Reinventing ETL for Detection and Response Teams

BSides SF, May 2024, Josh Liburdi

Who, Me? 👋

- 10+ years of industry experience[1]
  - Staff Security Engineer at Brex[2]
  - Previously: Splunk, Target, CrowdStrike, GE
- Working on security data solutions[3] for several years

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[1] Detecting, hunting, responding, consulting, engineering, architecting, and much more that I'd rather forget about.

[2] Warning: Opinions are mine and not representative of my employer or colleagues.

[3] Most closed source, some open source. See my talk from BSides SF 2019 for an example.

WTF is ETL?[4]

[4] ~~Don't worry, your SIEM vendor probably manages this for you.~~
You should be worried if your SIEM vendor manages this for you.

ETL in Brief

Extract

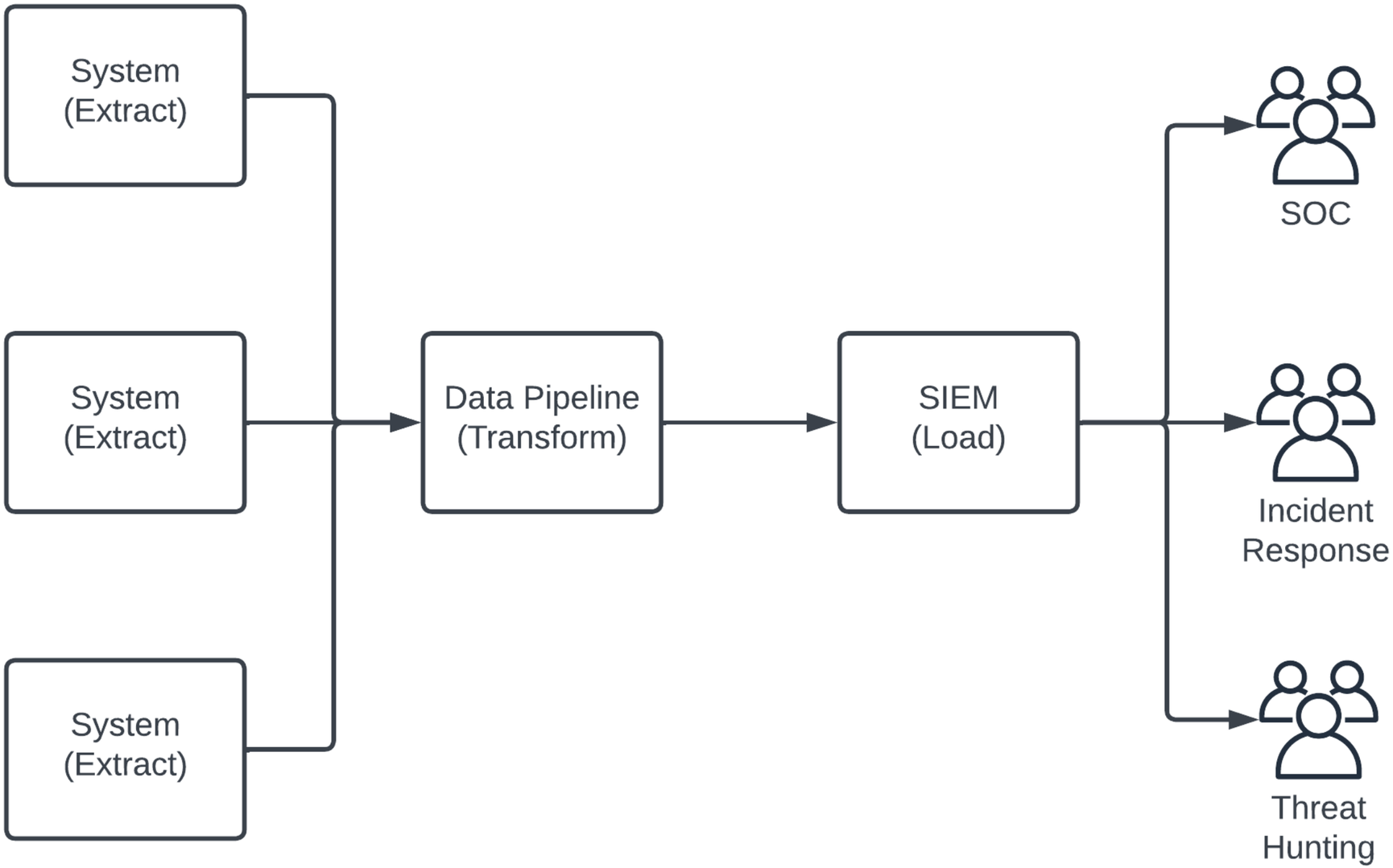
- Pull, receive, sync, read, or capture data

