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FLOWER – Network FLOW analyzER

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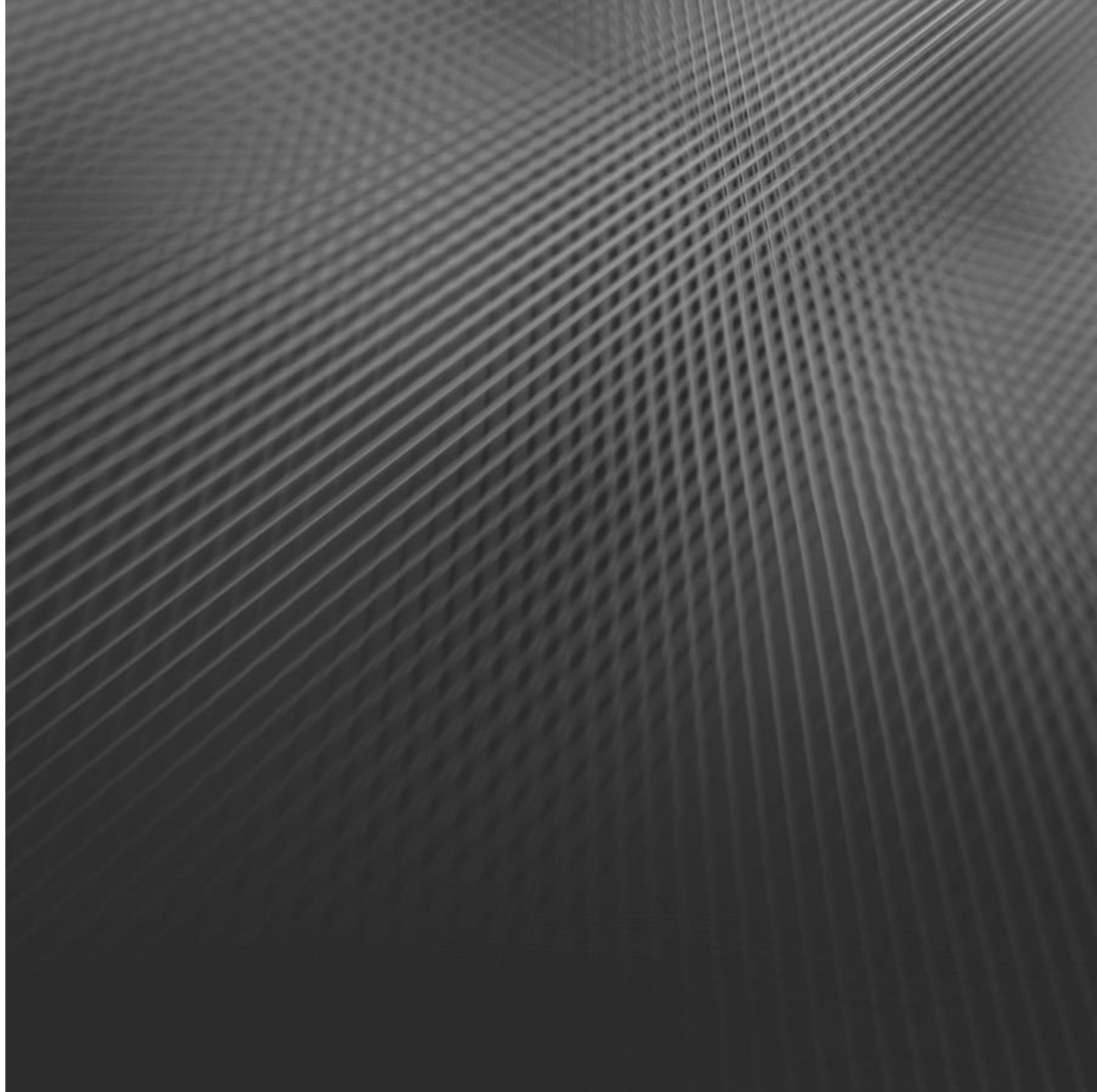

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PNNL is operated by Battelle for the U.S. Department of Energy

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Deep network packet header inspection across an enterprise

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What is FLOWER?

