



- SAME



EPUSP -



- DFD

IV WORKSHOP RNP2 (WRNP2)

Hotel Pirâmide, Natal, RN, 19-20 de Maio de 2003

Advanced Network Engineering and Applications from Space Missions

- AUTHORS -

Eduardo W. Bergamini

Serviços Aplicativos em Missões Espaciais - SAME
Instituto Nacional de Pesquisas Espaciais - INPE
Ministério da Ciência e Tecnologia - MCT
Av. dos Astronautas, 1758
12227-010 São José dos Campos, SP, BR
E-Mail: <e.w.bergamini@uol.com.br>

Wilson V. Ruggiero

Lab. de Arq. e Redes de Comp. - LARC
Dep. de Eng. de Comp. e Sists. Digs. - PCS
Esc. Politécnica da Univ. de S. P. - EPUSP
Av. Profº Luciano Gualberto
Travessa 3 - 158, Sala C1-46
Cidade Universitária, 05508-900
São Paulo, SP, BR
E-Mail: <wilson@larc.usp.br>

Gerhard K. L. Mayer

German Remote Sensing Data Center - DFD
German Aerospace Center - DLR
Oberpfaffenhofen / Wessling, Germany
E-Mail: <gerdventus.mayer@t-online.de>



– SAME



EPUSP –



– DFD

MOTIVATION

- The Basic Project that motivated this initiative is the existing, on going, International Cooperation Project between INPE (Brazil) and DLR (Germany), entitled ‘SLIM-Space Linked Multimedia Information Network Applied to Science, Research and Education’;
- The pre-project initiative between INPE/SAME and EPUSP/LARC, tested and demonstrated at COMDEX/Network + Interop 2000, under the topic: ‘TeleScience in Space Missions (TCME)’;
- Evolution from the preliminary presentation of INPE at the II WRNP2, held in IMPA, RJ, in April 2001.

NAME OF THIS ACTIVITY

SLIM - Earth Observation or SLIM-EO Application Service.



– SAME



EPUSP –



– DFD

MAIN OBJECTIVE

Establishment of an Application Service that will provide data information networks with real-time and near-real-time capabilities, for: transfer, temporary storage, archiving, delivery or retrieving access for authorized data centers and users, at National (Brazil) and International (Germany) level. High volume raw data files are the basic products to be transferred. Transfer of value added data products are also being considered.



– SAME



EPUSP –



– DFD

MAIN INSTITUTIONS

1. Instituto Nacional de Pesquisas Espaciais (INPE)

- Activity of Application Services in Space Missions (SAME);
- Space Research Areas in: Oceanography and Land Use, in Agriculture and Vegetation.

2. German Aerospace Research Establishment (DLR)

- Ground Systems Division / German Remote Sensing Data Center;
- BIRD Satellite Mission Scientific Organization.

3. Escola Politécnica da Universidade de São Paulo (EPUSP)

- Laboratório de Arquitetura e Redes de Computadores (LARC) / PCS.

4. Universidade Federal Rural de Pernambuco (UFRPe)

- Laboratório de Geociências e de Sensoriamento Remoto (GEOSERE).



