



# **Annex A: Existing top-down funding mechanisms**

**Development of a Funding Mechanism for  
Sustaining Open Source Software  
for European Public Services**

**April 2022**

**Deloitte.**

## Study Authors

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## European Commission

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## **A Annex: Existing top-down funding mechanisms for FOSS**

In this annex we present almost 20 top-down funding mechanisms for FOSS, divided into four categories:

- funding from government,
- funding from traditional, industrial endowment funds,
- funding from technology endowment funds, and
- funding from industry/science consortia.

More than half of these mechanisms have been expanded into longer case studies. The description of most of these mechanisms concludes in an info block summarising the main characteristics of the mechanism. For some of the cases we interviewed people who are responsible for a fund, or asked them for additional input.

We have presented our overall findings, consisting of aggregated commonalities and peculiarities, in Chapter 2 of the Report.

## A.1 Funding from government

### A.1.1 The EU Framework Programmes

The [\(RTD\) Framework Programmes](#)<sup>1</sup> (Framework Programmes for Research and Technological Development, or FPs in short) are a series of multi-annual programmes to support and foster research, innovation and technology in the European Union.<sup>2</sup> That makes them the European equivalent of the funding programmes run by the US National Science Foundation (NSF), as discussed in section <A.1.5>. The Programmes cover almost every scientific discipline and are the main funding mechanism for scientific research<sup>3</sup> in what is now called the European Research Area (ERA).<sup>4</sup>

#### The EU Framework Programmes

- **vision/aims:** a series of multi-annual programmes to support and foster research, innovation and technology in the European Union;
- **model:** the Programmes cover almost all scientific disciplines and are the main funding mechanisms for scientific research in what is now called the European Research Area (ERA);
- **grants:** Horizon 2020 ran from 2014 to 2020, and provided nearly 80 billion EUR in funding.

Horizon Europe, the new Framework Programme for the period 2021–2027, is currently being finalised. It will have a budget of around 95.5 billion EUR.

The first Horizon Europe Strategic Plan (2021–2024) is expected to be adopted in February 2021.

One of the novelties is the European Innovation Council (EIC), which aims to support innovations of a breakthrough and disruptive nature, and to scale up potential that is too risky for private investors. 70% of its budget of over 10 million EUR has been earmarked for SMEs.

- **geographical target:** worldwide, with a strong focus on Europe (ERA) and its neighbours;
- **application process:** not yet available;
- **disbursement:**
  - Pathfinder: Applicants will learn the results of the assessment within five months of closure of the call, and successful applicants will receive the grant three months later.
  - Accelerator: Applicants will learn the result within one month and receive grants within five months.
- **base:** Brussels, Belgium
- **websites:**

#### A.1.1.1 The European Research Area (ERA)

The European Research Area ([ERA](#)) is the research equivalent of the provisions that allow people to move and reside freely within the territory of the EU, and allow goods, capital, services, workers/professionals and businesses to move freely

<sup>1</sup> [https://ec.europa.eu/info/research-and-innovation\\_en](https://ec.europa.eu/info/research-and-innovation_en)

<sup>2</sup> [https://ec.europa.eu/info/research-and-innovation/strategy\\_en](https://ec.europa.eu/info/research-and-innovation/strategy_en)

<sup>3</sup> [https://ec.europa.eu/info/research-and-innovation/funding\\_en](https://ec.europa.eu/info/research-and-innovation/funding_en)

<sup>4</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/era\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/era_en)

within the [European single market](#).<sup>5</sup> The ERA aims "to create a single, borderless market for research, innovation and technology across the EU. It helps countries be more effective together, by strongly aligning their research policies and programmes. The free circulation of researchers and knowledge enables better cross-border cooperation, building of critical mass, and continent-wide competition."<sup>6</sup>

#### **A.1.1.2 Horizon 2020, Horizon Europe, and an open vision for Europe**

[Horizon 2020](#)<sup>7</sup> (FP8) ran from 2014 to 2020, and provided nearly 80 billion EUR in funding. It was driven by the Innovation Union research and innovation policy, aiming to:<sup>8</sup>

- make Europe into a world-class science performer,
- remove obstacles to innovation, and
- revolutionise the way public and private sectors work together, notably through European Innovation Partnerships (EIPs).<sup>9 10</sup>

In 2015, the then Commissioner for Research, Science and Innovation Carlos Moedas set up three new main pillars for the next research and innovation policy, all based on openness (as set out in the book '*Open innovation, open science, open to the world; A vision for Europe*'<sup>11</sup>):

##### Open Innovation:

Opening up the innovation process to people with experience in fields other than academia and science (i.e. [co-creation](#), user-centric, multi-collaborative), thereby helping knowledge to circulate more freely and be used to develop products and services that can create new markets.<sup>12</sup>

##### Open Science:

focusing on spreading knowledge as soon as it is available using digital and collaborative technology, instead of the (traditional) standard practice of publishing results in scientific publications only at the end of the research process;

thereby allowing end users to be producers of ideas, relations and services, and in doing so enabling new working models and new social relationships, leading to a new modus operandi for science.

Note that in addition to open access and open research, this method of working also includes FAIR (Findable, Accessible, Interoperable and Reusable data) and open data (FAIR/O) sharing to become the default.<sup>13</sup>

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<sup>5</sup> <https://ec.europa.eu/growth/single-market/>

<sup>6</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/era\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/era_en)

<sup>7</sup> <https://ec.europa.eu/programmes/horizon2020/en>

<sup>8</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/innovation-union\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/innovation-union_en)

<sup>9</sup> <https://ec.europa.eu/programmes/horizon2020/en/area/partnerships-industry-and-member-states>

<sup>10</sup> [https://ec.europa.eu/info/horizon-europe/european-partnerships-horizon-europe\\_en](https://ec.europa.eu/info/horizon-europe/european-partnerships-horizon-europe_en)

<sup>11</sup> <https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1>

<sup>12</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-innovation-resources\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-innovation-resources_en)

<sup>13</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science_en)

Furthermore, next to open access, open source is mentioned as one of the two trends at the roots of open science. It is not part of this vision though.

#### Open to the World:

promoting international cooperation in the research community, thereby allowing Europe to access the latest knowledge worldwide, recruit the best talent, tackle global challenges, create business opportunities in new and emerging markets, and use science diplomacy as an influential instrument of external policy.<sup>14</sup>

These became the three main policy goals for the second part of the Horizon 2020 programme. They also form the basis under the new ERA (revitalised in 2018–2020)<sup>15 16</sup> and the new Horizon Europe programme (2021–2027) that was just launched.<sup>17</sup>

### **A.1.1.3 'Open innovation, open science, open to the world'**

From the book 'Open innovation, open science, open to the world; A vision for Europe':<sup>18</sup>

*The globalisation of research and innovation has become increasingly visible, particularly in terms of collaborative research, international technology production, and the worldwide mobility of researchers and circulation of knowledge.*

The world is becoming both more R&D-intensive and multipolar, and the relative weight of the EU (and the US and Developed Asian Economies) in this new global R&D landscape is falling (in favour of China).

As more research and innovation is performed outside Europe, the EU will need to access this knowledge. And to remain a major global player, the EU must promote itself as an attractive location for carrying out research and innovation and be successful in the global competition for talent, while at the same time preserving its economic interests, notably as regards intellectual property rights and standards.

Note that when discussing scientific collaboration (pages 64–65), China and the category of Developed Asian Economies are seen as partners rather than competitors.

More from the book:

*Horizon 2020 is the main vehicle, fully open to participants from across the world and with many topics specifically targeting international cooperation. [page 66]*

EU policy initiatives such as Horizon 2020, the European Fund for Strategic Investments ([EFSI](#)), and the European Structural and Investment Funds (ESIF)<sup>19</sup> should also attract international partners to invest in research and innovation in Europe; initiatives should also be open to partnering with entities outside Europe. [page 67]

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<sup>14</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/international-cooperation\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/international-cooperation_en)

<sup>15</sup> [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_20\\_1749](https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1749)

<sup>16</sup> <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/aae418f1-06b3-11eb-a511-01aa75ed71a1>

<sup>17</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy_en)

<sup>18</sup> <https://op.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1>

<sup>19</sup> [https://ec.europa.eu/regional\\_policy/en/funding/](https://ec.europa.eu/regional_policy/en/funding/)

International collaboration plays an increasingly important role both in improving the competitiveness of research and innovation systems and in fostering new knowledge production worldwide. [page 67]

Countries neighbouring the ERA (pages 72–73) need special attention "to foster integration into, or alignment with, the European Research Area". For example, through the Policy Support Facility (PSF), which "provides Member States and countries associated to the programme with practical support to design, implement and evaluate reforms that enhance the quality of their research and innovation investments, policies and systems".

The European Commission holds regular science and technology cooperation dialogues with some 20 key international partner countries all over the world.

Commissioner Carlos Moedas on openness:

The advent of digital technologies is making science and innovation more open, collaborative, and global.

The Open Innovation goal has led to a debate on a possible European Innovation Council (EIC) and the creation of a Seal of Excellence to facilitate links between Horizon 2020 and other funding programmes. The Open Science goal is materialising in the development of a European Science Cloud and greater openness to scientific data generated by Horizon 2020 projects. The Commission has already taken historic steps to be Open to the World by signing Association Agreements with Ukraine and Tunisia to Horizon 2020, as well as international agreements with China and South American countries.

#### **A.1.1.4 Horizon Europe**

Horizon Europe,<sup>20</sup> the new Framework Programme for the period 2021–2027, is currently being finalised. It is part of the new EU long-term budget (the Multi-annual Financial Framework (MFF)),<sup>21</sup> and will have a budget of around 95.5 billion EUR, which represents a 30% increase compared to the Horizon 2020 programme.<sup>22</sup>

The core structure of Horizon Europe consists of three pillars: fundamental science, global challenges, and innovation. The figure below gives an overview of the structure of the Programme.

Defence research and development is part of Horizon Europe, but has its own programme in the form of the European Defence Fund.<sup>23</sup>

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<sup>20</sup> [https://ec.europa.eu/info/horizon-europe\\_en](https://ec.europa.eu/info/horizon-europe_en)

<sup>21</sup> [https://ec.europa.eu/info/horizon-europe/commissions-proposal-horizon-europe\\_en](https://ec.europa.eu/info/horizon-europe/commissions-proposal-horizon-europe_en)

<sup>22</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_20\\_2345](https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2345)

<sup>23</sup> [https://ec.europa.eu/info/horizon-europe\\_en#proposal](https://ec.europa.eu/info/horizon-europe_en#proposal)

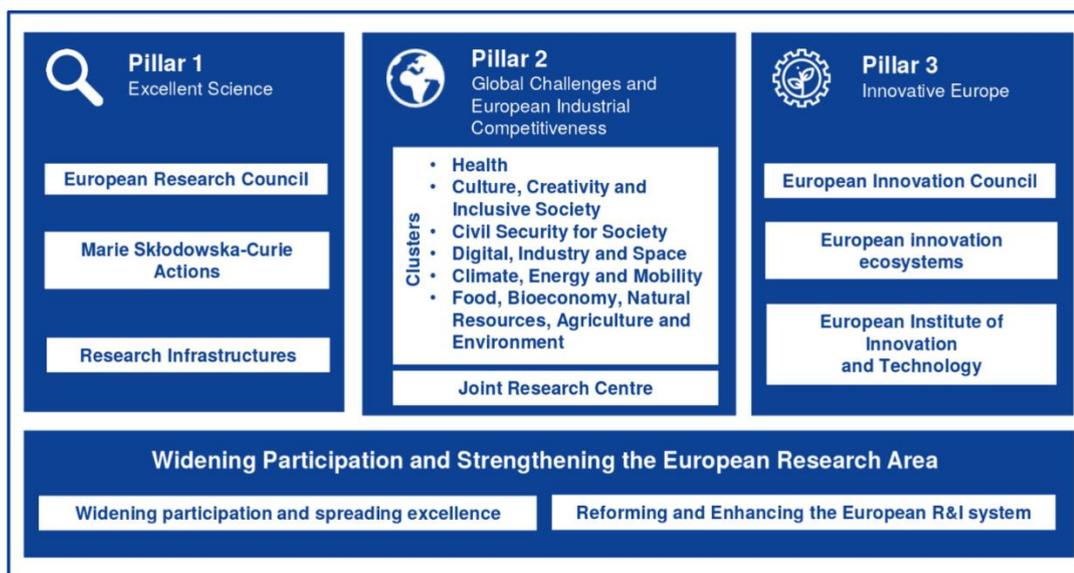


Figure 1 - The Structure of Horizon Europe. Source: Horizon Europe – Investing to shape our future<sup>24</sup>

### A.1.1.5 First Horizon Europe Strategic Plan

The first Horizon Europe Strategic Plan (2021–2024) is expected to be adopted in February 2021.<sup>25 26</sup> The first work programmes are expected to be published by April 2021, although the work programmes for the European Research Council (ERC) and European Innovation Council (EIC) may be published earlier.<sup>27</sup>

### A.1.1.6 The European Innovation Council (EIC)

One of the novelties is the European Innovation Council ([EIC](https://ec.europa.eu/research/eic/index.cfm)),<sup>28 29</sup> part of the Innovative Europe pillar, and a complement to the European Institute of Innovation and Technology ([EIT](https://eit.europa.eu/)).<sup>30 31</sup> The EIC will support innovations of a breakthrough and disruptive nature, and scale up potential that is too risky for private investors. 70% of its budget of over 10 million EUR has been earmarked for SMEs (managed by the Executive Agency for SMEs, EASME).<sup>32 33</sup>

The idea is for EIC to provide a one-stop shop for helping innovators create markets of the future, leverage private finance, and scale up their companies; keywords: innovation centric, risk taking & agile, pro-active management and follow up.

<sup>24</sup> [https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future\\_en](https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en)

<sup>25</sup> [https://ec.europa.eu/info/horizon-europe\\_en#implementing-horizon-europe-strategic-planning](https://ec.europa.eu/info/horizon-europe_en#implementing-horizon-europe-strategic-planning)

<sup>26</sup> [https://ec.europa.eu/info/files/orientations-towards-first-strategic-plan-horizon-europe\\_en](https://ec.europa.eu/info/files/orientations-towards-first-strategic-plan-horizon-europe_en)

<sup>27</sup> [https://ec.europa.eu/info/horizon-europe\\_en#proposal](https://ec.europa.eu/info/horizon-europe_en#proposal)

<sup>28</sup> <https://ec.europa.eu/research/eic/index.cfm>

<sup>29</sup> [https://ec.europa.eu/info/files/european-innovation-council-eic\\_en](https://ec.europa.eu/info/files/european-innovation-council-eic_en)

<sup>30</sup> <https://eit.europa.eu/>

<sup>31</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_20\\_2345](https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2345)

<sup>32</sup> <https://ec.europa.eu/easme/en>

<sup>33</sup> [https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future\\_en](https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en)

EIC has two complementary instruments to bridge the gap from idea to investable project:<sup>34</sup>

- Pathfinder (previously known as FET Open and FET Proactive):<sup>35</sup> grants (from early technology to pre-commercial); through a fast-track procedure for bottom-up proposals, for small consortia, and time-to-grant not exceeding six months. Applicants will be informed about the results of the assessment by independent experts within five months of closure of the call, and successful applicants will receive the grant three months later.
- Accelerator (previously known as SME Instrument):<sup>36</sup> grants only and blended financing (from pre-commercial to market and scale-up). The blended financing consists of a grant plus equity funding. Applicants will be informed about the result within one month and receive grants within five months. For the equity, additional due diligence will be undertaken before the investment is made.<sup>37</sup>

A pilot for EIC<sup>38</sup> has been running since 2017. In the first two years of its existence, EIC supported 1276 projects with a total of 730 million EUR in funding. In March 2019 an additional budget of 2 billion EUR was made available for the last two years of the pilot.<sup>39</sup>

#### **A.1.1.7 The EIC Pathfinder**

"Pathfinder funding schemes support scientific and technological excellence within the EIC. Applicants are invited to think how to shape the future with high-risk/high-gain, long-term and multidisciplinary research enabling the emergence of visionary innovative ideas that may translate in future technological innovation."<sup>40</sup>

The current descriptions of the Pathfinder instrument (February 2021) all refer to information under the now expired Horizon 2020 programme,<sup>41</sup> so we have done no further exploration of this instrument here.

#### **A.1.1.8 The EIC Accelerator**

"The EIC Accelerator is designed for small and medium-sized enterprises (SMEs) with radically new ideas underpinned by a business plan for rolling out marketable innovation solutions and with ambitions to scale up. It targets for-profit SMEs only, including young companies and start-ups, from any sector – there are no set topics."<sup>42</sup>

"Only single companies (as opposed to consortia) can apply for EIC Accelerator. Companies that apply must be established in an EU Member State or a Horizon Europe associated country.<sup>43</sup> Large corporates, research centres or scientists cannot apply directly but they can participate in projects as subcontractors or third

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<sup>34</sup> <https://ec.europa.eu/research/eic/index.cfm?pg=funding>

<sup>35</sup> <https://ec.europa.eu/research/eic/index.cfm?pg=pathfinder>

<sup>36</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/eic-accelerator-funding-opportunities>

<sup>37</sup> [https://ec.europa.eu/research/eic/pdf/ec\\_eic\\_factsheet\\_032019.pdf](https://ec.europa.eu/research/eic/pdf/ec_eic_factsheet_032019.pdf)

<sup>38</sup> <https://ec.europa.eu/research/eic/index.cfm>

<sup>39</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_19\\_1694](https://ec.europa.eu/commission/presscorner/detail/en/IP_19_1694)

<sup>40</sup> <https://ec.europa.eu/research/eic/index.cfm?pg=pf2>

<sup>41</sup> <https://ec.europa.eu/research/eic/index.cfm?pg=pf2>

<sup>42</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/eic-accelerator-funding-opportunities>

<sup>43</sup> [https://ec.europa.eu/info/research-and-innovation/strategy/international-cooperation\\_en#countries-and-regions](https://ec.europa.eu/info/research-and-innovation/strategy/international-cooperation_en#countries-and-regions)

parties and don't need to be established in an EU Member State or associated country."<sup>44</sup>

"EIC Accelerator helps you develop your business concept further into a market-ready product, service or process aligned with your company's growth strategy. Activities could, for example, include trials, prototyping, validation, demonstration and testing in real-world conditions, and market replication. If the activity concerns a primarily technological innovation, a Technology Readiness Level ([TRL](#)) of 6–8 is envisaged for projects requesting grants only. Projects will receive between 0.5 and 2.5 million EUR in the form of grants. They can request a higher or lower amount when applying, but it needs to be duly justified. Projects should normally take 12 to 24 months to complete, but could be longer in exceptional and well-justified cases."<sup>45</sup>

### **A.1.1.9 The EIC Fund**

In June 2020, the legal entity for the EIC Fund was created. The EIC Fund targets "the funding gap at the start-up and scale-up stage, where currently the European venture capital market relatively underperforms as compared to the global venture capital market".<sup>46</sup>

The EIC Fund will provide equity funding from 0.5 million to 15 million EUR to companies selected for EIC Accelerator blended finance support, in exchange for an expected 10–25% ownership stake. "The [European Investment Bank](#), as advisors of the EIC Fund on behalf of the European Commission, will manage the ownership stakes of the Commission."<sup>47</sup>

From 2021 the EIC Fund will be financed by the EIC. "Depending on the demand and quality of proposals, it is expected that at least one third of the EIC budget will be in the form of equity managed by the EIC Fund."<sup>48</sup>

"Furthermore, the EIC Fund will increase financing by crowding-in private investment, co-investing with venture capital funds, national promotional banks, corporate venture funds and other private investors. In addition to equity funding, EIC Accelerator-supported companies receive grant funding of up to 2.5 million EUR and have access to mentoring, business coaching<sup>49</sup> (through the Enterprise Europe Network, EEN)<sup>50</sup> and matchmaking with investors, corporates and likeminded entrepreneurs."<sup>51 52</sup>

### **A.1.1.10 First round through the EIC Fund**

On 6 January 2021 the European Commission announced the first round of direct equity investment through the EIC Fund. 42 startups and SMEs will together

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<sup>44</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/eic-accelerator-funding-opportunities>

<sup>45</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/eic-accelerator-funding-opportunities>

<sup>46</sup> <https://ec.europa.eu/research/eic/index.cfm?pg=investing>

<sup>47</sup> [https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22\\_en](https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22_en)

<sup>48</sup> [https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22\\_en](https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22_en)

<sup>49</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/coaching-under-eic>

<sup>50</sup> <https://een.ec.europa.eu/>

<sup>51</sup> <https://ec.europa.eu/easme/en/section/sme-instrument/business-acceleration-support-and-coaching-services>

<sup>52</sup> [https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22\\_en](https://ec.europa.eu/info/news/official-entity-european-innovation-council-equity-fund-high-impact-innovation-2020-jun-22_en)

receive equity financing of around 178 million EUR. The equity investments, ranging from 500,000 to 15 million EUR per beneficiary, complement the grant financing already provided.<sup>53</sup>

"Under the EIC Accelerator a total of 293 companies have already been selected for funding worth over 563 million EUR in grants since December 2019. Among those, 159 companies have been selected to additionally receive the new equity investments from the EIC Fund. The 42 companies announced today are the first of this group to successfully pass the evaluation and due diligence process. The other 117 companies are in the pipeline to receive investments pending the outcome of the relevant process.<sup>54</sup>

#### **A.1.1.11 The application process**

The application process for the EIC Accelerator under the now expired Horizon 2020 programme is described here:

<https://ec.europa.eu/easme/en/section/sme-instrument/eic-accelerator-funding-opportunities#inline-nav-2>

Part of Horizon Europe's implementation strategy is to shift the focus from administration to content:<sup>55</sup>

- by simplifying the model grant agreements and guidance to beneficiaries; and
- through the funding and tenders portal, a one-stop shop for easy access to EU funding and project implementation.

