Submission to the Power of Choice
Australian Energy Market Commission

Dear Commissioners

I would like to draw your attention to some consequences of not selecting a common application layer for Australian metering. In the early days of mobile phones in the USA, the free market economy allowed cellular service providers to select their preferred standard. The result was disastrous for consumers. Consumers experienced severe limitations, being unable to roam into other service provider coverage areas and when they changed service provider, they were forced to change number and often to purchase a new handset. The early days of the cellular service provider market drove the development of interoperable standards and today these common standards ensure that mobile phones work around the globe.

At present meters and meter communications network mirror the early days of the USA cellular market. Meter providers choose from a range of incompatible metering standards and communications networks. Meter service providers must then employ special software to communicate with installed meters. These incompatible back office systems significantly increase the chance of meter replacement when customers select another service provider with customers paying either directly or indirectly for the meter replacement. Referring to Question 8 in the “AEMC 2012, Power of choice - giving consumers options in the way they use electricity, draft report, 6 September 2012, Sydney”:

- *Does the separation of the provision of metering services from retail energy contracts remove the need for meter churn when a consumer changes retailer?*

Such separation alone is probably insufficient to avoid meter churn. The Australian energy market already supports competitive provision of metering services, but meter replacement still occurs when customers churn. Market requirements ensure that the new meter has exactly the same metrology functions therefore the meter replacement is only required to ensure compatibility with the new service provider’s existing back office software. To avoid meter replacement it is necessary to ensure that meters can be (seamlessly) transferred from one service provider’s back office system to another. It is suggested that removing the risk of meter churn requires:

(i) a common meter protocol; and
(ii) a common means of supporting remote communications with all installed meters.

Your supplementary paper “Principles for metering arrangements in the NEM to promote installation of DSP metering technology” dated 6th September 2012 considers the minimum meter functionality. This paper did not recommend the inclusion of Function 18, Interoperability for Meters/Devices at the Application Layer. In so doing it suggests we have not learnt from the early days of cellular service providers, with non-interoperable standards adversely affecting consumers’ ability to choose the most appropriate service provider.

During the preparation of the Smart Metering Infrastructure Minimal Functional Specification the Business Requirements Working Group (BRWG) reviewed available standard application layers. The applicable document Interoperability – Review of Meter Protocols is attached for your reference. The NSMP discussion paper notes that the selection of a standard meter protocol removes a significant barrier to interoperability by ensuring that all meters "speak the same language". It also suggested that selecting a standard meter protocol has minimal effect on meter cost.

While a common meter protocol ensures that all meters speak the same language, it is also necessary to ensure compatibility across the meter communications networks. Specifically service providers must be able to communicate remotely with any meter regardless of which network it is connected to in the same way that mobile phones now operate. The National Stakeholder Steering Committee requested the preparation of a discussion paper detailing requirements for remote communications with installed Smart Meters. The resulting Meter Access paper is attached for your reference. Section 4.2 presents possible methods of supporting (secure) remote access to meters.

At the very least, common standards will avoid the need for meter replacement when customers change provider. It will also support the development of new customer services which can be offered to the entire market. These are some of the lessons learnt from the early days of the commercial cellular industry, which have resulted in a much better outcome for all customers.

Please contact me if you would like to discuss these matters further.

Regards

Dr Martin Gill

Former Business Requirements Work Stream Leader
National Smart Metering Program

8th October 2012

NSMP
National Smart Metering Program

# NSMP Business Requirements Work Stream

# Interoperability - Review of Meter Protocols

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# Table of Contents

# 1 Document Control

## 1.1 Version Control

| Version | Date | Description | Amended by |
|---|---|---|---|
| 0.1 | 13/8/2010 | First Draft | Dr Martin Gill<br>Harry Koller |
| 0.2 | 30/8/2010 | Inclusion of details from OFGEM Prospectus | Dr Martin Gill |
| 1.0 | 17/9/2010 | Version 0.2 issued to NSSC as version 1.0. | Dr Martin Gill |
| 1.1 | 7/12/2010 | Major update (28/11/2010)<br>Added references to relevant European interoperability directives<br>Reorder document and include NSSC TOR task. Clarify definition of meter protocol | Dr Martin Gill<br>Harry Koller |

## 1.2 Approval

| Authorised by | Signature | Date |
|---|---|---|
| NSSC Program Director | | |

## 1.3 References

The following documents are referred to in this document.

| Ref. No. | Document Name | Version |
|---|---|---|
| 1 | NERA, Cost Benefit Analysis of Smart Metering and Direct Load Control: Phase 1 Overview Report | September 17, 2007 |
| 2 | OPENmeter D2.1/Part 4<br>State-of-the-Art Technologies & Protocols<br>Description of State-of-the-Art Communication Protocols and Data Structures | Version: 1.0<br>19th June 2009 |
| 3 | NIST Special Publication 1108<br>NIST Framework and Roadmap for Smart Grid Interoperability Standards<br>Office of the National Coordinator for Smart Grid Interoperability | Release 1.0<br>January 2010 |

| Ref. No. | Document Name | Version |
|---|---|---|
| 4 | LonMark: Interim Smart Grid Roadmap<br>Appendix C: Requirements, Standards Gaps, and Discussion Issues for the Action Plan<br>http://www.lonmark.org/connection/solutions/InterimSmartGridRoadmapLonMarkAppendixC.doc | Downloaded 11th August 2010 |
| 5 | NSMP Access and Contestability Principles | 10th May 2010 |
| 6 | Kalkitech<br>DLMS - COSEM (IEC 62056) Source Code Products and Solutions | http://www.kalkitech.com/ |
| 7 | NSMP Use of the HAN to support Function 24 | Version 0.5 |
| 8 | Smart Metering Implementation Programme:<br>Statement of Design Requirements | Ref: 94b/10<br>27th July 2010 |
| 9 | Smart Metering Implementation Programme:<br>Regulatory and Commercial Framework | Ref: 94h/10<br>27th July 2010 |
| 10 | PricewaterhouseCoopers Energy Sector Series<br>ZigBee Smart Energy<br>Presented by Bob Heile Chairman, ZigBee Alliance | 13th August 2010 |
| 11 | NSMP Gap Analysis British Gas Specification | Version 1.0 |
| 12 | Électricité Réseau Distribution France (ERDF)<br>Interoperability in ERDF Linky Project | Metering Europe<br>September 23, 2010 |
| 13 | Directive 2009/72/EC of the European Parliament and of the Council | 13th July 2009 |
| 14 | Mandate M/441 5 SM-CG Technical Report on Communications | Draft v0.4.0 |
| 15 | Interoperable Device Interface Specifications (IDIS)<br>Interoperability Specification Release 1<br>Package 1 PLC Profile | Edition 1.0, 2010<br>Excerpt w3.5 |

## 1.4 Disclaimer

This discussion paper was produced by Dr Martin Gill of KEMA Consulting in order to assist the Business Requirements Working Group (BRWG) in the development of the Smart Metering Infrastructure Minimum Functionality Specification. This paper has not been vetted or endorsed by the BRWG or the NSSC.

# 2 Introduction

The NSSC terms of reference request NSSC to:

(r) advise the MCE on the whether insufficient interoperability between different meters, communications infrastructures and metering management systems may introduce further market power risks or reduce competition in metering - in particular:

(i) the materiality of this risk

(ii) international progress on communications standards and practices to support interoperability

(iii) the most appropriate framework to manage this risk in the Australian market

As Business Requirements Work Stream Leader, KEMA has been providing background papers on Interoperability for meters/devices at the application layer (SMI F.S. section 7.18) and hardware component interoperability (SMI F.S. section 7.19) during 2009 and 2010.

This briefing paper for the NSSC:

- Explains how a meter protocol may support interoperability
- Discusses the benefits, costs and risks of interoperability via a meter protocol
- Examines two major competing meter protocols and recent international developments
- Summarises the main findings
- Recommends next steps

Please note that a separate briefing paper on access to the smart meter by multiple parties will be prepared for NSSC for their February 2011 meeting. The Program Director decided that this topic was too complex to include in this paper and should be addressed separately.

# 3 Interoperability

## 3.1 Interoperability and a Meter Protocol

Consumers now take interoperability for granted, however this has not always been the case. Without interoperability consumers are forced to make technology choices. In the 1980's consumers were forced to choose between the easy to use but proprietary Mac, with higher hardware prices and a limited range of software applications, or the (geeky) IBM PC, and because of its open design, cheaper clones.

Taking another example: Today we can view our banking details via the internet without considering the physical communications media (for example dial-up, ADSL, cable, wireless, etc.). Despite a wide range of different physical communications media we can still access information, which is possible because of the use of well-defined interoperability standards.

Right from the start it is necessary to separate discussions about meter protocols and discussions about communications. Figure 1 shows an everyday example of using the telephone to attempt to communicate with someone overseas, but unless that person speaks the same language we will fail to pass information. A meter protocol is therefore carried over communications, but should be considered separately from the communications. The meter protocol is language used to exchange information, which requires communications, but is not provided by the communications.


**Figure 1: The meter protocol is the language used to transfer information**

To further highlight the difference between the meter protocol and the communications path consider that all meters in the Australian market-place currently support one common communications interface, the meter optical port[1]. Despite Australian Standards requiring all meters to support this communications port it is not possible to use one (handheld) system to configure every meter because each meter vendor uses a different language. So while Australian standards specify a common communications interface they do not specify a common meter protocol.

Figure 2 depicts those areas which are affected by the selection of a meter protocol within the scope of SMI[2].

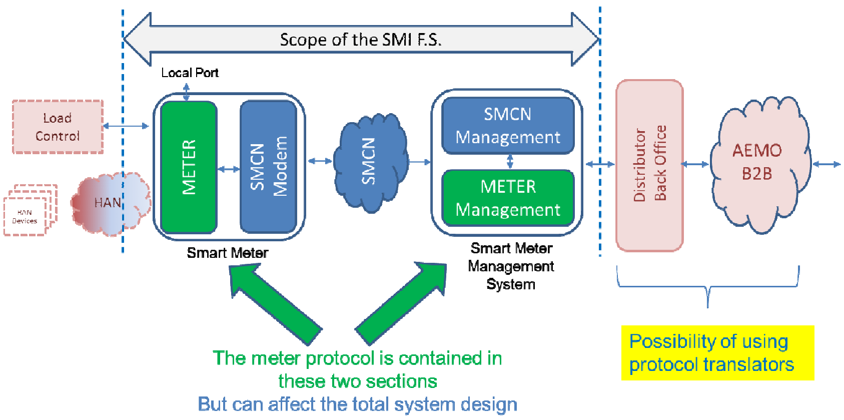


**Figure 2 Meter Protocol in the context of the Smart Metering Infrastructure**

The Australian energy market is able to operate despite numerous different meter protocols. This is made possible because of the use of protocol translators. Figure 2 shows that such protocol translators could be run in the Distributor Back Office or in the AEMO Business to Business gateway.

The use of protocol translators by Meter Data Providers is already used widely throughout the National Electricity Market (NEM) for remote reading of Type 4 meters using the MV-90 system. As discussed in the NERA Cost Benefit analysis [Ref 1], the MV-90 system is actually a collection of protocol translators that allows data acquisition from meters with different meter protocols. This is depicted in the following figure:

[1] It is acknowledged that Australian standards support either the American ANSI port or IEC Flag port, but it is still possible to use the same optical probe on both.

[2] Note that for clarity the Smart Meter Management System (SMMS) has been split into two components, specifically Meter Management and Smart Meter Communications Network (SMCN) management.

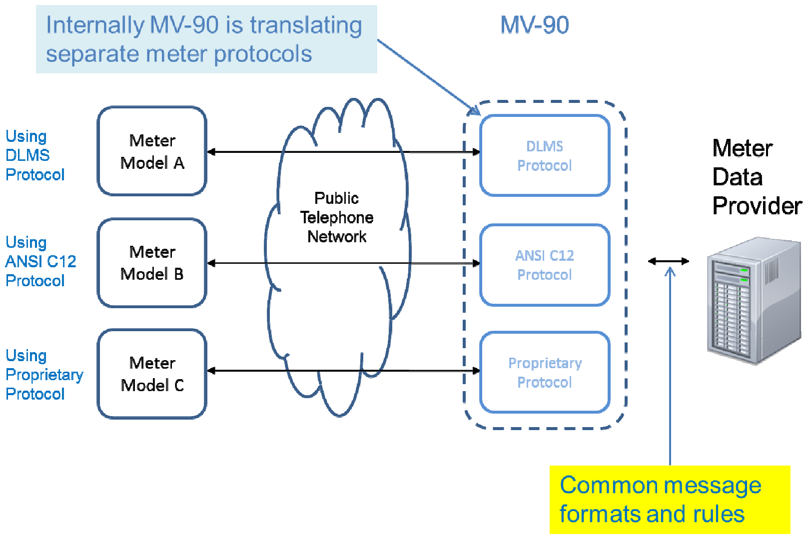


**Figure 3: Interoperability provided by protocol translation**

Two way communications with Type 4 meters for large customers is currently supported in the NEM. This is achieved because most Type 4 meters have a GPRS or 3G modem and the MDP uses a public telecommunications network (e.g. GPRS or 3G) to communicate with the meter.

This leads to a suggested definition for ‘meter protocol’ which is separate from the communication technology as:

> A meter protocol is a formal description of digital message formats and the rules for exchanging those message formats with meters

This definition of meter protocol is suggested in order to highlight that meter protocols should be considered independently of the supporting smart meter communications network technology[3].

To conclude the meter protocol supports interoperability **at the meter**. The use of a common meter protocol allows a single smart meter management system to exchange information with all the meters to which it can establish communications.

For example, EA proposes to have a SMMS that is capable of communicating with smart meters with a Wi-MAX modem and smart meters with a LTE modem. If all EA meters have the same standard meter protocol (e.g. DLMS/COSEM or ANSI C.12), then the meters, excluding the communications technology modem, are interoperable at the application layer.

## 3.2 Benefits of Interoperability

The NERA Cost Benefit Study [Ref 1] identified that the benefits arising from interoperability for meters/devices at the application layer may include:

- lower initial and ongoing meter costs due to improved competition; and
- lower costs of back-end IT systems through use of a standardised application layer.

The benefits from hardware component interoperability may be:

- lower costs of meters because vendors other than the smart metering systems vendor can provide complying meters; and

[3] When selecting a smart meter communications network it is necessary to ensure that it can support the meter protocol.

- lower technological risk, because it is possible to replace the communications module without replacing the entire meter.

