Brief descriptions of each and of IEC 1037 for ripple control are given in section 2.1.3.

4.2 PSTN Network Overlaid on PLC/DLC Infrastructure with Relevant Standards

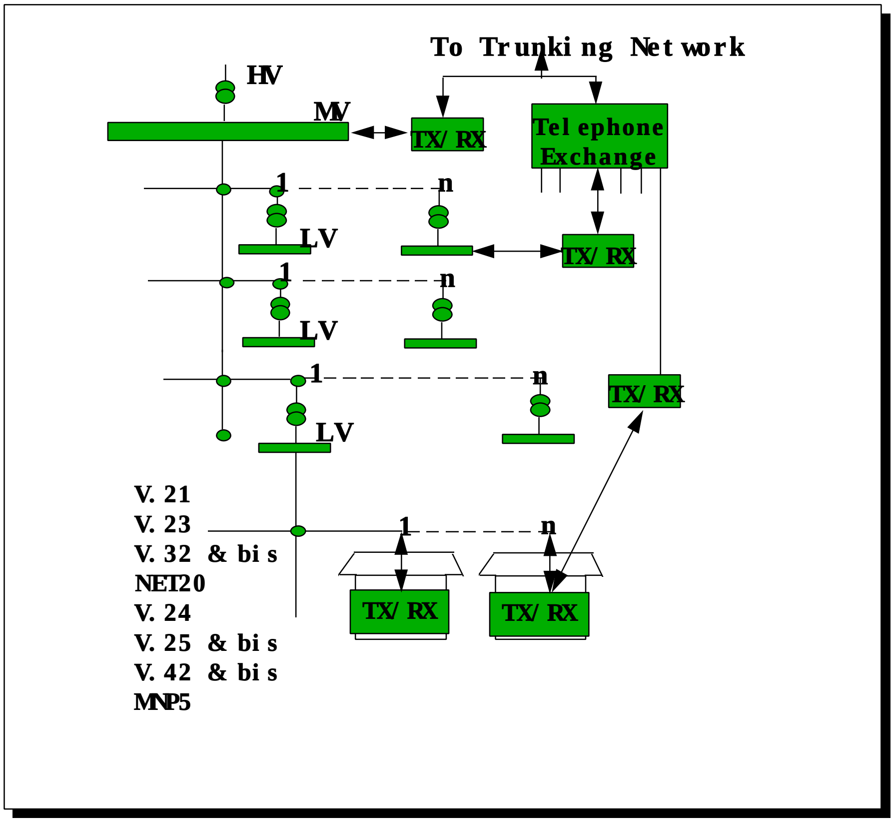

Figure 4.2

Comments on Figure 4.2

The V. series listed in the portfolio of Figure 4.2 refer to a set of recommendations drafted by ITU-T (formerly CCITT) which describe characteristics of modems which transmit data over analogue networks. MNP5 and v.42 (& bis) describe error correction and compression protocols applicable to data, and NET20 refers to *Basic Approval of Modems* and has an ETS (ETSI) reference of T/TE 04-17. Details of all these recommendations are readily available in the public domain.

4.3 ISDN Network Overlaid on PLC/DLC Infrastructure with Relevant Standards

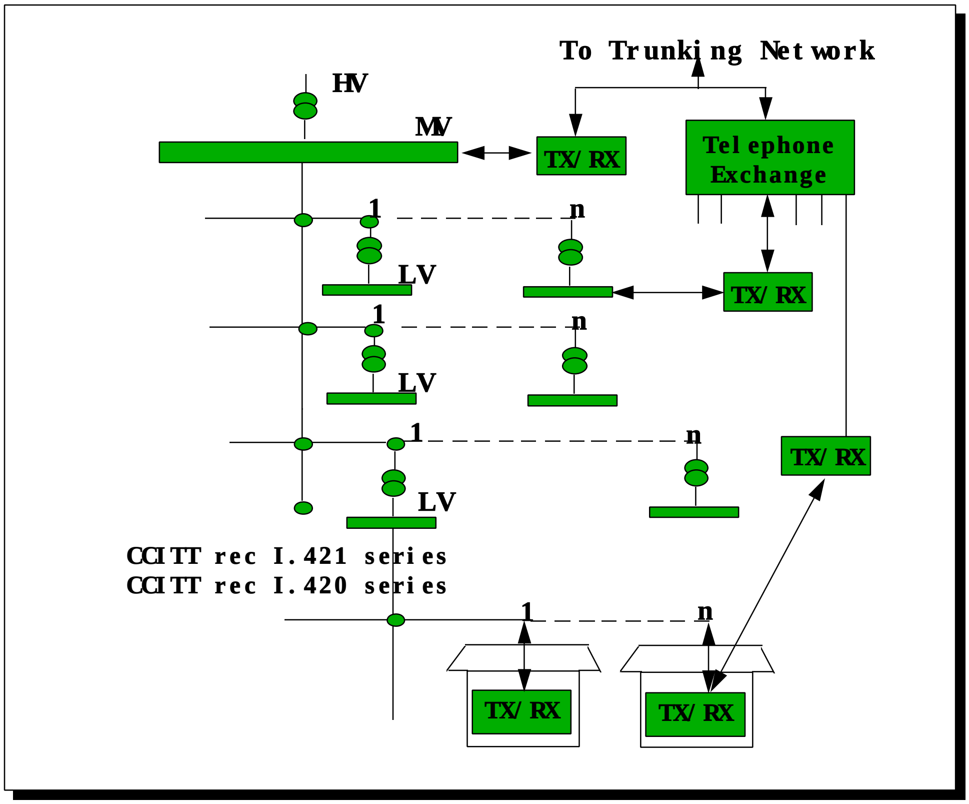

Figure 4.3

Comments on Figure 4.3

I.420 describes a series of standards detailing ISDN Basic Rate Access and is related to the three lower layers of the OSI model as follows :

ISO Layer	Document Title	ITU-T ref	Series Title
Layer 3	Supplementary Services	I.452/Q.932	I.420
	Specification	I.451/Q.931	
	General Aspects	I.450/Q.930	
Layer 2	Specification	I.441/Q.921	
	General Aspects	I.440/Q.920	
Layer 1	Physical	I.430	

Table 3 ITU-T Basic Rate Interface Recommendations

Primary Rate Access differs to Basic Rate Access at Layer 1 only :

Layer 1	I.431

Table 4 ITU-T Primary Rate Interface Recommendations

4.4 Cellular and Trunked PMR Networks Overlaid on Distribution Network with Relevant Standards

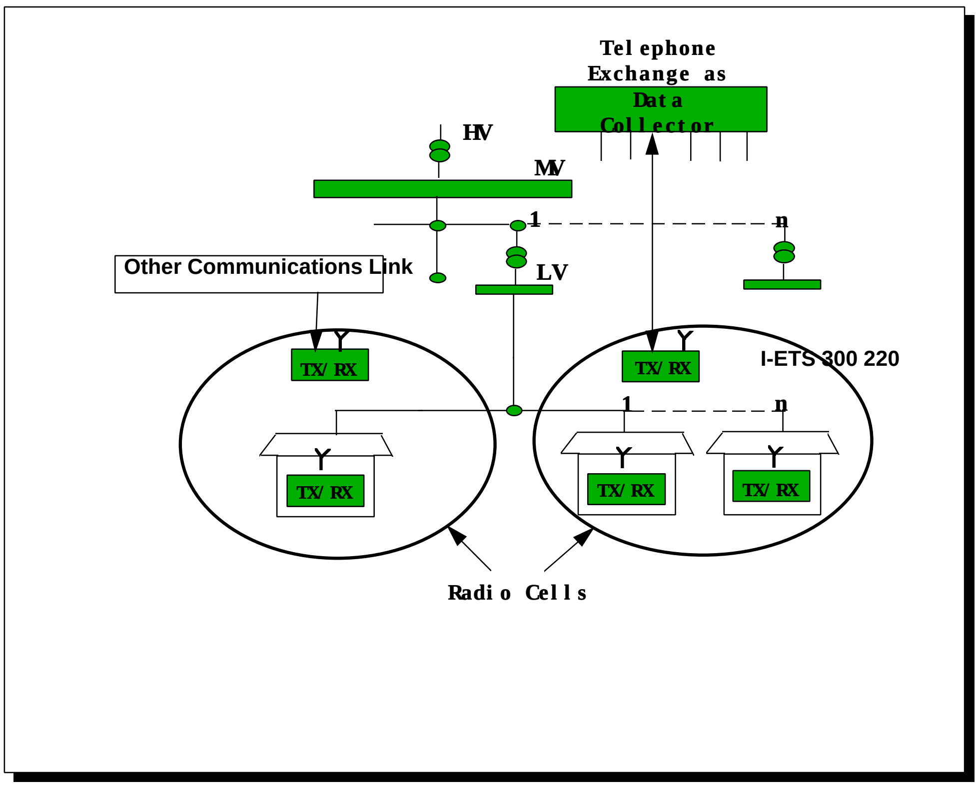

Figure 4.4

Comments on Figure 4.4

I-ETS 300 220 was drafted by RES 6 (Radio Equipment and Services, Technical Sub-committee 6) of ETSI and refers to Short Range Devices :
Technical characteristics and test methods for radio equipment to be used in the 25MHz to 1000MHz range with transmission power levels ranging up to 500 MW.

