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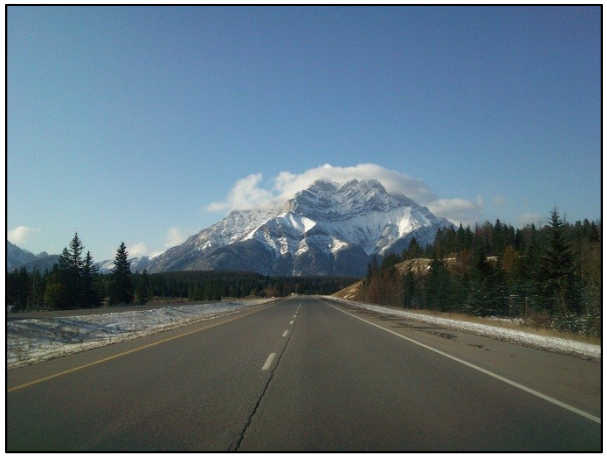
Mobile ***Cloud*** Computing Client

Standards Based Access to Cloud Resources



OGF 27 - Banf

9 November 2011

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Sponsored by DISA's Office of the CTO

Introduction

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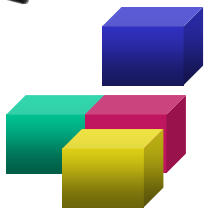
- **Mobile Cloud Client Overview**
  - Mobile *Cloud* Computing Client Defined
  - Overview of Project's Goals and Vision
  - Standards/Specifications Choice
  - Implements Open Cloud Computing Interface (OCCI)
    - Published by Open Grid Forum (OGF)
  - Implements Cloud Data Management Interface (CDMI)
    - Published by Storage Network Industry Association (SNIA)
- **Android Cloud Client Overview**
  - Acts as a cloud management client
  - Details on development published to:
    - http://cloud.r2ad.net

- **Development Overview – APIs**
  - Development Environment
  - Cloud APIs – overview
    - OCCI, CDMI, OpenStack, others



Cloud APIs

Mobile *Cloud* Computing

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- **My Mobile Device acts as a Cloud Terminal**
  - Uses cloud storage and/or runs cloud based applications
  - Client accesses Cloud Services (hopefully using standards)
- **My Data is in the Cloud**
  - My data can be stored in the cloud securely and redundantly
  - Data and applications can also be accessed from other devices.
  - May choose to provide access to family, friends, co-workers, etc.
- **Let the Cloud do a lot of the work**
  - Process data for me faster than I can (i.e. navigation assistance, video/photo processing, language translation, science, business, etc.)
  - Render to me (i.e. streaming, reports, mapping, documents, etc.)
  - Allow me to share my data – collaborate! Socialize!
  - Cloud services become "Client Aware", e.g.: I'm using an Android
- **However, I'm not Always Connected…**
  - Cache data for access data when off-line, applying security best practices
  - synchronize when re-connected
  - If cached on my device, it is also should also be secured

Our Mobile Cloud Client Overview

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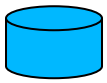
Implemented mobile application to allow management of storage and infrastructure (VMs).

GPS

HTTPS

SQLite Cache



RESTful Invocations

For Example,

Cloud Data

Management Interface (CDMI)

Open Cloud Computing Interface (OCCI)

Cloud Data & Services

IaaS

PaaS

SaaS

Cloud Services built using PaaS or traditional and hosted via IaaS

Today: Android, iPhones, Blackberries, etc.

(multi-core, lots of RAM, multi-sensor)

Powerful COMPUTERS!

Mobile Cloud Client Overview (cont)

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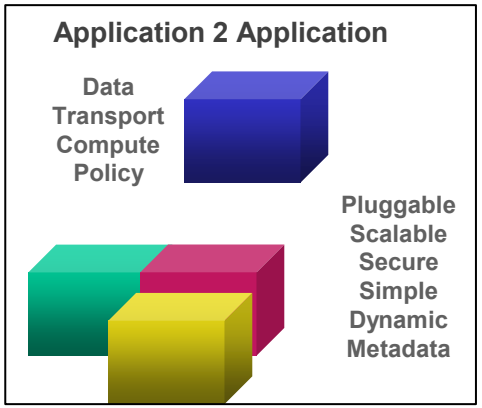
- Cloud Client Implements Two Key Specifications
  - Open Cloud Computing Interface (OCCI)
  - Cloud Data Management Interface (CDMI)
  - Evaluated by NIST Cloud Computing Forum & Workshop
- Porting JavaFX Code to Android
  - Demo/Integrate at Storage Network Industry Association (SNIA) Lab Interops and Distributed Management Task Force (DMTF) Symposium
  - Focusing on:
    - Infrastructure as a Service Management
    - Data Storage
- Share Code on Android Forge.mil
  - Once Finished – publish to GIT hub
  - JavaFX version already uploaded



