

# 3. Tutorial

## Task 1

Get informed about the Proxy software design pattern. Create a proxy for the Calculator class from the 1st tutorial. The proxy should cache last 10 calculations and return the cached results when the new and the cached operation/operands pairs match.



Tutorial3-Task1-Template.zip

Shared on Dropbox



Tutorial3-Task1-Solution.zip

Shared on Dropbox

## Task 2

Answer the following questions:

1. What is Middleware?
2. Which services are usually provided by Middleware?
3. What is a Remote Procedure Call?

## Task 3

What is Marshalling?

The following project implements a scenario, in which a client requests a server with printing functionality to format and print given data. The connection is established by middleware, which in addition takes care of transfer of typed objects.

- Read the code and learn how the connection gets established
- Implement the methods `Marshall` and `Demarhsall`
- Start the two projects `Client` and `Server` and test your implementation



Tutorial3-Task3-Template.zip

Shared on Dropbox



# TCP Congestion vs Flow Control

## Flow Control

Sender ensures to not overwhelm the receiver → does not send packets faster than they are consumed

- all received packets are acknowledged (ack message)
- ack message contains the value of the current receive window (receive window is the space left in the receive buffer)
- TCP sliding window: max. amount of **unacknowledged** bytes that can be sent before an ack is received

## Congestion Control

Do not overwhelm the network (between two nodes). Algorithms (RFC 2581)

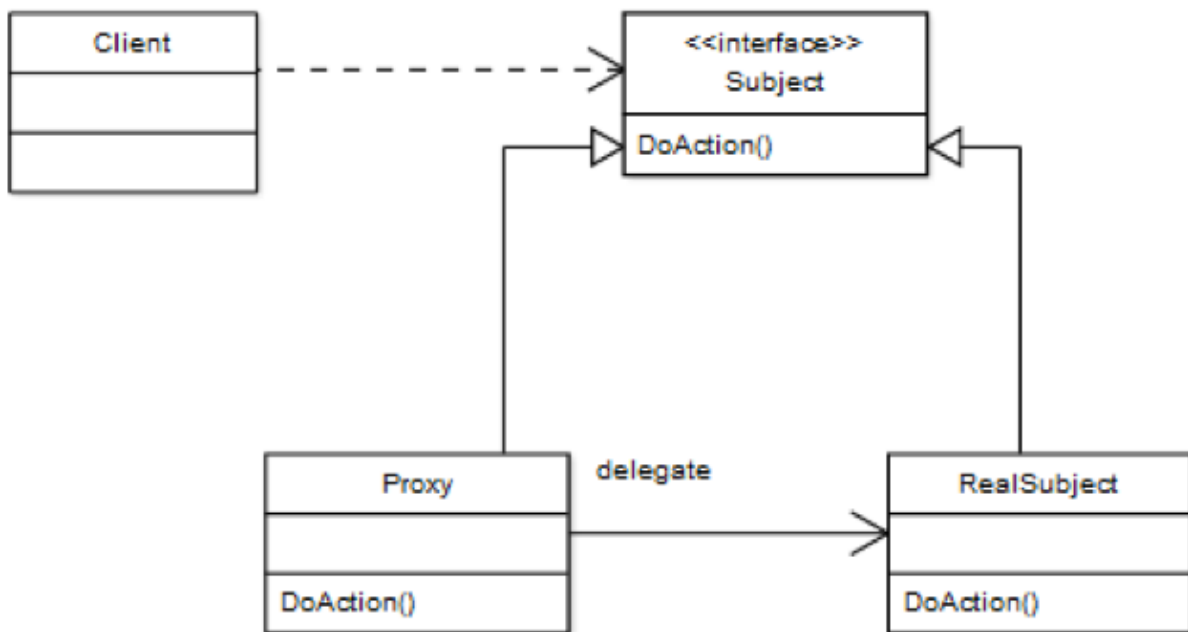
- TCP Slow Start
  - start with small window, continuously increase window size
- Congestion Avoidance
  - started when TCP Slow Start leads to dropped packets,
  - detected by having a timeout on expected acks
  - reduce window size (is continuously increased again, but not as far as where the congestion happens before)
- Fast Retransmission
  - If the sender receives  $\geq 3$  duplicate acks, segments are retransmitted immediately instead of waiting for the retransmission timer
- Fast Recovery
  - On duplicate acks go into congestion avoidance instead of starting TCP Slow Start with window size of 1

