



CENGN Annual Report

Fiscal Year 2017

April 1, 2016 - March 31, 2017



Our Vision

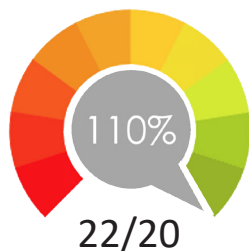
CENGN, an NCE (Networks of Centres of Excellence) funded CECR (Centres of Excellence for Commercialization and Research), works with small and medium-sized businesses, multinationals, the government, and academia to strengthen Canada's leadership in next generation networking (NGN). This Centre of Excellence strives to create an ecosystem that accelerates the growth of the Canadian information and communications technology (ICT) sector.

CENGN is a consortium of its member organizations. These competing organizations come together, putting aside their rivalry, and instead cooperate in CENGN's vision to support commercialization in Canada – CENGN calls this: co-opetition. The goal of CENGN is to strategically fill the gaps identified in the Canadian telecommunications commercialization ecosystem – to ensure that Canadian small and medium enterprises (SMEs), start-ups and researchers have access to industry guidance/knowledge and a multi-vendor open-platform for validation of their technologies and services.

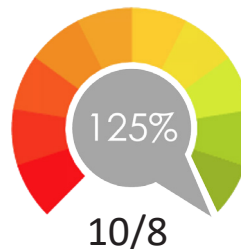
This support is critical to SMEs looking to migrate innovation from the research phase to commercialization. No single consortium partner can deliver the functionality of CENGN. The strength and uniqueness of CENGN's approach comes from a combined contribution of CENGN's talented team and its members, who contribute their expertise and equipment to lower the barrier to entry for Canadian SMEs.

Key Performance Indicators

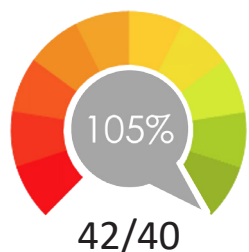
Members & Partners



Small & Medium Enterprises



Students



Training

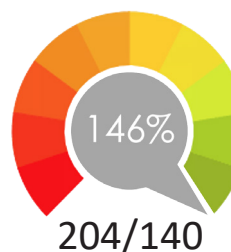


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Letter from the Chairman



Welcome to the third annual report of the Centre of Excellence in Next Generation Networks (CENGN). The Centre has now been operational for just over 2 ½ years, half way through our initial 5-year NCE funding period. As you read this report I hope you agree with me that we have continued to meet and in many cases, exceed the targets that we set in our original application to the NCE CECR program.

As a consortium of our members and partners, our primary mission is to enable commercialization for Canadian SMEs and foster Canada's leadership in the global ICT market. Demand for our validation and testing capabilities from SMEs remains high, and over 20 projects have now been successfully completed.

Training is a key part of our mission. To support this goal, we have made students central to CENGN's operation. Our internship program is now employing 40 students per year, and the total number of students who have participated in this program is nearing our 7-year target. It is rewarding to see many of these students go on to secure employment in the industry as the next generation of innovative thinkers. CENGN training courses have attracted several hundred industry professionals during the year, and as Fall approaches, our annual summit is fast becoming a key date in the calendar.

This year, we have made some big steps towards securing additional financing. In particular, we have secured an agreement in principle from the Province of Ontario to fund an Ontario Smart Infrastructure Testbed. Extending the CENGN Cloud to 15 Regional Innovation Centres and 3 Regional hubs across Ontario will provide the connectivity to enable industry and academia to collaborate in numerous smart projects. Our ambition in future years is to extend this to the whole of Canada.

We could not achieve our mission without our core Industry members, who not only provide generous financial and in-kind support, but set our strategic direction. Inevitably, in the dynamic environment in which we work some churn of membership is expected. This year, CENGN has gained the membership of Bell Canada, GENBAND, and Mitel to join our commercialization team. Our wider engagement with the community continues to be strong with over 60 partners. I would like to thank our members and NCE for the support they have given us over the last 3 years, and continue to provide for us. With this continued collaboration and support between industry, academia, and research, we are truly reaching our goal to enable Canada as a world leader in ICT.

Mike Scott
Chairman of the Board

Letter from the President



Since inception, CENGN has collaborated with industry members, partners, SMEs, federal and provincial governments, and academia. As a leader in NGN, and an NCE funded CECR, CENGN has propelled Canada's leadership role in the world's ICT community. This year, our organization has made efforts to expand Canada's ICT presence through various projects with industry members, partners, and SMEs, while also benefitting from the support of academia, researchers, and government.

Specifically in Ontario, we have seen major growth in the tech sector and a shift in NGN focus to Smart City Infrastructure and 5G. This past May, the provincial government announced \$63.3 in grant funding for CENGN (matched by CENGN industry members). This support from the Ontario government will allow CENGN to expand its infrastructure across the province to interconnect its 18 Regional Innovation Centres, allowing SMEs the opportunity to innovate in NGN beyond the tech sectors of Ottawa, the GTA, and Waterloo. FY2017 saw projects from a variety of Canadian SMEs, including: AP1, inBay Technologies, Inocybe Technologies, Intervyoo Me, Kontron, Noviflow, SMATS, and Solana.

It is our mission to provide Canada's SMEs with the support they need to validate and commercialize their products, whether that be through a partnership with an industry leader or by validating their solution on our open multi-vendor testbed. This year, CENGN worked with our partners and members to develop cutting-edge technology and resources to be leveraged by Canadian SMEs. Some major additions to our services in FY2017 include: our 10Gbps peering connection with ORION, the implementation of Wind River's Titanium Edge into our CENGN infrastructure, and the deployment of a LoRaWAN based LPWAN (low power wide area network) that allows SME and student access to the entire Eleven-X Canadian network.

Aside from providing resources to SMEs, CENGN provides various opportunities to academia, researchers, and students. Over the past year, we provided internships to over 42 students in engineering, project management, finance, administration and marketing to give them the real-world experience they need to excel in their careers. Our team strongly believes that students are key to accelerating Canada's high-tech ecosystem and ensuring there is a rich talent pool of professionals for Canadian businesses to draw from. This year we also worked closely with the open source Linux Foundation communities such as OPNFV, OpenDaylight, and OpenStack. Through these organizations, we participated in organizing Ottawa meetups, and collaborating on open source projects like building and operating Canada's only Pharos lab which is available to students, academia and Canadian industry.

This AGM report takes a closer look at the accomplishments listed above, as well as additional successes including training KPIs, important events, media coverage, and more. Looking forward, we plan to build off our momentum to continue accelerating Canadian tech innovation and solidifying our country's leadership role in ICT and NGN.

Ritch Dusome
President & CEO

Members & Government

Tier 1 Members



Tier 2 Members



Government



Partners, SMEs, & Academia

Partners



Small & Medium Enterprises



Academia



Board of Directors



Mike Scott
Chairman



Ritch Dusome
President and CEO



Chris Bachalo
Director Service Provider
Solutions at Juniper Networks



Sam Bucci
IP Transport Business Division
at Nokia



Sandra Crocker
Associate Vice-President
(Strategic Initiatives &
Operations) at Carleton University



Code Cubitt
Managing Director at Mistral
Venture Partners



Robert Fitts
Director of Corporate
Development at EXFO Inc



Joe Hickey
Vice President Sales &
Marketing at Christie Walther
Communications



Rob Keates
Manager of IP/Optical Standards
at TELUS



Michael McCallen
Business Development Director
of Network & Service
Enablement at Viavi



Mike McGann
Director of Wealth Management
at ScotiaMcLeod



Blair Patacairk
Managing Director of
Investment & Trade at Invest
Ottawa



Matt Pearson
Ottawa Leader of SR&ED and
Business Incentives at Ernst &
Young



Debbie Weinstein
Lawyer at LaBarge
Weinstein LLP

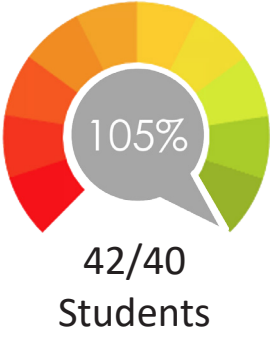


Peter Wilenius
Vice President of Business
Development at CANARIE Inc



Steven Wood
Principal Engineer – Enterprise
Architecture and
Software-defined WAN

