The difference in IP serial device server

■ Introduction

We can have different method to add more serial ports in one PC. Each solution may have dedicated feature in function. If you did not take care such difference, then same application software may have different action. Now IP network is very popular in our environment. We may use IP serial device server in our application. If we did not take care the difference in real COM port and virtual COM port, we may have problem in our application environment for same software. In this application note we try to offer some message for such difference.

■ The feature in multi-serial port solution

1. In one PC we may have COm1/COM2 serial port available. Generally COM1/COM2 will have fixed I/O address and IRQ assigned. We will use software driver embedded in Windows system for COM1/COM2 serial port. Application software engineer may use the feature in COM1/COM2 to write application software. And they always use COM1/COM2 to verify application software's function. Generally we can find the hardware for COM1/COM2 is embedded in motherboard and they have dedicated IRQ without share. So the action in COM1/COM2 is accessed directly with small latency time. In normal procedure COM1/COM2 UART controller will generate IRQ to notify transmit empty condition for new data to transmit.

2. The other method to add more serial ports is add-on card. Generally we may have more than 2 serial ports in one card and share the same IRQ. Card maker will offer software driver for add-on card to service data transmission. When add-on card uses IRQ to ask service. Because IRQ is shared with multiple serial ports, IRQ service routine need to check which serial port asks to service. Some card may have status register to indicate which serial port to ask service. Some card may poll each serial port one by one to check which serial port to generate IRQ. Now you can find that the latency time for add-on card will be higher than COM1/COM2. If you wrote the application software based on COM1/COM2, then you may have problem for such longer latency time.

3. The other method to add more serial ports is USB bus to connect with external USB to serial port converter box. Because USB bus is half-duplex structure, so everything is handle by PC. PC will poll USB device periodically to service. All serial port's data will use USB packet to transfer. So the latency time for USB to serial port converter to transfer is longer than add-on card.

■ The feature for IP serial device server

1. IP serial device server will use local CPU to handle the serial port data transmission task.

2. Such serial port data will be exchanged with TCP packet to transfer in IP network environment.

3. The virtual COM driver in PC will exchange serial port data from application software and TCP packet from IP network.

4. Now we try to find the latency time for IP serial device server to send data to target serial device. When application software need to send out serial port data. The first step is to ask virtual COM port driver to send. Then virtual COM port driver will convert such data to TCP packet and ask LAN driver to send. The TCP packet is sent to IP serial device server. Then the target data is sent in serial port.

5. Now we have different time point for user to think that data is sent. In application software we may have different condition to say data sent. We may say in the time point for data from application software to virtual COM driver's buffer. We may say in the time point for data from virtual COM driver to LAN driver. We may say in the time point for TCP packet sent. So it is not easy to say data sent in serial port and target serial device can receive your data.

6. Because TCP packet is connection type in network, so we can promise data to send between IP devices. But we can't estimate the latency time for data received in other site. It may be 10ms to send. It may be 200ms to send. It may be 10sec to send. Or you never finish such task (because network may be broken, you need to wait available).

7. Now you can find that it is not easy to say the latency time for IP serial device server to send serial port data. If your application software based on COm1/COM2 condition to handle the logic, then you may have big problem in IP serial device server environment.

8. For example, we may send one control code "A" for PC to target serial device. Traditionally we may suggest that target serial device may need 10ms to prepare response data. So application software may wait up to 20ms for response data. Now we use IP serial device server and the control code may send to target serial device 200ms later. So application software may receive response data 400ms later. If original application were based on COM1/COM2 to prepare the procedure, then you may always have time out condition. So you never have correct function in your application software.

