# CCN

# CCNx 1.0 Network Software

Computer Science Laboratory
Networking & Distributed Systems

March 2014



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# CCN 1.0

## Cleaned API

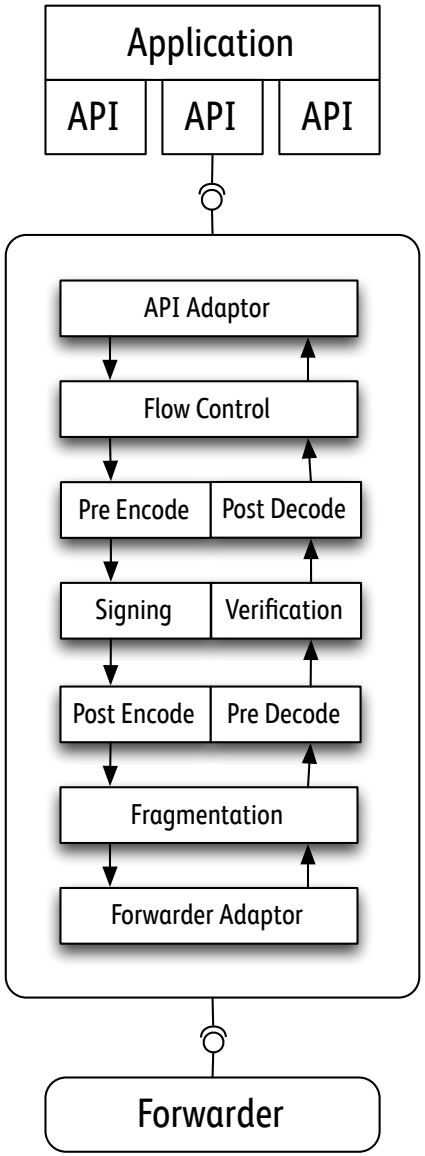
Lowered the learning curve
Separated concerns

## Cleaned Code

Improved maintainability
Increased modularity

## Cleaned Protocol

Defined minimum protocol
Specified auxiliary protocols



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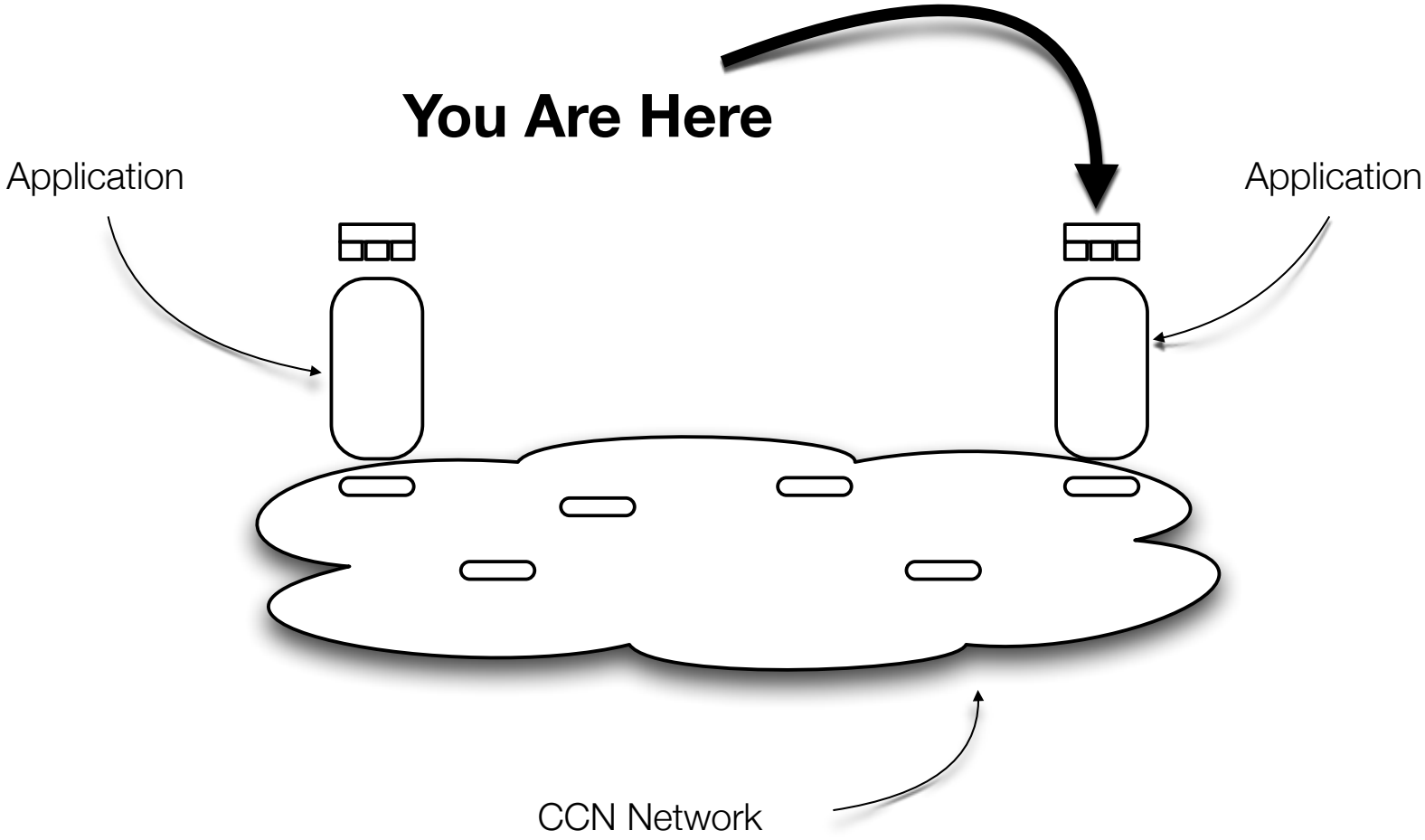
# Overview



