Data Article

Exploration of daily Internet data traffic generated in a smart university campus

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A B S T R A C T

In this data article, a robust data exploration is performed on daily Internet data traffic generated in a smart university campus for a period of twelve consecutive (12) months (January–December, 2017). For each day of the one-year study period, Internet data download traffic and Internet data upload traffic at Covenant University, Nigeria were monitored and properly logged using required application software namely: FreeRADIUS; Radius Manager Web application; and Mikrotik Hotspot Manager. A comprehensive dataset with detailed information is provided as supplementary material to this data article for easy research utility and validation. For each month, descriptive statistics of daily Internet data download traffic and daily Internet data upload traffic are presented in tables. Boxplot representations and time series plots are provided to show the trends of data download and upload traffic volume within the smart campus throughout the 12-month period. Frequency distributions of the dataset are illustrated using histograms. In addition, correlation and regression analyses are performed and the results are presented using a scatter plot. Probability Density Functions (PDFs) and Cumulative Distribution Functions (CDFs) of the dataset are also computed. Furthermore, Analysis of Variance (ANOVA) and multiple post-hoc tests are conducted to understand the statistical difference(s) in the Internet traffic volume, if any, across the 12-month period. The robust data exploration provided in this data article will help Internet Service Providers (ISPs) and network administrators in smart campuses to develop empirical
model for optimal Quality of Service (QoS), Internet traffic forecasting, and budgeting. © 2018 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Specifications Table

| Subject area           | Engineering          |
|------------------------|----------------------|
| More specific subject area | Information and Communication Engineering |
| Type of data           | Tables, graphs, figures, and spreadsheet file |
| How data was acquired  | For each day of the one-year study period, Internet data download traffic and Internet data upload traffic at Covenant University, Nigeria were monitored and properly logged using an open source software, Free-RADIUS, Radius Manager web application, and Mikrotik Hotspot Manager. Raw, analyzed |
| Data format            | Internet data download traffic and Internet data upload traffic were monitored and logged for only nineteen (19) days in December, 2017 because the university proceeded to end-of-year break afterward. |
| Experimental factors   | Descriptive statistics, boxplot representations, time series plots, frequency distributions, correlation and regression analyses, Probability Density Functions (PDFs), Cumulative Distribution Functions (CDFs), Analysis of Variance (ANOVA) test, and multiple post-hoc test are performed to explore the dataset provided in this data article. All statistical computations were done using the Machine Learning and Statistics toolbox in MATLAB 2016a software. |
| Experimental features  | The dataset on Internet data traffic provided in this article were collected at Covenant University, Canaanland, Ota, Nigeria (Latitude 6.6718° N, Longitude 3.1581° E) |
| Data source location   | A comprehensive dataset is provided in Microsoft Excel spreadsheet file and attached as supplementary material to this data article for easy research utility and validation |

Value of the data

- The data provided in this data article can be used to accurately predict Internet data traffic in a smart campus environment. Predictions of Internet data traffic will help network engineers to improve the Quality of Service (QoS) of computer networks and also ensure efficient utilization of the networks in a smart university campus [1,2].
- Availability of dataset on Internet data traffic obtained from real scenarios will facilitate more empirical research in the areas of computer networking and Internet traffic engineering [3,4].
- This dataset is made available to give correct facts and figures on Internet data traffic in a Nigerian university campus that is driven by Information and Communication Technologies (ICTs) [5,6].
- Free access to daily Internet data traffic of a period of one year will facilitate the development of empirical prediction models that can be used by Internet Service Providers (ISPs) and Internet subscribers in a smart university campus for effective network planning and traffic forecasting [7–12].
- Robust data exploration that is performed in this data article will help the university network administrators to gain useful insights about the traffic peak and off-peak periods. Also, the descriptive statistics, frequency and probability distribution plots, correlation analysis, ANOVA test and multiple post-hoc test results will give better understanding of the relationships between the Internet data download traffic and the Internet data upload traffic in a smart campus [13–15].
1. Data

