Statusreport Wettzell for eVLBI Activities

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Observations RT Wettzell

- Observations from the Year 1983 to 2002.
- Observations which are reasonable for eVLBI Transfer

Observations at the RADIOTELESKOP WETTZELL from 1983 - 2002

BEOBACHTUNGEN	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Σ 2002
POLARIS-A/IRIS-A/ NEOS-A+B/CORE	3	67	72	72	72	73	73	73	59	48	60	62	52	53	52	45	51	58	90	106	**1241**
INT [Δ(UT1)]	0	73	211	276	281	282	287	287	292	236	281	225	287	200	277	248	278	235	200	202	**4658**
IRIS-S	0	0	0	4	5	3	3	12	12	12	12	12	12	12	12	10	12	12	12	0	**157**
EUROPE	0	0	0	0	0	5	2	4	3	5	4	6	6	6	6	5	6	7	3	4	**72**
NASA-Geod./CORE	0	2	12	12	12	5	1	0	21	22	15	23	15	33	5	6	7	6	6	13	**216**
NASA-Planet-Astr.	0	0	0	0	2	2	0	0	0	0	0	0	2	0	8	3	0	0	0	3	**20**
USNO	0	0	0	0	0	0	0	0	1	11	6	14	4	4	0	0	2	0	0	0	**42**
UNI/MPIfR/Inst.	0	0	0	0	0	0	0	3	5	0	2	2	3	5	2	4	2	3	1	3	**35**
Mobile Kampagne	0	0	0	0	0	0	10	0	4	21	4	4	-	0	0	0	0	0	0	0	**43**
Sonst. 1bis8h(K4)	0	16	13	25	27	1	19	23	22	1	1	2	6	10	1	0	1	0	0	21	**189**
Sonst.24h|Mk-II	-	-	1 | 0	0 | 0	1 | 0	7 | 3	18 | 3	3 | 4	9 | 1	13 | 0	0 | 0	2 | 0	0 | 0	2 | 0	-	-	1 | 16	-	-		**57|27**
AnlagenLaufZeit[h]	78	2061	2856	3191	3290	3137	2972	3322	3568	3259	3420	3775	3323	3568	3044	2642	2917	2941	3512	4023	**60899**
Wettzell-Team [h]	*344*	*2640*	*3688*	*3908*	*4032*	*3976*	*3408*	*3976*	*3842*	*2921*	*2703*	*3468*	*2957*	*3140*	*2701*	*2428*	*2828*	*2548*	*2919*	*3620*	***62047***
Studenten [h]	-	-	-	*192*	*224*	*56*	*1140*	*256*	*443*	*1690*	*1365*	*808*	*390*	*504*	*214*	*201*	*286*	*383*	*676*	*383,5*	***9212***
Σ Beob.zeit [h]	*344*	*2640*	*3688*	*4100*	*4256*	*4032*	*4548*	*4232*	*4285*	*4611*	*4068*	*4276*	*3347*	*3644*	*2915*	*2629*	*3114*	*2931*	*3595*	*4004*	***71259***

Wettzell eVLBI candidates

- The Intensive Observations (Baseline Wz-Kokee) are well predestinated for the first regular eVLBI Data transfer. There are 4 Intensives per week, i. e. about 202 Intensive Obser. per year in Mk5 mode (Transport delay 2-3 days)
  - 1 hour Observation with a data stream of about 130 Mbit/s results in a data volume of about 32 to 36 GByte on a Mk5 System
- Additionally we do 22 Intensive Observations (Baseline Wz-Tsukuba) in K-4 mode (Transport delay 5-6 days)
  - The 1 hour K-4 Observation has data stream of about 256 Mbit/s with a data volume of about 83 Gbyte
- These Observations would be a good starting point for an eVLBI data transmission across the ocean to USA and Japan.

