Climate Services: Markets, Systems & Data Exploitation

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Brief Overview of CGI

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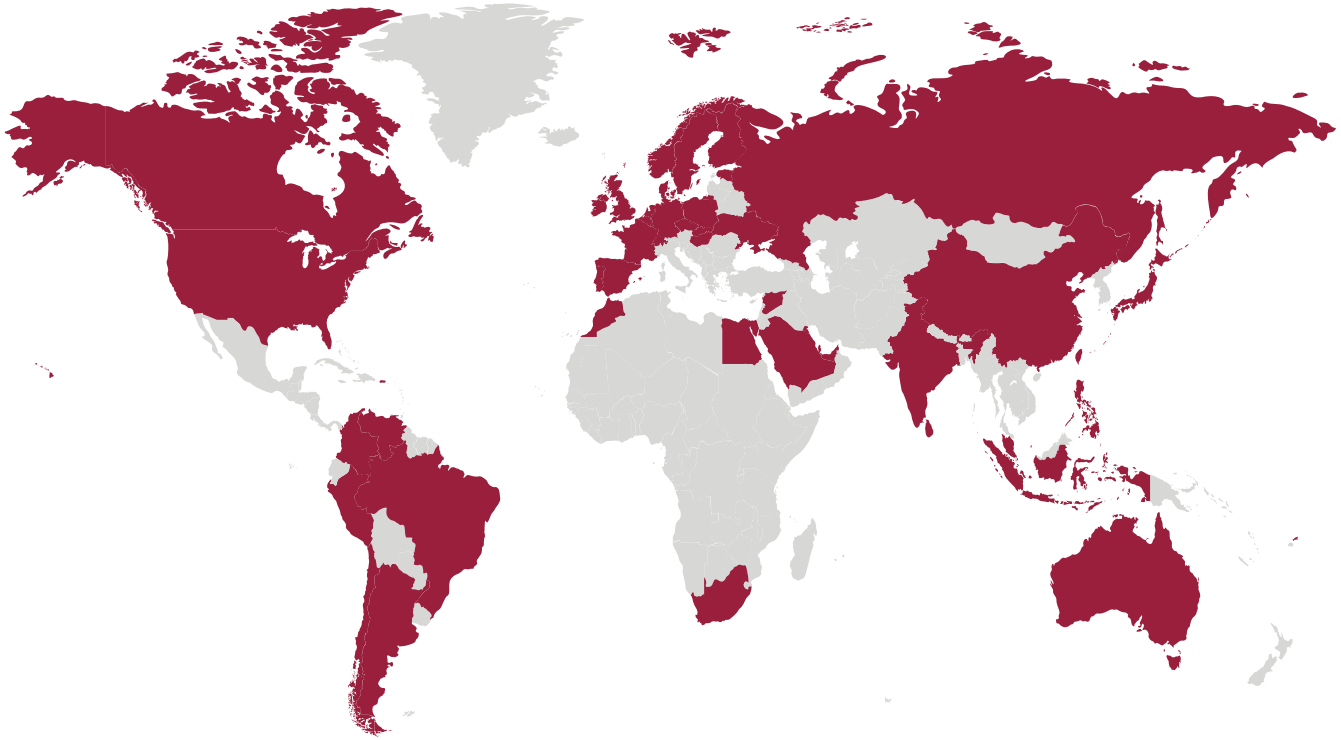
World's 5th largest independent IT and Business Process Services firm



