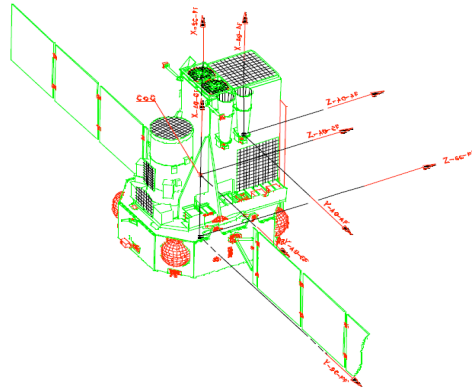


Integral TM Bandwidth Dynamic Allocation



F.Cordero (Vega GmbH) 9th November 2007

VEGA

Integral TM Bandwidth Dynamic Allocation



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The problem

- TM bandwidth of Integral is 256pkts/8s.
(TM pkts are 448bytes fixed length in Integral)
- The allocation among the subsystems is the following:

IBIS	128
SPI	105
JEM-X1	8
JEM-X2	0
OMC	5

 - 246 P/L (96 fixed + 150 programmable) →
 - 2 CDMU (1HK pkt + 1Report pkt)
 - 4 AOCS (3HK pkts + 1Report pkt)
 - 3 RTU HK pkts
 - 1 Memory Dump pkt
- As packet acquisition is based on fixed PST programmed once per revolution, bandwidth resource usage is *in-efficient* → ***If a PT does not have a packet to transmit that bandwidth is lost.***
- At present the average unused bandwidth is about 27.5pkts/8s (~11%).

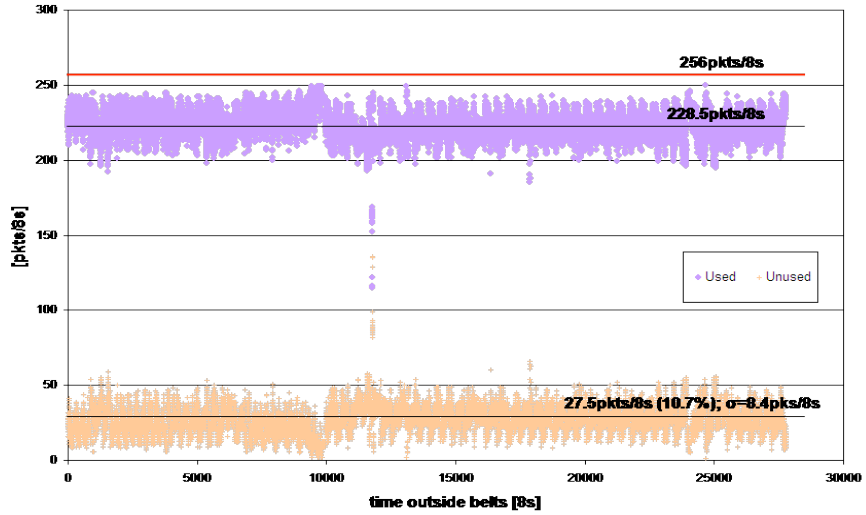
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2

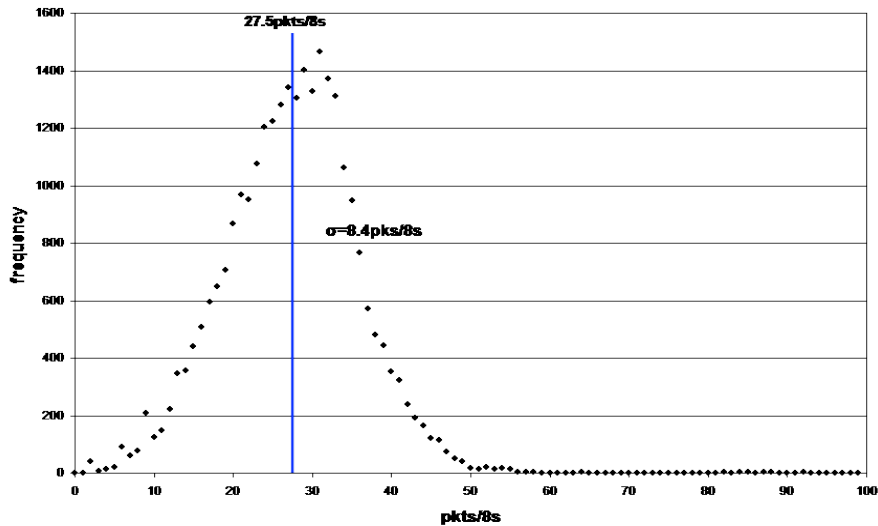
TM bandwidth usage (rev.616)



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Frequency distribution of Nr of unused packets



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Possible solutions

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- To exploit the unused TM packets, a more clever packet acquisition mechanism is needed on-board.
- The static PST mechanism - implemented by the CDMU Standard Application Software (SASW) – needs to be enhanced to dynamically re-allocate unused packets.
- The allocation algorithm must be such that the nominal P/L bandwidth share (i.e. currently 128,105,8,0,5 pkt/8s) is always granted.
- Possible algorithms are (just for example):
 - a) If a PT does not have any packet to transmit in a PST slot, then that PT is no more polled/or polled less frequently till the end of the TM cycle and the unused PST slots re-programmed on-the-fly to other PTs.
 - b) At a given TM cycle, the nr of the previous cycle unused PST slots of a PT is transferred to other PTs less one packet. Should that packet be used, then at the next cycle the nominal allocation is restored.
 - c) Allow the PTs to acquire all-together more than 256pkts and stop the acquisition when that limit is reached (but ways to ensure nominal share to be studied).

