

Ph☀ebus

Network Middleware for High-Performance Networking

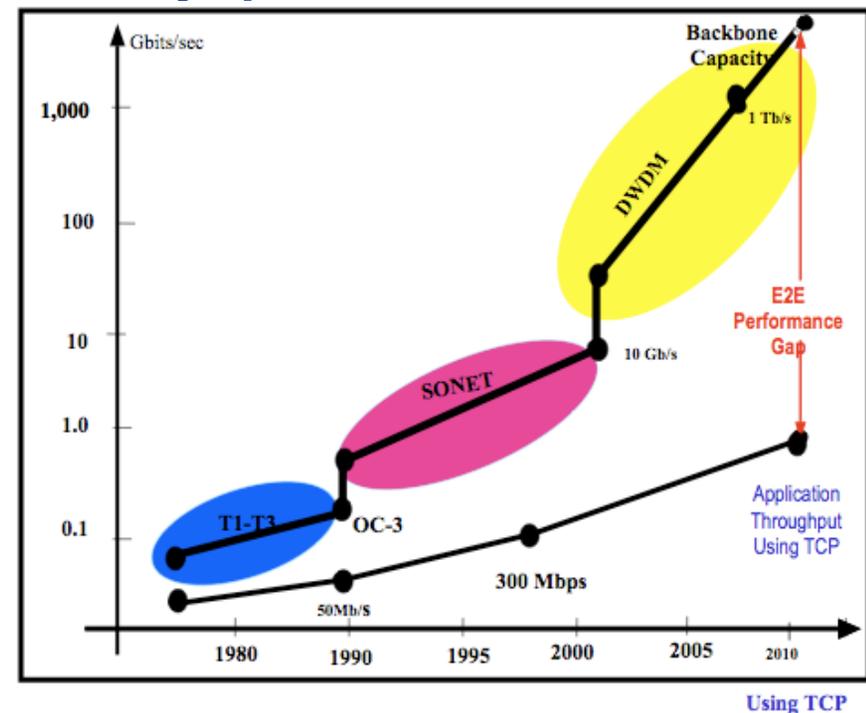
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Introduction and Motivation

- ☀ Networks are increasingly critical for science and education
- ☀ Data Movement is a key problem
- ☀ Network speeds can increase dramatically but users' throughput increases much more slowly

