



Radio Astronomy Data Model for Single-Dish Multiple-Feed Telescopes, and Robledo Archive Architecture

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Talk Overview

— [Introduction

— [Radio Astronomy DATA Model for Single-dish multiple-feed telescopes: RADAMS

— DSS-63 Antenna

— RADAMS Entities & Relationships

— RADAMS Workflow

— [Conclusions & Future Work

Introduction

AMIGA



— [Analysing the interstellar Medium of Isolated GALaxies

— Exhaustive multi-wavelength study of a complete sample of ~1000 isolated galaxies, and public galaxy catalogue at the IAA (CSIC).

— Optical, Ha, and IR luminosities, radio-continuum emission, and atomic and molecular gas contents compiled from literature or derived from our own observations, together with POSS-I and POSS-II digitized images.

AMIGA+



— [AMIGA archive exploitation

— [Extension of the AMIGA archive to sub-mm wavelengths

— [Development of radio-astronomical archives and Virtual Observatory integration

— Collaborations already in place: DSS-63, IRAM 30m

— Gaining expertise for: SMA and ALMA archives

AMIGA+ & Radio-VO

— [So, we're doing VO archives. Why? Because VO:

— Enables new science

— Allow for easier Dissemination & Exploitation of data archives

— Can help in providing useful data for non-radio-astronomers

— [Besides...

— We've gathered some experience

— There's room for innovation in the Radio-VO space!

Virtual Observatory (VO)

— [Definition

— Set of common practices and data models that allow for easy discoverability of interoperable data-sets, with unified description by means of a common data model.

— [And what is a data model?

— Description of the set of entities needed for information storage in a particular field, specifying both the data being stored, and the relationships between them.

Virtual Observatory (VO)

— [Common data interchange format (XML), protocols (Web Services: SOAP, XML-RPC), and data models

— XML-based FITS replacement: VOTABLE

— Web-Services based common query techniques: SIAP, SSAP...

— XML metadata data-set description by standardised data models (Characterisation, STC, Provenance, Curation...)

Radio-VO Data Models

— [Lamb and Power's Raw Radio-Telescope DM IVOA note

— [ATCA's Australian Telescope Online Archive DM

— VO compliance through interfaces

— No further definition of IVOA standards

— [No standard single-dish DM

**Radio Astronomy DAta Model for
Single-dish multiple-feed telescopes:
RADAMS**

Target: DSS-63 70-m antenna

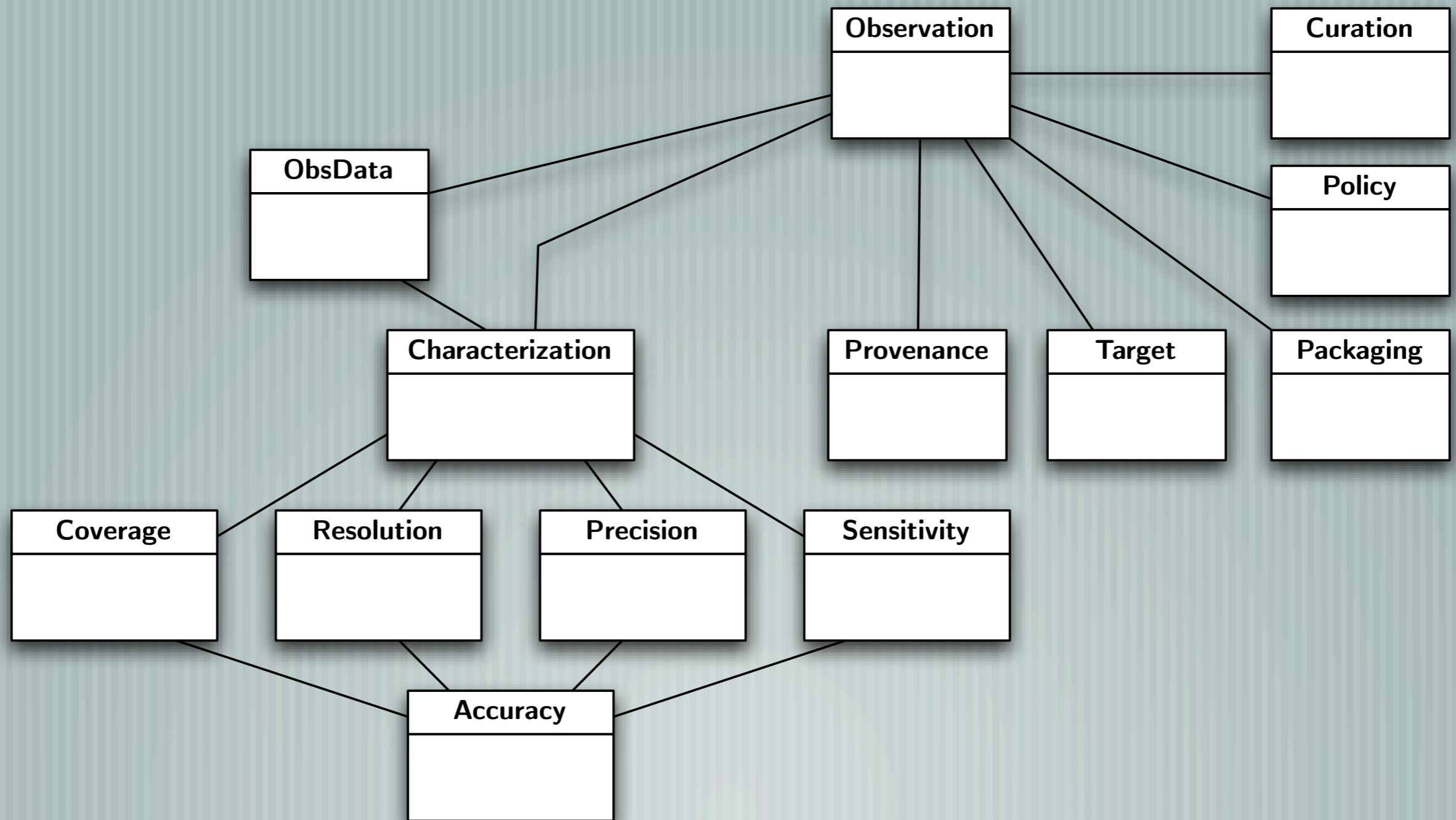
42" HPBW, 0.7 K/Jy, 49% max aperture efficiency, parabolic Cassegrain antenna

LCP or RCP, cooled HEMT amplifier, K-band (22 GHz) receiver

384-sample, 2-16 MHz bandwidth spectrometer



RADAMS Logic Structure



RADAMS Sources: IVOA Work

— [IVOA Working Groups mainly dedicated to Data Modelling

— [Sources for this Data Model:

— Data Model for Observation

— McDowell, Bonnarel et al., IVOA Data Model WG Internal Draft

— Data Model for Astronomical Dataset Characterisation

— McDowell, Bonnarel et al., IVOA Data Model WG Note

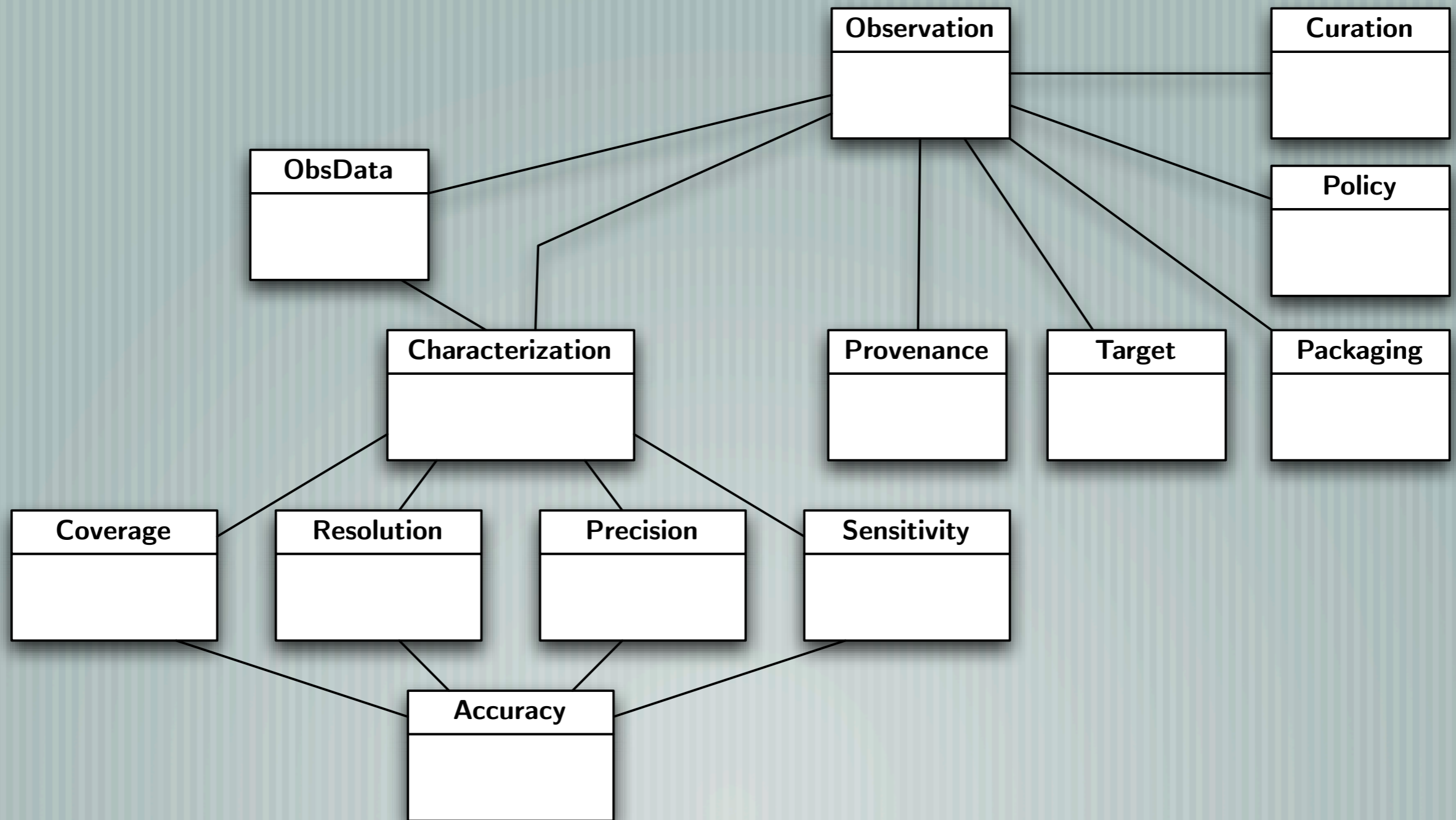
— IVOA Spectral Data Model

— McDowell, Tody et al., IVOA Data Model WG Working Draft

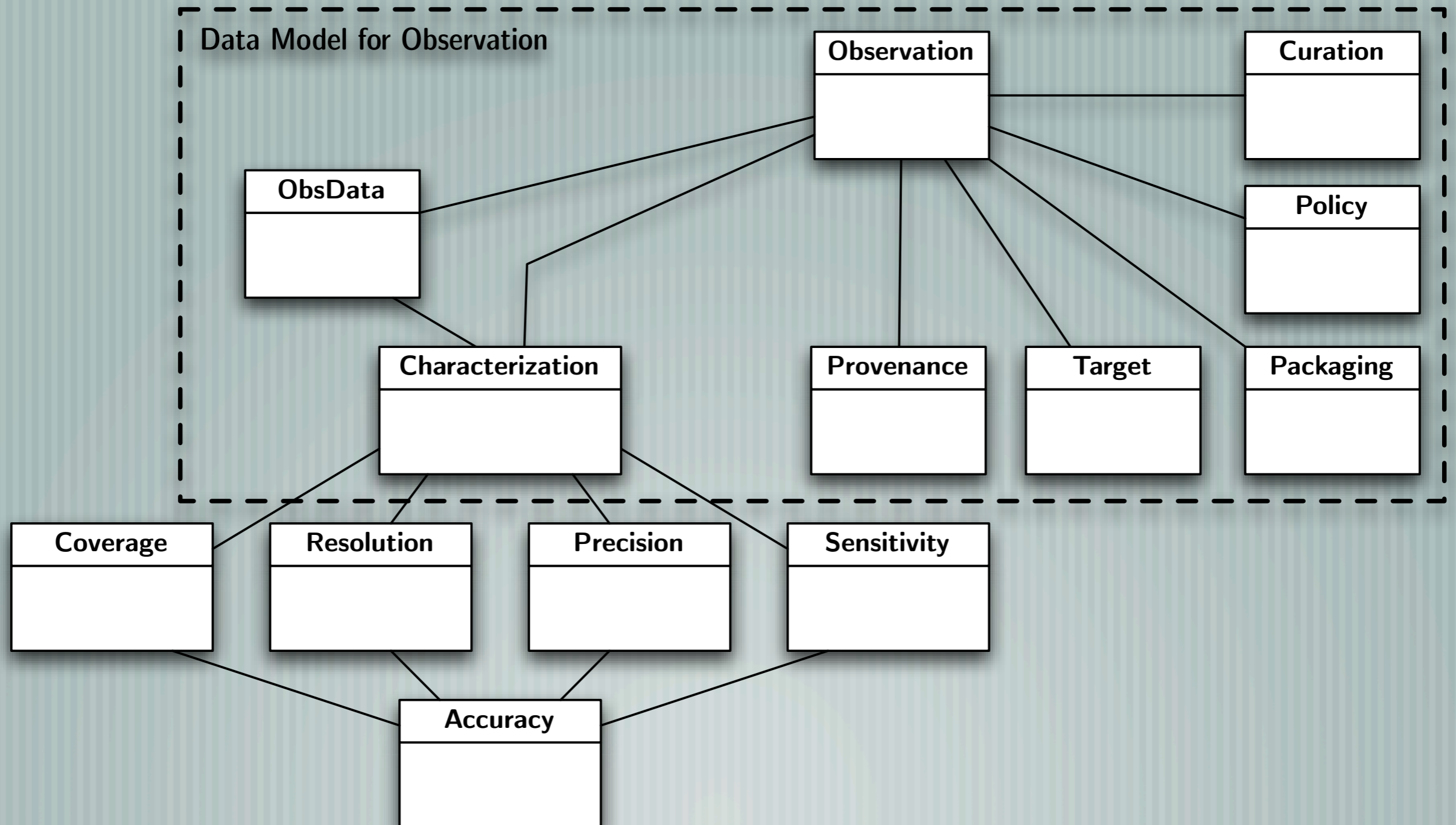
— IVOA Data Model for Raw Radio Telescope Data

