Public Key Distribution Network (PKDN) for DTN Security Key Management

IETF95 DTN Working Group Meeting

https://tools.ietf.org/html/draft-viswanathan-dtn-pkdn-00

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Kapali Viswanathan (kapaleeswaran.viswanathan@boeing.com)

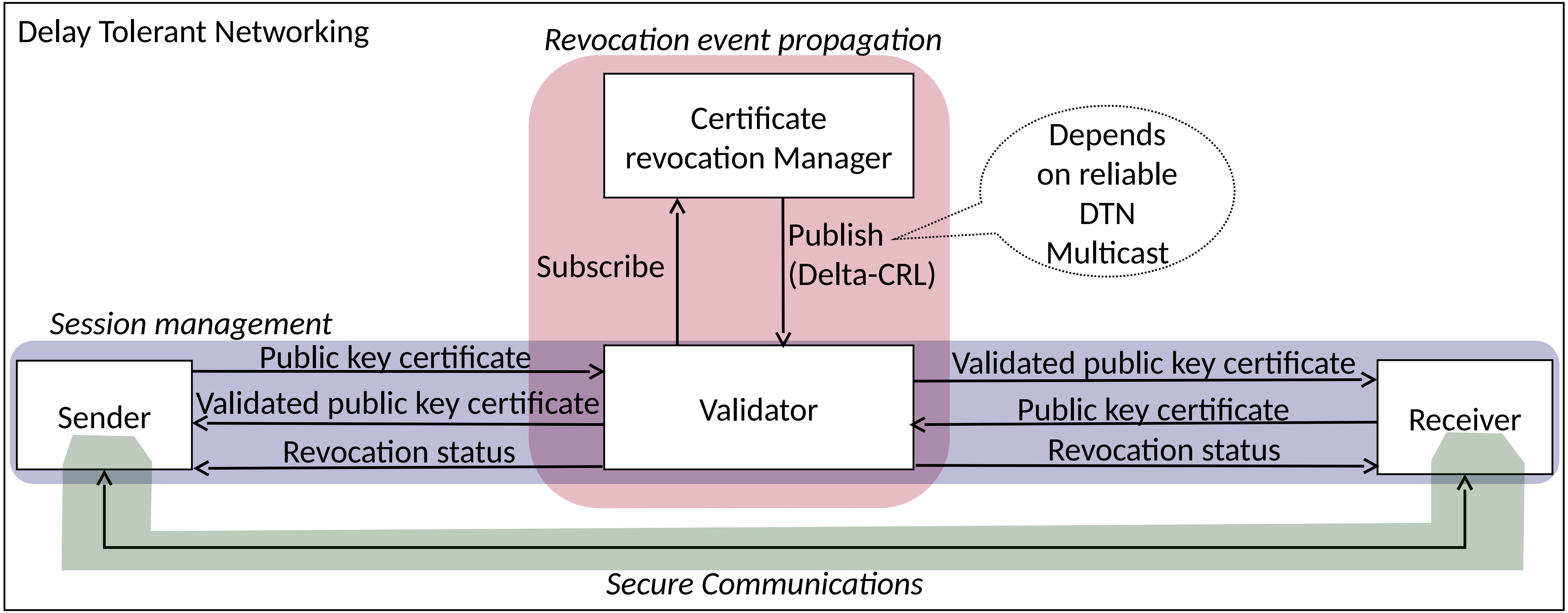
Fred L. Templin (fred.l.templin@boeing.com)

Overview

- PKDN Overview
- PKDN Entities and Functions
- PKDN & DTN Key Management Requirements
- Changes Since Last Version

PKDN Overview

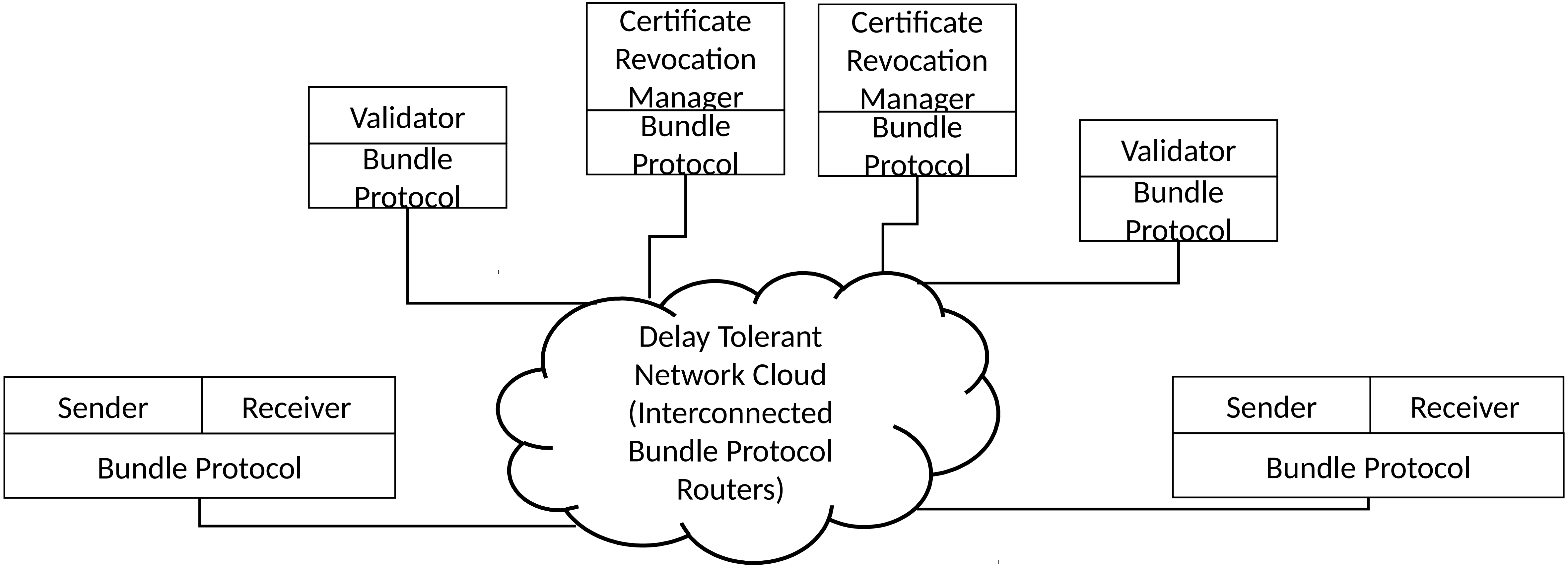
- Certificate revocation manager certifies one or more validators.
- Sender chooses a validator either by configuration or by discovery. Current PoC implements choice by configuration.


Delay Tolerant Networking
Revocation event propagation
Certificate revocation Manager
Subscribe
Publish (Delta-CRL)
Depends on reliable DTN Multicast
Session management
Sender
Public key certificate
Validated public key certificate
Revocation status
Validator
Validated public key certificate
Public key certificate
Revocation status
Receiver
Secure Communications

