FULLY CONNECTED GENERALIZED REARRANGEABLY NONBLOCKING MULTI-LINK 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-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.

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 multi-link multi-stage network $V_{mlink}(N,d,s)$ having inverse Benes connection topology of five stages 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. 1B is a diagram 100B of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ (having a connection topology built using back-to-back Omega Networks) of five stages 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. 1C is a diagram 100C of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having an exemplary connection topology of five stages 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. 1D is a diagram 100D of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having an exemplary connection topology of five stages 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. 1E is a diagram 100E of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ (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=2, 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 an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having Baseline connection topology of five stages 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. 1G is a diagram 100G of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having an exemplary connection topology of five stages 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. 1H is a diagram 100H of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having an exemplary connection topology of five stages 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. 1I is a diagram 100I of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ (having a connection topology built using back-to-back Banyan Networks or back-to-back Delta Networks or equivalently back-to-back Butterfly networks) of five stages 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. 1J is a diagram 100J of an exemplary symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ having an exemplary connection topology of five stages 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. 1K is a diagram 100K of a general symmetrical multi-link multi-stage network $V_{mlink}(N,d,s)$ with $(2\times\log_d N)-1$ stages with s=2, 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 asymmetrical multi-link multi-stage network $V_{mlink}(N_1,N_2,d,s)$ having inverse Benes connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, 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. 1B1 is a diagram 100B1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1,N_2,d,s)$ (having a connection topology built using back-to-back Omega Networks) of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, 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. 1C1 is a diagram 100C1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1,N_2,d,s)$ having an exemplary connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, 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. 1D1 is a diagram 100D1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1,N_2,d,s)$ having an exemplary connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, 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. 1E1 is a diagram 100E1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1,N_2,d,s)$ (having a connection topology called flip network and also known as inverse shuffle exchange network) of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where p = 3, 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. 1F1 is a diagram 100F1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1, N_2, d, s)$ having Baseline connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where $p = 3$, $d = 2$ 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. 1G1 is a diagram 100G1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1, N_2, d, s)$ having an exemplary connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where $p = 3$, $d = 2$ 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. 1H1 is a diagram 100H1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1, N_2, d, s)$ having an exemplary connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where $p = 3$, $d = 2$ 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. 1I1 is a diagram 100I1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1, N_2, d, s)$ (having a connection topology built using back-to-back Banyan Networks or back-to-back Delta Networks or equivalently back-to-back Butterfly networks) of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where $p = 3$, $d = 2$ 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. 1J1 is a diagram 100J1 of an exemplary asymmetrical multi-link multi-stage network $V_{mlink}(N_1, N_2, d, s)$ having an exemplary connection topology of five stages with $N_1 = 8$, $N_2 = p^* N_1 = 24$ where $p = 3$, $d = 2$ 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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