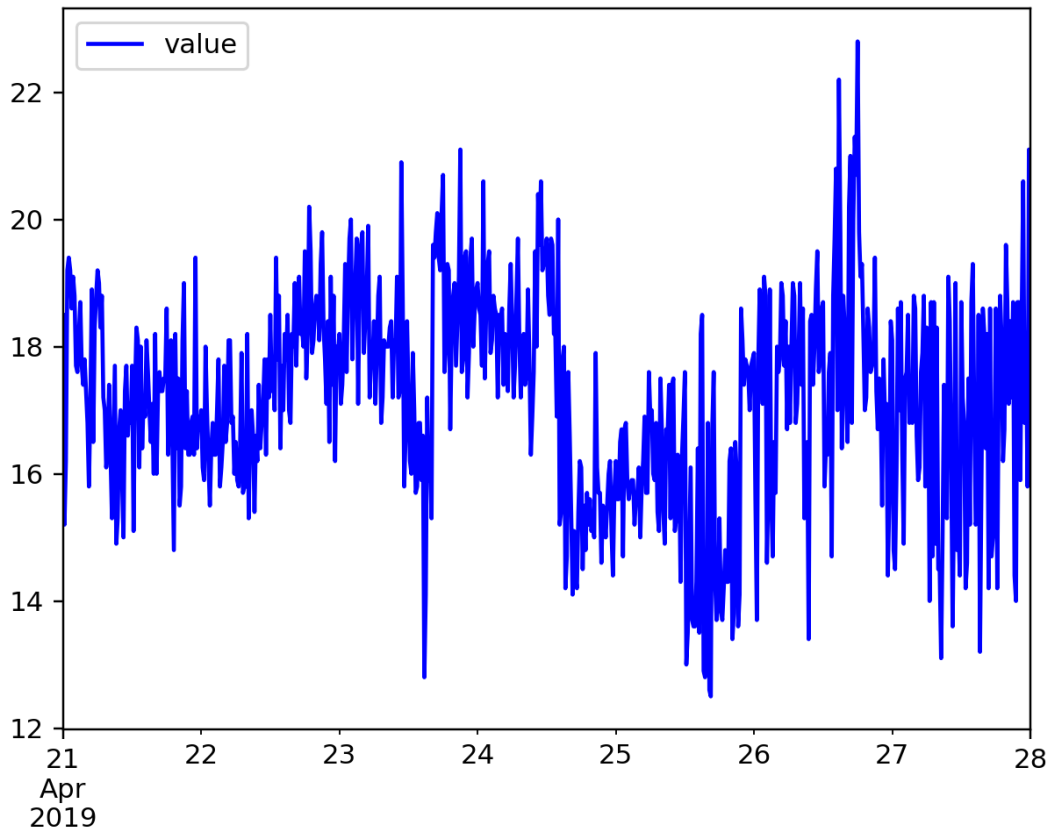
SUBMISSION_2

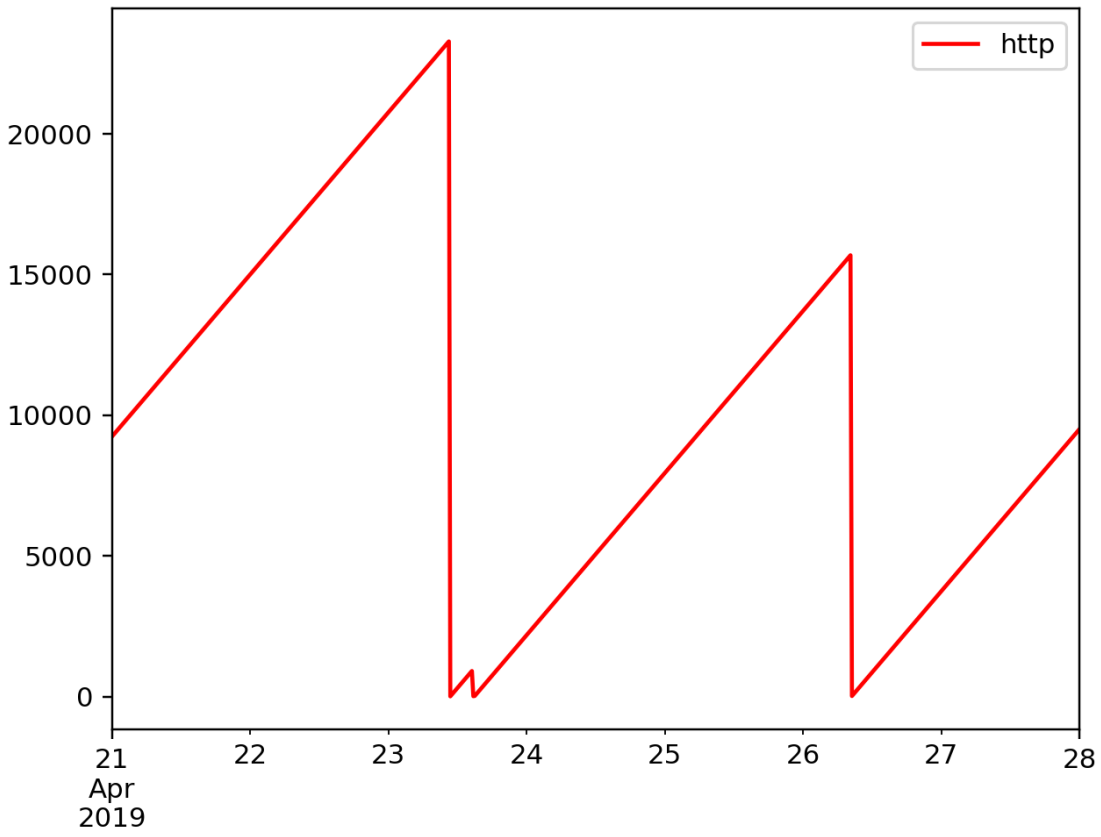
```
# libraries
%matplotlib notebook
import pandas as pd
import numpy as np
import matplotlib
import seaborn
import matplotlib.dates as md
from matplotlib import pyplot as plt
from mpl_toolkits.axes_grid1 import host_subplot
import mpl_toolkits.axisartist as AA

from sklearn import preprocessing
from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
from sklearn.covariance import EllipticEnvelope

from sklearn.ensemble import IsolationForest
from sklearn.svm import OneClassSVM

df =
pd.read_csv("/Users/nkochura@us.ibm.com/Documents/ML_COMPETITION_DATAAI
/https-github.ibm.com-ML4DevOps/data/grafana_data_cpu_http.csv")

df.head()
```

	timestamp	value	http
0	4/21/19 0:00	18.5	9244.0
1	4/21/19 0:15	15.2	9304.0
2	4/21/19 0:30	16.2	9364.0
3	4/21/19 0:45	19.2	9424.0
4	4/21/19 1:00	19.4	9484.0

```
print(df.info())
#
df['http'] = df['http'].astype(float)
print (df['http'].mean())
print(df['value'].mean())
print(df['timestamp'].head(10))
