

ZABBIX
SUMMIT
2024

Key points of data structure in Zabbix when automatically drawing topology

2024/10/04

Takeshi Tanaka

NTT Com Engineering Corporation, Japan

Introduction

Who am i?

Takeshi Tanaka from Japan

Working on IT since 2000

Joined NTT Group in 2008

Engaged in Zabbix business at NTT Group since 2011.

Monitoring System Engineer at NTT Com Engineering.

- > Monitoring system design
- > Product planning



(<https://www.nttceng.com/>)

NTT Com Engineering Corporation

- Technology subsidiary of NTT Communications
- Founded in 1987 (NTT Fanet Systems)
- In 2023, take over NTT Communications' Zabbix business.
(NTT Communications Group's Zabbix business started in 2007)

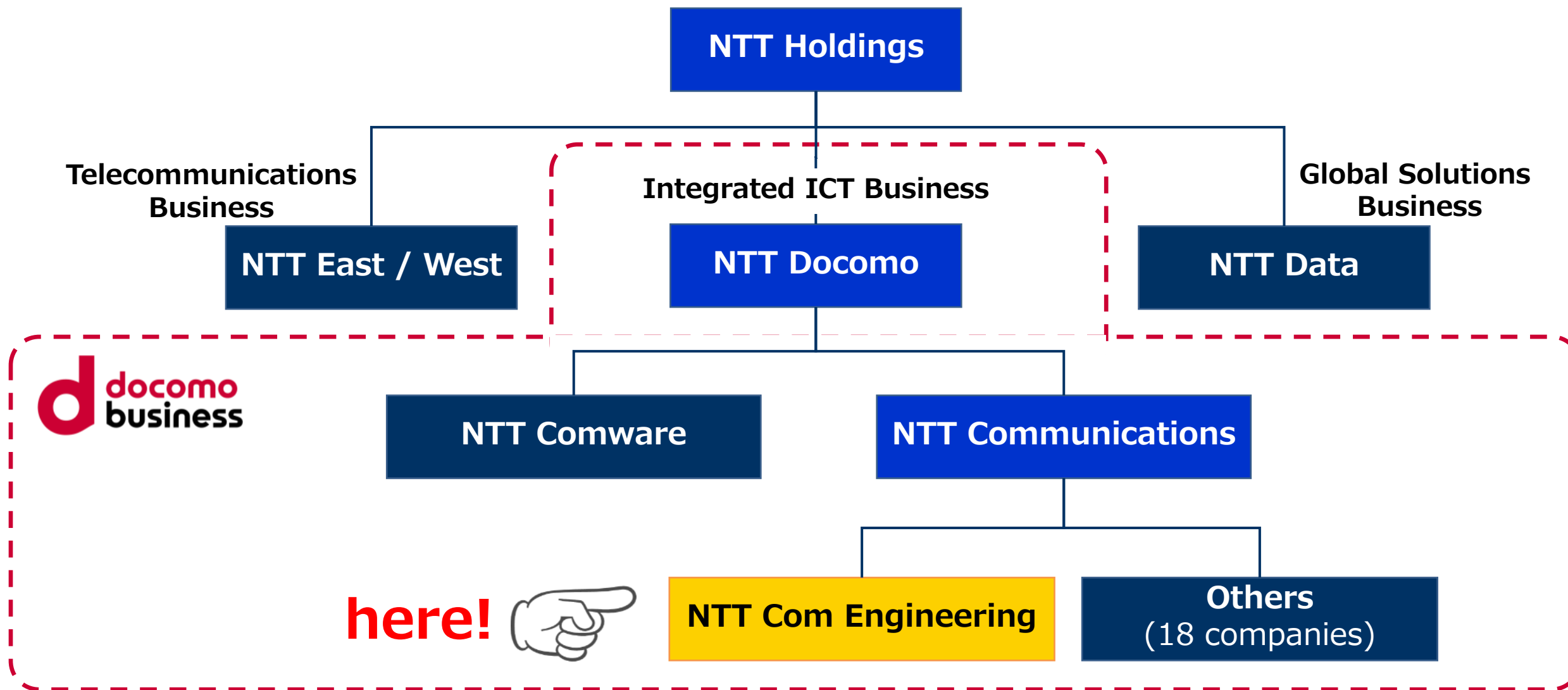
What is NTT?

- Government-affiliated telecommunications group in business for over 72 years
- Consists of Nippon Telegraph and Telephone Corporation (NTT), the controlling holding company, 952 consolidated subsidiaries, and 141 affiliated companies

1958: Founded as a public corporation to take over the national telegraph and telephone business

1985: Privatized with the liberalization of the telecommunications business in Japan

1999: Spun off into separate operating companies

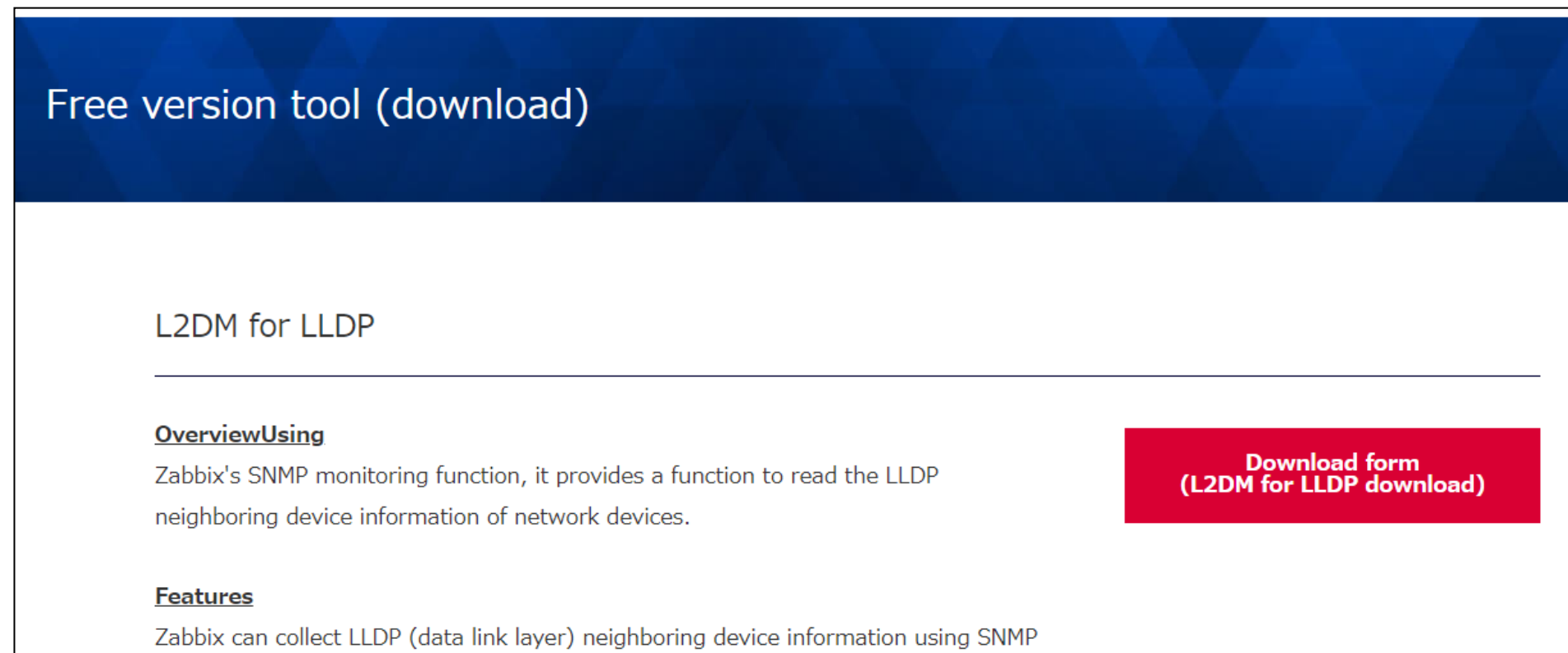


Background and Objectives

Mechanism for detecting adjacent devices

We presented our developments at Zabbix Summit 2018.

- A function to collect information on neighboring devices from network switches
- Support for Zabbix 3.0 - 7.0 loadable modules (latest version 1.9)
- Compiled modules, source code, and templates are available



Free version tool (download)

L2DM for LLDP

OverviewUsing
Zabbix's SNMP monitoring function, it provides a function to read the LLDP neighboring device information of network devices.

Download form (L2DM for LLDP download)

Features
Zabbix can collect LLDP (data link layer) neighboring device information using SNMP

<Caution>
Japanese only.
Please use automatic translation.

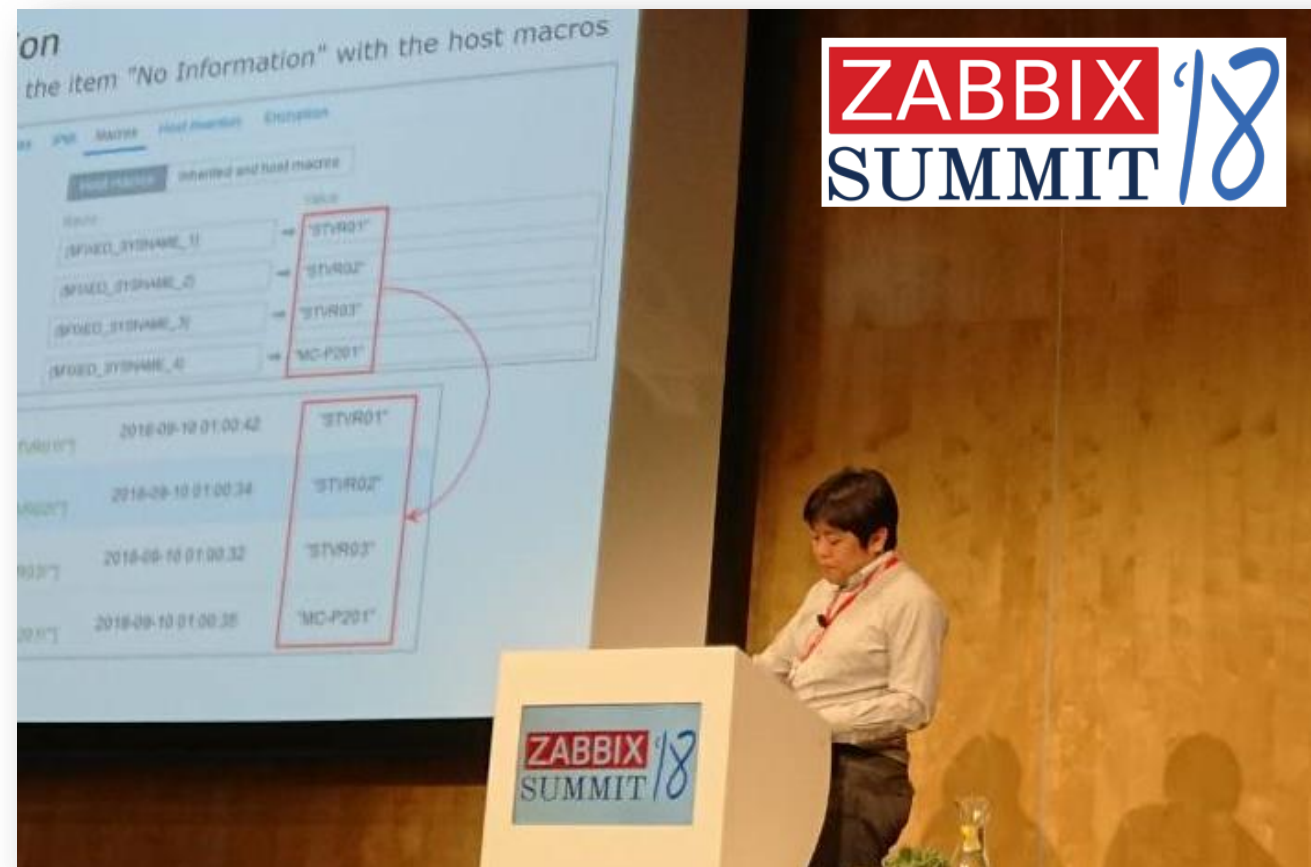


<https://www.zabicom.com/zabbix/solution/tools-jp/>

Development Background

We received a comment after the presentation that it might be possible to automatically generate network diagrams.

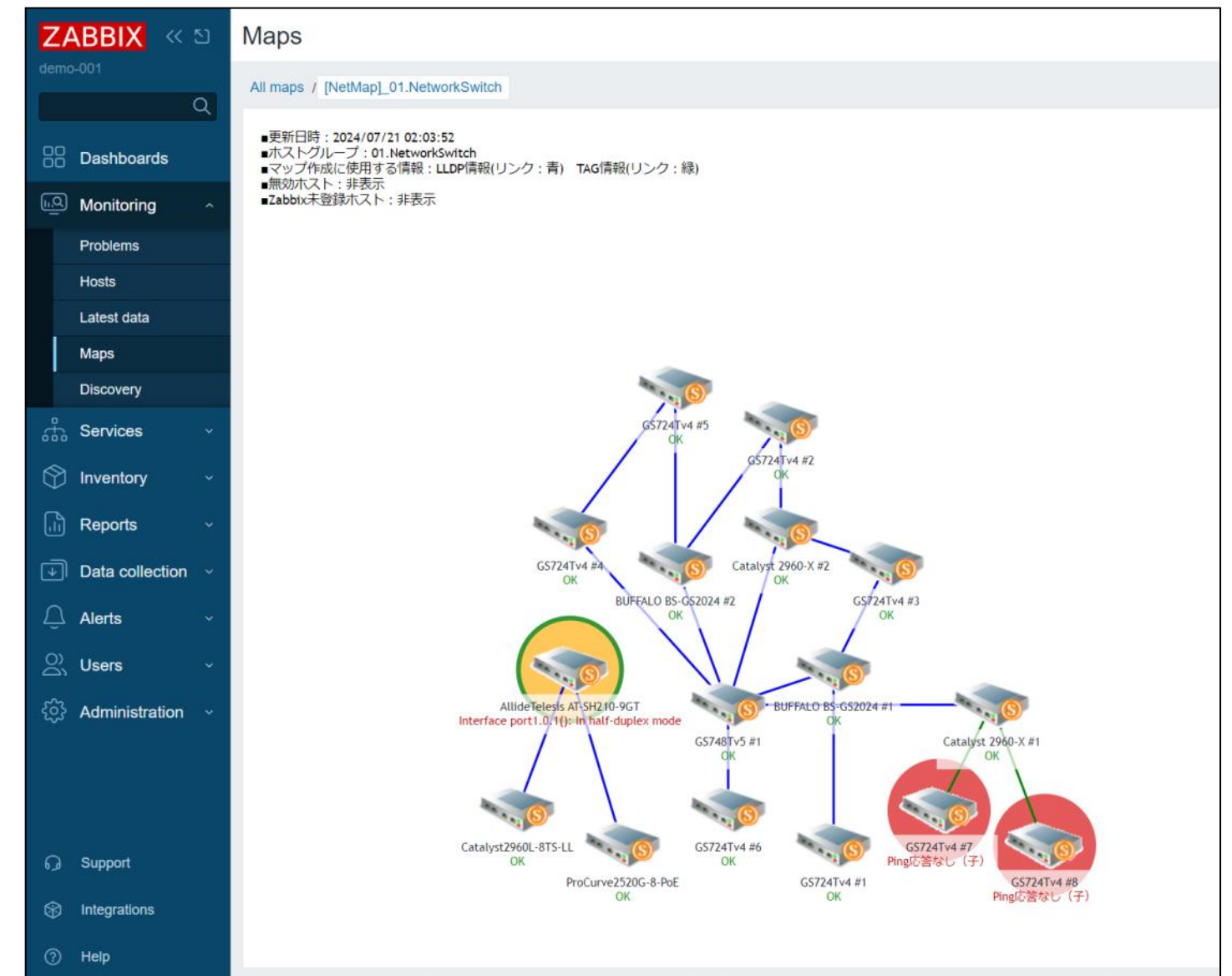
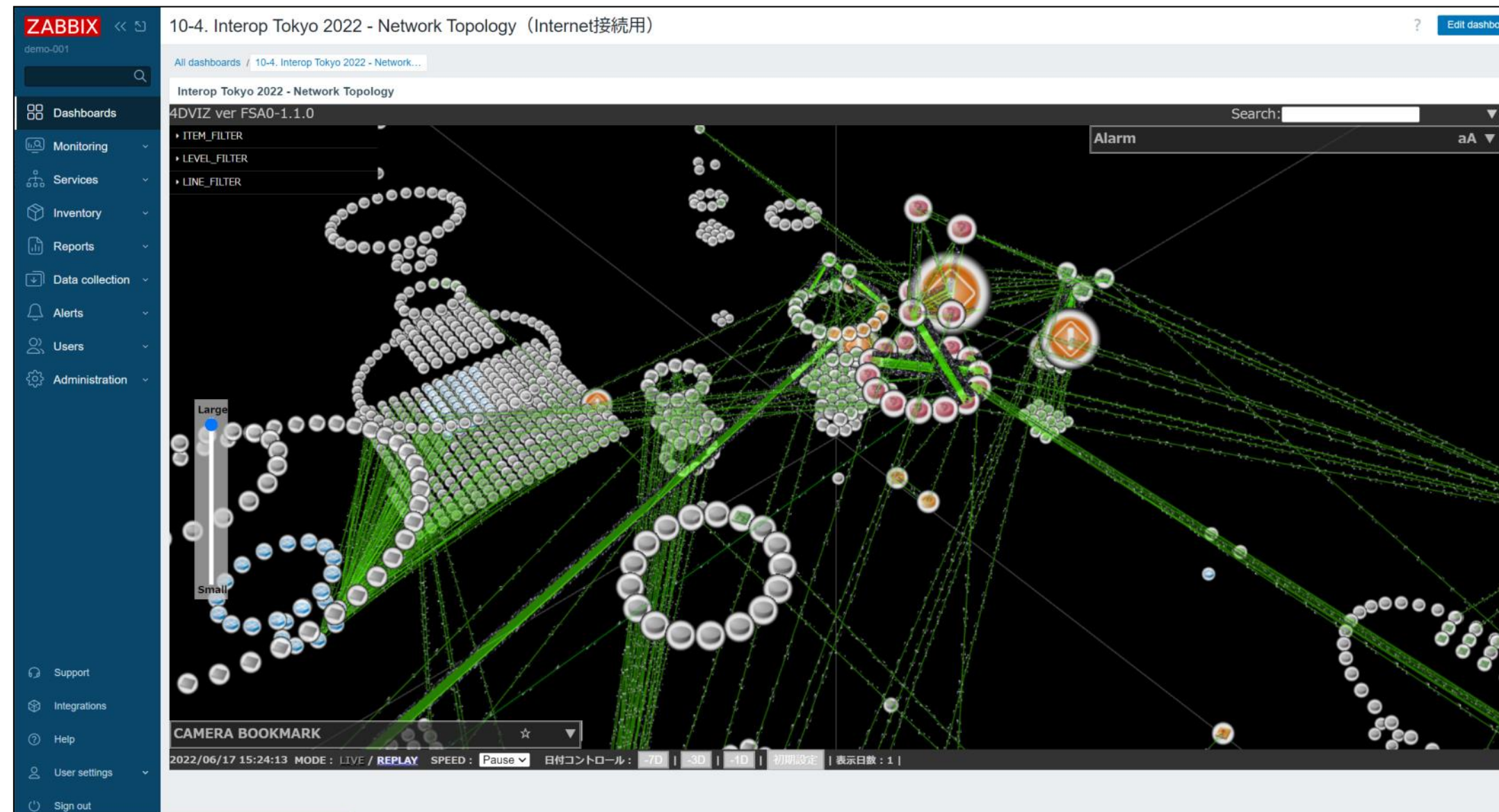
- After several development projects, automatic generation of network topology was achieved.
- We will present the results of the development in 2019 and beyond.



Development Objectives

Two types of implementations for automatic generation of network diagrams are described.

- 3D network diagram using external drawing engine (left)
- 2D network diagram using Zabbix Map (right)

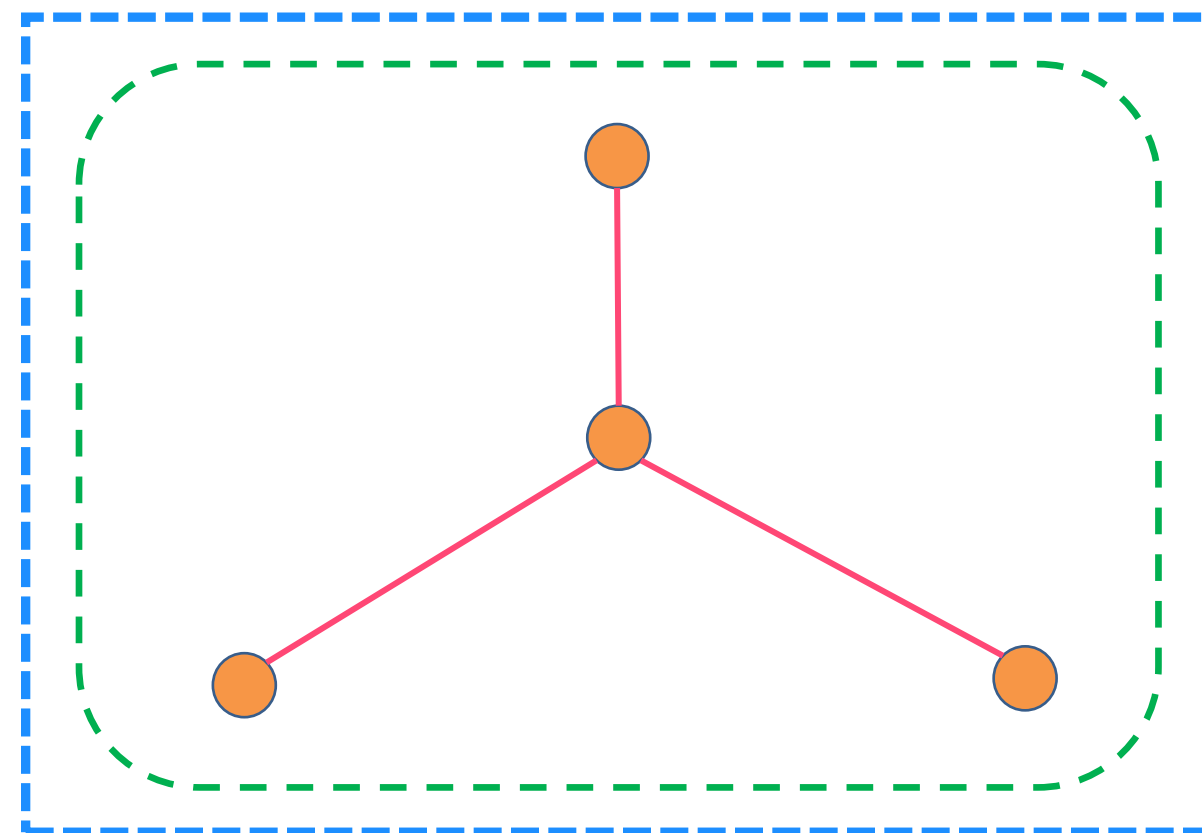


Store topology information in Zabbix

Elements needed to draw topology

The following elements are required to draw a network topology.

- Node information ⇒ Nodes that are members of a topology
- Link information ⇒ Connection information between nodes that are members of a topology
- Drawing engine ⇒ A program to draw the topology
- Placement logic ⇒ Logic to automatically place nodes and links in the topology

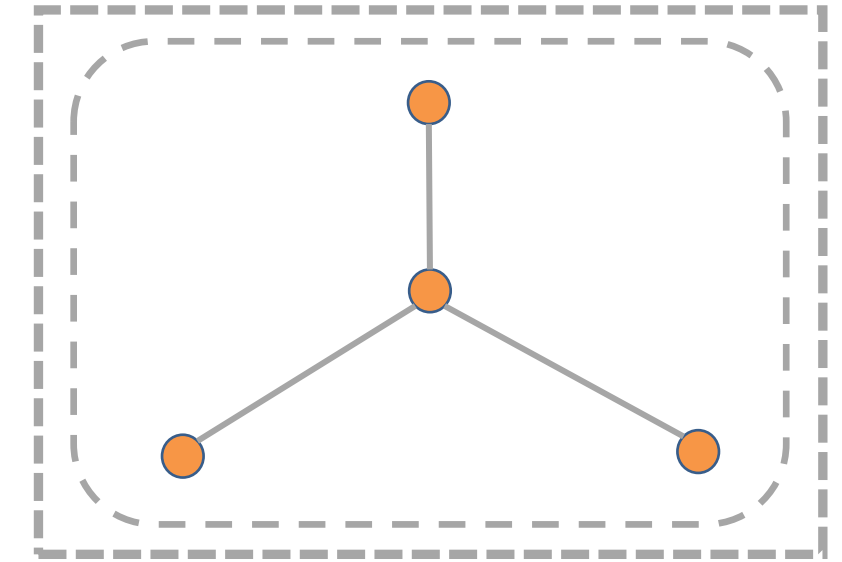


- Node information
- Link information
- Drawing engine
- Placement logic

Store Node information in Zabbix

Register as 1 host = 1 node

- Hosts: guaranteed uniqueness in the topology
- Host inventory: additional information about the node
- Failure information: additional information of node
- Network Discovery: Automatically follows the increase of hosts



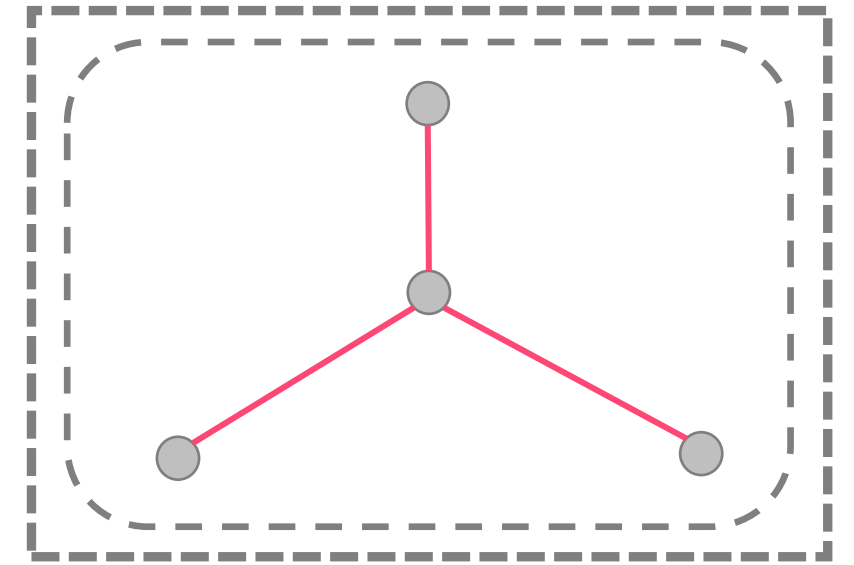
Hosts have no history, so it is impossible to refer to past information



Where should Zabbix store link information?

The following locations were considered as possible locations for storing link information

- History data
- Inventory
- Tags



History Data

<input type="checkbox"/>	Host	Name ▲	Last check	Last value
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.1] - [Connect to] Host ?	54s	ProCurve2520G-8-PoE
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.1] - [Connect to] Host Descr ?	54s	ProCurve J9298A Swit...
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.2] - [Connect to] Host ?	54s	Catalyst2960L-8TS-LL
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.2] - [Connect to] Host Descr ?	54s	Cisco IOS Software, C...
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.3] - [Connect to] Host ?	54s	SR-S310TL2
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.3] - [Connect to] Host Descr ?	54s	'SR-S310TL2' '2.1 V14...
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.4] - [Connect to] Host ?	54s	APLGM110GTSS
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.4] - [Connect to] Host Descr ?	54s	Gigabit Ethernet Switch
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.5] - [Connect to] Host ?	54s	QX-S3109TP
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.5] - [Connect to] Host Descr ?	54s	NEC Comware Platfor...
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.6] - [Connect to] Host ?	54s	** No Information **
<input type="checkbox"/>	AllideTelesis AT-SH210-9GT	[Port - port1.0.6] - [Connect to] Host Descr ?	54s	** No Information **

Inventory & Tag

New host

Host IPMI **Tags** Macros **Inventory** Encryption Value mapping

Disabled Manual **Automatic**

Type

Type (Full details)

Name

Alias

OS

Where should Zabbix store link information?

	neighboring device information	one-to-one connections	one-to-many connections	automatic updating	manual updating	history
History data	✓	✓	✓	✓		✓
Host Inventory	✓	✓		✓	✓	
Host Tags	✓	✓	✓		✓	



No storage location that can meet all requirements.

Where should Zabbix store link information?

	neighboring device information	one-to-one connections	one-to-many connections	automatic updating	manual updating	history
History data	✓	✓	✓	✓		✓
Host Inventory	✓	✓		✓	✓	
Host Tags	✓	✓	✓		✓	



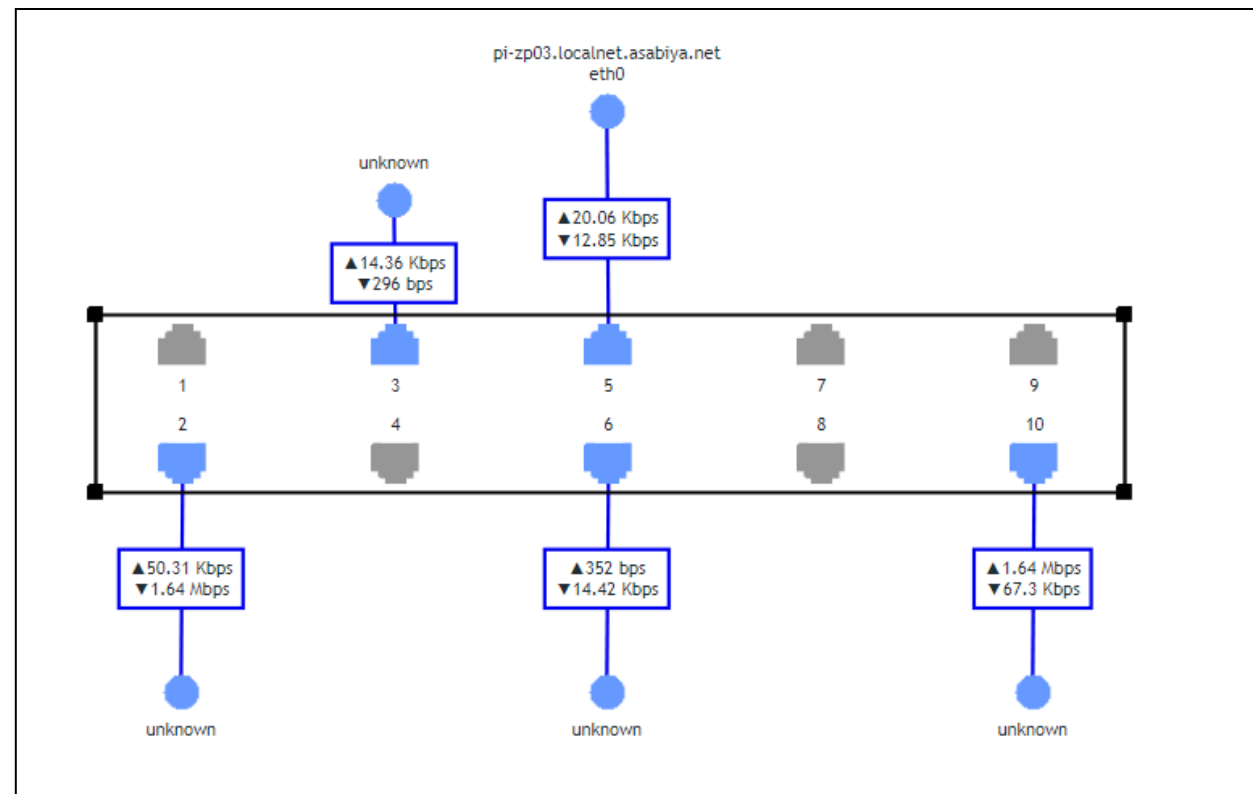
Use historical data and tags together

Drawing engine and placement logic

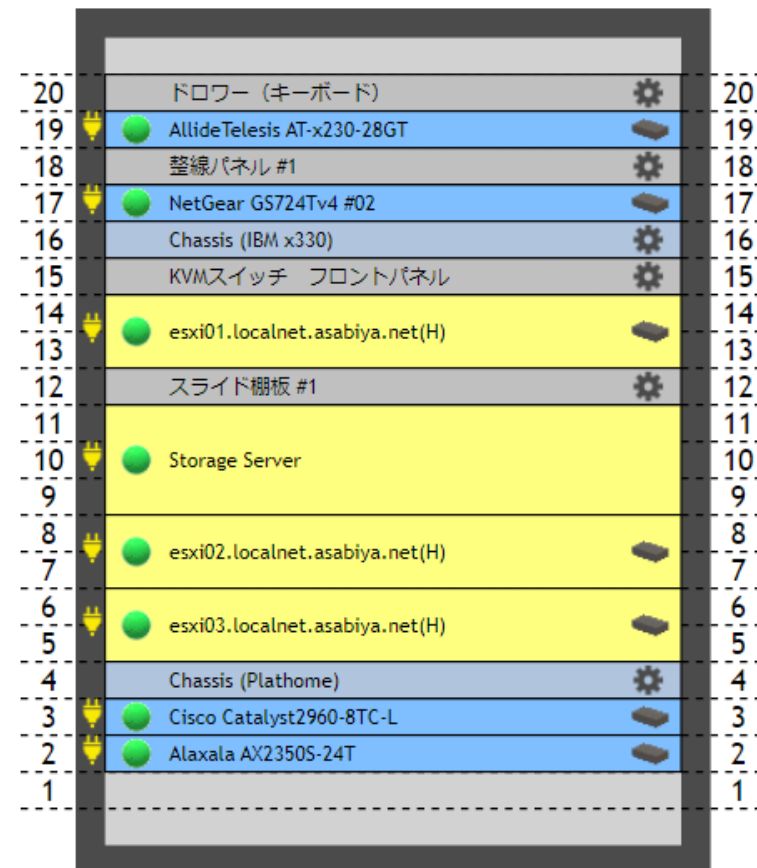
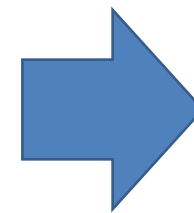
2D Drawing engine

Zabbix map functionality can be automatically drawn using API

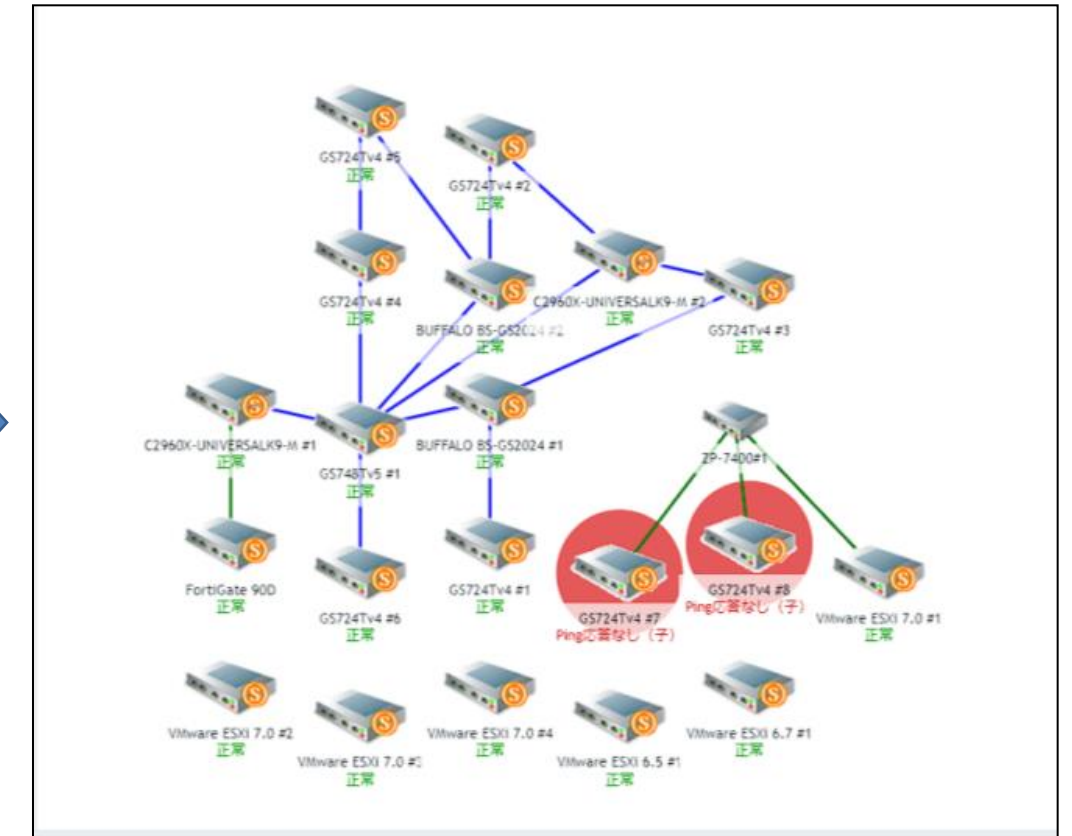
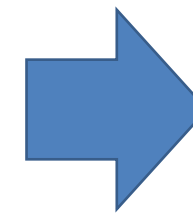
- Inclusion of Zabbix monitoring results
- Fault information is displayed in real time.
- No functionality to display past status or progress.
- Know-how accumulated through development projects



Network devices diagram (2018~)



