Errata for
"A Comparison of Overlay Routing and Multihoming Route Control"

August 2004

The measurement results reported in our paper titled "A Comparison of Overlay Routing and Multihoming Route Control" that appeared in *Proc. ACM SIGCOMM 2004* contain a few, minor quantitative errors. These errors arise due to erroneous RTT measurement samples collected by a testbed node in Seattle. We discovered this issue after submitting the final version of the paper.

The errors due to the misbehaving node primarily affect the performance of overlay routing paths originating from Seattle. Eliminating the discrepancy due to the measurements collected at this node has the following effects on our analysis: (1) The RTT performance of overlay routing paths from Seattle changes significantly affecting our observations of the relative benefits of overlay routing and multihoming route control in Seattle (see below); (2) Our observations involving paths from other cities are unchanged and (3) On the whole, the final results make the key observations in our paper *even stronger*. Specifically, the gap between the RTT performance from k-overlay routing and k-multihoming is a fraction smaller than what we reported in our SIGCOMM 2004 paper.

We have addressed the discrepancy due to the Seattle testbed node, recomputed the RTT performance comparison results for overlay routing and route control and published our corrected findings in an extended version of our paper. This is now a CMU SCS Technical Report number CMU-CS-04-158 [1].

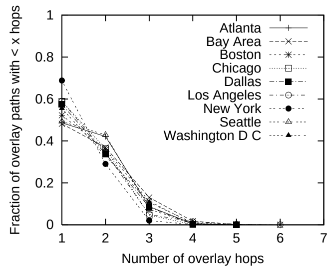
Below, we provide a list of key graphs and tables appearing in various sections of the SIGCOMM proceedings version of our paper that have changed significantly. Please refer to the technical report for the accompanying explanation and the complete set of new results.

Section 5.3: 1-Multihoming vs 1-Overlays

The correct version of *Figure 3* in the proceedings is shown in Figure 1 below. The performance metric for Seattle (1.34) is now consistent with other cities. The number reported for Seattle in the proceedings version was 1.71.

City	1-multihoming/ 1-overlay
Atlanta	1.35
Bay Area	1.20
Boston	1.28
Chicago	1.29
Dallas	1.32
Los Angeles	1.22
New York	1.29
Seattle	1.34
Wash D.C.	1.30
Average	1.29

(a) 1-multihoming RTT relative to 1-overlays



(b) 1-overlay path length

Figure 1: **Round-trip time performance:** Average RTT performance of 1-multihoming relative to 1-overlay routing is tabulated in (a) for various cities. The graph in (b) shows the distribution of the number of overlay hops in the best 1-overlay paths. These figures correspond to *Figure 3* in the proceedings version.

Section 5.4: 1-Multihoming versus k-Multihoming and k-Overlays

The correct version of *Figure 5(a)* in the proceedings is shown in Figure 2 below. 3-Overlay routing achieves 25–50% better performance than 1-multihoming (compared to 25–80% reported in the proceedings) .

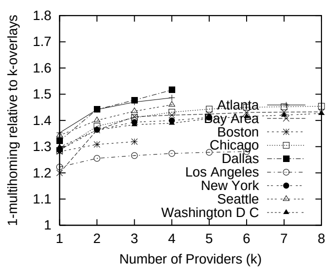


Figure 2: **Benefits of k-overlays:** The RTT of 1-multihoming relative to k-overlays. This corresponds to *Figure 5(a)* in the proceedings version.

Section 5.5: k-Multihoming versus 1-Overlays

The correct version of *Figure 6 (a)* in the proceedings is shown in Figure 3 below. The performance in Seattle is now consistent with the performance in other cities. In the proceedings version, the difference between the curves for Seattle and other cities was about 30%, on average.

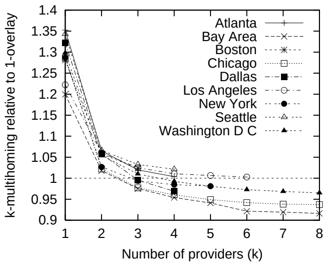
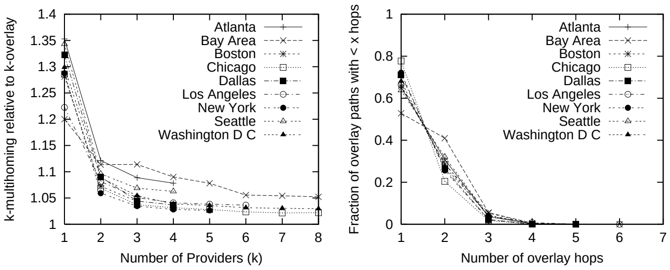


Figure 3: **Multihoming versus 1-overlays:** The RTT of k-multihoming relative to 1-overlays. This corresponds to *Figure 6(a)* in the proceedings version.

Section 5.6: k-Multihoming vs k-Overlays

The correct version *Figure 7* in the proceedings is shown in Figure 4 below. The gap between 3-overlays and 3-multihoming is 3–12% across the various cities (as against 5–15% reported in the proceedings). Also, the best overlay path coincides with the best 3-multihoming BGP path in 67% of the cases (as against 64% reported in the proceedings), on average across all cities.



(a) Relative RTTs (b) 3-Overlay path length

Figure 4: **RTT improvement:** RTT from k-multihoming relative to k-overlay routing, as a function of k, is shown in (a). In (b), we show the distribution of the number of overlay hops in the best k-overlay paths, for k=3. These correspond to *Figure 7* in the proceedings version.

Section 5.8.1: Propagation Delay and Congestion Improvement

The number of points above the $y = x/2$ line in *Figure 11* should be 66%, as opposed to the 72% reported in the proceedings version. Also, the correct version of *Table 2* in the proceedings is shown in Table 1 below.

Total fraction of lower delay overlay paths	33%	
	Fraction of lower delay paths	Fraction of all overlay paths
Indirect paths with $>$ 20ms improvement	4.8%	1.6%
Prop delay improvement $<$ x% of overall improvement (whenever overall improvement $>$ 20ms)		
$<$ 50%	2.2%	0.7%
$<$ 25%	1.7%	0.6%
$<$ 10%	1.3%	0.4%

Table 1: **Analysis of overlay paths:** Classification of indirect paths offering $>$ 20ms improvement in RTT performance. This corresponds to *Table 2* in the proceedings.

Section 5.8.2: Inter-domain and Peering Policy Compliance

The correct version of *Table 3* in the proceedings is shown in Table 2 below. About 67% of indirect paths violated either the valley-free routing or prefer customer policies. However, a large fraction of overlay paths (25%) appeared to be policy compliant. The corresponding fractions reported in the proceedings were 70% and 22% respectively.

	Improved Overlay Paths			**>20ms Imprv Paths**		
	%	*RTT Imprv (ms)*		*%*	*RTT Imprv (ms)*	
		Avg	90th		Avg	90th
Violates Inter-Domain Policy	**66.8**	8.3	17	**68.7**	33.7	40
Valley-Free Routing	61.0	8.2	17	58.5	33.7	40
Prefer Customer	14.9	8.9	18	16.3	41.3	47
Valid Inter-Domain Path	**25.2**	7.3	15	**19.4**	36.1	44
Same AS-Level Path	15.3	6.9	13	9.4	40.9	53
Earlier AS Exit	1.9	5.6	10	0.8	43.2	51
Similar AS Exits	6.9	6.4	12	4.9	39.6	55
Later AS Exit	6.5	7.9	14	3.7	42.1	51
Diff AS-Level Path	9.9	8.0	17	10.0	31.5	39
Longer than BGP Path	4.5	7.6	17	4.6	30.9	43
Same Len as BGP Path	4.8	8.6	18	5.3	32.0	37
Shorter than BGP Path	0.6	6.2	9	0.1	36.4	55
Unknown	**8.0**			**11.9**		

Table 2: **Overlay routing policy compliance:** Breakdown of the mean and 90th percentile round trip time improvement of indirect overlay routes by: (1) routes did not conform to common inter-domain policies, and (2) routes that were valid inter-domain paths but either exited ASes at different points than the direct BGP route or were different than the BGP route. This corresponds to *Table 3* in the proceedings.

References

[1] A. Akella, J. Pang, A. Shaikh, B. Maggs, and S. Seshan. A Comparison of Overlay Routing and Multihoming Route Control. Technical Report CMU-CS-02-158, CMU CS, Pittsburgh, Pennsylvania, August 2004.