SOFTWARE – TRL9

- **Linux based Application (CentOS 7+ / RHEL 7+ / Ubuntu 16.04)***
- **Captures real-time IPv4 and IPv6 data**
  - Cannot be Detected on Network (listen only)
  - Data records are bidirectional versus unidirectional network flows
  - Data is parsed using **RFC** specifications
  - Data logged in a well-defined structured **CSV** format
  - Deep **packet header** inspection
  - Detect **anomalies** (e.g., malformed/corrupt headers)
  - Reveal tunneled communications (GRE, IPv6 over IPv4, Teredo, etc.)
  - Read pre-recorded PCAP data files

*Limited availability on Windows/macOS X

Where is FLOWER?

Deployments

- **In production for 10+ years**
  - ~100 US DOE facilities in 2008
  - ~75% of bulk electricity transmission grid
  - Used at PNNL on 40G enterprise backbone
    - ✓ Living Lab
  - Independently tested by AIS* on 100G network
  - Licensed to Z-SofTech Solutions, LLC.
  - 1 prototype to collect wireless data
  - 1 collaboration with edge computing

*Assured Information Security

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What FLOWER is NOT

- Comprehensive data analytic and visualization tool
- Zeek (Bro) – Deep packet inspection
- GrassMarlin – Exploratory tool (limited)
- PacketBeats – Data Lake
- Can’t run on AWS or Azure without Packet Forwarding or PCAP files
  - no physical tap in the cloud

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Why use FLOWER?

- **Simple to Deploy Almost Anywhere**
  - As software on existing servers (small footprint)
  - Dedicated appliance (Pi, NUC, Data Center)
  - Works on VMs, Docker, systemd-nspawn
  - Collect Data via back channel (stealth)
- **FAST!**
  - Can capture millions of packets per second
- **Integrates with existing SIEM and data archives**
  - Splunk, Hadoop, InfluxDB, and RDBMS
- **Independently tested and verified**
  - Assured Information Security, Inc. (https://www.ainfosec.com)
- **Well Documented**
  - Build, Installation, Data, and Operations Guides

