



Omnissiah

Zabbix Summit Online 2021

Jacob Robinson
Systems Engineering Manager

About Me: Jacob Robinson

- Systems Engineering Manager at WeWork, previously an AV Engineer and an Automotive Design Engineer
- Blog - monitoreverything.net
- WeWork is a New York City based commercial real estate company that provides flexible shared workspaces for companies



wework



Zabbix at WeWork

- Zabbix is used as WeWork's global monitoring solution for every site it operates which includes over 650 buildings and 150,000 active hosts in Zabbix
- Monitoring
 - Devices
 - Network equipment
 - Security cameras
 - AV amplifiers and control systems
 - Items
 - ISP status
 - Wireless client count
 - Device switch port configuration
 - TV power state





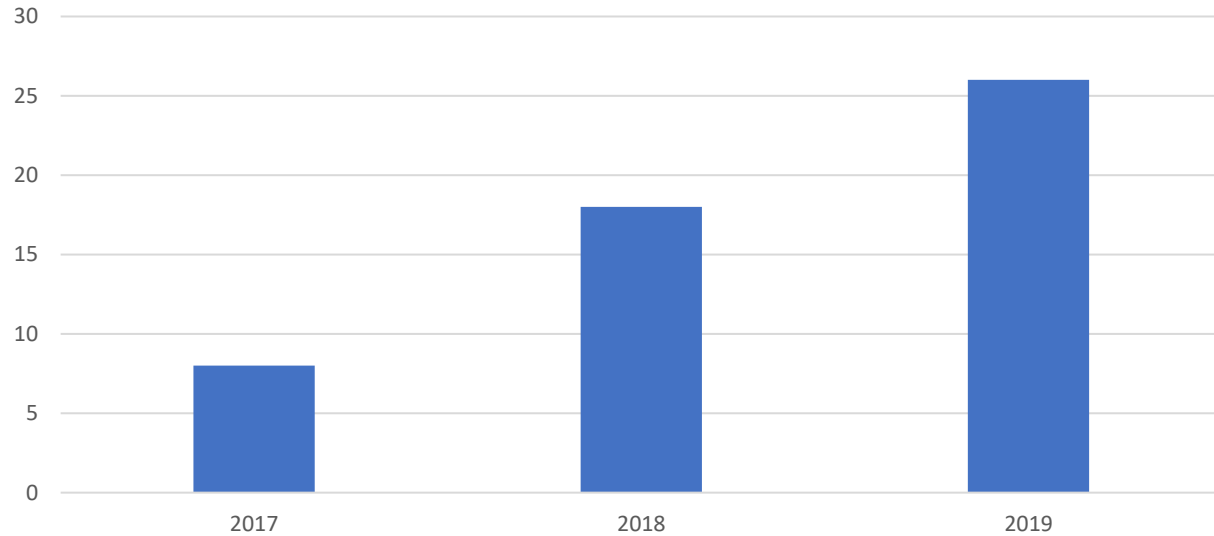
Early Monitoring at WeWork

- Manual host creation
- Airtable Bases of devices
- Google Sheets with IPv4 information for user reference



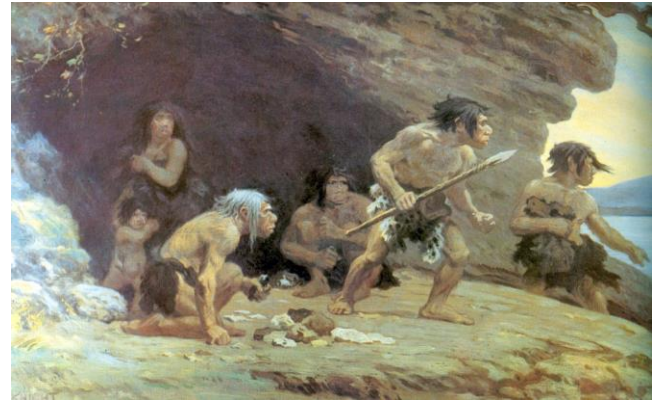


Average Buildings Opened Per Month



Early Monitoring at WeWork

- No standardization for Host names, Templates, Groups
- Dashboards manually created
- Host data became out-of-date quickly
- ICMP and simple SNMP relied on for host status
- Actual host health was unknown





Problem

WeWork operates over 650 buildings connected on an internal network of various devices. Different generations of standards for the network structure as well as the devices on the network cause confusion and create difficulty in accurately recording device and network information.



