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Distributed radiofrequency signal acquisition and synthesis along a White Rabbit network using embedded boards (Raspberry Pi4 + SPEC)

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White Rabbit (WR) allows for synchronizing any device on a dedicated GbE network with
sub-ns accuracy (typically 60 ps at 1s integration time) most often materialized by providing 1-PPS and 10 MHz outputs. However, practical applications for distributed coherent radiofrequency (RF) synthesis or acquisition, e.g. for a distributed RADAR requiring coherent local oscillators and synchronized sampling for Direction of Arrival measurement, must exploit the WR clocks. After demonstrating last year [1] the use of WR implemented on PCi SPEC boards on embedded single board computers (OEM version of the Raspberry Pi4), we discuss how the WR-synchronized clocks can be used for generating the signals needed for RF signal synthesis and acquisition, first by using external network synchronizing dedicated peripherals (ADi AD9548) and then thanks to CERN's control of the Si570 oscillator controlling the analog to digital converter of the FMC-ADC board implemented by Tomasz Włostowski. We show from phase noise measurements that the local oscillator fluctuation is the main source of instability and the phase locked loops do not add additional noise. Perspectives include merging distributed acquisition brought by the WRTD project with this PLL controlling feature to provide coherent acquisition capability.
[1] https://github.com/oscimp/WRTD-FMC-ADC