- SAME

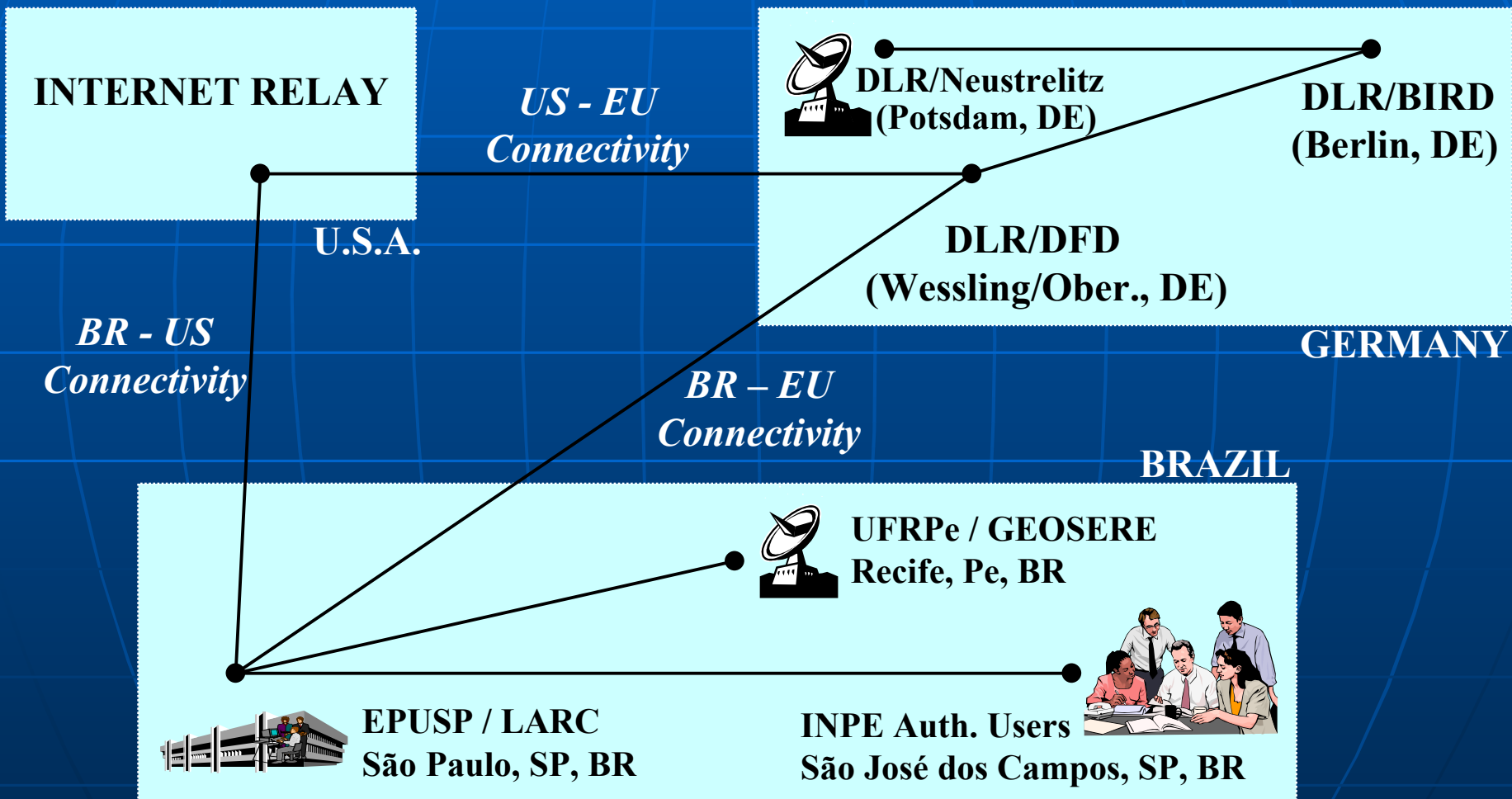


EPUSP -



- DFD

BACKBONE TOPOLOGY OF THE INFORMATION NETWORKS





- SAME



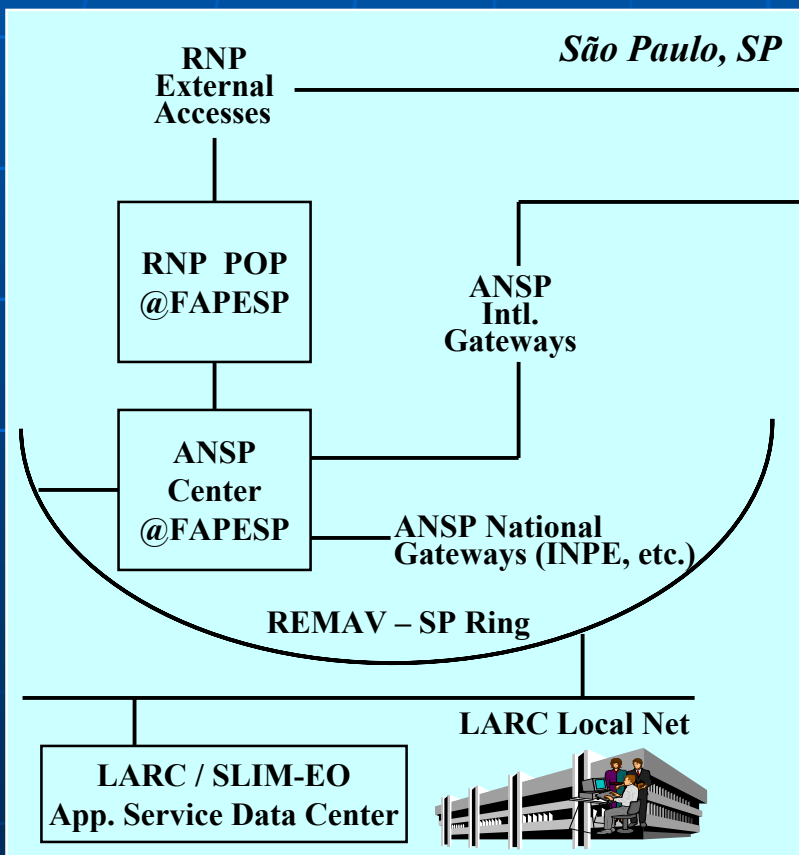
EPUSP -



- DFD

RELEVANT DETAILS OF LOCAL TOPOLOGIES

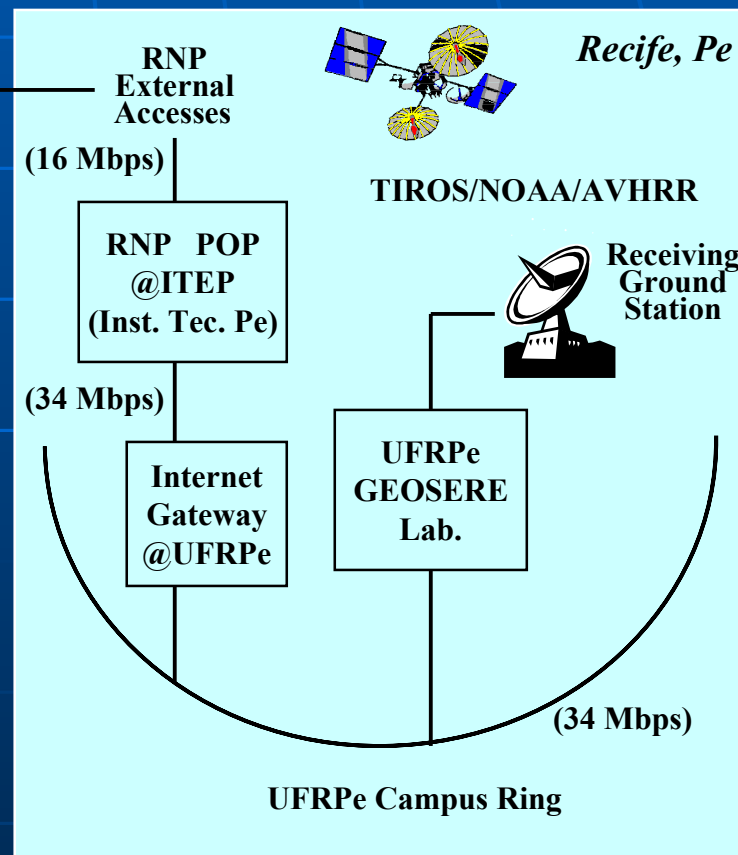
- AT LARC/EPUSP -



RNP Backbone Connectivity

US & EU Connectivities

- AT GEOSERE LAB./UFRPe -





- SAME



- EPUSP



- DFD

MAIN DATA PRODUCTS FOR TRANSFER

- **RAW DATA**

- AVHRR/NOAA/TIROS HRPT multi-spectral satellite images
NOAA 17 descending orbit; NOAA 12 and ascending orbit NOAA 16 satellites, as back-ups
- BIRD (Bi-spectral Infra Red Detection) satellite images

