TESTING TIMES
FOR SMART METERING

POINT OF VIEW

The critical role of Quality Assurance and Testing in the success of SMIP and six actions to take now
INTRODUCING THE COG ALLIANCE

CSC, Oracle, GE and Trustis have joined together to create the COG alliance — enablers of smart metering transformations that will help energy companies develop competitive advantage from smart metering.

**CSC**: Known for developing and supporting some of the world’s most complex IT systems integration programmes and delivering on its client commitments, CSC is the company often behind the systems and programmes that make businesses, governments and communities work.

**ORACLE**: With more than 380,000 customers and with deployments across a wide variety of industries in more than 145 countries around the globe, Oracle offers a comprehensive technology stack. Oracle pre-integrates its hardware and software to minimise integration effort and consequently reduce the total cost of ownership.

**GE**: One of the world’s leading infrastructure companies, GE provides solutions to energy, transport, healthcare, home, business, and aviation sectors. In the UK, their software is the network management platform for 90% of electrical networks and GE equipment and services generate 18% of the UK’s energy needs.

**TRUSTIS**: Recognised as the UK subject matter expert for high assurance ‘compliant PKI’ solutions and with conclusive expertise in smart metering, Trustis offers design and build as well as fully hosted or managed services using, in many cases, SC cleared personnel.

To find out more about the COG alliance, contact Phil Matthews at pmatthews3@csc.com
INTRODUCTION

In May 2013 the Department of Energy and Climate Change (DECC) announced the mass deployment of smart meters would be delayed until the autumn of 2015, with the intention to provide more time for the design, build and testing of critical systems. The delay highlighted not only the huge complexity and number of ‘moving parts’ in the Smart Metering Implementation Programme (SMIP), but also highlights the pivotal role that end-to-end Quality Assurance (QA) and Testing will play in ensuring its success.

Drawing upon our significant experience of QA and Testing, this paper shares some of our learning, including pitfalls to be avoided, in addition to suggesting six actions which energy suppliers should be undertaking now.

“One point everyone will agree on is that a successful smart metering deployment can only be achieved by a programme that has “SMART” characteristics:

SPECIFIC – You can clearly define what aspects of the security model, meter standards, user scenarios etc need to be delivered and tested.

MEASURABLE – You must have an understanding of how you will measure and track progress. Your progress should be tracked in terms of time, documentation and what working technology has been delivered.

ATTAINABLE – Before starting you need to be clear on the skills and tools needed to achieve the desired outcomes and that you can deliver these.

RELEVANT – If tracking deliverables such as document production, you must also be able to track the quality and completeness of that document.

TIME-BOUND – The SMIP implements a level of change and rollout that is unprecedented, compounded by challenging timescales. To keep to time, you will need to have an approach that uncovers the larger risks and issues early and that allows for careful resolution monitoring.

From our experience such SMART characteristics can only be achieved by the use of centralised QA and testing processes, either within each energy supplier or, where appropriate, shared across the industry.

“Fundamentally you can’t do your own QA, it’s a question of seeing your own blind spots.”

Ron Avitzur, The Graphing Calculator Story
Members of the COG alliance have helped many organisations to implement a centralised QA/Testing Centre of Excellence. Typically there have been reported three major benefits:

**INCREASE IN THE QUALITY OF SOFTWARE**

**DELIVERABLES BY 20-30%**

This is indicated by the reduction in defects after they go live and is tracked using a range of metrics to monitor testing progress, application quality and production readiness.

**INCREASE IN TEST COVERAGE BY 50%**

A centralised QA framework will include a traceability matrix to ensure all requirements are mapped to test scenarios so that all functionality is covered by test cases. Risk based testing ensures critical functionality is covered while automation ensures this and all less critical functionality is covered. Re-use and repeatability are key features of a centralised QA framework. This approach ensures that the many technology combinations involved can be tested.

**REDUCTION IN TEST COST BY 20%**

Due to the challenges in getting technology, data and users correctly set-up to conduct testing; often initial tests fail. We achieve a higher quality in tests by identifying defects earlier in the life cycle. This is achieved by the use of re-usable assets in the QA/testing frameworks, and consistent application of best practice implementation processes.

**DEPLOYMENT PLANNING**

Energy suppliers’ smart meter deployment plans will need to encompass not only the capabilities and contributions of their IT department and a plethora of impacted business units (e.g. billing, customer engagement, customer services, call centres, installation etc.), but will also need to take full account of the work being undertaken by various partners and third party suppliers.

