# Comcast Telecom Consumer Complaints

In [70]:
```
#Importing libraries

import pandas as pd
import numpy as np

#from sorted_months_weekdays import *
#from sort_dataframeby_monthorweek import *

from matplotlib import pyplot as plt
%matplotlib inline
import seaborn as sns

#import plotly.express as px
#import plotly.graph_objects as go
```

In [71]:
```
# reading data to data frame
df = pd.read_csv('Comcast_telecom_complaints_data.csv')
```

## Basic data check

In [72]:
```
df.shape
```

Out[72]:
```
(2224, 11)
```

In [73]:
```
df.dtypes
```

Out[73]:
```
Ticket #                        object
Customer Complaint              object
Date                            object
Date_month_year                 object
Time                            object
Received Via                    object
City                            object
State                           object
Zip code                         int64
Status                          object
Filing on Behalf of Someone     object
dtype: object
```

In [74]:
```
df.head()
#df.tail()
```

Out[74]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State | |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 250635 | Comcast Cable Internet Speeds | 22-04-15 | 22-Apr-15 | 3:53:50 PM | Customer Care Call | Abingdon | Maryland | 2 |
| **1** | 223441 | Payment disappear - service got disconnected | 04-08-15 | 04-Aug-15 | 10:22:56 AM | Internet | Acworth | Georgia | 3 |
| **2** | 242732 | Speed and Service | 18-04-15 | 18-Apr-15 | 9:55:47 AM | Internet | Acworth | Georgia | 3 |
| **3** | 277946 | Comcast Imposed a New Usage Cap of 300GB that ... | 05-07-15 | 05-Jul-15 | 11:59:35 AM | Internet | Acworth | Georgia | 3 |
| **4** | 307175 | Comcast not working and no service to boot | 26-05-15 | 26-May-15 | 1:25:26 PM | Internet | Acworth | Georgia | 3 |

In [75]:
```
#Checking duplicate rows based on all columns
dup_df = df[df.duplicated()]
dup_df
```

Out[75]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State | Zip code | Status | Filin Beha Some |
|---|---|---|---|---|---|---|---|---|---|---|---|

In [ ]:
```
# based on the results we see that thare are no duplicate row entrys ba
sed on all the columns
```

In [76]:
```
#checking missing values
df.isnull().sum()
```

Out[76]:
```
Ticket #                      0
Customer Complaint            0
Date                          0
Date_month_year               0
Time                          0
Received Via                  0
City                          0
State                         0
Zip code                      0
Status                        0
Filing on Behalf of Someone   0
dtype: int64
```

In [ ]:
```
# we see that there is no missing values in the data set.
```

In [77]:
```
df.describe(include='all')
```

Out[77]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State | |
|---|---|---|---|---|---|---|---|---|---|
| **count** | 2224 | 2224 | 2224 | 2224 | 2224 | 2224 | 2224 | 2224 | 2 |
| **unique** | 2224 | 1841 | 91 | 91 | 2190 | 2 | 928 | 43 | |
| **top** | 317911 | Comcast | 24-06-15 | 24-Jun-15 | 3:25:33 PM | Customer Care Call | Atlanta | Georgia | |
| **freq** | 1 | 83 | 218 | 218 | 2 | 1119 | 63 | 288 | |
| **mean** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 47 |
| **std** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 28 |
| **min** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 1 |
| **25%** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 30 |
| **50%** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 37 |
| **75%** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 77 |
| **max** | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | 99 |

## Observations 1:

- We have 2224 rows and 11 columns
- We see date and date_month_year and time are of type object and we may need to format it to correct data type for further analysis
- There are no duplicates records based on all columns
- There are no missing values in the given dataset

# to Analyze:

- Provide the trend chart for the number of complaints at monthly and daily granularity levels.
- Provide a table with the frequency of complaint types.
  - Which complaint types are maximum i.e., around internet, network issues, or across any other domains.
- Create a new categorical variable with value as Open and Closed. Open & Pending is to be categorized as Open and Closed & Solved is to be categorized as Closed.
- Provide state wise status of complaints in a stacked bar chart. Use the categorized variable from Q3. Provide insights on:
  - Which state has the maximum complaints
  - Which state has the highest percentage of unresolved complaints
- Provide the percentage of complaints resolved till date, which were received through the Internet and customer care calls.

## Data Preparation & Approach

Looking at the above set of details to analyse, we need to first prep the given data

- for checking the trend of number of complaint,s we need to format the given date and time data which is currently in string/object into correct datetime fromat so that we can apply datetime funcstions to the data to summarise or create plots correctly

- To find out the complaint types, we need to create a custom Complaint Types category based on the customer complaints
  - Since there is no complaint types or category provided, we can use pandas methods to find the key word frequency ( example, internet, billing, etc) using the Customer Complaints data to get the general sense on what type of issues/complaints are being reported
  - using these key word frequency, we can create a custome category of Coustomer complalints

- Using this newly created Complaint Types category we can create afrequency table of complaint types

- We need to create a new Status Category column in the data frame using the Status column ( Open, Closed, Pending and solved , such that Open & Pending is to be categorized as Open and Closed & Solved is to be categorized as Closed.

