Ground System Architectures Workshop (GSAW) 2022

Ground Data System Solutions for Multiple Spacecraft Identification Codes per Spacecraft

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CCSDS Spacecraft Identification Field Code Assignment Control Procedures

- CCSDS 320.0-M-7 Cor. 1
- Applies to SCID field in transfer frame versions 1-4 (TC, TM, AOS, Proximity-1, and USLP)

Transfer Frame Version	Range of SCID
1	0–1023
2	0–255
3	0–1023
4	0–65535

- Space Assigned Numbers Authority (SANA) assigns SCIDs

CCSDS Spacecraft Identification Field Code Assignment Control Procedures

- “[T]he SCID is not intended to provide a unique identifier for the spacecraft and its data in perpetuity.
- “Because of the increasing numbers of operational spacecraft, there is a concern that, at any one time, the number of vehicles under active operational control not exceed the namespace in the available assignment domains.
- “It is inevitable that the SCIDs will have to be reused…”

Excerpted from CCSDS 320.0-M-7 Cor. 1

CCSDS Spacecraft Identification Field Code Assignment Control Procedures

Downlink frequencies, excerpted from CCSDS 320.0-M-7 Cor. 1

Table 2-1: ITU Frequency Bands

ITU Frequency Ranges	Commonly Used Frequency Band Name[1]	ITU SRS/EESS/SOS Near Earth Downlink Allocations	SANA FBD	ITU SRS Deep Space Downlink Allocations	SANA FBD
0–30M Hz	HF-band		HF		HF
30–300 MHz	VHF-band		VHF		VHF
300–1000 MHz	UHF-band		UHF		UHF
1–2 GHz	L-band	1.525–1.535 GHz SOS	L		L
2–3 GHz	S-Band	2.200–2.290 GHz EESS & SRS & SOS	S-NE	2.290–2.300 GHz SRS-DS	S-DS
3–6 GHz	C-Band		C		C
6–10 GHz	X-Band	8.025–8.400 GHz EESS 8.450–8.500 GHz SRS	X-NE	8.400–8.450 GHz SRS-DS	X-DS
10–17 GHz	Ku-Band	13.400–13.750 GHz EESS & SRS	Ku	12.750–13.250 GHz SRS-DS (secondary)	Ku
17–22 GHz	K-Band		K		K
22–32.5 GHz	Ka-Band	25.250–27.500 GHz ISS* 25.500–27.000 GHz EESS & SRS	Ka-NE	31.800–32.300 GHz SRS-DS	Ka-DS
32.5–40.5 GHz	Ka-Band	37.000–38.000 GHz SRS 37.500–40.500 GHz EESS (secondary)	Ka-S	37.000–38.000 GHz SRS	Ka-S
40.5–75 GHz	V-Band	65.000–66.000 GHz EESS & SRS	V		V
75–112 GHz	W-Band	81.000–84.000 GHz SRS (secondary)	W		W
112–275 GHz	mm	To Be Supplied (TBS)[2]	mm	TBS[2]	mm
TBS[2]	Optical 1064 nm	TBS[2]	O1	TBS[2]	O1
TBS[2]	Optical 1550 nm	TBS[2]	O2	TBS[2]	O2

ISS* = Inter-Satellite Service restricted to space research and Earth exploration-satellite data

[1] The commonly used 'letter band' designators, such as X-band or Ka-band, are not defined internationally for satellite communications, and the ITU discourages their use because of the related ambiguities.
[2] Precise values will be added in the future as actual frequencies for near Earth and deep space are allocated.

CCSDS Spacecraft Identification Field Code Assignment Control Procedures

- Unique SCID assignment domain for each Transfer Frame Version Number (TFVN) and Frequency Band (FB) combination (or bins)
  - TFVN: 1-4 (4 options)
  - FB: X, S-NE, Ka-DS, UHF, etc. (22 options)
- Concatenation of FB, TFVN and SCID is Qualified SCID (Q-SCID)
- “As long as the same TFVN and FB are used for uplink and downlink, only one SCID need be assigned.
- “The assignment process will attempt to assign the same SCID in each assignment domain, but this is not guaranteed.”

