

# Buffering Sucks!

DENOG #7

Darmstadt – 29. October 2015



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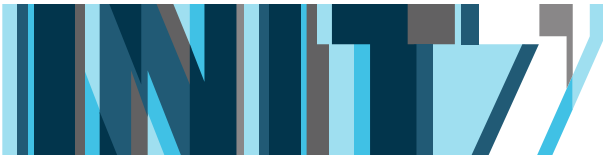
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**Buffering Sucks!**

# Buffering root causes #1

## **Streaming Video – degraded user experience**

- Lack of bandwidth: with a 2Mbps DSL or Edge connection HD video (3-5Mbps, depending on compression) is not possible
- Client has insufficient CPU power (these days no longer relevant)
- WiFi Quality – common but individual issue
- Over-Subscription of the shared node (mainly cable networks)



# Buffering root causes #2

## **Streaming Video – degraded user experience**

- Streaming source too far away (i.E. source in the US; dependency of Throughput and Latency)
- Adaptive Streaming: HD changes into SD, then into LowRes – it works, but...
- Routing / Algorithm issues: client-server mismatch (beware of inefficient Anycast routing!)
- Last but not least: Oversubscribed interconnection



# Buffering root causes #3

## [Tech insertion] Anycast Routing

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- Accidentally we preferred Twitch AS46489 Anycast prefix 199.9.248.0/21 in **New York** due to lower MED. A change shifted the Twitch ingress traffic to **London**, which improved the user experience a lot.

```
SSH@r1lon1.core#sh ip bgp 199.9.248.0/21
Number of BGP Routes matching display condition : 8
Status codes: s suppressed, d damped, h history, * valid, > best, i internal
Origin codes: i - IGP, e - EGP, ? - incomplete
  Network          Next Hop          MED    LocPrf    Weight Path
*>i 199.9.248.0/21  London           3      150      0      46489 i
*i 199.9.248.0/21  Amsterdam        3      150      0      46489 i
*i 199.9.248.0/21  New York         2      150      0      46489 i
*i 199.9.248.0/21  New York         2      150      0      46489 i
*i 199.9.248.0/21  Amsterdam        3      150      0      46489 i
*i 199.9.248.0/21  Frankfurt        3      150      0      46489 i
*i 199.9.248.0/21  Frankfurt        3      150      0      46489 i
* 199.9.248.0/21   [Transit]        1      60       0      1299 46489 i
```





**Daniel Manser** @Thaek\_ · 15. Okt.

@TwitchSupport Streaming using swiss @fiber7\_ch IP results in traffic from SanFrancisco not EU datacenter (often severe buffering), pls fix!



**Fiber7. No Limits.**

@fiber7\_ch

Folgen

@Thaek\_ please send us (noc at init7 dot net) the source IP of the Twitch stream, we'll check this with @TwitchSupport

Übersetzung anzeigen

11:43 - 18. Okt. 2015



**Daniel Manser** @Thaek\_ · 20. Okt.

@Twitch traffic now coming from London for #Fiber7 - no issues anymore. Thx @fiber7\_ch for contact @TwitchSupport so they finally fixed this



**Fiber7. No Limits.** @fiber7\_ch · 20. Okt.

@Thaek\_ it was a wrong preference of @init7 traffic towards @Twitch as they use anycast. Thanks for the heads-up. @TwitchSupport @tdeutsch





