

Appointment scheduling integration in healthcare in the case of Betty24 and AGFA ORBIS

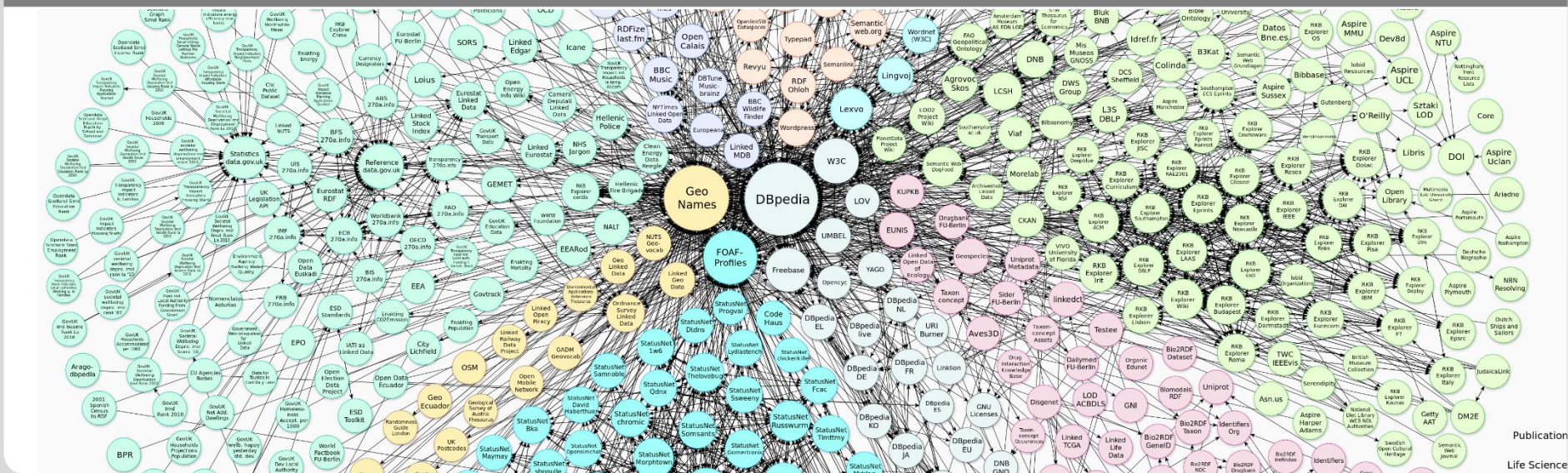
Tobias Dillig

Supervisor: Patrick Philipp, Anne Zander

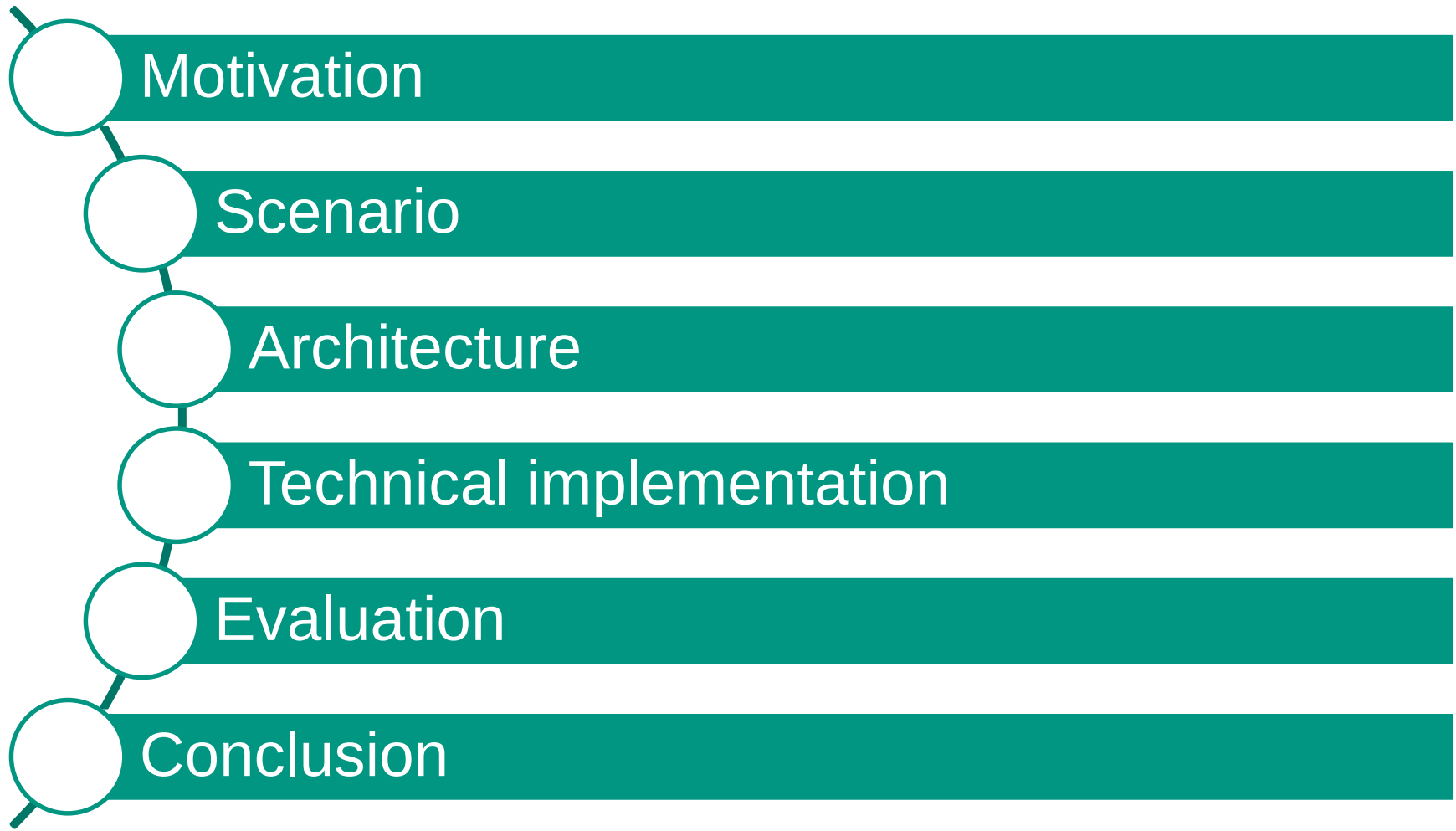
Prof. Dr. York Sure-Vetter

Bachelor thesis
Final presentation

Institute of Applied Informatics and Formal Description Methods (AIFB)



Structure



Profil

Städtisches Klinikum Frauenklinik Karlsruhe

Frauenheilkunde und Geburtshilfe



Moltkestraße 90 (Haus S)
76133 Karlsruhe
Tel. 0721 974-2401

[Kontakt / Rezeptbestellung](http://www.klinikum-karlsruhe.com/)
[http://www.klinikum-karlsruhe.com/...](http://www.klinikum-karlsruhe.com/)

Praxisärzte

Leistungen

- Geburtshilfe
- Gynäkologie
- Gynäkologische Onkologie
- Brustzentrum
- Spezielle Geburtshilfe und Perinatalmedizin
- Endokrinologie und Reproduktionsmedizin
- Urogynäkologie

Sprachen

Oktober 2016		31.10.2016			
Mo 31.10	Di 01.11	Mi 02.11	Do 03.11	Fr 04.11	Sa 05.11
09:00					
11:00					

Grund des Besuchs *

Dysplasie-Sprechstunde

Hinweis zum Besuchsgrund!

Patient *

weitere Familienmitglieder hinzufügen

Beschreibung der Beschwerden

Ihr Text in diesem Feld wird nach strengsten
Datenschutzkriterien verschlüsselt und
gesichert; er ist ausschließlich seitens der
Arztpraxis zu lesen.

E-Mail Erinnerung ☐

Ihr Termin:

Wählen Sie einen Termin im Kalender

Termin buchen

OTMS* are awesome!



asynchronously



location-independent



time-independent



scalable

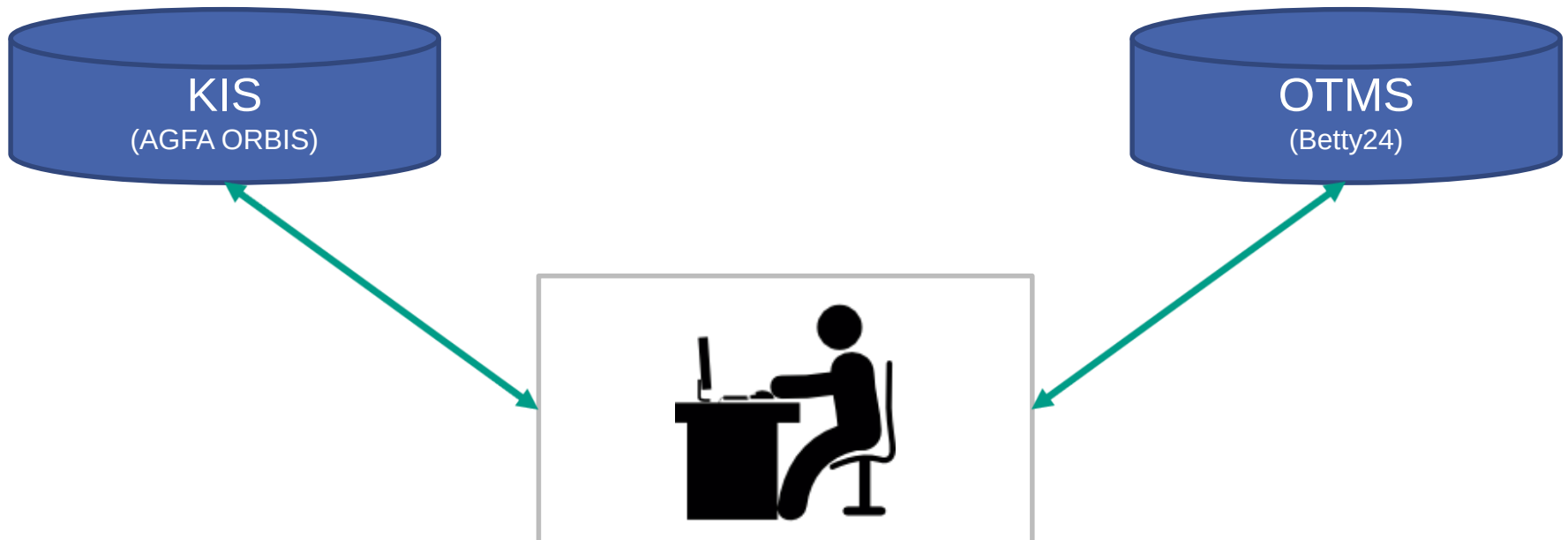
* appointment scheduling management system
„*Online-Terminmanagementsystem*“

see Prinz, 2015

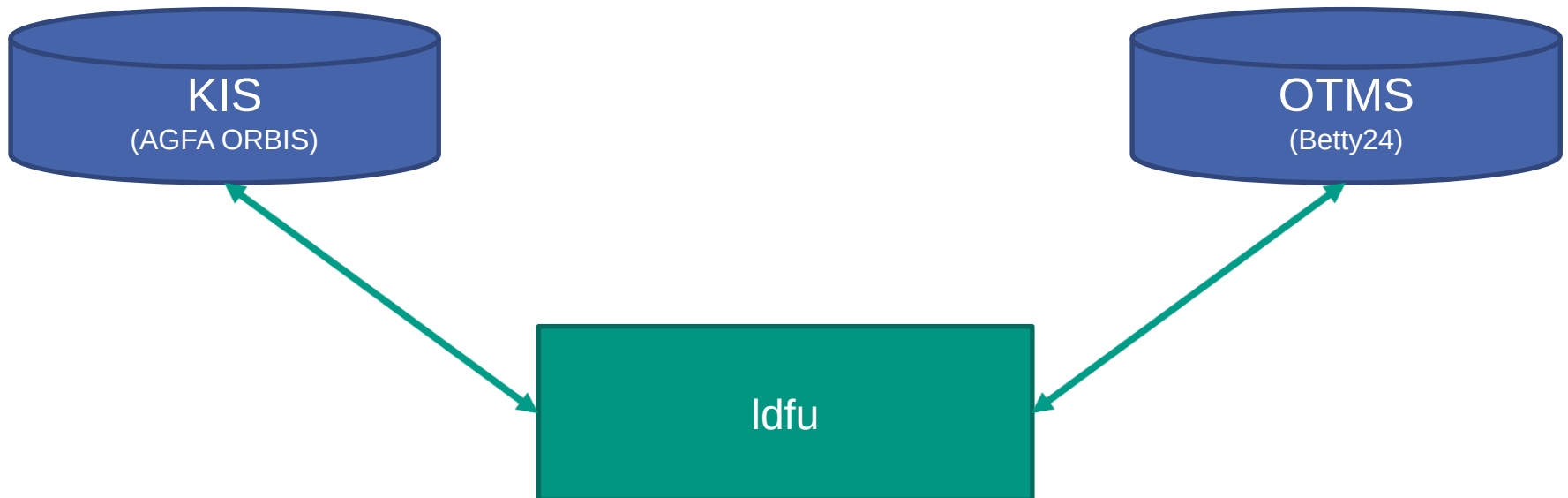
Scenario



Scenario



Scenario

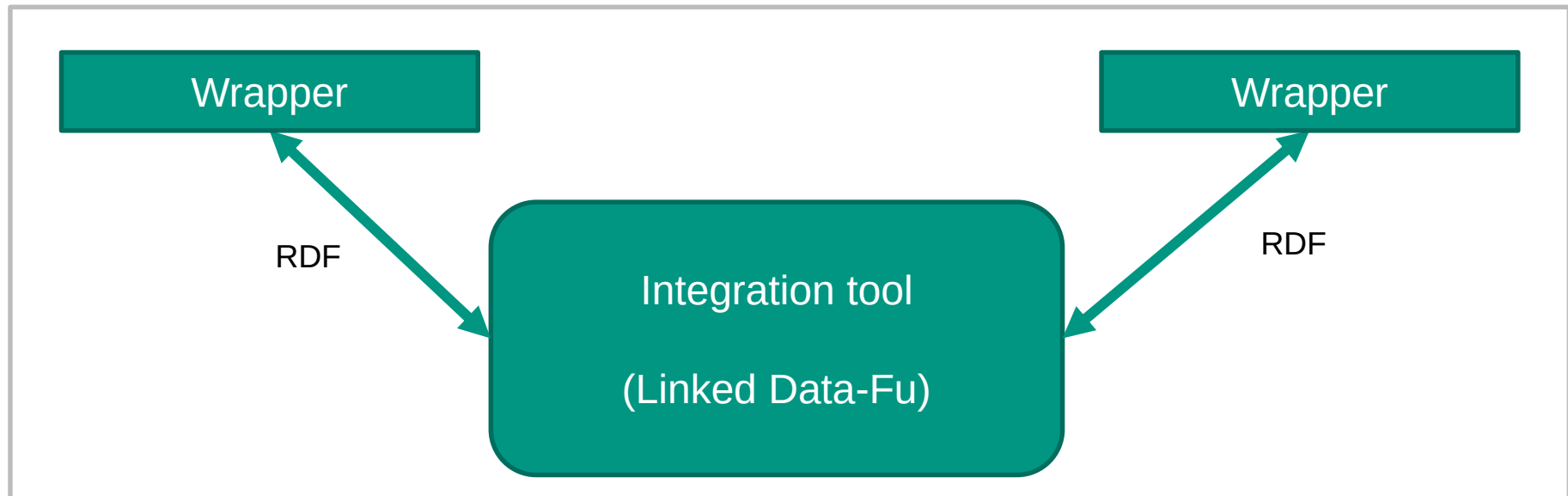


Ldfu – Linked Data-Fu

„end-to-end data processing system for data integration and system interoperability with Linked Data“

