An Introduction to Twisted

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Web Server

(HTTP)

```
twistd web --port tcp:8080 --path .
```

Chat Server

(IRC)

```
twistd words --irc-port tcp:6667
--auth file:passwords.txt --group channel
```

Secure Shell Server

(SSH)

sudo twistd conch -p tcp:2222

Name Server

(DNS)

twistd dns -p 5553 --hosts-file=hosts

File Server

(FTP)

```
twistd ftp --port 2121 --root .
```

BitTorrent Client

https://github.com/staceysern/bittorrent

Twisted

An event-driven, networking engine

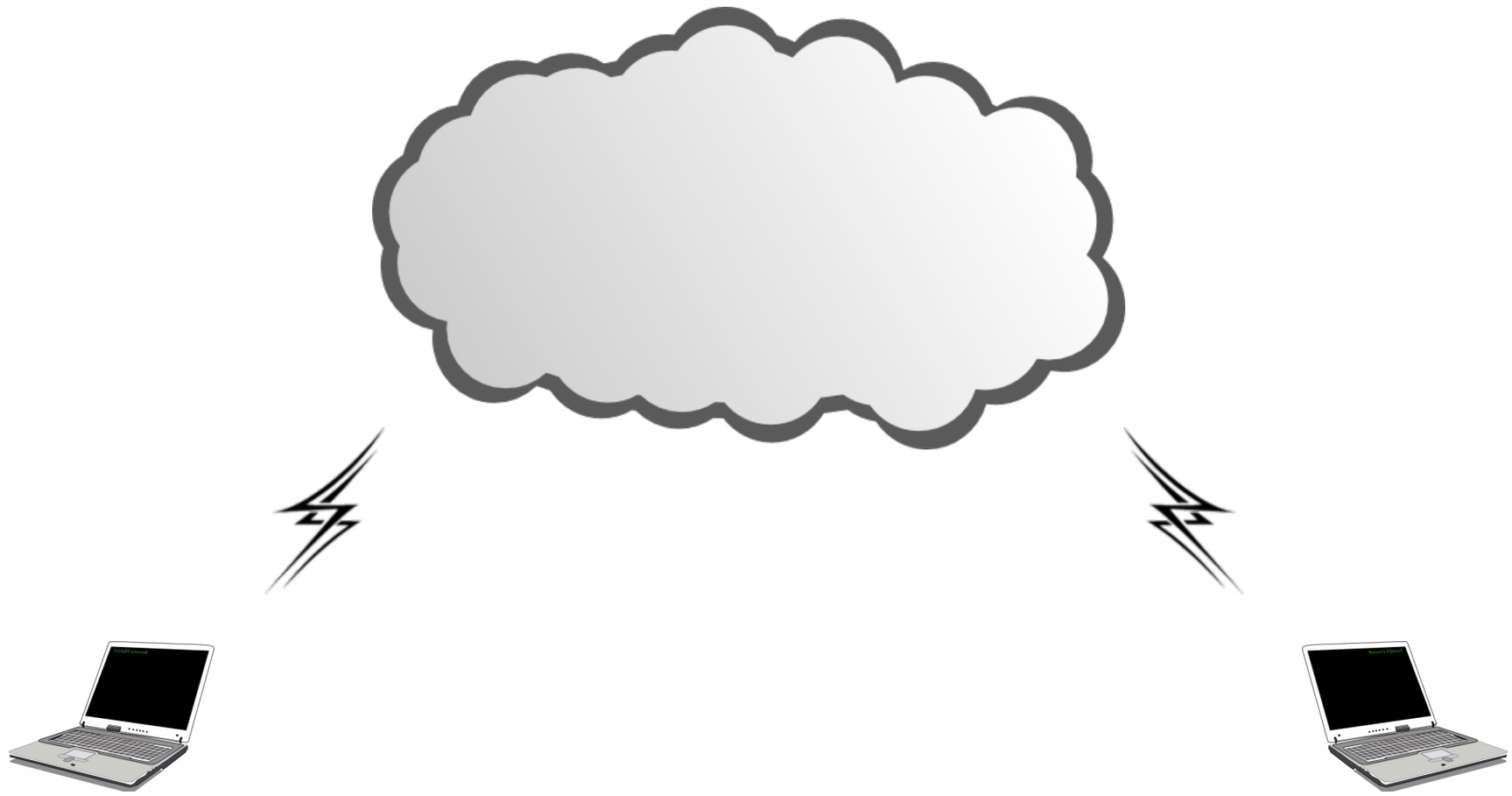
Twisted

An event-driven, networking engine

- Event-driven, networking engine
- Event-driven programming abstractions
- Networking abstractions
- Low-level APIs
- High-level APIs
- Applications

