2018 – 2019
Annual Report
of Achievements & Financial Statements

Compute • Calcul Ontario

In November 2016, Compute Ontario (CO) gathered stakeholders from across Ontario to formulate a plan that reflected the needs of the ecosystem. Working with our consortia, partners, and all levels of the government, Compute Ontario formed a strategic plan that was organized into the following **five strategic** pillars that would guide us over the next five years:

Contribute to efforts to progress advanced research computing and its value nationally, in collaboration with partners across the country.

Coordinate Ontario's efforts to develop, retain and increase access to highly qualified personnel and broader access to data for high impact research in a way that is consistent with our values.

Coordinate and support the advanced computing needs of Ontario's academic research community and other key stakeholders, in partnership with sites across the province that deliver and manage these services.

Serve as a credible voice regarding policy; coordinating and advocating key strategies that enhance advanced research computing and its use.

Build trust with and serve as a focal point for connecting communities and constituents throughout Ontario's advanced research computing ecosystem.

In year four of our mandate, this Annual Report describes the progress achieved in each of these strategic pillars. **It is important to note** that many of our achievements do not fit exclusively under **only** one of the strategic pillars. By design, the strategic pillars work in conjunction to support and enhance the advanced research computing sector. For example, while we have chosen editorially to describe our annual conference and regional information exchanges under the strategic goal (#5) of serving as a trusted broker and catalyst, the outcomes also advance our strategic goal (#3) of advancing the sector through partnerships. Therefore, it is best to consider these strategic pillars as mutually reinforcing and to consider the achievements descried in this report within that context.

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Message from Board Chair and President & CEO

Mark Daley
Board Chair

Nizar Ladak
President & CEO

Advanced research computing (ARC) continues to evolve at a dramatic pace, offering opportunities for economic growth, innovation, and new discoveries. Realizing this potential requires rapid and agile growth of the enabling infrastructure, and, most importantly, the human expertise to support the ambitions of our researchers.

Since our establishment in 2014, we have been a partner in the constantly evolving ARC ecosystem, working alongside our community to help launch projects that further Ontario's position as a global hub of high-tech research and innovation. Compute Ontario enables a rich, complex, ecosystem of stakeholders to perform cutting-edge research, help attract and develop talent, facilitate public sector collaboration, advance education and training and stimulate the advancement of Ontario's knowledge economy.

Fueled by government funded start-up accelerators, welcoming immigration policies, and a healthy venture capital market, Toronto is now rated number three (behind only San Francisco and Seattle) in North America for technology talent, according to the CBRE: Commercial Real Estates Services Canada Group's 2018 Annual Report. Toronto overtook Washington DC, adding 80,000 jobs over the last five years in the technology sector. Moreover, the increased

need for technology talent has also spurred growing demand throughout Ontario. Waterloo and Hamilton, for example, have been acknowledged as among some of the top knowledge — and service — based economies in North America; their respective markets have grown by 40 per cent and 52 per cent in the last five years according to the report.

Our annual report highlights key initiatives over the past year that are driven by the needs of our ecosystem and have been informed by our key stakeholders. These initiatives, stemming from the strategic priorities we co-developed with our partners, look to further the goals of the larger digital research infrastructure (DRI) ecosystem in Ontario and nationally.

In the year ahead, Compute Ontario will continue our commitment to supporting increased access to technology infrastructure and the development, and retention, of Ontario's highly qualified personnel (HQP). We look forward to continuing to work with you, our community!

Mark Daley
Board Chair

Nizar Ladak
President & CEO

❝ **Our annual report highlights key initiatives over the past year that are driven by the needs of our ecosystem and have been informed by our key stakeholders."**

Introduction

At the time this report is being written, Canada's ARC ecosystem is undergoing significant changes. A new national organization is being formed to oversee and coordinate the growth of Canada's ARC sector. Research data management, research software, and ARC are being brought together under a single national coordinating organization. Over a half a billion dollars ($572.5M) was identified in the 2018 federal budget to support this new organization and the growth of this sector. Indeed, since Compute Ontario's strategic pillars were established some four years ago, the spotlight on this sector and the remarkable achievements

by researchers using ARC has been incredibly exciting. Against this backdrop, our commitment to our mission has never been stronger.

Compute Ontario's 2018 — 2019 annual report offers concrete examples of organizational achievements accomplished through partnerships under each of our strategic pillars. These achievements and initiatives underscore our commitment to work collaboratively to address new challenges, and showcase the value derived from tapping into the expertise and tools that exist in Ontario's ARC ecosystem.

Our Vision

Drive advanced computing to accelerate research and enhance competitiveness in the global marketplace, for a more prosperous Ontario

Our Mission

In collaboration with our partners, Compute Ontario will drive advanced computing to accelerate research and enhance competitiveness in the global marketplace resulting in a more prosperous Ontario. Compute Ontario will further position Ontario as a global leader in advanced computing and a global focal point for highly qualified personnel.

Our Values

| **Trust** | **Accountability** | **Collaboration** | **Innovation** | **Excellence** |

Strategic Pillar 1:
Advance ARC and its value

Contribute to efforts to progress advanced research computing and its value nationally, in collaboration with partners across the country.

Since our inception, we have worked towards improving access to advanced research computing to enable research and innovation, in order to catalyze competitiveness in industry and support Canada's technology-driven economy. Using our existing assets in technology, expertise within our networks, and talent, Compute Ontario launched the following initiatives this past year:

1 Ontario Public Service Hackathon

2 Smart Cities Data Governance Report

Ontario Public Service Hackathon

Compute Ontario's mission is to drive the use of ARC to enhance competitiveness in the global marketplace, resulting in a more prosperous Ontario. The artificial intelligence (AI) practitioners' group within the Ontario Public Service (OPS) identified a strong need to leverage available technologies and infrastructure to increase efficiencies at various levels of the government.

Along with our consortia partners, the Centre for Advanced Computing (CAC), SciNet, SHARCNET, and HPC4Health, we helped the Government of Ontario organize a three-day OPS Information Management and Information Technology (I+IT) AI Hackathon event in January 2019. This event brought together individuals from multiple disciplines such as technology, policy, and business administration across various Ontario ministries. The hackathon demonstrated how ARC and AI could support emerging I+IT capabilities to solve existing challenges faced by OPS staff while also providing them with hands-on training.