#### **A.1.1.12 Open-source software**

Just like in the Horizon 2020 programme, open-source software is never mentioned in the current documents on Horizon Europe, nor in the reports and materials that shaped the proposal for this programme.<sup>56</sup>

The reason is that the European Commission considers software to be different from documents<sup>57</sup> (even though both fall under the protection of copyright) and from open data<sup>58</sup> (even though both are data). Software, i.e. computer programs, is defined in Directive 2009/24/EC on the legal protection of computer programs as follows:

*"For the purpose of this Directive, the term 'computer program' shall include programs in any form, including those which are incorporated into hardware. This term also includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage."*

Yet, with openness as the main driver behind the current research and innovation policy, everything else that is open is there: open data, open access, open science, open innovation, and open to the world.

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<sup>53</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_20\\_2530](https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2530)

<sup>54</sup> [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_20\\_2530](https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2530)

<sup>55</sup> [https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future\\_en](https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en)

<sup>56</sup> [https://ec.europa.eu/info/horizon-europe/commissions-proposal-horizon-europe\\_en#reports-and-materials-that-shaped-the-proposal](https://ec.europa.eu/info/horizon-europe/commissions-proposal-horizon-europe_en#reports-and-materials-that-shaped-the-proposal)

<sup>57</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32011D0833&from=EN>

<sup>58</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019L1024&from=EN>

This translates to the requirement of open science across the Horizon Europe programme as follows:<sup>59</sup>

- mandatory open access to publications:
- beneficiaries shall ensure that they or the authors retain sufficient intellectual property rights to comply with open access requirements.
- open access to research data should be ensured:
  - in line with the principle "as open as possible, as closed as necessary";
  - a Data Management Plan for [FAIR](#) (Findable, Accessible, Interoperable, Reusable) and Open Research Data (FAIR/O) is mandatory.

## A.1.2 The EU-FOSSA 2 project

The discovery of the Heartbleed bug in 2014 made it clear that the security of FOSS needed to be addressed. The EU-FOSSA 2 project,<sup>60</sup> a preparatory action,<sup>61</sup> aimed to improve the security and integrity of critical FOSS, for programs used by the European Commission as well as the wider public. It did this by setting up bug bounty programmes, organising hackathons, and engaging with developer communities.<sup>62</sup>

The total budget for the EU-FOSSA 2 project was 2.6 million EUR.<sup>63</sup> <sup>64</sup> Over EUR 1 million of this was available for the bug bounty programmes.<sup>65</sup> Another part of the budget was reserved to cover travel expenses for some invitees to participate in the hackathons and the 'Workshop about the future of Open Source Software and Open Source Hardware'.

### A.1.2.1 Bug bounty programme<sup>66</sup>

The EU-FOSSA 2 bug bounty programme initially targeted 15 open-source programs: [7-Zip](#), [Apache Kafka](#), [Apache Tomcat](#), [Drupal](#), [DSS](#), [FileZilla](#), FluxTL,<sup>67</sup> [glibc](#), [KeePass](#), Midpoint,<sup>68</sup> [Notepad++](#), [PHP Symfony](#), [PuTTY](#), [VLC](#) and [WSO2](#). The programme was executed by the ethical hacker and bug bounty platforms Deloitte/Intigrity,<sup>69</sup> [HackerOne](#)<sup>70</sup> and Yes We Hack<sup>71</sup>/[Econocom](#).

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<sup>59</sup> [https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future\\_en](https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en)

<sup>60</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>61</sup> [https://ec.europa.eu/info/news/eu-fossa-2-eus-open-source-cybersecurity-project-ends-2020-jul-14\\_en](https://ec.europa.eu/info/news/eu-fossa-2-eus-open-source-cybersecurity-project-ends-2020-jul-14_en)

<sup>62</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>63</sup> [https://archive.fosdem.org/2018/schedule/event/eu\\_bug\\_bounties/](https://archive.fosdem.org/2018/schedule/event/eu_bug_bounties/)

<sup>64</sup> <https://www2.deloitte.com/be/en/pages/risk/articles/eu-fossa-2-project.html>

<sup>65</sup> [https://joinup.ec.europa.eu/sites/default/files/custom-page/attachment/2018-05/EU-FOSSA%20%20SuperSEC%20Final\\_0.pdf](https://joinup.ec.europa.eu/sites/default/files/custom-page/attachment/2018-05/EU-FOSSA%20%20SuperSEC%20Final_0.pdf)

<sup>66</sup> [https://ec.europa.eu/info/news/20-year-old-open-source-bug-found-and-fixed-under-eu-fossa-2-project-2019-dec-11\\_en](https://ec.europa.eu/info/news/20-year-old-open-source-bug-found-and-fixed-under-eu-fossa-2-project-2019-dec-11_en)

<sup>67</sup> <https://joinup.ec.europa.eu/collection/ifdm-integrated-fisheries-data-management/solution/flux-tl>

<sup>68</sup> <https://evolveum.com/midpoint/>

<sup>69</sup> <https://www.cyberbutler.eu/products/intigrity-ethical-hacking-and-bug-bounty-platform/>

<sup>70</sup> <https://www.hackerone.com/>

<sup>71</sup> <https://www.yeswehack.com/>

Over 600 bugs were reported, of which more than 200 have been accepted. Of those, more than 70 are classified as of 'high' or 'critical' [severity](#). [Ethical hackers](#) who found and fixed these bugs have collectively received almost 200,000 EUR in rewards.

Under the EU-FOSSA 2 bug bounty programme, a 20-year-old bug was discovered in [PuTTY](#),<sup>72</sup> an open-source remote session client mainly used on the Windows platform. The hacker who reported the issue was rewarded with 3,250 EUR from the bug bounty programme. The discovery and fixing of this and hundreds of other bugs proves the value of the EU-FOSSA initiative, which was launched for exactly this purpose.<sup>73</sup>

### **A.1.2.2 Hackathons<sup>74</sup>**

In 2019 the European Commission organised two highly successful hackathons in Brussels. During these weekends filled with coding, knowledge sharing and socialising, the developer groups managed to do work that would have taken them months using their normal communication methods: chat, e-mail and [bug tracking systems](#). At the same time, the events provided an excellent opportunity for many long-time co-developers to finally meet in person, for senior members to share their wisdom, and to get new people involved in the projects.

The first hackathon took place at the beginning of April and brought together more than 60 people from the [Symfony](#) community, mostly from Europe but also from Cuba, Morocco and Russia. Together they managed to address or resolve over 230 issues related to this popular [PHP](#) web framework.<sup>75</sup>

For the second hackathon, more than 30 developers from six Apache projects ([Tomcat](#), [SpamAssassin](#), [Karaf](#), [Camel](#), [PLC4X](#)<sup>76</sup> and [Singa](#)) gathered in Brussels over the first weekend of May. Attendees came from all over the world, including Croatia, Ireland, Poland, Romania, Russia and the US. The gathering allowed developers from these countries to meet, exchange expertise, and build connections between their projects.<sup>77</sup>

For the third hackathon, close to 100 developers from 18 countries and four continents gathered in Brussels for the third and final EU-FOSSA 2 Cyber Security hackathon. In two days they co-created eight different open-source projects. Developers from the European Commission and external open-source developers had the opportunity to exchange their experiences while fixing security vulnerabilities and enhancing their software in a fun and inspiring and fun atmosphere.<sup>78</sup>

For those who were unable to bear the costs themselves, the European Commission sponsored travel expenses for the hackathons. The same is true for the 'Workshop

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<sup>72</sup> <https://www.chiark.greenend.org.uk/~sgtatham/putty/>

<sup>73</sup> [https://ec.europa.eu/info/news/20-year-old-open-source-bug-found-and-fixed-under-eu-fossa-2-project-2019-dec-11\\_en](https://ec.europa.eu/info/news/20-year-old-open-source-bug-found-and-fixed-under-eu-fossa-2-project-2019-dec-11_en)

<sup>74</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>75</sup> [https://ec.europa.eu/info/news/first-eu-fossa-hackathon-it-happened-2019-may-03\\_en](https://ec.europa.eu/info/news/first-eu-fossa-hackathon-it-happened-2019-may-03_en)

<sup>76</sup> <https://plc4x.apache.org/>

<sup>77</sup> [https://ec.europa.eu/info/news/apache-communities-hack-together-eu-fossa-2-2019-jun-25\\_en](https://ec.europa.eu/info/news/apache-communities-hack-together-eu-fossa-2-2019-jun-25_en)

<sup>78</sup> [https://ec.europa.eu/info/news/third-eu-fossa-2-cyber-security-hackathon-2019-nov-19\\_en](https://ec.europa.eu/info/news/third-eu-fossa-2-cyber-security-hackathon-2019-nov-19_en)

about the future of Open Source Software and Open Source Hardware' (in November 2019, in conjunction with DG CONNECT)<sup>79</sup>

### **A.1.3 The ISA<sup>2</sup> Sharing and Reuse Awards Contest**

The ISA2 programme<sup>80</sup> "supports the development of digital solutions that enable public administrations, businesses and citizens in Europe to benefit from interoperable cross-border and cross-sector public services." It was the successor to the ISA programme and ran from 1 January 2016 until 31 December 2020.

ISA2 comprised 54 actions<sup>81</sup> and a total budget of 131 million EUR. It was managed by the Interoperability Unit of DG Informatics of the European Commission, DIGIT.D2.<sup>82</sup>

The biannual 'Sharing & Reuse Awards' are part of the ISA2 action 'Promoting sharing and reuse of IT solutions' (2016.31)<sup>83</sup> The contest aims to "raise awareness about the benefits of sharing and reuse of IT solutions in the public sector."

The awards ceremony for the 2017 edition took place at the Sharing & Reuse Conference 2017 on 29 March 2017 in Lisbon, Portugal.<sup>84</sup> A total of 100,000 EUR was awarded to the best of 17 public administrations (out of 118 applications) that had realised benefits from sharing IT solutions and whose solutions had potential for wider reuse in Europe.<sup>85 86</sup>

The 2019 edition<sup>87 88</sup> brought in 68 solutions from 20 countries, of which 16 were selected as winners over four categories.<sup>89</sup> They were announced at an awards ceremony that took place during the Sharing & Reuse Conference on 11 June 2019 in Bucharest, Romania.<sup>90</sup> Just as in the 2017 edition, the winning team and the runner-up in each category received prizes of 15,000 and 10,000 EUR respectively.

#### **A.1.3.1 Procedures**

These were the four categories for the Sharing and Reuse Awards Contest 2019:<sup>91</sup>

1. Most innovative open source software
2. Open source software with the biggest impact on citizens or businesses

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<sup>79</sup> <https://ec.europa.eu/digital-single-market/en/news/open-source-software-vivid-discussions-workshop-about-future-oss>

<sup>80</sup> [https://ec.europa.eu/isa2/isa2\\_en](https://ec.europa.eu/isa2/isa2_en)

<sup>81</sup> [https://ec.europa.eu/isa2/actions\\_en](https://ec.europa.eu/isa2/actions_en)

<sup>82</sup> [https://ec.europa.eu/isa2/isa2\\_en](https://ec.europa.eu/isa2/isa2_en)

<sup>83</sup> [https://ec.europa.eu/isa2/actions/promoting-sharing-and-reuse-interoperability-solutions\\_en](https://ec.europa.eu/isa2/actions/promoting-sharing-and-reuse-interoperability-solutions_en)

<sup>84</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sr-conference-2017>

<sup>85</sup> [https://ec.europa.eu/isa2/awards\\_en](https://ec.europa.eu/isa2/awards_en)

<sup>86</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sr-awards-contest>

<sup>87</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/about-sr-awards-2019>

<sup>88</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-2019>

<sup>89</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-2019-results>

<sup>90</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-conference-2019>

<sup>91</sup> [https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019\\_Procedure%20guide\\_2.pdf](https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019_Procedure%20guide_2.pdf)

3. Most innovative shared IT services (commonly developed or shared)
4. Shared IT services (commonly developed or shared) with the biggest impact on citizens or businesses

The proposed solutions had to fulfil the following criteria:<sup>92</sup>

- developed by – or for – a public administration from an EU Member State,<sup>93</sup> EFTA country<sup>94</sup> or an EU candidate country<sup>95</sup>;
- only one solution per category per organisation;
- either open-source software or a shared IT service;
- being reused by at least one public administration;
- published on Joinup<sup>96</sup> in English; and
- solutions that received a monetary reward at the previous contest are not eligible to participate.

A Procedural Guide<sup>97</sup> was made available for interested parties, providing the important dates, eligibility and evaluation criteria, step-by-step submission guidelines, award ceremony details, useful links, and contact information.

Submissions (for a specific category) had to be submitted through an online form (now disabled)<sup>98</sup> in the period from 29 November 2018 to 28 February 2019 (later extended to 12 March).<sup>99</sup>

After a first eligibility check, the Evaluation Committee<sup>100</sup> would test the eligible applications against the evaluation criteria, rank them, and create a shortlist of the 32 best-ranked solutions. The Jury<sup>101</sup> would make the final selection and agree on the ranking of the 16 leading solutions, choosing the two winners in each category and providing the ranking for the remaining solutions, who each received a certificate of excellence.<sup>102</sup>

The Procedural Guide also provided the criteria that their solutions would be assessed against (more detail in the Guide):<sup>103</sup>

- solution design and governance,

<sup>92</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-application-guidelines>

<sup>93</sup> [https://europa.eu/european-union/about-eu/countries/member-countries\\_en](https://europa.eu/european-union/about-eu/countries/member-countries_en)

<sup>94</sup> <https://www.efta.int/about-efta/the-efta-states>

<sup>95</sup> [https://ec.europa.eu/neighbourhood-enlargement/countries/check-current-status\\_en](https://ec.europa.eu/neighbourhood-enlargement/countries/check-current-status_en)

<sup>96</sup> <https://joinup.ec.europa.eu/>

<sup>97</sup> [https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019\\_Procedure%20guide\\_2.pdf](https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019_Procedure%20guide_2.pdf)

<sup>98</sup> <https://ec.europa.eu/eusurvey/runner/SR-awards>

<sup>99</sup> [https://ec.europa.eu/isa2/news/sharing-reuse-awards-2019-%E2%80%93-deadline-submissions-extended-until-12-march\\_en](https://ec.europa.eu/isa2/news/sharing-reuse-awards-2019-%E2%80%93-deadline-submissions-extended-until-12-march_en)

<sup>100</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-evaluation-committee-0>

<sup>101</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-jury>

<sup>102</sup> [https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019\\_Procedure%20guide\\_2.pdf](https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019_Procedure%20guide_2.pdf)

<sup>103</sup> [https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019\\_Procedure%20guide\\_2.pdf](https://joinup.ec.europa.eu/sites/default/files/inline-files/Sharing%20and%20Reuse%20Awards%20contest%202019_Procedure%20guide_2.pdf)

- impact/extent of reuse,
- sustainability,
- innovation (for categories 1 and 3), and
- user-centricity (for categories 2 and 4).

A page of FAQs (Frequently Asked Questions) provided roughly the same information, but in the form of questions and answers.<sup>104</sup>

Information on privacy aspects related to participating in the contest was provided in a separate Privacy statement.<sup>105</sup>

#### A.1.4 Prototype Fund

The Prototype Fund<sup>106</sup> is a "funding programme of the [German] Federal Ministry of Education and Research (BMBF)<sup>107</sup> that is managed and evaluated by the Open Knowledge Foundation ([OKF](https://okfn.org/))<sup>108</sup> Germany."<sup>109 110</sup> Individuals and small teams (of

##### The Prototype Fund

- **vision/aims:** supporting independent individual developers and small teams (German innovators) in implementing their open-source software ideas up to the prototype stage;
- **model:** a funding programme of the German Federal Ministry of Education and Research (BMBF) that is managed and evaluated by the Open Knowledge Foundation (OKF) Germany;
- **grants:** applications are accepted twice a year for up to 47,500 EUR in start-up funding over a period of six months; in addition, the funding includes two coaching sessions as well as consulting and networking; the amount of funding is always 95% of the overall project budget;<sup>1</sup>
- **geographical target:** you have to be a legal adult and a German resident, self-employed and paying German taxes; or you have to be a legal partnership ([Gbr](https://www.gbr.de/)) made up entirely of German residents;<sup>1</sup>
- **application process:** the Fund publishes a full timeline from call to closure of the projects,<sup>1</sup> and another page on the criteria for funding and concrete advice on what an application should look like;<sup>1</sup>

the application form consists of eight questions, requiring you to do your application in German; a jury of experts will evaluate and rate all submissions; all applicants will hear whether their applications have been successful 8-12 weeks after the deadline;

- **disbursement:** three installments during and at the end of the project (based on work packages);
- **base:** Berlin, Germany
- **website:** <https://prototypefund.de/en/>
- **Wikipedia:** –

<sup>104</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-faq>

<sup>105</sup> <https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-contest-20182019-privacy-statement>

<sup>106</sup> <https://prototypefund.de/en/>

<sup>107</sup> <https://www.bmbf.de/en/index.html>

<sup>108</sup> <https://okfn.org/>

<sup>109</sup> <https://okfn.de/en/projekte/prototypefund/>

<sup>110</sup> <https://prototypefund.de/en/about-2/>

freelance coders, hackers, user-experience (UX) designers and more) can receive funding in order to test their ideas and develop open-source applications in the areas of [Civic Tech](#), [Data Literacy](#), IT Security and Software Infrastructure."<sup>111</sup>

#### A.1.4.1 Grants

The Prototype Fund "supports independent individual developers and small teams in the implementation of their open-source software ideas up to the prototype stage. Applications are accepted twice a year for up to 47,500 EUR in start-up funding over a period of six months. In addition, the funding includes two coaching sessions as well as consulting and networking."<sup>112</sup> "During the project term, they'll connect the participants with investors, potential partners and other support programmes."<sup>113</sup>

The Fund is specifically aimed at German innovators: you have to be a legal adult and a resident of Germany, self-employed and paying German taxes.<sup>114</sup>

The Fund has organised two funding rounds per year since 2017.<sup>115</sup> Since then, it has granted 8.1 million EUR to 191 projects (February 2021),<sup>116</sup> organised over almost two dozen topics.<sup>117</sup>

All code produced<sup>118</sup> has been published on [GitHub](#)<sup>119</sup> or similar platforms.

#### A.1.4.2 The application process

The Prototype Fund has published a full timeline, from call to closure of the projects, showing three installments during and at the end of the project (based on work packages).<sup>120 121</sup>

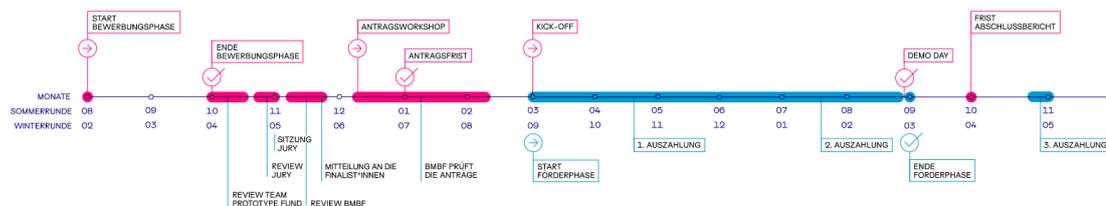


Figure 2 - Timeline showing dates and milestones during the application and funding phase of the Prototype Fund<sup>122</sup>

- 111 <https://prototypefund.de/en/about-2/>
- 112 <https://prototypefund.de/en/apply/>
- 113 <https://prototypefund.de/en/apply/faq/>
- 114 <https://prototypefund.de/en/apply/faq/>
- 115 <https://prototypefund.de/en/projects/?filter=timeline>
- 116 <https://prototypefund.de/>
- 117 <https://prototypefund.de/en/projects/?filter=topics>
- 118 <https://prototypefund.de/en/projects/?filter=code>
- 119 <https://github.com/prototypefund>
- 120 <https://prototypefund.de/en/apply/faq/>
- 121 <https://prototypefund.de/en/apply/timeline-application/>
- 122 <https://prototypefund.de/en/apply/timeline-application/>

There is a separate page on the criteria for funding, emphasizing:<sup>123</sup>

- thematic focus, e.g. relevance, social-digital approach, reach, and making and keeping innovation accessible;
- degree of innovation;
- feasibility;
- reach and social value of the project;
- chances of success;
- preventing double funding;
- and of course: it is mandatory that the software will be open source.