Problem Simplified

- Over 650 buildings, 150,000 active hosts on the network
- Manual creation too difficult
 - A lot of work – a lot of potential for entry error
 - Devices on incorrect subnet
 - DHCP

Solution - Ommissiah

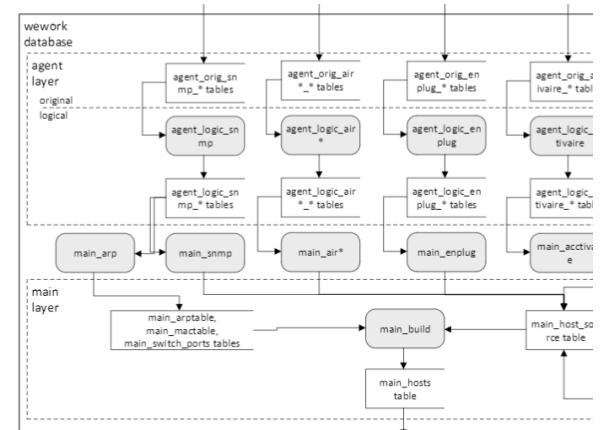
Develop system that uses limited reference data to automatically detect and identify hosts, generate and update standardized entries, and sync with Zabbix on a regular basis

"Hail the Ommissiah! He is the God in the Machine, the Source of All Knowledge."



Overview

- Reference data is used for classification and process efficiency
- Microservice architecture is used
- All programs are written in Python 3 and interface with the primary "wework" database





Reference Data

- Important ref_ data:
 - Building – all building (site) information such as Marketing Name, Address, Timezone
 - Department – device department such as AV, Networking, Security
 - Device Type – type of device such as Amplifier, Camera, Router
 - Model – device model such as SRX 550, Solstice Pod, TSW-1060
 - Region – region of building such as US (United States), LATAM (Latin America)
 - Subnet – buildings internal IPv4 subnet and netmask
 - Territory – building territory such as Mountain West Texas or South India
 - Vendor – device vendor such as Cisco, Juniper, Mersive, Crestron
 - WAN Subnet – buildings public IPv4 subnet and netmask

```
ref_building
ref_ctrl_task_result
ref_ctrl_task_status
ref_department
ref_device_type
ref_device_type_vendor
ref_devicetype_snit_fieldset
ref_model
ref_module_type
ref_programs
ref_programs_queries
ref_region
ref_region_snit_company
ref_server
ref_server_region
ref_snipeit_components
ref_snipeit_table
ref_snit_custom_fields
ref_subnet
ref_territory
ref_tv_type
ref_tv_vendor_model
ref_vendor
ref_wansubnet
ref_zabbix_table
ref_zbx_hostinfo_table
```



Layers

- A layer is a collection of tables from a database with a common purpose and prefix in the name
 - agent_
 - ref_
 - main_
 - zbx_
- Small applications that do something within a specific layer
- Data travels from layer to layer for changing, processing and aggregating depending on the purpose of the layer



Four Steps of a Cycle

1. Prepare external data sources
2. Collect information about hosts from different sources
3. Identify each host type and vendor based on the information collected
4. Create, change, or delete hosts in monitoring based on detection



1. Prepare external data sources

- Provides method of user manual entry when necessary
 - Must be standardized as much as possible
 - Web GUI
- Netbox
 - Building – all building (site) information such as Marketing Name, Address, Timezone
 - Device Type – type of device such as Amplifier, Camera, Router
 - **Subnet – buildings internal IPv4 subnet and netmask**
 - WAN Subnet – buildings public IPv4 subnet and netmask
- MAC address OUI API





