SEC Modification Proposal, SECMP0028, DCC CR4749

Prioritising Over The Air Messages

Preliminary Impact Assessment (PIA)

Version:	**0.3**
Date:	**23rd September 2022**
Author:	**DCC**
Classification:	**DCC PUBLIC**

Data Communications Company

Contents

1 Executive Summary

The Change Board are asked to approve the following:

- Total cost to complete the Full Impact Assessment of £**15,260**.
- The timescales to complete the Full Impact Assessment of 40 working days.
- ROM costs for SECMP0028, up to the end of Pre-Integration Testing (PIT) of £350,000 to 750,000.

Problem Statement and Solution

Periods of high Over The Air (OTA) message volumes going through the DCC Systems could result in message queuing and increased processing times. Without prioritisation of consumer-driven OTA messages during periods of high system traffic, consumers may experience unnecessary outages and delays to their supplies being made live following outages. Depending on the vulnerability of affected consumers, the implications could be severe if not addressed.

There have already been instances of Users not receiving important On Demand Responses in time because there was so much Scheduled data collection going on.

Modification Benefits

The Modification would establish multiple tiers of priority in the Data Service Provider (DSP) that can categorise OTA messages depending on the relative importance of processing them quickly. OTA messages with a 'Priority Level 1' would be fast-tracked in any DSP queues such that they are resolved ahead of any lower priority level OTA messages. By including commands, responses and alerts as part of the solution this would ensure that consumers and Users receive key Smart Metering data and requests before less important OTA messages without a corresponding negative impact on supply and business processes.

Reconfiguring priority levels will be a relatively simple process, allowing configuration changes as the types of traffic change.

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2 Document History

2.1 Revision History

Revision Date	Revision	Summary of Changes
16/08/2022	0.1	Initial version, for DCC internal review
23/08/2022	0.2	Reviews with DSP completed
06/09/2022	0.21	Minor typos updated
22/09/2022	0.3	Changed Modification title after Proposer feedback

2.2 Associated Documents

This document is associated with the following documents:

Ref	Title and Originator's Reference	Source	Issue Date
1	SECMP0028 Modification Report v0.4	SECAS	25/07/2022
2.	SECMP0028 Business Requirements v0.7	SECAS	25/07/2022

References are shown in this format, [1].

2.3 Document Information

The Proposer for this Modification is Andy Knowles of Utilita. The proposal was initially submitted in December 2016. An Initial Modification Report was prepared and published in January 2017.

The Preliminary Impact Assessment (PIA) was requested of DCC on 27th July 2022. This is issued as DCC CR4749.

It should be noted that the term "OTA Message" or "OTA message" has been used throughout the Requirements and supporting documentation published by SECAS. The terms 'OTA' and 'Message' are defined terms but not used together. 'OTA' is usually only used in the context of firmware images in the SEC. DCC proposes that the term should be defined using GBCS terminology as follows.

OTA Messages can be:

- A Command, Response or Alert
- Alert: A Message generated by a Device including in response to a problem or the risk of a potential problem
- Command: An instruction to perform a function received or sent via any interface
- Response: A response to a Command received or sent over any interface

Note that DCC believes that this definition and usage would require an exception or acknowledgment within the Performance Measurement Report (PMR) and/or the Performance Measurement Methodology (PMM).

3 Context and Requirements

In this section, the context of the Modification, assumptions, and the requirements are stated.

The requirements have been provided by SECAS, the Proposer and the Working Group.

3.1 Current Arrangements

The Proposer has noted that periods of high Over The Air (OTA) message volumes going through the DCC Systems can result in message queuing and increased processing times. As a consequence, consumers may be adversely impacted. This is because increased processing times for OTA messages driven by Energy Consumers, e.g., prepayment meter top ups, could cause a loss of supply or a delay in regaining supply.

3.2 What is the Issue?

Currently, the DCC are required to process all OTA messages in accordance with the Target Response Times (TRTs) outlined in Smart Energy Code (SEC) Section H3.14 and SEC Appendix E 'DCC User Interface Services Schedule'. In situations where there are high volumes of OTA messages the DCC Total System could approach or exceed processing capacity. This could cause DCC Users to experience variations to service performance and delays to TRTs.