We designed training programs in collaboration with our partners to develop the skills the staff needed to leverage ARC and AI technologies, identified expert resources for coaching and evaluation, and provided them with advanced computing capabilities. Over 70 participants were divided into five teams that served different groups based on their problem statements: Land and Transportation Cluster (LTC); Central Agencies Cluster; Enterprise Financial Services/ Ontario Shared Services; Information Privacy Office (IPA); and, Children and Youth Social Services Clusters. Each team collaborated to deliver solutions using "big data" and methodologies such as data carpentry, advanced data analytics, or AI. The teams were provided with half a day of hands-on training, in addition to trainers working with them over the following day and a half to develop a better understanding of the problem and how they can leverage AI to address it and in turn, present their solutions.

A "blue ribbon panel" comprising senior I+IT executives from the Ministry of Economic Development, Job Creation, and Trade (MEDJCT), the Ontario Digital Service (ODS), the Ministry of Government and Consumer Services (MGCS) and Compute Ontario, evaluated each presentation and provided feedback to the teams on the last day of the event.

Impact

Through experts from our consortia partners, over 700 hours of training were provided to the OPS teams to enable them to leverage emerging technologies and advanced analytic techniques to meet business needs. The commercial value of the training was over $60,000 but was delivered at no cost to the OPS as part of our commitment to increasing access to and advocating for the utility of ARC.

The event was a great success for the OPS teams as they created practical solutions to their everyday work challenges while increasing efficiencies and productivity. For instance, the Archives of Ontario team created a solution for a problem related to the IPA that reduced the duration of a process from 136 hours to just 13 minutes with one computer program. In effect, this result eliminated manual processes being used by the archivists and allowed them to focus and maximize their skill in the valuable work they provide Ontarians. LTC, another participating team, explored the use of AI to predict collision occurrences and creating automated countermeasures to mitigate the primary event that could cause them. Using data sets of time, location, vehicles, environment, and other factors, the team used machine learning algorithms to identify hotspots of clusters and create targeted mitigation programs. One can begin to imagine the number of preventable collisions and lives this work may save.

Participants recommended additional training events from Compute Ontario that would similarly foster collaboration and facilitated knowledge transfer in formal evaluations. They shared an overwhelmingly positive view of the hackathon and thought it "met the needs of their set objectives and helped to advance policy/program work, and uncover barriers in regulations, technologies, and other aspects of their work through the use of ARC, AI, and other emerging technologies."

Photo:
Smart Cities
Governance Lab

Smart Cities Data Governance Report

Advances in technology and our increasing abilities to collate, interpret and integrate sources of data bring new opportunities to improve the lives of Ontarians and solve existing challenges. Policy makers are grappling with a rapidly shifting dynamic between advancing innovation strategies that leverage personal and public data, like building smart cities, while ensuring privacy and security of individual data.

Through our smart cities project, Compute Ontario and ORION (Ontario's Research and Education Network) sought to provide smart city collaborators, with a vision for advancing smart cities initiatives in an evolving data environment.

We convened diverse groups of stakeholders, to provide insights on different data governance models, such as data trusts, which work to ensure that data collection and use delivers social and economic benefits while protecting privacy. We examined various practices of collecting and governing data that are currently being leveraged in smart cities initiatives from around the globe, with a focus on understanding what could be adopted in Ontario's context.

Below is a summary of the key aspects of our work:

- **Establishing a Smart Cities Advisory Committee:** With representation from municipalities, academia, civil society and industry – the advisory committee brought expertise in law, privacy, security, emerging technologies, economic development, as well as experience in implementing and evaluation smart city initiatives in Canada and internationally. The committee's role was to guide early project work, suggest areas for further exploration, and validate concepts as they emerged in pilot research.

- **Hosting the Smart Cities Governance Lab:** The Smart Cities Data Governance Lab, held at Catalyst 137 in Kitchener, Ontario in March 2019, brought together 125 representatives from the research, industry, government, and other (not-for profit and media) communities, to explore a citizen-centred approach to smart cities, and opportunities for open architecture. The morning featured speakers exploring: challenges and opportunities associated with leveraging technology for better data management, the data sharing experience of research and private sector organizations, Canada's approach to leveraging policy to enable technology for the public good, a legal overview of data trusts, and how to empower digital leadership in local communities. A workshop led by MaRS Discovery District (MaRSDD) in the afternoon, explored the different types of data governance in three use cases scenarios to understand what could be applied in Ontario's context. We then shared a report with our community, summarizing the outcomes of the lab.

- **Prototyping data governance:** CO and ORION partnered with the Institute for Clinical Evaluative Sciences (ICES), MaRSDD, and Miovision to develop three use cases which examine the possibility of applying different data governance frameworks within the Ontario context.

ICES explored the potential of health data trusts by focusing on the capacity to expand its ability to disclose health information as de-identified data for non-research purposes, and evaluate ICES' service as a data trust for secondary use of data in smart health applications. ICES ultimately concluded through research and legislative review that, with regulatory amendments, ICES could operate as a data safe haven. A data safe haven offers a feasible path for expanding access to health data in Ontario, allowing policymakers and health system stakeholders to use data in a more actionable way.

MaRS explored the potential of a civic data trust for mobility data which can provide valuable insight into the flow of vehicles, mass transit, and people in an urban environment. These insights could help planners develop new strategies to manage the traffic congestion and associated productivity losses which plague many Ontario municipalities in a citizen-centric way.

Miovision focused on the creation of an open architecture software platform that facilitates equitable access to data and sharing between data stewards, generators, and users. To create greater access to data, the platform makes use of a distributed ledger to promote economic development activity.

Broad and varied, the CO and ORION pilot activities have generated a wealth of insights on opportunities, challenges, and potential approaches to addressing key data governance issues in smart city deployments. The pilot projects have also offered reflections on the increasing importance of different types of data and their impact on social and economic development in Ontario.

