IARPA ReSCIND
IBM Capabilities

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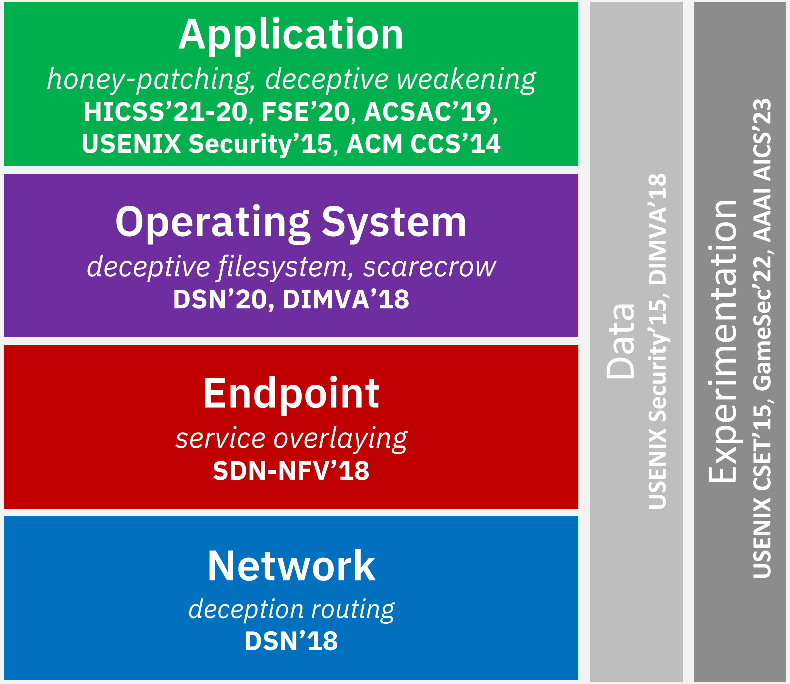
Research

Cyberdeception Research at IBM

Embedded threat sensory and attacker engagement

Capabilities: language-based and systems security, compilers, program analysis, operating systems, access control, container/cloud technologies, machine learning, CTF, security gamification



Application

honey-patching, deceptive weakening

HICSS'21-20, FSE'20, ACSAC'19, USENIX Security'15, ACM CCS'14

Operating System

deceptive filesystem, scarecrow

DSN'20, DIMVA'18

Endpoint

service overlaying

SDN-NFV'18

Network

deception routing

DSN'18

Data

USENIX Security'15, DIMVA'18

Experimentation

USENIX CSET'15, GameSec'22, AAAI AICS'23

Technical approach

- Embed deceptions along production attack paths for increased threat visibility and high-fidelity attack signals
  - Application, middleware, operating systems, ...
  - Cf. conventional honeypots and honeynets
- Conceal high-value data and resources
- Explore attack biases to “crook source” attacker intelligence