Twisted

An event-driven, networking engine



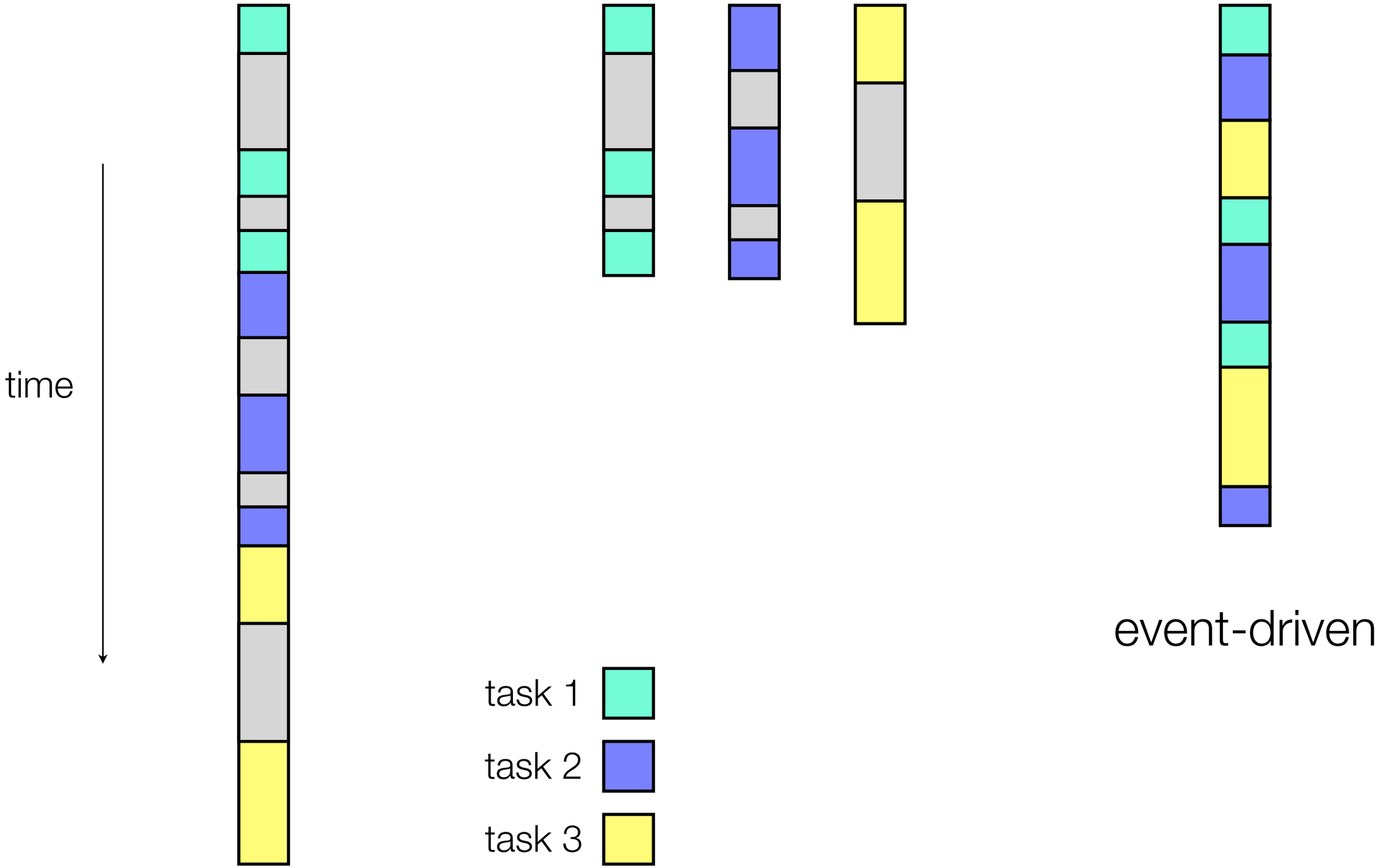
Twisted

An event-driven, networking engine

single-threaded
synchronous

multi-threaded
synchronous

single-threaded
asynchronous



event-driven

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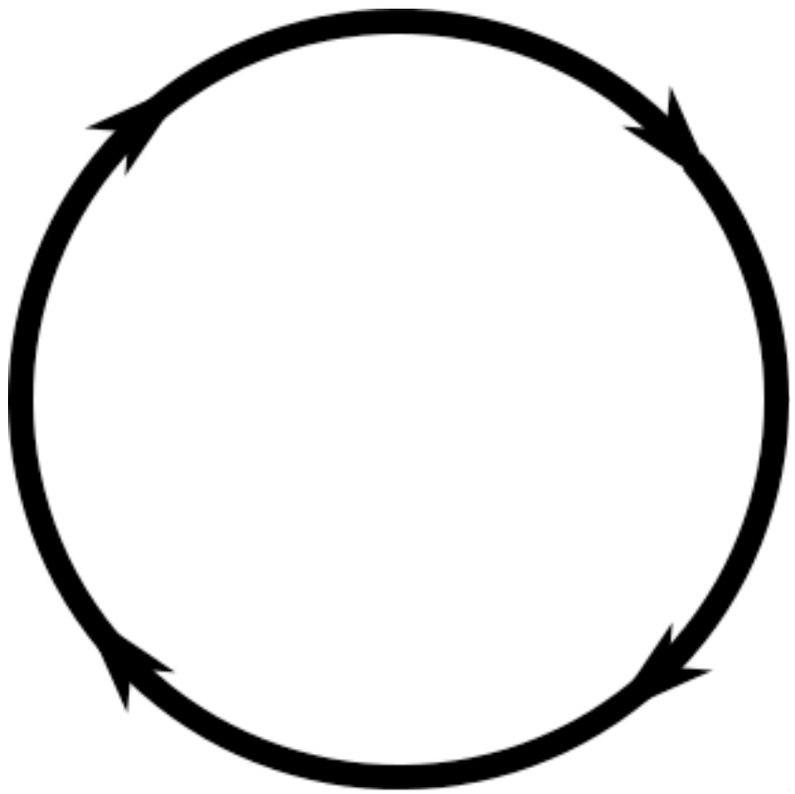
Reactor