Rack mounting diagram (2021~)

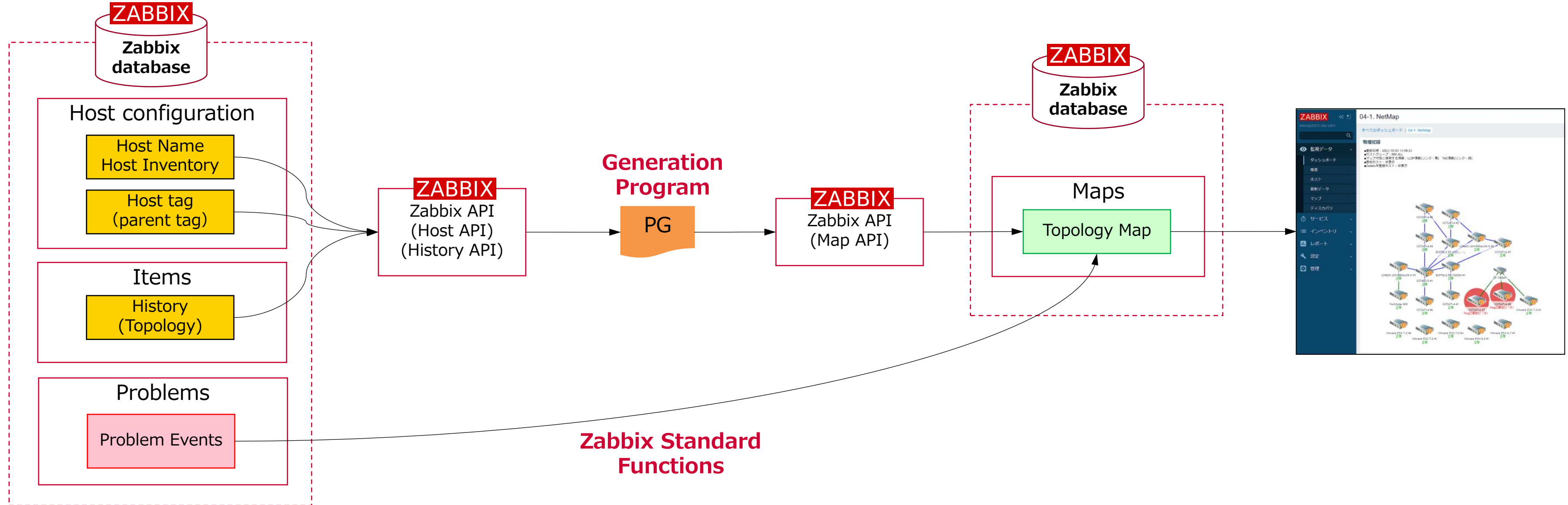


Network Topology (2023~)

2D drawing system structure

System structure to generate 2D network topology from Zabbix information

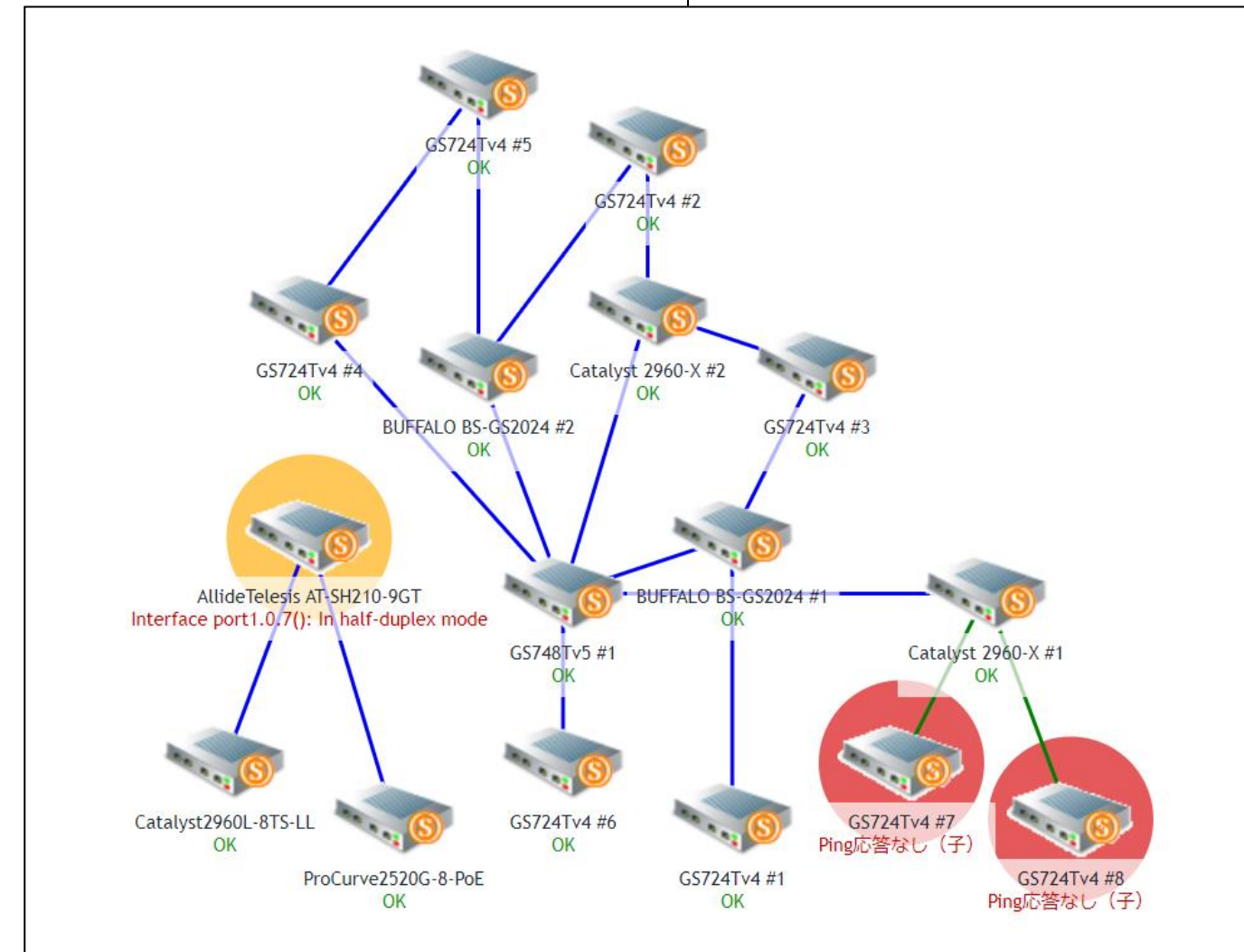
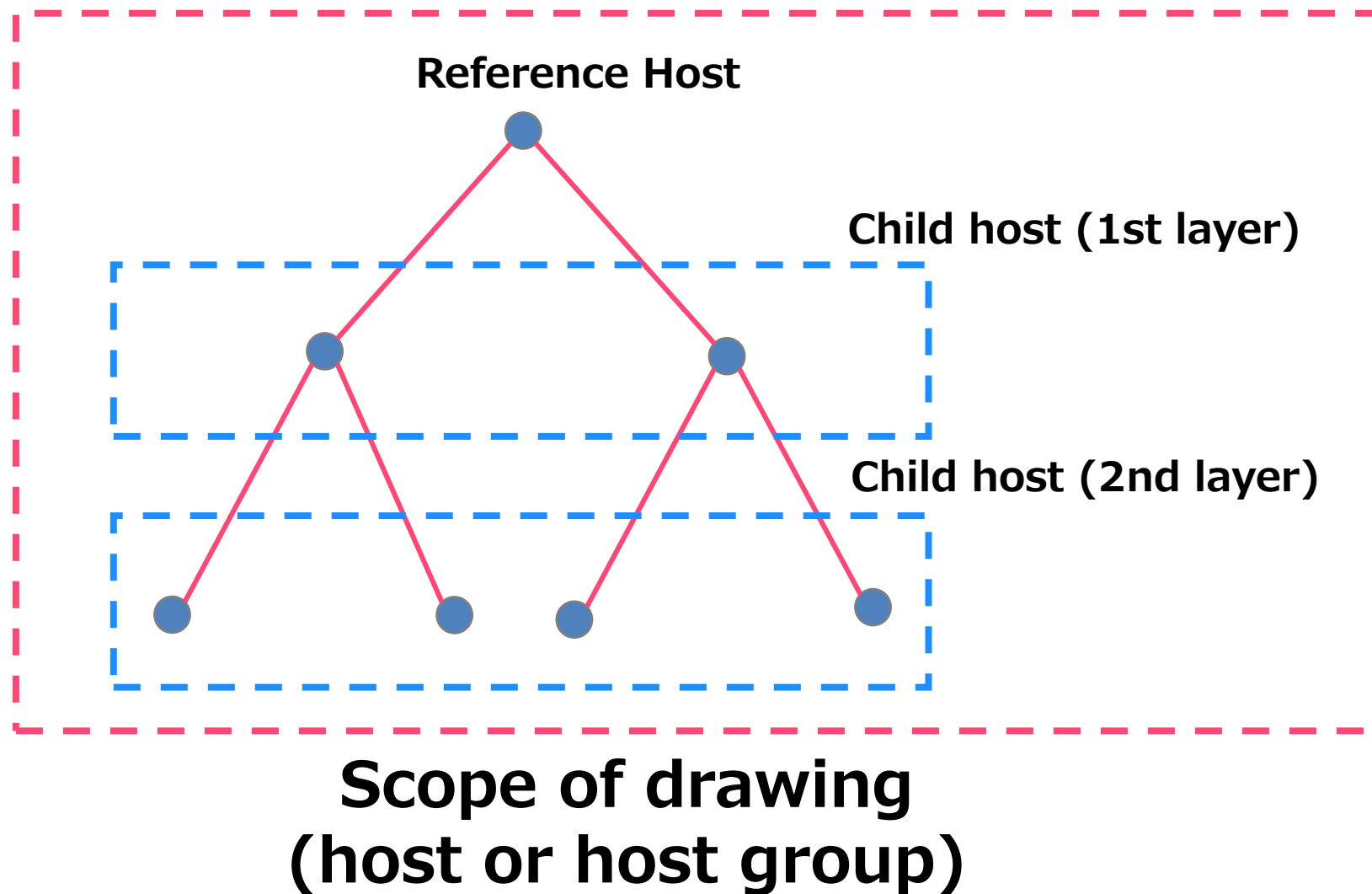
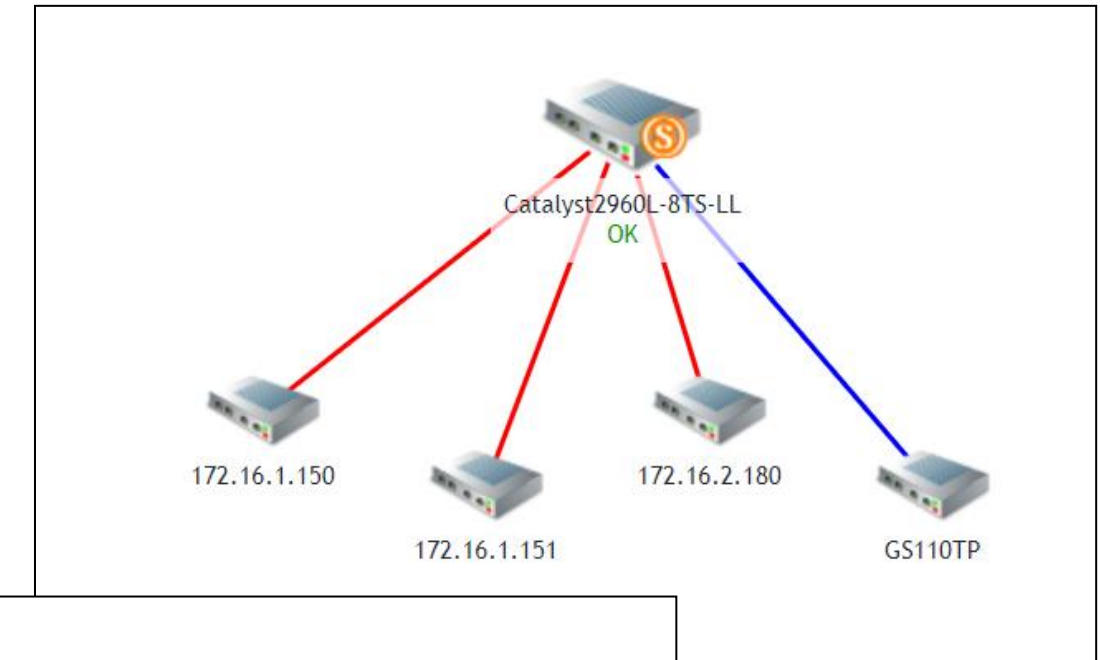
- Extract information on neighboring devices and generate maps using Zabbix API.
- Linkage with fault information is realized by standard functionality of maps.



Logic of 2D placement

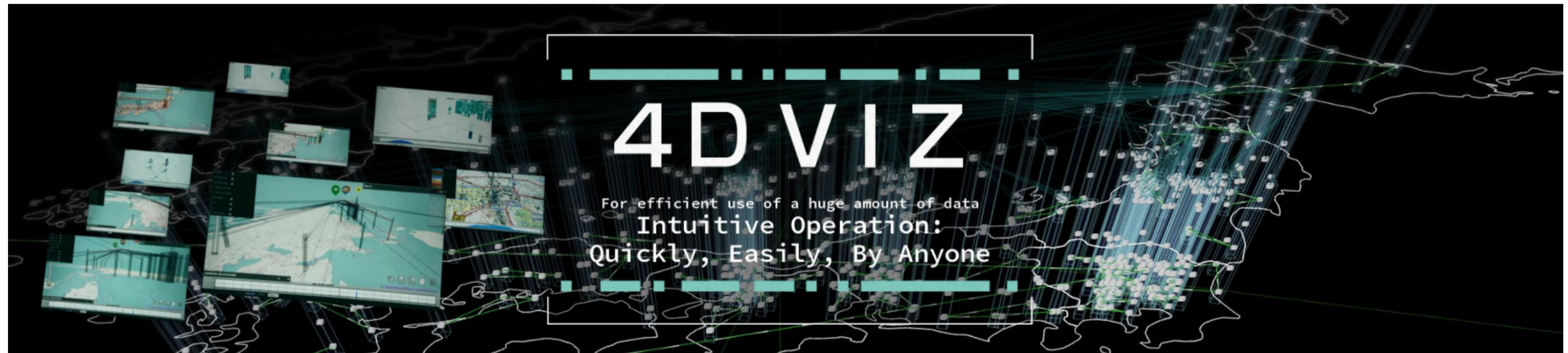
Stacked network diagram

- Specify a host or a group of hosts as a drawing target.
- Set a reference host from among the range of drawing targets.
- Search for and place child hosts of the reference host (repeat)



3D Drawing engine

- 4D rendering engine (3D + time)
- Jointly developed by NTT Laboratories and NTT Comware
- 3D rendering is done on the client (web browser)
- Can be embedded in Zabbix dashboard (URL object)
- Engine can be embedded in Zabbix dashboard (URL object).
- Ability to keep track of changes and replay past states over time.

