Intel® Select Solution for Blockchain: Hyperledger Fabric*

Accelerate blockchain development and deployment on an optimized, verified infrastructure based on Hyperledger Fabric.

Enterprises face numerous challenges today, such as centralization, manual processes, and lack of trust, which can contribute to slower transactions and increased business expenses. Blockchain technology offers an option to resolve these challenges by adding transparency, privacy, anti-tampering protections, and traceability to transactions. These characteristics enable blockchain to help reduce costs and improve efficiency by streamlining processes and increasing transaction speeds. While organizations are enthusiastic about blockchain technology, there are concerns with deployment complexity, infrastructure overhaul, choosing the best platform for their business models, and scalability. To help address these concerns, the Intel® Select Solution for Blockchain: Hyperledger Fabric* provides a verified, tested solution, based on high-performance Intel® Xeon® Scalable processors and reliable Intel® Solid State Drives (SSDs), that simplifies blockchain deployment on Hyperledger Fabric and adds modularity and enterprise-grade privacy for organizations seeking to build blockchain solutions.

The Intel Select Solution for Blockchain: Hyperledger Fabric

Hyperledger Fabric provides a foundation for developing applications and solutions with a modular architecture, and it enables components, such as consensus and membership services, to be plug-and-play. Moreover, confidential transactions only appear on the ledgers of parties to those transactions, maintaining confidentiality. To implement modular architecture, Hyperledger Fabric uses container technology to host *chaincode*: smart contracts that compose the application logic of the system. While Hyperledger Fabric provides the building blocks for scalable blockchain for business use, it still requires high-performance, easy-to-deploy hardware to provide full benefits to businesses.

The Intel Select Solution for Blockchain: Hyperledger Fabric helps optimize price and performance while significantly reducing infrastructure evaluation time. Specifically, the Intel Select Solution for Blockchain: Hyperledger Fabric combines the Intel Xeon Scalable processor platform, Intel SSDs, and Intel® Ethernet Network Adapters to empower enterprises to quickly harness reliable, comprehensive solutions that allow their organizations to:

- **Prepare** blockchain infrastructure investments for the future with scalable storage and compute

- **Generate excellent total cost of ownership (TCO)** with general-purpose hardware that IT organizations are used to managing

- **Accelerate time to market** by using a turnkey solution with a rich development toolset that is optimized for crucial software libraries

Solution Components

The Intel Select Solution for Blockchain: Hyperledger Fabric combines the Intel Xeon processor Scalable family, Intel® 3D NAND SSDs, and the Intel® Ethernet 700 Series to enable businesses to quickly deploy reliable blockchain solutions on a performance-optimized infrastructure.

Intel® Xeon® Processor Scalable Family

Intel Xeon Scalable processors provide the Intel Select Solution for Blockchain: Hyperledger Fabric with an excellent performance-to-cost ratio because of their built-in technologies that can provide enhanced performance and efficiency for cryptographic hashing and blockchain security, such as:

- **Intel® AES New Instructions (Intel® AES NI)**, a set of built-in encryption instructions that can greatly improve the compute efficiency of cryptographic algorithms, such as those used in blockchain transactions, while offering greater performance and improved security

- **Intel® Advanced Vector Extensions 512 (Intel® AVX-512)**, which provides 512-bit instructions that can accelerate performance for demanding workloads and usages like blockchain

- **Intel® Run Sure Technology**, which increases system resiliency, protects critical data, reduces unplanned server downtime, and increases data integrity

- **Intel® Trusted Execution Technology (Intel® TXT)**, software that helps protect critical confidential information, such as blockchain encryption keys, without compromising performance

What Are Intel® Select Solutions?

Intel Select Solutions are verified hardware and software stacks that are optimized for specific software workloads across compute, storage, and network. The solutions are developed from deep Intel experience with industry solution providers, in addition to extensive collaboration with the world's leading data center and service providers.

To qualify as an Intel Select Solution, solution providers must:

1. Follow the software and hardware stack requirements outlined by Intel

2. Replicate or exceed Intel's reference benchmark-performance threshold

3. Publish a detailed implementation guide to facilitate customer deployment

Solution providers can develop their own optimizations to add further value to their solutions.

