

Resource Transfer in the Global RPKI

Randy Bush – 2007.12.08

Abstract

Transfer of actual address space and/or autonomous system number resources between two internet registries (ISPs, RIRs, NIRs, etc.) is reasonably achievable for most useful operational needs. In this paper, we describe, at a high level, how this may be accomplished.

Terms

An *Internet Registry (IR)* is the IANA, an RIR, an NIR, an LIR, an ISP, or an end site which may hold IP resources and is the subject of one or more certificates using RFC 3779 extensions.

Seller and *Buyer* are used to describe the end parties to a transfer, the selling IR transferring the resource to the buying IR. For the purposes of this document, the terms *seller* and *buyer* are used, although layer nine considerations may require less commercial formal roles.

Transfer is the sale and corresponding purchase of literal address space or autonomous system numbers between two parties. The seller relinquishing some amount of resource and the buyer being allocated a similar amount but not the same literal address space, is not a transfer, and is not further considered here.

The *Swing Point* is the IR at the lowest point in the RPKI hierarchy which the seller and buyer have as a common parent and which has agreed to be used as the agent of transfer.

A Simple Case

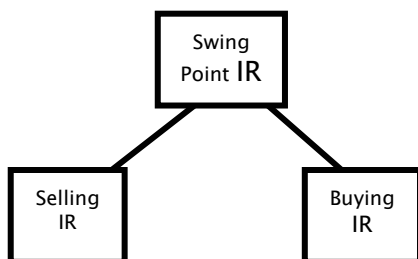


Figure 1 – Simple Relationship

As a formal business relationship between all parties to a transfer provides a level of trust which allows simple transactions, we first consider the simple case where the seller and the buyer are both directly known to the swing point, see Figure 1.

The transfer is done in the following steps (see Figure 2):

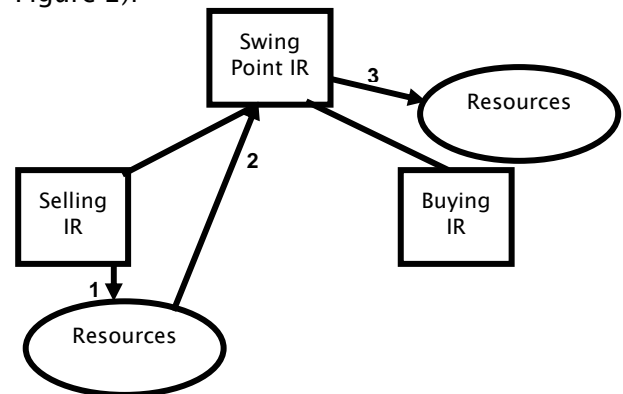


Figure 2 – Simple Transfer

1. The seller creates a certificate describing the subset of the seller's resources which are to be transferred.
2. The seller tells the swing point that it wishes to transfer the resources described by the certificate to the buyer
3. The swing point issues a new expanded certificate to the buyer describing the buyer's old holdings plus the new resources.
4. When the seller and the buyer are comfortable that both the technical aspects (customers swung, routing

done, etc.) and the business aspects of the transfer have been accomplished, they inform the swing point which then shrinks the seller's resource certificate, removing the transferred resources.

The Torn Euro Protocol

Due to issues of cancellation, renegeing, and fraud, step 4 above, where the seller and the buyer tell the swing point that the deal is done, needs to be formal in some fashion. For this purpose, we envision a yet to be described *torn Euro protocol*, where the buyer and the seller each hold one half of a virtual torn Euro note, and the swing point believes the transaction to be complete when it has received both halves and they match.

This protocol has yet to be described, and Steve Kent has taken on the task of looking for an existing simple example that can be borrowed for the purpose.

A More Complex Case

What happens when the seller is not a direct customer of the swing point, see Figure 3.

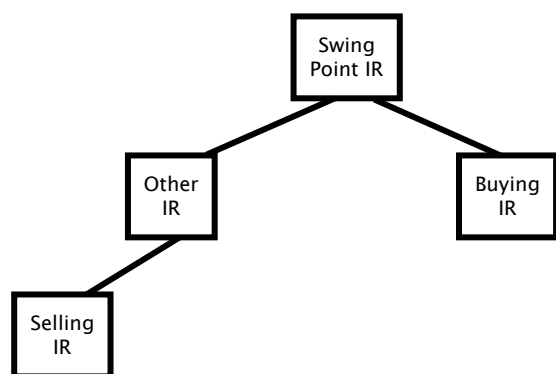


Figure 3 – Seller is Grandchild of Swing Point

The swing point needs to be assured that it is contractually able to move the resource given its relationship to the Other IR. As RFC 3779 extensions do not codify business issues such as PI/PA, and rights to resell, this has to be handled out of band, there is no way to

automate it. But this is part of today's IR address space management process and will continue to be handled manually.

