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Optimising

S-57 to S-101 conversion

Aims and Objectives

- Aims
  - Systematically, Look at how existing S-57 data could be “optimised” to prepare data for conversion to S-101
  - Examine current converter technology and process, process and results
  - Report, summarise and suggest next steps
- The story so far…
  - Existing tools, ESRI converter, SPAWAR viewer, ENC viewers, other
  - Data contributed by member states
  - Developed a systematic methodology
  - Carried out intensive data conversion and evaluated results
  - Detailed UOC vs DCEG comparison
  - Reporting to TSM Busan
  - Further detailed work on selected areas and supporting theory

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Background

- Project goals are to systematically look at data conversion
  - S-57 data to S-101 data
  - Driven by UOC/DCEG
- Memories of HHIWG 2006
  - Comparison of model for DNC and ENC
  - S-57/S-101 are much more similar models
- Update to that process
- Looking at the bigger picture

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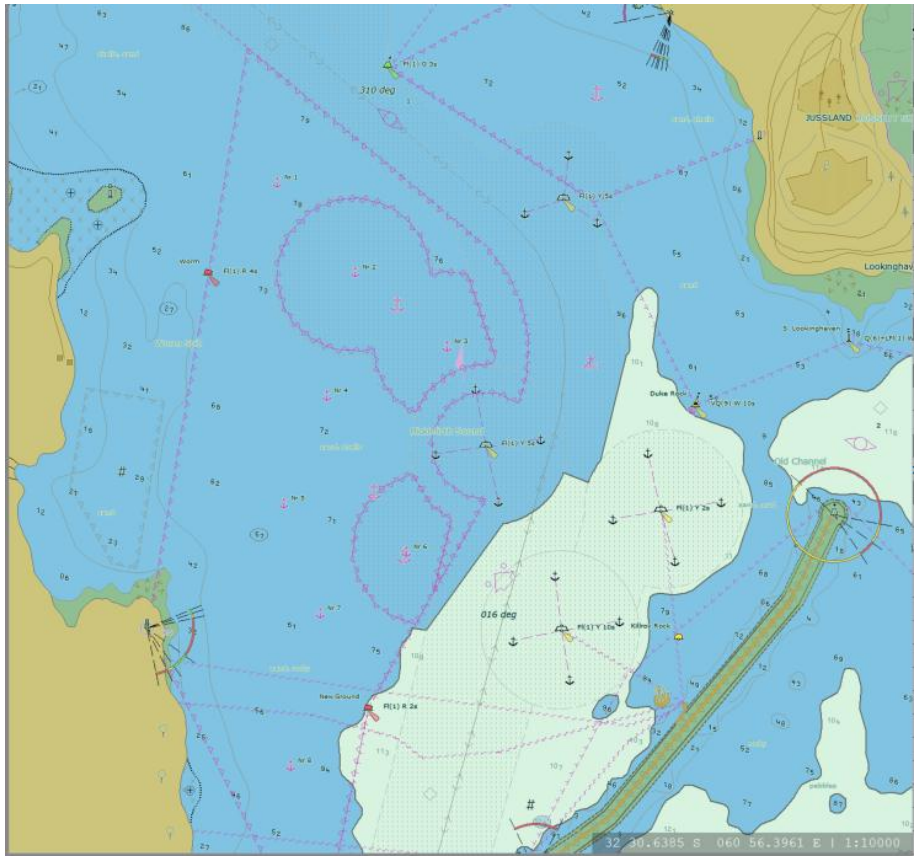
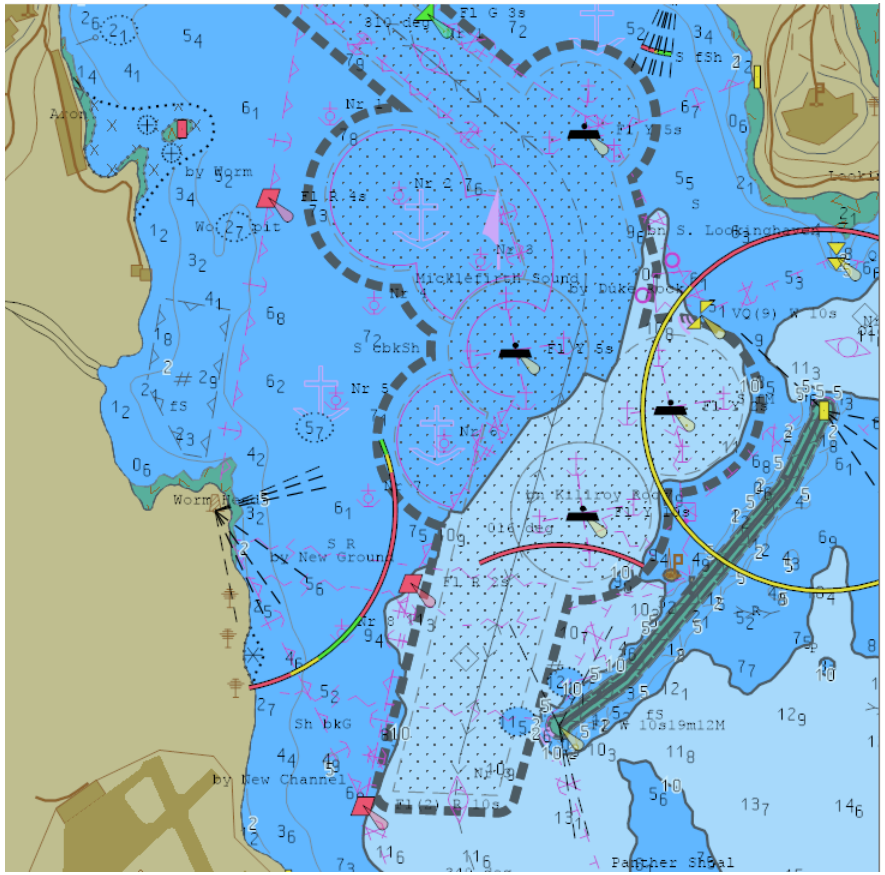
The Short Version





