

Smarter technology for all

# ISG Portfolio Overview

April 2023

Lenovo

# ISG Vision

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Be the **most trusted** partner – empowering customers' Intelligent Transformation, and helping solve humanity's greatest challenges

# Infrastructure Solution Group Portfolio

Enterprise Clients	Cloud Service Providers (CSP)	Telco Service Providers	High Performance Computing (HPC)
<p>Solutions designed for a variety of customers.</p> <p>Targeted for general purpose workloads like database, analytics, etc.</p>	<p>ODM+: Design, Build, Deploy &amp; Support</p> <p>End-to-end global capability</p> <p>Full vertical integration reducing costs</p>	<p>NFV Infrastructure &amp; Edge</p> <p>Highest performance &amp; reliability</p> <p>Validated telco solutions</p>	<p>Highest performing supercomputers*</p> <p>Industry leading Neptune™ Liquid Cooling</p> <p>Full rack level integration and ship worldwide</p>

Cloud    Big Data & AI    Business Apps    Database    DevOps

## Strategic Software Partners

IBM    Microsoft    Nutanix    RedHat    Veeam    VMware    SAP

## Lenovo Software






## Infrastructure Solutions

Software Defined



**ThinkAgile**

Tower, Rack, & Dense Servers    Storage



**ThinkSystem**



**ThinkEdge**

**TruScale**    **Lenovo Services**    Discover    Design    Implement    Optimize    Security    Customer Support    Retire    Sustainability

# Server portfolio addressing the needs of customers



## General Purpose Servers

- Designed for a variety of customers with a diverse set of applications
- Multiple form factors – rack, tower & dense
- Targeted for general purpose workloads like database, analytics, etc.

## Specialized & Segment Opt. Servers

- Optimized for specific workloads like AI, HPC etc.
- Optimized for extreme environments like Edge
- Purpose built – Storage rich, GPU rich servers, Ruggedized

## CSP Servers

- Fully customized solutions for the Tier1 CSPs
- Semi customized solutions for the Tier2/3 CSPs
- Partnering with CSPs to rollout cutting-edge technologies

## Geo Specific Servers

- Developed exclusively for GEOs based on customer needs
- Specialized designs for government & data sovereignty compliance

## OEM / Embedded Servers

- White-labeled to fully-customized for OEMs
- Bezel, BIOS, ID, packaging customization
- Joint development model

# LENOVO SERVER PORTFOLIO

Comprehensive compute capabilities from the edge to the enterprise

## ThinkSystem ST series

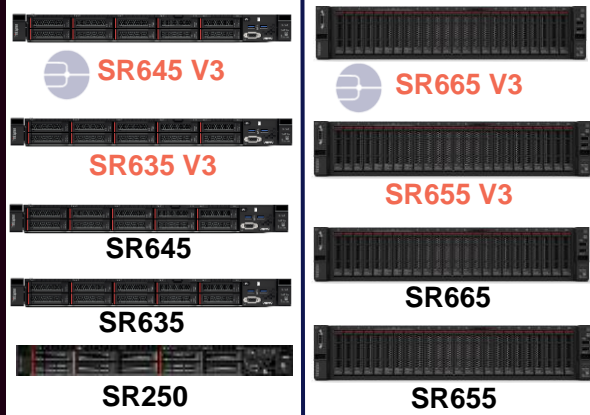
Powered by Intel®



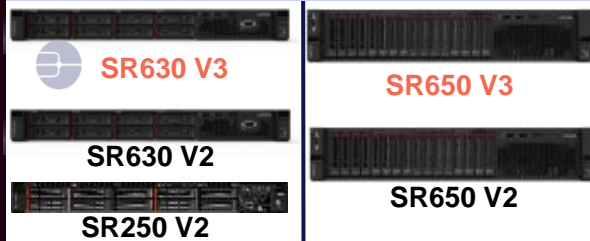
## ThinkSystem SR series

1U 2U

Powered by AMD



Powered by Intel®



## ThinkSystem Modular Platforms

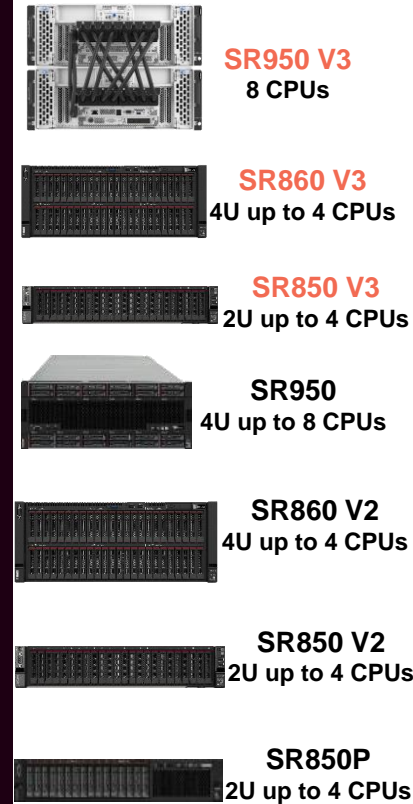
Powered by Intel®

### SD series (Dense)



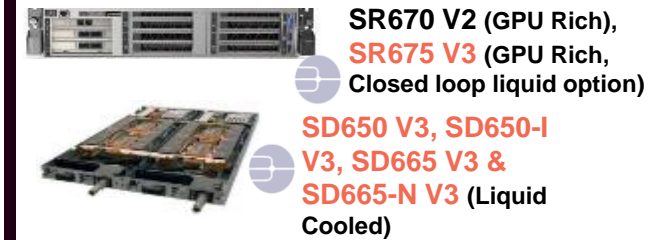
## ThinkSystem Mission Critical

Powered by Intel®



## ThinkSystem Segment Optimized

HPC/AI Optimized AMD & Intel®



### HR series (Hyperscale)



### SE series ThinkEdge



# ThinkEdge From Far Edge to Core

## Edge Client



SE10



-40C to +70C  
Intel ATOM  
Up to 32 GB RAM



M90n-1



0°C to +50°C  
Intel Celeron, i3  
Up to 8GB RAM



SE30



-20°C to +60°C  
Core™ i3, i5  
Up to 16GB RAM



SE50



0°C to +50°C  
Core™ i3, i5, i7  
Up to 32GB RAM



SE70



-20°C to 60°C  
NVIDIA Jetson  
Up to 16GB RAM

## Edge Server



SE350



0°C to 55°C  
Xeon® D-2100  
Up to 256GB RAM



SE450



-5°C to 55°C  
Xeon® SP 3<sup>rd</sup> Gen  
Up to 1TB RAM

## Datacenter



SR630, SR645



0°C to 35°C

### Gateways

#### Diverse Portfolio

From ultra compact gateways to data center grade products.

