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Security Issues in 802.11b WLANs - An Application Developers Perspective

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Workshop on Wireless Ad Hoc Networking, IISc

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Agenda

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- Communication Security Requirements
- 802.11b Security Architecture
- Security Issues in 802.11b
- Proposed Solutions for Enhanced Security

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ommunication Security equirements

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- Privacy
- Data Integrity
- Authentication

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802.11b Security Architecture

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- Link-layer security protocol
- Prevent link-layer eavesdropping
- Control network access
- WEP (Wired Equivalent Protocol)
- Essentially, equivalent to wired access point security

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/EP Requirements

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- Reasonably Strong (??)
- Self-synchronizing
- Computationally efficient
- Exportable
- Optional

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WEP Encryption

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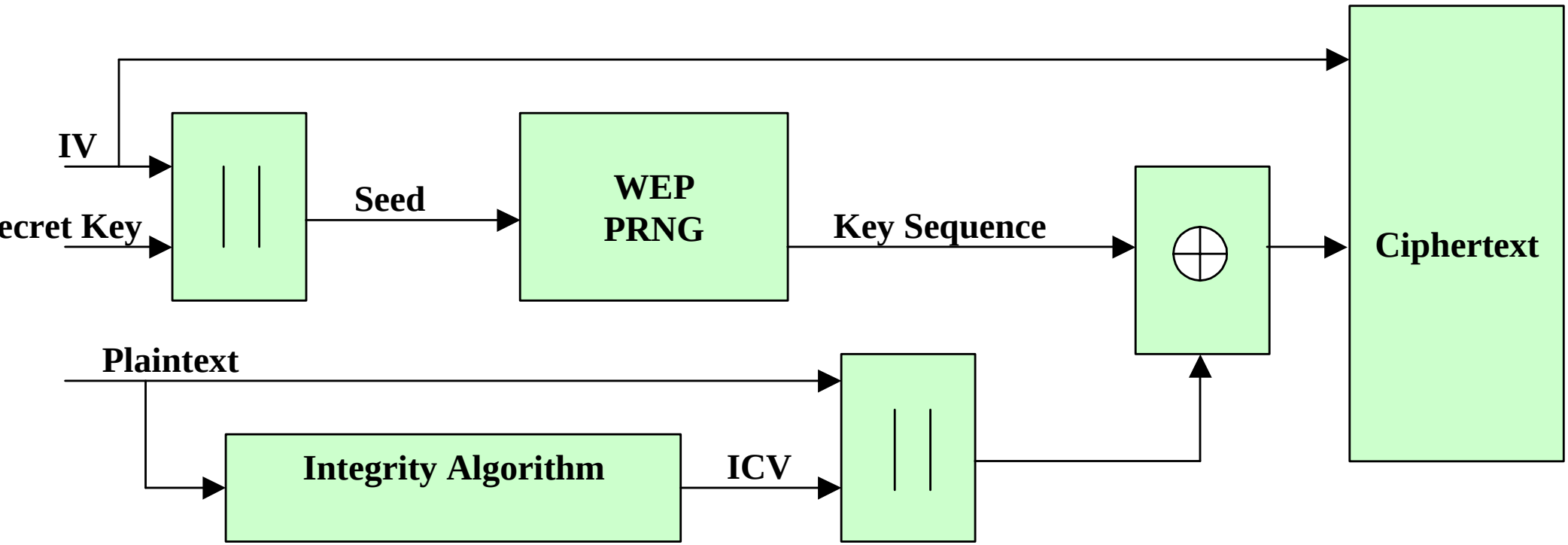