Standards or Commercial or Both

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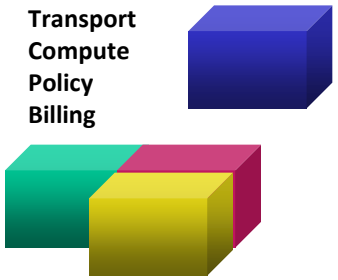
Example Interfaces to Standardize

Data
Transport
Compute
Policy
Billing



Desirable Features

Pluggable
Scalable
Secure
Simple
Dynamic
Metadata
RESTful

Standardized IaaS/PaaS Layer

OCCI | CDMI | OVF | Other Specs

Standardized Approach:

Code Once

Adoption Required

Many Commercial Cloud Providers

- Amazon
- Google
- IBM
- HP
- Microsoft
- Yahoo
- Appistry
- Others…

Cloud abstractions using standards:

OpenNebula,

OpenStack,

jCloud, Deltacloud, others...

Which One to Use?

Client code maintenance a concern

Overview OCCI

RESTful API for Service Management (IaaS and more)

consisting of 3 parts (OGF proposed recommendations)

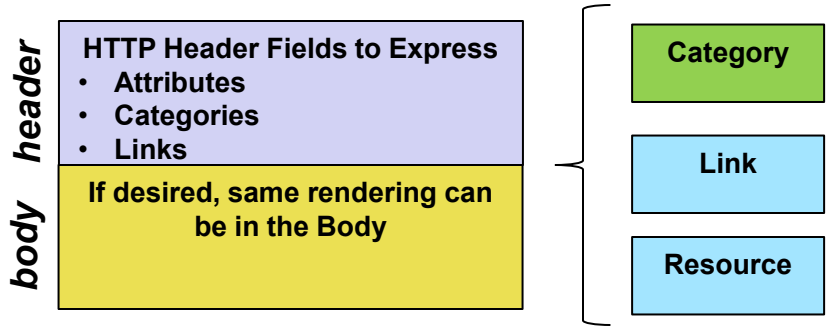
- Core – defines the OCCI model
- Rendering – defines RESTful rendering using text/plain or text/occi (JSON and XML in next version)
- Infrastructure – defines IaaS resource parameters
  - Compute, Storage, Network

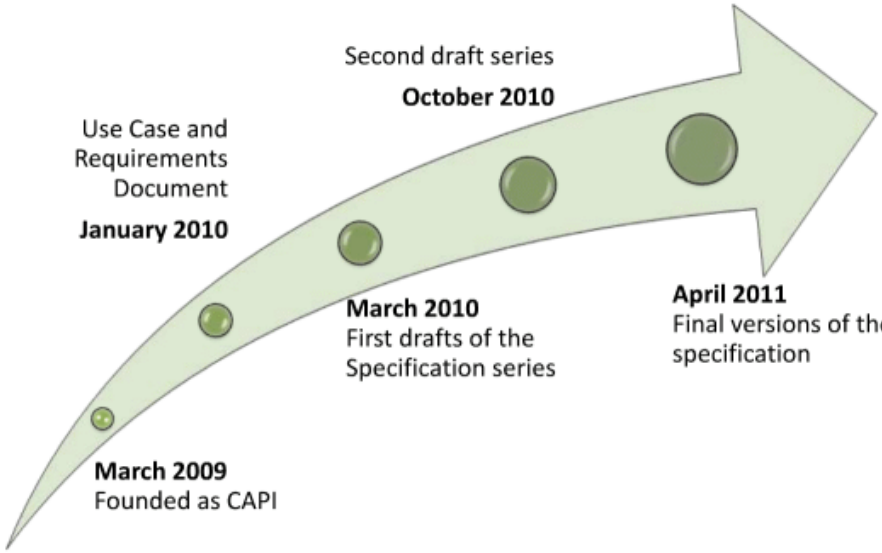
easily extendible by

- linking to new or external objects and ser
- adding new attributes to existing objects

