

Staukontrolle durch Active Queue Management

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Zusammenfassung—

I. EINFÜHRUNG UND MOTIVATION

- Problem
Das Internet hat mittlerweile eine Größe erreicht, bei der man sich nicht mehr komplett auf Ende-zu-Ende Staukontrolle verlassen kann [1]. Sehr viele Router stellen aufgrund der sternförmigen Struktur des Internets Flaschenhälse dar.
- Problemstellung
Die mittlere Pufferauslastung soll gering gehalten werden, um E2E Staukontrolle zu ermöglichen [2].

II. STAUKONTROLLE IN NETZEN

- Vorschläge zur Staukontrolle
Vorschläge zur Gewährleistung und Verbesserung der Internetperformance [3]
- congestion collapse
Congestion collapse und wie es dazu führt [4].
- Warum ist das Problem so schwer zu identifizieren
Was sind die Gründe für das Problem [5]?
- Mechanismen zur Staukontrolle in ATM Netzwerken
Auswahlkriterien zwischen den beiden Ansätzen rate-based und credit-based [6].
- Standard TCP Verhalten bei Staus
Warum ist es keine gute Idee TCP die Staukontrolle selbst zu machen [7]? Gleichbehandlung aller Datenströme [8].
- Explicit Congestion Notification
Vor- und Nachteile von ECN bei TCP [9]
- Router Mechanismen zur Staukontrolle
Vor- und Nachteile von normaler Staukontrolle in Routern [1]
- Überleitung zu Active Queue Management
Active Queue Management ist eine Lösungsansatz zur Staukontrolle [10]

III. DEFINITION UND ANWENDUNG VON ACTIVE QUEUE MANAGEMENT

- Effizientes Active Queue Management in Internet Routern [11]
- Dimensionierung von Router Puffern [12]
- Stochastische Modellierung und die Theorie von Queues [13]
- Analyse und Simulation eines gleichbehandelnden Queue Algorithmus [14]

IV. DIE GÄNGIGSTEN ACTIVE QUEUE MANAGEMENT ALGORITHMEN

- RED (Random Early Detection) [15] [16]
Adaptive RED[17]
- BLUE [18]
- ECN [19]
- PI Controller [20]

V. VERGLEICH DER VORGESTELLTEN ALGORITHMEN

- Vergleich RED, ARED, PI [2]
- Vergleich RED, PI [21]
- Vergleich RED, BLUE, ARED, ECN, PI [10]

VI. AUSBLICK UND ANDERE ANSÄTZE

- Ein wirklich optimaler Algorithmus muss noch gefunden werden [10]
- Statt Staukontrolle andere Wege suchen (CHOCe) [22]

