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Implementation of CDMA Encoding/Decoding Method for On Chipusing Verilog

Avinash 1, B.Raja Rao2
1P.G Student, VLSI
2 Associate Professor, Department of Electronics and Communication Engineering, Kits engineering College,divili.

Abstract
Code Division Multiple Access (CDMA) is proposed as the physical layer empowering influence of Network-On-Chip (NoC) interconnects for its conspicuous highlights, for example, settled idleness, ensured benefit, and diminished framework multifaceted nature. CDMA interconnects have been received by the NoC people group as it begins in remote correspondences where each piece in a CDMA encoded information word is transmitted on a different channel to maintain a strategic distance from obstruction. Be that as it may, the remote obstruction issue can be productively moderated in on-chip interconnects dispensing with the requirement for imitating the CDMA channel. Also, remote channels are successive ordinarily which isn't the situation in on-chip interconnects where parallel transports are the default correspondence implies. After CDMA was received by the NoC people group, a similar remote CDMA plot has been kept up where every datum bit is encoded in a different CDMA channel and the encoding/deciphering rationale is duplicated for information parcels. In this work, we present a novel CDMA encoding/deciphering plan called Aggregated CDMA (ACDMA) for NoC interconnects in which all bundle bits are encoded in a solitary CDMA channel, thusly, wiping out the zone and vitality overheads came about because of imitating the channel encoding/translating rationale.

I. INTRODUCTION

Current Systems-on-chips (SoCs) are winding up hugely parallel with numerous agreeably interconnected Processing Elements (PEs). Interconnecting the PEs is ordinarily accomplished through transports and Networks-on-Chips (NoCs) [1]. In NoCs, traded information is packaged into parcels and cross a few system layers going by the physical layer which characterizes how bundles are really transmitted between NoC units. The physical layer of a NoC is actualized by switches utilizing crossbar switches. Code Division Multiple Access (CDMA) is a medium sharing system that use symmetrical codes to empower synchronous bundle directing. Not at all like timeshared channels, CDMA use the code space to empower channel sharing. CDMA has been proposed as an on-chip interconnect strategy for both transport and NoC interconnect designs [2]. Numerous favorable circumstances of utilizing CDMA for onchip interconnects incorporate lessened power utilization, settled correspondence inertness, and decreased

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framework multifaceted nature [3]. Using CDMA in NoC interconnects is embraced from the remote interchanges writing, where the information is spread by symmetrical codes at the transmitters, the spread information are included the remote channel, and the gotten total is decoded at the beneficiaries. Established CDMA frameworks depend on the Walsh symmetrical code family to empower medium sharing. Many research bunches have examined a few parts of CDMA in NoCs, including our gathering which introduced the Overloaded CDMA for on-chip Interconnects (OCI) [4] [5] [6]. A 14-hub CDMA-based system has been produced in [7]. The system uses 7 Walsh codes and task of the Walsh codes to the system hubs is dynamic dependent on the demand from every hub. Two structures have been presented in [7]: a sequential CDMA organize where every datum contribute the spreading code is sent in one clock cycle; and a parallel CDMA arrange where all information chips are sent in a similar cycle. The sequential and parallel CDMA-based systems have been contrasted with an ordinary CDMA organize, a meshbased NoC, and a Time Division Multiple Access (TDMA) transport. For a similar system region, the throughput of the parallel CDMA arrange is higher than that of the work based NoC and the TDMA transport because of the concurrent medium access nature of CDMA. Standard-premise codes are proposed as a substitution to Walsh CDMA codes in [8]. Standard-premise codes look like TDMA flagging on the grounds that each code comprises of just a solitary chip of one and the rest of the chips are zeros. The TDMA codes' symmetry empowers them to supplant the Walsh codes as spreading and despreading CDMA codes, which decreases the multifaceted nature of the channel viper and decoder as the whole of TDMA codes is restricted to zero or one for each clock cycle.

2.Existing method

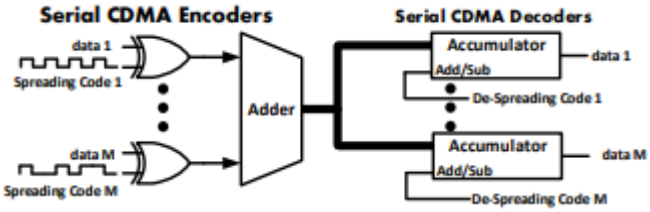

Figure 1. Conventional CDMA crossbar .

