The CDS Information System

Overview & stats 2023

CDS Council – November 2023

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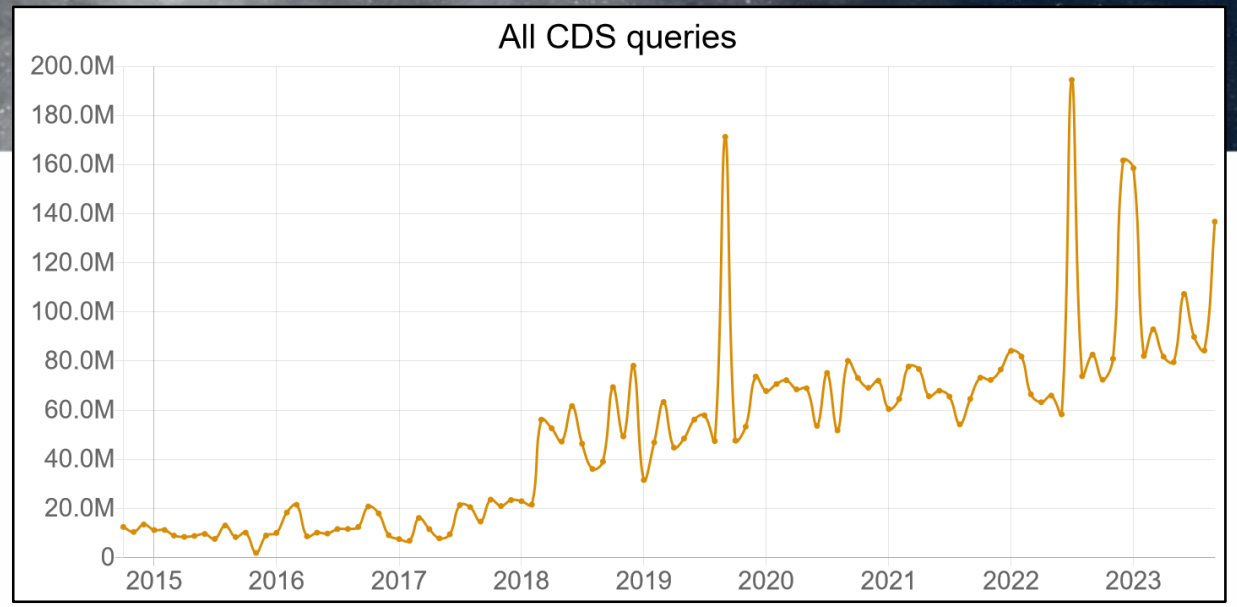
on behalf of all the CDS staff

Global usage 2023

- **3.0 million requests** per day
- **>390K unique IPs** per month

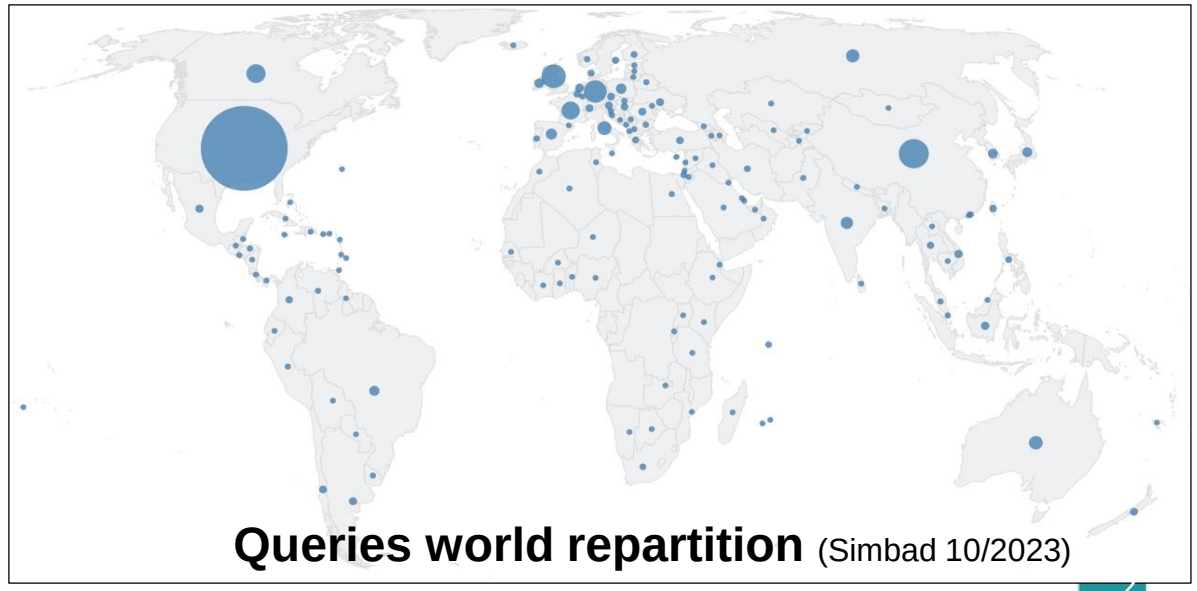


CDS main metrics *(Oct 2022 - Sep 2023)*

compared to Oct 2021 - Sep 2022

Main services	**Simbad** *Astro.object DB*	**Vizier** *Catalog service*	**Aladin** *Image service*	**Total**
users/month	190.3K +23% Adv.users: 1088	61.1K +35%	390.2K +8%	**> 390.2K**
queries/day	448.9K +30%	727.1K +100%	1.8M +5%	**3.0M**
load/day	6.1GB -13%	no data	263.3GB +62%	**> 269.4GB**
data volume	44.2GB +28%	77.0TB -3%	713.1TB +39%	**790.1TB**
data content	16.9M obj +17%	24.3K cats +6%	1203 HIPS +16%	
reliability	99.82% +0.08%	97.94% -1.2%	99.84% -0.09%	**> 97.94%**

(Bots have been removed of these stats)
users/month Based on unique IP (Adv.Users = only based on "advanced scientifical queries") on the main site
queries/day Based on effective DB queries (object queries, catalog queries, HiPS tile queries...)
load/day Downloaded from CDS servers
data volume Volume of service (data + index)
data content Number of service "items"
reliability Percentage of service availability (mirrors included)

