RPKI Repository Delta Protocol (RRDP) Delta File Retention Policy

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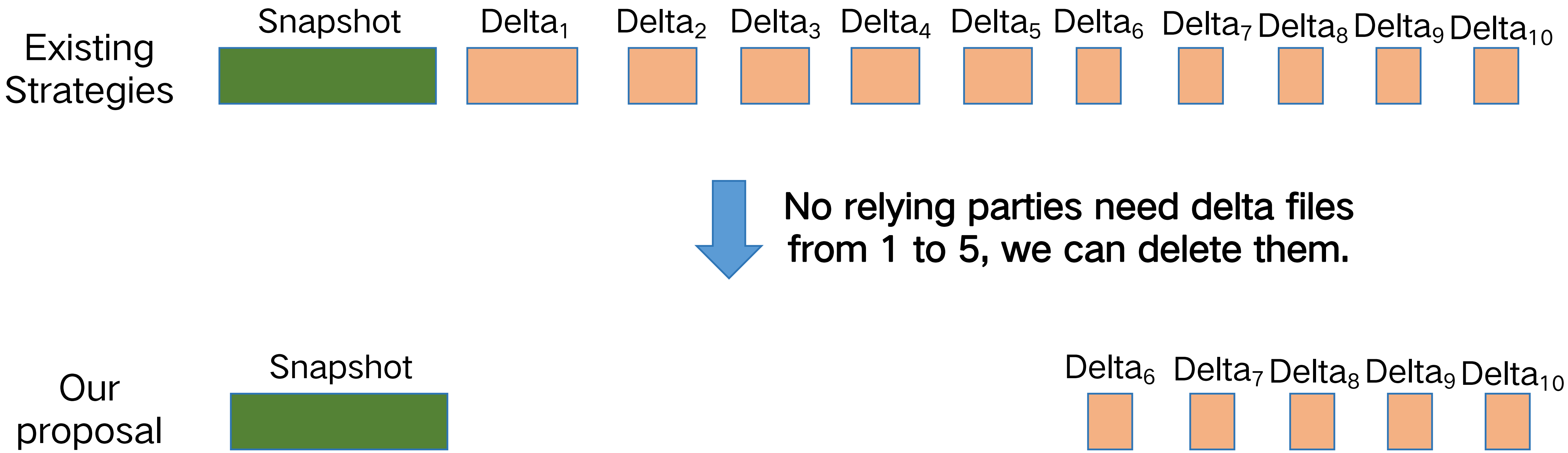
Key Idea: Adaptive Delta File Retention Policy

□Key idea

- ◆Only maintain delta files that might be used by active relying parties



Key Idea: Adaptive Delta File Retention Policy

- **Key idea**
  - Only maintain delta files that might be used by active relying parties
- Benefits
  - Better adaptation to actual client update patterns
  - Reduced storage requirements for RRDP servers
  - Improved efficiency in delta file management
  - Potential performance improvements for notification file processing
  - Maintained backward compatibility with existing RRDP clients
- Three main components
  - Client tracking mechanism
  - Minimum serial number determination method
  - Delta file pruning algorithm

Existing Delta File Retention Strategies

- RFC8182: size-based retention
  - Section 3.3.2 mandates that the combined size of the delta files in the notification file maintaied by the server cannot exceed that of the snapshot file
  - Yet, free to further limit the number of deltas
- Count-based retention
  - Maintaining a fixed number of most recent delta files, *e.g.*, *the last 500 delta files*
- Time-based retention
  - Keeping delta files for a specified recent time period, *e.g.*, *2 hours*

Challenges of Existing Strategies

- RFC8182: size-based retention
  - Not consider client access patterns
  - Inefficient server storage use, especially along with number increasement of existing objects (*e.g.*, ROA, ASPA) and the addition of more new ones (*e.g.*, MOA, ...)
- Count-based retention
  - Not match actual client needs, *e.g., discarding deltas that are still needed*
  - Not adapt to changing repository update frequencies
- Time-based retention
  - Not match actual client needs
  - Not account for varying repository update frequencies
  - Inefficient server storage use for maintaining deltas longer than necessary

Adaptive Delta File Retention Policy

◻Client tracking mechanism

◆Tracking the serial numbers accessed by clients with a data structure that records *client ID*, *serial number*, and *last access time*

Client ID	Serial Number	Last Access Time
Client A	42	July 10, 2025, at 12:00PM UTC
Client B	37	July 11, 2025, at 08:30AM UTC
Client C	45	July 11, 2025, at 14:15PM UTC

◻Minimum serial number determination method

1. Initialize *min_serial* to the current repository serial number;

2. For each active client in the tracking data:

a. If the client's serial number is less than *min_serial*, update *min_serial* to the client's serial number;

3. Return *min_serial*.

Adaptive Delta File Retention Policy

- Delta file pruning algorithm
  1. Obtaining the minimum serial number (*min_serial*);
  2. For each delta file:
     a. Extract the "from" serial number (*from_serial*) from the delta file metadata;
     b. If *from_serial* < *min_serial*, mark the delta file for deletion;
  3. Delete all marked delta files;
  4. Update the notification file to remove references to the deleted delta files.

Note: the adaptive delta file retention policy described here can be integrated with the size-based retention policy specified in RFC8182.

Privacy Considerations

- Client tracking mechanism raises privacy concerns
- So, take steps to protect client privacy
  - Anonymization
    - *e.g.*, use anonymized identifiers instead of storing actual IP addresses
  - Data minimization
    - Store only the minimum information needed
  - Data retention
    - Delete tracking data for clients that have not been seen for a configurable period

Summary & Next Step

◻Summary

- ◆By tracking the minimum serial number accessed by active clients, repositories can safely prune older delta files that are no longer needed, while ensuring that all active clients can still perform incremental updates.

◻Next step

- ◆Seek feedback and comments
- ◆Collaborations are welcome
- ◆Working on the simulation codes of different policies to quantify the benefits
- ◆Will share the results in the next meeting

Thanks!