5G (ENCQOR) Technology Development Challenge

Artificial Intelligence/Machine Learning (AI/ML) Driven Multi-Layer Self-Optimizing Network (SON) for 5G era systems

Challenge Launch Date	• July 3, 2019
Challenge Deadline	• July 31, 2019
Challenge Statement	The objective of this research challenge is to develop and verify Artificial Intelligence/Machine Learning (AI/ML) driven approaches for automated design, planning and operations of 'full stack' 5G era systems employing the principles of self-organization and self-optimization.
Project Partner	• Ciena Corp
Timeline	2 years
Available funding	Up to $135 000
Applicant Type	• Ontario based University or College
Location	• Activities to be completed at the applicant institution and may include some travel to ENCQOR hub sites and/or Ciena office in Ottawa.
Project Details	5G is revolutionary. The extreme radio characteristics enabled by 5G networks will put wireless service capabilities on par with wireline broadband connectivity resulting in pervasive connectivity with a promise to connect anything, anywhere, at anytime. This pervasive connectivity when complemented with recent advances in machine intelligence, cloud, and robotics will lead to unprecedented immersive experiences provided by swarms of autonomous devices, thereby ushering in a new era of pervasive automation. Pervasive automation blurs planning, design and operations into a continuum. In this continuum optimum operation through is achieved on a ongoing basis by: 1. appropriate sensing of condition 2. discerning of meaning 3. inferring of current/potential deviation from desired operation 4. deciding on action 5. acting on these decisions to restore/maintain optimum operation.

	The expectation is that future service demands on 5G networks will be vastly complex and will evolve rapidly in directions that are not currently anticipated to support new technologies. This will create an increasing pressure for efficient utilization of resources. The complexity results from the inter-relationship, inter-action, and inter-connectivity of intelligent components (e.g., network nodes, access points, data centers) within a system and between this system and its dynamic environment. Managing the complexity of such systems with dynamically responsive evolving arrangement of intelligent components becomes the key challenge of future market-place. Considering also the spread of performance demand, as well as regulatory and commercial demarcations, along with the absence of any single governing body, the overall system will necessarily be a fluid federation of distributed intelligences. In the ultimate system, the arrangement of all parts of the system including those of the resulting intelligence will be determined by the system itself, i.e., the system will be Self Organizing and Self Optimizing. The key objective of this research challenge is to explore various approaches to manage complexity of future systems with non-traditional design and operational methodologies, employing principles of self-organization and self-optimization. One of the first uses of self-optimizing or self-governing systems came about in cellular radio systems, with the Self Optimizing Networks (SON) capabilities specified by NGMN and 3GPP for optimization of resources across heterogenous access networks. These systems, however, are based on static policies and limited in functional scope that addresses 3GPP RAT (Radio Access Technologies) only. The objective of this project is to discover, assess, implement and verify various approaches to employ use of classical machine learning techniques to the development of a self optimizing network. Machine learning techniques may include Deep Neural Networks, as well as new intelligence sciences, e.g. Emergent Intelligence, for design, planning and operations of full stack self-organizing and self-optimizing systems. Some examples may include multi-layer organization and optimization of multiple functional stacks comprising of heterogenous radio resources (e.g. 3GPP and non 3GPP RAT), fixed access and transport resources (e.g. optical wavelengths), and compute and store infrastructure resources contributed by disparate providers.

Project Goals/ Outcomes	The outcome of the project should be a Pre-commercial lab trial of 5G SON for optimization of e2e 5G stack running in two or more Innovation Hubs on the ENCQOR network. Other goals/ deliverables that are of interest to the Anchor Firm (Ciena): - Architecture, interfaces and information models - Software artifacts including but not limited to mobility data plane and control plane software, automation software, ML algorithms, policy signatures.
Applicant Capabilities	Ciena is seeking academic teams with expertise in the following areas: • 5G control plane, data plane and management plane • 3GPP SON systems • Data Science, Artificial Intelligence, Deep Learning • Self-Optimizing systems design, models and algorithms • Autonomic systems design, models and algorithms
Additional Information	If awarded funding selected applicants will be supported directly by project resources from the Ciena CTO organization • This challenge is related to the following ENCQOR challenge from fall 2018: Self Optimizing Fabric Research and Co Creation- Academic

Launched in 2018, the ENCQOR 5G Academic Technology Development Program partners Ontario based Researchers with ENCQOR 5G Anchor Firms on 5G technology development projects. Areas of research interest are defined by Challenge Statements submitted to OCE by the ENCQOR 5G Anchor Firms and posted to the OCE website on a rolling basis.

If you are interested in developing an expression of interest, please visit the program guidelines for information on next steps.

For any questions about new Challenge Statements or the ENCQOR 5G SME Technology Development Program please contact Sarah Fairlie at sarah.fairlie@oce-ontario.org'