WhaleCo Streaming Analysis

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Data Cleaning and Data Preprocessing

In [1]:
```
#Importing required libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [88]:
```
members_df=pd.read_excel(r"C:\Users\ARPITA SINGH\Desktop\WhaleCo_Members_CS.xlsx",sheet_name='Customers') #reading the d
```

In [89]:
```
members_df
```

Out[89]:

	customer_id	Address	State	zip_code	first_name	last_name	email	Occupation	found_salary	internal_rank	sub_date
0	WhaleCo509770	798, Cedar Crossing, Walnutridge Road	WA	56026	Evelyn	Diaz	ediaz@whaleco.com	Journalist	45000	Bronze_Member	2024-02-15
1	WhaleCo744205	34, Chestnut Glen, Oak Grove	PA	62065	Mason	White	mwhite@whaleco.com	Event Planner	45000	Bronze_Member	2024-01-28
2	WhaleCo332440	915, Sycamore Road, Maple Lane	KY	12617	Eleanor	Williams	ewilliams@whaleco.com	Construction Worker	55000	Bronze_Member	2023-11-02
3	WhaleCo792248	463, Elm Crossing, Cherry Lane	IL	78245	Sofia	White	swhite@whaleco.com	Automotive Technician	55000	Bronze_Member	2023-02-11
4	WhaleCo841154	916, Parkside Boulevard, Dogwoodvale Street	VA	54556	Charlotte	Mitchell	cmitchell@whaleco.com	Photographer	45000	Bronze_Member	2023-09-26
...	...	...	...	...	...	...	...	...	...	...	...
5995	WhaleCo643188	532, Pine Street, Magnolia Street	VA	49274	Emily	Andrade	eandrade@whaleco.com	Pharmacist	55000	Bronze_Member	2023-12-26
5996	WhaleCo938206	55, Pine View, Walnutridge Road	AL	68487	Alexander	Burgos	aburgos@whaleco.com	Public Relations Specialist	100000	Silver_Member	2023-08-12
5997	WhaleCo565380	513, Hawthornhill Lane, Juniper Avenue	IA	24228	Jacob	Rodriguez	jrodriguez@whaleco.com	Public Relations Specialist	45000	Bronze_Member	2023-09-29
5998	WhaleCo112059	266, Pinecrest Place, Birch Circle	VT	32665	Leah	White	lwhite@whaleco.com	Social Worker	45000	Bronze_Member	2023-08-26
5999	WhaleCo677079	624, Ashwood Street, Chestnuthill Drive	WY	78912	Lily	Davis	ldavis@whaleco.com	Environmental Scientist	65000	Bronze_Member	2023-07-23

6000 rows × 15 columns

In [90]:
```
members_df.info()#information of dataset
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6000 entries, 0 to 5999
Data columns (total 15 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   customer_id    6000 non-null   object
 1   Address        6000 non-null   object
 2   State          6000 non-null   object
 3   zip_code       6000 non-null   int64
 4   first_name     6000 non-null   object
 5   last_name      6000 non-null   object
 6   email          6000 non-null   object
 7   Occupation     6000 non-null   object
 8   found_salary   6000 non-null   int64
 9   internal_rank  6000 non-null   object
 10  sub_date       6000 non-null   datetime64[ns]
 11  unsub_date     388 non-null    object
 12  months_subbed  389 non-null    float64
 13  sub_unsub      5983 non-null   object
 14  active_months  5611 non-null   float64
dtypes: datetime64[ns](1), float64(2), int64(2), object(10)
memory usage: 703.2+ KB
```

In [91]:
```
members_df.shape #checking the shape of dataset
```

Out[91]:
```
(6000, 15)
```

In [92]:
```
members_df.columns #checking coulums of the dataset
```

Out[92]:
```
Index(['customer_id', 'Address', 'State', 'zip_code', 'first_name',
       'last_name', 'email', 'Occupation', 'found_salary', 'internal_rank',
       'sub_date', 'unsub_date', 'months_subbed', 'sub_unsub',
       'active_months'],
      dtype='object')
```

In [93]:
```
members_df=members_df.drop(columns=['Address','first_name','zip_code','last_name','email','sub_date','unsub_date','']) #
```

In [94]:
```
members_df.columns #refreshing the columns of dataset
```

Out[94]:
```
Index(['customer_id', 'State', 'Occupation', 'found_salary', 'internal_rank',
       'sub_unsub', 'active_months'],
      dtype='object')
```

In [95]:
```
members_df.isnull().sum()#checking the null values in dataset
```

Out[95]:
```
customer_id        0
State              0
Occupation         0
found_salary       0
internal_rank      0
sub_unsub         17
active_months    389
dtype: int64
```

In [96]:
```
members_df['sub_unsub'] = members_df['sub_unsub'].fillna('Not Available')# filling missing values with "Not Availabel"
members_df['active_months'].fillna(members_df['active_months'].median(), inplace=True) #handling the null value with imp
```

In [97]:
```
members_df.isnull().sum()
```

Out[97]:
```
customer_id      0
State            0
Occupation       0
found_salary     0
internal_rank    0
sub_unsub        0
active_months    0
dtype: int64
```

In [14]:
```
members_df.describe() #statistical summary of dataset
```

Out[14]:

	found_salary	active_months
count	6000.000000	6000.000000
mean	70132.500000	7.316000
std	28801.762689	4.215618
min	45000.000000	0.000000
25%	45000.000000	4.000000
50%	55000.000000	7.000000
75%	85000.000000	11.000000
max	140000.000000	15.000000

In [15]:
```
orders_df=pd.read_excel(r"C:\Users\ARPITA SINGH\Desktop\WhaleCo_Orders_CS.xlsx") #reading orders dataset
```

In [16]:
```
orders_df
```

Out[16]:

	customer_id	ord_number	product_name	Price	OSAT_Score	NPS_Score	streams_per_month	hours_viewed	internal_accounts
0	WhaleCo851582	Ord893028-987374	WhaleCo VIP	150.0	6.0	6.0	277.0	143.216667	5.0
1	WhaleCo468440	Ord658712-282253	WhaleCo Pay as you Go Package	5.0	6.0	8.0	130.0	34.983333	5.0
2	WhaleCo264909	Ord704267-830194	WhaleCo Extra	35.0	6.0	9.0	132.0	125.750000	2.0
3	WhaleCo440254	Ord475039-656499	WhaleCo Exclusive	10.0	6.0	6.0	253.0	130.050000	2.0
4	WhaleCo490763	Ord801385-680903	WhaleCo Prime	120.0	7.0	9.0	166.0	68.416667	1.0
...	...	...	...	...	...	...	...	...	...
49995	WhaleCo600508	Ord564863-474170	WhaleCo Pay as you Go Package	5.0	8.0	8.0	209.0	99.100000	3.0
49996	WhaleCo437918	Ord250141-235246	WhaleCo Prime	120.0	8.0	9.0	126.0	8.816667	2.0
49997	WhaleCo842958	Ord759441-960450	WhaleCo Hardwood Package (NBA)	65.0	7.0	6.0	118.0	27.516667	5.0
49998	WhaleCo597785	Ord946778-469758	WhaleCo Exclusive	10.0	6.0	6.0	15.0	111.433333	1.0
49999	WhaleCo215036	Ord122544-327981	WhaleCo Unlimited Streaming	200.0	8.0	9.0	61.0	24.366667	1.0

50000 rows × 9 columns

In [17]:
```
orders_df.info() #information of the data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50000 entries, 0 to 49999
Data columns (total 9 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   customer_id        50000 non-null  object 
 1   ord_number         50000 non-null  object 
 2   product_name       50000 non-null  object 
 3   Price              49960 non-null  float64
 4   OSAT_Score         49998 non-null  float64
 5   NPS_Score          49994 non-null  float64
 6   streams_per_month  49980 non-null  float64
 7   hours_viewed       49971 non-null  float64
 8   internal_accounts  49994 non-null  float64
dtypes: float64(6), object(3)
memory usage: 3.4+ MB
```

In [18]:
```
orders_df.shape #cheking the dataset shape
```

Out[18]:
```
(50000, 9)
```

In [19]:
```
orders_df.columns #colums of the dataset
```

Out[19]:
```
Index(['customer_id', 'ord_number', 'product_name', 'Price', 'OSAT_Score',
       'NPS_Score', 'streams_per_month', 'hours_viewed', 'internal_accounts'],
      dtype='object')
```

In [20]:
```
orders_df.isnull().sum() #checking null value in the data
```

Out[20]:
```
customer_id           0
ord_number            0
product_name          0
Price                40
OSAT_Score            2
NPS_Score             6
streams_per_month    20
hours_viewed         29
internal_accounts     6
dtype: int64
```

In [21]:
```
orders_df['Price'].fillna(orders_df['Price'].median,inplace=True)#imputing median for missing values
orders_df['OSAT_Score'].fillna(orders_df['OSAT_Score'].mode,inplace=True)#imputing missing values with mode
orders_df['NPS_Score'].fillna(orders_df['NPS_Score'].mode,inplace=True)#imputing missing values with mode
orders_df['streams_per_month'].fillna(orders_df['streams_per_month'].mean,inplace=True)#imputing missing values with mea
orders_df['hours_viewed'].fillna(orders_df['hours_viewed'].mean,inplace=True)#imputing missing values with mean
orders_df['internal_accounts'].fillna(orders_df['internal_accounts'].mean,inplace=True)#imputing missing values with mea
```

In [22]:
```
orders_df.isnull().sum()
```
Out[22]:
```
customer_id          0
ord_number           0
product_name         0
Price                0
OSAT_Score           0
NPS_Score            0
streams_per_month    0
hours_viewed         0
internal_accounts    0
dtype: int64
```

In [23]:
```
orders_df.describe()
```
Out[23]:

	customer_id	ord_number	product_name	Price	OSAT_Score	NPS_Score	streams_per_month	hours_viewed	internal_a
count	50000	50000	50000	50000.0	50000.0	50000.0	50000.0	50000	
unique	5975	50000	23	22.0	5.0	5.0	301.0	13423	
top	WhaleCo131891	Ord893028-987374	WhaleCo Online Gaming Streaming Package	25.0	8.0	9.0	261.0	<bound method NDFrame._add_numeric_operations....	
freq	25	1	2247	4400.0	18503.0	18622.0	197.0	29	

In [26]:
```
packages_df=pd.read_excel(r"C:\Users\ARPITA SINGH\Desktop\WhaleCo_Orders_CS.xlsx",sheet_name='Packages') #reading packag
```

In [27]:
```
packages_df
```
Out[27]:

	product_name	Price	Index
0	WhaleCo Kids Premium Sub	25	1
1	WhaleCO 360 Office Premium	45	2
2	WhaleCo Babies & Tots Package	75	3
3	WhaleCo Prime	120	4
4	WhaleCo Plus	30	5
5	WhaleCo Unlimited Streaming	200	6
6	WhaleCo Now Unlimted Radio Package	20	7
7	WhaleCo Online Gaming Streaming Package	180	8
8	WhaleCo Premium StockMarket Watch Package	450	9
9	WhaleCo All-Access	300	10
10	WhaleCo Boost Cellular Plan & Internet	80	11
11	WhaleCo Pro College Student (Only) Package	40	12
12	WhaleCo Gold	95	13
13	WhaleCo Sunday Ticket (NFL)	115	14
14	WhaleCo VIP	150	15
15	WhaleCo Other Sports Package	55	16
16	WhaleCo Hardwood Package (NBA)	65	17
17	WhaleCo Outdoor & Adventure Advantage Package	100	18
18	WhaleCo Choice	25	19
19	WhaleCo Extra	35	20
20	WhaleCo Exclusive	10	21
21	WhaleCo First Tv Package (For K12 Students ONLY)	100	22
22	WhaleCo Pay as you Go Package	5	23

In [28]:
```
packages_df.info() #information about data
```
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 23 entries, 0 to 22
Data columns (total 3 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   product_name  23 non-null     object
 1   Price         23 non-null     int64 
 2   Index         23 non-null     int64 
dtypes: int64(2), object(1)
memory usage: 680.0+ bytes
```

In [29]:
```
packages_df.shape
```
Out[29]:
```
(23, 3)
```

In [30]:
```
packages_df.isnull().sum()
```
Out[30]:
```
product_name    0
Price           0
Index           0
dtype: int64
```

In [31]:
```
packages_df.describe()
```
Out[31]:

