Data Communications Company

Scaling and Optimisation

Consultation on proposed changes to WAN modulation.

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Table of Contents

1. Context and Executive Summary

1. The Data Communications Company (DCC) is Britain's digital energy spine, supporting the transformation of the energy system. DCC is licensed by the Government and regulated by the energy regulator Ofgem to connect smart meters in homes and small businesses across Great Britain to a single secure, digital network. DCC supports the roll-out and operation of second-generation (SMETS2) smart meters, as well as the migration and operation of existing first-generation (SMETS1) meters onto our network.

1.1. Executive Summary

2. The operation of smart meters is reliant on communication with DCC through the Wide Area Network (WAN). Great Britan is split in to three Communication Service Provider (CSP) Regions for WAN provision.

3. The CSP North (CSPN) Region utilises a Long-Range Radio (LRR) solution. When opted for, LRR was considered the optimal coverage option for the geographically diverse location due to the long-range reach and high levels of in-building penetration that the technology would afford. For these reasons the LRR solution was deemed to be more suitable for CSPN than a cellular network solution. However, the long-range reach of this technology impacts the volume of data that can be transferred.

4. As the volume of smart meters installed in CSPN has increased, so too has the demand placed on the WAN. Utilisation of the network has changed from initial concept including the size of messages, the timing of messages and the overall volume. These evolving requirements as installation volume has increased ultimately led to a requirement to increase the capacity of the network to maintain performance.

5. The CSPN Scaling and Optimisation (S&O) project was established in 2021. The project was tasked with identifying the risks of capacity being exceeded as smart metering continues to scale up in CSPN, and to identify potential solutions to reduce or manage those risks.

6. The project validated DCC's capacity concerns and assessed that requirements have evolved materially since the solution was chosen, and that the CSPN network as currently designed and implemented will not be capable of meeting demand as the utilisation of the network has evolved as installations increase. This is described within the CSP.N Service Scaling and Optimisation CSP North Radio Network Phase 1 Report[1].

7. The S&O project has looked at the medium-term risk where at least 5 million premises in CSPN are expected to be connected to the network by end 2026. Longer-term risks, and further rollout beyond that point will be managed separately by the Future Connectivity Strategy.

8. The S&O project has analysed options to increase network capacity and ensure the performance of the network. The project has established a roadmap of solutions to support the operation of up to 5 million Communications Hubs (CHs) in CSPN by the end of 2026 and has received approval to implement those solutions. DCC is due to publish the Phase 2 Report on the approved options which will be available on the SECAS website shortly. See Appendix One for more detail.

[1] CSP.N Service Scaling and Optimisation CSP North Radio Network Phase 1 Report.

9. As set out in the Phase 2 report, whilst the recommended set of measures deliver scaling, work also identified an additional solution that would deliver performance optimisation, by changing in the technical method of transmitting communication across the network.

10. In addition to the capacity solutions identified in S&O project, DCC has also identified an option that would deliver performance benefits and is therefore consulting with customers to gather their input. This proposal utilises a higher order modulation technique for transmitting data, referred to as 4FSK, and it allows more data to be transmitted within a given transmission bandwidth. This would increase the number of Service Requests (SRs) that could be delivered in a single transmission (or "packet") and more generally allow SR's to be sent in in fewer packets.

11. The delivery and deployment of the 4FSK solution could be implemented by the end of 2026. This would enable 4FSK communication to operate where possible, alongside the current 2FSK communication. This change would provide benefits including optimisation and improved message delivery speed, first time success rates while also allowing additional SR volume to be sent across the network should demand increase. The changes required could be delivered at a cost capped at £4 million.

12. There are a number of items that will need to be developed to implement the solution, including changes to Communications Hub Firmware, Radio Network Interface, transmission Kit and the Network Control Suite. The lead time for development and testing the solution is anticipated to be approximately 30 months, and that the CSP-N network will continue to be used until at least 2033, DCC is keen to understand if there is customer support for implementing the 4FSK solution, that would optimise the service (as outlined in earlier points). DCC is therefore consulting now in order to be able to implement in 2026.

1.2. Purpose of the consultation

13. This consultation provides details of the proposal to utilise higher modulation communication across the WAN, the benefits that it will provide, and the likely costs to make such a change. Parties are invited and encouraged to provide their feedback on the proposal.