Impact

Through this project, Compute Ontario has contributed to the advancement of smart cities by building a better understanding of data governance models and their applicability in Ontario. More importantly, this work developed prototypes that demonstrate actionable solutions for advancing smart city initiatives in high-value ways that can be implemented in Ontario. This work advanced our strategic pillars of advancing ARC through partnerships (#3), serving as a credible policy voice, (#4) and acting a trusted broker and catalyst (#5). This initiative also showcased Compute Ontario's ability to convene and engage a diverse group of experts to develop innovative solutions that will improve the lives of Ontario residents. From this work alone, we have developed a dozen new partnerships, but more importantly, have stimulated additional collaboration and projects among our consortia and other organizations in this sector.

Photo:
SciNet
Summer School

Strategic Pillar 2:
Develop & Retain HQP

Coordinate Ontario's efforts to develop, retain and increase access to highly qualified personnel (HQP), and broader access to data for high impact research in a way that is consistent with our values

Any innovation-driven economy today relies on skilled people to support it. We commonly refer to these individuals as HQP. They play a crucial role in enhancing competitiveness in an economy by advancing research, and development of solutions, products, and services. To further our commitment to advancing HQP in Ontario, we launched the following initiatives:

1 Advanced Research Computing — Artificial Intelligence (ARC-AI) Platform

2 Industry Engagement Committee

3 Summer Schools and Training

Advanced Research Computing — Artificial intelligence (ARC-AI) Platform

In order to broaden access to ARC resources for high-impact research, Compute Ontario took the initiative of developing a new platform that leveraged existing provincial investments in HQP, ARC, and datacenters. Building on these assets, Compute Ontario developed an ARC-AI platform that supports the evolving research needs of the province by addressing concerns around long-term data storage, leveraging secure cloud environments, and combining high performance computing (HPC) and AI to accelerate research. The ARC-AI platform also presents a unique opportunity to further address the goals of Compute Ontario's Technology Investment Strategy while harnessing newer trends in the design and configuration of HPC systems.

> **...Compute Ontario took the initiative of developing a new platform that leveraged existing provincial investments in HQP, ARC, and datacenters"**

The ARC-AI platform consists of the following three components:

- **AI platform for general science research:** This pilot involved layering new hardware onto the supercomputer Graham, at the University of Waterloo. This new hardware enables researchers to generate AI-powered insights and perform AI-guided simulations, which can greatly reduce the time to solve a problem. The new AI layer includes the latest NVIDIA "Volta" GPU, which is 47% faster than the previous one, and the ability to employ eight GPUs at a time, which resulted in a 43% increase in the number of GPUs available, both of which are a first for researchers in Ontario.

- **Secure cloud platform:** This pilot meets the ARC needs of projects and applications that require enhanced security and privacy, such as those that deal with personal health information and smart cities data. Currently, 19 Principal Investigators from McMaster University have used this platform to work on projects such as the CHILD study[1], which is the largest population-based birth cohort study in Canada. The platform also serves as a template, and proof-of-principle, for those looking to build similar systems to work with sensitive data requirements and high-risk projects.

- **Archival and backup storage platform:** This platform increases storage capacity while significantly improving data integrity and availability by introducing cross-site replication for both archival and backup storage. Ontario consortia can now backup critical data at multiple sites while all researchers have access to the data archive capability provided at SciNet with a copy for disaster-recovery at CAC. The platform has increased archival storage capacity in Ontario's systems by 27PB and provides end-to-end data integrity to researchers.
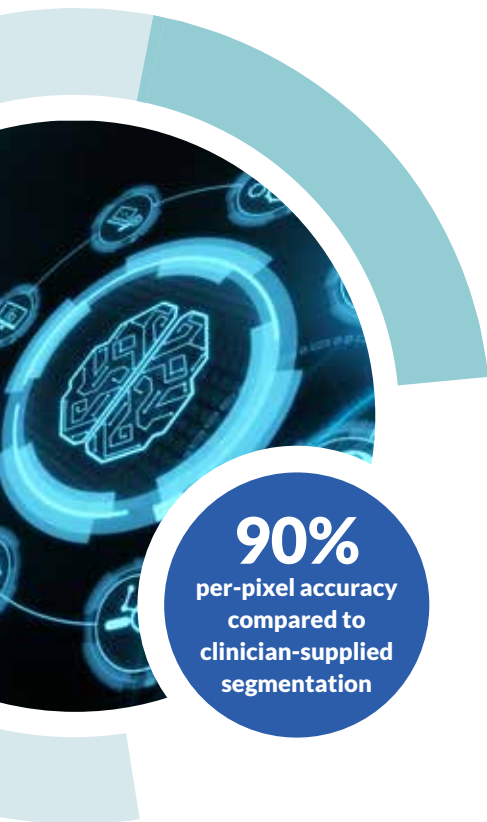
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1. About CHILD Cohort Study. https://childstudy.ca/about/

Impact

There has been an overwhelmingly positive response to the ARC-AI platform. Aggressive user uptake demonstrates the pressing need to scale resources within the province. The ARC-AI platform has built capacity, increased security, and reduced the time needed to solve problems. In addition, the ARC-AI platform has also been used in training over 50 HQP and enabled 10 projects and continues to support the launch of more studies at universities across Ontario. The ARC-AI platform also demonstrates progress toward strategically advancing ARC and its value (pillar #1), and addressing the ARC needs of the province through partnerships (pillar #3). However, the HQP, knowledge, and the number of projects that have matured since the implementation of the ARC-AI platform led us to report it under developing and retaining HQP. Here are some of the successful projects enabled by the ARC-AI platform:

> " **The ARC-AI platform has built capacity, increased security, and reduced the time needed to solve problems.**"

90%
per-pixel accuracy compared to clinician-supplied segmentation

- **Improved Natural Language Processing:** Led by Drs. Jimmy Lin and Olga Vechtomova from the University of Waterloo, two research groups utilized the AI platform for general research to generate three papers on state-of-the-art NLP research. The impact of these papers in research practice will be captured in future reports. The availability of 8 GPUs on a single server played a critical role in cutting down their research time significantly.

- **Automated organ segmentation with increased efficiency:** The secure cloud platform enabled a group of researchers from McMaster University, led by Drs. Ranil Sonnadara and Luis Braga, to develop a process to segment images of organs using cascading deep learning models. This methodology has achieved 90% per-pixel accuracy compared to clinician supplied segmentation. The increased speed with new GPUs enabled the creation of this methodology, which will result in a publication.

