

OpenWIS v5

*A long-term vision
for the evolution of the WIS*



Met Office

Toulouse, 20-23 March 2017

Draft Recommendation 5.5(1)/1 (CBS-16)

” WIS 2.0 will provide users with seamless access to diverse information from a wide range of sources and will enable weather, water and climate information to be related to socioeconomic and other application contexts. Through an open ecosystem of tools, applications and services, WIS 2.0 will allow all information providers to manage, publish and share their data, products and services and will allow all users to develop value added services and new products.”

Draft Recommendation 5.5(1)/1 (CBS-16)

WIS 2.0 strategy

Accessibility: Enhance data collection, high-volume, reduced complexity

Interoperability: Industry standard formats

Visibility: Data visible to government, commerce and citizens

Utility: Exploit meteorological data in context with data from other domains

Draft Recommendation 5.5(1)/1 (CBS-16)

WIS 2.0 strategy

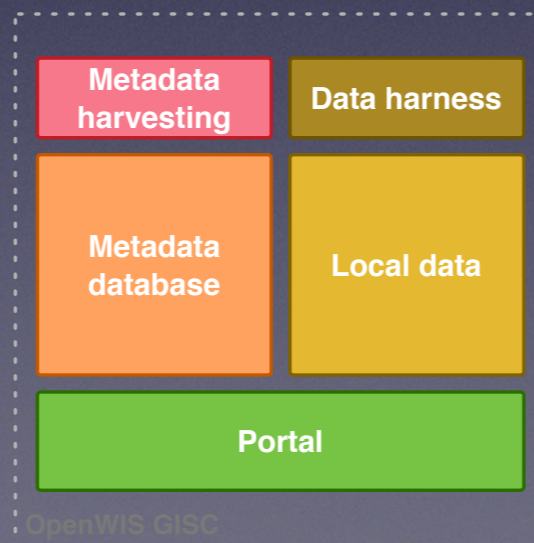
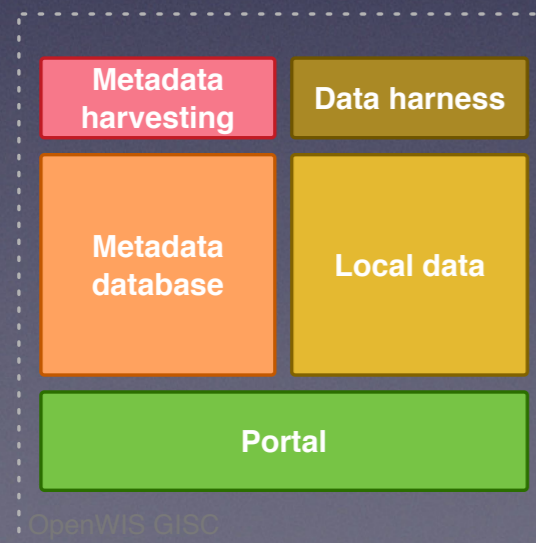
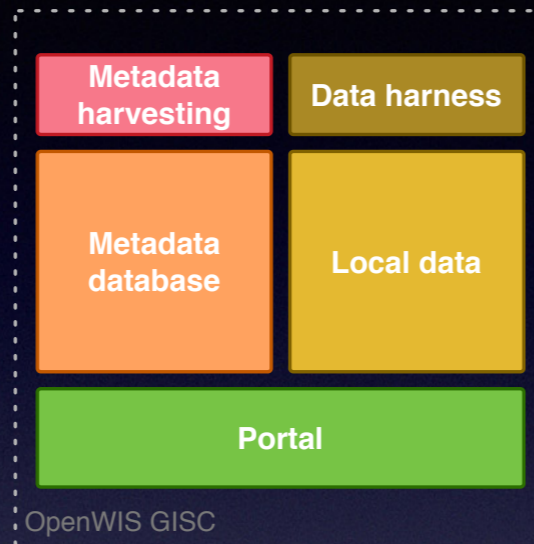
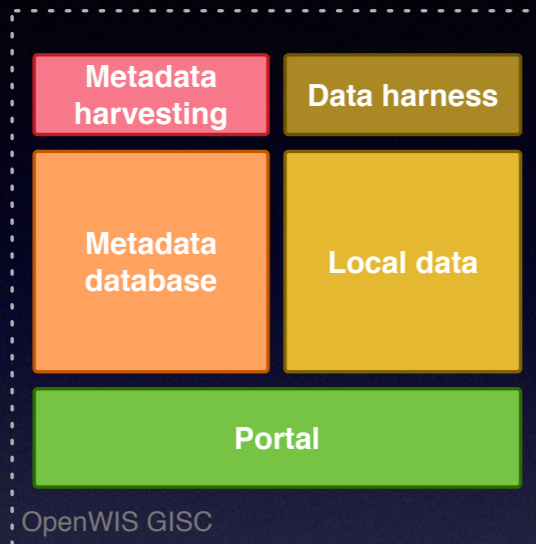
Reliability: Safe with guaranteed performance