400 offices,
40 countries
around the world

International Space presence including ESA, EC, Eumetsat

Enabling 24x7 'follow the sun' services

95% on-time, on-budget delivery

Global end-to-end IT and business process services leader

10,000 clients across the globe

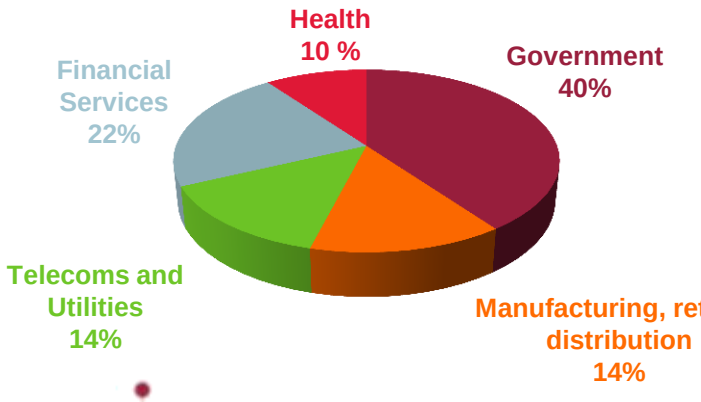
Client satisfaction: 9/10

100+ mission-critical IP-based solutions

High-end consulting with 40 year pedigree

System Integration, IT & business process outsourcing

68,000 professionals: most are also shareholders



2014 Revenue
CAD$10.5 Bn
(£5.5Bn / €7.5Bn)

We operate in many diverse market sectors

Over 10,000 commercial and government organizations worldwide

Credentials in Climate and Earth Observation

- We build and deliver large, complex, mission-critical, operational upstream and downstream Earth Observation ground systems;
- We have a long heritage and strong reputation as a highly reliable systems integration delivery partner;
- Examples include:
  - Real-time meteorological data processing systems for EUMETSAT's 1st, 2nd and now 3rd generation Meteosat satellites;
  - Real-time processing of MTSAT-1&2 data for the Japanese Met Agency;
  - Management of the ongoing evolutions of the European Space Agency's multi-mission EO payload data processing systems at ESRIN;
  - Systems engineering in the ESA Climate Change Initiative for two of the Essential Climate Variables (Sea Level and Sea Ice);
  - Climate R&D projects including CHARMe and QA4ECV, working closely with scientific institutes including ECMWF, Met Office, Universities.
  - Several ongoing projects developing downstream applications of EO.

Climate Services Marketplace

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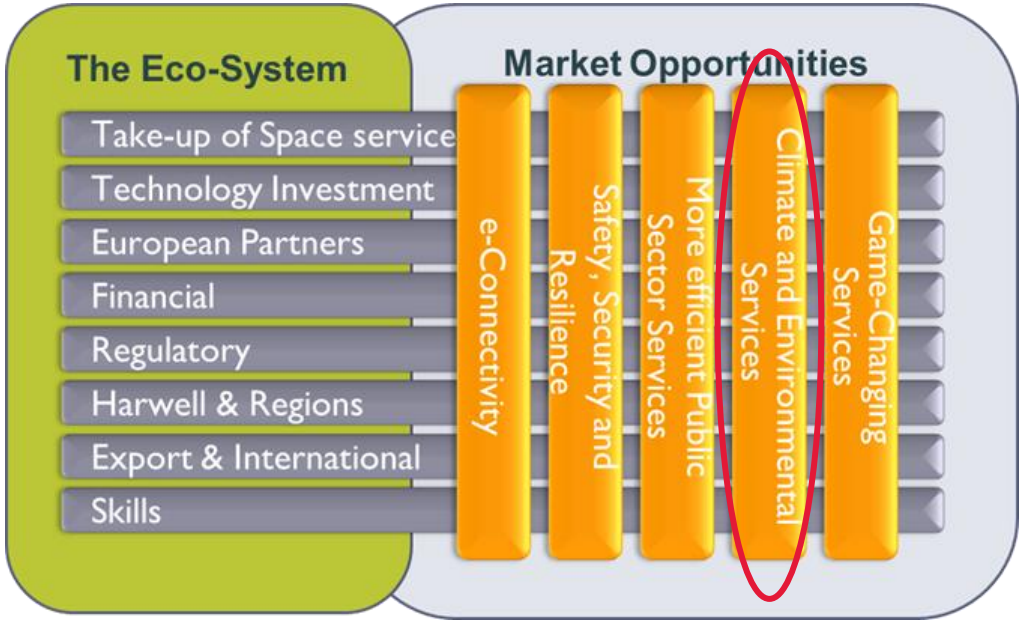
Background research from the UK

