Data Server Subsystem Software

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Data Server Software Subsystem CSCI Definition

Science Data Server (SDSVR)

- **Purpose: Manages access to and storage of a collection of earth science and related (but not document) data.**

Document Data Server (DDSVR)

- **Purpose: Manages access to and storage of a collection of earth science related documents.**

Storage Management (STMGT)

- **Purpose: Manages and provides persistent services and storage.**

Data Distribution (DDIST)

- **Purpose: Provides distribution services to the Data Server.**

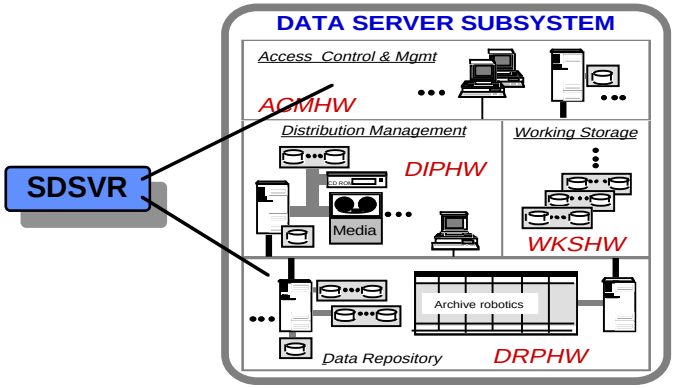
Data Server Software Subsystem
Science Data Server

Purpose:

- **Stores Earth Science Data Objects**
- **Enables access to Earth Science Data Object Services**
- **Maintain sessions with clients**
- **Advertises services**
- **Provides subscription services**

Key Topics

- **Session Management**
- **Data Types**
- **Data Type Services**
- **Subscriptions**



Science Data Server
Session Management

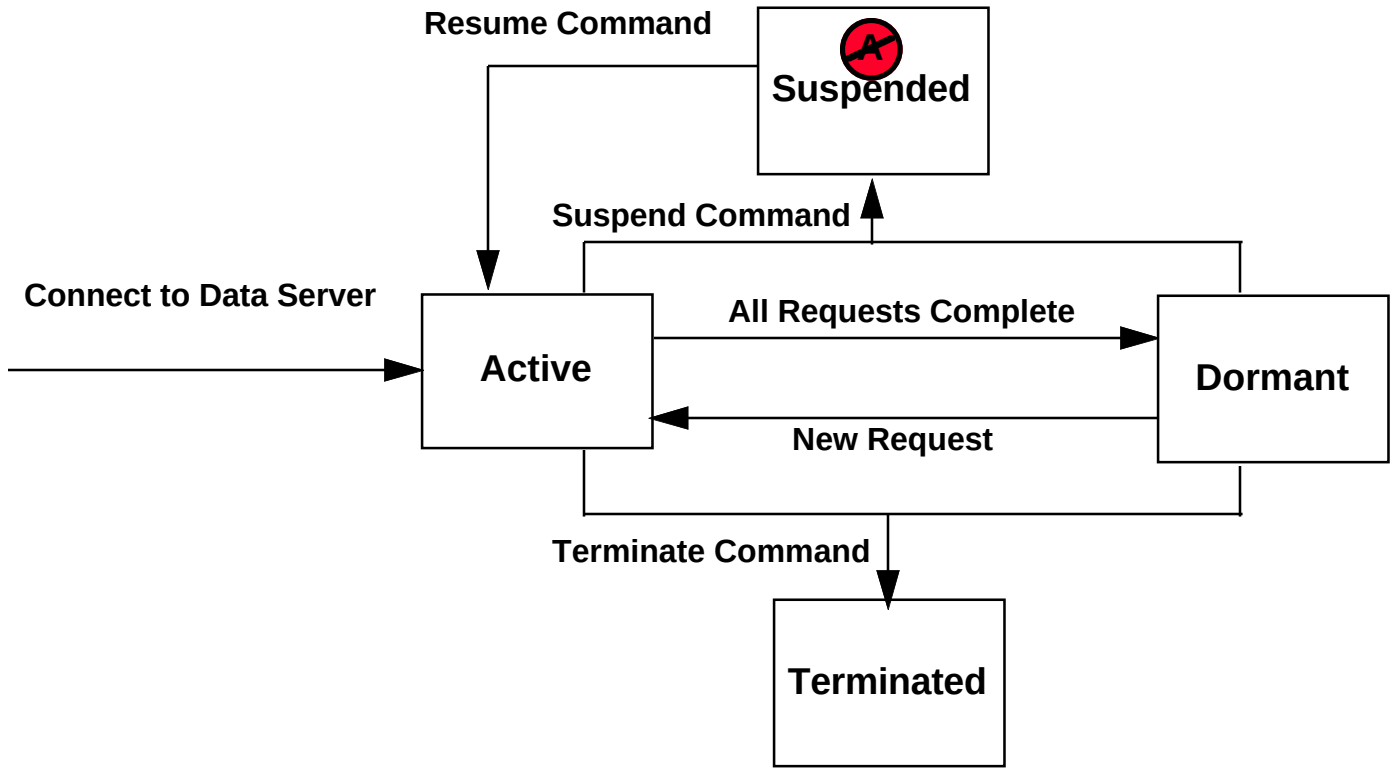
Session: Manages interaction between the external client and the data server.

Key Features of Sessions

- **Stateful connections to a service provider**
- **Retains context of client's activity**
- **Support of "long term" connection and retention**
- **Allows administrative tuning and management of user access load in support of resource management**

Science Data Server Session Management

Session State Transition Diagram



Science Data Server
Data Types

Three levels of abstraction:

- **ESDT**
  - **Provide a view of data objects from the Earth Science perspective**
  - **Examples: QAStatistics, AST15, CER03, BrowseData**
- **CSDT**
  - **Provide a common implementation view of data objects**
  - **Examples: DsSdSwaths, DsSdRectangularGrid, DsSdAccessTables**
- **Persistence and Transport**
  - **Current technology used for persistence and/or transport of portions of data objects**
  - **Rel. A: HDF, EOS-HDF, SFDU**

Science Data Server Data Types
Rel A ESDT products - CSDT

Product	Primary CSDT	Name
CER01	DsSdSwath	Bi-Directional Scan (BDS)
CER02	DsSdSwath	ES-8 ERBE-Like Product
CER03	DsSdGrid	ES-9 ERBE-Like Product
CER04	DsSdSwath	Single Satellite Cloud-Radiation Pixel (CRS)
CER05	DsSdGrid	Hourly Single-Satellite Flux Product (FSW)
CER06	DsSdGrid	Monthly & Regional Flux Data Product (SRBAVG)
CER07	DsSdGrid	Synoptic Cloud-Radiation (SYN)
CER08	DsSdGrid	Regional, Monthly Average (AVG)
CER09	DsSdSwath	Single Satellite Instrument Earth Scan (IES)
CER11	DsSdSwath	Single Satellite TOA Fluxes, Surface Fluxes, and Cloud Properties (SSF)
CER12	DsSdGrid	Surface and TOA Fluxes (SFC)
CER13	DsSdGrid	ES-4 ERBE-Like Product
CER14	DsSdGrid	ES-4G ERBE-Like Product
CER15	DsSdGrid	Zonal and Global Monthly Average (ZAVG)
CER16	DsSdGrid	Clear Reflectance and Temperature History (CRH)
CERX01	DsSdSDT	Satellite Ephemeris / Ancillary
CERX06	DsSdGrid	Meteorological, Ozone & Aerosols
CERX02	DsSdGrid	ERBE-like Daily Data Base
CERX03	DsSdGrid	Clear Reflectance and Temperature History (CRH)
LIS01		Level 1A Product
LIS02	DsSdPoint	Background Images Product
LIS03	DsSdPoint	Events Product
LIS04	DsSdPoint	Group Product
LIS05	DsSdPoint	Flash Product
LIS06	DsSdPoint	Area Product
LIS07	DsSdPoint	Orbit Product
LIS08	DsSdPoint	Vector Product
LIS09	DsSdImage	Browse Product
LIS10	DsSdPoint	Level-4 Product