flexible API

- active development and existing implemer





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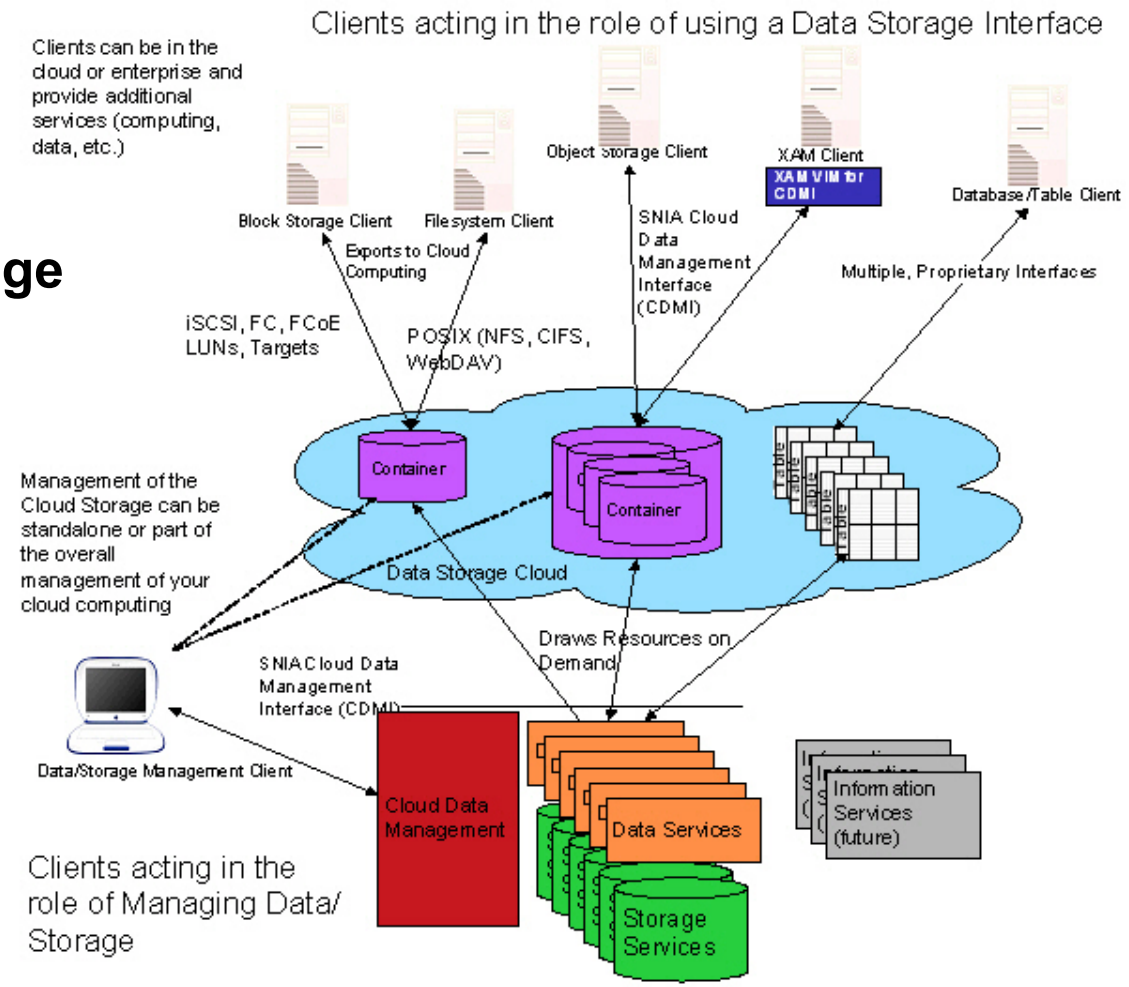
Florian Feldhaus, TU Dortmund

Overview CDMI

RESTful API for Cloud Data Management developed by SNIA

Standardize Access:

- object storage
- support for legacy storage
  - NFS, CIFS and WebDAV
- containers for grouping
- metadata
- simple management



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Cloud Client Interactions (earlier)

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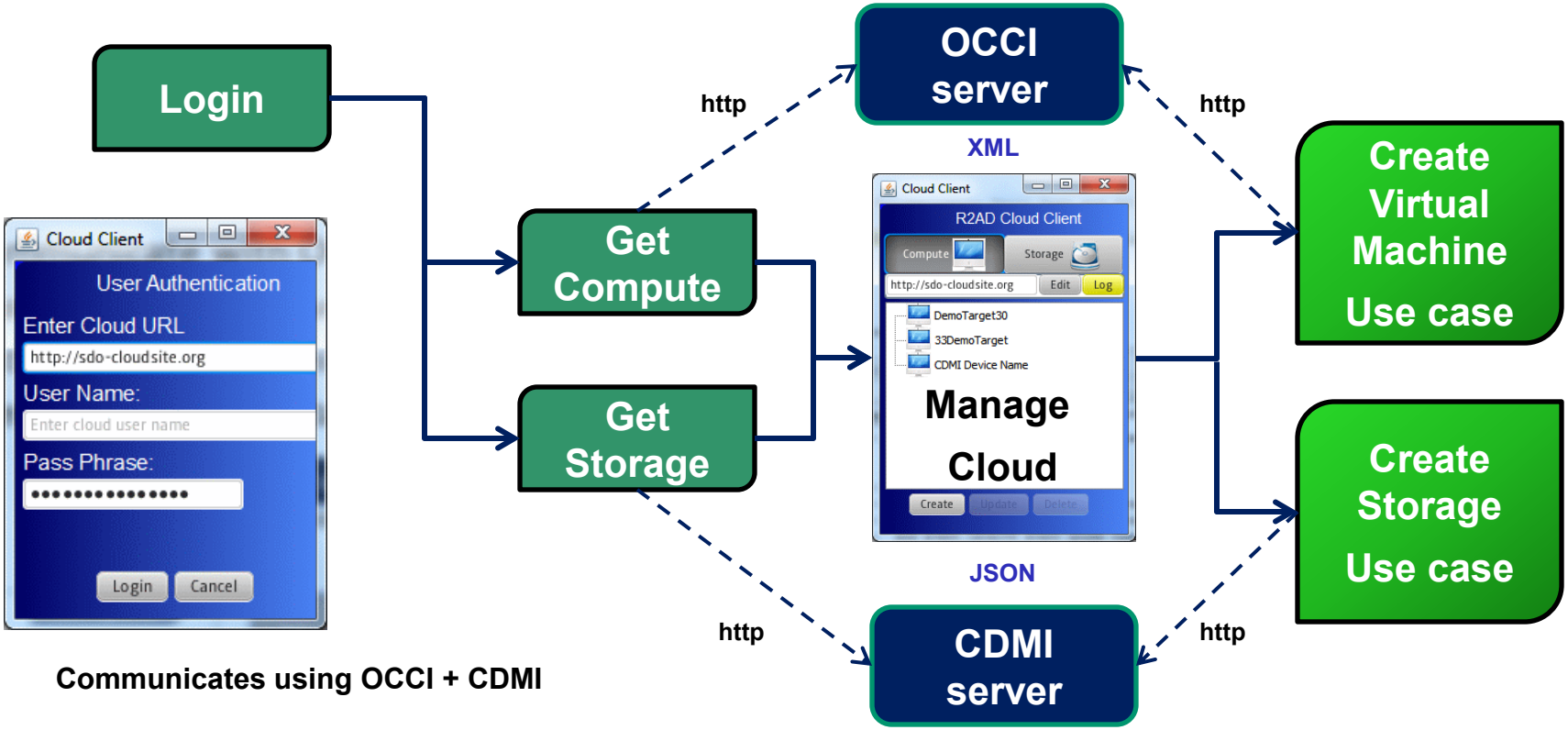
- Used local test servers & simple RESTful HTTP Get/Put
- Design was Use Case Driven (Keep Goals on Target)
- Initial Client Design
  - Developed with JavaFX (mobile Java platform)
  - Focused on CDMI and OCCI specifications



Communicates using OCCI + CDMI

Cloud Client Interactions (Fall 2011)

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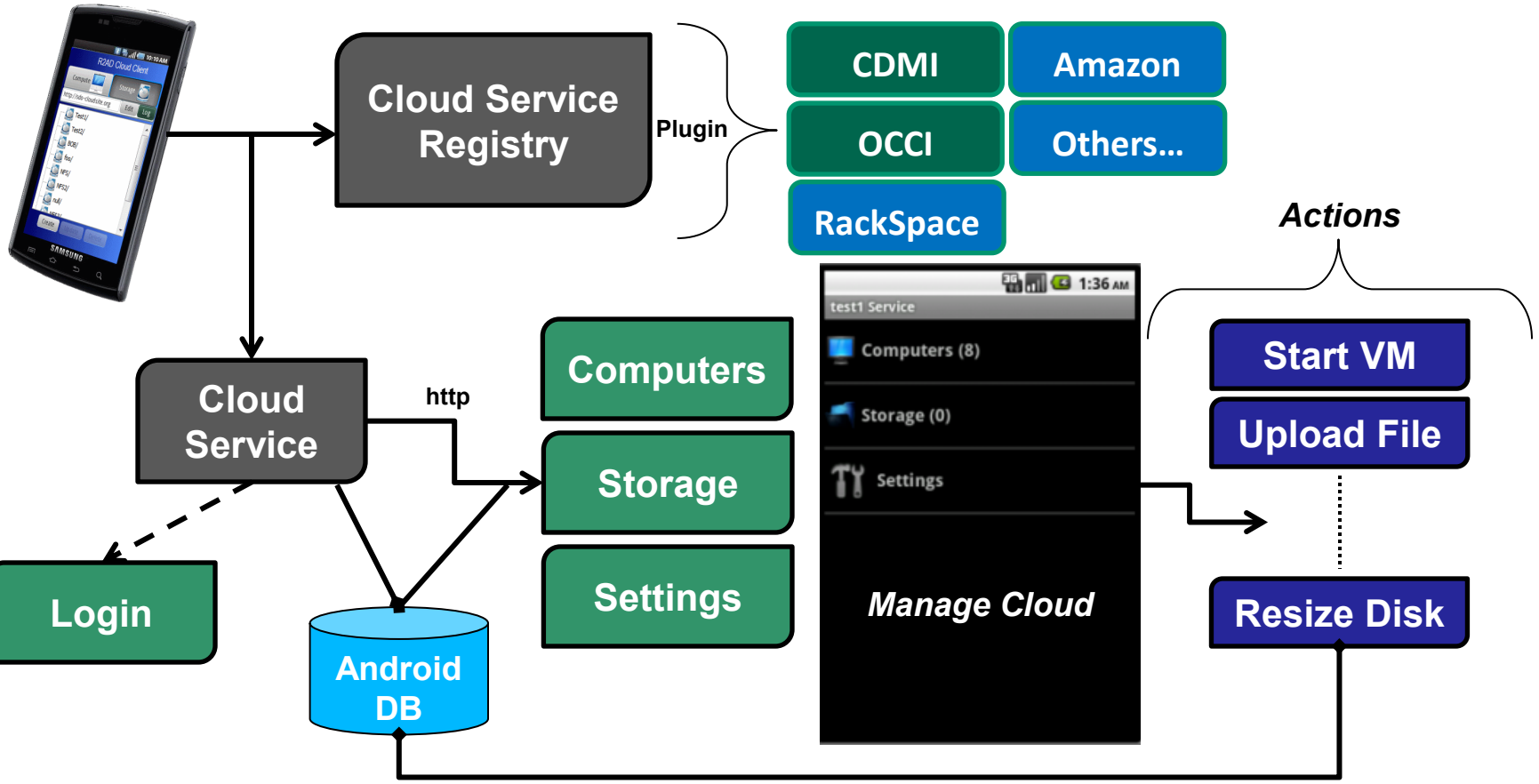
Current Android Cloud Client Design

Ported to Android v2.2+ (re-use existing Java code)

Generic Android activity model allowing multiple cloud protocols

Cloud types (Service, Computers, Storage) have known properties (display related) and dynamic Actions



Cloud Client User Experience – Android 2011

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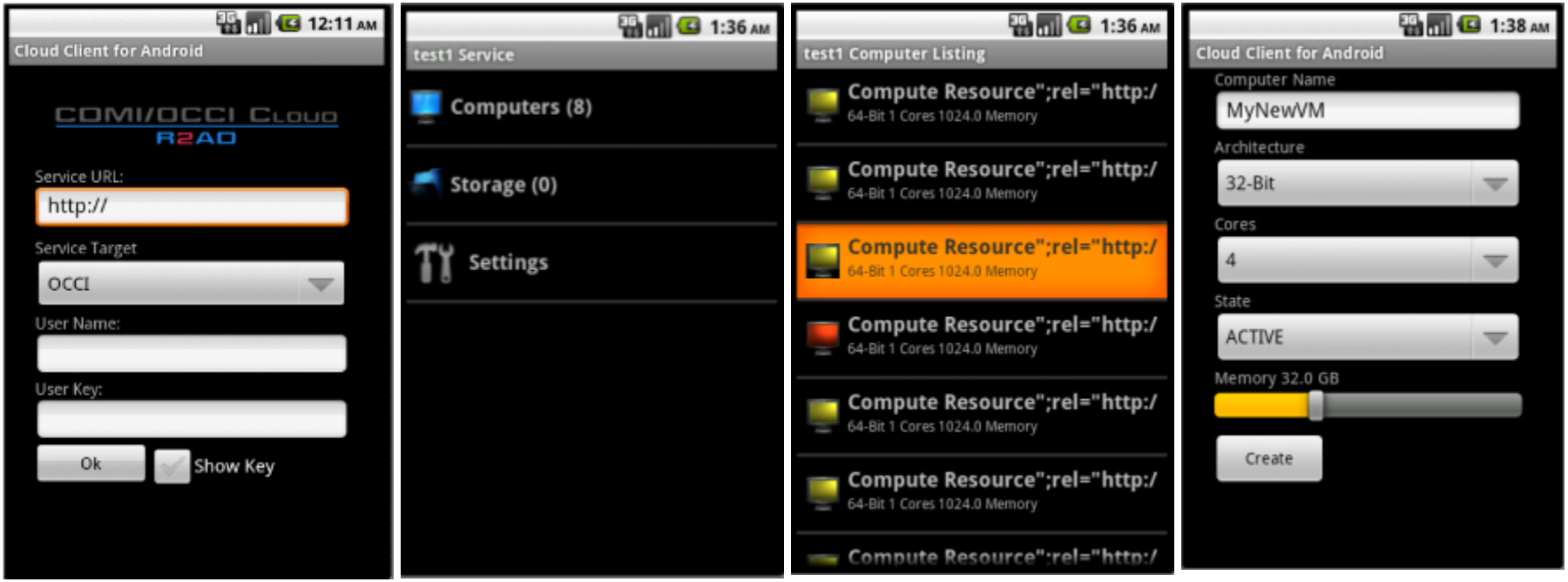

Ported the 2010 JavaFX client to Android (50% complete). Demo'd this version at recent DMTF Alliance Partner Technical Symposium event in Boulder, CO July 2011. R2AD attended/participated in recent 2011 CLOUD PLUGFEST, Sep 18-22, 2011

http://www.snia.org/cloud/cloudplugfest/

SNIA's Cloud Plugfest Interactions

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Storage Network Industry Association (SNIA) hosts Cloud Plugfests periodically!

Most recently in Santa Clara last September.
http://www.snia.org/events/storage-developer2011/plugfest

Cloud Server Interactions

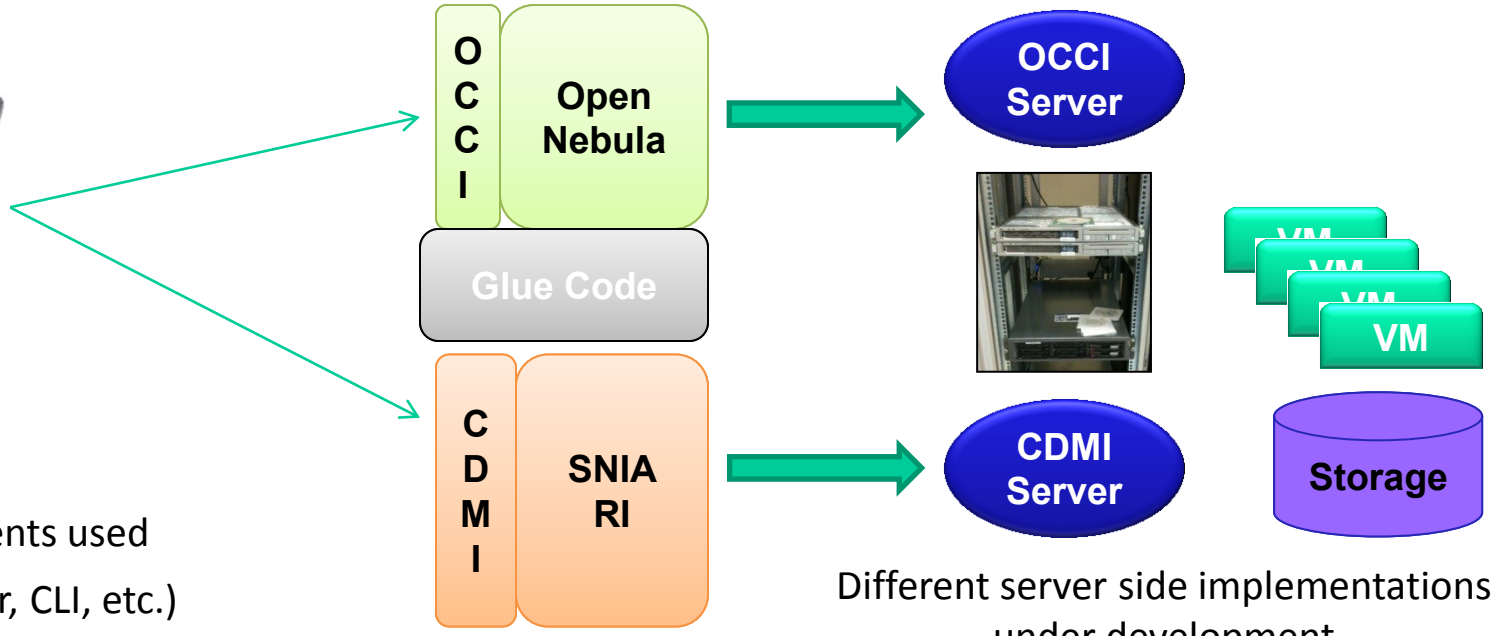
Using OCCI server which was configured as part of an Open Nebula instance.

The CDMI server communicated to SNIA RI for storage access.

As part of the SNIA plug-fests, computers are established at SNIA's lab in Colorado and elsewhere

Different clients used

(iPad, Browser, CLI, etc.)