Academia



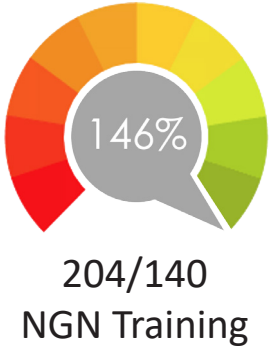
Every year, CENGN brings in approximately 40 of Canada’s most tech-savvy students in the fields of project management, admin, marketing, engineering and finance. CENGN strives to grow a talent pool that is second to none, giving the country’s tech industry a skilled workforce with relevant training to draw from. CENGN also partners with Canadian universities and colleges to facilitate and collaborate on the most innovative research projects in NGN.



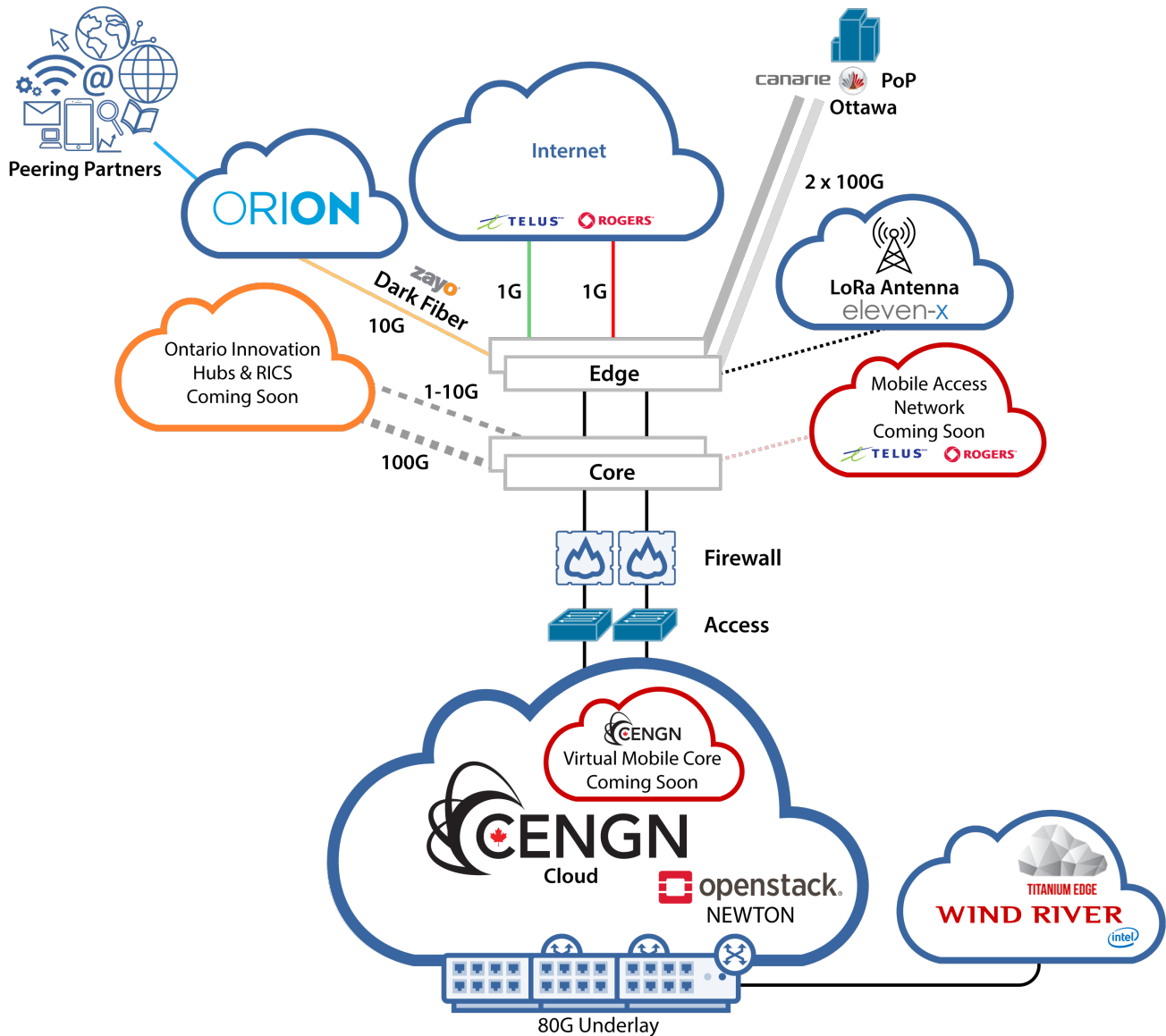
Training



CENGN is training the next generation of networking professionals by utilizing its own talented team, leveraging the resources of its members, and partnering with best in class companies. This is done through meetups, lunch and learns, bootcamps, competitions, and training courses focused on teaching the latest advancements in software defined networking and network functions virtualization (NFV). In FY2017 CENGN hosted three Introduction to SDN & ONF exams, one OpenStack and two Open Source Networking meetups, a CENGN Summit student training session, the Telus-Juniper SDN Throwdown, and the Juniper Networks Academic Bootcamp.



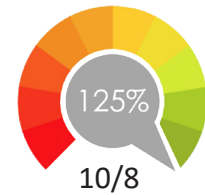
CENGN Open Cloud Infrastructure



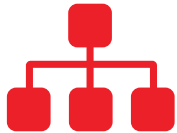
- Multi-vendor infrastructure
- CENGN member in-kind contribution
- White-box servers and switches
- Open source software for cloud infrastructure and operational support systems
- OpenStack-based cloud infrastructure with 80G underlay
- Redundant edge, core and access network supporting a multi-layered data centre environment
- High speed external network connections
- Multi Gbps internet transit
- 10G connection to public cloud service providers
- 2x100G WAN metro link
- Ontario Innovation Centres connectivity (coming soon)
- LoRa (low power wide area network technology for IoT) antenna and gateway
- Wind River Titanium Edge network function virtualization infrastructure
- CENGN mobile core/home network (coming soon)

Commercializing Canadian Innovation

