

## Towards a Collaborative National Research Data Management Network

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### Abstract

This paper describes the plans and strategies to develop Portage, a national network of sustainable, shared services for research data management (RDM) in Canada. A description of the RDM context in Canada is provided. This environment has heightened expectations around the Government of Canada's Open Science plans and includes deliverables aimed at improving access to publications and data resulting from federally funded scientific activities. At the same time, a recent environmental scan published by Canada's three federal research granting councils reveals significant gaps in services, infrastructure, and funding mechanisms to support RDM. In addition, Canada's RDM environment consists of stakeholders from a variety of communities with minimal ongoing coordination or cooperation.

The Portage network was conceived as a collaborative network model based on libraries' strong connections with researchers across the disciplines, an ethos of curation and preservation, and experience with systems for managing data in all its forms. A pilot project provided Portage with a vision and set of principles, and identified several objectives as the small wins that would build the trust and shared understanding required for a successful network. Current services and activities of Portage, including a data management planning tool and an infrastructure project, are described in this paper.

Portage now faces the challenge of moving from project to operational network, and the challenge of establishing a sustainable governance model. CARL appointed a Steering Committee that will be proposing a full governance model at the conclusion of this transition period. Using a framework of factors identified in the literature, several relevant collaborative and network governance models are being explored.

This paper outlines experience to date with Portage and matters under consideration for long-term sustainability, with a goal of engaging international colleagues in discussion and furthering the concepts for the benefit of RDM networks everywhere.

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## The Canadian Context for Research Data Management

Research data management (RDM) in Canada spans several jurisdictions and a diversity of stakeholders. Canada is a federal system in which responsibility for most aspects of higher education rests with the country's provinces and territories. However, the federal government does support research nationally. Three federal research granting councils (often referred to as the Tri-Agencies) and the Canada Foundation for Innovation, which funds research infrastructure, are national bodies under the Government of Canada. Further funding is provided by the Government of Canada to support a national high-speed optical research network (CANARIE) and advanced research computing (Compute Canada), which are national agencies that work collaboratively with regional counterparts.

Recognizing the range of players and the need for facilitation and support of common interests, the National Research Council formed the Research Data Strategy Working Group in 2008, consisting of members from across sectors and multiple research domains. Coming out of the 2011 National Data Summit, this Working Group was transformed into Research Data Canada (RDC) and has recently become a program under the auspices of CANARIE. RDC has a mandate to work at a policy level with stakeholders across the country, including promoting the funding of RDM, and it represents Canadian interests in the Research Data Alliance

It is widely acknowledged in Canada that there are significant gaps in our ability to support sound RDM practices. An environmental scan published by the Tri-Agencies in 2015 asserts:

‘Canada still lacks infrastructure, services and funding mechanisms to support widespread RDM. Infrastructure funding remains focused on domain-based solutions that support research excellence, rather than data sharing and preservation after the lifespan of the project’ (Shearer, 2015).

Much of the focus for improving the accessibility and preservation of research data has been targeted at the massive datasets produced through large science projects, however there is a plethora of research projects every year that produce data that reside on the hard drives of researchers and are neither catalogued nor accessible. A 2013 survey of over 300 Canadian researchers undertaken by Susan Mowers et.al found that only 4% of respondents shared their data through a ‘curated digital data repository,’ and another 14% used an institutional repository or a ‘public domain archive’ The vast majority, 81% of respondents, indicated that they stored data on their local hard drives (Mowers, 2013).

It is also recognized that the needs for RDM sit within the broader ecosystem of digital research infrastructure. In response to a recent public consultation by Industry Canada on developing a Canadian digital research infrastructure strategy, the Leadership Council for Digital Infrastructure observed gaps in advanced research computing, advanced research software, research data management, research data storage, and high-speed networks. It also noted the need for coordination across the ecosystem stating:

‘Key footings are in place, however, the challenge is now to foster a shared strategic vision, undertake foundational system-wide planning and coordination, and to provide greater clarity around mandates, roles, and responsibilities for implementation both within each of the ecosystem’s components and for the ecosystem as a whole’ (Leadership Council for Digital Infrastructure, 2015).

The driving forces behind these concerns include growing expectations at the federal level. The Open Science section of Canada’s Action Plan on Open Government 2014-16 has an aim ‘to maximize access to federally funded scientific research to encourage greater collaboration and engagement with the scientific community, the private sector, and the public’ (Open Government Canada, 2014). The new federal government, elected in November 2015, has promised to accelerate and expand open data initiatives and to increase support for science and scientists. Perhaps most significantly in terms of the immediate needs of researchers, the Tri-Agencies in 2015 invited targeted stakeholders to review and provide feedback on a draft Statement of Principles on Digital Data Management. In early 2016, they plan to adopt the statement as a living document to be reviewed and revised as required through continual stakeholder engagement and as the RDM environment evolves in Canada and globally.

