



# Member Update

[www.ripe.net](http://www.ripe.net)

Information bulletin for the members of the RIPE Network Coordination Centre

April 2004

The RIPE NCC Member Update is intended for LIR contacts.

If you are not the right person to receive this update, please forward it to the appropriate colleague.

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## New Instance of DNS Root Server Makes Internet History

For the first time in Internet history the number of instances of DNS root servers outside the United States has overtaken the number within. The balance was tipped by the recent launch in Frankfurt of an anycast instance of the RIPE NCC operated K-root server (<http://k.root-servers.org>).

The K-root server is one of the 13 DNS root servers that resolve lookups for domain names all over the world and form a critical part of the global Internet infrastructure. The K-root server has been operated by the RIPE NCC since 1997 when the first server was installed at the London Internet Exchange (LINX) in London, UK.

Deployment of anycast instances of the K-root server further improves the distribution of this crucial service in various Internet regions and its resilience against Distributed Denial of Service (DDoS) attacks. As K-root is one of the 13 root servers, this also means improvement for the whole Root Server System.

RIPE NCC technicians were among the pioneers of the anycast concept for root servers and have deployed instances of the K-root server, hosted at the LINX, at the AMS-IX in Amsterdam and at the DE-CIX, Frankfurt. The RIPE NCC is planning to have up to 10 instances of the K-root server deployed by the end of 2004.

"We operate K-root as a service to the Internet at large on behalf of our 3,500 members, across more than 100 countries, to whom we provide Internet resources and co-ordination services," stated Axel Pawlik, Managing Director of the RIPE NCC. "As a membership association we are directly responsible for fulfilling the needs of our members. Our members are committed to providing reliable DNS service because their businesses depend on it."

Anycast allows exact copies of the server, including the name and IP address, to be deployed in different locations. These copies are deployed in collaboration with local partners but are under sole management and administrative control of the RIPE NCC. Using anycast makes

the root server system more difficult to attack and improves the DNS response for local communities by providing shorter paths between clients and servers.

"Our strategy is to deploy servers at multiple locations where there is a lot of Internet connectivity. We do that in close co-operation with ISPs who are also our members," said Andrei Robachevsky, Chief Technical Officer at the RIPE NCC.

"However, by taking full operational responsibility for the servers themselves, the RIPE NCC can build a very strong service that is resilient to disasters and attack."

By locating the servers at Internet exchange points, they have the advantage of being as hardened as the infrastructure at these points themselves. "This is very economical because we do not need to spend extra money to harden these sites or to develop their connectivity," noted Robachevsky. "Service quality and security is not always proportional to money spent."

"We do not need fancy, hardened Network Operations Centres," added Daniel Karrenberg, Chief Scientist of the RIPE NCC, who installed the first instance of k.root-servers.net at the London Internet Exchange (LINX) back in 1997. "Our engineering builds on diversity and distribution of

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*The mission of the RIPE NCC is to perform activities for the benefit of the membership; primarily activities that the members need to organise as a group, although they may compete with each other in other areas.*

## RIPE Meetings

RIPE Meetings are open to anyone. The meetings address technical and policy issues affecting Internet administration and operations specific to IP networking.

As announced at RIPE 47 by Rob Blokzijl, RIPE Chair, two RIPE Meetings will be held in 2005. At the end of 2005 the community will be asked for feedback to decide if RIPE should continue with two meetings or return to a three meeting per year schedule. The RIPE NCC will offer additional support to RIPE Working Groups to facilitate discussion and progress between RIPE Meetings.

### Next RIPE Meeting: RIPE 48

RIPE 48 will take place from 3 – 7 May 2004 at the Hotel Krasnapolsky in Amsterdam, the Netherlands. At RIPE 48 there will be various working group sessions of interest to network operators and administrators. For the latest up-to-date information and to register for the upcoming RIPE Meeting please refer to:  
<http://www.ripe.net/ripe/meetings/ripe-48>

### Upcoming RIPE Meetings

RIPE 48: 3 - 7 May 2004, Amsterdam, the Netherlands

RIPE 49: 20 - 24 September 2004, Manchester, United Kingdom ■

## New Instance of DNS Root Server Makes Internet History *Continued from page 1*

functions. The servers will continue to run reliably for a very long time even if our Network Operations Centres should be down. We monitor the quality of the root name service from more than 50 locations worldwide, and we publish the results for everyone to see.”

These results are available through the RIPE NCC DNS Monitoring site. The site uses the Test Traffic Measurements (TTM) network to provide an up-to-date service overview of certain DNS root and Top-Level Domain (TLD) name servers. The DNS Monitoring site is available at:  
<http://dnsmon.ripe.net>

“The strength of the Internet does not come from centralistic or hierarchical designs but from de-centralised and distributed design and engineering,” noted Karrenberg. “Operationally, the root servers are equal peers and client software can choose any one of them based on an estimate of which provides the best service to the client's location at the time.”

The strength of the root name server system lies in its diversity on all levels, a legacy of the late Jon Postel who oversaw its construction in the 1990s. “It is not a weakness but a strength of the system that servers are operated by a widely diverse group of organisations,” said Pawlik. “Measurements show that the current system is performing well,” he added. “It will be hard to introduce more central or hierarchical structures without substantially weakening the system as a whole.”

Further information about guidelines for hosting a K-root local node, along with information and statistics on the current production K-root global nodes, can be found on the K-root web site at:  
<http://k.root-servers.org> ■

## Address Supporting Organization (ASO) General Assembly Meeting

The fifth ASO General Assembly Meeting will be held on Wednesday, **5 May 2004** in Amsterdam, the Netherlands. This meeting will be hosted by the RIPE NCC alongside the RIPE 48 Meeting and will be open to all parties with an interest in ASO policy matters. A detailed meeting agenda will be published in due course on the ASO web site at:

<http://www.aso.icann.org>

The RIPE NCC is hosting the ASO Secretariat for 2004. ■

## RIPE NCC General Meeting

The RIPE NCC General Meeting (GM) is open to all members of the RIPE NCC. The GM enables the membership to openly discuss the performance of the RIPE NCC and the quality of the services that it provides to its members.

The next RIPE NCC General Meeting will be held alongside RIPE 48 on:

**Friday, 7 May 2004**

**14:00 -17:00 (CET)**

**Grand Hotel Krasnapolsky**

**Amsterdam, the Netherlands**

Information about the RIPE NCC General Meeting is available at:

<http://www.ripe.net/ripenncc/about/gm> ■

# The Internet Model - Stability Through Co-ordination and Consensus

The following article was a co-ordinated statement from the Regional Internet Registries released during the World Summit on Information Society (WSIS) process.

It is important that policy makers - both in the public and private sectors - have a sound understanding of how the Internet has developed and what has made this development so successful. Clear understanding of the unique way in which the Internet's technologies and resources are developed and co-ordinated will ensure the future stability, growth and global reach of the Internet.

The Internet has evolved in a way that ensures that no single entity is "in charge". Hundreds of different organisations and thousands of different companies make decisions every month that might affect how the Internet develops. Through this decentralised process, the companies that supply connectivity, services, computers, software, and content - along with the customers who purchase them and employ the network for their own purposes - are free to innovate, experiment, generate value, and benefit from the connectivity, information, and services that are available. More than any other communications medium, it is the users that define what the Internet is and what it will become.

The unprecedented growth and innovation that we have seen in the Internet sector is

due in large part to this lack of constraint on its technological development. In addition, the policy development and implementation processes employed have been open, transparent and inclusive, ensuring that both the public and private sector can contribute to the technical co-ordination of the Internet. These long-established, bottom-up industry self-regulatory processes have been encouraged and facilitated at national, regional and global levels by a range of private sector led organisations. These include the Internet Engineering Task Force (IETF), the Internet Society (ISOC), the Regional Internet Registries (RIRs) and the Internet Corporation for Assigned Names and Numbers (ICANN).

These organisations and groups share several common characteristics: they are open, independent, not-for-profit organisations that work together to meet the needs of the global Internet community. They facilitate direct participation by any interested party and ensure that the technical policies for allocating Internet resources (such as IP addresses and Autonomous System Numbers) are defined by those who require them for their operations. This self-regulation

has been the key to the successful growth and innovation of the Internet and is flexible enough to adapt to changing future needs.

These forums give governments the opportunity to work with the private sector and the Internet community. It is through the combined expertise of the business sector, technical experts, non-governmental organisations (NGOs), academics and professional associations that the stability, growth and global reach of the Internet can effectively be co-ordinated.

These well-tested mechanisms encompass the experience needed to accommodate the Internet's characteristics and operational necessities. We enthusiastically invite governments to actively participate in these well-established processes. Continued support of the decentralised, open, bottom-up innovation that has made the Internet the powerful, global tool that it is today will ensure the stability of the Internet tomorrow. ■



## Upcoming RIPE NCC Regional Meetings

The RIPE NCC Regional Meetings have been established as a new activity in 2004. Regional meetings are a chance to establish direct contact and enhance the dialogue between the RIPE NCC and its members, and will help us to provide more regional support to our membership.

Last year's RIPE NCC Regional Meeting in Dubai was very successful and feedback from attendees has been positive. There were a total of about 120 attendees, made up mainly of network operators from countries in the Middle East. The number of attendees and the range of countries represented were impressive. Feedback revealed that the meeting helped identify many issues that attendees had in common

and that the first-hand information given by the RIPE NCC and guest speakers was considered of great value. In addition, the meeting gave the RIPE NCC a much clearer impression of the IP networking issues specific to our members in the Middle East.

The next RIPE NCC Regional Meeting will be held in Moscow (Russia) in June 2004, and will include two days of presentations and discussions as well as a one-day seminar on Internet resource requests. The aim of this meeting is to develop local contact and support for members in this area, and to provide attendees with information about Internet resource allocation and Internet management issues relevant to them.

The second RIPE NCC Regional Meeting of 2004 aims to offer support to the African

region. The meeting is planned to take place in Nairobi (Kenya) in July 2004. While gathering input from our African membership regarding their operations, we also want to provide support for co-ordination efforts concerning the emerging Regional Internet Registry, AfriNIC.

We welcome input and feedback from our members in the relevant regions in order to tailor the regional meeting information to their interests. Please send your suggestions to <contact@ripe.net>.

For information about RIPE NCC Regional Meetings please visit:

<http://www.ripe.net/ripencc/regional-meetings/index.html> ■

# DataTAG - High Bandwidth, Long Distance. Where Is My Throughput?

Robin Tasker (r.tasker@dl.ac.uk), CCLRC, Daresbury Laboratory, Warrington, Cheshire, UK

## Introduction

The [DataTAG] transatlantic testbed is based on equipment and network funded jointly by the European Union (IST-2001-32459), the US National Science Foundation through the Electronic Visualisation Lab (EVL) at University of Illinois in Chicago (UIC) and the US Department of Energy (DoE) through the California Institute of Technology (Caltech).

The European project partners include CERN, INFN, INRIA, PPARC and the University of Amsterdam, while the US partners include Argonne, Caltech, Northwestern University, Starlight, the University of Michigan and UIC. There are in addition many other institutes and Laboratories that have collaborated closely with the project.

The testbed was established to create a large scale intercontinental Grid testbed involving the EDG project, several national projects in Europe, and related Grid projects in the USA and to investigate both advanced networking and Grid interoperability issues between these different Grid domains.

In this article we describe some of the work done on transport applications in support of end-to-end performance over high bandwidth, long delay networks typical of inter-continental connectivity. Some familiarity with Linux and the operation of [TCP] is assumed.

## Understanding the Problem

Many Grid-enabled computing applications wishing to transfer large volumes of data over wide area networks require high data rates in order to do so. However, such applications are rarely able to take full advantage of the high-capacity (>2.5 Gbit/s) networks installed today. Recent data [TCP-TD] showed that 90% of the bulk TCP flows used less than 5 Mbit/s, and that 99% used less than 20 Mbit/s. There are many issues that contribute to poor performance but from this data it is clear that over-provisioning is not in itself the solution.

On October 1, 2003, DataTAG set a new Internet2 Land Speed Record [LSR] by transferring 1.1 Terabytes of data in less than 30 minutes from Geneva to Chicago across the DataTAG testbed at an average rate of 5.44 Gbits/s using a single standard TCP stream. This shows that outstanding performance is possible if all the associated risks are correctly managed.

DataTAG has identified areas where it is possible to improve the end-to-end performance, and has specifically focused on the end-system and on TCP itself.

## Developing Solutions

### The End System

In DataTAG a methodology was developed to characterise end-system capability. For different combinations of motherboard, network interface card (NIC) and Linux Kernel, measurements

were made using the [UDPmon] tool to generate trains of UDP/IP frames with differing frame MTU and inter-frame spacing. UDP/IP frames were chosen for the tests as they are processed in a similar manner to TCP/IP frames, but are not subject to the flow control and congestion avoidance algorithm defined for the TCP protocol. The data collected are used to determine three indicators of performance,

- Latency which is a measure of round trip time (RTT) using Request-Response UDP frames;
- UDP Throughput based on the measurement at the receiver of streams of UDP packets transmitted at regular intervals; and
- Bus Activity measured directly on the PCI Bus

DataTAG has also produced a Technical Report [Kernel] which describes the structure and organization of the networking code of the Linux kernel including the main data structures, the sub-IP layer, the IP layer, and two transport layers: TCP and UDP.

### Transport Protocols - The Use of TCP

Standard TCP (TCP Reno) is designed to operate in the two distinct phases of slow start and congestion avoidance. The latter is of particular relevance to DataTAG where the combination of long distance and high bandwidth mitigates against good TCP performance.

TCP uses an algorithm known as Additive Increase, Multiplicative Decrease (AIMD) which adjusts the TCP congestion window (cwnd) such that for each acknowledgement received in a RTT **without loss**, the cwnd is increased thus,

$$cwnd \rightarrow cwnd + 1 / cwnd$$

and for each window experiencing loss, the cwnd is decreased thus,

$$cwnd \rightarrow cwnd - 1/2 * (cwnd)$$

The congestion control mechanism constrains the congestion windows that can be achieved by TCP. For example, for a standard TCP connection with 1500-byte packets and a 100 ms round-trip time, achieving a steady-state throughput of 10 Gbit/s would require an average cwnd of 83,333 segments, and a packet drop rate of at most one congestion event every 5,000,000,000 packet (or equivalently, at most one congestion event every 1 2/3 hours). This is not realistic.

There is a body of work [Floyd] that has examined how TCP may be improved to deliver the performance required under these conditions whilst retaining the notion of "fairness" of operation. DataTAG has developed implementations that attempt to address these problems and here we describe our work using High Speed TCP [Floyd] and Scalable TCP [Kelly].

High Speed TCP modifies AIMD parameters such that the cwnd increases more rapidly with larger cwnd and as a consequence returns to the 'optimal' cwnd size sooner for the network path; and

conversely decreases the cwnd less aggressively than standard TCP in order to alleviate the decrease in throughput.

Scalable TCP modifies the AIMD parameters such that there are fixed adjustments for the increase and decrease of cwnd such that the increase is greater, and the decrease on loss is less, than standard TCP.

Figure 1 compares the performance of standard TCP, High Speed TCP and Scalable TCP by measuring the throughput measured for a range of packet drop frequencies between end-systems located in Geneva and Chicago connected via the DataTAG testbed. It can be seen that both modified TCP stacks are able to perform far more effectively where realistic packet loss is an issue.

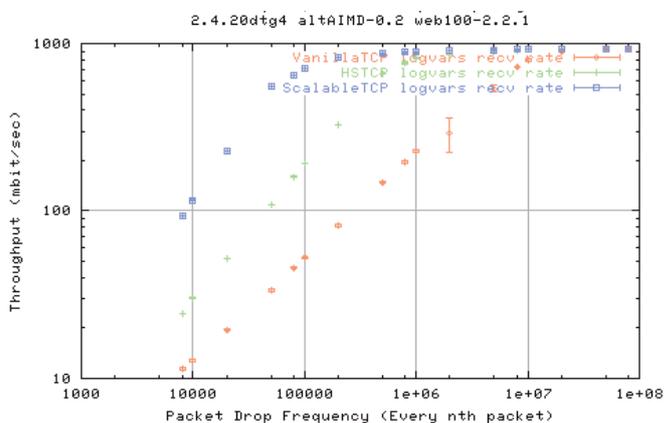


Figure 1 : TCP throughput measured as a function of packet drop frequency for standard, High Speed and Scalable TCP flows. The figure presents results derived from the DataTAG provision (a high bandwidth-high delay network) operating at 2.5 Gbits/s.

### User Applications

Whilst DataTAG has demonstrated that some real end-to-end performance improvements can be achieved through end-system and transport protocol improvements, it remains true that user applications can limit these gains. Figure 2 shows the measured throughput achieved using High Speed TCP for a single TCP connection, and a disk-to-disk transfer using respectively http-Get and GridFTP as the user application. The effect of the disk system can be clearly seen but more alarmingly the performance delivered is dramatically dependent upon the particular application in use.

### Conclusions

There are unfortunately no simple answers to the question, "High bandwidth, Long distance. Where is my throughput?". The answer is more prosaic; there are components on the end-to-end path that can be optimised for performance and there are those which are beyond a user's control. Certainly DataTAG has demonstrated that careful management of the accessible components that contribute to overall performance can make a significant difference and it is only by highlighting the complete set of issues involved progress can be made. ■

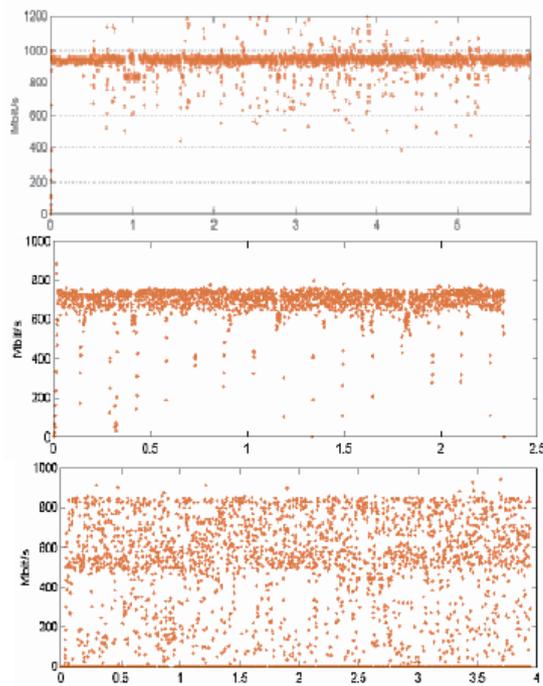


Figure 2 : Throughput measured using a single High Speed TCP connection (top), http-Get over High Speed TCP (middle) and GridFTP over High Speed TCP, all as a function of time

References	
DataTAG	<a href="http://www.datatag.org">http://www.datatag.org</a>
Floyd	1. HighSpeed TCP for Large Congestion Windows, Internet draft draft-floyd-tcp-highspeed-01.txt, work in progress, 2002. 2. Limited Slow-Start for TCP with Large Congestion Windows, Internet draft draft-floyd-tcp-slowstart-01.txt, work in progress, August 2002.
Kelly	1. On engineering a stable and scalable TCP variant, Cambridge University Engineering Department, Technical Report CUED/F-INFENG/TR.435, June 2002. 2. "Scalable TCP: Improving Performance in HighSpeed Wide Area Networks", ACM SIGCOMM Computer Communication Review, Vol. 33, No. 2, pp. 83-91, April 2003.
Kernel	<a href="http://datatag.web.cern.ch/datatag/papers/drafts/linux_kernel_map/">http://datatag.web.cern.ch/datatag/papers/drafts/linux_kernel_map/</a>
LSR	<a href="http://cern.ch/info/Press/PressReleases/Releases2003/PR15.03E-Speedrecord.html">http://cern.ch/info/Press/PressReleases/Releases2003/PR15.03E-Speedrecord.html</a>
TCP	Crowcroft and Phillips (2002), TCP/IP and Linux Protocol Implementation, Wiley
TCP-TD	A TCP Tuning Daemon (2002) Tom Dunigan, Oak Ridge National Laboratory (ORNL) thd@ornl.gov; Matt Mathis Pittsburgh Supercomputing Center (PSC) mathis@psc.edu; Brian Tierney Lawrence Berkeley National Laboratory (LBNL) ltierney@lbl.gov
UDPmon	R. Hughes-Jones A tool for investigating network performance. Writeup and tool available from <a href="http://www.hep.man.ac.uk/~rich/net">http://www.hep.man.ac.uk/~rich/net</a>

# AfriNIC Starts its Public Policy Development

Adiel Akplogan, AfriNIC Project Manager

AfriNIC is the emerging Regional Internet Registry for the African and Indian Ocean region. Incorporated in Mauritius, AfriNIC is in its transition process to get formal recognition from ICANN. In January 2004, AfriNIC launched a policy working group to put together the first set of policies for Internet resource allocation in the Africa Region.

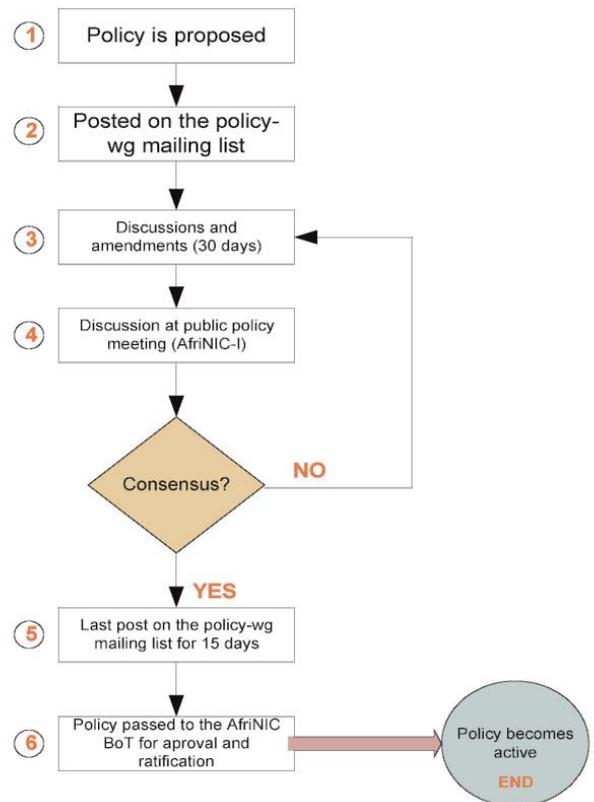
The policy working group has proposed a transitional Policies Development Process based on what is commonly used in the Internet community. This means that the policies are proposed and discussed by community and ratified by the board after a global consensus. Here is a step-by-step description of the process:

1. A policy is proposed (by anyone).
  2. It is posted to the AfriNIC policy-wg mailing list for discussion. (The policy-wg list will, from now onwards, be open to community at all times, and anyone can join the list for discussion).
  3. After at least 30 days of discussion and comments on the mailing list, the policy is brought to the public open policy (face to face) meeting for the community and members' endorsement through consensus. (The first meeting will be the AfriNIC-1 meeting in Dakar, Senegal, May 2004).
- \* Consensus is general agreement of the group and is not measured by a majority vote.
4. If there is consensus at the meeting, go to step 5, if not, back to step 3.
  5. A last call for comments on the policy will be announced on the policy-wg list. A period of 15 days will be given for the community to suggest any final changes and amendments.
  6. The Board of Trustees will then ratify and adopt the policy for use.

This process is subject to modification at any time by the community after a global consensus on the modification proposed and subject to ratification by the AfriNIC Board of Trustees.

You can participate in the AfriNIC policy discussions by subscribing to the discussion list: <policy-wg@afriNIC.org> (Subscription: <policy-wg-request@afriNIC.org> with "subscribe" in the subject or in the body of the e-mail).

AfriNIC is holding its first Public Policy Meeting (AfriNIC-1) in May 2004 in Dakar, Senegal. Registration will be opened shortly on the AfriNIC web site: [www.afriNIC.net](http://www.afriNIC.net). ■



## Inter-Domain Routing Workshop

The Inter-Domain Routing Workshop will take place at the RIPE NCC in Amsterdam 1 - 2 May 2004, the weekend before RIPE 48, which will also be held in Amsterdam.

The goal of the workshop is to bring together a focused group of operators, vendors and researchers to discuss important mid-term and long-term operational problems, as well as new academic ideas, in an open forum.

More information is available at: <http://www.tm.uka.de/idrws/>

If you have any questions or suggestions, please contact: <idrws@ripe.net>. ■

## New Rates for Test Traffic Measurements Service (TTM) Fee

From 2004, the rates for the TTM service fee have been reduced to €1000 per year for the first test box, and €500 per year for the second to ninth test box. At the same time, a new Acceptable Use Policy (AUP) for the TTM data was introduced (ripe-300).

More information about TTM is available at: <http://www.ripe.net/ttm/>

## Current Policy Developments in RIPE

### Consensus Reached on ripe-152 Status

At the RIPE 47 Meeting, the Address Policy Working Group reached a consensus to mark ripe-152 ("Charging by Local Internet Registries") as a historical document.

The Address Policy Working Group is considering the following issues:

### Policy development process

There is a need to have a clearly defined, documented process for policy issues. The Address Policy Working Group Chair will form a task force via the mailing list to write a policy development process proposal.

### Changing the 80% rule for IPv4 allocations

The Address Policy Working Group Chair will start a discussion on the mailing list.

### AfriNIC proposal for /22 minimum allocation size

The minimum allocation for African members of the RIPE NCC should be changed from /21 to /22 (from 196.200/13 block only). Final consensus for this will be sought on the mailing list.

### DENIC proposal for IPv4/IPv6 Anycast DNS Infrastructure Policy

The full description of the policy proposal is available at:

<http://www.ripe.net/ripe/meetings/ripe-47/presentations/ripe47-ap-anycast.pdf>

Further discussion will take place on the Address Policy Working Group mailing list to form a formal proposal.

To participate in these discussions, please e-mail: <[address-policy-wg@ripe.net](mailto:address-policy-wg@ripe.net)> ■

### New Routing Information Service (RIS) Locations

New route collectors were installed at the MIX (Milan) in November 2003 and NYIIX (New York) in February 2004. If your organisation is present at either location, then please contact the RIPE NCC at <[rispeerings@ripe.net](mailto:rispeerings@ripe.net)> to set up a peering session. The RIPE NCC is also interested in setting up peerings at any of the other RIS locations.

The RIPE NCC's Routing Information Service has gradually grown to over 300 IPv4 and IPv6 peers at eleven data collection points in Europe, Japan and North America. More information is available at:  
<http://www.ripe.net/ris/index.html>

## LIR Portal Version 2.0

The RIPE NCC LIR Portal was released in January 2003 to help reduce response time and improve communication with RIPE NCC members. The portal provides LIRs with increased and simplified access to the RIPE NCC via a customised web interface.

Since version 1.0 was released, the following features have been added:

- Allocation Editor, allowing users to modify allocation objects
- Public Key Infrastructure (PKI) authentication
- Functionality allowing all eight request forms to be completed and submitted directly through the portal
- An IPv4 PA assignment wizard that takes the user through the request steps one-by-one
- Multi LIR login, allowing users to switch between LIR accounts without logging out
- Custom content: notification of training courses within the LIR's country
- The ability to download registry data in XML format

Version 2.0 of the LIR Portal was released in December 2003. New features of the portal will continue to be added based on input from the membership.

At the end of 2003, there were 2,183 active LIR accounts and 4,296 user accounts. This is an average of almost two user accounts per LIR registered with the portal. ■

## The Number Resource Organization (NRO)

Formed by the Regional Internet Registries (RIRs) to formalise their cooperative efforts, the NRO exists to protect the unallocated Number Resource pool, to promote and protect the bottom up policy development process, and to act as a focal point for Internet community input into the RIR system.

The NRO has recently signed a Memorandum of Understanding (MoU) with AfriNIC. This MoU covers the provision of start-up funding from the NRO to cover the initial cost of setting up AfriNIC administratively and operationally.

The RIPE NCC is hosting the NRO Secretariat for 2004.

More information about the NRO is available at:  
<http://www.nro.org/>

## RIPE NCC Training Courses

### LIR Training Courses

London, United Kingdom  
Thursday, 1 April 2004

London, United Kingdom  
Friday, 2 April 2004

Amsterdam, the Netherlands  
Monday, 5 April 2004

Berlin, Germany  
Friday, 16 April 2004

Istanbul, Turkey  
Thursday, 22 April 2004

Amsterdam, the Netherlands  
Tuesday, 4 May 2004  
\* IP Tutorial RIPE 48 \*

Bratislava, Slovakia  
Thursday, 13 May 2004

Cairo, Egypt  
Monday, 24 May 2004

Paris, France  
Friday, 28 May 2004

Sofia, Bulgaria  
Thursday, 3 June 2004

Kiev, Ukraine  
Friday, 11 June 2004

Amsterdam, the Netherlands  
Friday, 18 June 2004

Stockholm, Sweden  
Wednesday, 23 June 2004

### Routing Registry Training Courses

Istanbul, Turkey  
Friday, 23 April 2004

Bratislava, Slovakia  
Friday, 14 May 2004

Stockholm, Sweden  
Thursday, 24 June 2004

### DNSSEC Training Courses

Sofia, Bulgaria  
Friday, 4 June 2004

## Conference Calendar

Conferences and meetings that may be of interest to RIPE NCC members:

### April 2004

ARIN XIII • Vancouver, BC/Canada  
<http://www.arin.net/ARIN-XIII/> • Sunday, 18 April - Wednesday, 21 April

PAM2004 • Antibes Juan-les-Pins/France  
<http://www.pam2004.org/> • Monday, 19 April - Tuesday, 20 April

### May 2004

IDRWS 2004 - Inter-Domain Routing Workshop • Amsterdam/the Netherlands  
<http://www.tm.uka.de/idrws/> • Saturday, 1 May - Sunday, 2 May

RIPE 48 • Amsterdam/the Netherlands  
<http://www.ripe.net/ripe/meetings/ripe-48/> • Monday, 3 May - Friday, 7 May

RIPE NCC General Meeting • Amsterdam/the Netherlands  
<http://www.ripe.net/ripencc/about/gm/> • Friday, 7 May

ITU TELECOM AFRICA 2004 • Cairo/Egypt  
<http://www.itu.int/AFRICA2004/> • Tuesday, 4 May - Saturday, 8 May

INET/IGC 2004 • Barcelona/Spain  
<http://www.isoc.org/inet04/> • Monday, 10 May - Friday, 14 May

ITU-T Study Group 2 • Geneva/Switzerland  
<http://www.itu.int/ITU-T/studygroups/com02/> • Tuesday, 18 May - Friday, 28 May

AfriNIC-I • Dakar/Senegal  
<http://www.afrinic.net/announcements.htm> • Sunday, 23 May - Monday, 24 May

### June 2004

TERENA NC • Rhodes/Greece  
<http://www.terena.nl/conferences/tnc2004/> • Monday, 7 June - Thursday, 10 June

RIPE NCC Regional Meeting • Moscow/Russia  
<http://www.ripe.net/ripencc/regional-meetings/> • Wednesday, 16 June - Friday, 18 June

CENTR (22nd GA) • Stockholm/Sweden  
<http://www.centri.org/ga.html> • Monday, 21 June - Tuesday, 22 June

ARIN Regional Meeting • Cape Town/South Africa  
<http://www.arin.net/> • Wednesday, 23 June - Thursday, 24 June

### July 2004

RIPE NCC Regional Meeting • Nairobi/Kenya  
<http://www.ripe.net/ripencc/regional-meetings/> • Date to be confirmed

ICANN • Kuala Lumpur/Malaysia  
<http://www.icann.org/> • Monday, 19 July - Friday, 23 July

### August 2004

IETF 60 • San Diego, CA/USA  
<http://www.ietf.org/> • Sunday, 1 August - Friday, 6 August

SIGCOMM 2004 • Portland, OR/USA  
<http://www.acm.org/sigs/sigcomm/sigcomm2004/> • Monday, 30 August - Friday, 3 September