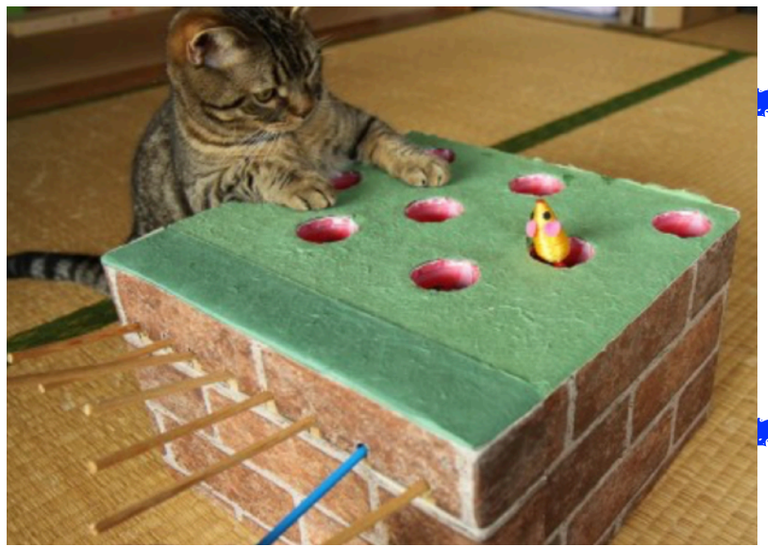
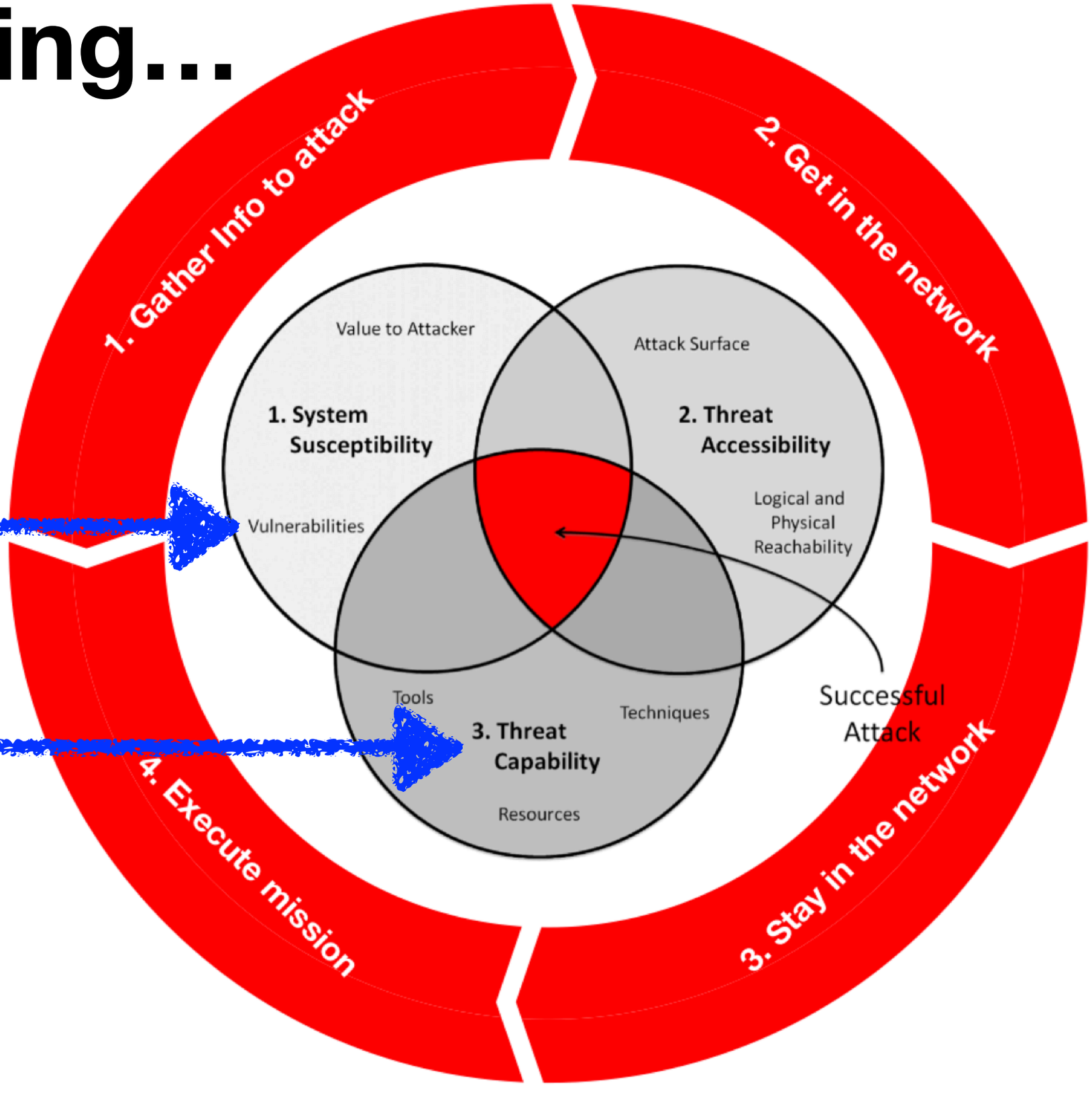
Increasing cost-of-attack through **Isolation**