The Short Version:

- Conversion basically works. You can convert S-57 into a form of S-101 and display them side by side
- There are complexities in the encodings though – some detail in this presentation
- It is possible to treat data beforehand to make it convert “better”
- We don’t know what “better” is yet….
- The conversion coverage you get depends on your converter capabilities

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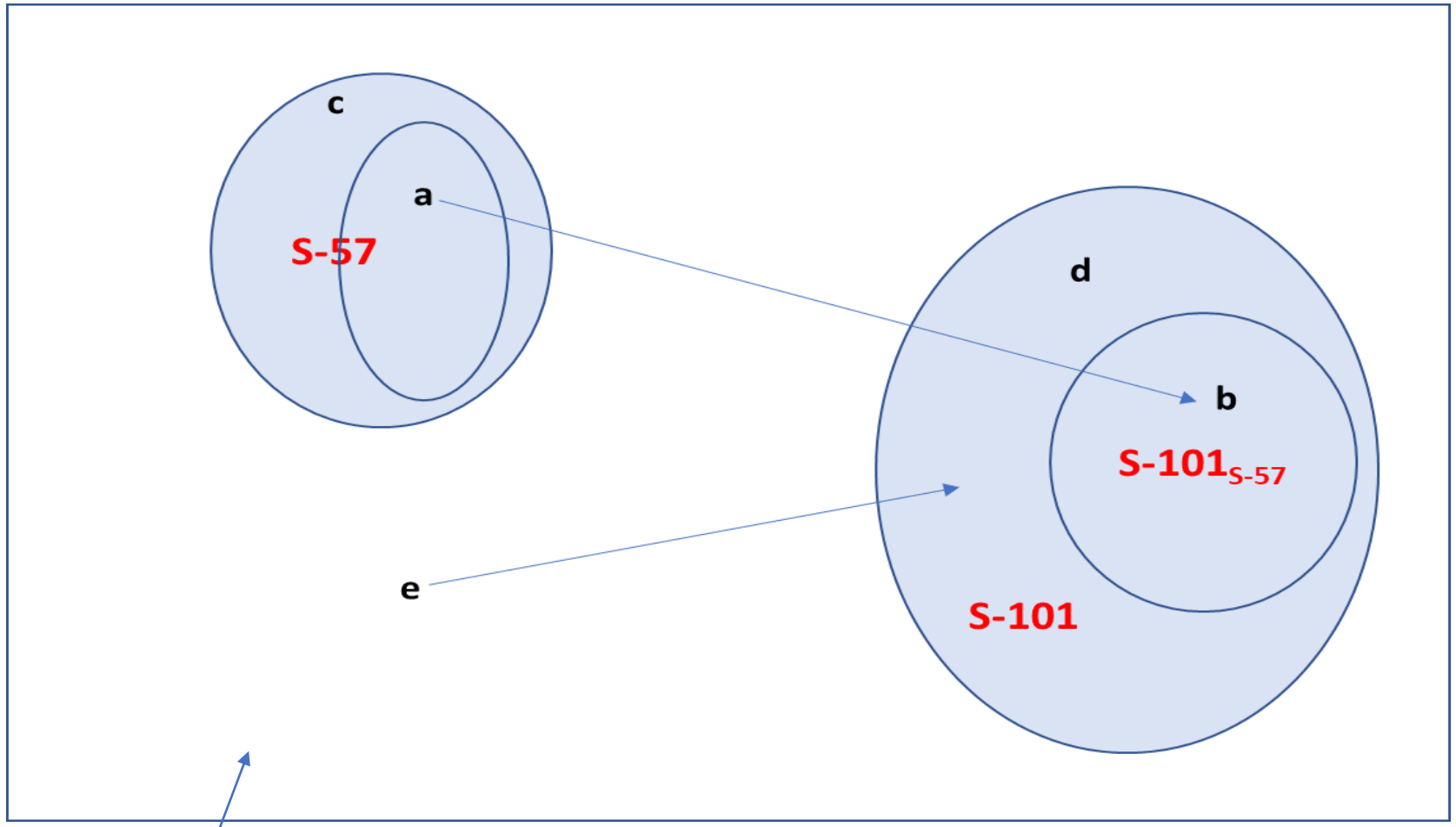
Where we start: Feature Categories



(a) Things in S-57 which can be translated into an S-101 equivalent without loss

(b) The domain of features defined by the S-57 source

(c) Anything in S-57 which can't be (or doesn't need to be) translated into an S-101 equivalent

(d) Features defined in S-101 which currently have no defining mechanism in S-57

(e) Real world features which previously had no representation in S-57 which are now expressible in S-101 (these are encoded into features (d)).

