

R-Cloud Tasking Form – Part B: Statement of Requirement (SoR)

Title of Requirement	Generation After Next User Planes (GUPs)
Requisition No.	RQ0000022726
SoR Version	2

1.	Statement of Requirements
1.1	Summary and Background Information
	<p>This task is part of the Network Infrastructure Services (NIS) project under the Communications & Networks Programme commissioned by the Chief Scientific Advisor's mandate and funding. The indicative budget for the task is £500k.</p> <p><u>Background</u></p> <p>The Ministry Of Defence (MOD) have an ongoing challenge to deliver increasingly large and rich data streams to deployed forces. These forces often find themselves in situations where bandwidth can be Denied, Degraded, Interrupted and/or Limited (DDIL) and experience transmission latencies much longer than those of commercial Internet service providers. Dstl are keen to keep exploring new technologies and techniques that could assist in improving service delivery to the war fighter in future theatres of operation. The NIS project is specifically investigating what new and novel techniques might be applicable to the generation-after-next (GAN) networks for Defence to assist in this challenge. These GAN networks must be Agile, Reliable and Resilient with sufficient capacity to support the voice and data communications required to deliver information advantage to the war fighter when and where they need it the most for their particular role during a given mission state.</p> <p>The NIS Project is exploring a number of aspects of how these future networks will adapt and overcome these challenges.</p> <p>The subject area of Programmable User Planes (PUP) is gaining popular acceptance in industry for data centres, big data processing and is showing great promise in improving quality of service and networking performance even further.</p> <p>For example, applications making use of the Programming Protocol-independent Packet Processors (P4) enabled technology are allowing industry to make great strides in improving</p>

	<p>end-to-end network throughput, enhancing security and releasing core processing power for other tasks.</p> <p>Such advances include new and improved ways of obtaining network telemetry and providing alternative packet structuring methods.</p>
<p>1.2</p>	<p>Requirement</p>
	<p><u>Aims</u></p> <p>Dstl would like to explore if Programmable User Planes (PUP) technologies and techniques can be utilised in a more dynamic, less reliable scenario such as those found in military deployed and tactical networks. In particular, P4, IP framing and network telemetry are of interest, but Dstl are open to suggestions of other areas, within the province of PUPs, that could prove fruitful in providing benefit in solving some of the issues inherent in the scope of the MOD challenge.</p> <p>This exploration will provide a base understanding to MOD of the techniques and technologies involved and provide recommendations indicating which topics should be pursued further to help steer future research tasks in this area.</p> <p>The recommendations provided will be supported by evidence based assessment methods and criteria that will have been created and documented as part of the work.</p> <p><u>Technical Requirement</u></p> <p>Dstl are looking to industry to provide a team of suitably qualified & experienced personnel¹ to conduct studies into these areas and produce recommendations about the technologies and techniques as they relate to the MOD challenge.</p> <p>This study should be directed primarily at identifying those PUP techniques that are applicable to the following areas:</p> <ul style="list-style-type: none"> - Improving end to end transmission of <ul style="list-style-type: none"> o Voice (Voice MOS score of 3.6 or higher) o Track Data o Instant Messaging (i.e. XMPP) o Video - Variable prioritisation of traffic

¹ Evidence must be supplied as part of the proposal and will be assessed under technical acceptance criteria 2, 3, and 4.

- Automatic Link/Network Establishment
- Dynamic route/path/bearer selection
 - o Mission, Environment, Situation Aware
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- Monitoring for network performance
- Enabling rapid infield deployment of new techniques.

When considering the areas above, an assessment method and criteria will be needed to quantify the evidence supporting any recommendations made to allow comparisons to be drawn.

In particular Dstl would like the focus of the studies to be in the following areas as a minimum:

Network Telemetry

Techniques in this area are starting to experiment with advancements in the programmable user plane. The latest contributions feature packet level hop-by-hop and near real-time network visibility and exploit programmability of the user plane. The IETF recently published an RFC (RFC 9232 Network Telemetry Framework, May 2022) to highlight and contextualize the key techniques and developments in Network Telemetry.