<http://linked-data-fu.github.io>

- Calls periodically RESTful APIs of the wrappers
- Processes data based on rule sets
 - Is able to integrate and synchronize data (interacts based on rules)



Scenario - requirements

low maintenance costs



Scenario - requirements



privacy

low maintenance costs



Scenario - requirements



privacy

low maintenance costs



scalability



Scenario - requirements



privacy



expandability

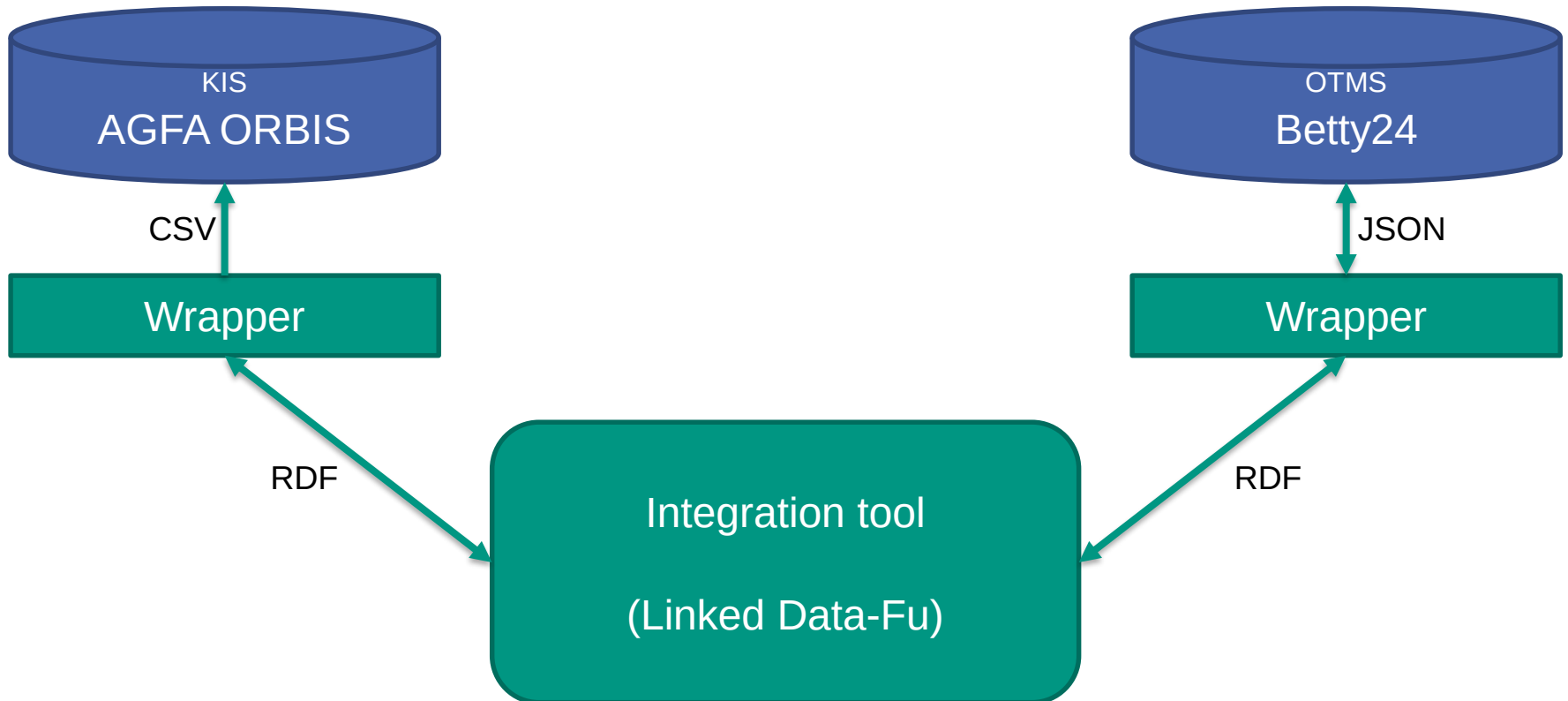
low maintenance costs



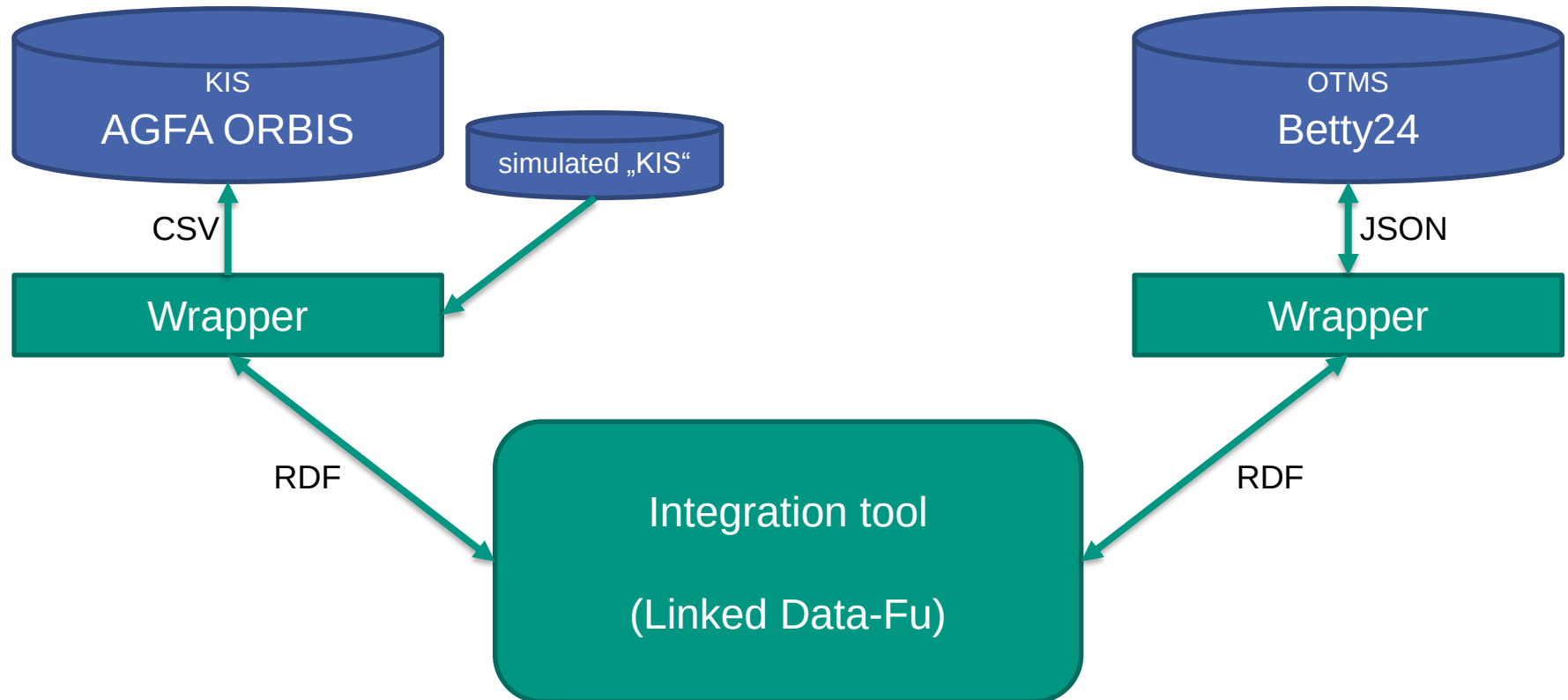
scalability



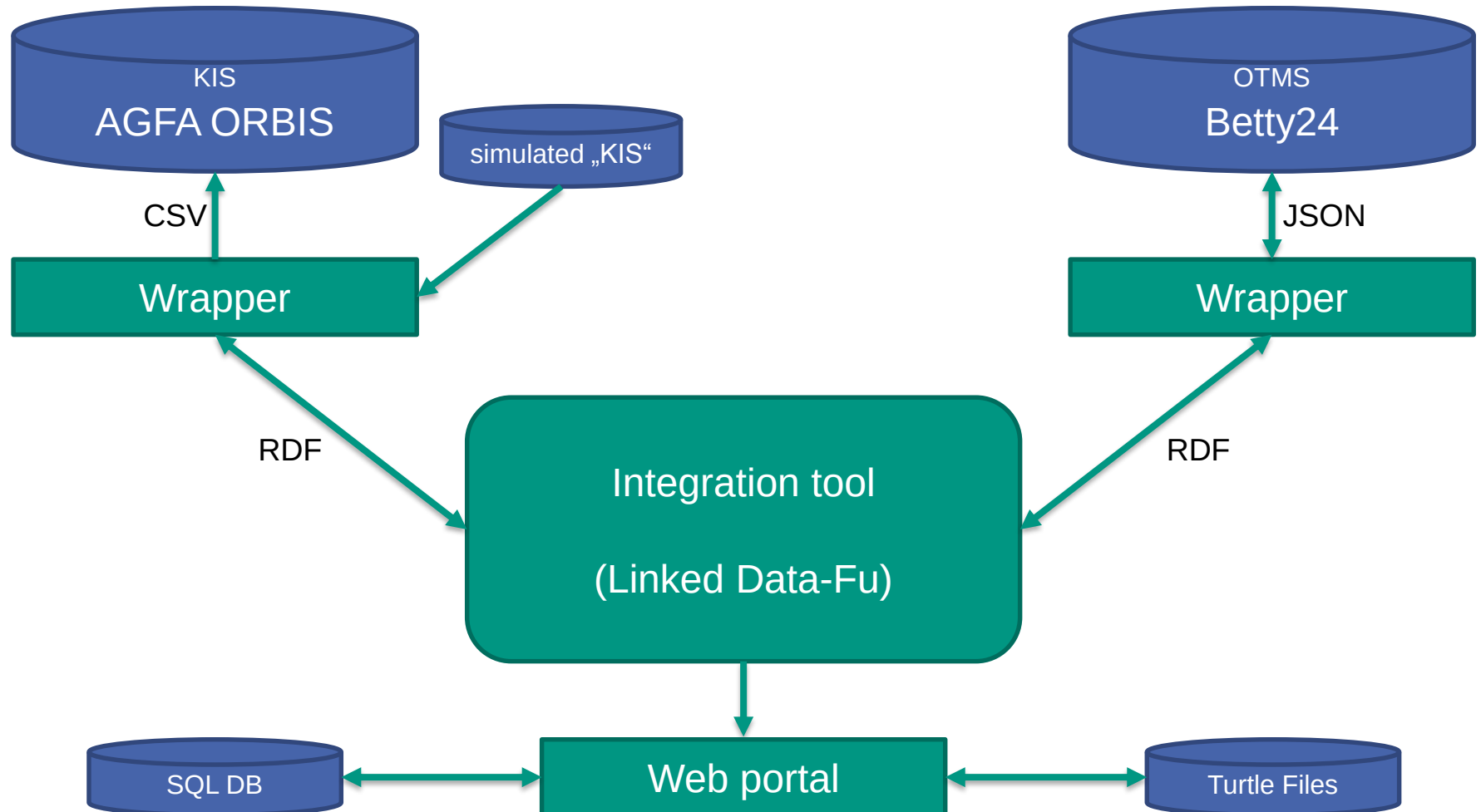
Architecture



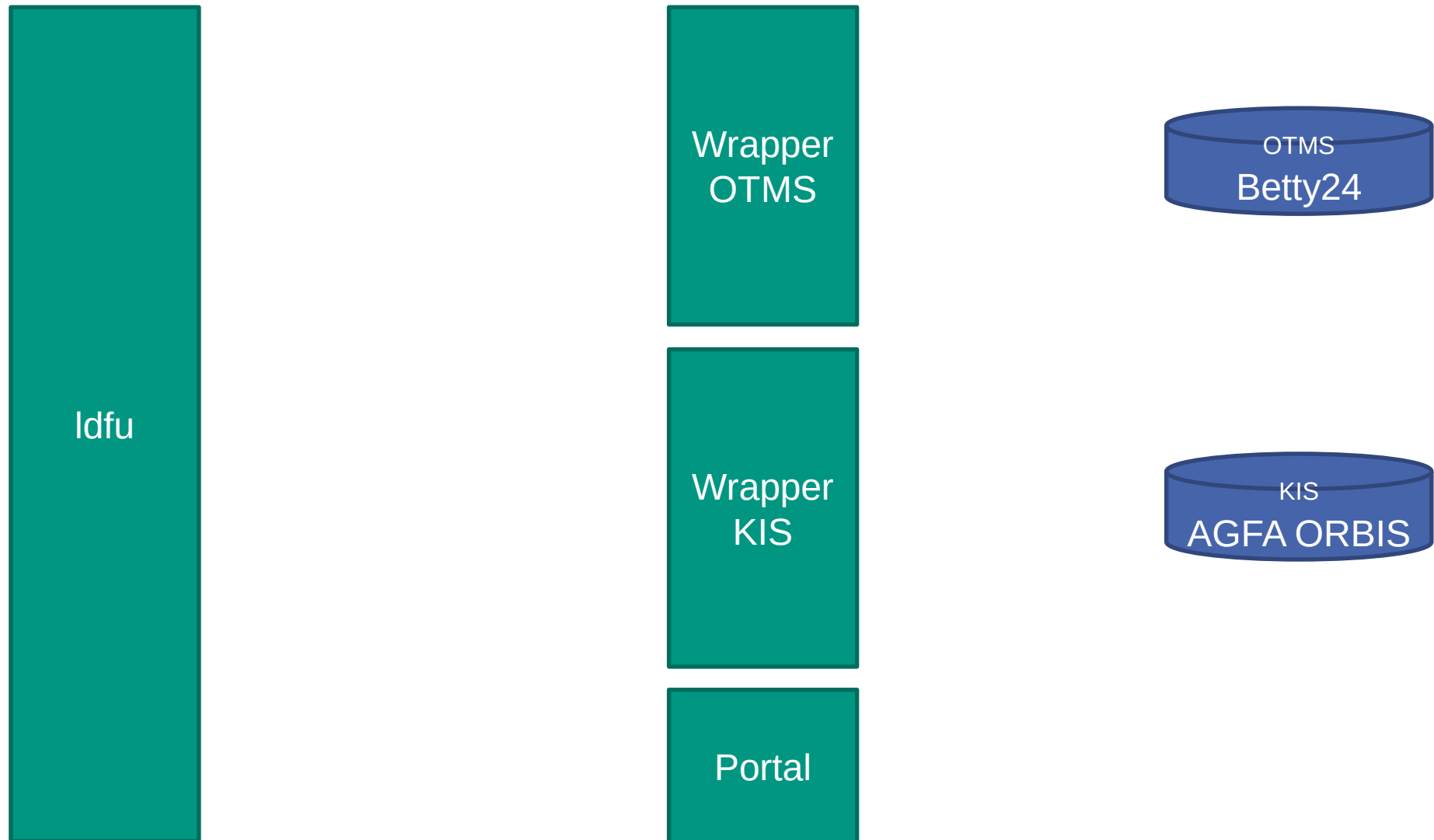
Architecture



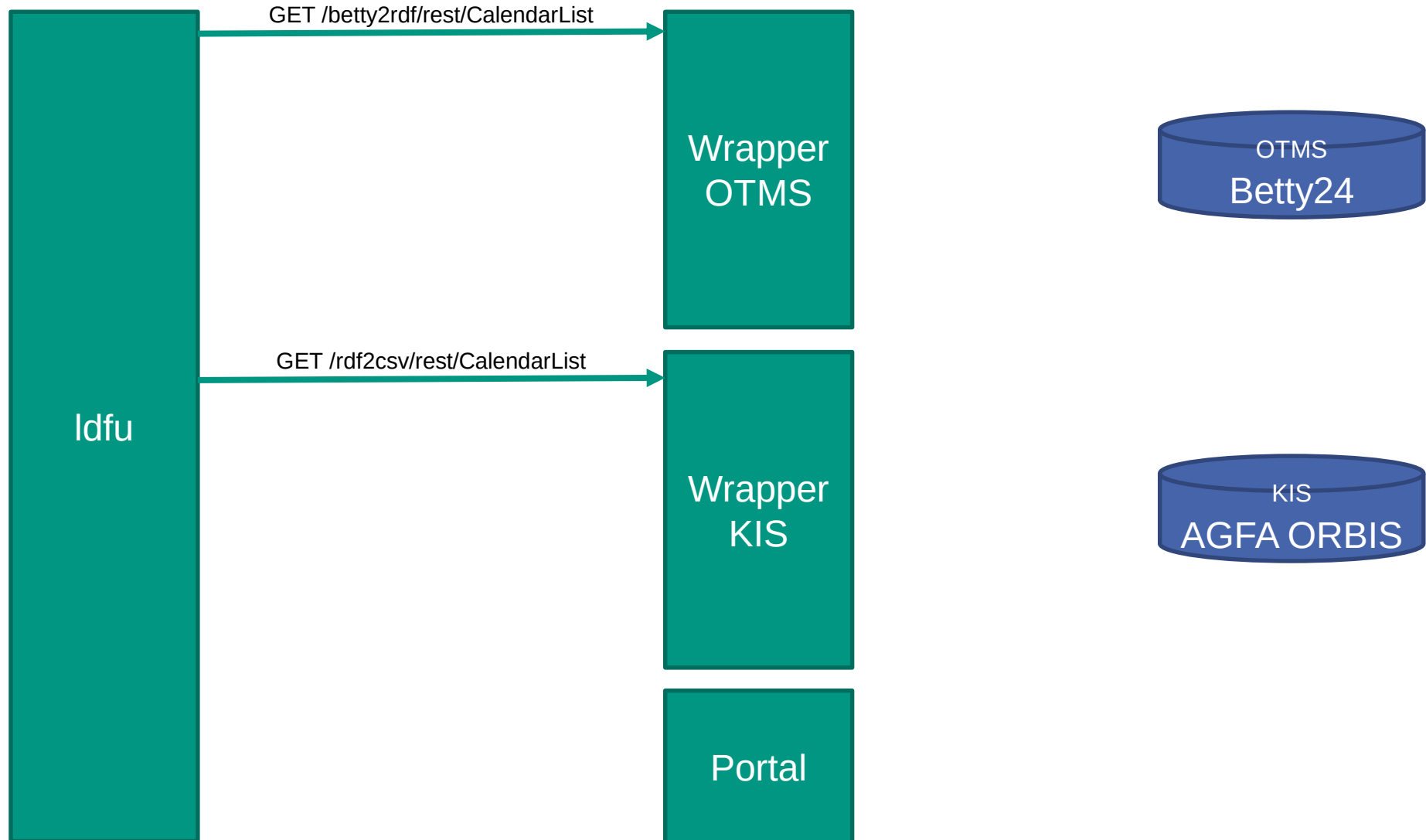
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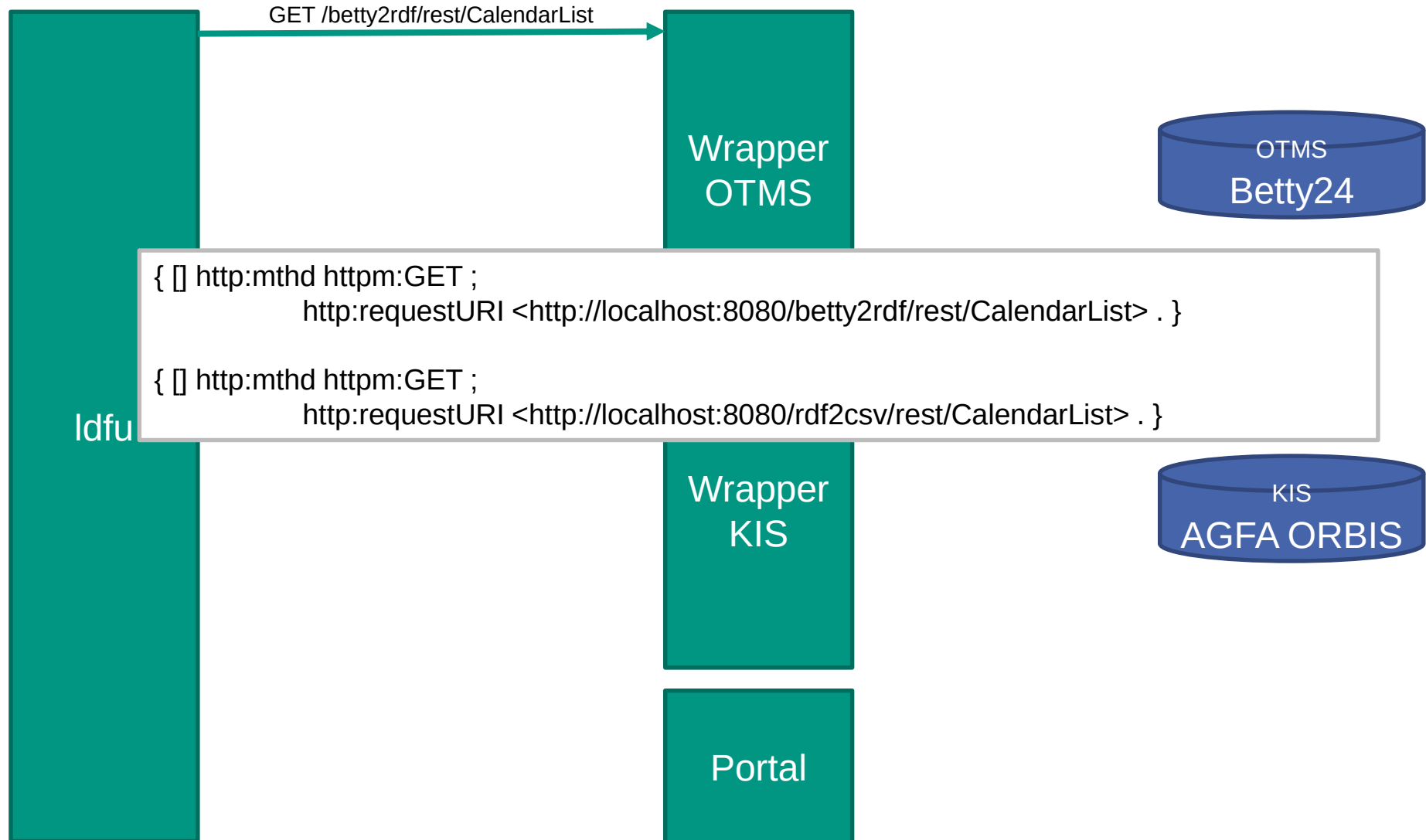