	Price	Index
count	23.000000	23.00000
mean	100.869565	12.00000
std	103.755089	6.78233
min	5.000000	1.00000
25%	32.500000	6.50000
50%	75.000000	12.00000
75%	117.500000	17.50000
max	450.000000	23.00000

Checking orders and packages columns to merge

In [32]:
```
packages_df.columns
```
Out[32]:
```
Index(['product_name', 'Price ', 'Index'], dtype='object')
```

In [33]:
```
orders_df.columns
```
Out[33]:
```
Index(['customer_id', 'ord_number', 'product_name', 'Price', 'OSAT_Score',
       'NPS_Score', 'streams_per_month', 'hours_viewed', 'internal_accounts'],
      dtype='object')
```

In [34]:
```
merged_df=pd.merge(orders_df,packages_df,on='product_name',how='left') #combining both orders and packages sheets as mer
```

In [35]:
```
merged_df
```
Out[35]:

	customer_id	ord_number	product_name	Price	OSAT_Score	NPS_Score	streams_per_month	hours_viewed	internal_accounts	Price	Index
0	WhaleCo851582	Ord893028-987374	WhaleCo VIP	150.0	6.0	6.0	277.0	143.216667	5.0	150.0	15.0
1	WhaleCo468440	Ord658712-282253	WhaleCo Pay as you Go Package	5.0	6.0	8.0	130.0	34.983333	5.0	5.0	23.0
2	WhaleCo264909	Ord704267-830194	WhaleCo Extra	35.0	6.0	9.0	132.0	125.75	2.0	35.0	20.0
3	WhaleCo440254	Ord475039-656499	WhaleCo Exclusive	10.0	6.0	6.0	253.0	130.05	2.0	10.0	21.0
4	WhaleCo490763	Ord801385-680903	WhaleCo Prime	120.0	7.0	9.0	166.0	68.416667	1.0	120.0	4.0
...	...	...	...	...	...	...	...	...	...	...	...
49995	WhaleCo600508	Ord564863-474170	WhaleCo Pay as you Go Package	5.0	8.0	8.0	209.0	99.1	3.0	5.0	23.0
49996	WhaleCo437918	Ord250141-235246	WhaleCo Prime	120.0	8.0	9.0	126.0	8.816667	2.0	120.0	4.0
49997	WhaleCo842958	Ord759441-960450	WhaleCo Hardwood Package (NBA)	65.0	7.0	6.0	118.0	27.516667	5.0	65.0	17.0
49998	WhaleCo597785	Ord946778-469758	WhaleCo Exclusive	10.0	6.0	6.0	15.0	111.433333	1.0	10.0	21.0
49999	WhaleCo215036	Ord122544-327981	WhaleCo Unlimited Streaming	200.0	8.0	9.0	61.0	24.366667	1.0	NaN	NaN

50000 rows × 11 columns

In [36]:
```
merged_df.shape
```
Out[36]:
```
(50000, 11)
```

In [37]:
```
merged_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 50000 entries, 0 to 49999
Data columns (total 11 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   customer_id        50000 non-null  object 
 1   ord_number         50000 non-null  object 
 2   product_name       50000 non-null  object 
 3   Price              50000 non-null  object 
 4   OSAT_Score         50000 non-null  object 
 5   NPS_Score          50000 non-null  object 
 6   streams_per_month  50000 non-null  object 
 7   hours_viewed       50000 non-null  object 
 8   internal_accounts  50000 non-null  object 
 9   Price              45684 non-null  float64
 10  Index              45684 non-null  float64
dtypes: float64(2), object(9)
memory usage: 4.6+ MB
```

In [39]:
```
merged_df.head(2)
```

Out[39]:

	customer_id	ord_number	product_name	OSAT_Score	NPS_Score	streams_per_month	hours_viewed	internal_accounts	Price	Index
0	WhaleCo851582	Ord893028-987374	WhaleCo VIP	6.0	6.0	277.0	143.216667	5.0	150.0	15.0
1	WhaleCo468440	Ord658712-282253	WhaleCo Pay as you Go Package	6.0	8.0	130.0	34.983333	5.0	5.0	23.0

In [40]:
```
merged_df.isnull().sum()
```

Out[40]:
```
customer_id             0
ord_number              0
product_name            0
OSAT_Score              0
NPS_Score               0
streams_per_month       0
hours_viewed            0
internal_accounts       0
Price                4316
Index                4316
dtype: int64
```

In [41]:
```
merged_df['Price '] = merged_df['Price '].fillna(merged_df['Price '].median()) #handlinh the null value in the data whil
merged_df['Index'] = merged_df['Index'].fillna(-1)
```

In [42]:
```
merged_df.isnull().sum()
```

Out[42]:
```
customer_id          0
ord_number           0
product_name         0
OSAT_Score           0
NPS_Score            0
streams_per_month    0
hours_viewed         0
internal_accounts    0
Price                0
Index                0
dtype: int64
```

Now for final merge checking merge_df column and member_df column

In [44]:
```
members_df.columns
```

Out[44]:
```
Index(['customer_id', 'State', 'Occupation', 'found_salary', 'internal_rank',
       'sub_unsub', 'active_months'],
      dtype='object')
```

In [45]:
```
merged_df.columns
```

Out[45]:
```
Index(['customer_id', 'ord_number', 'product_name', 'OSAT_Score', 'NPS_Score',
       'streams_per_month', 'hours_viewed', 'internal_accounts', 'Price ',
       'Index'],
      dtype='object')
```

In [46]:
```
merged_df.rename(columns={'Customer_id':'customer_id'},inplace=True)# renaming the Custormer_id with suitable feature
```

In [229]:
```
final_df=pd.merge(members_df,merged_df, on='customer_id', how='left') #combining final dataset with members and merged_d
```

In [230]:
```
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 50408 entries, 0 to 50407
Data columns (total 16 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   customer_id        50408 non-null  object
 1   State              50408 non-null  object
 2   Occupation         50408 non-null  object
 3   found_salary       50408 non-null  int64
 4   internal_rank      50408 non-null  object
 5   sub_unsub          50408 non-null  object
 6   active_months      50408 non-null  float64
 7   ord_number         50406 non-null  object
 8   product_name       50406 non-null  object
 9   OSAT_Score         50406 non-null  object
 10  NPS_Score          50406 non-null  object
 11  streams_per_month  50406 non-null  object
 12  hours_viewed       50406 non-null  object
 13  internal_accounts  50406 non-null  object
 14  Price              50406 non-null  float64
 15  Index              50406 non-null  float64
dtypes: float64(3), int64(1), object(12)
memory usage: 6.5+ MB
```

In [231]:
```
final_df.isnull().sum() #checking null value in the data
```

Out[231]:
```
customer_id          0
State                0
Occupation           0
found_salary         0
internal_rank        0
sub_unsub            0
active_months        0
ord_number           2
product_name         2
OSAT_Score           2
NPS_Score            2
streams_per_month    2
hours_viewed         2
internal_accounts    2
Price                2
Index                2
dtype: int64
```

In [232]:
```
final_df.dropna(inplace=True) #removing null value
```

In [233]:
```
final_df.isnull().sum()
```

Out[233]:
```
customer_id          0
State                0
Occupation           0
found_salary         0
internal_rank        0
sub_unsub            0
active_months        0
ord_number           0
product_name         0
OSAT_Score           0
NPS_Score            0
streams_per_month    0
hours_viewed         0
internal_accounts    0
Price                0
Index                0
dtype: int64
```

In [234]:
```
# Checking the number of unique values in each column
unique_values = final_df.nunique()
unique_values
```

Out[234]:
```
customer_id           5974
State                   50
Occupation              50
found_salary            10
internal_rank           10
sub_unsub                3
active_months           16
ord_number           49988
product_name            23
OSAT_Score               5
NPS_Score                5
streams_per_month      301
hours_viewed         13423
internal_accounts        8
Price                   19
Index                   22
dtype: int64
```

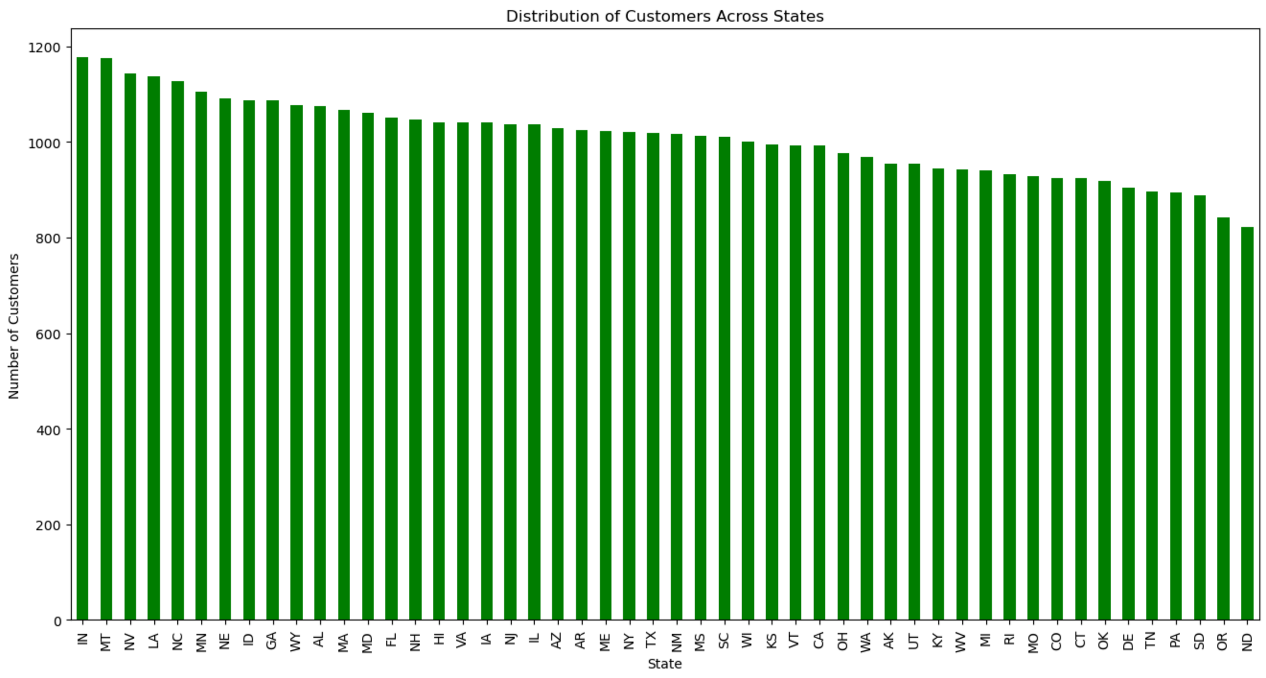
Now my data is validate and ready to analysis

EDA (Exploratory Data Analysis)

Task-1Customer Demographics

In [235]:
```
#Distribution of Customers Across States
plt.figure(figsize=(16,8))
final_df['State'].value_counts().plot(kind='bar', color='green')
plt.xlabel('State')
plt.ylabel('Number of Customers')
plt.title('Distribution of Customers Across States')