Officially, all open-source licenses are allowed, but the Fund recommends the (highly permissive) MIT licence.<sup>124</sup>

The second half of the same page gives some concrete advice on what an application should look like.<sup>125</sup>

The application form consists of eight questions that need to be answered in German.

A jury of experts<sup>126</sup> will evaluate and rate all submissions.

All applicants will hear 8–12 weeks after the deadline whether their applications have been successful.<sup>127</sup>

Once you have made it into the final round, the Fund will work with you to file the required paperwork with the Federal Ministry for Education and Research during the application workshop.

The project term of the round starts with a kick-off workshop in Berlin, to which all participants are invited. After the kick-off workshop, you will work on your projects for the next six months until Demo Day, when all projects are presented to the community.<sup>128</sup>

#### **A.1.4.3 Similar (national) initiatives**

Note that there is a similar fund under the name Prototype Fund Switzerland,<sup>129</sup> a joint initiative by Opendata.ch<sup>130</sup> and Mercator Foundation Switzerland,<sup>131</sup> and another Prototype Fund run by the US-based Knight Foundation<sup>132</sup> As such, the Prototype Fund is more of a funding programme and concept.

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<sup>123</sup> <https://prototypefund.de/en/apply/auswahlkriterien/>

<sup>124</sup> <https://prototypefund.de/en/apply/faq/>

<sup>125</sup> <https://prototypefund.de/en/apply/auswahlkriterien/>

<sup>126</sup> <https://prototypefund.de/en/apply/jury/>

<sup>127</sup> <https://prototypefund.de/en/apply/faq/>

<sup>128</sup> <https://prototypefund.de/en/apply/faq/>

<sup>129</sup> <https://prototypefund.opendata.ch/en/>

<sup>130</sup> <https://opendata.ch/>

<sup>131</sup> <https://www.stiftung-mercator.ch/de/>

<sup>132</sup> <https://knightfoundation.org/prototype/>

### **A.1.5 The National Science Foundation (NSF)**

The National Science Foundation ([NSF](https://www.nsf.gov/))<sup>133</sup> is an independent US federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense." It supports "basic research and people to create knowledge that transforms the future," thereby:<sup>134</sup>

- being a primary driver of the US economy,
- enhancing the nation's security, and
- advancing knowledge to sustain global leadership.

The budget for the year 2021 is 8.5 billion USD, which is about 27% of all federally supported basic research. The NSF's main funding mechanism is "limited-term grants – currently about 12,000 new awards per year, with an average duration of three years – to fund specific research proposals that have been judged the most promising by a rigorous and objective merit-review system. Most of these awards go to individuals or small groups of investigators. Others provide funding for research centers, instruments and facilities."<sup>135</sup> An extensive list of grant activities appears at the bottom of the page <https://www.nsf.gov/about/glance.jsp>

NSF is divided into seven directorates:<sup>136</sup>

- Biological Sciences,
- Computer and Information Science and Engineering,
- Engineering,
- Geosciences,
- Mathematical and Physical Sciences,
- Social, Behavioral and Economic Sciences, and
- Education and Human Resources.

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<sup>133</sup> <https://www.nsf.gov/>

<sup>134</sup> <https://www.nsf.gov/about/>

<sup>135</sup> <https://www.nsf.gov/about/glance.jsp>

<sup>136</sup> <https://www.nsf.gov/about/who.jsp>

NSF supports almost all fields of fundamental science and engineering (and education), including 'high risk, high return' ideas, novel collaborations, and long-

#### **The National Science Foundation**

- **vision/aims:** US federal agency to promote the progress of science, to advance the national health, prosperity, and welfare, and to secure the national defence; see NSF Strategic Plan: 'Building the Future: Investing in Discovery and Innovation – NSF Strategic Plan for Fiscal Years (FY) 2018-2022';<sup>1</sup>
- **model:** budget for 2021 is 8.5 billion USD, which is about 27% of all federally supported basic research;
- **grants:** mostly limited-term grants – currently about 12,000 new awards per year, with an average duration of three years – to fund specific research proposals;
  - in all fields of fundamental science and engineering and education (except medical sciences), including 'high risk, high return' ideas, novel collaborations, and long-shot, "sci-fi" projects;
  - engineers and educators are supported directly through their own home institutions;
  - About Funding: <https://www.nsf.gov/funding/aboutfunding.jsp>
- **geographical target:** USA;
- **application process:** proposals in response to three types of programmes, and "Dear Colleague Letters", as well as unsolicited proposals;
  - more than 50,000 proposals per year, of which about 11,000 are funded.
  - Each proposal is evaluated by a minimum of three independent reviewers, after which a programme officer will decide on their review and recommendation (which all in all may take up to six months).
  - The division director will make the final decision, after which the grant will be processed by a DGA officer.<sup>1</sup>
- **disbursement:** generally within 30 days;
- **base:** Alexandria, Virginia, USA;
- **website:** <https://www.nsf.gov/>
- **Wikipedia:** [https://en.wikipedia.org/wiki/National\\_Science\\_Foundation](https://en.wikipedia.org/wiki/National_Science_Foundation)

shot, "sci-fi" projects.<sup>137</sup> The only exclusion is medical sciences, which is the primary domain of the National Institutes of Health ([NIH](https://www.nih.gov/)).<sup>138</sup>

#### **A.1.5.1 Funding**

NSF does not hire researchers or directly operate research facilities. Scientists, engineers and educators are supported directly through their own home institutions (typically universities and colleges). Facilities and equipment are funded through cooperative agreements with research consortia that have competed successfully for limited-term management contracts.<sup>139</sup>

NSF makes "grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organisations and other research organisations throughout the US."<sup>140</sup>

<sup>137</sup> <https://www.nsf.gov/about/what.jsp>

<sup>138</sup> <https://www.nih.gov/>

<sup>139</sup> <https://www.nsf.gov/about/what.jsp>

<sup>140</sup> <https://www.nsf.gov/about/how.jsp>

### **A.1.5.2 Proposals**

Proposals should ask for a specific amount of support for a specific project. Funding requests are pulled ("generated") by NSF using programme descriptions, programme announcements, programme solicitations (via Grants.gov),<sup>141</sup> and Dear Colleague Letters (DCLs).<sup>142</sup> But scientists and engineers are also welcome to send in unsolicited proposals.

All in all, NSF receives more than 50,000 proposals per year, of which about 11,000 are funded. (In addition, it receives more than 15,000 applications for graduate and postdoctoral fellowships, of which a few thousand are funded.)<sup>143</sup>

Each proposal is "evaluated by a minimum of three independent reviewers consisting of (volunteering) scientists, engineers and educators who do not work at NSF or for the institution that employs the proposing researchers."

Based on the reviews, a programme officer makes an 'award' or 'decline' recommendation to the division director, who will make the final decision.

An officer at the Division of Grants and Agreements (DGA) will then process the grant for business, financial and policy implications, before issuing the grant and accompanying cooperative agreement.<sup>144</sup>

The Merit Review process is described in some detail at [https://www.nsf.gov/bfa/dias/policy/merit\\_review/](https://www.nsf.gov/bfa/dias/policy/merit_review/).

For more detail see the 'Proposal & Award Policies & Procedures Guide' (PAPPG).<sup>145</sup>

### **A.1.5.3 No FOSS policy**

Even though there were some open-source related initiatives at NSF more than a decade ago (Software Development for Cyberinfrastructure (SDCI)<sup>146</sup> and Software for Science and Engineering<sup>147</sup>), we have not found anything recent online.

The term 'open source' is not found in the latest PAPPG (1 June 2020), though the document states that "Investigators and grantees are encouraged to share software and inventions created under the grant or otherwise make them or their products widely available and usable."<sup>148</sup>

In July 2019, science writer Anna Nowogrodzki<sup>149</sup> wrote an article for Nature on how hard it is to get scientific open-source software funded, and what researchers – most often not software engineers themselves – can do to make their software productions more sustainable. According to her, the maintenance of open-source software does not fit the funding requirements of NSF and NIH. A quote from one of her interviewees: "They'll fund 50 different groups to make 50 different algorithms, but they won't pay for one software engineer."<sup>150</sup>

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141 <https://www.grants.gov/>

142 [https://www.nsf.gov/pubs/policydocs/pappg18\\_1/pappg\\_1.jsp](https://www.nsf.gov/pubs/policydocs/pappg18_1/pappg_1.jsp)

143 [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papp](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp)

144 <https://www.nsf.gov/about/how.jsp>

145 [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papp](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp)

146 <https://www.nsf.gov/pubs/2011/nsf11504/nsf11504.htm>

147 [https://www.nsf.gov/cise/oac/taskforces/TaskForceReport\\_Software.pdf](https://www.nsf.gov/cise/oac/taskforces/TaskForceReport_Software.pdf)

148 [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papp](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp)

149 <https://www.linkedin.com/in/anna-nowogrodzki-9a83a52b/>

150 <https://www.nature.com/articles/d41586-019-02046-0>

## A.1.6 CERN

CERN<sup>151</sup> (the European Organisation for Nuclear Research) performs fundamental research at the frontier of particle physics. It operates the largest particle physics laboratory in the world, best known for its accelerators/detectors, and it plays an important role in developing the technologies of tomorrow, from materials science to computing.<sup>152</sup>

The most striking example of the latter is CERN's invention of the World Wide Web<sup>153</sup> (the basic implementation comprising the HTML markup language, hyperlinks, the web browser and server, and the HTTP transport protocol) for which all software was published as open source shortly after the invention.<sup>154</sup>

As part of its research work CERN has also published several of its other software productions under a FOSS licence.<sup>155</sup>

### A.1.6.1 The MALT project

The MALT project<sup>156</sup> (short for Microsoft Alternatives) aims for CERN to reassess its IT procurement strategy for core services.<sup>157</sup> It was started in 2018, after Microsoft announced that CERN would no longer be allowed to use Microsoft products under a licence for academic institutions. The new contract increased the cost more than tenfold and would have been unaffordable in the long term.<sup>158</sup>

Other proprietary suppliers to CERN have followed a similar path: "Once installed, well-spread and heavily used, the leverage used to attract CERN service managers to the commercial solutions [based on CERN's status as an academic, non-profit or research institute] tends to disappear and be replaced by licensing schemes and business models tuned for the private sector."<sup>159</sup>

"The initial objective of MALT was to investigate the migration from commercial software products to open-source solutions, so as to minimise CERN's exposure to the risks of unsustainable commercial conditions. By doing so, the laboratory is playing a pioneering role among public research institutions, most of whom have recently been faced with the same dilemma."<sup>160</sup>

Note that the MALT strategy has been formulated in terms of IT management rather than of ideology.

The project's principles of engagement are to:

- deliver the same service to every category of CERN personnel,
- avoid vendor lock-in to decrease risk and dependency,
- keep hands on the data, and

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151 <https://home.cern/>

152 <https://home.cern/about/what-we-do/our-impact>

153 <https://home.cern/science/computing/birth-web>

154 <https://home.cern/about/what-we-do/our-research>

155 <https://joinup.ec.europa.eu/collection/open-source-observatory-osor/news/open-source-culture>

156 <https://malt.web.cern.ch/malt/>

157 <https://malt.web.cern.ch/malt/global/info/>

158 <https://home.cern/news/news/computing/migrating-open-source-technologies>

159 <https://home.cern/news/news/computing/migrating-open-source-technologies>

160 <https://home.cern/news/news/computing/migrating-open-source-technologies>

- address the common use-cases.

These are some of the migrations explored since then:

- a definitive switch in January 2020 from Facebook Workplace to Mattermost<sup>161</sup> (an open-source chat/sharing system);<sup>162 163</sup>
- a pilot for the migration from Microsoft's Exchange mail and calendaring system to the Kopano groupware suite (a restart of Zarafa),<sup>164</sup> followed by a pilot based on Dovecot (an IMAP mail office server) and the Open-Xchange app suite;<sup>165</sup>
- other open-source software packages CERN has been evaluating and/or implementing include:<sup>166</sup>
  - FreeIPA (an identity/LDAP server),
  - Keycloak (an SSO/identity/access management server),
  - LibreOffice (an office productivity suite),
  - diagrams.net<sup>167</sup> (a tool for creating technical diagrams),
  - ownCloud (a file hosting system),
  - WordPress (a content management system),
  - Drupal (another content management system),
  - Alfresco (an information management system),
  - LimeSurvey (a web application for statistical surveys),
  - DHTMLX Gantt (for drawing Gantt project management charts),
  - Linphone (a VoIP/SIP softphone),
  - Chocolatey (a package manager and installer for Windows),
  - Flatpak (a package management and deployment tool for Linux),
  - OpenShift (a containerisation platform), and
  - Elasticsearch (a distributed search engine).

In this list are several solutions from suppliers that use the open-core business model (i.e. they offer closed-source commercial add-ons to an open-source core). CERN aims to avoid these proprietary extensions, which suffer from the same drawbacks as fully closed solutions, by simply not using them or by developing the missing functionality themselves.<sup>168</sup>

### **A.1.6.2 CERN and KiCad**

CERN uses and adopted the KiCad PCB design suite (see section ...) in its central design office, complementing proprietary solutions. Below we present some key

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<sup>161</sup> <https://mattermost.com/>

<sup>162</sup> <https://home.cern/news/news/computing/cern-ends-trial-facebook-workplace>

<sup>163</sup> <https://joinup.ec.europa.eu/collection/open-source-observatory-osor/news/cern-uses-mattermost>

<sup>164</sup> <https://joinup.ec.europa.eu/collection/open-source-observatory-osor/news/open-source-culture>

<sup>165</sup> <https://cernmail-pilot.cern.ch/appsuite/>

<sup>166</sup> <https://malt.web.cern.ch/malt/global/malt-table/>

<sup>167</sup> <https://www.diagrams.net/>

<sup>168</sup> <https://malt.web.cern.ch/malt/global/selection-policy/>

points specifically with regard to PCB design and KiCad at CERN. It also includes points from an interview with Javier Serrano,<sup>169</sup> leader of the Electronics Design and Low-level software section in CERN's Controls Electronics and Mechatronics group, on 22 January 2021:

CERN's involvement in KiCad<sup>170 171</sup> predates the MALT strategy. The main aim for its adoption was to be able to share designs efficiently with people outside the institute. As Serrano says: *"We are hardware designers who want to share our designs under an open-source licence", but as far as we know there are no generally usable open formats for schematic designs and board layouts available. In 2006-2007 we made an inventory of the available open-source PCB EDA tools, and found that KiCad was the most promising out there, but we were missing some features to be able to use it at work. Two years later we decided to adopt KiCad, and help to bring it to a level that would make it usable for us."*

The costs to CERN were limited: According to Serrano, the implementation of the highly valued push-and-shove router, for example, was done by a staff member in his spare time. Serrano continues: *"If some of the labs and universities using KiCad made one person available for one year, that could result in many people having a great impact on the development of KiCad. We should have guidelines to organise such a coordinated effort."*

According to Serrano, what CERN does with KiCad can serve as an example of how to implement the MALT strategy for other software packages.

A recent presentation by Serrano of what CERN is doing with KiCad at the institute's Mechanics department made clear it that it is too early to take a similar approach for 3D/CAD designs, e.g. using [FreeCAD](#) (see section <4.6>). But at least now the people in charge of mechanical CAD tools at CERN know the KiCad case better and can judge to what extent it applies to them.

At CERN, schematics are typically designed by engineers. The PCB layouts are then designed by the technicians in the Drawing Office.

The designers can select one of the three available tools (all officially supported) to use for their schematic designs:

- Altium Designer,<sup>172</sup>
- Cadence Allegro,<sup>173</sup> and
- KiCad.

At this moment, having a board designed using KiCad is actually more expensive than when done with one of the other two tools, because the cost of a design is based on an hourly rate, and designing in KiCad takes longer. It is not clear to which extent this is related to the tools or, more likely, to the fact that PCB designers in the Drawing Office have many more years of experience with the proprietary tools.

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<sup>169</sup> <https://home.cern/news/news/knowledge-sharing/making-hardware-design-open-and-free>

<sup>170</sup> <https://joinup.ec.europa.eu/collection/open-source-observatory-osor/news/special-kind-economic-actor>

<sup>171</sup> <https://ohwr.org/project/cern-kicad/wikis/home>

<sup>172</sup> <https://www.altium.com/altium-designer/>

<sup>173</sup> [https://www.cadence.com/en\\_US/home/tools/pcb-design-and-analysis/pcb-layout.html](https://www.cadence.com/en_US/home/tools/pcb-design-and-analysis/pcb-layout.html)

The contribution of the (for some cases very high) licensing costs of Altium and Cadence to the total cost in this case is limited, since CERN is allowed to use these tools under an academic licence (Cadence via Europractice).<sup>174</sup>

The Microsoft case that gave rise to the MALT strategy shows that arrangements for academics can end abruptly.

Standardisation of the open formats that KiCad is currently using for its schematics (in .sch files) and boards (in .kicad\_pcb files) could be a way to break open the lock-in by proprietary tool vendors, who would then be forced (by their customers, i.e. "the market") to also support export to these formats (in addition to the import of KiCad files) to provide true interoperability.

At this moment, creating an exporter to KiCad for a closed proprietary tool takes a lot of reverse engineering.

The file formats are well documented and this idea has been brought up before in the KiCad.info Forums.<sup>175</sup> However, the formats currently are not generic enough and linked too closely to KiCad's features. Standardising a format would be a lot of work, which definitely is a major hurdle.

Furthermore, the developer/user community generally does not trust standardisation bodies. The 2019 report on 'The Relationship Between Open Source Software and Standard Setting' goes into the tensions between open source licensing, patents and standards, and the stakeholders involved.<sup>176</sup>

The adoption of the [Office Open XML format](#) (i.e. Microsoft's docx, xlsx, pptx) as a supposedly open standard and the accompanying [corruption of the ISO ballot process](#) serves as a deterrent example of how far proprietary software vendors may be willing to go in pursuing their commercial interests.

There are several (possible) ways to bring in money to sustain and further develop KiCad:

- since November 2019 KiCad has been hosted by the Linux Foundation,<sup>177 178</sup> which sets up a separate legal entity for each of its projects. Apart from providing the ability to receive donations through the Linux Foundation, this legal entity could also be developed into a larger foundation, which would give KiCad more exposure (hence income).
- KiCad could feature a button that would allow designers to order the required components (from the Bill of Materials, BOM) directly from one of the suppliers they have partnership agreements with. This would mirror what the PCB manufacturers (some of whom are donors to KiCad; see section ...) already do for their customers.
- the traditional FOSS way: build a company based on providing services.