Within the NSMP several discussions have taken place about what these benefits actually mean for two areas:

- Ability to use different meters
- Ability to use different communications solutions

These will be discussed in the following sections, but first we return to the initial example of interoperable standards which allow us to view our banking details using a range of different internet browsers (Internet Explorer, Chrome, Firefox, etc) while accessing the internet via a range of different communications options. This is made possible by well-defined interfaces between different layers. The bank is able to develop its website (Application) confident that browsers compliant to the HTML standard will display it correctly. Browser developers are able to interface to the communications confident that the communications vendor has correctly implemented Internet Protocol. This (overly) simplified version of the Open Systems Interconnect (OSI) model is depicted in Figure 4 along with a suggested mapping to the SMI:

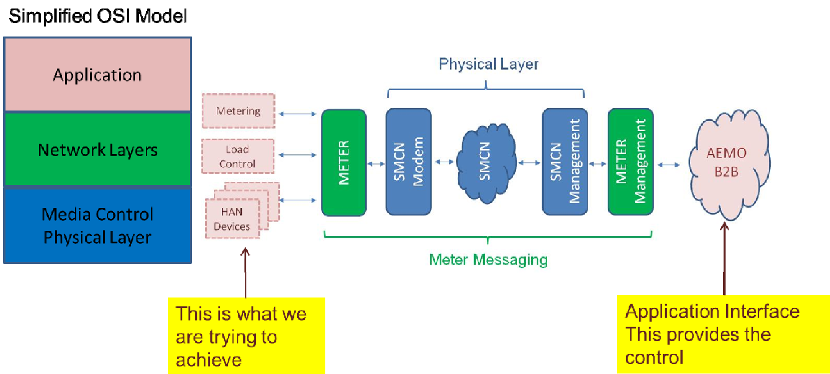


**Figure 4: Simplified OSI model and its relevance to SMI**

Figure 4 can be related to our earlier example of surfing the internet: we want to access websites regardless of the physical layer (dial-up, cellular). In a similar manner the meter protocol should support our application including meter data collection, load control and interactions with HAN devices independently of the selected smart meter communications solution or vendor specific meter hardware.

### 3.2.1 Ability to use different meters

It must be emphasized that interoperability between meters does not necessarily support meter interchangeability. Section 10 of the Smart Meter Co-ordination Groups Mandate M/441 provides two (separate) glossary definitions[4]

- *interoperability* is the 'ability of a system to exchange data with other systems of different types and/or from different manufacturers'
- *interchangeability* is the 'ability to exchange one device by another without reducing the original functionality and without dysfunction or loss of efficiency for the whole system. Not to be confused with interoperability'.

The difference is largely due to the choice of communications medium. This is explained in M/441:

> Whereas interoperability is a general and achievable objective, the scope of interchangeability is limited due to the fact that in a smart metering system a number of different communication media will

[4] The glossary definition of interoperability was used in the Introduction, and is included here to simplify comparison of the difference.

be used to adapt to differing economical and technical environments. Whereas communicating entities using the same media are likely to be interchangeable, entities using different communication media (e.g. power line carrier and wireless) may not be interchangeable.

So interoperability between meters does not necessarily support meter interchangeability. This difference has been recognised by several meter vendors leading them to create the Interoperable Device Interface Specifications (IDIS) Association. In addition to having their meters certified for compliance to the metering standard DLMS/COSEM they add testing of the physical communications layer. Package 1 describes the complete Open Systems Interconnect (OSI) stack with a physical communication media using power line carrier. Meters which are tested to Package 1 are then marked

IDIS 1
No 100820

**Figure 5: IDIS Package 1 Certification Mark**

The IDIS 1 certification mark provides confidence that different metering products are interchangeable. The use of DLMS/COSEM ensures that when the IDIS Association defines other physical layers, all meters will support interoperability with IDIS 1 certified products, but because of the different physical communications layer they will not be interchangeable.

To emphasize the point, selection of a meter protocol will not allow businesses to install different meters from a range of manufacturers without considering the communications path to the meter. Selection of a common meter protocol will ensure that back office systems will be able to communicate with any meter, but with the restriction “once communications with the meter is established”.

### 3.2.2 Ability to use different communications solutions

In the OSI model the separation of the network layers from the physical layer means that different communications solutions can be used. The selection of a meter protocol ensures that one Meter Management System can access meters attached to different communications networks. This is depicted in the following figure:

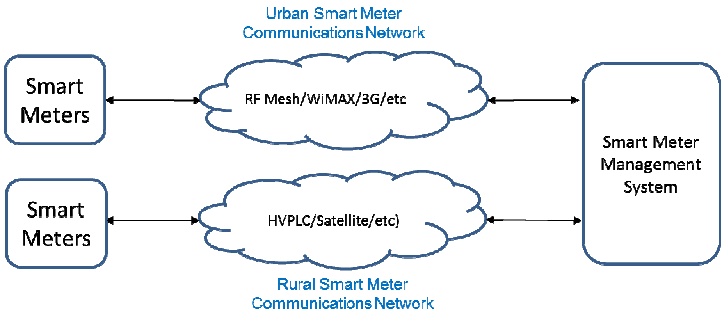


**Figure 6: SMMS using different Communications Networks**

A clear advantage of this solution is that a distributor can select an off-the-shelf Meter Management system and use it to communicate with a range of different communications solutions deployed throughout their region (this is especially true for distribution businesses that cover a range of meter densities including urban, rural and remote areas.).

A completely separate function is the provision of a standard interface supporting the connection of different communications solutions. In this case an existing function, the HAN, is used to support the connection of alternative communications solutions.

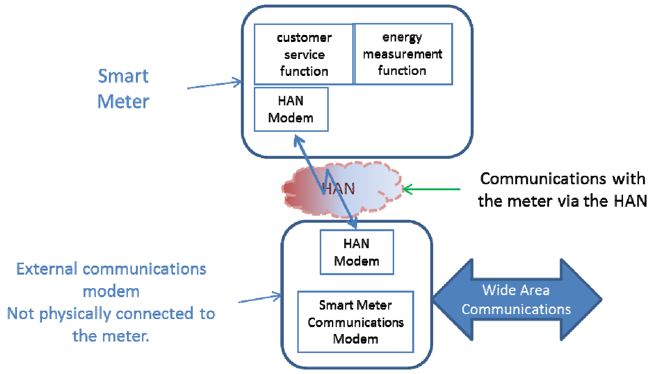


**Figure 7: Two alternatives to connect the Smart Meter Communications Modem**

For this solution to work the selected HAN protocol must support tunnelling. Tunnelling ensures that the HAN can carry any message sent from the SMMS to devices on the HAN, even if the selected HAN standard does not understand the underlying message. This functionality is now supported by some HAN technologies. Taking the specific example of ZigBee Smart Energy Profile[5], the following slide highlights features added to the latest release.

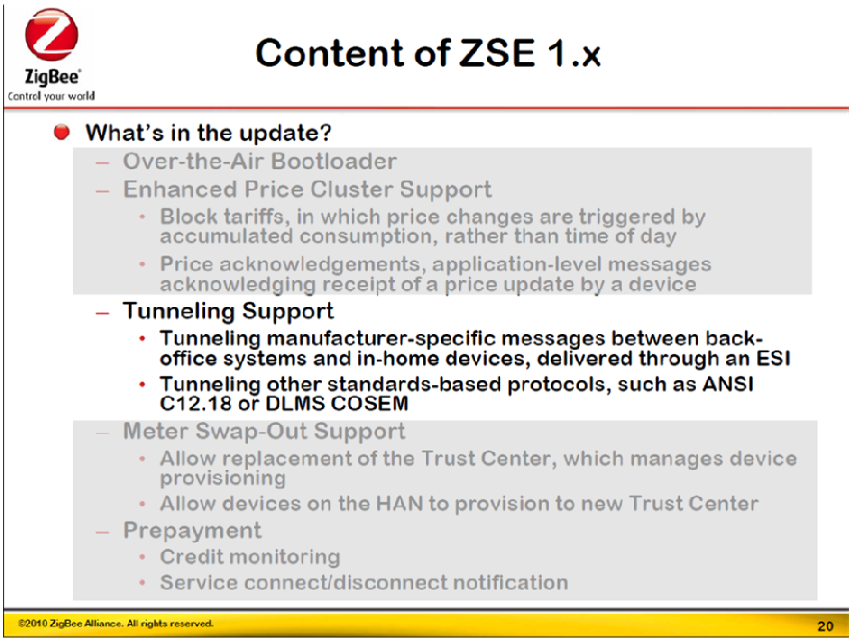


**Figure 8: HAN Technology supporting tunnelling of meter protocols**

Figure 8 is taken from the presentation by Bob Heille and highlights that tunnelling of both C12.18 and DLMS meter protocols is possible over a ZigBee HAN. It is also highlighted that the use of tunnelling through the HAN is fundamental to the planned deployment of 2 million meters by British Gas. Their solution uses a separate communications hub to communicate with smart electricity and gas meters.

[5] ZigBee Smart Energy Profile is the HAN standard specified for the Victorian AMI deployment

## 3.3 The Need (cost) for Standards Compliance Testing

An interesting observation is made by the IDIS Association

> "Standards guarantee open technology but they do not guarantee the availability of products which are tested for interoperability".

Regardless of which meter protocol is selected there is a need to ensure that the equipment correctly implements the standard, including any extensions to the specification. Today it is common to see products carrying certification logos clearly indicating that they comply with relevant standards. A selection of product compliance logos are shown in Figure 9 below.

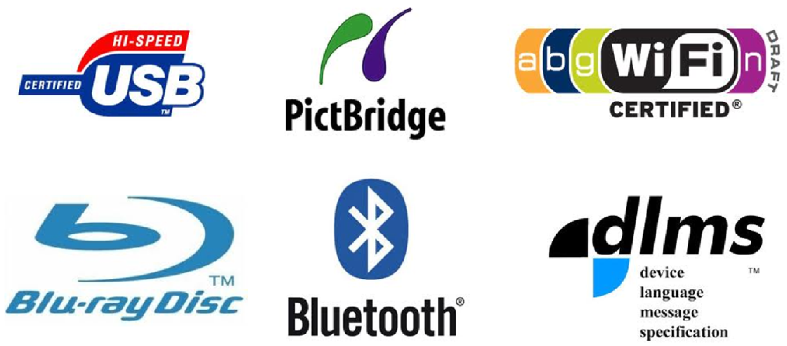


**Figure 9: Examples of Certification Logos**

Purchasing a device carrying the appropriate logo gives confidence that it will work in the way intended. For those of us who recall the early days of Personal Computing where hardware and software applications might work with (genuine) IBM PCs but not on (cheaper) clones. The standards were not well defined and certification testing of interoperability did not exist.

Certification testing ensures that the device correctly implements the defined standard. Ideally the standards body should define the testing regime. Referring to the IDIS Association:

### 4. IDIS Conformance Testing

IDIS components are tested for conformity according to the rules set be [sic] the IDIS Industry Association.

Every IDIS devices carries an IDIS Test Label which identifies:

- the Extensions to the minimal IDIS functionality implemented in this device
- the Test Report produced by the type-testing of this device

The Test Report clearly identifies:

- The type and manufacturer of the device
- The Extensions supported by the device
- The additional Options supported by the device

Test Reports are available through the IDIS association.

An example of an IDIS test label was included in Figure 5. Ideally the compliance testing should be conducted by a third party allowing a certified product to be purchased. For example the ZigBee Alliance has realised the importance of Certification Testing and has ensured that there are a number (currently three) approved testing laboratories. Taking the specific slide from Bob Heile's recent presentation

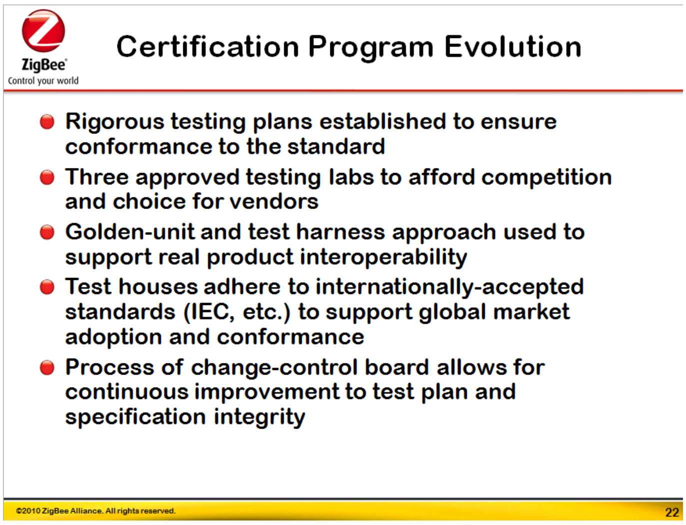


**Figure 10: Summary of ZigBee Smart Energy Certification Program**

It is also possible to consider establishing a specialist test certification facility. This is the approach taken by Électricité Réseau Distribution France (ERDF). ERDF have developed a PLC based smart metering specification, including the need for interoperability. In order to ensure vendor solutions comply with their standard they have established their own testing laboratory for 35 million smart meters. Taking a slide from this presentation:

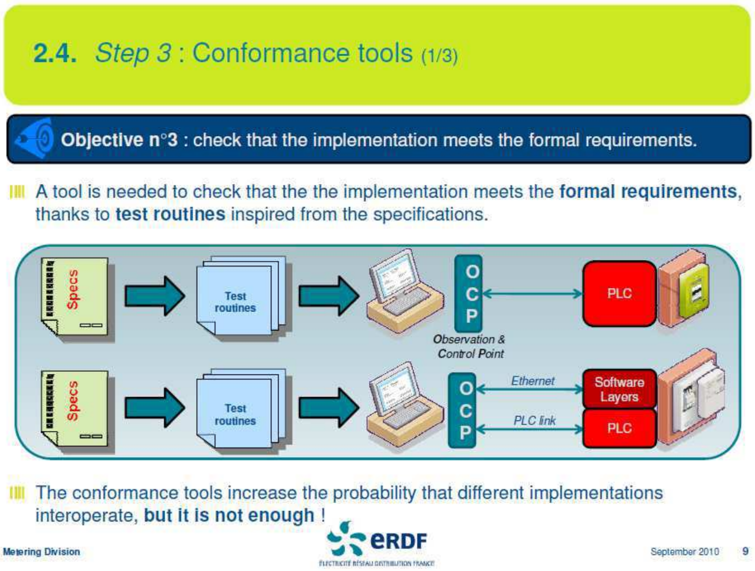


**Figure 11: ERDF have developed compliance test scripts from their functionality specification**

## 3.4 Benefit of proprietary metering protocols

While this paper presents reasons for selecting a standard meter protocol it is important to remember that there are valid reasons why such a wide range of communications solutions is currently being offered by vendors. These solutions currently extend from 4G cellular solutions supporting data rates of several Mbps and latencies of milli-seconds through to high voltage powerline carrier solutions transmitting milli-bps (e.g. 0.0008bps) and latencies of 10's of minutes. Returning to our internet example, it would be impossible to surf the web using a 0.0008bps high voltage powerline carrier system and a waste of bandwidth to use 4G solutions to read dam levels once a day (since they only change slowly).

Performance Levels included in the SMI F.S. require messaging to groups of meters. While it is possible for a 4G solution to individually address thousands meters in only a few minutes, the high voltage powerline carrier solution must rely on broadcast to reach a similar number. To maximize the efficiency of the system it is necessary for the SMCN Management system to be closely coupled with the Meter Management system as depicted in Figure 2. Compare this with the OSI model shown in Figure 4 where the SMCN Management system has been separated from the Meter Management system. This separation may mean that the Meter management system does not fully utilize the capabilities of the SMCN, resulting in higher costs.

Specific examples

All communication solutions rely on collection points so if the SMMS uses knowledge of how the meters are deployed on these collection points there is the potential for significant performance improvements. This is depicted in the following figures. Figure 12 depicts a SMMS sending messages one at a time and waiting for the meter acknowledgement before sending the next message. Because the first four messages are all going through the same collection point the SMMS must wait for each transaction to complete. It should be noted that while the other two collection points could support concurrent communications they are not being used, wasting system capacity.

