Data Management

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DMS Hardware Mapping

Real Time Server

DMS
- Telemetry Archiver
- Data Retriever
- Event Listener
- Event Handler
- Event Retriever

Analysis
- Clock Correlation
- RT Statistics
- SSR

COTS
- RTWorks

Data Server

CMS
- Schedule Controller
- Ground Schedule
- Load Catalog
- Spacecraft Model
- Command Model

DMS
- Queue Manager
- Playback Merge
- Event Handler
- Event Archiver
- Event Retrieve
- Disk Cleaner
- SDPS I/F
- Data Retriever
- File Manager
- PDB Input
- PDB Validation
- PDB Edit
- PDB Reporting
- OD Generation

COTS
- Sybase
- DBTools

User Station

DMS
- Data Retriever
- Event Listener
- Event Handler
- Event Retrieve

Analysis
- Request Manager
- Off-Line Analysis
- DSS Advisor
- DSS DataServer

COTS
- Sybase
- DBTools
- RTWorks
- DBX
- IMSL
- Altair

IST

DMS
- Data Retriever
- Event Listener
- Event Handler
- Event Retriever

Analysis
- Request Manager
- Off-Line Analysis

COTS
- Sybase
- DBTools
- DBX
- IMSL

Data Management Overview

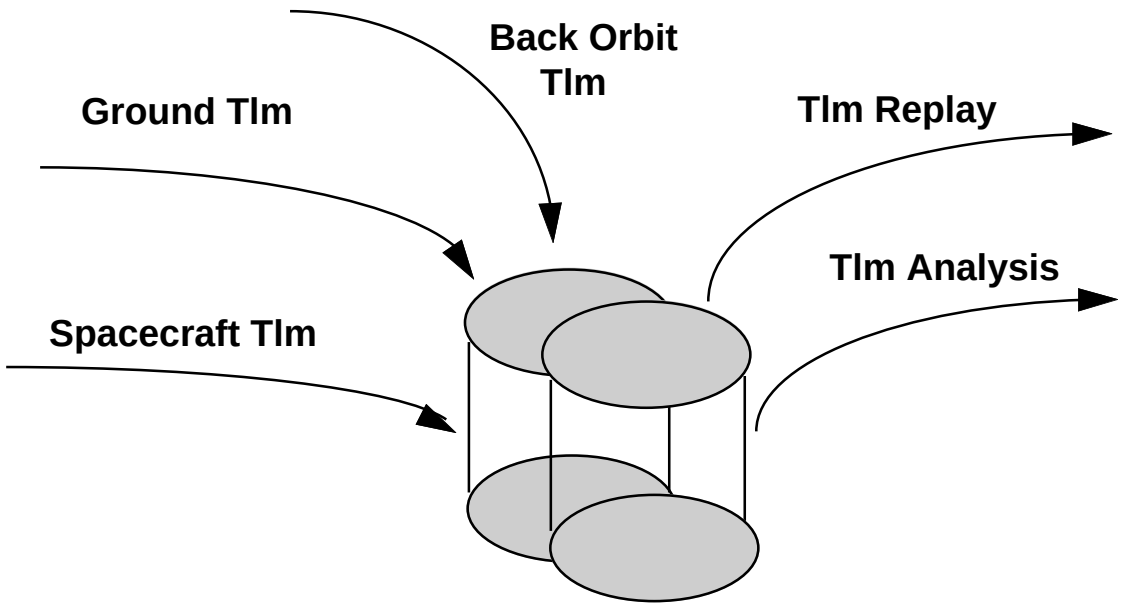
FOS Database

Database Features

Project Data Base (PDB)

Telemetry Archive
Event Processing
File Management

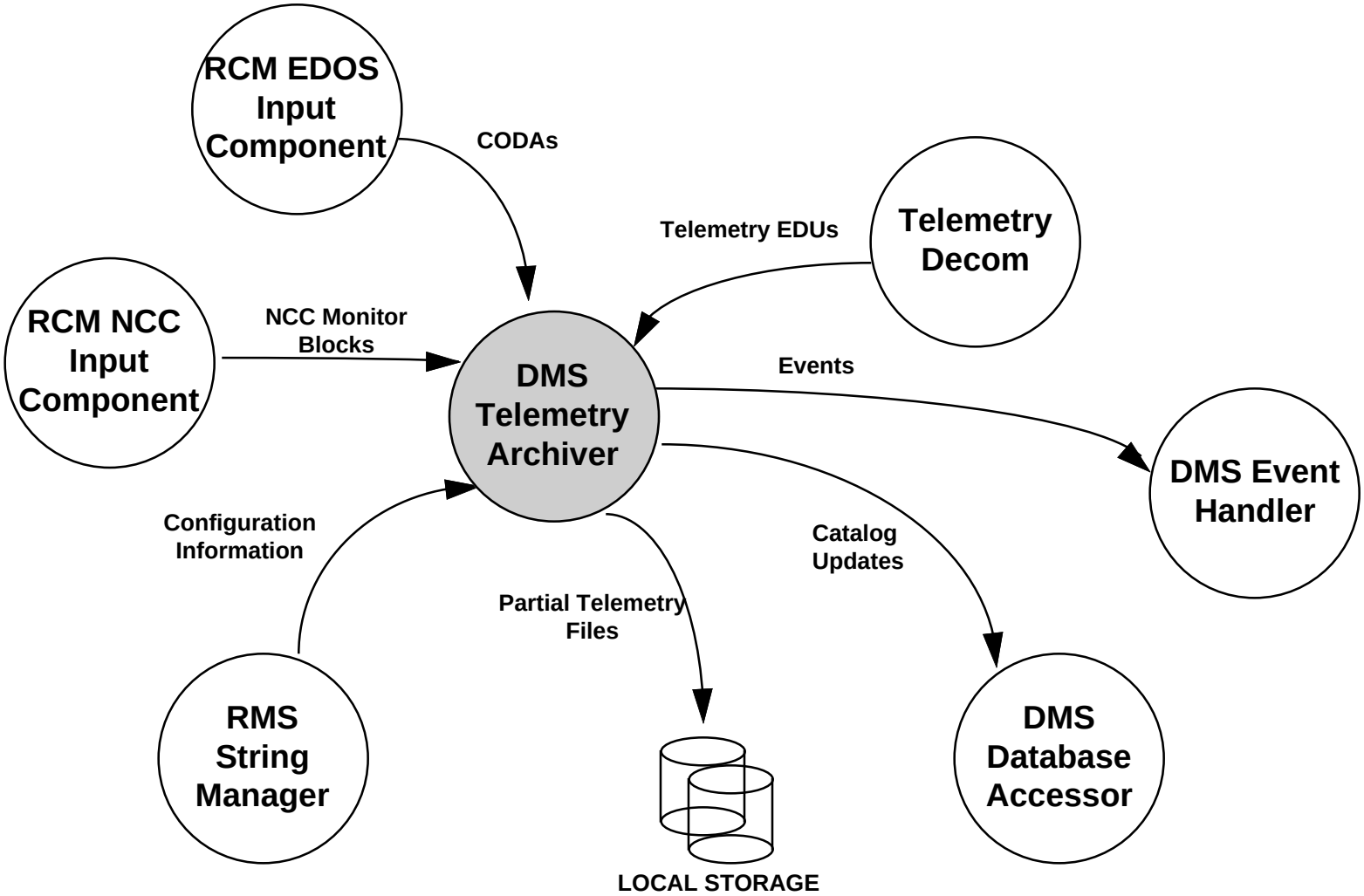
DMS Telemetry Archive Overview



DMS Telemetry Archive Overview

- Archives Real-Time Spacecraft and Ground Telemetry
- Merges Back-Orbit Housekeeping Telemetry With Real-time to Create Seamless Archive
- Retrieves Telemetry for Replay and Analysis Purposes

DMS Telemetry Archiver Context Diagram



DMS Telemetry Archiver

Process Description

- **Archives Spacecraft Telemetry**
  - **Housekeeping**
  - **Health & Safety**
- **Archives Ground Telemetry**
  - **EDOS CODAs**
  - **NCC Monitor Blocks**

