Nack-Duplicate processing

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This document is a recommendation to forwarding strategy designers on how a Nack with reason Duplicate should be processed.

# Semantics of Nack-Duplicate

In NFD forwarding, the incoming Interest pipeline checks the Interest Table (PIT) entry and Dead Nonce List (DNL) to see whether the Nonce field of the incoming Interest packet is a duplicate of a previous Nonce value on an Interest packet with the same name. If the incoming Nonce is found to be a duplicate, a Nack with reason Duplicate is returned to the downstream, and the Interest is not forwarded.

## Upcoming duplicate Nonce detection change

In NFD 0.5.0, the incoming Nonce is compared with Nonce values of previous incoming Interests of the same name, regardless of where the Interests came from. In a future version of NFD, the incoming Nonce will be compared with Nonce values of previous incoming Interests of the same name except those coming from the same downstream. In other words, if the same downstream transmits the same Interest with the same Nonce twice, NFD 0.5.0 will return a Nack-Duplicate in reply to the second Interest, but a future version of NFD will treat the second transmission as a strategy retry and will not return a Nack.

# Recommendation of Nack-Duplicate processing

We recommend a strategy to process an incoming Nack-Duplicate using the following procedure:

1. Record the Nonce as duplicated in the PIT out-record related to the upstream who transmitted the Nack-Duplicate, so that the same Nonce would not be transmitted to the same upstream again.
2. Iterate through all unexpired PIT in-records, and pick a PIT in-record whose last incoming Nonce is not recorded as duplicated in the PIT out-record. When multiple PIT in-records are eligible, the newest PIT in-record should be used because its Nonce is less likely to be seen by the upstream.

## Implementation concern

In NFD strategy API, send Interest action does not allow strategy to specify which Nonce to use in an outgoing Interest packet. Either this API should be extended, or this procedure should be implemented in the outgoing Interest pipeline.