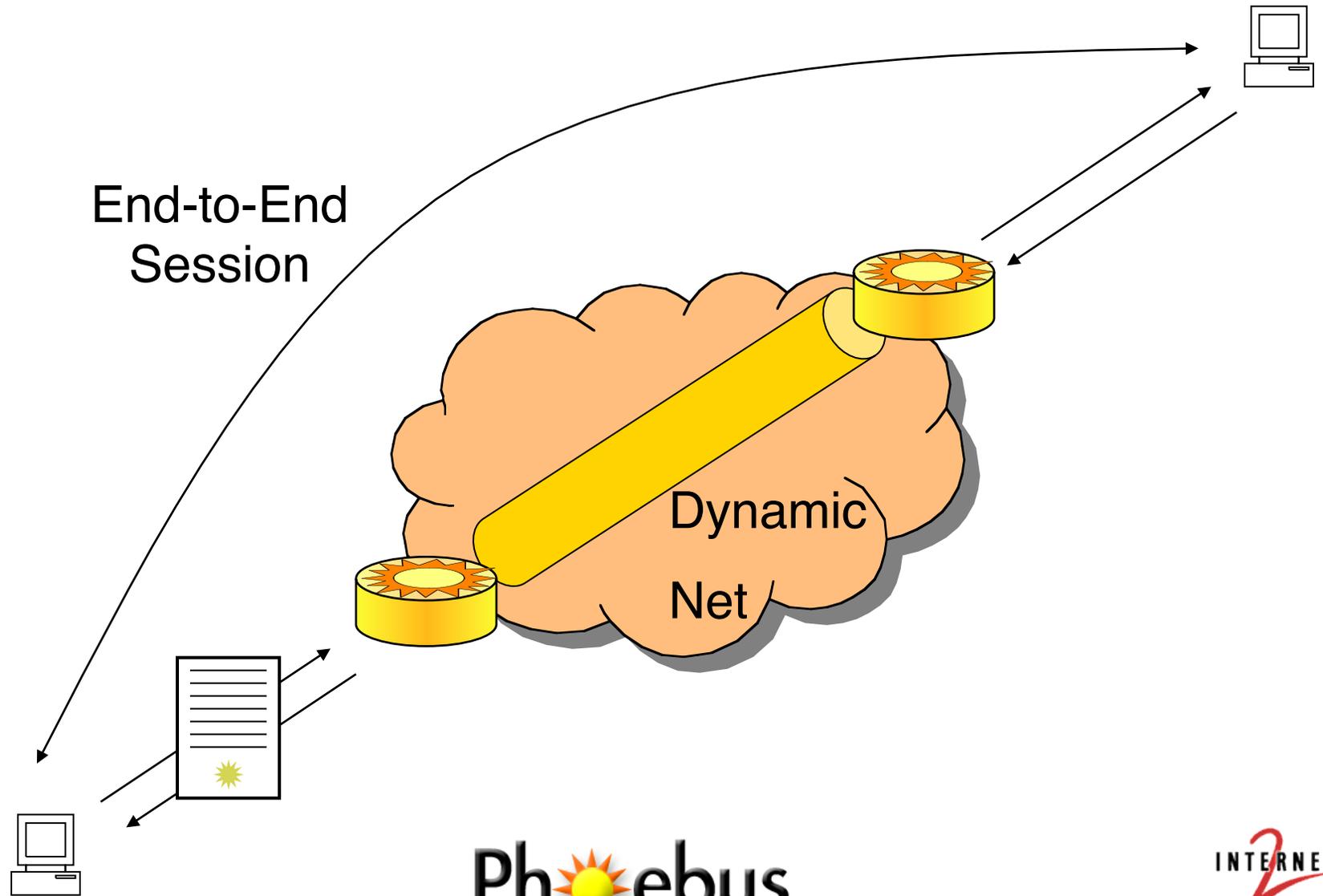
* Source: DOE



Ph☀ebus

- ☀ The Phoebus project aims to help bridge the performance gap by bringing revolutionary networks to users
 - * Phoebus is another name for the mythical Apollo in his role as the “sun god”
- ☀ Phoebus is based on the concept of a “session” that enables multiple adaptation points in the network to be composed
- ☀ Phoebus provides a gateway for legacy applications to use advanced networks
- ☀ Open source WAN accelerator

Ph☀ebus

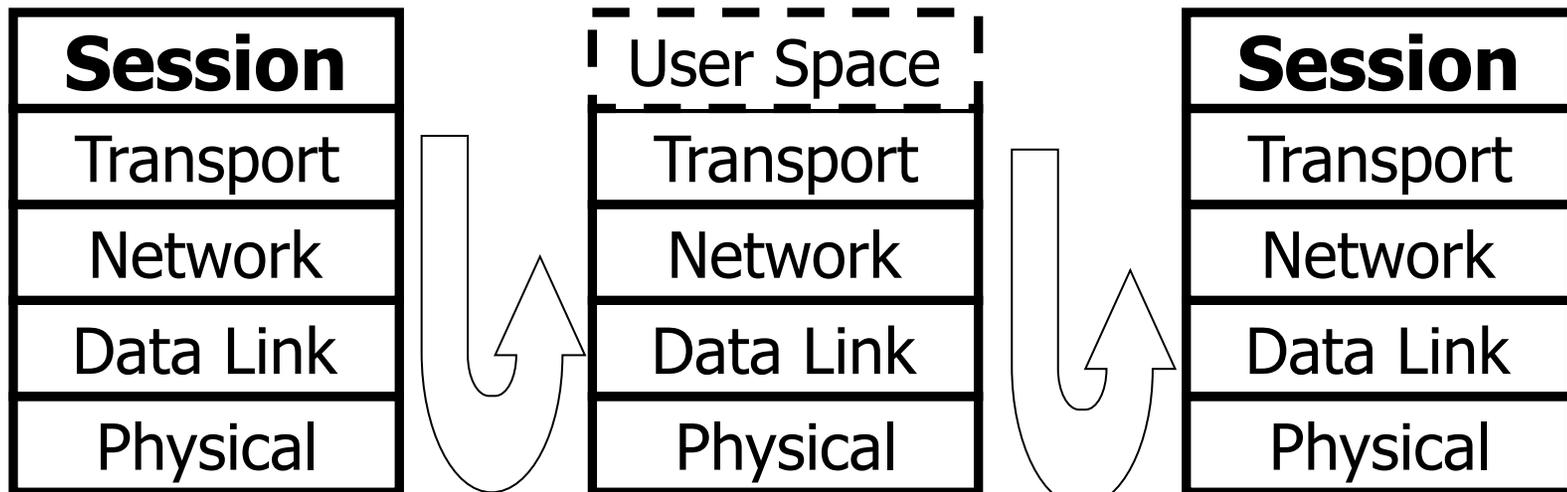


Ph☀ebus

INTERNET²

Session Layer

- ☀ A *session* is the end-to-end composition of *segment-specific* transports and signaling
 - ☀ More responsive control loop via reduction of signaling latency
 - ☀ Adapt to local conditions with greater specificity
 - ☀ Buffering in the network means retransmissions need not come from the source