— Lamb and Power, IVOA Radio IG Note

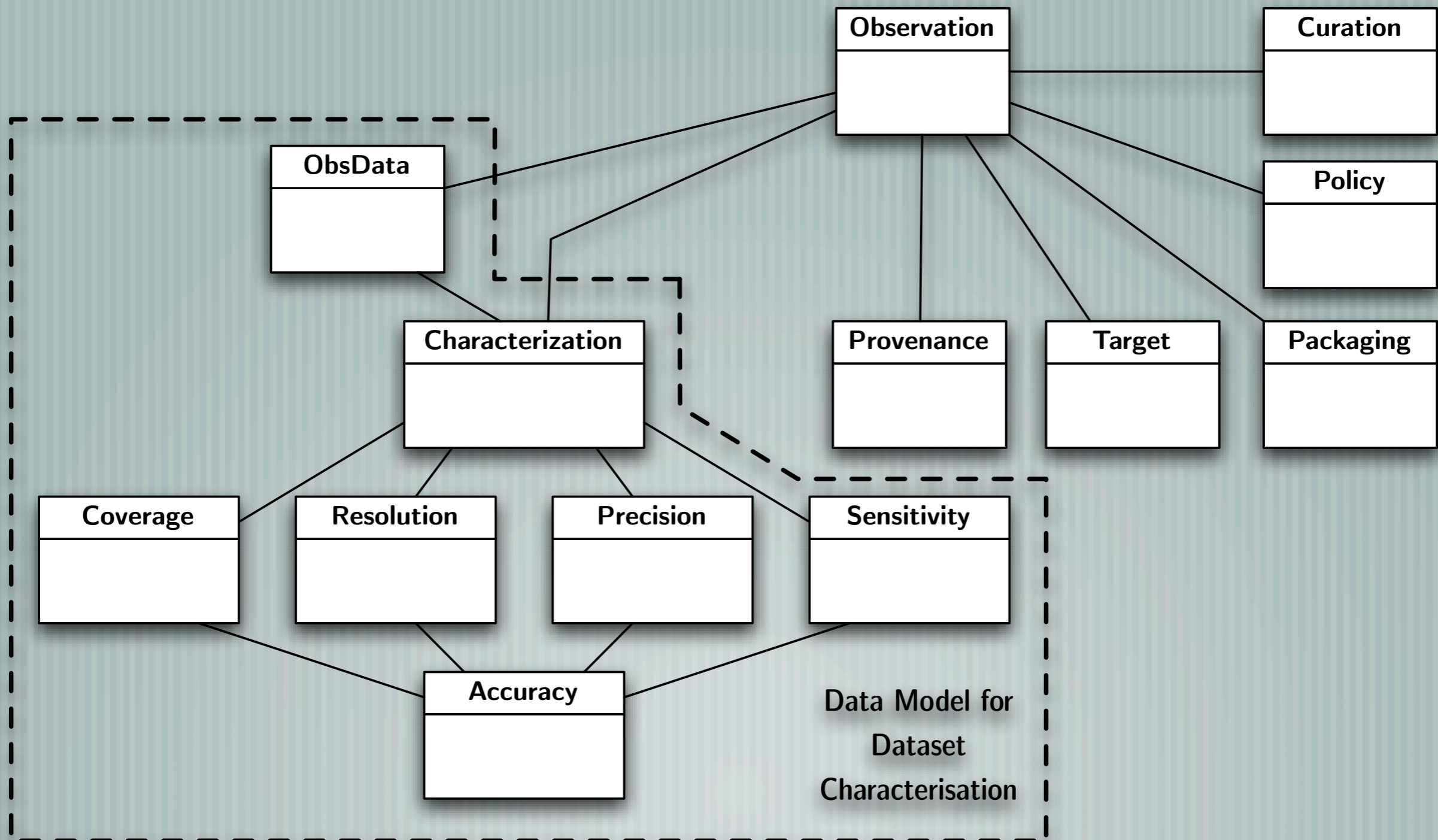
RADAMS Logic Structure



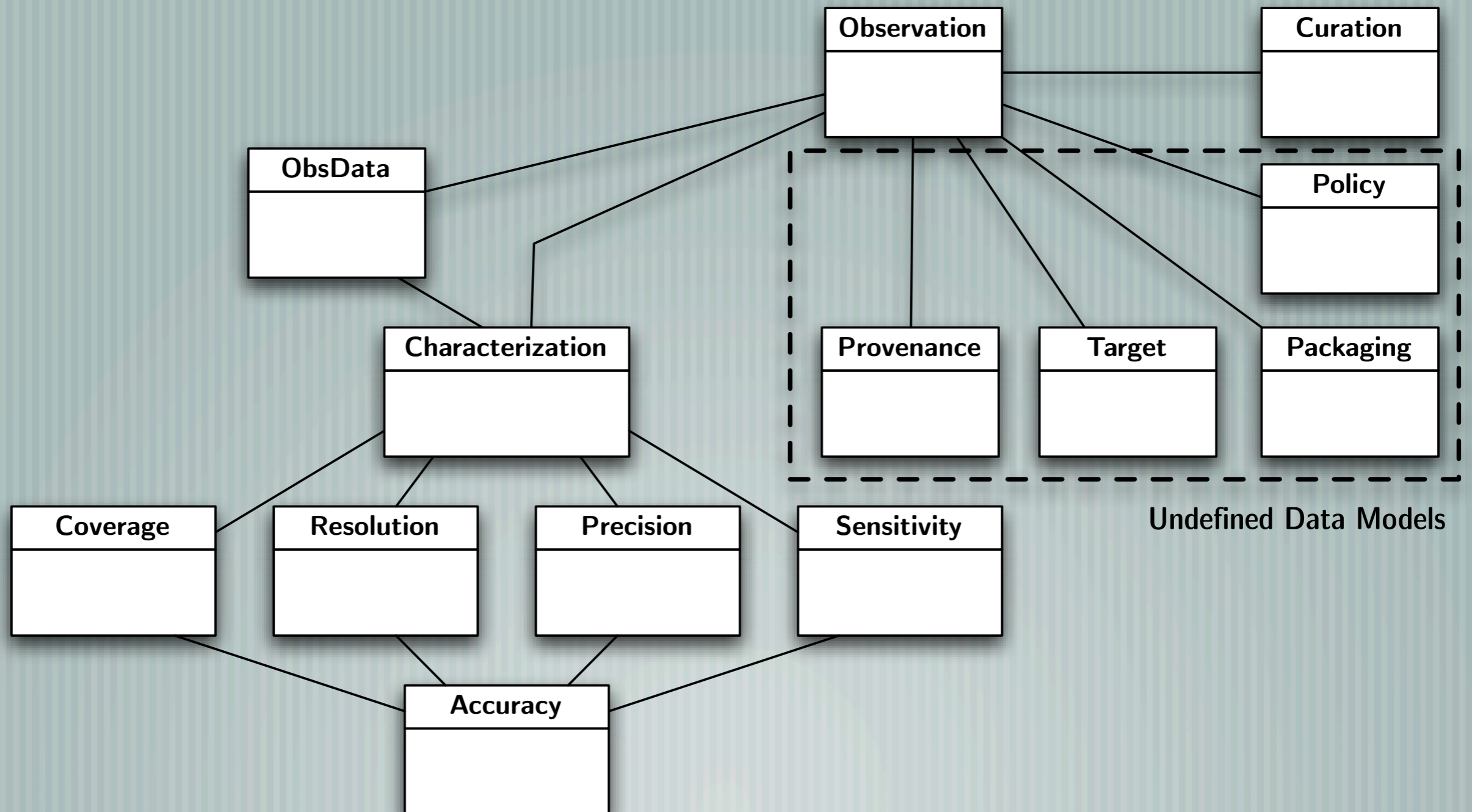
RADAMS Logic Structure



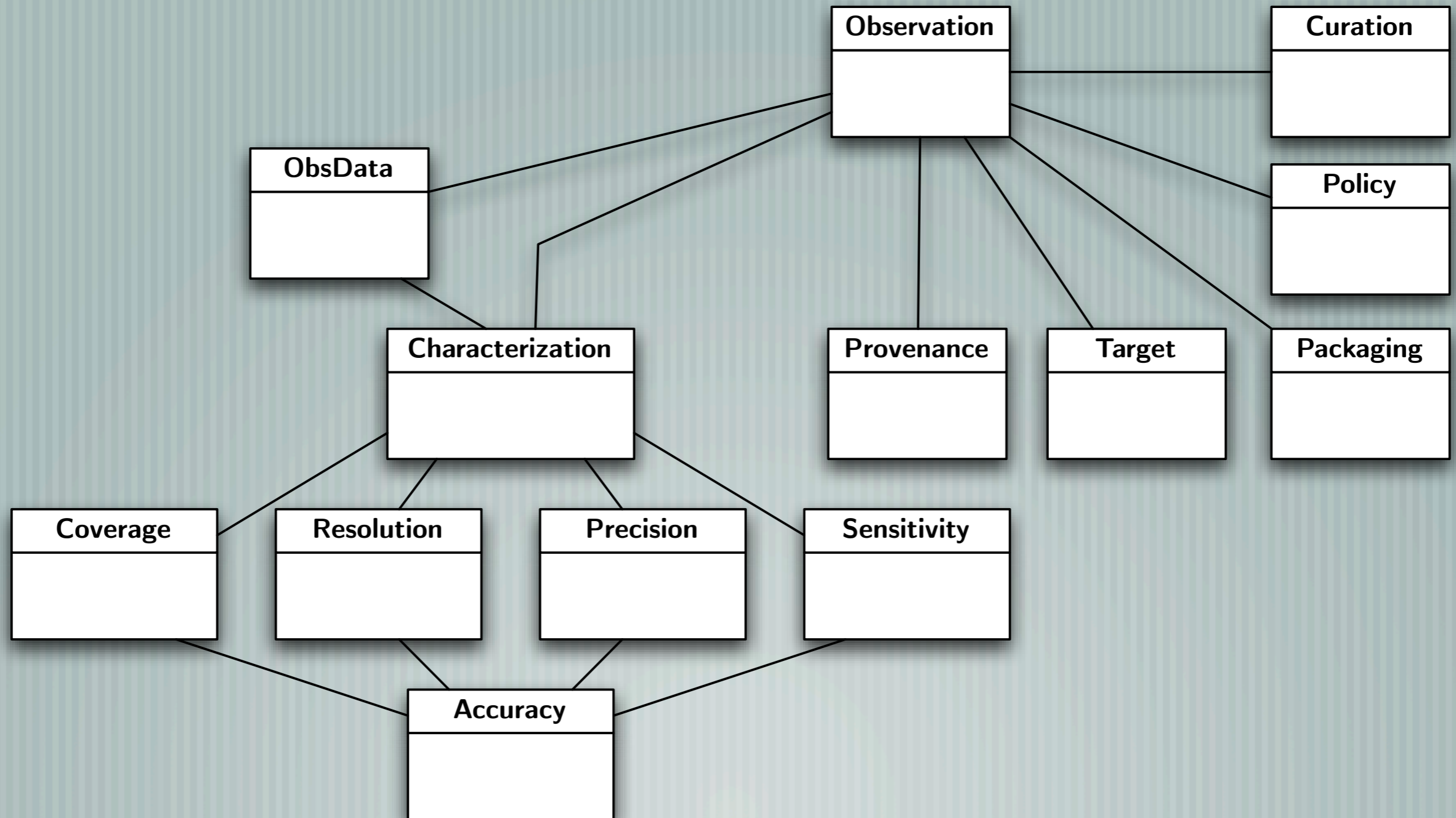
RADAMS Logic Structure



RADAMS Logic Structure



RADAMS Logic Structure



RADAMS Detail

Table 7.1: AxisFrame.Spatial metadata.

