Network Vulnerability Scanning

Looking from Afar

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Game Plan

- Setting the stage.
- Discussing the interesting questions:
  - What to scan?
  - From where to scan?
  - How hard to scan?
- Putting it all together (and then some).
- Questions/discussion/open mike session.

Intro and Basics:
What Is This Guy Talking About?!?

The Objective at Hand

- Identify vulnerable systems
- ... in your network
- ... from afar
- **and** how they are vulnerable.
- Ultimate goal:
  Make sure no vulnerable systems will be compromised.

General Approach

- Find systems in your network (that you care about).
- Determine whether they are vulnerable (from wherever you are looking).
- Mitigate discovered vulnerabilities.

None of these steps is trivial!

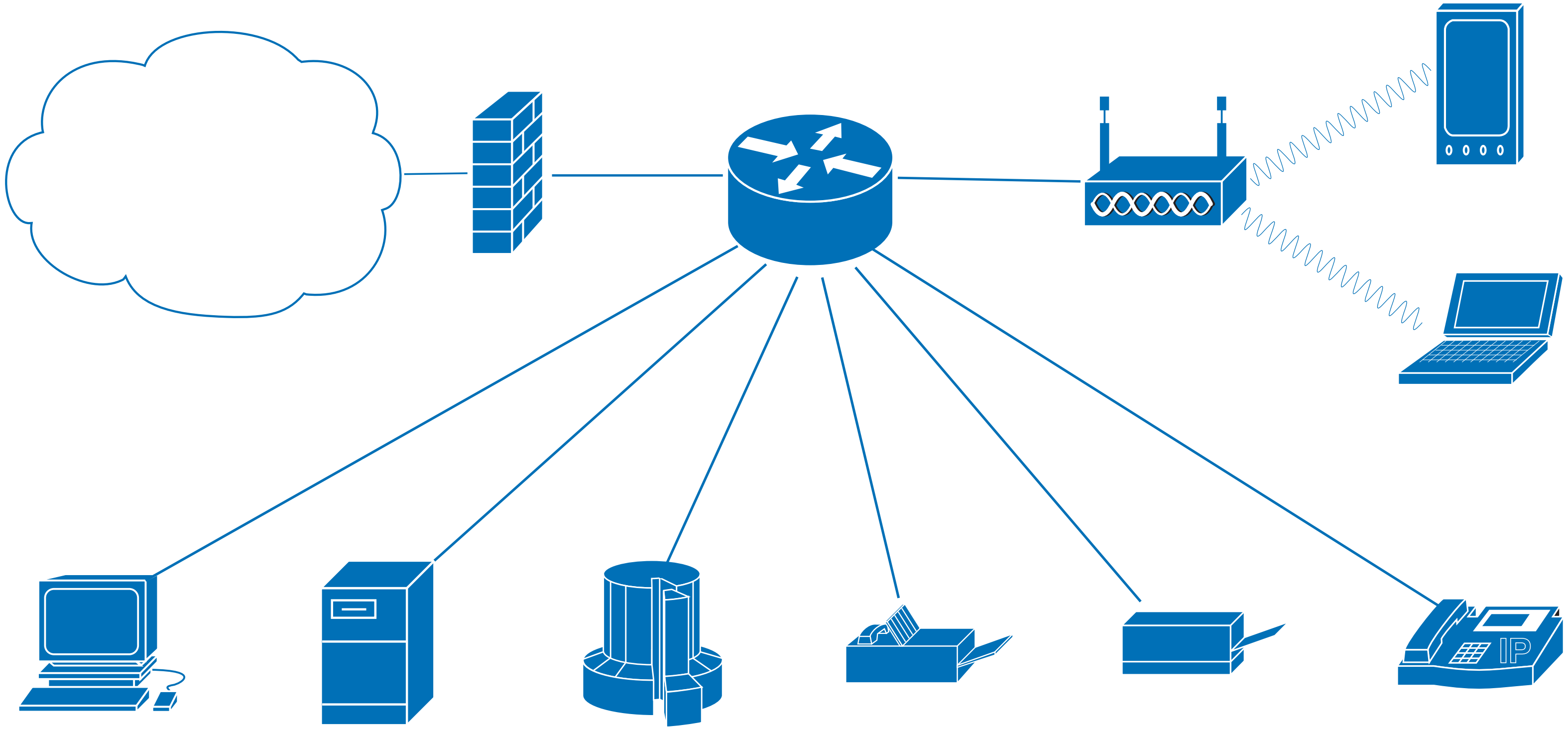
We will ignore mitigation for this talk.

