

CAS Clouds: a Case Study of Community Cloud

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Chinese Academy of Sciences

ISGC 2016, Taipei, 17 March 2016

Outline

- Community cloud
- CAS Clouds and the STCloud
- STCloud overview
- Technical issues
- Policy issues
- Conclusions

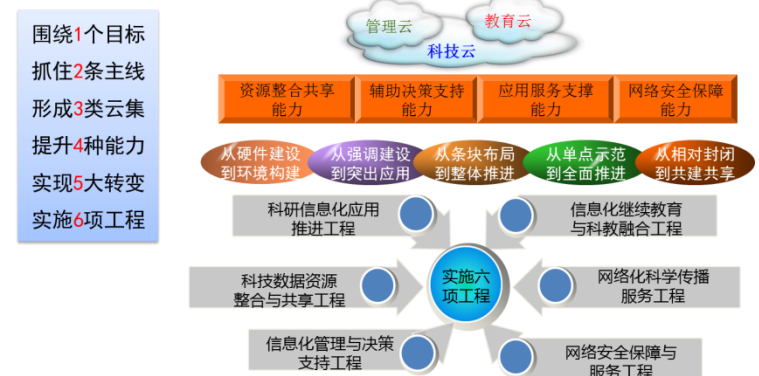
Cloud's Deployment Models

by NIST, 2011

- Private cloud
 - exclusive use by a single organization
- **Community cloud**
 - exclusive use by a specific community of consumers from organizations that have shared concerns
 - e.g., mission, security requirements, policy, and compliance considerations
- Public cloud
 - open use by the general public
- Hybrid cloud
 - a composition of two or more distinct cloud infrastructures (private, community, or public)

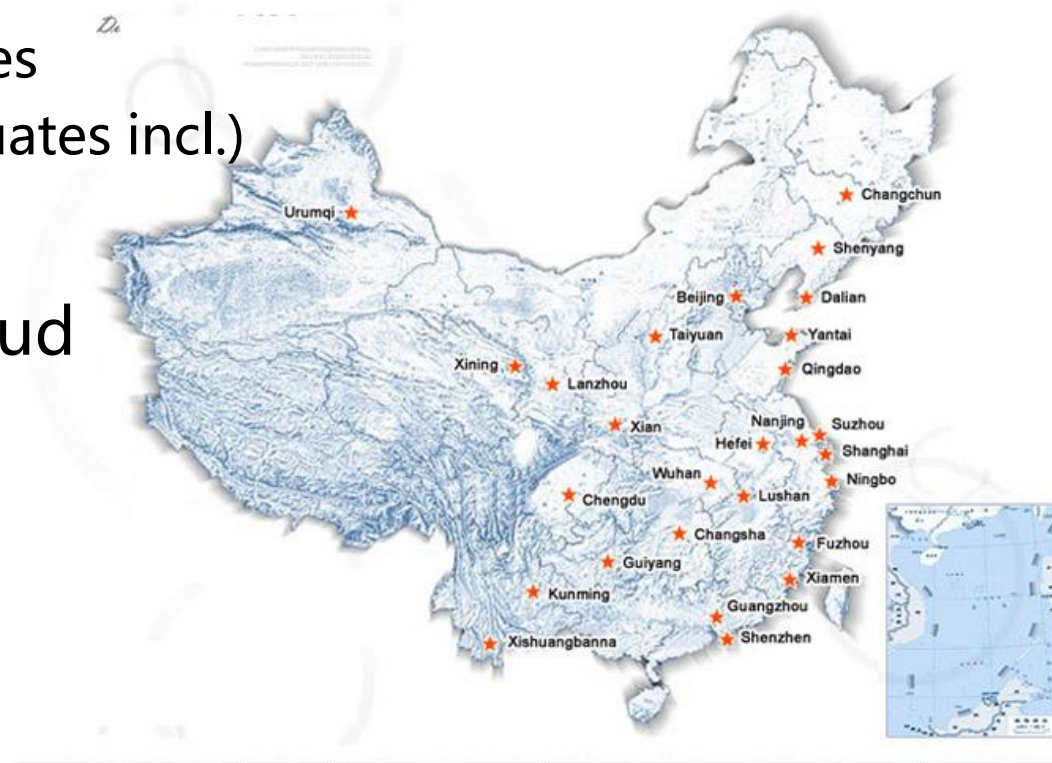
CAS Clouds – The STCloud

- Chinese Academy of Sciences
- The 12th Five-year Program
- Three sets of clouds
 - Science and Technology Cloud – STCloud
 - Management Cloud
 - Education Cloud



CAS STCloud

- A cloud for all researchers in CAS
- CAS has
 - 120+ institutes
 - distributed in 20+ cities
 - 100,000+ users (graduates incl.)
- Key features of STCloud
 - On-demand
 - Ubiquitous
 - **UGC and community services (provider/consumer)**



STCloud's model

- The academy launched the project, led by CNIC
- An institute is an independent organization
- Private cloud: for the academy as a whole
- But, Community cloud
 - for the institutes
- The model issue does matter, whether in policy or in technology

How to be a community

- The academy, obviously
- But, competition from the industry(e.g. aliyun)
 - why we need a cloud provided by the academy ?
- Common interests/concerns
 - resources: networking, HPC, data ...
 - supporting services
 - security

STCloud's foundation

- Network - CSTNET
- HPC environment
- Scientific Data/Storage environment

China Science & Technology Network (CSTNET)

- Connect NCFC backbone network with Internet in 1994 and establish **CSTNet** in 1995, which was one of the four backbone network in China in 1996 and launched **GLORIAD** in collaboration with the U.S. and Russia in 2004

