salbnet: A Self-Adapting Load Balancing Network

Jörg Jung

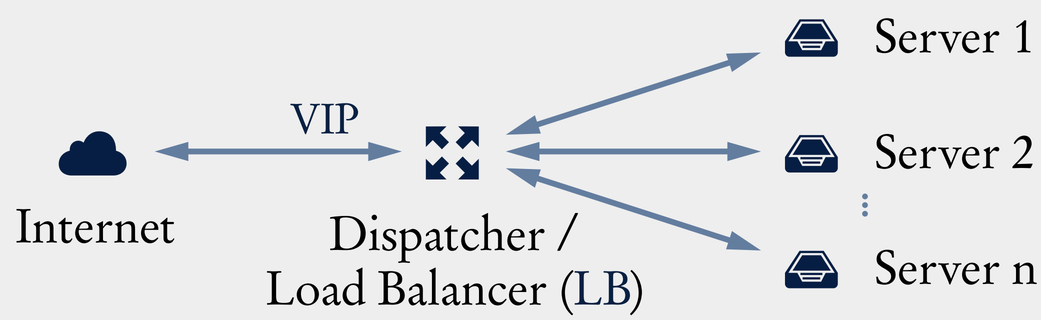
University of Potsdam
Institute for Computer Science
Operating Systems and Distributed Systems

February 2014

Outline

1 Introduction

Dispatcher based Server Load Balancing (SLB): scalable, flexible and fault tolerance services



Motivation

Measurements in [Zinke and Schnor 2013] show the influence of weights

Sophisticated algorithms are required for heterogenous workloads and heterogenous back end servers of ISPs:

Self-adapting *credit* based SLB algorithms for better performance

Simulations in [Lehmann et al. 2008] show the advantages of the credit based SLB algorithms

→ Efficient implementation for credit based SLB required

→ Measurements to compare traditional and credit based SLB algorithms:

Weighted Round Robin (WRR) and Dynamic Pressure Relieve (DPR)

