

EOS Mission Support Network Performance Report

This is a monthly summary of EMSnet performance testing for February 2005 -- comparing the measured performance against the requirements.

Highlights:

- Flows to and from LaRC and NSIDC were transitioned from EMSnet to NISN PIP this month. This transition directly and indirectly affected the ratings
 - There were some initial problems with the transition, which lasted long enough to dominate the calculations. These problems have now been fixed, and will not have any long term effect.
 - The MRTG values for these flows are no longer available, as they no longer flow through the EMSnet routers. Since NISN PIP service is shared with other inter-center users, even if the NISN PIP routers provided MRTG data, the amount attributable to EOS could not be ascertained.
 - The "Flow" data, used in the "integrated" measurements, was also unavailable, for the same reasons – the flow no longer goes through the gsfc-gw EMSnet router. However, in March, substitute flow data is being collected from the LARC and NSIDC ECS routers. While somewhat useful, this data excludes formerly EMSnet flows to non-ECS destinations, such as LaTIS at LaRC, and LASP and SIDADS at NSIDC.
- The "Integrated measurements" continue to be used as the basis for the ratings (where available).
- Mostly stable performance.
- Significant changes in testing are indicated in Blue, Problems in Red

Ratings:

Rating Categories:

Rating	Value	Criteria
Excellent:	4	Total Kbps > Requirement * 3
Good:	3	1.3 * Requirement <= Total Kbps < Requirement * 3
Adequate:	2	:Requirement < Total Kbps < Requirement * 1.3
Almost Adequate:	1.5	Requirement / 1.3 < Total Kbps < Requirement
Low:	1	Requirement / 3 < Total Kbps < Requirement / 1.3
Bad:	0	Total Kbps < Requirement / 3

Where Total Kbps = Integrated Kbps (where available)

Else = User Flow + iperf monthly average

Ratings Changes:

Upgrades: ↑: None

Downgrades: ↓:

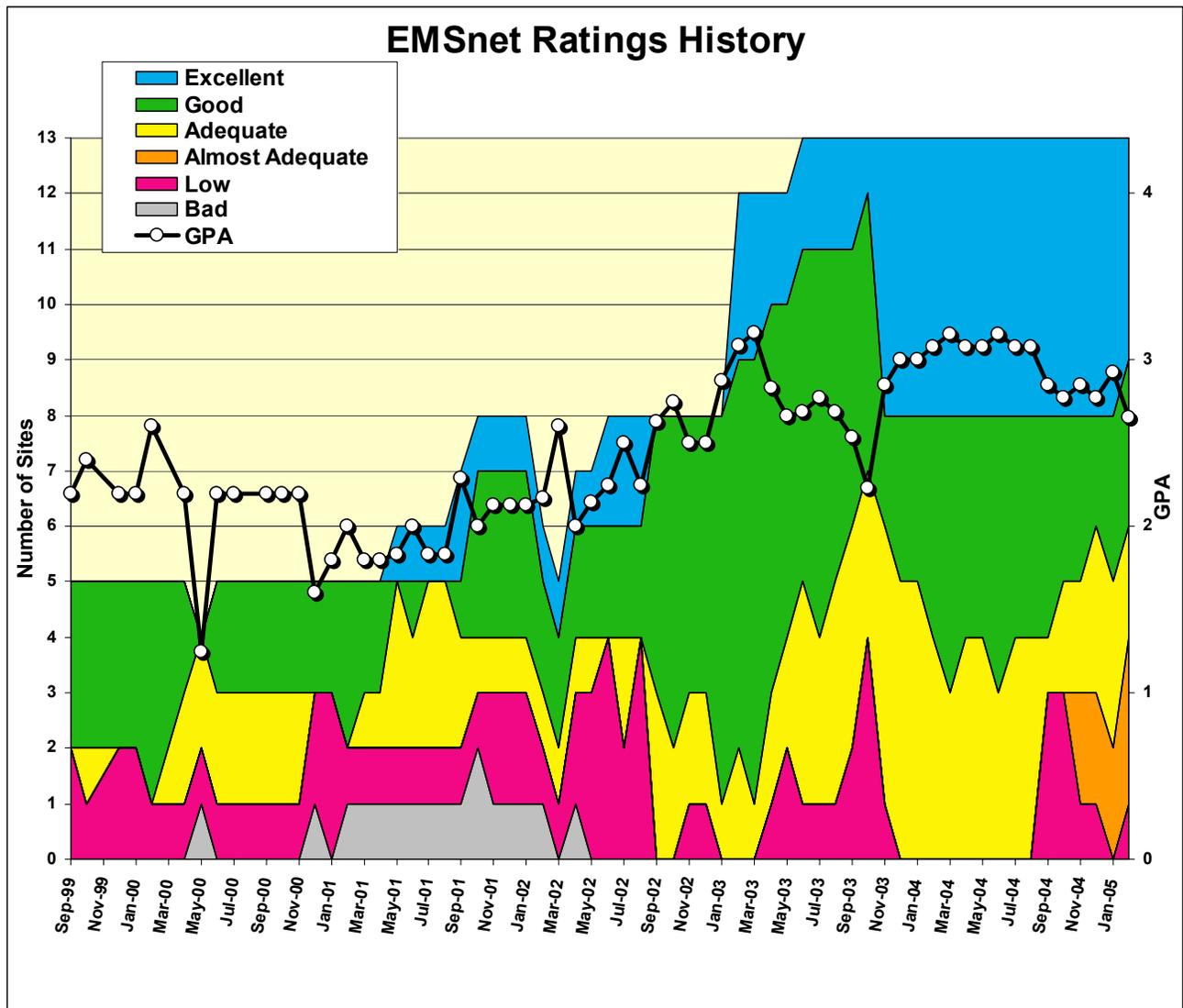
GSFC → EDC: Adequate → **Almost Adequate**

GSFC → LaRC: Adequate → **Almost Adequate**

LaRC → JPL: Almost Adequate → **Low**

JPL → NSIDC: Excellent → **Good**

GSFC → NSIDC: Good → **Adequate**

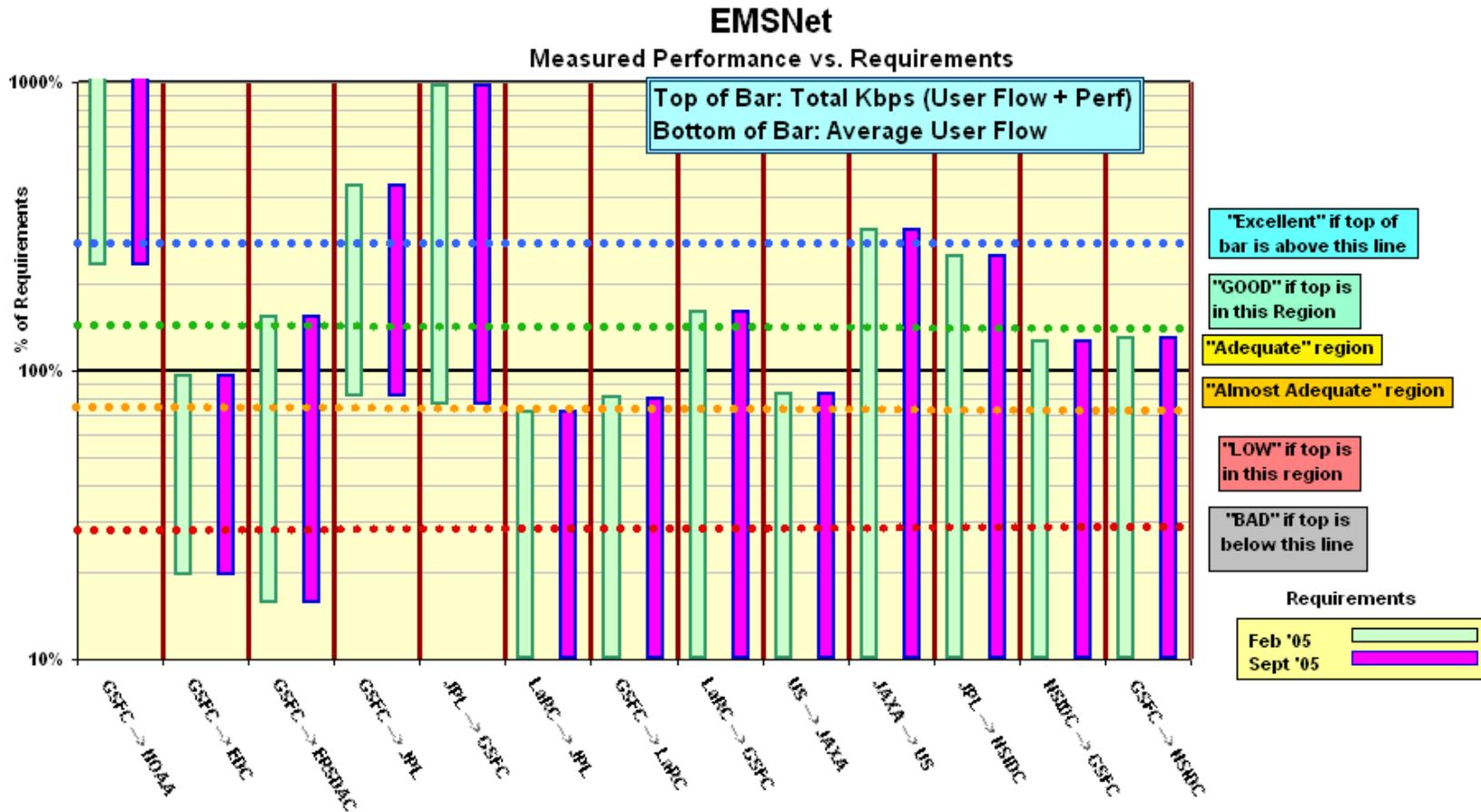


The chart above shows the number of sites in each classification since EMSnet testing started in September 1999. Note that these ratings do NOT relate to absolute performance -- they are relative to the EOS requirements.

Network Requirements vs. Measured Performance

February 2005		Requirements (kbps)		Testing								
Source → Destination	Team (s)	Current	Future	Source → Dest Nodes	Avg User Flow kbps	iperf Avg kbps	Total Avg kbps	Integrated kbps	Rating re Current Requirements		Rating re	
		Feb-05	Sep-05						Feb-05	Prev	Sep-05	
GSFC → ASF	QuikScat, Radarsat	n/a	n/a	GSFC-CSAFS → ASF	13	1190	1203	1190	n/a	n/a	n/a	
ASF → JPL	QuikScat, Radarsat	n/a	n/a	ASF → JPL-SEAPAC	429	1351	1779		n/a	n/a	n/a	
GSFC → NOAA	QuikScat	189	189	GSFC-CSAFS → NESDIS	433	2928	3361	2928	Excellent	E	Excellent	
GSFC → EDC	MODIS, LandSat	285361	285361	GSFC-PTH → EDC PTH	55480	270763	326243	273386	AA	A	LOW	
GSFC → ERSDAC	ASTER	568	568	GDAAC → ERSDAC	88	786	874		GOOD	G	GOOD	
GSFC → JPL	ASTER, QuikScat, MLS, etc.	1275	1272	GSFC-CSAFS → JPL-SEAPAC	1035	5480	6515	5565	Excellent	E	Excellent	
JPL → GSFC	AMSR, etc.	1155	1155	JPL-PODAAC → GDAAC	875	11601	12475		Excellent	E	Excellent	
LaRC → JPL	TES, MISR	40311	40311	LDAAC → JPL-TES	n/a	29001	29001	29001	LOW	AA	LOW	
GSFC → LaRC	CERES, MISR, MOPITT	57711	58456	GDAAC → LDAAC	n/a	46548	46548	46548	AA	A	AA	
LaRC → GSFC	MODIS, TES	31695	31695	LDAAC → GDAAC	n/a	50661	50661	50661	GOOD	G	GOOD	
US → JAXA	QuikScat, TRMM, AMSR	1665	1665	GSFC-CSAFS → JAXA	65	1271	1336	1392	AA	AA	AA	
JAXA → US	AMSR	512	512	JAXA → JPL-SEAPAC	0	1586	1586		Excellent	E	Excellent	
JPL → NSIDC	AMSR	1342	1342	JPL-PODAAC → NSIDC SIDADS	n/a	3336	3336		GOOD	E	GOOD	
NSIDC → GSFC	MODIS, ICESAT, QuikScat	13326	13326	NSIDC DAAC → GDAAC	n/a	16906	16906		Adequate	A	Adequate	
GSFC → NSIDC	MODIS, ICESAT, QuikScat	64118	64118	GSFC-PTH → NSIDC DAAC	n/a	80256	80256	82792	Adequate	G	Adequate	
Notes: Flow Requirements (from BAH) include TRMM, Terra , Aqua, QuikScat, ADEOS-II								Ratings Summary				
								Feb-05	Req	Sep-05		
								Score	Prev	Score		
*Criteria:	Excellent	Total Kbps > Requirement * 3						Excellent	4	5	4	
	GOOD	1.3 * Requirement <= Total Kbps < Requirement * 3						GOOD	3	3	3	
	Adequate	Requirement < Total Kbps < Requirement * 1.3						Adequate	2	3	2	
	Almost Adequate	Requirement / 1.3 < Total Kbps < Requirement						Almost Adequate	3	2	2	
	LOW	Total Kbps < Requirement / 1.5						LOW	1	0	2	
	BAD	Total Kbps < Requirement / 3						BAD	0	0	0	
								Total	13	13	13	
								GPA	2.65	2.92	2.62	

This graph shows two bars for each source-destination pair. Each bar uses the same actual measured performance, but compares it to the requirements for two different times (October '04, and September '05). Thus as the requirements increase, the same measured performance will be lower in comparison.



Interpretation: The bottom of each bar is the average measured MRTG flow to a site. Thus the bottom of each bar indicates the relationship between the requirements and actual flows. Note that the requirements include a 50% contingency factor above what was specified by the projects, so a value of 66% would indicate that the project is flowing as much data as requested. The top of each bar represents the sum of the MRTG user flow plus the iperf measurement – it is this value which is used as the basis of the ratings

1) ASF

Rating: **N/A**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/ASF_EMS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → ASF	1.34	1.19	0.65	0.01	1.20	1.18
ASF → NESDIS	1.38	1.36	0.33			
ASF → NSIDC	0.16	0.16	0.11			
ASF → GSFC-CSAFS	1.37	1.30	0.42			
ASF → JPL-SEAPAC	1.38	1.35	0.43			

Comments: Thruptut was very stable this month to and from all destinations except NSIDC. The 1.3 to 1.4 mbps total from is as expected for a single T1 (1.54 mbps) circuit, as is the 1.2 mbps inbound. **The performance to NSIDC dropped as a result of the NSIDC switch from EMSnet to PIP**; previous performance was similar to the other destinations

Since the requirement from ADEOS has been deleted, the remaining ASF requirements are very low, and are mostly based on estimated ECS interDAAC queries, not production flows. These flow estimates are not considered reliable enough to use as a basis for testing, so the rating is "N/A".

2) EDC:

Rating: **↓ Adequate → Almost Adequate**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/EDC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-PTH → EDC-PTH	286.7	270.8	242.6	55.5	326.2	273.4
G-DAAC → EDC LPDAAC	227.4	203.1	115.7			
ERSDAC → EDC	5.0	4.3	3.7	(via APAN / Abilene / vBNS+)		
GSFC → EDC	70.8	61.0	40.0	via MAX / vBNS+		
EDC → GSFC	136.0	125.3	87.3			

Requirements:

Date	mbps	Rating
FY '05	285.4	Almost Adequate

Comments:

The rating is based on testing between the GSFC performance test host ("GSFC-PTH"), located outside the ECS firewall and the EDC performance test host ("EDC-PTH"), also located outside the ECS firewall. The comparison of this result with the GDAAC to LPDAAC result shows the effect of high levels of loading on the GDAAC and EDC ECS firewalls.

The rating is based on the "Integrated" measurement, and as usual is lower than the sum of the MRTG and iperf. The lower user flow this month had only a very small contribution to the integrated measurement. This 273 mbps value is slightly below the requirement, so the rating drops to "Almost Adequate".

The poor results from ERSDAC to EDC-PTH (in support of the planned ERSDAC to EDC ASTER flow, replacing tapes), together with the much better performance in the opposite direction, shows that there is a peering problem between Abilene and vBNS+ in DC. The flow from GSFC-MAX to EDC was rerouted this month to go via MAX instead of NGIX-E, and performance improved greatly. This demonstrates that the problem is in the Abilene to NGIX-E connection

3) JPL:

Ratings: GSFC → JPL: Continued **Excellent**
 JPL → GSFC: Continued **Excellent**
 LaRC → JPL: **↓** Almost Adequate → **Low**

Web Pages:

- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_PODAAC.shtml
- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_TES.shtml
- http://ensight.eos.nasa.gov/Missions/terra/JPL_MISR.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JPL-SEAPAC	6.2	5.5	2.5	1.0	6.5	5.6
GSFC-PTH → JPL-PODAAC	5.7	5.1	2.7	1.0	6.1	5.1
LaRC DAAC → JPL-SES	29.8	29.0	12.9	N/A		
LaRC DAAC → JPL-MISR	30.0	29.2	20.4			
LaRC PTH → JPL-PTH	N/A	N/A	N/A			
JPL-PODAAC → GSFC DAAC	12.3	11.6	4.2	0.9	12.5	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → JPL combined	Feb '05	1.60	Excellent
JPL → GSFC combined	Feb '05	0.63	Excellent
LaRC DAAC → JPL-SES	Feb '05	30.6	Almost Adequate
LaRC DAAC → JPL-MISR	Feb '05	18.5	Adequate
LaRC DAAC → JPL-Combined	Feb '05	40.3	Low

Comments:

GSFC → JPL: Performance on this circuit has been mostly stable since the BOP switchover on 15 August '02; well above the requirement; the rating remains "Excellent". The "integrated" data is (like most other sites) just slightly higher than the iperf results alone, and lower than the sum of the median iperf and average MRTG. This again indicates that adding a small average user flow to the median iperf overstates the true situation.

LDAAC → JPL: This flow was switched to NISN PIP on 10 Feb, and thrupt initially dropped to 10 mbps. Thrupt improved to 28 mbps on 14 Feb, then recovered fully to 40 mbps on 26 Feb. However, the Feb 14-26 thrupt dominated the calculations above. Also, both MRTG and user flow data became unavailable at that time (user flow data was restored in March from the LaRC ECS router). These factors combined to reduce this rating to "Low". The LaRC-PTH to JPL-PTH testing also was disabled by this transition, since the LaRC-PTH node switched to PIP, while JPL-PTH remained on EMSnet, and thus did not have connectivity.

Note: The measured thrupt this month is above the MISR and close to the SES requirements, but well below their combined value. However, the MISR requirement is open to some interpretation. The formal QA flow is only 9.7 mbps – this value is used to generate the "combined" requirement. But the science data also flows on the same circuit. If this was added to the requirement, it would push the total MISR flow requirement to 18.5 mbps, and the total requirement to 49.1 mbps, which is higher than the nominal circuit speed. This configuration is based on a management decision to set the circuit capacity at this level to reduce cost, in the expectation that both projects' requirements are bursty and include contingency. Thus the actual requirements of both projects are expected to be met with this circuit capacity.

JPL → GSFC: The requirement from JPL to GSFC includes flows from NASDA and ASF which go via JPL, and includes GSFC and NOAA destinations. Since many of these flows were related to ADEOS, this requirement dropped substantially with the removal of ADEOS. The combined requirement is now only 0.63 mbps, and the combined 12.5 mbps thrupt is more than 3 times that, so the rating remains "Excellent".

4) NSIDC:

Ratings: GSFC → NSIDC: ↓ Good → Adequate
 NSIDC → GSFC: Continued Adequate

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NSIDC_EMS.shtml

GSFC ↔ NSIDC Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-DAAC → NSIDC	91.1	82.5	33.7	N/A	82.5	82.5
NSIDC → GSFC-DAAC	17.0	16.9	13.2	N/A	16.9	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → NSIDC	Jan '05	64.1	Adequate
NSIDC → GSFC	Dec '04	13.3	Adequate

Comments:

GSFC → NSIDC: This flow was switched from EMSnet to NISN PIP on 8 February. Thruput initially dropped (to a peak of 80 mbps), but recovered a week later. The rating is now based on testing from G-DAAC to the NSIDC DAAC (The GSFC-PTH node went down during the month, and its performance does not accurately reflect the true performance). As a result of this switch, both the MRTG and user flow data became unavailable at that time. Thus the total thruput value dropped slightly, and is no longer 30% above the requirement. (The requirement varies from month to month, based on planned ICESAT reprocessing. This month the reprocessing is NOT included, reducing the requirement from 79 mbps in December '04.) So the rating drops to "Adequate".

NSIDC → GSFC: Performance from NSIDC to GSFC was stable this month, and remains slightly below 30% above the requirement, so the rating remains "Adequate".

Other Testing:

Source → Dest	Medians of daily tests (mbps)			Requirement	Rating
	Best	Median	Worst		
JPL → NSIDC-SIDADS	3.76	3.34	2.28	1.34	Good
GSFC-ISIPS → NSIDC (iperf)	90.2	85.1	32.3		
GSFC-ISIPS → NSIDC (ftp)	21.5	21.3	6.1		
NSIDC → GSFC-ISIPS (iperf)	16.2	15.6	14.8		
ASF → NSIDC	0.16	0.16	0.11	0.73	Bad

Comments:

JPL → NSIDC-SIDADS: This flow switched from EMSnet to PIP on Feb 8, and thruput dropped from 6.1 mbps previously. Thruput is no longer more than 3 x the requirement, so the rating drops to "Good".

GSFC-ISIPS ↔ NSIDC: Performance from ISIPS to NSIDC – both ftp and iperf – was traced to LAN problems at GSFC, and was fixed on 8 February, after having problems since July '04. Performance is now at nominal levels for the circuit capacity. Testing from NSIDC to ISIPS is stable and gets very similar thruput as NSIDC to GDAAC.

ASF → NSIDC: The median thruput dropped with the switch to PIP last month (was 1.4 mbps). It is now less than 30% of the requirement, so the rating drops from "Good" to "Bad".

5) GSFC ↔ LaRC:

Ratings: LDAAC → GDAAC: Continued **Good**
 GSFC → LARC: ↓ Adequate → **Almost Adequate**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/LARC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GDAAC → LDAAC	47.2	46.5	21.6	N/A	46.5	46.5
GSFC-NISN → LaTIS	47.5	40.1	4.9			
LDAAC → GDAAC	51.1	50.7	26.3	N/A	50.7	50.7

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → LARC (Combined) *	FY '05	59.4	Almost Adequate
GDAAC → LaRC ECS	FY '05	17.8	Good
GSFC → LARC *	FY '05	41.6	Almost Adequate
LDAAC → GDAAC	FY '05	31.8	Good

Comments:

GSFC → LaRC: The GSFC→ LaRC ECS DAAC flow was switched from EMSnet to NISN PIP on 8 February (GSFC → LaTIS had been flowing on PIP since November). The combined 59.4 mbps requirement had been split as indicated above when the flows were on separate circuits, but will again be treated as a single requirement as they are now both on PIP. So the rating is now based on the GDAAC to LaRC ECS DAAC thrupt, compared to the combined requirement.

Initially, the PIP PVC was not increased to accommodate the increased load, and thrupt to ECS dropped. The PVC was increased in late February (too late to affect this monthly median calculation), so performance will be better in March. MRTG and user flow data are also no longer available (but the ECS user flow data will be restored in March).

So for February, the reduced GSFC→ LaRC ECS DAAC thrupt is below the combined requirement, but by less than 30%, so the combined rating drops from "Adequate" to "Almost Adequate".

LaRC → GSFC: Performance remained stable with the switch to PIP. The requirement jumped from 6.8 mbps to 31.7 mbps in Oct '03, to incorporate this backhaul of all LaRC science outflow via GSFC (which is no longer planned, due to the switch from EMSnet to PIP). The thrupt is more than 30% above this requirement, so the rating remains "Good".

6) NOAA NESDIS:

Rating: Continued **Excellent**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NOAA_NESDIS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → NESDIS	2.93	2.93	1.57	0.43	3.36	2.93
GSFC-CSAFS → NESDIS via MAX	7.15	7.00	4.55			
ASF → NESDIS	1.38	1.36	0.33			
JAXA (NASDA) → NESDIS	1.41	1.31	0.36			
JPL → NESDIS via MAX	3.39	3.11	2.33			

Requirements:

Source → Dest	FY	Mbps	Rating
GSFC-CSAFS → NESDIS	'05	0.19	Excellent

Comments: The dominant flow to NOAA is Quikscat data, from GSFC CSAFS.

Like other sites, the "Integrated" results are lower than the sum of the median iperf and average MRTG. In this case the 3.36 mbps total iperf + user flow again exceeds the 2 x T1 circuit capacity, providing strong evidence that the integrated results are more accurate. Since the thruput is more than 3 times the FY '05 requirement, the rating remains "Excellent".

Note that the flow from JAXA is limited by the TCP window size of the JAXA test source, and the long RTT.

Results from GSFC SAFS to NOAA, via MAX (instead of EMSnet) were also stable, about double the EMSnet performance. Results from JPL, via Abilene to the MAX increased a little, but were still lower than expected.

7) US ↔ JAXA:

Ratings: JAXA → US: Continued **Excellent**
 US → JAXA: Continued **Almost Adequate**

Web Pages http://ensight.eos.nasa.gov/Networks/emsnet/NASDA_EOC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/GSFC_SAFS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JAXA-EOC	1.53	1.27	0.80	0.07	1.34	1.39
JAXA-EOC → JPL-SEAPAC	1.61	1.59	0.74	0.01	1.60	
JAXA-EOC → GSFC-CSAFS	1.46	1.37	0.54			

Requirements

Source → Dest	Date	mbps	Rating
GSFC → JAXA	Jan '05	1.67	Almost Adequate
JAXA → US	FY '04, '05	0.51	Excellent

Comments:

US → JAXA: The requirements above were reduced in November '03, due to the removal of ADEOS flows. They have again been reduced last month (were 2 mbps previously).

Performance has been stable since it recovered on January 13 (thruput had dropped on November 27 to below 1.0 mbps). The rating remains "Almost Adequate".

