Université de Rennes

Appel à projets - Année 2025

Contrats doctoraux «Ordinaires»

Direction de la Recherche et de l'Innovation

ECOLE DOCTORALE : Matisse **POLE DE RECHERCHE : Mathématique-Numérique**

Unité de recherche d'accueil

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Sujet

Titre : Latency-Driven container network optimization in edge industrial IoT

Mots clés : Edge-Computing, Routing, Performance Evaluation, Latency-based optimization

Cotutelle internationale (oui/non) : non **Si oui, préciser l'établissement et le pays de rattachement** :

Descriptif (15-30 lignes) :
Contexte socioéconomique et scientifique ; Les hypothèses et questions posées ; Les grandes étapes de la thèse et démarche ; Approches méthodologiques et techniques envisagées

Cloud computing and its three facets (IaaS, PaaS and SaaS) have become essential in today's Internet Applications, offering many advantages such as scalability, elasticity or flexibility. Although countless businesses have moved their IT operations to the cloud, there remains many challenges to enable cloud technologies to address a very wide variety of needs.

In the context of IIoT applications (i.e. critical response time environments such as Manufacturing or Monitoring of critical equipment) latency is at the center of a tremendous number of studies to optimize the placement of resources in distributed architectures. To ensure that the quality of service is guaranteed, several solutions exist to reconfigure the components placement (migration) and can reduce the overall latency by changing the components and routes. However, knowing precisely which component is the source of the problematical latency remains scarcely addressed. When taking a decision for a reconfiguration or a migration, which can be triggered due to latency issue, it can be beneficial to check if the source of the latency can be solved before instantiating a migration or a full reconfiguration. Some studies exist where a comparison of response time is done between the major cloud actors depending on the load. Proper measurement protocols exist but always refer to specific case studies and would not allow to be integrated in edge systems.

The objective of this thesis is to study the optimization of the container network in Edge-based IIoT systems based on latency measurement, by evaluating the control plane cost of a change in the architecture. It will particularly address the problem of how to identify the origin of a latency issue, and based on this finding, propose routing optimizations that take into account the cost and elasticity of the control plane.

➢ Ce document est à renvoyer par la direction de l'unité de Recherche aux animateurs du Pole Recherche et à l'école Doctorale pour le 13 février 2025 au plus tard