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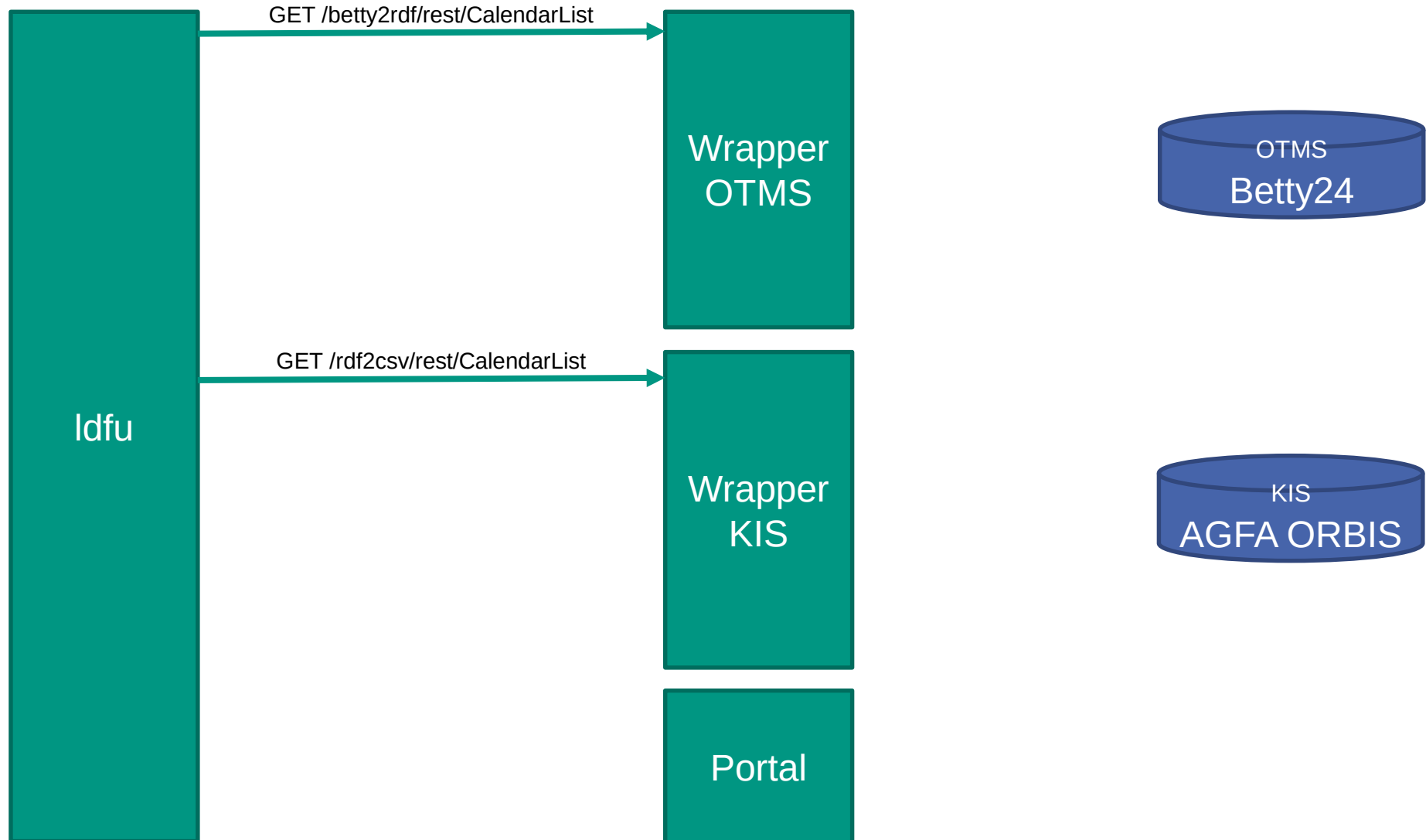
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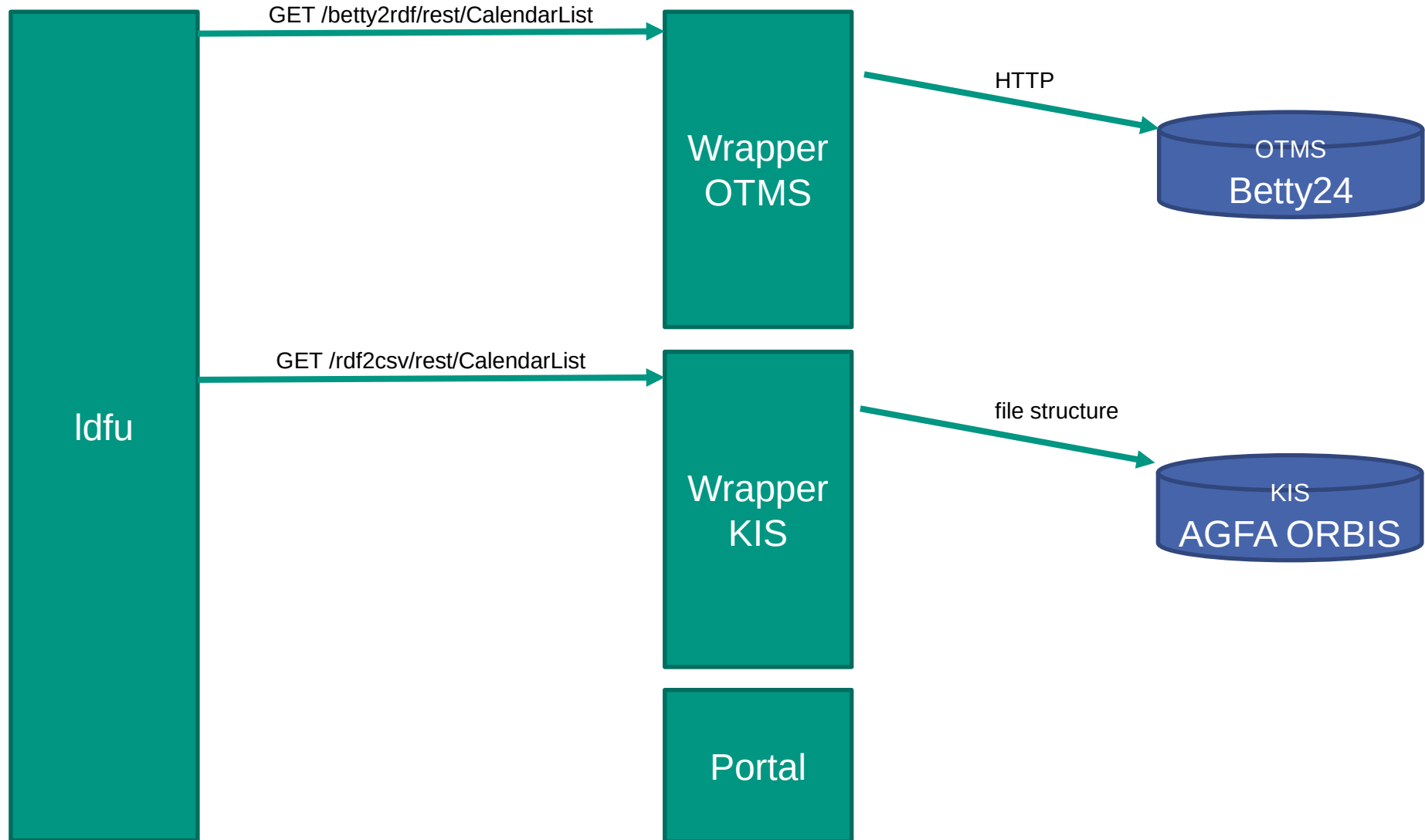
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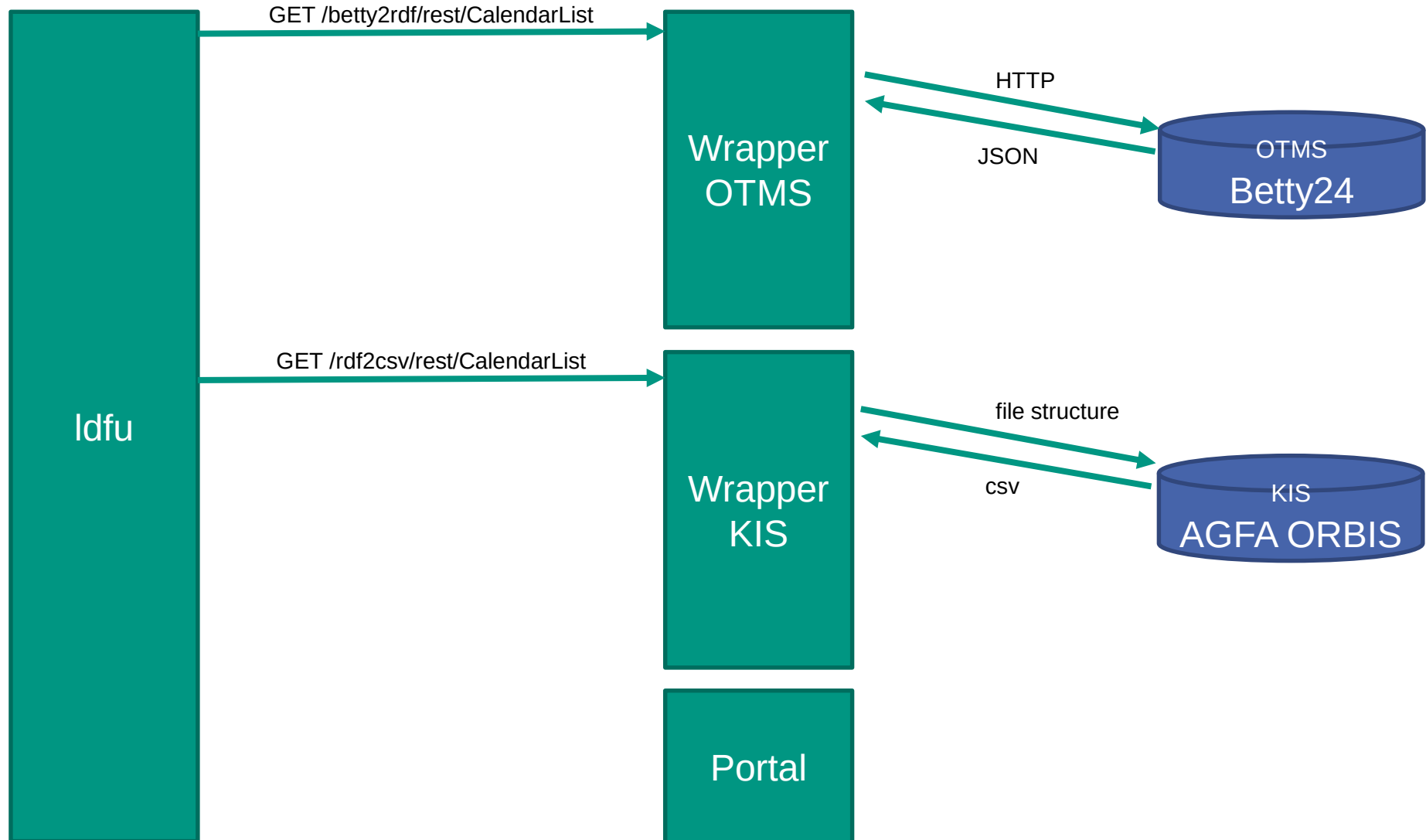
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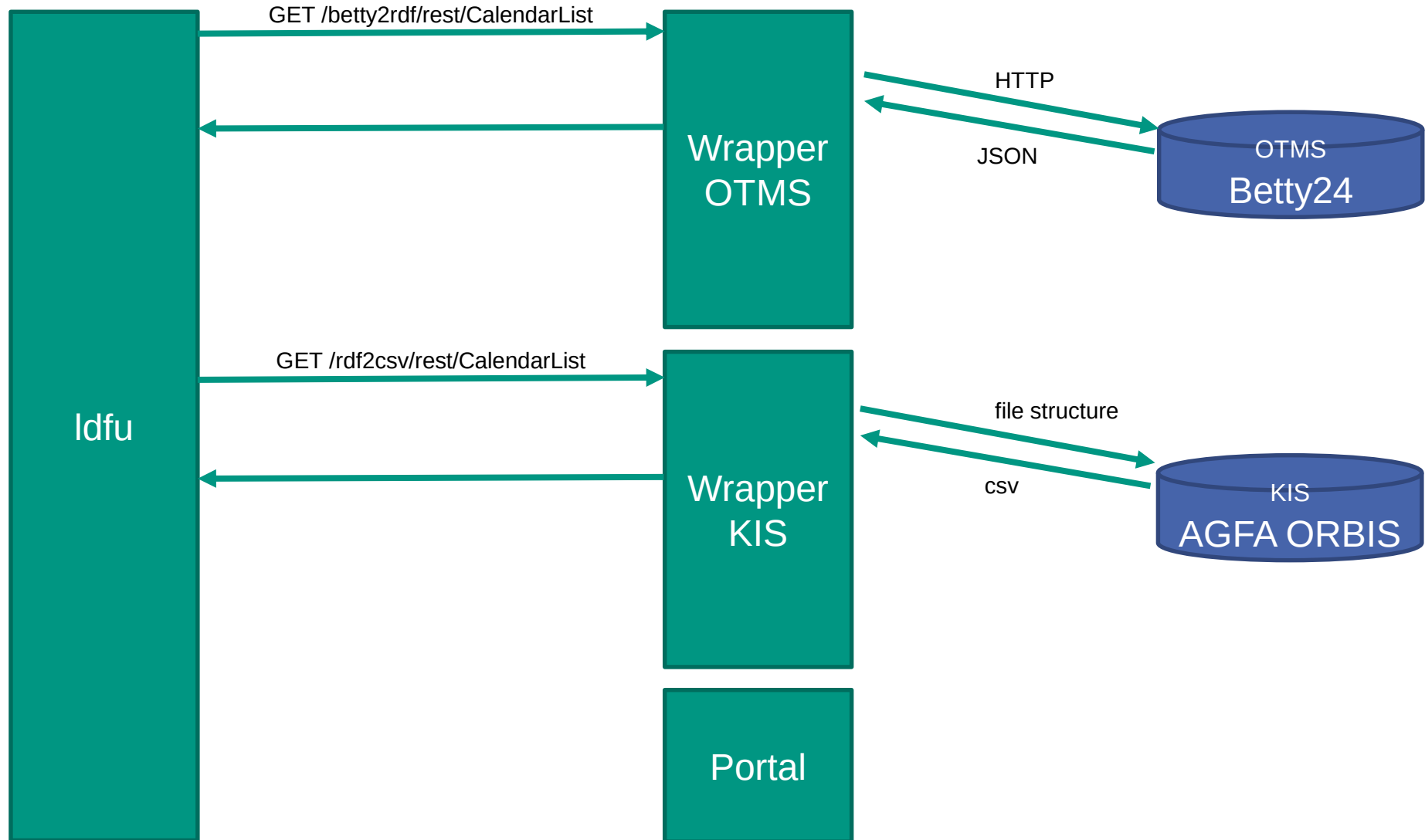