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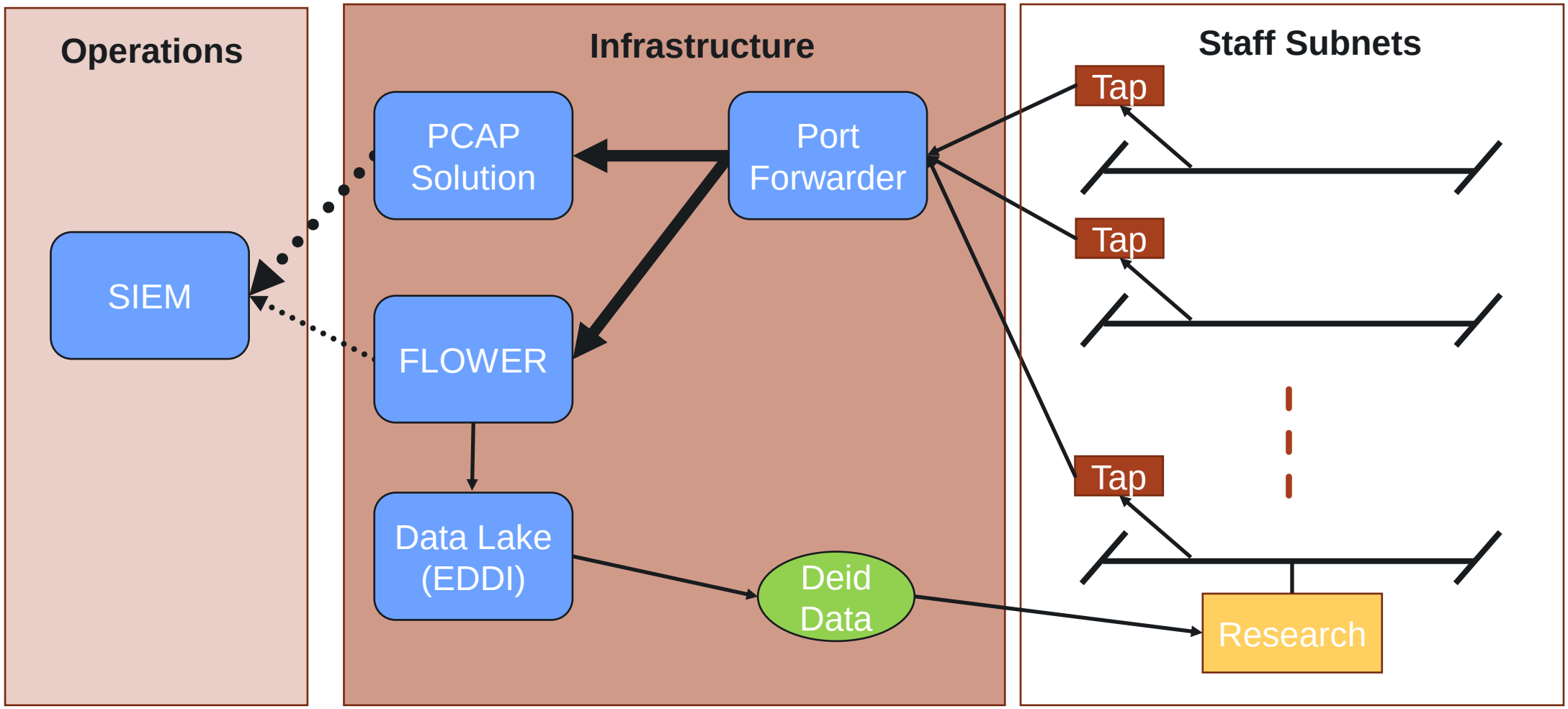
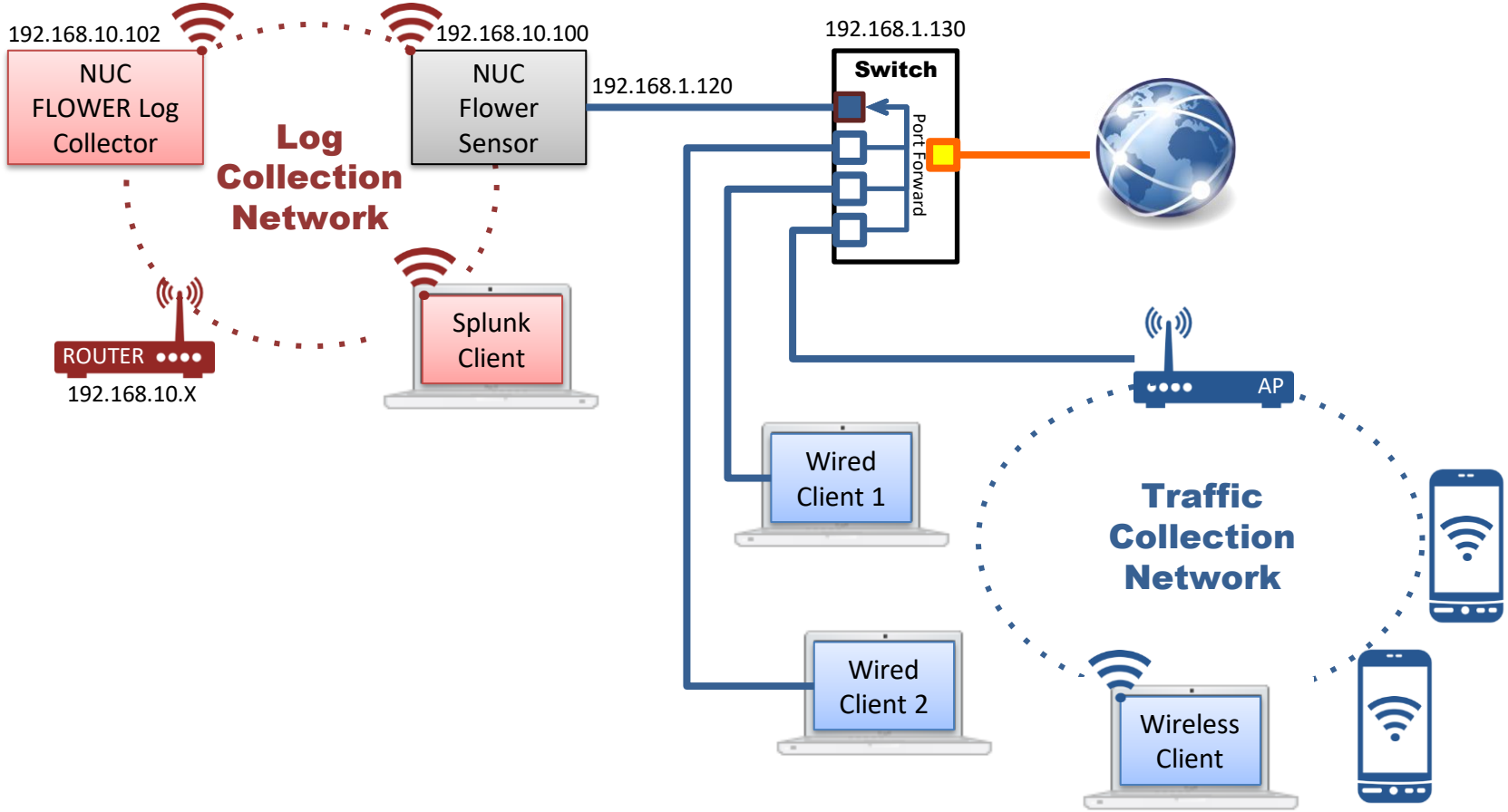