14. This consultation is expected to impact the following Parties:

    - Large Suppliers;
    - Small Suppliers;
    - Electricity Network Operators;
    - Other Users.

2. Scaling and Optimisation Background

15. As installation volumes increase and utilisation of the network has evolved, the risk of capacity issues materialising in CSPN WAN has increased as a consequence. In the summer of 2021 DCC submitted a report to the Department of Energy Security and Net Zero (the Department), Ofgem and CSPN which highlighted concerns that there were risks that CSPN would not be able to meet the demand of current and future requirements working at scale based on updated modelling of volumes of activity.

16. In late 2021, based on the conclusions of the report, DCC, the Department and CSPN mobilised a triparty working group (the S&O project) to model and evaluate the performance of the CSPN network at scale. The project was also tasked to support the development of a scaling and optimisation plan for CSPN to ensure industry rollout targets could be achieved without issue.

17. The project validated the concerns initially raised by DCC and confirmed that network requirements have evolved materially since 2012. It was established that CSPN network, as currently designed and implemented, would not be capable of meeting the evolved requirements at scale without intervention to address this risk. The summary level outcomes and conclusions of the modelling activity were shared with DCC Customers through SEC forums and at the Smart Metering Delivery Group (SMDG), and via the CSPN Service Scaling and Optimisation Phase 1 Report.

18. The project has evaluated technical and non-technical solutions to ensure that the network continues to perform as expected, focusing on developing a clear and deliverable roadmap of solutions to mitigate the medium-term risk up to the end of 2026 (where 5 million CHs are expected to be connected to the network in CSPN), and separately, the longer-term risks from 2027 and beyond (supporting further CH rollout and/or higher traffic demand on the network).

19. As part of this work, the S&O project has also identified a potential change to improve the effective management of the available network capacity (optimising the network), this change is not required to deliver the level of scaling needed for 2026 but could be beneficial for network performance.

20. Since 2022, and during phase two of the project, DCC completed extensive customer engagement including with SEC Panel and SEC Sub-Committees and at the SMDG. During this engagement DCC provided Parties with updates on potential solutions, including anticipated cost ranges, and invited input on the options preferred by DCC Customers.

21. In September 2023 DCC engaged with Ofgem on plans to implement the solutions to mitigate the risks to capacity in the CSPN region in the medium term. Those improvements were developed and described in the Outline Business Case (OBC) which was presented to SEC Operations Sub-Committee and the Technical Architecture and business Architecture Sub-Committee (TABASC) in late 2023.

22. In January 2024, and following the HM Treasury Green Book Business Case process, DCC submitted a Full Business Case (FBC) to the Department detailing the preferred roadmap of solutions to deliver the scaling required to support up to 5m CHs in CSPN (reflecting the evolved requirements).

23. In February 2024 the Department responded to the FBC with a non-objection decision for the S&O project and the DCC Board approved moving forward on a range of solutions to ensure the network can support the connection of up to 5 million CHs at the current demand for communication.

24. In its non-objection letter the Department also required DCC to define a specific plan to consider the potential for the additional CSPN modulation solution, including consultation

with Parties. This reflects the finding of the Phase 2 report which identified the additional option of modulation changes that could provide additional performance optimisation. **This consultation seeks feedback on the proposed solution regarding the modulation of data communications across the CSP WAN and that proposal and is described below.**

3. Proposed changes to the modulation of data communication across CSPN WAN

25. When Service Requests (SRs) reach the CSPN network, they are split into data packets and transmitted across the WAN to the CH. In the current solution, 2FSK modulation technique is used to represent the data. Each SR, depending on its size, is split into a number of data packets, and transmitted in 2FSK modulation.

26. With current 2FSK communication, approximately 94% of all SRs traffic requires more than 1 downlink and uplink data packet. Each data packet adds load to the CSPN WAN and requires more time to deliver the SR command & retrieve the SR response. SRs are often sent in more than one packet which increases the risk of failure and retries where a single packet fails to be delivered, or where the recombination of those packets fails.

27. 4FSK is a modulation technique where data is more efficiently transmitted and enables a single data packet to contain more information compared to a 2FSK data packet. The proposed amendment for CSPN is to support 4FSK modulation to Communication Hubs that can benefit from the change.

