Scientific Visualization of Extremely Large Distributed Astronomical Surveys

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Introduction

- Euclid Space Mission (ESA-M)

  - Extra galactic surveys (visible, infrared, spectroscopy)
- 10's of PB data
- Collaborators all over the world
- Multiple Science Data Centers
- Multiple Use Cases - status of processing, data release etc.

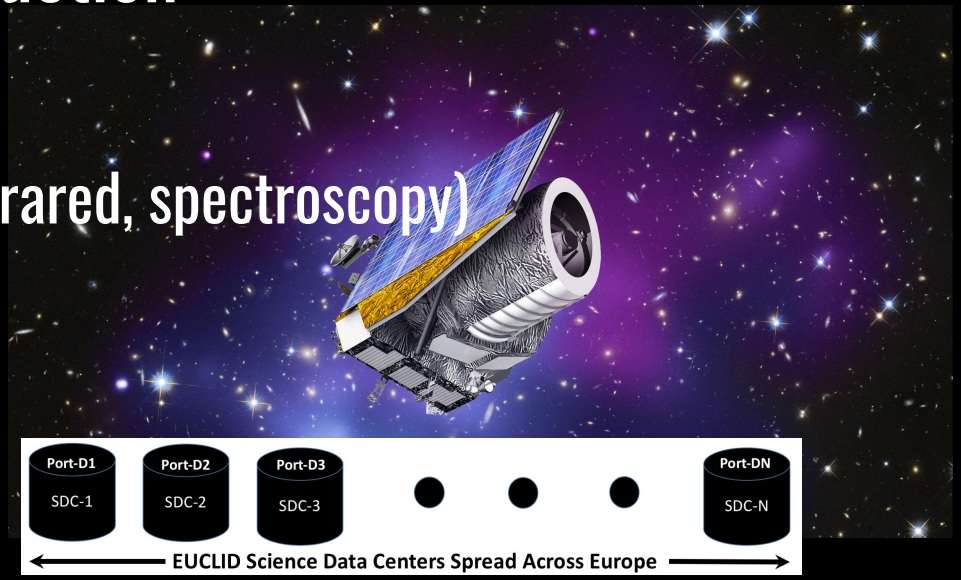

image source: ESA website

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Challenges

- Need a Distributed Visualization framework
- SDCs (heterogeneity)
- Network between SDCs - from 10s to several 100s Mbps
- Data availability/Progress according to Observation Plan
- Scalable, Flexible, Future proof framework

Two prong approach → reduce the data size (optional) and

→ enable distributed visualization

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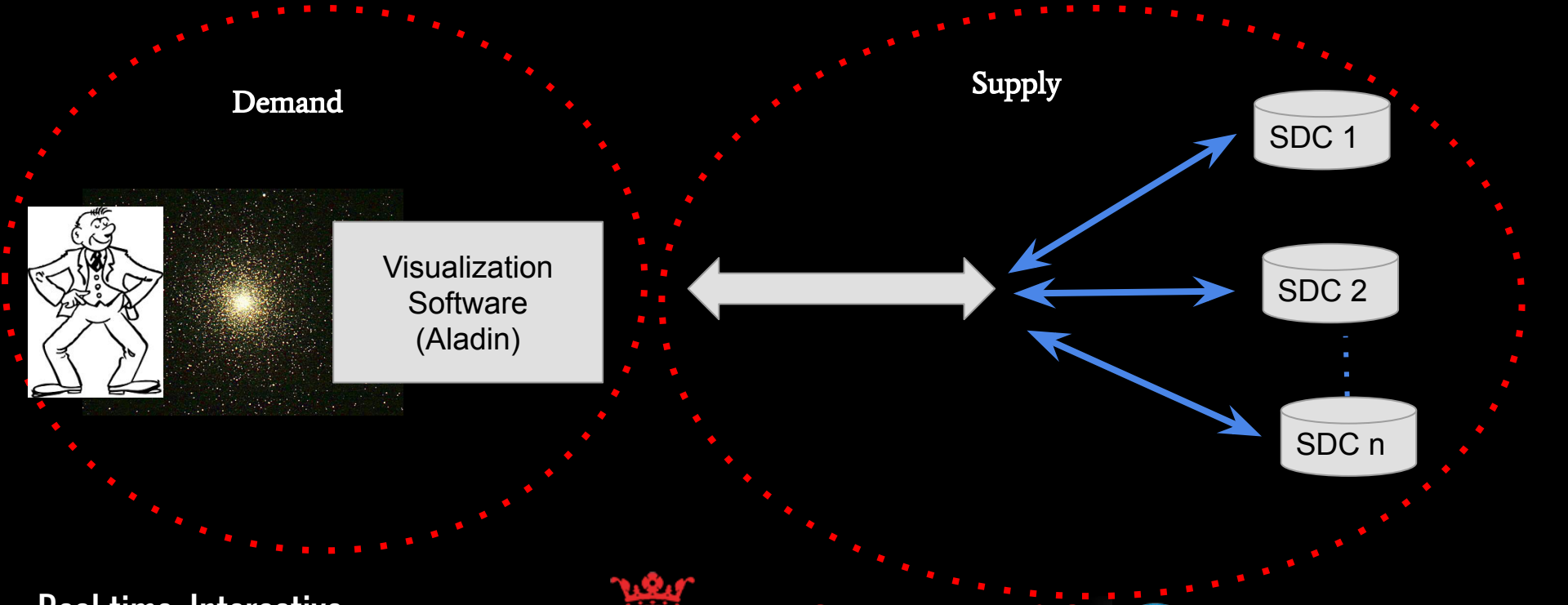
Visualization Framework



