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Time Critical Network Communication for Industrial Robots

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Architecture

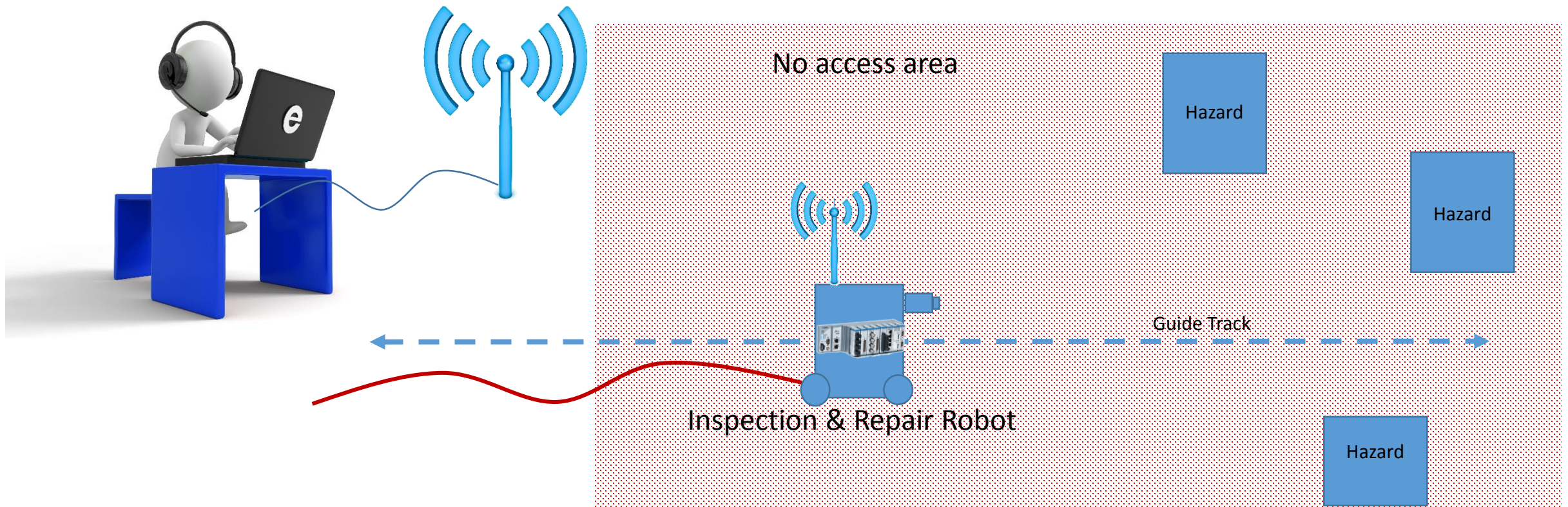
Initial Code

Frist Callout

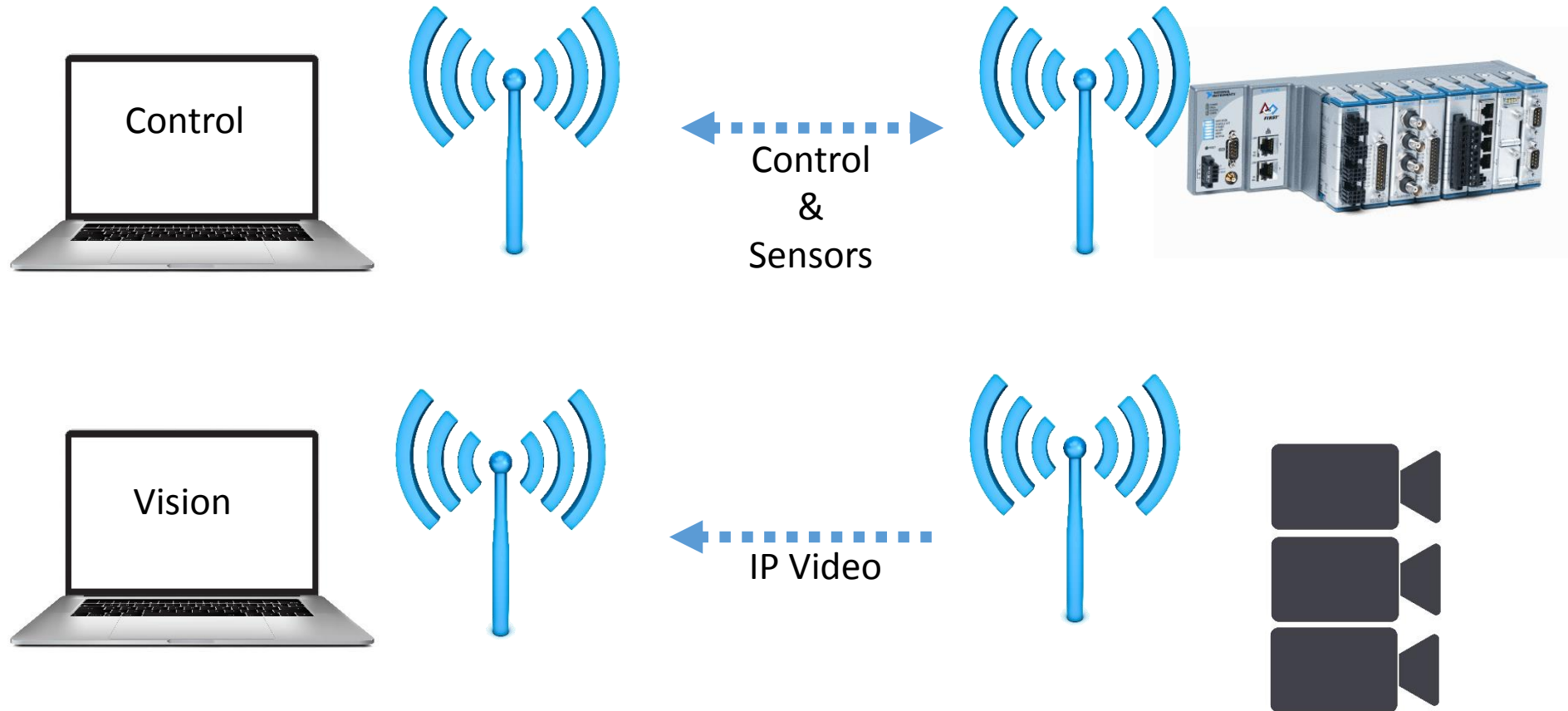
Second Callout

