ZABBIX SUMMIT '18

Monitoring and visualization of LLDP information in Zabbix

NTT Com Solutions
an NTT Communications Company

Agenda

- Introduction
- Technical choice & Problems
- Solution
- Use case
- Unresolved issue & Plan for the future
- How to use

Introduction

About me

Takeshi Tanaka

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System Architect & Management
 > Monitoring system design
 > Product planning

NTT Com Solutions since 2008

About Corporation

NTT Com Solutions Corporation (https://www.nttcsol.com/)

- Technical subsidiary of NTT Communications Group
- Founded in 1988
- Provide Zabbix support service for Japanese market from 2008
- First Zabbix premium partner in the world

NTT Communications
Transform. Transcend.

NTT Com Solutions
an NTT Communications Company

About Corporation

- We provide Zabbix to many companies.
  (communication, manufacturing, finance, etc.)

- At the beginning, we provided a Japanese version of Zabbix 1.4.

- Currently we are provide Zabbix for large-scale enterprise systems.

  30,000 hosts
  1,200,000 items
  60,000 triggers
  4,000 NVPS

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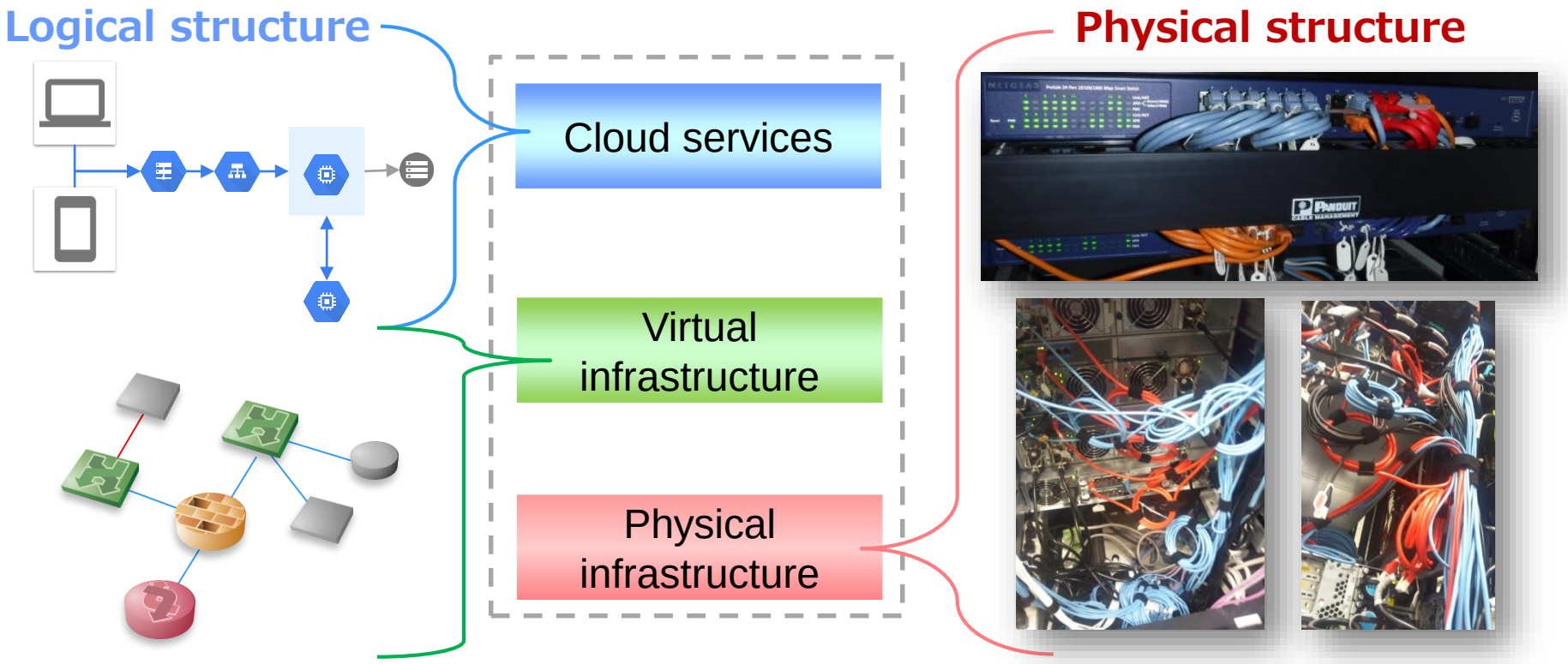
Motivation of the project

The current system is a combination of logical and physical structure.

- Logical structure provides visualization.
- Physical structure has limited visualization.

It is a big problem with large-scale cloud services and communication line services.



Problems cause

It does not work!

Customers

Which customers are affected?

Sales staff

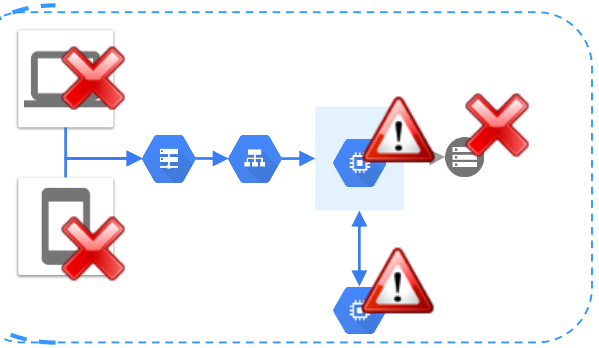
Do not ask me!

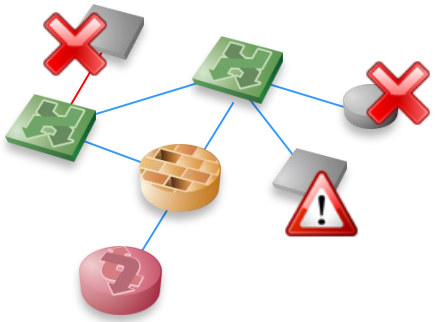
System administrator

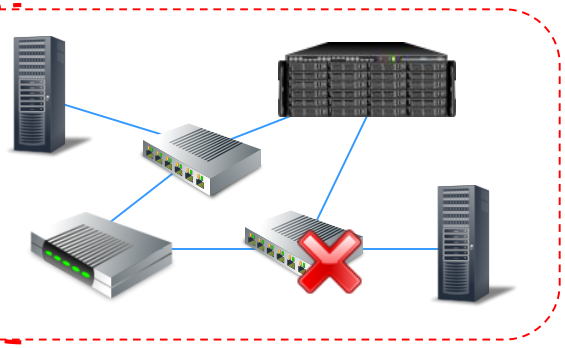
Cloud services

Virtual infrastructure

Physical infrastructure



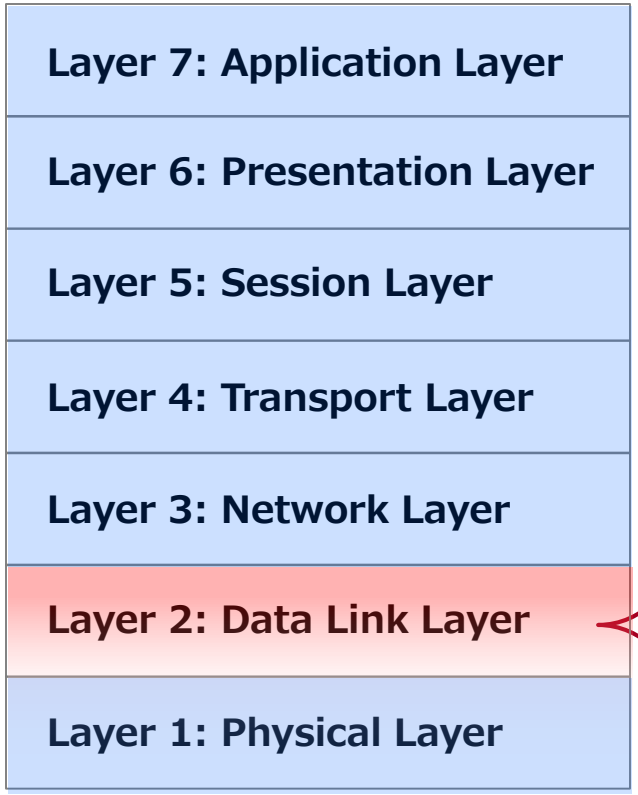




Technical choice & Problems

Technical choice

- The information neighbor devices managed in data link layer
- Manufacturers have their own neighbor discovery protocol. (CDP is most famous)
- We chose LLDP because of versatility

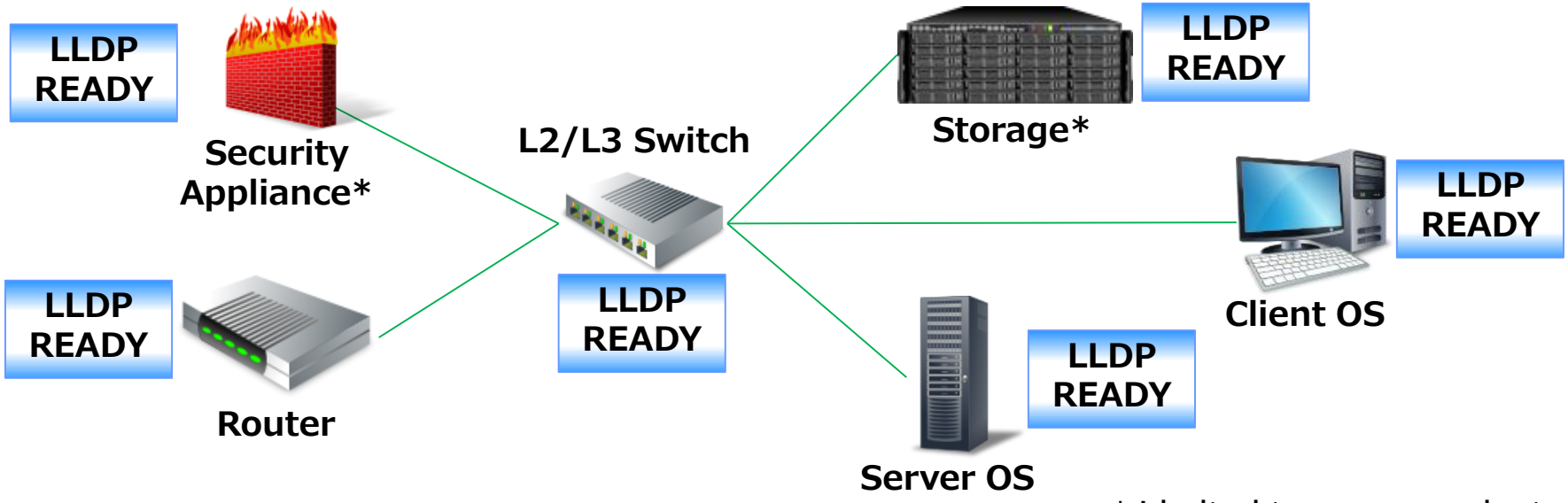


Neighbor discovery protocols

CDP	Cisco Discovery Protocol
EDP	Extreme Discovery Protocol
FDP	Foundry Discovery Protocol
NDP	Nortel Discovery Protocol
L2MS	Layer2 Management Service
LLTD	Link Layer Topology Discovery
ISDP	Industry Standard Discovery Protocol
LLDP	**Link Layer Discovery Protocol**