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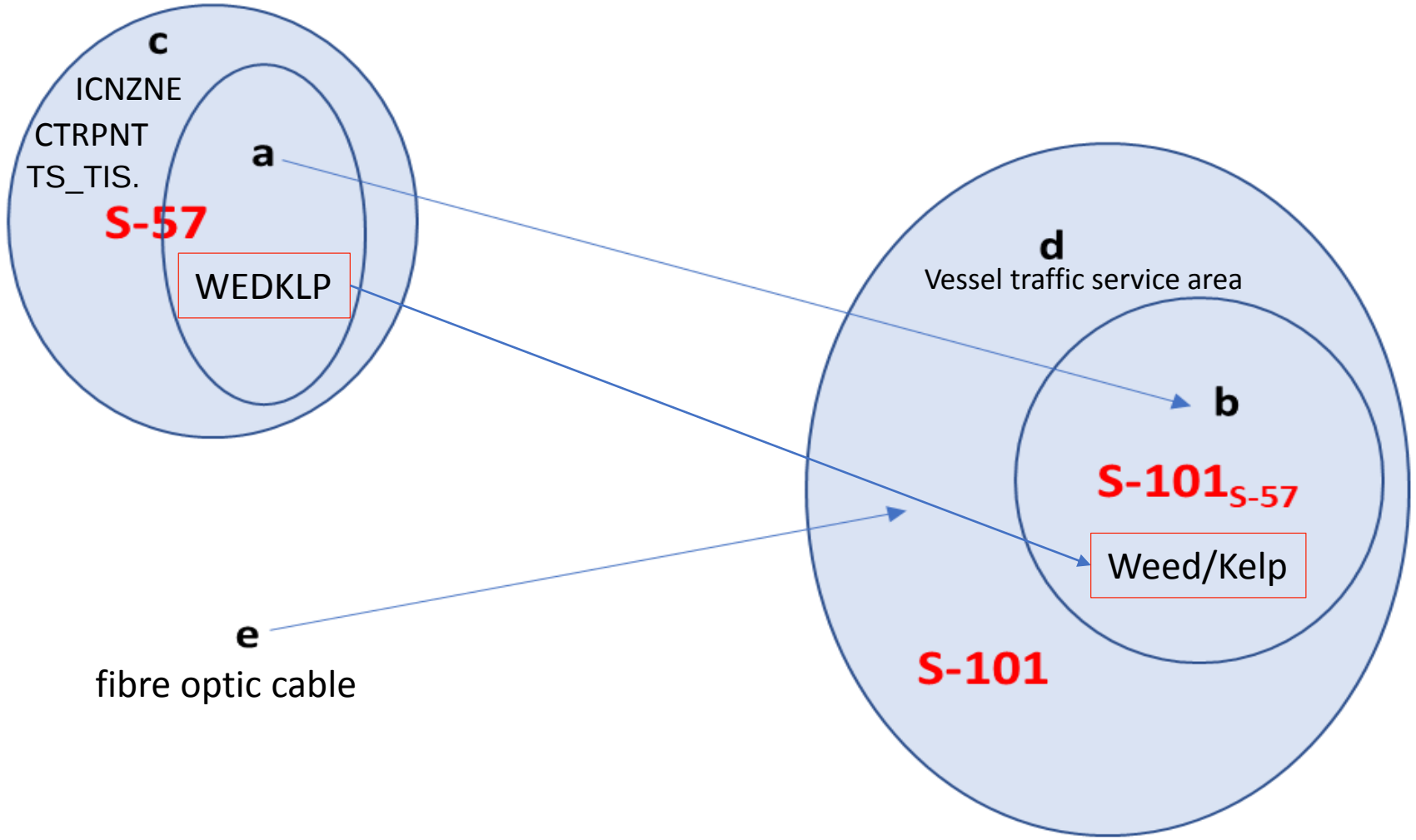
Categories of features



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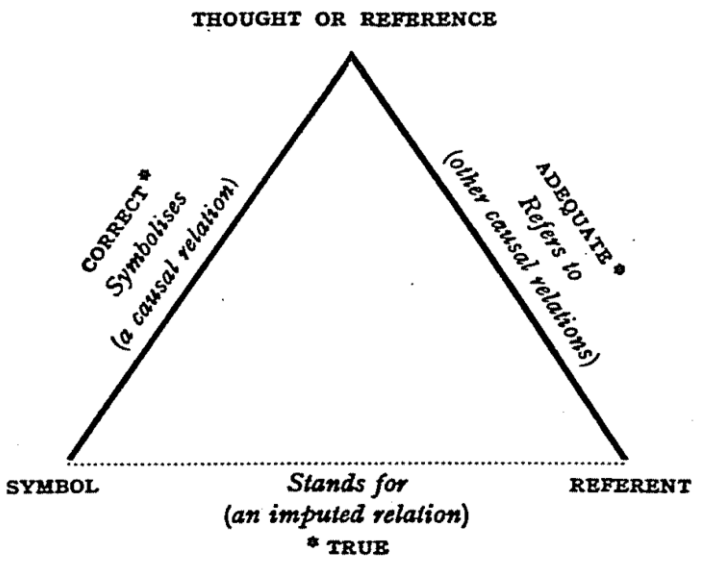
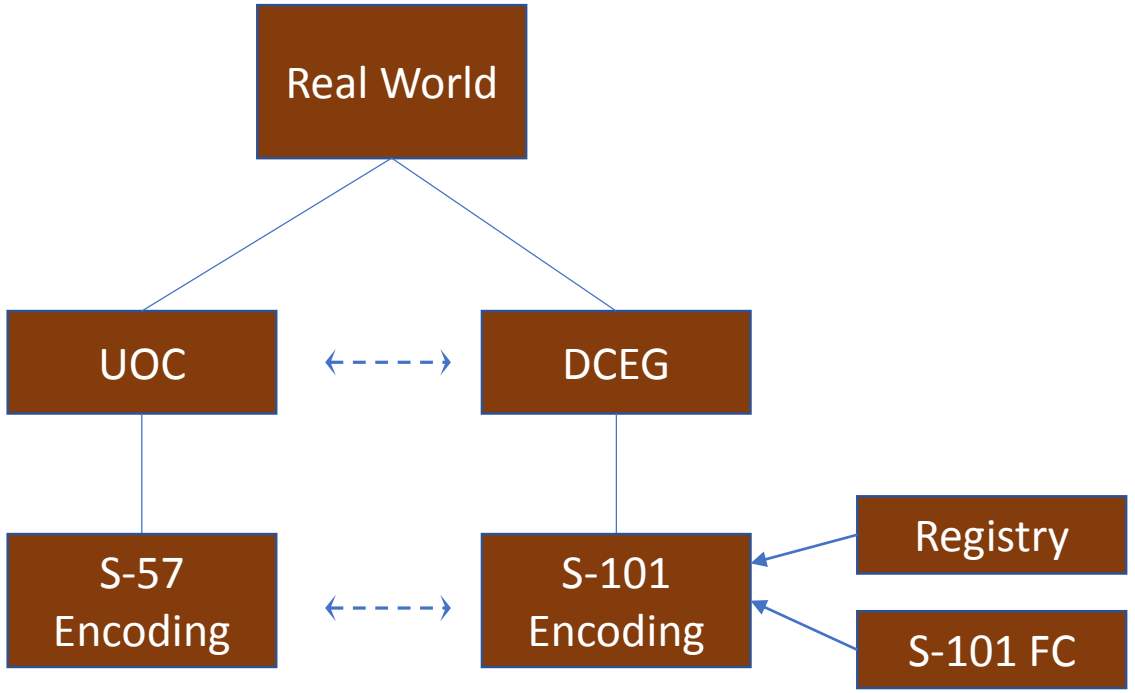
Why is the UOC important? semiotics, catalogues and encoding…