Key Requirements

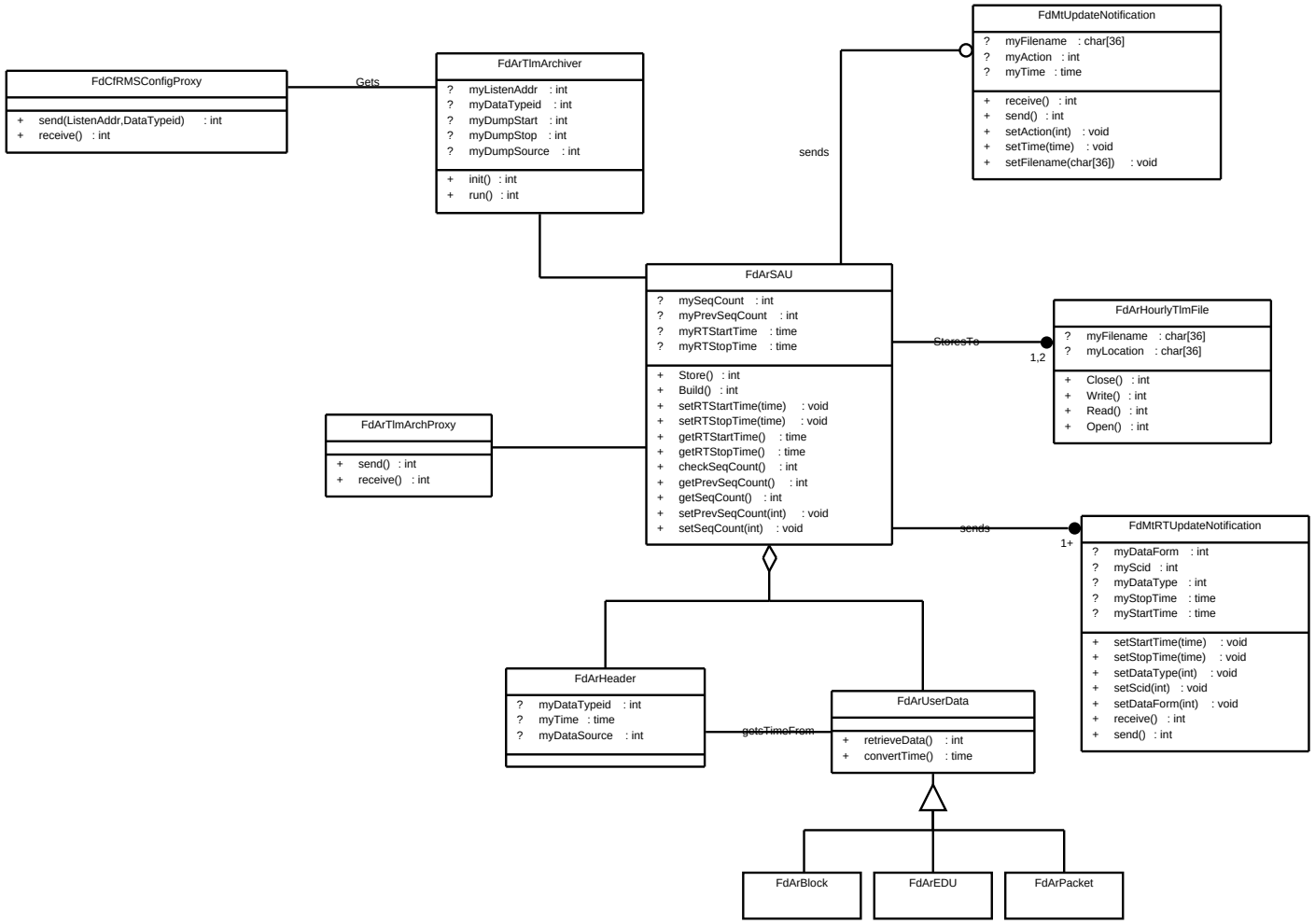
- **Archive all spacecraft and ground telemetry**
- **Archive telemetry in chronological order**

DMS Telemetry Archiver

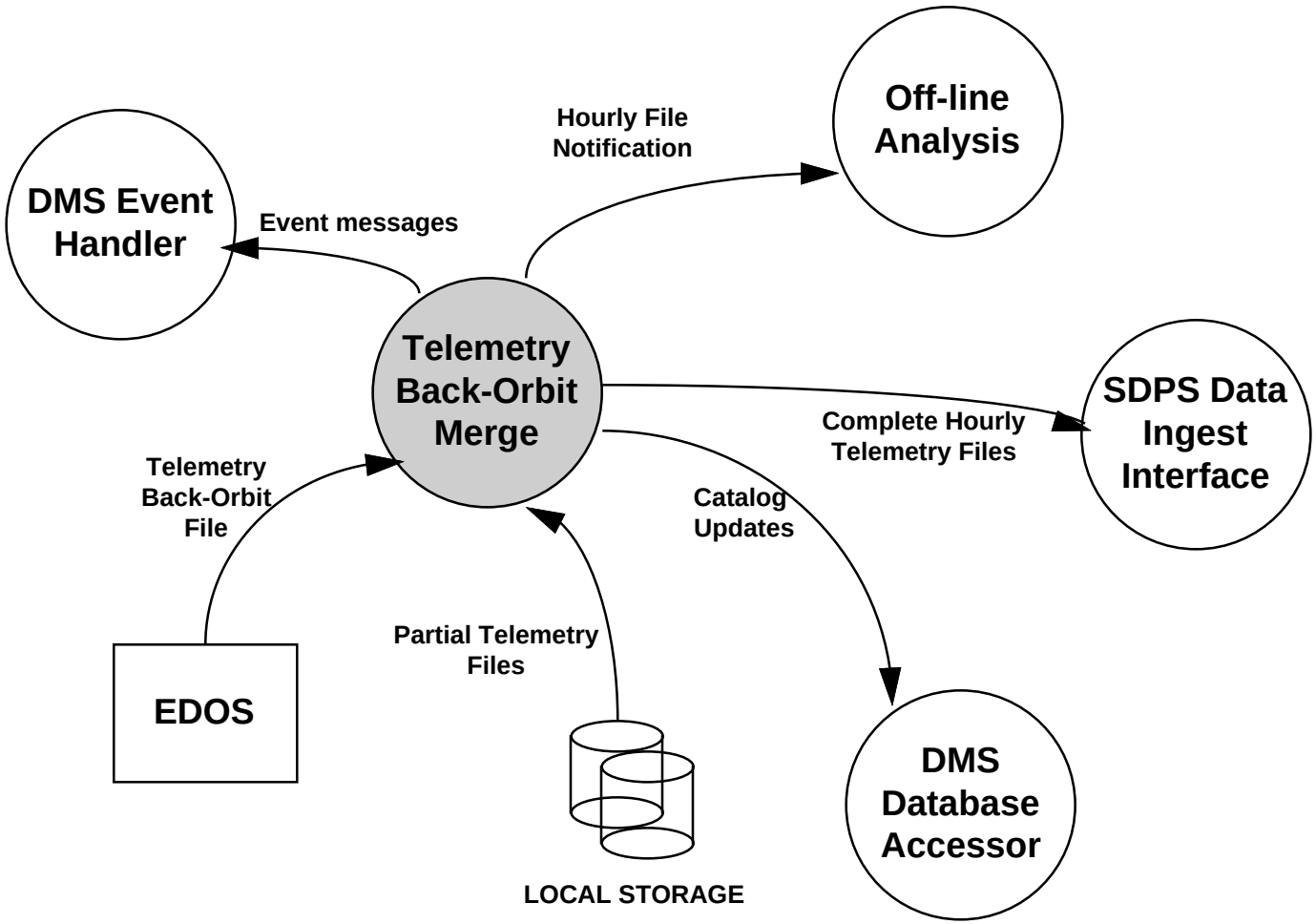
Design Implementation

- **RMS provides configuration information to Archiver Process on the RTS**
  - **Backup archivers exist on backup Real-time Server**
- **Receives spacecraft telemetry from Telemetry Subsystem**
- **Receives ground telemetry from Real-Time Contact Manager Subsystem**
- **Telemetry is stored in hourly files**
- **Naming convention is <Spacecraft (3 chars)>YYYYDDDHH.<data type>**
  - **(e.g., AM1199810012.hk)**
- **Archive records are called Standard Archive Units and consists of:**
  - **Time, data type, data source, data packet**
- **Updates telemetry catalog**
  - **Time, spacecraft id, data type, data source**
- **User can view telemetry catalog**

DMS Telemetry Archiver Object Model



DMS Telemetry Merge Diagram



DMS Telemetry Merge Description

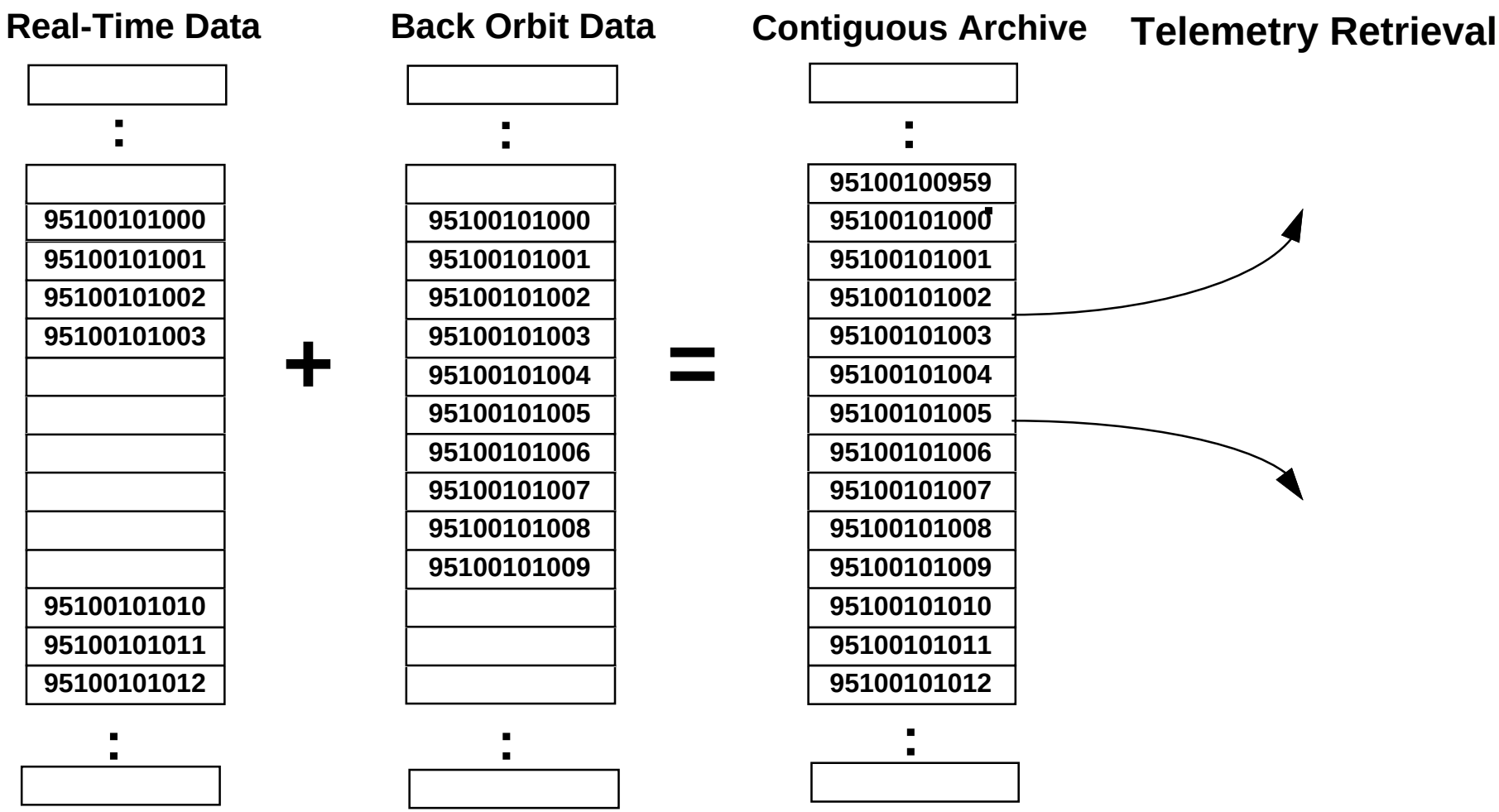
Process Description

- **Merges Back-Orbit housekeeping telemetry with real-time housekeeping telemetry**
- **Notifies Off-Line Analysis when statistics can be performed**

