



**canarie**

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**CANARIE Annual Business Plan 2018-19**

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## 1 Overview

CANARIE is pleased to present its Annual Business Plan for fiscal year 2018-19 (FY19). The document includes past accomplishments as well as CANARIE's future plans to achieve its expected results. Risks and risk mitigation strategies are also presented.

CANARIE's programming and activities are defined by the following trends that are shifting the research and innovation landscape:

- 1) the digitization of research,
- 2) the use of data analytics in all research fields,
- 3) data preservation and reuse, and
- 4) the adoption of cloud technologies in all sectors.

These trends continue to drive CANARIE's programs and investments into Canada's National Research and Education Network (NREN). In FY19, CANARIE will continue to launch and execute programs that build on strong foundations and evolve to support better alignment and integration of the components of digital research infrastructure.

CANARIE's planned activities include the ongoing evolution and expansion of the national research and education network; management of the Research Software program and the expansion of the user community for these powerful research software tools; and the evolution of services, and expansion of the user base for the Digital Accelerator for Innovation and Research (DAIR) program. To complement its key programs, CANARIE will continue to offer value-added services (access and identity management solutions) to introduce efficiencies in research workflows as well as to improve the user experience. CANARIE will work with the research community and the granting councils to foster the development of a national approach to research data management through its support of Research Data Canada. Lastly, CANARIE will continue to work with its private sector and academic partners in the Centre of Excellence in Next Generation Networks (CENGN), to support the rapid commercialization of leading-edge networking technologies.

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## 2 About CANARIE

### Role of CANARIE

CANARIE's role in Canada's innovation ecosystem was set out in its 1993 Articles of Incorporation: *to contribute to Canadian competitiveness in all sectors of the economy, to wealth and job creation and to the quality of life of Canadians*. CANARIE achieves this by designing and delivering digital infrastructure, and driving its adoption among Canada's research, education and innovation communities.

This direction to CANARIE to contribute to competitiveness "in all sectors of the economy" informs the horizontal perspective that CANARIE takes to Canada's innovation ecosystem. Rather than addressing the needs of a specific vertical sector, CANARIE looks across the public, private and not-for-profit research, education and innovation sectors to identify gaps, and then, through community engagement, works to address those gaps with a range of services and programs.

This horizontal view has driven CANARIE activities over the course of its history, and has helped shape Canada's digital infrastructure landscape. The following represents a sampling of these initiatives:

- laying the groundwork, with universities and provincial partner networks, for the first commercial Internet in Canada;
- incubating the Internet Registration Authority in Canada, now known as CIRA;
- supporting hundreds of Canadian businesses, educational and health organizations in their transition to digital models and processes via the Technology Development, Technology Diffusion program, Technology Applications Development program, and E-business, E-learning and E-health programs; and
- developing the grid certificate authority in Canada that provides secure access to data generated from the Large Hadron Collider and other advanced digital technologies.

More recently, CANARIE has:

- worked with provincial and territorial network partners to continually evolve what is arguably one of the world's leading National Research and Education Networks, which supports Canadians from coast to coast to coast engaged in advanced research, education and innovation;
- worked with global peers to align international research and education infrastructures to support globally collaborative research, including, most recently, the completion of the world's first 100G transatlantic network link for research and education purposes;
- ensured Canadians benefit from a robust Identity and Access Management framework, aligned with international frameworks, that provides secure access to digital services and resources in Canada and around the world;
- identified the gap in research software in the ecosystem and championed the development of powerful research software tools to accelerate discovery, including the creation of a software registry that makes reusable software tools available to all researchers;
- recognized the need to develop and evolve a national strategy for research data management, and is supporting Research Data Canada as it works with stakeholders to develop this strategy;
- engaged with digital research infrastructure providers and other stakeholders to provide advice and guidance on the evolution of the ecosystem to the Minister of Science; and
- incited Canada's small business community to embrace cloud computing technologies, providing more than 850 businesses with cloud resources that enable rapid product development and accelerated time-to-market.

