A new distributed data analysis framework for better scientific collaborations

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The problem of analyzing distributed data

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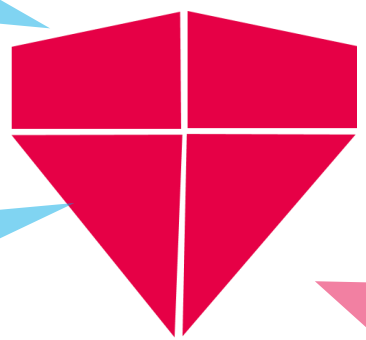
Let's do some research together!

Awesome! Let me run some tests on your model data.

Alright! But that's too much data and …



I can't give you access to my super computer!

No worries, I do my analysis with python, so let's just use the de-messaging-python framework!

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HELMHOLTZ ZENTRUM FÜR UMWELTFORSCHUNG UFZ

GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel

JÜLICH FORSCHUNGSZENTRUM

GFZ Helmholtz-Zentrum Potsdam

KIT Karlsruher Institut für Technologie

AWI

Hub Terra

Hub Atmo

Hub Mare

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Presentation material and Code

https://github.com/Chilipp/de-messaging-python-presentation-20210428

AK Datenanalyse

Distributed data analysis Working Group within Datahub

Contributors

- **HZG:** Philipp S. Sommer, Viktoria Wichert
- **GFZ:** Daniel Eggert (Digital Earth)
- **AWI:** Tilman Dinter, Brenner Silva, Angela Schäfer
- **Geomar**: Klaus Getzlaff, Andreas Lehmann
- **KIT:** Christian Werner
- **UFZ:** Lennart Schmidt

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What is distributed Data analysis

Examples

Ship campaign

- Sonne (Geomar) and Ludwig Prandtl (HZG) measure real-time-data in a campaign.
- Sonne sends to internal area of Geomar, Ludwig Prandtl to HZG.
- How can people from HZG access and analyze the data at Geomar?

Model simulations

- Compare a COSMO-CLM-Simulation (HZG) with output of the Baltic Sea Model (Geomar)
- And with ship measurements
- How to share terra-bytes of data?
- How to get the latest version?

It's about *analyzing* distributed data

The ideal world

- We all have one single big cloud
  - Run model simulations in the cloud
  - Store NRT data in the cloud
- Post processing and data analysis runs in the cloud
- Someone from HZG needs access to data from Geomar? *Just grant it.*

The real world

- We have many different clusters.
  - Every center (or even every scientist) has different requirements
  - We are behind VPNs
  - Each center has his own cluster for processing, storage, etc.
- Someone from HZG needs access to data from Geomar? *Ok, I upload it to Dropbox.*

Can we do it without the cloud?

What we need:

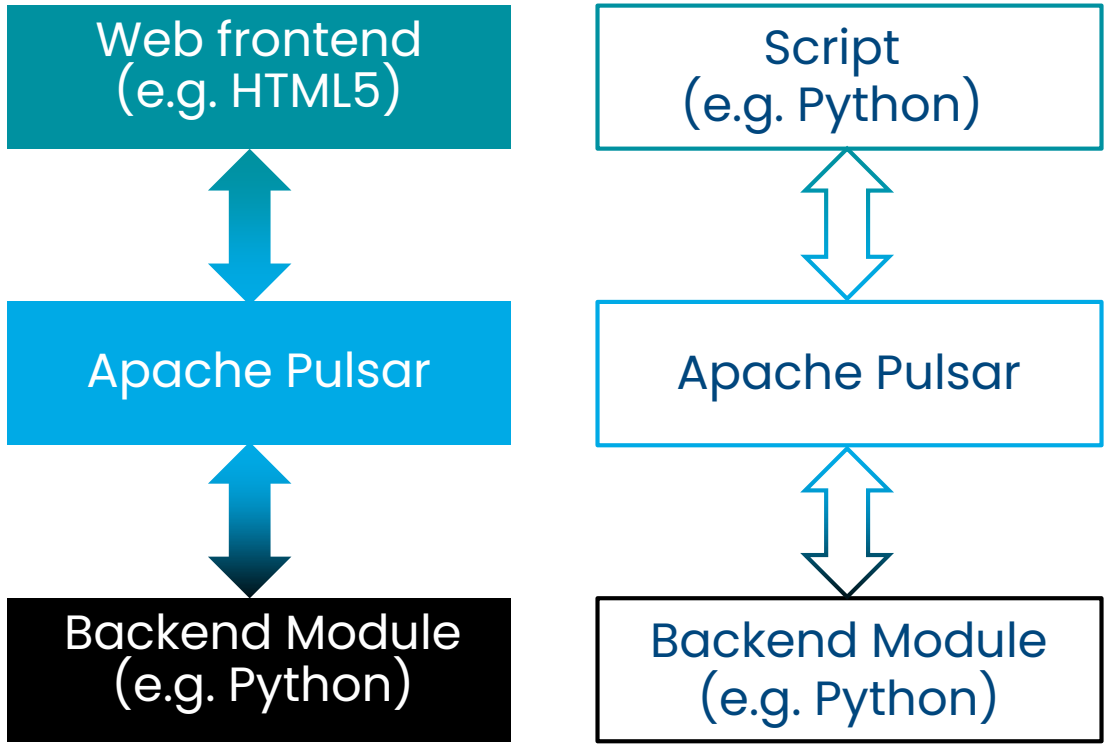
- Access to data in another research center
- Access to computing power in another research center