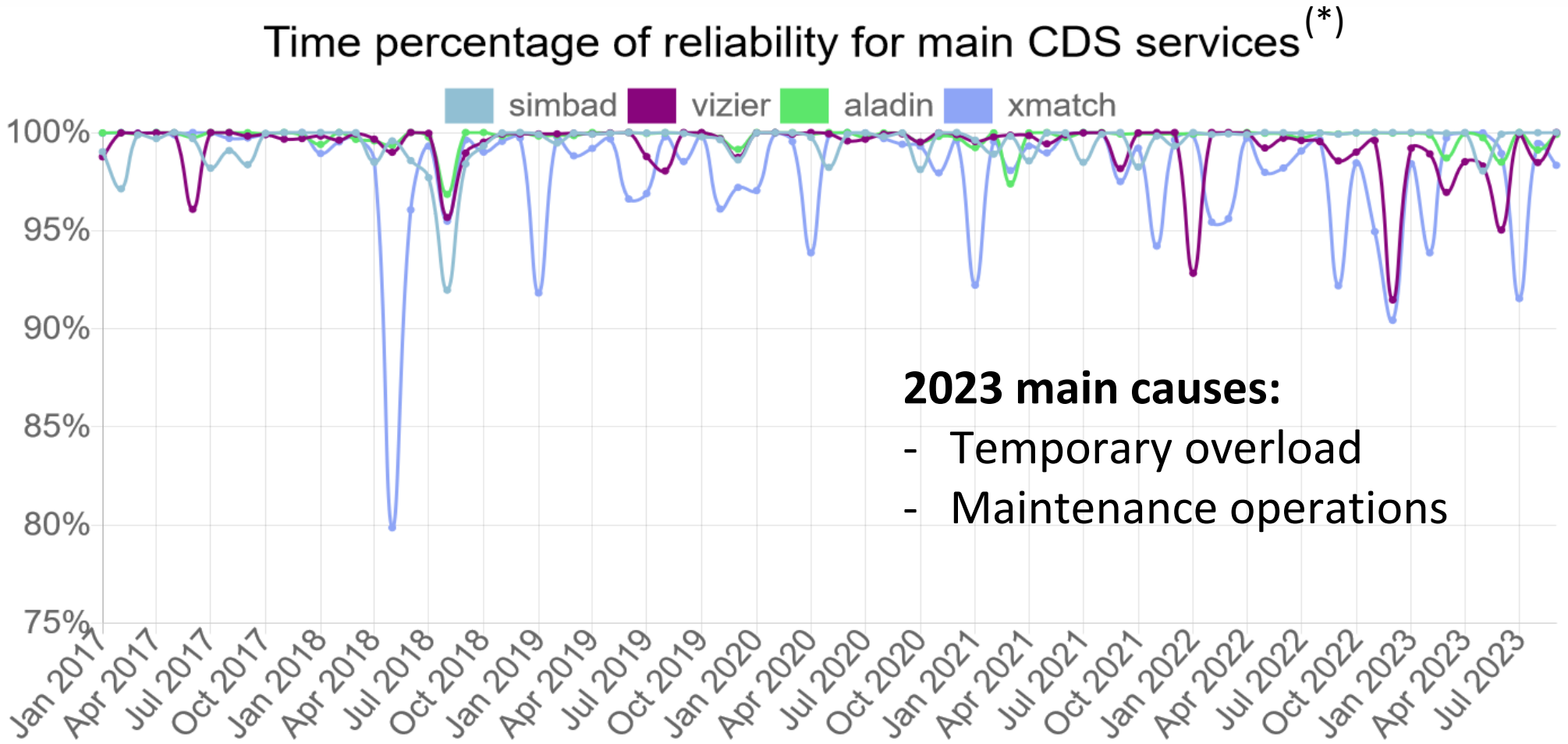


Queries world repartition (Simbad 10/2023)

Constraints and consequences

- **Our goal** : **permanent availability** 24 hours a day, 7 days a week, in a classic academic context (technical staff without on-call duty)
- **Our architecture**: **total duplication : services + data**, on several distinct geographical sites (still in progress)
- **It guarantees**:
  - the **performance** and **continuity** of services
  - the assurance of a **rapid resumption** of service in the event of a major accident at one of the sites (PRA)

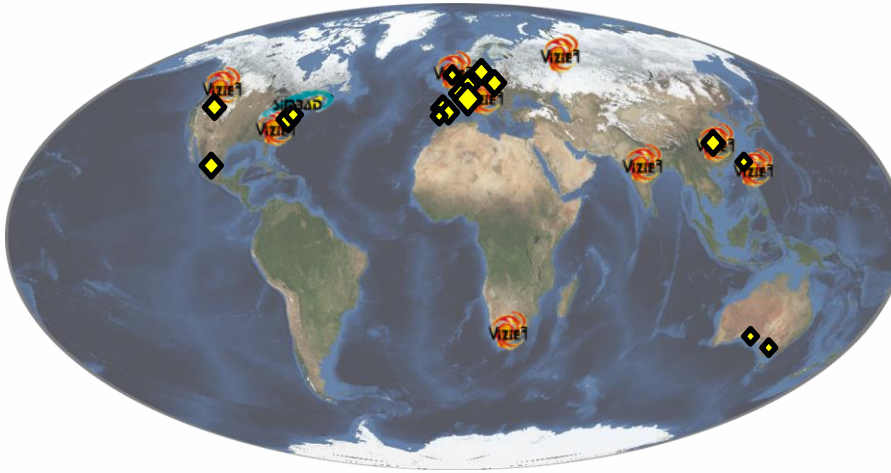
CDS S.I. reliability



(*) Based on tests every 9 minutes. Only partial inclusion of service redundancy (~30-minute delay).