Under current arrangements, OTA messages are processed in the order in which they are received across the DCC Total System and there is no mechanism for prioritising specific OTA messages during high volume periods. It has also been noted that delays to the processing of consumer-driven Service Requests could cause the User to resend the same message until the desired Response is received, which may exacerbate the high volume of messages and cause further delays to Response times.

The Proposer believes that the SEC arrangements have been primarily drafted to cater for credit consumers and do not adequately cater for Prepayment Consumers, and has highlighted that delays to the processing of consumer-driven Service Requests, for example Service Reference Variant (SRV) 2.2 'Top Up Device', may lead to negative impacts on the consumer experience. This is because this Service Request could action the enabling or disabling of supply for Prepayment consumers.

3.3 Impact of the Issue

In the case of the DCC Systems being overloaded and not processing OTA messages, cost and reputational damage would be caused to Suppliers and to the industry as a whole.

In a Request for Information issued by SECAS in September 2021, no SEC Parties identified situations where Consumer-driven Service Requests had been delayed during periods of high system traffic. Separate consultations conducted with DCC Users and Service Providers as part of the DCC's Network Enhancement Plan concluded that without technical enhancements to mitigate the increases in DCC Total System traffic, instances of process delays were highly likely to increase.

Without prioritisation of consumer-driven OTA messages during periods of high system traffic, and specifically those OTA messages relating to Prepayment top ups, the Proposer believes consumers may experience unnecessary outages and delays to their supplies being made live following outages. Depending on the vulnerability of affected consumers, the implications could be severe if not addressed.

There have already been many instances of Users not getting their important On Demand Responses in time because there was so much Scheduled data collection going on.

3.4 Solution Approach

The Proposed Solution will be applied to Smart Metering Equipment Technical Specifications (SMETS)1 and SMETS2+ Devices.

The Solution would establish multiple tiers of priority in the DSP that can categorise OTA messages depending on the relative importance of processing them quickly. OTA messages with a 'Priority Level 1' would be fast-tracked in any queues such that they are resolved ahead of any OTA messages with lower priority levels (subsequently higher numbers denoting lower priority). OTA messages with lower priority levels would still be processed in the order consistent with their assigned levels.

Figure 1 below demonstrates the prioritisation method intended to be delivered by the Proposed Solution:

- Messages will be processed in order of their Priority Level, regardless of the order in which they are received
- Priority Level 2 messages will be processed once there are no Priority Level 1 messages waiting, and so on for the remaining Priority Levels
- Newly received messages with a higher Priority Level than the queued messages will be processed ahead of them

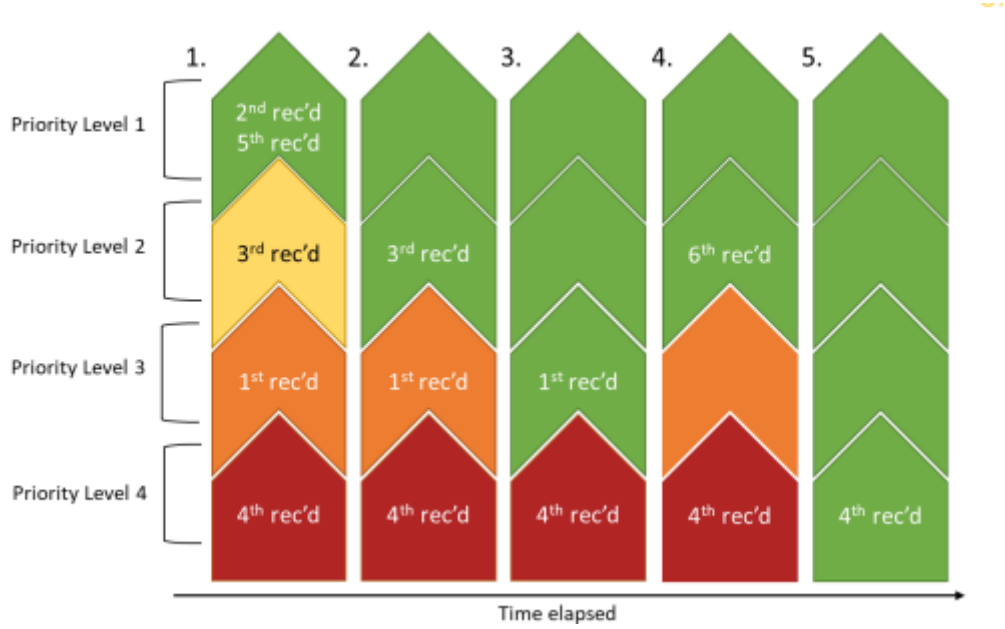

Figure 1: Proposed Prioritisation of Messages

At the Requirements Workshop for this Modification the following points were made:

- Regarding the use of a 'Priority Lane' with dedicated infrastructure, the DCC and Service Providers advised this would likely result in a significant increase to implementation costs. All members agreed that the prioritisation levels should apply

at all times to avoid complicating the solution with an 'activation mechanism', and that the solution should be "digital only" i.e., with no added infrastructure.