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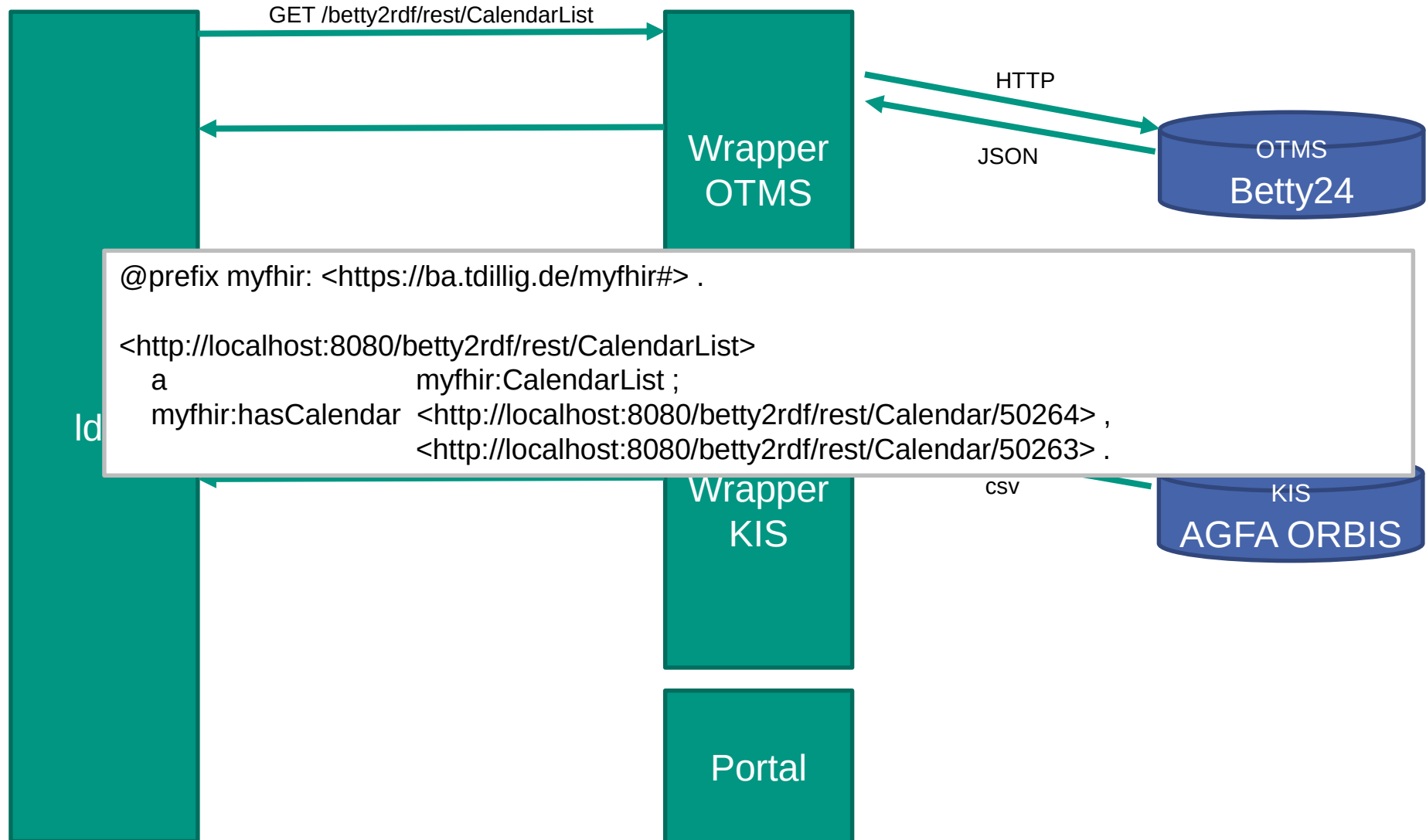
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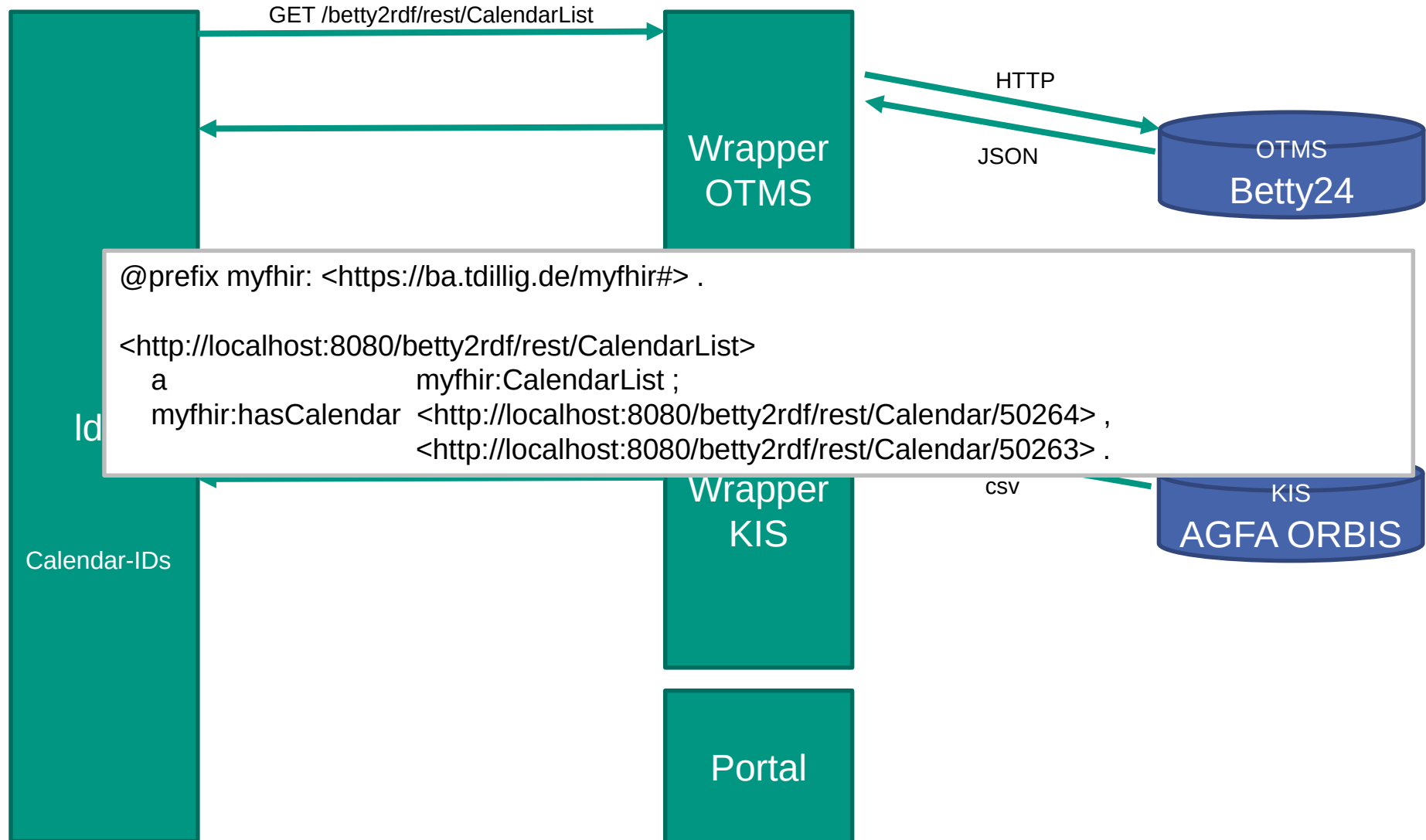
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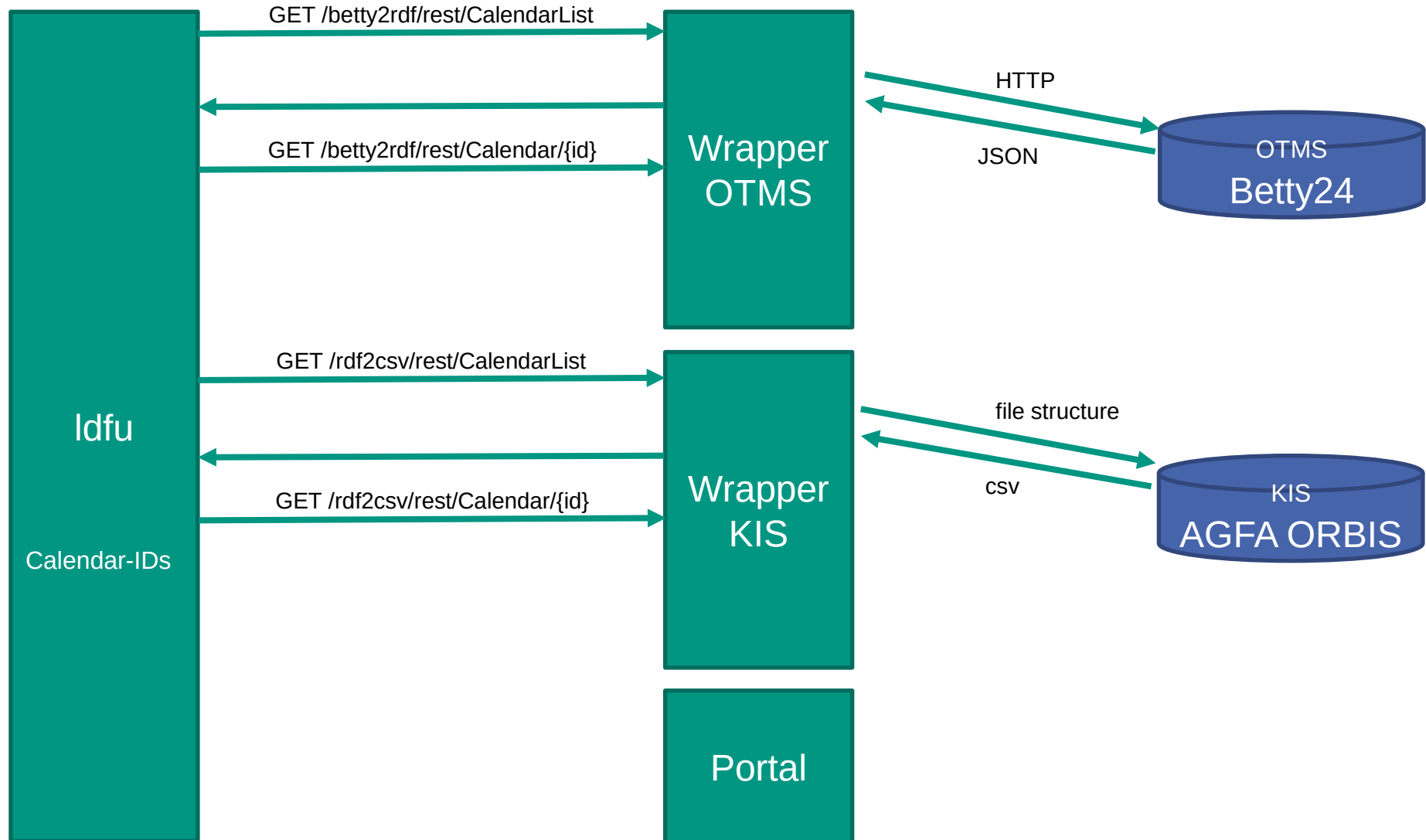
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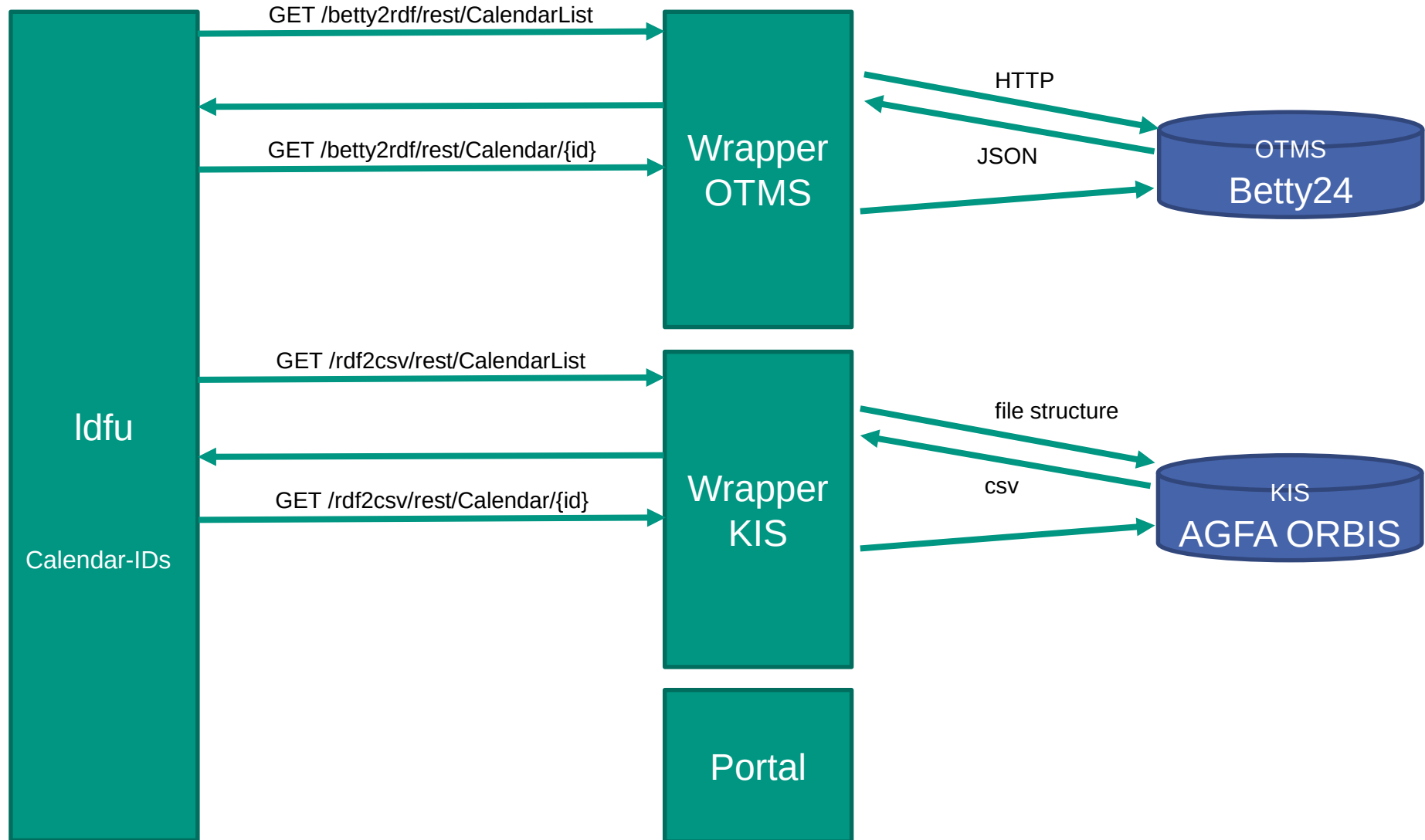
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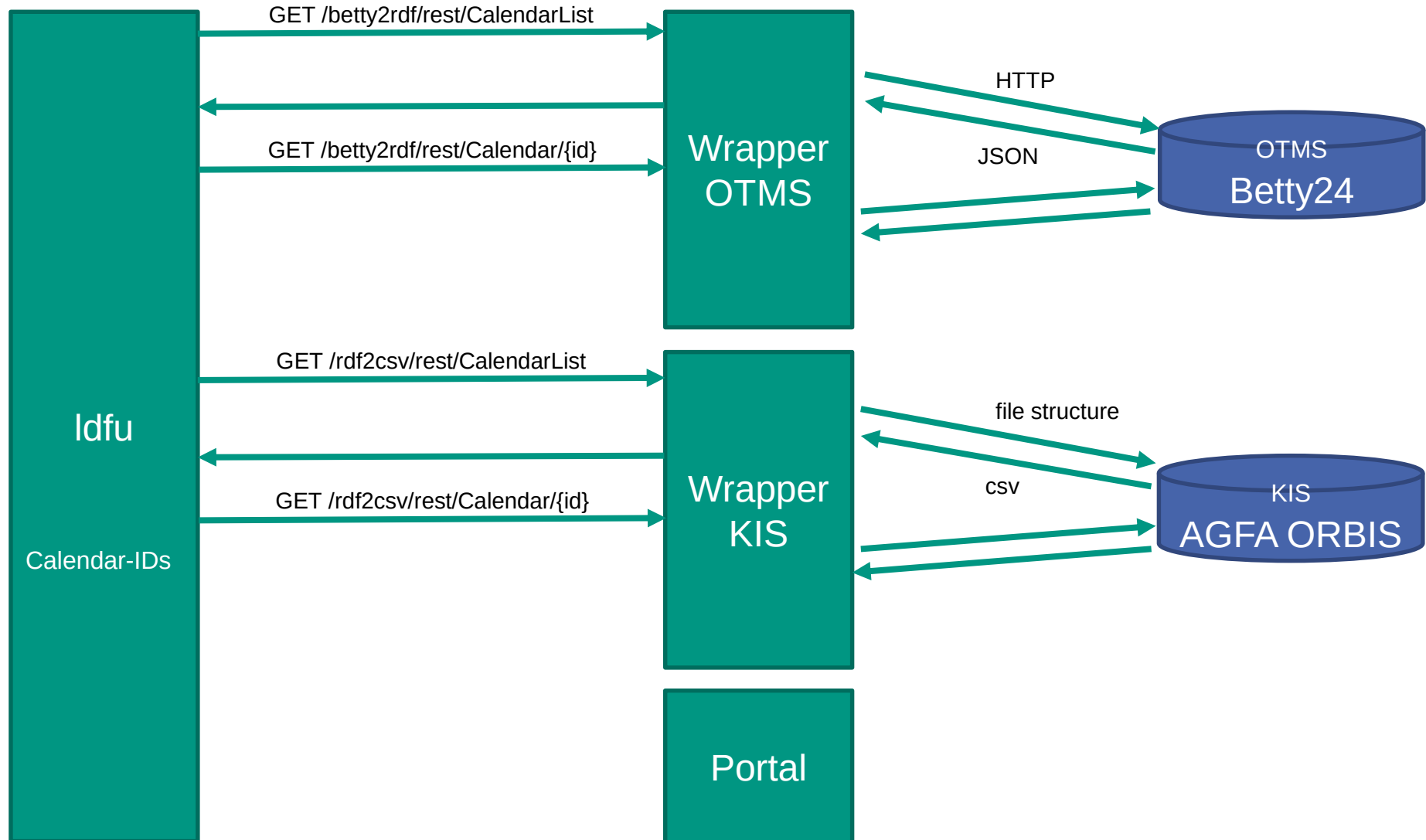