28. This change will result in fewer data packets being transmitted across the network for any individual SR. For example, the number of packets transmitted across the network to the CH for the SR 4.6.1 (Retrieve Import Daily Read Log) to ESME will be reduced from two to one packet each for the initial request and the subsequent response. Because fewer data packets are sent the success rate is anticipated to increase which will result in fewer retries and thus further benefit efficient use of the available capacity. If 4FSK is implemented in CSPN the volume of SR traffic that requires more than one download and upload link can be reduced from the current 94% to between 53% and 59%.

29. This change will not impact DCC Customers or the way they send or receive data. There will be no impact and no additional actions required to either send SRs or receive responses/alerts. Implementing this change in CSPN system will not impact any SEC requirements or existing service levels.

30. 4FSK modulation will not be appropriate for all CH connections. A higher signal quality is required to utilise 4FSK, and so for a CH to be able to utilise 4FSK it must have a sufficiently strong network connection.

31. Modelling indicates 60% of the CHs in CSPN will have a sufficiently strong network connection to successfully operate in 4FSK. It is therefore anticipated that, by 2026, approximately 3 million CH out of 5 million CH could benefit from operating in 4FSK. Once the CH is installed using 2FSK, CH signal quality will be assessed within days and instructed to operate in 4FSK.

32. In urban areas, where radio towers are found at higher concentrations, more CH will be able to use 4FSK when compared to rural areas. Figure One below shows an example of the difference between the ability to communicate through 2FSk and 4FSK in urban and rural areas.

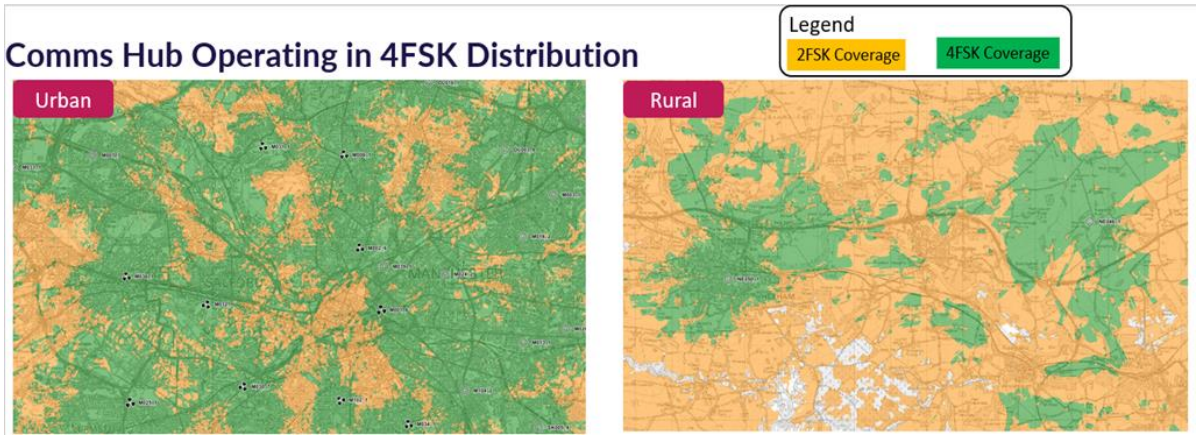

Figure One. Maps showing the difference in modulation utilisation potential between urban areas (on the left) and rural areas (on the right).

33. It is modelled that between 41% and 47% of SRs could be transmitted using 4FSK modulation. Where 4FSK modulation is utilised, it will result in higher success rates in delivering SRs and the associated data packets since there is less opportunity for failure, (and so there will be higher first-time success rates) and it will speed up the response delivery for each 4FSK SR by around 66%. The current success rate of an SRV transmitted by a single packet is 95%, while the success rate of an SRV transmitted through multiple packets is 85%.

34. Delivering the solutions identified in S&O Project will address the congestion in CSPN core network. Addressing this congestion first will enable the 4FSK benefits to be realised. It is also important to note that whilst implementing the 4FSK solution will improve the performance of the network in the areas it is able to be used, it is also estimated that a further 300-430 million additional SRs could be handled per month (30%+ growth) and provides a level of future proofing to the network should an increase in SR volume be seen beyond 2026.

35. To implement 4FSK, updates to software/firmware will be required to the Radio network Interface (RNI); the Network Control Suite (NCS); the Transmission Kit (TK) and Communication Hubs (CH). Figure Two below illustrates where these software changes in DCC systems will be required and highlights the benefits achieved in each area. The solution will not require DCC customers to make any changes to their systems or processes.