- The DSP noted that full process pathways should be considered when assigning priority levels, not just standalone OTA messages, as queueing is a bigger issue when DSP is sending messages back to the Service User rather than in the CSP network. Assigning priority levels to Alerts will be discussed and agreed by the Working Group.

3.5 Business Requirements

The business requirements are as follows.

Requirement 1: To assign a priority level to all OTA messages allowing them to be processed in a specific order in the DSP Systems.

The solution would establish multiple tiers of priority in the DSP that can categorise OTA messages depending on the relative importance of processing them quickly. OTA messages with a 'Priority Level 1' would be fast-tracked in any queues so that they are processed ahead of any OTA messages with lower priority levels (subsequently higher numbers denoting lower priority). OTA messages with lower priority levels would still be processed in the order consistent with their assigned levels. The solution would establish the following criteria against each priority level:

Priority Level	Criteria
1	OTA messages relating to the continuity of a consumer's energy supply.
2	OTA messages which are required for an engineer to complete on-site activities.
3	OTA messages with an indirect impact on a consumer's energy supply, and/or OTA messages required to comply with a consumer request.
4	None of the above criteria apply.

DCC notes that:

1. The number of Priority Levels and their associated Service Requests, responses, and Alerts will need to be determined by the Working Group and industry sub-committees before Go Live.

2. The solution will be designed such that the number of Priority Levels is not fixed at four, and is configurable.

3. The full range of OTA messages should be considered in this solution, such as emergency firmware updates, Business as Usual Device firmware updates, critical and non-critical commands.

4. In design discussions for other proposed changes, a priority level for Responses and Alerts has been suggested as follows:

    a. Service Responses other than Scheduled Service Request responses (see item d below)

b. High Priority Alerts: a configurable list of Northbound[1] High Priority Alerts, which may include both Device Alerts and DCC Alerts

c. Other Alerts: Device Alerts and DCC Alerts other than high priority alerts

d. Scheduled Service Request Responses: responses to commands sent out as a result of a scheduled operation

A detailed piece of work will be required prior to the FIA being issued to determine the number of priority levels and the assignment of Service Requests, Responses, and Alerts to each.

Requirement 2: To make all priority level assignations fully configurable.

It must be relatively simple to change an OTA message's assigned priority level. In the event that a new process is introduced or there is a change to an existing process, certain OTA messages with a lower priority may become part of a critical pathway for an urgent process. Equally, changes to processes may result in certain OTA messages no longer being crucial to the success of those processes. It is therefore necessary to introduce a method by which priority levels can be reconfigured as and when appropriate.

As part of the PIA, SECAS requested the DCC investigate the technical solution for changing priorities. Although not covered in this PIA, SECAS and the Proposer will engage with industry to determine which bodies or committees should have oversight for changes to the Priority Levels. This could also apply in the hypothetical instance that powers are introduced for Sub-Committees to override priority levels in an infrastructure critical event.

[1] Northbound; Responses and Alerts received by the DSP from Smart Metering Devices
Southbound; Requests received by the DSP from Service Users

4 Description of Solution

The following sections give an overview of the high-level outline solution created to support the PIA discussion and associated PIA responses from DCC and its Service Providers, along with considerations of design assumptions with the solution.

4.1 High Level Architecture

Currently all messages are passed from Request Manager North (RMN) to Message Gateway North (MGN) irrespective of type of message or rate limiting. This will change to minimise the chance of a High Priority message (Priority Level 1) being delayed by a Low Priority message.

A key principle of the design is that full process pathways should be considered when assigning priority levels, not just standalone OTA messages, as queueing is a bigger issue when the DSP is sending messages back to the Service User rather than over the CSP network. Queues are the DSP technical solution for exchanging messages from tier to tier in a loosely coupled fashion. The "queue" will build up if the destination tier cannot process quickly enough, but there is always a queue, even if it is just one message long.