CCSDS Spacecraft Identification Field Code Assignment Control Procedures

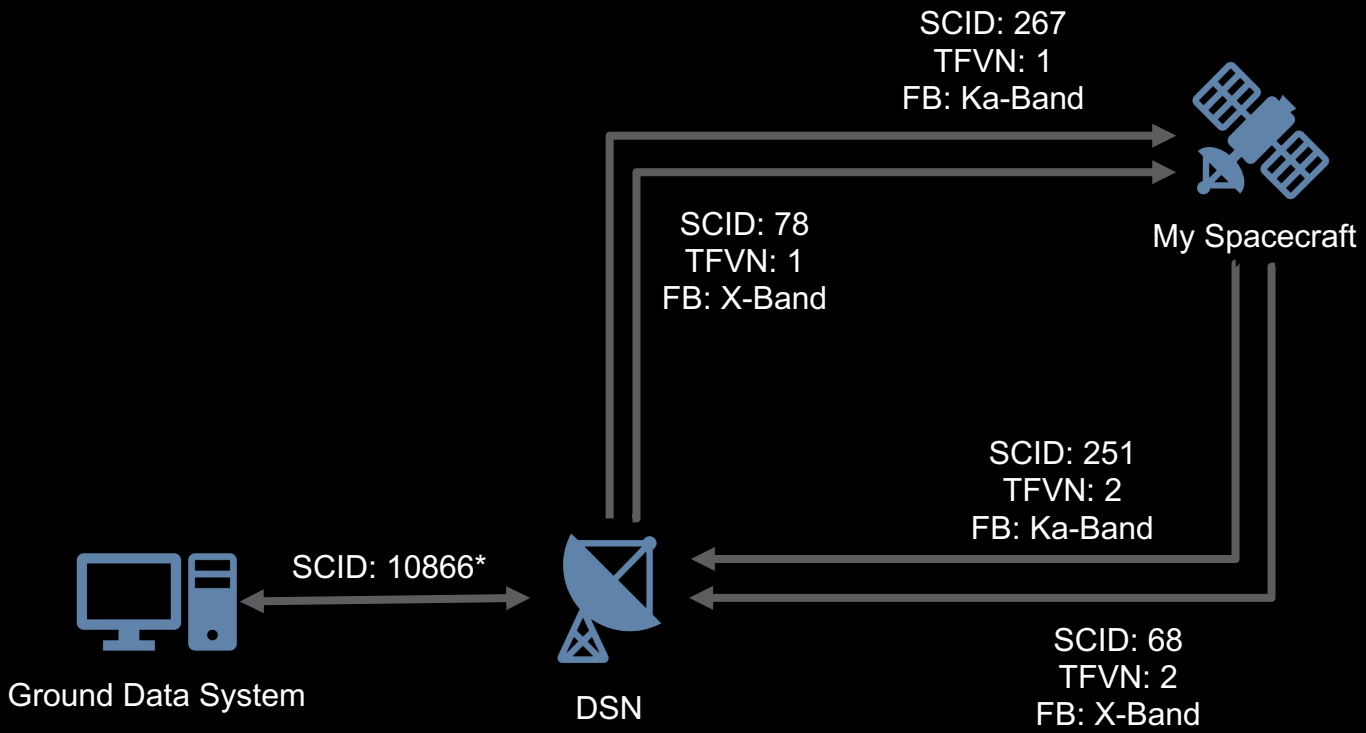
Status	Spacecraft	Scid	GSCID	QSCID	Version	Channel protocol	Frequency Band	Link Type
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x0A8	UHF-Band0A8	1	TC	UHF-Band	Forward
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x0A8	X-Band0A8	1	TC	X-Band	Forward
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x0A8	UHF-Band0A8	1	TLM	UHF-Band	Return
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x0A8	X-Band0A8	1	TLM	X-Band	Return
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x1A8	UHF-Band1A8	2	AOS	UHF-Band	Forward
Assigned	MARS-2020 [1.3.112.4.7.211]	0x00A8	0x1A8	X-Band1A8	2	AOS	X-Band	Forward

URL: https://sanaregistry.org/r/spacecraftid/?status=&spacecraft=211&scid=&scid_lookup=exact&version=&version_lookup=exact&channel_protocol=&frequency_band=&link_type=&oid=&filter=Apply+filters

