

Supporting Document Connectivity

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1 General

This is a supporting document. It might deliver additional information to 'Handbuch Technik' (Technical Manual) of the BBCS Contract. However, it has just educational character and no contractual relevance.

2 Service Access Point (SAP)

The ISP has the possibility to have additional SAPs on one connectivity link. The additional SAPs shall be in the same routing group. The ISP cannot order more SAPs than the number of free slots on the CER. Swisscom will not install an extra CER solely for the purposes of increasing the number of SAPs. All SAPs are managed by Swisscom.

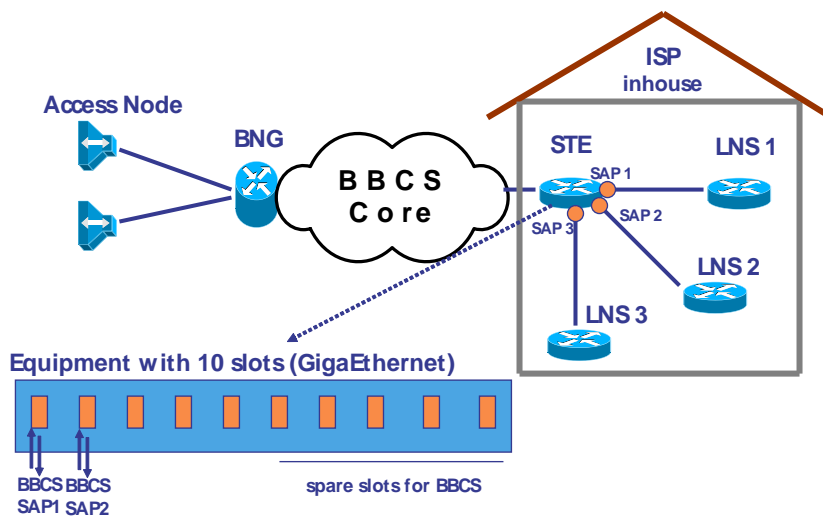


Figure 1: Service Access Point definition for connectivity

3 Routing

3.1 Round Robin

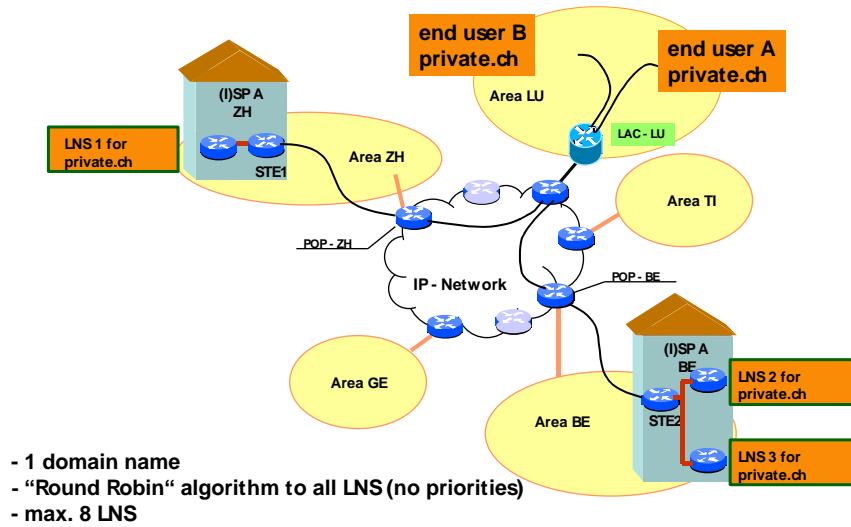


Figure 2: Session Balancing BBCS Basic Service Level

3.2 Dynamic Routing

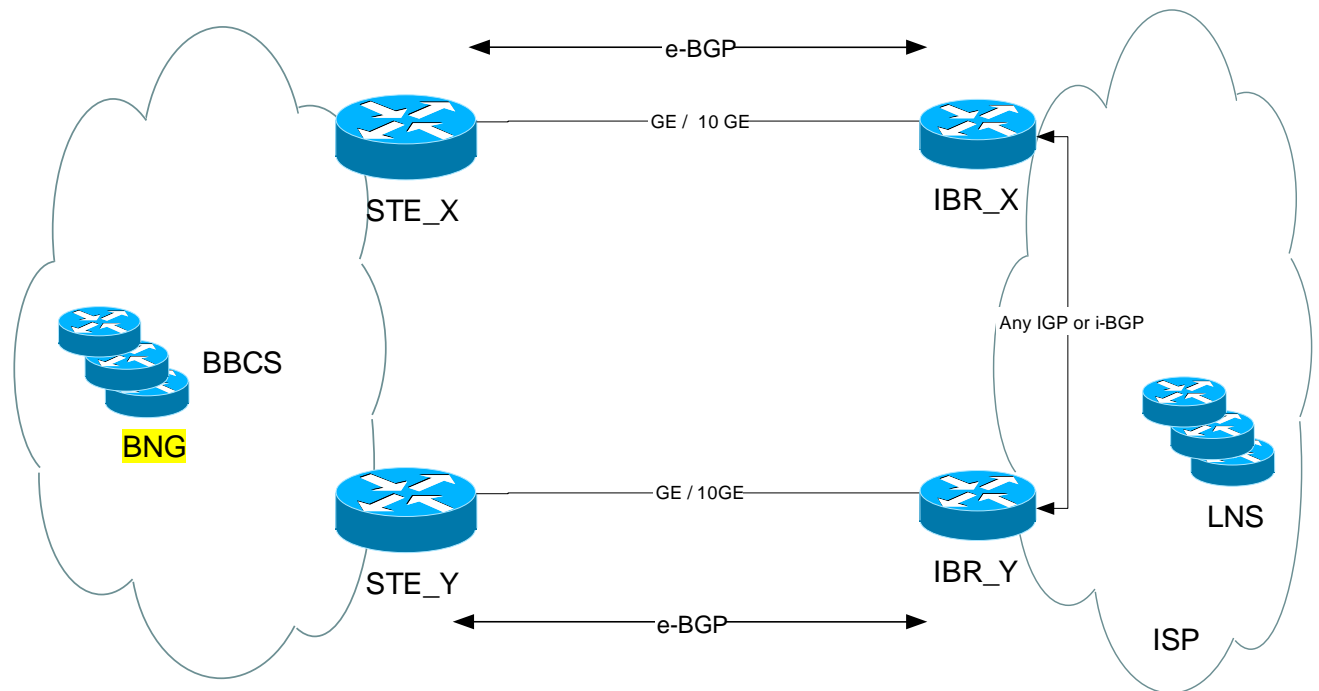


Figure 3 : Diagram "dynamic Routing" with two redundant links

4 Load Balancing

4.1 Load Balancing between POPs

4.1.1 Load Balancing between POPs: Traffic ISP → Swisscom

It is the responsibility of the ISP to balance the traffic to the LAC over parallel links. Load balancing is a good idea for the ISP since Swisscom upgrades the connectivity links based on the aggregated traffic. If there is no load balancing, the aggregated traffic may never reach the limit where a link upgrade is triggered.

There are different approaches for the ISP to load balance traffic. The following are two examples to balance the traffic on the two links from ISP → BBCS:

- Static Route from LNS to IBR:

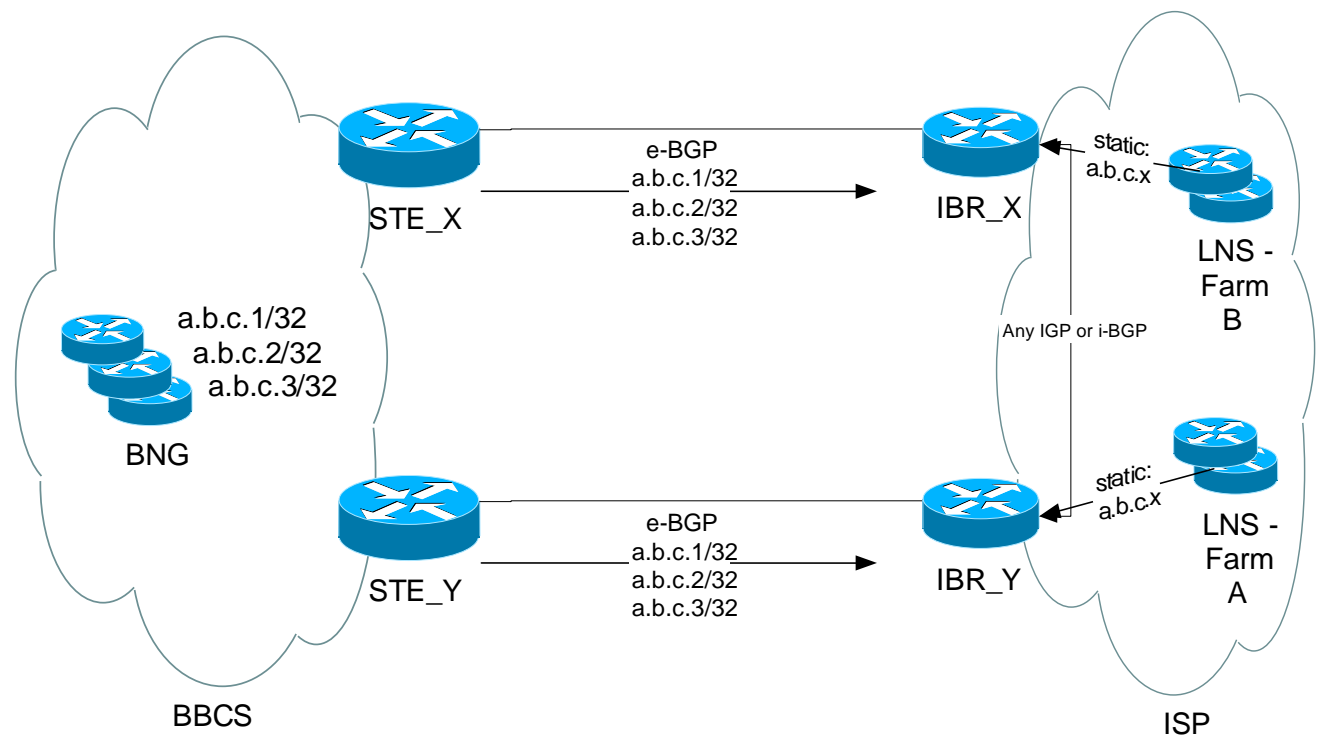


Figure 4: Static route from LNS to IBR

In this scenario the ISP has organised its LNS in two parts. Each LNS in farm A has a static route for the LAC subnets to IBR_Y and farm B points to IBR_X. Between IBR_X & IBR_Y any IGP or i-BGP redistributes from e-BGP.

If an LNS in farm A has an IP packet for destination a.b.c.1, it sends it to IBR_Y. IBR_Y will send the packet out to the BBCS routers, as the route from e-BGP has the lower admin distance than the IGP or i-BGP route.

If there is a link break, IBR_Y will use the remaining IGP or i-BGP route to a.b.c.1. The disadvantage of static routes on the LNS is that neither of the IBR may be down.

- Dynamic Routing to LNS from IBR:

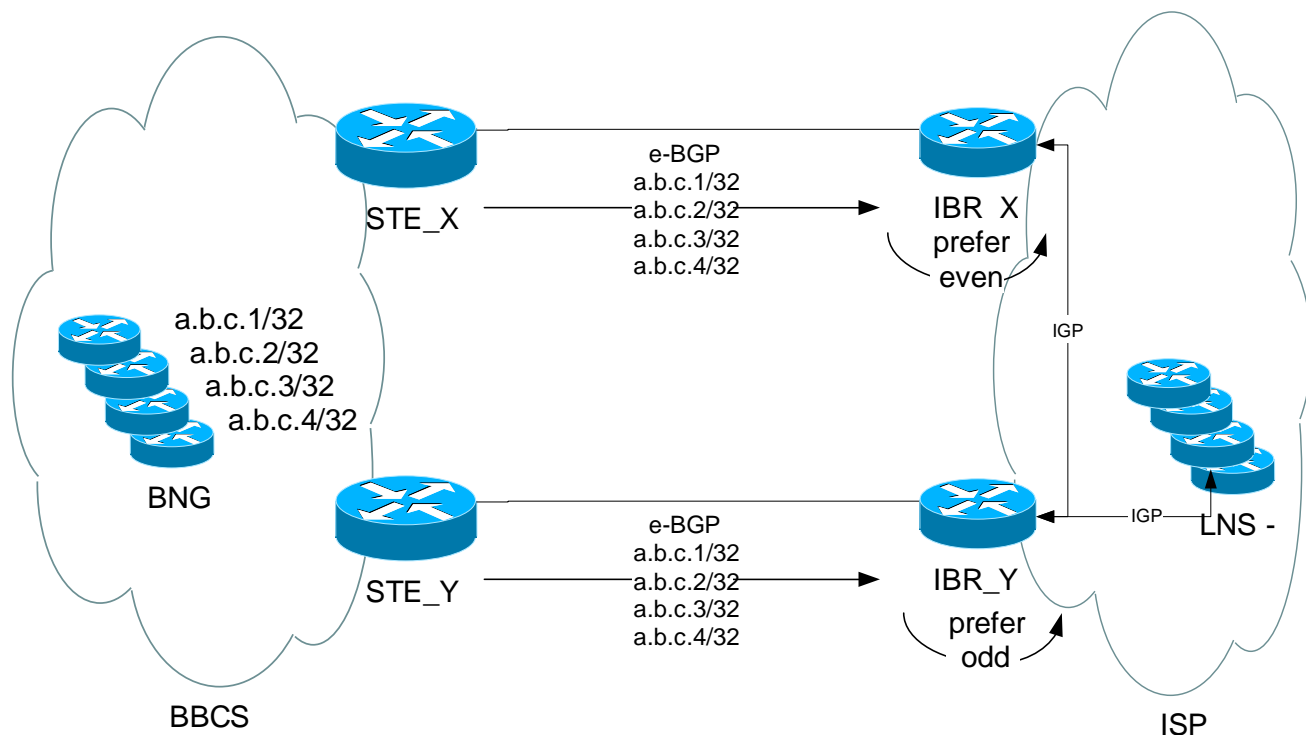


Figure 5: Redistribution between e-BGP and IGP in ISP network

This approach assumes:

- The ISP runs an IGP and redistributes e-BGP.
- The LAC are about equally distributed in odd and even addresses (Swisscom addresses LAC in consecutive order).

The ISP needs to redistribute the LAC routes with different route maps on IBR_X and IBR_Y into IGP. So traffic from LNS to even addresses is forwarded through IBR_X and vice versa. For OSPF, odd and even routes can be redistributed into OSPF with different metric. So both routes are in the OSPF database, but just the preferred one in the global routing table. If there is a link break, the redundant route shows up in the routing table.

4.1.2 Load Balancing between the POPs: Traffic Swisscom → ISP

As the typical traffic ratio for DSL subscriber's traffic is 3:1, there is no need for load-balancing in this direction (although the ISP might have traffic preferences for certain LNS). Swisscom recommends sending these BGP-routes out with a longer AS-path from this interface (BGP AS-path length). We recommend lengthening the path with the private AS# 65002.

NOTE: Do not use MED, as the CER is in an AS of its own (AS65001) and MED is a non-transitive attribute.

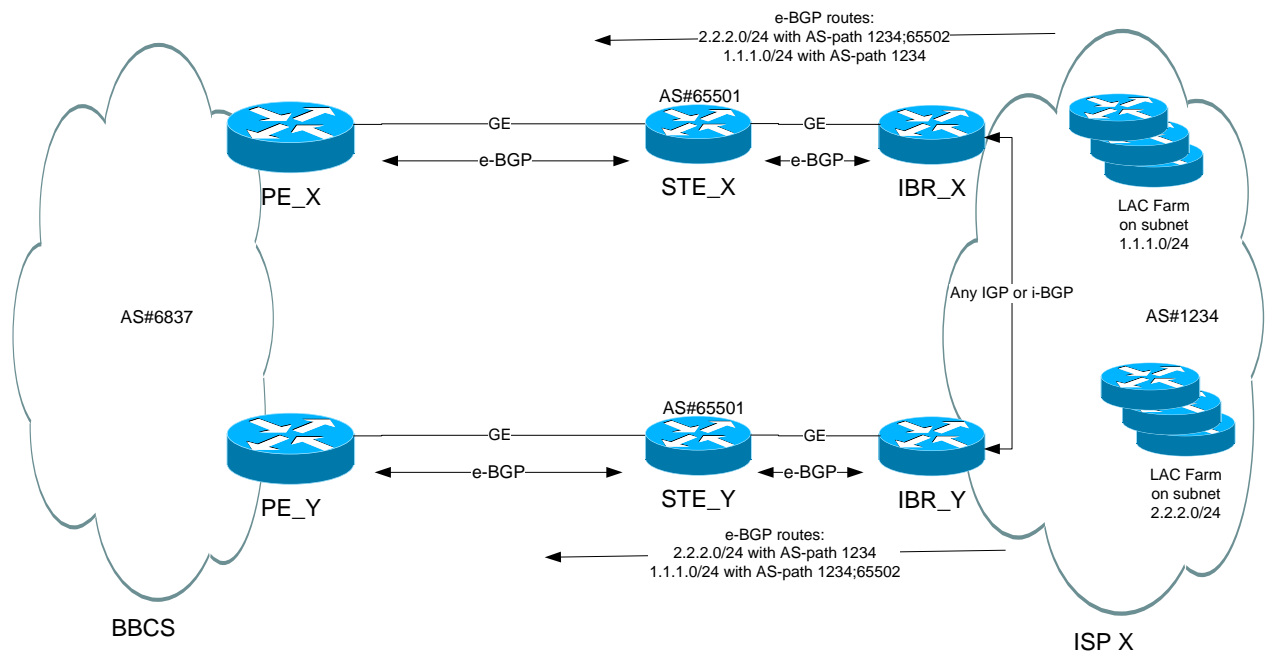


Figure 6: Example for load-Balancing for traffic from ISP

In this example, traffic for LNS farm on subnet 2.2.2.0/24 will use the shorter AS-path and enter IBR_Y and vice-versa. Redundancy in case of link failure is provided by Swisscom.

Load Balancing on two parallel links in the same POP

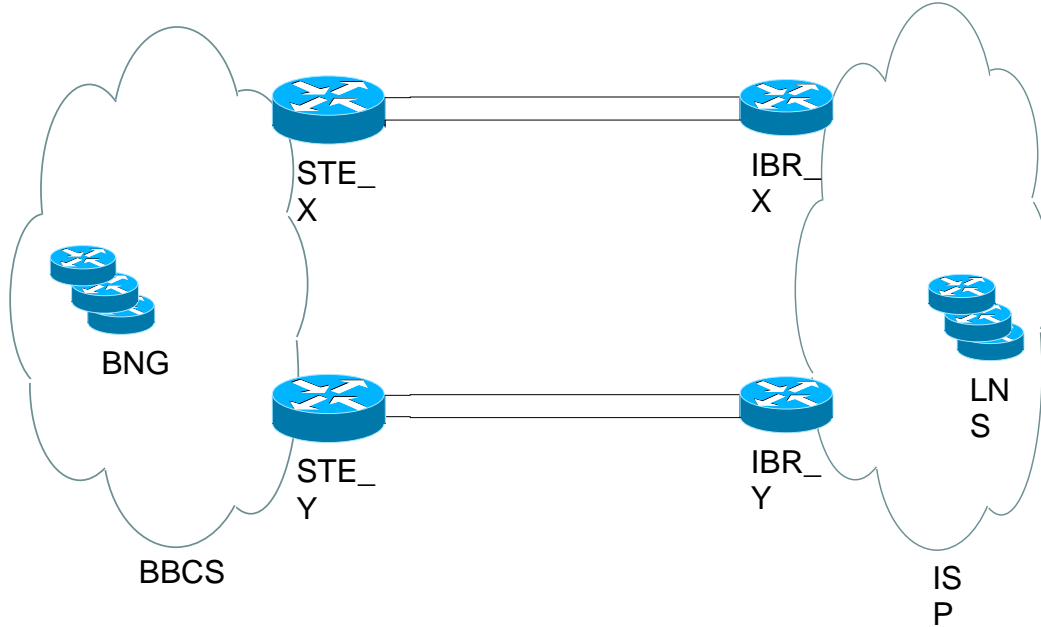


Figure 7: Pair of parallel links to ISP

When the ISP is connected to BBCS with one pair of parallel links per POP, load balancing on the two links within the same POP is necessary. Load balancing on these parallel links must be coordinated with ISP and Swisscom. Different parameters must be considered:

- ISP Equipment – what protocols does the ISP Router/Switch support?
- Swisscom Equipment – Is there a switch at the ISP site which supports Link-Bundling?

Load Balancing on two parallel links in the same POP: Traffic Swisscom → ISP

Based on the equipment at the ISP site, there is a solution for load balancing on parallel links to the same router.

Two parallel e-BGP sessions, load balancing done by e-BGP (multi path)

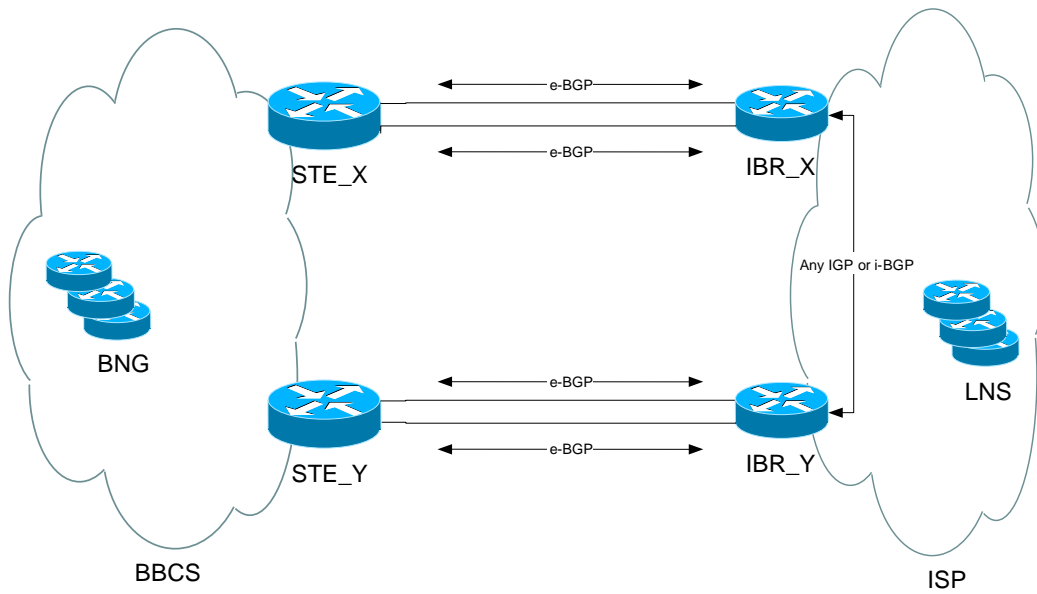


Figure 8: Pair of parallel links to ISP – each link has its own e-BGP session

When setting up parallel links, close coordination with Swisscom is required.