Intel® SSD Data Center Family

Storage latency can be a bottleneck for blockchain performance. For this reason, the Intel Select Solution for Blockchain: Hyperledger Fabric uses the Intel SSD DC S4500 and Intel SSD DC P4510. Based on Intel 3D NAND technology, these enterprise data center SSDs provide a 3.2x lower annualized failure rate (AFR) than hard-disk drives (HDDs).[1]

Intel® Ethernet Connections and Intel® Ethernet Adapters

The Intel Ethernet 700 Series accelerates the performance of the Intel Select Solution for Blockchain: Hyperledger Fabric. This solution features the Intel Ethernet 700 Series with 10 gigabit Ethernet (GbE) for validated performance ready to meet high quality thresholds for data resiliency and service reliability for most media types and port speeds, and it is backed by extensive testing, validation, and worldwide product support.[2,3,4,5]

Verified Performance through Benchmark Testing

All Intel Select Solutions are verified through benchmark testing to meet a prespecified minimum capability level of workload-optimized performance. To do this for the Intel Select Solution for Blockchain: Hyperledger Fabric, Intel chose Hyperledger Caliper*, a blockchain benchmark tool and one of the Hyperledger* projects hosted by The Linux Foundation. Hyperledger Caliper enables users to measure the performance of a specific blockchain implementation for a set of predefined use cases. Specifically, Intel verified the performance of the Intel Select Solution for Blockchain: Hyperledger Fabric by testing the transactions per second (TPS), as measured by Hyperledger Caliper.

Base Configuration

The Intel Select Solution for Blockchain: Hyperledger Fabric is available in a "Base" configuration, as shown in Table 1. The Base configuration specifies the minimum required performance capability for an Intel Select Solution for Blockchain: Hyperledger Fabric.

To refer to a solution as an Intel Select Solution for Blockchain: Hyperledger Fabric, a server vendor or data center solution provider must meet or exceed the defined minimum configuration ingredients and reference the minimum benchmark-performance thresholds listed below.

Table 1. Base configuration for the Intel® Select Solution for Blockchain: Hyperledger Fabric*

INGREDIENT	INTEL® SELECT SOLUTION FOR BLOCKCHAIN: HYPERLEDGER FABRIC* **BASE CONFIGURATION**
PROCESSOR	2 x Intel® Xeon® Gold 5115 processor (2.40 GHz, 10 cores, 20 threads), or a higher number Intel Xeon Scalable processor
MEMORY	96 GB (12 x 8 GB 2,666 MHz DDR4 RDIMMS) or higher
BOOT DRIVE**	1 x Intel® SSD DC D3-S4510 (M.2 or 2.5-inch) (240 GB or higher)
DATA TIER**	2 x Intel SSD DC P4510 (1 TB or higher)
DATA NETWORK	10 Gb Intel® Ethernet Converged Network Adapter X710-DA2/DA4
MANAGEMENT NETWORK PER NODE	Integrated 1 GbE or better
NETWORK SWITCHES	
TOP OF THE RACK (ToR) SWITCH	10 gigabits per second (Gbps) 48x port switch**
MANAGEMENT SWITCH	1 Gbps 48x port switch**
SOFTWARE	
FABRIC SOFTWARE	Intel® Omni-Path Fabric software version 10.7.0.0.145 or later
LINUX* OS	Ubuntu* 16.04.5
HYPERLEDGER FABRIC SDK	1.1.0 or later
DOCKER*	18.x
DOCKER COMPOSE*	1.22.x
NODE.JS*	8.x or later
APPLIES TO ALL NODES	
TRUSTED PLATFORM MODULE (TPM)	TPM 1.2 discrete or firmware TPM (Intel® Platform Trust Technology [Intel® PTT])
FIRMWARE AND SOFTWARE OPTIMIZATIONS	Intel® Volume Management Device (Intel® VMD) enabled** Intel® Boot Guard enabled Intel® Trusted Execution Technology (Intel® TXT) enabled