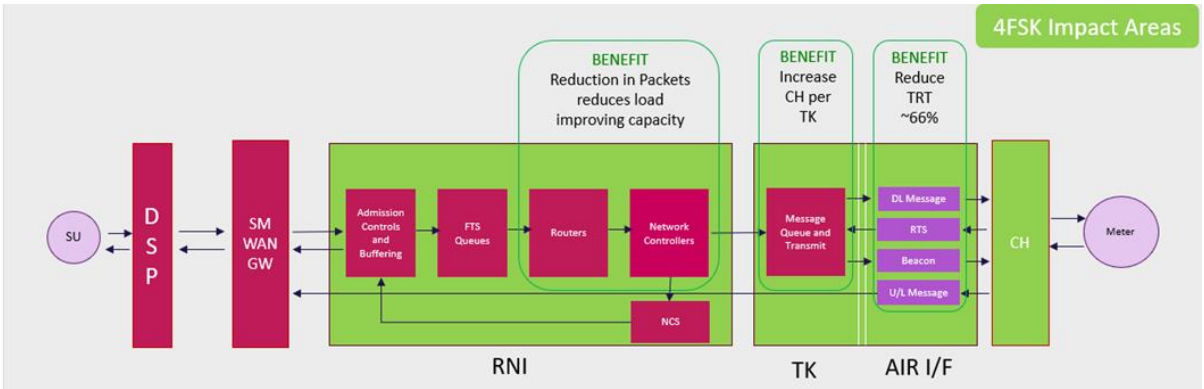

Figure Two. Schematic of communication network between a Service User and Smart Metering installation, highlighting where 4FSK changes would be made and their benefits.

36. DCC has requested an Impact Assessment from CSPN which has provided a one-off cost to deliver, capped at £4 million.

37. The lead-time to develop and test the solution varies for each aspect of change. Firmware developments for CHs is expected to require the longest lead time and would not be available until the end of 2026. DCC is therefore consulting now to gather Customer views on the proposed change.

Q1	Considering the proposed benefits to communications in CSPN and the cost involved, does your organisation agree with implementing the proposed changes? Please provide a rationale for your response.

Q2	Do you have any other comments?

4. Next Steps

38. DCC will share consultation responses with the Department and will review those responses to evaluate whether there is support for the proposal.

39. If there is sufficient support for the proposal DCC will work collaboratively with Parties and the Department to progress development and implementation plans and share delivery timelines. If there is insufficient support for the proposal DCC will not continue to progress the solution.

40. DCC will publish a consultation conclusion document once responses have been reviewed and confirm to Parties if support for the proposal has been received or not.

41. In all cases, DCC will continue to progress the agreed roadmap of scaling solutions, as set out in Appendix 1.

5. How to Respond

Please provide responses by 1700 on 21 May to DCC at consultations@smartdcc.co.uk.

Consultation responses may be published on our website www.smartdcc.co.uk. Please state clearly in writing whether you want all or any part, of your consultation to be treated as confidential. It would be helpful if you could explain to us why you regard the information you have provided as confidential. Please note that responses in their entirety (including any text marked confidential) may be made available to the Department for Energy Security and Net Zero (The Department) and the Gas and Electricity Markets Authority (the Authority). Information provided to The Department or the Authority, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 2018, and the Environmental Information Regulations 2004). If The Department or the Authority receive a request for disclosure of the information, we/they will take full account of your explanation (to the extent provided to them), but we/they cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

If you have any questions about the consultation documents, please contact DCC via consultations@smartdcc.co.uk.