Reason of choosing LLDP

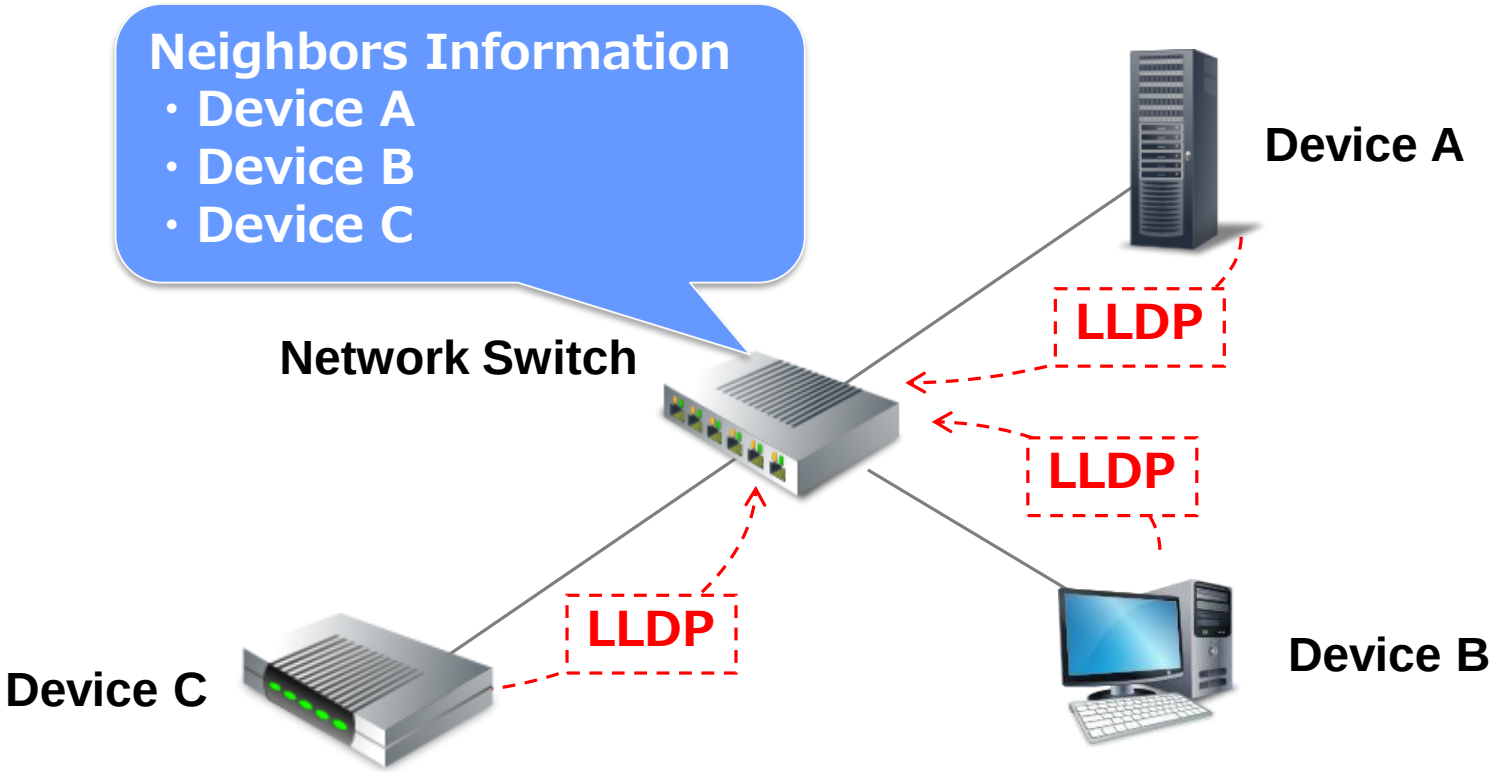
- LLDP is standardized and can be used for multi-vendor environment.
- Many network switch products are supported.
- Some other devices are also supported.
  (Storage, Security Appliance, etc)
- LLDP service for OS is provided.



* Limited to some products

What is LLDP?

- LLDP Standardization as IEEE 802.1AB in 2004
- Periodically send LLDP packets with multicast
- Information on neighbor devices can be read by SNMP (LLDP-MIB)



Problems in using LLDP with Zabbix

- OID changes every time linkup is done
- This is the standard behavior of LLDP-MIB
- Zabbix SNMP monitoring can not collect LLDP information

Example (Neighbor device information of port 9)

Link up => LLDP-MIB::lldpRemPortDesc.**880804.9.29** = STRING: eth0

Link down

Link up => LLDP-MIB::lldpRemPortDesc.**880994.9.30** = STRING: eth0

Link down

Link up => LLDP-MIB::lldpRemPortDesc.**881165.9.31** = STRING: eth0

OID structure of LLDP-MIB

LLDP-MIB has a special structure of OID.

Structure of OID (LLDP RemoteSystemData)

LLDP-MIN::LLDPRemoteTree.**[timeMark]**.**[Local Port Num]**.**[MSAP Entry]**

- [timeMark] is assigned at the time of receiving the LLDP packet.
- [Local Port Num] is assigned a fixed value of port number.
- [MSAP Entry] are assigned in the order in which LLDP packets are received.

Example (LLDP Remote Port Description)

```
LLDP-MIB::lldpRemPortDesc.409504.22.14 = STRING: Gigabit Ethernet Interface 8
LLDP-MIB::lldpRemPortDesc.412944.21.16 = STRING: g24
LLDP-MIB::lldpRemPortDesc.415827.19.18 = STRING: GigabitEthernet0/1
LLDP-MIB::lldpRemPortDesc.1115550.1.44 = STRING: Interface   2 as eth0
LLDP-MIB::lldpRemPortDesc.1115550.2.43 = STRING: Interface   3 as eth1
LLDP-MIB::lldpRemPortDesc.1115550.4.42 = STRING: Interface   4 as eth2
```

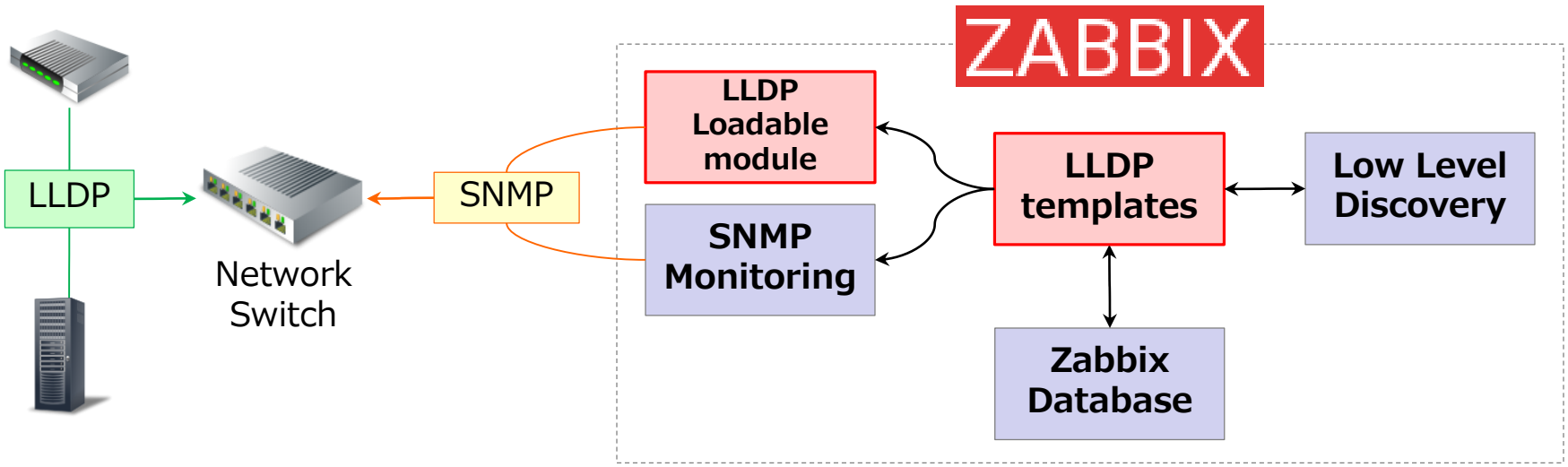
Solution

Development of loadable modules and templates

In order to obtain information from the OID structure of LLDP-MIB, we developed two functions.

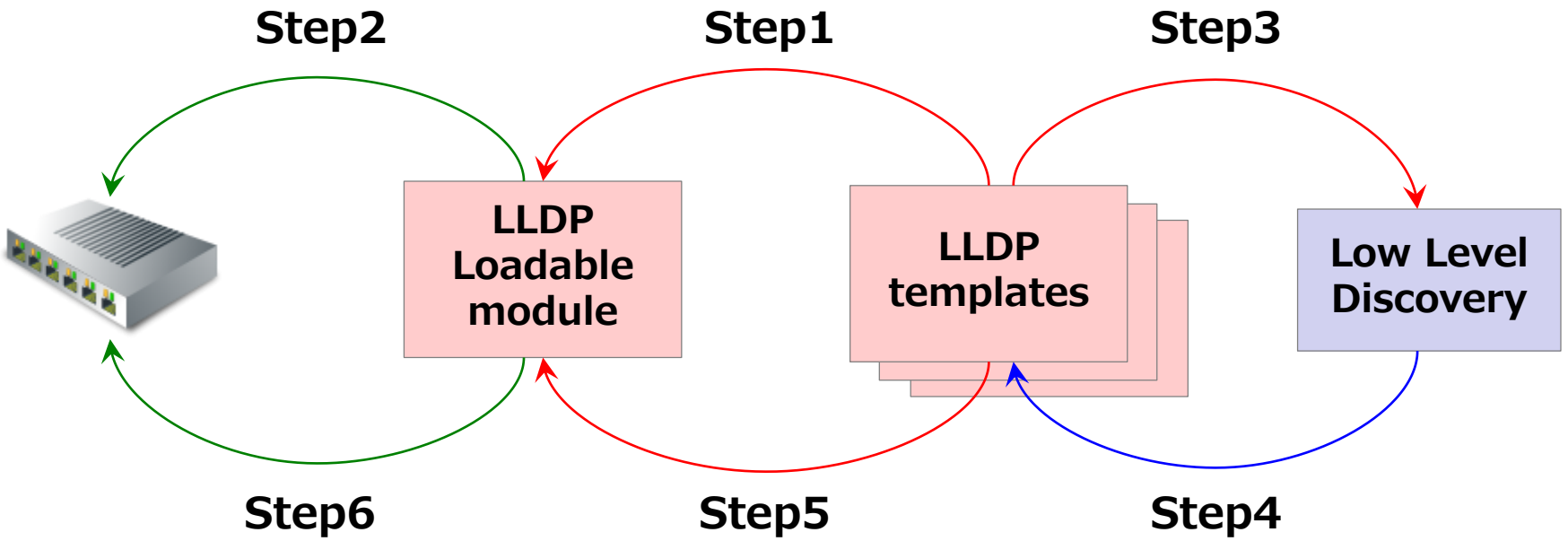
1. Loadable module for reading LLDP-MIB

2. Template to generate items with LLD from LLDP-MIB
   (Follow the change of OID)



Structure of monitoring

Step1. Request for LLDP Information list to the loadable module
Step2. Read LLDP-MIB with SNMP
Step3. Pass structure information to LLD
Step4. Generate items
Step5. Request information to the loadable module
Step6. SNMP monitoring



