Lenovo Blockchain Configuration for Hyperledger Fabric on ThinkSystem Servers

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Describes the solution configurations for Hyperledger Fabric blockchain platform

Solution based on the versatile Lenovo ThinkSystem SR650 servers

Deployment considerations for cost-effective and scalable solutions

Uses Intel processors, storage and network devices to deliver highest performance

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1 Introduction

This document describes the Lenovo Blockchain Configuration for Hyperledger Fabric on ThinkSystem Servers. It provides a predefined and optimized hardware infrastructure for high performance implementation of Hyperledger Fabric software. This configuration guide provides planning, design considerations, and best practices for implementing Hyperledger Fabric with Lenovo and Intel products.

Billions of transactions of all types take place every day. These transactions must be secure, verifiable, fast, and efficient, and every stage of a transaction requires a level of trust. Yet, these requirements are not always achieved. Invoices can get lost or delayed, Web sites can be hacked, fraud can be committed, and there often is too much manual intervention and a lack of transparency among all parties.

Blockchain technology promises to improve many aspects of how organizations conduct business. It provides a transaction data record that is transparent and unchangeable. Benefits include:

- Enhanced trust in business processes. All partners in a business network have access to the data in a shared, distributed ledger and data is recorded based on an agreed upon protocol.
- Higher levels of automation. Delivering transparent data to analytics tools is a key challenge for all enterprises. By using cryptographic techniques to ensure immutability, Blockchain facilitates smart contracts and eliminates manual reconciliation steps that can take weeks and months to complete.

Blockchain technology has been used for nearly a decade as the underlying foundation of cryptocurrencies and more recently in medical, cybersecurity, music, farming, shipping, and other industries. One of the key software frameworks fuelling the exploration and adoption of enterprise blockchain services is Hyperledger Fabric. Hyperledger is the open source consortium advancing business blockchain technologies hosted by The Linux Foundation; and Fabric is one of several frameworks hosted by Hyperledger. Because of its focus on B2B processes, Hyperledger Fabric is one of the most prominent enterprise blockchain offerings in existence today.

The Lenovo blockchain configuration for Hyperledger Fabric combines the reliability of Lenovo servers and firmware with the power of Intel technology along with the Hyperledger Fabric software to create a solution that will propel your company into the world of blockchain. The configurations have been verified by Intel via the Intel Select Solution program.

2 Solution overview

The Lenovo Blockchain configuration for Hyperledger Fabric is a combination of the Hyperledger Fabric software framework and world class Lenovo servers using the most advanced Intel technology to propel your company into the world of blockchain. The solution meets Intel specifications and performance thresholds to also qualify as an Intel Select Solution

2.1 Hyperledger Fabric

One of the Hyperledger projects hosted by The Linux Foundation is the Hyperledger Fabric which is an enterprise blockchain framework that is open source, production-ready and supports distributed ledger solutions on permissioned networks for a wide range of industries.

Hyperledger Fabric allows components, such as consensus and membership services, to be plug-and-play. Its modular architecture maximizes the confidentiality, resilience, and flexibility of blockchain solutions. There are several technical advantages of Hyperledger Fabric:

- Permissioned Membership allowing access only to known identities
- Modular architecture providing higher performance, scalability, and levels of trust by separating out transaction processing into three phases: distributed logic processing and agreement ("chaincode"), transaction ordering, and transaction validation and commitment
- Data partitioning into Channels, allowing for data to go to only the parties that need to know
- Protection of digital keys and sensitive data for enhanced identity management
- Plug-in support for preferred implementation for components such as identity, encryption, etc.

2.2 Lenovo ThinkSystem Servers

2.2.1 Lenovo ThinkSystem SR650

The Lenovo ThinkSystem SR650 is an ideal 2-socket 2U rack server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The SR650 server is particularly suited blockchain applications due to its rich internal data storage, large internal memory and selection if high performance Intel processors. It is also designed to handle general workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), enterprise applications, collaboration/email, and business analytics.

