



Under the Hood

The Wire to the Internet

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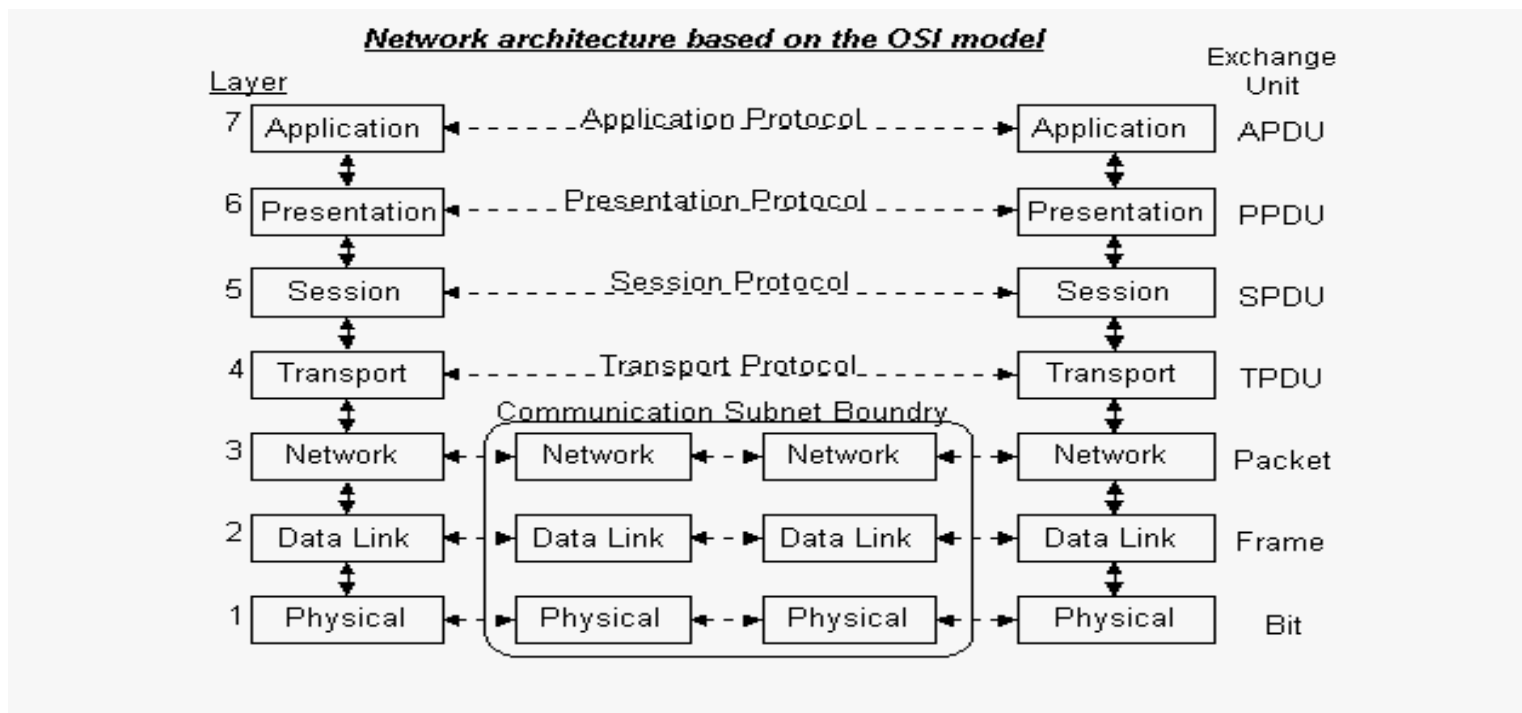


Agenda

- Network Model
- Network Layer Protocols
 - HTTP, FTP, ...
- Network Infrastructure
 - Cabling, Hubs, ...
- PC Hardware
 - PCI, PCMCIA,
- Demo

7 Layer OSI Model

People Don't Need To See Paula Abdul





A Simple Approach

- A 4 Layered Network View
 - Physical
 - Data (MAC addr, switching)
 - Network (IP addr, routing)
 - Application (65K conversations possible via Ports)

- Think like a network device, not the User!



A Host

- A MAC address is unique for each Network Card (NIC).
- IP addressing
 - Reserved address space
 - 10.x.x.x Class A
 - 172.16-31.x.x Class B
 - 192.168.x.x Class C
 - What address to use?
 - If is isn't reserved, you may not get out
 - Requesting address space
 - ICANN or your ISP
 - DHCP
 - DNS issues
 - IPv6 vs IPv4
 - Vendor support
 - Is it a real User requirement?
- Operating System Support
 - Remote logins, "shrink wrap" support, file portability, etc





Your Network

- What Protocols?
 - The Internet as most see it (http, https)
 - File sharing (FTP, SMB)
 - Terminal Access (Telnet, SSH, X11)
 - Email (smtp, pop, imap)
- Network Address Translation (NAT)
 - We all connect as one!
 - Do you need to NAT?
- Myth: Proxy servers or firewalls
- One way Firewall?
 - I can see you, hopefully you can't see me.



The Enterprise Network

- Network Elements
 - Cables (voice/data)
 - Hubs and Switches
 - Routers and Firewalls
- Network Design
 - Topology
 - Bandwidth
 - Applications



A little Telephony history (1 of 2)

- House wiring
 - Dial tone = 48 volts
 - Ring = up to 150 volts
- Color Pairs
- Why talk about phone wiring?
 - Networks start from the wire
 - Most older buildings have legacy wiring
 - Do you reuse the building wiring?

Your House Wiring		
Pair 1	Pair 2	
Green	Yellow	Tip
Red	Black	Ring



A little Telephony history (2 of 2)

- Color blind?
 - Primary Colors/Secondary Colors of bundles
 - Data cable colors you need to know. (Secondary Colors)
 - Do you have to remember colors?
 - Today most network connects are CAT5 and come color coded.

Primary Colors	Secondary Colors
White	Blue
Red	Orange
Black	Green
Yellow	Brown
Violet	Grey (Slate)

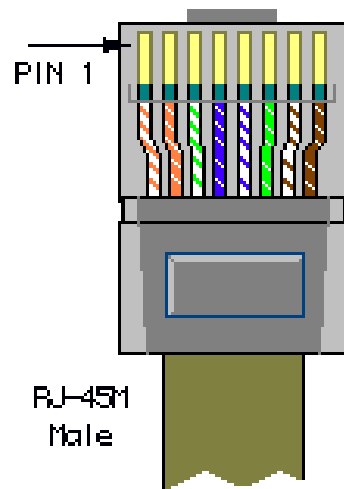
100 Pair Cable Bundle Tag Colors	
Bundle Num (pair #)	Tagged Color Wrap
1 (1-25)	Blue
2 (26-50)	Orange
3 (51-75)	Green
4 (76-100)	Brown

Cable Types (1 of 4)

- What is the difference between Cat 3, 5, 6
- Cables you need to know how to make (Straight Through and Crossover)
- Tools of the trade (toner, crimper, cable checker, scissors)

Crossover Cable

RJ-45 PIN	RJ-45 PIN
1 Rc+	3 Tx+
2 Rc-	6 Tx-
3 Tx+	1 Rc+
6 Tx-	2 Rc-

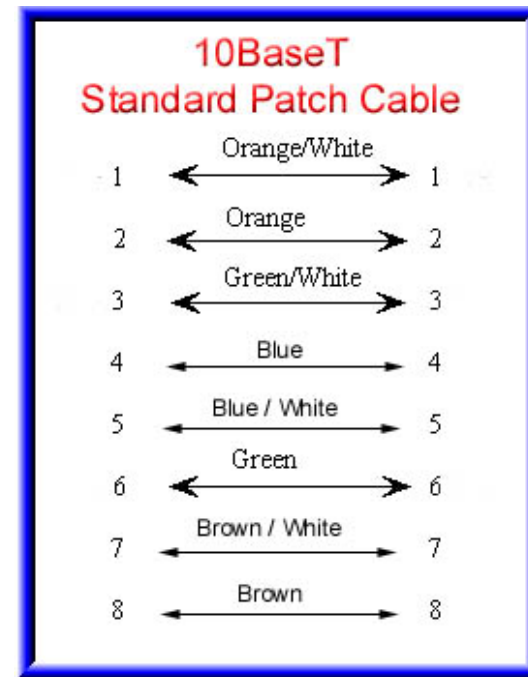
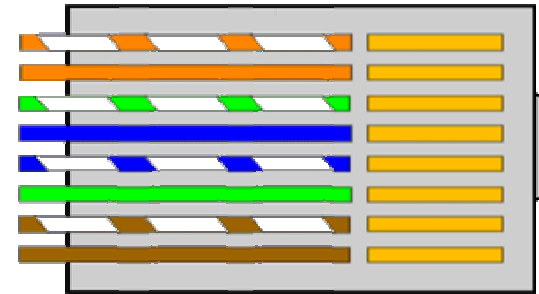
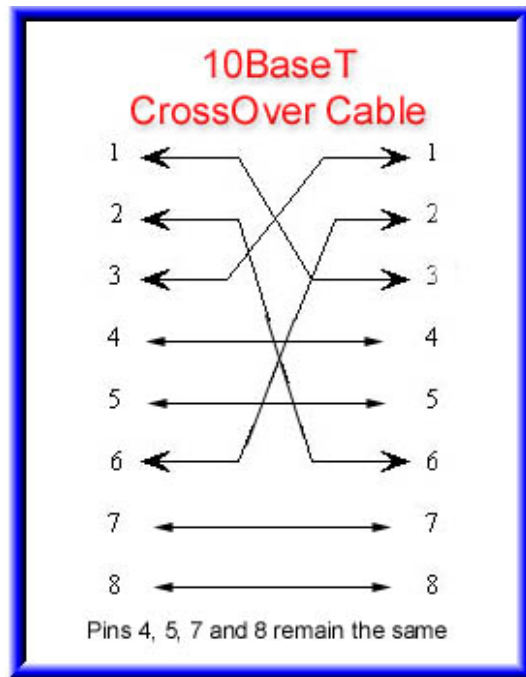
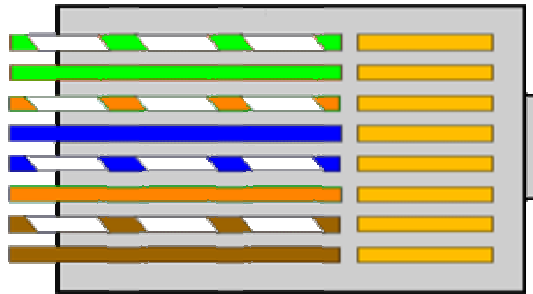


AT&T 258A - EIA/TIA 568B

Straight Through Cable

RJ-45 PIN	RJ-45 PIN
1 Tx+	1 Rc+
2 Tx-	2 Rc-
3 Rc+	3 Tx+
6 Rc-	6 Tx-

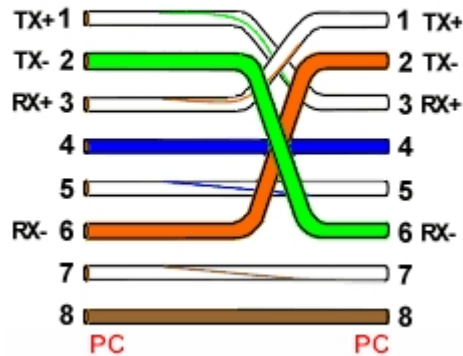
Cable Types (2 of 4)



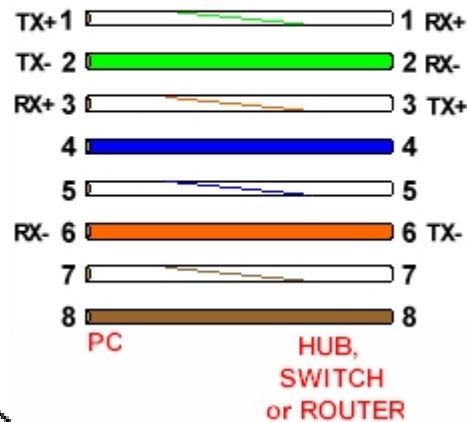
Cable Types (3 of 4)

