What is Signal Fabric?

... to debug, reason and understand dynamic system behavior

in context of system of systems

driven in real time from ingestion to reasoning

across interconnected domains; OSes, apps, devices, services, users

serving multiple personas; engineers, business, marketing, data scientist

by intelligence delivered by AI micro-agents, from generic to domain specific

through connected and directed experiences

at massive scale
Human Scaling

Today is “you get what you look for”. Human capacity determines bounds of explorations. Need to reverse the flow, let the system bring questions prioritized for human attention.
tribal knowledge about system is ephemeral, exists either in fragile heads of engineers or in undiscoverable and unenforceable documents. No long-term memory.

A spike in CPU load on the front-end web service boxes was caused by republishing application frameworks related to an RS3 feature. Since application frameworks are leveraged by some apps on every Win10 device, this republishing uncovered a perf bug/issue which required more CPU cycles than normal for automatic update scans.

The higher volume of requests received by the frontends resulted in increased latency with our Azure Table caching layer and hence that lead to increased concurrency and that lead to increased CPU cycles.
Meaning is Use

A **category** and it’s **meaning** is not some concrete object or mental model, it is **behavior** born out of specific **usage**.

Capturing **user interactions** and **intentions** as users use the system; what they see, use and share, where navigate, when and how act.

Providing us with dynamic **categories** and their **importance** to user, team, organization and track a category **evolution** over time.
Blackboard

... is micro agent computational framework, enabling graph to become reactive.

Allows diverse domain experts to contribute their expertise in low cost way to agent, that can react to changes in representation, make local decision and update representation.

Hosts anything from ML to rules-based agents, using any technology stack.

- Composition
- Adaptive Scheduling
- Explanations
Current

**OBSERVING**
“... able to create metrics and dashboards to observe my component ...”

**UNDERSTANDING**
“... able to reason about the behavior my component in the context of the entire ecosystem ...”

**SIMULATION**
“... able to explore the impact of my component decisions on the entire ecosystem, in silicon ...”

**ACTING**
“... able to describe high level business and engineering goals and the system optimizes in a self regulate manner ...”

---

**LIMITATIONS**

- Data Silos
- Ephemeral Knowledge
- Hardware Scaling
- Telemetry Paradox
- DB Technologies
- Human Scaling

---

**Metrics**
- If-then
- Known Knowns
- Local
- Ad hoc DB queries

**Relationships**
- Feedback loops
- Known Unknowns
- Collective
- Auto Explorations

**Models**
- Dynamic Equilibrium
- Unknown Unknowns
- Simulations & Games
- Massive Experiments

**Acting**
- Self regulating
- Adaptivity
- Generative Designs
Lexi
A SYSTEM FOR DEEP REASONING OVER “THINGS” IN REAL TIME
Agents & Data Flows

Key Signals
- Anomalies
- Patterns

Anomaly Agent
- Frequent Pattern Agent

Usage
- Usage frequency Agent

5/20/2019
Lexi Skills

Experts/Power Users
Habits
Recommendations
Frequently Seen Together
Trending
Personal History
Who’s Looking Now
Top Log Search

Top View for Alert
Views in context of Alert
Key Signals
Anomalies
Historically Correlated
Historically Anomalous Together
Top Used Entities
Signals, Views, Services, Users, Teams, etc.
## Lexi Incident Insights

**45 INCIDENTS FOUND**

- **Only Active**
- **Enable Grouping**

### Search incidents...

These 4 Incidents have occurred together 5 times and are related with medium confidence.

<table>
<thead>
<tr>
<th>MITIGATED</th>
<th>SEVERITY 2</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active from 00:00:12 until</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ACTIVE | SEVERITY 3 | Find correlated incidents |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started at</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These 2 Incidents seem to be the same.

<table>
<thead>
<tr>
<th>MITIGATED</th>
<th>SEVERITY 2</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active from 00:00:12 until</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Drop this incident off the timeline if it doesn't belong to any group**
Lexi Incident Insights

49 INCIDENTS FOUND

Search incidents...

These 4 Incidents have occurred together 5 times and are related with medium confidence.

<table>
<thead>
<tr>
<th>MITIGATED</th>
<th>SEVERITY 2</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active from:</td>
<td>until:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACTIVE</th>
<th>SEVERITY 3</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These 2 Incidents seem to be triggered on the same source.

<table>
<thead>
<tr>
<th>ACTIVE</th>
<th>SEVERITY 3</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This incident does not appear related to any others.

<table>
<thead>
<tr>
<th>ACTIVE</th>
<th>SEVERITY 3</th>
<th>Find correlated incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xpert Alert:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thanks for your feedback. We'll use your info that Incident didn't belong in any groups to help train our algorithm.
Extensibility Platform: Weaver

- Example of Friedman Smoothing as a Transform
Federated signal relationship graph

Types of Relationships:

1. Human-defined
   • Explicit dependency models (service tree, xpert models)
   • Explicitly entered links (IcM Linkages)

2. Observed
   • Agent-discovered topology (dependency agents, distributed tracing)
   • Key signals

3. Learned
   • Algorithmically inferred (correlations, frequent co-occurrence patterns in anomalies, alerts, incidents)
High Level Architecture

Graph **identities**
augmented by **context**
guided by **dynamic ontology**
federated data
stored in **most appropriate storage**
integrated with **ingestion pipeline**

**Bring Your Own** storage, pipeline
and orchestration

glued by **micro agent** computational
**framework**, enabling graph to
become **reactive**.
Simulations & Games

- Executable designs
- Stress large scale, chaos monkey, system invariants, network partitioning, Jepsen tests, FxCop for DS, play with thousands parameters, find bottlenecks and failures, explore flows, what-if, etc
- 1K nodes on single core

Prototype build upon

- **Communicating Sequential Processes**
- **Discreet Event Simulation**
- Async Time Synchronization
  - allows for massive parallelism