CENGN projects aim to commercialize promising technology originating in research institutions, start-ups, and SMEs. We are committed to removing the barriers to commercialization, accelerating product introduction, as well as reducing product development time and costs. The projects CENGN accepts can be divided into seven major categories:



SME Commercializations

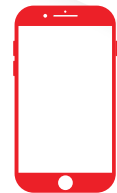


SDN/NFV/SD-WAN

Software-defined networking (SDN) and NFV are complementary technologies that transform network infrastructures to be intelligently and centrally controlled. Software-defined networking wide area network (SD-WAN) on the other hand, provides orchestration, cloud-based WAN automation, and removes the burden of manual WAN configuration and provisioning.

INTERNET OF THINGS (IoT)

IoT refers to the ever-growing network of devices for internet connectivity and the communication that occurs between internet enabled devices and systems – think your cellphone, tablet, and smart car all talking to one another. IoT in networking refers to how devices are sensed or controlled across infrastructure.



DATA CENTRE/CLOUD

Data centres and cloud networks are storage systems that house data in hardware and on the internet. These projects relate to building, maintaining and operating cloud infrastructures.

SECURITY

Virtual security encompasses the tools and programs used to protect the identity, assets, and technology of individuals or an organization. Today's cloud solutions and IoT applications require security technology that effectively prevents increasingly dynamic cyber-attacks.



MOBILE NETWORKS

Mobile networks are communication networks where the last link is wireless – think a cellular radio tower connecting a voice and data network to your cellphone. Projects in this area usually involve wireless network integration, cellular connectivity in remote areas, and resource management of a mobile broadband network.

NETWORK TRANSPORT

The transport layer of a network provides host-to-host communication services for applications. Network transportation is complex, and requires multiple operational support systems to build, provision, operate and maintain.

