National Polar-orbiting Operational Environmental Satellite System (NPOESS)
Interface Data Processing Segment (IDPS) Architecture

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The IDPS segment (Figure 1) combines software and hardware flexibility, expandability, and robustness to meet stringent performance requirements levied by the NPOESS system level requirements. Sensor application packets are passed to IDPS. The data stream is broken into granules, which are a subsectioning of the data stream into manageable time intervals. The granules of data can be processed in parallel by IDPS thus ensuring processing of high quality products within latency timelines.

Ingest (ING)

The ING Subsystem creates sensor Raw Data Records (RDR) from multiple Sensor Application Packet streams received from C3S. It separates the incoming streams into granules by sensor. Ingest extracts NPOESS Auxiliary data from Stored Mission Data (SMD) and create RDRs or Bus TM and S/C Diary information. It also accepts external Ancillary data sets that are required for EDR processing.

Processing (PRO)

The PRO Subsystem encapsulates all of the data algorithms that must be executed to turn the RDRs into higher level products. First processing creates sensor specific SDRs or Temperature Data Records (TDRs) from RDRs. These are corrected, calibrated and geolocated sensor data. A complex set of processing chains (see Figure 6) is then used to produce the required 46 EDRs. Some of these are produced as individual products or one algorithm may yield a group of related EDR products.

Data Management (DMS)

The DMS Subsystem provides internal short-term (24 hour requirement) storage of all NPOESS data, as well as management of shared memory (cache), which is a critical component of the IDPS in meeting data product latency.

Infrastructure (INF)

The INF Subsystem provides the Workflow management functions for IDPS. It has total control of process startup, monitoring, shutdown and re-start upon error conditions. INF also provides common utilities and tools, such as logging, debug, timers, performance monitoring, data availability and accounting, and HW monitoring.

Data Delivery (DDS)

The DDS Subsystem is the single provider of all data between IDPS and the local Central. It converts requested products into Hierarchical Data Format 5 (HDF5) format with data and metadata aggregation. HDF5 is a self-describing data format with community supplied implementation libraries.

Data Quality Monitoring (DQM)

The DQM Subsystem provides the Data Quality Engineer automated and ad-hoc processing in support of Data Quality Notifications from the Processing system. The Data Quality Engineer is provided with a tool kit of Geographic Information System based modules that allow the IDPS data to be registered to a geographic grid and analyzed, viewed, and trended. The DQM and the DQE support the program's larger Calibration and Validation (Cal/Val) activities and supports the troubleshooting of data anomalies.

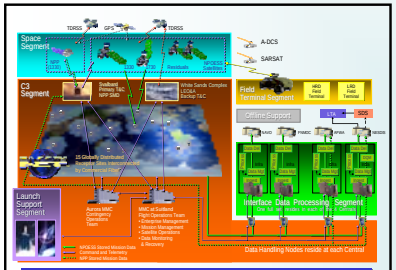

Figure 2- NPOESS System

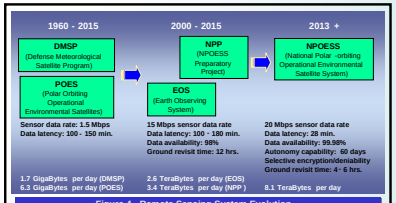

Figure 4 - Remote Sensing System Evolution

Figure 4 depicts the evolution of Government remote sensing systems over the last 40 years. NPOESS, the National Polar-orbiting Operational Environmental Satellite System is the next generation low-earth orbiting environmental remote sensing platform. NPOESS will play a pivotal role in our nation's weather forecasting and environmental awareness for the next two decades.

* -- current estimates

NPOESS products are generated from a complex network of processing algorithms. A number of interdependencies between algorithms exist in order to provide the required data quality to the end User. Figure 6 illustrates the interdependencies between products and processes within the IDPS needed to produce the NPP-era SDRs, EDRs, and Gridded Intermediate Products (GIP's). The algorithm interactions for the NPOESS era will be even more intricate. The execution of this processing flow for each granule of data is managed within the Infrastructure SI by the Workflow Manager (WFM) component through the use of a configurable Data Processing Guide (DPG).

