SANA: CCSDS Space Protocols Parameters Registries

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Introduction

- The Consultative Committee for Space Data Systems (CCSDS)
  - makes engineering specifications for space protocols.
  - comprehensive reviews from the member agencies.

Rationale for Protocol Registries

- Protocols payloads :
  - typically have fields containing values such as numbers or strings
  - For example, a frame contains a header field identifying the type of payload within the frame. That field is typically a number, where each number is unique for any given type of payload.
  - Over time, multiple kinds of payload may be defined in their own protocol specification document.

Rationale for Protocol Registries

- Each new payload requires a new number assignment
  - Adding a number value to a field usually does not harm or change the frame protocol specification.
- In the past, the CCSDS process required to update the protocol book.
  - Heavy process to « just » add an assignment.
- How to streamline this process?
  - Through protocol parameters registries.
  - Where no updates to specifications is needed to register a new assignment.

SANA Rationale

- Many protocol engineering standards organizations such as the Internet Engineering Task Force (IETF), the Institute of Electrical and Electronics Engineers (IEEE), or the Third-Generation Project (3GPP) have a registry function and operator.
- CCSDS did similarly.

SANA Rationale

- Space Assigned Numbers Authority(SANA)
  - Protocol parameters registries for CCSDS and space community.
  - The registries are managed by an operator, named SANA operator, on behalf of the CCSDS engineering community.
  - SANA was inspired by the IETF registry, named Internet Assigned Numbers Authority(IANA).
  - SANA creation and governance is specified in CCSDS Yellow Book 313.0.

SANA Benefits

- Having a centralized registry for protocol parameters :
  - Streamline the process of getting new number of string assignments
  - garantees coherence and uniqueness of protocol parameters,
    - which is very important for multi-agencies and organizations using the same protocols.
  - Enables coordination of mission operations when mission specific assignments are needed.
- It is a very important component of a protocol standard organization.

Scope

- The SANA operator
  - assigns and registers CCSDS protocol parameters and other CCSDS objects
  - as directed by the criteria and procedures specified in CCSDS documents.
- SANA manages
  - only the protocol registries of the CCSDS, which owns the corresponding protocol space.
  - SANA may make reference to external registries as a service to the space community.

Scope

- SANA
  - does not do the engineering of the protocols
  - nor decides how a registry should be defined or structured.
- It is up to the engineering community, i.e. CCSDS, to define. Obviously, as a registry expert and operator, SANA is involved in helping the community to define registries.
- SANA is really a service to the engineering community.

SANA Oversight

- SANA is
  - created and managed by the CCSDS Management Council (CMC).
  - The CMC delegates the oversight of the SANA operations to the SANA Steering Group (SSG), a group of individuals from CCSDS member agencies nominated by CMC.

SANA Registries Availability

- All CCSDS protocol registries managed by SANA are available at
  - http://sanaregistry.org.
- By default, the registries are public. However, provisions are made for restricted access to registries whenever the need is identified.

SANA Registries Availability

- As of May 2012, about 40 protocol parameters registries are available at SANA.
- Few registries are not currently managed by SANA, which means SANA does not do the assignments of new numbers.
  - the spacecraft identifiers registry is currently managed by the NASA National Space Science Data Center (formely World Data Center). A synched copy of the spacecraft identifiers registry under http://sanaregistry.org.
  - UTC offsets, which is managed by the Observatoire de Paris. A synched copy of the UTC offsets registry under http://sanaregistry.org.

SANA Registry Example

- A typical protocol parameter registry is a table of assigned values with a description and a reference.
- For example, the following table is an extract of the « Protocol Identifier » registry managed by SANA and located at

  http://sanaregistry.org/r/protocol_id/protocol_id.html.
- This registry is used to manage the values of the “Protocol Identifier” field in the Encapsulation Packet carried in the CCSDS Space Data Link Protocol[CCSDS 133.1].

Protocol Identifier

Protocol Identifier	Description	Status	Reference
00O	Fill (the encapsulation data field, if present, contains no protocol data)	Assigned	CCSDS 133.1
00l	LTP over CCSDS encapsulation packets	Provisional	CCSDS 734.1
0l0	Internet Protocol Extension (IPE)	Assigned	CCSDS 702.1
0ll	CFDP	Assigned	CCSDS 727.0
100		Unassigned	
101		Unassigned	
110	Extended Protocol ID for Encapsulation Service	Assigned	CCSDS 133.1
111	Arbitrary Aggregations of Octets	Assigned	CCSDS 133.1

Recent assignment from LTP specification request.

Protocol Identifier

- The “001” assignment has a status of “Provisional”
  - since the codepoint was requested but the document requesting the codepoint has not yet been officially approved.
  - When the document is approved, the status changes to “Assigned”.
- Other possible values for “Status” are:
  - “Unassigned” means the value is available for assignment and
  - “Reserved” means the value is reserved and cannot be assigned by SANA.

Registry Registration Policy

- Each registry is defined with a registration policy. This policy defines how new or updated values will be assigned by SANA. Examples of registration policies are listed in the following table.

Registration Policy Examples

Policy	Description
CCSDS Member Agency Representative	A new assignment may only be requested by a CCSDS member agency representative. When a new request is received by SANA, SANA will validate with the corresponding CCSDS member agency representative that the request is genuine. After the validation, SANA will assign a new value for the request.
CCSDS Blue Book	A new assignment may only be requested by the means of a CCSDS Blue book. In this case, the blue book will contain a "SANA Considerations Section" that will request the assignments. SANA assigns a new value provisionally until the book is published, in which case the assignment becomes official
First-Come-First-Serve	No validation is done by SANA. Anyone can request a new value. Note that this is often too liberal, but is shown here as possible registration policy.
CCSDS WG Review	A new assignment may come from anyone but the request will be reviewed by the designated CCSDS working group chair, or in absence, the CCSDS area director.

Requesting an Assignment

- If an organization requires a new assignment in a SANA managed registry, then the first action is to verify the registration policy of the registry.
- As shown above, the registration policy governs how SANA will assign new values in a registry.
- For example, if a registry registration policy is “CCSDS Member Agency Representative”, then the engineer should have its member agency representative send the request on his behalf to SANA.

Requesting a new Registry

- A new registry is normally requested by adding a “SANA Considerations Section” in a CCSDS book. That section will contain the following key information:
  - the name and title of the registry
  - the structure of the registry, such as the type of values to be registered
  - the registration policy governing the assignments of the registry
  - the initial content of the registry
- See : http://sanaregistry.org/howto.html.

Registries Implementation

- Each registry is implemented as a XML file with XSLT and Relax-ng definitions. The registries are presented on the web site using standard HTML created by the automated XSLT translation of the XML file. Each registry is cryptographically signed with the SANA PGP key.
- Using XML enables the community to automate the pulling of the registry data and to easily convert the registry to its own format as desired.

Registries Implementation

- Each registry is available at http://sanaregistry.org/r/registry_name, where “registry_name” is changed to the mnemonic chosen for the registry.
- For example, the “AMS Transport Service” registry is available at http://sanaregistry.org/r/ams_transport_service .
- Browser-side Javascript are used for sorting the various columns. (very useful for large registries such as spacecraft identifiers).

Registries Mission Assignments

- Sometimes, SANA registries are used for mission specific assignments.
  - For the purpose of the Delay-Tolerant Networking (DTN) deployment on the International Space Station(ISS), the CCSDS DTN working group and NASA has requested codepoints for identifying Licklider Transmission Protocol(LTP) Engine Identifiers and Bundle Protocol(BP) Compressed Bundle Header Encoding(CBHE) Node Numbers assignments to SANA.

Sample Registries

- The following table is a list of some of the registries available at SANA
- http://sanaregistry.org

CCSDS Abbreviations

Space Agencies

AMS Transport Service

Bundle Protocol Compressed Bundle Header Encoding Service Numbers

Control Authority Organizations

Control Authority Organizations Contacts

CCSDS File Delivery Protocol (CFDP) Entity Identifier

CLCW Version Number

Sample Registries

Extended Protocol Identifiers

Frame Secondary Header Version Number

CCSDS Glossary

Internet Protocol Extension Header

Member Agency Control Authority Office Registries

Multiplexer Access Point Identifier (MAP ID)

Navigation Data Messages XML Schema

CCSDS Object Identifiers (OID)

Packet Version Number

Proximity-1 Port Identifier

Protocol Identifier

SANA can also manage and register XML schemas and files

Sample Registries

SCPS-NP Domain Identifier (D-ID)

SCPS-NP End System Identifier (ES-ID)

SCPS-NP Path Identifier (P-ID)

SCPS-NP Transport Protocol Identifier (TP-ID)

SCPS-TP Connection Identifier

SCPS-TP Extended Capability Binding Space Identifiers

Space Link Identifiers Registries

Space Packet Protocol Application Process Identifier(APID)

Spacecraft Identifiers

CCSDS Terms

Transfer Frame Version Number (TFVN)

UTC Offsets

Virtual Channel Identifier (VCID)

Sample Registries

At the time of the publication, additional registries are being defined such as:

Licklider Transmission Protocol Engine Identifiers

Licklider Transmission Protocol Client Service Identifiers

Radio Sources

XML Telemetric and Command Exchange(XTCE) NASA Government Satellite(GovSat) Tailoring

XML Telemetric and Command Exchange(XTCE) Tailoring Guide

Browser-side Sorting Capabilities

- Spacecraft id (unsorted)