Product	Primary CSDT	Name
1A-VIRS		VIRS Level 1A Product
1B-01	DsSdSwath	VIRS Radiances
3B-42	DsSdGrid	Rain estimates
3B-43	DsSdGrid	Surface rainfall map
1A-TMI		TMI Level 1A Product
1B-11	DsSdSwath	TMI Radiances
2A-12	DsSdSwath	Vertical hydrometeor profiles
3A-11	DsSdGrid	TMI Emission
1A-PR		PR Level 1A Product
1B-21	DsSdSwath	PR Total Power
1C-21	DsSdSwath	Radar reflectivity
2A-21	DsSdSwath	Surface reflectivity
2A-23	DsSdSwath	PR Qualitative
2A-25	DsSdSwath	Hydrometeor profiles
2B-31	DsSdSwath	Combined radar/radiometer
3B-31	DsSdGrid	Rainfall combined
3A-25	DsSdGrid	PR Rainfall
3A-26	DsSdGrid	Surface rain
1B-51	DsSdSwath	GT Calibration
1C-51	DsSdSwath	OC Reflectivities
2A-52	DsSdSwath	Measurable precipitation
2A-53	DsSdSwath	Rain map
2A-54	DsSdSwath	Convective map
2A-55	DsSdSwath	3-D Reflectivities
3A-53	DsSdGrid	5-day rainfall map
3A-54	DsSdGrid	Rainfall map
3A-55	DsSdGrid	Monthly 3-D Structure
GPI	native	Global Precipitation Index
GPCP	native	Global Rainguage Data
SAT	native	Surface Air temperature
SSMI_L1B	native	SSM/I brightness temperatures

Science Data Server Data Types
Rel A ESDT products - CSDT (cont.)

V0 Migration		
Product	**Primary CSDT**	**Name**
G-1	DsSdGrid	Daily Land Mosaic
G-2	DsSdGrid	10-Day Land Mosaic
G-3	DsSdImage	Daily Browse
G-4	DsSdImage	10-Day Browse
G-11	DsSdSwath	High Resolution Raw
G-26	DsSdGrid	CDTOMS Gridded
L-1	DsSdGrid	S4 Regional, Zonal, and Global Averages
L-3	DsSdGrid	S4G Regional, Zonal, and Global gridded averages
L-4	DsSdGrid	S4GN Regional, Zonal and Global gridded averages (Non-scanner only algorithm)
L-5	DsSdGrid	S9 Radiant Exitance and Albedo (scanner)
L-7	DsSdNDArray	S10N Radiant Exitance and Albedo (Non-scanner only)
L-8,L-11,L-14	DsSdSwath	S8 Processed archival tape
L-33	DsSdGrid	O3 Monthly Average
L-34	DsSdNDArray	Cloud Occurrence
L-35	DsSdPoint	Aerosol Profile
L-36	DsSdPoint	H2O Profile
L-37	DsSdPoint	NO2 Profile
L-38	DsSdPoint	O3 Profile
L-48	DsSdGrid	Stage D2 Product
L-49	DsSdGrid	Stage D1 Product
L-50		Stage Dx Product
M-13	DsSdSwath	SSM/I Pathfinder Antenna Temperatures
M-14		SSM/I Pathfinder Atmospheric Moisture
M-15 & M-48	DsSdSwath	SSM/I Pathfinder Precipitation Rate
M-56	DsSdGridded	TOVS Pathfinder C1 MSU Monthly am

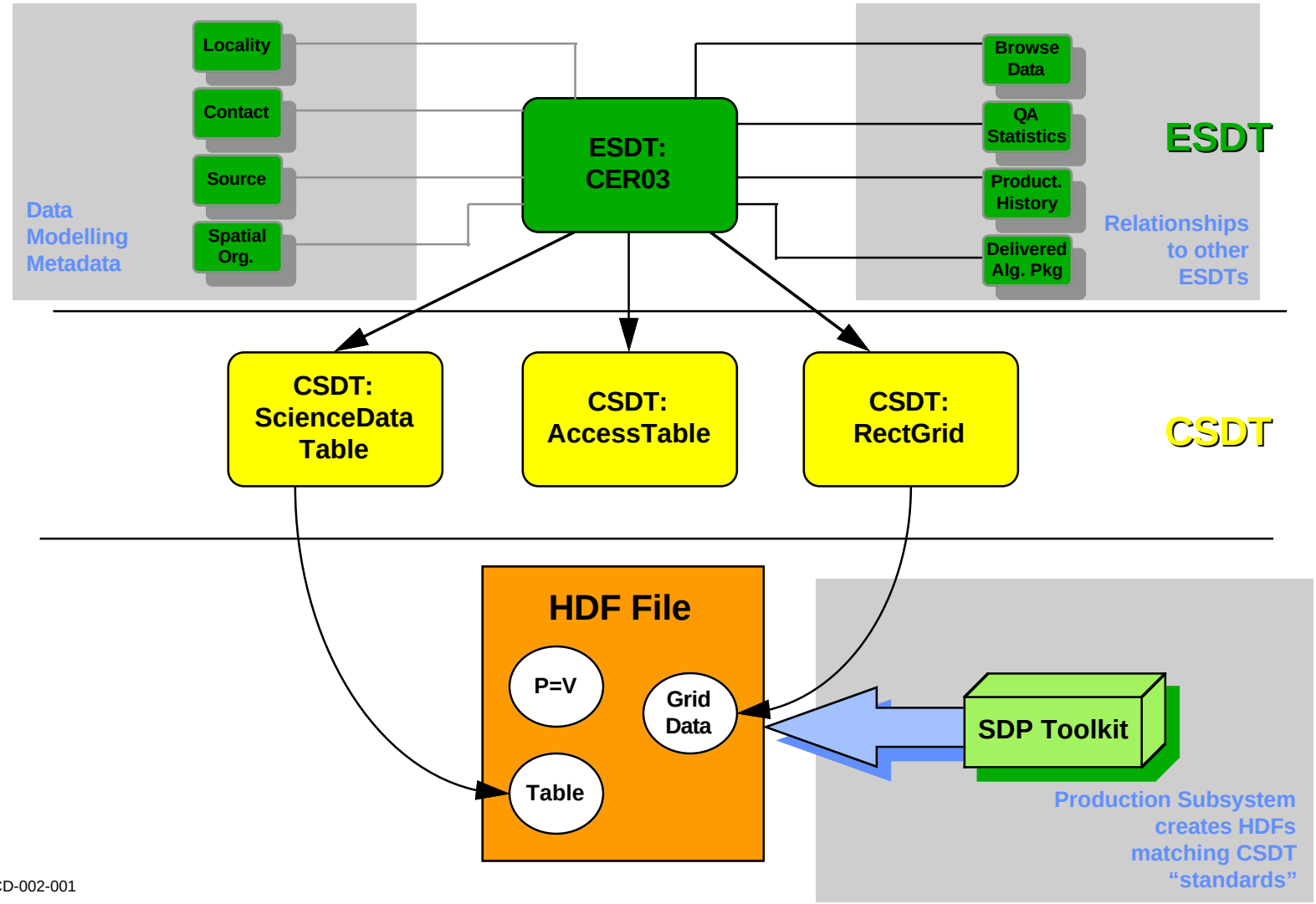
V0 Migration		
Product	**Primary CSDT**	**Name**
M-57	DsSdGridded	TOVS Pathfinder C1 MSU Monthly pm
M-58	DsSdGridded	TOVS Pathfinder C1 MSU Pentad am
M-59	DsSdGridded	TOVS Pathfinder C1 MSU Pentad pm
M-60	DsSdGridded	TOVS Pathfinder C1 MSU Daily am
M-61	DsSdGridded	TOVS Pathfinder C1 MSU Daily pm
M-63		SMMR Pathfinder Brightness Temperature
NMC-MRF	DsSdGrid	MRF 00Z
NMC-ETA	DsSdGrid	ETA 00z
NMC-FNL	DsSdGrid	FNL
NESDIS-TKTG02	DsSdSwath	AVHRR aerosol global analyzed field
NESDIS-EDR	DsSdSwath	Environmental Data Record
NESDIS-SSMI_PRECIP	DsSdSwath	SSM/I total precipitable water
NESDIS-SSMI_RAIN	DsSdSwath	SSM/I instantaneous rainfall
NESDIS-TITG01	DsSdSwath	SUBV/2 stratospheric ozone profiles
NESDIS-TJTG01	DsSdSwath	AVHRR Vegetation index
IERS-Bulletin A	native	IERS Bulletin A
IERS-Bulletin B	native	IERS Bulletin B
DCW	native	Digital Chart of the World
owe13a.img		Olson World Ecosystems v1.3a
owe14d.img		Olson World Ecosystems v1.4d
owe14dr.img		Olson World Ecosystems v1.4dr
fnocmod.imgs		FNOC modal elevation
fnocmax.imgs		FNOC maximum elevation
fnocmin.imgs		FNOC minimum elevation
fnocmod.imgs_dec		FNOC modal elevation DEC

Science Data Server Data Types
Rel A ESDT products - CSDT (cont.)

V0 Migration		
Product	**Primary CSDT**	**Name**
fnocmax.imgs_dec		FNOC maximum elevation DEC
fnocmin.imgs_dec		FNOC minimum elevation DEC
etop05.dat		Etop05 surface elevation
etop05.dat_dec		Etop05 surface elevation DEC
AST00	native	ASTER Level 0 data

V0 Migration		
Product	**Primary CSDT**	**Name**
AM CER00	native	CERES Level 0 data
MIS00	native	MISR Level 0 data
MOD00	native	MODIS Level 0 data
MOP00	native	MOPITT Level 0 data
L0R	DsSdSwath	Landsat 7 Level 0 data

Science Data Server Data Types



Science Data Server Data Types

Activities to date:

- **Represented in L4 Requirements Matrix (for Release A products)**
  - **URL:**

    SDPS PDR info: http://edhs1.gsfc.nasa.gov/Info/pdr/440wp01info.html

    Postscript version http://edhs1.gsfc.nasa.gov:8001/waisdata/pdr/440wp0202.ps

    Excel version http://edhs1.gsfc.nasa.gov:8001/waisdata/pdr/440wp0202.xls
- **ESDT - CSDT mapping**
  - **first pass in L4 Requirements Matrix, second pass complete (for Release A products)**
- **CSDT - HDF(-EOS) mapping**

Science Data Server
Data Type Services

Types of Data Type Services

- **Selection**
  - **Services that support the location and selection of granules of interest**
- **Browse**
  - **Services that support a “real-time” on-line aid to ordering**
- **Reduction**
  - **Services that allow a product to be reduced in volume before distribution to the client**
- **Transformation**
  - **Services that support the geo- and mathematical-transforming of data**
- **Distribution**
  - **Services that enable the physical formatting and replication of data to user defined locations and/or media**

Science Data Server
Data Type Services: Reduction

Reduction services are provided to allow users to select only pertinent data to be disseminated.

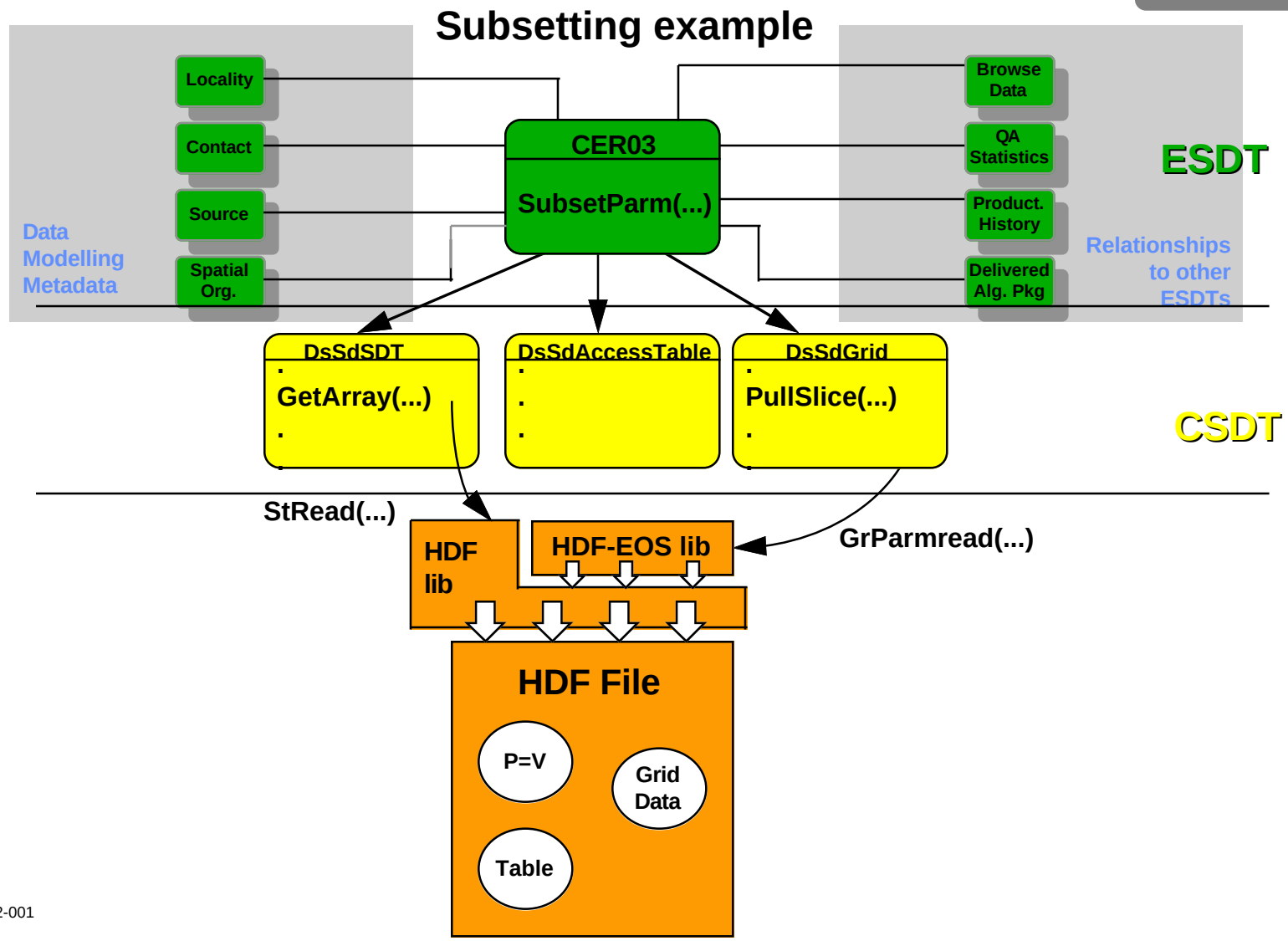
Two types provided by ECS

- **Subsetting - extraction of a contiguous portion of data**
- **Subsampling - extraction of data based on a defined pattern**