Cost effectiveness: Shared components, economy of scale

Capacity-building: Training services

OpenWIS v3

Typical GISCs



Autonomous systems

Nothing shared

Large data

=> Large infrastructure

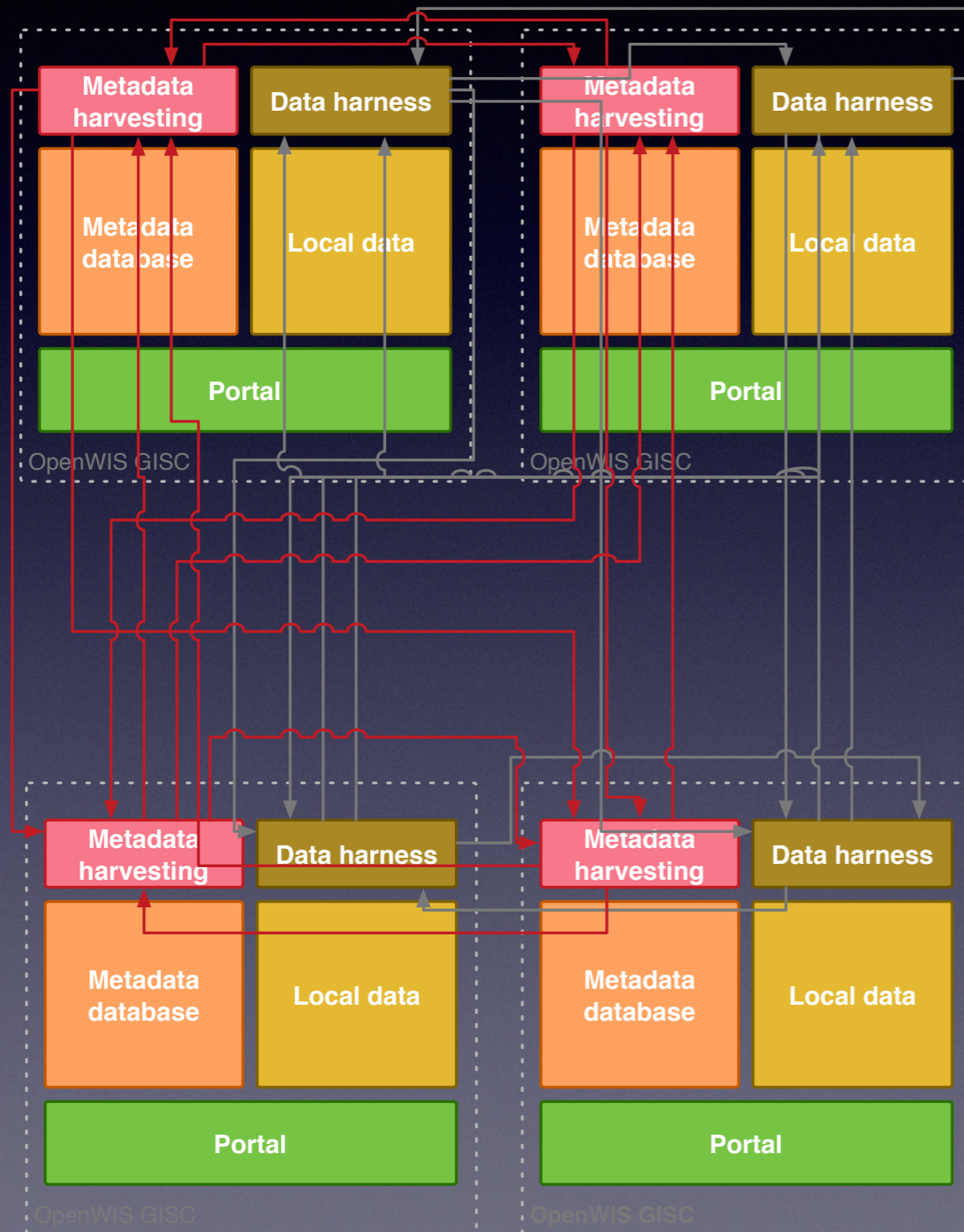
=> Long processing

Complex installation

Clustering complexity

OpenWIS v3

Data exchange



High-traffic

GISCs become data distribution hubs

Same data processed again and again

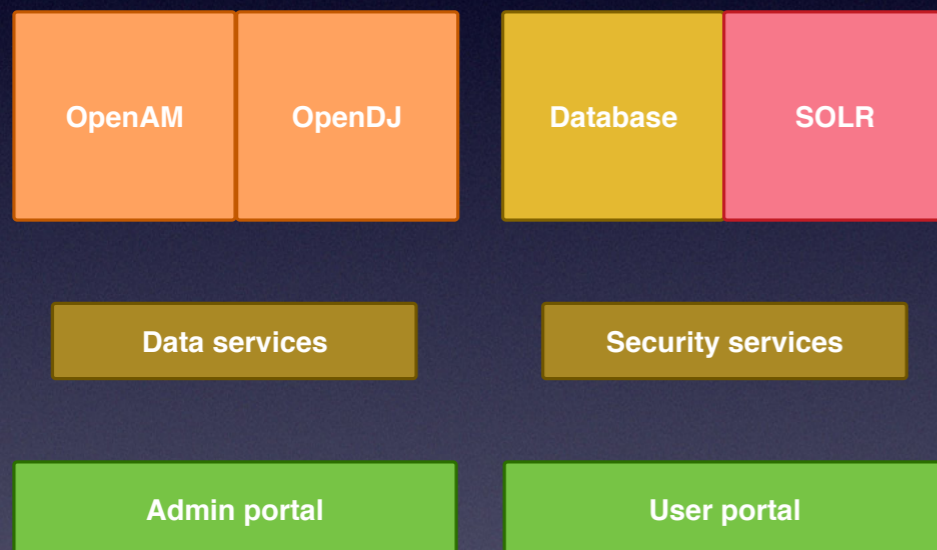
Slow harvesting

No discovery mechanism

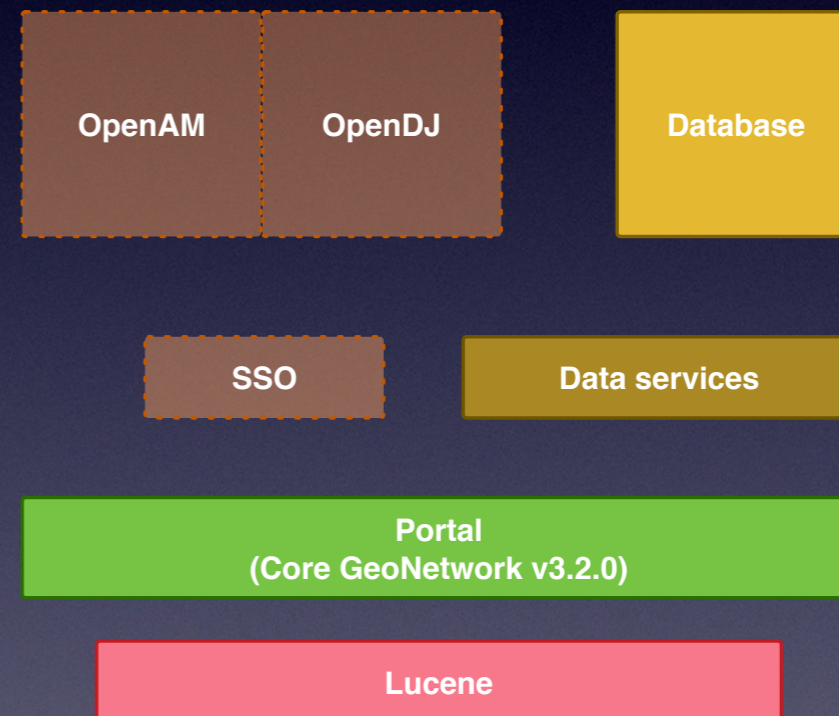
OpenWIS v3 to v4

Overview

v3



v4



Better UI but no changes in terms of data processing, bandwidth usage...

OpenWIS v4

Harvesting performance - out of the box

Embedded H2
Local shapefile

Very slow when data
accumulates

Practically unusable
after 100K records

PROVIDER	GEONETWORK			
	3.1.0-SNAPSHOT (develop/991048eb763a39ba3cf4cf4d88d23f19e391ea1b)			
	set (iso19139)	records	time (sec)	rate (r/sec)
France http://wispi.meteo.fr/openwis-user-portal/srv/oaipmh	WIS-GISC-TOULOUSE	2947	674	4,37
Moscow http://meta.gisc-msk.wis.mecom.ru/openwis-portal/srv/ru/oaipmh	WIS-GISC-MOSCOW	3429	1837	1,87
Melbourne http://wis.bom.gov.au/openwis-user-portal/srv/oaipmh	WIS-GISC-MELBOURNE	1113	454	2,45
Brasilia http://gisc.inmet.gov.br/oai/provider	WIS-GISC-BRASILIA	557	836	0,67
Tokyo http://www.wis-jma.go.jp/meta/oaiprovider.jsp	WIS-GISC-TOKYO	Nassos Michas: Did not start fetching (~30'). Could not stop it, had to restart Jetty.		
Beijing http://oai.dwd.de/oai/provider	WIS-GISC-BEIJING	61600	69388	0,89
Germany http://oai.dwd.de/oai/provider	WIS-DE	30245	65094	0,46
Seoul http://gisc.kma.go.kr/openwis-user-portal/srv/oaipmh	WIS-GISC-SEOUL	Nassos Michas: WIS-GISC-SEOUL was only returning 1 record		
Exeter http://wis.metoffice.gov.uk/openwis-user-portal/srv/oaipmh	WIS-GISC-EXETER	17033	Had to restart it multiple times, so no accurate readings	
France http://wispi.meteo.fr/openwis-user-portal/srv/oaipmh	WIS-DCPC-EUMETSAT	21	80	0,26
France http://wispi.meteo.fr/openwis-user-portal/srv/oaipmh	WIS-GISC-JEDDAH	248	724	0,34
TOTAL:		116945		

OpenWIS v4

Harvesting performance - PostGIS

Embedded H2
PostGIS shapefile

Better but still slow

GEONETWORK 3.1.0-SNAPSHOT (develop/2f56642b5e71ddd946ba8ca4a1d52a58323571d9) - Embedded Jetty/PostGIS (8 threads)/Java8			
set (iso19139)	records	time (sec)	rate (r/sec)
WIS-GISC-TOULOUSE	3242	576	5,63
WIS-GISC-MOSCOW	3429	1393	2,46
WIS-GISC-MELBOURNE	1113	It was very slow, had to restart multiple times.	
WIS-GISC-BRASILIA	557	321	1,74

After some long source code profiling sessions...

