



# CCSDS USLP Activities April 2016



Deutsches Zentrum für Luft- und  
Raumfahrt e. V.



National Aeronautics and  
Space Administration





# Overview:



- ◆ The purpose is to discuss highlights regarding DLR and HOSC USLP activities over the last 6 months and focusing on CCSDS interoperability testing
- ◆ Two implementations
  - The USLP implementation from Stefan Veit at German Aerospace Center.
  - The USLP implementation from Kevan Moore at Marshall Space Flight Center.
- ◆ Prototype and Test team members
  - DLR - Stefan Veit at German Aerospace Center
  - NASA - Kevan Moore at Marshall Space Flight Center
- ◆ Additional support from the CCSDS USLP team as required

# Overview:

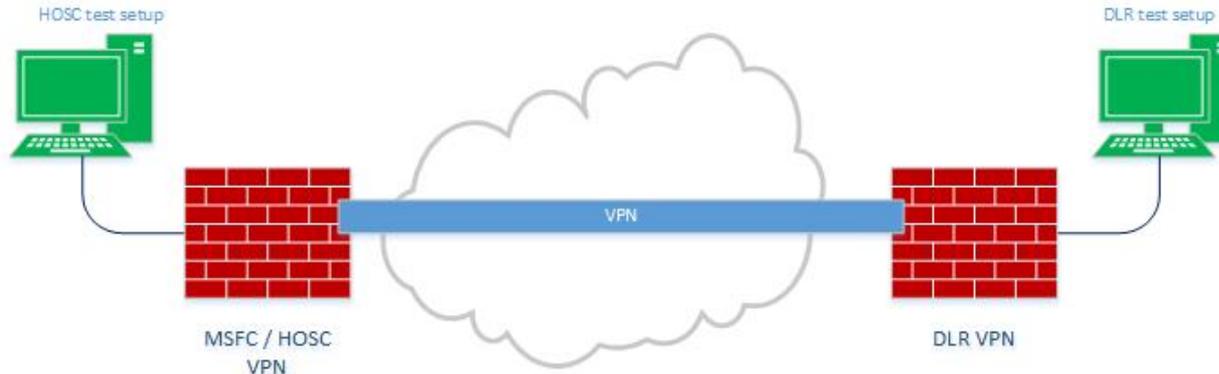


- ◆ Specification status
  - ◆ CCSDS 732.1-W-0 USLP July version of the White book was the initial spec
  - ◆ Basis for USLP work
    - Two independent implementations by two independent organizations
    - DLR and NASA/HOSC
    - Budgetary considerations affected late start-up for HOSC
- ◆ Current updating testing and prototyping based on
  - March 9<sup>th</sup>, 2016 document update
  - Comments and discussions from the ongoing USLP working group

# Current Interoperability Testing

## ◆ Overall test configuration:

- ◆ At least one node shall be established by each participant; DLR and NASA HOSC.
- ◆ Unique test stations at each end shall be established based on test conductors' particular setup.
- ◆ Two test conductors are required; one at MSFC/HOSC and one at DLR.
- ◆ Connections are protected by IPSEC VPN.





# Current Interoperability Testing

- ◆ The HOSC took the lead to generate a preliminary test plan with basic configurations detailed by participants
  - ◆ DLR
    - ✦ Originally Based on July 20 White Paper, Now Based on March 9<sup>th</sup> 2016 White Book
    - ✦ SLES 12 with 64 bit
    - ✦ Implemented in C++
  - ◆ MSFC HOSC
    - ✦ Originally Based on July 20 White Paper, Now Based on March 9<sup>th</sup> 2016 White Book
    - ✦ Developed with MSFC Tech Excellence funding
    - ✦ Executing on SuperMicro/KVM virtual servers
    - ✦ Linux based on RHEL5.11 with 64 bit



# ★ Current Interoperability Testing

- ◆ Testing is at local and remote locations
- ◆ Test configuration use UDP/IP transfer of data is via IPSEC VPN to the remote tester using two methods
  - ◆ USLP frames can be sent between senders A and B or
  - ◆ Send A can send a UDP packet to Sender B
    - ✦ Sender B will incorporate the UDP packet into a USLP frame
    - ✦ Sender B will transfer the USLP frame back to Sender A
    - ✦ Sender B can test a variety of feature with Sender A without A reconfiguring



# Outcome of Interoperability Testing



- ◆ Testing and prototyping has been an ongoing activity since late last year
- ◆ Initial testing entailed establishment of the VPN and continuity testing, ping
- ◆ Once the testing environment was established, testing conducted as needed to evaluate protocol development and is ongoing



# Test cases



Test cases are repeated each from a both directions respectively in order to exercise source and destination nodes adequately.

1. Transfer Frame Header Only
2. Transfer Frame header and Transfer Frame Data Field
  - a. Data Field with minimum and maximum data octets with each Construction Rule
  - b. Spanning Packet Service with packets larger than the datazone
  - c. Data field with Extended Protocol ID and Isochronous Insert Zone
  - d. Data field and On-Demand Insert Zone
  - e. Data field and Security Header and Trailer
  - f. Data field and Operational Control field
  - g. Fixed length frames with encapsulation idle packets
  - h. Data field and Isochronous Insert Zone, Security Header/Trailer
  - i. Data field and On-Demand Insert Zone, Security Header/Trailer, and Operational Control Field
  - j. Data field and On-Demand Insert Zone, Security Header/Trailer, Operational Control Field, and Frame Error Control Field



# Test cases

Test cases are repeated each from a both directions respectively in order to exercise source and destination nodes adequately.

## 1. Upcoming test activities

- a. Construction Rule 111 with several packets (needs to be discussed in the meeting)
- b. VC multiplexing
- c. MAP multiplexing (the most complex feature, will be tested at the very end hopefully)
- d. On-Demand Insert Zone (+Service) a late tested item
- e. Octet Stream (+Service) a late tested item



# Test summary matrix



# BACKUP





# Abbreviations and Acronyms

CCSDS	Consultative Committee on Space Data Systems
DLR	Deutsches Zentrum für Luft- und Raumfahrt e. V.
HOSC	Huntsville Operations Support Center
ID	Identification
IPSEC	Internet Protocol Security
MAP	Multiplexer Access Points
MSFC	Marshall Space Flight Center
OCF	Operational Control Field
TFDF	Transfer Frame Data Field
USLP	Unified Space Link Protocol
VC	Virtual Channel
VPN	Virtual Private Network