

Call for Proposals

Accelerating Scientific Discovery (ASDI 2018)

Enhancing Data- and Compute-Intensive Research

2018

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1 Introduction

1.1 Background

The Netherlands eScience Center is the Dutch national center of excellence for the development and application of research software to advance academic research.

In many areas of scientific research today, there is an urgent need for methods and tools that help manage and exploit the rapidly increasing wealth of scientific data produced by modern instruments. This urgency is no longer felt solely in headline-grabbing and inherently large-scale initiatives such as the Human Genome Project or the Large Hadron Collider but is rapidly permeating virtually all levels and directions of (experimental) research. Having the methods and tools available to effectively handle very large quantities of research data, the process of scientific discovery – from initial idea to new scientific breakthrough – is accelerated significantly, and entirely new research opportunities may open up for the very first time. Managing and exploiting this wealth of data is a generic challenge and has spawned a new research strategy referred to as (digitally) enhanced science, or eScience.

eScience is an inherently multi-disciplinary pursuit concerned with bridging the gap between the demands of data- and compute-intensive domain research on the one hand, and the capabilities of state-of-the-art ICT on the other – ranging from high-performance computing and networking, to large-scale data management, and novel big data analysis methods. The challenge of eScience is not only to ensure that most value is gained from new research endeavours, but also to exploit the often domain-independent nature of eScience tools. As such, eScience aims to deliver sustainable and discipline overarching solutions, made available for reuse and tailored to problem-specific needs. Also, eScience aims to not reinvent the wheel, but rather to utilize and creatively combine existing methods and tools as much as possible.

The eScience Center supports and reinforces multi-disciplinary data- and compute-intensive research in the Netherlands through creative and innovative use of eScience in all its manifestations. To achieve this, the eScience Center fosters research collaborations aiming to accelerate scientific breakthroughs by effectively utilizing advanced ICT technologies, and by making large-scale data analysis possible across multiple disciplines. The eScience Center collaborates closely with many partners such as SURFsara and SURFnet, academic and non-academic institutes, various commercial technology providers, and universities.

We share our ideas and the tools we develop. Together with a wide range of partner organizations, we advance not just the research projects we fund and collaborate in, but the state of academic research in general.

We are convinced that research in every academic discipline can be improved by taking advantage of available digital technologies. We take a multidisciplinary approach, using our deep knowledge of both academic research and software development to help define and solve innovative research challenges.

Discipline Areas

Although eScience is relevant in virtually all research domains, for this call the eScience Center distributes its efforts over two broad discipline areas. These areas explicitly cover both early adopters of eScience as well as directions with an emerging potential to exploit eScience:

- **Environment & Sustainability**, incl. a.o.: agriculture & food, climate research, ecology, energy, logistics, water management, etcetera;
- **Humanities & Social Sciences**, incl. a.o.: archaeology, gender studies, linguistics, media studies, pedagogy, psychology, sociology, theology, etcetera.

Core Technological Competences

The eScience Center develops, scouts and applies the ICT technologies and software best suited to solving research questions. The set of technologies applied at the eScience Center is therefore inherently dynamic. The eScience Center has identified a series of core technologies, however, that underpin existing projects and that are likely to continue to be crucial in new projects for the foreseeable future. Maintaining at least operational expertise in these areas allows the eScience Center to serve as a valuable and even essential partner in a large variety of research projects dealing with data- and compute-intensive problems.

Today, the eScience Center's core technological competences include:

- **Optimized Data Handling**, incl. real-time data analysis, database optimization, data interoperability, combining structured and unstructured data;
- **Big Data Analytics**, incl. data exploration, analysis, data mining, machine learning, text analysis, natural language processing, statistics and visualization, structured and unstructured data, from data to information to insight;
- **Efficient Computing**, incl. high-performance and distributed computing (e.g. Grid, Cloud), heterogeneous computing, efficient algorithms, use of accelerator hardware (e.g. GPUs), and green computing.

A further description of the eScience Center's core technological competences is provided in Appendix A.

It is the intention for projects funded by the eScience Center to utilize and exploit these competences in pursuit of their scientific goals. However, the eScience Center is also committed to working with project leaders, strategic associates and partner organizations to develop additional expertise and adapt to needs, urgencies and external developments.

1.2 Purpose of this call

This call focusses on the *acceleration of the process of scientific discovery* in the discipline areas of Environment & Sustainability and Humanities & Social Sciences.