```

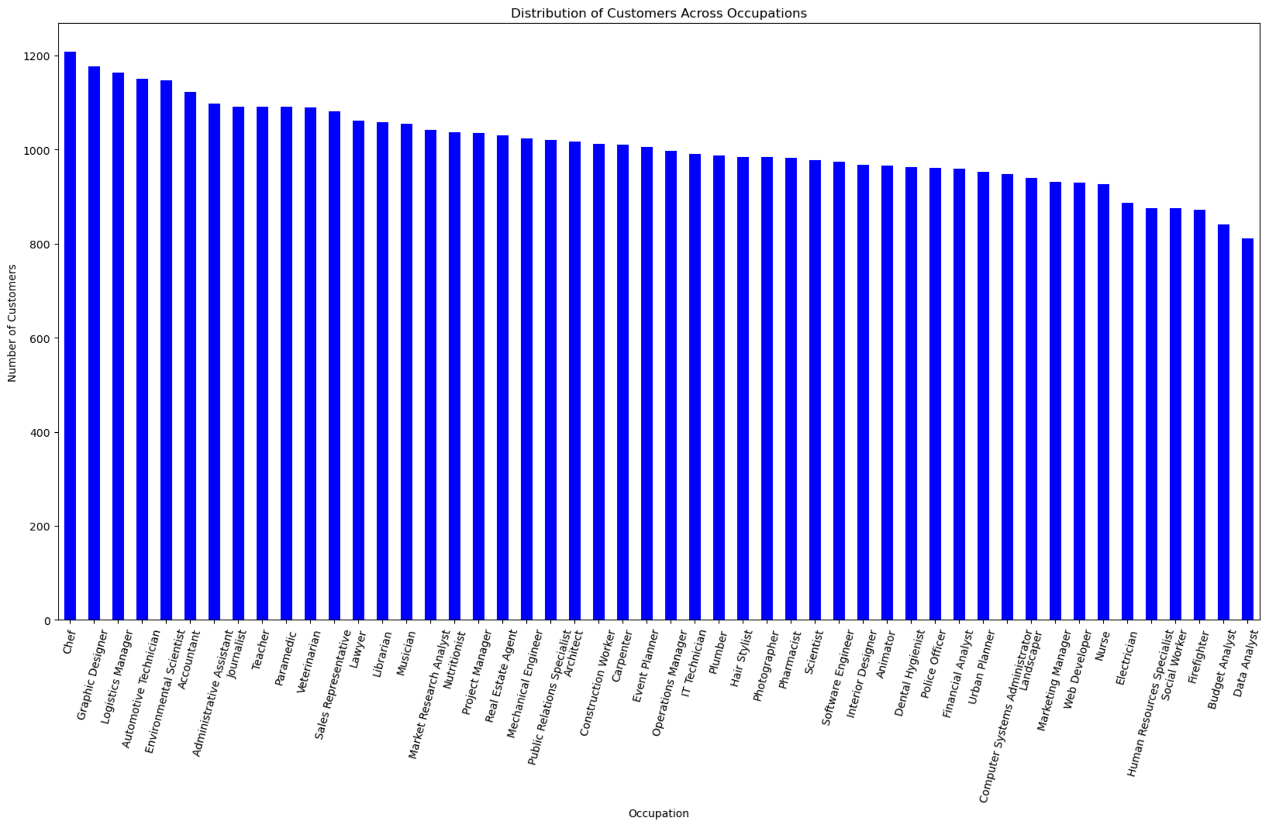
Out[235]:
```
Text(0.5, 1.0, 'Distribution of Customers Across States')
```



Observation:The bar chart shows the number of customers in each state. State IN, MT has the highest number of customers, followed by State LA and NC. States OR and ND have relatively fewer customers compared to other states.

In [293]:
```python
#Distribution of Customers Across Occupations
plt.figure(figsize=(20,10))
final_df['Occupation'].value_counts().plot(kind='bar', color='blue')
plt.xlabel('Occupation')
plt.ylabel('Number of Customers')
plt.title('Distribution of Customers Across Occupations')
plt.xticks(rotation=75)
```

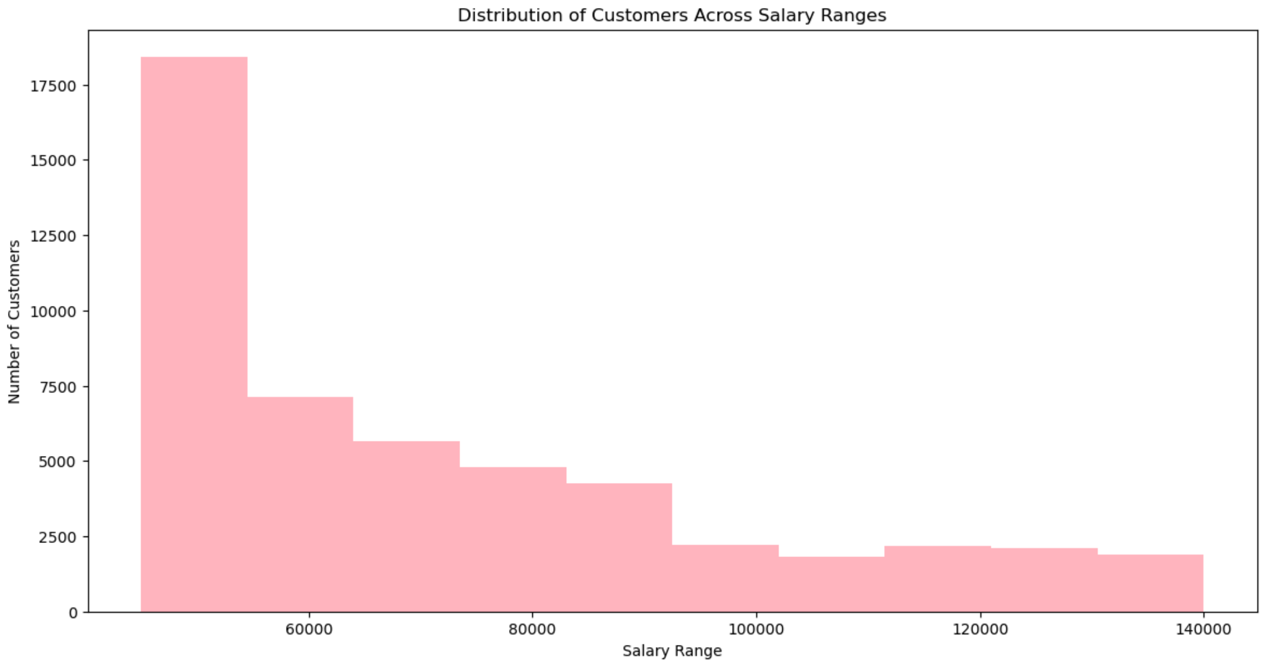
Out[293]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33,
        34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]),
 [Text(0, 0, 'Chef'),
  Text(1, 0, 'Graphic Designer'),
  Text(2, 0, 'Logistics Manager'),
  Text(3, 0, 'Automotive Technician'),
  Text(4, 0, 'Environmental Scientist'),
  Text(5, 0, 'Accountant'),
  Text(6, 0, 'Administrative Assistant'),
  Text(7, 0, 'Journalist'),
  Text(8, 0, 'Teacher'),
  Text(9, 0, 'Paramedic'),
  Text(10, 0, 'Veterinarian'),
  Text(11, 0, 'Sales Representative'),
  Text(12, 0, 'Lawyer'),
  Text(13, 0, 'Librarian'),
  Text(14, 0, 'Musician'),
  Text(15, 0, 'Market Research Analyst'),
  Text(16, 0, 'Nutritionist'),
  Text(17, 0, 'Project Manager'),
  Text(18, 0, 'Real Estate Agent'),
  Text(19, 0, 'Mechanical Engineer'),
  Text(20, 0, 'Public Relations Specialist'),
  Text(21, 0, 'Architect'),
  Text(22, 0, 'Construction Worker'),
  Text(23, 0, 'Carpenter'),
  Text(24, 0, 'Event Planner'),
  Text(25, 0, 'Operations Manager'),
  Text(26, 0, 'IT Technician'),
  Text(27, 0, 'Plumber'),
  Text(28, 0, 'Hair Stylist'),
  Text(29, 0, 'Photographer'),
  Text(30, 0, 'Pharmacist'),
  Text(31, 0, 'Scientist'),
  Text(32, 0, 'Software Engineer'),
  Text(33, 0, 'Interior Designer'),
  Text(34, 0, 'Animator'),
  Text(35, 0, 'Dental Hygienist'),
  Text(36, 0, 'Police Officer'),
  Text(37, 0, 'Financial Analyst'),
  Text(38, 0, 'Urban Planner'),
  Text(39, 0, 'Computer Systems Administrator'),
  Text(40, 0, 'Landscaper'),
  Text(41, 0, 'Marketing Manager'),
  Text(42, 0, 'Web Developer'),
  Text(43, 0, 'Nurse'),
  Text(44, 0, 'Electrician'),
  Text(45, 0, 'Human Resources Specialist'),
  Text(46, 0, 'Social Worker'),
  Text(47, 0, 'Firefighter'),
  Text(48, 0, 'Budget Analyst'),
  Text(49, 0, 'Data Analyst')])
```



Observation:The bar chart displays the number of customers in each occupation category. Occupation chef has the highest number of customers. Occupations Business analyst and data analyst have relatively fewer customers compared to other occupations

In [237]:
```python
#Distribution of Customers Across Salary Ranges
plt.figure(figsize=(14,7))
plt.hist(final_df['found_salary'], bins=10, color='lightpink')
plt.xlabel('Salary Range')
plt.ylabel('Number of Customers')
plt.title('Distribution of Customers Across Salary Ranges')
```

Out[237]:
```
Text(0.5, 1.0, 'Distribution of Customers Across Salary Ranges')
```

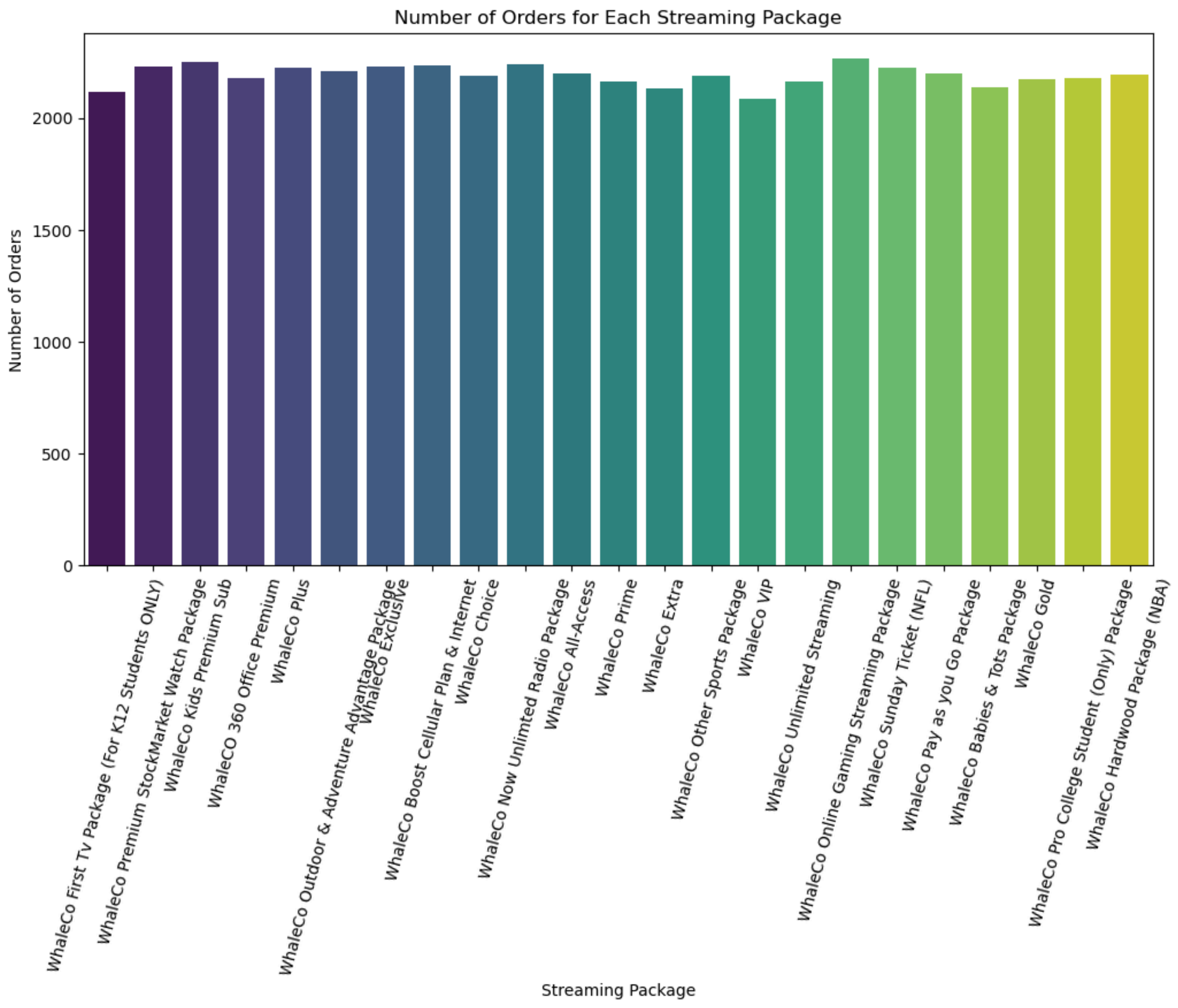


Observation:The histogram shows the distribution of customers based on their salary ranges. Most customers fall into the salary range of 60000. There are fewer customers in the higher salary ranges above 100000

Task-2. Product Performance

In [238]:
```
#Identify the Most Popular Streaming Packages
plt.figure(figsize=(12,6))
sns.countplot(x='product_name', data=final_df, palette='viridis')
plt.xlabel('Streaming Package')
plt.ylabel('Number of Orders')
plt.title('Number of Orders for Each Streaming Package')
plt.xticks(rotation=75)
```

Out[238]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22]),
 [Text(0, 0, 'WhaleCo First Tv Package (For K12 Students ONLY)'),
  Text(1, 0, 'WhaleCo Premium StockMarket Watch Package'),
  Text(2, 0, 'WhaleCo Kids Premium Sub'),
  Text(3, 0, 'WhaleCO 360 Office Premium'),
  Text(4, 0, 'WhaleCo Plus'),
  Text(5, 0, 'WhaleCo Outdoor & Adventure Advantage Package'),
  Text(6, 0, 'WhaleCo Exclusive'),
  Text(7, 0, 'WhaleCo Boost Cellular Plan & Internet'),
  Text(8, 0, 'WhaleCo Choice'),
  Text(9, 0, 'WhaleCo Now Unlimted Radio Package'),
  Text(10, 0, 'WhaleCo All-Access'),
  Text(11, 0, 'WhaleCo Prime'),
  Text(12, 0, 'WhaleCo Extra'),
  Text(13, 0, 'WhaleCo Other Sports Package'),
  Text(14, 0, 'WhaleCo VIP'),
  Text(15, 0, 'WhaleCo Unlimited Streaming'),
  Text(16, 0, 'WhaleCo Online Gaming Streaming Package'),
  Text(17, 0, 'WhaleCo Sunday Ticket (NFL)'),
  Text(18, 0, 'WhaleCo Pay as you Go Package'),
  Text(19, 0, 'WhaleCo Babies & Tots Package'),
  Text(20, 0, 'WhaleCo Gold'),
  Text(21, 0, 'WhaleCo Pro College Student (Only) Package'),
  Text(22, 0, 'WhaleCo Hardwood Package (NBA)')])
```

