It Takes a Village

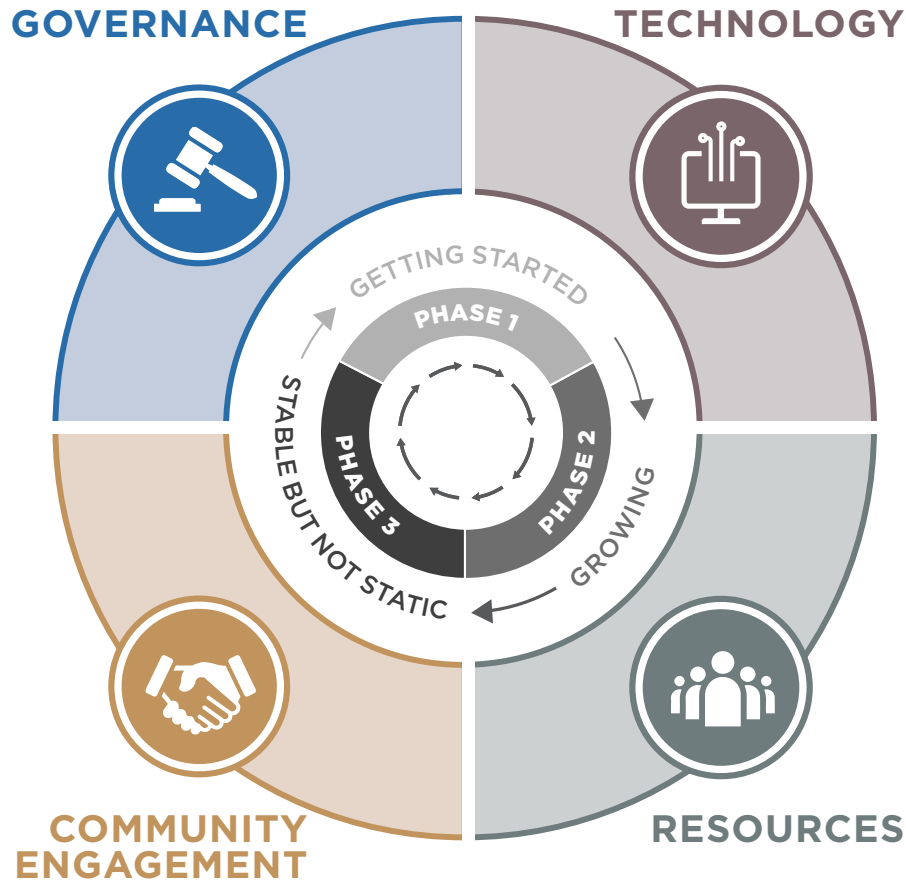## Open Source Software Sustainability

A Guidebook for Programs Serving Cultural and Scientific Heritage

Sustainability Wheel

GOVERNANCE

Phase I: Establishing
Working with original engineers, project staff, or organization. Go to page 11.

Phase II: Stabilizing
Functional but limited in one or more aspects. Go to page 12.

Phase III: Evolving
Strong management structures; not necessarily formal governance. Go to page 13.

TECHNOLOGY

Phase I: Laying the Groundwork
In design, pre-release or early beta testing phase; small set of early adopters. Go to page 20.

Phase II: Expanding and Integrating
Have more than one public release. Go to page 21.

Phase III: Preparing for Change
In production, well-adopted, supported. Technology stack stable. May be looking to next generation. Go to page 22.

RESOURCES

Phase I: Creating Consistency
Funded by single organization, grant-funded or volunteer operated. Go to page 26.

Phase II: Diversification
Distributed resourcing; meeting expenses, small number of revenue streams. Go to page 27.

Phase III: Stable, but not Static
Diverse staff support and income streams; focused on long-range strategy. Go to page 28.

COMMUNITY ENGAGEMENT

Phase I: Getting Beyond Initial Stakeholders
Focused on primary stakeholders; lack of engagement with broader communities. Go to page 32.

Phase II: Establishing CE Infrastructure
Determining how to facilitate engagement that works for community. Go to page 33.

Phase III: Evolving CE
Established infrastructure to enable engagement. Go to page 35.

Facet: Resources

Phase I: Creating Consistency

Core Goal

Create a sustainability plan focused on achieving a consistent and sustained level of resources. That may be a mix of reliable, diverse, predicable financial resource streams as well as time/efforts commitments from volunteers or consistently allocated staff time from dedicated institutions. Move program resources from early enthusiasm and grant funding to the next step.

OSS programs do not have to go it alone.

Characteristics

Phase I programs are typically funded by a single organization, grant-funded or volunteer operated, and may not have a long-term plan for ongoing support such as membership or any earned income streams. There is often a single program owner or champion writing grants, shifting internal resources and obtaining necessary internal support. Software development staff may be grant-funded and therefore not permanent members of the team, or may be temporarily re-assigned from other projects. A small number of contributors generally means that a loss of one person has an outsized impact.

Concerns and Roadblocks

In a program's early days, it may be difficult to make the case to those who control the resources that the program is important. Tensions between what users and programs need, such as local vs. community needs, infrastructure, iteration, and exploration of potential uses outside of the original community, may be different from the solid plans funders would like to see. Unrealistic expectations placed on small teams can lead to burnout.
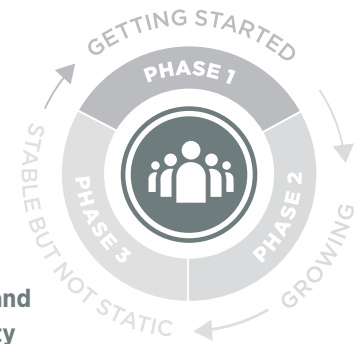
Moving Forward: Objectives

- **Undertake business and financial sustainability planning**

  Understanding a program's market and end users, and the options for long-term dedicated resources, are critical to long-term financial sustainability. Options for obtaining sustainable resources include but are not limited to earned revenue streams, in-kind contributions from multiple organizations, sponsorship or membership programs for active users, and other arrangements for shared revenue. Some programs may have resources that can assist with these efforts in house or at their founding/sponsoring organization, but others will need to look outside for assistance.

- **Determine human resources needed to move forward**

  In addition to financial resources, human resources are needed to develop functional specifications, write code, and perform community outreach. Within the OSS program's business plan, enumerate the people and skill sets required to support program elements in priority order, and be clear about what may be delayed or deferred when resources are focused on one aspect of a program over another.

- **Explore partnerships and collaborations**

  OSS programs do not have to go it alone. Many programs explore partnerships with similar communities or engage with fiscal sponsors or nonprofits to serve as home organizations that provide administrative structure around program's activities.

Facet: Resources

Phase II: Diversification

Core Goal

Diversify income streams and talent pools to mitigate reliance on one source of income or program member.

Characteristics

Phase II programs have generally moved to distributed resourcing – be it membership fees, cost recovery, value-added services, institutional commitments of in-kind resourcing, or a mix. They are able to meet day-to-day expenses, but may still be reliant on a small number of organizations and revenue streams, and have difficulty funding out-of-the-norm expenses. On the personnel side, Phase II programs have a strong core team and are usually able to recruit diverse team members, but retention can be difficult without long-term funding assurances.

Concerns and Roadblocks

It can be difficult to recognize when things are not working and to identify ways to pivot to more successful paths. Converting users to community members and contributors can be difficult. Transitioning from user support to institutional support is challenging. Expanding into different countries or regions can bring its own set of issues, from the mundane, such as difficulty with financial transactions, to the foundational, such as a lack of understanding of open source contribution models.

Moving Forward: Objectives

- **Expand community of funders and contributors**

  Grant funding and contributions from original stakeholders will only take the program so far. In order to grow and sustain, program staff need to seek a more diverse set of funds and contributors. Programs may explore diversifying income streams via memberships, sponsorships, or providing support and services around their application. New contributors may be identified via bounty models (offering payment or "bounties" for specific work), workshops or hackathons at conferences, student interns and/or the user community's personal networks.
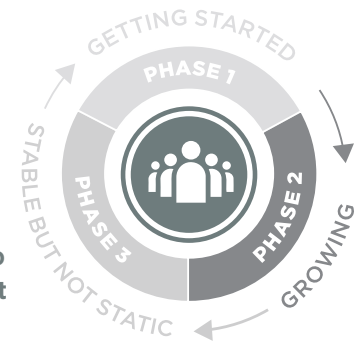
- **Work with vendors to support development needs**

  In some cases, the community of implementers and users for an open source application may have sufficient technological resources to provide code contributions and all the necessary implementation support. In others, however, implementing institutions just don't have the human resources and skills in house – a common challenge for cultural and scientific heritage organizations. In these instances, vendors providing services and support around the OSS may be a good source of development resources for the program. Working with vendors involves considerable requirements analysis on both sides; in the end, the service provider needs to develop the features in a way the implementing institution can use but also in a way that is generic enough that other organizations can use them too. If done well, these types of arrangements can provide a high level of community engagement while covering the costs of continuing to develop the software. Some programs choose to create formal registered service provider agreements with outside vendors.

Converting users to community members and contributors can be difficult.

- **Cultivate expectations around community contributions**

  Programs should provide structure to support community contributions, with established expectations around contributions. Community efforts should be encouraged to help with answering technical questions, fostering the development of code committers, supporting regular community gatherings, and assisting with strategies related to software development and community engagement.

Facet: Resources

Phase III: Stable, but Not Static

Core Goal

Focus on resilience – ensuring that the program is aware of changes in the landscape and has plans to address them. In other words, make sure to continue to evolve to meet the community's needs.

Characteristics

Phase III programs generally have diverse staff support and income streams covering daily operations, and can focus on long-range strategy and even endowment formation. Money is available for R&D and infrastructure programs, and the loss of or change to one income stream does not spell disaster. On the human side, Phase III programs have paid staff and a strong contributor model with many skill sets and roles represented.

Concerns and Roadblocks

Large contributions by implementing institutions may be mirrored by expectations around how program priorities are set. Grant funding that allows for more exploratory or experimental work can be hard to come by. Chasing revenue can cause a loss of focus, or move priorities away from the ultimate needs of the end users of the OSS.

Make sure to continue to evolve to meet the community's needs.
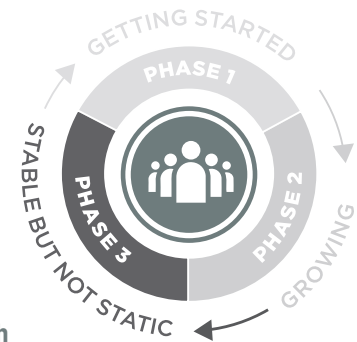
Moving Forward: Objectives

● **Focus on alliances and partnerships with leading institutions**

Large, well-funded organizations may be drawn to the notion that with OSS, they can have a strong voice in governance and program direction, while supporting the needs of their often-diverse constituents. Partnerships with leading organizations can provide steady sources of income, in-kind contributions such as development resources, and intangible benefits associated with the organization's reputation such as shared ownership and responsiveness.

● **Shift business model in response to external events**

Programs need to evaluate their resource plans in response to the broader technology landscape and trends in the domain the OSS serves. It is critical to develop a board or advisory group that has the right skill set for identifying trends and determining how to mitigate their effect on a program's viability. Some trends may be positive, such as the current increased focus in higher education on supporting open resources and technologies. Other trends may be challenging, such as cuts to funding agencies.

● **Calibrate revenue streams to a global economy**

Open source software can be very attractive to organizations in developing economies. Program staff must be flexible in their expectations for financial and in-kind contributions from these organizations; for example, by calibrating financial requirements for governance participation on a sliding scale.

Resources Resources and Tools

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- "Reports and Resources." Nonprofit Technology Network. Accessed 1 February 2018. https://www.nten.org/knowledge/reports-and-resources/.

- "Planning for Sustainability." OSS Watch. Accessed 1 February 2018. http://oss-watch.ac.uk/resources/planningsustainability.

Katherine Skinner discussing the "Steps" model created by Educopia.

Resources Case Studies

Guidebook case studies provide first-hand accounts from forum participants about their program's work toward sustainability. Resource case studies are from the DuraSpace organization and Specify program.

DuraSpace

By Michele Kimpton and Jonathan Markow
http://www.duraspace.org/
http://duraspace.org/sites/duraspace.org/files/2014%20
DuraSpace%20Annual%20Report.pdf

2014 was a year of growth and transition for DuraSpace. DuraSpace's key goals for the year were to increase community participation and engagement in the open source projects, and to increase transparency regarding DuraSpace's role and how funds are allocated to projects and services. To help achieve these goals, DuraSpace transitioned from a sponsorship to a community membership program to support the open source projects. A key objective of the new membership program was to increase community engagement by establishing a robust governance structure for each open source project. By the end of 2014 steering groups and leadership groups had been established for each of the projects. Participants in these groups came directly from the membership.