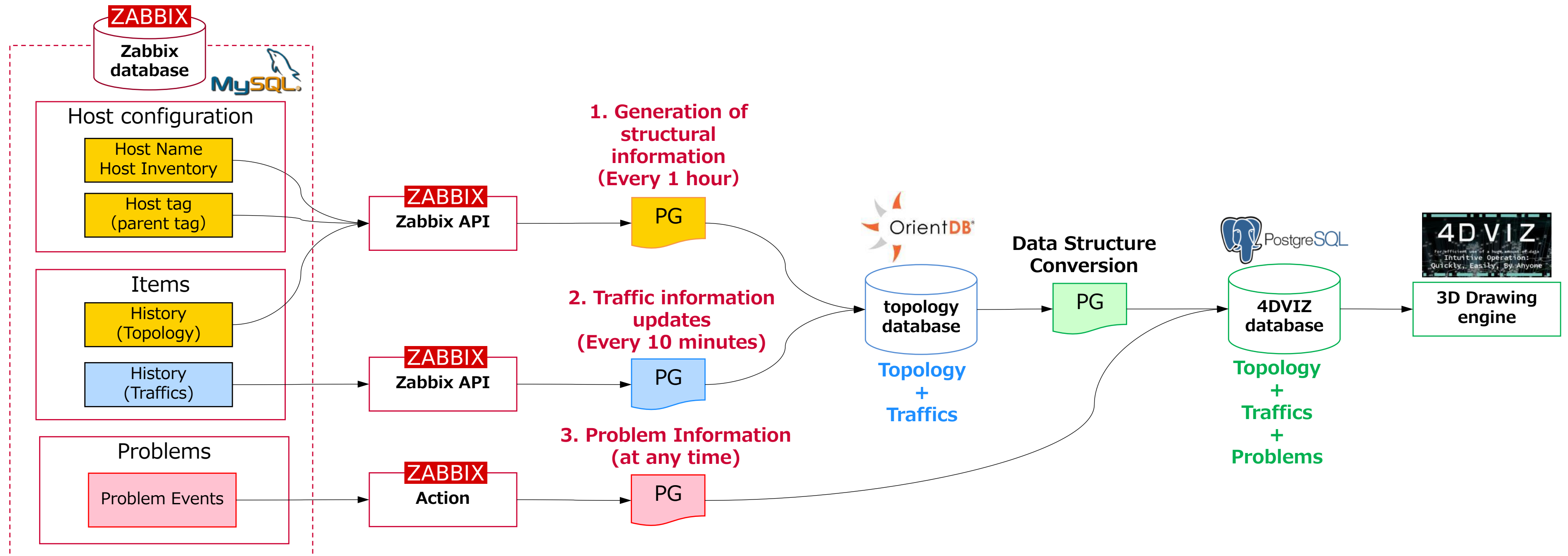


<https://sc.nttcom.co.jp/english/4dv/>

3D drawing system structure

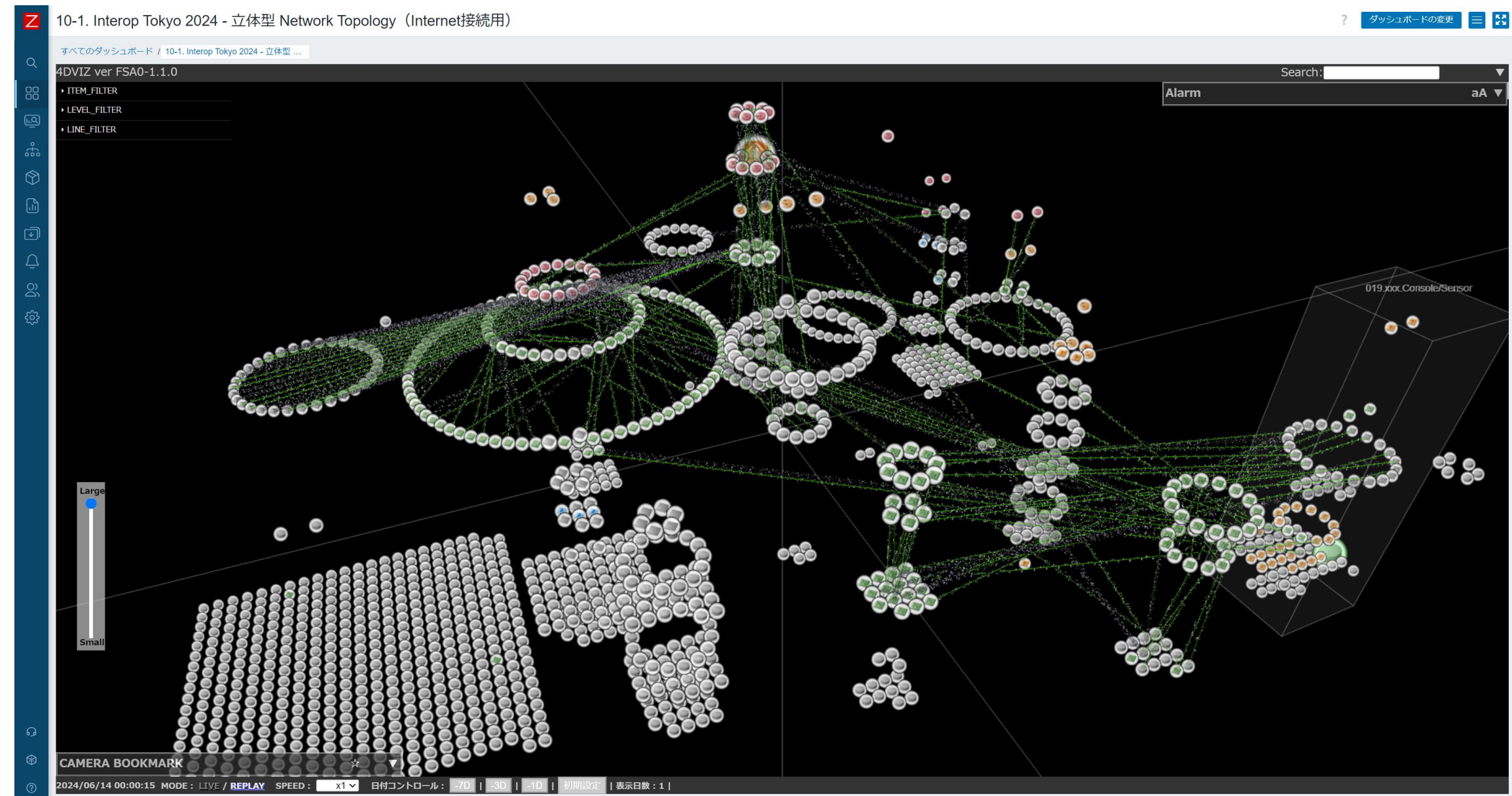
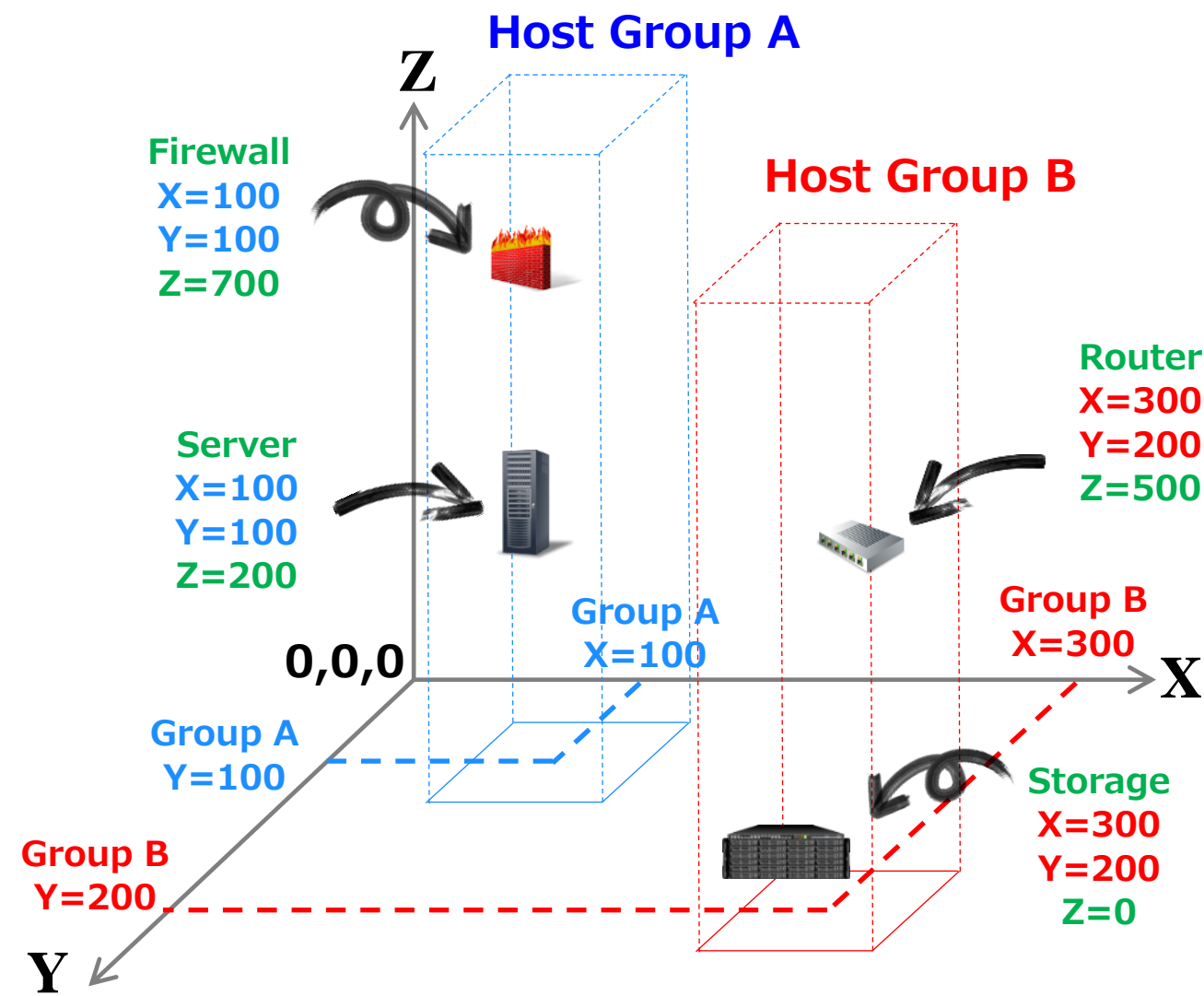
System structure to generate 3D network topology from Zabbix information

- Structure, traffic and fault information is used to generate the topology.
- Linking information in three different paths depending on the frequency of information updates.



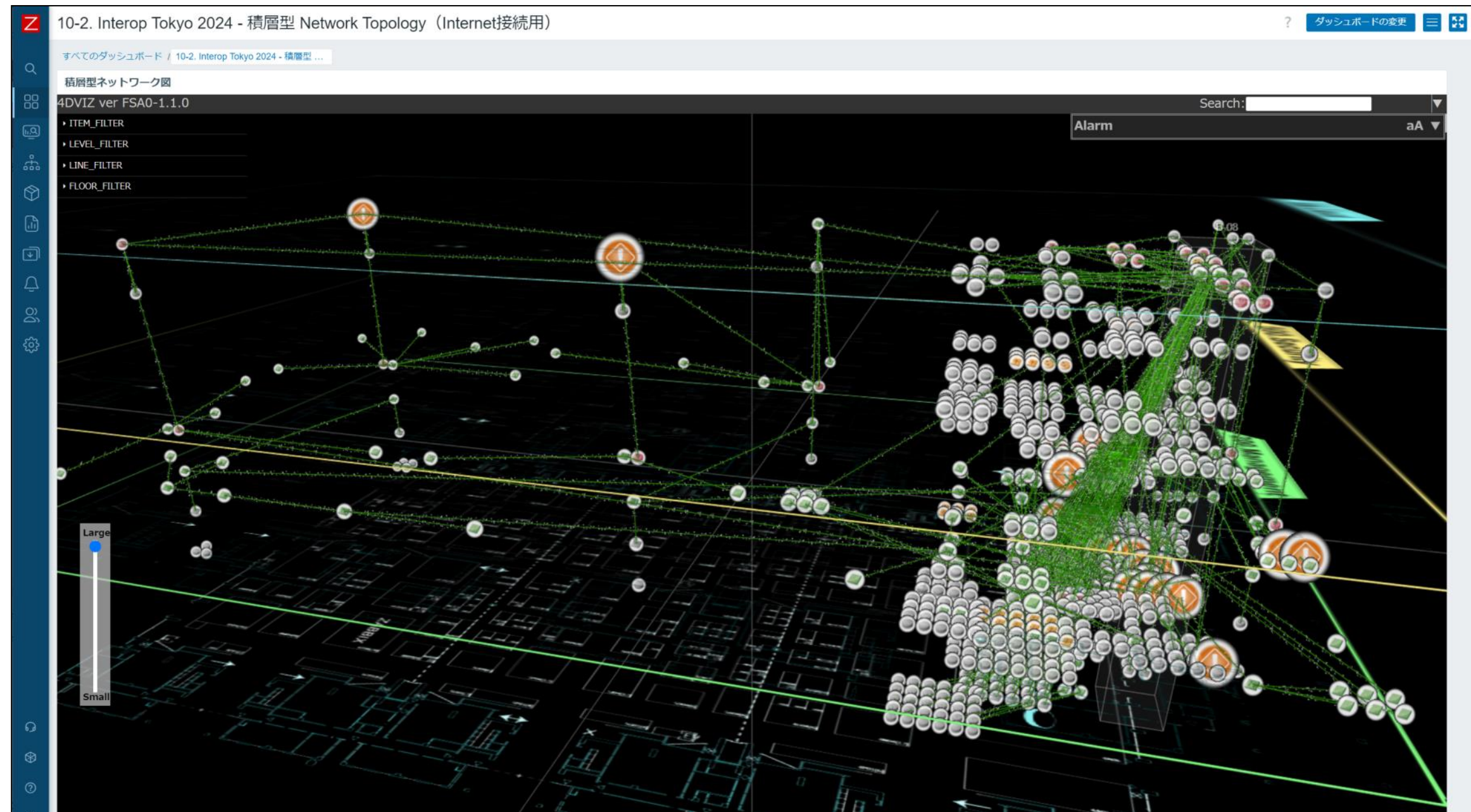
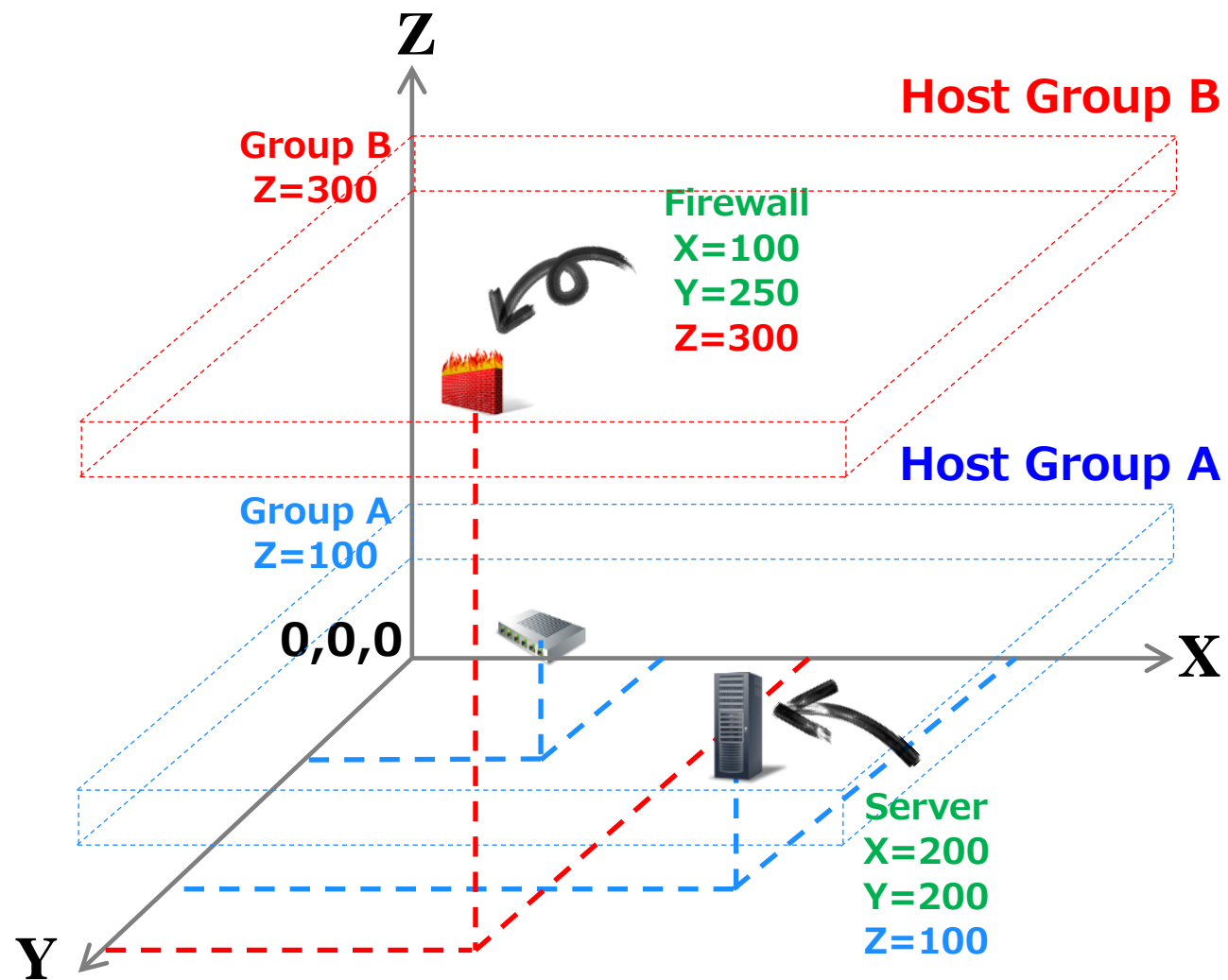
Logic of 3D placement (3D network diagram)

- Fixed 2 axes (x,y) for host group
- One axis (z) information is set for each host.



Logic of 3D placement (Multilayer network diagram)

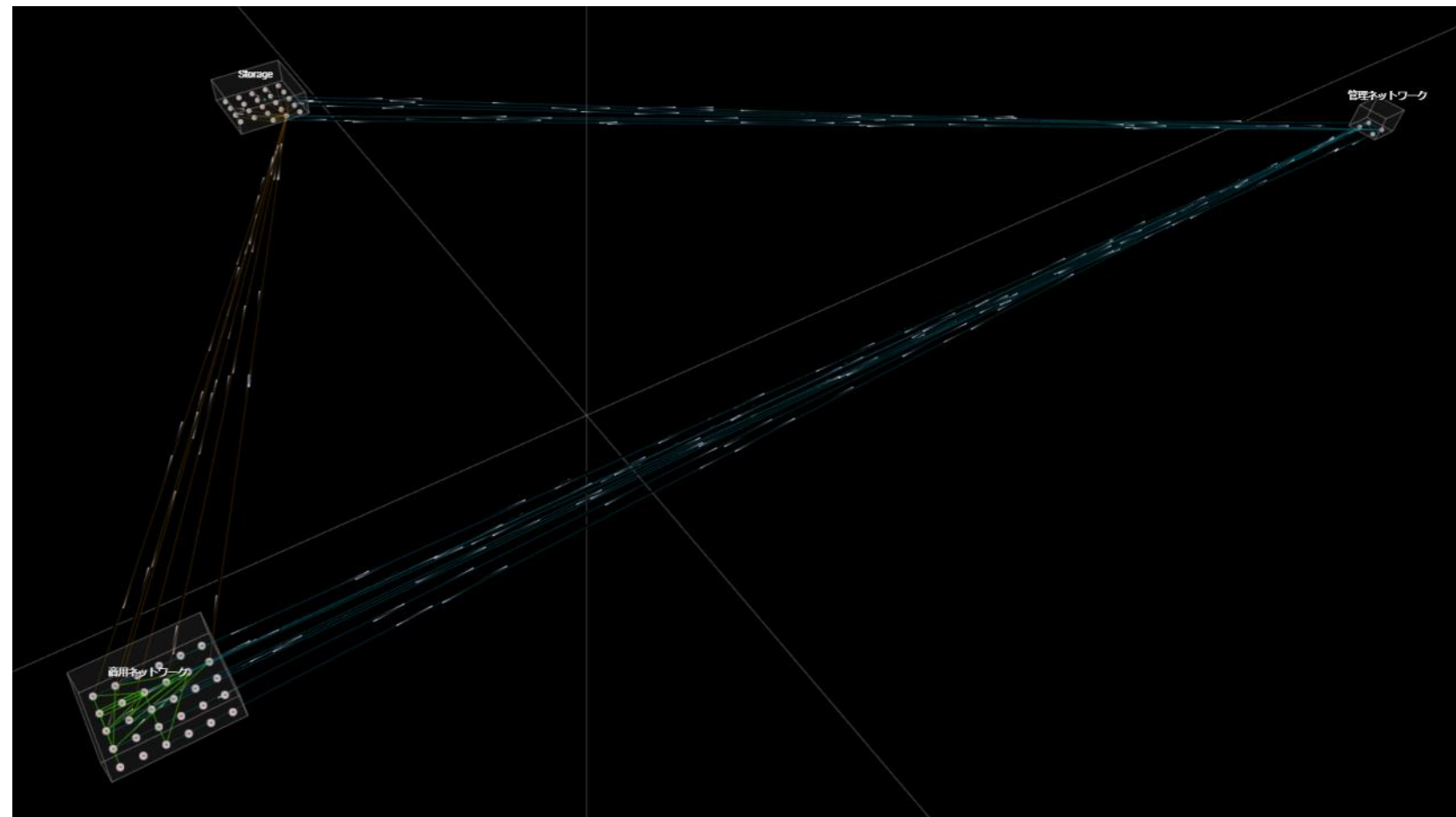
- Fixed 1 axis (z) for host group
- Set 2-axis (x,y) information for each host