The traditional CDMA crossbar utilized in the writing is portrayed in Figure 1. The crossbar interconnects N transmit ports to N get ports utilizing N-chip length Walsh spreading codes. The parallel information from each transmit port is encoded utilizing a XOR encoder; the information bit is XORed with a one of a kind N-chip spreading code doled out to the transmit-get combine and transmitted in N clock cycles. Information spread from all encoders are included by the CDMA channel snake and sent to all get port. The decoder at each get port concentrates the information from the channel entirety by associating the channel total with the relegated

spreading code. The connection activity is executed utilizing an aggregator and a multiplexer since the despreading code chips are unipolar ("0" or "1"). In the majority of the CDMA interconnect related work, every datum bit in an information word is encoded and transmitted in a different CDMA channel and the encoding/translating rationale is repeated W times for information bundles of width W which is an immediate use of the remote CDMA standards in NoC interconnects. Be that as it may, remote correspondence channels are successive essentially because of the impedance issue. Different access and MIMO procedures can empower simultaneous information transmission on a similar remote channel to the detriment of expanding the transmitter/collector unpredictability. in on-chip interconnects, then again, a solitary channel can be effectively used to empower parallel information transmission as clamor and obstruction impacts can be proficiently relieved [9]. In this work, we present a solitary channel, multi-bit CDMA crossbar in particular Aggregated CDMA (ACDMA) NoC crossbar.

3. PROPOSED NOC CROSSBAR ARCHITECTURE

The ACDMA crossbar actualizes the psychical layer of the NoC by interconnecting N transmit (TX) ports to N get ports where the information width of each port is W where W = log2 max(dj). The abnormal state design of the ACDMA crossbar delineated in Figure 2(a) is made out of three principle parts; encoders, channel snake, and decoders. The encoders spread information from every TX port utilizing W XOR entryways as appeared in Figure 2(b). Rather than including the spreading chips of the Walsh symmetrical code to the outcome in the encoder hinder as recommended by (2), this activity is put off to the direct snake obstruct with the end goal to consolidate the channel viper with the spreading code adders. The yield of each encoder is, in this manner, restricted to W-bit width. The encoder yields are then included to frame the whole Si of (3). To limit the basic way of the channel snake, the expansion is finished utilizing a tree viper engineering as delineated by Figure 2(c) where the leafs of the tree are the encoders of every TX port, and the base of the tree is the channel aggregate yield. Since there are N leafs, the stature of the tree is log2(N). The width of the yield wires from every viper in the tree is equivalent to the width of the info wires in addition to one to counteract floods. Since the contribution to the firs dimension of adders is (W +1)- bit wide and the stature of the viper tree is log2(N), at that point the width of the yield wires at the root snake is W +1+log2(N). Pipeline registers are embedded after each phase in the tree to limit the basic way of the channel. The entirety Si is then sent to all the N decoders, a decoder for every RX port.

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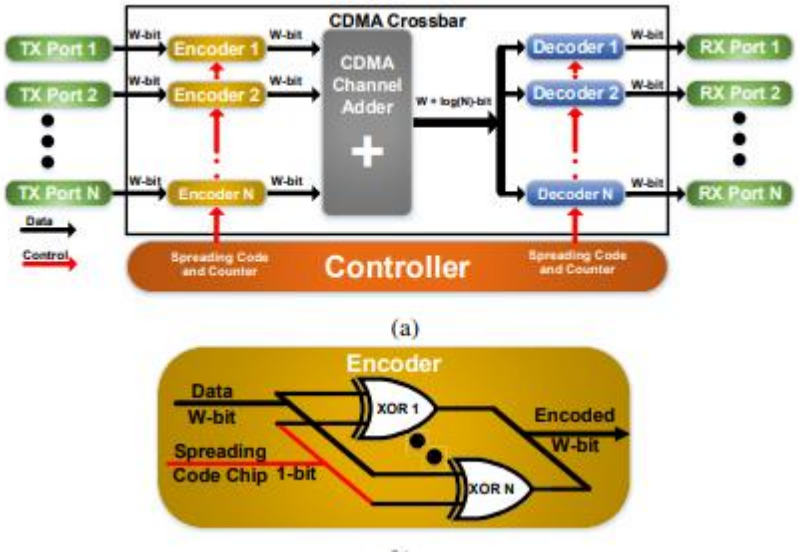