- Real time, Interactive
- Desktop feel but no copy

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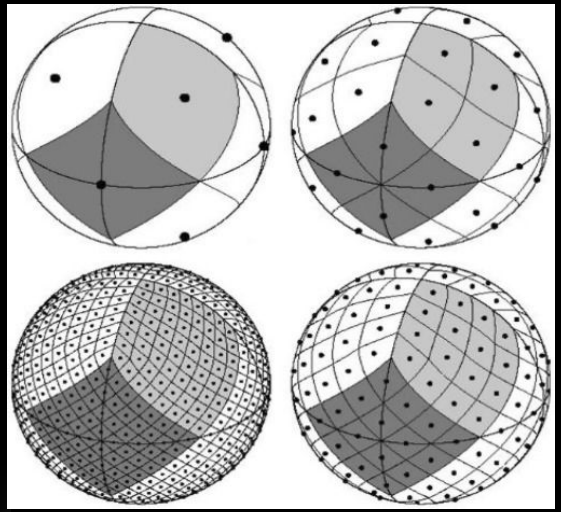
HiPS Survey

HiPS is a hierarchical tiling mechanism developed by CDS (P.Fernique et al, A&A 578, 114, 2015)

It enables multilayer visualization

- HiPS is the defacto standard for survey maps
- HiPS is http compliant



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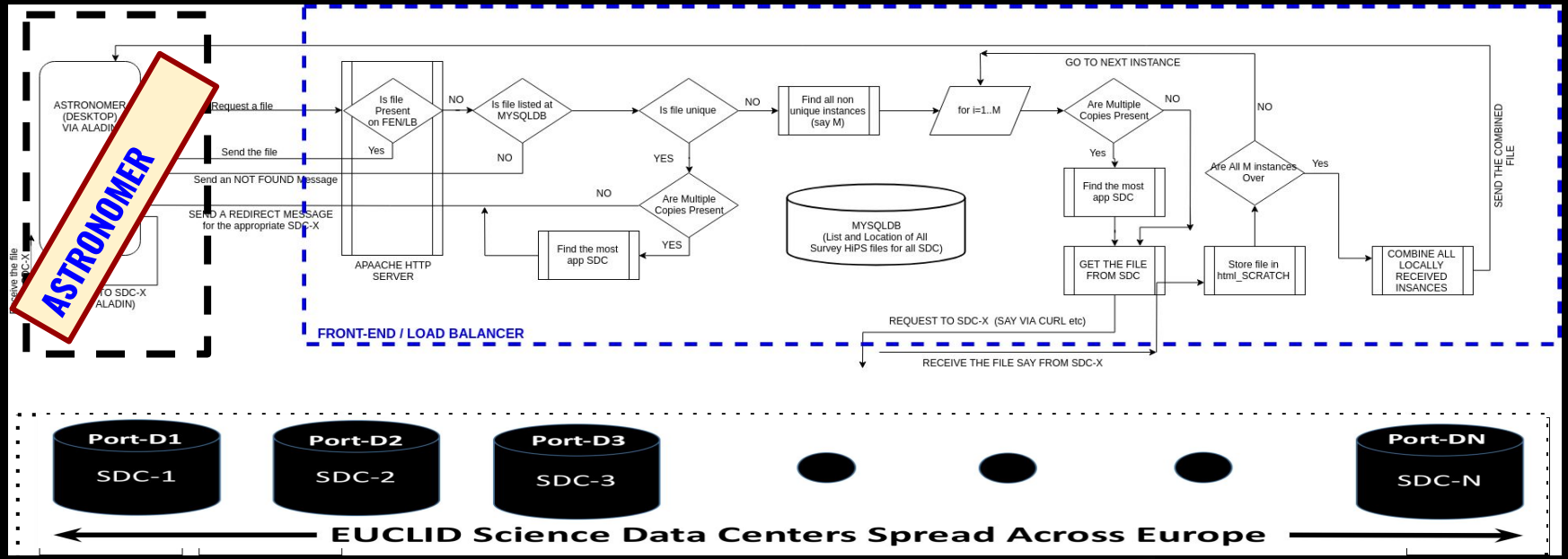
Visualization Framework with LAMP Stack