Ubiquitous access to reliable Internet services is pivotal to achieving sustainable smart education in university campuses [16–18]. Accurate Internet data traffic prediction models are required for computer network planning and forecasting to guarantee efficient Quality of Service (QoS) in enterprise computer networks and applications. However, computer network planning are usually carried out based on theoretical formulations and simulations due to paucity of empirical data from real life scenarios. In this data article, a robust data exploration is performed on daily Internet data traffic in a smart university campus for a period of twelve consecutive (12) months (January–December, 2017).

For each month, descriptive statistics of daily Internet data download traffic and daily Internet data upload traffic are presented in tables. The mean, median, mode, standard deviation, variance, kurtosis, Skewness, range, minimum, maximum, and sum of the daily Internet data traffic download and upload for January–December, 2017 are presented in Tables 1 and 2 respectively.

2. Experimental design, materials and methods

A robust data exploration was performed on daily Internet data traffic in a smart university campus for a period of twelve consecutive (12) months (January–December, 2017). For each day of the one-year study period, Internet data download traffic and Internet data upload traffic at Covenant University, Nigeria were monitored and properly logged using an open source software, FreeRADIUS, Radius Manager web application, and Mikrotik Hotspot Manager. FreeRADIUS software was installed in Linux Operating System (OS) for authentication, authorization, and accounting services. Radius Manager Web application was used to add users, to edit and create cards, and to harvest data in a more user-friendly format. Mikrotik Hotspot Manager was used to integrate the smart campus network to the enterprise edge. Statistical computations were done using the Machine Learning and Statistics toolbox in MATLAB 2016a software. Boxplot representations of the daily download traffic and the daily upload traffic for the 12-month period are shown in Figs. 1 and 2 respectively.

3. Data exploration

Time series plots are provided to show the trends of data download and upload volume within the smart campus throughout the 12-month period. Figs. 3–6 show the trends in data download traffic for the first, second, third, and fourth quarters of year 2017 respectively. Similarly, the patterns of data upload traffic for the first, second, third, and fourth quarters of year 2017 are shown in Figs. 7–10 respectively. Frequency distributions of the dataset are illustrated using histograms. Figs. 11–14 show the histogram distributions of the data traffic volume for first, second, third, and fourth quarters of 2017.

| Table 1 | Descriptive statistics of daily IP data download traffic in Terabytes (TB). |
|---------|--------------------------------------------------------------------------------|
|         | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Mean    | 2.28| 2.30| 2.88| 2.72| 2.41| 2.23| 1.89| 1.20| 3.15| 3.20| 3.17| 2.33|
| Median  | 2.60| 2.40| 2.90| 2.60| 2.20| 2.20| 1.90| 0.92| 3.25| 3.20| 3.00| 2.40|
| Mode    | 3.40| 2.00| 2.90| 2.50| 2.00| 2.00| 2.10| 0.82| 3.50| 3.00| 3.00| 2.40|
| Standard Deviation | 1.21| 0.66| 0.79| 0.52| 0.82| 0.49| 0.71| 0.80| 0.40| 0.49| 0.69| 0.97|
| Variance | 1.46| 0.44| 0.63| 0.27| 0.66| 0.24| 0.51| 0.64| 0.16| 0.24| 0.48| 0.94|
| Kurtosis | 1.61| 4.38| 5.12| 3.80| 3.18| 3.67| 5.58| 6.03| 2.63| 1.78| 5.56| 3.96|
| Skewness | −0.47| −1.16| 0.48| −0.16| 0.95| 0.81| 0.87| 2.00| −0.69| 0.11| 0.76| 0.75|
| Range   | 3.51| 2.74| 4.20| 2.60| 3.30| 2.00| 3.70| 3.30| 1.50| 1.60| 3.80| 4.09|
| Minimum | 0.19| 0.36| 1.20| 1.30| 1.20| 1.50| 0.60| 0.50| 2.20| 2.40| 1.40| 0.81|
| Maximum | 3.70| 3.10| 5.40| 3.90| 4.50| 3.50| 4.30| 3.80| 3.70| 4.00| 5.20| 4.90|
| Sum     | 70.81| 64.36| 89.40| 81.60| 74.80| 67.00| 58.46| 37.20| 94.40| 99.10| 95.00| 44.21|
Table 2
Descriptive statistics of daily IP data upload traffic in Terabytes (TB).