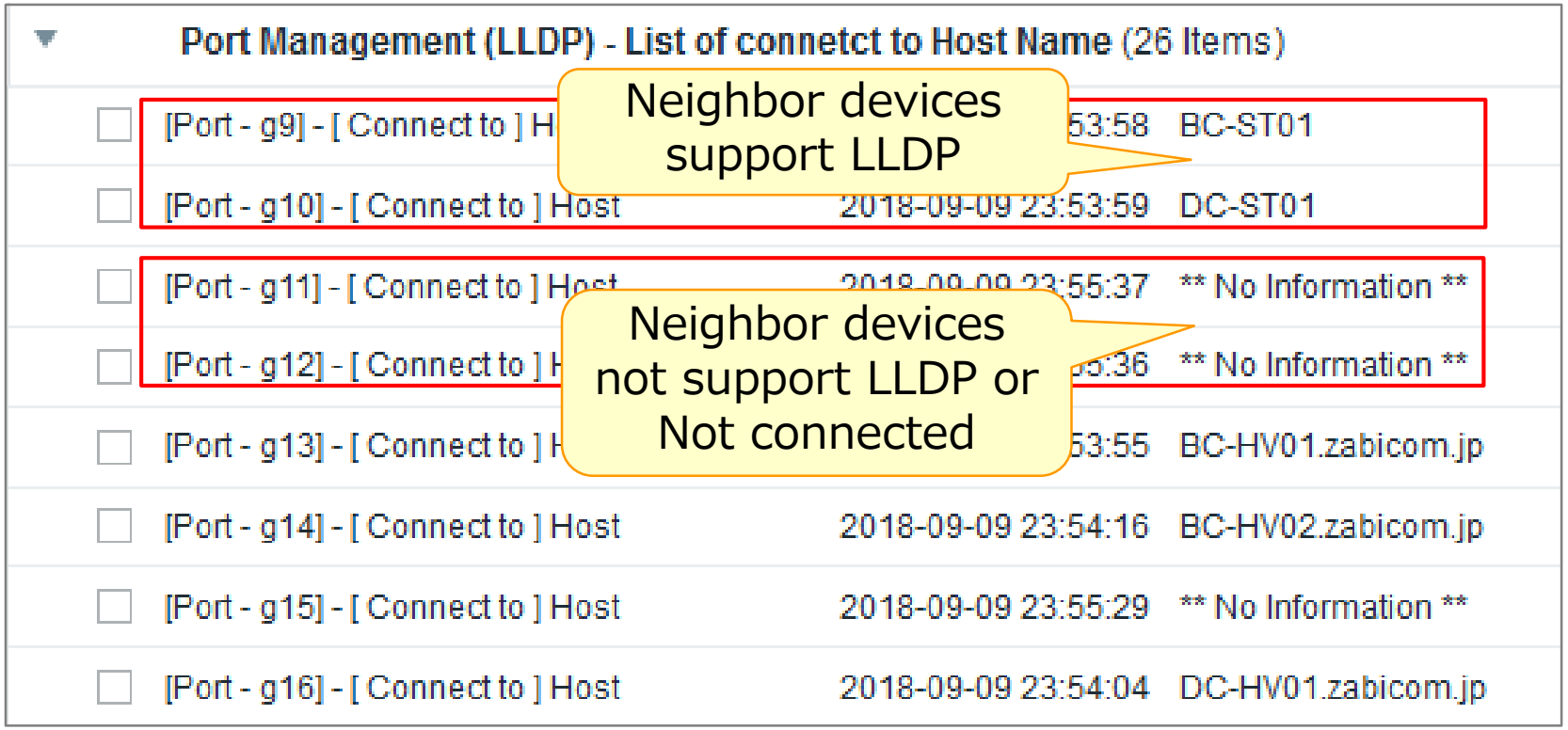
Monitoring items

The loadable module provides the ability to gather useful information from the LLDP-MIB.

LLDP-MIB	Collected data
lldpRemSysName	identify the system name of the remote system. (Hostname)
lldpRemSysDesc	identify the system description of the remote system. (OS Type, Model name …etc)
lldpRemPortIdSubtype	The type of port identifier encoding used in the associated 'lldpRemPortId' object.
lldpRemPortId	identify the port component associated with the remote system. (Port name, MAC Address …etc)
lldpRemPortDesc	identify the description of the given port associated with the remote system. (Port name …etc)

Monitoring result

・Neighbors Host Name
・"No Information" is written to ports that do not have neighbor devices



Monitoring result - Neighbor device: Catalyst2960

[Port - g1] - [Connect to] Host	2018/09/22 18:37:15	S-ZL2SW01
[Port - g1] - [Connect to] Host Descr	2018/09/22 18:36:49	Cisco IOS Software,...
[Port - g1] - [Connect to] Interface Descr	2018/09/22 18:35:31	[Gi0/11 to MGT]
[Port - g1] - [Connect to] Interface Info	2018/09/22 18:35:57	Gi0/11
[Port - g1] - [Connect to] Interface Info Type	2018/09/22 18:36:23	interfaceName (5)