As a matter of fact, "after a series of conversations with professional KiCad users and PCB fabrication houses about what they needed to support their growth and

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<sup>174</sup> <http://www.europractice.stfc.ac.uk/welcome.html>

<sup>175</sup> e.g. <https://forum.kicad.info/t/changes-to-eeschema-and-its-file-format-any-info-dates/3297>

<sup>176</sup> <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/relationship-between-open-source-software-and-standard-setting>

<sup>177</sup> <https://www.linuxfoundation.org/en/press-release/kicad-joins-linux-foundation-to-advance-electronic-design-automation/>

<sup>178</sup> <https://kicad.org/blog/2019/11/KiCad-Joins-the-Linux-Foundation/>

success with KiCad," lead developers Seth Hillbrand<sup>179</sup> and Wayne Stambaugh<sup>180</sup> did just that. Both previously having day jobs, in 2019 they started a new company,<sup>181</sup> KiCad Services, based in California, USA.<sup>182</sup> In addition to providing commercial support ("KiPro"), the company offers contracted feature development.<sup>183</sup> The price of support depends largely on the versions of KiCad that need to be covered: an annual subscription for the latest version (6) costs USD 400.<sup>184</sup> The option to receive support under a Non Disclosure Agreement is an important differentiator from support through the KiCad.info Forums.<sup>185</sup>

In the summer of 2019, the CERN & Society Foundation,<sup>186</sup> "supporting and promoting the mission of CERN, and disseminating its benefits to the wider public",<sup>187</sup> ran a campaign to collect donations for the further development of KiCad.<sup>188 189</sup>

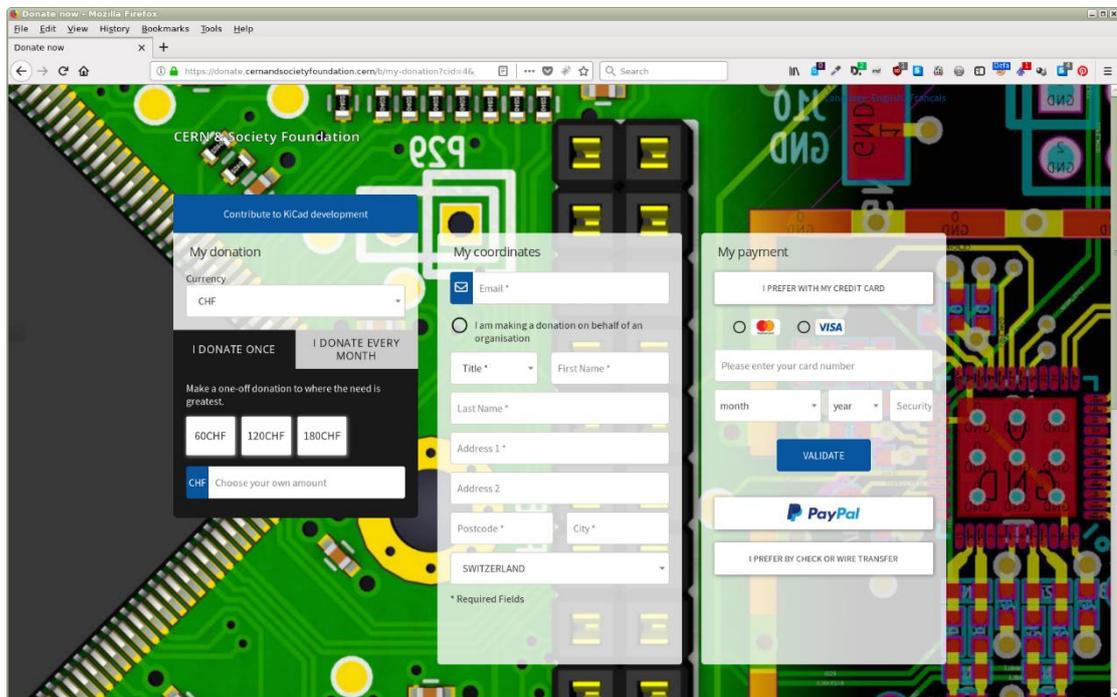


Figure 3 - The donation page for KiCad at the CERN & Society Foundation<sup>190</sup>

179 <https://www.linkedin.com/in/sethillbrand/>

180 <https://www.linkedin.com/in/wayne-stambaugh-b5161746/>

181 <https://kicad.org/blog/2019/12/Project-Leader-Joins-KiCad-Services-Corporation/>

182 <https://www.kipro-pcb.com/>

183 <https://www.kipro-pcb.com/about-us/>

184 <https://www.kipro-pcb.com/main/subscribe/>

185 <https://www.kipro-pcb.com/faq/>

186 <https://cernandsocietyfoundation.cern/>

187 <https://cernandsocietyfoundation.cern/our-mission>

188 <https://cernandsocietyfoundation.cern/projects/kicad-development>

189 <https://forum.kicad.info/t/kicad-donation-campaign/11734/18>

190 [https://donate.cernandsocietyfoundation.cern/b/my-donation?cid=4&\\_cv=1](https://donate.cernandsocietyfoundation.cern/b/my-donation?cid=4&_cv=1)

Last year KiCad ran an 'End of Year Fund Drive' (which ended on 15 January 2021).<sup>191</sup> It brought in USD 14,275, which was matched by KiCad Services (up to USD 10,000), bringing the total to USD 24,275.<sup>192</sup>

Note that KiCad has been sponsored by about a dozen companies and organisations.<sup>193</sup>

CERN itself currently is not contributing financially to KiCad, since "the development of PCB design tools is not part of their mandate". But every project done in KiCad by the Drawing Office results in a list of issues and possible solutions that is shared with the community.

CERN itself currently does not pay for support. The organisation could do that, as it does for Altium and Cadence, but currently its local experts solve its problems (two of KiCad's lead developers work at CERN).

### A.1.7 The European Space Agency (ESA)

The European Space Agency (ESA)<sup>194</sup> is "dedicated to the peaceful exploration and use of space for the benefit of humankind". It was established in 1975<sup>195</sup> and has 22 European member states (including Canada under a cooperation agreement),<sup>196</sup> "pushing the frontiers of science and technology, and promoting economic growth in Europe".<sup>197</sup>

Information on ESA's relationship with the EU (as captured in December 2016 in the resolution 'Towards Space 4.0 for a United Space in Europe')<sup>198</sup> is available at [https://www.esa.int/About\\_Us/Corporate\\_news/A\\_European\\_vision](https://www.esa.int/About_Us/Corporate_news/A_European_vision).

#### The European Space Agency funding model

- **vision/aims:** the peaceful exploration and use of space for the benefit of humankind, shaping the development of Europe's space capability and ensuring that investment in space continues to deliver benefits to the citizens of Europe and the world;<sup>1</sup>
- **model:** funded by a financial contribution from all the Agency's member states, calculated according to each country's gross national product. In addition, ESA conducts a number of optional programmes, for which each member state can decide whether to participate and how much to contribute. ESA's budget for 2021 is 6.49 billion EUR.<sup>1</sup>
- **funding:** software developed under ESA contracts can be published under an open-source licence, but this requires explicit authorisation;
- **base:** Paris;
- **website:** <https://www.esa.int/>; FOSS policy: <https://essr.esa.int/esa-open-source-policy>
- **Wikipedia:** [https://en.wikipedia.org/wiki/European\\_Space\\_Agency](https://en.wikipedia.org/wiki/European_Space_Agency)

<sup>191</sup> <https://kicad.org/blog/2020/12/KiCads-2020-End-of-Year-Fund-Drive/>

<sup>192</sup> <https://kicad.org/blog/2021/01/2020-Year-End-Funding-Drive-Results/>

<sup>193</sup> <https://kicad.org/about/kicad/>

<sup>194</sup> <https://www.esa.int/>

<sup>195</sup> [https://www.esa.int/About\\_Us/Corporate\\_news/A\\_European\\_vision](https://www.esa.int/About_Us/Corporate_news/A_European_vision)

<sup>196</sup> [https://www.esa.int/About\\_Us/Corporate\\_news/Member\\_States\\_Cooperating\\_States](https://www.esa.int/About_Us/Corporate_news/Member_States_Cooperating_States)

<sup>197</sup> [https://www.esa.int/ESA\\_Multimedia/Videos/2019/11/This\\_is\\_ESA](https://www.esa.int/ESA_Multimedia/Videos/2019/11/This_is_ESA)

<sup>198</sup> [https://www.esa.int/About\\_Us/Ministerial\\_Council\\_2016/European\\_ministers\\_ready\\_ESA\\_for\\_a\\_United\\_Space\\_in\\_Europe\\_in\\_the\\_era\\_of\\_Space\\_4.0](https://www.esa.int/About_Us/Ministerial_Council_2016/European_ministers_ready_ESA_for_a_United_Space_in_Europe_in_the_era_of_Space_4.0)

### **A.1.7.1 Open-source software**

Software developed under ESA contracts has been officially able to be published under an open-source licence since 2004, but this requires explicit authorisation from the ESA Software Licensing Board in a Software Licensing Authorisation (SWLA), which uses two different licensing regimes:<sup>199</sup>

ESA Community Software is restricted to individuals or entities belonging to the ESA member states. For distribution outside of the ESA member states, requires the use of a specific licensing framework.

An overview page lists a dozen available ESA-specific licenses, varying from strong copyleft to permissive.<sup>200</sup>

### **A.1.7.2 The European Space Software Repository (ESSR)**

The European Space Software Repository<sup>201</sup> (ESSR, formerly OSSR) "promotes reuse of (open-source) software, and provides all parties involved in European space software development (in particular SMEs) access to results of previous investments."

Note that the repository does not contain the software itself – unlike the GitHub<sup>202</sup> and GitLab<sup>203</sup> source code management portals for example – just meta information such as the name, description, creation and last modification date, version control system, owner, licence type, project homepage and download link.<sup>204</sup>

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<sup>199</sup> <https://essr.esa.int/esa-open-source-policy>

<sup>200</sup> <https://essr.esa.int/license/list>

<sup>201</sup> <https://essr.esa.int/>

<sup>202</sup> <https://github.com/>

<sup>203</sup> <https://about.gitlab.com/>

<sup>204</sup> <https://essr.esa.int/about>

## A.2 Funding from traditional, industrial endowment funds

### A.2.1 The Ford Foundation (case study)

The Ford Foundation is a North American charity organisation established by the Ford family (of the Ford Motor Company) in 1936. From its current endowment of 12 billion USD, it makes available 500 million per year in grants all over the world.<sup>205</sup>

The Foundation's key value and driver is social justice:<sup>206</sup>

"A world in which all individuals, communities, and peoples work toward the protection and full expression of their human rights; are active participants in the decisions that affect them; share equitably in the knowledge, wealth, and resources of society; and are free to achieve their full potential."

#### The Ford Foundation

- **vision/aims:** social justice; by reducing poverty and injustice, strengthening democratic values, promoting international cooperation, and advancing human achievement; through civil society, in collaboration with governments, the private sector, academia, and the creative community;
- **model:** grants funded from a 12 billion USD industrial/family endowment;
- **grants:** 500 million USD per year; FOSS-specific grants in a cooperation with Sloan Foundation, Mozilla Foundation and Open Society Foundation (see section <A.2.3> on Critical Digital Infrastructure Research);
- **geographical target:** 11 regions: USA and 10 underdeveloped countries/regions;
- **application process:** after submitting an idea through a simple online form, a programme officer will reach out to the submitter within 45 days, if the Foundation is interested;
- **disbursement:** -;
- **base:** New York, USA;
- **website:** <https://www.fordfoundation.org/>; governance documents: <https://www.fordfoundation.org/about/library/?filter=Governance%20Documents>
- **Wikipedia:** [https://en.wikipedia.org/wiki/Ford\\_Foundation](https://en.wikipedia.org/wiki/Ford_Foundation)

These are the key take-aways from their mission statement:

*"Across eight decades, our mission has been to reduce poverty and injustice, strengthen democratic values, promote international cooperation, and advance human achievement. We believe that social movements are built upon individual leadership, strong institutions, and innovative, often high-risk ideas.*

- *Investing in individuals*

*Through leadership development, scholarships, exchanges, and professional training programs, we have supported tens of thousands of leaders around the world.*

- *Building institutions*

*We have created or helped sustain thousands of pathbreaking organizations working on a broad range of social change issues.*

<sup>205</sup> <https://www.fordfoundation.org/about/about-ford/our-origins/>

<sup>206</sup> <https://www.fordfoundation.org/about/about-ford/mission/>

- *Supporting new ideas*

*Ford has invested in the early stages of novel ideas for social good – among them public media, microfinance, women's rights, public interest law, digital human rights, and many more. We focus on strengthening civil society at every level through supporting participation by people of diverse backgrounds and life experiences. We also closely collaborate with governments, the private sector, academia, and the creative community.”*

### **A.2.1.1 Grant programmes**

Under the 'Challenging inequality' flag,<sup>207</sup> the Foundation runs seven thematic programmes:

- Cities and States<sup>208</sup>
- Civic Engagement and Government<sup>209</sup>
- Creativity and Free Expression<sup>210</sup>
- Future of Work(ers)<sup>211</sup>
- Gender, Racial, and Ethnic Justice<sup>212</sup>
- Natural Resources and Climate Change<sup>213</sup>
- Technology and Society<sup>214</sup> (see below).

In addition to these seven thematic programmes, there are two programmes specifically reflecting the values of the Foundation. The first of these is about (disability) inclusion, while the second aims to change the current global capitalist system for the better, in collaboration with other institutions:

- Disability inclusion<sup>215</sup>
- Mission Investments<sup>216</sup>

The BUILD (Building Institutions and Networks) programme, which stands on its own, is "a five-year, 1 billion USD investment in the long-term capacity and sustainability of up to 300 social justice organisations [reducing inequality] around the world."<sup>217</sup>

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<sup>207</sup> <https://www.fordfoundation.org/work/challenging-inequality/>

<sup>208</sup> <https://www.fordfoundation.org/work/challenging-inequality/cities-and-states/>

<sup>209</sup> <https://www.fordfoundation.org/work/challenging-inequality/civic-engagement-and-government/>

<sup>210</sup> <https://www.fordfoundation.org/work/challenging-inequality/creativity-and-free-expression/>

<sup>211</sup> <https://www.fordfoundation.org/work/challenging-inequality/future-of-work-ers/>

<sup>212</sup> <https://www.fordfoundation.org/work/challenging-inequality/gender-racial-and-ethnic-justice/>

<sup>213</sup> <https://www.fordfoundation.org/work/challenging-inequality/natural-resources-and-climate-change/>

<sup>214</sup> <https://www.fordfoundation.org/work/challenging-inequality/technology-and-society/>

<sup>215</sup> <https://www.fordfoundation.org/work/challenging-inequality/disability-inclusion/>

<sup>216</sup> <https://www.fordfoundation.org/work/challenging-inequality/mission-investments/>

<sup>217</sup> <https://www.fordfoundation.org/work/our-grants/building-institutions-and-networks/>

### A.2.1.2 On the Technology and Society programme

The Technology and Society programme<sup>218</sup> listed above revolves around "equal access to, and fair regulation of, digital technology that is designed to advance transparency, privacy, access to knowledge, and free expression for all people." It works to protect civil and human rights and freedom of expression by supporting "the growth of technically sophisticated, diverse organisations dedicated to advancing equitable and more inclusive digital spaces and systems; and seeking to develop the technological capacity of social justice organisations".

The figure below shows a snapshot of what this specific programme has achieved so far.

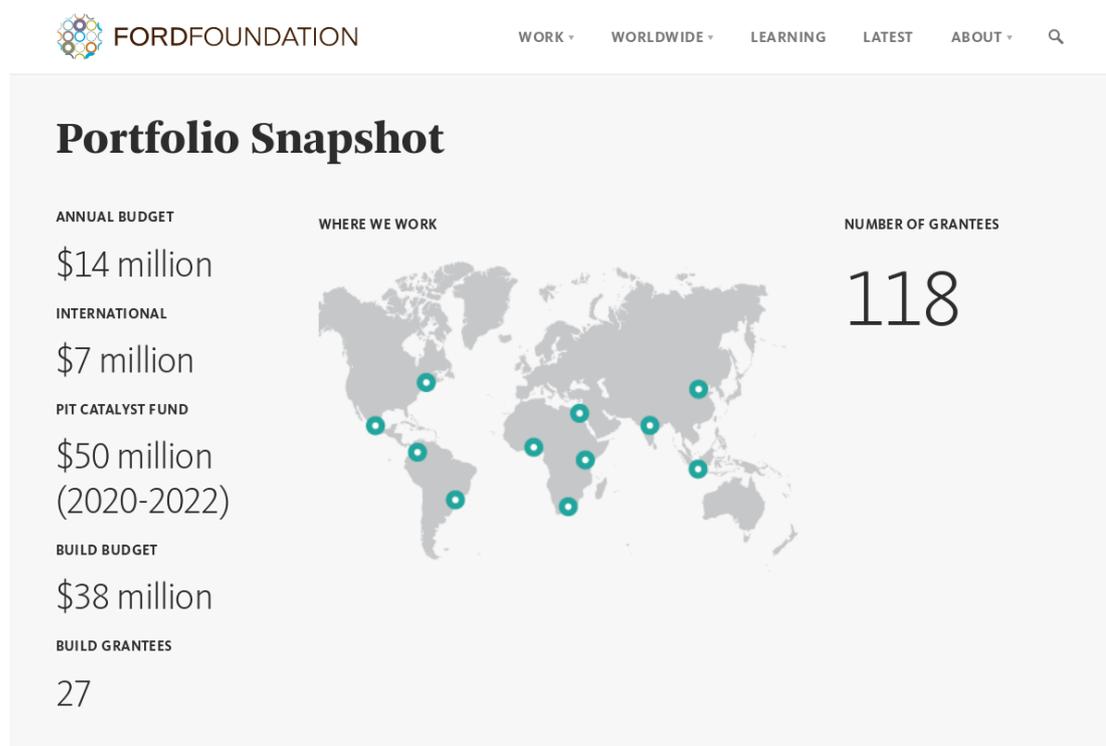


Figure 4 - A portfolio snapshot showing what the Foundation's Technology and Society programme has achieved so far. Source: programme page<sup>219</sup>

Importantly, the programme's strategy emphasises that:<sup>220</sup>

- the internet should be designed and governed as a vital public good, and
- the impact and capacity of civil society should be increased, allowing citizens to negotiate solutions with governments and the private sector,

The first item resonates strongly with the notion of FOSS as common good.

Building on the second item, from a [vendor lock-in](#) perspective, one could argue that the position of individual public agencies too should be strengthened (in this case, relative to the private sector, i.e. "Big Internet"). This could be done, for example, through:

- legislation: top-down, e.g. for public tenders:

<sup>218</sup> <https://www.fordfoundation.org/work/challenging-inequality/technology-and-society/>

<sup>219</sup> <https://www.fordfoundation.org/work/challenging-inequality/technology-and-society/>, visited on 14 January 2021

<sup>220</sup> <https://www.fordfoundation.org/work/challenging-inequality/technology-and-society/strategy/>

- guaranteeing equal opportunity or even taking affirmative action for FOSS and SMBs, and
- requiring and enforcing the use of open standards;
- their buying power (e.g. increasing market power through demand bundling),
- competition/participation (e.g. developing/sponsoring FOSS alternatives for all government agencies – and anyone else – to use), e.g. developing an open-source [CAPTCHA](#)<sup>221</sup> [issues]<sup>222</sup>
- more in-house expertise and better demand formulation, e.g. through:
  - collaboration between agencies in [shared services centres](#), and
  - participation in (FOSS) developer and user groups (as for example stated in the 'Open Source Software Strategy 2020–2023; Think Open' for the European Commission itself:<sup>223</sup> "bringing the Commission closer to the open source community, and making us an agile contributor and an active participant").

### A.2.1.3 Fellowships

Although the vast majority of its grants go to organisations, the Foundation does have several types of personal grants (fellowships):<sup>224</sup>

- The Ford Global Fellowship:<sup>225</sup> launched in 2020, a USD 50-million investment over the next 10 years that will bring together 240 promising leaders worldwide;
- the International Fellowships Programme (IFP; expired):<sup>226</sup> established in 2001 with an initial grant of 280 million USD; over its 12 years, more than 4,300 fellows from 22 countries completed a graduate or post-graduate programme;
- Ford-Mozilla Open Web Fellows<sup>227</sup> (see section A.2.1.6 below), and
- Disability Futures Fellows:<sup>228</sup> spotlighting the work of disabled creatives, in partnership with the Andrew W. Mellon Foundation.<sup>229</sup>
- The Ford Foundation Fellowship Programme:<sup>230</sup> excellent students living in the US, with "a commitment to pluralism, and a strong interest in teaching and research" can apply for a fellowship through the National Academy of Sciences ([NAS](#)).<sup>231</sup>

<sup>221</sup> [https://ec.europa.eu/isa2/actions/developing-open-source-captcha\\_en](https://ec.europa.eu/isa2/actions/developing-open-source-captcha_en)

<sup>222</sup> <https://github.com/matomo-org/matomo/issues/13905>

<sup>223</sup> [https://ec.europa.eu/info/departments/informatics/open-source-software-strategy\\_en](https://ec.europa.eu/info/departments/informatics/open-source-software-strategy_en)

<sup>224</sup> <https://www.fordfoundation.org/work/investing-in-individuals/>

<sup>225</sup> <https://www.fordfoundation.org/work/investing-in-individuals/the-ford-global-fellowship/>

<sup>226</sup> <https://www.fordfoundation.org/work/investing-in-individuals/international-fellowships-program/>

<sup>227</sup> <https://foundation.mozilla.org/en/what-we-fund/fellowships/>

<sup>228</sup> <https://www.fordfoundation.org/work/investing-in-individuals/disability-futures-fellows/>

<sup>229</sup> <https://mellon.org/>

<sup>230</sup> <https://www.fordfoundation.org/work/our-grants/individuals-seeking-fellowships/>

<sup>231</sup> <https://sites.nationalacademies.org/pqa/fordfellowships/index.htm>

- JustFilms:<sup>232</sup> part of the Creativity and Free Expression programme;<sup>233</sup> it funds "social justice storytelling and the 21st-century arts infrastructure that supports it".

#### **A.2.1.4 The grant application process**

Every grant application starts by submitting an idea to the Foundation through a simple online form<sup>234</sup> that asks for:

- a short description (up to 400 characters),
- a longer description (up to 2000 characters),
- the region your idea applies to (out of a dozen), and
- your name, e-mail address, and (optionally) an organisation.

If the Foundation is interested in hearing more, a programme officer will reach out to the submitter within 45 days.

The same submission page gives an impression of the low chances of success: "in a typical year, less than one% of unsolicited grant ideas result in funding."

