Wireless Encryption

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Identifying our weaknesses gives us strength and that's when we get dangerous.

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Knowing is half the battle

WEP Encryption

WEP

Wired Equivalent Privacy

Protects against digital eavesdropping

Disallows network access

Utilizes an inefficient key

Intended Purpose

Control access

Confidentiality

Data integrity

Efficiency

Wasn’t reviewed by academia

Did not receive input from cryptologists

Was ratified in 1999

Restriction of exporting cryptography technologies led to manufacturers restricting their devices which impacted WEP’s functionality

Utilized RC4 algorithm which is designed for encrypting randomized keys and WEP didn’t allow for randomizing

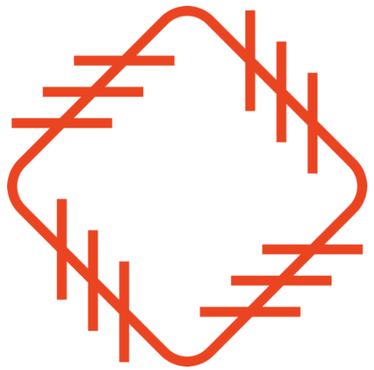
Can be cracked if enough traffic can be intercepted

Its 104-bit WEP key provides no significant practical advantage

WPA and WPA2 Encryption

WPA

The TKIP creates unique encryption keys for each wireless frame, which creates a more secure network connection

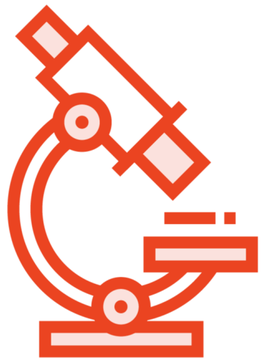


Adopted in 2003

Designed to patch WEP issues

Utilizes a pre-shared key (PSK)