Twisted's event loop

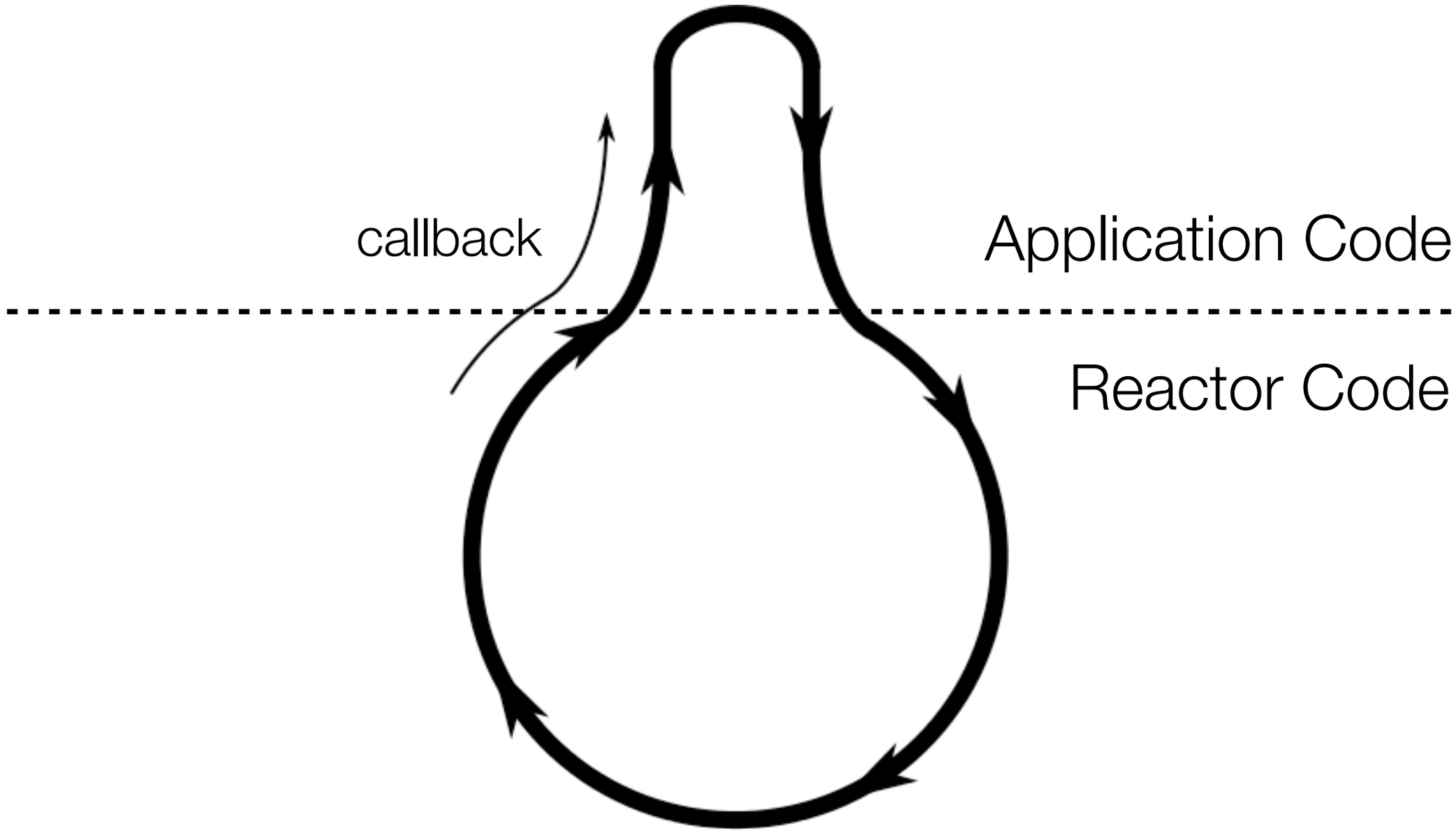


Reactor

Twisted's event loop

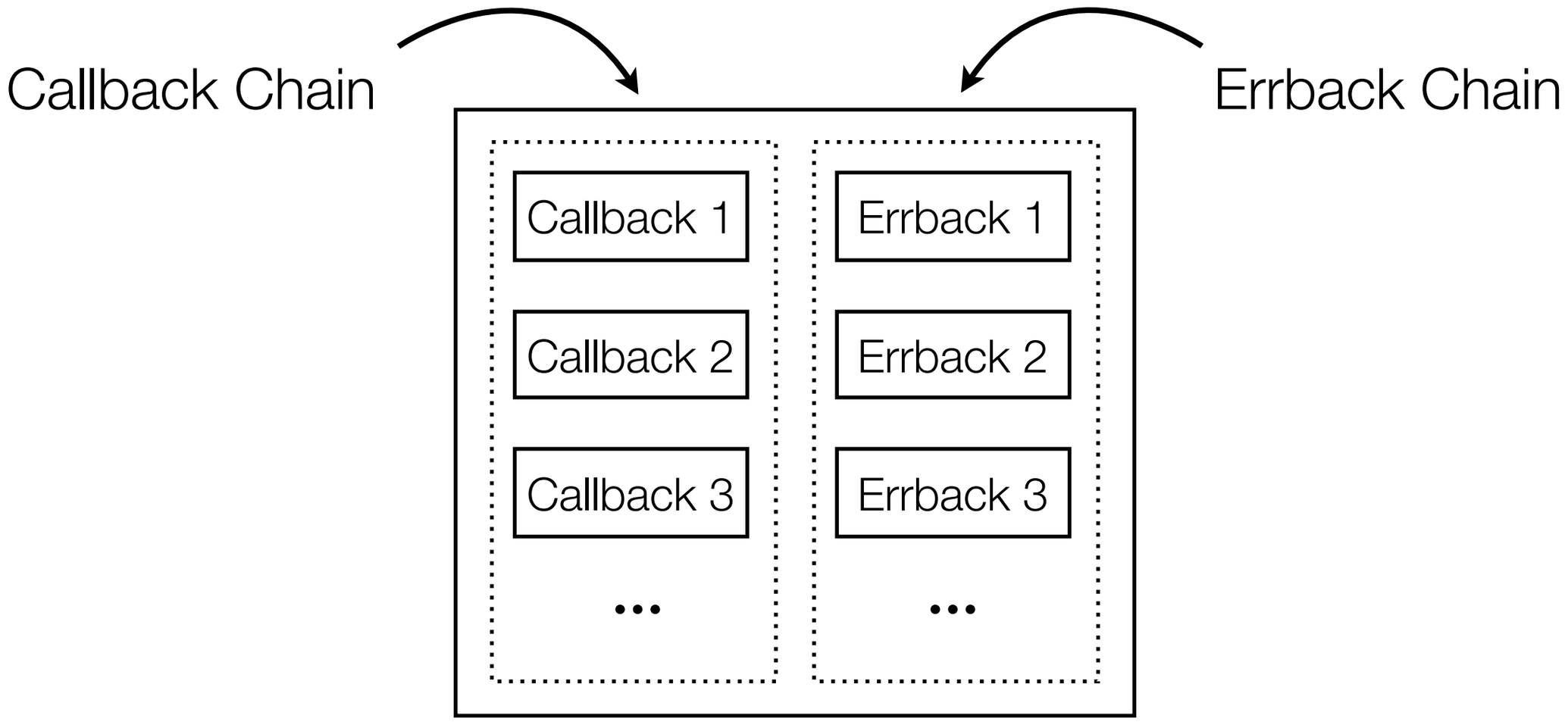
Interface

server & client	server	client
run()	listenTCP()	connectTCP()
stop()	listenUDP()	connectSSL()
callLater()	listenSSL()	