- **Preserving and enabling access to Canada's at-risk audiovisual heritage:** The multi-institutional Archive/Counter-Archive (A/CA) team from York, Queen's, Ryerson, and Concordia Universities is utilizing the archival and backup storage platform under the guidance of Dr. Janine Marchessault to preserve Canada's vulnerable audiovisual media. They are also using the platform to train next generation preservationists to continue building on these practices to protect this media and enable access to it.

Through this platform, Compute Ontario has increased Ontario's capacity to enable HQP to develop new innovations and transformations across sectors, and trained new generations of researchers and scientists.

"The committee recommended a framework to achieve our goals, and a series of recommendations that is intended to advanced industry and academic collaborations benefiting Ontarians."

Industry Engagement Committee

Improved collaboration between industrial and academic research creates a system for sharing resources, collaboration and problem-solving, enhancing Ontario's competitive capacity to solve complex issues through advanced technical expertise. In order to investigate this opportunity, Compute Ontario's Board of Directors established a special purpose Board sub-committee.

The committee was chaired by Carolyn McGregor, Compute Ontario board member and the University of Ontario Institute of Technology (UOIT) Canada Research Chair in Health Informatics. The Industry Engagement Committee brought together a diverse set of voices to define Compute Ontario's industry engagement strategy in relation to our strategic priorities, and identify opportunities for collaboration that could further our impact.

The committee also considered ways in which Compute Ontario could facilitate or complement the work of our partner organizations such as SOSCIP and the Vector Institute in enhancing industry engagement within the ARC ecosystem. The committee recommended a framework to achieve our goals, and a series of recommendations that is intended to advanced industry and academic collaborations benefiting Ontarians.

As a result of this initiative, Compute Ontario has begun conversations with the consortium of mining organizations in Ontario, and the Durham College about an analytics study that would facilitate skills development in HQP.

Summer Schools and Training

Compute Ontario continued to support HQP training efforts by our consortia through their annual summer schools and training programs. Whether by financial support or by providing coordinating assistance, the partnerships with the consortia achieved remarkable outcomes in training HQP across Ontario and Canada. Moreover, our consortia play a leadership role nationally in training and development, as is shown in the table below, with 67% of all training in the Compute Canada Federation delivered by Ontario.

 Our consortia also lead efforts in Canadian representation at international events as well. For instance, SciNet is the only Canadian participant at the acclaimed Petascale Computing Institute which comprises international supercomputer centers who come together to provide training. SciNet also sponsored Canadian participants for and took part in the annual IHPCSS, an international HPC summer school that took place in Czech Republic in 2018.

 In 2018 – 2019, the consortia partners delivered 25,236 hours of training to 10,064 attendees. A table of the training hours provided by Compute Ontario's consortia partners follows below.

25,236
hours of training to 10,064 attendees

Photo:
SHARCNET
Summer School

67%

of all training in the Compute Canada Federation, is delivered in Ontario.
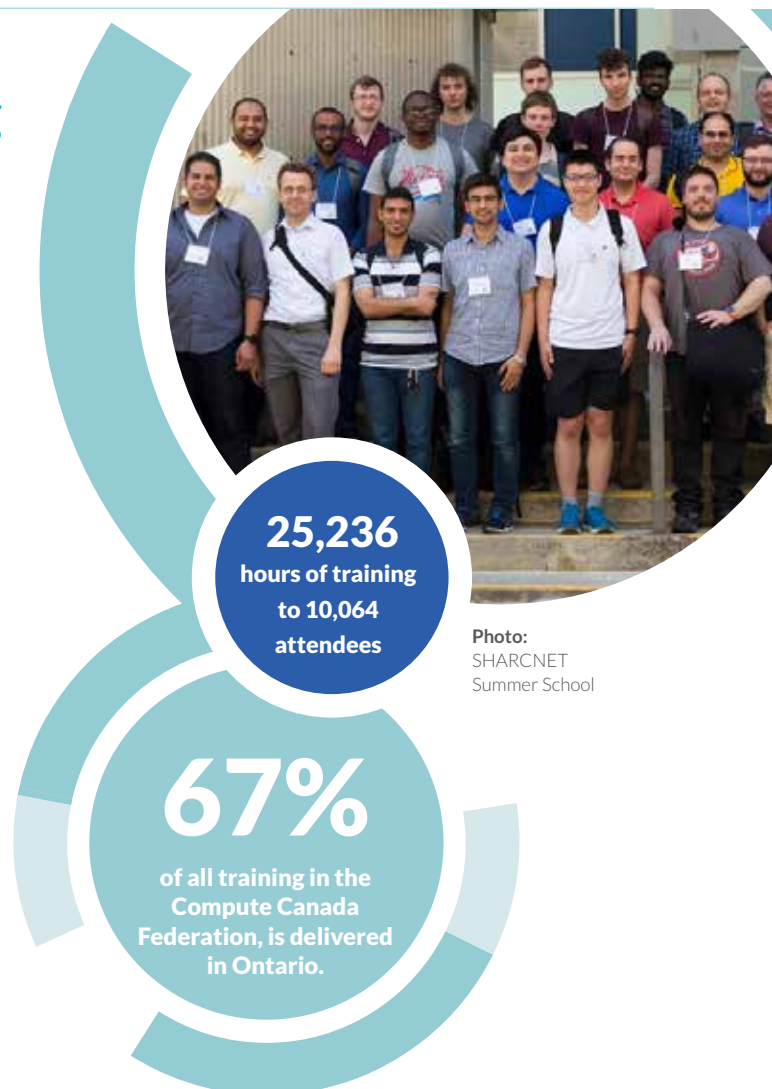
Partner	N° of training events	N° of attendees at events	N° of training hours delivered*	Online training video views*	Online training video hours
SciNet	156	5,555	9,382	NA	NA
SHARCNET	85	2,994	6,953	87,930	62,210
HPC4Health	29	1,103	5,857	NA	NA
CAC	23	412	3,044	NA	NA
Total	293	10,064	25,236	87,930	62,210

*1 hr session w/ 10 participants = 10 hrs training delivered

Strategic Pillar 3:
Advance ARC through Partnerships & Collaboration

Coordinate and support the advanced computing needs of Ontario's academic research community and other key stakeholders, in partnership with sites across the province that deliver and manage these services.