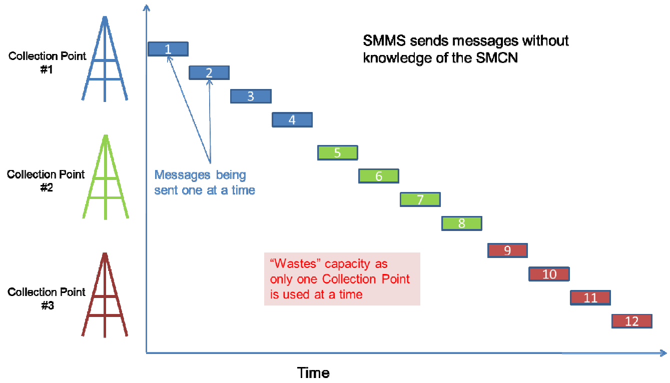


**Figure 12: Potentially slower response when the SMMS does not use knowledge of SMCN**

Figure 13 shows that the SMMS is now using knowledge of the SMCN. In this case it sends the first message to Collection Point #1, and concurrently selects the 5th and 9th messages because it understands that the addressed meters are available via other Collection Points. In this manner three messages are processed concurrently significantly reducing the time taken to send the 12 messages.

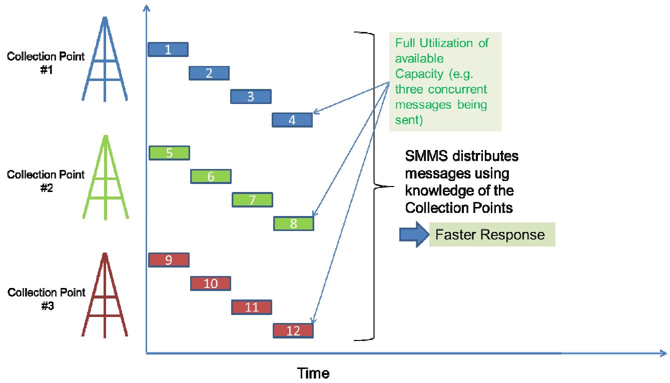


**Figure 13: Potentially higher performance when SMMS uses knowledge of SMCN**

As highlighted in the introduction of this paper the internet works because of interoperable standards. Transmission Control Protocol and Internet Protocol (TCP/IP) is the interoperable standards that provide the backbone of modern wired and wireless communications. As such it may appear to be a simple decision to specify that the SMCN must support TCP/IP since this would ensure connectivity from the SMMS to the Smart Meter in an open and interoperable way.

Meter Data Providers reading Type 4 meters using dial-up connections were keen to move to TCP/IP as it removed the need for large banks of dial-up modems. Calculations also revealed that it would be much cheaper as GPRS data charges would be lower than the point-to-point CDMA and GSM calls being made.

Unfortunately early attempts to adopt GPRS (using TCP/IP) found that the costs were not lower as the TCP/IP protocol was adding significant overheads to the cost of the communications (these overheads were on top of the meter protocol). Note that a similar finding is described in the Ofgem Statement of Design Requirements:

> 4.16. There is emerging interest in end-to-end internet protocol (IP) solutions for smart metering systems. Claimed benefits include availability of solutions developed over many years for other application areas. A possible downside is the extra bandwidth overhead (IP uses more bytes to transmit information than other protocols) which may preclude some WAN technology solutions.

Referring to Figure 4: TCP/IP only describes the Network Layers, it does not attempt to describe the Application Layers. As such there is no guarantee that communications solutions using TCP/IP achieve interoperability. To emphasize this point the metering protocol DLMS (see Section 4.1) and ANSI C12 (See Section 4.2) both support TCP/IP but are not interoperable.

Finally some vendors are keen to suggest that their (proprietary) protocols provide solutions where standard meter protocols would fail. The specific example was the use of the DLMS protocol for battery powered gas meters. Vendors claim that overheads in the DLMS protocol reduce battery lifetime to uneconomic levels.

The European market is taking a different approach by insisting on the use of standards. If a suitable standard does not exist then they will develop one. This simply means that if an existing standard is found to be deficient it is redesigned to remove that deficiency and the resultant design is made into a new standard. This is an expensive and time consuming process and would be difficult to justify just for the Australian market.

## 3.5 Costs and risks of a Standard Meter Protocol

In the NERA Cost Benefit Analysis the recommendation was to select an open standard for use on the Home Area Network. Despite the obvious benefits NERA did not recommend the selection of an open standard for the meter protocol. Instead NERA reported that metering vendors indicated that the costs of complying with a specified standard meter protocol would be dependent on the approach to implementing that protocol. In addition to the direct costs to vendors there may also be costs associated with:

- developing or adopting an open protocol standard;
- any delays to a smart meter rollout if an Australian standard was developed (lost opportunities to realise the benefits);
- the purchase of a proprietary protocol to be made open, if this approach was adopted; and
- metering manufacturers complying with the open protocol standard, compared to their own protocols.

These costs are likely to differ depending on the approach adopted to develop an open Meter protocol standard.

Further points of consideration are that an Open Standard should be available at minimal cost (including licensing fees). Responsibility for maintaining the standard is performed by an independent, not-for-profit organisation which is funded by its members. Membership of the organisation should not be restricted (including the use of membership fees to restrict membership).

So the main benefits of selecting an open standard is therefore lower cost, greater competition and the ability to influence the standard (through membership of the organisation). It is therefore clear why International smart meter deployments are so keen to select open meter protocols rather than attempt to develop their own or adopt proprietary solutions.

Selecting a standard is not without risks. Most of us would have friends who purchased the “technically superior” Beta video player over VHS, however when the market settled on VHS they were left with an expensive solution. Even when one solution does not differ significant the cost to change will inhibit the ability to introduce a new standard, for example consider the costs involved in switching Australia's mains frequency from 50Hz to 60Hz.

Mandating one standard also stifles innovation, for example European PAL television signals offered advantages over the American NTSC colour system, however once the standard was selected and deployed the American public had to settle for Never The Same Colour. It was only delays in selecting a new analogue television standard throughout the USA that left the door open for the development of the technically superior digital high definition television standards.

Finally it is necessary to point out that meter manufactures tend to support one meter protocol. Selecting one protocol may reduce the number of vendors who are prepared to develop solutions for the Australian market. Reduced competition between the remaining vendors could lead to higher prices.

# 4 Review of Standard Meter Protocols

Many meter protocols were initially designed to support local meter reading. While most meter protocols have now been extended to allow remote meter reading, many do not support the functionality required to meet the objectives of the NSMP. The NSMP objectives require two way communications with the smart meter, including the ability to control (potentially several) load control contactors, the supply contactor and to interact with devices installed on the HAN. All these transactions must be done securely.

The following table is an extract from OPENmeter State-of-the-Art Technologies & Protocols.

**Table 1: OPENmeter (European) Perspective of meter protocols**

| Specification | Field of application | | | |
|---|---|---|---|---|
| | Local AMR | Remote AMR | AMI | Home automation |
| IEC 61334 PLC | - | Y | Y | - |
| IEC 62056-21"FLAG" | Y | Y | - | - |
| IEC 62056-31 Euridis | Y | Y | - | - |
| IEC 62056 DLMS/COSEM | Y | Y | Y | Y |
| EN 13757 M-Bus | Y | Y | Y | Y |
| SML | Y | Y | Y | Y |
| DIN 43863-4 | | Y | Y | |
| IEC 60870-5 | Y | Y | - | - |
| IEC 61968-9 | NA | NA | NA | NA |
| SITRED | Y | Y | Y | - |
| PRIME | Y | Y | Y | - |

While the OPENmeter analysis takes a European perspective it suggests that three protocols could provide the flexibility required by the NSMP. The following analysis only considers DLMS/COSEM as M-Bus is not designed to operate across a broad range of communications technologies and SML is not (currently) documented as a standard.

The search for protocols also considers protocols developed in the USA, where the ANSI C12 series of meter protocols is universally adopted.

## 4.1 DLMS/COSEM

DLMS/COSEM is an open international standard for data exchange in a standard, interoperable manner independent of the meter manufacturer and over a range of communication media. The DLMS protocol is described in a range of IEC standards including IEC 62056-Part 46, 47, 53, 61 and 62 along with several other relevant standards. It should be noted that DLMS supports electricity, gas and water smart meters.

The DLMS User Association supports the standard, and membership is open with nominal annual membership fees. Currently the Association has around 130 members from 50 countries. The DLMS

Association also offers conformance testing to ensure devices carrying the DLMS logo have been tested for interoperability.

DLMS is a comprehensive protocol and as such more software is required to implement the protocol. Concerns have been expressed that this could drive up the cost of the smart meter. While it is acknowledged that the micro-processors used in typical meters contain around 64kBytes of memory, modern smart meters are being supplied with processors with several mega-bytes of memory. A quick search of the internet reveals that it is possible to purchase a DLMS stack written in C source code which details typical memory requirements. For example Kalkitech:

> "Kalki provides an easy upgrade path for Meter OEMs to implement DLMS protocol in their existing/new meters by providing a DLMS Server Source Code Library (ANSI C) containing the full protocol stack with three simple interfaces to hook-in the meter data, configuration and hardware-platform-specific features." and

> "The ROM size for a full stack, using all features is found to be about 16kB (without meter configuration information) and runs on under 4kB RAM. Configuration info for a typical meter with about 150 objects, a few Associations and profile capture-object lists was seen to occupy an additional 10kB (ROM or RAM)"

Purchase, license and additional memory costs indicate that the Kalkitech DLMS solution would add less than $1 to the total cost of each meter. Kalkitech also report that some meter vendors have produced working prototypes in less than a month using their protocol stack.

DLMS has gained acceptance throughout Europe and has been specified as the application protocol in several major smart meter deployments, including Ofgem Prospectus for Smart Metering, British Gas, the Netherlands, Iberdrola (PRIME) and ERDF. It is also being considered to replace the existing Chinese developed metering standard DL/T-645 and for future Indian meter deployments. All these markets are significant to Australia as they use meters meeting IEC requirements including the bottom connected form factor preferred in Australia.

Finally while Table 1 indicated that DLMS already supports Home Automation is this not strictly correct. Once again referring to the OPENmeter document:

> "Home automation is currently not supported by DLMS/COSEM. However, DLMS/COSEM devices may serve as a gateway towards HA systems."

This solution is depicted in Figure 14 which shows the meter serving as a gateway to provide access to the HAN. The important point is that the smart meter communications system is shown as the physical layer so is also performing as a simple gateway. In this solution it is possible to change the smart meter communications solution without affecting messaging to the meter, or the HAN.

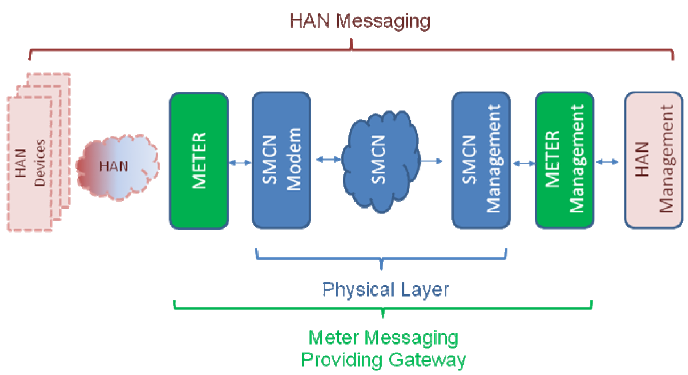


**Figure 14: DLMS meter operating as a gateway to the HAN**

### 4.1.1 Certification of Compliance

The DLMS association fully supports certification of devices. Equipment showing the DLMS logo (included in Figure 9) indicates that the device has passed a defined compliance testing regime. The DLMS association has developed a comprehensive set of test steps to ensure that the device under test correctly implement the standard. In the case of DLMS the test steps are documented in a separate specification which the association refers to as the Yellow Book.

Equipment can either be tested by certified test houses or vendors can purchase software which automatically steps through the test steps (purchasing the testing software allows vendors to self-test). In both cases the results of the testing (the test report produced by the software) are submitted to the DLMS Association along with details of the device in order to be allowed to show the compliance logo.

### 4.1.2 Australian Deployments

KEMA is aware of at least one successful deployment of SMI using the DLMS metering protocol.

The installation of Type 4 meters using DLMS has also been undertaken. There are reports that these deployments have revealed that DLMS incurs higher data overheads than proprietary protocols. These higher overheads could have a performance implication when used on communications networks with limited data bandwidth or where the communications technology incurs “per byte” data costs. These arguments are less relevant when using high bandwidth communications.

## 4.2 ANSI C.12

The American National Standards Institute (ANSI) has provided a standard metering protocol for many years. The C12 series of standards ensures interoperability between meter vendors by describing common data structures for typical meter exchanges (for example the collection of interval energy data). The protocol has been extended to provide remote meter reading over a range of communications links and most recently over IP connections.

The ANSI standard is simple and straight forward. It can be successfully implemented on very modest micro-processors with less potential to impact hardware costs than the DLMS protocol.

The NIST report on interoperability notes

> “It is recognized that C12.22 is an important standard relevant to the transport of C12.19 tables” and
>
> “Several issues were raised in other comments received, including concerns about layering, security, and the need for better alignment with Internet Protocol and harmonization with the IEC 62056(Device Language Message Specification (DLMS)/Companion Specification for Energy Metering (COSEM)) standard”

When Dr Gill was developing an ANSI solution for the Australian market he found that there were no standard commands to switch supply contactors or load control contactors. These commands were easily added using factory extensions to the protocol, but as discussed in Section 3.3, in order to maintain interoperability between vendors it would be necessary for a central authority to manage these protocol extensions.

The largest deployments of SMI with HAN functionality are occurring in the USA. All of the meters used in these deployments are based on ANSI C12, which does not support the HAN. The solution to this problem is presented by the OSI model, where communications with devices on the HAN is supported directly from the Modem installed in the meter. The SMCN essentially provides virtual channels separately supporting the Meter and HAN.

This ANSI solution is depicted in Figure 15 should be compared with the DLMS solution shown in Figure 14. While the provision of separate virtual channels on communications links is a well proven solution it does require the SMCN modem to be able to support the creation of two separate communications paths, one for the meter and the other for the HAN. This may restrict the ability to employ other communications solutions, because the modem must contain additional intelligence to support the message separation.

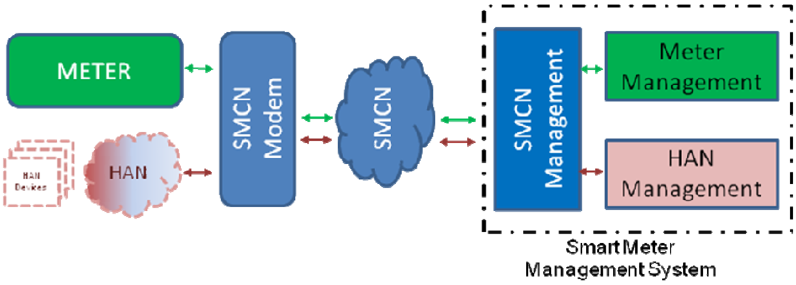


**Figure 15: The SMCN provides separate virtual channels**

### 4.2.1 Certification of Compliance

The ANSI standard does not specify compliance testing although it appears some test houses are able to offer a testing service.