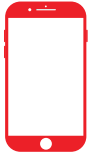


NETWORK APPLICATIONS

As network functions become virtualized and increasingly software-defined, new applications need to be developed to support them. These network applications have advanced analytics that enable real-time decision making and support operations with discovery, monitoring and troubleshooting.



FY2017 Project Highlights

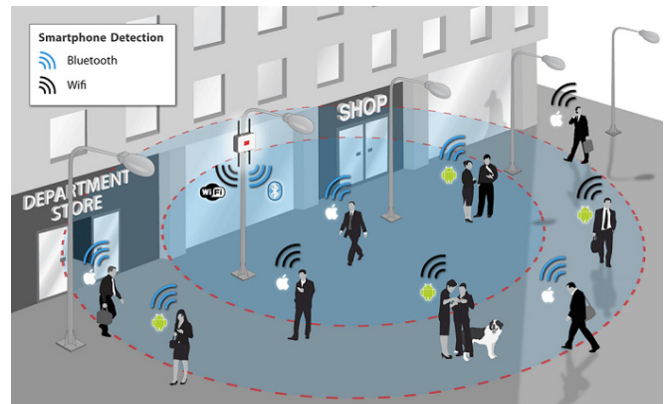


Testing the AP1 Beacon's Functionality and Capacity to Transfer Data

AP1 fosters an advanced proximity ecosystem to collect behavioral insights for customer engagement. AP1's ApBeacon solution leverages beacon technology using Wi-Fi and Bluetooth to send IoT information such as user location from user devices to a cloud server.

Example: AP1 beacons being deployed in a shopping centre to provide immediate business opportunities for stores and customers with targeted notifications.

CENGN provided the cloud resources, including virtual machines, the network, the internet connection, and hardware hosting to deploy the project in CENGN's cloud platform. CENGN then introduced AP1's solution at the 2016 IoT613 Conference, providing exposure for AP1 to a range of multinational and local companies working in IoT or consuming IoT products.



Secure Logins with InBay Technologies idQ Trust as a Service and Authentication for Linux

InBay Technologies provides passwordless authentication and authorization solutions for increased security. Their idQ tool adds another layer of authentication to a system or account, by implementing a push notification condition that requires a trusted mobile device.

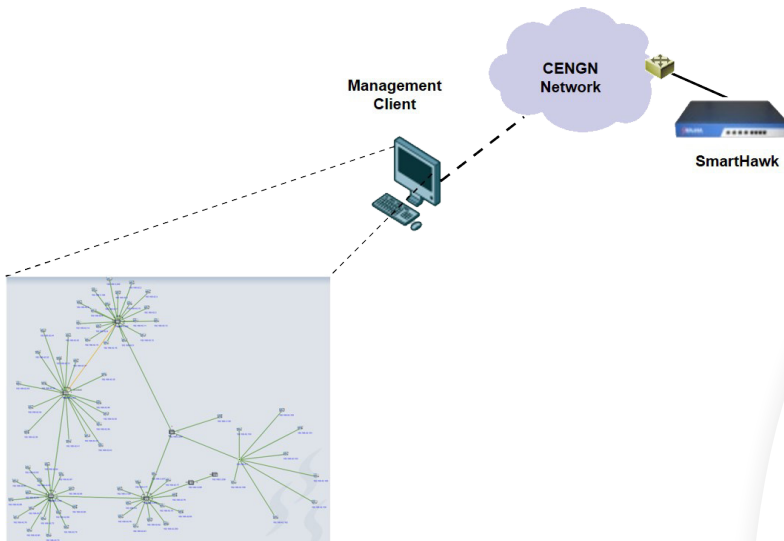
InBay's idQ solution was deployed on CENGN's testbed and was validated by testing four different security scenarios. The scenarios proved successful, and were showcased in a proof-of-concept video.





Solana's Smarthawk Solution Provides Network Mapping Capabilities

Solana Networks delivers intelligent software products and solutions for IP networks. Their SmartHawk product provides auto discovery and network mapping capabilities for both Layer-2 and Layer-3 IP networks. Its patented approach to network discovery makes SmartHawk an industry leader in fast, scalable and accurate network topology.