During the year 2018 – 2019, Compute Ontario focussed on how we could better support our researchers and their needs. We continued to focus on supporting our partners in training HQP, and built a researcher-led line of communication through the following initiatives:

1 | **Health Artificial Intelligence Data Analysis Platform (HAIDAP)**

2 | **Co-hosting the Technical Experts of Compute Canada (TECC) in Ontario**

Health Artificial Intelligence & Data Analysis Platform (HAIDAP)

Healthcare is a critical public service that also represents the largest expenditure for the government of Ontario. At the same time, Ontario has amassed a rich collection of longitudinal health data, and is also home to the highest concentration of digital researchers in the country.

Through partnerships with the Vector Institute for Artificial Intelligence, HPC4Health, and ICES, Compute Ontario convened a diverse group of experts in health data, AI and ARC to create the Health Artificial Intelligence & Data Analysis Platform (HAIDAP). The HAIDAP is a powerful proof-of-concept research computing platform where HPC converges with AI to deliver new insights into health challenges. Through a secure private cloud, researchers and clinicians can leverage AI and Machine Learning (ML) technologies to analyze vast amounts of data, leveraging the platform to create more tailored patient care programs and promote research innovation within the ecosystem. HAIDAP will examine whether ARC can offer earlier detection, better diagnosis and treatment of various diseases and illnesses, thereby reducing healthcare costs and improving the quality of life for Ontario residents.

" **...Ontario has amassed a rich collection of longitudinal health data, and is also home to the highest concentration of digital researchers in the country.”**

Impact

Within the first year of its launch, the HAIDAP has catalyzed research, supported new discoveries, and demonstrated that ARC has the potential to transform healthcare.

- **Accelerating health solutions:** Dr. Laura Rosella and Mathieu Ravaut developed a deep-learning model that can efficiently run multiple analyses at the same time, using more data than previously, and saving the team copious amounts of time when performing predictive analysis using health data. Their model will result in the identification of different sub-types of diabetes, allowing more personalized care, and reducing costs for the healthcare system and improving treatment outcomes.

- **Developing HQP:** The HAIDAP has provided some of the best in-class AI and ML researchers, students, and trainees with the opportunity to develop their skillsets while working with provincial-level health data. Over 15 HQP have been onboarded and developed during 2018 – 2019, a crucial step in building the next generation of healthcare experts. This impact, as also advances our strategic pillar #2 of developing HQP.

- **Scaling data access and modeling:** As a first within the country, the HAIDAP now serves as a reference point to develop expanded health data access models and enhance digitally-enabled healthcare research. It is Compute Ontario's intention that this work can be leveraged to benefit researchers nationally, and we have initiated conversations to extend this work across Canada.

As a proof-of-concept, the HAIDAP is producing practical and actionable results as well as informing health policy in the areas of population health and system management which are unique to Ontario. It is a valuable investment in research talent, which is enabling technical skills and the ability to apply advanced analytic methods to further health AI research in Ontario and globally.

Technical Experts of Compute Canada (TECC) in Ontario

In order to continue our "grassroots" approach in sector growth, and to understand how we can better serve the needs of ARC users and researchers within the province, Compute Ontario co-hosted the annual TECC meeting in Ottawa with Compute Canada. Assistant Deputy Minister, Dr. Nipun Vats, of the Ministry of Innovation, Science and Economic Development (ISED) provided a keynote address to participants. Dr.Vats and ISED Director, Sinead Tuite, provided an overview of next steps in the development of a nationally coordinated ARC strategy. The meeting resulted in an engaging discussion with ARC users and researchers highlighting their requirements, and how the new national governing organization (currently being formed) and Compute Ontario can support them in their work.

Strategic Pillar 4:
Serve as a credible policy voice and advocate

Serve as a credible voice regarding policy; coordinating and advocating key strategies that enhance advanced research computing and its use

With the announcement of the formation of a new federal governing body for Canada's ARC sector, Compute Ontario continued to provide support to partners within the ecosystem. Compute Ontario helped with informed decision-making in areas of policy, governance, and strategy by communicating the needs of the ecosystem with decision makers provincially and federally through the following initiatives:

1 **Meetings with Compute Canada and regional partners**

2 **Supporting ISED with thought leadership**

3 **Representing consortia in MSI budget discussions with the Canadian Foundation for Innovation (CFI)**

Meetings with Compute Canada and Regional Partners

In order to communicate the research needs of the province and recommend a more researcher-centric approach to ARC decision making and investment strategy, we continued bi-weekly meetings with the executive teams of our regional partners and Compute Canada. These meetings focussed on knowledge exchange of best practices within the regions, furthering communication on ARC-related needs and initiatives, and how we could better support the advancement of Canada's competitiveness through ARC-led research.

> " **Through Compute Ontario's communication with the CFI, 45 positions that were slated to be defunded in error were retained."**

Supporting ISED Through Thought Leadership

The federal government announced an investment of $572.5 million in the March 2018 budget to support the development of a DRI strategy over the course of five years. In order to best communicate the ARC needs of Ontario and better inform decision making at the federal level, Compute Ontario convened a steering committee of diverse voices from across the province. Building on our existing collaboration with the Leadership Council for Digital Research Infrastructure (LCDRI), Universities Canada, and the U15 Group of Canadian Research Universities, we published a white paper that identified principles to inform ARC-related decision making in order to develop a competitive DRI strategy. Experts and researchers in Ontario who were well-versed with the needs of the community were critical contributors to these principles. Compute Ontario's President and CEO was asked to present this paper to ISED along with recommendations for the ARC ecosystem in Ontario.

Representing Consortia in MSI Budget Discussions with the CFI

We continued to represent our consortia partners provincially and federally in communicating their needs and those of Ontario researchers. During the Major Science Initiative (MSI) budget discussions with the CFI, we represented our four consortia partners, SciNet, CAC, SHARCNET, and HPC4Health, in a series of challenging budget negotiations. Between December 2018 and March 2019, Compute Ontario convened feedback sessions and budget analysis meetings between the consortia and the CFI that were able to better inform the CFI on how resources were being used. Through Compute Ontario's communication with the CFI, 45 positions that were slated to be defunded in error were retained. Retaining these key positions resulted in HQP staff that were able to facilitate research and innovation, and continue to play key roles within their organizations.

