Fractal clustering and similarity measure methods for analysis of Wireless LAN controller efficiency

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Abstract

The efficiency of WiFi system with dozens of base stations in relative small physical area is determined by the optimal allocation of the radio channels to the mobile devices. Based on the increased penetration rate of the high traffic capable smart phones and accentuated usage of these devices in dense populated buildings intelligent hardware tools are needed to offer QoS level to the users. The radio resource management of IEEE 802.11 network is provided by a wireless LAN controller. This node maintains an allocated control connection to each of the base stations providing enhanced quality level of the WiFi hot zone services. Modern base stations have capability to listen periodically the radio channels to detect the signal intensity. The controller samples in different moments each of the channels without affecting the own radio frame processing and collects in this way radio resource usage. Based on special criteria like number of active nodes, traffic intensity, interference, noise intensity the periodically executed management algorithm modifies the distribution of active channels on the hot zone level. In our concept scanning the radio signal intensity of each channel by the base stations can be considered as a sampling process of individual sensor data distributed in physical space. Eighteen WiFi access points having each thirteen channel sensors in 2.4 GHz range and sixteen channel sensors in 5 GHz range were used to capture radio signal intensity in a dense populated building. Holding special criteria in the scanned signal intensity values is considered as a complex event. Fractal clustering and similarity measure methods were used to analyse sensor grouping behaviour of the radio resource management algorithm of the wireless controller. Our work is focused on usability of Hurst parameter and fractal dimension to characterize efficiency of the wireless LAN controller.

Keywords: WiFi LAN, Sensor Network, Internet of Things, Complex Event Processing, Event Stream Processing, Self-Similarity, Hurst exponent, Hausdorff dimension, Box-counting dimension.

MSC: 65C60, 60G35, 91A28

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