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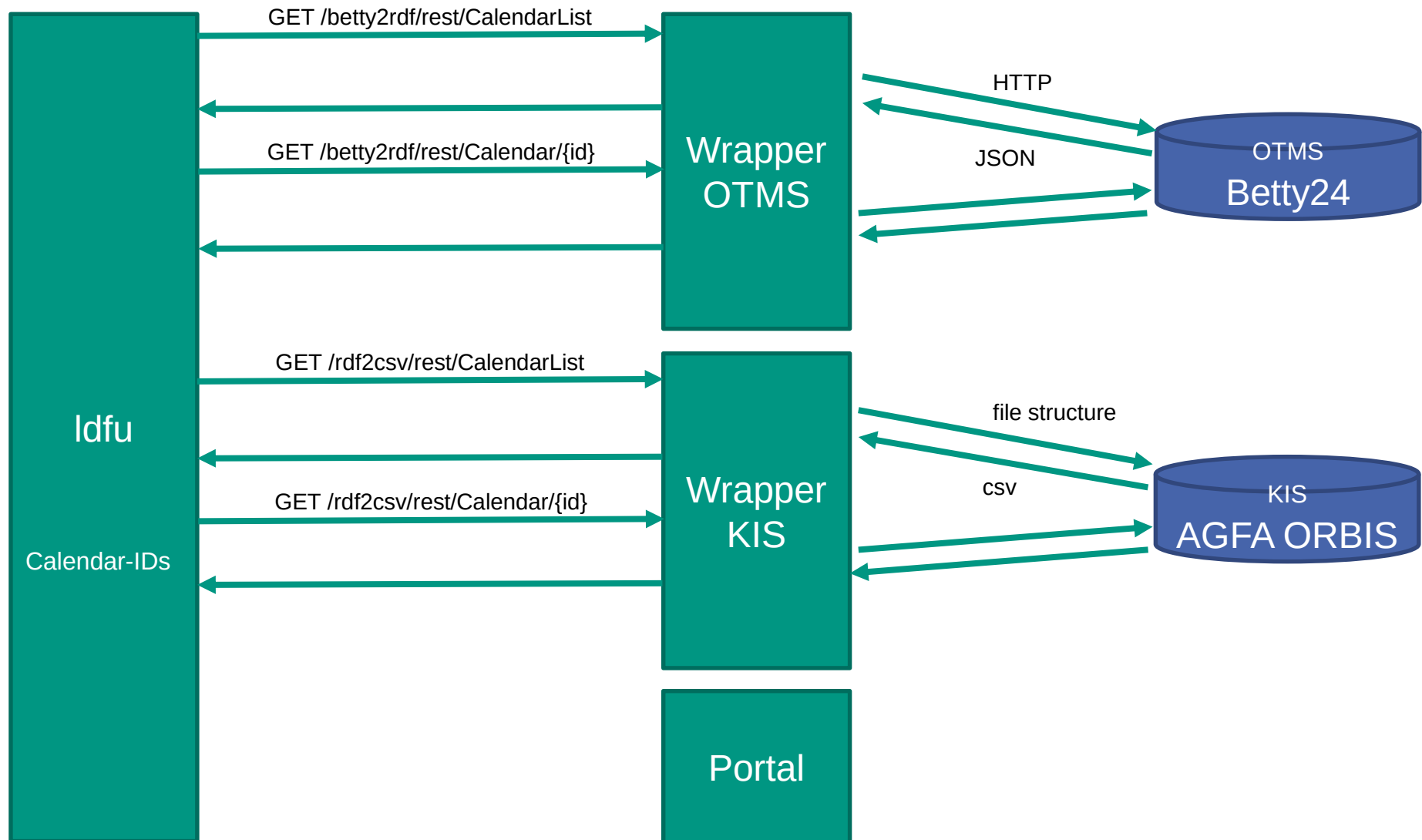
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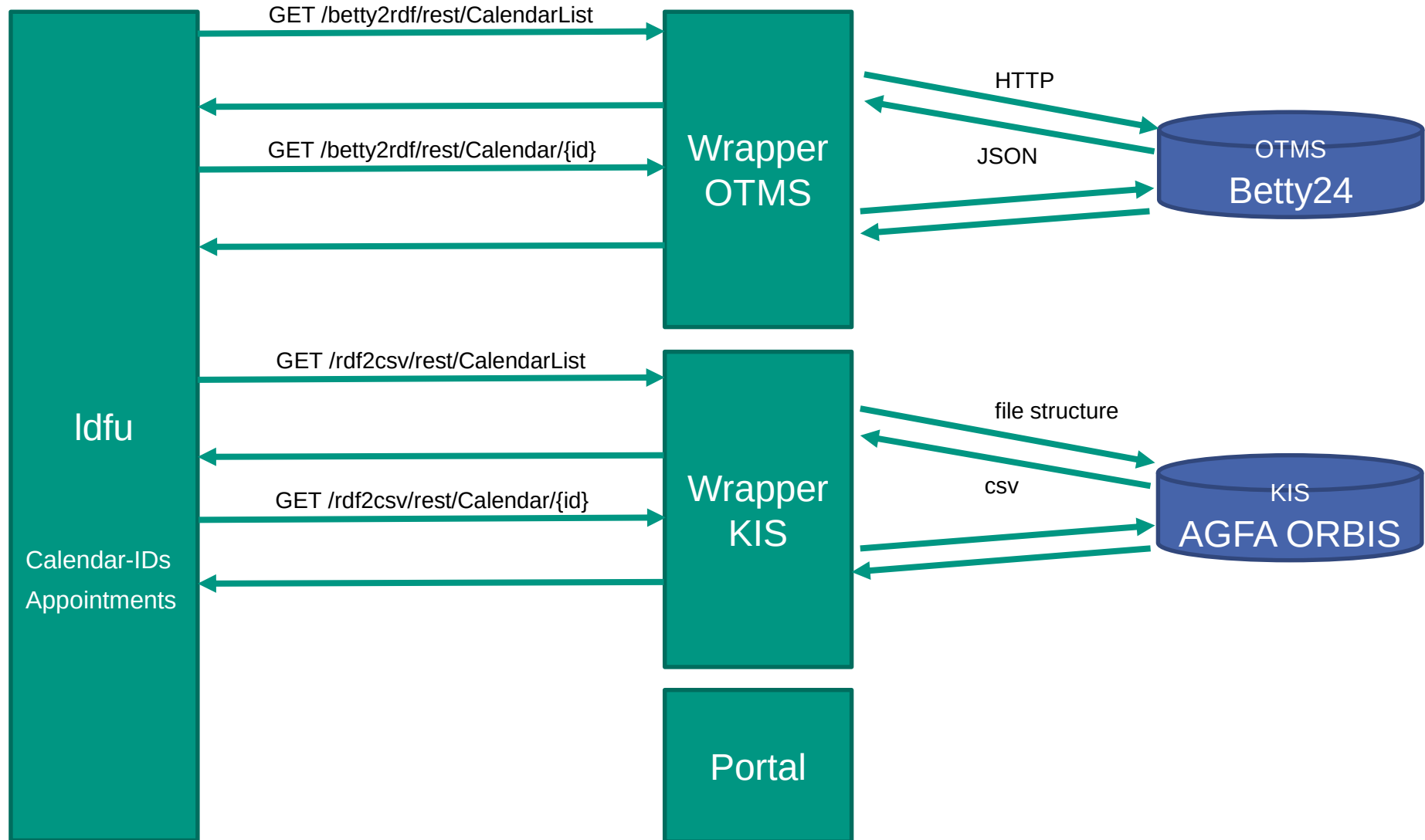
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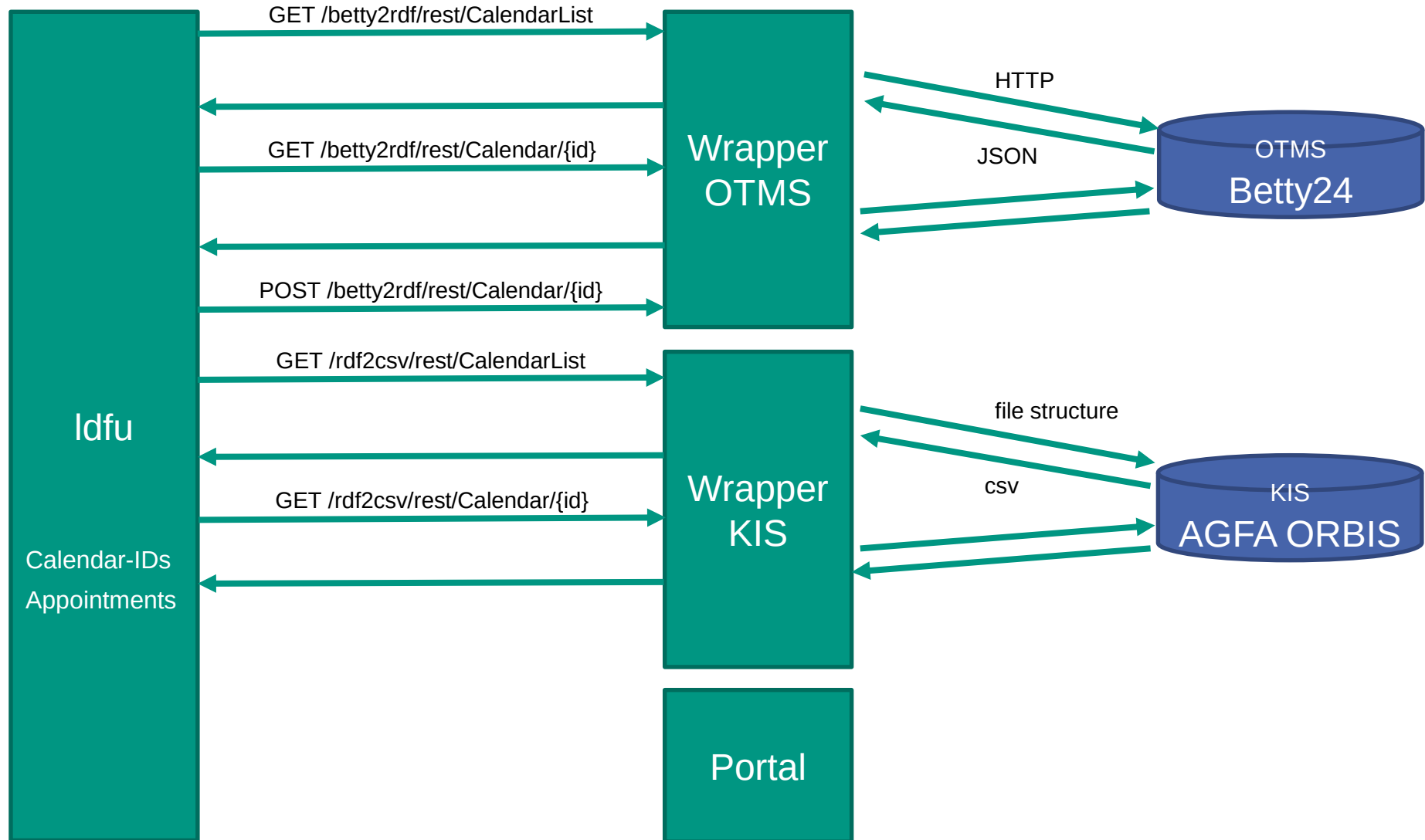
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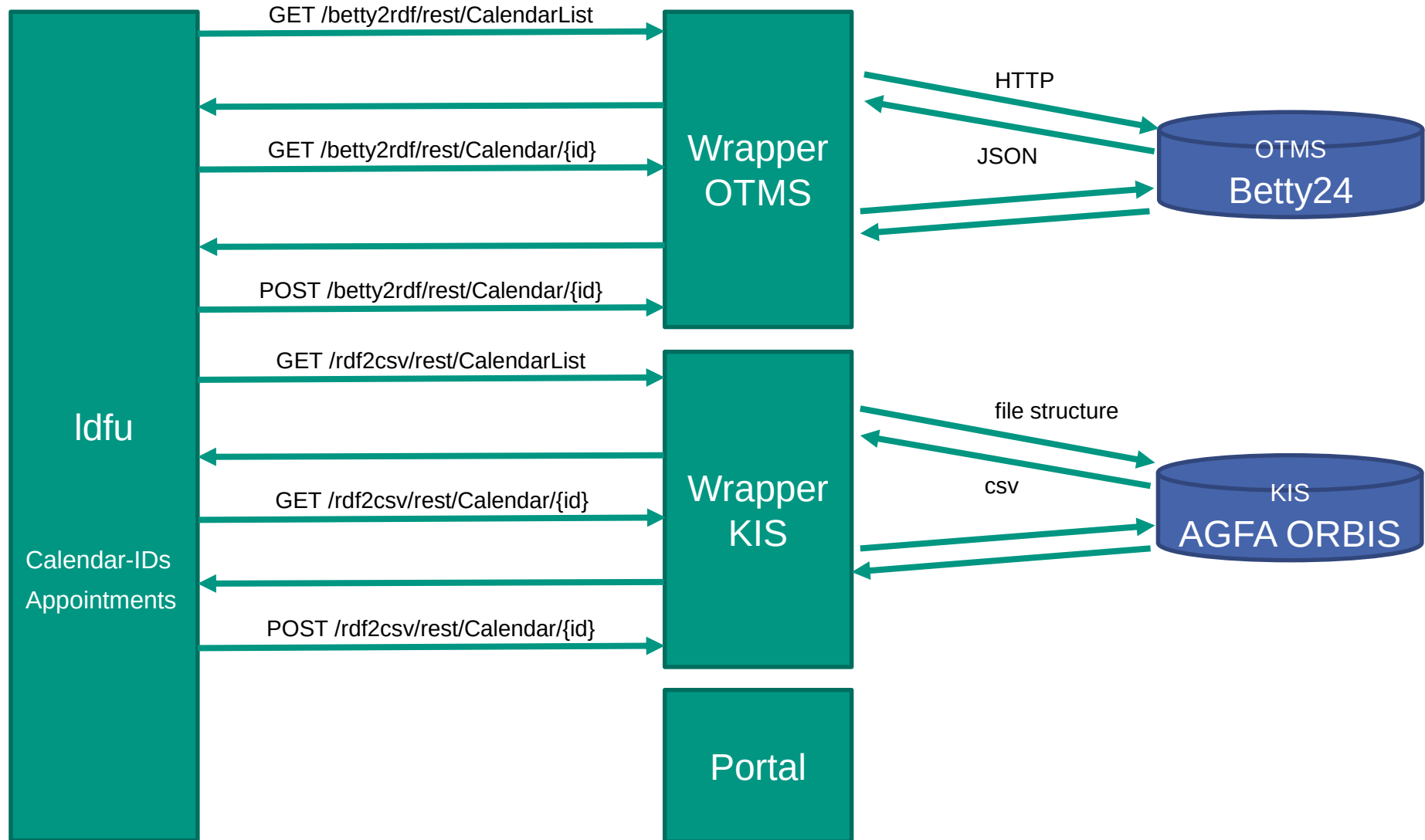