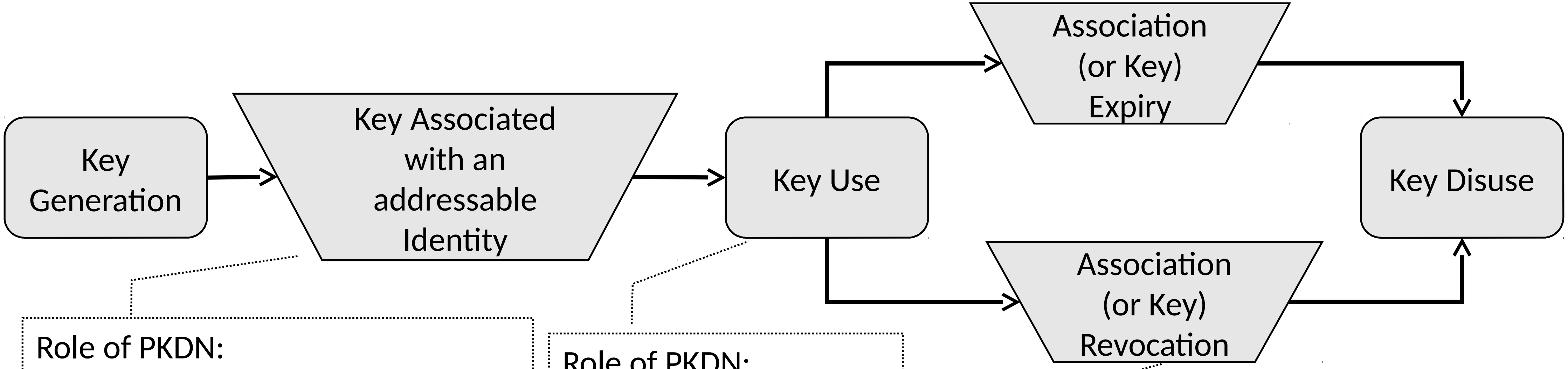
CRL = Certificate Revocation List

Delta-CRL = Additions to CRL

PKDN Layering



PKDN Event Propagation



Key Generation

Key Associated with an addressable Identity

Key Use

Association (or Key) Expiry

Association (or Key) Revocation

Key Disuse

Role of PKDN:

- Association performed by arbitrary external software (e.g. X.509 PKI software)
- PKDN references key uniquely as: (key-fingerprint, expiry-timestamp)

Role of PKDN:

- Provides an in-band mechanism to exchange validated certificates

Role of PKDN:

- Propagates public key revocation events to a network of validators using multicast communication
- Notifies public-key revocation events to *interested* endpoints

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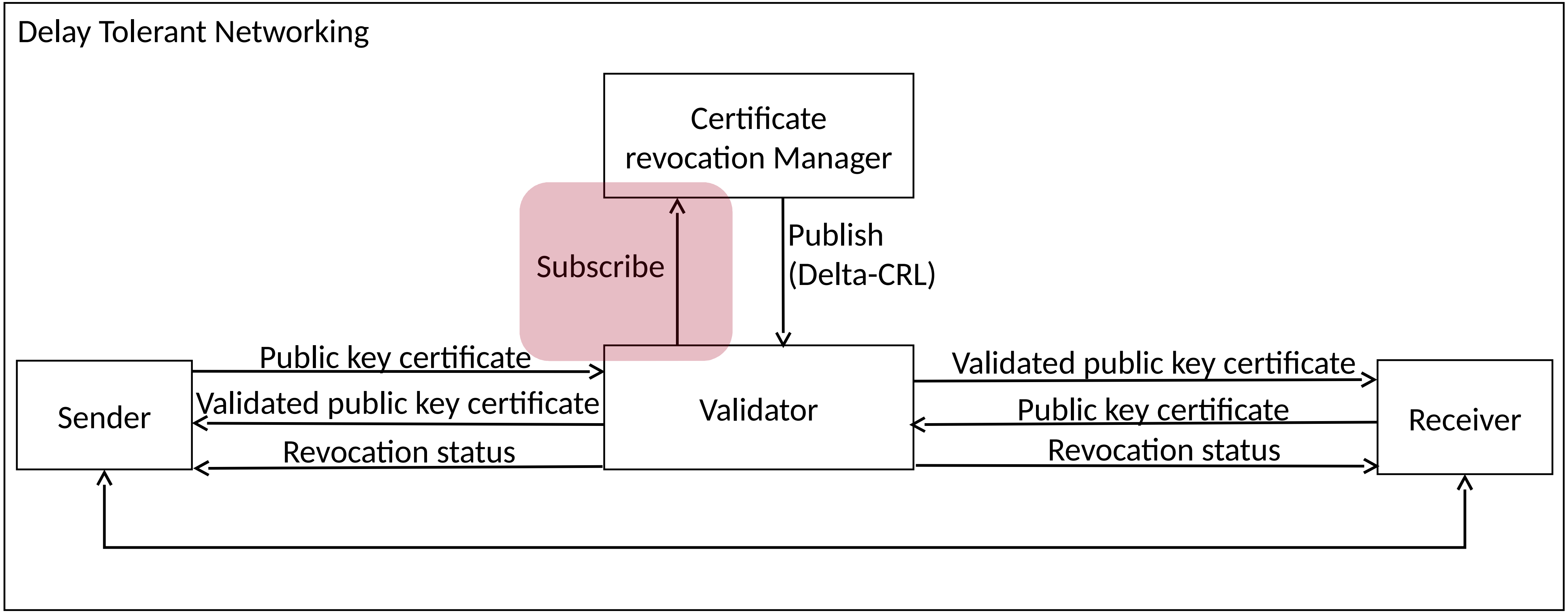
Revocation event subscription



