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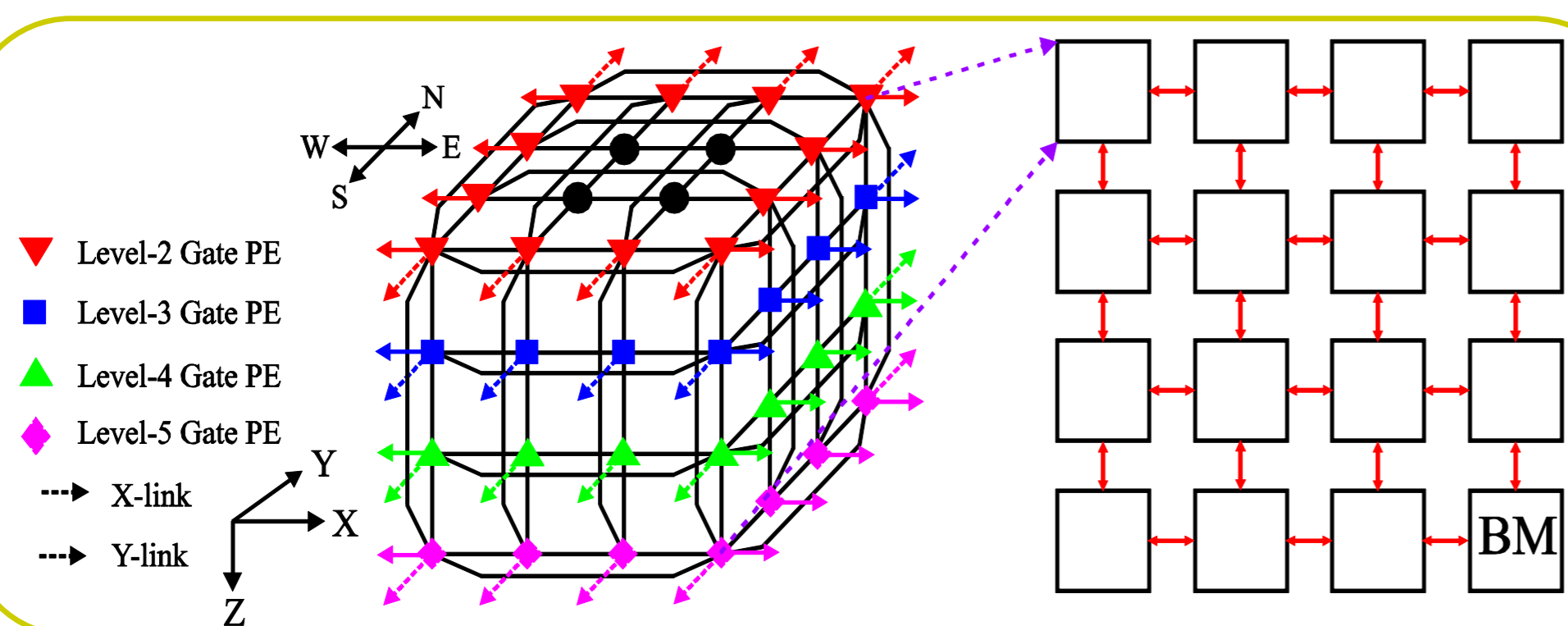
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Abstract

