CS 303 Logic & Digital System Design

A Simple Telephone Conversation

Muhammad Ammad Zohair 26277

Overview

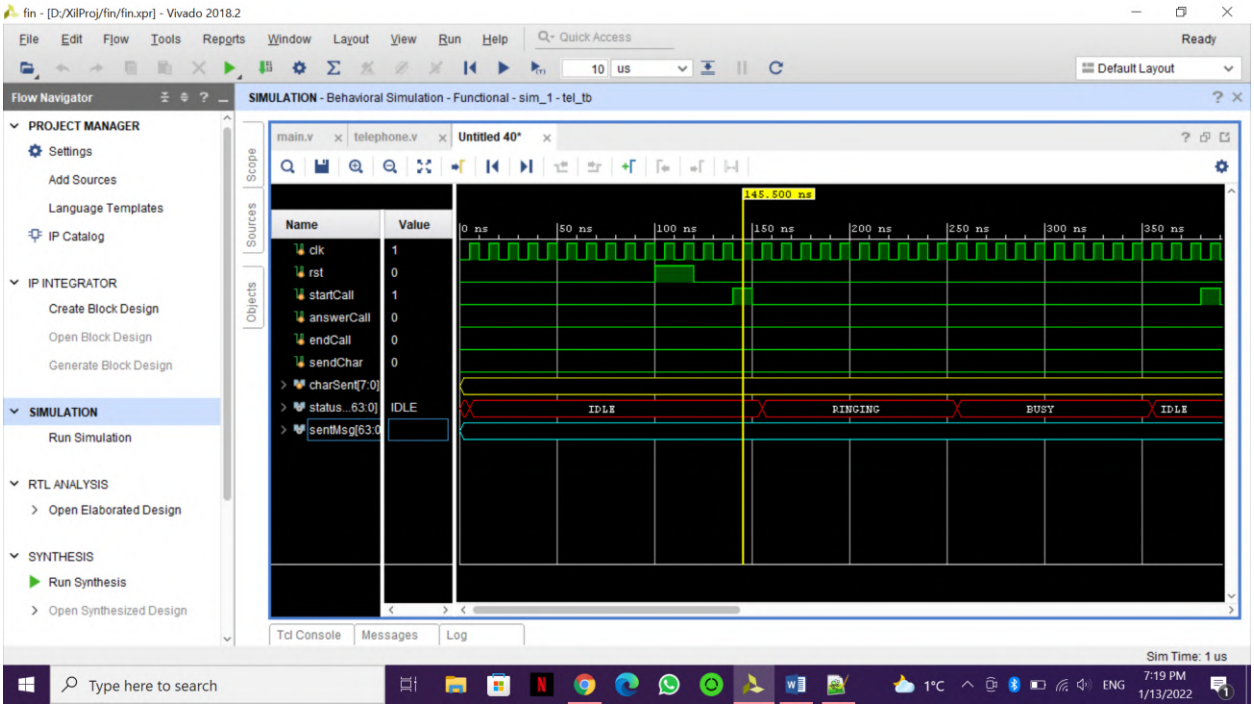
The goal of this project was to design a simple one-sided telephone conversation using a sequential circuit. The implementation contains a state machine with 6 states:

1. IDLE: The circuit starts in this state and a reset input (rst) re-initializes the circuit to the idle state. The circuit will continue to remain in this state until the startCall input is received which leads us to the Ringing state.
2. RINGING: The circuit will remain in the Ringing state for a maximum of 10 clock cycles after which it goes to the Busy state. If endCall request is received before 10 clock cycles have elapsed, the circuit will go to the Rejected state and similarly, if answerCall request is received then it goes to Call state.
3. REJECTED: The circuit stays in this state for 10 clock cycles before returning to the Idle state. It also outputs “REJECTED” to statusMsg during this time.
4. BUSY: The circuit stays in this state for 10 clock cycles before returning to the Idle state. It also outputs “BUSY ” to statusMsg during this time.
5. CALL: The circuit stays in this state until an endCall request is received or (DEL) character is sent by the caller. In both cases, the circuit proceeds to the Cost state. In Call state, the caller is allowed to send characters to the callee by setting charSent and pressing sendChar. These ASCII characters are only considered valid if their decimal values lie between 32 and 127.
6. COST: Total cost of the telephone conversation is displayed in sentMsg output for 5 clock cycles after which the circuit goes back to Idle state.