5 Some Key Standardised Protocols Useful to DA/DSM

This section considers some protocols which have been proposed for use in DA/DSM systems. Currently both IUC and DLMS are being proposed as having protocols suitable for DSM in assisting designers in forming suites of standards more able to give guidance at system level. This avoids standards describing lower level sub-systems in isolation, which can lead to a lack of open interconnectivity to other systems and their standards. Some proprietary protocols which dominate in the field of in-building communications which is related to the work of Annex II are also included

5.1 EPRI's Integration of Utility Communications Systems (IUC)

Split into four phases, Phase 1 of this project was completed in December 1991 to develop a Utility Communications Architecture (UCA). Output included 6 reports regarding the exchange of information within and between utilities. Phase II was completed in December 1992 and is an extension to the architecture development allowing access to, and sharing of, data across connected computers at a utility via software termed Database Access Integration Services (DAIS). Phase III will include demonstrations of the communications architecture and data integration. Phase IV develops models of systems and methods for planning designing and maintaining communications systems with a variety of available communications media.

The UCA is an open or non-proprietary communications architecture based on the 7 layer Open Systems Interconnection (OSI) reference model. UCA contains a specification of communication standards based on the specific requirements for the utility industry. Examples of these standards are:

- Remote file transfer, access and management (FTAM)
- Store and Forward messaging/ Electronic mail (MHS)
- Remote terminal access (VT)
- Messaging Services for devices in real-time networking environments(MMS)

The Enhanced Performance Architecture 3 layer model of figure 3.1 is also considered as reduced coding overhead makes it suitable for time critical applications.

Demonstration projects will be implemented showing integrated utility computer systems using ISO/IEC standards that were identified in the first phase of the project. The aim of the project is to increase the availability of information systems, or parts thereof, complying with ISO/IEC standards. The most notable standards group in this area is the IEC which proposes the IEC 870-5 family of protocols focusing on defining communications mechanisms for Energy Management Systems and the IEC 1334 family for Distribution Automation using distribution line carrier systems. In line with the UCA efforts, IEC has also begun recently to develop a UCA compliant (in fact termed ISO compliant, the same basis for UCA work) series of standards, IEC 870-6.

According to UCA reports, a primary aspect related to the introduction of communications standards is protocol testing. This is introduced in section 3.4.

UCA version 1.0 specification contains a useful basis for the development of compliant systems but does not as yet address fully all requirements in the communications chain such as control centre, power plant, distribution automation and customer interface requirements.

An initiative called *Forum for Electricity Utility MMS Implementation*' was begun in May 1992 to address UCA applications issues. The Forum provides an opportunity for manufacturers and users to learn together the details of the UCA profile and to work out companion standards recommendations as needed. Working groups active in this forum focus on five areas :

- profiles
- control centres
- substations
- the customer interface
- feeder control

Exemplary output from some of these groups include an Inter Control Centre Communication [ICCP] as a companion standard by the control centre group which was adopted by IEC committee 57 as the second Application Service Element for Telecontrol: TASE 2.

Also, an object model was defined for Integrated Protection, Control and Data Acquisition by the working group for substations. A first draft was published in early 1995.

The other groups include the customer interface and feeder control relevant to DSM and DA, respectively, and are in early stages of development.

Data flows of company or utility functions were identified and described in order to define the communications system requirements. This information was obtained from questionnaires sent to participating members. Characteristics listed are similar to those contained in data infrastructures and IEC TC 13 and TC14 Technical Report Type 3 tables : User Requirements for Local and Remote Meter Data Exchange - Applications and Performance.

A project EurUCA has been started to identify commonality of standards and applications for European and USA applications.

IEC ad-hoc working groups followed by the EurUCA project include:

Application Programming Interface for EMS
` Integration Tools for Distribution Management Systems
Substation communication interfaces

CIGRE groups (e.g. 35.01) and IEEE groups are currently working on open systems requirements.

Of note to Annex II is that in compiling data flow information, it was found that most utilities are very interested in the information exchange between utilities and customers. They also expressed interest in new data flows arising from liberalisation of energy markets.

Phase II focused on the demonstration of tools and techniques for system integration rather than on communications protocols. Object oriented techniques were considered a as possible solution such as Common Object Request Broker Architecture (CORBA) defined by the Object Management Group (OMG). The strategy of this phase is to find products that enable interoperability between diverse systems. Interconnectivity is a necessary precondition but may not be sufficient to reach the desired interoperability at an application level. Products that enable this interoperability should not only comply to ISO/IEC standards, but also create possible migration paths for the use of de-facto communication protocols from ones of de-jure. Figure 5 represents some of these OSIE terms.

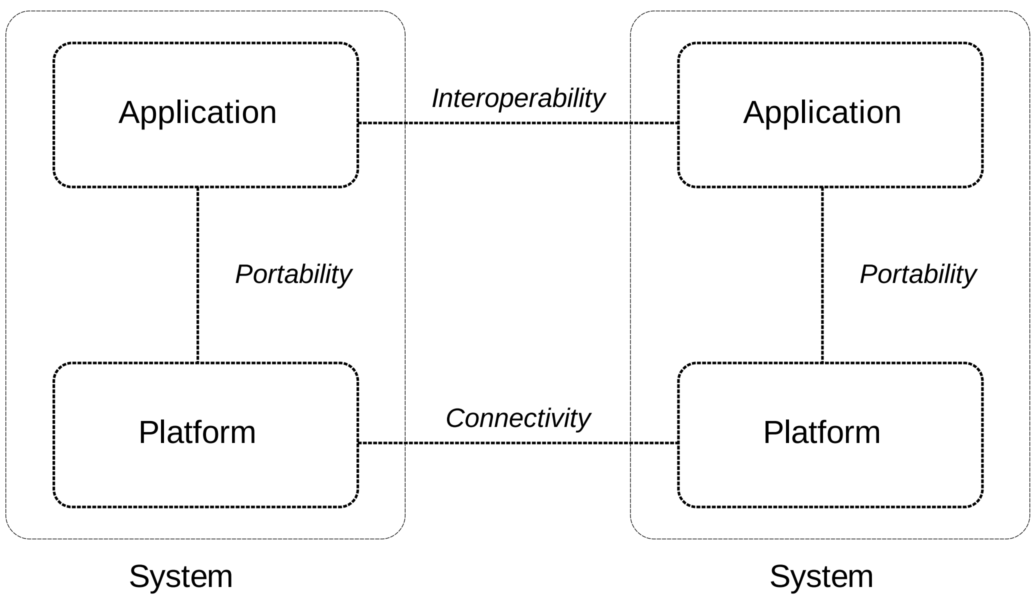

Figure 5

5.2 Distribution Line Messaging Specification (DLMS)

5.2.1 A Brief History

The electricity industry has made extensive use of telecontrol, teleprotection and telemonitoring schemes in managing its supply of electricity to consumers over several decades. Implementation of such systems has included a variety of communications media and network topologies which depend on strategies to use either central control points, distributed control points or hybrids.

IEC Technical committee 57, Work Group 9 (Distribution automation using distribution line carrier systems) has a remit which covers preparation of standards for equipments and its communications aspects when using power lines as communications links. A main output has been the drafting of standards describing DLMS.

This method was derived in the late eighties from a Manufacturing Message Specification (MMS) which is used for automating large scale manufacturing facilities in the USA. It is a client-server based protocol where the client issues requests and the servers send back corresponding responses. Although this information exchange is a two way process there is a facility for the server to transmit an unsolicited response in event driven cases such as found in alarm conditions. This last feature would be essential in many DSM applications, e.g. updating of tariff structures stored by remote meters.

DLMS employs a concept of Virtual Distribution Equipment (VDE) where all equipments irrespective of source or manufacturer have a common representation. This is modelled by the virtual equipment showing the same defined behaviour as seen by the communications systems wherever it is placed physically. In RMR for example, the meter placement may be within the meter or at an interface with it and the local network. Devices which conform to the VDE specification, and which are designed for the same application, should be interchangeable. Presently application oriented objects such as defined objects for meters based on DLMS are being standardised by IEC TC13 WG14, CENELEC TC13 CEN TC294 and CEN/CENELEC JWG RRM.

VDE's contain resources i.e. data or other objects, related to their application. In order to have access to the VDE's resources, it is necessary to be connected to them, reciprocally agree identification, and define access rights. Access to the resources is managed by services. DLMS has 22 services but only 4 are mandatory. The principal resource is the Virtual Dataset which contains Virtual Variables. Each Virtual Variable models an actual variable in a formal and logical construction. Some variables models have universal access and some have restricted access. When a variable has restricted access this is handled by the Virtual Association for an Application (VAA).

5.3 M Bus

M Bus was devised by Professor Horst Ziegler in co-operation with Texas Instruments GmbH and Techem GmbH for apartment heating systems typical of countries in mainland Europe. It is implemented on a twisted pair local network with a topology of a master device (controller unit) supporting 250 slaves (controlled units). Main features related to the OSI model layers are detailed below.