|       | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Mean  | 0.29| 0.43| 0.49| 0.48| 0.36| 0.31| 0.28| 0.19| 0.58| 0.65| 0.64| 0.33|
| Median| 0.32| 0.47| 0.47| 0.50| 0.29| 0.31| 0.29| 0.15| 0.59| 0.64| 0.65| 0.28|
| Mode  | 0.14| 0.07| 0.15| 0.14| 0.14| 0.20| 0.06| 0.06| 0.40| 0.69| 0.23| 0.14|
| Standard Deviation | 0.16| 0.14| 0.14| 0.09| 0.18| 0.06| 0.11| 0.14| 0.06| 0.06| 0.12| 0.17|
| Variance | 0.02| 0.02| 0.02| 0.01| 0.03| 0.00| 0.01| 0.02| 0.00| 0.00| 0.02| 0.03|
| Kurtosis | 1.71| 3.55| 5.43| 8.61| 3.49| 2.45| 2.55| 5.07| 4.47| 2.89| 7.23| 6.52|
| Skewness | 0.24| 1.04| 0.19| 2.07| 1.19| 0.18| 0.07| 1.80| 1.16| 0.16| 0.39| 1.74|
| Minimum | 0.51| 0.56| 0.73| 0.47| 0.66| 0.25| 0.48| 0.52| 0.27| 0.28| 0.77| 0.72|
| Maximum | 0.54| 0.63| 0.88| 0.60| 0.80| 0.44| 0.54| 0.58| 0.67| 0.80| 1.00| 0.86|
| Sum    | 8.96| 12.17| 15.12| 14.27| 11.26| 9.23| 8.66| 5.94| 17.29| 20.10| 19.06| 6.24|

Fig. 1. Boxplot representation of daily data download traffic in Terabytes (TB).

Fig. 2. Boxplot representation of daily data upload traffic in Terabytes (TB).
Correlation and regression analyses are performed to establish a linear relationship the data download traffic and data upload traffic. The relationship yielded a correlation coefficient (R) of 0.8791. A linear regression equation that represent the relationship is provided in the scatter plot shown in Fig. 15. Probability Density Functions (PDFs) and Cumulative Distribution Functions (CDFs) of the dataset are also computed. PDF and CDF models of Normal, Logistic, Non-parametric, Rician, Weibull and Nakagami distributions were used to fit the empirical data as shown in Figs. 16 and 17. The CDF model distribution fittings of the dataset are shown in Figs. 18 and 19. Distribution fitting parameters for download data traffic (January–December, 2017) based on the six distribution models are presented in Table 3. Estimates and standard errors of download data traffic distribution parameters for the six models are presented in Table 4. Similarly, the distribution fitting parameters for upload data traffic (January–December, 2017) based on the six distribution models are presented in Table 5. Estimates and standard errors of download data traffic distribution parameters for the six models are presented in Table 6.

Furthermore, Analysis of Variance (ANOVA) and multiple post-hoc tests are conducted to understand the statistical difference(s) in the Internet traffic volume, if any, across the 12-month period. The results of the ANOVA test and the multiple post-hoc test conducted on download data traffic are presented in Tables 7 and 8 respectively. Likewise, the results of the ANOVA test and the multiple post-hoc test conducted on upload data traffic are presented in Tables 9 and 10 respectively. The multiple post-hoc comparison results for download data traffic and upload data traffic are depicted graphically in Figs. 20 and 21.