CDS service architecture

- 2 **geographically distinct local machine rooms**
- **External mirror sites** (in France and in other countries)
- Server **virtualisation**, via a cluster of VMWare hypervisors, and Docker encapsulations
- Data storage equipment: **2 RAID6 bays synchronised on the 2 local sites** ("CDS Allsky data system")
- Archive storage equipment : **800To cheap disks**



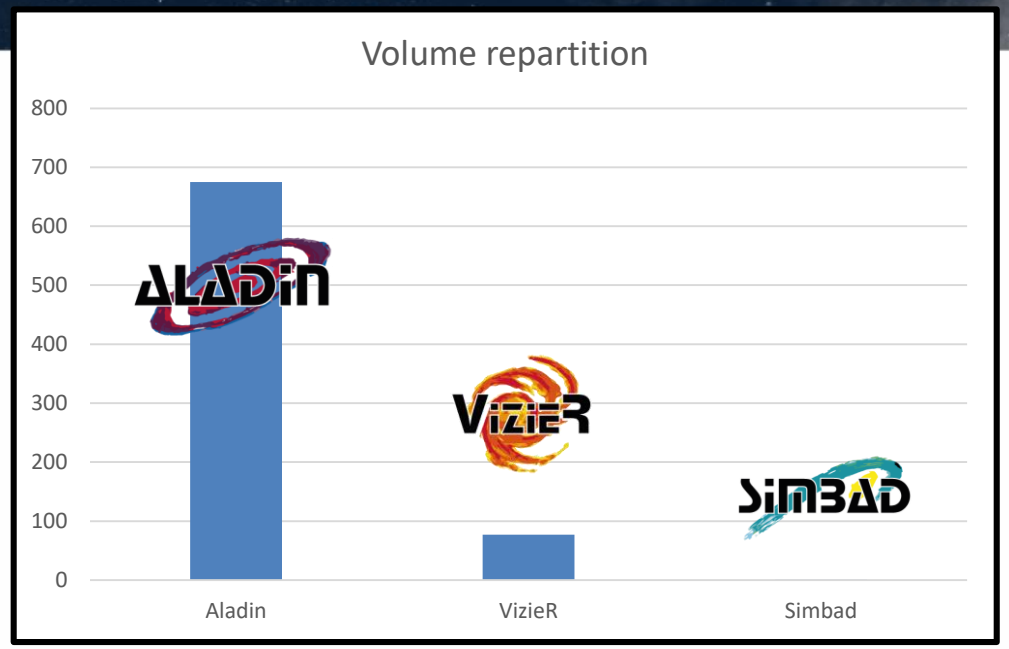
- **2 local computer rooms**
  => Unistra DC
  => Replicated elements in IPHC DC
- **7 external sites** (6 VizieR + 1 Simbad mirrors)
- **20 partner HiPS sites** (Aladin tiles)

