ARP Attacks
arp-sk in action

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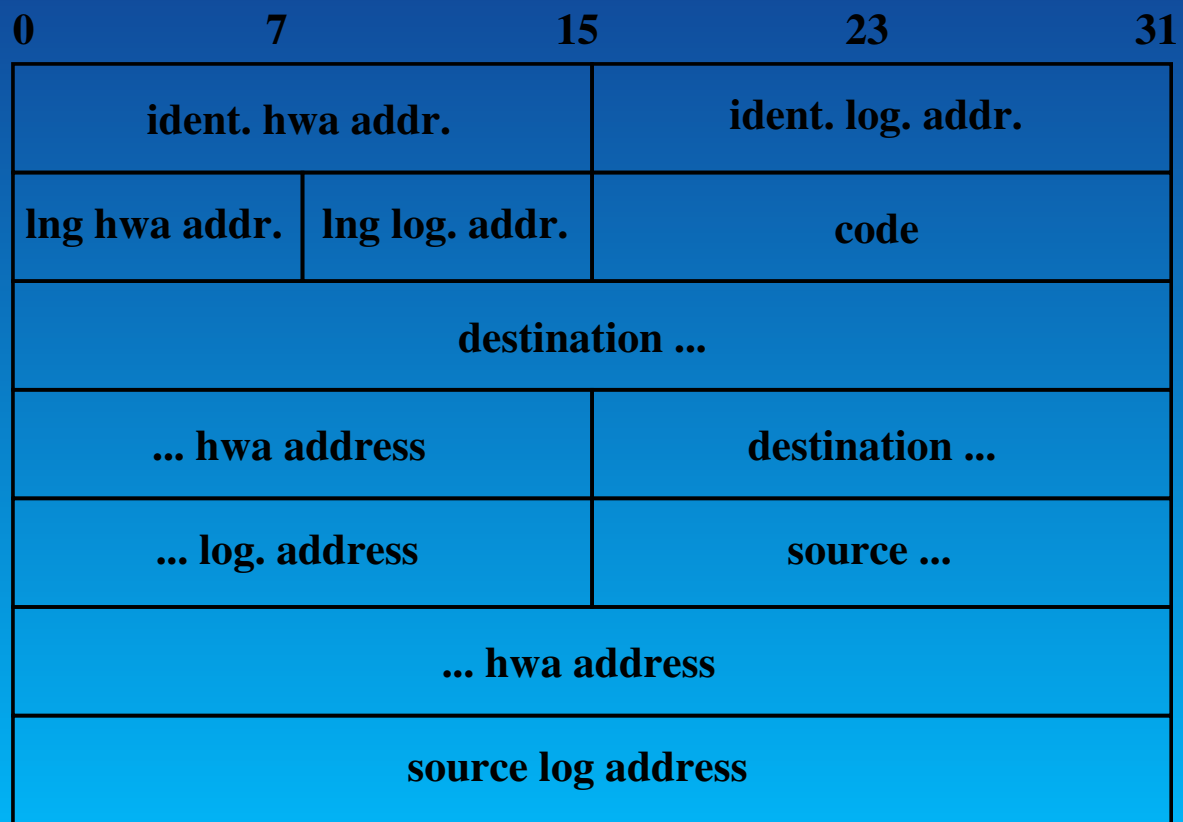
November 15th 2002

- Introduction
  ARP basics and LAN attacks
- arp-sk
  Tool presentation
- ARP cache poisoning
  ARP cache poisoning applications using arp-sk

Introduction : ARP protocol (1/2)



Introduction : ARP protocol (2/2)

- ARP (Address Resolution Protocol - RFC 826)
  binding layer 2 (Ethernet) et layer 3 (IP) addresses
  - client sends a layer 2 broadcast request (who-has)
  - destination answers a layer 2 unicast frame (reply)
- ARP cache usage
- no link between layer 2 and layer 3 information