Case Study: Psyche Mission

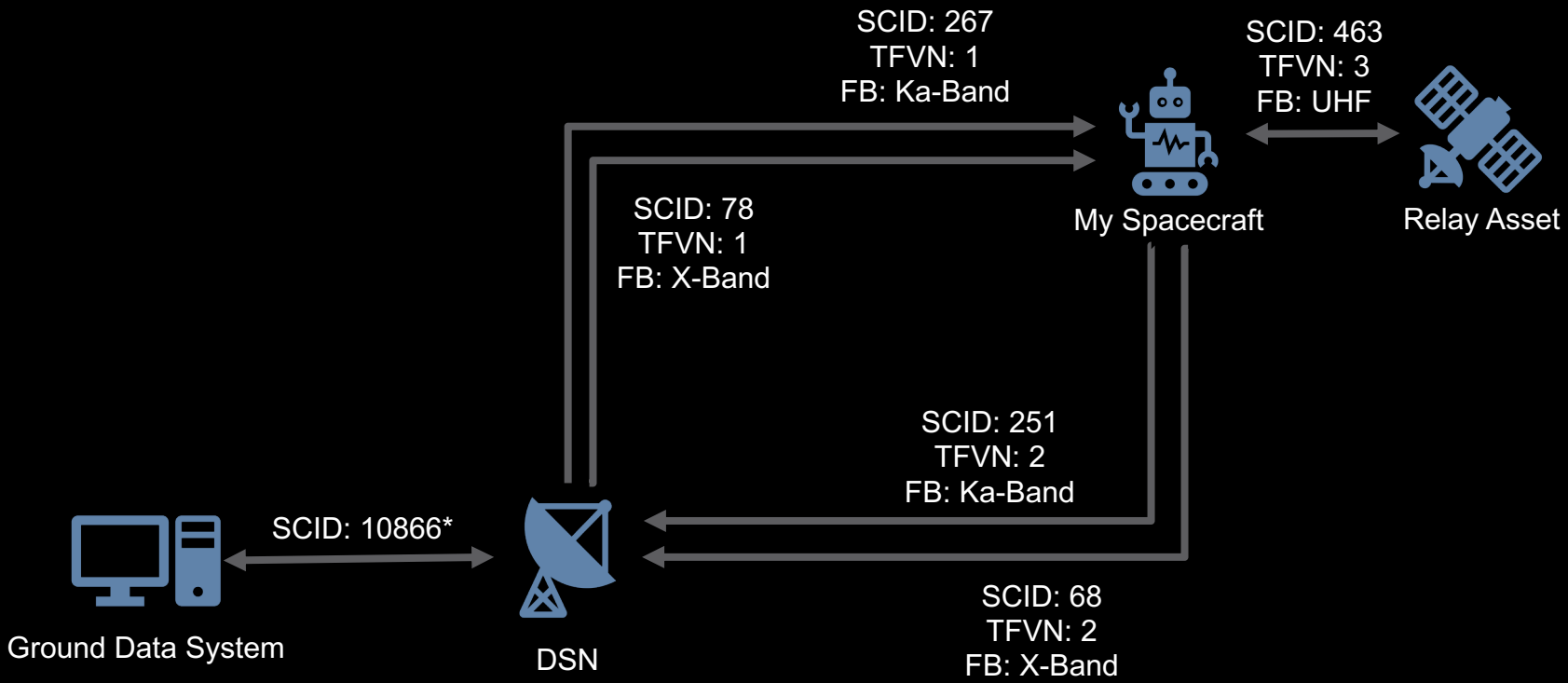
- Initially, SANA-assigned forward, return, and Deep Space Network (DSN)-assigned SCIDs for Psyche spacecraft were all different
- Much of AMMOS mission control software is designed for single SCID value per spacecraft
- Mission worked out a one-off solution with CCSDS and DSN: Forward, return and DSN SCIDs are now synchronized
- Solution may not be repeatable for future missions

Possible Future Scenarios



* DSN plans to extend the SCID range from 0-255 to 0-65535

Possible Future Scenarios



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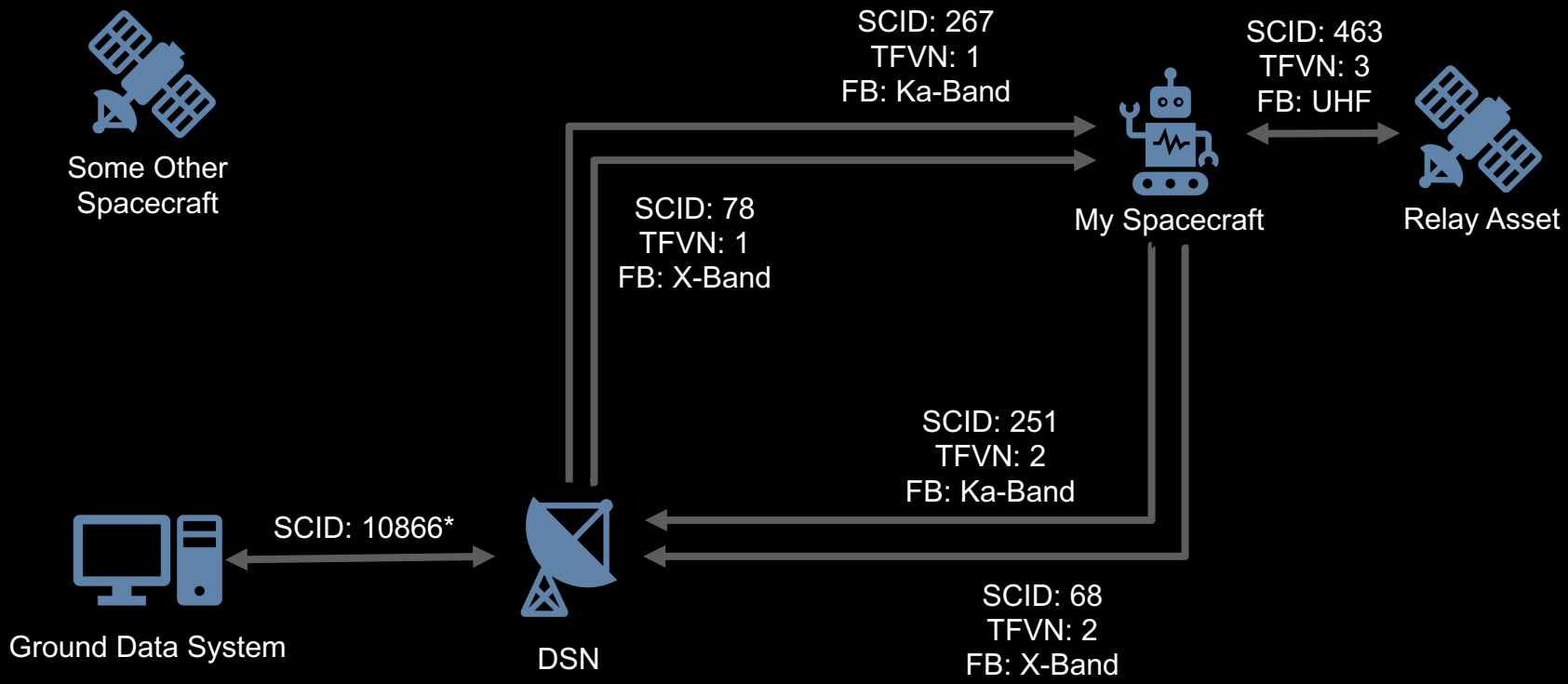

