

JAXA Approach on Virtualization and Cloud Computing

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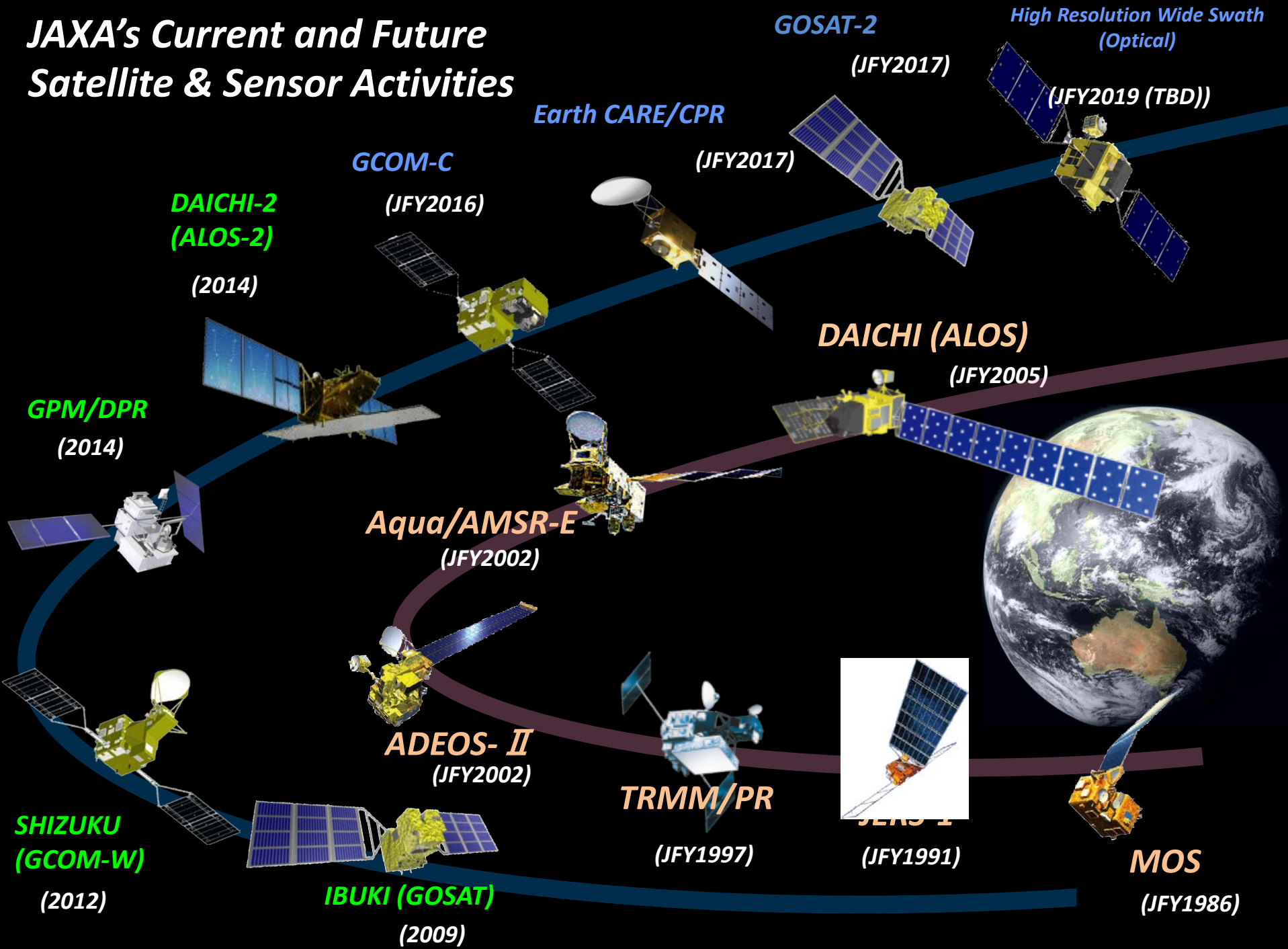
Satellite Applications and Operations Center