5.3.1 Technical Characteristics at Physical Layer

The transfer of bits from Master to slave is by modulation of voltage level where logic 1 (mark) is +36 V and logic 0 (space) is + 24V. Bit transfer from slave to master is achieved by modulation of current consumption of the slave. Logic 1 is up to 1.5 mA and logic 0 between 11 and 20 mA. Transmission is half duplex with transmitted data rates between 300 and 9600 Baud. Characters are 8 bit with start, stop and parity bits.

5.3.2 Message Format at Datalink Layer

Four types of frame structure are used which vary in length. A single character is used for acknowledgements, and there are short and long control frames. Other frames have start, checksum, and stop fields.

5.4 Some Dominant Proprietary Communications Protocols

Some dominant proprietary communication protocols are described in the following sections with other important used protocols and bus systems listed in Section 5.4.5.

5.4.1 European Home Systems, EHS

5.4.1.1 Background

The European Home System was conceived in 1987 at Thorn EMI's Central Research Laboratories (CRL). With the National Economic Development Organisation (NEDO), Thorn approached the European Commission for assistance. An Integrated Home System project was agreed under the Eureka research programme and a consortium of eight other European companies was formed. A preliminary standard was published on completion of the project in February 1988. Work continued under the Esprit research programme with an enlarged consortium including Thorn, Philips, BT, SGS-Thomson with Philips Consumer electronics division as the project leader. This Esprit project 2431 ran for two years and by 1990 had produced version 1 of its standard. A second project started in 1990 to test and validate this standard, now called the 'White Book', resulting in a version 1.1.

In April 1992, the EC agreed to support a range of projects under the Esprit programme which could demonstrate commercial promise. Two main types of project for EHS were devised to market the technology: components, which seek to develop the hardware on which EHS depends; and applications, in which companies study and develop software for specific sectors such as hotels and office buildings. Due to a recession in the construction industry with fears that the domestic market would take a long time to recover, some of the later projects looked to extend the EHS specification to commercial buildings. This puts EHS into direct competition with EIBus and Batibus for market share of commercial buildings control systems.

5.4.1.2 Technical Information

Developed for domestic users, EHS is easy to install and use since any suitably equipped appliance when plugged into the bus will identify itself and communicate with any other HS devices on the bus without any commissioning or programming. This process is called enrolment.

An HS-equipped product contains an industry-standard micro controller, a modem chip and some coupling components for connection to the bus. The current EHS specification allows for connection to six types of media with data transfer rates dependent on the medium chosen :

i) Mains-borne signalling at 2.4 kbps
ii) Twisted pair cable (similar to PSTN cable) at 9.6 kbps
iii) Twisted pair cable at 64 kbps
iv) Coaxial cable, similar to TV aerial leads at 9.6 kbps
v) Infra-red at 1.1 kbps
vi) Radio frequency at 1.2 kbps

Other media will be included although most effort has focused on mains-borne, and work is advanced on twisted pair and coaxial cables. The network uses *controllers* and *devices*, where controllers both send commands to, and interrogate, devices. Devices which are not equipped with HS components can also communicate with controllers via *device co-ordinators* which act as relay agents. *Feature controllers* plug into the bus to determine how the appliances work together, e.g. a TV set and video camera could co-operate as a video entry-phone which could flash a picture when a door bell is rung.

5.4.1.3 Marketing and Standards

EHS is marketed as an open system with the Standard administered by EHSA. Twisted pair and DLC have both been used as communication media for EHS based implementations.

5.4.2 Echelon Corporation's LONworks

5.4.2.1 Technical Information

LONworks is marketed as a solution to any control network application. Principal suppliers of the technology, which includes transceivers and connectivity products, are Echelon Corporation (creators of LONworks), Motorola, and Toshiba.

A control network can be considered, in essence, to be a group of nodes, each with one or more sensors or actuators and some computing ability, communicating over one or more media using standard protocols. Communication amongst nodes can be configured as peer-to-peer (distributed control) or master-slave (centralised control). Computing ability of LONworks chips, called Neuron chips, allows distribution of the processing load, e.g. intelligent sensors which perform data-logging and some analysis at a meter site.

Present limitations of silicon Neuron chips restrict LONworks applications to a maximum transmission rate of 1.25 M bps with end-to-end response times of 7 - 13ms across a given network. Functions of the Neuron chips are stored in embedded intelligence and are able to implement a common network protocol and control functions, and also control a physical interface to a communications medium.

A major application of LONworks is to building management systems. Sub-systems of LONworks are designed to be flexible and have a limited 'open interconnection' (to other LONworks systems only) allowing several sub-systems to co-operate with diverse applications, e.g. a security sub-system sensing the location of staff and transmitting information to heat and light sub-systems thereby assisting in an optimal use of building resources.

5.4.2.2 Marketing and Standards

LONworks is marketed as an open system where interoperation between LONworks products of different manufacturers is guaranteed, protocol-converting elements such as gateways are redundant, and the communication media of connecting sub-systems is shared. In summary advantages claimed include :

1. Interoperability (amongst different products which support LONworks protocols)
2. Low cost of installation
3. Reduced costs of reconfiguration
4. Easy growth
5. Elimination of components such as gateways.

Twisted pair and dlc have both been used as communications media in a variety of applications implemented in LONworks.

5.4.3 European Installation Bus

5.4.3.1 Background

The European Installation Bus (EIBus) was developed for in-building environments to provide integrated building management systems. It uses a twisted pair medium often installed as a standard part of modern building installations to support control, monitoring and signalling functions within properties ranging from residential to large commercial.

5.4.3.2 Technical Information

The main applications of EIBus are, of course, related directly to building management applications and include :

Lighting control
Shutter control
Local control of Heating, Air-conditioning and Ventilation
Monitoring and Signalling
Alarms
Load Management

Siemens, the originator of EIBus, aims to sell EIBus technology as a bottom-up solution under the Trade name *instabus.* It has a decentralised bus topology allowing local independent busses which may operate independently in small scale and functionally limited applications. With a standard unit, up to approximately 64 individual devices may be connected to a branch line able to support signalling rates of 9.6 kbps.

5.4.3.3 Marketing and Standards

EIBus is considered by its originators as a systems approach to a large class of applications in domestic and commercial buildings. This includes home systems and in-building services automation systems. A policy to standardise and link these two fields is proposed in order to assist in developing standards to avoid divergent and incompatible technologies which may reduce market share. Siemens aims to make EIBus an open system to ease acceptance by manufacturers and standards bodies and thereby expand its market. It is claimed that EIBus provides a generic solution to in building communications, rather than a single proprietary technology.

Standards committees listed as relevant to building management systems include :

ISO/IEC JTC1/SC 25 WG1 on Home Electronic Systems
CENELEC TC 105 on Home Electronic (Automation) Systems which includes commercial and industrial buildings and associated outdoor installations.

EIBus (and Batibus) are considered as a major input to a French committee: **UTE/CEF 65C/GE7** Networks for Technical and Administrative Management of Buildings, which has close links to CENELEC TC 105 via a Vilamoura procedure.

On May 1990 the European Installation Bus Association EIBA was founded in Brussels. By the end of 1990 approximately 50 companies were registered as EIBA members consisting of manufacturers supporting and using EIBus technology. Due to overlap of markets for ESPRIT (home consumer products) and EIBus (building management systems), several partners of ESPRIT have also registered in EIBA. Co-operation also exists with EHSA which continued the ESPRIT 2431 project on Home Systems, to provide a technological linking policy, attain technological convergence where possible, and co-ordinate European or international standardisation or both.

5.4.4 Batibus

5.4.4.1 Background

Batibus was developed by Merlin Gerin Ltd, a member of the Schneider Group, specifically for building control. Since October 1989, however, Batibus has been promoted as an open system by forming a Batibus Club which includes over seventy companies from eight European countries.

Batibus was developed from Merlin Gerin's range of equipments for distribution and power control in buildings. By joining the Factory Instrumentation Protocol Group, FIP, in 1985 Merlin Gerin acquired expertise in developing communication protocols. Development began in 1988 with support from Electricité de France, and Landis and Gyr. It uses a simple bus structure of a twisted pair and is claimed to support many applications in a variety of environments from commercial and industrial to selected residential premises.

5.4.4.2 Technical Information

The claimed advantages of Batibus include :

i) Multifunctionality, capable to handle both the comfort and security needs of people working or living in buildings;

ii) Simplicity, easy to install with a single cable providing the communications medium for all building services functions using the ducts and channels provided for the building's power cables;

iii) Easy reconfiguration, a flexible addressing scheme allows easy expansion for roll-out of the system or to accommodate further development of buildings;

iv) Common components, Batibus uses freely available chips manufactured by a number of suppliers such as Intel's 8031s, 8088s and NEC's 75108s which are families of standard microcontrollers;

v) Remote access, by using Minitel or similar, access to Batibus can be made via the Public Telephone Network.