=> Sequential HTTP harvesting and indexing
does not scale!

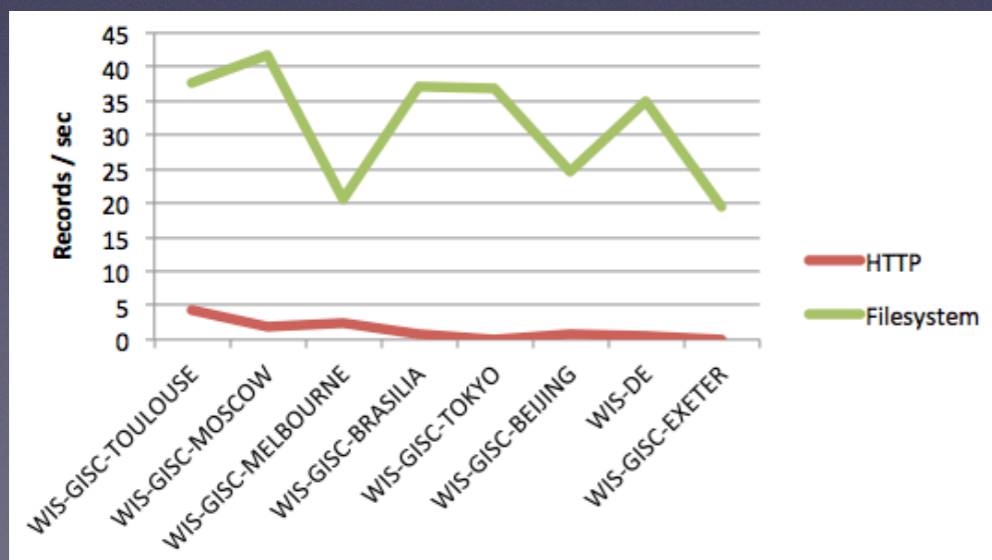
OpenWIS v4

Harvesting performance - offline harvesting

Fetch all metadata offline

Perform filesystem-based indexing

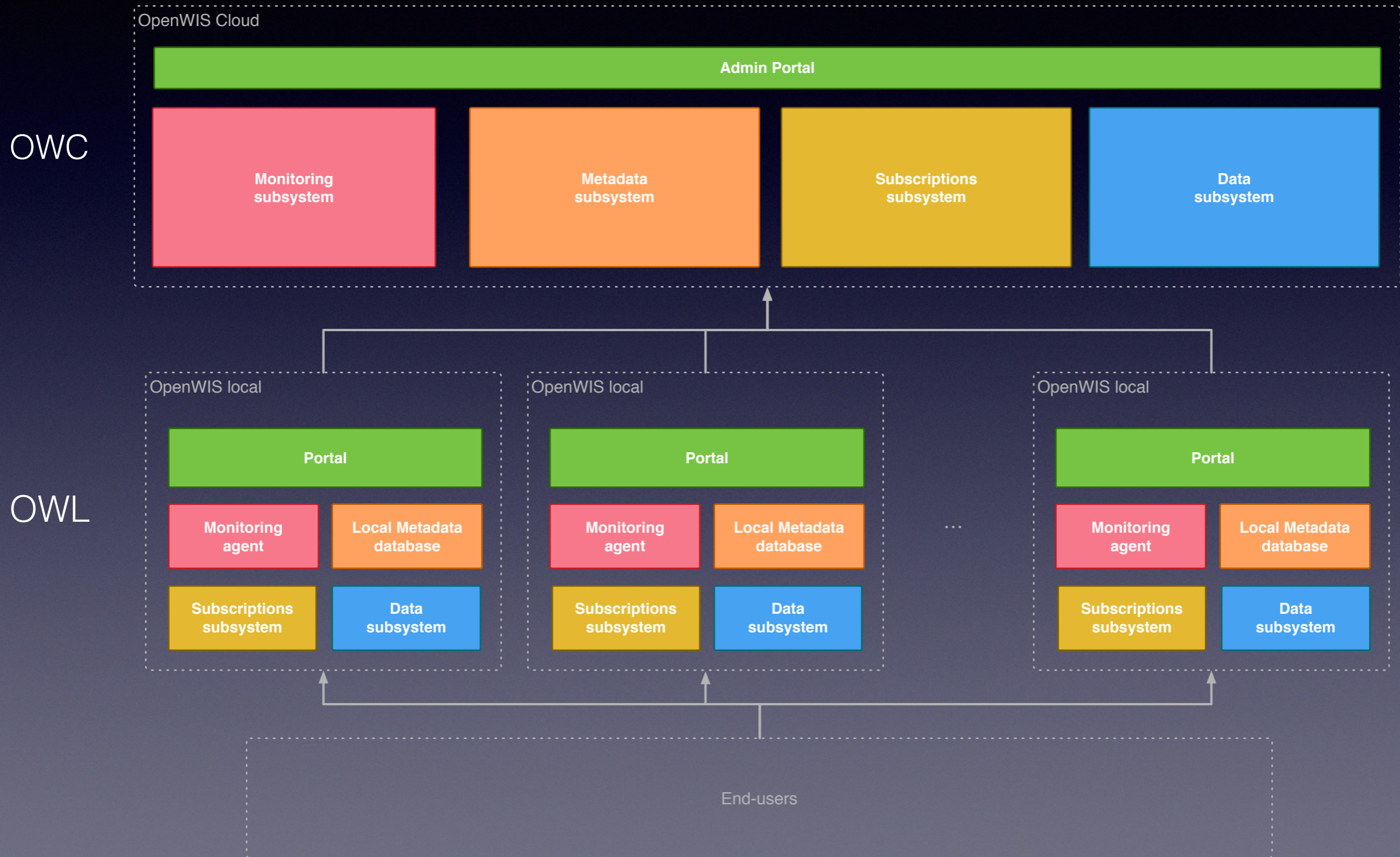
Seems to be the only option for prod



GEONETWORK 3.1.0-SNAPSHOT (develop/2f56642b5e71ddd946ba8ca4a1d52a58323571d9) - Embedded Jetty/PostGIS (8 threads)/Java8 - Filesystem import			
set (iso19139)	records	time (sec)	rate (r/sec)
WIS-GISC-TOULOUSE	3242	86	37,70
WIS-GISC-MOSCOW	3429	82	41,82
WIS-GISC-MELBOURNE	1113	54	20,61
WIS-GISC-BRASILIA	557	15	37,13
WIS-GISC-TOKYO	24419	664	36,78
WIS-GISC-BEIJING	61600	2504	24,60
WIS-DE	30415	869	35,00
WIS-GISC-SEOUL	WIS-GISC-SEOUL was only returning 5 records		
WIS-GISC-EXETER	17033	880	19,36

OpenWIS v5

Architecture overview



OpenWIS v5

Architecture overview

Why a "hybrid" cloud?