Firmware version

Host Description (lldpRemSysDesc)

```
Cisco IOS Software, C2960X Software (C2960X-UNIVERSALK9-M), Version 15.2(2)E3, RELEASE SOFTWARE (fc3)
```

Port Name

Interface Description (lldpRemPortId)

```
Gi0/11
```

Port Description

Interface Information (lldpRemPortDesc)

```
[ Gi0/11 to MGT ]
```

Monitoring result - Neighbor device: NAS(Linux)

☐	[Port - g9] - [Connect to] Host	2018-09-09 23:58:58	BC-ST01
☐	[Port - g9] - [Connect to] Host Descr	2018-09-09 23:58:32	Linux 2.6.39.4-ato...
☐	[Port - g9] - [Connect to] Interface Descr	2018-09-09 23:57:14	eth0
☐	[Port - g9] - [Connect to] Interface Info	2018-09-09 23:57:40	10:6F:3F:D5:F0:AA
☐	[Port - g9] - [Connect to] Interface Info Type	2018-09-09 23:58:06	macAddress (3)

Host Description (lldpRemSysDesc)

```
Linux 2.6.39.4-atom_usi #1 SMP Tue Dec 22 09:25:48 JST 2015 x86_64
```

Kernel version

Interface Description (lldpRemPortId)

```
eth0
```

Interface Name

Interface Information (lldpRemPortDesc)

```
10:6F:3F:D5:F0:AA
```

MAC Address

Monitoring result - Neighbor device: ESXi

☐	[Port - g14] - [Connect to] Host	2018-09-10 00:04:16	BC-HV02.zabicom.jp
☐	[Port - g14] - [Connect to] Host Descr	2018-09-10 00:03:50	VMware ESX Rele...
☐	[Port - g14] - [Connect to] Interface Descr	2018-09-10 00:02:32	port 67108866 on ...
☐	[Port - g14] - [Connect to] Interface Info	2018-09-10 00:02:58	14:02:ec:35:55:1e
☐	[Port - g14] - [Connect to] Interface Info Type	2018-09-10 00:03:24	macAddress (3)

Host Description (lldpRemSysDesc)

Build number

```
VMware ESX Releasebuild-3073146
```

Interface Description (lldpRemPortId)

vSwitch Name

```
port 67108866 on vSwitch vSwitch2
```

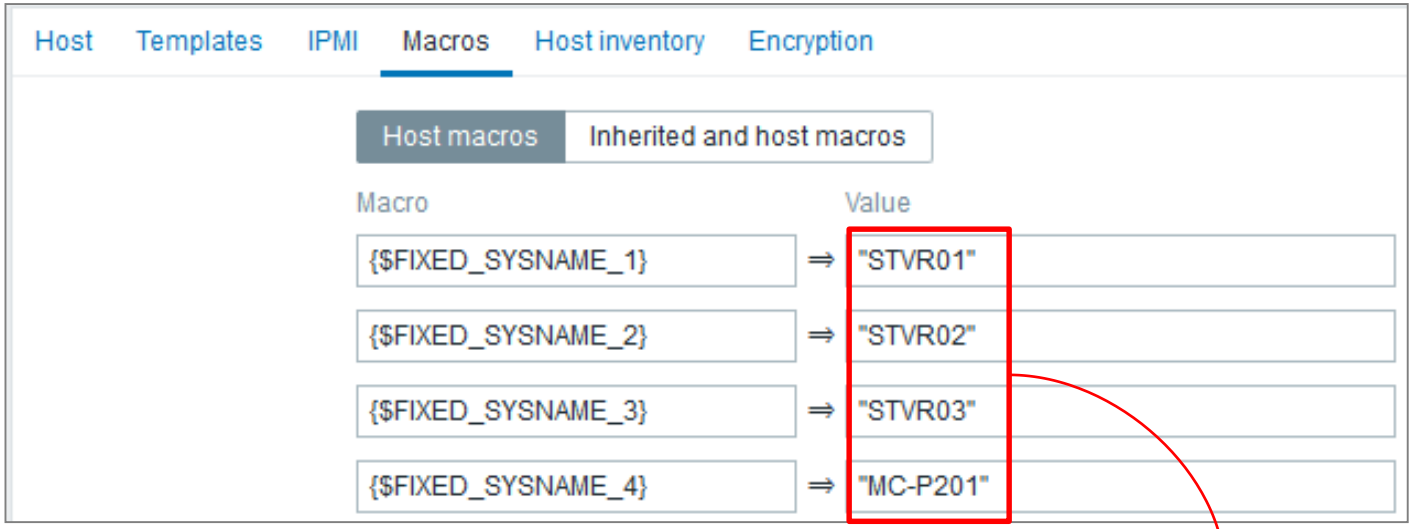
Interface Information (lldpRemPortDesc)

MAC Address

```
14:02:ec:35:55:1e
```

Additional function

- This function overwrites the item "No Information" with the host macros



Compatibility test

- This function performed a compatibility test on the physical machines.