Domestic Bandwidth: **90+ G**

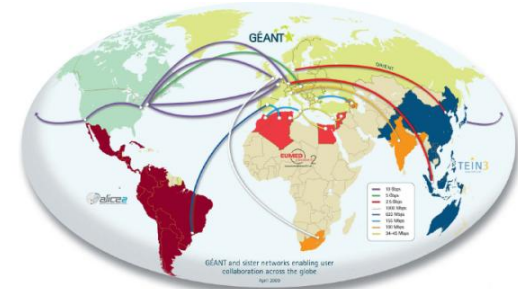
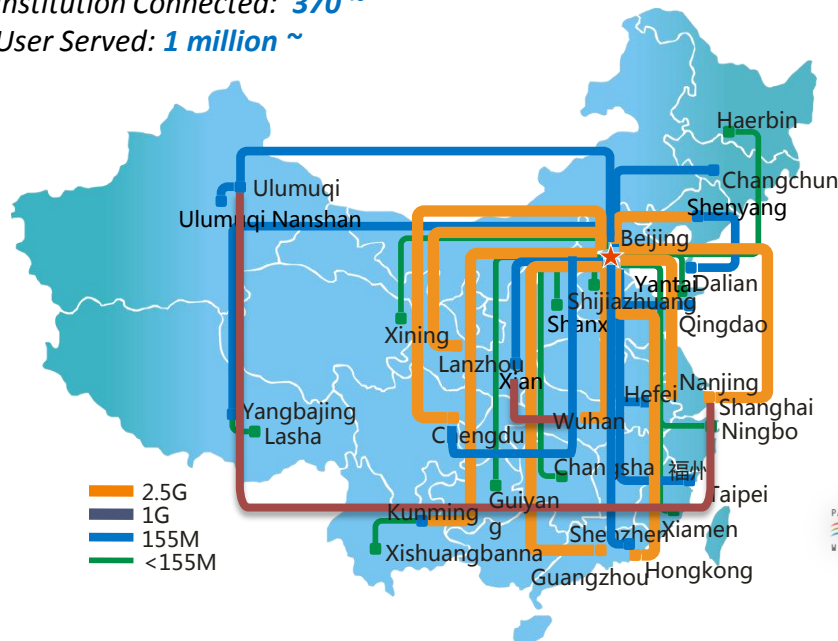
International Bandwidth: **22 G**

Core Network : **10G**

Backbone Network : **2.5G/1G**

Institution Connected: **370 ~**

User Served: **1 million ~**



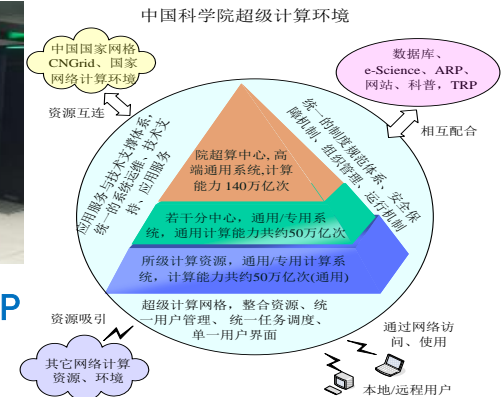
CAS HPC Environment

• 3-level HPC centers

- CAS Supercomputing Center at CNIC
- 10 Regional Centers
- 18 Institute Centers



2014: 300T → 2016: 2.3P



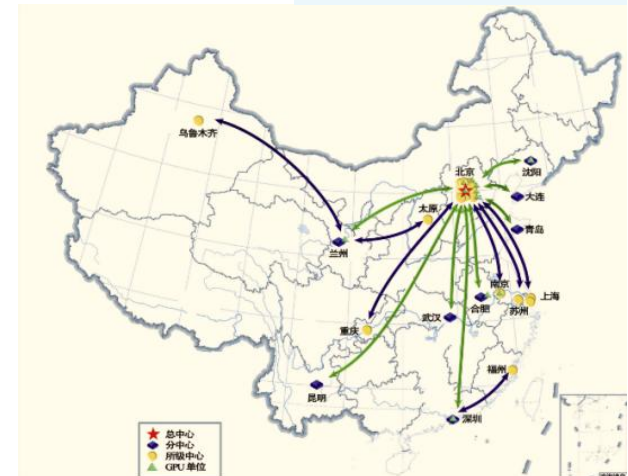
• National infrastructure - CNGrid

- Operation and Management Center of CNGrid
- The north main node of CNGrid



• Supercomputing Innovation Alliance

- Initiated by CNIC in 2013
- 50+ institutions including supercomputing center, supercomputer manufacturer and HPC user



CAS Scientific Data / Storage Environment

- Scientific Databases of CAS since 1983, which launches the historical beginning of China scientific data management and applications
- Distributed storage resources at CNIC and a dozen of institutes
- Chinese National Committee for CODATA



Scientific Databases

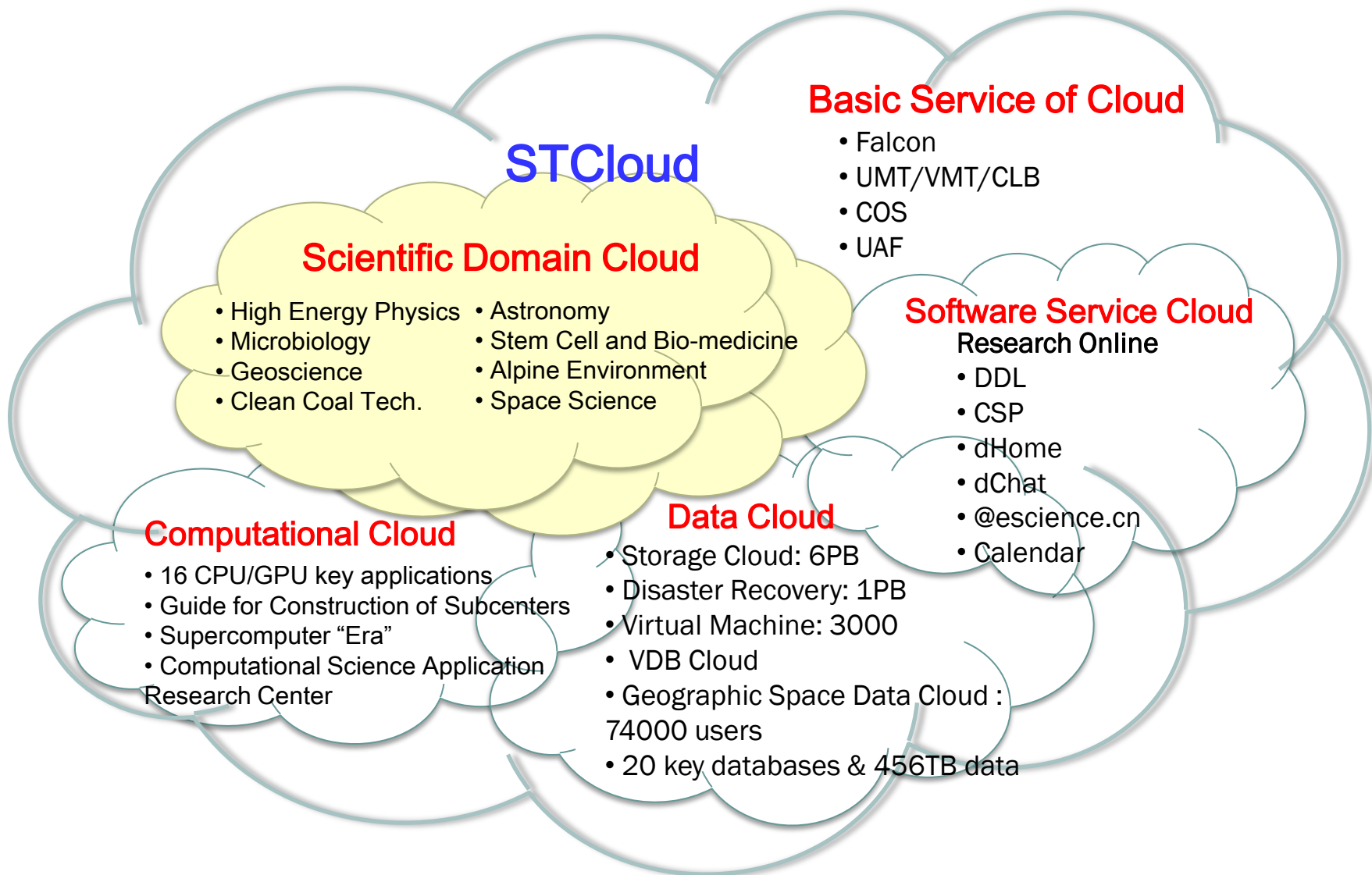
- 61 institutes
- 200TB data

Storage node across China

- 50PB capacity



STCloud's composition



STCloud Status

Using one ID to access many services/resources provided by many institutes in STCloud



SaaS for scientific collaboration

- Team-based Document Library
 - dropbox + wiki
 - 8200+ teams, 26k+ monthly active users
- Information Management for Conferences
 - 2000+ conferences, 110+ institutes
- Messaging for teams
- Scholar Homepage



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Announcements

The deadline of abstract submission has been extended to Friday, December 31, 2015



Welcome Address

Invitation to International Conference on Hydrogen Production (ICH₂P-2016)

It is my great pleasure to invite you to attend the International Conference on Hydrogen Production 2016 (ICH₂P-2016), to be held at Zhejiang University in Hangzhou, China from May 8 to 11, 2016.

The conference will have particular value and interest to researchers, scientists, engineers and industries who are working in the field of hydrogen production technologies ranging from policy making to marketing. The ICH₂P-2016 is organized by Zhejiang University, China, which is one of 21st Frontier Program supported by Ministry of Education.

The International Conference on Hydrogen Production is a multi-disciplinary international conference on the production of hydrogen through various thermal,



Important Dates

December 15, 2015

One-page abstract due (through website)
January 5, 2016


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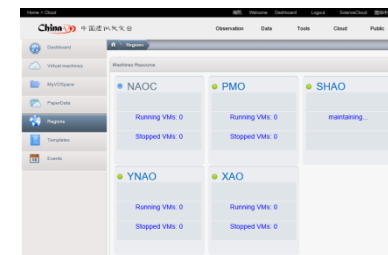
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9. Multi-criteria decision making approaches for supplier evaluation and selection: A literature review • Article

Application services

- 240+
- More and more services by institutes – doubles in 2015



Top 10 App Services in Sept. 2015

China Virtual Observatory (202897)

Inst. of Automation UAS (124367)

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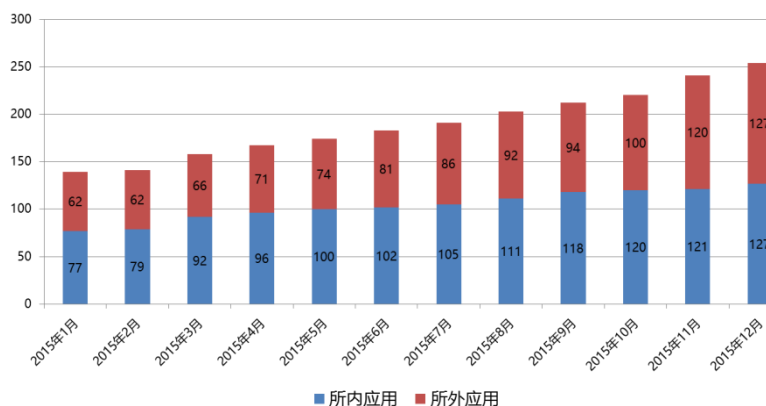
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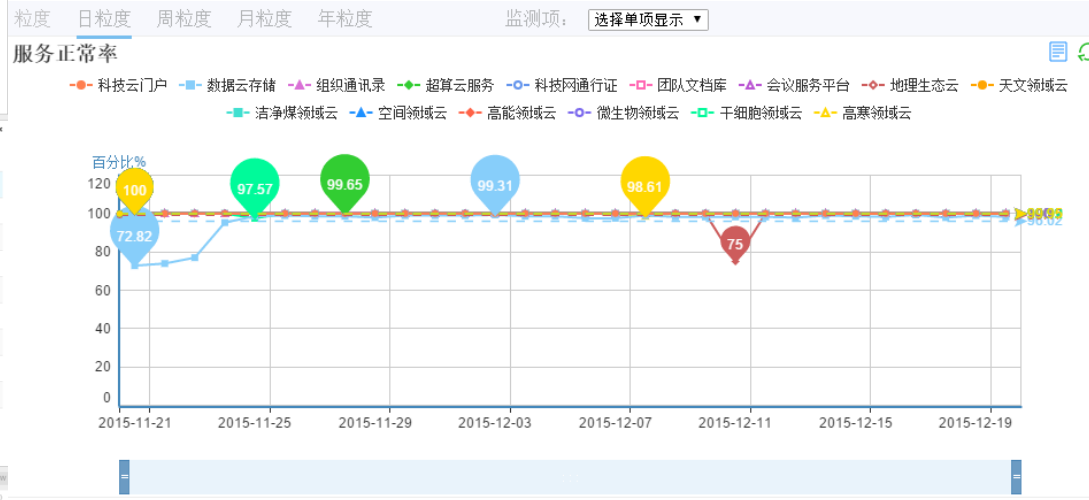
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* Excluding CAS email, DDL, CSP and cstnet.cn

- Service Management
- Logging and monitoring



eduroam CN

- Access service easier
- Expand and reinforce the community

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- 中国科学院高能物理研究所 (IHEP, Institute of High Energy of Physics, CAS)
- 中国科学院上海天文台 (SHAO, Shanghai Astronomical Observatory, CAS)
- 中国科学院生态环境研究中心 (RCEES, Research Center for Eco-Environmental Sciences, CAS)
- 中国科学院寒区旱区环境与工程研究所 (CAREERI, Cold and Arid Regions Environmental and Engineering Research Institute, CAS)
- 中国科学院上海分院 (CAS Shanghai Branch)

大学机构

- 北京大学 (PKU, Peking University)
- 中国科学技术大学 (USTC, University of Science and Technology of China)
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- 西安交通大学 (XJTU, Xi'an Jiaotong – Liverpool University)
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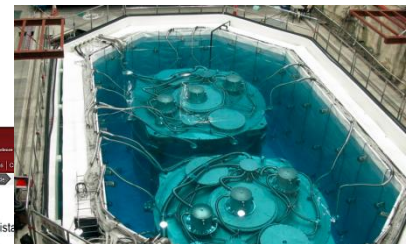
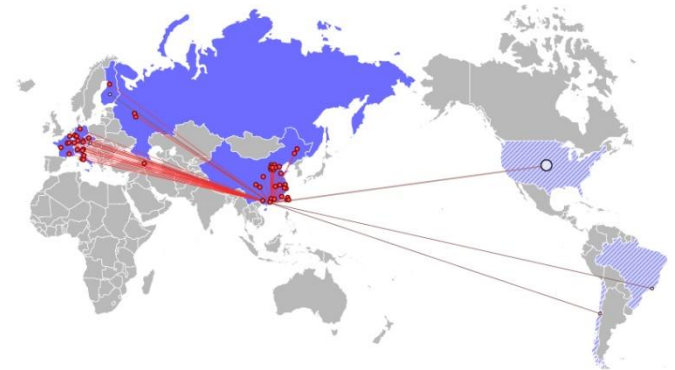
- 中国科技网网络中心 (CSTNET, China Science and Technology Network)

Scientific Domain Clouds

- Astronomy SDC
- Clean Coal Technology SDC
- Space Science SDC
- High Energy Physics SDC
- Microbiology SDC
- Geoscience SDC
- Biomedicine SDC
- Cold Environment Joint Monitoring SDC

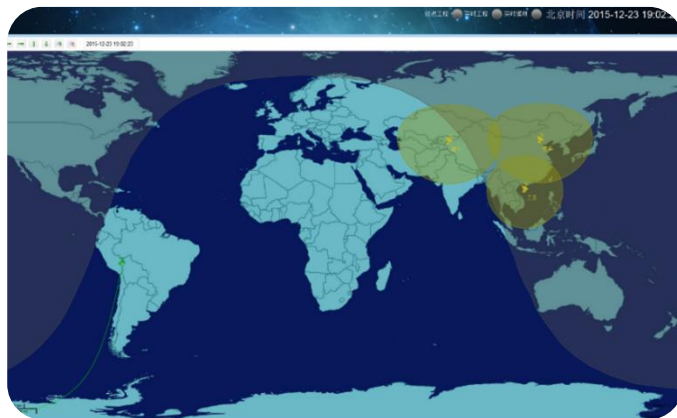
Supporting HEP research

- High Throughput Computing and Mass Storage services for **Daya Bay neutrino experiment** and BES-III
- Lots of scientific results
 - Fundamental Physics Breakthrough Prize 2015
- Services
 - 15000+ CPU cores, 5PB disk, 5PB tape
 - 10G IPv4/IPv6 international link
 - 24 million jobs, 50 million CPU hours
 - data transferred 3PB/year

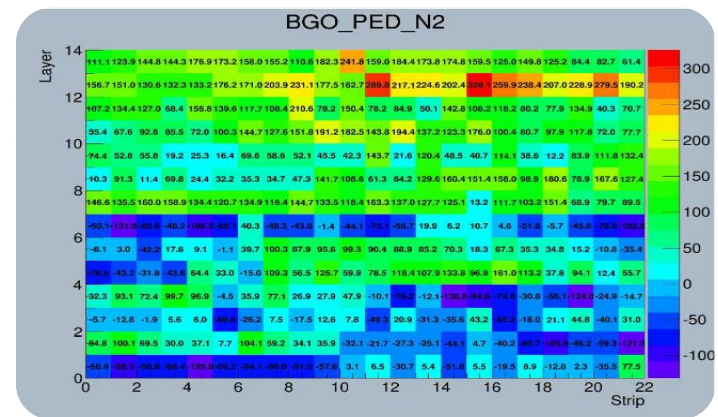


Powering Strategic Priority Research Program

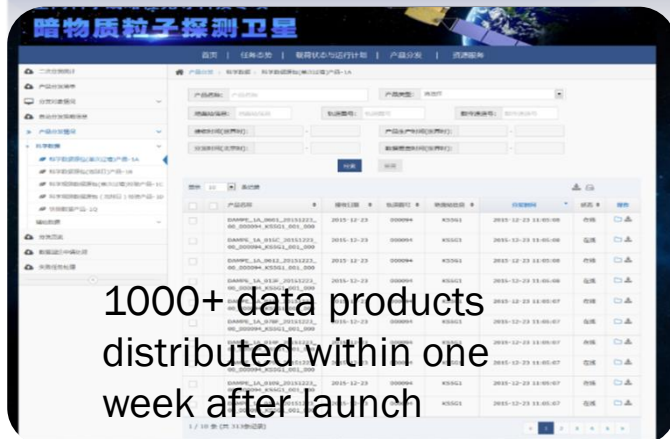
The satellite “DARk Matter Particle Explorer” Wu-Kong



Monitoring

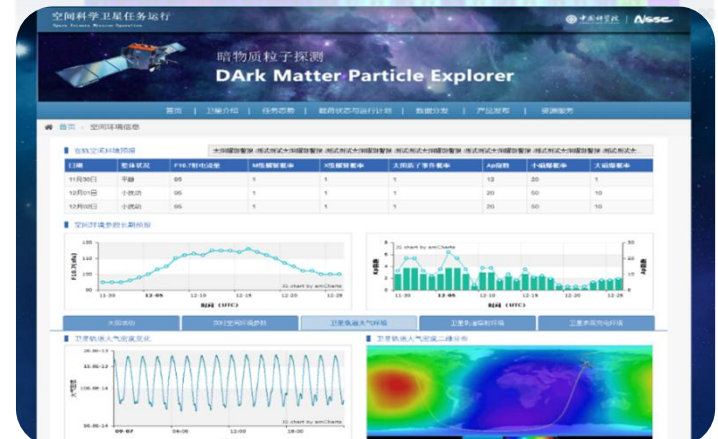


Scientific Data Snapshot



1000+ data products
distributed within one
week after launch

Data Product Distribution



Space Environment Support

Supernova search

- Scientists and the public work together at the Virtual Observatory of China
- A 10-year-old student found 3 candidates



China 中国虚拟天文台

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公众超新星搜寻项目

開始您的超新星搜尋之旅

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Technical issues

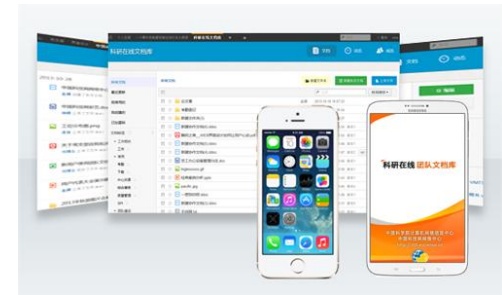
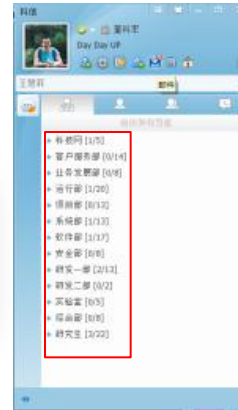
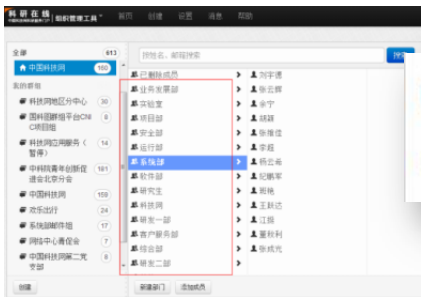
- Identity Management
- Platform-as-a-Service
- Continuous Integration
- Measurement and Operation

Identity management

- Requirements
 - Unified Authentication & Single Sign-On
 - Delegate Authorization
 - Open standard
 - Friendly Interface and easy-to-use
 - Web browser AND mobile clients
- Solution
 - Build on the existing CAS E-mail accounts
 - OAuth2
 - SAML (Shibboleth) added recently

Sync apps by Message Queue

Management UI



.....

VMT

Email System

IM

DDL

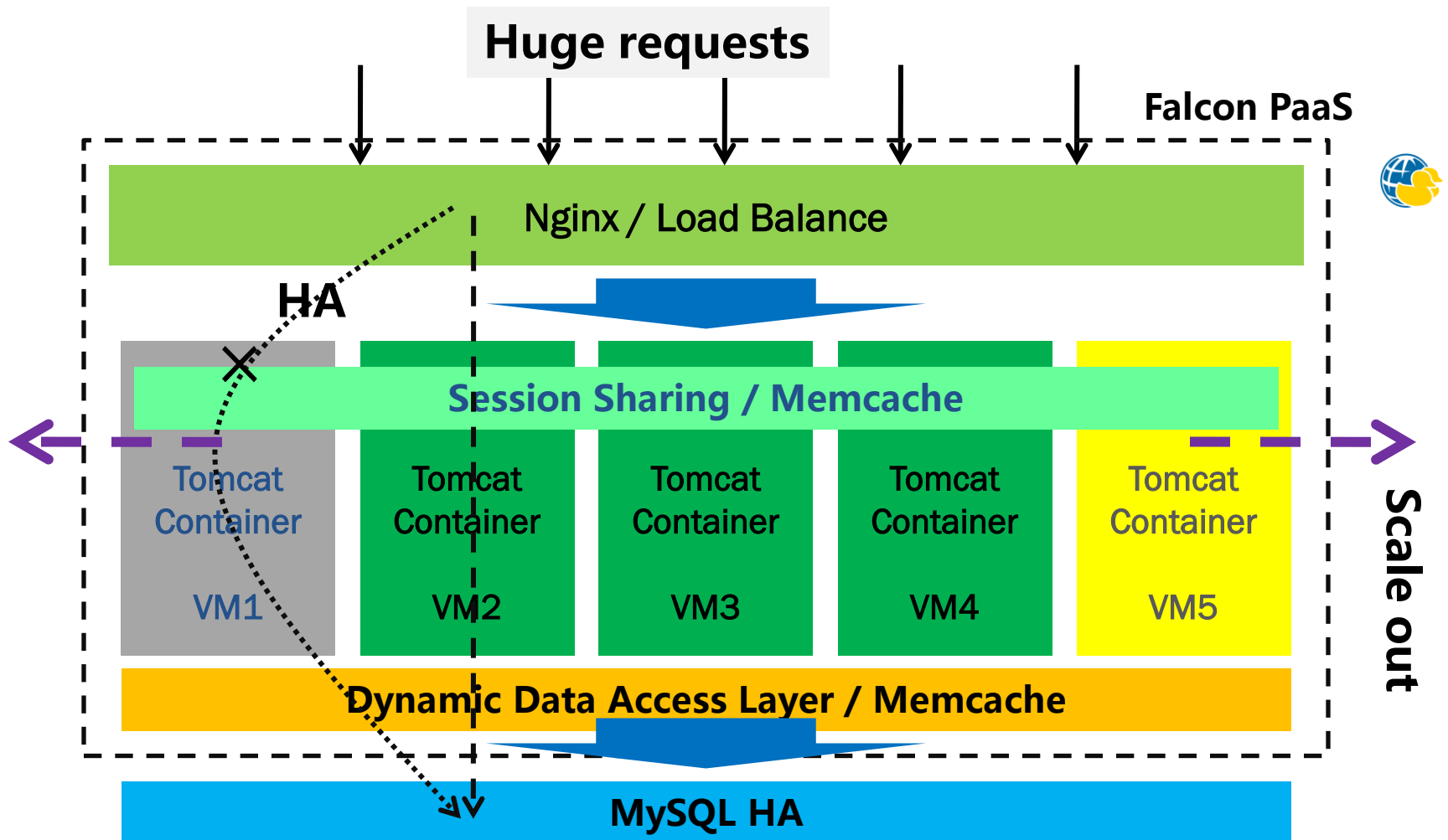


Message-based Information Sync mechanism (Duckling-Falcon)