Problem at Wettzell > the last mile

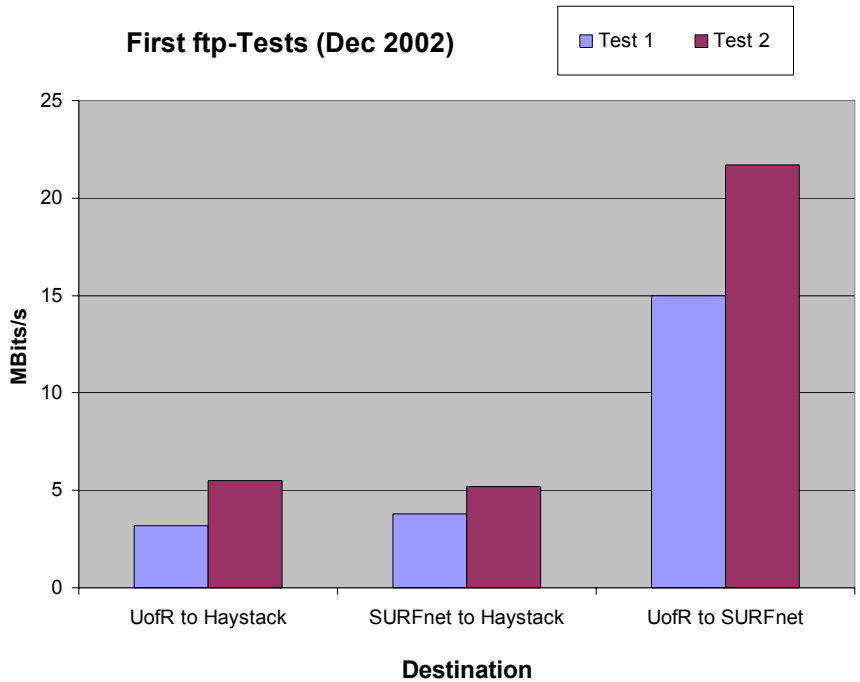
- Wettzell is at a location far off from the fast INTERNET links. At the moment we are connected to the Internet with 2 Mbit/s. The next node with a better Internet access is the DFN node at the University of Regensburg. The University of Regensburg is connected with OC3 (155 Mbit/s) to the DFN. The DFN fibre cable has a transmission capability of OC48 to the international nodes
- For the next future we will intend to get a 34 Mbit/s connection to the DFN. This is a realistic and affordable solution for Intensive (i. e. a regular Intensive will be transmitted in about 4 to 5 hours!)
- Probably the 34 Mbit Internet connection includes a fibre-cable to the station Wettzell

Transportation Costs versus Delay-Time

- 202 Intensive transports to 54 $ per day = 10368 $ per year.
  - Delay due to the transport: about 2.6 days
- 22 K-4 transports to 125 $ per day = about 2750 $ per year.
  - Delay due to the transport: 5 to 6 days
- Costs for a 34 Mbit/s Internet connection to Wettzell = about 35,000 $ per year.
  - Delay: about 4 to 8 hours

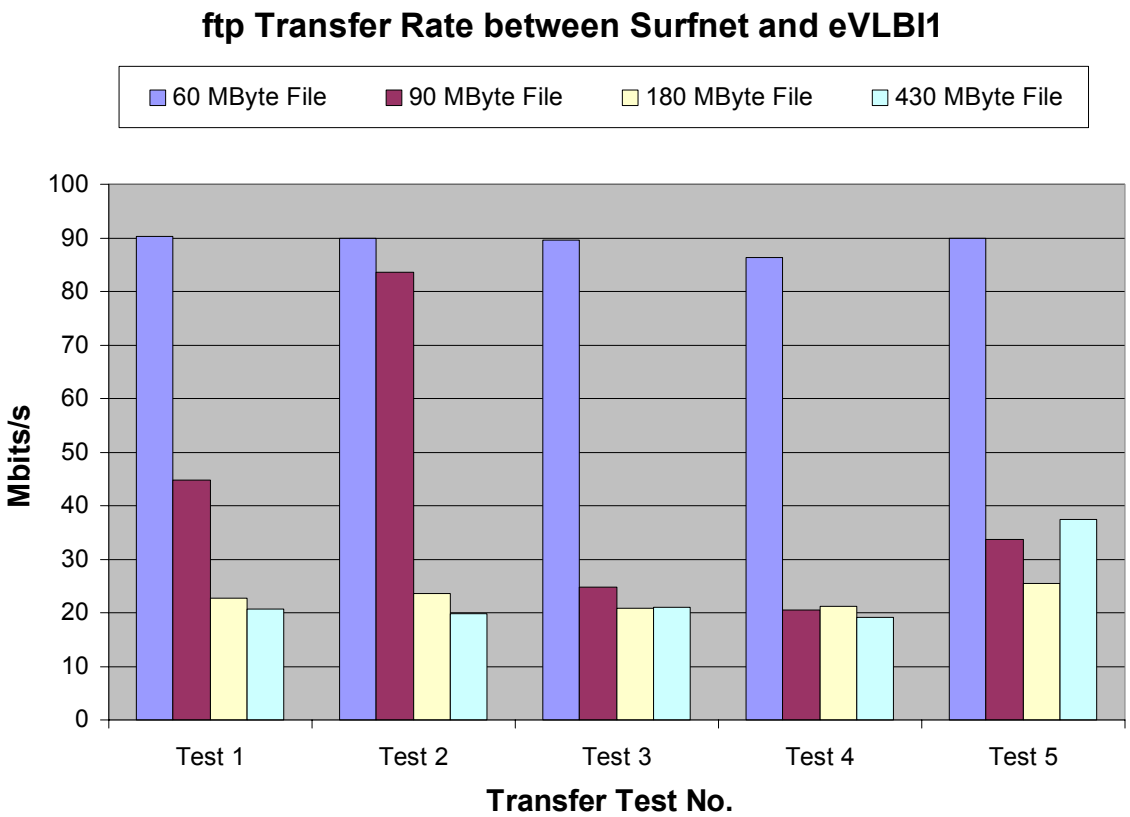
First ftp-tests with Haystack and SURFnet

- There was almost no difference in transfer rates between UofR and SURFnet
- The transfer rate from UofR to SURFnet was about 22 Mbit/s
- A Iperf-Test between Surfnet and UofR results in 91 Mbits/s



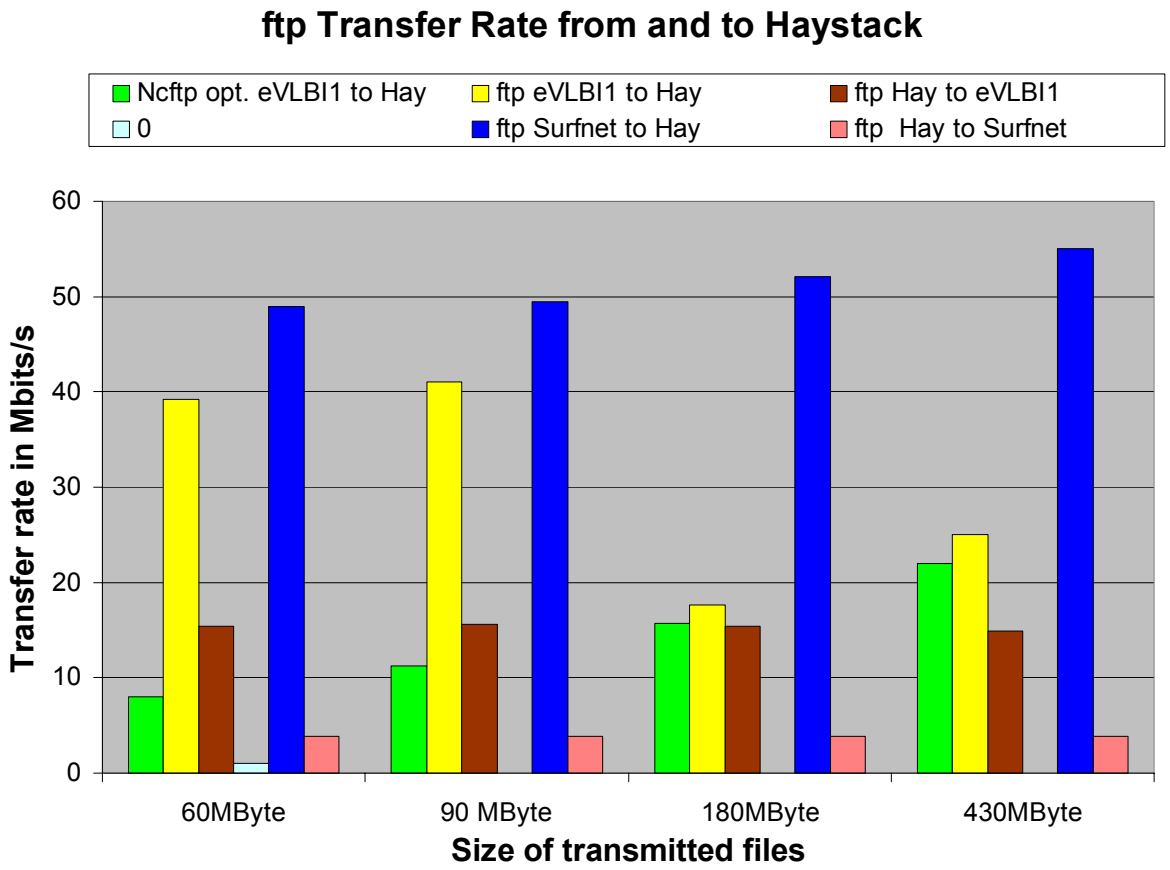
Transfer Tests from UofR to SURFnet

- Smaller files can be transmitted at maximum speed
- Larger Files are limited through data traffic and the PC Hard- and Soft-ware configuration
- I suppose, that a transfer rate up to 80 or 90 Mbits/s would be possible for a well tuned System