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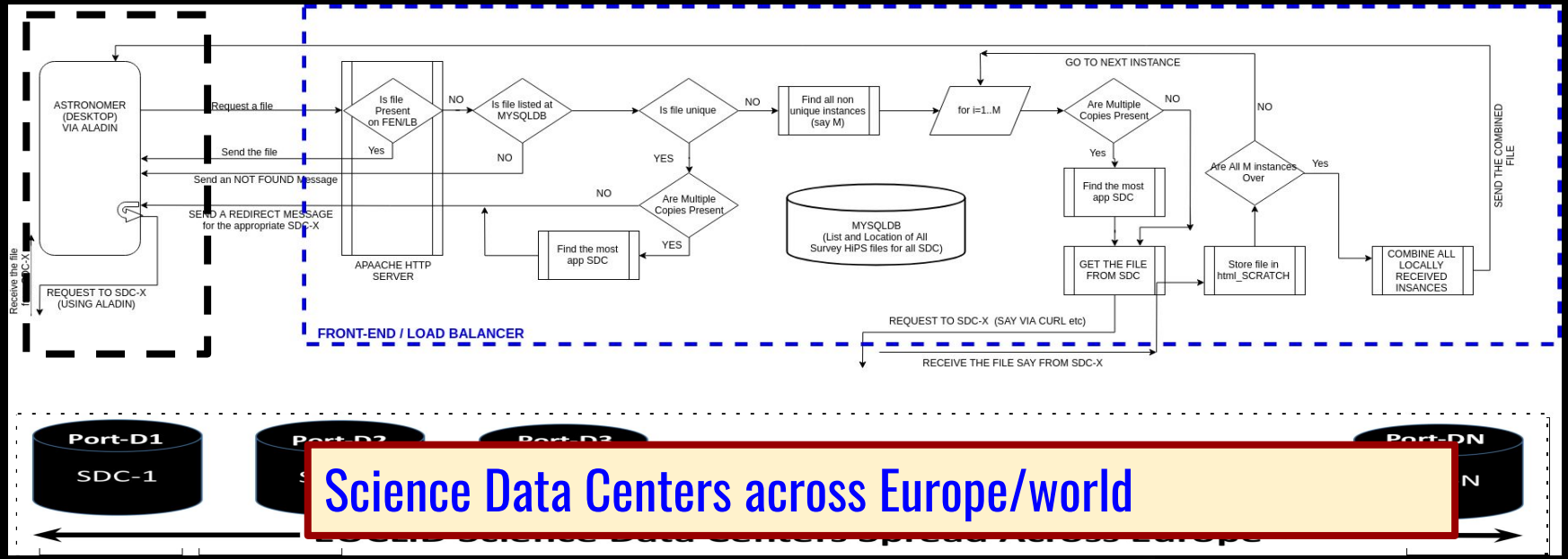
Visualization Framework with LAMP Stack



Science Data Centers across Europe/world

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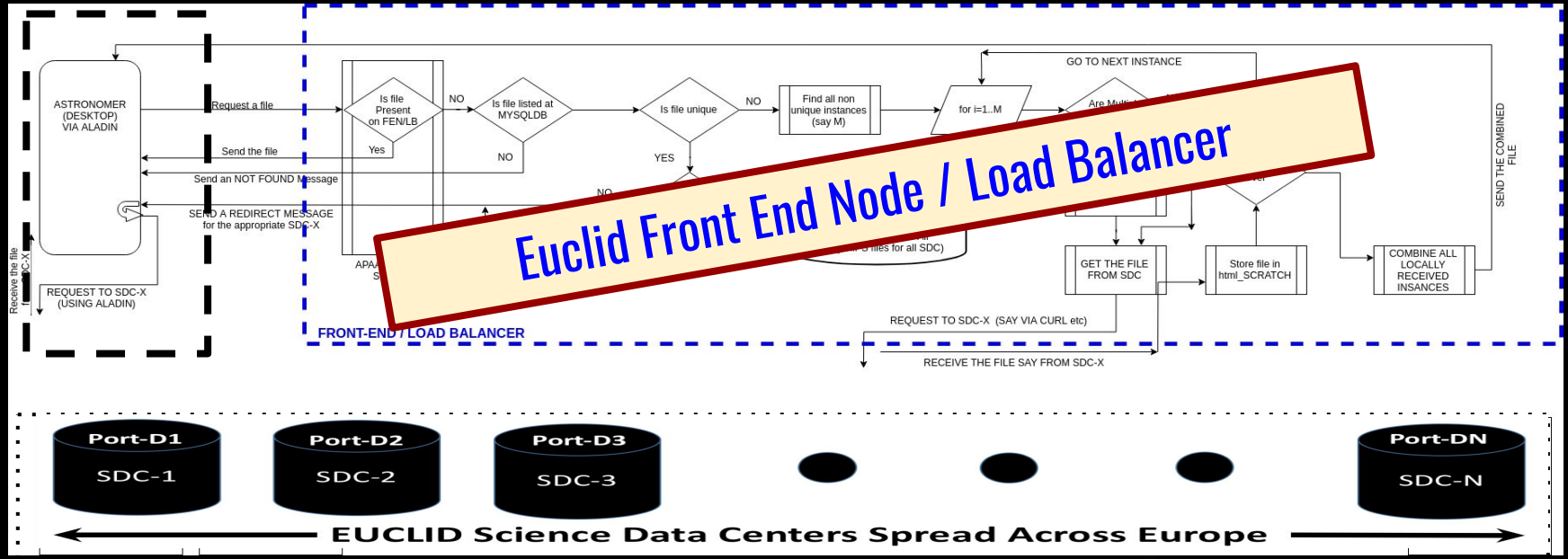
Visualization Framework with LAMP Stack