prepared by J.C

Never Ending…





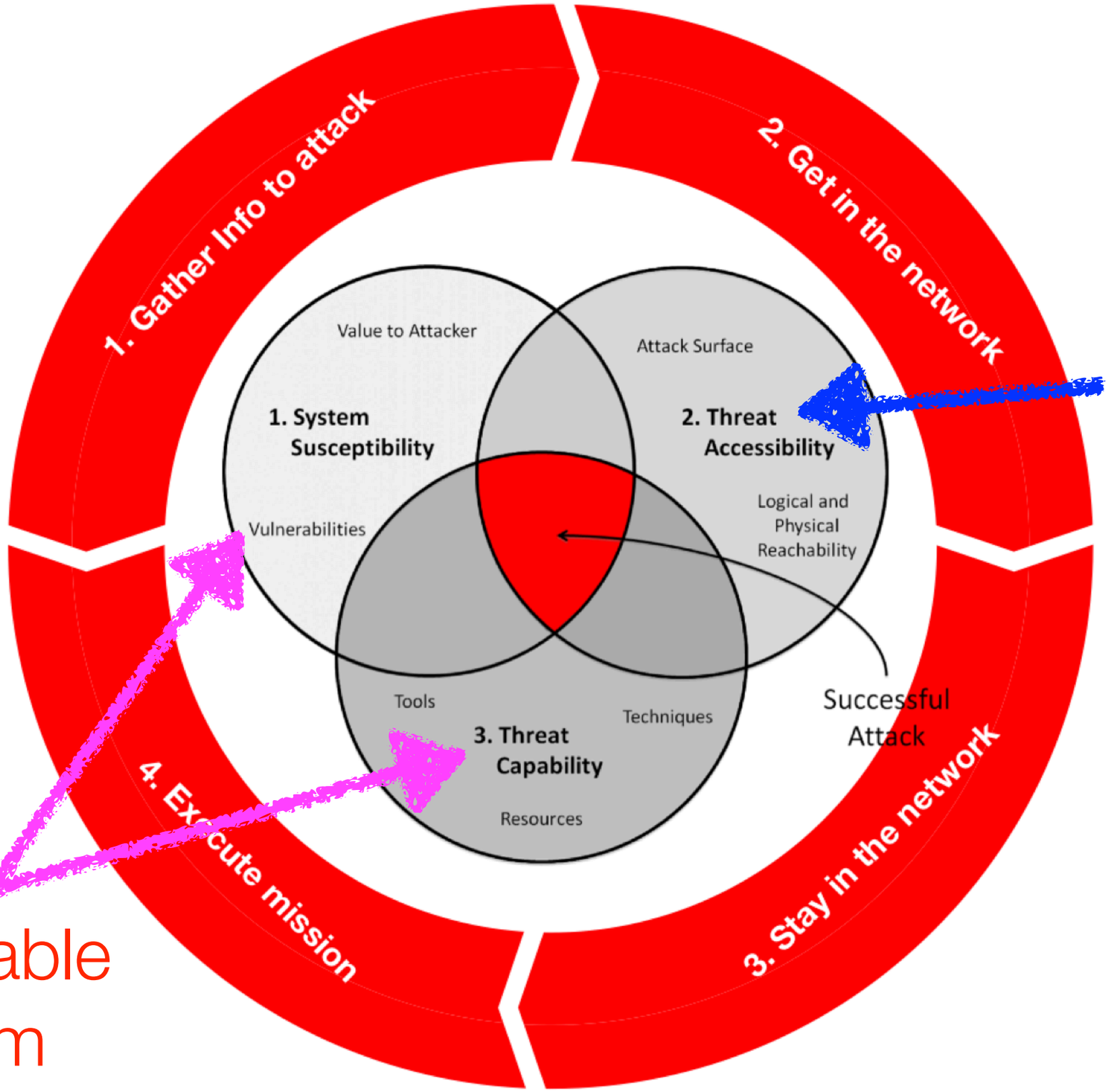
Realities

- Free/leaked offensive tools, source-codes, tutorials…
- Detail research available online freely but unfortunately give malware authors/threat-actors better offensive techniques
- Direct monetary rewards, no need degrees/certs