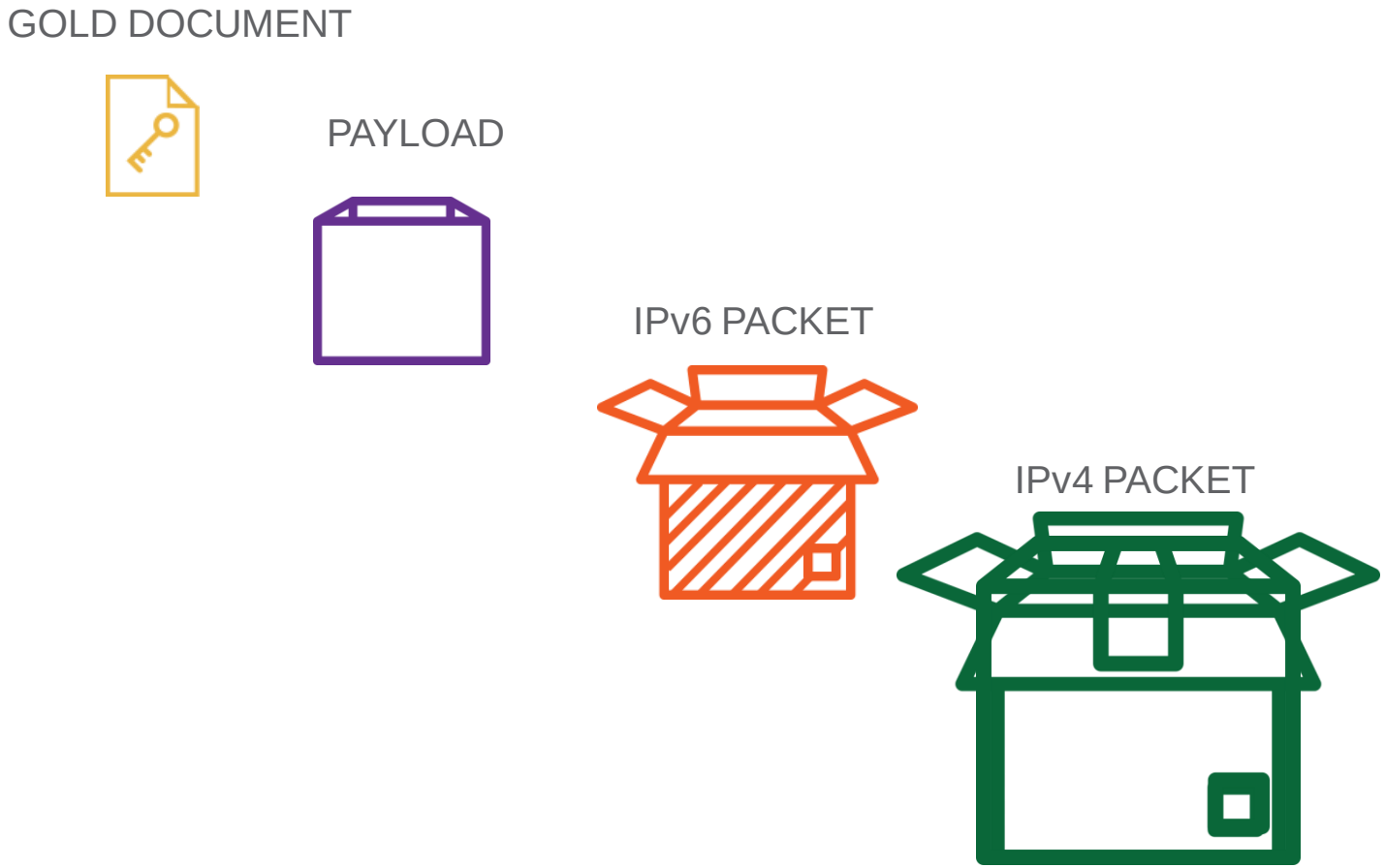
Enterprise Taps



