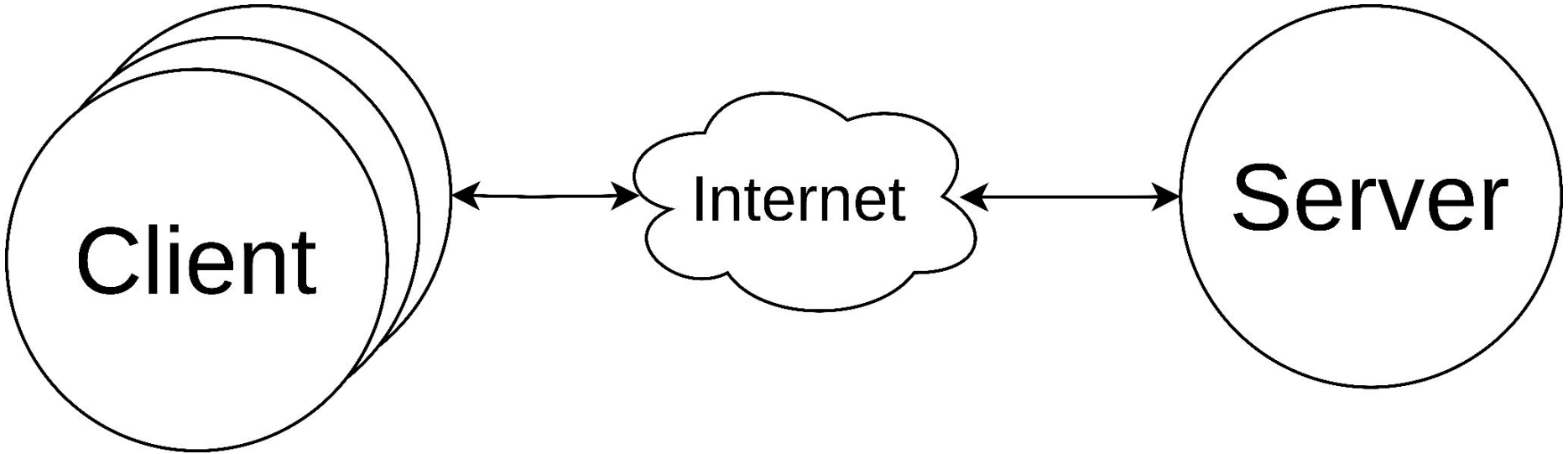
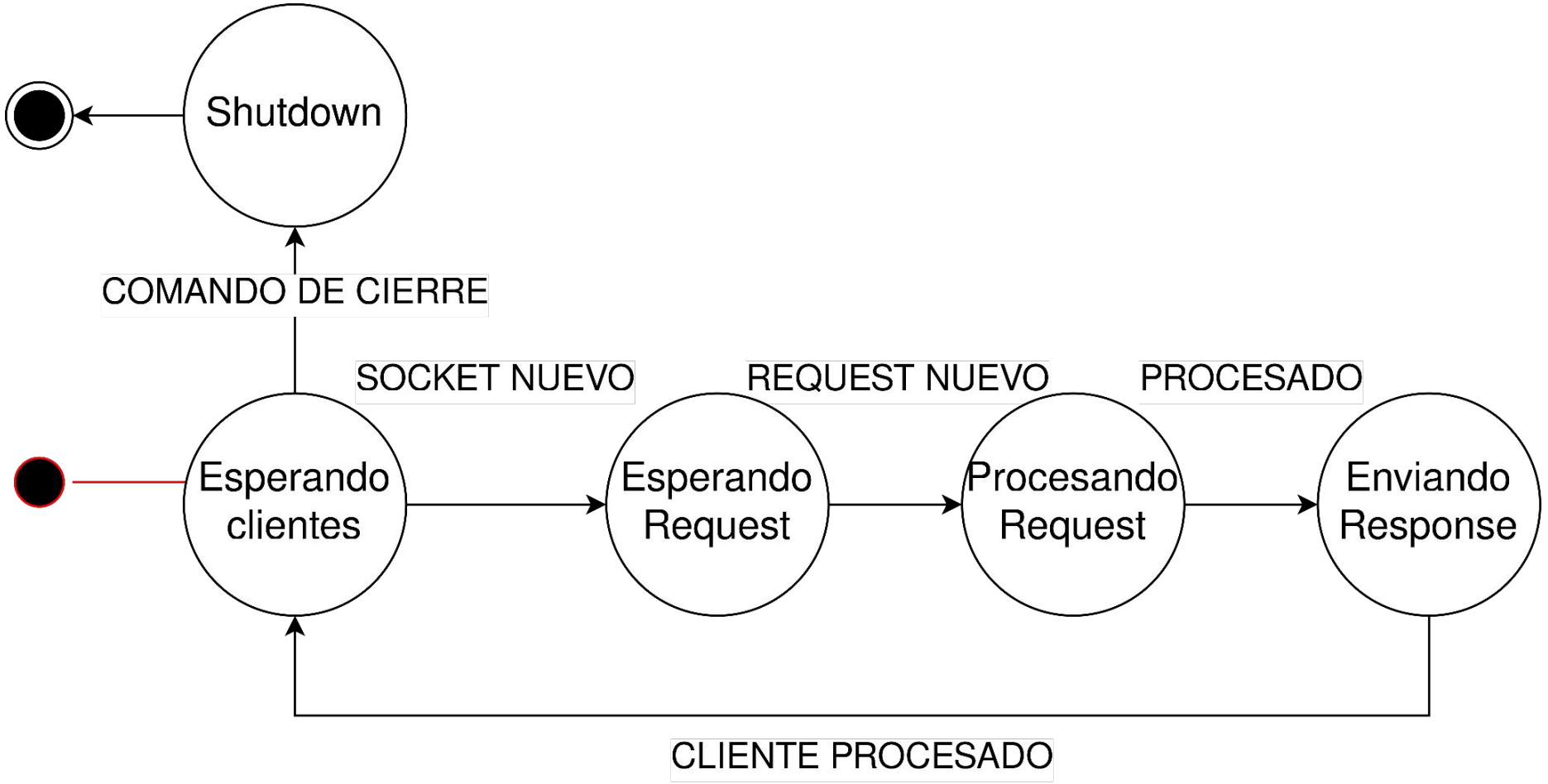
Arquitectura Client-Server

