In [1]:

```
import pandas as pd
import pandas_profiling
import numpy as np
```

In [2]:

```
data=pd.read_csv("data_test.csv")
```

In [3]:

```
print('Number of data points\n : ', data.shape[0])
print("********************* \n")
print('Number of features\n  : ', data.shape[1])
print("********************* \n ")
print('Features : ', data.columns.values)
data.head()
```

```
Number of data points
 :  50000
*********************

Number of features
  :  38
*********************

Features :  ['sesno' 'actno' 'nasno' 'start' 'lastupd' 'bytesin' 'bytesout' 'state'
 'closedt' 'closereason' 'lastbytesin' 'lastbytesout' 'bytepulse'
 'timepulse' 'subsno' 'internalid' 'ipaddr' 'macaddr' 'cpno' 'devid'
 'svctype' 'snatip' 'qosno' 'agentid' 'extlocation' 'extnasip' 'extnasid'
 'userid' 'fupuploadbytes' 'fupdownloadbytes' 'fupseconds' 'accessopname'
 'session_charge' 'multi_acct_id' 'proxyno' 'nasid' 'nasip' 'userid-2']
```

Out[3]:

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | fupuploadbytes | fupdownl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 4 | 1 | 2019-08-31 18:07:23.226076 | 2019-08-31 18:13:20.226076 | 323316 | 311381 | C | NaN | 6 | ... | 0 | |
| **1** | 2 | 4 | 1 | 2019-08-31 18:28:22.848888 | 2019-08-31 18:30:37.848888 | 143327 | 59698 | C | NaN | 6 | ... | 0 | |
| **2** | 4 | 4 | 1 | 2019-08-31 18:35:54.926522 | 2019-08-31 18:37:01.926522 | 19858 | 16736 | C | NaN | 6 | ... | 0 | |
| **3** | 3 | 4 | 1 | 2019-08-31 18:31:32.666854 | 2019-08-31 18:35:34.666854 | 60325 | 82050 | C | NaN | 6 | ... | 0 | |
| **4** | 5 | 4 | 1 | 2019-08-31 18:37:19.775424 | 2019-08-31 18:43:45.775424 | 37628 | 53620 | C | NaN | 6 | ... | 0 | |

5 rows × 38 columns

In [3]:

```
data.columns
```

Out[3]:

```
Index(['sesno', 'actno', 'nasno', 'start', 'lastupd', 'bytesin', 'bytesout',
       'state', 'closedt', 'closereason', 'lastbytesin', 'lastbytesout',
       'bytepulse', 'timepulse', 'subsno', 'internalid', 'ipaddr', 'macaddr',
       'cpno', 'devid', 'svctype', 'snatip', 'qosno', 'agentid', 'extlocation',
       'extnasip', 'extnasid', 'userid', 'fupuploadbytes', 'fupdownloadbytes',
       'fupseconds', 'accessopname', 'session_charge', 'multi_acct_id',
       'proxyno', 'nasid', 'nasip', 'userid-2'],
      dtype='object')
```

In [89]:

```
data.describe()
```

Out[89]:

| | sesno | actno | nasno | bytesin | bytesout | closedt | closereason | lastbytesin | lastbytesout | bytepu |
|---|---|---|---|---|---|---|---|---|---|---|
| **count** | 50000.000000 | 50000.000000 | 50000.000000 | 5.000000e+04 | 5.000000e+04 | 0.0 | 50000.00000 | 0.0 | 0.0 | 5000 |
| **mean** | 25754.416440 | 372.753940 | 1.361740 | 3.076771e+06 | 2.652597e+07 | NaN | 4.12652 | NaN | NaN | |
| **std** | 14863.777337 | 1168.286462 | 0.480509 | 2.578459e+07 | 1.108968e+08 | NaN | 0.89087 | NaN | NaN | |
| **min** | 1.000000 | 4.000000 | 1.000000 | 0.000000e+00 | 0.000000e+00 | NaN | 1.00000 | NaN | NaN | |
| **25%** | 13044.750000 | 4.000000 | 1.000000 | 9.510000e+02 | 6.700000e+02 | NaN | 4.00000 | NaN | NaN | |
| **50%** | 25641.500000 | 4.000000 | 1.000000 | 1.613100e+04 | 8.035000e+03 | NaN | 4.00000 | NaN | NaN | |
| **75%** | 38347.250000 | 4.000000 | 2.000000 | 1.223095e+05 | 5.926050e+04 | NaN | 4.00000 | NaN | NaN | |
| **max** | 136319.000000 | 18691.000000 | 2.000000 | 9.582576e+08 | 2.865270e+09 | NaN | 17.00000 | NaN | NaN | |

8 rows × 33 columns

In [6]:

```
data['closedt'].isna().sum()
```

Out[6]:

```
50000
```

In [7]:

```
data["lastbytesin"].isna().sum()
```

Out[7]:

```
50000
```

In [8]:

```
data["lastbytesout"].isna().sum()
```

Out[8]:

```
50000
```

In [9]:

```
data["extnasip"].isna().sum()
```

Out[9]:

```
50000
```

In [10]:

```
data["extnasid"].isna().sum()
```

```
data["extnasid"].isna().sum()
```

Out[10]:

```
50000
```

In [11]:

```
data["accessopname"].isna().sum()
```

Out[11]:

```
50000
```

In [12]:

```
data["session_charge"].isna().sum()
```

Out[12]:

```
50000
```

In [13]:

```
pandas_profiling.ProfileReport(data)
```

Out[13]:

# Overview

## Dataset info

| | |
|---|---|
| **Number of variables** | 38 |
| **Number of observations** | 50000 |
| **Total Missing (%)** | 38.3% |
| **Total size in memory** | 14.5 MiB |
| **Average record size in memory** | 304.0 B |

## Variables types

| | |
|---|---|
| **Numeric** | 5 |
| **Categorical** | 8 |
| **Boolean** | 1 |
| **Date** | 0 |
| **Text (Unique)** | 2 |
| **Rejected** | 22 |
| **Unsupported** | 0 |

## Warnings

- `accessopname` has 50000 / 100.0% missing values **Missing**
- `accessopname` has constant value **Rejected**
- `agentid` has 50000 / 100.0% missing values **Missing**
- `agentid` has constant value **Rejected**
- `bytepulse` has constant value 1 **Rejected**
- `bytesin` has 7200 / 14.4% zeros **Zeros**
- `bytesout` has 7373 / 14.7% zeros **Zeros**
- `closedt` has 50000 / 100.0% missing values **Missing**
- `closedt` has constant value **Rejected**
- `cpno` has 50000 / 100.0% missing values **Missing**
- `cpno` has constant value **Rejected**
- `devid` has 50000 / 100.0% missing values **Missing**
- `devid` has constant value **Rejected**
- `extlocation` has 20173 / 40.3% missing values **Missing**
- `extlocation` has a high cardinality: 644 distinct values **Warning**
- `extnasid` has 50000 / 100.0% missing values **Missing**

- extnasid has constant value Rejected
- extnasip has 50000 / 100.0% missing values Missing
- extnasip has constant value Rejected
- fupdownloadbytes has constant value 0 Rejected
- fupseconds has constant value 0 Rejected
- fupuploadbytes has constant value 0 Rejected
- internalid has a high cardinality: 6271 distinct values Warning
- ipaddr has 3697 / 7.4% missing values Missing
- ipaddr has a high cardinality: 46292 distinct values Warning
- lastbytesin has 50000 / 100.0% missing values Missing
- lastbytesin has constant value Rejected
- lastbytesout has 50000 / 100.0% missing values Missing
- lastbytesout has constant value Rejected
- macaddr has 990 / 2.0% missing values Missing
- macaddr has a high cardinality: 34428 distinct values Warning
- multi_acct_id has 50000 / 100.0% missing values Missing
- multi_acct_id has constant value Rejected
- proxyno has 50000 / 100.0% missing values Missing
- proxyno has constant value Rejected
- qosno has constant value 1 Rejected
- session_charge has 50000 / 100.0% missing values Missing
- session_charge has constant value Rejected
- snatip has 3713 / 7.4% missing values Missing
- snatip has a high cardinality: 46277 distinct values Warning
- state has constant value C Rejected
- subsno is highly correlated with actno (ρ = 1) Rejected
- svctype has 50000 / 100.0% missing values Missing
- svctype has constant value Rejected
- timepulse has constant value 1 Rejected
- userid has 50000 / 100.0% missing values Missing
- userid has constant value Rejected
- userid-2 has a high cardinality: 5671 distinct values Warning

