

DARPA-SN-25-34

Special Notice

Request for Information:

Formal Methods to Deliver
Resilient Systems (FMDRS)

DARPA-SN-25-34

January 23, 2025

Amendment 1



Defense Advanced Research Projects Agency

675 North Randolph Street
Arlington, VA 22203-2114

Request for Information (RFI)

Formal Methods to Deliver Resilient Systems (FMDRS) Defense Advanced Research Projects Agency (DARPA) Information Innovation Technology Office (I2O)

Posting Date: January 23, 2025

Responses Due: February 25, 2025, at 5:00 p.m. Eastern Time (ET)

E-mail: DARPA-SN-25-34@darpa.mil

RFI DESCRIPTION:

The Defense Advanced Research Projects Agency (DARPA) Information Innovation Office (I2O) seeks community feedback on the draft DARPA Guide to Formal Methods to Deliver Resilient Systems for Proposals (“the FMDRS Guide”), provided as Attachment A to this Request for Information (RFI). DARPA is interested in feedback from all capable sources, particularly those sources with formal methods implementation experience, on the scope and breadth of the FMDRS Guide.

The goal of this RFI is to solicit robust feedback on the FMDRS Guide. Responses to this RFI will be used to inform the use of the FMDRS Guide in future DARPA solicitations.

BACKGROUND:

DARPA seeks to create resilient systems, including hardware, cyber-physical systems, and purely software systems. Over the past decade, DARPA has produced a set of scalable tools that can secure and prove the absence of exploitable vulnerabilities across nearly all existing and future DoD systems. These tools employ software development practices based on formal mathematical methods (“formal methods”). For purposes of this RFI and related documents, “formal methods” refer to mathematically rigorous techniques for producing software and machine-checked evidence that systems will act in ways that are intended and not in unintended ways. The broad applicability of these software tools provides an opportunity for drastically improving the security of the DoD’s massive catalog of deployed legacy code and future capabilities to ensure DoD capabilities can successfully complete their mission.

When applicable and appropriate, future DARPA Research and Development (R&D) solicitations will require proposers to develop and submit a Resilient Systems Implementation Plan (“the Plan”), demonstrating how the proposal team will design, implement, and deliver resilient system capabilities. The Plans are expected to be appropriately tailored in their technical complexity and sophistication to the type of research being conducted. For example, the Plan for a 6.1 Basic Research program would include basic security practices, like parser generators, while the Plan for a 6.3 program with technology meant to transition directly to operational use would need to develop a sophisticated, threat-informed plan. DARPA anticipates proposers will leverage the FMDRS Guide to develop the Plan. DARPA intends to evaluate the Plan in accordance with the solicitation. Judicious use of formal methods to defend against a well-articulated and appropriately chosen threat model will make proposals competitive.

REQUESTED INFORMATION:

DARPA seeks constructive feedback on the FMDRS Guide. DARPA is particularly interested in the assessment of whether the FMDRS Guide provides sufficient information to create the Plan for proposers who lack specific expertise in formal methods. Please see Appendix A for further details. DARPA intends the FMDRS Guide to be generalizable across all DARPA technical offices with

technical subject matter varying widely; as such, any feedback submitted should be at the agency level.

Responses are welcome from all capable sources including, but not limited to, private or public companies, individuals, universities, university-affiliated research centers, not-for-profit research institutions, and U.S. Government-sponsored labs. Note that DARPA assumes that feedback through standard scientific discourse, including direct communication with the corresponding authors or through additional manuscripts, will proceed as usual and views this RFI as in addition to that discourse.

SUBMISSION INSTRUCTIONS:

Responses to this RFI should be submitted no later than 5:00 p.m. ET on February 25, 2025.

Unclassified responses to this RFI should be submitted to DARPA-SN-25-34@darpa.mil. Classified submissions are not anticipated. NO CLASSIFIED INFORMATION SHOULD BE SENT TO DARPA-SN-25-34@darpa.mil.

To the maximum extent possible, respondents should submit non-proprietary information. If proprietary information is submitted, it is the respondent’s responsibility to clearly mark what is considered proprietary information. All proprietary information should be clearly labeled “Proprietary.” Note, “confidential” is not a classification marking used to control the dissemination of U.S. Government National Security Information as dictated in Executive Order 13526 and should not be used to identify proprietary business information. DARPA will disclose submission contents only for the purpose of review by DARPA staff, other Government agencies, or DARPA Support Contractors/SETAs.

NOTE: DARPA may reach out to respondents to clarify and/or discuss technical information received against this RFI.

FORMAT AND CONTENT INSTRUCTIONS:

DARPA is strongly encouraging all respondents to submit a single integrated response. All submissions must be submitted as an unprotected Microsoft Word document or PDF file. Submissions not meeting this requirement may be discarded.

All submissions must be written in English and all pages shall be formatted for printing on 8-1/2 by 11-inch paper with 1-inch margins and font size no smaller than 12-point font. Font sizes of 8 or 10-point may be used for figures, tables, and charts. Submissions should be concise and must not exceed 10 pages; submissions in excess of the page limit may not be reviewed.

Page limit includes:	Page limit does NOT include:
Technical feedback	Cover Sheet
Technical figures, tables, charts	References (Optional)

See Appendix A for the RFI submission template, which describes content requirements.

