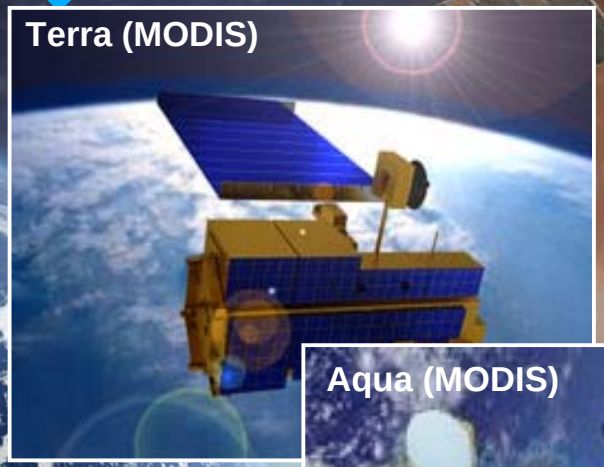
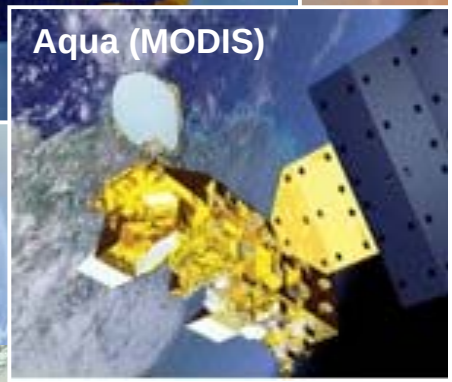
Goddard Space Flight Center

JPL

UNIVERSITY OF MARYLAND



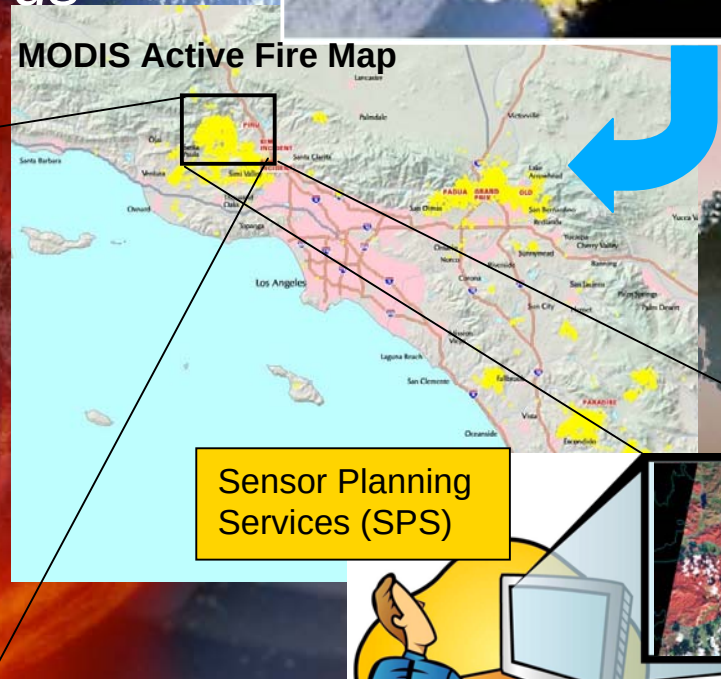


Making Space-based Sensors Discoverable on the Internet Using A Service Oriented Architecture and Open Geospatial Consortium Standards

January 29, 2007

Dan Mandl NASA/GSFC

Co-authors:
Rob Sohlberg/Univ. of Md.
Stu Frye/MitreTek
Pat Cappelaere/Vightel
Steve Ungar/GSFC
Troy Ames/GSFC
Steve Chien/JPL

