DTN Build Basics
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EPOC
Engagement and Performance Operations Center

ABOUT EPOC

Over the last decade, the scientific community has experienced an unprecedented shift in the way research is performed and how discoveries are made. Highly sophisticated experimental instruments are creating massive datasets for diverse scientific communities and hold the potential for new insights that will have long-lasting impacts on society. However, scientists cannot make effective use of this data if they are unable to move, store, and analyze it. The Engagement and Performance Operations Center was established in 2018 as a collaborative focal point for operational expertise and analysis and is jointly led by Indiana University (IU) and the Energy Sciences Network (ESnet). EPOC provides researchers with a holistic set of tools and services needed to debug performance issues and enable reliable and robust data transfers. By considering the full end-to-end data movement pipeline, EPOC is uniquely able to support collaborative science, allowing researchers to make the most effective use of shared data, computing, and storage resources to accelerate the discovery process.

EPOC supports six main activities:

- **Roadside Assistance and Consultations** via a coordinated Operations Center to resolve network performance problems with end-to-end data transfers;
- **Application Deep Dives** to work more closely with application communities and understand full workflows for diverse research teams in order to evaluate bottlenecks and potential capacity issues;
- **Network Analysis enabled by the NetSage** monitoring suite to proactively discover and resolve performance issues;
- **Data Transfer Testing/ Data Mobility Exhibition** to check transfer times against known good end points;
- **Provision of managed services** via support through the IU GlobalNOC and our Network Partners;
- **Coordinated Training** to ensure effective use of network tools and science support.

Building a budget friendly 10 Gbps capable Data Transfer Node, or DTN, is a relatively straightforward process. The following are guidelines for hardware selection based on work done by ESnet from their Fasterdata website (https://fasterdata.es.net) and data gathered from DTNs successfully deployed in both research and production environments.

Chassis - Since the DTN is going to be an always-on resource, a chassis that supports redundant power supplies is preferred. Chassis height in Rack Units (RU) should be chosen based on the number and physical size of drive bays needed to achieve the total capacity and fault tolerance characteristics desired. For instance, a 1RU chassis will typically only support four 3.5” drives

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versus eight 2.5” drives. 2RU and 3RU chassis configurations can support greater numbers of drives.

Processor - Central Processing Unit (CPU) selection consists of two considerations: clock speed and core count. A core speed of at least 3GHz is needed to keep up with high speed TCP streams. Since one TCP stream will occupy one processor core, multiple cores are needed for multi-stream TCP transfers. The total number of cores should reflect the anticipated number of simultaneous TCP streams, however we recommend a four core processor as a baseline. Server-grade processors, such as the Intel Xeon or AMD EPYC are recommended.

Memory - Random Access Memory (RAM), or simply system memory, should be configured in such a way as to populate all available memory slots on the motherboard. For instance, if the server has 8 memory slots, all 8 slots should be populated with identically sized RAM modules. This configuration ensures maximum memory bandwidth between the CPU and RAM. In practice this means using a higher quantity of lower capacity RAM modules to achieve the desired total capacity. We recommend a minimum of 16 GB of RAM for any DTN configuration.

Drive Configuration - The number and type of drives depends on several factors, including desired total capacity, intended RAID level, and available drive bays in the selected chassis. In general, we recommend running RAID 10, which requires drives to be installed in pairs with a minimum complement of four drives. RAID 10 gives the performance benefits of RAID 0 along with the fault tolerance of RAID 1. Solid State Drives (SSD) have significant performance advantages over traditional mechanical drives, however the cost per gigabyte of mechanical drives is lower, so the choice between these technologies should reflect both budget and performance considerations.

Network - Most servers have at least two 1 Gbps NICs included, however a 10 Gbps NIC usually must be specified as an add-on. Typical 10 Gbps NICs have dual SFP+ ports which can accommodate a variety of optic modules, allowing you to select a module compatible with your current network configuration. Cards made by Broadcom and Intel are typically well supported across multiple operating systems.

If you have specific DTN requirements that you’d like to discuss, or simply need clarification on any of the topics covered above, please contact the EPOC team at epoc@iu.edu and use the subject line DTN.

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