2. Collect information about hosts from different sources

- Agent Layers - collects and prepares source data about hosts from various sources
 - Activaire API (background music players)
 - Airtable
 - Enplug API (digital signage players)
 - Netbox API
 - Nmap
 - SNMP scan
 - Solstice Pod API (screen share devices)
 - Wireless Access Points (various APIs, SNMP)
- Agent sub-layers - Copies the records from the agent_orig sub-layer and executes queries to correct, delete, or transform the records. This sub-layer helps remove "junk" records and fix minor spelling errors



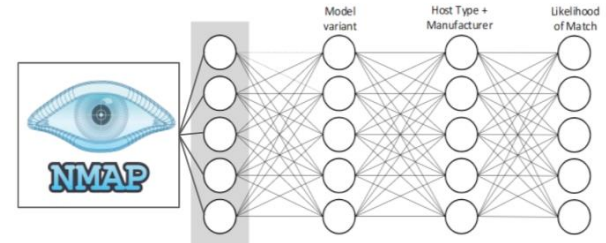
2. Collect information about hosts from different sources

- SNMP or API
 - Hardware information
 - Make
 - Model
 - Generation
 - Serial number
 - Different MACs for multiple NICs
 - Software information
 - Version
 - Settings

```
SNMPv2-MIB::sysDescr.0 = STRING: EPDU MI 38U-A IN: L6-30P 24A 1P OUT: 36XC13:6XC
SNMPv2-MIB::sysObjectID.0 = OID: SNMPv2-SMI::enterprises.534.6.6.7
DISMAN-EVENT-MIB::sysUpTimeInstance = Timeticks: (8943623) 1 day, 0:50:36.23
SNMPv2-MIB::sysContact.0 = STRING:
SNMPv2-MIB::sysName.0 = STRING: PDU
SNMPv2-MIB::sysLocation.0 = STRING:
SNMPv2-MIB::sysServices.0 = INTEGER: 72
SNMPv2-MIB::sysORLastChange.0 = Timeticks: (0) 0:00:00.00
SNMPv2-MIB::sysORID.1 = OID: SNMPv2-MIB::snmpMIB
SNMPv2-MIB::sysORID.2 = OID: SNMP-FRAMEWORK-MIB::snmpFrameworkMIBCompliance
SNMPv2-MIB::sysORID.3 = OID: SNMP-MPD-MIB::snmpMPDCompliance
SNMPv2-MIB::sysORID.4 = OID: SNMP-USER-BASED-SM-MIB::usmMIBCompliance
SNMPv2-MIB::sysORID.5 = OID: SNMP-VIEW-BASED-ACM-MIB::vacmMIBCompliance
SNMPv2-MIB::sysORDescr.1 = STRING: The MIB Module from SNMPv2 entities
SNMPv2-MIB::sysORDescr.2 = STRING: SNMP Management Architecture MIB
SNMPv2-MIB::sysORDescr.3 = STRING: Message Processing and Dispatching MIB
SNMPv2-MIB::sysORDescr.4 = STRING: USM User MIB
SNMPv2-MIB::sysORDescr.5 = STRING: VACM MIB
SNMPv2-MIB::sysORUpTime.1 = Timeticks: (0) 0:00:00.00
SNMPv2-MIB::sysORUpTime.2 = Timeticks: (0) 0:00:00.00
SNMPv2-MIB::sysORUpTime.3 = Timeticks: (0) 0:00:00.00
SNMPv2-MIB::sysORUpTime.4 = Timeticks: (0) 0:00:00.00
SNMPv2-MIB::sysORUpTime.5 = Timeticks: (0) 0:00:00.00
IF-MIB::ifNumber.0 = INTEGER: 2
IF-MIB::ifIndex.1 = INTEGER: 1
IF-MIB::ifIndex.2 = INTEGER: 2
IF-MIB::ifDescr.1 = STRING: LOOPBACK
IF-MIB::ifDescr.2 = STRING: Quadnet.0
IF-MIB::ifType.1 = INTEGER: softwareLoopback(24)
IF-MIB::ifType.2 = INTEGER: ethernetCsmacd(6)
IF-MIB::ifMtu.1 = INTEGER: 1500
IF-MIB::ifMtu.2 = INTEGER: 1500
```