JAXA

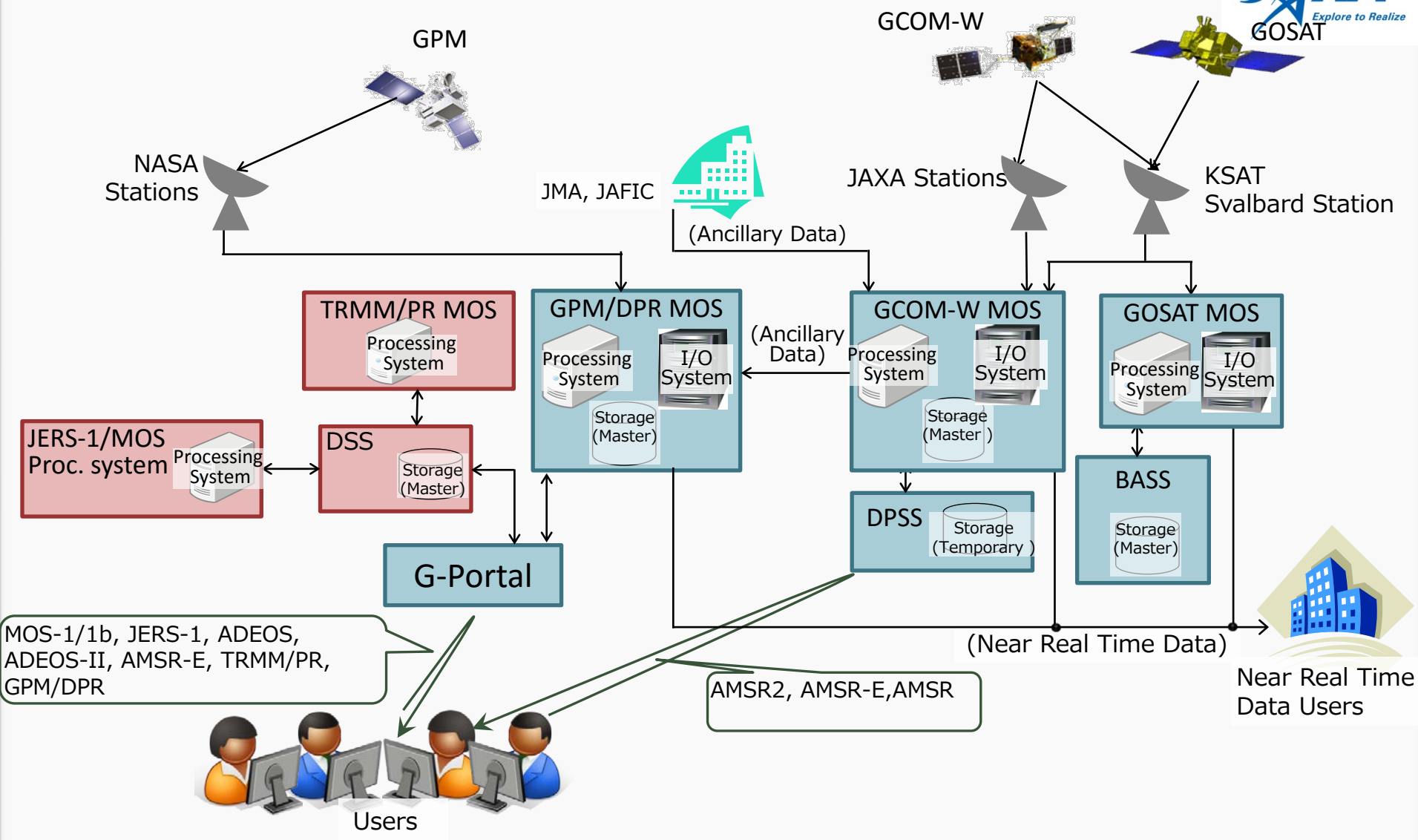
JAXA Ground Systems for EO Satellites

- Mission Operation System (MOS)
- Infrastructure System (G-Portal, Network, Storage, etc)
- Satellite Control System
- Research System
- Flight Dynamic System (FDS)
- Data Receiving Stations, etc

JAXA's Current and Future Satellite & Sensor Activities



Current Systems (As of April, 2016)



MOS-1/1b, JERS-1, ADEOS, ADEOS-II, AMSR-E, TRMM/PR, GPM/DPR

AMRS2, AMRS-E, AMRS



Users

Located in Tsukuba (TKSC)
 Located in Hatoyama (EOC)

Distance
 : 20km

JMA : Japan Meteorological Agency
 KSAT : Kongsberg Satellite Services
 BASS : Data Storage System
 DPSS : GCOM-W1 Data Providing Service

G-Portal: EO Satellite Data Portal
 DSS : Data Storage System

COST

REDUCTION

REDUCTION

REDUCTION

How it started in JAXA? (1/2)

- Phase1: 2010~2014
 - Target : Cost for System Replacement
 - [Study1] Which system can work on cloud?
 - [Study2] Virtualization can reduce the replacement cost?

How it started in JAXA? (2/2)

- Phase2 : 2014~
 - Target : Cost for Operation and Maintenance
 - [Study 3] Which system can be migrated into the new “common” system?
 - [Study 4] Which type of servers; cloud, on-premises or/and supercomputers are appropriate for the “common” system?

