Lessons learned:

Sinkholing the Zeroaccess botnet

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Agenda

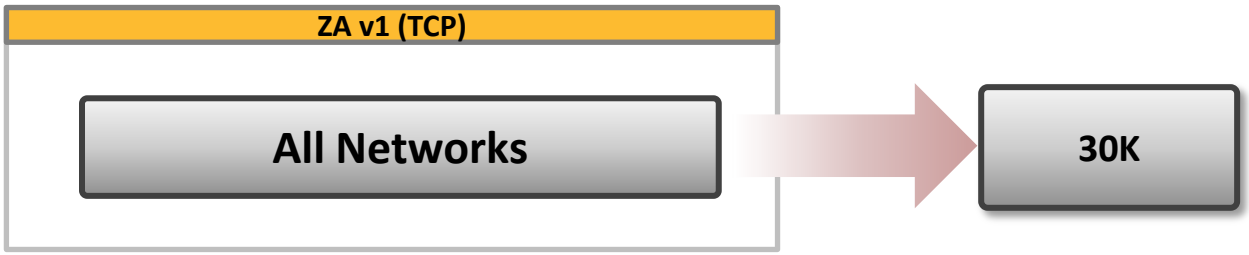
1. Introduction to Zeroaccess
2. Details of the P2P protocol
3. The sinkhole operation
4. Results of the sinkhole operation
5. Next steps

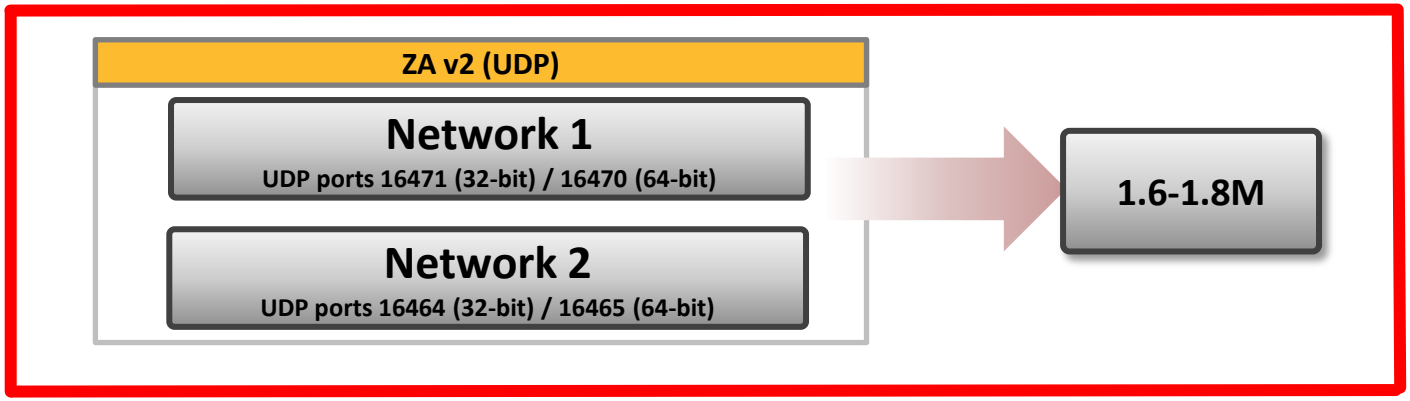
Zeroaccess (ZA) – Introduction

- Zeroaccess is a botnet, also known as ‘Sirefef’ or ‘ZAccess’ or ‘Zerokit’
- First appeared in Summer 2011
- Two major versions
  - Version 1, rootkit, TCP P2P (2011)
  - Version 2, user mode, UDP P2P (2012)
- Infected computers exclusively use the peer-to-peer (P2P) network to distribute payloads
- Can be thought of as a framework to load any module/malware
- Infection vectors include social engineering, exploit kits, and other downloaders
- Pay Per Install (PPI) and revenue sharing model
- Primary revenue is through click-fraud
- Malicious payloads use their own C&C infrastructure