Operates with a stronger 256-bit key

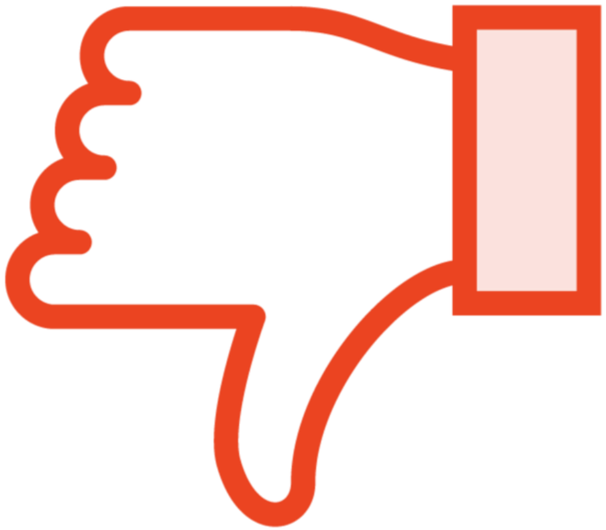


Includes message integrity

Checks to see if packets have been captured or altered

WPA

Did not require a hardware purchase due to its ability to run a firmware upgrade



Creates exploits making it almost as insecure as WEP

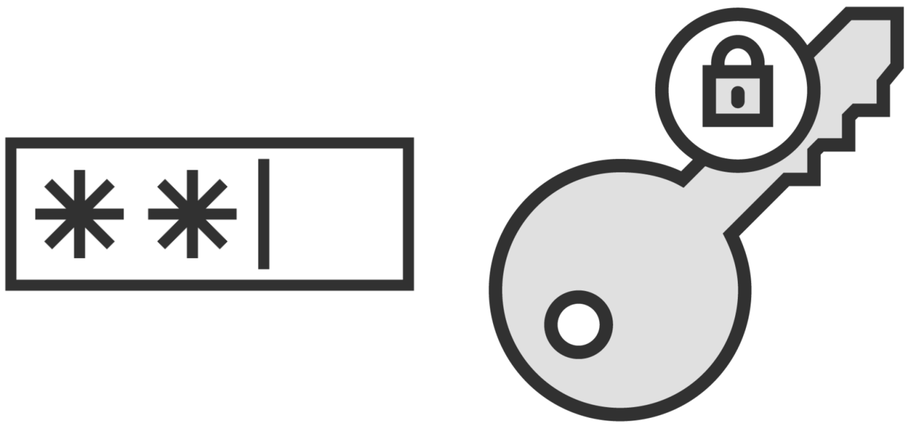
WPA2

WPA Personal

Uses a pre-shared key

Encrypts using a 256-bit key

Requires eight to 63 ASCII characters



WPA2 Enterprise

Addresses distribution concerns and manages static passphrases

Uses EAP or RADIUS

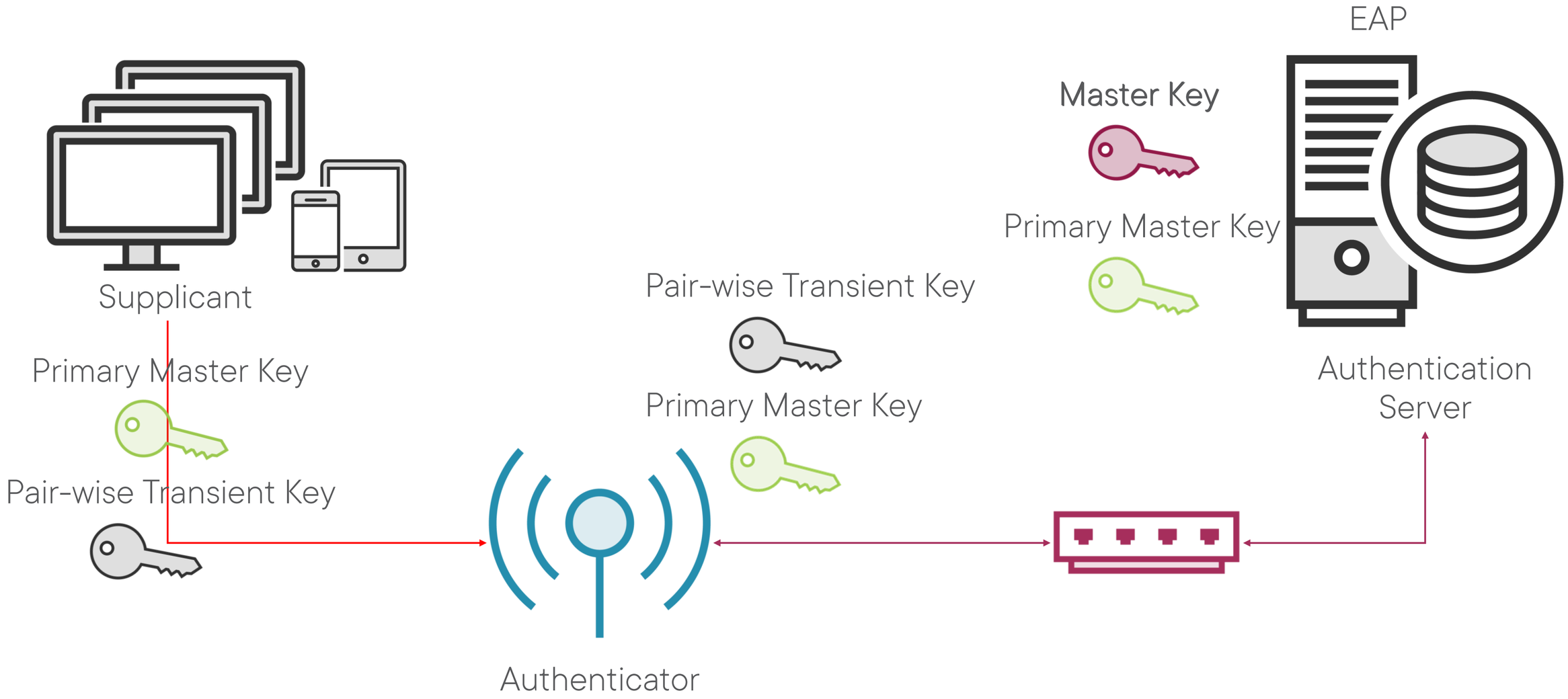
Requires credentials

802.1x

Supports both user and machine authentication with port-based controls

Supports both wired switches and wireless access points

How 802.1x Works



Security Issues Found in WPA

Vulnerable to password-cracking attacks

All packets are vulnerable to encryption

Vulnerable to packet spoofing and decryption that allows attackers to hijack TCP connections

GTK predictability which allows malicious traffic to be injected into the network

IP addresses of the subnet can easily be identified or guessed

Security Issues Found in WPA2

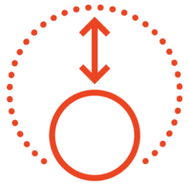
Vulnerable to both man-in-the-middle (MiTM) and denial-of-service (DoS) attacks

Vulnerable to an exploit known as key reinstallation attack (KRACK)

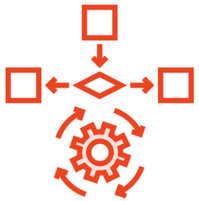
It's WPA2 key can be disclosed by determining the WPS's PIN through simple steps

WPA3 Encryption

WPA3

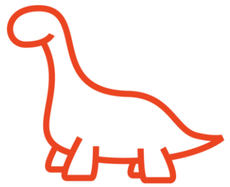


Supports both large and small deployments



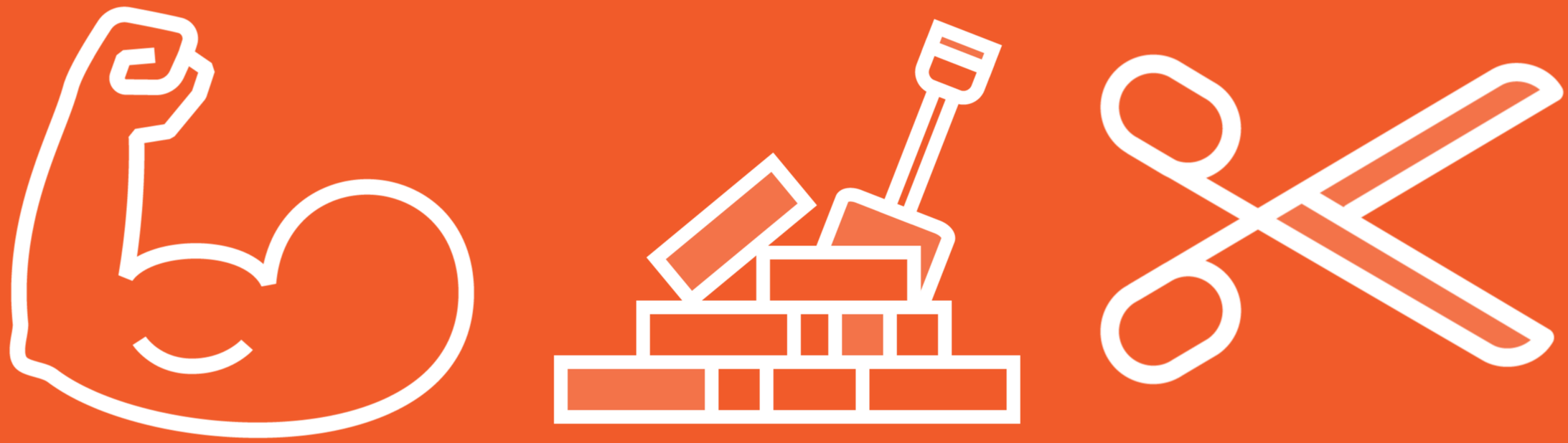
Utilizes encryption algorithms like AES and TKIP

Includes enhanced network resilience to deliver a stronger defense against eavesdropping and forging attacks



Rejects outdated legacy protocols

WPA2 Compared to WPA3



WPA2 Compared to WPA3

- **Layered security strategy**
- **Improved protocol to protect passwords**
- **Specifies standards**

Modes of Operation

WPA3 Personal

Resistant to offline dictionary attacks

Resistant to key recovery

Provides users password choices

Easy accessibility

WPA3 Enterprise

Authenticated encryption

Key derivation and validation

Key establishment and verification

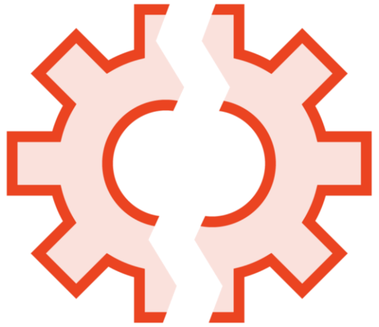
Frame protection

Breaking Encryption

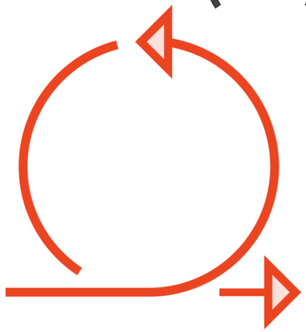
IV Vulnerabilities

How to break encryption

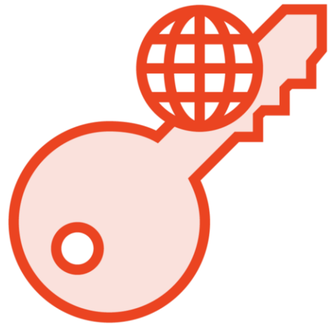
Predictable



Feeble initialization vectors (IVs)



