EAA CA2

December 16, 2016

1 EAA CA2

1.1 Analysing a resource usage/load

1.1.1 GitHub

Find me on github at: https://github.com/dmateusp/EAA/blob/master/CA2/EAA%20CA2.ipynb

1.1.2 The system configuration:

- Motherboard: 2560 MB memory
- Processor: 1 CPU, execution cap: 100%
- Operating system: Linux Fedora 64bits (virtual machine)
- Memory: 1 disk, virtual size 19.25GB (actual size 11.74GB)

1.1.3 The test:

The resource tested here is the processor, only 1 CPU is used for simplicity.

1.1.4 Report

This report is 411 words long

Importing libraries

```
In [15]: import pandas as pd
         import matplotlib.pyplot as plt
         from numpy import arange
         plt.style.use('ggplot')
```

Reading the data and converting to numbers

```
In [16]: def numerical_converter(n):
             try:
                 return int(n)
             except ValueError:
                 return float(n)

         with open('results.dat','r') as f:
```

```
        next(f)
        df = pd.DataFrame(map(numerical_converter, l.rstrip().split()) for l i

        df.columns = ['C0', 'N', 'idle'] # setting the header
```

```
In [17]: df.head() # displaying five first rows
```

```
Out[17]:      C0  N   idle
         0    50  1  78.62
         1    88  2  78.91
         2   123  3  73.72
         3   152  4  68.69
         4   180  5  63.40
```

1.2 Ui vs N

Ui is the utilisation of resource, `Ui`

N is the number of concurrent users

Ui for a CPU is the amount of time not spent in idle task

The resource here is the CPU, each loadtest runs during 11 seconds and a summary is generated every second during 10 seconds, the data used is the average of those summaries, the busy time will be calculated with the formula `100 - idle`.

`Ui = (100 - idle)`

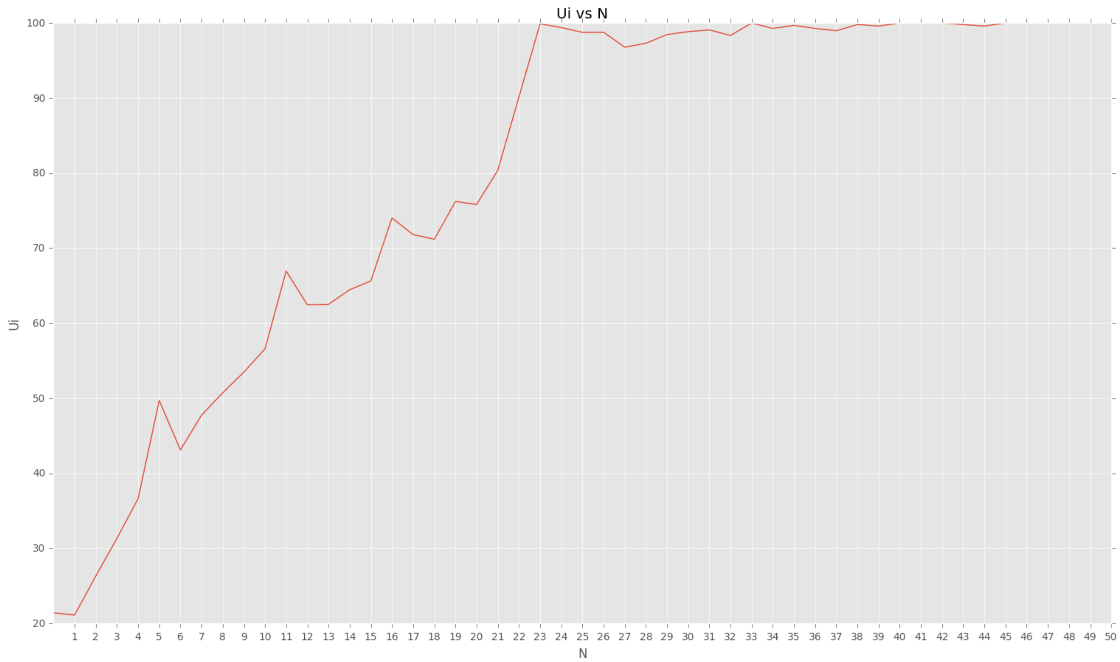
```
In [18]: df['Ui'] = (100 - df['idle']) # calculating Ui
```

```
In [19]: df.head() # displaying five first rows
```

```
Out[19]:      C0  N   idle     Ui
         0    50  1  78.62  21.38
         1    88  2  78.91  21.09
         2   123  3  73.72  26.28
         3   152  4  68.69  31.31
         4   180  5  63.40  36.60
```

```
In [20]: plt.plot(df['Ui'])
         plt.xticks(df['N'])
         plt.title("Ui vs N")
         plt.xlabel("N")
         plt.ylabel("Ui")

         fig = plt.gcf()
         fig.set_size_inches(18.5, 10.5)
         plt.show()
```