ZA – Size

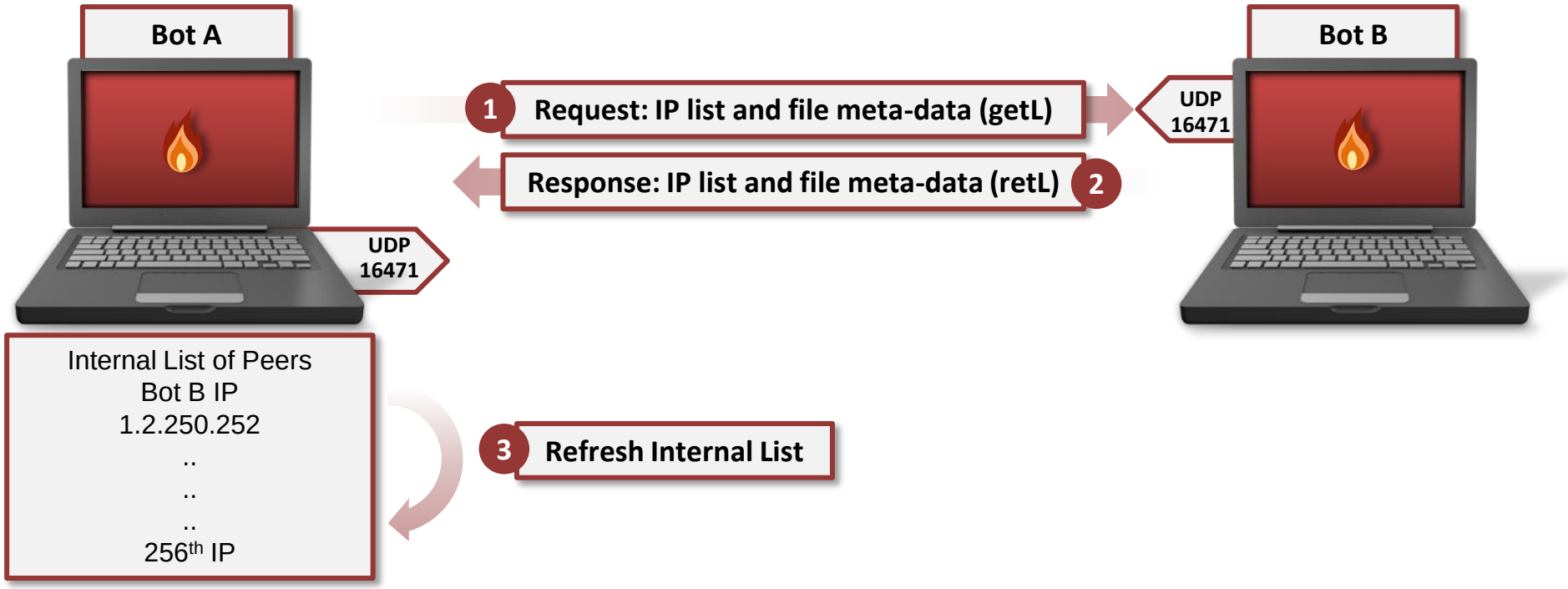
- Counts are of average daily unique infected hosts, measured in May 2013
- Networks are subdivided into 32-bit and 64-bit client networks; no inter-network / cross-port communication



