# Mass memory trend supporting file based operations

# Presentation outline

- Syderal Solid State Mass Memory (SSMM) and File System experience
- Main concepts for file based SSMM design
- CFDP functions allocation on SSMM architecture

# Syderal file systems experience:

## Gaia PDHU

- File system features
  - User data packets acquired and appended to files based on a file ID tag,
  - Files are statically defined including:
    - Cyclic and dynamic data files
    - No hierarchy
    - No namespace lookup
- Logical file structure
  - Linked list of sectors
  - Sector size: few Mbits
- Downlink selection
  - Files downlink priority
  - Files deletion priority
  - Files max data loss
  - Sectors loss retransmission
  - Granularity: one sector

# EarthCare MMFU

## File system features

- PUS service 15
- APID based source packets storage into packet stores
- No hierarchy
- No namespace lookup

## Logical file structure

- Sequence of source packets
- Linked list of blocks
- Block size: few Mbits

## Downlink interface

- Sequential downlink with pointers
- Packet range selection
- Granularity: one source packet

# NG-SSMM

## File system features

- PUS service 15
- CFDP
- APID based source packets storage into packet stores or files
- No hierarchy
- No namespace lookup
- Directories: one level

## Logical file structure

- Sequence of source packets
- Linked list of blocks
- Configurable block size

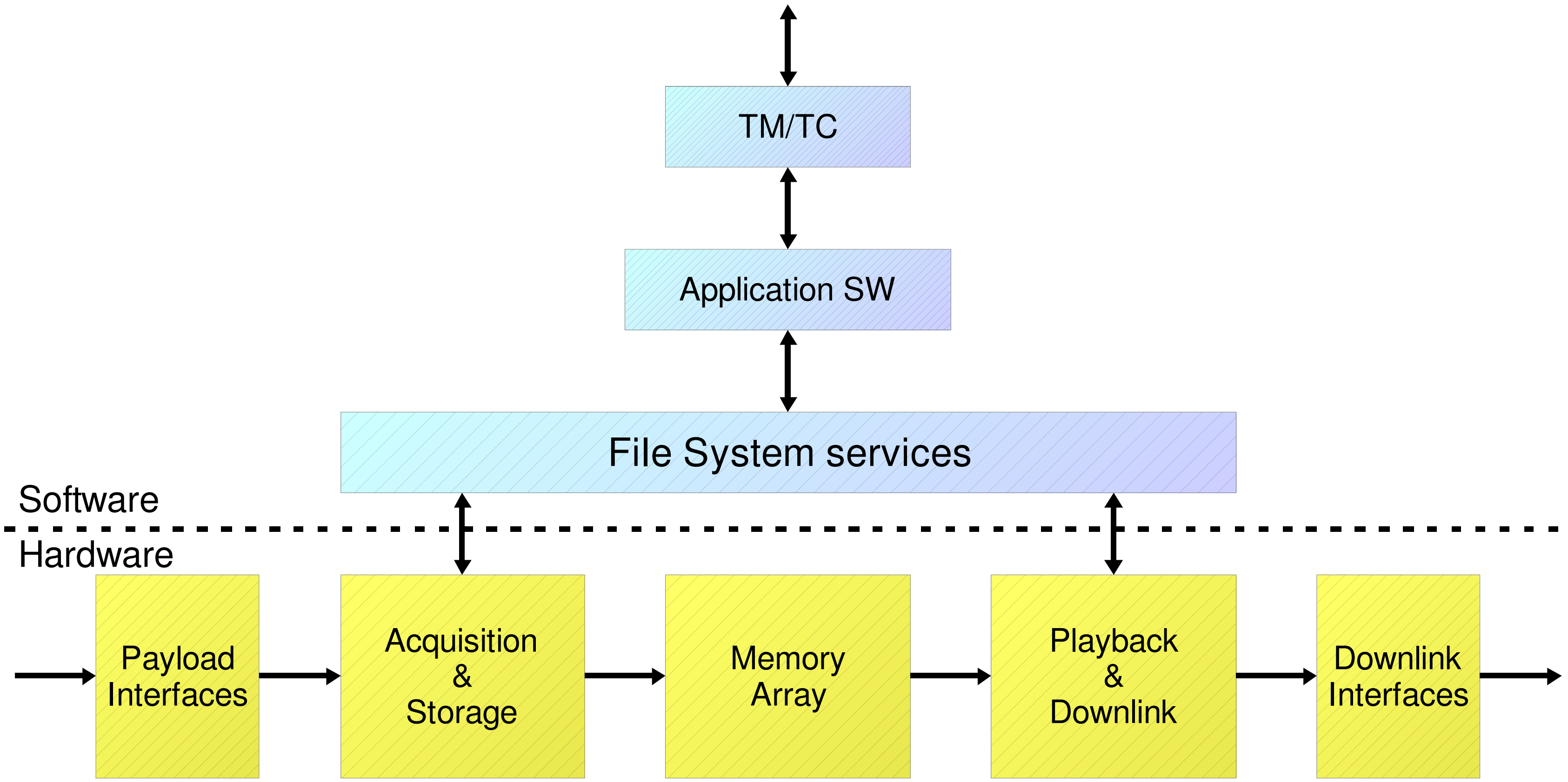
## Downlink interface

- Sequential downlink with pointers
- Packet range selection
- Granularity: one source packet / CFDP file data PDU