callback
Application Code
Reactor Code

Deferred

An abstraction for managing callbacks

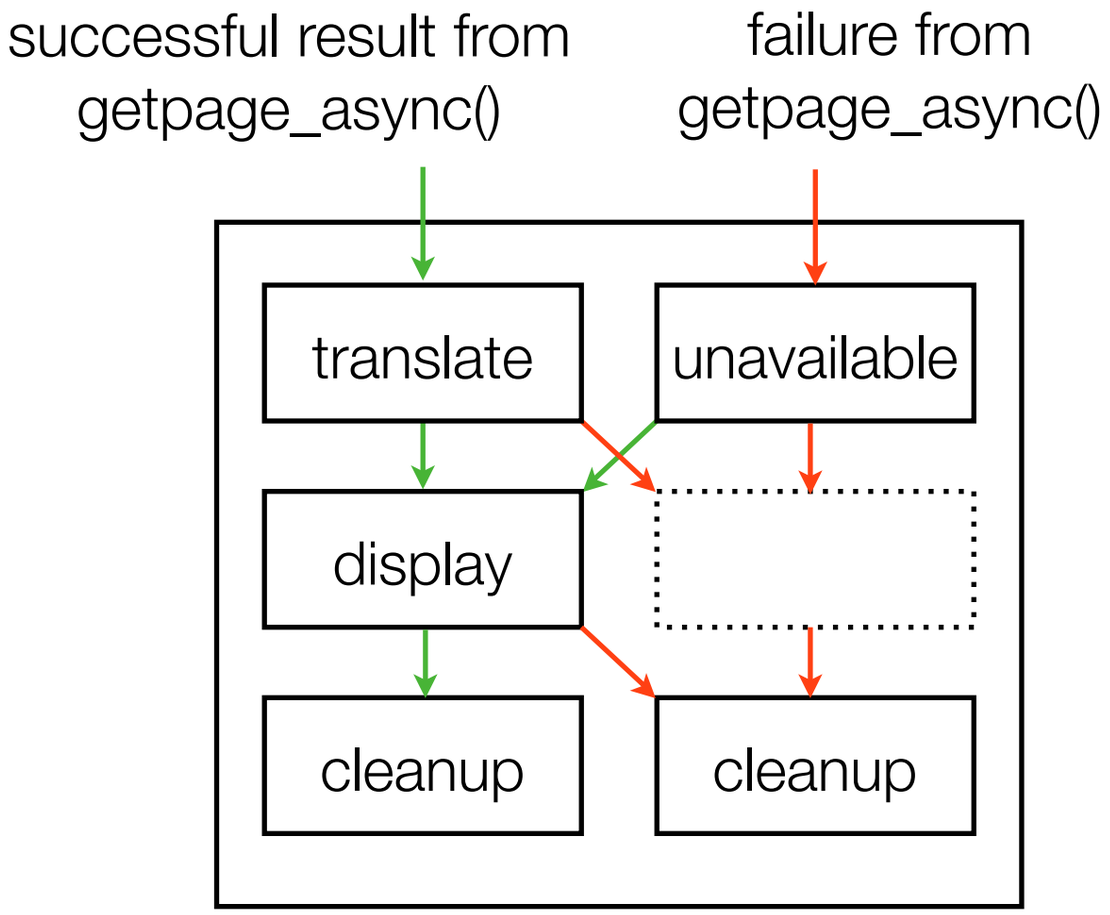


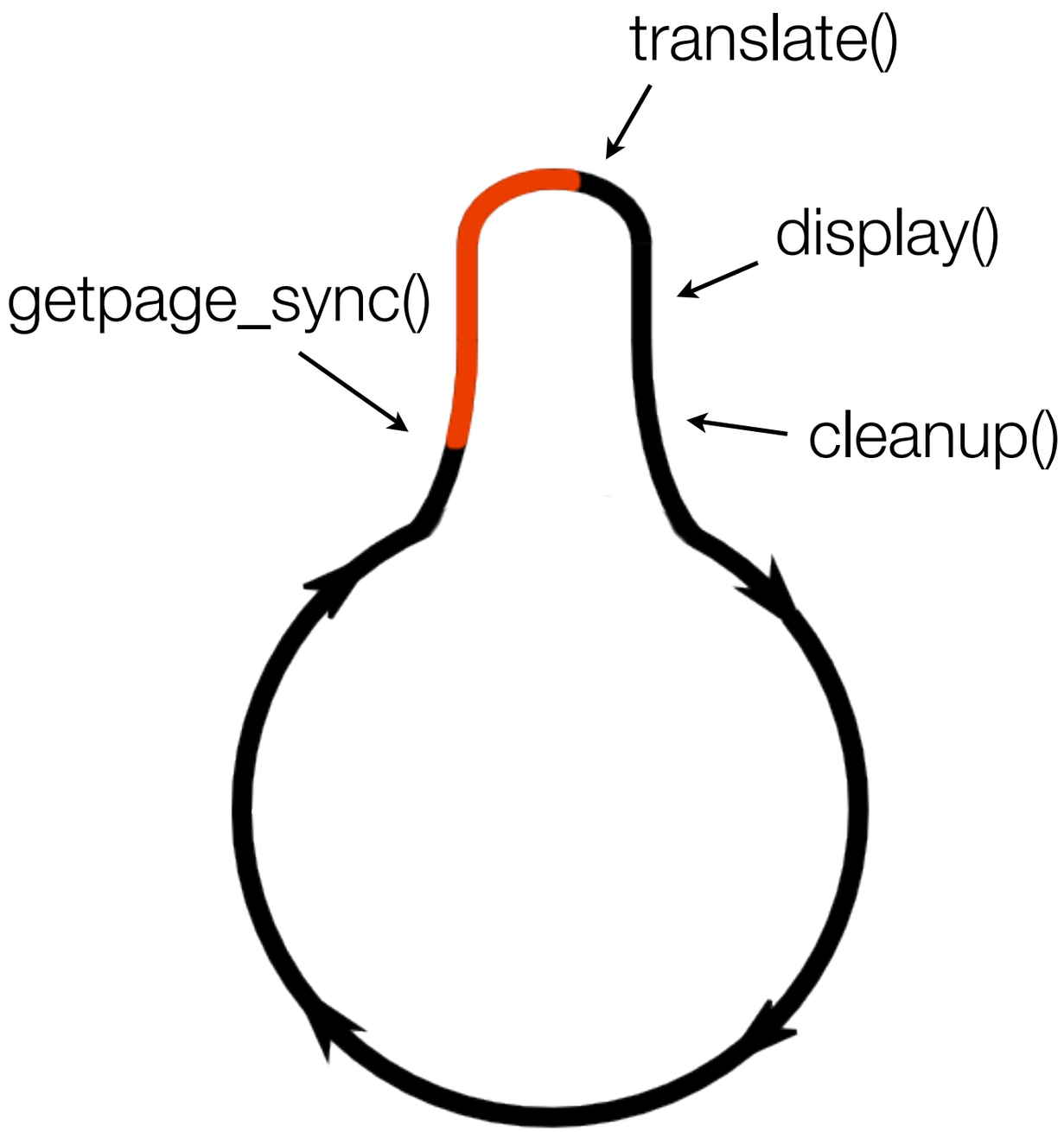
Synchronous

```
try:
    p = getpage_sync()
except Exception:
    unavailable()
else:
    t = translate(p)
    display(t)
finally:
    cleanup()
```