The ThinkSystem SR650 server supports:

- Up to two 2nd Generation Intel Xeon Scalable processors
- Up to 3 TB 2666 MHz or 2933 MHz TruDDR4 memory
    - RDIMMs: 1.5 TB (768 GB per processor)
    - 3DS RDIMMs: 3 TB (1.5 TB per processor) (requires processors that support more than 1 TB of memory capacity per socket)
- Up to 24x 2.5-inch or 14x 3.5-inch drive bays with an extensive choice of NVMe PCIe SSDs, SAS/SATA SSDs, and SAS/SATA HDDs
- Flexible I/O Network expansion options with the LOM slot, the dedicated storage controller slot, and up to 6x PCIe slots

Figure 1 Lenovo ThinkSystem SR650

Combined with the Intel Xeon Scalable Processors (Bronze, Silver, Gold, and Platinum), the Lenovo ThinkSystem SR650 server offers an even higher density of workloads and performance that lowers the total cost of ownership (TCO). Its pay-as-you-grow flexible design and great expansion capabilities solidify dependability for any kind of workload with minimal downtime.

The ThinkSystem SR650 server provides high internal storage density in a 2U form factor with its impressive array of workload-optimized storage configurations. It also offers easy management and saves floor space and power consumption for most demanding use cases by consolidating storage and server into one system.

This configuration recommends the ThinkSystem SR650 for the following reasons:

- **Storage speed:** With additional NVMe U.2 adapters, each of the 24 configured 2.5-inch drives can use the fastest NVMe drives available.
- **Performance**: This hardware uses the latest Intel Xeon Gold and Platinum Scalable processors and TruDDR4 memory for efficient ledger creation
- **Flexibility**: Server hardware uses embedded storage, which results in simple scalability (by adding nodes)
- **PCIe slots**: Up to 7 PCIe slots are available if rear disks are not used, and up to 3 PCIe slots if the Rear HDD kit is used. They can be used for network adapter redundancy and increased network throughput
- **Higher power efficiency**: Titanium and Platinum redundant power supplies that can deliver 96% (Titanium) or 94% (Platinum) efficiency at 50% load
- **Reliability:** Outstanding reliability, availability, and serviceability (RAS) improve the business environment and helps save operational costs

For more information, see the Lenovo ThinkSystem SR650 Product Guide: https://lenovopress.com/lp1050-thinksystem-sr650-server-xeon-sp-gen2.

2.3 Intel Technology

2.3.1 Intel Xeon Scalable Performance Processors

The Intel Xeon Scalable processors (SP) have many new features which allow the Hyperledger Fabric software to run at its very best. Of the many new technologies that Intel brings to the market, the following help directly to make blockchain run on the Hyperledger Fabric the most efficiently and performant of any processor family.

The second generation of the Intel Xeon Scalable processor family are the latest processors for data center

workloads with frequency, architecture improvements, artificial learning/deep learning optimization which also supports Intel Optane persistent memory (PMem).

The Intel Xeon Platinum processor offers up to 28 cores per socket and frequency up to 3.6 GHz, which offers the best performance targeted for demanding, mission-critical workloads like Hyperledger Fabric.

The Intel Xeon Gold processor offers up to 24 cores per socket and frequency up to 3.4 GHz, that offers workload-optimized performance and advanced reliability.

The Intel Xeon Silver processor offers up to 12 cores per socket and frequency up to 3.0 GHz and offers essential performance and power efficiency.

Other features include:

- Highest Intel Ultra Path Interconnect (Intel UPI) speed at up to 10.4 GT/s to boost multi-processor data flow
- Enhanced performance across 6 memory channels at DDR4-2666 MHz
    - Support for Intel Optane PMem
    - Enhanced DDR4 performance support
- Highest accelerator throughput with 2 FMA of Intel Advanced Vector Extensions-512 (Intel AVX-512) per CPU
- Intel Turbo Boost Technology and Intel Hyper-Threading Technology (Intel HT Technology)

2.3.2 Intel Solid State Drives

The Intel Optane and Intel 3D NAND based SSDs delivers performance, Quality of Service (QoS), and capacity improvements to further optimize storage efficiency, enabling data centers to do more per server, minimize service disruptions, and efficiently manage at scale.