![Fig. 3. (a)–(c). Download traffic volume in first quarter, 2017.](image-url)
Fig. 4. (a)–(c). Download traffic volume in second quarter, 2017.
Fig. 5. (a)–(c). Download traffic volume in third quarter, 2017.
Fig. 6. (a)–(c). Download traffic volume in fourth quarter, 2017.
Fig. 7. (a)–(c). Upload traffic volume in first quarter, 2017.
Fig. 8. (a)–(c). Upload traffic volume in second quarter, 2017.
Fig. 9. (a)–(c). Upload traffic volume in third quarter, 2017.
Fig. 10. (a)–(c). Upload traffic volume in fourth quarter, 2017.
Fig. 11. (a)-(f). Frequency distributions of data download and upload traffic in first quarter, 2017.
Fig. 12. (a)–(f). Frequency distributions of data download and upload traffic in second quarter, 2017.
Fig. 13. (a)–(f). Frequency distributions of data download and upload traffic in third quarter, 2017.
Fig. 14. (a)–(f). Frequency distributions of data download and upload traffic in fourth quarter, 2017.

Fig. 15. Scatter plot of data download traffic and data upload traffic.
Fig. 16. Download data traffic distribution fittings using PDF models.

Fig. 17. Upload data traffic distribution fittings using PDF models.
Table 3

Distribution fitting parameters for download data traffic (January–December, 2017).

| Parameter      | Normal  | Logistic | Rician  | Weibull | Nakagami |
|----------------|---------|----------|---------|---------|----------|
| Log Likelihood | –473.562| –477.028 | –472.879| –475.457| –485.289 |
| Domain         | \( -\infty < y < \infty \) | \( -\infty < y < \infty \) | \( 0 < y < \infty \) | \( 0 < y < \infty \) | \( 0 < y < \infty \) |
| Mean           | 2.483   | 2.524    | 2.482   | 2.477   | 2.462    |
| Variance       | 0.859   | 0.919    | 0.858   | 0.8313  | 0.958    |

Table 4

Estimates and standard errors of download data traffic distribution parameters.

| Parameter | Normal    | Logistic   | Rician    | Weibull   | Nakagami  |
|-----------|-----------|------------|-----------|-----------|-----------|
| \( \mu \) | 2.483     | 2.524      | 2.494     | 2.776     | 1.680     |
| \( \sigma \) | 0.927     | 0.528      | 0.991     | 2.958     | 0.127     |
### Table 5
Distribution fitting parameters for upload data traffic (January–December, 2017).

|                     | Normal | Logistic | Rician | Weibull | Nakagami |
|---------------------|--------|----------|--------|---------|----------|
| Log Likelihood      | 86.969 | 75.92    | 93.032 | 90.011  | 86.668   |
| Domain              | $\infty < y < \infty$ | $\infty < y < \infty$ | $0 < y < \infty$ | $0 < y < \infty$ | $0 < y < \infty$ |
| Mean                | 0.420  | 0.423    | 0.421  | 0.420   | 0.417    |
| Variance            | 0.0359 | 0.041    | 0.035  | 0.035   | 0.038    |

### Table 6
Estimates and standard errors of upload data traffic distribution parameters.

| Parameter | Normal | Logistic | Rician | Weibull | Nakagami |
|-----------|--------|----------|--------|---------|----------|
|           | Approx | Std Err  | Approx | Std Err  | Approx | Std Err  | Approx | Std Err  | Approx | Std Err  |
| $\mu$     | 0.420  | 0.010    | 0.422  | 0.010    | 0.345  | 0.017    | 0.473  | 0.011    | 1.211  | 0.082    |
| $\sigma$  | 0.189  | 0.007    | 0.112  | 0.004    | 0.216  | 0.012    | 2.375  | 0.104    | 0.212  | 0.010    |