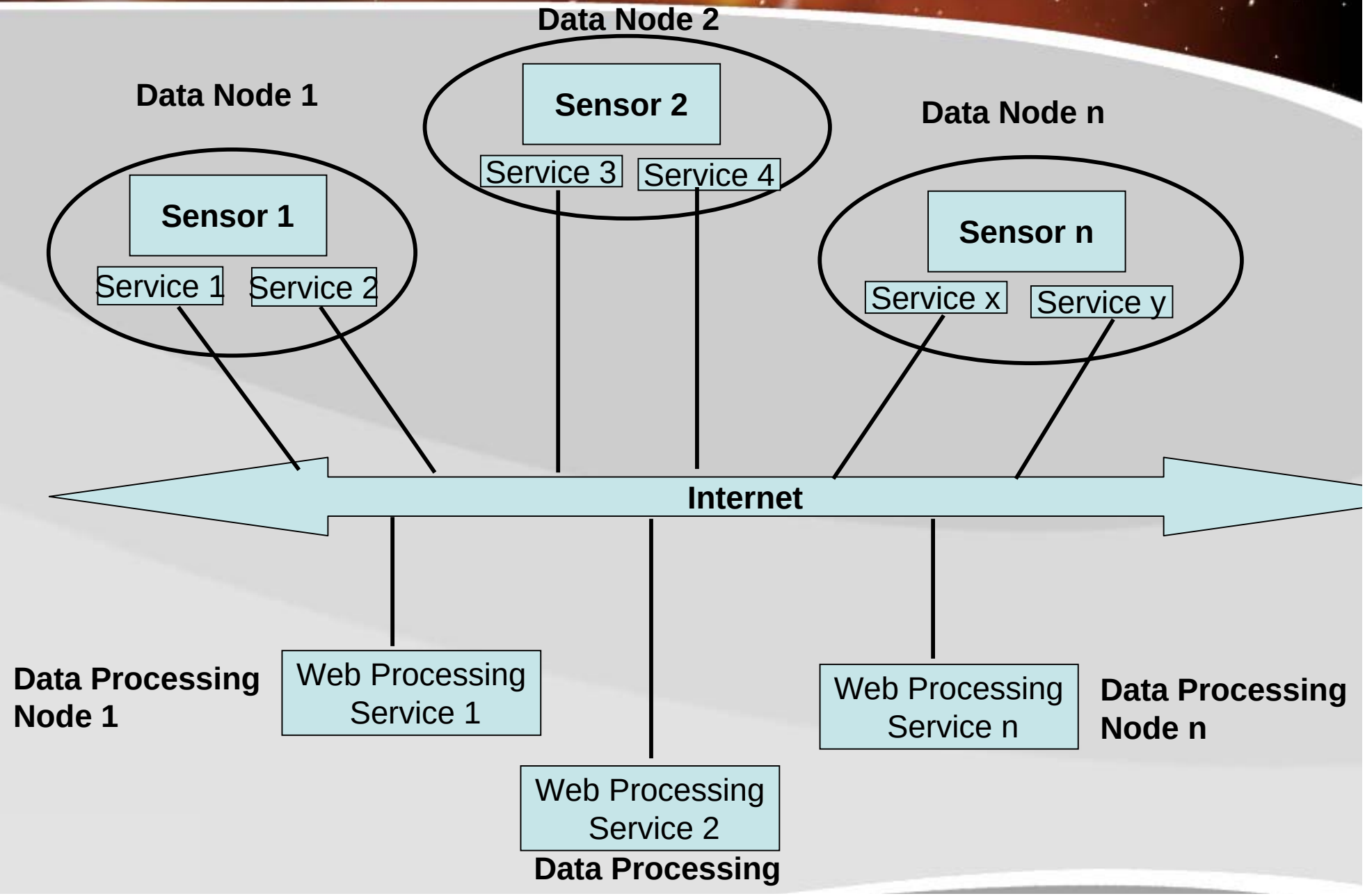


White Paper for ESTO

Introduction

- NASA/GSFC prototyping open source software based on Open Geospatial Consortium (OGC) standards to enable user-centric geospatial sensor web services
- User can access:
  - Data from sensors (space-based, unmanned aerial vehicles and in-situ)
  - Services to perform various levels of data processing
  - Models which describe how to create desired science products from available sensor data
- Science products/algorithms are registered on a catalog server and are easily discoverable, accessible, modifiable and extensible via service chains

Basic Concept



Reference Architecture for an Inter-Operable Sensor Web

Requested data from sensor data nodes or data processing nodes via Internet

Register

Web Map Service

Map

Register

Discover

Catalog Service for Web (CSW)
(Product Features and Service Capabilities)

Register

"Thin" Web Client (blog, wiki, IM, forum)

SensorML

SensorML

SensorML Capabilities Document

Data Processing Node

SensorML Capabilities Documents

Web Coordinate Transformation Service (WCTS)

Web Processing Service (WPS)

Web Coverage Service (WCS)

In-situ Sensor Data Node

UAV Sensor Data Node

EO-1 Satellite

Web Feat Service (W

Workflow Editor

Geospatial Processing Models

Satellite sensor data product

Sensor Plan Service (SP

Sensor Ale Service (SA

Optimizer Scheduler

Check Workflow Feasibility

Sensor Observati Service (SO

Execute

Instantiation Service

Satellite Data N

Execute

Decision Support System & Tools

XML SCRIPT

Workflow

GMSEC

IF

Target EO-1 User Scenario

- Department of Homeland Security (DHS) analyst requests fire, flood, ice breakup, and other features of interest to analyze emergency response in disaster area
- Client DSS Model queries catalog and finds sensor capabilities and processing services that can potentially supply the requested features
- Catalog returns EO-1 and other data sources as possible source via Catalog Services for the Web (CSW).
- Access to high resolution EO-1 data is granted based on user/role permission
- No recent EO-1 data is available for the disaster site, so satellite tasking is required and achieved (at no cost to DHS) via DSS Optimizing Scheduler and SPS service
- Analyst is notified via instant message that Hyperion/ALI data products are available. High resolution imagery is retrieved via SOS, WCS and WFS services
- Analyst requests data processing to extract desired features from EO-1 data and Workflow Engine executes data processing algorithms in response
- Processed features are overlaid on maps, annotated by the analyst, and shared with other users via blog, wiki, and/or forum

Benefits of Architecture

	Current Way	Vision for New Way
Method to develop new algorithms	Custom (license fees)	Open source building blocks (no fees)
Interoperability	Low	High
Cost to create & implement new algorithms/service chains	High	Low
Data storage and transfer requirements	High: Store/archive and transfer all sensor data	Modest to Low: Filter and transfer only needed features; archive virtual produc
Ease of finding and reusing existing algorithms	Difficult	Easy with automatic discovery