1. Convergence of organization info. and team info.
2. Unified management of profiles and attributes for apps

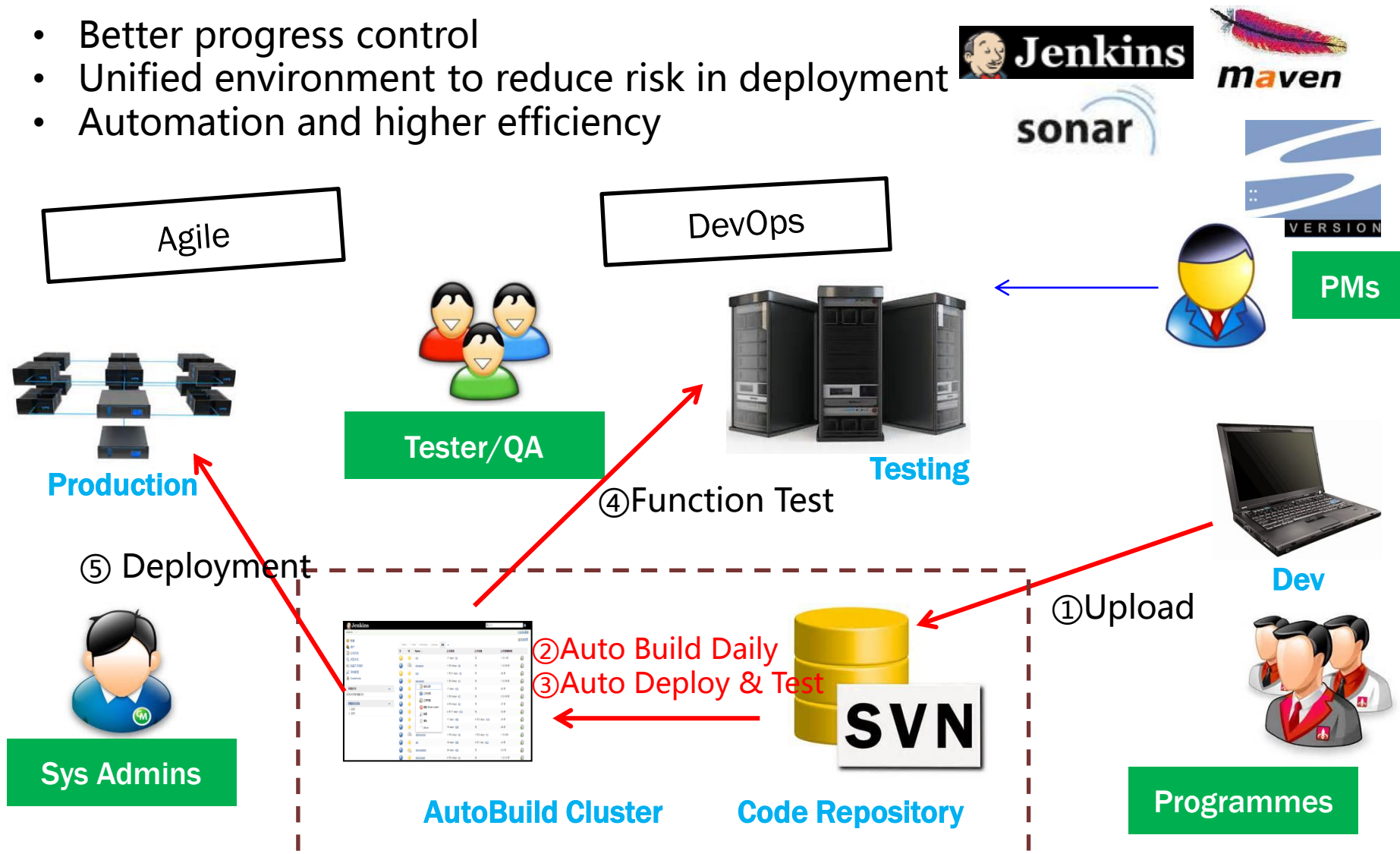
Scalable PaaS

- ✓ Stateless (Shared session)
- ✓ Instance Migration
- ✓ On-demand Scale out (Web HA)



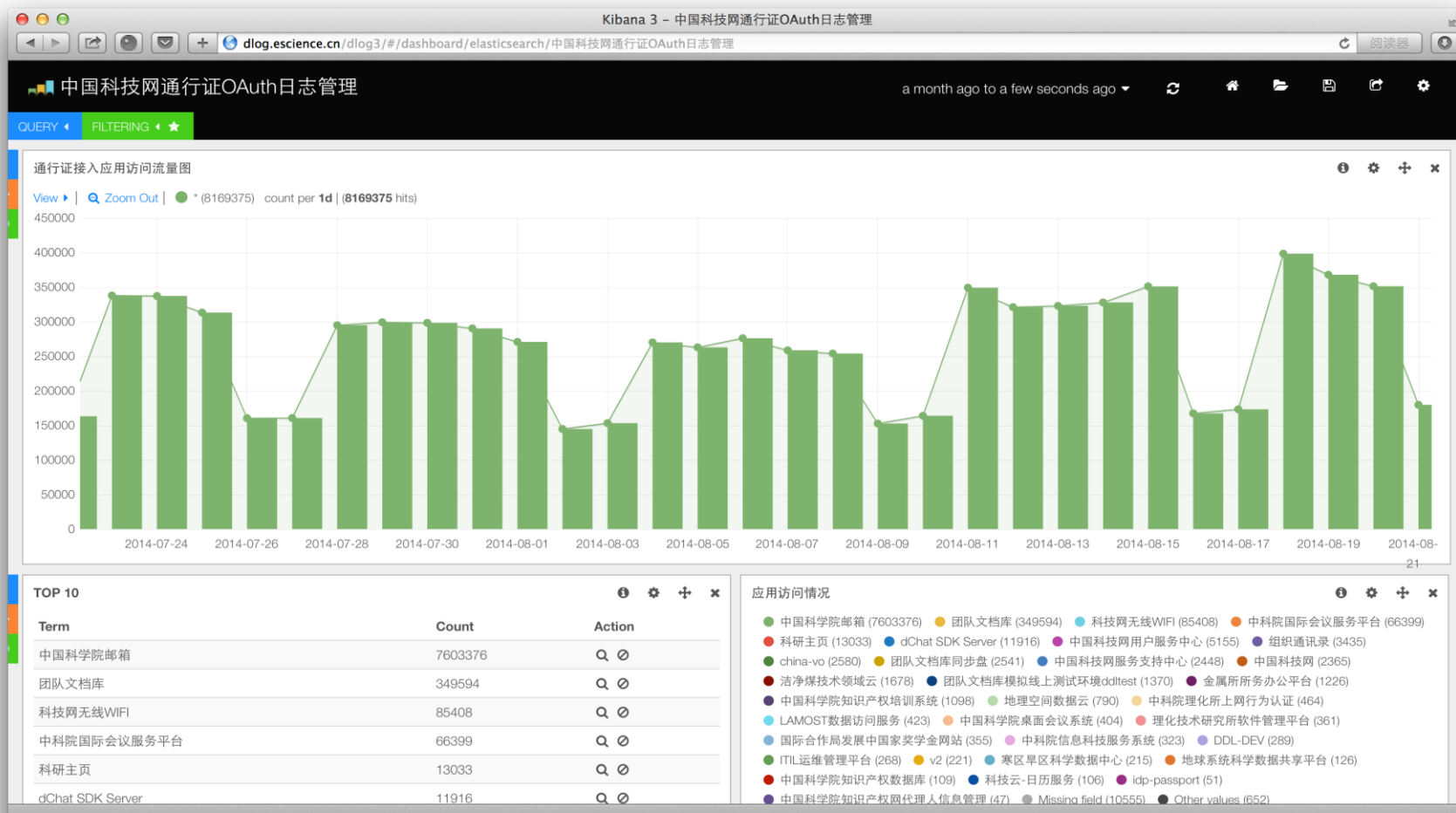
CI – Continuous Integration

- Better progress control
- Unified environment to reduce risk in deployment
- Automation and higher efficiency



Centralized log service (dlog)

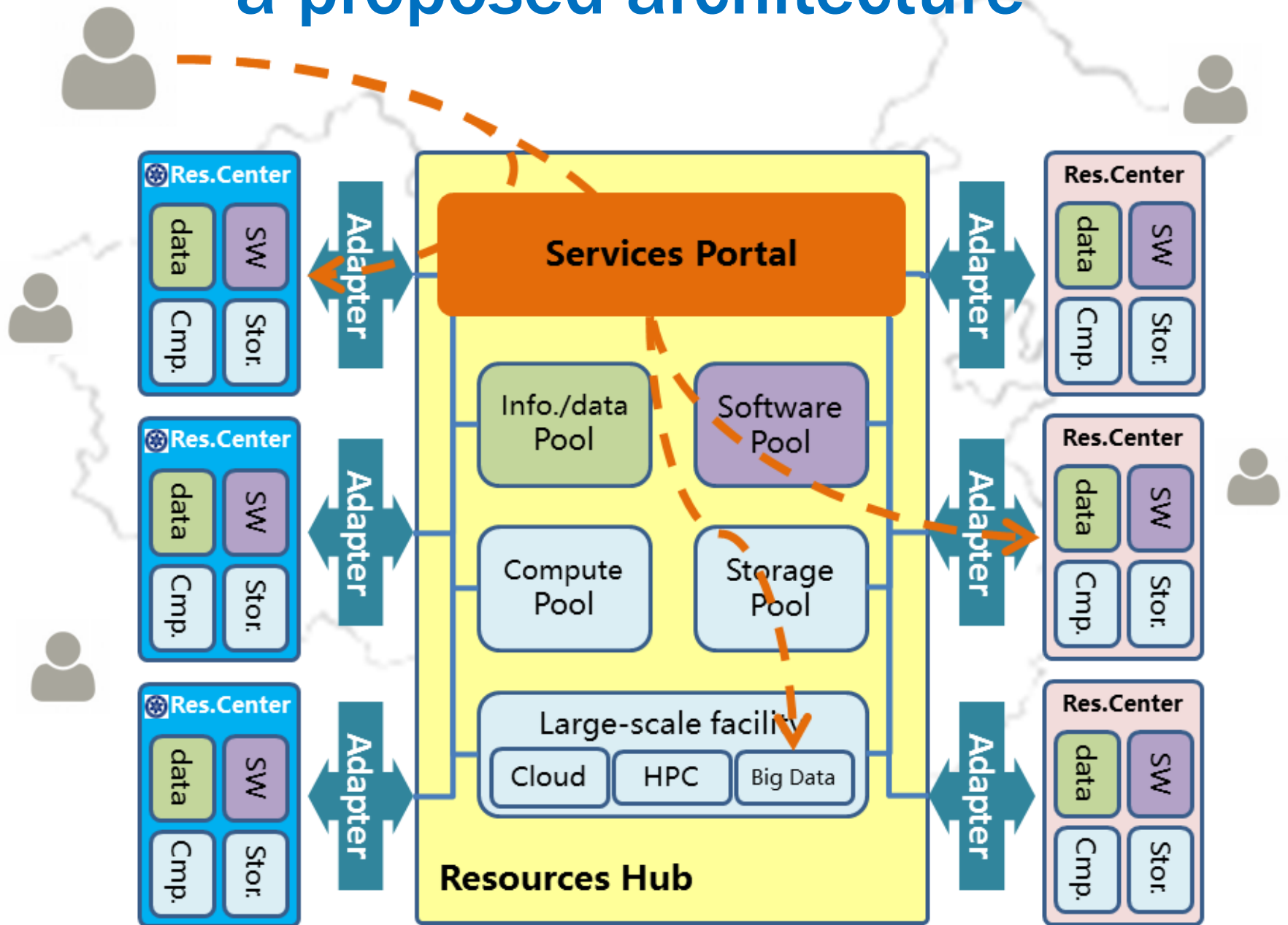
collect, storage, analysis and visualization of logs for application services



Architecture for community cloud

- Federation
 - Service / Identity (SP, IdP)
 - Institutes, universities, S&T service companies.....
 - Model: mesh vs. Hub-and-spoke
- Microservices
 - Loosely coupled, high cohesion
 - Fault tolerant (complexity)
 - DevOps; challenges to teams

a proposed architecture



Policy issues

- Charging or not
- Availability, Sustainability
- Security responsibility

Charging

- Economic model
 - who pays for support/maintenance and operational costs, infrastructure/capital costs?
- The academy invests on infrastructure, provides part of operational costs
- Part of operational costs shared by institutes
- Support costs (personnel costs) are underestimated and not recognized properly

99% or 99.95%

- How to manage availability and service levels across the community cloud?
- So far, core services run by a dedicated team at CNIC and application services by institutes as “best effort”
- When more services and more dependency exist, the situation will be different

Security responsibility

- “What is the legal impact of a service outage, i.e. Organization A is pursued legally due to a service outage caused by Organization B's infrastructure within their community cloud?”
- Regarding security, which is paid very much attention in China, it is a quite practical issue now.

Conclusions

- Community cloud is good for research and education
 - lots of specific applications
 - a large amount of developers come from users (researchers and graduates)
- Yet not easy
 - quite a few issues to solve
- Network is the most important foundation
 - NRENs play an important role to frame the community
- Tech solution: Microservices + Federation
- Open community, open source software
 - Better trust

Next steps

- China's 13th five-year plan 2016-2020
- CAS Informatization Program continues
 - a bit more funds
 - challenges are huge
- STCloud will expand beyond CAS
 - serve more users from universities/non-CAS institutes
 - get more resources in
- Better service is always the key
- And Trust !
 - no formal model exists to define good practice or identify liability for the security of the information within community clouds

THANK YOU