5.4.4.3 Marketing and Standards

In order to provide a platform for easy dissemination of technical information, the Batibus Club was formed in 1989. Its aim is to encourage a rapid acceptance of Batibus as a de-facto communications standard for building control and is achieved by:

- providing members with information on all aspects of Batibus including specifications, test procedures and standardisation work;

- encouraging exchange between members of the club;

- promoting the Batibus system through publications and participation in shows and exhibitions.

Membership allows use of the Batibus system's patent, trade mark and logo for promotional activities and on approved products subject to testing by designated laboratories. Product licences are available to prospective manufacturers and include information on hardware diagrams, and the firmware required to control the Batibus microprocessors. Manufacturers also have an option to develop their own components based on Batibus specifications.

A vigorous testing procedure conforming to **ISO 9646** is used to check all proposed products support the Batibus protocol, internetwork appropriately with each other, and comply with EMC emission guidelines (**801.X series**).

Representation in the international standards scene is achieved through participation in the activities of **CENELEC TC 105** by several Batibus experts. The French body **UTE/CEF 65C/GE7** Committee on Networks for Technical and Administrative Management of Buildings has received a European mandate.

Members of Batibus feel it is unlikely that a dominant standard for building control communications systems will emerge in the near future. The Batibus Club aims to establish Batibus as a serious de-facto standard through active promotion and early availability of Batibus-compatible products.

5.4.5 Other important used protocols

FieldBus	Elkomatic
CEBus	BACnet
Cyplex	BEMS
I-Bus	ArcNet
Bitbus	HES
Profibus	

6 Current Status of Work Groups Influential in DA/DSM Communications

A review of returned Questionnaire IV's showed two principal Technical Committees producing documentation considered highly relevant to Annex II: IEC TC's 57 and 13. The scopes of these technical committees are:

IEC Technical Committee 13

To prepare international standards for electrical energy measuring and electrical load control equipment (such as watt-hour meters, maximum demand indicators, telemetering for consumption and demand, equipment for remote meter reading, time switches, equipment for the control of tariffs and consumer services) including the equivalent electronic forms of these devices and their accessories.

IEC Technical Committee 57

To prepare international standards and reports for telecontrol, teleprotection and associated telecommunications equipment and systems such as power line carrier, used in the planning, operation and maintenance of electric power systems.

Some qualification to TC 57's scope includes:

i) Standards and documents prepared by other IEC TC's and other organisations such as the ITU and ISO shall be used where applicable.

ii) Although the work of TC 57 is chiefly concerned with standards for electric power systems, these standards may also be useful for application by the relevant bodies to other geographically widespread processes.

iii) Whereas standards related to protection relays are treated in TC 41, TC 57 deals with the transmission aspects of teleprotection systems.

CENELEC's TC 294 has a remit for Remote Reading of Meters other than electricity meters and has a close association with CLC TC 13 which, in turn, has a mandate to, or mirrors the work of, IEC TC 13. Each is described below with a brief history and a summary of more recent decisions or aims which influence the production of documentation relevant to DSM/DA.

As an aid to review, two diagrams from Questionnaire IV showing the relationships between the TC WG's of IEC, CEN and CENELEC are shown below :

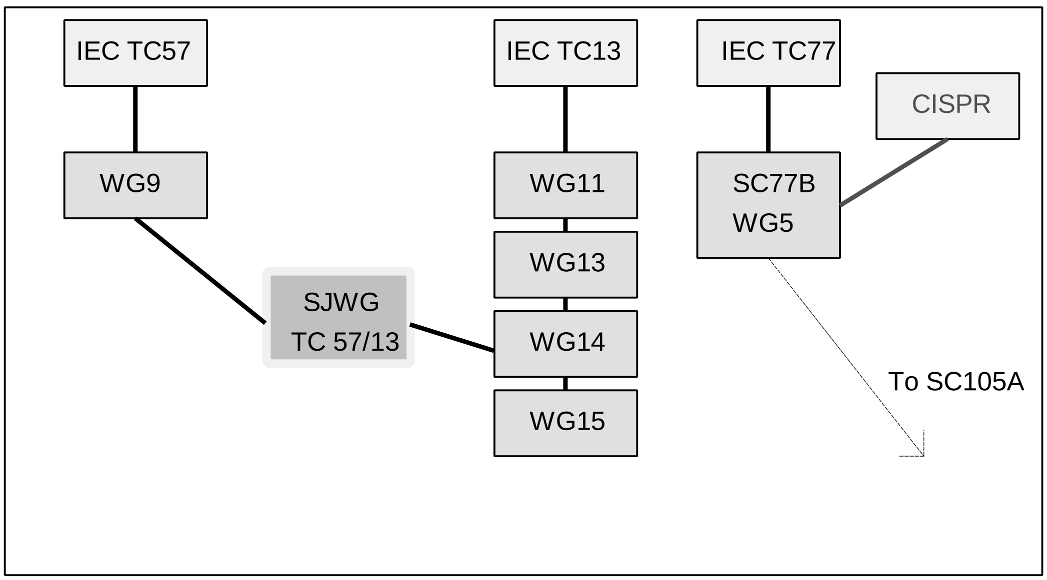

Figure 6.1

TC13	Equipment for Electrical Energy Measurement and Load Control (Electricity Meters)
WG11	Static Domestic Watt-hour Meters (Basic Meter Standards)
WG13	Reliability of Static Meters
WG14	Data Exchange for Metering, Tariff and Load Control
WG15	Prepayment Meters
TC57	Power System Control and Associated Communication (Telecontrol and Teleprotection)
WG9	Standards for PLC and DLC Communications
TC57/13	
SJWG	Co-ordination between TC13/WG14 and TC57/WG9
TC77	Electromagnetic Compatibility (EMC)
SC77B	High Frequency Phenomena
WG5	EMC Aspects of Mains Signalling
SC77A	Low Frequency Phenomena
WG3	High Frequency Disturbances on PLC

Table 1

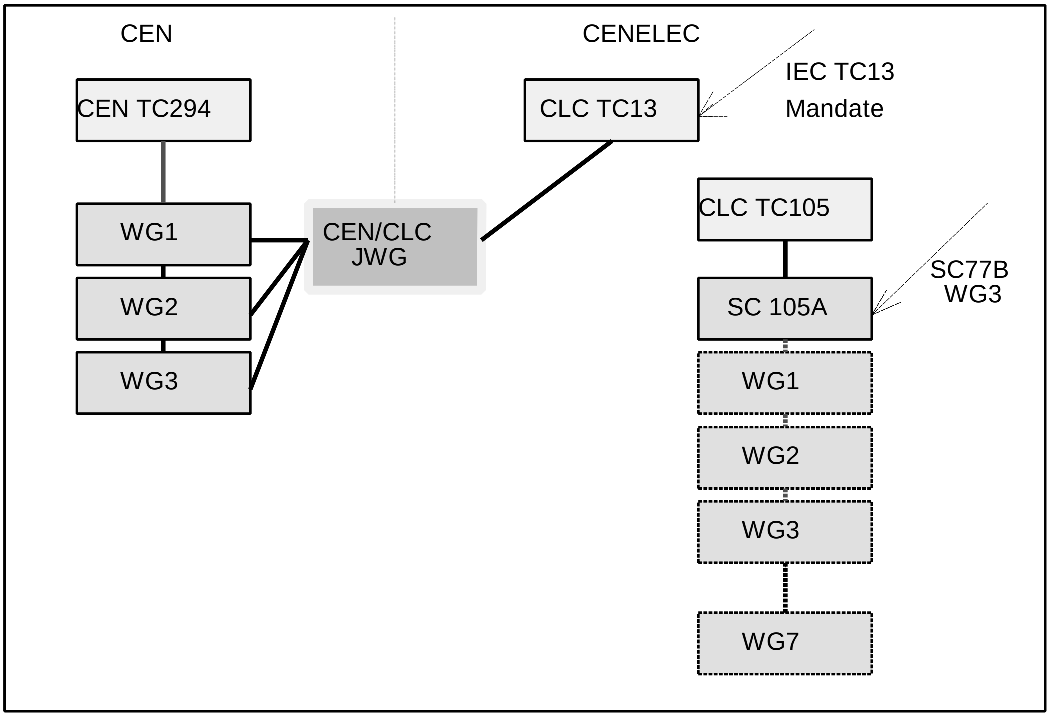

Figure 6.2

CEN	
TC294	Remote Reading of Meters for Fluids and Energies
WG1	User Requirements
WG2	Architectures
WG3	Protocols
CEN/CENELEC	
JWG	Joint Working Group on Remote Meter Reading
AH1	Common User Requirements
AH2	Common System Architectures
AH3	Common Physical and Data Link Layers
(AH = Ad Hoc Working Groups)	
CENELEC	
TC13	Electricity Meters
TC105	Home Automation Systems
SC105A	Signalling on LV Installations
WG1	Output Voltages in 3 - 9 kHz Band
WG2	Immunity Standards
WG3	Protocols and Interfaces
WG4	Filters
WG5	Output Limits in the 9 - 95 kHz Band
WG6	Spread Spectrum
WG7	Amplitude Modulation

Table 2

6.1 IEC TC's 57 and 13 Special Joint Working Group 1 [SJWG 1]

6.1.1 A Brief History

In 1989, WG9 of TC 57 declared its intention to produce standards for mains-borne communications applied to DA and DSM. This provoked a dispute with TC 13 and was resolved by setting up a Special Joint Working Group (SJWG) shared by TC 13, WG 14 and TC 57 WG 9. This group would propose the best use of IEC resources, avoid duplication of work, and resolve sources of potential conflict.

