Columbus Software Solutions (CSS)

May 2018

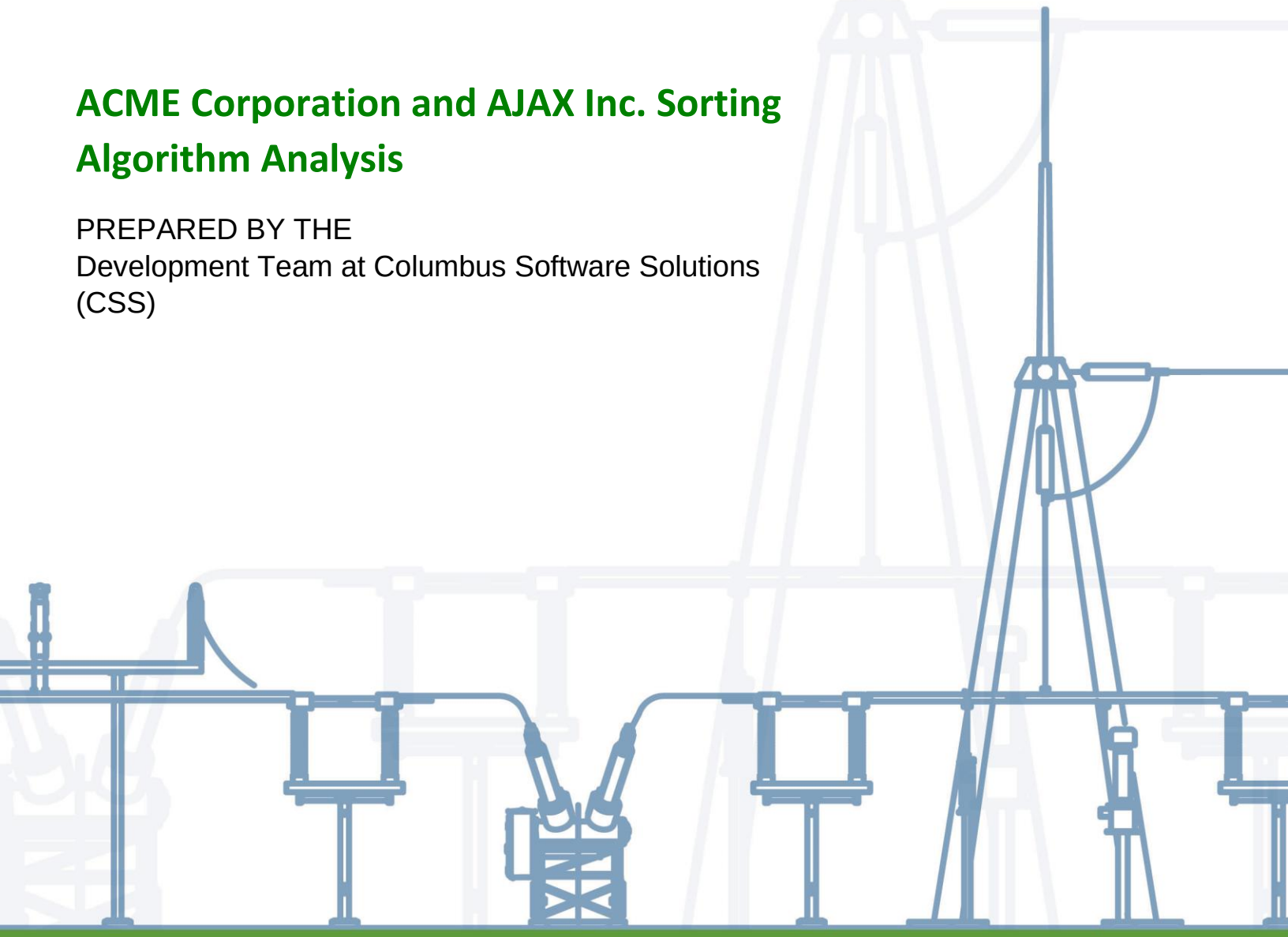
TECHNICAL REPORT

CSS-TR

COLUMBUS SOFTWARE SOLUTIONS

ACME Corporation and AJAX Inc. Sorting Algorithm Analysis

PREPARED BY THE
Development Team at Columbus Software Solutions (CSS)