Attribute	FITS Keyword	UCD	Description
axisName	assign	meta.id; meta.main	Axis name.
calibrationStatus	assign	obs.calib; meta.code	Calibration status from a controlled vocabulary: uncalibrated, calibrated, relative ^a , normalized ^b .
ucd	assign	meta.ucd; meta.main	Main UCD.
unit	assign	meta.unit; meta.main	Identification Frame Unitary name.
refPos	assign	meta.ref; meta.id	Identifier system calibration or F
spaceRefFrame	assign	WCSNAME or RADESYS	pos.frame; meta.id
coordEquinox	assign	pos; time.equinox	pos; time.equinox
epoch	assign	pos; time.epoch	pos; time.epoch
independentAxis	assign	pos; obs.param; meta.code	pos; obs.param; meta.code
undersamplingStatus	assign	pos; obs.param; meta.code	pos; obs.param; meta.code
regularStatus	assign	pos; obs.param; meta.code	pos; obs.param; meta.code

^arelative refers to calibrated data, except if normalized refers to dimensionless quantities between two commensurable datasets.

Table 7.40: Calibration metadata^a.

Attribute	FITS Keyword	UCD	Description
timestamp	DATE-RED	obs.param; time.epoch	Timestamp for the calibration step being performed.
parameter.name	assign	obs.calib; obs.param; meta.id	Keyword defining the parameter that we will characterise with the remaining attributes.
parameter.type	assign	obs.calib; obs.param; meta.code	Type of calibration parameter used, from a controlled vocabulary: additive, factor, polynomial, exponential, logarithmic.
parameter.value	assign	obs.calib; obs.param; meta.number	Value for the main calibration parameter, where parameter.type is not polynomial.
parameter.sigma	assign	obs.calib; obs.param; meta.number	Value of sigma, for exponential calibrations.
parameter.calCoeff.[n]	assign	obs.calib; obs.param; meta.number	n th degree coefficient for polynomial calibration parameter; polynomial degree is defined from the maximum n.

^aIt is mandatory that at least one [parameter.name, parameter.value] triplet appears, with fluxScale as parameter.name, antennaTemperature, mbBrightnessTemperature, or S_nu as the parameter.type of string.

Table 7.39: Processing Step metadata.

Attribute	FITS Keyword	UCD	Description
timestamp	DATE-RED	obs.param; time.epoch	Timestamp for the processing step being performed.
type	assign	obs.param; meta.code	Type of processing to source data; comes from a controlled vocabulary: unweightedAverage, nonWeightedAverage.
softwarePackage	assign	meta.software; meta.id	Software package used for processing; should come from a controlled vocabulary: CLIPPER, AIPS, AIPS++, CASA, MOPS, GILDAS, MIRA, MIR, other. In case of other, the actual package name should be added as a parameter, with parameter.name as softwarePackage and the parameter.value as the package name.
parameter[n].name	assign	obs.param; meta.code	Additional processing parameter name, whose value will be in parameter.value; eventually, we will have a controlled list of possible parameter.name values.
parameter[n].type	assign	obs.param; meta.code	From a controlled vocabulary: integer, float, string... At least all of FITS data types should be present.
parameter[n].value	assign	obs.param ^a	Value for the parameter indicated by parameter.name.

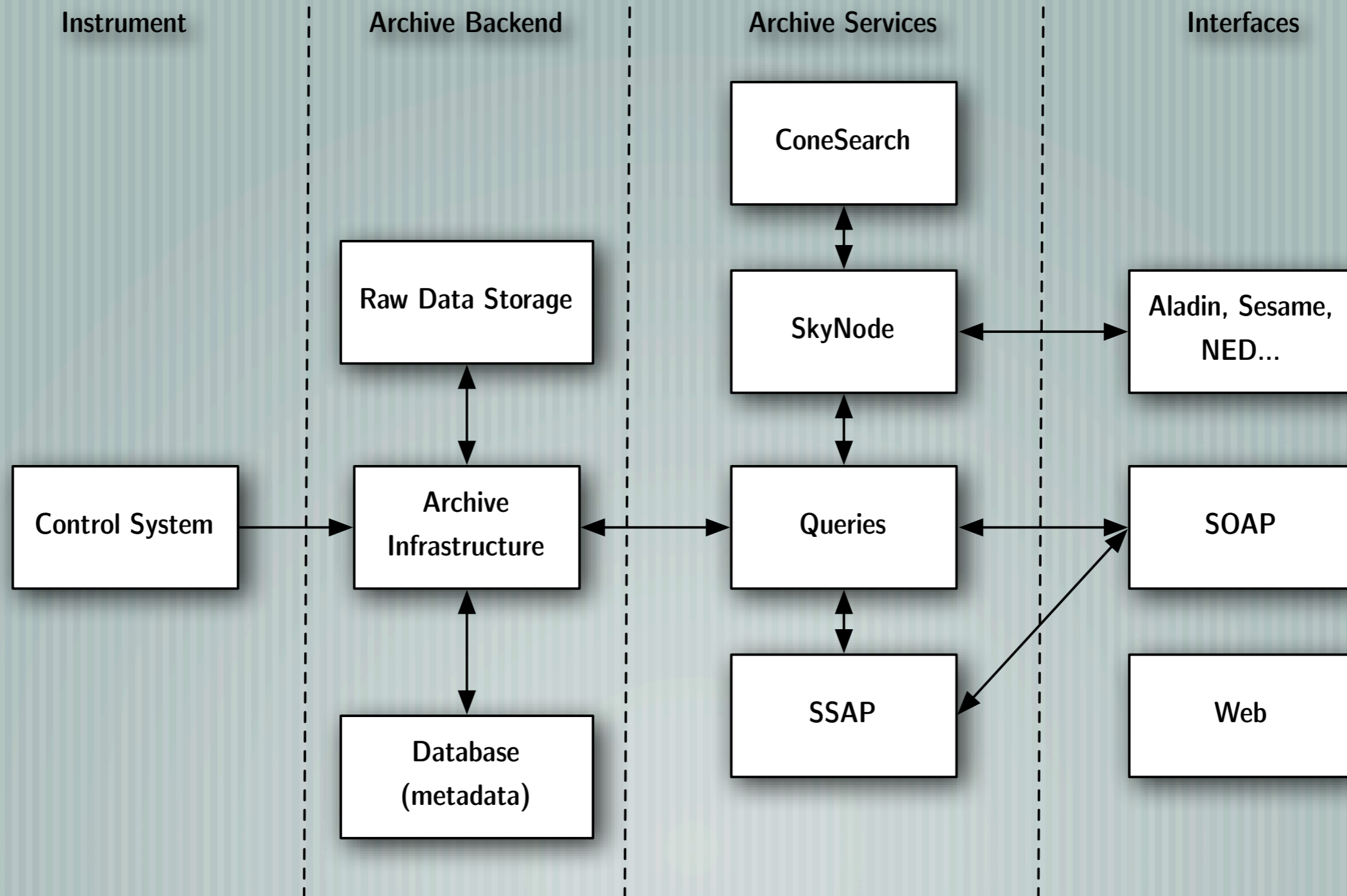
^aThe final UCD to mark parameter[n].value will be calculated when writing the VOTable, as it depends on parameter.type; it will be obs.param; meta.number most of the time, but it could be obs.param; meta.name or obs.param; meta.code, depending on the context.