Transform

- Filter, normalize, or enrich data

Load

- Store, visualize, or alert on data


System
(Extract)
System
(Extract)
System
(Extract)
Data Pipeline
(Transform)
SIEM
(Load)
SOC
Incident
Response
Threat
Hunting

ETL Turns *Data* into *Information*

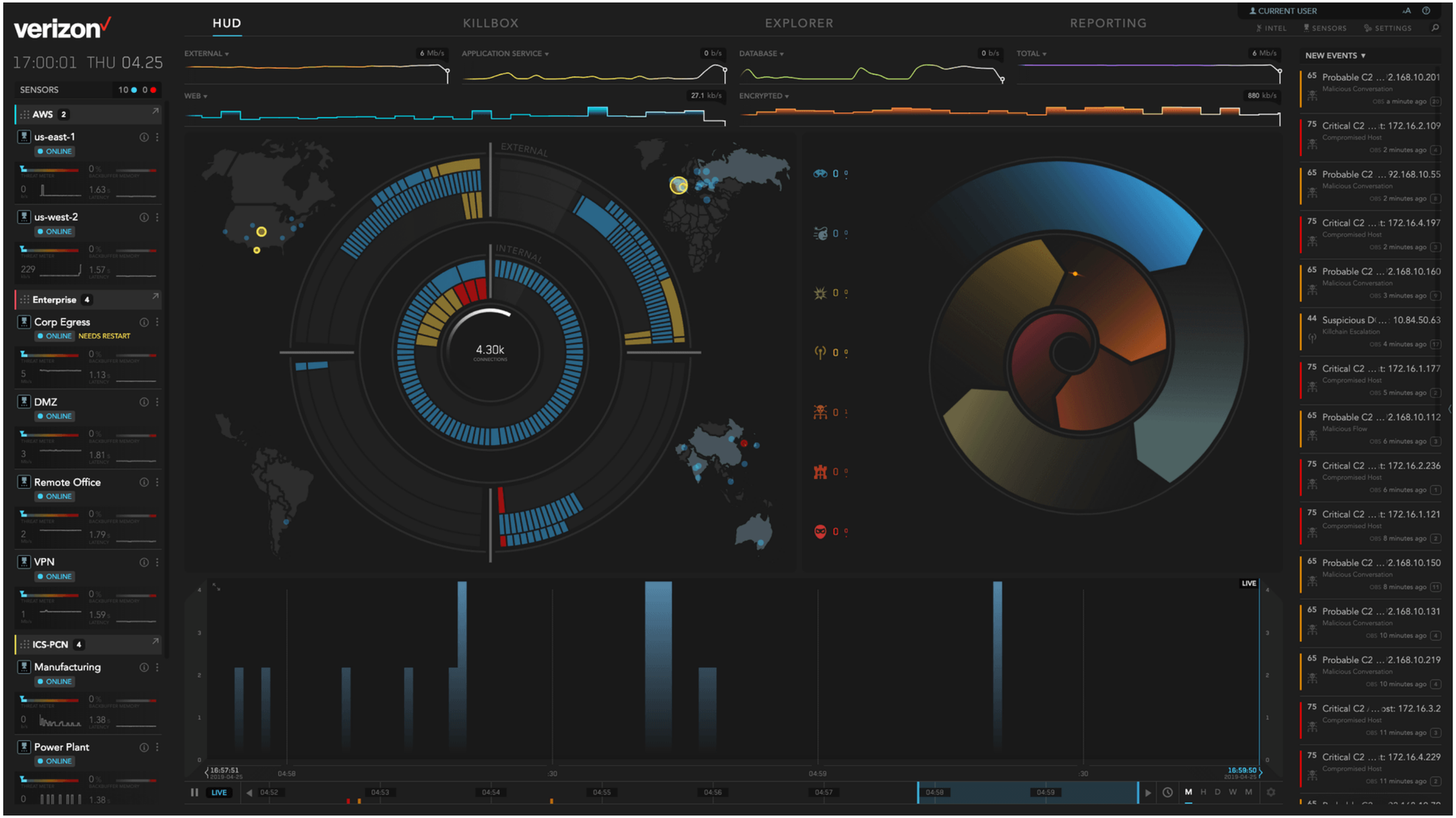
The Current State of Security ETL

```
{
  "LocalAddressIP4": "0.0.0.0",
  "ContextBaseFileName": "Spotify",
  "event_simpleName": "NetworkConnectIP4",
  "ContextTimeStamp": "1714267028.786",
  "ConfigStateHash": "2248159763",
  "ConnectionFlags": "0",
  "ContextProcessId": "339011099229862299",
  "RemotePort": "443",
  "aip": "[REDACTED]",
  "ConfigBuild": "1007.4.0018305.1",
  "event_platform": "Mac",
  "LocalPort": "0",
  "Entitlements": "15",
  "name": "NetworkConnectIP4MacV13",
  "EventOrigin": "1",
  "id": "fb542841-cbea-4323-b62e-1e0b2ac90d07",
  "Protocol": "6",
  "EffectiveTransmissionClass": "3",
  "aid": "[REDACTED]",
  "RemoteAddressIP4": "35.186.224.39",
  "ConnectionDirection": "0",
  "InContext": "0",
  "timestamp": "1714268077295",
  "cid": "[REDACTED]"
}
```

```
{
  "event": { "category": "network", "type": "connection" },
  "host": {
    "id": "[REDACTED]",
    "name": "[REDACTED]",
    "public_ip": "[REDACTED]"
  },
  "process": {
    "command_line": "/Applications/Spotify.app/Contents/MacOS/Spotify",
    "name": "Spotify",
    "pid": "3390110992298622 99",
    "start": "2024-03-06T18:46:21.000000Z"
  },
  "network": { "direction": "outbound", "transport": "tcp" },