Therefore the process is the same as for the simple case, except that, before issuing the expanded certificate to the buyer in step 3, the swing point must assure itself that policy and contractual issues are cleared. It might be well-advised to contact the intermediate IR and gain its consent, possibly with the assistance of the seller. The bottom line is that the swing point does own/control the resource being transferred, and therefore has the prerogative to act within its perception of the liabilities it is incurring.

This freedom allowing the seller to be indirectly related to the swing point may be induced to more levels of indirection. It is the swing point's obligation to perform diligence on the iterative financial, contractual, and policy obligations of the relationships down to the seller. Unfortunately, the RPKI can not automate this.

The Indirect Buyer

The case where the buyer is not directly known to the swing point is more difficult. Among other issues, the buyer may not be an existing resource holder at all, i.e. there may be no path down from the IANA root to the buyer. In this case, the buyer must explore the graph and choose an IR with which to contract a relationship. This can be both a business issue and a policy issue, e.g. can a buyer in Asia choose a parent which is, directly or indirectly, an ARIN customer?

The case where the buyer contracts directly to become a customer of the swing point has been explored above. What if the buyer becomes a grandchild of the swing point, as in figure 4?

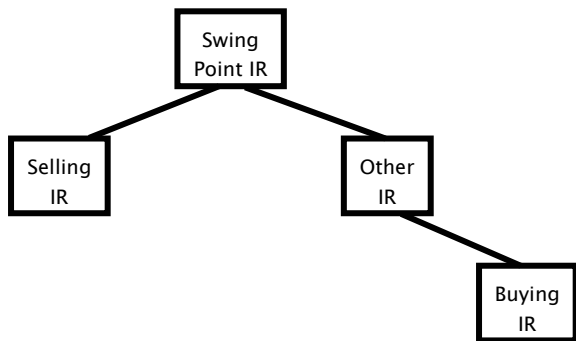


Figure 4 – The Indirect Buyer

Somewhat analogously to the case of the indirect seller, the swing point has to iteratively verify that the IRs between it and the buyer are all willing to contractually and technically accept the resource(s) to be allocated to the buyer. But, in the case of the indirect buyer, the iterative conditions are much stronger. In the indirect seller case, the swing point has contractual control of the chain between it and the seller. In the case of the indirect buyer, all intermediate IRs between the swing point and the buyer must give business and technical consent. The swing point can not force its child to issue a resource certificate to the buyer.

Things may not be as bad as they appear at first blush. The buyer is actually contracting to its parent, and part of that contract will presumably be that the parent agrees to issue the resource certificate to the buyer when it receives the resource from its parent. And this presumably applies to the buyer's parent's relationship to a grandparent and so forth. On the other hand, the swing point has no mechanical way to test the willingness of the IRs on the buyer's indirect chain. But the swing point can know when the buyer is happy that it has received the resources, as the buyer will give it the buyer's half of the torn Euro.

The Difference Between Buyer and Seller Chain

Essentially, the difference between an indirect buyer chain and an indirect seller chain is that

the swing point has the logical, though maybe not contractual, prerogative to pull address space from the seller's chain, but does not have the power to push it down the buyer's chain. All IRs on the buyer's chain must agree to certify downward toward the buyer.

Conclusion

While there is no automated method for the RPKI to assist the parties to a transaction in determining that all business and policy aspects of a transaction are satisfied, these layer eight and nine issues can be resolved using normal manual business practices. The RPKI, assisted by the torn Euro protocol, can provide the mechanisms to safely conduct the actual certified transfer of the resources.

Undoubtedly, there are complex cases which can not be handled by resource transfer as described in this paper. The goal here has been to find the simple cases which can be handled, and not attempt to boil the ocean. We believe that the majority of useful and needed operational cases can be handled.

Ettore Bugatti, maker of the finest cars of his day, was once asked why his cars had less than perfect brakes. He replied something like, "Any fool can make a car stop. It takes a genius to make a car go."

Acknowledgements

Clearly this has yet to be worked out at a formal detailed level. But operational folk from AfriNIC, APNIC, ARIN, and RIPE, were kind and polite enough to review it at the Vancouver meeting.