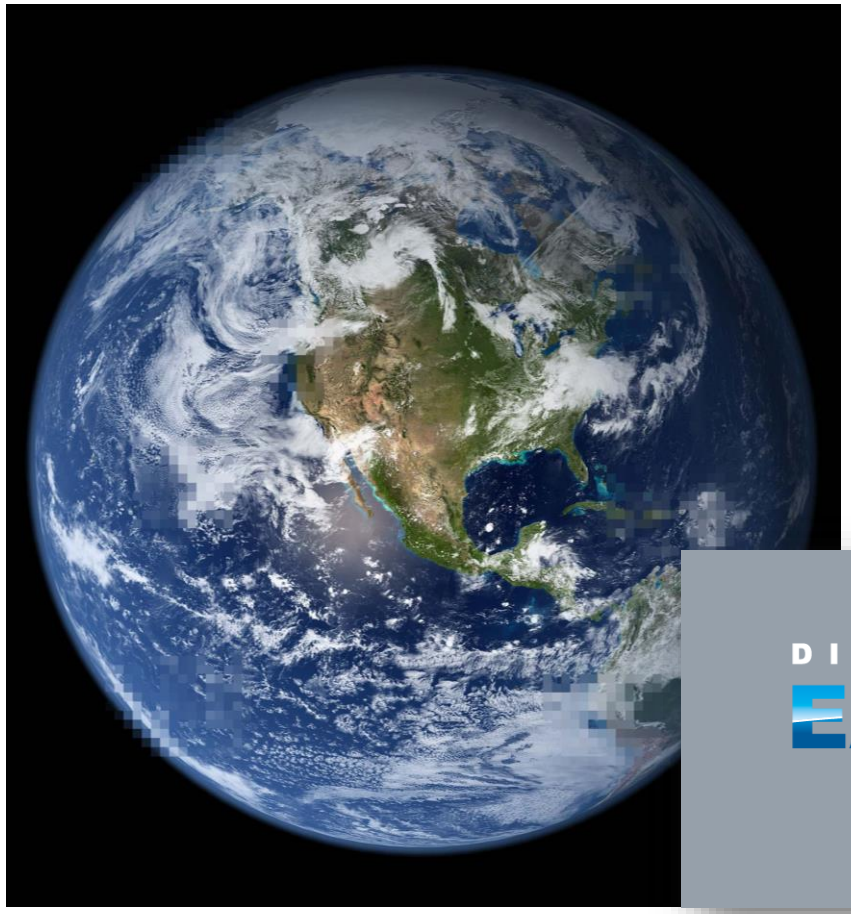
And:

- It must be safe
- It must be easy

We are not the first

with this idea





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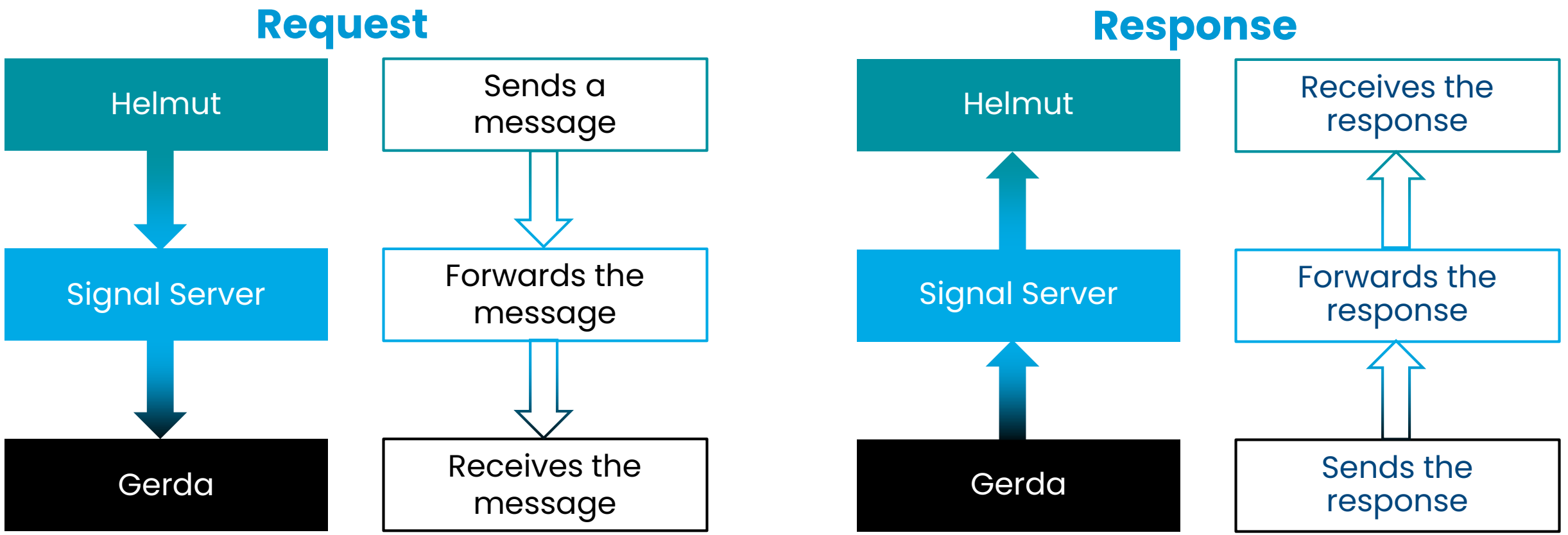
Just like ~~WhatsApp~~Signal



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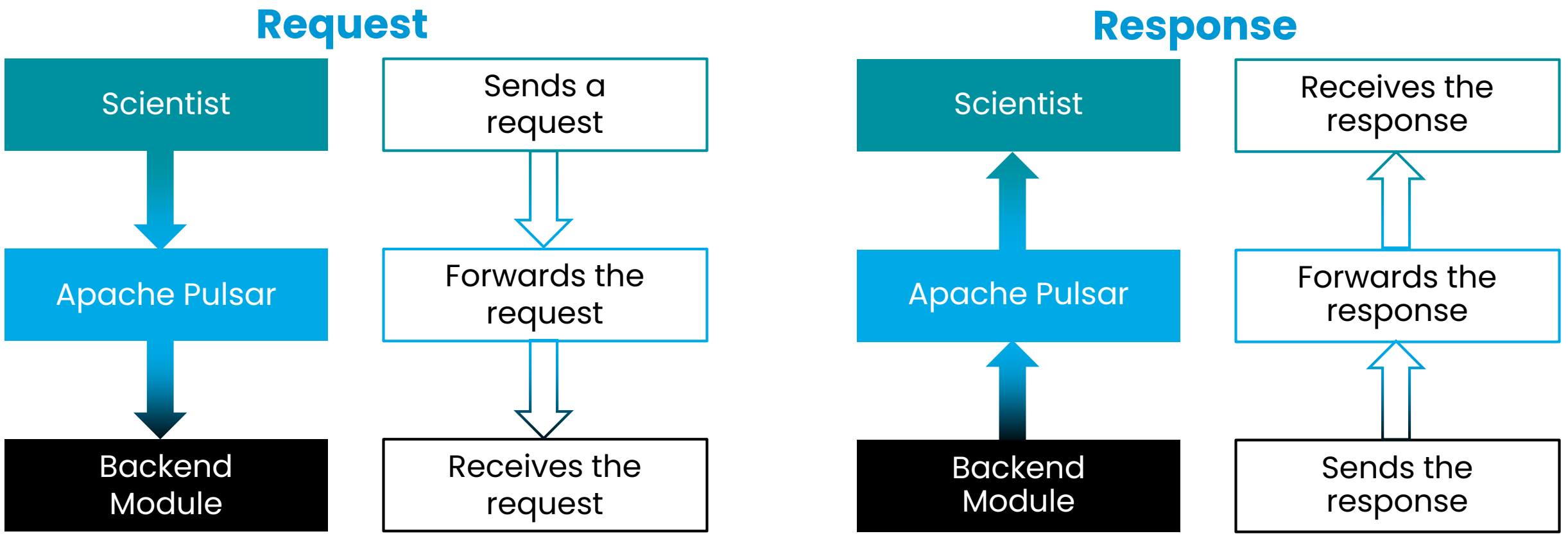