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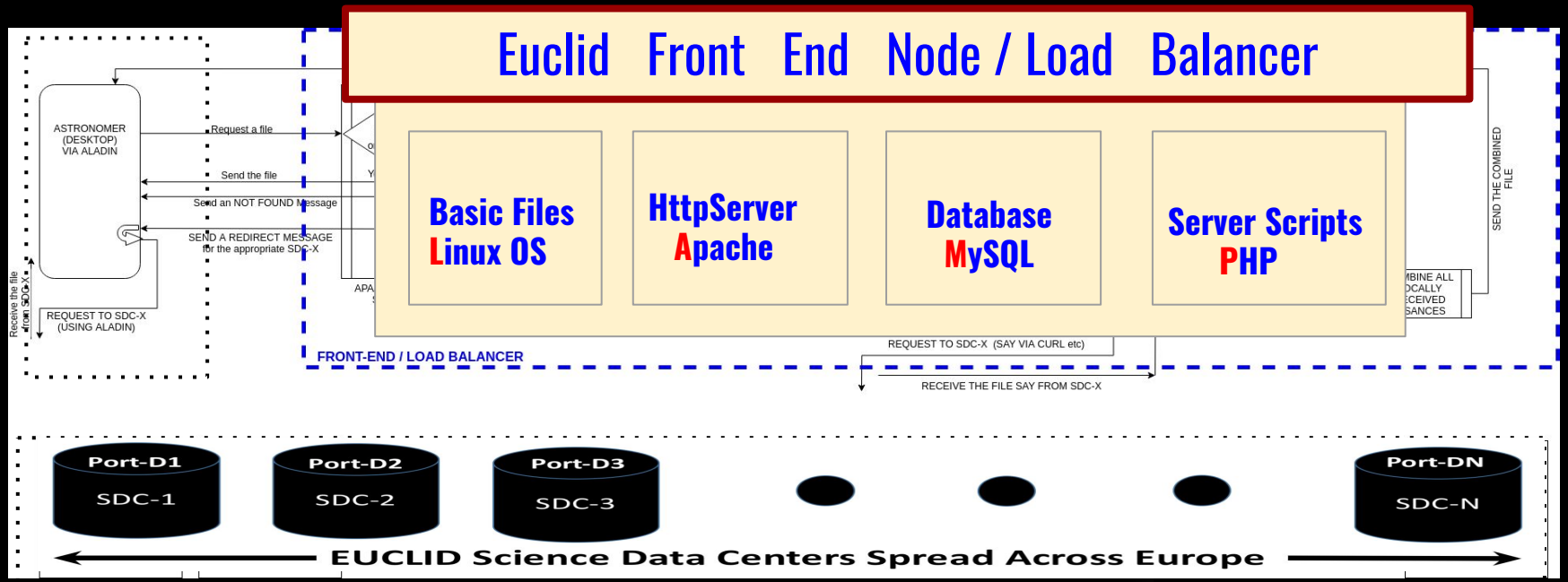
Visualization Framework with LAMP Stack