# IP Interconnection / Peering #1

**„The caller pays...“**



# IP Interconnection / Peering #2

## **„The caller pays...“**

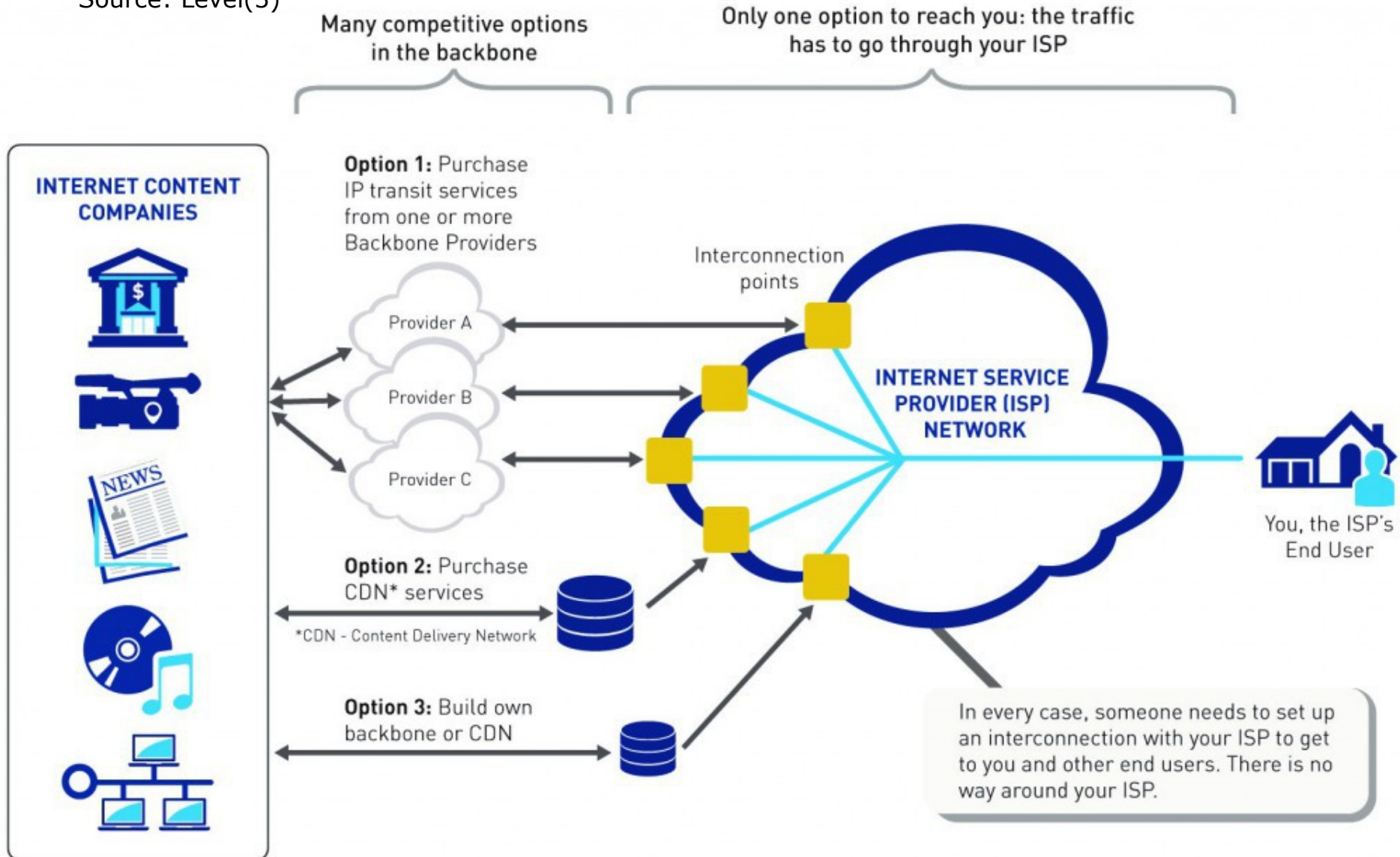
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- Who is calling with an IP connection?
- Broadband customer calls the Youtube server?
- ...or vice versa: is Youtube server calling the broadband customer?
- 95% of the data is flowing from server to client (end customer), but as a matter of fact, the client is causing the traffic



# IP Interconnection / Peering #3

Source: Level(3)



# IP Interconnection / Peering #4

## **Broadband provider can monopolize his end customers – at least momentarily**

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- There is no alternative way: data towards the end customer must compellingly flow via interconnection points
- Zero-Settlement-Peering is most common and is the foundation of the internet
- Broadband provider (mainly incumbents or large cable operators) tend to become more and more restrictive providing sufficient interconnection



# IP Interconnection / Peering #5

## **Broadband provider can monopolize his end customers – at least momentarily**

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- Not upgrading interconnection capacity to the requirements is nowadays a common passive-aggressive behavior
- End customers are suffering: Buffering is very common, especially during prime time



# IP Interconnection / Peering #6

## **Broadband provider can monopolize his end customers – at least momentarily**

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- Asymmetric traffic ratio – Video (i.e. Netflix) has up to 50 times more outbound traffic
- Typical traffic ratio of a broadband provider is 1:5 bis 1:10 (outbound:inbound)
- Some large broadband operators require traffic ratio of 1:1,5 bis 1:3 from their zero settlement peers



# IP Interconnection / Peering #7

## **Broadband provider can monopolize his end customers – at least momentarily**

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- Those who don't meet this required traffic ratio (no content provider can!) have to pay excessive prices for peering capacity
- If you don't pay: your data is stuck in congestion
- Large broadband operators want to get paid twice: due to the temporary monopoly they can force the double sided market



# IP Interconnection / Peering #8

## **Broadband provider can monopolize his end customers – at least momentarily**

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# Economic damage of buffering # 1

## **Peering [is | would be] cheap**

- IP Interconnection / Peering is cheap: the business cost per broadband customer is just a few cent per month – for the sake of happier customers
- Content Provider are easy to deal for peering or dedicated cache servers (please talk to our community fellows at A, A, A, F, G, L, N, T, Z...)