## Proxy Pattern

Problem: control access to objects

- Delay creation / initialization of real objects
- Access mediation and control
- Caching

Solution: Substitution by a Proxy



## Middleware

*The software layer that lies between the operating system and applications on each side of a distributed computing system in a network*

Krakowiak, Sacha. "What's middleware?". ObjectWeb.org

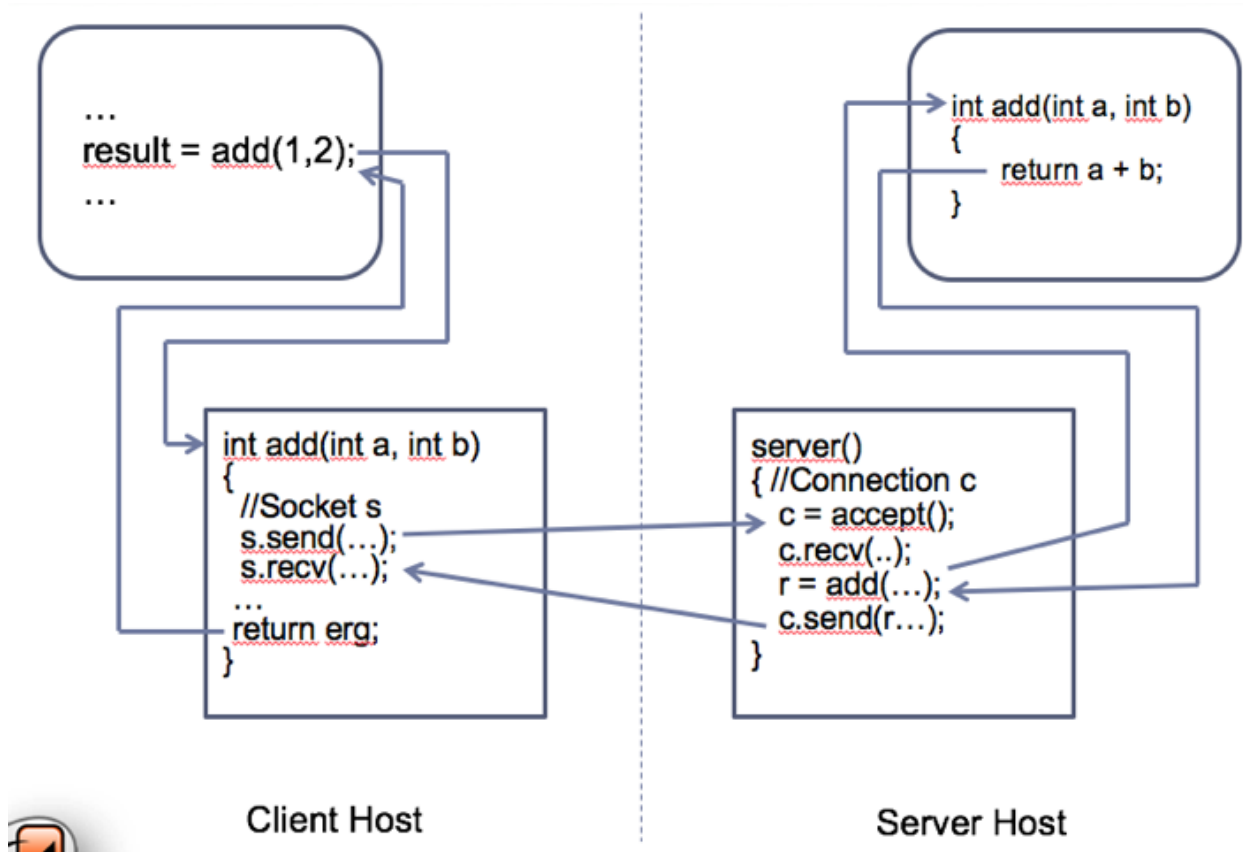
### Goal

- Connect heterogeneous network and software systems

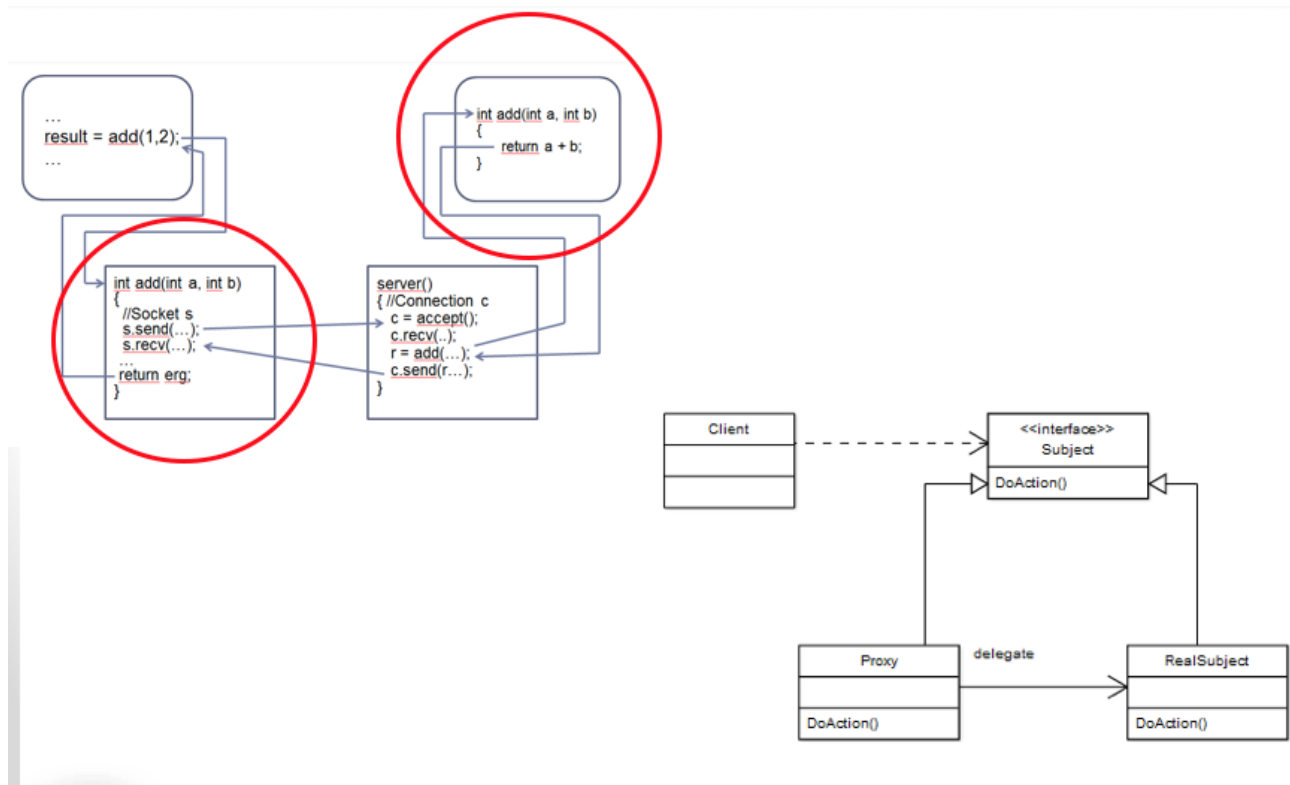
### Toolbox:

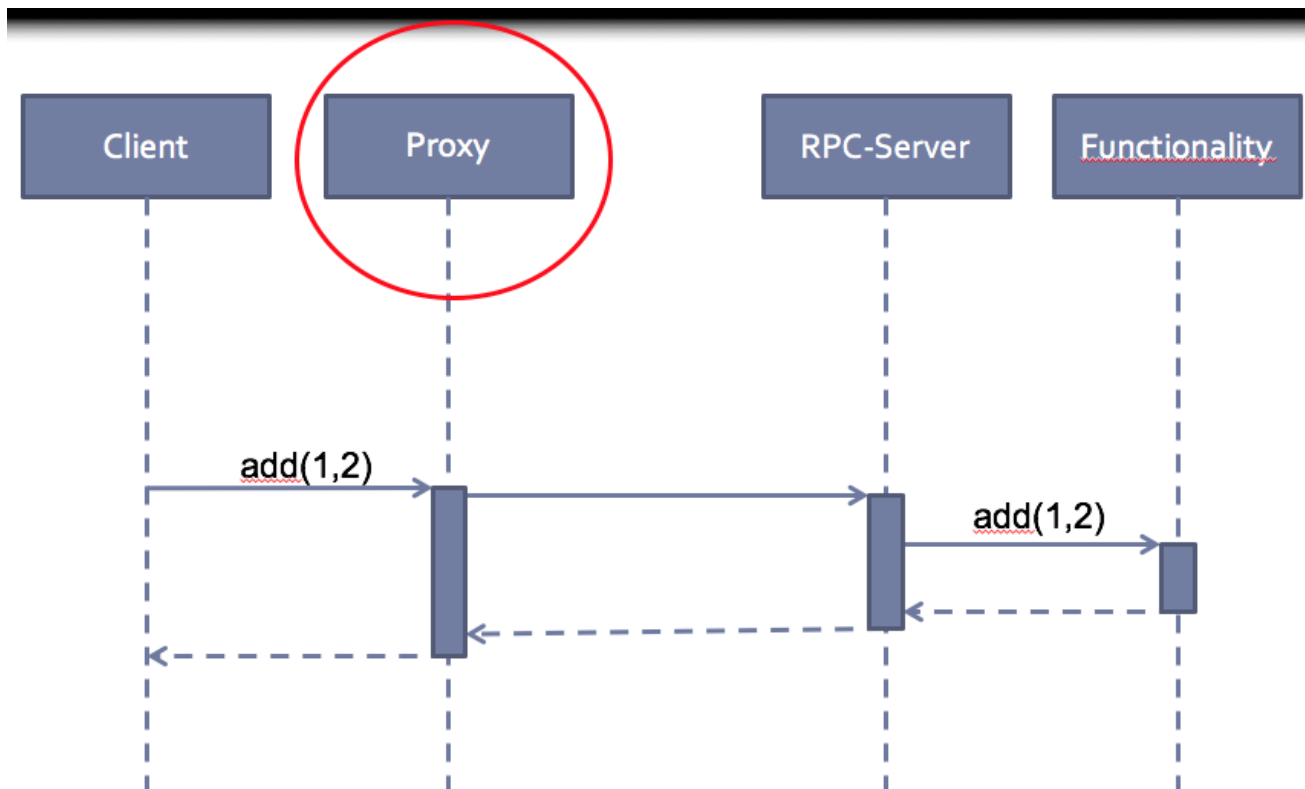
- Messaging facilities
- Session management
- Transaction management
- Security services
- Directory services

## RPC



## Proxy Pattern





## Marshalling

- Passing signature of a function, parameters and return values to a different process (potentially on a different machine)
- Usually implemented by conversion of structured data into a dedicated format, which can be transferred to other processes or systems (*serialization / deserialization*)
- Reverse process: *demarshalling* (or *unmarshalling*)