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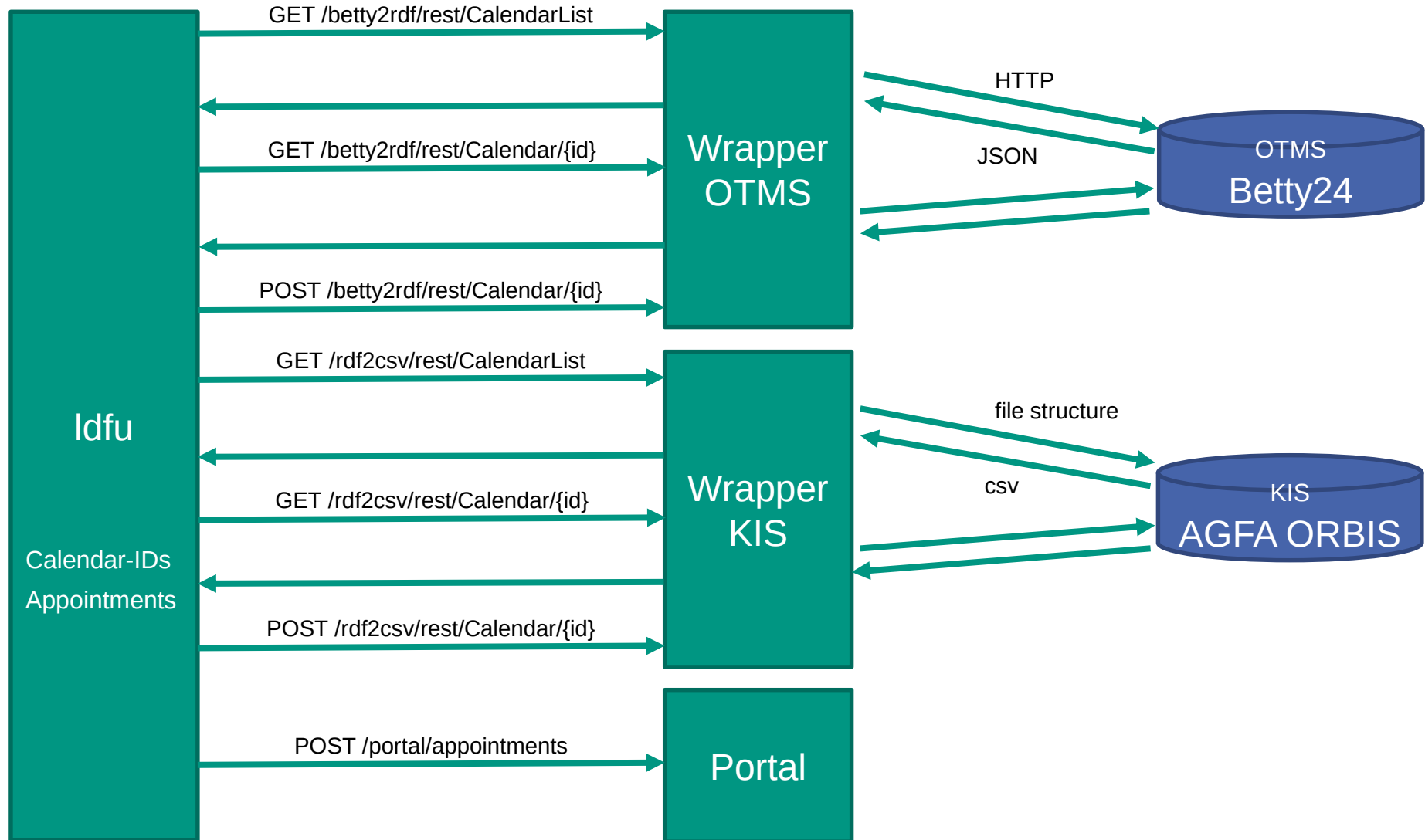
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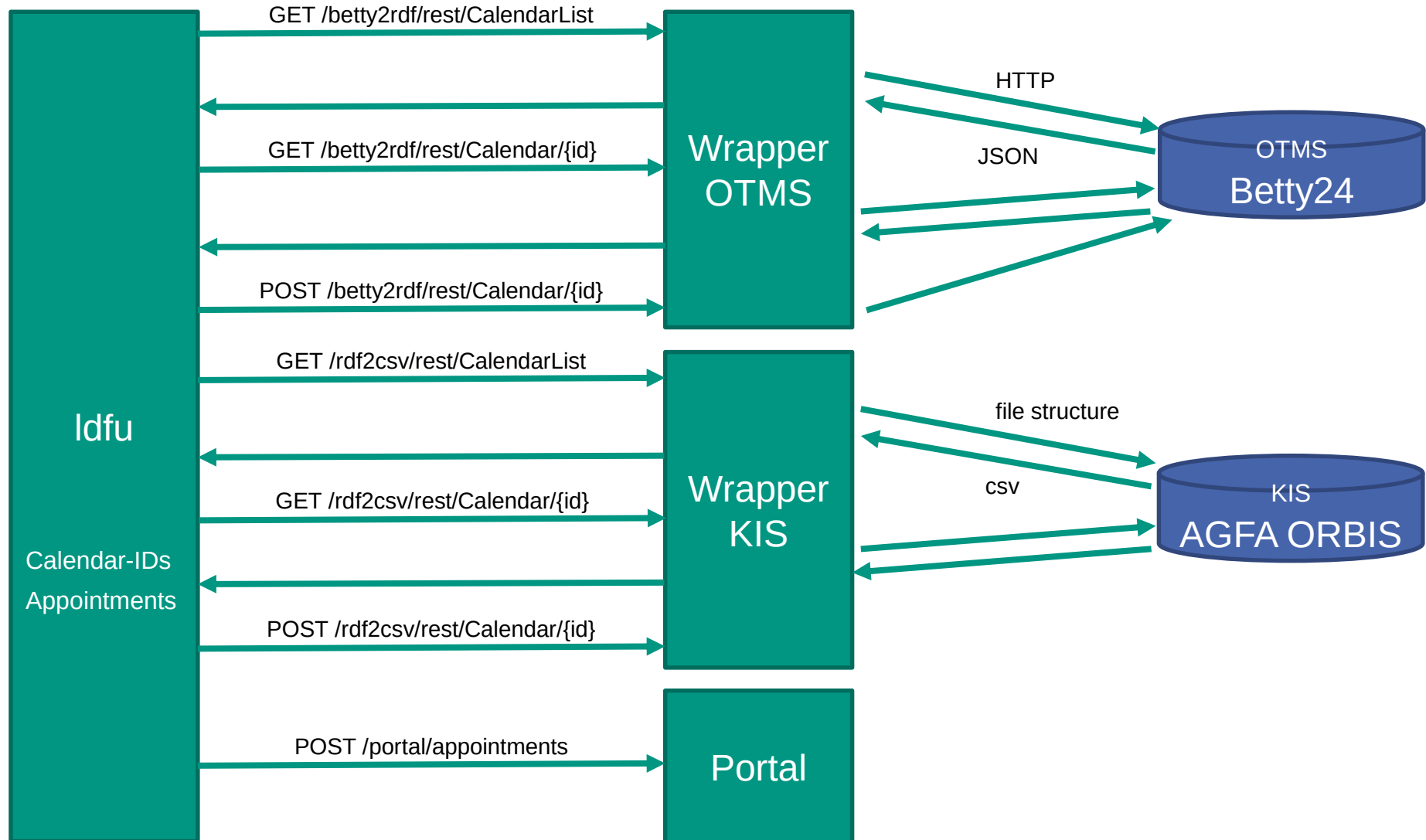
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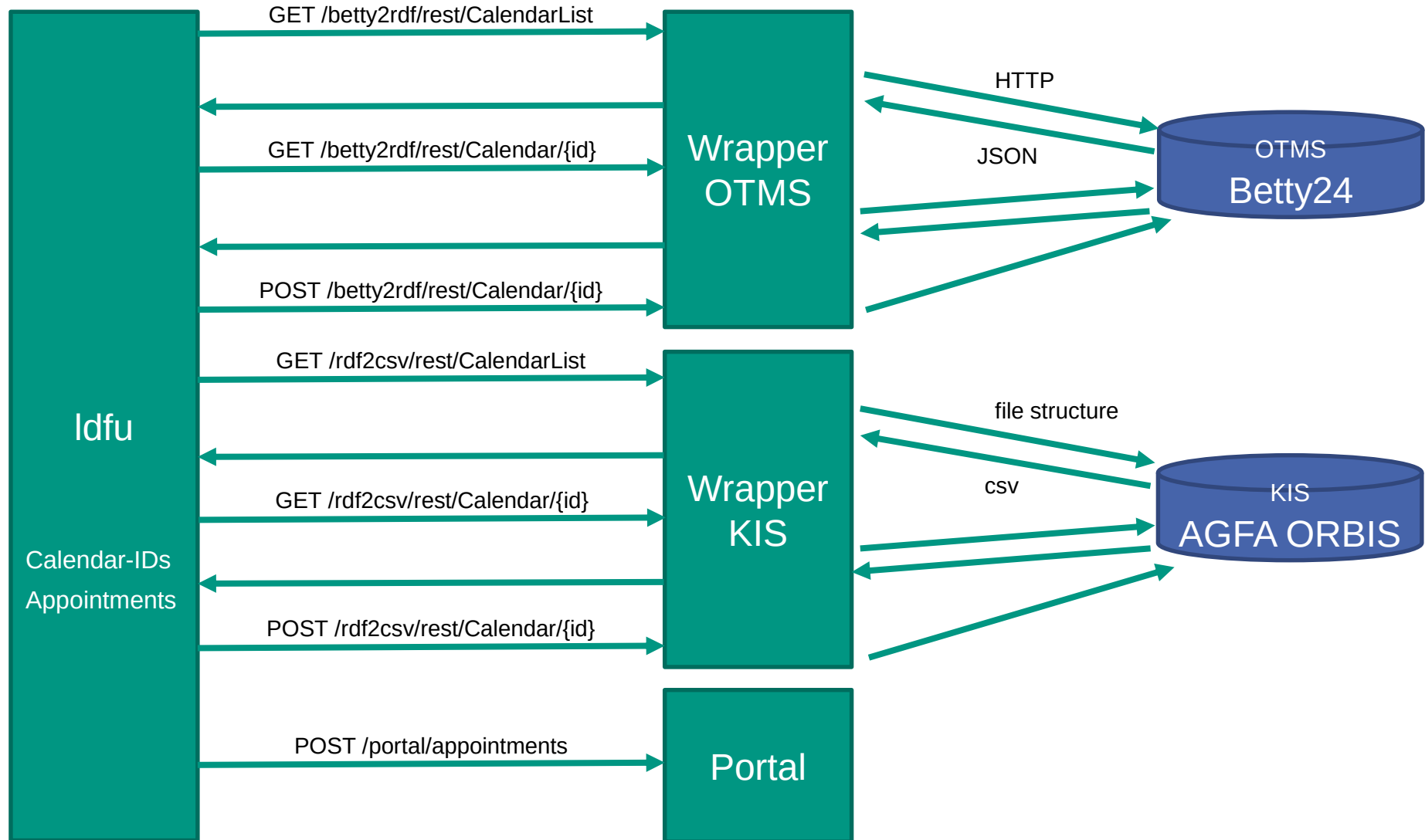
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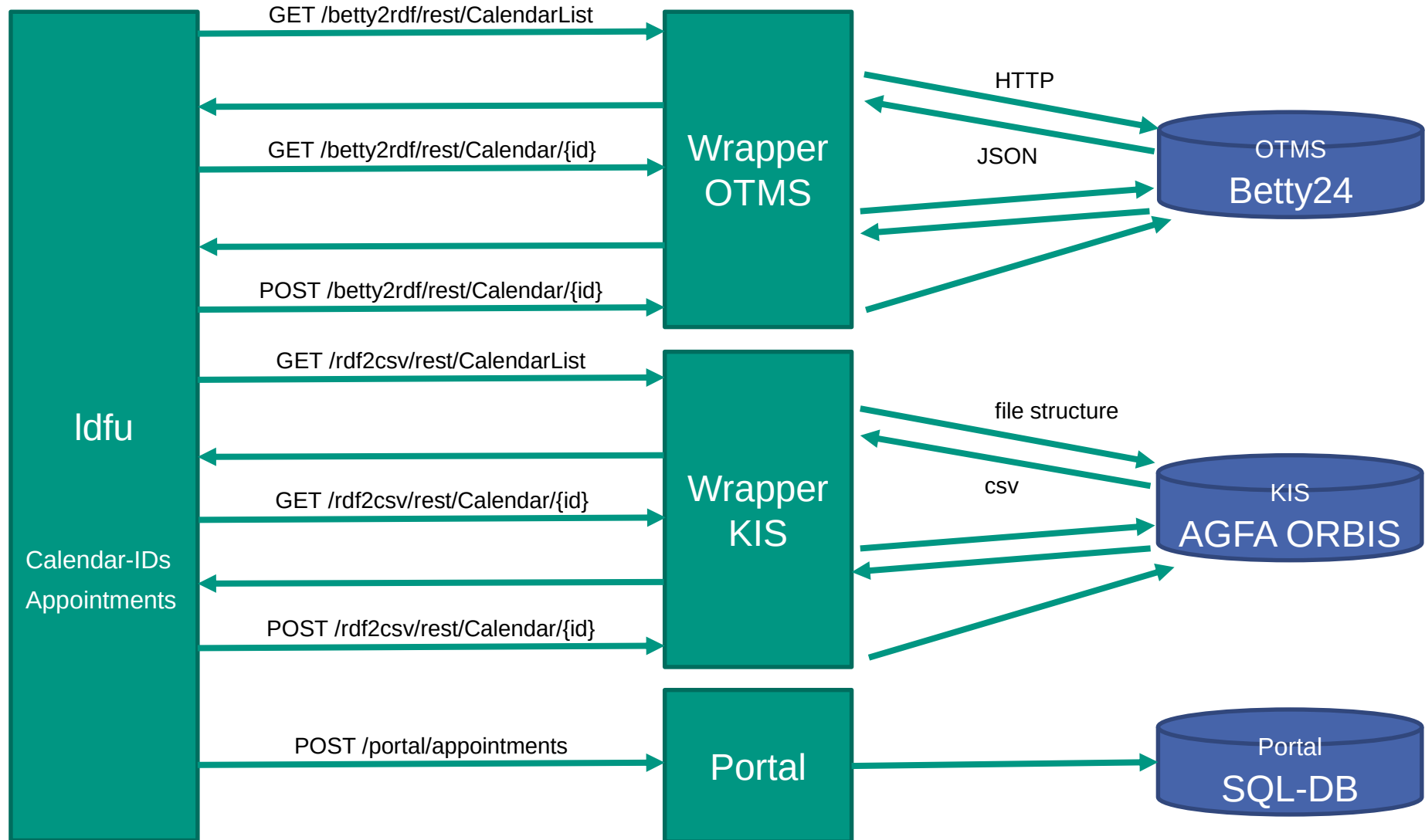
Architecture