At a second meeting of SJWG 1 in June 1991, several fundamental recommendations were made :

1. Acceptance for development as an international standard of an Enhanced Performance Architecture DCP specification then being developed by Electricite de France, with DLMS as a protocol appropriate to both joint DA/DSM systems and for separate systems using DLC as the communications medium;

2. Designation of work on the Physical and Data Link layers to WG 9 and of the Application Layer to WG 14 with a later modification to WG 9 to work on DA Applications;

3. Further to 2 above that preparation by each WG of a specification of User Requirements from which to construct the Application Layers;

4. That the SJWG should involve itself in any joint work identified, for example, the network management aspects which would be required to complement a 3 layer protocol.

6.1.2 More recent developments

In achieving the SJWG's aim, WG 9 had to justify to its parent TC 57 the adoption of DLMS in preference to other protocols being devised in other WG's of TC 57 such as IEC 870-5 (including a 3 layer protocol for telecontrol applications) and IEC 870-6 (based on a 7 layer protocol for communications between control centres). IEC 870-6 was demonstrated as an unrealistic solution to such applications as the simpler functions of RMR due to complexity of installation and overhead. IEC 870-5 is a well defined set of established standards including an application layer but was shown to have drawbacks for DLC implementation. The main decision issues between IEC 870 and DLMS protocols are summarised in figure 6.3 below :

Comparison Issues of IEC 870 to DLMS

Issues	IEC 870	DLMS
Conformance Testing	Difficult	Inherent
Equipment Management	No	Yes
Communication Management for varying Network Topologies	No	Yes
Implementation and Upgrading Costs	Small starting costs; large upgrade costs	Appreciable starting costs; very low upgrade costs
Confidentiality, Encryption of Data	Not yet	Yes
Authentication, Control of Access	No	Yes
Data Integrity	Very Good	Adequate
Broadcast Capability	Limited	Yes
Experience	Proven on reliable Lines	Under development for power lines
Relaying along the communications Network	Not foreseen	Yes

Figure 6.3

At SJWG's second meeting in 1992, it was decided to produced a series of specifications of Physical and Data Link layers as reports rather than standards to avoid inhibiting technical development by accommodating trial encoding and coupling methods without endorsing any single, technical solution.

According to the Convenor of this TC, the DLMS structure may return to its 7 layer representation. Enhanced application layers may not be considered and will lack functionality; sub-layers are required though to interface correctly with the lower layers. According to the Australian response to the Questionnaire on Standards, work of SJWG is complete.

Contact :
Australia monitors proceedings via Walter Hagmann of Landis and Gyr, Switzerland.

6.2 IEC TC's 57 and 13 Other Working Groups

TC13
Contact :
Jukka Suonperä of Enermet Oy, Finland

TC13 Working Group 9
Contact :
Bevan Holcombe of SEQEB, Australia

TC13 Working Group 11

Contact :

Swiss Convenorship (ref P. Fuchs of Landis and Gyr, Switzerland)
Reijo Takala of Enermet Oy, Finland

DA/DSM Output :

IEC 387
(pre 1970 sub committee SC 13A : IEC 145, 211)

TC13 Working Group 14

Contacts :

Paul Fuchs (Secretary) of Landis & Gyr, Switzerland
Vic Church of Sydney Electricity, Australia
Kari Keränen of Enermet Oy, Finland

Recent Developments :

At meetings of 7-8th Dec 1995 and 27-28th June 1996, IEC TC 13 ,WG 14 composed several Companion Specifications implementing the DLMS protocol (now renamed to Device Language Message Specification) under development. UK will submit one of its own for DLMS on top of IEC 1107 (incorporating the FLAG protocol) to be termed FLAG+. An explanatory guide was to be produced and was discussed at a WG 14 meeting in June 1996. Australia attended last 6 meetings (early 1996/95) up to April 1994 in Finland. A meeting was held in Durban, Australia, 1995.

DA/DSM Output :

IEC 1107, 1142.
Glossary of IEC 50 done in part by Swiss members of TC 13 WG 14.

TC57

Recent Developments :

Met in Sydney Nov 1993, Minneapolis US May 1995.
General meeting due in Dresden Sep 9-10th ,1996

Contacts :

Followed by Bevan Holcombe Australia.
Juhani Hämäläinen of IVO International, Finland

TC57 Working Group 7

on Telecommunication Standards for Inter-control-centre Communication

Contact :

W Strabbing of KEMA, The Netherlands

TC 57 Working Group 9

Contact :

Kari Keränen of Enermet Oy, Finland

DA/DSM Output

This WG works on the IEC 1334 series on Distribution Automation using DLC Systems which describes the systems architecture, mains signalling requirements and data communication protocols including references OSI layers, DLMS and two forms of Frequency Shift Keying.

TC 77 SC77B Working Group 5
Formerly IEC SC77A/WG3
Contact :
Touko Salo, Enermet Oy, Finland

6.3 CENELEC Technical Committee 294 and CEN/CENELEC JWG with CLC TC 13

From the preceding figures, TC 294 's relationship to CENELEC TC 13 (CLC TC 13) can be seen. CLC TC 13 also has a mandate or mirror arrangement with IEC TC 13. TC 294 is considered below as it covers metering other than of electricity and therefore gives an overview of the DSM application of RMR.

6.3.1 A Brief History of TC 294

CEN TC 176 had a remit covering metering of heating systems, particularly heating of apartment blocks in Germany where legislation requires accurate metering of individual consumption rather than block apportionment where each customer is charged an average derived from an apartment block consumption total.

Meterbus system on dedicated twisted pair networks installed in apartment blocks was proposed. EN 1434 backed by Texas Instruments who supplied the chip sets to implement such systems. Schlumberger and Siemens were soon concerned that M-Bus would dominate in other metering applications so lobbied to form TC 294 with a remit to cover all metering within CEN. Members of TC 176 countered by lobbying to allow M-Bus as input to TC 294. The counter to this was that common building structures differ outside mainland Europe implying that M-Bus is not an optimum solution in many cases. This main argument has been influential in preventing M-Bus dominating the market.

6.3.2 Work Item Areas for WG's 1 - 3 of TC 294

CEN TC 294 Remote Reading of Meters for Fluids and Energies has three WGs : WG1 with a remit of User Requirements, work almost complete; WG2 on Architectures, British Gas attends; WG3 on Protocols, British Gas convenes. These work groups produce three work item areas:

1. Glossary
2. Application Layer
3. Physical Properties and Protocols

DLMS is undertaken by TC 294 WG2 and CEN/CENELEC AHWG1, with EDF taking an active role. Output from WG 2 includes companion standards for remote Meter Reading using DLMS and it is currently working on companions specifications to show possible implementations in the metering of gas, heat and water. It is claimed only 500K bytes of overhead code is necessary to accomplish this.

DA/DSM Output

Other output includes work on the Glossary of IEC 50 by Swiss members in conjunction with members of TC 13 WG 14.

Recent Developments

The first meeting of the joint working groups was in October 93. At the next, 3 adhocs were formed. AHWG3 covers Common Physical and Data Link Layers and is currently considering two main approaches to devising protocols : standards drafted in relation to media considered ; and packet formats defined in standards irrespective of media.

AHWG3 is considered contentious because all members have protocols to offer. A possible solution considered is the use of twisted pair as a starting point since such infrastructures are well established. Possible implementations therefore include M-Bus and IEC 1142 (Euridis) with DLMS which is supported by Schlumberger and is used, for example, by Gaz de France. In the near future suitable solutions on a technical basis only will be considered and proprietary solutions will be excluded.

Contacts :

Olli Hirsimäki, Enermet Oy, Finland for CEN TC 294
Reijo Takala, Enermet Oy, Finland for CEN TC 294 and CENELEC TC 13 JWG (including electricity metering).

6.4 Other TC's Contacts

CENELEC TC 105A	Touko Salo, Enermet Oy, Finland
CEN 176	Olli Hirsimäki, Enermet Oy, Finland

7 Avenues of Influence Available to Annex II

The drafting processes of several international and European standards bodies is investigated below. A national standards body typical of Annex II's participating countries is also considered. Some bodies such as ETSI cover many aspects of telecommunications, most of which are outside the scope of DSM/DA but they are included in this survey to provide a useful insight into modern standards producing organisations. The drafting processes of these bodies are therefore detailed below to show where lobbying and other external influence may be brought to bear in the interests of Annex II.

7.1 Initiating a Standard - General

The need for a standard may be recognised in one of several ways :

1. It may arise from a planning exercise by one of the standards organisations.

2. It may result from a request from an industrial organisation for study in a particular area.

3. It may be identified by a national government or the European Commission as being needed as part of the approvals or regulatory process.

