



WAN Bandbreiten Management

DECUS Symposium
21. April 2004

Engelbert Epple
Senior Technical Consultant
HP Network Solutions Group
engelbert.epple@hp.com



© 2004 Hewlett-Packard Development Company, L.P.
The information contained herein is subject to change without notice

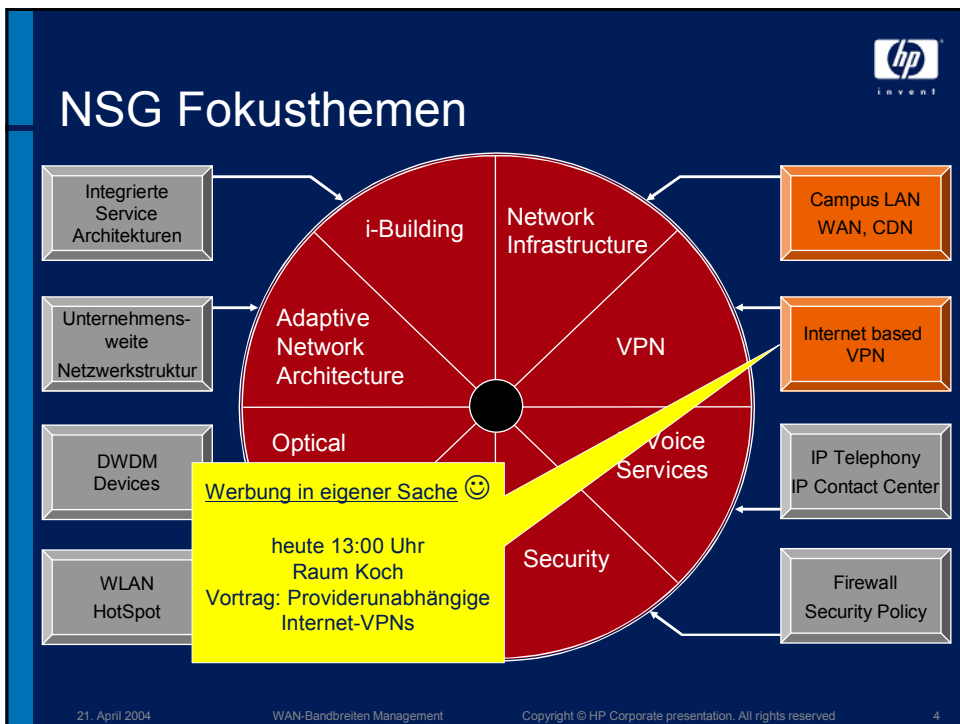



Inhalt

- HP's Network Solution Group
- Wer ist Packeteer
- Traffic Shaping
 - Überblick: Prinzip
 - Traffic Analyse / Monitoring
 - Traffic Control
 - Kompression
- Return of Invest
- WAN Assessment beim HP Kunden
- Case Study
- Future Look



21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 2






NSG WAN Partner

WAN Netzwerkkomponenten – supported by HP:



<p>Cisco <u>Alle Cisco Komponenten:</u> Router, MLS Switches, Firewall, Concentrator, CallManager, Aironet, Content Switch</p>	<p>Paketeer</p> <ul style="list-style-type: none"> • PacketSeeker • PacketShaper • Xpress Compression • Policy- und Report Center
<p>Checkpoint / Nokia</p> <ul style="list-style-type: none"> • Firewall 1 (NG) • Nokia Appliances IP Security Platforms 	<p>Cosine</p> <ul style="list-style-type: none"> • IP Service Delivery Platform

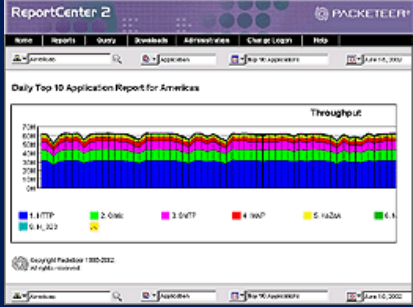
21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
5



Paketeer

- Paketeer (NASDAQ: PKTR)
- ca 250 MA weltweit
- Gegründet Januar 1996
- Rate Control patentiert:
Intelligent bandwidth management
- Produkte
 - PacketShaper = Kernprodukt, Traffic Shaping
 - PacketSeeker = Packetshaper monitoring only
 - XPress = Software auf Packetshaper
 - PolicyCenter = Win2K SW, manage multiple PS
 - ReportCenter = Win2K SW, customized reports
- shipped more than 25,000 units ww
- Mitbewerb
 - Cisco: NBAR
 - Peribit: SR-xx
 - Expand
 - Allot

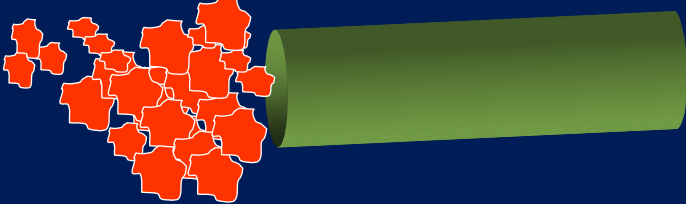


21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
6

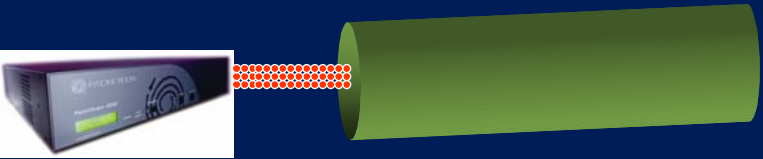


Prinzip

Verkehr ohne TCP Rate Control -- "Kies"



Verkehr mit TCP Rate Control -- "Sand"



21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 8

The slide features the HP logo in the top right corner. The diagrams illustrate the concept of traffic shaping by comparing uncontrolled traffic (represented by large stones) to controlled traffic (represented by small sand grains) passing through a pipe.

TCP Rate Control

Kein Rate Control

Kritische Applikationen „leiden“ unter Banbreitenfressern

TCP Rate Control

Kritische Applikationen arbeiten gut trotz hoher Last

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
9

Analyse des Traffics

PacketShaper entdeckt und klassifiziert **automatisch** über 400 unterschiedliche Applikationen:

7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

PacketShaper

Routers
Switches

Liste **gefällig** ?