Architecture



Architecture



Livedemo

Technical implementation

Wrapper

Apache Tomcat Application

- Jersey as REST-Framework
- Apache Jena as RDF-API
- Unirest as HTTP-Client
- built by Apache Maven

Web portal

PHP Application

- F3 as REST-Framework
- EasyRDF as RDF-API
- Twitter Bootstrap v4
- FullCalendar
- SQL Database and TTL Filestore

Idfu

- via command line interface
- running every 5 min

Evaluation

- Server grade hardware
 - KVM virtualized
 - Intel Xeon E3-1245v2 @ 3,4Ghz (4 Threads incl. HT)
 - 6 GB DDR3 RAM

- 30 appointments in OTMS and KIS
 - result: 60 appointments in every system (OTMS, KIS, portal)

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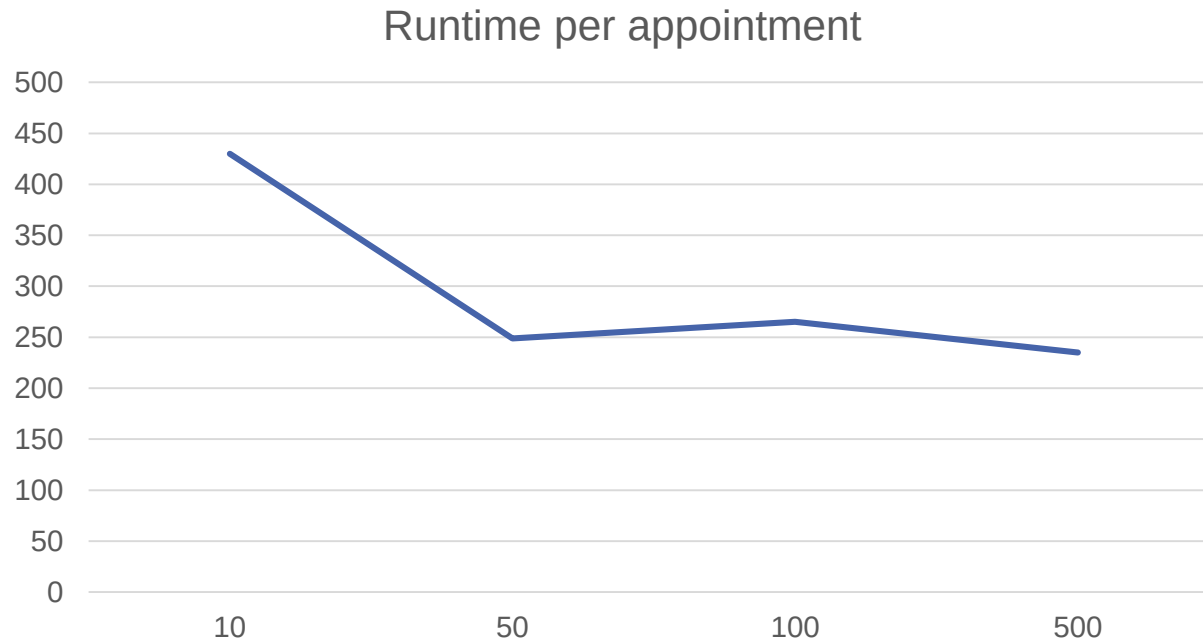
# of app.	10	50	100	500
runtime	4,3 s	12,4 s	26,5 s	117,6 s

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- Yes, it's fast!
 - HTTP Keel-Alive
 - Idfu is multithreaded
 - multithreaded HTTP-Client??

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- why 250ms?!
 - latency

Evaluation – Idfu is fast?

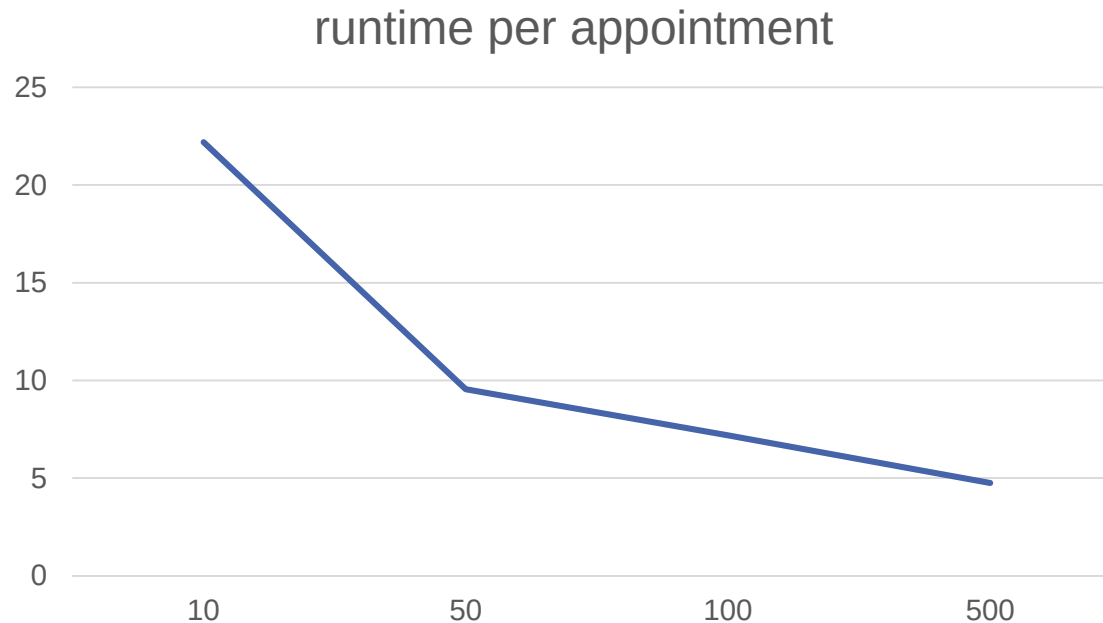
```

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<http://localhost:8080/rdf2csv/rest/Calendar/50264/Appointment/4d2a8d674541329395c87ac3d4e008c1
<http://localhost:8080/rdf2csv/rest/Calendar/50264/Appointment/4d2a8d674541329395c87ac3d4e008c1
[INFO] POST http://localhost:8080/betty2rdf/rest/Calendar/50264: OK, 200 in 202 ms
<http://localhost:8080/rdf2csv/rest/Calendar/50263/Appointment/0a3fe1597abb7c0cc7417df37e428ef3
<http://localhost:8080/rdf2csv/rest/Calendar/50263/Appointment/0a3fe1597abb7c0cc7417df37e428ef3
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<http://localhost:8080/rdf2csv/rest/Calendar/50263/Appointment/0f01c6bf8c784cd9840fb5f1e13eea75
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```

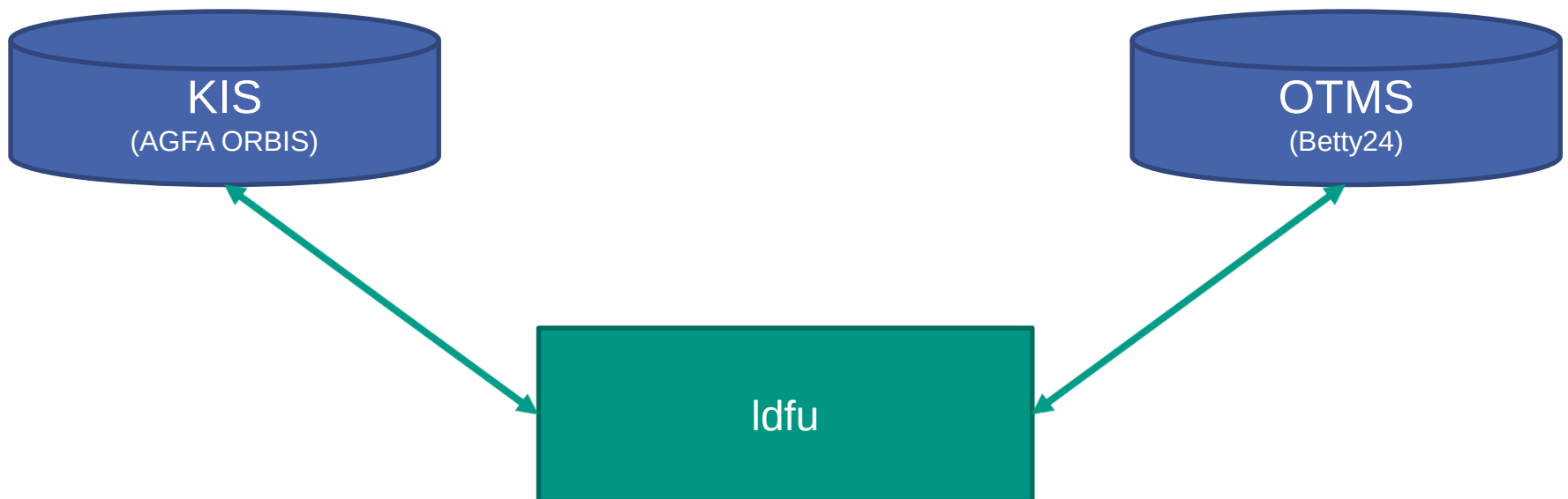
Evaluation - local

# of app.	10	50	100	500
runtime	222	478	720	2380
runtime p. app.	22,2	9,56	7,2	4,76



Conclusion

- Integration and synchronization is almost possible in realtime
- Idfu is the right tool for it



Future Work

- Implement DELETE methods in wrappers & Idfu rules
- Improve stats
- Implement HL7 Wrapper for deeper integration in KIS
- Add algorithm for collision handling
- Add algorithm for predictions based on prior appointments

Thank you for listening.

Questions?

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