Network Monitoring, Management and Automation

Network Documentation

and

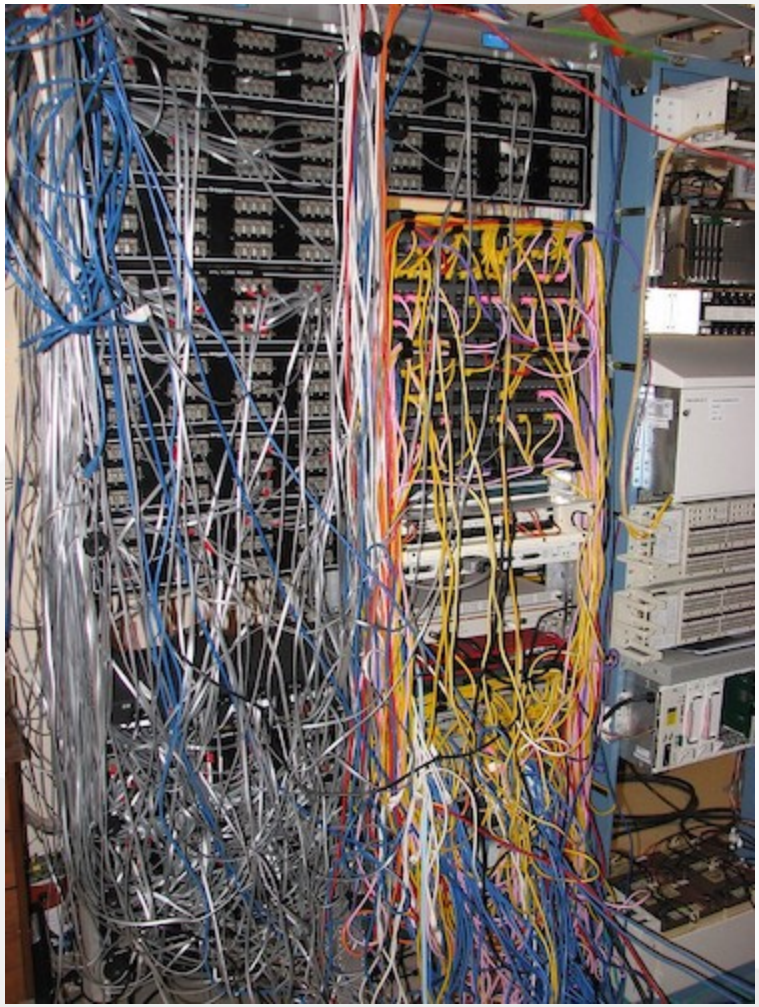
Netdot

npNOG 5

Dec 8 - 12, 2019

Have you ever asked,
"How do you keep track of it all?"

Document,
Document,
Document!



Documentation

Basics, such as documenting your switches…

- What is each port connected to?
- Can be simple text file with one line for every port in a switch:
  - switch1, port 1, Room 29 - Director's office
  - switch1, port 2, Room 43 - Receptionist
  - switch1, port 3, Room 100 - Classroom
  - …
  - switch1, port 25, uplink to backbone
- This information might be available to your network staff, help desk staff, via a wiki, software interface, etc.
- Remember to label your ports!

Documentation (Contd.)

Maybe this process should be automatic. Tools to help automate network documentation are something to consider.

- You can write local scripts (programs) to do this.
- Consider among several automated documenation systems for networks.
- You'll probably end up using and doing both.

Documentation: Labelling

Nice... :)

Problems With Documentation

In most cases:

- Lack of clear procedures and methods
- Dispersion
- Lack of structure
- Lack of correlation
- Lack of tools... or, too many tools
- Lack of time and human resources

Requirements for a Tool

- Open standards based
- Generic and flexible
- That uses a relational database
- Automates tasks
- Exports configurations
- Web and command-line interfaces (CLI)
- Authentication and authorization
- Reports
- Open source code
- Application programming interface (API)

{net.} NETwork DOcumentation Tool

- Started in 2002. Required by the University of Oregon Network Services and NERO (http://www.nero.net)
- Nothing equivalent available as Open Source
- Started as something much simpler
- Ccentralizing and correlating information is critical:
  - Topology
  - Cable plant
  - IP and Mac addresses
  - DNS, DHCP, etc.