Attacks : MAC Spoofing

- ethernet source address spoofing inside ethernet frame
- targets switches « CAM tables » (layer 2 addresses)

➥ Pros

- ▶ traffic redirection

➥ Cons

- ▶ target does not receive packets anymore, but continues to emit
- ▶ conflits inside switch tables
- ▶ not very stealthy

Attacks : ARP Spoofing

- who-has sent using broadcast
- answering instead of legitimate host with spoofed datas

➥ Pros

- traffic redirection
- no need to bother with switches

➥ Cons

- Incertain result depending on who replies first

Attacks : ARP cache poisoning (1/2)

- create/modify victim ARP cache entries
- victim's packets are directly sent to attacker

➥ Create an entry

- unicast who-has messages (Ok with RFC)
- unicast who-has with spoofed datas

➥ Modifying an entry

- ARP spoofing : reply with spoofed datas

Attacks : ARP cache poisoning (2/2)

- Pros
  - traffic redirection
  - administrators rarely monitor ARP stuff
  - difficult to actively prevent it
- Cons
  - easy to detect

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arp-sk (1/2)

- Why a new tool ?
  - gather functionnalities from different existing tools (arpspoof, macof, arping ...)
  - **complete** ARP headers manipulation (both Ethernet **and** ARP)
  - add new functionnalities (mapping, promiscuous mode detection, ...)
- arp-sk structure (since version 0.99.0)
  - librairy providing basics functions
  - arp-sk binary
  - modules (dynamic libs) describing « scénarii » (one module == one functionnality)

arp-sk (2/2)

- arp-sk options
  - classical ones : emission frequency (in s, μs or random), frame number, interface...
  - basic module : packet type (-w, -r), Ethernet addresses (-s, -d), addresses within ARP message (-S, -D - [IP][:MAC]), randomly generated addresses (Eth and ARP, –rand*)
- TODO
  - add new modules
  - porting to other OS (especialy OpenBSD and Solaris)
  - create a librairy to build « network scénarii »

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ARP cache updates

- Opportunistic behaviour
- Entries creation
- Entries modification
- Entries deletion
- Let's attack...

Parameters we can play with:

- Ethernet: source MAC address
- Ethernet: destination MAC address
- ARP: layer 2 source
- ARP: layer 2 destination
- ARP: layer 3 source
- ARP: layer 3 destination

Entries creation

- ARP request
- ARP reply (depends on the OS and ARP cache state)
- Gratuitous ARP
- ⇒ Not very useful

Entries update

- ARP request
- ARP reply
- Gratuitous ARP

↪ Interesting hosts are usually cached (DNS, GW, etc.)