From both areas, the eScience Center welcomes proposals with significant data- and/or compute-intensive challenges at their heart. First and foremost, a competitive proposal aims to undertake novel scientific discovery in the discipline area of choice. The scientific discovery must be driven by a clearly defined set of scientific research questions originating from the discipline itself. Solving these questions is possible (only) by utilizing, combining and/or developing scalable, robust, and sustainable methods and tools for Optimized Data Handling, Big Data Analytics, Efficient Computing, or beyond. As such, a competitive proposal combines a clear, credible, and innovative scientific goal with a technical solution providing the computing capabilities, data management and/or analytics required to support that goal.

A competitive proposal stresses the expected impact of the provided solutions on the stated research questions, and on the daily process of scientific discovery. Moreover, it will indicate to what extent, and in what way, the provided solutions may have potential value to other research problems (within the same domain, or even in other domains). Next to this potential for reuse and generalization, a competitive proposal provides a sustainability section, describing measures taken to ensure usability and availability of developed solutions beyond the duration of the project itself.

The eScience Center specifically requests proposals that aim to develop (standards-based) open source/open access solutions¹, where possible extending or working in concert with the eScience Center's core technological competences – developed and made available as part of the Research Software Directory (see Appendix B). Also, in each awarded project and under co-supervision of the eScience Center an effort is made to deliver sustainable and re-usable software solutions. To this end, additional manpower will be made available on top of the awarded grant itself (Section 1.3).

An additional purpose of this call is to improve and expand the link between state-of-the-art scientific research questions and the capabilities of advanced e-Infrastructure (e.g. high-performance computing, large-scale data storage, lightpath connectivity; see also Appendix C). For this reason, further infrastructural support services may be provided by SURFsara and SURFnet to proposals with clear e-Infrastructure needs.

Typically, the project leader will be working in (and have leading expertise in) the selected discipline area². However, given the nature of many of today's data- and compute-intensive research problems, proposals of multidisciplinary teams to achieve their scientific goals are specifically welcomed (see Fig. 1). Public-private collaborations are positively valued, but the inclusion of one or more industrial partners as part of the research team is not a necessary requirement.

¹ Applicants are asked to endorse and follow the [NLeSC Strategy towards Publishing, Licensing, and IP](#). For alternative agreements, contact the eScience Center before proposal submission.

² Exceptions are possible but must be justified.



Fig. 1: Projects awarded in this call primarily will constitute collaborations between Domain Science and the Netherlands eScience Center. Each awarded project typically is led by a researcher from either the discipline area of Environment & Sustainability or the discipline area of Humanities & Social Sciences. Active participation of researchers from ICT- or Data Science is encouraged but not obligatory.

1.3 Available budget

In this call, each grant will consist of two parts: 1) an 'in cash' contribution for the employment of local research personnel and other expenses, and 2) an 'in kind' contribution in the form of highly skilled eScience Research Engineers employed by the eScience Center.

In this call, the total available budget is as follows: k€ 660 in cash funding and 4.0 FTE³ in kind funding. With a total of 4 projects to be awarded, a typical project will receive k€ 165 and 1.0 FTE contribution from one or more eScience Research Engineers employed by the eScience Center and whose time is allocated to the project.

On top of this, for each project an additional 0.25 FTE in terms of eScience Research Engineer support will be made available to pursue sustainable and re-usable software solutions to ensure impact of the developments beyond the lifetime of the project and, preferably, beyond the discipline area considered (see Section 2.2). Proposals with clear e-Infrastructure needs may also obtain additional support from SURFsara and SURFnet.

It is the aim of this call to grant at least one project in each of the selected discipline areas described above.

1.4 Validity of this call

This call for proposals is valid for the assessment procedure of pre-proposals submitted before the deadline of Thursday **17 May 2018, 14:00 CET**, and full proposals submitted before the deadline of Thursday **30 August 2018, 14:00 CET**.

³ FTE = Full Time Equivalent; 1.0 FTE represents 1680 hours for the duration of the project.

2 Guidelines for applicants

2.1 Who can apply?

Proposals can be submitted by researchers from any Dutch university or research institute affiliated with NWO or KNAW. Each proposal is to be formally submitted by a single named researcher (the 'principal investigator' or PI) on behalf of a team comprising researchers from one or more institutes. The PI is also the proposed project leader. A copy of the proposal must be submitted to the director or dean of the PI's institute. Proposals are granted only if the PI's institute has been informed of the proposal and accepts the conditions relating to grants awarded in this call.

Further requirements:

The PI must:

- have a PhD;
- hold a contract (period of appointment) for at least the duration of the application process and the research for which the grant is being applied.