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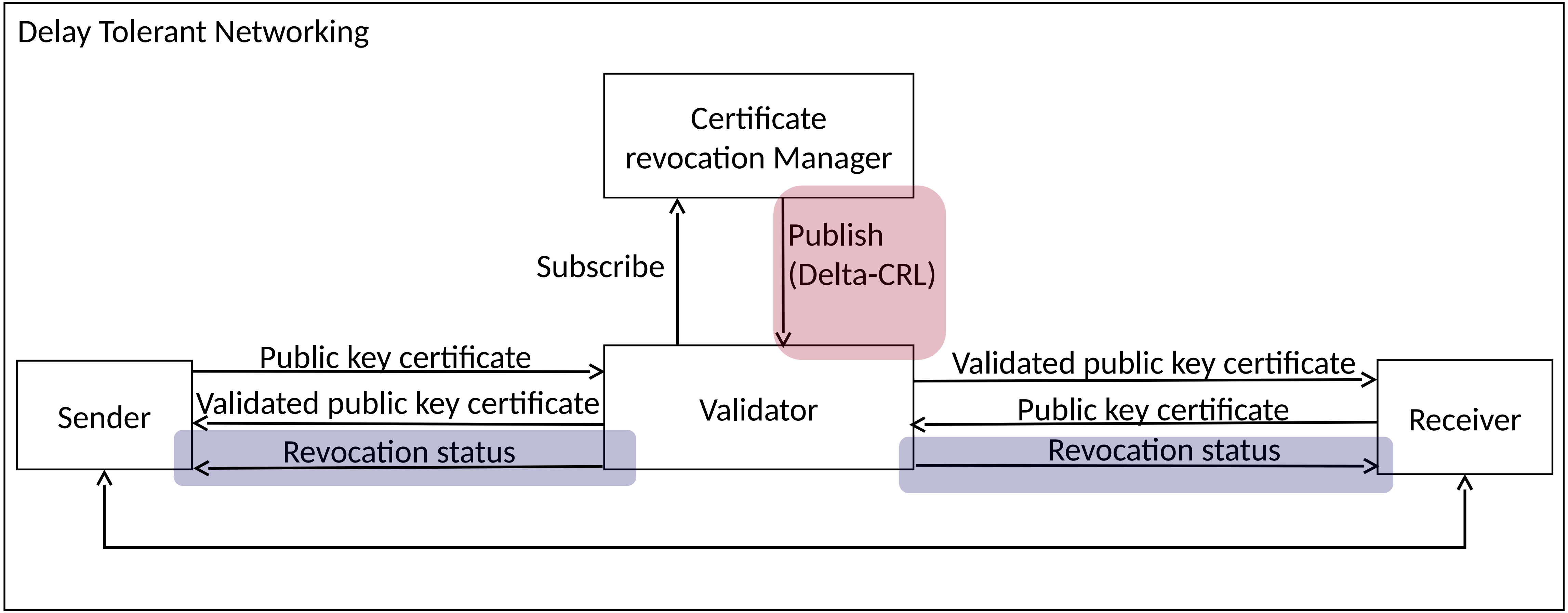
Revocation event & status propagation



