

Environmentally Friendly Storage Architectures

Presenter: Tejas Chopra, Netflix, Inc.

Agenda

- Introduction
- Benefits of energy efficient Storage
- Energy Efficient Storage Technologies
- Storage Architecture Design
- Energy Efficiency in Cloud
- Tools to explore



Introduction

- Sr. Software Engineer, Netflix
- Founder, GoEB1
- TEDx speaker
- Tech 40 under 40 award winner
- ex-Box, Apple, Samsung, Datrium, Cadence



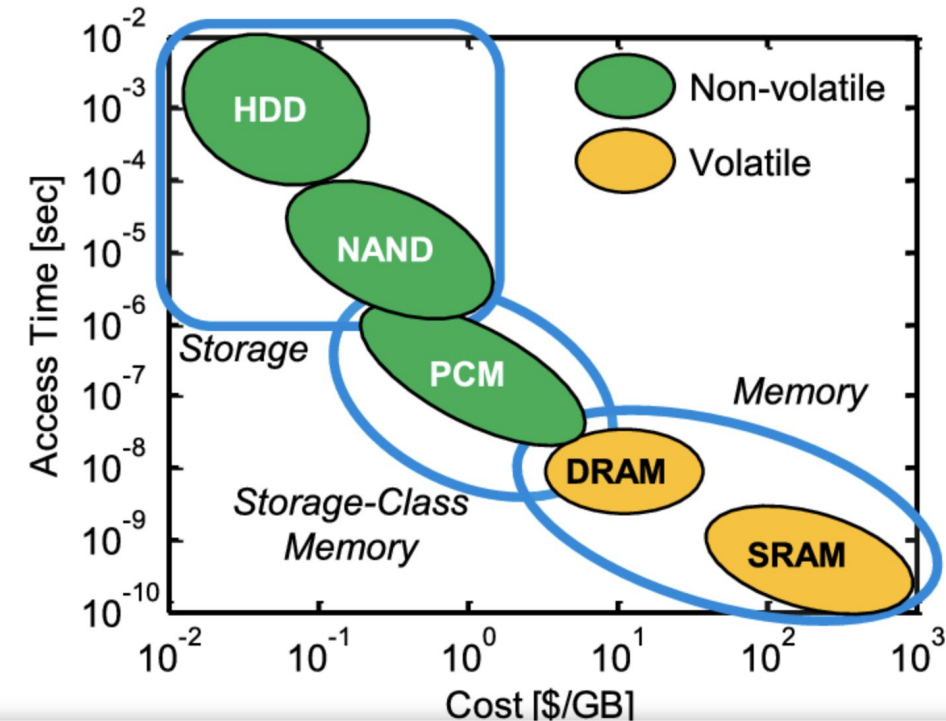
Benefits of Energy Efficient Storage

- Help reduce data centers' operating costs
- Help reduce greenhouse gas emissions
- Increase in data will result in sub-linear increase in energy
- Data centers in US accounted for 1% of country's total electricity consumption: 215 terawatt hours



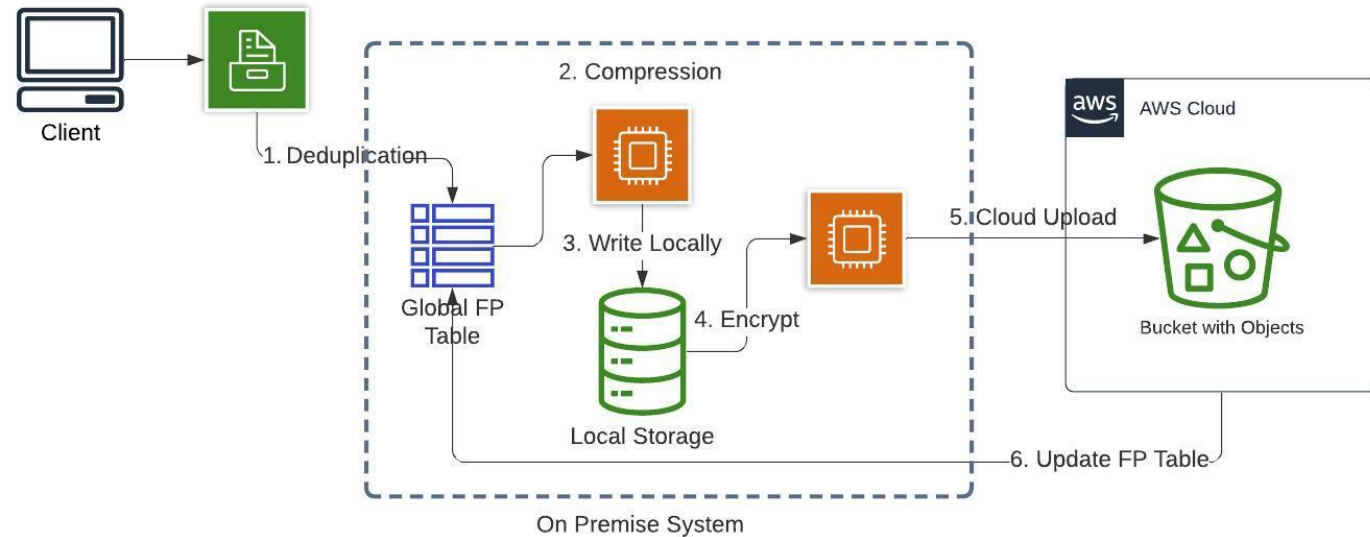
Energy Efficient Storage Technologies

- SSDs
 - No moving parts, less power, 2-3 watts v/s 6-7 watts (HDD)
 - Faster data access
 - 50% less power than HDDs
- PCM
 - Stores data by changing state of material from amorphous to crystalline.
 - Combines speed of DRAM with non-volatility of Flash
 - Faster transfer rates
- MRAM:
 - Magnetic states to store information
 - Do not need constant flow of electricity to retain stored data. Longer lifespan than NAND
- Cost
 - Higher initial costs, so need to be combined with appropriate architecture design



Storage Architecture Design

- Significant energy savings - upto 70%
- Some techniques for saving environment
 - Caching
 - Tiering
 - Compression
 - Deduplication
 - Thin-provisioning
 - Erasure-coding



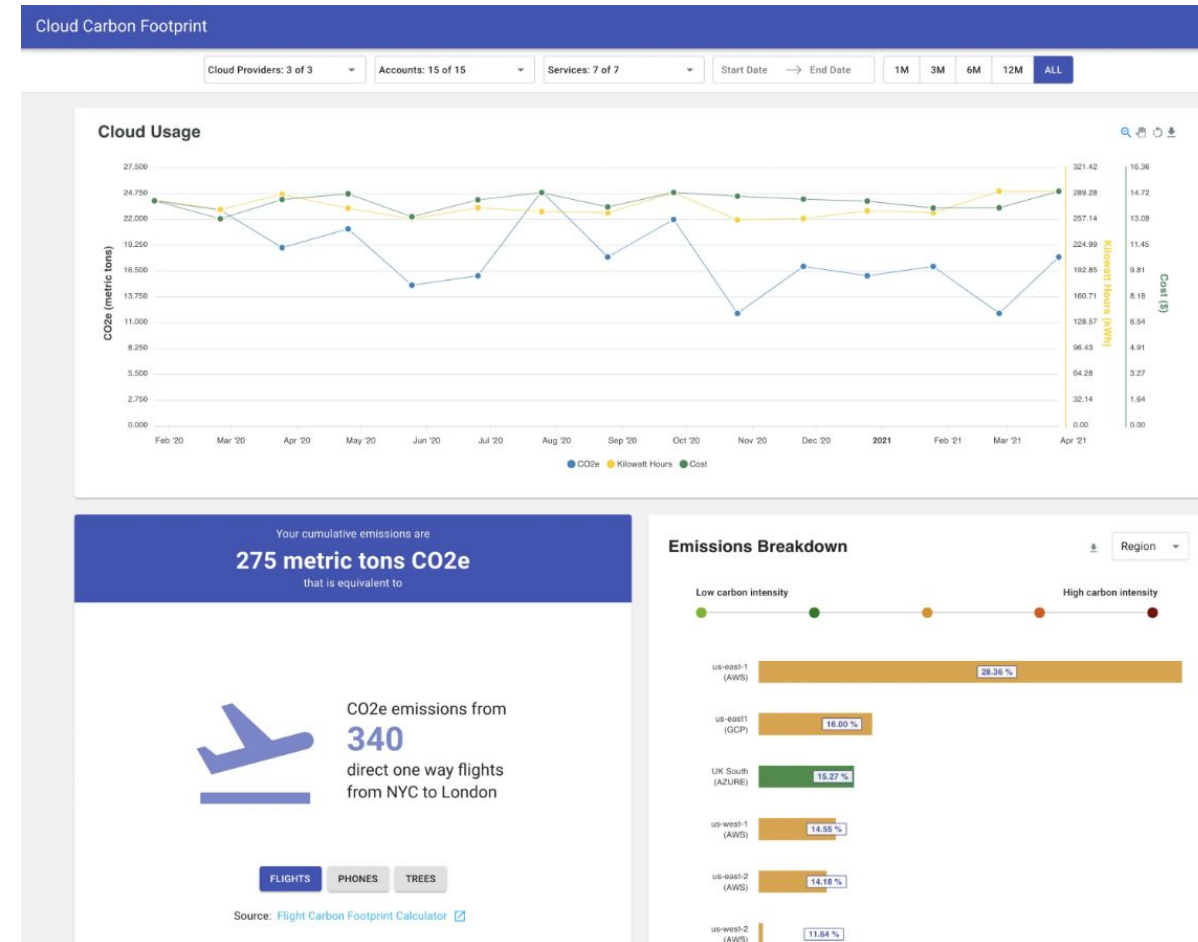
Energy Efficiency in Cloud

- AWS
 - Electric system overhaul - saves 100s of MWH annually
 - ML for cooling which is 40% of data center's energy consumption
 - Relying on renewable energy to power the data center
- Azure
 - Project Natick: Subsea data centers - failure rates of 1/8th of those on land
 - Carbon negative by 2030
- GCP
 - Data centers use 50% less energy
 - Custom servers, voltage regulators that improves power distribution efficiency by 2%



Tools to explore

- Cloud Carbon Footprint (CCF)
- CodeCarbon
- Carbon Diet
- AWS Carbon Footprint Tool
- Microsoft Carbon Impact Dashboard
- Google Carbon Footprint
- Green Software Foundation Carbon Rating



Thank You!