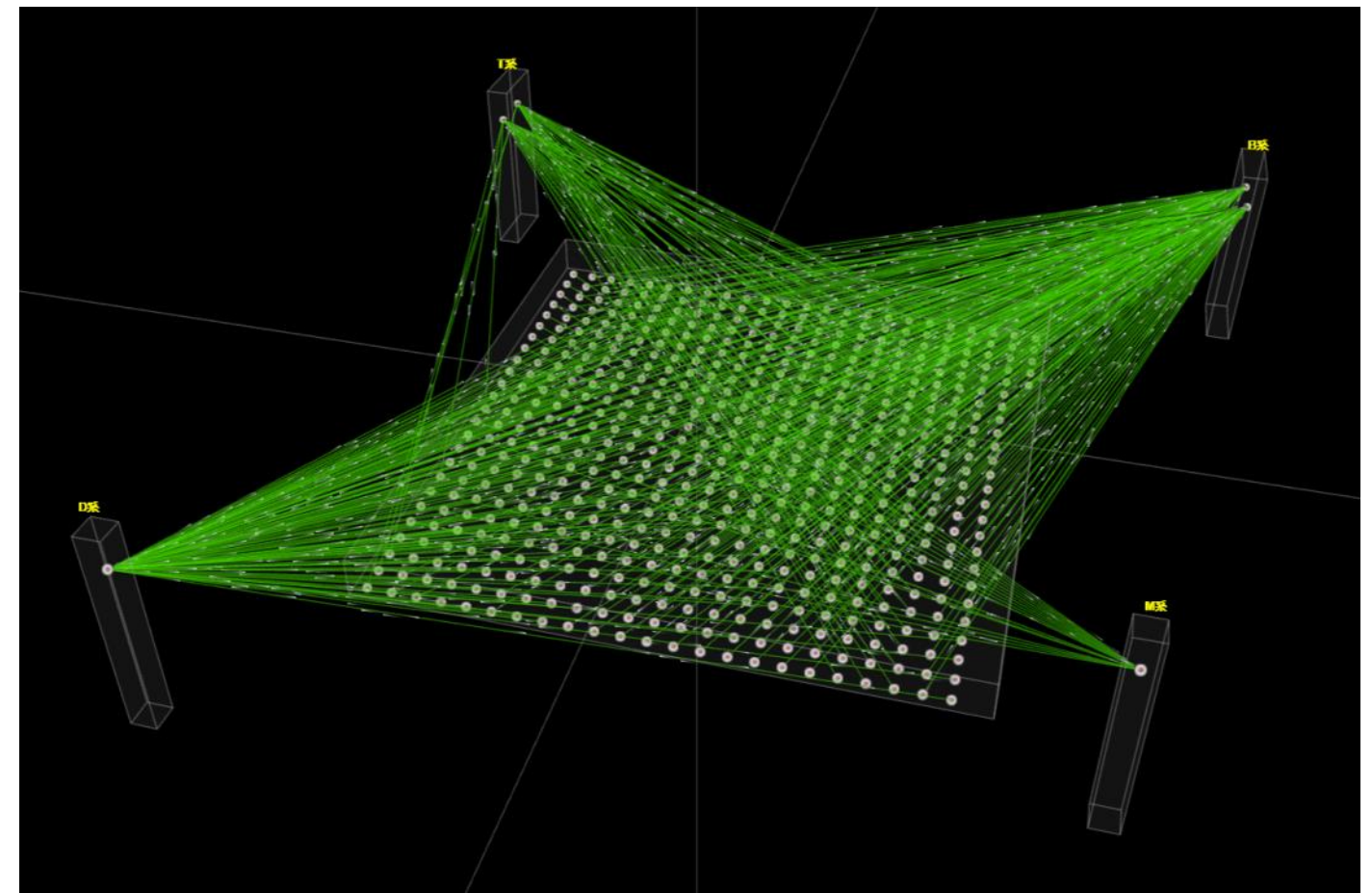
Try it on a real network

Network drawing experiments

- The development was done using a small network.
- To confirm the practicality of the system, it is necessary to test the system on a network consisting of many devices.
- The network of the IT exhibition “**Interop Tokyo**” was used as the site for the large-scale test.



**Drawing tests in small-scale environments
(50 physical machines)**



**Drawing test in virtualization infrastructure
(500 virtual machines)**

What is Interop Tokyo?

IT exhibition held in Tokyo every June (first held in 1994)

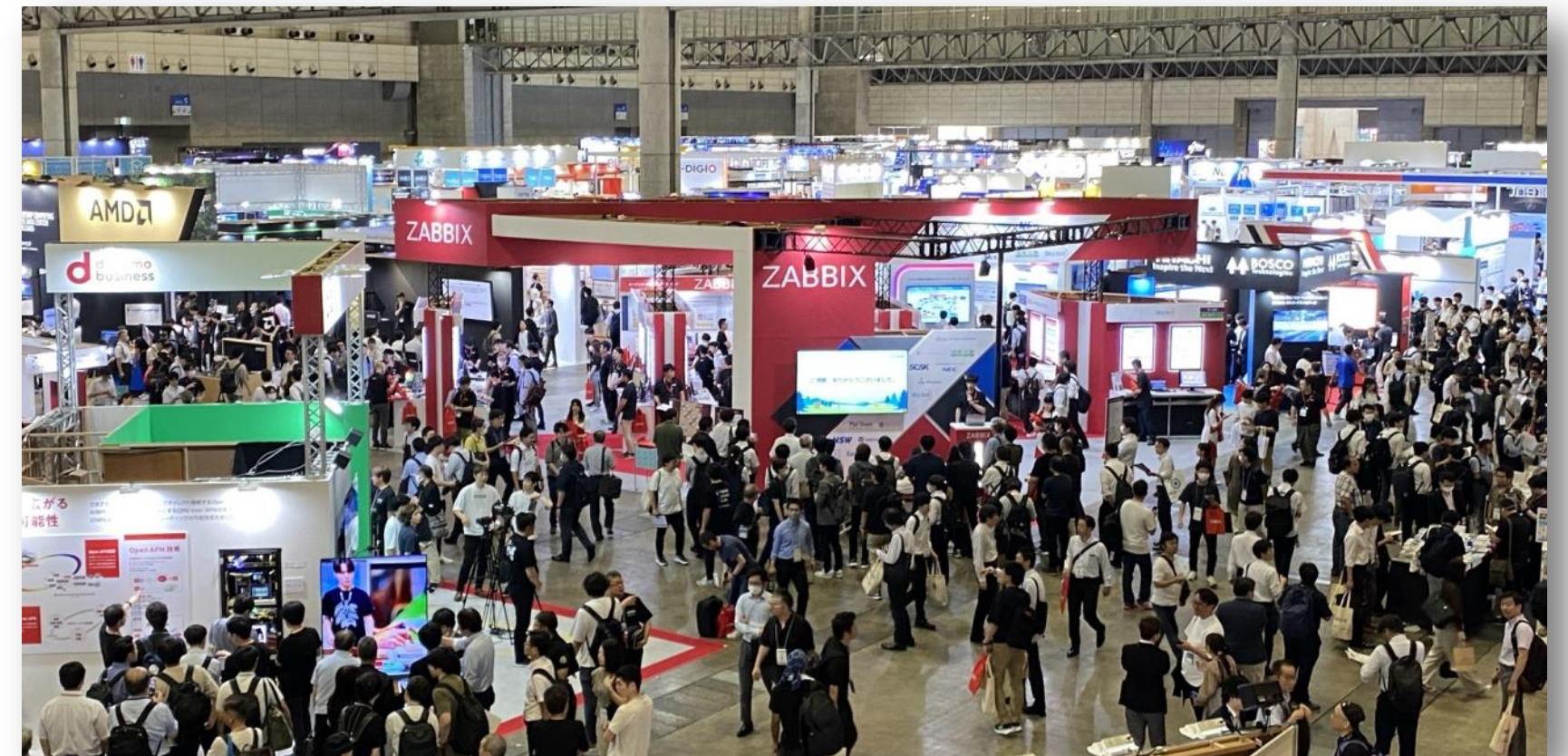
Held for 3 days from June 12 to 14, 2024 (31st time)

- Number of participating/exhibiting companies: 542
- Number of visitors: 124,482 (cumulative total for 3 days)

Zabbix Japan also exhibited at the booth

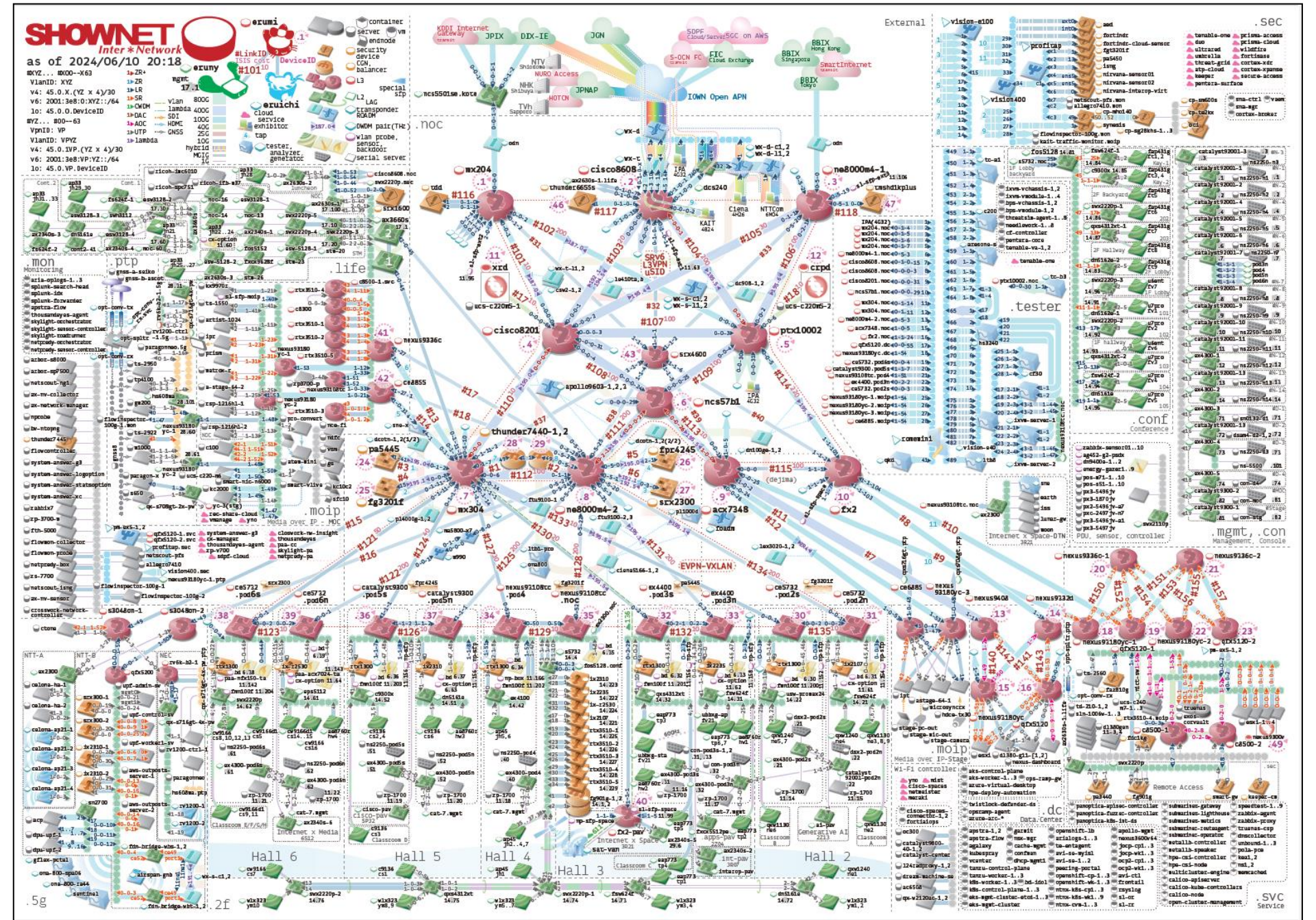
“**Shownet**” event for networking at the exhibition will be held

Interop[®]24
Tokyo **JUNE 12-14**
MAKUHARI MESSE, JAPAN



What is Shownet?

- Networking events run by volunteer technicians
- The goal of the event is to verify the interoperability of various devices.
- Held for 9 days from 5/30 to 6/7, 2024
 - Devices/Products/Services: 2,300
 - Number of participants: 650
- Zabbix Japan has participated every year since 2013
- We have been participating since 2015 to support the event.



<https://www.interop.jp/2024/assets/file/e-web.pdf>

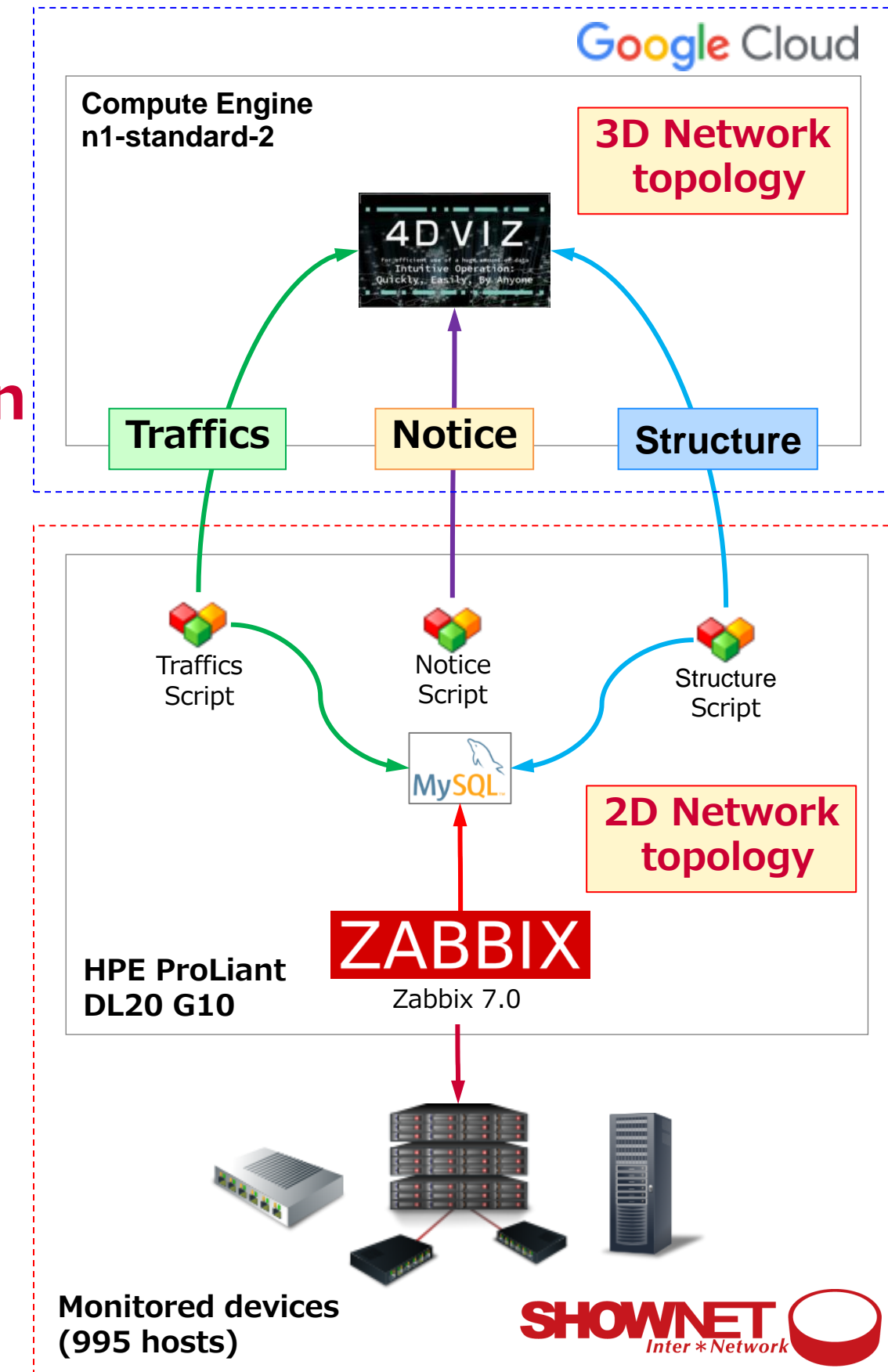
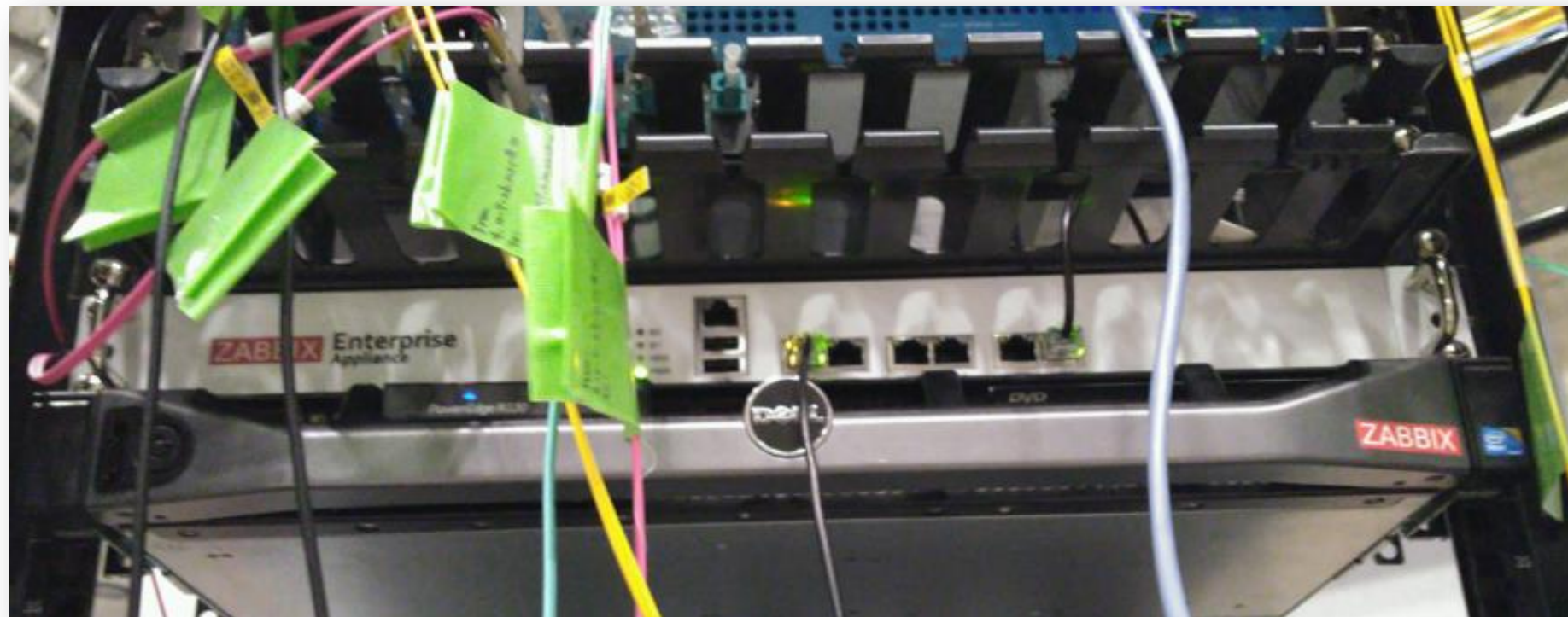
ShowNet 24 overview