RADAMS Detail

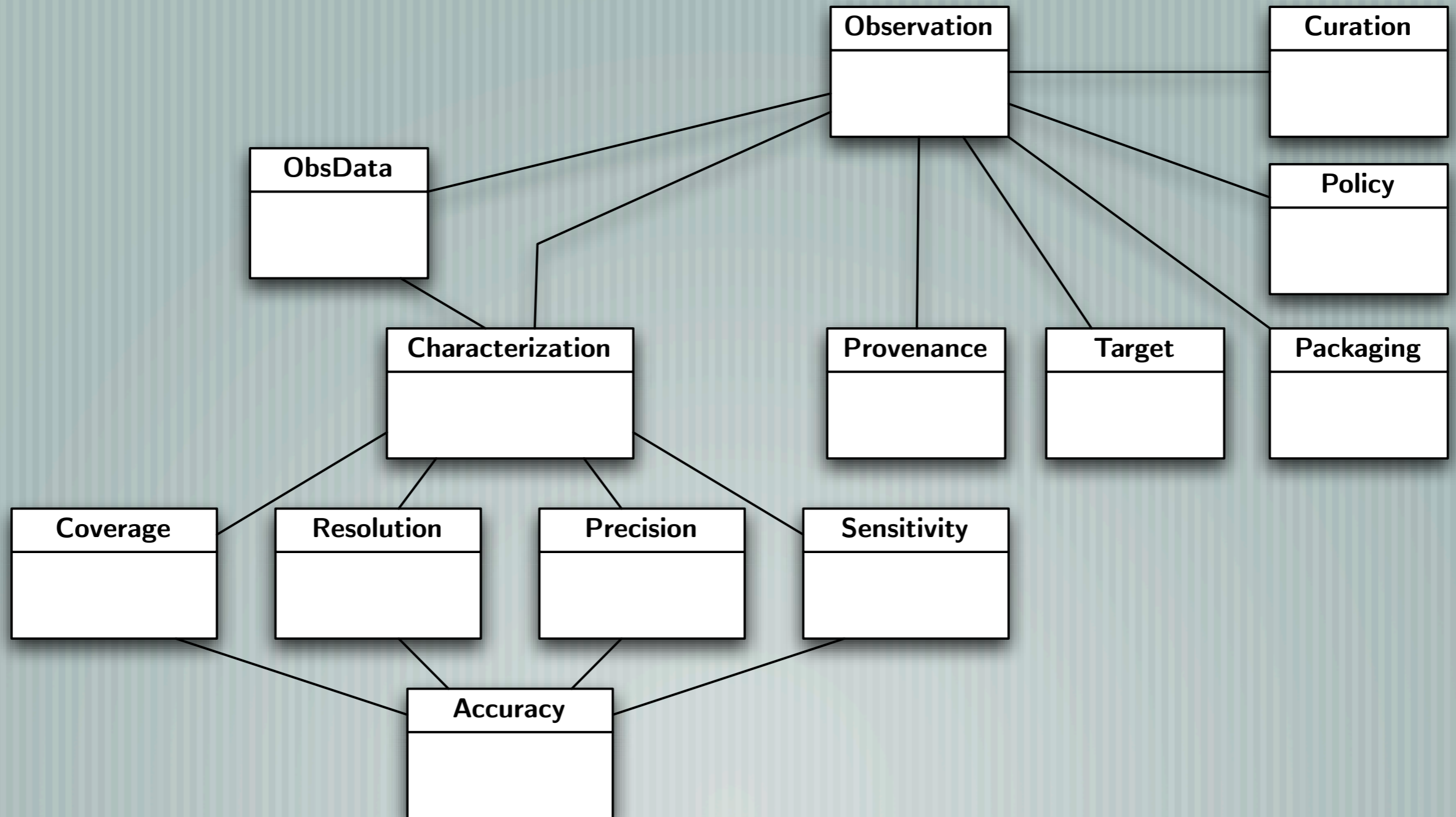
Table 7.39: Processing Step metadata.

Attribute	FITS Keyword	UCD	Description
timestamp	DATE-RED	obs.param; time.epoch	Timestamp for the processing step being performed.
type	assign	obs.param; meta.code	Type of processing applied to source data; comes from a controlled vocabulary: unprocessed, noiseWeightedAverage, nonWeightedAverage.
softwarePackage	assign	meta.software; meta.id	Software package used for data processing; should come from a controlled vocabulary: CLASS, AIPS, AIPS++, CASA, MOPSIC, GILDAS, MIRA, MIR, other. In the case of other, the actual package that was used should be added as a parameter, with param-