Spatial, temporal and band/parameter for each

- **only where applicable**

Science Data Server
Data Type Services: Reduction



Science Data Server Subscriptions

Subscriptions: Mechanism provided for a client to declare what they want to happen upon the occurrence of a well-defined event.

Key Features of Subscriptions:

- **Based on an Event/Action model**
- **Future events are subscribed to**
- **Subscribable events are advertised**
- **Events declared by ESDTs and system objects**
- **Time-based subscriptions are available**
- **Actions can be any allowed service request**
  - **series of request commands allowed (script-like)**
- **Notifications are viable actions**

Science Data Server Subscriptions

Practical applications of subscriptions

- **Standard processing**
  - **Administrator submits to Ingest Server:**

    Event: Arrival of CERES L0 data

    Action: Notify Planning Subsystem
- **QA**
  - **QA Client submits to LaRC ERP Data Server**

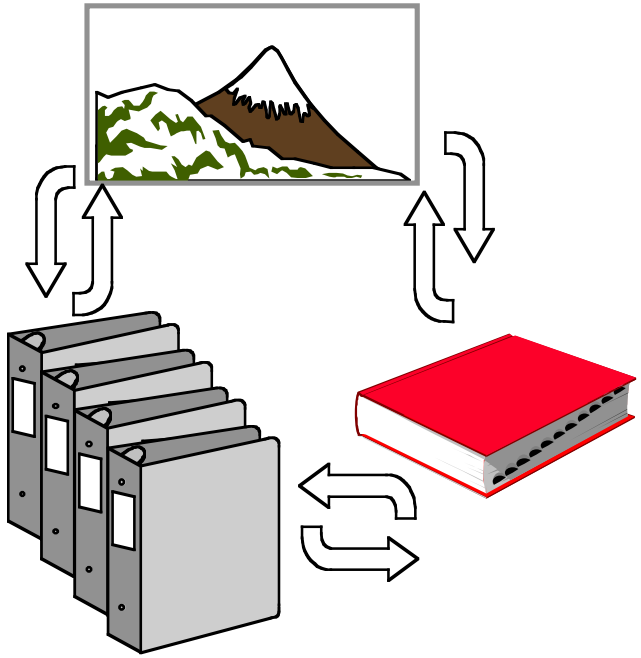
    Event: Creation of CER11 data product

    Action: Send CER11 Browse data

Data Server Subsystem
Document Data Server (DDSRV)

Purpose

- **Provides access to and storage of document data types (e.g. guide and reference papers)**
- **Maintains sessions and provides subscription service**
- **Advertises its data and services**



Data Server Subsystem
Document Data Server (DDSRV)

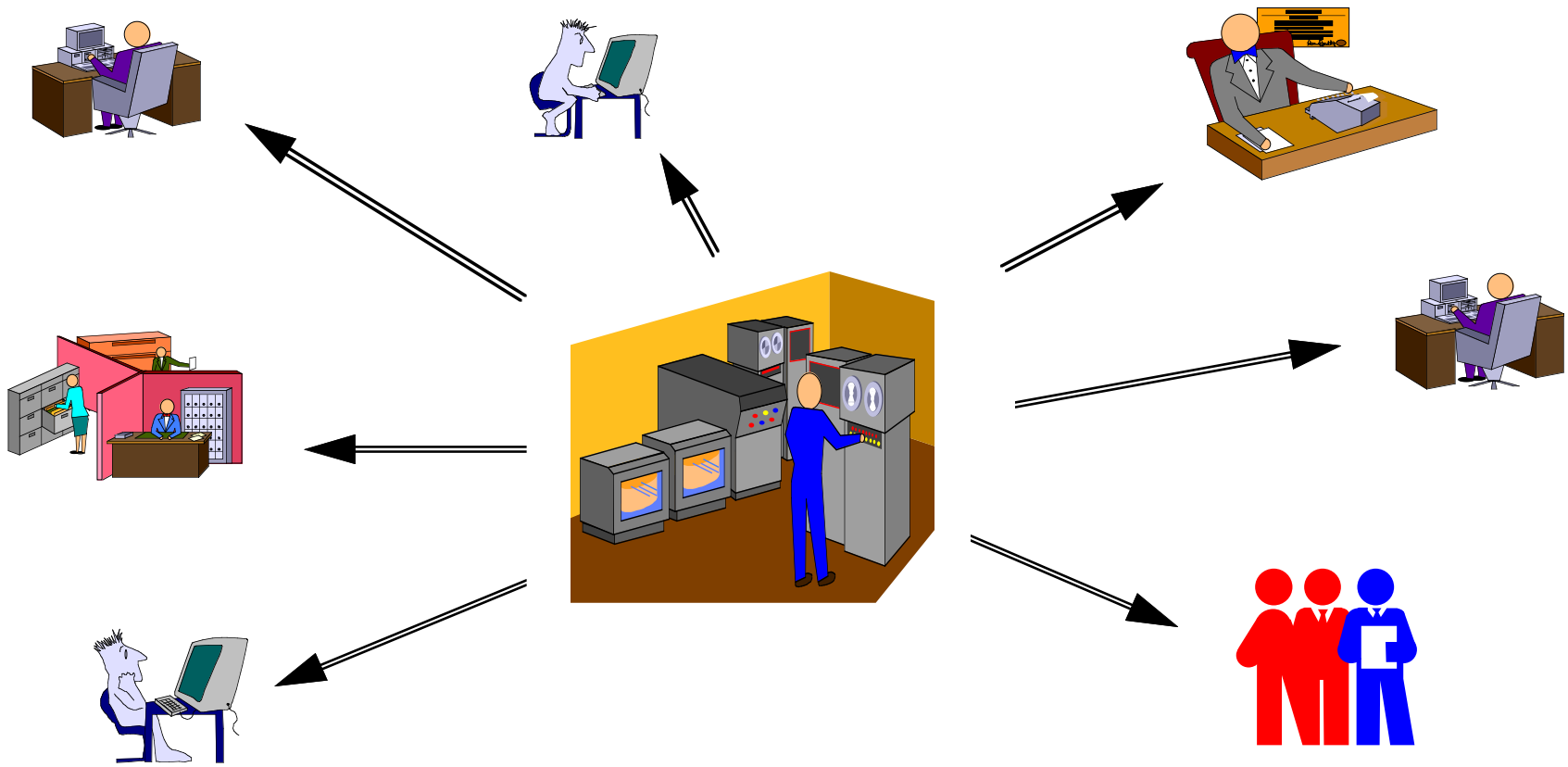
Design Concepts

- **Maximum use of COTS/OTS**
  - **WAIS/http implementation**
- **Commonality with Data Server generic services**
  - **Session, Subscription, Request**
- **Major Interfaces**
  - **Client, Interoperability and Ingest Subsystems**
  - **Data Distribution and Storage Management CSCI**
- **DDSRV Earth Science Data Types**
- **Directory - information about ECS collections presented to conform to the GCMD**
- **Guide - information about granule collections**
- **Reference Papers - information about scientific work associated with ECS data**