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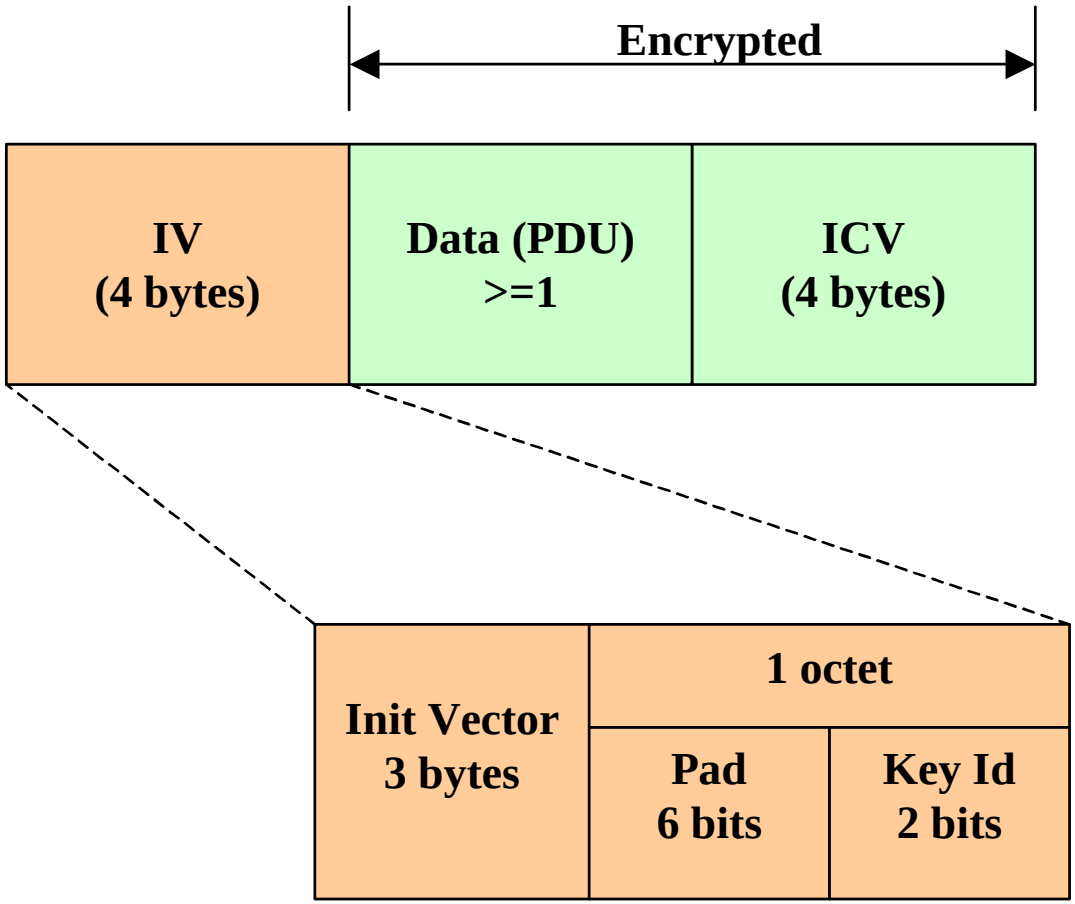
WEP Data Frame (Payload)