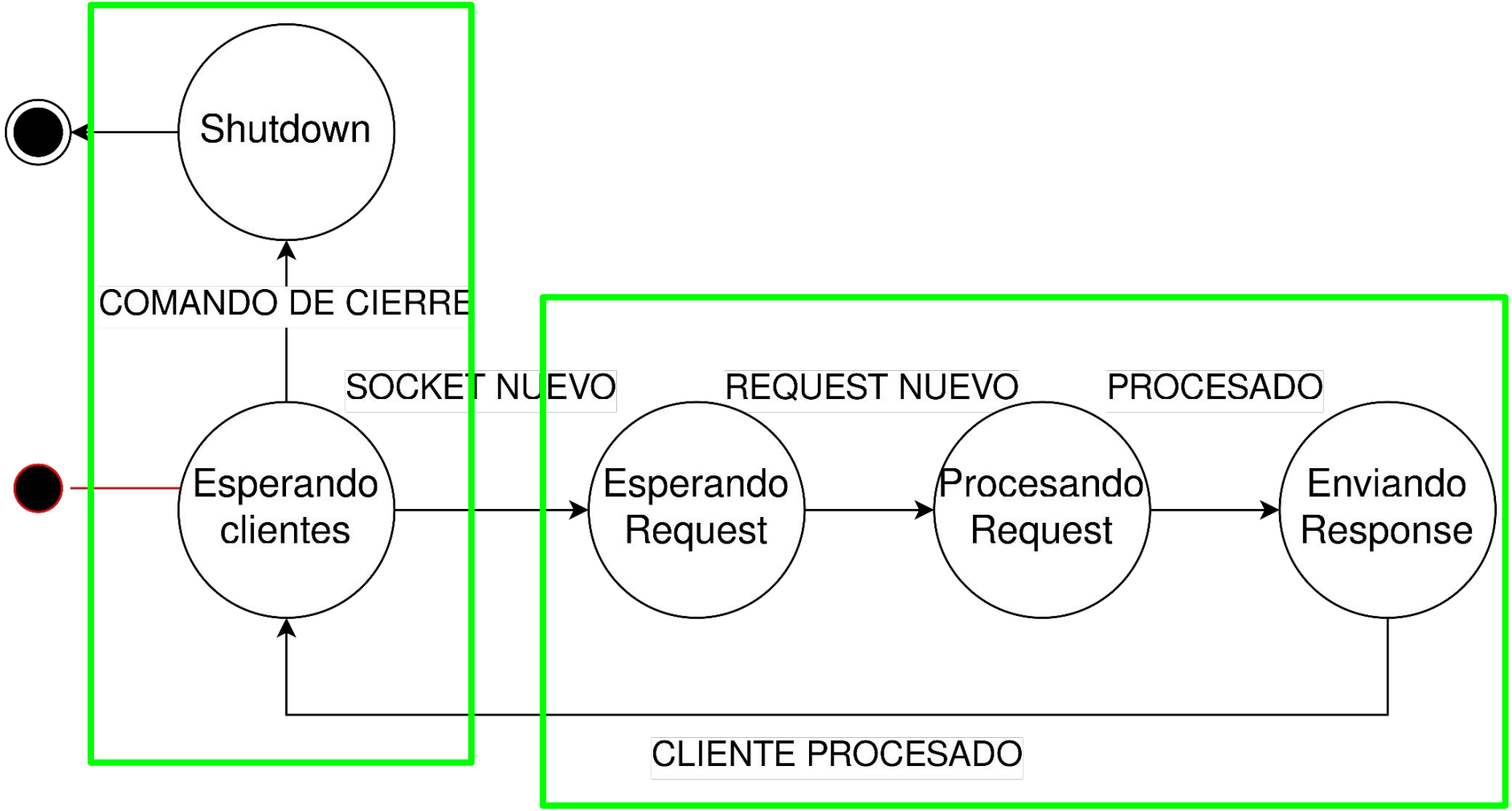
Taller de Programación I - Cátedra Veiga - FIUBA