## **Libraries and Research Data Management**

The Canadian Association of Research Libraries (CARL) has for some years focused on data management as a strategic priority. This included a well-received education program for research librarians, as well as advocacy with federal agencies and others about the importance of national support for research data sustainability.

Many Canadian research libraries have provided data services through a research data library as far back as the 1990s, focusing on purchased or licensed Statistics Canada data, financial data, or consortial collections, such as the ICPSR. In many instances, these libraries collaborated in the development and support of storage and retrieval tools for these data collections. Many were also involved in the ultimately unsuccessful National Consultation on Access to Scientific Research Data, which was intended to work towards a national research data strategy (Humphrey, 2012).

Some Canadian research libraries are already involved in the development of RDM services within their own institutions and also in the context of their regional consortia, but there are still many whose research data management needs are not yet being addressed. And while some RDM services are most appropriately delivered locally by the individual institution, many other services may benefit from being undertaken collectively by library consortia, especially given the resources and expertise involved with RDM. Managing research data is complex, with diversity in formats, metadata, and analytical tools. Not only do researchers need assistance, but so do service providers. In addition, researchers and their data cross institutional boundaries, as should services, data access and re-use.

Although the current focus of institutions and regional networks must be their own constituents, many of the individuals involved have the knowledge, experience, and vision needed to develop a national network and they are willing to collaborate. Seeing this opportunity, CARL recognized that bringing together communities of practice could help build capacity and envisioned the collaborative development of national, shared

services that provide some level of support for all Canadian research libraries through the development of a national, library-based research data management network.

## From Pilot Project to Portage Network

Development of the Portage network began in 2014 with a pilot project led by CARL and steered by representatives of each of Canada's four regional library consortia. At the conclusion of this project, CARL committed to transforming Portage into an operational network that supports a set of ongoing services and appointed an inaugural Director in September 2015.

### Vision and Scope

The broad vision articulated for Portage is a future in which Canada capitalises on the trend towards data-intensive research to become a world leader in research and innovation. This is a future that was seen to be achievable through comprehensive support for research data management at a national scale.

The pilot project had several broad aims: to bring together existing library-based initiatives to coordinate activities better and to build capacity across the country; to lay the foundation for a library-based research data management network; and to work closely with other stakeholders (e.g. CANARIE, Compute Canada, Research Data Canada) to ensure integration with and support for other infrastructures and RDM relevant initiatives in Canada.

By the end of the pilot period, two broad and interrelated categories of activity had been identified. The Portage network would be a national research data management service to assist researchers and other RDM stakeholders through 1) a library-based network of expertise on RDM, and 2) national platforms for planning, preserving, and discovering research data.

### Stakeholders

It is understood that RDM is essentially a collaborative endeavour and the network will involve multiple RDM stakeholders. Libraries have a strong connection with researchers across disciplines, an ethos of curation and preservation, and experience with systems for managing data in all its forms. Other key stakeholders on any campus include research services and ethics offices, information technology service units, and of course researchers themselves. All these stakeholders already rely on research infrastructure provided by national organizations responsible for high speed networks, high performance computing, and research funding.

Shortly after the pilot was initiated, Research Data Canada launched a set of initiatives that dovetailed with aspects of the pilot and that helped facilitate connections with key stakeholders. In particular, the work with Compute Canada (Canada's high performance computing service), which is described below, has created new opportunities for a preservation pipeline service.

The first priorities of the Portage Director included developing closer relationships with numerous stakeholder groups, including the Canadian Association of Research Ethics Boards, the Canadian Association of Research Administrators, and the Vice-Principals of Research of the largest research universities.

## Small Wins

Those overseeing the pilot set several objectives that dealt with pressing RDM needs and also served to build the foundation for a successful collaborative network. A meta-analysis of 137 studies of collaborative governance across a range of policy areas identifies a series of factors that are crucial within the collaborative process: face-to-face dialogue, trust building, and the development of commitment and shared understanding:

‘A number of case studies suggest that collaboration is more likely to ensue when the possible purposes and advantages of collaboration are relatively concrete and when “small wins” from collaboration are possible... These small wins can feed back into the collaborative process, encouraging a virtuous cycle of trust building and commitment’ (Ansell and Gash, 2007).