Strategic Pillar 5:
Serve as a Trusted Broker and Catalyst

Build trust and serve as a focal point for connecting communities and constituents throughout Ontario's advanced research computing ecosystem.

Compute Ontario continued to act as a connector to facilitate knowledge exchange and sharing of resources within the ARC ecosystem by creating the following platforms for communication and collaboration:

Photo:
Ontario Advanced
Research Computing
Copngress

130
stakeholders from the ecosystem, including HQP, academics, researchers, policymakers, innovators, industry, and students.

2018 – 2019
Compute Ontario launched a series of Regional Information Exchanges (RIEs)..

Ontario Advanced Research Computing Congress (OARCC)

We hosted our first conference, the Ontario Advanced Research Computing Congress (OARCC), at the MaRS Centre in Toronto on May 15-17, 2018. The conference brought together over 130 stakeholders from the ecosystem, including HQP, academics, researchers, policymakers, innovators, industry, and students. The event convened stakeholder groups within the ARC sector and fostered collaboration, engagement, and discussion around innovation and research. Formal evaluations from the event indicated that one of the most valued outcomes participants reported on was the ability to receive knowledge from a cross-section of experts and the opportunity to interact with a diverse group of leaders.

Regional Information Exchanges

During 2018 – 2019, Compute Ontario launched a series of Regional Information Exchanges (RIEs) with our consortia partners to promote sharing of best practices within each organization and further discussions on how we can better support researchers in Ontario. Through a system of sharing updates from each of our consortia partners on their "Made in Ontario" solutions, activities, and collaborations, Compute Ontario facilitated engaging discussions around ARC and its use to create a positive impact on Ontario. Moreover, the timing of these exchanges was vital to having the credibility to convene the subsequent discussions that took place between December 2018 and March 2019 with the CFI on the budget needs of the various consortia.

Performance Measures

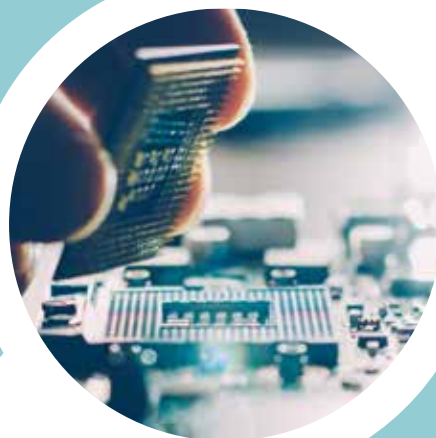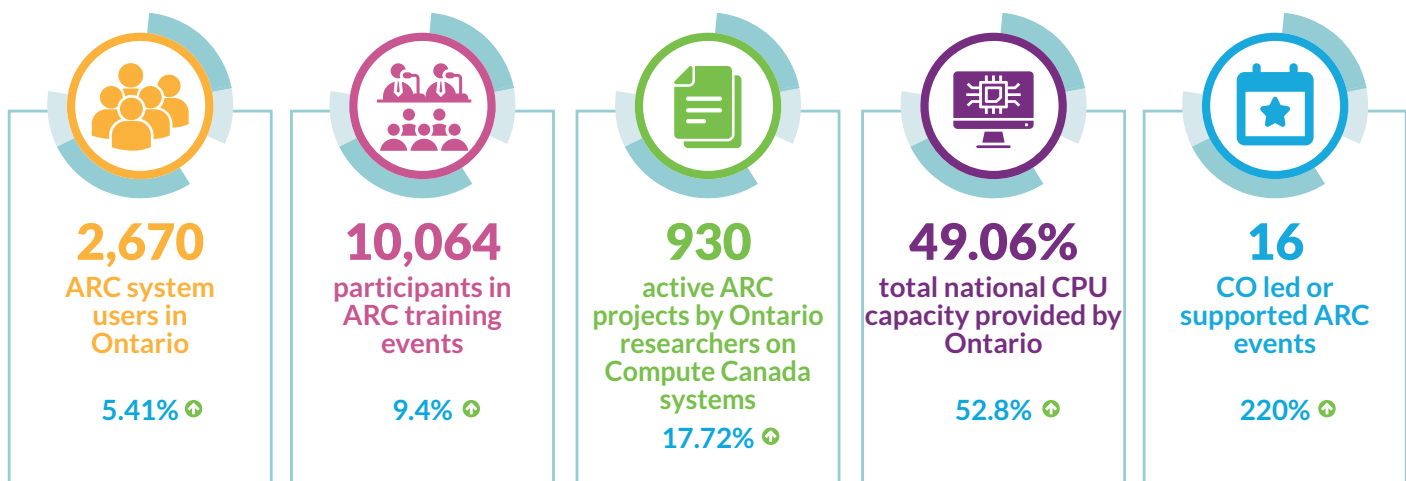Compute Ontario tracks measurable items that articulate both, the value CO brings to Ontario, as well as the growth of Ontario's ARC ecosystem. These measures help monitor organizational activities and outcomes against our strategic priorities. Below are highlights from CO's 2018 – 2019 performance measures:[2]

| **2,670** ARC system users in Ontario 5.41% ⬆ | **10,064** participants in ARC training events 9.4% ⬆ | **930** active ARC projects by Ontario researchers on Compute Canada systems 17.72% ⬆ | **49.06%** total national CPU capacity provided by Ontario 52.8% ⬆ | **16** CO led or supported ARC events 220% ⬆ |

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2. Compute Ontario is mandated to track and submit a list of performance measures to the government of Ontario as specified in the Ontario Transfer Payment Agreement

Financial Statements

For the period April 1, 2018 to March 31, 2019, which represented the fourth operating year for Compute Ontario, the Ministry of Economic Development, Job Creation and Trade provided funding in the amount of $1.58m. There were eligible carry forward funds from the previous year for a total operating budget of $1.73m. All funding was received from the Ministry on schedule. All Compute Ontario staff positions were in place during 2018 – 2019 and several key initiatives were undertaken.