- any additional helper columns can be added to the dataframe to help make analysis easy

## Formatting date and time

In [78]:
```
df_comcast=df.copy()
```

In [79]:
```
df_comcast.head()
```

Out[79]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State | |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 250635 | Comcast Cable Internet Speeds | 22-04-15 | 22-Apr-15 | 3:53:50 PM | Customer Care Call | Abingdon | Maryland | 2 |
| **1** | 223441 | Payment disappear - service got disconnected | 04-08-15 | 04-Aug-15 | 10:22:56 AM | Internet | Acworth | Georgia | 3 |
| **2** | 242732 | Speed and Service | 18-04-15 | 18-Apr-15 | 9:55:47 AM | Internet | Acworth | Georgia | 3 |
| **3** | 277946 | Comcast Imposed a New Usage Cap of 300GB that ... | 05-07-15 | 05-Jul-15 | 11:59:35 AM | Internet | Acworth | Georgia | 3 |
| **4** | 307175 | Comcast not working and no service to boot | 26-05-15 | 26-May-15 | 1:25:26 PM | Internet | Acworth | Georgia | 3 |

In [80]:
```
#sorting all data by col = Date          Date_month_year in ascending or
der of Date      Date_month_year
df_comcast.sort_values(by='Date_month_year',ascending=True,inplace=Tru
e)
df_comcast.head()
```

Out[80]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | S |
|---|---|---|---|---|---|---|---|---|
| **1416** | 218108 | Comcast Business Phone/Internet Contract Disag... | 04-04-15 | 04-Apr-15 | 6:39:55 PM | Internet | Newnan | Geo |
| **1483** | 217985 | bait and switch services for monetary gain | 04-04-15 | 04-Apr-15 | 4:07:36 PM | Internet | Orcutt | Califo |
| **584** | 217999 | Misleading information given | 04-04-15 | 04-Apr-15 | 4:21:46 PM | Internet | Des Moines | Washin |
| **561** | 218043 | comcast services | 04-04-15 | 04-Apr-15 | 5:32:05 PM | Internet | Denver | Colo |
| **1892** | 218168 | Multiple Unauthorized and Unwarranted Credit C... | 04-04-15 | 04-Apr-15 | 8:10:35 PM | Customer Care Call | Shoreview | Minne |

In [81]:
```
#combing date and Time and creating a new col
df_comcast['datetime']= df_comcast['Date']+' '+df_comcast['Time']
df_comcast.head()
```

Out[81]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | S |
|---|---|---|---|---|---|---|---|---|
| **1416** | 218108 | Comcast Business Phone/Internet Contract Disag... | 04-04-15 | 04-Apr-15 | 6:39:55 PM | Internet | Newnan | Geo |
| **1483** | 217985 | bait and switch services for monetary gain | 04-04-15 | 04-Apr-15 | 4:07:36 PM | Internet | Orcutt | Califo |
| **584** | 217999 | Misleading information given | 04-04-15 | 04-Apr-15 | 4:21:46 PM | Internet | Des Moines | Washin |
| **561** | 218043 | comcast services | 04-04-15 | 04-Apr-15 | 5:32:05 PM | Internet | Denver | Colo |
| **1892** | 218168 | Multiple Unauthorized and Unwarranted Credit C... | 04-04-15 | 04-Apr-15 | 8:10:35 PM | Customer Care Call | Shoreview | Minne |

In [82]:
```
df_comcast[['datetime']].info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2224 entries, 1416 to 464
Data columns (total 1 columns):
datetime    2224 non-null object
dtypes: object(1)
memory usage: 34.8+ KB
```

In [83]:
```
#Converting datetime which is in string/object format to datetime forma
t
df_comcast['datetime'] = pd.to_datetime(df_comcast['datetime'],format=
'%d-%m-%y %I:%M:%S %p')
df_comcast[['datetime']].info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2224 entries, 1416 to 464
Data columns (total 1 columns):
datetime    2224 non-null datetime64[ns]
dtypes: datetime64[ns](1)
memory usage: 34.8 KB
```

In [84]:
```
#checking that the datetime col is formatted correctly and applying dat
etie methods
df_comcast.loc[1416,'datetime'].day_name()
```

Out[84]:
```
'Saturday'
```

In [18]:
```
df_comcast.shape
```

Out[18]:
```
(2224, 12)
```

In [85]:
```
df_comcast.head(2)
```

Out[85]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State |
|---|---|---|---|---|---|---|---|---|
| **1416** | 218108 | Comcast Business Phone/Internet Contract Disag... | 04-04-15 | 04-Apr-15 | 6:39:55 PM | Internet | Newnan | Georgia |
| **1483** | 217985 | bait and switch services for monetary gain | 04-04-15 | 04-Apr-15 | 4:07:36 PM | Internet | Orcutt | California |

In [ ]:
```
# sorting the dataframe by date in ascending order
```

In [86]:
```
df_comcast.sort_values('datetime',inplace=True)
df_comcast.head()
```

Out[86]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | |
|---|---|---|---|---|---|---|---|---|
| **1852** | 211255 | Comcast harassment | 04-01-15 | 04-Jan-15 | 12:18:47 AM | Customer Care Call | Schaumburg | |
| **1160** | 211472 | comcast cable | 04-01-15 | 04-Jan-15 | 10:43:20 AM | Customer Care Call | Lockport | |
| **1430** | 211478 | Comcast | 04-01-15 | 04-Jan-15 | 10:47:35 AM | Internet | North Huntingdon | Pennsy |
| **2144** | 211677 | Comcast refusal of service | 04-01-15 | 04-Jan-15 | 12:01:06 PM | Customer Care Call | Wayne | Pennsy |
| **1237** | 211775 | Horrible Service | 04-01-15 | 04-Jan-15 | 12:28:58 PM | Customer Care Call | Mckeesport | Pennsy |