Refactored Solution

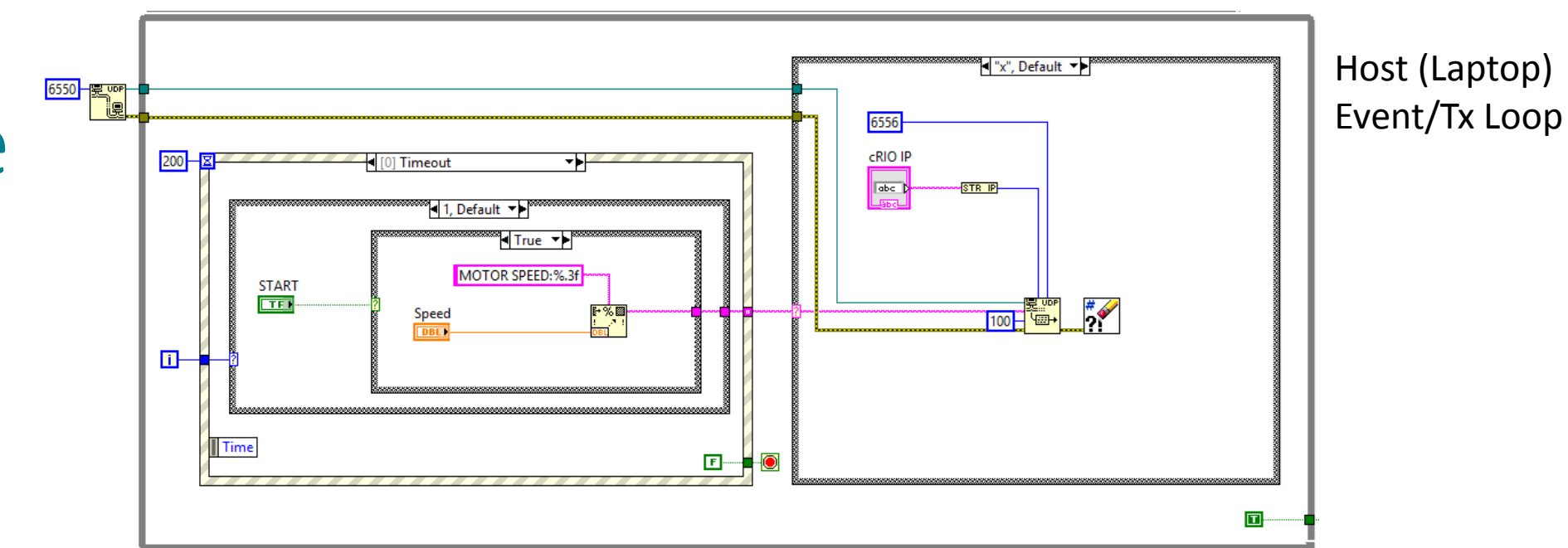
Challenge



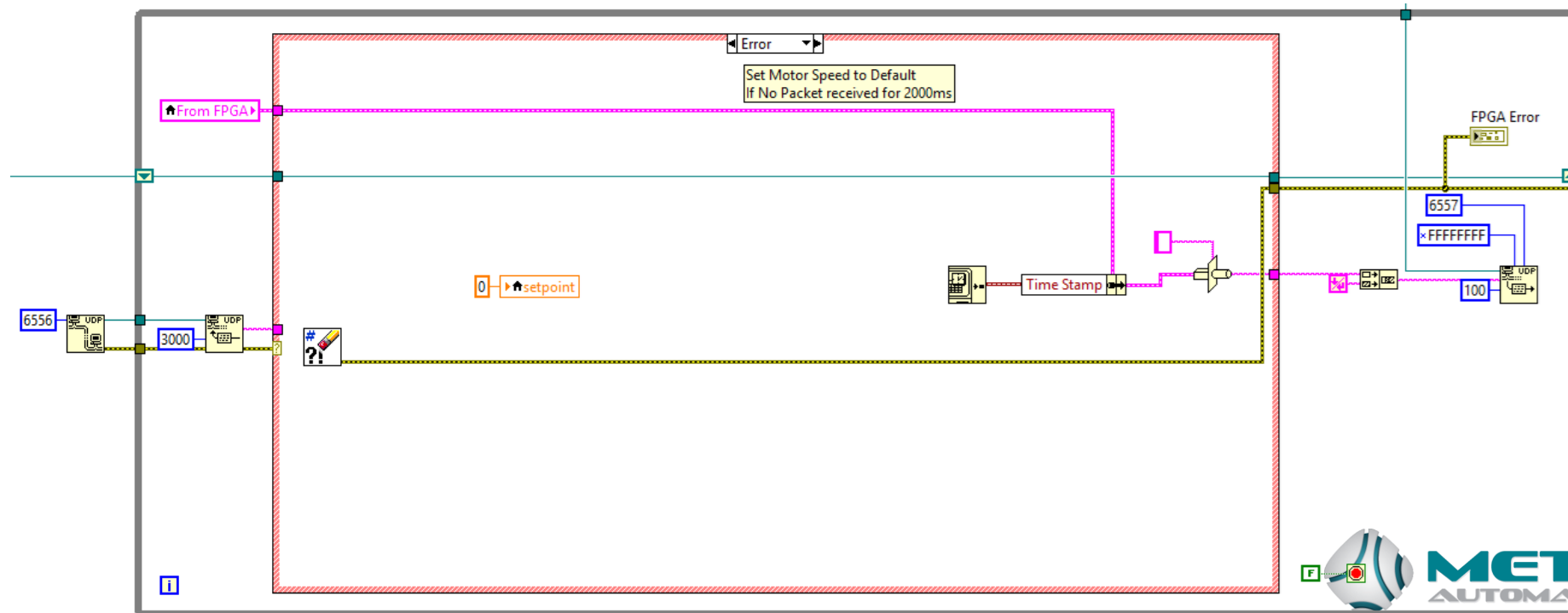
Communications Architecture



Initial Code