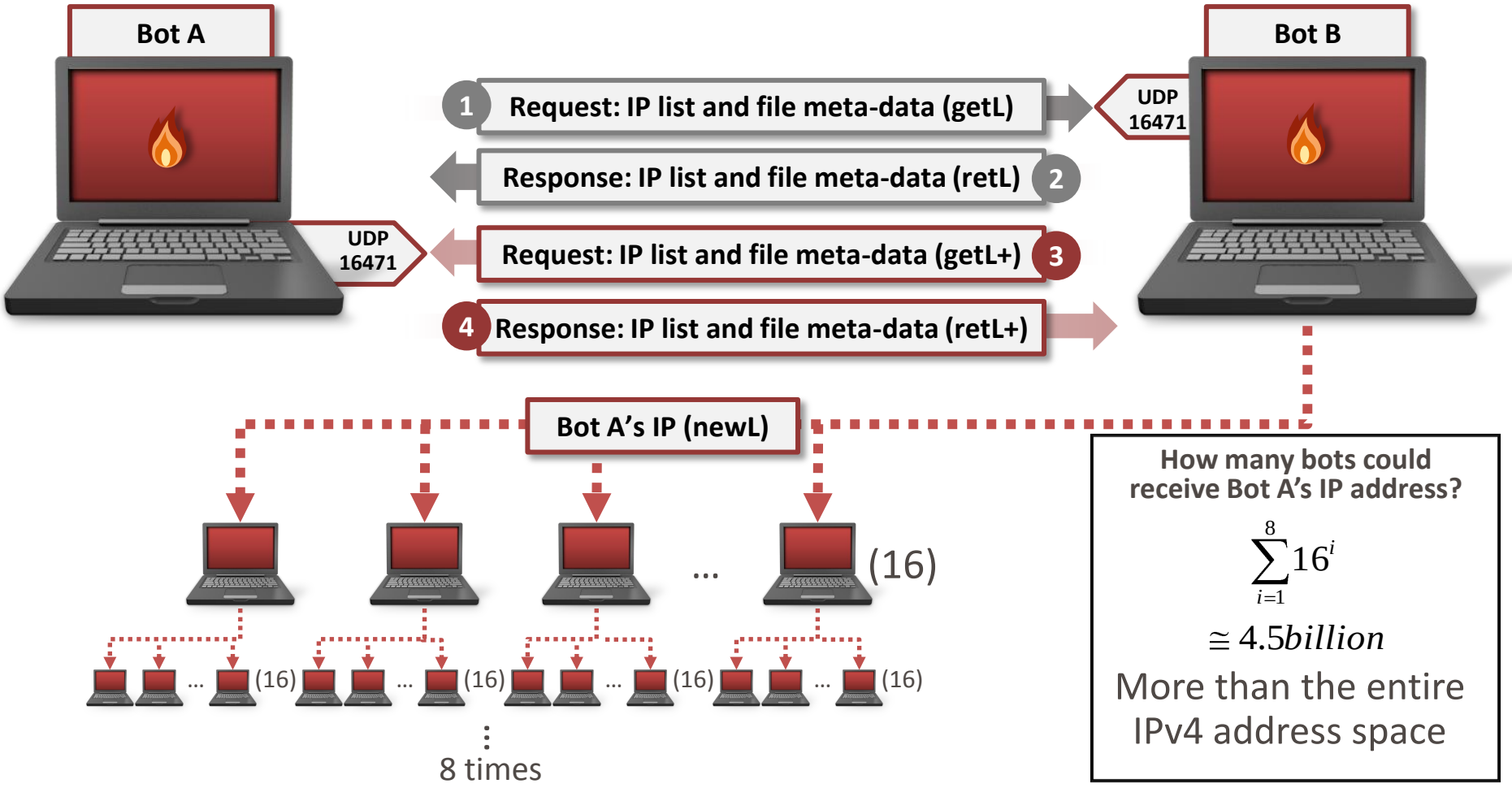


What would a sinkhole of Zeroaccess look like?

ZA – P2P Operation



ZA – P2P Operation



How many bots could receive Bot A's IP address?

$$\sum_{i=1}^{8} 16^i$$

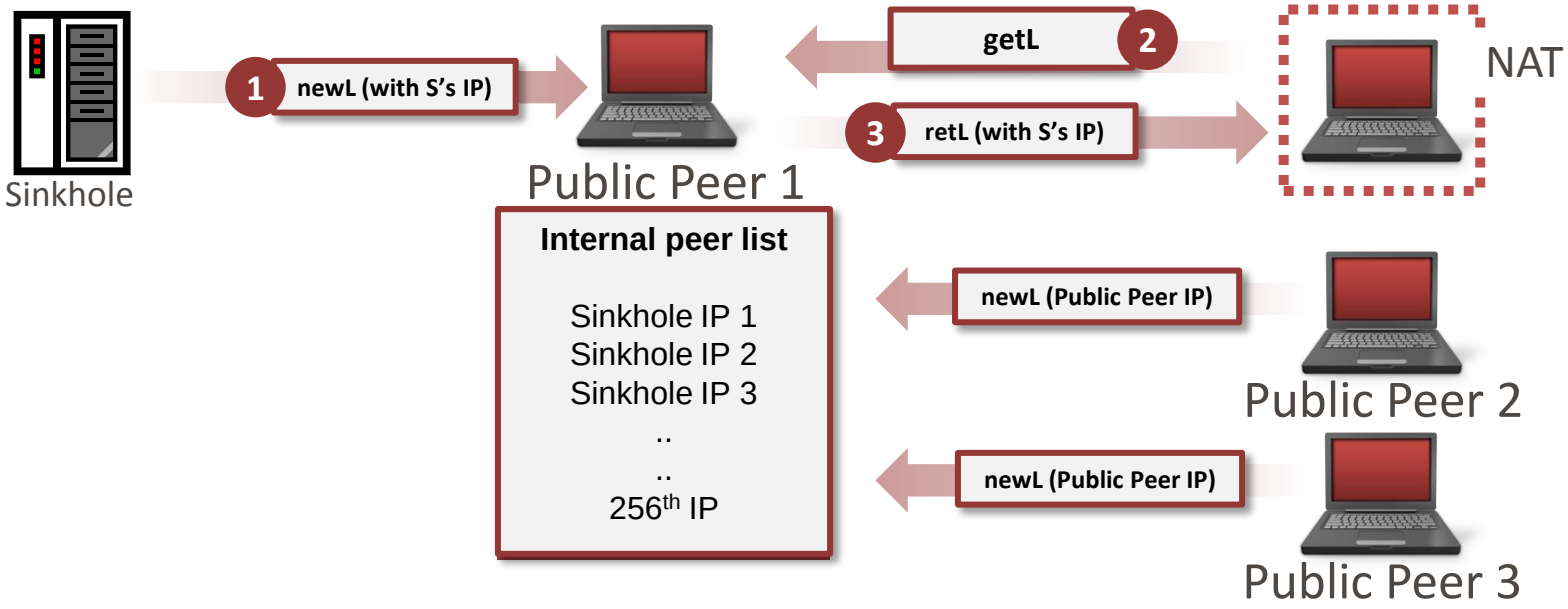
$$\cong 4.5 billion$$

More than the entire IPv4 address space

ZA – Could the P2P network be sinkholed?

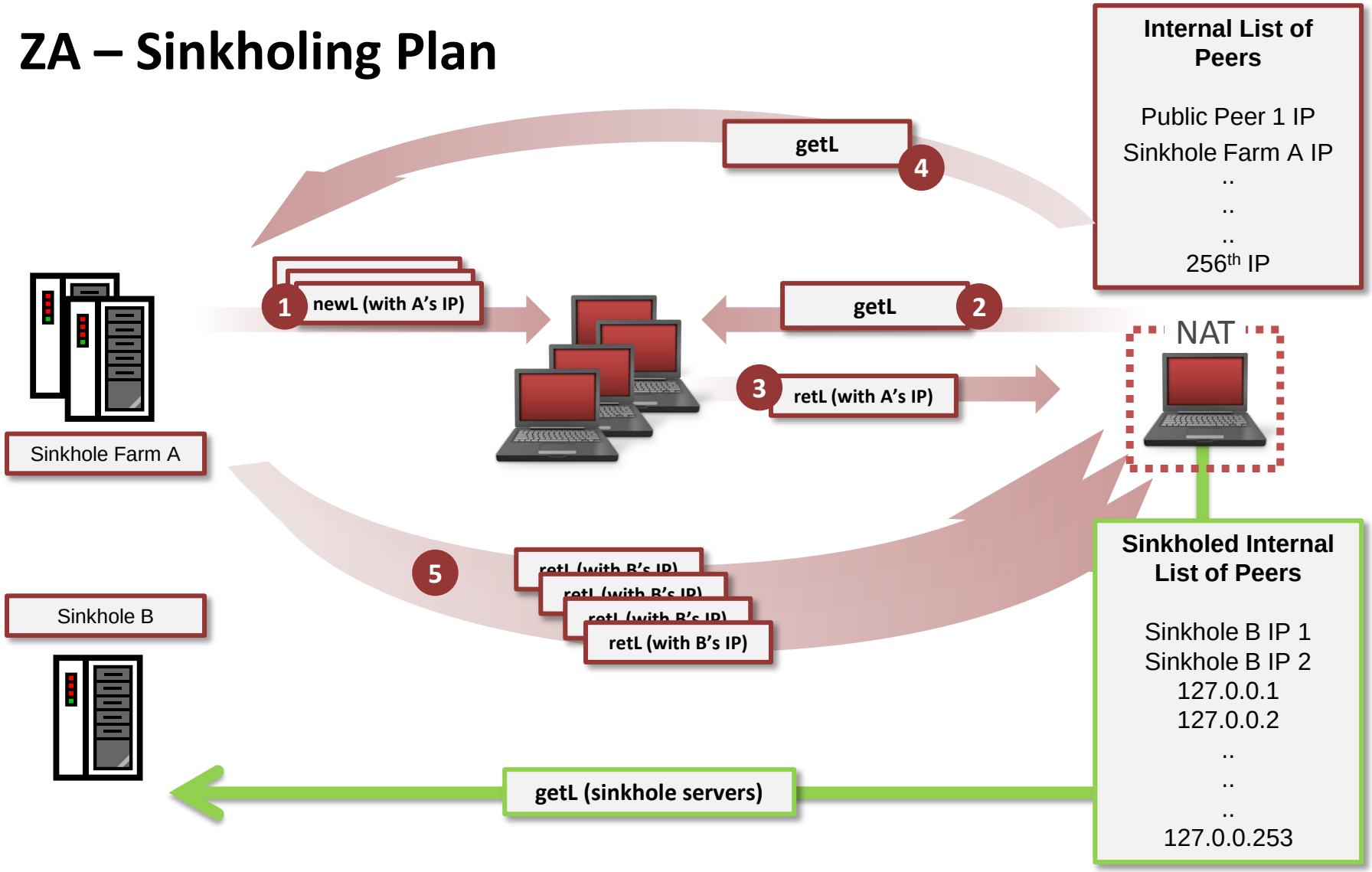
- Identified weaknesses
  - Relatively small fixed length internal peer list (256 IPs)
  - Unsolicited P2P messages are accepted from any IP
  - IP list in P2P messages is not digitally signed, only payload file meta data is digitally signed
  - Any IP address can be introduced into a remote peer's internal peer list

ZA – Challenges to sinkholing



- Takes a very large amount of continuous bandwidth
- IP churn makes it difficult to know all the public peers (super nodes)
- Zeroaccess author could use newL's in the same way to retake public peers
- Difficult to run in a network simulation prior to deployment

ZA – Sinkholing Plan

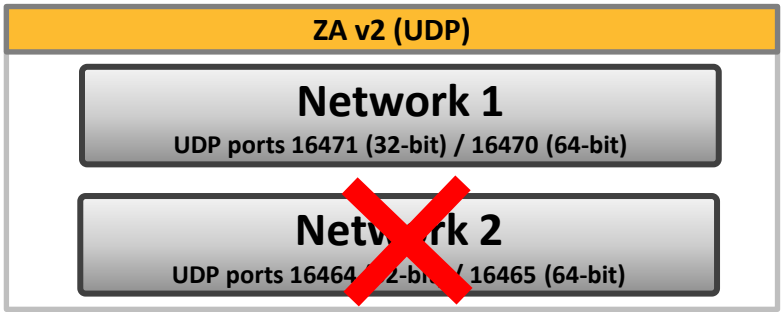


ZA – The sinkhole master plan

- Preconditions to launching the sinkhole operation
  - Simulate infected peers to understand runtime behaviour
  - Test sinkholing infected computers on a private LAN with various NAT devices
  - Test against the live P2P live as much as possible without actually sinkholing
- Expected results
  - Infected peers behind NAT devices are sinkholed and the payloads can no longer be updated
  - All infected machines can be identified for remediation

ZA – “The best laid plans of mice and men…”

- From April to June 2013, the simulation and testing of the sinkhole plan progressed
- On **June 29, 2013**, new P2P code was distributed to Zeroaccess version 2 network 2