All components modularised as *containers*

Pick'n'mix deployment approach

Use/Deploy what you need

Fully-automated, *single line* deployment

Fully-automated clustering and high-availability

OpenWIS v5

Cloud

Harvesting and Indexing at OWC

Heavy processing at OWC

Data storage (e.g. GTS) at OWC

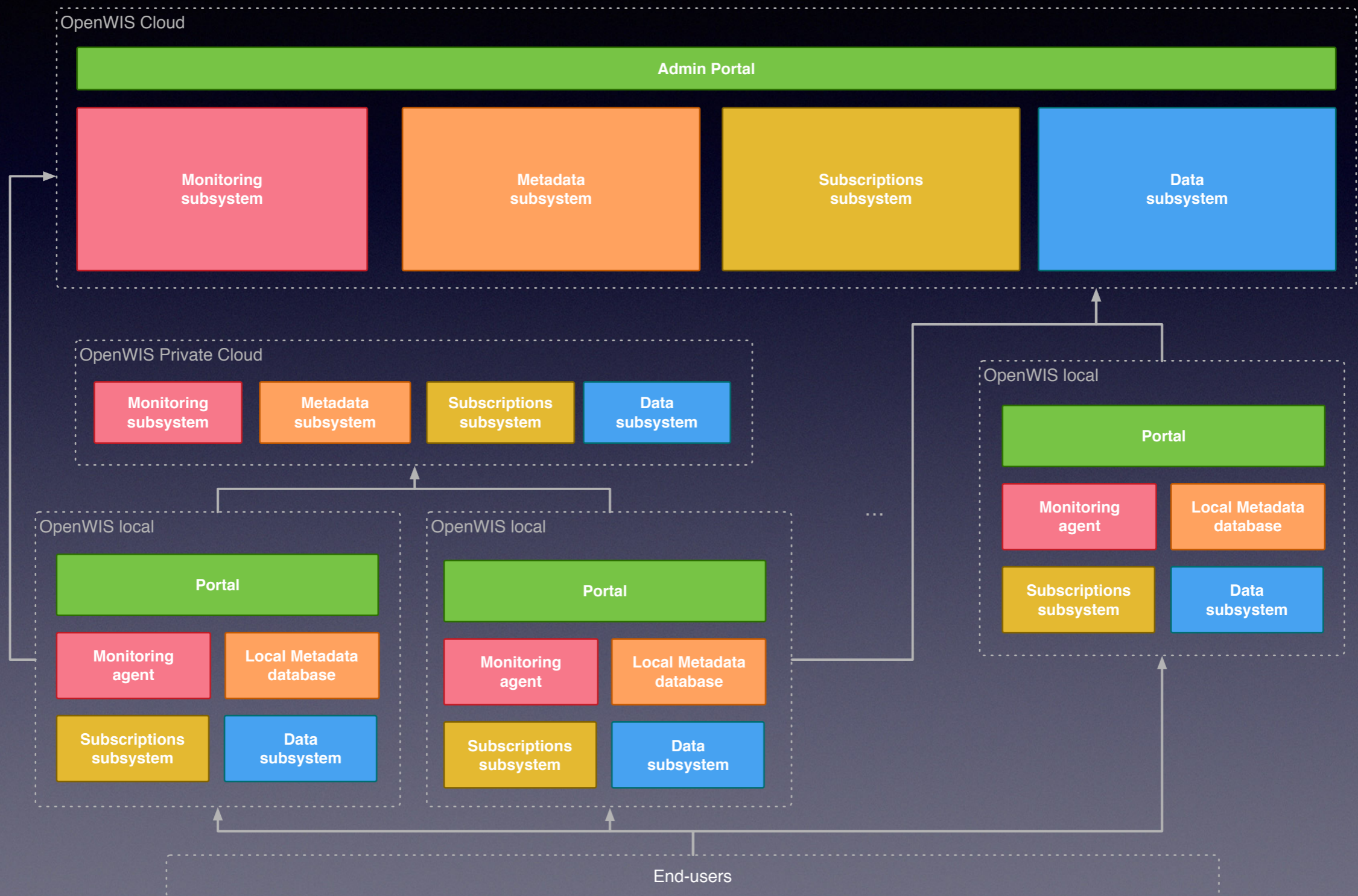
OWL to maintain localised/private data

Open Access to data if published at OWC

How to support private data exchange?

OpenWIS v5

Private cloud



OpenWIS v5

Private cloud

OWPC allows private data exchange

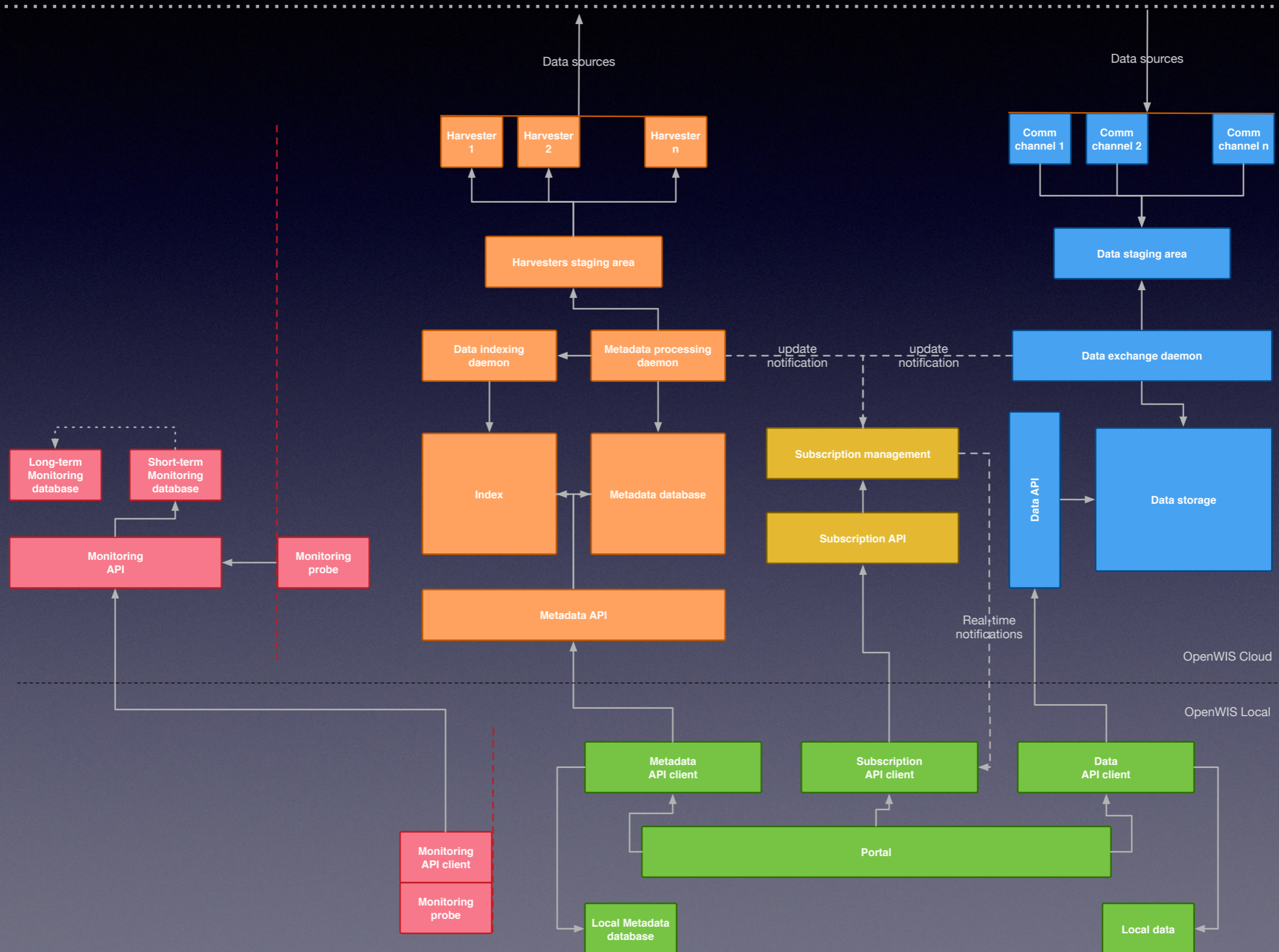
Easy to setup, minimal resource usage

OWL can consume services from OWC and/or zero or more OWPCs

OWPC provides efficiency even at small scale

OpenWIS v5

High-level architecture



OpenWIS v5

High-level architecture

Fully asynchronous harvesting and indexing

Message-driven data/metadata architecture

Subscriptions mechanism based on messaging

State of the art technical stack:

Angular2, ActiveMQ, Apache Camel, Apache CXF,
OSGi via Apache Karaf, Elasticsearch, JEE,
Docker, Postgres

OpenWIS v5

Cloud infrastructure agnostic

Because of containers-based architecture members are free to decide what to use

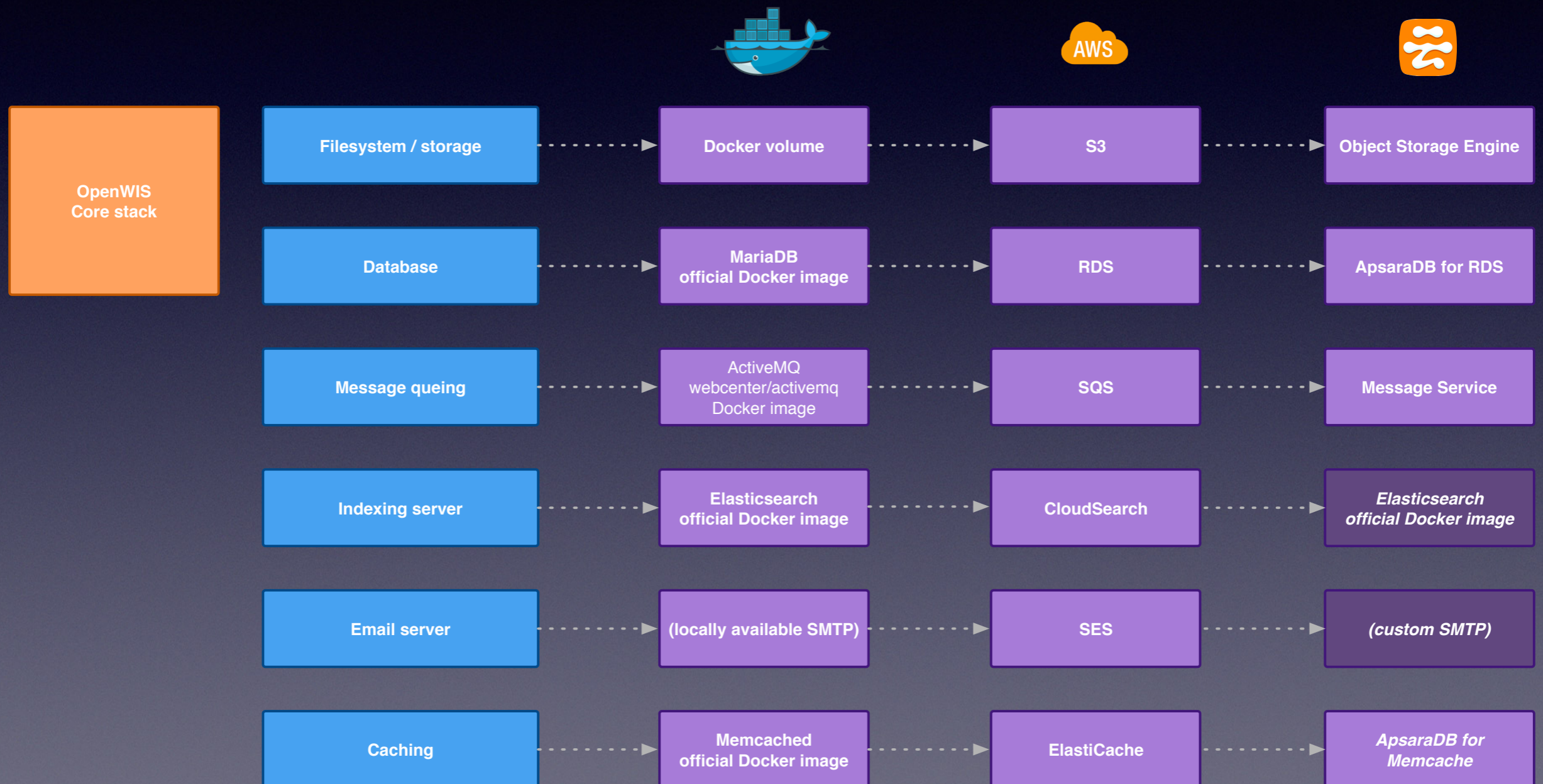
An "all inclusive" configuration will be provided for quick and easy setup

Individual components can be replaced with cloud-specific counterparts

Examples...