# Variables

### ~~accessopname~~

Constant

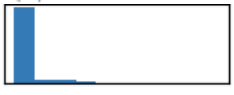
*This variable is constant and should be ignored for analysis*

| Constant value |
|---|

### actno

Numeric

| | |
|---|---|
| Distinct count | 5671 |
| Unique (%) | 11.3% |
| Missing (%) | 0.0% |
| Missing (n) | 0 |
| Infinite (%) | 0.0% |
| Infinite (n) | 0 |
| Mean | 372.75 |
| Minimum | 4 |
| Maximum | 18691 |
| Zeros (%) | 0.0% |



Toggle details

## ~~agentid~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

## ~~bytepulse~~

Constant

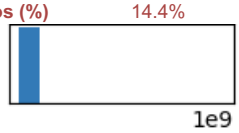
*This variable is constant and should be ignored for analysis*

| Constant value | 1 |
|---|---|

## bytesin

Numeric

| | |
|---|---|
| **Distinct count** | 31937 |
| **Unique (%)** | 63.9% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |
| **Infinite (%)** | 0.0% |
| **Infinite (n)** | 0 |
| **Mean** | 3076800 |
| **Minimum** | 0 |
| **Maximum** | 958257566 |
| **Zeros (%)** | 14.4% |

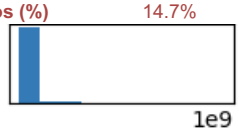



Toggle details

## bytesout

Numeric

| | |
|---|---|
| **Distinct count** | 27654 |
| **Unique (%)** | 55.3% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |
| **Infinite (%)** | 0.0% |
| **Infinite (n)** | 0 |
| **Mean** | 26526000 |
| **Minimum** | 0 |
| **Maximum** | 2865270028 |
| **Zeros (%)** | 14.7% |




Toggle details

## ~~closedt~~

Constant

*This variable is constant and should be ignored for analysis*

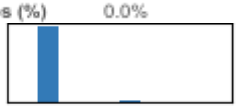
| Constant value | |
|---|---|

## closereason

Numeric

| | |
|---|---|
| **Distinct count** | 5 |
| **Unique (%)** | 0.0% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |
| **Infinite (%)** | 0.0% |
| **Infinite (n)** | 0 |
| **Mean** | 4.1265 |
| **Minimum** | 1 |

| | |
|---|---|
| Maximum | 17 |
| Zeros (%) | 0.0% |



Toggle details

~~cpno~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value |
|---|

~~devid~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value |
|---|

## extlocation

Categorical

| | |
|---|---|
| **Distinct count** | 644 |
| **Unique (%)** | 1.3% |
| **Missing (%)** | 40.3% |
| **Missing (n)** | 20173 |

| | |
|---|---|
| WLAN:wlan0:2657:RailWire:T310C:TT-ER-ER-SDAH-DDJ-AP-01-01:1… | 1603 |
| WLAN:wlan0:2479:RailWire:T310C:PGCIL-WR-CR-BB-SNRD-AP-01-0… | 668 |
| WLAN:wlan0:3941:RailWire:T310C:TT-ER-ER-HWH-BLY-AP-01-01:1C… | 629 |
| Other values (640) | 26927 |
| (Missing) | 20173 |

Toggle details

~~extnasid~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value |
|---|

~~extnasip~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value |
|---|

~~fupdownloadbytes~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | 0 |
|---|---|

~~fupseconds~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | 0 |
|---|---|

~~fupuploadbytes~~

Constant

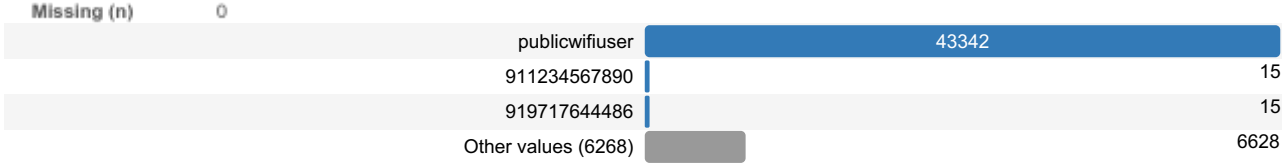
*This variable is constant and should be ignored for analysis*

| Constant value | 0 |
|---|---|

## internalid

Categorical

| | |
|---|---|
| **Distinct count** | 6271 |
| **Unique (%)** | 12.5% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |

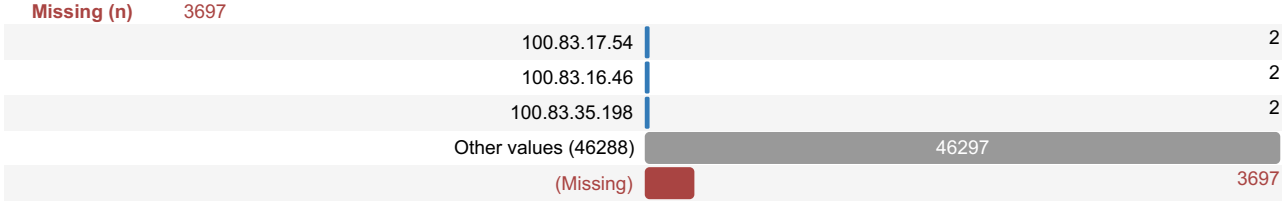



Toggle details

## ipaddr

Categorical

| | |
|---|---|
| **Distinct count** | 46292 |
| **Unique (%)** | 92.6% |
| **Missing (%)** | 7.4% |
| **Missing (n)** | 3697 |




Toggle details

## ~~lastbytesin~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

## ~~lastbytesout~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

## lastupd

Categorical, Unique

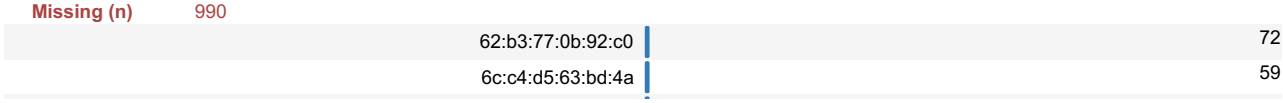
| First 3 values | |
|---|---|
| Last 3 values | |

Toggle details

## macaddr

Categorical

| | |
|---|---|
| **Distinct count** | 34428 |
| **Unique (%)** | 68.9% |
| **Missing (%)** | 2.0% |
| **Missing (n)** | 990 |



| | |
|---|---|
| e4:98:d1:b0:7a:88 | 44 |
| Other values (34424) | 48835 |
| (Missing) | 990 |

Toggle details

~~multi_acct_id~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

## nasid

Categorical

| | |
|---|---|
| **Distinct count** | 2 |
| **Unique (%)** | 0.0% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |

| | |
|---|---|
| ERS-J480-BNG-R-T2-SR | 31913 |
| HWH-J480-BNG-R-T2-ER | 18087 |

Toggle details

## nasip

Categorical

| | |
|---|---|
| **Distinct count** | 2 |
| **Unique (%)** | 0.0% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |

| | |
|---|---|
| 172.31.32.61 | 31913 |
| 172.31.32.64 | 18087 |

Toggle details

## nasno

Boolean

| | |
|---|---|
| **Distinct count** | 2 |
| **Unique (%)** | 0.0% |
| **Missing (%)** | 0.0% |
| **Missing (n)** | 0 |
| **Mean** | 1.3617 |

| | |
|---|---|
| 1 | 31913 |
| 2 | 18087 |

Toggle details

~~proxyno~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

~~qosno~~

Constant

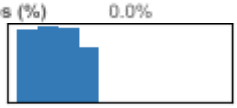
*This variable is constant and should be ignored for analysis*

| Constant value | 1 |
|---|---|

## sesno

Numeric

| | |
|---|---|
| Distinct count | 50000 |
| Unique (%) | 100.0% |
| Missing (%) | 0.0% |
| Missing (n) | 0 |
| Infinite (%) | 0.0% |
| Infinite (n) | 0 |
| Mean | 25754 |
| Minimum | 1 |
| Maximum | 136319 |
| Zeros (%) | 0.0% |