Necessary Decisions Along the Way

- What systems do you care about?
- Where do you want to be looking from?
- How hard do you want to look?

Again, all of the above decisions are tricky!

The Overall Picture



Decisions, Decisions

What to Scan

- Obvious approach:

  Go to the ITIL configuration management database and get a list of all devices.

- If this works for you, great!

  However:

  - CMDB might be outdated.
  - Only managed devices listed.
  - Potentially not all devices reachable (dynamic addresses).

What to Scan – Cont’d

- Alternative approach:

  Scan your network ranges (`nmap`, `zmap`).
- Might work well. If it does, great again!

  This is potentially not trivial either:
  - IPv6 comes with **huge** address spaces, so full scans are prohibitive.
  - IPv6 comes with privacy extensions → unlikely that all devices have stable IP addresses.
  - MAC randomization → not even stable MAC addresses.

What to Scan – Cont’d Cont’d

- Yet another idea:

  Pulling in other data sources:

  - From the inside: Network equipment caches/state tables,
  - from the outside: services like `shodan.io`,
  - or “specialized” lists for particular scans (for example, SSL certificate lists for scans targeting SSL vulnerabilities).

- Likely to produce very accurate device lists.

  Obviously, this requires extra effort though.

What to Scan – Some Musings

- Building device lists is, well, reconnaissance.
- Some approaches look an awful lot like black-hat attacks.
- The more devices you scan, the more vulnerable devices you might find.
- Do you care about all devices equally?
- Be sure to talk to device owners beforehand (at least for critical devices).

