Alternative Models for RIPE NCC Revenue & Charging 1997

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1. Scope & Process

This report describes the revenues that must be generated for operating the RIPE NCC in 1997. A number of alternative charging models are considered which can be used to generate the required revenues. These models are described in detail and the benefits and drawbacks of each are considered carefully, resulting in a recommendation for a charging model for 1997.

This document provides input for the deliberations of the RIPE NCC contributors committee. The revenue figures and a particular charging model are expected to be decided at the contributors committee meeting on September 11th, 1996. After that meeting the revenue and charging model chosen will be described in a separate document, to be submitted to TERENA for formal endorsement as the charging mechanism to be implemented in 1997. This document will remain unchanged, providing documentation and background of the models researched.

Related Documents

The companion document "RIPE NCC Activities & Expenditures 1997" (ripe-act), describes the activities to be undertaken with these revenues.

2. Introduction

The services provided by the RIPE NCC are funded by those ISPs which operate a local Internet Registry serviced by the RIPE NCC. Together, representatives of the local IRs make up the RIPE NCC contributor's committee.

During the annual meeting of the RIPE NCC contributors in September 1995, the charging model described in "RIPE NCC Revenue & Charging 1996" (ripe-134) was formally endorsed. Simultaneously, the RIPE NCC was requested to investigate the possibility of implementing a more usage based charging system in 1997 (see ripe-132).

In this document, we describe a number of alternative charging models that were investigated as part of a study performed at the RIPE NCC in the first half of 1996. The study was split in two parts and performed by MBA students as master's theses projects.

In the first part of the project, it was determined that because the RIPE NCC is a non-profit service organisation, it should charge for its services based on a "cost +" scheme. The revenues received must pay for the costs of the services rendered (cost), and provide stability should the circumstances in which the organisation operates need to change significantly, or should some unforeseen disaster take place (plus).

Because the RIPE NCC is a service organisation which has activities at its heart, it was determined that the most suitable mechanism for investigating the cost of services is *Activity Based Costing* (ABC). The second part of the project therefore consisted of an ABC study into the services performed at the RIPE NCC.

In addition to determining the actual costs of specific services, charges required to cover the "plus" factor must be determined. In Section 3, we consider the issues which effect the stability of the RIPE NCC, and therefore determine what the "plus" factor should be. In Section 4, we turn our attention to the categorisation of services performed at the RIPE NCC which enables us to define and evaluate a number of charging models in Section 5. Finally, in Section 6, we argue for a given charging model, based on fairness, ease of implementation, the degree to which it will enable long term stability for the RIPE NCC, and to which it will encourage the application of global address space policies.

3. The "Plus" Factor

Each organisation needs a different level of reserves to guarantee long term stability, and each organisation has different liabilities that need to be covered. It is the earning of revenues beyond the costs of operations, i.e. the "+" that enables an organisation to build up necessary reserves and cover its liabilities. The level of "+" that must be earned in a given year, is determined by the current and the target level of reserves, and the time frame in which the target level must be reached.

To guarantee the long term stability of the RIPE NCC, it must be possible to quickly respond to changing requirements. To this end, a half year's operating costs will be needed. Because the RIPE NCC is growing at such a rapid pace, the precise figure must be updated annually to reflect the changes in operating costs.

The liabilities which make up the second aspect of the "+", consist of two distinct elements. The first is one year's salary for each RIPE NCC employee. This is in keeping with standard Dutch employment regulations. Again, as with the operating costs, the precise figure must be adjusted annually. The second liability that needs to be covered are taxes owed from the years prior to 1996. The accumulated profit over this period, which consists mainly of the profits from 1995 has not yet been declared as taxable income. This is a new occurrence and is presently receiving our full attention. We expect this to be resolved with the Dutch tax office in the short term. We currently expect the owed taxes and a possible fine will have to be paid. To cover the worst case, we must reserve kECU 232 to cover this tax liability.

The third and final aspect of the "+" is the time frame over which the reserves and the liabilities should be built. For the RIPE NCC, we consider a two year time frame to be applicable. During a longer period circumstances can change dramatically, thereby rendering the argued for "+" levels obsolete, whereas a period shorter than two years makes contributors pay too much for long term stability from which future contributors will also benefit, and should therefore contribute to.

The "+" figures for 1997, derived according to the above arguments are given in Table 1 below.

1997 "+" Figures	
Purpose	kECU
Half year operating costs	996
One year salary costs	1377
Tax Reserves	232
Total "+" to be earned	2605
Reserve build up (2 years)	
Reserves expected at start 1997	958
"+" to be earned per year	823
Tax to be paid per year	443
"+" to be earned per year	1267

Table 1: The "+" Figures for 1997

4. The "Cost" Factor

In order to evaluate various "cost +" charging models for the RIPE NCC, a study was performed to investigate the actual cost of the services provided by the RIPE NCC during the 1996 calendar year. One of the key reasons to investigate a new charging model is to associate the cost of providing services to the amount actually paid for them.

In that study, the services performed by the RIPE NCC have been categorised into one of three areas, namely, (1) services for new registries, (2) ISP coordination services, and (3) registration services. Each of these categories are described in more detail below.

As described in the companion document "RIPE NCC Activities & Expenditures 1997" (ripe-act), the total costs for the RIPE NCC for services provided in 1997 are approximately 1990 kECU. (The amount will fluctuate slightly depending on the charging model used.) The revenue that must be generated in 1997 is therefore given by 1267 kECU "+" and 1990 kECU (cost), which brings the total required revenue to 3260 kECU.

Before we describe the RIPE NCC services, a short word about terminology: The term "service" as used here differs from the term "activity" used in ripe-act, in that a service is a clearly measurable item that can be obtained from the RIPE NCC. For example, holding a training course for the staff of local IRs is a clearly measurable service. Likewise performing a reverse delegation is a distinct service. Many activities, however, may be associated with performing each distinct service.

4.1. Services for New Registries

New registries need services which differ from those required by existing registries. For example, they require initial support from administrative staff at the RIPE NCC in order to find out what they need to read and how to set up a registry. Documentation is produced at the RIPE NCC aimed to assist new local IRs in understanding the Internet registry system and their role in it. In this sense new registries incur extra documentation costs. In addition to remote help, courses for new local IRs are held in order to facilitate the future working relationship between the RIPE NCC and the new registry. These courses, held both in the Netherlands and elsewhere in Europe, consume management, administrative and trainer time.

4.2. Coordination Services

The activities grouped in this area are quite diverse. However, they share a common purpose: to support the coherent operation of the Internet in the RIPE NCC service area. As such, the majority of these services are of a technical nature, such as RIPE database software maintenance and development, DNS quality monitoring, etc., and therefore require engineering time. The information services provided by the RIPE NCC also fall in this category, and consume both administrative and engineering time. Coordination services are accessible to the general Internet public, as is necessary if they are to be effective. RIPE NCC contributors, however, always receive precedence when special support is needed.

4.3. Registration Services

These are services directly related to the RIPE NCC's role as the Regional Internet Registry for Europe and the surrounding areas. Handling of requests for assignment or allocation of IP address space, management of reverse domains associated with this address space as well as auditing and quality control to ensure fair and expedient processing of requests all fall into this service category. In general, these services consume hostmaster time. However, engineering time is also required to (partially) automate these services in order to make them both scalable and auditable. Registration services are accessible only to local IRs that contribute to the funding of the NCC.

5. Charging Models

The three distinct services that the RIPE NCC provides will be charged for separately, though they will be compiled into one final charge for each individual registry. The differing methodologies possible for charging for each of the services has led to the creation of three different charging models; hereafter known as model 1, model 2, and model 3. Model 1 is similar to the flat fee charging system currently in use. Model 2 is a detailed usage-based charging system, and model 3 is a system in which charges are levied based in part on the amount of address space held by a registry. All of the models charge for new registry services and coordination services in the same way, notwithstanding minor variations due to differing overheads. The key difference between the models is the way that registration services are charged for.

For all models a sign up fee is charged which will cover the cost of providing services to a new registry. For 1997, the sign-up fee will remain 2000 ECU, as discussed in Section 5.1.

In model 1 a combined flat subscription fee will be charged for the provision of coordination services and registration services. This subscription fee will differ according to the size of the registry. The fee for a large registry is 7000 ECU; for a medium registry, 4550 ECU; and for a small or enterprise registry, 2550 ECU. A more detailed description of model 1 is given in Section 5.2.

Model 1 RIPE NCC Fees for 1997	
Registry Size	ECU
Large	7000
Medium	4550
Small	2550
Enterprise	2550

Table 2: Model 1 Fees for 1997

In models 2 and 3, a subscription fee is charged for coordination services and is stratified according to the size of the registry. The charges will be 5800 ECU for a large registry, 3350 ECU for a medium registry, and 1350 ECU for a small registry. These charges will be justified in detail in Section 5.3.

In model 2, the variable fee charged for registration services is based on the number of each request type sent in by a registry, and the inherent costs that a request incurs. This charge is therefore different for all registries. However, the charges per service are detailed in Section 5.4.1, and the resulting fees for some example registries are given in Appendix B.

The variable fee for registration services in model 3 is based on the amount of address space held by a registry, as well as the length of time the registry has held the address space. The fees are based on the assumption that the more (and newer) address space held by a local IR, the greater the workload it generates for the RIPE NCC. As with model 2 the fee differs per local IR. The detailed charges are described in Section 5.4.2., with the charges for example registries being compared with those for model 2 in Appendix B.

In Table 3, we present a summary of the charging models 2 and 3.

Models 2 & 3 - Fees for 1997			
	Subscription	Variable	
Registry Size	ECU	Model 2	Model 3
Large	5800	service fee	allocation fee
Medium	3350	service fee	allocation fee
Small	1350	service fee	allocation fee
Enterprise	1350	service fee	allocation fee

Table 3: Model 2 & 3 Fees for 1997: Variable service charges in Model 2 are outlined in Table 4, and variable allocation charges in Model 3 are outlined in Table 5.

All subscription fees are to be paid annually in advance. A registry who joins part way through a year will pay only for the quarter in which they join and all subsequent quarters, with each quarter carrying one fourth of the annual charge. Variable fees are to be paid quarterly in arrears after receipt of an invoice from the RIPE NCC. A *Supernational* registry will be billed as a multiple large registry with the same conditions as in 1996 (see ripe-134).

5.1. Sign-up Fees

The cost of supporting new registries in 1996 and that forecasted for 1997 is detailed in Table A.1 in Appendix A.

Since 1995, the charge for setting up a new local IR has been fixed at 2000 ECU. This price both covers the cost of setting up a new registry, and discourages those not serious about performing local registry services from starting up. This is essential in preventing address space wastage and fragmentation, and therefore directly benefits the conservation and aggregation aims of the registry system. Since this fee has proven successful and has never raised complaints among the contributors, we propose to keep the sign-up fee of 2000 ECU in 1997, though the actual costs will be reduced. Doing so will produce a contribution of about 490 kECU towards the "+" required for 1997 (see Table A.2 in Appendix A).

5.2. Model 1 - Flat Fee Based

As mentioned at the start of Section 5, a combined flat fee for coordination and registration services is charged using model 1. Charges for coordination services are the same for models 1, 2 and 3, and amount to 5800 ECU for a large registry, 3350 ECU for a medium registry, and 1350 ECU for small and enterprise registries. These charges are described in detail in Section 5.3.

Added to the coordination services fee is the charge for registration services. In this model, this is a flat fee and is independent of the actual use that is made of registration services. The fee is the same for all registries irrespective of size, because in the study performed on usage-based costing, it was determined that the level of service required by a registry does not depend on its size.

Because registration services are charged for based on their cost, the charge for 1997 will be approximately 1200 ECU per registry, resulting in total charges of 7000 ECU, 4550 ECU, 2550 ECU and 2550 ECU for large, medium, small and enterprise registries respectively.

The advantages that this charging model offers are:

- Each local IR knows in advance what its charges for 1997 will be.
- Administrative costs for the RIPE NCC are lower than with the other models.

- The charges are not service dependent which encourages local IRs to request services as needed, and not to circumvent the system to avoid paying extra fees.

A key disadvantage of this charging model is:

- It is not a fair way of splitting the RIPE NCC costs as some registries incur more costs than others, resulting in a degree of cross-subsidisation.

5.3. Subscription Fees

Because the coordination services, as detailed in ripe-act are agreed to by all contributing local IRs on an equal basis, the costs for those services should be shared among the contributors on an equal basis. The costs for these services during 1997 will be about 875 ECU per local IR (as detailed in Table A.3 in Appendix A).

As will be discussed in Section 5.4, the fees for registration services should be kept at an absolute minimum. Therefore, the "+" described in Section 3 must be retrieved from the sign-up fees together with the subscription fees for coordination services, which means the remaining "+" for 1997 must be earned from coordination services. ,LP We propose, however, that this remaining plus not be earned from all local IRs on an even basis. As with the charging model applied in 1995 and 1996, a weighting system will be applied so that large registries pay a proportional amount more than mediums which in turn pay more than smalls. Using this system, large, medium, small and enterprise registries will pay roughly 5800, 3350, 1350 and 1350 ECU respectively for coordination services in 1997. Details are shown in Table A.4 in Appendix A.

5.4. Variable Fees

In this section, we describe two alternative models for variable charging for registration services. They both share the property with model 1 that the revenues they generate cover only the costs of registration services. This is to encourage use of these services as needed, in order to further the aims of the Internet Registry system.

Model 2 is a detailed usage-based charging system, and model 3 introduces charges based on the amount and the age of address space held by each registry.

5.4.1. Variable Fees - Model 2

This model is a detailed usage based charging system. In this model, registries pay for exactly those services they receive and thus there is no cross-subsidisation of registration services as may occur with Model 1. The exact costs were derived from the study on usage-based costing and the forecast budget for 1997. The charges to be set for an individual registration activity will be no more or less than the cost of that activity. In this way charges for registration services will be kept as low as possible thereby negating (to the extent possible), the tendency for registries to alter their registration policies in order to save money. However, the tendency to avoid using services to avoid paying for them will surely arise, and may lead to practices that conflict with global Internet registry policies.

Table 4 shows the individual charges for registration activities forecast for 1997.

Model 2 - 1997 Registration Service Fees	
Service	ECU
Initial Request	123
Assignment Window Exceeded	91
PI Assignment	98
Address Allocation	84
AS Number Assignment	68
Reverse Delegation	33

Table A.4: Charges for registration services if Model 2 is applied.

An advantage that this charging model offers is:

- It is a fair usage-based model that prevents cross-subsidisation.

Some disadvantages that are found with this model are:

- It will encourage avoidance of useful registration services.
- It may encourage practices that conflict with Internet registry policies.
- It is difficult for registries to forecast exactly what their charges for the forthcoming year will be.
- The administrative overhead to maintain this model is higher than for the other two models.

5.4.2. Variable Fees - Model 3

Charging based on this model is based on the amount of address space allocated to a registry and the time it was allocated. Because the primary activities performed in registration services are controlling and evaluating past and proposed address space usage, the amount of work generated by a specific local IR depends on the amount of address space that has been allocated to it, and the time the allocations were made. In other words, the more address space a registry has, and the more recently it has been acquired, the more work it will generate for the RIPE NCC.

In order not to penalise those registries who have in the past received address space not knowing registration thereof could eventually be charged for, a weighted scale of charging will be used. The result of this scale is that the charge for an address becomes progressively more expensive as the date of allocation nears the present day. This also reflects the work level. Old allocations generate less work for registration services than new ones do. The mathematical model used to calculate the figures for this charging model is described in Appendix C.

To maximise fairness, without introducing monthly charges, charging for address space will be carried out per quarter. Finally to minimise the potential side effects this model might have on aggregation, the charges will be accompanied by a small per allocation request fee of 200 ECU. This is sufficient to discourage registries from repetitively taking smaller allocations than actually needed to minimise registration costs (which would be bad for aggregation). The resulting income reduces the charges per quarter for address space held.

For an indication of the charges that would be levied, see Table 5, which shows the prices that would be charged per quarter in 1997 for a /16 that was allocated at a given time. (Note that the charges for a /17, /18, and /19 can be computed by dividing by 2, 4, and 8 respectively.) Please note that these are draft figures and that the actual prices will be about 10% lower, and will include minimal charges for address space acquired before 1994.

Charges for a /16				
Acquired in	To be paid in			
Quarter	1997-1	1997-2	1997-3	1997-4
1994-1	42.21	29.96	21.66	16.07
1994-2	84.42	59.92	43.33	32.15
1994-3	126.63	89.88	64.99	48.22
1994-4	168.84	119.84	86.66	64.29
1995-1	211.04	149.79	108.32	80.37
1995-2	253.25	179.75	129.98	96.44
1995-3	295.46	209.71	151.65	112.51
1995-4	337.67	239.67	173.31	128.59
1996-1	379.88	269.63	194.98	144.66
1996-2	422.09	299.59	216.64	160.73
1996-3	464.30	329.55	238.30	176.81
1996-4	506.51	359.51	259.97	192.88
1997-1	548.72	389.46	281.63	208.95
1997-2	0.00	419.42	303.29	225.02
1997-3	0.00	0.00	324.96	241.10
1997-4	0.00	0.00	0.00	257.17

Table 5: Example allocation charges based on the model in Appendix C - actual charges will be about 10% lower.

From Table 5 it becomes apparent that the overall price per address unit goes down over time. This is due to the economies of scale obtained by stable costs and a rapid increase in the allocation of address space.

The advantages of this model are:

- It encourages conservation because it is cheaper for registries to wait on requesting address space and to maximise usage of their allocations.
- It is a fair usage based charging model.
- It improves the stability of the RIPE NCC, because the revenue generated does not depend directly on the number of registries.

The disadvantages that this model has are:

- It has an increased administrative overhead in comparison to model 1 (but which is much lower than model 2).

- Registries do not know exactly what their charges in the forthcoming year will be.

6. Recommendation

Because the revenue generated with model 3 does not depend directly on the number of local IRs serviced, it improves the long term stability of the RIPE NCC. Although the number of local IRs has grown at an exponential rate in the last two years, it is not known how long this expansion will continue, or whether a consolidation may occur at some point. A charging model in which the income of the RIPE NCC depends directly on the number of registries, will leave the RIPE NCC unstable in case of market changes, and for this reason, we prefer model 3 in comparison to model 1.

Moreover, with model 3, the registration service fees paid by a local IR are determined in part by the rate that it distributes address space. This is by far the most objective measure that can be used to evaluate the usage rate of a local IR. As such this model is extremely fair.

We strongly recommend that Model 2 **not** be applied. Whereas it may be considered fair in that it applies strict measures of service usage, it has a number of essential disadvantages. Implementation of model 2 would probably encourage registries to carry out practices which conflict with global Internet address registration policies. This would be detrimental to the fair, efficient, and co-operative registration system that now exists. In fact, it threatens the very aims the Internet registry system was implemented to uphold.

Both in terms of stability and fairness, model 3 is to be preferred in comparison to model 1. Meanwhile, model 2 may endanger the Internet registry system. For these reasons, we recommend that model 3, allocation based charging be implemented for the RIPE NCC in 1997. However, because model 1 is easy to administer and has proven to work in the past, we consider this to be an acceptable alternative for 1997.

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Appendix A: Charging Details

Note that in all tables, the forecast figures for 1997 differ depending on the charging model chosen. This is because the administrative overhead introduced effects all charges.

New Registry Services Costs					
Activity	Cost per	1996	1997 Model 1	Model 2	Model 3
Initial contact	new local IR	244	139	139	139
Local IR course	attendee	544	293	296	295
Total	2 attendees + contact	1332	725	731	729

Table A.1: New Registry Services Costs with costs for 1996 based on model 2 only.

Revenue Earned with Start Up Fees			
	Cost ECU	Charged ECU	Total "+" earned in 1997 KECU
Model 1	725	2000	489
Model 2	731	2000	487
Model 3	729	2000	488

Table A.2: 1997 revenue to be earned with start up fees

Coordination Services Costs per Local IR		
Activity	Cost 1996 ECU	Cost 1997 ECU
Model 1	384	868
Model 2	384	875
Model 3	384	871

Table A.3: Coordination services costs per local IR, with costs for 1996 based on charging model 2.

Coordination Services Charges			
	Cost ECU	Plus ECU	Total ECU
Model 1			
Large	868	4826	5694
Medium	868	2413	3281
Small	868	483	1351
Enterprise	868	483	1351
Model 2			
Large	875	4959	5833
Medium	875	2479	3354
Small	875	496	1371
Enterprise	875	496	1371
Model 3			
Large	871	4892	5764
Medium	871	2446	3317
Small	871	489	1361
Enterprise	871	489	1361

Table A.4: Charges to be levied for coordination services in 1997.

Appendix B: Charging Examples

RIPE NCC Charging Examples					
				1996	
Registry	Size	Current	Model 1	Model 2	Model 3
		ECU	ECU	ECU	ECU
A	small	1500	2550	3839	2401
B	small	1500	2550	3849	1611
C	small	1500	2550	2031	1474
D	medium	4500	4550	3994	5658
E	medium	4500	4550	5151	5404
F	medium	4500	4550	4386	3460
G	large	8500	7000	6496	6679
H	large	8500	7000	6291	8616
I	large	8500	7000	10221	8218

Table B.1: Charges resulting from the alternative methods for example registries.

Appendix C: Computing the Charges for Model 3

In this appendix, we summarize the mathematical model which lead to the allocation based registration charges presented for model 3 in Section 5.4.2.

Let

n be the number of the quarter since the start of 1994 (so 1 ˜ Quarter 1 of 1994, and 13 ˜ Quarter 1 of 1997);

$A(n)$ be the amount of address space allocated in Quarter n;

$A(0)$ be the amount of address space allocated before January 1, 1994; and let

$T(n)$ be the total amount of address space allocated during or before Quarter n, so

$$T(n) = \sum_{i=0}^{n} A(i)$$

Note that $A(n)$ has been estimated for $11 \le n \le 16$ (e.g. Q3,1996 - Q4,1997) based on current trends in address space allocations. The values are determined based on the following measure of acceleration in address space allocations.

Let

$$A'(n) = A(n) - A(n-1)$$

and

$$A''(n) = A'(n) - A'(n-1)$$

for $n > 1$, then the expected amount of address space to be used in Quarter $n + 1$ is given by

$$A(n+1) = A(n) + A'(n) + A''(n).$$

Based on these estimates for $A(n)$, we also have expected values for $T(n)$ for $11 \le n \le 16$.

Now, let

$R(n)$ be the amount of revenue that must be earned in Quarter n.

Given this information, we could simply introduce a flat IP address registration charge defined by

$$C_n = \frac{R(n)}{T(n)} .$$

A local IR that has been allocated a total $L(n)$ during or before Quarter n would then pay $C_n L(n)$.

As stated in Sections 5.4.2, however, the work generated by a local IR depends not only on how much address space has been allocated to it, but also on how recently. In other words, while address space allocated to a local IR in the distant past still generates work in terms of database maintenance and reverse delegations, address space assignment approvals and audits are rarely required.

For this reason, we introduce a weighted charging for address space, so that the amount a local IR pays for registration services decreases as the age of the address space they hold increases. First, let

D_n be a constant which determines the address space registration fees in Quarter n (the value of which will be derived below).

To determine the charges for address space in each quarter, we must find a set of weights w_i for $0 \le i \le n$ such that:

$$0 < w_0 < w_1 < w_2 < \cdots < w_{n,}$$

$$R(n) = D_n \sum_{i=0}^{n} w_i A(i),$$

and

$$\sum_{i=0}^{n} w_i = 1$$

Because

$$\sum_{i=0}^{n}(i+1) = \frac{(n+1)(n+2)}{2} ,$$

the following definition for the weights w_i satisfy all three properties:

$$w_i = \frac{2(i+1)}{(n+1)(n+2)} ,$$

if the quarterly charging constant D_n is defined by

$$D_n = \frac{R(n)}{\sum_{i=0}^{n} w_i A(i)} .$$

Using these expressions for w_i and D_n, the required revenues will be generated with the weighted charging fee defined below.

In Quarter n, a local IR that obtained an allocation $a(i)$ in Quarter i, will pay a registration fee of

$$C(i,n) = a(i) w_i D_n$$

for that allocation.

The total registration fees for the local IR in Quarter n will therefore be given by:

$$C(n) = \sum_{i=0}^{n} C(i,n) = D_n \sum_{i=0}^{n} w_i a(i).$$