CCSDS Spacecraft Monitoring & Control (SM&C) Working Group

**Spring 2015 Workshop, Pasadena, USA**

**MINUTES**

The following changes have been made in the management of MOIMS and SM&C:

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| **POSITION** | **PREVIOUS** | **NEW** |
| **MOIMS AREA DIRECTOR** | **Nestor Peccia** | **Mario Merri** |
| **MOIMS DEPUTY AREA DIRECTOR** | **Roger Thompson** | **Brigitte Behal** |
| **SM&C WG CHAIR** | **Mario Merri** | **Dan Smith** |
| **SM&C WG DEPUTY** |  | **Mehran Sarkati** |



**MONDAY 23 March 2015**

1. Mario gave a very thorough presentation on the current status of SM&C and of a vision for where it is headed. As MOIMS AD, he will still be heavily involved in the SM&C efforts that he has been a part of since they started. Mario hopes that NASA WG leadership means more NASA funding, faster completion of documents and better infusion into missions.
2. Nestor noted that the WG needs to look at the project list. He felt that some entries were out of date and some were missing. He also explained that we could add projects as DRAFT, with no need for now to provide schedule and funding plans for them. XML, HTTP, TCP-IP are not defined as projects. But ESA working on draft bluebooks. They need to be in the system.
3. The WG will work on the list of Projects on Wednesday.
4. Key service areas of the full SM&C vision are at different stages of maturity:
   1. MO M&C – in final approval
   2. MO Common – internal review
   3. NAV – needs joint effort between SM&C and NAV WGs
   4. Telerobitics WG – early stages
   5. Mission Planning BOF – just getting started
5. Mehran asked whether we can we keep a catalog of Agency work in progress or available. Could use WIcki. A lot of work is being done outside of CCSDS that gets very little visibility. Nestor: But we need to have an official plan to be measured against. Eight books seems like a lot of standards. Please put a lot as DRAFT without schedule. But if it is real, put it down with schedule and make it active.
6. Challenge – If Agencies develop their own services do they become standards? Just catalog items?
7. Successful ESA-DLR prototyping. Action, alert, statistic, conversion, group, parameter, aggregation, check. Focus on the services, didn’t need to worry about MAL and the message transport. Highest level in stack was privately developed to show independence. Kept track of info needed by each side to get it all to work, helped identify whether there were any ambiguities in the specification. ESA. Just about done. DLR, delayed due to people. Plan for 10 weeks. Then will report in mid-July 2015. ESA lessons learned used to modify the book, providing latest updates.
8. Question to think about: Should prototypes be done to start creating standard apps or are they really focused just on testing out the document and API?
9. M&C Services. RIDs. 19 of them. DLR/ESA/CNES very active with implementations and prototypes.
10. XTCE. Ron Jones. How should we do the tailoring guides? ESA’s is Magenta. ESA next gen system will use XTCE and will do their own tailoring to be compatible with CNES ISIS – will do new one. XTCE-CC (Common Core). ACTION: Dan to meet with Tom Gannett to develop solutions, then alert the WG and MOIMS AD.
11. XTCE and MO services comparison. Ron Jones presented Kevin Rice’s work on comparing the MO service needs to the XTCE content. Although valuable, a new approach for presenting the results will be developed. This new approach was worked out on the white board and better matches what Mehran had been expecting. Sam Cooper and Ron Jones will work on the new approach. The real question is “Can the services find the referenced info on parameters and commands in the XTCE data base? How should we handle the gaps in the support?”