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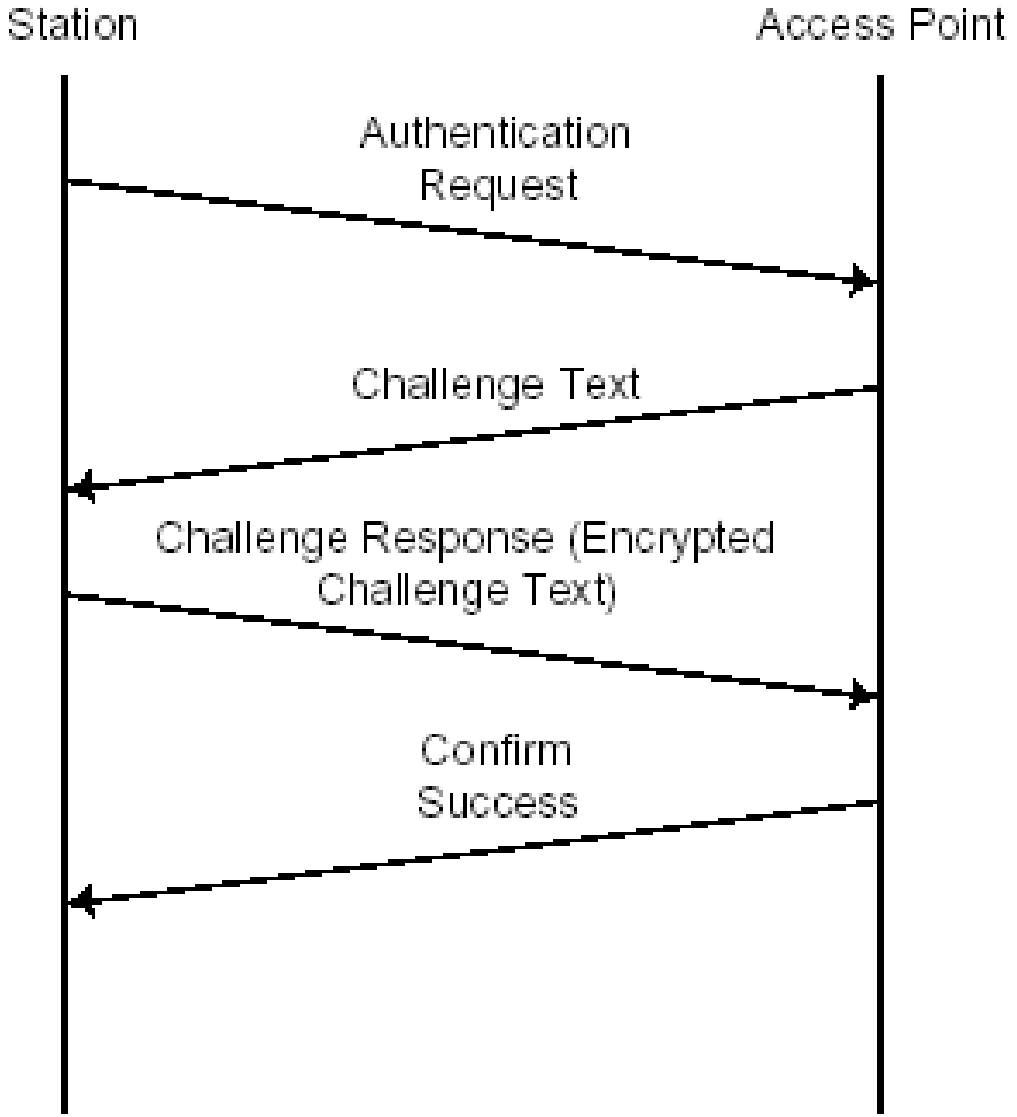
02.11b Shared Key Authentication



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Security Issues

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- War Driving / Sniffing
- Rogue Access Points
- MAC Address
- SSID
- WEP

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War Driving

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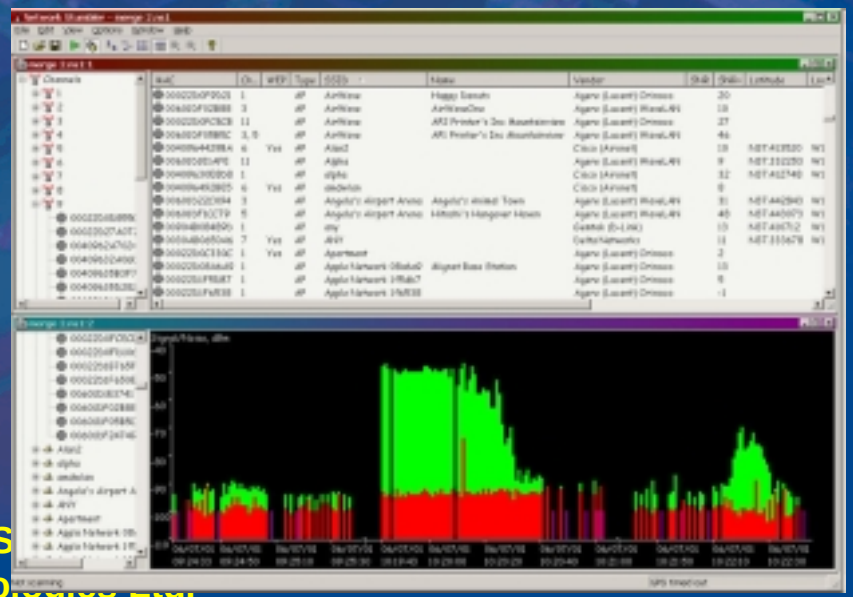
- War driving is one of the latest hacker fads
  - http://www.wardriving.com/
- Involves driving around and scanning in search of unprotected 802.11 wireless networks
- Several War Driving tools are available
  - NetStumbler
  - AiroPeek
  - MobileManager
  - Sniffer Wireless
  - THC-WarDrive