3. Identify each host type and vendor based on the information collected

- Nnml layer - Collects all host data together, trains the neural network with it, and attempts to predict the types of hosts and manufacturers
- Main layer - Combine all the data together and continue to add data such as MAC addresses
 - Main- processes tables from agent sub-layers to set host type and manufacturer
 - Main ARP- saves ARP and MAC tables
 - Main Build - generates main_hosts which is combination of every main table in this layer



4. Create, change, or delete hosts in monitoring based on detection

- Zabbix layer - This layer converts the generated data to the Zabbix structuring and synchronizes it with the current monitoring
 - Host Groups - Uses Zabbix API to copy information about hosts and groups to primary “wework” database
 - From Main - converts main_hosts structure to Zabbix structure
 - Sync - Uses Zabbix API to synchronize Hosts and Groups





4. Create, change, or delete hosts in monitoring based on detection

- Includes:
 - Groups
 - Hosts
 - Groups
 - Templates
 - MACROS
 - Inventory
 - Tags
 - Statistical hosts
 - Dashboards
 - Formulas
- Creating, updating, deleting





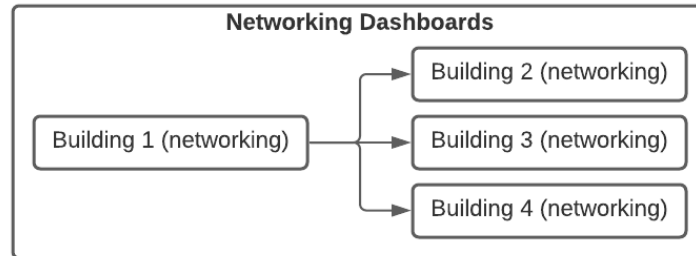
Result

- All hosts detected and identified automatically
- Groups, Templates, Tags are all set automatically
- Visible hostnames have type, vendor, sometimes model, MAC, IP
- Host inventory contains hostname, OS, serial, VLAN, MAC, contact email, location details, lat/long, model, vendor, switch port configuration, predicted floor, time zone

Type ▲	Host count
Access Control System	3145
ALS systems	25
Amplifier	662
BGM Player	370
Building Management	899
Camera	27690
Channel Expander	163
Computer	204
Dante Device	81
Digital Signage	2246
Display	11
DM Device	94
DSP	183
Environmental monitor	126
Firewall	2
Hypervisor	46
Managed Switch	3213
Microphone Reciever	277
NAS	1

Dashboards

- Automatic creation based on single manually generated dashboard template
Creation process adapts based on Building, Host, or Group





Problem Revisited

WeWork operates over 650 buildings connected on an internal network of various devices.

Omnissiah is scalable to any number of buildings and devices.

Different generations of standards for the network structure as well as the devices on the network cause confusion and create difficulty in accurately recording device and network information.

Omnissiah can learn new devices and accurately keep standardized records of the device physical and network information.



User Experience

- Important to make software function well
- Omnisiah allows for users to
 - See more information about hosts
 - Easily search and filter by region, territory, building, device

Example: See more information about hosts

Host inventory

Overview Details

Host name Camera_Bosch_000 [redacted]

Visible name Camera Bosch (00 [redacted] 10 [redacted])

SNMP interfaces

IP address	DNS name	Connect to	Port	Default
10 [redacted]	[redacted]	<input type="radio"/> IP <input type="radio"/> DNS	161	<input checked="" type="radio"/>

Hardware F0003D43

Software 39500570

Monitoring [Web](#) [Latest data](#) [Problems](#) [Graphs](#) [Screens](#)

Configuration [Host](#) [Applications 10](#) [Items 29](#) [Triggers 8](#) [Graphs](#) [Discovery](#) [Web](#)

[Cancel](#)

Host inventory

Overview Details

Type Camera

Serial number A 4 [redacted] 2

Tag cctv

MAC address A 000 [redacted]