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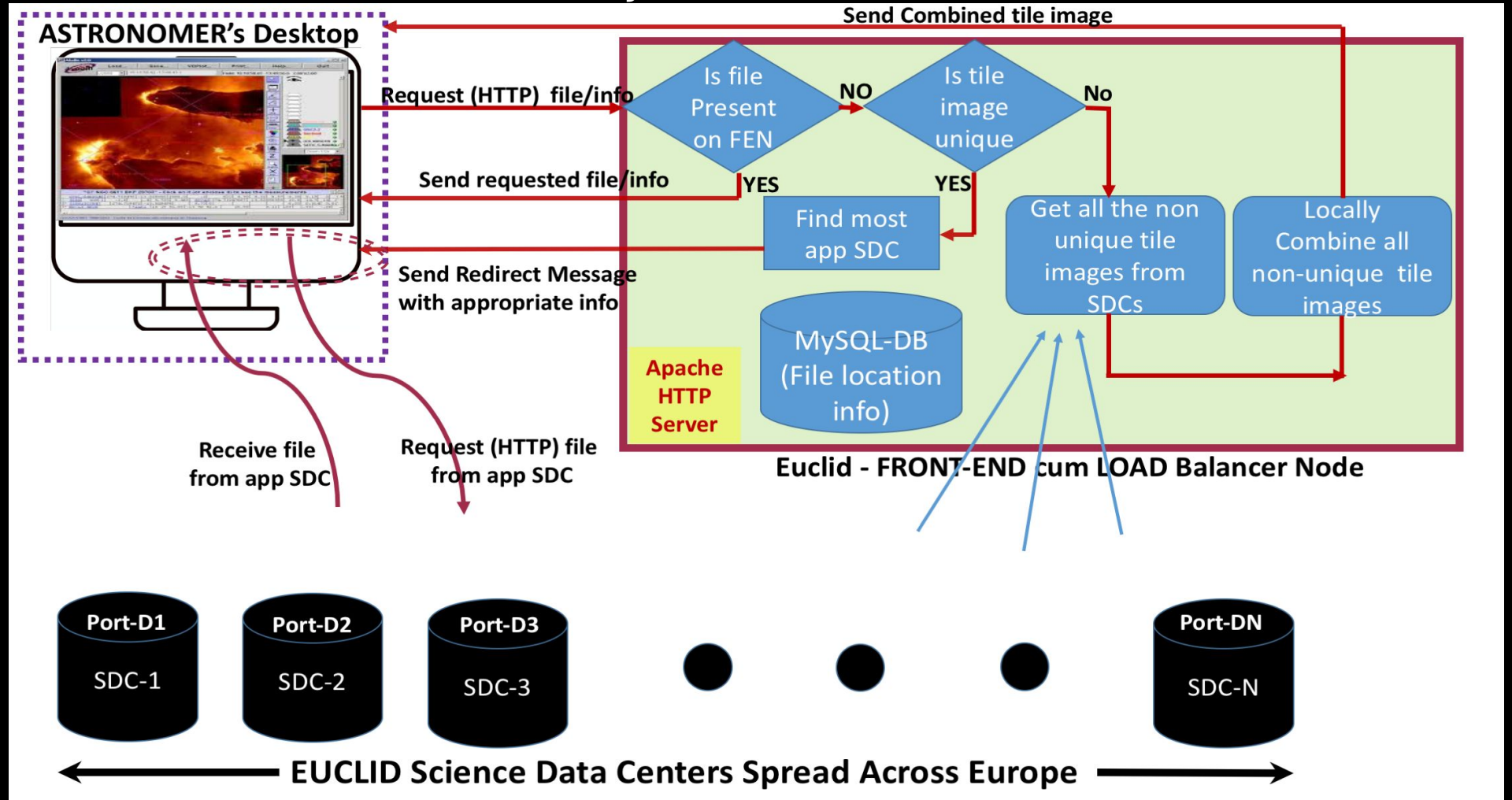
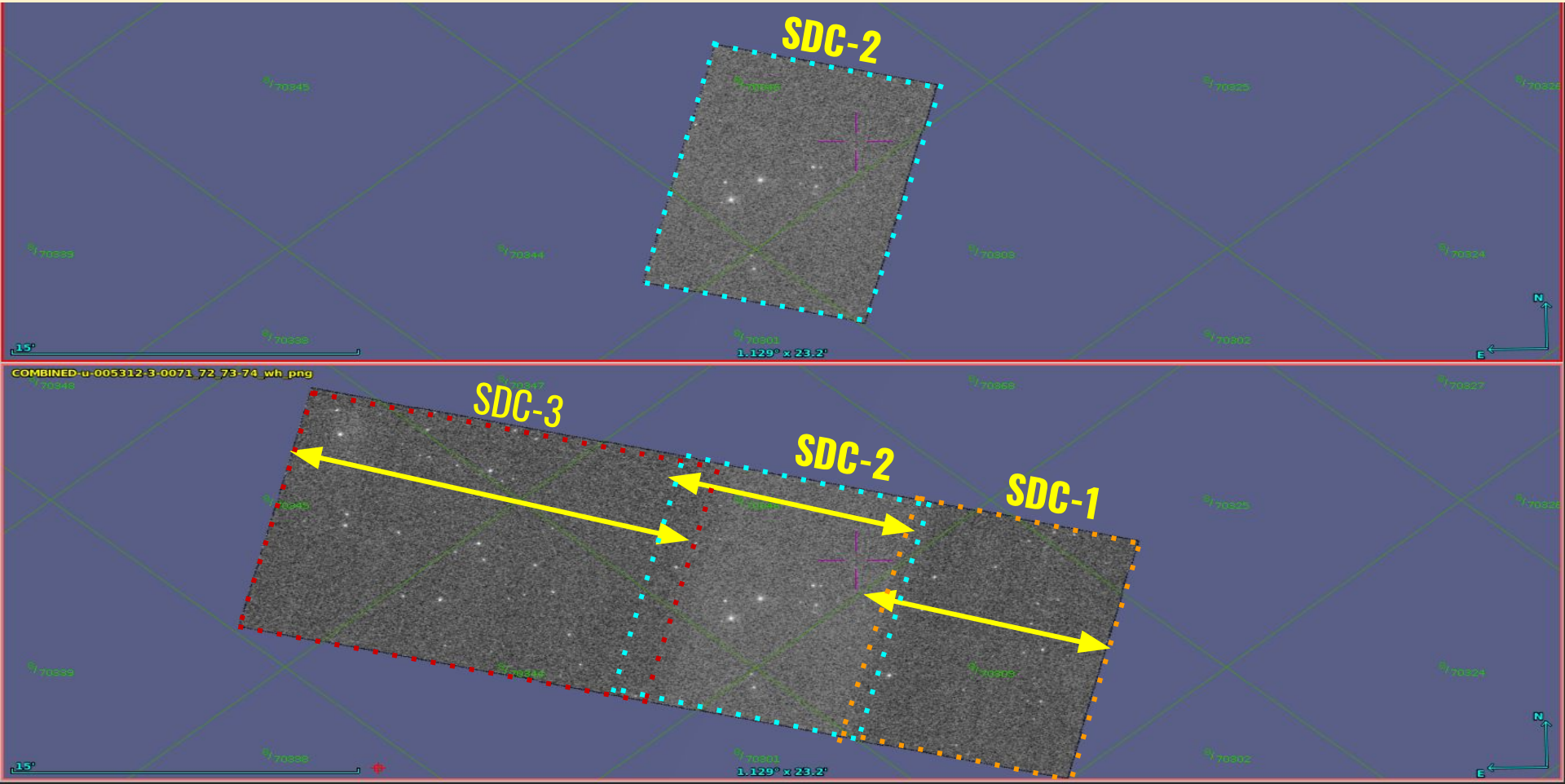
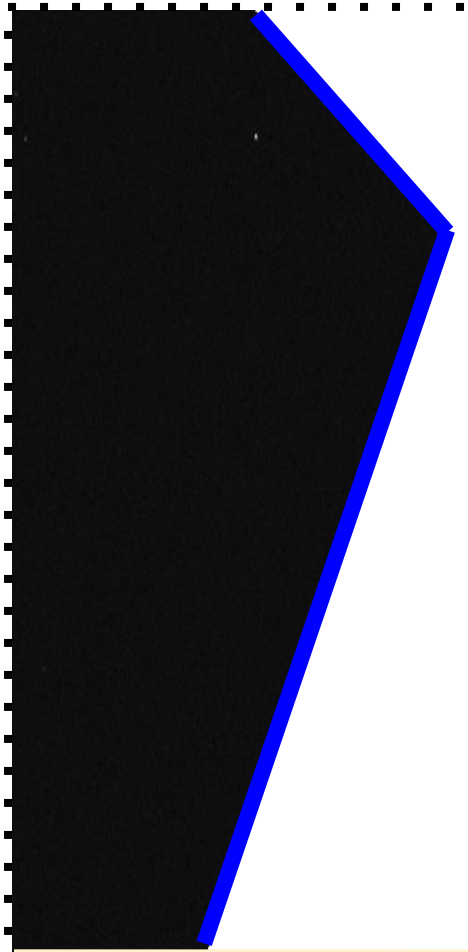
Fully Distributed Visualization