Key Requirements

- **Merge telemetry packets to create contiguous archive**
- **Ensure telemetry archive does not contain duplicate data**
- **Replace poor quality packets with good quality packets**

DMS Telemetry Merge



DMS Telemetry Merge

Design Implementation

- **Merge process is fully automated**
- **EDOS sends back orbit telemetry file to the EOC**
- **CSS KFTP service notifies DMS Telemetry Merge of the arrival of the back orbit file**
- **Creates contiguous archive by building telemetry archive from back orbit telemetry and filling in gaps with real-time telemetry**
  - **Duplicate data is ignored**
  - **Bad quality data is replaced**
- **Analysis is notified when hourly file is fully merged**
  - **Automatically performs statistics**
- **Updates telemetry catalog to reflect merging process**
- **Automatically sends merged telemetry file to SDPS Long-Term archive**
  - **Telemetry files are immediately backed up**

DMS Telemetry Requests

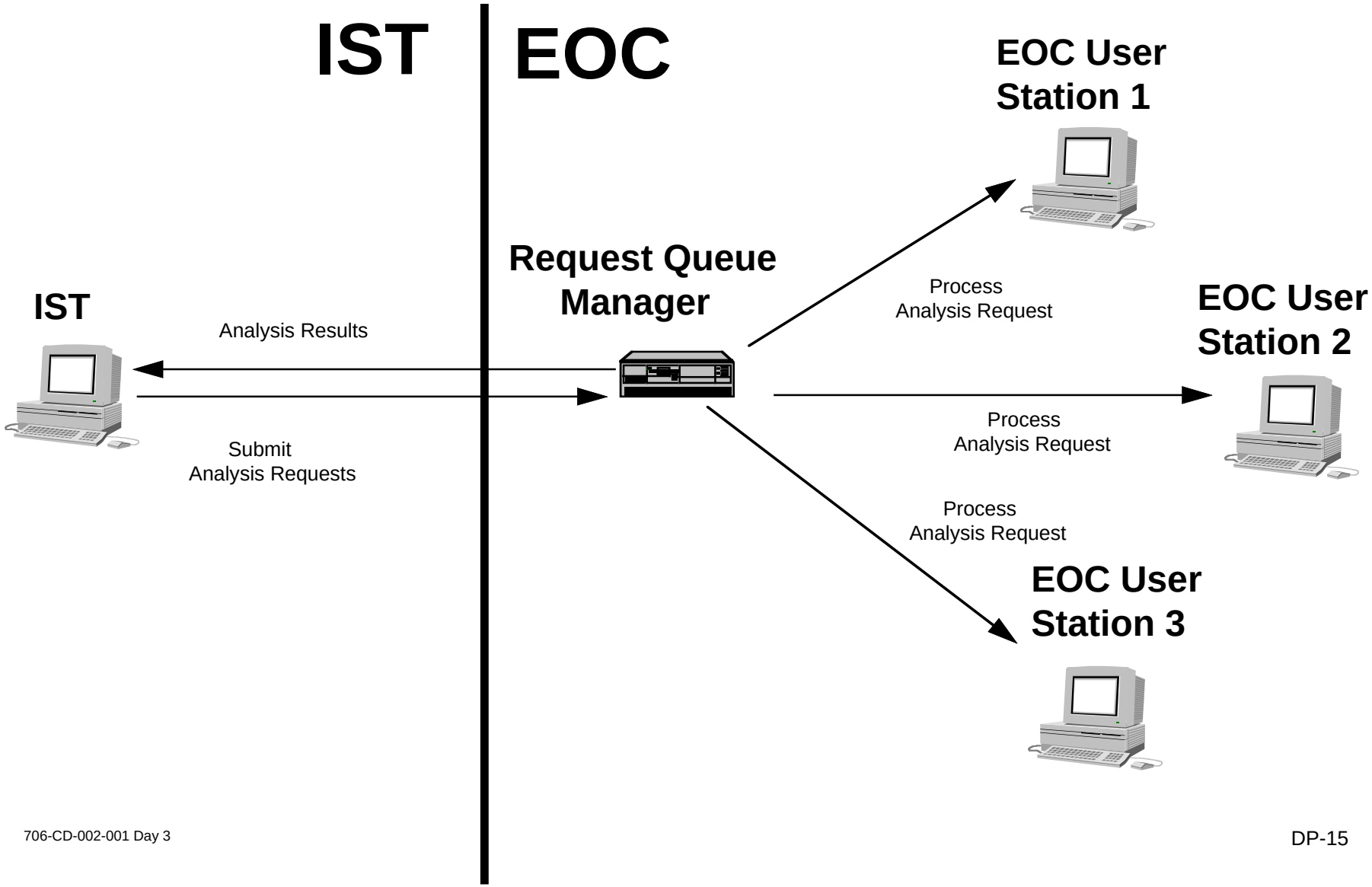
Process Description

- **Queue Manager**
  - **Provides queue for telemetry replay and analysis requests**
  - **Provides queue services**
  - **Distributes analysis requests to User Stations**
- **Data Retriever**
  - **Retrieves telemetry data from archive**
  - **Serves telemetry packets to analysis for analysis requests**
  - **Serves telemetry packets to decom for shared and dedicated replays**

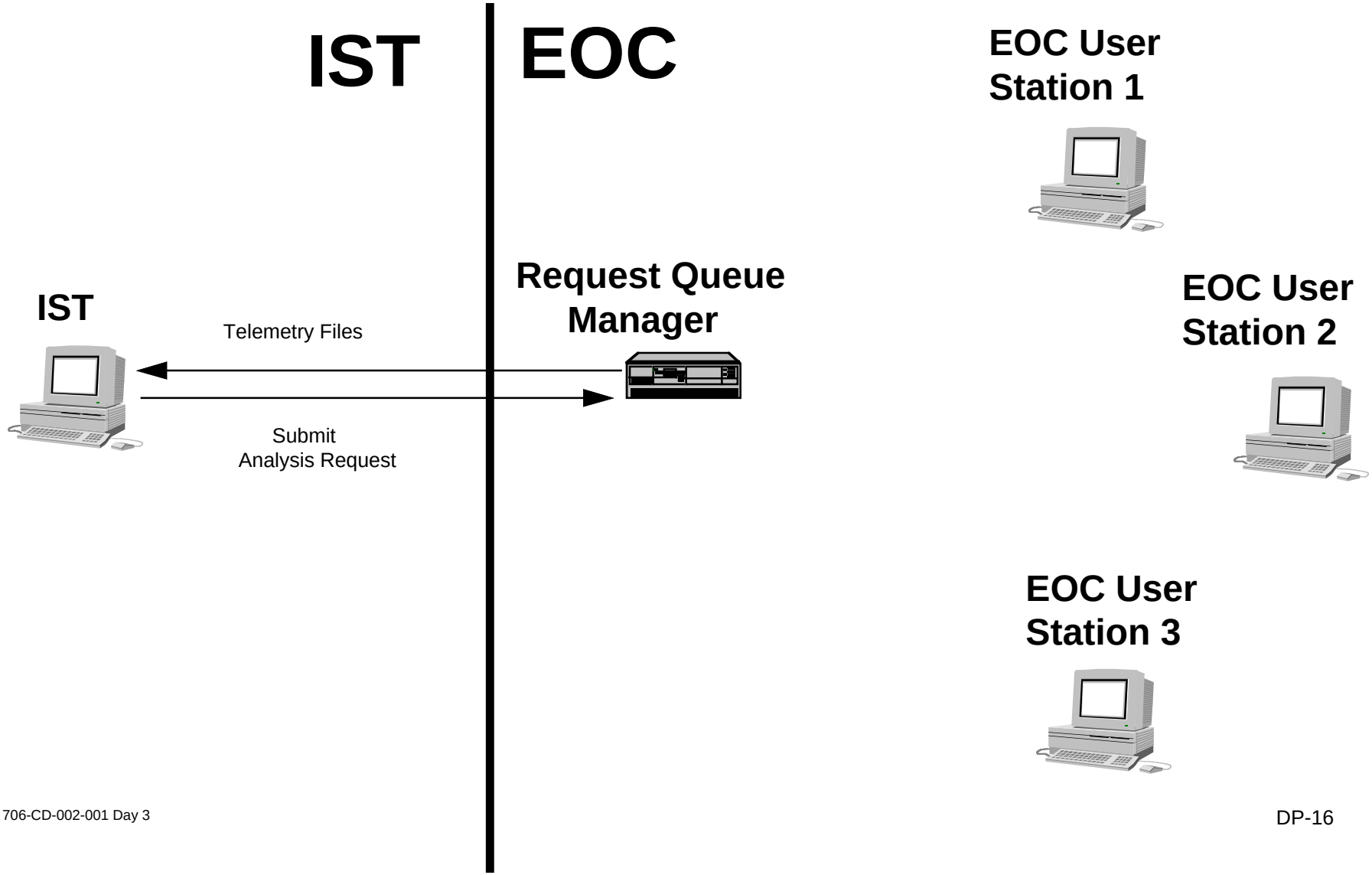
Key Requirement

- **Provide the capability to process simultaneous requests**
- **Delete requests from the queue**
- **Provide the capability to replay archived telemetry at user selectable rates**