- Complex & vulnerable systems; no end to patching (vendors' failures/incompetencies becomes our problem)
- Demanding use-cases/SLAs to support
- Low/no budget for security
- Shortage of skilled~~/certified~~ technical staffing

#WannaCry

ALL successful attacks require <u>all 3 conditions to exists</u>; susceptibility, accessibility & capability



Viable Option

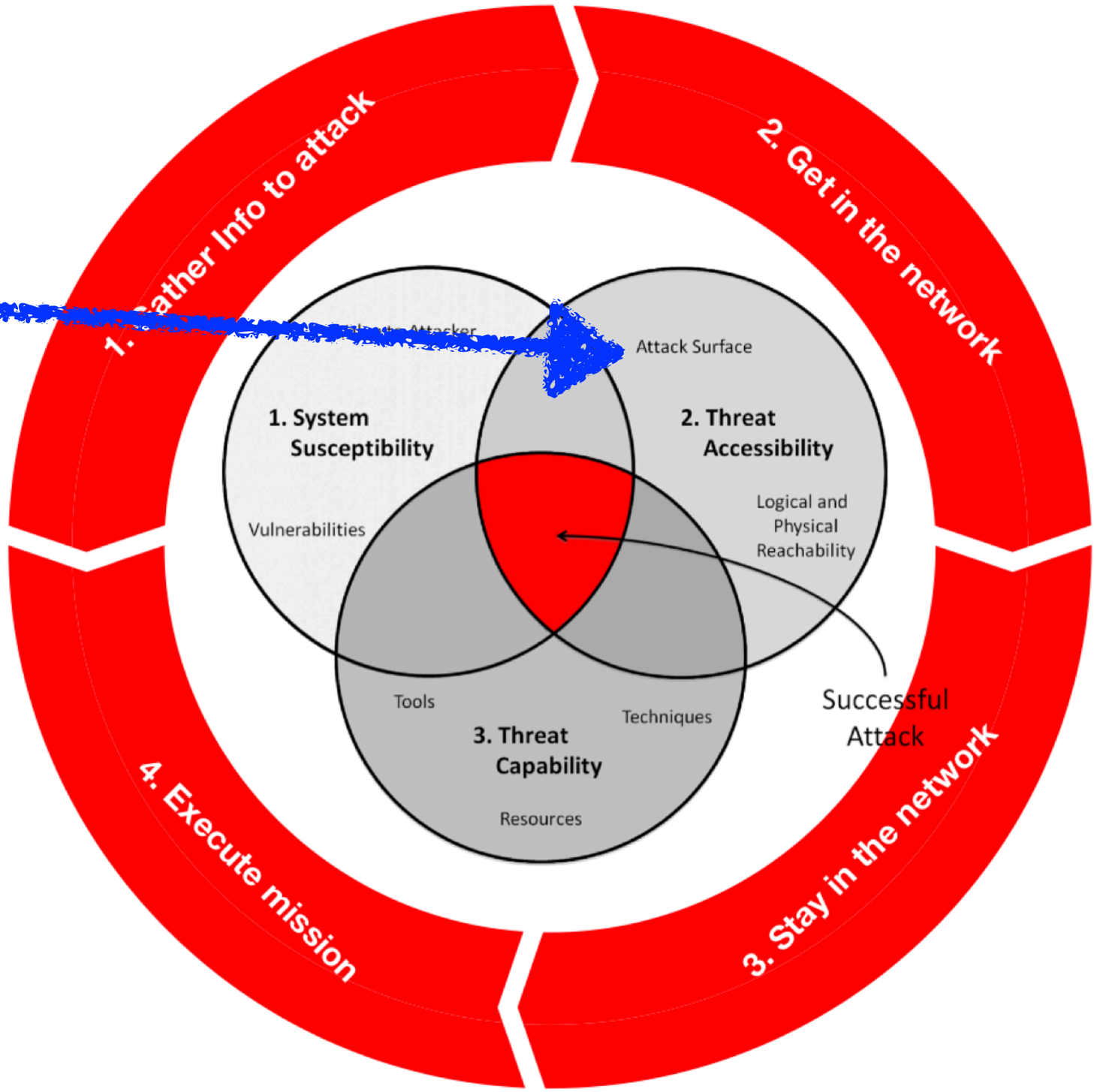
Intractable Problem

“Enumerating bad things is a bad idea…”

“Knowing what not to do doesn’t mean we know what to do…”

Top ways to get to victims

1. **Email**
2. **Browser**
3. Others (eg. installing tainted apps, removable media, Man-in-the-Middle/Browser/ Device…)



Isolation deals with “Stage 2” of externally controlled attack…

	Tactics	Users	Services	Networks
Stage 1 **Gather Info**	External Reconnaissance	Social Engineering Awareness	Deceptive Traps	
Stage 2 **Get in**	Deliver payload	Moving Target & Layered Endpoint Defense		Isolation
	Run payload			
	Install payload			
	External control			
Stage 3 **Stay in**	Internal reconn.	Deceptive Traps		
	Gain privilege-access	Least Privilege Principle Multi-Factor Authentication		
	Abuse credentials			
	Internal control	Privilege User Management & Monitoring		
Stage 4 **Execute mission**	Steal (Confidentiality)	Application Security, Data Protection & Key Management		Outbound Controls
	Tamper (Integrity)			Isolation
	Deny (Availability)	Redundancy & Recovery		
	Damage (Safety)			

External & Internal Actors

What can Isolation do?

- Disrupts delivery of payload (Threat Accessibility)
- Even if somehow payload runs within isolated networks, it is harder to contact typical remote **C**ommand-&-**C**ontrol servers
- Not limited to APT, blocks ransomware too

		Tactics	Users	Services	Networks
External Actors	*Stage 1* **Gather Info**	External Reconnaissance	Social Engineering Awareness	Deceptive Traps	
	Stage 2 **Get in**	Deliver payload	Moving Target & Layered Endpoint Defense		Isolation
		Run payload			
		Install payload			
		External control			
External ~~& Internal~~ Actors	*Stage 3* **Stay in**	Internal reconn.	Deceptive Traps		
		Gain privilege-access	Least Privilege Principle Multi-Factor Authentication		
		Abuse credentials			
		Internal control	Privilege User Management & Monitoring		
	Stage 4 **Execute mission**	Steal (Confidentiality)	Application Security, Data Protection & Key Management		Outbound Controls
		Tamper (Integrity)			Isolation
		Deny (Availability)	Redundancy & Recovery		
		Damage (Safety)			

COTS “Isolation” Solutions

Host Isolation

Bromium®

BUFFERZONE

Network Isolation

Menlo Security
IT’S SAFE TO CLICK

fireglass

- Just to list a few examples; I don’t do (pre)sales…
- Network layer easier to deploy; zero-client setup

Working Principles of “Isolation Platforms”

Malicious payloads are contained within these disposable Containers*.
<u>Users’ devices are unaffected</u>.

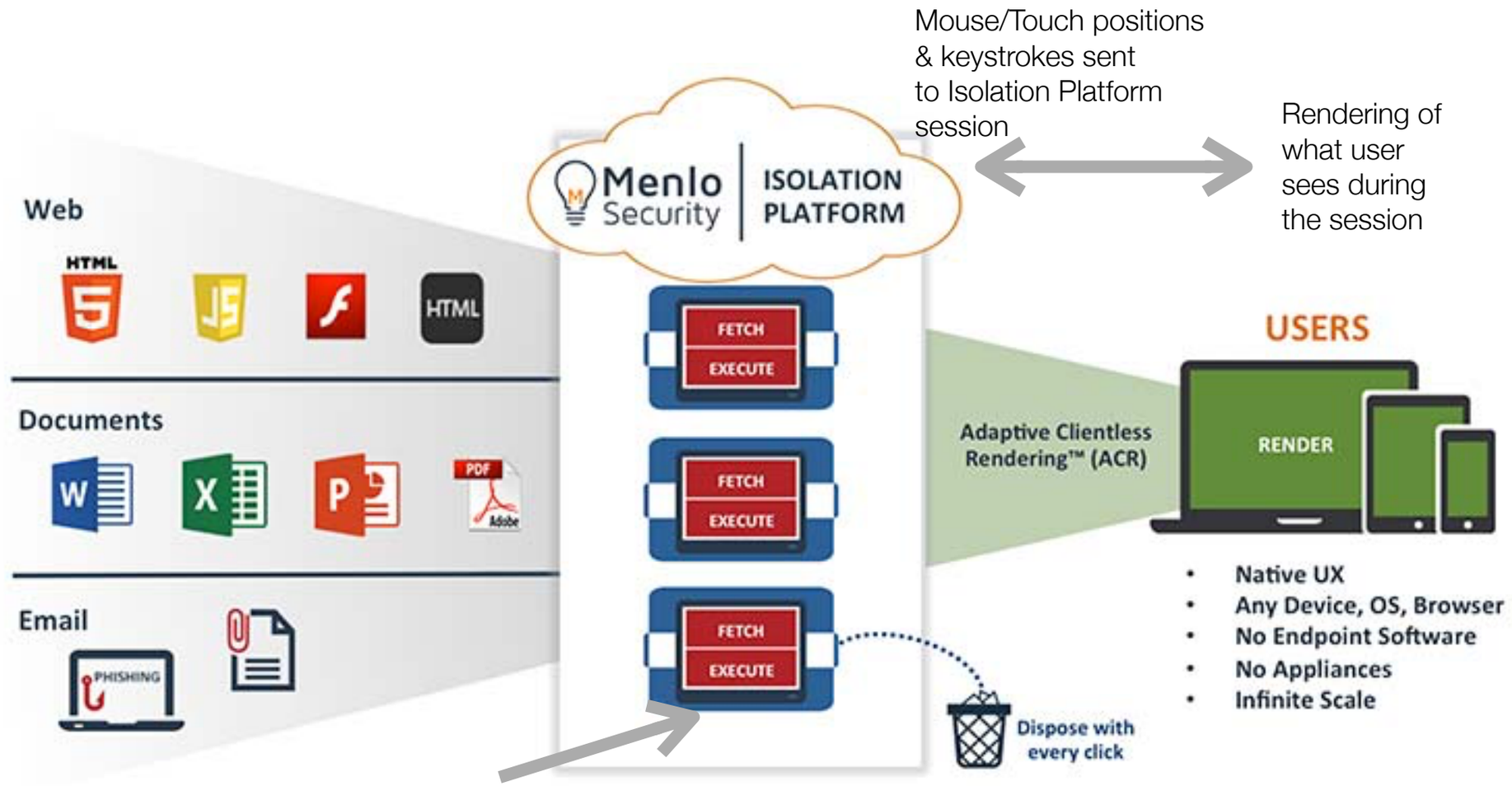


Diagram source: https://www.menlosecurity.com

* Works like a Virtual Machine but without the overheads…

Isolation solves ‘Threat Accessibility’ but how to get & use external contents?

- Typical use-cases: copy-&-paste, screen-capture, print out physical copy, save to disk **as files**, **view email/URL/ document**… the last two are typically how bad guys get in & take-control remotely.

- Traditional/physical air-gaps tend to use multiple keyboards, mice or secure-KVM switches + wiring; **A hassle in terms of getting content across disjoint networks & peripherals support!**

- **External contents need to get into isolated machines. How to ensure that these contents are safe for consumption?**

Let's say we have **low budget** for IT ~~security~~

- Two separate **V**irtual **D**esktop **I**nfrastructure; one for internet surfing, the other for intranet clients.

- VDI is nothing new, can reduce cost in terms of $$$, electricity bill$, IT-operations efforts.

- Low power ARM processor thin-clients are cheap, ~US$60, MoQ = 1

- Many thin clients have dual display ports & some with dual ethernet ports. Let's see how to support a 'seamless' experience

VDI Server(s)
for Internet Zone

Safe ingestion of external contents

VDI Server(s)
for Intranet Zone

Mouse positions & keystrokes

RDP session to **disposal VM** running browser & document viewers

Session rendering

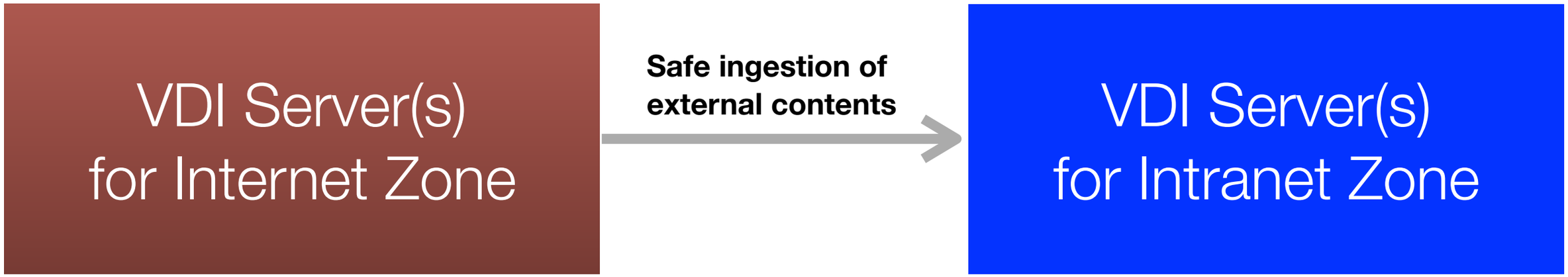
Low-cost thin client with little/zero storage

RDP session to VM for intranet applications

- No KVM switches/cables to deal with!
  ‘Seamless’ since 1-set of keyboard + mouse, if needed, audio redirection for internet tele-conferencing

- Users can copy-&-paste text, screen-capture images, view/save files… automated content transfer to intranet client-zone

- Can be adapted for laptop + monitor. When used out-of-premise, use Isolation Platforms like Menlo-Security or Fire.Glass as forward-proxy



What is this ‘Disposal’ Internet VM?