Genauere Klassifizierung nach:

- Application
- Port
- URL
- Protocol
- IP Address
- MAC Address
- IP Precedence

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
10



Begriffe

- Klassifizierung nach verschiedenen Kriterien
 - Class based
 - Host based
 - Flow Detailed Record (demnächst)
- Analyse
 - Watch Mode am Switch (Span-Port)
 - **Zwischen WAN-Router & LAN-Switch**
- Packetseeking = PacketShaper im Monitoring Modus

...übrigens:

With Packeteer products, **HP OpenView** users will be able to launch our browser-based PolicyConsole, in context, with OpenView. Console integration and Packeteer's comprehensive enterprise MIB allow the network manager to manage our products in a manner **consistent with other OpenView-managed devices**.

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
11



Klassifizieren

Welche Applikationen nutzen das Netz ?



Traffic Class Name	Class ID	Policy ID	Current Pkts	1 Min Pkts	Class Size	Over. Rate Pkts/Sec	Partition Min/Max	Policy
Inbound			21.1k	95.0k	1.0M	0	uncommitted-queue	Priority (0)
Localhost	28	8	0	0	3388	0		
SMB	19	19	0	11.4k	998k	0	900k-1M	Ignore
MS_Exchange	19	19	0	0	0	0		Rate (0, 50k, 100k)
JD_Edwards	0	0	0	0	0	0		
FileMaker	28	NA	0	11.4k	998k	0		
FTP	22	NA	28	39	100k	0		Rate (0, 50k, 100k)
Print	20	NA	0	1	73.2k	0	50k-75k	Rate (0, 25k, 100k)
FTP	3	3	0	0	613	0		
Localhost	0	NA	0	0	0	0		
Print	0	NA	0	0	0	0		
tn3270	0	NA	0	0	0	0		
tn5250	0	NA	0	0	0	0		Rate (0, 50k, 100k)
Printer	26	26	19.7k	19.2k	54.5k	0		Rate 200k, Band
Oracle	0	0	0	0	0	0	500k-700k	
Printer	4	NA	12	12	21	0		Printer (1)
RealAudio	0	0	0	0	0	0		

Class based traffic




- Inbound
 - Localhost
 - Citrix
 - JD_Edwards
 - MS_Exchange
 - Default
 - DHCP
 - FileMaker
 - FTP
 - Legacy Access
 - Print
 - tn3270
 - tn5250
 - Napster
 - Oracle
 - POP3
 - RealAudio
 - SMTP
 - SSH
 - VoIP
 - Web
 - e-Commerce

- AutoDiscovery
- Traffic Typen die der PacketShaper erkannt hat, werden automatisch im Class Tree angezeigt

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
12

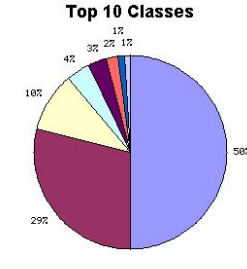
Analysieren (1)



Was oder Wer konkurriert auf meinem Netzwerk?

- Top Talkers & Listeners
- Traffic Distribution

Top 10 Classes



Class Name	Average Rate (bps)	(%)
1. /Inbound/HTTP	5761	50
2. /Inbound/FTP	3370	29
3. /Inbound/WinMedia	1122	10
4. /Inbound/NetBIOS-IP	416	4
5. /Inbound/Oracle	304	3
6. /Inbound/Default	279	2
7. /Inbound/NetBEUI	123	1
8. /Inbound/SunRPC	107	1
9. /Inbound/AppleTalk	22	<1
10. /Inbound/RIP	14	<1
All other classes	14	<1


period: 1-hour, 19-Jul-2000 14:00 to 19-Jul-2000 15:00

Top Talkers

	DNS Name	IP Address	Usage
1	upgrade.entrypoint.com	206.64.127.71	31%
2	www9.cnn.com	207.25.71.29	18%
3	www.amazon.com	208.216.181.15	10%
4	No such name	208.249.117.71	6%
		204.71.200.170	4%
		204.71.200.67	4%
		204.202.131.230	4%
		216.200.14.115	4%
		204.202.129.230	2%
		208.185.160.9	2%

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
13

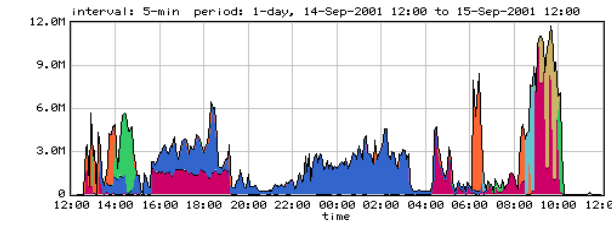
Analysieren (2)



Was oder Wer konkurriert auf meinem Netzwerk?


- Traffic Distribution Erweiterte Anzeige

interval: 5-min period: 1-day, 14-Sep-2001 12:00 to 15-Sep-2001 12:00



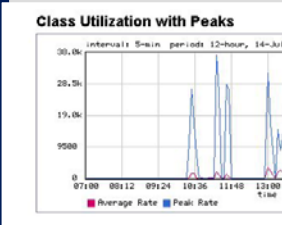
- /Inbound/HTTP
- /Inbound/DiscoveredPorts/TCP_Port_4662
- /Inbound/WinMedia
- /Inbound/Default
- /Inbound/QuickTime
- /Inbound/Real
- /Inbound/ROL-IM-ICQ
- /Inbound/Localhost
- /Inbound/SSL
- /Inbound/SameSide

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
14

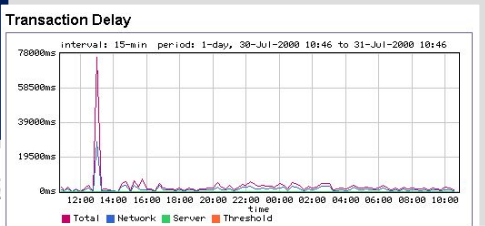


Analysieren (3)

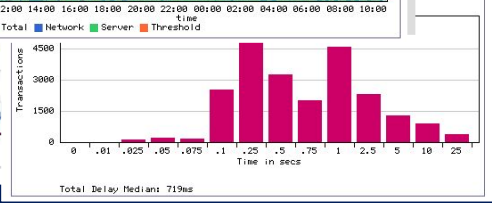
- Umfassendes Monitoring und Evaluation Werkzeug
- PacketShaper zeigt die laufenden Applikationen und deren Performance **OHNE zusätzliche Clients zu installieren**
 - Network delay
 - Server delay



Class Utilization with Peaks
interval: 5-min period: 12-hour, 14-Jul-




Transaction Delay
interval: 15-min period: 1-day, 30-Jul-2000 10:46 to 31-Jul-2000 10:46