### Table 7
ANOVA test results for download data traffic.

| Source of Variation | Sum of Squares | Degree of Freedom | Mean Squares | F Statistic | Prob > F |
|---------------------|----------------|-------------------|--------------|-------------|----------|
| Columns             | 116.44         | 11                | 10.59        | 19.41       | $3.16 \times 10^{-30}$ |
| Error               | 185.93         | 341               | 0.55         |             |          |
| Total               | 302.37         | 352               |              |             |          |

### Table 8
Multiple post-hoc test results for download data traffic.

| Groups Compared | Lower limits for 95% confidence intervals | Mean Difference | Upper limits for 95% confidence intervals | $p$-value |
|-----------------|------------------------------------------|-----------------|------------------------------------------|-----------|
| Jan             | –0.6435                                  | –0.0144         | 0.6148                                   | 1.0000    |
| Jan             | –0.1216                                  | –0.5997         | 0.0133                                   | 0.0619    |
| Jan             | –1.0538                                  | –0.4358         | 0.1822                                   | 0.4732    |
| Jan             | –0.7416                                  | –0.1287         | 0.4842                                   | 0.9999    |
| Jan             | –0.5672                                  | 0.0509          | 0.6689                                   | 1.0000    |
| Jan             | –0.2145                                  | 0.3984          | 1.0113                                   | 0.0053    |
| Jan             | 0.4713                                   | 1.0842          | 1.6971                                   | 0.0000    |
| Jan             | –1.4805                                  | –0.8625         | –0.2445                                  | 0.0003    |
| Jan             | –1.5255                                  | –0.9126         | –0.2996                                  | 0.0001    |
| Jan             | –1.5005                                  | –0.8825         | –0.2645                                  | 0.0002    |
| Jan             | –0.7457                                  | –0.0426         | 0.6604                                   | 1.0000    |
| Feb             | –1.2144                                  | –0.5853         | 0.0438                                   | 0.0971    |
| Feb             | –1.0555                                  | –0.4214         | 0.2127                                   | 0.5702    |
| Feb             | –0.7435                                  | –0.1143         | 0.5148                                   | 1.0000    |
| Feb             | –0.5689                                  | 0.0652          | 0.6993                                   | 1.0000    |
| Feb             | –0.2164                                  | 0.4128          | 1.0419                                   | 0.5907    |
| Feb             | 0.4694                                   | 1.0986          | 1.7277                                   | 0.0000    |
| Feb             | –1.4822                                  | –0.8481         | –0.2140                                  | 0.0008    |
| Feb             | –1.5273                                  | –0.8982         | –0.2691                                  | 0.0002    |
| Feb             | –1.5022                                  | –0.8681         | –0.2340                                  | 0.0005    |
| Feb             | –0.7455                                  | –0.0283         | 0.6890                                   | 1.0000    |
| Mar             | –0.4541                                  | 0.1639          | 0.7819                                   | 0.9994    |
| Mar             | –0.1420                                  | 0.4710          | 1.0839                                   | 0.3327    |
| Mar             | 0.0325                                   | 0.6505          | 1.2686                                   | 0.0288    |
Table 8 (continued)