{net.} Design Goals

- Reutilize components (don't reinvent the wheel)
  - There are Open Source packages that help to resolve many Network Management problems.
- Independent of the RDBMS using abstraction (http://www.masonhq.com)
  - MySQL, Postgres, etc.
- Use of Object Relations Mapper tools (ORM)
- Minimize the number of programming languages.
  - Perl and Javascript
- Low impact graphical interface.

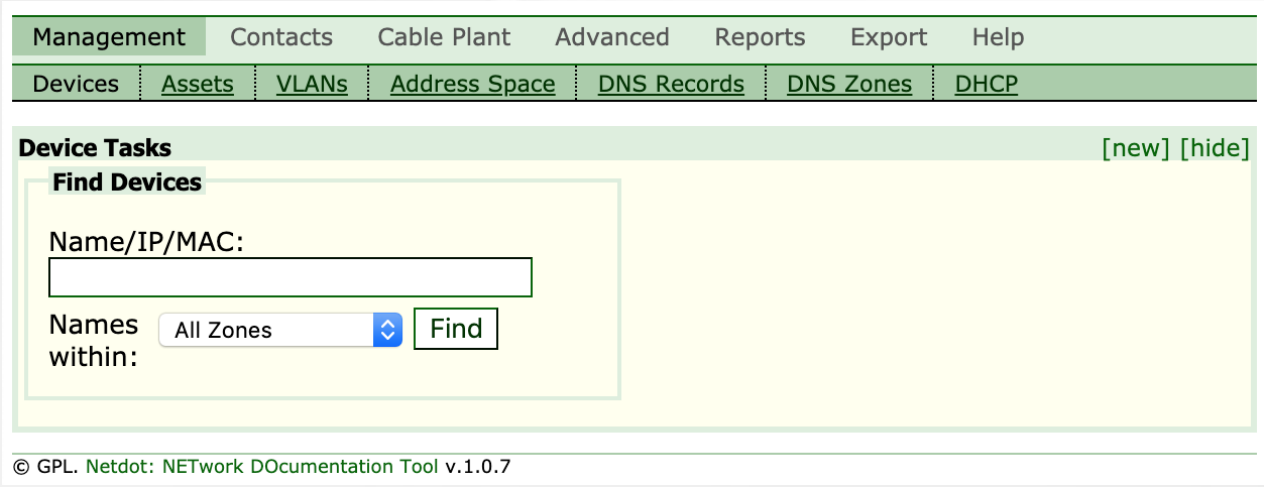
{net.} Functionality

Core functionality includes:

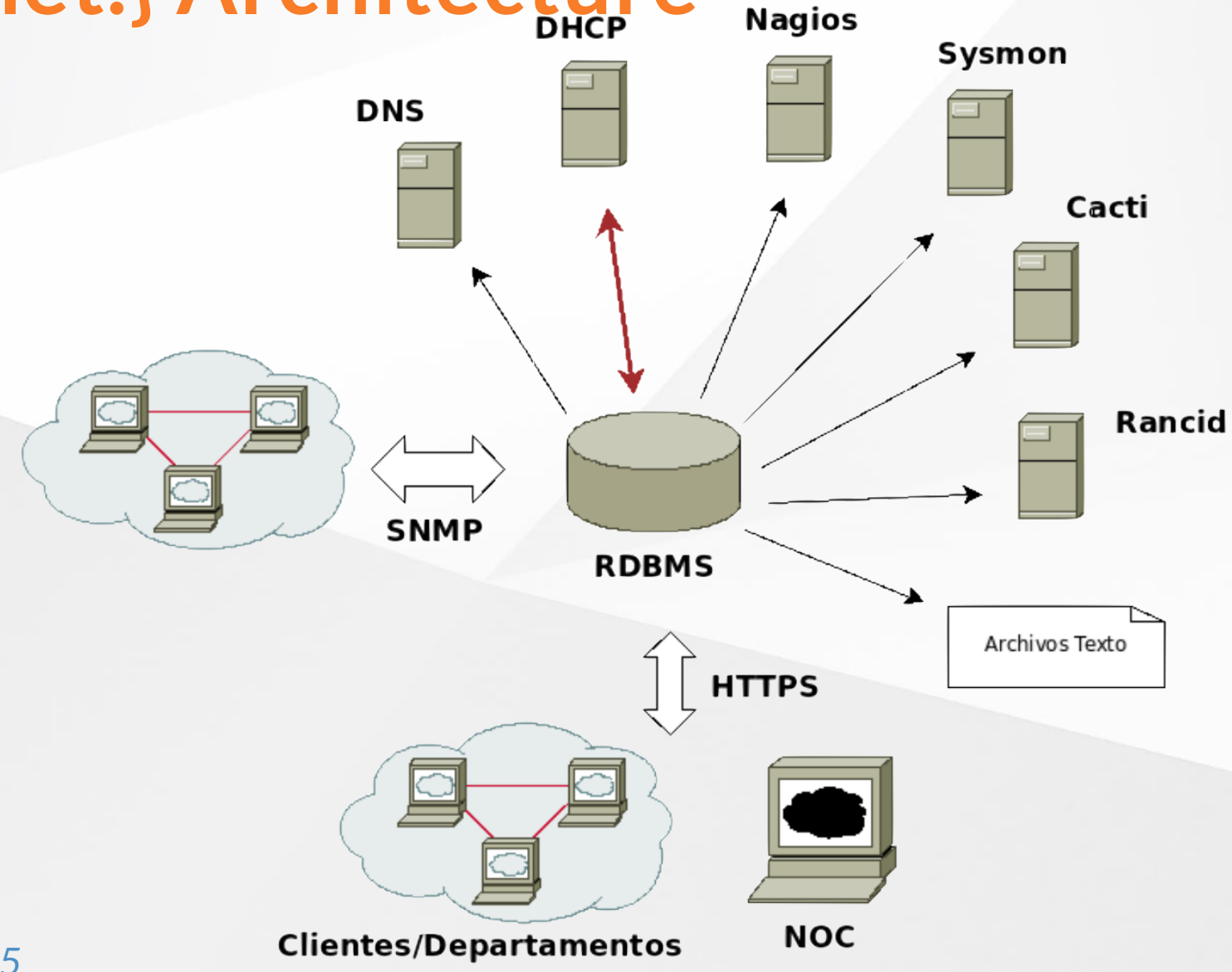
- Discovery of network interfaces via SNMP
- Layer 2 topology discovery and graphics using:
  - CDP/LLDP
  - Spanning Tree protocol
  - Switches forwarding tables
  - Router point-to-point subnets
- IPv4 and IPv6 address management (IPAM)
  - Address space visualization
  - DNS and DHCP configuration managment
  - IP and Mac address correlation

{net.} Functionality (Contd.)

- Cable plants (sites, fibre, copper, closes, circuits)
- Contacts (departments, providers, vendors, etc.)
- Exports for tools like Nagios, Sysmon, RANCID, Cacti, etc.
  - For example, automate Cacti configuration
  - I.E., how to automate node creation in Cacti
- User access-level: admin, operator, user
- Ability to draw pretty pictures of your network.



{net.} Architecture



{net.} Network Devices

- Can be added via SNMP (preferred) or manually
- Automatic updates via SNMP
- Manufacturer, model, software version, name and domain, dates
- Maintenance contracts, out of band access, SNMP version and community
- Interfaces, VLANs, IP addresses, BGP peers
  - ARP tables (routers), redirection tables (switches)
- Topology
- Images, comments, change history

{net.} Topology

{net.} uses many sources of topological information:

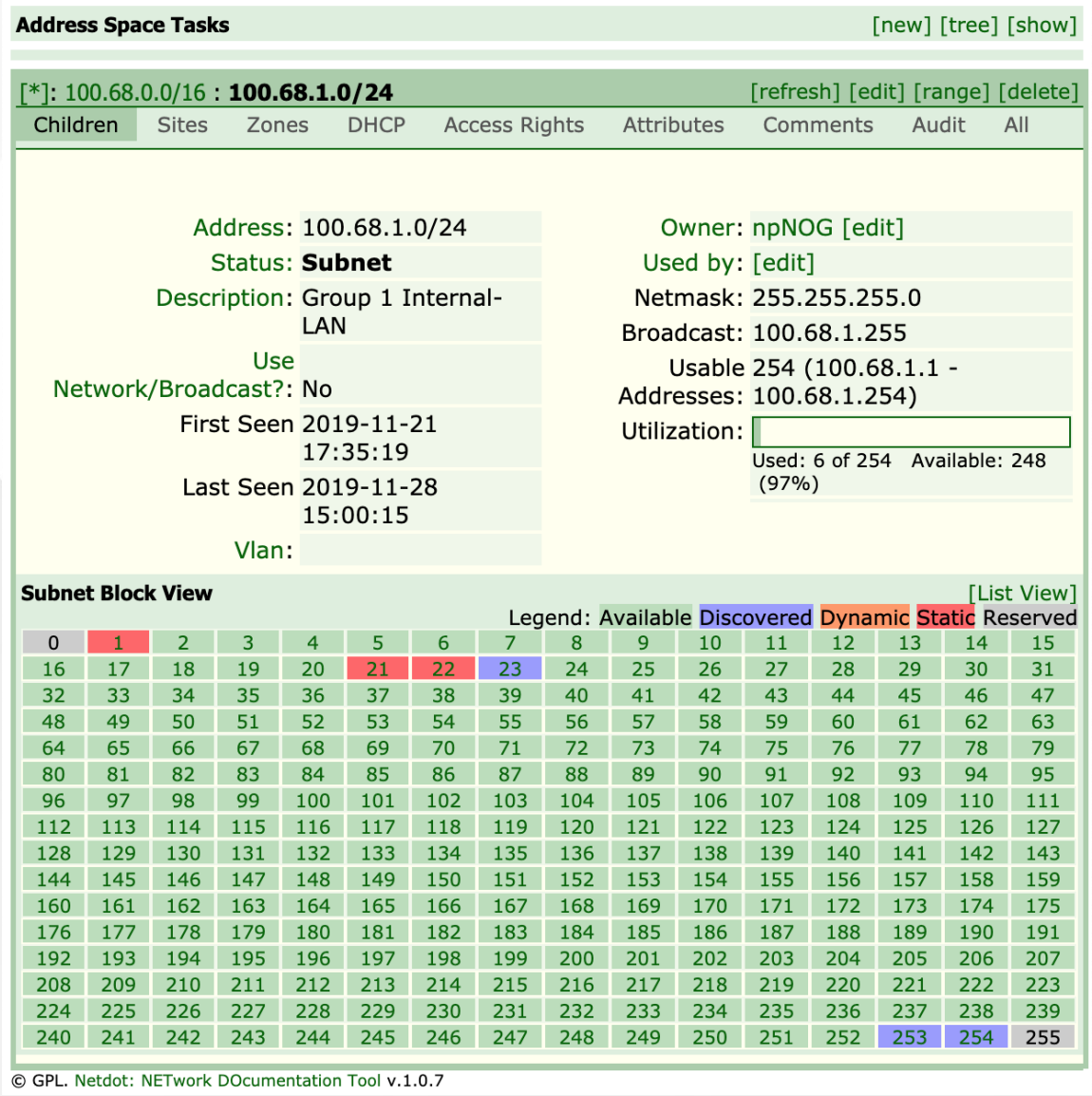
- CDP and LLDP protocols
- Analyze redirection tables
- Spanning Tree protocol
- Point-to-point networks

Netdot can dynamically draw the topology of a network or a segment of a network.

{net.} IP Space: Addresses and Blocks

- Hierarchical (drill-down) and graphical representation
- Support for IPv4 and IPv6
- Classification in:
  - Block
- Container
- Subnet
- Reserved
  - Address
- Static
- Dynamic
- Reserved

{net.} Visualisation of IP Address Space



Address Space Tasks [new] [tree] [show]

[*]: 100.68.0.0/16 : **100.68.1.0/24** [refresh] [edit] [range] [delete]

Children | Sites | Zones | DHCP | Access Rights | Attributes | Comments | Audit | All

Address:	100.68.1.0/24	Owner:	npNOG [edit]
Status:	**Subnet**	Used by:	[edit]
Description:	Group 1 Internal-LAN	Netmask:	255.255.255.0
		Broadcast:	100.68.1.255
Use Network/Broadcast?:	No	Usable Addresses:	254 (100.68.1.1 - 100.68.1.254)
First Seen	2019-11-21 17:35:19	Utilization:	Used: 6 of 254 Available: 248 (97%)
Last Seen	2019-11-28 15:00:15		
Vlan:			

Subnet Block View [List View]

Legend: Available Discovered Dynamic Static Reserved

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

{net.} IP Space: Blocks & Addresses

- Subnets are discovered from router interfaces
- From ARP tables we can know:
  - Addresses in use in each subnet
  - Mapping of IP to MAC
- Information added for blocks (or subnets)
  - Group that uses the block
  - Group that administers the block
  - Percent utilization of addresses (subnet)
  - Percent utilization of sub-divisions (containers)
- Information added for addresses
  - First and and last time seen
  - interface and device
  - Services to monitor with Nagios (HTTP, DNS, SSH, DHCP, Radius, LDAP, etc.)

{net.} Cabling

- Inter-building cabling (backbone)
  - Buildings and closets where cabling starts and stops.
  - Type of fiber, length, quantity of fibers
- Fibers
  - Interconnections (splicing) and sequences
  - Measurements, tests, interfaces, circuits
  - Status

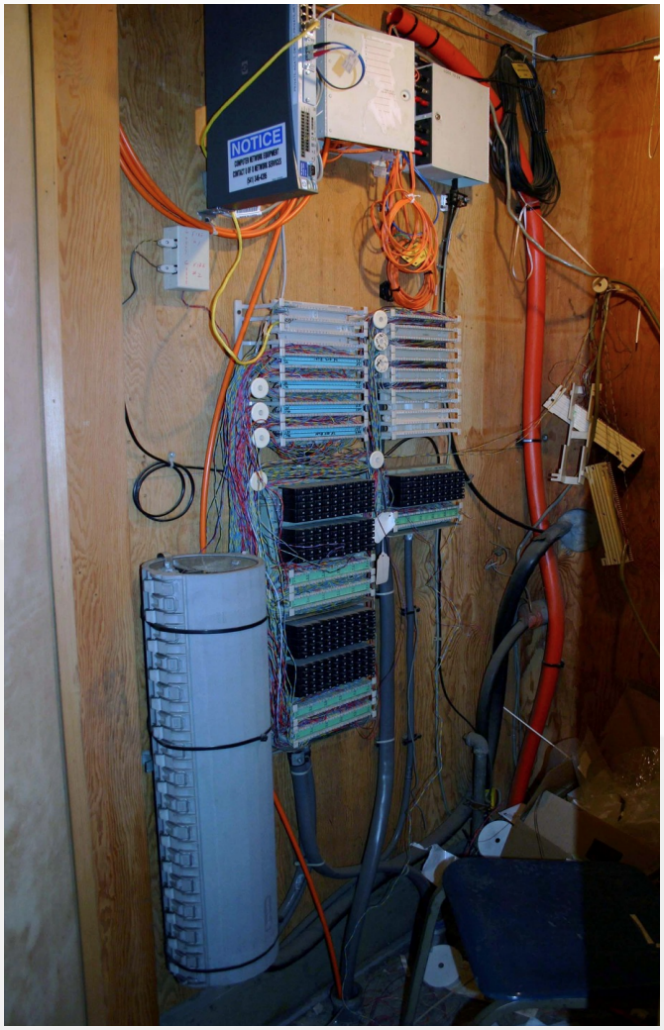
{net.} Cabling (Contd.)

- Intra-building cabling (interior cabling)
  - Closet where it begins
- Level
  - Building
  - Interface (port) where it is connected
  - Outlet where it terminates (id)
- Office number or room
  - Level
- Building

{net.} Cabling (Contd..)

- Physical data
  - Dimensions, number and types of panels, type of ventilation, number of copper pairs, number of racks, etc.
- Cabling that terminates in the closet
  - Fiber and twisted pair
- Photos