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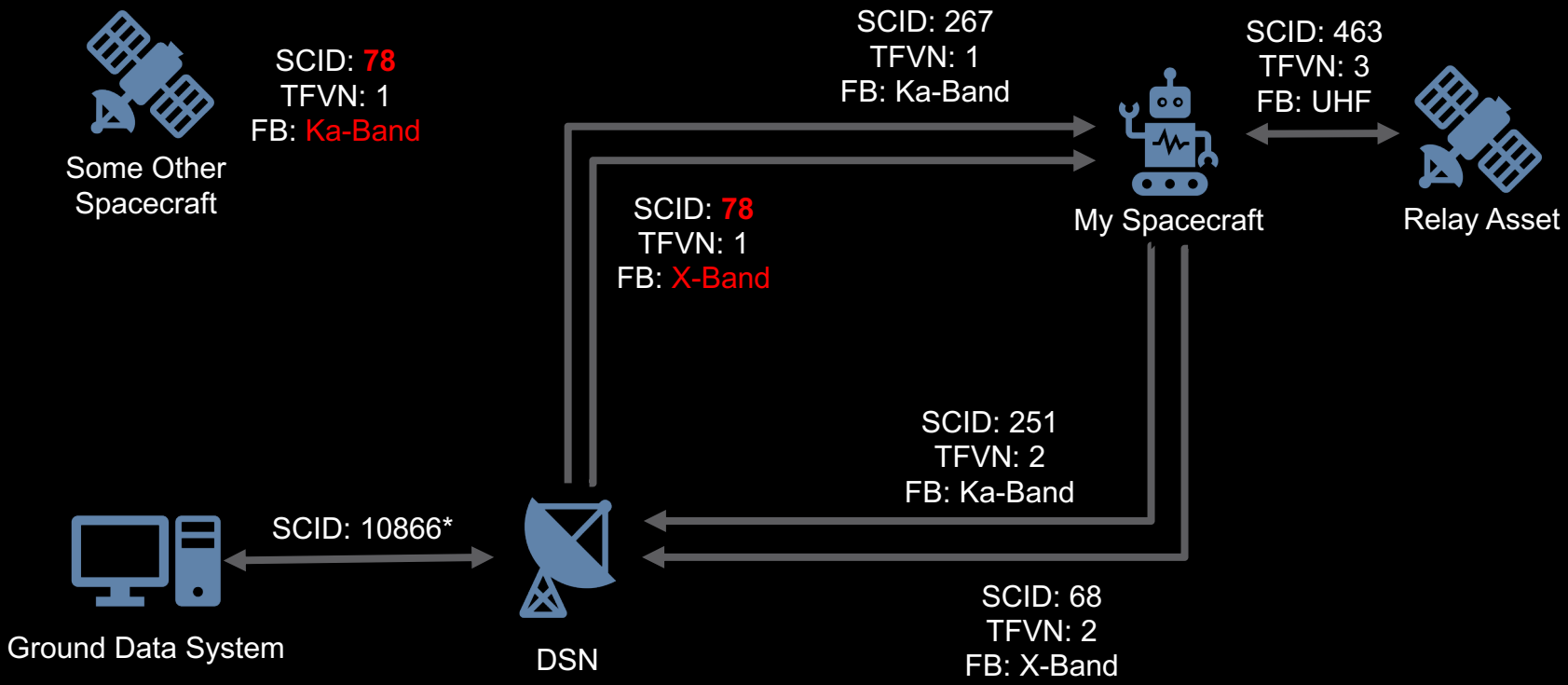