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Session Layer Benefits

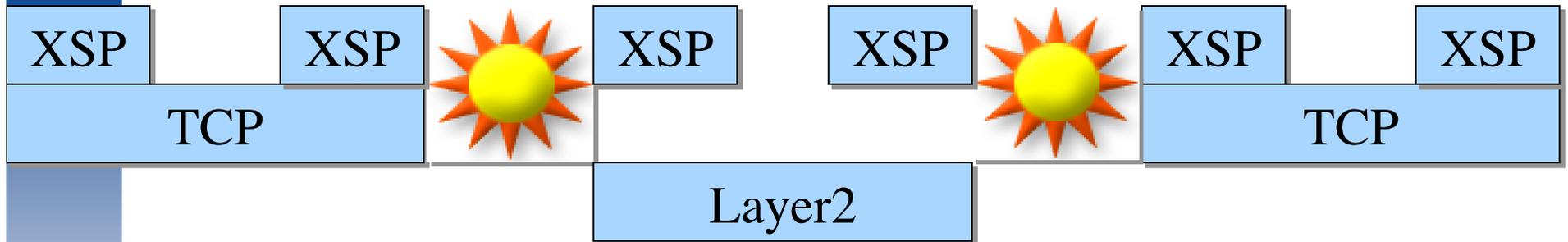
- ☀ A session layer provides explicit control over *adaptation points* in the network
- ☀ Transport protocol
 - * Rate-based to congestion based
 - * Shorter feedback loops
- ☀ Traffic engineering
 - * Map between provider-specific DiffServ Code Points / VLANs
- ☀ Authorization and Authentication
 - * Rich expression of policy via e.g. the Security Assertion Markup Language (SAML)

Phoebus Signaling

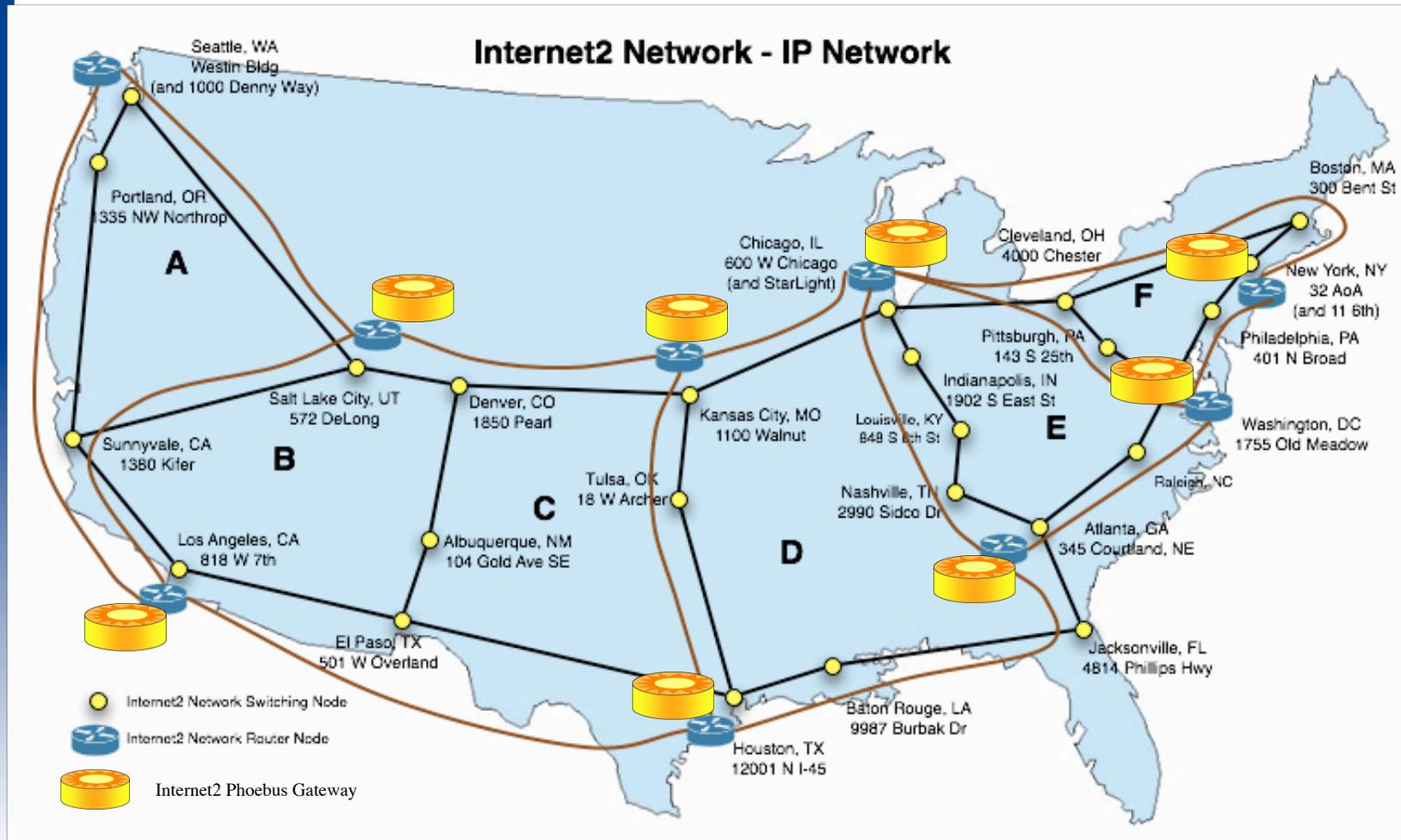
- ☀ Phoebus speaks to the control plane to provision network resources
 - ☀ Can allocate circuits from the OSCARS IDC
 - ☀ Which underlies ION
 - ☀ Also, direct communication with DRAGON
- ☀ Once the connection is established to the Phoebus node, traffic can begin to flow
 - ☀ Could be sent over an existing link if unable to provision
- ☀ Phoebus can finish the connection over the commodity network if the allocation times out

Session Layer Protocol

- ☀ The eXtensible Session Protocol (XSP) can be used to manage a multi-layer connection



Deployment Status



Phoebus Authentication

- ☀ Password
 - * SQLite/MySQL/File backends
- ☀ Trusted Host/Subnet
- ☀ GSI
 - * Globus-based
- ☀ Anonymous
 - * The session has no identifying information
- ☀ Accepted authentication handler can be set on a per host/per subnet basis

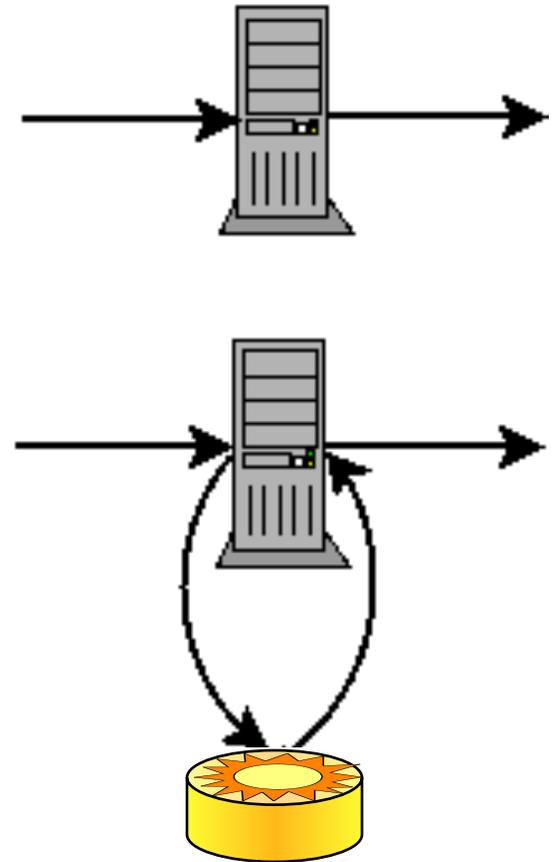


Implementation - Library

- ☀ The client library provides compatibility with current socket applications
 - * AF_LSL
- ☀ On Linux, LD_PRELOAD is used for function override
 - * `socket()`, `bind()`, `connect()`, `setsockopt()`...
 - * Allows Un*x binaries to use the system without recompilation
- ☀ Prototype working on MacOS X

