JSC / OTF
CCSDS Mission Operations
Project Status

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Introduction

- iPAS
  - Implemented Command and Telemetry using CCSDS Mission Operations
- MCC21
  - Currently implementing private services using the CCSDS Message Abstraction Layer

Mission Control Center Role for iPAS

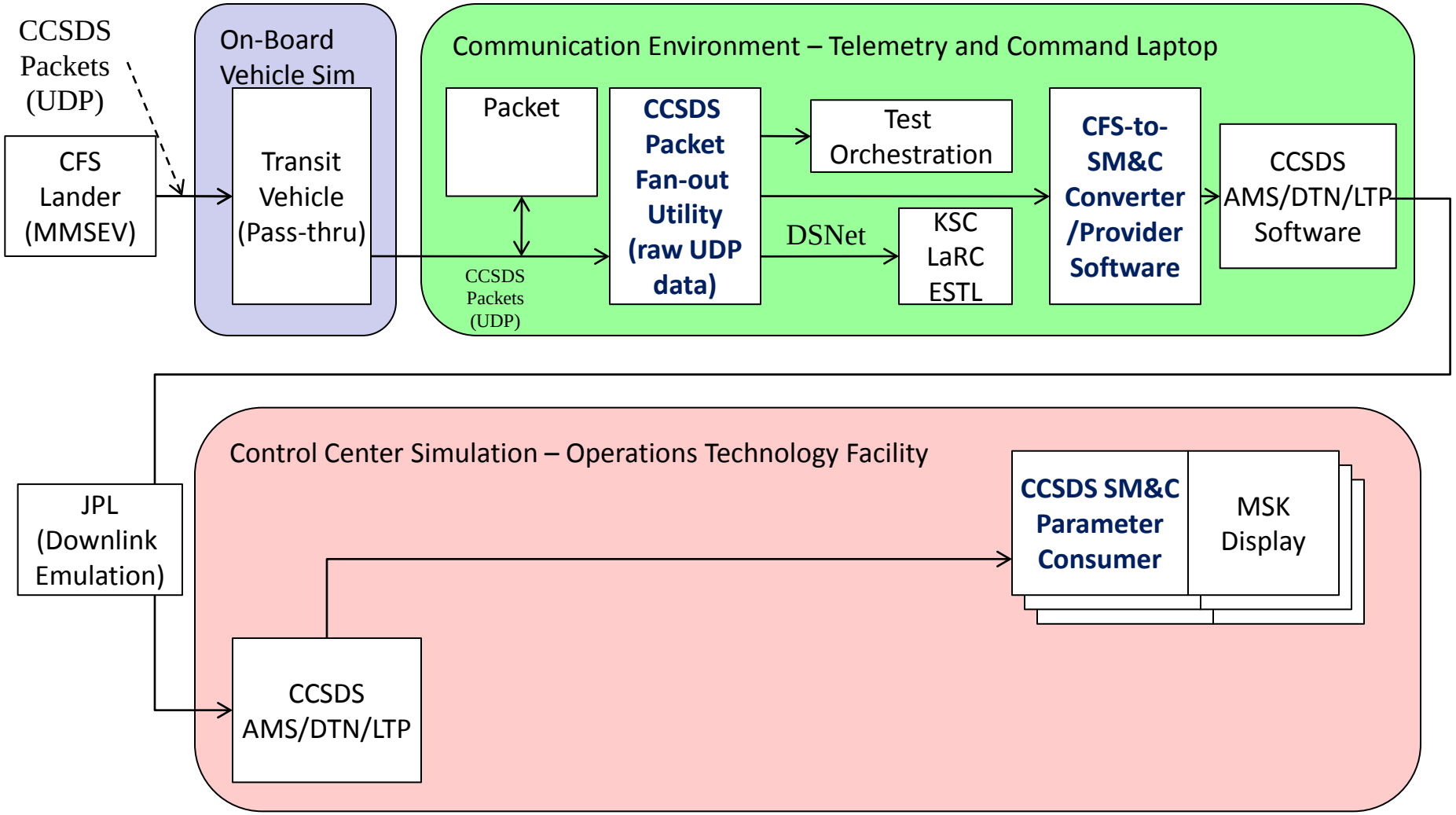
- To apply internationally standardized protocols to iPAS command and telemetry streams
  - Utilize Consultative Committee for Space Data Systems (CCSDS) standards
    - Encode MMSEV telemetry and command CCSDS Space Packets with the CCSDS Spacecraft Monitoring and Control (SM&C) protocol
    - Utilize the CCSDS Asynchronous Messaging System (AMS) to interface SM&C with CCSDS Delay / Disruption Tolerant Networking (DTN)
    - Transfer DTN data bundles over the space-to-ground segment with the CCSDS Licklider Transmission Protocol (ltp)
    - Adapt JSC MSKView display and control software to interface with SM&C

