SANA: CCSDS Space Protocols Parameters Registries

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Space Assigned Numbers Authority
http://sanaregistry.org

The Consultative Committee on Space Data Systems (CCSDS) produces space telecommunications protocols specifications. CCSDS has recently created a new entity, named the Space Assigned Numbers Authority (SANA), to create and manage registries for the protocols assignments of the space protocols developed within CCSDS and space agencies. To help the community to get all registries in a single place, SANA also keeps an in-synced copy of registries managed by some related organizations such as the Spacecraft Identifiers and the Control Authorities registries. This paper presents SANA, the registries it manages on behalf of CCSDS, the space agencies and the space telecommunications community, the process to request a new registry, to update the registries and the policies behind. Examples of registries on SANA (http://sanaregistry.org) site include: Spacecraft Identifiers, Radio sources(Quasar), Delay- Tolerant Network Bundle Protocol identifiers, Licklider Transport Identifiers, Space packet numbers, Transfer frame identifiers, ...

I. Introduction

C ONSULTATIVE Committee for Space Data Systems (CCSDS) has been producing engineering specifications for space protocols for quite a long time. To produce high-quality standards, the process used to publish a specification is pretty comprehensive and requires reviews from the member agencies.

Protocols payloads typically have fields of values such as numbers or strings that are used, for example, to identify a specific function within a protocol. 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. However, given that an assignment of a new number is necessary for the underlying transport frame header, the frame protocol specification also needs to be updated to add that new payload type number. Adding a number value to a field does not harm or change the frame protocol specification. Therefore, the whole update and review process of the frame protocol specification is avoided.

As in 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), CCSDS has setup a registry of registries for these objects named the Space Assigned Numbers Authority(SANA). 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[1].

Having a centralized registry for protocol parameters also guarantees coherence and uniqueness of protocol parameters, which is very important for multi-agencies and organizations using the same protocols. It is a very important component of a protocol standard organization.

II. SANA 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. Whenever a protocol space is not owned by CCSDS but its registry is of use to the CCSDS community, SANA may make reference to that external registry.

SANA does not do the engineering of the protocols nor decides how a registry should be defined or structured. This role remains to the engineering community, i.e. CCSDS. Obviously, as a registry expert and operator, SANA is

involved in helping the community to define registries. Therefore, SANA is really a service to the engineering community.

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.

III. 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.

Some registries are not currently managed by SANA, which means SANA does not do the assignments of new numbers. For example, the spacecraft identifiers registry is currently managed by the NASA National Space Science Data Center (formerly World Data Center). For the benefit of the community, SANA keeps a synched copy of the spacecraft identifiers registry under http://sanaregistry.org/r/spacecraftid. Another registry not managed by SANA is the UTC offsets, which is managed by the Observatoire de Paris. SANA keeps a synched copy of the UTC offsets registry under http://sanaregistry.org/r/utc_offsets.

IV. 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.

Protocol Identifier	Description	Status	Reference
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	

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[2,3].

Over time, various encapsulated payloads were added to the CCSDS link protocol. Each new payload is described in its own specification document and requires a new and unique protocol identifier. Therefore, the registry extract above shows some of the assignments that were made over time. The first column lists the codepoints. The second column describes the usage of the codepoint. The third column identifies the status of the assignment. The last column points to the reference document requesting the assignment of that codepoint.

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.

V. 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.

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,

Policy	Description
	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.

VI. 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.

VII. 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

More information on how to write a SANA Considerations section is available at: http://sanaregistry.org/howto.html.

VIII. 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.

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.

IX. Registries Mission Assignments

The following is an example of the use of SANA registries for space missions. 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. This is an example of assignments for specific missions where unique values must be assigned to each node on the network, independent of which agency the node belongs to. The role of the centralized registry is then key to a successful and coherent deployment.

X. 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
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
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)

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

Bundle Protocol Compressed Bundle Header Encoding Node Numbers
Licklider Transmission Protocol Engine Identifiers
Licklider Transmission Protocol Client Service Identifiers
Radio Sources
XML Telemetric and Command Exchange(XTCE) NASA Government Satellite(GovSat) Tailoring Guide
XML Telemetric and Command Exchange(XTCE) Tailoring Guide

XI. 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) of more than two thousand (2000) definitions. This enables the document authors to reuse the definitions and provide better coherence within the CCSDS documents.

XII. 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.

XIII. Acknowledgements

References

[1] Space Assigned Numbers Authority (SANA) – Role, Responsibilities, Policies and Procedures, CCSDS 313.0-Y-1,Yellow Book Issue 1. Washington, D.C.: CCSDS, July 2011.

[2] Space Packet Protocol. Recommendation for Space Data System Standards, CCSDS 133.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2003.

[3] Space Link Identifiers, Recommendation for Space Data System Standards, CCSDS 135.0-B-4. Blue Book. Issue 4. Washington, D.C.: CCSDS, October 2009.