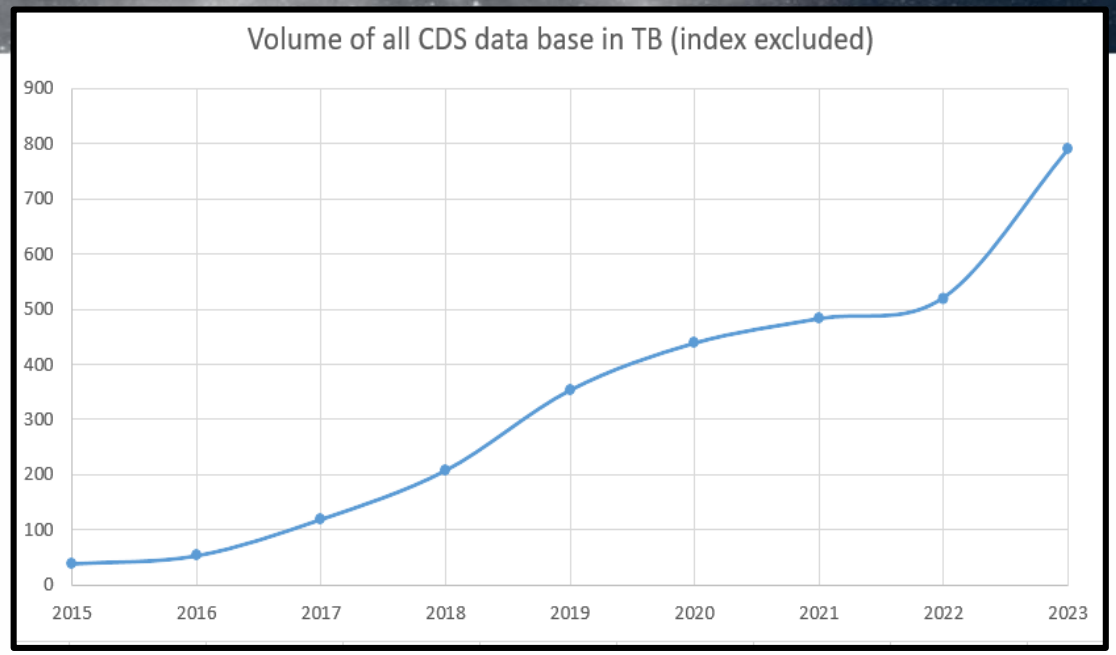
Local machine rooms evolution

- **Retirement** of CDS installations in the **local server room on the ObAS** site
  - Strong encouragement from the University to close this room (corresponding to University and national level policies of rationalization/reduction of small server rooms)
  - Technical limitations of the server room
- **Our solution: Partnership with the IPHC** (UMR7178) on the CNRS Cronenbourg campus.
  => Technical and functional conditions well adapted
- **University Data Centre will become the main local site** for our installations.

Relocation achieved during 2023 spring

Operational storage

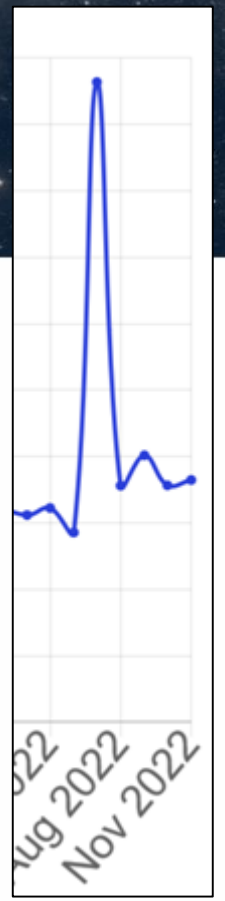




- Sept 2023: **790 TB** : 90% for Aladin, 9% VizieR
- Evolution relies to the volume of astronomical data published (bibliographic data, tables, catalogues and image surveys)
- Redundancy/wasteSpace factor : x5 (RAID6, mirror, snapshots, preparation, backup…)

- *Disk storage provisional plan : ~5 PB in 2025, ~9 PB in 2029 (including redundancy)*

Servers



- **CDS services** require **low CPU power** (except Xmatch service)
  But **a mistake to undersize the servers** because the availability constraint implies the capacity to absorb "peaks“
  => The technical solution: **virtualise the servers** as far as possible on VMWARE hypervisors (presently 5)

- **Computing machines** for data preparation
  => **3 big machines** are sufficient for the task (Aladin HiPS, VizieR big catalogs)

Software development strategy

- **Open source software** supported by a dynamic community (e.g. Postgres, astropy, etc.)
- **''In-house'' developments** for libraries and tools particularly specific to our activity (e.g. management of spatial indexes, astronomical libraries, bibliography processing, etc.)
  => Under Open licence (French minister recommendation)
- Use of paid software remains exceptional, justified by the absence of an equivalent free solution (e.g. VMWare). These paying solutions are considered as transitory

- At least **two developers per service**.

