Self-organizing Architectures for Autonomic Management of Future Cities

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By 2030, 60% of the world's population is expected to live in cities placing an increasing strain on their transportation, security, business, communication, water-management, and energy-supply systems. To improve quality of life and ensure sustainability, future cities will rely on information technology to optimize the delivery of services and the use of resources. In this context, our research is exploring how self-organizing algorithms can be used for autonomic management of urban-scale critical infrastructures. In this presentation I will describe two case studies of the use of such algorithms to improve urban traffic control (UTC) and highway management respectively. Within the REALT project, we are applying our Distributed W-Learning (DWL) algorithm to decentralised optimization of UTC systems towards multiple heterogeneous policies. An evaluation of DWL in a large-scale simulation of urban traffic shows significant performance improvements over traditional techniques, for example, significantly shortening average vehicle waiting time at high traffic loads. Within the Managed Motorway project, a collaborative cruise control system is being developed to improve road transportation reliability by actively shaping traffic in order to improve the predictability of journey times. The presentation will also consider a number open research questions in the field

Vinny Cahill holds a Personal Chair in Computer Science at Trinity College Dublin where he also serves as Head of the Discipline of Computer Systems. Prof. Cahill's research addresses many aspects of distributed systems, in particular, middleware and programming models for mobile, ubiquitous and autonomic computing with application to optimization of urban resource usage and service delivery in order to improve the quality of life and sustainability of cities. He has a particular interest in self-organizing systems. He has published over 100 peer-reviewed publications in international conferences and journals. Contact him at vinny.cahill@scss.tcd.ie or www.dsg.scss.tcd.ie/~vjcahill