Visualization in practice





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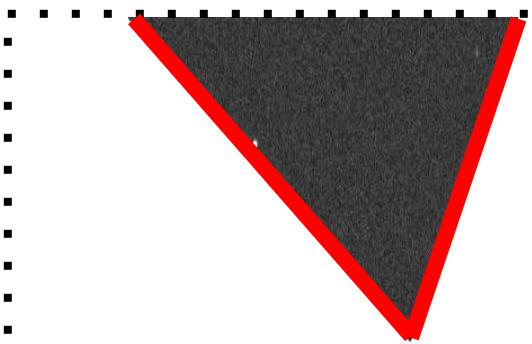

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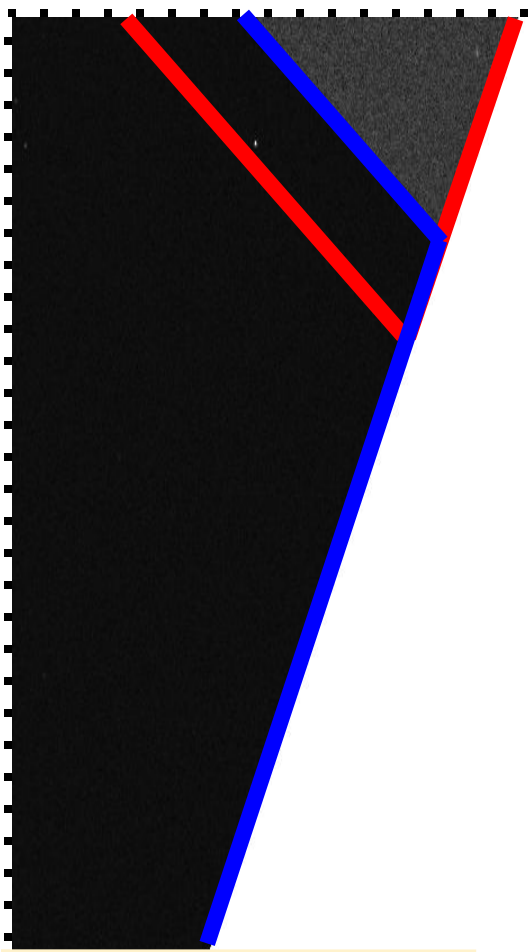