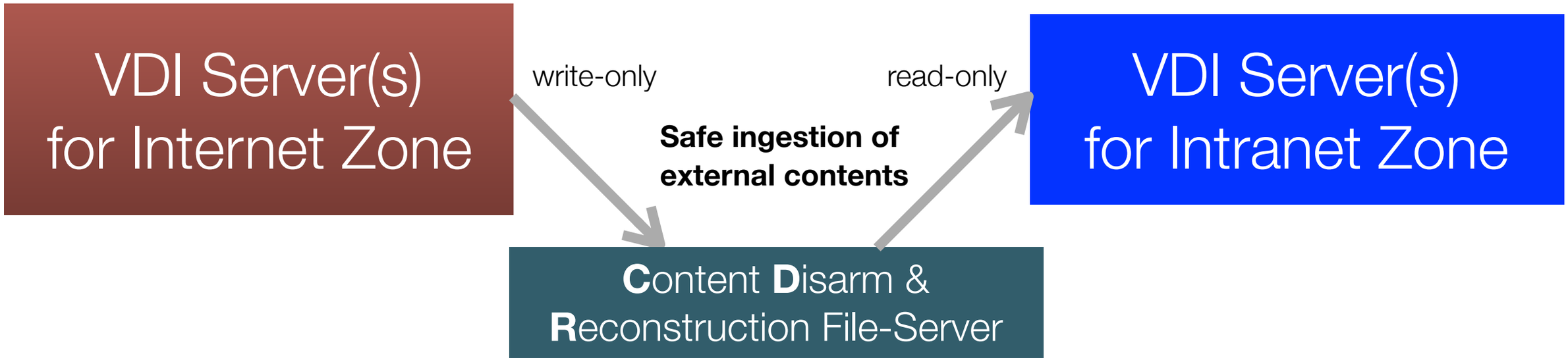
- Essentially a hardened Windows/Linux VM running in Internet-kiosk mode, allocated with minimal computing-resources for use browser for both surfing & viewing of documents

- Use built-in application-whitelisting Software Restriction Policies/AppLocker for Windows-based VMs.

- Install free malware analysis/debugging tools to fool malware & threat-actors. Honey-tokens as trip-wires eg fake credentials in sysprep files. #Deception

- Use freeware like ToolWiz Time Freeze. Revert VMs to original state after reboot. Deters any backdoor/persistence after successful code-execution. Have another master-copy VM template, turn on Time-Freeze to deploy after patching. Linux can do “Live/read-only mode”.

- A simple clip-board-to-file tool that writes to a network folder. File saving writes to the same dedicated folder for ‘Safe Ingestion’.



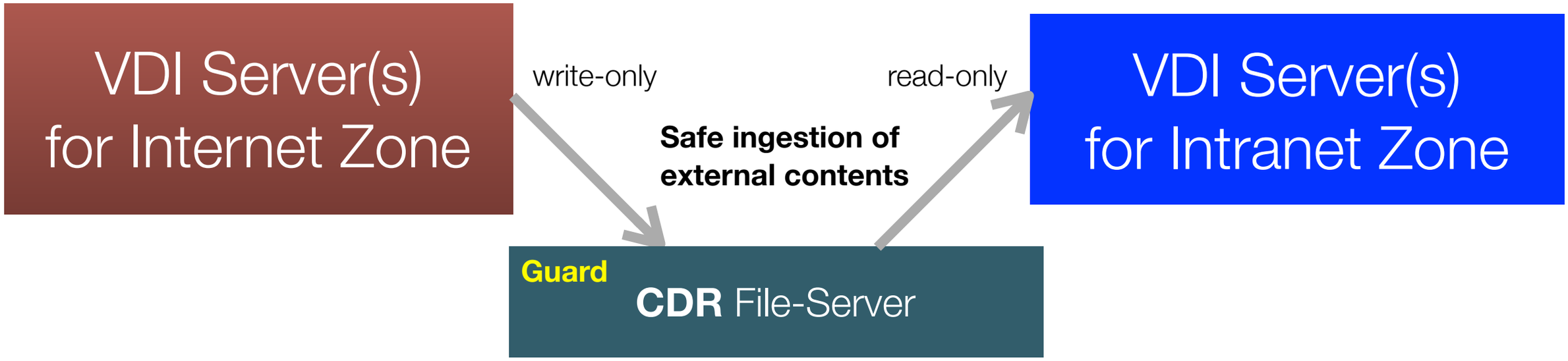
What is '**Safe Ingestion**'? A "Guard".

- Let's say attackers took over a VM within internet zone…
  Assume he didn't fall for honey-tokens/traps/fake-debugging…

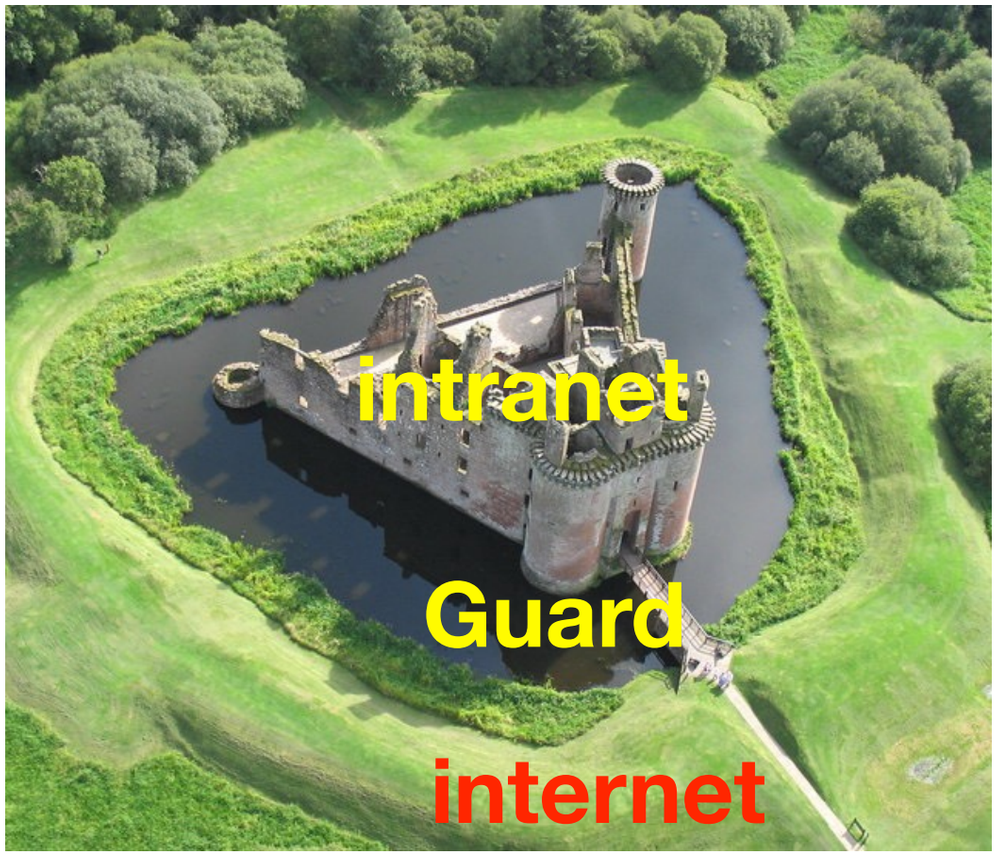
- Between the 2 zones, there's a file-server that **only expose write-only folders** to Internet Zone & **read-only folders to Intranet**. All other ports/services blocked on the file-servers.

- File-server performs CDR using file-format conversion* to "flatten" malicious active-contents. Rejects ALL executable files.

* if budget permits, go for static-content-analysis products that block any shell-codes/malicious-scripts within **data contents, especially for contents that cannot be converted**. Don't waste money on sandboxes or anti-virus.



Past



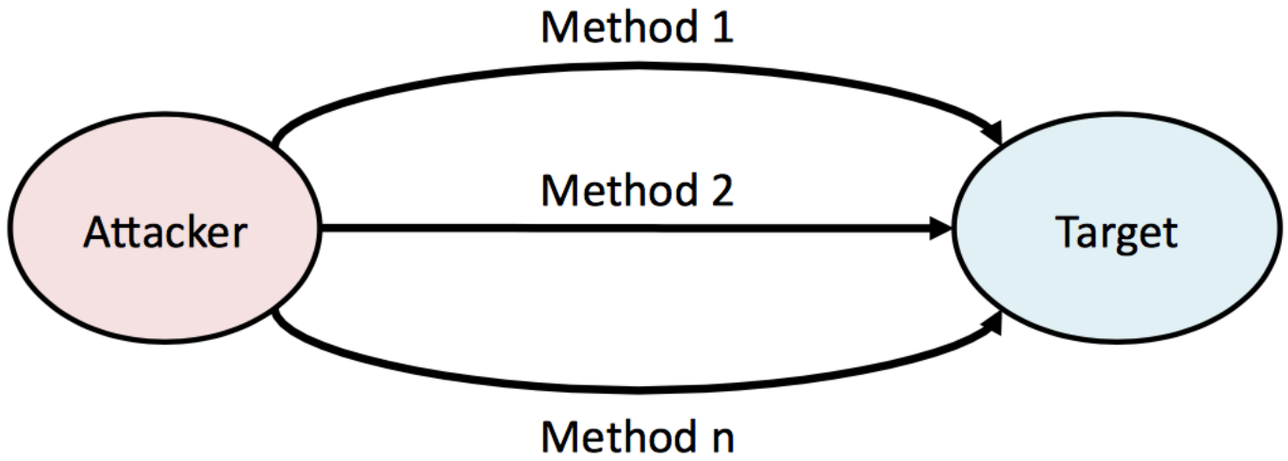
Present

Future

Let’s look at the theory behind this approach…

Three-Tenets Threat Model

http://www.dartmouth.edu/~gvc/ThreeTenetsSPIE.pdf



Conceptual Ingredients			
Attack Requirements	Capability	Accessibility	Susceptibility
Defender's 3 Tenets	Detect, React, Adapt **Deceive***	Move Key Assets "Out-of-band"	Focus on What's Critical
Routine Activity Theory (RAT) of Crime	Motivated Offender	Lack of Guardianship	Suitable Target
Criminal Law	Means	Opportunity	Motive

