Standard Autonomous File Server: SAFS

Susan K. Semancik/584
Annette M. Conger/CSC

email: Susan.K.Semancik.1@gsfc.nasa.gov phone: (757) 824-1655
Annette.M.Conger.1@gsfc.nasa.gov (757) 824-2596
URL: http://www.wff.nasa.gov/~web/safs/

SAFS: Purpose

The purpose of the Standard Autonomous File Server (SAFS) is to create an operational system which will

- provide automated management of large data files which are the result of mission specific data functions, and
- provide customers access to these files in a timely fashion without interfering with the assets involved in the acquisition and processing of the data.

SAFS: Design Requirements

What SAFS does:

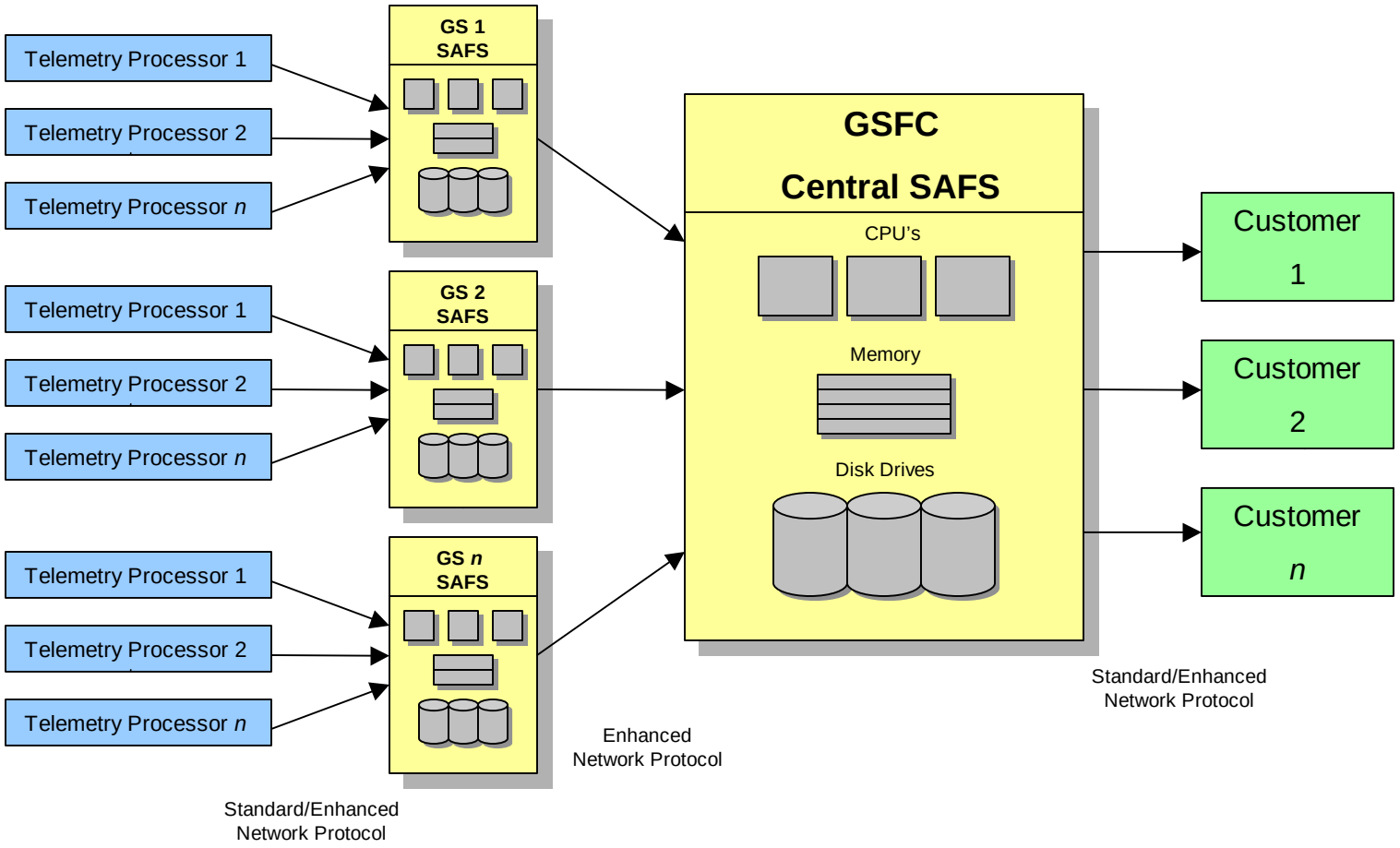
- Requires no human interaction for nominal operations.
- Provides for email notifications to and from customers.
- Allows customers to “pull” data.
- Provides for data “push” to customers.

