# The Princess ~ Dilemna ~

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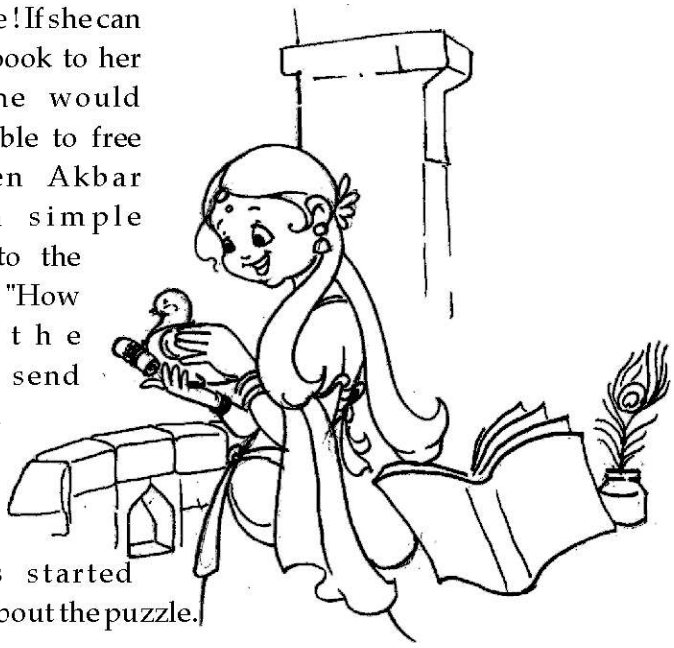
Emperor Akbar was very fond of puzzles. One day he walked into court and posed this question to his courtiers. "A princess has been imprisoned on the top of a far-away unknown tower, with only her maid and a flock of pigeons for company. Of course. She feels miserable ! She does not have any hope of escaping.
One day she comes across an ancient book hidden among the stones of the tower. The book explains the various routes into the tower and the ways to overcome its obstacles. Suddenly, the princess sees a ray of hope ! If she can send the book to her prince, he would soon be able to free her. Then Akbar asked a simple question to the courtiers, "How does the princess send the book to the prince?" All the courtiers started thinking about the puzzle.



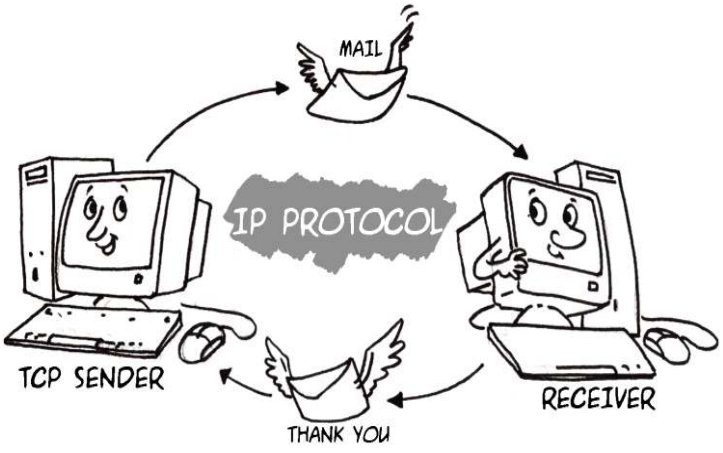
One of the courtiers suggests that she should tie the book to a pigeon and send it. Another objects that the book would be too heavy for a pigeon. Another solution was offered,"Since the whole book would be too heavy, why not send only few pages with each pigeon ?". But the doubter among the courtiers warned, "Pigeons might get lost or intercepted and then the book would be lost for good".

While they are debating, Birbal walks into the court. Seeing that all the courtiers were just arguing without giving any solution, Akbar asked the same question to Birbal. The entire court is silent awaiting Birbal's reply.

Birbal says, "Jahanpanah, it is quite simple. The princess gets her maid to make a copy of the book. The maid should be careful in putting numbers on the pages. She can send a page with one pigeon. This way she has to send many pigeons, each carrying one page. When the prince receives a pigeon, he removes the page and sends back the page number with the pigeon.
All the courtiers were eager to know how this would workout. Birbal continued, "Due to some accident, a pigeon may not deliver a page to the prince. Then the princess must know which pages are received and which are not. If she knows that a page was not received, it's easy. Since she has the original, she can resend a copy of the lost page."

Akbar and all the courtiers realized the importance of Birbal's solution. If a lot of information has to be sent, it can be divided in smaller sections. Smaller section is easier to send. Each section can be sent separately. All we have to be careful about is accounting of the sections at the sender's and the receiver's ends.

Interestingly, a similar situation happens in computer networking. (See Box information).
Most computers on the Internet today communicate using something called the TCP/IP protocols. IP stands for Internet Protocol and its work is similar to the pigeons in the above story. Given a packet (page) and a destination, IP tries to deliver the packet to the destination. However, IP does not give any guarantee for delivery and packets may be destroyed.




TCP stands for Transmission Control Protocol and its work is similar to that of the princess (on one side) and the prince (on the other side).

When some information is to be sent from one computer to another using TCP, the TCP sender stores the information in a buffer. Next, the TCP sender breaks the information into small sized packets. It then puts a sequence number on the packets and gives them to IP for delivery to the receiver.

Note that we are using Sender for the computer which is sending information and Receiver for the computer which is receiving information.

When a packet reaches the receiver, the TCP receiver checks the sequence number. If it is a new packet, it uses IP to send back an Acknowledgment to the Sender. In this way the Sender can keep track of which packets have reached. If the Sender does not receive the acknowledgment for any packet within a reasonable amount of time, it retransmits the packets.

You might say, "That's all! I thought it must be very complicated." Well, you are right in a way. The basic idea we have learnt now, but there may be lots of problems. Can you think of a few?

Going back to our princess' example, What happens if the prince gets 45th packet after the 42nd? What should he do? How long should he wait for the next pigeon, after one has arrived (and returned)? What if a pigeon dies in transit (in either direction)? The list of questions can go on!

**What is a network?**
A network is a collection of wires that are used to connect various computers to each other. The computers can use these wires to send information or messages to each other. The term network may also be used for a set of lines, tubes, wires, roads that cross each other.

**What is a protocol?**
A protocol is the system of rules on the correct and acceptable way to behave. In the computer scientist's language, a protocol is a method for connecting computers so that they can exchange information.

**What is a buffer?**
A buffer is a place in a computer's memory for storing information temporarily.

Some interesting related websites are:
http://computer.howstuffworks.com/
http://vlib.org/Computing.html/

*Illustrations: Mrs. Kaumudi Sahasrabudhe*