CANARIE's current activities build on these successes and respond to evolving research, technology and policy environments. CANARIE understands the value and impact of ever-increasing amounts of digital data on research, education and innovation, and works with stakeholders to ensure Canadians have the digital infrastructure ecosystem that can leverage these data assets to support Canadian leadership in multidisciplinary discovery and innovation.

## **CANARIE Funding**

The majority of the funding for CANARIE is provided by the Government of Canada through a Contribution Agreement with Innovation, Science and Economic Development Canada. The Government of Canada's ongoing confidence and investment in CANARIE since 1993 is a testament to the critical nature of the infrastructure and the role that digital infrastructure plays in leveraging complementary government investments in research and innovation.

## **Focus of Activities: 2015 – 2020 Mandate**

CANARIE's focus in its current mandate is on strengthening Canada's digital infrastructure ecosystem, as Canadians engaged in data-intensive, collaborative research and innovation are increasingly dependent on this critical infrastructure.

CANARIE will also work with the community to improve the security of the NREN and of institutions connected to the NREN. Through the Joint Security Project, NREN partners and representatives from connected institutions will work collaboratively to develop a national view of the security position of the NREN and institutions connected to it.

CANARIE activities in the current mandate will focus on the following three areas, which align directly with the Expected Results outlined in CANARIE's Contribution Agreement with the Government of Canada.

### ***Network Operations***

In order to address the evolving needs of users in the research, education and innovation communities, CANARIE operates and evolves a pan-Canadian collaboration capability through the delivery of a world-leading high performance network and network-based services. CANARIE will:

- a) Increase network capacity and performance to keep pace with the growth in demand (currently an annual average growth rate of ~50%);
- b) Expand network reach to address the needs of research and education communities from coast to coast to coast; and
- c) Evolve the network services portfolio to enhance research, collaboration and innovation.

### ***Technology Innovation***

To bring new collaboration capabilities not previously offered to Canada's research community by creating and funding new software technologies. CANARIE will:

- a) Drive the adoption of software tools and services to utilize and exploit data;
- b) Increase the impact of tools and services to users;
- c) Support research data management through the development of tools and applications; and
- d) Promote the collaborative development of data management tools.

### ***Private Sector Innovation***

In order to leverage CANARIE resources to stimulate commercialization, CANARIE delivers a cloud-based program, the Digital Accelerator for Innovation and Research (DAIR) that enables advanced information and communications technology (ICT) research and provides an opportunity for entrepreneurs to accelerate time-to-market. CANARIE will:

- a) Leverage the network to support innovation, development and adoption of transformative ICT technologies; and
- b) Facilitate academic and private sector partnerships to drive collaborative innovation and commercialization.

To leverage the investment in the network, CANARIE supports CENGN's role to foster innovation and commercialization of new ICT technologies in partnership with CENGN. CANARIE will:

- a) Allow access to the CANARIE network to support the CENGN testbed

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## 3 2016-17 Accomplishments

The following sections describe CANARIE's accomplishments under each of the three Eligible Activities outlined in the Contribution Agreement that governs CANARIE's programs from 2015-2020:

### 3.1 Network Operations

To evolve and expand the CANARIE network in a flexible and cost-effective manner over the long-term, CANARIE's vision is to deploy fibre from coast-to-coast across Canada. In high-use, high-growth network corridors, CANARIE purchased fibre and therefore has the flexibility to add capacity and deploy transformative technologies at a considerably lower incremental cost. The alternative, which is a leased services model, has the cost/traffic curve that is linearly much higher, and would become prohibitively expensive as network traffic continues to grow at ~50% on a ten-year annualized basis.