### 4.2.2 Australian Deployments

The solutions deployed in the Victorian AMI program have (to-date) selected communications solutions developed in the USA. In these solutions the SMCN and SMMS are based on the data tables described in ANSI C12. As such requests from the SMMS to a meter expect data to be provided in a form compatible with the C12.19 data structures. Those meters which do not use the ANSI C12 protocol contain additional meter software to format their internal data to comply with the C12 standard.

## 4.3 Custom Solutions

Recognising that it is not possible to find a solution meeting all the requirements of the NSMP it is necessary to consider creating a single unique solution for the Australian market. This is essentially the solution offered by Freestyle.

Rather than selecting a single meter protocol Freestyle offers the possibility of presenting a common interface to a wide range of solutions through the development of protocol converters. Like MV-90 the protocol converter runs on top of other protocols (both proprietary and standard). It is noted that this is the interoperability model suggested in the NERA Phase 1 report.

It must be highlighted that MV90 supports interoperability through the use of protocol translations. MV-90 is a proprietary solution requiring meter vendors to pay for the protocol translator to be developed (in order to support their proprietary metering protocol) and then Meter Data Providers to pay software maintenance fees to be eligible to install the new protocol translator. In addition MV-90 only supports interoperability of meter data, it does not attempt to address meter settings configuration. As such while the Phase 1 report suggests it as an example of interoperability, it fails to deliver many of the benefits.

So while the Freestyle solution has the capability of supporting both metering data and meter settings, the questions remain: Who is responsible for the development of the protocol converter and Who will pay for its development?

While the Freestyle's solution is well thought out however at this stage Freestyle does not meet the suggested requirements for an open interoperable standard.

### 4.3.1 Certification of Compliance

KEMA is unable to comment on any compliance regime offered by Freestyle.

### 4.3.2 Australian Deployments

Freestyle's solution is currently being adopted by several SMI vendors active in the Australian market.

## 4.4 Recent International Developments

### 4.4.1 European Union

The NSMP is not alone when considering the cost and benefits provided by Interoperability. Indeed the development of international meter protocol standards is inspired by the desire to achieve interoperability.

Directive 2009/72/EC of the European Parliament and of the Council considers the rollout of Smart Metering systems throughout Europe. ANNEX I Measures on Consumer Protection states:

> The Member States, or any competent authority they designate, shall ensure the interoperability of those metering systems to be implemented within their territories and shall have due regard to the use of appropriate standards and best practice and the importance of the development of the internal market in electricity.

It is important to note that this Directive will affect all European Smart Meter rollouts.

The European Mandate M/441 prepared by the Smart Meter Co-ordination Group Technical Report on Communications attempts to provide a technical framework to implement the EU Directive. This (draft) report describes underlying principles, architectural considerations and even use cases, but it does not recommend a single metering standard. Despite the large body of work underpinning the report it instead provides a comprehensive list of existing standards which should be developed under the mandate.

### 4.4.2 OFGEM

Ofgem's Prospectus discusses the rollout of Smart Meters throughout Great Britain and recognises the importance of interoperability. From the Regulatory and Commercial Framework:

> 5.11. The ability to switch supplier is fundamental to protecting consumers and promoting effective competition in the retail energy market. [cut]
>
> 5.12. The first critical requirement to achieve this is technical interoperability. [cut]
>
> 5.13. The other critical challenge is agreeing the terms on which a new supplier will take on a smart meter, known as "commercial interoperability". The terms need to cover not just use of the meter (an enduring issue) but also use of the communications (until DCC[6] is in place).
>
> 5.14. Establishing an agreed technical specification and a basis for new suppliers to take on meters is important both in ensuring retail competition is not affected but also in giving suppliers and investors the confidence to invest in the new meters. Without that the concern is that any investment could be stranded.

As shown in Figure 2 above, the NSMP supports these aims using the AEMO B2B gateway, for example processes and procedures to support retailer switching are well established. What it does not provide is competition for the provision of the services below the AEMO gateway. It is readily accepted that Australia's geography means that it is not cost effective to deploy a single communications solution in all areas, for example Performance Levels in Remote areas differ from those available in Urban areas, however the requirement to justify that the cost of the deployed solution is prudent often means that different solutions are selected. This is also recognised in the Ofgem Statement of Design Requirements:

[6] As set out in the "Communications Business Model" supporting document, we propose the creation of a new licensable activity related to procurement and contract management functions needed to deliver the central data and communications services. We envisage the granting of a licence to undertake this activity to a company that would act as a data and communications management entity (referred to as DataCommsCo or DCC).

> 5.7. The GB competitive metering market incentivises suppliers to seek best value from meter procurement, installation and management arrangements. It is clear that suppliers have different business models for delivering metering services that may not naturally encourage interoperability.

The NSMP has provided a high level description of the SMI functionality. The Ofgem documentation notes that the preparation of such high level functional requirements is an important first step, however more is required to achieve interoperability:

> 5.9. We have developed the high-level functional requirements list into more detailed functional requirements. The functional requirements set out what the smart meter system must do in order to deliver the Smart Metering Programme business case. However the functional requirements are not - on their own - sufficient to guarantee technical inter-operability.

Finally while the Ofgem documentation highlights the importance of interoperability, it does not assume that a solution is available and that the preparation of suitable standards will take more work. Ofgem have considered two models for the development a technical specification and suggest that the best solution is:

> Option 2 – the programme develops functional requirements and then facilitates the development of technical specifications by industry.

## 4.5 Management of Meter Protocol Extensions

There are a number of areas in which Australian SMI requirements differ from overseas markets (for example dedicated load control circuits, the five supply capacity limits, etc). These differences make it unlikely that any standard is going to provide all the functionality that the NSMP requires. This is elegantly stated in the OPENmeter document:

> "To cover the largest possible range of applications, international standards specify a wide range of possibilities and options. They can be seen as a set of standard building blocks, of which tailor-made applications can be built. On the other hand, they specify only those elements, on which an international consensus can be reached."

Most standards are now developed in such a way that the protocol can be extended to support new functionality. From the LonMark document:

> "ANSI C12.19 has too much flexibility, so that implementations of different meters are often not interoperable. Some standard meter profiles need to be developed to constrain that flexibility for common types of meters and metering requirements."

It is very important to note that in order to maintain interoperability these extensions must be managed to ensure that vendor solutions remain fully compatible. Once again referring to the OPENmeter document (In the meter protocol standard DLMS, these extensions are referred to as companion specifications):

> "While the internationals standard has all the indispensable elements that are necessary to build interoperable systems, companion specifications are useful to facilitate achieving interoperability."

> "Such companion specifications are generally project specific" and

> "It is essential that this companion standard be developed by a joint effort of manufacturers and utilities and other stakeholders"

The Smart Meter Coordination Group (SM-CG) indicates that their preference is to attempt to influence the standards directly. This is outlined in their Principles detailed under section 5.1 of Mandate M/441

> The European Standards Organisations will first assess the suitability of international, European and national standards and will give preference to (draft) European and international standards. If no suitable standard is available for any specific part of the smart metering system, the ESO shall identify the gap between the existing standard(s) and the required standard(s), considering national proposals where useful, and then work to improve these standard(s) and/or develop new ones where needed. Technical committees will seek co-operation with other relevant fora and consortia.

It is important to note that it is not only during the specification phase of the project that management of any protocol extensions is required. On-going maintenance is required to ensure features added during the SMI service life remain interoperable. It is also vitally important to consider who will undertake the compatibility testing (this is discussed in section 3.3). The party responsible for coordinating the development and management of any required protocol extensions is beyond the scope of this discussion paper.

# 5 Summary of findings

This paper has highlighted that the meter protocol must be considered separately from the supporting smart meter communications network. This lead to the definition of a meter protocol as

> A meter protocol is a formal description of digital message formats and the rules for exchanging those message formats with meters

The selection of a meter protocol is an essential feature of the SMI. Most overseas deployments of SMI have tended to specify the meter protocol. This may be because while the selection of the meter protocol itself does ensure interoperability, it is true to state that not specifying a meter protocol provides a barrier to interoperability.

This paper has considered the main contenders for selection as a standard meter protocol, the European developed DLMS/COSEM and the American developed ANSI C12 series.

The ANSI C12 and DLMS protocols can both be implemented into smart meters with minimal impact to the meter hardware cost. Recent development work has ensured that both protocols can be successfully transmitted over a range of communications technologies. While there may be differences in the performance level achieved when transmitted over some communications technologies, the difference is unlikely to provide a reason for selecting one over the other.

Neither the DLMS nor ANSI protocol is able to provide all the functionality described in the SMI F.S. Both protocols support extensions to the basic functionality, however careful planning and management of any extensions must occur to ensure interoperability across vendors and jurisdictions for the life of the SMI.

The paper has presented the importance of selecting a meter protocol which is certified to comply with the stated standard. At this stage DLMS would appear to have a distinct advantage over ANSI in this area. While certification provides confidence it is unable to include testing of any protocol extensions required to implement specific Australian functionality. The costs to provide testing and certification of the protocol extensions would be in addition to the management of the extensions listed above.

The cost and complexity to develop an Australian specific metering protocol would be difficult to justify. Overseas markets are moving rapidly to enhance the standard metering protocols, most notably to support the Home Area Network (and load control). There are potentially opportunities for Australia to influence the development of these enhanced protocols which would directly address the issues of protocol management and certification.

This finding should be treated with caution, as the selection of one meter protocol would limit the number of metering manufacturers with access to the Australian market, thereby reducing competition in meter provision (potentially increasing meter prices).

# 6 Next steps

In its terms of reference, the NSSC is required to:

- determine the materiality of the risks of higher meter costs associated with a lack of interoperability in meter provision; and
- if the risks are material, develop a least cost approach to managing the risks associated with a lack of interoperability.

Given the current lack of meter protocol that meets the functionality requirements of the SMI F.S., it is too early to make this assessment. This assessment should wait until there is a real choice of an international meter protocol that meets the requirements of the SMI F.S.

Furthermore, the cost and complexity of developing and maintaining an Australian specific metering protocol, or Australian specific meter protocol extensions, with appropriate product certification, does not appear to be justified at this time. Particularly, if an international meter protocol later emerges that meets the requirements of the SMI F.S.

The Secretariat has provided Ofgem with a copy of the SMI F.S. (version 1.0) with the objective of getting as much of the Australian functionality adopted in the EU and Ofgem smart meter technical specification.

The recommended next steps are:

1. KEMA working with the BRWG (until end May 2011) is to continue to liaise with Ofgem and answer any queries regarding the SMI F.S.
2. The on-going responsibility to monitor developments in meter protocols is transferred to SCO. SCO can determine how it wants to progress further work in this area post May 2011.

# Appendix A – Glossary

The following acronyms are in the NSMP Glossary.

| | |
|---|---|
| ACOSS | Australian Council of Social Services |
| AEMC | Australian Energy Market Commission |
| AEMO | Australian Energy Market Operator |
| AER | Australian Energy Regulator |
| AMI | Advanced Metering Infrastructure (Victorian smart metering program) |
| AS | Australian Standard |
| B2B | Business to Business |
| BPRG | B2B Procedures Reference Group (established under the IEC) |
| BPPWG | Business Processes and Procedures Working Group (established under the NSSC) |
| BRWG | Business Requirements Working Group (established under the NSSC) |
| CATS | Consumer Administration and Transfer Solution |
| COAG | Council of Australian Governments |
| DNSP | Distribution Network Service Provider |
| DRET | Commonwealth Department of Resources, Energy and Tourism (also referred to as RET) |
| EEEC | Equipment Energy Efficiency (E3) Committee |
| ENA | Energy Networks Association |
| ERDF | Électricité Réseau Distribution France |
| ESC | Essential Services Commission |
| FRC | Full Retail Contestability |
| FRMP | Financially Responsible Market Participant |
| HAN | Home Area Network |
| IEC | Information Exchange Committee (established under section 7.2A.2 of the Rules) |
| IHD | In-home Display |
| LNSP | Local Network Service Provider |
| MCE | Ministerial Council on Energy (established under the COAG) |
| MDA | Metering Data Agent |
| MOU | Memorandum of Understanding |
| MRG | Metrology Reference Group (established under the RMEC) |
| MSATS | Market Settlement and Transfer Solution |
| NCRE | National Consumer Roundtable on Energy |
| NECF | National Energy Consumer Framework |
| NEL | National Electricity Law |
| NEM | National Electricity Market which excludes Western Australia and Northern Territory |
| NEMMCO | National Electricity Market Management Company |

| | |
|---|---|
| NEO | National Electricity Objective (as set out in section 7 of the NEL) |
| NER | National Electricity Rules |
| NSMP | National Smart Metering Program |
| NSSC | National Stakeholder Steering Committee (National Smart Metering Program) |
| OMRV | Operating Model Requirements Version (Victorian AMI Program) |
| PDRG | Business Process & Data Reference Group (established under the RMEC) |
| PLC | Power Line Carrier (using distribution wires as the communications media) |
| PTWG | Pilots and Trials Working Group (established under the NSSC) |
| RET | Commonwealth Department of Resources, Energy and Tourism |
| RIS | Regulatory Impact Statement |
| RFP | Request for Proposal |
| RMEC | Retail Market Executive Committee (an advisory committee to AEMO) |
| RP | Responsible Person |
| RPWG | Retail Policy Working Group (established under the MCE) |
| RWG | Regulation Working Group (established under the NSSC) |
| SCO | Standing Council of Officials (as established under the MCE) |
| SM | Smart Metering |
| SMCN | Smart Metering Communication Network |
| SME | Subject Matter Expert |
| SMI | Smart Metering Infrastructure |
| SMMS | Smart Metering Management System |
| SMWG | Smart Metering Working Group (established under the SCO) |
| TOR | Terms of Reference |
| WG | Working Group |

NSMP
National Smart Metering Program

# NSMP Business Requirements Work Stream

# Meter Access

| | |
|---|---|
| **Version number:** | Version 0.2 |
| **Status:** | Draft |
| **Author:** | Dr Martin Gill |
| **Date published:** | 27th January 2011 |
| **File name:** | NSMP Meter Access v02 |

# Table of Contents

# 1 Document Control

## 1.1 Version Control

| Version | Date | Description | Amended by |
|---|---|---|---|
| 0.1 | 13/1/2011 | First Draft | Dr Martin Gill |
| 0.2 | 26/1/2011 | Added role of the SMMS after review by Peter Egger | Dr Martin Gill |
| | | | |

## 1.2 Approval

| Authorised by | Signature | Date |
|---|---|---|
| NSSC Program Director | | |

## 1.3 References

The following documents are referred to in this document.

| Document Name | Version |
|---|---|
| NSMP Interoperability – Review of Meter Protocols | Version 1.1 |
| NSMP Smart Metering Infrastructure Minimum Functionality Specification | Version 1.1 |
| National Electricity Rules<br>Chapter 7 - Metering | Version 26 |
| Australian Energy Regulator<br>Victorian electricity distribution network service providers<br>Advanced Metering Infrastructure remote services charges<br>Review under ESCV Guideline 14 | Draft<br>November 2010 |

## 1.4 Disclaimer

This discussion paper was produced by Dr Martin Gill of KEMA Consulting in order to assist the Business Requirements Working Group (BRWG) in the development of the Smart Metering Infrastructure Minimum Functionality Specification. This paper has not been vetted or endorsed by the BRWG or the NSSC.