[Study1] Which system can work on cloud? :2010~2011

- Some servers might be placed on cloud, but there were so many issues.
 - COTS license
 - COTS performance
 - I/O speed (within cloud)
 - Network between Cloud systems and JAXA systems



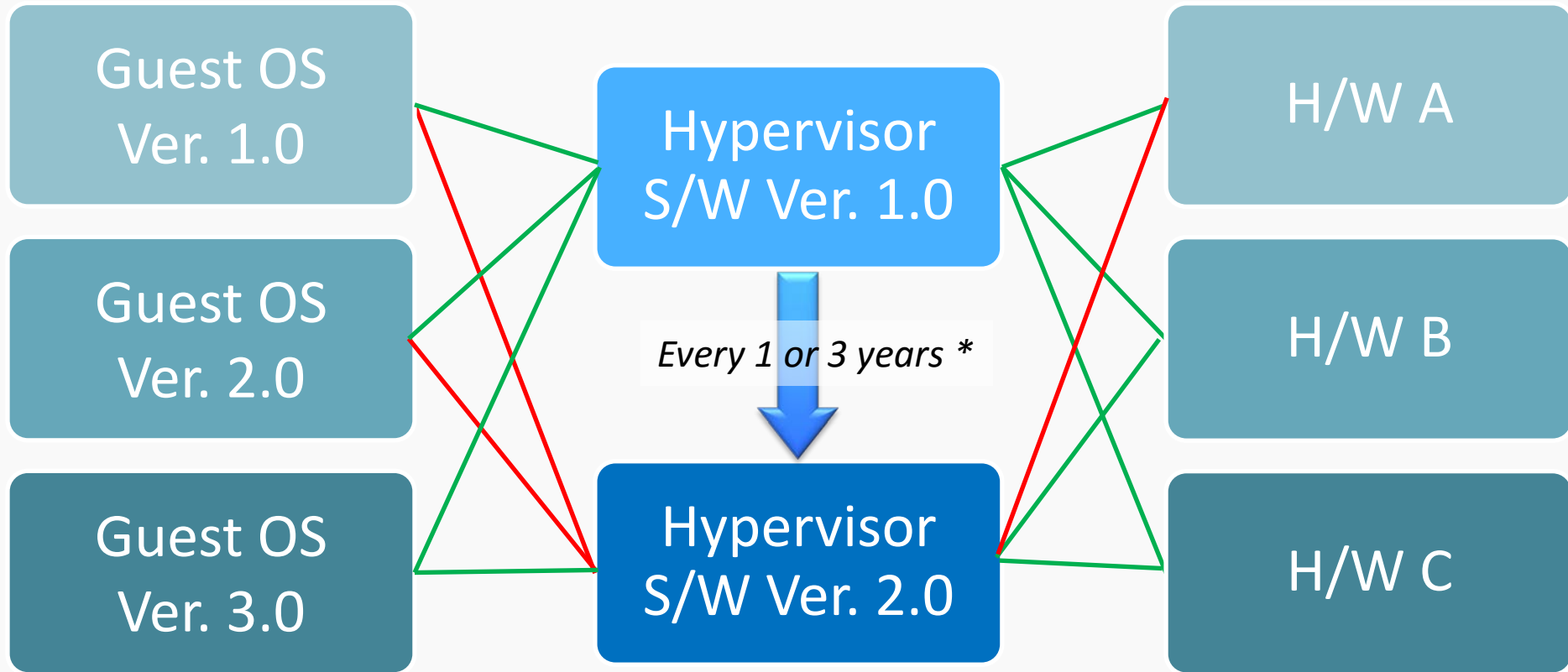
“NO GO” at that moment

[Study2]Virtualization (1/2) :2013~2014

- A hypervisor S/W Study results
 - Purpose : to decrease migration/replacement frequency
 - Target: VMware, KVM, Xen

		VMware	KVM	Xen
Vendor	Development	VMware Inc.	linux-kvm.org	Xen Project
	Sales	VMware Inc.	Redhat Inc.	Citrix Inc.
Release Frequency		1 year	3 years	1 year
H/W Compatibility		Based on "Hardware Compatibility List"		
Guest OS Compatibility		Based on "Compatibility List"		
Technical Support		5 years	5 or 10 years	5 years

[Study2]Virtualization (2/2)



OK ——— NG ———

* In general, support (maintenance updates and upgrades, bug and security fixes) duration is about 5 years.

