



Strategy for an Internet Based Best Effort Regional PPP Product Delivery Free from Outages and Outliers – The EUREF Example

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Federal Agency for Cartography and Geodesy



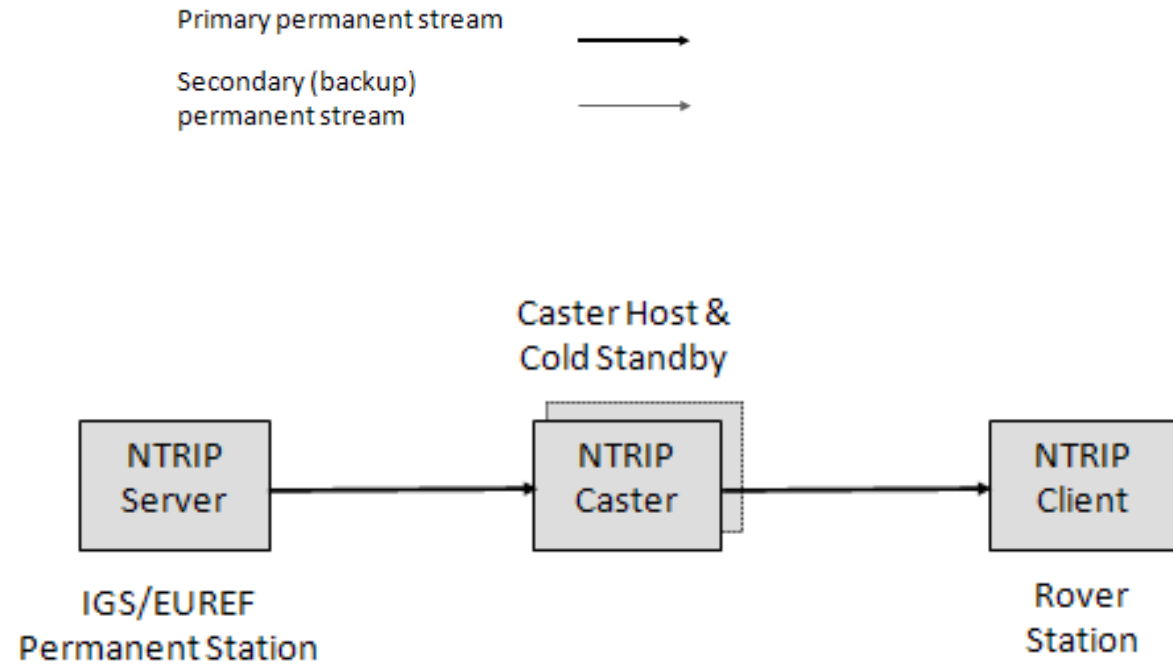
- **Introduction**
- **Strategy for observation collection**
- **Strategy for product dissemination**
- **Using backup resources**
- **Impacts**
- **Conclusions**



- **Important for introduction of new EUREF product**
 - **Is there a need for this?**
 - **Who would be the users?**
 - **What are their requirements?**
 - **Product reliability**
 - **Product availability**
 - **Product accuracy**
 - **Unambiguousness of the product**
 - **Acceptance by manufacturers, providers, software engineers**

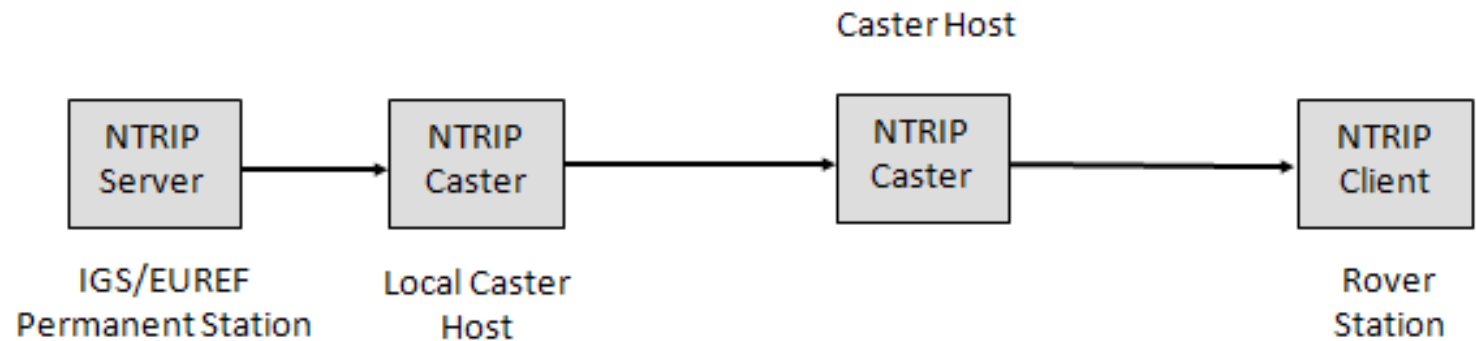


Real-time GNSS - Backup concept



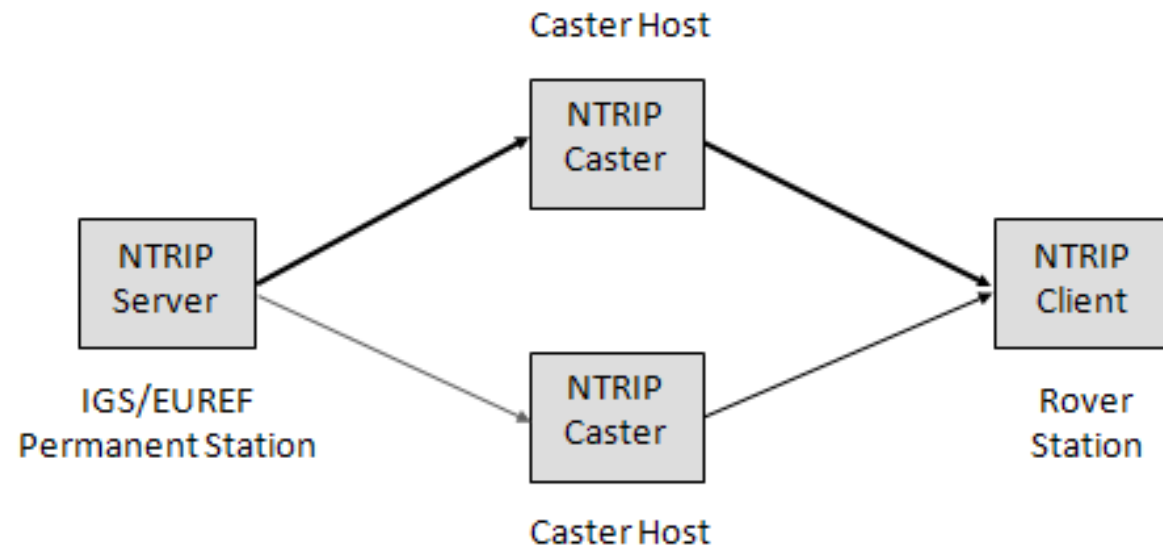


Real-time GNSS - Backup concept



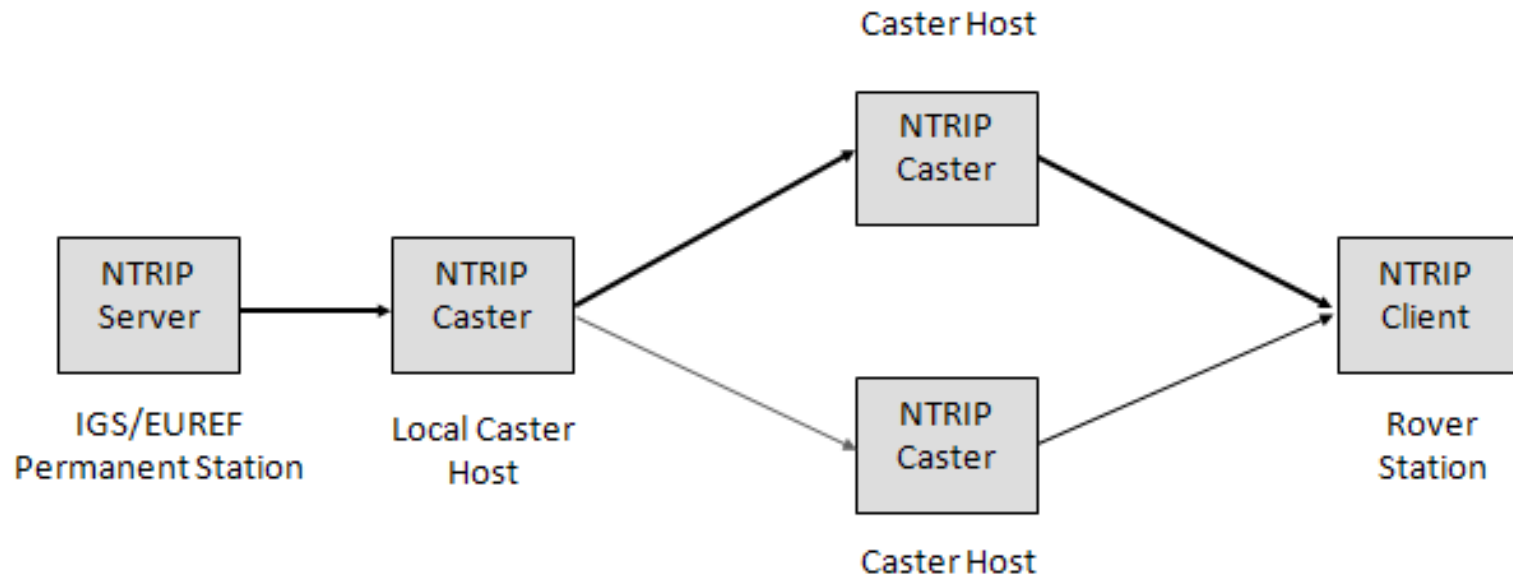


Real-time GNSS - Backup concept



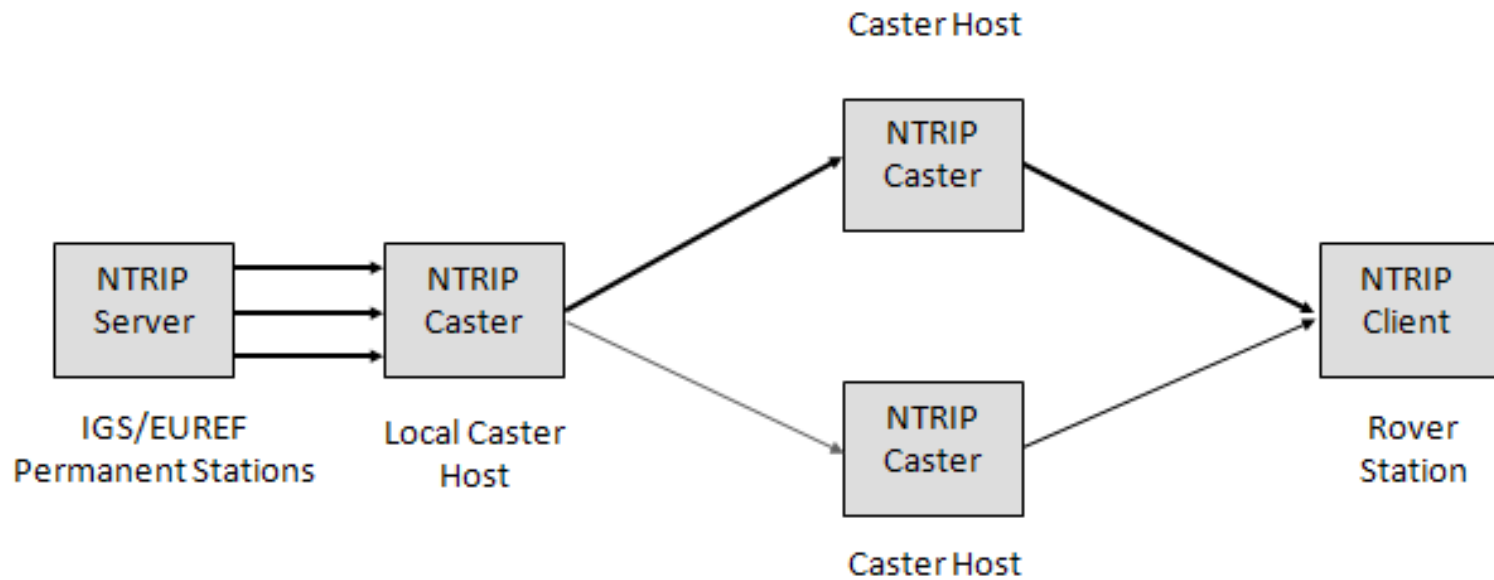


Real-time GNSS - Backup concept



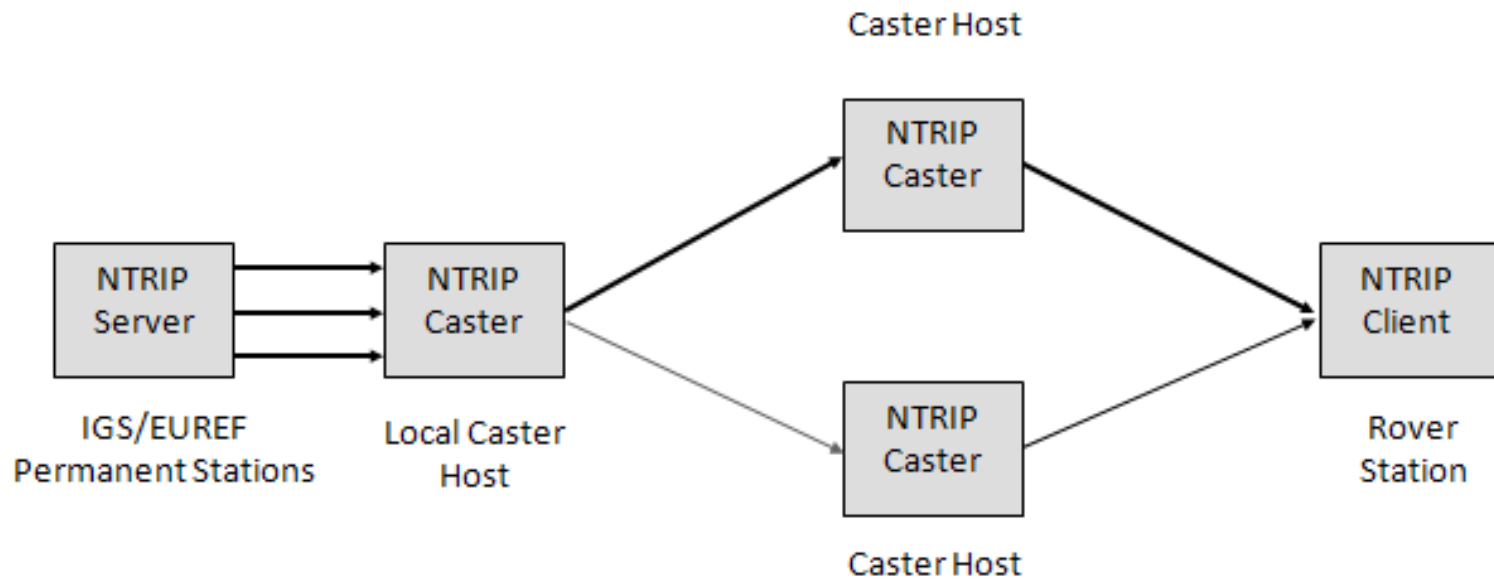


Real-time GNSS - Backup concept



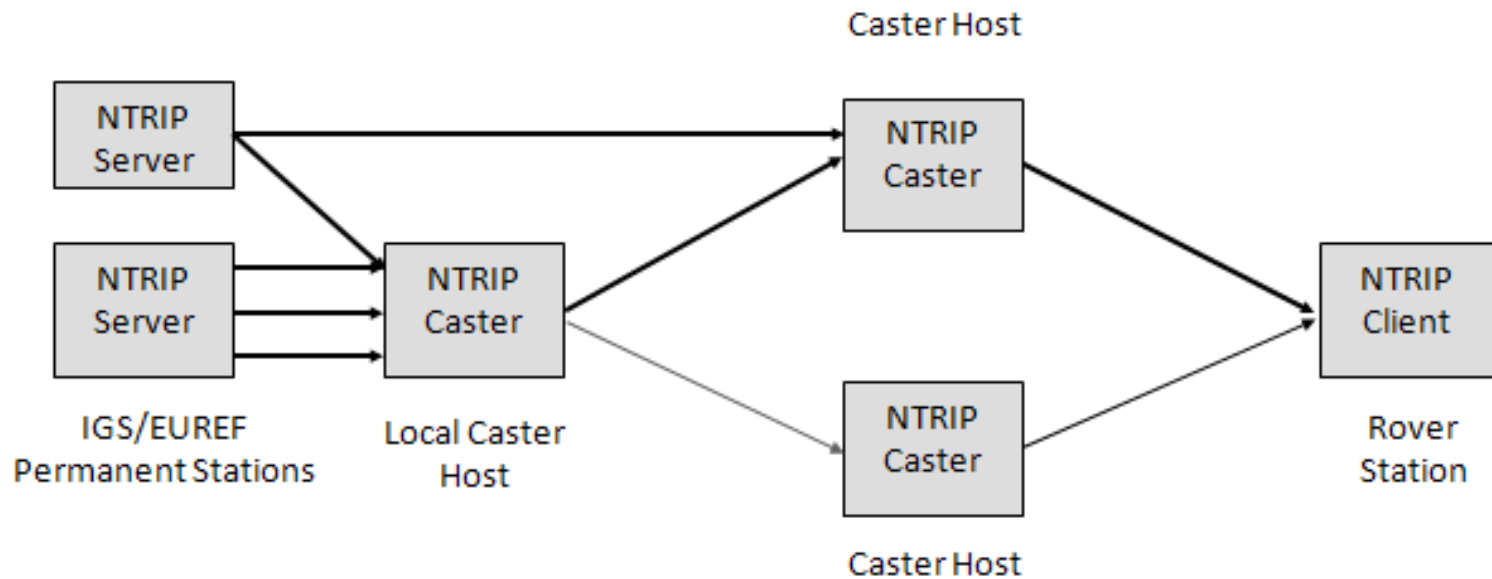


Real-time GNSS - Backup concept





Real-time GNSS - Backup concept



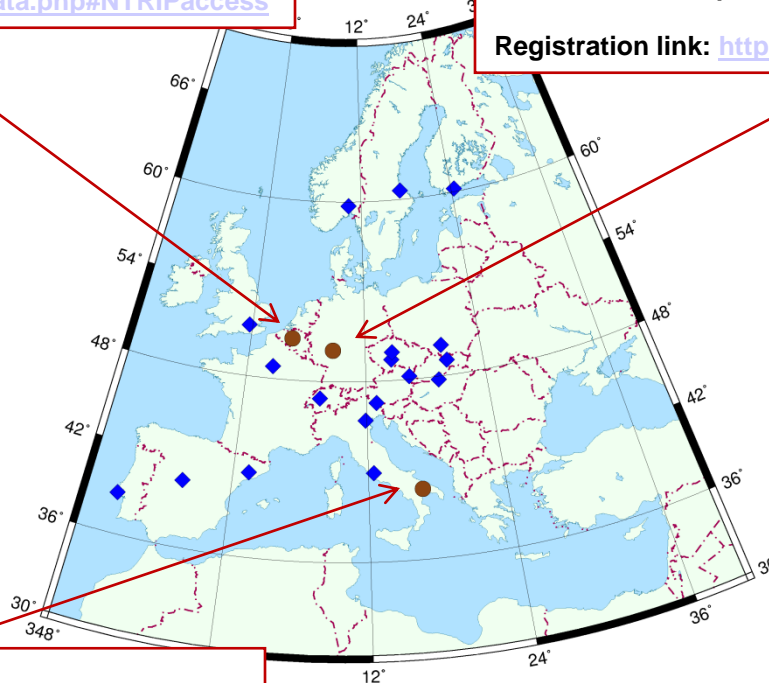


Regional Broadcaster: ROB
Link: <http://www.euref-ip.be>
Located: Royal Observatory of Belgium
Number of EPN stations: 115
Number of mountpoints at all: 149

Registration Link: <http://www.gnss.be/data.php#NTRIPaccess>

Regional Broadcaster: BKG
Link: <http://www.euref-ip.net>
Located: Federal Agency for Cartography and Geodesy
Number of EPN stations: 115
Number of mountpoints at all: 141

Registration link: <http://igs.bkg.bund.de/ntrip/registration>



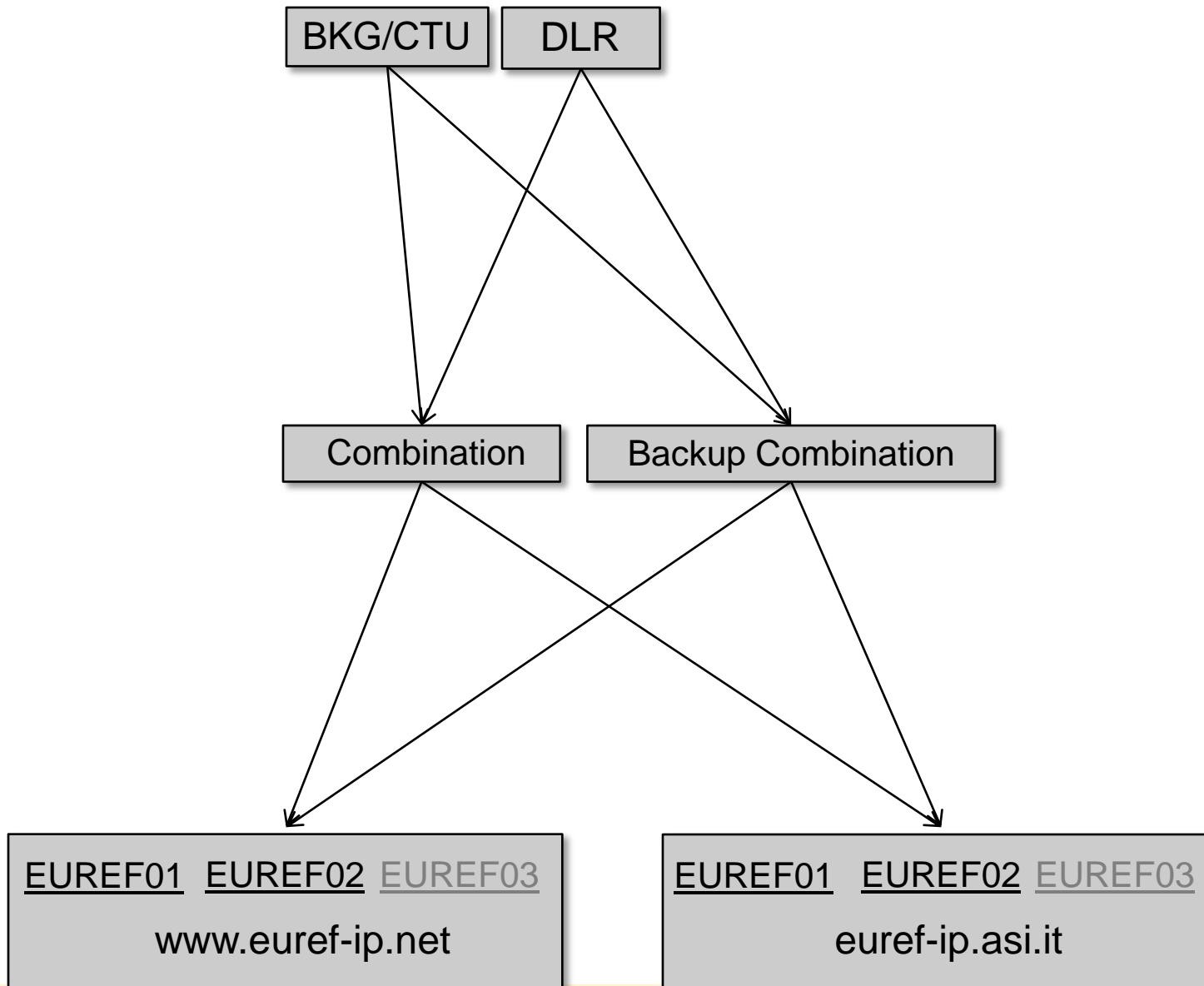
Regional Broadcaster: ASI
Link: <http://euref-ip.asi.it:2101/>
Located: ASI/CGS Centro di Geodesia Spaziale
Number of EPN stations: 113
Number of mountpoints at all: 114

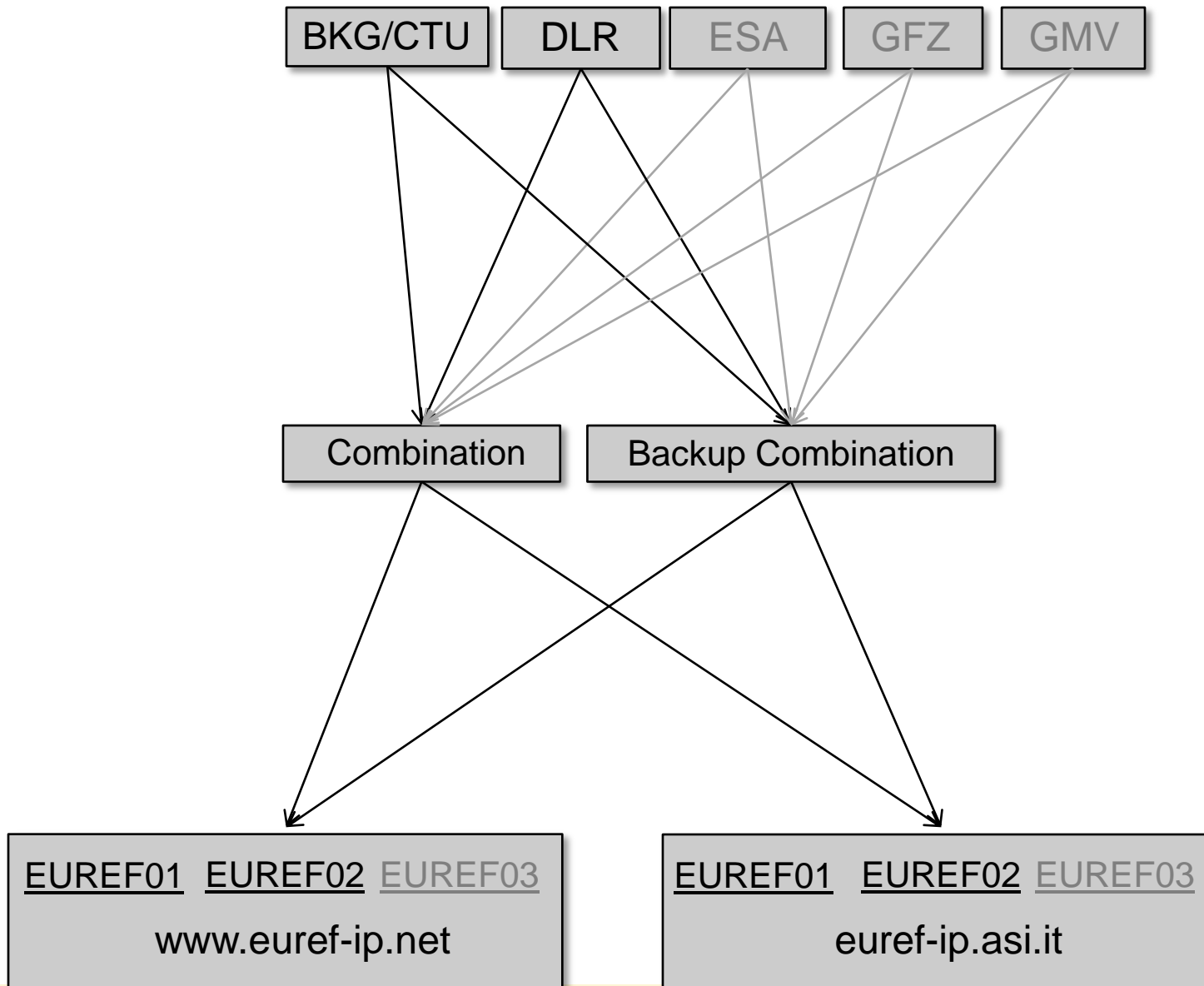
Registration mail: domenico.iacovone@e-geos.it

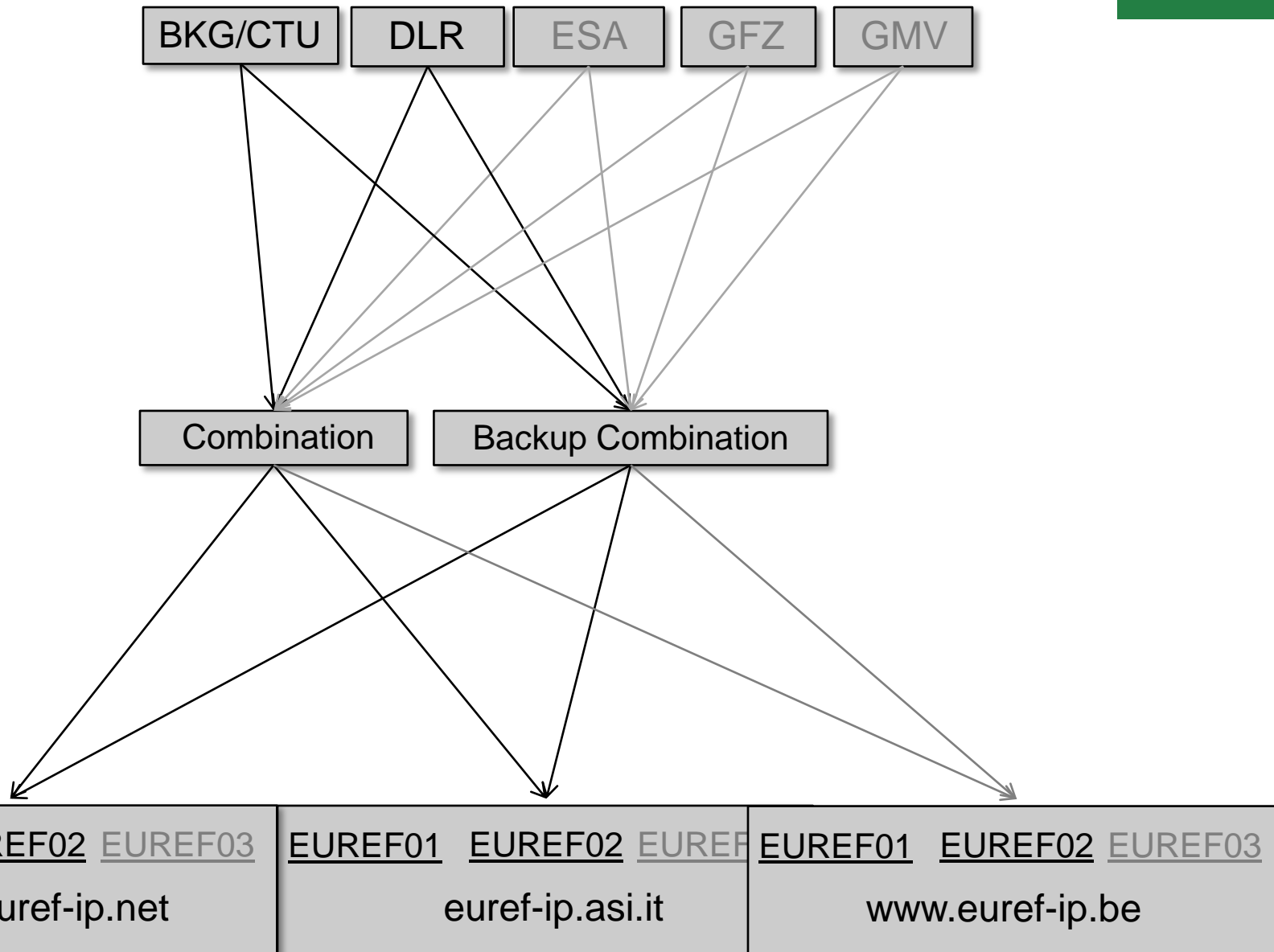
Blue diamonds: Local, national or other (e.g., IGS) Ntrip Broadcaster supporting EUREF activities
Red dots: EPN Regional Broadcaster
(see http://www.epncb.oma.be/dataproducts/data_access/real_time/broadcasters.php for a complete list of Ntrip Broadcasters)

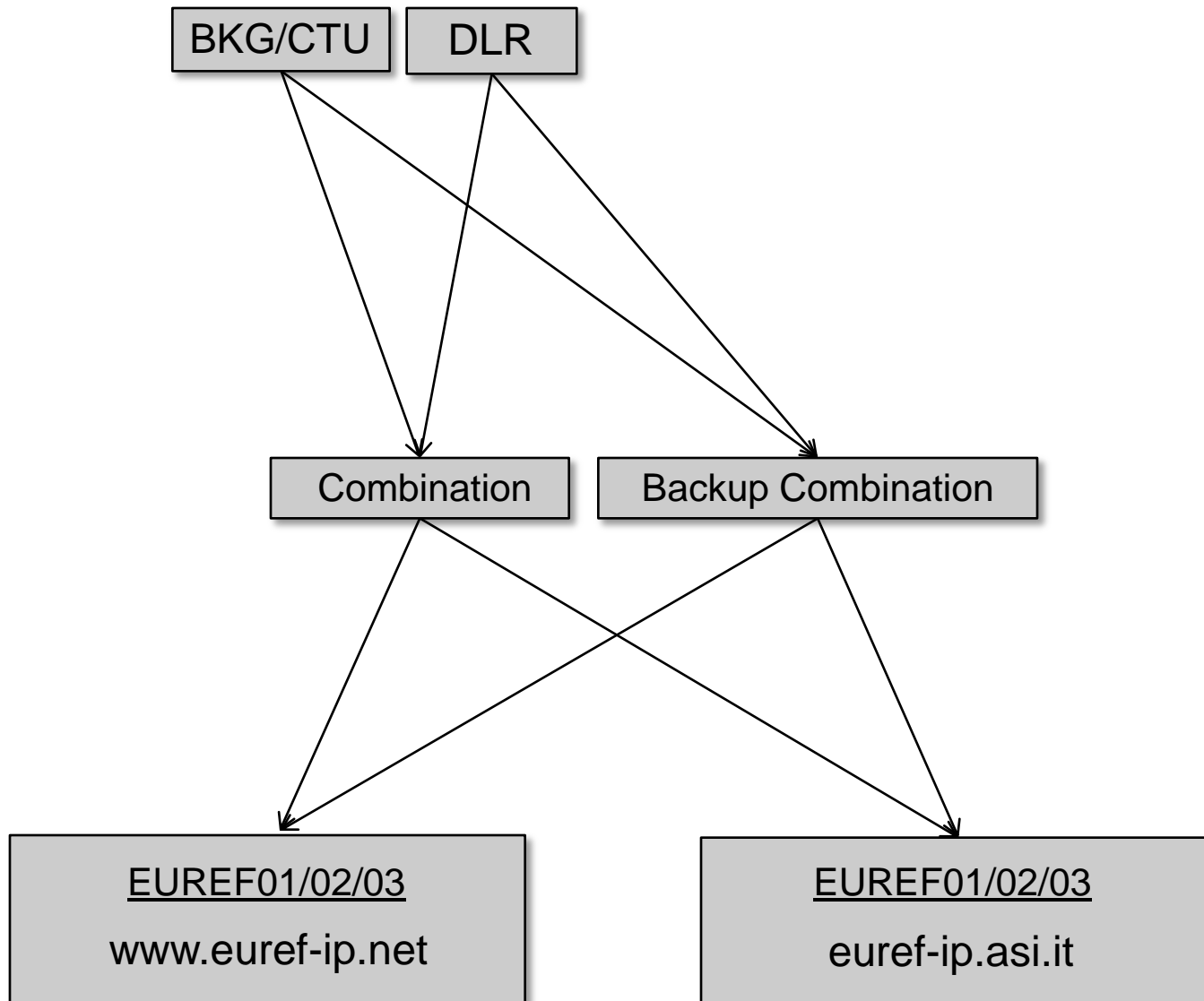


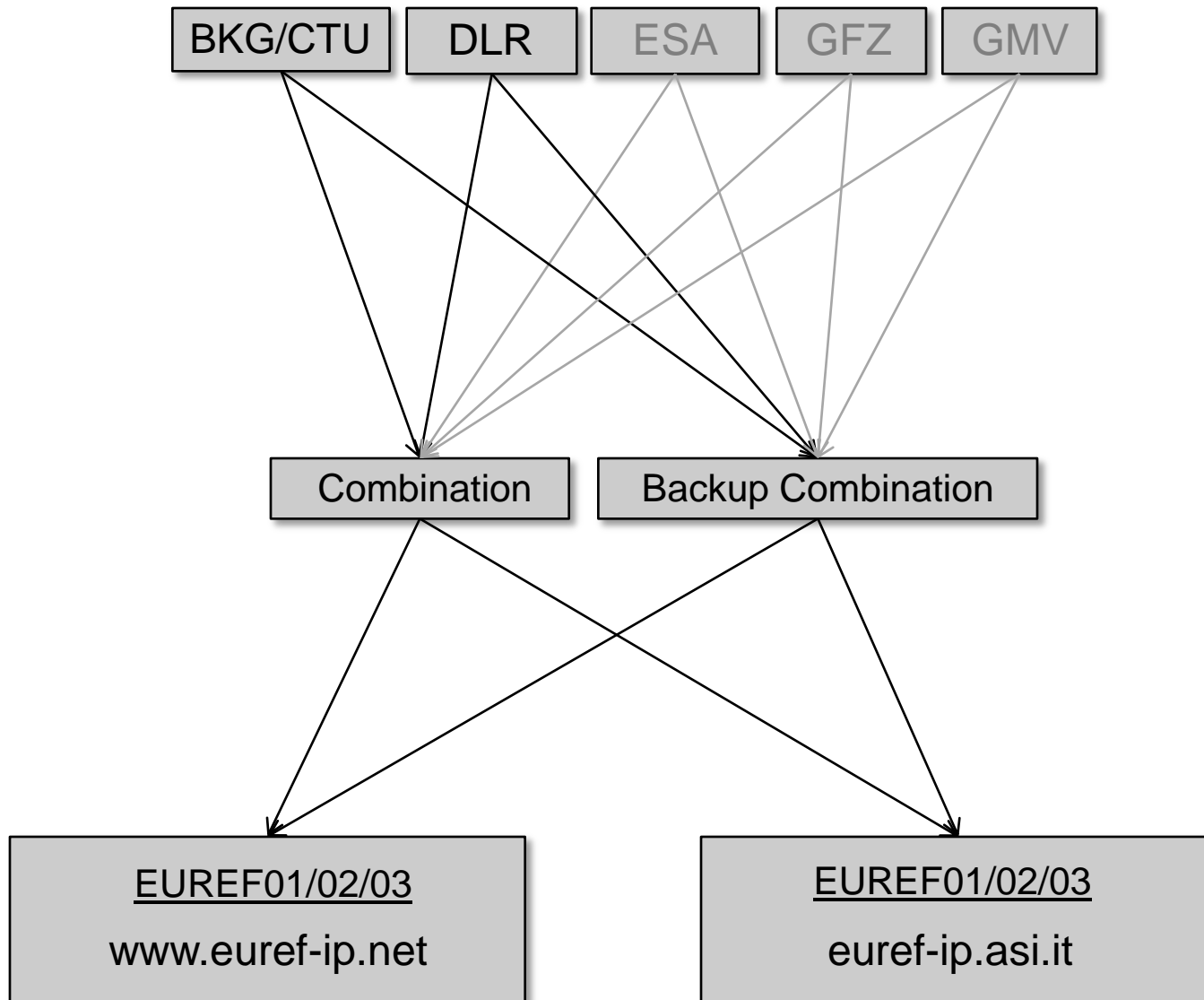
- **IGS Real-Time Pilot Project**
 - **Individual products from various ACs, mainly GPS-only, some GPS+GLO**
 - **Various combination products, Single-Epoch or Kalman filter approach, GPS-only**
 - **Reference IGS08 (realisation of ITRF2008)**
- **Real-time EUREF-IP product**
 - **Products for GPS-only, GPS+GLO, coming up: GPS+GLO+GAL**
 - **Reference ETRF2000 (realisation of ETRS89)**

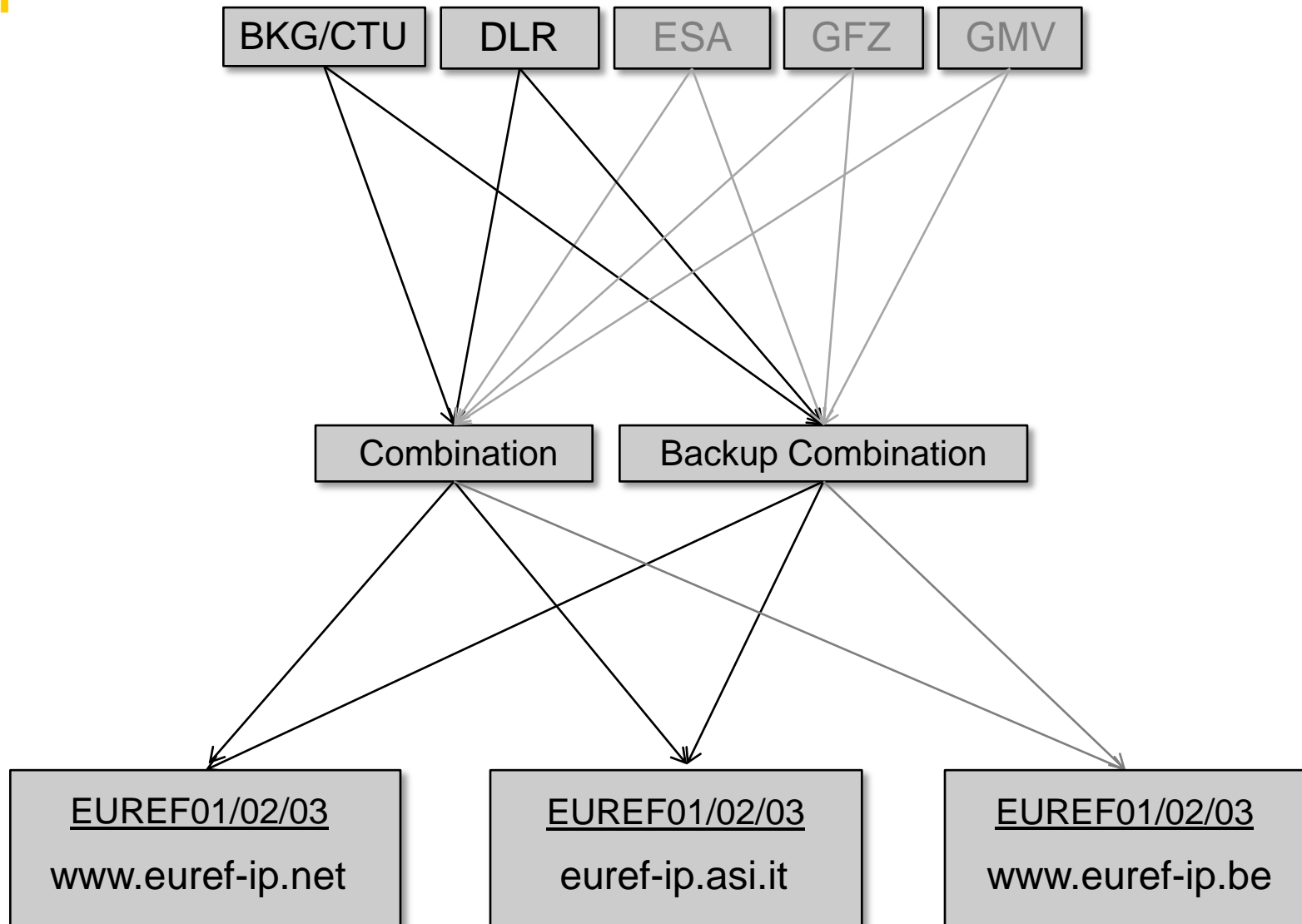


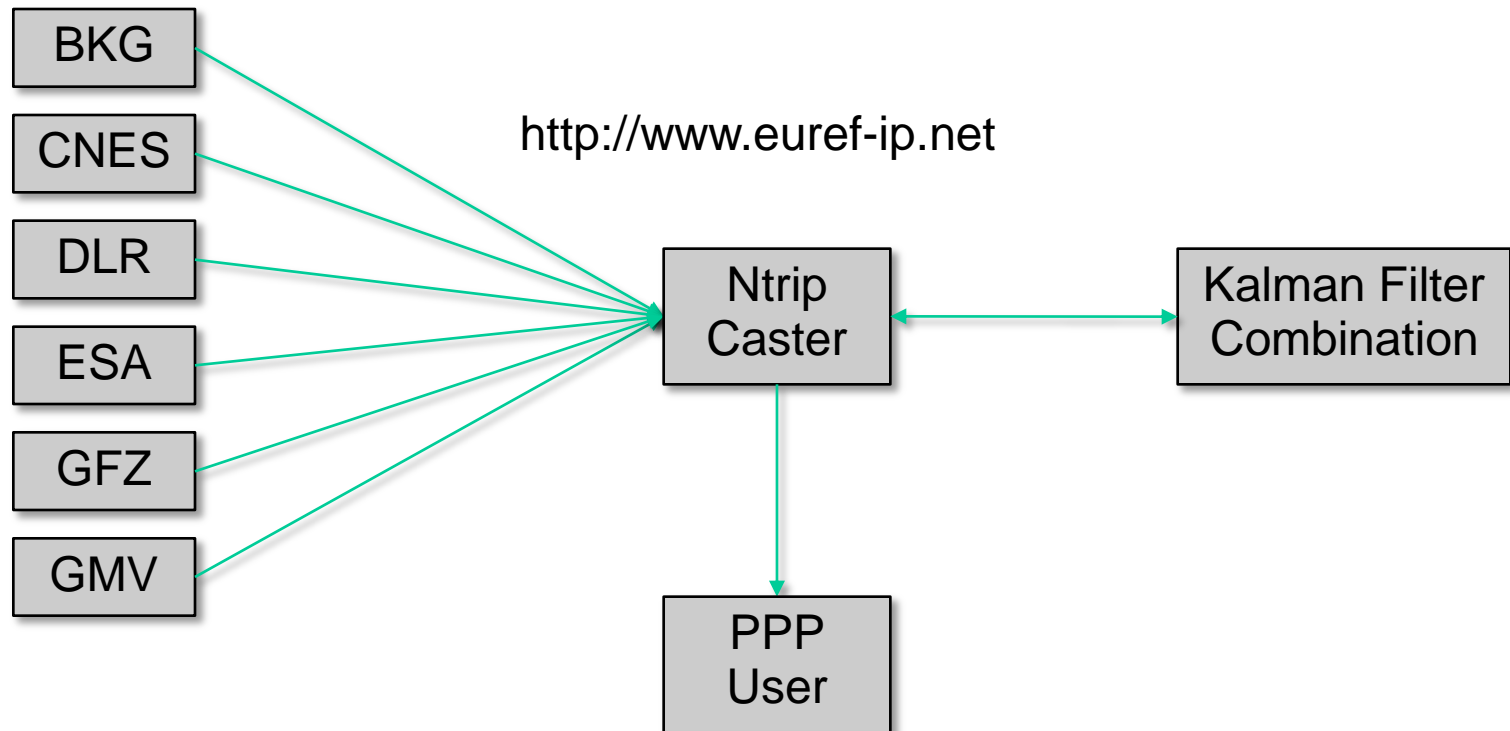








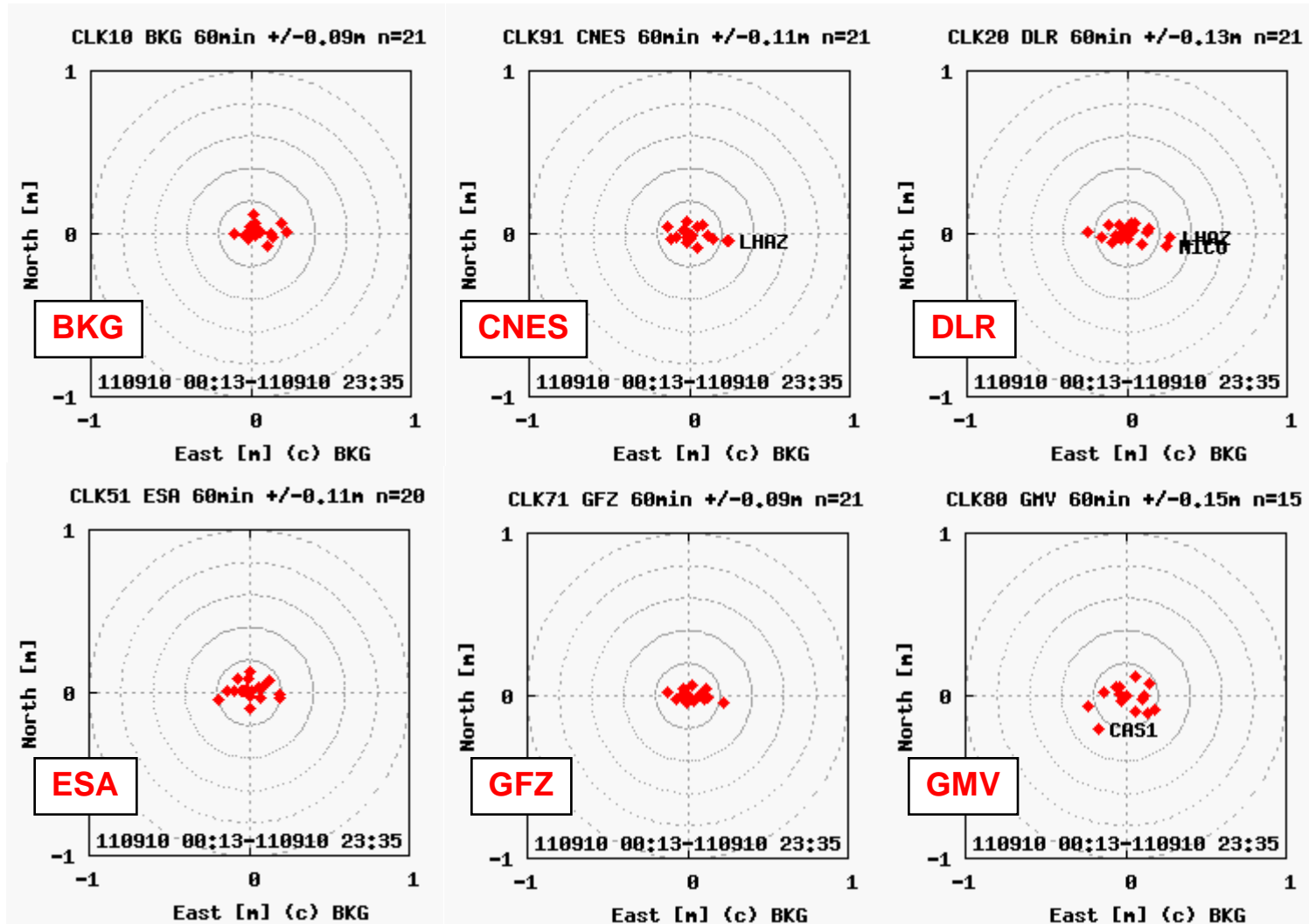






Real-time orbit/clock performance tests

2D PPP displacements after 60 min convergence time



2 m

NtripCaster WWW Admin Interface - Windows Internet Explorer

http://www.euref-ip.net/admin?mode=sources

File Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

/DARE0	656080	62.25.98.134	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:08:52:56	62.25.98.134	10	33764	341987	81	and 36 seconds
/MOSE0	660140	151.100.84.21	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:09:32:26	151.100.84.21	9	28203	254169	74	1 days, 1 hours, 47 minutes and 6 seconds
/SOFI0	677018	217.159.29.3	NTRIP Leica System 1200/1.0	07/Mar/2012:11:57:43	217.159.29.3	6	29833	180405	69	23 hours, 21 minutes and 49 seconds
/TORI0	688463	130.192.28.27	NTRIP Caster/2.0.15 (direct access)	07/Mar/2012:15:48:26	130.192.28.27	5	22895	114477	63	21 hours, 31 minutes and 6 seconds
/EUREF02	702687	141.74.33.11	NTRIP BNC/2.6	07/Mar/2012:16:05:07	141.74.33.11	4	15475	54714	5	19 hours, 14 minutes and 25 seconds
/OSLS0	723873	193.156.101.72	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:18:37:56	193.156.101.72	10	10972	109834	52	16 hours, 41 minutes and 36 seconds
/TRDS0	723874	193.156.101.72	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:18:37:56	193.156.101.72	9	11104	89319	53	16 hours, 41 minutes and 36 seconds

Fertig

Internet 100%

NtripCaster WWW Admin Interface - Windows Internet Explorer

http://euref-ip.asi.it:2101/admin?mode=sources

File Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

/MATE0	240907	192.168.1.57	NTRIP Leica System 1200/1.0	08/Mar/2012:07:31:00	192.168.1.57	3	4456	13213	14	3 hours, 45 minutes and 41 seconds
/IZAN0	242752	193.144.251.13	NTRIP Caster	08/Mar/2012:08:46:08	193.144.251.13	0	3152	0	0	2 hours, 30 minutes and 33 seconds
/EUREF01	242812	141.74.33.11	NTRIP BNC/2.6	08/Mar/2012:08:48:02	141.74.33.11	0	1185	0	0	2 hours, 28 minutes and 39 seconds
/EUREF02	242819	141.74.33.11	NTRIP BNC/2.6	08/Mar/2012:08:48:19	141.74.33.11	2	2021	4053	8	2 hours, 28 minutes and 22 seconds
/CLIB0	244452	78.46.59.40	NTRIP Caster	08/Mar/2012:09:58:40	78.46.59.40	0	1723	0	0	1 hours, 18 minutes and 1 seconds
/spt0	244477	194.16.178.54	NTRIP Caster	08/Mar/2012:09:59:10	194.16.178.54	0	901	0	0	1 hours, 17 minutes and 31 seconds
/SALAO	244485	193.144.251.13	NTRIP Caster	08/Mar/2012:09:59:10	193.144.251.13	0	1709	0	0	1 hours, 17 minutes and 31 seconds

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NtripCaster WWW Admin Interface - Windows Internet Explorer

http://www.euref-ip.net/admin?mode=sources

File Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

												seconds
/KRA10	693180	149.156.118.211	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:14:37:29	149.156.118.211	6	1124	6661	8			54 minutes and 14 seconds
/KRAW0	693181	149.156.118.211	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:14:37:29	149.156.118.211	4	765	3054	8			54 minutes and 14 seconds
/WROC0	693261	156.17.181.110	NTRIP NtripServerCMD Version 1.6	07/Mar/2012:14:37:51	156.17.181.110	8	1160	9159	12			53 minutes and 52 seconds
/SISNET0	693394	78.46.59.41	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:14:40:56	78.46.59.41	1	201	201	7			50 minutes and 47 seconds
/EUREF02	695821	147.32.131.18	NTRIP BNC/2.6	07/Mar/2012:15:04:25	147.32.131.18	3	364	1089	5			27 minutes and 18 seconds
/TERU0	696682	193.144.251.13	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:15:13:56	193.144.251.13	4	321	1097	5			17 minutes and 47 seconds
/VEN10	697338	192.106.234.17	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:15:19:56	192.106.234.17	4	213	779	4			11 minutes and 47 seconds
/MATE0	697407	192.106.234.17	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:15:20:26	192.106.234.17	9	179	1524	10			11 minutes and 17 seconds
/HUEL0	697410	193.144.251.13	NTRIP Caster/2.0.15 (relay)	07/Mar/2012:15:20:26	193.144.251.13	3	354	1068	4			11 minutes and 17 seconds

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NtripCaster WWW Admin Interface - Windows Internet Explorer

http://euref-ip.asi.it:2101/admin?mode=sources

File Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

												seconds
/TORI0	213190	78.46.59.40	NTRIP Caster	07/Mar/2012:13:47:59	78.46.59.40	0	1741	0	0			1 hours, 43 minutes and 42 seconds
/BOR10	213972	78.46.59.40	NTRIP Caster	07/Mar/2012:14:37:00	78.46.59.40	0	1799	0	0			54 minutes and 41 seconds
/EUREF02	214433	147.32.131.18	NTRIP BNC/2.6	07/Mar/2012:15:03:51	147.32.131.18	2	372	739	4			27 minutes and 50 seconds
/BSCN0	214728	192.134.134.3	NTRIP Caster	07/Mar/2012:15:19:40	192.134.134.3	0	207	0	0			12 minutes and 1 seconds
/MARS0	214729	192.134.134.3	NTRIP Caster	07/Mar/2012:15:19:40	192.134.134.3	0	196	0	0			12 minutes and 1 seconds
/ALAC0	214733	193.144.251.13	NTRIP Caster	07/Mar/2012:15:19:40	193.144.251.13	0	224	0	0			12 minutes and 1 seconds
/ALBA0	214734	193.144.251.13	NTRIP Caster	07/Mar/2012:15:19:40	193.144.251.13	0	216	0	0			12 minutes and 1 seconds
/CANT0	214736	193.144.251.13	NTRIP Caster	07/Mar/2012:15:19:40	193.144.251.13	0	228	0	0			12 minutes and 1 seconds
/CEU10	214737	193.144.251.13	NTRIP Caster	07/Mar/2012:15:19:40	193.144.251.13	0	372	0	0			12 minutes and 1 seconds

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http://euref-ip.asi.it:2101/admin?mode=sources

Datei Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

/HOE21	245955	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:11	78.46.59.40	0	731	0	0	35 minutes and 33 seconds
/JOZ20	245959	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:11	78.46.59.40	0	809	0	0	35 minutes and 33 seconds
/WARE0	245971	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:41	78.46.59.40	0	438	0	0	35 minutes and 3 seconds
/WROC0	246303	78.46.59.40	NTRIP Caster	08/Mar/2012:11:04:11	78.46.59.40	0	453	0	0	20 minutes and 33 seconds
/BOR10	246334	78.46.59.40	NTRIP Caster	08/Mar/2012:11:05:41	78.46.59.40	0	675	0	0	19 minutes and 3 seconds
/ORID0	246351	78.46.59.40	NTRIP Caster	08/Mar/2012:11:06:11	78.46.59.40	0	433	0	0	18 minutes and 33 seconds
/CAGZ0	246399	78.46.59.40	NTRIP Caster	08/Mar/2012:11:08:11	78.46.59.40	0	904	0	0	16 minutes and 33 seconds
/HOFN0	246400	78.46.59.40	NTRIP Caster	08/Mar/2012:11:08:11	78.46.59.40	0	383	0	0	16 minutes and 33 seconds
/SASS1	246478	78.46.59.40	NTRIP Caster	08/Mar/2012:11:12:11	78.46.59.40	0	258	0	0	12 minutes and 33 seconds
/EUREF02	246755	141.74.33.11	NTRIP BNC/2.6	08/Mar/2012:11:24:28	141.74.33.11	2	4	5	2	16 seconds

End of source listing

Fertig Internet 100%

http://euref-ip.asi.it:2101/admin?mode=sources

Datei Bearbeiten Ansicht Favoriten Extras ?

Konvertieren Auswählen

NtripCaster WWW Admin Interface

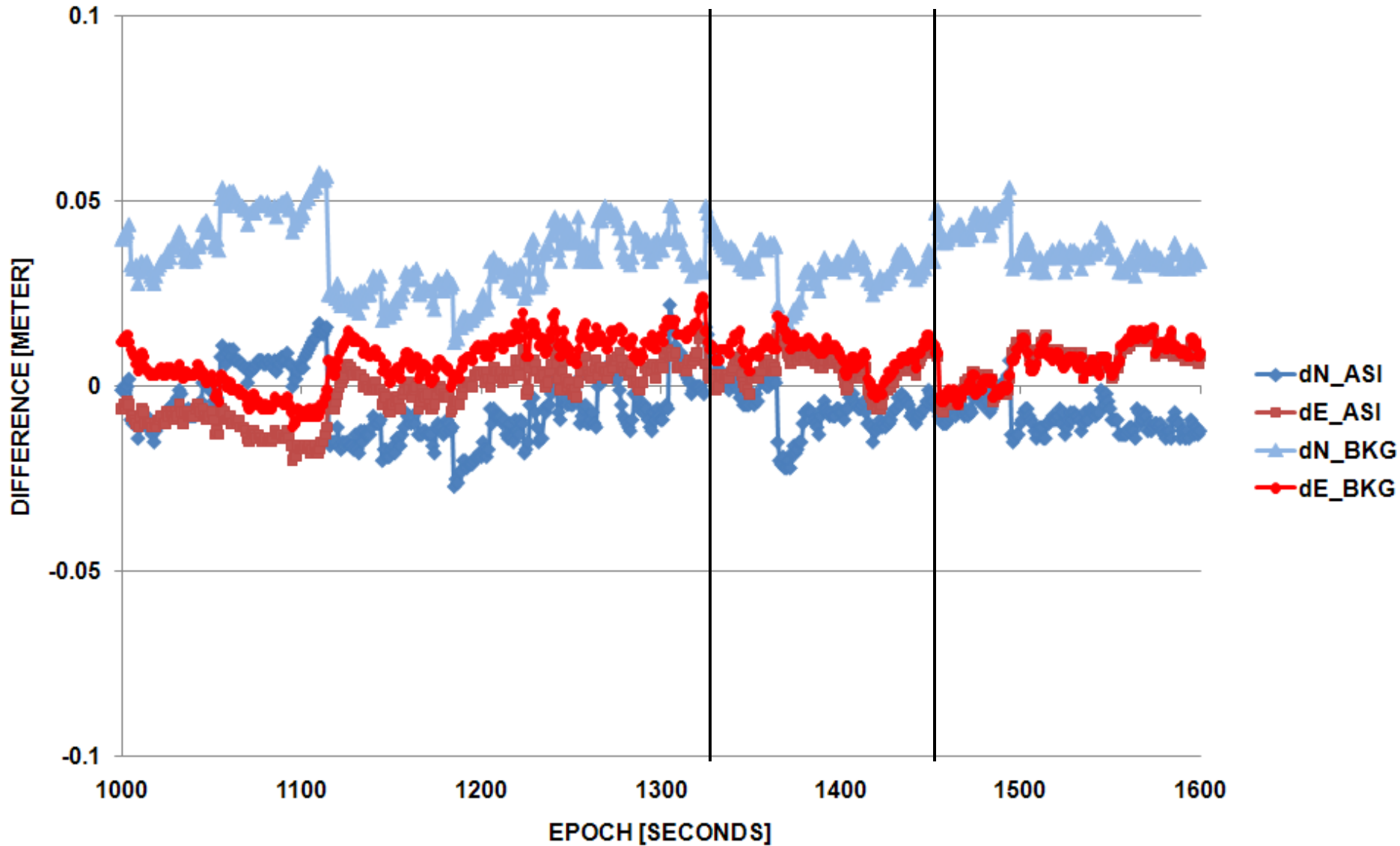
/HOE21	245955	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:11	78.46.59.40	0	731	0	0	35 minutes and 33 seconds
/JOZ20	245959	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:11	78.46.59.40	0	809	0	0	35 minutes and 33 seconds
/WARE0	245971	78.46.59.40	NTRIP Caster	08/Mar/2012:10:49:41	78.46.59.40	0	438	0	0	35 minutes and 3 seconds
/WROC0	246303	78.46.59.40	NTRIP Caster	08/Mar/2012:11:04:11	78.46.59.40	0	453	0	0	20 minutes and 33 seconds
/BOR10	246334	78.46.59.40	NTRIP Caster	08/Mar/2012:11:05:41	78.46.59.40	0	675	0	0	19 minutes and 3 seconds
/ORID0	246351	78.46.59.40	NTRIP Caster	08/Mar/2012:11:06:11	78.46.59.40	0	433	0	0	18 minutes and 33 seconds
/CAGZ0	246399	78.46.59.40	NTRIP Caster	08/Mar/2012:11:08:11	78.46.59.40	0	904	0	0	16 minutes and 33 seconds
/HOFN0	246400	78.46.59.40	NTRIP Caster	08/Mar/2012:11:08:11	78.46.59.40	0	383	0	0	16 minutes and 33 seconds
/SASS1	246478	78.46.59.40	NTRIP Caster	08/Mar/2012:11:12:11	78.46.59.40	0	258	0	0	12 minutes and 33 seconds
/EUREF02	246755	141.74.33.11	NTRIP BNC/2.6	08/Mar/2012:11:24:28	141.74.33.11	2	4	5	2	16 seconds

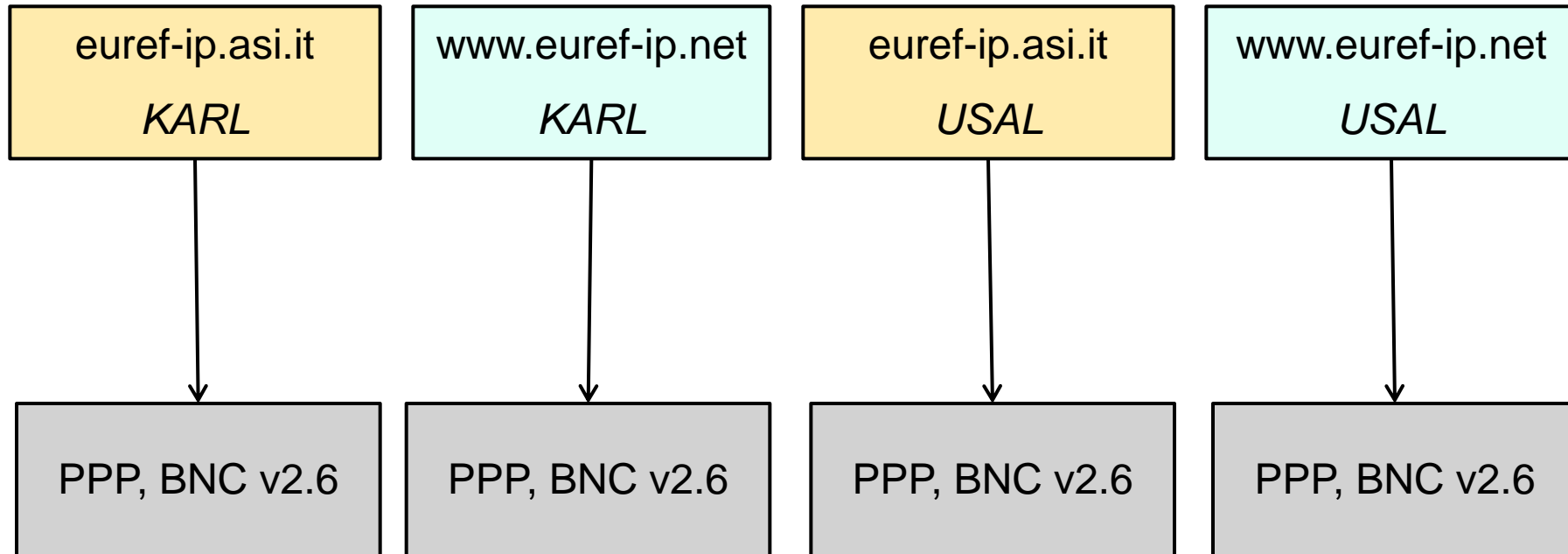
End of source listing

Fertig Internet 100%



BNC26: PPP solution, difference to ref. coordinates, mountpoint USAL

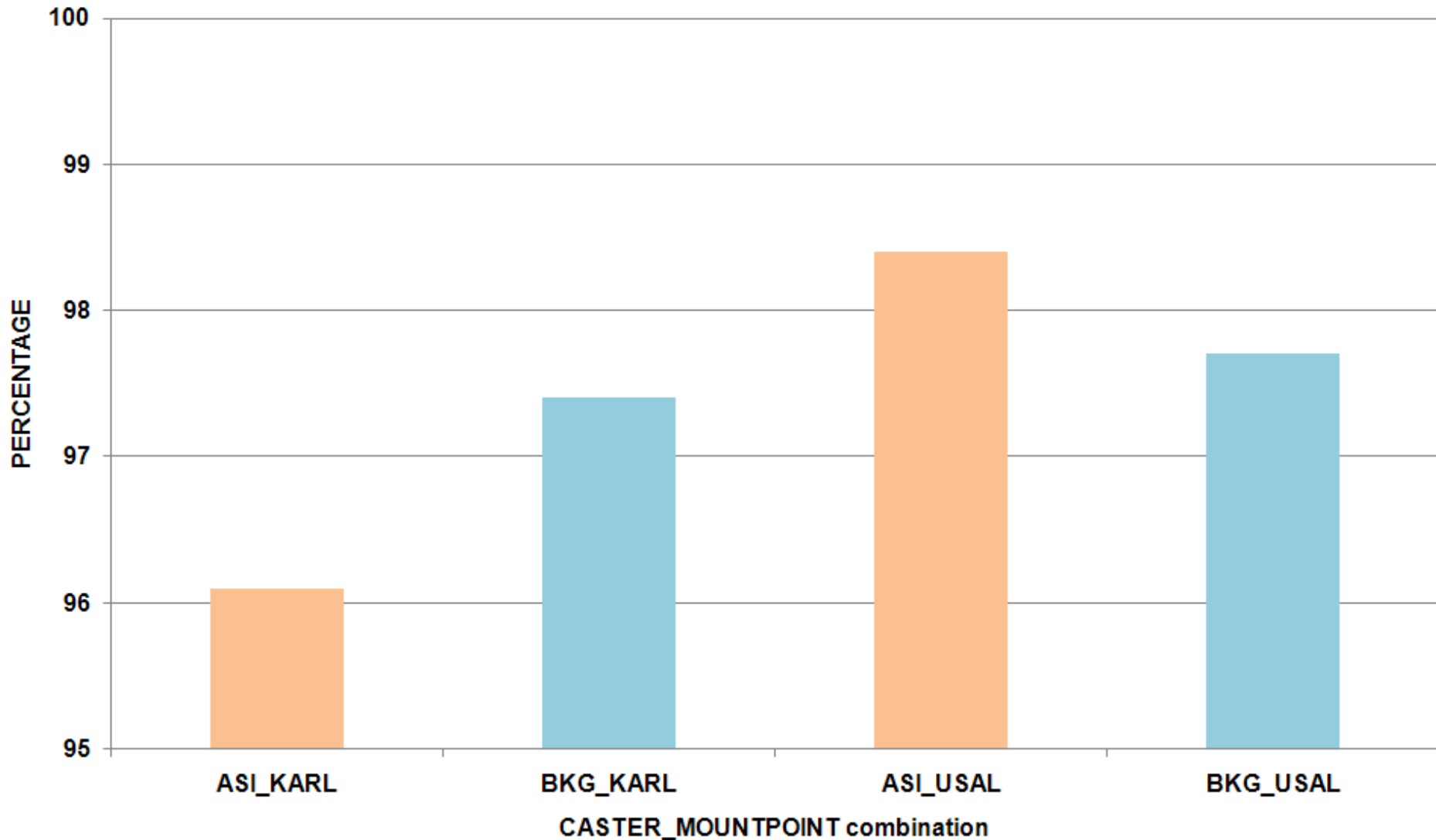




Simultaneous PPP Test Using EUREF02 Orbit/Clock Corrections



**BNC26: percentage of PPP solutions for different caster/mountpoint combinations
(over three days)**





- **Parameter to ensure consistency between primary and backup:**
 - **Use identical input (same data streams)**
 - **Use the same output (product mountpoint)**
 - **Use the same software (revision)**



- **Issues affecting consistency**
 - **Robustness of internet connection: bandwidth, interruptions, downtimes, ...**
 - **Interruption of computation: PC failure, etc.**



- **ETRS89-related real-time combination corrections available: EUREF01 (GPS), EUREF02 (GPS+GLO)**
- **Backup concept implemented for observation collection and product dissemination**
- **Switching between primary and backup resources causes no significant loss of performance**
- **Products available via Ntrip from three EUREF broadcasters:**
<http://euref-ip.asi.it>
<http://www.euref-ip.be>
<http://www.euref-ip.net>