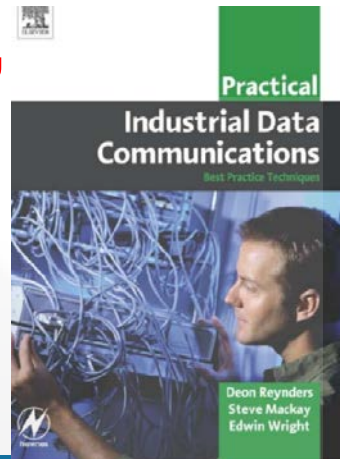


# Troubleshooting Tips: Data Communications, Networking and TCP/IP

by  
Steve Mackay



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## Overall Presentation

A quick introduction to troubleshooting industrial data communications systems from cabling & hardware; TCP/IP utilities to protocol analysis.

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## Objectives

- Basics of troubleshooting
- Focus on TCP/IP Utilities
- Introduction to Protocol analysis



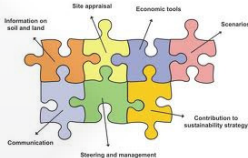
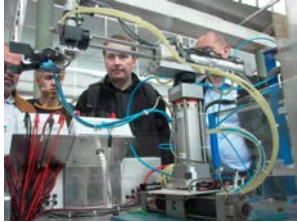
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Lesson Today:  
Topics

# Topics

- Overall concept
- Hardware & Cabling
- TCP/IP Utilities
- Packet Analysis



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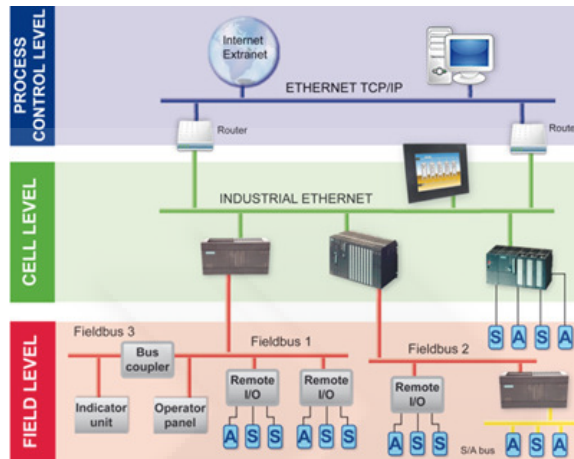
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# 1.0 Introduction

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## Overall Concept



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## Tools of the trade

- Cable tester
- TCP/IP (and other third party) Utilities
- Protocol Analyzer (e.g. Wireshark)

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## 2.0 Hardware & Cabling



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### Hardware and Physical Cabling

- Check cable on both sides of connection
- Switch lights
- Incorrect wire type and components
- Straight versus cross over cable
- Excessive untwists
- Damaged RJ-45 connector
- Electrical noise and shielding



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## 3.0 TCP/IP Utilities

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### Utilities

- Ping
- Arp
- Netstat
- Nbtstat
- Ipconfig
- Tracert

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## Ping -t

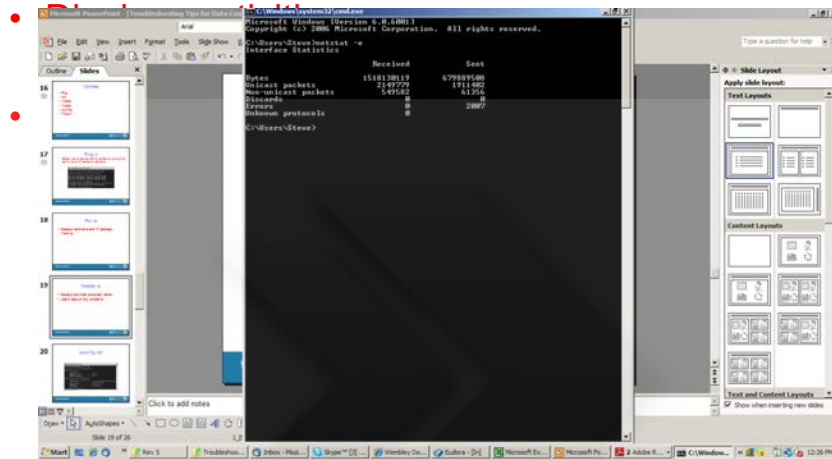
- Easiest ways to test connectivity across the network and confirm that an IP address is reachable

```
C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\Deon>ping 192.168.0.3
Pinging 192.168.0.3 with 32 bytes of data:
Reply from 192.168.0.3: bytes=32 time<1ms TTL=48
Reply from 192.168.0.3: bytes=32 time<1ms TTL=48
Reply from 192.168.0.3: bytes=32 time<1ms TTL=48
Reply from 192.168.0.3: bytes=32 time<1ms TTL=48
Ping statistics for 192.168.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\Documents and Settings\Deon>
```