Intel Optane PMem modules accelerate applications for fast caching and fast storage to increase scale per server and reduce transaction costs for latency sensitive workloads.

Intel 3D NAND based SSDs extends leadership in flash memory with an architecture designed for higher capacity and optimal performance, a proven manufacturing process providing accelerated transitions and scaling.

3 Minimal Configuration Requirements

This section describes the hardware and software infrastructure aspects of the Hyperledger Fabric solution as tested by Lenovo and Intel. To support different customer environments, different configurations are allowed for supporting different amounts of data sizes and performance levels. These should be discussed with your Lenovo Business Partner when discussing how best to use Hyperledger Fabric.

3.1 Lenovo ThinkSystem SR650 Server

The base components necessary for this Intel Select Solution start with a Lenovo ThinkSystem SR650 server using 2nd Generation Intel Xeon Gold processors are documented in Table 1: ThinkSystem SR650 Example configuration. We recommend for Hyperledger Fabric to use these components at a minimum to run the Fabric software.

Table 1: ThinkSystem SR650 Example configuration

Component	Description
Server	ThinkSystem SR650
Processor	2 × Intel Xeon 5218 Scalable Processor (or higher)
Memory	12 × ThinkSystem 8GB TruDDR4 memory RDIMMs or 3DS RDIMMs
Storage (OS) (optional)	ThinkSystem 2.5" Intel Entry SATA 6Gb Hot Swap SSD
Storage (Blockchain DATA)	1 × ThinkSystem U.2 Intel P4610 1.6TB Mainstream NVMe SSD
Network	Intel X710-DA2 PCIe 10GbE 2-Port SFP+ Ethernet Adapter

3.2 Software Requirements

Table 2 Operating System and Software Requirements lists the software used to test the configuration in this paper. We suggest using the product versions (or newer) as follows.

Table 2 Operating System and Software Requirements

Software	Description
Ubuntu Server Operating System	16.04.6 LTS
Hyperledger Fabric SDK	V1.4.0
Docker CE	18.06.1-ce, build e68fc7a
Docker Compose	1.22.0, build f46880fe
NodeJS	v8.16.2

3.3 System Firmware

Our system was tested with the Lenovo firmware versions listed in Table 3 Lenovo System Firmware. Ensure that your system firmware levels are at these versions or better for use with a Hyperledger Fabric setup.

Table 3 Lenovo System Firmware

Type	Version	Build	Release Date
Lenovo XClarity Controller (XCC) BMC	3.62	CDI346N	2020-04-13
Lenovo UEFI	2.51	IVE152L	2020-01-14
Lenovo xClarity Platform Management (XPM)	1.81	PDL124L	2020-03-26

4 Why Intel Select Solutions

Key benefits of investing in an Intel Select Solution from Lenovo include:

- **Simplified evaluation**: New workload integration and the transition to software-defined infrastructure are two areas where IT managers spend more and more time and money sorting through endless options, searching for optimal solutions. Intel Select Solutions are tightly specified in terms of hardware and software components to eliminate guesswork and speed decision-making.
- **Fast and easy deployment**: With pre-defined settings and rigorous system-wide tuning, Intel Select Solutions are designed to increase efficiency in IT's testing process, speed time to service delivery, and increase confidence in solution performance.
- **Workload-optimized performance**: Intel Select Solution configurations are designed by Intel and our partners to deliver to a performance threshold for the workload and are built on the latest Intel architecture foundation including the recently launched Intel Xeon Scalable platforms.

Resources

Lenovo ThinkSystem SR650 Server

- https://lenovopress.com/lp1050-thinksystem-sr650-server-xeon-sp-gen2

Lenovo XClarity Administrator

- https://lenovopress.com/tips1200-lenovo-xclarity-administrator

Hyperledger Fabric

- https://www.hyperledger.org/projects/fabric

Document History

Number	Date	Description
Version 1.5	July 23 2020	Intel Select Solution Certification
Version 1.0	October 31 2019	Initial version