

5G (ENCQOR) Technology Development Challenge

Distributed Mobility Management of Ultra Reliable Low Latency Communications

Challenge Launch Date	January 3, 2019
Challenge Deadline	January 31, 2019
Challenge Statement	<p>Ultra-Reliable Low-Latency Communications services have time critical operations which necessitate that control and intelligence are close, in physical terms, to the point of data collection and processing to ensure appropriate control function performance. In future, Access Clouds providing connect, compute and store adjacent to end users, will support high-speed control loops governing the operation of such applications in concert with the control loops running within the user devices themselves. Many of the users of these services will be mobile requiring occasional transfer of the application stack hosted in the Access Cloud between physical data centers. Many user applications will be non-stallable during this transfer. Mechanisms to ensure this transfer are not well understood and are the focus of this research area. The goal is to develop procedures, methods and algorithms to support seamless transfer of control loops between data centers with operating timeframes in the ms to 10's ms ranges.</p>
Project Partner	Ciena
Timeline	It is anticipated that solutions will take at least two years to develop and verify.
Available funding	Up to \$150 000
Applicant Type	Ontario based College/University.
Location	Ontario
Project Details	<p>Edge Compute (EC) offers processing capabilities for applications requiring stringent latency and reliability constraints, such as Tactile Internet or Autonomous Driving, through micro data centers distributed across networks. The location of full function application stacks is dependent upon the performance and latency constraints of the application as well as resource (Spectrum as well as DC resources) accessibility and availability. This imposes serious technological challenges, particularly for mobile applications requiring high degree of mobility with stringent latency and reliability performance constraints.</p> <p>Multiple tiers of data centers are anticipated for communications service provider networks, with addition of two tiers to metro topologies – an Access DC physically close to the user and used for ultra reliable low latency</p>

	<p>communication services, e.g. Tactile Internet, and a larger Local DC offering lower cost support for locality driven application stacks that are not constrained by stringent requirements, e.g. content delivery.</p> <p>Many Ultra Reliable Low Latency services (e.g. TI) are anticipated to be highly mobile while requiring low latency and high reliability from the network. While distributing functional components closer to the user is necessary to serve time/performance sensitive applications, it introduces a significant degree of complexity in mobility management procedures which are currently designed for centrally anchored applications. For example, user flows which are anchored at the Packet Data Network Gateway (P-GW) located in a central location in current implementations, would be distributed down to the Access DC for serving TI applications.</p> <p>This necessitates creative mobility management techniques that allow for seamless transfer of full stack applications across Access Data Centers while preserving the stringent latency constraints driven by the service requirements. Mobile services will require that application support moves seamlessly between Access DCs. Non-stallable applications will require that mechanisms be found so that users perceive application availability seamlessly during application transfers. Control loop performance of TI applications must also be maintained by keeping the transport latency within the budget. This will likely require rich interconnection within Access Clouds in some portions of networks.</p> <p>A solution will encompass all aspects of a network (hardware & software) plus full stack application coordination to resolve. It is necessary that a solution be found to enable highly mobile ultra reliable low latency applications in public and private networks.</p>
<p>Project Goals/ Outcomes</p>	<p>Deliverables will include:</p> <ul style="list-style-type: none"> - Solution concepts and algorithms encompassing processor hardware and control software structure - Solution concepts describing boundary conditions requiring the deployment of additional network connectivity between Access DCs - Techniques and methods to maintain control function during transfer of application anchor point (e.g. transfer of state data between control application instances) - Data set definitions derived from network sensing to enable solutions
<p>Applicant Capabilities</p>	<p>Project resources will be drawn from the Ciena CTO organization, SME and Acadamia. The skills required for the project are listed below:</p> <ul style="list-style-type: none"> - Extensive Mobility Management design and algorithms - Distributed Cloud System design - Distributed Shared Memory systems design - Distributed Systems and Advanced IPC techniques <p>Applied Intelligence and self-learning algorithms pertaining to mobile control and data plane design.</p>

Additional Information	There has been some initial work performed by edge computing forums to look into this topic but with significantly relaxed criteria, e.g. Open Edge Computing. It is also suggested applicants peruse the IEEE 5G 2017 and 2018 Dresden summit material related to this topic.