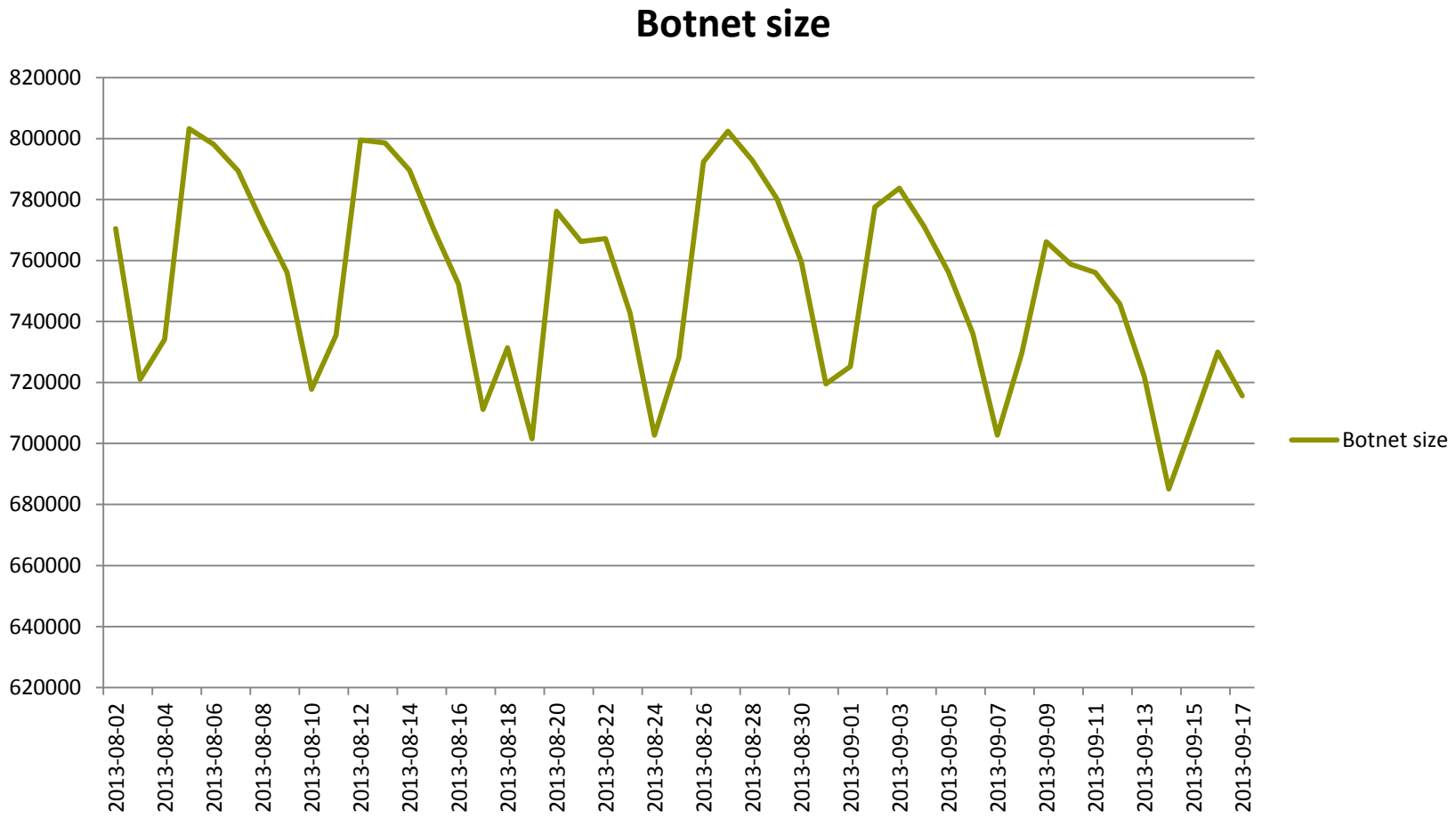


- The update made P2P Network 2 much more resilient to sinkholing
  - Reduction in instruction set (newL dropped)
  - Introduction of secondary internal peer list (holds ~16M IPs)
  - Altered run-time peer communication (secondary peer list for redundancy, and connection state table)