2

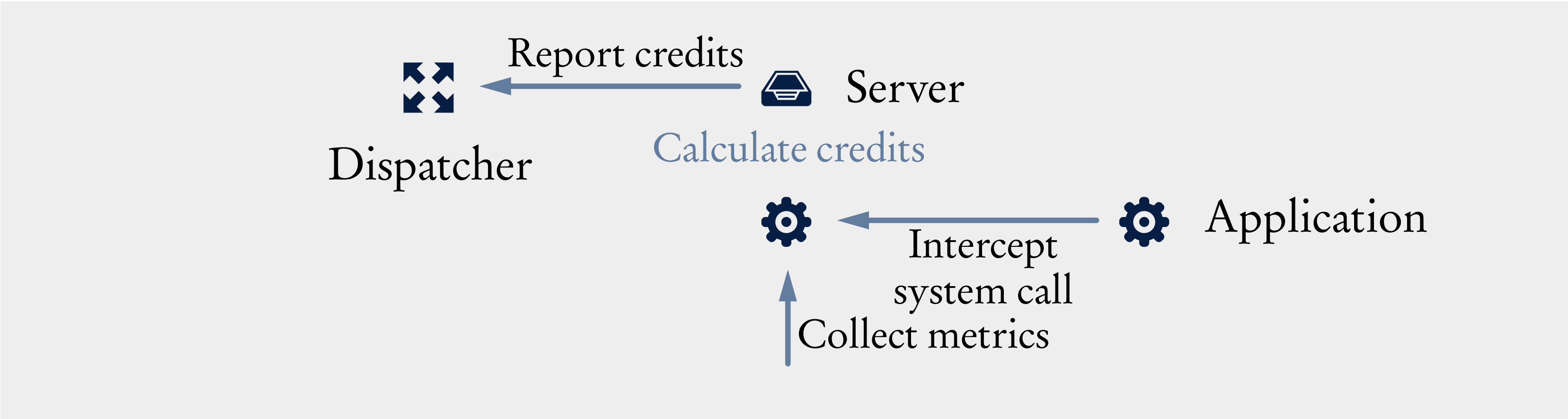
Credit based SLB

Application independent *implicit* metrics are used to calculate *credits*

Back end server *push* credits to the LB

Credits represent the number of connections

Credit Reporting

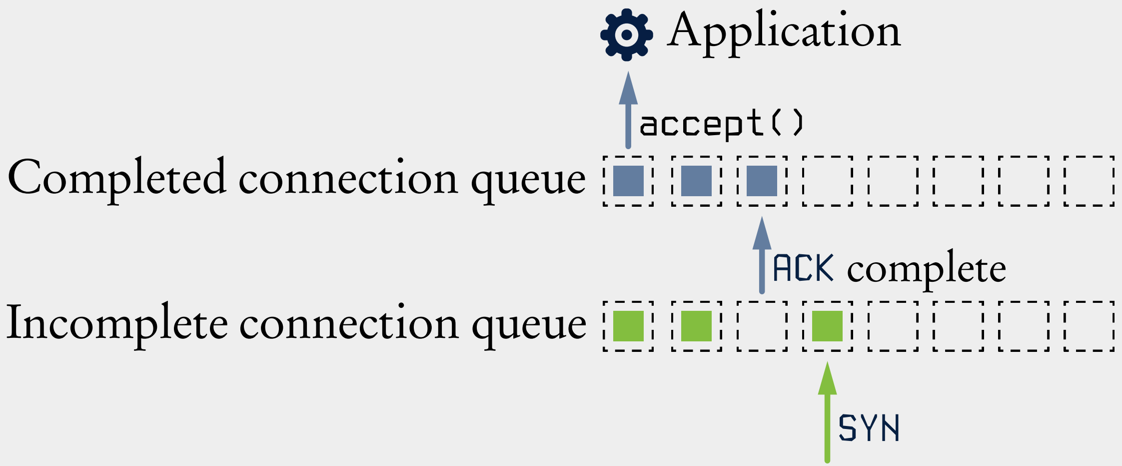


Reporting Algorithms:

Dynamic Pressure Relieve (DPR) and DPR-Quantize (DPR-Q)

→ Reporting credits based on the (amount of processed) credit metric (data)