Zabbix Server

- HPE DL20 G10(6core 16GB)
- Zabbix 7.0
- Rocky Linux 9
- 995 hosts
- **2D Network Topology Function**

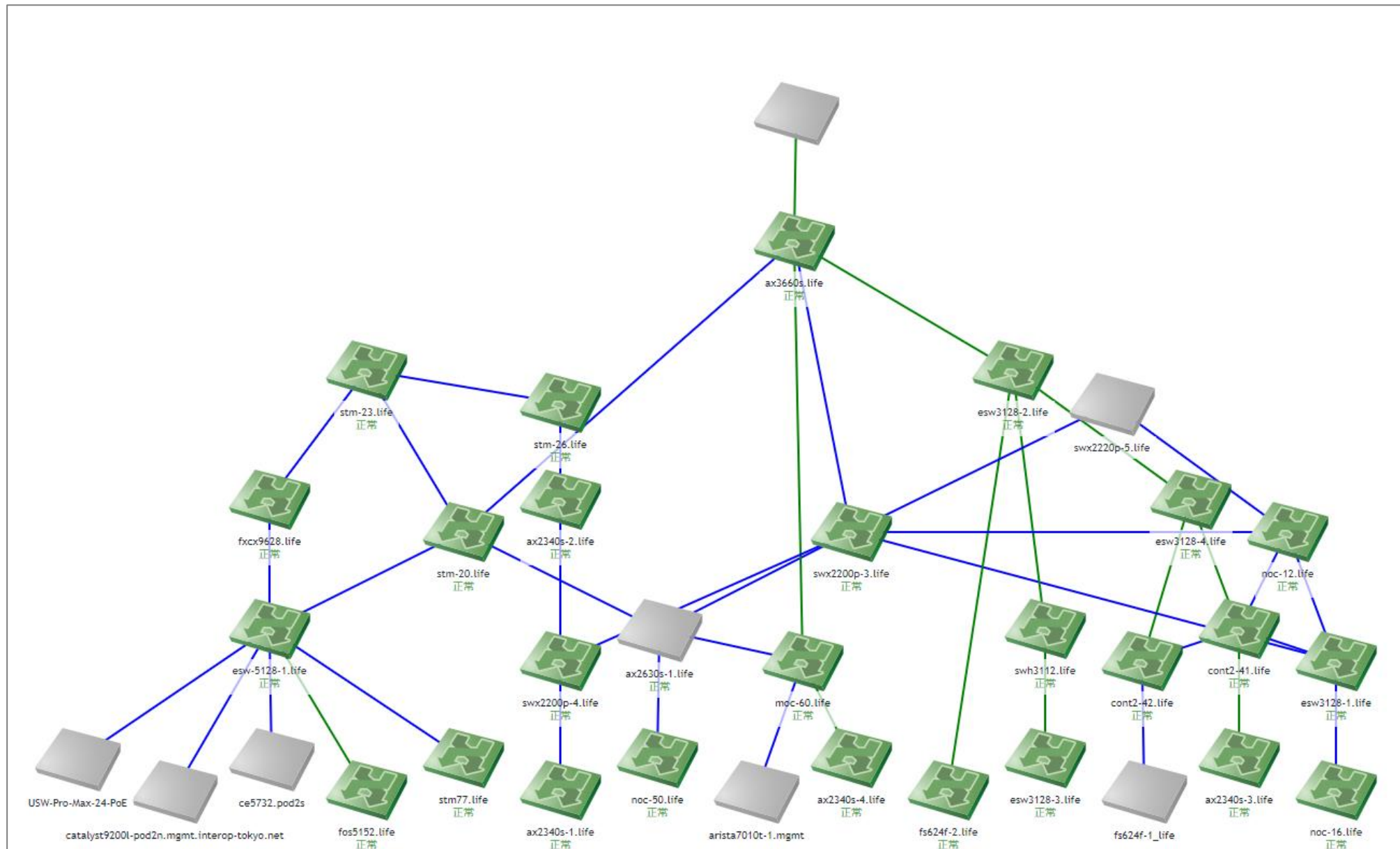
4DVIZ Server

- Google Cloud
- n1-standard-2(2core 8GB)
- **3D Network Topology Function**
- **Work period = 6days**
- **Staff = 4**

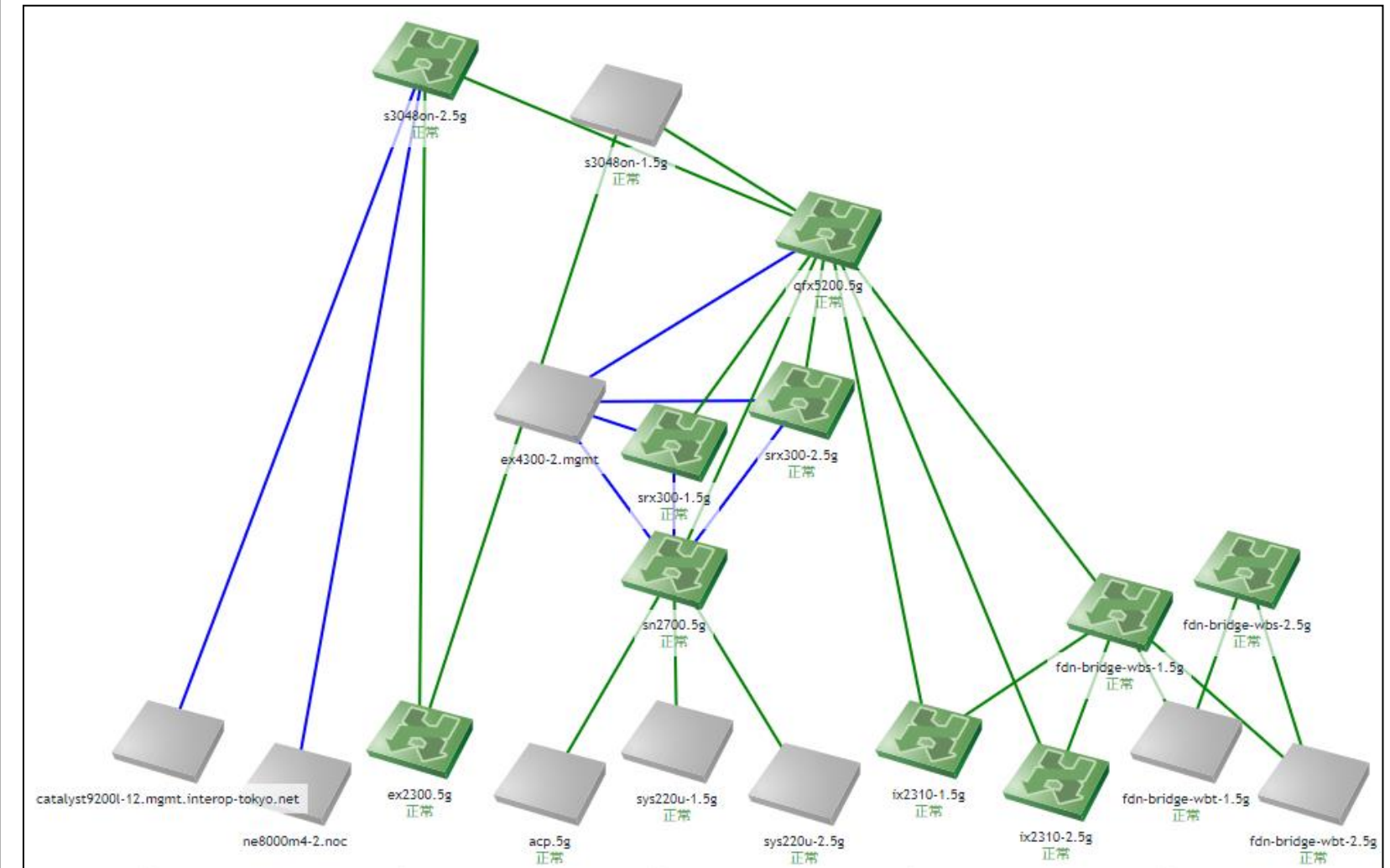


2-D Network Topology

- Draw a network diagram for each host group.
- Drawing of LLDP adjacent device information in combination with tags



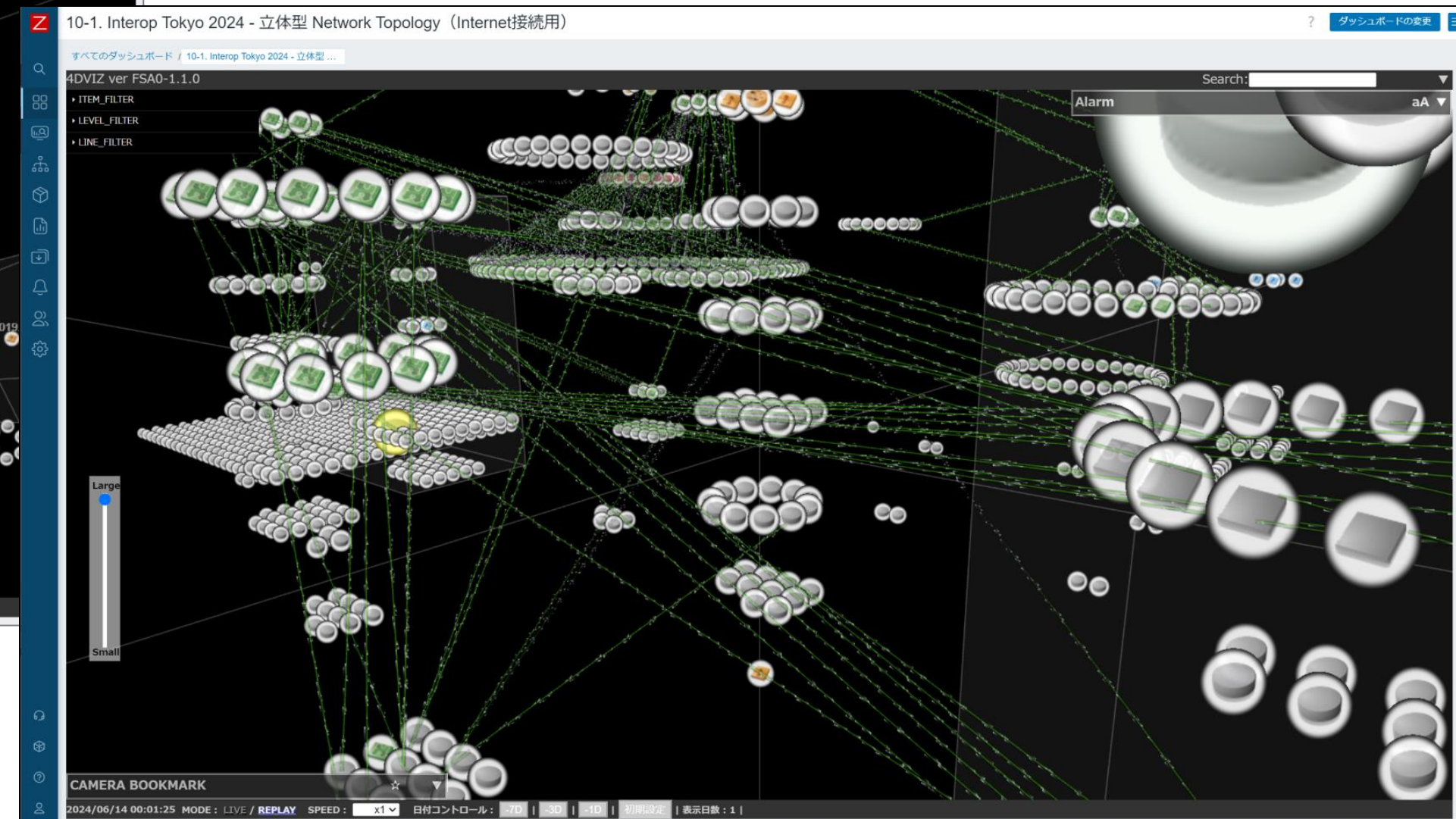
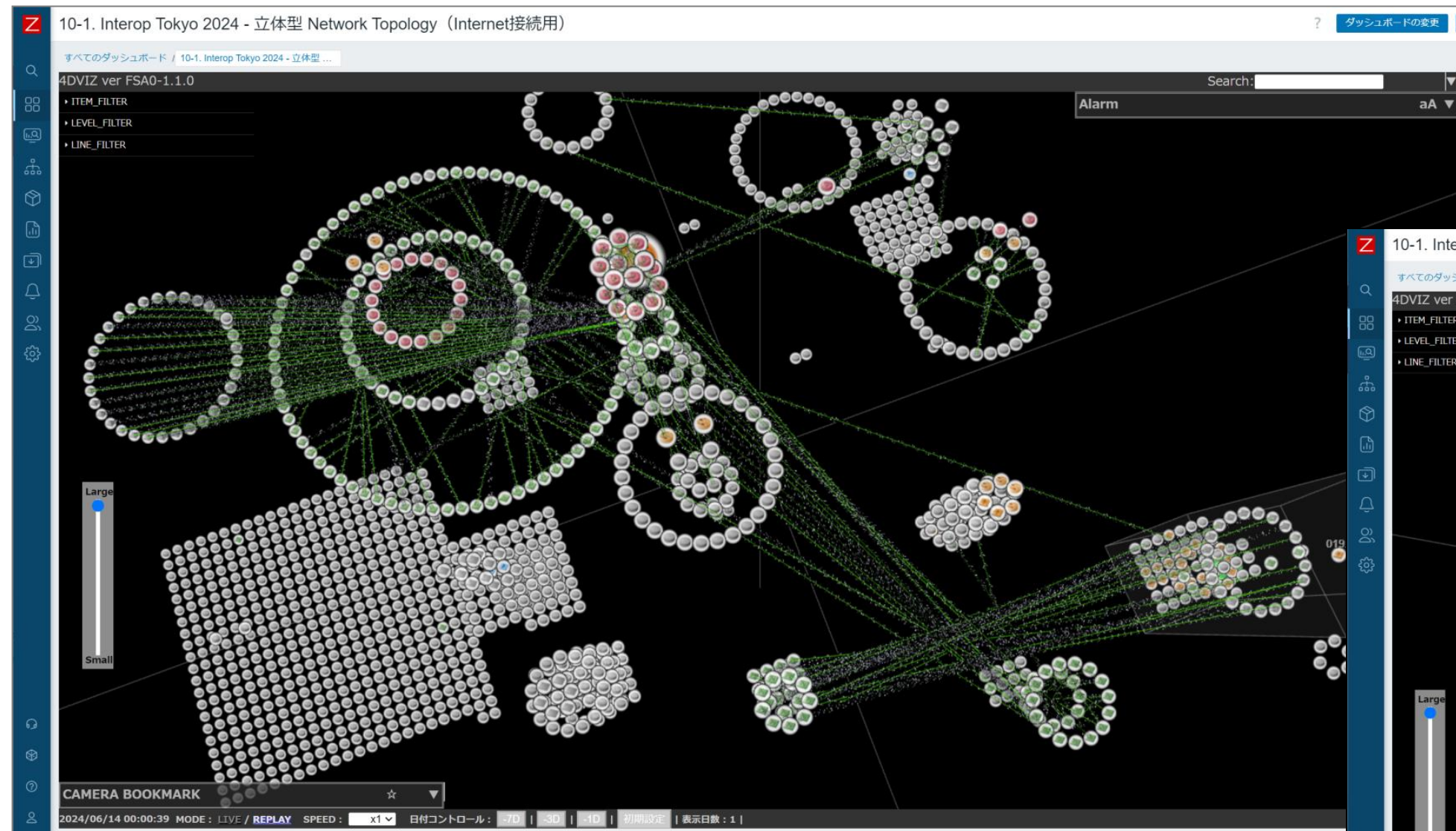
Administrator Network