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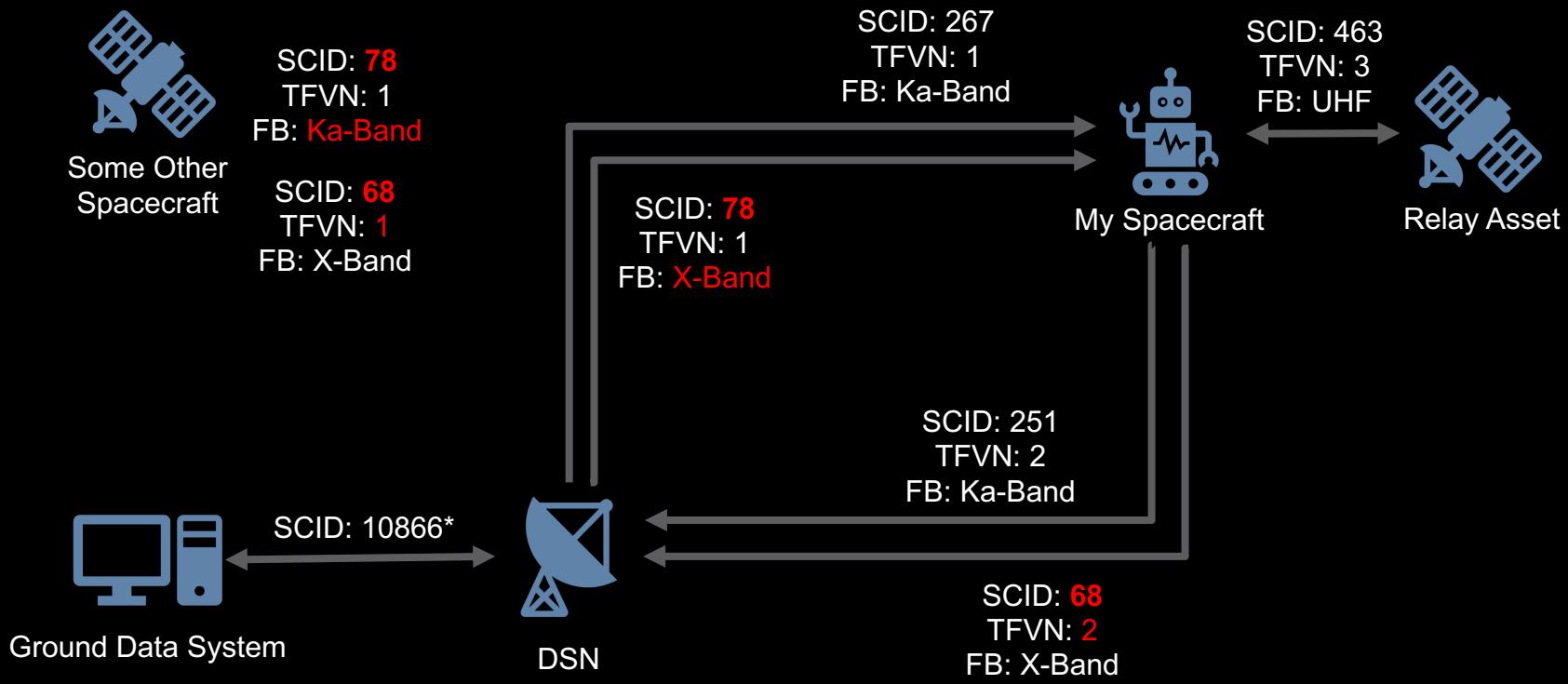

