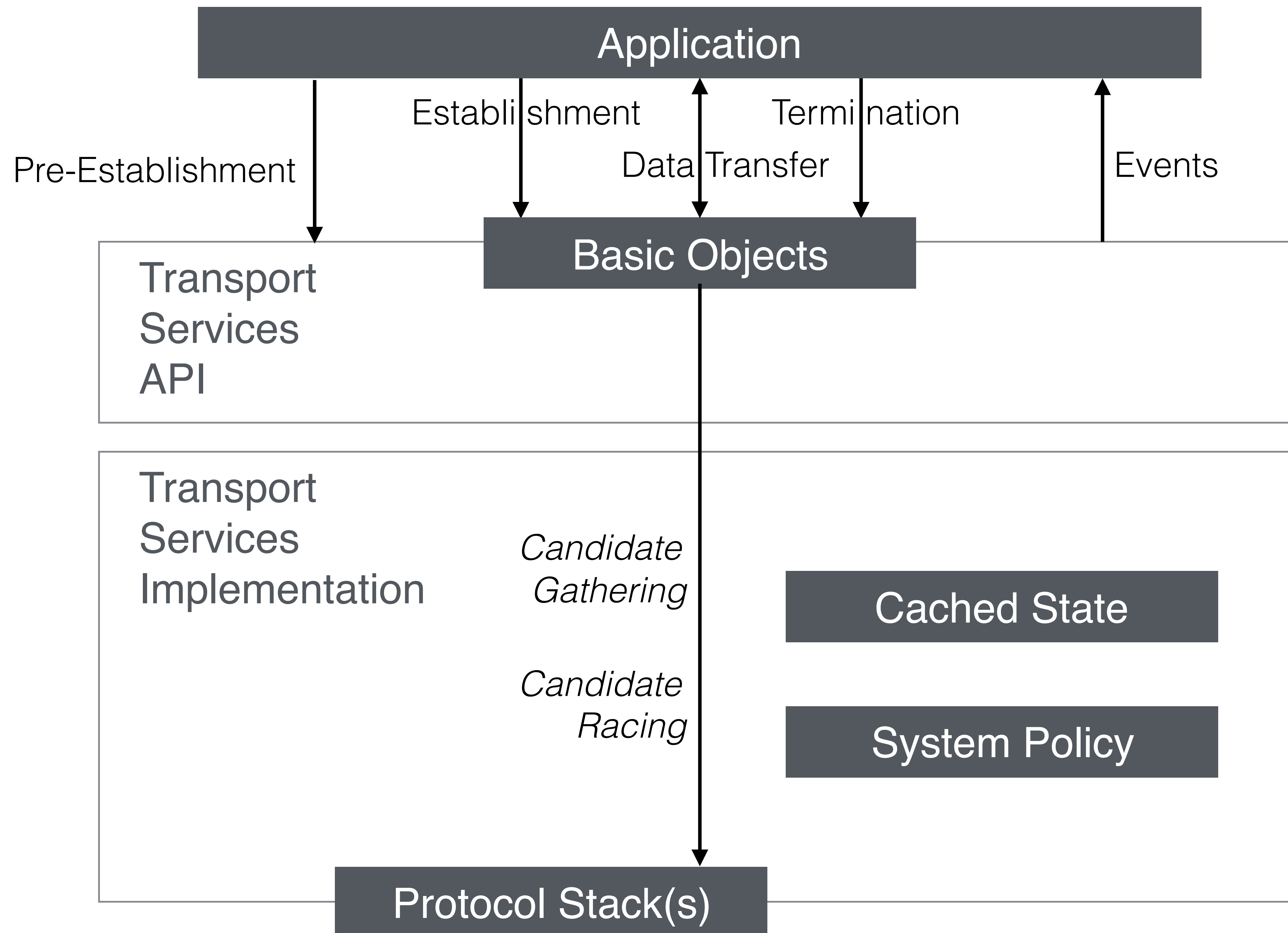
An Abstract Application Layer Interface to Transport Services

