CyberSG R&D Programme Office (CRPO)

GRANT CALL – THEMED AND EMERGING AREA

RULES AND GUIDELINES

1. Overview

1.1. The CyberSG R&D Programme Office (CRPO) is a new national centre at Nanyang Technological University, Singapore. CRPO will focus its efforts on three main thrusts to advance cybersecurity comprehensively: cutting-edge research and development, advancements in technology and translational development, and fostering ecosystem/industry growth and training.

1.2. CRPO aspires to propel Singapore to the forefront of cybersecurity innovation and implementation, fuelled by funding from the Cybersecurity Agency of Singapore (CSA). This financial backing empowers CRPO to finance visionary projects proposed by diverse entities, including Research Institutes based in Singapore (RIs), Institute of Higher Learning (IHLs), and Industries based in Singapore. The scope of these initiatives spans the entire Technology Readiness Level (TRL) spectrum, from nascent concepts at TRL 1 to advanced, field-tested solutions at TRL 9, all within the dynamic realm of cybersecurity.

1.2.1. CRPO serves as a key research translation centre, driving the conversion of research into tangible outcomes. It establishes a strong governance framework for translational activities, fosters an inclusive ecosystem for talent development and communication, and collaborates with NTUitive Pte Ltd ("NTUitive") to streamline IP management. CRPO aims to create a user-friendly policy framework for SMEs and MNCs, facilitating the adoption of innovative cybersecurity inventions. It is more than a funding entity, acting as a catalyst for the holistic advancement of Singapore's cybersecurity landscape.

1.2.2. In Frontier Research and Development, the emphasis is on enhancing core cybersecurity capabilities through fundamental research and addressing societal challenges with moon-shot initiatives. Translation and Industry-Driven Technology Development involve translating fundamental research into commercial potential, creating a local cybersecurity innovation platform, and catalyzing industry growth through grant management and collaborations with governmental and private partners.

1.2.3. The third thrust, Translation and Innovation, aims to demonstrate cybersecurity capabilities. Translation and Innovation will be done through incubators, training, and hackathons, while providing cybersecurity technology training to industries and schools. CRPO aims to raise awareness and adoption of cybersecurity technologies, develop a strong talent pool, and facilitate talent flow across sectors through various schemes.

1.3. CRPO is set to initiate the CRPO Grant Call – Themed and Emerging area to back the advancement of cyber technologies and innovation addressing tangible issues with transparency and accountability. The goal is to generate national benefits for Singapore.

1.4. The CRPO Grant Call is a competitive funding initiative aimed at fostering research projects that push the boundaries of cyber technologies within Singapore-based Institutes of Higher Learning (IHLs)[1], Research Institutes (RIs)[2], and Industry Partners[3]. We enthusiastically invite proposals from diverse and collaborative teams, including academics, researchers, scientists, engineers, domain experts, and other professionals, to contribute to the advancement of cutting-edge cyber technology science.

1.5. For details regarding the timeline of the CRPO Grant Call - Themed and Emerging area and the submission deadline for proposals, kindly review Section 6.

2. Scope of Grant Call

2.1. Aligned with the aforementioned goals and directions, this grant call will concentrate on cybersecurity research.

2.2. **Themed and Emerging Areas Grants:** This pillar aims to foster innovative research addressing major industrial and societal challenges, aligning with national strategic goals. These initiatives support and enhance government programs like the Smart Nation initiative. Innovative methodologies and systems to address fundamental and emerging cyber security problems. We expect the research efforts from these projects to contribute to the establishment of a trustworthy smart nation for Singapore. The Themed and Emerging Area Grants are long gestation projects that still have industry relevance and are highly strategic to Singapore challenges. The themes revolve around in multiple ways, including urgent demand from industry or government agencies and new promising cyber security directions. We list a couple of sample grant calls that could be undertaken by this program, focusing on the security of AI systems, network systems, cryptographic systems, hardware systems, and autonomous systems.