**TUESDAY 24 March 2015**

1. The Chocolate Fairy showed up with treats before everyone showed up.
2. Sam Cooper presented an overview of Common services. This effort partially addresses the MOSG action to look at simplifying system configuration efforts and reducing the scope of what is needed in mission-specific I CDs. 5 key services: DIRECTORY, LOGIN, REPLAY, INTERACTION, CONFIGURATION.
   1. LOGIN SERVICE. API to interact with whatever your system uses. Not coordinated with other CCSDS groups which may also have similar needs.
   2. INTERACTION SERVICE. For when an applications needs input from a user.
   3. REPLAY SEERVICE. Plays out of archive. Limited definition needs clarification on appropriate use. SHOWS THE IMPORTANCE OF EVERYONE REVIEWING THE DOCUMENT. Could meet with archive working group and discuss. Lots of concerns.
   4. DIRECTORY SERVICE. Will support both standard (CCSDS) and unique services. Allows early registration of services without full timeframe of CCSDS processes (good thing).
3. COM vs COMMON is confusing for our document and service area names. Multiple name change choices were discussed throughout the week.
4. Mehran presented the use of MO services with the OPSAT mission – a satellite to experiment with mission operations concepts and software. MO services on-board. Uses MO packets.
5. Erwann Poupart presented CNES’s EyeSat effort. Student pilot project for a 3U cubesat.
6. Mehran. Protocol bindings. Not really hard except for documents, testing. 3 options on approach. Generally prefer mapping MAL header info into target protocol header and then encoding the body of the MAL message for use as the body of the target message. For pub/sub, looking at how to maintain QOS throughout routing.
7. Transport and binding. Wireshark Dissector monitors/displays traffic on MAL. Very nice and valuable tool. May have license agreement issue if released embedded within an SM&C product.
8. Sam Cooper noted that apps shouldn’t need to know what transport is used, but they can know! Very different than concept that apps do not know. Not quite as cleanly layered as some thought. This “feature” to know the transport provider is only available in the JAVA API. There may be issues with how the message headers are copied across different transport approaches. ACTION/ISSUE. Sam wants creepy crawlers in to the layers, but the documentation was not clear whether this is a general capability, a hidden function, etc. Do we want it for all cases? Should we update the documents?

**WEDNESDAY 25 March 2015**

1. Sam Cooper presented details of the new CONFIG SERVICE (part of COMMON SERVICES). Config Files. Service to activate, remove, etc. 3 types> hardcoded, for use without COM, COM-compliant. Concerned that a full configuration may include everything that normally would contained in some very large data bases. Not clear what should be managed through the CONFIG service. Will take a lot of work to finish the details.
2. COM vs COMMON name came up again. Will leave it as is to minimize documentation rework efforts.
3. Space Packet Binding Document. Review of comments. Things went very well with Peter. All comments now resolved. Minor updates being made.
4. Worked on the roadmap, but there is a ways to go. Focus was on the binding and encoding documents. Although Nestor would like DRAFT PROJECTS in the system without completion date but will show a future plan we did not have time to work on the longer-term plan for future documents.
5. The encoding and transport documents (Projects) are:
   1. Space Packet Binding with Fixed or Variable Encoding (existing Project)
   2. HTTP with XML (New Project entered)
   3. TCP-IP with Split Binary (new Project request entered)
   4. ZeroMQ with ??? (existing Project)
6. Dan Smith discussed issues with the NASA effort to develop the C++ API and sample software. Sam Cooper has been very helpful and offered to continue to provide guidance to the developer at NASA/JSC. There are helpful documents and posted software that should help speed up the effort. Dan Smith will work to obtain regular status to better track the effort and the SM&C group will provide help where needed. Deliverable is the API book and to show “significant usage”. Significant useage could be shown in a memo from NASA stating that is have been used in an internal prototype effort. Nicholas at CNES has also worked with C++ on similar efforts and could be another resource.

**THURSDAY 26 March 2015**

1. Since we are near Hollywood, the day started with two movies. One on the complexities of building systems for space and one on the cool missions NASA is working on.
2. Navigation Services. Presented by Tiago Nogueira. NAV is working on formats, not services. Their products are widely used. New SM&C approach is more aligned with the NAV products and the options already supported by the NAV team. SM&C is not inventing any new capabilities for NAV. Since NAV needs telemetry (hardware message), should the NAV group or SM&C group build the actual NAV input file? **ACTION TO MOIMS AD**: Set up new coordination with NAV to show these concepts and whether any issues fall out of it that need further discussion. Also, clarify with the MOIMS AD which WG is responsible for generating, for example, the NAV Services Blue Book. Tiago and Ian to look at use cases and advocacy.
3. Mehran discussed a new service definition effort. Poland has joined ESA and is working on an SM&C Mission Data Distribution Service DRAFT as part of an effort to gain ESA-related experience. Currently thought of as a new Blue Book, but others felt that we can not keep adding Blue Books for each new service and it should be a service added to an existing book.
4. Discussion with the IOAG/MOSG:
   1. ICD point: Lots of non-technical logistic/organisational aspects are in the ICD. Also the XML specs have been put in the ICD, which are not necessary to be repeated. The actual technical information can be condensed in a few pages. Moreover, some of the technical information shall be covered by the envisaged support services (Directory and Configuration Service). SC, has still the action to identify these technical information which would disappear from ICD, if Directory/Configuration Services are used.  
        
      b. Tookit point: A number of supporting tools, software and documentation has been created by ESA, which are available on GitHub. What is missing is an entry point for new comers to be able to easily find the information they need. Wikipedia could be a good entry point. SC/DS have the action to compile the list of the items, which could compose the toolkit. In Fall meeting, the WG shall review the list and identify which ones already exist and which ones need still to be developed. The conclusion was, the WG shall remain responsible for devising the plan and the list of the components of the toolkit but not responsible for its implementation and maintenance. This would most likely be done in a need driven manner by the agencies.  
        
      c. Loads of uncoordinated discussions on the feedback from IOAG. The points are all important and valid. We would like to continue discussing them and providing answers where possible.