CROSS-OVER

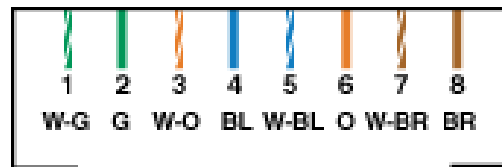
Wiring Standards Used
T568A T568B



STRAIGHT-THROUGH
Wiring Standards Used
T568A T568A

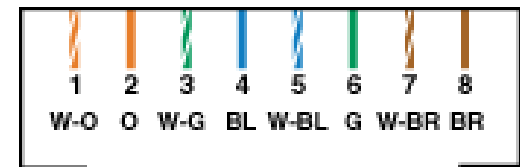
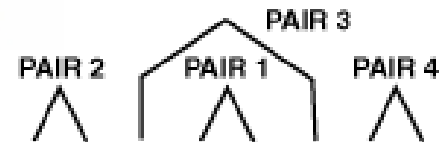


HUB,
SWITCH
or ROUTER



JACK POSITIONS

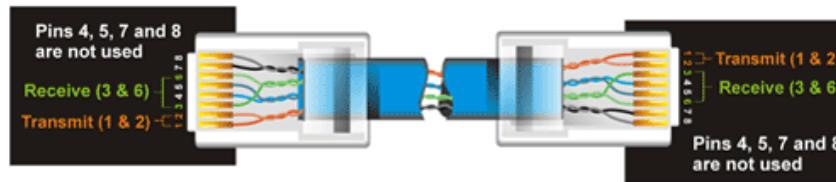
Configuration: 568A



JACK POSITIONS

Configuration: 568B

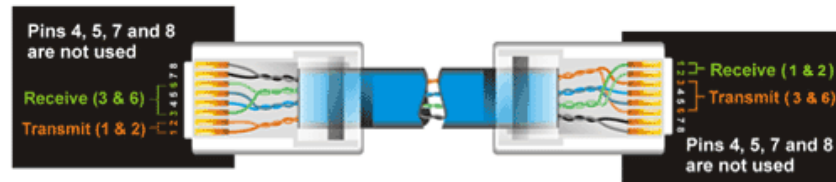
Cable Types (4 of 4)



Pin number	Wire Color
Pin 1 ==>	Orange/White
Pin 2 ==>	Orange
Pin 3 ==>	Green/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Green
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown

Straight-Through		
Wire	Becomes	
1	→	1
2	→	2
3	→	3
6	→	6

Pin number	Wire Color
Pin 1 ==>	Orange/White
Pin 2 ==>	Orange
Pin 3 ==>	Green/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Green
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown



Pin number	Wire Color
Pin 1 ==>	Orange/White
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Pin 5 ==>	Blue/White
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Pin 7 ==>	Brown/White
Pin 8 ==>	Brown

Crossed-Over		
Wire	Becomes	
1	→	3
2	→	6
3	→	1
6	→	2

Pin number	Wire Color
Pin 1 ==>	Green/White
Pin 2 ==>	Green
Pin 3 ==>	Orange/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Orange
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown



Hubs and Switches

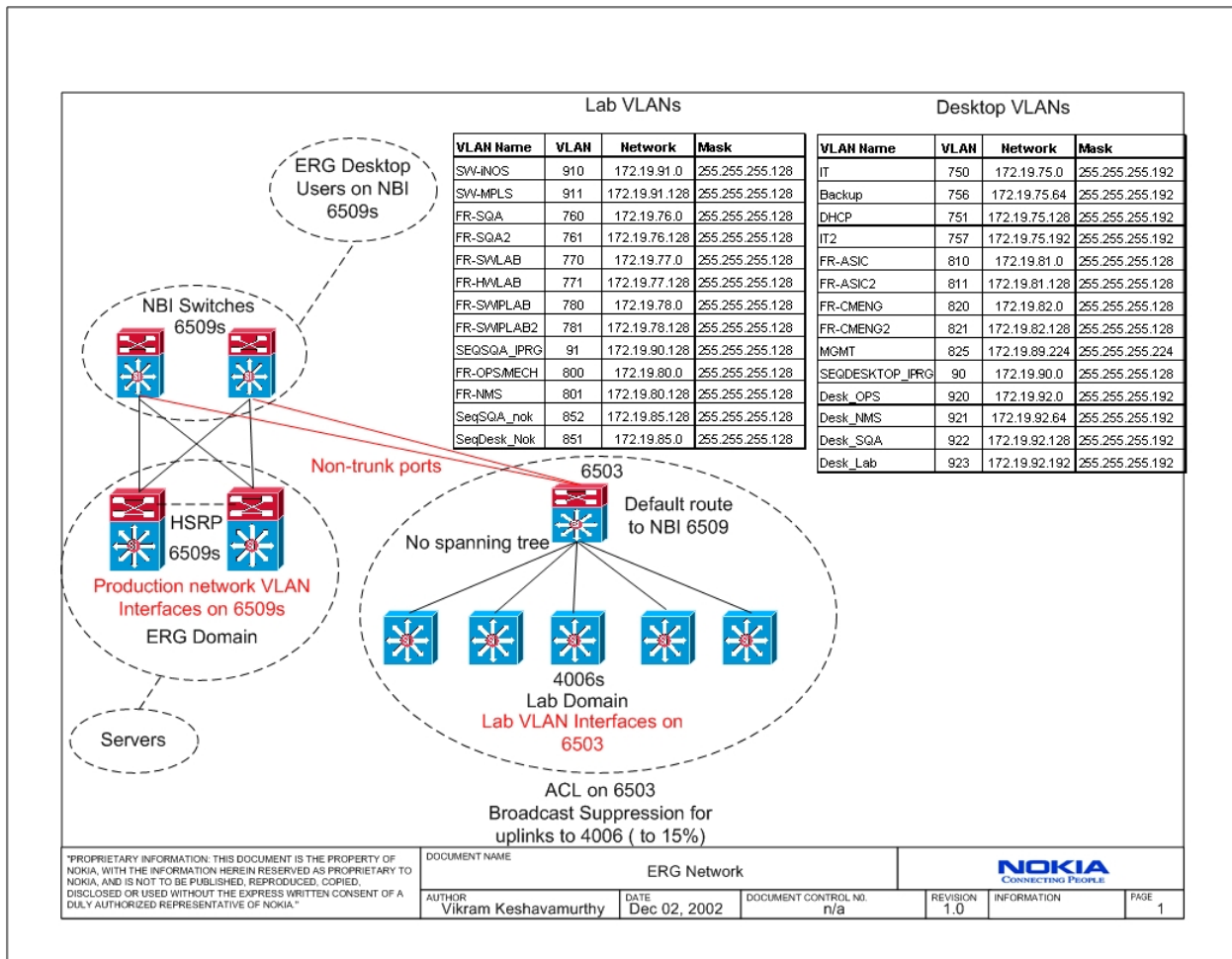
- Hubs
 - All for one, one for all
 - Repeater
- Switches
 - Forwarding based on MAC (bridge)
 - Auto-negotiation (speed/duplex)
 - In-line power
 - Segmentation (vlans)
 - How are they managed?
 - Embedded Web servers
 - SNMP (Simple Network Management Protocol)
 - What can be managed
 - Interfaces, Auto-negotiation, segments, broadcasts, etc.
 - Routing?