It is therefore essential that a comprehensive QA and testing framework forms an integral part of the deployment plan providing defined, measurable certification and validation across the entire programme lifecycle. A common starting point for all energy suppliers in creating the deployment plan is likely to be the testing phases identified by DECC:

- Protocol
- CPA
- DCC Solution
- Pre-Integration
- Systems
- Cryptographic
- Security Systems
- Control, Data Protection
- User Integration
- Market Entrant
- Interface Testing
- End to End (Supplier & DCC)

How each energy supplier chooses to embed the critical customer experience within each of the identified test phases is likely to determine the extent to which early indicators of customer satisfaction, with the planned smart metering implementation approach, can be generated and accordingly amended and enhanced.

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**QUALITY ASSURANCE FRAMEWORK AND GOVERNANCE MODEL**

A typical centralised QA/testing framework such as that illustrated here would enable Energy Suppliers to establish a multi-pronged programme capable of governing the multitude of parallel project activities that will be taking place during their smart meter deployment programme.
TESTING FRAMEWORK MUST ADDRESS THE CUSTOMER EXPERIENCE

The customer benefits of smart meters include:

- end of the estimated bill
- ‘accurate’, near real-time, usage data
- no need for manual meter readings
- end to service repair ‘guessing game’
- Increased control over energy usage and cost

Of course, it is the customers who will judge the energy supplier’s delivery of those benefits. The customer may expect their information to be consistently and securely accessible via multiple channels, such as web and mobile apps, call centres, twitter and periodic billing. It is therefore imperative that customer experience is clearly defined in a supplier’s QA/testing framework.

Traditionally, the ‘hands on’, dry run activities for customers occur towards the end of a programme. As a result defects or functions that don’t meet the customer expectation only start to become apparent during user testing. Our experience indicates that user concerns revealed at this late stage are usually valid and can be tracked back to gaps in the requirements when the solution was first in development.

This means it is important that the customer experience is properly incorporated into early phases of test design, in order to support deployment readiness. Testing can provide experience and generate valuable material for training ‘smart staff’ on the use of the new and voluminous data which will be generated by smart meters.

ENABLING CUSTOMERS TO EXPERIENCE THE BENEFITS OF SMART METERS BEFORE MASS DEPLOYMENT

The introduction of smart metering should be an invitation to interact with this real time reporting technology and so the new customer experience should be online and instantaneous. Energy suppliers must be ready to react and adjust their customer engagement strategies to take account of the ‘real time’ customer voice.

Smart metering QA/testing will need to include an innovative use of the latest testing methods to cover web based and mobile applications. The tests need to be realistic, particularly in their ability to simulate real-life performance, and mirror closely what the customer will see (usability testing). Consumer communication alternatives have redefined business communications and so testing strategies will similarly need to demonstrate innovation, for example:

- Web application performance testing
- Mobile application testing
- Validation of social media interfaces to customer care centre functions

“Actual tests are part of planning too. At least, they can be, if done consciously.” Ben Simo

PROGRAMME AND SENIOR EXECUTIVE DASHBOARDS

A well run QA/testing framework provides senior executives with powerful reporting dashboards to manage their smart meter programme. This enables them to have an on demand, real-time, single source, end-to-end programme view. Progress milestones are displayed per project, per team and per vendor. As an innovative approach to client engagement, it is possible to conduct testing outcome ‘dashboards’ via the web or mobile apps, making results available to customers.
There are so many parties involved in the smart meter deployment that repeatability and regression testing will be key, for the solution will have to cope with constant change. The hardware standards for smart meters alone, with the various SMETS versions, are still emerging and have yet to be tested for interoperability, let alone the additional technology required for other parties involved such as comms providers, meter installers and the energy suppliers themselves. Not only does the solution have to work, but it has to work at scale as this will be the world’s largest and arguably most complex deployment of smart meters.

The broad benefits of test automation are;
- Lower cost and time to deploy tools and create automation
- Enable solutions for emerging test challenges (e.g., smart grids, security compliance)
- Standardise test platforms and infrastructure
- Continue and enhance the ability to handle multiple technologies, for example meters inherited when customers change supplier, and the new supplier has little experience of the inherited meter technology
- Grow the offering by supporting interfaces for non-developers to script

The right testing automation products provide energy suppliers with the ability to replicate customer usage patterns that will be invaluable as smart capabilities such as dynamic pricing are trialled and rolled out.