The PI will be responsible for scientific progress, reporting, and financial accounting.

It is encouraged to have links with business partners to enlarge the potential for valorization of the project. As such, it is possible for co-applicants to be employed by a non-academic partner.

Further conditions:

In addition to the above requirements, the following conditions hold:

- the PI may submit only one proposal in that capacity in this call;
- the PI may not also submit a proposal in that capacity in other calls published by the Netherlands eScience Center in 2018;
- the simultaneous submission of identical/very similar proposals is not permitted;
- proposals submitted to more than one competition can be awarded only once;
- the PI can only submit a full proposal in the second phase of this call if he/she also submitted a pre-proposal in the first phase.

2.2 What can be applied for?

A project grant may be requested for a maximum total in cash budget of **k€ 165** and a minimum total in kind budget of **1.0 FTE** (= 1680 hours). The project duration must be between 18 and 36 months.

The available in cash budget is primarily intended to cover expenses for local research personnel. Part of the in cash budget, however, may also be reserved for additional resources and expenditures.

Typically, the project budget will be as follows:

- a. **1 Postdoc position for the duration of 2 years.** The cost associated with this position includes an individual bench fee of up to k€5 as a contribution to travelling expenses, or other approved expenditure. Budget for local personnel should follow the most recent VSNU agreement⁴.
- b. **A maximum of k€20** for project-related equipment, Open Access publication, software, and (non-eScience Center personnel) travel expenses. The costs for equipment and software must equal or exceed k€5, and its necessity must be justified; equipment and software with a purchase price of less than k€5 is deemed part of the standard infrastructure of the local institute and is therefore ineligible for funding. Travel expenses must be incurred by the project team members, with a maximum of k€10. The necessity of travel, equipment and software in support of the project must be justified.

The total of a) + b) may not exceed k€ 165.

- c. **A minimum of 1.0 FTE** in terms of support provided by personnel employed by the eScience Center. Of the total requested FTE, 15% comprises internal overhead. The remaining 85% covers all activities performed on behalf of the project by one or more eScience Research Engineers in particular, and by the assigned eScience Center Coordinator who oversees the project at the eScience center and communication personnel. In case more than 1.0 FTE is requested, the in cash budget for a) + b) is lowered by k€ 8.5 per 0.1 FTE.

The additional 0.25 FTE (see Section 1.3) for sustainability and generalization of software results and – where possible – inclusion in the Research Software Directory (see Appendix B), is on top of the abovementioned 1.0 FTE. This 0.25 FTE need not be included in the requested project budget. The distribution of the total in kind contribution over the project period will be determined together with the eScience Center at the start of the project.

eScience Research Engineers are scientists employed at the eScience Center who work at the interface of various scientific disciplines and advanced ICT. They will become an integral part of the projected research team focusing on the development and implementation of eScience technologies and software. Primarily, they will ensure that the research team will be able to make easy and effective use of the envisioned technological solutions. They will help to interpret the results of the research and to make the delivered eScience tools useable for a broad range of users. Where applicable, they will also co-author research publications together with the research team. The eScience Research Engineers perform their project activities both at the eScience Center in Amsterdam and at the project locations (typically at the institute of the main applicant). In this way, they contribute directly to the project team whilst also providing a direct link to the expertise available throughout the eScience Center and its wider networks.

⁴ See: <http://www.nwo.nl/financiering/hoe-werkt-dat/salaristabellen>.

The eScience Center **Coordinator** is an experienced project manager, responsible for the daily supervision of the Engineer(s) assigned to the project and is – together with the PI – in charge of monitoring progress and the delivery of project results.

2.3 When can applications be submitted?

The round consists of two phases:

1. A mandatory pre-proposal phase, in which the main research ideas and projected outcomes are to be outlined. A template application form can be obtained from the eScience Center webpage for this call (via www.esciencecenter.nl). The closing date for the submission of pre-proposals is **17 May 2018, 14:00 CET**.
2. The full proposal phase, in which selected applicants are invited by the independent Assessment Committee to submit a detailed application. A template application form can be obtained from the eScience Center webpage for this call (via www.esciencecenter.nl). The closing date for the submission of full proposals is **30 August 2018, 14:00 CET**.

Further information about the procedure, including a timetable, is found in Section 3.1.

2.4 Preparing an application

A pre-proposal has three parts: a fact sheet, the application form, and a list of suggested referees / non-referees. A full proposal has two parts: a fact sheet, and the application form.

