DNS Monitoring tools

Hands-on Workshop with Prometheus and Grafana

Mauricio Vergara Ereche

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Intro

Why monitoring? (First the theory)

Monitoring and Analyzing DNS Servers

- What to monitor?
  - Internal Service status
    - Is the service available/responding/answering
    - How fast are we responding
    - What's the server capacity
    - More complex questions

      Client characterization

      Group/classify bulks of data

      Grouping set of servers into different views.

      Analyze traffic and search of patterns
  - External service status
    - Is the service available everywhere?
    - Are we giving the same answer consistently to every client?
    - Perception of service from the client side

Possible solutions (external monitoring)

- Using monitoring distributed services (à la “looking glass”)
  - RIPE: DNSMON
  - ThousandEyes: DNS Monitoring
  - Uptrends Monitoring
  - DNSChecker Propagation and Resolution tool

- DIY approach
  - RIPE Atlas
  - NLNOG Ring
  - Any cloud hosting service (build your own farm of monitors)

- **OUT OF SCOPE FOR THIS PRESENTATION**

Possible solutions (internal monitoring)

- Let’s do some graphs!
  - `RRDtools` or similar approaches.
    - `Nagios, Icinga, MRTG, Cacti, Observium, Zabbix, Prometheus`
  - Let’s do elastic graphs!
    - `Kibana, Grafana`

- What about the complex questions?
  - Analyze `syslog` and daemon `logs`
  - Command line tools
    - `dnstop, tcpdump, wireshark`
  - Collect traffic and then analyze
    - Capture: `pcap, dnscap, dnstap, dsc`
    - Analyze: `packetq` or your usual *swiss army knife* (`Perl, Python, awk`) with their own DNS libraries

- Build one solution for most of these requirements

Prometheus

What is Prometheus?

- Open-Source system Monitoring and Alerting toolkit
  - Mostly written in Go lang
- Features:
  - Time series: metric name and key/value pairs
  - `PromQL` query language
  - Time series collection happens with **pull model** via HTTP
  - **Push** time series supported via intermediary gateway (exporter)
- Components:
  - Prometheus server
  - Client libraries
  - Push gateway
  - Exporters
  - AlertManager

Grafana

What is Grafana?

- Open-Source metric analytics and visualization suite
  - Most commonly used for visualize time-series data
- Features:
  - Web based
  - Dashboard oriented: graphs, heatmaps, histograms, etc.)
  - Alarms, Plugins, Public engaged community
- Several data sources / plugins
  - Graphite
  - InfluxDB
  - **Prometheus**
  - OpenTSDB
  - MySQL
  - PostgreSQL
  - ClickHouse
  - ElasticSearch

Hands on!

Lab environment

- Ubuntu 18.04LTS
  - VirtualBox machine: https://bit.ly/2m58gU2
    - If you didn't installed it locally, I have a few over here
    - It has already installed and configured BIND, NSD and Knot
    - Pre-configured `apt-get` repositories to make things faster

      Check out `/etc/apt/sources.list.d/`

- Login
  - User: **lactld**
  - Password: **lactld2019**
  - User has sudo password ☺

- Check if it is able to connect to internet.
  - TIP: Virtualbox connected Network as **Bridged Adapter**

Prometheus

Install & Usage

Install Prometheus

- https://prometheus.io/docs/prometheus/latest/installation/
- Ubuntu provides packages a bit outdated, so we grab another:

```
curl -s https://packagecloud.io/install/repositories/prometheus-
deb/release/script.deb.sh | sudo os=ubuntu dist=xenial bash

apt –y install prometheus
# vim /etc/prometheus/prometheus.yml
sudo systemctl enable /usr/lib/systemd/system/prometheus.service
service prometheus start
```

- Web based interface: `http://${IP}:9090`
  - Access internals: `http://${IP}:9090/metrics`

Configuring Prometheus node-exporter

- node-exporter collects information from the server
  - Newer: https://launchpad.net/ubuntu/+source/prometheus-node-exporter

```
sudo dpkg –i ~lactld/prometheus-node-exporter_0.18.*.deb

# vi /etc/default/prometheus-node-exporter
sudo service prometheus-node-exporter restart

curl –s http://${IP}:9100/metrics | egrep network.*_bytes.*
```

- Add the new exporter to **`/etc/prometheus/prometheus.yml`**

```
- job_name: node
  static_configs:
     - targets: ['localhost:9100’]

sudo service prometheus restart
```

Prometheus Expressions & Templates

- Expression browser:
  - https://prometheus.io/docs/prometheus/latest/querying/basics/
  - Visit: `http://${IP}:9090/graph`

```
node_network_receive_bytes_total
rate(node_network_receive_bytes_total[1m])
```

- Console Templates
  - https://prometheus.io/docs/prometheus/latest/configuration/template_reference/

```
# /usr/share/prometheus/console_libraries

service prometheus restart
```

  - Visit: `http://${IP}:9090/consoles/index.html.example`

Homework: Getting to know Grafana

- What is the metric for:
  - Disk space usage on /
  - CPU usage
  - Memory consumption
- Make a graph with those metrics
- View/edit a template.