4. It may be the recognition of a *de facto* standard.

The process of drafting standards differs from one standards body to another. Below are details of some major bodies which produce documentation appropriate to DSM and Annex II.

7.2 Drafting Processes - General

Working groups are responsible for drafting the technical content of standards and comprise of technical experts and representatives from governments and national standards bodies. Many of the technical experts come from commercial organisations and give an advantage to standards committees in providing access to a wide range of expertise and associated resources to progress their work. An advantage to manufacturers is an opportunity to influence the direction of development of a standard although it may also be seen as a compromise to producing a standard without bias.

The conflict may show in intellectual property rights: if alternative patented solutions to a problem exist then it is likely that rival patent holders will each try to have their solution included in a standard and promote licence revenue. To counter this, both the ITU-T and ISO/IEC JTC1 require that companies holding patents which may cover some aspect of a standard make a statement concerning the availability of licences. The usual statement is that the company is prepared to make licences available on reasonable grounds with non-discriminatory terms.

7.3 Maintenance of Standards - General

No approved and published standard is perfect, however much time and effort is put into its creation. Experience in using a standard will show up its defects and possible enhancements may become apparent in time. These may result from changing needs or advances in technology leading to proposed alterations. Corrections should be undertaken without delay and the standards organisation can publish a supplement to the standard with amendments.

Enhancements to standards is more difficult. A main problem is that the development time of communications equipments takes years and a change in the specification can only increase costs and delay completion. Another more serious problem is where a piece of equipment built to an enhanced standard would be incompatible with one built to the preceding standard. To minimise this problem, standards are designed as far as is reasonable to be extendible and allow equipment conforming to the specification to be downwards compatible. Also, to avoid frequent changes, proposed enhancements may be accumulated by a standards organisation and the new version of a standard will be issued several years after the old one.

Corrections and changes to a standard can be proposed by a member of the standards organisation , or sometimes through a liaison from another standards organisation. In the ITU-T, for example, a member will submit a written contribution to a Study Group meeting to propose a change. If the Study Group agrees that the Recommendation should be changed then the person responsible for editing the Recommendation (the editor) will produce a *Draft Revised Recommendation*. This then has to proceed through the same development process as for a new Recommendation. In the ISO every standard is reviewed at least every 5 years by the committee responsible. In addition, any national body can request a review at any time. If a decision is made to revise the standard then the revision follows the normal standards development process. An enhancement to a standard can be published as an Amendment, the development of which follows the same procedure as for a new standard.

7.4 The International Telecommunications Union (ITU)

7.4.1 The Drafting Process in Producing ITU-T Recommendations

The work program of the ITU-T is specified in a series of Questions, a number of which are assigned to each Study Group[ ]. Each question is studied by a Rapporteur's Group of experts which meets sufficiently often to progress the work (two to four times per year). The text of each draft Recommendation is maintained by an Editor and is updated as a result of written contributions to the meetings and by discussion. When a draft recommendation is considered complete it is offered for approval by the Study group. If there is not total agreement then it is returned to the Rapporteur's Group for amendment. Once a draft Recommendation has been approved by the Study Group, it is submitted for approval either by the next World Telecommunications Standardisation Conference meeting (once every four years) or alternatively to an accelerated procedure which allows approval to be obtained in about seven months. Once approved the Recommendation is published by the ITU and may be purchased by any interested party. In the UK, for example, the DTI-sponsored co-ordination committees meet to prepare UK contributions and to advise the DTI on how to vote.

7.5 European Committees for Standardisation (CEN) and Electrotechnical Standardisation (CENELEC)

7.5.1 The Drafting Process in CEN and CENELEC

CEN/CENELEC deal only with precise and limited subjects for which Standardisation is clearly and urgently needed which can be pursued with intensive work and which are approved for inclusion in their programme of work. Proposals may be made by CEN/CENELEC technical bodies or by international organisations or by European trade, professional, technical or scientific organisations. Such proposals shall be presented to the Central Secretariat using the appropriate form provided by the Central

Secretariat for submission to the Technical Board. The Technical Board shall decide whether or not a project will be pursued and is if so, how it should be dealt with in the light of all relevant information including any plan developed by a Programming Committee.

Once the need for a new work item has been established, the agreements for co-operation with IEC and ISO come into operation. These require the consideration of existing ISO and IEC standards or working drafts, or within the scope of the agreement, the offer of the work to these organisations for the development within a given time, of a standard that is mutually acceptable to the relevant European and international organisations. The Technical Board shall decide on the possible transfer of a work item to ISO or IEC according to the relevant agreement. If no suitable ISO or IEC documents exist, then any other appropriate document may be considered at the discretion of the Technical Board or responsible Technical Committee or its secretariat as the basis for work leading to a European Standard or Harmonisation document.

If not otherwise ruled by an agreement with an ASB (Associated Body), a document prepared by an organisation other than ISO or IEC may, by decision of the Technical Board, be considered for adoption as an EN or HAD provided that the draft complies with the requirements of the NP rules and that equivalent English, French and German texts are provided. The procedure shall be laid down in each case by the Technical Board. When the adoption of such documents as EN and HAD involves modifications to the original, the author shall be informed. See also CEN/CENELEC Memorandum 7 on Participation of a national standards institution in the activities of another standards institution.

An consideration by CEN/CENELEC which should be noted is that EN or D's may be envisaged as appropriate as the outcome of a '*de novo*' project intended to satisfy a specific European need.

EN's may result from the questionnaire procedure, from technical committee work or from a combination of these two processes.

7.5.2 The Questionnaire Procedure

Allows the Technical Board to determine the level of interest in pursuing a proposed work item. It serves a purpose identical to that of a CEN/CENELEC enquiry where text in the official (English, German and French) languages is forwarded by the Technical Committee secretariat to the Central Secretariat for allocation of a preliminary EN [prEN] or prHD number and distribution to CEN/CENELEC members for public comment.

This permits the Technical Board to find out

- whether enough interest exists in harmonisation on the subject proposed

- the existing degree of national harmonisation with the reference document in question, and

- whether that document would be acceptable as EN, HD, or ENV.

The questionnaire has two applications :

- for an entirely new reference document, using the Primary Questionnaire (PQ);

- for a revised reference document of which the previous edition has already been adopted as an EN or HD, using the Updating Questionnaire (UQ).

An UQ is sent automatically by the Central Secretary where no Technical Committee is involved, whereas each PQ requires the authority of the Technical Board.

A PQ may also be suggested to the Technical Committee where considered necessary for the progress of the Technical Committee's work. If the Technical Board decides to launch a PQ without a preceding formal proposal the letter accompanying the PQ shall refer to the Technical Board decision.

Both PQ and UQ shall be circulated to members by the Central Secretariat with three months as a normal time limit for replies. Members shall include in their replies the fullest information relating to proposals for common modifications, special national conditions, requests for national deviations and so on. The results of the PQ/UQ, together with any comments received, shall be circulated by the Central Secretariat without delay.

If the reference document is not an ISO or IEC standard and/or a language version is missing, at least the English version shall be issued but with a time limit of six months for replies, with the understanding that within three months all three versions will be available.

The borderline between national standards and regulations varies from country to country. Therefore members should explain in detail the effect of national regulations and compulsory testing and approval on harmonisation.

When evaluating the replies, the Technical Committee or Technical Board shall, in the light of adoption or rejection of the comments, reach one of the following decisions :

1. Comments referred to a Technical Committee or Reporting Secretariat or special ad hoc group for technical advice before a final decision is made;

2. Reference document to be put to the formal vote or the adoption as EN, HD or ENV;

3. Further technical work required on the reference document to be allocated to an existing or new technical body;

4. No harmonisation necessary or possible due to insufficient national interest, proposal to Technical Board for standstill to be released;

5. A CEN/CENELEC Report to be issued as a means for giving adequate first-hand information on the harmonisation situation; decision to be taken by the Technical Board regarding continuation of standstill.

Sufficient interest to harmonise is deemed to exist if at least three members request it in writing during the questionnaire procedure.

7.5.3 Formal Association with CEN/CENELEC of other Bodies contributing to European Standardisation

If CEN/CENELEC feel it appropriate that in specific fields the preparatory work can be done by an existing outside organisation, the Technical Board may submit a proposal of that nature to the Administrative Board of CEN or General Assembly of CENELEC, respectively. If the Administrative Board or General Assembly agrees in principle, a person, preferably the President will be entrusted together with the Secretary General to negotiate details with the organisation concerned. Recognition of and collaboration with such an Associated Body (ASB) shall be established on the basis of an agreement signed by the President after decision of the General Assembly.

Such an agreement shall cover at least the following matters :

1. Precise identification of the particular subjects on which preparatory work will be undertaken by the ASB;

2. Assurance that the preparatory work will be presented in accordance with the CEN/CENELEC rules for the presentation of standards;

3. Assurance that representatives of all CEN/CENELEC members will have the possibility of participating in the preparatory work;

4. Definition of the stage at which the preparatory work will be introduced into the normal CEN/CENELEC procedures;

5. Recognition that CEN/CENELEC will be solely responsible at least for the formal voting and national implementation procedures;

6. Notification of new projects and drafts to CEN/CENELEC for the purposes of the CEN/CENELEC information procedure implementing Directive 83/189/EEC and the EFTA Council Decision of 24 October 1984, on the understanding that the date of notification intitiates standstill in accordance with Standstill guidelines listed in Section 6.2.1 of CEN internal regulations, Part 2.

