The Study on Difference among Flow Specifications in Internet

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Abstract

Aggregate flow is the base methodology of network measurement and the orientation of next generation network management. For the same data, different flow specifications lead to different results, and the costs also vary significantly. To analyze the correlations among specifications, we select seven wide used specifications and calculate their single disparity degree and comprehensive similarity degree based on seven metrics: average flow number per second, average active flow number per second, average hold flow number per second, average flow recreate time, recreate flow number, unique flow number and aggregate flow cost. Comprehensive evaluation standard shows that the difference among flow specifications is less than 20%, and the specification of 16sec-5-tuple is significantly similar with 15sec-NetFlow. Moreover, the similarity between specifications of 2-tuple and 3-tuple granularity with the same timeout value is great, while 3-tuple costs comparatively less. We also summarize the correlations between specifications from the perspective of all the single metrics.

1. Introduction

The insight into Internet measurement is very essential for producing accurate simulation model, improving efficiency of existed network equipments, network anomaly and attack detection and so forth [1]. Flow is the base of network measurement while aggregate flow can provide clues to high level network behavior research. For TCP protocol, the accurate definition of flow is based on the SYN and FIN control mechanism, which can't be applied on the large scale network traffic. On the other hand, not all traffic uses transport layer protocols that support SYN and FIN functionality, for example, UDP. To avoid these drawbacks, Claffy introduced a new definition of flow based on 5-tuple granularity (host pair, port pair, protocol) and timeout value [2],[3]. After her first advice of 64 second timeout, researches also issued other granularities and values, like Ryu's adaptive timeout strategy [4]. We call the combination of flow granularity and timeout value flow specification in this paper, which simplifies the process of aggregate flow. Besides 5-tuple granularity, there are several wide used ones, such as 2-tuple (host pair) and 3-tuple (host pair and protocol).

For the same data set, different flow specifications will lead to different results, precision and cost, which mainly consist of memory cost and CPU power cost. On the other hand, there are some correlations among these specifications. The objective of this paper is to find an operational methodology for quantitatively analysis of the cost, precision and correlations, providing clues to 1) selecting optional flow specification for certain requirements 2) replacing some specifications with others having similar precision but comparatively less cost and 3) classifying flow specifications.

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2. Methodology

To achieve the research target, we introduce the statistical methodology based on metrics. In details, firstly we choose the flow specifications to be analyzed and a group of flow-oriented metrics, and then profile the traffic data with these specifications to get the flow entries and statistical results corresponding to the metrics. After that, we select appropriate similarity and disparity degree definition to analyze the results of single and comprehensive metrics respectively. At last we demonstrate the similarity and disparity degree among flow specifications, as well as calculate the cost of aggregate process.

2.1. Flow specifications

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There are seven flow specifications p_1—p_7 in this paper, as depicted in Table 1.

Table 1. Flow specifications

Notation	flow specification	p_4	64sec 2-tuple
p_1	16sec 2-tuple	p_5	16sec 3-tuple
p_2	16sec 3-tuple	p_6	16sec 5-tuple
p_3	16sec 5-tuple	p_7	15sec-NetFlow

Where
2-tuple: source IP address, destination IP address
3-tuple: source IP address, destination IP address, protocol
5-tuple: source IP address, destination IP address, source port number, destination port number, protocol

2.2. Metrics

In this paper, we select six metrics as the base of similarity and disparity degree analysis:

a) average flow number per second m_1: Flow setup requires CPU power on the routers to maintain flow state. Total number of flows is correlated with timeout value, the less the timeout, the greater the number of flows, because shorter timeout tends to split long-lived flows into several short ones.

b) average active flow number per second m_2: Flow is active between its first and last packet regardless of the timeout interval after the last packet.

c) average hold flow number per second m_3: After the last packet of flow, the flow entry still needs to be held in memory until timeout expires. This metric reflects the router workload because the greater the number of hold flow, the more memory required for maintenance and the more search time for accessing certain flow entries.

d) unique flow number m_4: the number of flows which have different granularities, the flows having the same granularity should be counted once, this metric should be determined by flow granularity regardless of timeout value.

e) recreate flow number m_5: the number of flows which have the same granularities. Thrashing will occur if flow demands are larger than available router resources and require constant closing and reopening of flows. Furthermore, the majority of packets and bytes of Internet traffic are carried by a small percentage of long-lived flows [5]. So decreasing recreate flows and keeping long-lived flows can improve the router efficiency greatly.

f) average flow recreate time m_6: We define recreate time as the interval between the two sequent flows having the same granularity.

2.3. Data source

The data sets (IP Trace) we utilize in this study are from 2.5G backbone of CERNET regional site and collecting time is Nov.10.2005, Jan.5.2007, and July.16.2008. All these IP Traces are of 60 minutes duration, from 2:00 p.m. to 3:00 p.m. of the day.

2.4. Analysis methodology of disparity and similarity degree

2.4.1. Single evaluation standard. Single disparity degree concentrates on single metric. For certain data set IPTrace[k], k=1..3, we aggregate flows with the flow specifications p_j, j=1..7 mentioned in 2.1 and calculate results $V_m[k][i][j]$ based on the metrics defined in 2.2, i=1..6.

For specified parameter IPTrace[k] and metric m_i, We define single disparity degree as follows:

$$s[k][i][j_1,j_2]=\begin{cases}\dfrac{\left|Vm[k][i][j_1]-Vm[k][i][j_2]\right|}{Vm[k][i][j_1]} & j_1\neq j_2\\ 0 & j_1=j_2\end{cases}$$

where j_1 , j_2=1..7 and $s[k][i][j_1,j_2]$ is a 7*7 matrix.

2.4.2. Comprehensive evaluation standard. Single disparity degree only depicts the correlations among flow specifications from one certain aspect, and a comprehensive evaluation standard will lead us into deeper insight. Based on the cosine-similarity expression in similar theory, we define the comprehensive similarity degree $r[k][j_1,j_2]$, which is expressed for specified parameter IPTrace[k] as follows:

$$r[k][j_1,j_2]=\begin{cases}\dfrac{\sum_{i=1}^{6}\left(Vm[k][i][j_1]*Vm[k][i][j_2]\right)}{\sqrt{\sum_{i=1}^{6}Vm^2[k][i][j_1]*\sum_{i=1}^{6}Vm^2[k][i][j_2]}} & j_1\neq j_2\\ 1 & j_1=j_2\end{cases}$$

where j_1 , j_2=1..7 and $r[k][j_1,j_2]$ is a 7*7 matrix.

2.4.3. Cost evaluation standard. To provide clues to selecting optional flow specification for certain requirements and replacing some specifications with others having approximate precision but less cost, we need to calculate the cost of flow specifications. So we introduce two standards to evaluate total cost: memory cost and CPU cost.

a) Memory cost: memory cost=T_{hold} * Num_{flow}, where T_{hold} means average flow hold time, Num_{flow} means total number of flows. This cost is only associated with data set and flow specification.

b) CPU cost: the execution time of aggregate flow process, which is determined by specific algorithm, computer configuration, the processes running on the computer and so forth.

3. Experiment results

3.1. Results of single evaluation standard

According to the expression in 2.4.1 and the three Traces in 2.3, we calculate the disparity degrees corresponding to the six metrics in 2.2 among the seven flow specifications, getting three groups, each with 6, a total of 18 single disparity degree matrixes, which are included in Appendix 1.

3.2. Results of comprehensive evaluation standard

Based on the cosine-similarity expression in 2.4.2 we obtain comprehensive similarity degree matrixes M_1, M_2, M_3, corresponding to the three traces. The final similarity degree matrix M is calculated as $M=(M_1+M_2+M_3)/3$.

$$M = \begin{bmatrix} 1.0000 & 0.9959 & 0.7600 & 0.9389 & 0.9297 & 0.6657 & 0.7736 \\ 0.9959 & 1.0000 & 0.8086 & 0.9639 & 0.9575 & 0.7208 & 0.8210 \\ 0.7600 & 0.8086 & 1.0000 & 0.9343 & 0.9403 & 0.9887 & 0.9998 \\ 0.9389 & 0.9639 & 0.9343 & 1.0000 & 0.9993 & 0.8759 & 0.9417 \\ 0.9297 & 0.9575 & 0.9403 & 0.9993 & 1.0000 & 0.8841 & 0.9474 \\ 0.6657 & 0.7208 & 0.9887 & 0.8759 & 0.8841 & 1.0000 & 0.9852 \\ 0.7736 & 0.8210 & 0.9998 & 0.9417 & 0.9474 & 0.9852 & 1.0000 \end{bmatrix}$$

where m_{ij} means the comprehensive similarity degree between specification p_i and p_j, and the closer it is to 1, the more similarity is. Table 2 shows the similar correlations among the flow specifications based on the matrix above.

Table 2. Similar correlations between flow specifications

source specification	p_1	p_2	p_3	p_4	p_5	p_6	p_7
similar specification	p_2	p_1	p_7	p_5	p_4	p_3	p_3

3.3. Results of cost evaluation standard

We execute the aggregate flow processes with different flow specifications and three traces on the same computing server under the environment of similar system workload. Table 3 depicts the average cost.

From Table 3 we can find that there is great difference among memory cost, while CPU cost is very close. Besides, CPU cost is affected by many uncontrolled factors. So the cost of flow specification should be mainly determined by memory cost.

Table 3. Cost of flow specifications

	16-2	16-3	16-5
memory cost 1.0e+009	1.1977	0.9949	1.2618
CPU cost (second)	3757	3804	3862
64-2	64-3	64-5	NetFlow
3.0244	2.7307	3.7360	1.1680
4004	4114	4252	4336

4. Discussions and conclusions

In this section, we analyze the experiment results to demonstrate the correlations among flow specifications from the aspects of single evaluation standard and also comprehensive evaluation standard. Furthermore, we discuss the substitution plan of specifications based on their costs.

a) Firstly we uncover the great similarity among flow specifications of single metric:

Average flow number per second: Specifications of 16sec-5-tuple, 64sec-5-tuple and 15sec-NetFlow are similar with each other.

Unique flow number: The specifications with the same timeout value are similar with each other, and the ones with 5-tuple are similar with NetFlow. These correlations are due to the fact that unique flow number is only determined by flow granularity, regardless of timeout value.

Recreate flow number: Specification of 16sec-5-tuple is significantly similar with 15sec-Netflow.

Average active flow number per second, average hold flow number per second, average recreate time: The similarities among 16sec-2-tuple, 16sec-3-tuple, 16sec-5-tuple and 15sec-NetFlow are great, moreover, specifications of 64sec-2-tuple, 64sec-3-tuple, 64sec-5-tuple are similar with each other.

b) Though there are some differences among flow specifications from the aspect of comprehensive evaluation standard, the majority of them are less than 20%.

c) The comprehensive similarity degree between 16sec-5-tuple and 15sec-NetFlow is very close to 1. Based on this great similarity and the truth that NetFlow is the most wide used traffic analysis tool, we can draw the conclusion that 16 second timeout value is more appropriate to nowadays network than 64 second, which is also introduced in [6]. As a result, researchers can obtain almost the same results by replacing 15sec-NetFlow with 16sec-5-tuple without utilizing SYN and FIN control mechanism of TCP.

d) Specifications of 2-tuple and 3-tuple are similar greatly in the case of the same timeout value. Additionally, the cost of 3-tuple is comparatively less, so we can substitute 3-tuple for 2-tuple.

e) If we need to analyze data set on one or more single certain metrics and comprehensive characterization, we can choose some other specifications with approximate precision but less cost compared to the expected specification. However, it is notable that the similar relationships and substitution plans are only applicable to the flow specifications and metrics mentioned in this paper.

5. Future work

In this paper, we introduce statistical methodology and select a group of metrics, calculating the single disparity degree and comprehensive similarity degree among flow specifications using similar system theory. Unfortunately, the conclusions are only applicable to the flow specifications and metrics in this paper. Though the correlations are very useful, the new research methodology is also of great importance because it can provide clues to selecting optional flow specification for certain requirements and replacing some specifications with others having similar precision but less cost. We hope to extend this methodology to be applied to other flow specifications, metrics and more complex evaluation standards. Moreover, we also plan to collect more traces to further analyze the similar relationships among flow specifications.

6. References

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7. Appendix 1.

Disparity degree of average flow number per second:

Trace1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.4394	0.1021	0.3898	0.5924	0.2165	0.1352
16-3	0.7837	0.0000	0.6016	0.0884	0.2730	0.3976	0.5425
16-5	0.1137	0.3756	0.0000	0.3204	0.5461	0.1274	0.0369
64-2	0.6389	0.0812	0.4715	0.0000	0.3320	0.2841	0.4173
64-3	1.4536	0.3756	1.2030	0.4971	0.0000	0.9225	1.1218
64-5	0.2763	0.2845	0.1459	0.2213	0.4798	0.0000	0.1037
NetFlow	0.1564	0.3517	0.0383	0.2944	0.5287	0.0939	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.0922	0.1203	0.2644	0.3068	0.0451	0.0995
16-3	0.1015	0.0000	0.2340	0.1897	0.2365	0.0518	0.2111
16-5	0.1074	0.1896	0.0000	0.3433	0.3813	0.1476	0.0186
64-2	0.3594	0.2341	0.5229	0.0000	0.0577	0.2981	0.4946
64-3	0.4427	0.3097	0.6162	0.0613	0.0000	0.3776	0.5862
64-5	0.0472	0.0493	0.1732	0.2296	0.2741	0.0000	0.1514
NetFlow	0.0905	0.1743	0.0189	0.3309	0.3696	0.1315	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.3357	1.6076	0.3536	0.5170	1.4246	1.6184
16-3	0.5054	0.0000	2.9255	0.0269	0.2729	2.6499	2.9417
16-5	0.6165	0.7453	0.0000	0.7521	0.8148	0.0702	0.0041
64-2	0.5470	0.0277	3.0341	0.0000	0.2528	2.7509	3.0507
64-3	1.0704	0.3753	4.3988	0.3383	0.0000	4.0198	4.4210
64-5	0.5876	0.7260	0.0755	0.7334	0.8008	0.0000	0.0799
NetFlow	0.6181	0.7463	0.0041	0.7531	0.8155	0.0740	0.0000

Disparity degree of average active flow number per second:

Trace 1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.1436	0.0748	0.9887	0.8684	0.7334	0.1269
16-3	0.1676	0.0000	0.0803	1.3221	1.1816	1.0240	0.0195
16-5	0.0808	0.0744	0.0000	1.1494	1.0194	0.8734	0.0563
64-2	0.4972	0.5694	0.5348	0.0000	0.0605	0.1284	0.5609
64-3	0.4648	0.5416	0.5048	0.0644	0.0000	0.0723	0.5327
64-5	0.4231	0.5059	0.4662	0.1473	0.0779	0.0000	0.4963
NetFlow	0.1453	0.0191	0.0597	1.2776	1.1398	0.9852	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.1121	0.0799	1.2298	1.2295	0.9722	0.1370
16-3	0.1263	0.0000	0.0363	1.5114	1.5111	1.2212	0.0280
16-5	0.0868	0.0350	0.0000	1.4235	1.4232	1.1434	0.0620
64-2	0.5515	0.6018	0.5874	0.0000	0.0001	0.1156	0.6130
64-3	0.5515	0.6018	0.5873	0.0001	0.0000	0.1154	0.6129
64-5	0.4929	0.5498	0.5335	0.1307	0.1305	0.0000	0.5624
NetFlow	0.1587	0.0288	0.0662	1.5838	1.5835	1.2852	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.1003	0.1508	0.6772	0.6501	0.8774	0.0721
16-3	0.1115	0.0000	0.2791	0.8641	0.8340	1.0866	0.1916
16-5	0.1310	0.2182	0.0000	0.4574	0.4338	0.6314	0.0684
64-2	0.4038	0.4636	0.3139	0.0000	0.0162	0.1193	0.3608
64-3	0.3940	0.4547	0.3026	0.0165	0.0000	0.1378	0.3502
64-5	0.4673	0.5208	0.3870	0.1066	0.1211	0.0000	0.4289
NetFlow	0.0673	0.1608	0.0734	0.5644	0.5390	0.7510	0.0000

Disparity degree of average hold flow number per second:

Trace 1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.3003	0.0893	1.2283	0.7423	1.4757	0.1599
16-3	0.4292	0.0000	0.3017	2.1848	1.4901	2.5383	0.2007
16-5	0.0980	0.2318	0.0000	1.4467	0.9130	1.7183	0.0776
64-2	0.5512	0.6860	0.5913	0.0000	0.2181	0.1110	0.6230
64-3	0.4260	0.5984	0.4773	0.2790	0.0000	0.4209	0.5178
64-5	0.5961	0.7174	0.6321	0.0999	0.2962	0.0000	0.6607
NetFlow	0.1904	0.1671	0.0841	1.6525	1.0739	1.9469	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.0986	0.0552	1.7110	1.5960	2.2191	0.0238
16-3	0.1094	0.0000	0.1707	2.0076	1.8801	2.5713	0.0830
16-5	0.0523	0.1458	0.0000	1.5691	1.4602	2.0507	0.0748
64-2	0.6311	0.6675	0.6108	0.0000	0.0424	0.1874	0.6399
64-3	0.6148	0.6528	0.5935	0.0443	0.0000	0.2400	0.6240
64-5	0.6894	0.7200	0.6722	0.1579	0.1936	0.0000	0.6967
NetFlow	0.0243	0.0767	0.0809	1.7770	1.6592	2.2975	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.2166	0.8709	1.1260	0.7890	4.7418	0.7555
16-3	0.2765	0.0000	1.3883	1.7139	1.2837	6.3296	1.2410
16-5	0.4655	0.5813	0.0000	0.1363	0.0438	2.0690	0.0617
64-2	0.5296	0.6315	0.1200	0.0000	0.1585	1.7008	0.174
64-3	0.4410	0.5621	0.0458	0.1884	0.0000	2.2095	0.0187
64-5	0.8258	0.8636	0.6742	0.6297	0.6884	0.0000	0.6943
NetFlow	0.4304	0.5538	0.0657	0.2110	0.0191	2.2707	0.0000

Disparity degree of recreate flow number:

Trace 1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.4997	0.6655	0.5827	0.7393	0.8473	0.6589
16-3	0.9986	0.0000	0.3315	0.1660	0.4789	0.6949	0.3182
16-5	1.9898	0.4959	0.0000	0.2476	0.2205	0.5435	0.0199
64-2	1.3965	0.1991	0.1984	0.0000	0.3752	0.6341	0.1825
64-3	2.8353	0.9190	0.2828	0.6004	0.0000	0.4144	0.3083
64-5	5.5499	2.2772	1.1908	1.7331	0.7078	0.0000	1.2343
NetFlow	1.9315	0.466	0.0195	0.2233	0.2357	0.5524	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.0877	0.2243	0.3507	0.3762	0.4491	0.2223
16-3	0.0962	0.0000	0.1497	0.2882	0.3163	0.3961	0.1475
16-5	0.2892	0.1761	0.0000	0.1629	0.1959	0.2897	0.0026
64-2	0.5401	0.4050	0.1946	0.0000	0.0394	0.1515	0.1978
64-3	0.6032	0.4625	0.2436	0.0410	0.0000	0.1168	0.2469
64-5	0.8151	0.6559	0.4079	0.1786	0.1322	0.0000	0.4117
NetFlow	0.2858	0.1730	0.0026	0.1651	0.1980	0.2916	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.3823	0.4144	0.5813	0.6927	0.7344	0.3460
16-3	0.6189	0.0000	0.0520	0.3221	0.5025	0.5700	0.0588
16-5	0.7077	0.0548	0.0000	0.2850	0.4753	0.5465	0.1169
64-2	1.3882	0.4752	0.3985	0.0000	0.2662	0.3657	0.5620
64-3	2.2544	1.0102	0.9058	0.3627	0.0000	0.1356	1.1285
64-5	2.7651	1.3257	1.2048	0.5765	0.1569	0.0000	1.4625
NetFlow	0.5290	0.0556	0.1046	0.3598	0.5302	0.5939	0.0000