In [63]:
```
# now that we have created a col with correct datetime format, we can c
reate additional columns for Year, Month and date
# using the pandas datetime methods
```

In [25]:
```
#df_comcast.drop(['date'],axis=1,inplace=True)
#df_comcast.head(2)
```

In [87]:
```
#df_comcast['Year'] = pd.DatetimeIndex(df_comcast['datetime']).year
#df_comcast['Month'] = pd.DatetimeIndex(df_comcast['datetime']).month
#df_comcast['date'] = pd.DatetimeIndex(df_comcast['datetime']).date

df_comcast['Year'] = df_comcast['datetime'].dt.strftime('%Y')
df_comcast['Month'] = df_comcast['datetime'].dt.strftime('%b')
df_comcast['date']=df_comcast['datetime'].dt.strftime('%d-%b-%Y')

# convert this date to correct date format
df_comcast['date'] = pd.to_datetime(df_comcast['date'])
```

In [27]:
```
df_comcast.head(2)
```

Out[27]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State |
|---|---|---|---|---|---|---|---|---|
| **1852** | 211255 | Comcast harassment | 04-01-15 | 04-Jan-15 | 12:18:47 AM | Customer Care Call | Schaumburg | Illinois |
| **1160** | 211472 | comcast cable | 04-01-15 | 04-Jan-15 | 10:43:20 AM | Customer Care Call | Lockport | Illinois |

In [88]:
```
df_comcast[['date']].info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2224 entries, 1852 to 441
Data columns (total 1 columns):
date    2224 non-null datetime64[ns]
dtypes: datetime64[ns](1)
memory usage: 34.8 KB
```

In [ ]:
```
# adding helper column for count of tickets for aggregagtion
```

In [89]:
```
df_comcast['Ticket_count']=1
df_comcast.head(2)
```

Out[89]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | State |
|---|---|---|---|---|---|---|---|---|
| **1852** | 211255 | Comcast harassment | 04-01-15 | 04-Jan-15 | 12:18:47 AM | Customer Care Call | Schaumburg | Illinois |
| **1160** | 211472 | comcast cable | 04-01-15 | 04-Jan-15 | 10:43:20 AM | Customer Care Call | Lockport | Illinois |

In [ ]:
```

```

## Q1.Provide the trend chart for the number of complaints at monthly and daily granularity levels.

In [61]:
```
# now that we have created a col with correct datetime format, we can u
se the col to plot the trend charts
```

In [90]:
```
monthly_tickets_df = df_comcast.groupby(['Month'])[['Ticket_count']].su
m().reset_index()
monthly_tickets_df.head()
monthly_tickets_df.tail()

# sorting the monthly_tickets_df in calendar months order
from sorted_months_weekdays import *
from sort_dataframeby_monthorweek import *
monthly_tickets_df=Sort_Dataframeby_Month(df=monthly_tickets_df,monthco
lumnname='Month')
monthly_tickets_df.head()
```

Out[90]:

| | Month | Ticket_count |
|---|---|---|
| **0** | Jan | 55 |
| **1** | Feb | 59 |
| **2** | Mar | 45 |
| **3** | Apr | 375 |
| **4** | May | 317 |

In [91]:
```
import matplotlib.pyplot as plt
%matplotlib inline
```

In [92]:
```
plt.figure(figsize=(10,5))
plt.plot(monthly_tickets_df['Month'],monthly_tickets_df['Ticket_count
'])
plt.xticks(rotation=90)
plt.margins(0.02)

plt.title('Customer Complaints by Month')
plt.xlabel('Months')
plt.ylabel('Complaints')
plt.show()
```


In [93]:
```
daily_tickets_df = df_comcast.groupby(['date'])[['Ticket_count']].sum
().reset_index()
daily_tickets_df.head()
daily_tickets_df.tail()
```

Out[93]:

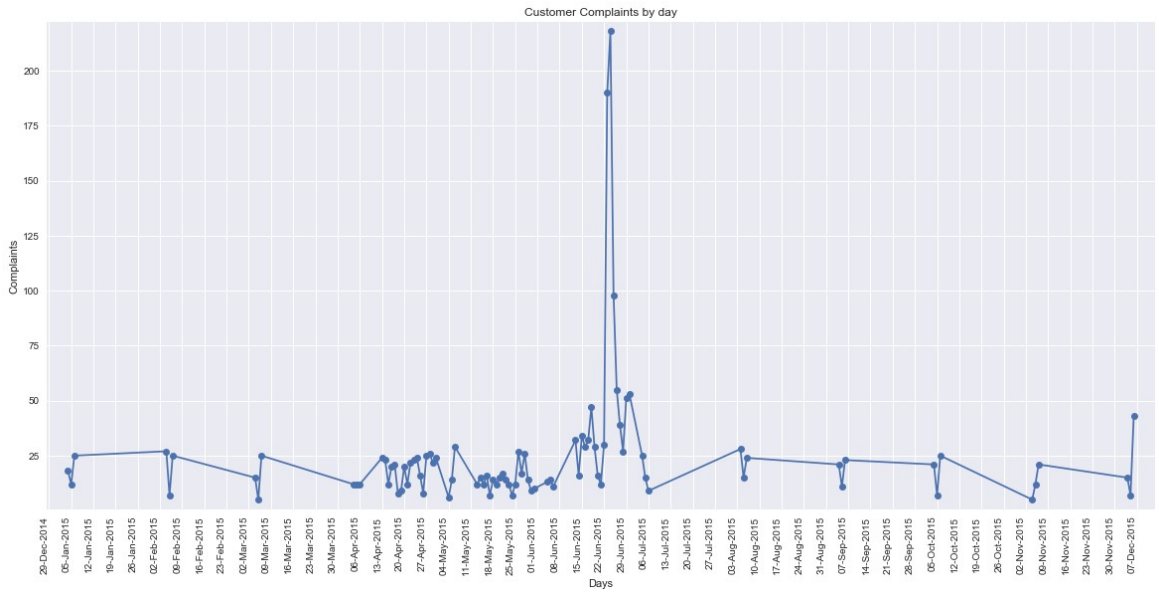
| | date | Ticket_count |
|---|---|---|
| **86** | 2015-11-05 | 12 |
| **87** | 2015-11-06 | 21 |
| **88** | 2015-12-04 | 15 |
| **89** | 2015-12-05 | 7 |
| **90** | 2015-12-06 | 43 |