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 673 entries, 0 to 672
Data columns (total 3 columns):
timestamp    673 non-null object
value        673 non-null float64
http         673 non-null float64
dtypes: float64(2), object(1)
memory usage: 15.9+ KB
None
9872.84398216939
17.188261515601784
0    4/21/19 0:00
1    4/21/19 0:15
2    4/21/19 0:30
3    4/21/19 0:45
4    4/21/19 1:00
5    4/21/19 1:15
6    4/21/19 1:30
7    4/21/19 1:45
8    4/21/19 2:00
9    4/21/19 2:15
Name: timestamp, dtype: object
# change the type of time  column for plotting
df['timestamp'] = pd.to_datetime(df['timestamp'])
print(df['timestamp'].head(10))
# df['value'] = (df['value'] + 10) * 1/10
# plot the data
df.plot(x='timestamp', y='value',color='blue')
df.plot(x='timestamp', y='http',color='red')
0   2019-04-21 00:00:00
1   2019-04-21 00:15:00
2   2019-04-21 00:30:00
3   2019-04-21 00:45:00
4   2019-04-21 01:00:00
5   2019-04-21 01:15:00
6   2019-04-21 01:30:00
7   2019-04-21 01:45:00
8   2019-04-21 02:00:00
9   2019-04-21 02:15:00
Name: timestamp, dtype: datetime64[ns]
```


