🗺️ Topology & Entity Context

> **Series:** OPLOGS | **Notebook:** 6 of 8 | **Created:** December 2025

Leveraging Entity Relationships in Log Analysis

This notebook explores how Dynatrace enriches logs with entity context
(hosts, processes, services, Kubernetes) for topology-aware analysis.

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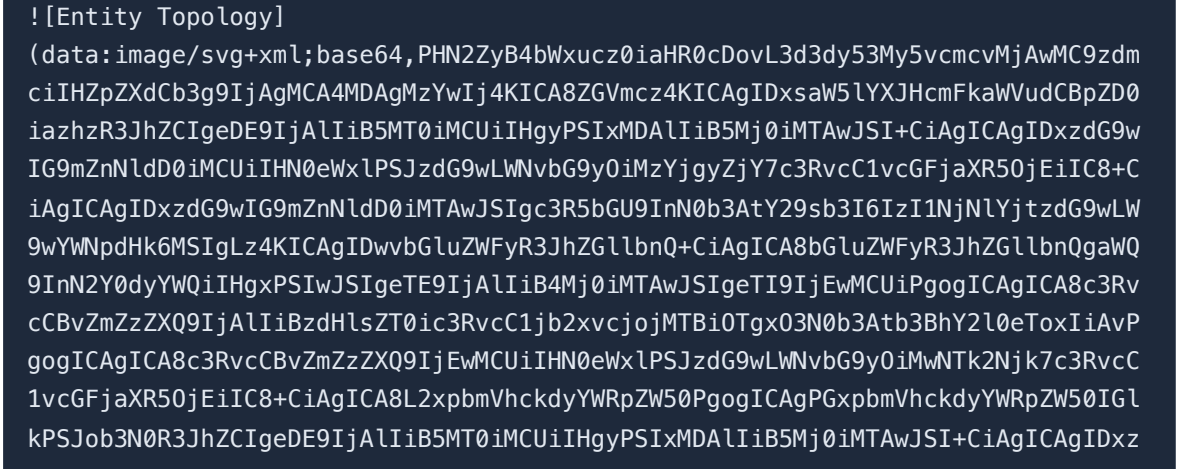
Prerequisites

- ✅ Access to a Dynatrace environment with log data
- ✅ Completed OPLOGS-01 through OPLOGS-05
- ✅ Understanding of Dynatrace entity model (helpful)

1. Entity Types Overview

Dynatrace automatically enriches logs with entity context:



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| Entity Field | Description | Example |
|--------------|-------------|----------|
| `dt.entity.host` | Host entity ID | `HOST-ABC123` |
| `dt.entity.process_group` | Process group ID | `PROCESS_GROUP-XYZ789` |
| `dt.entity.process_group_instance` | PGI ID | `PROCESS_GROUP_INSTANCE-
DEF456` |
| `dt.entity.service` | Service entity ID | `SERVICE-QRS012` |
| `dt.entity.kubernetes_cluster` | K8s cluster ID | `KUBERNETES_CLUSTER-
TUV345` |

### Kubernetes Context Fields

| Field | Description |
|-------|-------------|
| `k8s.namespace.name` | Kubernetes namespace |
| `k8s.pod.name` | Pod name |
| `k8s.pod.uid` | Pod unique identifier |
| `k8s.container.name` | Container name |
| `k8s.cluster.name` | Cluster name |
| `k8s.deployment.name` | Deployment name |
| `k8s.workload.name` | Workload name |
| `k8s.workload.kind` | Workload type (Deployment, StatefulSet, etc.) |

```python
// Discover available entity types in your logs
fetch logs, from: now() - 1h
| summarize {
    total_logs = count(),
    with_host = countIf(isNotNull(dt.entity.host)),
    with_process_group = countIf(isNotNull(dt.entity.process_group)),
```
```

````
    with_service = countIf(isNotNull(dt.entity.service)),
    with_k8s_cluster = countIf(isNotNull(dt.entity.kubernetes_cluster)),
    with_k8s_namespace = countIf(isNotNull(k8s.namespace.name))
  }
```

## 2. Host Topology

Analyze logs by host to understand infrastructure patterns.