In [94]:
```
from datetime import datetime, timedelta
from matplotlib import pyplot as plt
from matplotlib import dates as mpl_dates
plt.style.use('seaborn')
```

In [95]:
```
plt.figure(figsize=(20,10))
plt.plot_date(daily_tickets_df['date'], daily_tickets_df['Ticket_count
'], linestyle='solid')
plt.gcf().autofmt_xdate()
plt.gca().xaxis.set_major_formatter(mpl_dates.DateFormatter('%d-%b-%Y
'))
plt.gca().xaxis.set_major_locator(mpl_dates.DayLocator(interval=7))
plt.xticks(rotation=90)
plt.margins(0.02)

plt.title('Customer Complaints by day')
plt.xlabel('Days')
plt.ylabel('Complaints')

plt.show()
```




In [213]:
```
# using plotly charts to get the full view of the complainst by date
```

In [96]:
```
import plotly.express as px
import plotly.graph_objects as go
```

In [97]:
```
fig = px.line(daily_tickets_df, x="date", y="Ticket_count", title='Cust
omer complaints by day')
fig.update_xaxes(ticklabelmode="period",tickangle = -45,tick0 = 0.5,dti
ck = 0,rangeslider_visible=True)
fig.show()
```

## Observations 2:

* By looking at the Monthly chart and daily trend of customer complains ti
ckets, we see a steep rise in the month of
  May, Jun and July,in the number of tickets
* we see that highest number of complaints tickets are being handled in th
e month of June
* On June 24 2015, we have handled 218 complaints tickets, highest compare
d to any other days in the year
* We need to do further analysis to check why there is a sudden raise of t
ickets, especially in Jun

In [226]:
```
# Lets check number of tickets by status
```

In [98]:
```
df_comcast['Status'].value_counts()
```

Out[98]:
```
Solved     973
Closed     734
Open       363
Pending    154
Name: Status, dtype: int64
```

In [99]:
```
monthly_tickets_status_df = df_comcast.groupby(['Month','Status'])[['Ti
cket_count']].sum().reset_index()
monthly_tickets_status_df.head()
monthly_tickets_status_df.tail()

# sorting the monthly_tickets_df in calendar months order
from sorted_months_weekdays import *
from sort_dataframeby_monthorweek import *
monthly_tickets_status_df=Sort_Dataframeby_Month(df=monthly_tickets_sta
tus_df,monthcolumnname='Month')
monthly_tickets_status_df.head()
```

Out[99]:

| | Month | Status | Ticket_count |
|---|---|---|---|
| **0** | Jan | Closed | 39 |
| **1** | Jan | Open | 5 |
| **2** | Jan | Solved | 11 |
| **3** | Feb | Closed | 46 |
| **4** | Feb | Open | 4 |

In [408]:
```
df1=monthly_tickets_status_df[monthly_tickets_status_df['Status']=='Closed']
df2=monthly_tickets_status_df[monthly_tickets_status_df['Status']=='Open']
df3=monthly_tickets_status_df[monthly_tickets_status_df['Status']=='Solved']
df4=monthly_tickets_status_df[monthly_tickets_status_df['Status']=='Pending']

plt.figure(figsize=(15,5))
plt.plot(df1['Month'], df1['Ticket_count'],label='Closed')
plt.plot(df2['Month'], df2['Ticket_count'],label='Open')
plt.plot(df3['Month'], df3['Ticket_count'],label='Solved')
plt.plot(df4['Month'], df4['Ticket_count'],label='Pending')
plt.legend()

plt.title('Customer complaints by Month & Status')
plt.xlabel('Months')
plt.ylabel('Complaints')

plt.show()
```


In [ ]:
```
```

In [410]:
```
#fig = px.line(monthly_tickets_status_df, x="Month", y="Ticket_count", color='Status',
               #title='Customer complaints by Month & Status')
#fig.update_xaxes(tickangle = -45)
#fig.show()
```

## Observations 3:

* We can see that in the month of Jun, we received most number of ticekts and also most of the tickets were solved
* this kind of explains the spkie of tickets being handled in Jun
* It will be interesting to how was the trend of tickets handled by status month on month