- Work done by the UK “Innovation and Growth Strategy” (IGS) team
- The overall world market for the Space industry is likely to grow to at least £400 Bn (€500Bn+) by 2030
- The UK ambition is to grow its share of this from ~£11Bn in 2014 to over £40Bn (€50Bn+) in the same period; other European countries have equally ambitious plans
- Majority of this growth is projected to come from the downstream, i.e. applications and services exploiting space
- A key market opportunity lies in the development of **Climate and Environmental Services**



Credit: UK Innovation & Growth Strategy Team

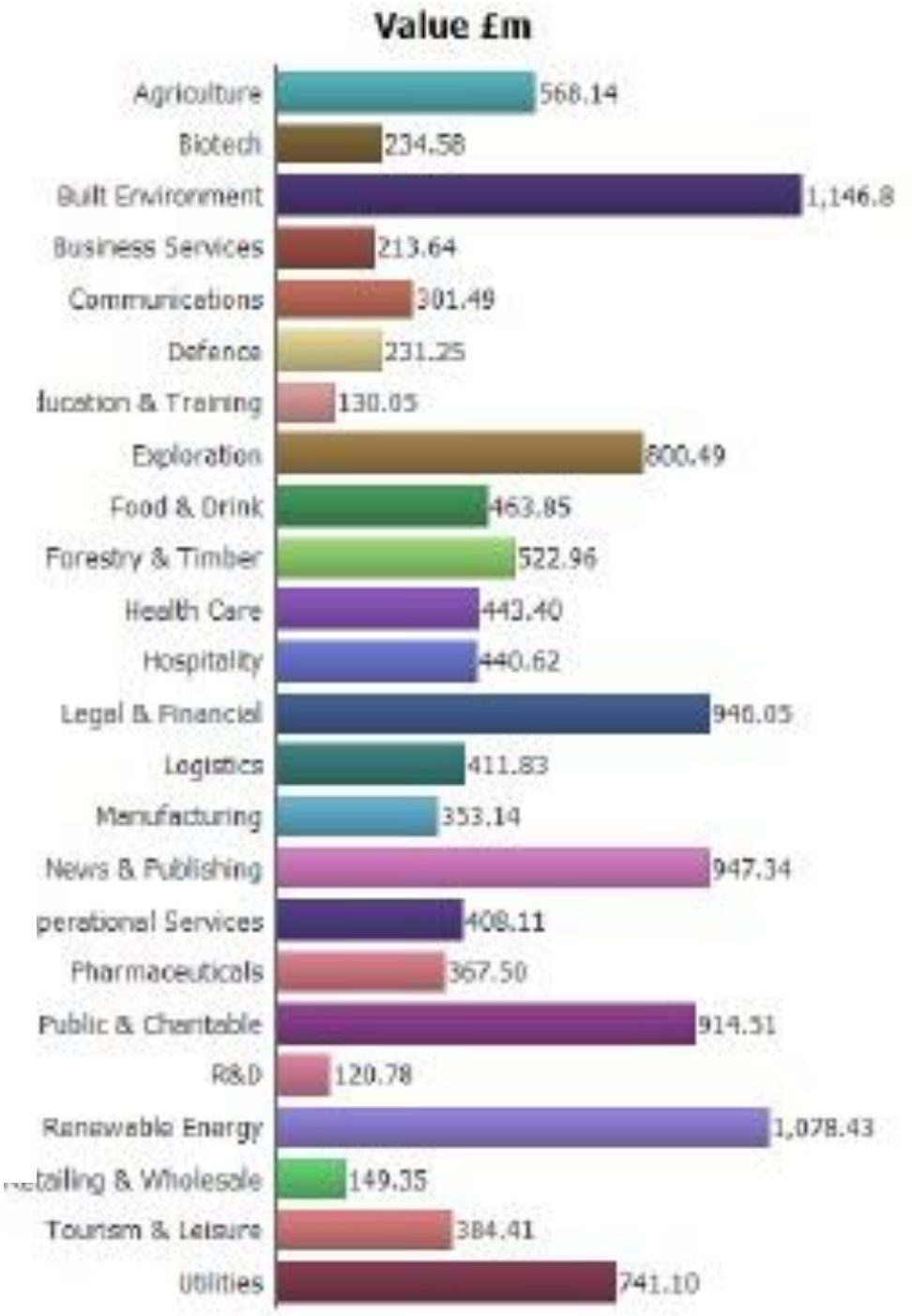
Climate Services Market

Figures from the “Global Weather and Climate Services Commercial Aftermarket 2010/2011” report by Knowledge Matrix

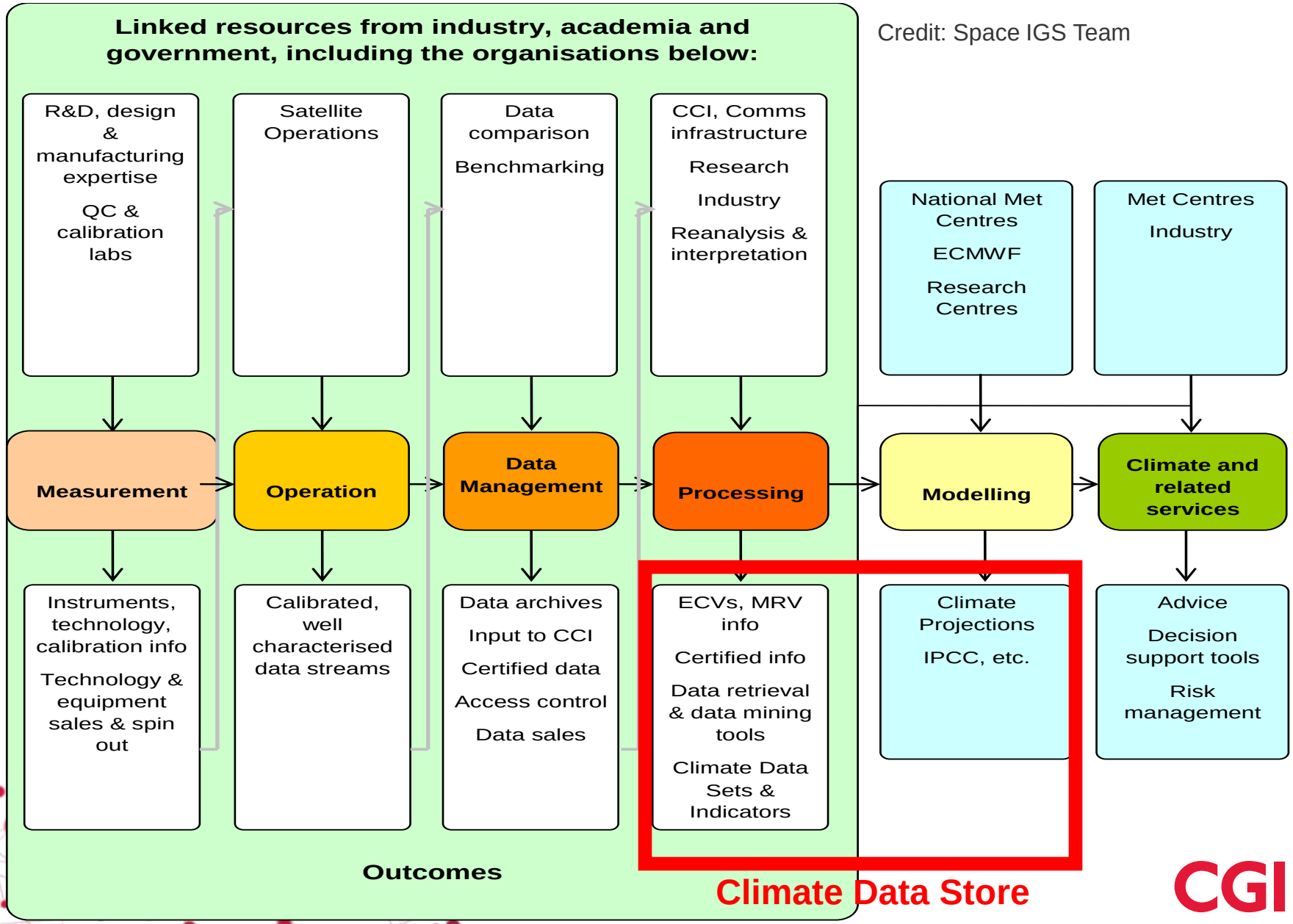
- Estimated **£12.3bn** global revenues for climate services in 2011 – projected to grow to **£16bn** by 2015 (NB this is *all* services, not just from space)