Transaction Delay Histogram
Total Delay Median: 719us

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
15

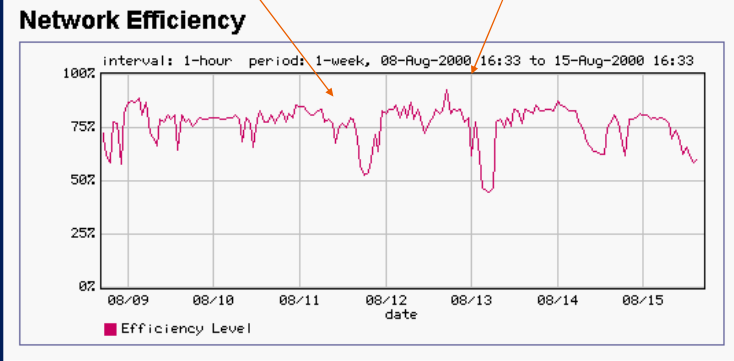


Analysieren (4)

Verschwendete Bandbreite

- Retransmissions
- Dropped Packets

WAN Datendurchsatz
z.B. 2Mb = 100%



Network Efficiency
interval: 1-hour period: 1-week, 08-Aug-2000 16:33 to 15-Aug-2000 16:33

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
16

Response Time Measurement

The diagram illustrates the components and timing of a network connection. On the left, a 'Branch of Client' (Italy) connects to a 'WAN' cloud, which then connects to a 'Central Office' (Germany) containing a 'Router', 'Packet Shaper', and 'Server'. These are connected to an 'Internal Network'. A 'TCP Connection' is established between the Client and the Server. The sequence diagram on the right shows the timing of this connection:

- Client:** T1 (SYN), T5 (ACK), T8 (Request data), T11 (Request data with push flag), T16 (Response data), T19 (ACK), T20.
- PacketShaper:** T2 (SYN), T4 (SYN-ACK), T6 (ACK), T9 (Request data), T12 (Response data), T15 (Response data with push flag), T18 (ACK).
- Server:** T3 (Server Transit Delay), T7 (Request data), T10 (Request data with push flag), T13 (Response data), T14 (Response data with push flag), T17 (Response data).

Key delay components shown:

- Server Transit Delay:** T2 to T3.
- Client Transit Delay:** T1 to T2.
- Round Trip Time:** T1 to T4.
- Server Delay:** T13 to T14.
- Total Delay:** T1 to T14.

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 17

Traffic Control


Bsp: Abregeln von NAPSTER-Traffic

Bsp. aus Referenz-Story Packeteer:
University of Connecticut

Der Trick: Eingriff in den TCP-Flow
Window-Size pro flow (von SYN/SYN ACK bis FIN/FIN ACK) verkleinern !

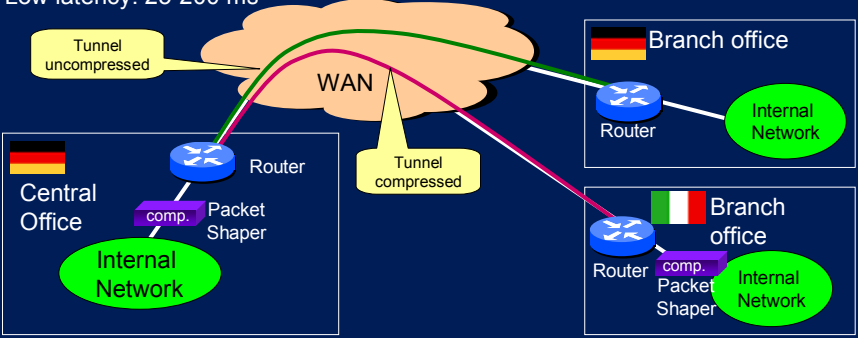
- Beeinflusst die Endsysteme
- auch eingehender Traffic aus dem Internet regulierbar z.B. auf den eigenen Web-Server

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 18




Kompression (1)

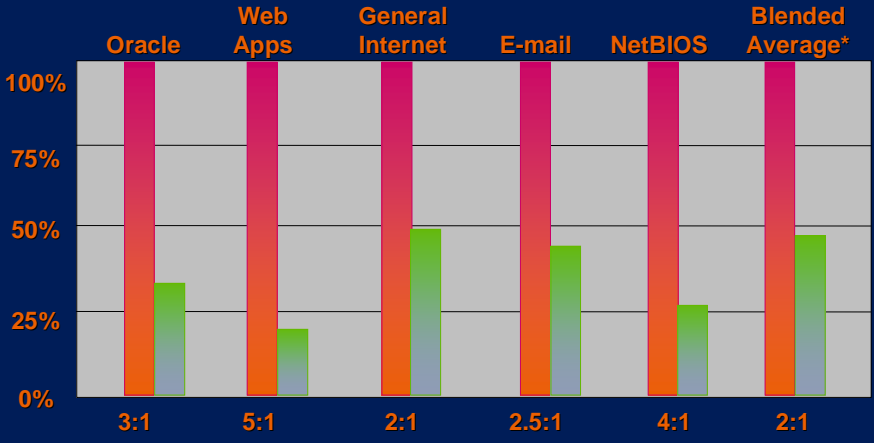
- STAC oder PREDictor Algorithmus, CNA (neu, Packeteer proprietary)
- **Clevere Kompression – Application-intelligent Compression**
Es werden nur die Applikationen komprimiert, die komprimierbar sind
z.B. FTP-Data = YES , SSL = NO (verschlüsselt !)
- Compression Estimator Mode
- Low latency: 25-200 ms



21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 19



Kompression (2)




Traffic Type	Ratio
Oracle	3:1
Web Apps	5:1
General Internet	2:1
E-mail	2.5:1
NetBIOS	4:1
Blended Average*	2:1