LITERATUR

- [1] S. Floyd und K. Fall, "Router mechanisms to support end-to-end congestion control," Lawrence Berkeley National Laboratory, Berkeley CA, Tech. Rep., 1997.
- [2] L. Le, J. Aikat, K. Jeffay, und F. Smith, "The effects of active queue management on web performance," in *Proceedings of the 2003 Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications*, Ser. SIGCOMM '03. ACM, 2003.
- [3] B. Braden, D. Clark, J. Crowcroft, B. Davie, S. Deering, D. Estrin, S. Floyd, V. Jacobson, G. Minshall, C. Partridge, L. Peterson, K. Ramakrishnan, S. Shenker, J. Wroclawski, und L. Zhang, "Recommendations on queue management and congestion avoidance in the internet," United States, 1998.
- [4] J. Nagle, "Congestion control in ip/tcp internetworks," *SIGCOMM Comput. Commun. Rev.*, vol. 14, Nr. 4, pp. 11–17, Okt. 1984. [Online]. Available: <http://doi.acm.org/10.1145/1024908.1024910>
- [5] R. Jain, "Congestion control in computer networks: issues and trends," *Network, IEEE*, vol. 4, Nr. 3, pp. 24–30, Mai 1990.
- [6] —, "Congestion control and traffic management in atm networks: Recent advances and a survey," *Comput. Netw. ISDN Syst.*, vol. 28, Nr. 13, pp. 1723–1738, Okt. 1996. [Online]. Available: [http://dx.doi.org/10.1016/0169-7552\(96\)00012-8](http://dx.doi.org/10.1016/0169-7552(96)00012-8)
- [7] R. Morris, "Tcp behavior with many flows," in *Proceedings of the 1997 International Conference on Network Protocols (ICNP '97)*, Ser. ICNP '97. IEEE Computer Society, 1997.
- [8] B. Suter, T. Lakshman, D. Stiliadis, und A. Choudhury, "Design considerations for supporting tcp with per-flow queueing," in *INFOCOM '98. Seventeenth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings. IEEE*, vol. 1, Mär. 1998, pp. 299–306vol.1.
- [9] S. Floyd, "Tcp and explicit congestion notification," *SIGCOMM Comput. Commun. Rev.*, vol. 24, Nr. 5, pp. 8–23, Okt. 1994.
- [10] K. Graffi, K. Pussep, N. Liebau, und R. Steinmetz, "Taxonomy of active queue management strategies in context of peer-to-peer scenarios," Technische Universität Darmstadt, Tech. Rep., 2007.
- [11] B. Suter, T. Lakshman, D. Stiliadis, und A. Choudhury, "Efficient active queue management for internet routers," in *Proceedings of INTEROP, Engineering Conference*, 1998.
- [12] G. Appenzeller, I. Keslassy, und N. McKeown, "Sizing router buffers," *SIGCOMM Comput. Commun. Rev.*, vol. 34, Nr. 4, pp. 281–292, Aug. 2004.

- [13] R. Wolff, *Stochastic modeling and the theory of queues*. Prentice Hall, 1998.
- [14] A. Demers, S. Keshav, und S. Shenker, "Analysis and simulation of a fair queueing algorithm," *SIGCOMM Comput. Commun. Rev.*, vol. 19, Nr. 4, pp. 1–12, Aug. 1989.
- [15] S. Floyd und V. Jacobson, "Random early detection gateways for congestion avoidance," *Networking, IEEE/ACM Transactions on*, vol. 1, Nr. 4, pp. 397–413, Aug. 1993.
- [16] V. Firoiu und M. Borden, "A study of active queue management for congestion control," in *INFOCOM 2000. Nineteenth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings. IEEE*, vol. 3, Mär. 2000, pp. 1435–1444vol.3.
- [17] S. Floyd, R. Gummadi, und S. Shenker, "Adaptive red: An algorithm for increasing the robustness of red's active queue management," AT&T Center for Internet Research at ICSI, Tech. Rep., 2001.
- [18] W. Feng, K. Shin, D. Kandlur, und D. Saha, "The blue active queue management algorithms," *IEEE/ACM Trans. Netw.*, vol. 10, Nr. 4, pp. 513–528, Aug. 2002.
- [19] K. Ramakrishnan, S. Floyd, und D. Black, "The addition of explicit congestion notification (ecn) to ip," United States, 2001.
- [20] C. Hollo, V. Misra, D. Towsley, und W.-B. Gong, "On designing improved controllers for aqm routers supporting tcp flows," in *INFOCOM 2001. Twentieth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings. IEEE*, vol. 3, 2001, pp. 1726–1734vol.3.
- [21] S. Kunniyur und R. Srikant, "Analysis and design of an adaptive virtual queue (avq) algorithm for active queue management," *SIGCOMM Comput. Commun. Rev.*, vol. 31, Nr. 4, pp. 123–134, Aug. 2001.
- [22] R. Pan, B. Prabhakar, und K. Psounis, "Choke - a stateless active queue management scheme for approximating fair bandwidth allocation," in *INFOCOM 2000. Nineteenth Annual Joint Conference of the IEEE Computer and Communications Societies. Proceedings. IEEE*, vol. 2, 2000, pp. 942–951vol.2.
- [23] S. Athuraliya, S. Low, V. Li, und Q. Yin, "Rem: active queue management," *Network, IEEE*, vol. 15, Nr. 3, pp. 48–53, Mai 2001.