



# The Cloud Computing Environment of China-VO

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Chinese Virtual Observatory (China-VO)  
National Astronomical Observatory of China

# Contents

- China-VO & Cloud Computing
- Architecture
- Technology details
- Application
- Maintenance



# China-VO

- Chinese Virtual Observatory (China-VO) is the national VO project in China initiated in 2002 by Chinese astronomical community leading by National Astronomical Observatories, Chinese Academy of Sciences.
- China-VO became a member of the IVOA with the recommendation of Dr. Jim Gray

## R&D Focuses

- China-VO Platform
- Unified Access to On-line Astronomical Resources and Services
- VO-ready Projects and Facilities
- VO-based Astronomical Research Activities
- VO-based Public Education

# The First twelve Years

OpenOffice.org

VOFilter

ID	RA	Dec	RABrr	Decrr	Epoch	Fmag	Fmagtr	jmag	jmagtr	classification	
1	N1333212-4098	231.73	44.65	0.27	0.27	1994.51	18.44	0.43	19.13	0.22	Non star
2	N1333212-3972	231.63	44.63								90 Star
3	N1333212-138	231.62	44.58								21 Star
4	N1333212-3673	231.60	44.59								90 Star
5	N1333212-118	231.60	44.61								20 Star
6	N1333212-3805	231.60	44.60								90 Star
7	N1333212-4015	231.59									
8	N1333212-4070	231.56									
9	N1333212-4099	231.64									
10	N1333212-4105	231.55									
11	N1333212-3963	231.64									
12	N1333212-4108	231.55									
13	N1333212-4126	231.63									
14	N1333212-3473	231.62									
15	N1333212-3884	231.72									
16	N1333212-3934	231.72									
17											

China VO 中国天文数据中心

- HOME
  - NEWS
  - DATA
  - SEARCH
  - VIRTUAL OBSERVATORY
  - APPLICATION
  - ABOUT
- OBJECT NAME RESOLVER
- Simbad @ NED [X/ALL] XML
- Search Reset Help
- LINKS
- International Virtual Observatory Alliance
  - Chinese Virtual Observatory
  - National Astronomical Observatories, CAS
  - Centre de Données astronomiques de Strasbourg (CDS)
  - NASA/IPAC Extragalactic Database (NED)
  - NASA/IPAC Infrared Science Archive (IRSA)
  - NASA/ADS
  - arXiv.org (Astrophysics)

China Virtual Observatory Services

- Simple Cone Search Service
- Table Access Service (TAP)

Chinese Astronomical Data

- LAMOST Pilot Sky Survey Data
- Chinese Small Telescope ARray (CSTAR) Photometric Catalog

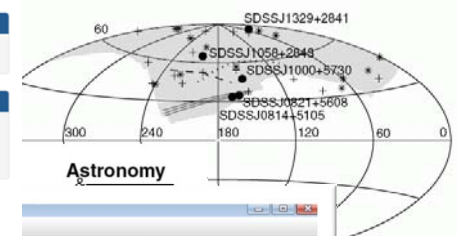
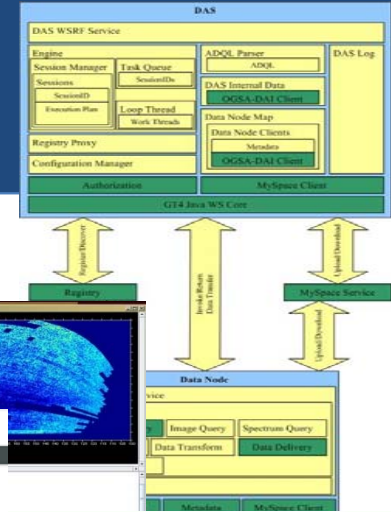
Astronomical Catalog

- The Sloan Digital Sky Survey (SDSS) Catalog
- USNO CCD Astromograph Catalog (UCAC)
- Tycho 2 Catalog

Data Mirrors

- CDS VizieR Mirror
- SDSS SkyServer Mirrors in Beijing
- CDS Astronomical Catalogues
- USNO CCD Astromograph Catalog (UCAC)
- The WISE All-Sky Data Release Source Catalog (WISE)
- The Two Micron All Sky Survey (2MASS)

VO-DAS



FitHAS

file Option About

- Header Viewer
- Single Archiving
- Batch Archiving
- Database Browser

Welcome to Header Archiving System (FitHAS)

FitHAS

Member of WORLD DATA SYSTEM

Copyright ©2005-2012, National Astronomical Observatories, Chinese Academy of Sciences  
23A Datun Road, Chaoyang District, Beijing, China  
Tel:010-64872500 E-mail: archive@nao.cas.cn

Search for the search pattern: 1001 001

1 Search Catalogue: 1001

2 Add Service: 1001

3 Service: 1001

4 Add Service: 1001

5 Add Service: 1001

6 Add Service: 1001

7 Add Service: 1001

8 Add Service: 1001

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99 Add Service: 1001

100 Add Service: 1001

Comment

spSpec-51911-045 spSpec-51911-045 spSpec-51911-045 spSpec-51911-045

View Sort By SAMP View FITS Version Control Edit Rate Add To Category Refresh Property

1911-045

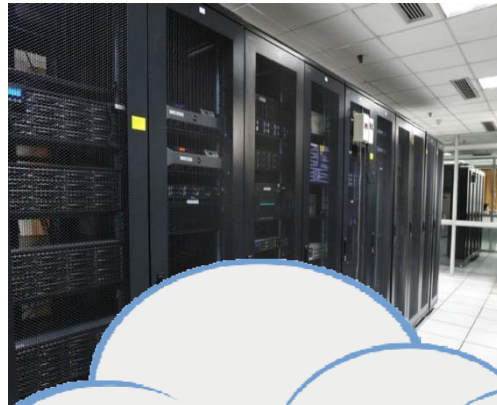
spSpec-51911-045 spSpec-51911-045 spSpec-51911-045 spSpec-51911-045

