HEASARC in the VO

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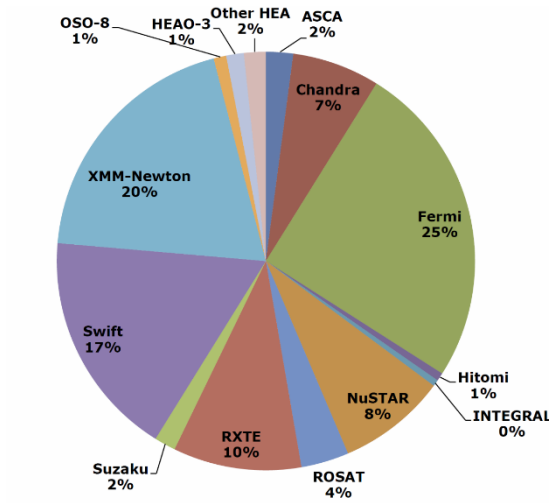
Summary

- Background
- HEASARC as a VO Provider
- HEASARC as a VO Consumer
- HEASARC as a VO Monitor
- By Protocol
- Plans and Comments

HEASARC Background

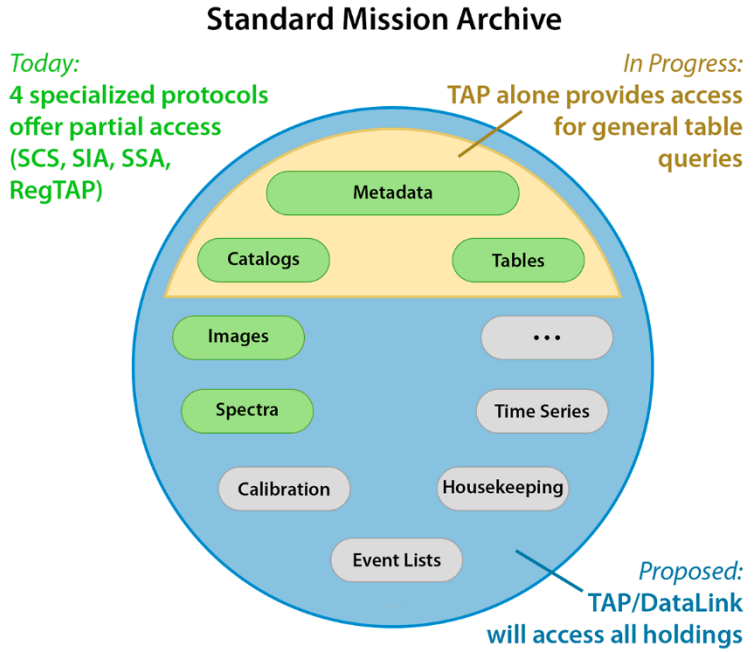
- Founded 1990 as NASA's first domain archive
  - Gamma-ray, X-ray and more recently CMB datasets.
  - Over 60 missions including a number shared with other archives (CXC, ESA, JAXA, MPE) including Swift, Fermi, Chandra, XMM, INTEGRAL, Suzaku, Hitomi, WMAP, SPT, …
- Data often 'different' from the CCD paradigm common to typical IR/Optical/UV missions
  - Individual photons, soft boundaries to images, correlated pixels, Poisson statistics, exposures strong functions of position/energy, mostly variable sources, ….
- Only 100B but covering ~10 decades in energy (not including CMB). ~200 TB/year downloads
- Data universally correlated with other domains



HEA mission distribution of datasets retrieved from HEASARC

HEASARC as a VO provider

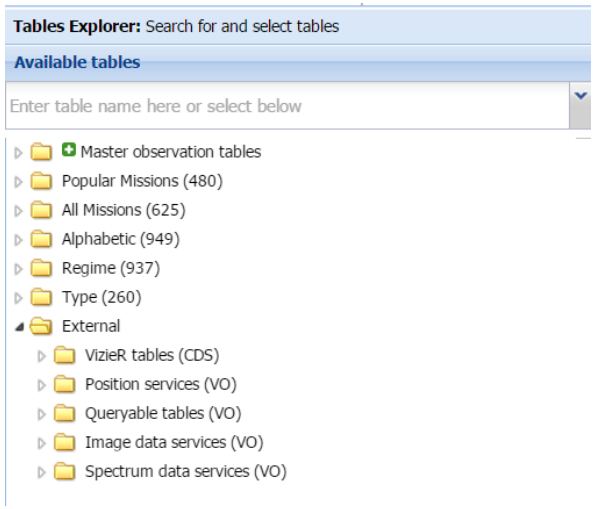
- Standard NAVO interface
  - Coordinated with other NASA archives
  - Cone access to mission observation and object tables
  - SIA to observation images
  - SSA to observation spectra
  - TAP access to all tables (~900)
- *SkyView* SIA to ~200 survey planes
- Publishing registry for all HEASARC VO resources
- VOTable available as format for table interfaces (query and download)
- About 50% of all queries are VO, mostly cone and SIA.