CENGN implemented SmartHawk in its data center to successfully monitor its environment for network and security performance issues. This implementation was tested to provide Solana with many operational benefits, as well as provide the opportunity to improve the tool's troubleshooting and diagnostic capabilities.



Traffic Management with the SMATS Traffic Signal Optimization Solution

The SMATS traffic signal optimization solution specializes in traffic data collection and analysis. The SMATS TrafficXHub sensor technology collects data via mobile MAC addresses to measure factors like travel-time, origin-destination data, and intersection performance. This data can then be analyzed to create algorithms that alleviate traffic congestion.

CENGN composed a testbed of more than 20 virtual and two physical TrafficXHub sensors in its cloud platform to test the solution. CENGN's testing and evaluation delivered validation through solid, quantitative results to help advance SMATS on the road to market.

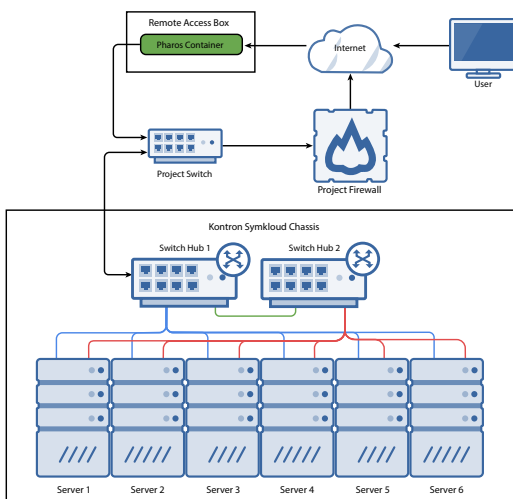


Industry Associations



CENGN believes that having strong relationships with industry associations is integral to foster an innovative and successful environment for the ICT and NGN sector. During FY2017, CENGN worked hand-in-hand with ETSI, ICTC, ONF, OpenDaylight, OpenStack, OPNFV, and SDX Central to grow the tech sector in Canada. These relationships provided CENGN with the ability to solidify its brand, promote Canadian innovation in ICT, and leverage cutting-edge technology for SMEs. Over the course of the year, CENGN partnered with its industry associations by contributing to events, hosting meetups, and collaborating on training programs.

CENGN Pharos Lab



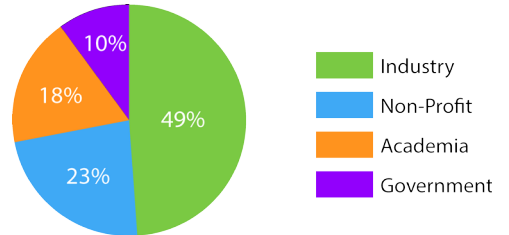
2017 saw CENGN build upon its relationship with OPNFV. This year, CENGN hosted the first OPNFV interns - three students that were given resources, mentors and CENGN office space while they worked on their OPNFV projects. FY2017 also marked CENGN's launch of Canada's OPNFV Pharos lab, a testbed project that provides the hardware infrastructure for development, integration, deployment, and testing of the OPNFV platform. The Pharos lab, as well as CENGN's mission to build on Canada's strength and leadership in NGN, were showcased at the OPNFV Summit by CENGN CEO, Ritch Dusome, in Berlin, Germany. CENGN also brought Canadian SMEs Civimetrix Telecom, Corsa, inBay Technologies, Inocybe Technologies, and Kontron to the summit to show off their products, build partnerships, and potentially push their solutions to the global market.

CENGN Summit 2016

Smart Infrastructure - Smart World

The CENGN Summit is a full-day event organized for members of industry, academia, research, and government involved in the ICT industry. The summit allows for organizations to learn about the latest and greatest innovations in different ICT sectors, such as IoT, NGN, and cybersecurity. Besides this, sponsors and participants are given the opportunity to demonstrate their role in the industry through panels, keynote talks, and both presentations.

