## CERAS

The Center for Education and Research in Information Assurance and Security



## 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

Collective Intelligence

a packet START CHECKSUM HEADER DATA Avoid data loss of tranmission 1. Send original msg (ex: 87) Pad length in the beginning of the msg (ex: 0287) 3. Check sum of the msg (ex: 87+13 = 100)

Diagram of client-server socket connection via xinetd.

128.46.137.236

128.46.137.235

Organize

Interaction

Server

Client

client.

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

When a robot tries to communicate to

another robot, the transmitter serves as a

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

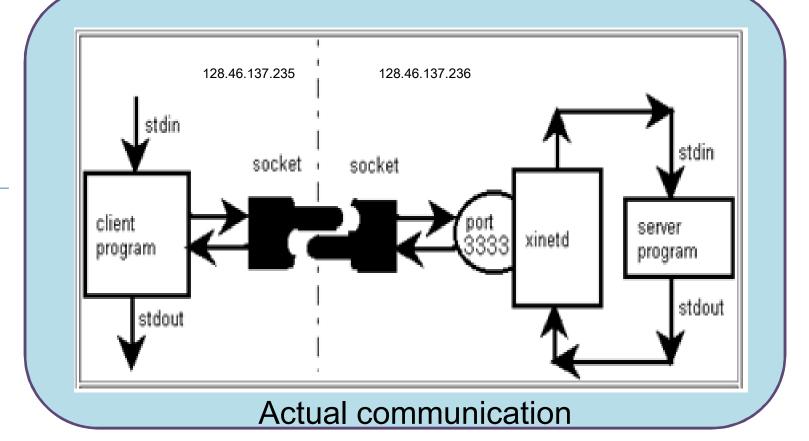
stdout from the server program are read from

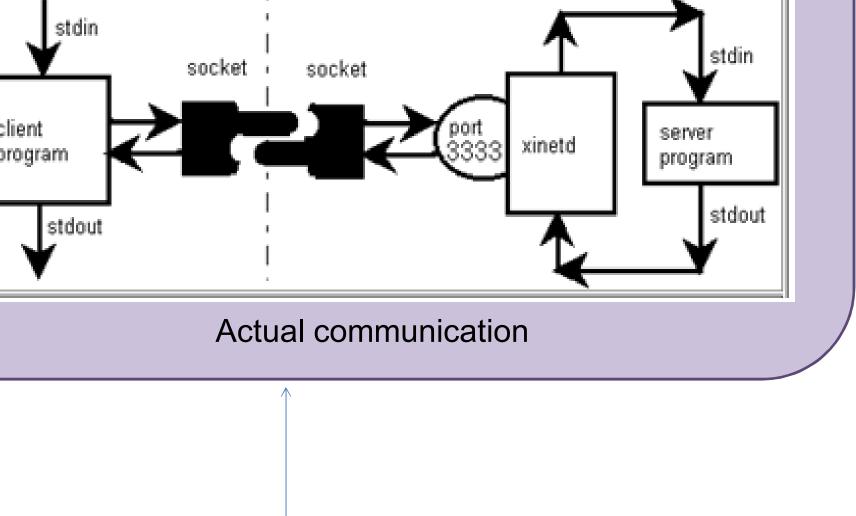
read as stdin to the server program, and

the client's socket reads.

Communication

Network







Wireless communication/ Serial communication

> Language (Speaking in English)

Natural



Hoyarobot (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..



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