In this design, all High Priority messages will continue to be passed straight to the MGN.

For delivery to Service Users, the Northbound prioritisation approach is that any Service Responses with lower priorities may be queued within the DSP to ensure that the Priority Service Responses received relating to On Demand requests are not subject to processing delays. Where large volumes of Scheduled Responses might slow down the delivery of the Priority On Demand Service Responses, the solution shall ensure that the On Demand Responses are returned to Users before the Scheduled Responses. To achieve this, the solution shall augment the prioritisation established in a previous change, CR1344, "DSP Buffering", such that Northbound messages are treated in one of the following ways:

1. Passed straight to Message Gateway North

2. Stored in the Motorway cache-based Northbound Message Store (NMS) for priority based retrieval

3. Stored in the Oracle based Service User Retry Buffer (SURB)

CR1344 also implemented a specific rate limit for each Service User (SU); if a SU has notified DCC of a required lower rate it has been implemented, otherwise a default rate is used. The first option is used only when there are no high priority messages in SURB for a specific Service User, and the current usage is lower than the current SU rate defined for that SU.

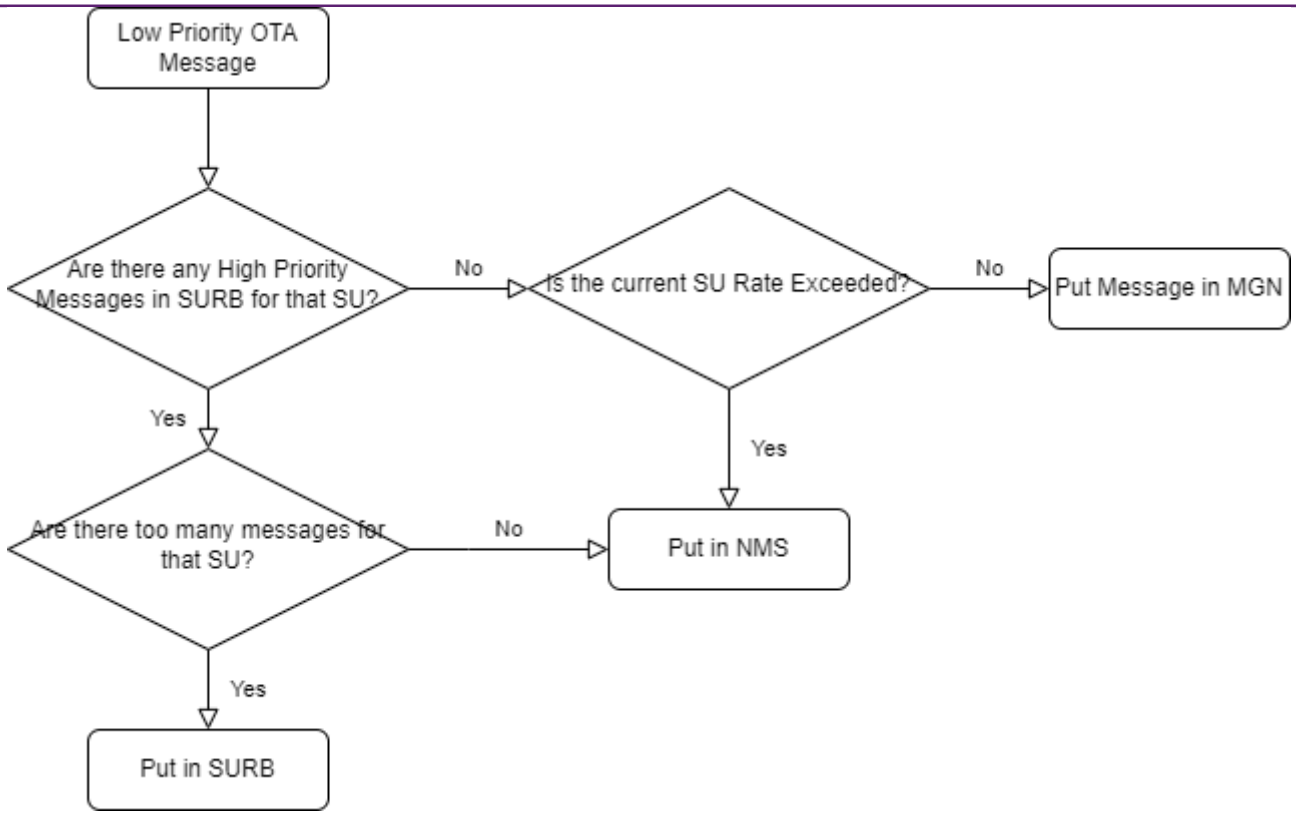

Figure 2: Northbound Prioritisation Flowchart

Low Priority messages are passed straight to the MGN only when there are no High Priority messages in Service User Retry Buffer for that Service User, and the Service User rate is within the current rate limit defined for that Service User. If this is not the case, and there is sufficient room in the NMS and there are not too many messages for the SU in the NMS, the message is stored in the NMS, from where messages are retrieved periodically and merged with Business as Usual (BAU) traffic according to message priority and SU rate limits. Otherwise, the low priority message is transferred to SURB and will be subject to the standard Northbound Buffering functionality.

The DSP solution will include prioritisation for both Southbound messages (Requests) and Northbound messages (Responses and Alerts) as shown in Figure 3 below.