In FY17, CANARIE

- Improved core nodes reliability via the completion of two redundancy projects to increase reliability in both the western and eastern parts of the network.
- Launched a user portal, with the first service being an *eduroam* reporting system for IT administrators at participating institutions. 56 portal users were added during FY17.
- Continued to explore more cost effective alternatives to existing connections for increasing network capacity to the north.
- Continued to work with provincial and territorial network partners to evolve the National Research and Education Network (NREN) through the NREN Program. Key accomplishments include:
  - The launch of the second competitive funding call for the NREN Program.
  - Worked in partnership with the RANs to implement the strategic plan for the NREN, which forms the basis for the NREN to work on shared national priorities and initiatives.
- Continued to represent Canada in other international initiatives to advance research and education networks:
  - CANARIE participates in, and is co-chair of the Global Lambda Integrated Facility (GLIF), an international consortium that provides advanced networking services to support data-intensive scientific research. The GLIF brings together the world's leading R&E networking engineers to develop an international infrastructure and advanced services.
- In partnership with four of the world's leading research and education networks, CANARIE is a member of the ANA-300G (Advanced North Atlantic) project. ANA-300G provides the research and education community with a reliable, advanced connection between North America and Europe via three transatlantic 100 Gbit/s links; speeds that were previously not available via subsea cable systems.
- Continued to operate the Canadian Access Federation (CAF), a service to enable higher-education communities to access Wi-Fi services (through *eduroam*) and other protected online content using their existing institutional credentials (i.e. username and password). Use of these services continues to increase with the addition of new participants and more wide spread use of *eduroam* and single-sign on technologies.

## 3.2 Technology Innovation

### Research Software

CANARIE continued to champion the development of powerful research software tools that accelerate discovery and enable research funds to focus on research activity rather than software development. Research software enables users to seamlessly access digital infrastructure and resources without having expert knowledge of these infrastructures, thereby expanding use of these resources across many research domains.

These tools are available via CANARIE's online research software portal ([science.canarie.ca](http://science.canarie.ca)). The online portal, the first of its kind in Canada, allows users to find reusable software services and examine each service's availability and usage statistics. The online portal creates a national clearinghouse for research software, and provides seamless access to advanced software tools in order to spur broad adoption by the research community.

In FY17, CANARIE

- Launched Research Software Call 2a, a pilot call promoting software sharing through direct platform reuse. The response was tremendous, with 70 notifications of intent to respond received, which ultimately resulted in 34 full proposals being submitted for the competitive funding call.
- Continued to monitor the six projects funded through Call 1 of the 2015-2020 mandate.
- Added new functionality to CANARIE's online research software portal, as well as evolving the [science.canarie.ca](http://science.canarie.ca) landing page.
- Continued to collaborate with the CFI and Genome Canada to explore mechanisms for aligning software projects in the community.
- Collaborated with the Sustainable Software Institute in the UK, to share best practices.

### Research Data Management

In FY17, CANARIE

- Provided funding, consistent with community input, to support Research Data Canada (RDC). RDC is an organization whose overarching goal is to improve the management of research data in Canada.

Through CANARIE funding, in FY17, RDC

- Was one of the original partners that created the Open Researcher and Contributor ID (ORCID) Canada consortium (ORCID-CA). ORCID-CA will facilitate better metrics for measuring the impact of research.
- Continued to work with both public and private organizations on the integration of best practices into Canadian research data management infrastructure. This outreach includes engaging broader stakeholder community via webinars and blog posts, public presentations, workshops, and working groups. RDC's Executive Director is one of six participants on the Leadership Council for Digital Research Infrastructure (LCDRI) subgroup working on recommendations to evolve the research data management ecosystem in Canada.



### **3.3 Private Sector Innovation**

Under the Private Sector Innovation objective, CANARIE leveraged its infrastructure and relationships to support adoption of digital technologies by Canadian SMEs to advance innovation and commercialization.