Entries deletion

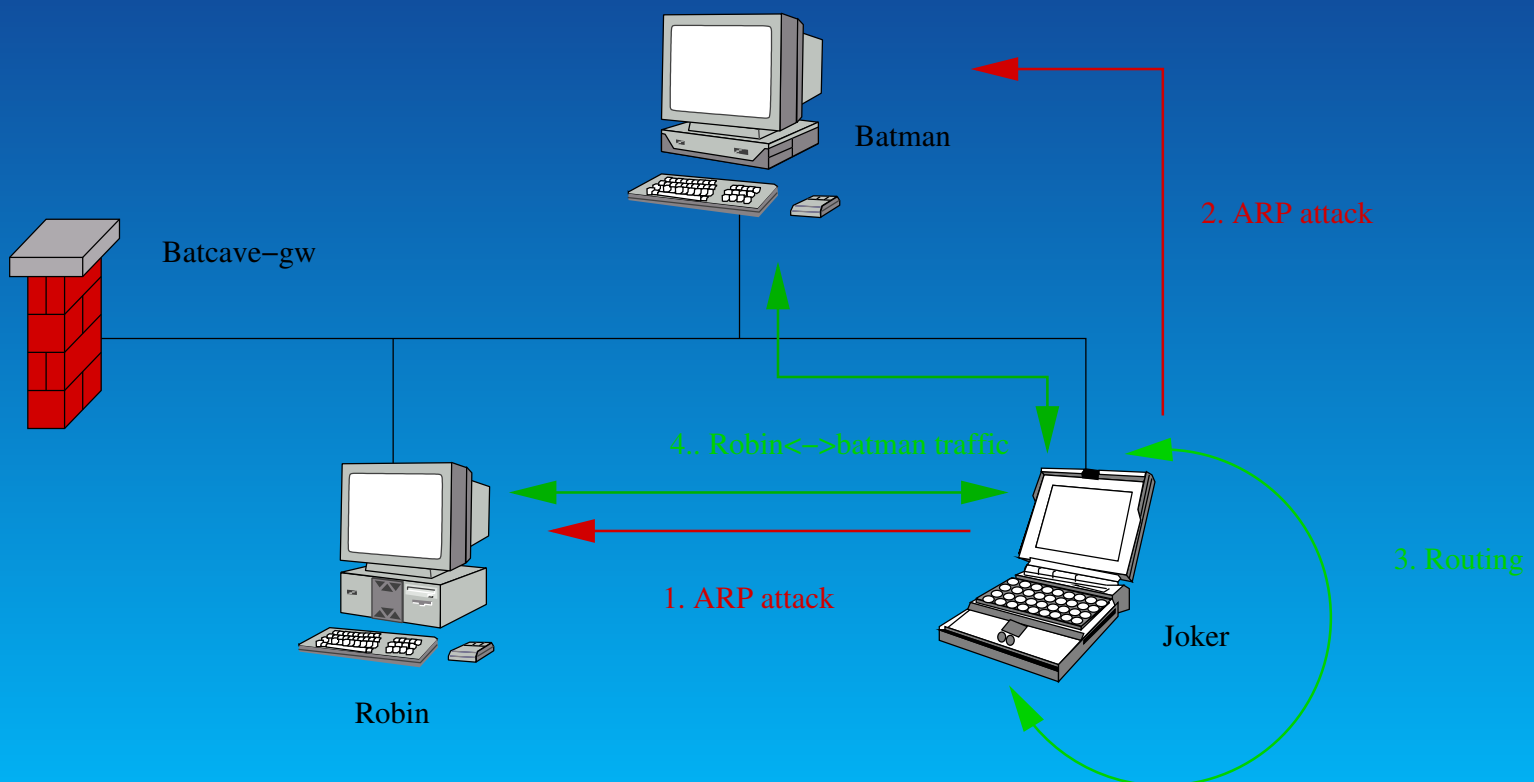
- Entries expire
- ARP cache has a limited size (about 500 entries for Linux)