1.2.1 Analysis

N represents the number of concurrent users, as we increase the number of users the resources are used more (here the CPU).

The CPU is getting saturated around 23 concurrent users where it reaches 95%, if this was a real system we could study other resources usage, if they saturated with less users we would have to upgrade these resources before (to enable the system to handle more concurrent users).

Otherwise the CPU would be the priority. A system can only go as fast as its slowest component, so the different resources of the system would have to be monitored to improve it effectively.

1.3 Di vs N

Di is the service demand, `Di = Vi * Si = Ui / X0`

N is the number of concurrent users

X0 is the throughput `X0 = C0/T = C0 / 10`

T is the length of time in the observation period (10 seconds)

`Di = Ui / (C0 / 10)`

```
In [29]: df['Di'] = df['Ui']/(df['C0']/10)
```

```
In [30]: df.head()
```

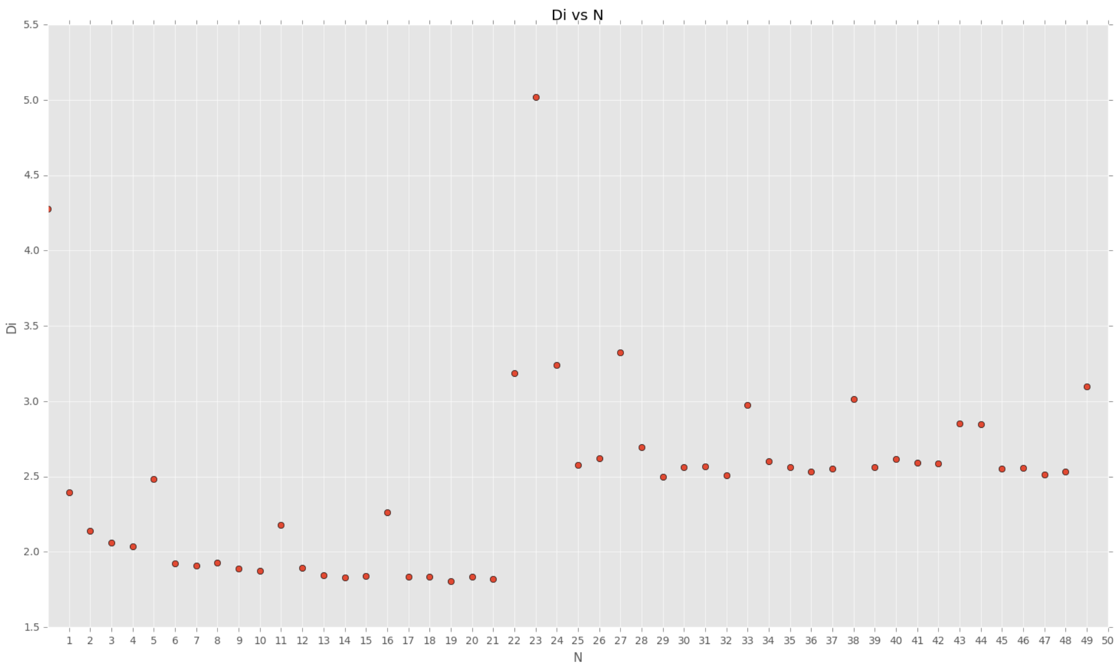
Out[30]:

	C0	N	idle	Ui	Di	X0
0	50	1	78.62	21.38	4.276000	12.50
1	88	2	78.91	21.09	2.396591	22.00
2	123	3	73.72	26.28	2.136585	30.75

```
3   152   4   68.69   31.31   2.059868   38.00
4   180   5   63.40   36.60   2.033333   45.00
```

```
In [39]: plt.plot(df['Di'],'o')
         plt.xticks(df['N'])
         plt.title("Di vs N")
         plt.xlabel("N")
         plt.ylabel("Di")

         fig = plt.gcf()
         fig.set_size_inches(18.5, 10.5)
         plt.show()
```



1.3.1 Analysis

The service demand is supposed to be constant overall, as it represents the time it takes for the CPU to complete one transaction. The average seems to be 2.5 (see summary at bottom of document).

1.4 X0 vs N

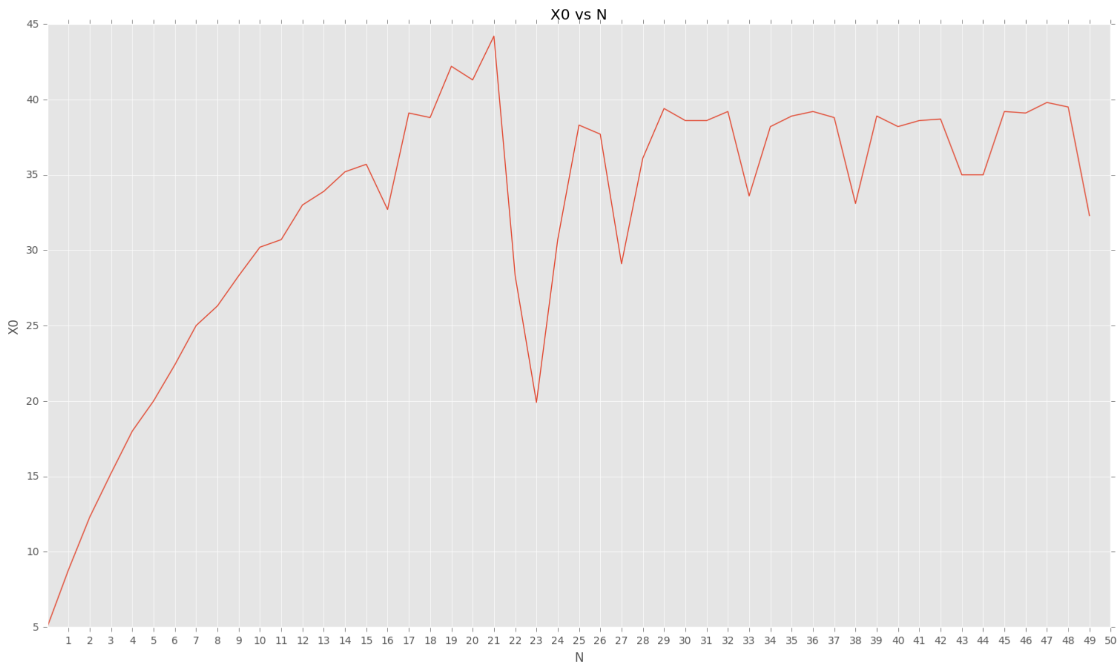
X0 is the system throughput, `X0 = C0 / T`

T is the length of time in the observation period

```
In [33]: df['X0'] = df['C0'] / 10
```

```
In [34]: plt.plot(df['X0'])
         plt.xticks(df['N'])
         plt.title("X0 vs N")
         plt.xlabel("N")
         plt.ylabel("X0")

         fig = plt.gcf()
         fig.set_size_inches(18.5, 10.5)
         plt.show()
```



1.4.1 Analysis

The system seems to have a maximum throughput of 40-45 which means that no matter how many users are using the system, it saturates around 40-45 transactions a second.

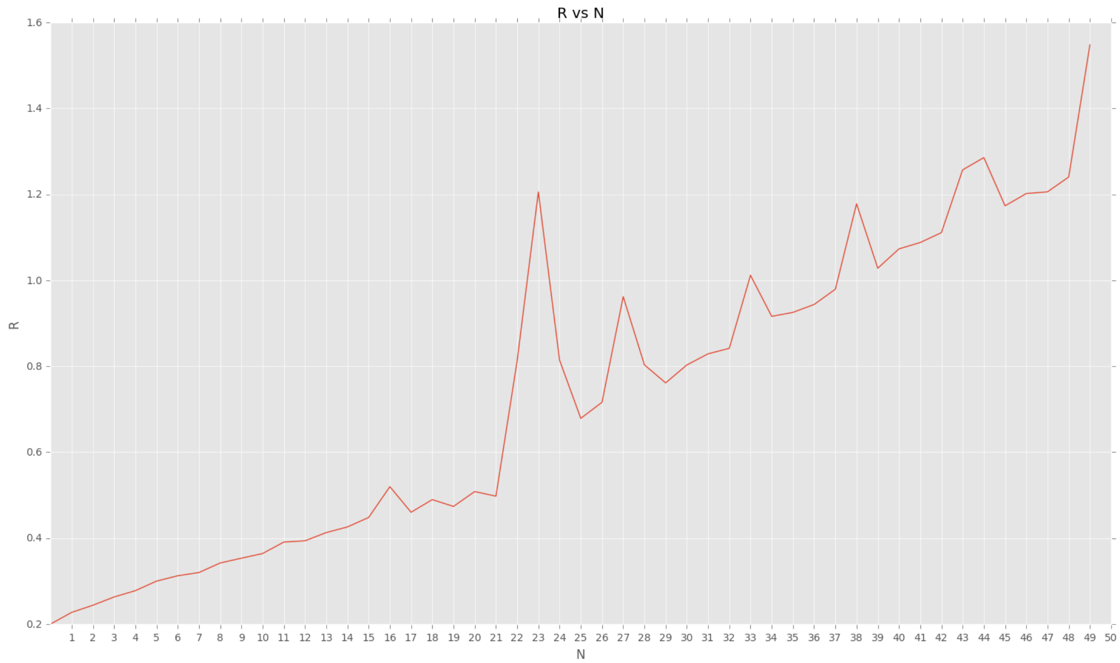
1.5 R vs N

R is the interactive response time, `R = X0 / N`

```
In [42]: df['R'] = df['N']/df['X0']
```

```
In [43]: plt.plot(df['R'])
         plt.xticks(df['N'])
         plt.title("R vs N")
         plt.xlabel("N")
         plt.ylabel("R")
```

```
fig = plt.gcf()
fig.set_size_inches(18.5, 10.5)
plt.show()
```



1.5.1 Analysis

The response time is the time it takes for a request to be answered by the system. This shows that as the number of users increase this response time increases, to almost 1.6 seconds.

If the response time was an important criteria in this system we would have to decide what is an acceptable response time and improve our system to achieve this goal.

In the example of websites, if the loading time is too long users will quit the website.

1.6 Summary

```
In [35]: summary = df.drop('N', 1).describe()[1:] # Strip off count as it will alwa
         summary
```

Out[35]:

	C0	idle	Ui	Di	X0
mean	326.060000	20.37960	79.62040	2.484450	32.606000
std	90.003041	25.19955	25.19955	0.620161	9.000304
min	50.000000	0.00000	21.09000	1.805924	5.000000
25%	293.750000	0.33500	62.98750	1.925115	29.375000
50%	354.500000	2.18000	97.82000	2.532149	35.450000
75%	388.750000	37.01250	99.66500	2.613024	38.875000
max	442.000000	78.91000	100.00000	5.020101	44.200000

```
In [36]: summary.plot(kind='barh', subplots=True, sharex=False)

         fig = plt.gcf()
         fig.set_size_inches(18.5, 18)

         plt.show()
```