Hardware F0003D43

Software 11500575

Location latitude 40.7529715

Location longitude -73.9842168

Model NDC-265-P

Vendor Bosch

Host networks {"sw_ip":"10 [redacted]","sw_port":20,"sw_port_name":"TwoGigabitEthernet1/0/13","sw_name":"ny07-6a","sw_floor":"6"}

Site address A 54 W 40th

Site address B WE-US-89820

Site city NY07 - 54 W 40th

Site state / province Tri-State

Site country US East

Site notes {"code":"WE-US-89820","newcode":"NYC7","oldcode":"NY07","timezone":-5.0,"dayoff":"67","tznname":"EST","floor":"6"}

[Cancel](#)

Example: Easily search and filter

Host groups

- Building/NSH05 - Capitol View
- Building/NSH05 - Capitol View Department AV
- Building/NSH05 - Capitol View Device BGM Player
- Building/NY07 - 54 W 40th
- Building/NY07 - 54 W 40th Department AV
- Building/NY07 - 54 W 40th Department Networking
- Building/NY07 - 54 W 40th Department Power
- Building/NY07 - 54 W 40th Department Security
- Building/NY07 - 54 W 40th Department Systems
- Building/NY07 - 54 W 40th Device Access Control System
- Building/NY07 - 54 W 40th Device Amplifier
- Building/NY07 - 54 W 40th Device BGM Player
- Building/NY07 - 54 W 40th Device Building Management
- Building/NY07 - 54 W 40th Device Camera
- Building/NY07 - 54 W 40th Device Digital Signage
- Building/NY07 - 54 W 40th Device DM Device
- Building/NY07 - 54 W 40th Device DSP
- Building/NY07 - 54 W 40th Device Managed Switch
- Building/NY07 - 54 W 40th Device Microphone Receiver
- Building/NY07 - 54 W 40th Device PDU
- Building/NY07 - 54 W 40th Device Phone
- Building/NY07 - 54 W 40th Device Printer
- Building/NY07 - 54 W 40th Device Remote Access Controller
- Building/NY07 - 54 W 40th Device Room Controller
- Building/NY07 - 54 W 40th Device Router

Select Cancel

Host groups

- Territory/South-West Device Wireless Access Point Vendor Cisco
- Territory/South-West Device Wireless Access Point Vendor Juniper
- Territory/South-West Device Wireless Access Point Vendor Ruckus
- Territory/South-West Device Wireless Controller
- Territory/South-West Device Wireless Controller Vendor Cisco
- Territory/South-West Device Wireless Controller Vendor Ruckus
- Territory/Tri-State
- Territory/Tri-State Department AV
- Territory/Tri-State Department Networking
- Territory/Tri-State Department Power
- Territory/Tri-State Department Security
- Territory/Tri-State Department Systems
- Territory/Tri-State Device Access Control System
- Territory/Tri-State Device Access Control System Vendor
- Territory/Tri-State Device Access Control System Vendor Mercury Security
- Territory/Tri-State Device Access Control System Vendor S2 Security
- Territory/Tri-State Device ALS systems
- Territory/Tri-State Device ALS systems Vendor Listen
- Territory/Tri-State Device Amplifier
- Territory/Tri-State Device Amplifier Vendor
- Territory/Tri-State Device Amplifier Vendor Ashly
- Territory/Tri-State Device Amplifier Vendor QSC
- Territory/Tri-State Device BGM Player
- Territory/Tri-State Device BGM Player Vendor
- Territory/Tri-State Device BGM Player Vendor Mlink

Select Cancel

Host groups

- Region/LATAM Device VTC
- Region/LATAM Device VTC Vendor Cisco
- Region/LATAM Device Wireless Access Point
- Region/LATAM Device Wireless Access Point Vendor Apple
- Region/LATAM Device Wireless Access Point Vendor Cisco
- Region/LATAM Device Wireless Access Point Vendor Ruckus
- Region/LATAM Device Wireless Controller
- Region/LATAM Device Wireless Controller Vendor Cisco
- Region/LATAM Device Wireless Controller Vendor Ruckus
- Region/US East
- Region/US East Department AV
- Region/US East Department Networking
- Region/US East Department Power
- Region/US East Department Security
- Region/US East Department Systems
- Region/US East Device Access Control System
- Region/US East Device Access Control System Vendor
- Region/US East Device Access Control System Vendor Mercury Security
- Region/US East Device Access Control System Vendor S2 Security
- Region/US East Device ALS systems
- Region/US East Device ALS systems Vendor Listen
- Region/US East Device Amplifier
- Region/US East Device Amplifier Vendor
- Region/US East Device Amplifier Vendor Ashly
- Region/US East Device Amplifier Vendor QSC
- Region/US East Device BGM Player