## Arp -a

- Displays hardware and IP address mapping

## Netstat -e



```
Microsoft Windows [Version 5.0.5400]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.

C:\Users\Stacey> netstat -e

          Received              Sent
Bytes      1518138119             679829580
Network packets      219779                171100
Multicast packets      54952                61376
Errors          0
Unknown protocols      0
C:\Users\Stacey>
```

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## Nbtstat

- Protocol Stats & TCP/IP connections

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## Ipconfig /all

```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Deon>ipconfig /all

Windows IP Configuration

Host Name . . . . . : c50
Primary Dns Suffix . . . . . :
Node Type . . . . . : Broadcast
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   Description . . . . . : Intel(R) PRO/1000 PL Network Connect
   ion
   Physical Address. . . . . : 00-00-D1-4F-AD-59
   Dhcp Enabled. . . . . : No
   IP Address. . . . . : 192.168.0.2
   Subnet Mask . . . . . : 255.255.255.0
   Default Gateway . . . . . :

C:\Documents and Settings\Deon>
    
```

## Tracert

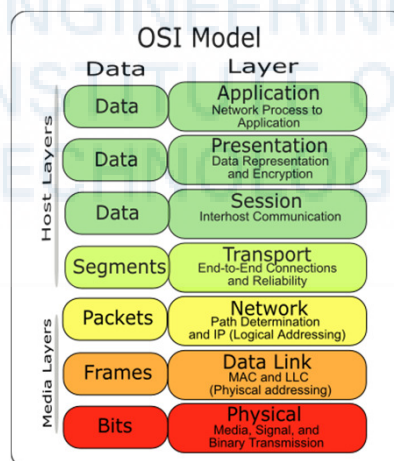
```

C:\Command Prompt
C:\>tracert msdn.microsoft.com
Tracing route to msdn.microsoft.com [66.246.3.197]:
over a maximum of 30 hops:
  0  100 ms  100 ms  100 ms  192.168.1.1
  1  200 ms  400 ms  300 ms  192.168.1.1
  2  200 ms  400 ms  300 ms  192.168.1.1
  3  200 ms  400 ms  300 ms  192.168.1.1
  4  200 ms  400 ms  300 ms  192.168.1.1
  5  200 ms  400 ms  300 ms  192.168.1.1
  6  200 ms  400 ms  300 ms  192.168.1.1
  7  200 ms  400 ms  300 ms  192.168.1.1
  8  200 ms  400 ms  300 ms  192.168.1.1
  9  200 ms  400 ms  300 ms  192.168.1.1
 10  200 ms  400 ms  300 ms  192.168.1.1
 11  200 ms  400 ms  300 ms  192.168.1.1
 12  200 ms  400 ms  300 ms  192.168.1.1
 13  200 ms  400 ms  300 ms  192.168.1.1
 14  200 ms  400 ms  300 ms  192.168.1.1
 15  200 ms  400 ms  300 ms  192.168.1.1
 16  200 ms  400 ms  300 ms  192.168.1.1
 17  200 ms  400 ms  300 ms  192.168.1.1
 18  200 ms  400 ms  300 ms  192.168.1.1
 19  200 ms  400 ms  300 ms  192.168.1.1
 20  200 ms  400 ms  300 ms  192.168.1.1
Trace complete.

DNS:
    
```

# 4.0 Packet Analysis

## OSI Model



## Packet Structure

13	2.456990	10.0.0.138	Broadcast	ARP	who has 10.0.0.50? Tell 10.0.0.138
14	3.211182	192.168.0.2	202.168.0.3	ICMP	Echo (ping) request
15	3.211211	192.168.0.2	202.168.0.3	ICMP	Echo (ping) request
16	3.234296	202.168.0.3	192.168.0.2	ICMP	Echo (ping) reply
17	3.458268	10.0.0.138	Broadcast	ARP	who has 10.0.0.50? Tell 10.0.0.138
18	4.211607	192.168.0.2	202.168.0.3	ICMP	Echo (ping) request

```

> Frame 14 (74 bytes on wire, 74 bytes captured)
> Ethernet II, Src: 00:a0:d1:4f:ad:59, Dst: 00:10:7b:7f:c0:b7
> Internet Protocol, Src Addr: 192.168.0.2 (192.168.0.2), Dst Addr: 202.168.0.3 (202.168.0.3)
  Version: 4
  Header length: 20 bytes
  Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
  Total Length: 60
  Identification: 0x17bd (6077)
  > Flags: 0x00
  Fragment offset: 0
  Time to live: 128
  Protocol: ICMP (0x01)
  Header checksum: 0x97ae (correct)
  Source: 192.168.0.2 (192.168.0.2)
  Destination: 202.168.0.3 (202.168.0.3)
  > Internet Control Message Protocol
    
```

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## Section 4 Conclusion



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