# Requirements

## Provide Structure and a Vocabulary

- Design simple parts connected by clean interfaces.
- Implement modularity and separate concerns.

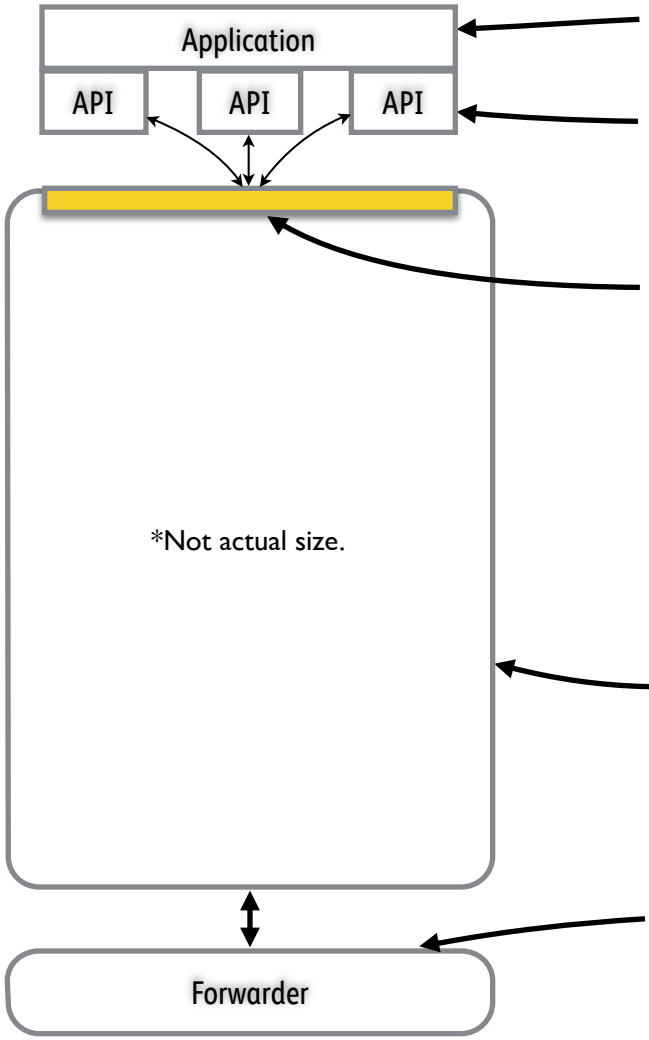
## Promote Stability and Enable Extensibility

- Design for composition and substitution of components.
- Implement the core functionality plus examples and proofs-of-concept.
- Design for evolution.

## Enable Productivity

- Design for inspection and debugging.
- Implement for usability and “learnability.”

# Vocabulary




A **program** that uses one or more CCN APIs to communicate

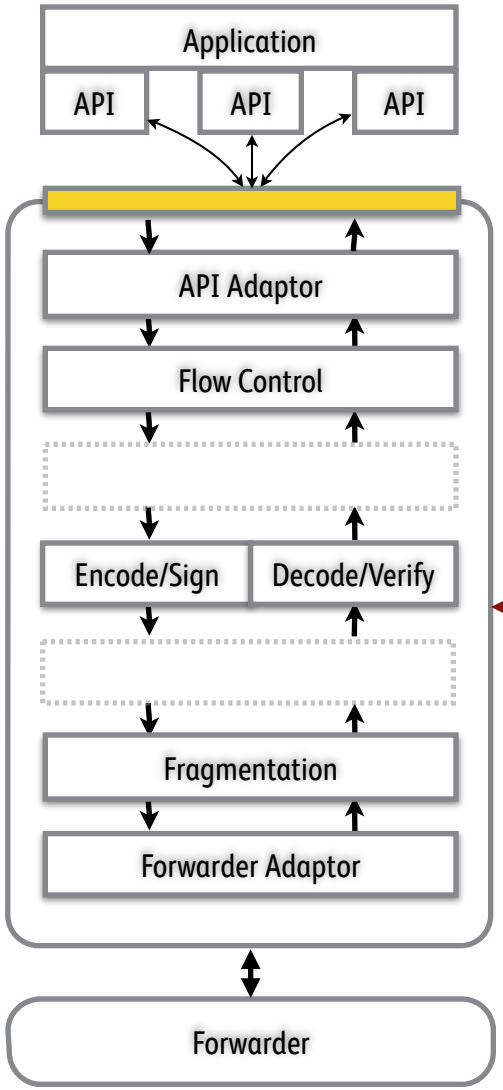
**Application Programming Interfaces** implement a particular kind of interaction with the CCN Transport

The **Transport Programming Interface** providing a uniform interface to the **Transport Framework**

**Transport Framework** containing one or more **Transport Stacks** conveying data between an API and the network

The CCN **Forwarder** directing traffic on the network

# Transport Stack




Simple component model

Components are passive or active

Assembled and initialized at create-time

Separates concerns

- From the application
- From other, individuated components.
- Permits component reuse.

Implements CCN object protocols

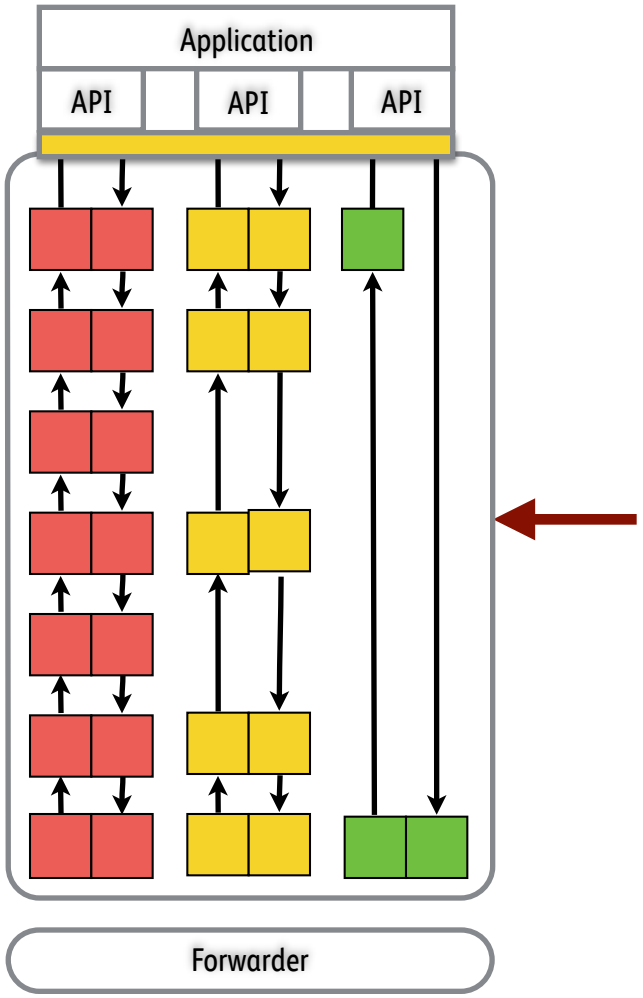
- Segmented objects
- Versioned objects
- CCNmq Message Queue protocol
- Key/Value protocol

Integrates external services

- External Caches
- Identity, Key and Certificate services
- Trust-model implementations

*Example only. Not all components are required for all stacks.

