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The successful removal of IPv4 from WLCG wide area network links

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The Worldwide Large Hadron Collider Computing Grid (WLCG) community's deployment of IPv6 on its worldwide storage infrastructure is very successful and has been presented by us at earlier ISGC conferences. The campaign to deploy IPv6 on CPU services and all worker nodes is progressing well. Dual-stack IPv6/IPv4 is not, however, a viable long-term solution; the HEPiX IPv6 Working Group has focused on studying where and why IPv4 is still being used, and how to change such traffic to IPv6. The agreed end goal is to turn IPv4 off wherever possible and for all wide area data transfers to happen over IPv6, to simplify both operations and security management.

This paper will report on our work since the ISGC2025 conference. Firstly, we will report on our ongoing campaign to encourage the deployment of IPv6 on CPU services and Worker Nodes. Then, we will present further work to identify and correct the use of IPv4 between two dual-stack endpoints. The Research Networking Technical Working Group has identified marking the IPv6 packet header as one approach for understanding complex large data flows. This provides another driver for full transition to the use of IPv6 in WLCG data transfers. Several WLCG sites have now stated their wish to move all their services to IPv6-only in the near future. We are now close to being able to support this, should the experiments they support agree.

We present the working group's proposed plans and timescale for moving WLCG wide area network links on LHCOPN and LHCONE to "IPv6-only". In the summer of 2025, ESnet and the Tier1 centres in the USA successfully removed IPv4 from their two LHCOPN links to CERN. We will present how this was done and our work and plans for the next LHCOPN links to remove IPv4. Our proposal is to complete this work on all LHCOPN links during 2026 in time for the WLCG 2027 data challenge (DC27). The long-term aim is to also remove IPv4 from WLCG data transfers over the LHCONE network before the start of HL-LHC run 4 in 2030. This would require completion of much of that transition before the data challenged DC29. We will present the steps towards making this possible.

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