  "server": { "ip": "35.186.224.39", "port": 443 },
  "user": {
    "email": "[REDACTED]",
    "roles": ["Sr. Analyst, [REDACTED]"],
    "status": ["[REDACTED]_active"]
  },
  "@timestamp":"2024-04-28T01:47:50.039000Z"
}
```

```
WITH proc AS (
    SELECT TargetProcessId, CommandLine FROM edr WHERE type = 'process_start'
),
host AS (
    SELECT Id, ComputerName FROM edr WHERE type = 'host_online'
),
dvc AS (
    SELECT HostName, UserEmail FROM dvc WHERE type = 'device_checkin'
),
idp AS (
    SELECT UserEmail, Department, Title FROM auth WHERE type = 'user_login'
)
SELECT
    CONCAT(idp.Title, ', ', idp.Department) AS UserRoles,
    COUNT(*) AS NumberOfConnections
FROM
    edr net
JOIN
    proc ON net.ContextProcessId = proc.TargetProcessId
JOIN
    host ON net.Id = host.Id
JOIN
    dvc ON host.ComputerName = dvc.HostName
JOIN
    idp ON dvc.UserEmail = idp.UserEmail
WHERE
    proc.CommandLine LIKE '%/Spotify.app/%'
    AND net.ConnectionDirection = 0
    AND NOT RLIKE(net.RemoteAddressIP4, '^(10\\.|172\\.(1[6-9]|2[0-9]|3[0-1])\\.|192\\.168\\.).*')
    AND net.RemoteAddressIP4 != '0.0.0.0'
    AND dvc.UserEmail IS NOT NULL
    AND idp.Department IS NOT NULL
    AND idp.Title IS NOT NULL
GROUP BY
    idp.Title, idp.Department;
```

```
SELECT
    COUNT(*) AS NumberOfConnections
FROM
    events udm
WHERE
    udm.ProcessCommandLine LIKE '%/Spotify.app/%'
    AND udm.NetworkDirection = 'outbound'
GROUP BY
    udm.UserRoles;
```