Credit Metric: TCP Backlog



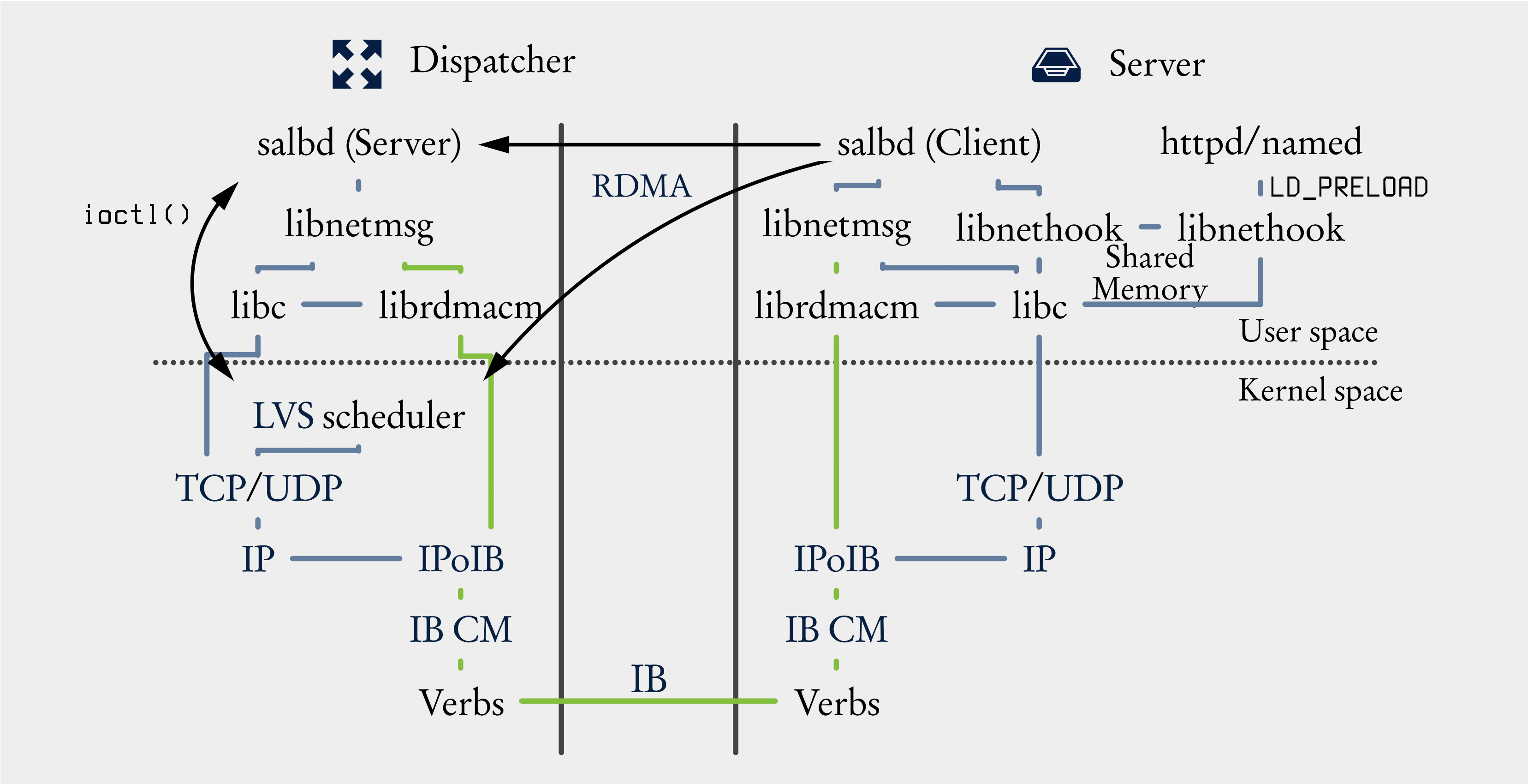
3 salbnet Implementation

salbd implements metric collecting and credit reporting (runs on the LB and the back end servers)

LVS scheduler module implements the credits scheduling

libnetmsg implements network abstraction for sending messages over Ethernet and InfiniBand

libnethook hooks into (socket) system calls in back end servers


Dispatcher
Server
salbd (Server)
salbd (Client)
httpd/named
RDMA
ioctl()
libnetmsg
libnetmsg
libnethook
libnethook
LD_PRELOAD
Shared
Memory
libc
librdmacm
librdmacm
libc
User space
Kernel space
LVS scheduler
TCP/UDP
TCP/UDP
IP
IPoIB
IPoIB
IP
IB CM
IB CM
Verbs
IB
Verbs

4
Measurements and Evaluation

Measurements in a ISP like SLB environment: *Wikipedia* instance based on a dump and traces from 2007/2008

Dispatcher based SLB scenario: two armed, NAT based and using route path with heterogeneous hardware and homogeneous software versions

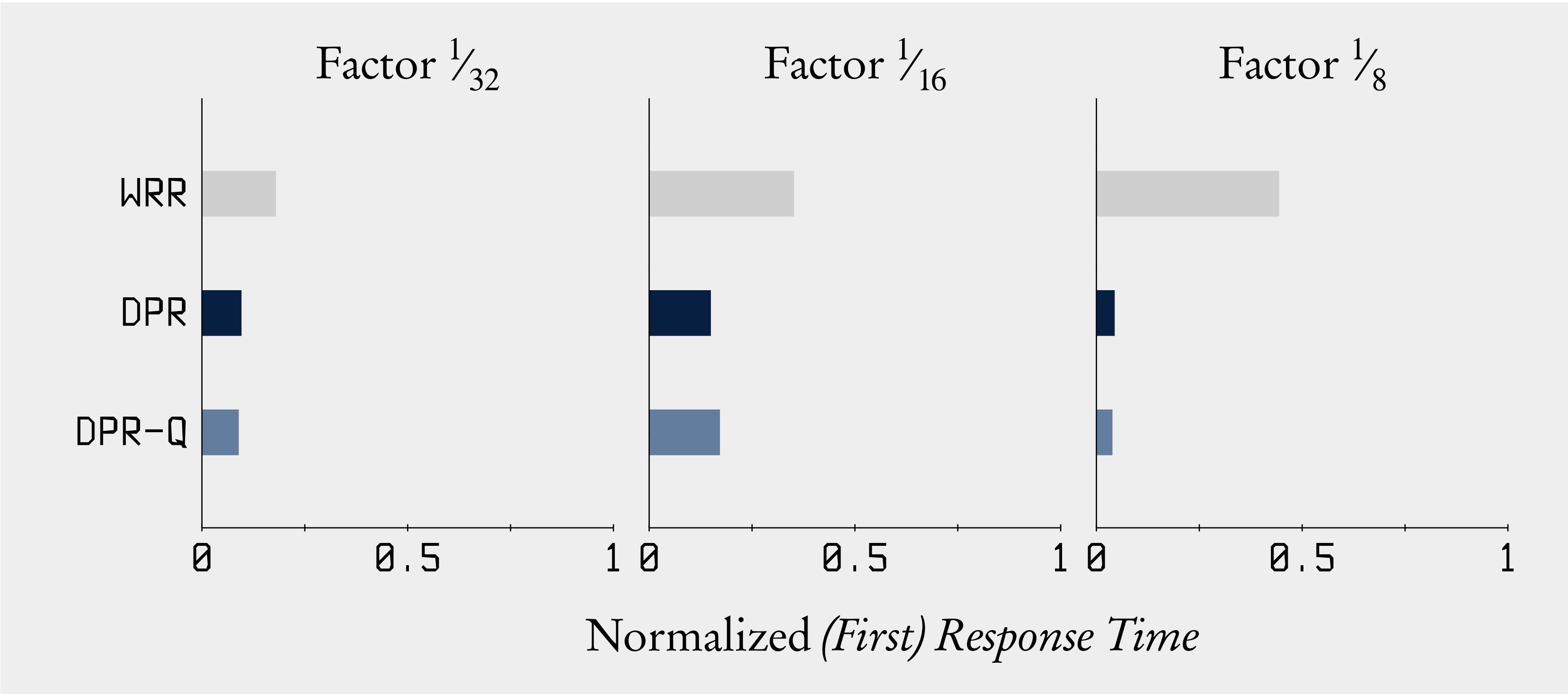
3 heterogenous back end servers require weights for the traditional WRR algorithm

