draft-ietf-sidr-rpki-validation-reconsidered

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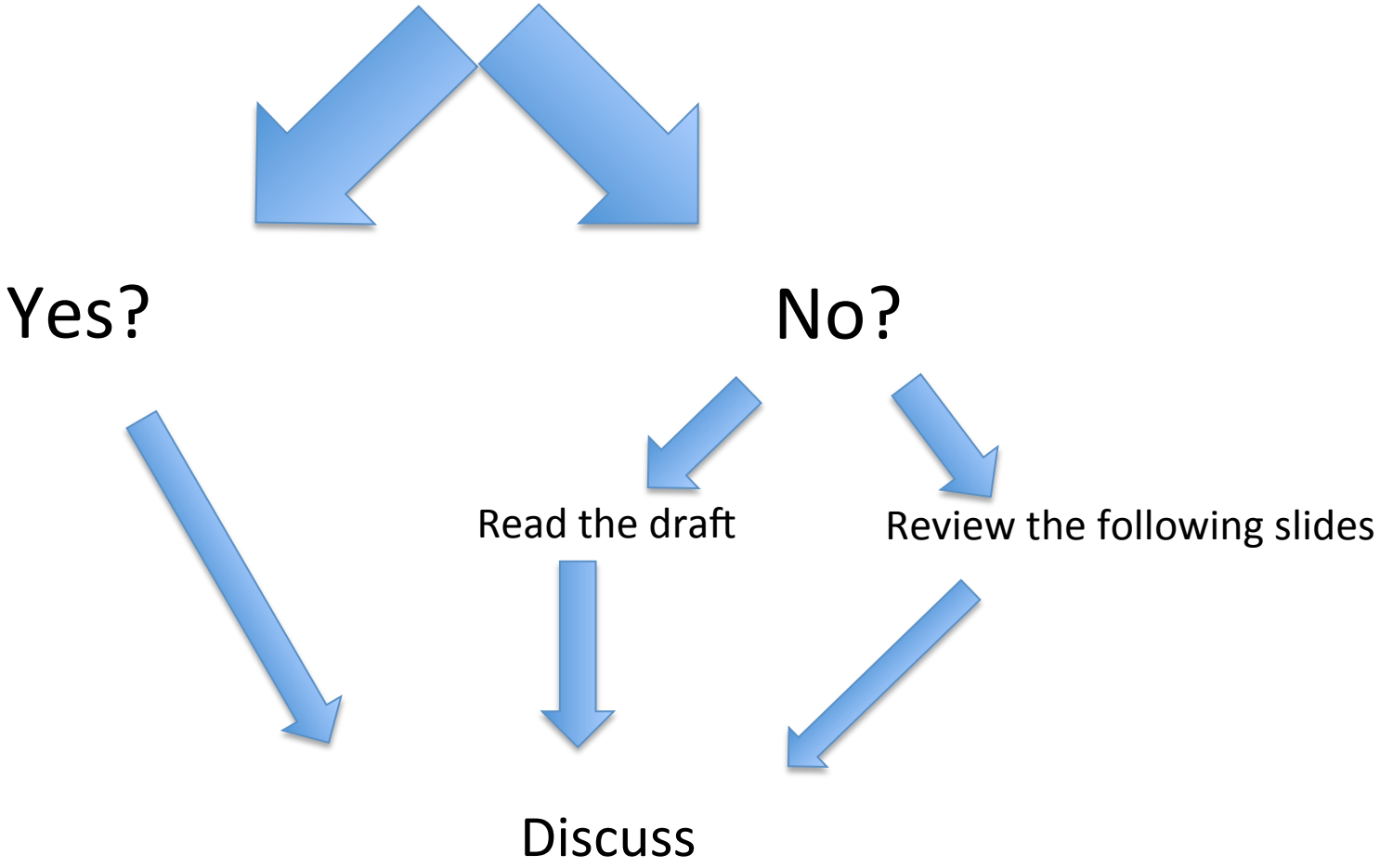
Have you read the draft?



1. Introduction

This document reviews the certificate validation procedure specified in RFC6487 and highlights aspects of potentially acute operational fragility in the management of certificates in the RPKI in response to the movement of resources across registries, and the associated actions of Certification Authorities to maintain continuity of validation of certification of resources during this movement.