OpenWIS v5

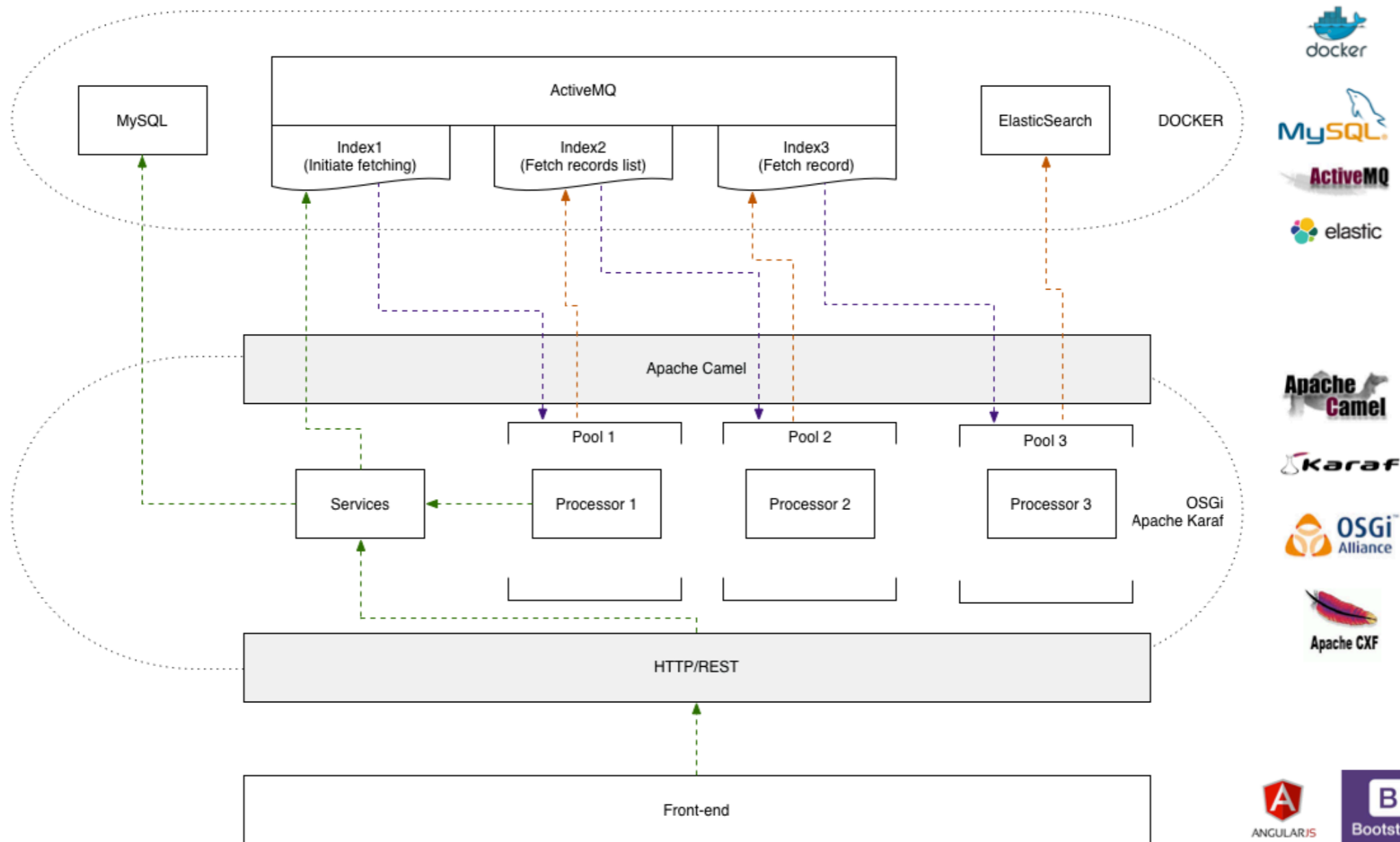
Cloud infrastructure agnostic



OpenWIS v5

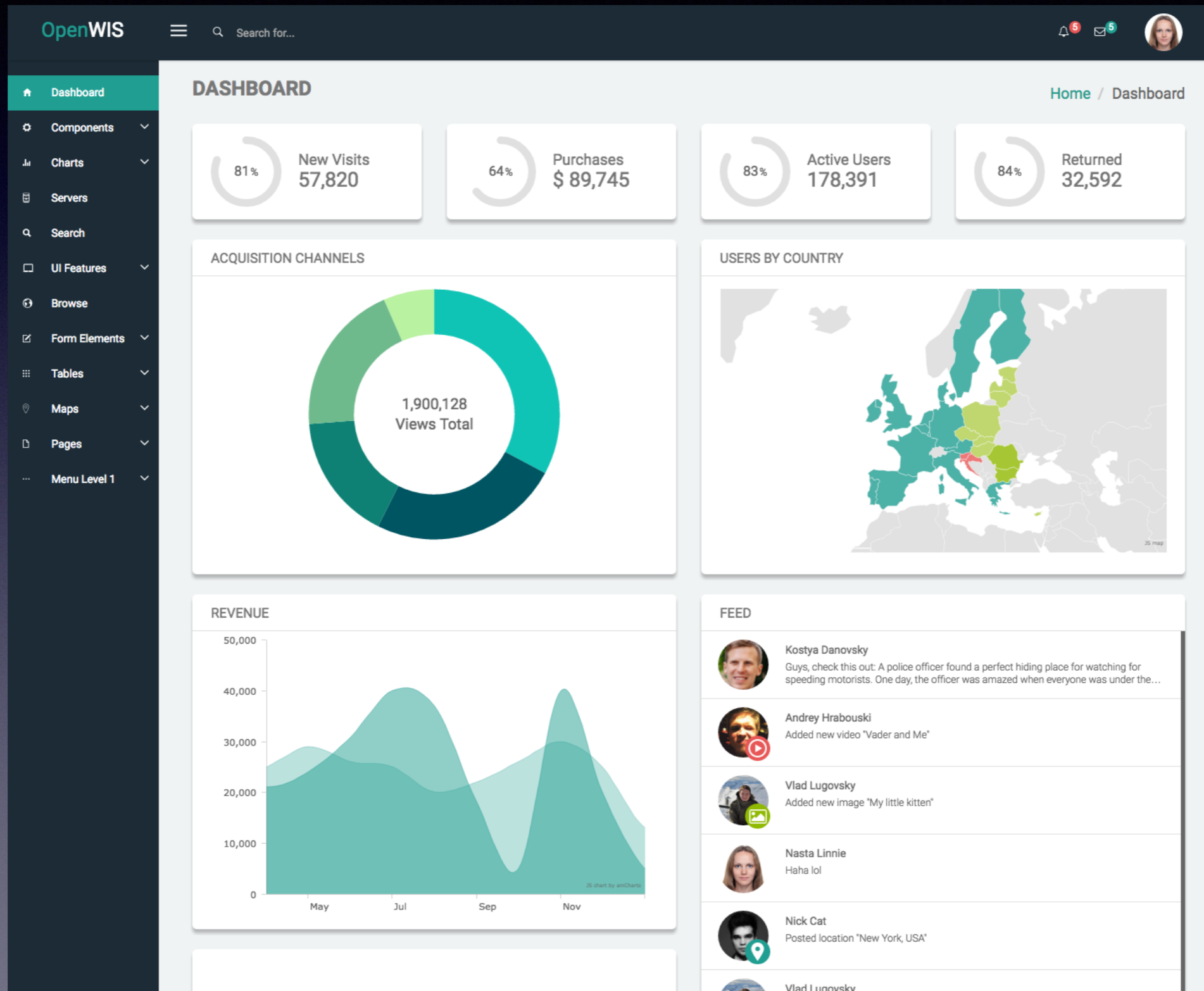
PoC - Architecture

Fully asynchronous / multi-threaded harvesting and indexing



OpenWIS v5

PoC - Home



OpenWIS v5

PoC - Adding servers for harvesting

OpenWIS Search for... Home / Servers

SERVICES

HARVESTING SERVERS

Location	URL	Server ID	Action
Melbourne	http://wis.dom.gov.au/openwis-user-portal/srv/oaipmh	WIS-GISC-MELBOURNE	Harvest
Beijing	http://oai.dwd.de/oai/provider	WIS-GISC-BEIJING	Harvest
Tokyo	http://www.wis-jma.go.jp/meta/oaiprovider.jsp	WIS-GISC-TOKYO	Harvest
Germany	http://oai.dwd.de/oai/provider	WIS-DE	Harvest
Moscow	http://meta.gisc-msk.wis.mecom.ru/openwis-portal/srv/ru/oaipmh	WIS-GISC-MOSCOW	Harvest
France	http://wispi.meteo.fr/openwis-user-portal/srv/oaipmh	WIS-GISC-TOULOUSE	Harvest
Exeter	http://wis.metoffice.gov.uk/openwis-user-portal/srv/oaipmh	WIS-GISC-EXETER	Harvest

[+ Add new](#)

REGISTER HARVESTING SERVER

Name: **Name dummy**

URL: **Administrator mss-support@metoffice.gov.uk**

Earliest timestamp: 2011-04-29T00:40:55Z

Granularity: YYYY-MM-DDThh:mm:ssZ

Protocol version: 2.0

Set to harvest:

- datasets (This set contains 1 records.)
- draft (This set contains 3,289 records.)
- WIS-GISC-BEIJING (This set contains 61,600 records.)
- WIS-GISC-BRASILIA (This set contains 557 records.)
- WIS-GISC-CASABLANCA (This set contains 0 records.)
- WIS-GISC-EXETER (This set contains 17,033 records.)
- WIS-GISC-JEDDAH (This set contains 268 records.)
- WIS-GISC-MELBOURNE (This set contains 1,113 records.)
- WIS-GISC-MOSCOW (This set contains 3,429 records.)
- WIS-GISC-NEW_DELHI (This set contains 0 records.)
- WIS-GISC-OFFENBACH (This set contains 36,092 records.)
- WIS-GISC-PRETORIA (This set contains 0 records.)
- WIS-GISC-SEOUL (This set contains 373 records.)
- WIS-GISC-TEHRAN (This set contains 68 records.)
- WIS-GISC-TOKYO (This set contains 24,419 records.)
- WIS-GISC-TOULOUSE (This set contains 3,272 records.)
- WIS-GISC-WASHINGTON (This set contains 0 records.)
- WIS-UNASSOCIATED (Tokyo) (This set contains 3,198 records.)