In [233]:
```
# Creating a table with the monthly_tickets_status_df
```

In [191]:
```
#groupng a df by Month and status
df_status = df_comcast.groupby(['Month','Status'])['Ticket_count'].sum
().unstack().fillna(0)
df_status.reset_index(inplace=True)


# sorting the mont column in correct month order
from sorted_months_weekdays import *
from sort_dataframeby_monthorweek import *
df_status=Sort_Dataframeby_Month(df=df_status,monthcolumnname='Month')

# cacluation to see total open ticekts % and Closed tickets % by month
df_status['Closed+Solved'] = df_status['Closed'] + df_status['Solved']
df_status['Open+pending'] = df_status['Open'] + df_status['Pending']
df_status['Total'] = df_status['Closed+Solved']  + df_status['Open+pen
ding']
df_status['Open_pct'] = df_status['Open+pending']/df_status['Total']
df_status['Closed_pct'] = df_status['Closed+Solved']/df_status['Total
']

#def highlightvalue(s):
    #if s.Open_pct > 0.10:
        #return ['background-color: yellow']*10
    #else:
        #return ['background-color: white']*10

#df_status=df_status.style.apply(highlightvalue, axis=1)

#df_status[['Open%']].style.applymap(lambda x: 'background-color : yel
low' if x>0.10 else '')
# formating the Open% and Closed %columns to display the values in %
#df_status['Open_pct'] = df_status[['Open_pct']].applymap(lambda x:
"{0:.2f}%".format(x*100))
#df_status['Closed_pct'] = df_status[['Closed_pct']].applymap(lambda
x: "{0:.2f}%".format(x*100))

def color_negative_red(value):
  """
  Colors elements in a dateframe
  green if positive and red if
  negative. Does not color NaN
  values.
  """

  if value > 0.10:
    color = 'red'
  else:
    color = 'black'

  return 'color: %s' % color
df_status=df_status.style.applymap(color_negative_red, subset=['Open_p
ct']).format({'Open_pct': "{:.2%}",'Closed_pct': "{:.2%}"})

df_status
```

Out[191]:

| | Month | Closed | Open | Pending | Solved | Closed+Solved | Open+pending | Total | Open_pct |
|---|---|---|---|---|---|---|---|---|---|
| **0** | Jan | 39 | 5 | 0 | 11 | 50 | 5 | 55 | 9.09% |
| **1** | Feb | 46 | 4 | 0 | 9 | 55 | 4 | 59 | 6.78% |
| **2** | Mar | 24 | 7 | 0 | 14 | 38 | 7 | 45 | 15.56% |
| **3** | Apr | 348 | 10 | 0 | 17 | 365 | 10 | 375 | 2.67% |
| **4** | May | 47 | 63 | 26 | 181 | 228 | 89 | 317 | 28.08% |
| **5** | Jun | 74 | 249 | 127 | 596 | 670 | 376 | 1046 | 35.95% |
| **6** | Jul | 31 | 6 | 0 | 12 | 43 | 6 | 49 | 12.24% |
| **7** | Aug | 40 | 4 | 0 | 23 | 63 | 4 | 67 | 5.97% |
| **8** | Sep | 28 | 5 | 0 | 22 | 50 | 5 | 55 | 9.09% |
| **9** | Oct | 25 | 3 | 0 | 25 | 50 | 3 | 53 | 5.66% |
| **10** | Nov | 10 | 2 | 0 | 26 | 36 | 2 | 38 | 5.26% |
| **11** | Dec | 22 | 5 | 1 | 37 | 59 | 6 | 65 | 9.23% |

### Observations 4:

- It appears that, there has been sudden jump in the customer complaints in may and jun
- mar, may, jul, and jul we seem to have highest open tickets compared to any other months

## Q2 - Provide a table with the frequency of complaint types.

- Which complaint types are maximum i.e., around internet, network issues, or across any other domains.

In [202]:
```
df_comcast_Complaints =df_comcast.groupby('Customer Complaint')[['Ticket_count']].sum().sort_values(by='Ticket_count',ascending=False)
df_comcast_Complaints.head(10)
```

Out[202]:

| Customer Complaint | Ticket_count |
|---|---|
| **Comcast** | 83 |
| **Comcast Internet** | 18 |
| **Comcast Data Cap** | 17 |
| **comcast** | 13 |
| **Comcast Billing** | 11 |
| **Comcast Data Caps** | 11 |
| **Data Caps** | 11 |
| **Unfair Billing Practices** | 9 |
| **Comcast data cap** | 8 |
| **Comcast data caps** | 8 |

Creating a frequency of complaints using the Customer Complaints column, doe snot give us much infromation

- firstly these Customer complaints provided are the full complaints information and not a category of complaints to demonstrate which type of Customer complaints are more than other.
- secondly, we do not have a pre defined Complaint Types to group these list of Customer complaints

To find out the complaint types, we need to create a custom Complaint Types category based on the customer complaints

Since there is no complaint types or category provided, we can use pandas methods to find the key word frequency ( example, internet, billing, etc) using the Customer Complaints data to get the general sense on what type of issues/complaints are being reported using these key word frequency, we can create a customer category of Customer complaints

In [204]:
```
# finding the frequency of the words appear in the Customer Complaints Column and visualing using wordcloud
```

In [210]:
```
from wordcloud import WordCloud, STOPWORDS
```

In [212]:
```
# converting the Custome Complaints col to list
complaints_list= df_comcast['Customer Complaint']

# capitalizing every word i the list
new_complaints_list=[]
for complaints in complaints_list:
    new_complaints_list.append(complaints.title())


#Creeating final list of words by removing undwated words
words = new_complaints_list
words = set(words)
stopwords = ['Comcast','And','To','For','My','Comcast','The','Of','Not
','With']
stopwords = set(stopwords)
final_Complaint_list = words - stopwords
final_Complaint_list = list(final_Complaint_list)
```

In [213]:
```
from collections import Counter
word_could_dict=Counter(final_Complaint_list)
wordcloud = WordCloud(width = 1000, height = 500).generate_from_freque
ncies(word_could_dict)

plt.figure(figsize=(15,8))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```


In [214]:
```
# from the word cloud we could see that Internet and Billing seems to
be more prominent types of issues
# we can explore more to see if there are any other group or types
```

In [ ]:
```

```

In [217]:
```
complaints = df_comcast['Customer Complaint'].str.split(expand=True).stack().value_counts()
complaints.head(50)
```

Out[217]:
```
Comcast        1031
Internet        317
and             269
service         251
internet        182
to              175
for             173
Billing         156
Service         153
Data            151
of              111
billing         111
comcast          90
my               75
not              75
with             72
Cap              63
speed            63
data             63
on               56
-                53
Unfair           48
me               47
in               47
Speed            47
customer         45
a                45
Caps             44
is               44
Xfinity          43
Practices        43
issues           43
bill             43
Issues           40
by               40
the              39
speeds           39
Complaint        39
I                38
Customer         38
no               37
from             37
cap              37
charges          36
services         35
COMCAST          35
Throttling       33
&                32
caps             31
Slow             30
dtype: int64
```

**looking at the word cloud and the details of complaints, we can probably create a Complaint Type category under**

• Internet # issues related to internet connectivity, speed, network • Billing # issues related to Billing, charges, etc • Data # issues related to data, data cap, etc • Service # customer service issues • Others # others This is just a best guess and map Complaint type category based on the frequency of words being found in the Customer Complaints details

In [218]:
```
# creating an additional column to df_comcast with Complaint_Types
```

In [238]:
```
masks = [df_comcast['Customer Complaint'].str.lower().str.contains('in
ternet'),
    df_comcast['Customer Complaint'].str.lower().str.contains('speed
'),
    df_comcast['Customer Complaint'].str.lower().str.contains('connect
ion'),
    df_comcast['Customer Complaint'].str.lower().str.contains('billing
'),
    df_comcast['Customer Complaint'].str.lower().str.contains('bil'),
    df_comcast['Customer Complaint'].str.lower().str.contains('fee'),
    df_comcast['Customer Complaint'].str.lower().str.contains('charge
'),
    df_comcast['Customer Complaint'].str.lower().str.contains('pric'),
    df_comcast['Customer Complaint'].str.lower().str.contains('data'),
    df_comcast['Customer Complaint'].str.lower().str.contains('cap'),
    df_comcast['Customer Complaint'].str.lower().str.contains('service
'),

]

values = [
    'Internet',
    'Internet',
    'Internet',
    'Billing',
    'Billing',
    'Billing',
    'Billing',
    'Billing',
    'Data',
    'Data',
    'Service'

]

import numpy as np

df_comcast['Complaint_Types'] = np.select(masks, values, default='Othe
rs')
```

In [239]:
```
df_comcast.head()
```

Out[239]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | |
|---|---|---|---|---|---|---|---|---|
| **1852** | 211255 | Comcast harassment | 04-01-15 | 04-Jan-15 | 12:18:47 AM | Customer Care Call | Schaumburg | |
| **1160** | 211472 | comcast cable | 04-01-15 | 04-Jan-15 | 10:43:20 AM | Customer Care Call | Lockport | |
| **1430** | 211478 | Comcast | 04-01-15 | 04-Jan-15 | 10:47:35 AM | Internet | North Huntingdon | Pennsy |
| **2144** | 211677 | Comcast refusal of service | 04-01-15 | 04-Jan-15 | 12:01:06 PM | Customer Care Call | Wayne | Pennsy |
| **1237** | 211775 | Horrible Service | 04-01-15 | 04-Jan-15 | 12:28:58 PM | Customer Care Call | Mckeesport | Pennsy |

In [240]:
```
#creating a table with the frequency of the newly created complaint Types
df_comcast.groupby(['Complaint_Types'])[['Ticket_count']].sum().sort_values(by='Ticket_count', ascending=False)
```

Out[240]:

| Complaint_Types | Ticket_count |
|---|---|
| **Internet** | 636 |
| **Others** | 612 |
| **Billing** | 542 |
| **Service** | 239 |
| **Data** | 195 |

- as per the data we can say that Internet, Billing and others are the three areas where we can see most of the complaints being recorded
- We can probably look more deeper into these complaints to understand more on the issues

# Q3. Create a new categorical variable with value as Open and Closed. Open & Pending is to be categorized as Open and Closed & Solved is to be categorized as Closed.

In [243]:
```
conditions= [df_comcast['Status']=='Closed',df_comcast['Status']=='Solved',
             df_comcast['Status']=='Open',df_comcast['Status']=='Pending']

values=['Closed','Closed','Open','Open']

df_comcast['Ticket_Status'] = np.select(conditions,values)
df_comcast.head()
```

Out[243]:

| | Ticket # | Customer Complaint | Date | Date_month_year | Time | Received Via | City | |
|---|---|---|---|---|---|---|---|---|
| **1852** | 211255 | Comcast harassment | 04-01-15 | 04-Jan-15 | 12:18:47 AM | Customer Care Call | Schaumburg | |
| **1160** | 211472 | comcast cable | 04-01-15 | 04-Jan-15 | 10:43:20 AM | Customer Care Call | Lockport | |
| **1430** | 211478 | Comcast | 04-01-15 | 04-Jan-15 | 10:47:35 AM | Internet | North Huntingdon | Pennsy |
| **2144** | 211677 | Comcast refusal of service | 04-01-15 | 04-Jan-15 | 12:01:06 PM | Customer Care Call | Wayne | Pennsy |
| **1237** | 211775 | Horrible Service | 04-01-15 | 04-Jan-15 | 12:28:58 PM | Customer Care Call | Mckeesport | Pennsy |

# Q4. Provide state wise status of complaints in a stacked bar chart. Use the categorized variable from Q3. Provide insights on:

Which state has the maximum complaints

Which state has the highest percentage of unresolved complaints

In [244]:
```
df_state=df_comcast.groupby(['State','Ticket_Status'])[['Ticket #']].count().reset_index()
df_state.head()
```

Out[244]:

| | State | Ticket_Status | Ticket # |
|---|---|---|---|
| **0** | Alabama | Closed | 17 |
| **1** | Alabama | Open | 9 |
| **2** | Arizona | Closed | 14 |
| **3** | Arizona | Open | 6 |
| **4** | Arkansas | Closed | 6 |

In [250]:
```
#plt.figure(figsize=(15,5))
#plt.bar(x=df_state[df_state['Ticket_Status']=='Closed']['State'],heig
ht=df_state[df_state['Ticket_Status']=='Closed']['Ticket #'],label ='C
losed')
#plt.bar(x=df_state[df_state['Ticket_Status']=='Open']['State'],height
=df_state[df_state['Ticket_Status']=='Open']['Ticket #'],label ='Open
')
#plt.title('State wise status of complaints')
#plt.xlabel('State')
#plt.ylabel('# of Customer complaints')
#plt.xticks(rotation=90)
#plt.legend()
#plt.show()
```

In [251]:
```
fig = px.bar(df_state, x="State", y='Ticket #', color="Ticket_Status",
title="state wise status of complaints")
fig.show()
```

### Which state has the maximum complaints

- from the above bar chart it is clear that Georgia has the Maxinum number of complaints

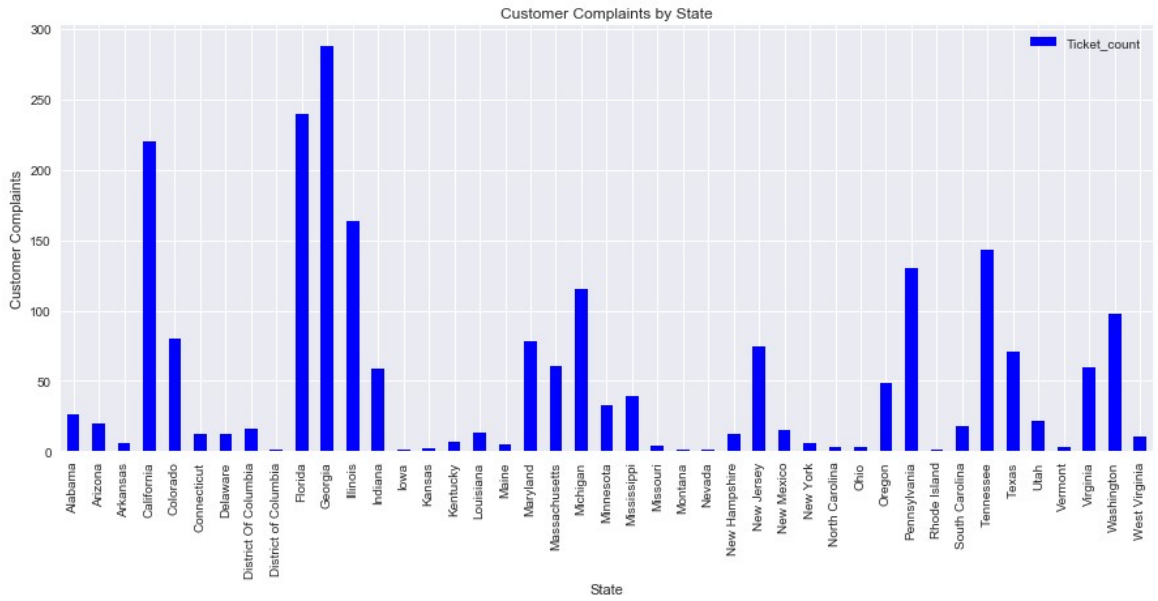
In [270]:
```
#State Group
df_state_grp = df_comcast.groupby(['State'])[['Ticket_count']].sum()
df_state_grp.loc[df_state_grp['Ticket_count']== df_state_grp['Ticket_count'].max()]
```

Out[270]:

| State | Ticket_count |
|---|---|
| Georgia | 288 |

In [ ]:
```
df_state_grp.loc[df_state_grp['Ticket count']== df_state_grp['Ticket count'].max()]
```

In [271]:
```