IST Distributed Telemetry Analysis Request



IST Local Telemetry Analysis Request

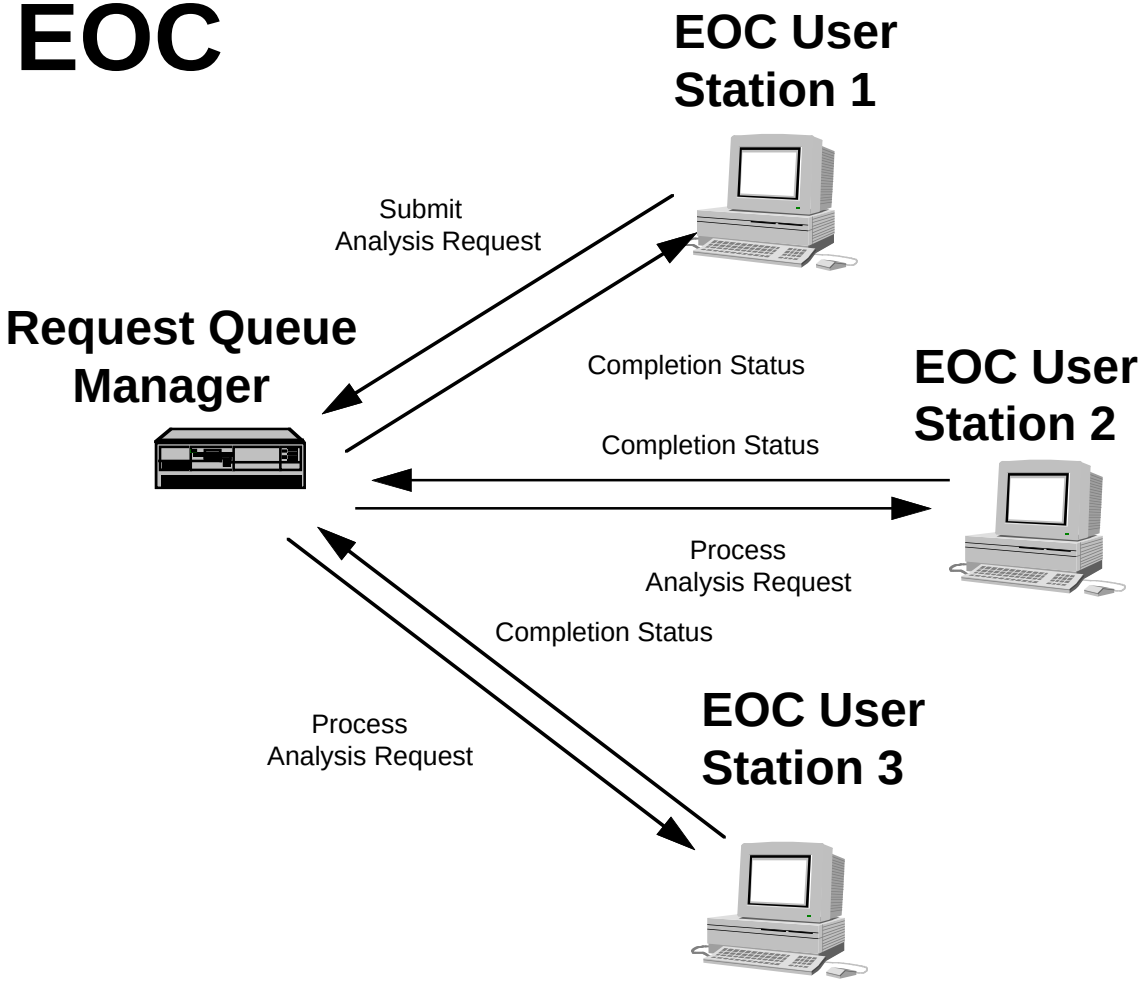


EOC Telemetry Analysis Requests

IST

IST

EOC



DMS Telemetry Requests

Design Implementation

- **Queue Manager**
  - **Receives Analysis, Dedicated Replay, and Shared Replay requests**
  - **Queue is centralized at the Data Server**
  - **Queue is checkpointed in case of failover**
  - **Request Managers register with the Request Queue Manager when they are ready to accept and process new requests; this allows processing to be done on machines with lighter loads**
  - **Request Manager can elect to process only replay requests**
  - **Distributes requests to available EOC User Stations for analysis requests**

DMS Telemetry Requests

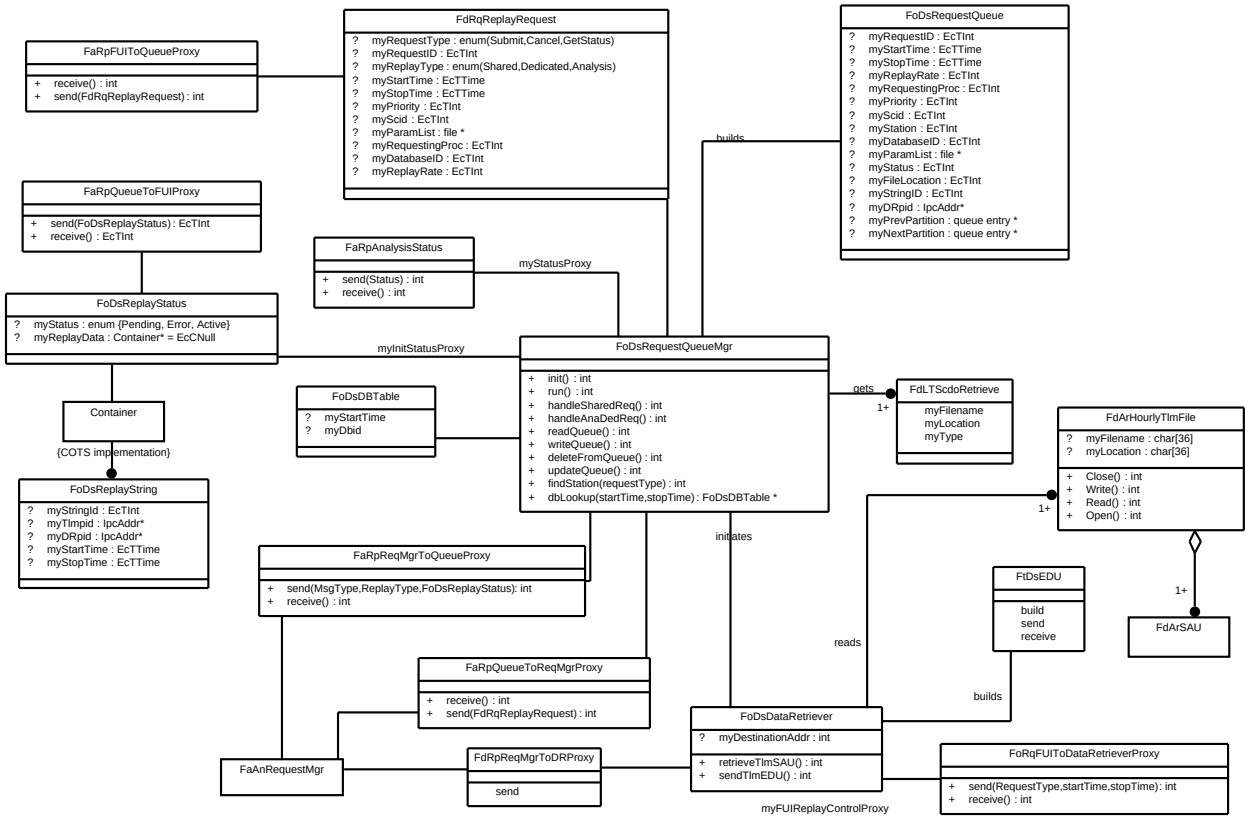
- **Queue Manager (cont.)**
  - **ISTs have the options to have requests processed at the EOC or locally**
    - **Queue Manager copies telemetry files to IST for local requests**
    - **DMS check local IST disk for telemetry files before sending request to Queue Manager**
  - **If needed, Queue Manager sends a request to SDPS Data Server for telemetry files**
  - **Queue Options**
    - **View**
    - **Prioritize**
    - **Delete**