Dstl would like to explore these techniques further to establish which, if any, might be worth pursuing further to provide benefit to the warfighter's deployed networks in DDIL and normal operational situations. This section of the work will focus on identifying those techniques that can be applied to deployed and tactical radio networks, identifying what the implications would be, including what benefits could be realised and what compromises or changes might be required to implement them.

This part of the study should include high-level proposals for demonstration (up to TRL3/4) of up to 3 of those techniques that show most promise or a detailed description of why this method of telemetry is not suited to the challenge scope. Any proposals should include Rough Order of Magnitude (ROM) costs and should be company agnostic in nature as they will be used to influence future open competition.

Should more than 3 techniques be identified, selection of those proposed for demonstration must be supported by creation or adoption² of an evidence based assessment method and scoring criteria justifying why those techniques were chosen over the others.

² If suitable one already exists

Deliverable outputs of this section will consist of contributions to the stated outputs below:

FD1 - Summary of techniques selected as most promising, recommendations for demonstrations including ROM costs and vendor agnostic outline details of what would be required to create and conduct the demonstration. Should no techniques prove suitable this section should include the reasoning why MOD should not be pursuing any of the user plane telemetry techniques at this time.

FD1.1 – Annex to FD1; more detailed description of the techniques explored, including analysis of applicability based on benefits and technical risks of implementing them in the MOD challenge scope.

Providing initial thoughts on suitability for use within the MOD challenge scope that categorises solutions into the following three options where MOD should:

- Actively pursue
- Monitor progress
- Discount as not applicable

In each case, justification and reasoning should be given for the selected category.

Detailed description of the selection process used, sufficient for someone to apply it to future studies of this sort.

The completed selection process, and justification for all conclusions reached and recommendations made with justifications.

IP Framing

The agile radio/intelligent bearer concept established that radios in the future will be a system made of systems, this could vastly increase the quantity and occurrence of information needed to adapt to a disruptive event. This task assumes that P4 or another approach will enable tightly integrated command and control of these features into a packet structure. Making use of this method will allow features to be integrated and adopted for particular scenarios without the need of employing additional traffic to manage these functions.

This part of the study will explore novel/adaptive structures that could provide benefits such as:

- Adaptable framing
 - To natively adopt new agile functions and equipment (such as a new smart antenna)

- Tune the size to the scale of the network
- Designed and reviewed structure (via feedback loops)
- Natively adopt agile and intelligent functions
- Build a framework which can enable evolution
- Develop a learning algorithm to enable management shortcuts

This will be accomplished by investigating:

- 1) A review of current IP and alternative framing structures for management traffic to identify those potentially suitable for future military radio concepts.
- 2) Initial thoughts pertaining to the performance of the structure, determining optimisations and “type casting” i.e. is there a static management frame or does it change;
 - a. How small of a data packet can it be, how often does it need to transmit, scalability, assurance
 - b. What sort of connection is required, stateful or stateless, connection oriented or connection-less
- 3) Design of framing structures that can encompass the future military radio concepts and the features and functions needed to support it. Design should include for example;
 - a. How and where are feedback loops within the frame structure?
 - b. If a structure is needed at all? I.e. headless packets
 - c. Consider the data fields for the frame

Deliverable outputs of this section will consist of contributions to the stated outputs below:

FD1 - Summary of the results and recommendations of the review and initial assessment of current IPv4/6 structures. Roadmap to a suite of IP structures that meet the needs of the future radio concepts. Summary of the costed options detailed in FD1.2.

FD1.2 – Detailed reporting of the review of IP4/6 framing structures and initial assessment of applicability to the future military radio concepts.