Different server side implementations under development

Development Environment

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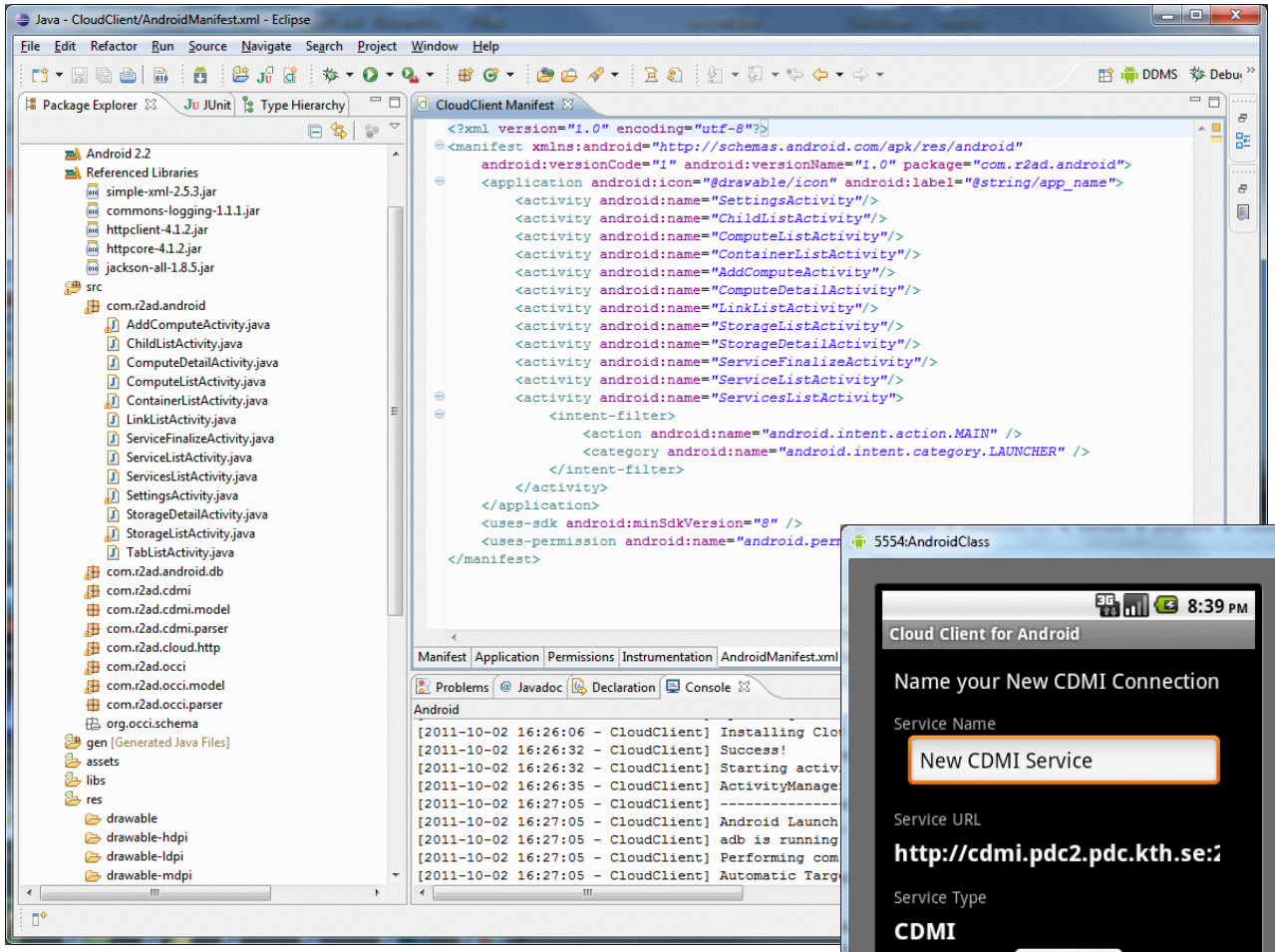

Eclipse with the Android SDK Run using Android Emulator

JavaScript Object Notation (JSON)

a lightweight data-interchange format

Development Experience

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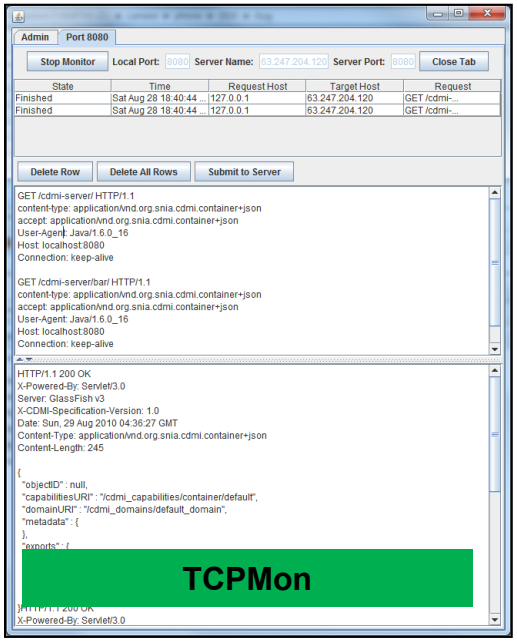
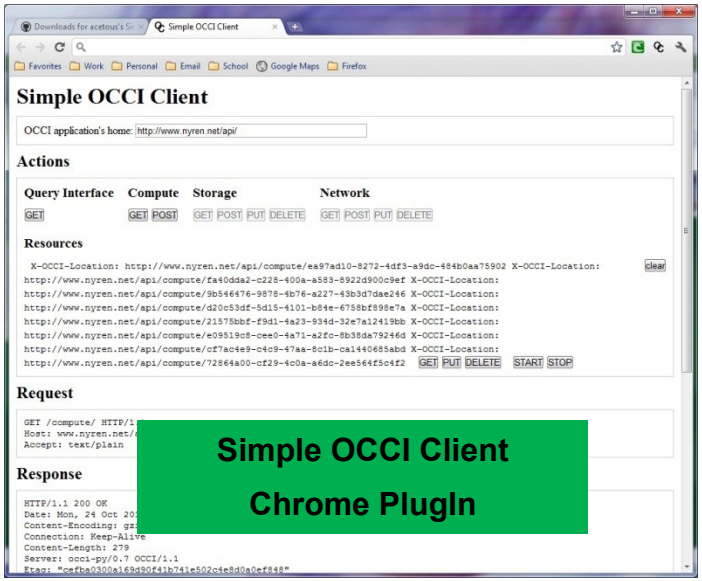
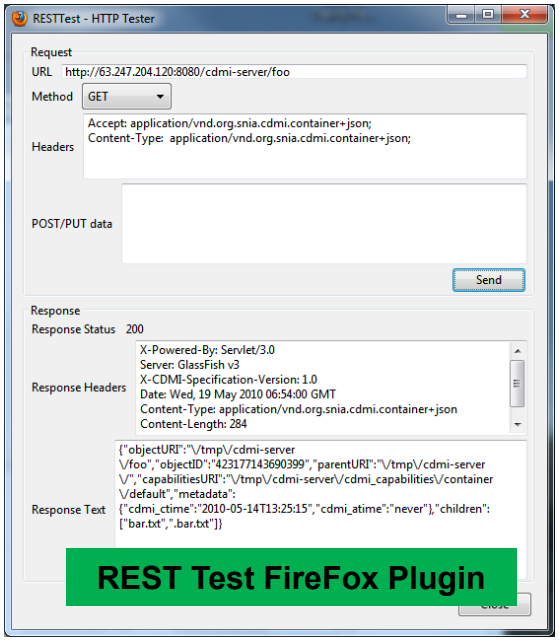
- VNC and Oracle Secure Global Desktop for server access & control as configured as part of the Teleclient® Solution
- VMWare vSphere for creating server snapshots, monitoring load, etc…
- SSH Remote Shell and WinSCP (file transfers)
- TCPMon - https://tcpmon.dev.java.net
- Plug-Ins
  - RESTTest (Firefox)
  - Simple OCCI Client (Chrome) (GitHub)

Gotcha's - Server availability and version specifications







RESTFul Cloud Services

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Many/Most Cloud Services are using Representational State Transfer (REST)

- Roy Fielding's doctoral dissertation
- Can represent resources using XML or JSON, or …

JavaScript Object Notation (JSON)

- A lightweight data-interchange format
- Used by CDMI and future OCCI specification

```
{
  "children“ : [
    "MyVideos"],
    "metadata": {}
}
```

Simple JSON example

Together, these APIs form a Cloud Operating System

JSON Library used in our Android Project

- **Jackson**
  - http://jackson.codehaus.org/Tutorial
  - Supports Streaming, Tree, and data binding (Object)
- **GSON (another one to consider)**
  - http://code.google.com/p/google-gson/
  - Converts between JSON and Java Objects

Security

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Recommendations for Mobile Cloud applications

Encrypt all data stored on the client, if any. Especially applicable for any account information (keys, URLs, etc.).

Use secure communications, i.e., TLS, and also encrypt messages between different internal apps.

Use parameterized queries for local SQL storage

Many other recommendations too (use PendingIntents, no world writable files, etc).

Reference implementations used by our client

CDMI: Test server provides both secured and unsecured connections. HTTP was used because it is simple.

Using HTTPS or Digest HTTP authentication would is easy to support.

OCCI: Depends on server, some secured with basic authentication using HTTPS, others were test servers using HTTP

Also experimented with our RackSpace account

Worked well. Interesting security model. After initial login, a dynamic endpoint is provided and authorization token must be in each header request

Requirements (current and future)

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Requirements grew from use-cases

- Simple get/put HTTP verbs from initial use-cases
  - As published by OCCI Working Group:
    - http://www.gridforum.org/Public_Comment_Docs/Documents/2009-09/occi-usecases.pdf
- Keep UI footprint small, knowing target was mobile device
- UI became more sophisticated with experience
- Add caching of data for off-line/disconnected access

Future Items to Implement

- Generate library for abstract use in end-user applications such as a cloud file store (videos, photos, MP3s), document synchronization, Phone backup, etc.
- Support newer versions of OCCI and CMDI as they become available
- Support OVF as a means to create VMs based on Templates

References/Links

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GIT Hub source code
https://github.com/r2ad/

OCCI: http://occi-wg.org/

OGF: http://www.ogf.org

CDMI: http://www.snia.org/cloud

SNIA PlugFest: http://www.snia.org/cloud/cloudplugfest

tcpMon: https://tcpmon.dev.java.net/

JSON Libraries used in our Android Project

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- **GSON**
  - http://code.google.com/p/google-gson/
  - **Converts between JSON and Java Objects**

Android Dev Kit: http://developer.android.com/sdk/index.html

Android & Java Training: http://www.jpassion.com/portal/

R2AD: http://www.r2ad.com
and http://cloud.r2ad.net

Conclusion

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Mobile Cloud Computing….

cloud in the palm of your hand!

Standards Instead of Cloud Silos!

Acknowledgements

OGF's OCCI Working Group

SNIA's Cloud Storage Technical Work Group (TWG)

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