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UTILIZATION OF SOFTWARE-DEFINED RADIO AS A BACKBONE FOR CONTEMPORARY GROUND STATION INFRASTRUCTURE

Abstract

Traditionally, communication with orbiting satellites has been established through specialized radio transceivers or DVB-S2/S modems. These devices tend to be expensive and application specific. In recent years, Software-Defined Radios (SDRs) have been rising in popularity due to their low cost and ability to emulate various hardware functions, handling a wide range of frequencies and modulation schemes. SDRs combine standard RF front-end with an analog-to-digital converter, allowing for post processing in the digital domain. In general, signal processing is a computationally expensive task, especially when performed on wideband signals, and still requires specialized hardware to meet tight timing requirements. However, modern environments for development of signal processing applications take advantage of contemporary advanced vector extensions (AVX) in common instruction set architectures (e.g. x86-64) and allow for parallel processing via single instruction, multiple data (SIMD) operations. Such optimization techniques have proven that sophisticated real-time DSP applications can be developed and deployed on consumer-grade computers rather than specialized FPGA or ASIC designs. This paper describes the difference between traditional hardware modems and SDR-based systems, giving insight on how SDRs are changing current ground station infrastructure and satellite operations.