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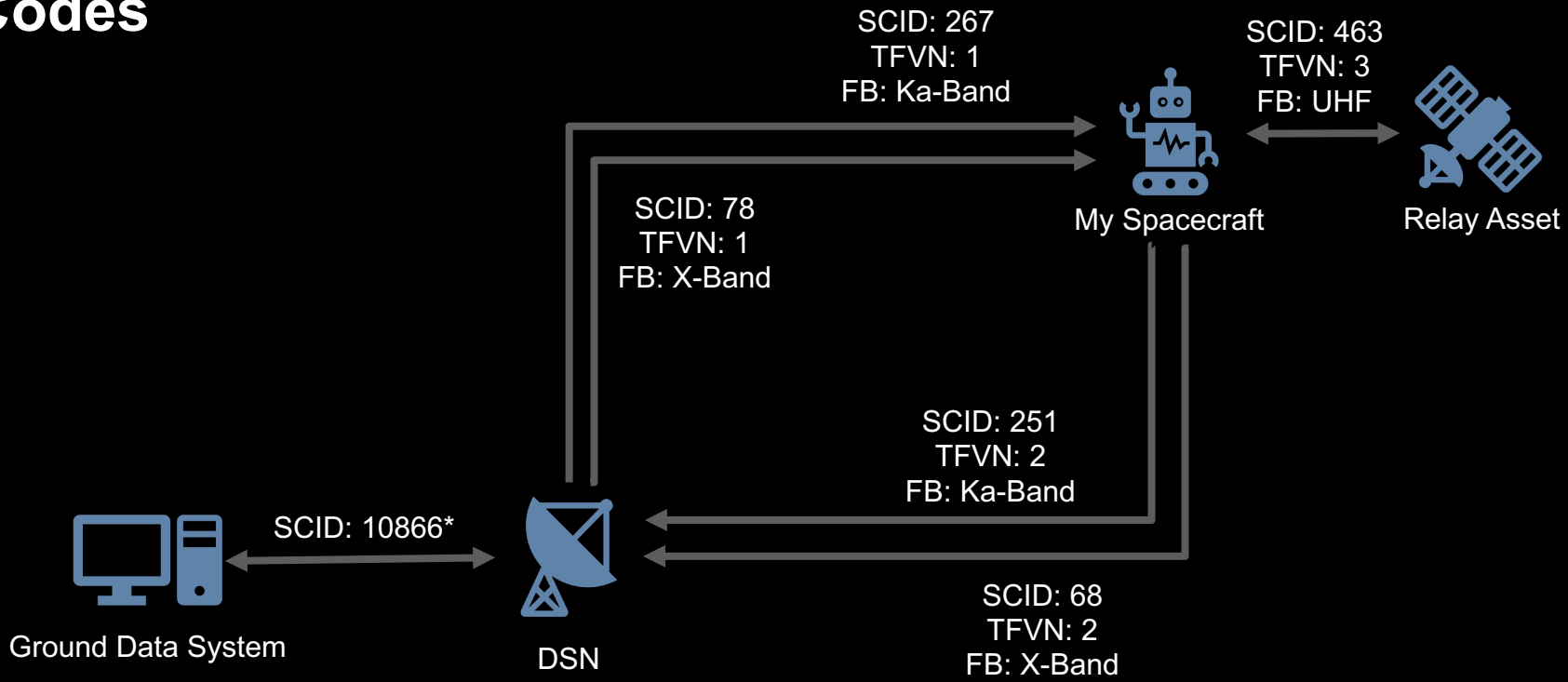
Object Identifiers (OIDs) and Spacecraft Identifier (SCID) Codes

- SANA assigns a globally unique, permanent Object Identifier (OID) to each spacecraft
- “As quickly as practical after reception of telemetry data, the SCID should be replaced with the OID, a globally unique, unambiguous, permanent label for the spacecraft and/or payload data set(s) that is independent of the SCID.
- “Thereafter, access to and identification of these data sets should be by means of this OID, or by some other agency assigned identifier, rather than the SCID field…”

Object Identifiers (OIDs) and Spacecraft Identifier (SCID) Codes



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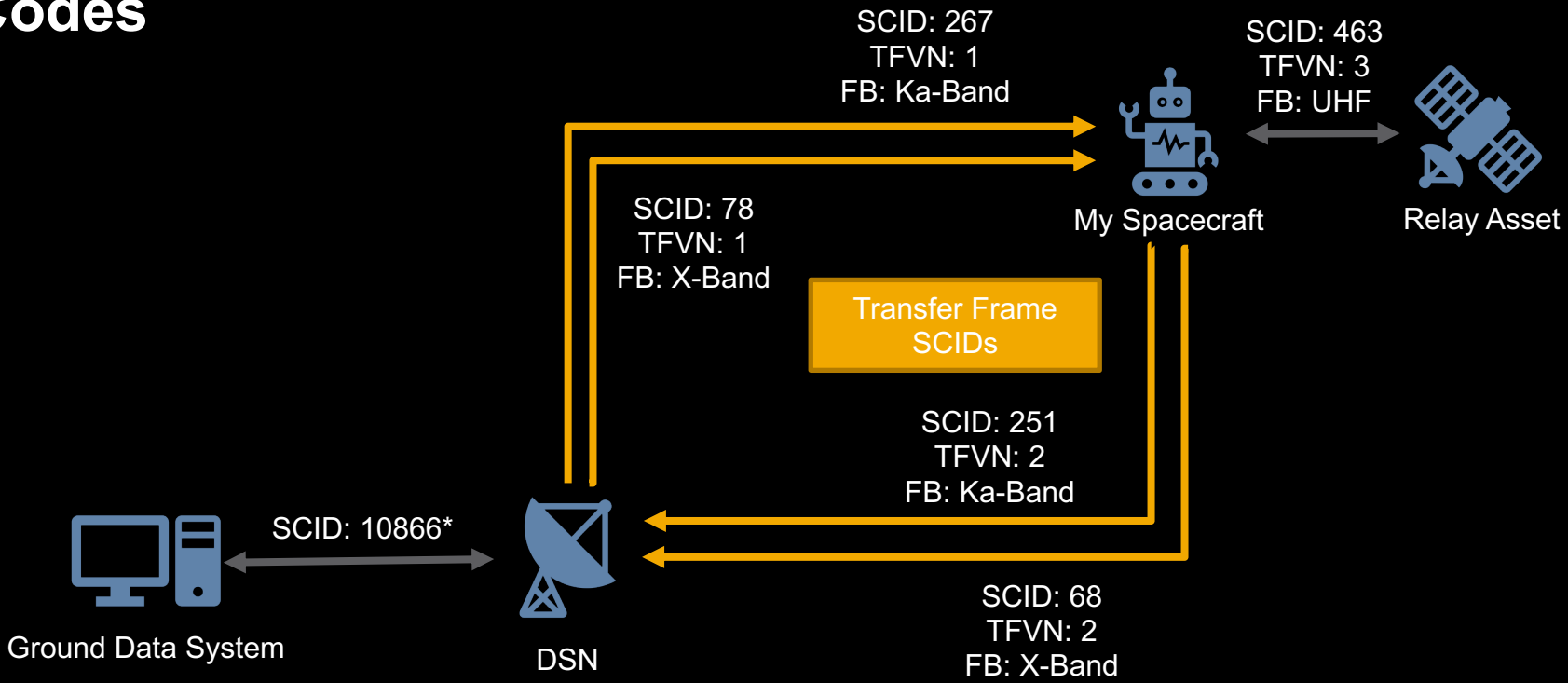

