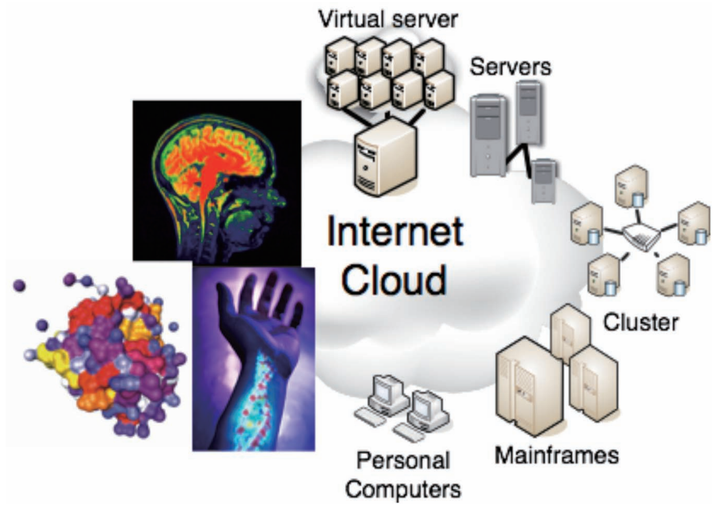
Throughput Evaluation for Improving Predictability over the Internet

Cybermedia Center, Osaka University, Japan

Motivation

Applications in Grid environment are required to share distributed large blocks of data among distributed multiple sites.
Network throughput for data transfer affects total processing time as well as the task processing.

The predicted network throughput would be a useful parameter on scheduling tasks to improve the total processing performance.

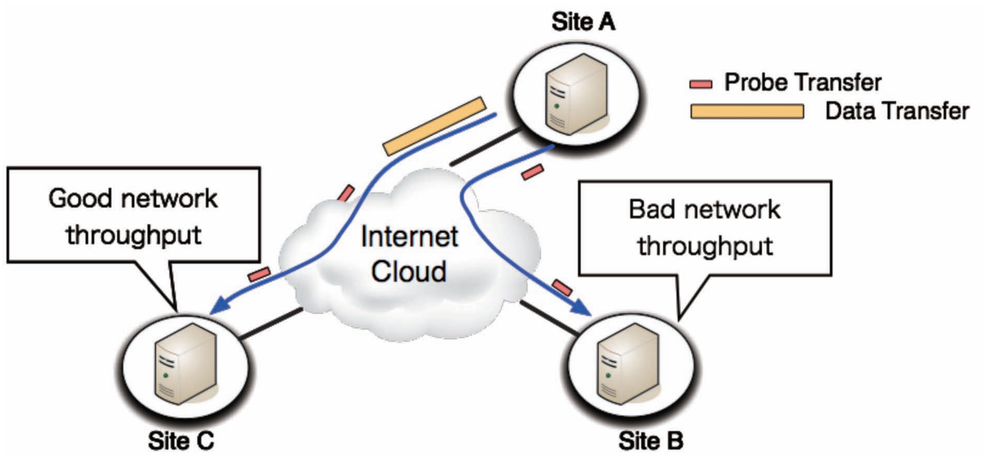


Purpose of our research

Improving precision of the throughput prediction method called “Network Weather Service” [1].
Adapting the prediction method to virtualized hosting environment, which shows anomalous behavior more frequently than physical nodes.

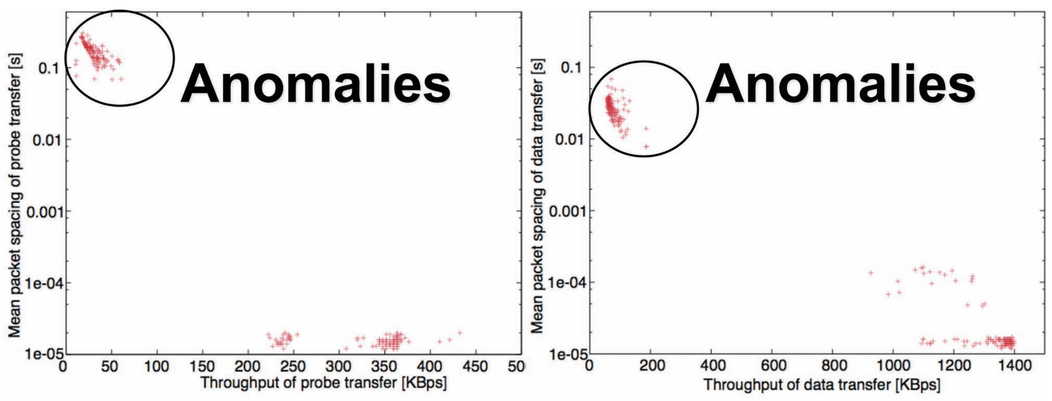
Connection pair

A network throughput prediction has been a challenging issue due to the dynamics of network traffic and no guarantee for bandwidth reservation.
Connection pair uses a small size of probe transfer to predict the throughput of a large size of data transfer.
In previous work [1], the restricted sets of pairs on probe and data size were examined on limited network environment.



Traffic anomalies

The evaluation results were affected by oversize packet spacings, which are caused by CPU scheduling latency.
The packet spacing which is larger than the TCP transmission period involves packet transmissions, which results in severe throughput[2].



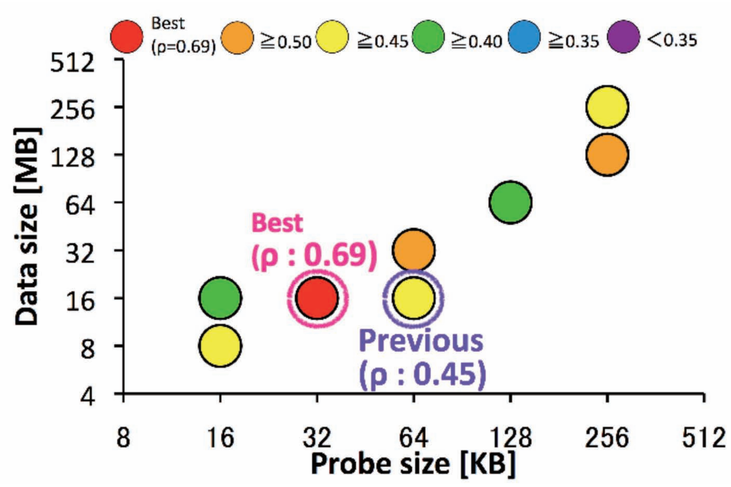
< Mean packet spacing and throughput on the best condition >

Experimental settings

We used PlanetLab nodes, equipped with a virtualization mechanism called V-Server (http://www.linux-vserver.org).
Various sizes for both probe and data transfer are used.
Correlation between both probes is evaluated by Spearman’ s rank correlation coefficient, one of non-parametric metrics.

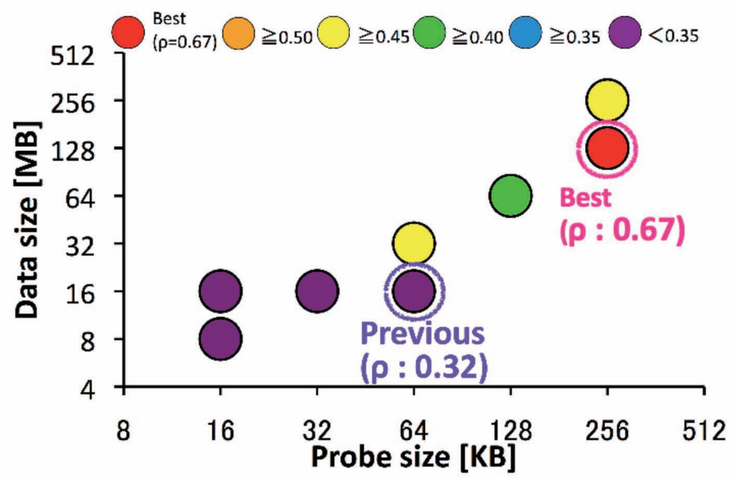
Original result

Smaller-size probes had better conditions than larger-size probes.



Results without anomalous cases

We re-evaluate the results without the anomalies, and a larger-size probe is required for improving predictability.
If throughput is decreased by the anomalies, we should carefully review measurement results.



Conclusion and future work

Anomalies from virtualized hosting environment have great impacts on the prediction results.
We re-evaluate the results without the anomalies, and found that larger-size probe is required for improving predictability.
Our future works are to measure throughput with various probe size and to devise an anomaly estimation method.

References

[1] M. Swany and R. Wolski, Multivariate Resource Performance Forecasting in the Network Weather Service, in Proceedings of IEEE/ACM Conference on High-Performance Computing and Networking, pp 1-10, November 2002,.
[2] C. Lee, H. Abe, T. Hirotsu, and kyoji Umemura, “Analysis of anomalies on a virtualized network testbed,” in Proceedings of the 10th IEEE International Conference on Computer and Information Technology, pp. 297–304, June 2010.

Chunghan Lee：Toyohashi University of Tech.Dept. of Electronic and Information Eng.
Hirotake Abe：Osaka University Cybermedia Center
Toshio Hirotsu ：Hosei University Faculty of Computer and Information Sciences
Kyoji Umemura ：Toyohashi University of Tech.Dept. of Computer Science and Eng.

Contact: Hirotake Abe
E-mail: habe@cmc.osaka-u.ac.jp