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War Driving Example

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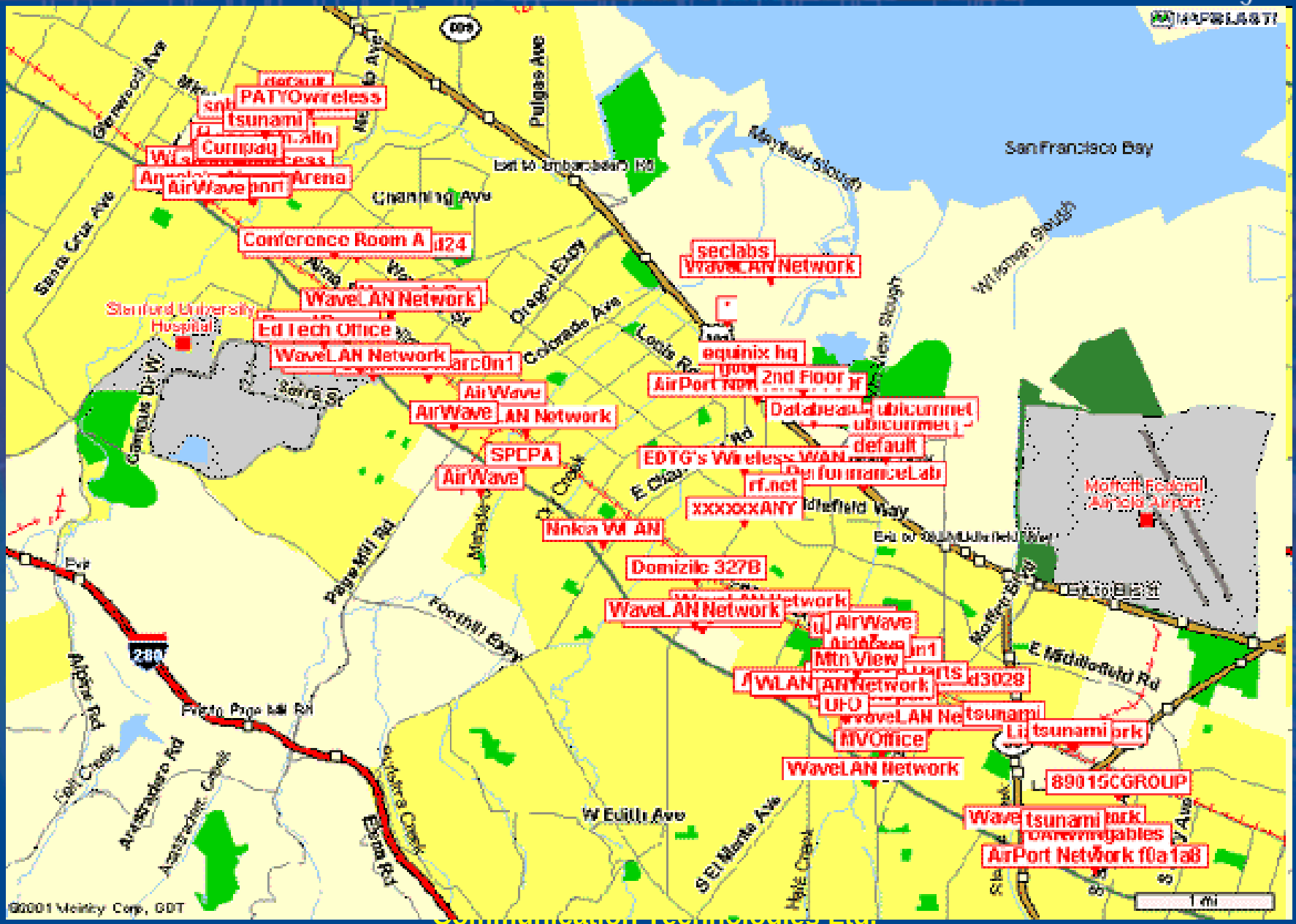

Rogue Access Points

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- Employees install access points without the knowledge of IT departments
- Security is rarely enabled
- Network becomes vulnerable to war driving / sniffing attacks

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MAC Address

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- Can control access by allowing only defined MAC addresses to access the network
- Complicated and difficult to maintain list of valid MAC addresses
- MAC addresses can be spoofed

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Service Set ID (SSID)

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- Service Set ID (SSID) is the network name given to a wireless network
- Can be used to access a specific access point by name
- The more people that come to know about the SSID the more likely that it will be misused
- Changes in SSID requires communicating it to all people who access the network

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Wired Equivalent Protocol (WEP)