DMS Telemetry Requests

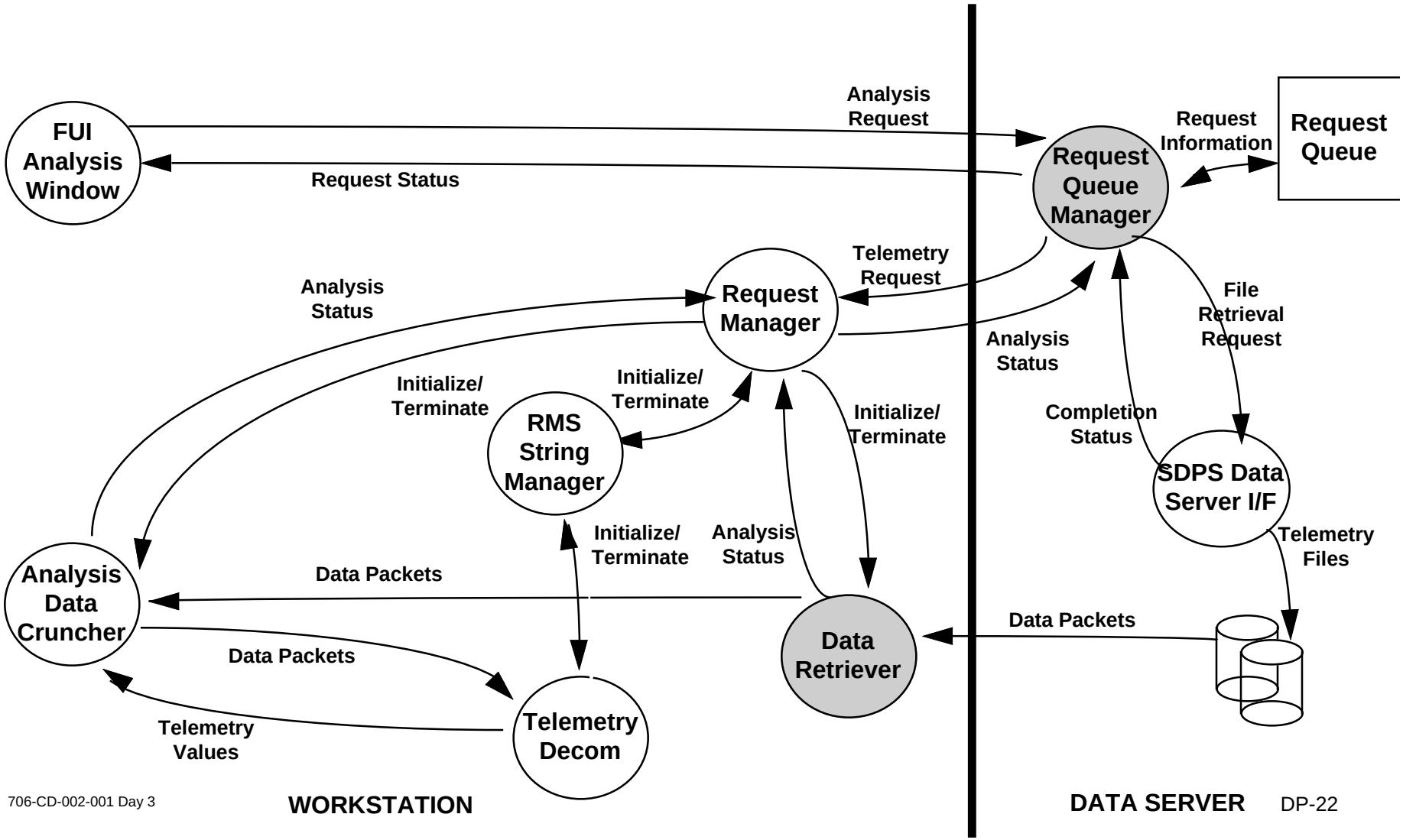
Design Implementation (cont.)

- **Data Retriever**
  - **Distributed to EOC User Stations for analysis and dedicated replay requests**
    - **Benchmarks of this concept were very favorable**
  - **Multicasts from the data server for shared replay requests**
  - **Uses start time, data type, and data source from the request to index into telemetry archive**
  - **Replay rates are selectable**
  - **User can control replay**
    - **Start, stop, pause, step by seconds**

DMS Telemetry Requests



DMS Telemetry Retrieval for Analysis Requests

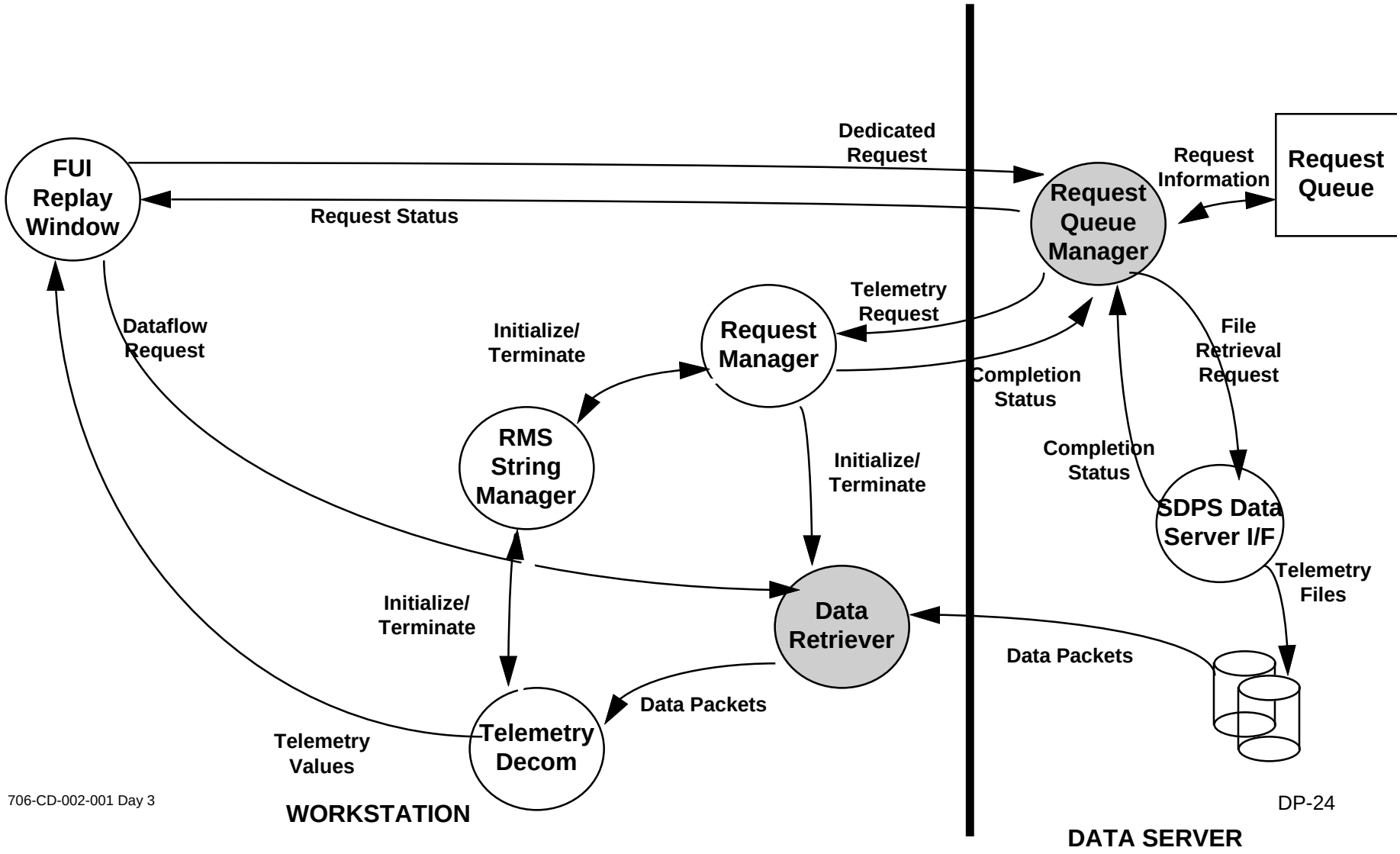


DMS Telemetry Retrieval for Analysis Requests

Analysis Requests

- **Analysis request is received from FUI Replay window manager**
- **Request Queue Manager sends a request to the SDPS Data Server Interface for any requested telemetry files which are located in long-term storage**
- **Request Queue Manager forwards the request to the Request Manager process and inserts the request into the queue**
- **Request Queue Manager notifies Request Manager when Data Retriever and telemetry data is available**
- **Processes required to perform analysis requests are initialized (Decom, Data Retriever, Analysis Data Cruncher)**
- **Data Retriever process begins retrieving and forwarding data packets**
- **The Request Queue Manager receives the analysis request status from the Request Manager and forwards the status on to FUI**
- **Request is terminated and deleted from the queue either upon job completion or at the request of the user**

