normal operation

When posting the tag into the ship, the question TagID (eg TagID = 1.) From the default sector 67 (= shore) is posted in the sector 66 (= not in the ship). This then runs via NMEA than $ PANSSY, sum is written-day increases by one. Furthermore, via $ PANSPT carried the message Taganzahl = 1 for sector 66th

The entire interface function is in this case shown by the service SIS_POS. This keeps all state in memory and writes only the relevant changes in the DB POS. If the day then seen from a space mark (example: mark space ID 130 detects the signal) of the tag is assigned to the sector 37, and this assignment is stored in the table with a corresponding timestamp pos.pos. This change of position is then transported also via NMEA via $ PANSPT to ILASST ($ PANSPT, 37,1,1).

Important: The number is not in the ship (sektor66) and signed off on land (sector 67) are reported only on the set $ PANSPT to ILASST and added there. Only the fields "This discovery has and Logged" and "missing day" run into the status field directly from the set $ PANSSY.

are in the event that is not registered when entering the ship TAGS aboard the tag "status" field is provided in the set $ PANSST. If this tag is located on board which carries the status of shore leave (sector 67, so logoff in pos.tags the DB) reported a disturbance at ILASST.

target

Tags which on shore (sector 67) are booked, must be represented as ashore via the packet transfer (NMEA UDP183) for ILASST. A transfer of TAGS tracked on the status and booked must only be done with / by the Tagactivator the service notebook. The end result is the quantity of TAGS in Tagactivator and BDC must always match, regardless of whether a tag is located, or in the status ashore on board not.

The correction shall be made so that's a "jumping back and forth" to the number "Tags logged on land" in the BDC not recognizable. = A blanket "Afterwards ends" of all TAG status logoff from pos.tags over $ PANSSPT here is not effective.

In this case should be a maximum latency of 0.2 seconds between the original packet and the correction, in order to ensure that the "correctly timed" takes place at the BDC.

It must be ensured that all tags are saved with the status of "Shore Leave" in the corresponding status at the correct time pos.pos in the table. With appropriate historical query the number of tags should at sector 67 (shore) always unambiguously the number be the "logged on land Tags" in PosActivators shown.

The error case

Enters a TAG with the status Logoff (= ashore) the vessel, and is detected by a mark space and localized, it is, without which he is registered (status = logoff in pos.tags) associated with the detected sector (zBSektor 37). Thereby it is shown in the ship quantitatively without being recorded in the sum "located and Logged".

Correctly in this case would the alarm (fault, $ PANSST) to ILASST and the retention of sector allocation 67 since the TAG is still on "shore leave".

error definition

First, the following information to the existing error cases was collected through interviews and simple tests:

1. A than on "shore leave" abgemeldeter day is seen by a mark on the ship, from
   the sector ashore away, and with the status "malfunction" in the assigned brand sector counted.

   - would correctly **Remain** "Malfunction" in the sector ashore with status.

Second A database with the status "Shore Leave" known day from sleep mode
   activated and stuck to the free deck in a support board near the door. The day is seen from this brand sporadically, and at sufficiently long non-Report on the open deck booked.

   - Right to remain in sector would also "malfunction" ashore with status.

In the following the following conditions are designed to be manufactured that are currently injured by the misconduct and should be met by the adjustments in the project.

1. The number "On land logged off" (tags in Sector 67 (PANSPT)) in ILOAD is always right
   with the number of deregistered tags in Tagaktivator (tags with status logoff in the database) match.

Second Both live and Historical: A day in the status logoff must not leave the sector 67
   and should not be counted in a sector in the ship.

Third Live: The number of booked and the located tags in ILOAD (from PANSSY) matches
   the sum of the tags in the sectors 1 to 66 match.

Therefore the following adjustments should be made on an abstract level.

- The live stream will be adapted so that the numbers of tags per sector and the sector status (PANSPT) can be overwritten with information from the database.

- The live stream will be adapted so that the numbers of booked and the located tags (PANSSY) can be overwritten with information from the database.

- Writes to the database are adjusted so that occupied tags can not leave the sector 67th

To achieve one this behavior is to be implemented the following:

- Depending on a NMEA filter processed on the two POS systems, the outgoing UDP data streams to the ILOAD servers.

- A database filter which modifies the write operations in the position table for deregistered tags on sector 67th

- A database observers or a view calculated each per sector logged-on tags, reads the sector status and interrogated processed.

A fundamental alternative in the approach which makes but a Nachimplementierung of large parts of the existing system needed is the collection of data for the live stream adjustments from the database, but by observing the incoming data streams of each room brands. In this case, however, the entire sector would have to be (and sector degradations) logic analyzed and re-implemented. As part of a troubleshooting project, this variant does not seem efficient because with less effort, the data can also be collected from the database (with little time offset by the SIS-POS service).

feasibility study

After providing a test system, the following questions were answered in a feasibility test.

Can all necessary data is collected and modified?

After the above analysis of faults and planning of changes hits on the NMEA data streams and persisted in the database table position are necessary.

The access and modification of the individual data are possible in principle with the following measures:

- Introduction of a NMEA filter. Changing the ILOAD Server addresses in the table to the address of ilasst NMEA filter. Introducing a new table with the actual ILOAD server addresses.

- Using UPDATE / INSERT triggers in mysql for the table with historical position data.

- Update a table of edited data (number per sector, sector status) through the UPDATE / INSERT trigger, or setting up a VIEWS with processed data.

It is not known and probably not conclusively explain whether the SISPOS service after an event (eg. Change of the sector through a day) initially sent a NMEA message or writes the data to the position table of the database. Therefore, it is possible that the filter of the live data stream can only use old data from the database for correction.

The danger is that if one day a sector to be reassigned and that information from the database is not yet known, the number is overwritten results, for example. in the next update from the database, this sector if then contains the day must be done to correct the number.

In order not to mask valid movements between sectors, for example, can. With a change in the numbers of tags per sector of a database query to the next an independent ship carried the new numbers for the changed sectors. A more detailed planning of the update behavior for the NMEA data stream occurs later in this document.

Is the timing behavior or the delay acceptable and CPU and memory sufficient to perform all processing in real time and keep all necessary data in main memory?

According to the foregoing analysis of the access to the data, the following essential components for the timing behavior resulting:

- In principle, sending The updated information can take place only when the SIS-POS service has persisted data. This delay can not be influenced by the to-implement correction system. An analysis of this period is not currently planned.

- Splitting, analyzing, and correcting joining the NMEA data stream.

- Adaptation of persisted data in the database.

There are the following assumptions for the timing behavior, which were not contradicted by previous experiments and will be clarified in more detail by an evaluation phase in the next step of the project:

- Unpacking and packing of the UDP packets and splitting into NMEA sentences can be implemented with high efficiency.

- Read the latest information from the database in an already prepared cache in main memory is very fast (array access for array with 67 integers).

- Position table INSERT trigger: Dominated by checking the logoff status of the tag. Change control and other behavior trivial.

- Sector per day as a table: Slows the INSERT trigger slightly. Redundant storage of the data can lead to inconsistencies.

- Sector per day than VIEW: Must be calculated at each reading. Performance dependent on indexing the position table.

In the case of an implementation of the NMEA-filter, which is dependent on the incoming rates of change of the sector tags, a large number of database queries by the NMEA filter can be produced. To mitigate this problem, a rate limit for sending the data of all or individual sectors in modifications of the data stream can take place.

In the following, several variations of such a rate limiting are (with and without coupling to the incoming data stream described).

A) With each day-per-sector message database is accessed.

Advantage: Only a delay in processing the information.
Disadvantage: Unpredictable behavior at high incoming message rate. Disadvantage: Due to high query load potentially delay the other NMEA sentences.

B) In order to achieve a defined update behavior, update the NMEA filter their

Information from the database in a fixed rate (for example. 5 Hz). All corrections take place with respect to this database state. If changes in the database state your own tags-per-sector messages are sent. Advantage: Original revision cycle is largely retained. Advantage: Better opportunities through forward other NMEA sentences unchanged. Disadvantage: There are but also inserted new PANSPT messages. Disadvantage: The refresh rate is limited.

Disadvantage: Unpredictable behavior at high incoming message rate.