# Main concepts for file based SSMM design

- Software based centralized metadata management including:
  - Logical to physical access translation
  - Files and directories namespace lookup
  - Hierarchical file system implementation
- Decoupled data, metadata and control flow
- Hardware based data flow from payload users to files
  - Data acquisition, allocation and storage into mass memory sectors or blocks
  - User data path configuration by the main controller
- Mechanisms for parallel write and read access to the memory array
- Mechanisms for device/bank/memory module data recovery in addition to symbol error correction

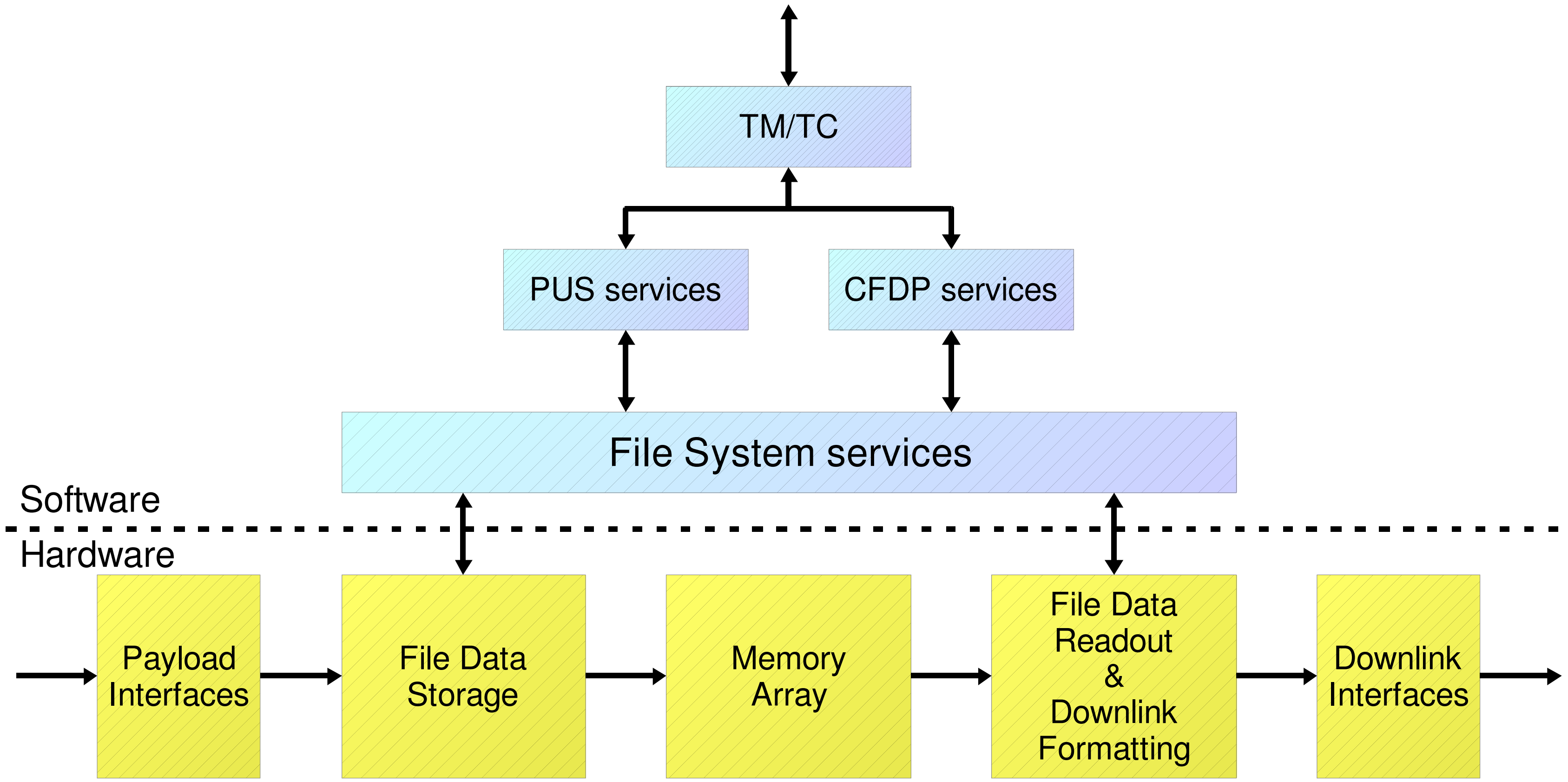
# SSMM functional architecture



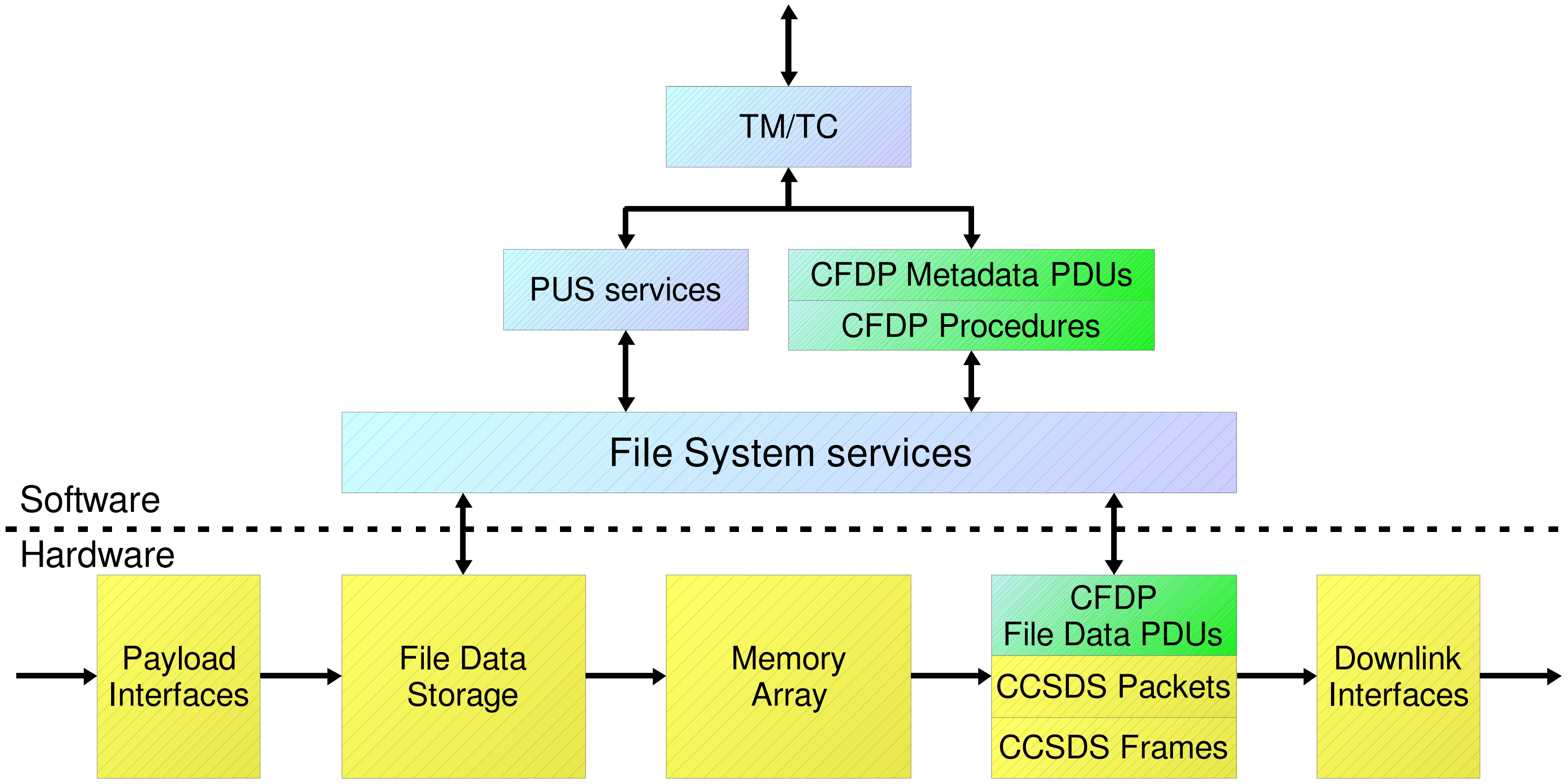
# CFDP impact on SSMM design

- CFDP in addition to PUS services
- Addition of PUS services accessing CFDP (it is preferred to have a dedicated PUS service for CFDP; it allows to leave unchanged the handling of existing PUS services)
- Files and packets virtual storage
- File system hierarchy
- Files and directories namespace lookup
  - Directory metadata storage
  - File system mount with directory tree reconstruction from metadata
- Packet store granularity: variable length packets depends on user data structure; they may interact with storage data structure (packet vs block size), complex random packets selection
- File granularity: configurable (file data PDU length), independent from both user data structure and mass memory storage structure, easy random selection of file data PDUs
- CFDP requires PDU and packets formatting in addition to data link layer formatting

# Allocation of PUS, CFDP, file data readout and downlink formatting functions



# Hardware and software allocation of key CFDP functions



# Conclusions

- CFDP File based approach rationalizes the mass memory downlink chain and improves independence of logical and physical implementation
- Main CFDP implementation efforts:
  - Hardware implementation of the downlink chain processing
  - Name space lookup, directories and hierarchical file system management
- A full CFDP file based downlink instead of a file and packet store system would simplify the SSMM implementation and avoid duplication of services

# Questions