[Study3] System Migration

- Goal : More cost-efficient system
 - Operation and Maintenance cost
- Same or similar functions will be migrated.
- Case1 : MOS (Mission Operation System) & Data Distribution system
- Case2 : Infrastructure system (Storage, NW)

Common System: Pros and Cons



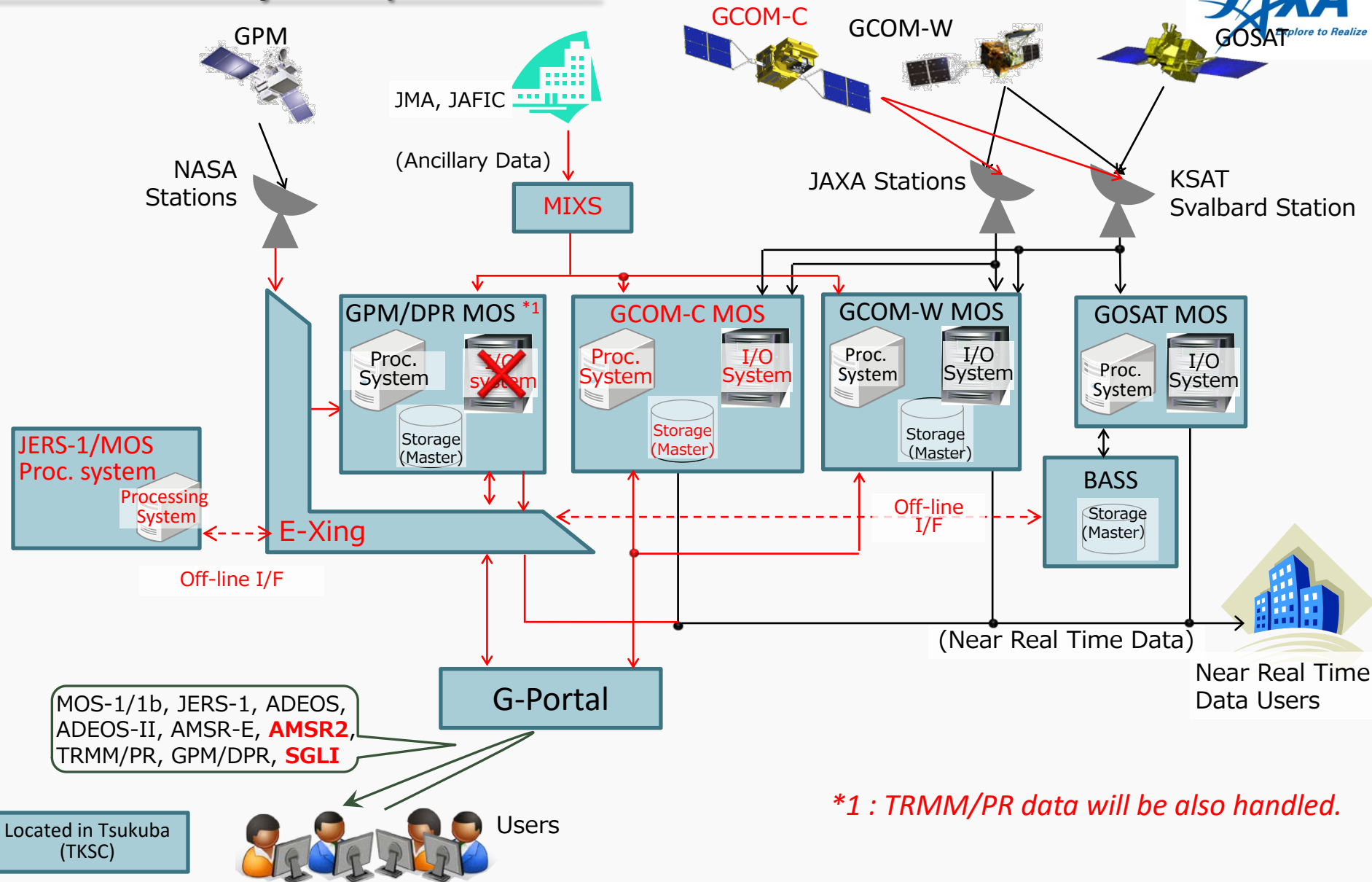
Pros

- Servers are handled as “resource”. If there is enough room, resource can be provided by a few clicks.
- Server procurement and application/system procurement can be divided.
- Service continuity during some server replacement and maintenance

Cons

- Failure on one server has impact on multiple functions.
 - But recovery using another server will be very soon.
- In “micro” view, performance may decrease.
 - But in “macro” view, overall performance will be increased.