Grafana

Install & Usage

Installing Grafana

- https://grafana.com/docs/v4.3/installation/debian/
- https://grafana.com/docs/v4.3/installation/rpm/

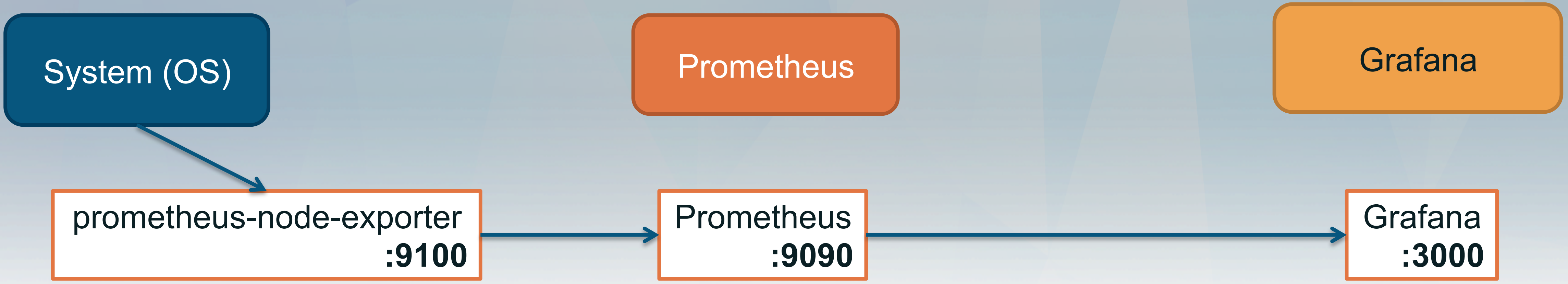
```
# curl -s https://packages.grafana.com/gpg.key | sudo apt-key add -
# sudo add-apt-repository "deb https://packages.grafana.com/oss/deb stable main"
# sudo apt-get update
sudo apt -y install grafana

sudo systemctl daemon-reload
sudo systemctl enable grafana-server
sudo systemctl start grafana-server
```

- Visit: `http://${IP}:3000`
  - `User: admin`
  - `Password: admin`

Configuring Grafana sources

- Add data source
  - Prometheus
  - URL: http://localhost:**9090**
  - Access: Server
  - HTTP Method: POST
  - -> Save & Test



Grafana Dashboard (part 1)

- New Dashboard
- Queries
  - Query A: `rate(node_network_receive_bytes_total[1m])`
    - Legend: Traffic IN
  - Query B: `rate(node_network_transmit_bytes_total[1m])`
    - Legend: Traffic OUT
  - Query C: `rate(node_network_receive_packets_total[1m])`
    - Legend: Packets IN
  - Query D: `rate(node_network_transmit_packets_total[1m])`
    - Legend: Packets OUT

Grafana Dashboard (part 2)

- Visualization
- Draw Modes
  - Alias or regex: /.*OUT.*/
    - Transform: negative-Y
  - Alias or regex: /.*Traffic.*/
    - Y-axis: 1
  - Alias or regex: /.*Packets.*/
    - Y-axis: 2
    - Points: true
- Axes
  - Adjust unit
  - Add Labels