### Base Station / DC Closet

#### Highest Performance

CPU & GPU rich systems for ultimate performance.

### Data Center

#### Flexible Deployment

In harsh environments with ruggedized devices & unique cooling capabilities.

# Lenovo Smart Data Management

Enable Data Intelligence for a Digital Transformation

## Efficient Data Management Solutions

capitalize on the expanding quantity and diversity of data

## Harness Data from Edge to a Hybrid Multi Cloud

optimized data management for distributed data

## Secure Data Management Capabilities

ensure data integrity and reduce risk

# Lenovo edge enterprise cloud data management

TruScale  
Infinite Storage



**NAS/SAN/Unified**  
DM Series



**SAN Storage**  
DE Series



**Hyperconverged**  
HX, VX, MX



**Hybrid Cloud**  
Cloud Volumes FabricPool  
Cloud Manager



WEKA

CLLOUDIAN

**Software Defined  
Storage**



DSS



**Disk Expansion**  
D Series



**Tape/Archive**



**Networking**  
DB Series - FC

VEEAM

COMMAVULT

IBM  
Spectrum  
Scale

IBM Cloud  
Object Storage

**Backup/  
Management**

Choice and Flexibility of Consumption Models Including **Lenovo TruScale** as a Service

Lenovo

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# Business Agility | Technology Flexibility

## ThinkAgile

## ThinkSystem



vmware®

### ThinkAgile VX Series

Engineered integrated system for VMware environments. Integrated with VMware vSan software



NUTANIX

### ThinkAgile HX Series

Designed for easy deployment and manageability. Integrated with Nutanix Software



Microsoft

### ThinkAgile MX Series

Quick and easy to deploy HCI solution with Microsoft WSSD certified hardware and S2D Storage Spaces Direct (S2D) feature of Windows Server – DataCenter Edition.



Microsoft

### ThinkAgile SXM for Azure Stack

Hybrid Solution: Private cloud workloads and public cloud workloads (Azure cloud platform) managed as one.



Lenovo

### ThinkSystem DM

Easy and fast to tier data across Private, Hybrid, or Public cloud with Integrated automation software.

## Turnkey Hybrid Cloud Platforms

# Accelerate hybrid cloud adoption for VMware Environments

Increased level of performance, security and storage

## ThinkAgile

### VX Integrated System



- Factory Integration of HW+SW
- Certified Firmware
- Simplified lifecycle management (LCM)
- ThinkAgile Advantage Warranty
- VMware Licenses
- Deployment Services
- Deployment Automation Utility
- Advanced Monitoring & Diagnostics

## ThinkAgile

### VX Certified Node

- Certified Hardware
- Certified Firmware
- Simplified lifecycle management (LCM)
- 24x7 access to support

## ThinkSystem

### vSAN Ready Node



- Build it Yourself
- No Component Control
- Customer Assumes Risk
- No Firmware Control
- Customer Manages Updates
- Multiple Support Vendors

TruScale Hybrid Cloud with VMware

# Lenovo ThinkAgile HX delivers hybrid cloud simplicity

Unify hybrid cloud infrastructure | Automate operations with accelerated service delivery

## ThinkAgile

### HX Certified Node

- Certified Hardware
- Certified Firmware
- Managed Firmware
- ThinkAgile Support
- Best Recipe
- Life Cycle Management



## ThinkAgile

### HX Integrated System

- Factory Integration of HW+SW
- Managed Firmware
- ThinkAgile Support
- Single Point of Contact
- Nutanix Licenses
- Deployment Services
- Best Recipe
- Life Cycle Management

TruScale

# Lenovo Hyperconverged Ecosystem with MX & SXM

## ThinkAgile

### Validated Node

- Certified Hardware
- Certified Firmware
- Managed Firmware
- ThinkAgile Support
- Best Recipe
- Life Cycle Management



## ThinkAgile

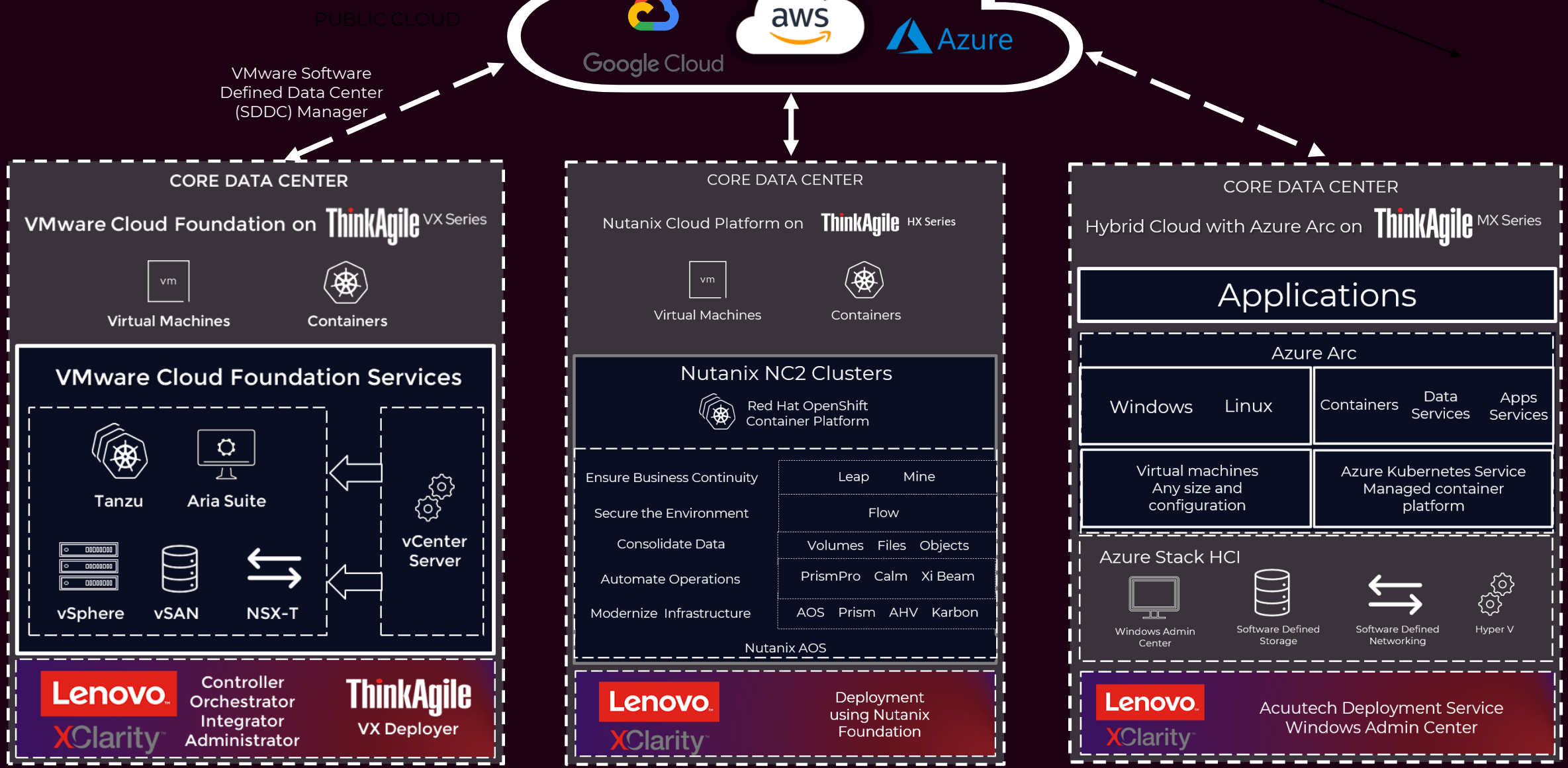
### MX Integrated System

- Factory Integration of HW+SW
- Certified Firmware
- Simplified lifecycle management (LCM)
- ThinkAgile Advantage Warranty
- Deployment Services
- Integration with Windows Admin Center for ease of deployment
- Advanced Monitoring & Diagnostics

TruScale

# Hybrid and Multi Cloud

# with ThinkAgile



# AZURE STACK HCI: *WORKLOAD FOCUS*



General purpose platform  
for ANY application/services

Industry-best performance  
for SQL Server databases

Virtual desktops  
with edge-local access

Tightly-integrated  
Kubernetes

**Any app for any reason**  
any VM, any container, anytime

**Windows or Linux apps**  
with resilience and performance

**Managed by Azure Arc**  
and added value from hybrid services

**Millions of storage IOPS**  
or database transactions

**Consistent low latency** with NVMe,  
RDMA, and persistent memory

**Accelerate Azure Data Services**  
and Big Data Clusters at the edge <sup>1</sup>

Deliver virtual apps, desktops & sessions  
with **low latency & data sovereignty**

**Cost savings** with your preferred VDI  
solution on subscription-based platform.

**Scale for performance** and number  
of desktops nearly linearly as more  
nodes are added, making capacity  
planning much easier

Run **K8s-compliant** containerized  
applications on resilient infra

**Simply deploy** K8s and scale  
using virtual infrastructure

**Leverage Azure** for burst and  
Arc for configuration management

# Lenovo ON DEMAND Solutions



## Simplicity Engineered

Lightweight HCI Stack  
Perfect for retail, edge  
and SMB



## Hybrid Cloud Infrastructure

Fully-integrated  
Kubernetes Stack for  
Cloud-native applications



## Fastest Virtual Workstation

Purpose-built virtual  
workstion private cloud for  
massive Oil & Gas Seismic  
and Oil Well data workflow

# Lenovo Management & Automation Software



Centralized systems management suite to monitor, manage and automate Lenovo's infrastructure



An automated platform to deploy, optimize and manage cloud infrastructure (bare metal servers, containers, VMs).



Lenovo intelligent computing orchestration (LiCO) brings several open-source components into a single GUI to make the access of computing resources easier for AI development and training and HPC cluster management

# XClarity Software Suite

Cloud automation and IT service management processes

Lenovo  
XClarity Integrators

- Integration into leading virtualization management consoles and IT service management tools
- VMware, Microsoft, Cloudforms, Chef, Puppet, ServiceNow, MSFT WAC

Innovative Centralized Management

Lenovo  
XClarity Orchestrator

Lenovo  
XClarity Administrator

- Centralized software-based delivery and management for ThinkSystem servers, storage, and networking
- Mobile app for anywhere management
- REST APIs for ease of integration into software-defined environments

Platform Management Tools

Lenovo  
XClarity Essentials

- Collection of one-to-one management tools
- Scripting tools

Embedded Platform Management

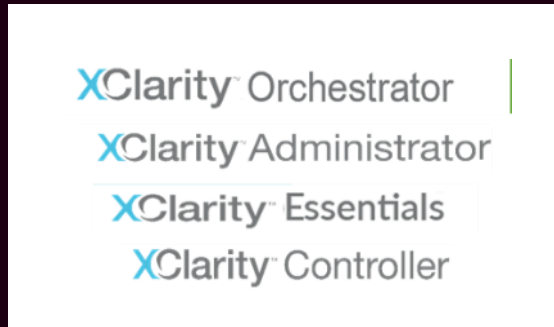
Lenovo  
XClarity Controller

- Embedded management engine common in all ThinkSystem servers
- Fresh, uncluttered graphical user interface
- Redfish-compliant web-based REST APIs for ease of inter-operability

# Intelligent Management - The Evolution to XClarity One

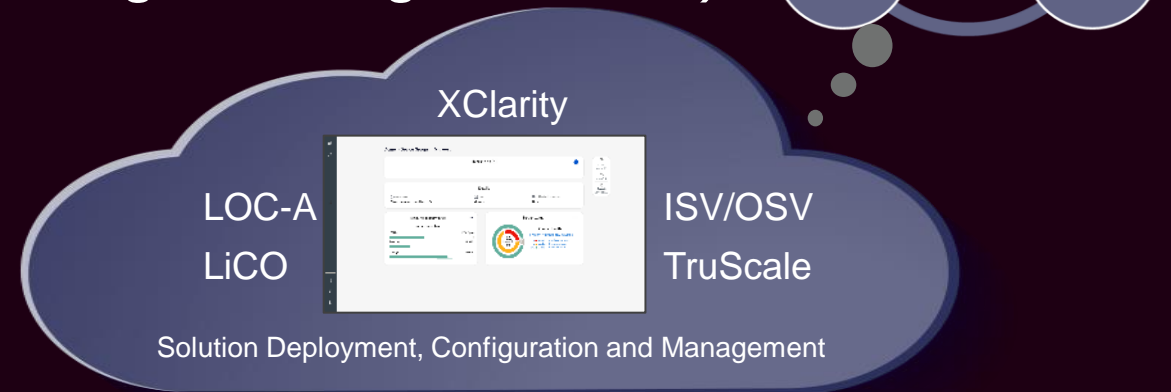
Available 2H 2023

## PRESENT XClarity Family



- New application, smaller footprint
- Intuitive user interface
- API's / SDK for Partner integration