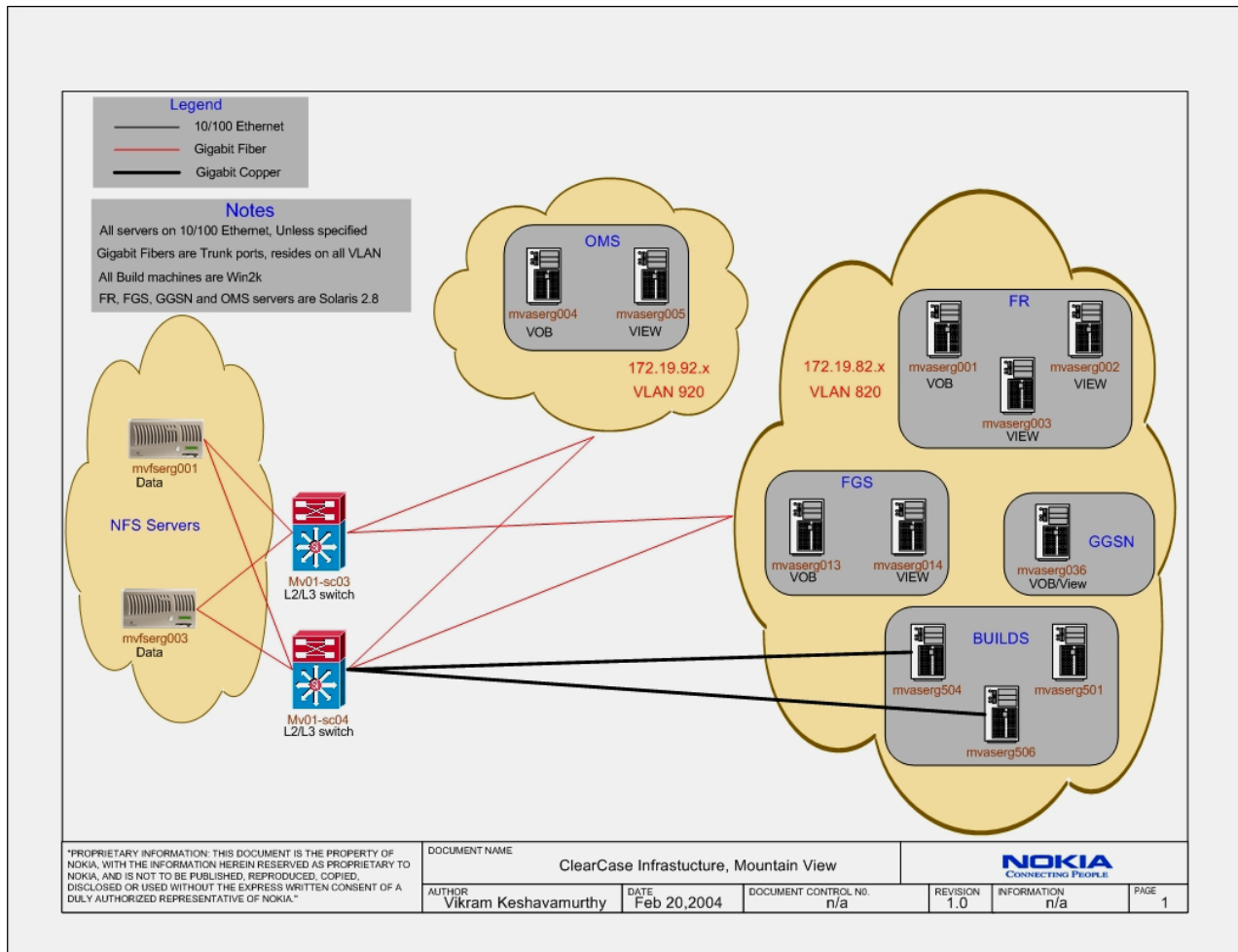
Routers and Firewalls

- Routers
 - Forward packets based on Network addresses
 - Routing protocols
 - IP addresses/subnets
 - Broadcast domains
 - Software vs. ASIC
 - FreeBSD, RedHat Linux, etc
 - Cisco, Linksys, Nokia, etc.
- Firewalls
 - Traffic analysis is based on SRC/DST IP addresses, ports, and/or packet contents.
 - NAT
 - Inbound/outbound Access Control Lists (ACL)
 - Software vs. ASIC

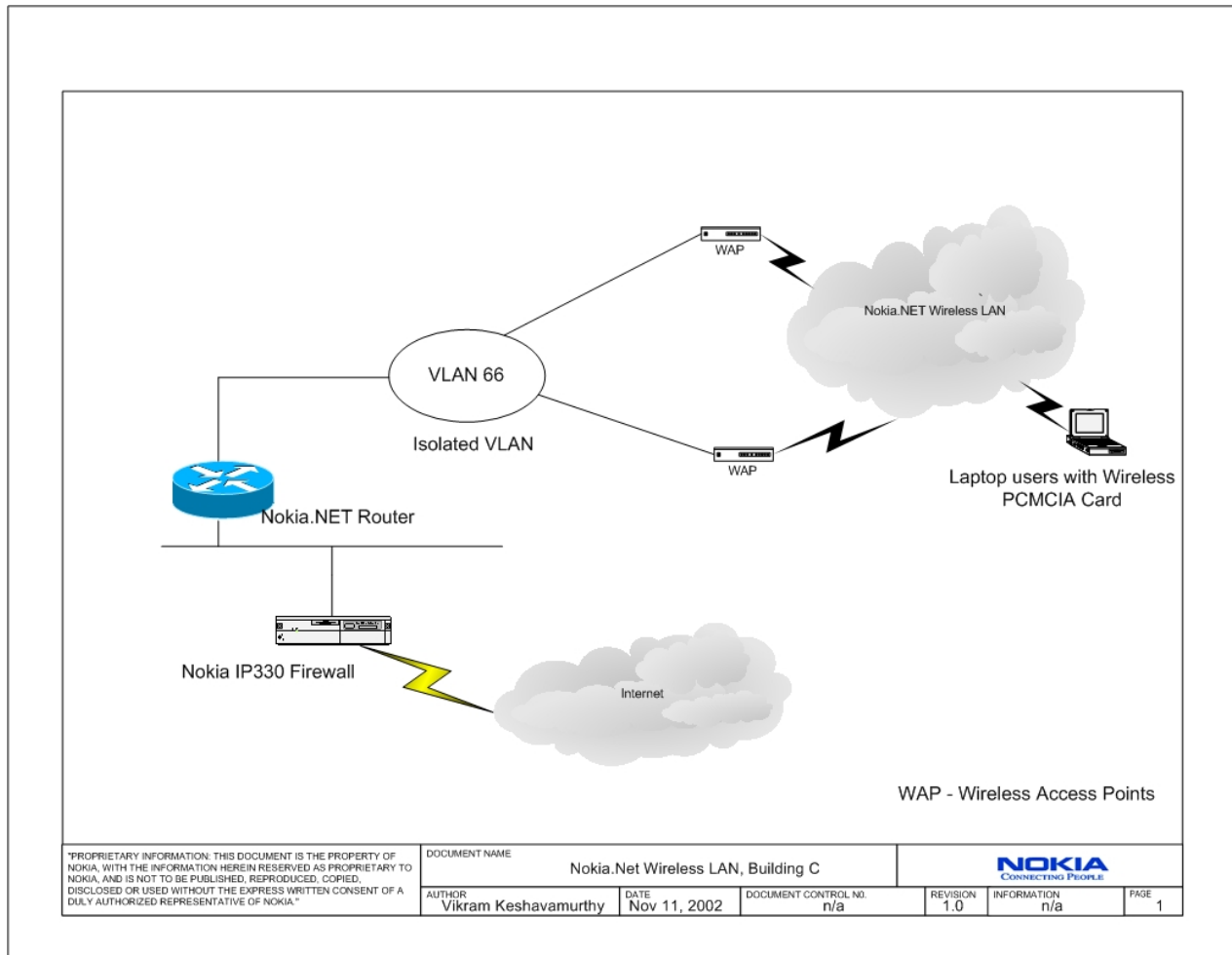
Network Diagram (example 1)



Network Diagram (example 2)



Network Diagram (example 3)





Wired vs. Wireless

- Media Types (Coax, Twisted Pair, Fiber, Wireless, Dialup?)
- Security – is it a concern?
- Speed – How fast is fast!
 - Remember that the slowest link in the network is the base speed all hosts will talk.
- Your cable plant
 - What type of media?
 - Wireless? What is your channel plan?



PC Hardware

- Types
 - PCI
 - PCMCIA
 - USB
- To install the hardware use these general rules:
 - PCI – install the card first, then software
 - PCMCIA and USB – install the software first, then the hardware



3COM Setup



Linksys Setup



PCI Card Setup



The Demo

- Setup a wireless access point
 - Web interface
- Ping test
 - PC connected via Cat5 to Access Point
 - PDA connected via Wireless



Summary

- Overview of network level protocols, architecture, and design
- “Under the Hood” look at real network components
- Demo of configuration and operation of wireless and wired links