Case 1 : Future Systems (~ JFY2017)



MOS-1/1b, JERS-1, ADEOS, ADEOS-II, AMSR-E, **AMSR2**, TRMM/PR, GPM/DPR, **SGLI**

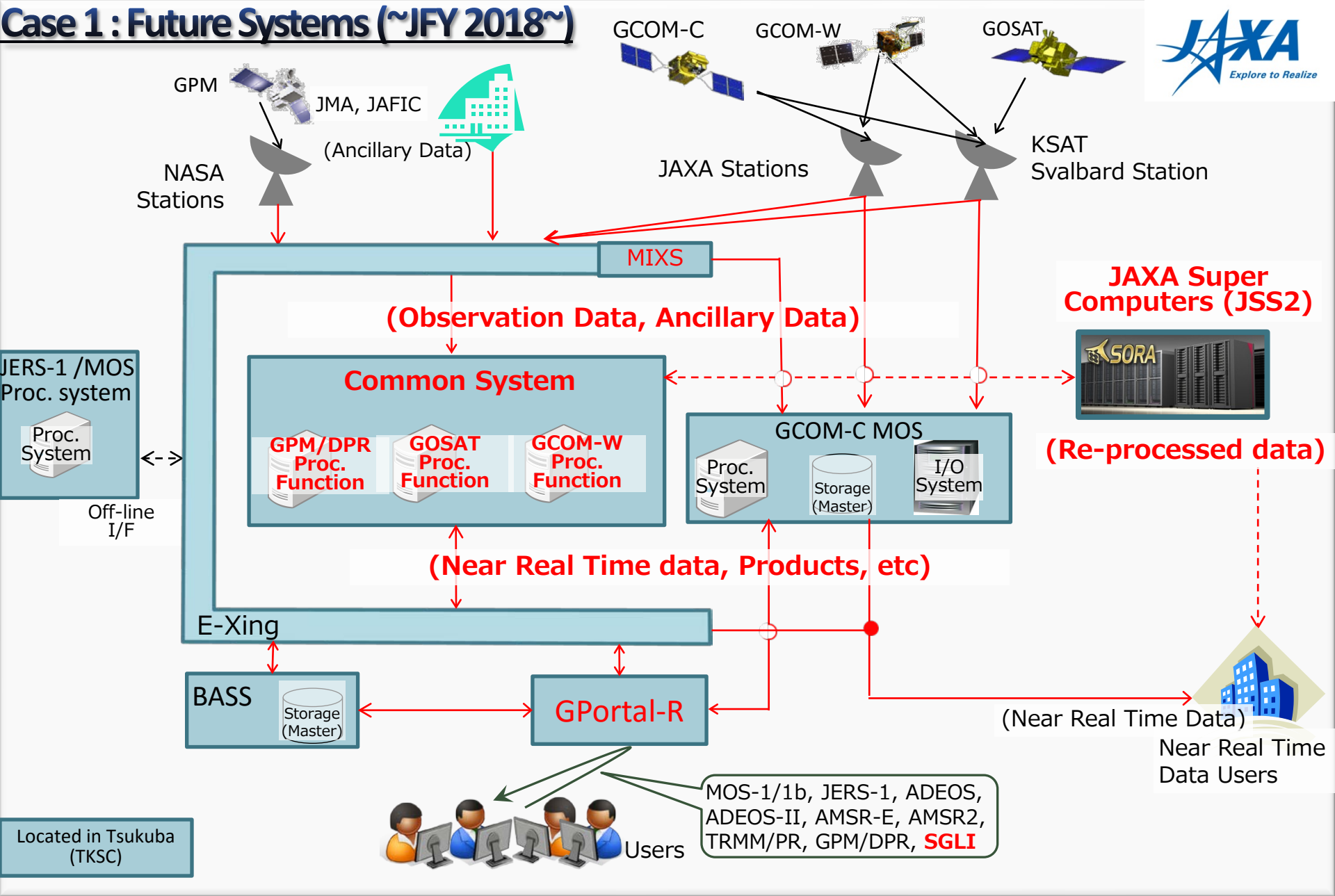
Located in Tsukuba (TKSC)



JMA : Japan Meteorological Agency
 KSAT : Kongsberg Satellite Services
 BASS : Data Storage System
 MIXS : Ancillary data management system

G-Portal: EO Satellite Data Portal
 E-XING :EO mission External Interface Gateway

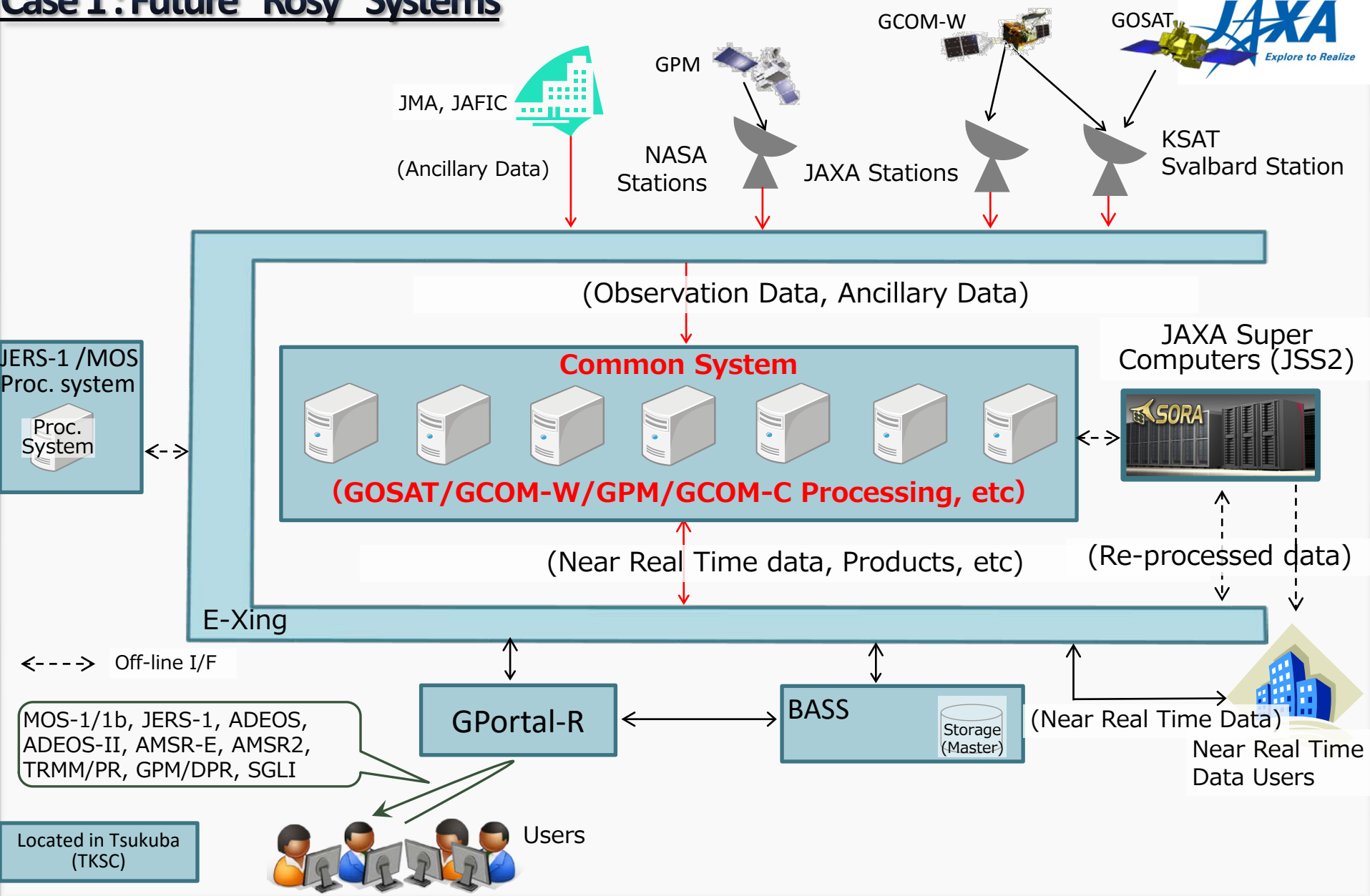
Case 1 : Future Systems (~JFY 2018~)



JMA : Japan Meteorological Agency
 KSAT : Kongsberg Satellite Services
 BASS : Data Storage System

GPortal-R: EO Satellite Data Portal
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Case 1 : Future "Rosy" Systems



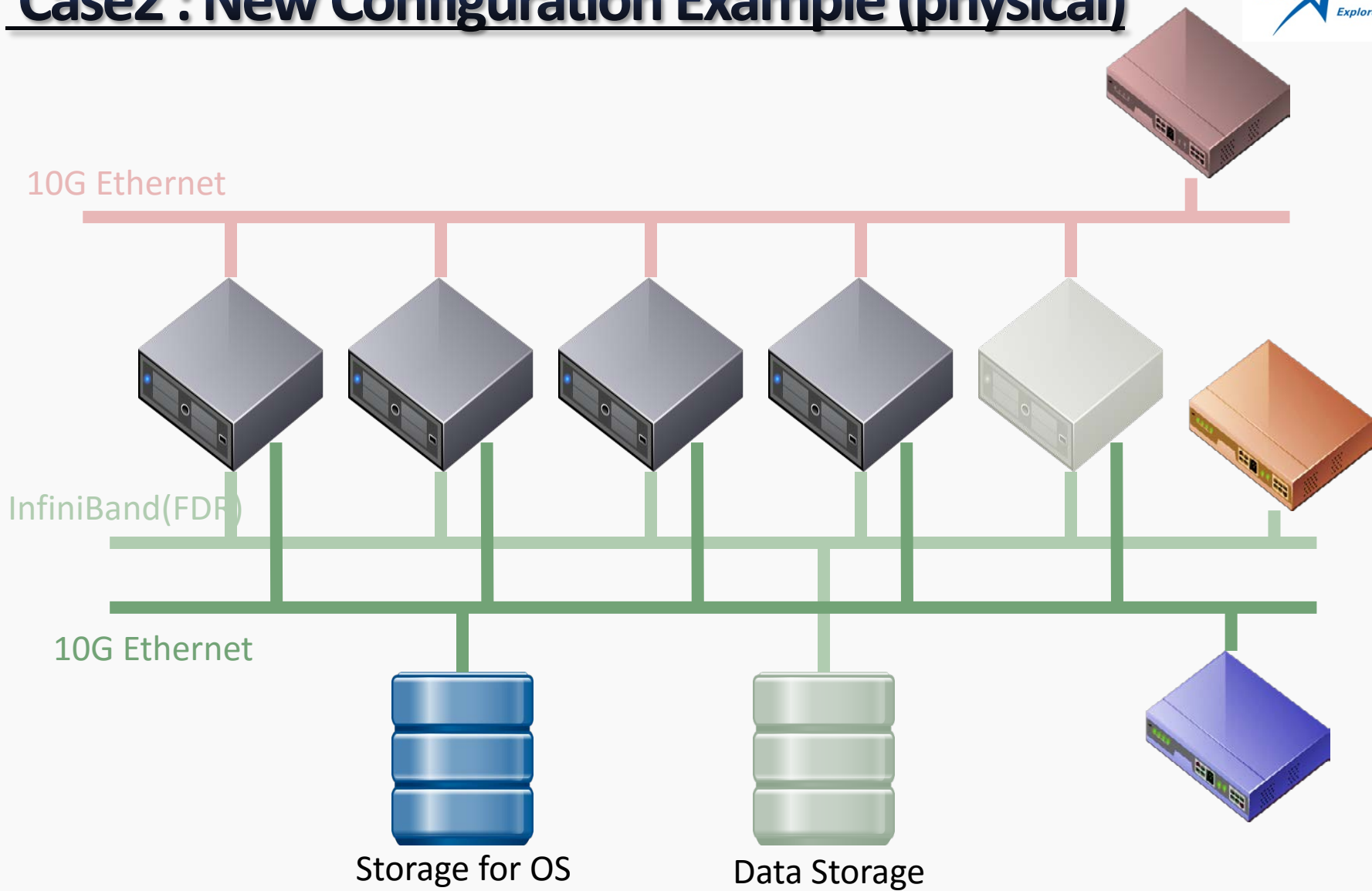
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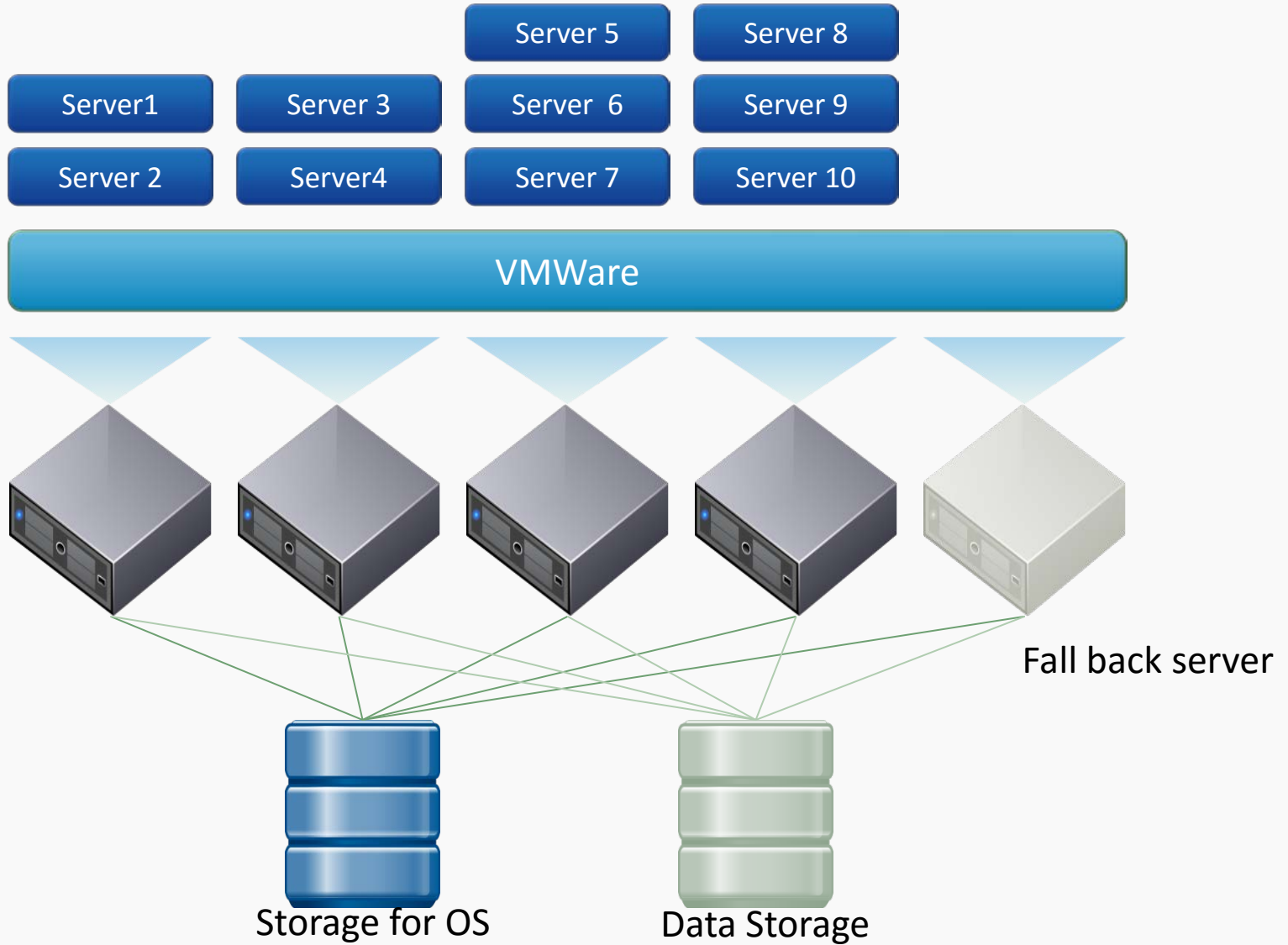
Case 2: Current situation