Workload: Reduced Wikipedia Traces

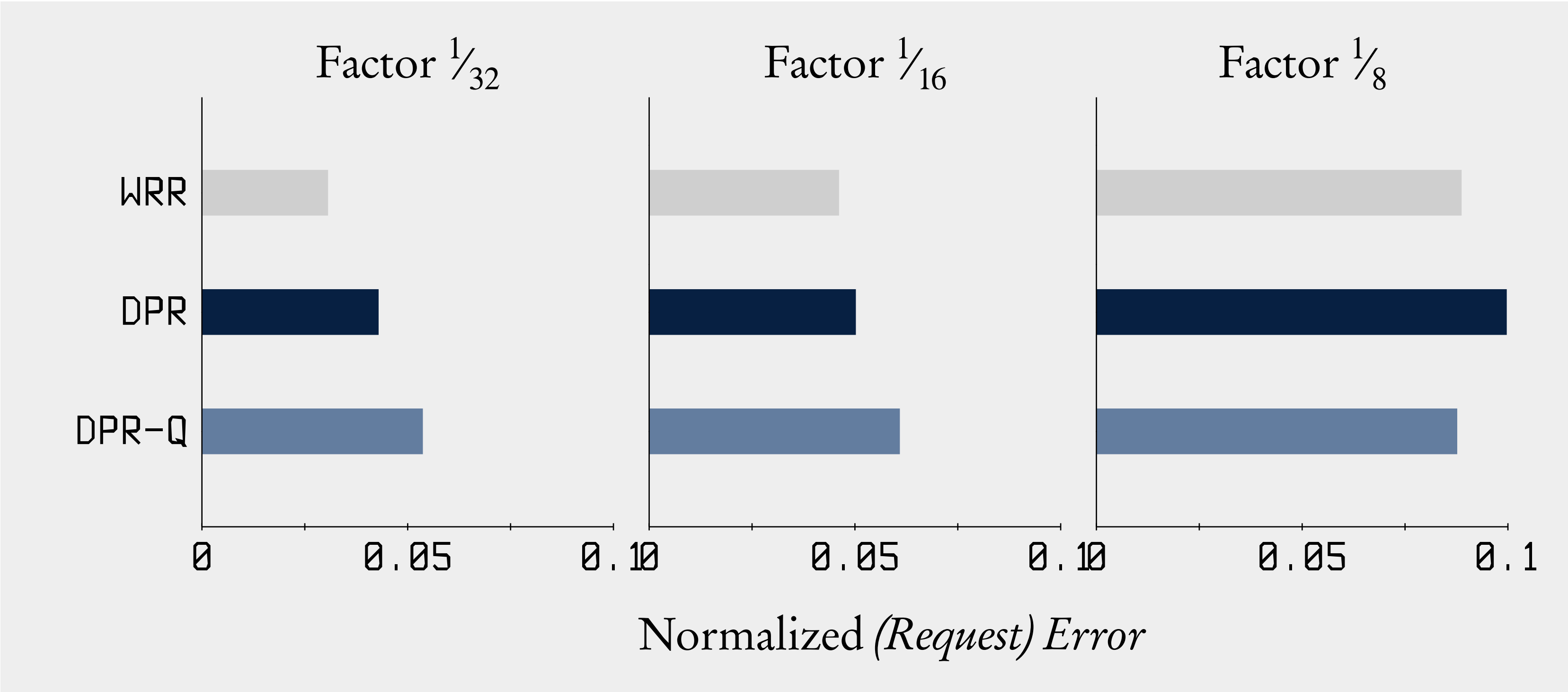
Number of requests from the first ten minutes of the (filtered and reduced) *Wikipedia* trace from 12. November 2007 (available from [Pierre 2010])

Factor	Requests	Mean req/s	Max req/s
1/32	49,532	82.55	91
1/16	99,063	165.12	183
1/8	198,125	330.21	366
1	1,584,996	2,641.66	2,925

Results: (First) Response Time



Results: (Request) Errors



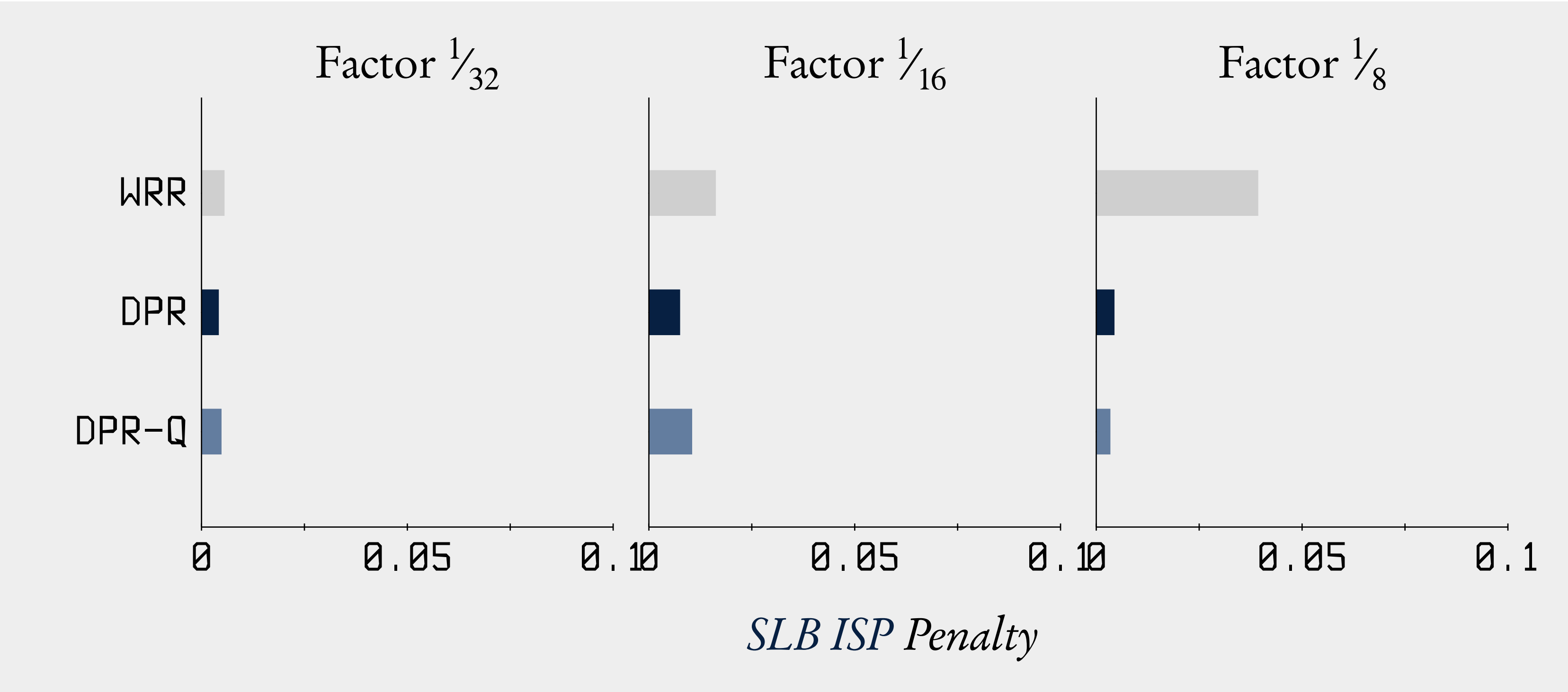
Measurement Metrics

(First) Response Time, (Request) Errors and Duration are combined into single *lower is better* penalty values

SLB ISP Penalty p_{ISP} used for comparison

$$p_{\text{ISP}} = \left(\frac{\text{response}_{\text{mean}}}{\text{response}_{\text{max}}}\right) \times \left(\frac{\text{request\_error}_{\text{mean}}}{\text{requests}_{\text{total}}}\right)$$

Results: SLB Penalty



5 Conclusions and Future Work

salbnet implementation for *credit* based SLB introduced

Previous simulations are confirmed:

- DPR and DPR-Q outperform traditional WRR

DPR-Q variant is slightly better than DPR, for higher workloads

Next step: salbnet and DNS, without InfiniBand and RDMA

References

[Lehmann et al. 2008] Janette Lehmann and Lars Schneidenbach and Bettina Schnor and Jörg Zinke. Self-Adapting Credit Based Server Load Balancing. In Helmar Burkhart, *Proceedings of the IASTED international Conference on Parallel and Distributed Computing and Networks (PDCN)*, pages 55–62. PDCN. ACTA Press. IASTED, Innsbruck, Austria, February 2008. ISBN: 9780889867130, ISBN CD: 9780889867147

[Pierre 2010] Guillaume Pierre. Wikipedia access tracesWikibench, October 2010. URL *http://www.wikibench.eu/?page_id=60*. Accessed May 2012

[Zinke and Schnor 2013] Jörg Zinke and Bettina Schnor. The Impact of Weights on the Performance of Server Load Balancing Systems. In Mohammad S. Obaidat and Pere Vilà and Isaac Woungang and Mario Marchese and Floriano De Rango and Jose Saldaña, *International Symposium on Performance Evaluation of Computer and Telecommunication Systems*, pages 541–548. SPECTS 2013, Simulation Series. IEEE Communications Society. Society for Modeling & Simulation International (SCS), Toronto, Canada, July 2013. ISBN: 9781627482745