**TEST DRIVING THE SMART METER PLATFORM**

With the right use of testing automation the entire performance testing activity can be conducted in a simulated environment rather than a real-time environment, removing the limitations of having to provide test networks and real smart meters. The latest engineered systems and cloud-based testing platforms can emulate millions of smart meters, cost effectively, meaning designs and architectures can be tested early prior to mass deployment and can simulate the interactions of different types of meters.

Simulation will be the best possible way to test performance and load as it is practically impossible to have a test bed that is a replica of the real-time environment. Our experience with test optimiser and simulation tools has shown it is possible to have a much broader coverage of scenarios across the end-to-end smart metering solution, and to include a wider variety of tests to push the limits of the system than has been previously attainable.

Data generation and data masking products allow the use of existing customer data, while protecting private and confidential data. Finally the use of testing technology makes it easier to analyse testing results and publish results with stakeholders and customers, in order to prove commitment to data protection and system integrity.

**SECURITY TESTING**

Customer concerns about security affirm the need for energy suppliers to develop comprehensive smart metering test programmes. Rigorous testing by suppliers should demonstrate compliance with the national security standards for critical national infrastructure and security standards set by the SMIP. Customers understandably will not tolerate security compliance that is compromised or minimised.

Customers expect their energy suppliers to use the appropriate experts for all aspects of the smart metering programme. The experts in security should have prior experience in enabling governments and their agencies so that they have an understanding of government mandated programmes, such as the UK SMIP. Security must be viewed as an end-to-end solution for the successful smart meter programme.

Compliance is the watchword. QA programmes which create oversight in testing can have huge impact on the performance of smart meter platforms. The energy suppliers have to establish firm plans which:
- Assure their ability to meet the security policy
- Implement operational test environments
- Identify risk and manage risks
The benefits of:

Actions that energy suppliers should do now:

1. **Define the testing strategy and approach**
   - Align the test approach to the architecture of both the DCC and their internal systems, in order to manage the test scope in line with the required changes.
   - Define the testing approach so that the performance and robustness of the end-to-end systems is measurable and repeatable.
   - Design scenarios and requirements to demonstrate the “testability” of customer initiated transactions.
   - Standardise the definition of testing requirements that will lead to more efficient test execution and coverage.
   - Create opportunities to build in repeatable processes for the project teams and QA/testing teams, that can then be used as a base to build quality into the entire deployment programme.
   - Demonstrate the readiness of infrastructure and applications by combining users from remote locations with tools such as load generators, to drive load into the application.

2. **Build DCC compliance into QA/testing programme**
   - View your testing broadly – can it be proved compliant with DCC regulation?
   - Identify and use testing strategies and testing tools to accelerate your programme.

3. **Matrix of testing types across the project lifecycle**
   - Ensure you understand a variety of testing types.
   - Manage interoperability testing by using stack certification to test where each hardware and software component can be tested against multiple configurations.
   - Manage the cryptography of smart meters throughout their lifecycle by using early and continuous performance testing.
   - Use regression testing to base tests around messages, this will allow suppliers to link business outcomes to the technical smart metering components whilst ensuring business and technical integrity can be maintained should change occur.
   - Detect defects early by using continuous integration to simulate missing components.

4. **Plan for stringent infrastructure testing**
   - Use simulation and isolate problems to avoid system failures or performance issues when upgrading technology.
   - Ensure infrastructure testing considers both business readiness and high availability.
   - Link your end-to-end communications planning to end-to-end QA/testing framework.

5. **Understand how test automation will reduce costs and increase test coverage**
   - Use test automation to significantly accelerate the use of repeatable compatibility, performance and security testing.
   - Have a plan for how to adopt test automation so that it creates maximum impact.

6. **Prepare for the people component of successful testing**
   - Ensure you have access to the right technical skills, business knowledge, technology and testing experience, when needed.
HOW THE COG ALLIANCE CAN HELP

• Provision of QA/testing frameworks to support energy suppliers’ testing efforts

• Support for independent testing and verification of smart meter technology such as head-end and meter data management systems in operation for UK energy companies today

• Utility industry experts, robust testing tools, infrastructure and test facilities

• Test Strategies based on real-life experience of multi-million meter deployments and validating the ‘upstream and downstream’ data flow

• Automated measurement and metrics dashboard solution designed for utility smart metering testing

• SAP ISU packaged accelerators - pre-built automated test scripts and defect prediction models

• Access to industry experts, ‘best in class’ solutions and tools from across the COG alliance (CSC, Oracle, GE and Trustis)