Local 5G Network

3-D Network Topology

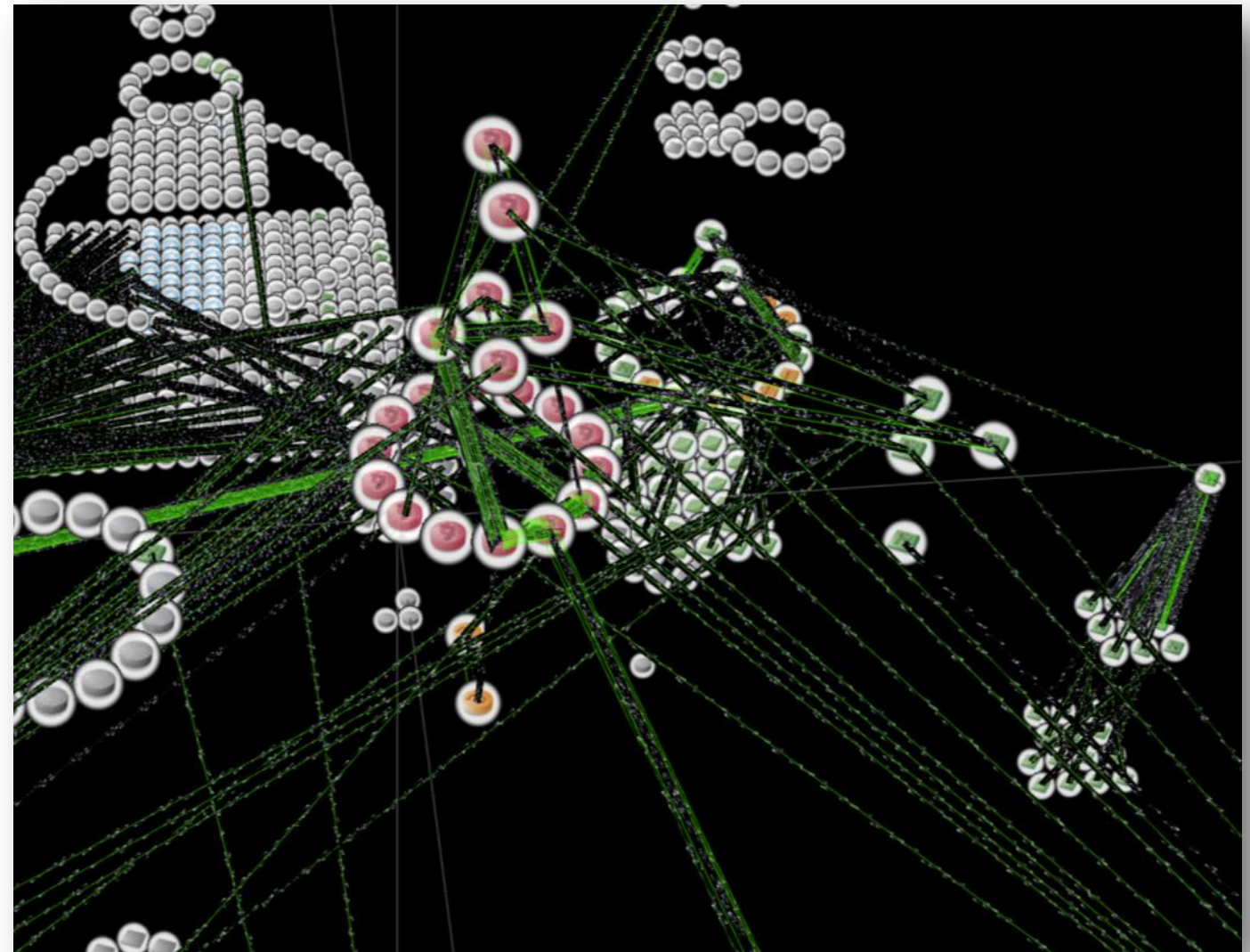
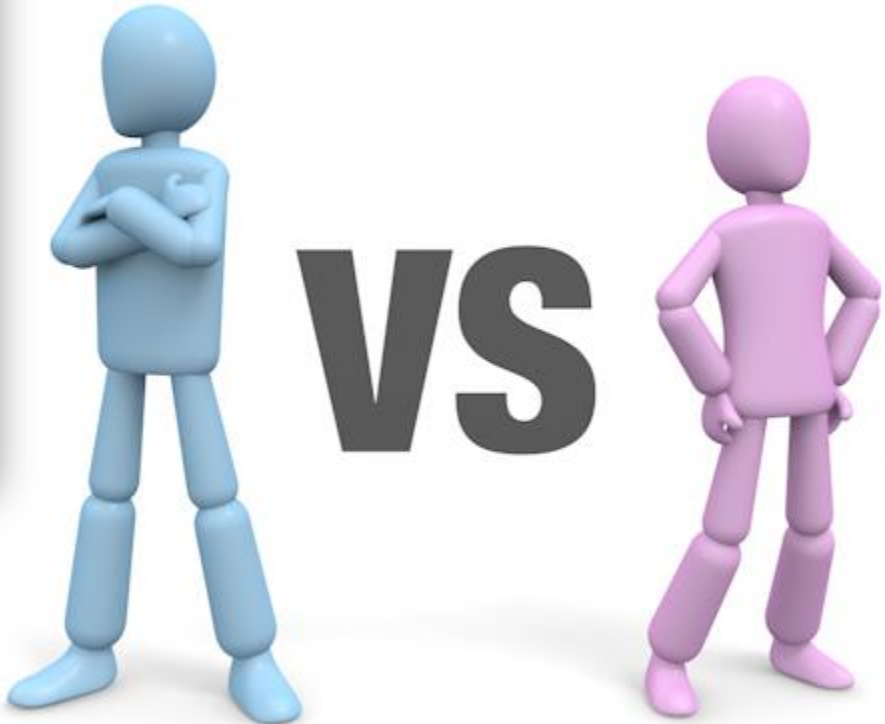
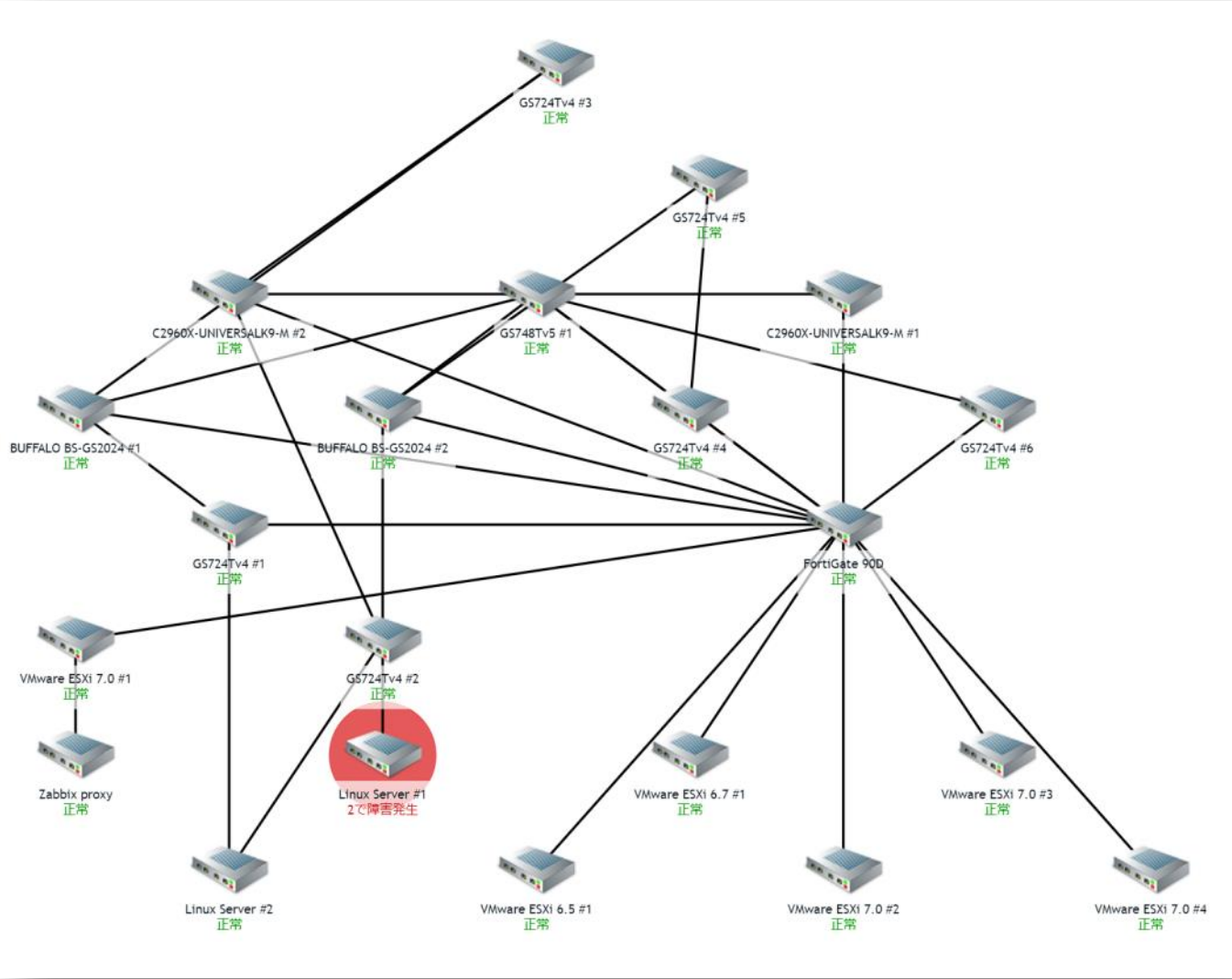
- Network diagram of hosts grouped by host group
- Upstream devices are drawn at the top and downstream devices are drawn at the bottom of the network.



2D vs. 3D

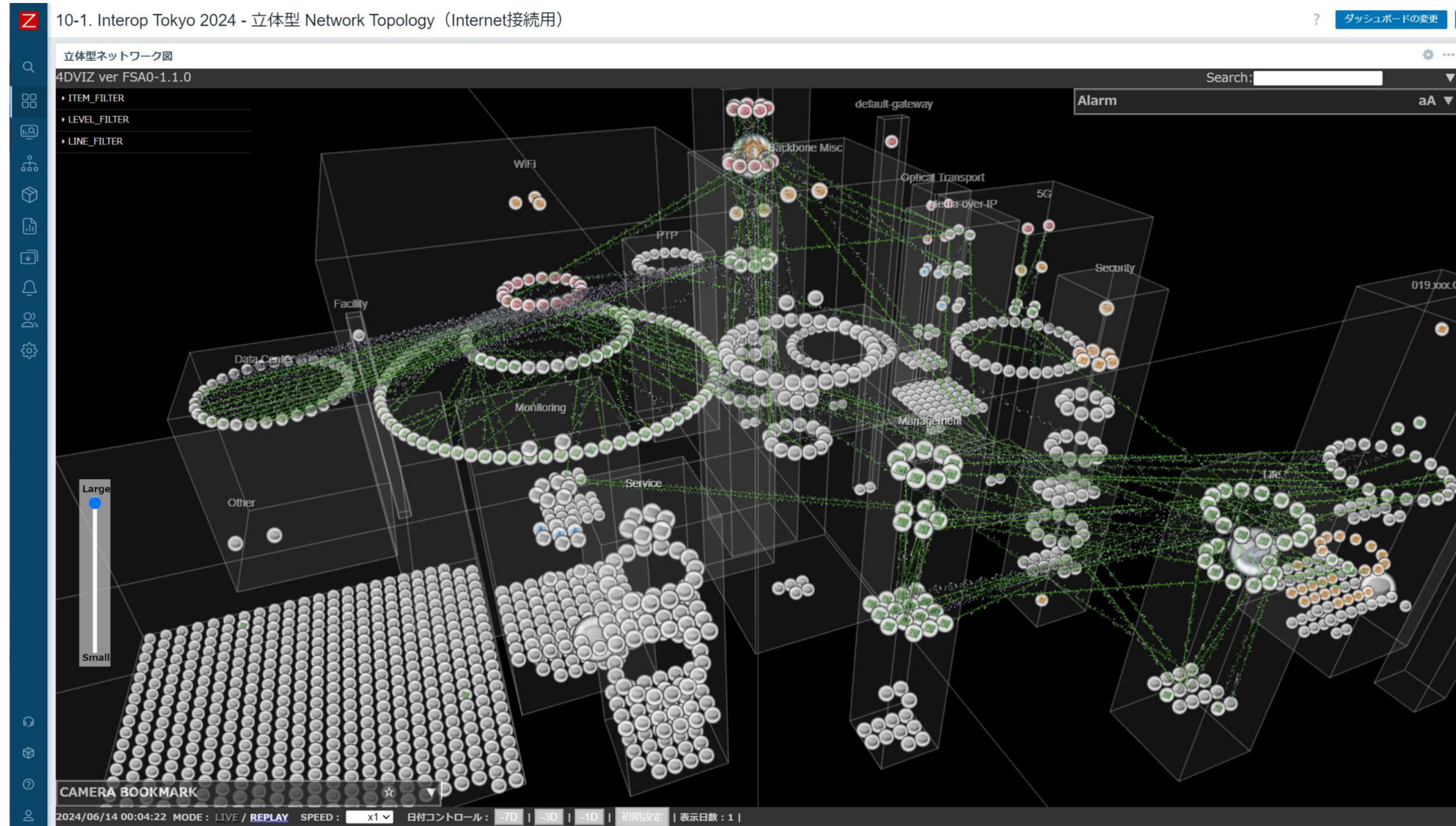
Which is better, 2D or 3D Network Topologys?

Which is a better way to represent network topology, 2D or 3D?



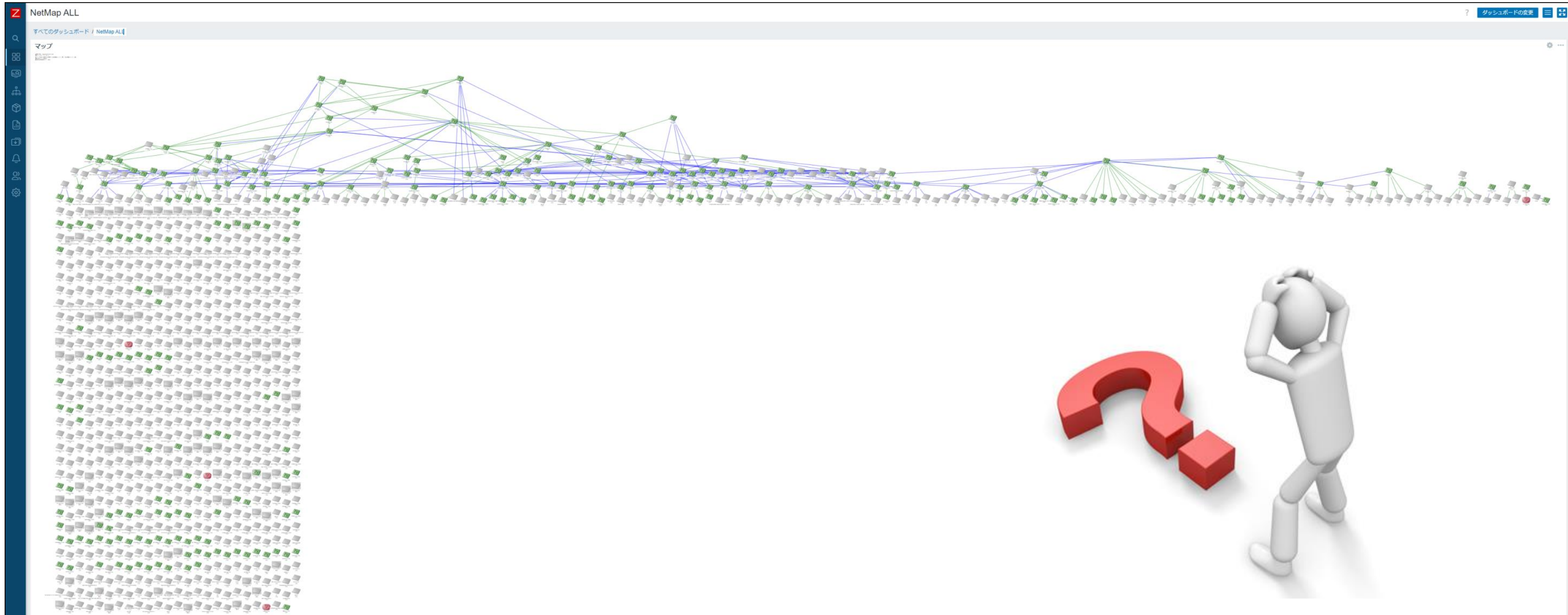
Draws many hosts in 3D

- Drawing 1000 hosts in 3D



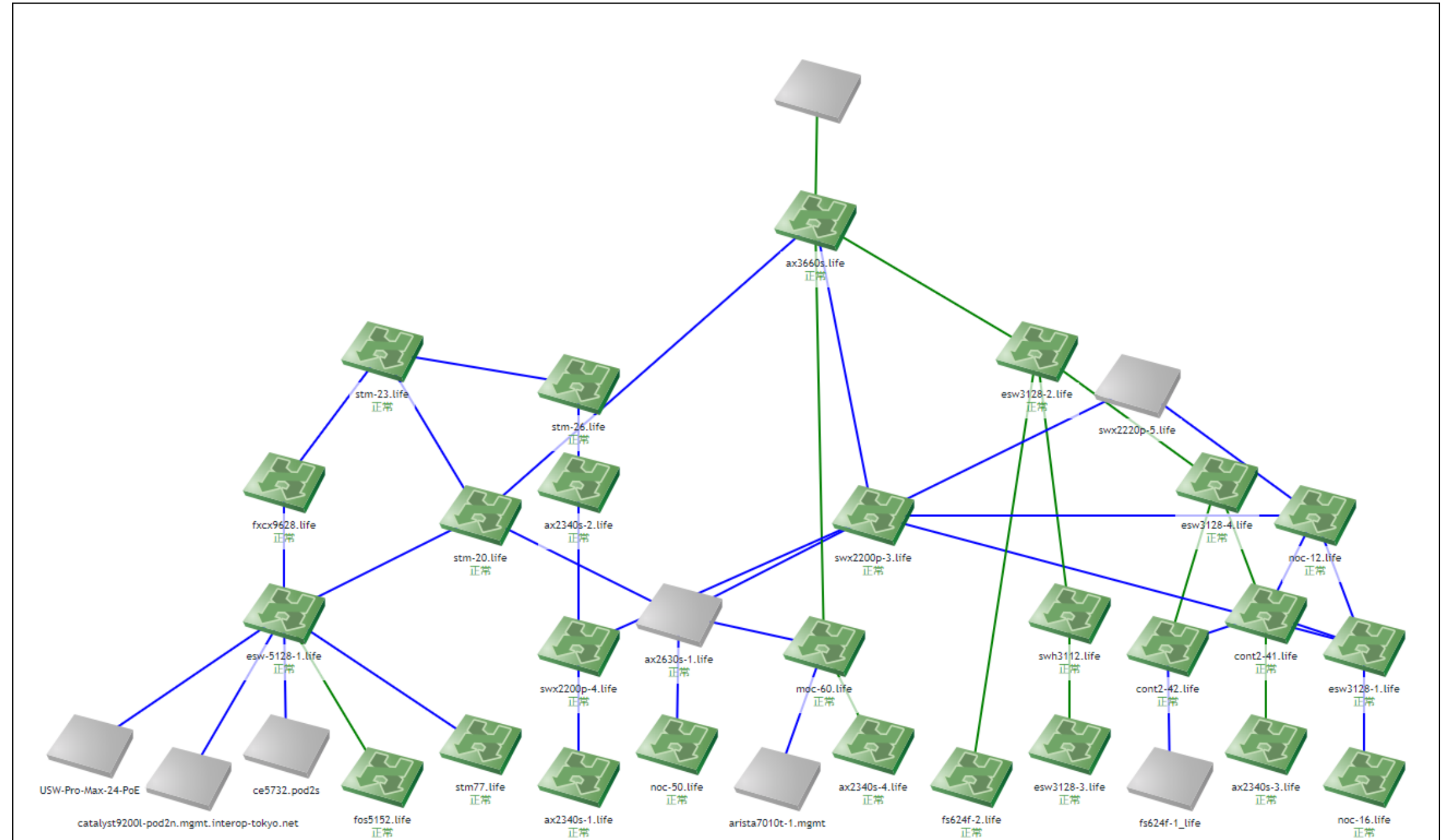
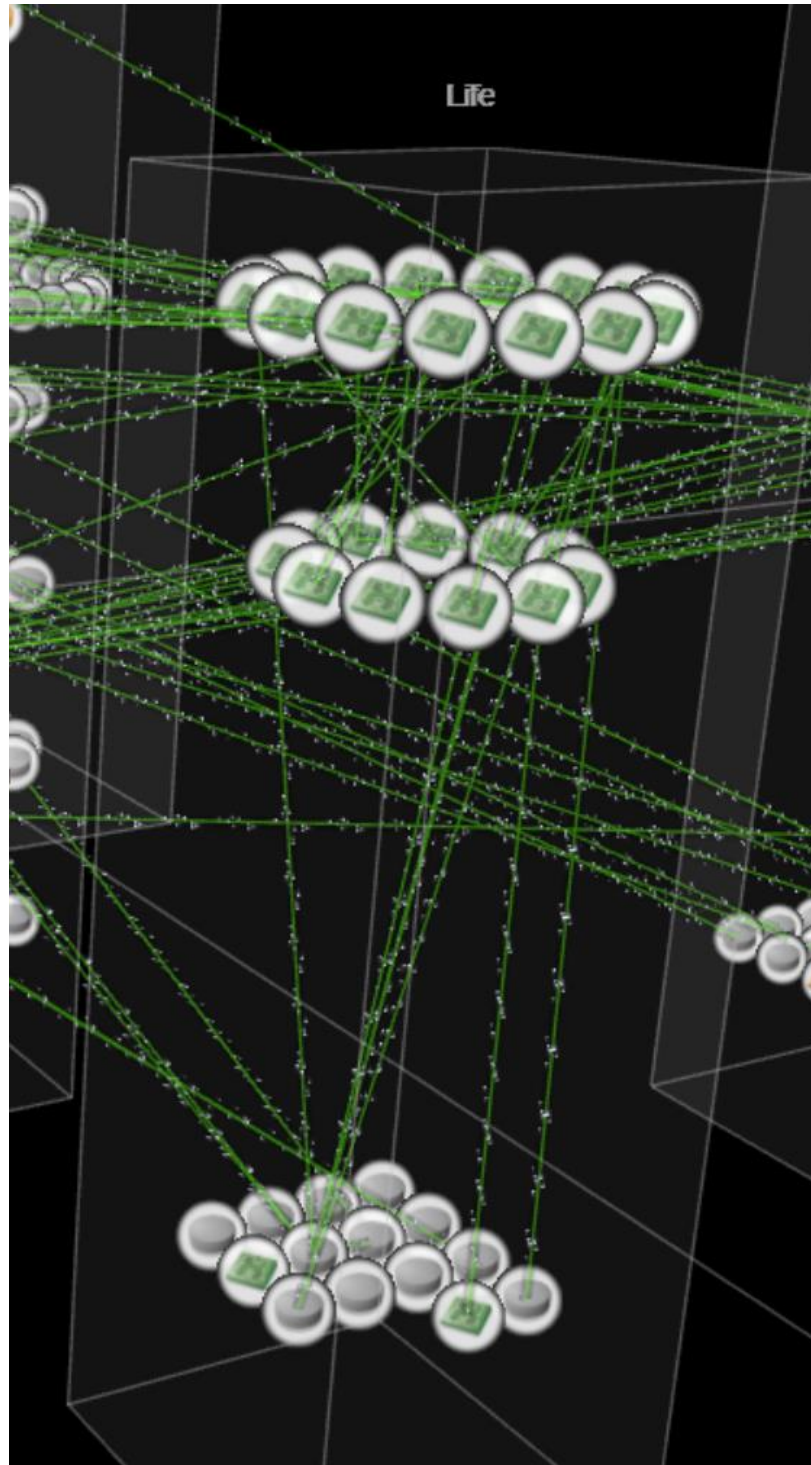
Draws many hosts in 2D

