Privilege escalation and lateral movement – December 2017 to June 2018

- Evidence of the attacker’s lateral movements was found in the proliferation of malware across a number of endpoints and servers.
  - Malware samples found and analysed by CSA were either tools that were stealthy by design, or unique variants that were not seen in-the-wild and not detected by standard anti-malware solutions.
- Such malware included RAT 1, another Remote Access Trojan referred to in this report as “**RAT 2**”, and the malware associated with the earlier-mentioned log file.

Privilege escalation and lateral movement – December 2017 to June 2018

- Evidence of PowerShell commands used by the attacker to distribute malware to infect other machines, and of malicious files being copied between machines over mapped network drives..
- CSA has also assessed that the attacker is likely to have compromised the Windows authentication system and obtained administrator and user credentials.
- This meant that the attacker would have gained full control over
  - all Windows based servers and hosted applications,
  - all employee workstations, and underlying data, within the domain.

Privilege escalation and lateral movement – December 2017 to June 2018

- *Establishing control over Workstation B on 17 April 2018*
  - Attacker gained access to Workstation B (SGH) & planted RAT 2, thus gaining control of the workstation
    -which **had access** to the SCM application.
  - Workstation B was used to log in remotely to the SGH Citrix Servers 1 and 2.

Queries to the SCM database from 26 June to 4 July 2018

From 26 June 2018, the attacker began querying the database from Citrix Server 2 using the A.A. account.

3 types of "**SQL**" queries which the attacker ran:

- (i) reconnaissance on the schema of the SCM database,
- (ii) direct queries relating to particular individuals, and
- (iii) bulk queries on patients in general.

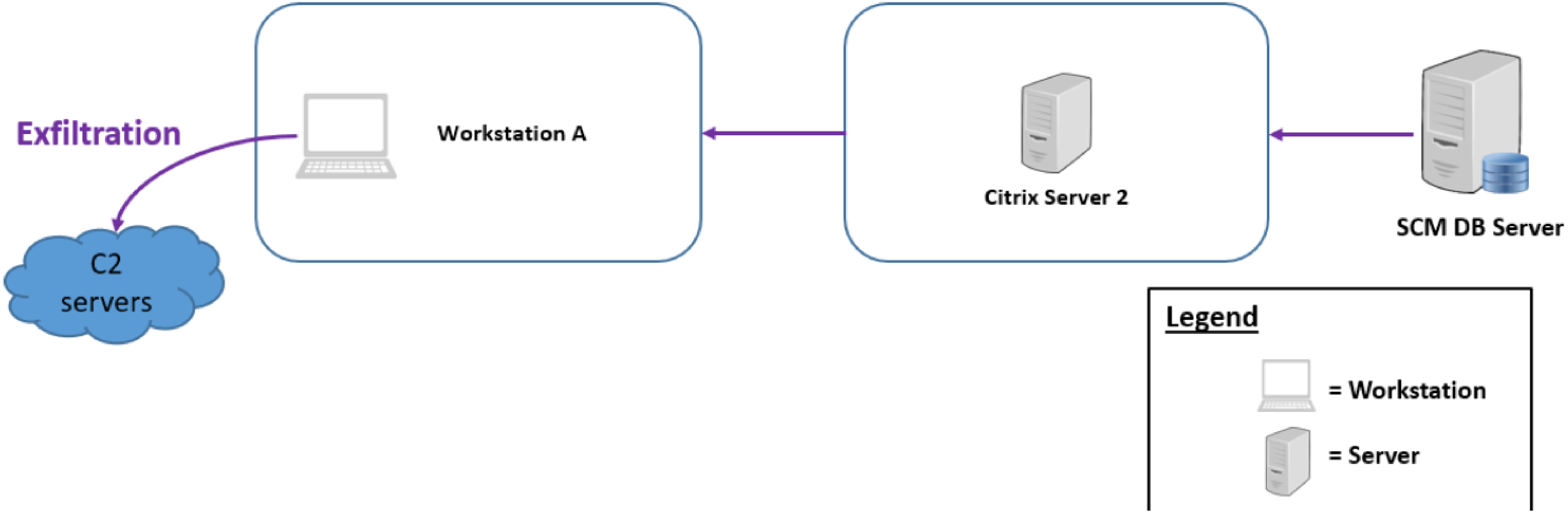
Queries to the SCM database from 26 June to 4 July 2018

The attacker was able to retrieve the following information from the SQL queries:

1. The Prime Minister’s personal and outpatient medication data;
2. The demographic records of 1,495,364 patients, including their names, NRIC numbers, addresses, gender, race, and dates of birth;
3. The outpatient dispensed medication records of about 159,000 of the 1,495,364 patients mentioned in sub-paragraph (b) above.

Queries to the SCM database from 26 June to 4 July 2018

Figure 11: Data exfiltration route



Queries to the SCM database from 26 June to 4 July 2018

- The copying and exfiltration of data from the SCM database was stopped on 4 July 2018, after staff from IHiS discovered the unusual queries and took steps to prevent any similar queries from being run against the SCM database.

Attempts to re-enter the SingHealth Network on 18 and 19 July 2018

- After detection of malware on and communications from the S.P. server, CSA recommended that internet surfing separation should be implemented, to prevent the attacker from exercising command and control over any remaining footholds it may have in the network.
- Internet surfing separation was implemented on 20 July 2018.
- No further signs of malicious activity were detected thereafter.