{net.} Closet Photo



{net.} Entities

- Branch
- Customer
- Department
- Manufacturer
- Peer (BGP)
- Provider
- Vendor

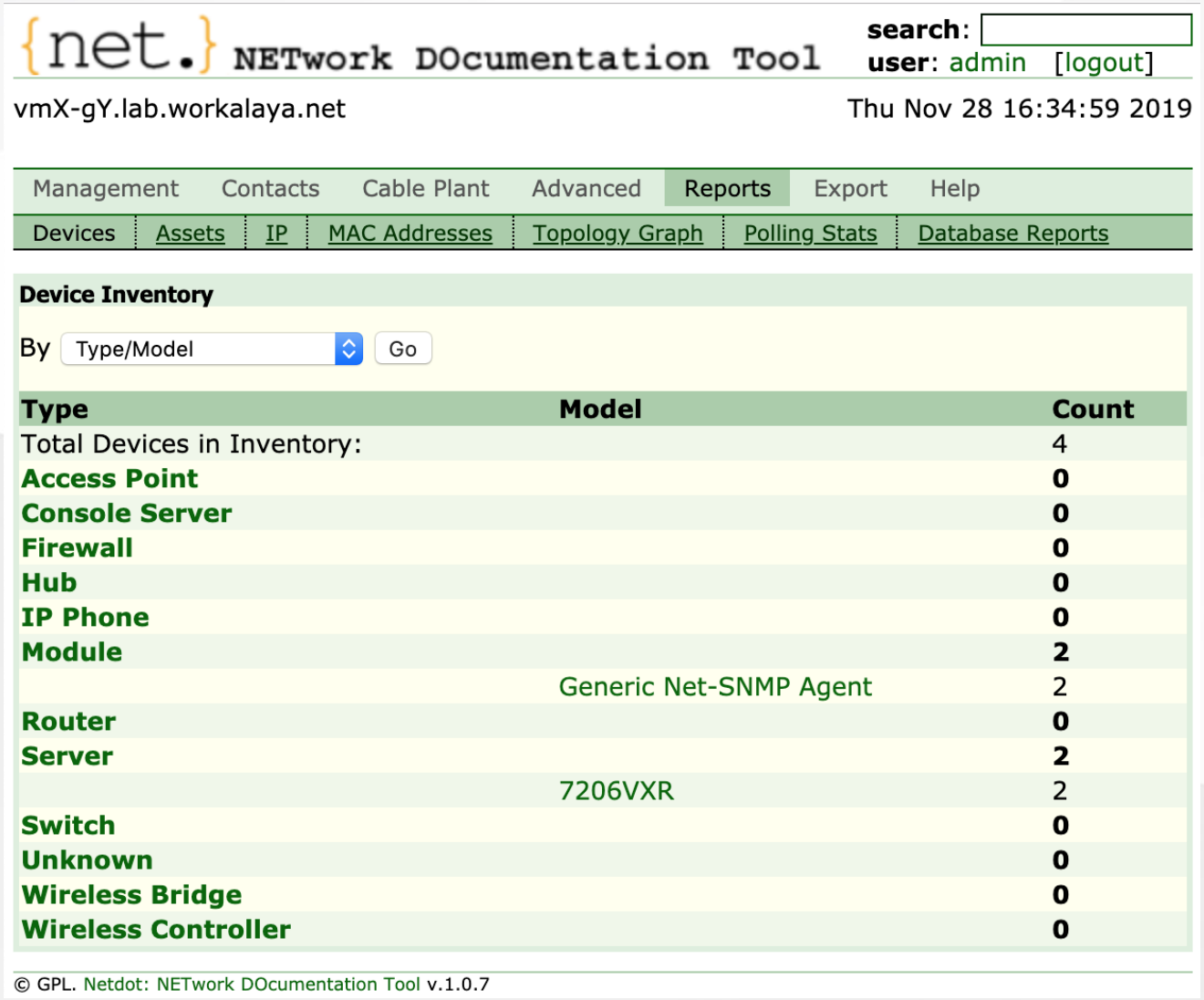
{net.} Contacts

- Based in individuals and roles (Person & Contact)
  - Information by individual
- Contact data
  - Locations, position, telephone, e-mail, beeper
- Roles
  - Administrative contact, technical, etc.
  - Notification schedule and levels
- Contact lists
  - Assigned to different resources
- Devices, subnets, cabling, etc.

{net.} Reports

- Devices
  - By category and by product
  - Out-of-date firmware
  - Duplex mismatches
- Most used MAC codes (Manufacturers)
- From the database
  - SQL table utilization reports

{net.} Inventory & Devices



{net.} Configuration Exports

Information contained within Netdot enables automatic generation of configurations for software packages.

- Monitoring devices and servces
  - Nagios, Sysmon
- Monitoring configurations
  - RANCID
- Traffic analysis
  - Cacti
- Services
  - DNS (Bind)
  - DHCP