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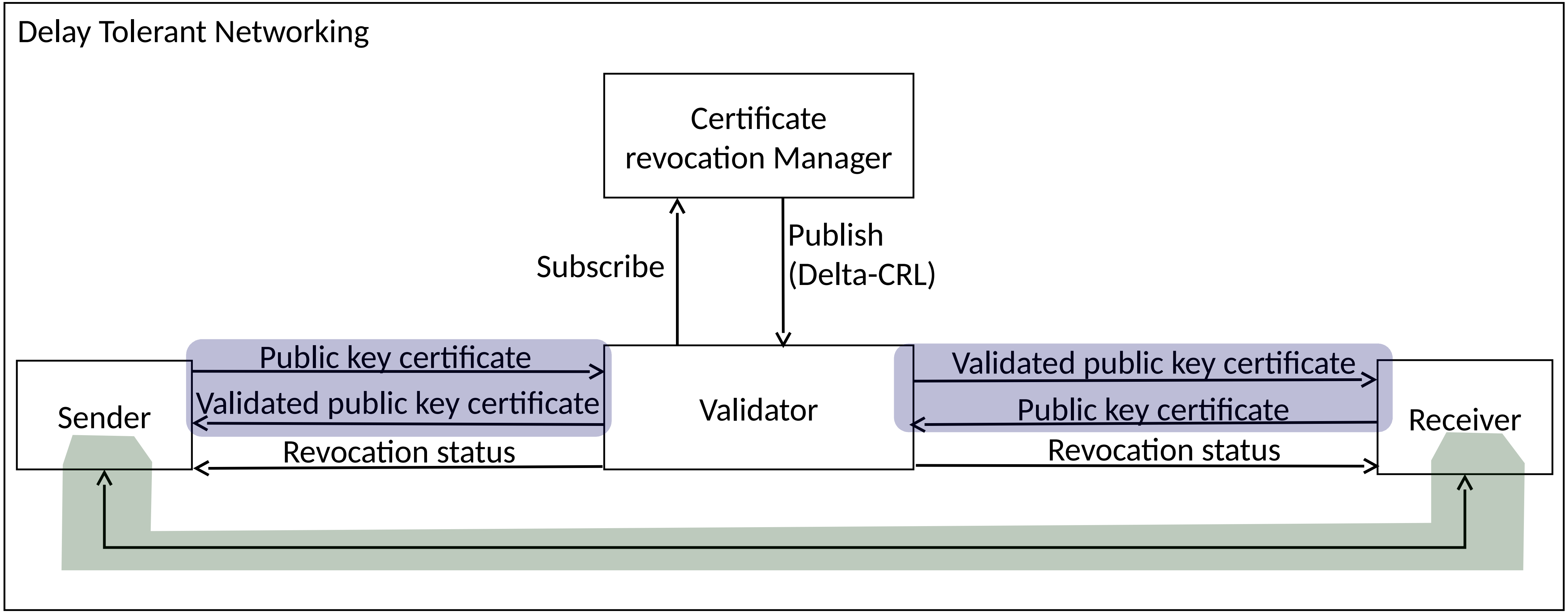
Session management and secure communication



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PKDN & DTN Key Management Requirements

https://datatracker.ietf.org/doc/draft-templin-dtnskmreq

REQ1: Must Provide Keys When Needed

- Receivers receive validated sender certificates encapsulated with initial message bundles

REQ2: Must Be Trustworthy

- Certificates are signed by trusted authorities
- Certificate revocations are signed by trusted authorities

REQ3: No Single Point of Failure

- Multiple CRMs are allowed
- Path redundancy from CRMs to Validators strengthen REQ3

REQ4: Multiple Points of Authority

- Multiple certificate and certificate revocation authorities can co-exist

REQ5: No Veto

- Validators, Senders, and Receivers can be configured to validate certificates and certificate revocations issued by multiple authorities

PKDN & DTN Key Management Requirements

REQ6: Must Bind Public Key with DTN Node Identity

- Realized using standard public key certificate structures (certificates minimally include address, public key, and expiry date)

REQ7: Must Support Secure Bootstrapping

- All PKDN entities must have root public key and root revocation public key manually installed

REQ8: Must Support Revocation

- Validators and CRM achieve this property

REQ9: Revocations Must Be Delay Tolerant

- Achieved by designing PKDN as a strict overlay on top of DTN and by using *event-driven semantics*

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- Draft title changed from ‘draft-viswanathan-dtnwg-pkdn-00’ to align document to DTN Working Group
- Now using unicast Certificate Revocations for interested parties instead of DTN-wide CRL multicast
- PKDN Validators remember the certificates of interest to individual receivers for a limited time period
- Senders must send fresh certificates through a PKDN validator before validator interest memory expiration

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