C) All original tags-per-sector are suppressed. With each with its own

Database query all Taganzahlen be (eg. Every 5 minutes) ships, and with a fixed rate (for example, 5 Hz) sent the changed numbers of tags per sector.

Advantage: Defined update behavior (see system documentation.). Advantage: Predictable behavior at high incoming message rate. by pass thorough low load option other NMEA sentences unaltered by time: advantage.

Neutral: Original revision cycle is completely masked.

Disadvantage: It must be determined when it is the database query allows data to be sent (detection master mode). This can eg. Incoming from the presence Day Pro-sector messages are made dependent.

For a database loss it is possible to forward the unchanged data in all variants. For all versions the update behavior of PANSSY must be adjusted accordingly and consistent.

In variants A) and B) the following aspects to ensure data consistency is observed:

- In the case of overwriting a record data is sent to all sectors, thus getting a consistent overall picture exists.

  Disadvantage: Additional messages at a correction with irrelevant data.

Variant C) shows up as most advantageous and should be preferred by mutual agreement in the next phase of the project during implementation.

Prototypical implementation and integration preliminary

To integrate preliminary examination on the real system following prototype implementation was created:

- A network proxy to intercept data to the NMEA interface, decoded and re-transmits.

- intercepting database trigger code data when adding and changing and performs on-Thefly adjustments.

The end of the preliminary test:

1. Commissioning of the system to ship 3 with two deregistered Tags:
   1.1. Deactivation of the POS server 1, POS server 2 as the master. Only work on POS server. 2
   1.2. A day in the steel cabinet near the rear guard object (Error Case 2), and a moving day (error 1).
   1.3. Shutdown of the previous "Shore Leave" Mitigation of the error.

Second Tests of the live view and the Historical View:

2.1. Live data of the tags visible as expected: Both tags as shown and disturbed are drawn in the map data according to their real position.
2.2. Query the historical data on 7.3. disturbed ILASST / BDC:
2.2.1. Workaround by injecting a PANSZA (special evaluation time) request to the System using the ILASST simulator.
2.2.2. Passive representation of the response to the injected request in ILASST (Display Only the total figures for outer cover (sector 66), and gangway (sector 67)).

Third Adjustment / test of historical analysis:

3.1. DB adjustments:

3.1.1. DB view logoff_tags list of the logged tag IDs

3.1.2. Trigger pos.pos: tags with ID from the list logoff_tags be at sector 67 booked.

Tabelle 1: Auswertung der Historischen Abfragen

Zeit	Sektor 66	Sektor 67	Ereignis/Datenbank
09:01:00	0	1	Aktivierung Tag 1, Sektor 67, Status OK
09:07:50	1	0	Tag 1 im Stahlschrank, Sektor 66, Status malfunction
09:22:38	0	0	Tag 1 im Stahlschrank, Sektor 37, Status malfunction
10:01:00	0	0	–
10:11:51	-	-	Aktivierung Tag 21 , Sektor 67, Status malfunction
11:01:00	0	2	Nach der Installation des DB Triggers: Beide Tags verlassen Sektor 67 nicht.

3.2. Test of historical interpretation at several time points (see Table 1).

4th Filter into the live data

4.1. Installation NMEA filter to POS server 2. Configuration SIS POS for outputting data to NMEA filter. Configuration of the NMEA filter for output to ILASST Server 1 & 2.

4.1.1. Basic function of data transfer: delay by packing and unpacking of an average of about 50 ms by the NMEA filter. Live data is displayed correctly and without visible delay in ILASST / BDC.

4.1.2. Simple load test by setting the update rate from the SIS-POS service to 1 second (Maximum): No visible change in the average delay. Slightly smaller variance of the delay.

4.2. Query Test Database: Duration of reading out the number of tags-per-sector through a simple database query?
In a filled with 40,000 entries pos table in MySQL Workbench: 100ms

By integrating preliminary review was to ensure that the design information has been understood correctly, and a fundamental integration of the adjustments in the existing system is.

Despite the failure in presenting the historical data was successfully corrected by the database filter. The passage of data through the NMEA filter has resulted in no visible delay in the graphical representation of the system.

the anticipated through the processing of data lags is possible in the next stage, the timing behavior of NMEA filter and the database adjustments should be investigated so that in regard to a statistically justified statement.