Space Assigned Number Authority(SANA) Registry: Spacecraft Identifiers

http://sanaregistry.org/r/spacecraftid/spacecraftid.html

Google

Spacecraft Name	Version	Id (hex)	Requestor Name	Requestor Affiliation	Requestor Affiliation Country	Assigned Date	Assignor	Status	Note
Space Telescope	1	03A	G.M. Levin	GSFC/NASA	US	1990-01-01	XX	Assigned	
Nimbus 7	1	026	F. Akers	GSFC/NASA	US	1990-01-01	XX	Assigned	
ERS-1	1	05A	G.F. Block	ESTEC/ESA	EU	1990-01-01	XX	Assigned	
ASTRO-SPAS	1	001	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
ASTRO-SPAS Sim.	1	002	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
Radarsat	1	0C9	W. E. Threinen	CSA	CA	1990-01-01	XX	Assigned	
ERS-2	1	003	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
ERS-2 Simulator	1	004	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
Cassini	1	052	J.N. Scott	GSFC	US	1990-01-01	XX	Assigned	
SOHO	1	015	H. K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
SOHO-Simulator	1	016	H. K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	

Browser-side Sorting Capabilities

- Spacecraft id (sorted by id)

Space Assigned Number Authority(SANA) Registry: Spacecraft Identifiers

http://sanaregistry.org/r/spacecraftid/spacecraftid.html

Google

Spacecraft Name	Version	Id (hex)	Requestor Name	Requestor Affiliation	Requestor Affiliation Country	Assigned Date	Assignor	Status	Note
ASTRO-SPAS	1	001	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
ASTRO-SPAS Sim.	1	002	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
ERS-2	1	003	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
ERS-2 Simulator	1	004	H.K. Uhrig	ESA	EU	1990-01-01	XX	Assigned	
CHANDRA(TC)	1	005	J. Deskevich	GSFC	US	1996-03-06	RP	Assigned	
KOMPSAT-1 (TC)	1	006	E.Sim	KARI	KR	1996-06-05	RP	Assigned	
FUSE (TC)	1	007	J. Deskevich	GSFC	US	1996-06-24	RP	Assigned	
SBSS (Tlm/TC)	1	008	R. Porter	GSFC	US	2005-09-30	RP	Assigned	
METOP1(TLMTC,S-)	1	00B	H.K. Uhrig	ESA	EU	1996-07-01	RP	Assigned	
METOP2(TLMTC,S-)	1	00C	H.K. Uhrig	ESA	EU	1996-07-01	RP	Assigned	
METOP3(TLMTC,S-)	1	00D	H.K. Uhrig	ESA	EU	1996-07-01	RP	Assigned	

Browser-side Sorting Capabilities

- Spacecraft id (sorted by spacecraft name)

Space Assigned Number Authority(SANA) Registry: Spacecraft Identifiers

http://sanaregistry.org/r/spacecraftid/spacecraftid.html

Google

Spacecraft Name	Version	Id (hex)	Requestor Name	Requestor Affiliation	Requestor Affiliation Country	Assigned Date	Assignor	Status	Note
AB7 (TCTLM)	1	219	J-M. Soula	CNES	FR	2009-06-02	JGG	Assigned	
ABRIXAS(Eng)	1	1E1	H.Wanke	DLR	DE	1997-09-04	RP	Assigned	
ABRIXAS(Flt)	1	1E4	H.Wanke	DLR	DE	1997-09-04	RP	Assigned	
ABRIXAS/A	1	046	B.Younes	GSFC	US	1999-09-22	JGG	Returned	
ABS-2 (TLM)	1	2B2	W. Horne	NASA	US	2011-02-23	JGG	Assigned	
ACE (TC/TLM)	1	05C	R. Kee	JPL	US	1997-01-23	RP	Assigned	[29]
ACYGNUS (TC)	1	11C	R. Porter	NASA	US	2009-11-20	JGG	Assigned	
ACYGNUS (TLM)	2	11C	R. Porter	NASA	US	2009-11-20	JGG	Assigned	
ADEOS 2	2	1A2	N.Iwasaki	NASDA		2004-06-04	RP	Returned	
ADS-1B (TCTLM)	1	230	M. Lugert	ESA	EU	2010-01-11	JGG	Assigned	
AEOLUS-S Sim(TCTLM)	1	201	N. Bobrinsky	ESA	EU	2005-06-10	RP	Assigned	[51]

CCSDS Glossary

- As part of an effort to keep the definitions of abbreviations and terms within CCSDS specifications,
- SANA with CCSDS secretariat created a centralized glossary:
  - http://sanaregistry.org/r/glossary/glossary.html
- This enables the document authors to reuse the definitions and provide better coherence within the CCSDS documents.

Conclusion

- The Space Assigned Numbers Authority(SANA, http://sanaregistry.org) is a registry service for the space community.
- It provides a centralized space for registering space protocol parameters in order to provide coherence and flexibility in assignments.

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References

- SANA : http://sanaregistry.org

- Space Assigned Numbers Authority (SANA) – Role, Responsabilities, Policies and Procedures, CCSDS Yellow Book 313.0-Y-1, July 2011.