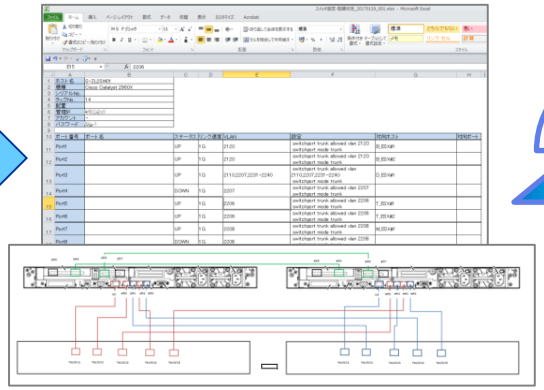
	Cisco 4000 series, ASR 1000 series, 9000 serise Catalyst 2900 series, 3000 series Nexus 9000 series, NCS 5500 series
	N1500 series, N2000 series, N3000 series S3000 series, S4000 series, S5000 series
	MX80 series, MX240 series, MX10000 series QFX5100 series, QFX10000 series
	GS series

Use case

Network Switch information management

Connection and Tagging

Create management table



Manual work

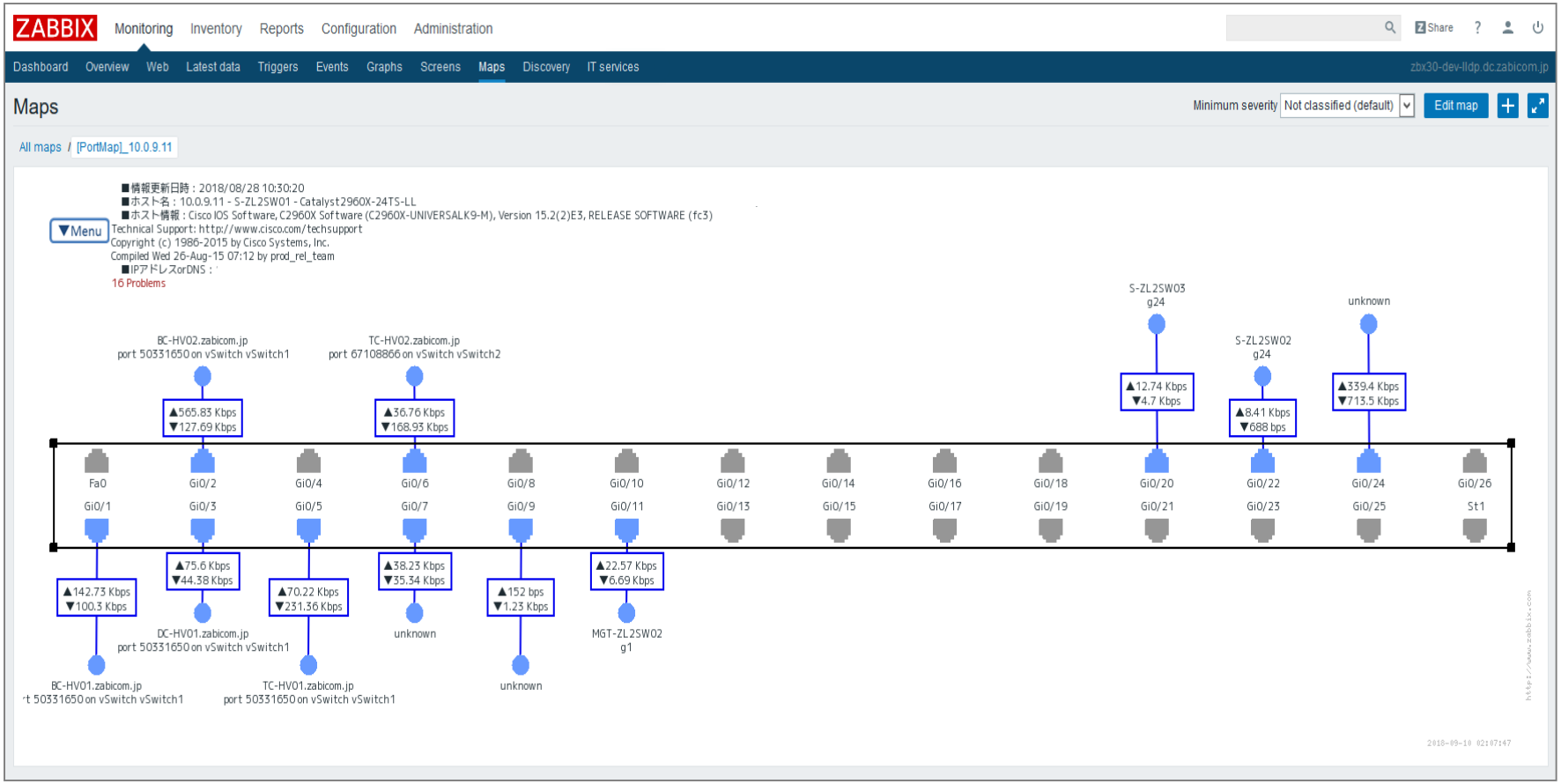
System administrator updates information

Manual work

☞ developed a function to visualize neighbor devices information.

Function 1 : Switch port map

- Automatic generation of switch port map using Zabbix API
- Display link status and neighbor device information



Function 2 : Switch port management table

・Automatic generation of port management table using Zabbix API

インターフェース一覧

ホストグループ Network Device (LLDP supported)　ホスト 10.0.9.11 - S-ZL2SW01 - Catalyst2960X-24TS-LL

CSVエクスポート

ホスト名（表示名）	[redacted] - S-ZL2SW01 - Catalyst2960X-24TS-LL
ホスト名	[redacted]
IPアドレスorDNS	[redacted]
ホスト情報	Cisco IOS Software, C2960X Software (C2960X-UNIVERSALK9-M), Version 15.2(2)E3, RELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.com /techsupport Copyright (c) 1986-2015 by Cisco Systems, Inc. Compiled Wed 26-Aug-15 07:12 by prod_rel_team

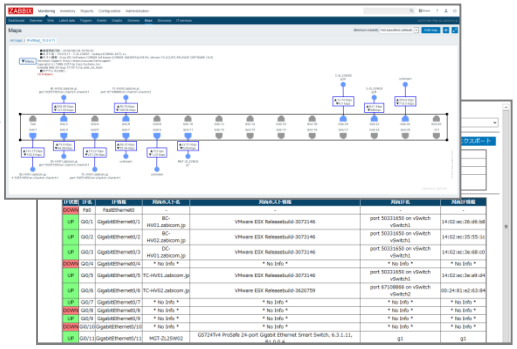
IF状態	IF名	IF情報	対向ホスト名	対向ホスト情報	対向IF名	対向IF情報
DOWN	Fa0	FastEthernet0	-	-	-	-
UP	Gi0/1	GigabitEthernet0/1	BC-HV01.zabicom.jp	VMware ESX Releasebuild-3073146	port 50331650 on vSwitch vSwitch1	14:02:ec:36:d6:b8
UP	Gi0/2	GigabitEthernet0/2	BC-HV02.zabicom.jp	VMware ESX Releasebuild-3073146	port 50331650 on vSwitch vSwitch1	14:02:ec:35:55:1c
UP	Gi0/3	GigabitEthernet0/3	DC-HV01.zabicom.jp	VMware ESX Releasebuild-3073146	port 50331650 on vSwitch vSwitch1	14:02:ec:3e:68:c0
DOWN	Gi0/4	GigabitEthernet0/4	* No Info *	* No Info *	* No Info *	* No Info *
UP	Gi0/5	GigabitEthernet0/5	TC-HV01.zabicom.jp	VMware ESX Releasebuild-3073146	port 50331650 on vSwitch vSwitch1	14:02:ec:3e:a9:d4
UP	Gi0/6	GigabitEthernet0/6	TC-HV02.zabicom.jp	VMware ESX Releasebuild-3620759	port 67108866 on vSwitch vSwitch2	00:24:81:e2:63:84
UP	Gi0/7	GigabitEthernet0/7	* No Info *	* No Info *	* No Info *	* No Info *
DOWN	Gi0/8	GigabitEthernet0/8	* No Info *	* No Info *	* No Info *	* No Info *
UP	Gi0/9	GigabitEthernet0/9	* No Info *	* No Info *	* No Info *	* No Info *
DOWN	Gi0/10	GigabitEthernet0/10	* No Info *	* No Info *	* No Info *	* No Info *
UP	Gi0/11	GigabitEthernet0/11	MGT-ZL2SW02	GS724Tv4 ProSafe 24-port Gigabit Ethernet Smart Switch, 6.3.1.11, B1.0.0.4	g1	g1

Improvement result

Connection and Tagging

Automatically collect and visualize LLDP information

ZABBIX



System administrator browses information

Automation work

Unresolved issue & Plan for the future

Unresolved issue

1. LLDP can not hold past information

・The cause is an LLDP-MIB structure and an item generation method of LLD

2. Multiple connect devices are connected to one physical port

・Problems with virtual machines sending LLDP packets.
・vSwitch will pass through LLDP packets sent by the virtual machines

Plan for the future

1. Support for CDP

・Read information of neighbor devices from CDP

・CDP is popular, and it is also demanded from customers.

2. Support for LLDP-MIB v2

・Enable to read the information stored in LLDP-MIB v2

・VMware ESXi stores information in LLDP-MIB v2

3. Automatic rendering of network topology

・Automatically generate network topology from neighbor information

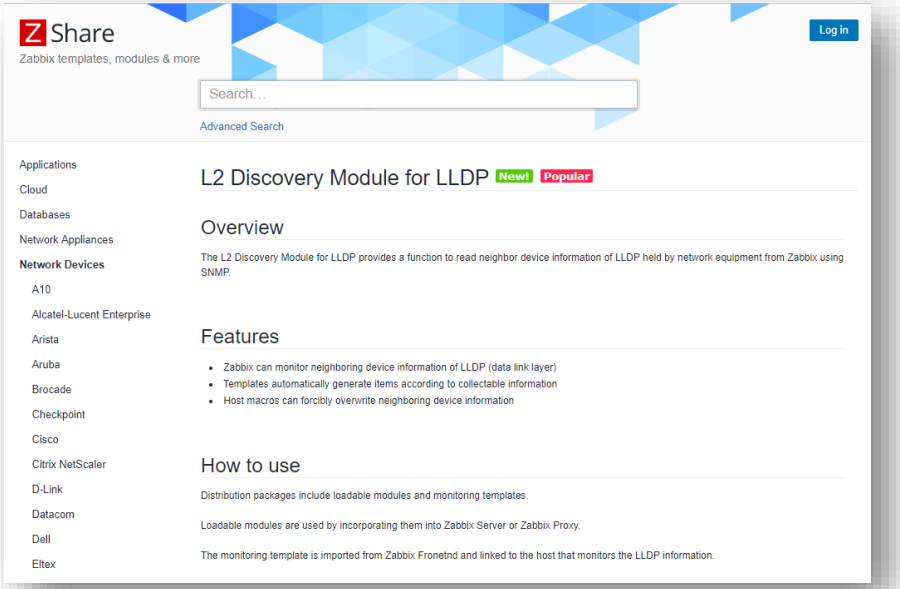
How to use

Download loadable modules and templates

The loadable module and template are published in Zabbix share

L2 Discovery Module for LLDP

- Binary and templates
- Loadable module source code



https://share.zabbix.com/monitoring-equipment/l2-discovery-module-for-lldp

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Thank you!

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