The boosting factors of the SpaceStream Paradigm

Cristoforo Abbattista; Daniela Drimaco; Leonardo Amoruso

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THE RIGHT INFORMATION
AT THE RIGHT TIME
IN THE RIGHT PLACE
The 3 Horizon of Innovation in Planetek

THE SPACESTREAM

Traditional EO Service:
- High recurring costs
- Generic Coverage Information
- Low Automation
- High Geographic Dependence

Info@as:
- Subscription Services
- Analytical Vertical Information
- Big Data Integration
- Globally Scalable (Auto) Services

SpaceStream:
- Satellite to User services
- Synthetic Sensors (virtual sensors)
- In Space processing of data
- Globally Scalable Services
The traditional EO Value Chain

A sharp separation between Up Stream and Down Stream activities.
EO Services will sell **Wisdom**

Networks of “*heterogeneous, distributed Ground Segments*”

Swarms of "*cooperative and competitive Space Agents*”

*UpStream and DownStream mixed in the FOG of the Continuous SpaceStream*
A shared Vision
Can we achieve THE SPACESTREAM?

EO data is a commodity

- We can get data at different time by different providers
- We have even complete background EO missions/constellations like Sentinel or Landsat

We can ask for more than data

- Responsiveness: *Normal Mode*
- Reactivity: *Emergency Mode*
- Low Latency: *Less Data more Services*

We can ask for more than data
Use Cases

Marine
- Phytoplankton bloom
- Oil spill
- Plastic island
- Thermal anomalies
- River Plume anomalies

Security
- Non collaborative Ships
- Accidents: Airplanes, Ships
- Situation Awareness
- Border Security
- Cross border activities
- Critical Infrastructure

Land
- Flooding
- Fires
- Heat Islands
- Thermal anomaly
- Cryosphere events
### Satellite needs and innovations

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<th>Smart Ground</th>
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| - Different operational modes  
- New Sensing capabilities  
- Compressive Sensing  
- Quantum Imaging | - High Performance Processing  
- Innovative Comm. Protocols  
- High speed memory  
- Attitude knowledge  
- Pointing capabilities  
- Self Awareness | - GeoAnalytics  
- On demand processing  
- AI Processing  
- On Board Payload data processing  
- Autonomous Tasking  
- CyberSecurity  
- BlockChain | - Peer to peer architectures  
- Health Monitoring  
- Knowledge Based Tasking  
- Tasking 4 Processing |
Artificial Intelligence Role

**Pre-Processing**
- Declouding
- Atmospheric correction
- Data Mining

**Data Fusion**
- Segmentation
- Classification
- Image Tagging
- Change Detection

**Processing**
- Multi-Sensor Data fusion
- Other Data
- Analytics
- Statistical
- CrowdSourcing
- Social

**Acquisition**
- Ground Stations
- On-Board processing
- Compression
- Health Data
- Calibration

**AI4EO**
SPACESTREAM
The future of EO
GeoAnalytics: RHETICUS
GeoAnalytics: RHETICUS
Artificial Intelligence

Cloud detection, Classification, Change detection, Super-resolution, Compression, …
Imagery could be produced by any device. Information about device identity, position, status, ownership, etc. is collected and organized to contribute to a signature.

The resulting signature, which in fact contains many information about imagery and its source, is sent to the shared ledger for being stored permanently.

Files are not identified by their names but by their signatures.
GPU4Space Library

- **Multi OS**: MS Windows, Linux, MacOS
- **Multi Processor**: Intel, AMD, ARM, Sparc
- **Multi GPU**: Intel, AMD, NVIDIA, ARM-Mali, Imagination-PowerVR
- **Multi GPU-API**: OpenGL, OpenCL, CUDA, Vulkan
- **Multi-platform**: CPU/GRID/GPU
- **Data Oriented**: Tensor and hierarchical Tensor (HDF5, NetCDF, FITS)
- **Constrained Memory Access**: Protection from SEU (Single-Event Upset) like buffer overflow/underflow and not allowed access to memory
- **Service Locator Pattern**: to extend at run time the execution programme without recompiling
The GPU platforms

Target Hardware
- NVIDIA Jetson AGX Xavier
- CPU: 8-core ARM 64-bit CPU
- RAM: 16 GB
- GPU: 512-core Volta GPU (with Tensor cores)

Test Hardware
- NVIDIA Jetson TK1
  - CPU: Quad-Core ARM Cortex
  - RAM: 1.7 GB
  - GPU: NVIDIA Kepler 192 core

Test Hardware
- NVIDIA Jetson TX1
  - CPU: Quad-Core ARM Cortex
  - RAM: 4 GB
  - GPU: NVIDIA Maxwell 256 core

- NVIDIA Jetson AGX Xavier
  - CPU: 8-core ARM 64-bit CPU
  - RAM: 16 GB
  - GPU: 512-core Volta GPU (with Tensor cores)
Quantum Imaging Sensor

CORRELATED Light Source

SENSOR 1: retrieves the direction of light rays

SENSOR 2: retrieves the "ghost" image of the scene
Cyber Security: CRUISE
Smart Ground Health Monitoring
Thank you for your attention

For further information

Cristoforo Abbattista
Head of Planetek SpaceStream SBU
abbattista@planetek.it