# 2 Introduction

## 2.1 Background

This paper will consider multi-party access to smart meters. When two (or more) parties have access to meter functionality, there may be a need to coordinate access to ensure a predictable outcome. The following figure shows a traffic light being used to control traffic at an intersection. The left hand figure shows the normal control sequence, one road is given a green light while the other road is stopped. The right hand figures depict possible consequences if users were given direct access to control the traffic light, firstly two red lights (so the traffic goes no-where) or two green lights (possibly resulting in collisions).

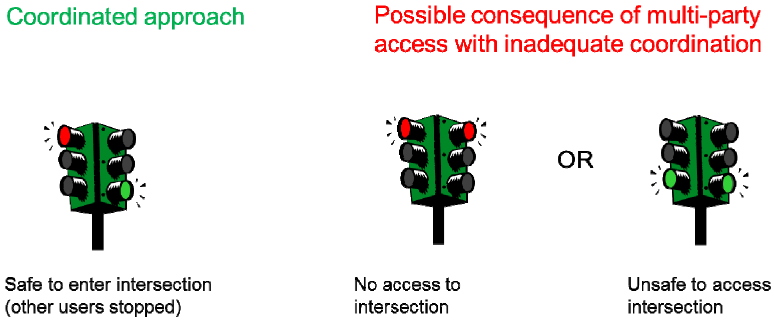


**Figure 1: Example of possible consequences from uncoordinated multi-party access to infrastructure**

To start the discussions this paper considers how participants in the Australian National Energy Market (NEM) can access meters today. An earlier discussion paper considered the current state of development of meter protocols needed to interact with meters. The meter protocol must be considered separately from the supporting communications network. This paper therefore considers how market participants send instructions to meters today using both manual and remote communications.

For reference the following figure shows the scope of the Smart Metering Infrastructure Functionality Specification (SMI F.S.).

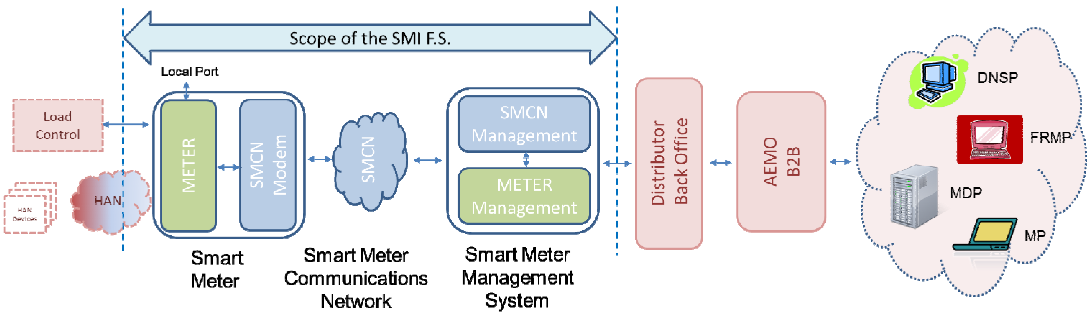


**Figure 2: Scope of the SMI F.S. in the context of the NEM**

It is generally assumed that the above figure only shows one communications path with the meter. A close examination of the Smart Meter actually reveals that there are several communications paths shown to the meter potentially supporting multi-party access. It is also important to note that it is also possible for multiple parties to attempt separate communications with a meter over a single communications channel (especially over Packet Based networks). All of these will be explored in this paper.

The paper then discusses the need to coordinate multi-party access to the SMI before presenting a number of possible methods ensuring coordination of any multi-party meter access.

# 3 Meter Access

## 3.1 Access to Meters in the NEM today

It is important to note that there are already a large number of meters deployed throughout the Australian Energy Market supporting multi-party access. As such this paper starts with lessons that can be learnt from existing meter access methods.

### 3.1.1 Meter Access via the Public Switched Telephone Network

Contestable Metering for meter types[1] 1, 2, 3 and 4 has resulted in a large population of meters across the NEM supporting remote access. Communications with these meters is provided by the Public Switched Telephone Network (PSTN). In order to access the meter it is only necessary to know the phone number[2] of the communications modem attached to the meter. Anyone with access to the PSTN can attempt to access the meter. This is depicted in the following figure:

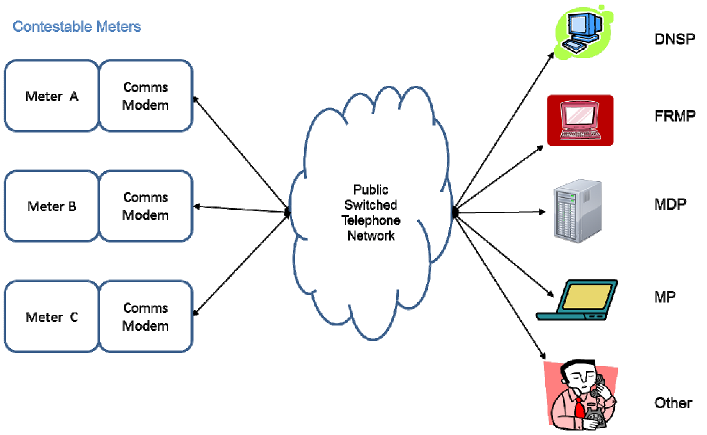


**Figure 3: Public Switched Telephone Network supporting remote meter access**

Figure 3 shows that anyone can attempt to access the meter. One important feature is that the PSTN will help coordinate meter access. When one user successfully rings (and connects) to the meter, another user attempting to gain access to the same meter will receive a busy signal. In this manner only one user can communicate with the meter at a time. This will occur regardless of the method that the user attempts to connect to the PSTN.

The second point is that there is a difference between being able to connect to the meter and being able to exchange information with the meter. While the PSTN allows anyone to call the meter there are additional safeguards restricting access to meter functionality and access to data contained within the meter. The National Electricity Rules (NER) require the use of passwords to secure metering data. Taking section 7.8.2 from Chapter 7 of NER:

(a) The *responsible person* must ensure that *metering data* held in the *metering installation* is protected from direct local or remote electronic access by suitable password and security controls in accordance with clause 7.8.2(c).

Figure 4 adds the back office systems. An important point of note is that each back office uses the same communications network to directly access each meter (in this case the PSTN).

[1] These are the existing *meter types* defined in NER Chapter 7 as a decision on the *meter type* assigned to smart meters is yet to be made

[2] The author acknowledges that the introduction of packet based communications systems (for example GPRS) means that meter access no longer requires a phone number. The possible consequences of this change will be discussed in the following section.

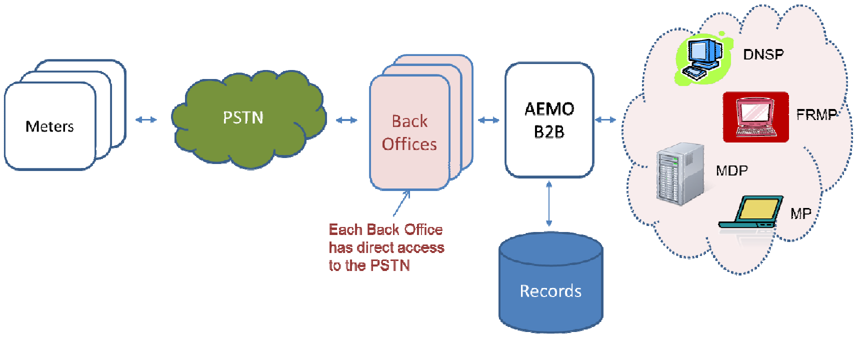


**Figure 4: Access to contestable meters via the Public Switched Telephone Network**

Another point shown in Figure 4 is that Market Participants may choose to avoid the need to install infrastructure to communicate to the PSTN by sending commands via the AEMO Business-to-Business (B2B) gateway. A rigorous set of rules govern these transactions, here it is only necessary to note that all future solutions must be able to comply with these rules.

We now consider one of the rules described in the National Electricity Rules (NER).

**7.8.3 Changes to metering equipment, parameters and settings**

Changes to parameters or settings within a *metering installation* must be:

(a) authorised by *NEMMCO* prior to the alteration being made;
(b) implemented by a *Metering Provider*;
(c) confirmed by the *responsible person* within 2 *business days* after the alteration has been made; and
(d) recorded by *NEMMCO* in the *metering register*.

The important point is the obligation to obtain authorisation *BEFORE* the alteration is made. This will be discussed further when considering how to provide coordinated access to smart metering infrastructure.

### 3.1.2 Connecting a modem to a meter

In the Australian metering market a remotely accessible metering installation will comprise a meter and a separate communications modem as shown in the following figure:

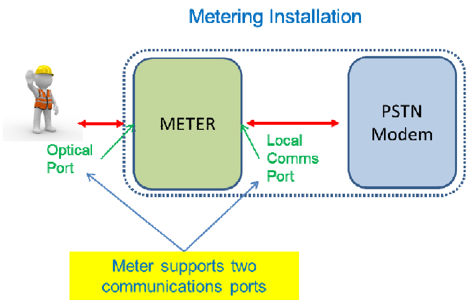


**Figure 5: Remotely Read Metering Installation**

The important point is that these remotely read meters already support multi-party access and even concurrent communications. Australian metering standards require all meters to be supplied with an optical port and in Figure 5 a service technician is shown accessing this port. The communications modem (in the figure shown as a PSTN Modem) is connected to the meter by a separate Local Communications Port (in many meters this port uses the old serial bus, RS232). The remaining question is what happens when concurrent communications with the meter is attempted?

#### 3.1.2.1 Concurrent meter access

*We start this section with a disclaimer: Meter behaviour when concurrent communications are attempted will be highly vendor specific. This discussion will present limitations known by Dr Gill to exist in metering* *solutions being offered in the Australian market today. It is recommended that this limitation is assumed to apply to all meters rather than consider what might be possible if more advanced solutions are deployed.*

In order to determine what happens when two users attempt to communicate with a meter it is necessary to consider the hardware limitations of the various components. As shown in Figure 5 the meter and communications modem are actually separate.

Most meters are based on small micro-processors. A quick review of available single chip metrology chips reveals they are only available with program memory sizes of 32 to 64 kBytes and RAM sizes of 1 to 2 kBytes. For those of us who can recall the early days of home computers, 64 kBytes severely restricted the number and complexity of programs that could be run. Early computer operating systems only ran one program at a time (there was no multi-tasking). The user was required to close the first program before running the next. In a similar manner meter operating systems should be assumed to support communications with one user at a time. The meter does not have the resources to manage two concurrent users.

Typically when one user logs onto the meter, this will disable the other communications port. For example in Figure 5 if the service technician is using the optical port to communicate with the meter, attempts to access the meter remotely via the PSTN will fail.

Smart meters appear to have the communications modem integrated into the meter, however internally the meter and SMCN modem are actually separate. This is most obvious when looking at modern smart meters which allow the SMCN modem to be replaced in the field. So even in the Smart Meter the communications modem should be considered to be connected to the meter by a local communications port (it is just that we are unable to see the local communications port).

The following figure attempts to depict high level transactions between SMI components that will occur when a single instruction is sent from the SMMS to the meter.

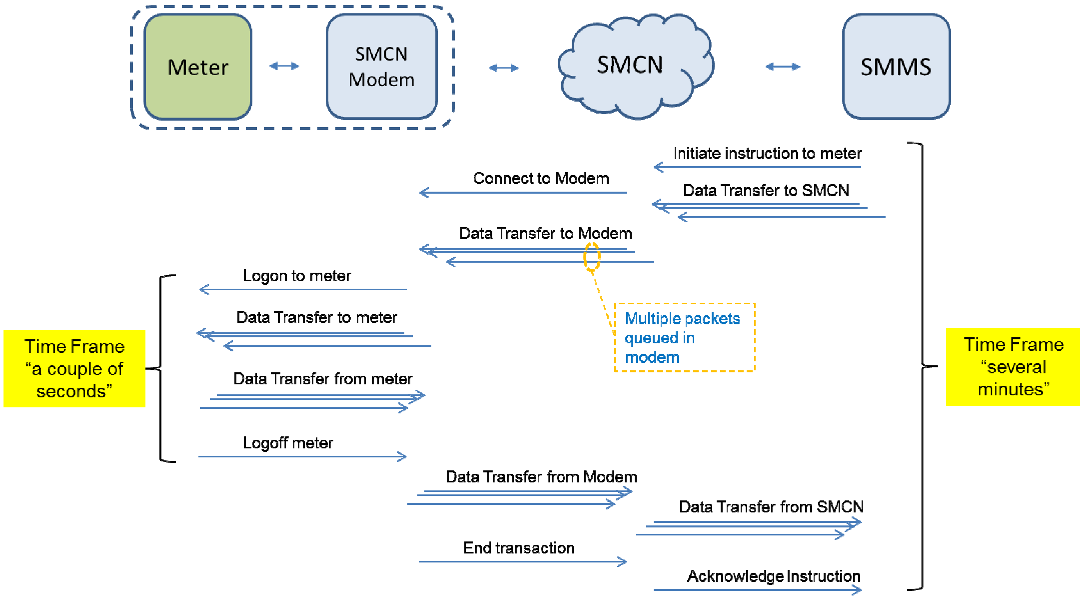


**Figure 6: Transactions occurring when a single instruction is sent to a meter from the SMMS**

The important point to be inferred from Figure 6 is that while the sending of the instruction to the meter may have a performance level of several minutes, the local communications port on the meter will only be active for a couple of seconds. During this time the SMCN modem is able to queue other commands.

In the following figure we consider how the SMMS, SMCN and Meter handle the sending of multiple instructions to a single meter.

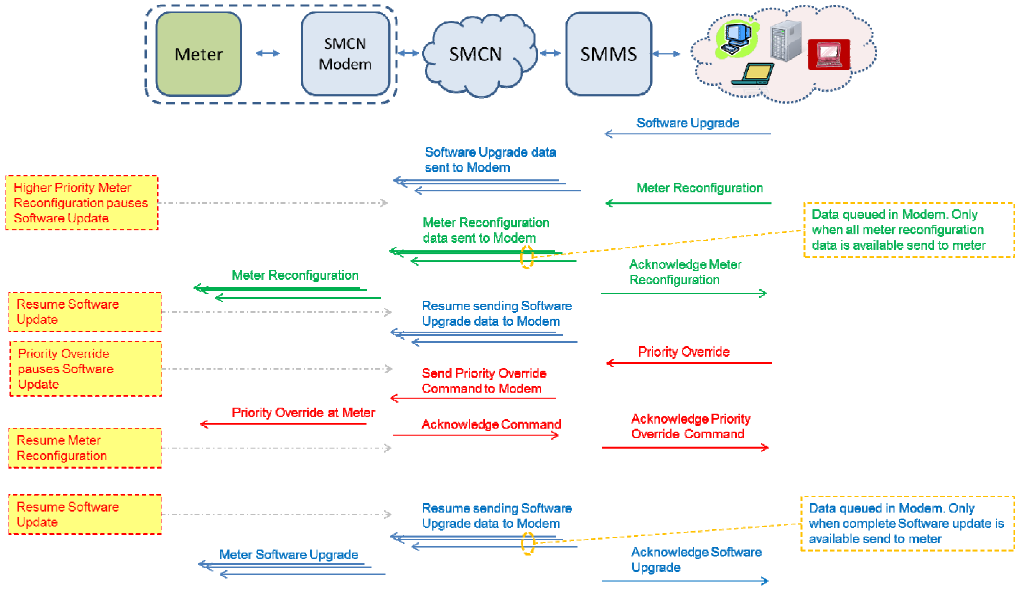


**Figure 7: Transactions occurring when multiple instructions are sent to a smart meter**

Figure 7 provides the example of three instructions being sent to an individual meter. In this example the SMMS receives the Software Upgrade instruction first, then Meter Reconfiguration and finally Priority Override. The example assumes that Software Upgrade is sent with a lower priority than the Meter Reconfiguration and Priority Override instructions. The figure shows that the low priority Software Upgrade is paused[3] (twice) to allow the higher priority instructions to be processed. The data already downloaded to the SMCN modem is not lost when the transfer is paused, the transfer resumes after the higher priority instructions are processed.