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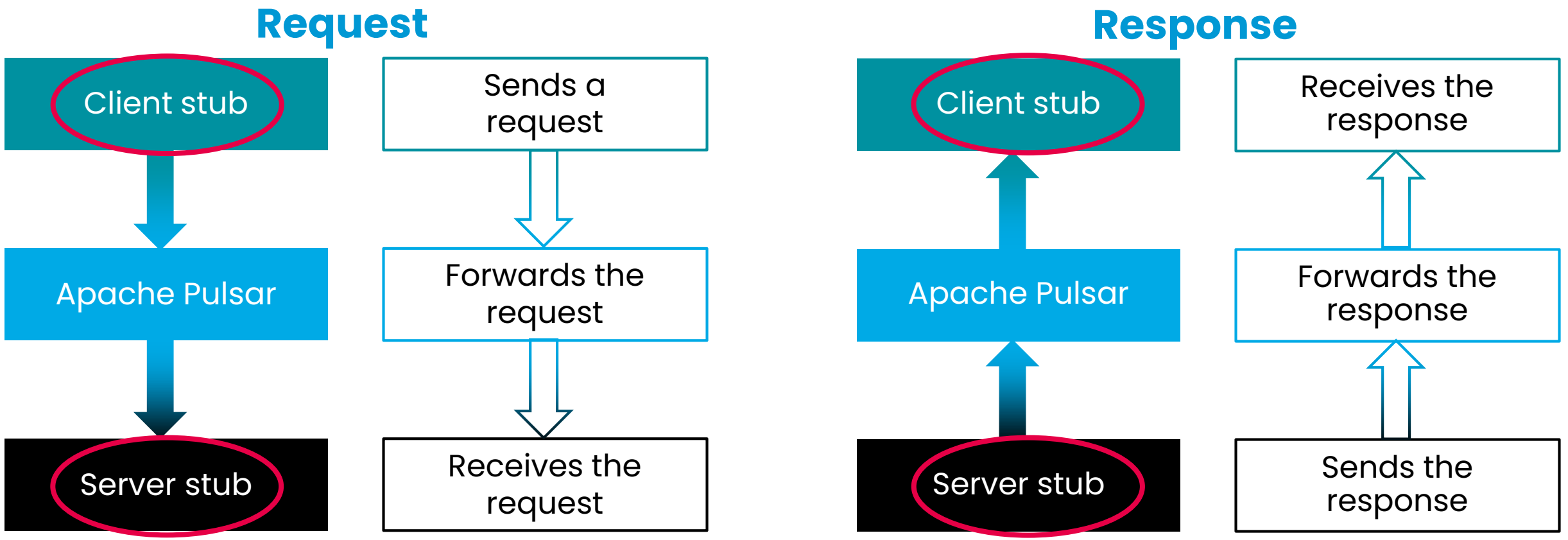
A Remote Procedure Call (RPC)