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Columbus Software Solutions Development Team

Members and Contributors

Austin Marshall
George Moore
Kianna Weldon

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ABSTRACT: Columbus Software Solutions was given the task of preforming an algorithm analysis on two sorting solutions. The first solution was created by ACME Corp. and the other was created by AJAX Inc. After carefully experimenting with both algorithms we determined that AJAX was a far superior sorting algorithm. AJAX had a complexity of $O(\log_2(n))$ and ACME had a complexity of $O(n(n+1)/2)$. Based on our test AJAX's sorting algorithm is 235, 300 times faster (average case) than ACEM's algorithm. Based on our results we believe that CSS should implement AJAX's sorting algorithm.

1. INTRODUCTION:

Software as a service (SaaS) is a software licensing and delivery model in which software is licensed to an entity on a subscription basis that is centrally hosted. SaaS is sometimes referred to as “on-demand software.” Many companies have used SaaS, including Microsoft, Google, and DocuSign. The advantage of using SaaS is that companies who deliver the software can reduce IT responsibilities and costs. The advantages for the entity using said software is that they do not have to invest in addition server capacity and software licenses. This is particularly beneficial for small businesses. However, there are some disadvantages to SaaS. These include software integration and security issues. For example, entities that use multiple SaaS applications and plan to integrate this software with existing hosted software can run into issues integrating the two together. Another disadvantage with SaaS is security. When a business uses SaaS they are relying on a third-party service provider to store and process their sensitive data. Identity and access management must be addressed. This is to ensure that the confidentiality, integrity, and availability of their data. Overall, SaaS is a very popular delivery method for large and small businesses. There are many lucrative advantages to both with some drawbacks. These should be carefully weighted by businesses to determine if SaaS is a good fit for their company.

2. Evaluation:

After carefully experimenting with both algorithms we determined that AJAX was a far superior sorting algorithm. AJAX had a complexity of $O(\log_2(n))$ and ACME had a complexity of $O(n(n+1)/2)$. Based on our test AJAX's sorting algorithm is 235, 300 times faster (average case) than ACME's algorithm. AJAX utilizes a quick sort method, and has a best case of: $O(\log_2(n))$ worst case of: O(n^2),and an average case of: $O(\log_2(n))$ (as stated above) .ACME utilizes a bubble sort method , and always uses the time complexity of: $O(n(n+1)/2)$ to return comparisons. Based on our results we believe that CSS should implement AJAX's sorting algorithm, as it is superior in both the amount of comparisons made and the price.