# Transport Framework




## Multiple Transport Stacks

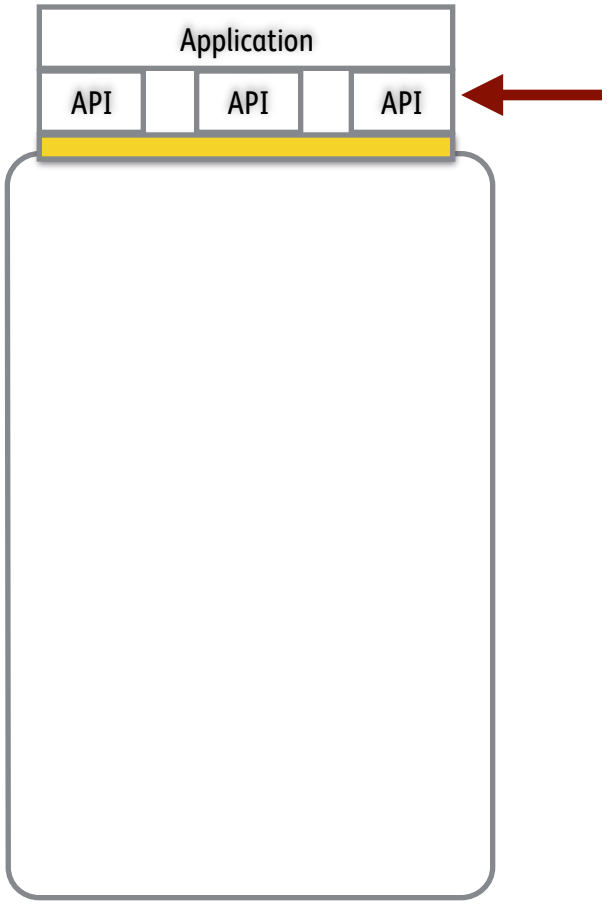
## Maintains for each Stack:

- Runtime state
- Performance information

## Maintains for the Framework:

- Runtime state
- Performance information
- Interfaces for extracting the data

# Application Programming Interfaces

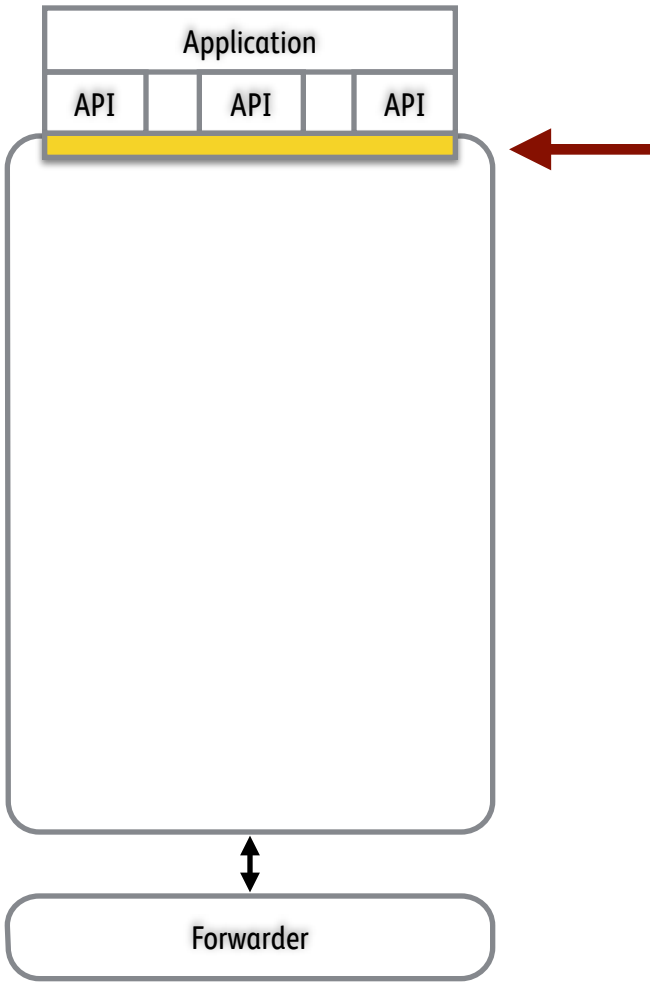



## Many possible APIs

- Sockets
- CCN Repository
- Streaming
- Message queuing

## Multiple simultaneous APIs

# Transport Programming Interface




Programmatic boundary between the API and the Transport Framework

Message based communication

Passes messages to and from the API

`Transport_Open`
: Opens and configure a Transport Stack

`Transport_Close`
: Closes a Transport Stack

`Transport_Send`
: Send a message to a Transport Stack

`Transport_Receive`
: Receive a message from a Transport Stack

`Transport_Notify`
: Signal that an event occurred.

# API Adaptor


Communicates between the API

and a specific Transport Stack

and the Transport Framework

Required component





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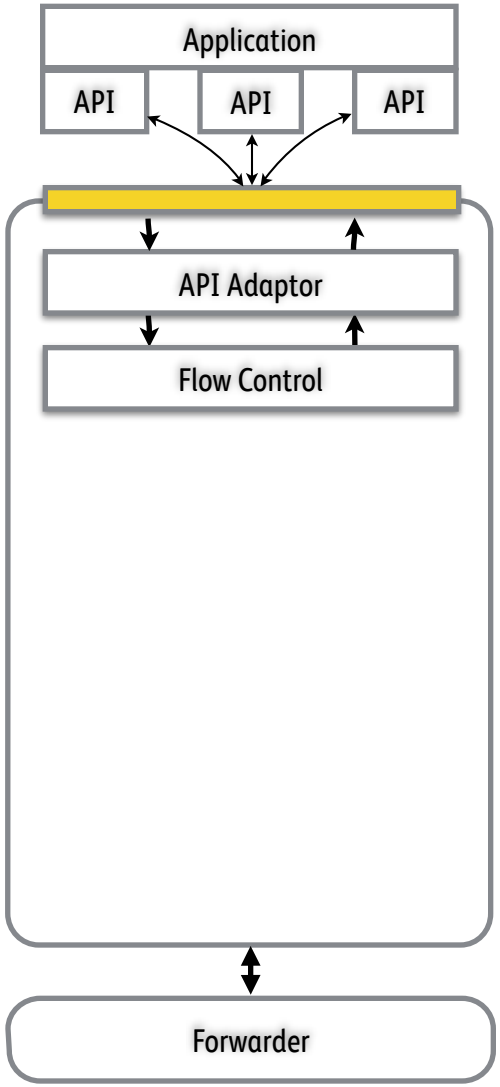
# Flow Control




Traffic shaping and management

Interest retransmissions

Interest pipelining

Content Object ordering

Link resolution

Optional component





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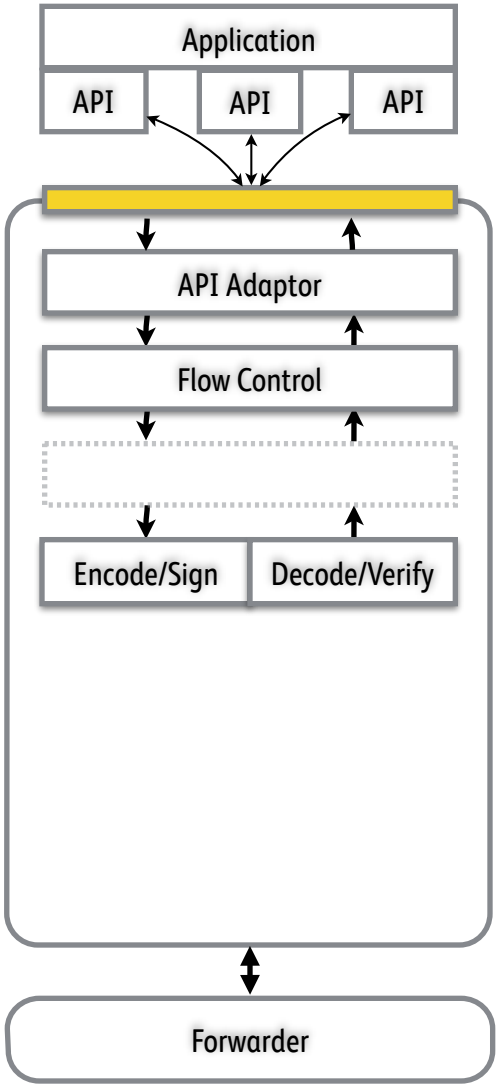
# Encoding and Signing Decoding and Verification




- Encode and sign outbound Content Objects
- Decode and verify inbound Content Objects
- Encode outbound Interests
- Decode inbound Interests
- Interfaces to external key stores and key management systems
- Optional component