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- Not an “industrial strength” encryption protocol
- Vulnerable to attack
  - Passive attacks to decrypt traffic based on statistical analysis
  - Active attacks to inject new traffic from unauthorized mobile stations, based on known plaintext
  - Dictionary-building attack that, after analysis of a day’s worth of traffic, allows real-time automated decryption of all traffic
- All users share the same encryption key
- Data headers are not encrypted
- Initialization Vector (IV) Misuse
- Weakness in RC4’s Key Scheduling Algorithm

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ttacks on WEP

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Downloadable procedures

To crack the key

- AirSnort: http://airsnort.sourceforge.net/
- WEPCrack: http://sourceforge.net/projects/wepcrack/

To brute force enter into WLAN

- THC-RUT: www.thehackerschoice.com/releases.php

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Proposed Solutions to Enhance Security

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- Virtual Private Network (VPN)
- Secure LAN (SLAN)
- Remote Authentication Dial In User Services (RADIUS
- IPsec
- 802.1x
- Proprietary WEP Implementations

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PN

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Enables you to send data between two computers across a shared or public network in a manner that emulates th properties of a point-to-point private link

Provides a scaleable authentication and encryption solution

Does require end user configuration and a strong knowledge of VPN technology

Users must re-authenticate if roaming between VPN servers

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PN Architecture

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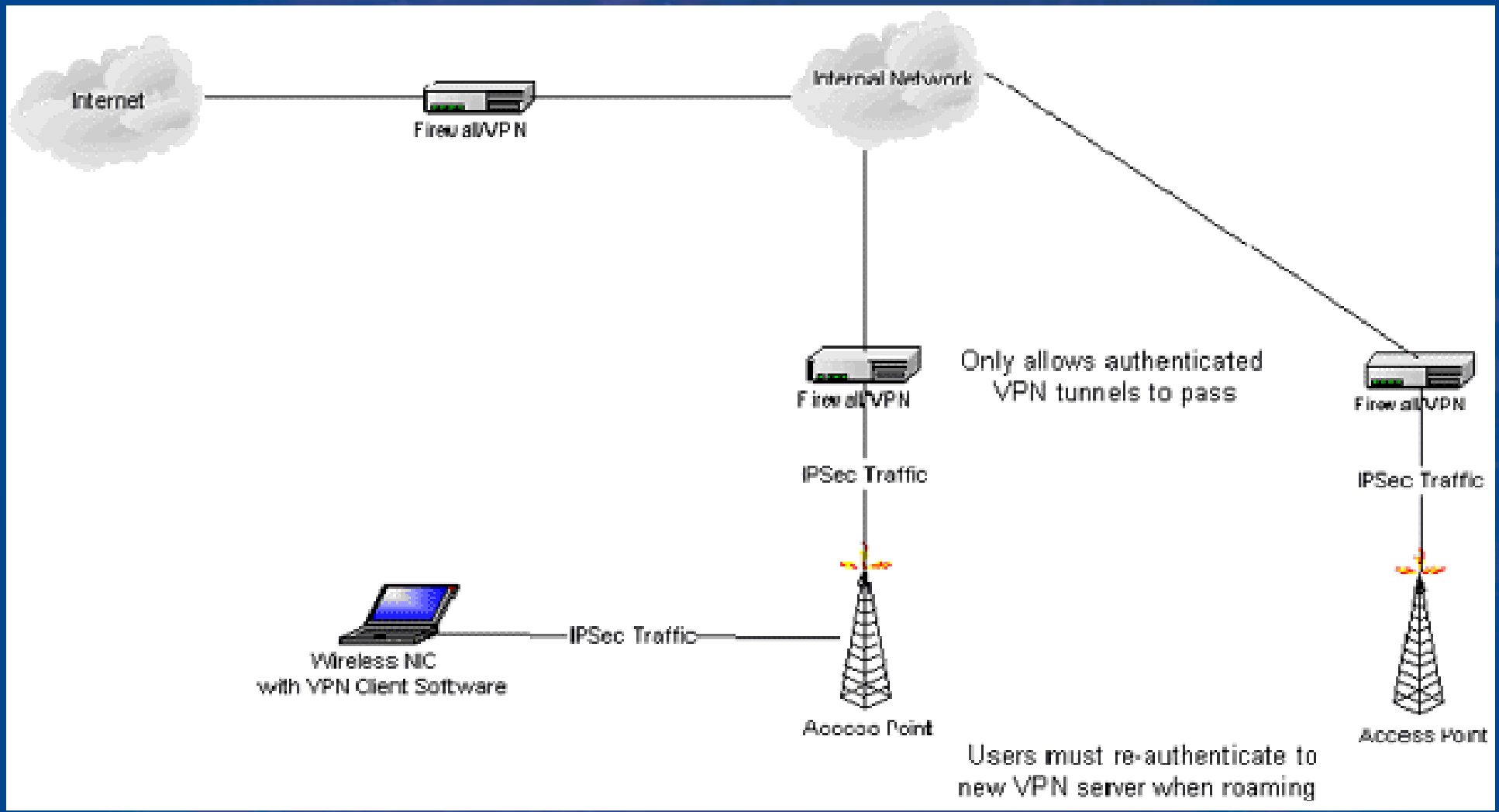