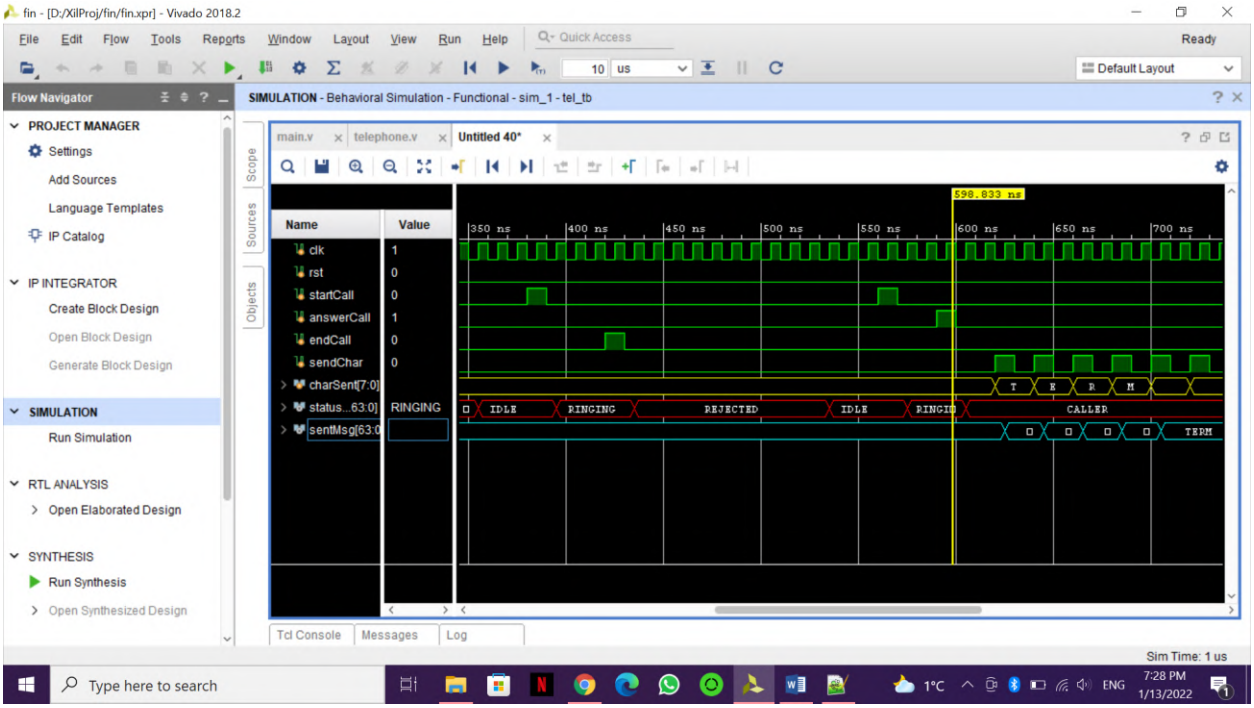
Simulation Results

I have used the test bench provided in SuCourse to simulate my design:

Caller starts call, statusMsg displaying "RINGING ", no answer for 10 clock cycles (and go back to BUSY), 10 clock cycles later go back to IDLE.

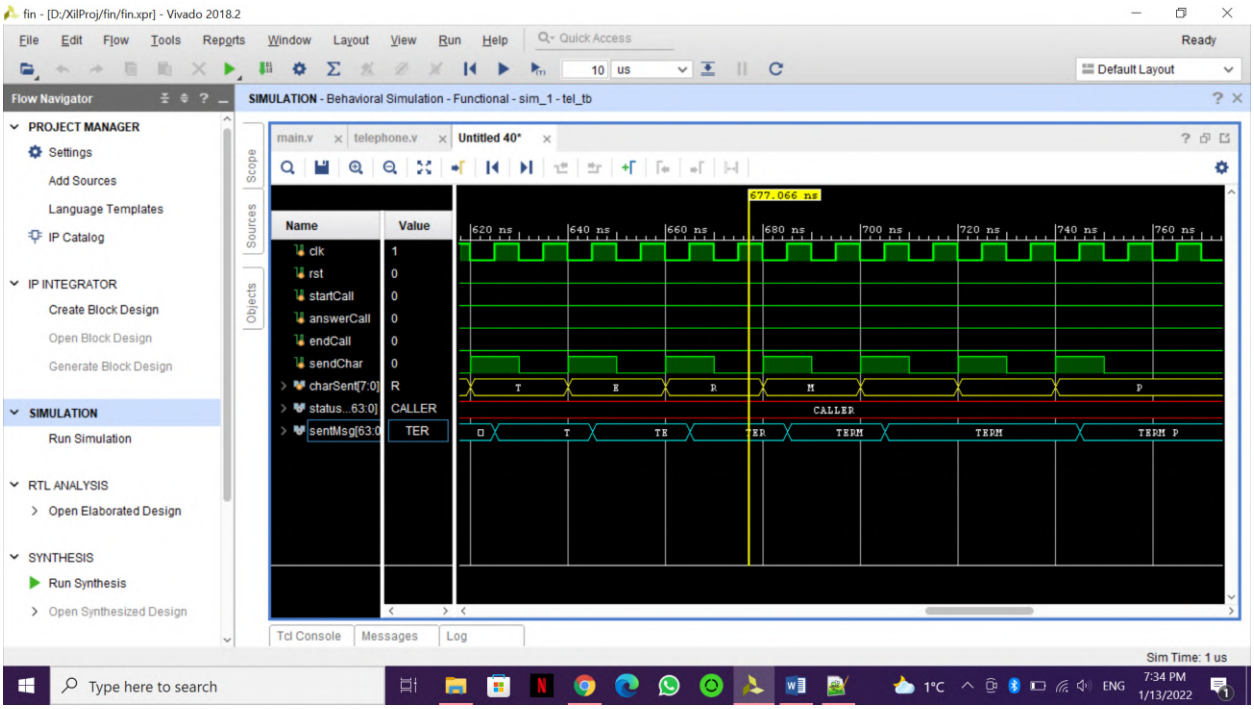


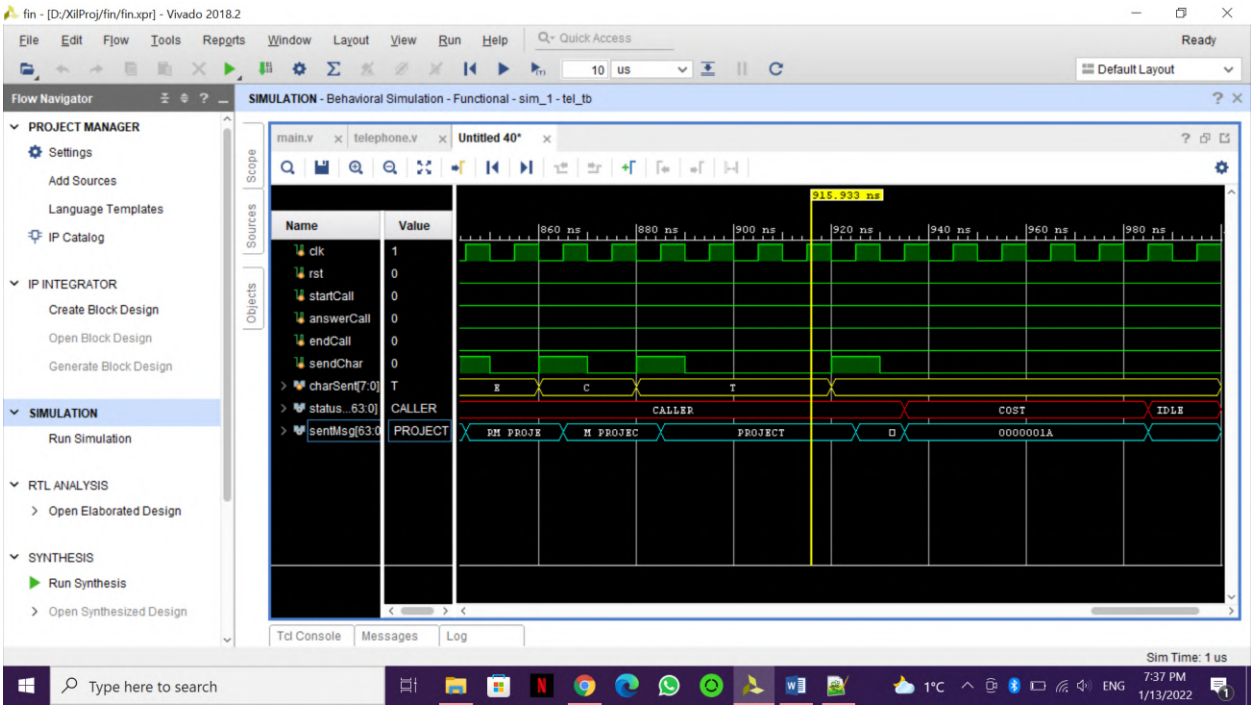
Caller starts call, callee rejects the call, statusMsg displaying 'REJECTED' for 10 clock cycles. Caller again starts the call, callee answers the call, statusMsg displaying "CALLER ".



Caller sends “T” “E” “R” “M” “(space)” “(invalid char)” “P” “R” “O” “J” “E” “C” “T”

Caller sends DEL to end the call, statusMsg displaying “COST “, statusMsg displaying total cost of call = 26 (0000001A in hex).





Synthesis Result

Number of LUTs = 157