verizon
17:00:01 THU 04.25
HUD
KILLBOX
EXPLORER
REPORTING
CURRENT USER
INTEL
SENSORS
SETTINGS
SENSORS 10 0
AWS 2
us-east-1
ONLINE
us-west-2
ONLINE
Enterprise 4
Corp Egress
ONLINE NEEDS RESTART
DMZ
ONLINE
Remote Office
ONLINE
VPN
ONLINE
ICS-PCN 4
Manufacturing
ONLINE
Power Plant
ONLINE
EXTERNAL 6 Mb/s
APPLICATION SERVICE 0 b/s
DATABASE 0 b/s
TOTAL 6 Mb/s
WEB 27.1 kb/s
ENCRYPTED 880 kb/s
EXTERNAL
INTERNAL
4.30k
CONNECTIONS
NEW EVENTS
65 Probable C2 ... 2.168.10.201
Malicious Conversation
75 Critical C2 ... t: 172.16.2.109
Compromised Host
65 Probable C2 ... 92.168.10.55
Malicious Conversation
75 Critical C2 ... t: 172.16.4.197
Compromised Host
65 Probable C2 ... 2.168.10.160
Malicious Conversation
44 Suspicious D... 10.84.50.63
Killchain Escalation
75 Critical C2 ... t: 172.16.1.177
Compromised Host
65 Probable C2 ... 2.168.10.112
Malicious Flow
75 Critical C2 ... t: 172.16.2.236
Compromised Host
75 Critical C2 ... t: 172.16.1.121
Compromised Host
65 Probable C2 ... 2.168.10.150
Malicious Conversation
65 Probable C2 ... 2.168.10.131
Malicious Conversation
65 Probable C2 ... 2.168.10.219
Malicious Conversation
75 Critical C2 ... ost: 172.16.3.2
Compromised Host
75 Critical C2 ... t: 172.16.4.229
Compromised Host
LIVE
16:57:51
16:59:50
LIVE
M H D W M