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[1] Institutes of Higher Learning (IHLs): Such as National University of Singapore (NUS), Nanyang Technological University (NTU), Singapore Management University (SMU), Singapore University of Technology and Design (SUTD), Singapore Institute of Technology (SIT), Singapore University of Social Sciences (SUSS), (refer to the complete list here: https://www.ica.gov.sg/reside/LTVP/apply/graduate-from-an-institute-of-higher-learning-seeking-employment-in-singapore/list_ihl).

[2] Research Institutes (RIs): Such as the Agency for Science, Technology and Research (A*STAR) institutes.

[3] Industry Partners: Singapore based companies and Singapore based Start-ups.

2.3. The proposed opportunities and focus areas shall include and not limited to:

2.3.1. Building trustworthy and robust AI systems
2.3.1.1. Building knowledge about the inherent vulnerabilities of AI systems

2.3.1.2. Developing solutions to enhance the security, privacy and robustness of AI systems

2.3.2. Enhancing the security of network systems
2.3.2.1. Designing defense solutions for various network systems and environments
2.3.2.2. Cyber-crime defense and forensics

2.3.3. Designing privacy-preserving computing systems
2.3.3.1. Privacy-preserving computing and machine learning in real-world computing applications
2.3.3.2. Artificial intelligence for Privacy Enhancing Technologies (PETs) in emerging computing paradigms

2.3.4. Secure autonomous unmanned systems
2.3.4.1. Anomaly detection and mitigation in an autonomous unmanned system
2.3.4.2. Security testing for autonomous unmanned systems

2.3.5. Improving hardware architecture for security and privacy
2.3.5.1. Secure hardware processor architectures and implementations
2.3.5.2. Hardware-enhanced computation for emerging applications and systems

2.4. The grant applicants are responsible for defining the proposed research, problem scope, technical approach, and potential impacts of the proposal. Additionally, proposals must explicitly address the following key points:

- Alignment of the proposal with CRPO's objectives and direction.
- Explanation of the novelty of the research and the significant research challenge it aims to address.
- Clarification of potential industry applications or impact.
- Presentation of the translation plan.
- Explanation of the relevance of the research to Singapore.

3. Funding Support

3.1. CRPO intends to unveil four (4) Themed and Emerging Area Grants aimed at soliciting innovative approaches to enhance the cybersecurity landscape of

both Singapore and the global community. The initiative seeks breakthrough research ideas that can propel advancements in cybersecurity technologies. Each challenge offers funding of up to Singapore Dollars one million five hundred thousand (SGD$1,500,000) for a selected grant applicant, supporting a duration of 1.5 to 2.5 years for each project.

3.2. The grant calls will be released as CRPO Summer Grant Call and CRPO Winter Grant Call. The first call is set to release sometime in July 2024. Please look at Section 6 for the planned timeline of Themed and Emerging Area Grants.

3.3. The proposal shall be based on a realistic budget with appropriate justifications that correspond to the scope of work to be accomplished.

3.4. The corresponding budget requested **includes** 30% Indirect Research Costs (IRC).

3.5. The total cost of each project includes all approved direct costs[4] and indirect research costs/overheads[5]. All expenditure budgeted should be inclusive of any applicable Goods and Services Taxes (GST) at the prevailing rates.

3.6. For all direct cost items proposed for the project, please refer to Annex C – Guidelines for the Management of CRPO Grants, including the list of "Non-Fundable Direct Costs" and note the following:

- Host Institutions must strictly comply with their own procurement practices.
- Host Institutions must ensure that all cost items are reasonable and are incurred under formally established, consistently applied policies and prevailing practices of the host institution.
- All items/services/manpower purchased/engaged must be necessary for the R&D work.

3.7. Research Scholarships are not eligible for support under the CRPO Grant Call.

3.8. Funds awarded cannot be used to support overseas R&D activities. All funding awarded must be used to carry out the research activities in Singapore only.

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[4] Direct costs are defined as the incremental cost required to execute the project. This excludes in-kind contributions, existing equipment and the cost of existing manpower as well as building cost. Supportable direct costs can be classified into expenditure on manpower (EOM), expenditure on equipment (EQP), other operating expenses (OOE) and overseas travel (OT).

[5] Indirect costs are expenses incurred by the research activity in the form of space, support personnel, administrative and facilities expenses, depending on the host institution's prevailing policy. Host institutions will be responsible for administering and managing the support provided by CRPO for the indirect costs of research, if any.