DMS Telemetry Retrieval for Dedicated Replay Requests

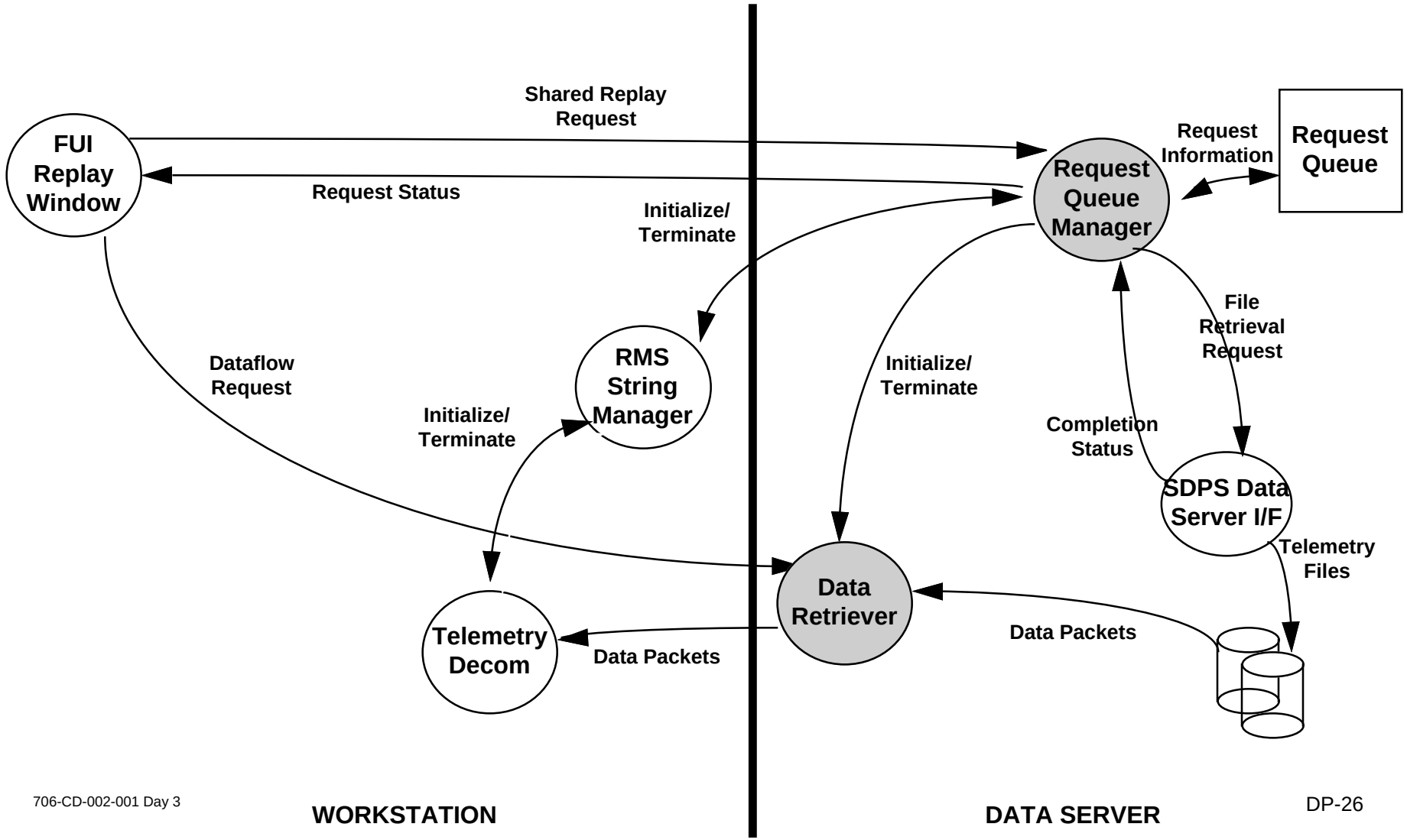


DMS Telemetry Retrieval for Dedicated Replay Requests

Dedicated Replay Requests

- **Request Queue Manager receives dedicated replay request from FUI Replay Window**
- **DMS Queue Manager sends a request to SDPS Data Server Interface for any requested telemetry files which are located in long-term storage**
- **Request Queue Manager notifies Request Manager when Data Retriever and telemetry data is available**
- **Processes required to perform dedicated replay request are initialized (Decom, Data Retriever)**
- **Data Retriever process receives a data request from the FUI Replay window and begins retrieving and forwarding data packets**
- **Request is terminated and deleted from the queue upon request of the user**

DMS Telemetry Retrieval for Shared Replay Requests

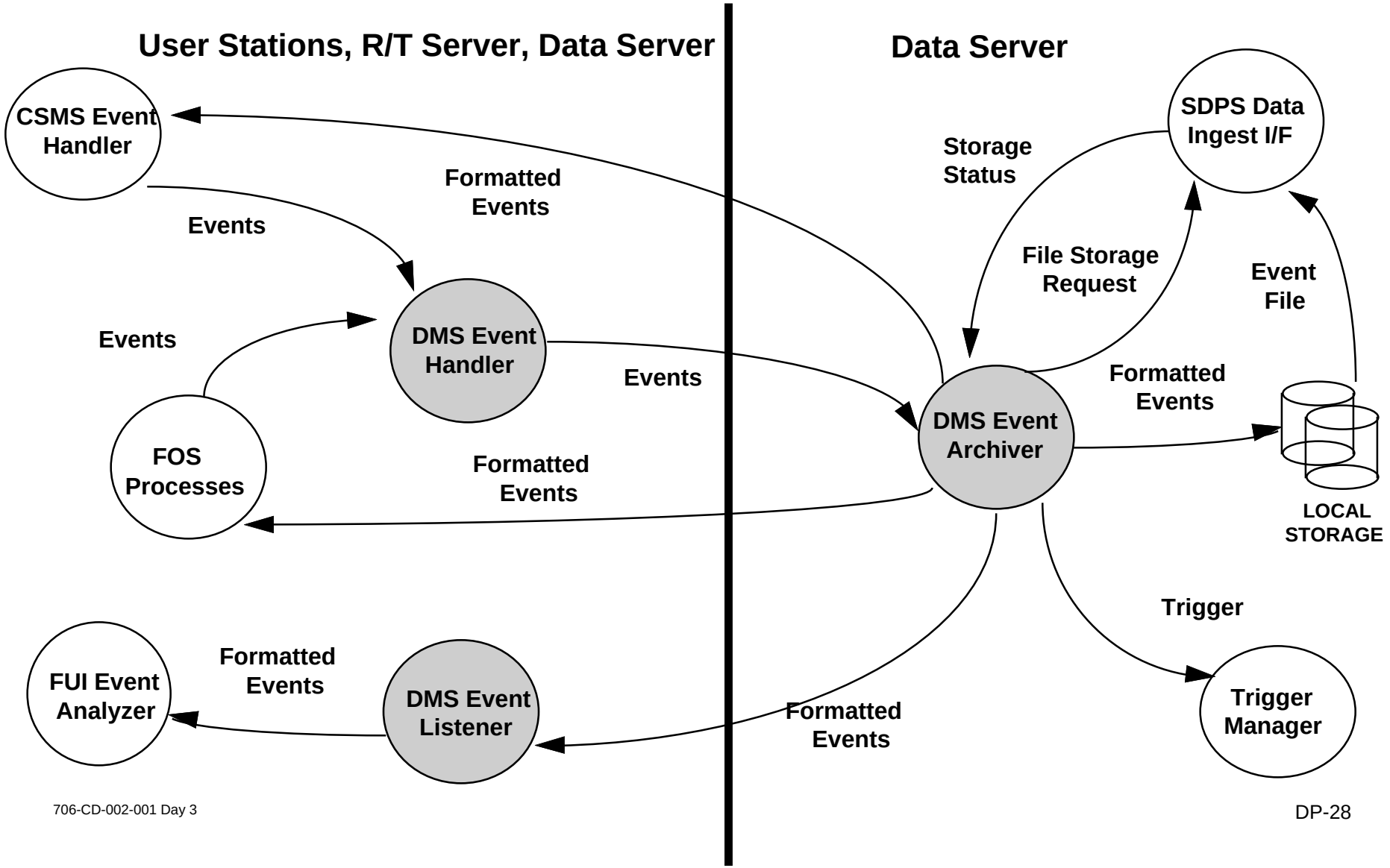


DMS Telemetry Retrieval for Shared Replay Requests

Shared Replay Requests

- **Shared replay request is received from FUI Replay window manager**
- **DMS Queue Manager sends a request to SDPS Data Server Interface for any requested telemetry files which are located in long-term storage**
- **Request Queue Manager initializes a Data Retriever process on the Data Server to multicast the telemetry data**
- **RMS String Manager initializes Telemetry Decom**
- **Ready status is sent to the FUI Replay Window**
- **Data Retriever process receives a data request from the FUI Replay window and begins retrieving and forwarding data packets**
- **Request is terminated and deleted from the queue upon request of the user**

DMS Event Processing



DMS Event Processing Context Description

Process Descriptions

- **DMS Event Handler**
  - **Located at User Stations, Data Server, and Real-Time Server**
  - **Receives events from FOS Processes and CSMS Event Handler**
  - **Routes unformatted events to DMS Event Archiver**
- **DMS Event Archiver**
  - **Located at the Data Server**
  - **Formats and archives events**
  - **Initiates triggers**
  - **Multicasts events over the network**

DMS Event Processing Context Description

- **DMS Event Listener**
  - **Located at User Stations, Data Server, and Real-Time Server**
  - **Reads formatted events from the network**
  - **Forwards formatted events to event display**

DMS Event Processing

Key Requirements

- **Archive all events in chronological order**
- **Provide event filtering**
- **Provide the capability to initiate a trigger based on an event**