The Problem with Security ETL

- Security and audit logs are diverse and have no standards
  - Security Data Quality Rating Scale: 😉 😞 💩 🫠 🤬
- SIEM (et al) are building blocks, not solutions
  - Good for search, OK[5] for storage, bad for analysis
- Increases cognitive load on practitioners
  - Experience and fatigue can lead to inaccurate conclusions

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[5] Ish. Depends on how deep your CFO's pockets are.

Inventing ETL for Detection and Response Teams

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Tenets of Security ETL

1. Data is available when it's needed
2. Data is easy to understand at a glance
3. Data is contextualized and actionable

Tenets of Security ETL (Opinion[6] Ed.)

1. Data is available when it's needed
    - *Federated SIEM is a Band-Aid™ on a third-degree burn*
2. Data is easy to understand at a glance
    - *Unified data models are the standard, not nice to have*
3. Data is contextualized and actionable
    - *Deriving insights from data should be effortless*

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[6] Again: Opinions are mine and not representative of my employer or colleagues.

It would be nice if my data was better, but *is this really a problem*?

— You, right now (probably)

Meet Your New Friend, Data Decay!

...when the data in your database becomes outdated or incorrect due to the time-sensitive nature of the data.

— *6sense*[7]

...the rate of data decay amplifies as already degraded data is being input through disparate processes without governance or attention to detail.

— *Leadspace*[8]

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[7] https://6sense.com/blog/data-decay/

[8] https://www.leadspace.com/blog/data-decay-what-why-and-how/

Decay? In *My* Data?

- Geolocation: 11% of IPs change their city in a week[9]
- Tor: 33% of routers up for less than a week[10]
- Proxies: ~10% daily churn in the largest provider networks[11]
  - Luminati Res. Proxy: 8,100,000+ active IPs, 11% daily churn
  - OxyLabs Proxy: 5,100,000+ active IPs, 9% daily churn

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[9] https://ipinfo.io/blog/how-many-ips-change-geolocation-over-a-year/

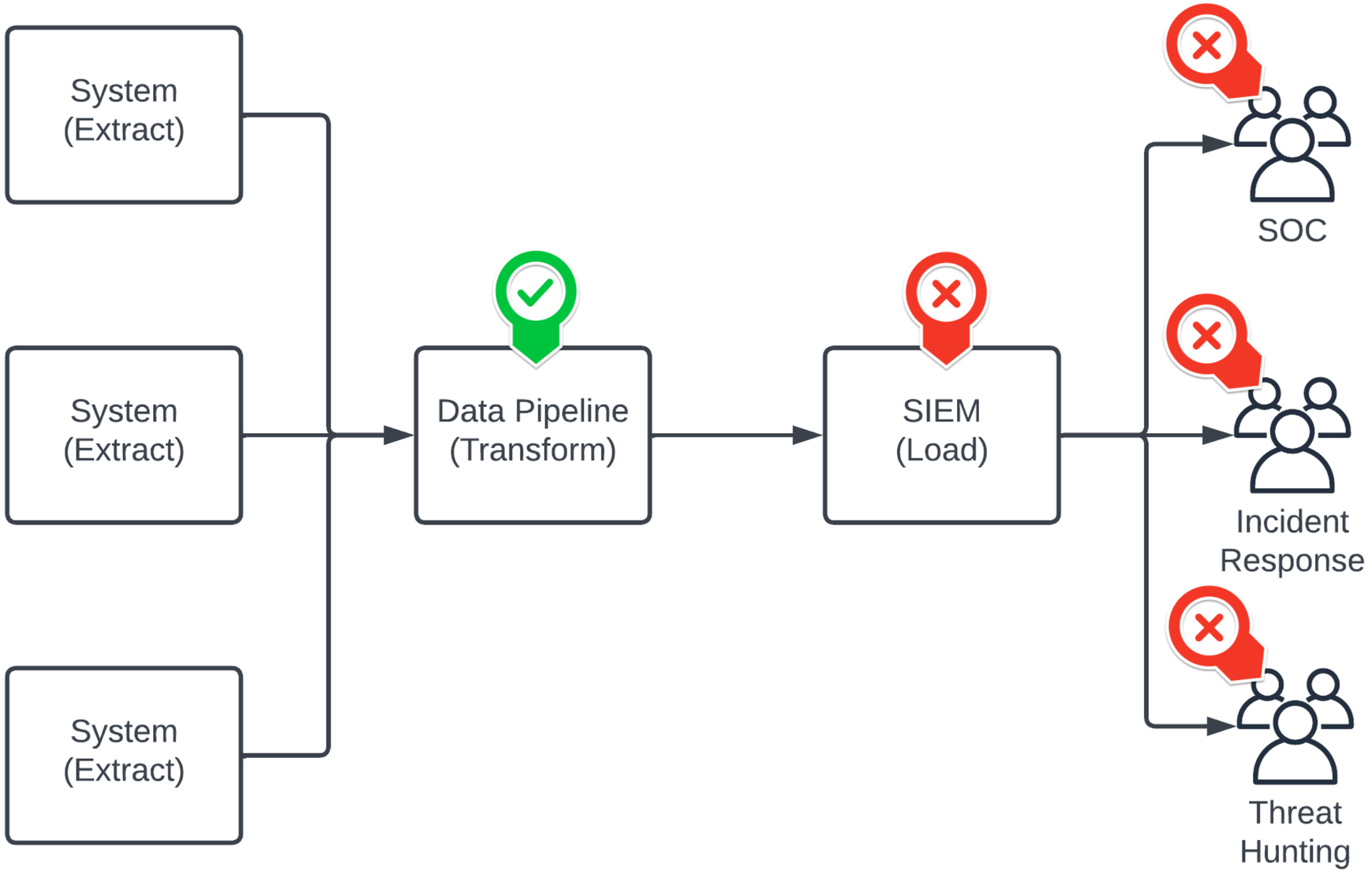
[10] https://torstatus.rueckgr.at/index.php?SR=Uptime&SO=Desc

[11] https://spur.us/

But Wait, There's More[12]...

- BGP Routing / ASN
- DNS Records
- WHOIS
- Domain Rank
- URL Reputation
- Open Services / Ports
- Cloud Resources
- User Groups / Roles
- Anti-Virus Results
- File Integrity
- Vulnerabilities
- Threat Intelligence

[12] And more, but I ran out of space on this slide.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Substation[13] from Brex

- Security analytics and data pipeline toolkit for the cloud
- Open source for 2+ years, used in production (AWS) for 3+ years
  - Billions of events and terabytes of data processed each day
  - Less than 1 hour of maintenance each week[14]
  - Costs a few cents per GB[15] of data processed

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[13] https://github.com/brexhq/substation

[14] Usually it's zero, but YMMV.

[15] This is *all AWS spend*.

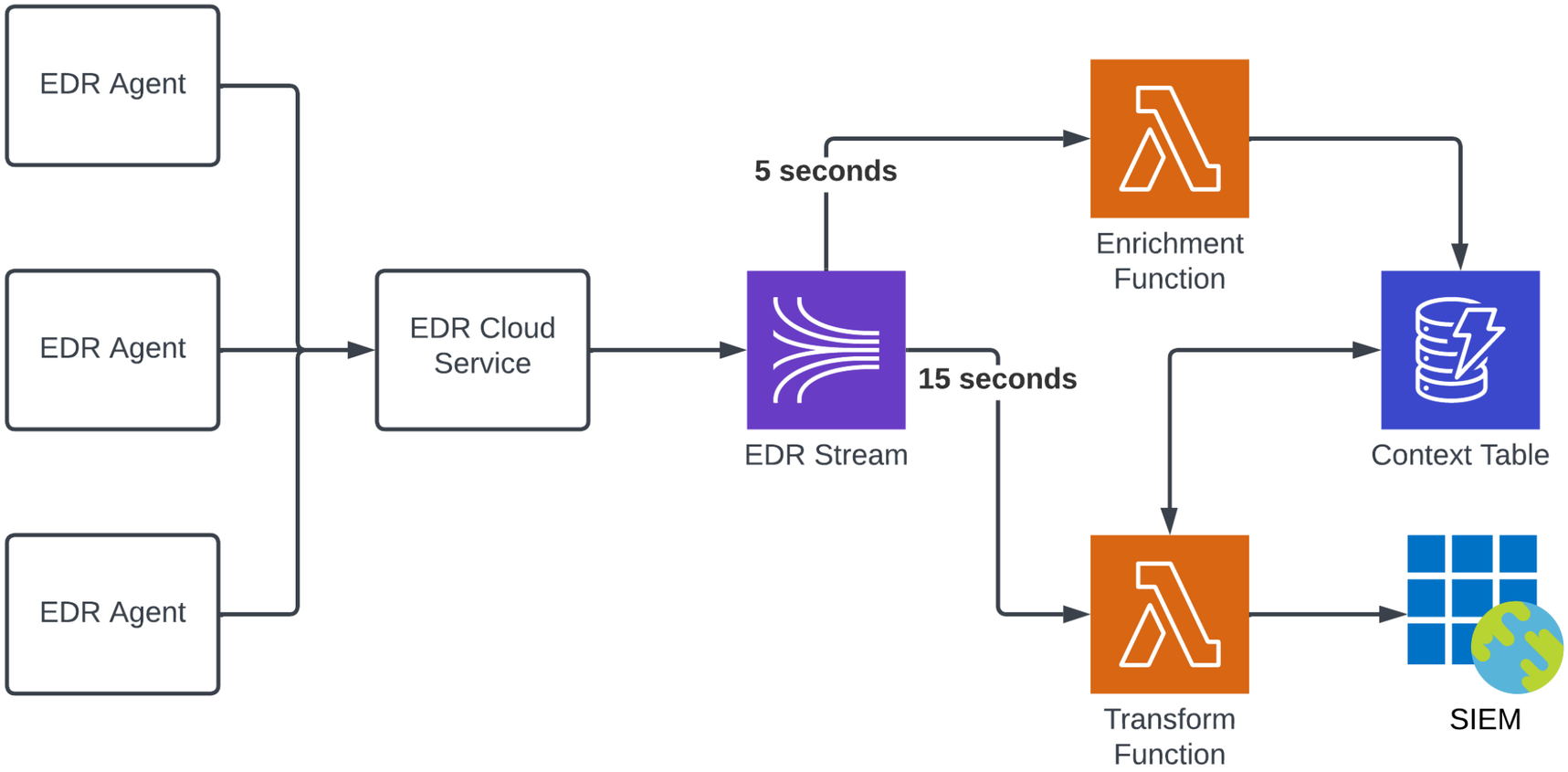
Substation Use Cases[16] and Examples

- Route data to / from almost anywhere (cloud & on-prem)
- Normalize data to any schema, open or proprietary
- Enrich data with asset, identity, and threat context
- S3, Kinesis, SQS, SIEM, HTTP, local files, and more
- Model event data to OCSF with optional validation
- Static lookups, dynamic lookups, real-time lookups

[16] These capabilities are table stakes for modern detection and response teams.

Let's Look at Some Foundational ETL Solutions You Won't See at RSA

Introducing... the Time Travel Pattern!



Before & After Time Travel


```
{
  "event": { "category": "network", "type": "connection" },
  "process": {
    "name": "Spotify",
    "pid": "339011099229862299"
  },
  "server": { "ip": "35.186.224.39", "port": 443 },
  "@timestamp":"2024-04-28T01:47:50.039000Z"
}
```



