



# Fully automated cloud-based science data processing for emirates mars mission

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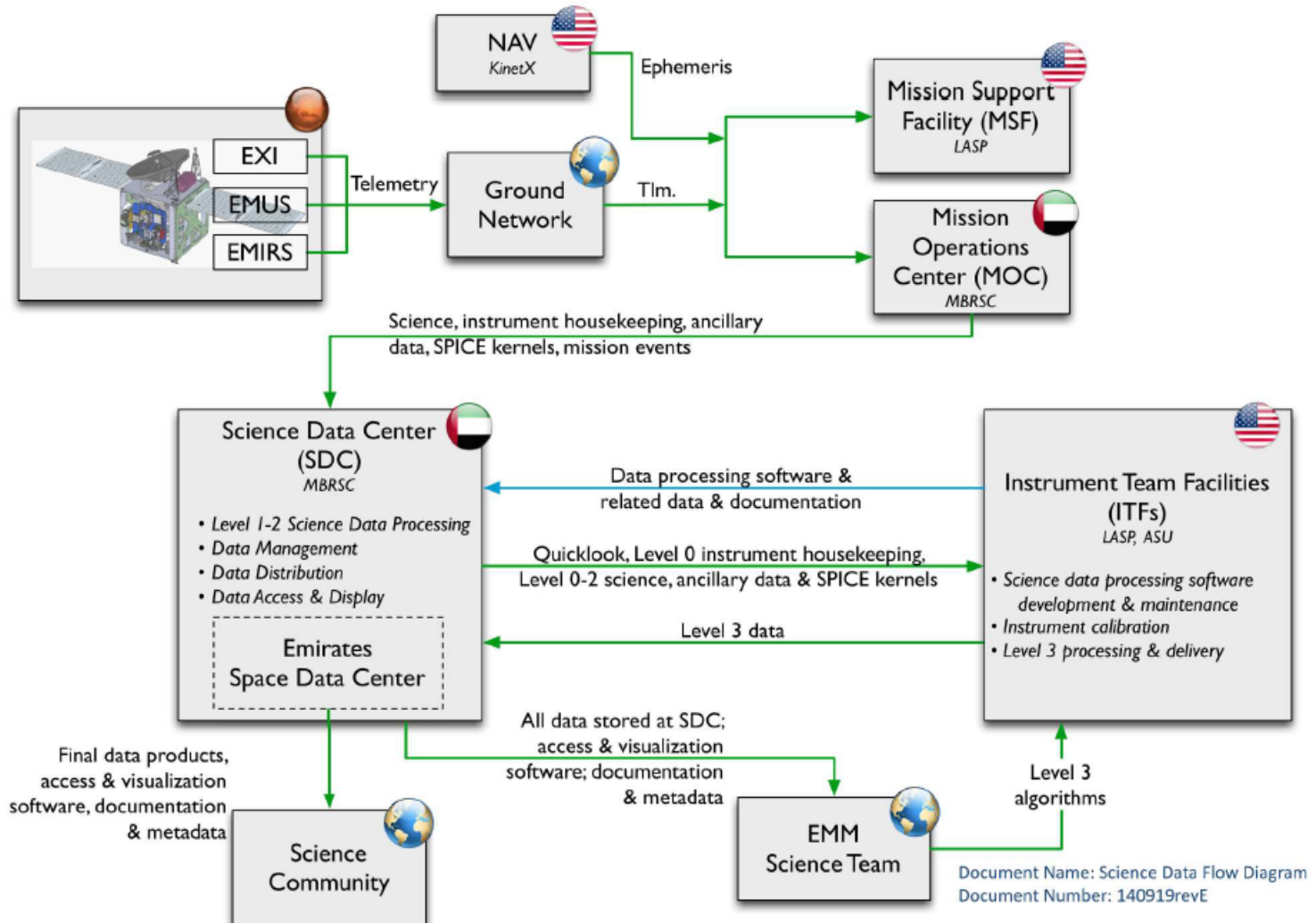
- Emirates Mars Mission Objectives
- EMM Instrumentation
- Science data flow
- EMM Science Data Center
- SDC Cloud implementation
- SDC cloud Orchestration
  - Data management
  - Data processing
  - Data dissemination

# Emirates Mars Mission Objectives

- Program objectives
  - Complete Mars orbiter insertion by the UAE's 50th anniversary in 2021
  - Contribute to Development of the S&T Sector in the UAE
  - Develop UAE Scientific Capabilities
  - Increase UAE's Contribution to the Scientific Community
- Scientific objectives
  - Understand climate dynamics and the global weather map through characterizing the lower atmosphere of Mars
  - Explain how the weather changes the escape of H and O through correlating the lower atmosphere conditions with the upper atmosphere.
  - Understand the structure and variability of H and O in the upper atmosphere, as well as identifying why Mars is losing them into space.