NAVO VO interface

HEASARC as a VO consumer

- Xamin interface:
  - Tries for general access to external cone, SIA, SSA and TAP services
  - VOTable as user table upload format
  - HiPS and MOC in AladinLite viewer
- *SkyView*
  - SIA to access remote services
  - HiPS and MOC for new surveys



Detail of Xamin query interface

WISE/SDSS/GALEX *SkyView* image generated from remote surveys

HEASARC as a VO Monitor

- Validation services
  - Monthly checks of all VO services with recorded results

    http://heasarc.gsfc.nasa.gov/vo/validation

    Cone, SIAv[12], TAP, SSA

    Using validators developed elsewhere
- Monitor services
  - Hourly check that sites are up
  - Low cost query to representative services at each site

    http://heasarc.gsfc.nasa.gov/vo/monitor

3CR Snapshots	99.9	99.9	IDOC	99.3	99.3	ROE Astrogrid	97.9	93.3
ARCHES	94.0	88.1	INAF	80.7	47.2	SDSS	98.9	97.3
ARVO	87.5	87.5	IRSA *	99.7	99.0	SVO	95.5	92.6
ASDC	96.2	96.2	IVOA	99.9	99.9	SkyBot	98.5	98.5
Astronet	14.4	14.4	IVOA RofR	99.8	99.8	StarDB	99.4	99.4
BSDC	99.3	99.3	JVO	99.7	98.8	Swinburne	100	100
CADC	99.9	99.9	MAGIC	0	0	TBL Narval	95.1	95.1
CDPP	97.9	97.9	MAST *	99.7	99.2	USNO	93.9	93.9
CDS	99.5	98.5	MAST NAVO Registry	99.4	99.2	VAO Closeout Repo	100	100
CSIRO	98.3	95.0	MPPPC	100	100	VO Paris	98.0	96.4
China VO	99.6	99.0	MSSL	23.0	23.0	XAOVO	94.0	94.7
DAME	75.6	75.6	NAO	85.7	85.7	XCAT	99.9	99.9
ESA VO	99.1	96.7	NCI	99.4	98.9			
ESO ORG	100	100	NEA	99.9	99.9			
GAVO	99.7	99.7	NED *	99.7	99.3			
GRAAL-VO	99.8	99.7	NEXSCI	99.9	99.9			
HEASARC *	99.4	98.3	NOAO	99.8	99.8			

Detail of uptime of VO data providers April 25-October 25 2017

By protocol

Apps

- SAMP: Used to be significant but HTTPS transition gutted it. Still in *SkyView* standalone
- VOTable: Used extensively both as input and output
- HIPS and MOC: Recently supporting creation of HIPS for in *SkyView* and AladinLite.

DAL

- DALI: Implicit in SSA, SIAv2
- DataLink: First prototype, in plan for next year
- Simple Cone search: ~850 services, monitor, Xamin client
- SIA: Both SkyView (~70) and Xamin (6) services, Xamin and *SkyView* client, monitor, V2 soon.
- SLAP: No

Cont'd

- SSA: A few services in Xamin, monitor
- TAP: 1 service with 900 tables, Xamin client, monitor, very low usage
- TAPRegExt: As needed to register service
- ADQL: In TAP Service (by implementing ADQL functions within Postgres, rather than implementing ADQL ab initio)
- SIMDal: No
- VOEvent Transport: No
- SODA: No – high level of protocol makes it harder

DM

- PhotDM: No

Cont'd

- SIMDM: No
- CharacterizationDM: No
- STC: Tiny bit in TAP (STC-S) but trying to contain the monster
- SpectralDM: implicit in SSA service. No explicit support
- ObsCore: No. Tried once but it was hard, data do not fit model well.

GWS

- PDL: No
- SSO: No
- VOSpace: No
- Credit delegation: No

Cont'd

- UWS: In TAP but Async rarely used.
- VOSI: In TAP and SSA, monitoring

Registry/Semantics

- IVOA Identifiers: When registering new services, monitoring
- Basic Profile: Registry entries
- Registry Interfaces: Publishing registry, monitoring
- Resource Metadata: Obsolete?
- StandardsRegExt: No
- SimpleDALRegExt: Implicitly but followed examples not doc.
- UCD/UCD1+ Controlled vocabulary: Table construction, no longer priority except for SCS
- UCD update process: No
- Vocabularies: No

SPD

- DocStd: NA

VOEvent

- VOEvent: No (despite being home of GCN)

Plans and Comments

- Over next few years:
  - Add SIA2 support (NAVO)
  - DataLink for all archive data (NAVO)
  - Further HiPS/MOC generation.
  - CAOM/ObsCore support (NAVO)

- HEASARC working within NAVO framework to provide comprehensive access to NASA astronomical resources.
- Continued strong commitment to VO.
- VO efforts have focused on data access relative to data standardization. Limited uptake outside of Apps&DAL protocols.
- Scope of VO standards has potential to be quite intimidating – even in retrospect.