4. Project Deliverables and Outcomes

4.1. Each project is expected to produce most, if not all, the following deliverables:

- Translation, Technologies deployed, including licences.
- Publications in top tier journals and conferences.
- Industry R&D jobs.
- PhDs and Masters trained.

4.2 In addition to the above deliverables, grant applicants may state deliverables applicable to the project.

5. Eligibility

5.1. The grant call is open to researchers from all Singapore-based Institutes of Higher Learning (IHLs), Research Institutes (RIs) and Industry Partners[6].

5.2. At the point of application, the Principal Investigator (PI) must hold a full- time[7] appointment in one of the eligible institutions. The PI must be a subject matter expert in the proposed domain, with strong record of publications in the proposed domain's conferences and journals.

5.3. Lead PI must be from the IHLs or the RIs and the Co-PI can be from the Industry Partners.

5.4. If applicable, Co-PIs must hold a full-time appointment in one of the eligible institutions at the point of application. At least one of the Co-PIs must be a subject matter expert in the proposed domain. For industry partner, the Co-PIs must hold full-time appointments at the company.

5.5. Researchers from Medical Institutions[8], Singapore based companies and Singapore based Start-ups, private sector, and other entities are eligible to apply as Collaborators.

5.6. Company collaboration(s) with in-kind contributions is encouraged, but not compulsory.

5.7. The team must have the right skills and experience to deliver the project and demonstrate sufficient engagement with stakeholders to scope the proposal.

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[6] National University of Singapore (NUS), Nanyang Technological University (NTU), Singapore Management University (SMU), Singapore University of Technology and Design (SUTD), Singapore Institute of Technology (SIT), Singapore University of Social Sciences (SUSS), A*STAR Research Institutes, Singapore based companies and Singapore based Start-ups.
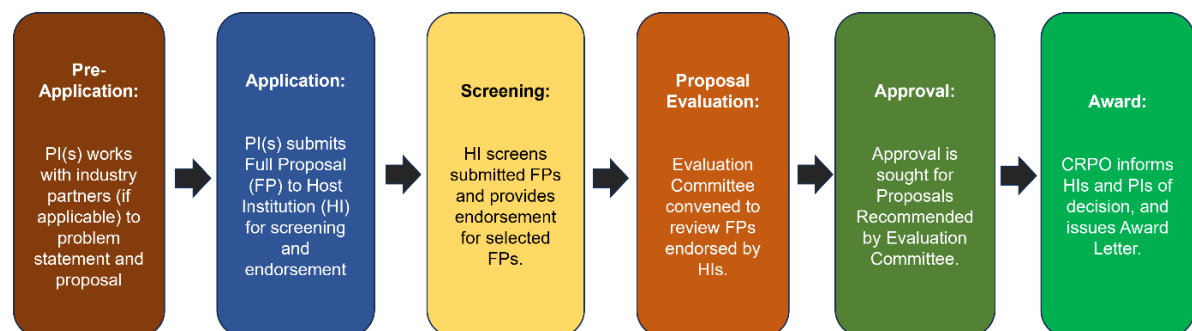
[7] Defined as at least 9 months of service a year based in Singapore or 75% appointment.

[8] Researchers from Medical Institutions in Singapore who hold at least 25% joint appointment in a Singapore-based IHL and/or A*STAR RI may apply as Lead PI or Co-PI. If awarded, the grant will be hosted in the IHL / A*STAR RI.
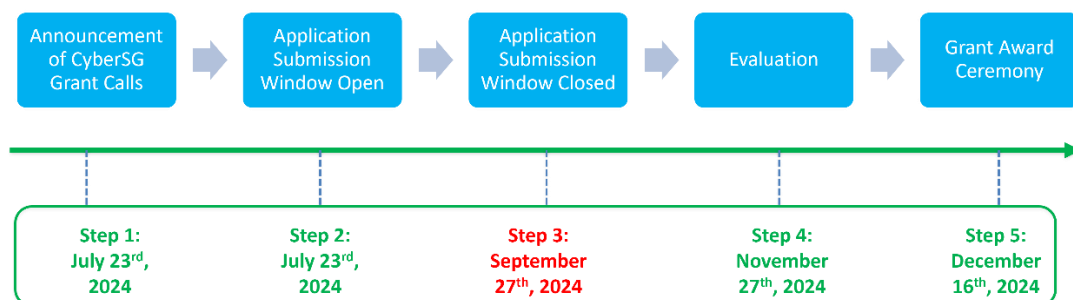
5.8. The overseas collaborators and/or visiting experts may be invited to Singapore on short term engagements to assist with specific project tasks. In this arrangement, the costs of airfare, accommodation and per diem can be budgeted under the other operating expenses of the project.