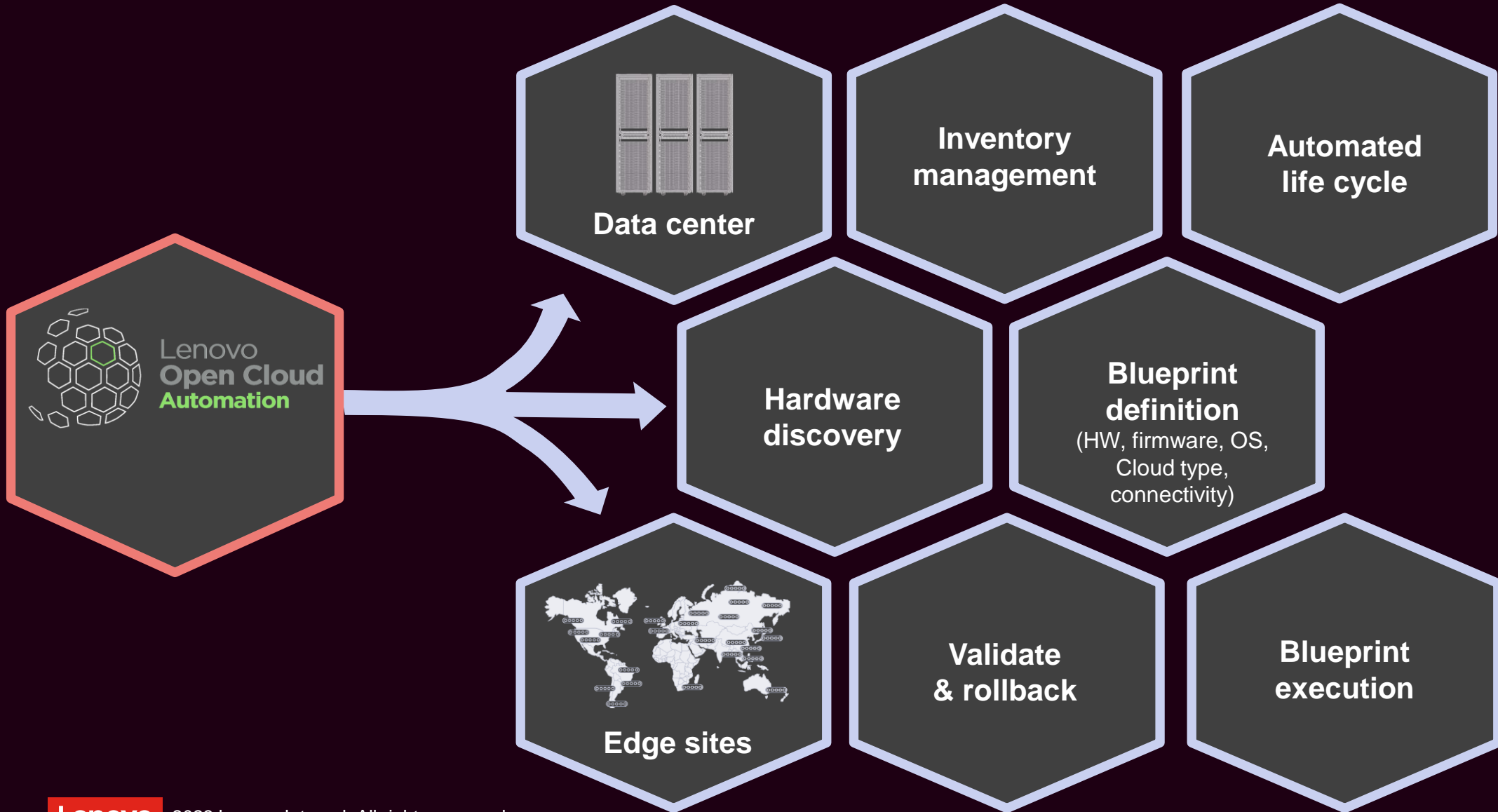
## XClarity One (Intelligent Management AAS)



- Unified Intelligent Hybrid Cloud Interface
- Cloud native developed services
- Support for Edge, Servers, PC's & Storage