| Groups Compared | Lower limits for 95% confidence intervals | Mean Difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|----------------|------------------------------------------|---------|
| Mar Jul         | 0.3851                                   | 0.9981         | 1.6110                                   | 0.0000  |
| Mar Aug         | 1.0709                                   | 1.6839         | 2.2968                                   | 0.0000  |
| Mar Sep         | -0.8808                                  | -0.2628        | 0.3552                                   | 0.9658  |
| Mar Oct         | -0.9258                                  | -0.3129        | 0.3000                                   | 0.8827  |
| Mar Nov         | -0.9008                                  | -0.2828        | 0.3352                                   | 0.9423  |
| Mar Dec         | -0.1461                                  | 0.5570         | 1.2601                                   | 0.2857  |
| Apr May         | -0.3109                                  | 0.3071         | 0.9251                                   | 0.9007  |
| Apr Jun         | -0.1364                                  | 0.4867         | 1.1097                                   | 0.3072  |
| Apr Jul         | 0.2162                                   | 0.8342         | 1.4522                                   | 0.0006  |
| Apr Aug         | 0.9020                                   | 1.5200         | 2.1380                                   | 0.0000  |
| Apr Sep         | 1.0497                                   | -0.4267        | 0.1964                                   | 0.5217  |
| Apr Oct         | 1.0948                                   | -0.4768        | 0.1412                                   | 0.3264  |
| Apr Nov         | 1.0697                                   | -0.4467        | 0.1764                                   | 0.4458  |
| Apr Dec         | 0.3144                                   | 0.3932         | 1.1007                                   | 0.8096  |
| May Jun         | -0.4384                                  | 0.1796         | 0.7976                                   | 0.9986  |
| May Jul         | -0.0858                                  | 0.5271         | 1.1400                                   | 0.1754  |
| May Aug         | 0.6000                                   | 1.2129         | 1.8258                                   | 0.0000  |
| May Sep         | 1.3518                                   | -0.7338        | -0.1157                                  | 0.0059  |
| May Oct         | 1.3968                                   | -0.7839        | -0.1709                                  | 0.0017  |
| May Nov         | 1.3718                                   | -0.7538        | -0.1357                                  | 0.0039  |
| May Dec         | 0.3170                                   | 0.3475         | 0.9565                                   | 0.7972  |
| Jun Jul         | -0.2705                                  | 1.0333         | 1.6514                                   | 0.0000  |
| Jun Aug         | 0.4153                                   | 0.9133         | -0.2903                                  | 0.0001  |
| Jun Sep         | 1.5364                                   | -0.9133        | -0.3454                                  | 0.0000  |
| Jun Oct         | 1.5815                                   | -0.9634        | -0.3454                                  | 0.0000  |
| Jun Nov         | 1.5564                                   | -0.9333        | -0.3103                                  | 0.0001  |
| Jun Dec         | 0.8010                                   | -0.0935        | 0.6140                                   | 1.0000  |
| Jul Aug         | 0.0729                                   | 0.6858         | 1.2987                                   | 0.0136  |
| Jul Sep         | 1.8789                                   | -1.2609        | -0.6428                                  | 0.0000  |
| Jul Oct         | 1.9239                                   | -1.3110        | -0.6980                                  | 0.0000  |
| Jul Nov         | 1.8989                                   | -1.2809        | -0.6628                                  | 0.0000  |
| Jul Dec         | 1.1441                                   | -0.4410        | 0.2620                                   | 0.6587  |
| Aug Sep         | 2.5647                                   | -1.9467        | -1.3286                                  | 0.0000  |
| Aug Oct         | 2.6097                                   | -1.9968        | -1.3838                                  | 0.0000  |
| Aug Nov         | 2.5847                                   | -1.9667        | -1.3486                                  | 0.0000  |
| Aug Dec         | 1.8299                                   | -1.1268        | -0.4238                                  | 0.0000  |
| Sep Oct         | 0.6681                                   | -0.0501        | 0.5679                                   | 1.0000  |
| Sep Nov         | 0.6431                                   | -0.0200        | 0.6031                                   | 1.0000  |
| Sep Dec         | 0.1123                                   | 0.8198         | 1.5273                                   | 0.0084  |
| Oct Nov         | 0.5879                                   | 0.0301         | 0.6481                                   | 1.0000  |
| Oct Dec         | 0.1669                                   | 0.8699         | 1.5730                                   | 0.0031  |
| Nov Dec         | 0.1323                                   | 0.8398         | 1.5473                                   | 0.0059  |

Table 9
ANOVA test results for upload data traffic.

