Platforms in the Cloud

Dan Sanderson, Google
December 4, 2014
Software as a Service (SaaS)
Gmail, Google Docs, NetSuite, SugarCRM

Infrastructure as a Service (IaaS)
Google Compute Engine, Amazon EC2; networking, storage
Software as a Service (SaaS)
  Gmail, Google Docs, NetSuite, SugarCRM

Platform as a Service (PaaS)
  Google App Engine, Heroku, Microsoft Azure

Infrastructure as a Service (IaaS)
  Google Compute Engine, Amazon EC2; networking, storage
All problems in computer science can be solved by another level of indirection.

— David Wheeler
- web applications
- managed servers
- automatic scaling
Why PaaS?
client
server
request

response
Self Hosted

- configuration
- deployments
- OS upgrades, security patches
- hardware failures
- peak provisioning
IaaS / Managed Servers

- configuration
- deployments
- OS upgrades, security patches*
- hardware failures
- peak provisioning*
Google App Engine
Google App Engine

• Easy deployment

• No servers to manage, no OS to update; App Engine does this for you

• Pay for what you use

  • Instance hours, storage, bandwidth, service calls
Google App Engine

- Built on Google infrastructure
- Based on Google’s internal best practices
- Based on standard technologies
App Engine Architecture
Instances and Request Handlers
Instances and Request Handlers

- Request handlers are ephemeral: now you see them, now you don’t
- Can’t rely on data persistence between requests
- Use storage services to persist data
Instances and Request Handlers

- In practice, app initialization is expensive
- An app instance is long running, can handle multiple requests in its lifetime
- Environment initialized; instance memory loaded
- Started and stopped as needed
- Can’t rely on a single user’s session to go to the same instance
Instance

Request handler
Instance

Request handler

...
threading enabled
threading enabled
threading enabled
Runtime Environments

- Sandboxing
- Data isolation
- Performance isolation
- Sandboxing → scalability
Runtime Environments

- Limits
- Request timer
- Restricted access to filesystem, sockets
- More performance isolation: RAM, CPU
- Data sizes: requests, responses, API calls, storage objects
- Limits $\rightarrow$ scalability
Runtime Environments

Python

Java

Go

PHP
Services

- Features with their own scalable infrastructure
- Architecturally distinct from the runtime environments
- Synchronous and asynchronous calling APIs
- Data storage, communication, data processing
Google Cloud Datastore
Google Cloud Datastore

• Scalable object storage

• Based on high-powered key-value storage ("BigTable"); see also "MegaStore"

• Named properties, typed values

• “Schemaless;” data modeling in app code

• Replication using Paxos
Google Cloud Datastore

- entities
- keys: kind, ID, [...]
- properties, typed values
p3 = Player(name='druidjane',
            level=7,
            create_date=now)

p3key = p3.put()
p3key = ndb.Key('Player', 324)
p3 = p3key.get()

if p3.level > 5:
    # ...
class Player(ndb.Model):
    name = ndb.StringProperty()
    level = ndb.IntegerProperty()
    create_date = ndb.DateTimeProperty()

p1 = Player()
p1.level = 7
p1.put()

p2 = Player()
p2.level = 'warrior'  # BadValueError
p2.put()
Google Cloud Datastore

- queries
  - kind (Player)
  - property filters (level > 7), property sort order (creation_date ascending)
- indexes
  - key, property (Player : level)
  - custom indexes
Every query is served by reading rows from an index.

Indexes are updated as data is updated.
Query speed is proportional to the size of the result set, not the size of the data set.
Google Cloud Datastore

- transactions
- local vs. global transactions
- datastore transaction locality = *entity groups*
  - defined by the key
- strong consistency vs. eventual consistency
From PaaS to IaaS
Managed VMs

- automatic scaling
- streamlined runtime
- optimized for small units of computation

- manual scaling
- full virtual machines
- suitable for large units of computation

Managed VMs

- automatic scaling
- full virtual machines
- more flexible software
Google Container Engine (GKE)
Thank you!

cloud.google.com

ae-book.appspot.com

*Programming Google App Engine with Python,* … with Java
Early Access available now

Dan Sanderson
profiles.google.com/
dan.sanderson