


IST-2000-32603	<p style="text-align: center;">Deliverable 1.3 Operational procedure to be followed by organisations connected to 6NET</p>	
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Editors:	János Mohácsi
Contributors:	Vincent Berkhout, Wim Biemolt, Bruno Ciscato, Rob Evans, Ioannis Kappas, Jac Kloots, Sabine Kühn, Simon Leinen, János Mohácsi, Agnes Pouele, Roberto Sabatino, Pekka Savola, David Sutherland, Bernard Tuy, Wilfried Woeber

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**Abstract:**

This document summarises the procedures and policies of interconnection in 6NET and the usage policy after the interconnection.


**Keywords:**

IPv6, Acceptable usage, Interconnection, Routing, Routing policy


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## The 6NET acceptable use and interconnection policy

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## 1 Introduction

The 6NET project is building a large-scale wide area test facilities for the testing, validation and demonstration of applications, services and features associated specifically with the new IPv6 technology. The 6NET core network is connecting the access routers of the national IPv6 test/pilot networks operated by the NREN partners and other networks as deemed suitable by the Project Management Committee. This document summarises the procedures and policies of interconnection and the usage policy after the interconnection.

## 2 6NET AUP

This chapter describes the acceptable usage policy (AUP) of 6NET.

### 2.1 *Acceptable Usage Policy (AUP)*

This Policy applies to any organisation authorised to use 6NET. It is the responsibility of 6NET organisations to ensure that members of their own user communities use 6NET services in an acceptable manner and in accordance with current legislation, including European and corresponding national laws.

Thus, it is recommended that each 6NET participant build its own statement of acceptable use in the context of the services provided to its users, and comply with this Policy.

6NET is established to do experiments on IPv6 technologies in a large international testbed, to support IPv6 research, and to transfer knowledge to the future GÉANT IPv6 service.


The 6NET Project Management Committee (6NET PMC) authorises the connection of any organisation to 6NET, that has any impact to the 6NET network.

The IPv6 traffic is regarded as research traffic if it is going between research and other organisation and if it is not generating any commercial revenue to any of the parties.

### 2.2 *Acceptable Use*

6NET-connected organisation may use 6NET for the purpose of interworking, exchange IPv6 research traffic, experiment with other 6NET Organisations, and with organisations attached to 6NET network.

6NET tolerates operational traffic but is not responsible for any disruption or interruption of this traffic for the needs of the experiments.

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### **2.3 Unacceptable Use**

6NET may not be used for any of the following:

- The creation or transmission of traffic that is prohibited in the section 2.1.
- Transmission of non-research traffic between two 6NET connected organisation.
- Deliberate unauthorised access to facilities or services accessible via 6NET.
- Deliberate activity of wasting staff effort or networked resources except if it is well defined in advance in a test plan and this test has been accepted and executed according to the D1.4.
- Deliberate activity of corrupting or destroying other users' data or violating the privacy of other users.
- Deliberate activity disrupting the work of other users except it is well defined in advance in a test plan and this test has been accepted and executed according to the D1.4.
- Deliberate use of an item of networking software or hardware after 6NET NCC has requested that use cease because it is causing disruption to the correct functioning of 6NET.

### **2.4 Resale of 6NET service**

None of the 6NET partners can provide access to 6NET for third parties without the prior agreement of 6NET PMC.

None of the 6NET partners or any other connected organisation is allowed to resell any 6NET services.

### **2.5 Compliance and sanctioning**


Each 6NET connected organisation should maintain compliance to the policy. If necessary, service may be withdrawn from the 6NET connected organisations, either by suspending or disconnecting them.

Each 6NET connected organisation is fully responsible for any misuse, loss or damage caused by them.

#### **2.5.1 Handling of non compliance**

After detecting a non-compliance by any 6NET partner:

1. The NREN is informed to take the necessary steps.
2. The NREN will react appropriately, and act internally based on their Acceptable Usage Policy.
3. If necessary the sanctioning take place based on decision of 6NET PMC.
4. 6NET NOC allowed in case of emergency, in the event of inadmissible use to suspend access or connection, without prior notification.

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### 3 General procedures about interconnection

#### 3.1 Access Circuits

The access circuit for the connection of the NREN to the 6NET core will be ordered by the NREN or via DANTE, depending on the initial agreement. Operation of the line is the responsibility of the NREN or DANTE via the 6NET NOC, similarly depending on initial agreement. The process of obtaining a new or upgraded Access Port involves discussions with WP1 by the 6NET partner, and finally approval by the 6NET Project Management Committee. As part of this process, the NREN should keep 6NET NCC and 6NET NOC informed about the delivery of any access line.

### 4 Interconnection

Interconnection to 6NET network as a whole can be established only with prior agreement of 6NET PMC. In the interconnection proposal the proposers should define the method of interconnection, the research to be carried out with the interconnection and benefit of interconnections for the partners or other IST projects.


6NET is a large scale IPv6 experiment. DANTE and 6NET project partners take no responsibility of interconnection service as a production service. However the network is operated according to the well established operational procedures defined in D1.2, and the network experiments are carried out based on the framework defined in D1.4.

The 6NET core network is operated by DANTE via 6NET NOC with guidance of 6NET NCC. The 6NET partner NRENs are connecting to 6NET core via their 6NET access routers. The 6NET partner NRENs are responsible of operation of 6NET network from access line of NRENs to the access router of 6NET partner university with guidance of 6NET NCC.