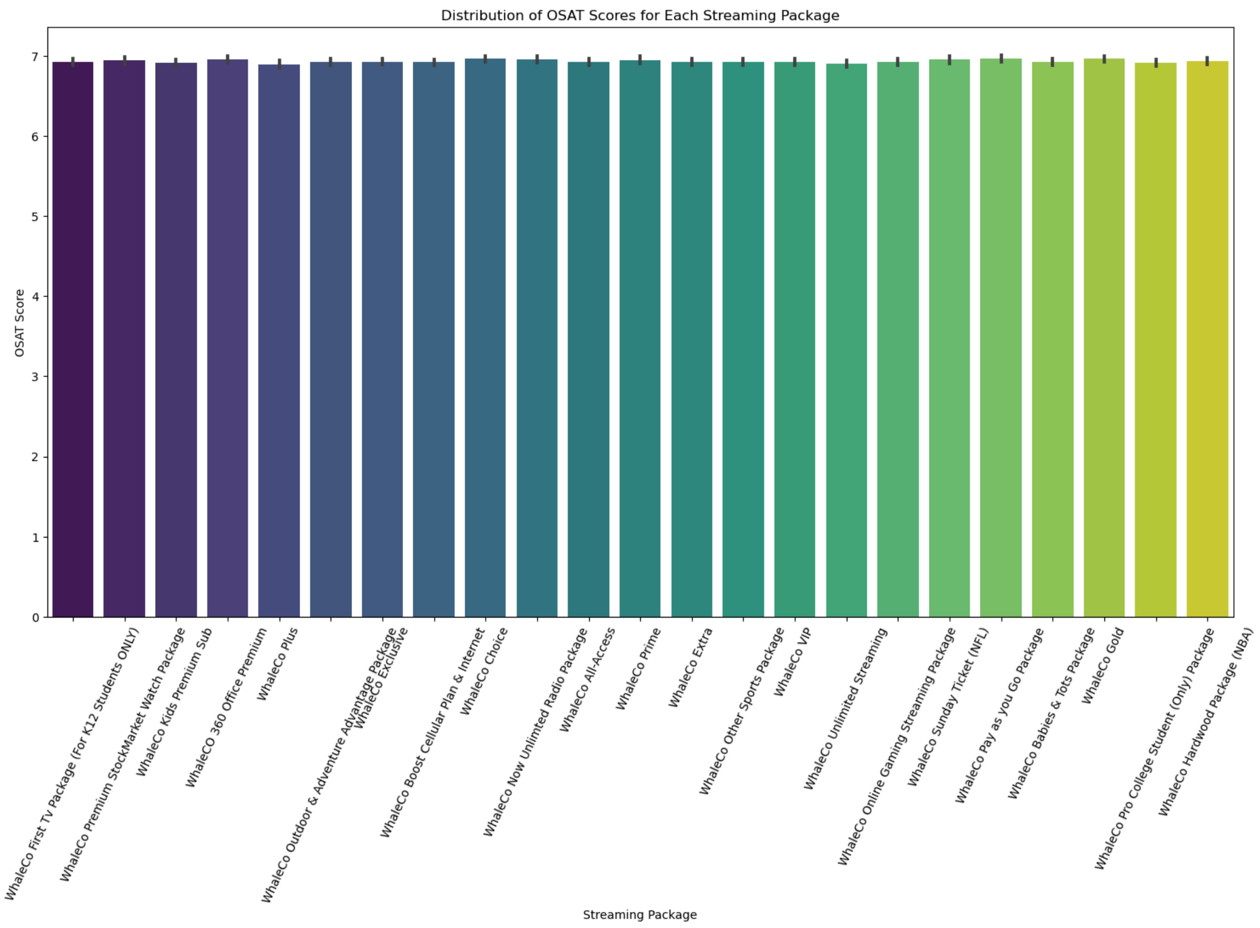


Observation: Most popular streaming packages is WhaleCo Unlimited Streaming

In [239]:
```
final_df['OSAT_Score'] = pd.to_numeric(final_df['OSAT_Score'], errors='coerce')#converting the datayape to numeric
final_df['NPS_Score']=pd.to_numeric(final_df['NPS_Score'],errors='coerce')
```

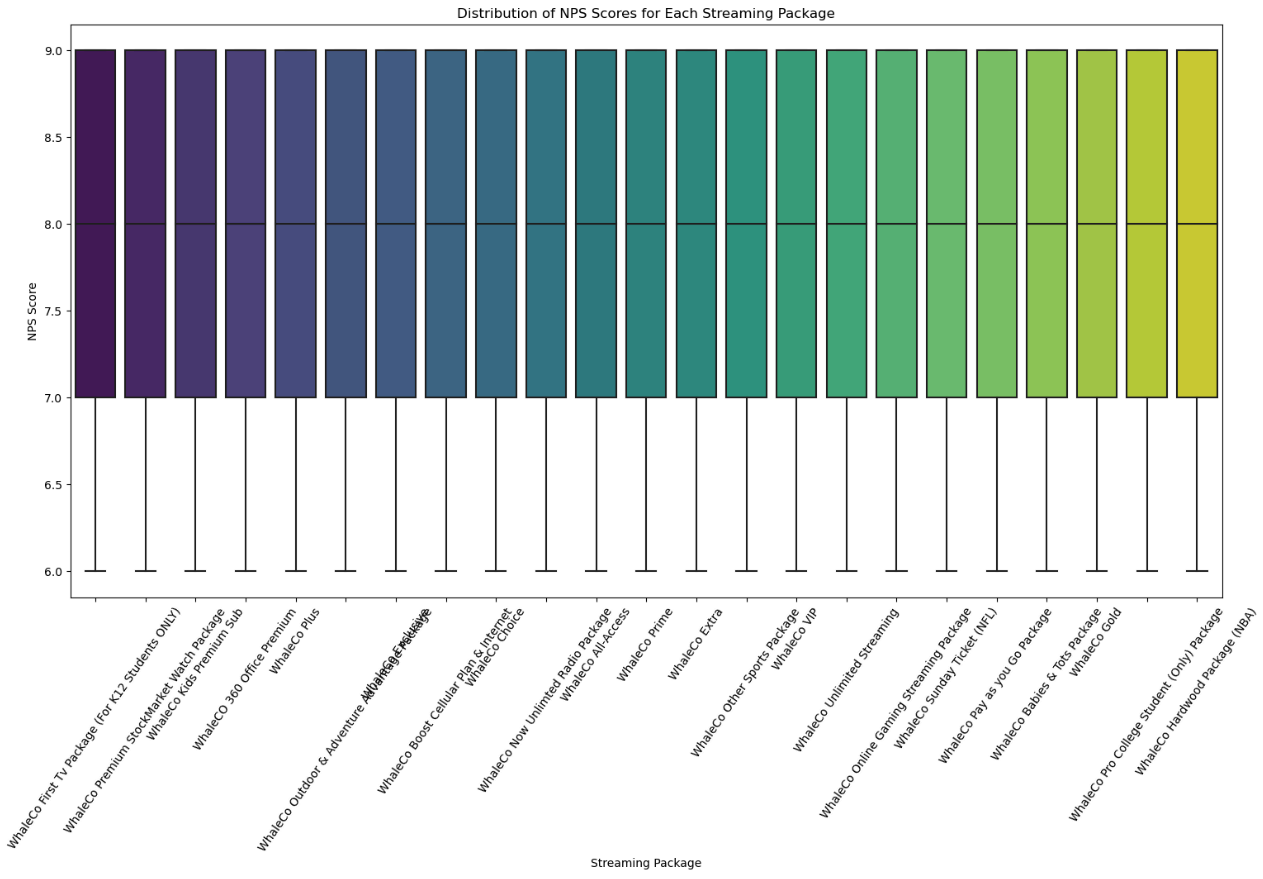
In [294]:
```
# Assess Customer Satisfaction Levels
plt.figure(figsize=(18,9))
sns.barplot(x='product_name', y='OSAT_Score', data=final_df, palette='viridis')
plt.xlabel('Streaming Package')
plt.ylabel('OSAT Score')
plt.title('Distribution of OSAT Scores for Each Streaming Package')
plt.xticks(rotation=65)
```

Out[294]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22]),
 [Text(0, 0, 'WhaleCo First Tv Package (For K12 Students ONLY)'),
  Text(1, 0, 'WhaleCo Premium StockMarket Watch Package'),
  Text(2, 0, 'WhaleCo Kids Premium Sub'),
  Text(3, 0, 'WhaleCO 360 Office Premium'),
  Text(4, 0, 'WhaleCo Plus'),
  Text(5, 0, 'WhaleCo Outdoor & Adventure Advantage Package'),
  Text(6, 0, 'WhaleCo Exclusive'),
  Text(7, 0, 'WhaleCo Boost Cellular Plan & Internet'),
  Text(8, 0, 'WhaleCo Choice'),
  Text(9, 0, 'WhaleCo Now Unlimted Radio Package'),
  Text(10, 0, 'WhaleCo All-Access'),
  Text(11, 0, 'WhaleCo Prime'),
  Text(12, 0, 'WhaleCo Extra'),
  Text(13, 0, 'WhaleCo Other Sports Package'),
  Text(14, 0, 'WhaleCo VIP'),
  Text(15, 0, 'WhaleCo Unlimited Streaming'),
  Text(16, 0, 'WhaleCo Online Gaming Streaming Package'),
  Text(17, 0, 'WhaleCo Sunday Ticket (NFL)'),
  Text(18, 0, 'WhaleCo Pay as you Go Package'),
  Text(19, 0, 'WhaleCo Babies & Tots Package'),
  Text(20, 0, 'WhaleCo Gold'),
  Text(21, 0, 'WhaleCo Pro College Student (Only) Package'),
  Text(22, 0, 'WhaleCo Hardwood Package (NBA)')])
```

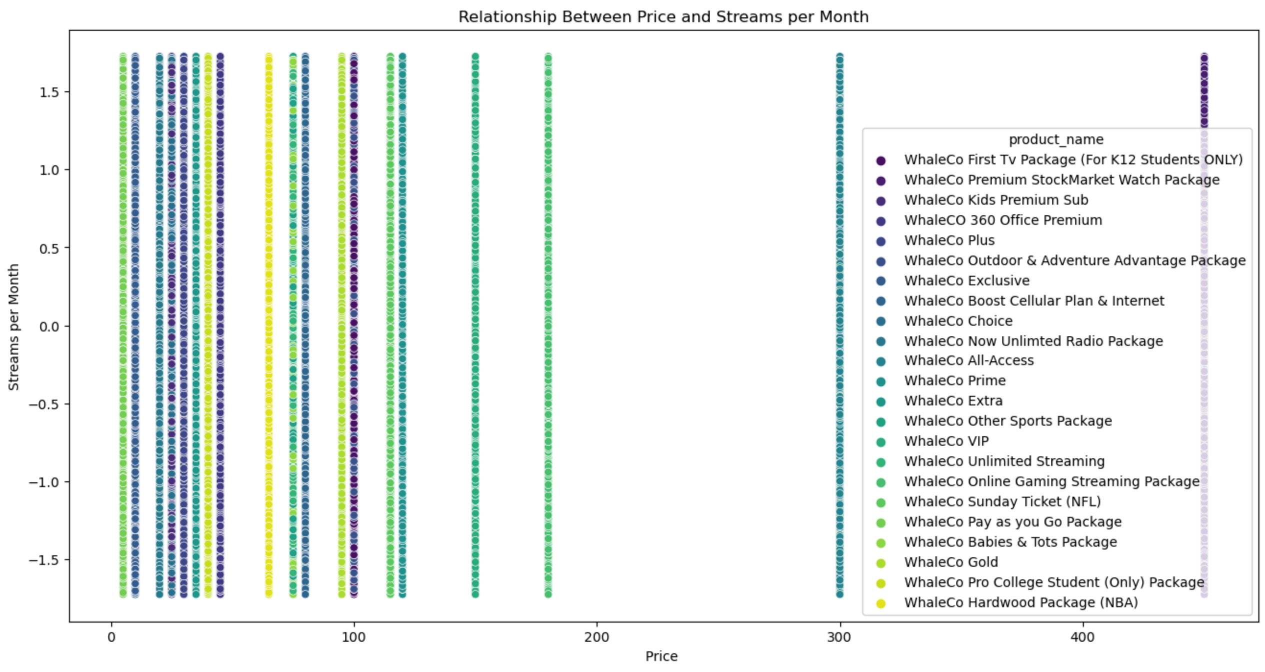


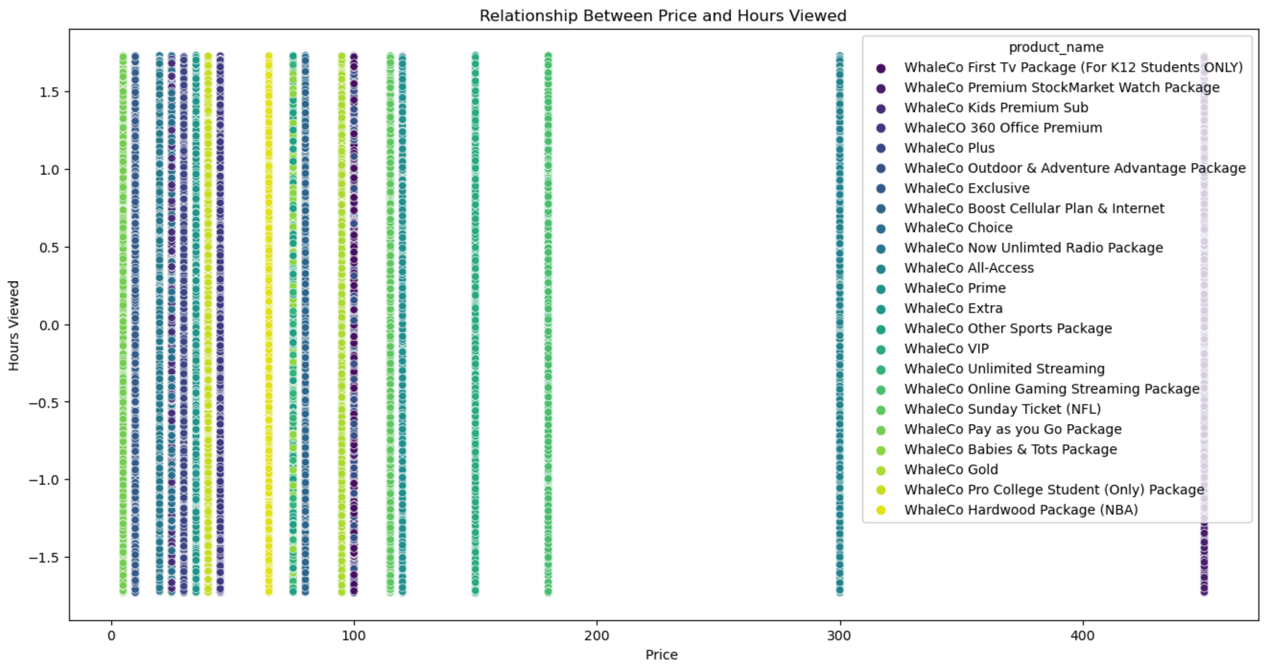
In [241]:
```python
plt.figure(figsize=(18,9))
sns.boxplot(x='product_name', y='NPS_Score', data=final_df, palette='viridis')
plt.xlabel('Streaming Package')
plt.ylabel('NPS Score')
plt.title('Distribution of NPS Scores for Each Streaming Package')
plt.xticks(rotation=55)
```

Out[241]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22]),
 [Text(0, 0, 'WhaleCo First Tv Package (For K12 Students ONLY)'),
  Text(1, 0, 'WhaleCo Premium StockMarket Watch Package'),
  Text(2, 0, 'WhaleCo Kids Premium Sub'),
  Text(3, 0, 'WhaleCO 360 Office Premium'),
  Text(4, 0, 'WhaleCo Plus'),
  Text(5, 0, 'WhaleCo Outdoor & Adventure Advantage Package'),
  Text(6, 0, 'WhaleCo Exclusive'),
  Text(7, 0, 'WhaleCo Boost Cellular Plan & Internet'),
  Text(8, 0, 'WhaleCo Choice'),
  Text(9, 0, 'WhaleCo Now Unlimted Radio Package'),
  Text(10, 0, 'WhaleCo All-Access'),
  Text(11, 0, 'WhaleCo Prime'),
  Text(12, 0, 'WhaleCo Extra'),
  Text(13, 0, 'WhaleCo Other Sports Package'),
  Text(14, 0, 'WhaleCo VIP'),
  Text(15, 0, 'WhaleCo Unlimited Streaming'),
  Text(16, 0, 'WhaleCo Online Gaming Streaming Package'),
  Text(17, 0, 'WhaleCo Sunday Ticket (NFL)'),
  Text(18, 0, 'WhaleCo Pay as you Go Package'),
  Text(19, 0, 'WhaleCo Babies & Tots Package'),
  Text(20, 0, 'WhaleCo Gold'),
  Text(21, 0, 'WhaleCo Pro College Student (Only) Package'),
  Text(22, 0, 'WhaleCo Hardwood Package (NBA)')])
```



In [295]:
```python
# Analyze the Relationship Between Package Attributes and Customer Behavior
#Relationship Between Price and Streams per Month
final_df['streams_per_month'] = pd.to_numeric(final_df['streams_per_month'], errors='coerce')
plt.figure(figsize=(16,8))
sns.scatterplot(x='Price ', y='streams_per_month', data=final_df, hue='product_name', palette='viridis')
plt.xlabel('Price ')
plt.ylabel('Streams per Month')
plt.title('Relationship Between Price and Streams per Month')

#Relationship Between Price and Hours Viewed
plt.figure(figsize=(16,8))
final_df['hours_viewed'] = pd.to_numeric(final_df['hours_viewed'], errors='coerce')
sns.scatterplot(x='Price ', y='hours_viewed', data=final_df, hue='product_name', palette='viridis')
plt.xlabel('Price ')
plt.ylabel('Hours Viewed')
plt.title('Relationship Between Price and Hours Viewed')

```
Out[295]:
```
Text(0.5, 1.0, 'Relationship Between Price and Hours Viewed')
```





Task-3. Customer Segmentation

In [243]:
```python
print(final_df['sub_unsub'].unique())#checking unique value in sub_unsub feature
```
```
['Subscribed' 'Unsubscribed' 'Not Available']
```

In [296]:
```python
tier_counts = final_df['sub_unsub'].value_counts()#subscription tier
tier_percentages = final_df['sub_unsub'].value_counts(normalize=True) * 100
print("Tier Counts:")
print(tier_counts)
print("\nTier Percentages:")
print(tier_percentages)
```

```
Tier Counts:
Subscribed       46952
Unsubscribed      3308
Not Available      146
Name: sub_unsub, dtype: int64

Tier Percentages:
Subscribed       93.147641
Unsubscribed      6.562711
Not Available     0.289648
Name: sub_unsub, dtype: float64
```

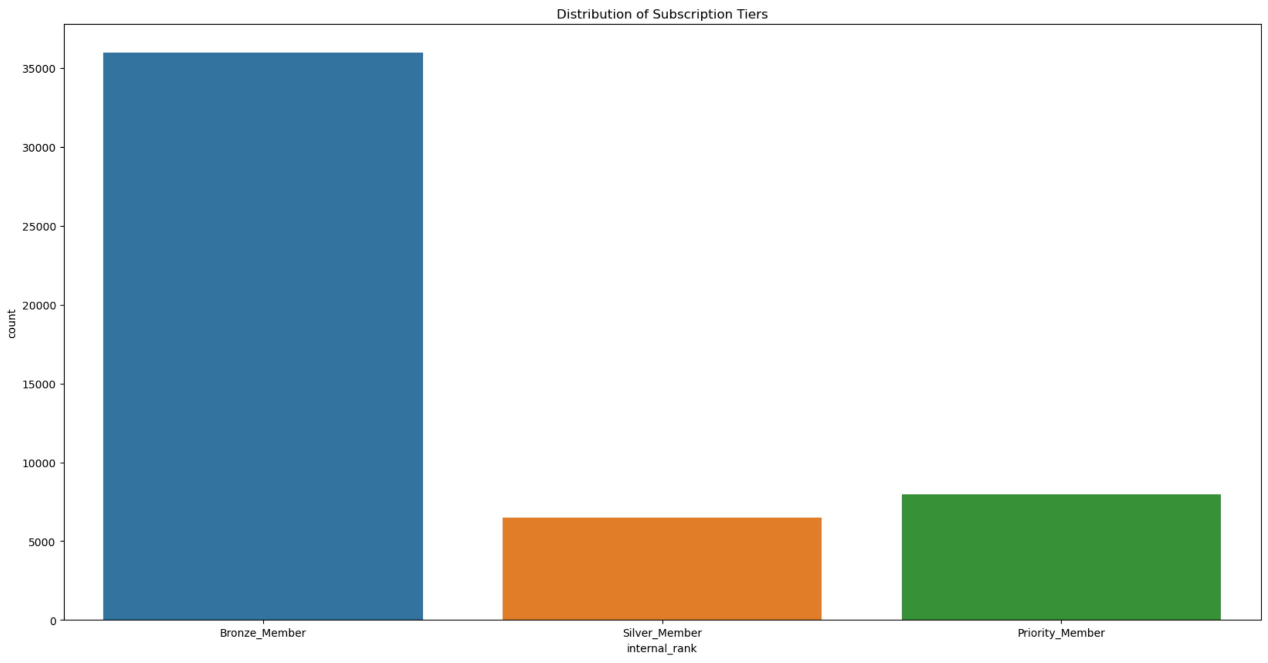
In [245]:
```python
#checking available value in  internal rank column
unique_values = final_df['internal_rank'].unique()
unique_values
```

Out[245]:
```
array(['Bronze_Member', 'Brone_Member', 'Silver_Member',
       'Priority_Member', 'Bronz_Member', 'Sier_Member', 'Priority_Memb',
       'Brze_Member', 'Bnze_Member', 'Prity_Memb'], dtype=object)
```

In [246]:
```python
# Renaming with correct value in the 'internal_rank' column
final_df['internal_rank'] = final_df['internal_rank'].replace('Brone_Member', 'Bronze_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Bronz_Member', 'Bronze_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Brze_Member', 'Bronze_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Bnze_Member', 'Bronze_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Sier_Member', 'Silver_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Priority_Memb', 'Priority_Member')
final_df['internal_rank'] = final_df['internal_rank'].replace('Prity_Memb', 'Priority_Member')

```

In [247]:
```python
plt.figure(figsize=(20,10))
sns.countplot(x='internal_rank', data=final_df)
plt.title('Distribution of Subscription Tiers')
```

