

Backup paths

Munich - 20 April 2007

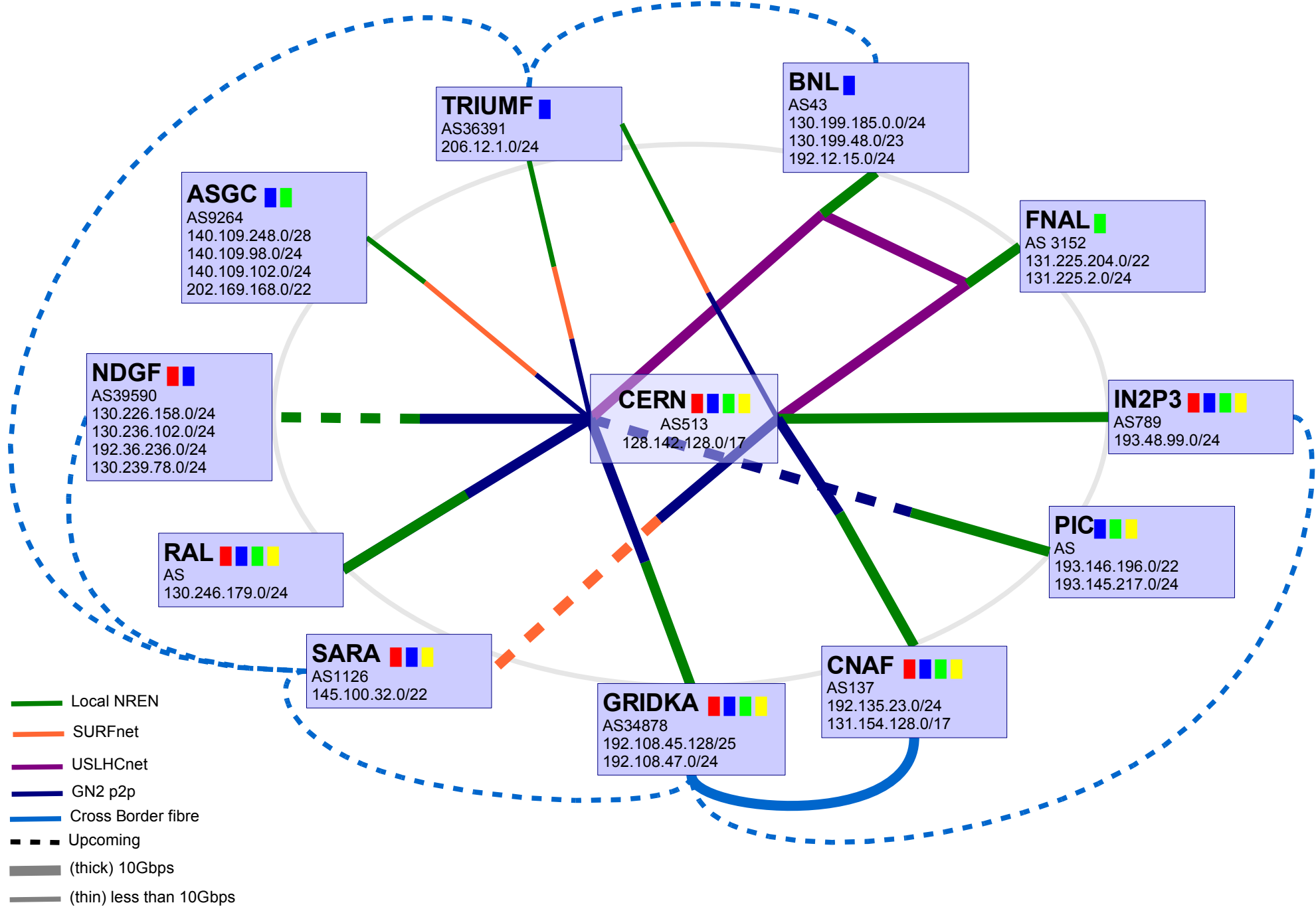
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Backup connectivity status

Today:

- FNAL, BNL, TRIUMF have backup with redundant links
- GRIDKA and CNAF provide backup one to the other
- IN2P2, SARA, NDGF have planned backup via other T1s
- RAL, PIC has no backup planned
- ASGC has backup via generic IP connectivity (outside LHCOPN)

LHCOPN current status



- Local NREN
- SURFnet
- USLHCnet
- GN2 p2p
- Cross Border fibre
- - - Upcoming
- (thick) (thick) 10Gbps
- (thin) (thin) less than 10Gbps

■ = Alice
 ■ = Atlas
 ■ = CMS
 ■ = LHCb

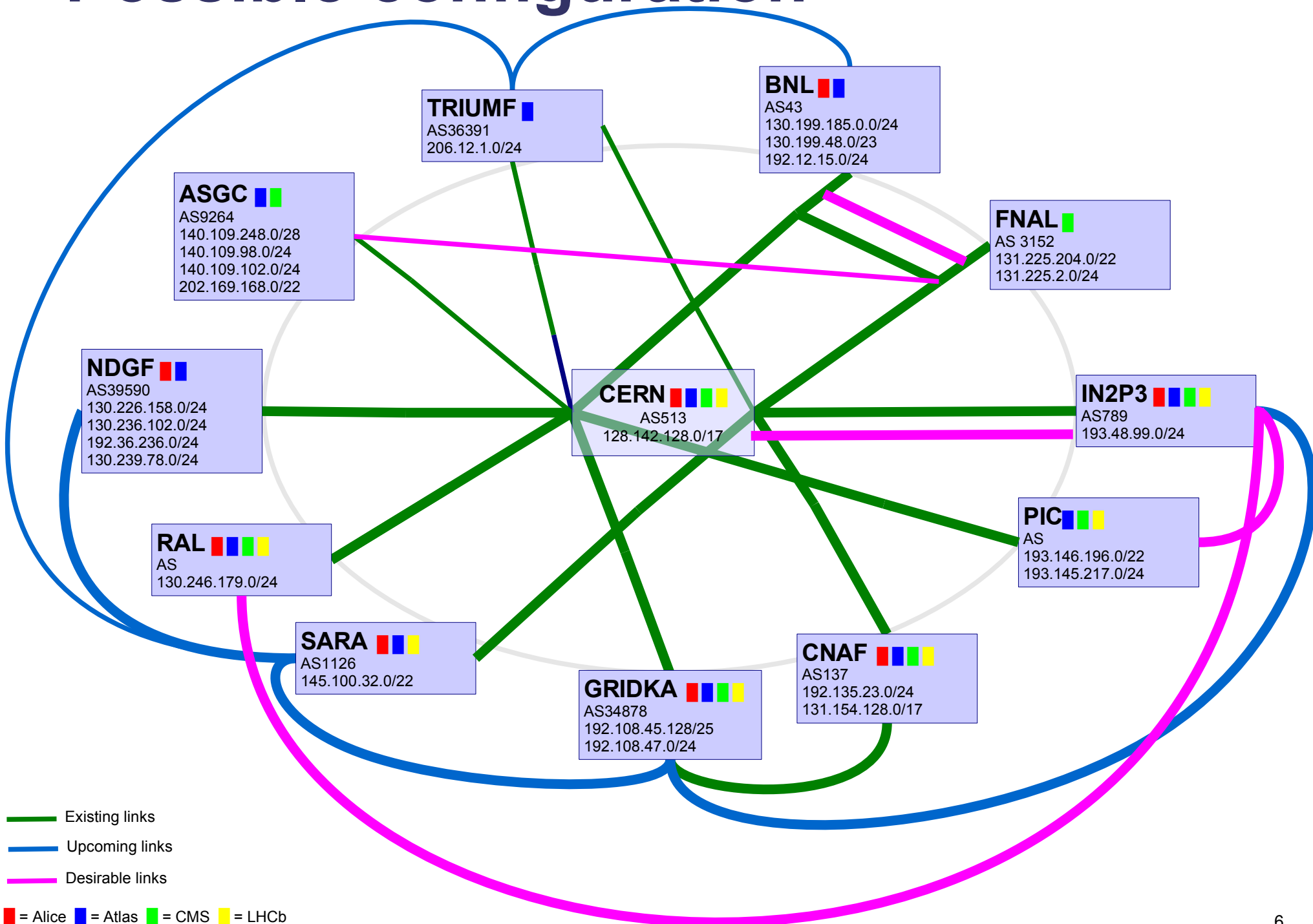
Weaknesses

- most of the Tier1s terminate all their links to a single router
- most of the current links use GN2-P2P. GN2 devices in the Geneva PoP and GN2 fibres landing there are single point of failures for several T1s.
- USLHCnet devices in Chicago and New York not redundant
- T1-T1-T0 transit policies not well defined

Improvements

- T1-T1-T0 transit always allowed (also to not directly connected ones). This imply that all Tier1s must follow the routing recommendations (BGP with public AS number)
- Increase connectivity mesh between T1s and between T1s and CERN avoiding GN2-P2P and USLHCnet

Possible configuration



GRIDKA



Primary path:

- DFN Karlsruhe-Frankfurt
- GN2 Frankfurt-Geneve

Backup paths:

- via GARR:**
- DFN Karlsruhe - Swiss border
 - SWITCH German border - Italian border
 - GARR Swiss Border-Milano
 - GN2 Milano-Geneve

- via IN2P3:**
- DFN Karlsruhe - French border
 - Renater German border –Lyon–Geneve

- via SARA:**
- DFN Karlsruhe – Dutch border
 - SURFnet German border – Amsterdam - Geneve

Single points of failure:

- GRIDKA router in Karlsruhe

CNAF

Primary path:

- GARR Bologna-Milano
- GN2 Milano-Geneve

Backup path:

- via GRIDKA:**
- GARR Bologna-Milano-Swiss Border
 - SWITCH Italian border – German border
 - DFN Swiss border – Karlsruhe – Frankfurt
 - GN2 Frankfurt – Geneve

Single points of failure:

- GARR router in Milano (?)
- GN2 Alcatel DWDM in Geneva
- Swiss fibres

Possible alternatives:

- path via IN2P3 transiting Gridka
- direct link to Geneva provided by SWITCH-GARR
- change path of the Milano-Geneve lambda inside GN2

SARA

Primary path:

- SURFNet-GN2: Amsterdam-Geneve

Backup paths:

- via Gridka** - SURFnet: Amsterdam - German border
 - DFN: Dutch border – Karlsruhe – Frankfurt
 - GN2: Frankfurt - Geneva

- via NDGF** - SURFnet: Amsterdam - Danish border
 - Nordunet: Dutch border – Koebenhavn
 - GN2: Koebenhavn - Geneva

Single points of failure:

- GN2 fibre Frankfurt-Geneva
- GN2 Alcatel DWDM in Geneva and Frankfurt

Possible alternatives:

- path via IN2P3 (direct link or transit via GRIDKA)

NDGF



Primary path:

- GN2: Koebenhavn - Geneve

Backup paths:

- via SARA** - Nordunet: Koebenhavn - Dutch border
 - SURFnet: Danish border - Amsterdam
 - SURFnet-GN2: Amsterdam - Geneva

Single points of failure:

- NORDUnet router in Koebenhavn (?)
- GN2 fibre Frankfurt-Geneva
- GN2 Alcatel DWDM in Geneva and Frankfurt

Possible alternatives:

- path via IN2P3 (direct link or transit via SARA)
- path via GARR (direct link or transit via GRIDKA)

IN2P3



Primary path:

- Renater: Lyon-Geneve

Backup paths:

- via Gridka** - Renater: Lyon - German border
 - DFN: French border – Karlsruhe – Frankfurt
 - GN2: Frankfurt - Geneve

Single points of failure:

- IN2P3 router in Lyon (?)
- Limited bandwidth in case of several failures of other T1's direct links

Possible improvement:

- double the bandwidth Lyon-Geneva

RAL



Primary path:

- JANET: Didcot-London
- GN2: London-Geneve

Backup paths:

- no

Single points of failure:

- whole link

Possible alternatives:

- path via IN2P3 or SARA (direct link)

PIC



Primary path:

- Rediris: Barcelona-Madrid
- GN2: Madrid-Geneve

Backup paths:

- no

Single points of failure:

- whole link

Possible alternatives:

- path via IN2P3
- direct link to Geneve provided by Rediris and Renater

TRIUMF



Primary path:

- Canarie: Vancouver-Amsterdam (5Gbps)
- SURFNet-GN2: Amsterdam-Geneve (5Gbps)

Backup paths:

- Direct 1G link:**
- Canarie: Vancouver-Amsterdam (1Gbps)
 - SURFNet-GN2: Amsterdam-Geneve (1Gbps)

- via SARA:**
- ??: Vancouver-Amsterdam
 - SURFnet-GN2: Amsterdam - Geneve

- via BNL:**
- Canarie: Vancouver - NewYork
 - ESnet: NewYork-Brookhaven-NewYork
 - USLHCnet NewYork - Geneve

Single points of failure:

- TRIUMF router in Vancouver (?)
- Anything in Canarie?

FNAL



Primary path:

- ESnet: Batavia - Chicago
- USLHCnet: Chicago - Geneve

Backup path:

- via New York:**
- ESnet: Batavia - Chicago
 - USLHCnet: Chicago – NewYork - Geneve

Single points of failure:

- Batavia-Chicago fibre (?)
- FNAL router in Batavia (?)
- USLHCnet devices in Chicago

Possible alternatives:

- Connection to NewYork without going via USLHCnet

Primary path:

- ESnet: Brookhaven - NewYork
- USLHCnet: NewYork - Geneve

Backup path:

- via Chicago:**
- ESnet: Brookhaven - NewYork
 - USLHCnet: NewYork - Chicago-Geneve

Single points of failure:

- Brookhaven - NewYork fibre (?)
- BNL router in Brookhaven (?)
- USLHCnet devices in New York

Possible alternatives:

- Connection to Chicago without going via USLHCnet

Primary path:

- ASnet Taiwan-Amsterdam (2.5Gbps)
- SURFnet+GN2 Amsterdam-Geneva (2x1Gbps)

Backup path:

- General purpose Internet:**
- ASnet Taiwan-Chicago.
 - USLHCnet Chicago-Geneve

Single points of failure:

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Possible alternatives:

- Connection from Chicago or NewYork to the LHCOPN provided by USLHCnet

Possible configuration