*Traffic Mix / Durchschnittswerte: In den meisten Fällen zwischen 2:1 und 3:1

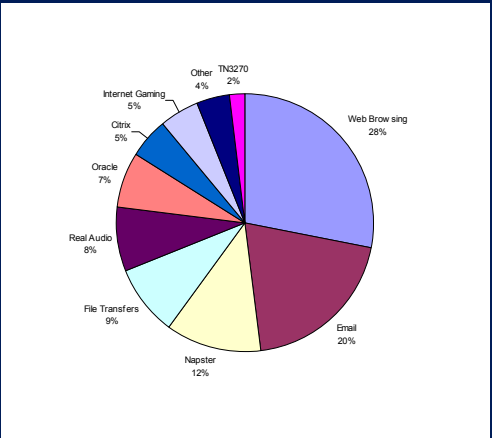
21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 20



 invest

Signifikante Kosten

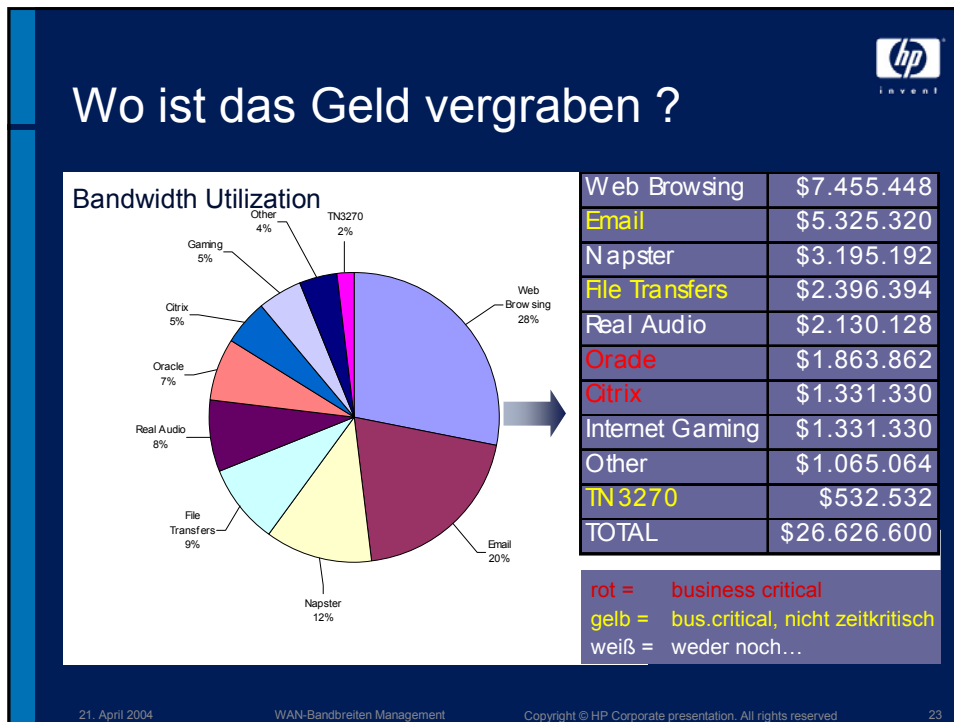
- Durchschnittliches Jahres Netzwerk Budget für Firmen mit 2500+ PCs is \$107.8M
- Durchschnittliche Kosten der WAN Schnittstellen des Kunden 24.7% des Netzwerk Budgets*



Category	Percentage
Web Browsing	28%
Email	20%
Napster	12%
File Transfers	9%
Real Audio	8%
Oracle	7%
Citrix	5%
Internet Gaming	5%
Other	4%
TNG270	2%

* Source: 2000 IDC500 Consensus of U.S. Network Executives at Firms With 2,500 or More PCs

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 22



ROI – Ein Beispiel

<h3>Kosten für Bandbreitenerhöhung</h3> <p>128kbps FR Link verdoppeln</p> <ul style="list-style-type: none"> - Einrichtung ca. 1000 € - Monatlich ca. 900 € (abhängig von der Strecke) <ul style="list-style-type: none"> - Kosten im ersten Jahr: ca. 11.800 € - Kosten in den folgenden Jahren ca. 10.800 € 	<h3>Bandbreiten Managing</h3> <p>PS1550 für „geplagten Link“</p> <ul style="list-style-type: none"> - Einrichtung ca.1400 € - Anschaffung ca. 4000 € - HP Service & Support ca. 100 € monatlich <ul style="list-style-type: none"> - Kosten im ersten Jahr: ca. 6.600 € - Kosten in den folgenden Jahren ca. 1200 €
--	---

ROI in ca. 7 Monaten

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 24



WAN Assessment bei einem Kunden

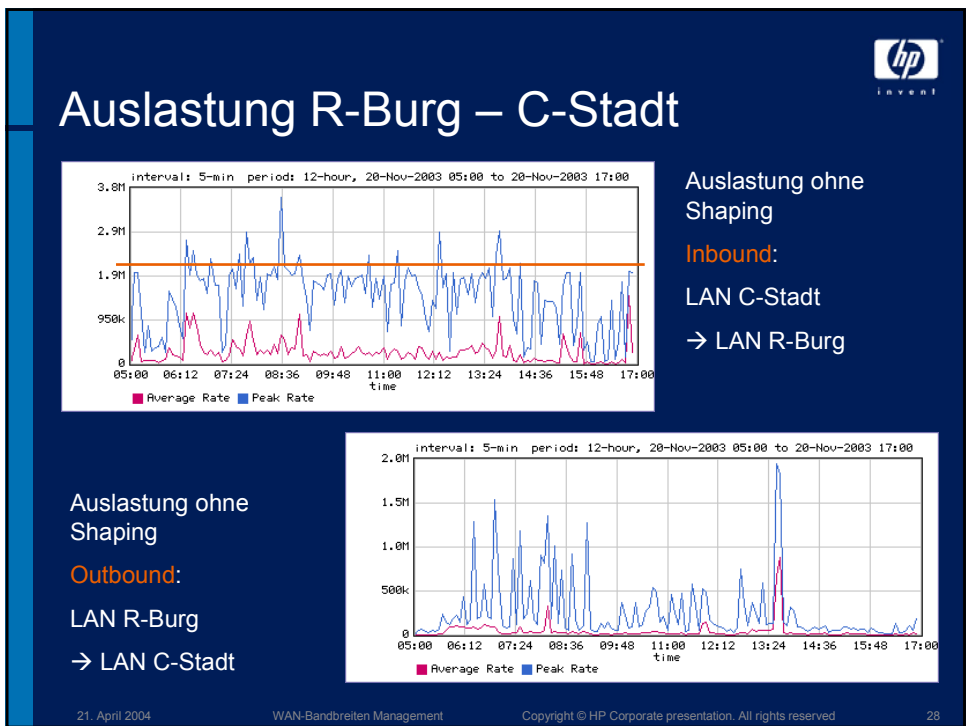
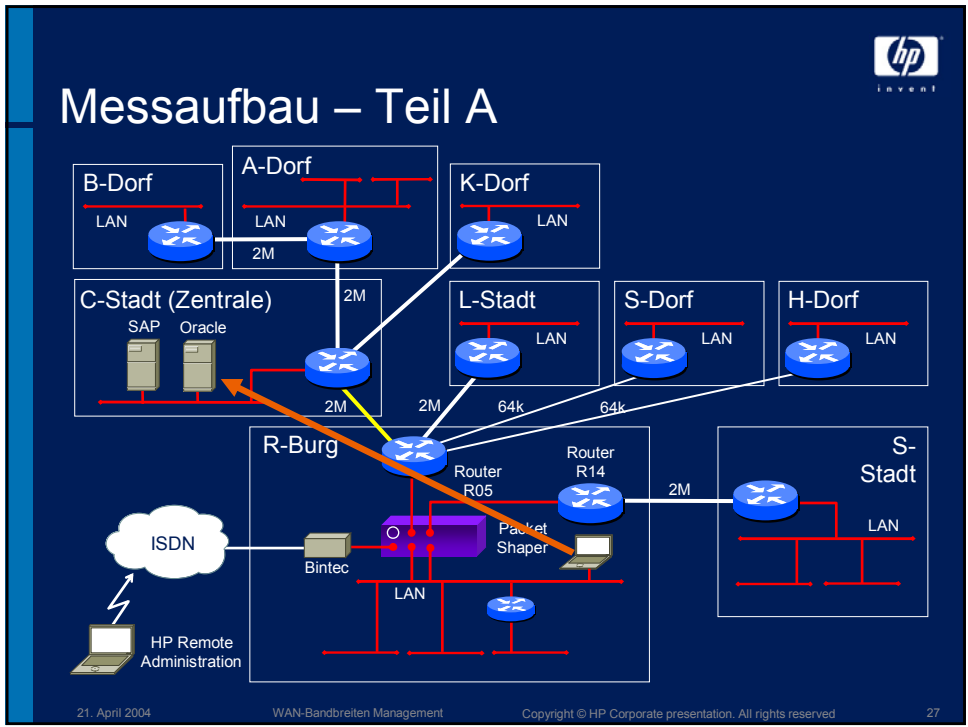


