



Selahattin Gökceli

Selahattin Gökceli received a bachelor's degree in electronics and communication engineering from Istanbul Technical University (ITU) in Turkey in 2015. He is working on his master's degree in telecommunication engineering at the same university. He has served as a member of the ITU Wireless Communication Research Laboratory since 2014. He is an NI Certified LabVIEW Associate Developer, and he has used LabVIEW as a programming tool in projects such as software defined radio implementations of OFDMA-based NCC systems, cooperative communication, and 5G techniques like full-duplex communication. His research interests include cooperative communication networks and 5G techniques.



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Semiha Tedik Başaran received bachelor's and master's degrees in telecommunication engineering from Istanbul Technical University in 2011 and 2014, respectively. She is working on a doctorate in telecommunication engineering at the university. Her research interests include full-duplex communication, power minimization of relay-aided transmission, network coding, and general communication theories.

OFDMA-Based Network Coded Cooperation Testbed: Implementation and Performance Results

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System Model

- Network coding implies combining the received packets at intermediate nodes, and it can improve the transmission reliability or transmission rate, according to the soft forwarding technique^[1]. Due to the broadcast nature of wireless networks, cooperative gain is inherently obtained in the network coding system, leading to network coded cooperation (NCC) systems^[2].
- Transmission of multiple nodes can be ensured by using time-division multiple access (TDMA) or frequency-division multiple access (FDMA). As an efficient implementation of FDMA, orthogonal frequency-division multiple access (OFDMA) can be used to serve multiple nodes under the condition of frequency-selective channels that may be encountered in both phases.
- We investigated the performance of an NCC-OFDMA system through image transmission by using software defined radio nodes. The implementation details are given in^[3]. As indicated with measurements, NCC is a very powerful technique for improving transmission quality. The proposed NCC-OFDMA scheme based on packet transmission significantly improves BER performance, according to direct transmission, and images can be received successfully.

Model Parameters

Carrier frequency	2.45 GHz
I/Q data rate	1 MS/sec
Number of bits used in one frame	2080 bits
Number of 4-QAM symbols	1040 samples
Number of subcarriers of the one user data portion	320 samples
Number of reference subcarriers	40 samples
Number of source/relay/destination node	3/1/1
Zero padding/DFT/CP length	120/1200/300 samples
Distance between sources and destination	50 cm

OFDMA Frame Structure

	Subcarrier Index						
	0-59	60-419	420-599	600	601-780	781-1140	1141-1199
ZP Sequence		Info+Reference	Info+Reference	DC	Info+Reference	Info+Reference	ZP Sequence
S_1	60 Samples 0 Sequence	360 Samples 180 Samples	0 Sequence 180 Samples	1 Sample	0 Sequence 180 Samples	0 Sequence 360 Samples	59 Samples 0 Sequence
S_2	60 Samples 0 Sequence	0 Sequence 360 Samples	180 Samples 180 Samples	1 Sample	0 Sequence 180 Samples	0 Sequence 360 samples	59 Samples 0 Sequence
S_3	60 Samples 0 Sequence	0 Sequence 360 Samples	0 Sequence 180 Samples	1 Sample	0 Sequence 180 Samples	360 Samples	59 Samples 0 Sequence