value
22
20
18
16
14
12
21
Apr
2019
22
23
24
25
26
27
28

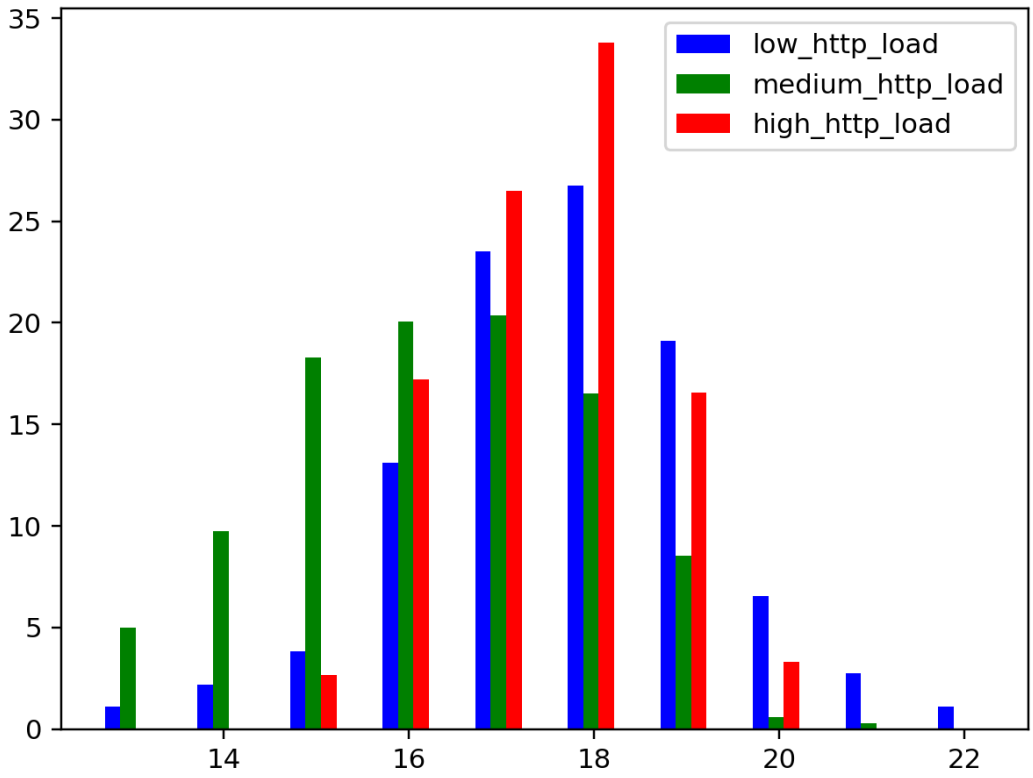


<matplotlib.axes._subplots.AxesSubplot at 0x129ed6278>

Categorize http load :"low":0 ,"medium":1,"high":2

```
#print (df.dtypes)
df ['cat'] = 1
df['highload'] = ((df['http'] >= 15000.0)).astype(int)
df['lowload'] = ((df['http'] <= 5000.0)).astype(int)

# An estimation of anomly population of the dataset
outliers_fraction = 0.01
# time with int to plot easily
df['time_epoch'] = (df['timestamp'].astype(np.int64)/100000000000).astype(np.int64)
# creation of 3 distinct categories
df ['cat'] = df ['cat'] + df['highload'] - df['lowload']

a = df.loc[df['cat'] == 0, 'value']
b = df.loc[df['cat'] == 1, 'value']
```

```
c = df.loc[df['cat'] == 2, 'value']


fig, ax = plt.subplots()
a_heights, a_bins = np.histogram(a)
b_heights, b_bins = np.histogram(b, bins=a_bins)
c_heights, c_bins = np.histogram(c, bins=a_bins)


width = (a_bins[1] - a_bins[0])/6

ax.bar(a_bins[:-1], a_heights*100/a.count(), width=width, facecolor='blue',
label='low_http_load')
ax.bar(b_bins[:-1]+width, (b_heights*100/b.count()), width=width, facecolor='green',
label ='medium_http_load')
ax.bar(c_bins[:-1]+width*2, (c_heights*100/c.count()), width=width, facecolor='red', label
='high_http_load')

plt.legend()
plt.show()
```