{net.} Exporting Configuration

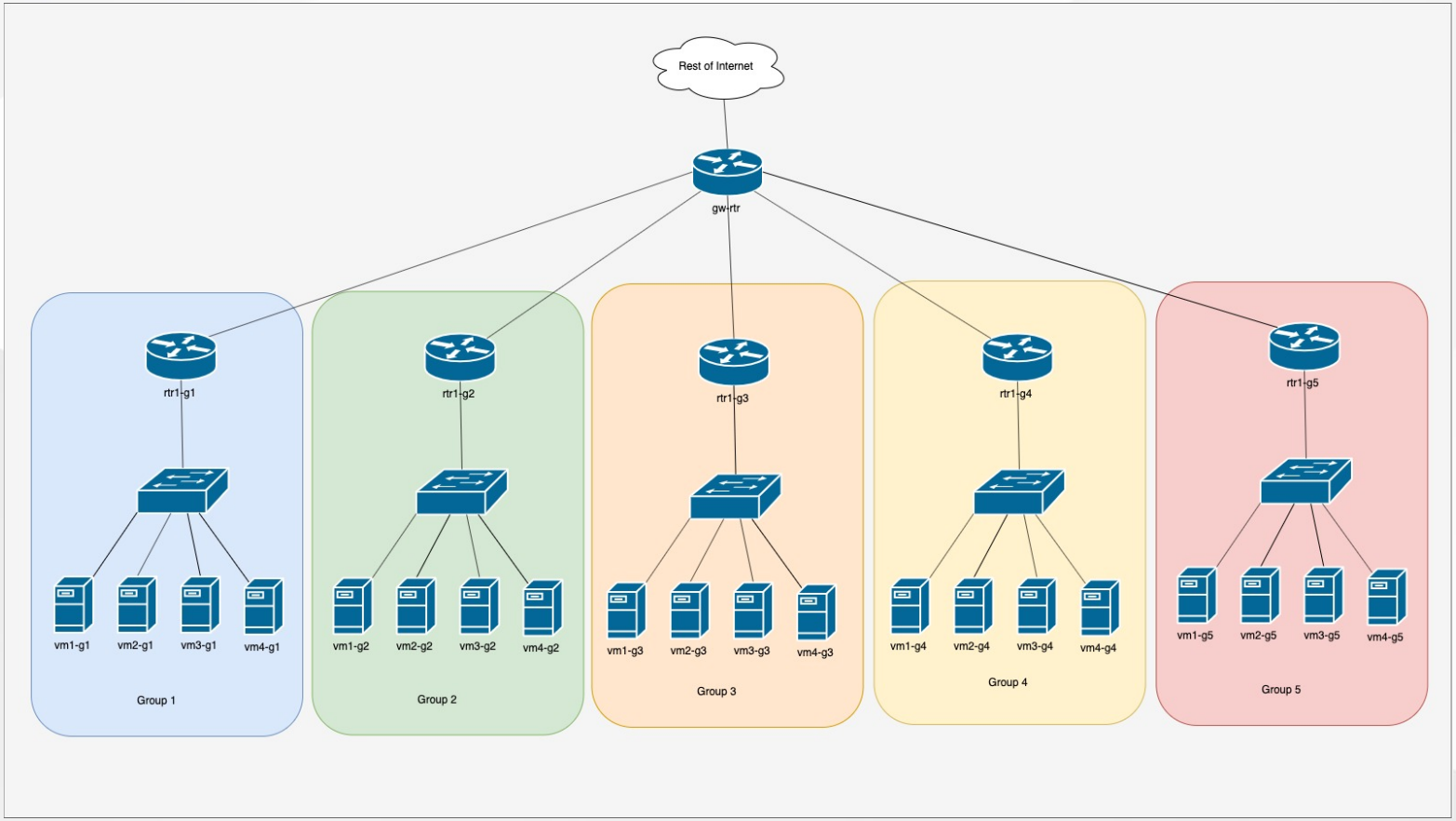
Recommendation:

- Netdot updates VCS (Git, Subversion, etc)
- Config mgmt system (Puppet, Chef, etc) distributes configurations, restarts services, etc.

{net.} Alternatives

- IPplan (http://iptrack.sourceforge.net/)
- NetDisco (http://netdisco.org/)
- RackTables (https://www.racktables.org/)

Documentation: Diagrams



Diagramming Software

- Windows
  - Visio: http://office.microsoft.com/en-us/visio/
  - Ezdraw: http://www.edrawsoft.com/
- Mac
  - Omnigraffle: https://www.omnigroup.com/omnigraffle
- Open Source
  - LibreOffice Draw
  - Pencil: http://pencil.evolus.vn/
  - Dia: http://live.gnome.org/Dia
- Web based
  - Google Docs drawings
  - Gliffy: https://www.gliffy.com/
  - draw: https://www.draw.io/

References

{net.} NETwork DOcumentation Tool
https://github.com/cvicente/Netdot/