
SYSTEM DESIGN DECISIONS

LungLink Project

Telemedicine 2025 – CEU San Pablo University

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1. COMMUNICATION PROTOCOL SELECTION

1.1. TCP vs UDP

The LungLink system requires reliable and ordered transmission of medical data like symptoms, ECG, and EMG signals. For this reason, we have examined the two most common transport protocols: TCP and UDP.

| | TCP | UDP |
|------------------------------|---|--------------------------|
| Reliability | Guaranteed acknowledgment retransmission with and | Not guaranteed |
| Order of data | Maintained | May arrive out of order |
| Connection | Persistent | Connectionless |
| Error detection | Automatic error handling | No retransmission |
| Suitability for medical data | High (lossless) | Low (possible data loss) |
| Implementation in Java | Supported by Socket and ServerSocket APIs | Simpler but unreliable |

1.2. Why LungLink uses TCP/IP

TCP/IP (Transmission Control Protocol over Internet Protocol) was chosen because it provides a stable and reliable communication channel. TCP ensures that every data packet is received in the proper sequence and resends any that are lost during transmission. This level of reliability is essential for LungLink, as the system handles sensitive medical information where data loss or corruption is unacceptable.

In comparison, UDP (User Datagram Protocol) is faster but fundamentally unreliable: packets can be lost, duplicated, or received in a different order, and there is no built-in mechanism for acknowledgment or retransmission. Although UDP can be useful for real-time applications, it is inappropriate for clinical settings where guaranteed delivery is required.

The comparison of TCP and UDP clearly shows that TCP is the suitable option for LungLink, guaranteeing reliable, sequential, and lossless communication between patient devices and the hospital server.

2. USE OF DECORATORS FOR DATA EXCHANGE

Java sockets will be utilized along with decorator streams to enable modular and extendable data management.

The Decorator Pattern allows `InputStream` and `OutputStream` to incorporate extra features like serialization, buffering, or encryption.

These decorators transform basic byte streams, enabling the system to send complex objects (such as patient data, symptoms, or signal packages) through TCP connections without manual serialization.

LungLink integrates TCP/IP with enhanced input/output streams to create a versatile, dependable, and secure communication framework ideal for telemedicine purposes.

3. COMMAND STRUCTURE / COMMUNICATION PROTOCOL

LungLink uses a simple, text-oriented communication protocol built on TCP. Every message follows a clear and structured format, guaranteeing that the server can correctly understand incoming commands and that the client always receives confirmation of their execution.

3.1. Client to Server Command Format

Commands transmitted from the client to the server follow this structure:

COMMAND_NAME|PARAMETER_1|PARAMETER_2|...

This uniform format allows the server to interpret commands easily and ensures consistency in all functions, including user administration, symptom reporting, and signal transmission.

3.2. Server to Client Response Format

For each request that is received, the server returns a confirmation to show if the operation was successfully handled:

- **Success**

OK|...

- **Error or invalid operation**

ERROR|...

This feedback system ensures the client is always informed about whether the command was executed properly or if there was a transmission or processing error, enhancing the reliability and strength of the entire communication framework.