Virtualizing Cloud Data Infrastructures with BRAD

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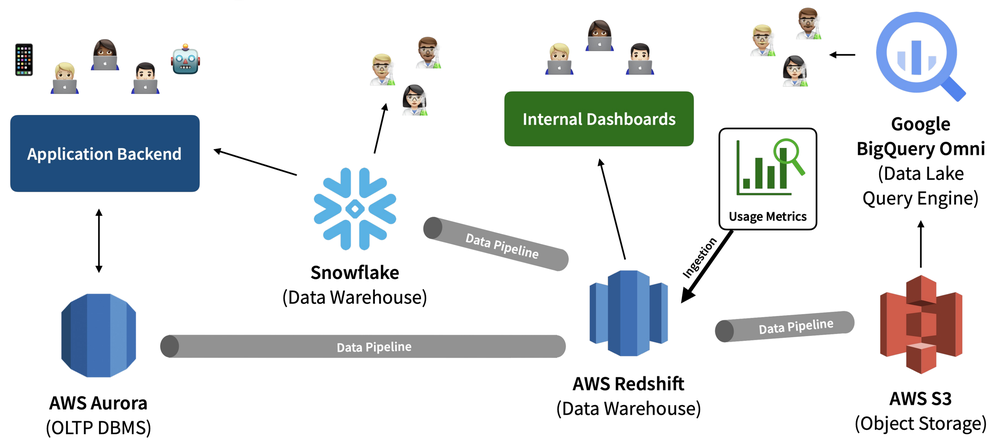
Design data infrastructures by focusing on application data use cases instead of physical infrastructure details

Data infrastructures are hard to design and change

- "One size does not fit all" led to a **plethora of specialized cloud engines** for data workloads
- Application code ends up **tightly coupled** to the physical infrastructure, making it hard to change

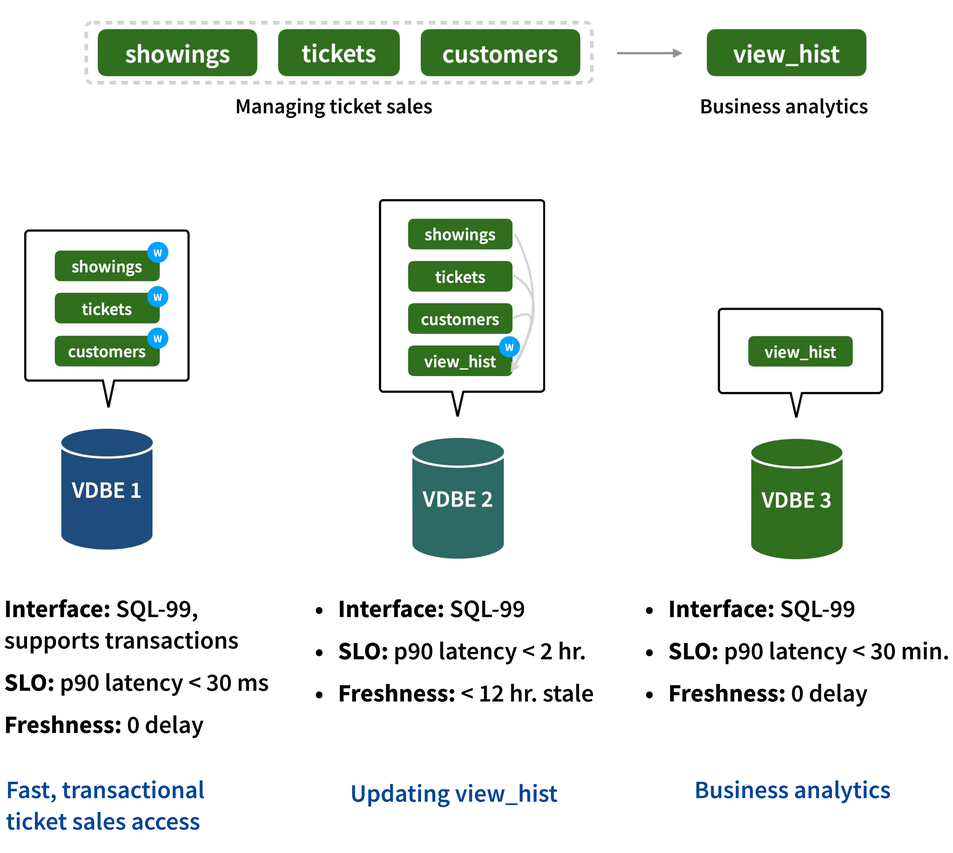


Virtual database engines (VDBEs)