- 17 servers are running
 - 4 servers will be removed (their functions will not be necessary).
 - 10 servers can be migrated into 5 servers -> Cost effective system!
 - Remaining 3 servers will be as they are (no big pros on migration).

Case2 : New Configuration Example (physical)



Case 2: New Configuration Example (logical)



[Study4] Cloud, On-premises or Super Computers?

- Only MOS and Infra./ Data Storage(BASS) is the target for this study.
 - The next phase “G-Portal” developer (contractor) did choose “on-premises”, not “cloud” environment.
- MOS Common system : “on-premises” or “cloud”?
- MOS Re-processing system : Super Computers
- BASS : “on-premises” or “cloud”?

Discussions are still on-going

Some Issues for Using Cloud

- Cost for data download
 - Egress charge...
- Network between Cloud and JAXA system
 - How to move BIG DATA to cloud?
 - “AWS snowball” may be one of the solutions.
- COTS
 - License conditions are varied.
- Vendor Lock-in
 - Switching from “Cloud vendor A” to “Cloud vendor B” will be “easily” possible?
- Security
 - Domestic located servers are preferable.
- (Not specific to cloud usage) spaghetti code

Future Idea (still under consideration)



- User service on Cloud
 - Collaboration with Cloud vendor, such as AWS and Google(Earth Engine)
- User “category” expansion is required.
 - Researchers -> Researchers + Business/Application users
 - Business/Application users may like services on cloud and start using our data more proactively. But at this moment, still unknown.
 - “Who wants this service? This service will be really used?” : Difficult to answer before starting the service.

1. How are you using cloud computing in your organization/project?

- We do not use cloud computing yet.

2. How mature is your organization in the use of cloud computing?

- Not yet mature!

3. Are you using public clouds, private clouds, hybrid clouds? Are you using multiple cloud providers? Which ones? (Vendors)

- N/A

4. What benefits have you seen from using cloud computing?
 - If used for data re-processing, the data will be ready within much shorter period. And no need to maintain servers for occasional re-processing.
5. What are the challenges you have faced? (security, costs, expertize, etc.)
 - Costs for data download
 - Network
 - COTS license issue
 - Vendor lock-in
 - Spaghetti code
 - Expertize (can be acquired via WGISS!)

6. What are your opinions about using cloud computing for your organization/project? Where do you think it is appropriate and where it is not?

- If data download cost issue and network issue is resolved, common data processing function and data storage function can be placed on cloud.
- User service portal may be the candidate if users are expected to increase drastically (or “burst” type access is expected)
- Systems with almost fixed CPU/memory/storage requirement have small pros to go to cloud.

7. What kind of Big Data challenges your organization/project is facing? Are they data management and/or data analytic challenges?
- Data management (storage)
 - Data analytic challenges (some user request for data analysis)
 - Data re-processing-> “using super computers” works very well at this moment
8. Do you see Cloud Computing as the solution to your Big Data challenges?
- Yes for data analysis
 - Not sure for data management