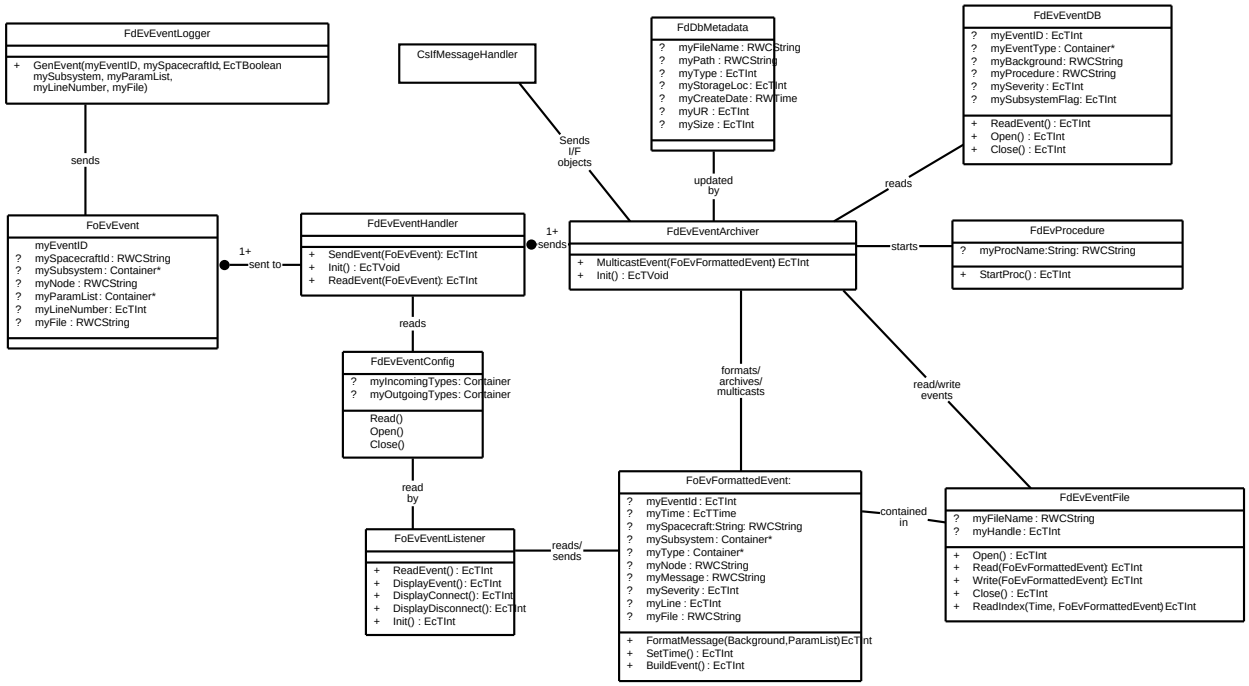
Design Implementation

- **Event Handler sends point-to-point to the Event Archiver where events are formatted and time-tagged**
  - **Ensures chronological time-tagging**
  - **Ensures that all events are archived**
- **Event Archiver formats events using events definitions, and archives formatted events in hourly event file**
  - **Time, event id, spacecraft id, subsystem, event type, node, event message, severity, line, file**

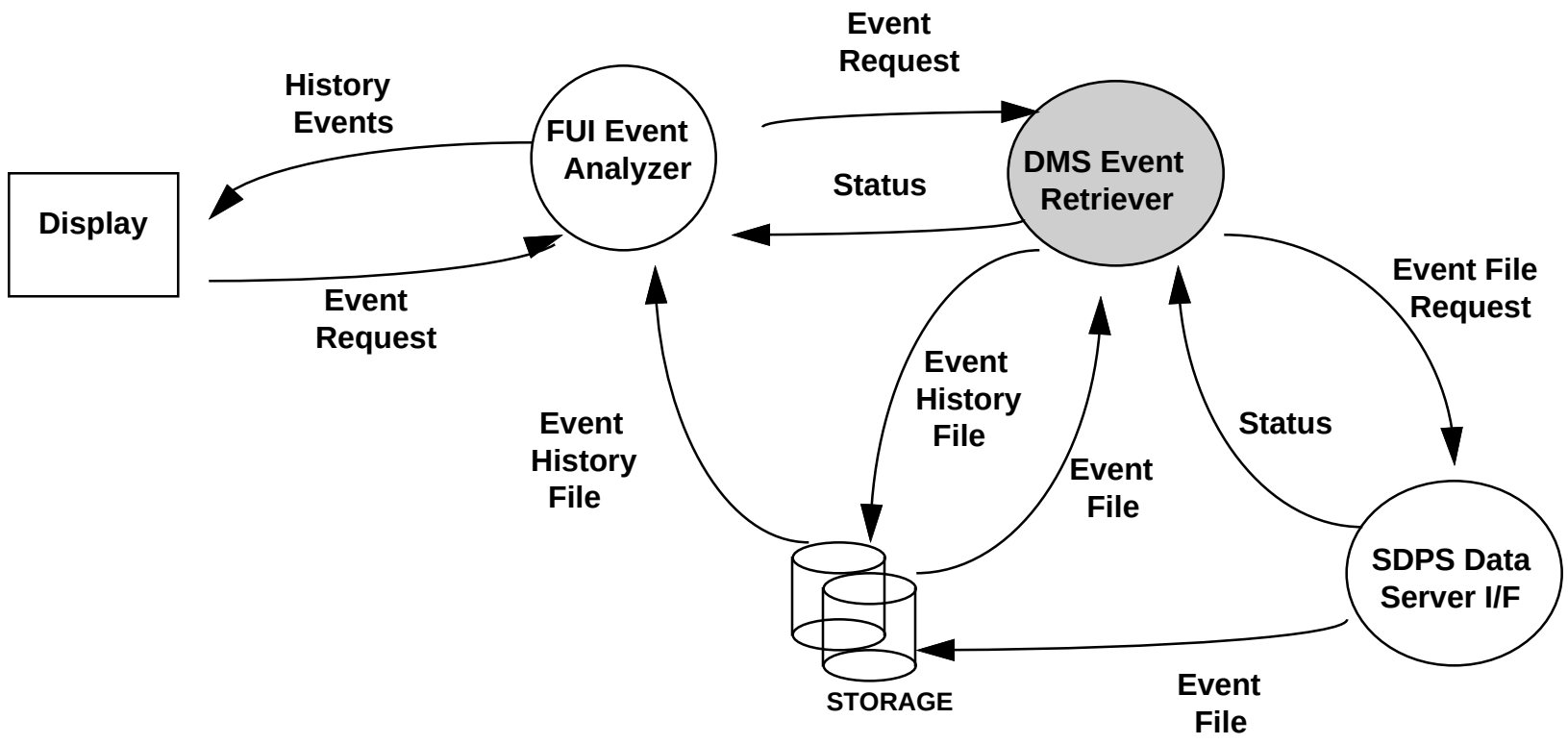
DMS Event Processing

- Event Archiver uses the event definitions to determine if there is an associated trigger, and/or if the event needs forwarded to a FOS process
- Event Archiver passes trigger information to Trigger Manager
  - Starts Procedure or Executable
- Event Archiver multicasts formatted events over the network
  - Allows all events to be displayed
- Event Handler (outgoing) event filters prevents duplicate events from being on the network
  - Example (limit violation events)
- Possible event filters are:
  - Event ID, Event types, Subsystem Id, Spacecraft Id
- Event Archiver automatically notifies SDPS Data Ingest Process that event file needs to go to long term storage

DMS Event Processing



DMS Event Retriever



DMS Event Retriever Context Description

Process Description

- **Responsible for reading formatted events from the event archive, and creating an event history file**

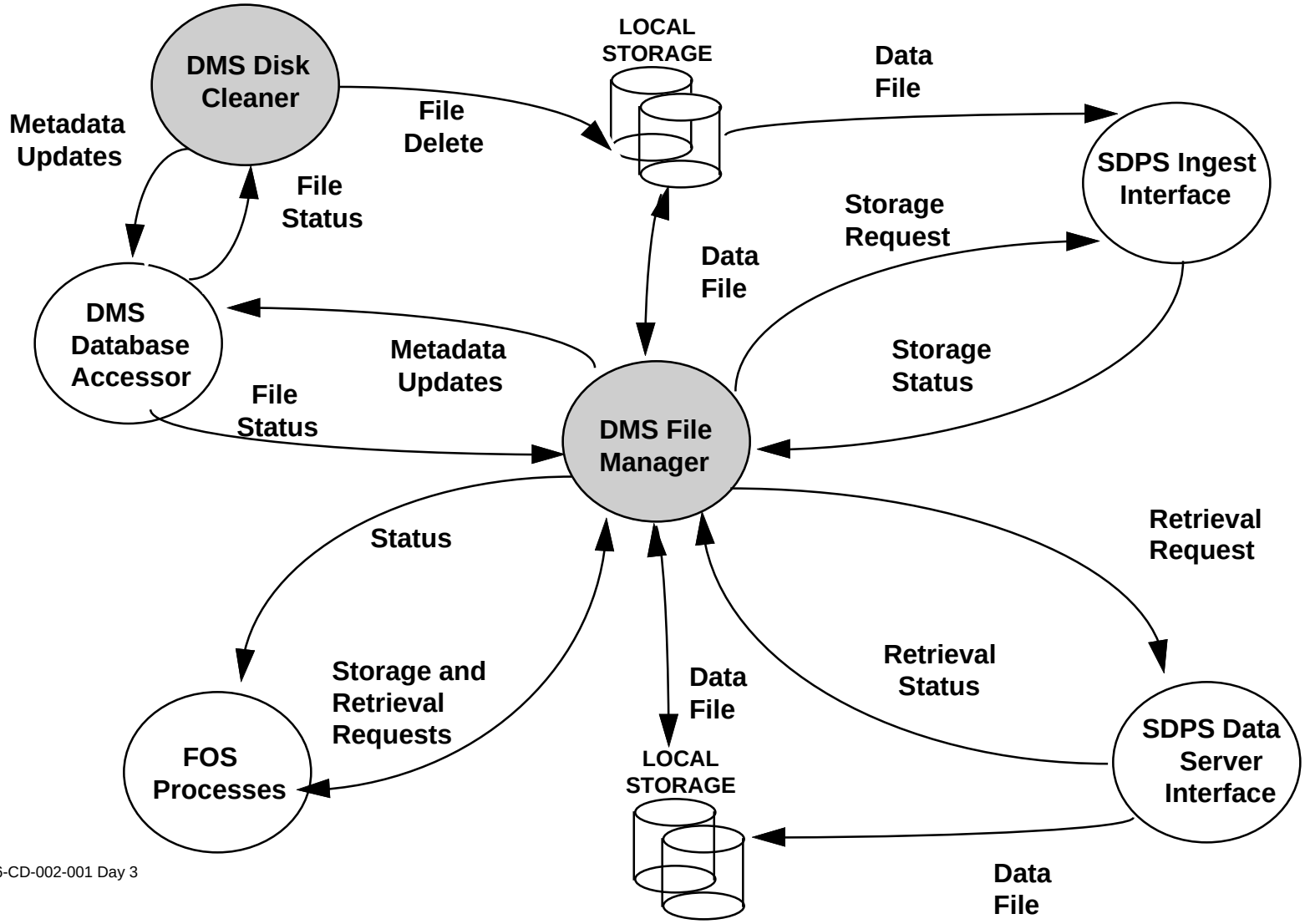
Key Requirements

- **Retrieve events in chronological order**
- **Filter events**

Design Implementation

- **Receives event history requests from FUI Event Analyzer**
- **Automatically retrieves event files from SDPS Interface process if needed**
- **Uses event request to determine how to filter events**
  - **Event history files are not as large if filters are used**
- **Event Filters**
  - **Event ID, Spacecraft ID, Event types, Subsystem ID**
- **Stores event history file in requested destination directory**