Asynchronous

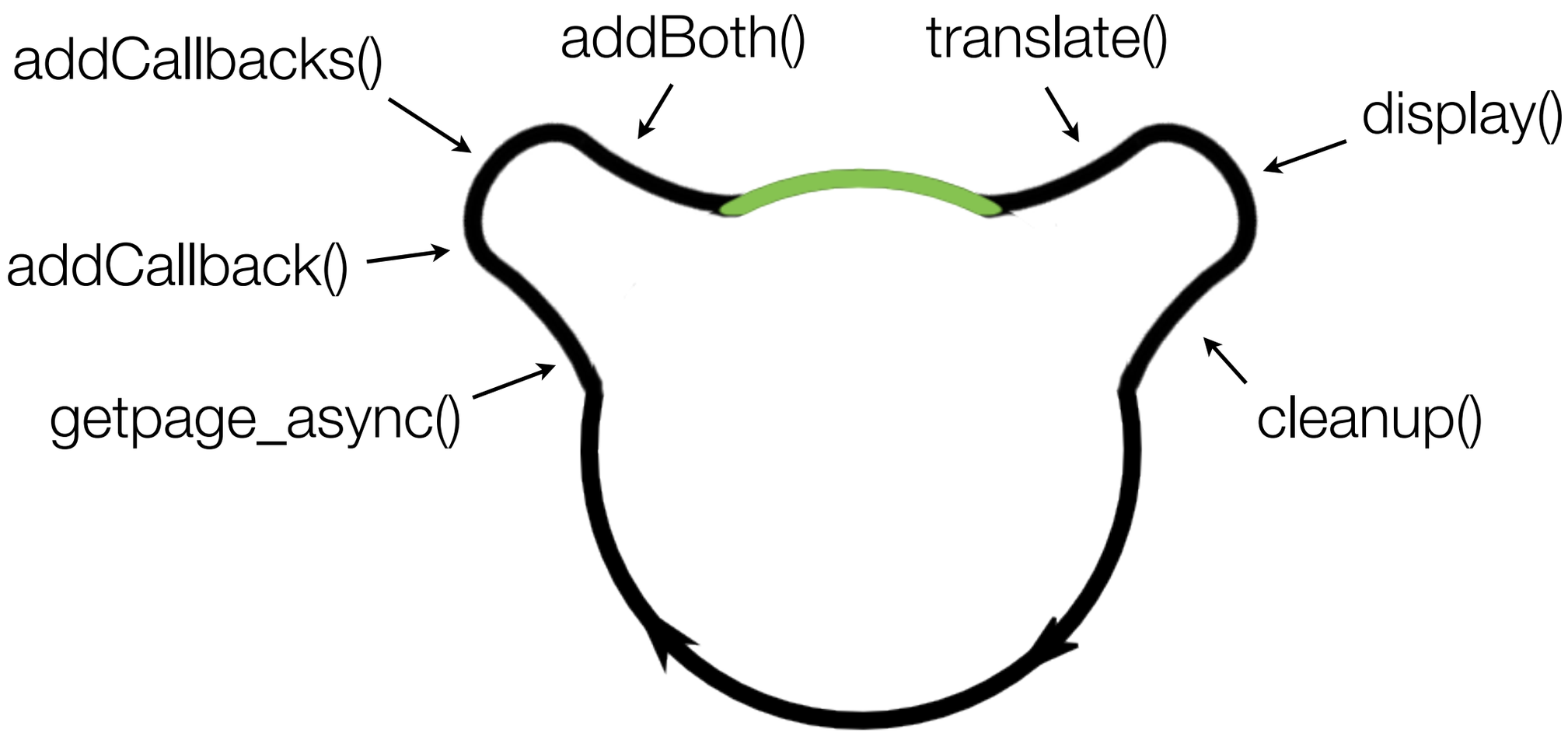
```
d = getpage_async()
d.addCallbacks(translate, unavailable)
d.addCallback(display)
d.addBoth(cleanup)
```



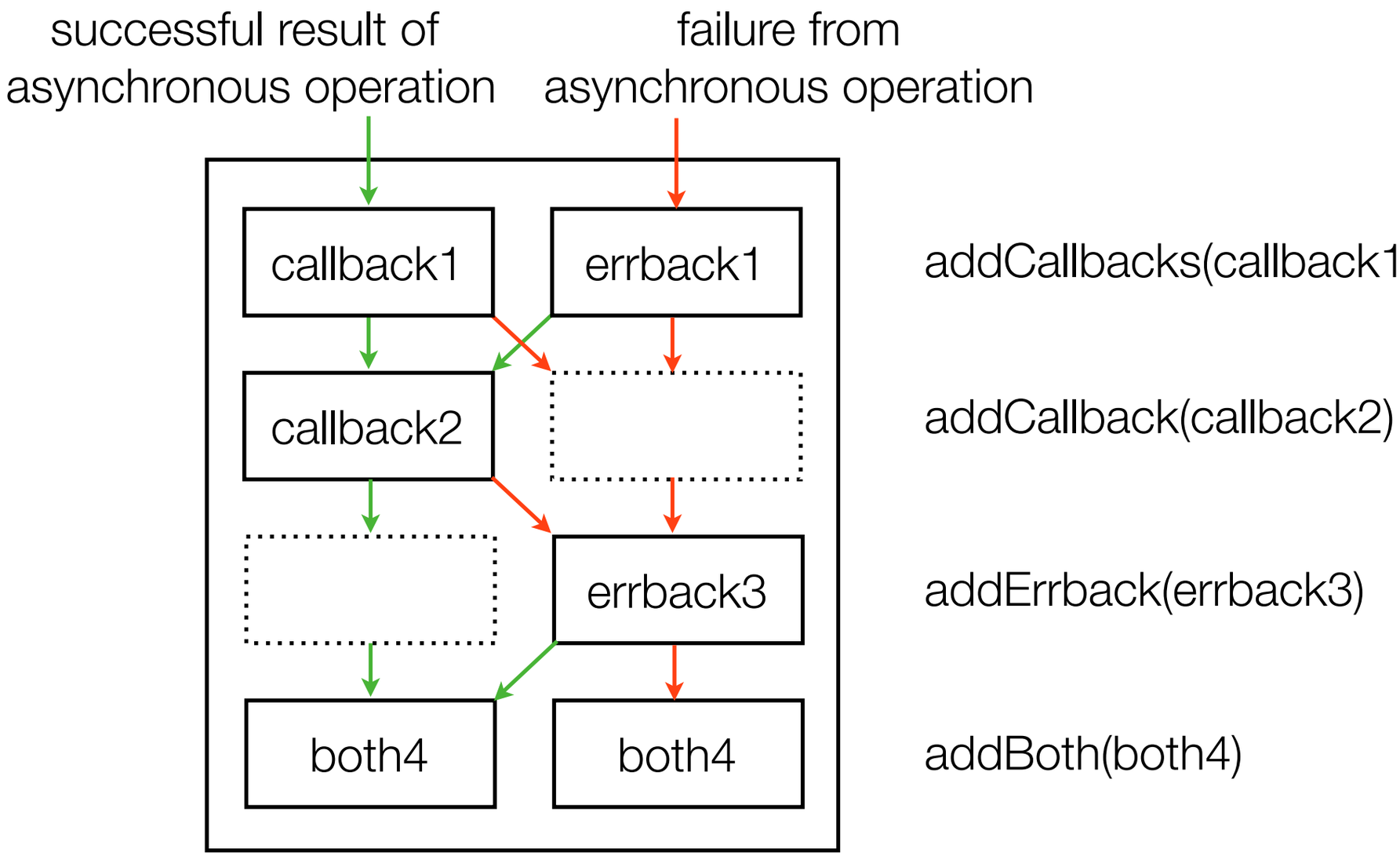


Synchronous

Asynchronous



Deferred


successful result of
asynchronous operation
failure from
asynchronous operation
callback1
errback1
callback2
errback3
both4
both4
addCallbacks(callback1, errback1)
addCallback(callback2)
addErrback(errback3)
addBoth(both4)