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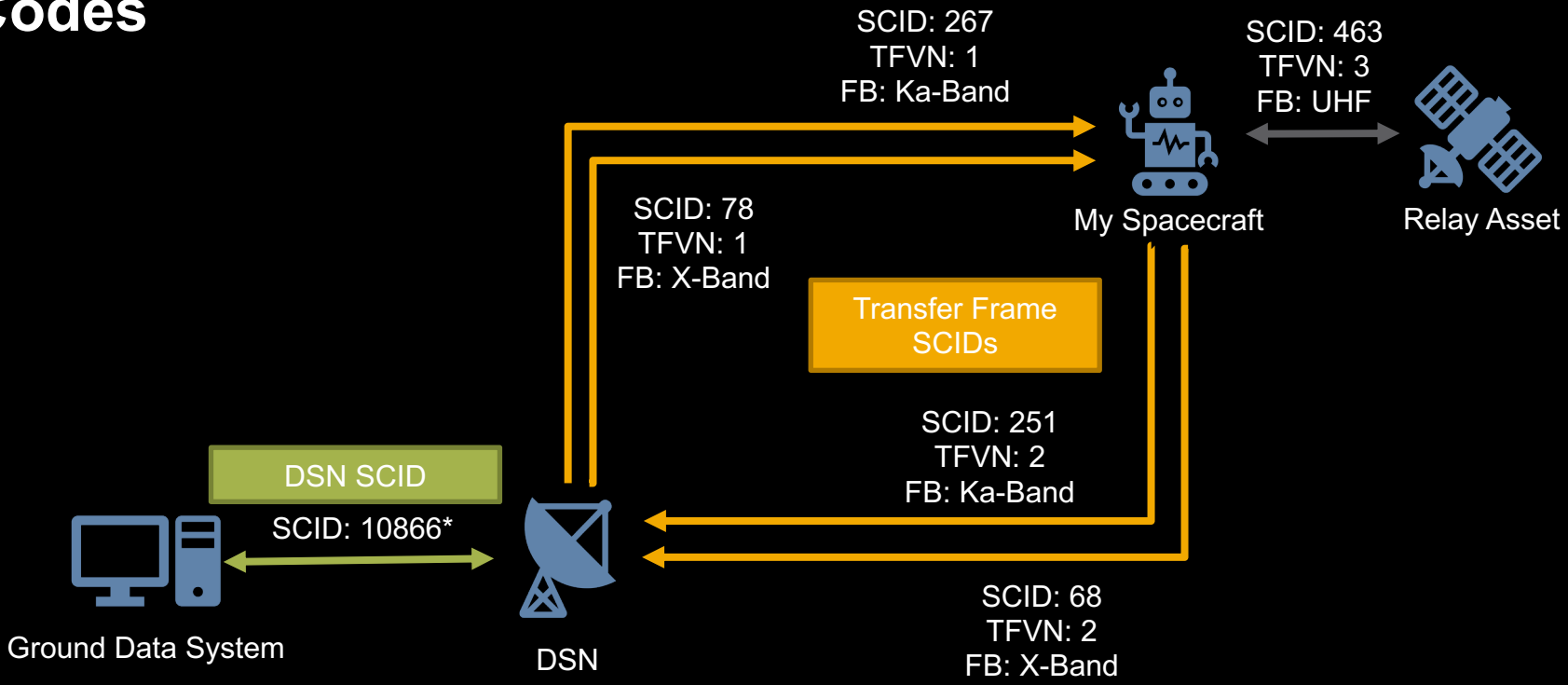