- The fact sheet can be completed directly in ISAAC, the electronic application system of NWO (www.isaac.nwo.nl). While completing the fact sheet, you can only make use of ASCII symbols ("plain text"). Therefore, use of (structural) formulas, illustrations, italics etcetera in the fact sheet is not possible. A link to the ISAAC submission system is available on the eScience Center webpage for this call.
- The correct application form must be used for preparing the proposal. The form is obtained from the eScience Center webpage for this Call (via www.esciencecenter.nl). The completed form must be attached to the ISAAC fact sheet as a PDF file.
- A list of possible referees/non-referees should be added to the ISAAC fact sheet in a separate PDF-file. For more information, please refer to paragraph 2.6.
- Possible letters of intent from (for example) private partners can be added to the ISAAC fact sheet in a separate PDF-file.
- Applications must be completed in English.
- The layout of the proposal should facilitate its readability. Use a font size of at least 10 points.

2.5 Specific conditions

The specific conditions that are valid for granted proposals are as follows:

- Awarded projects must commence within six months of the award date. If the project has not started within that period, the Board of the Netherlands eScience center has the right to withdraw the grant.
- In case any components (such as data sets, specialized hardware, etcetera) necessary for starting or continuing the proposed research are not available either at the start of the project or at the date specified in the project workplan, the eScience Center Board has the right to withdraw the grant.
- In case projected deliverables (i.e. research papers, software tools, data sets, or otherwise) have not been realized at the approximate date specified in the project workplan, the eScience Center Board has the right to withdraw the grant.
- **FAIR:** Researchers funded within this call for proposals must use the FAIR principles with respect to the sharing of data⁵.

Open Access

All scientific publications resulting from research that is funded by grants derived from this call for proposals are to be immediately (at the time of publication) freely accessible worldwide (Open Access). There are several ways for researchers to publish Open Access. A detailed explanation regarding Open Access can be found on www.nwo.nl/openscience-en.

Data Management / Software Sustainability

Responsible data management and high-quality software are part of good research. The eScience Center expects data and software that emerge from publicly funded research to become freely and sustainably available, as much as possible, for reuse by other researchers. Furthermore, the eScience Center aims to raise awareness among researchers of the importance of responsible data management and software sustainability, amongst other to enhance correctness and reproducibility of scientific results. Proposals should therefore satisfy the data management and software sustainability protocols of the eScience Center. Both these protocols consist of two steps:

1. Data management section / software sustainability section

The data management and software sustainability sections are part of the research proposal. Researchers should answer several questions about data management and software sustainability within their intended research project. Therefore, before the research starts the researcher will be asked to think about how the data collected must be ordered and categorized, and how the research software created will be licensed and published, so that these can be made freely available. Measures will often need to be taken during data and software production to make long-term storage, dissemination and re-use possible, also after the project has finished. Researchers can state which research data and software they consider relevant for storage, publication and reuse.

⁵ The FAIR Data Principles, see <https://www.force11.org/group/fairgroup/fairprinciples>

2. Data management plan / software sustainability plan

After a proposal has been awarded, the researcher should elaborate the data management and software sustainability *sections* into data management and software sustainability *plans*. Both plans should be provided to the eScience Center within a maximum of 4 months after the project has started. The eScience Center will approve the plans as quickly as possible. Approval of the data management and software sustainability plans is a condition for disbursement of the funding. The plans can be adjusted during the research. The eScience Center requests PIs to use one of several *certified data management templates* (see: www.lcrdm.nl), to best match the details of the awarded project and/or any specific requirements of the PI's research institute. Further information on data management and software sustainability plans will be made available on the eScience Center website (www.esciencecenter.nl).

The NWO Regulation on Granting applies insofar as it does not deviate from the specific conditions in this call for proposals.