5.9. Only research conducted in Singapore may be funded under CRPO Grant Call - Themed and Emerging area. Please refer to Annex B – Terms and Conditions of CRPO Grant.

5.10. Lead PI and Co-PIs should note that parallel submissions are not allowed – i.e., applicants must never send similar versions or part(s) of the current proposal application to other agencies or grants for funding (or vice versa). The proposals should not be funded, or currently considered for funding, by other agencies. Details of all grants currently held or being applied for by the Lead PI and Co-PIs in related areas of research must be declared in Annex A - CRPO Grant Call Proposal Template.

6. Review and Selection

6.1. Full proposals are to be submitted using the Proposal Template for CRPO Research Call in Annex A and must also adequately address the pointers stated therein.

6.2. Full proposals will be reviewed by the Evaluation Committee, based on the quality of the proposals in the key aspects listed in Section 2 as well as the following:

- Past research accomplishments of the PI, Co-PI and any collaborators
- Project management plan

6.3. An illustration of the application, review and selection process is shown below:

Pre-Application:	Application:	Screening:	Proposal Evaluation:	Approval:	Award:
PI(s) works with industry partners (if applicable) to problem statement and proposal	PI(s) submits Full Proposal (FP) to Host Institution (HI) for screening and endorsement	HI screens submitted FPs and provides endorsement for selected FPs.	Evaluation Committee convened to review FPs endorsed by HIs.	Approval is sought for Proposals Recommended by Evaluation Committee.	CRPO informs HIs and PIs of decision, and issues Award Letter.

6.4. The review will be carried out by the CRPO Evaluation Committee but based on reviews of the proposals solicited from local and overseas experts.

6.5. The review process is expected to take approximately 8 weeks. All decisions are final with no right of appeals.

6.6. The example summer timeline[9] for Themed and Emerging area CRPO Grant Call is shown below:

| Announcement of CyberSG Grant Calls	Application Submission Window Open	Application Submission Window Closed	Evaluation	Grant Award Ceremony
Step 1: July 23rd, 2024	Step 2: July 23rd, 2024	Step 3: September 27th, 2024	Step 4: November 27th, 2024	Step 5: December 16th, 2024

6.7. Please note that respective IHLs' or RIs' internal deadline for full proposal submission may differ. However, all proposals selected and endorsed by the Host Institutions must be submitted via email to CRPO@ntu.edu.sg according to the above timeline.

6.8. CRPO reserves the right to reject late or incomplete submission, and submissions that do not comply with application instructions.

7. Team Structure

7.1. One Lead-PI from Singapore-based Institutes of Higher Learning (IHLs) and Research Institutes (RIs) to conduct fundamental research.

7.2. One industry Co-PI from Singapore-based companies or startup to identify and translate IPs with commercial potential.

7.3. Potential customer collaborators who are willing to adopt the developed security solutions and provide requirement feedback.