Customer Value

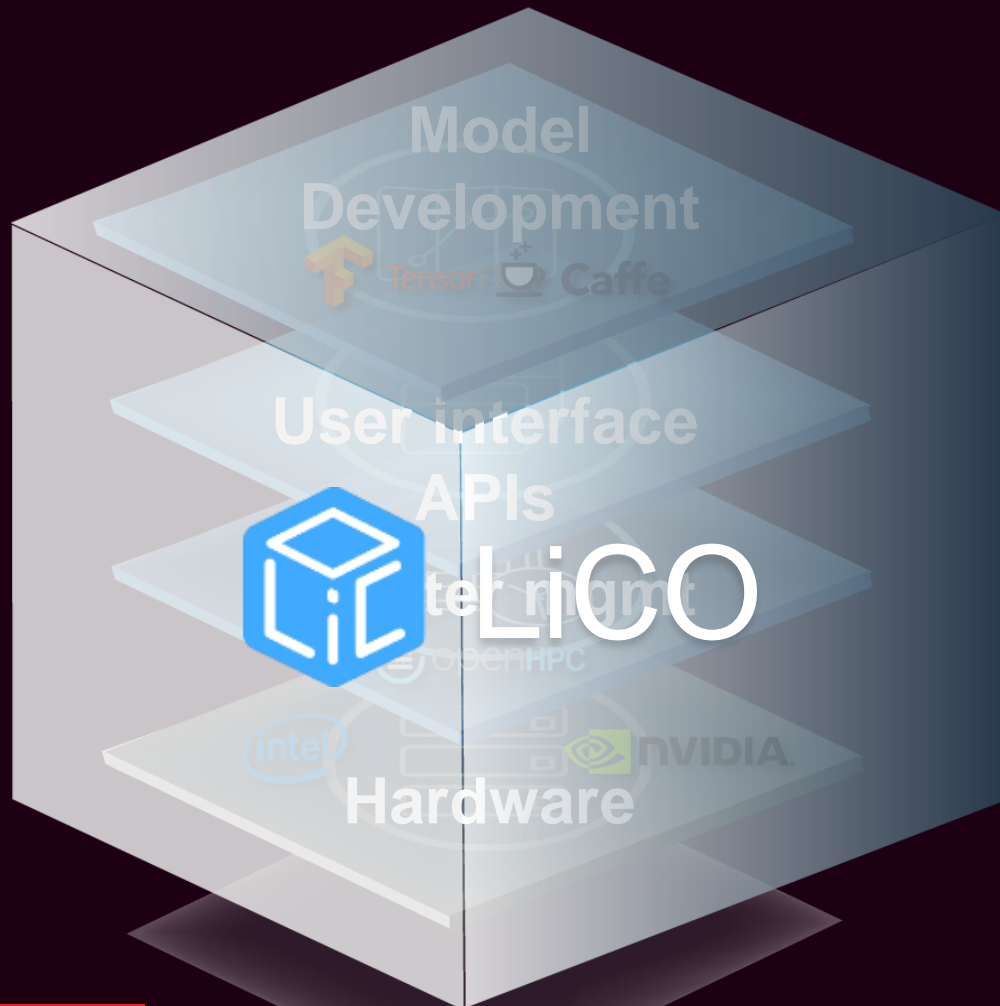
# LoCA: Scalable, Secure, Automation Deployment Software





# LiCO AI Platform

## Lenovo intelligent Computing Orchestration



- Simplifies AI Development
- Dynamic Scale-out Platform
- Real Time AI Monitoring
- AI Studio Module
- Lenovo Accelerated AI - no-code models
- Support NVIDIA NGC containers
- CLI access within LiCO for expert users
- Supports Kubernetes & OpenHPC stacks
- Supports Jupyter Notebooks
- **Configure solution with 1-click**

AI Training DRS

# Security Without Compromise

# ThinkShield

## Compliance:

Supports FIPS 140-3\*, enhanced NIST SP800-193 Compliance, CNSA Suite 1.0 Quantum-resistant cryptography

## Lenovo System Guard:

monitors a server's internal hardware inventory to detect and protect against supply chain attacks or hacking

## Trusted platform Module(TPM) 2.0:

hardware-based security which provides user authentication, remote access, and data protection.

## Protection:

Hardware-assisted encryption<sup>2</sup>, physical intrusion switches and secure boot

## Lenovo Immutable Root of Trust:

provides an embedded, silicon-based chip that ensures that the server can only be booted with trusted firmware.

## Secure Development Lifecycle:

drives security into products and services throughout the lifecycle including digital signatures on products, secure development processes and incident response teams.



**Designed to perform**



**Embedded hardware protection**



**Secure supply chain and business processes**

**100%** USA Audit Compliance

**6** Owned/ controlled manufacturing sites

**1** Secure Code Vault

**#9** High Tech Secure Supply Chain\*

# Lenovo AI Building Blocks



## Infrastructure

High performance storage & compute DC & edge portfolio that scales with your demand



## AI Center of Excellence

Find faster time to value by leveraging the Lenovo AI Innovation Centers



## Partner Ecosystem

Leverage certified solution partners to confidently address customer requirements.



## AI Solutions

Pre-validated solutions reduce the complexity with architecting, ordering and getting support for AI solutions – buy a solution, not a bag of parts.



# Accelerate your AI journey.

## In the Lenovo AI Center of Discovery & Excellence

Proof of Technology | Workshops | Partner Collaboration | Benchmarking | Best Practices  
Data Scientists | AI Architects | Engineers | Suppliers | Software Partners | Industry Consortia

**10+** global technical benchmarks

**40+** HPC & AI technical field sales.

**100+** engineers & researchers in the **Lenovo AI Research Lab**  
[Learn More](#)

**30+** AI Solution Partners with a global workforce of thousands.

**23k** Channel Fulfillment Partners

Industry Memberships





# Being open means being a trusted partner



Being open  
means  
offering  
a breadth  
of open  
infrastructure  
solutions

## Solutions

We work closely with our software partners to provide engineered, tested, and certified IT solutions that are high performance, scalable, and cost-effective.

AI

HPC

Big Data / Analytics

Hyperscale

Cloud

IoT / Edge

Database

Client  
Virtualization

Back Up & Disaster  
Recovery

Telco - NFV

## Infrastructure

Open, reliable and secure platforms that seamlessly integrate with your environment.