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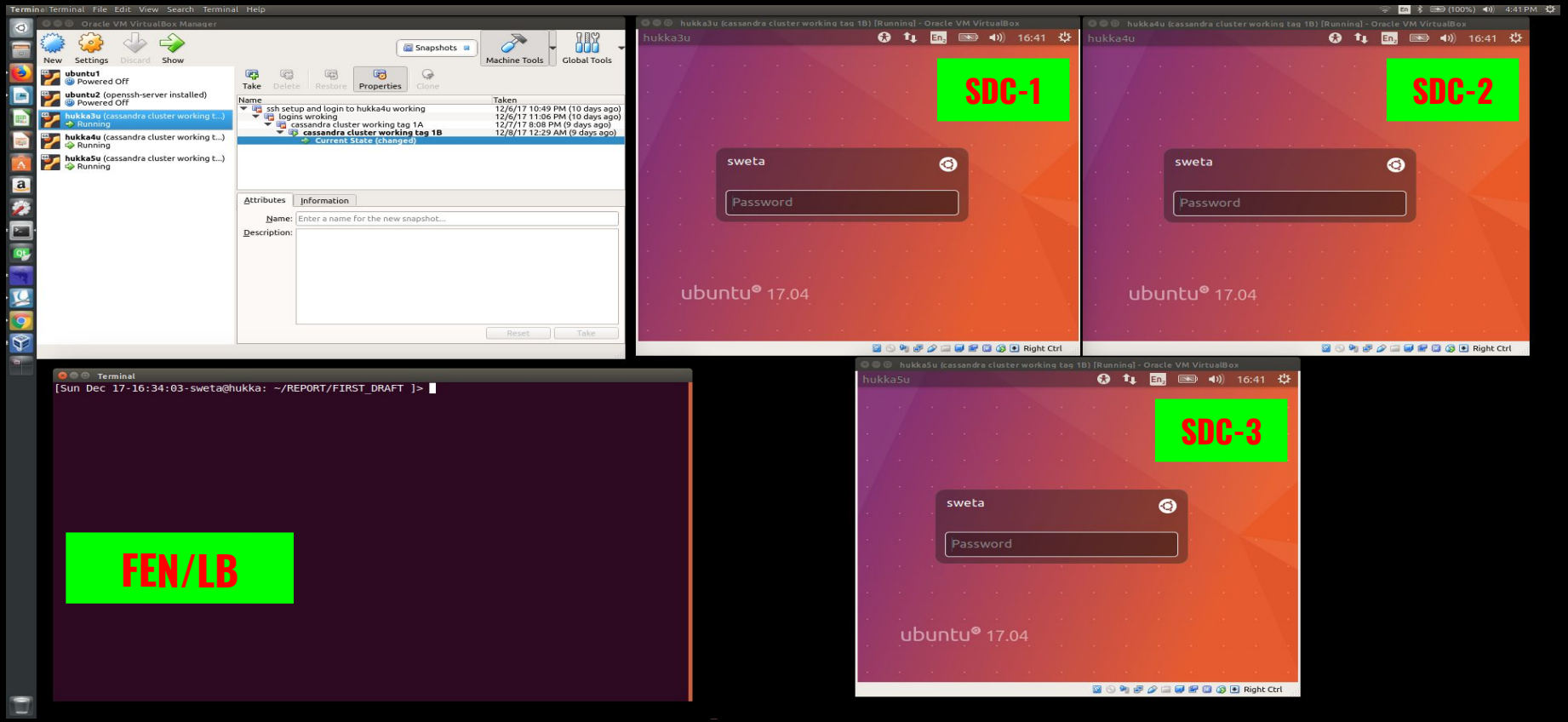
Virtual Machines as SDCs



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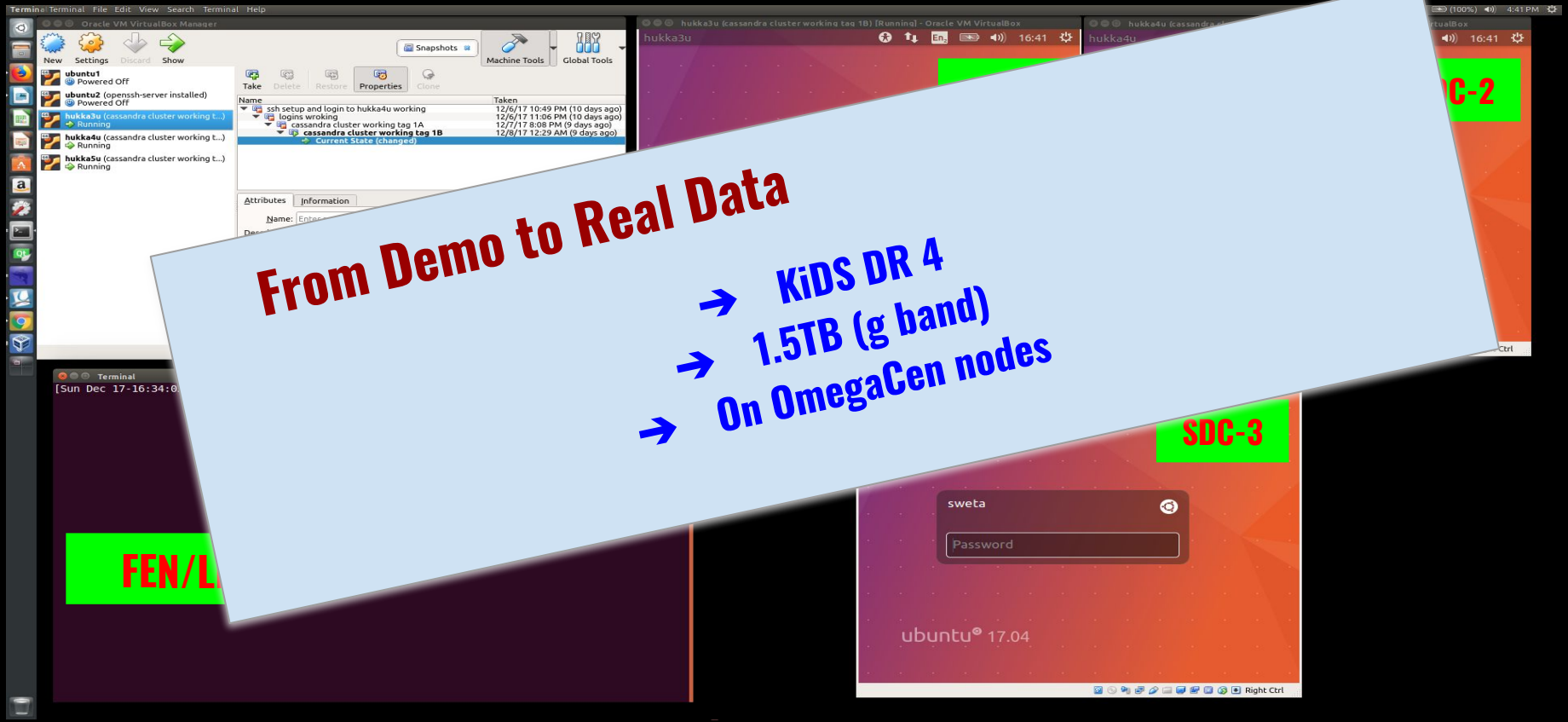