Capture FLOWER Data at Conference

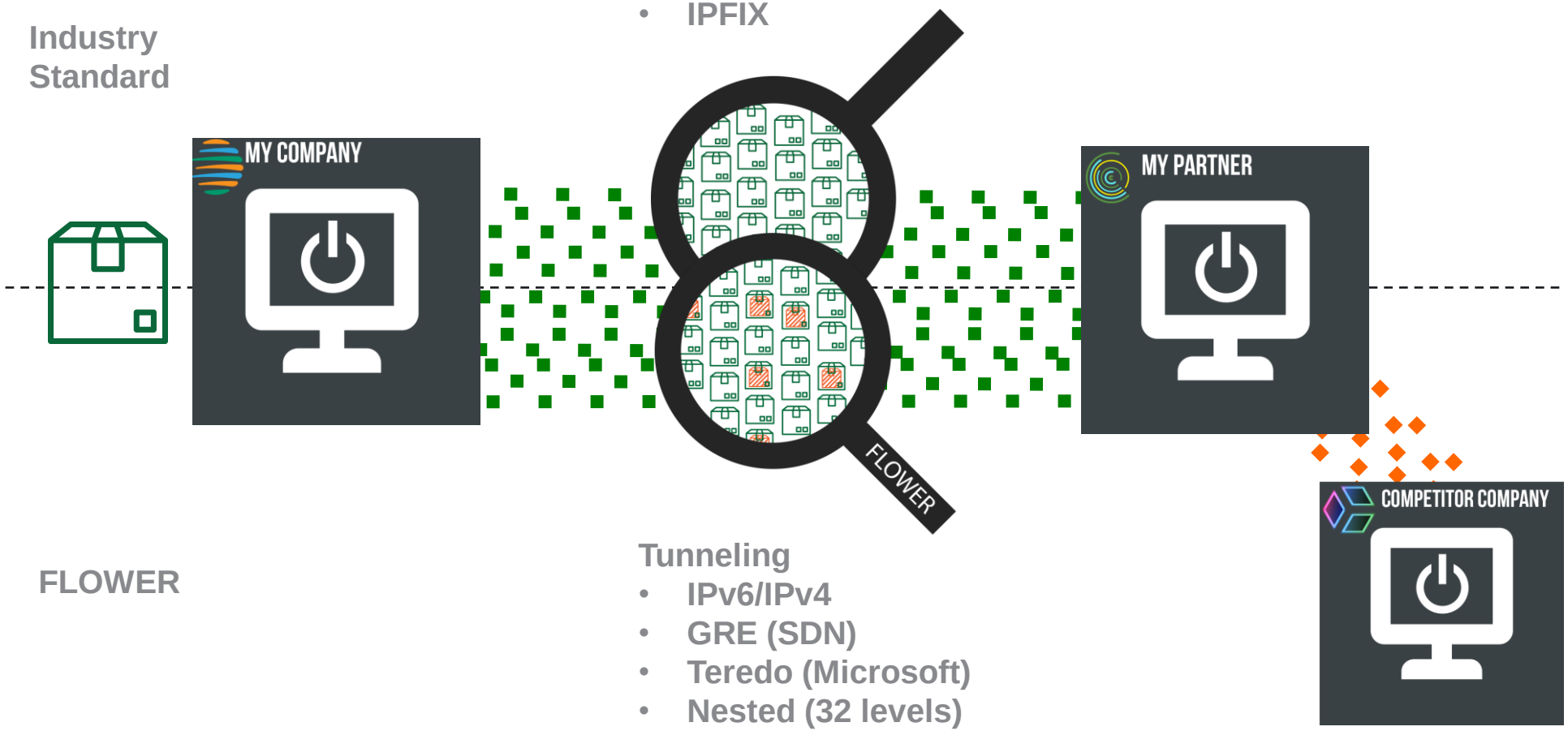


Example: Insider Threat – Data Loss



US-CERT SiLK
SolarWinds
- network flows
- IPFIX

Industry
Standard



FLOWER

Tunneling
- IPv6/IPv4
- GRE (SDN)
- Teredo (Microsoft)
- Nested (32 levels)

Anomaly Detection (RFCs)
VLAN Detection

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Ex: Splunk view of FLOWER Data

Industry Standard

	sTime	eTime	dur	sIP	dIP	sPort	dPort	pro	packets
1	2016/02/15T22:16:12.822	2016/02/15T22:16:12.841	0.019	172.31.28.230	172.31.0.2	46725	53	17	1
2	2016/02/15T22:16:12.841	2016/02/15T22:16:12.841	0.000	172.31.0.2	172.31.28.230	53	46725	17	1
3	2016/02/15T22:16:01.143	2016/02/15T22:16:12.928	11.785	172.31.28.230	216.218.226.238	0	0	41	11
4	2016/02/15T22:16:01.150	2016/02/15T22:16:12.928	11.778	216.218.226.238	172.31.28.230	0	0	41	9

FLOWER

	sTime	eTime	dur	fsIP	fdIP	sPort	dPort	pro	sPackets	dPackets
1	2016/02/15 14:16:01 -0800	2016/02/15 14:16:03 -0800	2.010699					58	3	3
2	2016/02/15 14:16:12 -0800	2016/02/15 14:16:12 -0800	0.019177	172031028230	172031000002	46725	53	17	1	1
3	2016/02/15 14:16:12 -0800	2016/02/15 14:16:12 -0800	0.086099			38832	80	6	8	6

	fsIP6	fdIP6	ICMP_ELF	TCP_ELF	tDepth	tsIP	tdIP	tpro
1	20010470000A08BE0000000000000002	20010470000A08BE0000000000000001	+8000-8100+8000-8100+8000-8100		1	172031028230	216218226238	41
2								
3	20010470000A08BE0000000000000002	2607F8B0400E0C04		+02-12+10+18-10-10-10+10+10-18+10+11-11+10	1	172031028230	216218226238	41