Key idea: Capture the application-specific properties desired in a database engine

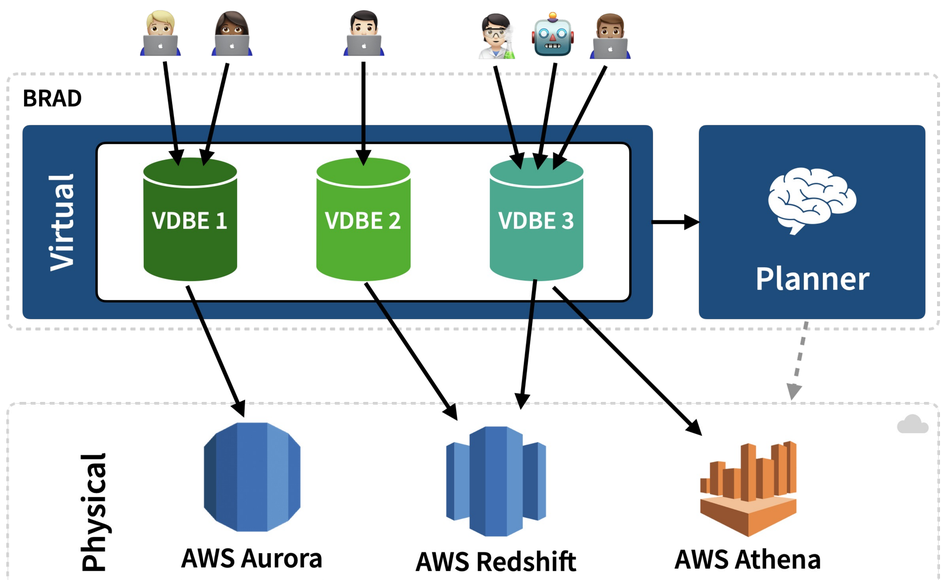
- 🗄️ **Set of tables** (with flag indicating writes)
- 🗣️ **Query interface** (SQL dialect, functionality required)
- 📈 **Performance SLOs** (e.g., p90 latency < 30 seconds)
- 🍃 **Freshness constraint** (VDBE's maximum staleness with respect to writes made to tables by any VDBE)

Key twist: The same table can be present in multiple VDBEs



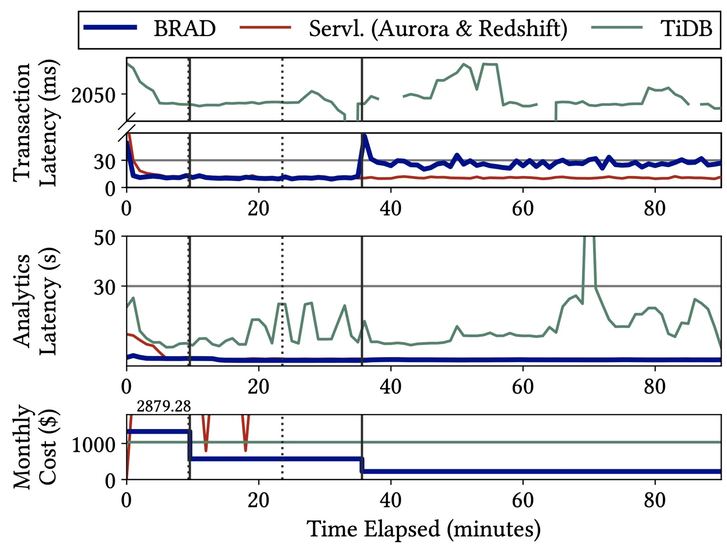
Realizing VDBEs in BRAD

- 🧭 BRAD implements VDBEs, working as **middleware**
- 🔌 BRAD exposes an **endpoint per VDBE**, forwarding queries to physical engines
- 🪄 BRAD **automatically realizes** VDBEs onto physical engines using **cost-based optimization** with **learned models**
- ↔️ Clients are **decoupled** from the physical infrastructure



BRAD optimizing data infrastructures

- BRAD **scales down** an overprovisioned infrastructure (Aurora and Redshift), maintaining SLOs while reducing cost
- Consolidates workload onto Aurora, shutting down Redshift
- Saves **4.6x in cost** over next best baseline (TiDB), **6.0x in cost** over starting physical infrastructure



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