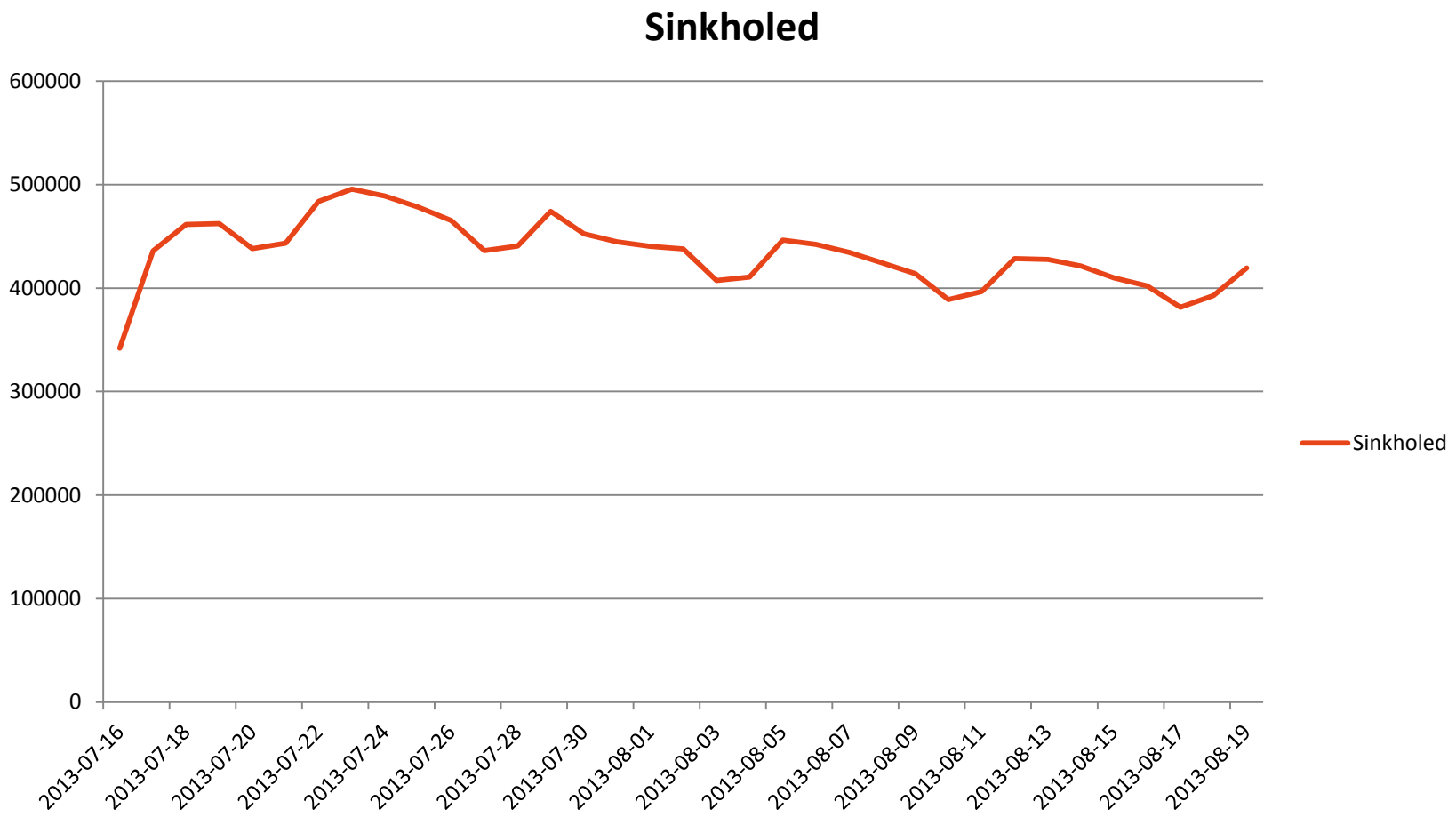
ZA – Sinkhole results

- P2P sinkhole of Network 1 initiated on **July, 15 2013**
- Available targets
  - June 29, 2013, protocol update reduced possible targets to ~900,000
- Sinkhole results week of July 17 – July 23 (in avg. daily IPs)
  - Botnet size: **797,235**
  - Number of bots sinkholed: **460,000**
  - High sinkhole count for 24 hour period **495,610**
  - Average proportion of botnet sinkholed: **58.7%**