Cartosemiotics





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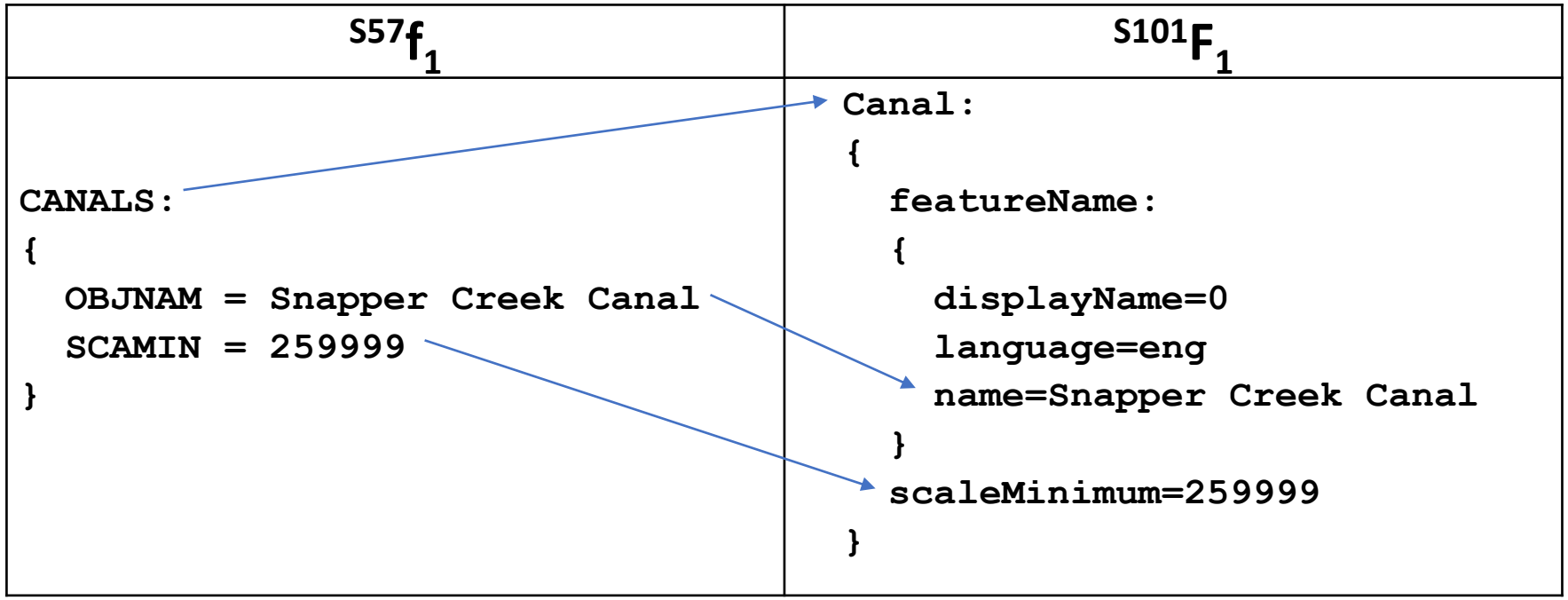
Simple transformation of a feature.



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A slightly more complex transformation

S57 f_2	S101 F_2
BOYSPP: { BOYSHP = 1 CATSPM = 27 COLOUR = 1,11 COLPAT = 1 INFORM = Danger shoal OBJNAM = Miami Springs Boat Club Shoal Buoy *SORDAT = 20050628* *SORIND = US,US,reprt,7thCGD,LNM 26/05* STATUS = 8 SCAMIN = 179999 }	BuoySpecialPurposeGeneral: { buoyShape=1 categoryOfSpecialPurposeMark=27 colour=1 colour=11 colourPattern=1 featureName: { displayName=0 language=eng name=Miami Springs Boat Club Shoal Buoy } status=8 scaleMinimum=179999 } additionalInformation provides { SupplementaryInformation: { language=eng text=Danger shoal } }

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Categories of transformation

- Types of transformation
- Dictionary – where a feature or attribute acronym maps to a single equivalent
  - LNDARE -> Land Area
  - VERLEN -> Vertical Length
  - SNDWAV -> Sandwaves
- More complex dictionary – where a feature or attribute maps to more than one equivalent
  - OBJNAM ->Feature Name
- Increasing levels of complexity
  - Multi feature or multi-attribute
  - Conditional

$S57f_1$	$S101F_1$
CANALS: { OBJNAM = Snapper Creek Canal SCAMIN = 259999 }	Canal: { featureName: { displayName=0 language=eng name=Snapper Creek Canal } scaleMinimum=259999 }

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Examples: Simple

- Fish Havens

S57	S101
OBSTRN: { CATOBS=5 }	Obstruction: { categoryOfObstruction=5 }

11.9.3 Fish havens (see S-4 – B-447.5)

If it is required to encode a fish haven, it must be done using an **OBSTRN** object (see clause 6.2.2), with attribute CATOBS = *5* (fish haven).