OpenWIS 2016

OpenWIS v5

PoC - Browsing results

The screenshot displays the OpenWIS v5 web interface. The top navigation bar includes the OpenWIS logo, a search bar, and user profile information. A left sidebar contains a menu with options like Dashboard, Components, Charts, Servers, Search, UI Features, Browse (highlighted), Form Elements, Tables, Maps, Pages, and Menu Level 1. The main content area is titled 'BROWSE' and shows a total of 46953 results. It features a grid of eight metadata record cards, each with a URN and a JSON snippet.

OpenWIS Search for... Home / Browse

BROWSE

Total: 46953

URN:X-WMO:MD:INT.WMO.WIS::FTEW38LEMM

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::FTEW38LEMM", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::SMVF03LFPW

— The bulletin collects SHIP reports: FM 13 (SHIP, Report of surface observation from a sea station). (Refer to WMO No.306 - Manual on Codes for the definition of WMO international codes) — The SMVF03 TTAAii Data Designators decode (2) as: T1 (S): Surface data. T2 (M): Main synoptic hour. A1 (V): Mobile ships and other marine stations. A2 (F): Area between 90°N - 30°N, 035°W - 070°E. (2: Refer to WMO No.386 - Manual on the GTS - Attachment II.5) — The following station codes are unknown: Ship

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::SMVF03LFPW", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::HHUI25LFPW

— The bulletin is coded as GRIB code form: FM 92 (GRIB, General regularly-distributed information in binary form) . (Refer to WMO No.306 - Manual on Codes for the definition of WMO international codes) — The HHUI25 TTAAii Data Designators decode (2) as: T1 (H): Grid point information (GRIB). T2 (H): Height. A2 (I): 48 hours forecast. ii (25): 250 hPa. (2: Refer to WMO No.386 - Manual on the GTS - Attachment II.5) — WMO No.9 - Volume C1 'Content' field: Bloc 'Européen' — Grid size: 1 X 1. — Forecast Offset: 48 (hours) — WMO No.9 - Volume C1 'Remarks' field: (60°W-65°E) (75°N-10°N) res 1°x1°, 126x66 points

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::HHUI25LFPW", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::MATCH_EUROPE_0.1DEG_FORE

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::match_europe_0.1deg_forecast_alllevels_S02_73H_96H_1h_NetCD", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::LOTOS_EUROS_EUROPE_0.1DE

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::lotos_euros_europe_0.1deg_forecast_alllevels_03_49H_72H_1h_NetCD", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::SILAM_EUROPE_0.1DEG_ANAL

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::silam_europe_0.1deg_analysis_surface_PM25_-24H_-1H_1h_NetCD", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/" }
```

URN:X-WMO:MD:INT.WMO.WIS::SISP21LEMM

URN:X-WMO:MD:INT.WMO.WIS::ULFR05LFPW

OpenWIS v5

PoC - Searching with Elasticsearch

OpenWIS

Search for...

5

5

Home / Search

SEARCH

Search term: temperature (14037 results)

URN:X-WMO:MD:JP.GO.JMA.WIS.DCPC-SAT::CSRS-HI8

The product is calculated by All IR Band . Area average of clear-sky brightness temperatures, where area is 16 x 16 pixel segment of satellite image. These contain the information of earth surface temperature and tropospheric water vapor amount. The dataset is provided in BUFR.

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:jp.go.jma.wis.dcp-sat:csrs-hi8", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://www.wis-jma.go.jp/meta/oaiprvider.jsp" }, "xmlns": "http://www.openarchives.org/OAI/2.0/", "xsi:schemaLocation": "http://www.openarchives.org/OAI/2.0/http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd", "GetRecord": { "record": { "metadata": { "gmd:MD_Metadata": { "gmd:identificationInfo": { "gmd:MD_DataIdentification": { "gmd:resourceConstraints": { "gmd:MD_LegalConstraints": { "gmd:useConstraints": { "gmd:MD_RestrictionCode": { "codeListValue": "otherRestrictions", "codeList": "http://wis.wmo.int/2012/codelist/WMOCodeLists#MD_RestrictionCode", "content": "otherRestrictions" }, "gmd:accessConstraints": { "gmd:MD_RestrictionCode": { "codeListValue": "otherRestrictions", "codeList": "http://wis.wmo.int/2012/codelist/WMOCodeLists#MD_RestrictionCode", "content": "otherRestrictions" }, "gmd:otherConstraints": { "gco:CharacterString": "Use: citation required for publication", "gco:CharacterString": "WMOEssential" }, "gmd:topicCategory": { "gmd:MD_TopicCategoryCode": "climatologyMeteorologyAtmosphere", "gmd:pointOfContact": { "gmd:CI_ResponsibleParty": { "gmd:organisationName": { "gco:CharacterString": "WMO/WIS/DCPC Tokyo (Meteorological Satellite Center)", "gmd:role": { "gmd:CI_RoleCode": { "codeListValue": "originator", "codeList": "http://wis.wmo.int/2012/codelist/WMOCodeLists#CI_RoleCode", "content": "originator" }, "id": "content_contact", "gmd:contactInfo": { "gmd:CI_Contact": { "gmd:address": { "gmd:CI_Address": { "gmd:electronicMailAddress": { "gco:CharacterString": "msc-dcpc@ml.kishou.go.jp" } } } } }, "gmd:descriptiveKeywords": { "gmd:MD_Keywords": { "gmd:keyword": { "gco:CharacterString": "satelliteObservation", "gmd:thesaurusName": { "gmd:CI_Citation": { "gmd:title": { "gco:CharacterString": "WMO_CategoryCode", "gmd:date": { "gco:nilReason": "template" } }, "gmd:type": { "gmd:MD_KeywordTypeCode": { "codeListValue": "theme", "codeList": "http://wis.wmo.int/2012/codelist/WMOCodeLists#MD_KeywordTypeCode", "content": "theme" } }, "id": "subikev" } } } } } } } } } } }
```

DE.DKRZ.WDCC.ISO2230052

```
{ "OAI-PMH": { "request": { "identifier": "de.dkrz.wdcc.iso2230052", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://oai.dwd.de/oai/provider" }, "xmlns": "http://www.openarchives.org/OAI/2.0/", "xsi:schemaLocation": "http://www.openarchives.org/OAI/2.0/http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd", "GetRecord": { "record": { "metadata": { "MD_Metadata": { "identificationInfo": { "MD_DataIdentification": { "extent": { "EX_Extent": { "geographicElement": { "EX_GeographicBoundingBox": { "northBoundLatitude": { "gco:Decimal": 49.06 }, "southBoundLatitude": { "gco:Decimal": 47.55 }, "westBoundLongitude": { "gco:Decimal": 6.5 }, "eastBoundLongitude": { "gco:Decimal": 10 } }, "temporalElement": { "EX_TemporalExtent": { "extent": { "gml:TimePeriod": { "gml:beginPosition": "2007-06-01", "gml:id": "temporal_extnt_day_20070601_20070831", "gml:endPosition": "2007-08-31", "gml:timeInterval": { "radix": 1, "unit": "day", "factor": -1, "content": 92 } } } } }, "descriptiveKeywords": { "MD_Keywords": { "keyword": { "gco:CharacterString": "energy balance", "type": { "MD_KeywordTypeCode": { "codeListValue": "theme", "codeList": "http://wis.wmo.int/2006/catalogues/gmxCodeLists.xml#MD_KeywordTypeCode", "content": "theme" } } } } } } } } } } }
```