Human-subject experimentation

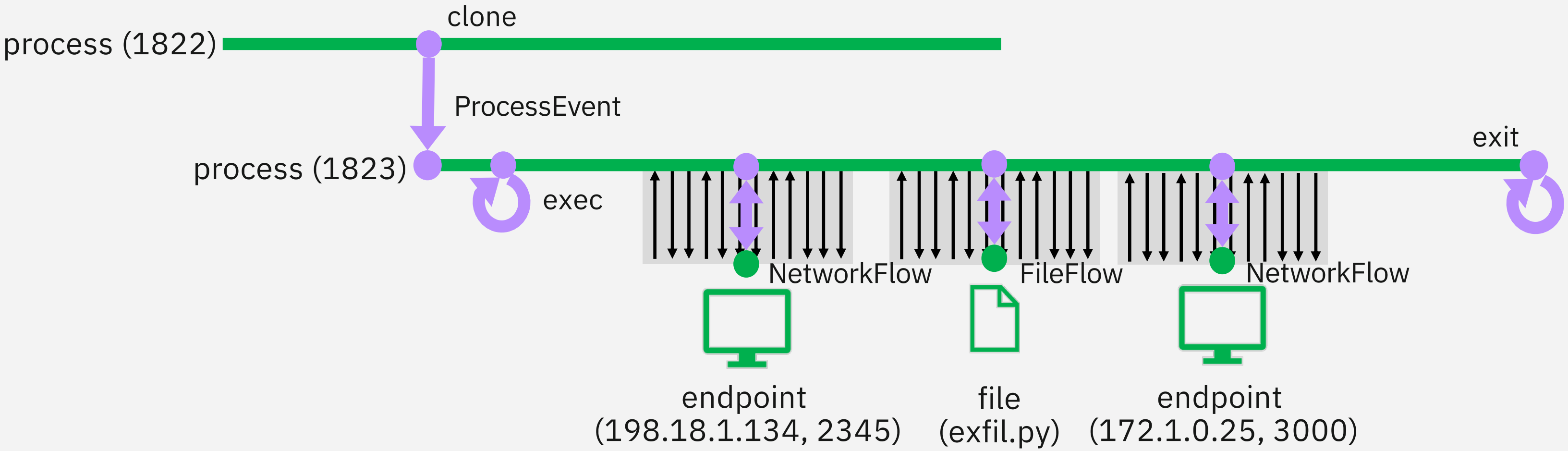
- Identify real-world adversarial threats
- Measure advantages of deploying deception strategies
  - Attack-defense CTFs
- Model human attacker behaviors
  - Role of game-theoretic decision models

Endpoint Observability Research at IBM

Relational observability

Capabilities: operating systems, eBPF, cloud-native computing, intrusion detection, rules engines, threat intelligence, graph analytics and representation learning, self-supervised learning

Semantically compressed system events for scalable **security monitoring** and **behavioral modeling**.