Select Cancel

External Applications

- AV Control Center
- Asset Management by Snipe-IT



The screenshot shows a Wework dashboard interface. At the top, there is a navigation bar with the Wework logo and links for Home, Ashly, Solstice, Activaire, and Admin. The main content area is titled "Home Page" and displays the following information:

- We Code:** WE-AR-31200
- Building Name:** ARC02 - Libertador 1000
- Address:** Av. Del Libertador 1000, Vicente López Buenos Aires B1638BEV
- Region:** LATAM
- Territory:** Argentina
- New Code:** BUE2
- Old Code:** ARC02

Below this information, there is a section titled "Conference Room Devices:" which lists the following items:

- Solstice Pod Libertador 12B
- Solstice Pod Libertador 12C
- Solstice Pod Libertador 13B
- Solstice Pod Libertador 11B
- Solstice Pod Libertador 11C
- Solstice Pod Libertador 7B



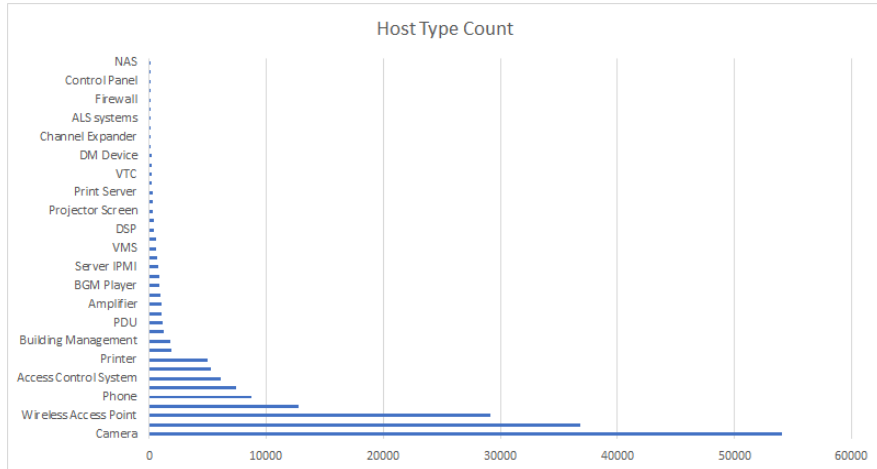
Success Story

- Q3 2021 WeWork migrated datacenters and changed all LATAM site IP networks
- Omnisiah completed the migration of LATAM with USC in 1 cycle



Zabbix Stats

1 cycle for Omnisiah is roughly 8 hours



Zabbix System Information			
Parameter	USC/LATAM	EMEA	APAC
Hosts	82567	34529	34182
Templates	316	316	316
Items	4873083	2246468	1897081
Triggers	1687531	846908	640013
New values per second	6505	2975	2602

Server			
Parameter	USC/LATAM	EMEA	APAC
Instance	r5.8xlarge	r5.4xlarge	r5.4xlarge
vCPUs	32	16	16
Memory (gb)	256	128	128

Database			
Parameter	USC/LATAM	EMEA	APAC
Instance	db.r5.8xlarge	db.r5.2xlarge	db.r5.2xlarge
vCPUs	32	8	8
Memory (gb)	256	64	64

Proxy		
Parameter	USC/LATAM 1	USC/LATAM 2
Instance	r5.4xlarge	r5.4xlarge
vCPUs	16	16
Memory (gb)	128	128



Thank you

Have a great Zabbix Summit 2021

Contact me:

Jacob Robinson

jacob.robinson@wework.com

monitoreverything.net