Data Server Subsystem
Data Distribution

Data Distribution

Provides the capability to monitor and control processing associated with the distribution of data by the Data Server



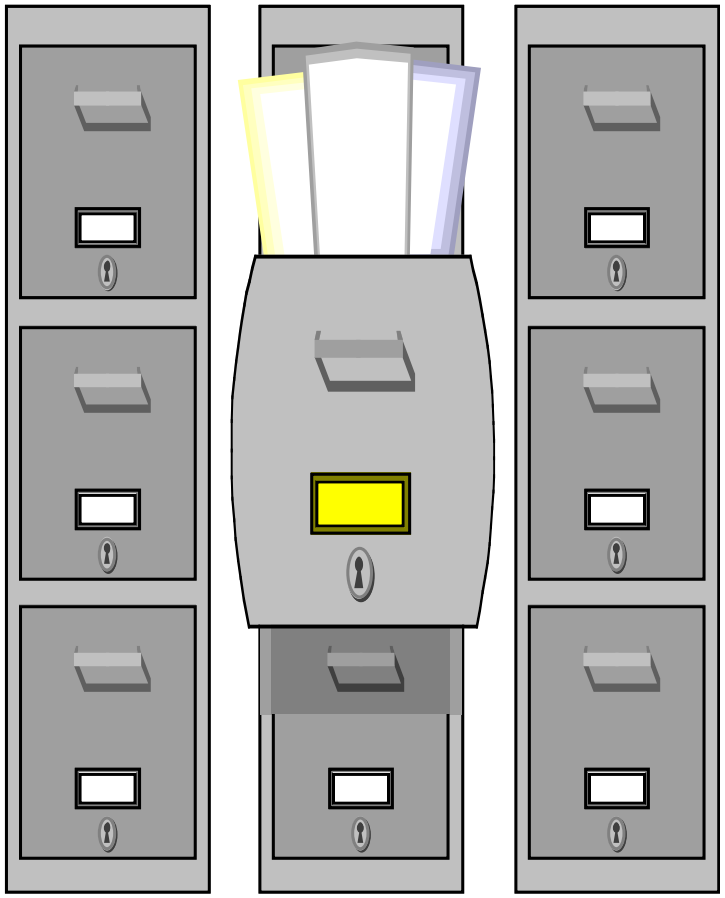
Data Distribution Functions

- **Functions**
  - **Distribute data via network or physical media**
  - **Provide Operations with monitor and control capability of distribution requests**
  - **Provide status of ongoing requests**
  - **Staging of data for access by remote users**
  - **Generate necessary packaging materials for physical distributions**
  - **Format data into requested format**

Data Distribution Services

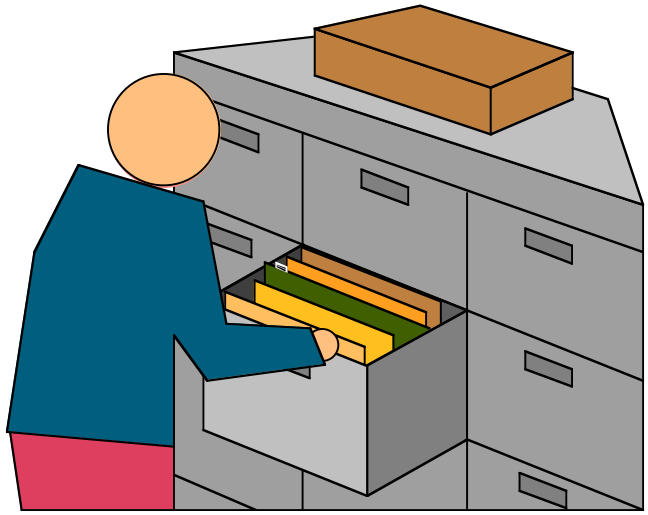
- Network Distribution
  - Uses CSMS provided services to “push” data across network
  - Data deposited on local disk for “pull” across network
  - Size limitations on “push” and “pull” selectable by Operations staff
  - Time limit for data on local disk (pull data) selectable by Operations staff
- Physical Media Distribution
  - Several media types supported
  - Supports mixed media requests
  - Estimates numbers of physical media
  - Minimizes the number of physical media
- Distribution Format
  - HDF for EOS products
  - Additional formats supported as required for non-EOS products

Data Server Subsystem



Storage Management

Provides an interface to storage resources and their services which are managed by the Data Server