```python
// Log volume by host
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.host)
| summarize {log_count = count()}, by: {dt.entity.host}
| sort log_count desc
| limit 15
```

```python
// Error distribution by host
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.host)
| summarize {
    total = count(),
    errors = countIf(loglevel == "ERROR" OR loglevel == "SEVERE")
  }, by: {dt.entity.host}
| fieldsAdd error_rate = (errors * 100.0) / total
| sort errors desc
| limit 15
```

```python
// Host with log.source breakdown
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.host)
| summarize {count = count()}, by: {dt.entity.host, log.source}
| sort count desc
| limit 20
```

## 3. Process Group Topology

Process groups represent logical application components across hosts.

```python
// Logs by process group
fetch logs, from: now() - 1h
````

```
| filter isNotNull(dt.entity.process_group)
| summarize {log_count = count()}, by: {dt.entity.process_group}
| sort log_count desc
| limit 15
```

```python
// Process group error analysis
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.process_group)
| filter loglevel == "ERROR"
| fieldsAdd content_preview = substring(content, from: 0, to: 80)
| summarize {error_count = count()}, by: {dt.entity.process_group,
content_preview}
| sort error_count desc
| limit 20
```

```python
// Process group to host mapping
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.process_group) AND isNotNull(dt.entity.host)
| summarize {count = count()}, by: {dt.entity.process_group, dt.entity.host}
| sort count desc
| limit 20
```

4. Kubernetes Topology

OpenPipeline enriches container logs with rich Kubernetes context.

```python
// Logs by Kubernetes namespace
fetch logs, from: now() - 1h
| filter isNotNull(k8s.namespace.name)
| summarize {log_count = count()}, by: {k8s.namespace.name}
| sort log_count desc
| limit 15
```

```python
// Kubernetes namespace with error breakdown
fetch logs, from: now() - 1h
| filter isNotNull(k8s.namespace.name)
| summarize {
    total = count(),
    errors = countIf(loglevel == "ERROR" OR loglevel == "WARN")
  }, by: {k8s.namespace.name}
```

```
| fieldsAdd error_percentage = round((errors * 100.0) / total, decimals: 2)
| sort errors desc
| limit 10
```

```python
// Pod-level analysis
fetch logs, from: now() - 1h
| filter isNotNull(k8s.pod.name)
| summarize {
    log_count = count(),
    error_count = countIf(loglevel == "ERROR")
  }, by: {k8s.namespace.name, k8s.pod.name}
| sort error_count desc
| limit 20
```

```python
// Workload analysis (Deployments, StatefulSets, etc.)
fetch logs, from: now() - 1h
| filter isNotNull(k8s.workload.name)
| summarize {
    log_count = count(),
    unique_pods = countDistinct(k8s.pod.name)
  }, by: {k8s.namespace.name, k8s.workload.kind, k8s.workload.name}
| sort log_count desc
| limit 15
```

```python
// Container-level detail
fetch logs, from: now() - 1h
| filter isNotNull(k8s.container.name)
| summarize {log_count = count()}, by: {k8s.namespace.name, k8s.pod.name,
k8s.container.name}
| sort log_count desc
| limit 20
```

5. Service Mapping

Connect logs to Dynatrace-detected services for full observability.

```python
// Logs by service entity
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.service)
| summarize {log_count = count()}, by: {dt.entity.service}
```

```
| sort log_count desc
| limit 15
```

```python
// Service error rates from logs
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.service)
| summarize {
    total = count(),
    errors = countIf(loglevel == "ERROR")
  }, by: {dt.entity.service}
| fieldsAdd error_rate = round((errors * 100.0) / total, decimals: 2)
| sort error_rate desc
| limit 15
```

```python
// Service to process group relationship
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.service) AND isNotNull(dt.entity.process_group)
| summarize {count = count()}, by: {dt.entity.service,
dt.entity.process_group}
| sort count desc
| limit 20
```

6. Cross-Entity Correlation

Use entity context to correlate logs across the topology.