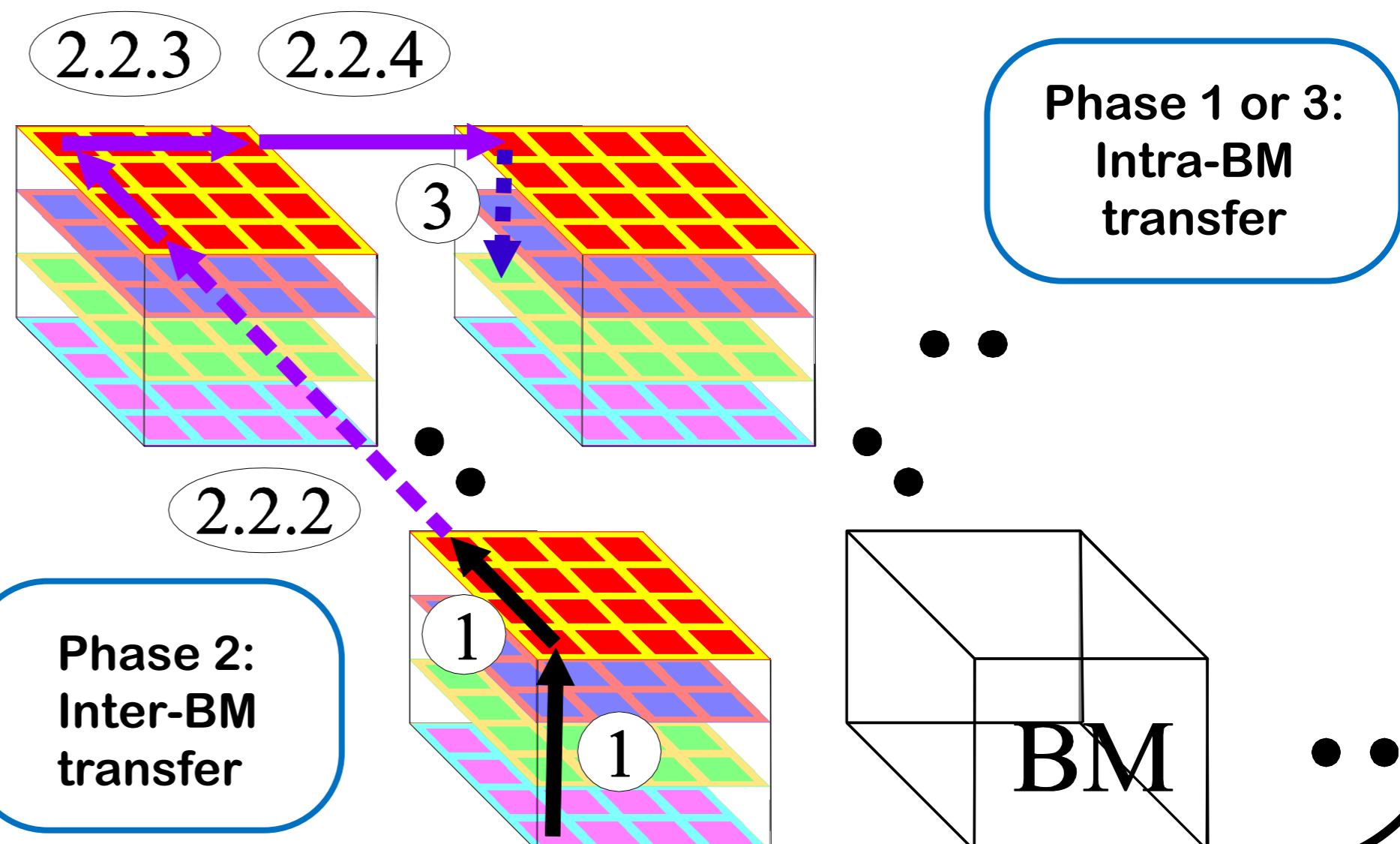
A Hierarchical 3D-Mesh (H3DM) Network is a 2D-mesh network of multiple basic modules, in which the basic modules are 3D-torus networks that are hierarchically interconnected for higher-level networks. In this paper, we evaluate the dynamic communication performance of a H3DM network using a deadlock-free routing algorithm with minimum number of virtual channels under the uniform and non-uniform traffic patterns; and compare it with other networks to show the superiority of the H3DM network over other networks. We have also evaluated the dynamic communication performance of the mesh and torus networks. It is shown that H3DM network yields low average transfer time than that of mesh and torus networks. The trade-off between throughput and latency of these networks shown that H3DM network provide better dynamic communication performance than that of mesh and torus networks before saturation.

1. Architecture of a H3DM Network



- Basic Module is a 3D-torus network ($m \times m \times m$)
- Higher level network is a 2D-mesh network ($n \times n$).
- Level ($i-1$) is used as subnets of Level- i .

2. Routing of Message

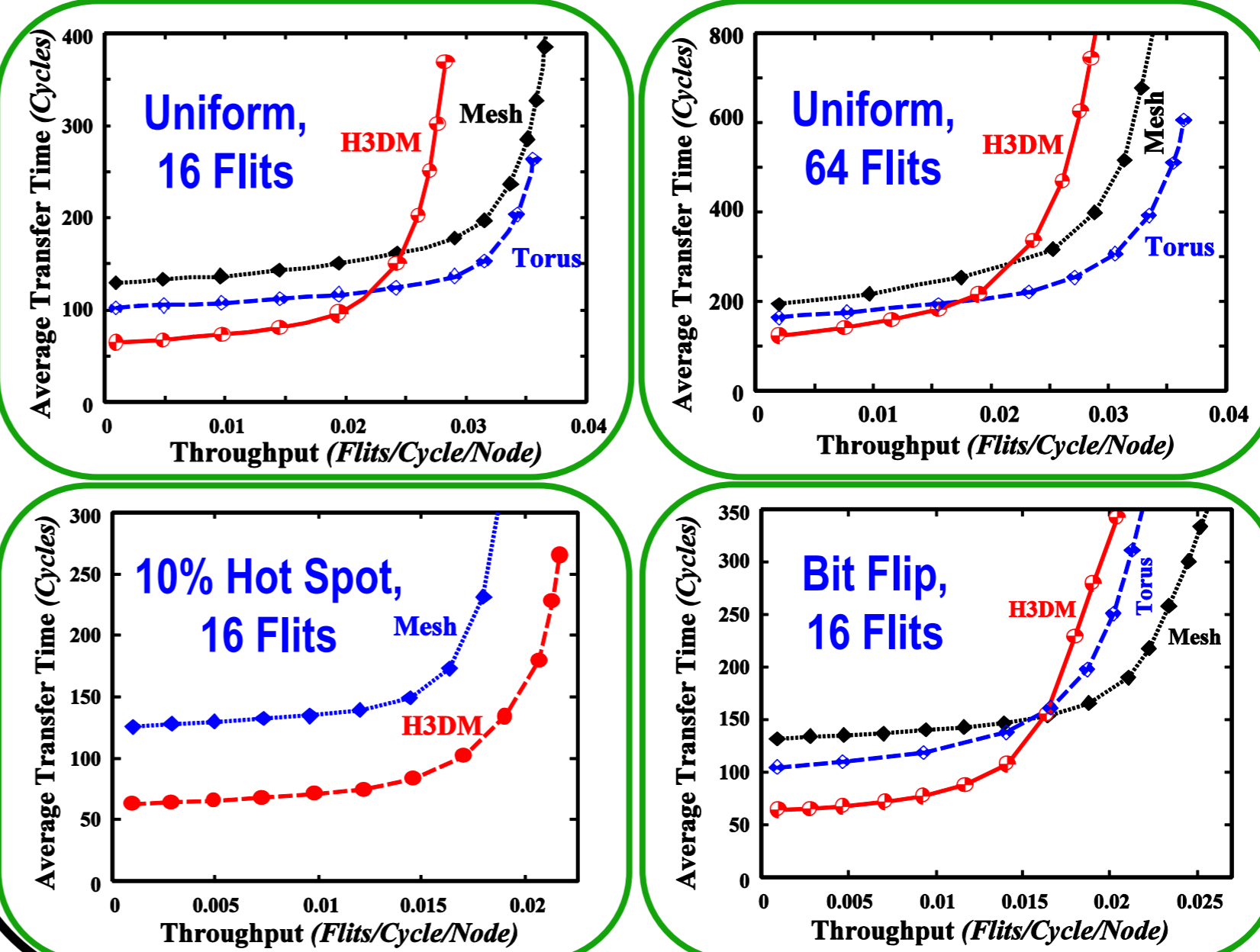


3. Deadlock Free Routing

- Phase-1 and Phase-3 share 2 virtual channels
- Sub-phase 2.i.1 and Sub-phase 2.i.3 utilizes channels over intra-BM links.
- Links at the contour of the BM are used in sub-phase 2.i.2 and sub-phase 2.i.4.
- Higher level mesh network share the virtual channel of intra-BM channels.

- H3DM is deadlock-free with 2 VCs.

4. Performance Evaluation



Zero load latency of H3DM is low
H3DM saturates early

5.(a) Applicability

- H3DM is a good choice of interconnection network for next generation massively parallel computer architecture.

5.(b) Novelty

- H3DM is a simple network.
- Routing of message is simple.
- Routing algorithm is deadlock free using 2 virtual channels.

6. Conclusions

- H3DM saturates earlier than mesh and torus due to shortage of interconnection.
- Up to saturation, H3DM is better than mesh and torus network.
- Zero load latency of H3DM is low.
- With the increase of non-uniformity and adversity H3DM yield high throughput.

7. Publications

- M.M. Hafizur Rahman, Asadullah Shah, and Yasushi Inoguchi, "A Deadlock Free Dimension Order Routing for Hierarchical 3D Mesh Network", *Proc. of Int'l Conference on Computer and Information Science (ICCIS)*, pp. 563-568, UTP, Malaysia, 2012. (SCOPUS Index)
- M.M. Hafizur Rahman, Asadullah Shah, and Yasushi Inoguchi, "On Dynamic Communication Performance of a Hierarchical 3D Mesh Network", *Proc. of 9th IFIP Int'l Conference on Network and Parallel Computing (NPC)*, LNCS 7513, Springer, pp. 179-186, Gwangju, South Korea, 2012. (ISI and SCOPUS Index).
- M.M. Hafizur Rahman, Asadullah Shah, and Yasushi Inoguchi, "On Nonuniform Traffic Patterns of a Hierarchical 3D Mesh Network", *Submitting in the International Arab Journal of Information Technology (IAJIT)*, Jordan, 2013. (ISI Index).