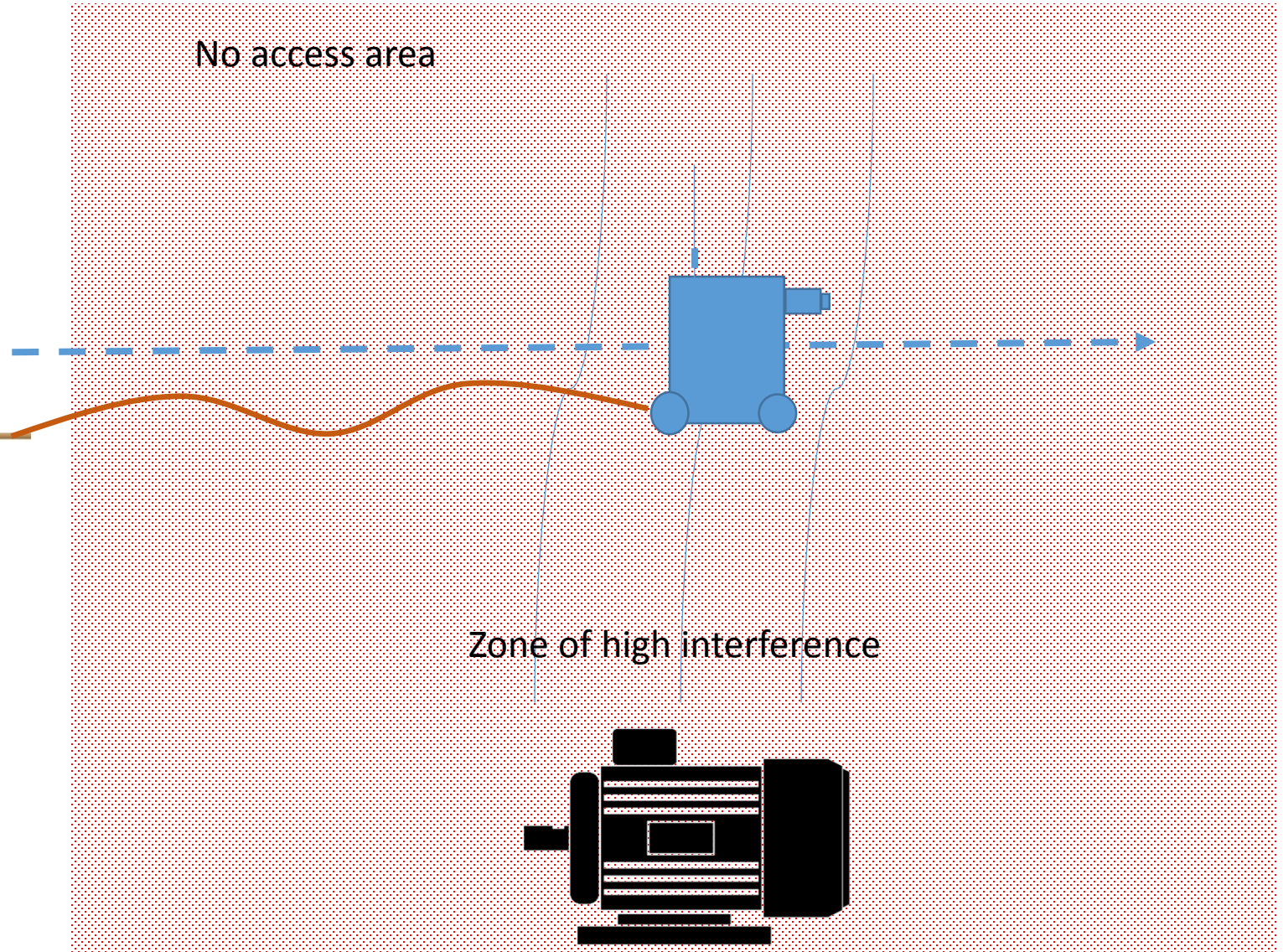


CompactRIO (Robot) Rx/Action Loop

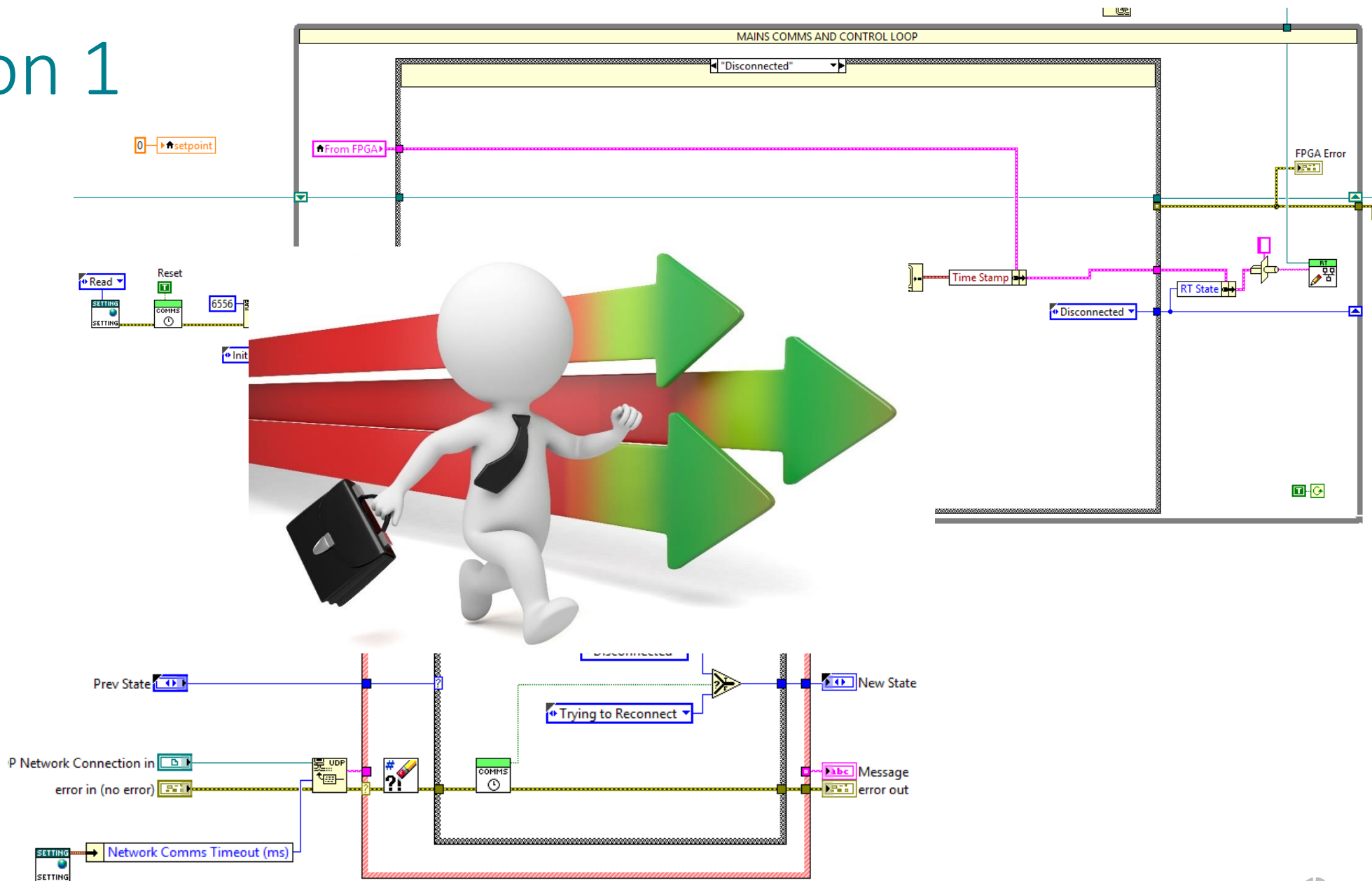


Callout 1

Robot stopping!