- **VALUE ADDED DATA**

Derived from AVHRR images:

- NDVI (Normalized Differential Vegetation Index) Images
- SST (Sea Surface Temperature) Images
- LST (Land Surface Temperature) Images

Legend: HRPT - High Resolution Picture Transmission
AVHRR - Advanced Very High Resolution Radiometer



- SAME



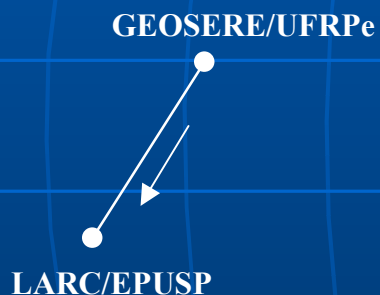
EPUSP -



- DFD

MAIN SERVICE INFORMATION NETWORKS (INs)

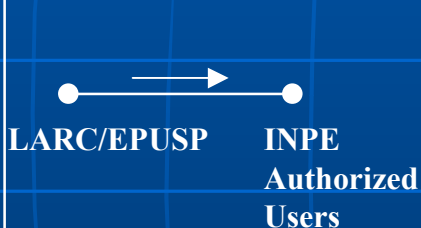
IN - 1



MAIN FUNCTION:

Continuous, real-time ingestion of AVHRR/NOAA/TIROS raw images. Near-real-time ingestion of NDVI, SST & LST, value added products.