13.10.2 Fish havens (see S-4 – B- 447.5)

If it is required to encode a fish haven, it must be done using an **Obstruction** feature (see clause X.X), with attribute **category of obstruction** = *5* (fish haven).

Distinction: Fishing facility; obstruction.

11.13.2 Log ponds (see S-4 – B-449.2)

If it is required to encode a log pond, it must be done using the object class **LOGPON**.

Geo object: Log pond (**LOGPON**) (P,A)
Attributes: NOBJNM OBJNAM STATUS INFORM NINFOM

INT 1 Reference: N 61

16.20.1 Log ponds (see S-4 – B-449.2)

If it is required to encode a log pond (also known as booming ground), it must be done using the feature **Log Pond**.

Remarks:
- Seasonal log ponds should be encoded using the complex attribute **periodic date range**.
- It is not required to separately encode any posts, piles or other log pond barrier supports.

Distinction:

If only life were always this simple….

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Examples: Multiple meanings

- M_NSYS
- Can be NavigationalSystemOfMarks or LocalDirectionOfBuoyage
- Also requires underlying M_NSYS vale for MARSYS

M_NSYS: **{** **MARSYS = 2** **}**	**NavigationalSystemOfMarks:** **{** **marksNavigationalSystemOf=2** **}**
M_NSYS: **{** **MARSYS =** **ORIENT = 248.4** **}**	**LocalDirectionOfBuoyage:** **{** **marksNavigationalSystemOf=1** **orientation=248.4** **}**

Within a data set, there may be some areas where the direction of buoyage is defined by local rules and must, therefore, be specified. These areas should be encoded as separate **M_NSYS** area objects, with the attribute ORIENT indicating the direction of buoyage (MARSYS must not be encoded). **M_NSYS** objects with a value encoded for ORIENT must not overlap, but in areas where local buoyage directions apply, **M_NSYS** with a value encoded for ORIENT may overlap **M_NSYS** with a value encoded for MARSYS (see Figure 16 below).

Remarks:

- The mandatory attribute **marks navigational – system of** is required for ECDIS portrayal, and must be populated with the same value as populated for the **marks navigational – system of** on the underlying **Navigational System of Marks** feature.

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More Complex

```
C_ASSO:
{
  OBJNAM = Los Coronados
  FFPT = 2602C6EC940BE211
  FFPT = 2602C5EC940BE211
  FFPT = 2602C8EC940BE211
  FFPT = 2602BEEC940BE211
}
LNDARE (2602C6EC940BE211):
{
  OBJNAM = North Coronado
}

LNDARE (2602C5EC940BE211):
{
  OBJNAM = Middle Coronado
}

LNDARE (2602C8EC940BE211):
{
}

LNDARE (2602BEEC940BE211):
{
  OBJNAM = South Coronado
}
```

```
IslandGroup:
{
  featureName:
  {
    displayName=0
    language=eng
    name=Los Coronados
  }
}
islandAggregation consistsOf
{
    LandArea:
    {
      featureName:
      {
        displayName=0
        language=eng
        name=North Coronado
      }
    }
}
islandAggregation consistsOf
{
    LandArea:
    {
      featureName:
      {
        displayName=0
        language=eng
        name=Middle Coronado
      }
    }
}
islandAggregation consistsOf
{
}
```

- Examples where multiple transformations are needed
- Simple -> Complex Attribution
- Associations C_ASSO -> Island Group

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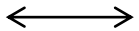
Creation of New Information

- New Features

11.13.5 Collision regulations

Some nations have introduced collision regulations (COLREG's) that may include demarcation lines differentiating between inland water rules and International Rules as a result of the Convention on the International Regulations for Preventing Collisions at Sea 1972. If it is required to encode COLREG's, it should be done using a narrow **CTNARE** object of type area (see clause 6.6) covering the demarcation line, with attribute INFORM and/or TXTDSC containing a short explanation about the regulation, (e.g. cautionary note from the paper chart). The attribute TXTDSC may be used instead of INFORM, or for longer explanations or notes.



16.26.1 Collision regulations limit (see S-4 – B-XXX)

If it is required to encode a collision regulations (COLREGs) demarcation line, it must be done using the feature **Collision Regulations Limit**.

Remarks:

- If it is required to encode the national regulation citation it must be done using the attribute **regulation citation**.

Distinction: Administration area.

- New Attribution

If it is required to encode a submarine cable, it must be done using the object class **CBLSUB**.

Geo object: Cable, submarine (**CBLSUB**) (L)
Attributes: BURDEP - if the buried depth varies along the cable, the cable must be encoded as several objects.
CATCBL - *1* - power line.
4 - telephone.
5 - telegraph.
6 - mooring cable/chain.
if encoded, the value of CATCBL must be one of the above.
CONDTN - *1* - under construction (during laying).
5 - planned construction (planned laying).
if encoded, the value of CONDTN must be one of the above.
DATEND DATSTA DRVAL1 DRVAL2 NOBJNM OBJNAM
STATUS - *4* - not in use (disused).
~~VERDAT~~ INFORM NINFOM

Remarks:

- Where a cable is disused, it should be encoded with the attribute STATUS = *4* (not in use (disused)), and the attribute CATCBL should not be encoded.