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Pros and Cons

Advantages

- Scientist can simply send a request and retrieve the response on any other machine
- Backend Module can run everywhere, not necessarily on a dedicated web server (e.g. on the cluster)

Disadvantages

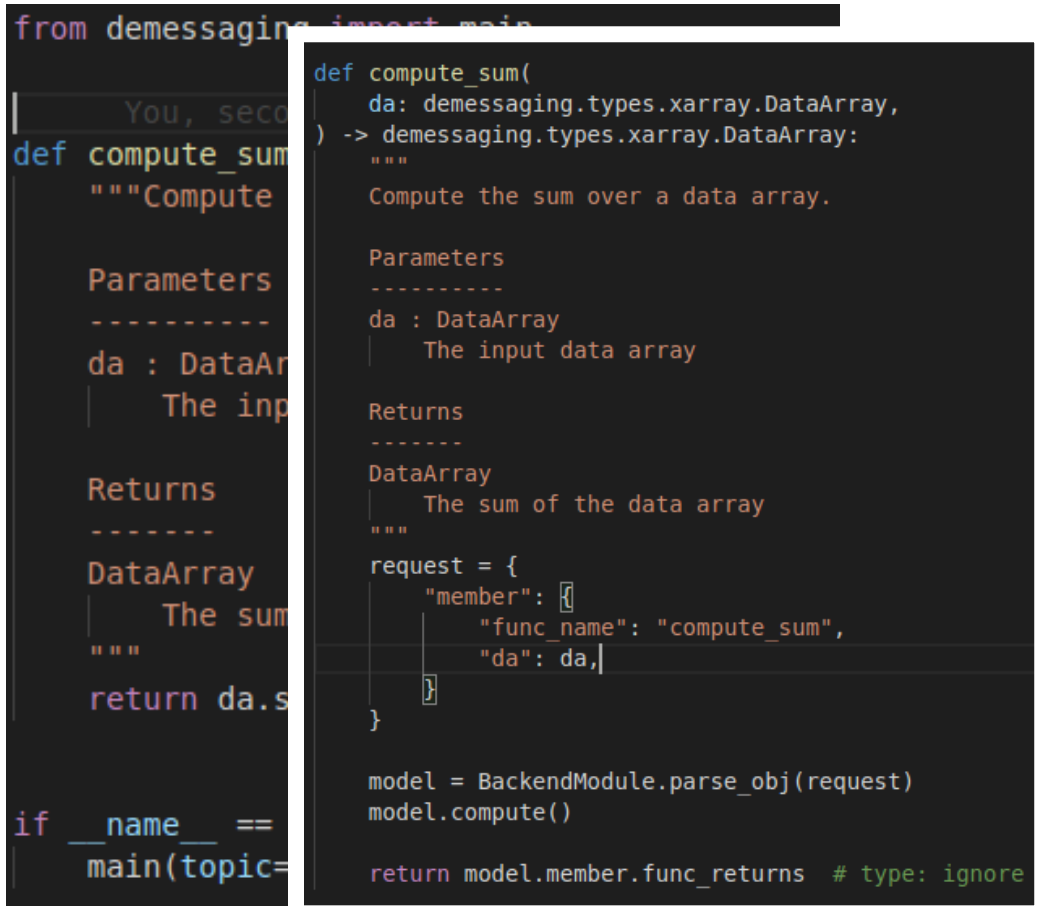
- Scientists are not familiar with web requests (nor are the backend module developers)
- Request needs serialization (transformation to JSON)
- Potential vulnerability for internal computing resources
- Scientists do have better stuff to do

Be nice

and do not add more work

Use the scientists methods

- abstract standard python functions and classes into web requests
- everything's basic python, (almost) no need for special stuff
- Client stub is automatically generated
- Requests are abstracted and standardized (JSONschema)



de-messaging-python

Summary

- Remote Procedure Call
- High-level API to easily create server and client stubs
- Very close to scientists common workflows

Outlook

- More effort into security
  - User management for backends
  - End-to-End encryption
- How to handle large amounts of data
- We are looking for use cases and project that may use our framework!

Thank you!

Vielen Dank.

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