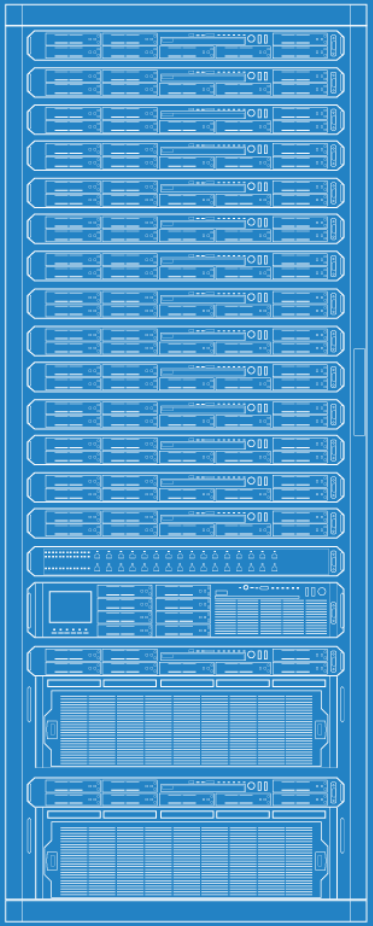
Logging IoT

Know what your IoT devices are doing



FOSDEM 2018

Peter Czanik / Balabit

ABOUT ME

- Peter Czanik from Hungary
- Evangelist at Balabit: syslog-ng upstream
- syslog-ng packaging, support, advocacy

- Balabit is an IT security company with development HQ in Budapest, Hungary
- Over 200 employees: the majority are engineers
- Balabit is now a One Identity company

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OVERVIEW

- What is syslog-ng
- The four roles of syslog-ng
- Why structured data
- IoT devices: consumer, networking, industrial
- syslog-ng on the server side
- Configuring syslog-ng

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syslog-ng

Logging
Recording events, such as:

```
Jan 14 11:38:48 linux-0jbu sshd[7716]: Accepted publickey for root
from 127.0.0.1 port 48806 ssh2
```

syslog-ng
Enhanced logging daemon with a focus on portability and high-performance central log collection.

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WHY CENTRAL LOGGING?

EASE OF USE

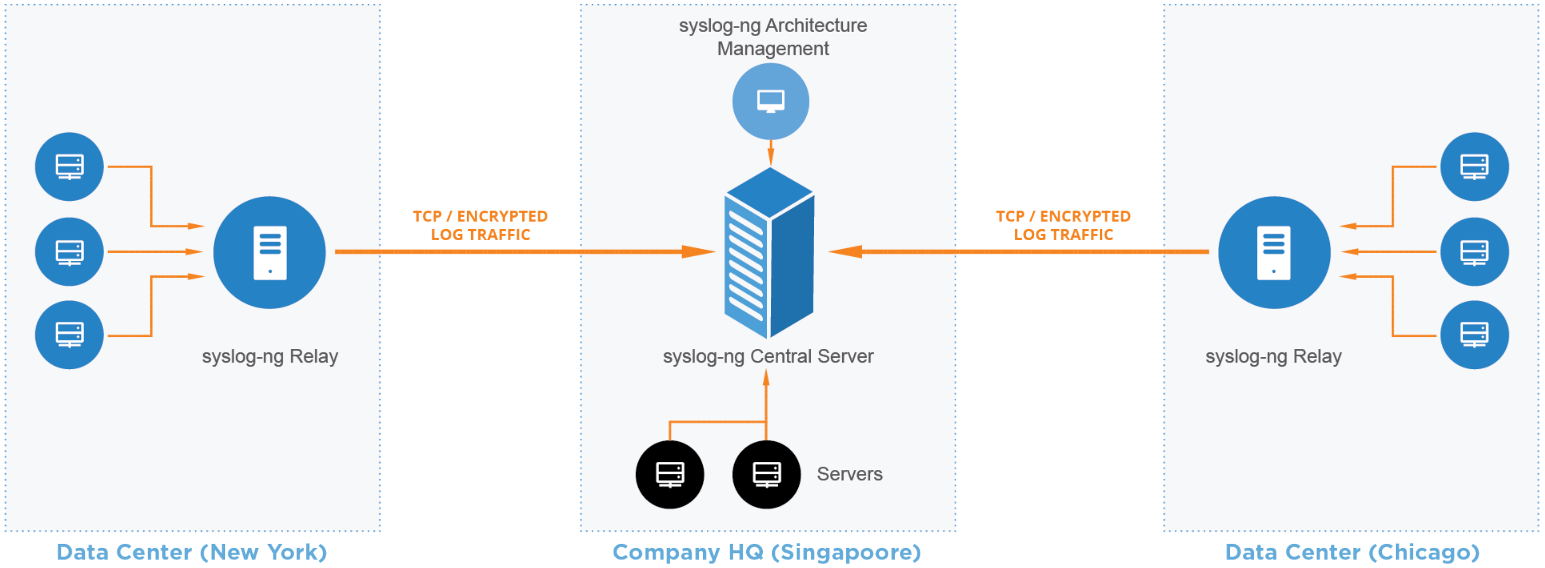
one place to check instead of many

AVAILABILITY

even if the sender machine is down

SECURITY

logs are available even if sender machine is compromised



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Why syslog-ng on IoT devices?

- Portable (x86, ARM, POWER, MIPS, etc.)
- Small footprint (written in C)

- Can perform complex processing & filtering
  - Send / save only relevant logs
  - In a ready-to-use format

- Use the same software on the client and server side

MAIN SYSLOG-NG ROLES

collector

processor

filter

storage
(or forwarder)

ROLE: DATA COLLECTOR

Collect system and application logs together:
contextual data for either side

A wide variety of platform-specific sources:

- /dev/log & co
- Journal, Sun streams

Receive syslog messages over the network:

- Legacy or RFC5424, UDP/TCP/TLS

Logs or any kind of data from applications:

- Through files, sockets, pipes, etc.
- Application output

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ROLE: PROCESSING

Classify, normalize and structure logs with built-in parsers:

- CSV-parser, DB-parser (PatternDB), JSON parser, key=value parser and more to come

Rewrite messages:

- For example anonymization

Reformatting messages using templates:

- Destination might need a specific format (ISO date, JSON, etc.)

Enrich data:

- GeoIP
- Additional fields based on message content

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ROLE: DATA FILTERING

Main uses:

- Discarding surplus logs (not storing debug level messages)
- Message routing (login events to SIEM)

Many possibilities:

- Based on message content, parameters or macros
- Using comparisons, wildcards, regular expressions and functions
- Combining all of these with Boolean operators

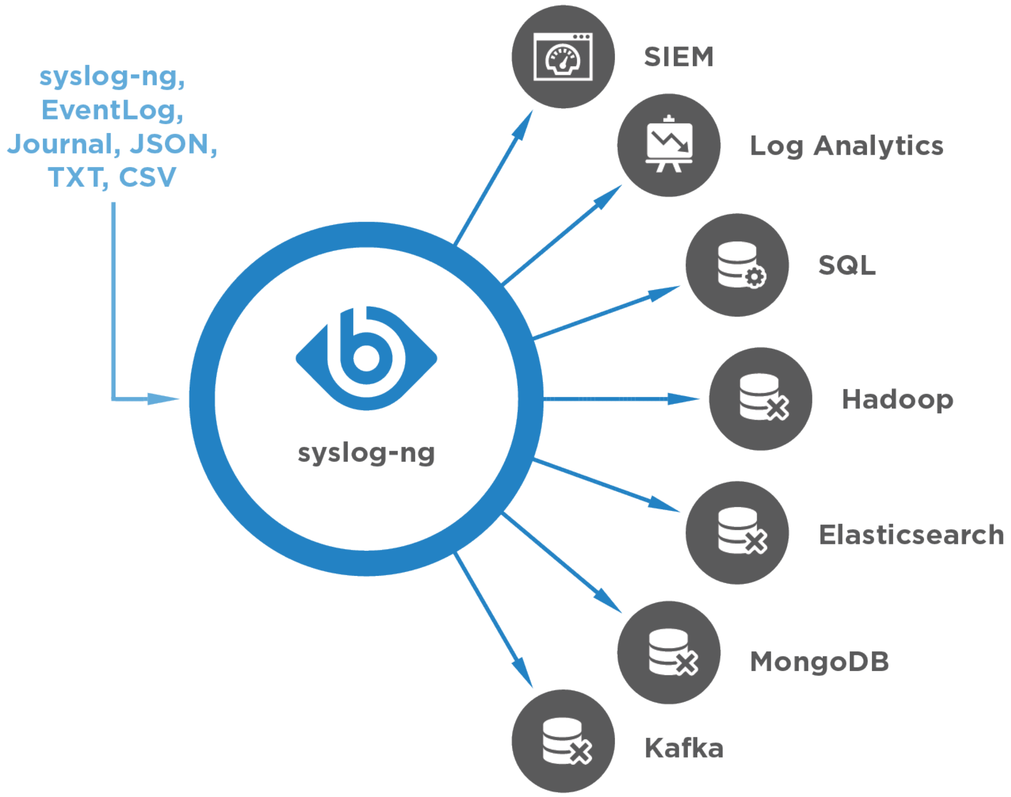
ROLE: DESTINATIONS

"TRADITIONAL"

- File, network, TLS, SQL, etc.

"BIG DATA"

- Distributed file systems:
  - Hadoop
- NoSQL databases:
  - MongoDB
  - Elasticsearch
- Messaging systems:
  - Kafka



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FREE-FORM LOG MESSAGES

Most log messages are: date + hostname + text

```
Mar 11 13:37:56 linux-6965 sshd[4547]: Accepted
keyboard-interactive/pam for root from 127.0.0.1 port
46048 ssh2
```

- Text = English sentence with some variable parts
- Easy to read by a human
- Difficult to search and report on

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SOLUTION: STRUCTURED LOGGING

- Events represented as name-value pairs. Example: an SSH login:

  app=sshd user=root source_ip=192.168.123.45

- syslog-ng: name-value pairs inside
  - Date, facility, priority, program name, program ID, etc.
- Parsers in syslog-ng can turn unstructured and some structured data into name-value pairs
  - CSV-parser, JSON parser, key=value parser
  - DB-parser (PatternDB),
  - Python parser

WHICH SYSLOG-NG VERSION IS THE MOST USED?

- Project started in 1998
- RHEL EPEL has version 3.5
- Latest stable version is 3.13, released two months ago

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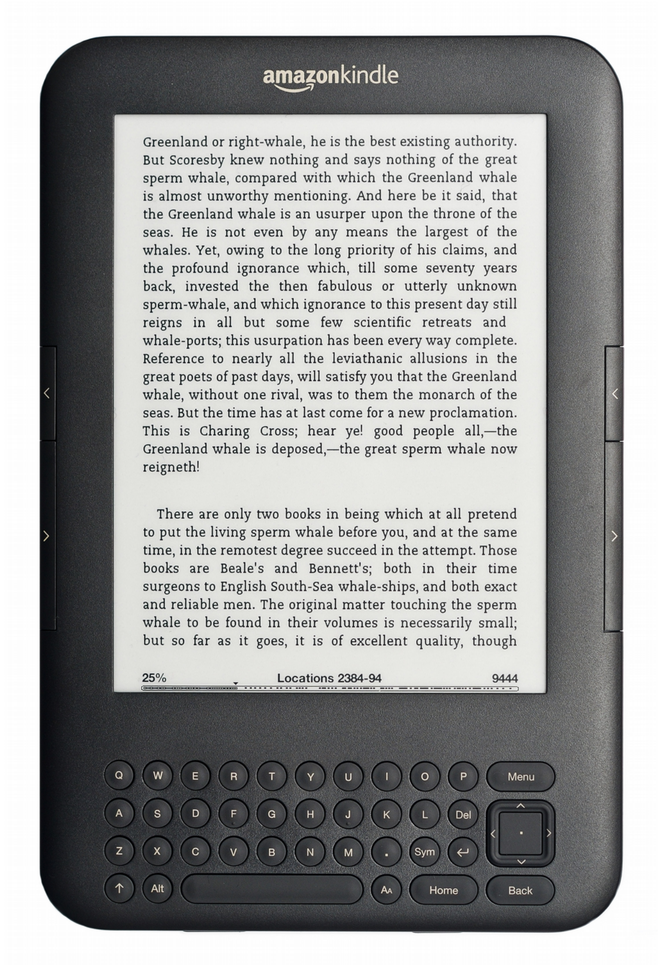

Greenland or right-whale, he is the best existing authority. But Scoresby knew nothing and says nothing of the great sperm whale, compared with which the Greenland whale is almost unworthy mentioning. And here be it said, that the Greenland whale is an usurper upon the throne of the seas. He is not even by any means the largest of the whales. Yet, owing to the long priority of his claims, and the profound ignorance which, till some seventy years back, invested the then fabulous or utterly unknown sperm-whale, and which ignorance to this present day still reigns in all but some few scientific retreats and whale-ports; this usurpation has been every way complete. Reference to nearly all the leviathanic allusions in the great poets of past days, will satisfy you that the Greenland whale, without one rival, was to them the monarch of the seas. But the time has at last come for a new proclamation. This is Charing Cross; hear ye! good people all,—the Greenland whale is deposed,—the great sperm whale now reigneth!

There are only two books in being which at all pretend to put the living sperm whale before you, and at the same time, in the remotest degree succeed in the attempt. Those books are Beale's and Bennett's; both in their time surgeons to English South-Sea whale-ships, and both exact and reliable men. The original matter touching the sperm whale to be found in their volumes is necessarily small; but so far as it goes, it is of excellent quality, though

25% Locations 2384-94 9444

Kindle e-book reader

Version 1.6

IoT: consumer devices

Where:

- Kindle
- BMW i3 electric car

How:

- Embedded, user is not aware

Why:

- Usage information
- Troubleshooting

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IoT: NAS, network devices

Where:

- Synology, FreeNAS, etc.
- Turris Omnia

How:

- Usually just CLI
- Some provide rich GUI

Why:

- Troubleshooting, security
- Central logging for SOHO network

IoT: industrial

Where:

- National Instruments real-time Linux devices
- Control and automation

How:

- Configuration through CLI
- GUI for browsing the logs

Why:

- Troubleshooting

IoT and central logging

Where:

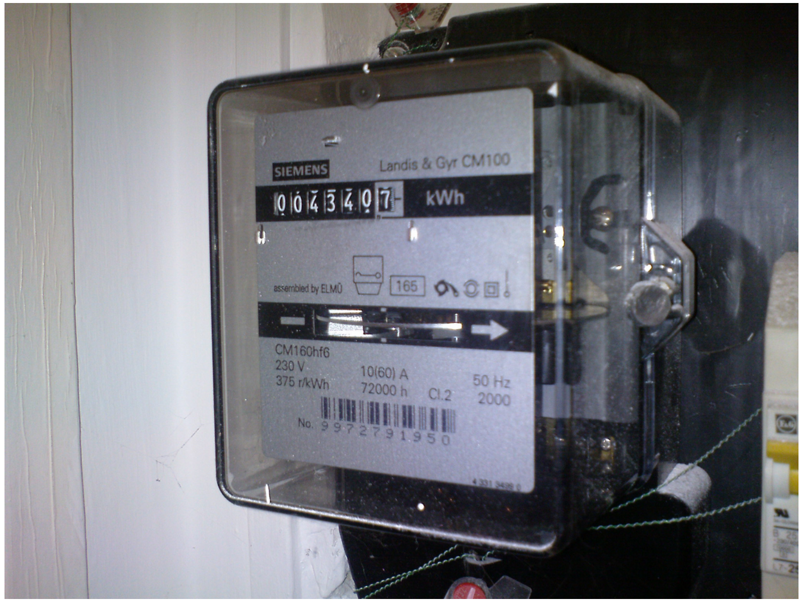
- Car industry
- Smart metering

How:

- Sending log and data through syslog
- Processing and storing to Big Data

Why:

- Usage data
- Troubleshooting
- Metering



CONFIGURATION

- “Don't Panic”
- Simple and logical, even if it looks difficult at first
- Pipeline model:
  - Many different building blocks (sources, destinations, filters, parsers, etc.)
  - Connected into a pipeline using “log” statements

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syslog-ng.conf: global options

```
@version:3.13
@include "scl.conf"

# this is a comment :)

options {
    flush_lines (0);
# [...]
    keep_hostname (yes);
};
```

syslog-ng.conf: sources

```
source s_sys {
    system();
    internal();
};

source  s_net {
    udp(ip(0.0.0.0) port(514));
};
```

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syslog-ng.conf: destinations

```
destination d_mesg { file("/var/log/messages"); };

destination d_es {
  elasticsearch(
    index("syslog-ng_${YEAR}.${MONTH}.${DAY}")
    type("test")
    cluster("syslog-ng")
    template("$(format-json --scope rfc3164 --scope nv-pairs --exclude R_DATE --key ISODATE)\n");
  );
};
```

syslog-ng.conf: filters, parsers

```
filter f_nodebug    { level(info..emerg); };

filter f_messages    { level(info..emerg) and
                        not (facility(mail)
                        or facility(authpriv)
                        or facility(cron)); };

parser pattern_db {
  db-parser(file("/opt/syslog-ng/etc/patterndb.xml") );
};
```

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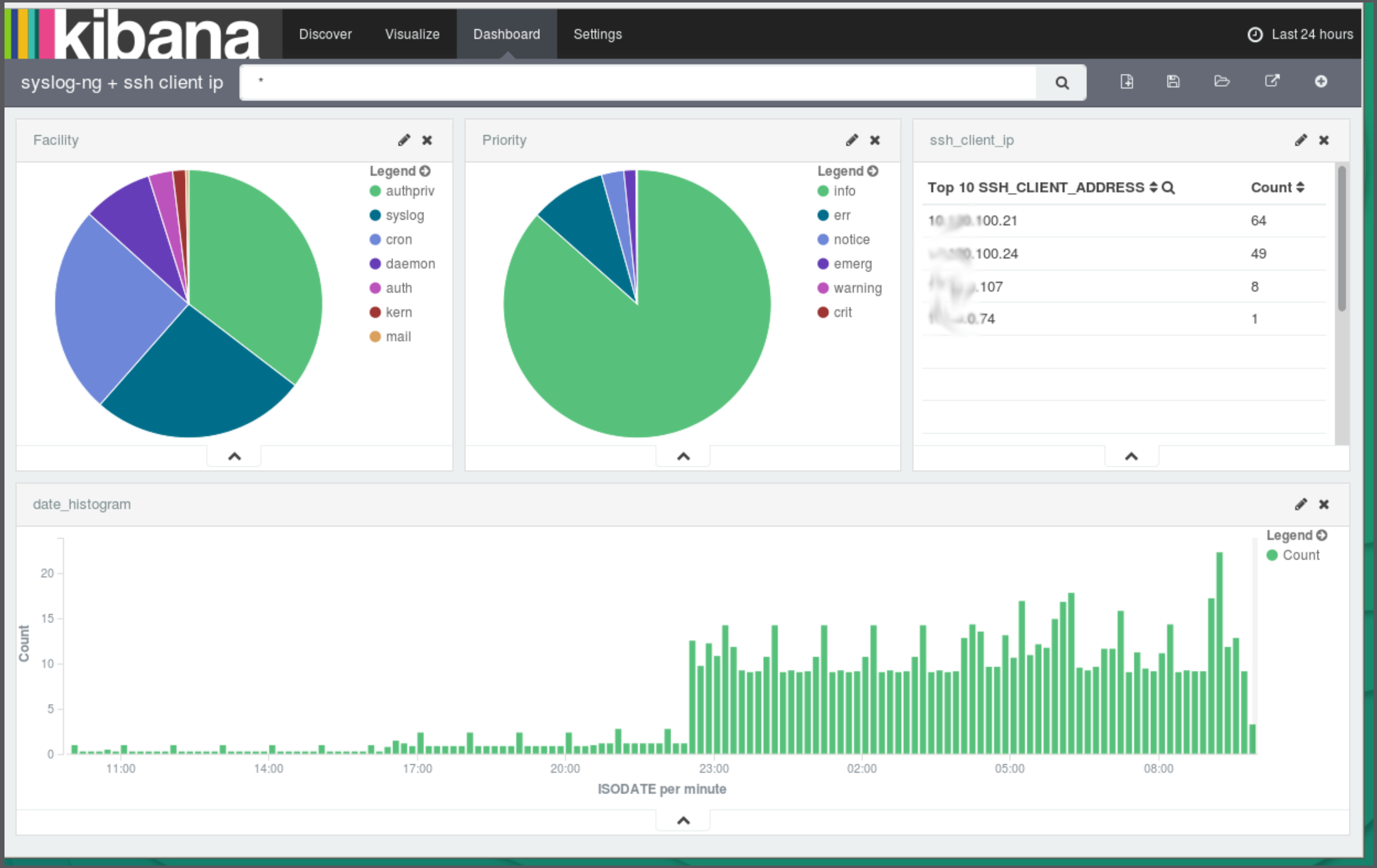
syslog-ng.conf: logpath

```
log { source(s_sys); filter(f_messages); destination(d_mesg); };


log {
  source(s_net);
  source(s_sys);
  filter(f_nodebug);
  parser(pattern_db);
  destination(d_es);
  flags(flow-control);
};
```