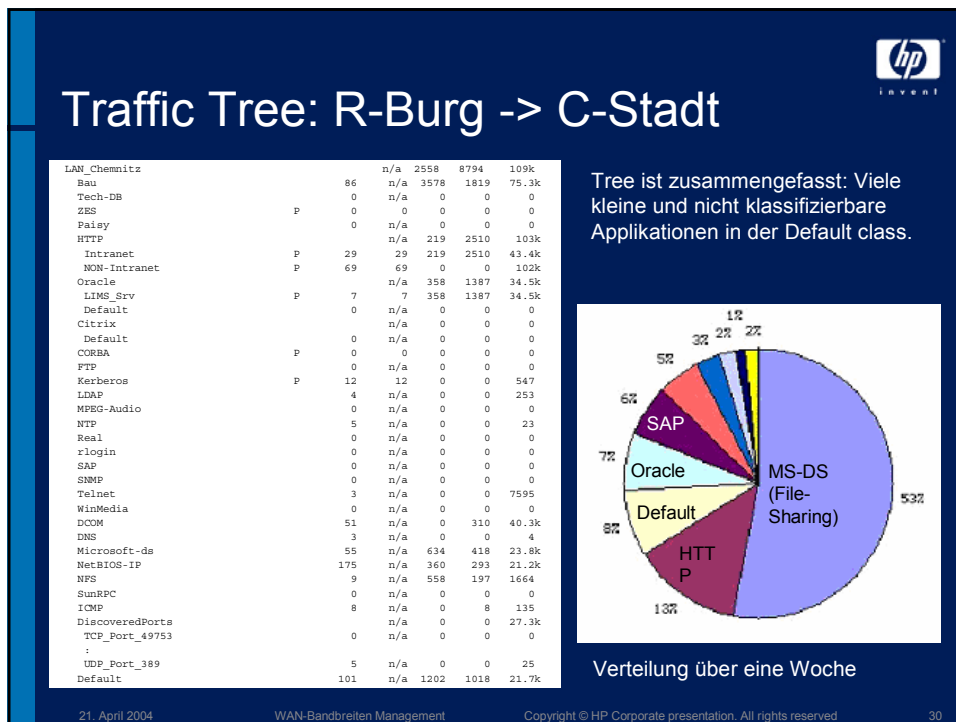
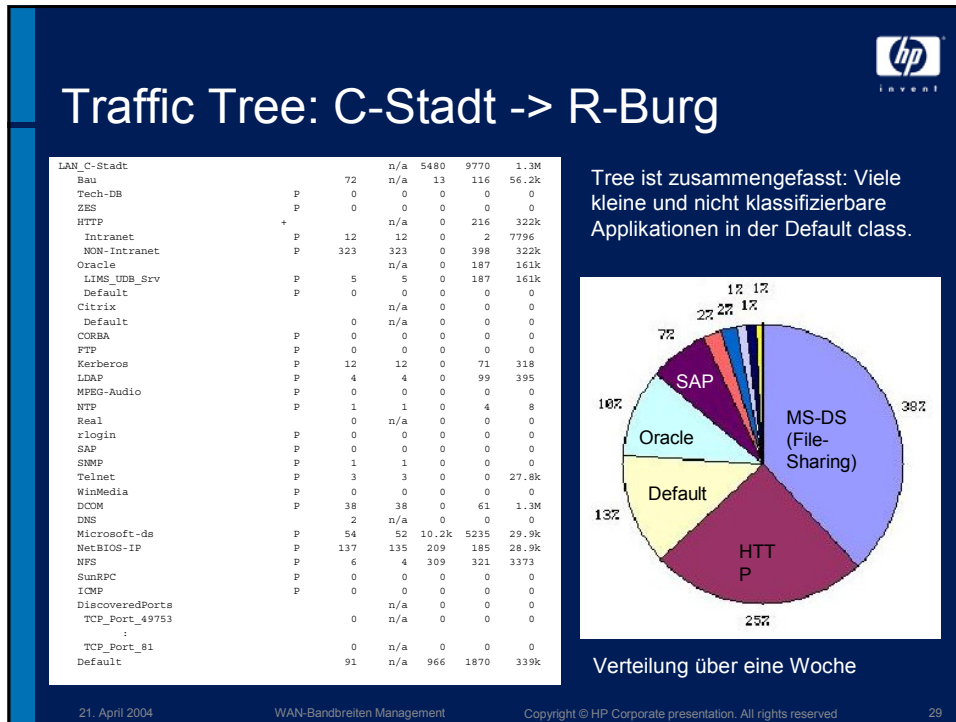
Teil A Analyse der Ist-Situation