Twisted

An event-driven, networking engine

- Event-driven, networking engine
- Event-driven programming abstractions
- Networking abstractions
- Low-level APIs
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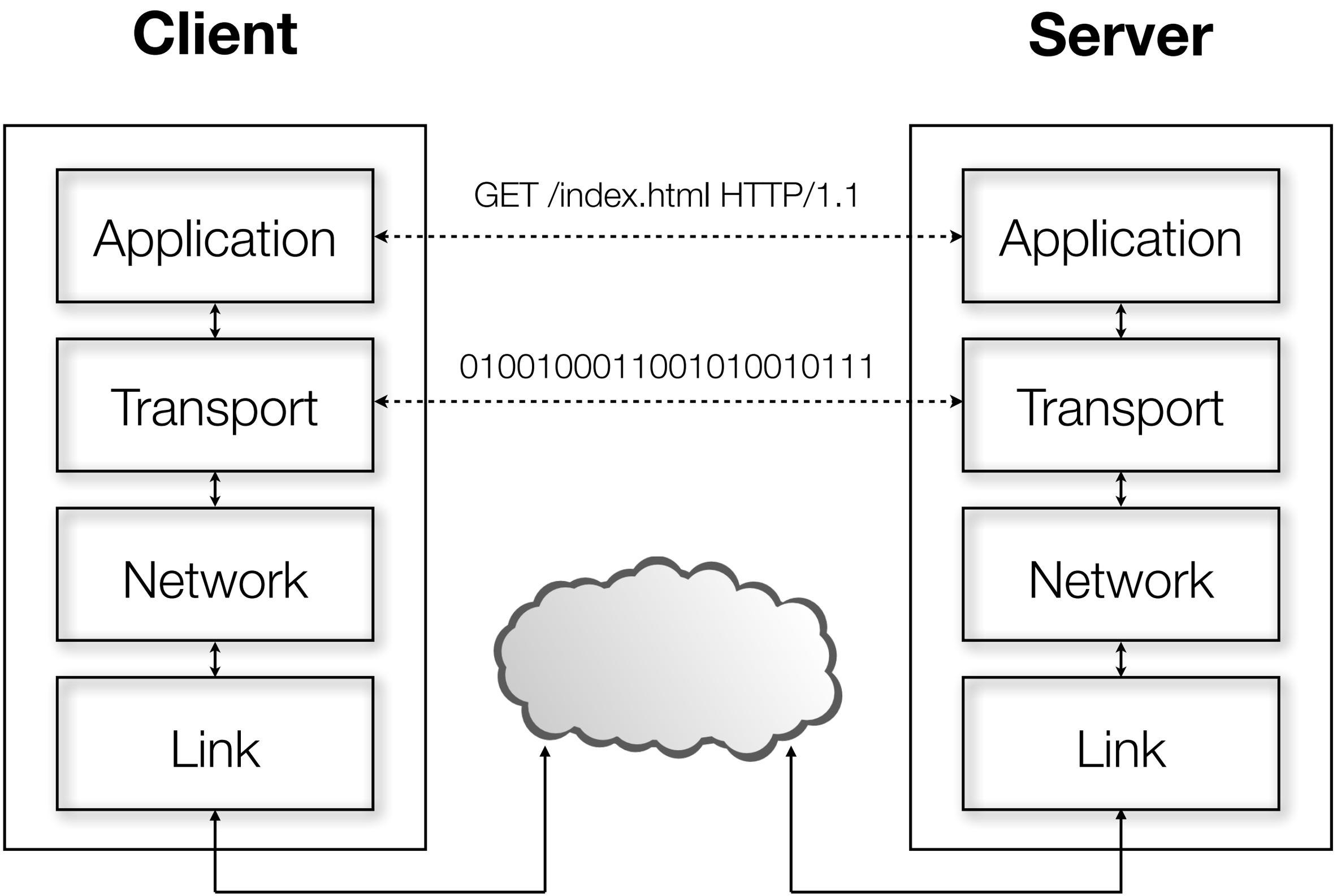
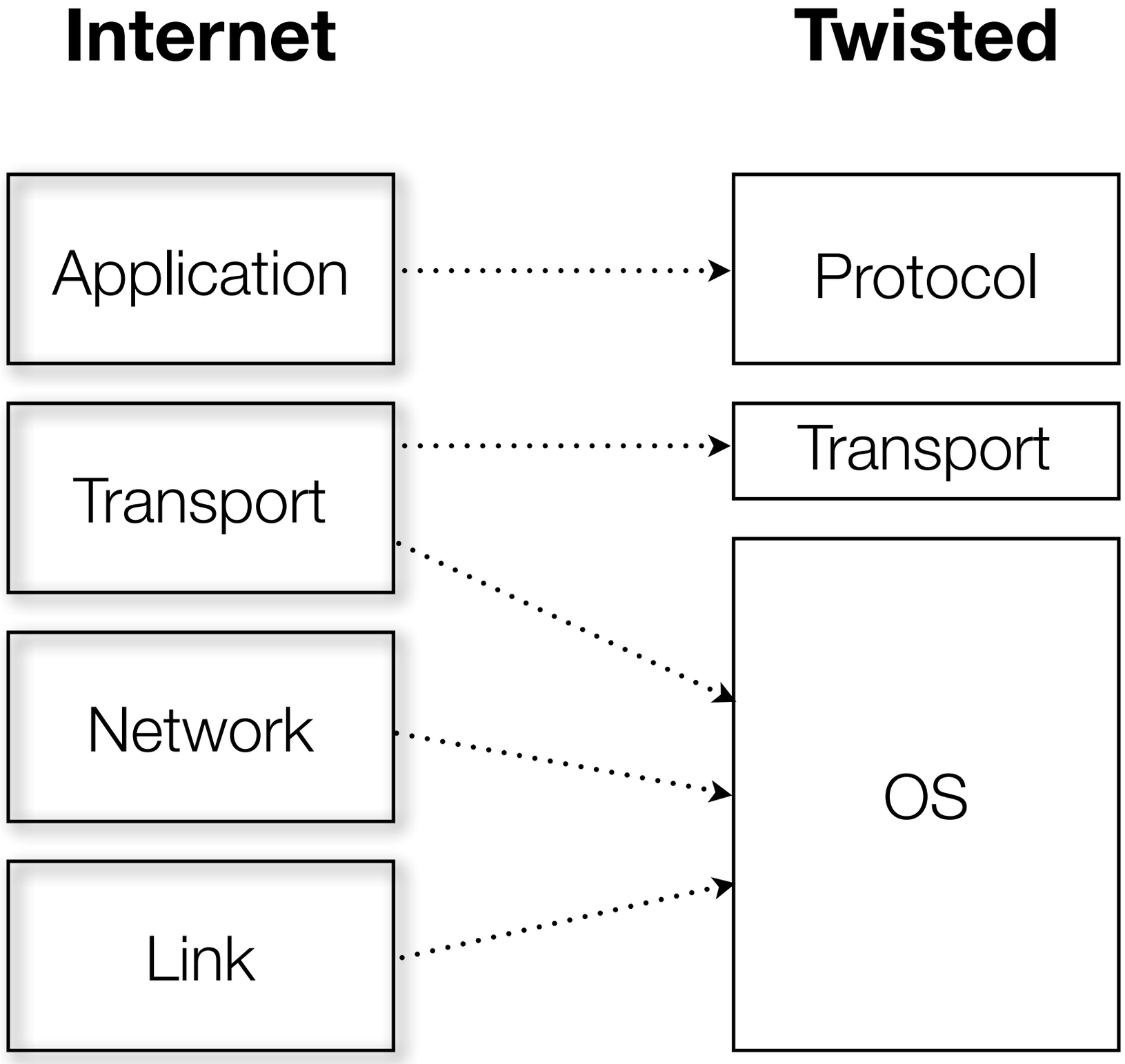
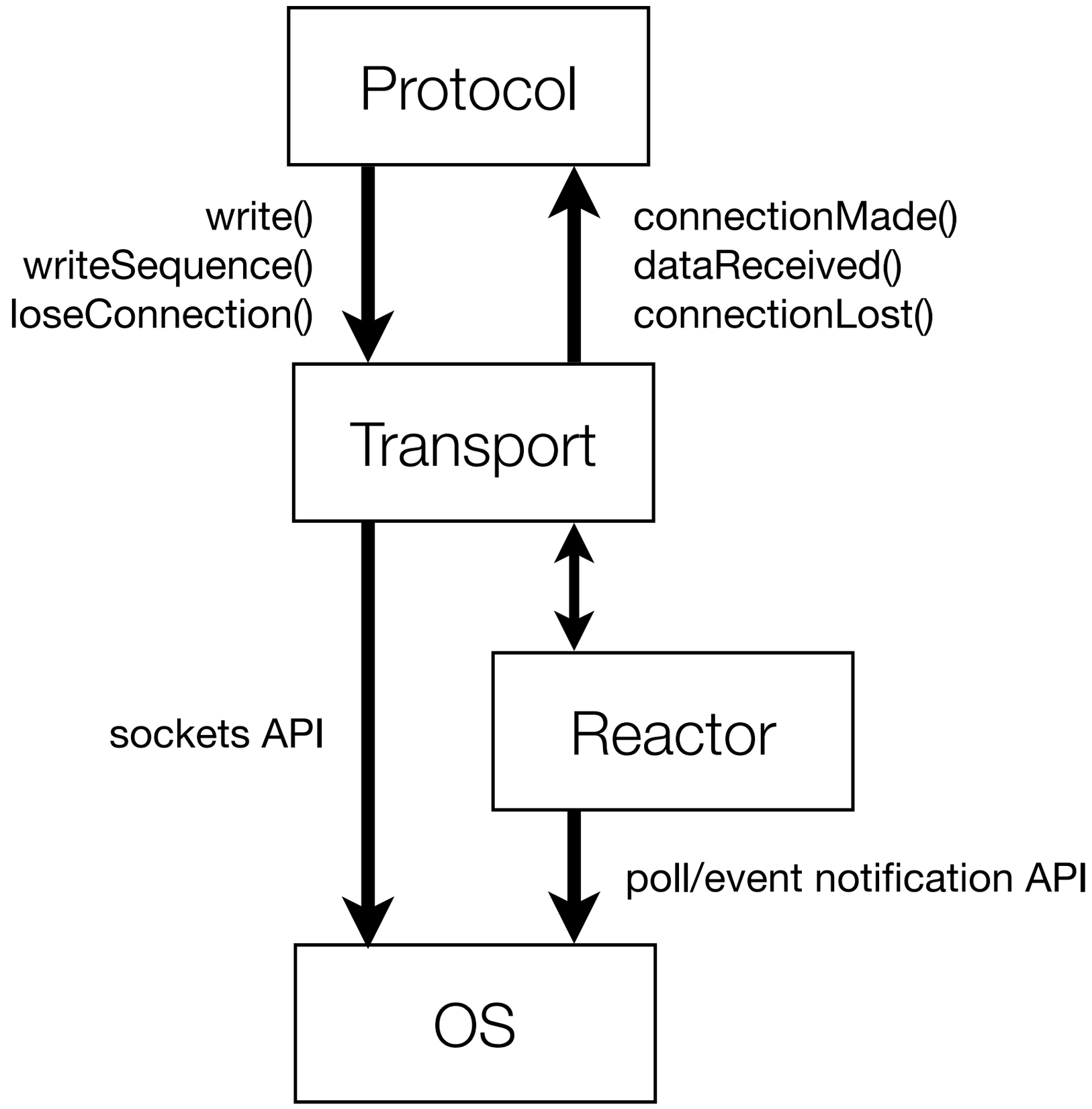
Internet Protocol Suite