	Acronym	Value		
Buried depth	(BURDEP)		RE	0,1
Category of cable	(CATCBL)	1 : power line 6 : mooring cable/chain 7 : ferry 8 : fibre optic cable	EN	0,1
Condition	(CONDTN)	1 : under construction 5 : planned construction	EN	0,1
Feature name			C	0,*
Display name			(S) BO	0,1
Language		ISO 639-1	(S) TE	0,1
Name	*(OBJNAM)* *(NOBJNM)*		(S) TE	1,1
Fixed date range			C	0,1
Date end	(DATEND)	ISO 8601: 2004	(S) TD	0,1
Date start	(DATSTA)	ISO 8601: 2004	(S) TD	0,1
Status	(STATUS)	1 : permanent 4 : not in use 13 : historic 18 : existence doubtful	EN	0,*
Scale minimum	(SCAMIN)	See clause X.X	IN	0,1

Deletion of Old Information

- Some Features have been deleted
- Many feature/attribute combinations have been prohibited (after extensive consultation)
- Coincident point features – still needed?

Boatshed. If the service being provided by the structure is known, object classes **SMCFAC** (see clause 4.6.5) or **HRBFAC** (see clause 4.6.1) may also be encoded.

- If it is required to encode an offshore building, landmark or silo/tank, an ECDIS Base Display object (e.g. **PILPNT**, **LNDARE**, **PONTON**) must also be encoded coincident to ensure the feature is always displayed on the ECDIS. Where fitted, lights should be encoded as described in clause 12.8, with the **BUISGL**, **LNDMRK** or **SILTNK** being used as the structure object for the **LIGHTS** equipment object(s) (see clause 12.1.1).
- For encoding offshore windmotors, see clause 11.7.4.

Facility (see clause X.X) may also be encoded.

- For buildings located in or over navigable water, the Boolean attribute **in the water** must be set to *True* to indicate that the feature is to be included in the ECDIS Base Display. Where such structures are located over the water it is not required to encode any supporting structures (for example piles, stilts).
- The complex attribute **vertical clearance fixed** must not be populated, unless the building is located over

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INFORM

- INFORM attribution is extensive in most member state data
- Covers many categories:
  - Structured Text as specified in UOC
  - Specified by UOC, no fixed structure
  - Determined by member state local UOC guidance (e.g. Fibre optic cables)
  - Ad Hoc.

> - The text "Discoloured water" on the source indicates the probable existence of shallow water. This should be encoded using a **CTNARE** object with attribute INFORM or TXTDSC containing a cautionary note (see clause 6.6).

- Could be used as source for new features / attribution for a suitably configured converter

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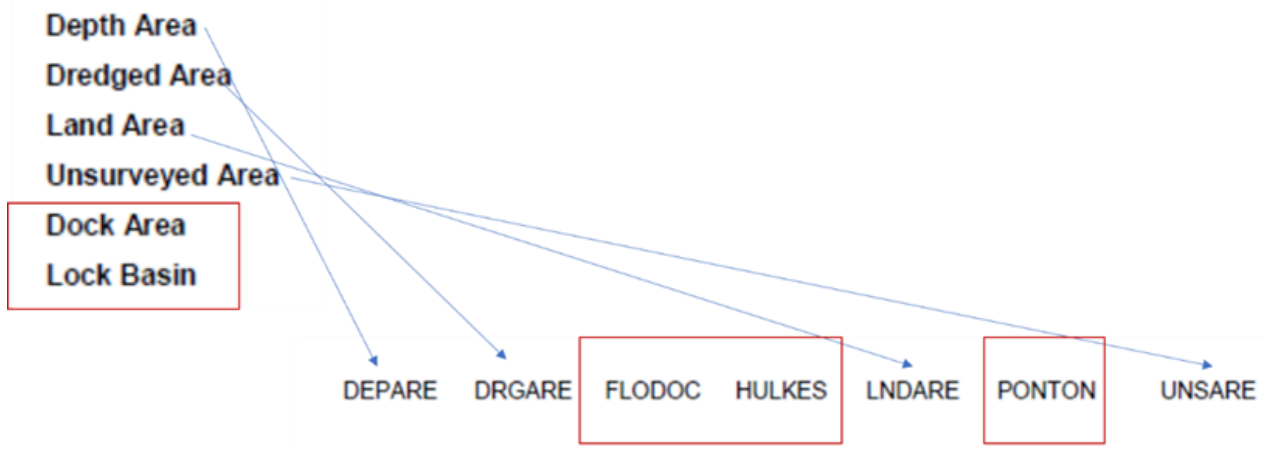
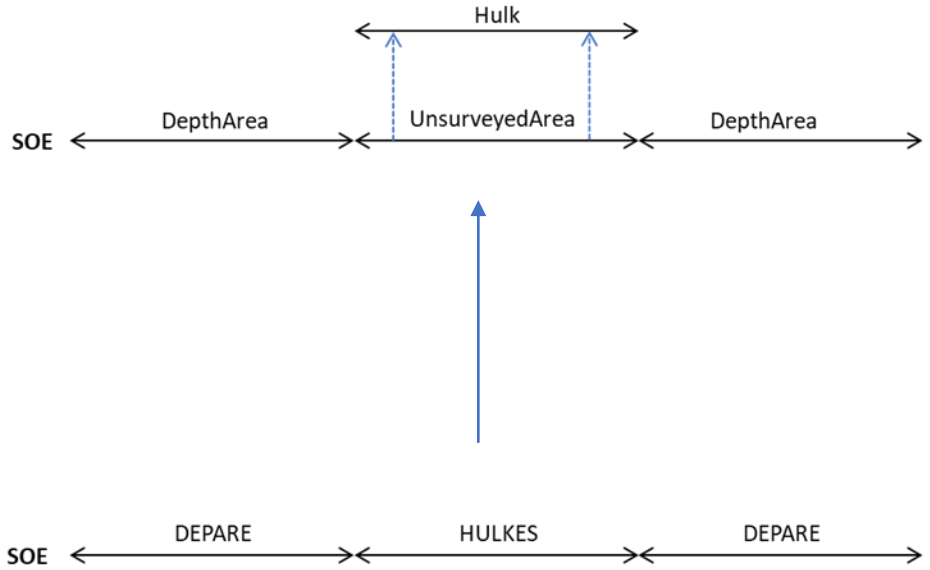
Group 1 / Skin of the Earth Features



