Telemetry –
the foundation of intelligent cloud orchestration.

Joe Butler,
Principal Engineer, Director Cloud Services Lab.

http://sched.co/1xj2LM9
Datacenter Trends and Challenges

- **50% Reduction in Compute Costs Every 2 Years**
- **2x Data Volume Every 18 Months**
- **2x Application Growth Every 2 Years**
- **2x Operational Costs Every 8 Years**
- **8x Increase in Management & Administration**

**Challenge - Decrease Operational Costs, with Increasing Scale and Consistent Performance**

1 – IDC Directions '14 – 2014
Orchestration – Business View

- Capacity Planning
- Workload Initial Placement
- Telemetry & Metering
- Re-balancing
- Billing/ Showback

- Fast, Simple policies, workload placement
- View of Service usage
- Optimize Cost, Minimize SLA violations
- Tuning Parameters
How do I ..

- Maximise advantage of capacity?
- Maximise efficiency of current resources?
- Optimise Workload placement?
- Best match services to platform ingredients?

automatically, and at scale.

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<th>TCO</th>
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Step back, there’s a lot going on.

- Complex,
- Multiple abstractions,
- Points of indirection,
- Blind spots.
LEARN

COLLECT

WATCH

DECIDE

ACT

APP

SERVER / STORAGE / NETWORK

LEARN

LEARN

LEARN

LEARN
Introducing Apex Lake

Framework & environment for research and PoC. Integrating Orchestration Research. Reference for collaboration. Not a product!
Watcher
Increasing Perspective

App/Service Metrics
Linux* top, iostat, mpstat, sar,....

HERE BE DRAGONS!
AND GOLD!
Full Stack Monitoring - ‘Merlin’

[Watcher]

Rich Monitoring & Performance Analysis

Instrument complete stack, in-band, out-of-band

Modular and flexible - dynamic agent reconfiguration

PCM (core/un-core counters)

High-resolution

Low overhead

Scalable
When 100% cpu_util not really 100%

[Watcher]

Filling the gap between SAR and vTune:
- PCM - Core / Uncore,
- Mem, IO, Cache,
- OS Scheduler.

Key insights
- High “Task Latency” (tasks ready to run but waiting)
- Very stable but low IPCs, L2/LLC hits (pcm)
- Memory throughput well under theoretical limits for platform (~40Gbit/Sec)
- Queries hitting on all memory NUMA nodes always.

Conclusions
- 40% of cycles spent servicing cold TLBs.
- Effective utilisation really 60%.
- Mem locality critical for efficiency on in-mem databases.
**InfoCore**

[Watcher]

Graph representation of full Software Defined Infrastructure stack

Captures evolving landscape with rich context.

Meta-data support e.g. workload fingerprints

Supports rich interactive visualisations, powerful graph comparison analytics
Orchestration Analytics Engine

[Decider → Actor]

Rich, flexible Analytics Framework

Execute user-defined Workbooks

Plug-in architecture to connect to any
- Data source e.g. Info Core, Merlin
- Analytics algorithm or engine
- Orchestrator e.g. Heat, OCCI

Example Workbooks
- Querying InfoCore and Merlin
- Covariance analysis
- Machine Learning Algorithms
- Workload fingerprinting
- Sub-graph comparison and service orchestration via OpenStack Heat
Apex Lake

Full Stack Monitoring
Hardware, OS, middleware & services. High res. Low overhead
Rich Data

Fingerprint Workloads
Characterise and Classify Workloads automatically
Classify Workloads

Information Core
Capture Infrastructure and Software Landscape over time
Comprehensive Context

Analytics Engine
Workbooks. Plug-in to arbitrary Data sources, Algorithms, Orchestrators
Analyze and Decide

Orchestrate
Instruct orchestrators
Enhance, Optimise

Intel Labs – Apex Lake
Workloads e.g. Ceph VMs can be co-located, or on different physical nodes.

Which VM Stack topology has best performance?

Adapt existing workloads so they adopt optimal topology.

Automatically.
What next?

Integration and proof-of-concept:
- Policy and SLA awareness,
- Modeling and Classification,
- Service on-boarding.

Collaborative Research:
- Application adaptation,
- Heterogeneity,
- Dev Ops and DSS/Policy tuning.
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Cloud Services Lab
Intel Labs Europe
Open Cloud Computing Interface

http://occi-wg.org/about/

• Protocol and RESTful API for Management Of Cloud Service Resources
• Originally a remote management API for IaaS, PaaS model based Services
• Highly extendible: inclusive of an evolving world of cloud resources
• Continuously Evolving: Monitoring, JSON, SLAs...

20 + Implementations: