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New generation Intel® Xeon® Scalable processors delivers unprecedented performance, compute density and I/O capacity making real-time high-performance Enterprise-class SQL Server deployments a reality today.

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THE AGE OF INFORMATION ACCELERATION

Vexata Provides the Missing Piece in The Information Acceleration Puzzle

We live in the Age of Information Acceleration - Enterprises now transact, analyze and respond to data in real-time thanks to application acceleration. Multi-core CPUs from Intel, and now with GPUs and FPGAs can accelerate applications to perform better than ever. High-speed 32Gb Fibre Channel (FC) and 100Gb Ethernet networks provide faster backbones for clustered databases and analytics platforms enabling applications to scale out acceleration to multiple nodes.

On the storage front, NAND Flash SSDs and newer media, including the ultra-low latency high-bandwidth Intel® 3D XPoint™, have emerged. Enterprises have been unable to fully exploit these media for application acceleration, due to the inefficient architectures of typical enterprise storage arrays which barely use 1/10th of the bandwidth of these SSDs while adding 100x latencies.

Vexata was created to solve the key missing piece of the application acceleration puzzle – that of accelerating the data infrastructure so that applications can access data in real-time. Vexata’s NVMe NAND Flash and future 3D XPoint Arrays (based on its patent pending Real Time Architecture) accelerate database and analytics platforms by 5x or more.

With state-of-the-art Supermicro server system and Building Block Solutions® supporting the Intel® Xeon® Scalable platform and Vexata Arrays incorporating the new Xeon® Scalable processors, and Intel® solid-state drives, enterprises can derive greater performance, scalability and security out of their data platforms.

This white paper presents some real-world performance results and benefits of migrating to implementations supporting the new generation Intel® Xeon® processor Scalable family.



Figure 1. Vexata's All Flash Array [Rear View (left) and Front View (right)]

The Vexata - Supermicro Collaboration

Vexata and Supermicro have been collaborating for over 3 years with the goal of bringing cutting-edge storage products and technologies, including reference architectures to the market. Supermicro's motherboards provide a solid foundation for compute, I/O and storage services offered by the Vexata Arrays. Vexata works closely with Supermicro to provide complete solution reference designs for Oracle, SQL Server, Kx and GPFS that deliver up to 50x performance improvements over similar reference designs from other All Flash Array (AFA) vendors. The launch of the Intel® Xeon® processor Scalable family offers yet another opportunity for Vexata and Supermicro to innovate and showcase the latest solutions.



Figure 2. Supermicro new generation X11 server and storage portfolio





CREATING ULTRA HIGH-PERFORMANCE DATA INFRASTRUCTURE SOLUTIONS WITH THE NEW INTEL® XEON® PROCESSOR SCALABLE FAMILY

Vexata's goal of boosting array performance with the new Intel® Xeon® processor Scalable family is centered on application acceleration. With servers supporting the new processor family, enterprise customers can experience a 30% or higher boost in database and analytics performance compared to solutions based on the previous generation.

With Supermicro X11 generation system and Building Block Solutions, the increased computing performance per core offered by the new processor family and the reduced I/O latency of the new platform provide significant advantages for I/O intensive workloads.

The Pressing Need for High Performance Microsoft SQL Server Data Warehouse

Vexata and Supermicro worked closely to evaluate Supermicro X11 generation servers for various data intensive use cases including Data Warehousing (DW) and OLTP. With the increasing importance of data-backed business decisions and the explosion in the volume and types of data collected, this paper focuses on the characteristics of system performance for data analytics. Specifically, to investigate and document reference designs that meet Data Warehouse Fast Track (DWFT) certification process developed by Microsoft for SQL Server, and to provide measurements and comparisons on the performance advantages offered by the next generation hardware.

Enterprises deploy SQL Server-based data warehouses to gain insights into historical data and report on important business metrics. The digitalization of enterprises has resulted in a need to gain real-time data insights at a large scale. Real-Time analytics and reporting are becoming a necessity, and existing data infrastructures that are based on distributed batch analytics are too slow and inefficient. A high-performance SQL Server DW that can address hundreds of TBs of data is a critical business tool to achieve real-time analytics and reporting.

Microsoft SQL Server is often deployed as a single instance non-clustered database on dual socket or quad socket x86 server hardware. The ability of a single server to ingest and analyze large data sets is crucial to the success of a SQL Server DW implementation. To sustain large datasets and provide enterprise class resiliency, a server is generally deployed with an external storage array. The ability of this array to achieve large bandwidth low latency data access at scale is key to the success of the Data Warehouse.

The Microsoft SQL Server DWFT provides enterprises with simple and easy deployment of DW solutions. The DWFT reference designs are right-sized for server, memory and I/O and are tested extensively and certified by Microsoft. With the efficiencies provided by Supermicro's server systems and Vexata's low-latency storage arrays it is now possible to manage over 100TBs with one dual-socket server.

A high-performance DW solution with SQL Server should answer the following questions:

- Can a single server achieve massive bandwidth of 10's of GB/s for analytics?

- Can the storage array achieve real-time analytics with massive bandwidth at ultra-low latencies?
- Can the combination of the server and array achieve a DWFT certification of over meaningful dataset sizes of 100TB and higher?

Vexata and Supermicro teams worked closely to answer these questions and deliver the world's fastest SQL Server DW that would ultimately enable enterprises to get closer to the goal of real-time.

What Can a Single Supermicro X11 Generation Dual-Socket Server Do for Your Data Infrastructure?

Most of the enterprise applications run on dual-socket x86 hardware. Achieving strong performance from a single dual-socket server is critical to large-scale deployment of a SQL Server DW instance. The Vexata solutions team focused on understanding what a single Intel® Xeon® Scalable processor-based server could achieve in terms of read and write bandwidths, and the results were extraordinary!

With the superior microarchitecture of the Intel® Xeon® processor Scalable family, more memory channels and higher bandwidth (6 channels running at 2666MHz per socket) and 48 PCI-E 3.0 lanes per socket, a single Supermicro dual-socket server with 4 Emulex LPe32002-M6 dual-port 32Gb FC adapters achieved over 35 GB/s of mixed read/write bandwidth. The results were shown on VDBench, which is an I/O generation tool.

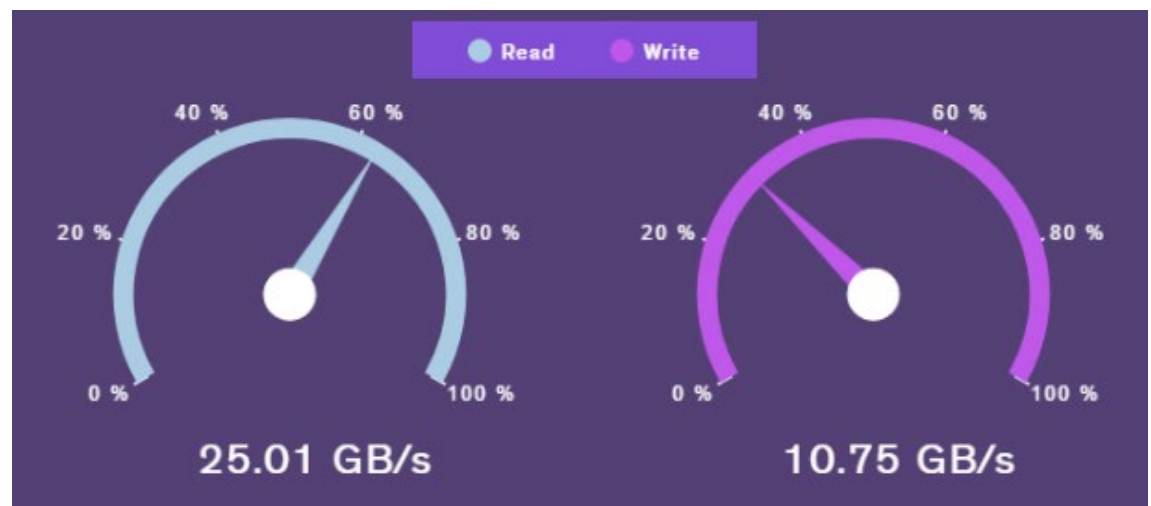


Figure 3. Over 35 Gb/s bandwidth achieved



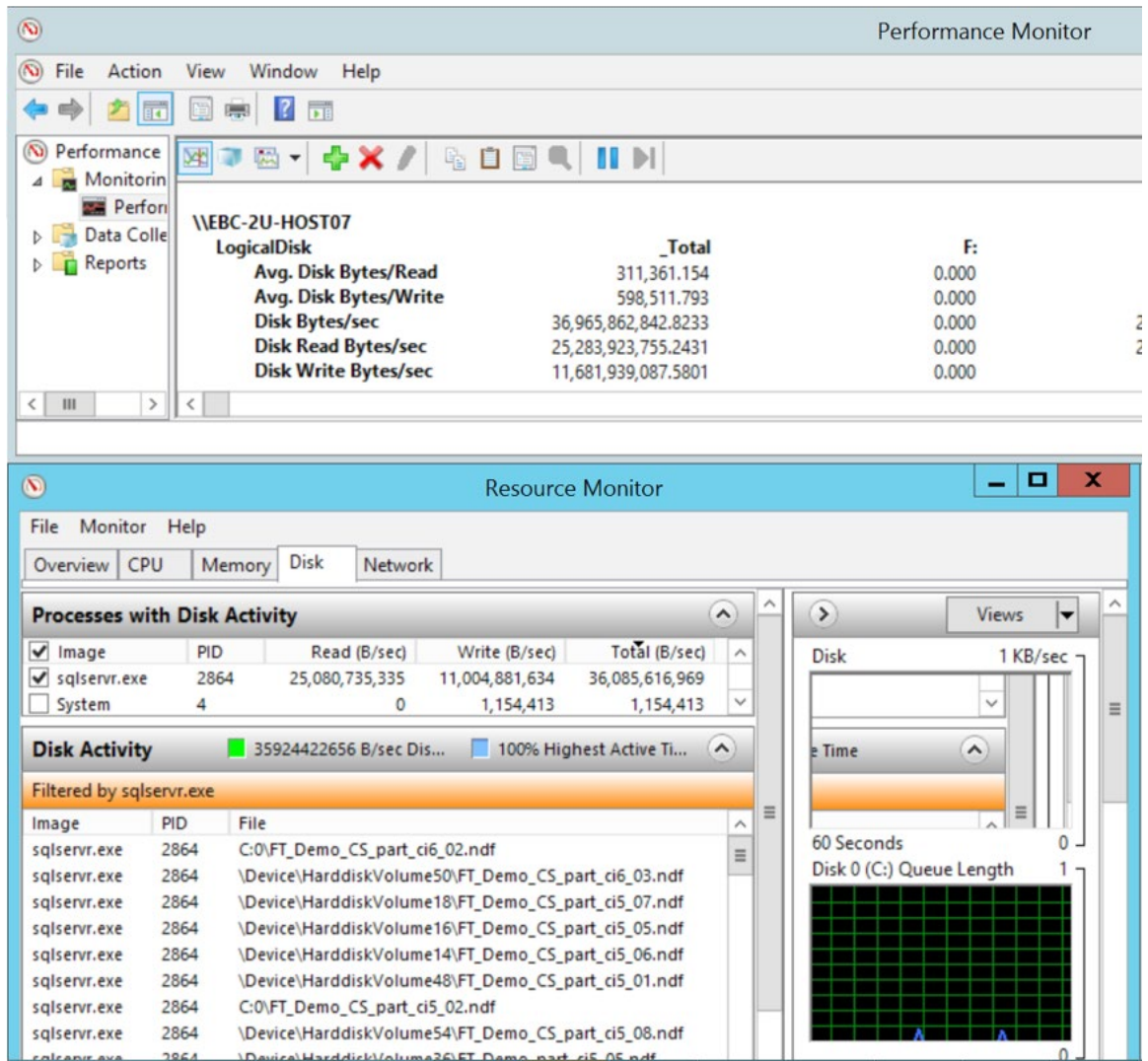


Figure 4. Performance Monitor and Resource Monitor results of SQL Server data consumption over 36GB/s combined workload.

How does this bandwidth compare to what most AFAs can deliver? We compared what is achievable in terms of bandwidth from a single Supermicro server with dual new generation Xeon processors to what a 42U 8-node AFA could achieve in terms of bandwidth. The new server showed nearly 1.5x better in performance. Clearly, there is a need for a storage array that can match or exceed the bandwidth that a new dual-socket Xeon server can deliver.

In addition to the increased ability to ingest data, the new X11 generation server also lowers I/O latencies by over 15% on writes and over 20% on reads. This increases the efficiency of the cores creating a magnifying effect to deliver even higher productivity per core.

What Can Vexata Do for Your SQL Server Infrastructure?

The Vexata Array is built to deliver ultra-high bandwidth needed for I/O intensive use cases such as the SQL Server Data Warehouse. A single Vexata array achieves 60GB/s of mixed read/write bandwidth in a small 6U form factor. This bandwidth is achievable at ultra-low latencies even for very large I/O block sizes including 256K, making real-time analytics a reality with the Vexata Array.

A SQL Server solution with a dual-socket new generation Xeon server and the Vexata Array with 36 cores achieved nearly 22GB/s of I/O performance in SQL compared to around 13GB/s for a Xeon E5-2600 v4 based system. Customers can benefit significantly by moving their SQL Server workloads to the new Xeon Scalable processor based servers.

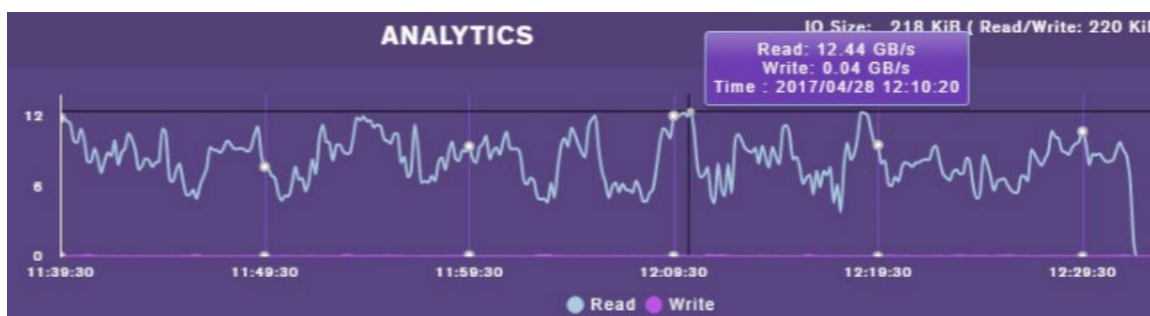


Figure 5. Intel® Xeon® E5-2600 v4 based server metrics @ 13GB/s of peak performance

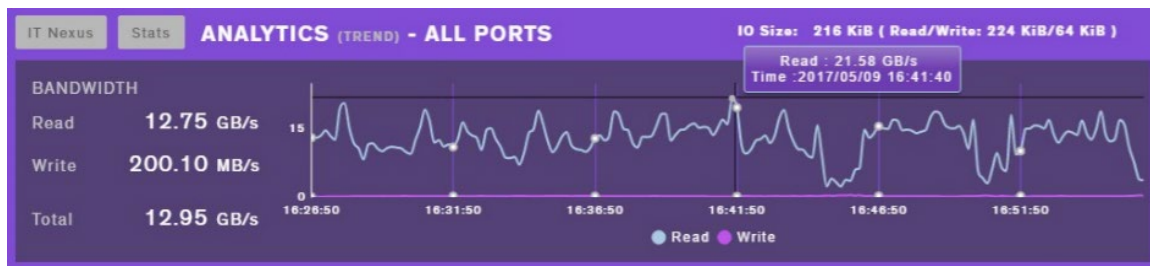


Figure 6. Intel® Xeon® Scalable processors based metrics @ 22GB/s of peak performance

With the significant read bandwidth of the Vexata Array, end customers can deploy Active-Standby or Active-Active SQL Server DW with two servers based on the new Intel Xeon Processor Scalable Family and one Vexata Array, making high-performance enterprise class SQL Server deployments a reality.





SQL SERVER DWFT SOLUTION WITH VEXATA ARRAY AND SUPERMICRO SERVERS WITH INTEL® XEON® PROCESSOR SCALABLE FAMILY

Vexata and Supermicro teams worked together to acquire the DWFT certification with the following main components:

- Microsoft® SQL Server® 2016 Enterprise Edition running on Microsoft® Windows Server® 2012 R2
- Vexata Flash Array with 100TB usable capacity
- Supermicro 2U SuperServer® 6029P-TRT featuring dual Intel® Xeon® Gold 6150 processors and 1TB DDR4-2666MHz memory.

For the first time, thanks to the superior I/O and memory bandwidth offered by the new generation SuperServer could achieve over 100TB performance rating with a maximum user capacity of 466TBs. Compared to a 75TB rating with a previous generation system, and 195TB maximum user data capacity, with the same number of cores. This is a direct 33% increase in performance and a 138% increase in the size of database that can be supported per deployment.

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-------------------------|---------------------|
| DWFT Certification #2016-026 | Vexata VX-100F with SuperMicro DWFT Reference Architecture | | | Report Date: 8/25/2016 | |
| DWFT Rev. 5.4 | | | | | |
| System Provider | System Name | Processor Type | Memory | | |
| | SuperMicro 6029P-TRT | Intel Gold 6150 2.7 GHz (2/36/72) | 1536 | | |
| Operating System | | SQL Server Edition | | | |
| Windows Server 2012 R2 | | SQL Server 2016 Enterprise Edition | | | |
| Storage Provider | Storage Information | | | | |
| | 8x 15.5 TB flash for data (RAID 6) / 4x 500 GB flash for tempdb (RAID 6) 2x 120 GB SSD for OS (RAID 1) 2x 2 TB flash for log (RAID 6) | | | | |
| Primary Metrics | | | | | |
| Rated User Data Capacity ¹ | Row Store Relative Throughput ² | Column Store Relative Throughput ³ | Maximum User Data Capacity ⁴ | | |
| (TB) | | | (TB) | | |
| 100 | 336 | 469 | 466 | | |
| Row Store | | | | | |
| Relative Throughput ² | Measured Throughput | Measured Scan Rate Physical | Measured Scan Rate Logical | Measured I/O Throughput | Measured CPU (Avg.) |
| | (Queries/Hr/TB) | (MB/Sec) | (MB/Sec) | (MB/Sec) | (%) |
| 336 | 380 | 9,185 | 10,619 | 9,902 | 91 |
| Column Store | | | | | |
| Relative Throughput ² | Measured Throughput | Measured Scan Rate Physical | Measured Scan Rate Logical | Measured I/O Throughput | Measured CPU (Avg.) |
| | (Queries/Hr/TB) | (MB/Sec) | (MB/Sec) | (MB/Sec) | (%) |
| 469 | 3,049 | 3,955 | N/A | N/A | 89 |
| <small>The reference configuration is a 2 socket system rated for 25TB using SQL Server 2014 and the DWFT V4 methodology ¹ Assumes a data compression ratio of 5:1 ² Percent ratio of the throughput to the row store throughput of the reference configuration. ³ Percent ratio of the throughput to the column store throughput of the reference configuration. ⁴ Reported metrics are based on the qualification configuration which specifies database size and SQL Server memory.</small> | | | | | |

Figure 7. Intel® Xeon® processor Scalable family 18-core DWFT Certificate

Supermicro, Vexata and Intel Enabling New Levels Performance and Efficiency for Real-time Data Analytics for SQL Data Warehouse Deployments



| | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------|-------------------------|---------------------|
| DWFT Certification #2016-025 | Vexata VX-100F with SuperMicro DWFT Reference Architecture | | | Report Date: 8/25/2016 | |
| DWFT Rev. 5.4 | | | | | |
| System Provider | System Name | Processor Type | Memory | | |
|  | SuperMicro 2028U-TR4+ | Intel Xeon E5-2699 v4 2.2 GHz (2/36/72) | 1024 GB | | |
| Operating System | | SQL Server Edition | | | |
| Windows Server 2012 R2 | | SQL Server 2016 Enterprise Edition | | | |
| Storage Provider | Storage Information | | | | |
|  | 8x 6.5 TB flash for data (RAID 6) / 4x 500 GB flash for tempdb (RAID 6) 2x 120 GB SSD for OS (RAID 1) 2x 2 TB flash for log (RAID 6) | | | | |
| Primary Metrics | | | | | |
| Rated User Data Capacity ¹ | Row Store Relative Throughput ² | Column Store Relative Throughput ³ | Maximum User Data Capacity ⁴ | | |
| (TB) | | | (TB) | | |
| 75 | 285 | 316 | 195 | | |
| Row Store | | | | | |
| Relative Throughput ² | Measured Throughput | Measured Scan Rate Physical | Measured Scan Rate Logical | Measured I/O Throughput | Measured CPU (Avg.) |
| | (Queries/Hr/TB) | (MB/Sec) | (MB/Sec) | (MB/Sec) | (%) |
| 285 | 300 | 8,520 | 8,285 | 8,402 | 97 |
| Column Store | | | | | |
| Relative Throughput ² | Measured Throughput | Measured Scan Rate Physical | Measured Scan Rate Logical | Measured I/O Throughput | Measured CPU (Avg.) |
| | (Queries/Hr/TB) | (MB/Sec) | (MB/Sec) | (MB/Sec) | (%) |
| 316 | 2,054 | 3,368 | N/A | N/A | 94 |
| <small>The reference configuration is a 2 socket system rated for 25TB using SQL Server 2014 and the DWFT V4 methodology ¹ Assumes a data compression ratio of 5:1 ² Percent ratio of the throughput to the row store throughput of the reference configuration. ³ Percent ratio of the throughput to the column store throughput of the reference configuration. Reported metrics are based on the qualification configuration which specifies database size and SQL Server memory.</small> | | | | | |

Figure 8. Intel® Xeon® processor E5-2699 v4 18-core DWFT Certificate

The DWFT 100TB rating was achieved through collaborations of Vexata and Supermicro and enables Enterprises to deploy large data warehouse instances and obtain real-time insights from the data. The new Supermicro X11 server solutions and Vexata Arrays propel the transition to the Age of Information Acceleration!

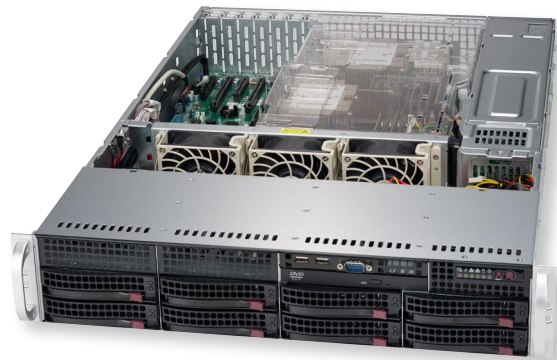


Figure 9. Supermicro 2U SYS-6029P-TRT



Intel Inside®. Powerful Productivity Outside.

About Super Micro Computer, Inc.

Supermicro® (NASDAQ: SMCI), the leading innovator in high-performance, high-efficiency server technology is a premier provider of advanced server Building Block Solutions® for Data Center, Cloud Computing, Enterprise IT, Hadoop/Big Data, HPC and Embedded Systems worldwide. Supermicro is committed to protecting the environment through its “We Keep IT Green™” initiative and provides customers with the most energy-efficient, environmentally-friendly solutions available on the market.

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About Vexata

Vexata is the leader in real-time enterprise storage solutions. Vexata’s unique breakthrough enterprise storage solutions enable transformative performance and scale from database and analytics applications. With its Vexata Array family of solid state storage systems using NVMe Flash and now 3D XPoint™ SSDs, Vexata systems deploy simply and seamlessly into existing storage environments.

www.vexata.com

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