Servers

Hyperscale

Storage

IoT / Edge

Hyperconverged

**ThinkSystem**

Enterprise  
Infrastructure

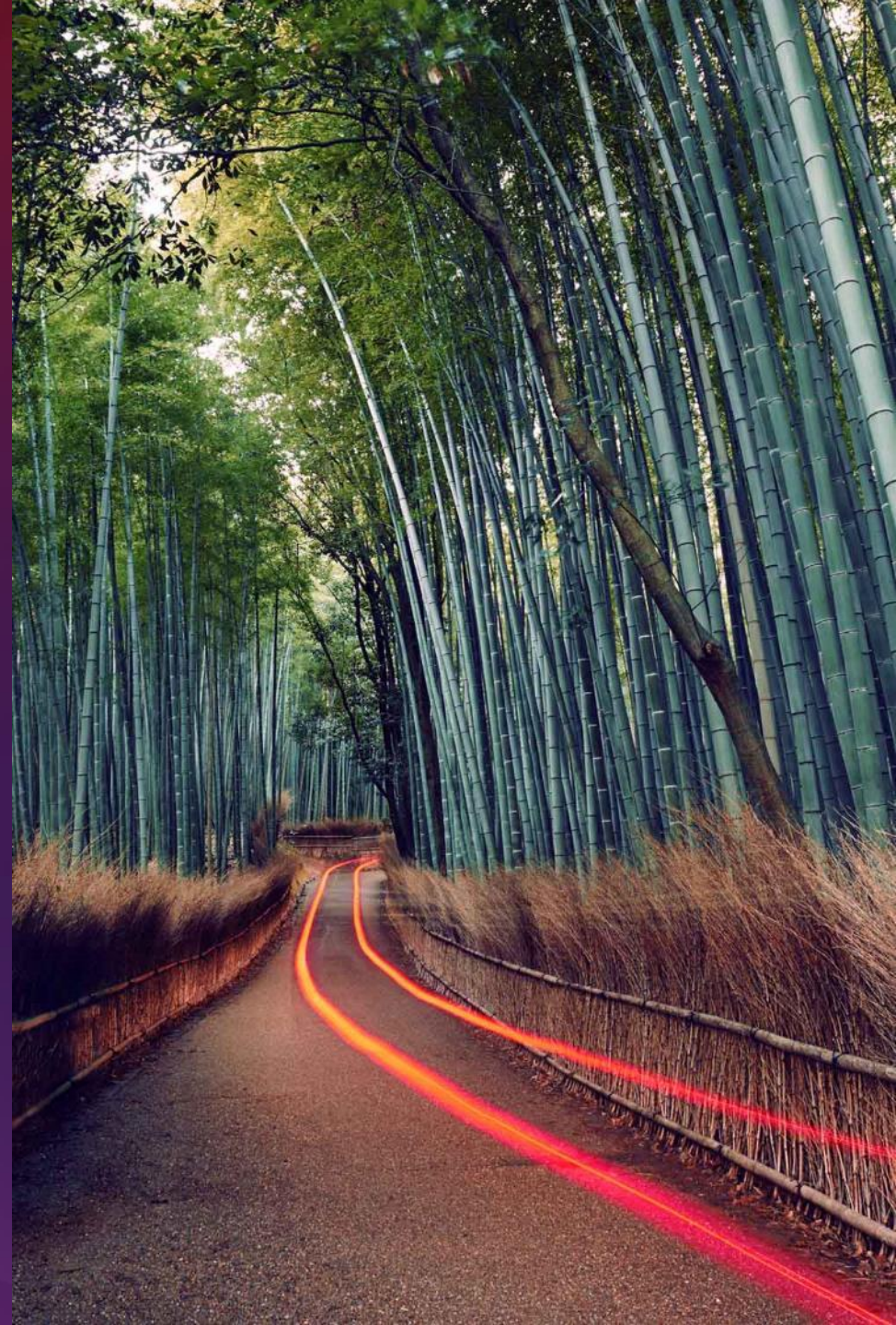
**ThinkAgile**

Software-Defined  
Infrastructure

**ThinkEdge**

Edge  
Infrastructure

# Sustainable Computing



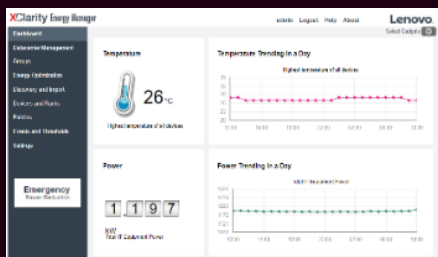
# Lenovo Innovation: Sustainable Computing

## Lenovo Energy- Efficient Technologies

### Energy Management Tooling

*Measure, manage, optimize power*

#### xClarity Energy Manager (LXEM)



#### Energy Aware Runtime (EAR)



### Efficient Component Selection

*Same work, less power*

#### Titanium Power Supplies



#### Idle Power State Controls

Dynamically optimize the frequency and power control

#### Low Loss Materials

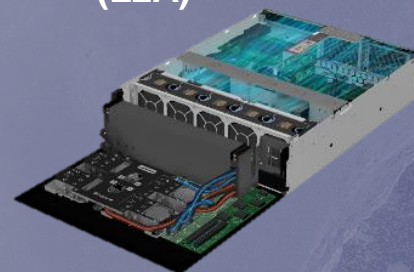


## Liquid-Cooling with Lenovo Neptune™

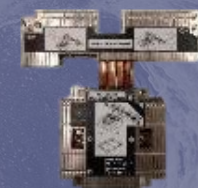
### Heat Mitigation Innovation

*Lower fan speed, less power*

#### Liquid to Air Exchanger (L2A)



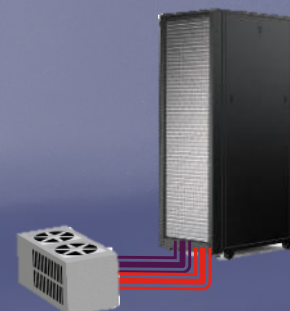
#### Thermal Transfer Module (TTM)



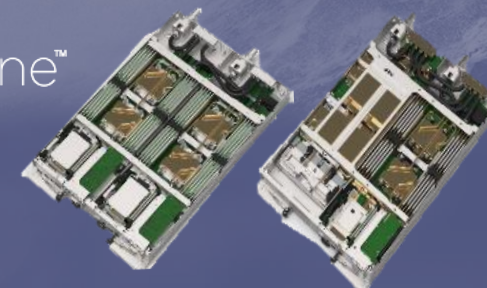
### Liquid Cooling

*Rethink how cooling gets done*

#### Rear Door Heat Exchanger



#### Direct Liquid Cooled Systems



# Sustainability End to End

## How We Service

### Lenovo TruScale

Avoids over-provisioning, reducing energy consumption for a lower carbon footprint

### Lenovo Asset Recovery

15 years experience in asset recycling and more than 1M+ assets properly disposed

### CO2 Offset Services

Carbon offset credits fund projects, including reforestation, renewable energy, and solar

## How We Build

### 100% Recyclable Packaging

Including the use of 90%+ recycled foam and bags made from 30% ocean bound plastic

### Factory Integrated Racks

Saving 3.5 million pounds of cardboard and 1.8 million pounds of plastic over 5 years