Toggle details

## ~~session_charge~~

Constant

*This variable is constant and should be ignored for analysis*

| | |
|---|---|
| Constant value | |

## snatip

Categorical

| | |
|---|---|
| Distinct count | 46277 |
| Unique (%) | 92.6% |
| Missing (%) | 7.4% |
| Missing (n) | 3713 |

| | |
|---|---|
| 100.83.37.125 | 2 |
| 100.83.17.54 | 2 |
| 100.83.44.207 | 2 |
| Other values (46273) | 46281 |
| (Missing) | 3713 |

Toggle details

## start

Categorical, Unique

| | |
|---|---|
| First 3 values | |
| Last 3 values | |

Toggle details

## ~~state~~

Constant

*This variable is constant and should be ignored for analysis*

| | |
|---|---|
| Constant value | C |

## ~~subsno~~

Highly correlated

*This variable is highly correlated with* `actno` *and should be ignored for analysis*

| | |
|---|---|
| Correlation | 1 |

## ~~svctype~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

~~timepulse~~

Constant

*This variable is constant and should be ignored for analysis*

| Constant value | 1 |
|---|---|

~~userid~~

Constant

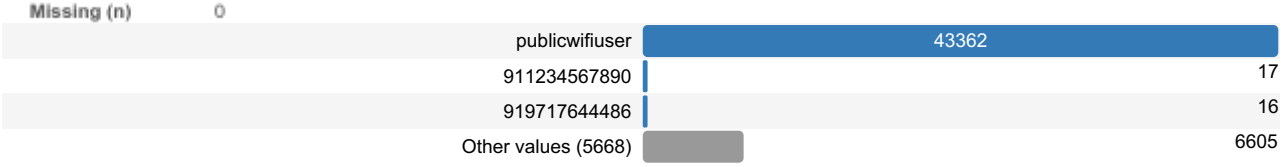
*This variable is constant and should be ignored for analysis*

| Constant value | |
|---|---|

## userid-2

Categorical

| | |
|---|---|
| Distinct count | 5671 |
| Unique (%) | 11.3% |
| Missing (%) | 0.0% |
| Missing (n) | 0 |




Toggle details

# Correlations

# Sample

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereasor |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 4 | 1 | 2019-08-31 18:07:23.226076 | 2019-08-31 18:13:20.226076 | 323316 | 311381 | C | NaN | 6 |
| **1** | 2 | 4 | 1 | 2019-08-31 18:28:22.848888 | 2019-08-31 18:30:37.848888 | 143327 | 59698 | C | NaN | 6 |
| **2** | 4 | 4 | 1 | 2019-08-31 18:35:54.926522 | 2019-08-31 18:37:01.926522 | 19858 | 16736 | C | NaN | 6 |
| **3** | 3 | 4 | 1 | 2019-08-31 18:31:32.666854 | 2019-08-31 18:35:34.666854 | 60325 | 82050 | C | NaN | 6 |
| **4** | 5 | 4 | 1 | 2019-08-31 18:37:19.775424 | 2019-08-31 18:43:45.775424 | 37628 | 53620 | C | NaN | 6 |

# observation

- Most features have NUll or constant value so these features can be ignored
- Useful features are start,lastupd,bytesin,bytesout

In [14]:

```
sdate=data["start"]
sdate= pd.to_datetime(sdate)
```

In [15]:

```
edate=data["lastupd"]
edate= pd.to_datetime(edate)
```

In [16]:

```
time_duration = edate-sdate
print(time_duration)
```

```
0       00:05:57
1       00:02:15
2       00:01:07
3       00:04:02
4       00:06:26
5       00:03:32
6       00:01:15
7       00:03:33
8       00:01:49
9       00:00:51
10      01:00:46
11      05:52:46
12      00:19:38
13      07:36:30
14      00:11:26
15      00:15:49
16      01:19:34
17      00:14:55
18      00:07:51
19      00:18:29
20      00:03:53
21      01:51:50
22      02:11:42
23      02:34:33
24      01:36:28
25      00:27:40
26      00:01:02
```

```
27       00:03:27
28       00:20:06
29       01:35:20
           ...
49970    00:15:07
49971    00:20:02
49972    00:20:07
49973    00:15:11
49974    00:20:12
49975    00:15:11
49976    00:24:52
49977    00:30:18
49978    00:30:04
49979    00:34:54
49980    00:39:55
49981    00:40:12
49982    00:14:53
49983    00:20:19
49984    00:14:56
49985    00:15:08
49986    01:10:04
49987    01:24:53
49988    00:59:53
49989    00:55:03
49990    00:15:03
49991    00:50:15
49992    01:20:17
49993    01:04:51
49994    00:59:51
49995    00:02:04
49996    00:02:02
49997    00:02:06
49998    00:14:31
49999    00:14:34
Length: 50000, dtype: timedelta64[ns]
```

In [17]:

```
data["session_duration"] = list(time_duration)
```

In [ ]:

```
# added a new feature session_duration
```

In [19]:

```
data.head()
```

Out[19]:

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | fupdownloadbytes | fupse |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 4 | 1 | 2019-08-31 18:07:23.226076 | 2019-08-31 18:13:20.226076 | 323316 | 311381 | C | NaN | 6 | ... | 0 | |
| **1** | 2 | 4 | 1 | 2019-08-31 18:28:22.848888 | 2019-08-31 18:30:37.848888 | 143327 | 59698 | C | NaN | 6 | ... | 0 | |
| **2** | 4 | 4 | 1 | 2019-08-31 18:35:54.926522 | 2019-08-31 18:37:01.926522 | 19858 | 16736 | C | NaN | 6 | ... | 0 | |
| **3** | 3 | 4 | 1 | 2019-08-31 18:31:32.666854 | 2019-08-31 18:35:34.666854 | 60325 | 82050 | C | NaN | 6 | ... | 0 | |
| **4** | 5 | 4 | 1 | 2019-08-31 | 2019-08-31 | 87000 | 59000 | C | NaN | 6 | ... | 0 | |

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | fupdownloadbytes | fupse |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 5 | 4 | 1 | 18:37:19.775424 | 18:43:45.776424 | 37628 | 53620 | C | NaN | 6 | ... | 0 | |

5 rows × 39 columns

In [20]:

```
data["session_duration"].describe()
```

Out[20]:

```
count                      50000
mean      0 days 00:20:37.861820
std       0 days 00:55:44.910238
min               0 days 00:00:00
25%               0 days 00:14:35
50%               0 days 00:14:52
75%               0 days 00:19:34
max               2 days 18:47:35
Name: session_duration, dtype: object
```

## Summary

- Nearly 75% of the users have a session duration of less than 19 minutes and max session duration recorded was lasting more than 2 days

In [26]:

```
import time
import datetime
```

In [27]:

```
def convert_to_unix(s):
    return time.mktime(datetime.datetime.strptime(s, "%Y-%m-%d %H:%M:%S.%f").timetuple())
```

In [28]:

```
 duration = data[['start','lastupd']]
    #pickups and dropoffs to unix time
duration_start = [convert_to_unix(x) for x in duration['start'].values]
duration_end = [convert_to_unix(x) for x in duration['lastupd'].values]
    #calculate duration of trips
durations = (np.array(duration_end) - np.array(duration_start))/float(60)
```

In [29]:

```
print(durations)
```

```
[ 5.95        2.25        1.11666667 ...  2.1        14.51666667
 14.56666667]
```

In [30]:

```
data["duration_minutes"] = durations
```

In [31]:

```
data.head()
```

Out[31]:

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | fupseconds | accessopnar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | fupseconds | accessopnam |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 4 | 1 | 2019-08-31 18:07:23.228076 | 2019-08-31 18:13:20.228076 | 928316 | 211381 | C | NaN | 6 | ... | 0 | Na |
| **1** | 2 | 4 | 1 | 2019-08-31 18:28:22.848888 | 2019-08-31 18:30:37.848888 | 143327 | 59698 | C | NaN | 6 | ... | 0 | Na |
| **2** | 4 | 4 | 1 | 2019-08-31 18:35:54.926522 | 2019-08-31 18:37:01.926522 | 19858 | 16736 | C | NaN | 6 | ... | 0 | Na |
| **3** | 3 | 4 | 1 | 2019-08-31 18:31:32.666854 | 2019-08-31 18:35:34.666854 | 60325 | 82050 | C | NaN | 6 | ... | 0 | Na |
| **4** | 5 | 4 | 1 | 2019-08-31 18:37:19.775424 | 2019-08-31 18:43:45.775424 | 37628 | 53620 | C | NaN | 6 | ... | 0 | Na |

5 rows × 40 columns

In [32]:

```
#looking further from the 99th percecntile
for i in range(90,100):
    var =data["duration_minutes"].values
    var = np.sort(var,axis = None)
    print("{} percentile value is {}".format(i,var[int(len(var)*(float(i)/100))]))
print ("100 percentile value is ",var[-1])
```

```
90 percentile value is 30.283333333333335
91 percentile value is 34.916666666666664
92 percentile value is 35.28333333333333
93 percentile value is 40.016666666666666
94 percentile value is 44.9
95 percentile value is 49.88333333333333
96 percentile value is 54.95
97 percentile value is 60.233333333333334
98 percentile value is 74.61666666666666
99 percentile value is 95.01666666666667
100 percentile value is  4007.5833333333335
```

# observation

- 99 percent of the users have a session duration of less than 95 minutes

In [33]:

```
data['Start Time'] = pd.to_datetime(data['start'])

data['day'] = data['Start Time'].dt.dayofweek


popular_day = data['day'].mode()[0]
print('\n\nThe most common day of the week is\n')
print(":-")
print(popular_day)
```

```
The most common day of the week is

:-
4
```

# observation

## observation

- The day traffic is maximum is Day 4 (Friday) Days are numbered from 0-6(Mon-Sunday)

In [34]:

```
data['hour'] = data['Start Time'].dt.hour
popular_hour = data['hour'].mode()[0]

data["minute"]=data["Start Time"].dt.minute
popular_minute =data["minute"].mode()[0]
print('\n\nThe most common start hour is\n')
print(":-")
print(popular_hour)
print("********")
print('\n\nThe most common start minute is \n')
print(popular_minute)
```

```
The most common start hour is

:-
18
********


The most common start minute is

16
```

In [35]:

```
data["Last Time"] = pd.to_datetime(data['lastupd'])

data['end_hour'] = data['Last Time'].dt.hour
popular_hour = data['end_hour'].mode()[0]

print('\n\n The most common end hour is\n')
print(":-")
print(popular_hour)
```

```
 The most common end hour is

:-
18
```

# summary

- Since 96 % of the data points have a session duration of less than 55 minutes, and maximum occuring start hour is 18:00
- so duration in which we can expect max traffic is between (19:17 - 20:12)

In [36]:

```
data.columns
```

Out[36]:

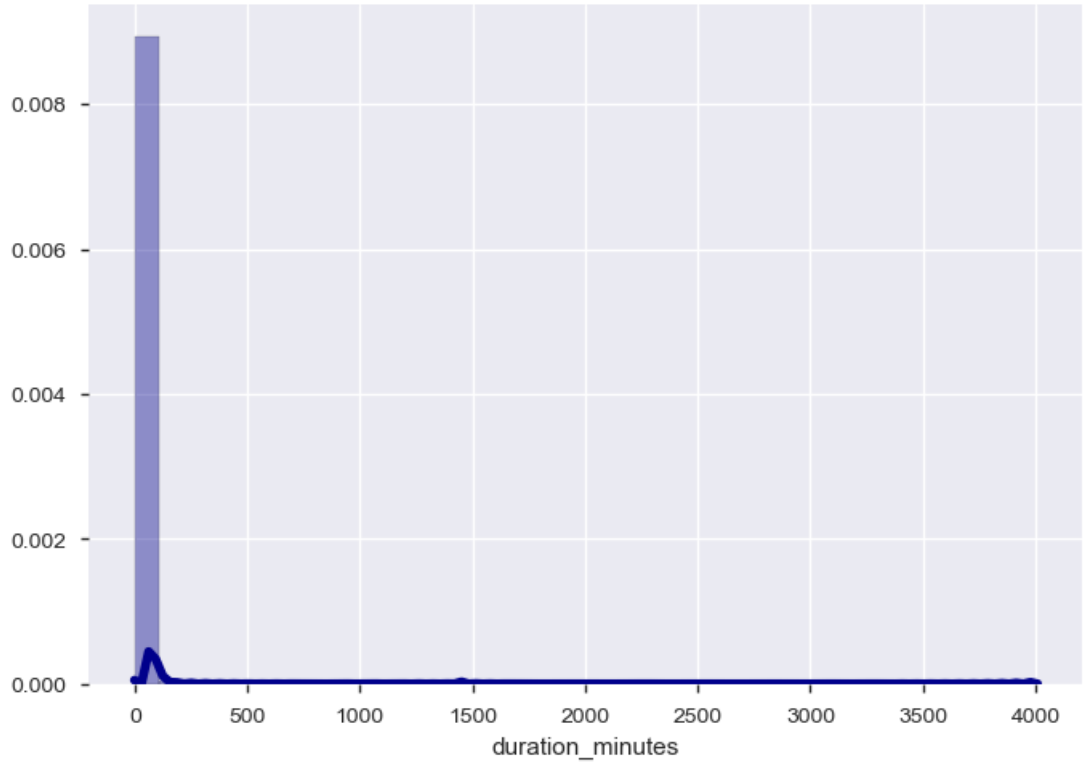
```
Index(['sesno', 'actno', 'nasno', 'start', 'lastupd', 'bytesin', 'bytesout',
       'state', 'closedt', 'closereason', 'lastbytesin', 'lastbytesout',
       'bytepulse', 'timepulse', 'subsno', 'internalid', 'ipaddr', 'macaddr',
       'cpno', 'devid', 'svctype', 'snatip', 'qosno', 'agentid', 'extlocation',
       'extnasip', 'extnasid', 'userid', 'fupuploadbytes', 'fupdownloadbytes',
       'fupseconds', 'accessopname', 'session_charge', 'multi_acct_id',
       'proxyno', 'nasid', 'nasip', 'userid-2', 'session_duration',
       'duration_minutes', 'Start Time', 'day', 'hour', 'minute', 'Last Time',
       'end_hour'],
      dtype='object')
```

In [38]:

```
# Density Plot and Histogram of all arrival delays
sns.distplot(data['duration_minutes'], hist=True, kde=True,
             bins=int(180/5), color = 'darkblue',
             hist_kws={'edgecolor':'black'},
             kde_kws={'linewidth': 4})
```

Out[38]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x6ec5a02c88>
```




In [55]:

```
unique_duration = data['duration_minutes'].value_counts()
print('Number of Unique durations :', unique_duration.shape[0])
```

```
Number of Unique durations : 2016
```

In [77]:

```
data["hour"].value_counts(normalize=True)
```

Out[77]:

```
18    0.18404
17    0.17170
16    0.14068
19    0.05190
10    0.04492
9     0.04490
20    0.03790
11    0.03756
8     0.03736
13    0.03566
12    0.03430
14    0.03242
21    0.03160
15    0.03036
7     0.02484
22    0.01674
6     0.01554
23    0.00822
5     0.00656
```

```
0     0.00466
4     0.00314
1     0.00266
3     0.00150
2     0.00084
Name: hour, dtype: float64
```

In [78]:

```
data["minute"].value_counts(normalize=True)
```

Out[78]:

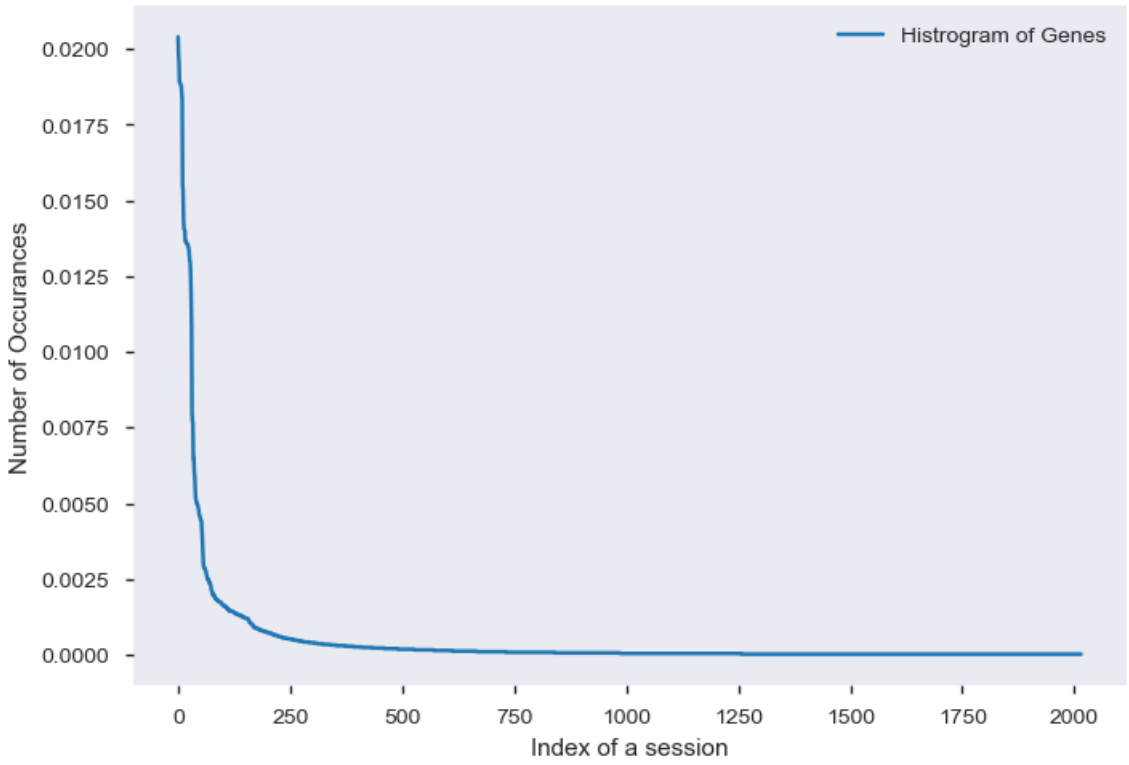
```
16    0.02068
18    0.01886
23    0.01882
17    0.01836
19    0.01816
39    0.01802
15    0.01798
28    0.01790
35    0.01778
42    0.01770
26    0.01764
29    0.01760
44    0.01758
33    0.01752
22    0.01744
21    0.01742
30    0.01736
25    0.01724
41    0.01724
32    0.01718
59    0.01718
3     0.01716
20    0.01692
54    0.01692
43    0.01688
51    0.01680
11    0.01680
37    0.01680
24    0.01676
47    0.01662
12    0.01650
45    0.01650
48    0.01648
38    0.01646
4     0.01646
14    0.01644
27    0.01644
56    0.01638
52    0.01630
36    0.01620
46    0.01604
49    0.01602
55    0.01600
0     0.01594
58    0.01590
57    0.01574
31    0.01574
40    0.01570
10    0.01568
7     0.01552
53    0.01548
50    0.01546
8     0.01544
6     0.01536
34    0.01520
9     0.01482
13    0.01474
2     0.01464
1     0.01462
5     0.01448
Name: minute, dtype: float64
```

# Summary

-we observe that 19:17 - 20:12 is the most busiest period

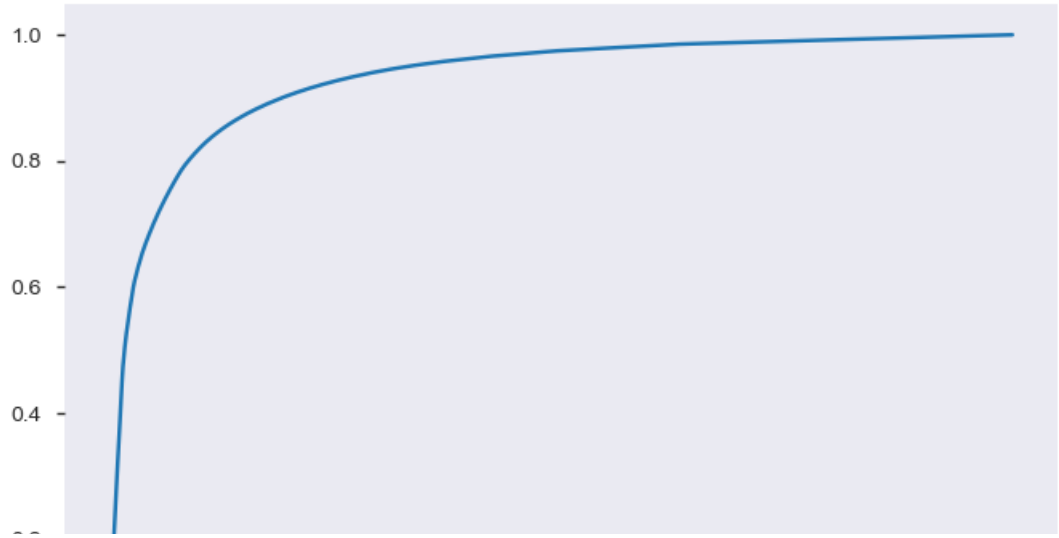
In [56]:

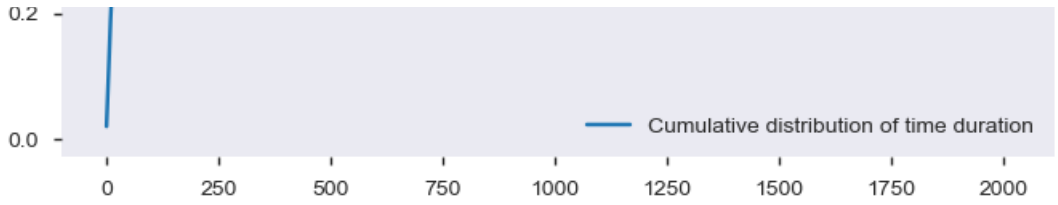
```
s = sum(unique_duration.values);
h = unique_duration.values/s;
plt.plot(h, label="Histrogram of Genes")
plt.xlabel('Time duration')
plt.ylabel('Number of Occurances')
plt.legend()
plt.grid(true)
plt.show()
```




In [59]:

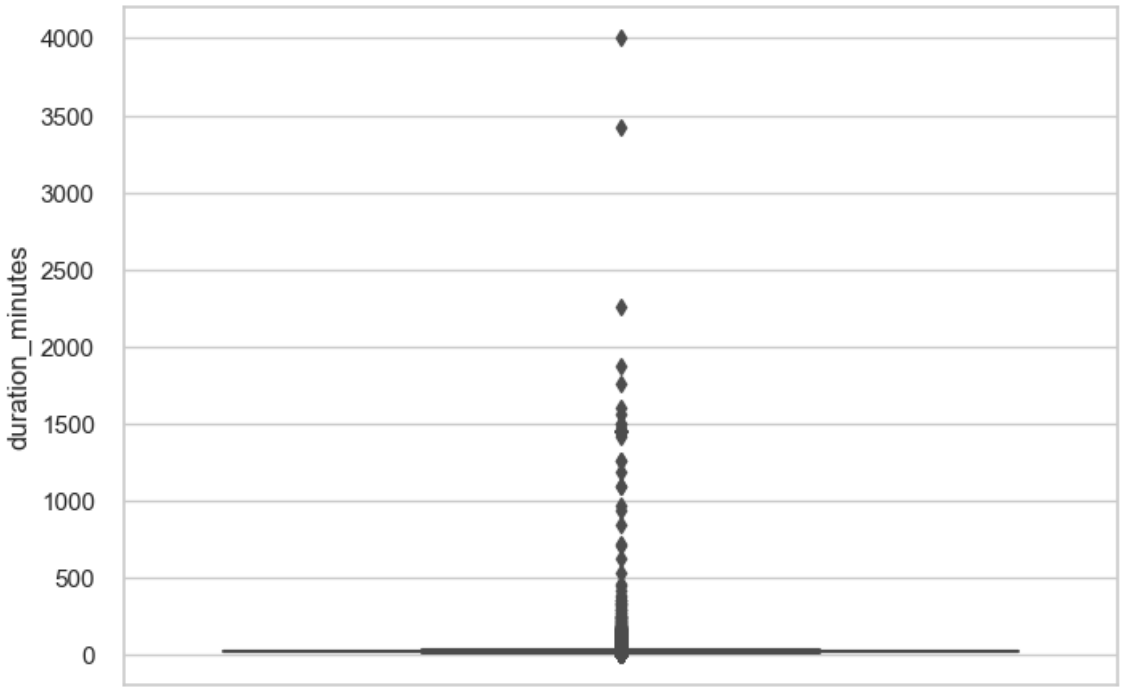
```
c = np.cumsum(h)
plt.plot(c,label='Cumulative distribution of time duration')
plt.grid()
plt.legend()
plt.show()
```





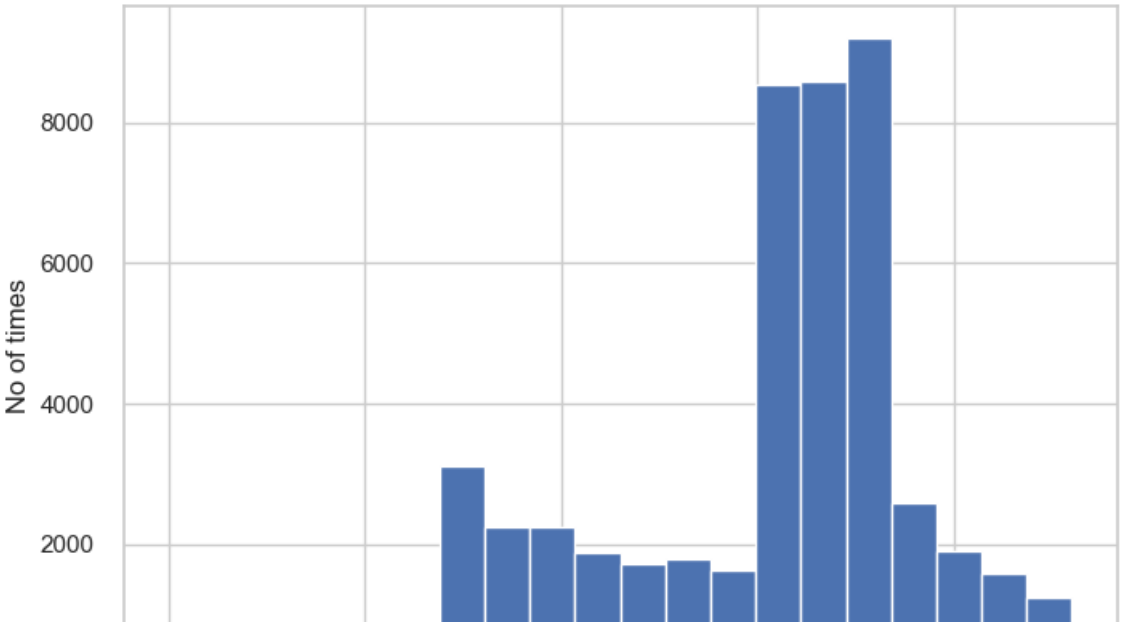

In [67]:

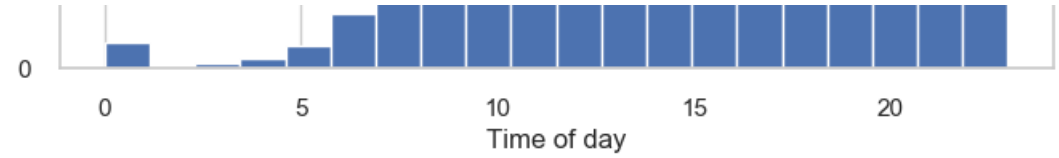
```
import seaborn as sns
sns.set(style="whitegrid")