DMS File Management



DMS File Management

Process Description

- **DMS File Manager**
  - **Stores and Retrieves data files**
  - **Updates File Metadata**
- **DMS Disk Cleaner**
  - **Removes old data files**

Key Requirements

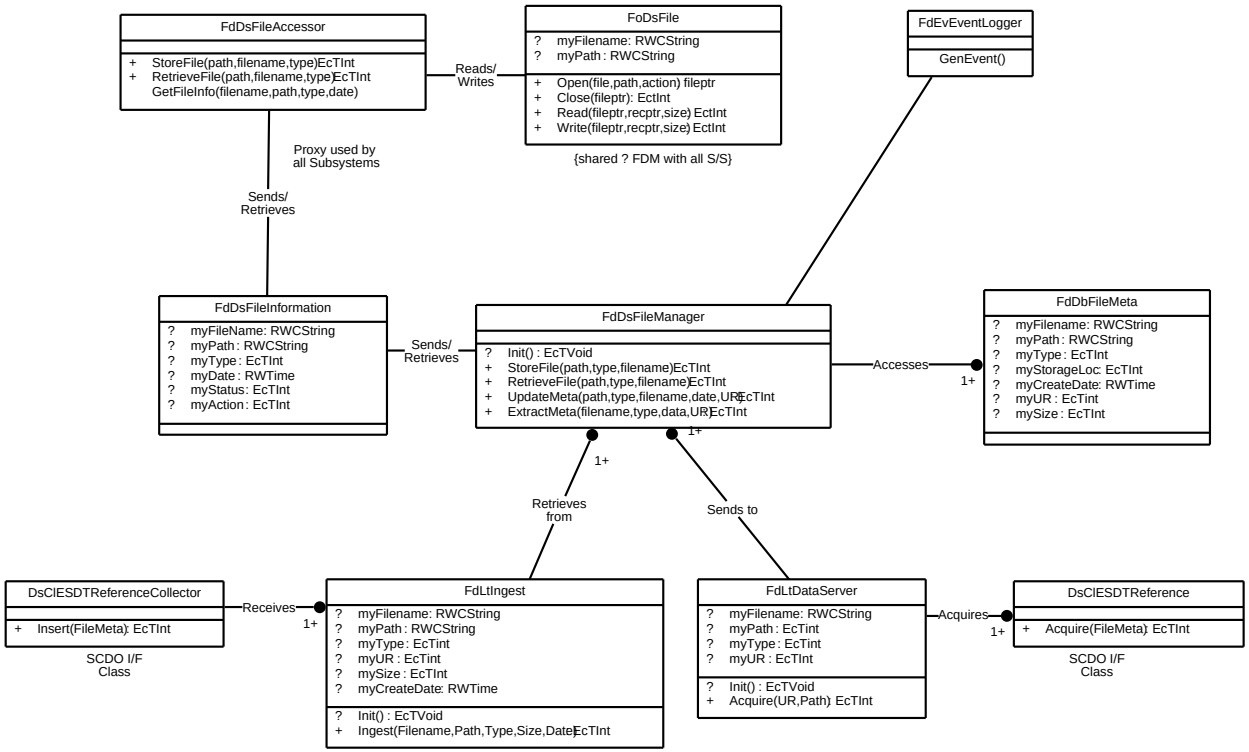
- **Provide the capability to store and retrieve data files**
- **Maintain data files at the EOC for a minimum of 7 days**

DMS File Management

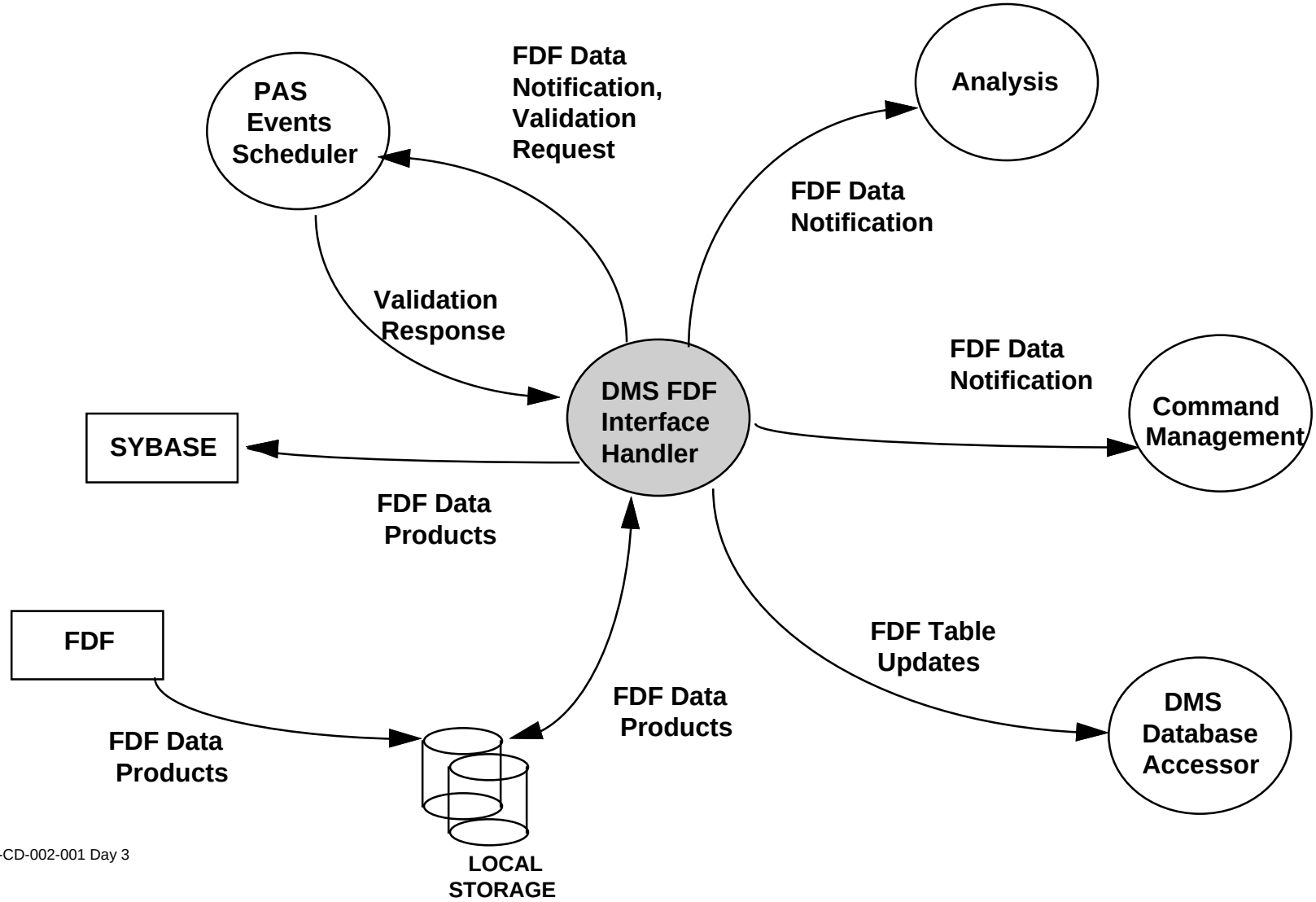
Design Implementation

- **FOS processes use DMS File Manager to store and retrieve data files**
  - **DMS automatically notifies SDPS when data files need copied to long-term storage**
  - **DMS automatically retrieves data files from SDPS if needed**
- **DMS File Manager uses file metadata table in Sybase to determine information about data files**
- **File metadata contains information about data files in the public directories and at the long term archive**
  - **Filename, Type, Storage location(Local,Long-Term), SDPS Universal Reference**
- **DMS Disk Cleaner removes data files from the disk after a predefined time (minimum of 7 days)**
  - **Uses file configuration information to determine file removal requirements**

DMS File Management



DMS FDF Interface



DMS FDF Interface Handler

Process Description

- **Provides interface to FDF**
- **Initiates the processing of FDF data products at the EOC**

Key Requirements

- **Must maintain information received from FDF**

Design Implementation

- **CSS KFTP service notifies DMS FDF Interface Handler of the arrival of the FDF data products**
- **Validates FDF data products**
  - **Uses Sybase to help perform validation**

    Syntax, Semantics, Cross Validations

DMS FDF Interface Handler

- **Upon successful validation, DMS formats and stores FDF data products**
  - **Updates Sybase tables and data files**
- **Notifies appropriate subsystems of arrival of new FDF data products**
  - **CMS, PAS, Analysis**