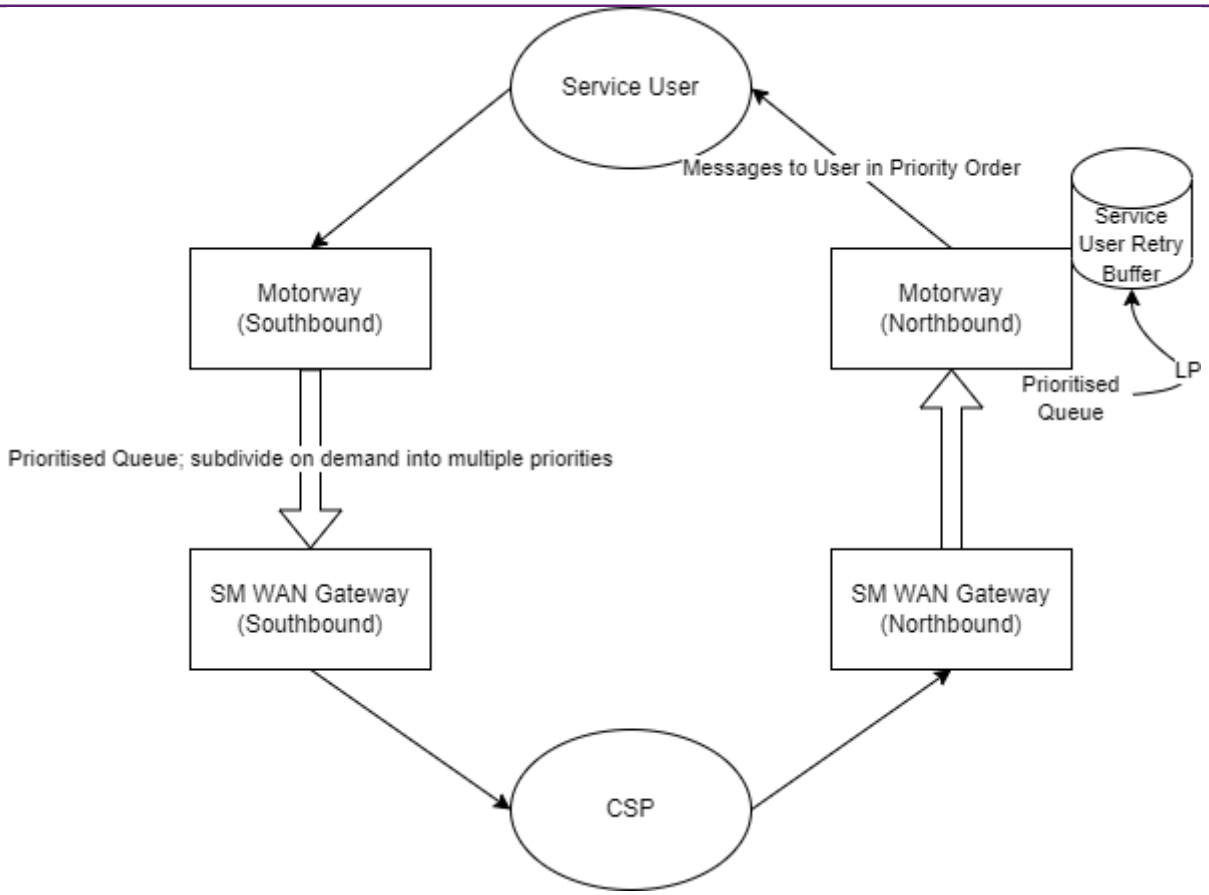

Figure 3: Northbound and Southbound Prioritisation

The solution will assign a priority to all Southbound messages (based on SRV and mode of operation) to be used when selecting work from queues for onward transmission to the Smart Metering WAN (SM WAN) and to prioritise delivering responses to Service Users. Note that the priority determined is not recalculated when handling the Northbound response (so rule changes will not apply to messages already in flight).

5 Impact on DCC Systems, Processes and People

This section describes the impact of SECMP0028 solution on DCC Services and Interfaces that impact Users and/or Parties.

5.1 Security Impact

This change does not impact on security design patterns, security component configuration, change communication flows or on exposed interfaces. It simply involves changes to the application business logic, reuse of extant components (including SURB), and changes to the format of alerts. As such, no penetration testing is recommended, nor is there any material impact on protective monitoring.

The implementation will be security assured throughout. This assurance includes reviewing designs, test artefacts and providing consultancy to the implementation and test teams. A more detailed security impact will be carried out as part of the Full Impact Assessment.

5.2 Technical Specifications

There is no anticipated impact on DUIS, GBCS, or any other technical specifications.

5.3 Integration Impact

This change involves additional work for the DSP system in prioritising messages and the resultant queuing and dispatching of those messages. The impact of these changes will be performance tested to ensure that the additional processing required to implement this prioritisation, queuing and dequeuing functionality is as efficient as possible and has no material impact on the DSP system. Any traffic that is queued and bypassed by higher priority traffic will, of course, spend longer 'inside' the DSP system than it would have, had it not been queued. Performance testing during PIT is required to both ensure that the performance of the system will allow the DSP to maintain Service Level Agreements (SLAs) and to establish where there is a material impact on the underlying infrastructure.

An element of regression testing will be carried out as part of the SEC Release that includes this change. However there is no anticipated requirement for SIT and UIT testing specific to this Modification.

5.4 Infrastructure Impact