Figure 2. (a) ACDMA crossbar high-level architecture

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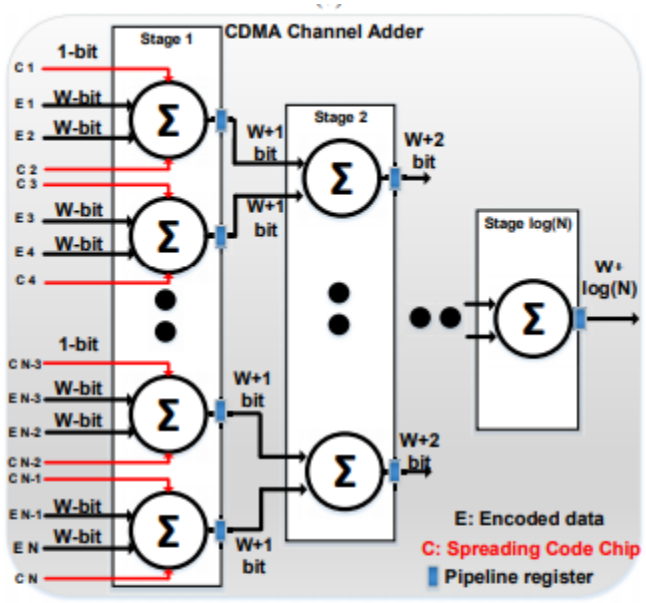
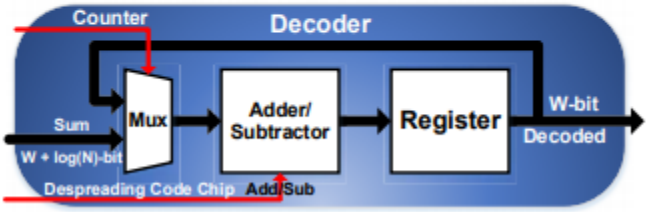


(c)



(d)

Figure 2. (c) ACDMA channel adder, (d)ACDMA decoder

The decoders execute the cross-connection of (4) in a cost productive way; the decoder comprises of just a viper/subtracter and an enlist arranged as an up/down gatherer as appeared in Figure 2(d). Since the despreading code Ck comprises of ±1 chips, cross connection is decreased to basic expansion and subtraction tasks of resulting wholes Si . Along these lines, the decoder is executed as an up/down aggregator; the snake/subtracter includes or subtracts the entirety Si from the outcome spared in the registers as per the benefit of despreading chip Ci k. Specifically, when the despreading chip is '1', the snake adds Si to the substance of the enroll however subtracts Si from the substance of the enlist when the despreading chip is '- 1'. Toward the finish of the disentangling cycle, the collector enlist holds N dk as indicated by (5), and on the grounds that N = 2n and n is a number, information dk is decoded by moving the gatherer content by log2(N) bits.

The quantity of two information XOR doors is the equivalent for the two circuits. The enhancement of the ACDMA crossbar over the regular CDMA crossbar is obvious in the

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quantity of channel viper wires; in the traditional CDMA crossbar, the quantity of the snake wires for the single-piece channel is expanded by one in each phase because of the extra convey bit. Along these lines, the quantity of viper wires in stage I is equivalent to 1+log2(N)−i. For a W-bit word, the quantity of viper wires is expanded to W+W(log2(N)−i), and since there are 2i adders at each stage, at that point the aggregate number of wires is equivalent to log2N−1 i=0 2i (W +W(log2N −i)). In the ACDMA crossbar, on the other hand, the quantity of snake wires for a W-bit word is W +log2(N)−i, which makes the aggregate number of wires equivalents to log2N−1 i=0 2i (W +log2N −i) which is a factor of W not as much as that of the regular CDMA crossbar. The lessened number of convey bits of the ACDMA crossbar is the prime explanation behind its prevalence. The quantity of wires for the decoder aggregator and the quantity of flip-slumps in the decoder registers is relative to the quantity of channel wires—the last phase of the viper. This pursues the multifaceted nature of the ACDMA crossbar is in a request of W not as much as that of the ordinary CDMA crossbar.

Simulation RESULTS

Device Utilization Summary (estimated values)			[-]
Logic Utilization	**Used**	**Available**	**Utilization**
Number of Slices	20	14752	0%
Number of Slice Flip Flops	19	29504	0%
Number of 4 input LUTs	31	29504	0%
Number of bonded IOBs	16	250	6%
Number of GCLKs	1	24	4%