Providing initial thoughts on suitability for use within the challenge scope that categorises solutions into the following three options where MOD should:

- Actively pursue
- Monitor progress
- Discount as not applicable

In each case, justification and reasoning should be given for the selected category.

This annex should also include a description of the method and criteria used to categorise the topics, which will need to be established as part of the study.

This annex should include up to 3 high level, ROM costed proposals for the creation of potential demonstrations to show the beneficial techniques up to TRL3/4. Each proposal should also include an estimation of challenges that would need to be overcome to modify and expand the scope of the demonstration to allow it to be included in other more uses such as future experimentation as part of a generic test bed suite.

Should none of the reviewed structures be applicable; the proposals for demonstration should be replaced with explanation as to why MOD should not pursue these methods for this

P4 and user plane programmability

This part of the study should focus on identifying other capabilities (not previously covered by the other two focus areas) that are enabled by P4, or other programmable user plane languages and compilers, that that could prove beneficial to a military deployed network during operational scenarios. For example during operations where available network bandwidth may be DDIL and/or latencies could be high, potentially longer than Satellite latencies. When selecting capabilities to explore those techniques that will improve end-to-end quality of service and resilience within the challenge scope should be given higher priority, only exploring others if time permits and all options within those topics have been exhausted.

Looking towards what P4 or other PUP architectures and compilers are available and if they are suitable for application to military systems or if new instantiations or designs would be required.

A review of the PUP Programs and APIs currently available and in development that show promise to provide benefit within in the challenge scope.

As comparisons and prioritisation will be needed a method of assessment and associated criteria for judgment will be required to created, used and documented.

Deliverable outputs of this section will consist of contributions to the stated outputs below:

FD1 – Summary of the conclusions and recommendations with justification resulting from the investigations of this part of the study. Summary of the ROM costed proposals for up to 3 demonstrators as described by FD1.3.

FD1.3– Detailed reporting of the exploration of the topics presented in this section. Providing initial thoughts on suitability for use within the challenge scope that categorises solutions into the following three options where MOD should:

- Actively pursue
- Monitor progress
- Discount as not applicable

In each case, justification and reasoning should be given for the selected category.

This annex should also include a description of the method and criteria used to categorise the topics, which will need to be established as part of the study.

The final reporting of this annex should include up to 3 high level, ROM costed proposals for the creation of potential demonstrations to show the beneficial techniques up to TRL3/4, or summary recommendations explaining why the programmable user plane techniques are not applicable. Each proposal should also include an estimation of challenges that would need to be overcome to modify and expand the scope of the demonstration to allow it to be included in other more uses such as future experimentation as part of a generic test bed suite.

General considerations for all of the research:

Where possible recommendations in each section should include an consideration of:

- Benefit
 - What benefit will the capability provide, should it prove viable
- Technical Risks
 - How likely is it to be realised?
 - What might prevent it?
 - Will current or future policies cause issues to implementation?
 - Such as Border Encryption, or Data Centric Security?
- Maturity/Adaptability
 - How long would it take to:
 - Create a lab-based demo
 - Conduct an infield demonstration
 - Realise the benefit
- Costs
 - Rough order of magnitude costs to reach:
 - Lab demonstration
 - In field demonstration

