

Benjamin Tobler Resumé

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ABOUT

Software engineer working in distributed database & storage systems, networking & virtualization.

AWS [EC2](#) team member from founding, through beta & GA, to \$1Bn ARR service. Owned hypervisor side of EC2 control plane through GA.

Led development of the [AWS VPC](#) control plane & [OCI Virtual Machine Service](#). Led project to enable teams to rapidly build and reliably operate services via automation & templates, guides & examples repository and common libraries.

Designed & implemented zero copy RPC and thread per core (M:N) user mode task & IO scheduling core to provide a high performance platform for [Amazon Aurora](#)'s distributed storage. [Patented](#) novel optimistic concurrency primitives to eliminate transaction aborts due to hot key contention under common workloads.

Designed HSM vendor independent API and [EMV \(Chip & PIN\)](#) verification for financial transaction processing. Implemented 10k connection solution for Java prior to non-blocking IO support.

EDUCATION

M.Sc. Computer Science (Distinction), [Network Security Protocols](#), University of Cape Town, 2005

Awarded [NRF](#) Prestige Scholarship for Masters study

Published in proceedings [IFIP SEC 2004](#) Toulouse (.pdf) & [ISSA 2003](#) Johannesburg (.pdf)

PATENTS

Selected database & virtualization management patents

[US9223843](#), [US9552242](#), [US20170083565](#), [US20210342311](#), [US9055117](#), [US8504691](#), [US8190682](#)

EMPLOYMENT

Oracle Cloud Infrastructure 2016 - 2021, Consulting MTS

Virtual Machine Service

Led the OCI VM offering definition, design & implementation for [OCI](#). Delivered with block storage and virtual network integration (via both VIF and virtio) in ~4 months.

Defined product requirements and implemented proof of concept for [Bring Your Own Image](#) support for VMware, VirtualBox, QEMU and other virtualization products.

Strictly serializable database for control planes

Designed novel ([patent 20210342311](#)) optimistic concurrency primitives (e.g. opaque test-and-increment counters) to eliminate transaction aborts caused by hot key contention under common workload patterns.

Advised client teams on strategies & schema designs for their use cases, e.g. source for cross region replication, and massive fan out metadata to distributed widely scaled out data planes.

Designed (in conjunction with TLA formal verification) and implemented proof of concept for new scalable transactional storage for future scaling and high availability.

Collaborated on design, implementation and deployment of transition to cell architecture to mitigate noisy neighbors and limit operational blast radius.

Amazon Web Services 2005 - 2014, Senior SDE

Amazon Aurora distributed storage

Developed task and IO scheduling core (including zero-copy, vectored IO custom RPC) to provide a platform for the team to develop features that met the ambitious latency and throughput requirements of the storage system. E.g. enabled highly concurrent and low latency messaging for the database engine to massively fan out (striped) writes to distributed storage.

Mentored remote Bay Area team through integration of database engine with distributed storage.

Designing to avoid (and profiled to identify) performance bottlenecks on the fast path. E.g. eliding locks and using suitable data structures and concurrency mechanisms for the M:N threading and partitioning model; Eliminating heap allocations by implementing custom C++ function objects for

callbacks and completions; Custom message buffer vectors to separate user data payloads from headers without copying.

Virtual Private Cloud

Led design and implementation the VPC virtual network management control plane. The system manages VPC customers' network metadata, including network topology maps to physical resources, metadata ACLs, and provides a stream source for distribution to hypervisors.

Collaborated with AWS Linux kernel team on successful effort to improve packet throughput on hypervisors. Achieved by moving source identification logic from control plane agent in user space, to a kernel module.

Extended and maintained the distributed firewall system that implements EC2 instance security groups across all the hypervisors in a data center.

Optimized in-memory representation of VPC network topology and security policy on hypervisors to support massive VPC & EC2 scaling while making efficient use of limited dom0 hypervisor memory.

EC2 from founding, through beta and GA

Designed and implemented the EC2 control plane hypervisor agent. Ran on > 100K physical hosts (and now > 1M hypervisors) to manage the customer virtual machine (EC2 instance) lifecycle. Extended the agent to collaborate with neighboring hypervisors to download and cache boot images from object store service (S3). The improvement allowed fast EC2 instance launches despite limited edge bandwidth (circa private beta launch).

Implemented many internal and public utilities, micro-services and tools for EC2: e.g. command-line AMI packager and up-loader, internal dynamic DNS vendor for EC2 instances and hypervisors, and network rate limiting at hypervisor to prevent noisy neighbor problems.

Helped grow the EC2 team in Seattle by ramping up new team members tasked with developing new EC2 networking and security functionality.