Mission Control Center Role for iPAS

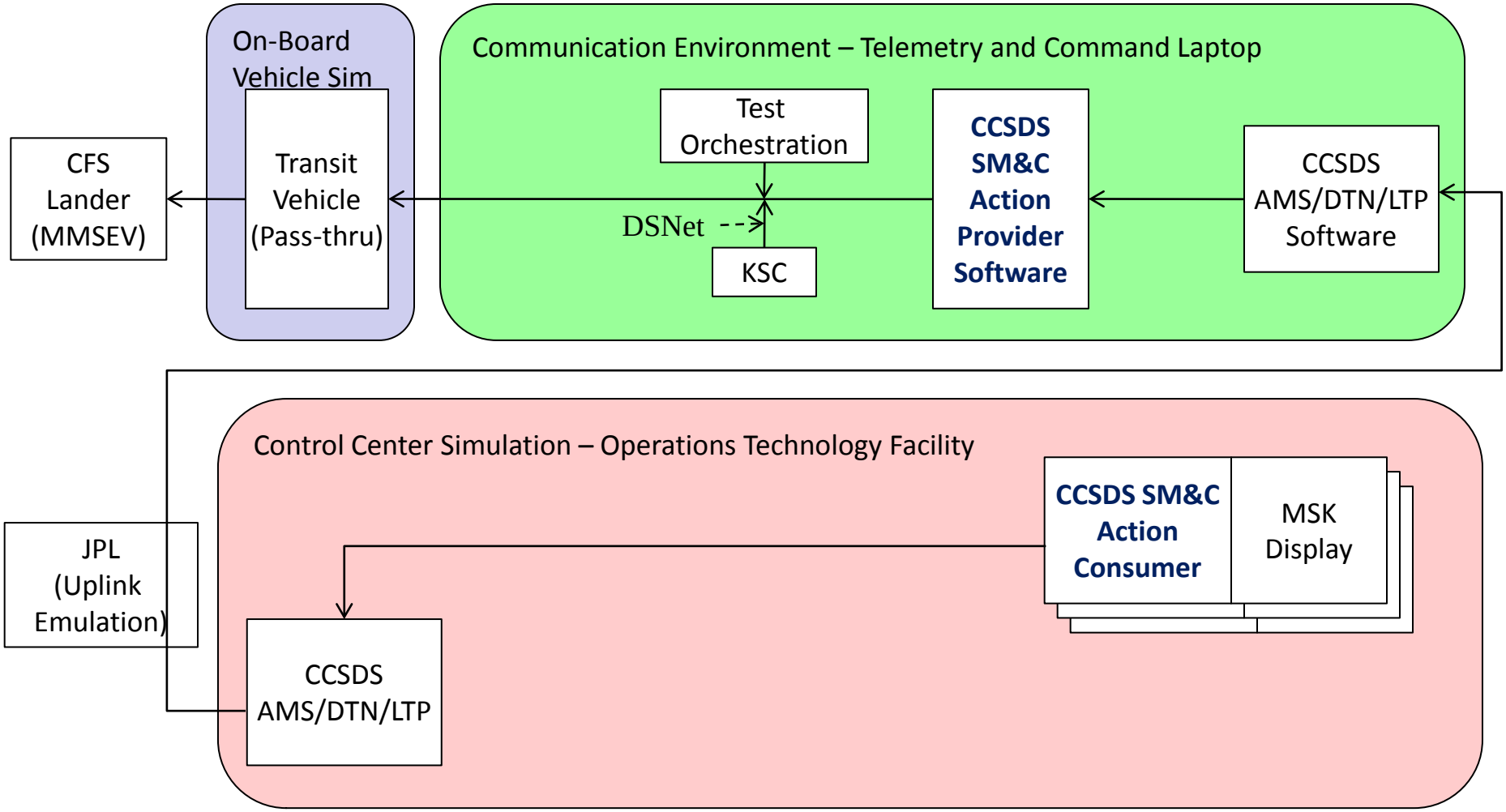
  - The iPAS is an application of ground-breaking work being done on integrating the entire SM&C / AMS / DTN / LTP protocol stack

- To begin to work with missions where light-time delay becomes significant

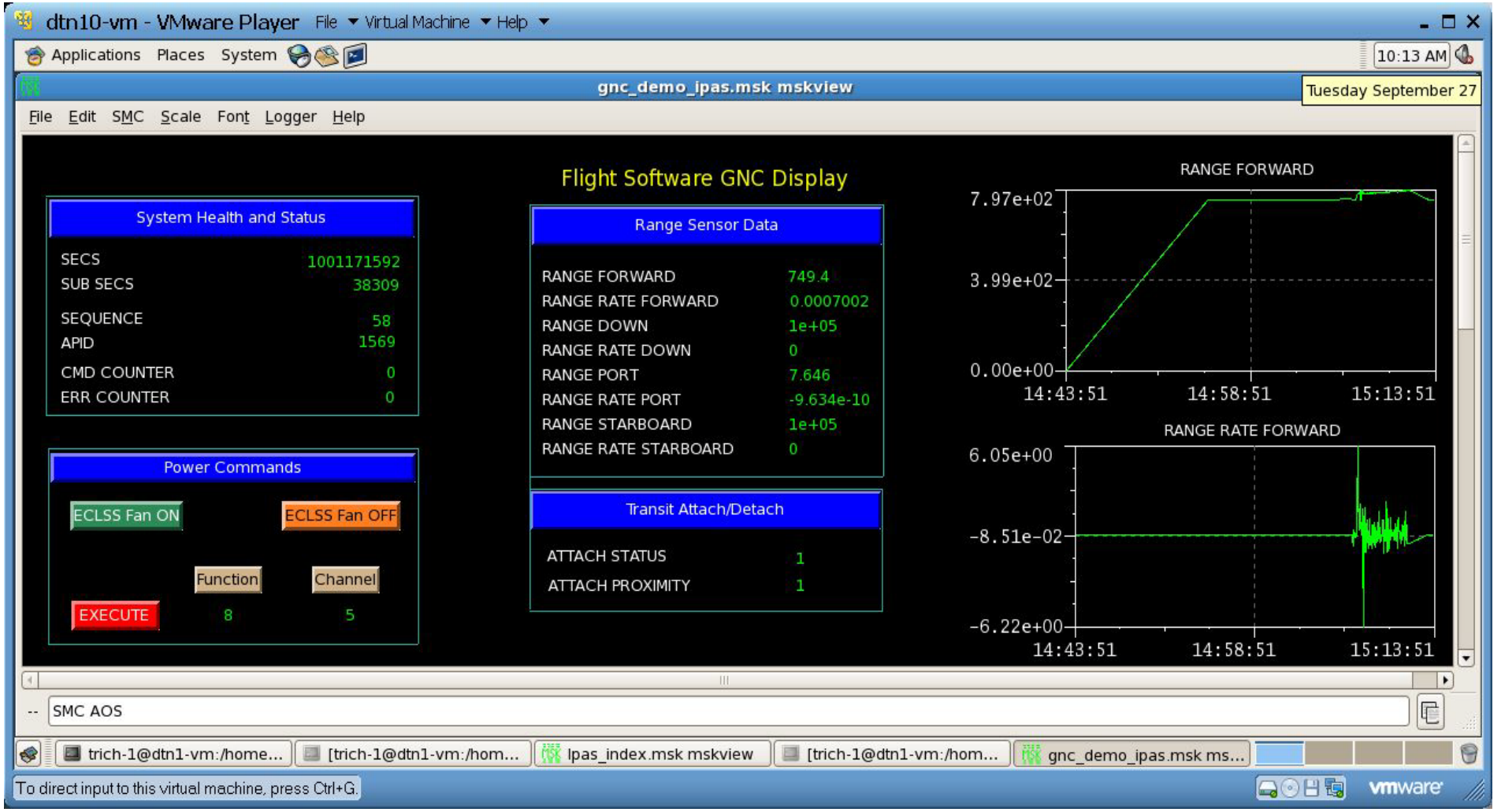
Telemetry Stream



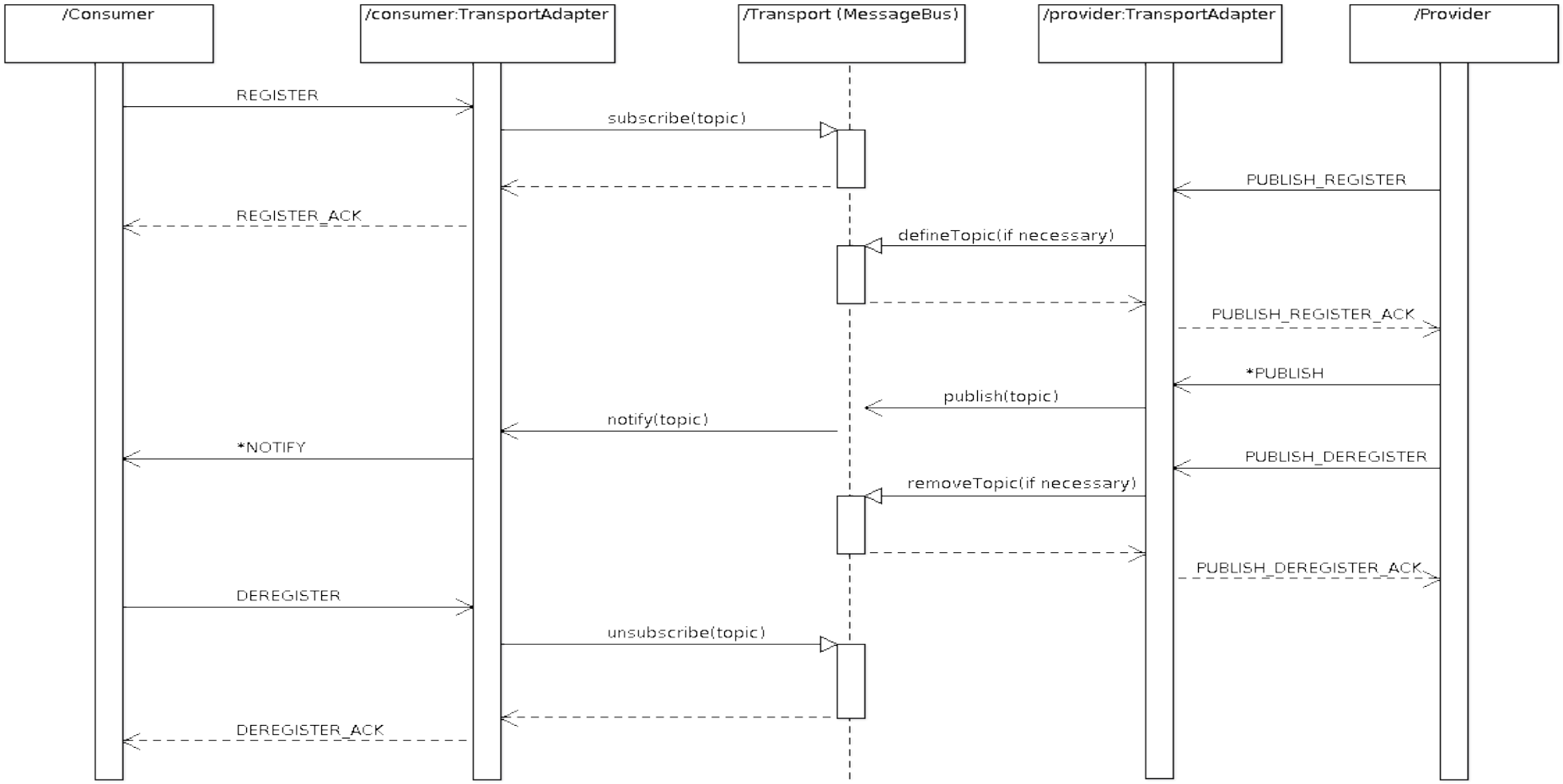
Command Stream



MSKView Telemetry and Command Display



Transport Broker



AMS Transport Broker

- AMS Role and Subject are defined in the MIB – are not dynamically added
- Role
  - Ground Zone, Session Name, Session Type, and Domain
- Subject
  - Area, Service and Operation
- MAL Abstract Broker filters subscription on the consumer side before issuing notify
- MCC21 Transport Broker will use middleware to filter subscriptions

MCC 21

- Mission Control Center for the 21st Century
- Data Centric architecture
  - TIM (Tagged Information Message)
- Services defined and implemented using Mission Operations Message Abstraction Layer
- OMG Data Distribution Service (DDS) is used as the message bus

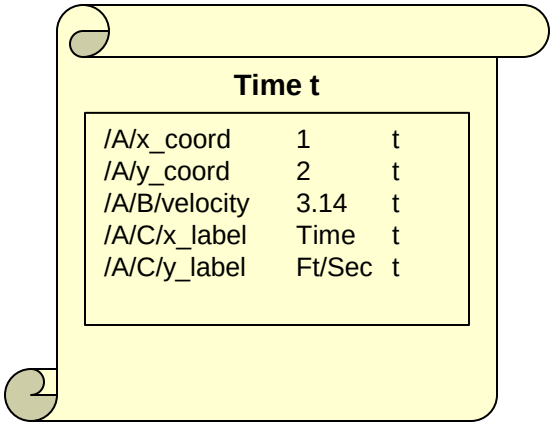
TIM Views

Application Layer

```
struct A {
   int x_coord;
   int y_coord;
   struct B {
      float velocity;
   }
   struct C {
      char* x_label;
      char* y_label
   }
}
```

Application Object

Common Services Layer



TIM

Message Bus and Storage

SDE Header

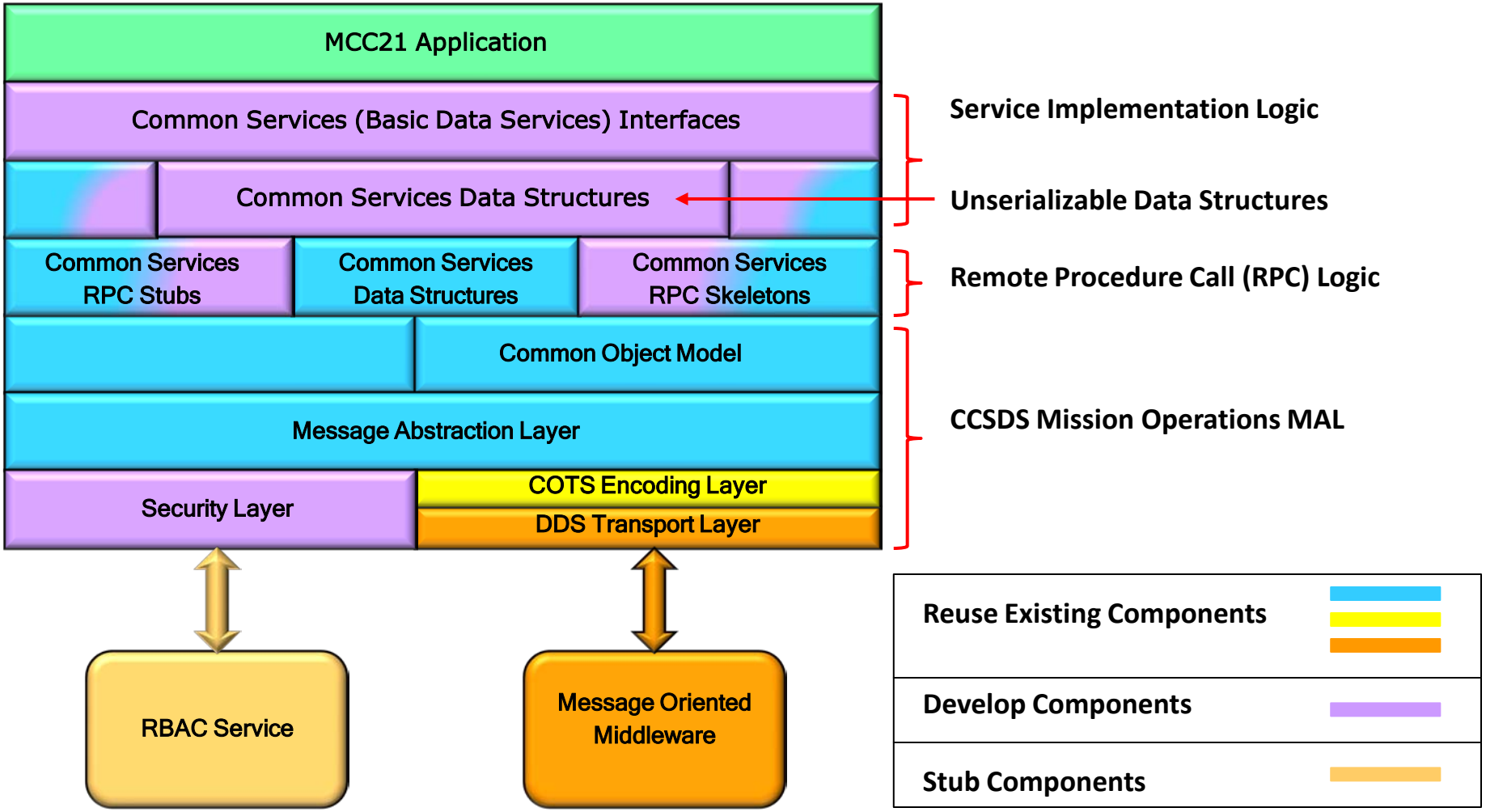
Name=/A , releaseTime= t
protectionStatus="group==telcom"

