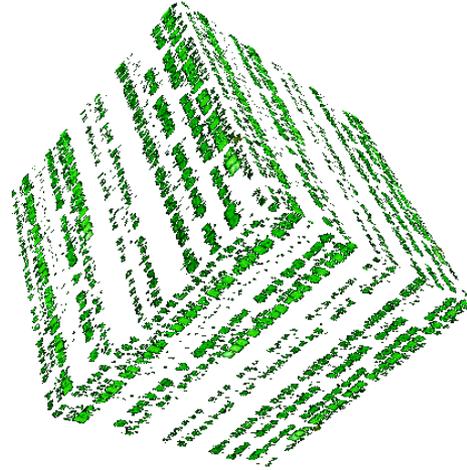




EarthServer



The EarthServer Federation: State, Role, and Contribution to GEOSS

Vlad Merticariu, Peter Baumann
rasdaman GmbH / Jacobs University
Germany

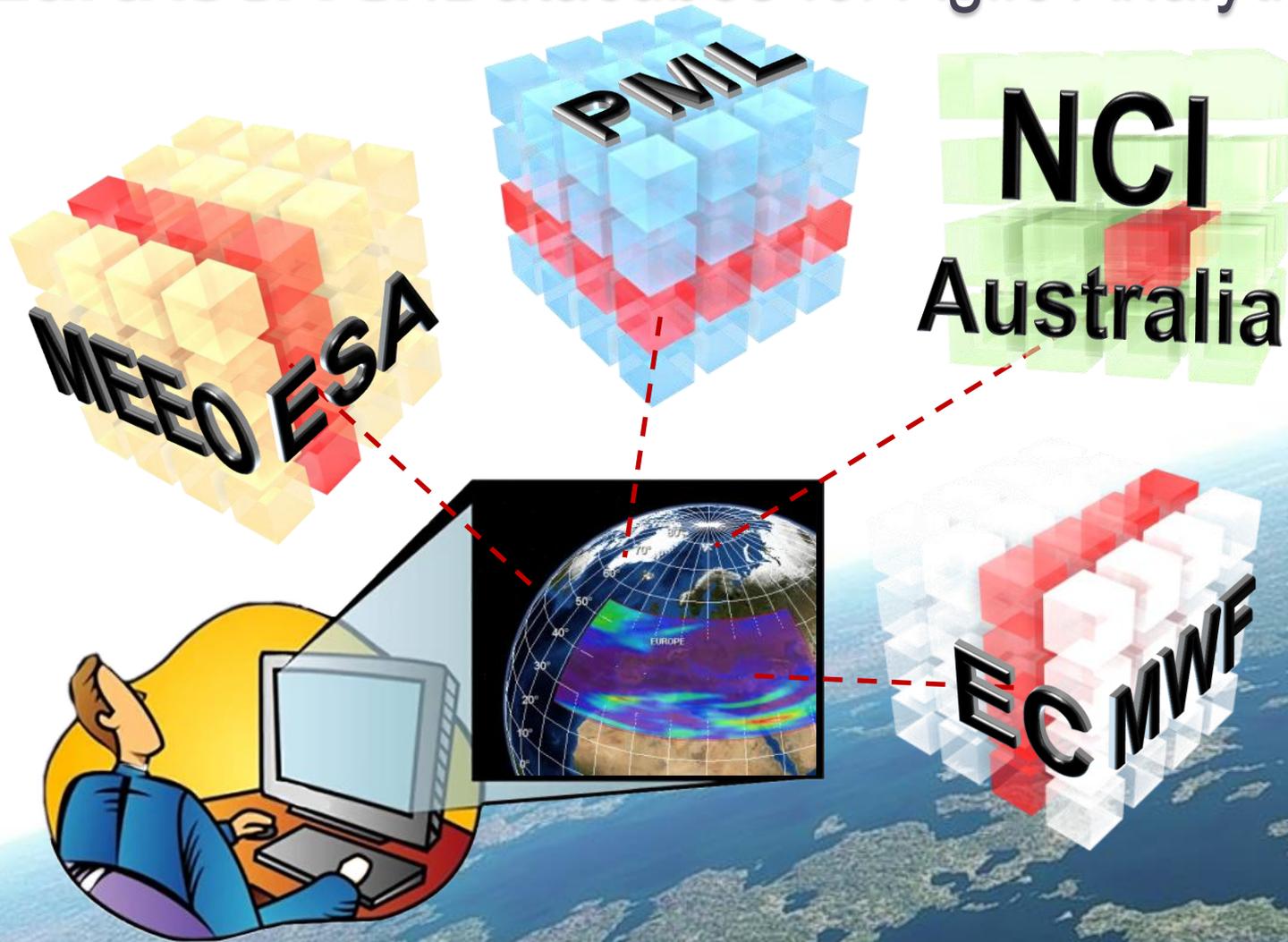
[gamingfeeds.com]