RIPE has allocated IPv6 address space to DANTE, and DANTE has made part of this address space (/40) available to the 6NET project for use in the core network and will be returned to DANTE after end of the project. The address prefix (usually /64) used for IPv6 interconnection at core is temporarily assigned to a particular interconnect by 6NET project, just for interconnection, based on the addressing plan (D3.1.1). It must be returned to the 6NET project when the interconnection has terminated. In other places, wherever interconnection occurs the interconnection policy of the corresponding NREN, university etc. is governing the address assignment.

Network planning is necessary for each new interconnection. The interconnecting parties shall describe each other about their short-term and long-term plans regarding:

- Establishment or discontinuing access lines that are used for interconnection
- Changes of their access line capacity
- Changes in routing policy of interconnection
- Routing policy changes that might have impact on interconnection
- Other network changes of importance to interconnection

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#### **4.1 Interconnection of 6NET partners**

6NET network is a three-level network consisting of core level, organisational (NREN) level and university/laboratory level.

##### **4.1.1 Core level interconnection**

The 6NET core network will be connected to access routers of the national IPv6 test/pilot networks operated by the NREN partners. The NREN partners are responsible for the interconnecting access line(s) and its maintenance.

For the core level interconnection the partner should be sTLA registrants or pTLA registrants. Usage of sTLA prefixes preferred to pTLA IPv6 prefixes. The one goal of the 6NET project is to test the operational policies and then transfer this operational knowledge to GEANT. The operational IPv6 networks should use sTLA, thus they are preferred.

##### **4.1.2 Organisational (NREN) level interconnection**

The 6NET NREN network will be connected to access routers of the IPv6 test/pilot networks operated by NREN/university partners. The partner NREN or the Partner University is responsible for the interconnecting access line(s) and its maintenance.

Universities and other research organisations should connect to their respective NRENs. 6NET partners, especially NRENs, can connect to 6NET their national research network.

#### **4.2 Interconnection of research/test labs of 6NET partners**


Research and test labs (that are not part of 6NET project) located at 6NET partners might be connected to 6NET network:

If the research laboratory is carrying out tests activities that is beneficial for the 6NET project as whole or as part or harmonises the IPv6 task force activities of European Commission.

Third-party organisation or 6NET partner NREN or university independently from 6NET project can be the operator of this research/test laboratory.

The interconnection can take place based on the prior agreement of 6NET PMC.

Operator of the interconnecting point is responsible for the interconnecting access line(s) and its maintenance.

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#### **4.3 *Interconnection of other NRENs that are not participating in the 6NET project***

Since non-6NET partner NRENs might run IPv6 related projects, which can be beneficial for the 6NET project as a whole or part, the interconnection policy is the same as described in the section 4.2.

Connectivity for these NRENs to 6NET can be provided and later GÉANT will provide universal connectivity.

#### **4.4 *Interconnection of GÉANT***

The GÉANT network will provide pan-European production IPv6 connectivity. In the future it is planned to connect 6NET, the European IPv6 testbed to GÉANT.

DANTE (as operator of GÉANT network) is responsible for interconnecting access line(s) and access points and their maintenance.

The currently running GÉANT IPv6 test program (GTPv6) is connected via RENATER without any additional cost to any of the projects.

#### **4.5 *Interconnection of Euro6IX***

Euro6IX is a co-ordinated initiative of major European Telecom companies, equipment manufacturers, solutions/software providers, research laboratories with the objective to research appropriate architecture, design, develop, deploy and validate the first Pan-European pre-commercial IPv6 Internet Exchanges Network, connecting several regional and strategic neutral IPv6 Internet Exchange points across Europe.


Thus, mutual interests exist for 6NET and Euro6IX project to interconnect each other.

Operators of 6NET network and the Euro6IX network will agree of interconnection of the two testbed networks. The operators of particular interconnection point are responsible for the interconnecting access line(s) and its maintenance.

#### **4.6 *Interconnection of other IST projects***

In principle, the 6NET infrastructure is open for other IST projects to use, and this deliverables gives guidance on the procedures for interconnecting.



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The interconnection has to be approved by the 6NET PMC and be regulated on a case by case basis.

The general rule is to be liberal to accept connection proposals to 6NET that might be mutually beneficial for IST projects.

#### ***4.7 Interconnection of research networks of international research organisations***

The 6NET network planned to be connected to one or more IPv6 Internet Exchange points (IXs) in the North America (e.g. 6TAP) and Asia and provide transit to and from those IXs if they are research related.

The interconnection will take place as planned in the D1.1 document. Additional interconnection might also be considered. If it is incurring any additional cost, the decision has to be taken by the 6NET PMC.

The 6NET is advertising only the prefixes of 6NET partner NRENs to these organisations. The list of the 6NET partner NRENs and their prefixes can be found on the Table 2 in the Appendix.

Care must be observed when advertising these prefixes to organisations outside of 6NET project. In some cases it may be undesirable if the organisation would re-advertise them elsewhere (e.g. 6Bone).

#### ***4.8 Interconnection of other institutions, commercial entities, IPv6 ISPs***


Interconnections can also be made at Internet Exchange points (IXs) in the countries of these partners (if the IX provides an IPv6 service). ISPs carrying out R&D or trials related to IPv6 can then either connect to one of the IXs, to partner's access router, or to one of the 6NET routers directly.

6NET PMC will decide about this type of interconnection. Each 6NET partner allowed to establish private peering interconnection with other institutions, commercial entities or IPv6 ISPs, if it does not imply any routing policy to 6NET.

This type of interconnection is intended for test only, and routing has to be determined accordingly.

#### ***4.9 Interconnection to 6Bone***

The 6Bone is currently a world wide informal collaborative IPv6 testbed project. The 6bone started as a virtual network (using IPv6 over IPv4 tunnelling/encapsulation) operating over

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the IPv4-based Internet to support IPv6 transport and used for testing of standards and implementations.

Interconnection to 6Bone is allowed via the 6NET NREN partners, but redistribution of the whole 6Bone routing table is strongly discouraged.

## 5 General interconnection rules

Some network configuration parameters of interconnection will be made public via 6NET or 6NET partner registries. This information has to be made available via RIPE or other Internet registry database.

Each of the interconnected partner should be ready to submit a summary of experiment report when the experiment has finished. The report may be published to general public for research purpose.

IPv6/v4 traffic that goes through 6NET can be analysed by 6NET project for research/statistics purposes. The result may be published to general public, for research purposes.

## 6 Routing policy for interconnection

The routing policy described in this section is a general guideline. The concrete initial implementation is described in the Appendix.

### 6.1 NREN Obligations

The NRENs, in operating their networks, have an obligation to implement and operate their routing in a manner such that the 6NET network, national networks, and third party networks are not adversely affected. In particular, this refers to the number of routes advertised, the frequency of announcements (especially the phenomenon known as “route flapping”) and the announcement of routes not belonging to the network (known as “bogus routes”) or preferred to receive from them. Which routes are preferred and why is described later in this chapter. To prevent bogus routes and enforce 6NET routing policy via route filtering will be tested during the 6NET project.


### 6.2 Routing Protocol and Route Aggregation

Where possible, the NREN should aggregate routes in order to minimise the number of routes that they announce.

IPv6 routing information will be exchanged between the NREN’s access router and 6NET using the BGP4+ routing protocol.

### 6.3 Loose Source Routing

There is usual policy, that IPv4 source routing on the backbone is disabled. Possibility to disable IPv6 source routing will be tested during the 6NET project.

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#### **6.4 Route Dampening**

The effect of route dampening will be tested in 6NET project. Application is not recommended as discussed in D1.1: " route dampening has dramatical impact on routing in IPv6 environment, since the exchanged routes are quite highly aggregated." The routing stability has to be measured some way in the 6NET project, and if it necessary, route dampening can be implemented.

#### **6.5 Routing policy terminology**

The "local" means networks that are topologically close: e.g. within the country or very well connected in that region.

NREN prefixes: the prefixes that are owned by NRENs or NREN research and educational partners. NREN is responsible providing good connectivity to the networks, whose prefix is announced by it. These prefixes should be aggregated as much as possible.

Other research prefixes: the prefixes, learned from native peering from other research organisation (e.g.: Abilene, ETRI, KOREN etc.)

Other prefixes: if a 6NET partner peers directly (either using native or tunnel) with **local** commercial ISPs, and these prefixes are not classified as NREN and other research prefixes, these prefixes are others.

IPv6 peering interconnection: Peering interconnection is an agreement between two networks, who want to exchange IPv6 data traffic (called peering) with communication protocol IPv6.

IPv6 transit traffic: IPv6 transit traffic is traffic that has its origin or destination in a network that is not part of bilateral IPv6 peering agreement.


IPv6 transit interconnection: Transit interconnection is an agreement, to provide IPv6 transit traffic.

#### **6.6 Routing policy**

Basically there are 3 kinds of traffic that might (theoretically) be applicable to 6NET:

- 1) Between 6NET partners (including non-commercial entities part of NREN's that are not part of 6NET)
- 2) Between a 6NET partner and some commercial organisation
- 3) Between two commercial organisations

Type 1) is trivially allowed. Type 3) is not allowed based on the AUP. Type 2) can be done locally or globally, the routing policy is trying to address these requirements.

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This routing policy is transitional and may change according to the needs of 6NET partners.

## 6.7 Problems with the current IPv6 routing practice

Currently there seem to be no viable commercial IPv6 transit providers, and IPv6 connectivity is still not a part of their production service: even if it was (here and there) available, only few would be inclined pay lots for it. This leads to a divergence in IPv4 and IPv6 policies:

- either most 6NET partner create peerings (usually via tunnels) to all the important IPv6 commercial internet service providers themselves (not necessarily local, perhaps even 5-10x per NREN),
- or there will be some co-operation within 6NET.

Especially the peering with 6Bone is complicated, since from 6Bone one can get very short ASpath in distance that are actually tunnelled from all over the world. 6NET should avoid this routing practice.

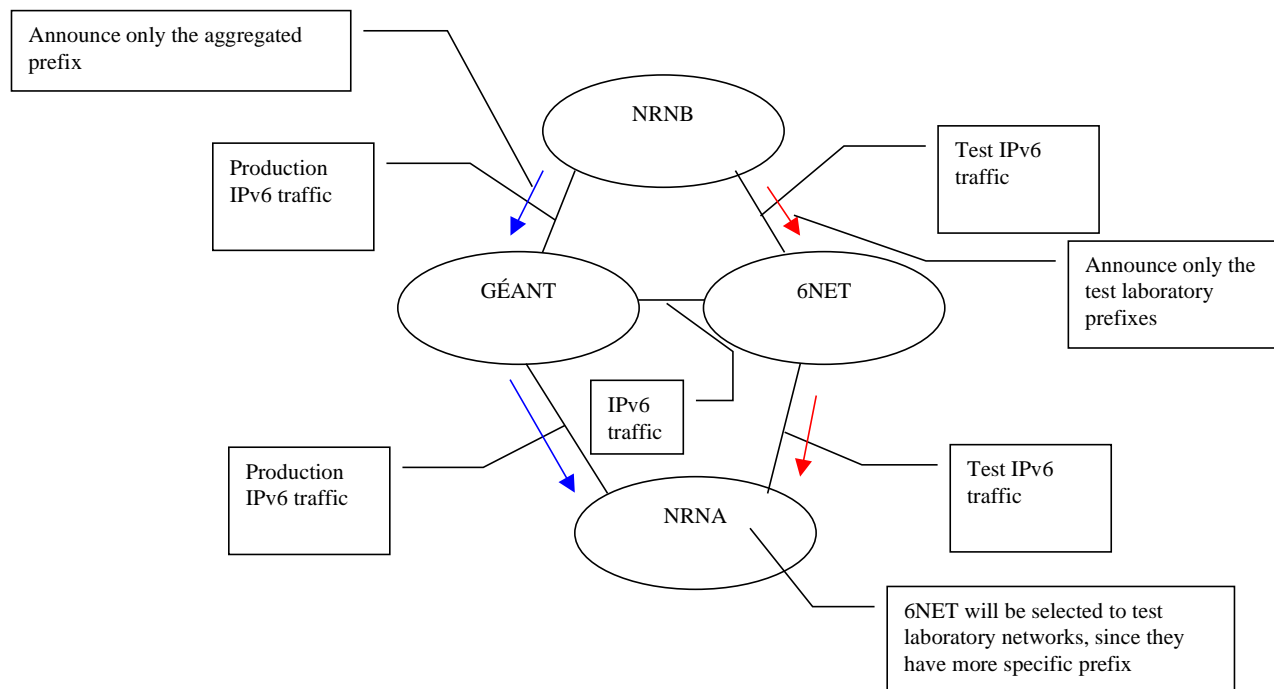
### 6.7.1 Handling of transit peering

- When an NREN receives prefixes from an outside of 6NET project and sends them to 6NET, it SHOULD control (unless explicitly agreed, e.g. for a party to act as last-resort relay to 6bone) the prefixes so that the prefixes are "local". i.e.: the whole 6bone/IPv6 routing table MUST NOT be advertised to 6NET unless agreed on.
- If a 6NET partner peers directly (either using native or tunnel) with **local** commercial ISPs or receives prefixes from outside of 6NET project, the member MAY advertise to 6NET these other prefixes (or part of it), in addition to its own. This advertisement is subject of decision of 6NET PMC. These routes will be marked so that these routes will not be advertised to other organisations outside of 6NET project
- When an NREN advertises 6NET prefixes to outside of the project, it SHOULD prevent exporting further 6NET routes unless there is an explicitly agreement in 6NET project. If the no measure taken against this re-export, the networks outside of 6NET will get optimal and symmetrical routes from this peering, but because of the wrong-mesh topology of 6Bone, the routing more likely be asymmetrical for parties reachable via these connected entities.

## 7 Possible treatment of laboratory traffic

It is recommended that each NREN maintain a list of prefixes, that belongs to the 6NET partner institution, laboratory of university etc. to be able to distinguish the test IPv6 traffic from the production IPv6 traffic.

The reason for this is, that in the future the environment will look like this:



**Figure 1 Treatment of the laboratory traffic**


By aggregating the more aggregated prefixes on their GÉANT peering and more specific prefixes, which are describing the laboratory networks, on their 6NET peering, NRENs can prefer using 6NET automatically for test laboratory networks.

## 8 Summary

This document described the procedures and policies of interconnection and the acceptable usage policy after interconnection. Summarises the different type of interconnections, the applicable policies in general, and the in the appendix it is providing a possible implementation to these policies, particularly paying attention to the routing.

## 9 Glossary of Terms

- IPv6 peering interconnection: Peering interconnection is an agreement between two networks, who want to exchange IPv6 data traffic (called peering) with communication protocol IPv6.
- IPv6 transit traffic: IPv6 transit traffic is traffic that has its origin or destination in a network that is not part of bilateral IPv6 peering agreement.
- IPv6 transit interconnection: Transit interconnection is an agreement, to provide IPv6 transit traffic.
- 6NET Network: 6NET network is a three-level network consisting of core level, organisational (NREN)level and university/laboratory level.
- 6NET PMC: 6NET Project Management Committee, the management group of 6NET project, that is responsible for the important decisions taken by 6NET project

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- NREN: National Research and Education Network. A body providing an IP networking service for research and educational purposes within a particular European country.
- D1.2: Operational procedures followed by the 6NET NOC.
- D1.4: Procedures for the approval and scheduling of 6NET tests
- 6NET NOC: The Network Operations Centre for the 6NET Services. Part of the 6NET NMS, it provides fault resolution for 6NET problems.
- 6NET NMS: The Network Management Service for the 6NET core network. It provides fault resolution and reporting for the 6NET core network.
- 6NET NCC: 6NET Network Co-ordination Centre consisting of 6NET Workpackage leaders, Cisco as project partner and WP6 members. Role of the 6NET NCC is to give guidance about the 6NET network.

## 10 Appendix - Routing policy definition

This appendix describes the initial planned implementation of 6NET routing policy. This plan will be used as a starting point for the routing work of WP3. The policy will be changed based on the initial experiences and research work of WP3.

This routing policy definition is based on the usual BGP4 communities, route tagging and their specific usage.

### 10.1 6NET core tagging

6NET autonomous system is : AS6680

The routers of 6NET core will tag the routes learned from other peer and NREN's peering accordingly the following way:

- Tag NREN prefixes with 6NET-NRN community. This community tagging is done based on prefix list defined in Table 2 in 10.4.
- Tag other research prefixes according to the Table1.
- Tag other prefixes with 6NET-OTHER community. All other routes that are not belonging to any other categories are treated as other routes. This is called other routes since 6NET itself cannot provide reliable connectivity to these routes. It is relied on other third party like IPv6 commercial ISP or 6Bone.

The community value is defined this way:


AS6NET:PEERINGNUMBER
----------------------

Here a table which can be extended with the current known peering.

Communities name	Value	Comments
6NET-NRN	6680:10	NREN routes
6NET-GEANT	6680:20	GEANT routes (AS20965)
6NET-NII	6680:30	NII routes (AS2097)
6NET-KOREN	6680:40	KOREN (AS9270)
6NET-6TAP	6680:50	ESNET, CANET, ABILENE
...	...	...
...	...	...
6NET-OTHER	6680:99	Any other routes

**Table 1 6NET core router tagging**

NRENs don't have to tag their routes based in table. The 6NET core routers do this tagging. The 6NET partner NRENs can benefit from these tagging by configuring their routing policy to rely on these tagging.

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## 10.2 Scheme for NREN's tagging

This numbering scheme is based on the GEANT numbering scheme, that has been discussed by DANTE and the NRENs and adapted to 6NET.

6NET participants can tag their routes accordingly to which routes they want to announce or prepend towards 6NET peering.

They will tag their routes the following way

AS6NET:XXY
------------

Where XX is a 6NET peer and Y the action


XX Value	6NET's peering
00	All 6NET's peering except NREN's
20	GEANT peering
30	NII peering
40	KOREN peering
50	6TAP peering
60	Reserved
99	Any other peering

Y Value	Action
0	Don't announce the routes
1	Prepend 6NET AS one time
2	Prepend 6NET AS two times
3	Prepend 6NET AS three times
6	Prepend 6NET AS six times

	XXYY Value	6NET's peering
6NET-DOISP	9999	DO announce routes to your commercial peering partners including 6Bone

The 6690:9999 (6NET-DOISP) tagging can be used by the NRENs to tag their routes to be announced to commercial ISPs and 6Bone. This tagging is valid only in option A, as will be described in the next sections.



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### 10.3 Implemented communities and their explanation

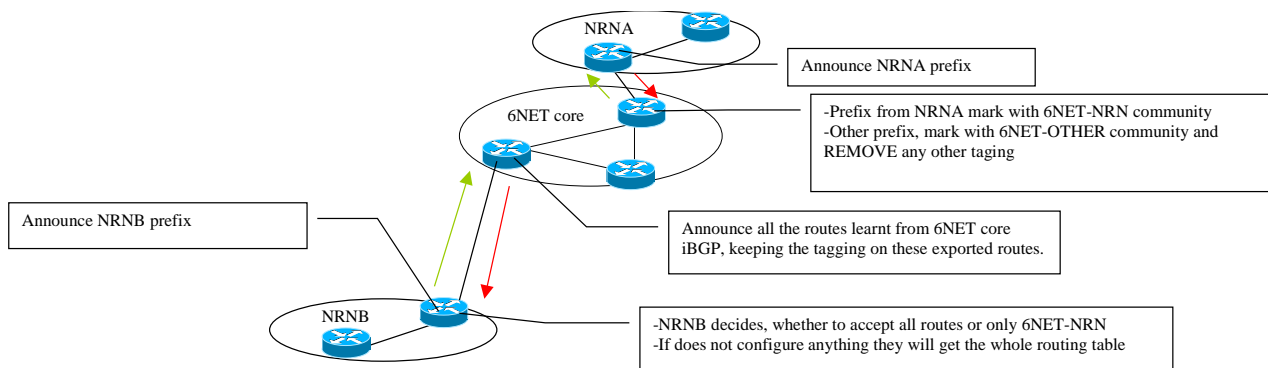
#### 10.3.1 NREN connectivity

The implemented communities for NRENs to use.

6NET's communities

Communities Name	Value	Comments
6net-interco-block	6680:000	Don't announce the routes to all the peers except 6NET partner NRENs
6net-interco-prepend3	6680:003	Prepend 6NET AS three times to all the peers except 6NET partner NRENs
6net-interco-prepend6	6680:006	Prepend 6NET AS six times to all the peers except 6NET partner NRENs

With these communities the NREN can prefer 6NET NRN peerings over other peering.



**Figure 2 Handling of 6NET NRN traffic**

#### 10.3.2 Other research network connectivity

GÉANT's communities

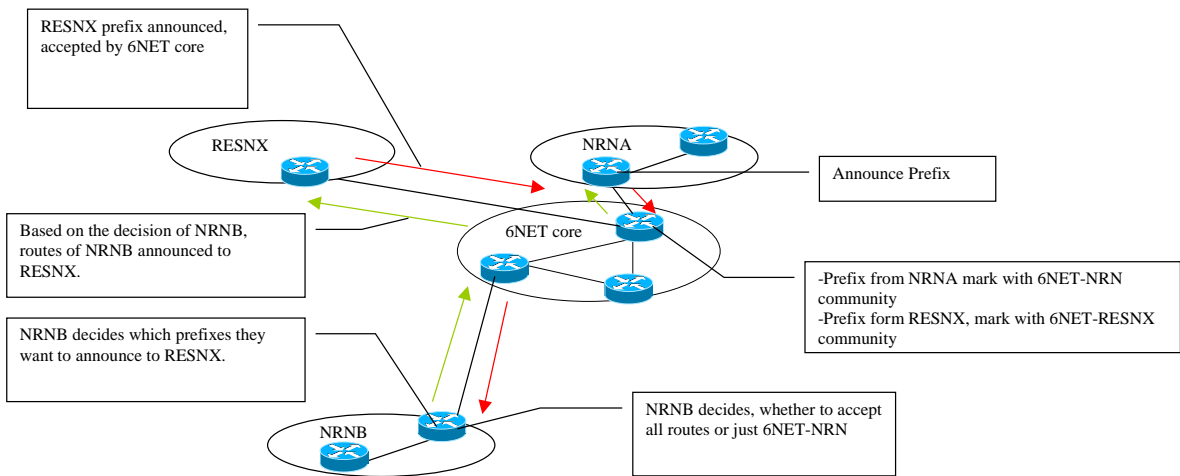
Communities names	Value	Comments
6net-geant-block	6680:200	Don't announce the routes to GÉANT
6net-geant-prepend3	6680:203	Prepend 6NETAS three times towards GÉANT
6net-geant-prepend6	6680:206	Prepend 6NET AS six times towards GÉANT

Can be used avoid using GÉANT. It can be useful to keep test traffic on 6NET.

NII's communities

Communities names	Value	Comments
6net-nii-block	6680:300	Don't announce the routes to NII
6net-nii-prepend3	6680:303	Prepend 6NETAS three times towards NII
6net-nii-prepend6	6680:306	Prepend 6NET AS six times towards NII

Similar communities can be defined and implemented for other research peerings.



**Figure 3 Routing policy for other research networks - The RESNX can represent any research network. The routing policy should be similar.**

The default behaviour is that NRENs do not configure anything, and they benefit from connectivity to RESNX (e.g. GEANT, NII, etc). NRN does not have to communicate their routing policy to operators of 6NET: not to announce their routes to the RESNX research network. They can simply tag their routes with a provided community 6NET-RESNX-BLOCK, and their routes won't be announced, but then it is their responsibility to filter out RESNX related routes on their peering.

10.3.3 Other connectivity

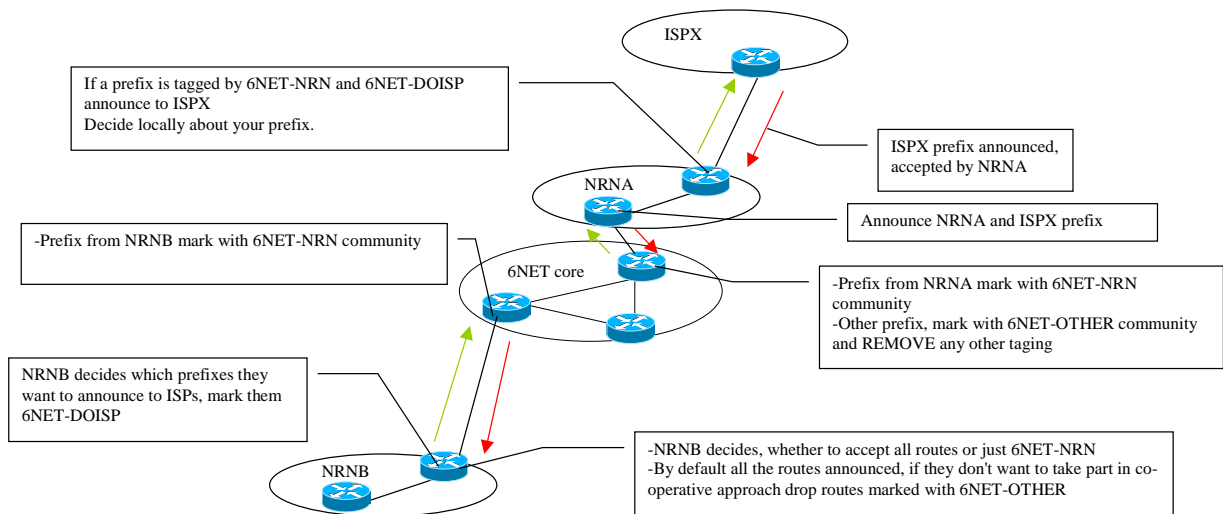
6NET will experiment with routing policy. For handling other connectivity there is two possible options. They might be tried during the 6NET project.

10.3.4 Other connectivity -option A

This approach is can be called cooperative approach, since it s relying on a co-operation between NRENs. In this approach, the default is to not to exchange other routes with NRENs, except it is requested by the particular NRENs.

Any other peering's communities

Communities names	Value	Comments
<b>6NET-DOISP</b>	<b>6680:9999</b>	<b>DO announce prefixes to commercial peers</b>



**Figure 4 Usage and processing of communities to allow traffic between a 6NET member and some commercial organisation in option a**

The **6NET-DOISP** community is a bit tricky, since it is a transitive community, and has to be passed over the 6NET core without touching it, if it is coming from NREN.

The decision of a particular NREN has to be consistent:

- If they do not accept AS6NET:6NET-OTHER routes, then cannot mark their routes with 6NET-DOISP community, otherwise it will generate black-hole for ISPX or will be reached by another route that can be unoptimal.
- If they don't want to participate this co-operative approach, thus not marking their routes, they have to drop the routes marked with AS6NET:6NET-OTHER, otherwise they will see black-hole towards ISPX, or they will reach ISPX via another route not via 6NET.

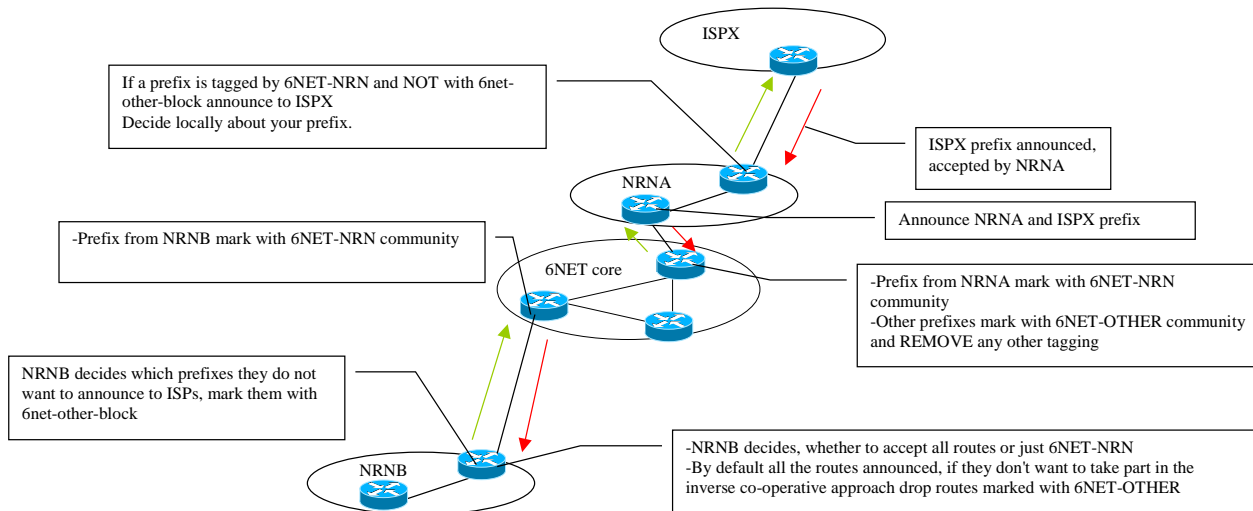
### 10.3.5 Other connectivity -option B

This approach is called inverse co-operative approach, since the NOT announcement of other routes has to be configured. By default the other routes are available for NRENs until they tell the opposite.

Any other peering's communities

Communities names	Value	Comments
6net-other-block	6680:990	Don't announce the routes to other peerings
6net-other-prepend3	6680:993	Prepend 6NET AS three times towards other peerings
6net-other-prepend6	6680:996	Prepend 6NET AS six times towards other peerings

(These communities only implemented in option b).



**Figure 4 Usage and processing of communities to allow traffic between a 6NET member and some commercial organisation in option b**

The decision of a particular NREN has to be consistent:

- If they do not accept `6NET-OTHER` routes, then must mark their routes with `6NET-OTHER-BLOCK` community, otherwise it will generate black-hole for ISPX or the traffic flow different paths, assuming there are any (e.g. via 6Bone), which can be unoptimal.
- If they don't want to participate this inverse co-operative approach, thus not marking their routes, they have to drop the routes marked with `6NET-OTHER`, otherwise they will see black-hole towards ISPX, or the traffic flow different paths, assuming there are any (e.g. via 6Bone), which can be unoptimal.


### 10.3.6 Discussion of option-a (co-operation) and option-b (inverse co-operation) solution

#### 10.3.6.1 Generic drawbacks of this routing policies

- Added complexity at the edges.
- Commercial IPv6 transit players are unlikely to get any bigger customer base due to this (and may see 6NET as competing with them).
- 6NET core routers will have to pass the received communities onward.

#### 10.3.6.2 Generic advantages of these methods

- Every member can control what happens with his prefixes and what commercial prefixes to accept.
- If a 6NET partner has local peering with commercial IPv6 ISP, the described 6NET routing architecture could be used to freely give the advantages of that to every 6NET partner. There will be considerably smaller need for tunnelled (across long distances) BGP peerings then, as every major player, at least in Europe, would be reachable in this way. This is especially useful for connecting "stub" networks, but international transit providers can also be connected when care is observed with access lists.

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- This is a way to make ISP's in Europe get better connectivity to 6NET partners, many ISP's would prefer to be peering with one or more 6NET partners and be part of option-a or option-b, to have their routes advertised to 6NET and 6NET to them

### 10.3.6.3 Drawbacks of option-a

- This routing policy seems to be less familiar to the NRENs.


### 10.3.6.4 Drawbacks of option-b

- A bit more complex to configure than option-a.
- The default behaviour is to use ISP networks. Probably not exactly what we want.

## 10.4 NREN's prefixes

Finding out the prefixes of a particular NREN is rather straightforward, since usually each NREN has its own IPv6 subTLA as described in table 2.

Name	Country	IPv6 Prefix	6NET partner	GÉANT partner	NORDUNET partner
DANTE	EU	2001:0798::/35	Yes	Yes	-
ACOnet	AT	2001:0628::/35	Yes	Yes	-
ARNES	SI	?	No	Yes	-
BELNET	BE	2001:06a8::/35	No	Yes	-
	BG	?	No	?	-
CESNET	CZ	2001:0718::/35	Yes	Yes	-
CYNET	CY	?	No	Yes	-
DFN	DE	2001:0638::/35	Yes	Yes	-
EENet	EE	?	No	Yes	-
FCCN	PT	2001:0690::/35	No	Yes	-
GRNET	GR	2001:0648::/35	Yes	Yes	-
HEAnet	IE	2001:0770::/35	No	Yes	-
HUNGARNET	HU	2001:0738::/35	Yes	Yes	-
LATNET	LV	?	No	Yes	-
GARR	IT	2001:0760::/35	Yes	Yes	-
IUCC	IL	?	No	Yes	-
LITNET	LT	2001:0778::/35	No	Yes	-
SURFnet	NL	2001:0610::/35 3FFE:600::/24	Yes	Yes	-
NORDUnet	Nordic	-	Yes	Yes	Yes
REDIRIS	ES	2001:0720::/35	No	Yes	-
PSNC	PL	3FFE:8320::/28 PL-ICM: 2001:06A0::/35 PL-CYFRONET:	Yes	Yes	-

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		2001:06D8::/35			
RENATER	FR	2001:0660::/35	Yes	Yes	-
RESTENA	LU	3FFE:4004::/32	No	Yes	-
RoEduNet	RO	?	No	Yes	-
SANET	SK	3FFE:2200::/24?	No	Yes	-
SWITCH	CH	2001:0620::/35 3FFE:2000::/24	Yes	Yes	-
JANET	UK	2001:0630::/35 3FFE:2100::/24	Yes	Yes	-
FUNET	FI	2001:0708::/35 3FFE:2620::/32	Yes	-	Yes
SUNET	SE	2001:06B0::/35	No	-	Yes
UNINETT	NO	2001:0700::/35 3FFE:2A00::/24	Yes	-	Yes
RHnet	IS	?	No	-	Yes
Forskningsnet	DK	3FFE:1400::/24?	Yes	-	Yes

**Table 2 European Research networks and their IPv6 address prefix**

There some other European research networks, which might connect to 6NET under the condition defined in section 4.3: INIMA (Albania), MARNET (FYROM), AMREJ (Serbia), BiHarnet (Bosnia-Herzegovina) and some Mediterranean countries.

### **10.5 Handling of other prefixes like 6to4 prefixes**

Since each 6NET partner NREN has either IPv6 subTLA or 6Bone pTLA, there is little need from partners to use 6to4 addresses for IPv6 connectivity. In any case, announcing of more specific 6to4 prefixes, like 2002:0101:0101::/48 is not recommended on the backbone. Connectivity to IPv6 networks that use 6to4 is achieved via 6to4 relays. 6NET partners operating 6to4 relays may allowed to announce the 6to4 prefix (2002::/16) to 6NET, based on the decision of 6NET PMC.


Any similar prefixes (e.g. Teredo) will be discussed later in the 6NET project, and their usage will be documented in the updated version of this deliverable.

### **10.6 Additional possible safeguard in the routing policy**

In addition, as an extra safeguard against loops in the case of third party problems, all AS-paths that are to be exported to 6NET from a commercial player SHOULD NOT have any AS of a 6NET NREN in the as-path.

### **10.7 Route Summarisation**

The 6NET core network will be summarised to /35, however it is using only /40. Later when the new global IPv6 allocation policy will be applied and sTLA become /32, this /35 summarisation will be maintained or will be changed to /36.

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### **10.8 Route filtering**

The 6NET core initially is not configured to do any filtering. The routers only tagging the routes learnt from their peering partners. Later when the "local" networks are discovered and enough operational experience obtained, 6NET can test enforcement routing policy via route filtering, and filtering the announcements.

### **10.9 Handling transit traffic**

NREN should announce only "local" routes to the 6NET network.

Routes considered to be local for an NREN:

- Routes belonging to the IPv6 sTLA of the particular NREN.
- Routes belonging to the 6Bone pTLA of the particular NREN.
- Routes belonging to an organisation that is locally connected (physically or via tunnel) to NREN in the country.
- Routes that is said to be local by the NREN, and can guarantee reasonable delay and bandwidth to the connected organisation via his infrastructure.

If NREN advertises 6NET prefixes to outside of the project, it **SHOULD** add no-export community to the routes unless there are explicitly agreement in 6NET project not to add this community. If the no-export specified the networks outside of 6NET will get optimal and symmetrical routes from this peering, but because of the wrong-mesh topology of 6Bone, the routing more likely would be asymmetrical for parties reachable via these connected entities.