ax = sns.boxplot(x=data["duration_minutes"],orient="v")
```




In [69]:

```
x = data["hour"]
plt.hist(x, bins=20)
plt.ylabel('No of times ')
plt.xlabel("Time of day")
plt.show()
```



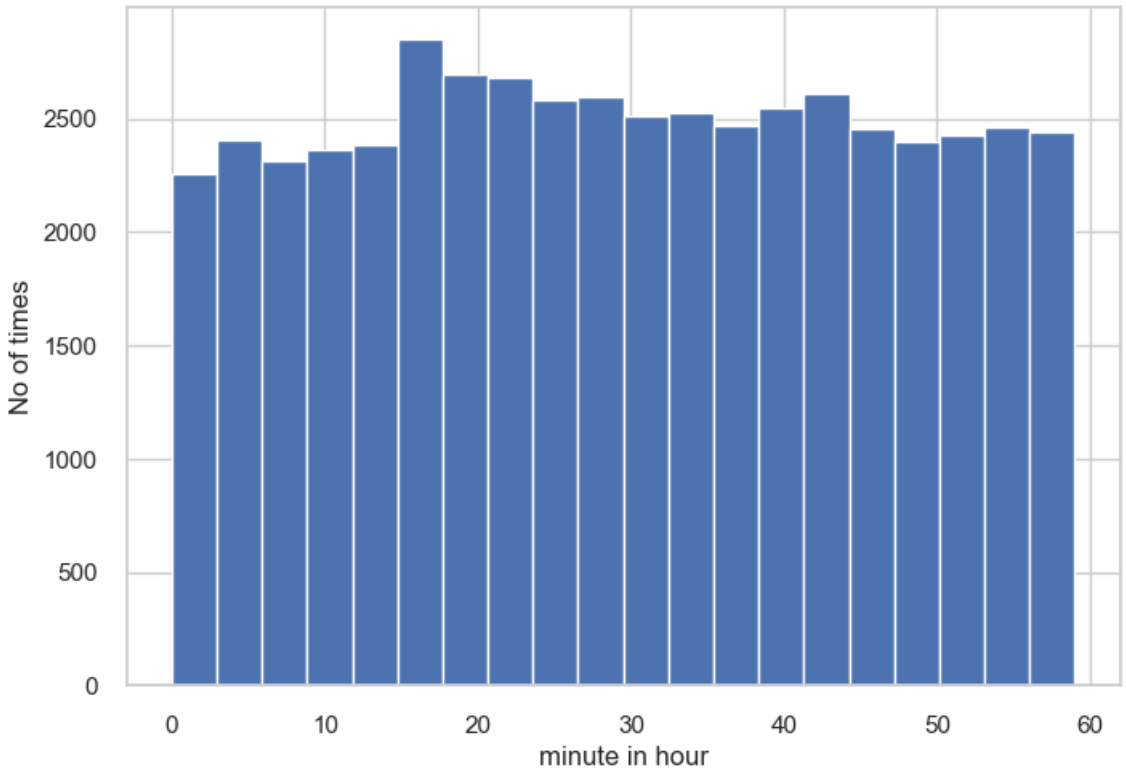



# observation

- Maximum traffic occurs in the hours of 16:00-18:00

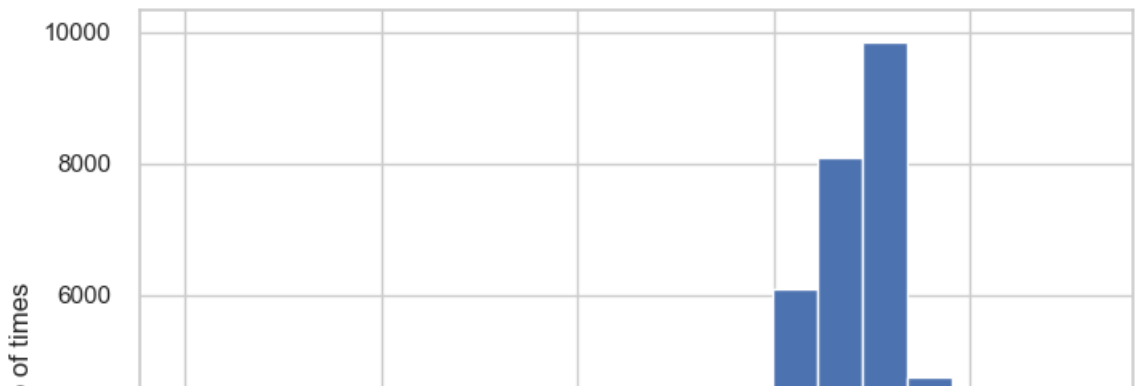
In [72]:

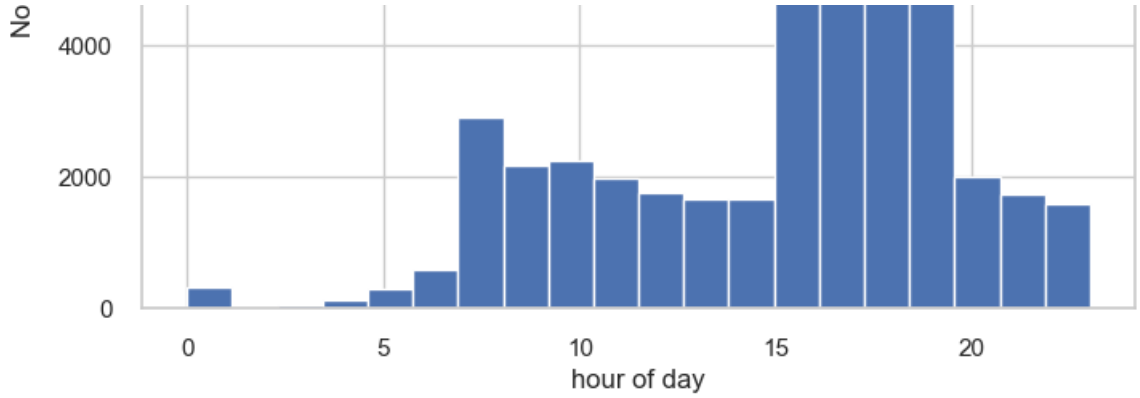
```
x_minute=data["minute"]
plt.hist(x_minute, bins=20)
plt.ylabel('No of times')
plt.xlabel('minute in hour')
plt.show()
```




In [73]:

```
x_end=data["end_hour"]
plt.hist(x_end, bins=20)
plt.ylabel('No of times')
plt.xlabel('hour of day')
plt.show()
```






In [74]:

```
group_time_start=data.groupby("hour")
group_time_start.first()
```

Out[74]:

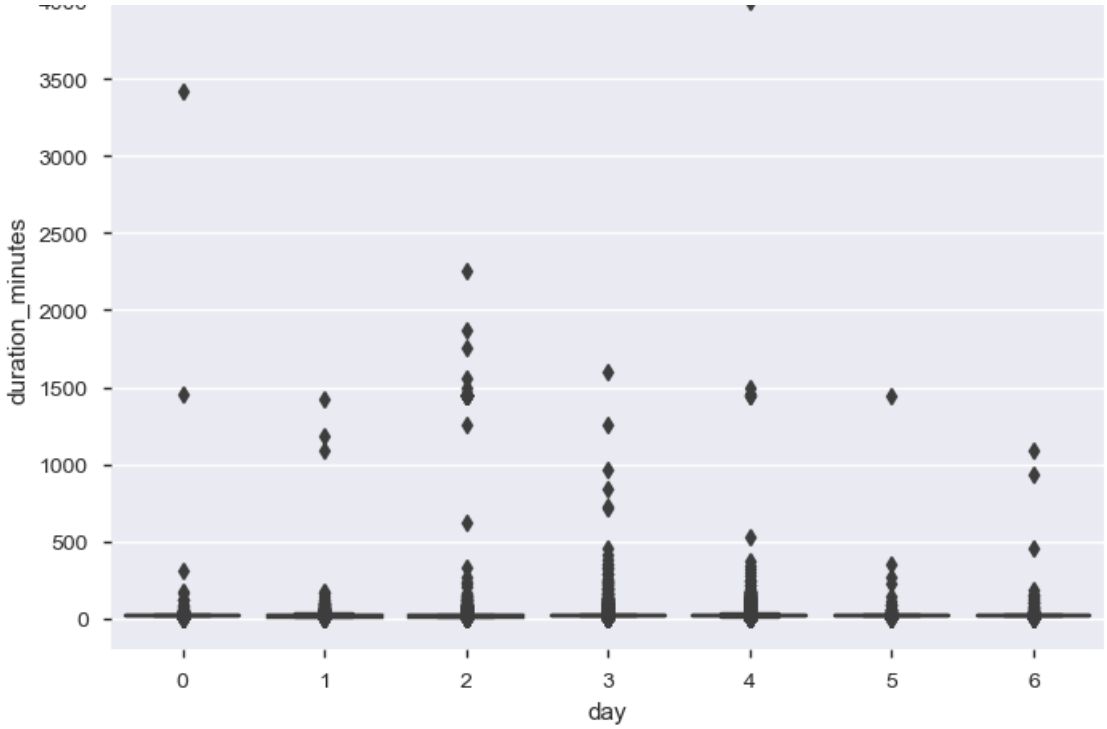
| hour | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | nasid | nasi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 31 | 4 | 1 | 2019-09-02 00:21:20.652516 | 2019-09-02 00:23:26.652516 | 148462 | 460374 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **1** | 13 | 4 | 1 | 2019-09-01 01:58:43.243091 | 2019-09-01 02:18:21.243091 | 749821 | 9778173 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **2** | 14 | 4 | 1 | 2019-09-01 02:18:28.454476 | 2019-09-01 09:54:58.454476 | 904710 | 6187965 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **3** | 37 | 4 | 1 | 2019-09-02 03:40:37.096921 | 2019-09-02 03:47:13.096921 | 72878 | 356971 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **4** | 40 | 4 | 1 | 2019-09-02 04:00:39.854469 | 2019-09-04 13:05:49.854469 | 7379520 | 136831655 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **5** | 98 | 4 | 1 | 2019-09-05 05:27:08.011236 | 2019-09-05 05:42:01.011236 | 80714 | 12053 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **6** | 161 | 4 | 1 | 2019-09-06 06:24:55.337842 | 2019-09-06 06:39:29.337842 | 4914 | 3237 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **7** | 100 | 4 | 1 | 2019-09-05 07:34:39.006828 | 2019-09-05 07:36:44.006828 | 0 | 0 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **8** | 101 | 4 | 1 | 2019-09-05 08:03:15.948019 | 2019-09-05 08:22:55.948019 | 4207 | 2496 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **9** | 168 | 4 | 1 | 2019-09-06 09:51:58.367447 | 2019-09-06 10:06:30.367447 | 951 | 1384 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| | | | | | | | | | | | | ERS- | |

| | sesno | actno | nasno | start | lastupd | bytesin | bytesout | state | closedt | closereason | ... | nasid | nasi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10 hour** | 15 | 4 | 1 | 2019-09-01 10:01:03.373392 | 2019-09-01 10:12:29.373392 | 70714 | 16349 | C | NaN | 6 | ... | BNG-R-T2-SR | 172.31.32.6 |
| **11** | 18 | 4 | 1 | 2019-09-01 11:49:36.151809 | 2019-09-01 12:04:31.151809 | 997167 | 5687037 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **12** | 19 | 4 | 1 | 2019-09-01 12:48:59.264159 | 2019-09-01 12:56:50.264159 | 233584 | 841735 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **13** | 21 | 4 | 1 | 2019-09-01 13:15:36.852458 | 2019-09-01 13:19:29.852458 | 124592 | 587388 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **14** | 47 | 4 | 1 | 2019-09-04 14:00:21.159309 | 2019-09-04 14:28:14.159309 | 117748247 | 833649462 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **15** | 23 | 4 | 1 | 2019-09-01 15:11:37.869632 | 2019-09-01 17:23:19.869632 | 285841 | 937645 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **16** | 57 | 4 | 1 | 2019-09-04 16:09:59.101119 | 2019-09-04 16:13:14.101119 | 0 | 0 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **17** | 24 | 4 | 1 | 2019-09-01 17:23:45.377603 | 2019-09-01 19:58:18.377603 | 1087078 | 85554114 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **18** | 1 | 4 | 1 | 2019-08-31 18:07:23.226076 | 2019-08-31 18:13:20.226076 | 323316 | 311381 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **19** | 9 | 4 | 1 | 2019-08-31 19:00:40.619193 | 2019-08-31 19:02:29.619193 | 59023 | 40130 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **20** | 11 | 4 | 1 | 2019-08-31 20:03:40.838944 | 2019-08-31 20:04:31.838944 | 10443 | 4887 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **21** | 26 | 4 | 1 | 2019-09-01 21:52:48.711587 | 2019-09-01 22:20:28.711587 | 354418 | 1477108 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **22** | 27 | 4 | 1 | 2019-09-01 22:20:46.867111 | 2019-09-01 22:21:48.867111 | 168976 | 599261 | C | NaN | 6 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |
| **23** | 95 | 4 | 1 | 2019-09-04 23:32:06.80028 | 2019-09-04 23:34:11.80028 | 0 | 0 | C | NaN | 4 | ... | ERS-J480-BNG-R-T2-SR | 172.31.32.6 |

24 rows × 45 columns

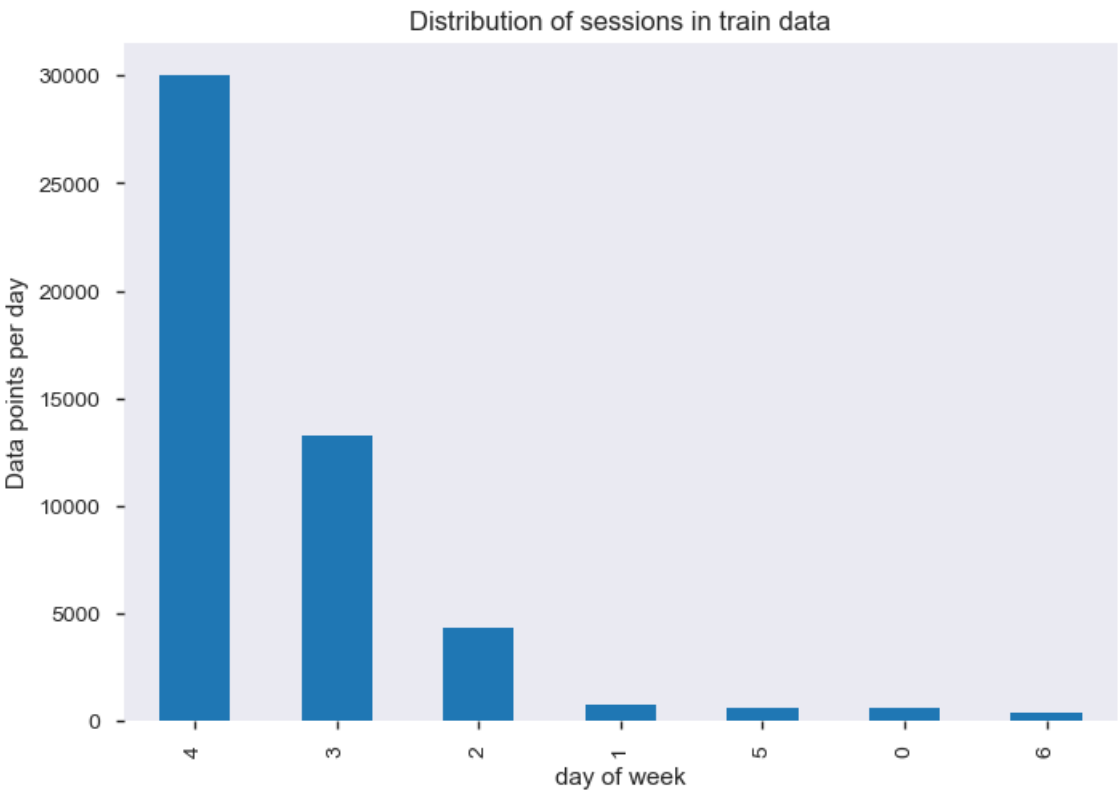
In [82]:

```
ax = sns.boxplot(x=data["day"], y=data["duration_minutes"], data=data)
```




In [86]:

```
# it returns a dict, keys as class labels and values as the number of data points in that class
train_class_distribution = data['day'].value_counts()
#test_class_distribution = test_df['Class'].value_counts().sortlevel()
#cv_class_distribution = cv_df['Class'].value_counts().sortlevel()

my_colors = 'rgbkymc'
train_class_distribution.plot(kind='bar')
plt.xlabel('day of week')
plt.ylabel('Data points per day')
plt.title('Distribution of sessions in train data')
plt.grid()
plt.show()
```

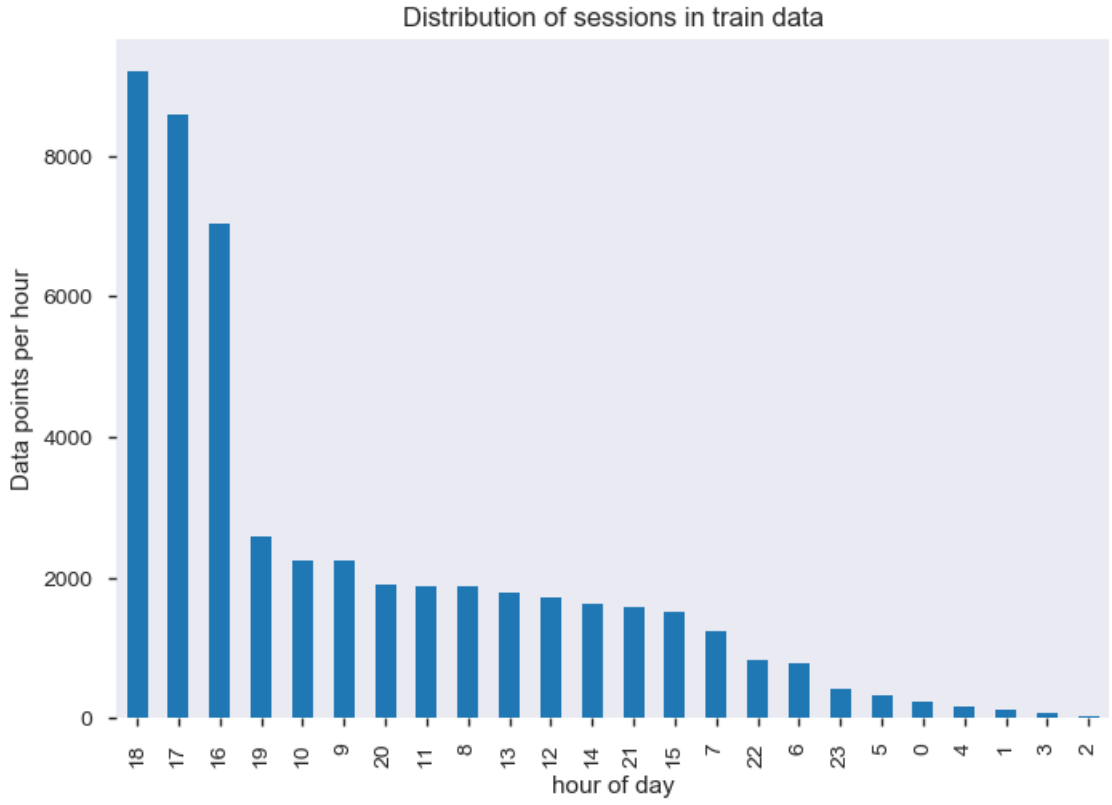


# summary

- Monday is day 0 and sunday is day 6.
- ## so friday is the day we have maximum traffic in the time period 19:17-20:12

In [87]:

```
# it returns a dict, keys as class labels and values as the number of data points in that class
train_class_distribution_hour = data['hour'].value_counts()
#test_class_distribution = test_df['Class'].value_counts().sortlevel()
#cv_class_distribution = cv_df['Class'].value_counts().sortlevel()

my_colors = 'rgbkymc'
train_class_distribution_hour.plot(kind='bar')
plt.xlabel('hour of day')
plt.ylabel('Data points per hour')
plt.title('Distribution of sessions in train data')
plt.grid()
plt.show()
```




In [ ]: