NREN proposal
for revisiting the T2-networking architecture of LHC

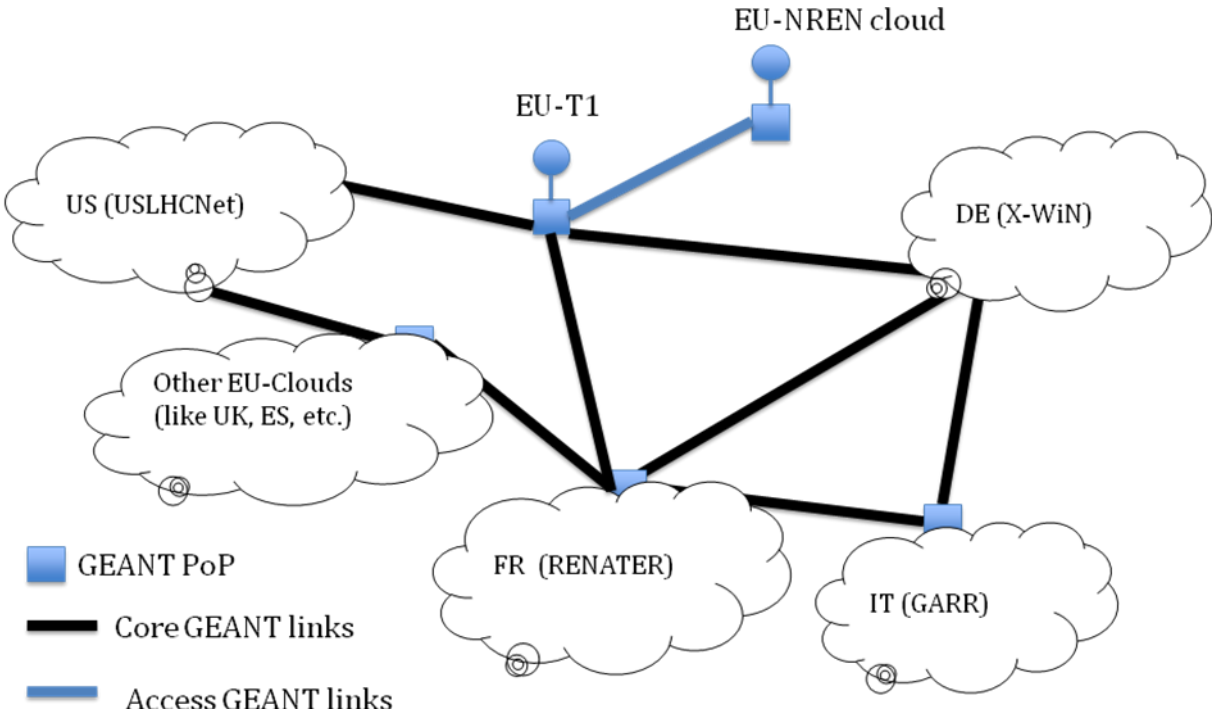
Problem Description

During summer 2010 Atlas and CMS defined their requirements in respect to networking for the evaluation phase of their experiments. One main result is a strategic change vis-à-vis the T1 centres: there is no longer a hierarchical relationship between a T1 and any of the T2 centres working for the experiments (MONARC model). This means that experiment evaluations (seen from T2 centres) may take place using in principle all T1 centres and moreover also some T2 centres as far as the data flows are concerned.

A boundary condition is that the experiments and its attached T2 and T3 centres must organize and fund the network connections themselves which means that in almost all cases this is a matter of national funding. Specifically there are no central funds available – for example through CERN – for that purpose and in so far a federated network architecture based on NREN infrastructures is the only possible structure.

The federated Architecture

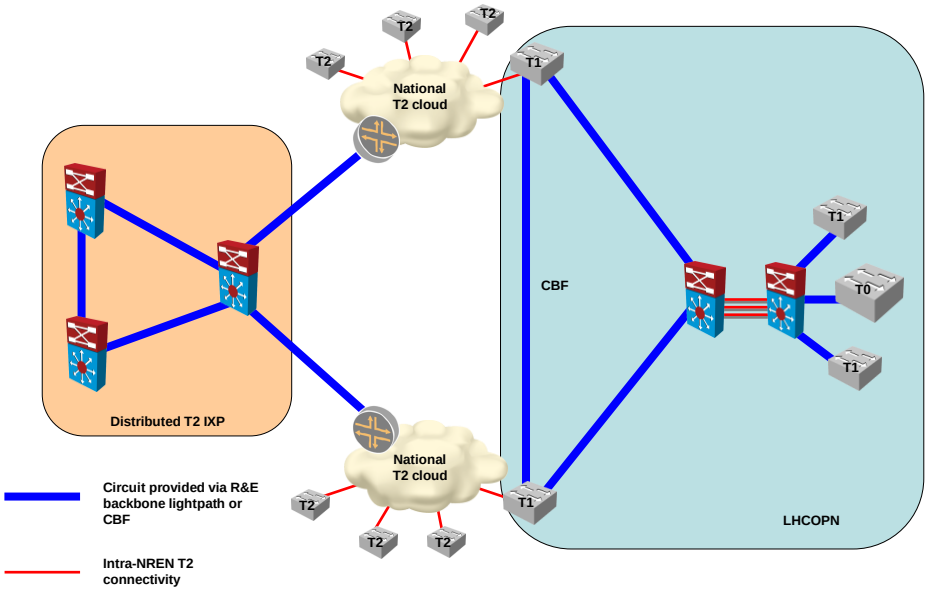
The following graph sketches the general architecture of a T2 network confirming the specification given in /1/. It starts with the assumption that the HEP communities in several countries/areas will organize their networking together with their national research networks. This is true for HEP communities in-DE (DFN), FR (RENATER), IT (GARR) and perhaps many more. Other NRENs are invited to also use this architecture. Attached to a national "network cloud" (not shown in the graph below) are then the T1-T2s (and T3s) in the country. The following graph expresses that logical structure:



Principle Architecture of worldwide T2 Interconnect (explanations see below)

1. The core links through GEANT and CBF could be realized with different technologies. This could be a 10G IP link or a L2 10G link. If required the links have redundant and path diverse characteristic. By the time this T2-network will be implemented, the 100G technologies will turn to be mature enough for having 100G trunks in the core.
2. The core network, provided by a combination of GEANT links and CBF paths will be organized as a mesh, The above sketch displays mostly a ring model, but any topology in-between the single star and the full mesh will be possible, provided the required resilience and capacities are in place.
3. Each national cloud (NREN) will have the responsibility to organize the T2 interconnections (including the T1), and to interconnect them with other national clouds through GEANT and eventually CBFs with neighbouring countries. The technical means for connectivity will be BGPfrom each national T2 cloud to the GEANT cloud of the VPN.
4. National clouds will have the possibility to participate to the core mesh (through their GEANT PoP) or to access to it through a single access link.
5. The costs of the core network (dedicated GEANT paths for instance) will be shared by the participating T2-networking countries (NRENs in those countries).
6. The transatlantic capacity should be shared between ESNet / USLHCNet and GEANT and should be procured in a way that additional capacity can be added without major delay (when the demand arises). If required the links have redundant and path diverse characteristic.
7. A common monitoring infrastructure, preferably the perfSonar system should be introduced.
8. It is assumed that the primary data from CERN-T0 reach a T2/T3 centre through LHCOPN and (one of) the T1 centres. LHCOPN is not used for the

purpose of T2-T1, T2-T2 or T2-T3 traffic. The coexistence of T2-networking with LHCOPN is illustrated below:



This sketch illustrates the separation between LHCOPN and the T2-Network. The T1s are fed through LHCOPN, and feed the T2s without transiting traffic (in telecom sense). Obviously, national T2 clouds may have single or multiple attachments to the GEANT cloud (just like many NRENs have already today).