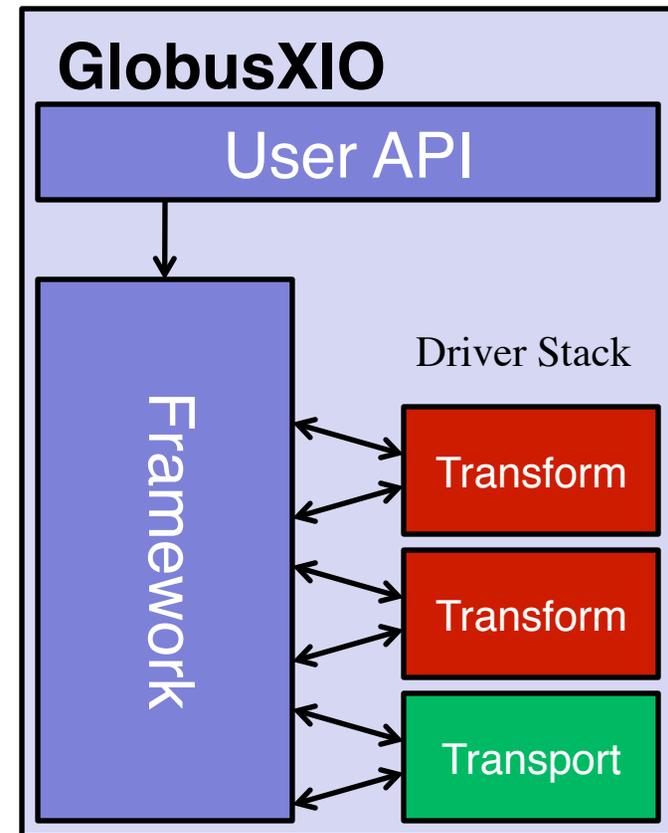
Implementation - Intercept

- ☀ Intercept the TCP connection with IP Tables (on Linux)
- ☀ Redirect to local forwarding process
- ☀ Establish connection with appropriate service nodes or end node
 - ☀ Based on policy
- ☀ Transparent to end hosts



Phoebus XIO Driver

- ☀ Provides a modular Phoebus transport driver for use with the Globus Toolkit
- ☀ Based on the TCP XIO driver
- ☀ Simplifies use of Phoebus Gateways
 - * Eliminates need for shim library