There were two significant ‘small wins’ that began as objectives in the pilot phase and came to fruition as Portage was launched. One of these objectives was to implement a national bilingual data management planning tool to support emerging requirements of the Canadian research granting councils. The other was to pilot a data preservation workflow using common repository software, an open source digital preservation system, and existing storage platforms.

## Data Management Planning

The project to implement a national bilingual data management planning tool served as the first instance of the envisioned Portage network of expertise. This project has been a model of collaboration drawing on a host institution, individuals at institutions across the country (referred to as the Data Management Planning Expert Group or DMPEG), and internationally the work of the Digital Curation Centre.

The service, called DMP Assistant, allows the creation of national templates to meet specific requirements of funding bodies or customised templates for individual institutional use. The bilingual, online web service is available to all researchers in Canada. It is hosted by the University of Alberta Libraries and is based on an implementation of the DCC DMP Online tool. In Canada, there are no specific requirements by funders for researchers to develop data management plans. Therefore, a default template was developed by the Portage DMP Experts Group, which represents a generic national data stewardship plan. As a result, one Canadian funding agencies has become interested in a demonstration project involving an identified set of researchers using DMP Assistant, to be carried out in 2016 in conjunction with the adoption of the Statement of Principles on Digital Data Management<sup>1</sup>.

The DMP Experts Group, the first expert group formed under the Portage network umbrella, oversaw the service implementation of DMP Assistant and is now responsible for coordinating ongoing support for data management plans. This is a group of individuals from institutions across the country who volunteered to apply their data management knowledge in this collaborative endeavour. DMP Assistant was launched in October 2015. An expert group dedicated to the data preservation pipeline partnership was struck in November 2015 and other groups will be started in the coming months dealing with discovery, ethics, peer certification of data repositories, and training.

<sup>1</sup> Statement of Principles on Digital Data Management: <http://www.science.gc.ca/default.asp?lang=En&n=83F7624E-1>

## Preservation Pipeline Platform

Portage is working to connect components of the various infrastructure and services needed for a national preservation and discovery platform. The ultimate aim is to enable all interested universities to participate – whether or not they have their own local infrastructure – by coordinating shared repositories and services under a cost model that recognizes varying institutional investments and needs.

The envisioned platforms will provide ingest and preservation services that include networked replication storage services. This infrastructure will be highly distributed with local, regional and central nodes, and will be based on standards that ensure interoperability across nodes and data types.

In addition to ingest and preservation, a complimentary set of services is envisioned to support the discovery of data contained in data repositories across Canada. To achieve this, metadata from repositories will be aggregated into an open registry through which discovery tools will be built to enable searching across data collections and repositories. The goals are to map common metadata elements and to allow an appropriate level of dataset integration across repositories.

In 2015, Compute Canada and Portage tested an experimental preservation pipeline assembled from Archivematica<sup>2</sup>, Globus Publication<sup>3</sup>, and customised code to establish an integrated workflow. Processing datasets from Canadian-funded research in the recent International Polar Year, this software stack demonstrated that automated processes could generate archival digital objects for research datasets and that these objects could be deposited with an access platform and archived on preservation storage. Once ingested into a discovery and access platform, datasets were discoverable and retrievable under appropriate controlled access conditions. This test also identified several enhancements required for a production system based on this specific design. Coming out of this project was an agreement between Portage and Compute Canada to build a production service based on improvements to this project's model.

## Envisioned Services and Platforms

As Portage evolves, its services will support all stages of the research lifecycle. This includes data management planning, research ethics, metadata production, data curation, preservation, and discovery. Several ideas for network services are in development:

- A comprehensive set of information resources that direct users to the most up-to-date, relevant, and trusted sources about research data management;
- Training and professional development programs for service providers (e.g. liaison librarians, research services administrators);
- Institutional engagement programs and consulting services to support the development of local services;
- Development and maintenance of platforms for preservation and discovery of research data;
- Assessment and research in RDM topics, in collaboration with international initiatives.

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<sup>2</sup> Archivematica: <https://www.archivematica.org>

<sup>3</sup> Globus Publication: <https://www.globus.org>



These services will both draw upon existing expertise and contribute to capacity building across the country. It is expected to take at least two years for all of these to become operational. The intention is to continue in these directions, while establishing a governance structure and sustainability framework.