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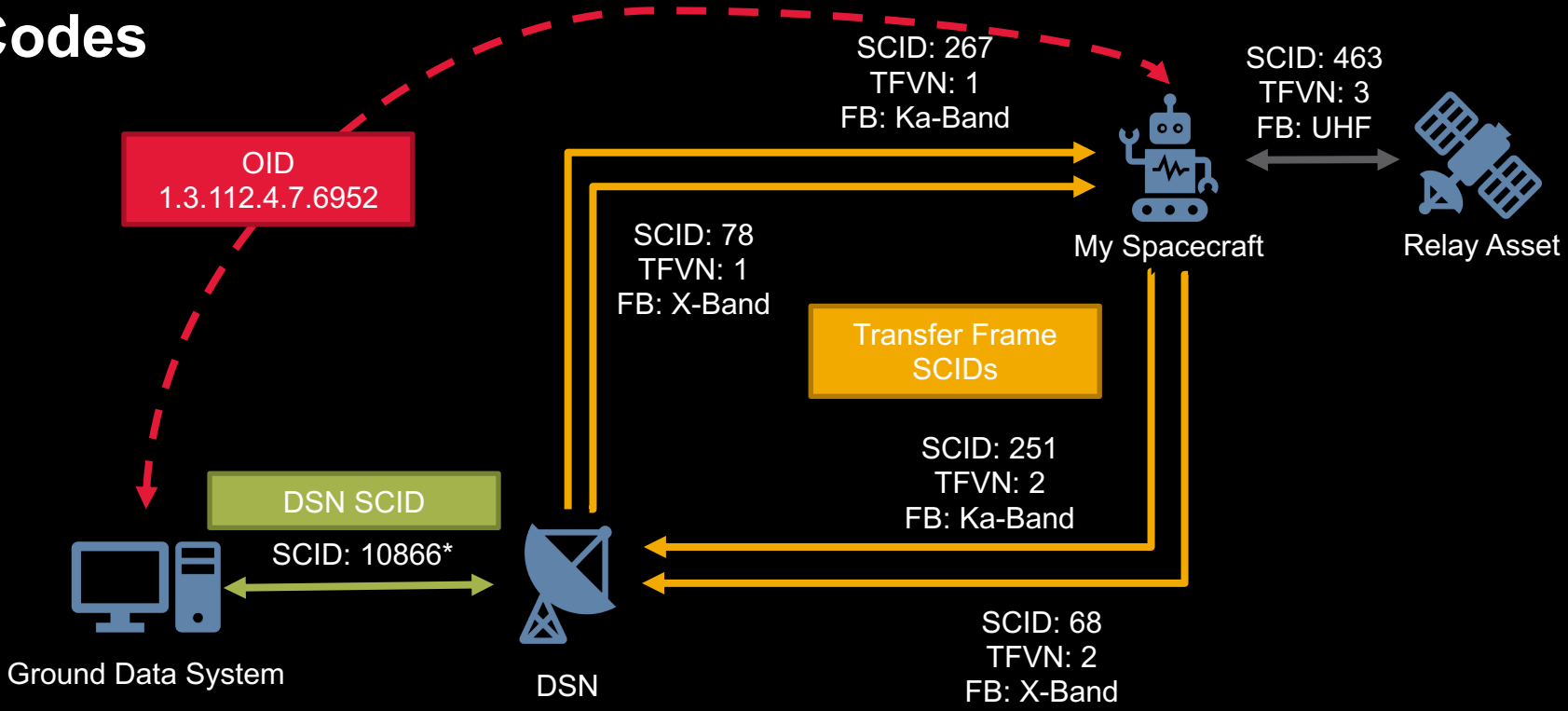

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AMMOS Operational Concept

- ‘All functional areas/subsystems of the AMMOS that require use of spacecraft identifiers to process, manage, and/or store spacecraft data shall utilize a globally unique, unambiguous, permanent label for the spacecraft that is based on the ISO OID.’
  — Multimission Ground Systems and Services (MGSS) Program Chief Engineer and System Engineering Office; Oct. 21, 2021

AMMOS Operational Concept

- This year (2022), all applicable AMMOS software will be updated to use OIDs as the primary identifier for spacecrafts and their data
- Maintain support for DSN SCID, but only for DSN interface and no longer *the* spacecraft identifier
- Add support for multiple transfer frame SCIDs per spacecraft

AMMOS Operational Concept

- AMMOS mission control software will allow user to select transfer frame (TF) SCIDs for return link, for each session
- User needs to select single TF SCID for forward link
- Each installation is for one mission, with one or more spacecrafts; each spacecraft associated to one or no OID in configuration

Summary

- OIDs should be the authoritative identifier for spacecrafts and data outside of space data link (or RF) domain, to both avoid problems and improve interoperability
- If spacecraft uses more than one TFVN and/or FB, assume different SCIDs will be assigned
- DSN-using missions also need to handle DSN-unique SCID assignments

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