7.5.4 Other Means to an External Liaison with CEN/CENELEC

Other proposed technical liaisons with CEN/CENELEC are subject to the authorisation of the Technical Board and are considered in accordance with the following criteria :

a) that the Central Secretariat has investigated thoroughly the relevance of the proposed liaison and that the nature of the assistance to be provided by the organisation concerned is clearly demonstrated with regard to the CEN/CENELEC work in question;

b) that there is a real need for such assistance and that it is positively sought by CEN/CENELEC members to support their efforts within the technical body in question;

c) that there is a realistic expectation that such assistance will be willingly given without delay by the organisation in question.

Organisations in technical liaison shall have observer status in the designated CEN/CENELEC work but no voting rights. All formal contacts with outside organisations, apart from technical liaisons, shall be made through the Secretary General after prior approval by the President. When, after liaison has been established, a CEN/CENELEC committee is invited to participate in a meeting of an international organisation, it is responsible for nominating its own representative.

7.6 The European Telecommunications Standards Institute (ETSI)

According to ETSI, a standard is defined as a document that contains technical specifications laying down the characteristics required of a product, such as levels of quality, performance, safety and its dimensions standard must be approved by a recognised standards body for repeated or continuous application. In ETSI, the creation of a technical standard involves several procedures for proposal, drafting and formal approval before publication and distribution. These procedures are summarised in the sections below.

7.6.1 The Proposal and Drafting of ETSI Standards

A need for a European Telecommunication Standard (ETS) is raised initially either by an individual, or by a company, or by a standards body and is considered by the principal authority for technical issues at ETSI, the Technical Assembly (TA). This Assembly approves a Work Programme on a three year rolling basis and distributes it amongst the ETSI Technical Committees to execute. Any proposals considered suitable may then become part of the ETSI Work Programme.

The technical work within a work programme is carried out by Technical Committees (TCs) each dealing with a particular area of the telecommunications field. These committees specify the scope of the standard, an exact title and also delegate experts to be responsible for producing a draft of the standard. The experts usually meet within either a sub Technical Committee, an Experts' Group, a Rapporteurs' group or an ETSI Project Team.

Once a standard has been drafted and approved by the Technical Committee, it is sent to the ETSI Secretariat which co-ordinates the subsequent steps in the ETSI standards approval procedure.

7.6.2 Standards Approval Procedure

Formal approval procedures are necessary to ensure that the draft standards are acceptable to network operators, administrations, manufacturers, service providers and users alike. The procedure normally takes at least 46 weeks but may be shortened in special cases. Each standard is managed within the ETSI Secretariat by a Technical Editor who works in close contact with the Technical Committee concerned. The Technical Editor is responsible for the editorial aspects of the document whilst the technical responsibility remains with the Technical Committee. The formal procedures include a public enquiry and a vote with national weighting. Any influence in these procedures would be gained via the National Standards Organisations (NSO's) which distribute drafts within their countries to all interested parties both ETSI members and non-members alike.

The NSOs are usually given a period of 17 weeks in which to transmit their national positions and any proposed modifications to the draft to the ETSI Secretariat. A Public Enquiry is only considered valid if at least half the NSO's have replied. At the end of a Public Enquiry, ETSI has a period of two weeks in which to collate the individual NSO's comments and dispatch them to the relevant TC chairman and back to the NSO's.

During the next 8 weeks modifications proposed are considered by the Technical Committee. Technical changes may be made to the draft at this point. The Technical Editor assigned to the draft standard, in his turn, makes any necessary editorial amendments to the document within a period of a further two weeks.

An updated standard goes to the next stage in the procedure, the National Vote. A Weighted National Vote is carried out in much the same way as a Public Enquiry. The procedure lasts for an 8 week period after which the NSO's notify ETSI of their national position. The Secretariat processes and dispatches the results of the Vote sending them back to the Technical Committees concerned and the NSO's. A Vote is considered valid only if at least half the NSO's have replied. A draft is accepted only when the percentage of positive votes exceeds 71%.

If a document is accepted, it is published by ETSI as a European Telecommunication Standard (ETS). If a draft fails, the calculation is repeated for European Community members and if 71% of Community Weighted National Votes are favourable, the standard is adopted within the European Community.

7.6.3 Documents Produced

ETSI draft and publish 3 types of document: the European Telecommunications Standard (ETS); the Technical Basis for Regulation (TBR); and the ETSI Technical Report (ETR). A fourth type is for internal use only: Technical Committee Reference Technical Reports (TCR-TRs) for members of TC's and STC's only.

Further types of ETS's depending on the state of completion of the approvals procedure include :

Interim, which includes a lettered code indicating status of the document. An interim ETS (I-ETS) has been approved by the relevant TC and has been submitted for Public Enquiry and has been approved by the ETSI National Weighted Voting procedure. The document remains an interim ETS for two to five years before being converted to an ETS or discarded.

prETS and *prI-ETS* are standards which are still in development. They have been approved by an ETSI TC but have yet to go through the ETSI standards approval process.

Technical Basis for Regulation [TBR's] are not regulations but give advanced notice of the technical specifications to be found in future regulations. They list essential requirements and are based on approved standards where available. A TBR undergoes a similar approval procedure to that of ETS's and I-ETS's.

ETSI Technical Reports [ETR's] contain complementary information about a technical environment relating to standardisation issues. They do not undergo the same approval procedures as the above documents and it is published once it has been approved by the Technical Committee concerned.

Technical Committee reference Technical Report [TCR-TR's] are documents which are of interest to two or more TCs and their STCs and are distributed to members only. They are approved by the Technical Assembly.

7.7 Drafting Process in ISO/IEC Joint Technical Committee 1 [JTC1]

This process follows a similar procedure to that used in IEC itself. The procedures and practices covering the technical work of ISO and IEC, and of CEN and CENELEC, are governed by the ISO/IEC Directives and the CEN/CENELEC Internal Regulations, respectively. With reference to an IEC/ISO Directive, Part 3, five successive stages in drafting standards within JTC1 are summarised below :

1. A proposal for a new work item is circulated to members of JTC1. If this is approved then work can commence.

2. A *working draft* document is prepared within a Working Group.

3. When sufficiently advanced, the document is submitted as a *Draft Proposal (DP)* to members of the JTC1 or one of its sub-committees for comment and vote.

4. When there is substantial support for the DP, possibly after revision, it goes forward as a *Draft International Standard* (DIS) for circulation to national bodies for approval.

5. When a DIS has received the support of the majority of JTC1 members, and at least 75% of the national bodies, it is published as an International Standard (IS).

In addition, a fast track procedure exists to allow existing standards from other organisations to be submitted directly for voting as a DIS. In the UK, for example, the BSI IST committee, with input from sub-committees and panels of experts, prepare UK contributions and determine the national voting position.

7.8 The Drafting Process of a National Standards Body Typical of Annex II Member Countries

7.8.1 The British Standards Institute (BSI) in relation to other European Standards Bodies

Like most national standards bodies within the European Union, BSI conforms to international and European procedures in an attempt to incorporate others work, and harmonise its own work, with Europe. BSI is therefore taken as a national body typical of other European and Australian bodies which has procedures allied closely with those of international and European bodies.

7.8.2 Guiding Principles

The basic principles of BSI are in line with other national standards bodies where its work is undertaken in the national interest with due account of all significant viewpoints, and with representation at all committee levels which, through its consultation procedures, has an authoritative body of opinion behind every National Standard.

BSI is seen as a gateway to participation at a national level in the standards work of six main International and European organisations:

- International Organisation for Standardisation (ISO)
- International Electrotechnical Commission (IEC)
- European Committee for Standardisation (CEN)
- European Committee for Electrotechnical Standardisation (CENELEC)
- CENELEC Electronic Components Committee (CECC)
- European Committee for Iron and Steel Standardisation (ECISS) administered by CEN .

The work of BSI is linked closely with the work of these bodies. As stated in section 7.7, the procedures and practices covering the technical work of ISO and IEC, and of CEN and CENELEC, are governed by the ISO/IEC Directives and the CEN/CENELEC Internal Regulations, respectively.

7.8.3 BSI Committee Structure and Procedures

Subject to the ultimate authority of subscribing members at a General Meeting, the Board is responsible for the policies of BSI and may delegate powers to the business Boards. under the Standards Boards are Standards Councils to which Standards Policy Committees are responsible for authorising work on new standards projects and for deciding the broad programme and priorities for work in their sectors. Reporting to the Standards Policy Committees, about 1000 technical committees are active at any one time.

Standards projects relating to international and European work now account for most of BSI's standards activity. Therefore, whenever practicable, the detailed committee structure is aligned with that of the corresponding international or European standards organisation, so that the committee responsible for national work has an equal responsibility for relevant international and European work.