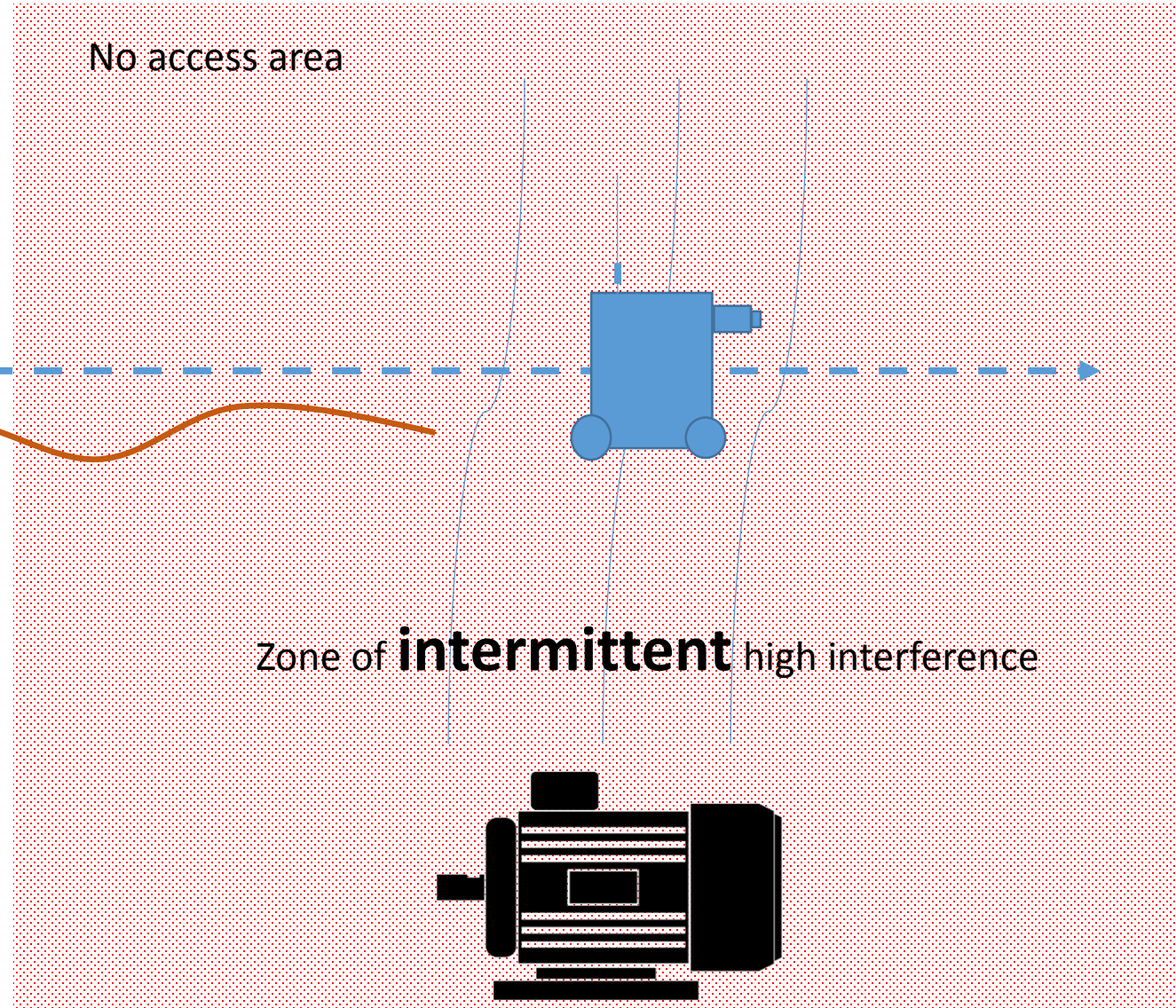


Solution 1



Callout 2

Robot stopping and
NOT returning.