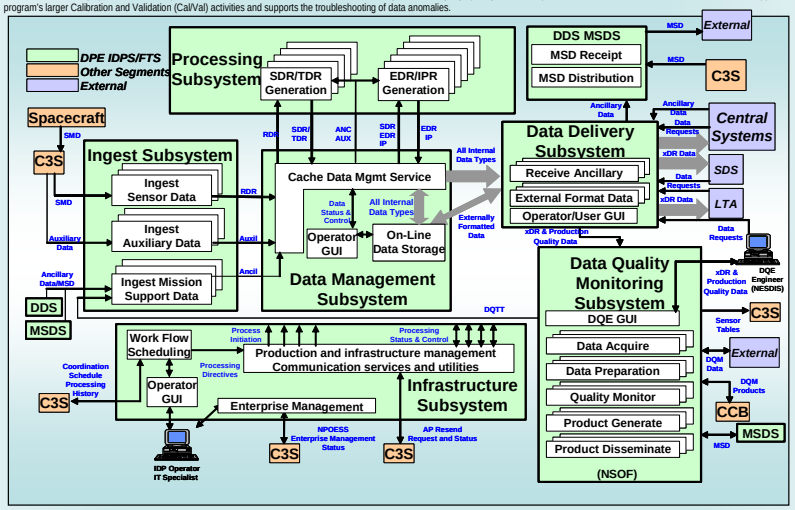

Figure 1- Interface Data Processing Segment Architecture

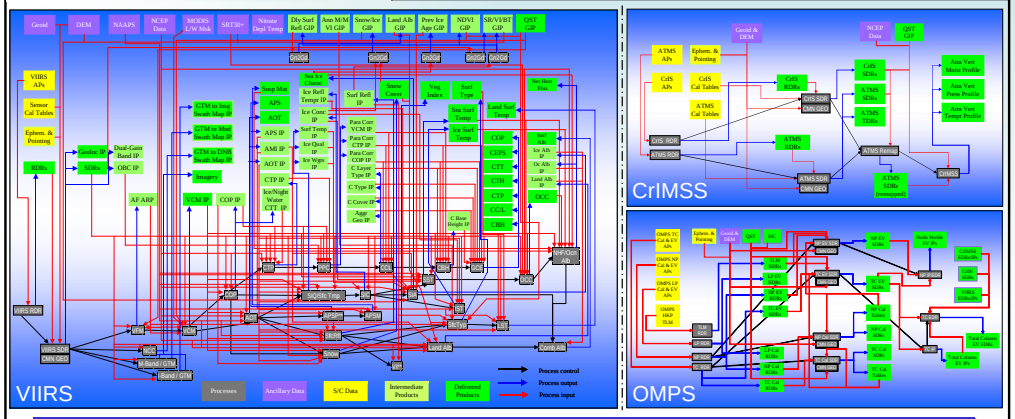

Figure 6- NPP Algorithm Processing Interdependencies

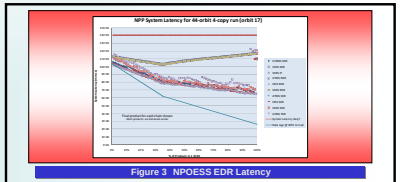

Figure 3 NPOESS EDR Latency

The NPOESS sensor suites on the NPOESS vehicles produce data at up to a 20 MB/sec rate. This is an increase over DMSP of more than 13:1. The total xDR (RDR, SDR and EDR) products produced by an instance of IDPS per day have a volume increase over DMSP of 2000:1 In addition to handling these increased rates, latency requirements (defined as time from sensing of phenomena to production and delivering of products) decreases by a factor of 4. A graphical representation of the latency requirements that are imposed on NPOESS and projected actual performance is contained in Figure 3.

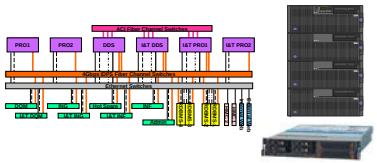

Figure 5- IDPS Hardware Architecture

IDPS utilizes a mix of IBM System p servers and Storage Area Network (SAN) / Fibre Channel technology to meet the program's demanding data product latencies, assure fast and successful delivery of data to Users, provide very high operational availability, and allow for significant expandability to meet any changes to support NPOESS objectives.

SUMMARY

The Interface Data Processing Segment is designed to provide high-quality environmental and meteorological data to the NPOESS System Users with very low latency. It leverages highly flexible and expandable, robust IBM hardware to maximize data availability, operational availability, and assured delivery. The IDPS SW architecture provides an efficient solution for NPP and provides a scalability to meet future NPOESS needs.