**Empowering organizations, large or small, to unleash the full power of technologies.**

## Lenovo Solutions

Digital Workplace

Industry Verticals

Hybrid Cloud

Sustainability

## Lenovo Services

Consulting

Deployment

Managed

Support

Security

## Lenovo TruScale

Device as a Service

Infrastructure as a Service

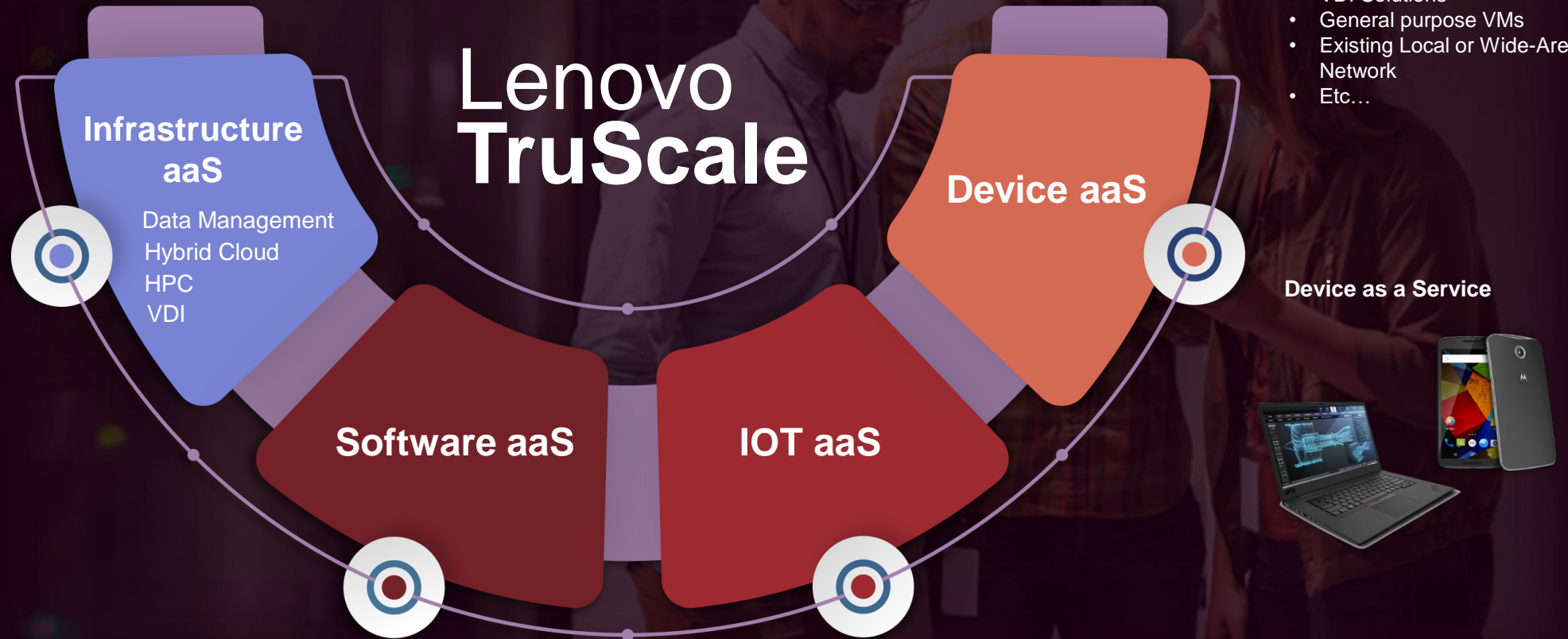
Software as a Service

# TruScale is an Umbrella for as-a-Service Lenovo Solutions

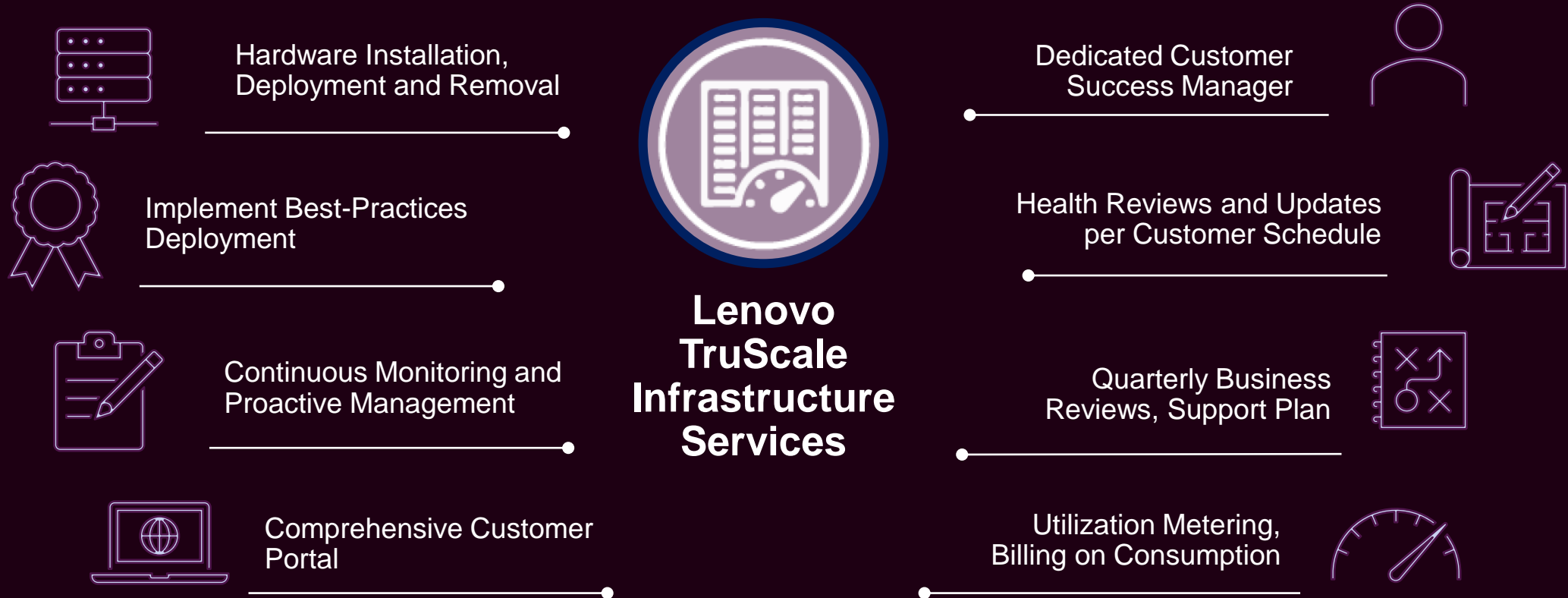
Subscription-based access to resources to fit your IT need for lower cost, faster deployment, improved security and simpler management.

- Refresh Planning
- Configuration
- Advanced Deployment
- Security & Endpoint Mgt
- Application updates
- Device recovery/retirement
- Etc...