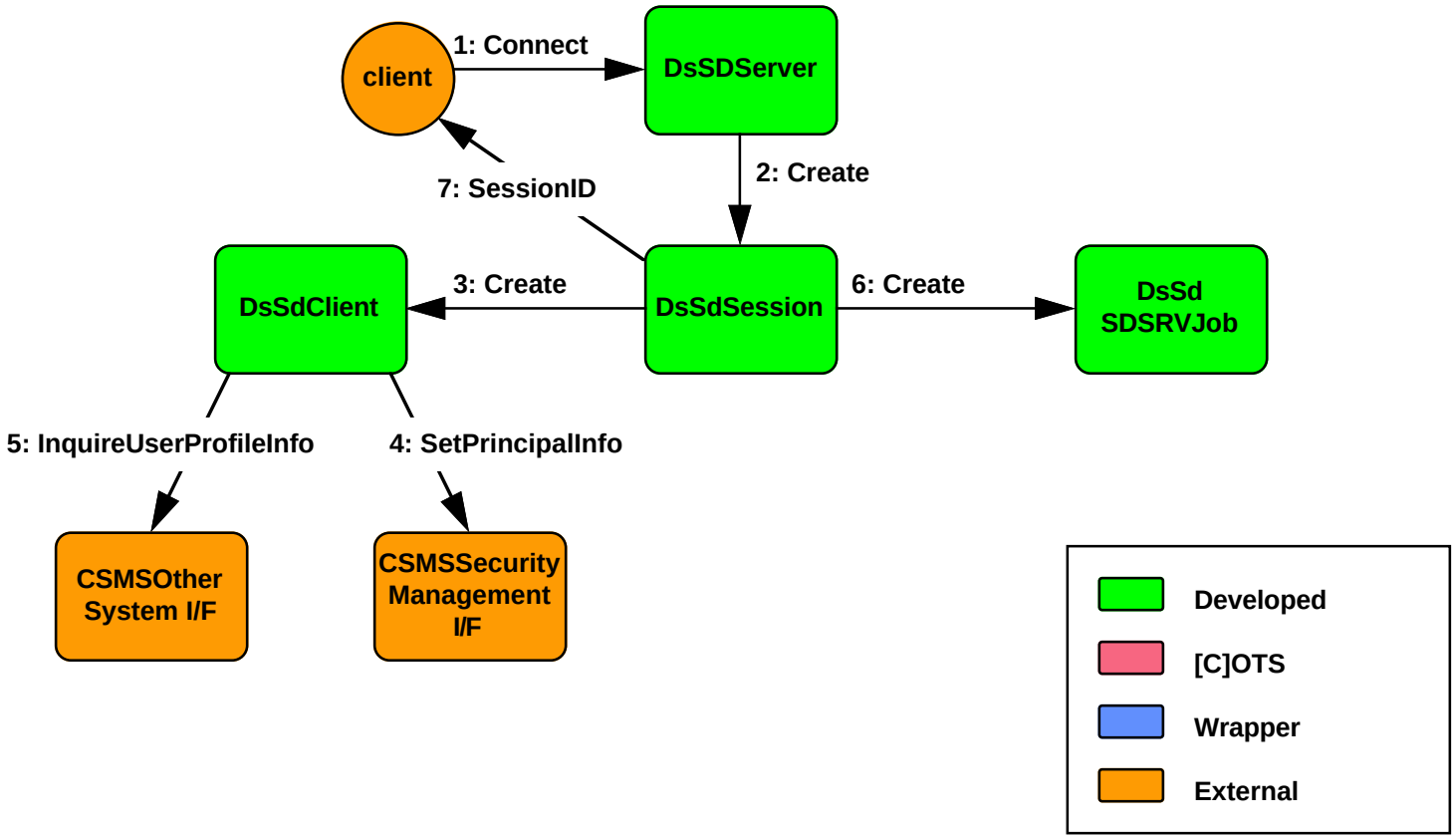
Storage Management CSCI

- RESOURCE SCHEDULING
  - Largely Data Driven
  - Resource reservations also supported
- REQUEST QUEUING
  - Bi- level - COTS and non-COTS resources
  - Queue management based upon request priority
  - Degradation of service possible to support reservation of resources
- STAGING DISK MANAGEMENT
  - Archive data retrieval aided by caching
  - FSMS Caching
  - Cache size selectable by Operations staff
- ARCHIVE STORAGE FORMATS
  - Formats selected should minimize retrieval post-processing
  - HDF
  - Determined by Data Type

Data Server Software Subsystem
Typical User Session

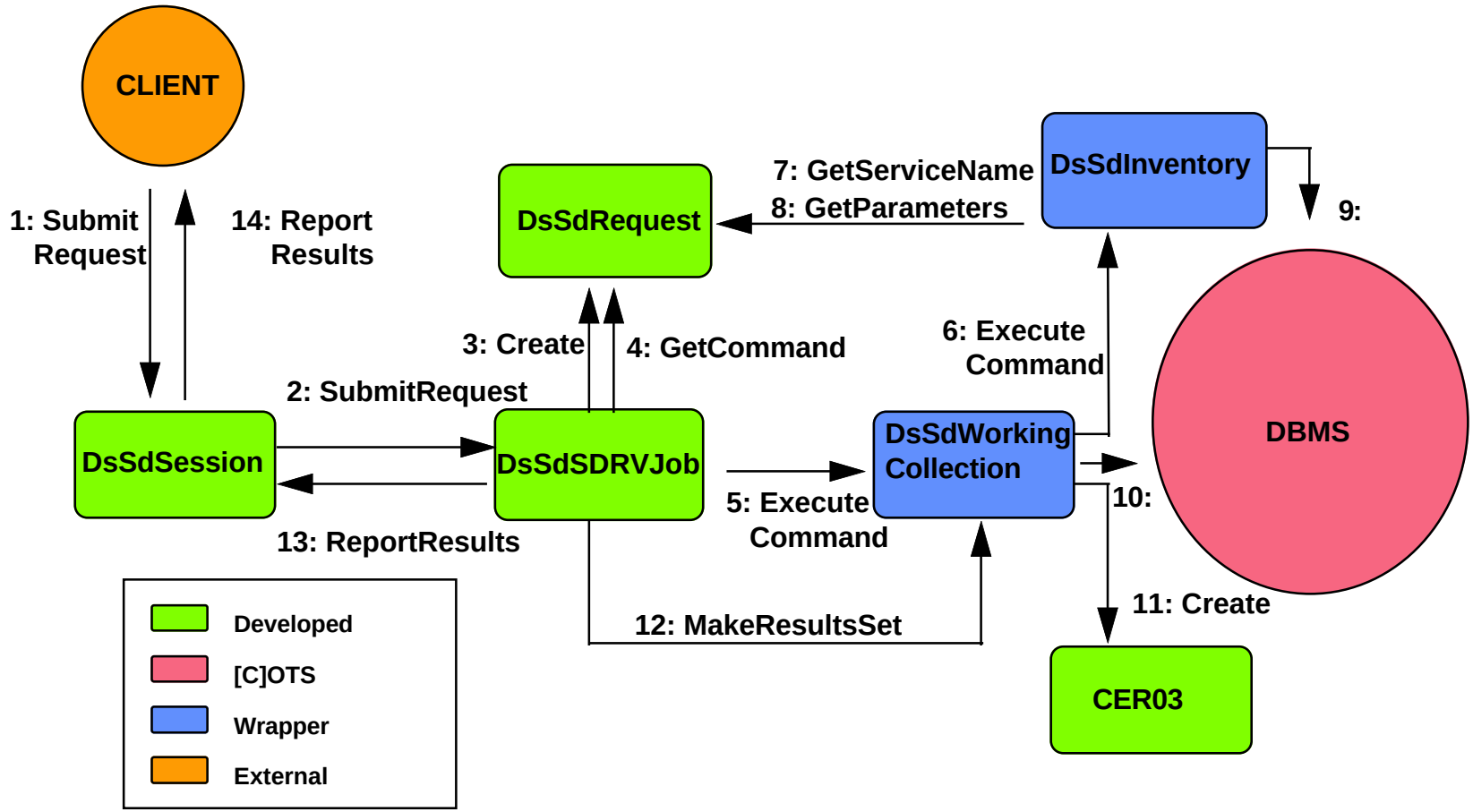
<u>Typical User Session</u>

1) Connecting to the Server
(From DID 305 Fig. 7.2-9)