In FY17, CANARIE

- Leveraged strong partnerships with a range of organizations to increase the visibility of the DAIR offering to Canadian SMEs. These include the Funding Road Show, Startup Canada, the IRAP Concierge program, the Association of University Research Parks, colleges, and a range of incubators across the country. These partnerships supported a 32% year over year growth of DAIR users, growing the user base to 853.
- CANARIE continued to support CENGN in a number of activities related to the development of its testbed including directly using the CANARIE network to enable the trial of an advanced networking solution involving two emerging Canadian solution providers. CANARIE is a founding partner in the Centre of Excellence in Next-Generation Networks. CENGN is a consortium of industry, academic and research leaders who are pooling their expertise and equipment to lower the commercialization barrier for Canadian SMEs and researchers.

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## 4 2018-19 Planned Activities

FY19 is the fourth fiscal year of CANARIE's 2015-2020 mandate. In order to deliver on its expected results for the mandate, CANARIE will undertake the following activities in the 2018-19 fiscal year:

### 4.1 Network Operations

CANARIE will continue to undertake all required activities to support and evolve the existing CANARIE network and the services delivered over it.

- 1) Network Program – As a result of this program, the CANARIE network will continue to operate and evolve as essential research infrastructure to support research, education and innovation. To achieve the results of this program, the following activities will be undertaken in the 2018-19 fiscal year:
  - i. Operate the network
  - ii. Increase capacity, redundancy, and reliability
  - iii. Continue to enhance network security and measurement monitoring tools
  - iv. Continue to enhance user access to support tools
  - v. Trial software-driven network services

The following measurable short and medium term outcomes will be achieved in FY19:

- Deployment of additional network capacity to meet the growing traffic need
  - Improved core node reliability
  - Improvement of network security monitoring and measurement system
  - Deployment of the Software Networking Pilot
  - Deployment of support tools accessible through the user portal
- 2) NREN Program – Through this program, CANARIE will continue to strengthen the impact of the co-delivery model with the regional networks to ensure greater consistency of access to infrastructure and services across the NREN. To achieve this, the following activities will be undertaken in the 2018-19 fiscal year:
    - i. Extend capacity, redundancy, and reliability through RAN networks
    - ii. Extend 100Gbit/s reach outward from CANARIE
    - iii. Connect institutional facilities
    - iv. Strengthen NREN partnerships

The following measurable short and medium term outcomes will be achieved in FY19

- Execution of projects funded under Call 3
- Technical and financial audits of projects funded under Calls 1 and 2
- Increased reliability and capacity on network segments shared by RANs
- Strategic alignment of NREN partners on the evolution of the NREN and the development and launch of projects to enhance security

- 3) Canadian Access Federation (CAF) Program – As a result of this program, Canada will continue to benefit from robust identity and access management services that enable secure and efficient remote access to distributed resources and tools, anytime. To achieve the results of this program, the following activities will be undertaken in the 2018-19 fiscal year:
- i. Adapt services to evolving standards
  - ii. Increase awareness and adoption
  - iii. Increase ease of service deployment, operation, and use
  - iv. Expand identity services

The following measurable short and medium term outcomes will be achieved in FY19:

- Increased adoption of CAF services, projected to grow to 165 participants by the end of FY19 based on the FY18 projected count of 153.

- 4) Infrastructure Extension Program (IEP) – As a result of this program, government research institutes will continue to leverage the research network in support of collaborative research with national and international partners. To achieve the results of this program, the following activities will be undertaken the 2018-19 fiscal year:

- i. Provide high-speed network connections to government research facilities
- ii. Ensure connections are adequate to meet user needs

The following measurable short and medium term outcome will be achieved in FY19:

- Continue to support connections to government research facilities that meet the performance needs of the government science community.