DARPACONNECT:

Entities who have not worked with DARPA before are encouraged to learn more about DARPAConnect, an initiative established to facilitate collaboration between DARPA and potential performers. The DARPAConnect team offers customized support, resources, and guidance on how to prepare your ideas for high-impact conversations with DARPA program managers. Please visit DARPAConnect.us to access a digital hub of online resources, including a curriculum for self-paced

learning, personalized support, and in-person and virtual events. In addition to the self-paced online materials, the DARPAConnect team is able to schedule one-on-one conversations to discuss your specific ideas, questions, and paths to DARPA. You can use the contact form at or email the [DARPAConnect.us](https://darpaconnect.us) team directly at darpaconnect@darpa.mil to request assistance.

ADMINISTRATIVE:

This RFI contains all information required to submit a response. No additional forms, kits, or other materials are needed. All administrative and technical questions should be directed to DARPA-SN-25-34@darpa.mil. Please refer to the Special Notice number (DARPA-SN-25-34) in all correspondence.

This RFI does not constitute a formal solicitation for abstracts or proposals; any abstract or proposal received against this RFI will be disregarded. In accordance with FAR 15.201(e), responses to this notice are not offers and cannot be accepted by the Government to form a binding contract. DARPA will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that DARPA is under no obligation to acknowledge receipt of the submission received, invite respondents to events, include tools identified in responses, or provide feedback to respondents with respect to any information submitted under this RFI.

**APPENDIX A
RFI SUBMISSION TEMPLATE
DARPA-SN-25-34**

COVER SHEET

Submission Title	
Submitter Organization	
Technical Point of Contact (POC)	Name: Address: Telephone: Email:
Administrative POC	Name: Address: Telephone: Email:

[Content requirements are stated in blue font and should be deleted prior to proposal submission. Responses to the RFI should cover at least one of the following questions]

1. Does the FMDRS Guide help potential proposers understand what is required to clearly articulate how to develop and demonstrate the ability to implement and deliver resilient software within a technical approach?
2. Does the FMDRS Guide help potential proposers understand how to address DARPA's security concerns using formal methods while meeting DoD mission objectives?
3. The FMDRS Guide includes a list of system aspects that DARPA is suggesting proposers consider addressing using formal methods. For each aspect, is it particularly easy or difficult for potential proposers to address? For aspects that are difficult, why? Are there any aspects that might be unclear to potential proposers?
4. Are there any system aspects that should be added to the FMDRS Guide? Are there any system aspects that should be removed from the FMDRS Guide?
5. There will be a website repository of tools that is built and maintained related to the effort.
 - (1) What tools should be included or excluded? What criteria would you use to decide that a tool should be included or excluded?
 - (2) Respondents are welcome to nominate one or more specific tools for inclusion at this time. If you would like to nominate a specific tool for inclusion, please provide the following information:
 - (1) the name of the tool;
 - (2) a description of what the tool is good for (when to use it);
 - (3) a description for counter indications (when not to use it);
 - (4) how mature is the tool, i.e., is it a research prototype; a well-maintained, open-source project; commercial product; or other;
 - (5) how the tool can be acquired and licensing information, such as whether the tool is open source or fees are required. Licensing information of the tool should include all licensing states, especially when there are Government Purpose Rights;
 - (6) a pointer to information on the web about the tool;
 - (7) a description of what kind of expertise is needed to use the tool and training material which can help those who are unfamiliar with it reach proficiency; and
 - (8) what else we should know about it, such as usability features which are particularly distinctive.

Please review example response to question 5 provided at the end of this RFI.

6. How much additional time, cost and effort would adding a resilient systems approach take versus not adding a resilient systems piece? Are there tradeoffs to innovation, development pipelines, business models, academic research, or others that have not been considered or addressed?
7. Part of the effort is to cultivate a formal methods ecosystem, including an event currently planned for 2025. Please provide name, contact information, and a brief bio for any persons interested in becoming part of that effort or attending future events in support of a formal methods ecosystem. This request does not constitute a formal invitation to any event or group.

Example Response to Question 5:

- (1) the name of the tool;

Response: The name of the tool is Frama-C.

- (2) a description of what the tool is good for (when to use it);

Response: The Frama-C analyzers can assist C developers in the certification of critical software by providing plug-ins to perform analyses, such as information flow and Linear Temporal Logic verification.

- (3) a description for counter indications (when not to use it);

Response: It is not applicable to code not written in ISO C99. Additionally, its analyses are often conservative, which means that it avoids false-positives: it won't report a problem unless it is sure that it exists. As a result, the absence of reported errors doesn't mean that the code is error-free, which might be an issue for some applications.

- (4) how mature is the tool, i.e., is it a research prototype; a well-maintained, open-source project; commercial product; or other;

Response: The tool is a well-maintained open-source project.

- (5) how the tool can be acquired and its licensing information

Response: Frama-C is open-source, with most sources licensed under LGPLv2.1, with some external libraries being exceptions. It can be downloaded from <https://frama-c.com/>

- (6) a pointer to information on the web about the tool;

Response: Website is <https://frama-c.com/>

- (7) a description of what kind of expertise is needed to use the tool and training material which can help those who are unfamiliar with it reach proficiency;

Response: User manuals and tutorials are freely available on the website. Technical support and training services are available.

- (8) what else we should know about it, such as usability features which are particularly distinctive.

Response: The tool is organized as a set of plug-ins, which allow gradual introduction of new features and analyses.