Conclusion & future steps

- ➔ Successfully developed and demonstrated distributed visualization framework for very large surveys
- ➔ Our framework works on heterogenous SDCs.
- ➔ Data size reduction using png instead of pure fits for hips survey generation has been explored
- ➔ It is also applicable to big, collaborative project like SKA
- ➔ It is being implemented on OmegaCen server nodes as SDCs
- ➔ Performance and Monitoring using ELK stack is in progress
- ➔ Further framework optimisation using caching and key value stores like cdb is being explored
- ➔ We are on our way to implement the framework for Aladinlite, as it works on the desktop version

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Thank You !

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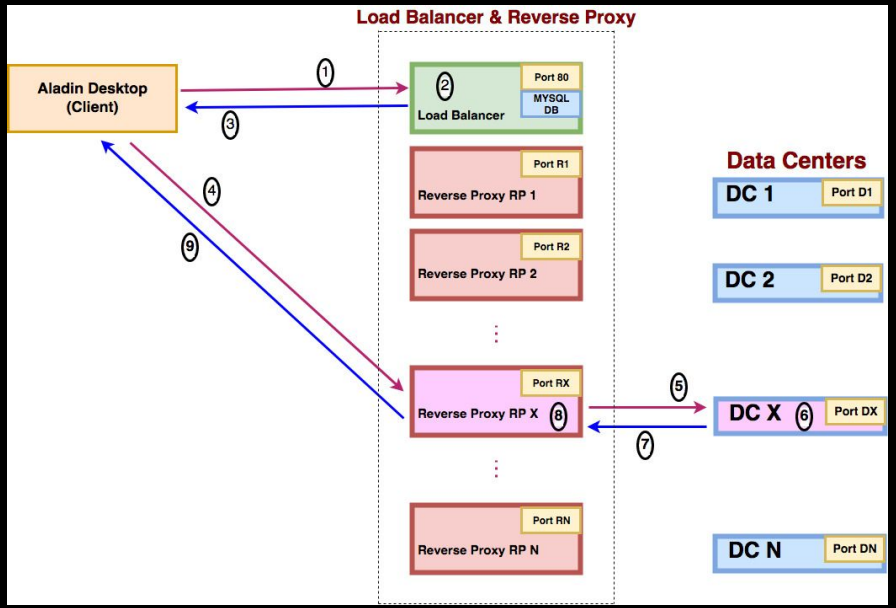
Architecture

Distributed Network Mode

Reverse Proxy Network Mode



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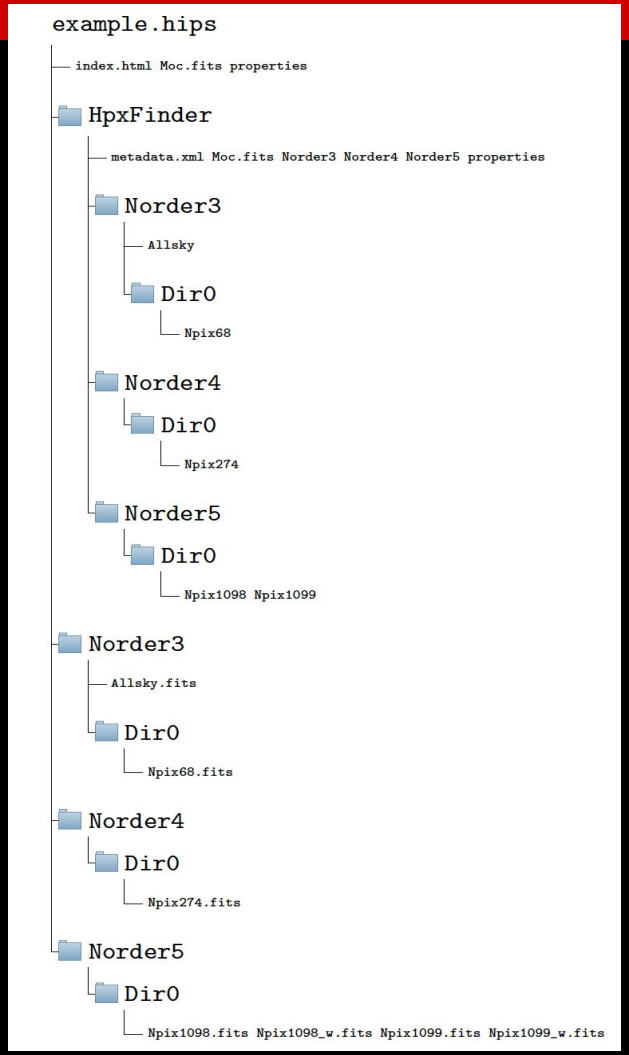

HiPS Survey

- HiPS is http compliant - allows it to be accessed via http server
- Simple Hierarchical Tree structure with directories and files

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LAMP Stack

1. Linux → open source(free), reliable(virus free)
2. Apache → most popular, open source, reliable, secure, fast, http,
3. MySQL → simple, sql, open source
4. PHP → open source, server side(code executed on server side), scripting language, communicate with MySQL

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