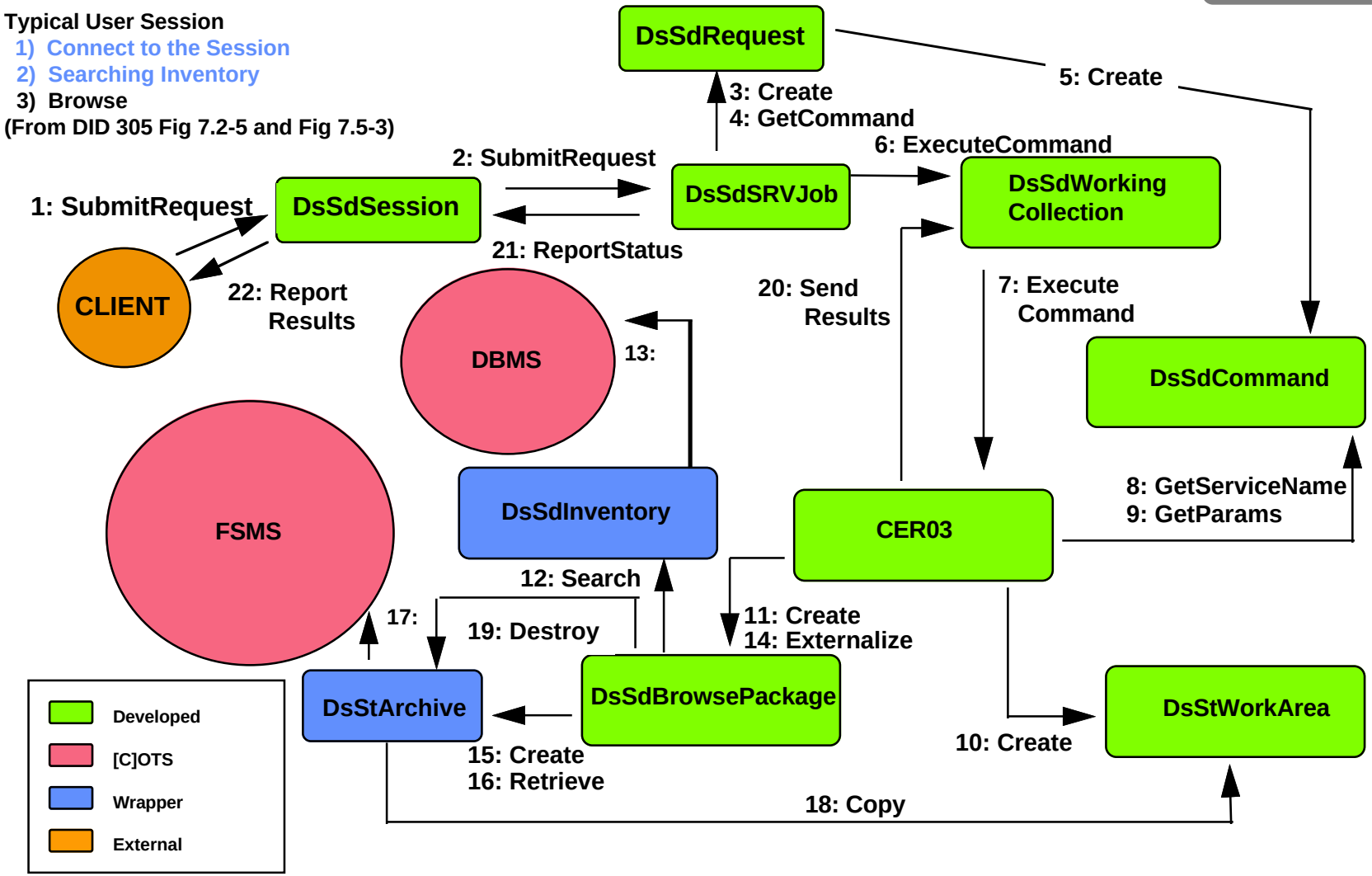


Data Server Software Subsystem
Typical User Session

Typical User Session
1) Connecting to the Server
2) Searching Inventory
(From DID 305 Fig 7.2-5)



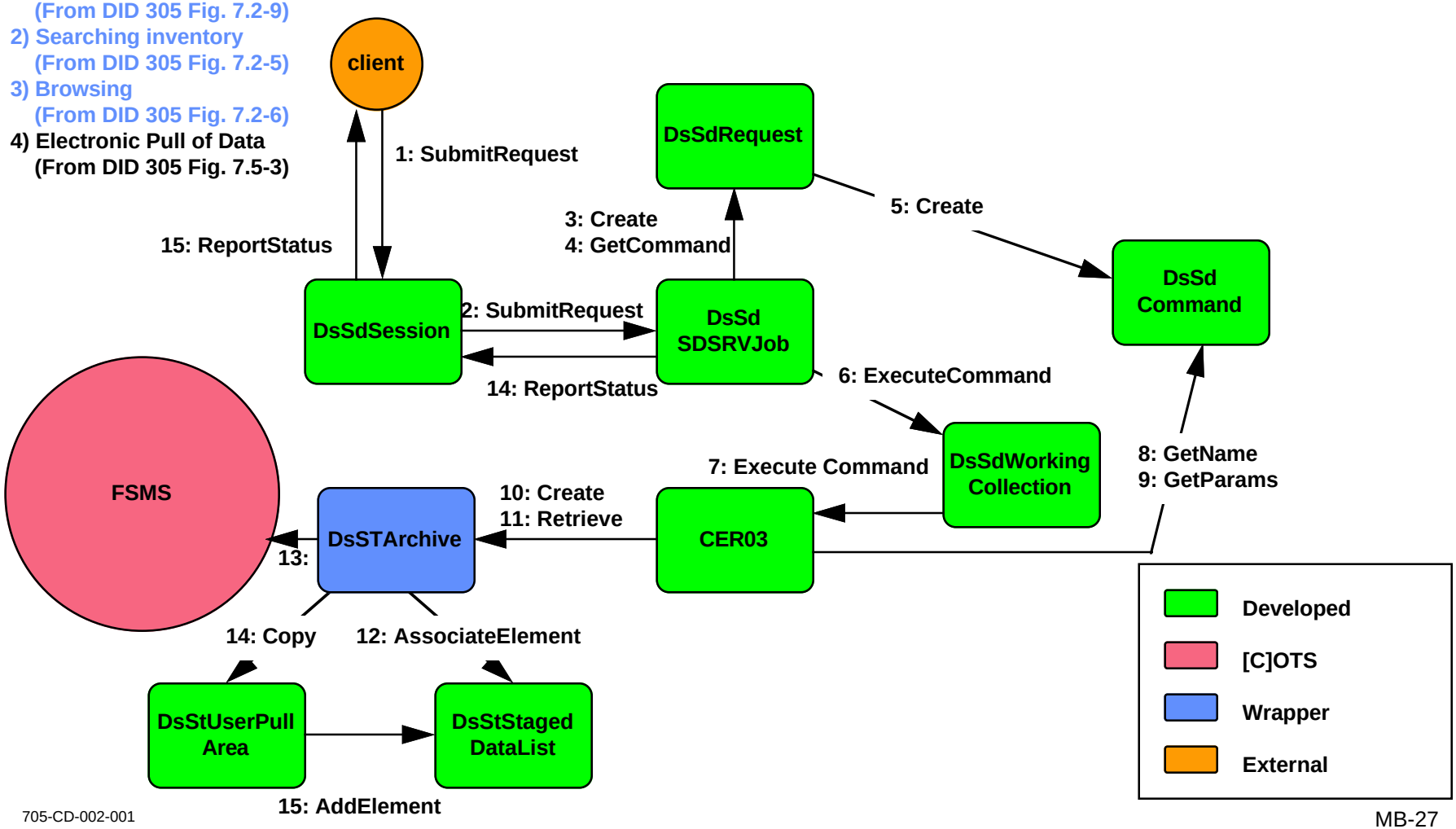
Data Server Software Subsystem
Typical User Session