Appendix One – Scaling and Optimisation Roadmap details

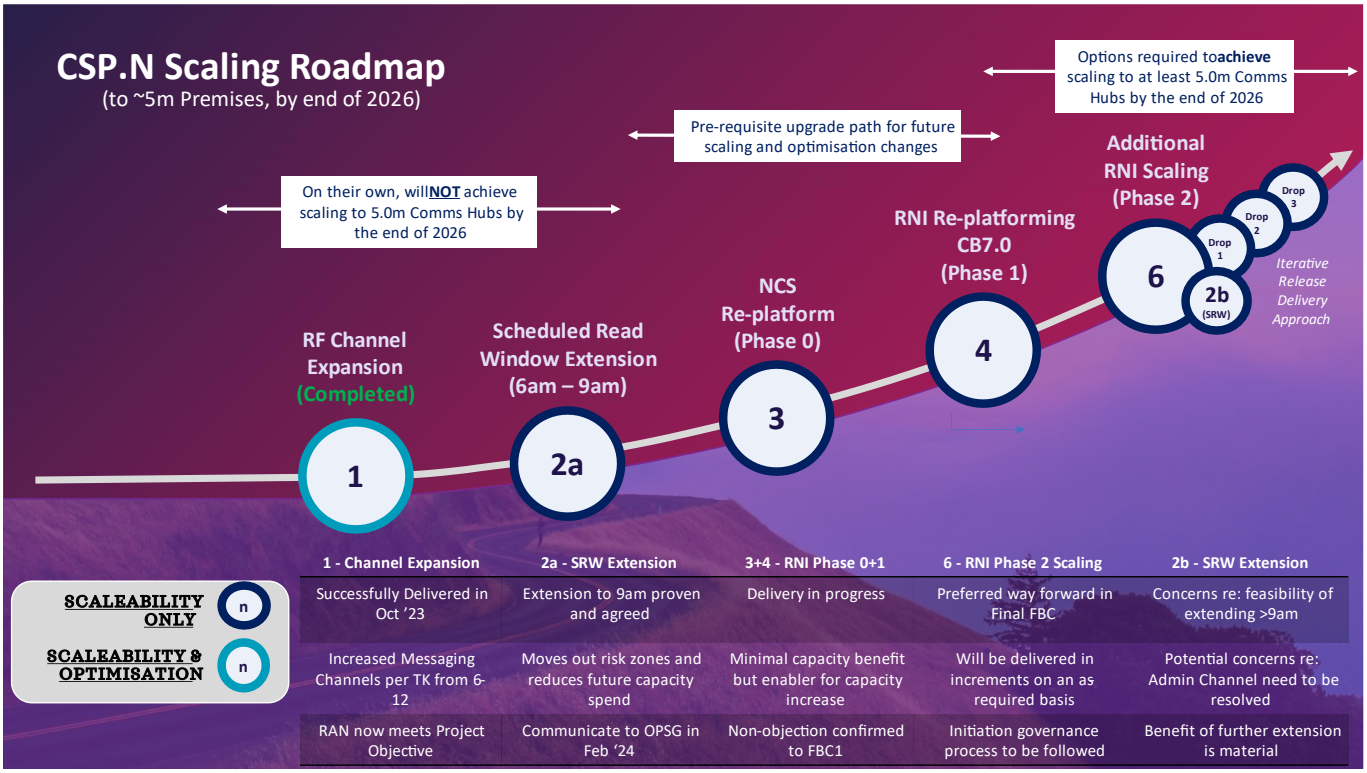

Figure 3. S&O roadmap showing the range of solutions to be delivered in the S&O Project.

The S&O project has assessed technical options to meet medium term goal of supporting up to approximately 5million premises and has recommended the below changes within the business case:

- Implementation of ***1 - RF Channel Expansion*** that mitigates against the identified risk of 'dense cells' occurring within the Radio Access Network (RAN) in the short-medium-term, up to end 2026, now complete.
- Implementation of the ***2a – Scheduled Read Window Extension*** (extending the window by 3 hours, in line with SRW Trial Results), additional trialling now underway to assess the extent to which the SRW can be extended within 2b as captured.
- Implementation of the ***3+4 - RNI Uplift Phase 0 and 1***, including ***3 - Phase 0 - NCS Re-platform*** and ***4 - Phase 1- RNI Re-platforming to CB7.0***, is required to deliver the pre-requisite upgrade path for future scaling and optimisation changes and will support 5Million Comms hub expected to reach in Dec'26. Delivery is progressing to plan, with testing underway, DCC expect to deploy in production in end of August 2024.
- Option to the implementation of the ***6 - Additional RNI Scaling (Phase 2)*** after scale testing of ***3+4 - RNI Uplift Phase 0 and 1***. RNI Phase 2 has been designed to enable delivery of individual small uplifts to ensure there is no nugatory spend. Delivery timescales for these changes will be determined after the scale testing is completed in June'24.