■ Some problem and suggestion in IP serial device server

1. Q: Why we have data write finished response in application software and target serial device do not receive data?

   A: Because virtual COM driver may transfer such data to LAN driver and we can't confirm such TCP packet will arrive IP serial device server.
   a) In TPORT/RPORT virtual COM driver we can give some compensation for this condition.
   b) We can use "ping" command to check the network transfer timing. It is normal condition we need to send TCP packet to IP serial device server. In TPORT/RPORT virtual COM driver we can run "tport_ap" program to set our serial port to map to target IP serial device server. There is one parameter "TCP delay time". The unit for this parameter is "ms". We can assign this value to compensate the timing for TCP packet to send from PC to target IP serial device server. This parameter will ask virtual COM port driver to say data transferred after this time delay.
   c) In some application we may not take care the time point the data to send (ex, send file to remote site is not timing sensitive function). Then we need to set "TCP delay time" parameter with 0 to have highest data transfer performance.
   d) In some application it is very important for timing point to send data (ex, "POLL" and wait "ACK" environment). Then we need to adjust "TCP delay time" parameter to cover timing problem.

2. Q: Why the data transfer performance is slower than COM1/COM2 port?

   A: Because you may set "TCP delay time" in "tport_ap" setup.
   a) Because virtual COM driver will add extra "TCP delay time" to respond data transferred to application software.
   b) If we did not set "TCP delay time" to "0", then we need to share the "TCP delay time" for real data transfer time. If such period were larger than real serial port data transfer time, then we may have "idle" period to wait to send serial port data.
   c) For such application environment don't care the timing for data transfer it is best to set "TCP delay time" with "0". So we can have best data transfer performance.

3. Q: My application software may be hung upon network "broken" condition.

   A: Because we use TCP connection in network.
      a) TCP connection mode will send data to remote site forever. When network in "broken" condition we can't send data to remote site. So virtual COM port driver will keep this task.
      b) If your application software did not take care this condition, then you will be "hung" here.
      c) So it is best to have time out feature to be set in your application software. Then we can skip this "hung" condition.

4. Q: My application software can't receive one complete message and will receive in separate timing point.

   A: Because IP serial device server will send back serial port received data ASAP. We need to have minimum latency time from serial port to application software.
      a) So we will use TCP packet to send serial port received data upon available. Because we can't confirm the real TCP packet transfer condition will be. So we may have one message received in serial port continuously and send in multiple TCP packet.
      b) For some application software they may need to receive one complete message upon data available. If there were several part received for one complete message, then we may have wrong process in application software. (For example, we may have MODBUS protocol to handle).
      c) To handle this condition we must set virtual COM port in "No flow control" mode. When you set serial port in "flow control" mode, it means that serial port throughput is important. Then we will send data ASAP.
      d) When you set serial port in "No flow control" mode, we suggest that you may have handshake protocol in application software. Then we will let IP serial device server to keep received data in buffer and send via TCP packet upon following condition. When we have received data buffer size over 200 bytes. Or we have over 20ms without data input. In this condition we can let application to receive one complete message upon data available.

5. Q: When I do not use my virtual COM port, the other Windows system can't use same serial port.

   A: You may install our TPORT driver for virtual COM port usage. You can install our RPORT driver.
      a) TPORT driver will start to connect with IP serial device server upon virtual COM port opened. And we will keep this TCP connection from now. It means that the serial port in IP serial device server will be used by this PC1 from now. So the other PC2 can't use this serial port from now.
      b) The purpose for TPORT driver is to keep TCP connection between this PC and IP serial device server. TCP connection procedure is timing heavy task to run. When we keep TCP connection, we can promise application software can use serial port anytime.
      c) If user need to have serial port used by multiple Windows system, then it is best to use RPORT driver. RPORT driver will start to connect with IP serial device server upon virtual COM port opened. RPORT driver will disconnect TCP connection upon virtual COM port closed. So any Windows can use same serial port upon serial port available (no other TCP connection established).
      d) Because RPORT will start to connect with IP serial device server upon virtual COM port opened. So you may open successfully or fail upon target time point. If you could not accept the condition for virtual COM port open fail condition, then it is best to use TPORT driver. So you can occupy such serial port in IP serial device server forever. TPORT driver will work as serial port in your PC. Nobody will share with you. RPORT driver will work as serial port assigned to any PC dynamically. You can ask to have extra serial port in your PC anytime. But you need to wait upon other people occupy your serial port.
      e) So user can install TPORT driver and RPORT driver to meet target application environment.