Demography Breakdown



1st Annual CENGN Summit
250+ Attendees
90+ Organizations

9 Keynote Speakers
12 Panel Members
12 Sponsors

CENGN Summit 2016 showcased several compelling keynote speakers from CENGN members, as well as presentations from City of Ottawa Mayor, Jim Watson, Member of Parliament, Karen McCrimmon, and Sir Terence Matthews, Chairman of Mitel. Beyond this, the summit showcased panels that represented the major challenges and opportunities facing NGN in Canada. The first panel focused on open networking innovation, the second on the role of Canada's service providers in the future of networking, and the third panel on how innovation hubs can foster development and innovation across Canada.



Website & Social Media

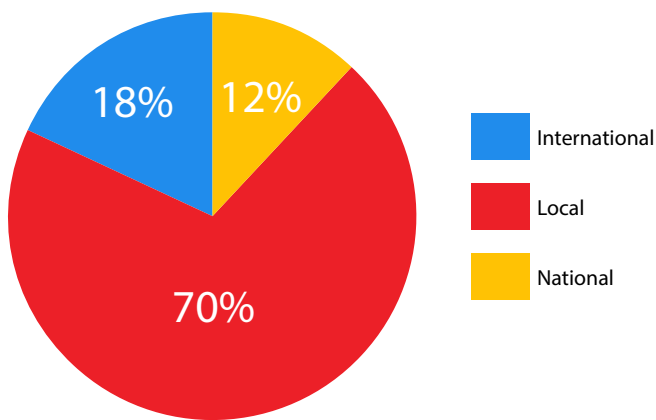
CENGN uses its website, social media, and newsletters as tools to stay engaged with its Canadian and international following and to grow its outreach in new target segments across the country. CENGN's followers are made up of both technical and business professionals from leading multinational organizations and Canadian small and medium enterprises, as well as public figure heads, not-for-profits, and researchers. In FY2017, CENGN sent **19,584** newsletters with an open rate of **31%**, **double the industry rate of 15%**. Over the year, CENGN saw a significant increase in engagement across all social media and its website.



Media Coverage

During FY2017, CENGN appeared in the news 33 times, being featured in articles from a variety of local, national, and international news sources. Breaking down the news coverage by topic, CENGN was featured in articles discussing innovative technology (33%), partnerships and members (27%), organizational growth (24%), and events (15%).

News Sources



“Among other things, CENGN hosts an internationally recognized data centre and infrastructure that companies can use to test their products. Having access to this type of facility is a major draw for the specialized talent that Kanata North is built on.”

Capital Mag | July

“CENGN’s fully operational multi-vendor data centre houses an OpenStack production environment connected to a real world WAN enabling connectivity speeds of more than 100 Gbps.”

Converge Network Digest | January

“CENGN is structured to create a “market pull” that is scalable, replicable and financially sustainable; a best practices model designed to accelerate the commercialization of next generation communications solutions.”

NCE/RCE | January

“I think of (CENGN) as a catalyst. What they’ve been able to do is bring folks in this space together to look at different opportunities to collaborate. That gives us the ability to do some prototyping, looking at some future ways of doing work together that maybe we wouldn’t have done otherwise.”

Ottawa Business Journal | February

Past Events



Discover TechNATA - Ottawa

OpenStack Summit - Texas

Startup Canada - Day on the Hill - Ottawa

TM Forum Live 2016 - France

Algonquin-hosted Cisco Academy Conference - Ottawa

CIRA Summit - Ottawa

OPNFV Summit 2016 - Berlin, Germany

SAVI Summit - Niagara Falls

IEEE-SA Open Source Symposium - Ottawa

TELUS-Juniper SDN/Network Automation Competition - Ottawa

Linuxcon North America - Toronto

ODL Summit - Washington

IEEE EPEC 2016 "horizons@EPEC" Conference - Ottawa

2nd Annual International Dinner Event (Kanata North BIA) - Ottawa

China Entrepreneurs Club (CEC) Luncheon & Roundtable (Invest Ottawa) - Ottawa

Fall Net Night - Ottawa (Carleton U)