7.8.4 Committee Organisation

7.8.4.1 Constitution and Membership

A distinction is drawn between the constitution of a committee, i.e. the bodies represented, and the membership who are the individual representatives nominated by those bodies to serve on the committee.

Together with their respective terms of reference, Standards Council constitutions are decided by the Standards Board, Standards Policy Committee constitutions by the appropriate Standards Council, and technical committee constitutions by the Standards Policy Committee.

With a committee's agreement, individuals who are not members may be sent papers at the request of a representative organisation. Such organisations are charged a basic annual fee for registration as *papers only recipients* and a small additional annual sum for each committee for which papers are required.

7.8.4.2 Representation on Committees

BSI seeks to bring together through its committees all those with substantial interest in particular projects, wherever possible through representative organisations. This achieves, economically a wide measure of consultation and support in standards work.

Trade associations or equivalents provide a channel for manufacturers and industrial users to be represented on BSI committees. Such organisations and others, including professional institutions, research organisations, government departments, national industries, certification bodies, testing laboratories, and educational bodies, are encouraged to seek representation on committees handling work in their sphere of influence. Individual experts may also be co-opted by committees for a given period or for a particular project.

7.8.5 Strategic Planning and Proposals for New Work

7.8.5.1 Strategic Planning

The Standards Policy Committees establish and maintain strategic plans in order to formulate the programmes of work of the technical committees reporting to them.

Rolling programs are used and are reviewed every year with regard to changes in demand and the staff resources available. Through consultation with the Standards Policy Committee chairmen, priorities can be adjusted during the year when necessary. Each programme takes into account the regular reviews of existing standards as well as demands for new work, and encompasses activity undertaken at the national level or through international or European collaboration.

7.8.5.2 Proposals for New Work

Requests for new standards or for improvements to existing standards may come not only from established BSI committees but from any source. Proposers are asked to complete a form to justify the proposal explaining its significance and setting out in detail the scope of the standard required and indicating the degree of support they can attract such as committee work, drafting, and research of the standard or a commitment to its use. If possible, the returned form should be accompanied by a draft prepared in accordance with guidance given in BS 0 : Part 3: 1991. At a minimum, the source of such a draft should be identified.

7.8.5.3 Assessment of Proposals

Each proposal is considered by or on behalf of the Standards Policy Committee in relation to the aims determined by the Standards Council. When there is no appropriate BSI committee a conference of all directly interested parties may be held to assess the value, the urgency and the practicability of preparing a standard.

In accordance with a Memorandum of Understanding on Standards with the Government, priority is given to consideration of requests by Government for standards work to be done in the national interest, provided that such requests are adequately documented in accordance with section above on Proposals for new work.

Staff of BSI available to undertake projects depends on the income BSI receives from Government and from sales. Standards with a potential to earn high revenue are therefore considered 'significant' although a low potential for sales should never be the sole reason for deferring or rejecting a project.

7.8.5.4 Announcement of New Work Started

When work on a new or revised standard is started, it is announced in the BSI News. This publication serves to alert organisations that may have a contribution to make to the work.

For national work, the announcement is made either :

a) immediately following the first BSI committee meeting to start the work, or
b) as soon as work starts on processing an initial draft, or
c) at the start of preparatory work on a major project prior to committee action, whichever is the earliest.

For international and European work, the BSI News announcement is made when work starts on an item included in the programme of work of the appropriate committee.

8 Conclusions

From a review of returned replies from participating countries to a Questionnaire on Standards, and from classifying standards according to DA/DSM functions, documents considered central to DSM communications systems were determined. For telecontrol and telemetering functions, IEC 870 series, 1334 series, 1107 and 1034 were considered key. Also various standards on energy metering were listed which defined the operation and the maintenance of meters. The technical committees which produce most of this work are IEC TC 57, 13 and also CEN/CENELEC TC 294.

A survey of both standardised and proprietary communications protocols showed a variety of methods with overlapping areas of application, each vying for market share. Of the standardised protocols, IUC and DLMS have had serious investment and publicity in attempts to offer solutions which integrate communications aspects of DSM and other applications, from abstract upper to physical, lower layers. They have had a mixed reception so far and further work is required to form a truly integrated set of guidelines. Of proprietary systems, EHS, LONworks and EIBus all enjoy active support from major companies including Philips, Merlin Gerin, Landis and Gyr, Siemens, Echelon, Toshiba and Motorola. Some members of these companies are also active in standards work groups and committees considered useful in a market strategy of acceptance of proprietary solutions via both a technical openness to potential buyers, and an introduction to the standards arena of their work by adoption of a potential de-facto standard or by lobbying. Most players consider no one technology will dominate in-building communication and DSM communications systems.

The activities of the three main TC's which produce standards related to DA/DSM have been summarised. Contacts to most DSM related working groups of these TC's have been given thereby giving an opportunity to influence the drafting and editing of DA/DSM standards.

Section 7 detailed the drafting processes of the main international and European standards bodies in order to show points in their procedures at which representation could be made. Affiliations and technical liaisons were also described where available as means suitable to gaining access to, and influencing the drafting and editing of, standards.

Influence can be brought to bear in either proposals for new work or standards, either wholly or in part, or in modifications to existing standards by editing or amendments. Of the standards bodies considered, their openness to new proposals varies, with newer bodies like ETSI making a conscious decision to allow access from standards bodies down to individuals, as opposed to longer established bodies such as the ITU with a more formal approach via national standards bodies representatives.

In terms of proposals for new work, CEN/CENELEC has relatively open access. A form is obtained from and returned to the Central Secretariat to present a case which may be submitted to the Technical Board for a final decision. Before drafting a proposal, research into existing ISO and IEC standards or working drafts or other suitable documents must be made to find prior standards. If none exist, the Technical Board or Committee or associated secretariat may decide on a basis of work leading to EN or HD. Documents prepared by an organisation other than ISO or IEC may be considered for adoption as an EN or HD provided the draft complies with certain rules and is available in the three working languages: Russian German and English. The outcome of a de novo project which satisfies a specific European need may also be considered as a basis for an EN or HD. A further avenue is via the Questionnaire procedure for either Primary or Updating form to initiate or edit standards, respectively. It is proposed that best access to the Questionnaire process is through members who receive them.

Preparatory work of standards with organisations outside standards bodies is possible if the Technical Board decides it is appropriate. A person, preferably the President with the Secretary General will negotiate details of an agreement with the organisation concerned and recognise it formally as an Associated Body, ASB. Other technical liaisons are subject to authorisation of the Technical Board in accordance with sec 7.5.4. They have observer status with no voting rights with access through the Secretary General.

ETSI is open to proposals from individuals or companies or standards body to the Technical Assembly which approves a Work programme on a three year rolling basis. Influence in editing standards is available via the NSO's which participate in Public Enquiries and National Voting

For the ISO/IEC JTC1 access to influence of Draft International Standards via NSO's who approve it. A fast track approach exists on submitting existing standards.

NSO's harmonise their work with international and European organisations so influence at all levels is possible. Representation on committees can be made via trade associations. Some allow monitoring of drafts by application with fee to be a papers only recipient.

Glossary of Terms

ref BS 0 : Part 1 1991 also BS EN 45020 : 1991

Definitions

Standardisation

Activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context.

Standard

Document, established by consensus and approved by a recognised body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Regulation

Document providing binding legislative rules, that is adopted by an authority.

National Standards Bodies

A standards body recognised at the national level that is eligible to be the national member in the corresponding international and regional standards organisations.

Consensus

General agreement, characterised by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments. Consensus in this definition need not therefore imply unanimity.

Distribution Automation (DA)

One definition of DA (ref EA Ltd Guide on DLMS , 95/208411) is :

'The application of equipment and systems for acquisition, processing and presentation of data regarding the status and performance of the distribution network, for remote operation of plant from a centralised or localised position, and for automatic reconfiguration of the network in response to specific network events.'

Customer Automation (CA)

Or DSM, the use of communications systems for applications such as remote meter reading, customer load control and provision of tariff and other supply information.

De Jure Standards

Standards which have been proposed, drafted and agreed through recognised procedures determined by standards bodies.

De facto Standards

Standards which are proprietary and, though widespread in use and acceptance, are not adopted as standards by Standards Bodies.

Standstill

is an obligation accepted by the members of CEN/CENELEC not to take any action, either during the preparation of an EN or HD or after its approval, which could prejudice the harmonisation intended and, in particular, not to publish a new or revised national standard which is not completely in line with an existing EN or HD. It applies to an individual standards project or work item accepted by the Technical Board with a clearly defined scope, and not to areas or programmes of work as such.

Abbreviations Used

TC Technical Committee

SC Often called a Sub-Technical committee which means a Technical Sub-committee

WG Working group

EN A CEN/CENELEC standard that carries an obligation to be implemented at national level by being given the status of a national standard and by withdrawal of any conflicting national standards.

ENV A prospective standard elaborated by CEN/CENELEC for provisional application while conflicting national standards may be kept in force in parallel.

HD A CEN/CENELEC standard that carries the obligation to be implemented at national level at least by public announcement of the HD number and title and by withdrawal of any conflicting national standards.