“For clarity”

Software upgrade is the only function which may be interrupted by higher priority instructions

To complete this section we highlight that the processors used in many communications modems are significantly more capable than those used in meters. Typically they offer several MBytes of memory and are based on multi-tasking operating systems. Such additional capability is largely ensured by the Remote Software Upgrade function described in the SMI F.S. The large amount of data that must be sent to a meter to upgrade its software can take several hours, however the SMI F.S. requires that the meter (including communications) must continue to operate normally. As such the communications modem must be able to accept other commands whilst downloading new software.

## 3.2 Role of the SMMS in managing multi-party access

When considering multi-party access it is also necessary to consider the role of the Smart Meter Management System (SMMS). All instructions, regardless of the original source, will be processed by the SMMS, before being sent to the meters via the SMCN. As such the SMMS plays a crucial role in the management of multi-party access.

The relevant text from Version 1.1 of the SMI F.S. is:

## 7.20 Meter Communications: Issuing Messages and Commands

### 7.20.1 Functional Requirements

[3] Note that Software Upgrade is the only SMI Function for which the SMI F.S. may require the instruction to be interrupted by a higher priority instruction.

a) The *SMI* shall have the capability to send messages or commands to an individual *meter* or groups of *meters*

b) The *SMI* shall support the ability to assign three priority levels to messages and commands sent to *meters*

c) The *SMI* shall have the ability to queue commands that are received. The queue shall process high priority commands before commands with lower priority. For commands with the same priority the commands will be processed in the order that they were received (that is first in, first out).

The following figure provides a visual interpretation of the requirements detailed in Section 7.20 of the SMI F.S.

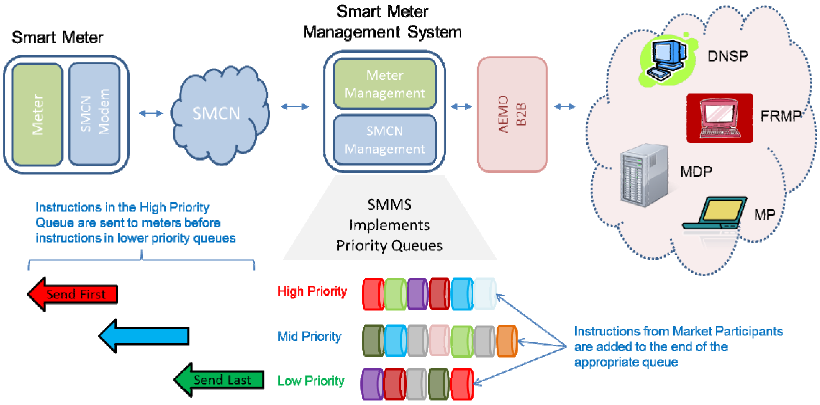


**Figure 8: SMMS is required to process Instructions in Priority Order**

The SMMS is required to process high priority instructions before lower priority instructions. In Figure 8 this is depicted as three separate queues corresponding to the three priority levels. New instructions are added to the right hand end of the appropriate queue. The SMMS takes the instruction from the left hand end of the high priority queue. Only when the high priority queue is empty will it then start to process lower priority instructions.

For clarity, once the SMMS starts sending an instruction to an individual meter it is unlikely that the SMMS will interrupt the exchange, even if a higher priority instruction is received by the SMMS. It is noted that in Figure 7 it was the Software Upgrade function being sent with low priority that was paused while higher priority tasks were undertaken. In the SMI F.S. Software Upgrade is the only function which specifies other functions must continue to operate. From Section 7.14.1 of the SMI F.S.

d) During and after a *software* upgrade the *meter*, *Smart Meter Communications Network* and *HAN* will continue to operate normally.

This clause was added since the Performance Level for Software Upgrade is at least 2 days (individual). Over this time frame the meter must continue to operate normally.

The situation is not as clear when considering sending commands to a group of meters. If the SMCN uses message broadcast to send group commands, then once it starts the broadcast a higher priority instruction will only be processed after the broadcast transmission is complete. If the SMCN uses individual messages to implement group messaging, then it is possible for the SMMS to be interrupted by higher priority instructions. It is noted that the difference is technology dependent and the SMI F.S. is written to be technology neutral. As such this level of detail is not included in the SMI F.S.

The SMI F.S. details performance levels for individual functions. The defined performance levels are measured from the SMMS to the meter and return, however functions are tested one at a time. In the context of multi-party access this implies that the performance level is measured from when the SMMS sends the instruction to the meter and therefore excludes any time in the priority queues. This is shown in the following figure.

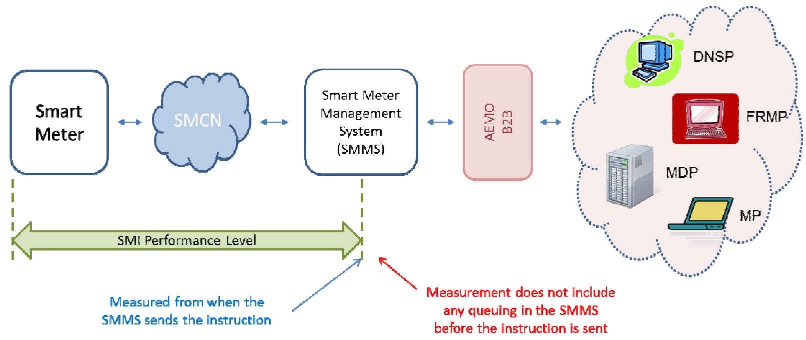


**Figure 9: Depiction of where the SMI F.S. Performance is measured**

Two critical factors will therefore affect the Service Level delivered to a market participant: Firstly the number of instructions already sent to the SMMS and the priority level assigned to those instructions. Clearly if other market participants have already sent a large number of high priority instructions, there will be a delay before the SMMS can process the latest instruction.

Service Levels that are supported by the SMI will be defined in the Business Process and Procedures Work Group. The discussions will have to consider how to coordinate multi-party access to what are fundamentally limited resources. This is a complex topic the challenges of which are easily introduced using black and white examples, while the final solution will probably require compromise (For example computer operating systems are designed to continue processing background (low priority) tasks despite foreground tasks having higher priority)

### 3.2.1 Packet Based Communications Networks

While contestable meters continue to utilize the PSTN, there has been a gradual change from circuit switched communications (i.e. normal voice telephone calls) to packet based communications (i.e. GPRS and 3G “internet” data communications). This change introduces several new challenges, not the least of which is concurrent multi-party access to meters. Since packet based communications are almost exclusively used throughout the modern SMCN we will now highlight several important differences compared to PSTN communications networks.

In a packet based communications system in addition to containing a small amount of the data being sent to the meter, each packet also contains the address of the intended recipient. Figure 10 therefore shows four users all of whom have access to the (packet based) communications network. They are sending data to a number of different meters, in this case three meters labelled A, B and C.

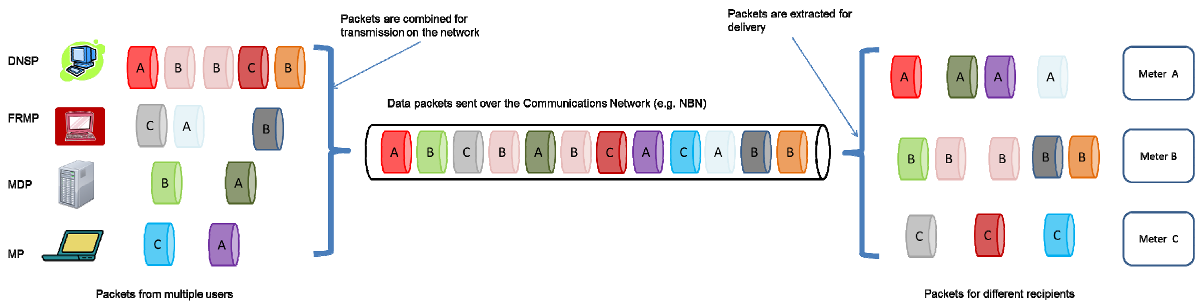


**Figure 10: Information packets from different users are combined for transmission on the communications network and extracted for delivery to the addressed recipient**

While Figure 10 presents an overly simplistic view of packet based communications there are a couple of concepts which can be introduced using this figure.

Due to packet size constraints several data packets may be required to send all the required data. This is depicted as two pink packets being sent by the Distribution Network Service Provider (DNSP) to Meter B.

When one user starts sending data to a meter, the communications network does not prevent other users sending data to the same meter. Figure 10 shows the DNSP sending three packets to Meter B (two pink and one orange), these three packets are received by Meter B, however Meter B also receives another packet between these packets (in this case the grey packet sent by the Financially Responsible Market Participant (FRMP)). If the meter does not take appropriate action the extra packet could seriously disrupt the original data transfer from the DNSP.

For a number of reasons it is also possible for data packets to be received in a different order from which they were sent. In Figure 10 a light blue packet is shown being sent by the Meter Provider (MP) before the brown packet sent by the DNSP. Meter C actually receives these two packets in reverse order. This could have implications, especially if the two packets contain contradictory commands, for example if one is a Priority Override command turning on the Controlled Load Contactor (CLC) and the other is a Priority Override to turn off the same CLC. Without coordination the possible reversal of the packet order could lead to an uncertain outcome.

Despite contestable meters using packet based communications systems the above issues are not seen. It could be argued that this is because the NER (Chapter 7) supports coordinated access with only one party assigned write access to the meter (another party is only given read access). Realistically even if multiple parties had write access the small number of commands sent to contestable meters means that there is almost no chance of concurrent access. The introduction of smart meters is expected to result in significantly more remote interaction with meters so the above potential issues need to be appropriately managed.

### 3.2.2 Access to communications networks

Figure 4 showed the PSTN being used to support communications to meters. In this case all users have access to the PSTN and therefore direct access to the meters. For the majority of packet based communications networks it is invalid to assume that it is possible to directly access the meter.

Consider that the vast majority of computers are assigned an address (the so called IP (Internet Protocol) address), however from experience we accept that this does not mean that any computer with an IP address can send data packets directly to another computer. For a range of very valid reasons access to computers is typically controlled through the use of firewalls. Figure 11 depicts an IT Network protected by a firewall. The firewall limits access to approved users (any requests from unapproved addresses are simply ignored). Note that firewalls can operate in both directions, for example most corporate IT departments limit employee (computer) access to the external internet (typically a list of blocked websites).

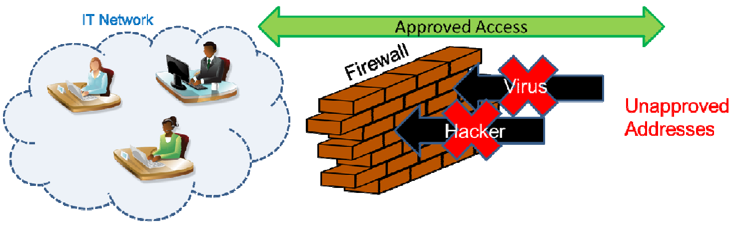


**Figure 11: Depiction of a Firewall blocking direct access**

Security concerns lead operators of Smart Metering Infrastructure to deploy firewalls in order to protect the smart meters. The actual situation in the majority of smart meter rollouts is depicted in Figure 12 and highlights that direct access to the meters is limited. In most cases only the DNSP has direct access to the SMI with direct access from all other users being blocked.

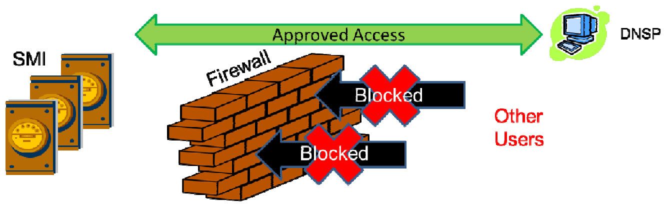


**Figure 12: Firewalls may limit user access**

Figure 12 accurately depicts the situation for the vast majority of meters deployed in the NEM today (specifically meter types 5 and 6), where the only access is via the DNSP. Market Participants wanting to access the meters must place service requests via the AEMO B2B gateway. This situation was shown in Figure 2 and again in Figure 4.

The important point is that the majority of meters in the NEM it is not possible for Other Users to directly access the meter. Access is achieved through the AEMO B2B gateway and DNSP Back office systems.

## 3.3 The need for coordination

The previous section raised the possibility of concurrent meter access. In this section we consider how existing rules ensure a predictable outcome. The following figure shows two market participants (in this case retailers) attempting to send contradictory commands to a meter (one requesting that the meter be re-connected and the other that it be disconnected).

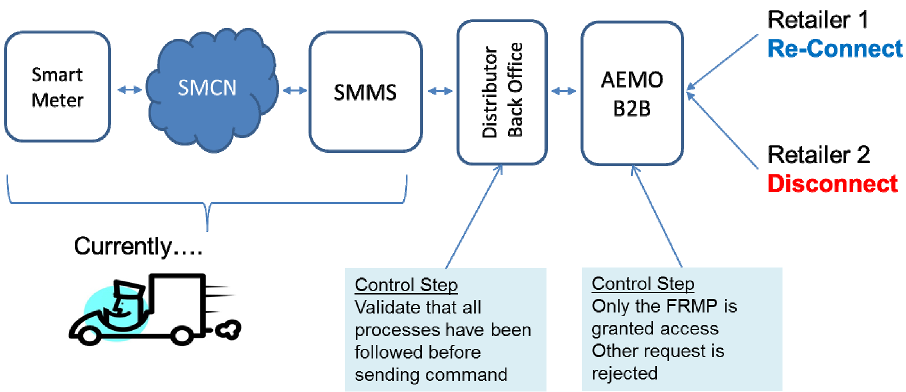


**Figure 13: Example of Coordinated Access in the NEM**

The NEM is set up to manage the contradictory commands in order to provide a predictable outcome for all market participants. Figure 13 shows two control steps applied to ensure that the outcome is consistent with the rules.

1. While two retailers have initiated the service request, only one will be financially responsible for the customer (the FRMP). Only the service request from the FRMP will be accepted by the B2B gateway and passed to the distributor.
2. Before a customer can be connected or disconnected there are additional checks that must be performed. For example before performing a reconnection safety checks outlined in jurisdictional legislation and procedures must be complied with (for example the customer may be informed to turn off all loads at the premises) and before a customer can be disconnected it is necessary to ensure that all steps detailed in relevant consumer protection legislation have been complied with (including that they are not registered as a life support customer, etc.). Only once the distributor has performed the required checks is the service request actually sent to the meter.

The introduction of smart meters will not change the required control steps. The major change will be how the command is delivered to the meter. Instead of manually delivering the command by sending a service vehicle to the premises to perform the action, it will be possible to perform the command remotely using the Smart Meter Communications Network (SMCN). In both cases after the service request is completed the distributor will then acknowledge that the service request has been completed and AEMO will inform the FRMP and update the Records (shown in Figure 4).