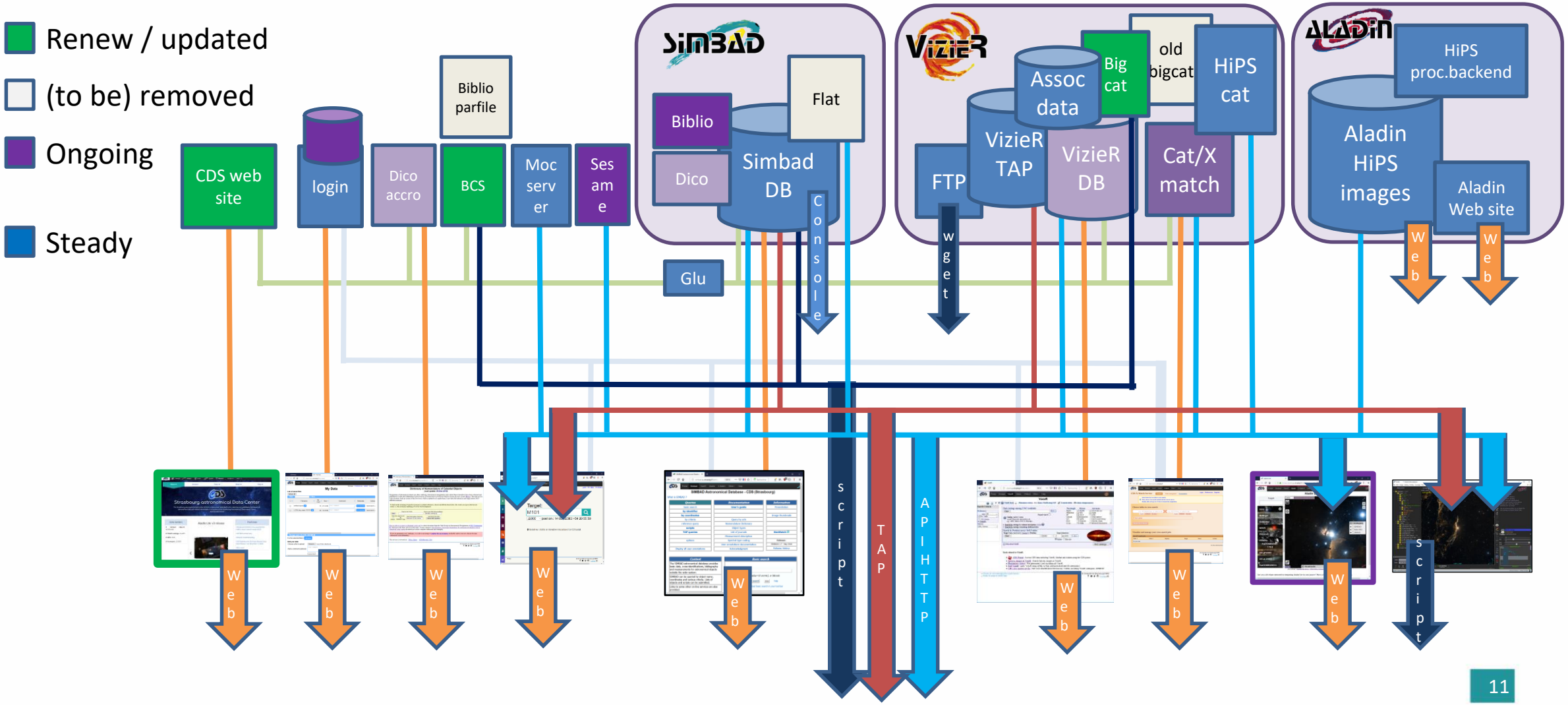
=> By the end of 2022, this strategy is assured partially with contractors

