7.5 Error Detection/Correction

Intent

Add redundancy to data to facilitate later detection of and recovery from errors.

Also Known As

Redundancy Check, Error-correcting Code, Parity

Motivation

Data residing on storage media or in transit across communication links is often susceptible to small, local errors.

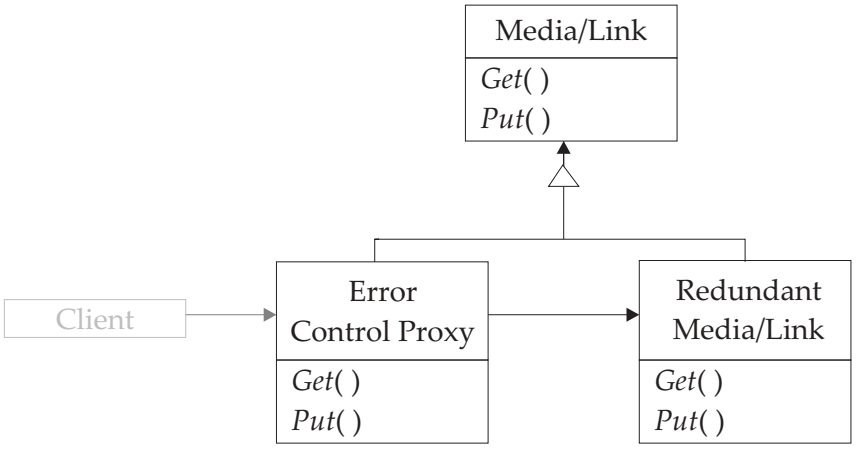
Applicability

Use Error Detection / Correction when:

- Storage media or communication links are susceptible to undetected or uncorrected errors.
- The format of data stored on media or communicated across a link can be modified to incorporate redundant error-control information.
- Some data expansion is acceptable.
- Data corruption is likely to be limited to a known number of errors per bit of data, and the distribution of errors is likely to be predictable in advance.

Structure

Error Detection / Correction consists of a Media device or a communications Link together with an Error Control Proxy.



Participants

- Redundant Media / Link

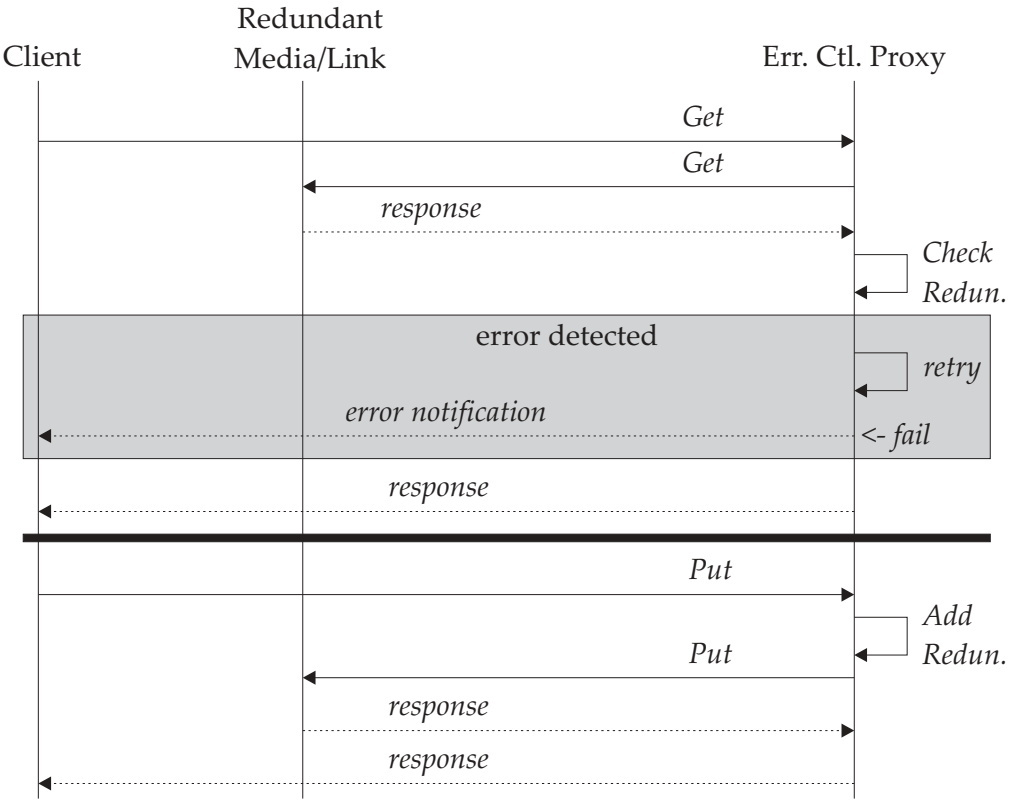
  The storage medium or communications link to which data will be written or from which data will be read.

- Error Control Proxy

  Adds redundancy to data written to a storage medium or communications link; uses redundant information to check integrity of (and, if possible, repair integrity of) data read from a storage medium or communications link.

Collaborations

- Error Control Proxy responds to client requests to put / get information to / from a communications link or media device.
- Error Control Proxy adds redundancy to information which is written to the link or device.
- Error Control Proxy checks previously added redundancy in order to verify the integrity of data retrieved from the communications link or media device. In the event that the verification fails, Error Control Proxy may retry the get operation before returning a failure code to the client.



Consequences

Use of the Error Detection / Correction pattern:

- Protects against loss of data integrity by detecting and, in some cases, correcting errors.
- Expands data by a known factor.
- Introduces a startup delay into data storage / transmission and retrieval / reception operations.

Implementation

Error-Control Code (for example, Cyclic Redundancy Check (CRC)), Cryptographic Hash, Digital Signature.

Note that performance overhead can be reduced to a constant startup latency by using streaming and parallelism.

Known Uses

RAID array, Disk storage CRC

Related Patterns

Error Control Proxy is a Proxy [GoF].