Archive Infrastructure

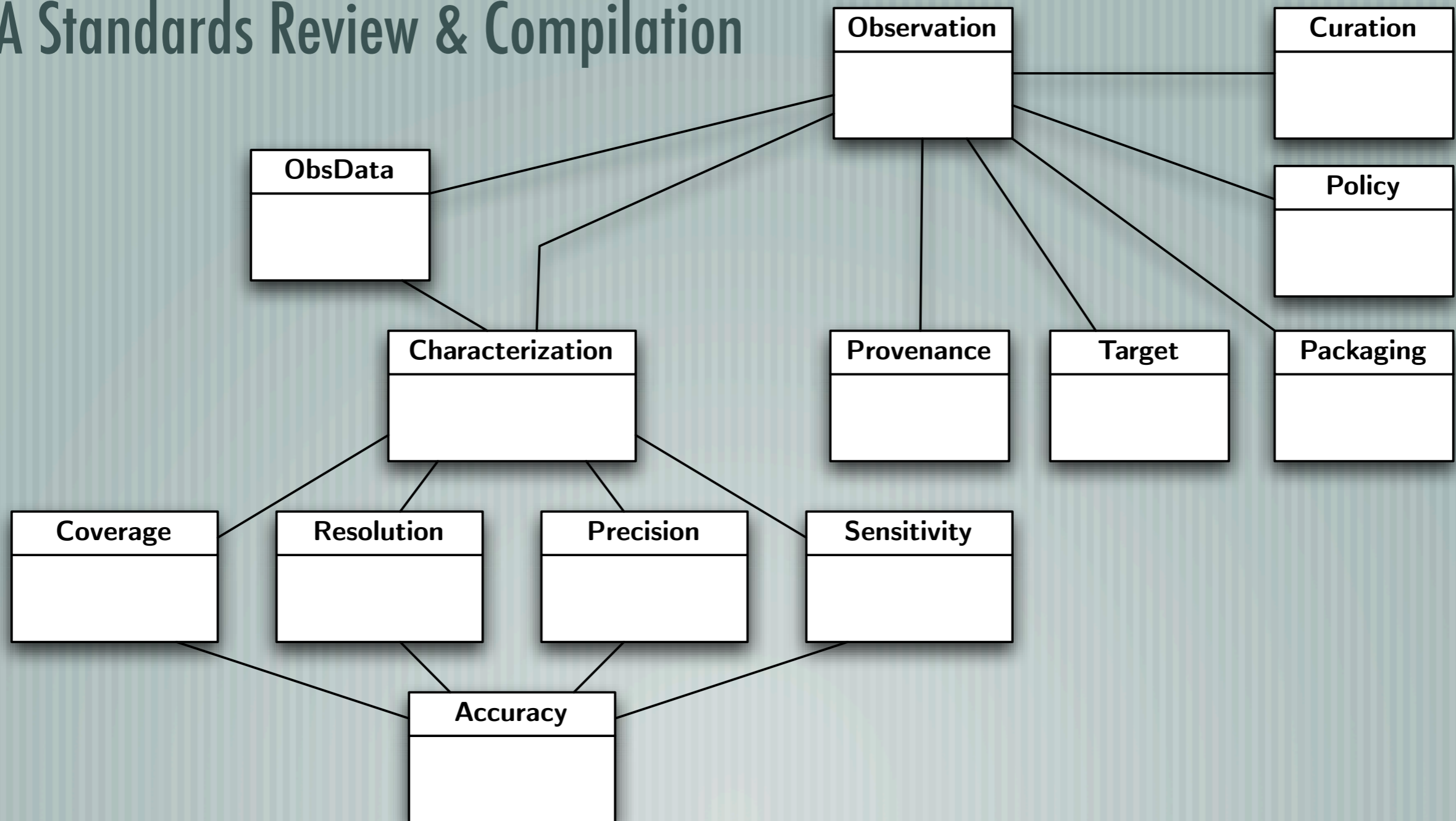


RADAMS Main Contribution



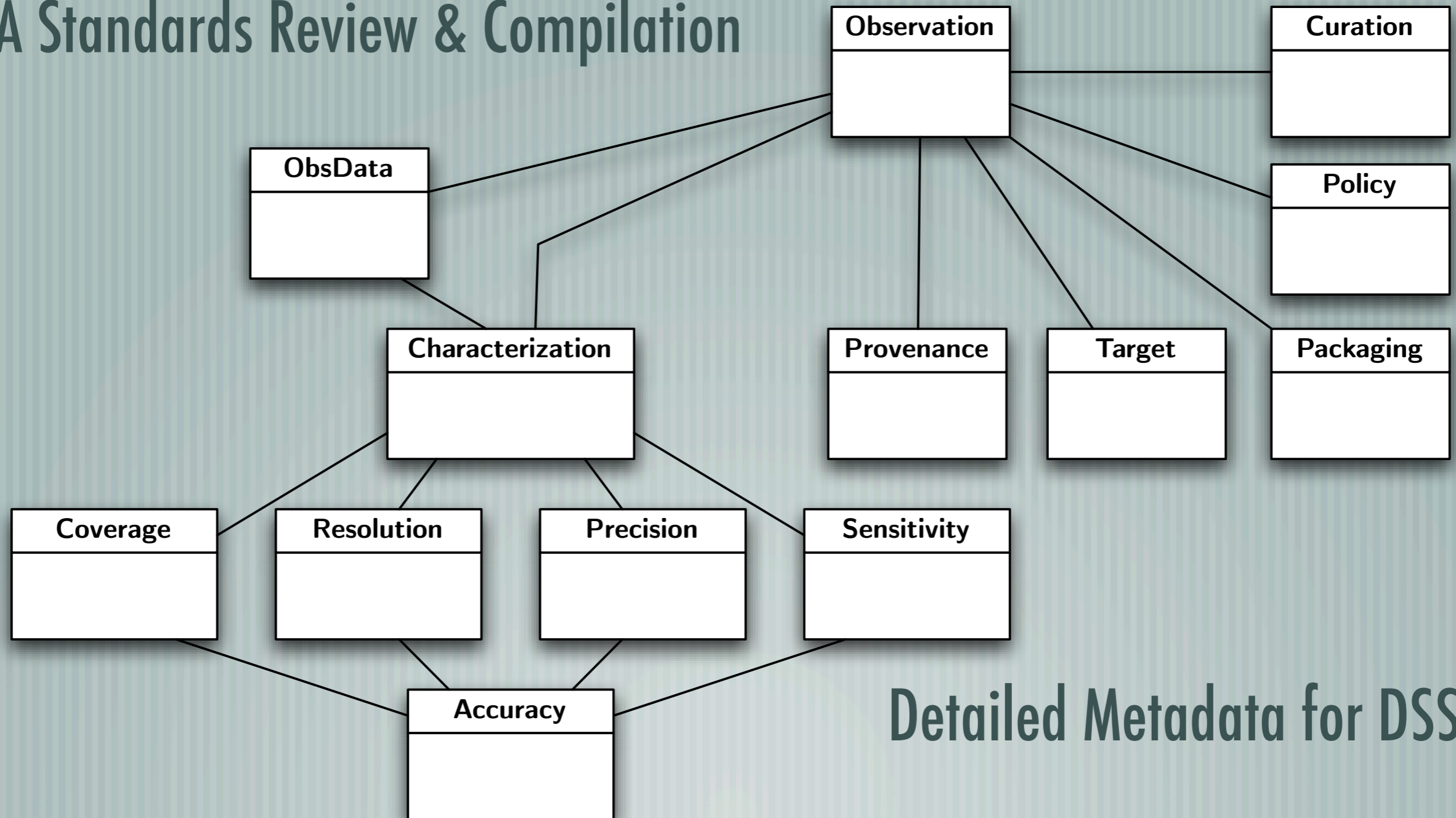
RADAMS Main Contribution

IVOA Standards Review & Compilation



RADAMS Main Contribution

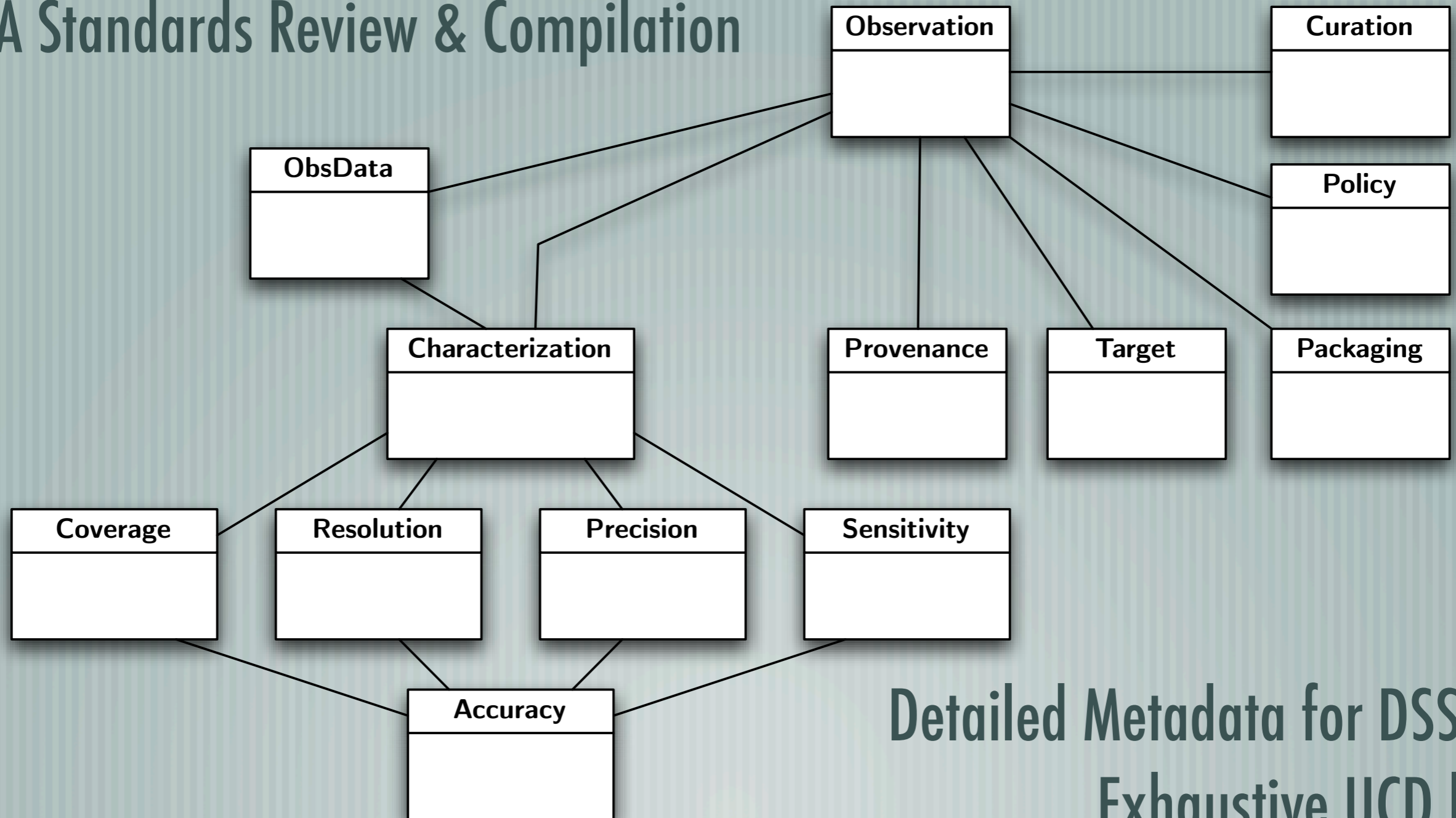
IVOA Standards Review & Compilation



Detailed Metadata for DSS-63

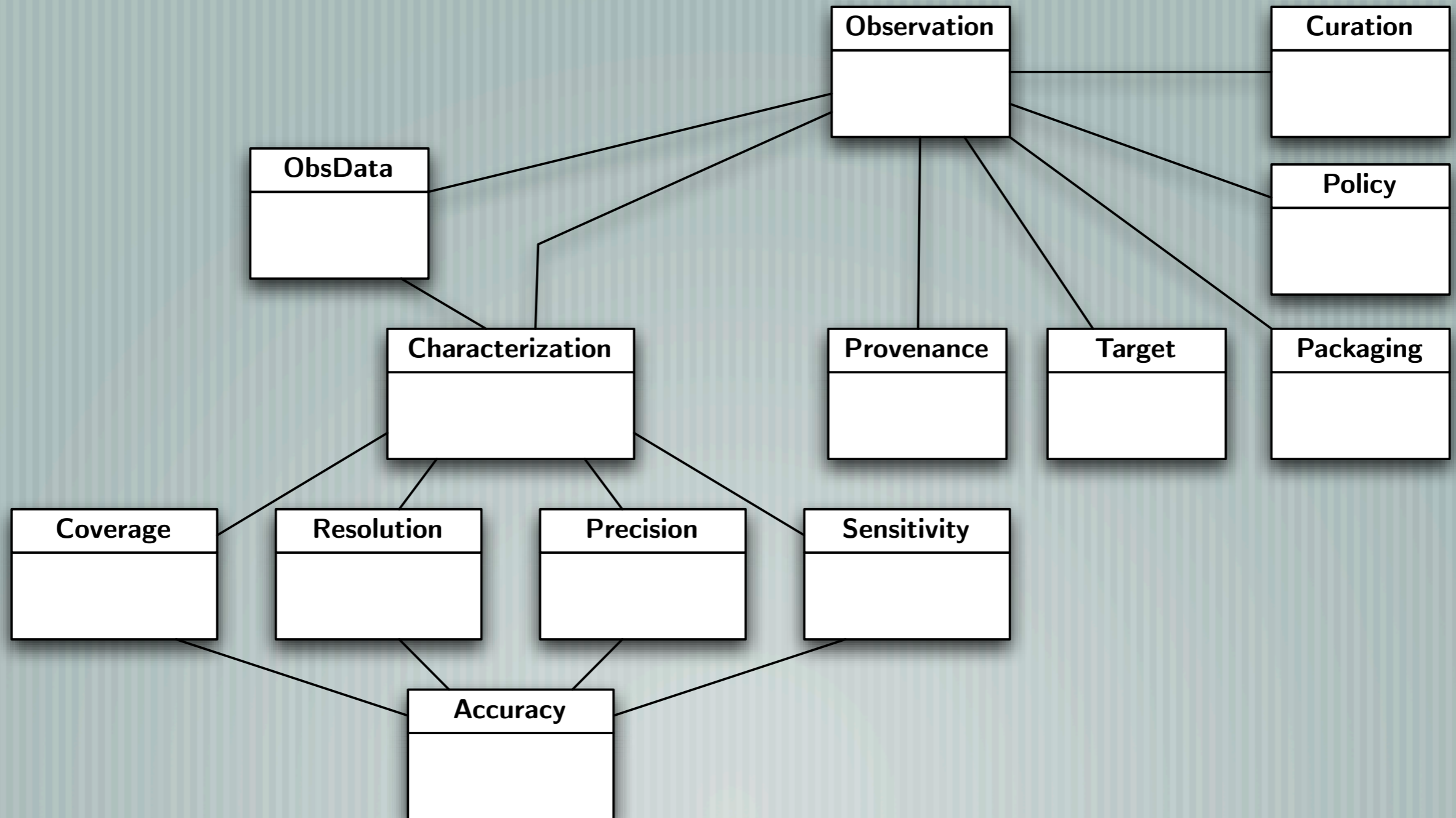
RADAMS Main Contribution

IVOA Standards Review & Compilation

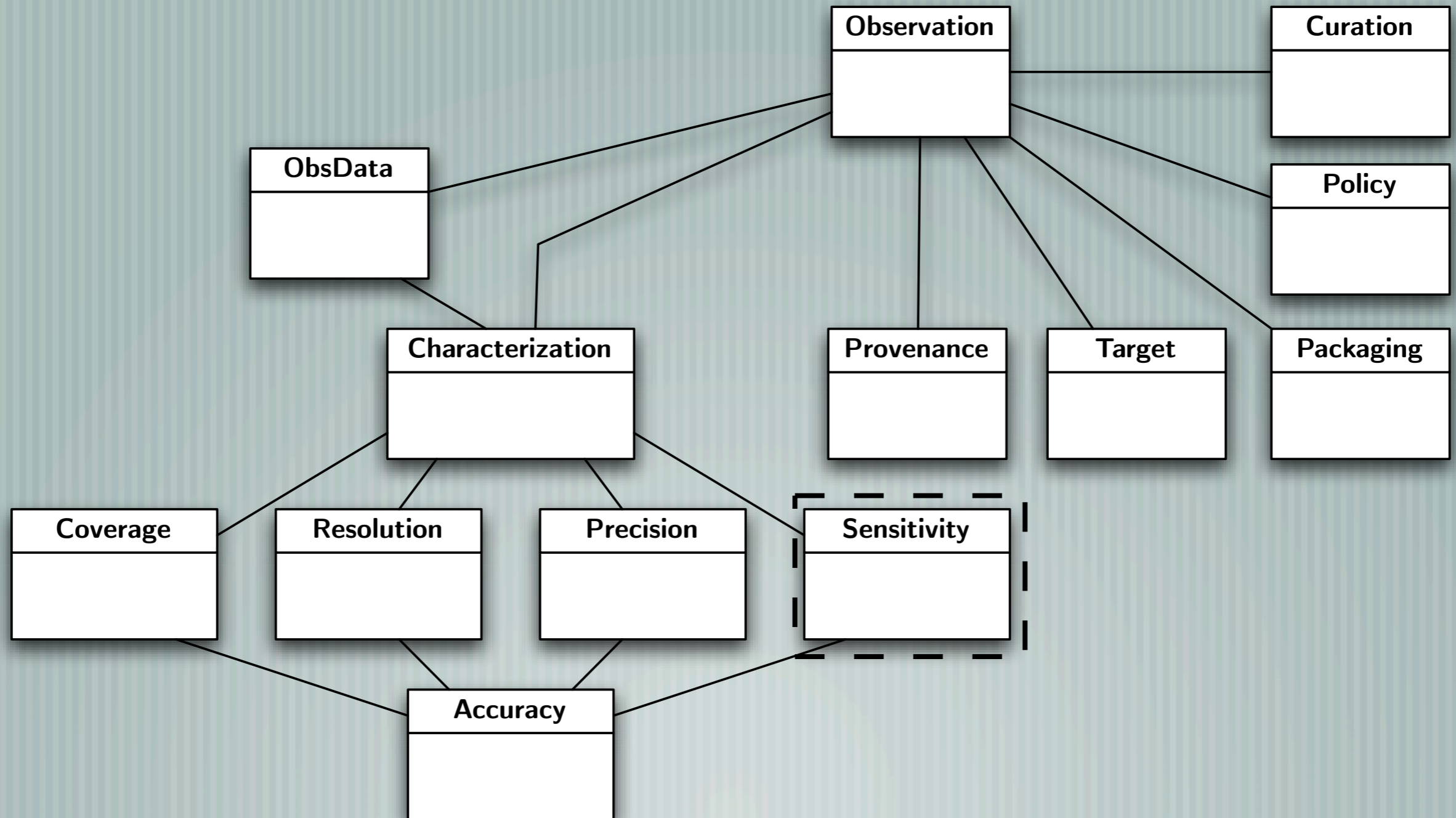


Detailed Metadata for DSS-63