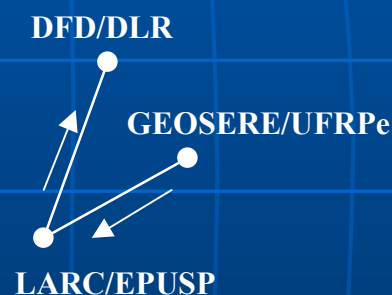
IN - 2



MAIN FUNCTION:

Continuous, near-real-time availability of AVHRR raw images and of NDVI, SST & LST value added products, and of non-real time BIRD satellite images, for visualization and up-load.

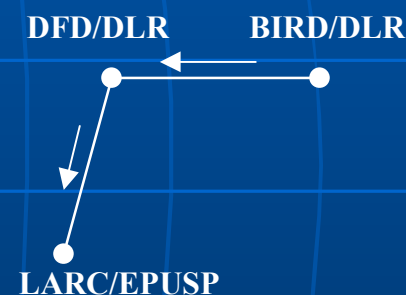
IN - 3



MAIN FUNCTION:

Back-up transfer in near-real-time of AVHRR/NOAA/TIROS raw images, on continuous mode.

IN - 4



MAIN FUNCTION:

Non-real time ingestion of BIRD satellite images.



– SAME



–



– DFD

MAIN DAILY VOLUME OF DATA PRODUCTS

■ **RAW DATA**

- AVHRR / HRPT: 4 passes (2/day + 2/night) @ ~80 MB / pass, uncompressed;
- BIRD : Eventual aquisition @ ~40 MB / pass, uncompressed.

■ **VALUE ADDED DATA**

- NDVI : 2 passes/day @ ~10 MB / pass, uncompressed;
- SST : 4 passes (2/day + 2/night) @ ~10 MB / pass, uncompressed;
- LST : 4 passes (2/day + 2/night) @ ~10 MB / pass, uncompressed.



– SAME



EPUSP –



– DFD

MAIN PILOT APPLICATIONS OF THE SERVICE

■ ***OCEANOGRAPHY***

- Sea Temperature of Atlantic Ocean
- Sea Buoy Network Data (Intl. Coop. Project), from TIP (Tiros Information Processor), embedded in AVHRR imagery
- Sea Currents
- Other applications

■ ***LAND USE***

- Land Surface Temperature
- Vegetation Index and Thematic Survey
- Agriculture Thematic Survey
- Other applications



– SAME



EPUSP –



– DFD

BASIC COMPONENTS OF THE APPLICATION SERVICE

- Plan - of - operation (operational maintenance)
- Automatic data transfer processes
- Data transfer processes on demand
- Temporary archiving
 - Transport buffers
 - User access buffers
- Medium and long term archiving
- WWW - URL (metadata, low resolution products, etc.)
- Authorized user extranets



– SAME



EPUSP –



– DFD

IMPORTANT TOPICS TO BE CONSIDERED

- Constant evaluation of the bandwidth of each segment of the topology: spectral capacity in function of time;
- Monitoring of alternative routing paths for National and International connections;
- Best possible performance for real and near-real-time data availability;
- Structuring of Directories for temporary, medium and long term archiving;
- Criteria for on-line and off-line archiving;
- Structuring of Web site for metadata and other complementary informations;
- Use of Extranets / Authorization for data access, delivery or dissemination;
- Exploration of data compression schemes.



– SAME



EPUSP –



– DFD

OTHER RELATED RESEARCH TOPICS

- Exploration of Multimedia techniques for: imagery animation, composition and aggregation of other related data;
- Performance measurements for real and near-real time data servicing with hybrid, medium to high speed network topologies;
- Static and dynamic routing diversity for optimization of data speed segmentation and for availability of connectivity;
- Exploration of Tele-Education schemes with the scientific applications;
- Lossy and lossless compression schemes optimized for context oriented data structures.