* Not part of the original paper

Defenders' Three-Tenets

Tenet 1 *Focus on What's Critical* - The first *Tenet* instructs the designer to consciously and methodically focus on including only those system functions that are essential to the mission. This is an acknowledgement of Occam's Razor by the system designer. Adherence to this *Tenet* reduces the number of potential susceptibilities, and therefore, the paths between the attackers' starting state (the system access points) and goal states in which mission essential functions, critical security controls, or critical data are compromised. This *Tenet* eliminates those access points and susceptibilities associated with unneeded functionality.

Tenet 2 *Move Key Assets Out-of-Band* - The second *Tenet* instructs the designer to consciously differentiate between user access and attacker access for a given system's mission. This *Tenet* modifies system availability and is accomplished by moving the data/processes used by mission essential functions, their security controls, and associated access points out-of-band of the attacker either logically, physically, or both. By "out-of-band" we mean not accessible by the attacker through their preferred or available access methods. Adherence to this *Tenet* reduces threat access for a given mission (use case) and may enable unalterable observations of system state by a security control sensor. The extent and strength of access differentiation between the user and attacker is greatly influenced by the type of out-of-band mechanism employed and whether its done in software or hardware.

Tenet 3 *Detect, React, Adapt* - The third *Tenet* instructs the designer to employ dynamic sensing and response technologies (i.e a security control sensor or reference monitor) that mitigate the threat's capabilities and exploitation attempts through automated (preferably autonomic) system behavior. Adherence to this *Tenet* confounds the attacker's capabilities by making the system's defenses unpredictable (nonstationary) and adaptive (with penalties) instead of merely being passive.

Proposed Approach mapped to 3-Tenets

	Thin-Clients	Internet Zone	Safe Ingestion of Contents	Intranet Zone
Tenet 1 **Focus on What's Critical**	Can only RDP or equivalent protocol. Block file-transfer & USB device forwarding.	Limited use-cases to viewing & saving external contents to sanitisation folders.	Limit to sanitisation of contents & logical 1-way content flow. Use data-diode if budget permits.	Run only necessary intranet apps. Limit outbound content transfer, use monitored channels for outbound file transfers.
Tenet 2 **Move key assets Out-of-Band**	No sensitive/internally generated contents, all done within intranet.	No sensitive/internally generated contents, all done within intranet.	All external contents are stored temporarily for sanitisation. It is mounted as read-only for intranet clients.	Locked thin-clients mitigate Insider USB exfiltration & internal content hidden in outbound TLS/SSL
Tenet 3 **Detect, React, Adapt**	Any attempt to run anything other than whitelisted app(s) will trigger disablement of thin-client	Use deception to deter threat actors. Use honey-token as sensor to reboot VM to clean state.	Monitor this path closely for anomaly instead of so many possible paths. Shut it off when necessary.	Without noisy internet traffic means better detection with higher signal-to-noise ratio.

What about Small-Medium-Businesses?

- This approach was conceived under a scenario of low/no budget for security products. We rearrange assets & configure them in accordance of 3-Tenets guidance.

- Look up Alibaba for “thin-client”, you will find the diagrams & sizing for VM-hosting servers for digital signages, Internet kiosks/classrooms…

- Content sanitisation file-server that enforces a “logical” one-way transfer is intended as a ‘poor-man’s data-diode.

- If it is too difficult to implement, then pay for Menlo-Security, Fire.Glass or similar cloud-based “isolation-proxy” subscriptions. **But still need to deal with safe content consumption.**

- All these catch-the-bad-signatures solutions are mostly waste of time (false-positives) & $$$ because it is **easy & free** to generate evasive RAT payloads & abuse system component to execute such malicious codes… with a freeware like Time-Freeze just reboot to revert disposable VM to fresh state.

Let's say there's **more budget** for IT security

- Use **application-protocol aware** firewalls to allow only RDP network traffic between thin-clients & zones. Guard against abusing thin-clients as pivot points. (Tenet 1 & 2)

- Likewise, **limit network to only file-share write-only** traffic from Internet-VDI-zone to file-server & **read-only** from file-server Intranet. (Tenet 1 & 2)

- Deploy **anti-exploitation** agents (eg. Morphisec or PANW TRAPS) &/or **host-isolation** like Bromium or BufferZone to guard file-server. (Tenet 3 & 2)

Thank you… Next round will focus on deception & detection!