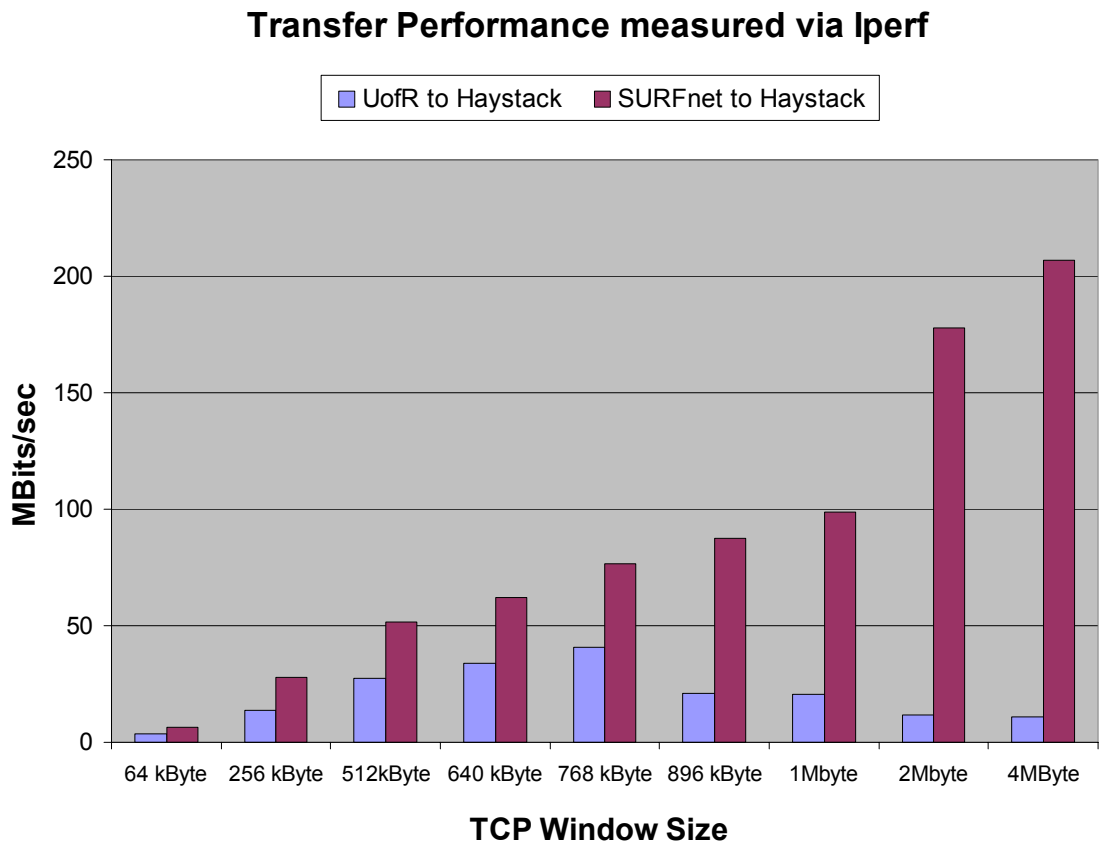
Data Transfer Rates via ftp to Haystack

- A continues optimization results in a better transfer rate for bigger files
- The transfer rate from Surfnet to Haystack is constant good
- The reverse path is anyway limited to 4 Mbits/s

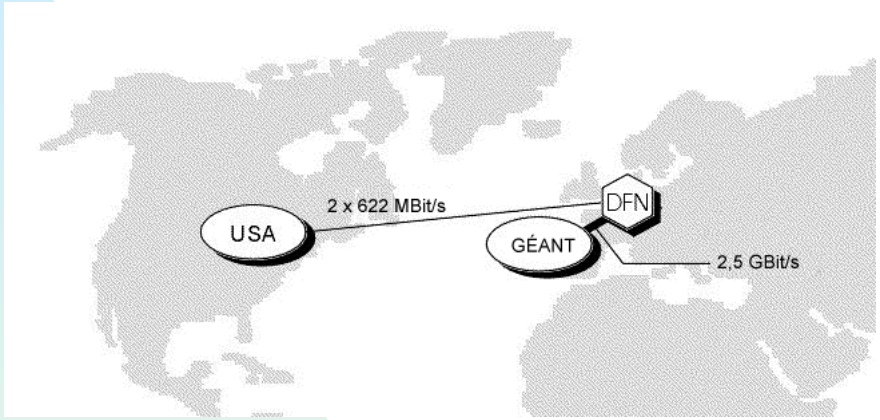


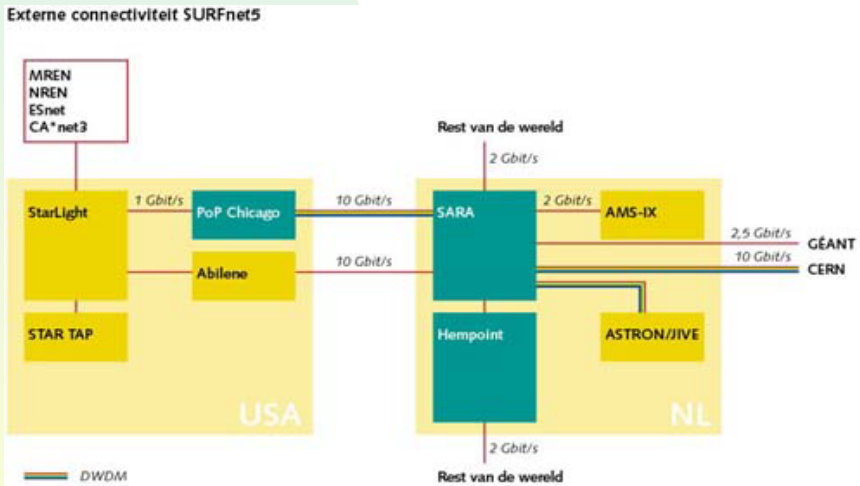
Data Transfer Test via Iperf

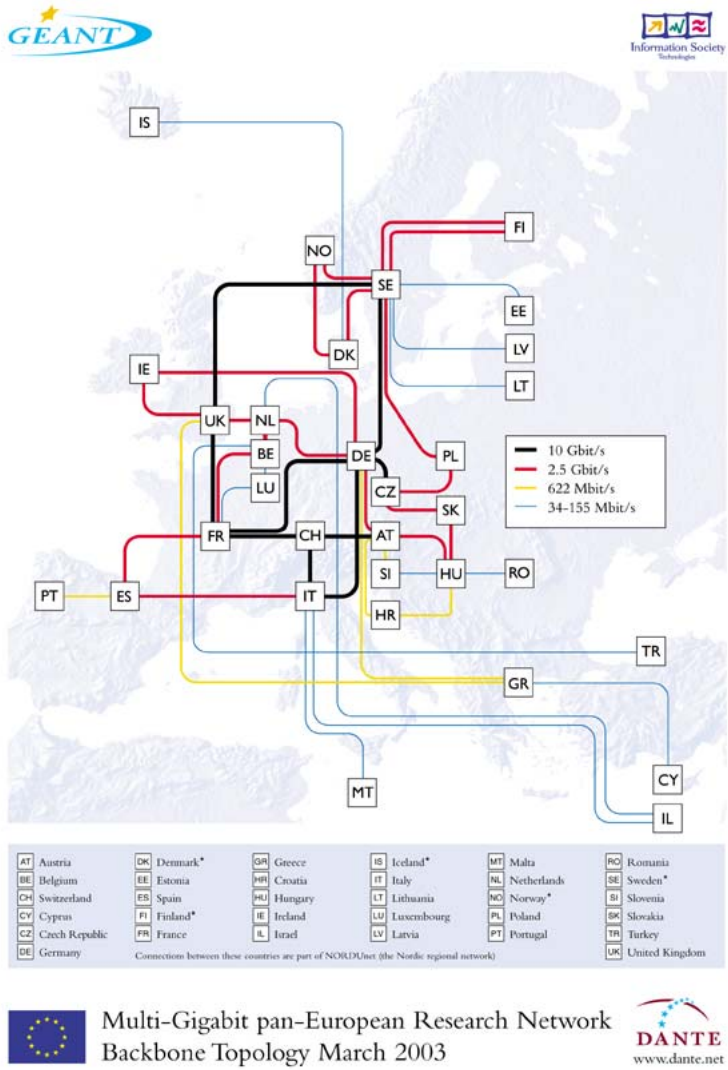
- The optimal TCP Window Size for the PC „eVLBI1“ to Haystack was 768 kByte
- Form SURFnet to Haystack the optimal TCP Window size is 4Mbyte



Internet links







Traceroute from UofR to Surfnet/wgsara

1	rrz.bb1-104.rz.uni-regensburg.de	0 ms
2	gwingate.rz.uni-regensburg.de	1 ms
3	ar-regensburg1.g-win.dfn.de	1 ms
4	cr-erlangen1-po2-0.g.win.dfn.de	2 ms
5	cr-stuttgart1-po4-2.g.win.dfn.de	12 ms
6	cr-frankfurt1-po8-0.g.win.dfn.de	13 ms
7	ir-frankfurt2-po3-0.g.win.dfn.de	13 ms
8	dfn.de1.de.geant.net	12 ms
9	de1-nl1.nl.geant.net	20 ms
10	PO2-0.BR0.Amsterdam1.surf.net	19ms
11	P11-0.CR1.Amsterdam1.surf.net	20 ms
12	PO0-0.AR5.Amsterdam1.surf.net	20 ms
13	wgsara9 Amsterdam1.Netherlight.nl	20 ms

Traceroute from UofR to Haystack/turtle

1	rrz.bb1-104.rz.uni-regensburg.de	0 ms
2	gwingate.rz.uni-regensburg.de	1 ms
3	ar-regensburg1.g-win.dfn.de	3 ms
4	cr-erlangen1-po0-0.g.win.dfn.de	13 ms
5	cr-stuttgart1-po4-2.g.win.dfn.de	14 ms
6	cr-frankfurt1-po8-0.g.win.dfn.de	14 ms
7	ir-frankfurt2-po3-0.g.win.dfn.de	14 ms
8	dfn.de1.de.geant.net	13 ms
9	de1-1.de2.geant.net	13 ms
10	abilene-gtren-gw.de2.de.geant.net	108 ms
11	dcne-abilene-oc48.maxgigapop.net	107 ms
12	arlg-so3-1-0.maxgigapop.net	108 ms
13	isi-e-arlg.max.gigapip.net	108 ms
14	Host Haystack turtle	118 ms

Traceroute from SURFnet to Haystack/turtle

1	Gi13-0-2.AR5. Amsterdam1.surf.net	0,3 ms
2	PO6-0.CR1. Amsterdam1.surf.net	0,4 ms
3	P0-0.BR1 Amsterdam1.surf.net	0,5 ms
4	nycmng-OC192-surfnet.abilene.ucaid.edu	13 ms
5	washng-nycmng.abilene.ucaid.edu	92 ms
6	dcne-abilene-oc48.maxgigapop.net	103 ms
7	arlg-so3-1-0.maxgigapop.net	97 ms
8	isi-e-arlg.max.gigapip.net	97 ms
9	Host Haystack turtle	97 ms

Problems to be solved

- No matter whether we will use a TCP or UDP protocol - in anyway the Software at the server must be optimized
  - Different protocols needs different tuning modes!
- Transfer Time versus Transfer Capacity
  => where is the breakpoint?
- We need an intelligent Software for the automatic data transfer (Connection loss, auto optimization, and so on)
- Firewalls limits the bandwidth > without firewall there are a lot of hazards via open ports
  - All Systemadministrators avoid to open more ports than absolutely necessary. (We use separate networks)
- What is the best OS for High Data Transfer Rates
  - The tuning possibilities are only partly well documented

eVLBI aspects for the next future

- Where is the bottleneck in the system and how can we improve the throughput to stable values for a longer time
  - We should be aware, that we use a scientific network => there is always a permanent progress and change in the network (This leads often to times of only small data traffic)
  - There are no granted point to point connections
- eVLBI requires additional manpower if you want to have continues throughput (Control of transmitted files)
- The Internet data transfer raises => but also the international data traffic and of course, the recorded bandwidth in VLBI (1 Gigabit/sec data rates and above)
- Where is the individual breakpoint between Delay, Costs and manpower for each station and for the correlators

Wettzell eVLBI objectives

- Intensive is an ideal candidate for starting a data transfer over Internet (eVLBI), since the data files are small and it is desirable to reduce the delay between recording data and getting result for UT1 as much as possible
- Wettzell will get a 34 Mbits/s internet access at the beginning of the next year. We will try to setup a transmission for:
  - 202 Intensive Observations (Baseline Wz-Kokee)
  - 22 Intensive Observations Baseline (Wz-Tsukuba)
- We will continue with Internet transfer tests at Servers in Germany, the Netherlands and the USA.
- I think, that there are data-rates from 30 to 80 Mbits/s to the USA possible with well configured Standard equipment, i. e. for a PC or Mk5 System with a 100Mbits/s Ethernet card.
- Internal tests for a connection between two Mk5 Systems and VSI compatible systems will follow

Conclusions:

- Wettzell will continue to get a better Internet connectivity in the next future.
- There is still a lot to do, to get a reasonable and reliable data transport via Internet. (Additional tests with a better PC or Mk5 Configuration, other Software-protocols, different servers and so on)
- Wettzell will try to start eVLBI for the Intensive Observation as soon as it is possible and reasonable