Information system

- Nov 2023: **CDS Information service** is based on **24 components**
- The permanent **evolution** of these components **is essential** to map:
  - The current needs (astronomy and data evolution)
  - The CDS human resources

- For each component, we evaluate its sustainability and we plan its renewal, evolution or withdrawal

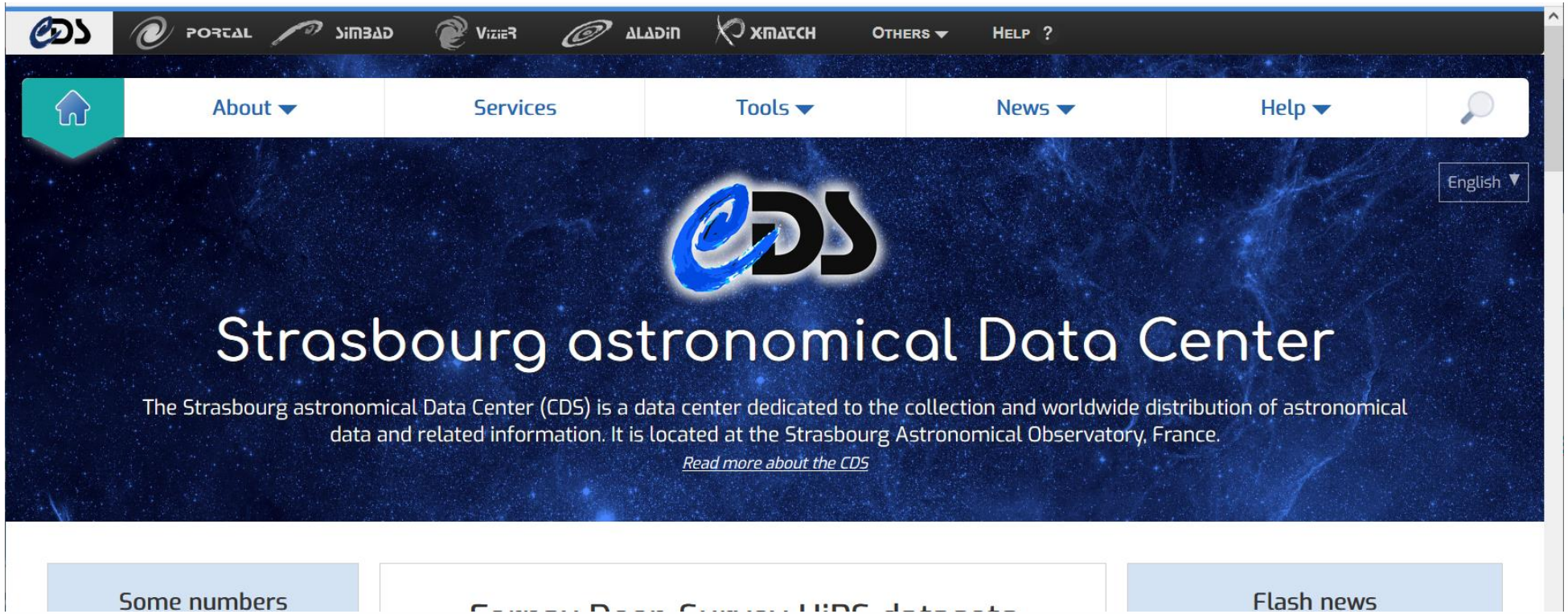
Evolution detail of IS components



Recent developments in the IS

- **BCS** - the deployment of the **new journal article management system**:
  => The "BCS" is replacing the old system (parfile based)
- **MOCset** - the evolution of the **global positional index of VizieR** for a MOC compatible solution (replacing Qbox).
- **QATSS** – new tool/lib for big catalog manipulations
- **Web site** - full redesign of **the CDS website** (deployement phase).

Questions ?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