Application	HTTP, FTP, SMTP, POP, IMAP, DNS, IRC
Transport	TCP, UDP, SSL/TLS
Network	IP
Link	Ethernet


Client
Server
Application
Transport
Network
Link
GET /index.html HTTP/1.1
0100100011001010010111
Application
Transport
Network
Link


Internet
Twisted
Application
Transport
Network
Link
Protocol
Transport
OS

ProtocolFactory	Used to create the appropriate Protocol when a new connection is established
Protocol	Represents one side of an application layer protocol which determines the format and meaning of data sent and received over a Transport
Transport	Represents one end of a connection between two endpoints over which data can be sent and received


Protocol
write()
writeSequence()
loseConnection()
connectionMade()
dataReceived()
connectionLost()
Transport
sockets API
Reactor
poll/event notification API
OS

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Echo Server

```
from twisted.internet import protocol, reactor

class EchoServer(protocol.Protocol):
    def dataReceived(self, data):
        self.transport.write(data)

class EchoServerFactory(protocol.Factory):
    def buildProtocol(self, addr):
        return EchoServer()

reactor.listenTCP(8000, EchoServerFactory())
reactor.run()
```

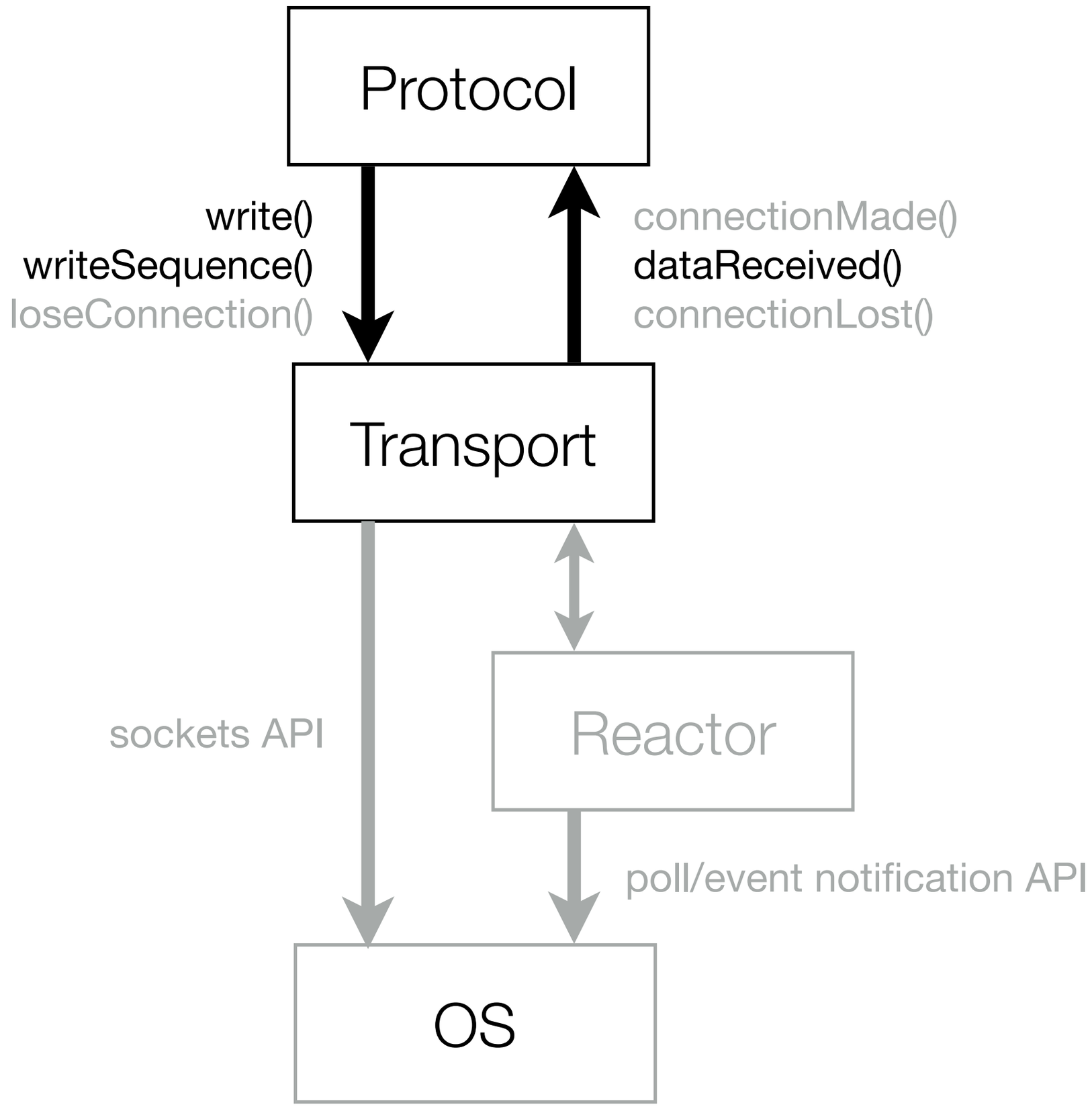
Echo Client

```
from twisted.internet import protocol, reactor

class EchoClient(protocol.Protocol):
    def connectionMade(self):
        self.transport.write(b'Hello, world!')
    def dataReceived(self, data):
        print(data)
        self.transport.loseConnection()

class EchoClientFactory(protocol.ClientFactory):
    def buildProtocol(self, addr):
        return EchoClient()

reactor.connectTCP('10.0.1.56', 8000, EchoClientFactory())
reactor.run()
```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SMTP

```
$ telnet aspmx.l.google.com 25
Trying 173.194.68.26...
Connected to aspmx.l.google.com.
Escape character is '^]'.
220 mx.google.com ESMTP ew5si11028094qab.7 - gsmtp
HELO
250 mx.google.com at your service
MAIL FROM:<sender@example.com>
250 2.1.0 OK ew5si11028094qab.7 - gsmtp
RCPT TO:<recipient@example.com>
250 2.1.5 OK ew5si11028094qab.7 - gsmtp
DATA
354 Go ahead ew5si11028094qab.7 - gsmtp
From: Sender <sender@example.com>
To: Recipient <recipient@example.com>
Subject: This is a test

This is only a test.
.
250 2.0.0 OK 1392752225 ew5si11028094qab.7 - gsmtp
```

SMTPClient

A Protocol which implements the client side of the SMTP protocol

API

getMailFrom()
getMailTo()
getData()
sentMail()

```
class SingleMessageSender(smtp.SMTPClient):
    def __init__(self, from_addr, to_addr, data):
        smtp.SMTPClient.__init__(self, None)
        self.from_addr = from_addr
        self.to_addr = to_addr
        self.data = data
        self.done = False

    def getMailFrom(self):
        if not self.done:
            self.done = True
            return self.from_addr

    def getMailTo(self):
        return [self.to_addr]

    def getMailData(self):
        return self.data

    def sentMail(self, code, resp, numOk, addresses, log):
        pass
```

Twisted Mail

Client Building Blocks

- SMTPClient
- SMTPSender
- SMTPSenderFactory
- sendmail()
- Extended SMTP (ESMTP) equivalents

Twisted Mail

Server Building Blocks

- SMTP
- ESMTP
- twistd mail

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twistd

A cross-platform utility for deploying Twisted applications

- Starting and stopping
- Logging
- Daemonizing
- Custom reactor
- Profiling

Twisted

An event-driven, networking engine

- Event-driven, networking engine (building blocks)
- Event-driven programming abstractions (Reactor, Deferred)
- Networking abstractions (Transport, Protocol, ProtocolFactory)
- Low-level APIs (TCP, UDP, SSL/TLS)
- High-level APIs (HTTP, SMTP, FTP, SSH, IRC, DNS)
- Applications (twistd)

Resources

- An Introduction to Asynchronous Programming and Twisted (http://krondo.com/?p=1327)

- Twisted Network Programming Essentials - Jessica McKellar & Abe Fettig

- Twisted Website (https://twistedmatrix.com)