Fig 3 Design summary

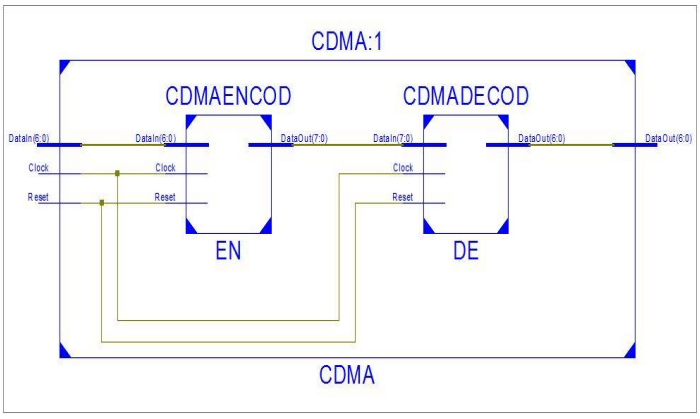

Fig 4. RTL Schematic

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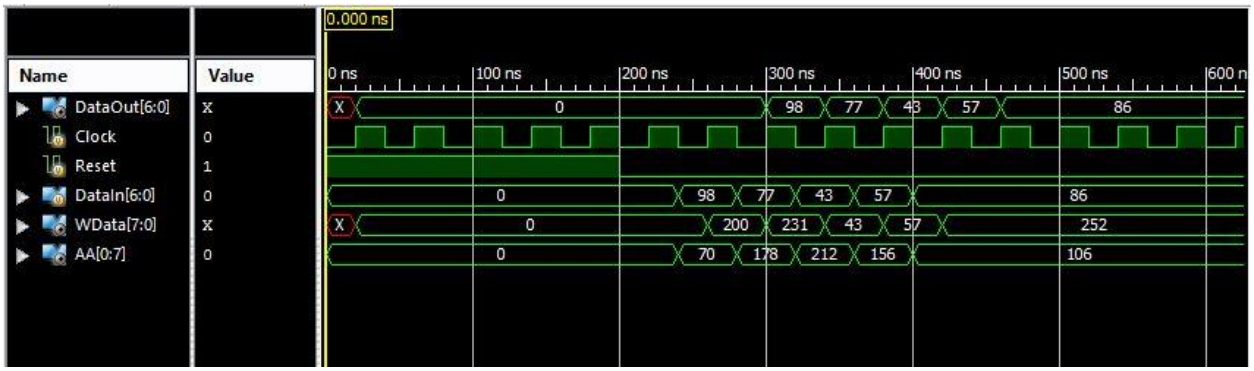

Fig 5. Encoder output

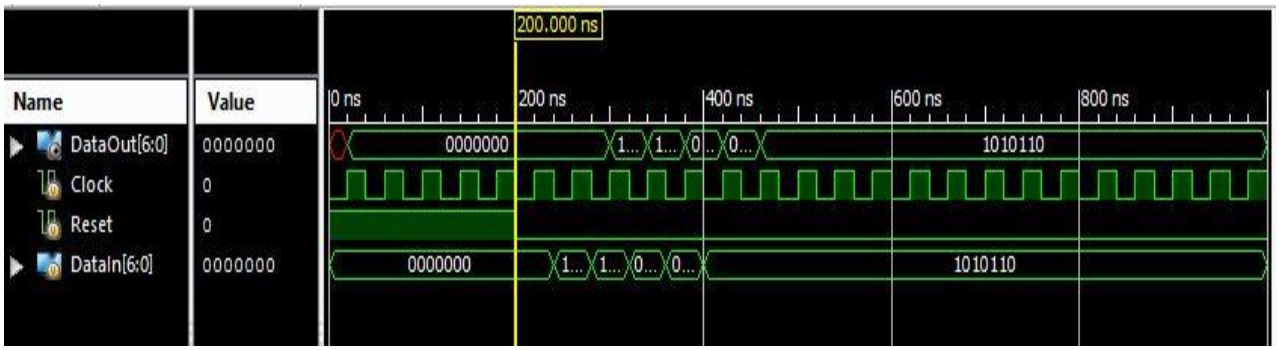

Fig 6. Decoder output

```
================================================================================
Timing constraint: Default OFFSET OUT AFTER for Clock 'Clock'
  Total number of paths / destination ports: 7 / 7
--------------------------------------------------------------------------------
Offset:              4.394ns (Levels of Logic = 1)
  Source:            DE/DataOut_6 (FF)
  Destination:       DataOut<6> (PAD)
  Source Clock:      Clock rising

  Data Path: DE/DataOut_6 to DataOut<6>
                                Gate     Net
    Cell:in->out      fanout   Delay   Delay  Logical Name (Net Name)
    ----------------------------------------  ------------
     FDR:C->Q             3    0.591   0.531  DE/DataOut_6 (DE/DataOut_6)
     OBUF:I->O                 3.272          DataOut_6_OBUF (DataOut<6>)
    ----------------------------------------
    Total                      4.394ns (3.863ns logic, 0.531ns route)
                                       (87.9% logic, 12.1% route)

================================================================================
```

Fig 7. Encoder output

V. CONCLUSION

In this work, we exhibited the ACDMA NoC crossbar to empower parallel transmission of multi-bit information bundles on a solitary CDMA channel. The overhead of channel replication is moderated which results in up to 60.5% territory and 55% power funds with 124% enhancement in throughput per region contrasted with the traditional CDMA crossbar. As a future work, we intend to construct and assess a full ACDMA-based NoC under various remaining tasks at hand and steering conventions.

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