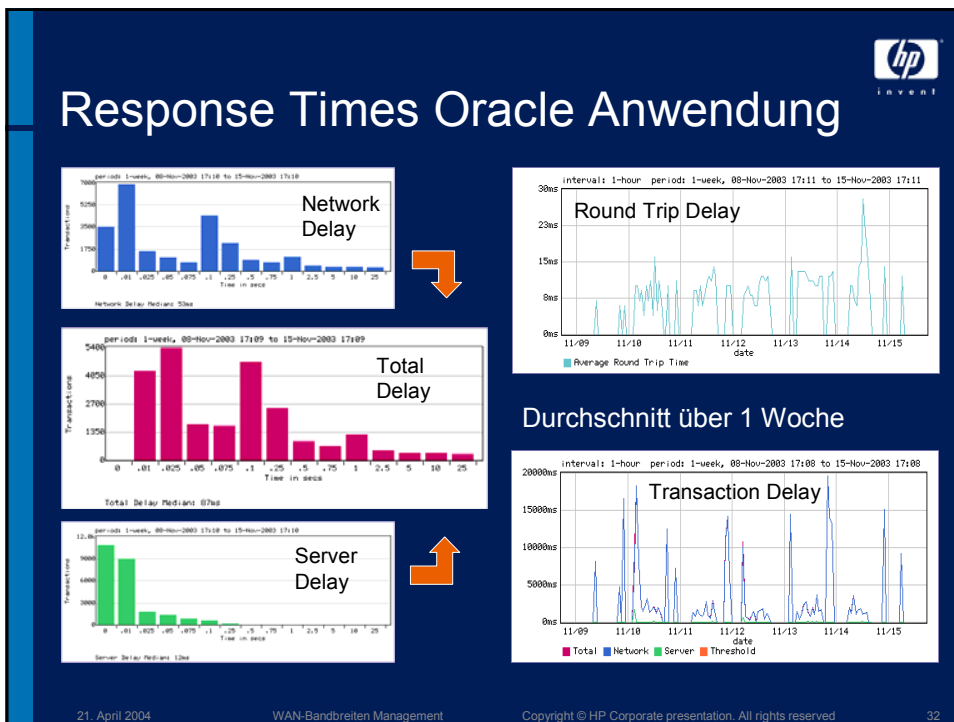
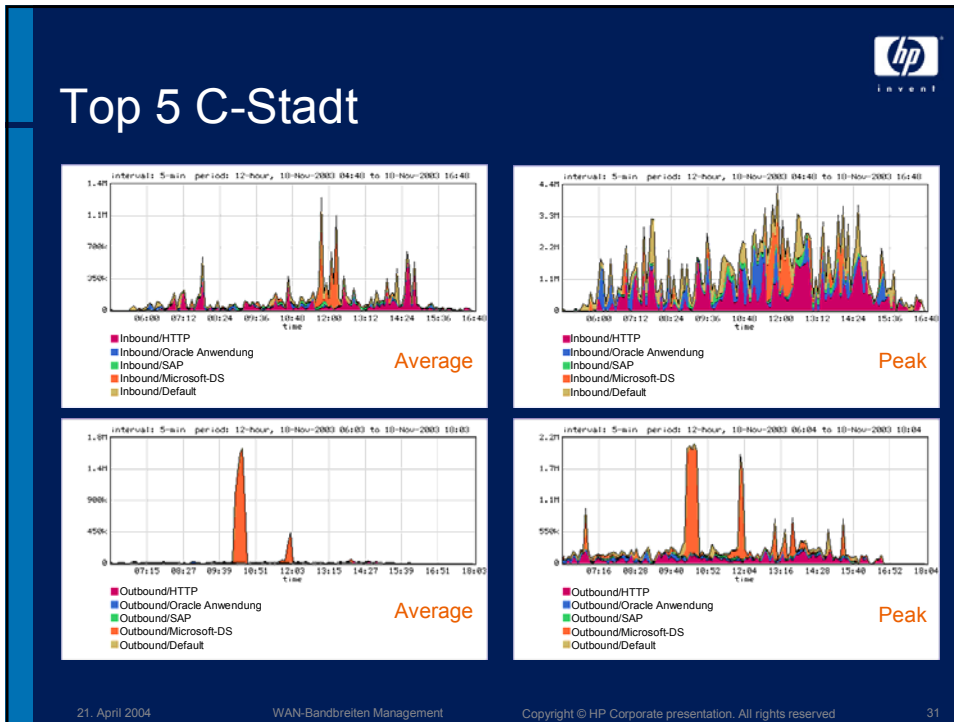
- Ziele:
- Feststellung, welche Applikationen sich die vorhandene Bandbreite teilen.
 - Eingrenzung eines Anwendungsproblems einer Oracle Applikation (Antwortzeiten)


Teil B Test mit Traffic Shaping

- Ziele:
- Optimierung der am meisten belasteten WAN-Verbindungen

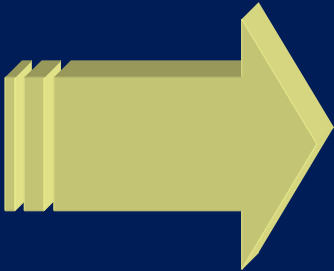









Teil A: Ist Aufnahme - Fazit

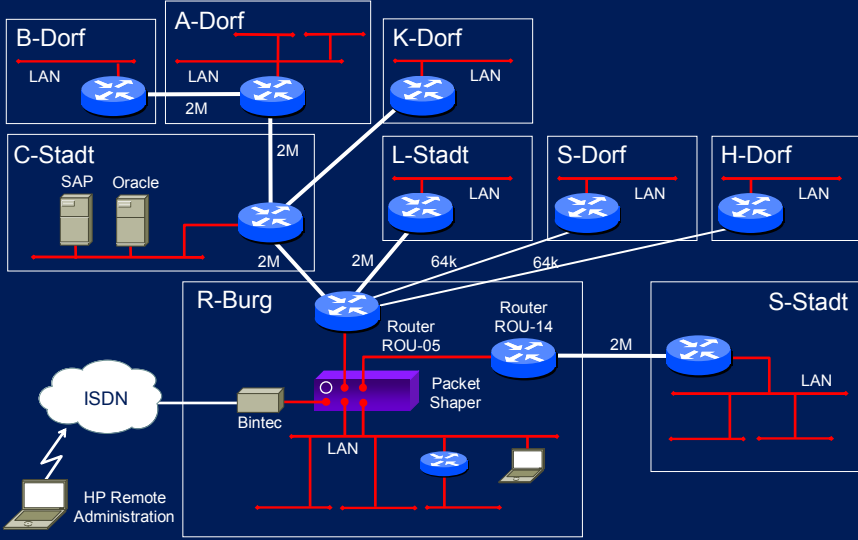


1. Die Bandbreite C-Stadt – R-Burg ist zu gering
2. Filesharing Dienste werden intensiv genutzt
3. HTTP (Intranet/Internet) wird intensiv genutzt
4. Der Traffic L-Stadt – C-Stadt wurde nicht erfasst (Position des PacketShapers)

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 33

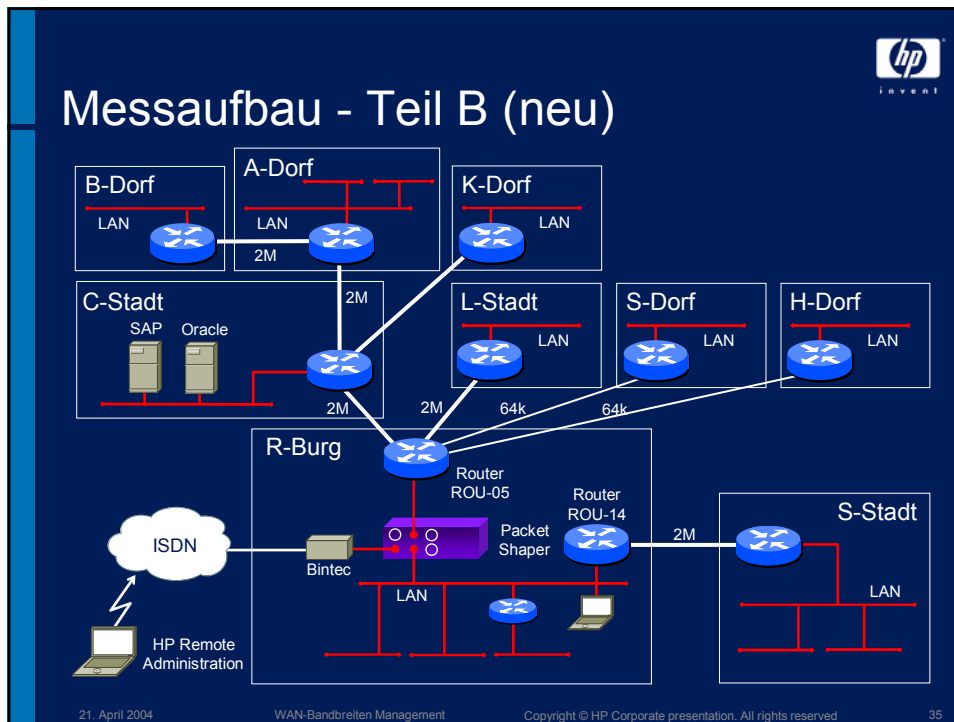


Messaufbau – Teil A (Review)



The diagram illustrates a network topology with several sites: B-Dorf, A-Dorf, K-Dorf, C-Stadt, L-Stadt, S-Dorf, H-Dorf, R-Burg, and S-Stadt. Each site is connected to a central R-Burg site. The R-Burg site is connected to an ISDN cloud and an HP Remote Administration laptop. The R-Burg site also contains a Bintec device, a Packet Shaper, and two routers: Router ROU-05 and Router ROU-14. The connections between sites are labeled with bandwidths: 2M, 64k, and LAN. The R-Burg site is connected to C-Stadt (2M), L-Stadt (2M), S-Dorf (64k), H-Dorf (64k), and S-Stadt (2M). The R-Burg site is also connected to B-Dorf, A-Dorf, and K-Dorf via 2M connections. The R-Burg site is connected to C-Stadt via a 2M connection. The R-Burg site is connected to L-Stadt via a 2M connection. The R-Burg site is connected to S-Dorf via a 64k connection. The R-Burg site is connected to H-Dorf via a 64k connection. The R-Burg site is connected to S-Stadt via a 2M connection. The R-Burg site is connected to B-Dorf, A-Dorf, and K-Dorf via 2M connections. The R-Burg site is connected to C-Stadt via a 2M connection. The R-Burg site is connected to L-Stadt via a 2M connection. The R-Burg site is connected to S-Dorf via a 64k connection. The R-Burg site is connected to H-Dorf via a 64k connection. The R-Burg site is connected to S-Stadt via a 2M connection.

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 34



Teil B: Traffic Shaping - 1

Vorgehen:

Versuch 1

- Oracle-Anwendung und SAP höher priorisieren
- Filesharing niedrig priorisieren
- sonst alles so lassen wie es ist


Versuch 2

Alle Applikationen erhalten eine Policy (Priorität)

A large yellow arrow points downwards from the text area.

HP logo and 'invent' tagline are in the top right corner.

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 36




Teil B: Traffic Shaping - 2

Versuch 1
 Oracle-Applikation und SAP höher priorisieren
 Filesharing niedrig priorisieren

... ernüchternd: Traffic R-Burg – S-Stadt wird extrem langsam.
 ... nicht priorisierte Applikationen werden alle gleich behandelt
 ... offenbar Problem wg. Halb-Duplex In/Outbound (deshalb das Umstecken)