# Economic damage of buffering #2

## Traffic congestion is costly

- Damage to the national economy caused by traffic congestion – «Die Welt» (Dec. 2013):

«Staus kosten jeden Haushalt 509 Euro im Jahr»



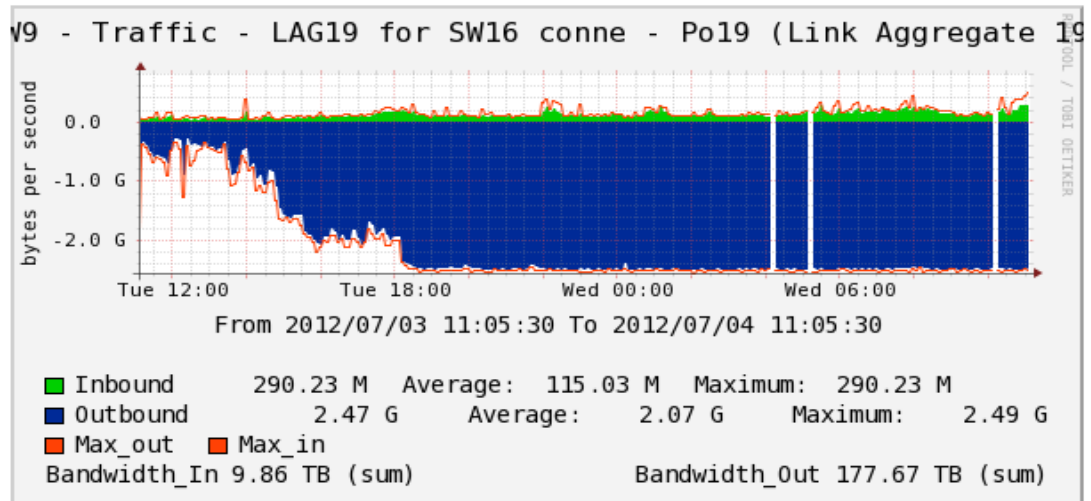
<http://www.welt.de/motor/article123059457/Staus-kosten-jeden-Haushalt-509-Euro-im-Jahr.html>



# Economic damage of buffering #2

## Cost calculation of interconnection congestion

- Damage to the national economy caused by interconnection congestion seems to be an unexplored field so far...



PS. random traffic graph from images.google...



# Economic damage of buffering #3

## Cost calculation of interconnection congestion

- Quick calculation (Milchbüechlirächnig):
  - 30Mio broadband connections in Germany
  - average accumulated buffering time per day: 1 Minute
  - Cost per hour waiting: 5€ \*)

\*) a debate on its own. See "Reservationslohn" at Wikipedia for background information  
<https://de.wikipedia.org/wiki/Reservationslohn>



# Economic damage of buffering #4

## Cost calculation of interconnection congestion

- Quick calculation (Milchbüechlirächnig):
- Avg. buffering time per year:  
 $360 \text{ days} * 1 \text{ min} = 6 \text{ hours}$
- Avg. buffering cost per broadband customer:  
 $6 \text{ hours} * 5 \text{ €} = 30 \text{ € per year}$
- Economic damage per year in Germany:  
 $30 \text{ Mio broadband subscribers} * 30\text{€} = 900 \text{ Mio €}$



# Economic damage of buffering #5

## **Conclusion**

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- A large part of Buffering is caused by insufficient interconnection, which is a result of the restrictive peering policy of the incumbent and other large broadband providers
- The ability to force the double sided market results in a few million extra revenue for the incumbent
- However the economic damage sums up to at least 900 Million € per year



# Economic damage of buffering #6

## **Conclusion**

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- In democratic countries like western Europe the economic gain of a multi billion company at the expense of the general public is commonly not tolerated
- When will the regulators wake up and force every market participant to cooperative peering and interconnection?



# Regulation #1

## **Exposure to the regulator**

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- Zero settlement peering is common. Unbalanced traffic ratio must no longer be a used to refuse peering.
- Disputes about interconnection must be resolved much quicker.
- Any broadband provider must be committed to act in the interest of their own end customer base (zero buffering).





# Regulation #2

## **Exposure to the regulator**

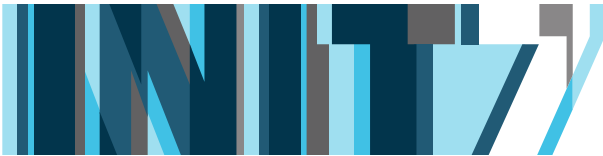
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- Telekom manages to get paid by everyone due to their market power (~18, 20 Mio broadband customers + mobile). This must not be tolerated.
- Other incumbents use Telekom as a leverage to force their restrictive peering policy.
- Regulators don't do much... quote of Marc Furrer, Chief ComCom Switzerland: «nur ein fauler Regulator ist ein guter Regulator» \*)

\*) <http://www.nzz.ch/wirtschaft/nur-ein-fauler-regulator-ist-ein-guter-regulator-1.18569005>



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