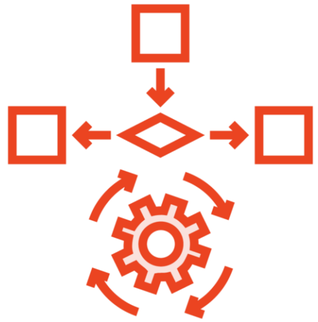
Reused many times



WEP uses a key scheduling algorithm

Vulnerable to FMS attacks

IV Vulnerabilities



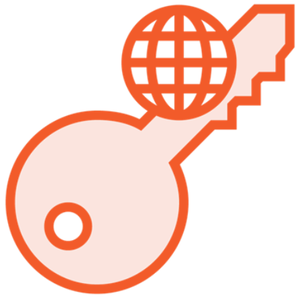
Takes advantage of RC4 algorithms

Simple tools exploit its weakness

Tampering is hard to identify

Can be detected quickly

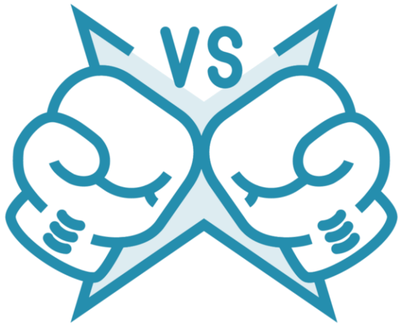
Sniffing tools capture its packets

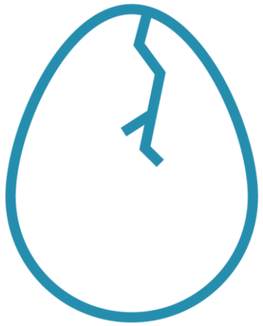


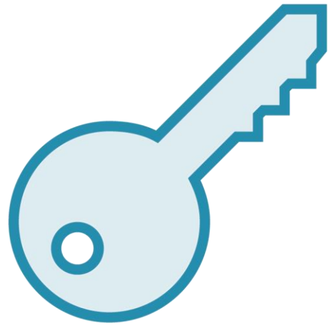
Base key is easily accessed

Initialization vectors are what makes WEP vulnerable and easy to crack

Breaking WPA's Encryption







Crackin' Tools

Aircrack-ng

KisMAC

Reaver

Breaking Encryption

WPA PSK

De-authentication attack

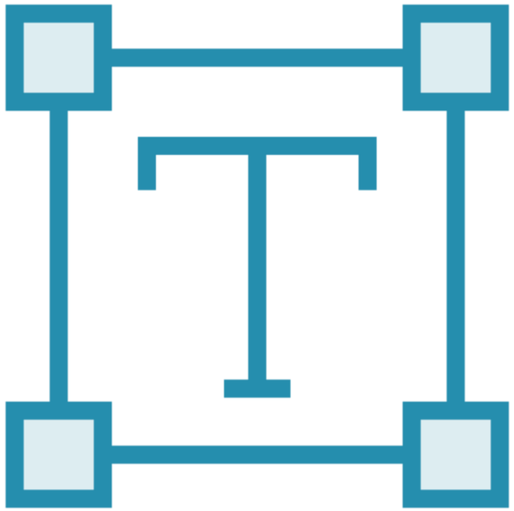
Guessing of IP addresses

WPS

Defense Measures

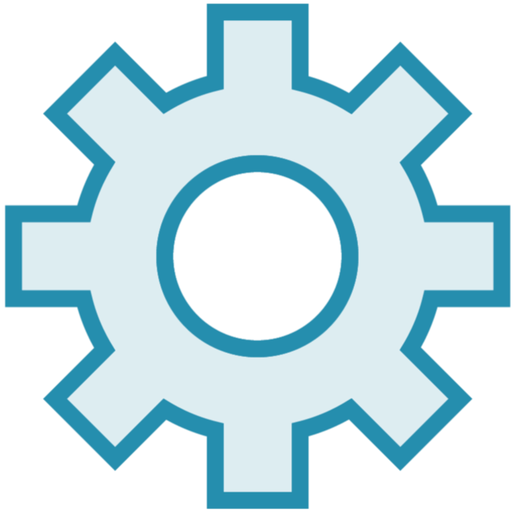
Knowing risks will help us and our networks become stronger and safer

Securing Networks



Passphrases

Added Controls



Client Settings

Demo

Cracking WPA-PSK Using Aircrack-ng

Demo

Examining the encryption options

Demo

Find WPS-Enabled APs

Demo

Find Normally and Hidden APs

Learning Check

Learning Check

- **Pre-shared keys / Same key**
- **Enterprise**
- **Dragonfly Key Exchange**
- **104-bits**
- **TKIP**

Up Next:
Appraising Wireless Threats