VLSI LAYOUTS OF FULLY CONNECTED GENERALIZED NETWORKS

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CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0037US entitled "FULLY CONNECTED GENERALIZED MULTI-STAGE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0038US entitled "FULLY CONNECTED GENERALIZED BUTTERFLY FAT TREE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0039US entitled "FULLY CONNECTED GENERALIZED REARRANGEABLY NONBLOCKING MULTI-LINK MULTI-STAGE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0040US entitled "FULLY CONNECTED GENERALIZED MULTI-LINK BUTTERFLY FAT TREE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0041US entitled "FULLY CONNECTED GENERALIZED FOLDED MULTI-STAGE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0042US entitled "FULLY CONNECTED GENERALIZED STRICTLY NONBLOCKING MULTI-LINK MULTI-STAGE NETWORKS" by Venkat Konda assigned to the same assignee as the current application, filed concurrently.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1A is a diagram 100A of an exemplary symmetrical multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ having inverse Benes connection topology of nine stages with N = 32, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1B is a diagram 100B of the equivalent symmetrical folded multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ of the network 100A shown in FIG. 1A, having inverse Benes connection topology of five stages with N = 32, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1C is a diagram 100C layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 1B, in one embodiment, illustrating the connection links belonging with in each block only.

FIG. 1D is a diagram 100D layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 1B, in one embodiment, illustrating the connection links ML(1,i) for i = [1, 64] and ML(8,i) for i = [1,64].

FIG. 1E is a diagram 100E layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 1B, in one embodiment, illustrating the connection links ML(2,i) for i = [1, 64] and ML(7,i) for i = [1,64].

FIG. 1F is a diagram 100F layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 1B, in one embodiment, illustrating the connection links ML(3,i) for i = [1, 64] and ML(6,i) for i = [1,64].

FIG. 1G is a diagram 100G layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 1B, in one embodiment, illustrating the connection links ML(4,i) for i = [1, 64] and ML(5,i) for i = [1,64].

FIG. 1H is a diagram 100H layout of a network $V_{fold-mlink}(N,d,s)$ where N = 128, d = 2, and s = 2, in one embodiment, illustrating the connection links belonging with in each block only.

FIG. 1I is a diagram 100I detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$.

FIG. 1J is a diagram 100J detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$.

FIG. 1K is a diagram 100K detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$.

FIG. 1K1 is a diagram 100M1 detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$ for s = 1.

FIG. 1L is a diagram 100L detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$.

FIG. 1L1 is a diagram 100L1 detailed connections of BLOCK 1_2 in the network layout 100C in one embodiment, illustrating the connection links going in and coming out when the layout 100C is implementing $V(N,d,s)$ or $V_{fold}(N,d,s)$ for s = 1.

FIG. 2A1 is a diagram 200A1 of an exemplary symmetrical multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ having inverse Benes connection topology of one stage with N = 2, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention. FIG. 2A2 is a diagram 200A2 of the equivalent symmetrical folded multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ of the network 200A1 shown in FIG. 2A1, having inverse Benes connection topology of one stage with N = 2, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention. FIG. 2A3 is a diagram 200A3 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2A2, in one embodiment, illustrating all the connection links.

FIG. 2B1 is a diagram 200B1 of an exemplary symmetrical multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ having inverse Benes connection topology of one stage with N = 4, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention. FIG. 2B2 is a diagram 200B2 of the equivalent symmetrical folded multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ of the network 200B1 shown in FIG. 2B1, having inverse Benes connection topology of one stage with N = 4, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention. FIG. 2B3 is a diagram 200B3 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2B2, in one embodiment, illustrating the connection links belonging with in each block only. FIG. 2B4 is a diagram 200B4 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2B2, in one embodiment, illustrating the connection links ML(1,i) for i = [1, 8] and ML(2,i) for i = [1,8].

FIG. 2C11 is a diagram 200C11 of an exemplary symmetrical multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ having inverse Benes connection topology of one stage with N = 8, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention. FIG. 2C12 is a diagram 200C12 of the equivalent symmetrical folded multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ of the network 200C11 shown in FIG. 2C11, having inverse Benes connection topology of one stage with N = 8, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 2C21 is a diagram 200C21 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2C12, in one embodiment, illustrating the connection links belonging with in each block only. FIG. 2C22 is a diagram 200C22 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2C12, in one embodiment, illustrating the connection links ML(1,i) for i = [1, 16] and ML(4,i) for i = [1,16]. FIG. 2C23 is a diagram 200C23 layout of the network $V_{fold-mlink}(N,d,s)$ shown in FIG. 2C12, in one embodiment, illustrating the connection links ML(2,i) for i = [1, 16] and ML(3,i) for i = [1,16].

FIG. 2D1 is a diagram 200D1 of an exemplary symmetrical multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ having inverse Benes connection topology of one stage with N = 16, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 2D2 is a diagram 200D2 of the equivalent symmetrical folded multi-link multi-stage network $V_{fold-mlink}(N,d,s)$ of the network 200D1 shown in FIG. 2D1, having inverse Benes connection topology of one stage with N = 16, d = 2 and s=2, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

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