## ENCQOR 5G Technology Development Challenge Statement

**Sensor-less Sensing of 5G Application Traffic**

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<tr>
<th><strong>Challenge Launch Date</strong></th>
<th>• December 13, 2018</th>
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<td><strong>Challenge Deadline</strong></td>
<td>• January 24, 2019</td>
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| **Challenge Statement**    | • **Sensor-less Sensing of 5G Application Traffic.**
                                5G networks are designed to provide an ultra-reliable, high speed communications infrastructure that can serve billions of devices, machines, and vehicles. A transformation from traditional human-based applications (e.g., video and voice) to industrial automation, UAVs, autonomous vehicle (AV) communications, and augmented and virtual reality (AR/VR) based applications is therefore anticipated. However, the underlying characteristics of 5G application traffic requires in-depth investigation and modeling to drive optimization of network architecture and functions across the 5G protocol stack.

As such, the challenge of this project is to:
1) develop deterministic and artificial intelligence solutions (e.g., deep generative modeling) for various 5G applications using real data-sets, and
2) develop techniques to classify and predict real-time 5G application traffic including short and long-term forecasts, and individual user and aggregate network traffic. The methodologies should require minimal application layer and contextual information and as such be “sensor-less”.

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<th><strong>Project Partner</strong></th>
<th>• Ericsson Canada Inc.</th>
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<td><strong>Timeline</strong></td>
<td>• 2 Years</td>
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<td><strong>Available funding</strong></td>
<td>• 100,000 CAD</td>
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<td><strong>Applicant Type</strong></td>
<td>• Ontario based College/University</td>
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<td><strong>Location</strong></td>
<td>• Work can be completed remotely with scheduled online meetings and face-to-face workshops</td>
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| **Project Details** | • **The main scope includes:**
   o **Modeling Traffic of 5G Applications:**
     ▪ Creating big data sets of various 5G applications such as AR/VR, Uplink/Downlink data traffic generated from |
Autonomous and Unmanned Aerial Vehicles (UAV), M2M and IoT devices.

- Developing both deterministic and artificial-intelligence based models for 5G application traffic.
- The created models should include time and space dimensions and consider both the individual user and network level traffic.

  ▪ **Techniques to Classify and Predict Real-time 5G Traffic**
    - Develop artificial intelligence (AI) or machine learning (ML) techniques to identify key features of each application type using the real data sets and models.
    - Develop perception and reasoning techniques to provide real-time data prediction over various time horizons.

- **Strategic importance for the development of the industry and the ENCQOR consortium:**
  - The challenge targets a largely unexplored area of classifying and predicting future 5G application which is paramount to optimizing 5G network architecture and protocols.
  - Builds a strong competence in artificial intelligence and machine learning for real world applications among Canadian early stage researchers.

### Project Goals/Outcomes

- Big data set of traffic patterns generated from 5G applications such as VR/AR, UL/DL traffic from autonomous vehicles, industrial automation and IoT devices.
- Mathematical and generative AI models (e.g., deep generative models) that represent patterns of 5G traffic applications.
- ML/AI-based techniques for real-time classification of 5G network traffic, and predictive models the can forecast traffic over various time horizons.

**Deliverables:**

- Stored and preprocessed big datasets containing 5G traffic streams for various applications.
- Derivations of the mathematical models for 5G application traffic.
- Supervised/unsupervised trained machine learning/AI models that classify 5G traffic and extract the key features of different applications.
  - All the models should be developed using open source ML/AI suites (e.g., Python and R libraries).
- A detailed assessment of the developed algorithms and their accuracy under various user traffic combinations.

### Applicant Capabilities

- 2 researchers (M.Sc. or Ph.D. level)
- Strong background in statistics, machine learning, data analytics, linear/non-linear optimization and artificial intelligence.
- Experienced in application traffic modeling.
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<th>Additional Information</th>
<th>N/A</th>
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