draft-trammell-taps-interface-00

Brian Trammell

TAPS — IETF 101 — London — 21 March 2018

Architecture Diagram

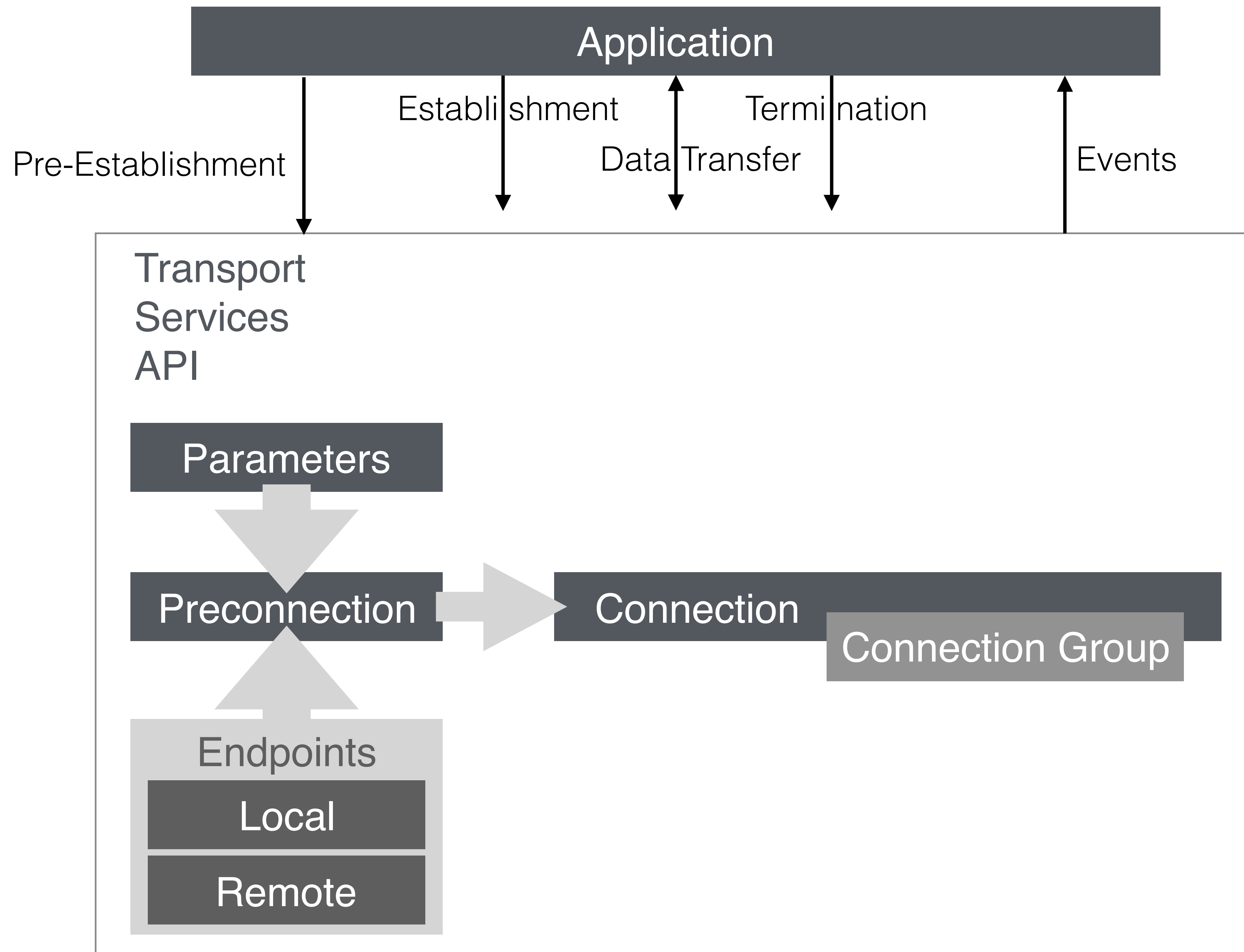


Interface Design Principles (§3)

We set out to define a ***single interface*** to a variety of transport protocols to be used in a variety of application design patterns, to enable applications written to a single API to make use of multiple transport protocols in terms of the features they provide, providing:

- explicit support for ***security properties*** as first-order transport features;
- ***asynchronous*** connection, transmission, and reception;
- support for ***multistreaming and multipath*** transport protocols; and
- ***atomic transmission of data***, using application-assisted framing and deframing where necessary.

Interface Diagram



Endpoints (§5.1)

- Remote and local endpoints can be specified at a variety of resolutions (e.g. hostname / service name, address / port, interface).
- Resolution is under transport services control, not application control.
  - May depend on PvD / selected protocol stack.
  - Open issue: resolution can leak interest when DNS is not private.

Transport Parameters (§5.2): Protocol and Path Selection Properties

- Protocol and path selection properties used to select/eliminate candidates during connection establishment.
- Five levels of preference: require, prefer, ignore, avoid, prohibit.
- Properties derived from minset:
  - Reliable Data Transfer
  - Preservation of Ordering
  - Per-Message Reliability
  - 0-RTT Session Establishment
  - Multiplexing (multistreaming)
  - RTX and ICMP notification
  - Checksum coverage control
  - Capacity profile
  - (path-only) Interface Type

Transport Parameters: Protocol Properties (§9.1)