```python
// Full topology view: Cluster > Namespace > Pod > Container
fetch logs, from: now() - 1h
| filter isNotNull(k8s.cluster.name)
| summarize {log_count = count()}, by: {
    k8s.cluster.name,
    k8s.namespace.name,
    k8s.workload.name,
    k8s.pod.name
  }
| sort log_count desc
| limit 25
```

```python
// Entity coverage report
fetch logs, from: now() - 1h
```

```
| summarize {
    total_logs = count(),
    host_coverage = round((countIf(isNotNull(dt.entity.host)) * 100.0) /
count(), decimals: 1),
    pg_coverage = round((countIf(isNotNull(dt.entity.process_group)) * 100.0)
/ count(), decimals: 1),
    service_coverage = round((countIf(isNotNull(dt.entity.service)) * 100.0)
/ count(), decimals: 1),
    k8s_coverage = round((countIf(isNotNull(k8s.namespace.name)) * 100.0) /
count(), decimals: 1)
  }
```

```python
// Logs without entity context (potential configuration issue)
fetch logs, from: now() - 1h
| filter isNull(dt.entity.host) AND isNull(dt.entity.process_group)
| summarize {orphan_count = count()}, by: {dt.openpipeline.source}
| sort orphan_count desc
```

```python
// Trace correlation: Logs with trace context
fetch logs, from: now() - 1h
| filter isNotNull(trace_id) OR isNotNull(span_id)
| summarize {
    logs_with_trace = count(),
    unique_traces = countDistinct(trace_id)
  }, by: {k8s.namespace.name}
| sort logs_with_trace desc
| limit 10
```

7. Using Entity IDs for Lookups

Entity IDs enable cross-data-type correlation.

```python
// Get distinct entity IDs for a namespace
fetch logs, from: now() - 1h
| filter k8s.namespace.name == "hipstershop"
| summarize {
    unique_hosts = collectDistinct(dt.entity.host),
    unique_pgs = collectDistinct(dt.entity.process_group),
    unique_services = collectDistinct(dt.entity.service)
  }
```

```python
// Find logs for a specific entity (replace with actual entity ID)
// fetch logs, from: now() - 1h
// | filter dt.entity.host == "HOST-XXXXXX"
// | summarize {count = count()}, by: {loglevel}

// Discovery query to find entity IDs
fetch logs, from: now() - 1h
| filter isNotNull(dt.entity.host)
| summarize {sample = takeFirst(dt.entity.host)}, by: {k8s.namespace.name}
| limit 10
```

8. Topology-Based Alerting Patterns

Use entity context to create meaningful alert conditions.

```python
// Alert pattern: Errors per namespace (for threshold alerting)
fetch logs, from: now() - 15m
| filter loglevel == "ERROR"
| summarize {error_count = count()}, by: {k8s.namespace.name}
| filter error_count > 10
| sort error_count desc
```

```python
// Alert pattern: Hosts with high error rate
fetch logs, from: now() - 15m
| filter isNotNull(dt.entity.host)
| summarize {
    total = count(),
    errors = countIf(loglevel == "ERROR")
  }, by: {dt.entity.host}
| filter total > 100  // Minimum sample size
| fieldsAdd error_rate = (errors * 100.0) / total
| filter error_rate > 5  // Alert if >5% errors
| sort error_rate desc
```

```python
// Alert pattern: Pod restarts (look for startup patterns)
fetch logs, from: now() - 1h
| filter contains(content, "started") OR contains(content, "initializing")
| filter isNotNull(k8s.pod.name)
| summarize {startup_count = count()}, by: {k8s.namespace.name, k8s.pod.name}
| filter startup_count > 3  // More than 3 starts in 1h = potential crash
loop
```

```
| sort startup_count desc
```

📝 Summary

In this notebook, you learned:

✅ **Entity types** - HOST, PROCESS_GROUP, SERVICE, KUBERNETES_CLUSTER
✅ **Host topology** - Log volume and errors by host
✅ **Process groups** - Application component analysis
✅ **Kubernetes context** - Namespace, pod, workload, container
✅ **Service mapping** - Connecting logs to detected services
✅ **Cross-entity correlation** - Full topology views
✅ **Alerting patterns** - Threshold-based topology alerts

➡️ Next Steps

Continue to **OPLOGS-07: Analytics & Dashboards** for aggregation and visualization patterns.

📚 References

- [Dynatrace Entity Model](https://docs.dynatrace.com/docs/platform/grail/dynatrace-query-language/dql-guide/dql-entities)
- [Kubernetes Monitoring](https://docs.dynatrace.com/docs/shortlink/kubernetes-monitoring)
- [Log Enrichment](https://docs.dynatrace.com/docs/observe-and-explore/logs/log-management-and-analytics/lma-log-enrichment)