2.6 Submitting an application

- A proposal can be submitted only via NWO's electronic application system ISAAC. Applications submitted otherwise will not be admitted to the selection procedure. The PI is obliged to submit the proposal via his/her personal ISAAC account. If the PI does not yet have an ISAAC account, this should be created at least one day before the submission deadline (www.isaac.nwo.nl). Possible registration problems may then still be resolved on time. If the PI already has a personal ISAAC account, the creation of a new account is not needed. For technical questions, please contact the ISAAC helpdesk (see Section 4.1.2).
- The proposal must be submitted as a PDF document and should arrive no later than the deadline set in Section 2.3.
- In the submission process in ISAAC, you will be requested to provide additional information. Please take this into account with regards to the set deadline.
- Applicants are requested to suggest up to three international referees. Please give their full names, email address and web address. You should not propose anyone with whom you have recently collaborated or with whom you intend to collaborate in the near future, whether as co-authors or in other forms of joint undertaking. Only referees who are not directly involved in the research project and research team to which your application refers can be considered. Moreover, suggested referees must not currently hold an appointment in the Netherlands.
- It is possible (but not mandatory) to give the names of up to three people who should NOT be approached as referee. In the interest of confidentiality, these names should not be included in the application itself but be sent by email separately (e-science@nwo.nl) before the deadline set in Section 2.3.
- The proposal summary provided in ISAAC, and the summary for non-experts, may be used for publication purposes, should your application be granted.
- In accordance with the agreement between NWO and the Association of Dutch Universities (VSNU), applicants should inform their employing institute of the submission by sending a copy of the application to the scientific director or dean of the institute or department. The eScience Center assumes that the employing institute or university is informed of, and accepts, this Call's granting conditions.

3 Assessment procedure

3.1 Procedure

Information event

To allow interested applicants to get acquainted with the eScience Center's strategy and approach, the role of the eScience Research Engineers, the capabilities of the Dutch National e-Infrastructure, the software technologies implemented and applied by the eScience Center, and the aim of this call for proposals, an information event will be organized at the eScience Center (Amsterdam, Science Park 140) on **10 April 2018**. Registration is required via www.esciencecenter.nl. Presence of at least one team member at the information event is highly recommended, but not mandatory.

Pre-proposal

The first evaluation of all submitted pre-proposals is carried out by members of the eScience Center Management Team, Coordinators, and eScience Research Engineers. This evaluation covers only the 'eScience' criteria outlined in Section 3.2 (eScience state-of-the-art, sustainability, re-use potential and lateral impact). In this phase, the scientific quality, novelty and impact is explicitly not evaluated. The eScience Center evaluation is sent to the independent Assessment Committee (AC; see Section 4.2) as input for their assessment of the pre-proposals.

Based on the pre-proposals and the eScience Center evaluation, and using the criteria outlined in Section 3.2, the Assessment Committee reviews the proposals, prioritizes the proposals within each discipline area, and advises the eScience Center on the highest ranked proposals that should be worked out into a full proposal.

Approximately six to eight weeks after the pre-proposal submission deadline, applicants will receive the advice of the eScience Center (which follows the advice of the AC), stating whether they may proceed with a full proposal. Based on the feedback from the AC, the eScience Center may suggest that applicants intending to work on closely related subjects submit a joint proposal.

Mid-procedure meeting

Applicants invited to submit a full proposal are also invited for a personal meeting at the eScience Center. In the meeting, applicants are given advice on how to incorporate any advice of the Assessment Committee, how to exploit eScience Center's competences in full, and how to best cover all review criteria.

Applicants with a negative AC advice, are not invited for a mid-procedure meeting. The eScience Center has capacity to provide this support for the invited finalists only.

eScience Center employees are not allowed to write any part of the proposal, or to serve as co-applicant.

Full proposal

All submitted full proposals are sent to international independent peer-reviewers. The review reports of the peer-reviewers are sent to the applicant, who will be given the opportunity to write a rebuttal. In a meeting, the AC will discuss all proposals using the submitted proposals, the peer-reviews and the rebuttals from the applicants. Proposals will be assessed following the criteria explained in Section 3.2.

Only in case a negative evaluation was given by the eScience Center in the pre-proposal phase, the eScience Center may give further advice to the Assessment Committee based on the full proposal. For all other proposals the eScience Center will not provide further advice to the Assessment Committee.

Applications are assessed within their discipline area, resulting in a prioritization of applications for each of the two discipline areas defined in this call. Based on the prioritization within each discipline area, the AC will compose a recommendation for granting and rejection to the Board of the Netherlands eScience Center. The AC will aim to fund at least one proposal in each of the selected discipline areas for this call.

Granting Decision

The Board of the Netherlands eScience Center decides on the awarded grants, based on the recommendations of the Assessment Committee.

Timetable

<i>10 April 2018</i>	Information event at the eScience Center
<i>17 May 2018</i>	Deadline pre-proposals
<i>Beginning of July 2018</i>	Announcement of results of pre-proposal round
<i>30 August 2018</i>	Deadline full proposals
<i>End of October 2018</i>	Applicants receive reviewer's comments and are given the opportunity to respond
<i>Mid-November 2018</i>	AC evaluation and prioritization
<i>Mid-December 2018</i>	Applicants informed of final decision

3.2 Admissibility and assessment criteria

3.2.1 Formal admissibility of applications

A proposal will be accepted for consideration only when all of the following conditions have been met:

- the proposal has been submitted by a researcher at a recognized institution (see Section 2.1);
- the proposal is consistent with the purpose of the call (see Section 1.2);
- the proposal was submitted online via ISAAC;
- the proposal was submitted before the deadline;
- the proposal meets the conditions and requirements of this call for proposals.