- Skin of the Earth Features have changed
- To convert to S-101, requires
  - Filling in area left by old SOE
  - New Holes in existing SOE to accommodate new features



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Consolidated Recommendations

- Look at any issues that might be caused by deletion of feature classes, attributes and primitives
- Look at changes to feature attribution bindings from the baselined S-101 feature catalogue. Changes to bindings should be evaluated at a policy level then for specific cases
- Geometry generally isn't generally an issue. Changes to Group 1/SOE features should be evaluated to check they conform to MS requirements.
- Audit current INFORM attribution against new S-101 features and attribution
- Evaluate if INFORM could be used to populate S-101 cell information
- Identification of features not expressible in S-57 but existing in S-101. What alternative encodings could there be for conversion?
- General review of individual member state encoding guidelines against new DCEG.
- This is a "Work in progress" – the existing converter will be upgraded/changed and DCEG will evolve.
- Consider the Bigger Picture

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Other recommendations

- Conversion from S-57 to S-101 is a specific case of a more general transformation from data from one domain to another
- The S-101 domain has a feature catalogue which exhaustively describes it. No corresponding feature catalogue exists for S-57 – one could be defined. This would help both assessment and conversion technology
- Transformations between these domains can be seen with increasing levels of complexity
  - Dictionary transformation
  - Feature to Feature including attribution transformation
  - Those involving Associations / Aggregations
  - Dataset level transformation

  A way of describing these could be defined which would clarify the equivalence between the UOC and the DCEG in a machine-readable way.
- Until an equivalent to S-58 exists it is difficult to be objective about the “success” of any conversion
- No universal model of how member states migrate from S-57 outputs to S-101 outputs currently exists. The readiness level of conversion/transformation processes should have a place in that transition.
- Need to consider ECDIS operation too!

$S57f_3$	$S101F_3$
OBSTRN: { INFORM = Submerged Weir }	Dam: { waterlevelEffect = 3 }

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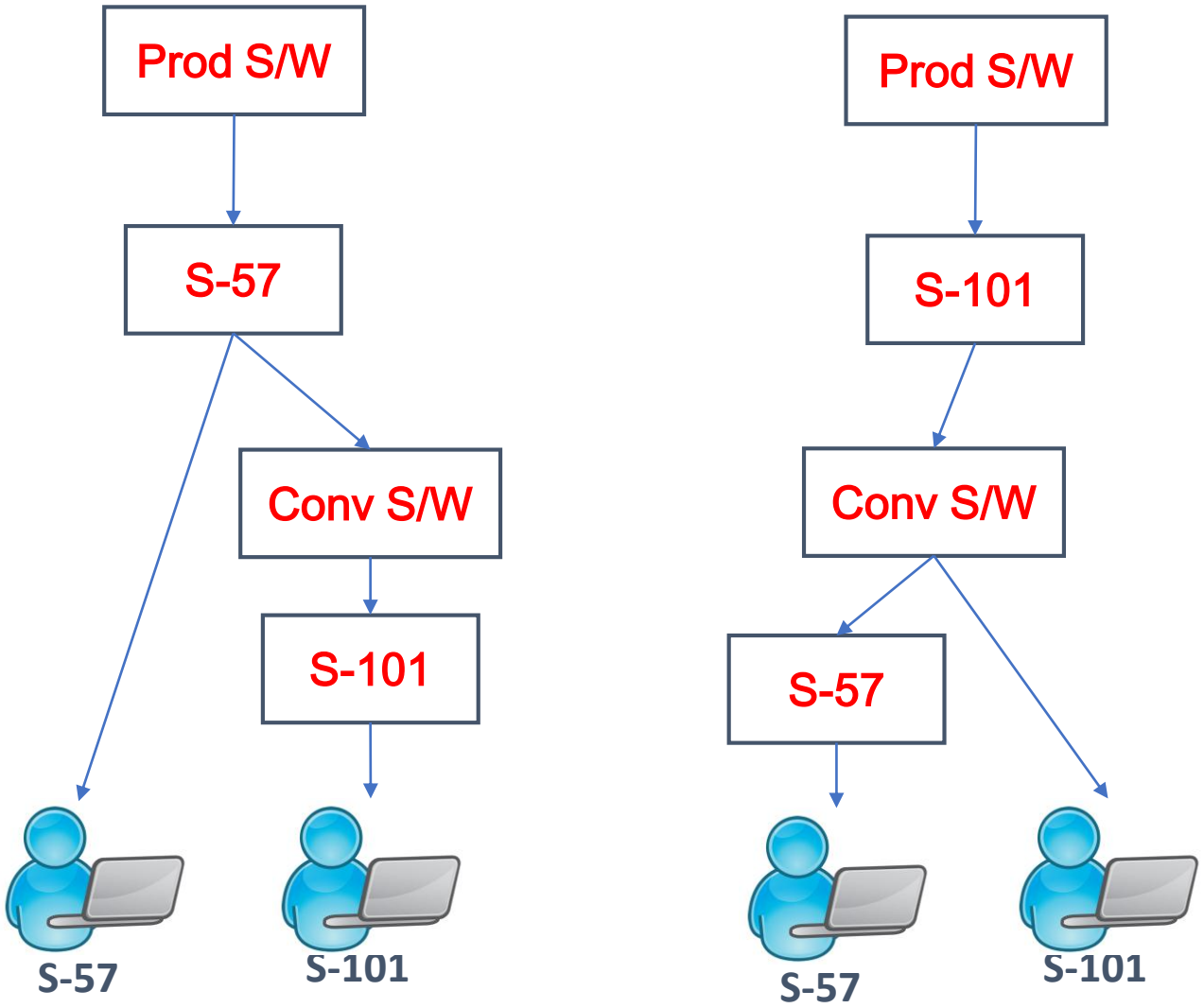
How will migration S57 - S-101 take place?