- Emirates Exploration Imager (EXI)
  - to capture high resolution images of Mars, and measure water ice and ozone in the lower atmosphere
- Emirates Mars Ultraviolet Spectrometer (EMUS)
  - to measure O and CO in the thermosphere and H and O variability in the upper atmosphere
- Emirates Mars Infrared Spectrometer (EMIRS)
  - to measure temperature and global distribution of dust, ice cloud, and water vapor in the lower atmosphere

# Science data flow



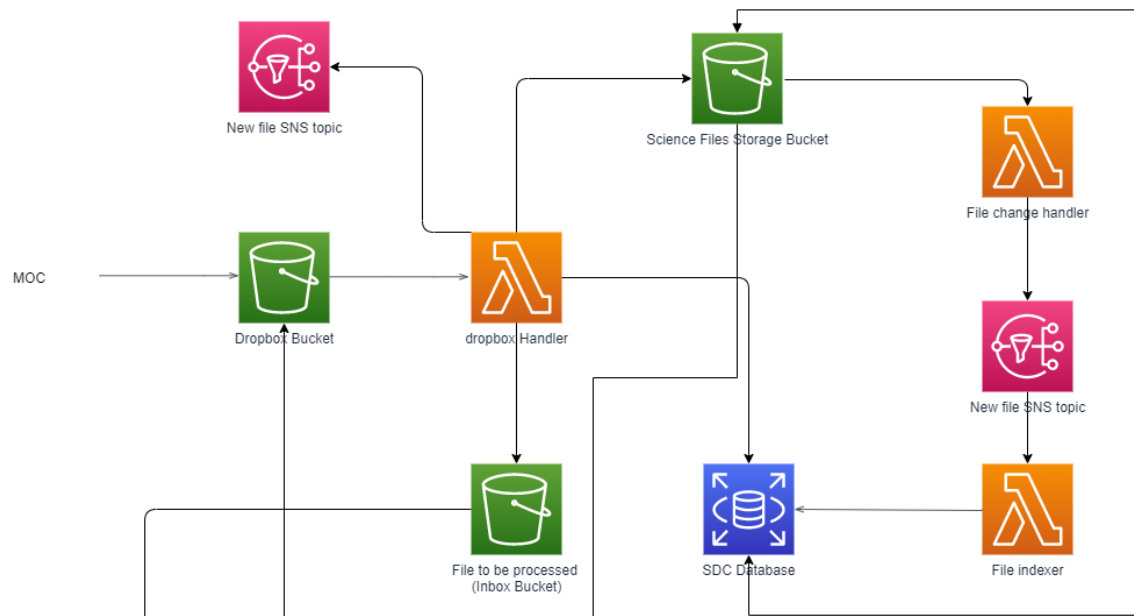
- Science data center is responsible for
  - Data management
    - Receive and manage Level 0 and ancillary data and SPICE kernels from the MOC
    - Maintain a secure, stable repository of all science data throughout the mission, and establish a long-term archive for storage beyond end of mission
  - Data processing
    - Receive and manage processing software from the ITFs
    - Generate higher level scientific products on a regular and automated basis
  - Data Dissemination
    - Disseminate science data products to the EMM science team and science community to perform science analysis

- The science data center fully deployed at Amazon Web Service (AWS)
- The system developed as a native cloud solution utilizing different cloud based managed services
- The system orchestrated so that it supports full end-to-end automation from receiving the raw science products to the delivery of higher level of scientific products to the science community
- Utilization of cloud technology allows for better system scalability, agility, reliability, Backup and restore, and reducing system Capex.

# SDC cloud Orchestration

- Data Management

- Mainly implemented using different Lambda functions (Serverless computing service) to manage and index the received science products
- The Lambda functions triggered once new file arrives or existing files deleted
- Simple Storage Service utilized to store all science products files
- Rational database service utilized to store the science products meta data







# SDC cloud Orchestration

- Data Dissemination

- The SDC takes advantage of AWS's capabilities to host static website content in an S3 bucket
- served by AWS Cloudfront to ensure low latency access to users around the globe
- APIs are built in API Gateway to query the SDC database for specific files or download relevant files to the end user.