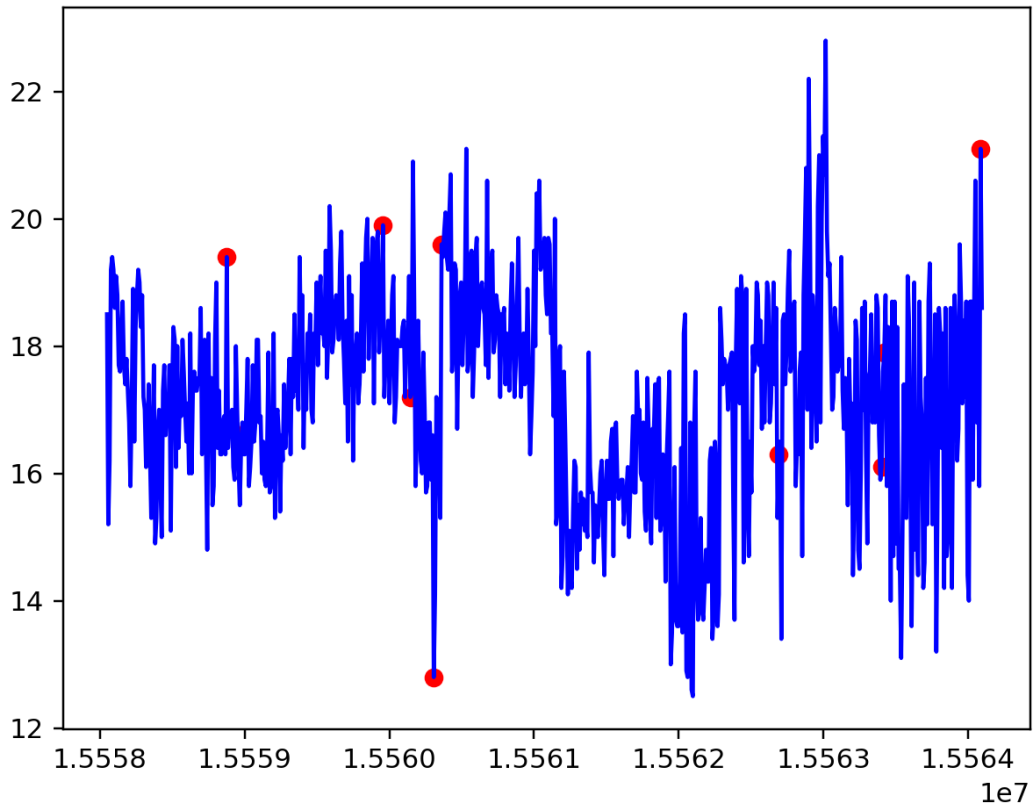
Cluster based anomalies

We group together the combination of features. The points that are far from the cluster **are points with usual combination of features we consider those points as anomalies.**

One class SVM

```
# Take useful feature and standardize them
data = df[['value', 'http', 'cat']]
min_max_scaler = preprocessing.StandardScaler()
np_scaled = min_max_scaler.fit_transform(data)
# train one class SVM
model =  OneClassSVM(nu=0.95 * outliers_fraction) #nu=0.95 * outliers_fraction  + 0.05
data = pd.DataFrame(np_scaled)
model.fit(data)
# add the data to the main
df['anomaly1'] = pd.Series(model.predict(data))
```

```
df['anomaly1'] = df['anomaly1'].map( {1: 0, -1: 1} )
print(df['anomaly1'].value_counts())
0    663
1     10
Name: anomaly1, dtype: int64
# visualisation of anomaly throughout time (viz 1)
fig, ax = plt.subplots()

a = df.loc[df['anomaly1'] == 1, ['time_epoch', 'value']] #anomaly

ax.plot(df['time_epoch'], df['value'], color='blue')
ax.scatter(a['time_epoch'],a['value'], color='red')
plt.show()
```




```
# visualisation of anomaly with http _load repartition(viz 2)
a = df.loc[df['anomaly1'] == 0, 'value']
b = df.loc[df['anomaly1'] == 1, 'value']

fig, axs = plt.subplots()
```

```
axs.hist([a,b], bins=32, stacked=True, color=['blue', 'red'])
plt.legend()
plt.show()
```