- Post-production conversion
- After production of ENC data conversion takes place (somewhere)
- End user systems are “single fuel”
- Users are S-101 or S-57 and migration of user base takes place over a period of time

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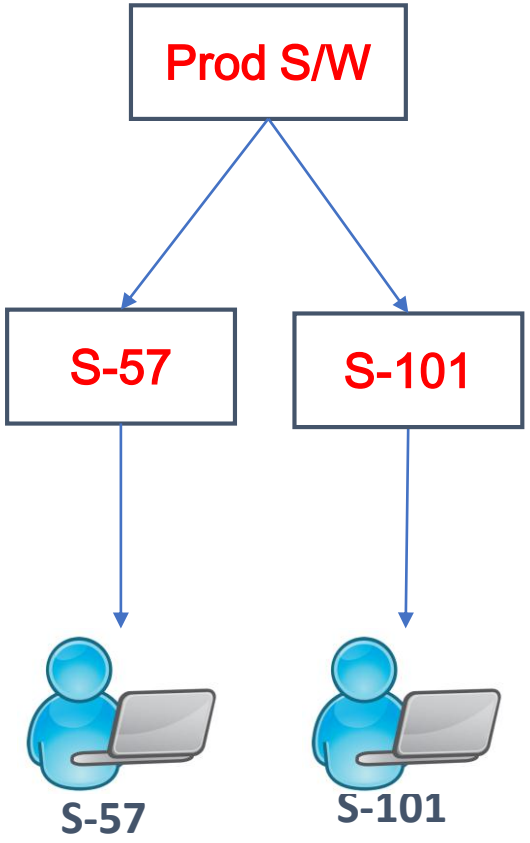
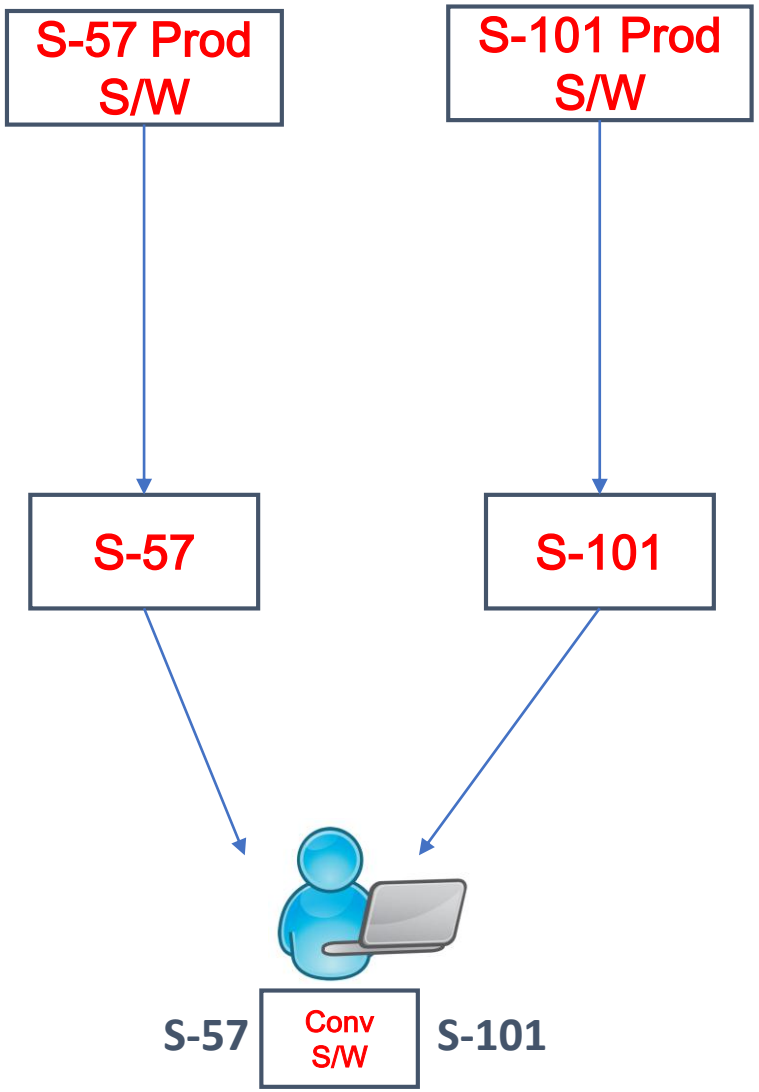
How will migration S57=>S-101 take place?





- Either:
  - Production software produces both S-57 and S-101
  - End user system (ECDIS) adds compatibility with S-101 format data (“dual fuel”)

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What's Next

- Project drawing to a close
- V1.1 of report is nearly out. Anyone interested can review
- Edge cases list (complex transformations)
- Other
  - Test data cell of edge cases
  - S-57 "feature catalogue"
  - Machine readable conversion description proposal
- Finalise any formal proposals

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