Testbed and Implementation

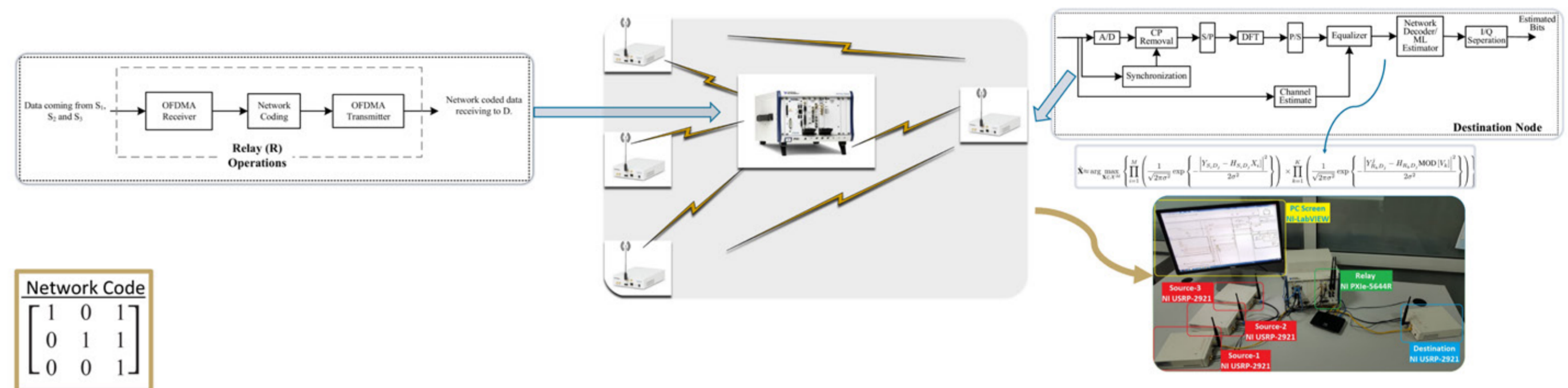


Figure 1. Implemented NCC-OFDMA Testbed

Results

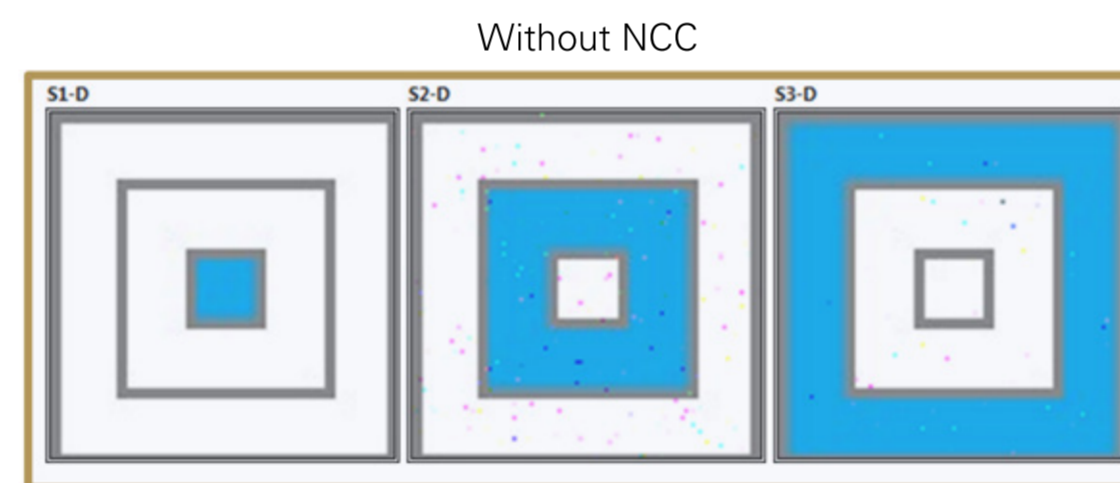


Figure 2. Received Images at Direct Link

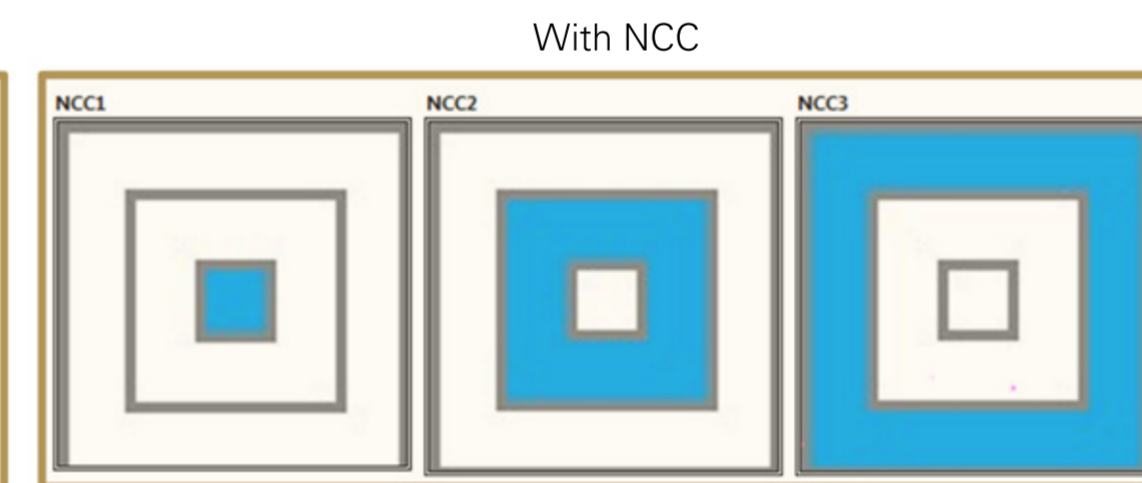


Figure 3. Received Images at Network Decoder

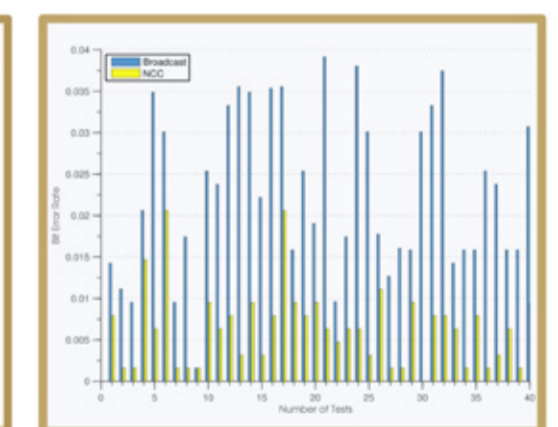


Figure 4. Link Performance Comparison for Source Nodes

References

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