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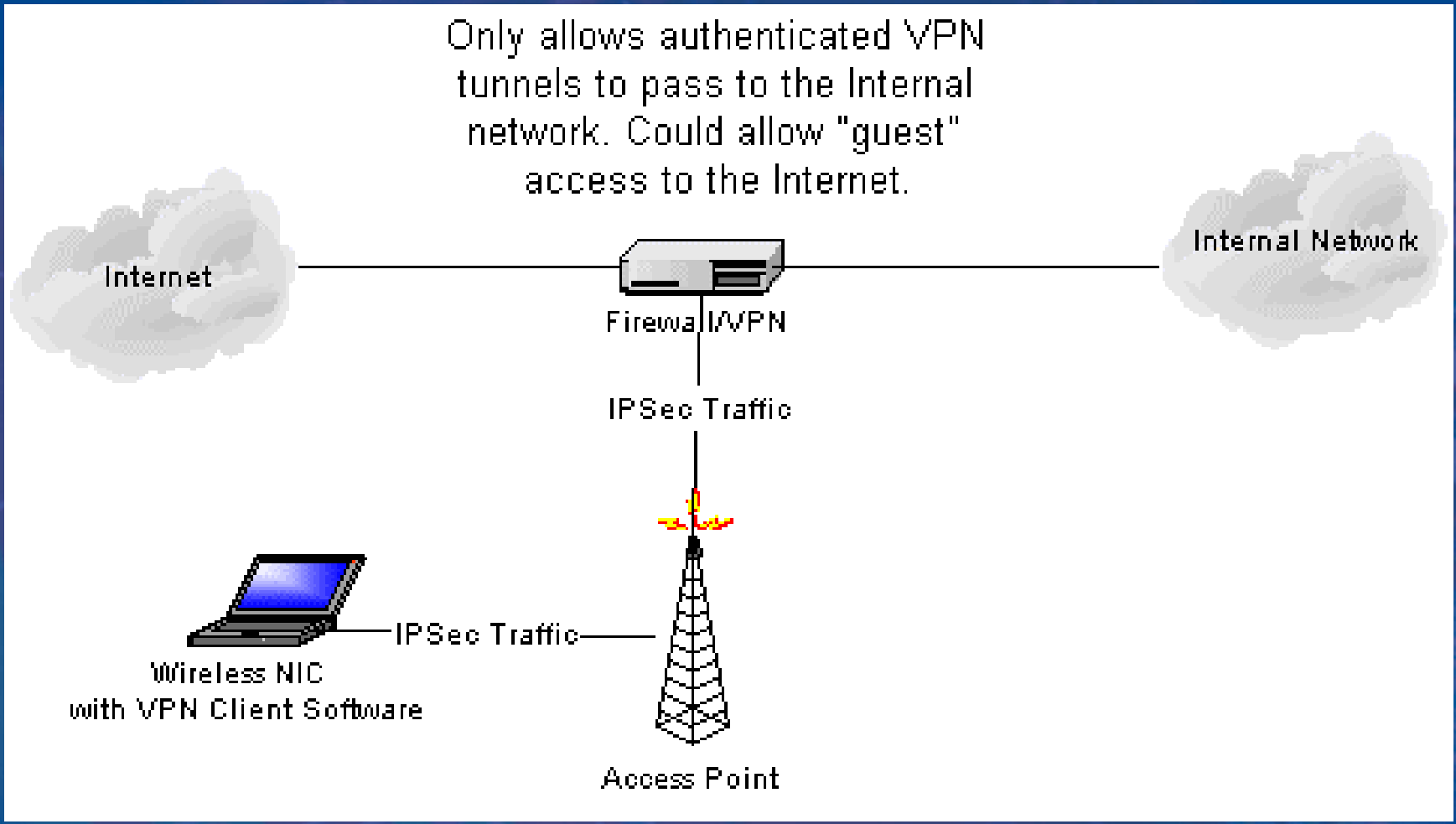
PN Architecture (contd.)