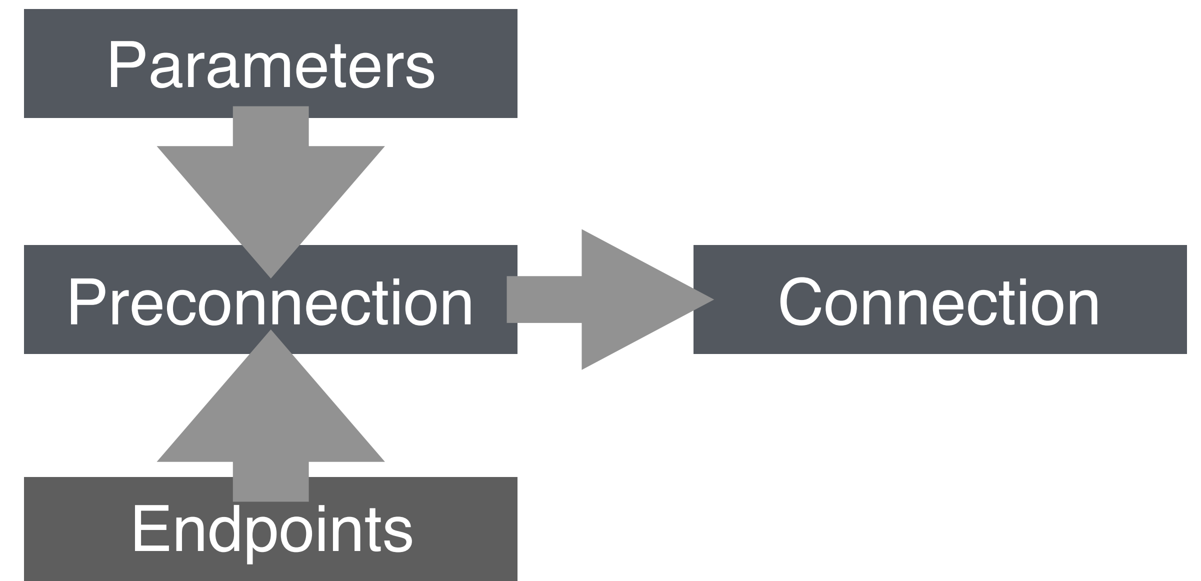
- Generic protocol properties allow configuration and querying of protocol stacks in a transport-independent way:
  - Relative Niceness within group
  - Group TX scheduler
  - Connection Abort timeout
  - RTX notification threshold
  - Minimum checksum coverage
  - Maximum 0RTT message size
  - Maximum non-fragmented message size
  - Maximum non-partial message size on send
  - Maximum non-partial message size on receive
- Specific protocol properties allow specific stacks to be configured in detail, should they be selected.

Transport Parameters: Security Parameters (§5.3)

- Generic security properties allow configuration and querying of security features in a protocol-independent way:

- Identity
- Private Key
- Groups
- Algorithms
- Ciphersuites
- Session Cache configuration
- Pre-shared keys
- Trust verification and identity challenge callbacks

Preconnection (§5)



- A ***preconnection*** describes the state of a connection that might exist in the future, including parameters and endpoint specifiers.
- This design allows the system to prepare and cache information based on application requirements before establishment
- Preconnections can also be used to *group* connections before establishment.
- Implementations of the interface may provide convenience calls to connect via an implicit preconnection.

Establishing Connections (§6)

- Three ways to establish a connection:
  - Active (`Initiate()`): application notified that the connection is up by a `Ready<>` event.
  - Passive (`Listen()`): application notified of each incoming connection by a `ConnectionReceived<>` event.
  - Simultaneous/Peer (`Rendezvous()`): application notified connection is up by a `RendezvousDone<>` event
- Data can be sent on an initiating connection immediately.
  - Details of 0RTT still an open issue.

Connection Groups (§6.4)

Connection
Connection Group

- Connections can be *entangled* into groups
- All connections in a group share protocol properties and may share connection state.
- Connections in a connection group are implemented as streams in a multistreaming protocol when available.
- `Preconnection.Clone()` creates preconnections whose eventual connections will be entangled.
- `Connection.Clone()` creates a new connection entangled with an existing one.
  - New streams yield a `ConnectionReceived<>` event

Sending Data (§7)

- Data (as a Message) sent with `Connection.Send()`
  - Sender-side framing allows for arbitrarily-typed application objects to be converted to octet streams.
- Send parameters control per-Send behavior:
  - Lifetime
  - Niceness
  - Ordered
  - Idempotent
  - Checksum Coverage
  - Immediate Acknowledgment
  - Instantaneous Capacity Profile
- Sending may yield `Sent<>` or `Expired<>` events

Receiving Data (§8)

- Application indicates readiness to receive via `Connection.Receive()`, message sent to application via supplied callback.
- Message contains an octet array, as well as transport metadata
- Messages are split from octet via application-provided receiver-side deframing when the transport doesn't provide its own framing
- Very large messages or lack of deframing may result in partial reception

Connection Termination (§10)

- `Connection.Close()`: orderly connection shutdown after pending send and receive, results in `Connection.Closed<>` event
  - Underlying stack closes after last Connection in a Group closes.
- `Connection.Abort()`: immediate connection shutdown, results in `Connection.Aborted<>` event
  - All Connections in a Group abort simultaneously.

Interface Diagram

Parameters

`Require()` `Prefer()` `Ignore()` `Avoid()` `Prohibit()`

Security parameters (Identity, PrivateKey, Algorithm, Group, Ciphersuite)

Preconnection

`Clone()`

`Initiate() → Ready<>`
`Listen() → CReceived<>`
`Rendezvous() → RDone<>`

Connection

`Clone()` → Connection Group

`Send() → Sent<>, Expired<>`
`Receive() → Received<>`

`Close() → Closed<>`
`Abort() → Aborted<>`

Endpoints

Local

Remote