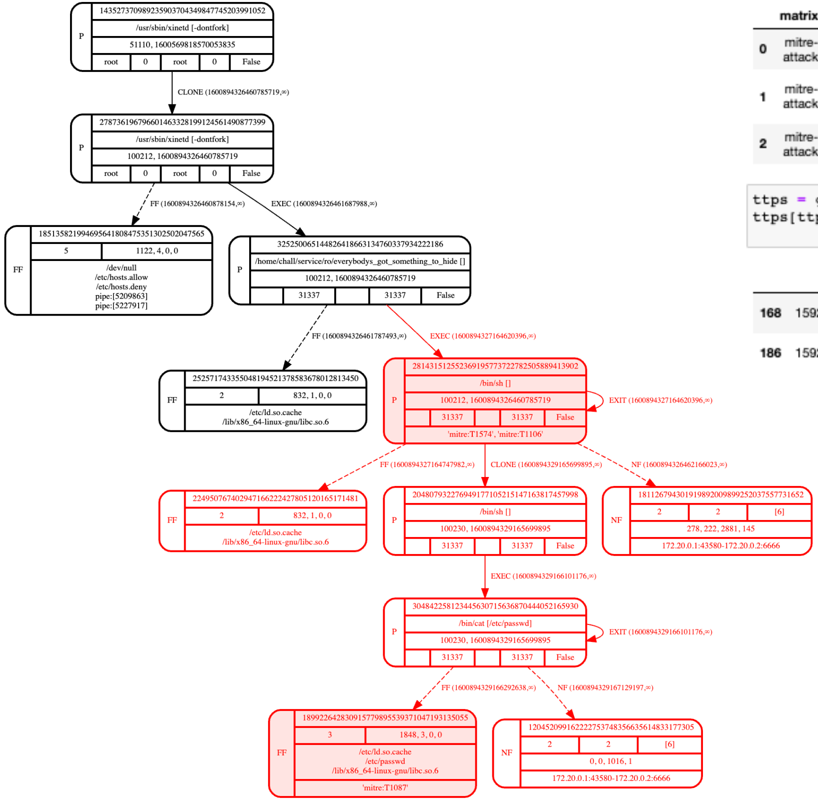


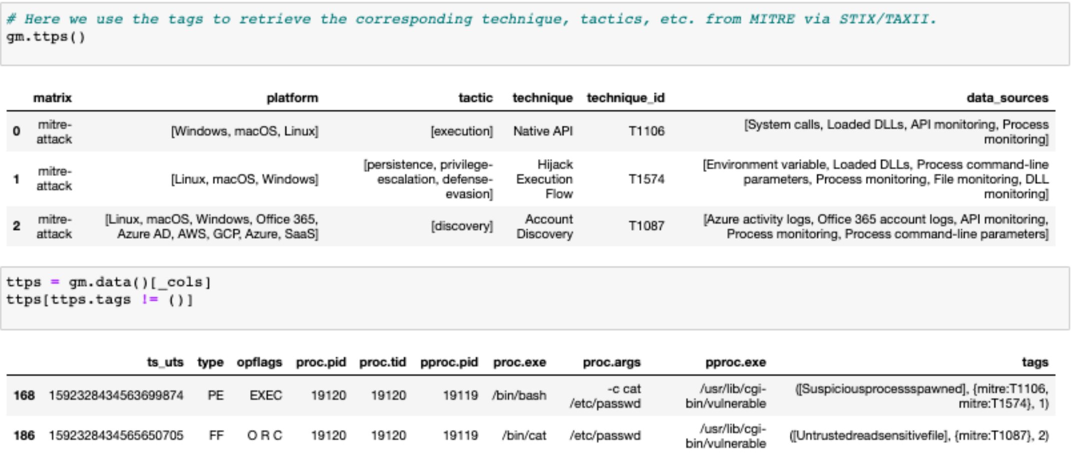
It’s open source!

sysflow.io | https://github.com/sysflow-telemetry

IEEE Big Data’20, FloCon’20-22, BlackHat Europe’21, AvengerCon’22

Provenance Tracking





```
# Here we use the tags to retrieve the corresponding technique, tactics, etc. from MITRE via STIX/TAXII.
gm.ttps()
```

	matrix	platform	tactic	technique	technique_id	data_sources
0	mitre-attack	[Windows, macOS, Linux]	[execution]	Native API	T1106	[System calls, Loaded DLLs, API monitoring, Process monitoring]
1	mitre-attack	[Linux, macOS, Windows]	[persistence, privilege-escalation, defense-evasion]	Hijack Execution Flow	T1574	[Environment variable, Loaded DLLs, Process command-line parameters, Process monitoring, File monitoring, DLL monitoring]
2	mitre-attack	[Linux, macOS, Windows, Office 365, Azure AD, AWS, GCP, Azure, SaaS]	[discovery]	Account Discovery	T1087	[Azure activity logs, Office 365 account logs, API monitoring, Process monitoring, Process command-line parameters]

```
ttps = gm.data()[_cols]
ttps[ttps.tags != ()]
```

	ts_uts	type	opflags	proc.pid	proc.tid	pproc.pid	proc.exe	proc.args	pproc.exe	tags
168	1592328434563699874	PE	EXEC	19120	19120	19119	/bin/bash	-c cat /etc/passwd	/usr/lib/cgi-bin/vulnerable	([Suspiciousprocessspawned], {mitre:T1106, mitre:T1574}, 1)
186	1592328434565650705	FF	O R C	19120	19120	19119	/bin/cat	/etc/passwd	/usr/lib/cgi-bin/vulnerable	([Untrustedreadsensitivefile], {mitre:T1087}, 2)

- Semantic system telemetry representation
  - Context, built-in provenance
  - Facilitates attacker modeling
- Automated MITRE TTP tagging
- Attack kill chain interpretation

Cyberpsychology-Informed Defenses

Model attacker limitations and cognitive biases

- Cyberdeception- and agility-based defense capabilities built into all layers of the IT stack
- Human-subject experimentation in controlled attack-defense scenarios

Understand, measure, and induce changes in cyber attack behavior

- Relational observability for cyber attack modeling and profiling
- Learning-based approaches based on observable security signals

Automate defensive cyber maneuvers based on observed cyber attack behavior

- Automated labeling and mapping of attacker TTPs to defensive cyber maneuvers
- Transparent injection of software, filesystem, and network deceptions into production networks

Thank you

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