The JustFilms grants and the Ford Foundation Fellowships Programme each have their own submission regimes.<sup>235 236</sup>

#### **A.2.1.5 The Grant Database**

Ford's Grant Database<sup>237</sup> shows that it has made 22,024 grants to 6,603 grantees totalling 7,841,795,643 USD from 2006 up to now. Narrowing the results down for the US, there have been 13,671 grants to 3,845 grantees totalling 5,915,349,069 USD. When searching the database for 'open source' and 'software', only very few results pop up: over the last ten years, about a dozen grants have been made, worth some 2.5 to 3 million USD.

Among these grantees we find familiar names and projects, such as:

- the Libraries.io project,<sup>238</sup> USD 75,000 in 2017 to Brave New Software Project, Inc.,<sup>239</sup>
- Mozilla Foundation (see below), USD 20,000 in 2020;
- the Digital Infrastructure Research Programme<sup>240</sup> (see section A.2.3), 605,000 USD in 2020 via the OpenCollective Foundation (fiscal sponsorship and hosting);<sup>241</sup>

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<sup>232</sup> <https://www.fordfoundation.org/work/our-grants/justfilms/>

<sup>233</sup> <https://www.fordfoundation.org/work/challenging-inequality/creativity-and-free-expression/>

<sup>234</sup> <https://www.fordfoundation.org/work/our-grants/idea-submission/>

<sup>235</sup> <https://www.fordfoundation.org/work/our-grants/justfilms/justfilms-inquiry/>

<sup>236</sup> <https://www.fordfoundation.org/work/our-grants/individuals-seeking-fellowships/>

<sup>237</sup> <https://www.fordfoundation.org/work/our-grants/grants-database/grants-all>

<sup>238</sup> <https://libraries.io/>

<sup>239</sup> <https://www.bravenewsoftware.org/>

<sup>240</sup> <https://www.fordfoundation.org/campaigns/critical-digital-infrastructure-research/>

<sup>241</sup> <https://opencollective.com/foundation>

- Software Freedom Conservancy Inc.<sup>242</sup> (see section [A.3.2.3](#)), USD 265,000 in 2019-2020 for the Outreachy programme<sup>243</sup> and the Reproducible Builds Summit<sup>244</sup> and programme.<sup>245</sup>

#### **A.2.1.6 Ford-Mozilla Open Web Fellows (case study)**

The Mozilla Foundation describes the type of Fellows they are looking for as "web activists, open-source researchers and scientists, engineers, and technology policy experts who work on the front lines of a movement to ensure the internet remains a force for good. They develop new thinking on how to address emerging threats and challenges facing a healthy internet." And they "are working to stop the spread of misinformation, put individuals in control of their data, keep artificial intelligence accountable, and provide innovative solutions for internet connectivity in low penetration environments. They are leaders who ensure smart cities and next-generation voice technology are diverse and equitable, and who conduct open research."<sup>246</sup>

The Fellowship projects Mozilla presents on its website include:

- building a more open, secure, and trustworthy Internet of Things (OpenDOTT);<sup>247</sup>
- infusing open-source practices and principles into scientific research ([open science](#));
- open web activists addressing issues like privacy, security, and inclusion online;
- examining the interplay of technology and public policy, and crafting legal, academic, and governmental solutions;
- developing and implementing digital strategies that support the relevance and sustainability of civil society organizations in the Global South (Tech + Society);<sup>248</sup>
- exploring the open Internet's strengths, analysing its weaknesses, and enhancing the movement to keep the internet as a global public resource that's open and accessible for all (Fellows in Residence, a brains trust that helps Mozilla develop new thinking around emerging issues).

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<sup>242</sup> <https://sfconservancy.org/>

<sup>243</sup> <https://www.outreachy.org/>

<sup>244</sup> <https://reproducible-builds.org/events/Marrakesh2019/>

<sup>245</sup> <https://reproducible-builds.org/>

<sup>246</sup> <https://foundation.mozilla.org/en/what-we-fund/fellowships/>

<sup>247</sup> <https://opendott.org/>

<sup>248</sup> <https://foundation.mozilla.org/en/what-we-fund/fellowships/fellows-for-tech-and-society/>

### The Mozilla Foundation

- **target/aims:** a healthy internet, as recorded in the Mozilla Manifesto;<sup>1</sup> "to ensure the internet remains a force for good, by investing in bold ideas, global leaders, and citizen-centered campaigns";
- **model:** a dual organisation consisting of the 501(c)3 Mozilla Foundation and its wholly owned subsidiary the Mozilla Corporation; receiving funds from various sources, such as:
  - an estimated 400-450 million USD annually in royalties (the bulk of their income) from Google, for having Google Search as the default search engine in the Firefox web browser,<sup>1</sup>
  - foundations, investors, charities and other organisation, such as the Ford Foundation, Internet Society ([ISOC](#)), and the European Union;
  - individual donations (VISA, PayPal, wire, check, Bitcoin);all grants (including fellowships as well as awards<sup>1</sup> and donations) for 2019 amount to 8.6 million USD, while contributions for that year were 11.7 million USD;
- **grants:** mostly fellowships for one-year full-time commitments connected to specific projects, mostly two years for the 'Tech + Society' project, although part-time arrangements are possible;
- **application process:** registration and full application submitted in English at Mozilla's Fluxx portal (an online platform for grant management);

applications will be reviewed by a restricted panel, after which Mozilla will select candidates for interviews, check references, and conduct interviews with host organisations;

the process, recommendations for project descriptions, and review criteria are described in the FAQ;

(due to the current restructuring of Mozilla, applications for Mozilla Fellowships are currently (14 January 2021) closed);
- **disbursement:** fellowship stipends are based on the fellowship track, level of engagement (i.e. full-time or part-time), and location of the fellowship; in addition to a stipend, Fellows also receive project and travel supplements, and full-time Fellows are also eligible for additional benefits (described in more detail in the FAQ);
- **base:** Mountain View, CA, USA;
- **website:** <https://foundation.mozilla.org/>; Mozilla Fellowships: <https://foundation.mozilla.org/en/what-we-fund/fellowships/>
- **Wikipedia:** [https://en.wikipedia.org/wiki/Mozilla\\_Foundation](https://en.wikipedia.org/wiki/Mozilla_Foundation)

The Fellowship directory<sup>249</sup> provides details of many more Fellows and projects Mozilla has been funding. Mozilla Pulse<sup>250</sup> (a publish-subscribe system managing loosely-coupled content) includes Foundation-funded as well as related projects.

The Fellowships Frequently Asked Questions (FAQ)<sup>251</sup> states that Fellows are expected to "*release any code and non-confidential content created during the fellowship under an open license determined in consultation with Mozilla.*"

Note that Principle 7 of the Mozilla Manifesto<sup>252</sup> reads that: "*free and open-source software promotes the development of the internet as a public resource.*" That resonates strongly with the vision set out in the 'Open Source Software Strategy

<sup>249</sup> <https://foundation.mozilla.org/en/what-we-fund/fellowships-and-awards-directory/#fellows-by-year>

<sup>250</sup> <https://www.mozillapulse.org/>

<sup>251</sup> <https://foundation.mozilla.org/en/what-we-fund/fellowships/fellowships-faq/>

<sup>252</sup> <https://www.mozilla.org/en-US/about/manifesto/>

2020–2023; Think Open',<sup>253</sup> as both recognise FOSS as a lever to increase the value of commons and lower their cost. The EC Open Source Software Strategy 2020-2022 states:

*"The Commission leverages the transformative, innovative, and collaborative power of open source, encouraging the sharing and reuse of software solutions, knowledge and expertise, to deliver better European services that enrich society and focus on lowering costs to that society".*

### **A.2.1.7 The Mozilla Open Source Support (MOSS) award**

The Foundation also runs a dedicated awards programme for FOSS: the Mozilla Open Source Support (MOSS) awards:<sup>254</sup> "Through the MOSS awards programme, we recognize, celebrate, and support open source projects that contribute to Mozilla's work and to the health of the Internet. MOSS broadens access, increases security, and empowers users by providing catalytic funding to open source technologists."

This programme has three tracks:

- Track I: Foundational Technology: supporting open source projects that Mozilla relies on;
- Track II: Mission Partners:supports open source projects that significantly advance Mozilla's mission;
- Track III: Secure Open Source Fund (SOS):<sup>255</sup>supporting security audits for widely used open source software projects as well as remedial work needed to rectify the problems found.

Among the projects that were audited this way,<sup>256</sup> we find:

- libssh,<sup>257</sup>
- Enigmil (members of the Autocrypt/OKC community were discussion partners in the community engagement part of the EU-FOSSA-2 project),<sup>258</sup>
- Knot DNS<sup>259</sup> and KNOT Resolver,<sup>260</sup>
- chrony,<sup>261</sup>
- GNU libmicrohttpd,<sup>262</sup>
- Dovecot,<sup>263</sup>
- ntp,<sup>264</sup>

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<sup>253</sup> [https://ec.europa.eu/info/departments/informatics/open-source-software-strategy\\_en](https://ec.europa.eu/info/departments/informatics/open-source-software-strategy_en)

<sup>254</sup> <https://www.mozilla.org/en-US/moss/>

<sup>255</sup> <https://www.mozilla.org/en-US/moss/secure-open-source/>

<sup>256</sup> [https://wiki.mozilla.org/MOSS/Secure\\_Open\\_Source/Completed](https://wiki.mozilla.org/MOSS/Secure_Open_Source/Completed)

<sup>257</sup> <https://www.libssh.org/>

<sup>258</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>259</sup> <https://www.knot-dns.cz/>

<sup>260</sup> <https://www.knot-resolver.cz/>

<sup>261</sup> <https://chrony.tuxfamily.org/>

<sup>262</sup> <https://www.gnu.org/software/libmicrohttpd/>

<sup>263</sup> <https://www.dovecot.org/>

<sup>264</sup> <http://www.ntp.org/>

- ntpsec,<sup>265</sup>
- dnsmasq,<sup>266</sup> and
- cURL.<sup>267</sup>

Note that Track III covers bugs as well as fixes. One of the lessons learned from the EU-FOSSA pilot<sup>268</sup> is that bug bounty programmes that do not include remedies may even decrease the security of software.<sup>269</sup> That's why the bug bounty programme of the EU-FOSSA-2 project and the programmes that OSPO will be running now also include a reward for remedial work.<sup>270</sup>

On the comparison to the Core Infrastructure Initiative (CII; see section <4.4>) of the Linux Foundation, Mozilla says:

*"We believe our model of support is different from and complementary to CII's. We view CII as focused on necessary, deeper-dive investments into the core FOSS security infrastructure, like in OpenSSL [the software library underneath the TLS/SSL security protocol, e.g. the little padlock symbol in the address bar of your web browser].<sup>271</sup> This is important work. Focusing on more point-in-time solutions, the SOS Fund's audit and remediation methodology targets a different class of OSS projects with lower-hanging fruit security needs, using an open public-facing application form."*

While Tracks I and II are subject to an application process, Track III allows anyone to nominate projects for an audit.

The explanatory pages on all three tracks contain elaborate information on the information that should be provided, and the criteria used to review an application or nomination. Nominating a FOSS project – including your own – for an audit can be done using a simple (Google) form.<sup>272</sup>

## A.2.2 Sloan Foundation

The Sloan Foundation is a North American charity organisation established in 1934 by Alfred P. Sloan, Jr. (then President and CEO of General Motors). From its current endowment of 1.95 billion USD (end 2019),<sup>273</sup> it makes grants within the USA primarily to support original research and education related to science, technology, engineering, mathematics, and economics. The Foundation's trustees believe that these fields are the chief drivers of the nation's health and prosperity, and that a reasoned, systematic understanding of the forces of nature and society, when applied inventively and wisely, can lead to a better world for all.<sup>274</sup>

The Foundation supports specific projects with one-time grants, but also provides continuing, longer-term support to some organisations. For example, it has been

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<sup>265</sup> <https://www.ntpsec.org/>

<sup>266</sup> <http://www.thekelleys.org.uk/dnsmasq/doc.html>

<sup>267</sup> <https://curl.se/>

<sup>268</sup> <https://joinup.ec.europa.eu/collection/eu-fossa-2/solution/eu-fossa-pilot>

<sup>269</sup> interview Dirk-Willem van Gullik, co-founder of the Apache Software Foundation, for the EU-FOSSA 2 project

<sup>270</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>271</sup> <https://www.openssl.org/>

<sup>272</sup> [https://docs.google.com/forms/d/1f0xSq9XM8v7YGdZ\\_FzeE67gqckbAsq6sH1mpQ4buTQE/viewform](https://docs.google.com/forms/d/1f0xSq9XM8v7YGdZ_FzeE67gqckbAsq6sH1mpQ4buTQE/viewform)

<sup>273</sup> [https://sloan.org/storage/app/media/files/annual\\_reports/2019\\_annual\\_report.pdf](https://sloan.org/storage/app/media/files/annual_reports/2019_annual_report.pdf)

<sup>274</sup> <https://sloan.org/about>

supporting Wikimedia Foundation<sup>275</sup> since 2008. In addition to these grants, the Foundation also awards Sloan Research Fellowships.<sup>276</sup>

#### **The Sloan Foundation**

- **vision/aims:** supporting original research and education in the USA related to science, technology, engineering, mathematics, and economics – fields that the Foundation believes are chief drivers of the nation's health and prosperity;
  - specifically: original initiatives led by outstanding individuals or teams; projects that have a high expected return to society, exhibit a high degree of methodological rigour, and for which funding from the private sector, government, or other foundations is not yet widely available;
- **model:** grants funded from a 1.95 billion USD industrial endowment;
- **grants:**
  - grants typically of the order of tens or hundreds of thousands of USD, for (research) projects and organisations, lasting from several months up to several years;
  - personal research fellowships worth USD 70,000;excluding the fellowships, the Foundation awards approximately 200 grants per year, totalling roughly USD 80 million in annual commitments;  
for 2019, the total amount disbursed for grants, programmes, and grant/programme management was 109 million USD, of which 4.3 million USD was management expenses;
- **geographical target:** USA;
- **application process:** a letter of inquiry, possibly followed by an invitation to submit a formal grant proposal;
- **disbursement:** per agreement, in lockstep with the substantive and financial reports;
- **base:** New York, USA
- **website:** <https://sloan.org/>; governance/bylaws document: [https://sloan.org/storage/app/media/files/governance\\_documents/bylaws12112018.pdf](https://sloan.org/storage/app/media/files/governance_documents/bylaws12112018.pdf)
- **Wikipedia:** [https://en.wikipedia.org/wiki/Alfred\\_P.\\_Sloan\\_Foundation](https://en.wikipedia.org/wiki/Alfred_P._Sloan_Foundation)

#### **A.2.2.1 Grants and fellowships**

- **Trustee Grants:** Grants for amounts greater than 250,000 USD. Applications are reviewed by an independent panel of experts and are presented quarterly to the Board of Trustees for approval.
- **Officer Grants:** Grants for amounts up to 250,000 USD. Depending on the amount or subject matter of the grant, Officer Grants may or may not have been reviewed by an independent panel of (external) experts. They are reported to the Board of Trustees quarterly.
- **Sloan Research Fellowships:** Awards of 70,000 USD awards to promising researchers in eight fields: chemistry, computer science, computational and evolutionary molecular biology, economics, mathematics, neuroscience, ocean sciences, and physics. An independent panel of senior scholars in each field selects fellowship winners. Since the beginning of the programme, some 456 million USD (2019) has been awarded to more than 5,700 fellows.

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<sup>275</sup> <https://wikimediafoundation.org/>

<sup>276</sup> [https://sloan.org/storage/app/media/files/annual\\_reports/2019\\_annual\\_report.pdf](https://sloan.org/storage/app/media/files/annual_reports/2019_annual_report.pdf)

### A.2.2.2 Open-source software

The annual report of 2019<sup>277</sup> provides an overview of the grants made that year, including several that specifically address open-source software:

- USD 884,838 over 15 months to develop a robust, trusted, popular, and extensible library of open-source software for privacy-protecting data analysis. [OpenDP]<sup>278</sup>;
- USD 431,265 over 19 months to develop and test privacy-protection techniques for encrypting, linking, and analysing sensitive data; the support was provided via NumFOCUS, a US charitable organisation "promoting open practices in research, data, and scientific computing by serving as a fiscal sponsor for open source projects and organising community-driven educational programs" (see section ...) <sup>279</sup>;
- USD 249,101 over 6 months to improve the scalability and performance of open source mapping software that makes geographic, demographic, and redistricting data usable by social scientists and the public. [Azavea]<sup>280</sup>;
- USD 400,000 over 36 months to utilise an open source energy system model to create an Open Energy Outlook for the USA. [Temoa: Tools for Energy Model Optimization and Analysis]<sup>281</sup>.

One of the Foundation's current programmes is 'Better Software for Science':

Rather than funding individual scientific software development projects, grants in this area focus mainly on tooling, institutions, economic models, and incentives around the production, maintenance, and adoption of research software. Current areas the Foundation is exploring include:

- open source as more than licensing strategy;
- how to reconcile software development best practices with research workflows and scholarly communication systems;
- career paths and incentives for those who build and maintain scientific software.

Examples of grants from this programme are:

- USD 677,783 over 24 months to develop and promulgate best practices in the review of statistical research software. Supported by the Sloan Foundation since 2013, rOpenSci<sup>282</sup> is an open source community that develops research software inside the R<sup>283</sup> computing environment;
- USD 64,032 over 12 months to develop community best practices and standards for discipline-specific software registries and repositories;
- USD 115,115 over 24 months to document and study the histories of the R and Python<sup>284</sup> programming languages;
- USD 116,290 over 12 months to construct a quantitative index of the health and sustainability of open source software projects used in academia;

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<sup>277</sup> [https://sloan.org/storage/app/media/files/annual\\_reports/2019\\_annual\\_report.pdf](https://sloan.org/storage/app/media/files/annual_reports/2019_annual_report.pdf)

<sup>278</sup> <https://projects.iq.harvard.edu/opendp>

<sup>279</sup> <https://numfocus.org/>

<sup>280</sup> <https://www.azavea.com/>

<sup>281</sup> <https://temoacloud.com/>

<sup>282</sup> <https://ropensci.org/>

<sup>283</sup> <https://www.r-project.org/>

<sup>284</sup> <https://www.python.org/>

- USD 20,000 over 6 months to support travel and attendance at JuliaCon2019<sup>285</sup> by underrepresented minorities in computing who are users of and contributors to the Julia<sup>286</sup> programming language (a modern and fast alternative to Python and R).<sup>287</sup>

The Grants Database contains all grants from 2008 onward.<sup>288</sup>

### A.2.2.3 The Julia programming language

The Sloan Foundation appears to have a weakness for the Julia programming language:<sup>289</sup>

*"In 2017, the Foundation made a two-year grant to help continue the development of the Julia programming language, a robust computing platform that is increasingly popular inside research communities. The resulting improvements have powered strong growth, and by the end of 2019 Julia was in use in over 1,500 universities and had been downloaded over 11 million times. The number of "packages" available – customizations of the Julia framework for specific purposes – nearly doubled between 2018 and 2019, from 1,688 to 3,119. Improvements to Julia include more user-facing documentation, like setup guides and use tutorials; a clearer, more useful error messaging framework; and improvements in package installation and performance measurement. The Julia team, however, was committed to more than just improving the technological chops of the platform. Grant funds were also used to broaden and diversify the Julia userbase. The team implemented ambitious plans to improve the diversity of its community, hiring a full time Director of Diversity and Training who held more than 40 training sessions with Julia user groups over the grant period."*

On the development and sustainability of FOSS in science:

*"In addition to directly funding software, the Technology programme actively supports efforts to develop and implement best practices in scientific software development. The Open Source Alliance for Open Scholarship published an online, freely available handbook<sup>290</sup> filled with best practices for scientists and other researchers wanting to create productive, open source collaborations in academia. The handbook includes useful tips on budgeting basics, sustainability models, tips on grant-writing and finding funding, guidance on hiring and promoting diversity and inclusion in open source projects, governance models, and more."*

And on the value of hackathons:

*"Hackathons are a specific mechanism by which open source projects gain new contributors. These events, typically lasting a few intense days, bring together computer programmers, software engineers, and other technologists to collaboratively produce software. They have become more common in research communities in recent years. With Sloan funding, James Herbsleb at Carnegie Mellon University studied hackathon design and outcomes.<sup>291 292</sup> His work*

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<sup>285</sup> <https://juliacon.org/>

<sup>286</sup> <https://julialang.org/>

<sup>287</sup> <https://julialang.org/blog/2012/02/why-we-created-julia/>

<sup>288</sup> <https://sloan.org/grants-database>

<sup>289</sup> [https://sloan.org/storage/app/media/files/annual\\_reports/2019\\_annual\\_report.pdf](https://sloan.org/storage/app/media/files/annual_reports/2019_annual_report.pdf)

<sup>290</sup> <https://osaos.codeforscience.org/>

<sup>291</sup> <https://dl.acm.org/doi/10.1145/2818048.2819946>

<sup>292</sup> <https://dl.acm.org/doi/10.1145/2660398.2660420>

*contrasted hackathons whose goal is to form a community around a new project with those intended to foster new work (and even businesses) on top of already-thriving software resources. In addition to a series of peer-reviewed publications, the project produced a toolkit, available for free at [hackathon-planning-kit.org](https://hackathon-planning-kit.org),<sup>293</sup> that contains detailed, practical guidance on 12 crucial decisions to be made by any hackathon planner. The toolkit covers everything from sample agendas, through participant recruitment strategies, to how often to schedule breaks."*

#### **A.2.2.4 The grant application process**

The Sloan grant application process<sup>294</sup> starts with sending a Letter of Inquiry (one, or two pages)<sup>295</sup> to the director of a specific programme. A grant-seeker who sends in a promising letter<sup>296</sup> may be invited to submit a formal grant proposal.<sup>297</sup> The process for evaluating a proposal is based on the peer review process used by high-quality academic journals. That means that the Foundation may seek independent expert review, and grant-seekers may be asked to revise their proposals.