7.4. An illustration of the team structure and the collaboration between the teams is shown below:

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[9] Timeline is subject to change and based on CRPO decisions.
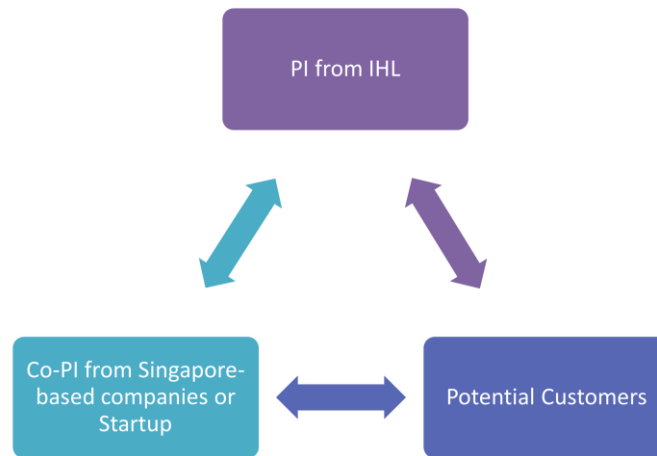
8. Research Project Performance Assessment

8.1. Successful teams will undergo a mid-term review on its project progress approximately 12 months after being awarded the grant.

8.2. Nearing approximately 18 months into the project for commercialization, the team will undergo a final review.

8.3. Nearing approximately 24 to 30 months (i.e., nearing end of the project) the team is also required to provide mature products atop the R&D outputs.

8.4. The grant awarded team receives benefits from marketplace and enter a virtuous cycle of R&D and commercialization.

8.5. The performance and potential of the team's research project will be evaluated during a midterm review (as referred in Section 8.1), which will be carried out by the CRPO Evaluation Committee. Teams will be required to give a presentation for the review. The project will be assessed primarily based on the progress of promised deliverables and quality of research outcomes.

8.6. If the team passes the midterm review, funding support for the team to continue the research project will be made available. CRPO reserves the right to terminate, after midterm review or at any point in time, a project that does not meet the minimum expectations of progress and achievement, upon recommendation by the Evaluation Committee.

8.7. The Evaluation Committee may also make recommendations to maximise the outcomes of funded projects which include, but are not limited to, adjustments to proposed durations, and qualifying only certain components of a project to proceed to completion.

8.8. Teams will be required to give a presentation after the end of term and within 4 weeks for final assessment.

9. Application

9.1. All applicants must fully comply with CRPO Grant Call Rules and Guidelines, Annex B – Terms and Conditions of CRPO Grant and Annex C - Guidelines for the Management of CRPO Grant, which can be downloaded from www.ntu.edu.sg/crpo.

9.2. Interested applicants should submit the CRPO Grant Application Form and other supporting documents in PDF (and Word if applicable). All applications must be submitted through the Host Institution via email to CRPO@ntu.edu.sg according to the timeline specified in Section 6.

9.3. Only complete application with the endorsement of the relevant institutional authority/director of research (or equivalent), will be accepted by CRPO.

9.4. Late submissions or submissions from individual applicants without the endorsement of the relevant institutional authority/director of research (or equivalent), will not be entertained.

10. Other Guidelines and Information

10.1. Proposal Content

10.1.1. The Proposal must adhere to the page limit, prescribed format and address the points as stated in Annex A-Proposal Template for CRPO Grant Call.

10.1.2. When applicable, a letter of support from the industry partner(s) is required. Commitment by the industry partner to provide the relevant proprietary datasets, a portion of project costs in cash and in kind will be viewed favourably.

10.1.3. Letter of support is required from the end customer for the deployment or end usage of the solution or the industry partner on the translation plan and deployment.

10.1.4. Research support office from the IHLs and/or Research institutes are required to ensure that information submitted by their researchers is complete and compliant with the requirements outlined in the application guidelines. Failure to do so will result in rejection without review.

10.2. Intellectual Property

10.2.1. Intellectual Property ("IP") developed under the grant call ("Research IP") shall be co-owned by the Institutions and Collaborators in accordance with their inventive or creative contributions, where such agreed terms shall be set out in a written agreement between the Institutions. The Investigators and Collaborators shall identify and disclose to the Institutions, details of all such Research IP. The IP arrangement is "Soley Developed Soley Owned and Jointly Developed Jointly Owned".

10.2.2. The Institutions shall keep and maintain a fully comprehensive and updated list of all such Research IP and make such details available to CRPO and/or the grantors for inspection at any time.

10.2.3. The Institutions shall grant CRPO a non-exclusive, non-transferable, sub-licensable, perpetual, irrevocable, worldwide, royalty-free right and license to use, modify, reproduce and distribute the Research IP for research, development and/or commercial purposes (The "CRPO License").

