FULLY CONNECTED GENERALIZED FOLDED MULTI-STAGE 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-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.

This application is related to and incorporates by reference in its entirety the U.S. Provisional Patent Application Docket No. M-0045US entitled "VLSI LAYOUTS OF FULLY CONNECTED GENERALIZED 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 folded multi-stage network $V_{fold}(N,d,s)$ having inverse Benes connection topology of five stages with N = 8, d = 2 and s=2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1A1 is a diagram 100A1 of an exemplary symmetrical folded multi-stage network $V_{fold}(N,d,2)$ having Omega connection topology of five stages with N = 8, d = 2 and s=2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1A2 is a diagram 100A2 of an exemplary symmetrical folded multi-stage network $V_{fold}(N,d,2)$ having nearest neighbor connection topology of five stages with N = 8, d = 2 and s=2 with exemplary multicast connections, 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 a general symmetrical folded multi-stage network $V_{fold}(N,d,2)$ with $(2\times\log_d N)-1$ stages 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 of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1,N_2,d,2)$ having inverse Benes connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1C1 is a diagram 100C1 of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ having Omega connection topology of five stages with N_1 = 8, N_2 = p* N_1 = 24 where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1C2 is a diagram 100C2 of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ having nearest neighbor connection topology of five stages with N_1 = 8, N_2 = p* N_1 = 24 where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1D is a diagram 100D of a general asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ with N_2 = p* N_1 and with $(2 \times \log_d N) - 1$ stages strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections in accordance with the invention.

FIG. 1E is a diagram 100E of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ having inverse Benes connection topology of five stages with N_2 = 8, N_1 = p* N_2 = 24, where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1E1 is a diagram 100E1 of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ having Omega connection topology of five stages with N_2 = 8, N_1 = p* N_2 = 24, where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1E2 is a diagram 100E2 of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ having nearest neighbor connection topology of five stages with N_2 = 8, N_1 = p* N_2 = 24, where p = 3, and d = 2 with exemplary multicast connections, strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections, in accordance with the invention.

FIG. 1F is a diagram 100F of a general asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 2)$ with N_1 = p* N_2 and with $(2 \times \log_d N) - 1$ stages strictly nonblocking network for unicast connections and rearrangeably nonblocking network for arbitrary fan-out multicast connections in accordance with the invention.

FIG. 2A is a diagram 200A of an exemplary symmetrical folded multi-stage network $V_{fold}(N, d, s)$ having inverse Benes connection topology of five stages with N = 8, d = 2 and s=1 with exemplary unicast connections rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 2B is a diagram 200B of a general symmetrical folded multi-stage network $V_{fold}(N, d, 1)$ with $(2 \times \log_d N) - 1$ stages rearrangeably nonblocking network for unicast connections in accordance with the invention.

FIG. 2C is a diagram 200C of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 1)$ having inverse Benes connection topology of five stages with N_1 = 8, N_2 = p* N_1 = 24 where p = 3, and d = 2 with exemplary unicast connections rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 2D is a diagram 200D of a general asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 1)$ with N_2 = p* N_1 and with $(2 \times \log_d N) - 1$ stages rearrangeably nonblocking network for unicast connections in accordance with the invention.

FIG. 2E is a diagram 200E of an exemplary asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 1)$ having inverse Benes connection topology of five stages with

$N_2 = 8$, $N_1 = p^* N_2 = 24$, where p = 3, and d = 2 with exemplary unicast connections rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 2F is a diagram 200F of a general asymmetrical folded multi-stage network $V_{fold}(N_1, N_2, d, 1)$ with $N_1 = p^* N_2$ and with $(2 \times \log_d N) - 1$ stages rearrangeably nonblocking network for unicast connections in accordance with the invention.

FIG. 3A is a diagram 300A of an exemplary symmetrical multi-stage network $V(N, d, s)$ having inverse Benes connection topology of five stages with N = 8, d = 2 and s = 1, rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 3B is a diagram 300B of an exemplary symmetrical multi-stage network $V(N, d, s)$ (having a connection topology built using back-to-back Omega Networks) of five stages with N = 8, d = 2 and s = 1, rearrangeably nonblocking network for unicast connections.

FIG. 3C is a diagram 300C of an exemplary symmetrical multi-stage network $V(N, d, s)$ having an exemplary connection topology of five stages with N = 8, d = 2 and s=1, rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 3D is a diagram 300D of an exemplary symmetrical multi-stage network $V(N, d, s)$ having an exemplary connection topology of five stages with N = 8, d = 2 and s = 1, rearrangeably nonblocking network for unicast connections, in accordance with the invention.

FIG. 3E is a diagram 300E of an exemplary symmetrical multi-stage network $V(N, d, s)$ (having a connection topology called flip network and also known as inverse shuffle exchange network) of five stages with N = 8, d = 2 and s = 1, rearrangeably nonblocking network for unicast connections.

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