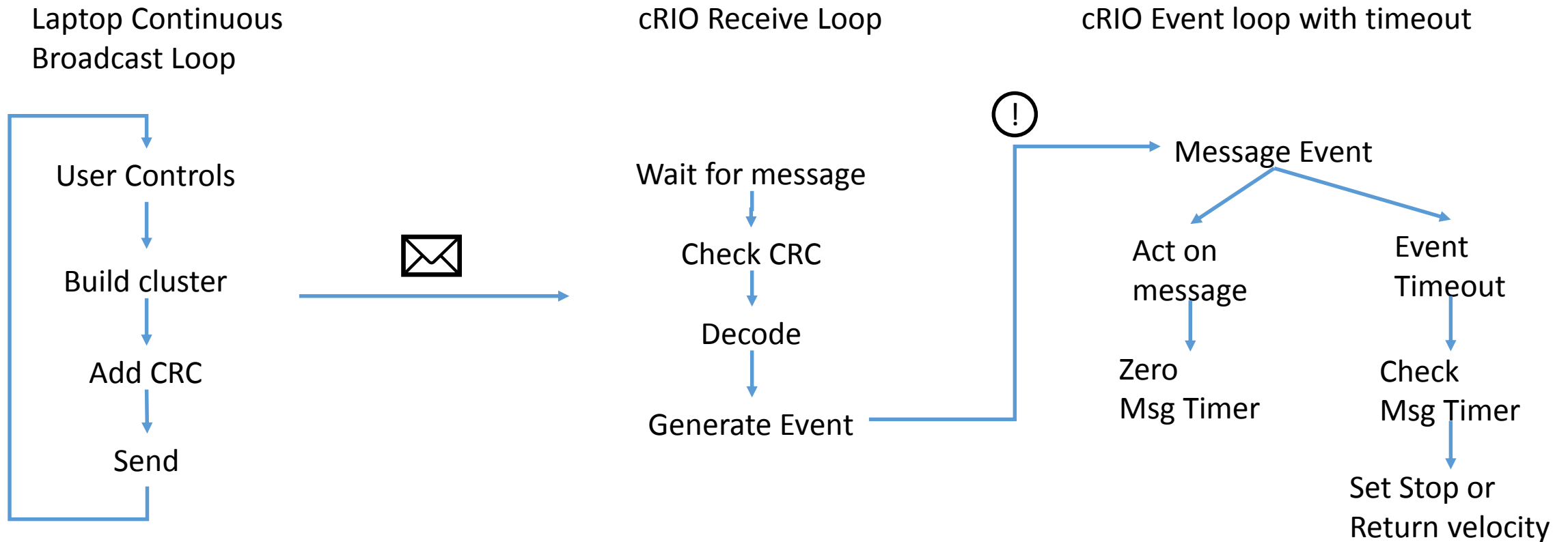


Proposal to improve reliability.

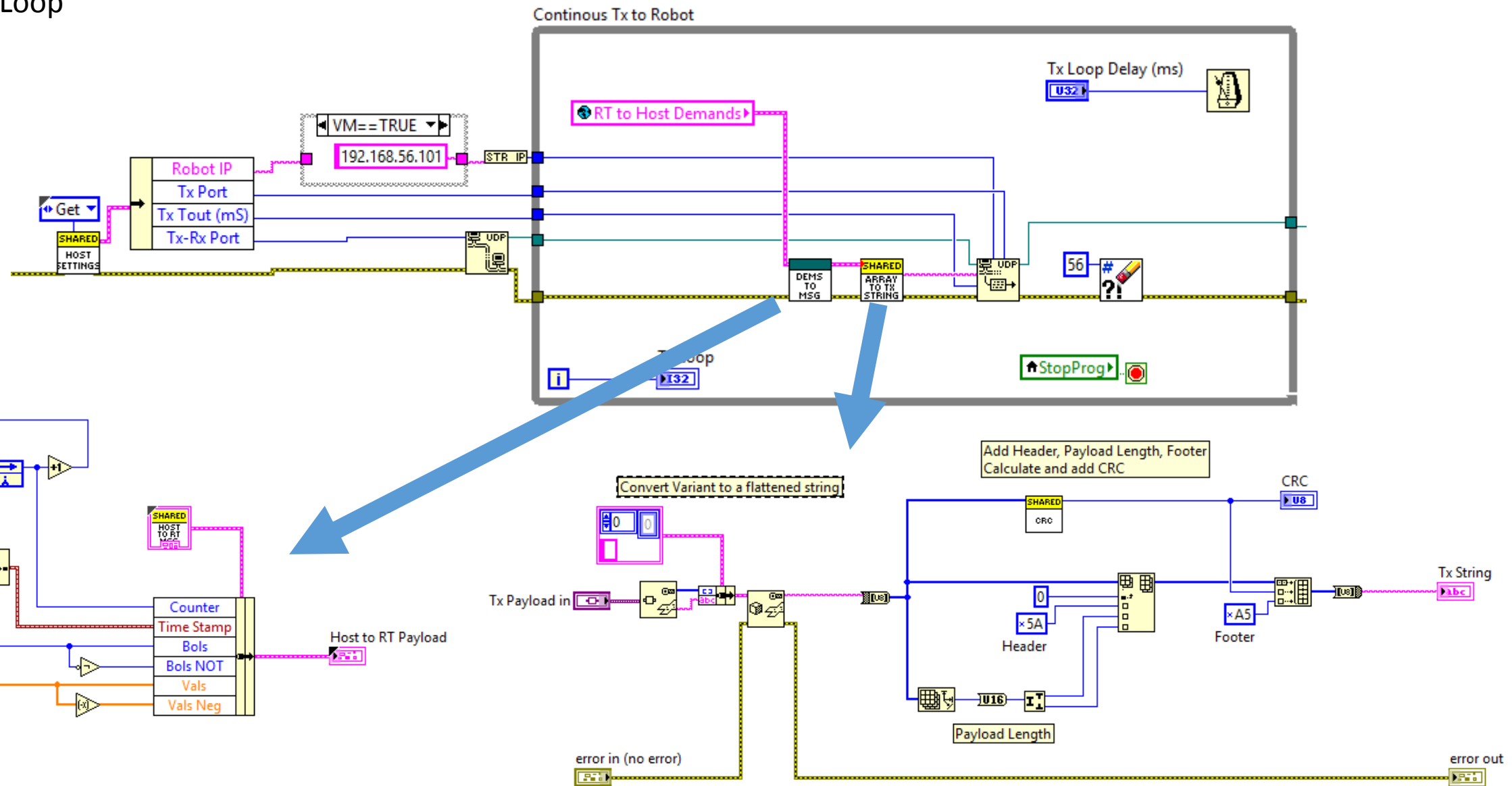
Key was to realise that we did not actually care if messages are lost,
provided enough messages get through to robot to maintain **timely** control.