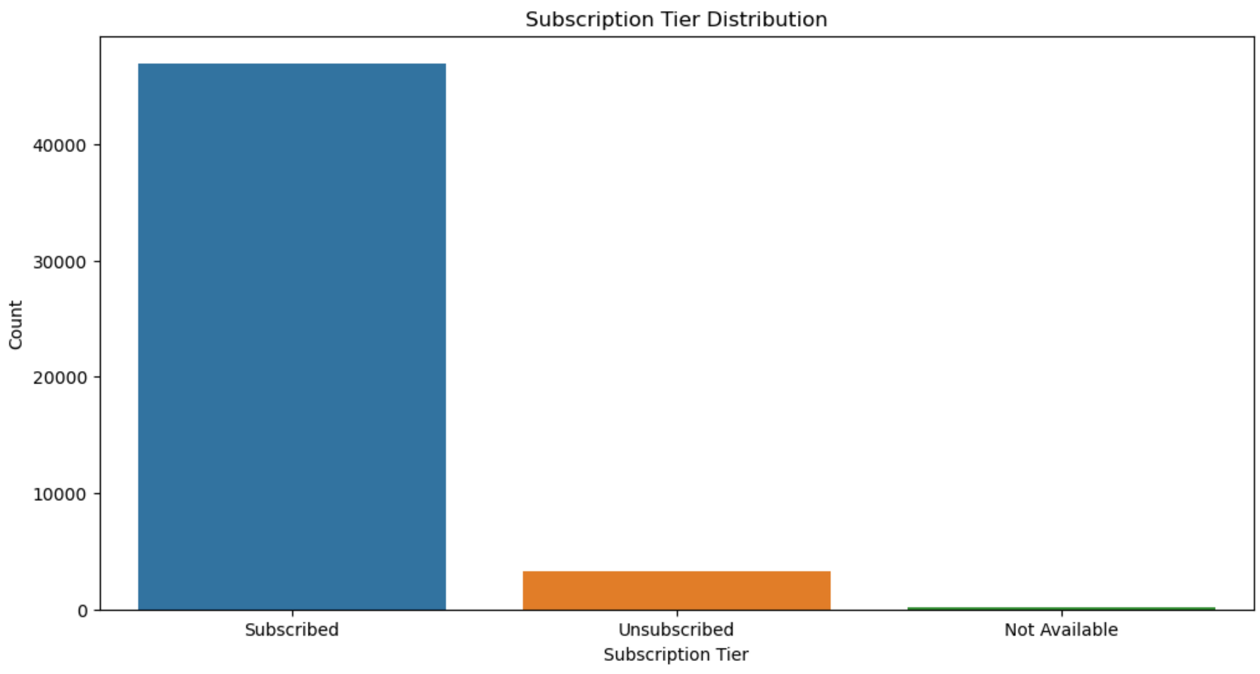
Out[247]:
```
Text(0.5, 1.0, 'Distribution of Subscription Tiers')
```



Observation:In subscription Bronze_Member has highest distribution

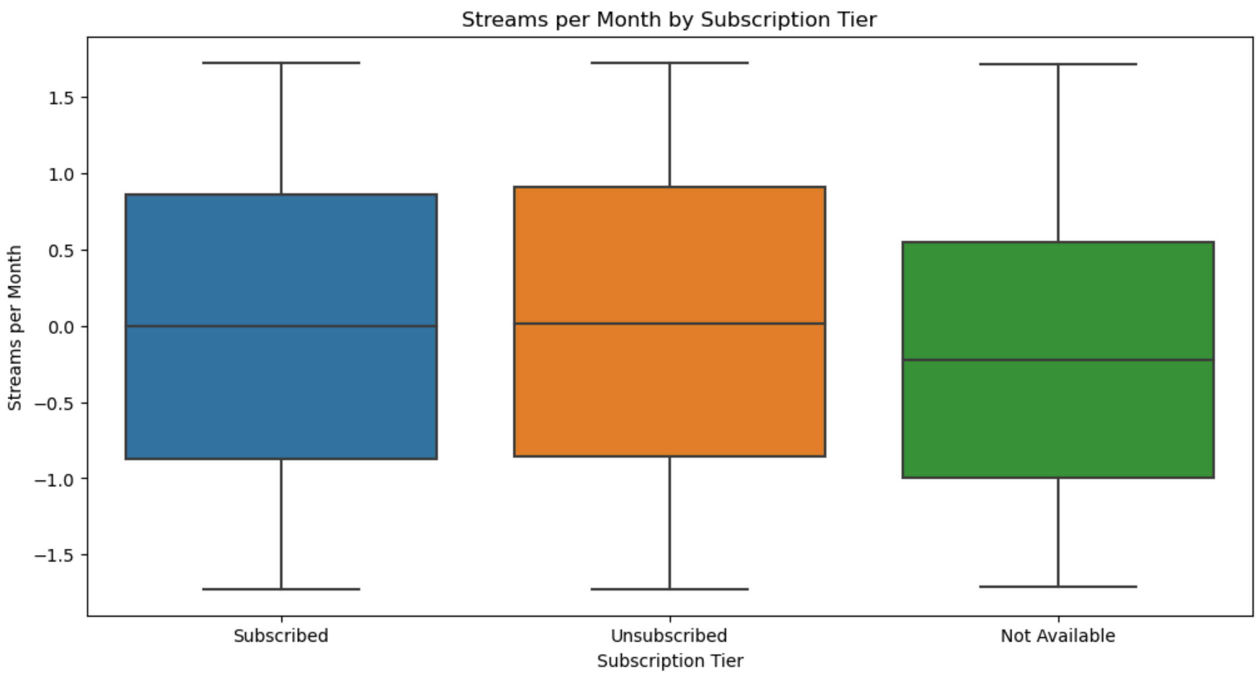
In [248]:
```python
# Calculate subscription tier counts and percentages
tier_counts = final_df['sub_unsub'].value_counts()
tier_percentages = final_df['sub_unsub'].value_counts(normalize=True) * 100

# Visualize subscription tier distribution
plt.figure(figsize=(12, 6))
sns.barplot(x=tier_counts.index, y=tier_counts.values)
plt.title('Subscription Tier Distribution')
plt.xlabel('Subscription Tier')
plt.ylabel('Count')
```

Out[248]:
```
Text(0, 0.5, 'Count')
```



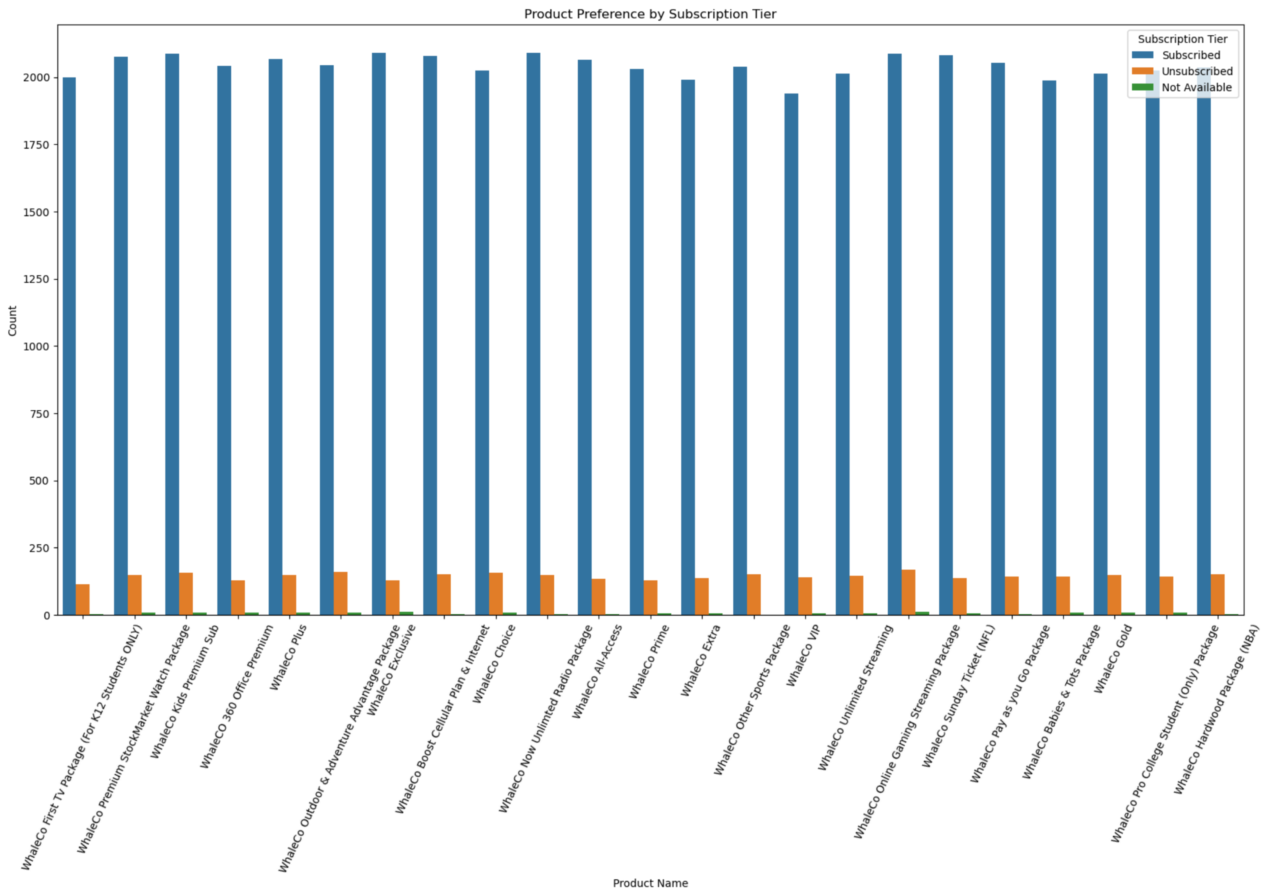
In [310]:
```python
# Behavioral Analysis
plt.figure(figsize=(12, 6))
sns.boxplot(x='sub_unsub', y='streams_per_month', data=final_df)
plt.title('Streams per Month by Subscription Tier')
plt.xlabel('Subscription Tier')
plt.ylabel('Streams per Month')
```

Out[310]:
```
Text(0, 0.5, 'Streams per Month')
```



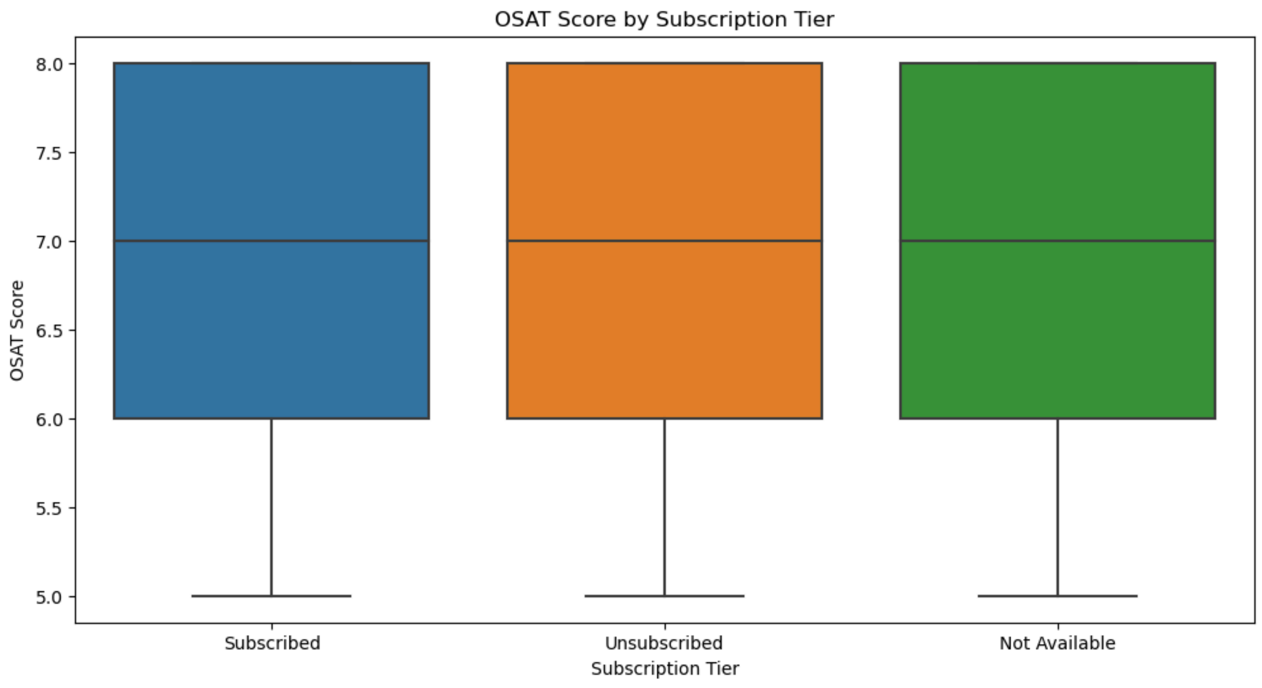
In [298]:
```python
# Preference Analysis
plt.figure(figsize=(20,10))
sns.countplot(x='product_name', hue='sub_unsub', data=final_df)
plt.title('Product Preference by Subscription Tier')
plt.xlabel('Product Name')
plt.ylabel('Count')
plt.legend(title='Subscription Tier')
plt.xticks(rotation=65)
```

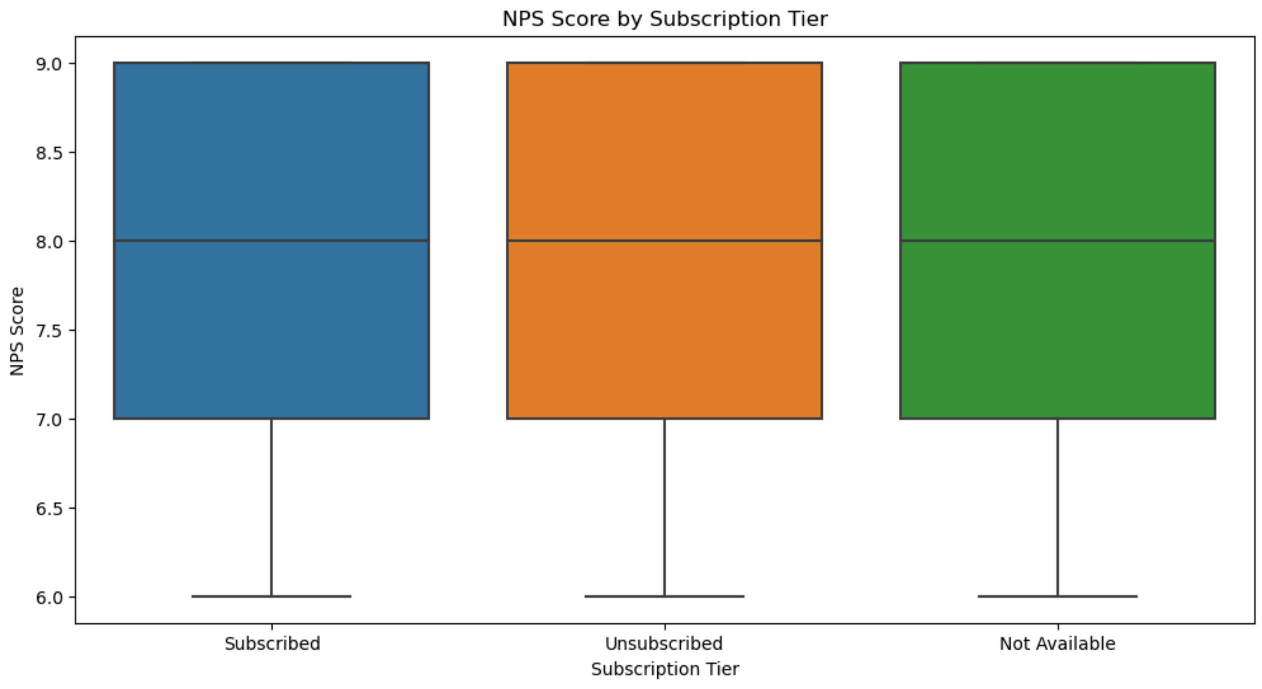
Out[298]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22]),
 [Text(0, 0, 'WhaleCo First Tv Package (For K12 Students ONLY)'),
  Text(1, 0, 'WhaleCo Premium StockMarket Watch Package'),
  Text(2, 0, 'WhaleCo Kids Premium Sub'),
  Text(3, 0, 'WhaleCO 360 Office Premium'),
  Text(4, 0, 'WhaleCo Plus'),
  Text(5, 0, 'WhaleCo Outdoor & Adventure Advantage Package'),
  Text(6, 0, 'WhaleCo Exclusive'),
  Text(7, 0, 'WhaleCo Boost Cellular Plan & Internet'),
  Text(8, 0, 'WhaleCo Choice'),
  Text(9, 0, 'WhaleCo Now Unlimted Radio Package'),
  Text(10, 0, 'WhaleCo All-Access'),
  Text(11, 0, 'WhaleCo Prime'),
  Text(12, 0, 'WhaleCo Extra'),
  Text(13, 0, 'WhaleCo Other Sports Package'),
  Text(14, 0, 'WhaleCo VIP'),
  Text(15, 0, 'WhaleCo Unlimited Streaming'),
  Text(16, 0, 'WhaleCo Online Gaming Streaming Package'),
  Text(17, 0, 'WhaleCo Sunday Ticket (NFL)'),
  Text(18, 0, 'WhaleCo Pay as you Go Package'),
  Text(19, 0, 'WhaleCo Babies & Tots Package'),
  Text(20, 0, 'WhaleCo Gold'),
  Text(21, 0, 'WhaleCo Pro College Student (Only) Package'),
  Text(22, 0, 'WhaleCo Hardwood Package (NBA)')])
```



In [251]:
```
# Customer Satisfaction Analysis
plt.figure(figsize=(12, 6))
sns.boxplot(x='sub_unsub', y='OSAT_Score', data=final_df)
plt.title('OSAT Score by Subscription Tier')
plt.xlabel('Subscription Tier')
plt.ylabel('OSAT Score')


plt.figure(figsize=(12, 6))
sns.boxplot(x='sub_unsub', y='NPS_Score', data=final_df)
plt.title('NPS Score by Subscription Tier')
plt.xlabel('Subscription Tier')
plt.ylabel('NPS Score')
```

Out[251]:
```
Text(0, 0.5, 'NPS Score')
```





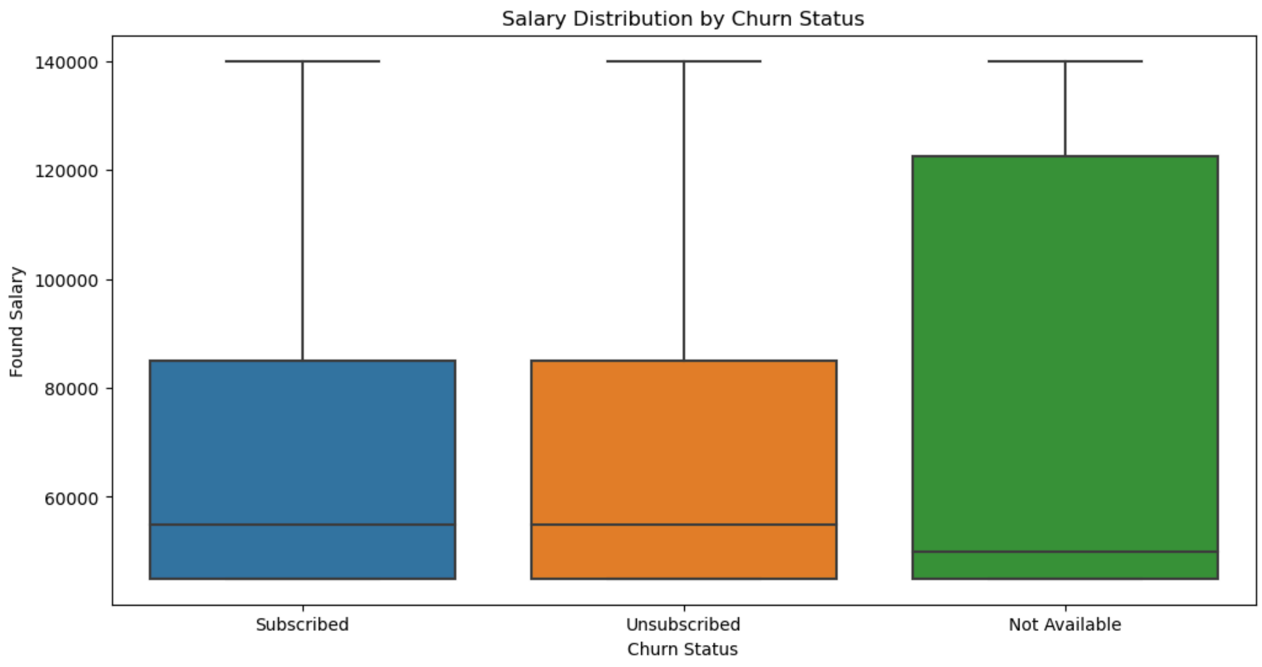
Task-4.Churn Analysis

In [252]:
```python
 #Investigate customer churn by calculating the churn rate and identifying factors that may contribute to customers unsu
# Calculate churn rate
total_customers = final_df['customer_id'].nunique()
churned_customers = final_df[final_df['sub_unsub'] == 'Unsubscribed']['customer_id'].nunique()
churn_rate = (churned_customers / total_customers) * 100

print(f"Churn Rate: {churn_rate:.2f}%")
```

```
Churn Rate: 6.48%
```

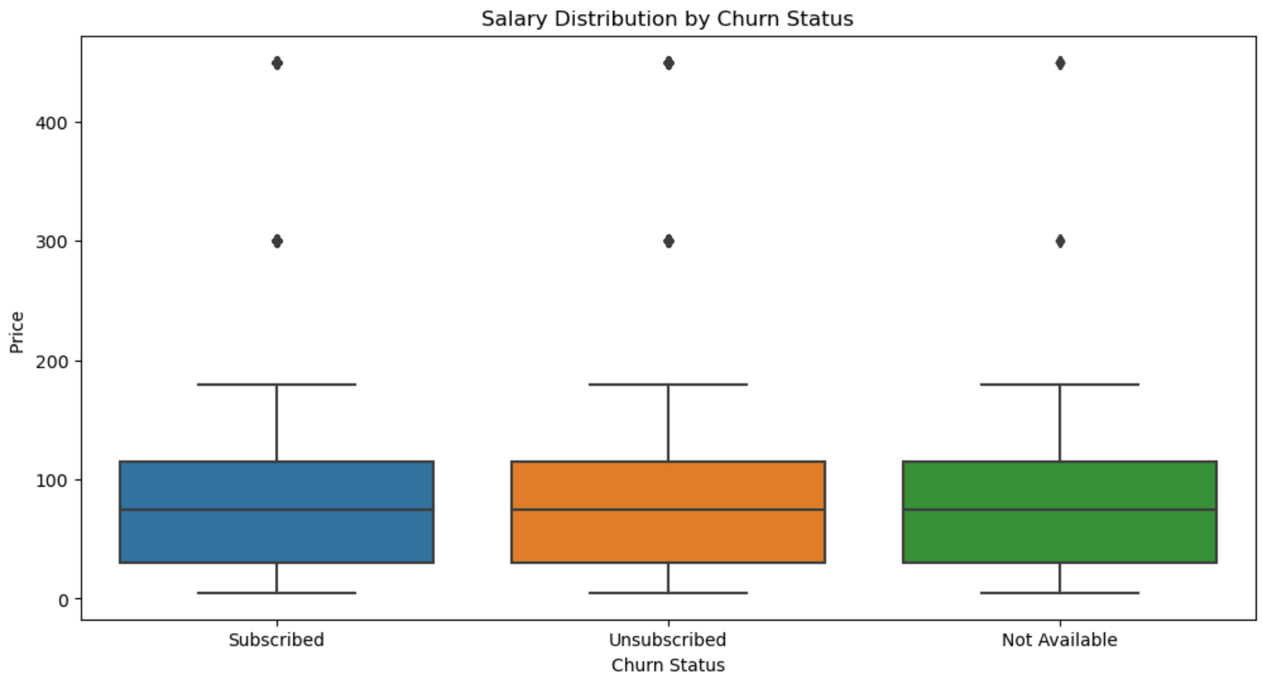
In [253]:
```python
plt.figure(figsize=(12, 6))#displaying the factors
sns.boxplot(x='sub_unsub', y='found_salary', data=final_df)
plt.title('Salary Distribution by Churn Status')
plt.xlabel('Churn Status')
plt.ylabel('Found Salary')
```

Out[253]:
```
Text(0, 0.5, 'Found Salary')
```



In [254]:
```python
plt.figure(figsize=(12, 6))#displaying the factors
sns.boxplot(x='sub_unsub', y='Price ', data=final_df)
plt.title('Salary Distribution by Churn Status')
plt.xlabel('Churn Status')
plt.ylabel('Price ')
```

Out[254]:
```
Text(0, 0.5, 'Price ')
```



In [255]:
```python
package_performance = final_df.groupby('product_name').mean()#average engagement metrics by packages
package_performance
```

Out[255]:

product_name	found_salary	active_months	OSAT_Score	NPS_Score	streams_per_month	hours_viewed	Price	Index
WhaleCO 360 Office Premium	70342.371324	7.335478	6.957261	7.948529	152.469669	83.491870	45.0	2.0
WhaleCo All-Access	69779.545455	7.388636	6.925455	7.931270	149.799454	84.251084	300.0	10.0
WhaleCo Babies & Tots Package	70072.497661	7.381197	6.919083	7.963050	151.562734	85.924672	75.0	3.0
WhaleCo Boost Cellular Plan & Internet	70438.675022	7.329006	6.917189	7.950761	148.473590	82.886216	80.0	11.0
WhaleCo Choice	69837.899543	7.378082	6.959361	7.960274	151.329374	82.903151	25.0	19.0
WhaleCo Exclusive	69236.111111	7.444892	6.926523	7.980287	150.082885	82.251047	10.0	21.0
WhaleCo Extra	69767.932489	7.245195	6.921707	7.949836	148.768293	84.415495	35.0	20.0
WhaleCo First Tv Package (For K12 Students ONLY)	69175.330813	7.308129	6.922023	7.943762	153.640019	82.240091	100.0	22.0
WhaleCo Gold	70626.439429	7.219254	6.962690	7.898204	152.982036	82.639969	95.0	13.0
WhaleCo Hardwood Package (NBA)	69607.664234	7.216241	6.936588	7.940237	150.664234	83.146688	65.0	17.0
WhaleCo Kids Premium Sub	70333.333333	7.461778	6.911556	7.930222	150.394304	83.281539	25.0	1.0
WhaleCo Now Unlimted Radio Package	69078.947368	7.340767	6.950937	7.956289	152.462533	84.313373	20.0	7.0
WhaleCo Online Gaming Streaming Package	70875.992939	7.376434	6.922330	7.906402	151.091471	83.584923	180.0	8.0
WhaleCo Other Sports Package	70757.644911	7.364217	6.920128	7.924236	147.772603	86.608421	75.0	-1.0
WhaleCo Outdoor & Adventure Advantage Package	70868.385346	7.241520	6.924921	7.964270	150.185436	83.704233	100.0	18.0
WhaleCo Pay as you Go Package	69677.125966	7.304229	6.966348	7.938608	149.815287	83.225869	5.0	23.0
WhaleCo Plus	69381.744604	7.281025	6.891637	7.923561	153.367806	84.264396	30.0	5.0
WhaleCo Premium StockMarket Watch Package	70316.001793	7.249216	6.938117	7.930076	150.124215	83.776828	450.0	9.0
WhaleCo Prime	70279.574861	7.236137	6.946371	7.938049	149.569579	82.792865	120.0	4.0
WhaleCo Pro College Student (Only) Package	70039.062500	7.299632	6.909926	7.948070	147.479080	81.403808	40.0	12.0
WhaleCo Sunday Ticket (NFL)	69925.809353	7.432554	6.949191	7.930306	150.359263	85.653201	115.0	14.0
WhaleCo Unlimited Streaming	69179.000925	7.403330	6.902868	7.916242	148.322536	83.229832	75.0	-1.0
WhaleCo VIP	69584.932821	7.356046	6.925624	7.898273	152.288526	82.784870	150.0	15.0

In [297]:
```python
Products_name=final_df.product_name.value_counts().index #to check  index of product name
Products_name
```

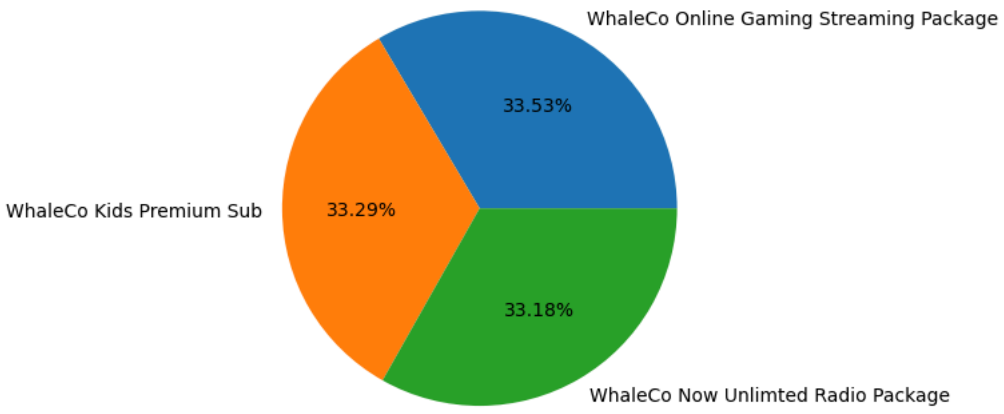
Out[297]:
```
Index(['WhaleCo Online Gaming Streaming Package', 'WhaleCo Kids Premium Sub',
       'WhaleCo Now Unlimted Radio Package',
       'WhaleCo Boost Cellular Plan & Internet', 'WhaleCo Exclusive',
       'WhaleCo Premium StockMarket Watch Package', 'WhaleCo Plus',
       'WhaleCo Sunday Ticket (NFL)',
       'WhaleCo Outdoor & Adventure Advantage Package', 'WhaleCo All-Access',
       'WhaleCo Pay as you Go Package', 'WhaleCo Hardwood Package (NBA)',
       'WhaleCo Other Sports Package', 'WhaleCo Choice',
       'WhaleCo Pro College Student (Only) Package',
       'WhaleCO 360 Office Premium', 'WhaleCo Gold', 'WhaleCo Prime',
       'WhaleCo Unlimited Streaming', 'WhaleCo Babies & Tots Package',
       'WhaleCo Extra', 'WhaleCo First Tv Package (For K12 Students ONLY)',
       'WhaleCo VIP'],
      dtype='object')
```

In [257]:
```python
Package_value=final_df['product_name'].value_counts().values #to check value of product name
Package_value
```

Out[257]:
```
array([2266, 2250, 2242, 2234, 2232, 2231, 2224, 2224, 2211, 2200, 2199,
       2192, 2191, 2190, 2176, 2176, 2171, 2164, 2162, 2138, 2133, 2116,
       2084], dtype=int64)
```

In [305]:
```python
#top 3 Products which Streaming Packages more
plt.pie(Package_value[:3], labels=Products_name[:3], autopct='%1.2f%%')

```

Out[305]:
```
([<matplotlib.patches.Wedge at 0x24092ece850>,
  <matplotlib.patches.Wedge at 0x24092ececa0>,
  <matplotlib.patches.Wedge at 0x24092edc3a0>],
 [Text(0.5440847895016822, 0.9560186932444943, 'WhaleCo Online Gaming Streaming Package'),
  Text(-1.0999315382033232, -0.012272378158760703, 'WhaleCo Kids Premium Sub'),
  Text(0.5547169475999614, -0.9498889977494117, 'WhaleCo Now Unlimted Radio Package')],
 [Text(0.29677352154637204, 0.5214647417697241, '33.53%'),
  Text(-0.5999626572018125, -0.006694024450233111, '33.29%'),
  Text(0.3025728805090698, -0.5181212714996791, '33.18%')])
```



Model Training and Algorithm

In [276]:
```python
from sklearn.model_selection import train_test_split# importing required libraries
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report

```

In [277]:
```python
final_df.columns
```

Out[277]:
```
Index(['customer_id', 'State', 'Occupation', 'found_salary', 'internal_rank',
       'sub_unsub', 'active_months', 'ord_number', 'product_name',
       'OSAT_Score', 'NPS_Score', 'streams_per_month', 'hours_viewed',
       'internal_accounts', 'Price ', 'Index'],
      dtype='object')
```

In [278]:
```python
X = pd.get_dummies(final_df[['State','Occupation','found_salary']])#independent features
y = final_df['sub_unsub']#dependent features

# Spliting  the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

```

In [280]:
```python
# Training the model
model = LogisticRegression()
model.fit(X_train, y_train)
```

Out[280]:
```
LogisticRegression()
```

In [282]:
```python
# Makeing predictions
y_pred = model.predict(X_test)
```

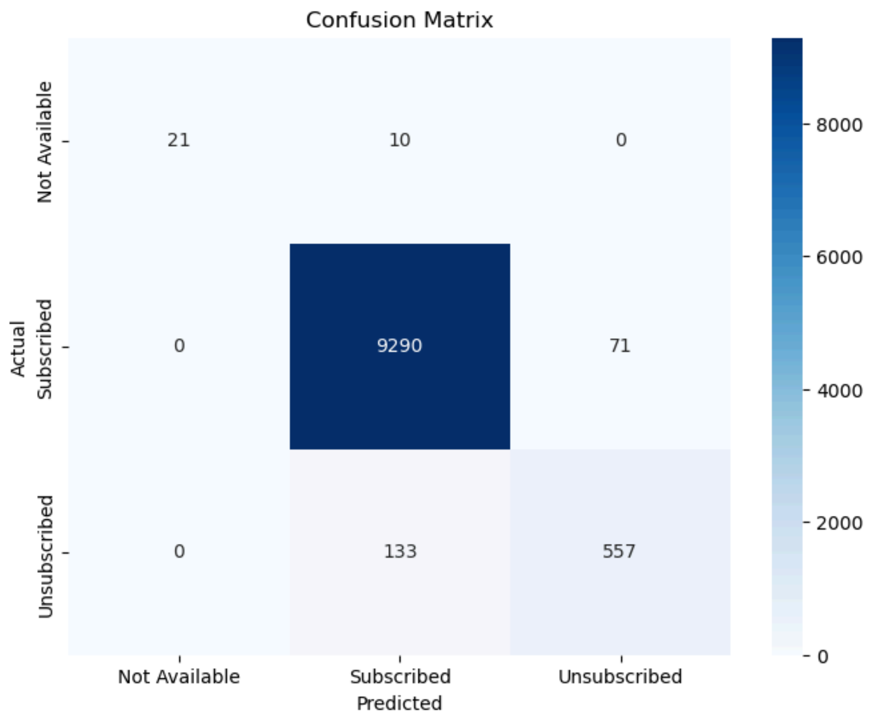
In [283]:
```python
# Evaluating the model
print("Accuracy:", accuracy_score(y_test, y_pred))
print("Classification Report:")
print(classification_report(y_test, y_pred))

```

```
Accuracy: 0.9284864114263043
Classification Report:

C:\Users\ARPITA SINGH\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318: UndefinedMetricWarning: Precisio
n and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to co
ntrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))

               precision    recall  f1-score   support

Not Available       0.00      0.00      0.00        31
   Subscribed       0.93      1.00      0.96      9361
 Unsubscribed       0.00      0.00      0.00       690

     accuracy                           0.93     10082
    macro avg       0.31      0.33      0.32     10082
 weighted avg       0.86      0.93      0.89     10082


C:\Users\ARPITA SINGH\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318: UndefinedMetricWarning: Precisio
n and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to co
ntrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\ARPITA SINGH\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318: UndefinedMetricWarning: Precisio
n and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to co
ntrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

Observation:The logistic regression model shows a promising 93% accuracy in predicting whether customers are subscribed. This aligns with our goal of understanding customer behavior. While it performs well for 'Subscribed' customers, it could be improved for predicting 'Not Available' and 'Unsubscribed' categories, which are crucial for our retention strategies.

In [303]:
```python
#confusion matrix
cm = confusion_matrix(y_test, y_pred, labels=model.classes_)
# Create a heatmap to display cinfusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, cmap='Blues', fmt='d', xticklabels=model.classes_, yticklabels=model.classes_)
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
```

Out[303]:
```
Text(0.5, 1.0, 'Confusion Matrix')
```



In [ ]:
```python

```