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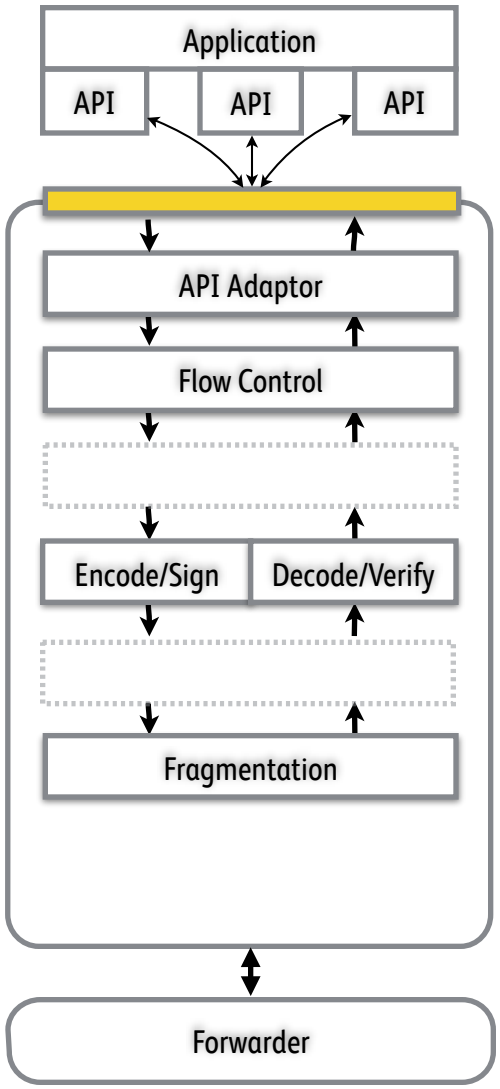
# Fragmentation

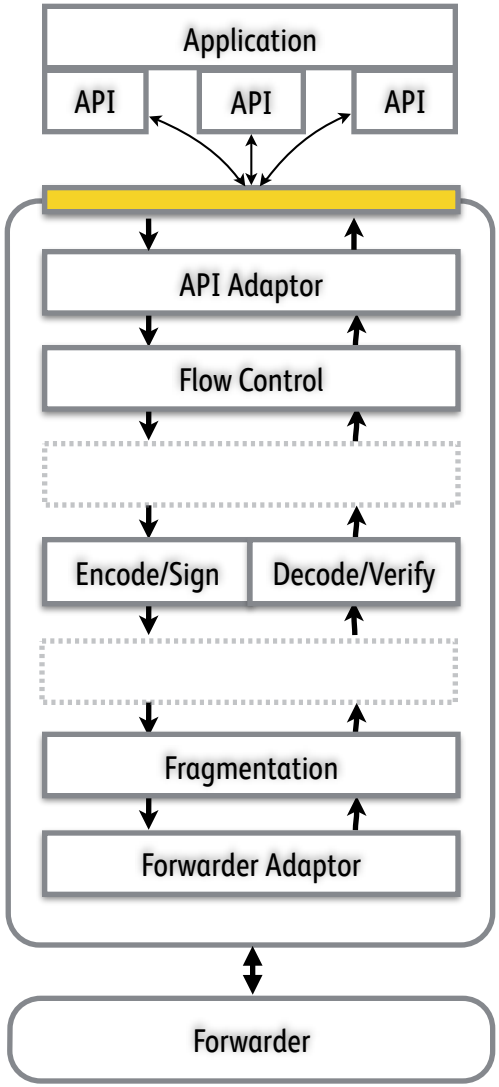



Outbound packet fragmentation

Inbound packet reassembly

Optional component

# Forwarder Adaptor

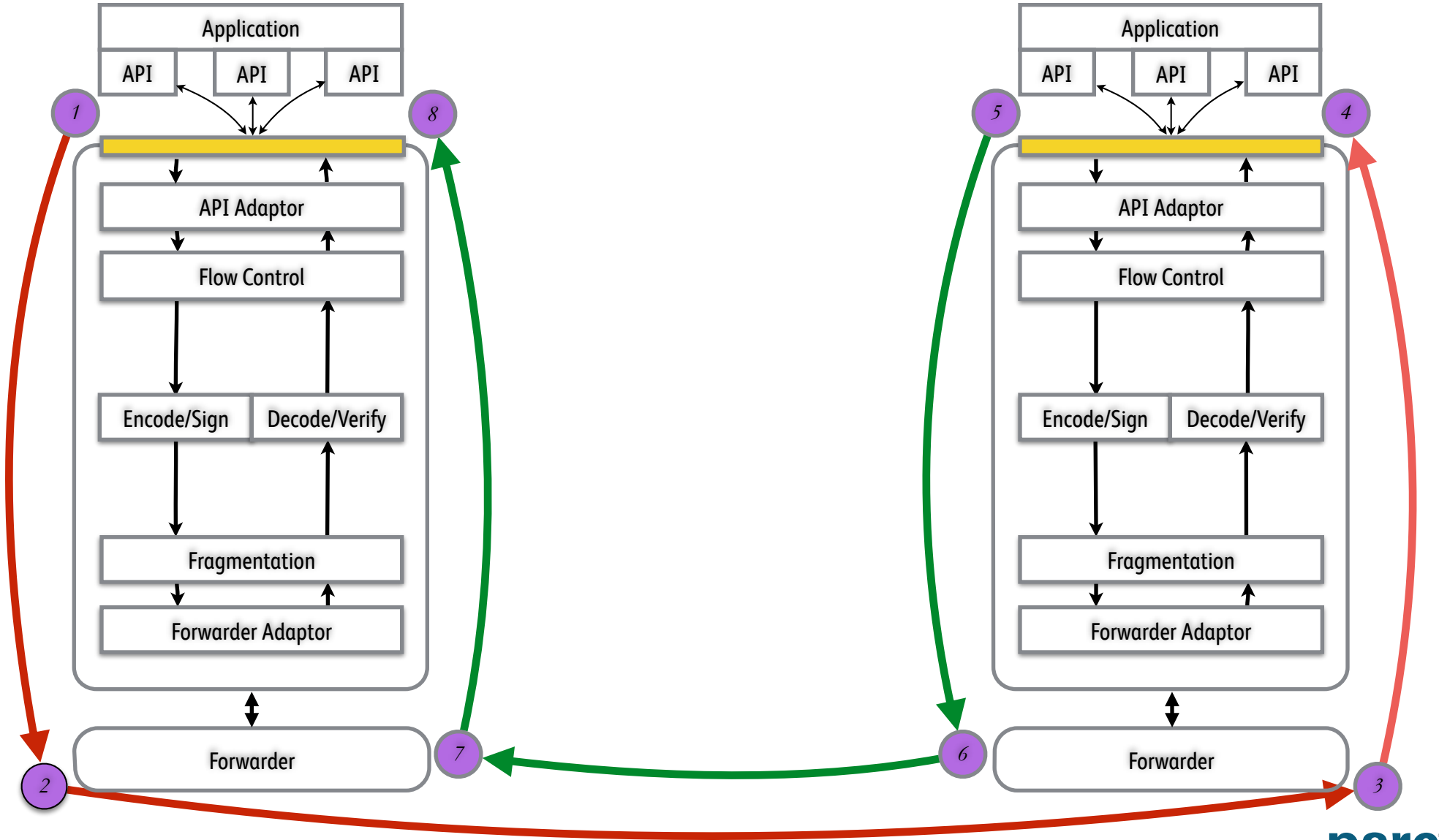



Communicates with a Forwarder.

Performs the necessary operations to control the Forwarder on behalf of the Transport Stack.

Required component

# Example Path





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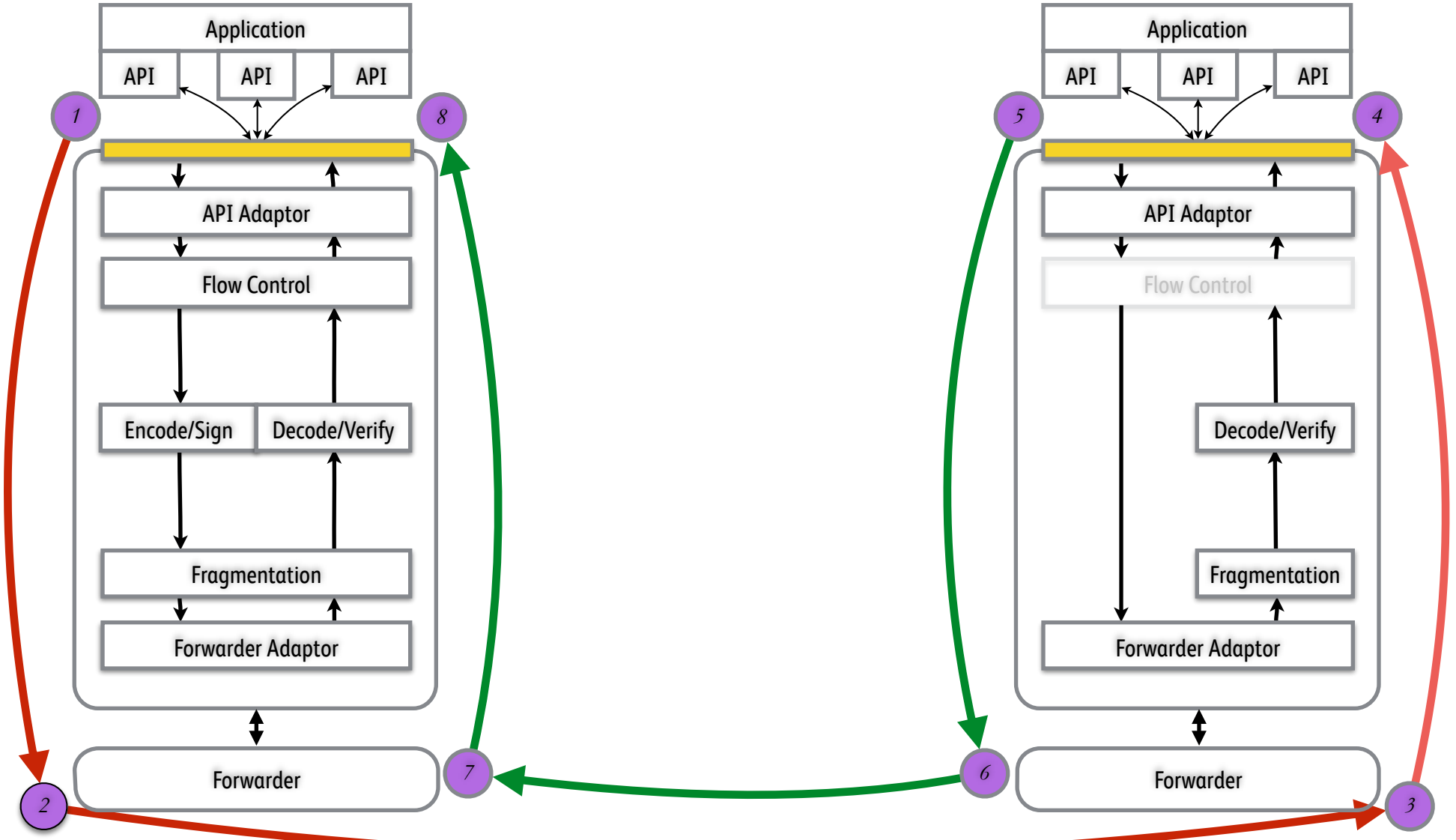
# Example Path





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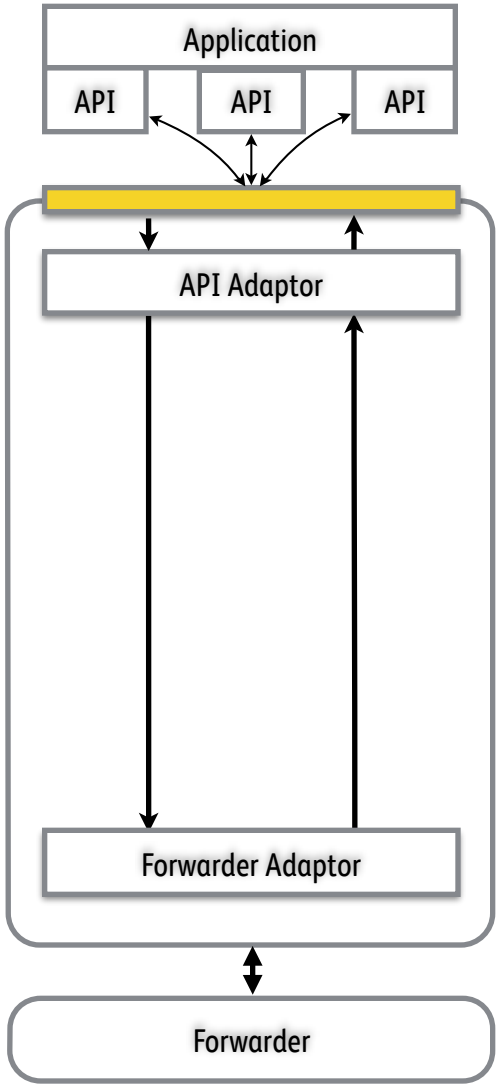
# Simplest Stack




The API encodes Interests and Content objects.

The Stack simply transmits them to the forwarder

# Software Components

**Algorithm Library**
*General purpose facilities (buffers, lists, maps, etc)*

**Transport *"Ready To Assemble"***
*A Transport Stack implementation*

**Security Library**
*Cryptographic and other security related facilities*

**Development Tools**
*Runtime and at Development time*

**CCN Core**
*CCN constructs as C objects*

**Unit Testing Tools**
*TDD, developer and release aids*

# Module Dependencies