⇒ We flood the cache, but we do not need to delete entries

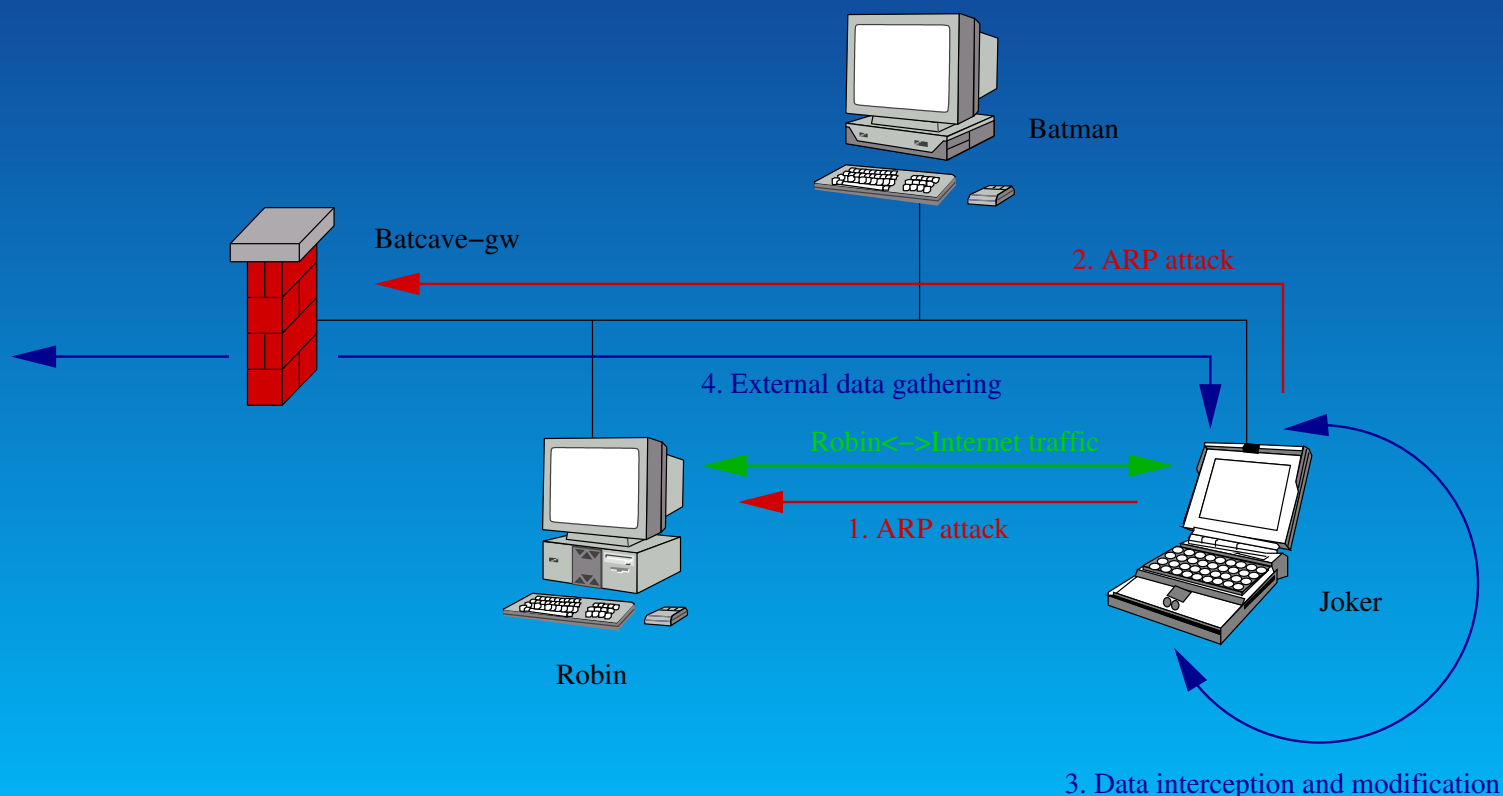
ARP cache poisoning applications

- Sniffing : we can listen to hosts traffic without using promiscuous mode
- Interception : we act as a transparent proxy for flows we intercept
- Modification : we can inject datas within proxied flows
- Hijacking : we can take one part's place within the flow
- Decrypting : classical MiM attack
- Spoofing : we can easily spoof another IP within the LAN
- DoS : flow destruction