Co-funded by
the European Union



EarthServer: Datacubes for Agile Analytics

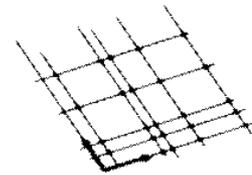
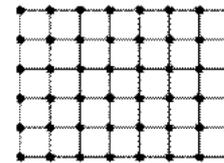
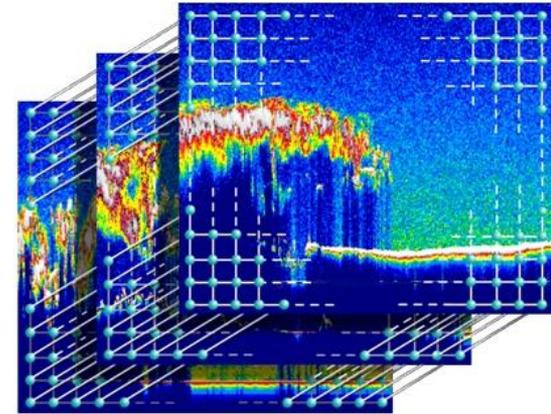


www.earthserver.eu



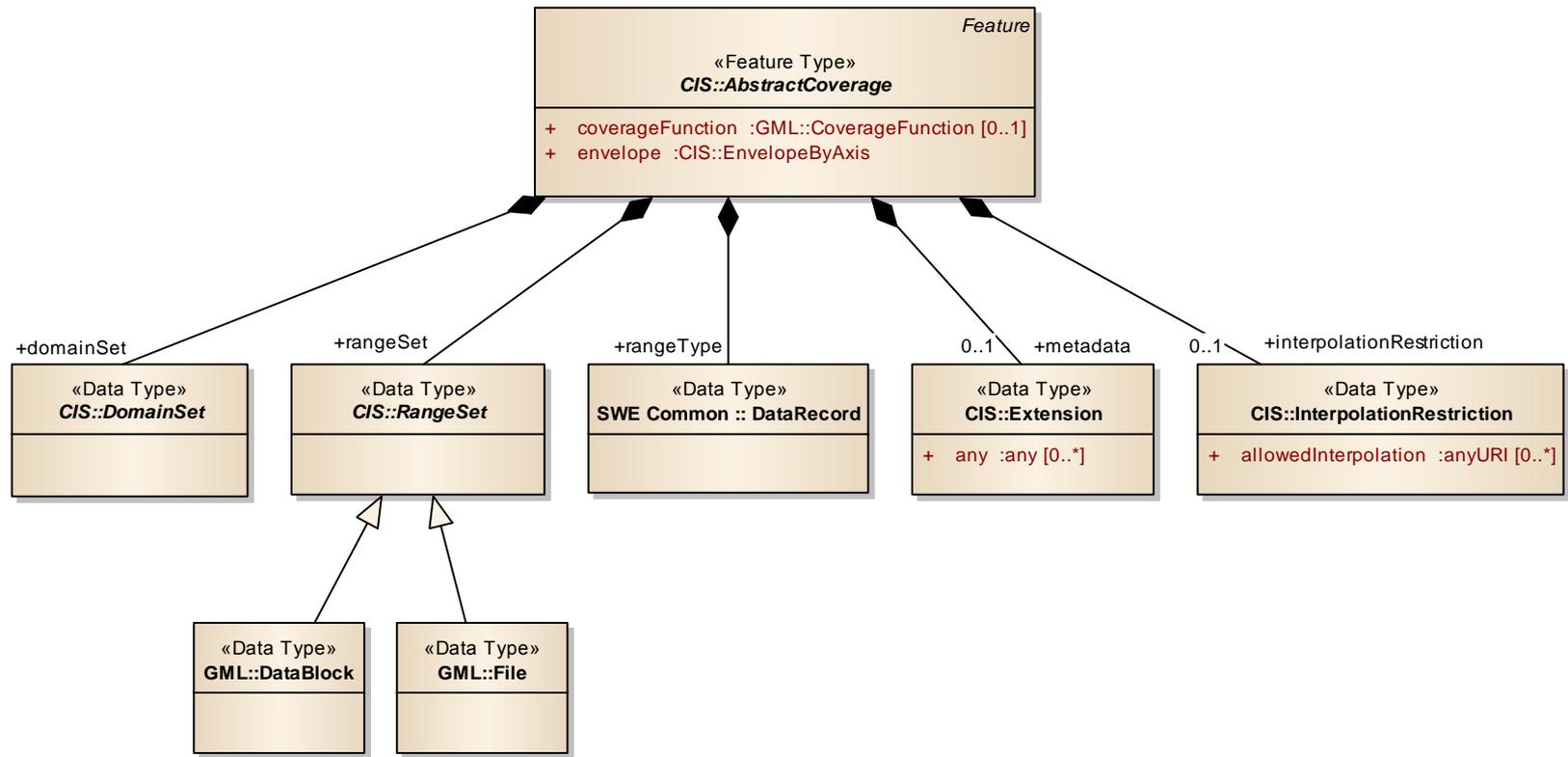
Datacubes???

- Spatio-temporal, multi-dimensional
 - Sensor, image [timeseries], simulation, statistics
- Suitable for humans
 - „one cube says more than a million images“
- Suitable paradigm for m2m querying
 - Arrays
- Automatic reorganization during ingest
 - Optimal support for any given workload
- ...but cubes are not enough!
 - Ornamented → irregular grids etc.
 - Integrated with metadata



OGC Coverage

class CIS::AbstractCoverage (as per coverage)

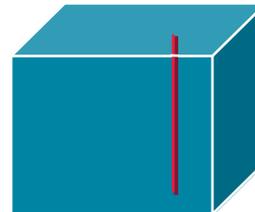
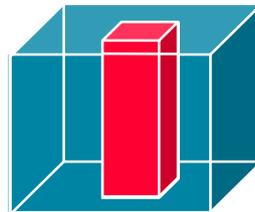
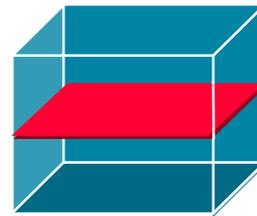
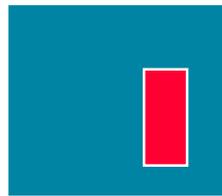


OGC Web Coverage Service (WCS)

- WCS **Core**: access to spatio-temporal coverages & subsets

- Formatting on the fly

- subset = **trim** | **slice**



Large, growing implementation basis:
 rasdaman, GDAL,
 QGIS, OpenLayers,
 OPeNDAP, MapServer,
 GeoServer, GMU, EOx-
 Server; Pyxis, ERDAS,
 ArcGIS, ...

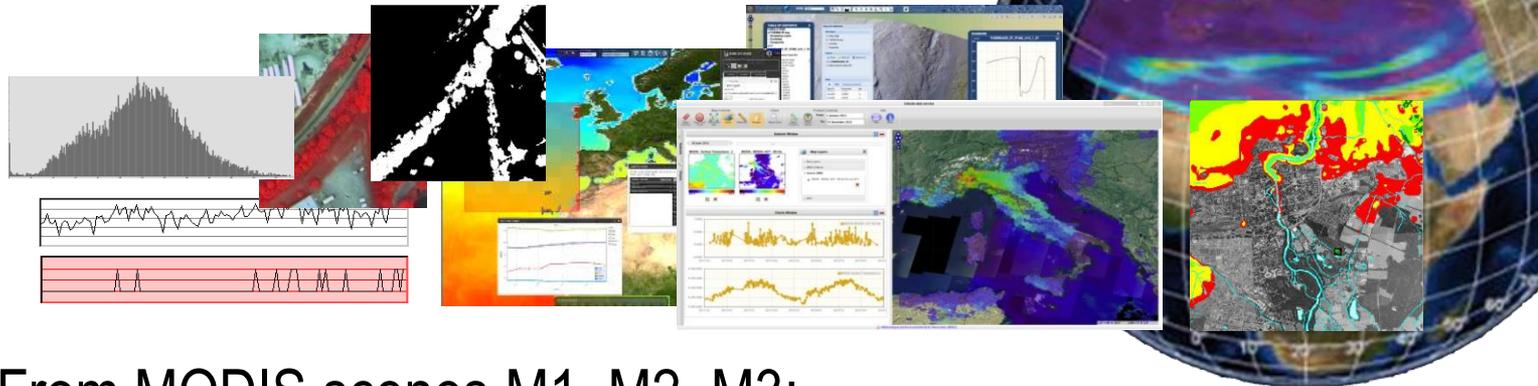
- WCS **Extensions**: optional functionality facets

- Band extraction, reprojection, up to flexible analytics (WCPS)



Querying Datacubes

- **Web Coverage Processing Service (WCPS)**
= spatio-temporal datacube analytics language



- "From MODIS scenes M1, M2, M3:
difference between red & nir, as TIFF"
• ...but only those where nir exceeds 127 somewhere

```
for $c in ( M1, M2, M3 )
where some( $c.nir > 127 )
return encode( $c.red - $c.nir, "image/tiff" )
```

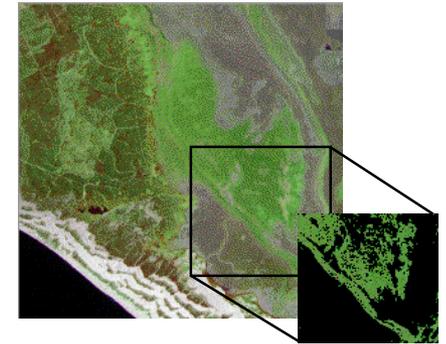
- Enabling data/metadata integration



EarthServer platform: rasdaman

= „raster data manager“: **SQL + n-D arrays**

- pioneer Array Database system
- Scalable parallel “tile streaming” architecture
- Mature, in operational use
 - 100+ TB databases
 - 1 query → 1000+ cloud nodes
- www.rasdaman.org



Scalable Geo Service Architecture

Web clients (m2m, browser)

Internet

rasdaman

geo services

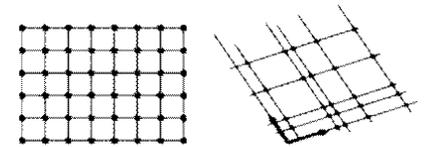
rasserver

File system

database

external files

OGC
WMS, WCS, WCPS,
WPS



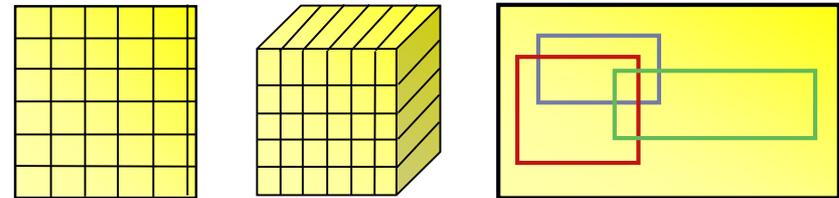
distributed query
processing
No single point of failure

alternative
storage

rasdaman Scalability

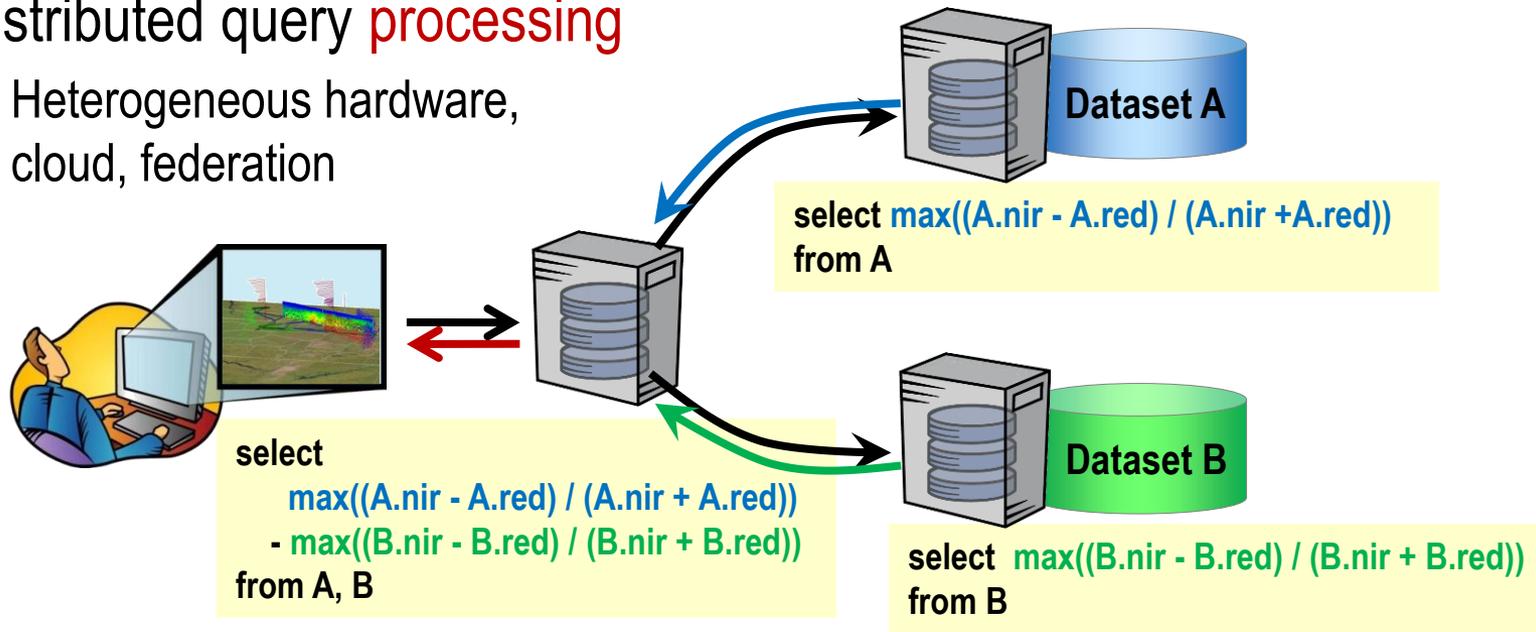
- Application-driven **data** partitioning & distribution

- storage layout language



- Distributed query **processing**

- Heterogeneous hardware, cloud, federation



Big Datacube Standards: the Wave is Rolling

- **OGC:**
 - Coverage Implementation Schema (CIS); WCS, WCPS
- **ISO:**
 - OGC Coverage Implementation Schema → ISO 19123-2
 - ISO 19123, reworked → ISO 19123-1
 - OGC WCS → ISO WCS
 - SQL/MDA („Multi-Dimensional Arrays“)
- **INSPIRE:** coverages & WCS
- **Research Data Alliance:**
 - Big Data Interest Group & Geospatial Interest Group
 - Array Database Assessment Working Group
- **W3C:** coverages





EarthServer

Global Federation

- Access, extract, aggregate, combine any-size datacubes
- **User** benefits:
 - single common information space, location transparent
 - OGC WCS for unified standardized access
- **Data provider** benefits:
 - More users, multiplied offering
 - Support in adopting standards
- earthserver.eu
 - Currently 200+ TB



keeping
contributions
visible

