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**Fast Cell Discovery in mm-wave 5G Networks with Context Information**

**Abstract:**

The exploitation of mm-wave bands is one of the key-enabler for 5G mobile radio networks. However, the introduction of mm-wave technologies in cellular networks is not straightforward due to harsh propagation conditions that limit the mm-wave access availability. Mm-wave technologies require high-gain antenna systems to compensate for high path loss and limited power. As a consequence, directional transmissions must be used for cell discovery and synchronization processes: this can lead to a non-negligible access delay caused by the exploration of the cell area with multiple transmissions along different directions. The integration of mm-wave technologies and conventional wireless access networks with the objective of speeding up the cell search process requires new 5G network architectural solutions. Such architectures introduce a functional split between C-plane and U-plane, thereby guaranteeing the availability of a reliable signaling channel through conventional wireless technologies that provides the opportunity to collect useful context information from the network edge.

In this article, we leverage the context information related to user positions to improve the directional cell discovery process. We investigate fundamental trade-offs of this process and the effects of the context information accuracy on the overall system performance. We also cope with obstacle obstructions in the cell area and propose an approach based on a geo-located context database where information gathered over time is stored to guide future searches. Analytic models and numerical results are provided to validate proposed strategies.

**Existing System:**

Having been used for many years as a reference technology in point-to-point links, standardization groups are now approaching mm-wave exploitation from a different angle: the Radio Access Network (RAN) design. This opens up new challenges as mm-wave RAN technology might suffer from severe propagation losses combined with an adverse propagation environment. On the one hand, the weak ability to diffract around obstacles makes mm-wave communications vulnerable to blockage problems, as witnessed by the hard characterization of mm-wave channel models. On the other hand, the short wavelength allows the use of antenna arrays with a relatively large number of elements accommodated in a small space, both on the base station (BS) and on the user’s mobile terminal (MT).

**Proposed System:**

Analytical results are further supported by exhaustive simulations to assess the impact of uncertainty in the localization and propagation impairments in realistic scenarios. To the best of our knowledge, this is the first work investigating the impact of obstacles on the cell search process. Their effect, combined with the inaccuracy of the location information, can severely harm the cell discovery procedure. To deal with this issue, we propose a geo-located context database able to speed up the cellular attachment operations by storing and processing the information about the previous cell discovery attempts. The proposed framework enables the use of mm-wave communications in radio access networks by providing a fast and reliable cell discovery procedure in realistic network scenarios.