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{
  "event": { "category": "network", "type": "connection" },
  "process": {
    "command_line": "/Applications/Spotify.app/Contents/MacOS/Spotify",
    "name": "Spotify",
    "pid": "339011099229862299",
    "start": "2024-03-06T18:46:21.000000Z",
    "parent": {
      "command_line": "/usr/libexec/runningboardd",
      "name": "runningboardd",
      "pid": "338971324198273501",
      "start": "2024-03-06T18:17:49.000000Z",
      "parent": {
        "command_line": "/sbin/launchd",
        "name": "launchd",
        "pid": "338053280202314993",
        "start": "2024-03-06T18:17:45.000000Z"
      }
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  "@timestamp":"2024-04-28T01:47:50.039000Z"
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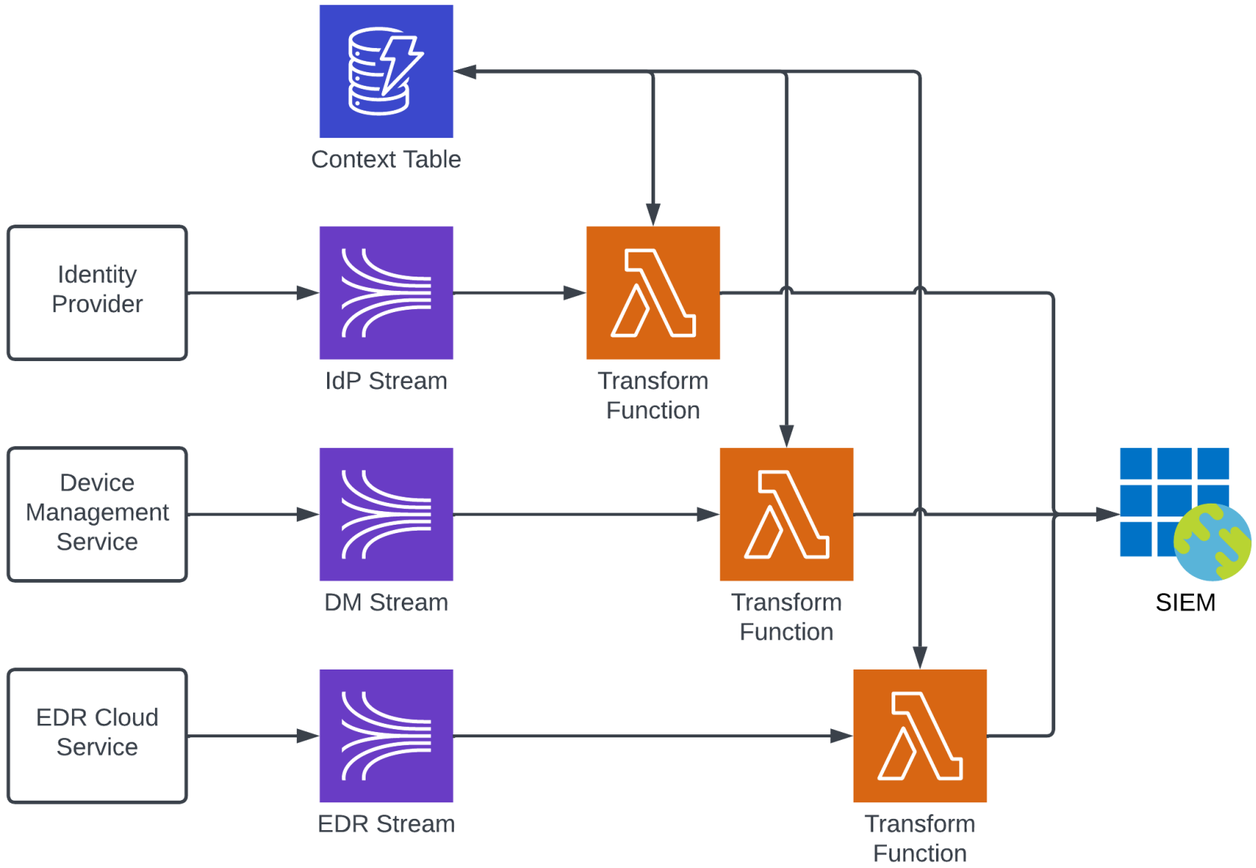
```

Introducing... the Telephone Pattern!



Before & After Telephone


```
{
  "event": { "category": "network", "type": "connection" },
  "host": {
    "id": "eb67b0b6a1d04086b75ee38d02018a10",
  },
  "process": {
    "name": "Spotify",
    "pid": "339011099229862299"
  },
  "server": { "ip": "35.186.224.39", "port": 443 },
}
```

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{
  "event": { "category": "network", "type": "connection" },
  "host": {
    "id": "eb67b0b6a1d04086b75ee38d02018a10",
    "name": "C02TG3H6JGH1"
  },
  "process": {
    "name": "Spotify",
    "pid": "339011099229862299"
  },
  "server": { "ip": "35.186.224.39", "port": 443 },
  "user": {
    "email": "alice@brex.com",
    "roles": ["Manager", "Security", "Engineering"],
    "status": ["idp_active"]
  }
}
```

Before & After Telephone


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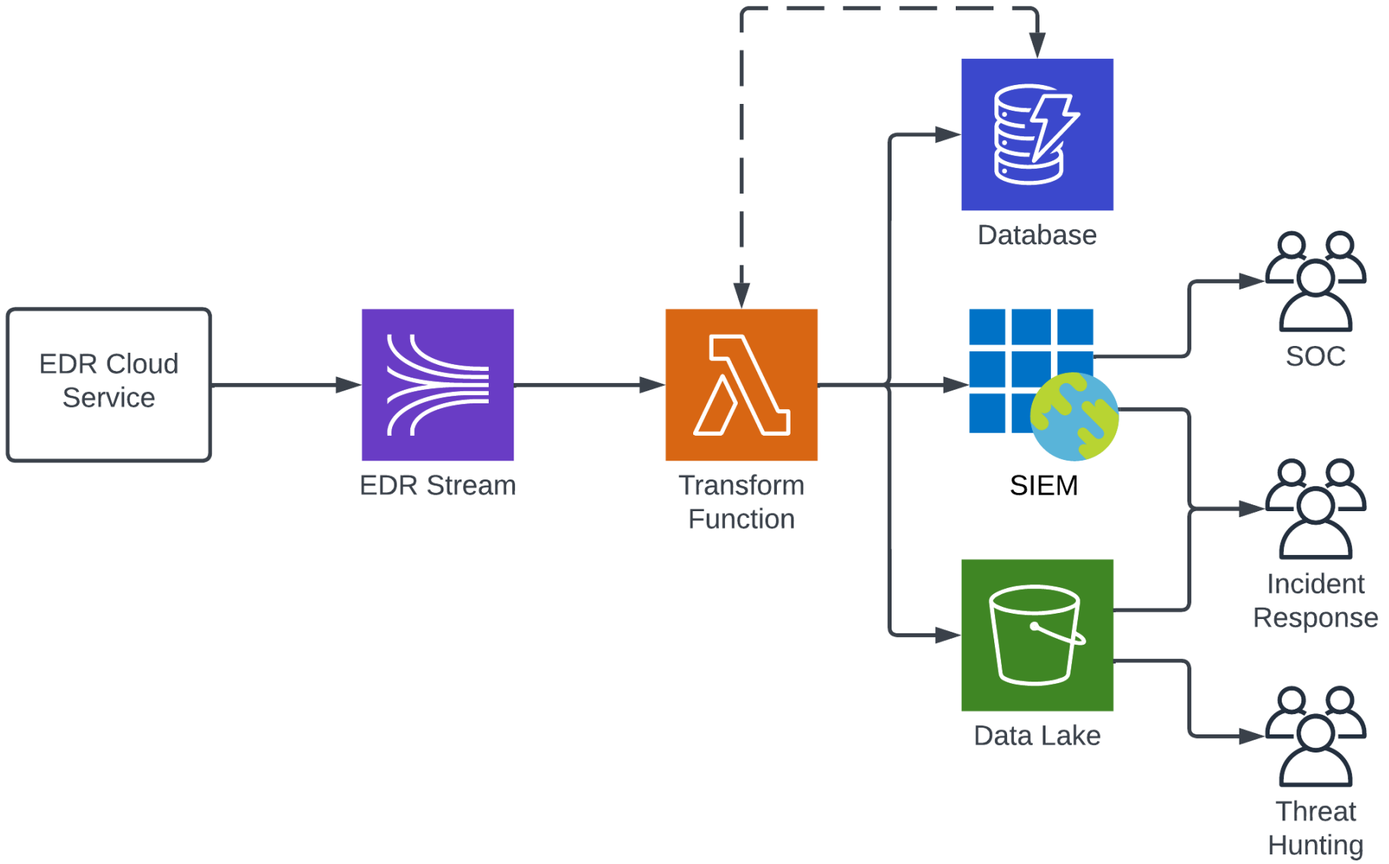
Introducing... the nXDR Pattern!



Before & After nXDR


```
{
  "process": {
    "command_line": "/usr/libexec/security_authtrampoline
      /usr/sbin/installer auth 22 -verboseR -allowUntrusted
      -pkg /private/tmp/xp-6100/epsvcp.pkg -target /",
    "name": "security_authtrampoline",
    "parent": {
      "command_line": "/private/tmp/update_XP-6100
        Series/EPSON.app/Contents/MacOS/EpsonInstaller",
      "name": "EpsonInstaller",
    }
  }
}
```



```
{
  "process": {
    "command_line": "/usr/libexec/security_authtrampoline
      /usr/sbin/installer auth 22 -verboseR -allowUntrusted
      -pkg /private/tmp/xp-6100/epsvcp.pkg -target /",
    "name": "security_authtrampoline",
    "parent": {
      "command_line": "/private/tmp/update_XP-6100
        Series/EPSON.app/Contents/MacOS/EpsonInstaller",
      "name": "EpsonInstaller",
    }
  },
  "threat": {
    "signals": [{
        "description": "Identifies when an authentication prompt
        is generated by the AuthorizationExecuteWithPrivileges API.",
        "name": "privilege_escalation_elevated_execution_with_prompt",
        "references": [
          "objective-see.com/blog/blog_0x2A.html"
        ],
        "risk_score": 73
    }]
  }
}
```

Before & After nXDR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Before & After nXDR


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```

These Solutions, and Dozens More, Can Be Deployed *Right Now* with Substation![17]

```
aws configure && \
make -s check && \
make -s build && \
make -s deploy EXAMPLE=terraform/aws/kinesis/time_travel
```

[17] https://github.com/brexhq/substation#testing

Open Source, Extra Reading, Contact Info

- github.com/brexhq/substation
- medium.com/@jshlbrd
- linkedin.com/in/joshliburdi