## Network Models

The challenge now, as Portage moves from project to operational network, is to establish a governance model that continues to encourage the ongoing engagement of a broad range of stakeholders, including existing library consortia, who are crucial to the successful delivery of services. Stakeholders have also expressed a desire for a model that remains lightweight and recognizes that the library landscape in Canada is already replete with membership organizations. The model must also enable the network to seek funding and sustain its operations for the longer term.

A key consideration in the network's governance and sustainability will be to confirm how membership is defined and the kinds of roles that members will play. For example, the University of Alberta Libraries' in-kind contributions relating to the DMP Assistant have been confirmed in a Memorandum of Understanding and need to be taken into account if the network adopts any form of institutional membership fees. It is anticipated that the business model may be a mixture of fees as well as external funding contributions. This will ensure long-term sustainability of the infrastructure and services, while also enabling the network to develop more quickly with targeted investments in priority areas.

### Canadian Collaborative Experiences

In the Canadian academic library landscape, there are numerous examples of co-operative endeavours to draw upon. They range from fairly loosely configured relationships that have minimal requirements for policy alignment or financial commitment to more formalized collaborations and organizations.

At the simpler end of the spectrum are arrangements such as resource sharing, where individual institutions maintain their own collection development policies and agree to borrowing/lending arrangements with other institutions, usually with some financial compensation and a mechanism for coordinating across the institutions. The four regional academic library consortia in the country serve such a coordinating function, and often take on more complex activities, such as licensing information resources and in some cases technical infrastructure and services to support digital library activities. The consortia are self-governing organizations in which each institution has an equal voice and an elected executive group works with a small staff. There are also more brokered arrangements involving another agency in delivering services or resources to a group of institutions. For example, the Data Liberation Initiative (DLI) is a partnership between post-secondary institutions and Statistics Canada that reduced the cost of purchasing access to major Canadian datasets collected by Statistics Canada and provides training and support services. An external advisory committee consisting of institutional representatives advises the DLI of its priorities and needs. The Canadian Research Knowledge Network (CRKN), another prominent example, began as a collaboration of university libraries coordinated by CARL to seek federal funding for a national site licensing project and eventually incorporated as a

separate organization with numerous staff and a governing board of members elected from participating institutions.

A general observation from experiences with these collaborations is that a variety of factors determine their success. The regional consortia have an advantage of physical proximity to enable face-to-face meetings, and with membership numbers ranging from 19 to 23 they are fairly small communities. At a national level, the cohesion of the DLI relates to dedicated staff at each partner institution who share a strong focus on data initiatives that are common across the country. With CRKN, it has been challenging at times to ensure strong membership engagement, but its major successes speak to its credibility with external agencies, such as funding bodies. Funding is a key consideration: federal-level funding opportunities often lead to national-level collaboration.

One of the obvious questions with regard to RDM is where the collaboration is best situated – is there a location element (institution, region, national) or is it an issue that should be addressed only by individual domains or disciplines of study? While domains have significant roles to play in defining and promoting data standards and practices among their own research communities, there are also common infrastructure needs that could be supported nationally and shared across domains. Without this sharing of infrastructure, the most likely outcome will be large service gaps across the country and an uneven playing field across domains. Portage aims to work at three levels: the research project or program level, the institutional level, and the network level. At the network level, there may be regional collaborative data storage opportunities or communities of expertise, and nationally there are opportunities in relationships with federal bodies involved in national digital infrastructure, information policy, and research funding.

### **Network Model Factors**

The collaboration envisioned in Portage is fairly complex and in ways we have not encountered before. While some of its relationships will be amongst individual institutions, the Portage network also intends to leverage the work taking place within the regional library consortia. In addition, it will cross organizations in various sectors involved in RDM, from advanced research computing to research ethics.

The literature on networks as forms of multi-organization governance provides useful insights for consideration in this phase of Portage network planning. Particularly helpful for our context is the work of Provan and Kenis, which mirrors our collaborative experiences and provides a framework upon which to build. They outline three forms of network governance, conditions that are likely to determine the success of one form over others, and the tensions inherent in each form. The different forms are distinguished by the degree to which the network is brokered and whether it is participant-governed or externally governed (Provan and Kenis, 2008).

In Participant-Governed Networks, the members themselves interact on a relatively equal basis in their shared responsibility for governance, and there is no distinct, formal administrative entity. A second network form is Lead Organization-Governed Networks, in which all major activities are coordinated through a participating member acting as a lead organization. The third form is the Network Administrative Organization (NAO), in which a separate entity is set up specifically to govern the network with an administrative office and governing board. According to Provan and Kenis, the key predictors of effectiveness of these network governance forms are trust, the number of



network participants, goal consensus, and the degree to which network-level coordinating skills are required.

In analysing the factors presented by Provan and Kenis, it seems that the Lead Organization-Governed Network model or the NAO model would be most suitable for Portage. In terms of trust, there are new relationships being formed amongst groups that have little experience with each other and with RDM, so there is not the strong density of trust that would lead to an effective Participant-Governed Network. The number of organizations that will be involved in Portage also speaks against the Participant-Governed Network model, which is better suited to a smaller number of organizations. With regard to goal consensus, the range of matters involved in RDM are so diverse and so new to many of the players that it is difficult to say that participants generally agree on network-level goals, so again the self-governance approach of the Participant-Governed Network is less suitable. The need for network-level competencies is fairly high in Portage, in that various tasks will require significant interdependence among members, and thus network-level coordination. This would suggest either a Lead Organization-Governed Network or NAO form of governance.

Provan and Kenis also note several tensions that can arise in any of the models of network governance, one of which is particularly relevant for the current stage of RDM service development: internal versus external legitimacy.

‘One issue is that network participants have their own legitimacy needs, as independent, autonomous organizations with their own goals. These internal legitimacy needs, which can focus on the needs of clients, employees, board members, and other organizational stakeholders, are not always compatible with the broader external legitimacy needs of the network as a whole. In addition, providing a public face to the network means that participants will less likely be directly involved in interactions with major network-wide stakeholders, such as funders, working instead with one another and through network-level staff. Thus, participants may feel left out or that their credibility is being undermined. Essentially, the tension is in part between individualistic versus collectivistic legitimacy concerns, and in part between a focus on building internal network interactions versus building the credibility of the network to outsiders’ (Provan and Kenis, 2008).

This is a real concern in the development of RDM services across a network of institutions and organizations: each one of the potential network members is in the process of establishing methods of supporting researchers and administrators with whom they have direct working relationships and responsibilities. Furthermore, they expect the network to support them and in no way compete with them. This legitimacy tension is a challenge for any network governance form, although the NAO has the advantage of a representative governing structure that can help address member perspectives and also provide a strong external presence.

At this early stage of development, Portage has taken the Lead Organization-Governed Network model instead of the NAO form of governance for a few reasons. As noted above, there is a desire for a model that is lightweight and there is little appetite for a new membership organization. As an existing membership organization, CARL can play the secretariat role of ‘lead organization’ for now. There is also a sense of a lean start-up culture – of needing to test ideas, gain feedback and continually iterate. Provan and Kenis note that network governance may change over time towards NAO

governed, but once established evolution from an NAO to another form is unlikely; ‘inertia is strongest when the governance form is more formalized’ (Provan and Kenis, 2008).

### **Networks of Expertise**

Another study that is very relevant to the collaborative development of RDM services is summarized in the 2015 CLIR publication titled ‘The Center of Excellence Model for Information Services’. The study examined the viability of the centre of excellence model as an approach to providing new services for the effective use of digital information in multiple institutions and recommended a variation: the development of ‘networks of expertise’ or ‘expert networks.’

‘This approach can leverage institutional strengths and help library leaders consider solutions beyond local environments. Rather than consolidating expertise in a separate center, this approach will keep experts at local institutions and rely instead on an active network to address issues across a wider spectrum of institutions. Through this method, existing organizations will start to change as they integrate experts more fully in the daily work and as a greater number of information professionals share knowledge. Both growth and sustainability will increase as organizations evolve to meet current needs’ (Kirchner et al., 2015).

The study provides a number of recommendations that Portage supports based on the pilot period of its development, such as the need for a community-building strategy and the advantages of bringing together experts with complementary skillsets for a limited time to address a particular issue. Portage aims to continue along this path.

## **Portage Interim Governance**

The organizational framework adopted for the Portage network in the spring of 2015 included a clear set of organizational principles and operational guidelines. A two-year development period was approved to establish operational services in a network of expertise and to develop collaborative infrastructure platforms. During this time, an organizational structure is being put in place to bridge Portage from a start-up operation to a national network managed through a sustainable governance model. An initial Steering Committee to provide guidance during this development period is described below.

### **Principles**

The principles guiding the development and ongoing operations of the Portage network are:

- Data are a public good;
- Intelligent access: openness, with respect for privacy;

- Collaborative approaches: cost savings and sharing expertise;
- Inclusiveness: aim to serve all researchers and create a more level playing field;
- Commitment to standards and operability;
- International relationships: liaise internationally and ensure our work is keeping pace with international practices;
- Respect for differences: flexibility to meet the needs of different regions, institutions, and disciplines;
- Open source: tools will be contributed back to the community;
- Stewardship: a sense of responsibility for managing research data over the long term.