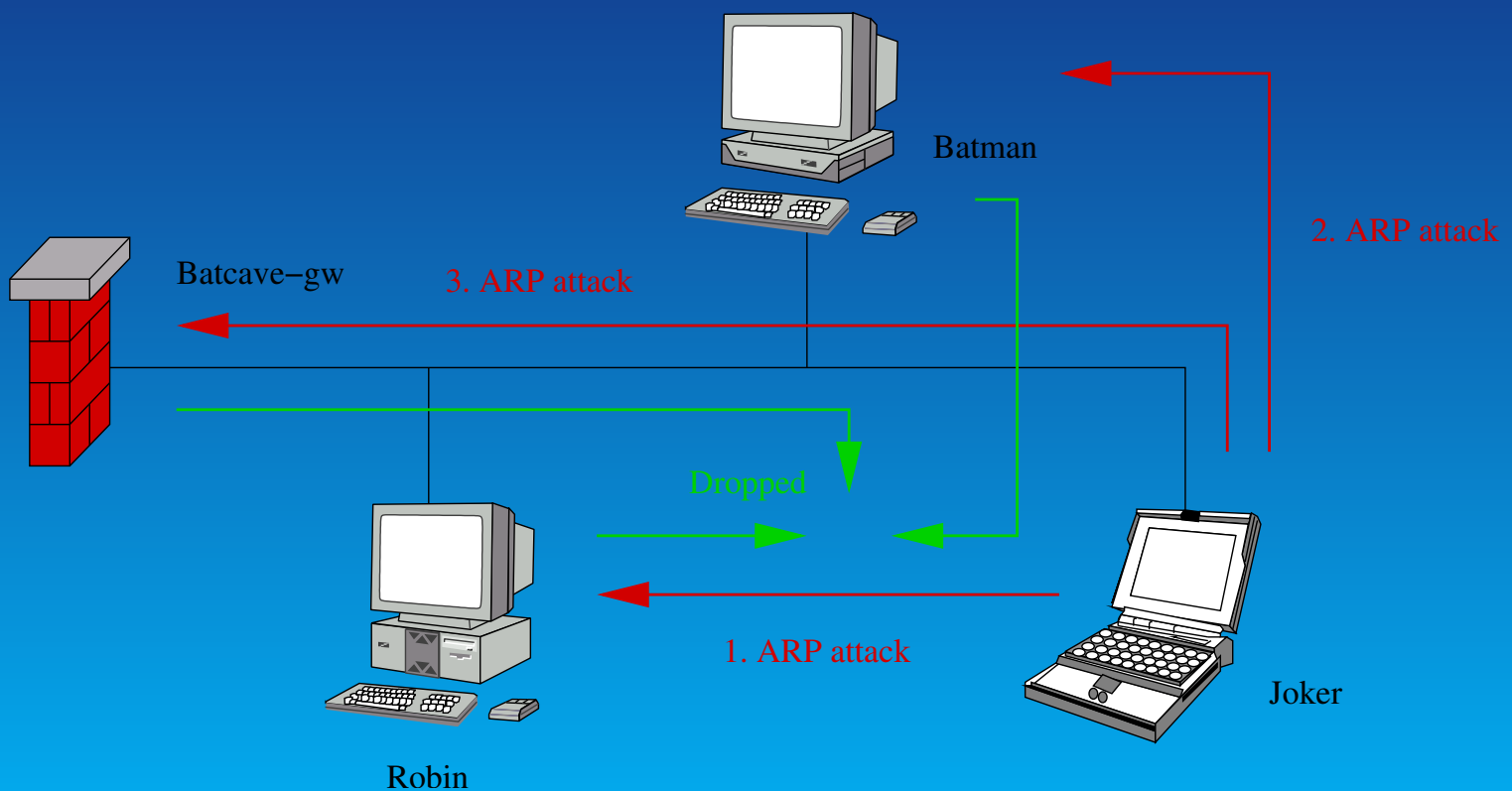
Sniffing with ARP MiM



Transparent proxying to intercept and tamper flows

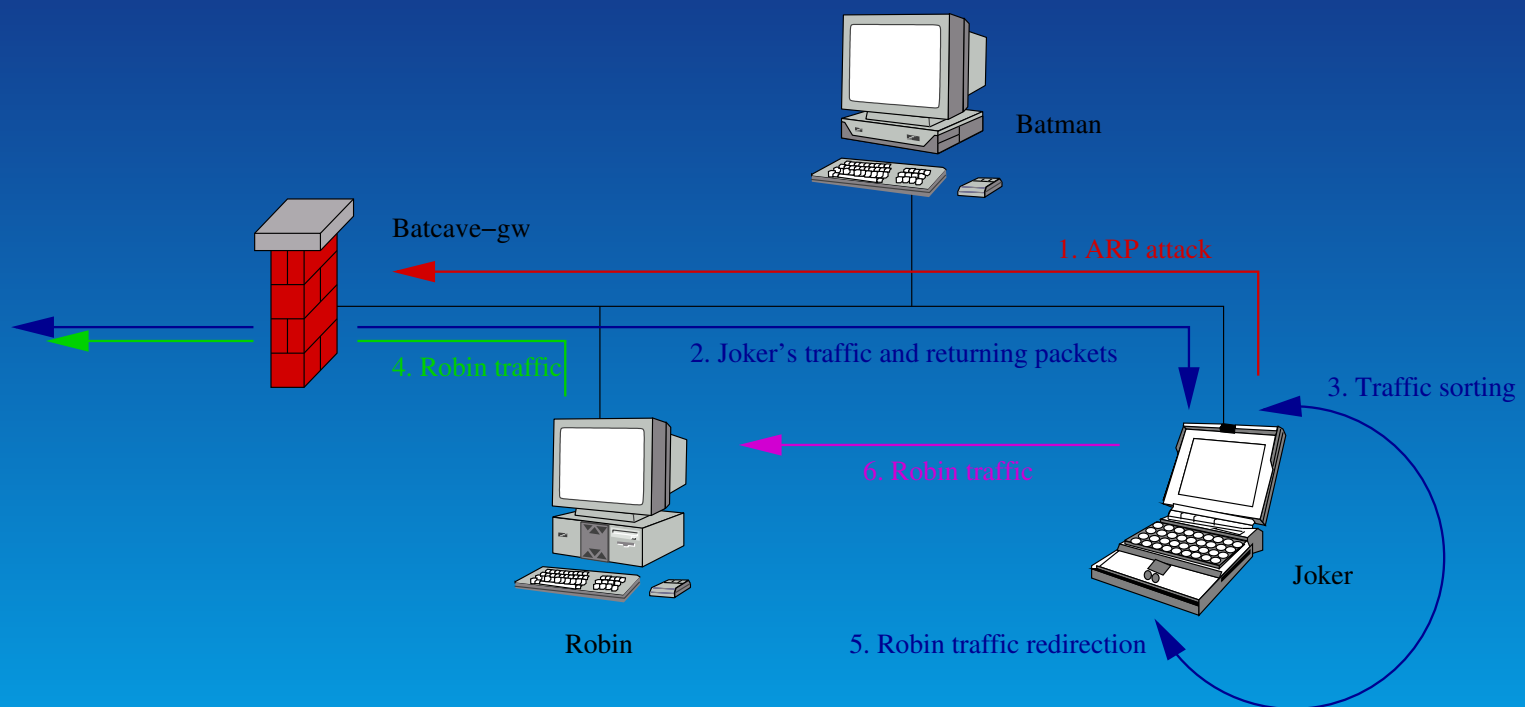


DoS



➥ Attacked hosts are likely to check their entries...

“Smart IP spoofing”



- We can also use ARP MiM ;)
- `http://www.althes.fr/ressources/avis/smartspoofing.htm`

Consequence

- Once an attacker gets root, he can attack the whole wire flows.

ARP is not secure and easy to fool : security was not in mind. We need stronger mecanism to enforce security :

- 802.1x
- Secure Link Layer
  `http://www.cs.wustl.edu/~fhunleth/projects/sll/sll_report.pdf`
- Authentication within applications

Must be clear that switches are not security tools !

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- MISC : french security magazine.
- http://www.miscmag.com/

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- Éric Detoisien for writing winarp-sk and winarp-mim for Win32 plateforms
- Laurent Licour and Vincent Royer for their experiments on OS behaviours