No infrastructure impact is expected from this Modification. It should be noted that the aggregated impact of many such changes to the DSP solution will ultimately result in a reduction of the available processing headroom assumed as part of the original Agreement. As such, it may be necessary for DSP to raise a BAU CR for the provision/ of additional infrastructure to ensure the DCC Total System does not experience performance problems that are the direct result of the accumulation of such changes.

5.5 Service Impact

The changes noted above are not expected to alter traffic volumes significantly, nor to add to message processing time. However, the Priority Level introduce some additional technical complexity to the DSP solution and has the potential to introduce additional service related Incidents. The DSP Service team will be required to closely monitor message volumes and response times post deployment and, based on past experience, might also be required to apply configuration adjustments to scheduling as required.

Although system alerting will be reviewed prior to deployment under normal transition to operation (TTO) tasks, it is likely that refinements to alerting thresholds will be required post deployment as traffic patterns change.

It is also expected that Service Users will raise a number of Incidents as they look for assistance and guidance after the changes to northbound traffic patterns are applied. This has been estimated at two medium complexity support cases per month.

The Contractor has provisioned an increase in the support during four months of the Early Life Support (ELS) period to ensure that any issues raised during this period are resolved with minimal impact. This ELS period will start once the Modification is deployed to production and the prioritisation is enabled; and will last for 4 months from this date.

5.6 Safety Impact

No impact is expected, but a full Safety Impact Assessment will be carried out as part of the production of the FIA.

5.7 Changes to Priority Levels

DCC recommends any changes to existing Priority Levels and the related OTA Messages should be included in a DSP Maintenance Release for ease of governance and monitoring.

5.8 Reporting

Note that DCC believes that would require some sort of exceptions or acknowledgment within the Performance Measurement Report (PMR) and/or the Performance Measurement Methodology (PMM). This should be reviewed as part of the Full Impact Assessment.

5.9 Legal Text

DCC recommends that the introduction of the new definition and usage of the term "OTA messages" should be included in the SEC or associated documentation.

DCC recommends that any specific ordering of the OTA messages is not encapsulated in the SEC. If this were not the case, any changes to the ordering, changes to business processes or changes to the nature and attributes of Alerts, Commands, or Responses would require a SEC Modification.