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Secure LAN (SLAN)

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- A GPL open-source “VPN” System
- Provides server authentication, client authentication, data privacy, and integrity using per session and per user short life keys
- Simpler and more cost efficient than a VPN
- Support for Windows and Linux
- Website: http://slan.sourceforge.net/

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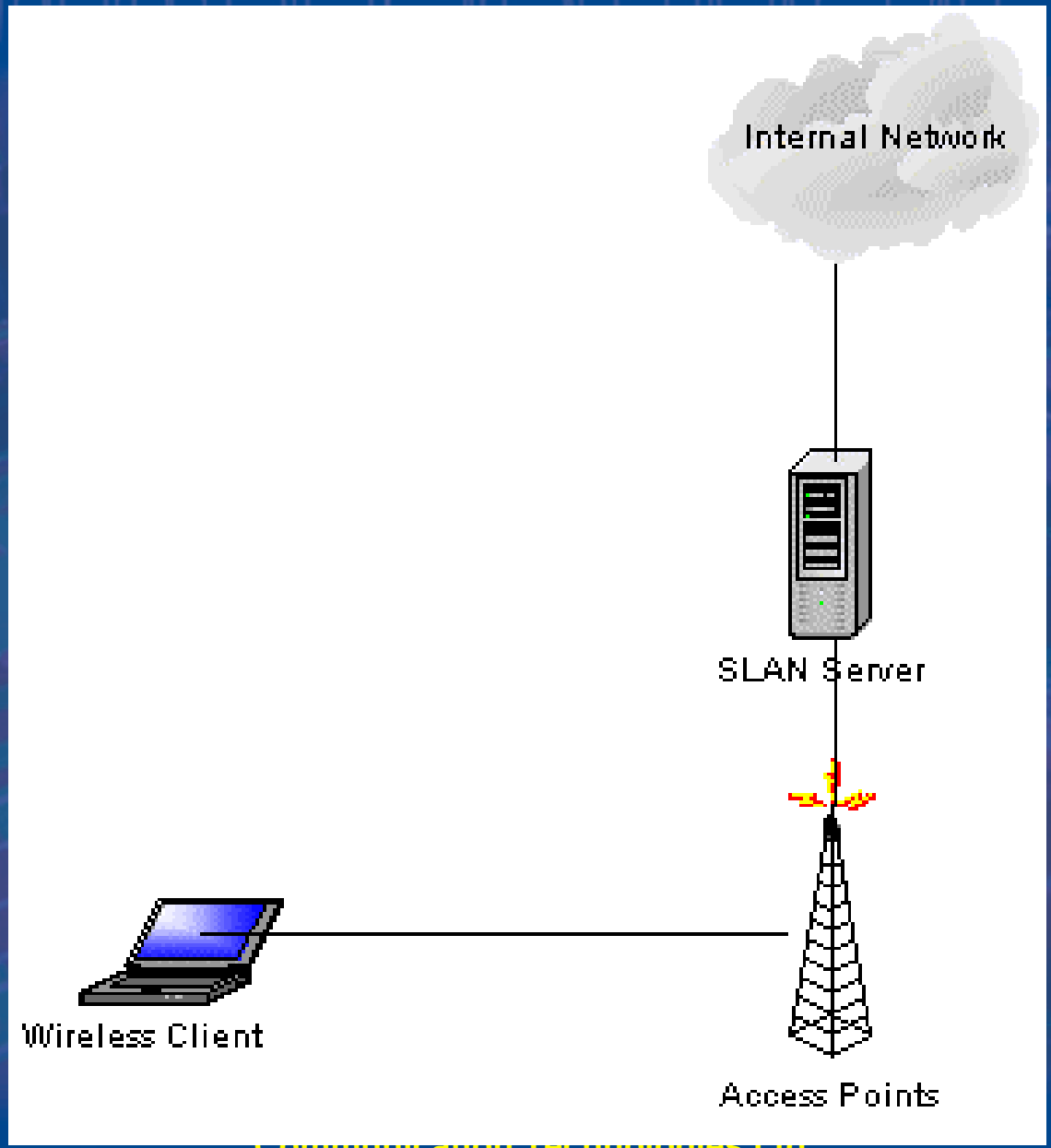
LAN Architecture