#### **A.2.2.5 Reporting<sup>298</sup>**

Reporting by the grantee consists of substantive reports and financial reports. Their due dates are part of the grant agreement. Both reports are free-form, and the details of the required contents are coordinated with the programme directors on an individual basis.<sup>299</sup> At the completion of the grant, unspent funds in excess of USD 100 must be returned.<sup>300</sup> Grantees who want to extend their grant completion dates without requiring any additional funds from the Foundation can request this from their programme directors.<sup>301</sup>

**Note:** Sponsoring travel and attendance expenses for JuliaCon and research into the organisation and value of hackathons are similar to what the European Commission was doing when it was organising hackathons and sponsoring travel expenses (for both hackathons and the 'Workshop about the future of Open Source Software and Open Source Hardware' (November 2019, in conjunction with DG CONNECT)<sup>302</sup> as part of the EU-FOSSA 2 project. (see section <A.1.2>)<sup>303</sup>

### **A.2.3 Critical Digital Infrastructure Research**

Critical Digital Infrastructure Research is a shared fund of the Ford and Sloan Foundations (see above). It was established out of concern for the continuity of our internet infrastructure – a new public good – of which much has been built by volunteers as FOSS. The two Foundations recognise that the software needs

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<sup>293</sup> <https://hackathon-planning-kit.org/>

<sup>294</sup> <https://sloan.org/grants/apply#tab-the-grant-application-process>

<sup>295</sup> <https://sloan.org/grants/apply#tab-letters-of-inquiry>

<sup>296</sup> <https://sloan.org/grants/apply#tab-tips-for-writing-a-successful-grant-proposal>

<sup>297</sup> <https://sloan.org/grants/apply#tab-grant-proposal-guidelines>

<sup>298</sup> <https://sloan.org/grants/grantees>

<sup>299</sup> <https://sloan.org/grants/grantees#tab-reporting>

<sup>300</sup> <https://sloan.org/grants/grantees#tab-unexpended-grant-funds>

<sup>301</sup> <https://sloan.org/grants/grantees#tab-no-cost-extensions>

<sup>302</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

<sup>303</sup> [https://ec.europa.eu/info/departments/informatics/eu-fossa-2\\_en](https://ec.europa.eu/info/departments/informatics/eu-fossa-2_en)

maintenance, just as physical infrastructure does, but that it has no specific owner.<sup>304</sup>

Aiming to "build toward a more diverse and well-funded ecosystem for critical digital infrastructure", the two Foundations came together in 2018 "to fund thirteen research projects that fill gaps in understanding of how digital infrastructure is built, maintained, and sustained".

The fund "follows from earlier efforts to map the landscape of open-source digital infrastructure, including a 2017 convention of funders which led to a seminal report from Nadia Eghbal,<sup>305</sup> "Roads and Bridges".<sup>306</sup> That report tells the story of digital infrastructure thus far, and the extent to which the underlying technology of the internet is vulnerable and at risk.<sup>307</sup> The report also uncovered significant research gaps<sup>308</sup> in our understanding of how open-source digital infrastructure is built, maintained, and sustained."<sup>309</sup>

Since the 2017 convening, "there is early evidence that more diverse international communities of developers could be engaged more effectively and equitably by open-source projects based in the US and Europe. Another research team is finding that burnout among developers is a real issue across digital infrastructure projects, regardless of whether ones' contributions are visible or not."<sup>310</sup>

### **A.2.3.1 Thirteen research projects**

In June 2018, a call for proposals was announced,<sup>311</sup> and in the following six weeks 240 applications were received. With the support of an advisory panel, these applications were narrowed down to 13 projects, which received a total of 1.3 million USD.<sup>312</sup>

From an overview document,<sup>313</sup> it becomes clear that eight of the 13 projects received grants managed by the Ford Foundation. The other five grants were managed by the Sloan Foundation. This indicates that the Critical Digital Infrastructure Research fund does not stand on its own as a legal entity. This is

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<sup>304</sup> <https://www.fordfoundation.org/campaigns/critical-digital-infrastructure-research/>

<sup>305</sup> <https://www.linkedin.com/in/nadiaeghbal/>

<sup>306</sup> <https://www.fordfoundation.org/work/learning/research-reports/roads-and-bridges-the-unseen-labor-behind-our-digital-infrastructure/>; she is also the author of the book 'Working in Public: The Making and Maintenance of Open Source Software': <https://www.amazon.com/Working-Public-Making-Maintenance-Software/dp/0578675862/>

<sup>307</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/every-day-we-rely-on-digital-infrastructure-built-by-volunteers-what-happens-when-it-fails/>

<sup>308</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/a-call-for-research-on-digital-infrastructure/>

<sup>309</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/a-critical-time-for-digital-infrastructure/>

<sup>310</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/a-critical-time-for-digital-infrastructure/>

<sup>311</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/a-call-for-research-on-digital-infrastructure/>

<sup>312</sup> <https://www.fordfoundation.org/just-matters/equals-change-blog/posts/announcing-13m-in-funding-for-digital-infrastructure-research/>

<sup>313</sup> [https://docs.google.com/document/d/1UCp2isozDZyHjxNdY\\_idtrG6nMB3hk37Ucu1HzFzYWo/edit](https://docs.google.com/document/d/1UCp2isozDZyHjxNdY_idtrG6nMB3hk37Ucu1HzFzYWo/edit)

also supported by a news article announcing that the 1.3 million USD grants were given by the Ford Foundation, "in partnership with" the Sloan Foundation.<sup>314</sup>

Each of the 13 projects focused on a specific research question, and most of the research was carried out by groups at universities (all based in the US):

1. What makes an open source project "critical digital infrastructure?", (carried out by Stanford University);<sup>315</sup>
2. What can the history of JavaScript teach us about techniques to mitigate harassment (a barrier to diversity and a threat to the sustainability of digital infrastructure projects) in open source communities? (final report drafted by Caroline Sinderson).<sup>316</sup>
3. What factors encourage and sustain international communities of contributors to open source projects? (carried out by UC Berkeley);<sup>317</sup>
4. What is the relationship between money and sustainability for community-driven, open-source software instruments that enable transformative research in stellar astrophysics? (carried out by Arizona State University,<sup>318</sup> the University of California Santa Barbara,<sup>319</sup> and the University of Wisconsin-Madison<sup>320 321</sup>);
5. To what extent are F/OSS projects supported by waged labor, and how does this affect project cohesion and sustainability? (carried out by the University of Canberra<sup>322</sup> and Telecom Paris Tech);<sup>323</sup>
6. How can funders and community leaders better meet the needs of digital infrastructure projects, and how are those needs distinct from projects at the application layer – particularly with respect to values, governing bodies, and supporting structures? (carried out by the Implicit Development Environments Research Group<sup>324</sup> in collaboration with Simply Secure);<sup>325 326</sup>
7. How do FOSS Foundations (trade associations or non-profits that provide services such as asset management to open source infrastructure projects) contribute to the operations, sustainability, and success of critical digital infrastructure projects? (conducted by Martin Michlmayr);
8. How might structural factors in the social networks of open source communities pose barriers to underrepresented newcomers, especially women, becoming full community members? (conducted by Carnegie Mellon University);<sup>327</sup>
9. How do non-financial and career incentives impact the motivation and productivity of contributors to open-source and proprietary digital infrastructure

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<sup>314</sup> <https://philanthropynewsdigest.org/news/ford-sloan-award-1.3-million-for-digital-infrastructure-research>

<sup>315</sup> <https://pacscenter.stanford.edu/research/digital-civil-society-lab/>

<sup>316</sup> [https://www.fordfoundation.org/media/5805/ford\\_report\\_final-1.pdf](https://www.fordfoundation.org/media/5805/ford_report_final-1.pdf)

<sup>317</sup> <https://www.berkeley.edu/>

<sup>318</sup> <http://cococubed.asu.edu/>

<sup>319</sup> <https://www.kitp.ucsb.edu/>

<sup>320</sup> <http://www.astro.wisc.edu/>

<sup>321</sup> <https://arxiv.org/pdf/2001.02559.pdf%20https://baas.aas.org/pub/2020i0201/release/2.pdf>

<sup>322</sup> <https://www.canberra.edu.au/research/faculty-research-centres/nmrc/research/mapping-the-co-production-of-digital-infrastructure-by-peer-projects-and-firms>

<sup>323</sup> <https://www.telecom-paris.fr/>

<sup>324</sup> <https://implicit-development.org/>

<sup>325</sup> <https://simplysecure.org/>

<sup>326</sup> <https://recommendations.implicit-development.org/>

<sup>327</sup> <https://www.isri.cmu.edu/>

- projects? (conducted by MIT,<sup>328</sup> Carnegie Mellon University Tepper School of Business,<sup>329</sup> and UCLA Anderson School of Business);<sup>330</sup>
10. In community-based open-source software projects, what is the visible and invisible work of maintaining trusted, functioning software infrastructure – especially as projects grow and transition from volunteer-based to various sustainability models? (conducted by UC Berkeley Institute for Data Science,<sup>331</sup> UC San Diego,<sup>332</sup> and University of Connecticut);<sup>333</sup>
  11. How can we measure, model, and reduce underproduction in open-source software infrastructure projects? (research conducted by the University of Washington);<sup>334</sup>
  12. How do mismatched conceptualisations between maintainers and users of a FOSS digital infrastructure project interact to affect the community health and thus sustainability of such projects? (research conducted by the Rochester Institute of Technology);<sup>335 336</sup>
  13. How can legal devices and institutions be adapted and applied (both locally and transnationally) to overcome the under-maintenance of critical digital infrastructure? (research conducted by the Guarini Institute for Global Legal Studies,<sup>337</sup> Institute for International Law and Justice,<sup>338</sup> and NYU School of Law).<sup>339</sup>

The researchers involved in these projects convened several times in the summer of 2020 to discuss their findings.<sup>340 341</sup>

The Critical Digital Infrastructure Research shared fund also has links with one of the Maintainers' conferences.<sup>342</sup> 'The Maintainers' is "a global research network interested in the concepts of maintenance, infrastructure, repair, and the myriad forms of labor and expertise that sustain our human-built world. Our members come from a variety of backgrounds, including engineers and business leaders, academic historians and social scientists, government and non-profit agencies, artists, activists, coders, and more."<sup>343</sup>

A value from their website that is highly relevant to us: "Societies must care for those individuals who take care of them."<sup>344</sup>

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<sup>328</sup> <https://mitsloan.mit.edu/>

<sup>329</sup> <https://www.cmu.edu/tepper/>

<sup>330</sup> <https://www.anderson.ucla.edu/>

<sup>331</sup> <https://bids.berkeley.edu/>

<sup>332</sup> <https://ucsd.edu/>

<sup>333</sup> <https://uconn.edu/>

<sup>334</sup> <http://www.com.washington.edu/>

<sup>335</sup> <https://www.rit.edu/>

<sup>336</sup> <https://github.com/FOSSRIT/mismatches>

<sup>337</sup> <https://www.guariniglobal.org/critical-digital-infrastructure>

<sup>338</sup> <https://www.iilj.org/>

<sup>339</sup> <https://www.law.nyu.edu/>

<sup>340</sup> <https://www.youtube.com/watch?v=qPE-tLy-MFI>

<sup>341</sup> <https://www.youtube.com/watch?v=txwo7Wx-TDk>

<sup>342</sup> <https://themaintainers.org/miii>

<sup>343</sup> <https://themaintainers.org/>

<sup>344</sup> <https://themaintainers.org/about-us>

Currently (February 2021), no funding proposals are accepted.<sup>345</sup>

## A.3 Funding from technology endowment funds

### A.3.1 NLnet Foundation

The NLnet Foundation<sup>346</sup> is a recognised philanthropic foundation making grants to "stimulate strategic technology research and development in the area of computer networking and the internet. NLnet looks at impact, so while projects may revolve around new technologies they can also focus on improving existing technology, encouraging new applications of existing technology or dissemination of relevant knowledge. The current focus is twofold: on strengthening the position of the individual user on the internet and on improving the overall security of the internet."<sup>347</sup>

NLnet is independent, and all projects are based on open standards, open-source software, hardware and content.<sup>348 349</sup>

#### NLNet Foundation

- **vision/aims:** stimulating strategic technology research and development in the area of computer networking and the internet; current focus on strengthening the position of the individual user on the internet and on improving the overall security of the internet;
- **model:** a recognised philanthropic non-profit foundation; legally: a foundation with [ANBI status](#) (the Dutch legal entity type for a public benefit organisation with tax benefits, compare the [US 501\(c\)\(3\) type](#));
- **grants:** focuses on micro-grants for "small, independent projects supporting independent researchers and developers";
- **geographical target:** worldwide;
- **application process:** lightweight, through an elaborate web form;<sup>1</sup> submitters will hear back within a few days after the deadline; in 2019 NLnet received in total 743 project proposals, of which 162 requests were at least partially funded;
- **disbursement:** smaller projects can be up and running in 6-9 weeks;
- **base:** The Netherlands;
- **website:** <https://nlnet.nl/>
- **Wikipedia:** <https://en.wikipedia.org/wiki/NLnet>

#### A.3.1.1 Origins

NLnet's origins date back to the 1980s, when it created the first [Unix](#)/internet network in the Netherlands and subsequently in Europe. In 1997, when this European Unix Network ([EUnet](#)) had evolved into a fully commercial operation, all commercial activities were sold to [UUNET](#) (the internet subsidiary of [WorldCom](#)), which after a series of acquisitions and mergers ended up in today's [Verizon](#).<sup>350</sup>

EUnet was decisive in the adoption of the [internet protocol suite](#) in Europe. The same can be said about the Amsterdam Internet Exchange ([AMS-IX](#)), currently the

<sup>345</sup> <https://www.fordfoundation.org/campaigns/critical-digital-infrastructure-research/>

<sup>346</sup> <https://nlnet.nl/>

<sup>347</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>348</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>349</sup> <https://nlnet.nl/foundation/>

<sup>350</sup> <https://nlnet.nl/foundation/history/>

third-largest internet exchange point in size,<sup>351</sup> after the Brazil Internet Exchange (IX.br) and Deutscher Commercial Internet Exchange (DE-CIX).<sup>352</sup>

### A.3.1.2 Funding sources

NLnet Foundation used to be an endowment fund, but it no longer is. It lost its principal sum of about 28 million EUR in the global financial crisis of 2008. Before that, the Foundation was able to hand out grant worth about 2 million EUR in total each year.<sup>353</sup>

After the loss of the endowment (and its continuity), the Foundation repositioned itself as a funding service provider, offering services such as:<sup>354</sup>

- subgranting (compare the Prototype Fund, see section <A.1.4>), typically for a fee of 10%, including:
  - application reviews,
  - quality assurance,
  - intermediating between parties, such as the Electronic Frontier Foundation ([EFF](#)) that does not accept grants directly from governments; ;
- organising the back-end for funding programmes, in collaboration with the Software Freedom Conservancy; and
- collaborating with other organisations.

Current funding comes from individuals and private and public organisations,<sup>355</sup> through donations, legacies, collaborative funding and subgranting mechanisms.<sup>356</sup>

From the 2019 annual report:<sup>357</sup>

*"In 2019 we received grants and donations from other foundations like Vietsch Foundation,<sup>358</sup> various international research networks, from NCSC<sup>359</sup> and from Radically Open Security,<sup>360</sup> the not-for-profit security company that volunteered to act as a fiscal fundraising entity for NLnet. Work also continued within the Internet Hardening Fund,<sup>361</sup> supported by the Netherlands Ministry of Economic Affairs. We continued our fruitful cooperation with The Commons Conservancy,<sup>362</sup> together with the European association of research networks [GÉANT](#) (and its members) and our subsidiary The Commons Caretakers."*

NLnet will "happily accept donations in any form that makes sense (including hardware and services) or any currency (even digital ones)." In addition to

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<sup>351</sup> [https://en.wikipedia.org/wiki/List\\_of\\_Internet\\_exchange\\_points\\_by\\_size](https://en.wikipedia.org/wiki/List_of_Internet_exchange_points_by_size)

<sup>352</sup> <https://nlnet.nl/foundation/history/>

<sup>353</sup> interview Michiel Leenaars, Director of Strategy at NLnet Foundation; 17 February 2021

<sup>354</sup> interview Michiel Leenaars, Director of Strategy at NLnet Foundation; 17 February 2021

<sup>355</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>356</sup> <https://nlnet.nl/>

<sup>357</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>358</sup> <https://www.vietsch-foundation.org/>

<sup>359</sup> <https://www.ncsc.nl/>

<sup>360</sup> <https://www.radicallyopensecurity.com/>

<sup>361</sup> <https://nlnet.nl/internethardening/>

<sup>362</sup> <https://commonsconservancy.org/>

PayPal/creditcards and bank transfers, it also accepts several types of cryptocurrencies.<sup>363 364</sup>

### **A.3.1.3 Programmes and grants**

NLnet focuses on micro-grants for "small, independent projects supporting independent researchers and developers. NLnet can fund or co-fund various types of projects, such as software development or standards efforts. NLnet does not require 'matching' for projects and may decide to fund 100% of your project. For smaller projects there is a fast procedure which could have your project up and running in 6–9 weeks."<sup>365</sup>

Even if NLnet cannot fund your project, it "might be able to help you get nearer money elsewhere." The foundation maintains an extensive list of alternative funding sources<sup>366</sup>

In addition to its own programmes, NLnet runs programmes for other funding organisations with compatible goals.

### **A.3.1.4 Next Generation Internet (NGI)**

As of 1 December 2018, NLnet was selected to coordinate two of the four first Research and Innovation Actions to kickstart the Next Generation Internet (NGI),<sup>367</sup> an initiative by the European Commission to help shape a trustworthy, resilient and sustainable internet as part of the Horizon 2020 research and innovation programme.<sup>368</sup>

- NGI Zero Discovery is a 5.6 million EUR grant that will support projects intending to improve and further develop open search and discovery technologies.
- NGI Zero PET is a 5.6 million EUR grant for projects working on privacy- and trust-enhancing technologies.

Between 2018 and 2021, a total of 11.2 million EUR will be granted by NLnet to independent researchers and open source developers working on these topics. Project proposals in line with the NGI vision and the call topics can request between EUR 5,000 and EUR 50,000, with the potential to scale up after successfully finalising an initial project. The call topics focus on privacy and trust-enhancing technologies and on search and discovery.<sup>369</sup>

### **A.3.1.5 Projects**

NLnet has been "financially supporting organisations and people that contribute to an open information society. It funds those with ideas to fix the safety, robustness and privacy of the internet. The procedure is fast, competitive and open to anyone."<sup>370</sup>

NLnet has contributed funding to "many important and very visible projects around fundamental standards, from securing the core routing protocols ([RPKI](#)) and the

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<sup>363</sup> <https://nlnet.nl/donating/foundation-form.html>

<sup>364</sup> <https://nlnet.nl/donating/>

<sup>365</sup> [https://nlnet.nl/foundation/can\\_do.html](https://nlnet.nl/foundation/can_do.html)

<sup>366</sup> See <https://nlnet.nl/foundation/network.html>

<sup>367</sup> <https://www.ngi.eu/>

<sup>368</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>369</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>370</sup> <https://nlnet.nl/>

domain name system of the internet ([DNSSEC](#)) to safer email, vendor-independent videoconferencing, more reliable wireless networks and private instant messaging – all based on open standards and verifiable open-source software and/or hardware. It spawned the world-renowned [NLnet Labs](#),<sup>371</sup> and supported great open-source projects like [Jitsi](#), ARPA2,<sup>372 373</sup> [WireGuard](#), NoScript,<sup>374</sup> [Tor Hidden Services](#), [GPLv3](#), [GNUnet](#), and webODF.<sup>375 376</sup>

A list of projects NLnet is currently contributing to (counting almost 300, February 2021), can be found at <https://nlnet.nl/project/current.html>. A list of projects supported since 2000 can be found at <https://nlnet.nl/project/>. The list organised by theme is at <https://nlnet.nl/thema/index.html>.