PatternDB & Elasticsearch & Kibana



Top 10 SSH_CLIENT_ADDRESS	Count
10.[redacted].100.21	64
[redacted].100.24	49
[redacted].107	8
[redacted].0.74	1

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ANONYMIZING MESSAGES

Many regulations about what can be logged

- PCI-DSS: credit card numbers
- Europe: IP addresses, user names

Locating sensitive information:

- Regular expression: slow, works also in unknown logs
- PatternDB, CSV parser: fast, works only in known log messages

Anonymizing:

- Overwrite it with a constant
- Overwrite it with a hash of the original

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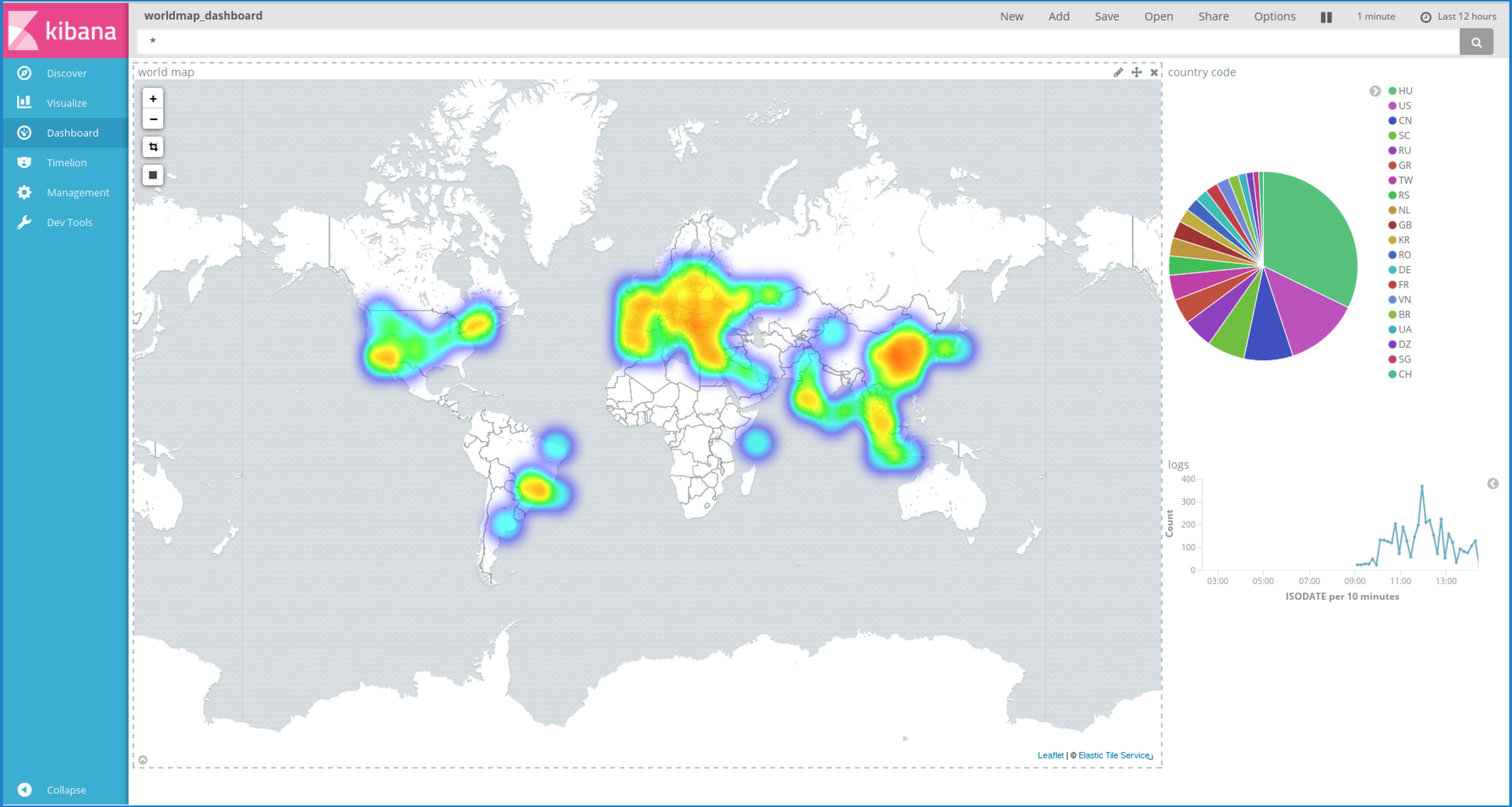
kibana
Discover
Visualize
Dashboard
Timelion
Management
Dev Tools
Collapse
worldmap_dashboard
New
Add
Save
Open
Share
Options
1 minute
Last 12 hours
*
world map
Leaflet | © Elastic Tile Service
country code
HU
US
CN
SC
RU
GR
TW
RS
NL
GB
KR
RO
DE
FR
VN
BR
UA
DZ
SG
CH
logs
Count
400
300
200
100
0
03:00
05:00
07:00
09:00
11:00
13:00
ISODATE per 10 minutes