3. Results:

Day – AJAX Price / ACME Price

Monday - $100,000 / $130,000 **AJAX is ~33% cheaper**

Tuesday - $10,000 / $13,000 **AJAX is ~23% cheaper**

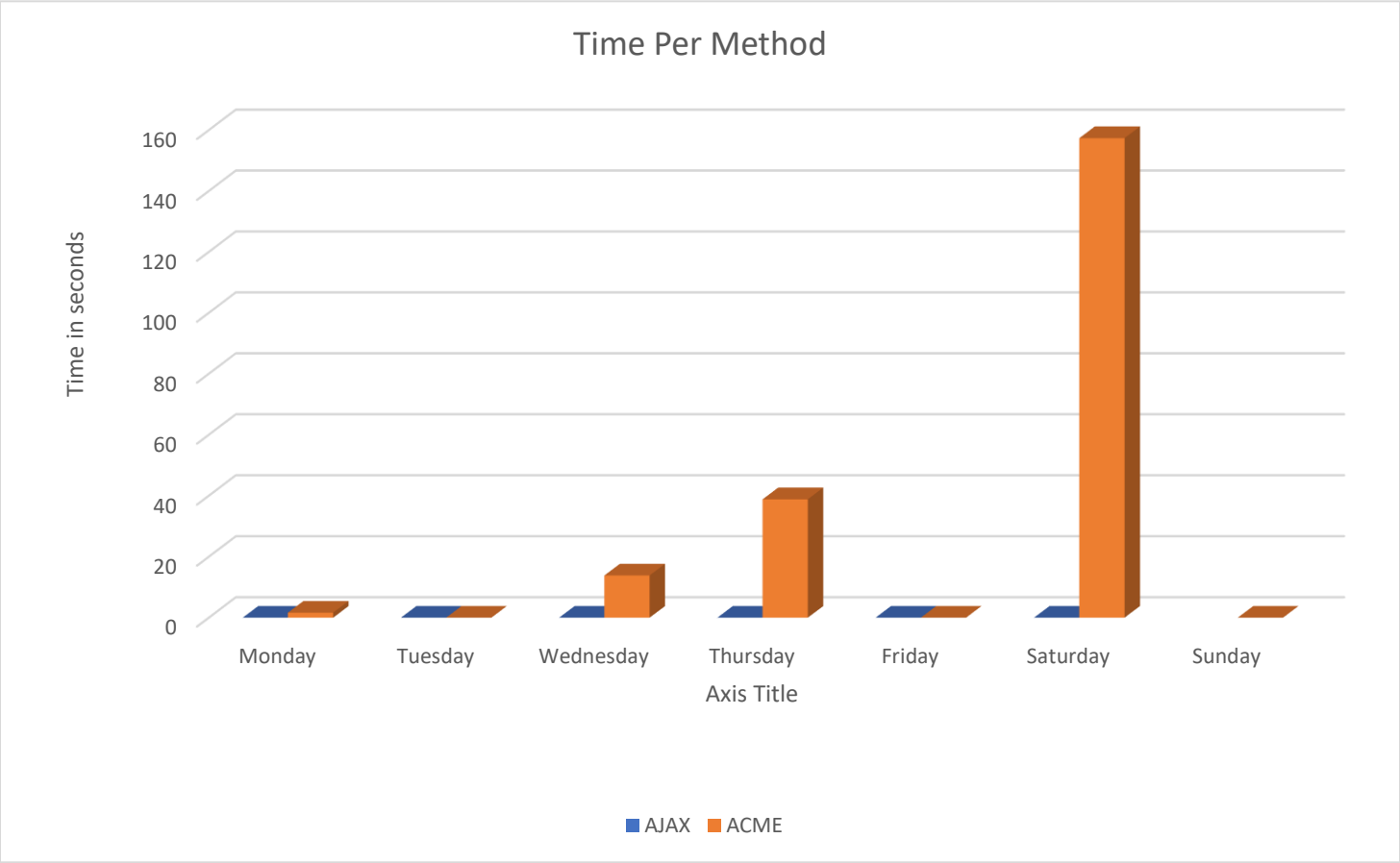
Wednesday - $300,000 / $390,000 **AJAX is ~23% cheaper**

Thursday - $500,000 / $650,000 **AJAX is ~23% cheaper**

Friday - $5,000 / $13,000 **AJAX is ~62% cheaper**

Saturday - $1,000,000 / $1,300,000 **AJAX is ~23% cheaper**

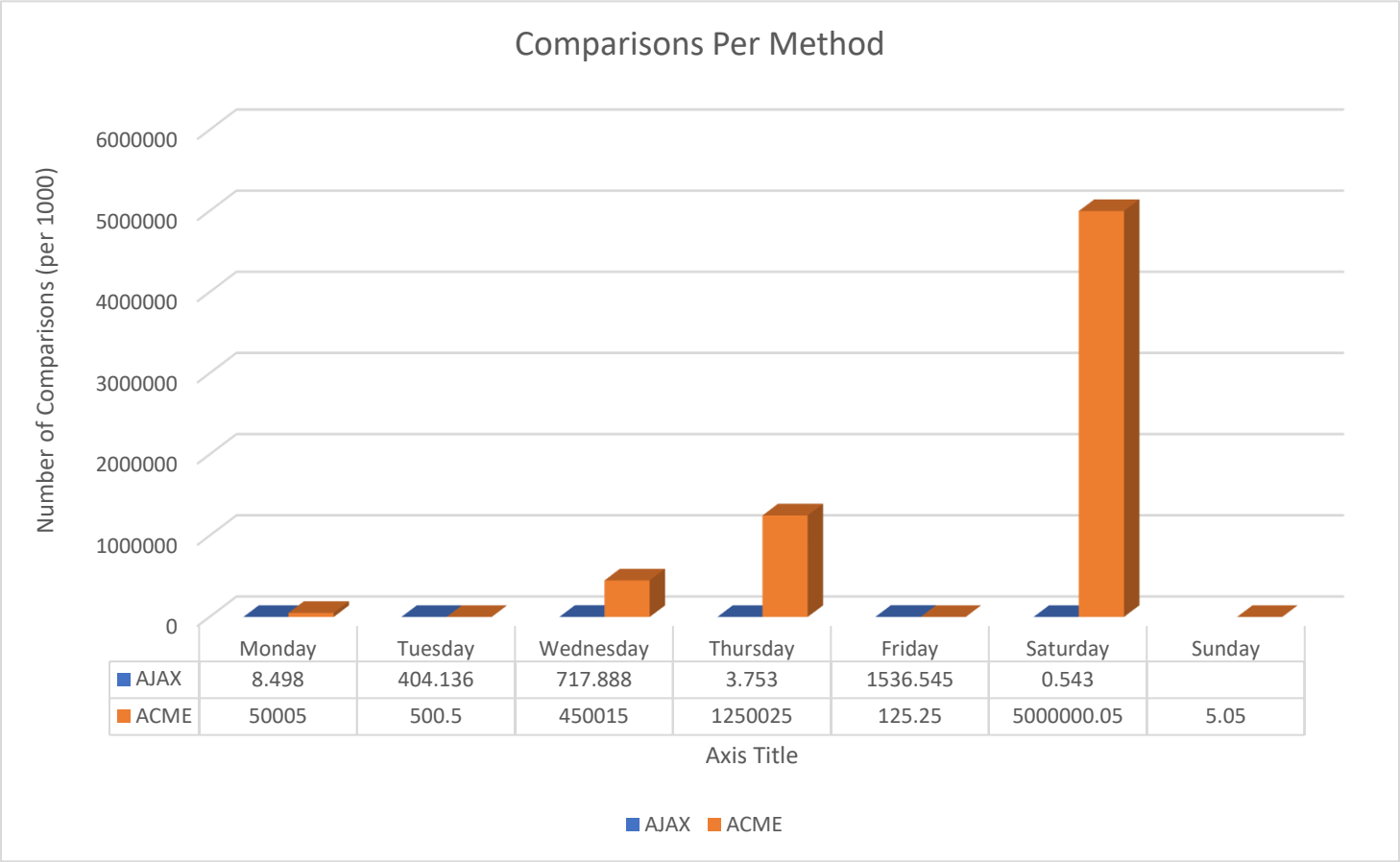
Sunday - $1,000 / $13,000 **AJAX is ~92% cheaper**