Once officially declared admissible, the proposal will be processed. Proposals with serious errors or omissions may be disqualified.

3.2.2 Assessment of contents

Proposals will be assessed by the referees and by the Assessment Committee based on the criteria below:

Scientific quality (25%)

- the proposed research should be at the forefront of the state-of-the-art within the discipline area at hand, also at an international level;
- the research team should be of the highest quality, and – if possible – already be recognized as representative (and authoritative) with respect to the proposed research questions, direction, and long-term vision.

Scientific novelty and impact (25%)

- the proposed research should be novel and represent a number of essential steps towards the long term aim of solving a specific, major scientific challenge;
- the proposed research can be expected to lead to one or more significant results (in particular in terms of a significant advancement within the selected discipline area);
- the proposed research should potentially change the modus operandi of scientific practice within the discipline area at hand, in terms of broadness, scale, speed of result-delivery, or otherwise;
- the proposal must indicate which efforts are made to promote the results of the project (publications, demonstrations, workshops, training, etcetera).

eScience state-of-the-art (25%)

- the eScience technologies (e.g. software for data analytics, data management, efficient computing, etcetera) applied should be sufficiently state-of-the-art, meaning that no alternative (proven) technologies exist that could serve better in solving the domain specific research questions, lead to more significant breakthroughs, or serve better in the pursuit of entirely new research questions;
- the research team should show awareness of the state-of-the-art of required eScience technologies; PIs can first contact the eScience Center, if needed.

Lateral impact, re-use and sustainability (25%)

- the proposal must indicate how the proposed solutions will find use beyond the proposed work itself, preferably across disciplines, also after finalization of the project;
- the proposed solutions and (software) deliverables must be open source/open access and permit use and/or interpretation by other researchers;
- the proposal must indicate how the project will build further collaborations, in science, industry, or both; inclusion of concrete letters of intent from such foreseen partners will be valued positively, but is not required;
- the proposal must indicate how maintenance and sustainability of project results will be secured and managed.

4 Contact details

4.1 Contact

4.1.1 Specific questions about this call

If you have specific questions about this call for proposals, please contact:

Dr. Barbara van der Sar-Reumer, Program Coordinator NWO

Tel.: + 31 (0)70 349 4602

Email: e-science@nwo.nl

If you have questions about the Netherlands eScience Center, or the eScience requirements for this call, please contact:

Dr. Frank J. Seinstra, Program Director Netherlands eScience Center

Tel.: + 31 (0)20 460 4770

Email: asdi-call@esciencecenter.nl

4.1.2 Technical questions about the electronic application system ISAAC

For technical questions about the use of ISAAC, please contact the ISAAC helpdesk. Applicants are requested to read the ISAAC manual before consulting the helpdesk.

The ISAAC helpdesk is available from Monday to Friday from 11.00 to 17.00 hours on +31 900 696 4747. Unfortunately, not all foreign telephone companies allow you to call a 0900 number in the Netherlands. You can also send your question by email to isaac.helpdesk@nwo.nl. You will receive a reply within two working days.

4.2 Other information

4.2.1 Members of the Assessment Committee

A separate Assessment Committee (AC) will be set up for the evaluation of the proposals submitted in this call. The AC will consist of independent eScience and domain experts. An expert is not allowed to be part of the Assessment Committee in case a member of his/her research group submits a proposal in this call.

4.2.2 Open Access

Please be aware that on December 1st, 2015, the NWO open access policy has been updated. For more information, please consult www.nwo.nl.

Appendix A:

eScience Center Core Technological Competences

The Netherlands eScience Center is the Dutch national center of excellence for the development and application of research software to advance academic research. We contribute to research projects in at least two important ways:

1. We continuously scout the international spectrum of research software; we have a broad overview of relevant software solutions and a detailed understanding of how to apply these in a broad range of research disciplines;
2. We have expertise to extend and build high-quality, sustainable, and reusable research software using modern software development techniques and standards.

Our core competence is the *creation* and *application* of research software. What software is already available? When and how can we apply this software? Can we extend already existing software? How do we build new software, if needed? In the process of extending and building software we apply high standards of software quality, and put significant effort into testing, documentation and packaging.

In addition to this core competence, we focus our efforts in three expertise areas: Optimized Data Handling, Big Data Analytics, and Efficient Computing. Together, these cover a large part of the spectrum of required software and expertise in research projects. Below each of these expertise areas is outlined further.

Optimized Data Handling

This expertise area includes a.o.:

- FAIR data
- streaming data
- databases
- linked data
- data fusion

Storing, accessing and sharing voluminous and rapidly generated data

Data are generated at increasing speed and abundance due to the miniaturization and parallelization of experiments, the deployment of sensors and the digitization of experimental practices. From radio telescopes to social media, the development and application of methods to store, access and share large volumes of rapidly generated data are becoming universally important.

At the eScience Center, we have expert knowledge on handling large volumes of data (using both traditional databases and their NoSQL alternatives), processing streaming data (as produced by sensors such as radio telescopes), and linked data (typically used to add meaning to text data). In addition, we have ample experience in sharing data according to FAIR-principles (i.e.: making data Findable, Accessible, Interoperable, and Reusable).

Big Data Analytics

This expertise area includes a.o.:

- machine learning
- natural language processing
- search
- computer vision
- visualization

Identifying patterns and relationships

From data to information to knowledge to insight. Current research challenges demand robust and reliable methods to identify the patterns and relationships contained in, but also obscured by, large amounts of data.

eScience approaches can enable researchers to recognize sources of relevant information, prepare raw data, use statistical tools, extract and search for meaningful information, recognize potential problems and make visualizations to communicate their findings.

With the application of statistics and state-of-the-art machine learning techniques at its core, the use of data-analytics and visualization are generic requirements for many scientists. Combining 'big data' with theory and conceptual models enables scientists to structure the wealth of data and provide skillful forecasts.

Efficient Computing

This expertise area includes a.o.:

- high-performance, distributed, and energy-aware computing
- efficient algorithms
- scalability
- ease-of-use

Optimizing for performance

As the ambition and data volumes of researchers grow, processing requirements grow accordingly. To keep up with the sizes of the data and models, software must be optimized for performance (resulting in more processing power per computer) and/or scalability (allowing more computers to share the processing load).

By applying state-of-the-art technologies such as GPUs, a significant performance increase can be achieved, while simultaneously reducing energy requirements. This requires expert knowledge, however, as GPUs are very hard to program.

Often, research data are stored in multiple locations and are too large to gather in a single place. In such cases, it may be necessary to move computing to the data, and not vice versa. Such a distributed computing solution requires specialized software to organize which computation runs where. For the user, such techniques are a means to an end, and must be made transparent to not get in the way of the research itself.

Appendix B:

The Research Software Directory (RSD)

The Research Software Directory (RSD)⁶ is the eScience Center's primary facility for open, sustainable and re-usable research software, expertise, and eScience research. First and foremost, the RSD contains *research software*. In part, this software constitutes results of the collaborations between the eScience Center and its project partners. Other parts of the RSD are formed by software that is developed in-house at the eScience Center, and by software developed by external parties to which the eScience Center has made significant contributions. The eScience Research Engineers contribute to the RSD by generalizing and inserting the technologies they develop in the projects in which they are partnering as a research team member.

Apart from the software itself, the RSD contains *supporting material* associated with the actual tools, applications, scientific workflows, algorithms and libraries. This material can take the form of documentation, best practice guides, tutorials, training material, papers, demos, blog posts, etcetera. This collection of supporting material grows as software is re-used in other projects. In this way, the software in the RSD is presented in its *research context*. This context helps researchers to quickly judge if a certain piece of software is relevant to their particular problem, if others in their field are using it, how to get started with the software, and whom to contact for questions. This improves the findability of software and promotes its re-use.

While the RSD is the primary facility for managing and disseminating software created in the eScience Center's project portfolio, all aspects of the RSD can be applied in a broader context than just a single project. As such, the RSD supports multiple research efforts, an entire research discipline, and even multiple disciplines. The RSD explicitly aims to promote the exchange and re-use of knowledge and best practices and to prevent fragmentation and duplication of research software.

Serving research communities

It must be stressed that the technological developments undertaken by and with the eScience Center are not aimed at realizing benefits for the eScience Center itself. All developments are in support of the scientific goals of the research project, with the additional aim to also serve other research communities as much as possible, now and in the future.

⁶ See also: www.esciencecenter.nl/expertise/ and <https://www.research-software.nl/>.

