Go Splunk Yourself

How Using Splunk to Analyze My Biometric Data Has Improved My Quality of Life

Josef Kuepker | Staff Sales Engineer

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Agenda
What are we learning today?

- About me
- What is Sleep Apnea?
- Why I started this project
- My diagnosis and timeline
- Data and analysis
- Future state
About Me

Who is this guy?
Who Is This Guy?

- Josef Kuepker
- Splunk since mid-2016
- Previous Lives
  - JP Morgan Chase
    - Incident Response, Cybersecurity Engineering
  - Department of Defense
    - Incident Response, Information Assurance
- Hobbies
  - Travel (Iceland is my favorite.)
  - Tinkering (Splunk, Gadgets, etc.)
Why Did I Start This Project?

And what is sleep apnea?
What Started This Project?
How I got here

E-Mail

To: [Redacted]

Subject: A secure message from your provider's office

Message: Hi Josef, your sleep study does show sleep apnea. [Redacted] You stop your breathing 46 times per hour during sleep. I have submitted a request to your insurance to do a cpap test in the lab where you will sleep in the office and we will put the air mask on your nose to make the apnea go away. Once it is approved [Redacted] will call you to schedule it.
Sleep Apnea
The reason I am here

A common, chronic sleep disorder identified by pauses in breathing or shallow breathing, which can:

• Last from seconds to minutes
• Vary the amount of light to deep sleep
• Lead to poor sleep quality and excessive daytime sleepiness
My Diagnosis Timeline
How long did this take?

December 2016
Sleep Study in lab and diagnosis of 46 pauses in breathing per minute

January 2017
Sleep Study in lab with CPAP to determine the best pressure (8 cmH2O)

February 2017
Research of CPAP and arguing with DME provider

April 2017
Receive the correct CPAP device and started Splunking it
Getting The Data and Analyzing It

Challenges and Findings
Getting The Data

What data is available?

► Depends on your device
  • Data is generally written in a binary format called EDF/EDF+.

► Will need conversion for Splunk.
  • Several Python libraries available.
  • SleepyHead is a free tool that can import the EDF(+) and export to CSV.
### The header record contains

<table>
<thead>
<tr>
<th>Field</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 ascii : version of this data format (0)</td>
<td>0</td>
</tr>
<tr>
<td>80 ascii : local patient identification</td>
<td>MCH-0234567 F 02-MAY-1951 Haagse_Harry</td>
</tr>
<tr>
<td>8 ascii : startdate of recording (dd.mm.yy)</td>
<td>17.04.01</td>
</tr>
<tr>
<td>8 ascii : starttime of recording (hh.mm.ss)</td>
<td>11.25.00</td>
</tr>
<tr>
<td>8 ascii : number of bytes in header record</td>
<td>768</td>
</tr>
<tr>
<td>4 ascii : reserved</td>
<td>EDF+D</td>
</tr>
<tr>
<td>8 ascii : number of data records (-1 if unknown)</td>
<td>2</td>
</tr>
<tr>
<td>8 ascii : duration of a data record, in seconds</td>
<td>0.050</td>
</tr>
<tr>
<td>4 ascii : number of signals (ns) in data record</td>
<td>2</td>
</tr>
</tbody>
</table>

### 1st signal

<table>
<thead>
<tr>
<th>Field</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ns * 16 ascii : ns * label</td>
<td>R APB</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * transducer type (e.g. AgAgCl electrode)</td>
<td>AgAgCl electrodes</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical dimension (e.g. uV)</td>
<td>mV</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical minimum (e.g. -500 or 34)</td>
<td>-100</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical maximum (e.g. 500 or 40)</td>
<td>100</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * digital minimum (e.g. -2048)</td>
<td>-2048</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * digital maximum (e.g. 2047)</td>
<td>2047</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * prefiltering (e.g. HP:0.1Hz LP:75Hz)</td>
<td>HP-3Hz LP-20kHz</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * nr of samples in each data record</td>
<td>1000</td>
</tr>
<tr>
<td>ns * 32 ascii : ns * reserved</td>
<td></td>
</tr>
</tbody>
</table>

### 2nd signal

<table>
<thead>
<tr>
<th>Field</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ns * 16 ascii : ns * label</td>
<td>EDF Annotations</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * transducer type (e.g. AgAgCl electrode)</td>
<td></td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical dimension (e.g. uV)</td>
<td></td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical minimum (e.g. -500 or 34)</td>
<td>-1</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * physical maximum (e.g. 500 or 40)</td>
<td>1</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * digital minimum (e.g. -32768)</td>
<td>-32768</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * digital maximum (e.g. 32767)</td>
<td>32767</td>
</tr>
<tr>
<td>ns * 8 ascii : ns * prefiltering (e.g. HP:0.1Hz LP:75Hz)</td>
<td></td>
</tr>
<tr>
<td>ns * 8 ascii : ns * nr of samples in each data record</td>
<td>60</td>
</tr>
<tr>
<td>ns * 32 ascii : ns * reserved</td>
<td></td>
</tr>
</tbody>
</table>
Log Format Conversion

Binary ➔ ASCII

```python
# code snip...
```

PEP 8: block comment should start with `#`
Converted Log Format

How changing the format helped

► REV 1 (~39GB):
  • 07-18-2017 06:05:58.960000  [signal=0] phyMax="3.0" fileDurationSecs="16380" phyMin="-2.0" digMax="1500" digMin="-1000" phyDim="L/s" samFreq="25.0" Flow_40ms="0.232"

► REV 2 (~30GB):
  • 07-18-2017 06:05:58.960000  [signal=0] phyMinMax="-2.0:3.0" fileDurSec="16380" digMinMax="-1000:1500" samFreq="25.0" Flow_40ms="0.232 L/s"

► REV 3 (~9GB):
  • 07-18-2017 06:05:58.960000  [0:Flow_40ms] 0.232 L/s -2.0:3.0 -1000:1500 16380 25.0
My sleep quality is not really affected by travel.

I am less likely to use my machine.

I travel a lot!
The AirFit seems to be the best overall mask for me.

Leak Rate was the only metric that had any significant change.
More Metrics!

- 97/105 nights
- 6.27 avgHrs/night
- 660mL per inhale
  - Avg human is 500mL
- 13.77 bpm
  - 12<X<25 is good
- Extremely low leak rate
1. Mask choice matters to a point, but pick for comfort.

2. Travel doesn’t have a significant impact on my sleep patterns.

3. There is a long timeline from suspicion to treatment. Be proactive and call frequently.

4. Be persistent with your DME and have your provider help.

5. I don’t get enough sleep.

What Did I Learn?

Takeaways
What’s Next?

1. Work on converting the annotations EDF+ file. Slightly different format.

2. Automate the process with RPi and wireless SD card.

3. Find additional data sources to add (sleep journal, temperature, etc).

4. Switch my device to Auto Mode to see if a variable pressure is better/worse.
THANK YOU!

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