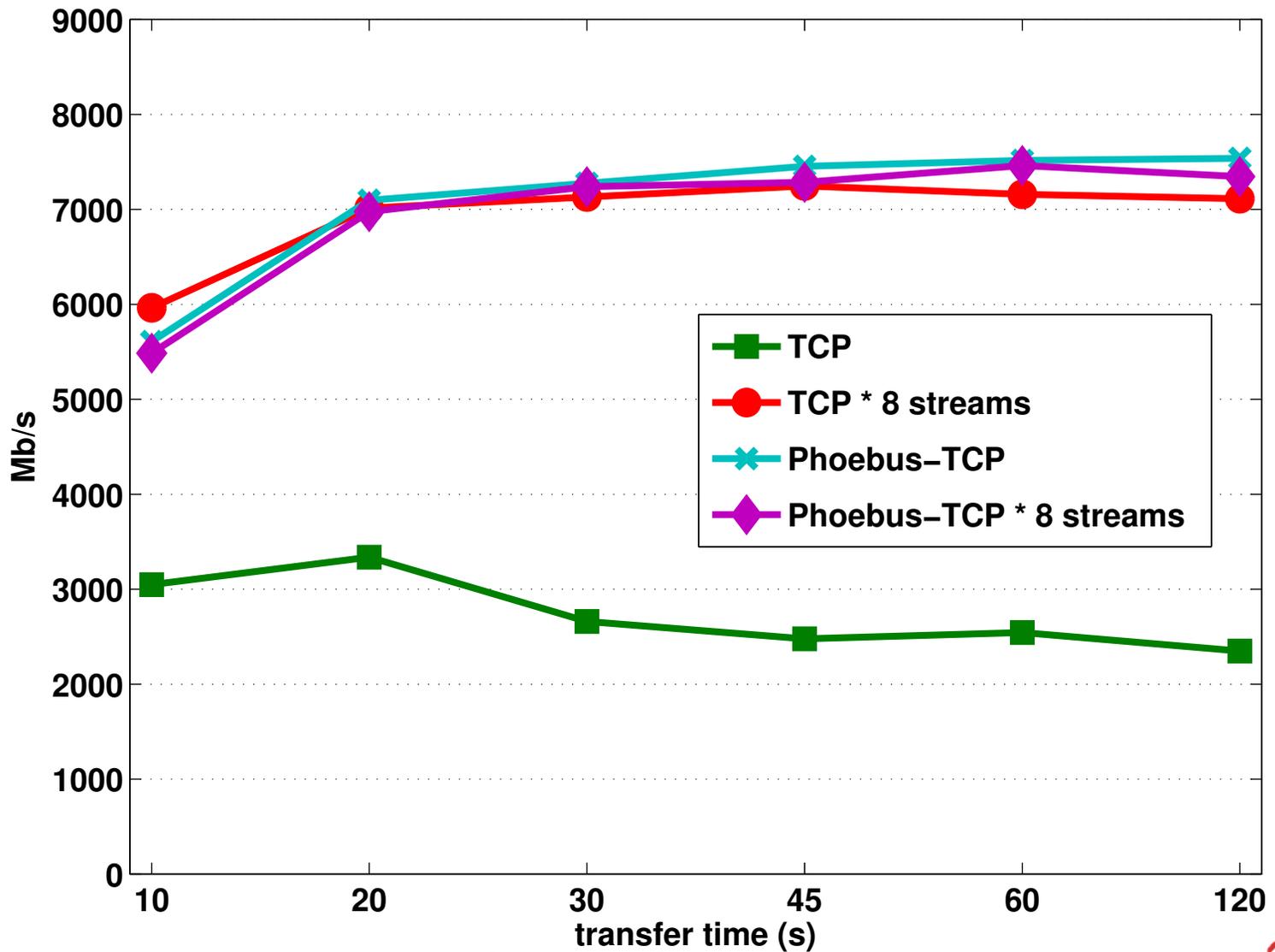
Phoebus and GridFTP

- ☀ *globus-gridftp-server* loads the Phoebus XIO driver when requested
- ☀ *globus-url-copy* extended to support Phoebus-based transfers
 - * with -ph flag or explicitly with `-dcstack`
- ☀ Support for advanced features
 - * 3rd party transfers
 - * Parallel streams