Continued growth of membership in DuraSpace was a key objective to expanding the organization's reach and engaging with software users both far and near. Thirty-three percent of the membership came from outside the United States. Focused efforts were made to increase engagement with users outside the USA, to better understand their needs,

> "A key objective of the new membership program was to increase community engagement."

and give them a more democratic way to voice their needs through the governance model established. Significantly reduced membership fees were available for institutions from developing countries, as low as $250 per year. The membership program provided a pathway for DuraSpace to

increase awareness and education about how to best contribute to and participate in open source projects, and to illustrate how global engagement and contribution drives successful community source software development.

DuraSpace also continued to expand its portfolio of hosted services running on cloud infrastructure. DuraSpace services continued to be developed and expanded based on the goal of providing small to mid-size organizations with services that enabled management, access to and preservation of their digital research and scholarship without having to pay for in-house technical expertise to deploy and maintain technologies. DuraSpace's goal was to enable any size institution the capability to access, manage and preserve their digital holdings regardless of the institution's size.

DuraSpace's success was based on a deep understanding of how to advance community source projects through community engagement, and how to continually adapt services to meet the emerging needs of the larger community invested the stewardship of our collective digital scholarship.

In fiscal year 2014, all revenue was derived from membership and services revenue. No revenue in 2014 came from grant funding, the first time in DuraSpace's history. In 2009, the organization was 100% grant funded and in 2014, 75% of revenue was derived from membership while 25% came from services.

Resources Case Studies

Specify

By James Beach
http://www.sustain.specifysoftware.org/
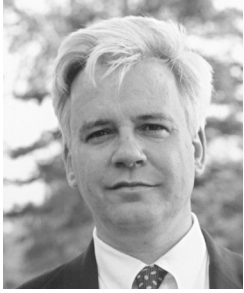
For over 400 years, field biologists have explored the world's wild places to discover and document the diversity of life on earth. Preserved animal and plant specimens from those forays provide the physical evidence for describing new species and for documenting species distributions in space and in time. Specify (http://www.specifysoftware.org) museum databases are catalogs of those specimens; they include descriptive, taxonomic, geographic and other types of specimen data.

In 1987, the U.S. National Science Foundation began funding the MUSE Project, the predecessor to Specify. Over the subsequent 30 years the two projects competed for $12M in grants with additional support from the University of Kansas. In 2017, with encouragement from NSF, we began a process to identify an organization/revenue model that would engage biological collections institutions to financially support future costs of the Specify Project's core software development and technical support services.

collections to use inexpensive or free software for the processing the data associated with curation and research.

Specify's open source license is valued by most small and medium-sized collections because the software is free to use. But large university and national museums have told us that open source licensing was a precondition for their adoption of it, because of an institutional commitment to open source software.

In transitioning Specify from grant funding to financial sustainability, our two biggest challenges are: 1) identifying an organization/financial model for generating revenue to sustain the project, and 2) finding a way to keep the project embedded within a research center or university. For the first challenge, a non-profit, membership organization model looks like the most promising option as it will enable us to leverage fees from larger "Founding Member" institutions who are in a position to, in effect, subsidize Specify for smaller collections with meager financial resources.

For the second challenge, being embedded within a university research campus gives us direct access to collections researchers for feedback and to inform priorities. More importantly, being under the wing of a university or research museum would give us benefits from existing infrastructure, including human resources, financial management,

> "Ultimately, economic sustainability of the Project will depend on the number of research institutions who value open source software enough to help underwrite it …"

Research institutions with natural history collections range in size from large national museums with tens of millions of specimens, to mid-size university collections (50,000-several million), to small college and free-standing collections (5,000-50,000). The Specify Software Project primarily serves mid- and small-sized museums – a total of about 500 collections in the U.S. and 37 other countries. Generally biological museums are sparingly-resourced; collections in some large U.S. state universities have budgets, exclusive of salaries, of a few thousand dollars per year. Such limiting financial resources drives the majority of biological

payroll services and the like. In addition, staff would enjoy the benefits of university employment which partially compensate for mid-range 'academic' salaries.

Ultimately economic sustainability of the Project will depend on the number of research institutions who value open source software enough to help underwrite it, extreme cost effectiveness for smaller institutions, and our ability to deliver mature and agile software products that keep up with evolving research requirements, community standards and architectures, and commercial computing technologies.