10.2.4. Except the rights expressly licensed or otherwise provided in this Rules and Guidelines or Annex B – Terms and Conditions of CRPO Grant, the Institutions shall in any event retain all rights, title and interest in all Research IP and shall have the free and unfettered right to use and commercialise (which include granting licenses to third parties) the Research IP for any purpose on a non-exclusive basis without seeking the consent of CRPO.

10.2.5. Management of all Research IP shall have reference to and be guided by the Public Sector Master Research Collaboration Agreement (PS MRCA) and key principles of the Singapore National IP Protocol for Publicly Funded R&D. In general, Research IP may be open-sourced for research and experimentation and licensed for commercial deployment.

10.2.6. The Institutions shall use best efforts to ensure that the Research IP is properly managed and wherever feasible, fully exploited and commercialised (including being made available for research and development or commercial purposes). Where required to do so by CRPO, the Institutions shall attend such meetings as CRPO may direct to discuss the potential for exploitation and commercialisation of Research IP.

10.2.7. The Institutions shall reserve a royalty-free, irrevocable, worldwide, perpetual and non-exclusive right for the Singapore Government and public sector agencies to Research IP for their statutory functions, non-commercial and R&D purposes.

10.2.8. The IP terms in Clause 10.2 of this Rules and Guidelines are deemed to be incorporated into the Terms & Conditions of CRPO Grant (Annex B).

10.3. Ethics and Confidentiality

10.3.1. All the Investigators, Collaborators, staff, and students working on the project must comply with the relevant local laws or regulations governing the research.

10.3.2. All teams are responsible for ensuring that ethical issues relating to their respective projects are identified and brought to the attention of the relevant regulatory bodies for approval. Approval to undertake the research must be granted before any work requiring approval begins.

10.3.3. Ethical issues should be interpreted broadly and may encompass, among other things, relevant codes of practice, the involvement of human participants, tissue or data in research, the use of animals, research that may result in damage to the environment and the use of sensitive economic, social or personal data.

10.3.4. The work should be conducted under strict international, national, and/or institutional guidelines on privacy and confidentiality protection of personal data use.

10.3.5. Whenever possible, all datasets used should be de-identified and anonymised, and/or proper consents and approvals should be obtained for the use of the data.

10.3.6. All the Investigators, Collaborators, staff, and students working on health and biomedical related projects should obtain CITI certification(https://about.citiprogram.org/en/homepage/) on biomedical data use or similar training and certification.

10.4. Project Support and Facilitation

CRPO is equipped with common research-engineering capabilities to facilitate or support the Cyber Security community. With respect to the grant call, the potential resources that applicants may leverage include:

10.4.1. **iTrust Testbeds:** iTrust is the proud host of several world-class testbeds and lablets. These testbeds and lablets together constitute a one-of-a kind facility for research and training in the design of safe and secure large-scale cyber physical systems. The testbeds aid in the design and testing of devices that fall under the Internet of Things. The lablets support training programs in the area of Cyber Physical Systems. The following testbeds and lablets are available to researchers at iTrust and its partners across the world. You can find more information here: https://itrust.sutd.edu.sg/testbeds/

10.4.2. **NCL Tesbeds:** National Cybersecurity R&D Lab (NCL), established in 2015 and funded under the National Cybersecurity R&D (NCR) Programme. NCL aim is to provide support to the Singapore cybersecurity R&D community in terms of their research experimentation and testing requirements. NCL offers computing resources and controlled experimentation environments to facilitate collaborative research among academia, government bodies, and industry. The infrastructure comprises a cluster of 300+ nodes with diverse provisioning mechanisms, security data, and security services. OpenStack, an open-source cloud computing infrastructure software project, serves as the foundation for managing the NCL infrastructure. In addition to Compute and Baremetal, NCL also supplies a range of GPU servers to accommodate the growing requirements of AI research. You can find more information here: https://ncl.sg/