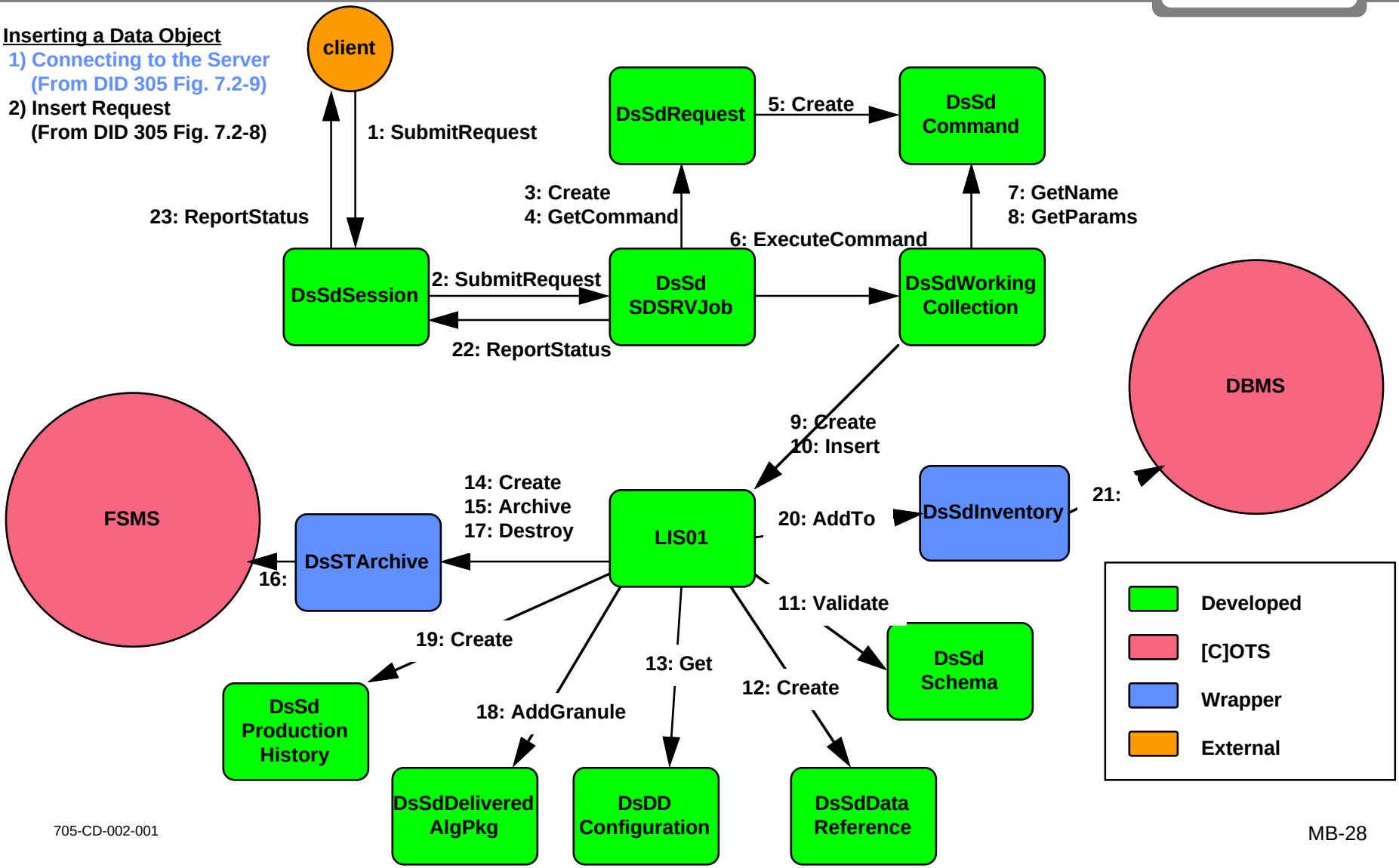
Data Server Software Subsystem
Typical User Session

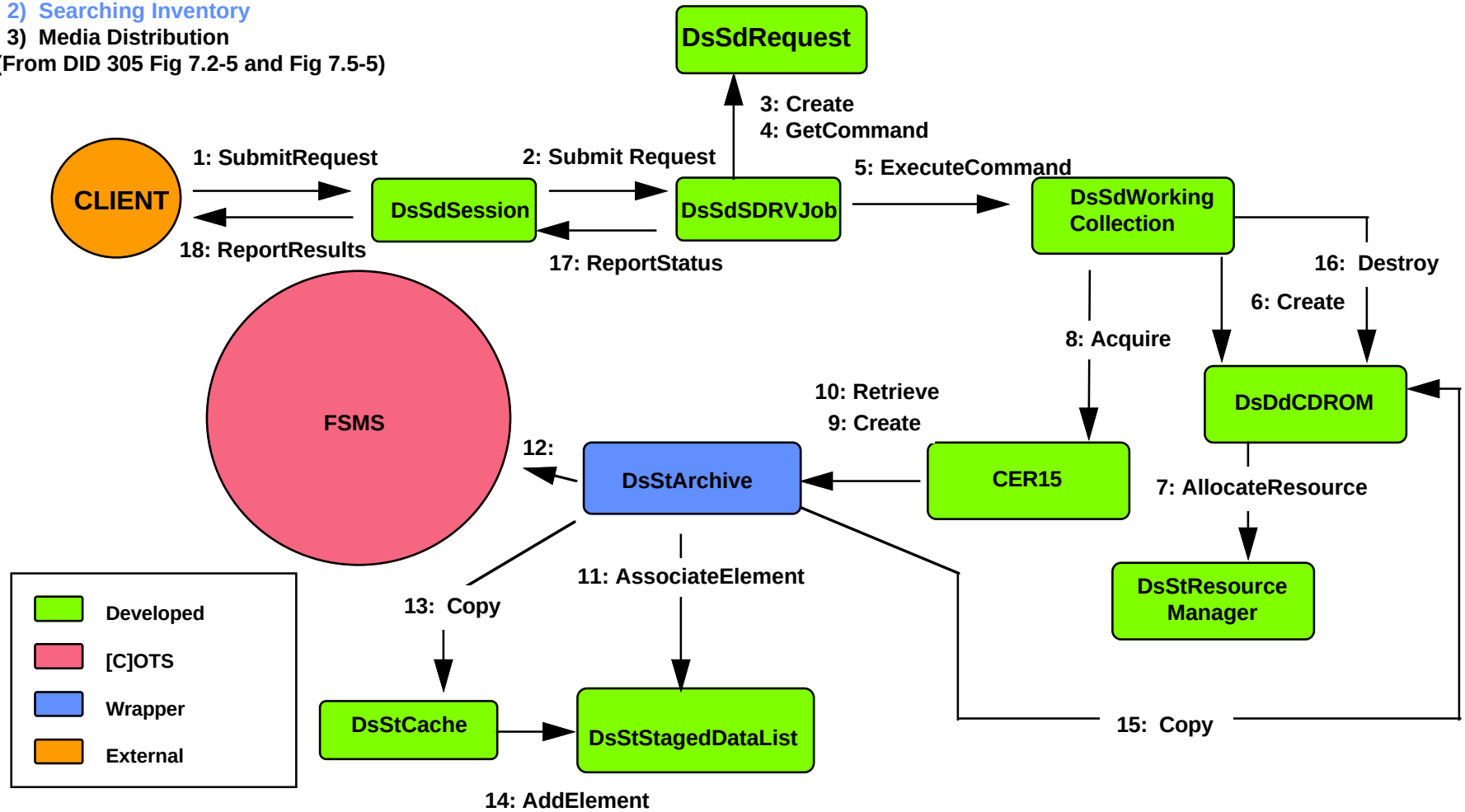
Typical User Session

1) Connecting to the Server
   (From DID 305 Fig. 7.2-9)
2) Searching inventory
   (From DID 305 Fig. 7.2-5)
3) Browsing
   (From DID 305 Fig. 7.2-6)
4) Electronic Pull of Data
   (From DID 305 Fig. 7.5-3)



Data Server Software Subsystem
Inserting a Data Object



Data Server Software Subsystem Media Distribution Request

Media Distribution
1) Connect to the Session
2) Searching Inventory
3) Media Distribution
(From DID 305 Fig 7.2-5 and Fig 7.5-5)