ZA – Graph of botnet size

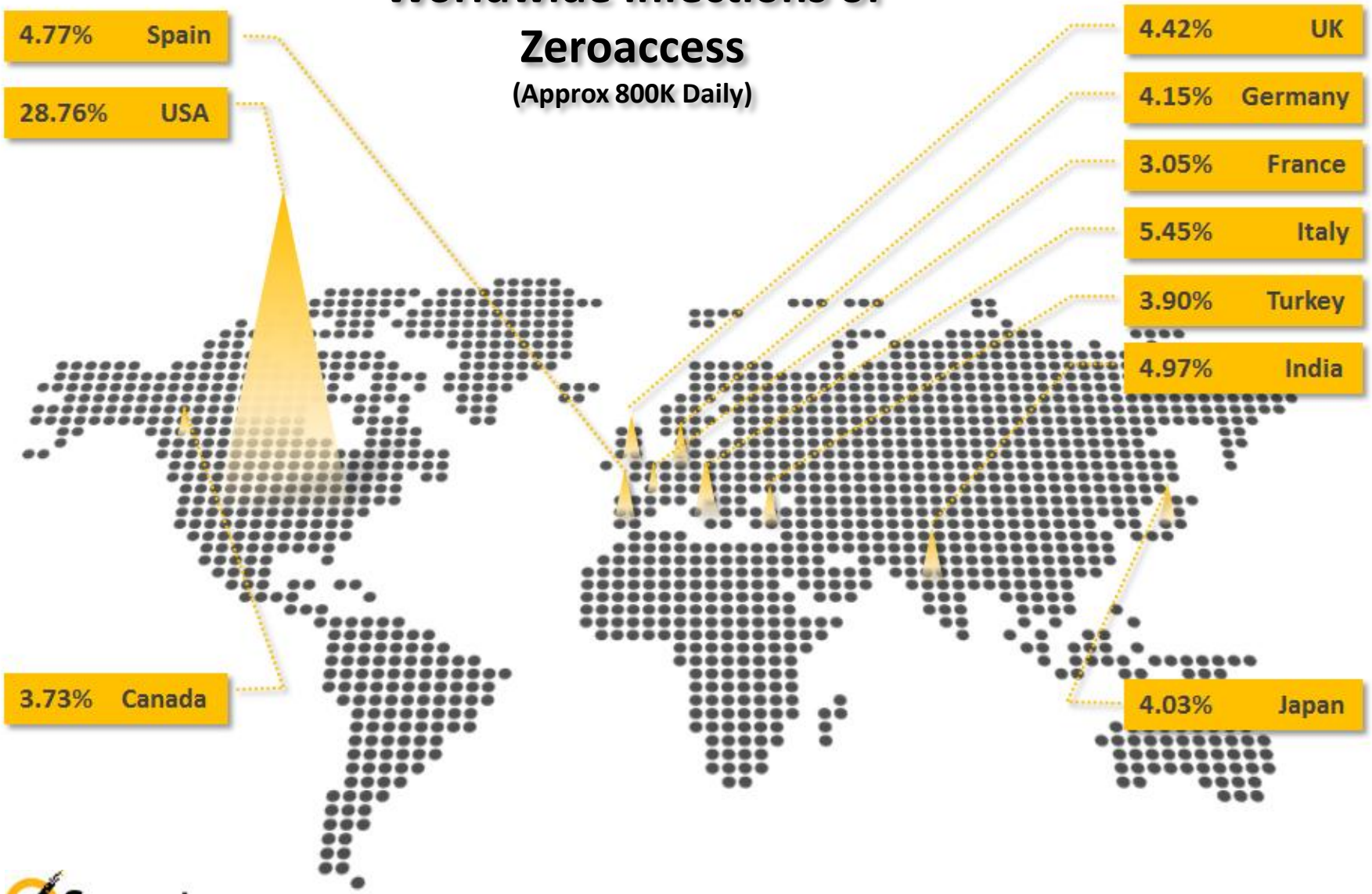


ZA – Graph of sinkhole size



Worldwide Infections of Zeroaccess

(Approx 800K Daily)



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ZA – Next steps

- Continue to work with ISP's and CERTs to clean up infections
- Continue monitoring P2P networks (sinkholed and not), as well as payload infrastructure
- Continue with other avenues of investigation

ZA – Questions

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Thank you!