Towards a Standard PaaS Implementation API: A Generic Cloud Persistent-Storage API

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Agenda

- Background
- Motivation
- Objective
- Std-PaaS API
- Conclusion and Future Work
Background (1/2)

- Cloud Computing Layers

Different Users

IT Professional

Developer

Business End User

Customizations

Application

Platform

IaaS

PaaS

SaaS

IT Professional

Developer

Business End User

Consumer

Service Provider

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Background (2/2)

- **PaaS**
  - Platform as a Service is a layer above IaaS
  - Platform: Software to develop, test, deploy, and manage software applications.
  - Provides APIs for **implementation** and deployment of cloud applications.
    - Our work is concentrated on Implementation API
  - E.g.,
    - Commercial
    - Open Source
Motivation

- PaaS Heterogeneity.
  - **Vendor Lock-in** problem.
  - Portability and Interoperability problems.
Objective

- Solutions to **vendor Lock-in** problem
  - Standard API.
  - Middleware layer
    - Implemented over the different PaaS platforms.
    - Provide a Generic API.
    - Provide an adapter for each specific PaaS platform.

→Therefore, we propose **Std–PaaS API** as a generic API for implementing portable cloud applications.
Std–PaaS API

- Introduction
- Std–PaaS API Architecture
- Hands on Designing Std–PaaS API
- Implementation Details
- Evaluation
- Detailed Operational Flow
Objective
• Overcomes vendor lock-in problem.

Advantages
• Provides developers with a set of generic service Implementation APIs.
• Write Once and Deploy Many

Middleware layer
• Among Cloud applications and heterogeneous PaaS Platforms.

Generic API
• for cloud Persistent storage service (PSS).
Std–PaaS API Architecture

Arch. Can be extended to include other PaaS platforms

Proprietary Development API

Provides developers with a set of generic implementation API

Std–PaaS API

Cloud Developer

Other PaaS Adapters

GAE Adapter

GAE Development API

Other PaaS Platforms
Generic API for cloud Persistent storage service (PSS)
• Stores large files (BLOB) on cloud.
• Blobs are stored inside a container.

Methodology to Design Generic API
1. Analyzing the vendor-specific PSS API
   • E.g., GAE → Google Cloud Storage (GCS) API
   • Azure → Azure Blob Storage API
2. Comparing between the specific PSS APIs
   • Identifying
     o Semantically common features.
     o Unique features.
3. Identifying the methods of the Generic API
Hands on Designing the Generic PSS API

All these APIs should be implemented by each specific adapter
## Hands on Designing the Generic PSS API

- Hide many specific implementation details:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Azure</th>
<th>GAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uploaded File Name</td>
<td>Blob</td>
<td>Object</td>
</tr>
<tr>
<td>Uploaded File is stored in</td>
<td>Container</td>
<td>Bucket</td>
</tr>
<tr>
<td>Can create Container?</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>Requires Storage Account?</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>Requires file content type?</td>
<td>×</td>
<td>√</td>
</tr>
</tbody>
</table>
A cloud JAVA application has been implemented as a web client
- **Uses** the Std-PaaS Persistent storage API.
- **Aims** to upload files to a cloud persistent storage
  - E.g., GAE and Azure.
- **Has advantage**: written once and deployed on all PaaS platforms that are supported by the Std-PaaS persistent storage API.
- **Import** a specific adapter when deploying to a specific PaaS.
  - E.g., import GAE adapter when deploying to GAE platform.
Detailed Operational Flow

Std-PaaS API Aims to implement portable app. For uploading files to any cloud.

Std-PaaS API Web client for the Cloud Storage Service

Cloud Storage Descriptor:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<tns:persistent_storage_service_manifest xmlns:tns="http://www.example.org/PersistentStorageService">
  <tns:description>this manifest describes a sample of a persistent storage service manifest</tns:description>
  <tns:storage_service_account>
    <tns:account_name>teststdstorage</tns:account_name>
    <tns:account_key>secret account key</tns:account_key>
    <tns:storage_service_account>
      <tns:container_name="mycontainer" provider="Azure"/>
  </tns:storage_service_account>
</tns:persistent_storage_service_manifest>
```

Select File to upload: Browse todayreport.txt
Submit
Detailed Operational Flow

Response Body:
1. succeed in creating & uploading the given file on the URL:
2. http://teststdstorage.blob.core.windows.net/mycontainer/todayreport.txt
Conclusion & Future Work

- **Std–PaaS API**
  - To overcome the **vendor lock-in** problem.
  - Helps developers to implement **generic** cloud applications.
- **1st Step:** Std–PaaS persistent storage API
  - Two adapters: GAE and Azure.
- **Evaluation:** a cloud JAVA application
  - Uses the proposed API
  - Deployed on GAE and Azure
- **Future Work**
  - Uses **semantic ontology** to generate the adapters in an automatic or semi-automatic way.
  - Enrich the Std–PaaS implementation API with more services API
Thanks
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Currently, Std-PaaS API supports two adapters:
- GAE and Azure.
- Maps the Generic API (the previous 5 steps) into a specific PaaS API.

To be extended: only new adapter should be implemented.
<persistent_storage_service_manifest>
  <description>
  this manifest describes a sample of a persistent storage service manifest
  </description>
  <storage_service_account>
    <account_name>myteststore3</account_name>
    <account_key>secret account key</account_key>
  </storage_service_account>
  <container name="mycontainer" provider="Azure"/>
</persistent_storage_service_service_manifest>
Implementation Details

XML Manifest → Configure Storage Service → Create Container

Configure Storage Service:
Creates a container using a specific PaaS API & store it in SST.

Create Container:
Stores the config. Parameters and a container obj.

Storage Service Type:
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XML Manifest ➔ Configure Storage Service ➔ Create Container ➔ Create Blob ➔ Storage Service Type

Uses the given container object to create a blob object and stores it in SST.

Stores, beside others, a blob obj.
Implementation Details

- XML Manifest
- Configure Storage Service
- Storage Service Type
- Create Container
- Create Blob
- Storage Service Type
- Upload Blob
- Storage Service Type

Stores, beside others, a URI of the uploaded blob
Implementation Details

- XML Manifest
- Configure Storage Service
- Create Container
- Storage Service Type
- Create Blob
- Storage Service Type
- Upload Blob
- Storage Service Type
- Access Blob

Uses the given URI to access the blob