ADIUS

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Several 802.11 access points offer RADIUS authenticatio

Clients can gain access to the network by supplying a username and password to a separate server

This information is securely sent over the network eliminating the possibility of passive snooping

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Psec

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Provides encryption and authentication services at the I
level of the network protocol stack

Can be used to secure nearly any type of Internet traffic

Legacy applications not implementing secure communications can be made secure using IPsec

Examples:

- Free S/WAN - http://www.freeswan.org/

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IPsec - Disadvantages

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- IPsec authenticates machines, not users
- IPsec does not stop Denial-of-Service attacks
- IPsec is not true end-to-end security
- IPsec cannot be secure if your system isn't

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02.1x

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Provides enhanced security for users of 802.11b WLANs

Provides port-level authentication for any wired or wireless Ethern
client system

802.1x was originally designed as a standard for wired Ethernet, bu
is applicable to WLANs

It leverages many of the security features used with dial-up
networking (RADIUS)

Also uses Extensible Authentication Protocol (EAP, RFC 2284)

Built in support in Windows XP

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02.1x Authentication

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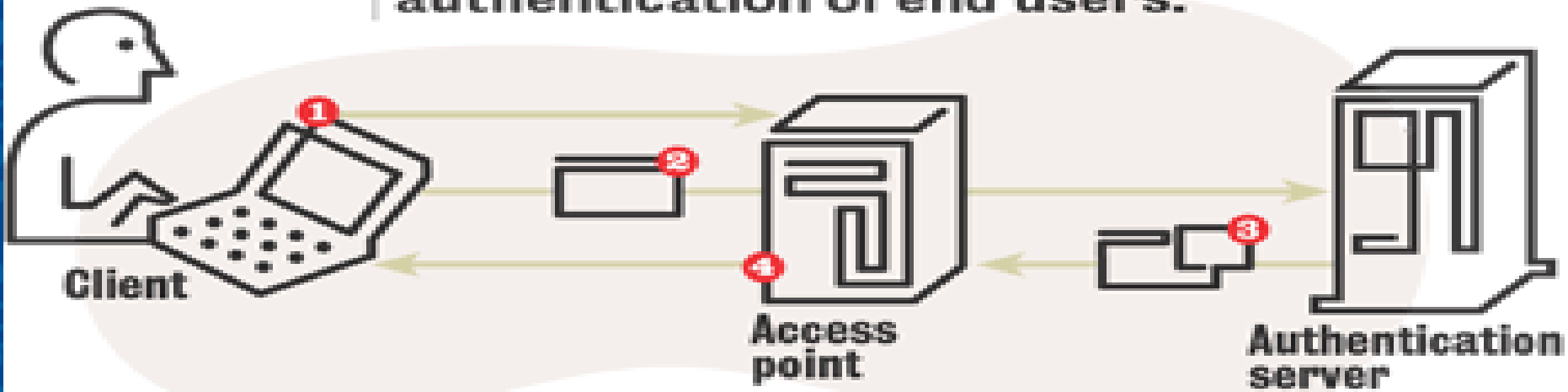
802.1X Authentication

HOW IT WORKS

802.1X authentication for wireless LANs provides centralized, server-based authentication of end users.



1. A client sends a "start" message to an access point, which requests the identity of the client.
2. The client replies with a response packet containing an identity, and the access point forwards the packet to an authentication server.
3. The authentication server sends an "accept" packet to the access point.
4. The access point places the client port in authorized state, and traffic is allowed to proceed.

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roprietary WEP Security

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Dynamic Key Refresh instead of static keys

Use of 3DES/AES instead of RC4 (NetMotion Wireless)

Disadvantages:

- Interoperability Issues (non-WiFi Compliant)

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Wireless LANs are very useful and convenient, but curre
security state not ideal for sensitive environments

Care must be taken before sensitive information is made
available over Wireless LANs

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