It is necessary for appropriate control steps to exist for all smart meter functionality. Such considerations are well beyond the scope of this discussion paper and readers interested in the development of SMI procedures are encouraged to refer to the work occurring in the NSMP Business Processes and Procedures Work stream.

### 3.3.1 Interactions between SMI functions

So far these discussions have not considered possible interactions between smart meter functions. The smart meter is a very simple device used to implement a number of different functions (as outlined in the SMI F.S.). Attempts to assign meter functionality across market participants may result in contradictory commands due to different incentives.

*It is emphasized that the following scenarios are theoretical. This paper does not attempt to assign meter functionality across market participants. The scenarios and functions are included to highlight some potential interactions between meter functions.*

*Scenario 1*

The local failure of a distribution asset results in localized supply constraints. To avoid damage to the network an export supply capacity limit is initiated for those customers downstream of the asset. Due to an excess of green power being available on the network (potentially leading to Quality of Supply issues) a Group Priority Override command is sent to turn on the CLC/R. Without appropriate coordination if meters for which supply capacity limiting is in operation also receive the priority override command, the additional load connected to the CLC/R could result in the supply capacity limit disconnecting the customer.

*Scenario 2*

Customer Supply Monitoring (SMI F.S Section 7.21) reports an active neutral swap at a meter. While this situation exists at the premises, use of the supply contactor might create a false sense of security since all circuits in the premises remain connected to the active line (and must be treated as live). Until the fault is rectified the supply contactor should be left in the on position, which may require supply contactor switch commands, including supply capacity control, to be blocked. (Note if Customer Supply Monitoring detects a degraded neutral connection it has been suggested that a more appropriate response is to immediately use the supply contactor to dis-connect the premises)

*Scenario 3*

A load aggregator offers demand reduction to market participants via agreements with customers to control load connected to the Home Area Network. A retailer who has negotiated an attractive price for supply (perhaps through the predictive purchase of hedge contracts) may not want their customers to reduce their demand. The potential therefore exists for contradictory commands to be sent to customers as the load aggregator and retailer have different objectives.

The above is not a complete list of potential interactions. As highlighted in scenario 3 the smart meter offers a number of separate functions all of which can be used to influence network demand. These are:

- Direct load control via the Controlled Load Contactor and/or Relay (SMI F.S. Section 7.6)
- Load control of devices connected to the Home Area Network (SMI F.S. Section 7.9) and
- Supply Capacity Control via the Supply Contactor (SMI F.S. Section 7.8)

The ability to reduce network demand may allow Distribution businesses to defer network augmentation and retail businesses to limit their exposure to pool price fluctuations. While both participants would wish to use the same meter functionality the time frames are very different.

The scenarios are presented to highlight that the introduction of smart meters potentially increases the need for coordination of all meter access.

# 4 Coordinating Multi-Party Meter Access

Before discussing possible methods of coordinating multi-party access to the meter it has been suggested that it is necessary to understand how two parties could access the smart meter.

## 4.1 Alternate Communications Paths

Establishing a second communications path to the meter provides a means of accessing the meter independently of the Smart Meter Communications System. Figure 2 actually shows a number of potential alternative paths to meter which are shown in greater detail in the following figure. These alternative communications paths present realistic methods of accessing the meter. Additional systems will be required to establish information exchange with the meter and to satisfy all regulatory controls.

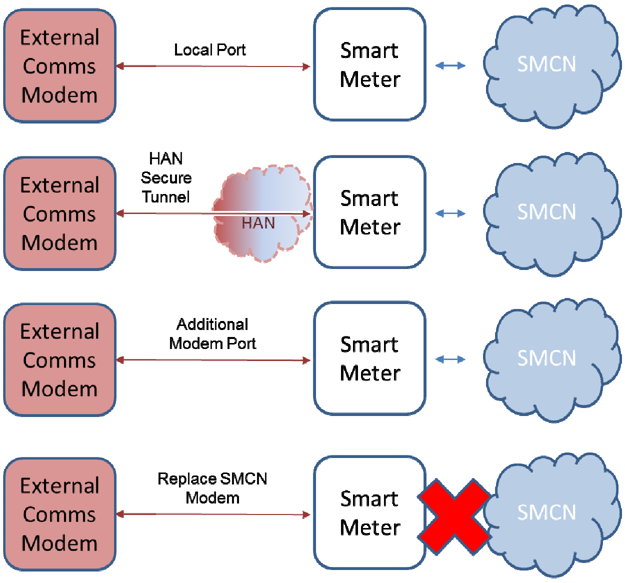


**Figure 14: Possible means of achieving alternative communications to the Smart Meter**

Describing the possible solutions shown in Figure 14:

*Local Port* – The SMI F.S. requires every smart meter to support a local port providing access to all meter data and functions. The local port is intended to allow local operation of the meter, however it is also possible to attach an external modem. Currently Australian metering standards restrict the local port to an optical port freely accessible from the outside of the meter. While this makes connecting the modem simple, avoiding the need for a distributor site visit, it leaves the connection difficult to secure and susceptible to accidental dislodgement (deliberate tamper). Note that the optical port does not provide power, so the external communications modem requires the installation of a separate external power supply.

*HAN Secure Tunnel* – Every smart meter will support a Home Area Network (HAN). One of the features requested of the HAN standard (SMI F.S Section 7.9) is the ability to support the secure tunnelling of alternative protocols over the HAN. This enables an external modem with HAN interface to support remote communications with the meter. The external modem must be an approved device to connect to the utility HAN, but this approval can be sent remotely (via the original SMCN). The external modem can be installed remotely from the meter (potentially inside the customer premises) which may simplify installation.

*Additional Modem Port* – Some participants in the NSMP have suggested that the SMI F.S. should mandate an additional modem port on the meter. The advantage of this solution (over replacing the SMCN modem) is that the original SMCN would remain operational. A sensible requirement for this additional port would be to provide power for the modem (greatly simplifying installation by removing the need for an external power supply). Besides the obvious cost implications of this solution (especially to the meter power supply) it would also increase the size of the meter potentially increasing meter installation costs. It is also very important to note that there is no standard for such a port, meaning that vendor specific solutions must be developed for each meter.

*Replace SMCN Modem* – In this solution the chosen SMCN modem is removed and replaced with an alternative modem. While this solution largely avoids the need for an external power supply it almost certainly incurs the cost of a distributor site visit and like the Additional Modem Port a separate solution must be developed for each vendor specific meter (realistically this solution would most likely be implemented by replacing the meter and would therefore result additional cost[4]).

It is not necessary to consider the actual technology used by the External Comms Modem. While earlier it was suggested that third party provided cellular communications are often utilized, it could also use the customer's own internet connection, the National Broadband Network or even private radio networks.

The solutions are presented only to highlight that it is possible to establish alternative communications to smart meters. In all cases it is necessary to consider the cost to install the modem, the cost to purchase and install external power supplies, the cost of monthly access/data charges and costs to ensure the solution is secure in addition to the actual cost of the communications modem.

## 4.2 Possible methods of coordinating access

Figure 2 showed how the AEMO B2B gateway provides facilitated access to a distributor's SMI for all market participants. The solutions shown in Figure 14 support alternative communications paths but there is still a need to coordinate all access to the meter. The alternate path must not be allowed to compromise the roles and responsibilities detailed in regulatory documents including the National Electricity Rules and customer protection frameworks. Coordination also ensures a predictable outcome (even when conflicting messages are sent).

A presentation given to the NSMP Regulation Working Group in August 2009 introduced three methods that may be able to provide coordinated access when employing multiple communications paths to meters. These are summarized as:

- Meter Coordinates Access with System Administrator managing meter passwords
- Single SMMS with centrally located System Administration
- Multiple SMMS with centrally located System Administration

Each of these will be explored in the following sections.

### 4.2.1 Meter Coordinates Access with System Administrator managing meter passwords

Section 3.1.1 discussed remote communications with contestable meters in the NEM. It was highlighted that the PSTN will allow anyone to access the meter. As such the NER assumes that the meter must coordinate access through appropriate management of meter passwords.

The following figure assumes that a similar strategy is adopted and that the smart meter coordinates all access. This is depicted in the figure as a Padlock shown over the smart meter. A dashed line shows that a "System Administrator" can modify the Padlock, including assigning permission to access data and control smart meter functions.

[4] It is noted that in some SMCN technologies meters may also relay messages for other meters (most often in RF Mesh and Low Voltage Distribution Line Carrier technologies). In these solutions removing a meter from the SMCN may adversely affect the reliability of communications with other meters)

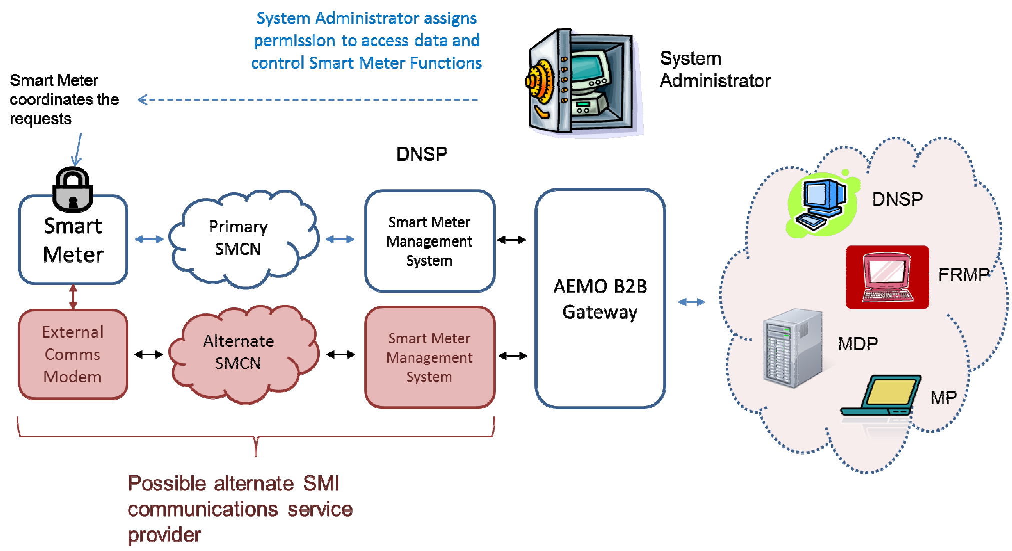


**Figure 15: Meter Coordinates Access with System Administrator managing meter passwords**

As highlighted above this is the situation for contestable meter types 1 to 4 in the market today. The Meter Provider retains full read and write access to the meter (including setting passwords), however they are required to support the provision of a read only password to Meter Data Providers, so they can access stored energy data.

The NER assumes that the PSTN is used to access the meter. As highlighted in Figure 3, the PSTN does not restrict meter access to market participants. This possibility is shown in the following figure:

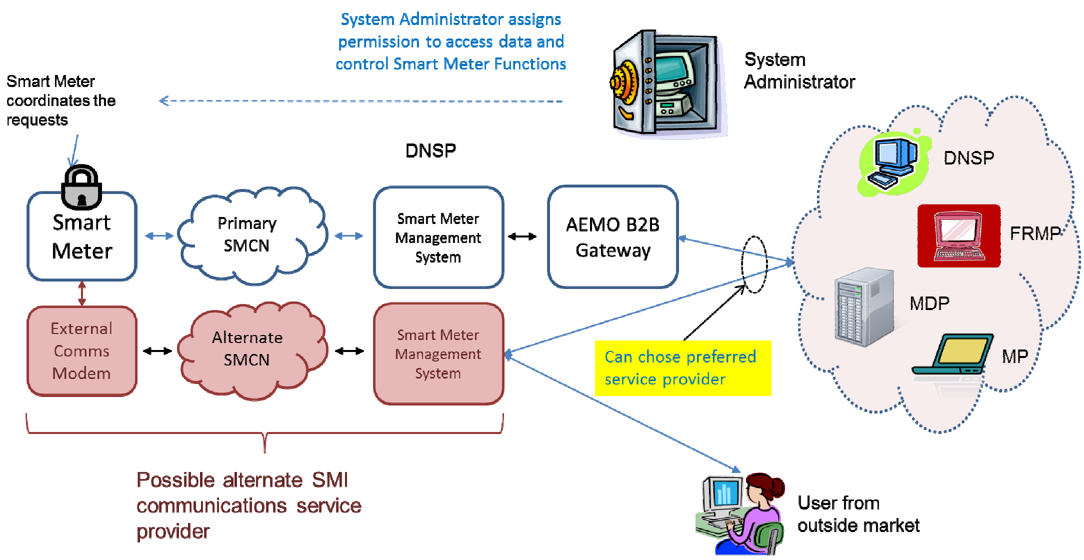


**Figure 16: Meter Coordinates Access shown supporting non-market participants**

If the Smart Meter coordinates all access then it is no longer important which communications path is used to reach the meter. It could be used to allow non-market participants to access some meter functions, for example Google could be granted access to read energy data directly from the meter via the customer's internet connection.

While all smart meters must implement access control, it is important to note that this access control is significantly more complex than "read only access" to stored data. If we assume that the desire is to allow one market participant to control one function but not another, then the meter would be required to assign access to individual meter functions. While the SMI F.S. lists some "20 functions" several functions have multiple sub-functions (for example the five supply capacity limits described under Supply Capacity Control, SMI F.S. section 7.8). It would also be necessary to separately control the allocation of meter parameter settings listed in Appendix B of the SMI F.S. Note that this level of control is not described in the SMI F.S.

Section 3.1.2.1 discussed the hardware limitations of typical meters. It was suggested that the smart meters should be considered the equivalent of a 1980's home computer (e.g. Commodore 64). These old computers only supported a single user, performing a single task and even then their limited memory and slow processor speed only allowed simple (small) programs. Such limitations would severely impede the ability to implement the coordination demanded in a smart meter rollout.

It is also difficult to see how it would be possible to coordinate possible interactions between meter functionality as discussed in Section 3.3.1.

While this solution most closely aligns with existing procedures it would limit the ability to support the control and access of features demanded in a smart meter rollout.

### 4.2.2 Single SMMS with centrally located System Administration

In this solution a single SMMS manages all communications with the meters. This is the situation for the vast majority of meters deployed in the Australian NEM today. As highlighted in Section 3.2.2 modern packet based communications networks (used for meter types 1 to 4) require all communications to occur through the DNSP back office and for meter types 5 and 6, all service orders are first processed by the DNSP back office.

This solution is shown in the following figure. Note that the SMMS is able to choose between the Primary SMCN and an alternative communications path to the meter.