Largest areas are:

- Built Environment – £1.15bn
- Renewable Energy – £1.08bn
- News & Publishing – £0.95bn
- Legal & Financial – £0.95bn
- Public & Charitable – £0.91bn
- Exploration – £0.8bn
- Utilities – £0.74bn
- Agriculture – £0.57bn



Climate Services Seamless Supply Chain



Credit: Space IGS Team

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System Development Considerations

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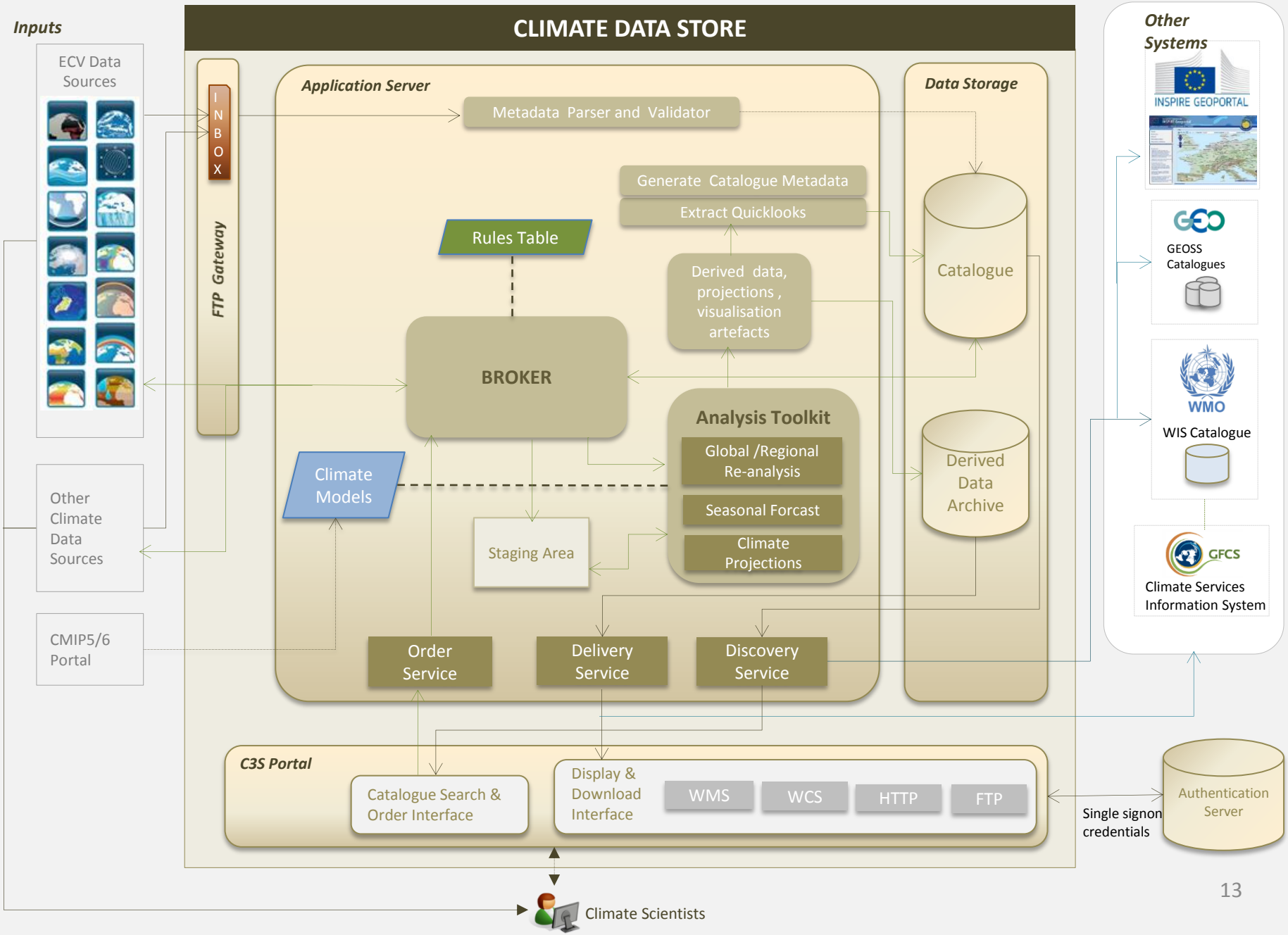
A possible mock-up of a C3S Climate Data Store Architecture



Key Architectural Points

- Distinct building blocks of the architecture might be:
  - User facing CS3 Portal component
  - Application Server component
  - Data Storage component
- Data, Metadata and Models:
  - External feeds from various ECV projects and other climate data sources are received from the appropriate data provider(s) via a broker service and ingested into C3S data catalogue;
  - Catalogue supports the CDS's Discovery service through the Portal's interface (via WMS, WCS interfaces). Having discovered the data, users can initiate data download from the data provider (via the broker), or initiate analysis/processing on the data;
  - Analysis / processing is achieved by ordering the execution of specific functions such as global/regional re-analysis, seasonal forecasts or climate projections. The broker forwards requests for data (from data providers) and applicable climate models (the CMIP5/6 archive for instance). Results can be visualised on the portal or made available for download by the user.
  - Climate data and analysis results exposed to the wider climate science community by exporting catalogue metadata into various initiatives (e.g. GEOSS, WIS, etc.)

Key Architectural Points (continued)

- Security
  - Access to core services in the CDS allowed only to authenticated users. User credentials can be shared with other existing climate service portals by communicating with a remote authentication server providing single-sign-on service.
  - Firewalls configured between each block, allowing only appropriate traffic between the defined hosts.
- Above all
  - The CDS should “start simple” and add complexity, be scalable, be resilient and sustainable, balance resilient central data stores with a federated/cloud approach, be consistent with modern industry and EU IT strategies (e.g. DG CONNECT)
  - The CDS should look to harness existing capabilities/infrastructures (e.g. CMIP5 federated data storage, and ESA CCI DAP), and developments from live initiatives/projects such as CHARMe and CLIPC.
  - An increasingly important element to us is to ensure the C3S CDS is sustainable and is flexible to be able to evolve in coming years.
    - A key concern is that the CDS architecture should not be overtaken within ~5 years by new cloud computing constructs, the “Internet of Things”, or some other step change in IT capability and functionality that comes along.

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Climate Data Exploitation

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C3S Data Exploitation

Make the data as open and accessible as possible!

- **API / Web Services** – Make data query and download services easily available
- **Export Catalogue Meta-data** – Available for us in GEOSS, WIS, etc.
- **Tools** – to allow easy mashing, (re-) formatting & visualisation of data
- **Hackathon(s)** – run a specific C3S hackathon, or discuss including climate data challenges in:
  - ESA App Camp
  - NASA Space Apps Challenge
  - Satellite Applications Catapult “Inventorthon”

- **Communications**
  - Work with relevant technology innovation centres (e.g. UK Catapult Centres or German Fraunhofer institutes)
  - Engage with national and European trade associations
  - Have a presence at conferences & workshops relevant to the target industries (e.g. renewable energy, water, etc)

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Thank you

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