6 Implementation Timescales and Approach

This Modification is expected to be implemented in a future SEC Release. Design, Build, and PIT is expected to take about six months to complete after the CAN is signed.

Details of the implementation will be finalised in the FIA.

6.1 Implementation Approach

Implementation of this change is assumed to follow a hybrid of agile and waterfall methodology. The release lifecycle duration will be confirmed as part of the FIA.

6.2 Testing and Acceptance

It is assumed that the change will be implemented and tested as part of a major release and will include release based regression testing in SIT and UIT.

7 Costs and Charges

The scope of supply under this PIA includes design, development (build), system testing, and performance testing within the PIT environments.

The Rough Order of Magnitude cost (ROM) shown below describes indicative costs to implement the functional and non-functional requirements as assumed above. The price is not an offer open to acceptance. It should be noted that the change has not been subject to the same level of analysis that would be performed as part of a Full Impact Assessment and as such there may be elements missing from the solution or the solution may be subject to a material change. As a result, the final offer price may result in a variation.

7.1 Design, Build and Testing Cost Impact

The table below details the cost of delivering the changes and Services required to implement this Modification. For a PIA, only the Design, Build and PIT indicative costs are supplied.

£	Design, Build and PIT
Prioritising Service Requests	£350,000 – 750,000

Based on the existing requirements, the total fixed price cost for a Full Impact Assessment by all Service Providers is £**15,260** and would be expected to be completed in 40 working days.

8 Risk, Assumptions, Issues, and Dependencies

In the following sections, Risks, Assumptions, Issues, and Dependencies have been identified. Two clarifications are also requested.

Further RAID may be established as part of the Working Group reviews and the FIA.

8.1 Risks and Issues

None at this time.

8.2 Assumptions

Ref.	Assumption	Impact
SECMP28-AA1	Prioritisation applies to all northbound messaging – responses, device alerts, S1SP Alerts and DCC Alerts.	Design principle.
SECMP28-AA2	All On-Demand instructions are in high priority (Level 1) categories. This is required in order to continue to support current Target Response Times.	If this is not the case, performance could be degraded. This will be reviewed as part of the FIA.
SECMP28-AA3	Prioritisation will be relatively static, i.e. how messages are prioritised will not change frequently and it is assumed that any change will be less frequent than once per year.	Many changes will require frequent configuration changes and efforts.
SECMP28-AA4	Although SIT and UIT testing is not required for this Modification, regression testing will be carried out based on other Modifications and CRs in a SEC Release, and will ensure this Modification is free of defects.	By testing the functionality changes in PIT, this approach reduces costs.

8.3 Dependencies

Ref.	Dependency	Impact
SECMP28-AD1	If Northbound Prioritisation is added to the solution by Marketwide Half Hourly Settlement (MHHS), the effort and cost to implement this change will be reduced.	DCC will monitor and review other changes.
SECMP28-AD2	The number and content of the Priority Levels must be defined and agreed by the Working Group before solution development can begin.	Without an agreed definition, any solution will be subject to change.

Appendix A: Glossary

The table below provides definitions of the terms used in this document.

Acronym	Definition
CAN	Contract Amendment Note
CR	DCC Change Request
CSP	Communication Service Provider
DCC	Data Communications Company
DSP	Data Service Provider
DUIS	DCC User Interface Specification
ELS	Early Life Support
ESME	Electricity Smart Metering Equipment
FIA	Full Impact Assessment
GBCS	Great Britain Companion Specification
MGN	Message Gateway North
NMS	Northbound Message Store
OTA	Over the Air
PIA	Preliminary Impact Assessment
PIT	Pre-Integration Testing
PMM	Performance Measurement Methodology
PMR	Performance Measurement Report
RMN	Request Manager North
ROM	Rough Order of Magnitude (cost)
SEC	Smart Energy Code
SECAS	Smart Energy Code Administrator and Secretariat
SIT	Systems Integration Testing
SLA	Service Level Agreement
SMETS	Smart Metering Equipment Technical Specification
SMWAN, SM WAN	Smart Metering Wider Area Network
SR	Service Request
SRV	Service Request Variant
SU	Service User
SURB	Service User Retry Buffer
TRT	Target Response Time
TTO	Transition to Operations (Implementation to Live)
UIT	User Integration Testing