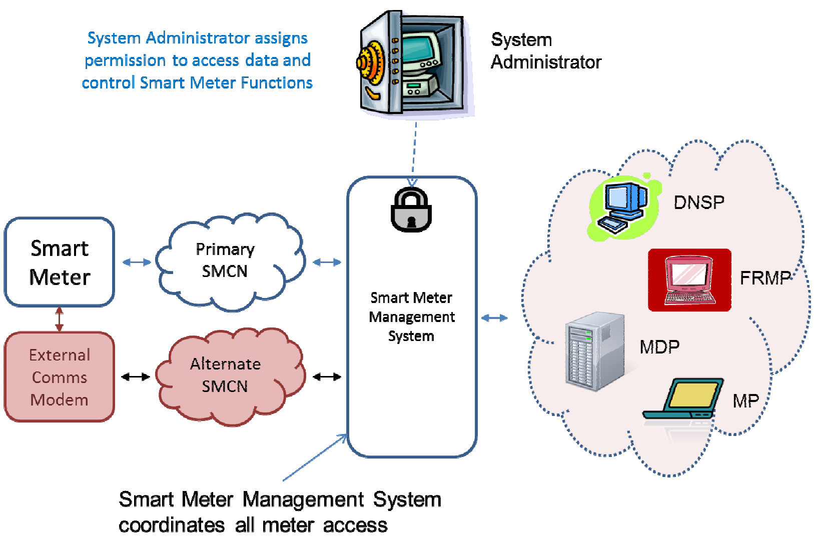


**Figure 17: Single SMMS with centrally located System Administration**

In Figure 17 the details of the System Administrator and SMMS are deliberately left vague, for example it could be assumed that the existing AEMO B2B gateway is providing the functionality or it could be implemented using a web-portal (for example as deployed to support the Texas Smart Meter rollout).

Use of a single SMMS makes it possible to coordinate the use of all meter functions. Section 3.3 presented a number of Control Steps that are required to ensure a predictable outcome when multiple Market Participants attempt to communicate with the meter. In Figure 17 these Control Steps are included in the "Padlock". A dashed line shows that the System Administrator can assign permission to access data and control smart meter functions. Referring to the example used in Section 3.3, the System Administrator would only allow the FRMP to send re-energisation and de-energisation commands to their assigned meters, requests from other retailers (not the FRMP) would be rejected. This is easily achieved since all interactions with the meter pass through the one SMMS.

This solution also has the potential to manage possible interactions between meter functionality as discussed in Section 3.3.1.

### 4.2.3 Multiple SMMS with centrally located System Administration

In this solution the alternate communications path to the meter is managed using a separate SMMS. In this figure the primary SMCN could be considered to be managed and used by the DSNP (for example in a mandated smart meter rollout).

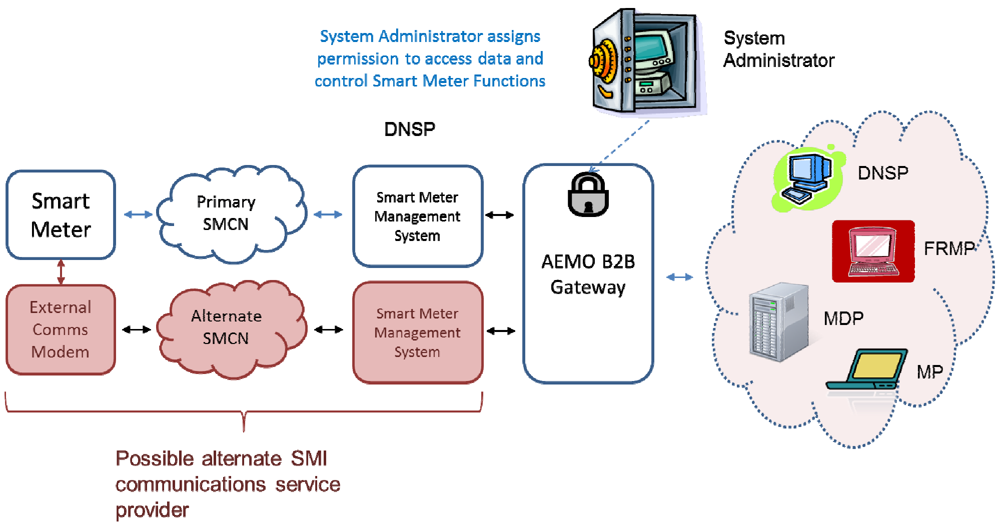


**Figure 18: Multiple SMMS with centrally located System Administration**

The Alternate SMI communications service provider is shown sharing information with the AEMO B2B gateway which implies that they are a registered market participant and must implement all the rules and regulations outlined in the National Electricity Rules.

Continuing to take examples from today's contestable meters, we could consider the second communications service provider to be performing the role of the meter data provider (MDP). As the MDP they can request a read-only password for the smart meter and commit to deliver metering data to the market. In this simple example there may be no need to coordinate access to meter functionality as the MDP has read-only access.

In the BPPWG they are currently creating a role for a Customer Function Service Provider (CFSP). The CFSP will be able to re-configure meters and control meter functionality. In this case the need to coordinate access to the meter must be considered. An answer may already exist in section 7.8.3 of the NER, taking the first point (the full section is shown above):

> **7.8.3 Changes to metering equipment, parameters and settings**
>
> Changes to parameters or settings within a *metering installation* must be:
>
> (a) authorised by *NEMMCO* prior to the alteration being made

This requires either SMMS to request permission from the AEMO B2B gateway before sending any instructions to meters affecting parameters or settings. This is shown in Figure 18 as the Padlock over the AEMO B2B gateway. The system administrator is therefore able to permit or deny requests to change meter settings.

The need to continuously request permission from the AEMO gateway before accessing the meter will place a large communications burden on the systems (potentially adversely affecting performance levels). A subtle change removes the need for the SMMS to request permission from the AEMO B2B gateway before accessing the meter. In this case (some or all) authorisations are pre-allocated. This is shown in the following figure where each SMMS now has its own padlock. Access to functionality is still controlled by the System Administrator.

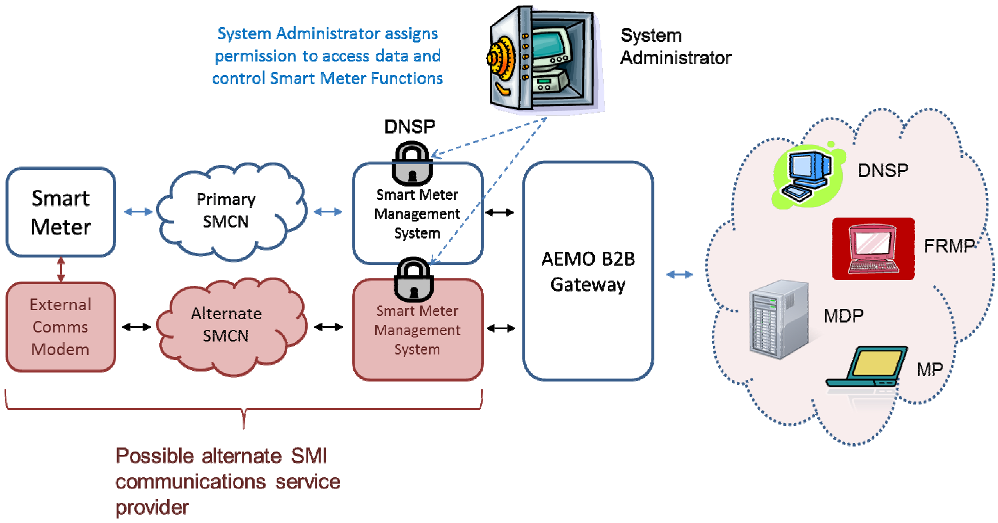


**Figure 19: Multiple SMMS each with separate access rights**

There is potentially one very big difference between Figure 18 and Figure 19 which must be explained. While removing the need to ask permission before accessing the meter appeared to have simplified the communications, it may compromise the ability to implement complex coordination of meter functions. For example referring to Scenario 2 presented in Section 3.3.1, the party responsible for reading the event log could differ from the party responsible for switching the supply contactor and/or setting supply capacity limits. There would therefore need to be additional messaging to ensure that the systems are able to handle the potentially complex interactions.

## 4.3 Summary

The following table summarizes the advantages and disadvantages of the solutions presented in Section 4.2.

**Table 1: Summary of solutions**

| Solution | Advantage | Disadvantage |
|---|---|---|
| Meter Coordinates Access with System Administrator managing meter passwords | Consistent with the controls detailed in the NER | Hardware limitations in the smart meter severely limit the ability to implement advanced access control<br>Impossible to handle possible interactions between functionalities |
| Single SMMS with centrally located System Administration | Duplicates the situation for the vast majority of meters in the NEM today | May limit contestability for provision of meter services |
| Multiple SMMS with centrally located System Administration | A flexible solution<br>Predefining access rights could reduce data requests to the System Administrator | More complex solution |

Note:

Currently the SMI F.S. does not describe the ability to restrict access by different users. It does not describe read-only passwords or assume that different users will be able to access one function, but not another. Changes will be required if this functionality is desired.

# Appendix A – Glossary

The following acronyms are in the NSMP Glossary.

| | |
|---|---|
| ACOSS | Australian Council of Social Services |
| AEMC | Australian Energy Market Commission |
| AEMO | Australian Energy Market Operator |
| AER | Australian Energy Regulator |
| AMI | Advanced Metering Infrastructure (Victorian smart metering program) |
| AS | Australian Standard |
| B2B | Business to Business |
| BPRG | B2B Procedures Reference Group (established under the IEC) |
| BPPWG | Business Processes and Procedures Working Group (established under the NSSC) |
| BRDRG | Business Requirements Definition Reference Group (established under the AMI program) |
| BRWG | Business Requirements Working Group (established under the NSSC) |
| CATS | Consumer Administration and Transfer Solution |
| COAG | Council of Australian Governments |
| DNSP | Distribution Network Service Provider |
| DRET | Commonwealth Department of Resources, Energy and Tourism (also referred to as RET) |
| EEEC | Equipment Energy Efficiency (E3) Committee |
| ENA | Energy Networks Association |
| ERAA | Energy Retailers Association of Australia |
| ESC | Essential Services Commission |
| FRC | Full Retail Contestability |
| FRMP | Financially Responsible Market Participant |
| HAN | Home Area Network |
| IEC | Information Exchange Committee (established under section 7.2A.2 of the Rules) |
| IHD | In-home Display |
| LNSP | Local Network Service Provider |
| MCE | Ministerial Council on Energy (established under the COAG) |
| MDA | Metering Data Agent |
| MDF | Metering Data File |
| MDFF | Metering Data File Format |
| MOU | Memorandum of Understanding |
| MRG | Metrology Reference Group (established under the RMEC) |
| MSATS | Market Settlement and Transfer Solution |
| MTWG | Metering Technology Working Group (established under the AMI program) |
| NCRE | National Consumer Roundtable on Energy |

| | |
|---|---|
| NECF | National Energy Consumer Framework |
| NEL | National Electricity Law |
| NEM | National Electricity Market which excludes Western Australia and Northern Territory |
| NEMMCO | National Electricity Market Management Company |
| NEO | National Electricity Objective (as set out in section 7 of the NEL) |
| NER | National Electricity Rules |
| NSMP | National Smart Metering Program |
| NSSC | National Stakeholder Steering Committee (National Smart Metering Program) |
| NT | Northern Territory |
| OMRV | Operating Model Requirements Version (Victorian AMI Program) |
| PDRG | Business Process & Data Reference Group (established under the RMEC) |
| PwC | PricewaterhouseCoopers |
| PTWG | Pilots and Trials Working Group (established under the NSSC) |
| RET | Commonwealth Department of Resources, Energy and Tourism |
| RIS | Regulatory Impact Statement |
| RFP | Request for Proposal |
| RMEC | Retail Market Executive Committee (an advisory committee to AEMO) |
| RP | Responsible Person |
| RPWG | Retail Policy Working Group (established under the MCE) |
| RWG | Regulation Working Group (established under the NSSC) |
| SCO | Standing Council of Officials (as established under the MCE) |
| SM | Smart Metering |
| SMCN | Smart Metering Communication Network |
| SME | Subject Matter Expert |
| SMI | Smart Metering Infrastructure |
| SMMS | Smart Metering Management System |
| SMWG | Smart Metering Working Group (established under the SCO) |
| SWIS | South Western Interconnected System in Western Australia |
| TFWG | Testing Framework Reference Group |
| TOR | Terms of Reference |
| TRWG | Technical and Regulatory Working Group (established under the AMI Program) |
| WA | Western Australia |
| WAIMO | Western Australian Independent Market Operator |
| WEM | Wholesale Electricity Market (Western Australia) |
| WIGS | Wholesale Inter-connector Generator and Sample |
| WG | Working Group |

# Appendix B – Reasons for installing alternate communications

While not a necessary consideration of this discussion paper one question often asked is why incur the cost of establishing a second communications path to the meter? A number of reasons are suggested below:

*Higher Performance Level*

Market participants do not feel that the performance level detailed in the SMI F.S. and therefore offered by distributors, is able to support proposed future customer offers.

*Privacy of Customer Offers*

During some BRWG meetings it was highlighted that some offers to customers should be treated confidentially. Having a separate communications path allows confidential messages to be sent to the customer without the need to pass through other back office systems.

*Service Charges*

Concern has been expressed at potential costs to access the SMCN. While there are no published prices the Australian Energy Regulator (AER) has considered remote services charges for accessing Smart Metering Infrastructure[5]. The review was conducted for the Essential Services Commission of Victoria (ESCV). The AER's draft recommendation is limited to a consideration of the SMI services, remote energisation, remote de-energisation, special read and meter reconfiguration. The report notes that remote energisation, remote de-energisation and meter reconfiguration will continue to use manual intervention for one to two years. Only the draft recommendation for Special Read costs can be used to provide an indication of likely service costs when using fully automated processing. Reproducing Table 3 from the AER recommendation:

**Table 2: AER Draft Decision for Special Meter Reads (their Table 3)**

| | Manual | | Remote Proposed | Remote Draft Decision |
|---|---|---|---|---|
| | **2010** | **2011** | **2010** | **2011** |
| CitiPower | **$23.82** | **$9.73** | **-** | **-** |
| Powercor | **$19.97** | **$14.86** | **-** | **-** |
| United Energy | **$29.91** | **$9.97** | **$2.00** | **$1.52** |
| JEN | **$20.91** | **$8.67** | **$1.93** | **$1.52** |

*Contestability for provision of SMI Service Functions*

Ensuring that there are alternative communications paths to the meter may allow third parties to complete for provision of the services. It is generally assumed that competition leads to higher service levels and lower costs for market participants.

*Improved communications reliability*

A spare communications link has the advantage of improving communications reliability, if one path fails the other can be used. Recall the failure of all Optus cellular communications in Brisbane (refer Figure 20). Any SMCN relying only on this commercial cellular network would have stopped working, however having

[5] Referred to as Advanced Metering Infrastructure in Victoria

an alternative means of communicating with the meters would have allowed the service provider to continue to communicate with the meter. A business case might be supported for some high value customers, for example those with large discretionary loads

Optus cable fault sparks outage

By Andrew Ramadge, Technology Reporter | news.com.au | July 15, 2008 12:00am

Recommend Be the first of your friends to recommend this.

A RUPTURED telecommunications cable shut down mobile and fixed-line phone calls and internet in Queensland and New South Wales for at least four hours today.

Hospitals, businesses and Brisbane Airport were affected by the outage after a fibre optic cable near Molendinar, west of Surfer's Paradise, was broken by workers laying a pipe.

Optus said the outage began at about 7.53am (AEST) this morning and was fixed by midday, but problems calling in and out of Queensland were reported well into the afternoon.

Queensland Premier Anna Bligh said it was unacceptable that the state's businesses and residents were so badly affected.

"Frankly, as the Premier of Queensland I am alarmed by the circumstances we see with telecommunications across Queensland today as a result of one cut in a cable," she said.

"We've seen chaos at airports, we've seen people unable to communicate with each other.

**Figure 20: Communications Links do fail (from www.news.com.au)**