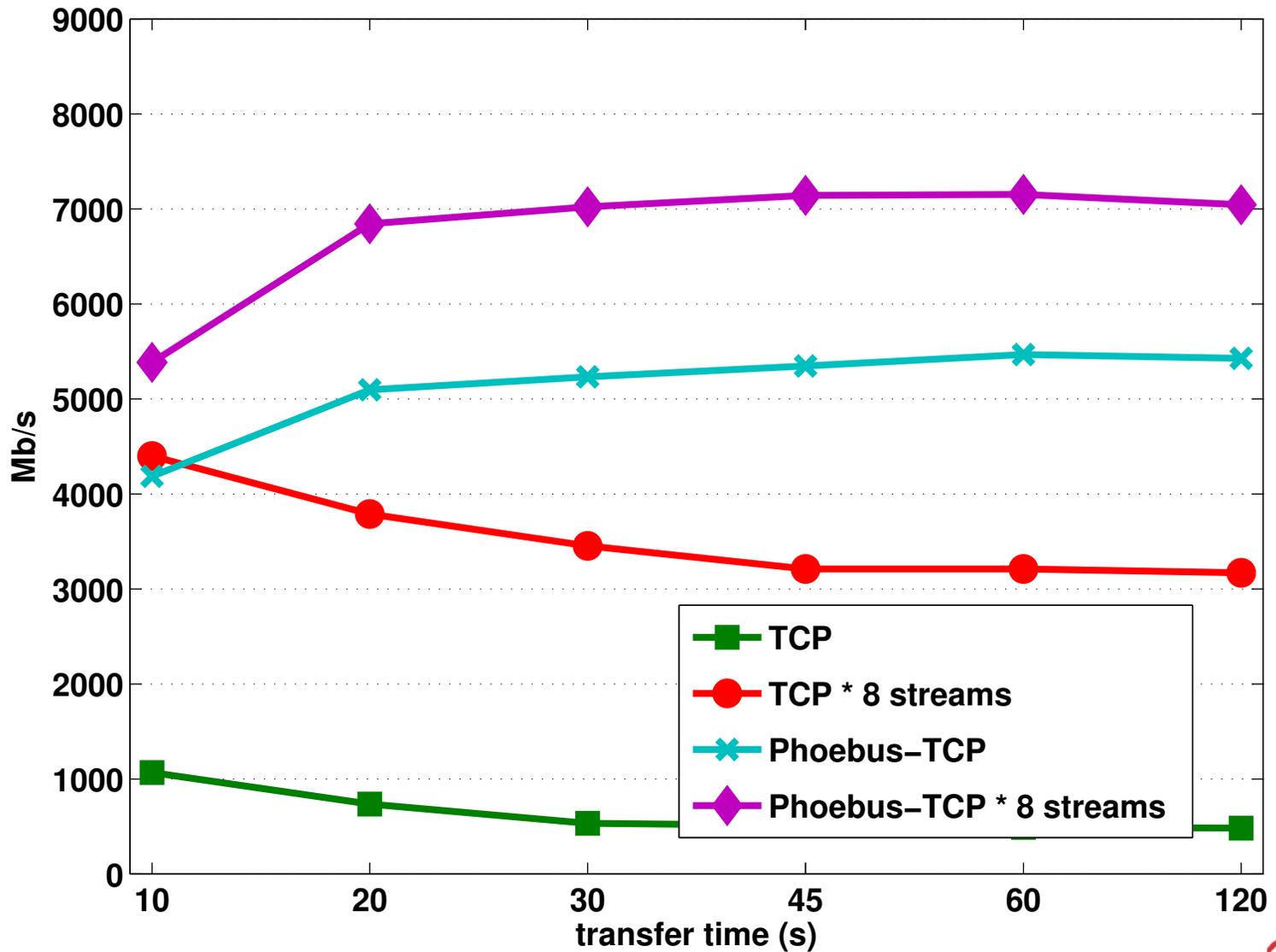
Windows Support

- ☀ SOCKS proxy support in development
- ☀ Java COGKit GridFTP
 - * globus-url-copy
- ☀ Firefox Plugin jTopaz
 - * available, uses Java implementation