Body

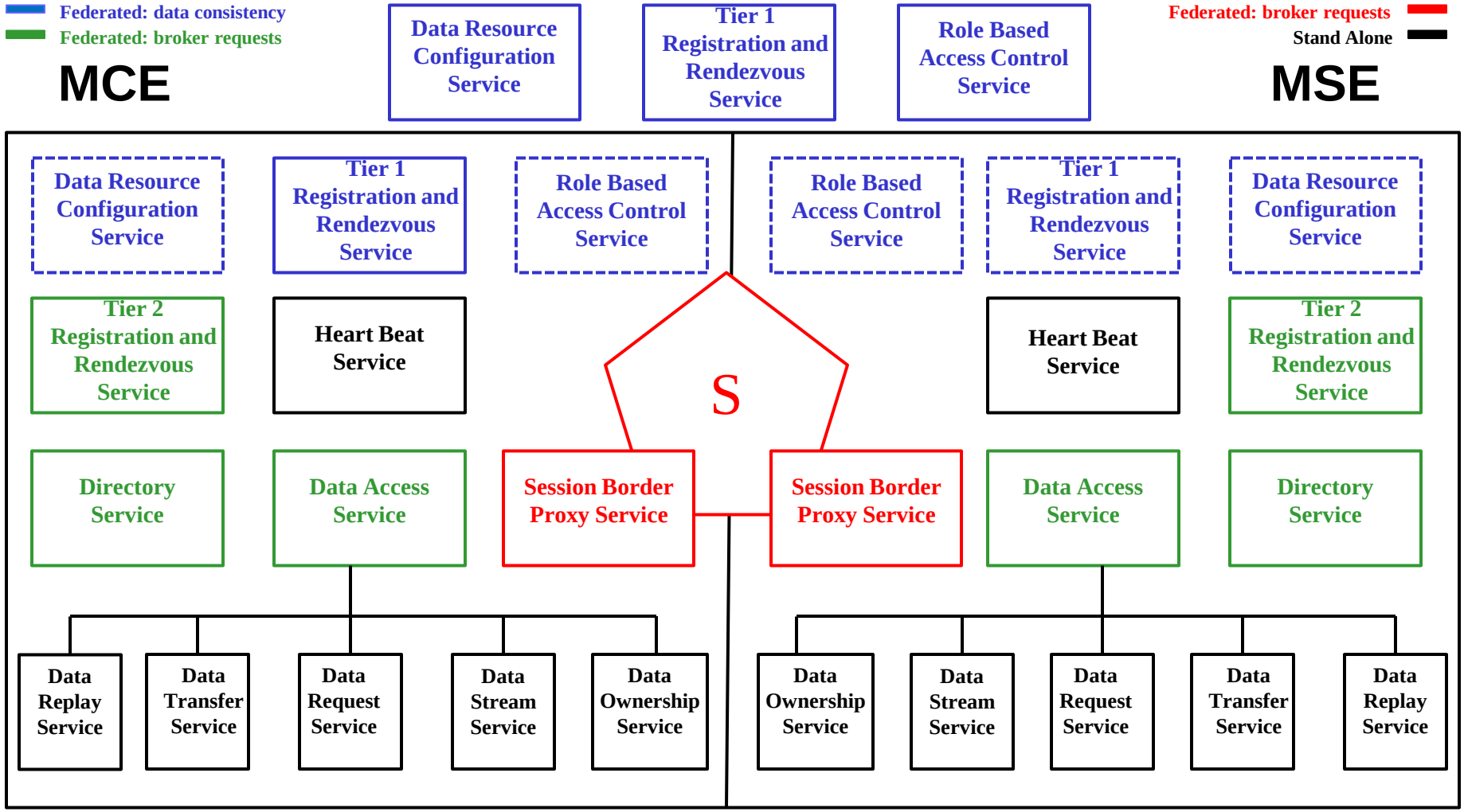
x_coord1	1	t
y_coord2	2	t
/B		
/velocity	3.14	t
/C		
/x_label	Time	t
/y_label	Ft/Sec	t

