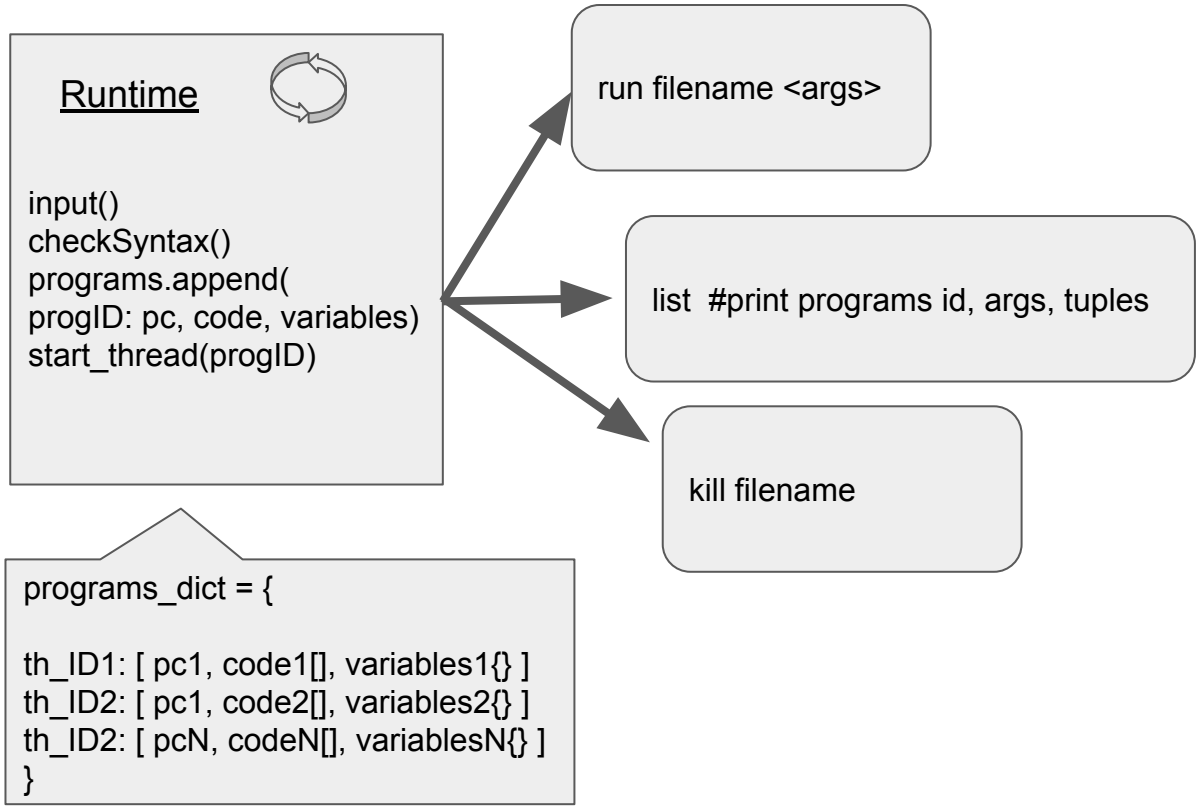
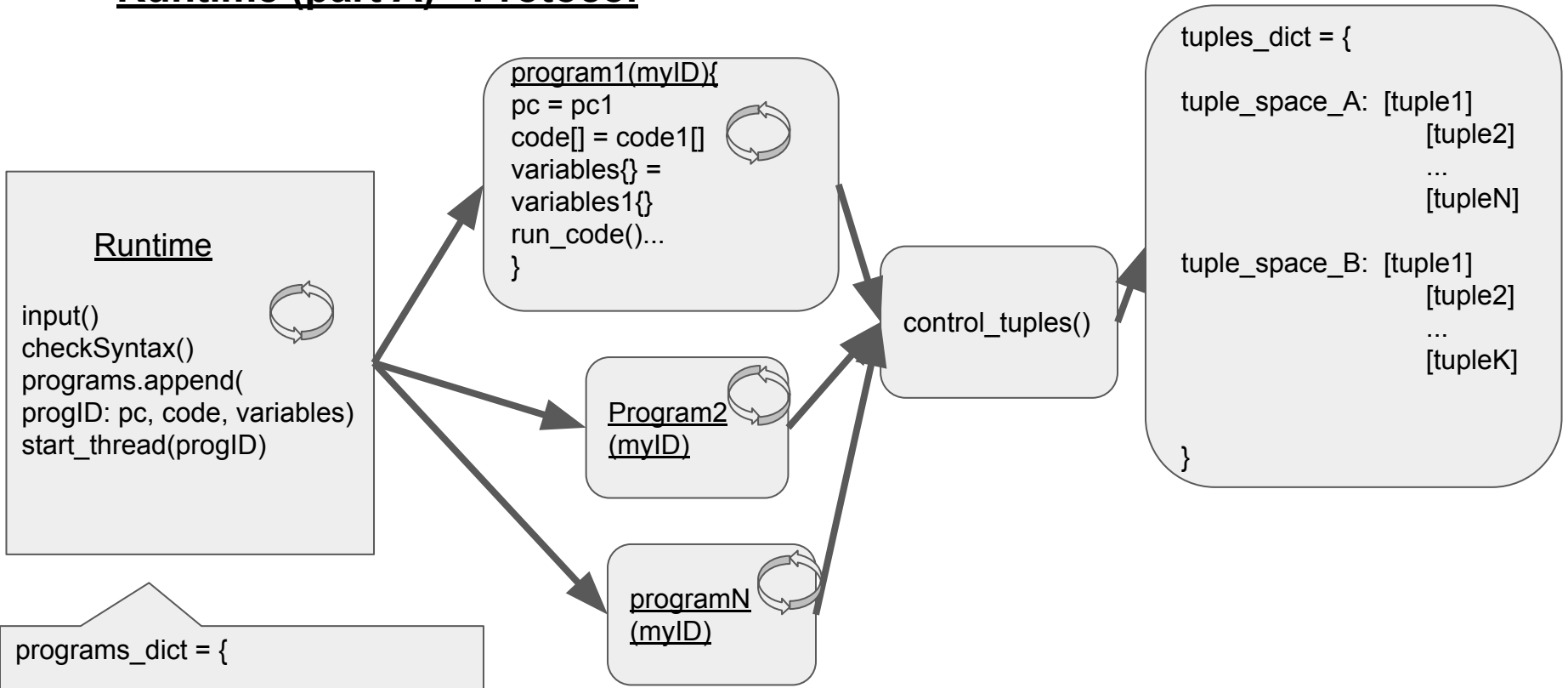
Runtime (part A) - Protocol



Runtime (part A) - Protocol



PUT & **GET**: BLOCKING CALLS TO CONTROL_TUPLES() FUNCTION

Runtime (part A) - Implementation

```
runtime(){
ID = 0
While True:

input_command()
If instr == run:
  ID += 1
  pc =0
  for each line in arg[0]:
     code[pc] = checkSyntax(line)
     pc += 1
  replace_labels_with_num_of_line()
  variables = {'arg[i]' : value_of_arg[i] ∀ i }
  programs_dict[ID] = [pc=0, code, variables)
  start_thread( ID )
elif instr == kill:
  flagStop = True
  delete programs_dict[id]
Elif instr == exit:
  for each ID in programs_dict:
    flagStop[ID] = True
    return
elif instr == list:
  Print_all( ID + arguments)
}
```

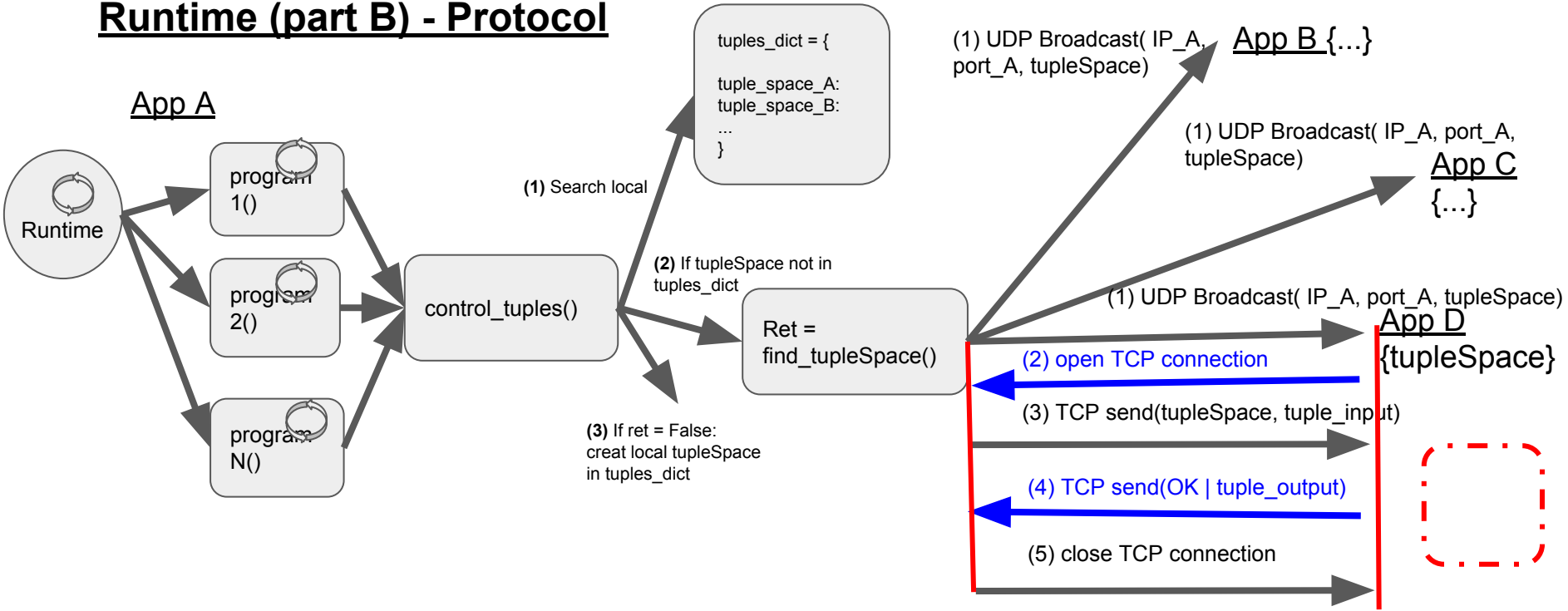
```
thread_code_implementation ( myID ){
code = programs_dict(myID)[1]
variables = programs_dict(myID)[2]
pc = 0
while pc < len(code)
  If flagStop == True:
     programs_dict[progr_id][0] = pc
     programs_dict[progr_id][2] = variables
     Exit
  if instr == 'ADD':
        …
  else if instr == 'PUT'
        control_tuples('PUT', tuple_space, input_tuple, myID)
  else if instr == 'GET'
        control_tuples('GET', tuple_space, input_tuple, myID)
        update_variables()
  else if instr == 'EXT':
        break

delete programs_dict( myID )
exit
}
```

PUT & **GET**: BLOCKING CALLS TO CONTROL_TUPLES() FUNCTION

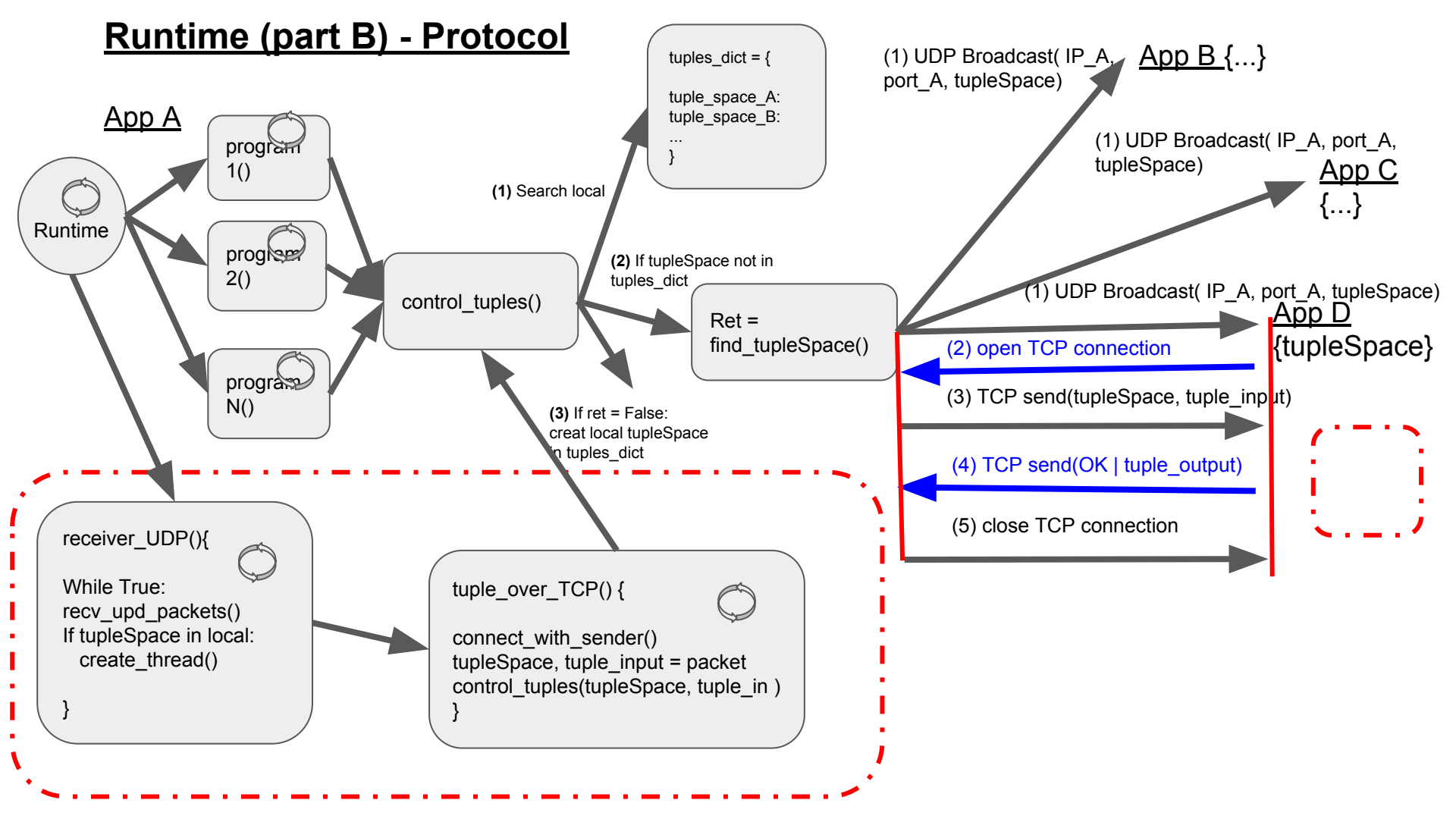
Runtime (part A) - Implementation

```
control_tuples( instr, tuple_space, input_tuple, th_ID ){
if tuple_space not in tuples_dict:
        #check if system is distributed
        if configuration.flagDistributed == True:
                ret = find_tuple_broadcast(instr, tuple_space,
input_tuple)
                return
        else:
                tuples_dict[tuple_space] = []

if instr == 'PUT':
        #put tuple in tuples_dict
        event_tuple.set()   #notify wait program
         event_tuple.clear()
Elif  instr == 'GET':
        If tuple not in tuples_dict:
                event.wait()
        Else:
                tuples_dict[tuple_space].pop()
}
```

Runtime (part B) - Protocol



Runtime (part B) - Protocol



```
find_tuple_broadcast(instr, tuple_space, input_tuple):
        #create udp socket for bradcast the tuple
        s = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
        s.setsockopt(socket.SOL_SOCKET,
socket.SO_BROADCAST, 1)
        s.sendto(packet,(broadcast_IP,udp_port))

        s.close()
        send_tuple_tcp(ip_addr, port, instr, tuple_space, input_tuple)


}
```

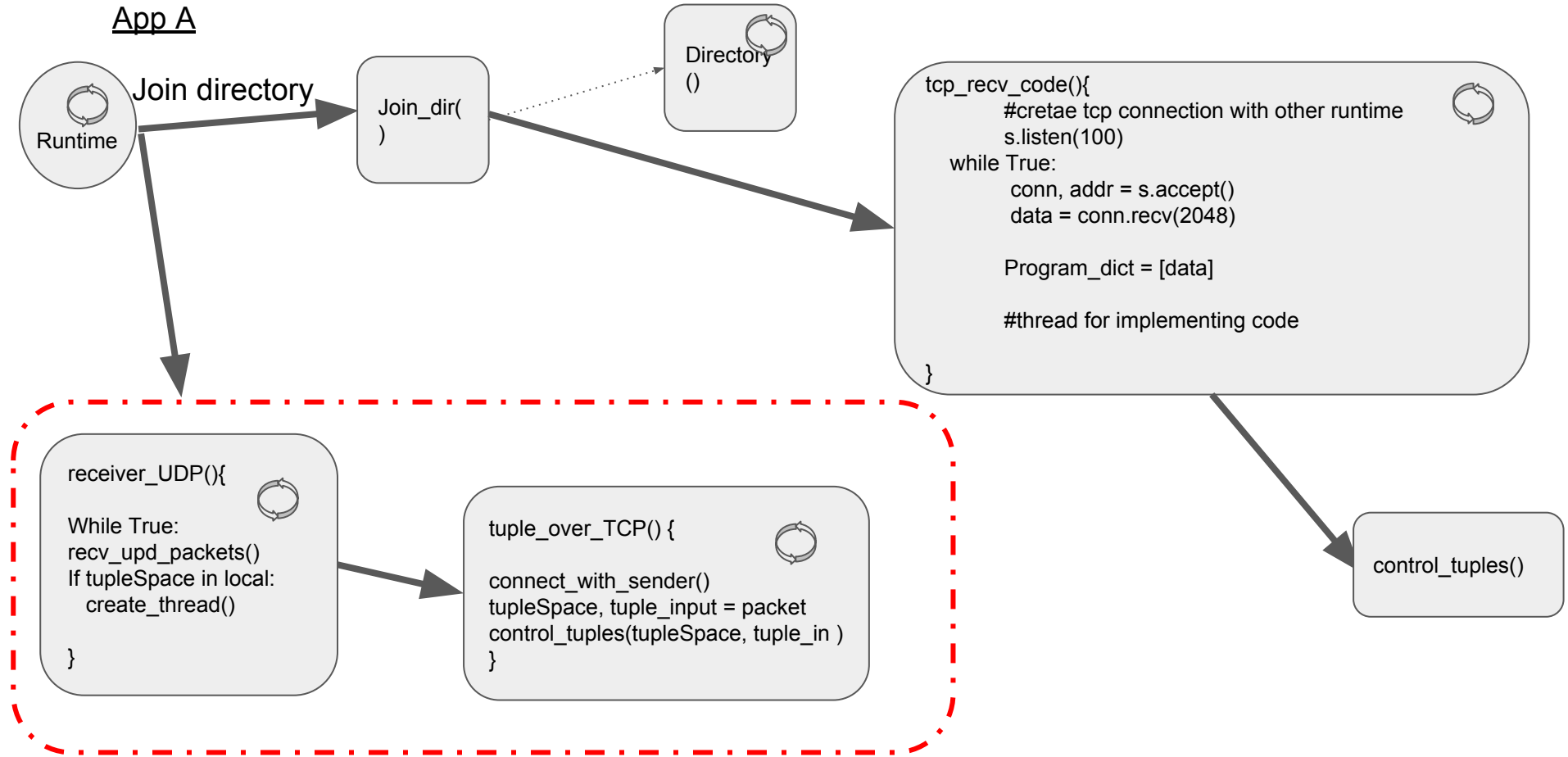
```
send_tuple_tcp(ip_addr, port, instr, tuple_space,
input_tuple):
        #create tcp socket for sending tuple
        s = socket.socket(socket.AF_INET,
socket.SOCK_STREAM)
        s.bind((TCP_IP, TCP_PORT))
        packet = (instr + tuple_space +input_tuple
        s.sendto(packet)

        while True:
         data = conn.recv(2048)
         if data != None:
                if b'OK' in data:
                        return data
                elif b'OK' not in data:
                        return 0
         else:
                return 0
}
```

Runtime (part C) - Protocol-Directory

```
#create tcp communication for info about ip and
port of hosts for tcp communication

hosts = {}
s = socket.socket(socket.AF_INET,
socket.SOCK_STREAM)   s.bind((ipAddr, 0))
port = s.getsockname()[1]

s.listen(100)

while True:
   connection, host_addr = s.accept()
   data = connection.recv(256)
If data == 'List':
        connection.send(hosts)
elif data == 'Join':
    #data = [ip, port] of hosts

     hosts[runtime] = [ip_addr, port]
     connection.send('OK')
```

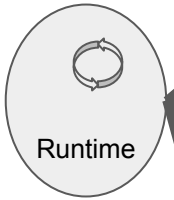
```
hosts = {}
hosts = {runtime1: [ip1, port1],
          'runtime2': [ip2, port2],
           ....
          }
```

Runtime (part C) - Protocol-Directory



Runtime (part C) - Protocol

App A



run filename <args>:

control_tuples()

Migrate <id> <ip> <port>

```
#terminate current id
flagStop[progr_id] = True
th=tcp_send_code_thread(progr_id,
ip_addr, port)
```

```
kill <id>:
        #check if program exists in
program_dicts
        flagStop[id] = True
r = programs_dict.pop(progr_id)
```

shutdown

```
tcp_send_code(progr_id, ip_addr, port) {
        sock = socket(AF_INET, SOCK_STREAM)
        sock.settimeout(None)
        sock.connect((ip_addr, port))

        #create packet: program_dict[progr_id]
        sock.send(packet)

        sock.close()

        programs_dict.pop(progr_id, None)
        return
}
```

Shutdown:

```
        #connect with directory for getting list of hosts
        #search inlist if exists a different rutime

        #if exists:
        for i in programs_dict:
                th = tcp_send_code_thread(progr_id, new_ipaddr,
new_port)
                th.start()

programs_dict.clear()
```