FITS Manager

# Astronomical Big Data



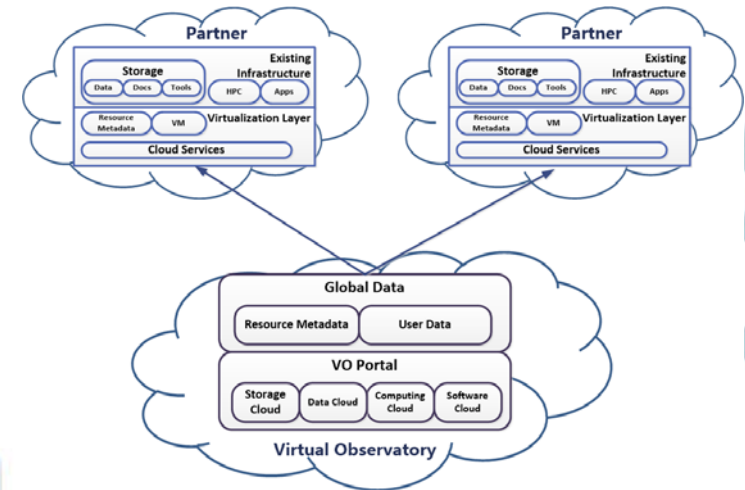
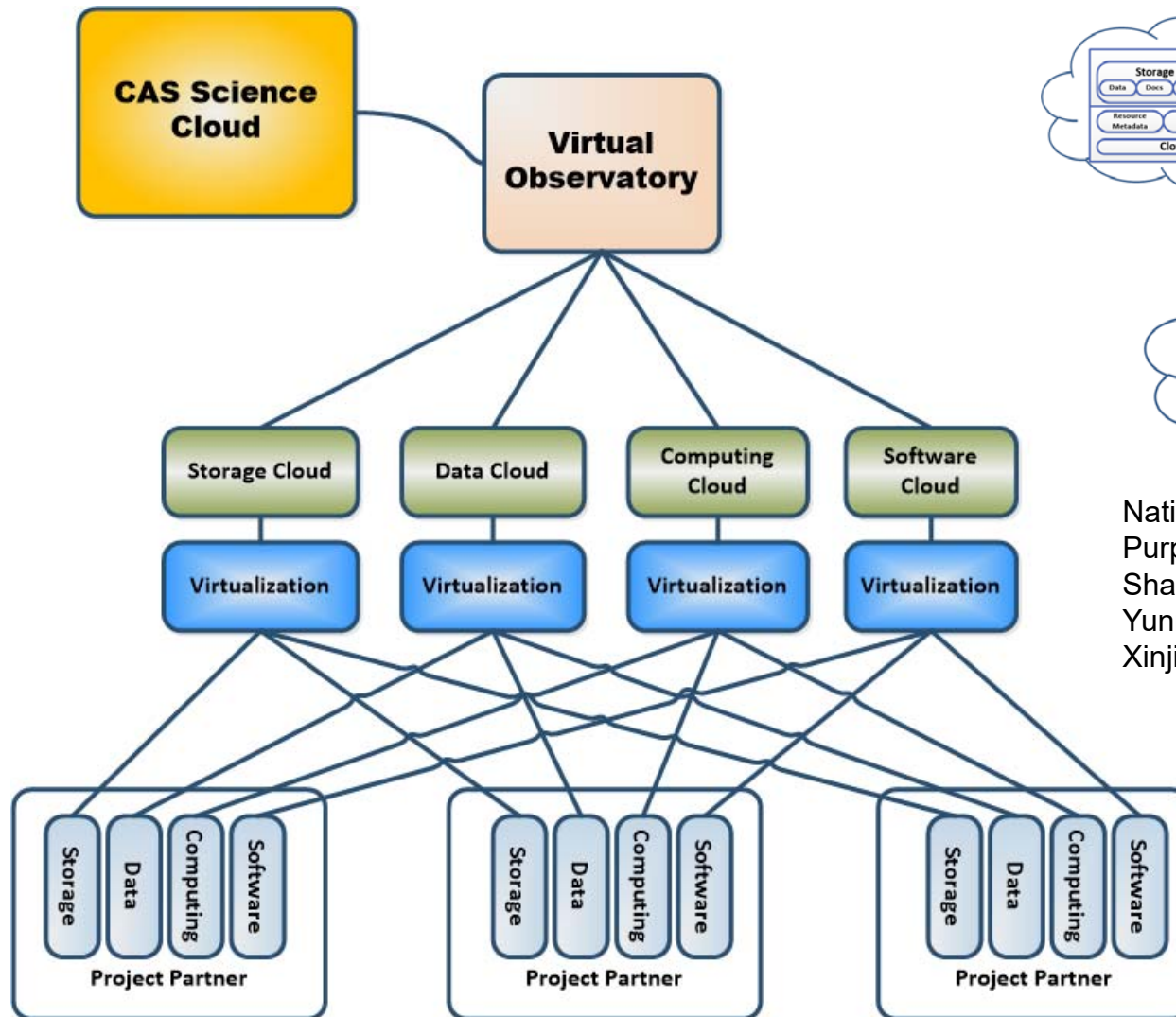
# Large-scale computing & Storage



Computation migration to data



# Astronomical Cloud in China-VO



National Astronomical Observatories, CAS  
Purple Mountain Observatory  
Shanghai Astronomical Observatory  
Yunnan Astronomical Observatory  
Xinjiang Astronomical Observatory

# The Portal of China-VO System

Home Login ScienceCloud 简体中文

China-VO 中国虚拟天文台 Observation Data Tools Cloud Public

进入图库

公众超新星搜寻项目

**热点新闻**

10岁小学生发现超新星，虚拟天文台开启科研新模式	平台注册用户数超过万人	丽江2.4米望远镜2015-2016观测季提案征集...
国内首个天文全民科学计划上线，邀您共同发现超新星	借力科学大数据，分享自己心中的宇宙	上海台1.56米望远镜数据实现统一访问
天文云教学V6就绪，IPv6应用实现新突破	天文领域云论文数据仓储库上线	更多...

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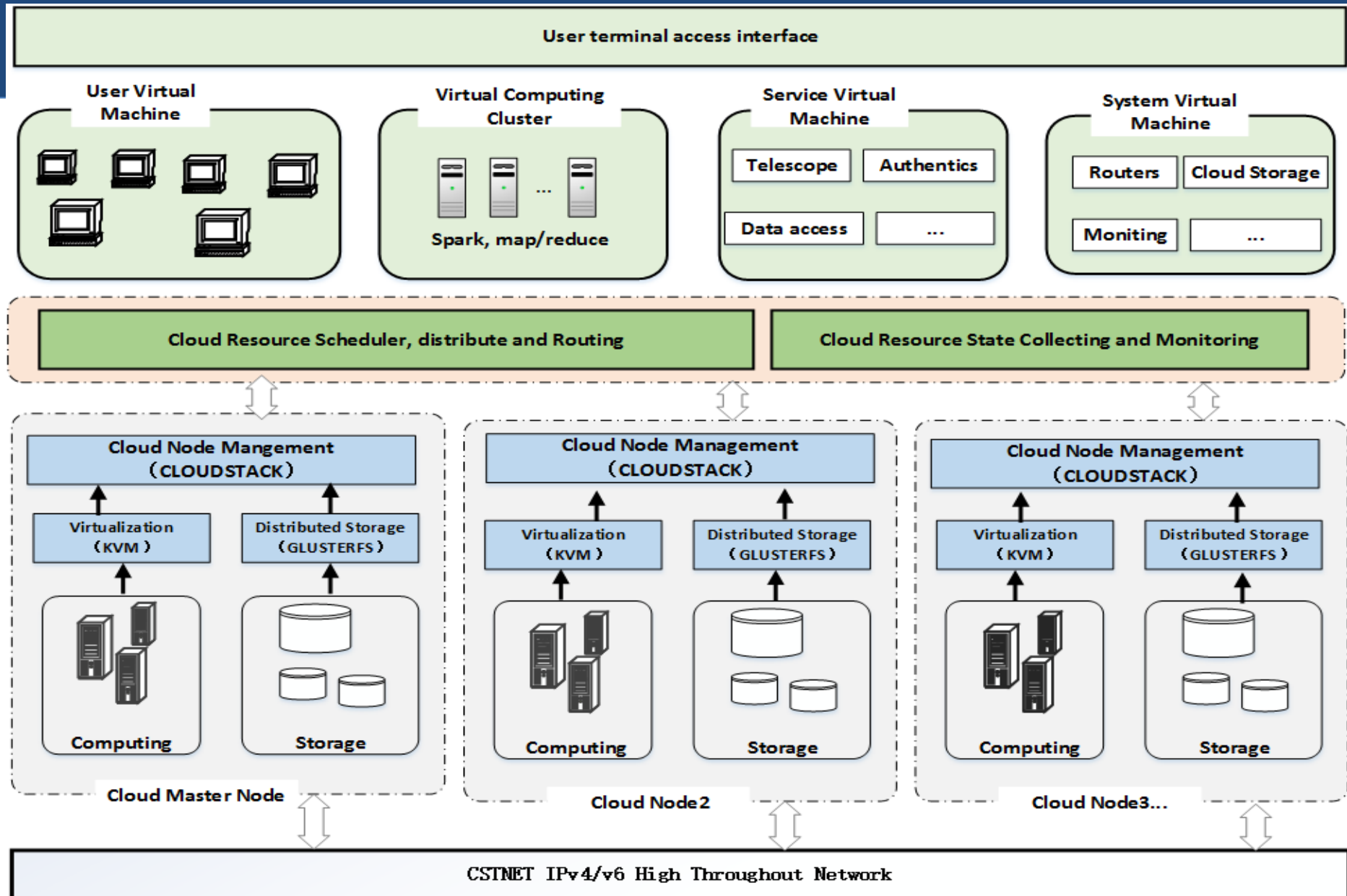
# Achievement

- Storage capacity:
  - 1500TB
- Calculate ability:
  - 702T+472 cores
- Network bandwidth:
  - 155Mbps-300Mbps
  - 10Gbps/1Gbps
- Users: 18684 +
- Nodes: 7
- Virtual Machine Instances: 500+
- Supported Telescope: 4
- Archived Dataset: 24
- Mirror Dataset: 9
- Astronomy Software Environment: 4

项目简介		PSP已知目标		旧图试看		开始搜寻			
<b>最新消息:</b> <span style="float: right;">8F</span>									
PSP系统文档 <a href="#">更多</a>		PSP新闻 <a href="#">更多</a>		15天内 提交/看图数 排名		24小时看图能手		搜寻大神	
PSP系统发现目标列表		2月21日~3月1日PSP系统发现四颗超新星候选体...		李昂 0.09%		宋韦肇凰 89300 张			
PSP发现者列表		2016年度发现的第二颗超新星		廖家铭 0.12%		计成 76116 张			
项目简介		PSP项目首次新星发现以及2016年第二颗超新星		张申炜 0.15%		高伟 73988 张			
操作说明				宋韦肇凰 0.18%		王晓兵-湖北襄阳 70198 张			
				赵从玺 0.20%		廖熙 59423 张			



# The Architecture of China-VO System



# Cloud Operation System

China-VO Customization Development

JQUERY+AJAX+JSON

UI

JAVA+SPRING+MYSQL

API

4.0

CentOS 6+KVM

Management  
server

The screenshot displays a cloud management interface. On the left is a navigation sidebar with items: Dashboard, Virtual machines, MyVOSp, PaperDa, Regions, Template, and Events. The main content area is titled 'Virtual machines' and 'ivoaserver1'. It features a 'Refresh' button and a 'machine' label. Below the title are tabs for 'Details', 'NICs', and 'Statistics'. A toolbar contains icons for power, refresh, delete, clone, key, share, and mail, along with a 'View Volumes' button. The 'Details' tab shows the following information:

Zone name	Astrocloud-NAOC
Host	
Domain Name	ASTROUSER
Account	10326617
Created	09 Jun 2015 09:51:54
Name	ivoaserver1
ID	fa52fa77-ecbe-497f-b39e-68f435329806

# Multi-node management



China-V3

# New Member: NJU



**School of Astronomy & Space Science**

Is the first university node.



# New Member: AliCloud



China 's largest public cloud provider

A screenshot of the AliCloud console interface. The top navigation bar includes 'Home', 'Products', a search icon, a notification bell with '56', and links for 'Billing Management', 'Support', 'Documentation', and a user profile 'lich@china-vo'. The main content area is a grid of service tiles. A dark sidebar on the left lists 'Base services' and other categories. A small utility bar with icons for language, time, and settings is overlaid on the grid.

Category	Service
Elastic Computing	Elastic Compute Service
Elastic Computing	Virtual Private Cloud
Elastic Computing	Server Load Balancer
Elastic Computing	Auto Scaling
Elastic Computing	Container Service
Elastic Computing	Resource Orchestration
Elastic Computing	BatchCompute
Analysis	E-MapReduce
Middleware	Enterprise Distributed Application Service
ApsaraDB	ApsaraDB for RDS
ApsaraDB	ApsaraDB for MongoDB
ApsaraDB	ApsaraDB for Redis
ApsaraDB	HybridDB for MySQL
ApsaraDB	ApsaraDB for HBase
ApsaraDB	Data Transmission Service
Cloud Communication	Short Message Service
Cloud Communication	AliCloud Mobile Push
Cloud Communication	Message Service
Cloud Communication	Direct Mail
Storage & CDN	Object Storage Service
Storage & CDN	Alibaba Cloud NAS
Storage & CDN	Table Store
Storage & CDN	Alibaba Cloud CDN
Monitor and Management	CloudMonitor
Monitor and Management	Resource Access Management
Monitor and Management	Resource Orchestration
Monitor and Management	ActionTrail
Monitor and Management	Key Management Service
Media Services	
Networking	Server Load Balancer
Networking	Virtual Private Cloud
Networking	Elastic IP Address
Networking	ExpressConnect
Networking	Alibaba Cloud CDN
Application Services	Log Service
Application Services	Performance Testing Service PTS
Application Services	Direct Mail
Application Services	API Gateway
Application Services	Market

# New Member: AliCloud



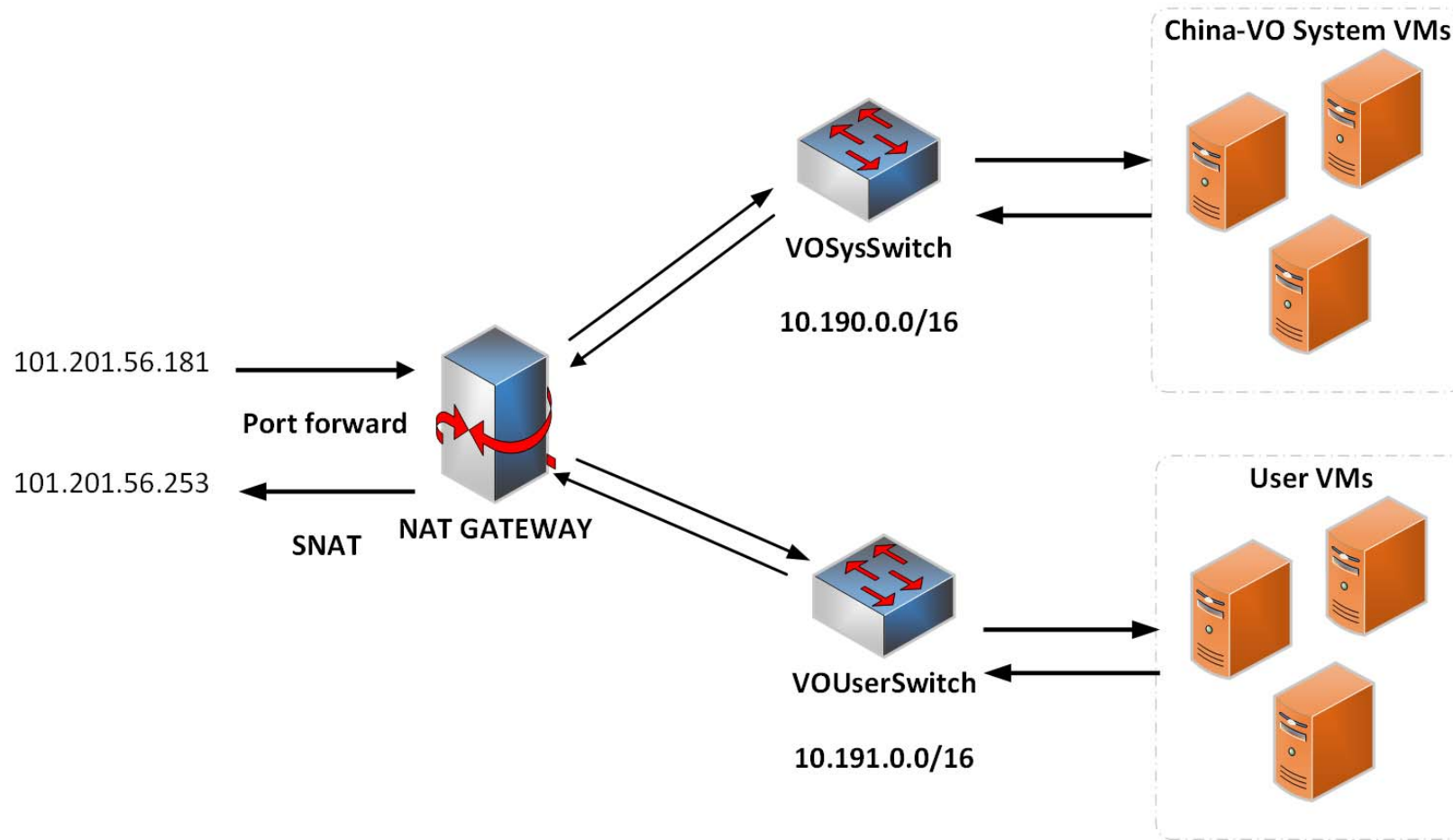
China 's largest public cloud provider

China South 1 (Shenzhen)	Asia Pacific SE 1 (Singapore)	China North 1 (Qingdao)	
China North 2 (Beijing)	China North 3 (Zhangjiakou)	China East 2 (Shanghai)	
US East 1 (Virginia)	Hong Kong	Middle East 1 (Dubai)	Asia Pacific SE 2 (Sydney)
China East 1 (Hangzhou)	EU Central 1 (Frankfurt)	Asia Pacific NE 1 (Tokyo)	
US West 1 (Silicon Valley)			



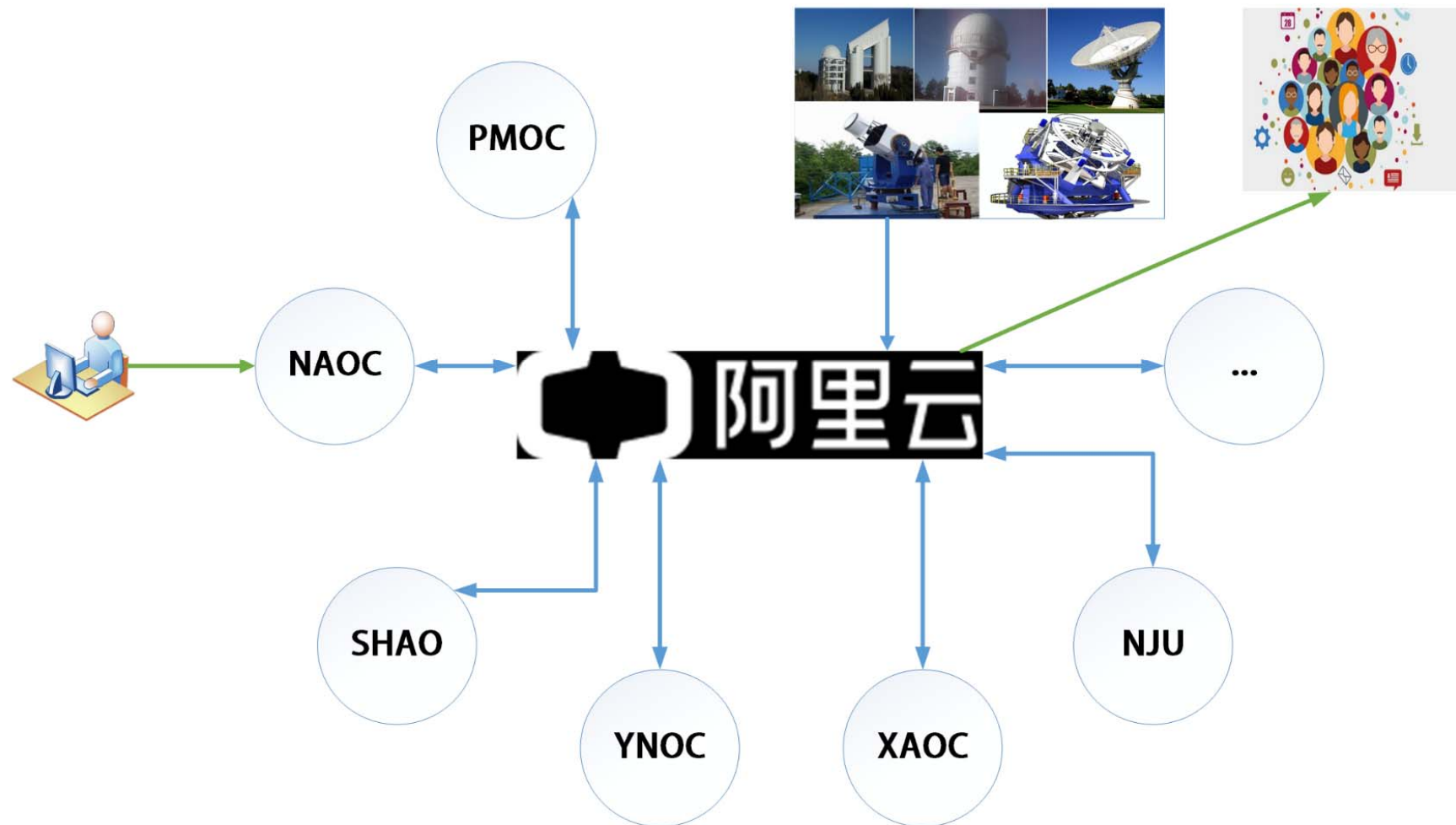


# New Member: AliCloud



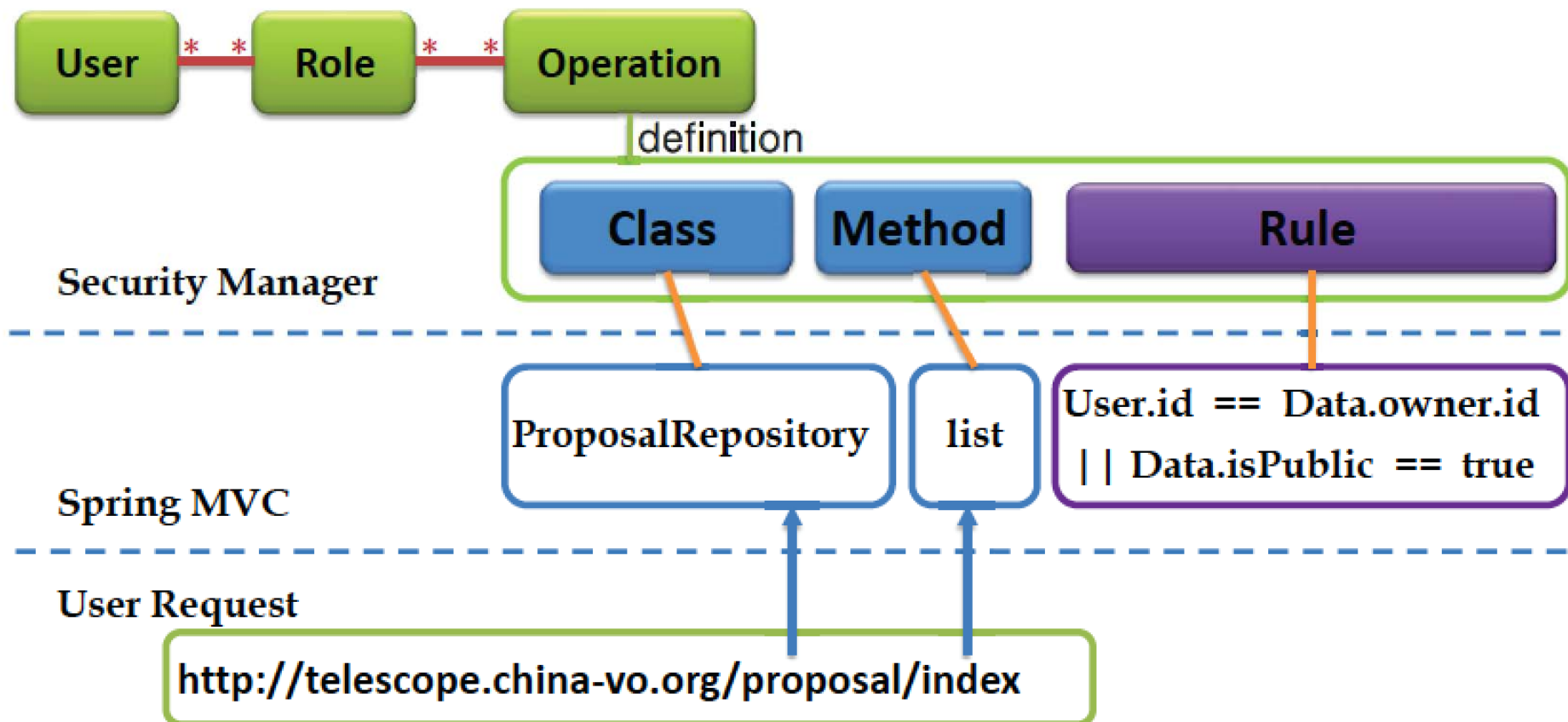
# New Member: AliCloud

## Distributed Hybrid Cloud Environment



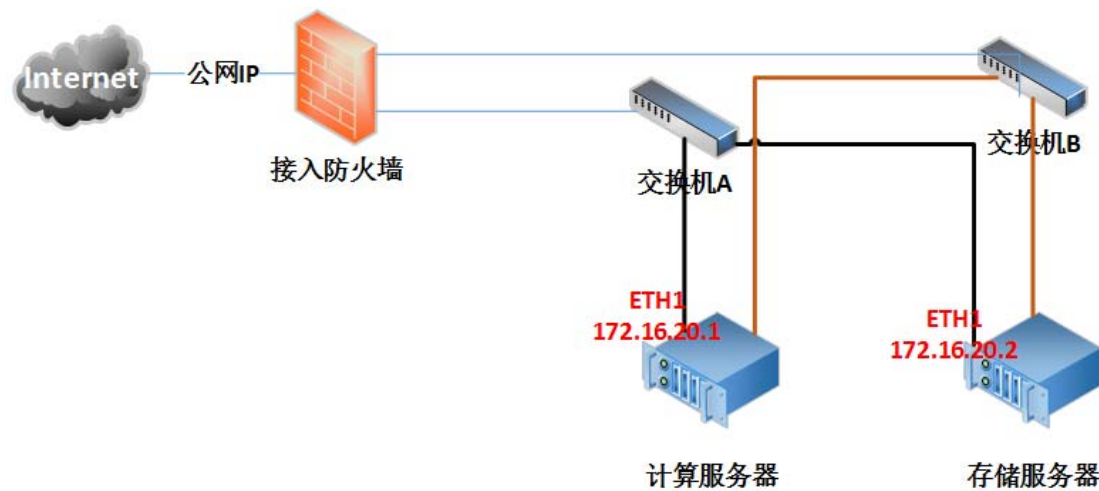
# Technology Details

- Single Sign On
  - CST cloud passport (OAuth 2.0)



# Technology Details

- Hardware and software configuration standard

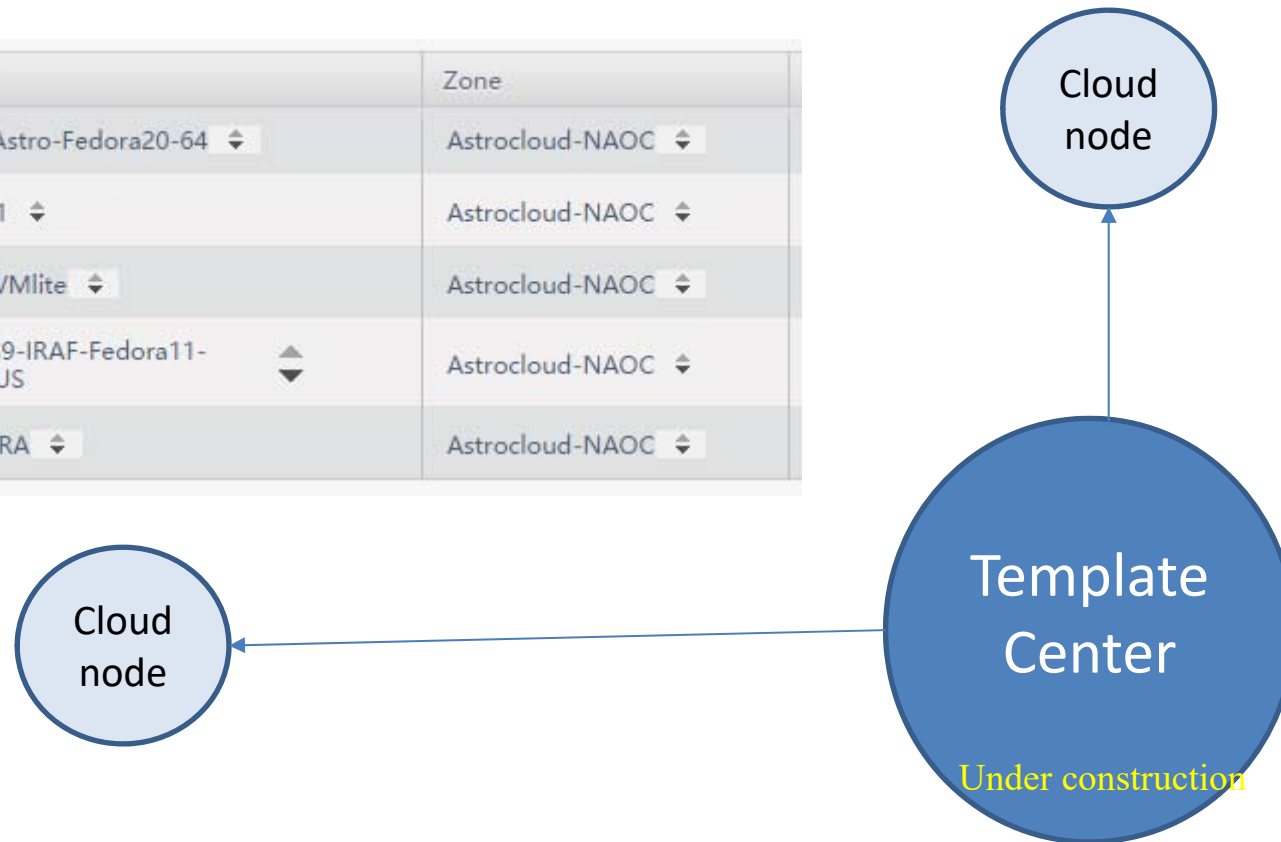


- Remote installation and configuration

# Technology Details

- VM Template management

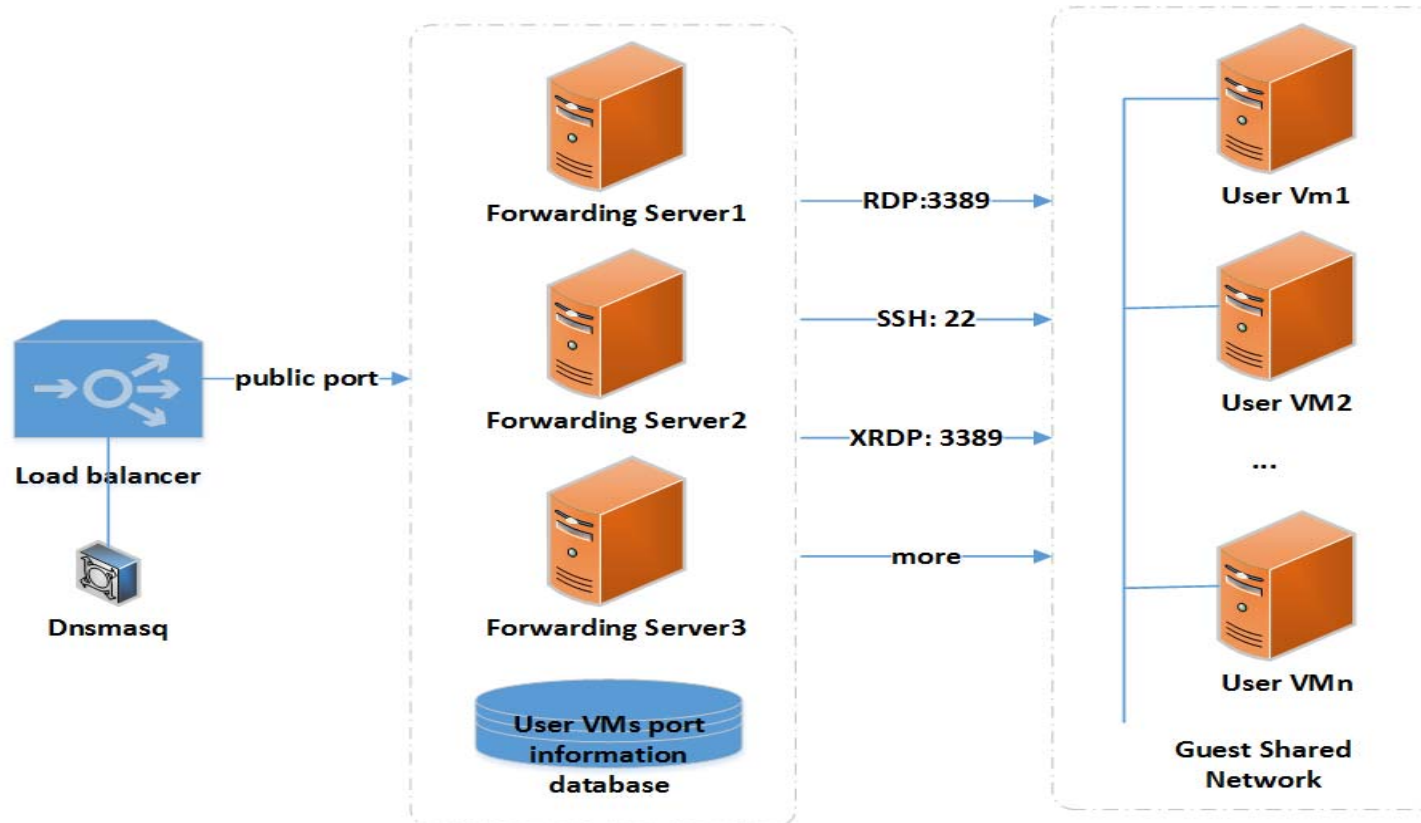
Name	Zone
Basic-Astro-Fedora20-64	Astrocloud-NAOC
AIRE0.1	Astrocloud-NAOC
pulsarVMlite	Astrocloud-NAOC
SCI-DS9-IRAF-Fedora11-32EN-US	Astrocloud-NAOC
MADARA	Astrocloud-NAOC



China-VO

# Technology Details

- Virtual machine access



# Technology Details

- The distributed storage--GlusterFS

## Storage for your Cloud

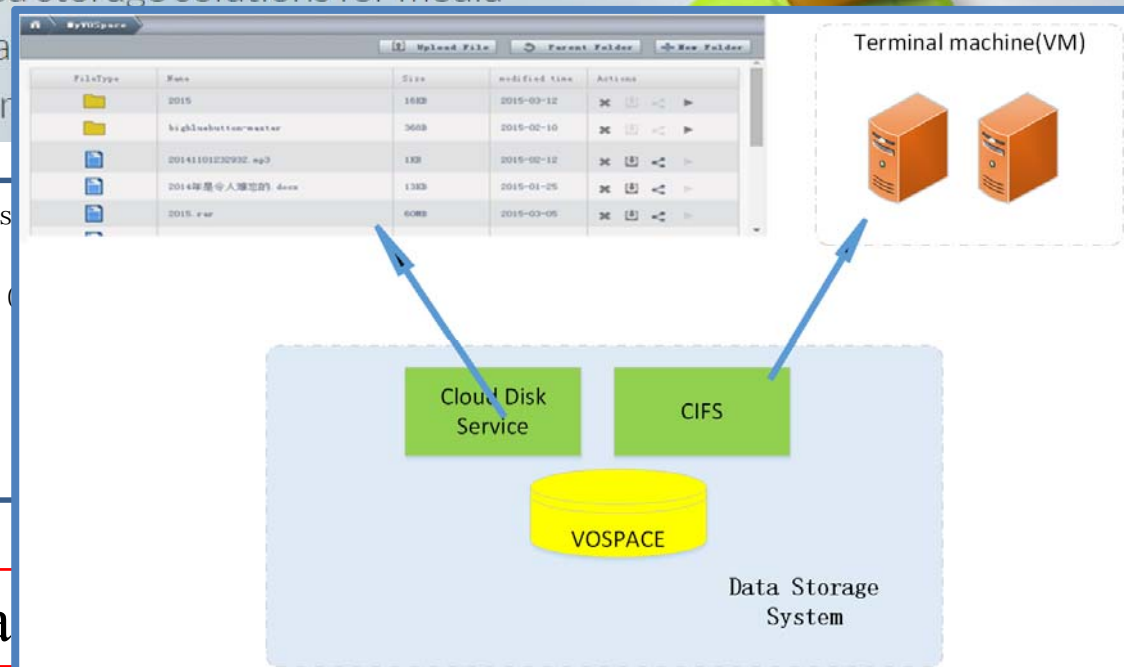
GlusterFS is a scalable network filesystem. Using common off-the-shelf hardware, you can create large, distributed storage solutions for media streaming, data analysis, and other data-intensive applications. GlusterFS is free and open source software.



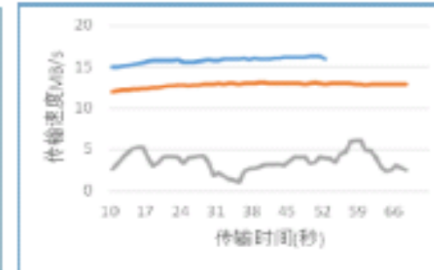
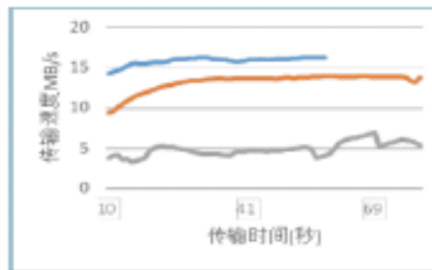
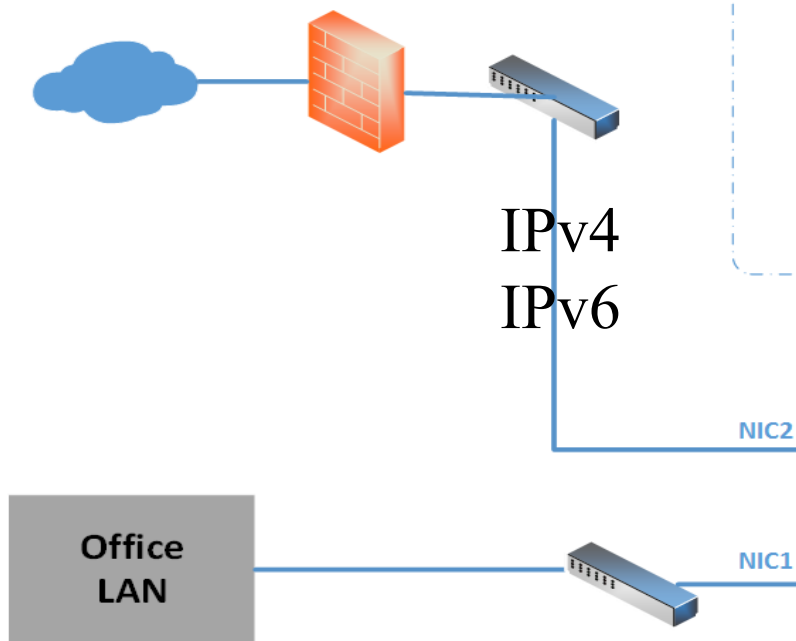
```
time dd if=/dev/zero of=/root/cloudvol/iotes  
  
1677721600000 bytes (1.7 TB) copied, 2343.0  
  
real 39m21.953s  
user 0m0.520s  
sys 20m29.405s
```

VOSPACE

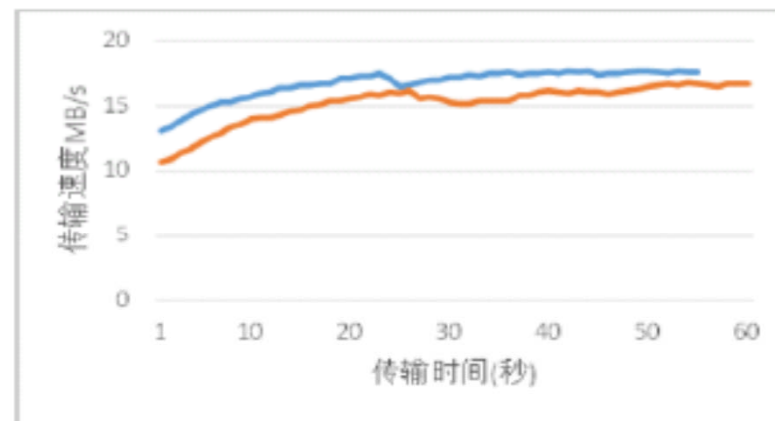
PaperData



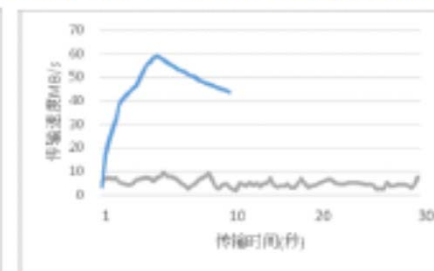
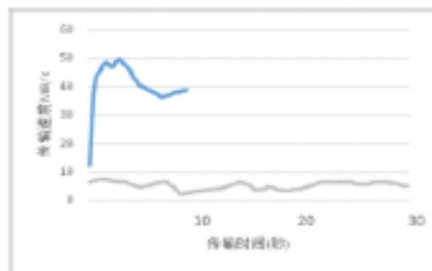
The speed in IPv6 is 50 times faster than IPv4



a) 在两个地域不同的云节点虚拟机上通过 SCP 下载文件的时间与速度对比图



b). 云内网虚拟机间使用 IPv4 与 IPv6 速度对比

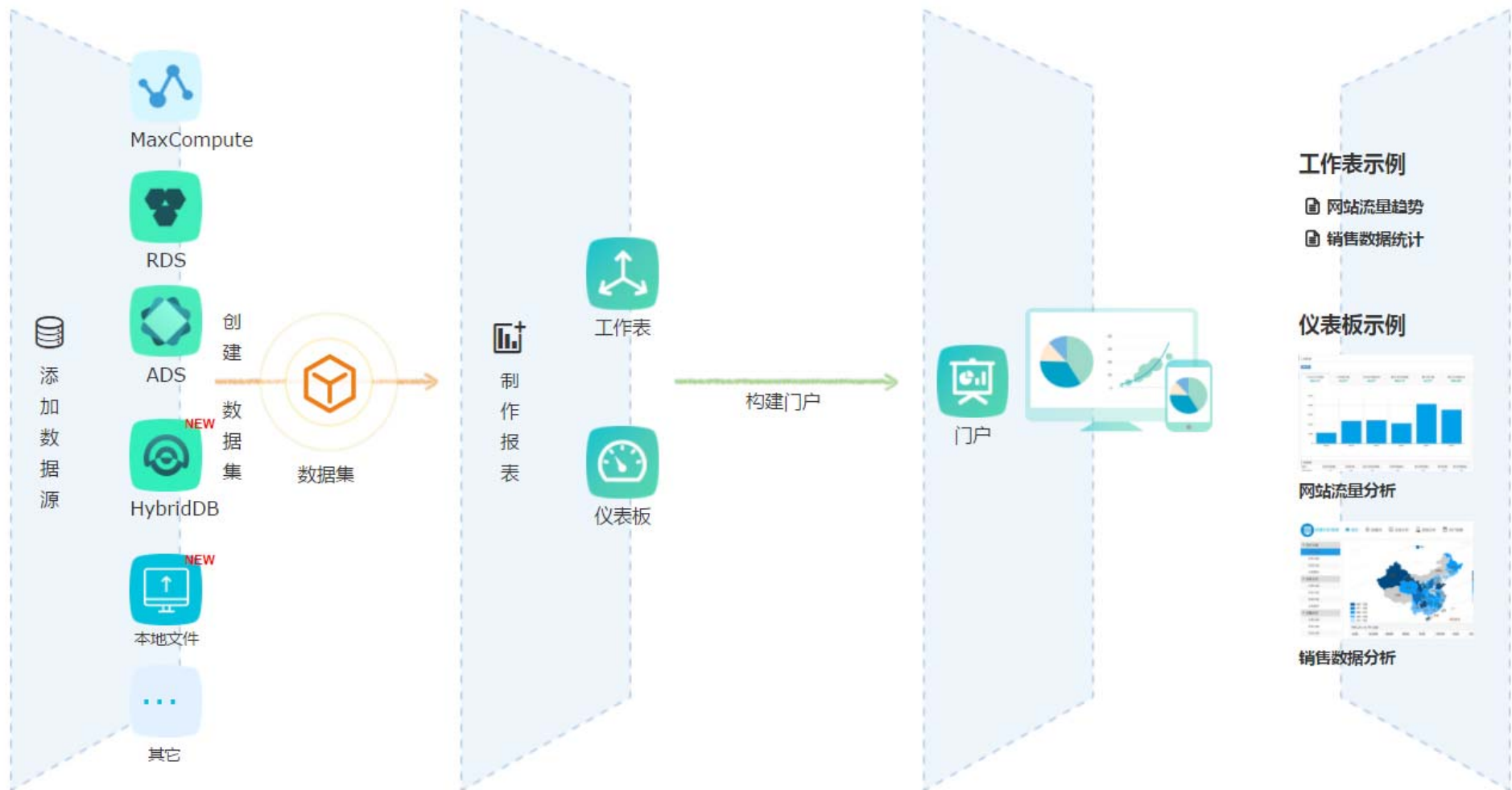


c). 在两个地域不同的云节点虚拟机上通过 wget 下载 VOSPACE 文件的时间与速度对比图



# Usage statistic

## Quick BI



# Application of China-VO Cloud

- Telescope proposal management
- Data archive and exploration
- Astronomy Teaching
- The astronomy big data processing
- WWT tours management
- ...



# Data Exploration

The screenshot displays a web-based data exploration interface. At the top, a navigation bar includes 'Save', 'App', 'Send', and 'Download' options. Below this is a table of astronomical data with columns: FITS, obsid, obsdate, planid, spid, fiberid, ra, dec, class, and subclass. A 'Download' menu is open, showing options: 'Upload all files to my VOSpace', 'Upload selected files to my VOSpace', 'Upload selected files to Baidu Cloud', and 'Download selected files'. A light curve plot is visible, showing 'Flux density (erg/s/cm<sup>2</sup>)' on the y-axis. A 'TwoM UCAC WISE' label is present. A second table is shown below, with columns: FITS, obsid, obsdate, planid, spid, fiberid, ra, dec, class, subclass, z, and rv. A 'Save' menu is open, showing options: 'Save current page as VOTable', 'Save current Page as CSV', 'Save current Page as FITS', 'Save all result as VOTable', 'Save all result as CSV', and 'Save all result as FITS'. A red arrow points to the 'Save' button in this menu.

FITS	obsid	obsdate	planid	spid	fiberid	ra	dec	class	subclass
						332.2022740000	-2.0567670000	STAR	K1
						332.4715760000	-2.0850150000	STAR	M0
						332.3687450000	-1.9557710000	STAR	G5

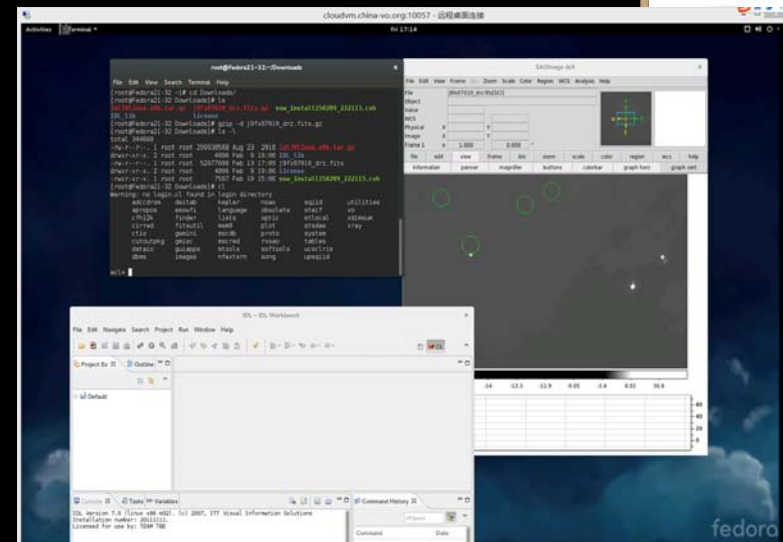
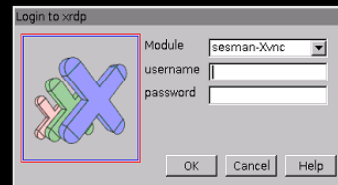
  

FITS	obsid	obsdate	planid	spid	fiberid	ra	dec	class	subclass	z	rv
						332.2022740000	-2.0567670000	STAR	K1	-23.06902964	null
						332.4715760000	-2.0850150000	STAR	M0	27.10000040	null
						332.3687450000	-1.9557710000	STAR	G5	25.03866609	null
						332.2066650000	-1.8686530000	STAR	G0	-22.16965227	null
						332.3487250000	-2.1360960000	STAR	K5	-6.63140917	null
						332.4444170000	-1.9240460000	STAR	G0	-2.46129608	null
						332.2223790000	-1.9876260000	STAR	F5	10.84948906	null
						332.3513810000	-1.8093330000	STAR	F5	-17.91859521	null
						332.5063740000	-2.0169000000	STAR	F9	52.65854525	null
						332.2444170000	-1.9198480000	STAR	K5	4.38896159	null
						331.5512340000	-1.6843560000	STAR	G5	-19.30963222	null

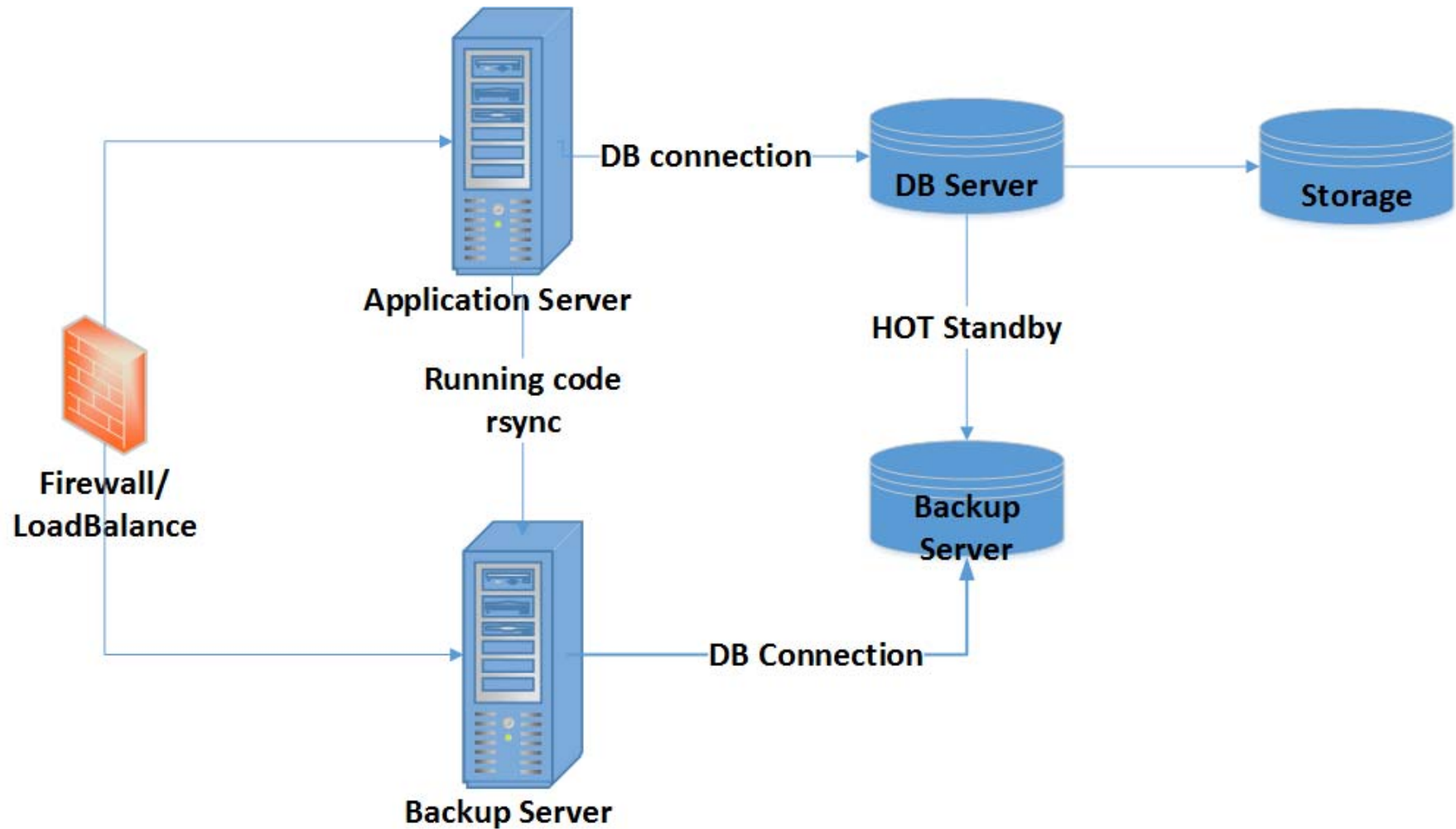
# Astronomy Teaching

- **Class: Multi-band astronomical data acquisition and processing**
- **VM Template Software:**
  - Python 2.7.5、Geany Editor
  - numpy、scipy、matlibplot
  - IDL7.0、SSW
  - DS9
  - IRAF
  - HEASOFT
  - CIAO
  - Glidas
  - CASA

cloudvm.china-vo.org:10057 - 远程桌面连接



# Maintenance



Thank You!



China-VO