****Test ran with 1/1000 daily average given**

<u>Day – AJAX Time in seconds / ACME Time in seconds</u>

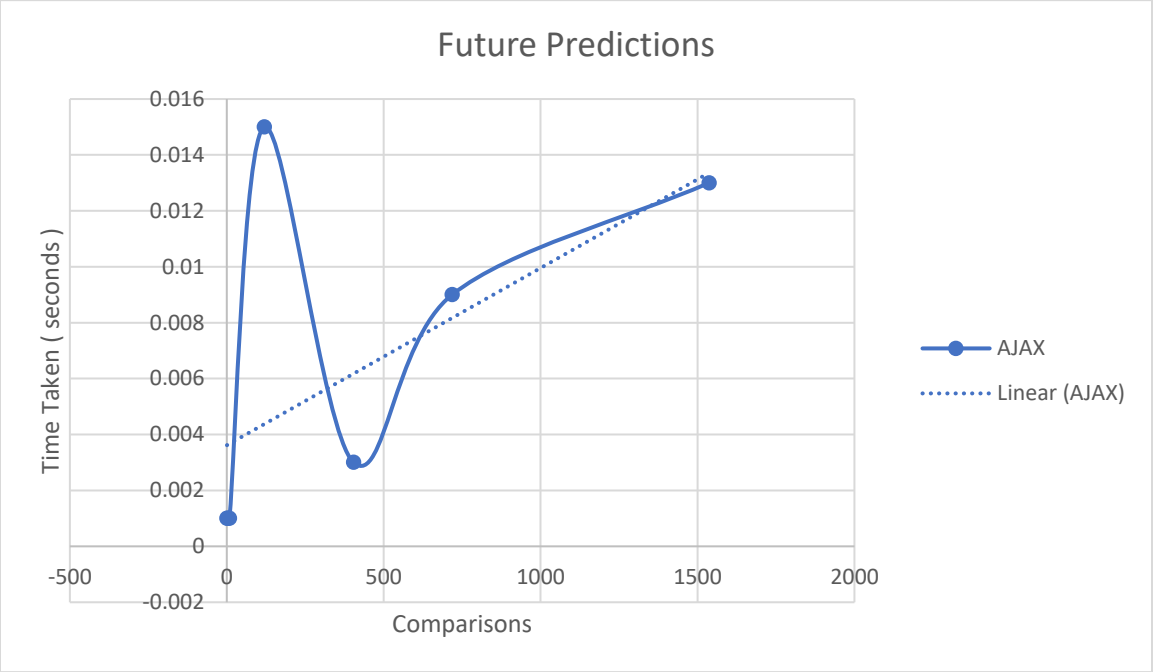
Monday - 0.01516304 seconds / 1.63876808 seconds	**AJAX is ~10,753% faster**
Tuesday - 0.00069652 seconds / 0.01445922 seconds	**AJAX is ~1,976% faster**
Wednesday - 0.00318358 seconds / 13.84492490 seconds	**AJAX is ~434,785% faster**
Thursday - 0.00881776 seconds / 38.82560825 seconds	**AJAX is ~440,211% faster**
Friday - 0.00089709 seconds / 0.00481366 seconds	**AJAX is ~437% faster**
Saturday - 0.01257752 seconds / 157.36201742 seconds	**AJAX is ~12,510,37% faster**
Sunday - 0.00064547 seconds / 0.00095908 seconds	**AJAX is ~49% faster**