## 4.2 Technology Innovation

- 1) Research Software – As a result of this program, CANARIE will continue to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers. To achieve the results of this program, the following will be undertaken in the 2018-19 fiscal year:

- i) Continue to enhance and promote the research software portal at [science.canarie.ca](http://science.canarie.ca)
- ii) Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community
- iii) Support and monitor funded projects in Calls 2a and 2b (previously known as Call 3)
- iv) Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers
- v) Define and launch a call for participation to understand the issues involved in supporting a large number of researchers with a single research platform, designed with reuse in mind
- vi) Work with select institutions to establish local research software development groups to support computational researchers at the institution level

The following measurable short and medium term outcomes will be achieved in FY19:

- Maintain visits to [science.canarie.ca](http://science.canarie.ca) consistent with FY18 levels

- Contracts in place and execution underway for all approved Call 2b platform contribution projects
  - Execution of projects funded under Call 2a
  - Financial audits of projects funded under Call 1
- 2) Research Data Management – As a result of this program, CANARIE will contribute towards promoting that Canada’s publicly funded data be available to accelerate discovery and commercialization by the academic and private sectors. The following activities will be undertaken in the 2018-19 fiscal year:
- i. Community coordination in support of policy creation, national standards, infrastructure and tools
  - ii. National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations
  - iii. Communication with international data infrastructure providers to work towards Canadian research data infrastructure that is compatible with international approaches
  - iv. Define and launch a competitive call to support Canadian Research Data Management projects

The following measurable short and medium term outcomes will be achieved in FY19:

- Contracts in place and execution underway for all approved projects of the competitive call

### **4.3 Private Sector Innovation**

The activities undertaken will include the delivery of the following programs, along with key initiatives listed under each program:

- 1) DAIR Cloud Testbed – As a result of this program, CANARIE will continue to leverage the CANARIE network to support Canadian firms’ ability to develop and test innovative ICT applications. To achieve the results of this program, the following activities will be undertaken in the 2018-19 fiscal year:
- i. Operate the cloud platform (embracing updates to the platform core technologies as necessary)
  - ii. Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market
  - iii. Create and publish educational content related to efficient and secure use of cloud services

The following measurable short and medium term outcomes will be achieved in FY19:

- Continued increase in the total number of DAIR users to 1211 by the end of FY19 based on the FY18 projection of 1053.
- New features added to the DAIR cloud infrastructure
- Content released to educate SMEs on efficient use of cloud services

- 2) CENGN Network Testbed – As a result of this program, the CANARIE network will be used to foster innovation and commercialization of new ICT technologies in partnership with CENGN. To achieve the results of this program, the following activities will be undertaken in the 2018-19 fiscal year:

- i. Ensure Network connectivity and related support for CENGN test bed initiative

The following measurable short and medium term outcome will be achieved in FY19:

- Additional participants in CENGN will be able to leverage the CANARIE network to support advanced testing and demonstration of new ICT products and services.

## 5 Program Delivery Timelines

		2018-19			
Eligible Activities	Initiatives	Q1	Q2	Q3	Q4
<b>Network Operations</b>					
Network Program	Operate the Network	Ongoing			
	Increase capacity, redundancy, reliability	Next project to increase network redundancy			
	Continue to enhance network security and measurement monitoring tools	Deployment of monitoring services			
	Continue to enhance user access to support tools	Development of support tools			
	Experimental software driven network services	Project to create software driven services			
NREN Program	Extend capacity, redundancy, reliability through RAN networks	Ongoing			
	Extend 100G reach outward from CANARIE	Ongoing			
	Connect institutional facilities	Ongoing			
	Strengthen NREN partnerships	Ongoing			
	Execute third competitive call	Implementation of projects			
CAF Program	Adapt services to evolving standards	Ongoing			
	Increase awareness and adoption	Ongoing			
	Increase ease of service deployment, operation, and use	Ongoing			
	Expand on identity services	Ongoing			
IEP Program	Provide high-speed network connections to government research facilities	Ongoing			
	Ensure connections are adequate to meet user needs	Ongoing			
<b>Technology Innovation</b>					
Research Software Program	Continue to enhance and promote the research software portal at science.canarie.ca	Ongoing			
	Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community	Ongoing			
	Support and monitor funded projects in calls 1 and 2a	Ongoing			
	Call 2b implementation	Approval	Development		
	Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers	Ongoing			
	Define and launch a call for participation to understand the issues involved in supporting a large number of researchers with a single research platform, designed from scratch with reuse in mind	Proposals / Development	Development		
	Pilot to establish local research software development groups to support computational researchers at the institution		Proposals	Approval	
Research Data Management	Community coordination in support of policy creation, national standards, infrastructure and tools	Ongoing			
	National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations	Ongoing			
	Communication with international data infrastructure providers to work towards Canadian research data infrastructure that is compatible with international approaches	Ongoing			
	Define and launch a competitive call to support Canadian Research Data Management projects	EOI / Proposals	Approval	Development	
	<b>Private Sector Innovation</b>				
DAIR Cloud Testbed	Operate the cloud platform	Ongoing			
	Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market	Ongoing			
	Create and publish educational content related to efficient use of cloud services	Ongoing			
CENGN Network Testbed	Network connectivity and related support for CENGN testbed initiative	Ongoing			

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## 6 Financial Plan

Economic Action Plan 2015 announced \$105 million in funding for CANARIE over five years to support the activities of CANARIE. CANARIE has identified a cash flow requirement of \$21.8 million for the 2018-19 funding year.

CANARIE covenants and agrees to hold, invest, administer, and disburse that amount in accordance with the stipulations of the Contribution Agreement. No interest or investment income is payable by the Minister on the funds to be provided.

### 6.1 Program Revenues and Expenses

<i>For the fiscal year</i>	<u>2018-19</u>
<i>(in 000s)</i>	
<b>REVENUES</b>	
<b>FUNDING</b>	
Innovation, Science and Economic Development Funding	21,800
<b>TOTAL FUNDING</b>	<u>21,800</u>
<b>PROGRAM REVENUES</b>	
User Fees	368
Interest Income	66
<b>TOTAL PROGRAM REVENUES</b>	<u>434</u>
<b>TOTAL REVENUES</b>	<u>22,234</u>
<b>EXPENSES</b>	
<b>PROGRAM EXPENSES</b>	
<b>Network Operations</b>	
Network Infrastructure & Services	10,923
NREN Program	3,377
<b>Technology Innovation</b>	
Research Software	3,914
Digital Infrastructure Innovation	1,500
Research Data Management	312
<b>Private Sector Innovation</b>	<u>1,322</u>
<b>TOTAL PROGRAM EXPENSES</b>	<u>21,348</u>
Operating Expenses & General Overhead	3,467
<b>TOTAL EXPENSES</b>	<u>24,816</u>
<b>EXCESS OF EXPENSES OVER REVENUES</b>	<u>(2,581)</u>

## 6.2 Cost Recovery

The following table summarizes CANARIE's cost recovery projections for the fiscal year.

<i>For the fiscal year</i> <i>(in 000s)</i>	<u>2018-19</u>
<b>CASH</b>	
IEP End User Fees - federal	100
IEP End User Fees - Non-federal	17
CAF Participation Fees	249
DAIR User Fees	2
<b>TOTAL CASH</b>	<u><b>368</b></u>
<b>IN-KIND</b>	
Research Software	465
<b>MATCHING FUNDS</b>	
NREN Program	1,211
DAIR	59
<b>TOTAL MATCHING FUNDS</b>	<u><b>1,270</b></u>
<b>TOTAL COST RECOVERY</b>	<u><u><b>2,103</b></u></u>

Throughout 2018-19, CANARIE will continue to charge fees to users of CANARIE services and programs.