Recap: Queremos manejar más de un cliente



```
void serve() {
  while (_keep_running) {
    Socket peer = acceptor_socket.accept();
    Request req = peer.receive_request();
    Response res = process_request(req);
    peer.send_response(res);
  }
}
```


Shutdown
COMANDO DE CIERRE
SOCKET NUEVO
REQUEST NUEVO
PROCESADO
Esperando clientes
Esperando Request
Procesando Request
Enviando Response
CLIENTE PROCESADO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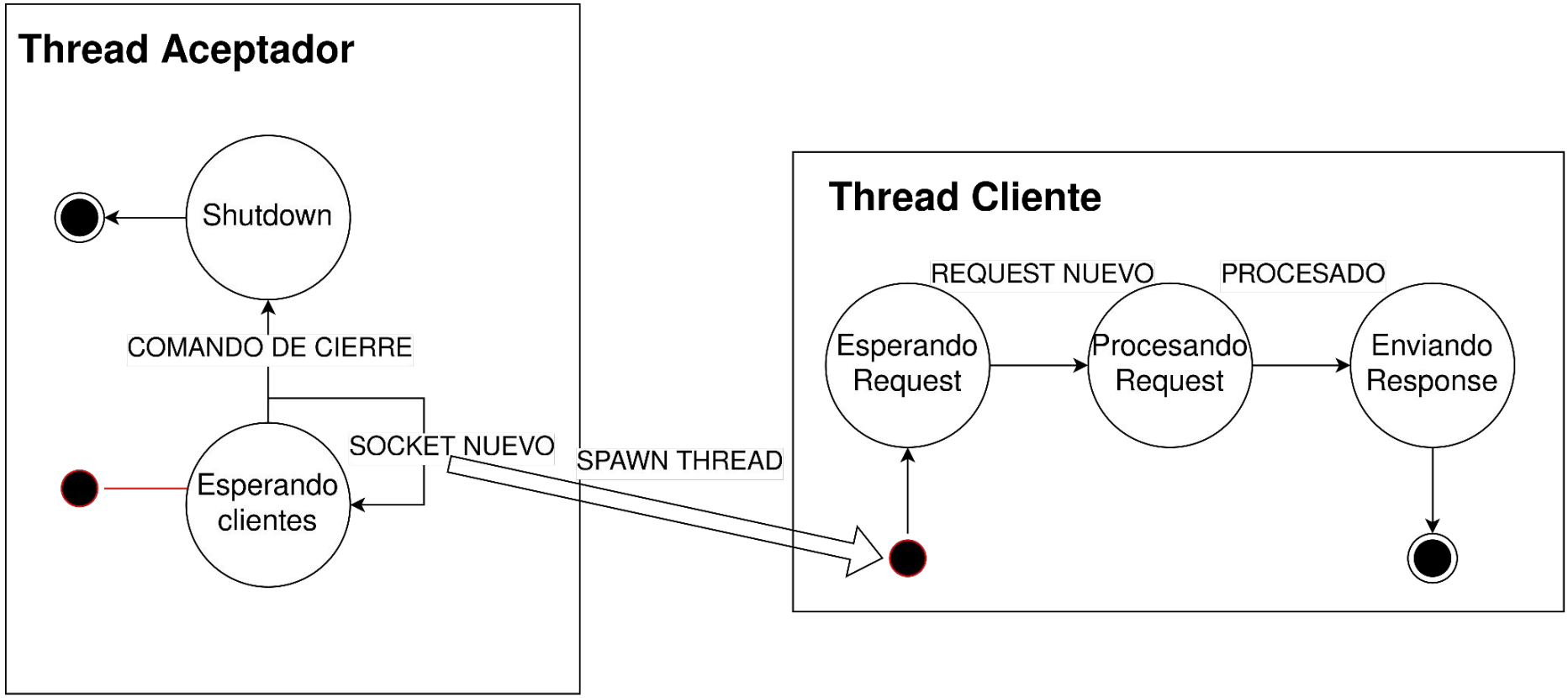
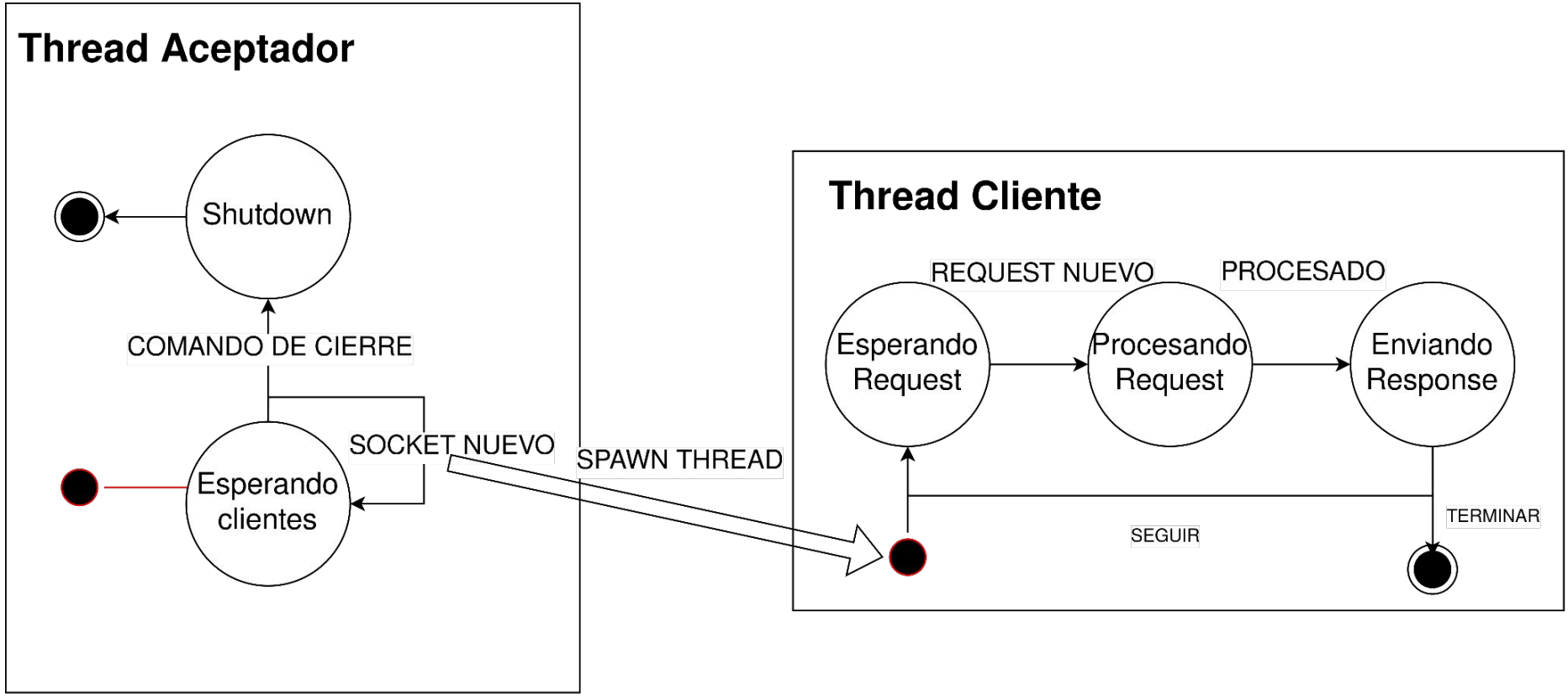
Caso 1: Thread por cliente (síncrono)



Caso 1.1: Thread por cliente Keep-Alive (síncrono)

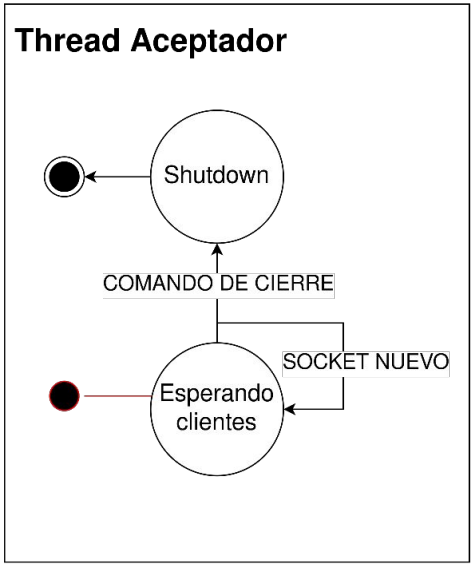


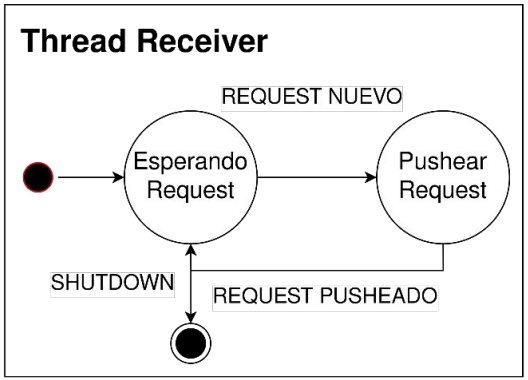
Asincronismo

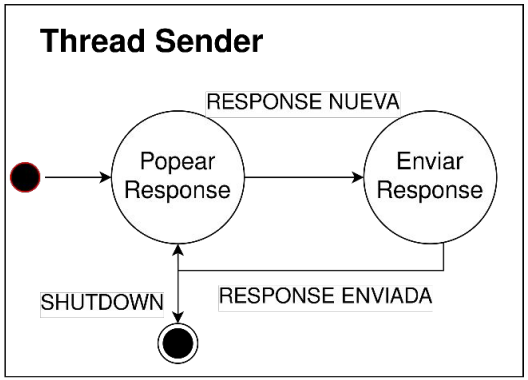
En vez de recibir, procesar el request y generar el response en el mismo hilo, podemos splitear en tres partes concurrentes:

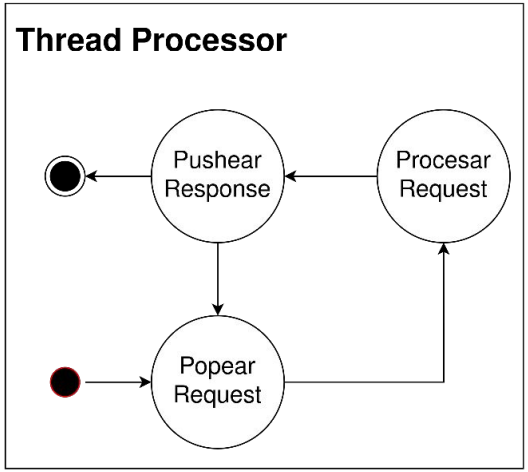
- Recibir request.
- Procesar request.
- Enviar response.

Caso 2: Dos threads por cliente Keep-Alive (asíncrono)







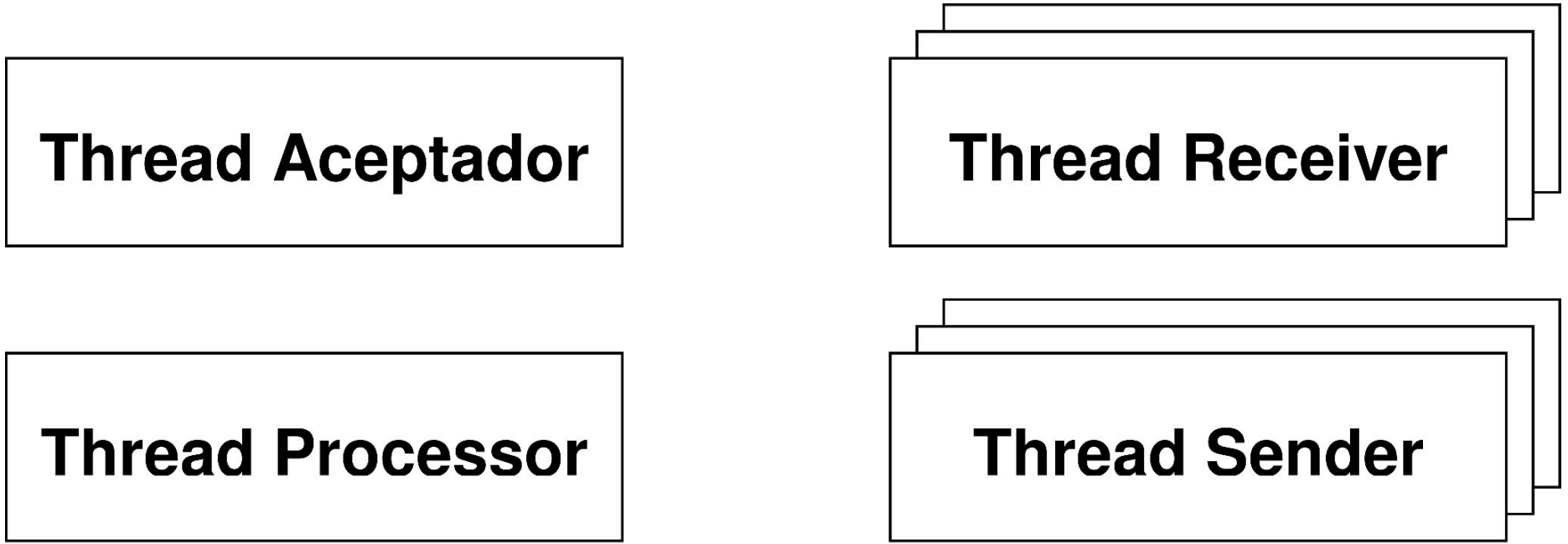


Receiver y sender comparten el mismo socket: ¿RC?

La implementación de POSIX garantiza que llamadas a recv y send son atómicas, con lo cual, si un hilo lee y otro escribe, **no hay RC**.

Más de un hilo leyendo o escribiendo sobre el mismo socket -> RC.

Servidor multithreaded

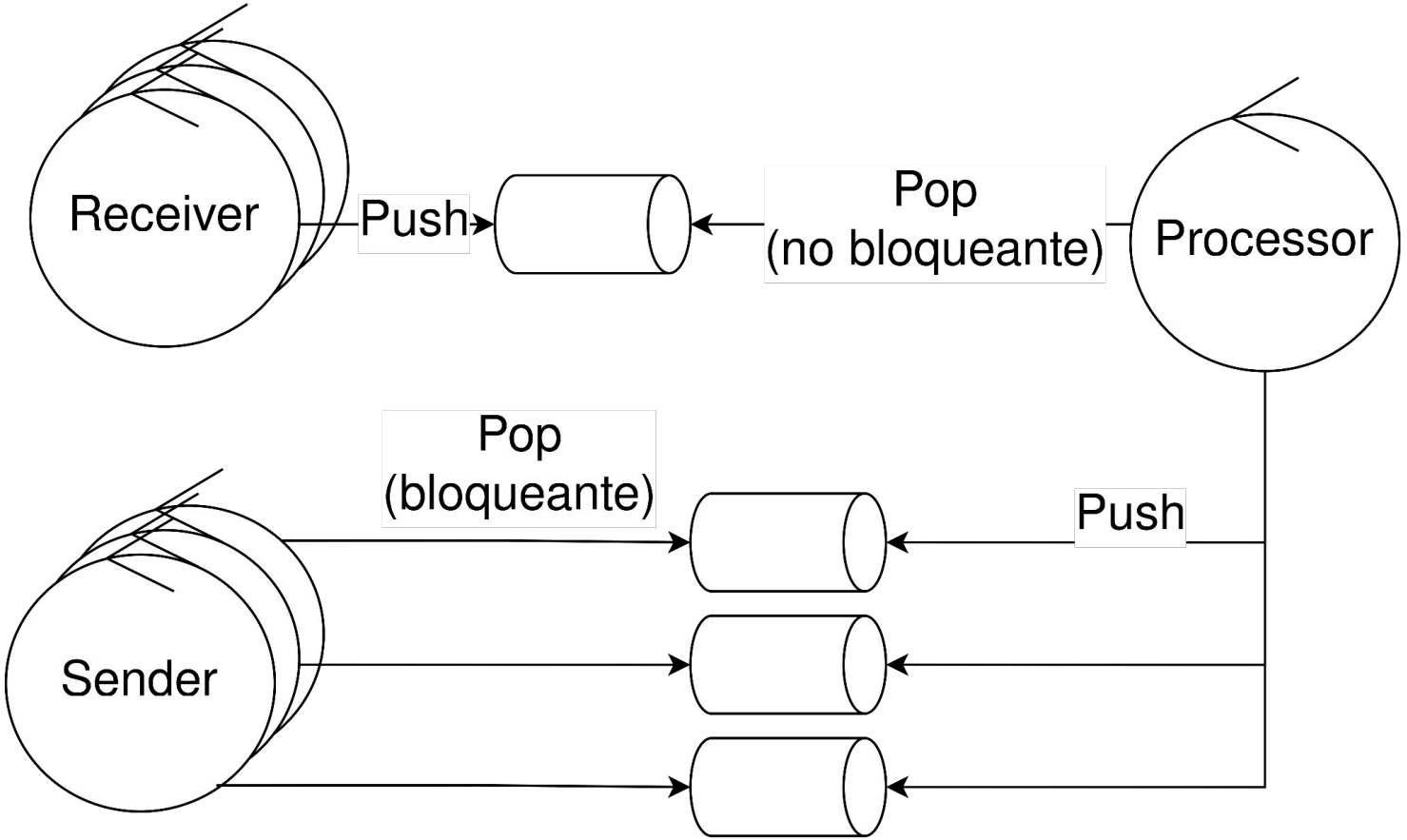


Share memory by communicating

La comunicación entre hilos receiver, sender y processor será mediante queues thread safe.

A estos hilos (receiver, sender, aceptador) los llamamos IO Threads.

Hilos, sockets y queues



Otras formas de implementar esto

- Thread pools
- Programación orientada a eventos (non-blocking IO)
- Combinación de ambas

```
class Acceptor : public Thread {
private:
    std::list<Client*> clients;
    Socket& sock;

    void run() {
        while (_keep_running) {
            auto peer = sock.accept();
            auto* client = new Client(peer);
            clients.push_back(client);
            client->start();
        }
    }
};
```

```
class Client : public Thread {
  Socket peer;

  // sync client
  void run() {
    while (_keep_talking){
      // peer.recv/peer.send
    }
  }
}
```

Problemas con esta implementación

- No podemos hacer un ***graceful shutdown*** del servidor
- **Leak** de la lista de clientes.

Graceful shutdown: Cierre ordenado del servidor. Se liberan ***todos*** los recursos (hilos, sockets, queues abiertas).

```
class Acceptor : public Thread {
    ...
    void reap_dead() {
        clients.remove_if([](auto* client) {
            auto client_dead = client->is_dead();
            if (client_dead) {
                client->join();
                delete client;
            }
            return client_dead;
        });
    }

    void shutdown() {
        for (auto* c : clients) {
            c->kill();
            c->join();
            delete c;
        }
    }
    ...
};
```

```
class Acceptor : public Thread {
    ...
    void run() {
        try {
            while (_keep_running) {
                ...
                reap_dead();
            }
        } catch (LibError& le) {
            // "falló" accept, es esperado
        } catch (std::exception& e) {
            // loggear error
        }
        shutdown();
    }
    ...
};
```

```
int main(int argc, const char** argv) {
  ...
  Socket socket(port);
  Acceptor acceptor(socket);

  std::string in;
  while (std::cin >> in; in != "q") {}

  socket.close();
  acceptor.join();

  return 0;
}
```