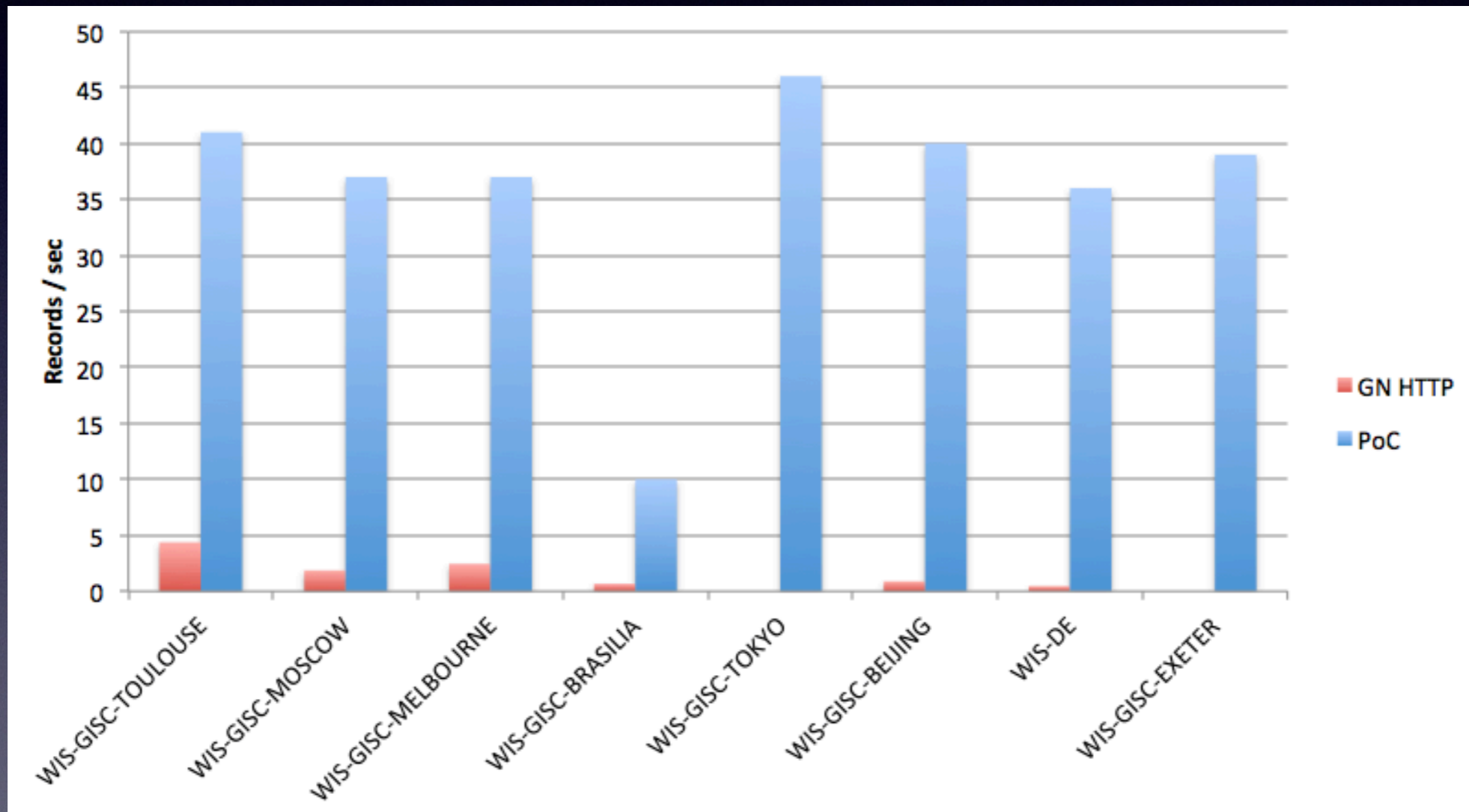
URN:X-WMO:MD:INT.WMO.WIS::SOVX05LFPW

The bulletin collects TESAC reports: FM 64 (TESAC, Temperature, salinity and current report from a sea station). (Refer to WMO No.306 - Manual on Codes for the definition of WMO international codes) — The SOVX05 TTAAii Data Designators decode (2) as: T1 (S): Surface data. T2 (O): Oceanographic data. A1 (V): Mobile ships and other marine stations. A2 (X): More than one area. (2: Refer to WMO No.386 - Manual on the GTS - Attachment II.5) — WMO No.9 - Volume C1 'Content' field: TESAC

```
{ "OAI-PMH": { "request": { "identifier": "urn:x-wmo:md:int.wmo.wis::sovX05LFPW", "metadataPrefix": "iso19139", "verb": "GetRecord", "content": "http://wispi.meteo.fr:80/openwis-user-portal/srv/en/oaipmh" }, "xmlns": "http://www.openarchives.org/OAI/2.0/", "xsi:schemaLocation": "http://www.openarchives.org/OAI/2.0/http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd", "GetRecord": { "record": { "metadata": { "gmd:MD_Metadata": { "gmd:identificationInfo": { "gmd:MD_DataIdentification": { "gmd:report": { "gmd:DQ_DomainConsistency": { "gmd:measureIdentification": { "gmd:RS_Identifier": { "gmd:codeSpace": { "gco:CharacterString": "INSPIRE" }, "gmd:code": { "gco:CharacterString": "Conformity_001" } }, "gmd:result": { "gmd:DQ_ConformanceResult": { "gmd:specification": { "gmd:CI_Citation": { "gmd:title": { "gco:CharacterString": "INSPIRE implementing Rules", "gmd:date": { "gmd:CI_Date": { "gmd:dateType": { "gmd:CI_DateTypeCode": { "codeListValue": "publication", "codeList": "http://wis.wmo.int/2010/metadata/version_1-2/WMOCodeLists.xml#CI_DateTypeCode", "content": "publication" } }, "gmd:date": { "gco:Date": "2011-05-15" } } } } }, "gmd:explanation": { "gco:CharacterString": "", "gmd:pass": { "gco:Boolean": true } } } } } }, "gmd:scope": { "gmd:DQ_Scope": { "gmd:level": { "gmd:MD_ScopeCode": { "codeListValue": "series", "codeList": "http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/gmxCodeLists.xml#MD_ScopeCode", "content": "series" } }, "gmd:lineage": { "gmd:LI_Lineage": { "gmd:statement": { "gco:CharacterString": "High data quality controlled according to the procedures of the GTS" } } } }, "gmd:identificationInfo": { "gmd:MD_DataIdentification": { "gmd:resourceConstraints": { "gmd:MD_LegalConstraints": { "gmd:useConstraints": { "gmd:MD_RestrictionCode": { "codeListValue": "otherRestrictions", "codeList": "http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/gmxCodeLists.xml#MD_RestrictionCode", "content": "otherRestrictions" } }
```


OpenWIS v5

PoC - Benchmarks



OpenWIS v5

PoC - Try it out

```
curl https://raw.githubusercontent.com/NMichas/OpenWIS-PoC/master/docker-compose.yml | docker-compose -f - up
```

If your Docker Engine is behind a proxy, you can inject your proxy's info as:

```
curl https://raw.githubusercontent.com/NMichas/OpenWIS-PoC/master/docker-compose.yml | HTTP_PROXY=http://  
proxy:port docker-compose -f - up
```