- As part of the legacy infrastructure extension program (IEP), CANARIE supports the costs to connect federal and non-federal labs to the NREN. The federal IEP connections cost recovery is a fixed annual amount paid by Shared Services Canada to offset the total annual cost of supporting these connections. For non-federal IEP connections, the amount in the budget represents 100% cost recovery of planned expenditures.
- The cost recovery for the CAF program will consist entirely of participation fees. The DAIR program cost recovery is comprised of user fees.
- In-kind cost recovery for the Research Software program represents a contribution from users that can include the time spent during development by the Principal Investigator, university faculty or administrative staff.
- The overall NREN program will result in at least a 65/35 split of costs between CANARIE and other funding sources (e.g., provincial government, RAN's partner funds, etc.) for funded projects. CANARIE's contribution level will be determined on a project-by-project basis – i.e., some may have a higher than 65% contribution (up to 100%) from CANARIE, and others may be lower. CANARIE will ensure the outcome of the NREN program meets its overall cost recovery target, hence, greater priority will be given to projects which have leveraged contributions.
- The DAIR program expects to realize matching funds on funded projects.

## 6.3 Funding Requirements

As indicated in the Program Revenues and Expenses shown above in Section 6.1, CANARIE's cash requirement for the 2018-19 fiscal year is \$21.8 million. Subsequent to the 2018-19 cash requirement, the balance remaining to be drawn down from the \$105 million Contribution will be \$25.9 million for the final year of this mandate.



#### **6.4 Investment Policy and Strategy**

CANARIE shall continue to invest and manage any advanced funds according to investment policies, standards and procedures that a prudent person would follow in making investment decisions regarding property belonging to others. CANARIE will manage the funds in accordance with the Contribution Agreement and in particular, the investment directives contained in Article IV of the Contribution Agreement. The objectives are twofold: (a) to provide funds on an "as needed" basis to meet the disbursement needs of CANARIE and (b) to maximize the investment income earned by CANARIE, subject to the Investment Policy and Investment Strategy adopted by CANARIE.

The Investment Policy and the Investment Strategy specify permitted transactions, risk limitations for all market and credit risks faced by CANARIE, and levels of authority of officials who can commit CANARIE to different types of transactions. The Investment Policy and Investment Strategy must be updated at the beginning of the mandate and then reviewed annually. The Policy and Strategy were most recently updated, reviewed, and approved by the Audit and Investment Committee in October 2017. The Investment Policy is guided by the constraints contained in the Contribution Agreement.

## 7 Risk Assessment, Mitigation Strategies, and Performance Monitoring Strategies

Due to the diversity and complexity of the ecosystem CANARIE operates in, risk management is essential for CANARIE to achieve the expected results defined in the Contribution Agreement.

Identified risks are classified based on the likelihood of occurrence of the risk, as well as the severity of the negative impact of the risk. The treatment of identified risks will vary based on these two dimensions as per the table below:

		Likelihood		
		Low (LL)	Medium (ML)	High (HL)
Potential Impact	Low (LI)	Accept risks	Accept risks with monitoring	Monitor and manage risks
	Medium (MI)	Accept risks with monitoring	Develop formal risk mitigation measures	Develop formal risk mitigation plan
	High (HI)	Identify mitigation steps and monitor regularly	Develop formal risk mitigation measures and monitor regularly	Develop formal risk mitigation plan and monitor regularly

### 1) Risks to delivery of the Contribution Agreement expected results:

#### a) Insufficient funds to meet emerging needs over the duration of the mandate (ML, MI)

##### Risk Statement:

The amount of funding has remained flat from the previous mandate and may hinder the organization's ability to fully deliver on its expected results.

##### Risk Mitigation:

- Where possible, continue to reduced fixed costs in the network as well as in the IEP program, as these represent the highest recurring annual costs to the organization;
- Monitor cost recovery to ensure targets are being met; and,
- Leverage Board oversight to ensure appropriate balance of investments across programs.

#### b) Network Operations Risks (ML, MI)

A critical component in undertaking the Network Operations activities is the completion and operationalization of the 100G national backbone from Halifax, NS, to Victoria, BC.

##### Risk Statement:

There is a risk that fibre needed to complete certain segments is either unavailable or too costly to procure or maintain. Among other things, this would make CANARIE less agile to respond to the needs of the research community, as well as face ever-growing network costs through the use of a growing number of leased wavelength services.