Canarie Summit - Montreal

Introduction to SDN Training & ONF Certification Exam - Ottawa

CENGN Summit - Ottawa

Ottawa Autonomous Vehicles Summit - Kanata

Cyber Forum 613 - Ottawa

Winter Net Night - Carleton U

Mobile World Congress - Barcelona

Careers Celebration of Excellence - uOttawa



Empowered and IXIA Event at CENGN - Ottawa

NRC Smart City Trip - Eureka

Innovation Week - London/Stockholm

OCE Discovery - Toronto

OPNFV Plugfest - Denver

June CENGN Roadshow - Edmonton, Vancouver, Ottawa, Toronto, Montreal, Calgary, Halifax

Commercialization Committee Meeting - Ottawa

Atrium Webinar - Ottawa

Round Table-Canadian Cyber Security Companies Group CCSCG - Ottawa

Pharos Webinar - Online

Commercialization Committee Meeting - Ottawa

CENGN AGM - Ottawa

IoT613 - Ottawa

FedDev Meeting - Ottawa (CENGN)

Education & Economy Summit - Ottawa

OpenStack Day Canada - Montreal

5G Canada - Ottawa

Ottawa Open Source Networking Meetup - Ottawa

Economic Club of Canada 2017 - Ottawa

Summer Job Fair 2017 - Carleton U

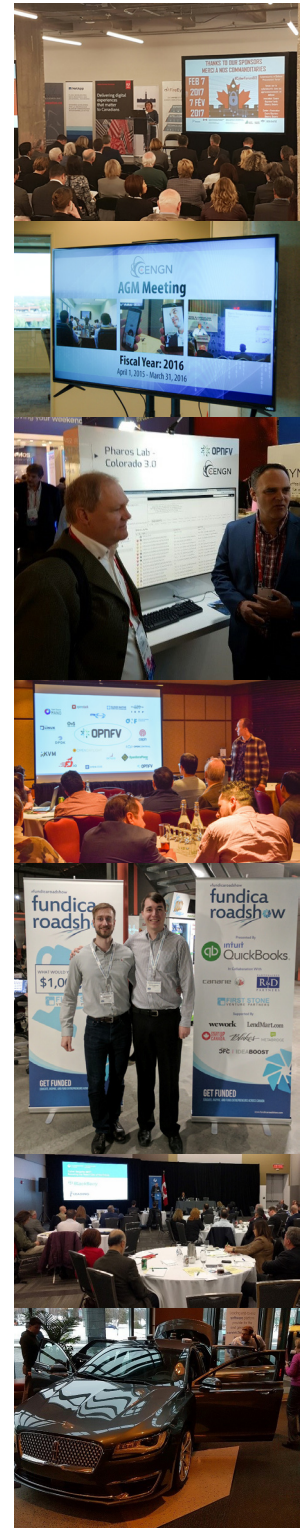
SDN Meetup - Montreal

Cyber Security - Ottawa

Open Source Networking Meetup - Ottawa



Ottawa Fundica Roadshow 2017 - Ottawa



Bold - Presented at, hosted, or sponsored event

Ontario Expansion



Expansion of CENG N Cloud Across Ontario

In May, CENG N was announced in the Ontario 2017 budget as a key player for the Ontario Government's 5G Technology initiative. The Ontario budget briefing identifies 5G networks as the back-bone of future technologies. Ontario will invest \$63.3 million over five years into CENG N's Cloud Expansion Project. The CENG N Cloud will connect 18 innovation centres across the province, directly supporting industries that underpin Ontario's economy, and provide SMEs with new, advanced networking capabilities.

The CENG N Cloud Expansion will advance the development and accessibility of NGN technology for SMEs in all areas of the province, as well as allow industries to leverage the increasingly important digital economy. With the new Ontario budget, CENG N will be able to support a much larger and widespread group of SMEs looking to commercialize their innovations. The Ontario CENG N Cloud Expansion will enable innovation in autonomous vehicles (AV), aerospace, public safety, cybersecurity, mining, eHealth, smart agriculture, and broadband Internet architecture in both rural and remote areas.



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