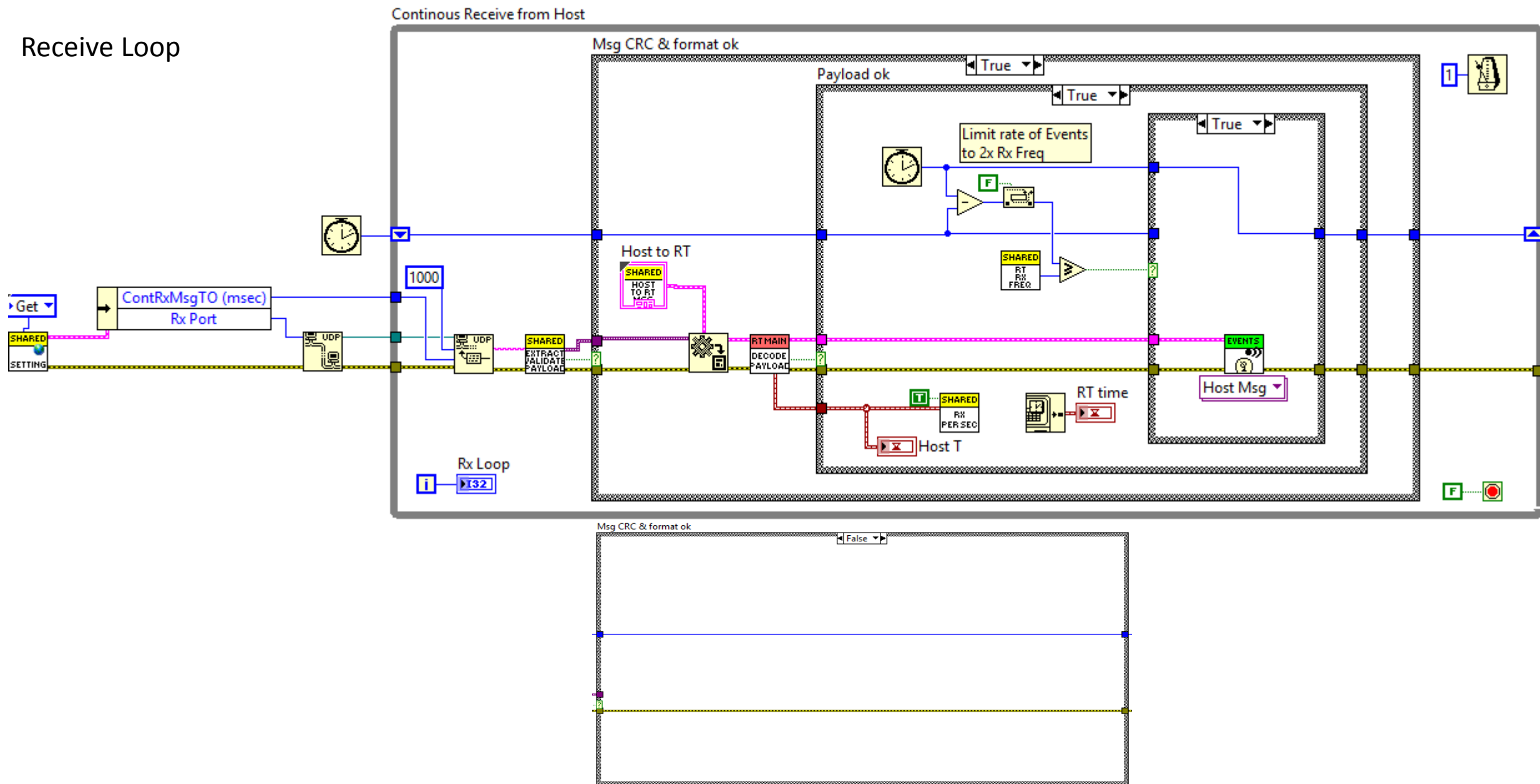
New Communications Architecture



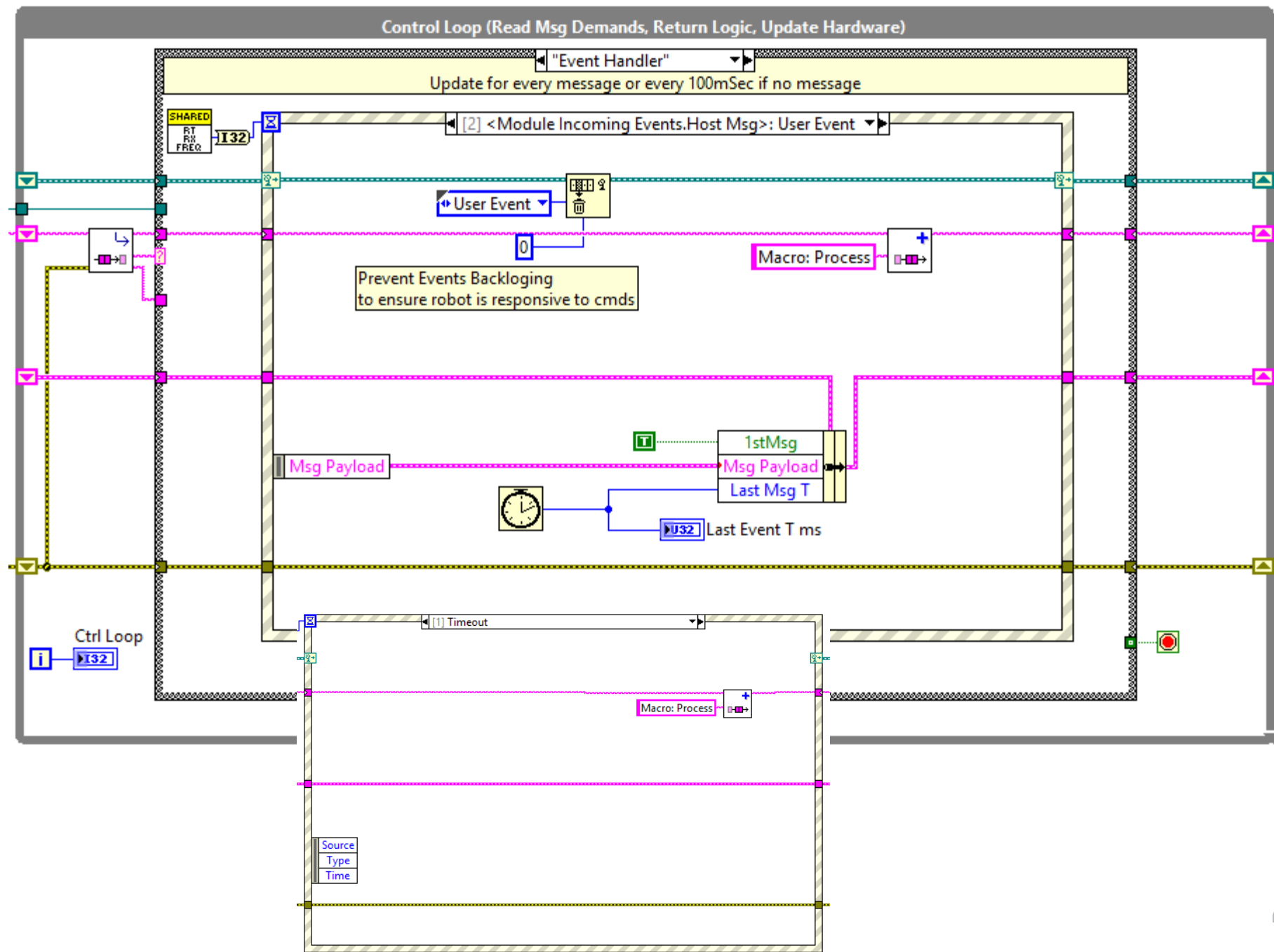
Broadcast Loop



Receive Loop



Action Loop



Demonstration

Background Information

User Datagram Protocol or Transport Control Potocol.

TCP would be normally used for mission critical data as UDP does not guarantee the safe arrival of the data at the destination.

For this application the key differences between TCP and UDP were:

1. The UDP sender broadcasts a message and does not know if it has been received (no handshake or retry)
2. The UDP functions do not perform any error checking on the packet.

Plenty of information about TCP, IP, and UDP on the National Instruments Website.

<http://www.ni.com/white-paper/2710/en/>

<http://www.ni.com/tutorial/4950/en/>

https://en.wikipedia.org/wiki/User_Datagram_Protocol

https://en.wikipedia.org/wiki/Transmission_Control_Protocol