In addition, Compute Ontario in partnership with ORION, was awarded $10m to be spent during 2018 – 2019 to enhance Ontario's ARC ecosystem. Funds awarded to Compute Ontario were further allocated to its partners to launch initiatives for the HAIDAP, ARC-AI platform and Smart Cities Governance Report.

A report on Compute Ontario finances is included in Table 1. Compute Ontario completed the year with operating expenditures totaling $1,592,133. The amount of $138,556 will be carried forward to next fiscal year as it fits within the eligible 10% carry forward limit set by the Ministry.

The commentary on individual line item variances are noted in the table, with the most significant variances highlighted below:

Salary and benefits expenses reflect the addition of contract support to assist with in year projects, which was overspent by $30k. This is offset by the savings from the Board and Corporate Secretary function which is now being managed by permanent CO staff.

The budget for conferences, meetings and events was overspent by $76k due to expenditures for CO's inaugural Ontario Advanced Research Computing Congress (OARCC). This is offset by carry forward funds from the previous year.

The premises category was under spent by $30k as it reflects the costs outlined in the MaRS lease agreement.

The special studies category was under spent by $30k as CO's Phase II Technical Study has been deferred to next fiscal year.

Table 1 – Compute Ontario Financial Variance Report

For the period ending March 31, 2019

Expense Category	Budget 2018 – 19	Actuals 31-Mar-19	Variance 31-Mar-19	Comments
Salaries, Wages & Benefits	$1,000,421	$1,030,898	($30,477)	all staff positions in place
Staff Training	$19,500	$19,593	($93)	training expenses as required, with focus on policy development and governance
Board & Corporate Secretary	$30,000	$0	$30,000	function managed by existing CO staff
Conferences, Meetings & Events	$80,000	$155,946	($75,946)	conferences and events held (including CO's OARCC), staff attendance at conferences
Premises	$109,427	$78,994	$30,433	rent based on MaRS contract
Special Studies	$224,140	$194,339	$29,801	additional studies (The Evidence Network, Institute on Governance, Brookfield Institute), strategic planning, consortia-funded proposals
Professional Services	$10,000	$11,996	($1,996)	additional administrative and communications support
Legal, HR, Procurement	$15,000	$18,403	($3,403)	legal advice for CO as required, recruitment
Accounting Financial	$0	$0	$0	Western donating backend services as in-kind
Insurance	$15,000	$4,873	$10,127	CGL, D&O, property insurance
Audit	$7,500	$14,127	($6,627)	using Western University's auditor
IT	$29,612	$25,400	$4,212	small hardware, software, phones, mobiles, IT support, cloud services, annual certificates
Media & Materials	$25,000	$31,641	($6,641)	creative services, media monitoring & advertising, web design & updates
Office Administration	$14,400	$5,923	$8,477	supplies, printing, courier, postage
TOTAL EXPENSES	**$1,580,000**	**$1,592,133**	**($12,133)**	
Carry forward	$150,689	$0	$150,689	eligible c/f from 2017 – 18
TOTAL BUDGET	**$1,730,689**	**$1,592,133**	**$138,556**	eligible c/f from 2018 – 19

Schedule of Expenditures of

COMPUTE ONTARIO / CALCUL ONTARIO

MINISTRY OF RESEARCH, INNOVATION AND SCIENCE FUNDING

And Independent Auditors' Report thereon

Year ended March 31, 2019

KPMG

KPMG LLP
140 Fullarton Street Suite 1400
London ON N6A 5P2
Canada
Tel 519 672-4800
Fax 519 672-5684

INDEPENDENT AUDITORS' REPORT

To the Management of Compute Ontario / Calcul Ontario and the Minister of Research, Innovation and Science (the "Ministry")

Report on Audit of the Schedule

Opinion

We have audited the accompanying schedule of expenditures of Compute Ontario / Calcul Ontario for the Ministry of Research, Innovation and Science (formerly the Ministry of Research and Innovation) funding for the year ended March 31, 2019 and notes to the schedule, including a summary of significant accounting policies (hereinafter referred to as the "schedule").

In our opinion, the accompanying schedule is prepared, in all material respects, in accordance with the financial reporting provisions in Article 7 of the agreement dated April 1, 2015 between Compute Ontario / Calcul Ontario (the "Organization") and the Ministry.

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the ***"Auditors' Responsibilities for the Audit of the Schedule"*** section of our auditors' report.

We are independent of the Organization in accordance with the ethical requirements that are relevant to our audit of the schedule in Canada and we have fulfilled our other ethical responsibilities in accordance with these requirements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Emphasis of Matter – Financial Reporting Framework

We draw attention to Note 2 to the schedule, which describes the applicable financial reporting framework.

The schedule is prepared to assist the Organization to meet the requirements of the funding agreement between Compute Ontario / Calcul Ontario and the Ministry of Research, Innovation and Science as described in Note 2 to the schedule.

KPMG

As a result, the schedule may not be suitable for another purpose.

Our opinion is not modified in respect of this matter.

Other Matter – Restriction on Use

Our report is intended solely for the Ministry and the Organization and should not be used by other parties.

Responsibilities of Management and Those Charged with Governance for the Schedule

Management is responsible for the preparation of the schedule in accordance with the financial reporting provisions in the Agreement between the Organization and the Ministry dated April 1, 2015, and for such internal control as management determines is necessary to enable the preparation of the schedule that is free from material misstatement, whether due to fraud or error.

Those charged with governance are responsible for overseeing the Organization's financial reporting process.

Auditors' Responsibilities for the Audit of the Schedule

Our objectives are to obtain reasonable assurance about whether the schedule as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditors' report that includes our opinion.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists.

Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the schedule.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit.

We also:

- Identify and assess the risks of material misstatement of the schedule, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion.

  The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Organization's internal control.

- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

- Communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Chartered Professional Accountants, Licensed Public Accountants

London, Canada

September 19, 2019

COMPUTE ONTARIO / CALCUL ONTARIO

MINISTRY OF RESEARCH, INNOVATION AND SCIENCE FUNDING

DRAFT Schedule of Expenditures

Year ended March 31, 2019, with comparative information for 2018

	Total 2019	Total 2018
Expenditures:		
Salaries, wages and benefits	$ 1,030,898	$ 912,346
Special studies	194,339	387,058
Conference, meetings and events	155,946	57,547
Premises	78,994	71,319
Media and materials	31,641	62,845
Information technology	25,400	27,785
Staff training	19,593	5,761
Legal, HR and procurement	18,403	12,588
Audit	14,127	13,613
Professional services	11,996	22,769
Insurance	4,873	5,173
Office administration	5,923	8,507
Total expenditures	$ 1,592,133	$ 1,587,311

See accompanying notes to the schedule.

Approved on behalf of the Board of Directors:

_____
Chair, Board of Directors

COMPUTE ONTARIO / CALCUL ONTARIO
MINISTRY OF RESEARCH, INNOVATION AND SCIENCE FUNDING

Notes to Schedule of Expenditures

Year ended March 31, 2019

1. **Project Description:**

   Compute Ontario / Calcul Ontario (the "Organization") signed an agreement dated April 1, 2015 with The Ministry of Research, Innovation and Science (formerly the Ministry of Research and Innovation) to fund the operating costs of the Organization (the "Project").

   Under the agreement, The Ministry of Research, Innovation and Science (the "Ministry") will provide a maximum of $8,500,000 cash contribution to the Project for the project period, which ends on March 31, 2021. The objective of the Project is to explore the merits of developing a high performance computing and big data strategy for the province.

   The schedule of expenditures of Compute Ontario / Calcul Ontario for the Ministry of Research, Innovation and Science funding presents the Organization's portion of eligible expenditures incurred for the Project during the reporting period.

2. **Significant accounting policies:**

   (a) Basis of accounting:

   The schedule is prepared in accordance with the basis of accounting prescribed in Schedule F of the Agreement dated April 1, 2015 between Compute Ontario / Calcul Ontario and The Ministry of Research, Innovation and Science.

   The schedule has not been prepared in accordance with the presentation principles or the presentation of all the financial statements and related note disclosures required by Canadian accounting standards for not-for-profit organizations.

   (b) Expenditures:

   Expenditures are eligible under the Project if they were incurred in the period of the Project and are directly related to the completion of the Project.

Governance

Compute Ontario operates under the oversight of a Board of Directors. Board membership and offices for the 2018 – 2019 fiscal year are listed below:

Sylvain Charbonneau
Secretary

Catherine Ann Middleton
Director

Mark Daley
Chair

Dan Sinai
Director

Charmaine Dean
Director

Ranil Sonnadara
Vice Chair

Vivek Goel
Director

Salim Teja
Director

Warren Keith Helland
Chair Governance & Nominations Committee

Susan Ursel
Director

Shannon MacDonald
Chair Audit & Resources Committee

Dereck Whitmell
Director

Carolyn McGregor AM
Chair Industry Engagement Committee

Industry Engagement Committee (Special Purpose Committee of the Board)

Don Aldridge
Executive Director
Centre for Advanced Computing (CAC), Queen's University

Lindsay Coolidge
Manager
Government & Community Relations, UOIT

Mark Gray
Cloud Team Lead
Pawsey Supercomputing Centre Australia

Gregory Hodgson
Post-doctoral Fellow & MBA candidate
Ryerson University

Ian Howcroft
CEO
Skills Canada

Sedef Akinli Kocak
Project Manager
Industry Innovation, Vector Institute

Jim Lambe
Country Director
Google Cloud

Jenn MacLean
Director
Collaboration, NGEN Canada

Carolyn McGregor
AM (Chair)
Canada Research Chair in Health Informatics,
The University of Ontario Institute of Technology

Catherine Ann Middleton
Board
Compute Ontario

Mark Patterson
Executive Director
Magnet

Ugo Varetto
CTO
Pawsey Supercomputing Centre Australia

Carl Weatherall
Executive Director & CEO
Canada Mining Innovation Council

Advisory Committees

Compute Ontario would like to acknowledge the expertise, effort and dedication of our advisory committees in helping to shape the work of our organization. A list of advisory members for the 2018 – 2019 fiscal year is listed below:

Scientific & Executive Directors Advisory Committee

Don Aldridge
Executive Director
Centre for Advanced Computing, Queen's University

Andrew Barker
Director
Institutional Research, University of Waterloo

Michael Bauer
Scientific Director
SHARCNET, Western University

Michael Brudno
Scientific Director
HPC4Health, The Hospital for Sick Children

Judith Chadwick
Assistant VP Research University of Toronto

W.Richard Peltier
Scientific Director
SciNET, University of Toronto

Technical Advisory Committee

Ken Edgecombe
Analytics Development Hub
Centre for Advanced Computing, Queen's University

Daniel Gruner
Chief Technology Officer
SciNET, University of Toronto

Chris MacPhee
Assistant Director
Operations, Centre for Advanced Computing,
Queen's University

John Morton
Technical Director
SHARCNET

Carl Virtanen
Associate Director
HPC4Health, University Health Network

Smart Cities Use Case Leads

Rosario Cartagena
Chief Privacy and Legal Officer
ICES

Charles Victor
Senior Director & External Services
ICES

Joe Greenwood
Lead Executive
MaRS Data Catalyst

Kurtis McBride
CEO & Co-Founder
Miovision

Smart Cities Advisory Committee

Andy Best
Executive Director
Open City Network

Tom Corr
President & CEO
Ontario Centres of Excellence

Craig Desjardins
Director, Office of Strategy
Innovation & Partnerships,
City of Kingston

Mark Dillon
Corporate Manager
Information Technology, City of Sarnia

Colin Earp
Partner – Infrastructure, KPMG Canada

John Jung
Canada Lead
Intelligent Communities Forum

Dan Mathieson
Mayor
City of Stratford

Cindy Van Ort
Chief Privacy Officer
Thomson Reuters

Frank Di Palma
Chair and Chief Information Officer
City of Vaughan

Eugene Wen
VP
Group Advanced Analytics, Manulife Financial

Compute Ontario

661 University Ave.

MaRS West Tower, Suite 1140

Toronto, ON M5G 1M1

computeontario.ca | info@computeontario.ca