21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
37

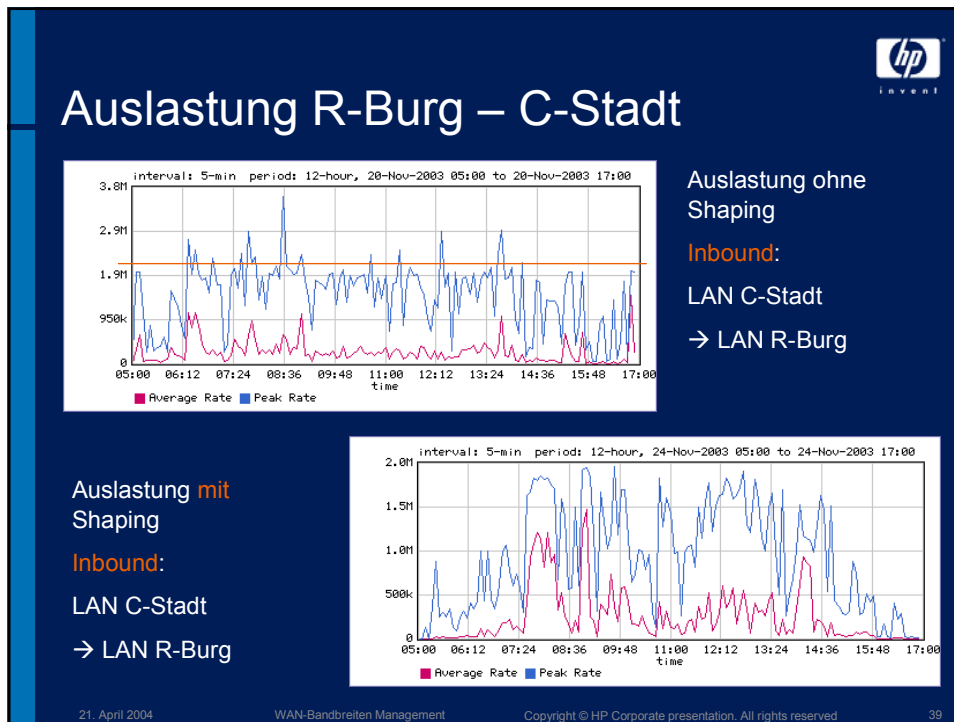


Teil B: Ist Aufnahme - 3

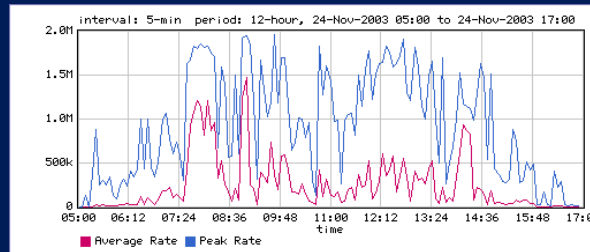
Versuch 2
 Alle Applikationen erhalten eine Priorität
 z.B. S-Stadt

Traffic Class Name	Class Hits	Policy Hits	Current (bps)	1.Min (bps)	Peak (bps)	Guar. Rate Failures	Pkt Exch (ms)	Partition Min-Max	Policy Type (Pri.) Guar.-Limit
Inbound			66.3k	59.4k	3.3M	0	NA	uncommitted_none	
Localhost	25396	25396	60.5k	51.6k	107k	0	764		Priority (0)
S-Stadt			127	165	1.8M	0	NA	2.0M - nonburstable	
LAN			112	160	1.8M	0	NA		
Tech-DB	0	0	0	0	0	0	NA		Rate (5) 0
ZES	0	0	0	0	0	0	NA		Rate (4) 150k
CORBA	0	0	0	0	0	0	NA		Rate (5) 0
FTP	0	0	0	0	0	0	NA		Rate (2) 0
HTTP	2089	2089	0	0	1.8M	0	29		Rate (3) 0
Kerberos	1267	1267	0	14	9617	0	14		Priority (0)
LDAP	10	10	0	0	2898	0	143		Priority (4)
NTP	26	26	0	0	22	0	NA		Priority (0)
Oracle	139	37	0	12	1.11M	0	60		Rate (6) 50k
SAP	8	8	0	0	93.7k	0	59		Rate (4) 20k
SNMP	38988	38988	0	137	28.1k	0	NA		Priority (0)
Telnet	1	1	0	0	63	0	8		Priority (5)
DCOM	1505	1505	0	0	1.4M	0	58		Rate (3) 0
DNS	1640	1640	0	2	12.0k	0	NA		Priority (0)
Microsoft-ds	3432	3432	0	171	1.6M	0	31		Rate (2) 0
NetBIOS-IP	12745	12745	139	108	187k	0	83		Rate (2) 0
ICMP	10278	10278	0	59	5404	0	NA		Rate (3) 0-2000
Default	1316	1316	114	87	15.3k	0	19		Rate (2) 0
Default	12662	NA	0	36	4034	0	83		


21. April 2004
WAN-Bandbreiten Management
Copyright © HP Corporate presentation. All rights reserved
38



Auslastung mit Shaping
Inbound:
LAN C-Stadt
→ LAN R-Burg



-
- ## Ergebnisse
1. Überlastsituation C-Stadt -> R-Burg bestätigt
 2. Oracle-Anwendung priorisiert bringt etwas – aber wenig
 3. Round Trip Delays sind okay
 4. Network Delays sind im Durchschnitt auch okay (100-150ms) – sie scheinen sich aber aufzuaddieren
 5. Oracle-Anwendung : wenige TCP-Sessions (3 – 5 pro Client) anderer (UDP ?) Traffic genutzt ?
 6. Insgesamt könnte Traffic Shaping die Gesamtsituation im WAN verbessern und Bandbreite sparen bzw. optimaler nutzen.
- Voraussetzungen:
- Verfeinern der Shaping Parameter
 - Andere Position des PS
21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 40



Case Study

Referenzstory einer Europäischen Fährgesellschaft

- 30 Sites, 1000+ Mitarbeiter
- MPLS Backbone und ISDN (kleine Niederlassungen)
- Herausforderungen waren
 - Telnet basierendes booking system
 - Priorisierung Kreditkartenabrechnung
 - Reduzierung Support Calls wg. Netzwerktrouble
 - QoS auch zu den kleinen Lokationen
- Ergebnis
 - Bessere Gesamt-Performance
 - Sehr gute Klassifizierung und Reporting des Traffics
 - QoS für Business kritische Anwendungen
 - “never before seen” Network visibility
 - QoS für MPLS **und** ISDN Verbindungen

21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 41



Future Look

Fakten:

- Das WAN ist der Flaschenhals im Corporate Network
- WAN Bandbreite ist immer teuer (monatliche Kosten)
- Applikationen fordern zunehmend immer mehr Bandbreite

Unsere Idee zur WAN Optimierung:

Netzwerkplanung unter Berücksichtigung von Applikations-Anforderungen:

- Theoretische Schätzung heute und künftig benötigter Bandbreite m.H. der Applikations-Verantwortlichen (Business)
- Praktische Messung heute benötigter Bandbreite pro Applikation (PacketSeeker)
- Vergleich Theorie mit Praxis: Entwicklung von Bandbreitenformeln pro Applikation
- Konsolidierung der theoretischen Formeln
- Schätzung künftig benötigter Bandbreite

Ziel: Bandbreiten proaktiv planen



21. April 2004 WAN-Bandbreiten Management Copyright © HP Corporate presentation. All rights reserved 42