### **A.3.1.6 Results**

In 2019 NLnet received in total 743 project proposals (compared to 141 in 2018), of which 162 were at least partially funded (against 26 in 2018).<sup>377</sup>

From the annual reports we learn that NLnet before receiving the coordination of the two NGI Actions was making grants of typically 500,000–600,000 EUR in total annually, at an additional cost of roughly 350,000–500,000 EUR.<sup>378</sup>

The budget for 2020 shows a total of 4,785,000 EUR, of which 4,268,333 EUR is allocated to programmes and projects, and 516,667 EUR (11%) to running the organisation, including staff costs.<sup>379</sup>

## **A.3.2 Amateur Radio Digital Communications (ARDC/AMPR)**

### **A.3.2.1 IPv4 address exhaustion**

Almost 40 years ago, radio amateurs received the IPv4 internet address block 44.0.0.0/8, containing over 16 million addresses, for their digital communication experiments. After peak interest during the period 1988–1995, today less than one third of this block ([AMPRNet](#)) is assigned (i.e. can be used).<sup>380</sup>

With the available [IPv4 addresses running out](#)<sup>381</sup> – first at the global Internet Assigned Numbers Authority ([IANA](#)), then at the Regional Internet Registries ([RIRs](#)) – a market has emerged for buying, selling and leasing IPv4 addresses.<sup>382</sup>

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<sup>371</sup> <https://www.nlnetlabs.nl/>

<sup>372</sup> <http://arpa2.net/>

<sup>373</sup> <https://nlnet.nl/project/arpa2/>

<sup>374</sup> <https://en.wikipedia.org/wiki/NoScript>

<sup>375</sup> <https://webodf.org/>

<sup>376</sup> <https://nlnet.nl/>

<sup>377</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>378</sup> <https://nlnet.nl/foundation/annuals/index.html>

<sup>379</sup> <https://nlnet.nl/foundation/annuals/2019-annual-report.pdf>

<sup>380</sup> <https://www.ampr.org/amprnet/>

<sup>381</sup> <https://www.ripe.net/publications/news/about-ripe-ncc-and-ripe/the-ripe-ncc-has-run-out-of-ipv4-addresses>

<sup>382</sup> <https://www.sidn.nl/en/news-and-blogs/ipv4-addresses-the-new-gold>

Current prices vary between 25 and 30 USD per address,<sup>383</sup> depending on the size of the blocks, and are expected to rise further over the coming years.

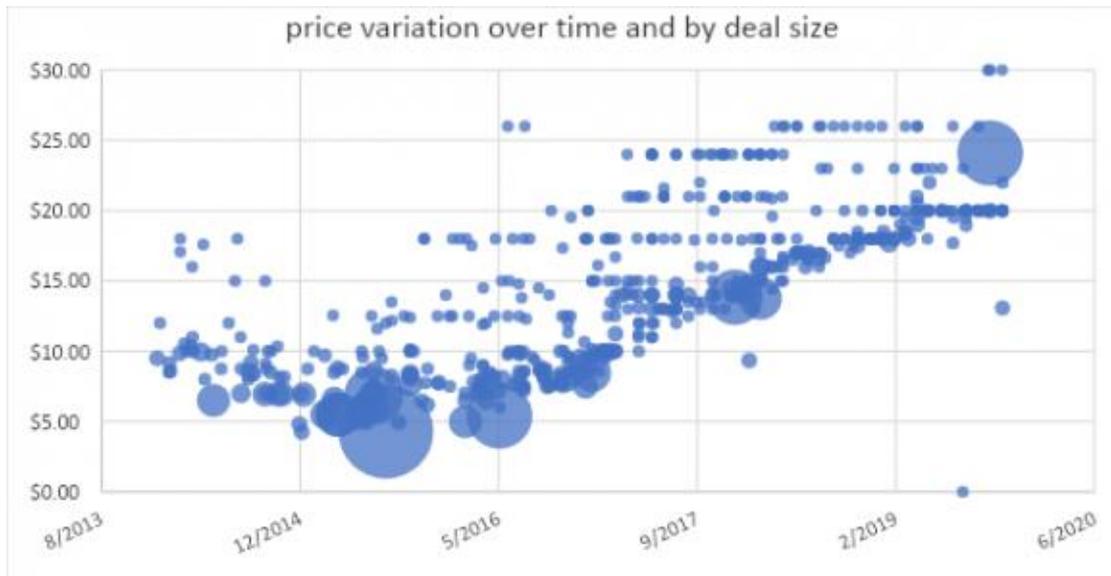


Figure 5 - IPv4 address prize variation over time and by deal size at the IPv4 Market Group<sup>384</sup>

At the same time, as the internet gradually migrates to [IPv6](#),<sup>385386</sup> the value of IPv4 addresses is expected to start declining again within the next ten years.<sup>387</sup> That means that the window of opportunity for holders willing to sell their IPv4 address blocks is limited.

<sup>383</sup> <https://ipv4marketgroup.com/ipv4-pricing/>

<sup>384</sup> From <https://ipv4marketgroup.com/ipv4-pricing/>

<sup>385</sup> <https://www.google.com/intl/en/ipv6/statistics.html>

<sup>386</sup> <http://v6asns.ripe.net/v/6?s= ALL>

<sup>387</sup> <https://www.ept.ca/2020/03/market-price-for-ip-address-is-predicted-to-rising-by-100/>

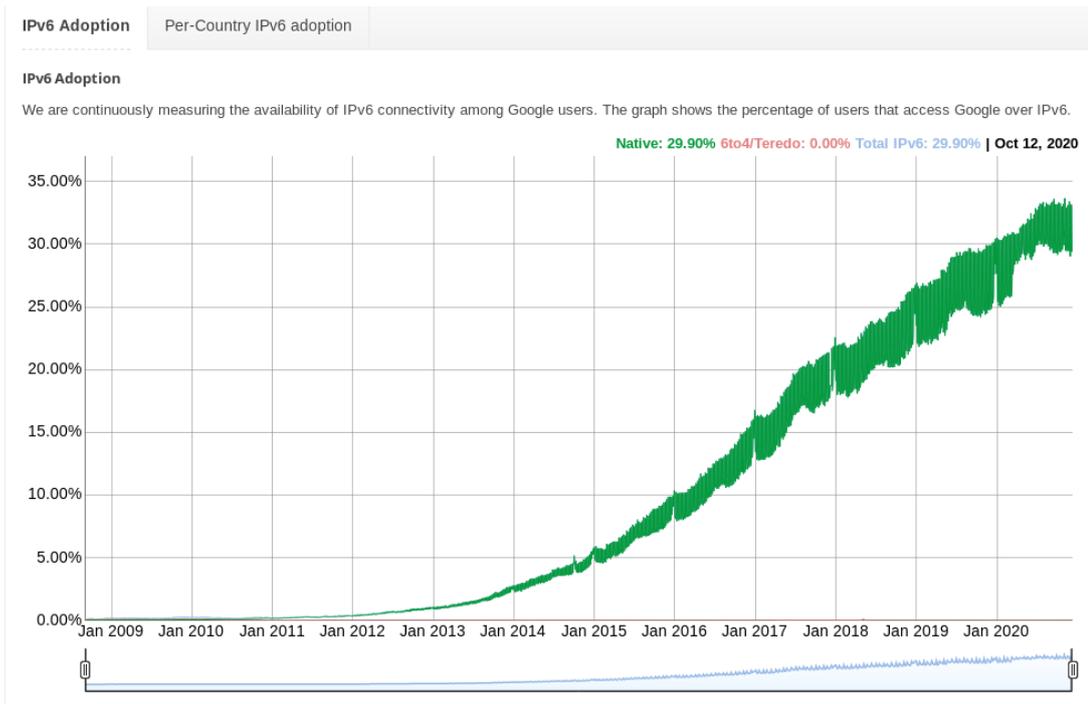


Figure 6 - User-side IPv6 adoption for Google's services, December 2020

#### IPv6 Enabled Networks

permalink: [http://v6asns.ripe.net/v6?s=\\_EU;s=\\_ALL;s=US;s=CN](http://v6asns.ripe.net/v6?s=_EU;s=_ALL;s=US;s=CN)

This graph shows the percentage of networks (ASes) that announce an IPv6 prefix for a specified list of countries or groups of countries

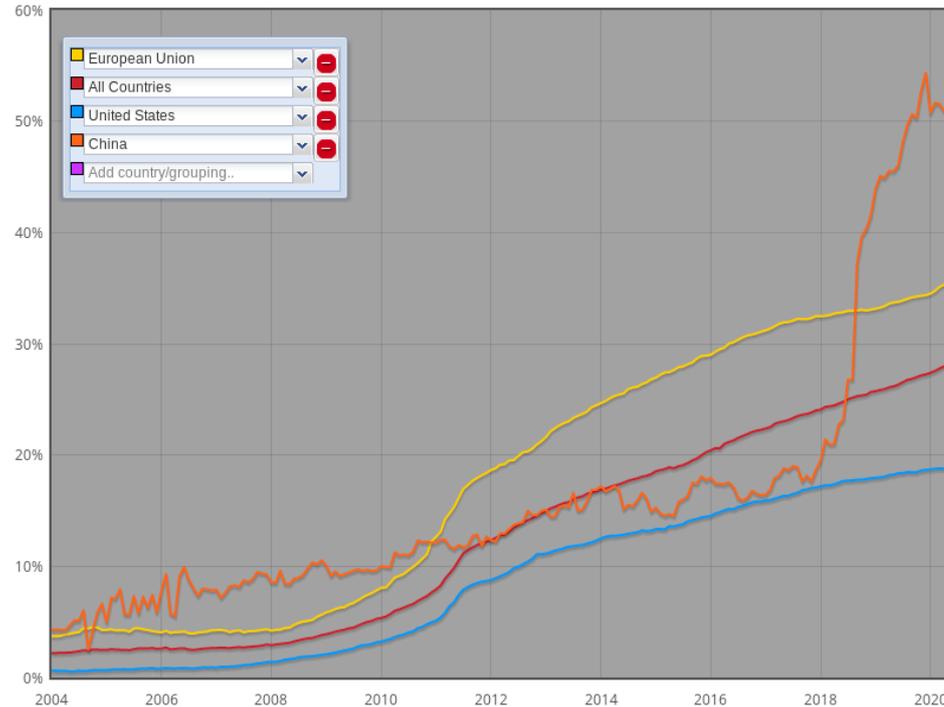


Figure 7 - Percentage of networks (ASes) that announce an IPv6 prefix, December 2020. Source: RIPE NCC

That is why the non-profit administrative/management organisation Amateur Radio Digital Communications ([ARDC](#)), which currently holds and manages the AMPRNet

address block, last year decided to sell a quarter of its IPv4 addresses.<sup>388</sup> A block of about one million addresses was sold to Amazon for 108 million USD.<sup>389</sup>

*"Now that we are receiving significant investment income from our address sale, in 2021 we will transition to a private grant-making foundation required to disburse at least 5% of our total assets each year, on average.*

*After many months of consideration and discussion, we decided to sell the unused address block 44.192.0.0/10 (the top one quarter of the original assignment) and establish an endowment to fund our program of grants and scholarships in support of communications and networking research with a strong emphasis on Amateur Radio.*

*We intend to make grants across the educational, research, and development spectrum. Awards are being made to support qualified organizations whose programs can advance the art of digital communication, with special emphasis on that which would benefit Amateur Radio.*

*Additionally, we may contract with research firms and consultants to carry out related research and development to produce procedures, techniques, methods, designs, and intellectual property that would then be made freely available for the benefit of all. We may also consider "buying out" certain existing intellectual property for the same purpose."*

This also means that ARDC could repeat this endeavour in the near future, thereby securing another large sum to add to their fund.

#### **ARDC / AMPR**

- **target/aims:** amateur radio, digital communication and internet communication
- **model:** a US 501(c)(3) nonprofit entity, managing a rolling endowment fund, aiming to disburse at least 5% of its total assets each year, on average
- **grants:** varying from 10,000 USD to half a million USD, to 24 projects, totaling 3.2 million USD, from August 2019 to December 2020<sup>1</sup>
- **disbursement:** -
- **base:** San Diego, CA, USA
- **website:** <https://www.ampr.org/>; bylaws document: <https://www.ampr.org/wp-content/uploads/Bylaws-2019-03-03.pdf>
- **Wikipedia:** <https://en.wikipedia.org/wiki/AMPRNet>

### **A.3.2.2 Grants**

The ARDC fund aims to improve the worlds of amateur radio, digital communication and internet communication,<sup>390</sup> along the lines of their mission statement:<sup>391</sup>

*"The mission of Amateur Radio Digital Communications (ARDC) is to support, promote, and enhance digital communication and broader communication science and technology, to promote Amateur Radio, scientific research, experimentation, education, development, open access, and innovation in information and communication technology."*

In addition, ARDC has developed a list of granting goals:<sup>392</sup>

- growth of amateur radio,

<sup>388</sup> <https://www.ampr.org/amprnet/>

<sup>389</sup> <https://www.amsat.org/pipermail/amsat-bb/2020-October/080028.html>

<sup>390</sup> <https://www.ampr.org/granting-goals/>

<sup>391</sup> <https://www.ampr.org/about/mission/>

<sup>392</sup> <https://www.ampr.org/granting-goals/>

- amateur radio technology and experimentation,
- internet technologies,
- digital communication,
- communication science and technology,
- education,
- open access, and
- innovation.

In their descriptions we find explicit references to freeing IP and open-source software, respectively:

*"Find us these innovative hams, and help us remove financial or regulatory or organizational barriers to unleash their ability to keep the field moving forward. Also, identify proprietary technologies where companies have sought to corner the market on ham radio innovations, and help us negotiate with them to release or re-license or reverse-engineer these technologies for use and improvement by all hams and by the general public."*

*"Free and open source software empowers billions of people and millions of servers. When ARDC funds new work in any of the above areas, we will require it to be able to freely spread without limit, to everyone who can benefit and to everyone who can contribute."*

The fund is currently granting financial support per project to [501\(c\)\(3\)](#) public charities and fiscal sponsorships (functioning as a proxy), government entities, and schools and universities, for now in only in the USA. They are currently working on the administrative requirements (according to IRS regulations and the laws governing private foundations) to extend this list to businesses and other organisations, individuals, schools and universities, and 501(c)(3)-equivalent organisations, based in the USA as well as abroad.

### **A.3.2.3 Applications**

The application process appears to be very lightweight and free-form:<sup>393</sup> Applications are asked to be concise, preferably in text-only format, and should contain:

- full contact data,
- a description of the organisation/project,
- how it aligns with ADRC's mission and granting goals,
- what the applicant hopes to accomplish,
- how much money he/she is asking for, and a justification for this, and
- how the funds would be spent and accounted for.

Applicants can even use a foreign language (i.e. their own, instead of English), and add a Google Translation (or similar) into English to their application.

After filing an application, a receipt is sent automatically, and the application is distributed to the members of the Grants Committee. The open-source conference review process software HotCRP<sup>394</sup> (a management system originally designed for the review of scientific and conference papers) is used to collect evaluations and opinions from the Committee members. During this process they may ask the applicant for additional information.

If the deliberations of the Grants Committee result in a positive recommendation, the proposal and the recommendation are forwarded to the Board of Directors, who

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<sup>393</sup> <https://www.ampr.org/giving/>

<sup>394</sup> <https://hotcrp.com/>

will do a similar round of evaluations. If the proposal is granted, they will determine any conditions to be attached to the grant, and the amount of the award.

All in all, it typically takes 30–90 days for an application to be fully processed in this way. Most, but not all, awards will be one-time (i.e. not repeated annually).

The list of organisations/projects that have received funds up to now also includes several typical FOSS/internet projects,<sup>395</sup> such as:

- the [NTPsec project](#)<sup>396</sup> (a [security-hardened](#) fork of the [reference implementation](#) of the [NTP internet time protocol](#)) [[grant](#)];
- the [GNU Radio project](#)<sup>397</sup> (a development toolkit for software-defined radio and signal processing) [[grant](#)];
- the Firmware Liberation Project,<sup>398</sup> by the Software Freedom Conservancy charity<sup>399</sup> [[grant](#)];
- the Strategic GPL Enforcement Initiative<sup>400</sup> (enforcing [GPL](#) license compliance), also by the Software Freedom Conservancy charity [[grant](#)]; and
- [Reproducible Builds](#)<sup>401</sup> (deterministic compilation that ensures that the binary compiled from the same source code is always the same, so users can verify that it has not been tampered with).

### A.3.3 Shuttleworth Foundation

The [Shuttleworth Foundation](#)<sup>402</sup> aims to drive social change by investing in social innovators. In its ideal future, the "global open knowledge society with unhindered access to essential information and limitless opportunities for innovation and replication" should make it "much easier to find solutions to social challenges". In this open knowledge society, "a superset of [open data](#), [open content](#), [open access](#) and open source is available to all".<sup>403</sup>

*"Openness is at the core of the Foundation's experiment in the world."<sup>404</sup> We wanted to understand what would happen if the values, processes and licences of the FOSS world were applied to areas outside of software," such as education, philanthropy, hardware and social development. "Philosophically and practically, we default to open instead of lock down. We are taking the stance closest to extreme openness as a counter balance to the prevailing idea of completely closed, in order to establish new norms along the continuum."<sup>405</sup>*

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<sup>395</sup> <https://www.ampr.org/grants/>

<sup>396</sup> <https://ntpsec.org/>

<sup>397</sup> <https://www.gnuradio.org/>

<sup>398</sup> <https://sfconservancy.org/copyleft-compliance/firmware-liberation.html>

<sup>399</sup> <https://sfconservancy.org/>

<sup>400</sup> <https://sfconservancy.org/copyleft-compliance/enforcement-strategy.html>

<sup>401</sup> <https://reproducible-builds.org/>

<sup>402</sup> <https://www.shuttleworthfoundation.org/>

<sup>403</sup> <https://www.shuttleworthfoundation.org/about/>

<sup>404</sup> <https://www.shuttleworthfoundation.org/>

<sup>405</sup> <https://www.shuttleworthfoundation.org/open/>

### The Shuttleworth Foundation

- **vision/aims:**
  - "an experiment in open philanthropy";
  - "driving social change by investing in social innovators";
  - "We wanted to understand what would happen if the values, processes and licences of the FOSS world were applied to areas outside of software," such as education, philanthropy, hardware and social development.
- **model:** privately funded [Purpose Trust](#),<sup>1</sup> investing in individuals through 1-3-year fellowships and small grants;
- **grants:**
  - fellowship grants: comparable to a full-time salary for a year, and
  - project funding: 275,000 USD per fellow per year, to be spent directly on his/her idea;

Twice a year, a number of small grants (worth USD 5,000, no strings attached) are awarded to "social change agents" based on nominations from the Fellows.

- **geographical target:** worldwide;
- **application process:** through an online form, accompanied by a five-minute application video and an up-to-date resume.

The first selection based on reviews of the applications and interviews thereafter takes four weeks. Decisions on the applicants on the shortlist will be made in the weeks and months thereafter.

Application numbers vary from 250-450 per round. No more than four fellows per intake are chosen. A substantial personal investment is required, which the Foundation will multiply by a factor of ten or more.

- **disbursement:** N/A
- **base:** Durbanville, South Africa<sup>1</sup>
- **website:** <http://www.shuttleworthfoundation.org/>
- **Wikipedia:** [https://en.wikipedia.org/wiki/Shuttleworth\\_Foundation](https://en.wikipedia.org/wiki/Shuttleworth_Foundation)

The Foundation was started in 2001 by [Mark Shuttleworth](#),<sup>406</sup> entrepreneur, and founder and CEO of [Canonical](#),<sup>407</sup> the company behind the most popular [Ubuntu Linux distribution](#).<sup>408</sup> Over the last two decades, Shuttleworth has donated (or invested) many millions of USD to open-source projects. In 2005 he committed to initial funding of 10 million USD to create the Ubuntu Foundation, thereby ensuring the continuity of the Ubuntu project.<sup>409</sup> And in 2006 he became a major contributor to the [KDE \(desktop\) project](#).<sup>410</sup>

The Foundation "invests in initiatives and individuals who challenge the status quo and actively contribute to positive change. We identify amazing people with innovative ideas, give them a fellowship grant, and multiply the money they put into their own project by a factor of ten or more."<sup>411</sup>

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406 <https://www.markshuttleworth.com/>

407 <https://canonical.com/>

408 <https://ubuntu.com/>

409 <https://ubuntu.com/blog/new-ubuntu-foundation-announced>

410 <https://dot.kde.org/2006/10/15/mark-shuttleworth-becomes-first-patron-kde>

411 <https://www.shuttleworthfoundation.org/>

Among the current Fellows<sup>412</sup> we find Julia Reda,<sup>413 414</sup> former Member of the European Parliament for the Pirate Party Germany, where she worked on EU copyright reform and was one of the instigators of the EU-FOSSA initiative (see section ...). With the support of the Shuttleworth Foundation, she will be returning to Berlin "to work full-time on advancing access to knowledge and culture through copyright reform."<sup>415 416</sup>

An overview of past Fellows can be found at <https://shuttleworthfoundation.org/fellows/alumni/>.