10.4.3. **NICE Facility:** National Integrated Centre for Evaluation (NiCE) @ NTU is a collaboration between Cyber Security Agency of Singapore (CSA) and NTU. Strategically located in NTU to leverage on their knowledge, expertise and experience in software and hardware assurance, NiCE will be a one-stop facility for product testing, inspection and evaluation. You can find more information here: https://www.ntu.edu.sg/nice

10.4.4. Facilitating Cyber Security Collaborations and Innovation

10.4.5. **Industry Connections and Matchmaking:** In our pursuit of advancing cybersecurity, CRPO endeavors to bridge the gap between industry and innovators. We actively collect, curate, and regularly update a comprehensive repository of the skillsets, needs, and interests within the Cyber Security industry. This valuable information is readily accessible on our website, empowering interested applicants to explore potential partnerships seamlessly. Whether you're seeking a collaboration or looking for a specific skillset, our platform acts as a dynamic hub for industry matchmaking.

10.4.6. **System Engineering and Rapid Prototyping:** At the heart of CRPO's capabilities lies a versatile engineering pool equipped with expertise in software and network engineering, web services, privacy-preserving applications, and AI/ML. This dedicated team, comprising the CRPO, stands ready to contribute to project prototyping and Proof of Concept (PoC) development. Leverage the collective skillset of CRPO's engineering talent to fast-track your project from conceptualization to tangible results, ensuring efficiency and innovation.

10.4.7. **Guidance on Translational Opportunities:** Entrepreneurs, researchers, and visionaries are encouraged to engage with CRPO in a dynamic exchange of ideas. We extend an open invitation for applicants to connect with us, seeking advice and insights on the translational efforts related to their cybersecurity concepts. Our experts are available to address queries, provide guidance, and share valuable perspectives on

navigating the landscape of translational endeavors. Unlock the potential of your ideas with CRPO's collaborative and supportive ecosystem.

10.4.8. In essence, CRPO serves as a catalyst for synergy within the Cyber Security realm, offering a platform where industry needs meet innovative solutions. From industry matchmaking to hands-on project support and insightful guidance, CRPO is committed to propelling the field forward through collaboration and knowledge exchange. Connect with us and embark on a journey of transformative cybersecurity innovation.

10.5. Alignment with CRPO's Research Focus:

10.5.1. Requests for resources detailed in Section 10.4 should align seamlessly with the current research focus of CRPO. It is imperative that applicants, in their proposals, clearly articulate how their resource needs directly contribute to and complement the ongoing research priorities of CRPO. This alignment is pivotal in ensuring that the resources requested contribute meaningfully to the advancement of our collective research objectives.

10.5.2. **Quantification of Resource Needs:** Applicants are expected to provide a clear and quantifiable assessment of their resource requirements within their proposals. This includes specifying the type and quantity of resources needed from CRPO to facilitate their research endeavors. This information will be critically evaluated as an integral part of the proposal request process, aiding in the efficient allocation of resources.

10.5.3. **Justification for Resource Requests:** Recognizing the constraints of limited resources, applicants must provide compelling justifications for their resource requests. The onus is on the applicants to elucidate how the requested resources align with the objectives of their research and why they are integral to the success of their projects. CRPO reserves the right to evaluate and, if necessary, turn down requests that do not meet the criteria of strategic alignment and justification.

10.5.4. **Cost Implications and Facilities:** Applicants should be mindful of the specific costs associated with the facilities mentioned in Section 10.4. Clearly outlining the budgetary requirements in their proposals will enhance the transparency of resource needs. This ensures that both CRPO and the applicants have a comprehensive understanding of the financial implications involved.

10.5.5. **Availability Considerations:** It is important to note that, due to various factors, some of the resources listed may not be immediately available. Applicants should be prepared to incorporate flexibility into their timelines, understanding that certain resources may require additional lead time for procurement or allocation.

10.5.6. In summary, CRPO values the strategic alignment, quantification, and justification of resource requests within the context of our research priorities. We encourage applicants to thoroughly assess their needs, articulate them clearly in their proposals, and engage in a collaborative dialogue with CRPO to optimize the utilization of available resources.

11. Contact Information

For any enquiries, please contact CRPO@ntu.edu.sg or vinay.ms@ntu.edu.sg