**SUMMARY OF ACTIONS**

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| ACTIONEE | DESCRIPTION | DUE DATE |
| Dan Smith | Meet with Tom Gannet to determine approach for posting the multiple XTCE tailoring documents. | 5/30/2015 |
| Sam Cooper and Ron Jones | Develop list of implied MO DB needs and compare to XTCE contents | 7/30/2015 |
| Everyone on SM&C Team | Review documents early and provide constructive comments | ongoing |
| Dan Smith and Mehran Sarkati | Complete SM&C Documentation Tree and CWE Project Plan and status | 1 June 2015 |
| To MOIMS AD | Determine which WG would be responsible for the NAV Services Blue Book and prototyping. | For next full meeting |
| Dan Smith | Coordinate joint meetings between SM&C and NAV to discuss NAV Service concepts and proposed solution(s) to potential overlap of NAV H/W message and MO services.. | For next full meeting |
| Ian and Tiago | Define operational use cases for the NAV Services | For next full meeting |

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| **Name/Agency** | **M-am** | **M-pm** | **T-am** | **T-pm** | **W-am** | **W-pm** | **Th-am** | **Th-pm** |
| Afarin, James (NASA) |  | x |  |  |  |  |  |  |
| Allard, Francois (ESA) | x | x | x | x |  | x | x | x |
| Amundsen, Mike (NASA) |  |  |  |  |  | x |  | x |
| Antonov, Ivan (FSA) |  | x | x |  |  |  |  |  |
| Behal, Brigitte (CNES) | x | x | x | x | x | x | x |  |
| Champsavoir, Nicolas (CNES) | x | x | x | x | x | x | x |  |
| Chaudhri, Geraldine (NASA) | x | x | x | x |  |  |  |  |
| Chouinard, Caroline (NASA) |  |  |  | x |  |  |  |  |
| Coelho, Cesar (ESA) | x | x | x | x | x | x | x | x |
| Cooper, Sam (ESA) | x | x | x | x | x | x | x |  |
| Duhaze, Marc (CNES) | x | x |  |  |  |  |  |  |
| Estefan, Jeff (NASA) |  |  |  |  | x | x |  | x |
| Fatig, Curtis (NASA) |  | x | x | x | x | x | x | x |
| Gartner, Stefan (DLR) | x | x | x | x | x | x | x | x |
| Giovannoni, Brian (NASA) | x |  | x |  | x | x |  |  |
| Harrison, Ian (ESA) | x | x | x | x | x | x | x | x |
| Jones, Ronald (NASA) |  | x | x | x | x | x | x |  |
| Kudrin, Leonid (FSA) | x | x | x | x | x | x | x | x |
| Merri, Mario (ESA) | x | x | x | x | x | x | x |  |
| Miyano, Yoshikazu (JAXA) | x | x | x | x | x | x | x |  |
| Munoz, Michela (NASA) |  | x | x | x | x | x |  |  |
| Newhouse, Marilyn (NASA) | x | x | x | x | x | x | x | x |
| Nichols, Kelvin (NASA) |  |  |  |  | x |  |  |  |
| Nogueira, Tiago (ESA) | x | x | x | x | x | x | x | x |
| Peccia, Nestor (ESA) | x |  |  |  |  | x |  | x |
| Poupart, Erwann (CNES) | x | x | x | x |  | x |  |  |
| Sarkarati, Mehran (ESA) | x | x | x | x | x | x | x |  |
| Smith, Dan (NASA) | x | x | x | x | x | x | x | x |
| Thompson, Roger (UKSA) | x | x | x | x | x | x | x | x |
| Van der Plas (ESA) | x | x | x | x | x | x | x | x |
| Wendler, Michael (DLR) | x | x | x | x | x | x | x | x |
| Zundo, Michele (ESA) | x | x | x | x | x | x |  | x |