Risk Mitigation:

- Establish and maintain senior level relationships with fibre and equipment providers;
- Engage Board and advisory committee members, where appropriate, to work within their organizations to support this initiative; and
- Identify suppliers of new fibre to build additional capacity in the main east-west network corridor.

c) Technology Innovation Risks (LL, HI)

The main program supporting this activity is the Research Software program. This program goal is to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers, while addressing a broader set of research disciplines.

Risk Statement:

Low adoption of the new interdisciplinary software development and the approach by the broader research and education community poses a significant risk to this program.

Risk Mitigation:

- Continued early engagement with research developers and researchers by using workshops, online communication tools etc.;
- Continued engagement with the Research Advisory Committee and ensuring its evolution to allow researchers' input to guide the program, while gaining their buy-in; and
- Strengthen alignment with other research software funders e.g. the CFI and Genome Canada, partnering with them to ensure greater synergies among funded platforms.

d) Research Data Management (ML, LI)

The mission statement for Research Data Canada (RDC) is to work with stakeholders to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Statement:

There is a risk that the stakeholder community remains fragmented with limited alignment on the objective to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Mitigation:

- Use of RDC working groups to address various topics required for alignment;
- Continued advocacy and engagement of stakeholders; and
- Advocacy of international best practices in research data management.

e) Private Sector Innovation Risks (LL, HI)

The main program supporting this eligible activity is the Digital Accelerator for Innovation and Research (DAIR) service. The primary goal of this program is to incentivize growth of Canada's ICT sector.

Risk Statement:

There is a risk that DAIR will not evolve to offer new services that are critical to the changing needs of the ICT sector, SMEs in particular and, therefore, become less relevant.

Risk Mitigation:

- Continuous interactions with SMEs and commercialization-supporting organizations (e.g. incubators, accelerators) to evolve the DAIR program;
- Marketing outreach programs to increase the awareness of the DAIR service;
- Working with other organizations that focus on SMEs such as IRAP to develop a consolidated offering; and
- Assess the utility of the service via user surveys and performance metrics.

2) Program Delivery Risks

a) Service Delivery via RANs (LL, HI)

Risk Statement:

The provincial and territorial RAN partners are separate organizations and, as such, may have objectives, which are not aligned with CANARIE objectives. As a result, this non-alignment could impact, or impede, CANARIE's ability to deliver on its mandate.

Risk Mitigation:

Ongoing effort to ensure alignment of provincial and territorial objectives with national objectives is essential. Specific activities include:

- Ongoing support for the NREN Governance Committee, comprised of CANARIE and RAN presidents;
- Creation of an NREN Business Strategic Plan to identify NREN priorities;
- Ensure program funding to the RANs is structured in a manner to assist in attaining NREN objectives that also support CANARIE's network objectives; and
- Ensure one CANARIE Board member represents RANs.

b) Attrition (ML-MI)

Risk Statement:

Loss of senior staff, key employees or key Board members could jeopardize the organization's ability to deliver on its programs.

Risk Mitigation:

For Board members:

- Board members are asked for a minimum 3 year term commitment;
- The Vice-Chair is the planned successor to the Chair and agrees to a 6 year term commitment upon commencing as Vice-Chair; and

- The Governance and Nominating Committee meets at least quarterly.

For internal staff:

- Succession planning for key staff;
- Performance evaluation with career discussions with all employees every 6 months; and
- Ongoing IT investments for information and knowledge retention.

### 3) Performance Monitoring Strategies

CANARIE collects metrics internally for all its programs, services, and for the network. External performance metrics are collected from the community in the form of user surveys and reports, and reporting from the regional networks. CANARIE works with Innovation, Science and Economic Development to integrate this information as part of an overall performance management strategy. Additionally, performance data for each eligible activity are included as part of CANARIE's annual reporting.

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## 8 Representation

CANARIE Inc. represents that it is not in default under the terms of the Contribution Agreement that is currently in force.