Exhaustive UCD lists

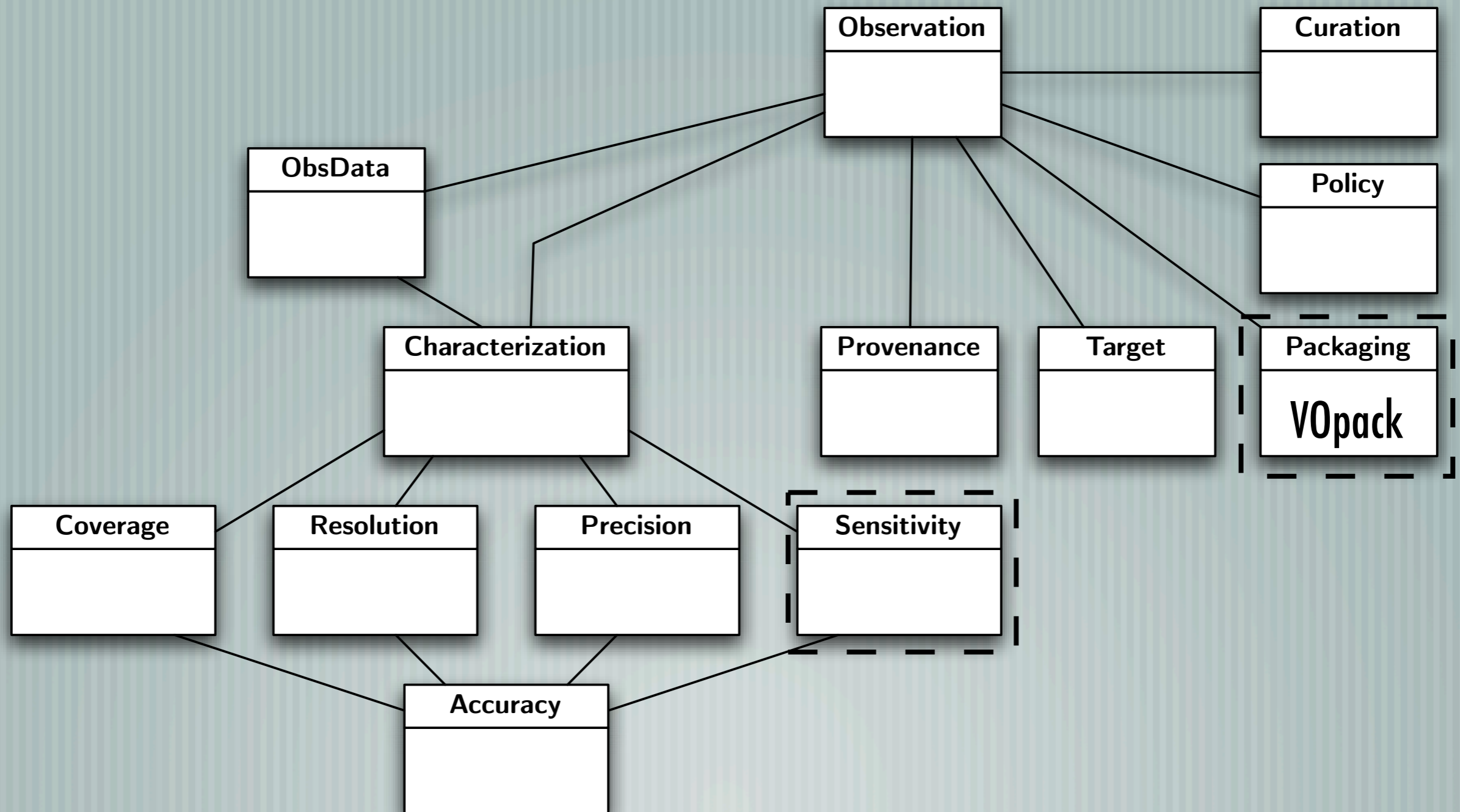
RADAMS Main Contribution



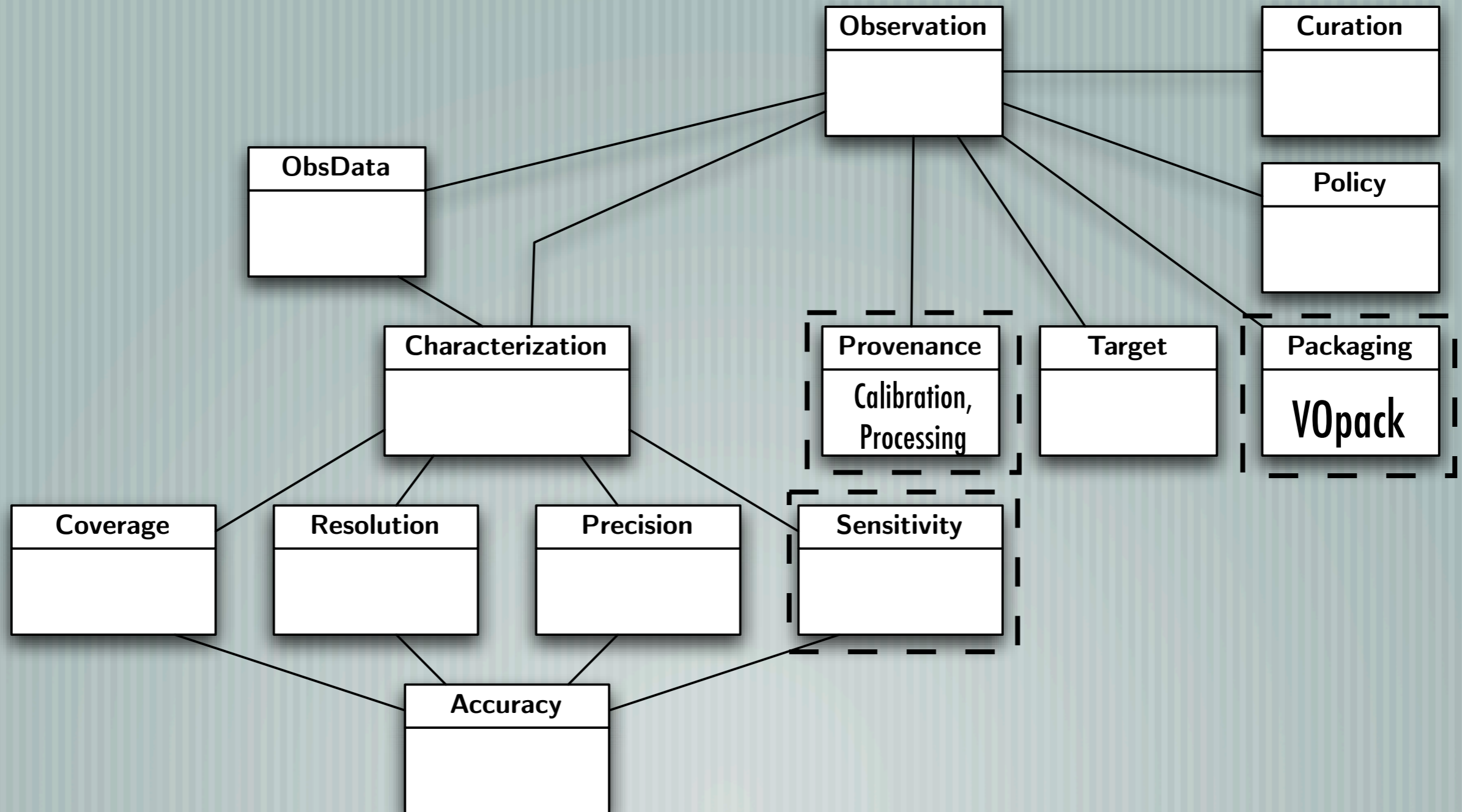
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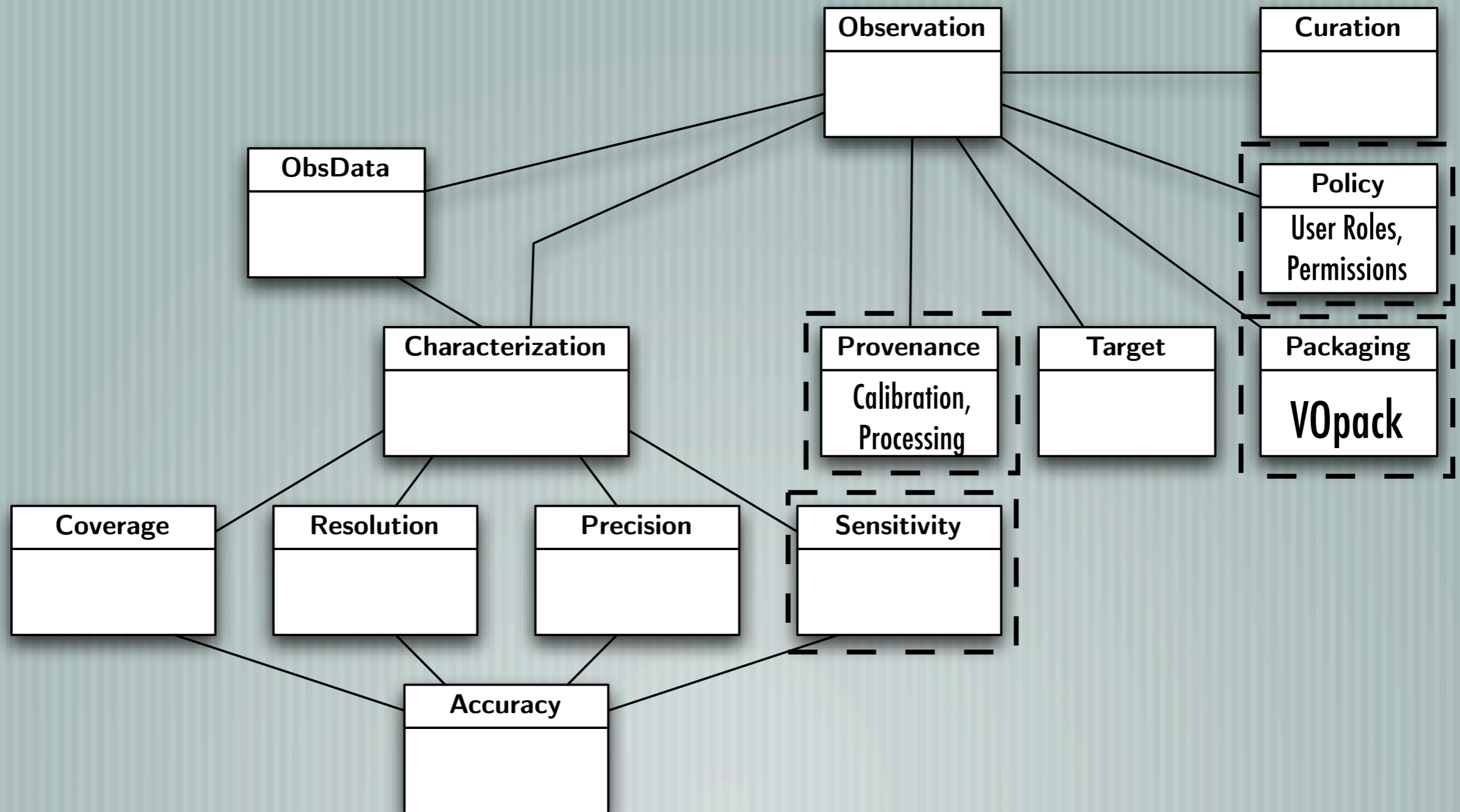
RADAMS Main Contribution



RADAMS Main Contribution



RADAMS Main Contribution



Conclusions & Future Work

Conclusions

- [Many IVOA standards are still under development (specially for radio-astronomy) but usable → Development of RADAMS
- [Detailed telescope DM as a result of standards' review
- [First definition of Policy, Provenance and Packaging elements
- [Initial archive infrastructure & workflow design
- [Colophon: archival initiatives drive definition & adoption of new IVOA standards

Future Work

— [Submission of RADAMS to IVOA Radio IG as IVOA Note

— VOPack proposal to IVOA DAL WG

— [Implementation of RADAMS for DSS-63

— [Extension of RADAMS for IRAM 30m

— Definition of data models for additional instruments &
Integration with IRAM's NCS

¡Gracias!

[Índice](#)