Wideband Interference Cancellation for mmWave Communication

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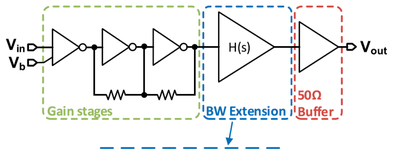
Communication at mmW Frequency

- Global data traffic to grow 7X by 2021 at a CAGR of 47% from 7 Exabytes in 2016 – Cisco Visual Networking Index.
- Multi-Gigabit data-rates possible with large un-congested bandwidths at mmW (27-40GHz).
- Efficient space-frequency sharing and secure communication with Beamforming.
- Multi-carrier wide-channel BW with complex modulation (for e.g. >64-QAM) is hard to equalize for keeping quadrature & gain flatness.

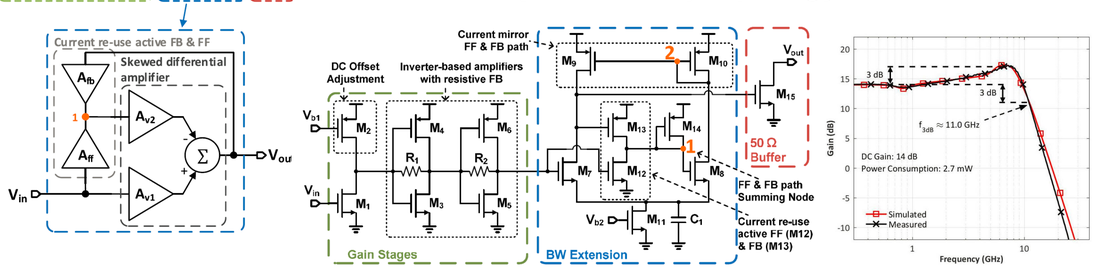
Recent Work at WSU

- Systems-level modeling of spatial interference cancellation for wide channel bandwidths
- Multi-antenna Tx/Rx modeling in MATLAB
- 10GHz wide bandwidth amplifiers
- 8-bit asynchronous voltage-to-time-to-digital ADC with highly linear time-amplifier
- Baseband solution for mitigating spatial interference

Wideband Baseband Amplifier

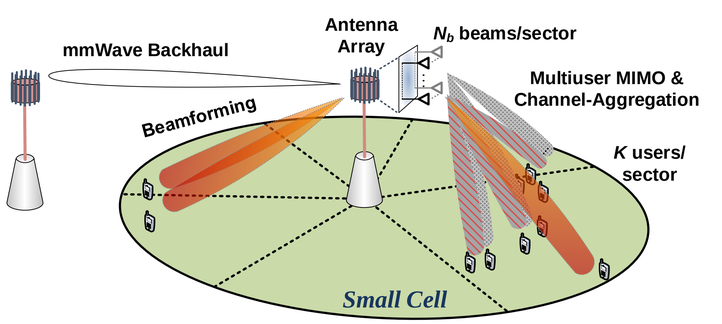


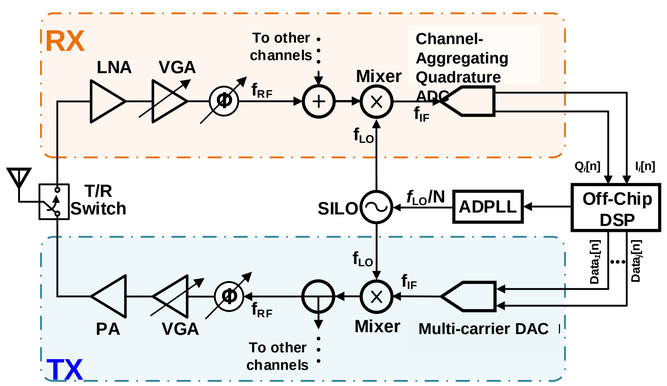
Gain-boosted, BW enhanced amplifier using a current reuse FF (Feed-Forward) and FB (Feed-Back) topology



A skewed differential amplifier architecture is proposed. This allows greater design control to improve nonlinear behavior of the amplifier.

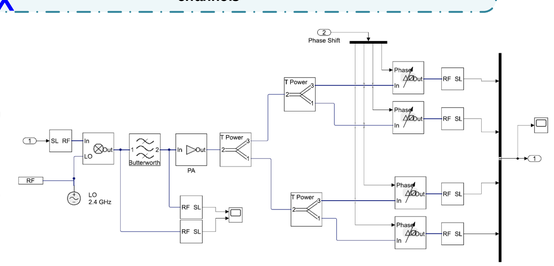
Dense mmW Networks

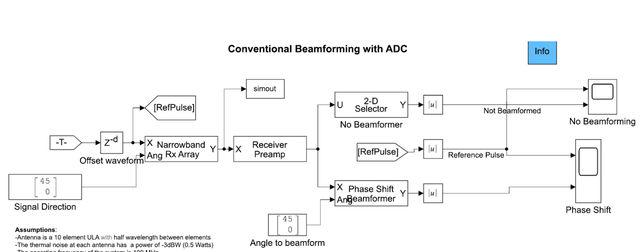




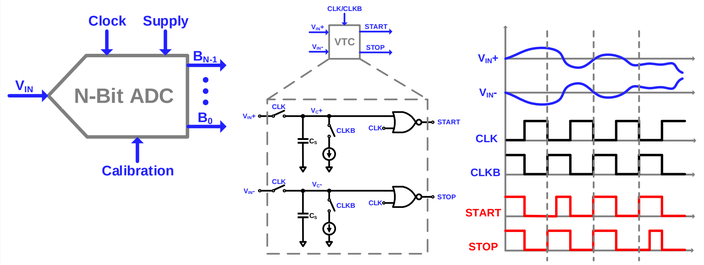
- Beamforming architecture proposed for easier reconfigurability and overcoming losses at mmW frequencies.
- Dense network architectures result in significant interference because of side-lobes
- Spectral congestion requires interference-free communication of signals adjacent in space
- Conventional phase-shift based interference cancellation results in insufficient cancellation of wideband interferes
- Requires large dynamic range of following ADC's
- 16-element array with ability to process higher order modulation schemes up to 512-QAM

MATLAB Multi-Antenna TX

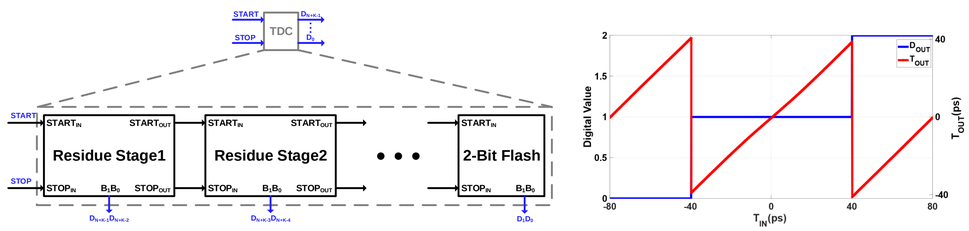




Asynchronous Time-Based Pipeline ADC



Linear NOR-based voltage-to-time converter



Conclusions & Future Work

Future Work

- Investigate wideband cancellation and high-resolution high-bandwidth data converters
- Demonstration of complete mmW Front-end design.

Acknowledgements

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