GeoIP

```
•   parser p_kv{ kv-parser(prefix("kv.")); };
•
•   parser p_geoip { geoip( "${kv.SRC}", prefix( "geoip." ) database( "/usr/share/GeoIP/GeoLiteCity.dat" ) ); };
•
•   rewrite r_geoip {
•       set(
•           "${geoip.latitude},${geoip.longitude}",
•           value( "geoip.location" ),
•           condition(not "${geoip.latitude}" == "")
•       );
•   };
•
•   log {
•       source(s_tcp);
•       parser(p_kv);
•       parser(p_geoip);
•       rewrite(r_geoip);
•       destination(d_elastic);
•   };
•
```

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WHAT IS NEW IN SYSLOG-NG

- Disk-based buffering
- Grouping-by(): generic correlation
- Parsers written in Python
- Elasticsearch REST API support
- HTTP(s) destination
- Wildcard file source
- Performance and memory usage improvements
- Many more :-)

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SYSLOG-NG BENEFITS FOR IoT AND BIG DATA

High-performance reliable log collection

Simplified architecture

Single application for both syslog and application data

Easier-to-use data

Parsed and presented in a ready-to-use format

Lower load on destinations

Efficient message filtering and routing

JOINING THE COMMUNITY

- syslog-ng: http://syslog-ng.org/
- Source on GitHub: https://github.com/balabit/syslog-ng
- Mailing list: https://lists.balabit.hu/pipermail/syslog-ng/
- Gitter: https://gitter.im/balabit/syslog-ng

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QUESTIONS?

My blog: https://syslog-ng.com/blog/author/peterczanik/

My e-mail: peter.czanik@balabit.com

Twitter: https://twitter.com/PCzanik

SAMPLE XML

```
•    <?xml version='1.0' encoding='UTF-8'?>
•    <patterndb version='3' pub_date='2010-07-13'>
•      <ruleset name='opensshd' id='2448293e-6d1c-412c-a418-a80025639511'>
•        <pattern>sshd</pattern>
•        <rules>
•          <rule provider="patterndb" id="4dd5a329-da83-4876-a431-ddcb59c2858c" class="system">
•            <patterns>
•              <pattern>Accepted @ESTRING:usracct.authmethod: @for @ESTRING:usracct.username: @from @ESTRING:usracct.device: @port @ESTRING::
     @@ANYSTRING:usracct.service@</pattern>
•            </patterns>
•            <examples>
•              <example>
•                <test_message program="sshd">Accepted password for bazsi from 127.0.0.1 port 48650 ssh2</test_message>
•                <test_values>
•                  <test_value name="usracct.username">bazsi</test_value>
•                  <test_value name="usracct.authmethod">password</test_value>
•                  <test_value name="usracct.device">127.0.0.1</test_value>
•                  <test_value name="usracct.service">ssh2</test_value>
•                </test_values>
•              </example>
•            </examples>
•            <values>
•              <value name="usracct.type">login</value>
•              <value name="usracct.sessionid">$PID</value>
•              <value name="usracct.application">$PROGRAM</value>
•              <value name="secevt.verdict">ACCEPT</value>
•            </values>
•        </rule>
```

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