50ms Latency, .001% loss

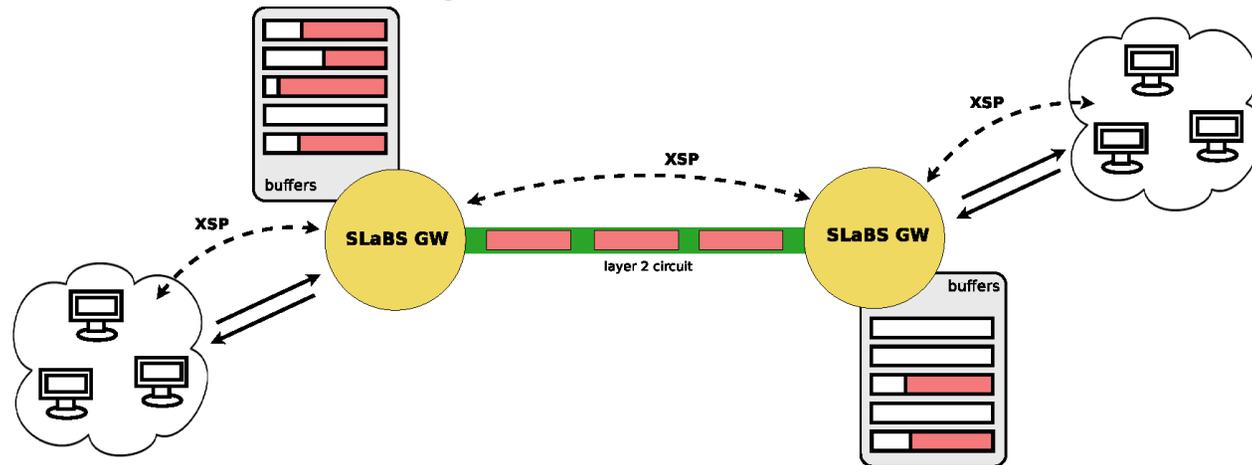


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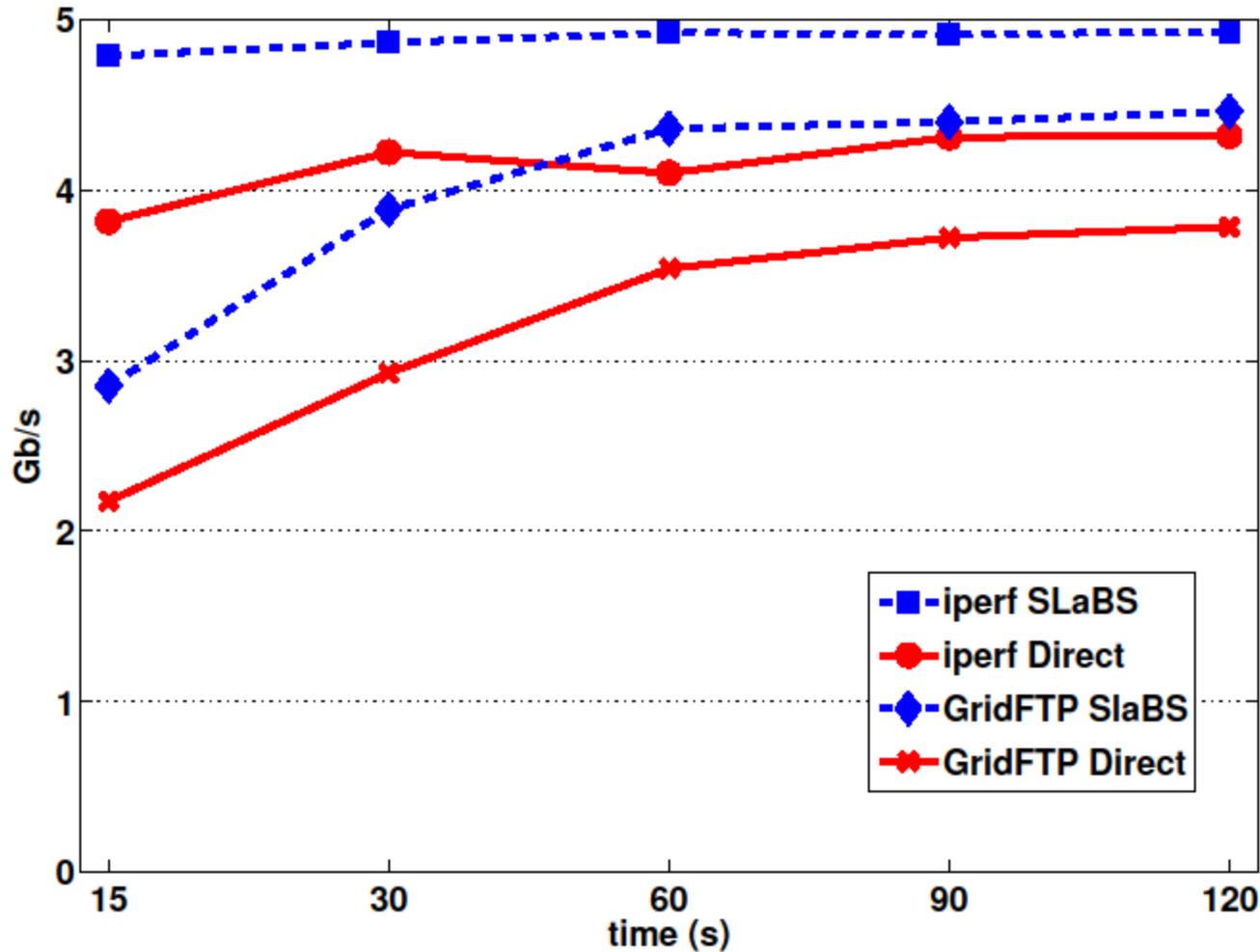
SLaBS

- ☀️ Apply burst switching concepts at session-enabled gateways
 - ☀️ Send relatively large PDUs versus small layer-3, layer-4 PDUs common today
- ☀️ Schedule and optimize bursts over dedicated resources
- ☀️ Reduce protocol overhead
- ☀️ Hide provisioning latencies



GridFTP and iperf

4 parallel streams over 5G WAN bottleneck with
115ms RTT



Ongoing Efforts

- ☀ Implementation on Multi Service PIC/DPC on Juniper
- ☀ Optimized Myrinet-based forwarding
- ☀ Refactoring into standalone xspd for End Site Control Plane Services (DOE Project with Phil Demar and Dantong Yu)
 - * A circuit maps pretty well to a session

Acknowledgements

☀ UD Students

- * Ezra Kissel, Omer Arap, Miao Zhang

☀ Internet2:

- * Aaron Brown, Guy Almes (now at Texas A&M), Eric Boyd, Rick Summerhill, John Vollbrecht, Matt Zekauskas, Jason Zurawski, Jeff Boote

☀ US Department of Energy Office of Science, Mathematical, Information and Computational Sciences (MICS) Program

- * Early Career Principal Investigator program



End

- ☀ Thank you for your attention
- ☀ Questions?