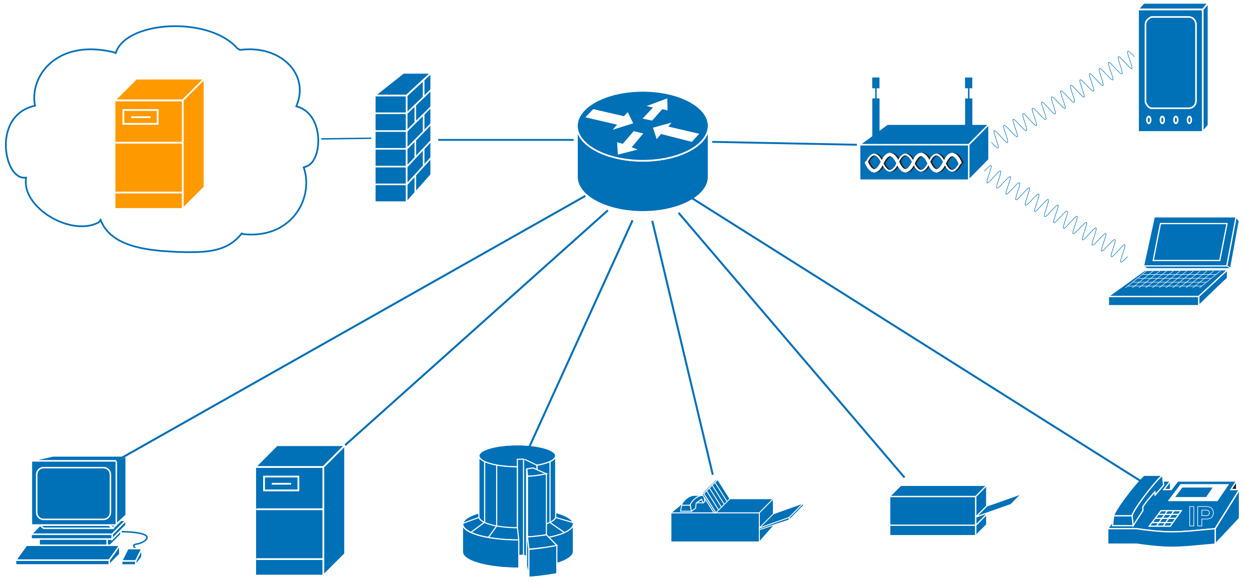
What to Scan – Wrap-Up

- More complete scans are desirable,
- **but** create a higher workload.
- Devices that you cannot act upon are at least debatable scan targets.
- Starting with the most valuable systems seems to be a sensible approach.

From Where to Scan

- This is a crucial decision!
- Essentially, three options:
  - From the outside (in other words, from outside the firewall),
  - from the inside (in other words, from inside the firewall), or
  - on the devices themselves.

Scanning from the Outside – Overview



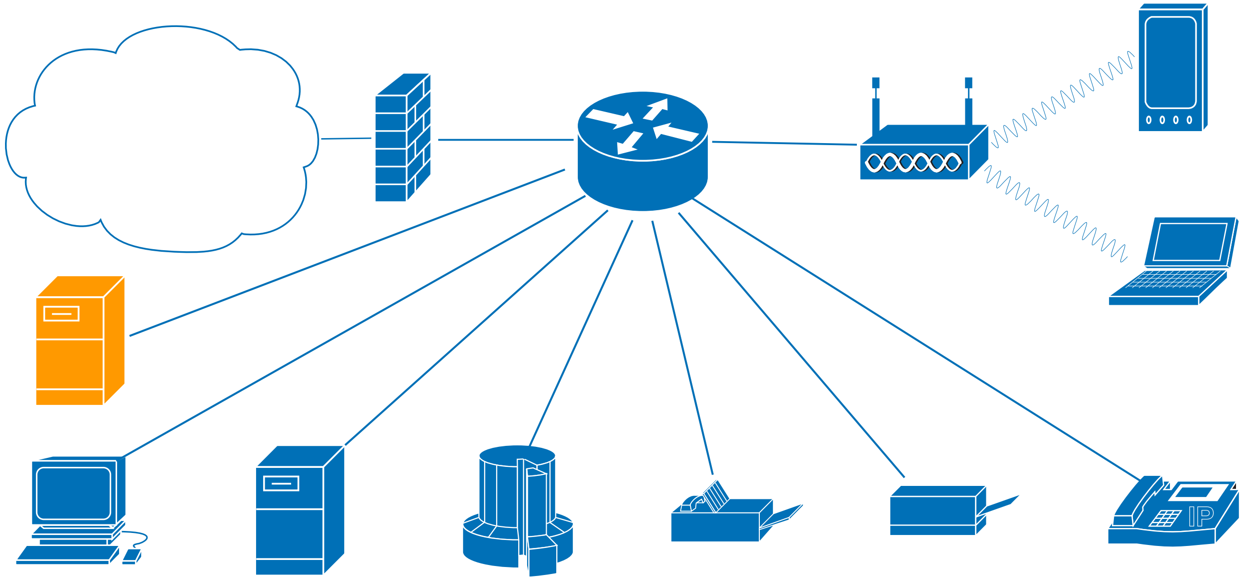
Scanning from the Outside – Considerations

- All network-based protections are in place and effective.

  → **Not** an complete picture of all vulnerabilites.

- Carries a significant amount of detection uncertainty.
- **However**, this is what an attacker sees.