Disparity degree of unique flow number：

Trace 1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.3177	1.0362	0.0000	0.2957	1.0582	0.9230
16-3	0.4655	0.0000	1.9841	0.4655	0.0000	2.0163	1.8182
16-5	0.5089	0.6649	0.0000	0.5089	0.6541	0.0000	0.0556
64-2	0.0000	0.3177	1.0362	0.0000	0.2957	1.0582	0.9230
64-3	0.4198	0.0000	1.8910	0.4198	0.0000	1.9221	1.7302
64-5	0.5141	0.6685	0.0000	0.5141	0.6578	0.0000	0.0657
NetFlow	0.4800	0.6452	0.0589	0.4800	0.6337	0.0703	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.1056	1.1754	0.0000	0.0944	1.1918	1.0846
16-3	0.1181	0.0000	1.4323	0.1181	0.0000	1.4507	1.3308
16-5	0.5403	0.5889	0.0000	0.5403	0.5837	0.0000	0.0417
64-2	0.0000	0.1056	1.1754	0.0000	0.0944	1.1918	1.0846
64-3	0.1043	0.0000	1.4022	0.1043	0.0000	1.4203	1.3020
64-5	0.5438	0.5920	0.0000	0.5438	0.5868	0.0000	0.0489
NetFlow	0.5203	0.5710	0.0435	0.5203	0.5656	0.0514	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.2634	4.7498	0.0000	0.2445	4.7784	4.6710
16-3	0.3577	0.0000	6.8062	0.3577	0.0000	6.8451	6.6993
16-5	0.8261	0.8719	0.0000	0.8261	0.8686	0.0000	0.0137
64-2	0.0000	0.2634	4.7498	0.0000	0.2445	4.7784	4.6710
64-3	0.3237	0.0000	6.6108	0.3237	0.0000	6.6486	6.5065
64-5	0.8269	0.8725	0.0000	0.8269	0.8693	0.0000	0.0186
NetFlow	0.8237	0.8701	0.0139	0.8237	0.8668	0.0189	0.0000

Disparity degree of average flow recreate time:

Trace 1

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.3108	0.4505	1.1577	1.3559	1.9144	0.3874
16-3	0.2371	0.0000	0.1065	0.6460	0.7973	1.2234	0.0584
16-5	0.3106	0.0963	0.0000	0.4876	0.6242	1.0093	0.0435
64-2	0.5365	0.3925	0.3278	0.0000	0.0919	0.3507	0.3570
64-3	0.5755	0.4436	0.3843	0.0841	0.0000	0.2371	0.4111
64-5	0.6569	0.5502	0.5023	0.2597	0.1917	0.0000	0.5240
NetFlow	0.2792	0.0552	0.0455	0.5552	0.6981	1.1006	0.0000

Trace 2

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.0466	0.2288	0.4576	0.4576	0.6610	0.2119
16-3	0.0445	0.0000	0.1741	0.3927	0.3927	0.5870	0.1579
16-5	0.1862	0.1483	0.0000	0.1862	0.1862	0.3517	0.0138
64-2	0.3140	0.2820	0.1570	0.0000	0.0000	0.1395	0.1686
64-3	0.3140	0.2820	0.1570	0.0000	0.0000	0.1395	0.1686
64-5	0.3980	0.3699	0.2602	0.1224	0.1224	0.0000	0.2704
NetFlow	0.1748	0.1364	0.0140	0.2028	0.2028	0.3706	0.0000

Trace 3

	16-2	16-3	16-5	64-2	64-3	64-5	NetFlow
16-2	0.0000	0.1488	0.1786	1.1250	1.1429	1.3690	0.0476
16-3	0.1295	0.0000	0.0259	0.8497	0.8653	1.0622	0.0881
16-5	0.1515	0.0253	0.0000	0.8030	0.8182	1.0101	0.1111
64-2	0.5294	0.4594	0.4454	0.0000	0.0084	0.1148	0.5070
64-3	0.5333	0.4639	0.4500	0.0083	0.0000	0.1056	0.5111
64-5	0.5779	0.5151	0.5025	0.1030	0.0955	0.0000	0.5578
NetFlow	0.0455	0.0966	0.1250	1.0284	1.0455	1.2614	0.0000