Orca

Orchestration and Reconfiguration Control Architecture

SHOWCASE 2

LOW LATENCY INDUSTRIAL COMMUNICATION

GOALS

This demonstration illustrates how ORCA SDRs can provide low-latency communications for remote robot control where a high-level of reliability is required.

CHALLENGES

- Providing requirements for various types of applications.
- Efficient spectrum sharing for industrial applications.
- Maintaining flexibility without compromising latency performance.
- Optimum hardware resource utilization to enable concurrent transmission on multiple channels by using the same hardware accelerator.

CONCEPT

- Standard compliant and run-time reprogrammable SDRs.
- Latency-enhancements to baseline standard compliant operation.
- Multi-channel virtualized transmitters deployed on a single hardware.
- Full duplex capable communication nodes.
- Reliable GFDM link.

RESULTS

-The cloud-based robot controller achieves a round-trip time below 1.3 ms on a software defined radio based PHY and MAC.

- A GFDM transmission, until -83 dBm receive power and equivalent to 700 m free space path loss, is employed to utilize the spectrum optimally.
- The virtualized transmitters are run-time configurable while they share the same hardware resources.
- 80-90 dB self-interference suppression by analog and digital self-interference cancellers, which allows a high-throughput in-band full duplex wireless link.

INNOVATION

- Reprogrammable standard compliant and full-duplex capable SDRs with high and low level MAC and reconfigurable real-time PHY
- A virtual transmitter behaves as eight dedicated transmitters sharing a single powerful hardware platform.
- Flexible non-orthogonal waveform transceiver capable of low-latency FDD communications for outdoor scenarios.

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DEMO SET UP

- Real-time networking for small robots: multiple standard compliant ORCA SDRs form a wireless network to connect two brainless robots to a central processing unit (Fig. 1 (up)).
- GFDM link for mission-critical communication: high-performance and robust GFDM communication, which enables advanced robot control (Fig. 1 (down)).
- Low Latency concurrent communication link: An SDR based hardware virtual transmitter communicates simultaneously with up to 8 commercial off the shelf chips on different frequency bands (Fig.2 (up))
- High-throughput bi-directional link: Two full duplex capable SDRs communicate simultaneously over the same channel. (Fig.2 (down)).

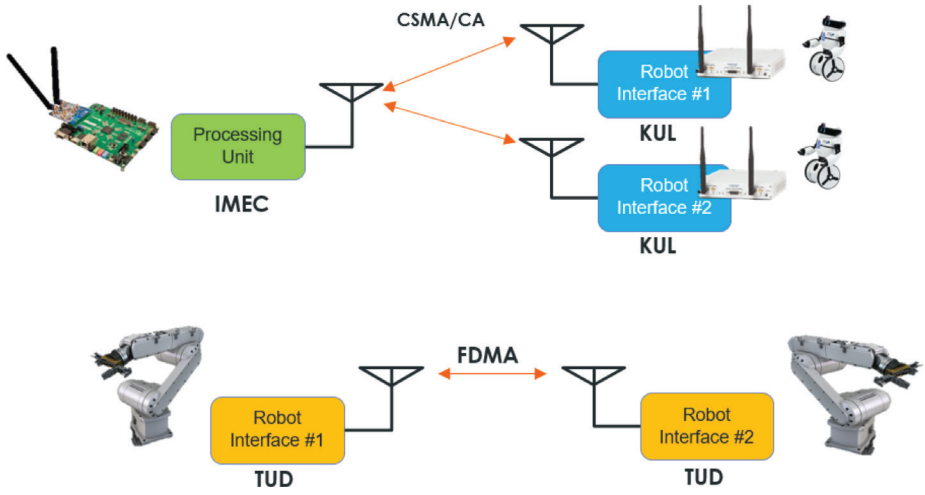

Fig. 1. Multiple wireless communication technologies for low-latency industrial applications.

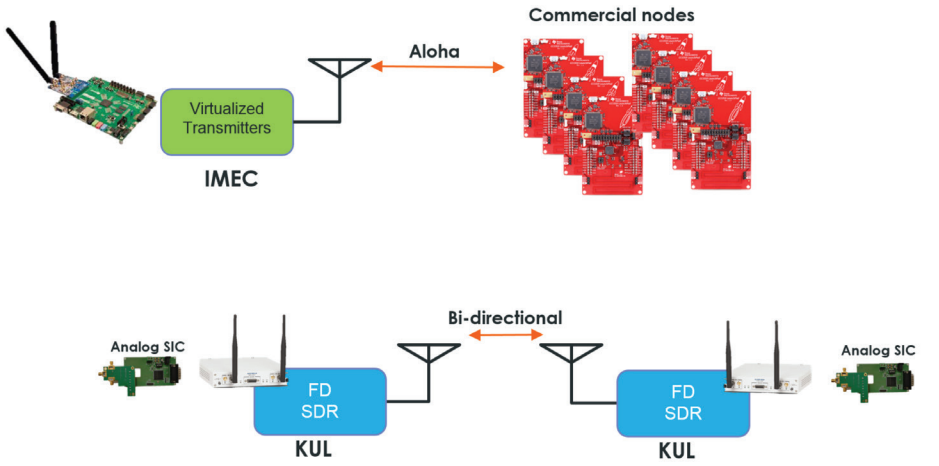

Fig. 2. (Up) A low latency concurrent communication link of the virtual transmitter with commercial off the shelf chips. (Down) In-band full duplex communication link by EBD-equipped SDRs

IMPACT

The presented ORCA achievements in this showcase open a wide perspective for researchers by employing various technologies, such as full-duplex, GFDM and hardware virtualization, in a realistic scenario where the reliability relies on the latency performance of the network.