ax=df_state_grp.plot(kind='bar',figsize=(15,6),rot=90,color='b',width=0.5)
plt.title('Customer Complaints by State')
plt.ylabel('Customer Complaints')
plt.show()
```




### Which state has the highest percentage of unresolved complaints

In [285]:
```
df_Open = df_comcast.groupby(['State','Ticket_Status'])['Ticket_count
'].sum().unstack().fillna(0)
df_Open['Open%']=df_Open['Open']/df_Open['Open'].sum()
df_Open.sort_values(by='Open%',ascending=False).head(3)
```

Out[285]:

| Ticket_Status | Closed | Open | Open% |
|---|---|---|---|
| State | | | |
| **Georgia** | 208.0 | 80.0 | 0.154739 |
| **California** | 159.0 | 61.0 | 0.117988 |
| **Tennessee** | 96.0 | 47.0 | 0.090909 |

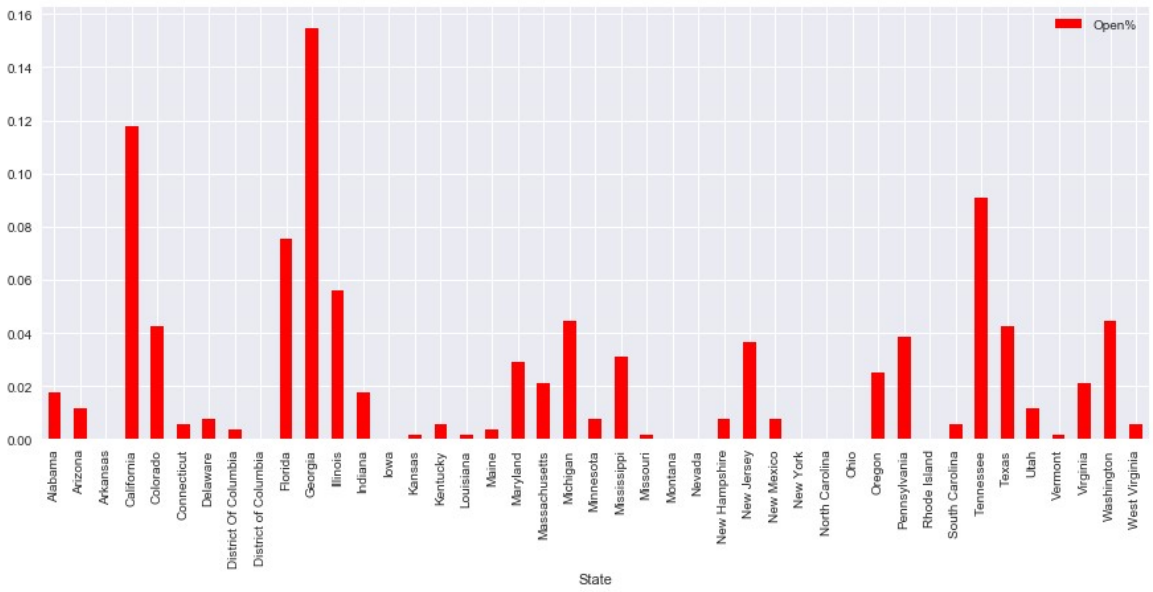
In [378]:
```
df_Open.loc[df_Open['Open%']== df_Open['Open%'].max()].style.format({'
Open%': "{:.2%}"})
```

Out[378]:

| Ticket_Status | Closed | Open | Open% |
|---|---|---|---|
| State | | | |
| **Georgia** | 208 | 80 | 15.47% |

In [284]:
```
df_Open.plot.bar(y='Open%',figsize=(15,6), color='red')
```

Out[284]: <matplotlib.axes._subplots.AxesSubplot at 0x12c321a3518>




# Provide the percentage of complaints resolved till date, which were received through the Internet and customer care calls.

In [365]:
```
df_resolved =df_comcast.groupby(['Ticket_Status','Received Via'])['Tic
ket_count'].sum().unstack().fillna(0)
df_resolved['Total']=df_resolved['Customer Care Call'] +df_resolved['I
nternet']
#df_resolved['Closed%'] = df_resolved['Closed']/df_resolved['Total']
df_resolved
#df_resolved.style.format({'Closed%': "{:.2%}"})
```

Out[365]:

| Received Via | Customer Care Call | Internet | Total |
|---|---|---|---|
| **Ticket_Status** | | | |
| **Closed** | 864 | 843 | 1707 |
| **Open** | 255 | 262 | 517 |

In [366]:
```
df_resolved.loc['Grand Total'] = df_resolved.sum()
df_resolved
```

Out[366]:

| Received Via | Customer Care Call | Internet | Total |
|---|---|---|---|
| **Ticket_Status** | | | |
| **Closed** | 864 | 843 | 1707 |
| **Open** | 255 | 262 | 517 |
| **Grand Total** | 1119 | 1105 | 2224 |

In [370]:
```
df_resolved_pct = df_resolved.div(df_resolved['Total'][-1]).mul(100).r
ound(2).astype(str) + '%'
df_resolved_pct
```

Out[370]:

| Received Via | Customer Care Call | Internet | Total |
|---|---|---|---|
| **Ticket_Status** | | | |
| **Closed** | 38.85% | 37.9% | 76.75% |
| **Open** | 11.47% | 11.78% | 23.25% |
| **Grand Total** | 50.31% | 49.69% | 100.0% |

In [371]:
```
# approximately 77% of the tickets were closed till date and out of wh
ich
# 39% is from Customer care call and 38% is via Internet
```

**#**

In [ ]:
```

```