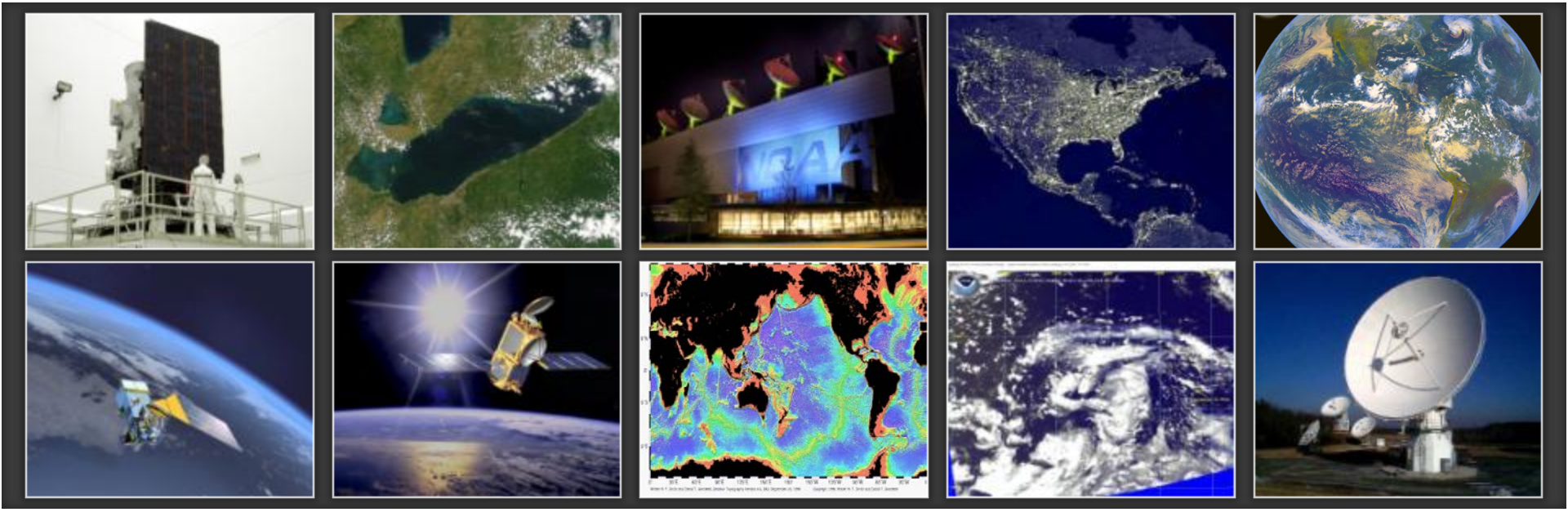


April 8, 2014

NOAA Operational Use of Internet2 and Partner MOU NRENS

Overview

The new generation of environmental weather satellites will generate multi terabytes a day of data. NOAA is planning to leverage Internet2 and connected international R&E Networks to acquire and externally distribute this data.

Outline

- NOAA, Internet2, and Partner Connectivity
- Current Operational Satellites & Data Volumes
- New Generation Satellites & Data Volumes
- Types of Traffic
- Future Traffic
- Data Distribution
- NOAA R&E Network Goals
- NOAA Reliability & Performance Needs

Mission

NOAA National Environmental Satellite, Data, and Information Service (NESDIS)

Dedicated to providing timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life, NESDIS does the following:

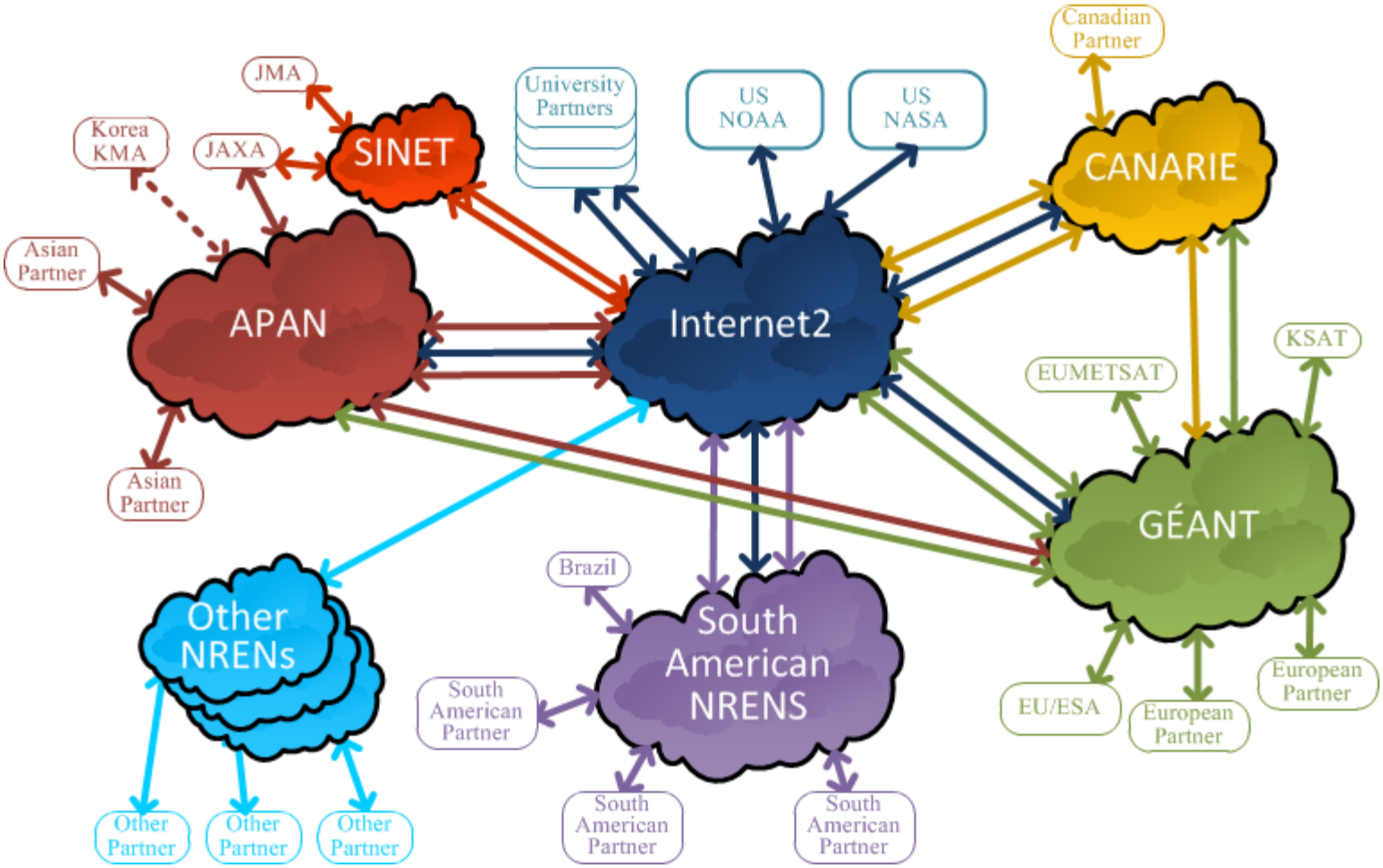
- acquires and manages the Nation's operational environmental satellites,
- operates the NOAA National Data Centers,
- provides data and information services including Earth system monitoring,
- performs official assessments of the environment, and
- conducts related research.

NOAA systems are part of the US National Critical Infrastructure

NOAA & Internet2

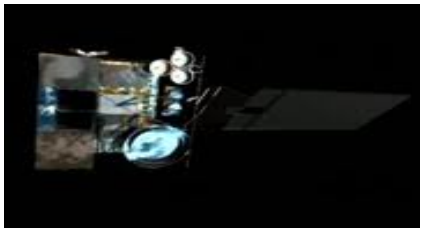
- NOAA is an I2 Affiliate Level 1 Member
- NOAA currently has 3 x 10 Gbps connections located in Silver Spring, MD, Boulder, CO, and Seattle, WA.
- NOAA currently uses I2 mainly to enable universities to access NOAA web sites and archived satellite data.
- Some of NOAA's Partners are connected to R&E Networks in their regions and NOAA would like to leverage that data path.

Partner Connectivity via Internet2



Current Operational Satellites

- Geostationary Orbit (GEO)
  - GOES-East
  - GOES-West



- Polar Orbit - Low Earth Orbit (LEO)
  - NOAA 15
  - NOAA 16
  - NOAA 18
  - NOAA 19

  - Soumi NPP (“new generation”)

Current Satellites Data Volumes

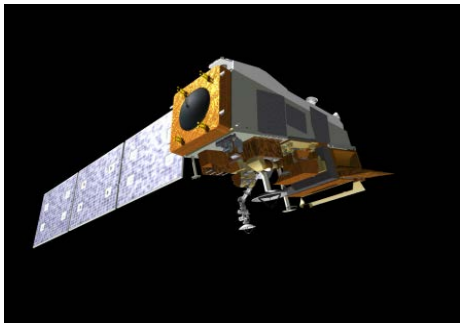
- Geostationary: Continuous data stream
- Polar (LEO): Intermittent data stream every ~100 minutes (lasting ~10 minutes)

  For the same amount of GEO data, LEOs need 10X the bandwidth

Satellite	Downlink /Day	Product/Day	Network External Distribution/Day
GOES-East/West	60 GB	100 GB	Minimal
POES 15, 16, 18, 19	8 GB	50 GB	300 GB
SNPP	**250 GB**	**3-4 TB**	**~3 TB (Requested)**

New Generation Satellites

- US GOES-R,S,T JPSS 1&2



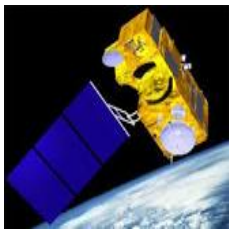
- International Partners

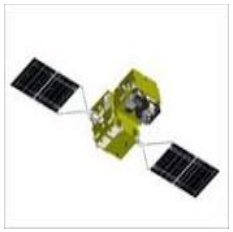
  Sentinel 1 (A&B), Sentinel 2 (A&B), Sentinel 3 (A&B)

  Himawari 8 & 9

  GCOM-C, ALOS-2

  Geo-KOMPSAT-2A





Expected Satellites Data Volumes

- US

Satellite	Downlink	Products/Day	Network External Distribution/Day**
GOES-R, S, & T	350 GB	3-4 TB/350 GB*	~5 TB/day
JPSS-1 & 2	250 GB	3-4 TB	~10 TB/day

- International Partners

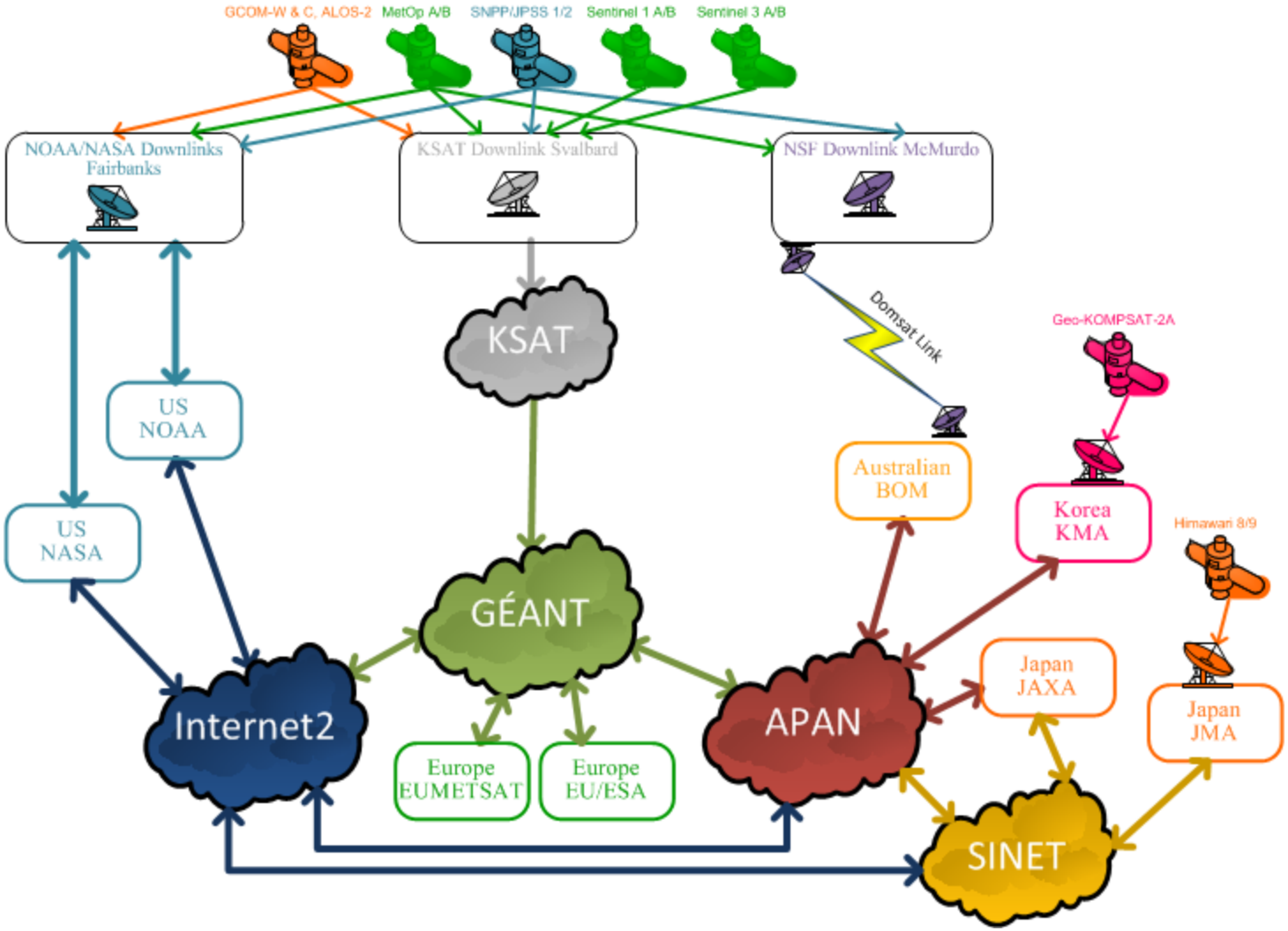
Origin	Satellite	Type	Products/Day
Europe/ESA	Sentinel 1 A&B	LEO	2-3 TB
Europe/ESA	Sentinel 2 A&B	LEO	3-4 TB
Europe/EUMETSAT	Sentinel 3 A&B	LEO	3-4 TB
Japan/JMA	Himawari 8 & 9	GEO	3-4 TB/350 GB*
Japan/JAXA	GCOM-C	LEO	2 TB
Korea/KMA	Geo-KOMPSAT-2A	GEO	3-4 TB/350 GB*

* Estimates of total products and full disk scans of interest to external partners ** Early estimates

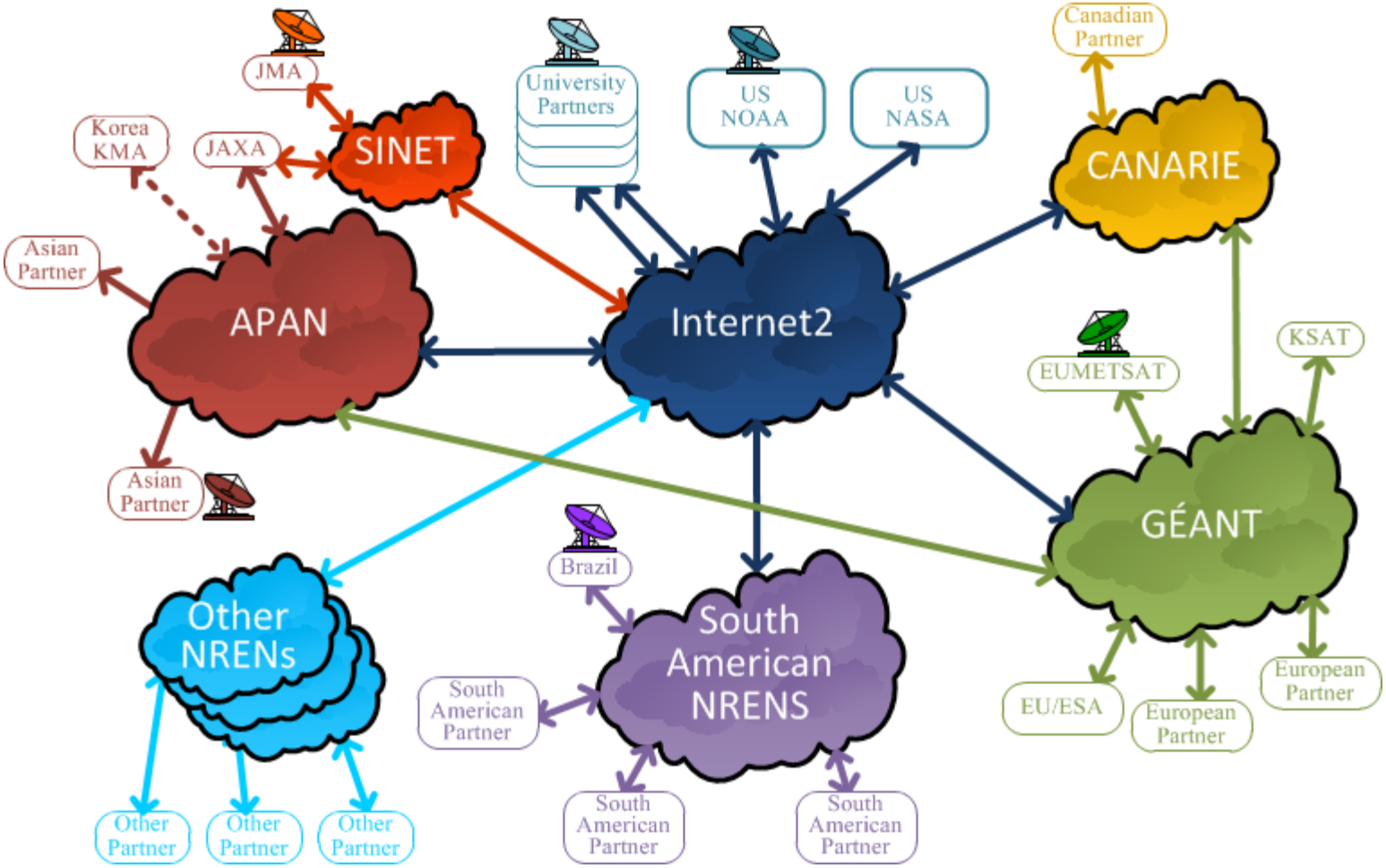
Types of Traffic

- Download Traffic from Polar Satellites (LEOs)
  - Orbital Command & Control and Sensor Data traffic
    - Main Sites Near Poles: Svalbard Norway, Fairbanks Alaska, McMurdo Antarctica (via Australia)
  - Direct broadcast Data traffic
    - International partner sites
    - Universities
- Satellite Product Distribution (GEOs & LEOs)
  - Direct Distribution (Unicasts)
  - Multicast Distribution

Future Partner Orbital Data Traffic



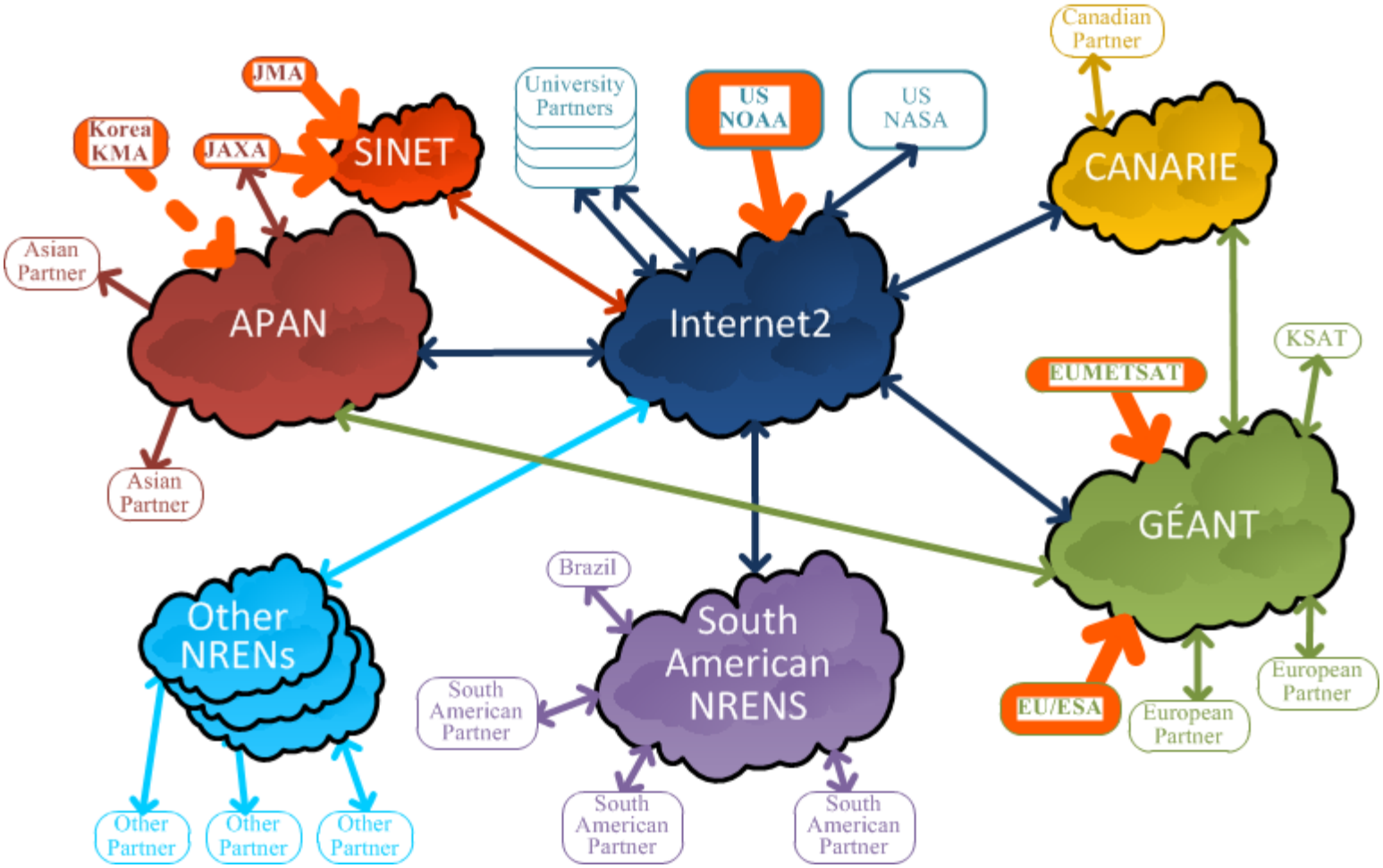
Future Direct Broadcast Traffic



NOAA Direct Data Distribution

- Product files (Unicast)
- Global Demand (many requests for same large data sets)
  - Where there are no direct broadcast receivers
  - For Weather Models
- Coverage of areas of interest to Partners
- NOAA Distribution systems have resource constraints (systems & bandwidth)
- Limited coverage data sets for some International partners and universities

Partners Direct Data Distribution



NOAA Multicast Data Distribution

- Product files
- NOAA Distribution systems have fixed resource needs (systems & bandwidth)
- Extensive data sets (files) can be streamed to all International partners and universities via either I2 or Partner R&E Networks, one copy sent of each data set
- Products sent as individual data streams
- Receiver must register and be approved
- Can subscribe to some or all of the streams

NOAA R&E Network Goals

- To replace (when appropriate):
  - Dedicated point-to-point circuits, especially internationally
  - Older Frame Relay and newer MPLS links
  - Internet traffic paths
- Reasons:
  - Cost; Inexpensive I2 local access circuit(s) can eliminate need for many expensive long haul international dedicated links
  - Simplicity; Reduced network interfaces with only need for circuit(s) connecting to local R&E Network. Partners can be reached via limited number of R&E Network links.
  - Security; Reduced number of network interfaces that need to be protected. Aggregation points enable more efficient and better security (including meeting US Government TIC mandate).

Confidentiality, Integrity, Availability

- NOAA and Partners exchange data and make it publically available.
- Data must not be tampered with or altered in any way.
- Data must be received, processed, and distributed within strict time constraints.

Ability to obtain a Service Level Agreement (SLA) that provides at least the minimum quality levels for the services NOAA needs.

NOAA Reliability Needs

- No single points of failure in networks
- Proactive network monitoring
- Fast, efficient detection and correction of network/telecommunication faults
- Contacts for network and end-to-end problem resolution (through partner R&E Networks)

NOAA Performance Needs

- Need a high level of assurance that our operational and critical traffic will be delivered within the time constraints needed.
- Need adequate network bandwidth and connectivity with partner R&E Networks, with proactive and responsive network provisioning to address problem areas.
- Need to collaborate with Internet2 to facilitate NOAA operational and time critical traffic receiving priority over less critical traffic when adequate network bandwidth is not available.

Summary

- NOAA has high hopes and expectations for the planned operational use of Internet2 to meet NOAA's operational and time critical traffic needs including SLAs and assurance of traffic delivery even under adverse conditions.

Thank You

Questions?

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