Data Communications Troubleshooting

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PREFACE

Data communication problems can be extremely difficult to solve. They can also be solved very simply. Why the differences? Let's look at modern medicine for a few examples.

A patient complains of a sore arm. The doctor takes his temperature (they always take your temperature), examines his arm, asks some questions about past medical history and sends him to X-ray. Looking at the x-rays, she sees an obvious crack in the bone and places a cast on his arm. That was a fairly simple solution. Now take the same patient back to 18th century Europe. Tools for diagnosing broken arms were lacking, but there was always blood-letting. If that didn't work, the doctor could try irritants, Phrenology, magnetism and magic.

Had the doctor possessed the proper tools to do the job, the time between complaint and correct treatment would have been shortened considerably.

The type of problem, the tools available, and the technique applied can shorten or lengthen the time required to solve the problem. This presentation will help you understand the problem, become aware of the tools, and improve your techniques.

From the viewpoint of most computer users, there are four types of malfunctions. They are usage, protocol, digital and analog. Usage problems are those arising from improper use of an otherwise working data comm link. Protocol problems go beyond the users' immediate control and involve the software that handles the link. Digital problems involve the interface between the data terminal equipment (DTE) and the data communications equipment (DCE). Analog problems are limited to the data communications facility, which is the wires between the modems or data sets.

There are many approaches to troubleshooting. The process of elimination by replacing equipment, stepping through software, and circuit checks by the halving algorithm are some ways. Symptomatic troubleshooting does not eliminate any of these methods, but it does reduce the time necessary by quickly pointing out the area of the malfunction.

HEATERS AND AIR CONDITIONERS 24-23

SYSTEM COOLS INTERMITTENTLY

Symptoms	Possible Causes
Electrical	
1. Unit operates intermittently.	1. Defective fuse, relay blower switch, or blower motor.
2. Clutch disengages prematurely during operation.	2. Improper ground, loose connection, or partial open in clutch coil.
Mechanical	
1. System operates until head pressure on builds up at which time clutch starts slipping; may or may not be noisy.	1. Compressor clutch slip.

Example: Troubleshooting guide from auto repair manual.

An example of symptomatic troubleshooting can be found in nearly any automobile repair manual. You may find a flowchart or table in which the axes are labeled SYMPTOM and PROBABLE CAUSE. The idea is to find the probable causes for the condition (or problem) encountered, then by testing or a process of elimination, discover the remedy. Newer methods have been developed which can suggest solutions.

AUTOMATIC TRANSMISSION 21-30

General Diagnosis Chart

Symptoms	Causes (see list below) 1	2	3	4	5	6	7	8	9
HARSH ENGAGEMENT FROM NEUTRAL TO D OR R	X			X					
DELAYED ENGAGEMENT FROM NEUTRAL TO D OR R		X		X	X	X	X	X	X
RUNAWAY UPSHIFT		X		X		X		X	
NO UPSHIFT		X		X		X	X		
3-2 KICKDOWN RUNAWAY		X		X		X			
NO KICKDOWN OR NORMAL DOWNSHIFT				X					
SHIFTS ERRATIC		X		X		X	X	X	X
SLIPS IN FORWARD DRIVE POSITIONS		X		X		X	X	X	X

1 Engine idle speed too high
2 Hydraulic pressures too low
3 Low-reverse band out of adjustment
4 Valve body malfunction or leakage
5 Low-reverse servo, band or linkage malfunction
6 Low fluid level
7 Incorrect gearshift control linkage adjustment
8 Oil filter clogged
9 Faulty oil pump

Example: Symptom/Cause Chart from auto repair manual

Let's get back to the computer. Think of all of the possible problems one can have with a data communications network: hangs, disconnects, errors in the data, delays, retries, and on and on. What could be the possible causes of these problems? Noise, fade, delay, program bugs, faulty equipment, operator error, and more can all cause aggravating malfunctions.

This is what you need to know to solve these problems in a timely manner:

A. The Basics — what is the environment, what was supposed to happen
B. The Symptoms — what did happen
C. The Causes — why
D. The Tests — what tests will give the right information
E. The Tools — what tools will do the tests
F. The Solution — what action to take

This presentation will help you learn how to get from A to F.

EXCERPT

Let me give you an example to show how knowledge of the symptoms, tests, and tools can make problem solving easier. A problem occurred at a site where the symptoms were terminal hangs and garbage on the screen sometime after the session started. There was never any problem signing on. This was a point-to-point terminal on a switched line using BELL 212A modems.

Three things were done in an attempt to resolve the

problem: the MPE I/O configuration was checked, the modem options were verified, and a 1640 data scope was put into the line. The 1640 showed that a DC1 was received followed by garbage. This was either printed as garbage or hung the terminal. The assumption that followed was that something was wrong with the terminal. The configuration of the terminal showed that it was "providing clock," as was the 212 modem. At this point, it was decided that the modem options listed in the Data Comm Handbook must be wrong.

This bit of troubleshooting had gone way off on a wild goose chase. No attempt was ever made to test the most basic part of the network, the telephone line. Simple modem self-tests and loop backs were completely ignored. The 1640 served no useful purpose at this point.

A more reliable approach would have been to start by defining the exact symptoms, determining the possible causes, and making some appropriate tests. Using the new information gained through this technique, troubleshooting would have been more directly related to the problem.

The Basics

HP262X terminal
Point-to-point terminal connection to a port
Switched public line
Full duplex modem with good complement of diagnostics

The Symptoms

Apparently random terminal hangs and garbage occurs only on one line

The Causes

Fortuitous line problems
Faulty modem
Faulty terminal

The Tests

Modem loop back with test pattern
Modem self-test
Terminal data comm test

The Tools

None needed

The Solution

Switched lines are susceptible to noise and other problems. Since each new connection uses a different route, conditioning is not available (and would not help noise anyway). Therefore, the terminal should be reset if it is hung or the data retransmitted if it was garbaged. If that doesn't help, redial the connection.

SUMMARY

This excerpt is an example of what my presentation will cover in much more detail. I am currently working on flowcharts and decision tables to make solving data comm problems easier by encouraging the use of symptomatic trouble shooting. This should lead to using the proper tools in the proper order.