

## Securing HARMS-based Communication between Heterogeneous Robots

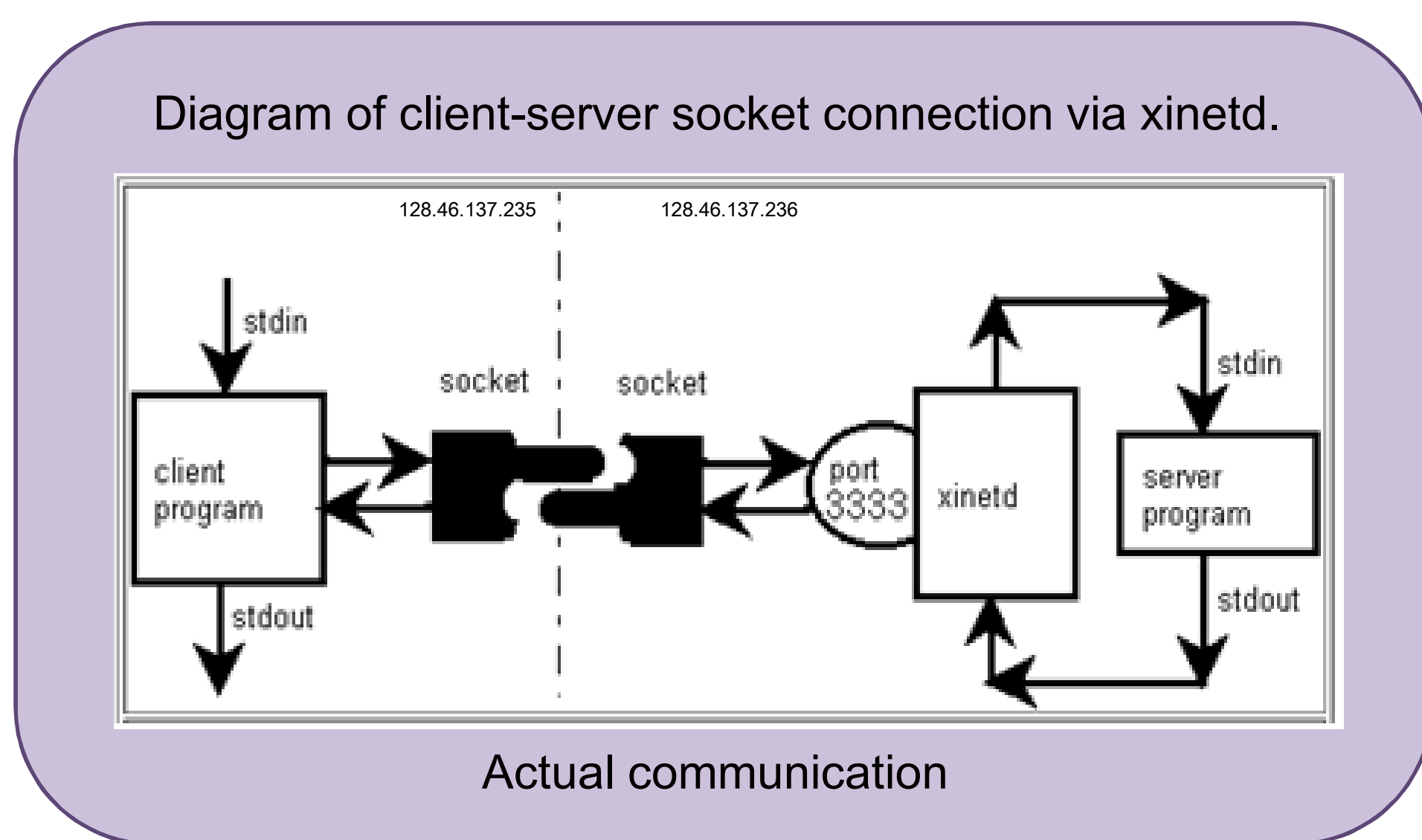
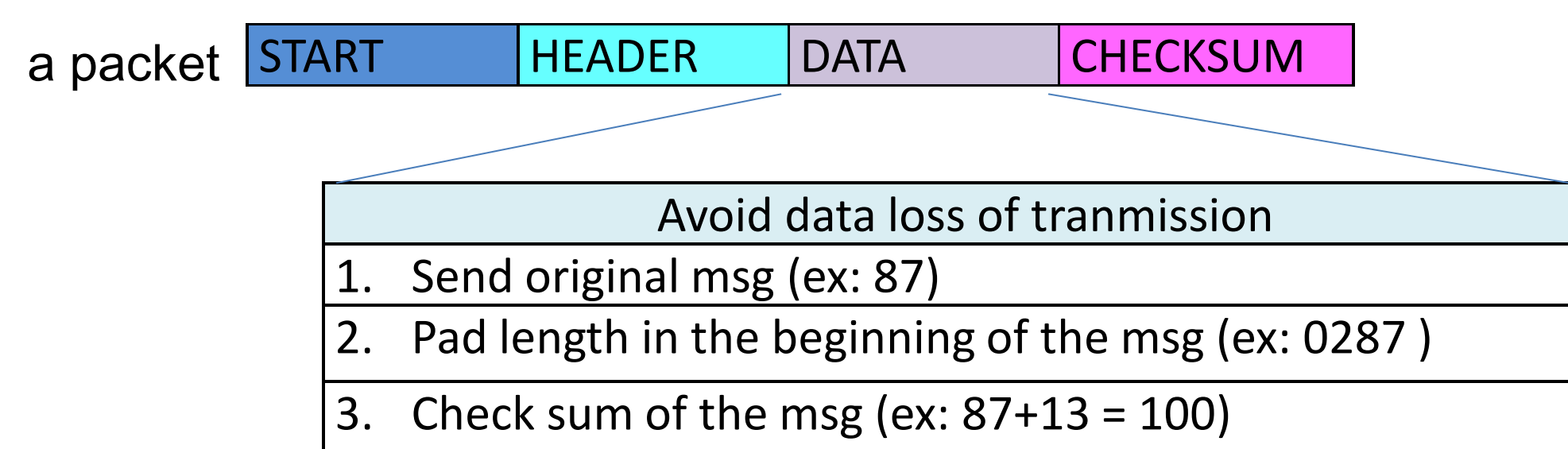
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### Previous (Background) Research Experience

- Socket Communication
- Communication among Human, Agent, Robot, Machine, and Sensor (HARMS)

### Current Research

- Secure communication in HARMS (Human, Agent, Robot, Machine, and Sensor) for Heterogeneous Robotic Teams
- Our aim is to be able to command and control the Robot by natural language
- Issues on communication in HARMS
  - Uncertain time delay
  - Uncertain data loss
  - Data transmission security problems

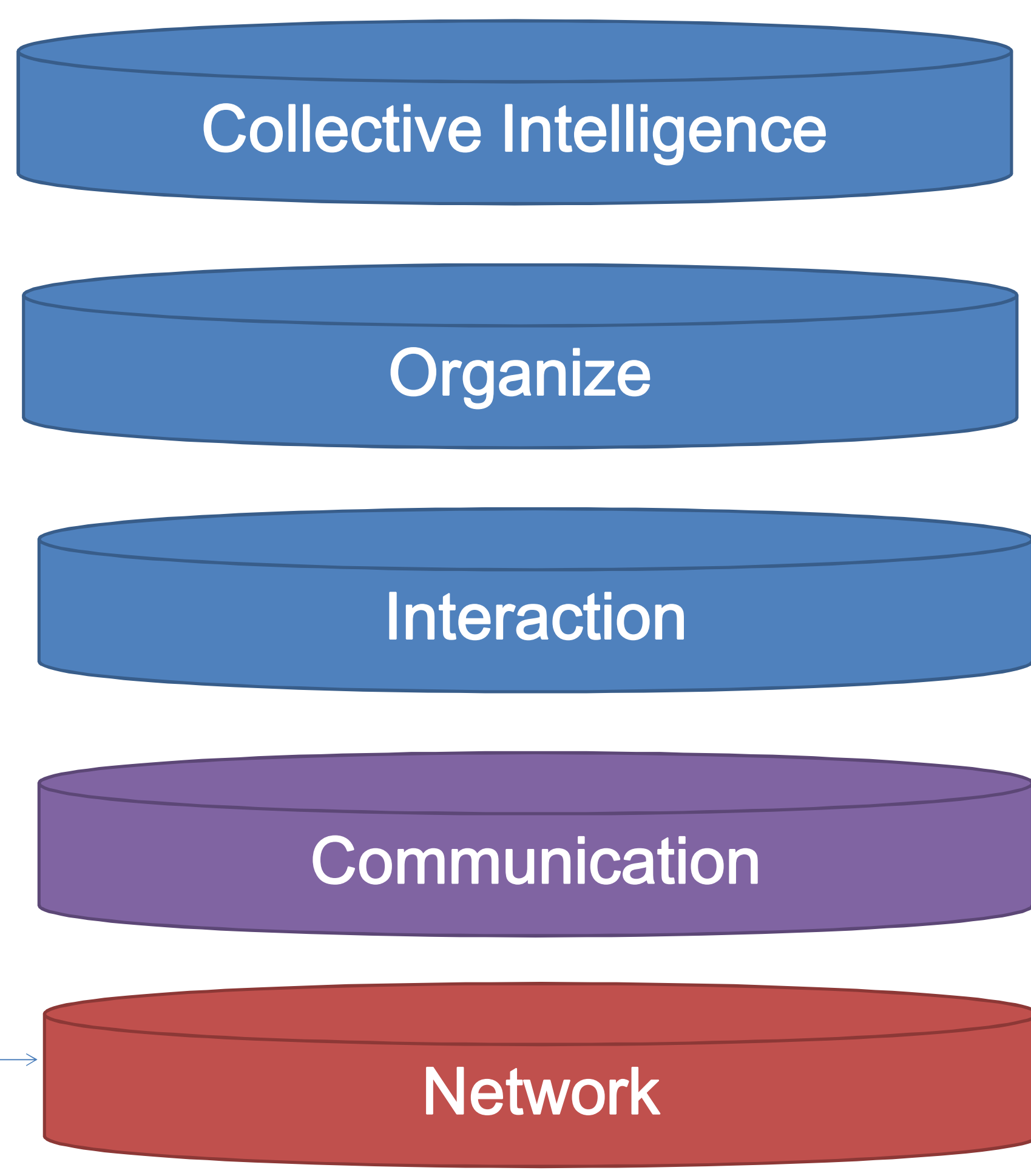
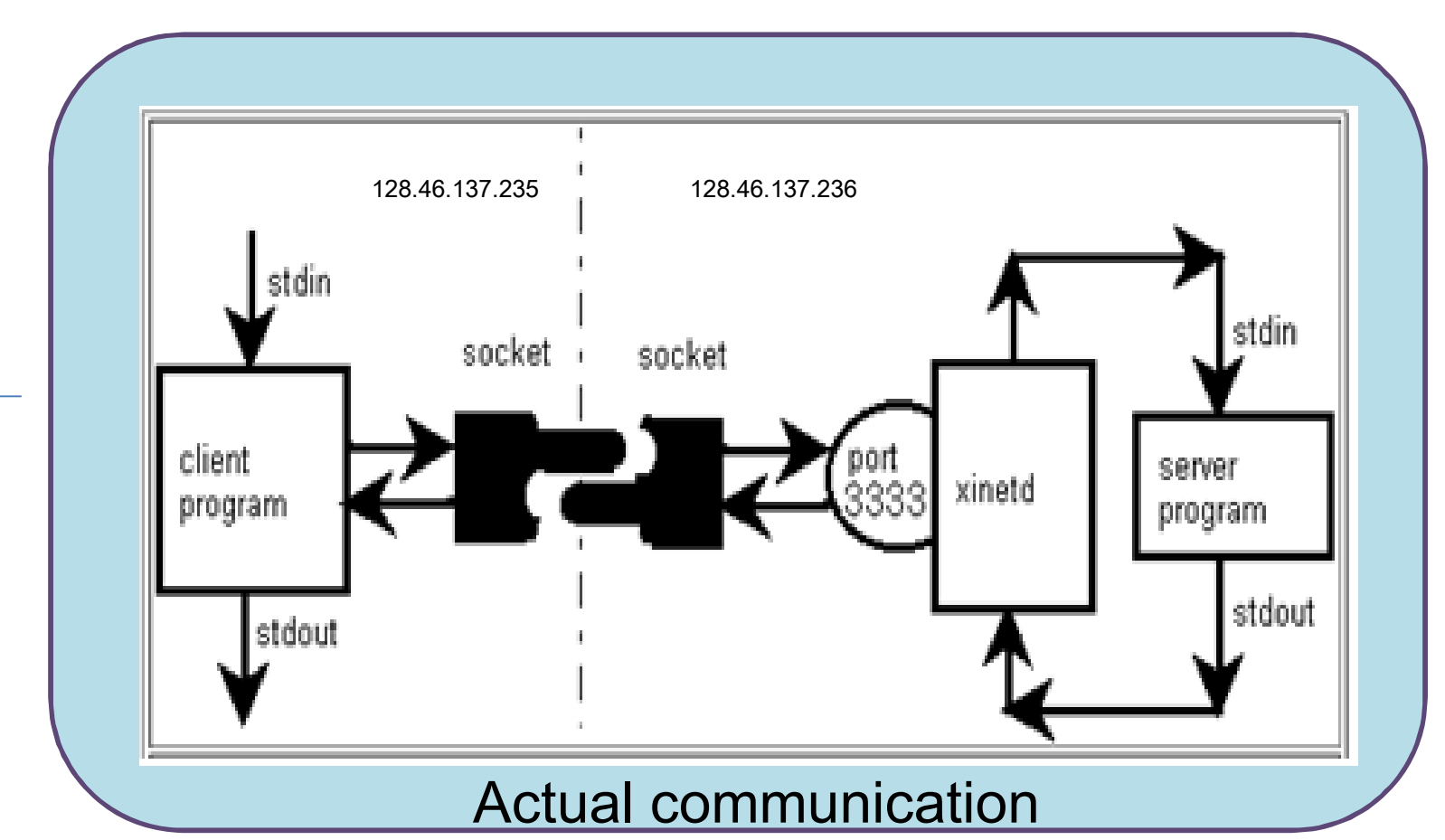


**Client**

- When a robot tries to communicate to another robot, the transmitter serves as a client.
- A "client" program can then connect its own socket to the server's socket, at which time the client program's writes to the socket are read as stdin to the server program, and stdout from the server program are read from the client's socket reads.

**Server**

- The receiver, servers as a "server" which is exposed via a socket connected to a certain /etc/services port number.



Wireless communication/  
Serial communication



Hoyo robot (Korea)

DARwin-OP (Dynamic Anthropomorphic Robot with Intelligence - Open Platform) is an affordable, miniature-humanoid-robot platform with advance computational power, sophisticated sensors, high payload capacity, and dynamic motion ability to enable many exciting research, education, and outreach activities..