Importing dashboards & Plugins

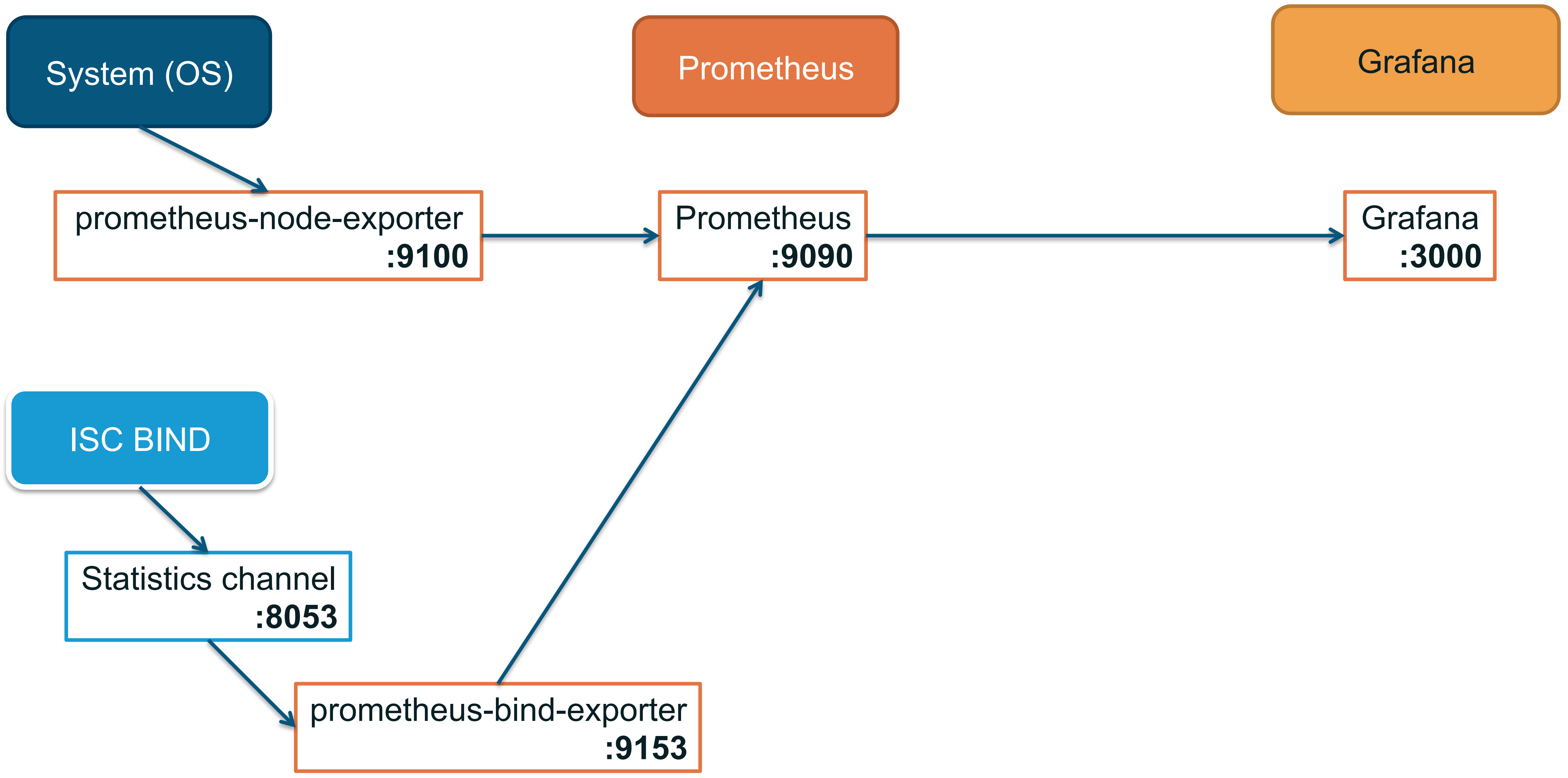
- Public repository for dashboards
  - https://grafana.com/grafana/dashboards
- Dashboards (check the number id)
  - Manage
    - Import -> Add ID -> Load
    - Select DataSource
    - Example: Node Exporter Monitoring (ID 10645)
- Public repository for Plugins
  - https://grafana.com/grafana/plugins

```
# https://grafana.com/grafana/plugins/grafana-piechart-panel/installation
sudo grafana-cli plugins install grafana-piechart-panel
```

Adding DNS Monitoring

ISC BIND

Main Idea Diagram



Configuring BIND statistics channel

- Enable statistics for BIND
  - Review config in `/etc/bind/named.conf`

```
statistics-channels {
        inet 0.0.0.0 port 8053 allow { 127.0.0.1; };
};
```

- Check `named.pid` exists at run time

```
# Check BIND PID location
service bind9 restart
ls -l /var/run/named/named.pid
```

- Check the bind channel interface: **`http://${IP}:8053`**

```
curl -s http://localhost:8053/xml/v3/status
```

Installing Prometheus BIND exporter

```
sudo apt install prometheus-bind-exporter
```

- Additional configurations:
  - Edit `/etc/default/prometheus-bind-exporter`

```
ARGS='-bind.stats-url http://localhost:8053/ -bind.stats-groups
"server,view,tasks" -bind.pid-file "/var/run/named/named.pid" -
bind.stats-version "xml.v3" -web.listen-address ":9153"'
```

- Restart and check if running

```
sudo service prometheus-bind-exporter restart
sudo netstat –vatpnW |grep prometheus
```

Add the new exporter into Prometheus

- Add config to `/etc/prometheus/prometheus.yml`

```
- job_name: dns
  static_configs:
    - targets: ['localhost:9153']
```

- Restart prometheus and check

```
sudo service prometheus restart
sudo netstat –vatpnW |grep prometheus
```

- You can also check Prometheus config at:
    - `http://${IP}:9090/config`

Configuration for Grafana

- Add dashboard 10024
  - Select source Prometheus

- **CHALLENGE TIME**
  - In our custom dashboard, create a Pie Chart for
    - Query distribution type
    - Show a Legend with porcentages
    - Group lesser known queries (below 3%)

  - **Solution:**
    - Query: bind_incoming_queries_total
    - Legend: {{type}}
    - Visualization Pie Chart, Combine Threshold: 0.03

What about other DNS Servers?

Knot, NSD ...and resolvers

Other DNS Servers

- Knot has statistics channel:
  - Prometheus exporter made by Alessandro Ghedini (Cloudfare)
  - https://github.com/ghedo/knot_exporter
- For Knot-resolver:
  - https://github.com/CZ-NIC/knot-resolver/tree/master/modules/http
- Unbound and NSD:
  - https://github.com/Jean-Daniel/dns_exporter
  - https://github.com/kumina/unbound_exporter

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