### A.3.3.1 On open-source software

Specifically on open-source software, from the Foundation's openness values and way of working:<sup>417</sup>

*"The Foundation subscribes to the ethos embodied in free and open source software – collaboration and the freedom to use, adapt and share resources. We apply the free and open source philosophy as the underlying principle to our work. We use open licences to allow learning and resources to be used, adapted and shared widely. We give preference to the use of free and open source software in our own initiatives and require partners to do the same."*

And:<sup>418</sup>

*"We insist upon open communications, open reporting, open source software, open resources and open licences. Software must be licensed with a license that complies with the [Open Source Definition](#).<sup>419</sup> Hardware is made open according to the [Open Source Hardware Definition](#).<sup>420</sup>"*

### A.3.3.2 Grants

The Foundation makes two types of grants:

- **fellowships:** the funding consists of two parts: the fellowship grant (comparable to a full-time salary for a year) and the project funding (275,000 USD per fellow per year, to be spent directly on his/her idea). Fellowships are assessed a year at a time, with the possibility to apply for a second or third year.<sup>421</sup>
- **Flash Grants:** Twice a year, the Foundation awards a number of small grants (worth USD 5,000, no strings attached) to "social change agents" based on nominations from the Fellows. For 2019, the website lists 29 recipients.<sup>422</sup>

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<sup>412</sup> <https://www.shuttleworthfoundation.org/>

<sup>413</sup> <https://juliareda.eu/en/>

<sup>414</sup> <https://www.shuttleworthfoundation.org/fellows/julia-reda/>

<sup>415</sup> <https://juliareda.eu/2020/02/shuttleworth-foundation/>

<sup>416</sup> <https://shuttleworthfoundation.org/thinking/2020/02/27/thinking-welcome-march2020-intake/>

<sup>417</sup> <https://www.shuttleworthfoundation.org/about/how-we-work/>

<sup>418</sup> <https://www.shuttleworthfoundation.org/about/how-we-work/>

<sup>419</sup> <https://opensource.org/osd-annotated>

<sup>420</sup> <https://www.oshwa.org/definition/>

<sup>421</sup> <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>

<sup>422</sup> <https://www.shuttleworthfoundation.org/fellows/flash-grants/>

In 2019 the Foundation spent 6,525,506 USD in total, of which USD 5,778,409 went to the fellowship programme and USD 747,098 (11.4%) into operational costs.<sup>423</sup>

### **A.3.3.3 The application process**

The Foundation "offers fellowships to individuals to implement their innovative idea for social change. They are most interested in exceptional ideas at the intersection between technology, knowledge and learning, with openness being the key requirement."

Although the Foundation used to fund projects and institutions as well, they "found multiple issues often took precedence over the mission. An institution's primary drive is always to take care of itself: it needs to survive, regardless of a particular project's success."<sup>424</sup>

Applications for fellowships can only be submitted through the online form (currently (January 2021) not available, stating that "applications will reopen on 1 August 2021 for a March 2022 intake").<sup>425</sup> This application should be accompanied by a five-minute application video and an up-to-date resume.<sup>426</sup> More details on what's expected from applicants (for last year's applications) are at <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>.

*"Application numbers vary from 250-450 per round. We choose no more than four fellows per intake."<sup>427</sup> About 1% of applicants is offered a fellowship. Also a substantial personal investment is required.<sup>428</sup> "We identify amazing people with innovative ideas, give them a fellowship grant, and multiply the money they put into their own project by a factor of ten or more."<sup>429</sup>*

The review process takes place in the four weeks following the application deadline. After going through the applications in the first two weeks, Foundation staff interviews the remaining candidates in the second two weeks. Decisions about the applicants on the shortlist are then made in the following weeks and months. For each round a different Honorary Steward is invited to provide his/her independent perspective on the applicants on the shortlist. The final decision is overseen and ratified by the board of trustees.

### **A.3.3.4 Success**

On the definition of success, the Foundation states:<sup>430</sup>

*"We work with you to understand what you see as a success, and encourage you to set your own markers for progress. We hold honest conversations around these self-defined indicators throughout the fellowship.*

*Five years after your funding ends, we look at the bigger picture and revisit your idea, look at your ongoing engagement with the fellowship, and ask if you are still working in the same or similar space.*

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<sup>423</sup> <https://shuttleworthfoundation.org/reports/2019/>

<sup>424</sup> <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>

<sup>425</sup> <https://www.shuttleworthfoundation.org/apply/form/>

<sup>426</sup> <https://www.shuttleworthfoundation.org/apply/>

<sup>427</sup> <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>

<sup>428</sup> <https://shuttleworthfoundation.org/thinking/2017/09/14/thinking-do-it/>

<sup>429</sup> <https://shuttleworthfoundation.org/>

<sup>430</sup> <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>

*Success within the fellowship is demonstrating best effort in implementing your idea, understanding the outcomes of those efforts and how they contribute to progress towards our agreed shared objectives."*

Commercialisation of an idea is allowed, but since the Foundation put in the initial funding, an equity share of 30% for that commercial venture is expected.<sup>431</sup>

## **A.4 Funding from industry/science consortia**

### **A.4.1 NumFOCUS**

NumFOCUS<sup>432</sup> (its name standing for 'Numerical Foundation for Open Code and Useable Science') is a [501\(c\)\(3\)](#) public charity based in the US. Its mission is to "promote open practices in research, data, and scientific computing by serving as a [fiscal sponsor](#) for open-source projects and organising community-driven educational programs."<sup>433</sup>

NumFOCUS believes that "diverse contributors and community members produce better science and better projects. As part of its DISC programme – Diversity & Inclusion in Scientific Computing – it strives to "increase participation by and inclusion of underrepresented people."<sup>434 435</sup>

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<sup>431</sup> <https://shuttleworthfoundation.org/thinking/2020/10/23/webinar-faq/>

<sup>432</sup> <https://numfocus.org/>

<sup>433</sup> <https://numfocus.org/community/mission>

<sup>434</sup> <https://numfocus.org/programs/diversity-inclusion>

<sup>435</sup> <https://numfocus.org/code-of-conduct>

## NumFOCUS

- **vision/aims:** "promoting open practices in research, data, and scientific computing by serving as a fiscal sponsor for open-source projects and organising community-driven educational programmes";
- **model:** a 501(c)(3) public charity, offering two main types of memberships:
  - fiscal sponsorship:
    - the Comprehensive Model, and
    - the Grantor-Grantee Model; and
  - affiliation;
- **funding:** corporate sponsors, event proceeds, foundation grants, and individual donations;
- **grants:** to members through programmes that support open-source scientific computing projects:
  - Community, Promotion, and Funding; and
  - the John Hunter Matplotlib Summer Fellowship;
- **geographical target:** worldwide;
- **application process:** open to projects that are scientifically oriented, open and kind; additionally for fiscal sponsorships: having a transparent governance model and a work roadmap; applications go through a web form, which presents you with about a dozen short questions on your project; applications are accepted on a quarterly basis;
- **disbursement:** -
- **base:** Austin, Texas, USA
- **website:** <https://numfocus.org/>;      **governance/bylaws**      **documents:** <https://numfocus.org/legal>
- **Wikipedia:** -

### A.4.1.1 Open-source software

NumFOCUS states, on open-source software:<sup>436</sup>

*"Open code promotes innovation & discovery.*

*Open-source software is increasingly the standard in academic research because it promotes accessibility and reproducibility.*

*Open source software also provides significant benefits for industry and business, allowing for-profit companies to enjoy the efficiencies of freely available, functional public code rather than pay to develop software from scratch. In effect, open source acts as a shared pool of public research and development (R&D) that companies can use directly and leverage to build solutions."*

### A.4.1.2 Launching sponsors

NumFOCUS was founded in 2012 by FOSS developers from the scientific computing community. Early financial support came from "corporate sponsors and the launch of the PyData educational event series. Continuum Analytics (now [Anaconda](https://www.anaconda.com/))<sup>437</sup> provided integral support on many levels during the early years, including space for the first NumFOCUS office, support staff, and salary of the Executive Director.

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<sup>436</sup> <https://numfocus.org/community/mission>

<sup>437</sup> <https://www.anaconda.com/>

They also launched the first PyData and contributed many resources and funds to the early events.<sup>438</sup>

*"Microsoft made a large donation in 2013 for NumFOCUS to use to support [IPython](#), our first fiscally sponsored project. A donation from J.P. Morgan was also received that year to support our women in technology programmes (now DISC) and the John Hunter Technology Fellowship."<sup>439 440</sup>*

#### **A.4.1.3 Current donors**

In addition to corporate sponsors, event proceeds, and foundation grants, NumFOCUS encourages individuals – whom it now calls Open Science Champions<sup>441 442</sup> – to donate, so it can sustain itself and its Sponsored Projects.<sup>443</sup> To that purpose, NumFOCUS has defined several levels of donorships:<sup>444</sup>

- Open Foundations: up to USD 250 annually, or up to USD 21 monthly (in the hundreds listed);
- Open Pathways: USD 250-499 annually, or USD 21-41 monthly (a few dozen listed);
- Open Opportunities: USD 500-\$999 annually, or USD 43-\$84 monthly (more than a dozen listed);
- Open Insights: USD 1,000-\$2,499 annually, or USD 84-\$208 monthly (more than a dozen listed);
- Open Innovations: USD 2,500-\$4,999, or USD \$209-\$416 per month (two listed); and
- Open Frontiers: USD 5,000+, or \$417+ per month (five listed).

There is also a list of a few hundred Project Sponsors who donated to specific Sponsored Projects.

Donations can be made through a web form.<sup>445</sup>

The site also lists other suggested ways to support NumFOCUS and its projects:<sup>446</sup>

- joining a local PyData Meetup chapter to help to plan a PyData conference<sup>447 448</sup> (held in 58 countries in 2019);<sup>449</sup>
- developing a hosted project;
- advocating for NumFOCUS to your employer, for example for a corporate sponsorship;<sup>450</sup>

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<sup>438</sup> <https://numfocus.org/history>

<sup>439</sup> <https://numfocus.org/programs/john-hunter-technology-fellowship>

<sup>440</sup> <https://numfocus.org/history>

<sup>441</sup> <https://numfocus.org/fundraising-and-support/numfocus-introduces-new-supporter-program>

<sup>442</sup> <https://numfocus.org/your-support>

<sup>443</sup> <https://numfocus.org/sponsored-projects>

<sup>444</sup> <https://numfocus.org/your-support-3>

<sup>445</sup> <https://numfocus.org/donate>

<sup>446</sup> <https://numfocus.org/addtional-ways-to-support>

<sup>447</sup> <https://pydata.org/>

<sup>448</sup> <https://numfocus.org/programs/pydata>

<sup>449</sup> <https://numfocus.org/wp-content/uploads/2020/02/NumFOCUS-Annual-Report-2019.pdf>

<sup>450</sup> <https://numfocus.org/wp-content/uploads/2018/07/NumFOCUS-Corporate-Sponsorship-Brochure-Apr-2020.pdf>

- asking your employer to match your donation or volunteer hours;<sup>451</sup>
- volunteering on a NumFOCUS committee;
- selecting NumFOCUS as a nonprofit organisation to support through your purchase while shopping, e.g. through [AmazonSmile](https://smile.amazon.com/),<sup>452</sup> the [Kroger](https://www.kroger.com/i/community/community-rewards) Community Rewards programme,<sup>453</sup> or a cashback via Giving Assistant;<sup>454</sup> and
- buying merchandise from the ([SpreadShirt](https://shop.spreadshirt.com/numfocus/)) shop, such as stickers, mugs and hoodies.<sup>455</sup>

#### A.4.1.4 Sponsorships

"NumFOCUS aims to ensure that funding and resources are available to sustain projects in the scientific data stack over the long haul. It does so through programmes that support open-source scientific computing projects: Community, Promotion, and Funding."<sup>456</sup>

Projects have two options when joining NumFOCUS:<sup>457</sup>

- **The fiscal sponsorship programme:** Projects formally become a part of NumFOCUS, whereby NumFOCUS provides financial administration, operational and legal support.

These projects can use NumFOCUS resources and infrastructure to help raise (tax-deductible) money for the project.

The services and expertise provided by NumFOCUS to projects of this type are:

- legal services: licensing, trademark registration and ownership, contracts and agreements;
- financial services: accounts payable and receivable, grant administration, contractor agreements, taxes and reporting; and
- operational services: technical infrastructure, conference and event planning, consulting on a variety of administrative requests.

Within the fiscal sponsorship programme there are two sub-options:

- the Comprehensive Model: The project formally becomes part of NumFOCUS, i.e. NumFOCUS maintains all legal and fiduciary responsibility for the project.

This helps protect individual contributors from legal liability and ensures that project assets are owned by the project and not by individual contributors.

- the Grantor-Grantee Model: A lightweight option, for when a project is in need of an entity to receive and manage grant funding.

The project remains a separate entity responsible for managing its own tax and liability issues. NumFOCUS ensures that the project will use the grant funds received to accomplish the ends described in the grant proposal.

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<sup>451</sup> <https://numfocus.org/match-your-donation>

<sup>452</sup> <https://smile.amazon.com/>

<sup>453</sup> <https://www.kroger.com/i/community/community-rewards>

<sup>454</sup> <https://givingassistant.org/>

<sup>455</sup> <https://shop.spreadshirt.com/numfocus/>

<sup>456</sup> <https://numfocus.org/projects-overview>

<sup>457</sup> <https://numfocus.org/projects-overview>

NumFOCUS' website lists about 40 projects of this type.<sup>458</sup>

- **The affiliation programme:** projects remain legally separate from NumFOCUS, so NumFOCUS does not assume any legal or fiduciary responsibilities, and does not provide any additional services.

These projects still benefit from their association with NumFOCUS through community, funding, and promotion.

The website lists more than 40 project of this type.<sup>459</sup>

In 2019, eight new sponsored and nine new affiliated projects joined NumFOCUS.<sup>460</sup>

There is also the **John Hunter Matplotlib Summer Fellowship**, named in memory of [Matplotlib](#) creator [John Hunter](#). It "sponsors one to two students to work full-time for three months on Matplotlib, supervised and mentored by a senior contributor from the project. The fellowship is designed to help prepare recipients to become active contributors and core maintainers of Matplotlib."<sup>461</sup>

#### A.4.1.5 Applications

Projects can apply for hosting at NumFOCUS if they are:<sup>462</sup>

- scientifically oriented,
- open (in the sense of both licence and community), and
- kind (in community culture).

For a Fiscal Sponsorship, projects should also have:

- a transparent, publicly visible governance model, and
- a roadmap outlining high-priority work areas.

Project applications go through a web form, which presents you with about a dozen short questions on your project.<sup>463</sup>

Applications are accepted quarterly.

#### A.4.1.6 The Sustainability Programme

The overall Sustainability Programme is sponsored by a large grant from the Sloan Foundation.<sup>464</sup>

NumFOCUS recognises that specifically foundational software has sustainability problems:

*"One of the challenges many open-source software projects face is sustainability. Like other open-source software infrastructure, foundational projects in the scientific computing ecosystem tend to operate largely without significant resources, despite being incredibly important to their users.*

*Our projects have enormous value; they're being used on a daily basis by millions of people, yet they do not have the appropriate resources to support and sustain critical open-source scientific computing projects. Most project leads are developers*

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<sup>458</sup> <https://numfocus.org/sponsored-projects>

<sup>459</sup> <https://numfocus.org/sponsored-projects/affiliated-projects>

<sup>460</sup> <https://numfocus.org/wp-content/uploads/2020/02/NumFOCUS-Annual-Report-2019.pdf>

<sup>461</sup> <https://numfocus.org/programs/john-hunter-technology-fellowship>

<sup>462</sup> <https://numfocus.org/projects-overview>

<sup>463</sup> <https://numfocus.typeform.com/to/VUPE35>

<sup>464</sup> <https://numfocus.org/programs/sustainability>

*with deep technical knowledge and passion, but little training or experience in the business practices required to sustain their project over time. As a result, many foundational infrastructure projects are at risk of languishing, being overburdened, or losing a central maintainer for lack of proper support."*

To solve these problems, NumFOCUS tries to find non-financial strategies, i.e. "identify sustainability mechanisms that will be effective in both academic and industry environments:"

- connect the NumFOCUS projects to each other to jointly develop and share information on sustainability strategies;
- connect project leads with people with relevant expertise and networks;
- provide training on skills related to open-source sustainability, including business and financial planning, marketing strategies, community engagement, governance, etc.; and
- support infrastructure that would help the projects more effectively manage finances, necessary technical resources, and client and business relationships.

#### **A.4.1.7 Support from the Sloan Foundation**

In 2019, the Sloan Foundation gave USD 30,000 "to support travel for up to two representatives from each of our projects to attend the annual NumFOCUS Summit, a gathering focused on promoting sustainability for our open-source scientific computing projects."

The Sloan Foundation also awarded USD 20,000 for JuliaCon (see section A.2.2.2).<sup>465</sup>

#### **A.4.1.8 Grants**

The NumFOCUS 2019 annual report highlights some notable grants, projects and milestones:<sup>466</sup>

- a 900,000 USD grant from the Gordon and Betty Moore Foundation<sup>467</sup>;
- a 2.3 million USD award from the National Science Foundation (see section A.1.5); and
- six grants from the Chan Zuckerberg Initiative<sup>468</sup> via its Essential Open Source Software for Science programme.

In 2019 NumFOCUS received USD 123,837 from individual sponsorships, of which USD 39,443 was for specific projects. The Project Direct Expenses were USD 1,326,366, and the Project and Core Mission Support was USD 1,025,863, the latter also including external events and Small Development Grants.

In the same year, NumFOCUS awarded USD 76,310 in small grants of up to USD 5,000 each. The average single grant amount was USD 3,816. An additional USD 9,000 was awarded in off-cycle grant requests.

USD 78,092 had to remain unfunded, because NumFOCUS "received more high-quality proposals than their current budget can accommodate."

The Small Development Grants are to "help our projects improve usability, grow their communities, and speed up the time to major releases. Eligibility is limited to

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<sup>465</sup> <https://numfocus.org/wp-content/uploads/2020/02/NumFOCUS-Annual-Report-2019.pdf>

<sup>466</sup> <https://numfocus.org/wp-content/uploads/2020/02/NumFOCUS-Annual-Report-2019.pdf>

<sup>467</sup> <https://www.moore.org/>

<sup>468</sup> <https://chanzuckerberg.com/>

our fiscally sponsored and affiliated projects, and calls for proposals are run three times per year.<sup>469</sup>

The application process is described in the 2020 Small Development Grants Prospectus.<sup>470</sup>

#### **A.4.1.9 Google's Summer of Code and Season of Docs**

In 2019<sup>471</sup> five of the NumFOCUS projects participated in the inaugural cohort for Google's Season of Docs (GSoD),<sup>472</sup> bringing together open-source and technical writer communities.<sup>473</sup>

2019 was also the fifth year NumFOCUS participated as an umbrella organisation for Google's Summer of Code ([GSoC](https://summerofcode.withgoogle.com/)).<sup>474</sup> 25 students working with twelve open-source projects worked under the NumFOCUS umbrella, while a few other (NumFOCUS) projects participated in the programme independently.<sup>475</sup>

#### **A.4.1.10 The NumFOCUS Community Alliance**

The NumFOCUS Community Alliance is "a coalition of nonprofit organisations and community groups who share our commitment to increasing collaboration, project sustainability, and diversity in the scientific computing community, and reflect support for open-source scientific computing. Members can have their events and activities cross-promoted by NumFOCUS in a reciprocal, supportive relationship."

No financial commitment to NumFOCUS is required to join.<sup>476</sup>

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<sup>469</sup> <https://numfocus.org/programs/sustainability#sdg>

<sup>470</sup> <https://numfocus.org/wp-content/uploads/2020/08/2020-Small-Development-Grants-Prospectus-Final.pdf>

<sup>471</sup> <https://numfocus.org/wp-content/uploads/2020/02/NumFOCUS-Annual-Report-2019.pdf>

<sup>472</sup> <https://numfocus.org/blog/numfocus-projects-to-apply-for-inaugural-google-season-of-docs>

<sup>473</sup> <https://developers.google.com/season-of-docs>

<sup>474</sup> <https://summerofcode.withgoogle.com/>

<sup>475</sup> <https://numfocus.org/programs/google-summer-code>

<sup>476</sup> <https://numfocus.org/community-alliance>