Secure Data Envelope

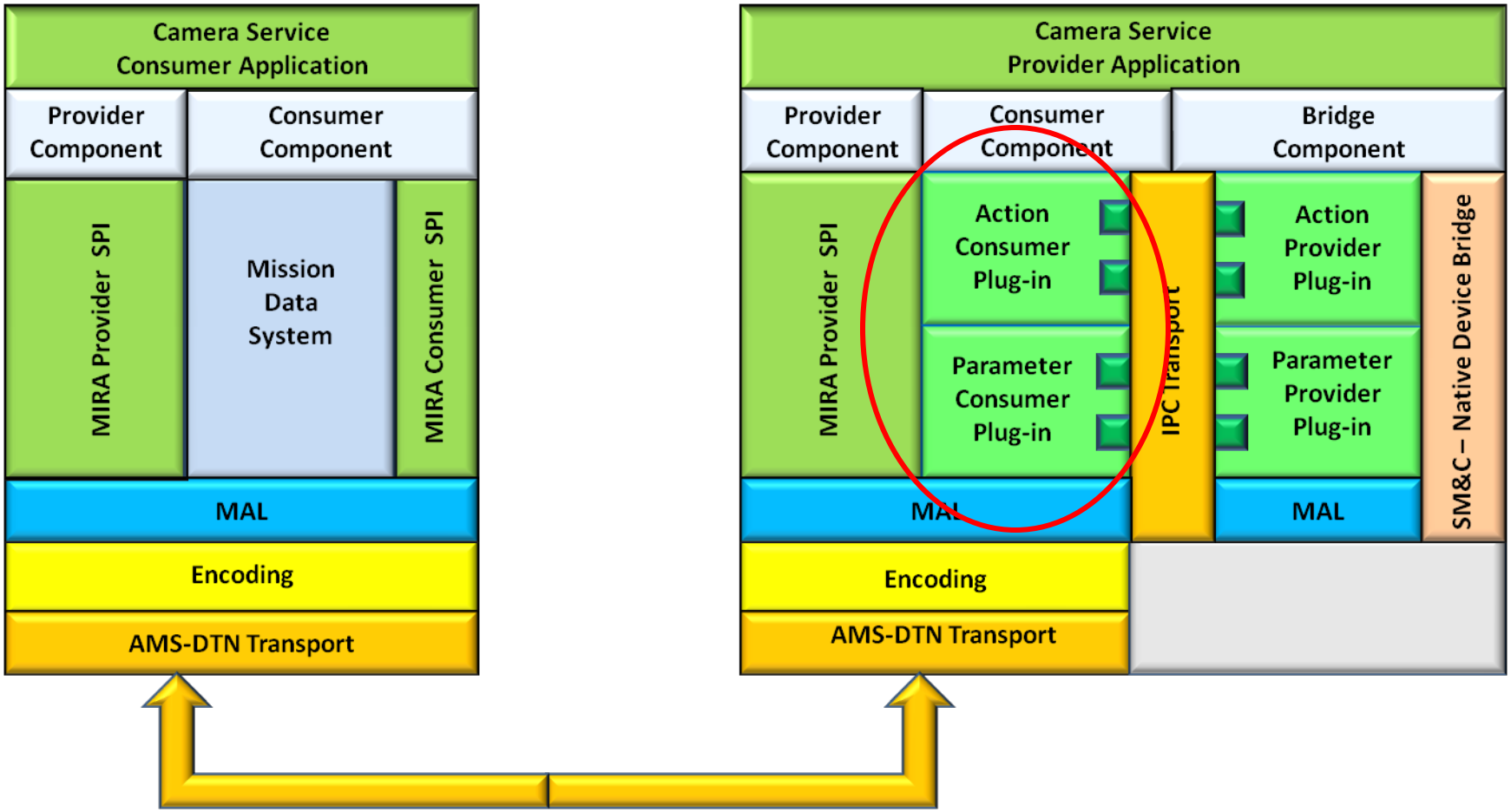
Prototype Architecture



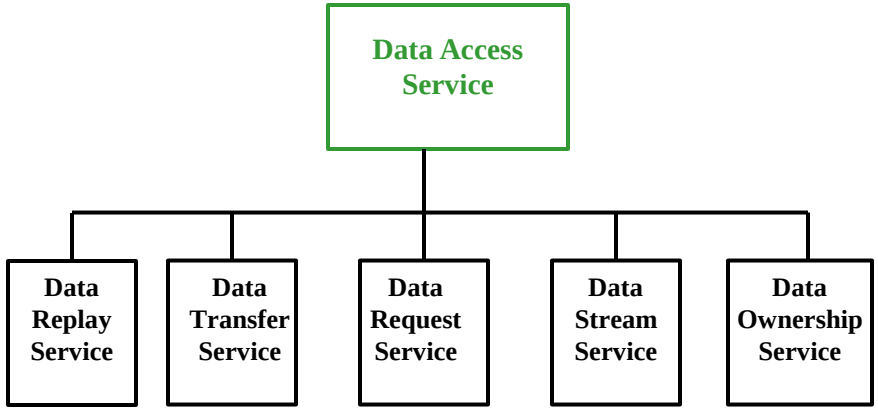
Prototype Services



Service Orchestration



Service Orchestration



- Data Access serves as the mediator to the underlying services that implement the logic
- Potential for multiple-inheritance for to implement many consumer adapters or provider handlers
- Use plug-in modules to encapsulate service consumer for each service.

Conclusion

- CCSDS Mission Operations been used to successfully in the MIRA and iPAS Projects
- Mission Operations system engineering concepts facilitated rapid specification of the MCC21 services
- MAL Framework jumpstarted development on the MCC21 project
  - Demonstrations are held at the end of each Agile iteration