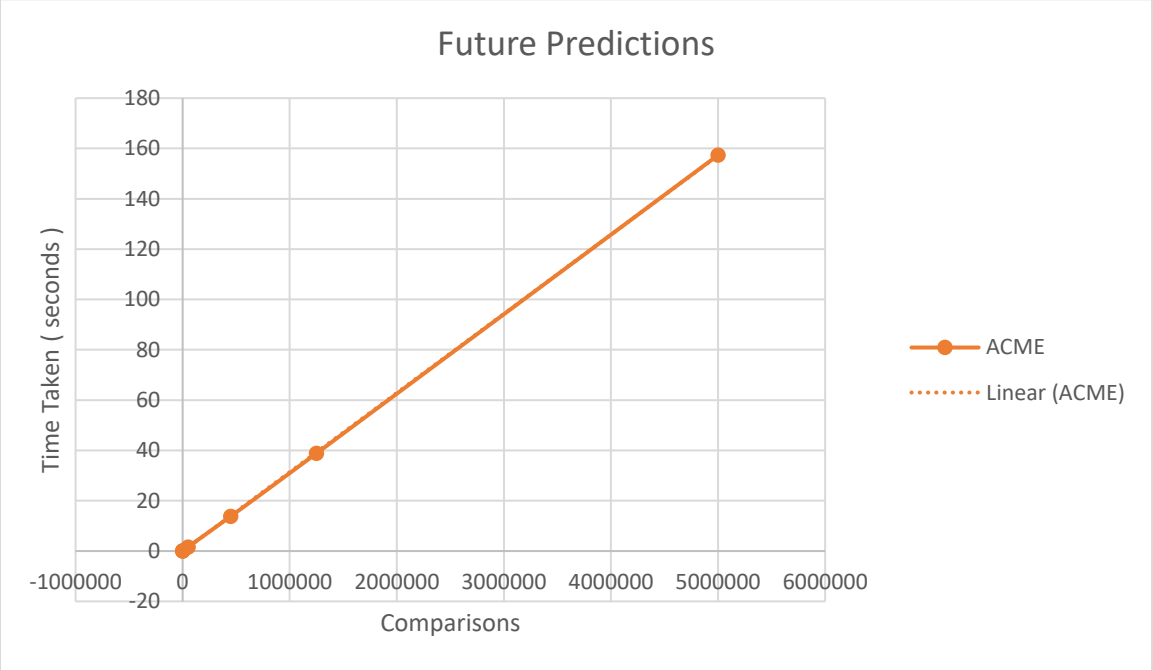


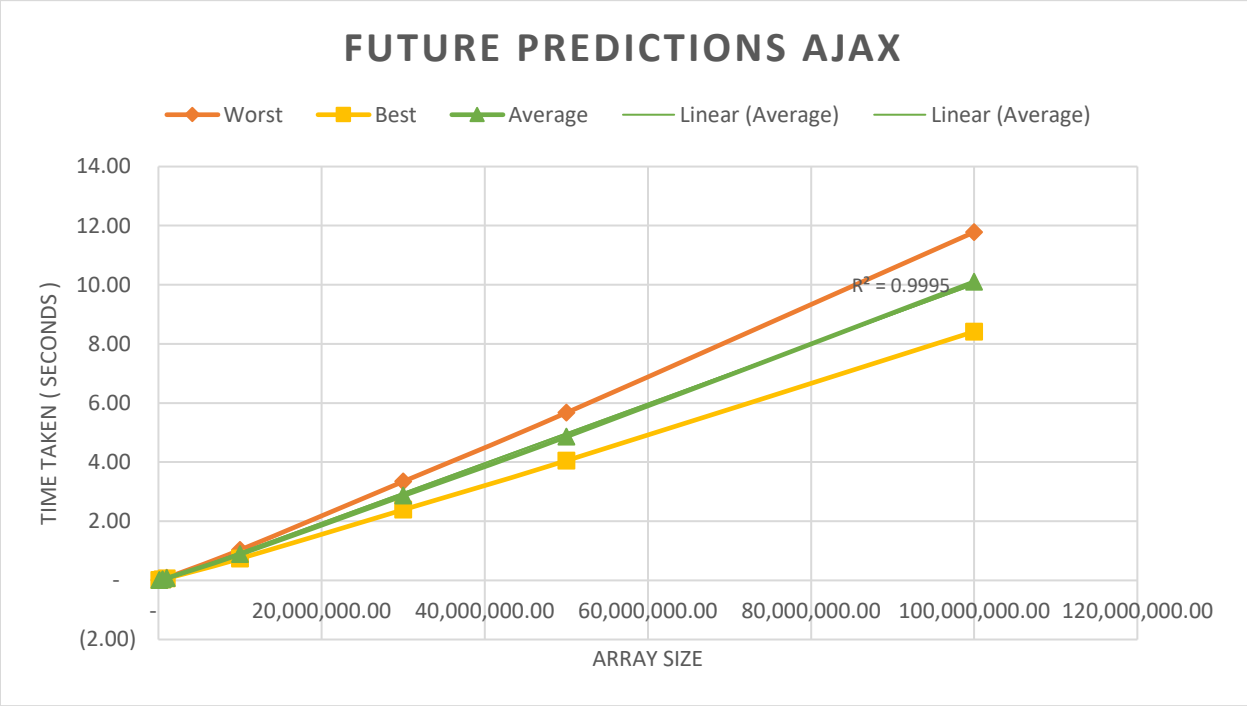
****Test ran with 1/1000 daily average given**