1.3	Options or follow on work <i>(if none, write 'Not applicable')</i>
	<p>Should any of the identified techniques show sufficient promise within the challenge scope then Dstl would be open to exploring them further to generate proof of concept (TRL3/4) demonstrations or models for further study to provide evidential proof of benefits within the military context.</p> <p>The proposed demonstrations from each section will be used to help steer, prioritise and assess suitability for uptake in following FYs of the NIS project and then help in producing Statements of Requirements for any that are selected to proceed to next FY. Due to the nature of MOD's commitment to ensuring impartiality and fairness to industry and maintaining value for money for public funding, any future activity will also need to be released to open competition through one of the MOD contracting frameworks.</p>
1.4	Contract Management Activities
	<p>How the research is conducted and organisation of the research teams will be left to the chosen vendor. Dstl will require the following during execution of the task to ensure that it is remaining on track and to allow them to redirect and reprioritise aspects if needed.</p> <p>Monthly meetings with the Technical Partner (TP) and Associates (ATP) consisting of:</p> <ul style="list-style-type: none"> - Spend to date - Progress against the plan - Highlight reporting of research to date - Discussion of (continued) direction of research - Outputs <ul style="list-style-type: none"> o Meeting minutes o Soft copy of presentation materials o Agreement of any prioritisation of the research <p>Delivery of final report for acceptance:</p> <ul style="list-style-type: none"> - At T_{end} - 3 weeks (at least) a completed version of the final report must be delivered to Dstl. This is to allow Dstl sufficient time to review the content and quality for acceptance. - The final report should consist of a higher level summary report with detailed annexes for the sections described above.

	<ul style="list-style-type: none"> - This review will be conducted by Dstl's TP, ATPs, Project Technical Authority (PTA) and Lead Technical Reviewer (LTR). - Any comments and required changes, if any, will be returned to the contractor no later than $T_{end} - 1.4$ weeks to allow them time discuss and implement changes to finalise the report. - The final release of funding will occur after delivery of the changed report and confirmation of the changes. <p>In addition to the monthly meetings, the Dstl TPs and ATPs will be available via email and telephone throughout the duration of the contract to provide advice and guidance on direction of research and the content of the reports. Dstl would encourage the successful contractor to provide early drafts of the content of the final report before the $T_{end} - 3$ week deadline to minimise the number of changes required by the final review.</p>
1.5	<p>Health & Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement</p>
	<p>No additional requirements other than those expected of normal working conditions in the UK are expected.</p>

[REDACTED]

1.7	Deliverable Acceptance Criteria
Error! Reference source not found.	<p>Monthly reporting will be reviewed by the TP and PM, and assessed against the invoice and expected and reported progress including any mitigating circumstances. If costs are reflective of the work undertaken then acceptance will be acknowledged by the PM via email, no later than 5 working days from delivery of ID1. At which point funds will be released.</p>
FD1	<p>The report will be in the Dstl report format (latest version of the template to be provided by Dstl, with guidance). Consisting of a main summary section with minimum of 3 annexes that provide more detail pertaining to the topics of interest. Acceptance criteria for the annexes are given in separate row below.</p> <p>The main section will summarise the research, conclusions and recommendations (including the demonstration proposals) from the detailed annexes.</p> <p>All sources will be referenced and acknowledged appropriately.</p> <p>Any background IPR will be clearly indicated when used.</p> <p>The report will be consistent with the principals of the Plain English Campaign (http://www.plainenglish.co.uk/) and will be free from all obvious spelling and grammatical errors before delivery.</p> <p>A final draft of the report will be delivered no later than close of play on October 3rd 2023. Dstl will undertake a review of the document.</p> <p>Final acceptance will be acknowledged by the PM, via email, no later than 5 working days from delivery of the revised FD1, at which point final funds will be released.</p>
Error! Reference source not found.	<p>Each annex will be in the Dstl report format (latest version of the template to be provided by Dstl, with guidance).</p> <p>Each annex will include a description of the selection criteria used, and the full details of how it was applied to each of the techniques explored.</p> <p>Each annex will include a minimum of 1 and a maximum of 3 costed proposals for demonstrations that show the benefits in the challenge scope or a single section of reasoned arguments explaining why the topic area is not suitable for the challenge scope. Each proposal must be vendor agnostic and should be generic in nature when referring to equipment and</p>