### **Operational Guidelines**

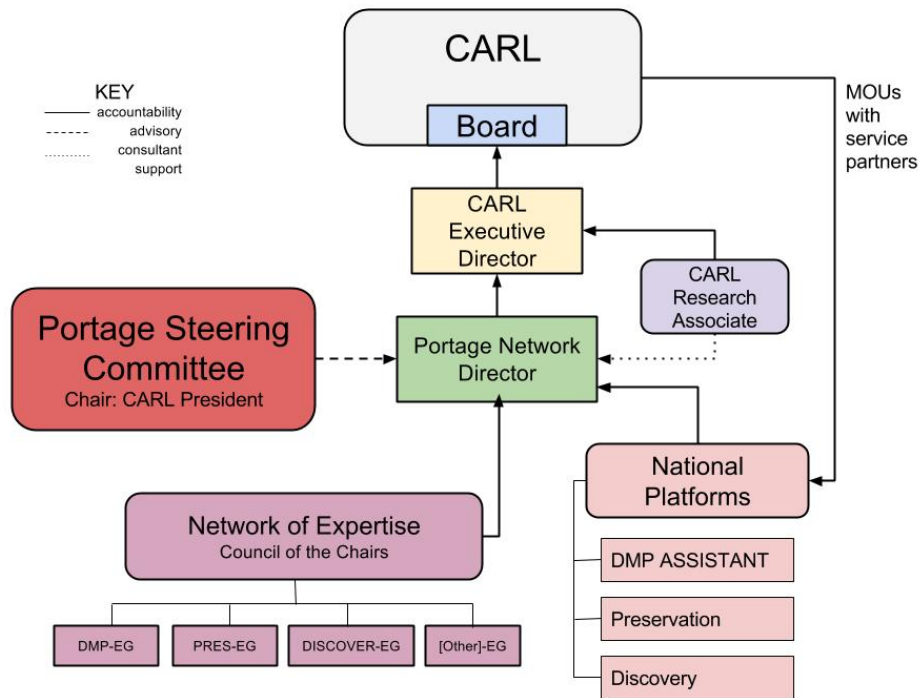
1. CARL and its partners have governance roles in the Portage network;
2. Portage, as one component in a larger digital research infrastructure that supports research data management in Canada, will function within this larger context and collaborate with other stakeholders to develop a sustainable and coherent national research data management environment;
3. Significant in-kind contributions will be made by university libraries. As an extension of their operations, participating libraries will provide infrastructure and staff support for both the network of expertise and national platforms for data management plans, preservation, and discovery;
4. Portage will work with other research digital infrastructure providers, such as Compute Canada, CANARIE and other institutions, to establish in-kind storage capacity for research data and to provide support for national platforms for data management plans, preservation, and discovery;
5. Administrative support for Portage and the Portage Director will be coordinated through the CARL office;
6. Portage will coordinate with other institutions and research organizations the connection of their data repositories to Portage's national platforms through the adherence to community-based standards.

### **Mandate and Membership of the Steering Committee**

The Steering Committee (SC) will advise on directions and priorities during the two-year development period when operational services are established for a network of expertise and collaborative platforms are developed for RDM services. The SC will also prepare plans for Portage beyond this development period, specifically helping the Portage Director prepare both governance and business models for ongoing operations. Furthermore, it will review operating principles, policies, and procedures and will identify priorities for investment and areas for development.

The SC membership will consist of representatives of CARL, the regional library consortia, organizations with whom Portage has a formal agreement, national

organizations representing RDM services and professionals from universities (including research administrators, research ethics boards, Vice-Presidents Research, information technology services, and others as identified), Research Data Canada, the Leadership Council on Digital Infrastructure, and the Digital Curation Centre.



**Figure 1.** Organizational chart for the Portage network, 2016-2017.

## Conclusion

Portage intends to create a national library-based network of RDM expertise and to facilitate the development of national platforms for planning, preserving, and discovering research data. Its success will depend on the engagement of a broad range of stakeholders, and establishment of an appropriate governance model and sustainability framework. The Steering Committee appointed for the two-year transition period from pilot project to operational network will need to consider a variety of factors as outlined in this paper. There is significant momentum and early signs of successful collaboration to build upon, and we look forward to both learning from the international digital curation community and reporting further progress in the years ahead.

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