| Source of Variation | Sum of Squares | Degree of Freedom | Mean Squares | F Statistic | Prob > F |
|---------------------|----------------|-------------------|--------------|-------------|----------|
| Columns             | 7.38           | 11                | 0.67         | 43.58       | 2.03 x 10^-58 |
| Error               | 5.25           | 341               | 0.02         |             |          |
| Total               | 12.63          | 352               |              |             |          |
Table 10
Multiple post-hoc test results for upload data traffic.

| Groups Compared | Lower limits for 95% confidence intervals | Mean Difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|----------------|------------------------------------------|---------|
| Jan Feb         | -0.2513                                  | -0.1456        | -0.0399                                  | 0.0004  |
| Jan Mar         | -0.3018                                  | -0.1988        | -0.0958                                  | 0.0000  |
| Jan Apr         | -0.2904                                  | -0.1866        | -0.0827                                  | 0.0000  |
| Jan May         | -0.1771                                  | -0.0741        | 0.0289                                   | 0.4391  |
| Jan Jun         | -0.1224                                  | -0.0186        | 0.0852                                   | 1.0000  |
| Jan Jul         | -0.0933                                  | 0.0097         | 0.1126                                   | 1.0000  |
| Jan Aug         | -0.0056                                  | 0.0974         | 0.2004                                   | 0.0843  |
| Jan Sep         | -0.3911                                  | -0.2873        | -0.1835                                  | 0.0000  |
| Jan Oct         | -0.4622                                  | -0.3593        | -0.2563                                  | 0.0000  |
| Jan Nov         | -0.4499                                  | -0.3461        | -0.2422                                  | 0.0000  |
| Jan Dec         | -0.1573                                  | -0.0392        | 0.0789                                   | 0.9953  |
| Feb Mar         | -0.1589                                  | -0.0532        | 0.0525                                   | 0.8930  |
| Feb Apr         | -0.1474                                  | -0.0409        | 0.0656                                   | 0.9843  |
| Feb May         | -0.0342                                  | 0.0715         | 0.1772                                   | 0.5413  |
| Feb Jun         | 0.0205                                   | 0.1270         | 0.2336                                   | 0.0055  |
| Feb Jul         | 0.0496                                   | 0.1553         | 0.2610                                   | 0.0001  |
| Feb Aug         | 0.1374                                   | 0.2431         | 0.3488                                   | 0.0000  |
| Feb Sep         | -0.2482                                  | -0.1416        | -0.0551                                  | 0.0009  |
| Feb Oct         | -0.2319                                  | -0.2136        | -0.1079                                  | 0.0000  |
| Feb Nov         | -0.2070                                  | -0.2004        | -0.0939                                  | 0.0000  |
| Feb Dec         | -0.0141                                  | 0.1064         | 0.2269                                   | 0.1456  |
| Mar Apr         | -0.0916                                  | 0.0122         | 0.1161                                   | 1.0000  |
| Mar May         | 0.0217                                   | 0.1247         | 0.2277                                   | 0.0044  |
| Mar Jun         | 0.0764                                   | 0.1802         | 0.2840                                   | 0.0000  |
| Mar Jul         | 0.1055                                   | 0.2085         | 0.3114                                   | 0.0000  |
| Mar Aug         | 0.1932                                   | 0.2962         | 0.3992                                   | 0.0000  |
| Mar Sep         | -0.1923                                  | -0.0885        | 0.0153                                   | 0.1862  |
| Mar Oct         | -0.2634                                  | -0.1605        | -0.0575                                  | 0.0000  |
| Mar Nov         | -0.2511                                  | -0.1473        | -0.0434                                  | 0.0002  |
| Mar Dec         | 0.0415                                   | 0.1596         | 0.2777                                   | 0.0006  |
| Apr May         | 0.0086                                   | 0.1124         | 0.2163                                   | 0.0206  |
| Apr Jun         | 0.0633                                   | 0.1680         | 0.2726                                   | 0.0000  |
| Apr Jul         | 0.0924                                   | 0.1962         | 0.3000                                   | 0.0000  |