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CDMU SASW change

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- These algorithms can be implemented modifying existing SASW mechanisms, e.g.:
 - **Modify PST mechanism**
 - PST slots reprogrammed either on-the-fly or on the shadow-programmable PST, activated at the next TM cycle.
 - **Modify BRAT mechanism**
 - Over-allocate PST TM slots (>256) to PTs, using subset of TC_SEND (~40) and NO_TRANS (14) slots and if needed RTU slots (~18) and
 - introduce a new BRAT control to limit the total amount of bandwidth (</=256 packets) instead of limiting the bandwidth of a single PT.
- Other problems to be studied:
 - Rules and constraints on PST slots must be now hardcoded in the SASW
 - Change of RTU packets closure mechanism if we want to free additional slots.
 - Ensure nominal share and priority rules to re-assign the unused bandwidth.
 - Interfaces in the planning system and monitoring of dynamic allocation in TM.
 - Compatibility of the selected option with instrument DPE software.
 - CDMU additional CPU load and memory to be evaluated.
- Performances could be further improved by exploiting the CDMU TM buffer (175 pkts), today running basically empty, to accommodate P/L TM peaks on VC7.
 - For instance bandwidth control (</=256) can start when 80% of buffer used by VC7.

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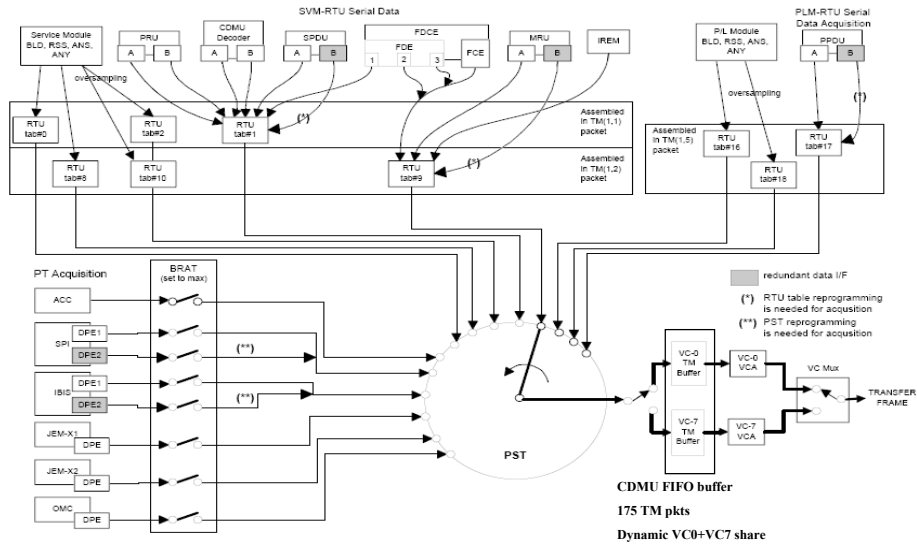
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PST and BRAT

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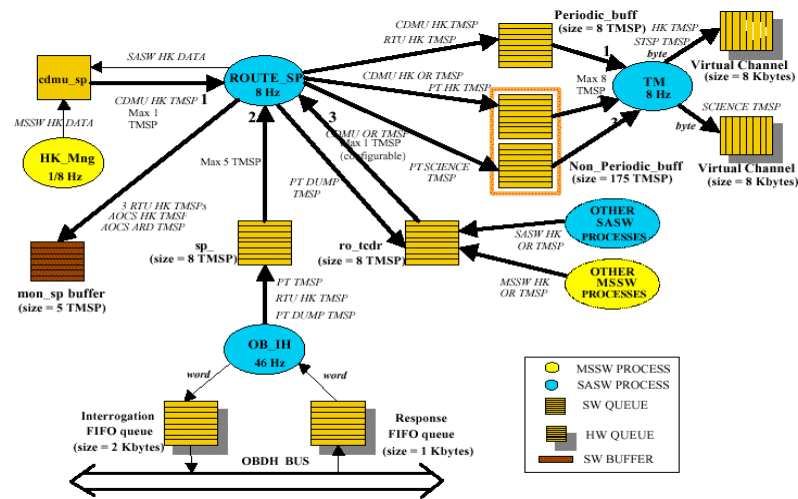
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CDMU SASW TM pkts processes and buffers

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On the short term

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- A closer look at today's bandwidth usage during the science observation window, reveals that there are 3 TM pkts that could be moved from platform to P/L.
- They currently fixedly allocated to:
 - 1 pkt for PT on-request memory dump
 - 1 pkt for on-request from CDMU
 - 1 pkt for on-request from AOCS

However :

- In the science window no PT memory dump is ever performed.
- Should it be exceptionally requested, the likelihood that this happens when all PTs saturate TM is very low (probability ~0.15%!).
- In any case, the dump packet would not be lost but stored in the CDMU VC0 buffer (175pkts), which has priority in downlink (VC7 can only go if VC0 buffer is empty).
- It is exceptional that ground send commands for on-request packets both to CDMU and AOCS. Should this happen they would be anyhow top priority in downlink.

Conclusion: → **The 3 pkts reserved for platform on-request TM pkts could be immediately re-assigned to P/L.**



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Proposed activity

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- Proposed activity is split in two phases:
 - Analysis of the possible solutions. The outcome will be a feasibility study.
 - Implementation of the CDMU SASW change, after agreement on the best option by all parties.
- All means are available at MOC for CDMU SASW change development and validation.
- Support of MOC engineers needed to use SDE, simulator and run independent validation.



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