SC26 Network Research Exhibition: Demonstration Publishable Abstract

High Performance Networking with the São Paulo Backbone High-Throughput RDMA across Intercontinental Circuits

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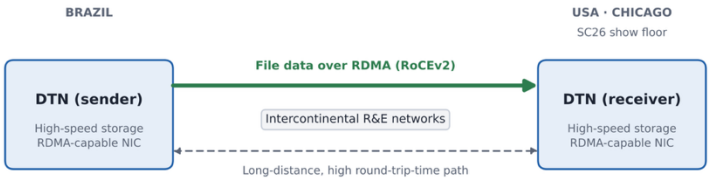
Abstract

The Research and Education Network of Sao Paulo (rednesp), connects dozens of research and education institutions across the State of Sao Paulo, Brazil, while providing high-capacity international connectivity to the USA and Europe. Following its 2022 design phase, rednesp began deploying a new backbone infrastructure known as "BackboneSP". This backbone connects ten major research and education institutions via 100 Gbps links, including: University of Sao Paulo (USP), University of Sao Paulo State (UNESP), University of Campinas (UNICAMP), Aeronautics Institute of Technology (ITA), Federal University of São Carlos (UFSCAR), Mackenzie University, Federal University of ABC (UFABC) and Federal University at São Paulo (UNIFESP), National Institute for Space Research (INPE) and Data Processing Company of the State of São Paulo (PRODESP). All links are fully operational, including a 100 Gbps connection between UNICAMP and the Brazilian Synchrotron Light Laboratory (LNLS), which is part of the Brazilian Center for Research in Energy and Materials (CNPEM) in Campinas. The backbone is connected to the USA through two 100 Gbps links and one 1.2 Tbps link, shared with Amlight and RNP.

The proposed experiment will evaluate high-throughput scientific file transfer using RDMA (RoCEv2) across a multi-domain, high-latency path between São Paulo, Brazil, and the SC26 show floor in Chicago. Building on promising local-lab tests between Data Transfer Nodes (DTNs), the team will measure end-to-end disk-to-disk performance over the intercontinental research and education network and compare it with conventional TCP-based transfers. The demonstration aims to characterize achievable performance, validate the infrastructure, and identify practical requirements for moving large scientific datasets across a wide-area network (WAN).

Goals

1. Sustained Throughput: Target sustained disk-to-disk transfer rates approaching the 400 Gbps aggregate target between the Rednesp core in São Paulo and the SC26 Caltech booth in Chicago, while validating line-rate 100 Gbps performance from individual BackboneSP nodes.



Goal: high, sustained disk-to-disk throughput across the WAN

2. Protocol Optimization: Benchmark RDMA (RoCEv2) over long-haul international links to identify hardware and protocol bottlenecks specific to wide-area networks. Compare RDMA with conventional TCP-based transfers over the same path and identify the network and host configurations required for long-distance research networks.
3. Infrastructure Validation: Demonstrate the operational capability and interoperability of the 400 Gbps hardware integration with BackboneSP.
4. Knowledge Sharing: Share the findings with the research and education networking community after the event.

Why RDMA?

In conventional TCP-based transfers, data is copied between application and kernel memory, while the host CPU performs transport-protocol processing. These costs can become significant at high link rates and over long-distance paths. RDMA allows a network adapter to access registered application memory directly (zero-copy and kernel bypass) and offloads transport processing to hardware, potentially reducing CPU overhead. RDMA over Converged Ethernet (RoCEv2) brings RDMA capabilities to

standard Ethernet/IP networks. Whether these advantages translate into higher sustained file-transfer throughput across an intercontinental WAN is the central question addressed by this demonstration.

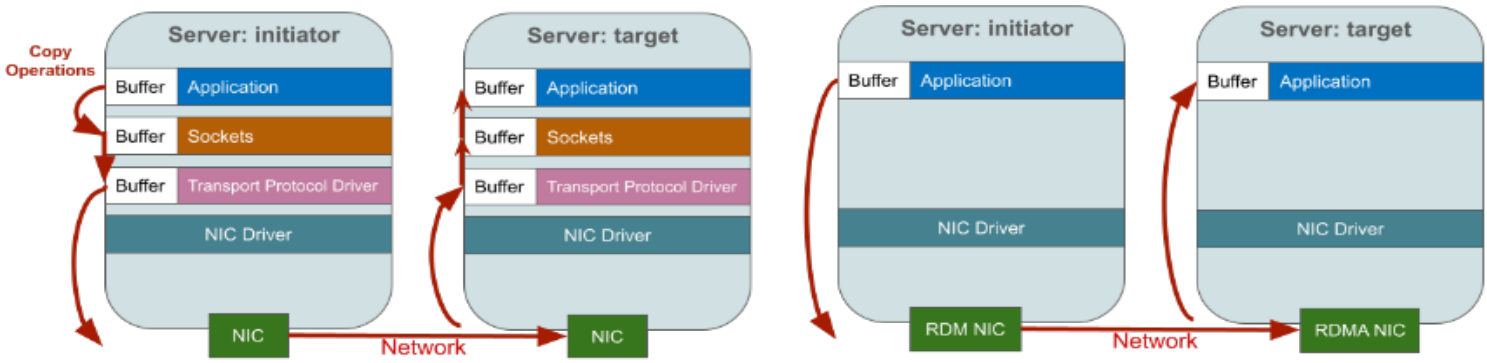


Figure 1. Conventional TCP/IP and RDMA data paths

Resources and Infrastructure

- AmLight 400 Gbps connection between the state of São Paulo, Brazil, and Florida, USA, via the Monet submarine cable.
- Three 400 Gbps SCinet connections linking Miami to the SC26 exhibition floor.
- Rednesp BackboneSP 100 Gbps nodes to aggregate traffic from major research institutions.
- High-performance Data Transfer Nodes (DTNs), equipped with 400 Gbps interfaces and NVMe storage, located at the Caltech SC26 booth and in São Paulo.

Involved Parties

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