| Apr Aug         | 0.1801                                   | 0.2840         | 0.3878                                   | 0.0000  |
| Apr Sep         | -0.2054                                  | -0.1007        | 0.0039                                   | 0.0723  |
| Apr Oct         | -0.2765                                  | -0.1727        | -0.0689                                  | 0.0000  |
| Apr Nov         | -0.2642                                  | -0.1595        | -0.0548                                  | 0.0000  |
| Apr Dec         | 0.0285                                   | 0.1473         | 0.2662                                   | 0.0030  |
| May Jun         | -0.0483                                  | 0.0555         | 0.1594                                   | 0.8460  |
| May Jul         | -0.0192                                  | 0.0838         | 0.1868                                   | 0.2473  |
| May Aug         | 0.0686                                   | 0.1715         | 0.2745                                   | 0.0000  |
| May Sep         | -0.3170                                  | -0.2132        | -0.1093                                  | 0.0000  |
| May Oct         | -0.3881                                  | -0.2851        | -0.1822                                  | 0.0000  |
| May Nov         | -0.3758                                  | -0.2719        | -0.1681                                  | 0.0000  |
| May Dec         | -0.0832                                  | 0.0349         | 0.1530                                   | 0.9983  |
| Jun Jul         | -0.0756                                  | 0.0283         | 0.1321                                   | 0.9992  |
| Jun Aug         | 0.0122                                   | 0.1160         | 0.2198                                   | 0.0139  |
| Jun Sep         | -0.3734                                  | -0.2687        | -0.1640                                  | 0.0000  |
| Jun Oct         | -0.4445                                  | -0.3407        | -0.2368                                  | 0.0000  |
| Jun Nov         | -0.4321                                  | -0.3275        | -0.2228                                  | 0.0000  |
| Jun Dec         | -0.1395                                  | -0.0206        | 0.0983                                   | 1.0000  |
| Jul Aug         | -0.0152                                  | 0.0878         | 0.1907                                   | 0.1862  |
| Jul Sep         | -0.4008                                  | -0.2969        | -0.1931                                  | 0.0000  |
| Jul Oct         | -0.4719                                  | -0.3689        | -0.2659                                  | 0.0000  |
| Jul Nov         | -0.4596                                  | -0.3557        | -0.2519                                  | 0.0000  |
| Jul Dec         | -0.1670                                  | -0.0489        | 0.0693                                   | 0.9721  |
| Aug Sep         | -0.4885                                  | -0.3847        | -0.2809                                  | 0.0000  |
| Aug Oct         | -0.5597                                  | -0.4567        | -0.3537                                  | 0.0000  |
| Aug Nov         | -0.5473                                  | -0.4435        | -0.3396                                  | 0.0000  |
Table 10 (continued)

| Groups Compared | Lower limits for 95% confidence intervals | Mean Difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|-----------------|------------------------------------------|---------|
| Aug Dec         | −0.2548                                  | −0.1366         | −0.0185                                  | 0.0086  |
| Sep Oct         | −0.1758                                  | −0.0720         | 0.0319                                   | 0.5017  |
| Sep Nov         | −0.1635                                  | −0.0588         | 0.0459                                   | 0.7988  |
| Sep Dec         | 0.1292                                   | 0.2481          | 0.3669                                   | 0.0000  |
| Oct Nov         | −0.0906                                  | 0.0132          | 0.1170                                   | 1.0000  |
| Oct Dec         | 0.2019                                   | 0.3200          | 0.4382                                   | 0.0000  |
| Nov Dec         | 0.1880                                   | 0.3069          | 0.4257                                   | 0.0000  |

Fig. 20. Graphical representation of multiple post-hoc test result for download data traffic.

Fig. 21. Graphical representation of multiple post-hoc test result for upload data traffic.
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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.07.039.

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.07.039.

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