Scanning from the Inside – Overview



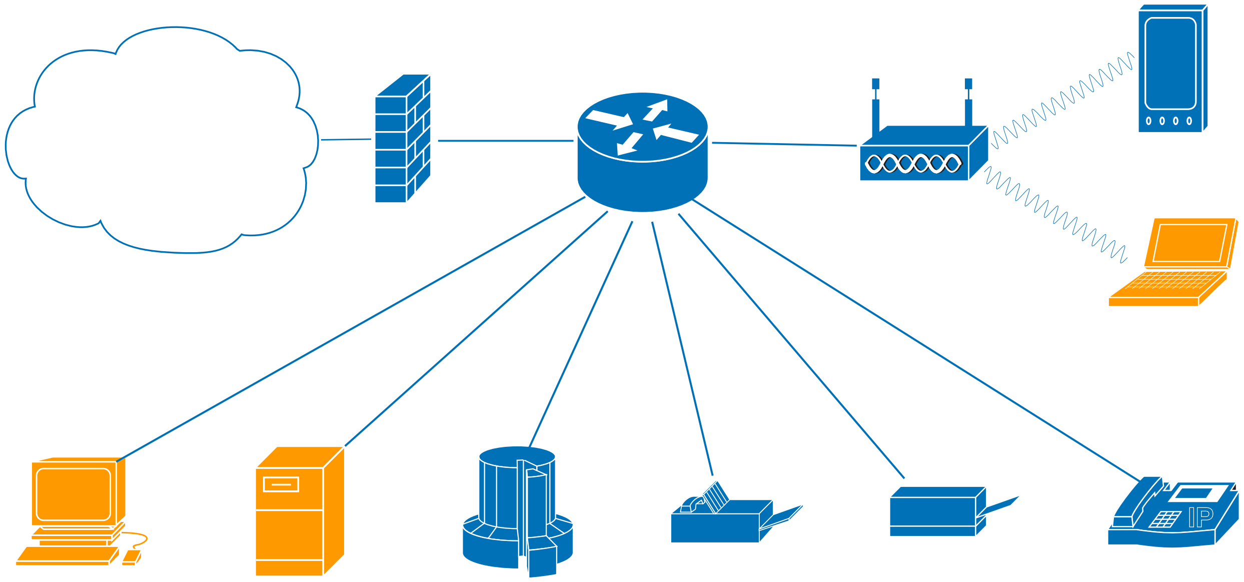
Scanning from the Inside – Considerations

- Scanned devices are “naked”, as no network mitigations and protections are in place.

  → Yields a more complete picture of what vulnerabilities actually exist.

- But may raise alarms that are not actually of concern.
- Also carries some detection uncertainty.

Scanning on the Devices – Overview



Scanning on the Devices – Considerations

- Best possible vantage point to detect **all** vulnerabilities.
- Detection uncertainty is small, but not zero.
- **But** requires cooperative devices!
- Locally-installed agent software might introduce new vulnerabilities.
- (Of course, all this touches local vulnerability scanning as discussed by Stefan Kelm.)

From Where to Scan – Additional Musings

- Vulnerability scans may look like actual attacks → good planning, coordination and communication is required.
- Scanning locally on the devices with agents might give you additional benefits for free (for instance, a device inventory).

From Where to Scan – Wrap-Up

- Generally speaking, scanning from “closer” to the target is preferable because of more accurate and more complete results.
- On the other hand, network security measures and mitigations need to be taken into consideration (and tested!) for good situational awareness.

How Hard to Scan

- Delicate balance:

  Pushing a system harder can improve detection accuracy,

  but pushing a system harder can tip it over and make the system owner mad at you.
- Be sure to consider the consequences if your scan actually (accidentally, of course) trips a system.

Wrap-Up

Final Remarks

- We have discussed
  - what to scan,
  - from where to scan, and
  - how hard to scan.
- Some (mostly) free software packages for vulnerability scanning:
  - Nessus (https://nessus.org) or OpenVAS/GSM (https://openvas.org) for (not only) network scanning,
  - Pakiti (https://github.com/CESNET/pakiti-server) for agent-based scanning.

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Thank you

Any questions?

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