Notes:

- This case has the integrated thrupt is again slightly HIGHER than the sum of the the iperf and MRTG – this indicates a problem with the data collection process.
- The requirement still includes 4 ISTs at JAXA for AMSR-E. Each IST has a requirement for 311 kbps, for a total of 1244 kbps. It could be questioned whether JAXA intends to operate all four of the ISTs simultaneously, or whether some ISTs are backups, in which case the network requirements would be reduced to a lower value.

JAXA → US: Performance remained consistent with the reduced ATM PVC. The requirement was reduced in November '03 due to the removal of ADEOS requirements. The rating remains "Excellent".

Note: JAXA has not yet implemented testing with multiple tcp streams, so performance to GSFC is limited by the TCP window size on JAXA's test machine, in conjunction with the long RTT. In order to reflect the actual capability of network, the rating is derived from testing from JAXA to JPL, which uses the same Trans-Pacific circuit, but has a shorter RTT, so will not be limited by the TCP window size. The Trans-Pacific circuit connects into the higher speed domestic EMSnet at JPL, which is not expected to be the limiting factor.

8) GSFC → ERSDAC:

Rating: Continued **Good**

Web Page : <http://ensight.eos.nasa.gov/Networks/emsnet/ERSDAC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL
	Best	Median	Worst		
GSFC → ERSDAC via EMSnet	0.79	0.79	0.53	0.09	0.87

Requirements:

Source → Dest	FY	Kbps	Rating
GSFC → ERSDAC	'03 - '05	568	Good

Comments: Testing to ERSDAC changed several times in February, with various test hosts and paths being used. The problems were solved, and the primary route between GSFC and ERSDAC was switched to APAN in late February.

So the test results from GDAAC to ERSDAC above was mostly on EMSnet, and thus reflects EMSnet performance.

APAN: Testing via APAN started in October.

Source → Dest	Medians of daily tests (mbps)		
	Best	Median	Worst
GSFC-MAX → ERSDAC (Gig-E)	11.1	9.6	3.8
GSFC-NISN → ERSDAC (Fast-E)	81.0	64.0	17.6
ERSDAC → GSFC-PTH	85.3	80.9	71.4
GSFC → Tokyo-XP	123.9	98.6	80.1
Tokyo-XP → GSFC	117.7	114.8	111.7
ERSDAC → EDC	5.0	4.3	3.7

Various configurations between GSFC and ERSDAC have been tested, and most of the problems have been identified. The results between GSFC and the Tokyo Exchange Point (to which ERSDAC is connected) show the potential for thruput to ERSDAC

Performance from ERSDAC to GSFC is good, limited by the ERSDAC FastE connection. **But from GSFC-MAX to ERSDAC, thruput is limited to about 5 mbps per TCP stream (2 streams were used in the results above).** This problem has been isolated to the Gig-E to Fast-E switch at Tokyo-XP. The GSFC-MAX source node is connected by Gig-E, and does not encounter a bottleneck until this switch (The Abilene and APAN WAN backbones are 10 Gbps!!!). Since TCP is bursty, packets can arrive at the switch output port faster than they can be sent out, so packets are lost. And TCP performance suffers.

Accordingly, testing was initiated from “GSFC-NISN”, which uses a Fast-E interface. It therefore does not have the capability to overload this switch port, and gets MUCH better thruput. EDOS will therefore have to use Fast-E connected hosts until the configuration at Tokyo-XP is corrected (e.g., using a router instead of a switch to drive the Fast-E to ERSDAC). The route from GSFC-NISN to ERSDAC is somewhat different than from GSFC-MAX: GSFC-NISN goes via NISN to Chicago, where it peers with APAN; from GSFC-MAX the route is via MAX to Abilene to the APAN peering in LA. So congestion on the NISN-Chicago circuit might be the explanation for the wide range (over 4:1) from daily best to worst

Problems are also evident from ERSDAC to EDC via APAN (planned for L1 data flow). In this case investigation has determined that the problem is packet loss in the Abilene – vBNS+ peering in DC, specifically, in the Abilene to NGIX-E circuit.