Appendix C:

In this call, all applicants are asked to indicate the project's e-Infrastructure needs, in terms of compute hours, data storage capacity, lightpath connectivity, or otherwise. A 'use-or-explain' policy will be applied, meaning that

- projects *without* e-Infrastructure needs are asked to give a brief explanation;
- projects with clear e-Infrastructure needs are expected to select the hardware resources and services as part of the Dutch National e-Infrastructure as first option, and to indicate the expected extent of use;
- projects with clear e-Infrastructure needs that aim to use international (e.g. PRACE, XSEDE, etcetera) or commercial (e.g. web, cloud, etcetera) hardware and services instead are required to give a brief explanation.

The use of the Dutch National e-Infrastructure is not a requirement, nor is it a formal review criterion. However, in all cases in which the Dutch National e-Infrastructure is not used, a justification should be provided.

The Dutch National e-Infrastructure

In this call, the Dutch National e-Infrastructure is defined as follows:

all publicly-funded hardware resources (e.g. compute, data, visualization, networking, etcetera) and directly connected support services (people, software), set up and maintained with the aim to support publicly-funded research in the Netherlands, and made available to either all or a selected subset of all researchers from a.o. Dutch universities and research institutes affiliated with NWO or KNAW.

The definition distinguishes between hardware resources and services available to all researchers in the Netherlands (Category I), and those made available to a selected subset (Category II). The Category I e-Infrastructure, outlined below, is formed by the hardware resources and services provided and maintained by SURFsara, SURFnet, DANS, and – in part – also by Nikhef and RUG-CIT.

The Category II e-Infrastructure is formed by all other hardware resources and services that are accessible to a selected group of researchers following thematic or geographic criteria. Examples of such infrastructures include the Distributed ASCI Supercomputer (DAS) and the many stand-alone local facilities at various universities (e.g. the Peregrine cluster (RUG-CIT), the GPFS data storage facilities (Target), the WUR HPC Cluster (Wageningen), etcetera).

Overview: Category I e-Infrastructure

While it is impossible to provide a complete overview of all resources part of the Dutch National e-Infrastructure in this call text, the following provides entrance points to the major Category I e-Infrastructure resources and services. For more information, it is advised to contact the organizations and institutes responsible for these resources directly, in particular SURF: <https://www.surf.nl/en/contact.html>.

Compute Resources and Services

- Cartesius: National supercomputer for maximum performance
<https://userinfo.surfsara.nl/systems/cartesius>
- HPC Cloud: Complete control over your own computing infrastructure
<https://www.surf.nl/en/services-and-products/hpc-cloud/index.html>
- Grid: Distributed computing system for fast processing of large data sets
<https://www.surf.nl/en/services-and-products/grid/index.html>
- Hadoop cluster: Big data processing and analysis
<https://www.surf.nl/en/services-and-products/big-data-services/index.html>

Data Resources and Services

- BeeHub: Easily save and share large volumes of data
<https://www.surf.nl/en/services-and-products/beeHub/index.html>
- Data Archive: Secure long-term storage of research data on tape
<https://www.surf.nl/en/services-and-products/data-archive/index.html>
- DataverseNL: Store, share and register research data online
<https://www.dans.knaw.nl/en/about/services/DataverseNL>
- EASY: Online archiving, depositing and downloading of research data
<https://www.dans.knaw.nl/en/about/services/easy>

Networking Resources and Services

- Lightpaths (SURFlichtpaden): Ultra-fast and high capacity connectivity
<https://www.surf.nl/en/services-and-products/surflichtpaden/index.html>

Cloud and Collaborative Resources and Services

- SURFconext: Online collaboration and services in a single environment
<https://www.surf.nl/en/services-and-products/surfconext/index.html>
- SURFdrive; Personal and secure cloud storage, synchronization, sharing
<https://www.surf.nl/en/services-and-products/surfdrive/surfdrive.html>

Visualization Resources and Services

- Remote visualization: Visualize large datasets on your desktop
<https://www.surf.nl/en/services-and-products/visualisation/index.html>
- Collaboratorium: Sophisticated presentation and visualization aids
<https://www.surf.nl/en/themes/research/overview-services-for-research/big-data-analytics-and-visualisation-processing-data/index.html>

SURF

For a complete overview of all Category I services provided by SURF, see:
<https://www.surf.nl/en/services-and-products>

DANS

For a complete overview of all Category I services provided by DANS, see:
<http://www.dans.knaw.nl/en/about/services>