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2	Evaluation Criteria
2.1	Method Explanation
	<p>All bids received by the closing date will be assessed against the Tender Evaluation Process detailed below. The Commercial & Technical evaluation teams will carry out separate evaluations as described below followed by a moderation exercise prior to combining their findings under the supervision of a Tender Evaluation Board to ensure an auditable coherent outcome.</p> <p>The Authority will use an evaluation model consisting of three criteria, weighted as follows;</p> <ul style="list-style-type: none"> • Technical: 80% + 1 Pass/Fail question. • Commercial: 3 Pass/Fail questions. • Cost: 20% <p>The overall evaluation of the tenders will be weighted ratio 80:20 for technical content and price. A technical score of 80 will be allocated to the best technically compliant tender. The technical scores for the remaining tenders will then be calculated as a proportion of 80. A price score of 20 will be allocated to the tender with the lowest price. The price score for the remaining tenders will then be calculated as a proportion of 20.</p> <p>The explicit equations for calculating the scores are as follows:</p>

Technical score of a tender

$$= \text{Maximum possible technical score} \times \frac{\text{Technical mark for the tender}}{\text{Technical mark of the best compliant tender}}$$

Price score of a tender

$$= \text{Maximum possible price score} \times \frac{\text{Price of the cheapest compliant tender}}{\text{Price of the tender}}$$

Scoring will be undertaken by the Technical Partner (TP) and two Assistant Technical Partners (ATP). These scores will then go into moderation discussions with the Project Technical Authority (PTA) and Lead Technical Reviewer (LTR).

After moderation the tender with the highest combined score (technical score + price score) that passes the commercial criteria will be awarded the contract.

2.2 Technical Evaluation Criteria

Technical aspects of the tenders will be scored using the 0, 3, 7, 10 system below. A mark of 0 (Not Answered) on any of the technical criteria shall result in a non-compliant bid and will therefore be discounted.

Mark		
0	Not Answered	Nil or inadequate response. Fails to demonstrate an ability to meet the requirement.
3	Acceptable	The response demonstrates sufficient and appropriate knowledge and understanding of the subject to meet the study objectives although the Tenderer would have to spend some of the time getting up to speed and learning about the current state of the art.
7	Good	The response is sufficiently detailed and demonstrates a good understanding of the subject. The Tenderer has broad previous experience in applicable subject areas and the response provides details of how the requirement will be fulfilled.

10	Excellent	The response demonstrates a comprehensive understanding of the subject and extensive previous experience in this field. It provides details of how the requirement will be met in full.
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This system will be applied to tender assessing degrees of compliance to the following weighted criteria.

ID	Criteria	Score	Weighting
1	Proposal strongly indicates that it has addressed all of the outlined technical requirements within the SoR and added additional requirements where requested.	0-10	3.5
2	Proposal demonstrates through the provision of evidence that the Contractor is experienced with novel networking concepts, in particular customisation of the user plane.	0-10	2
3	Contractor demonstrates that they have understanding or experience of the challenges presented to networking in DDIL environments, particularly in military operational scenarios.	0-10	1.5
4	The bidder identifies key individual(s) who will lead the delivery of the proposed work and provide evidence of their competency.	PASS/FAIL	N/A
5	Proposal indicates that the Contractor takes a flexible approach and is keen to help Dstl shape its requirement and provide the best possible solutions to achieve the desired outcomes.	0-10	1
6	Proposal indicates and provides evidence that the Contractor has the necessary resources and assets to successfully undertake the work packages stated within the SOR within the stated timescales.	0-10	2
	Total available score		100

2.3 Commercial Evaluation Criteria

Commercial aspects of the proposals will be scored on a pass/fail basis against the following criteria.

ID	Criteria	Score	Weighting
1	Compliance with the required quotation validity period of 60 days from tender due date.	PASS/FAIL	N/A
2	Proposal contains full details of the points of contacts for commercial, project management & technical, for the proposed contract duration.	PASS/FAIL	N/A
3	The Tenderer must provide a Firm Price to undertake the work.	PASS/FAIL	N/A

- The Commercial Criteria shall be reviewed on a strict pass/fail basis, failure in any of the Commercial Criteria shall result in a non-compliant bid.