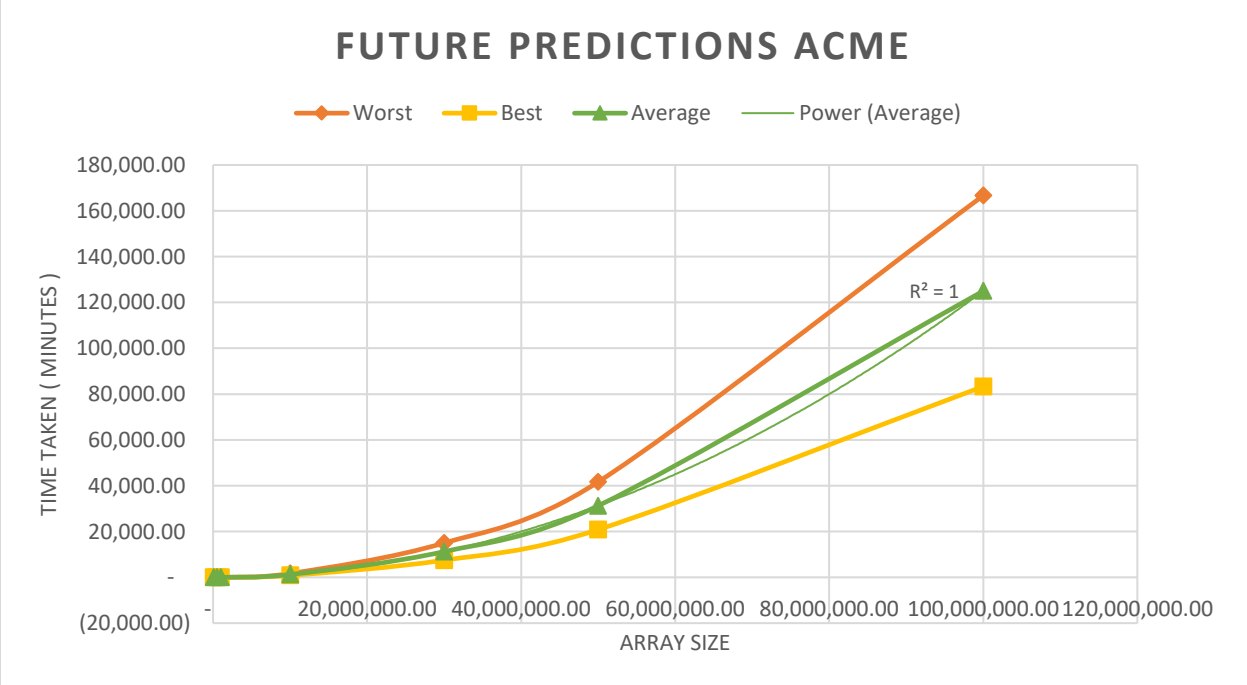
Day – AJAX Comparisons / ACME Comparisons

Monday – 119,595 comparisons / 50,005,000 comparisons	**AJAX has 41,812% less**
Tuesday – 8,498 comparisons / 500,500 comparisons	**AJAX has 5,890% less**
Wednesday – 404,136 comparisons / 450,015,000 comparisons	**AJAX has 111,352% less**
Thursday – 717,888 comparisons / 1,250,025,000 comparisons	**AJAX has 174,125% less**
Friday – 3,753 comparisons / 125,250 comparisons	**AJAX has 3,337% less**
Saturday – 1,536,545 comparisons / 5,000,000,050 comparisons	**AJAX has 45,888% less**
Sunday - 543 comparisons / 5,050 comparisons	**AJAX has 930% less**


Future Predictions
Time Taken (seconds)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
-500
0
500
1000
1500
2000
Comparisons
AJAX
Linear (AJAX)


Future Predictions
Time Taken (seconds)
180
160
140
120
100
80
60
40
20
0
-20
-1000000
0
1000000
2000000
3000000
4000000
5000000
6000000
Comparisons
ACME
Linear (ACME)


FUTURE PREDICTIONS AJAX
Worst
Best
Average
Linear (Average)
Linear (Average)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
-
(2.00)
TIME TAKEN (SECONDS)
R² = 0.9995
20,000,000.00
40,000,000.00
60,000,000.00
80,000,000.00
100,000,000.00
120,000,000.00
ARRAY SIZE


FUTURE PREDICTIONS ACME
Worst
Best
Average
Power (Average)
180,000.00
160,000.00
140,000.00
120,000.00
100,000.00
80,000.00
60,000.00
40,000.00
20,000.00
-
(20,000.00)
TIME TAKEN (MINUTES)
R² = 1
20,000,000.00
40,000,000.00
60,000,000.00
80,000,000.00
100,000,000.00
120,000,000.00
ARRAY SIZE