**Recommended, not required

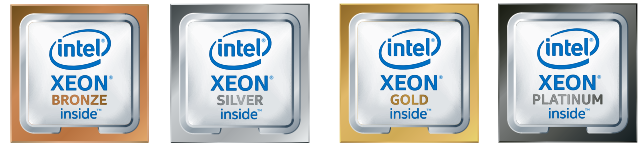## Technology Selections for the Intel Select Solution for Blockchain: Hyperledger Fabric

In addition to the Intel® hardware foundation used for the Intel Select Solution for Blockchain: Hyperledger Fabric, Intel technologies integrated in Intel Xeon Scalable processors deliver further performance and reliability gains:

- **Intel® Volume Management Device (Intel® VMD):** Enables hot-swap replacement of NVM Express* (NVMe*) SSDs from the PCIe* bus without shutting down the system, while standardized LED management helps provide much faster identification of SSD status. This standardization brings enterprise reliability, availability, and serviceability (RAS) features to NVMe SSDs, enabling you to deploy next-generation storage with confidence. IT professionals can now service these drives online without an outage, which minimizes interruptions and improves uptime and serviceability. The unique value of Intel VMD is that Intel is sharing this technology across the ecosystem for broad enablement.

- **Intel® Virtual RAID on CPU (Intel® VROC):** Delivers excellent performance and low power/TCO. Intel VROC supports full-featured RAID levels 0, 1, 5, and 10, and it is a host bus adapter (HBA)-less RAID solution.

- **Intel® QuickAssist Technology (Intel® QAT):** An offload engine to accelerate some critical workloads such as bulk cryptography, public key exchange, and data compression on Intel architecture–based platforms. Intel QAT on Intel Xeon Scalable processors offers outstanding capabilities: up to 100 Gbps encryption, 100 Gbps compression, and 100,000 decryption operations per second using a 2,048-bit RSA key.

- **Internet Wide Area Remote Protocol (iWARP) Remote Direct Memory Access (RDMA):** A host-offload, host-bypass technology that enables a security-enabled direct memory-to-memory data communication between two applications across a network. iWARP RDMA can make use of current Ethernet infrastructure without lossless network support. It also provides flow control and congestion management, and it is highly scalable.

- **Intel® Platform Trust Technology (Intel® PTT):** Root of trust with full TPM 1.2 functionality integrated into platform firmware. The new Intel PTT feature is available as an option versus a discrete chip to simplify integration and activation.

- **Intel® Boot Guard:** Hardware-based boot-integrity protection that prevents unauthorized software and malware takeover of boot blocks critical to a system's function, thus providing an added level of platform security based on hardware.

Intel® Xeon® Scalable Processors

Intel Xeon Scalable processors:

- Offer high scalability for enterprise data centers

- Deliver performance gains for virtualized infrastructure compared to previous-generation processors

- Achieve exceptional resource utilization and agility

- Enable improved data and workload integrity and regulatory compliance for data center solutions

Deploy an Enterprise-Ready Blockchain Solution with the Intel Select Solution for Blockchain: Hyperledger Fabric

Intel Select Solutions provide a fast path to data center transformation with workload-optimized configurations verified for Intel Xeon Scalable processors. When organizations choose the Intel Select Solution for Blockchain: Hyperledger Fabric, they get a pre-tuned and tested configuration that is workload-optimized and proven to scale so that IT can deploy blockchain solutions quickly and efficiently with less tuning.

Visit intel.com/selectsolutions to learn more, and ask your infrastructure vendor for Intel Select Solutions.

Learn More

Intel Select Solutions: **intel.com/selectsolutions**

Intel Xeon Scalable processors: **intel.com/xeonscalable**

Intel SSD Data Center Family: **intel.com/content/www/us/en/products/ memory-storage/solid-state-drives/data-center-ssds.html**

Intel Ethernet 700 Series: **intel.com/ethernet**

Intel Select Solutions are supported by Intel® Builders: **http://builders.intel.com**. Follow us on Twitter: **#IntelBuilders**

Intel and Blockchain: **intel.com/content/www/us/en/security/blockchain-overview.html**

Hyperledger: **hyperledger.org**

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