- Enterprise applications
- File sharing
- VDI Solutions
- General purpose VMs
- Existing Local or Wide-Area Network
- Etc...

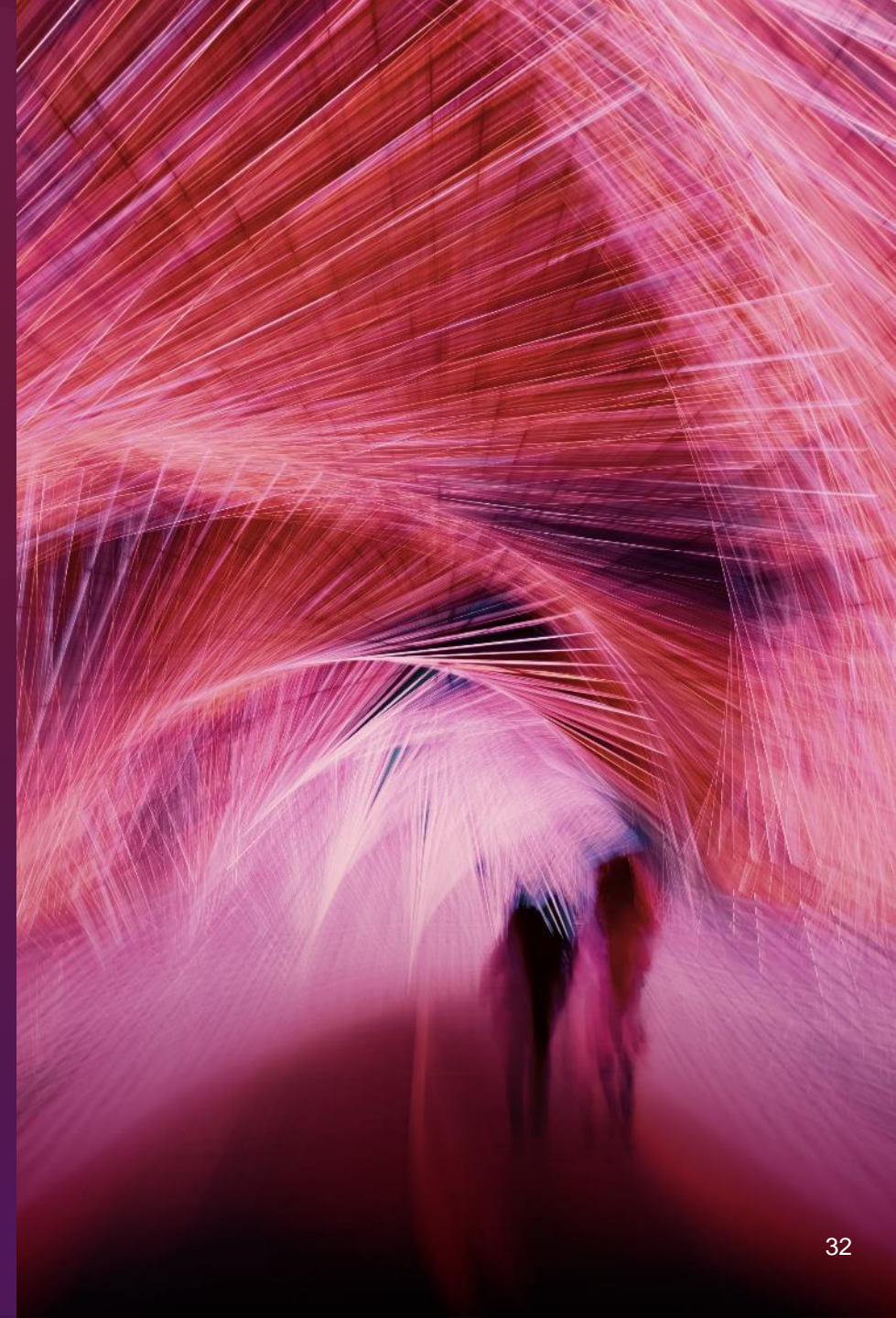


# Fast-track your vision of the future - IAAS



**As-a-Service offerings covering the full life-cycle of a system**

# Design & Manufacturing



# Common Design

Common design and processes to promote quality and scale across the portfolio.

# Common Components

Leveraging our \$60B+ procurement spend to deliver competitive cost to our customers.

# Common Suppliers

Procurement is power and trust

# Vertical Manufacturing

ODM+

The diagram illustrates a strategic framework. On the left, a dark grey box contains three strategic pillars: 'Common Design', 'Common Components', and 'Common Suppliers', each with a brief description. Below this box is another dark grey box labeled 'Vertical Manufacturing'. On the right, the text 'ODM+' is displayed in large white font. Two orange arrows originate from the right side of the top box: one points down to 'ODM+', and the other points up to 'ODM+'. A third orange arrow originates from the right side of the 'Vertical Manufacturing' box and points up to 'ODM+'.

# Global Manufacturing

**Ullo, Hungary**  
366,000 sq. ft.



**Monterrey, Mexico**  
450,000 sq. ft.



**Guadalajara, Mexico**  
64,000 sq. ft.



**Shenzhen, China**  
3,000,000 sq. ft.



**Hefei, China**  
3,600,000 sq. ft.



# TOTAL THINKSYSTEM/THINKAGILE PERFORMANCE BENCHMARKS

## 431 Current World Records on ThinkSystem & ThinkAgile

SAP	Transaction Processing	Virtualization	Compute	Energy Efficiency	Data Analytics	JAVA Application	High Performance Computing	Artificial Intelligence Computing
<b>13</b>	<b>13</b>	<b>12</b>	<b>37</b>	<b>19</b>	<b>55</b>	<b>48</b>	<b>185</b>	<b>49</b>
SAP SD 2T & BWoH	TPC-E TPC-H	SPEC virt_sc 2013 SPECvirt Datacenter 2021 VMmark v3.1	SPEC CPU	SPECpower_s sj2008	STAC-M3 TPCx-IOT TPCx-BB	SPECjbb2015	SPEC MPI2007 SPEC OMP2012 SPEC ACCEL SPEC Hpc 2021	MLPerf

## 999 Total World Record Benchmarks Since 2001

# ISG Vision

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Be the **most trusted** partner – empowering customers' Intelligent Transformation, and helping solve humanity's greatest challenges

Smarter  
technology  
for all

Lenovo

thanks.