- Draws 1000 hosts in 2D.
- Map aspect size is **13970 x 5135**



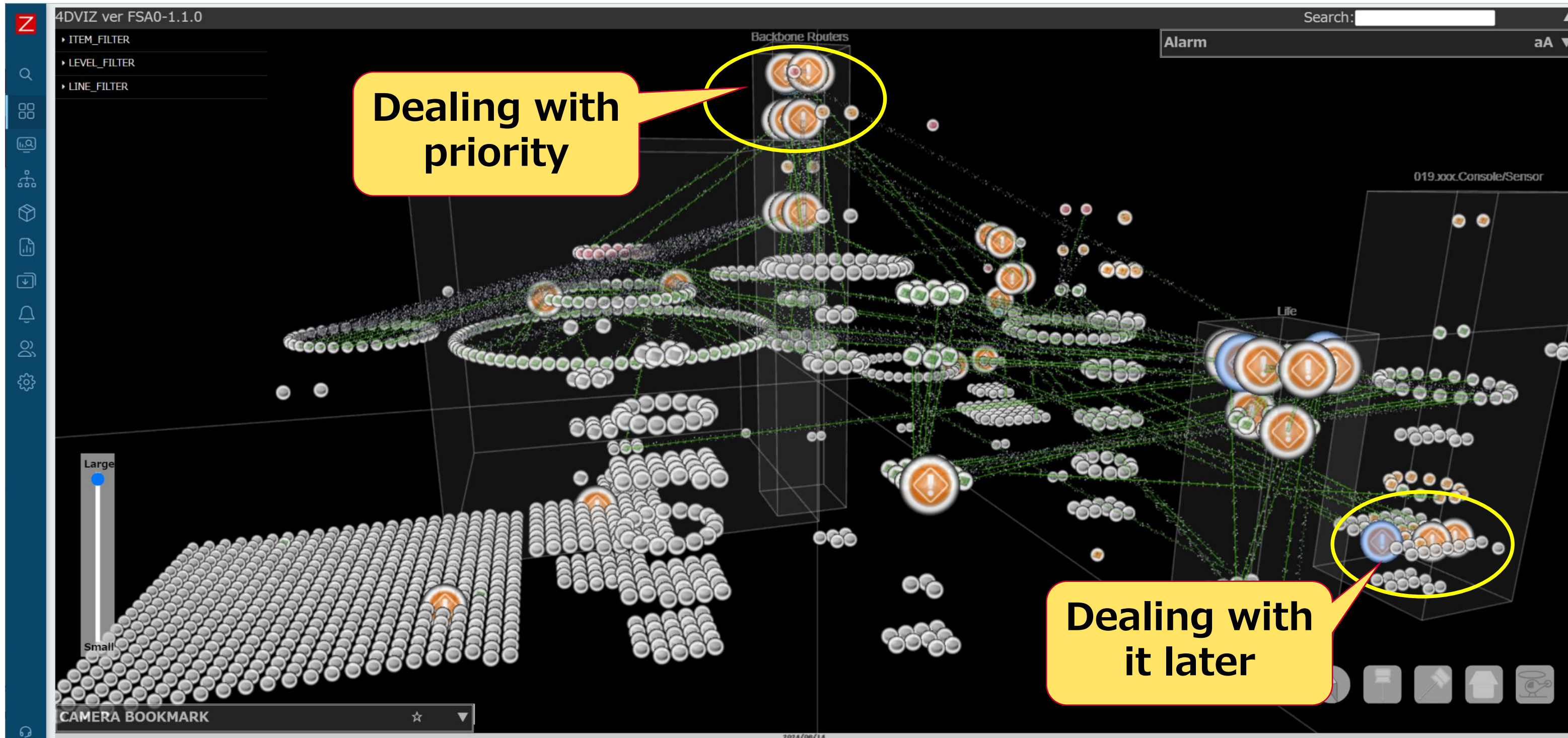
View part of the network

When drawing a part of the network, 2D is suitable to grasp the structure.



Complexity of information

- Highly important equipment is displayed at the top and terminal equipment at the bottom.
- The importance of the problem can be visually grasped.



High-level
problems



Low-level
problem



the right person in the right place

2D and 3D have a relationship that compensates for each other's weaknesses.
Can provide a variety of perspectives by generating from the same data source.

Advantages of 2D

- Easy to follow the relationship between hosts because there is no overlap of information.
- Suitable for grasping the part

Advantages of 3D

- High visibility even when there are many hosts.
- Suitable for a bird's eye view of the whole



Future of Topology Drawing

Benefits of network visibility with Zabbix

Automatic drawing of network topology in Zabbix has various advantages

Understand the relationship of hosts to the network

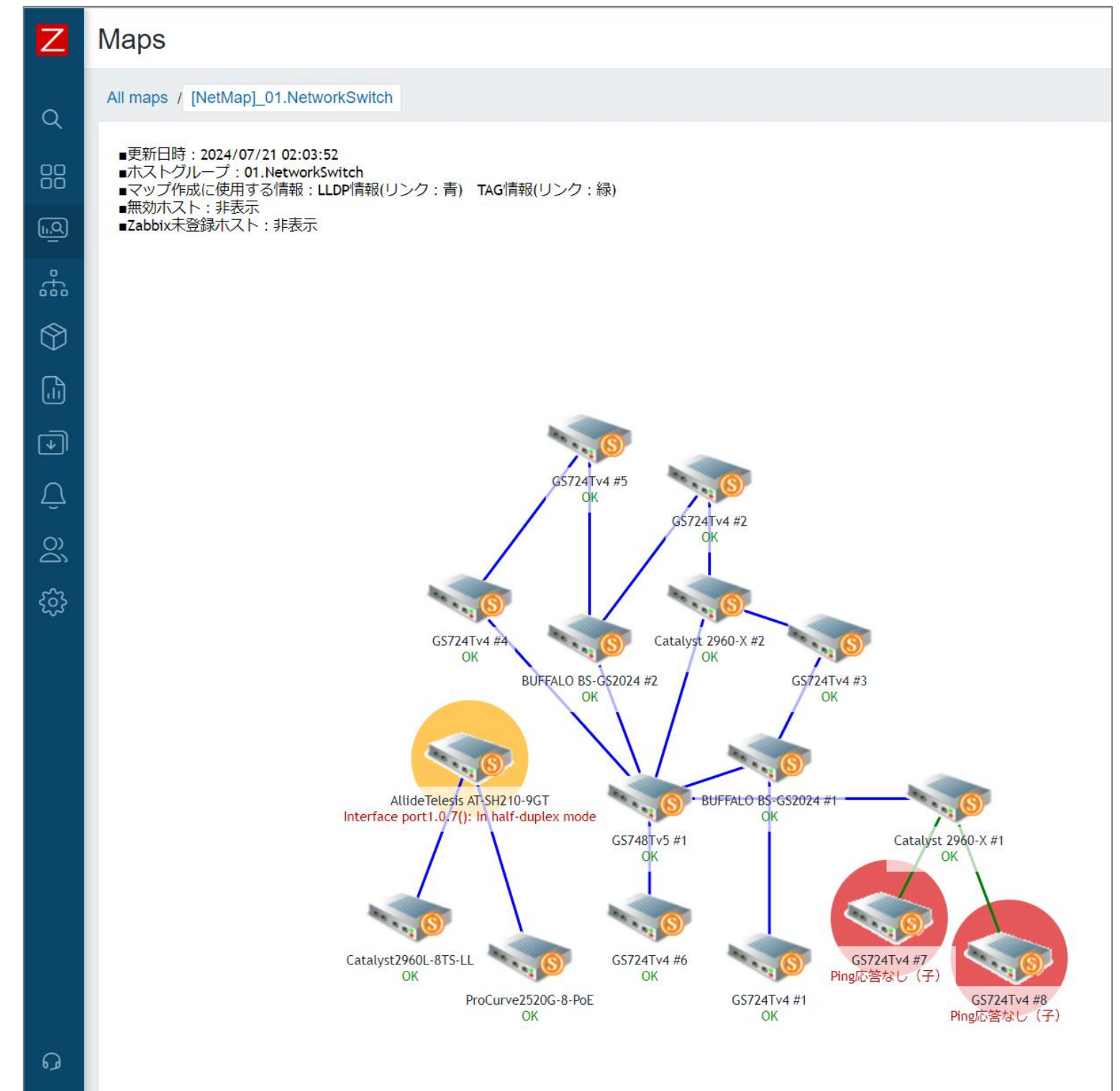
- Allow to have a large number of components in a single view
- Understand the relationship between a fault location and other hosts

Identification of patterns and trends

- Discover patterns and trends that cannot be obtained from textual information alone.
- Identification of structural bottlenecks

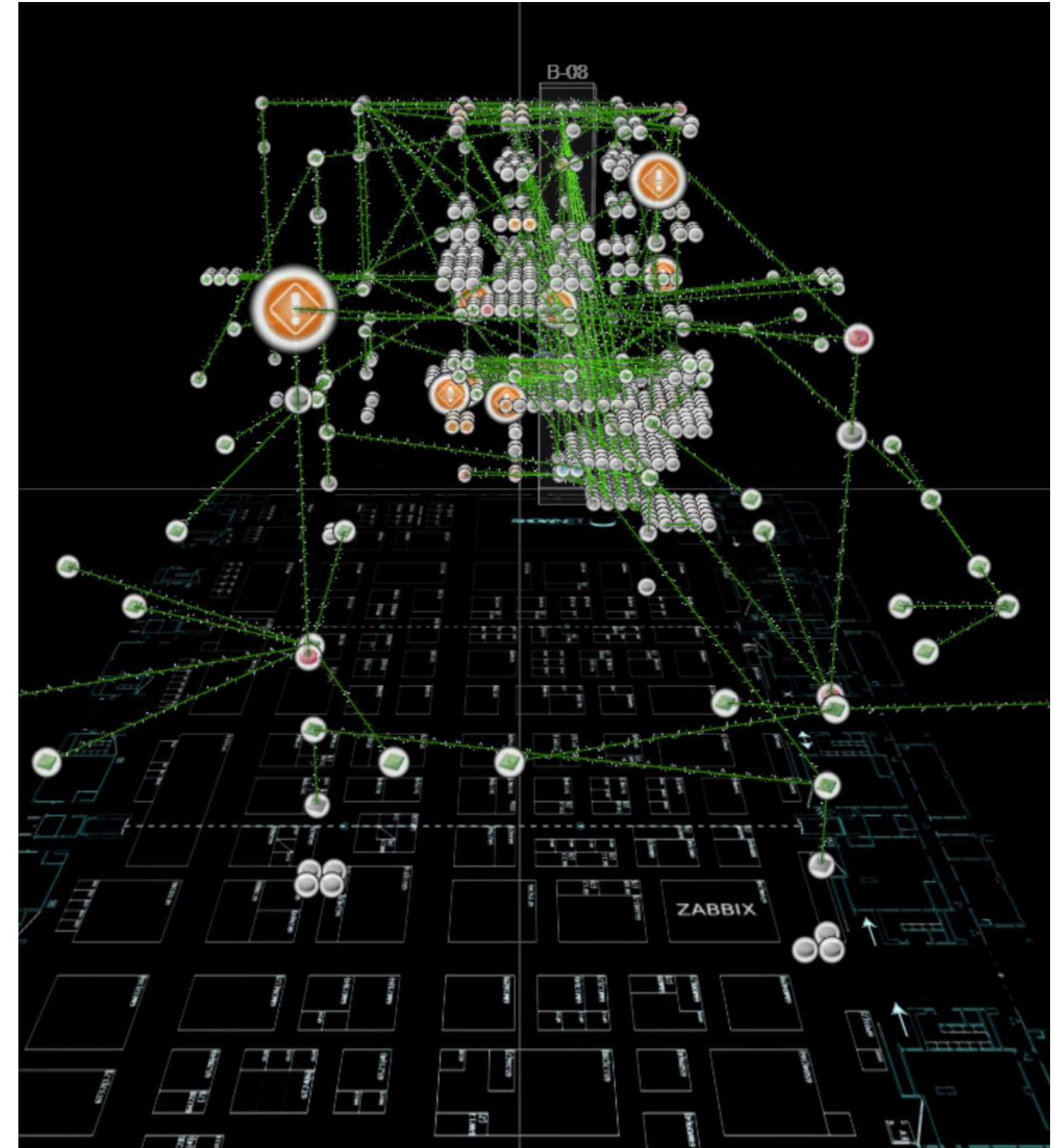
No need to manually create configuration diagrams

- Automatic generation of diagrams keeps them up-to-date.



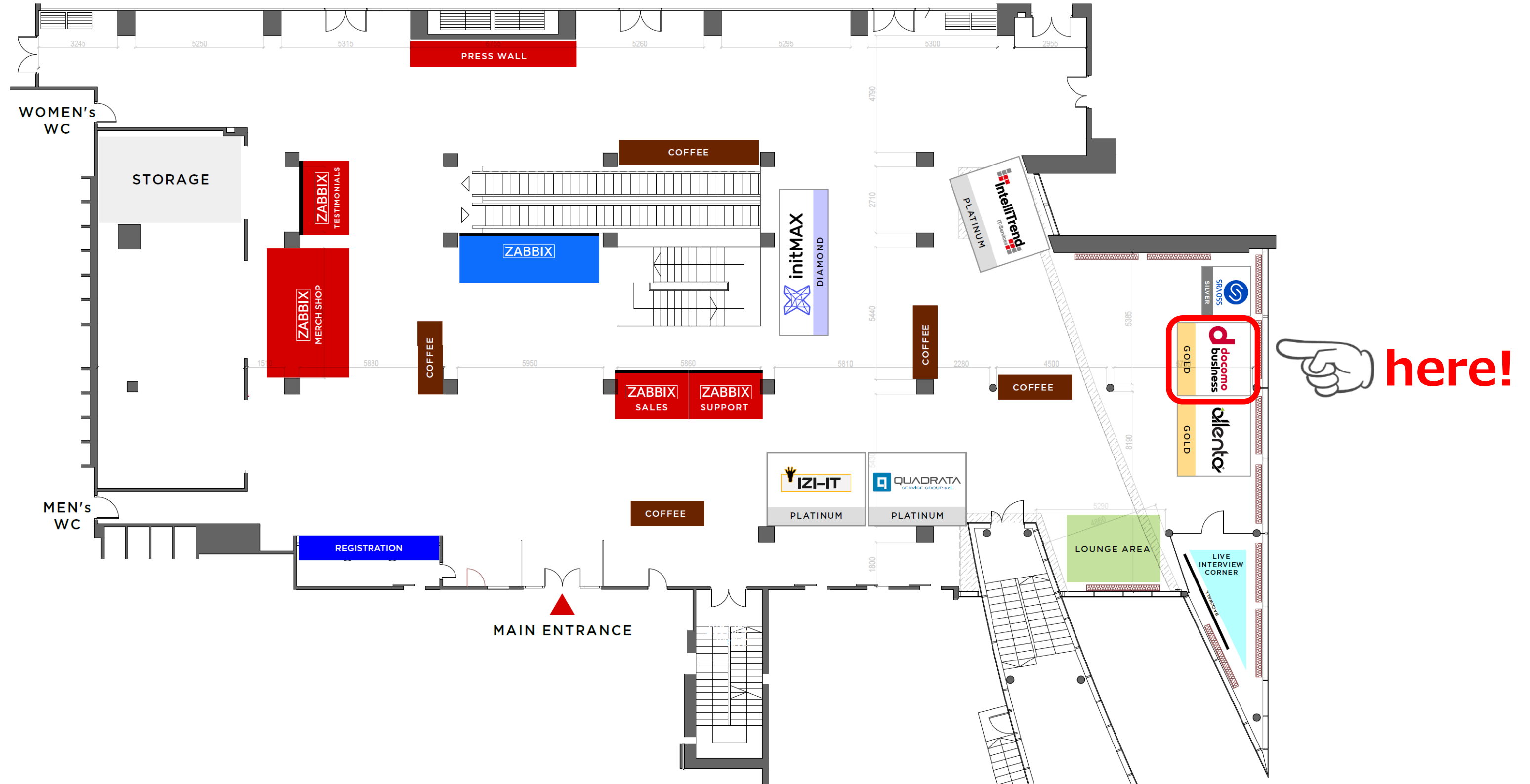
Future of topology generated by Zabbix

- This mechanism is a generic implementation for visualizing node relationships.
- It is possible to draw various topologies other than networks.
- We believe that there are countless uses for Zabbix in combination with the collection of information from nodes.
- We will continue to develop various visualization techniques to broaden the range of applications of Zabbix.



Presentations are on display.

Conference Hall





Thank you!