2. Certificate Validation in the RPKI

As currently defined in section 7.2 of [RFC6487], validation of PKIX certificates that conform to the RPKI profile relies on the use of a path validation process where each certificate in the validation path is required to meet the certificate validation criteria. This can be considered to be a recursive validation process where, in the context of an ordered sequence of certificates, as defined by each pair of certificates in this sequence having a common Issuer and Subject Name respectively, a certificate is defined as valid if it satisfies basic validation criteria relating to the syntactic correctness, currency of validity dates and similar properties of the certificate itself, as described in [RFC5280], and also that it satisfies certain additional criteria with respect to the previous certificate in the sequence (the Issuer part of the pair), and that this previous certificate is itself a valid certificate using the same criteria. This definition applies recursively to all certificates in the sequence apart from the initial sequence element, which is required to be a Trust Anchor.

For RPKI certificates, the additional criteria relating to the previous certificate in this sequence is that the certificate's number resource set, as defined in [RFC3779], is "encompassed" by the number resource set contained in the previous certificate.

The underlying observation here is that this definition of certificate validation treats a collection of resources as inseparable, so that a single certificate containing a bundle of number resources is semantically distinct from an equivalent set of certificates where each certificate contains a single number resource. This semantic distinction between the whole and the sum of its parts is an artifice introduced by the particular choice of a certificate validation procedure, as distinct from meeting any particular operational requirement, and the result is the introduction of operational fragility into the handling of RPKI certificates, particularly in the case where number resources are moved between the corresponding registries, as described here.

3. Operational Considerations

There are two areas of operational concern with the current RPKI validation definition.

The first is that of the robustness of the operational management procedures in the issuance of certificates. If a subordinate Certification Authority (CA) issues a certificate that contains an Internet Number Resource (INR) collection that is not either exactly equal to, or a strict subset of, its parent CA, then this issued certificate, and all subordinate certificates of this issued certificate are invalid.

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This constraint creates a degree of operational fragility in the issuance of certificates, as all CA's are now required to exercise extreme care in the issuance and reissuance of certificates to ensure that at no time do they overclaim on the resources described in the parent CA, as the consequences of an operational lapse or oversight implies that all the subordinate certificates from the point of INR mismatch are invalid. It would be preferred if the consequences of such an operational lapse were limited in scope to the specific INRs that formed the mismatch, rather than including the entire set of INRs within the scope of damage from this point of mismatch downward across the entire sub-tree of descendant certificates in the RPKI certificate hierarchy.

The second operational consideration described here relates to the situation where a registry withdraws a resource from the current holder, and the resource to transferred to another registry, to be registered to a new holder in that registry. The reason why this is a consideration in operational deployments of the RPKI lies in the movement of the "home" registry of number resources during cases of mergers, acquisitions, business re-alignments, and resource transfers and the desire to ensure that during this movement all other resources can continue to be validated.

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Avoiding such situations requires that CA's adhere to a very specific ordering of certificate issuance. In this framework, the common registry CA that describes (directly or indirectly) the resources being shifted from one registry to the other, and also contains in subordinate certificates (direct or indirect) the certificates for both registries who are parties to the resource transfer has to coordinate a specific sequence of actions.

4. Alternatives Approaches

If the current definition of the RPKI certificate validation procedure is considered to introduce unacceptable levels of fragility and risk into the operational environment, what alternatives exist?

One approach is to remove the semantic requirement to consider the collection of resources in the extension field of the RPKI certificate as an indivisible bundle. This would allow for a certificate to be considered as valid for some subset of the resources listed in this extension, without necessarily being considered as valid for all such described resources. The implications of this approach is that any mismatch between parent and subordinate over resources where the subordinate certificate lists resources that are not contained in the parent certificate would affect validity questions relating to only those particular resources, rather than invaliding the subordinate certificate for all resources, and all of its subordinate products. This would appear to offer a relatively precise match tot he defined problem space, and limits the scope of consequent third party damage in the event of a INR mismatch in the RPKI certification hierarchy.

Another approach may involve the alteration of the RPKI provisioning protocol [RFC6492] to include a specific signal from child to parent ("bottom up") relating to readiness for certificate revocation. At this stage it is entirely unclear how this signalling mechanism would operate, nor is it clear that it would alter the elements of operational fragility nor mitigate to any meaningful extent the risks of failure to ensure strict INR consistency at all times. This is a topic for further study.

5. Security Considerations

The Security Considerations of [RFC6487] and [RFC6492] do not address the topic described here. Obviously, within the current RPKI

validation procedure, any inconsistency in certificates located towards the apex of the RPKI hierarchy would invalidate the entirety of the sub-tree located below the point of this inconsistency. If the RPKI was used to control inter-domain routing in the context of a secure routing protocol, then the implications of this large scale invalidation of certificates would have a corresponding massive impact on the stability of routing. This appears to be a serious situation.

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