SAFS: Design Requirements

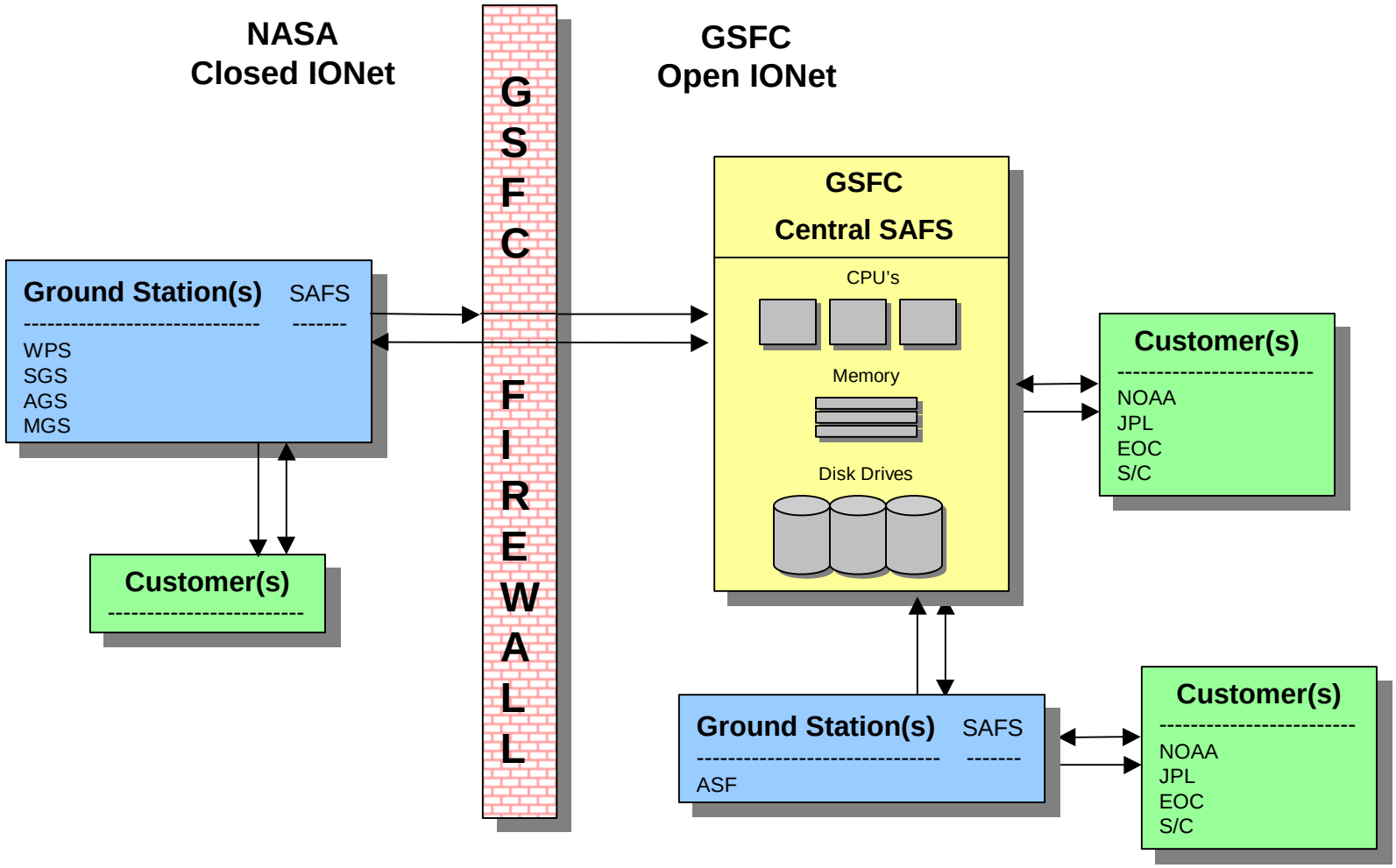
What SAFS does NOT do:

- Does not perform data compression, file splitting, or data encryption.
- Does not perform as an archival system for mission data.
- Does not have a firewall as part of its design.
- Does not have ground station control of its functions.

SAFS: Data Flow Diagram

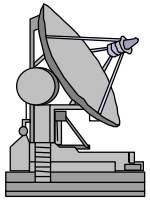


SAFS: Network Diagram

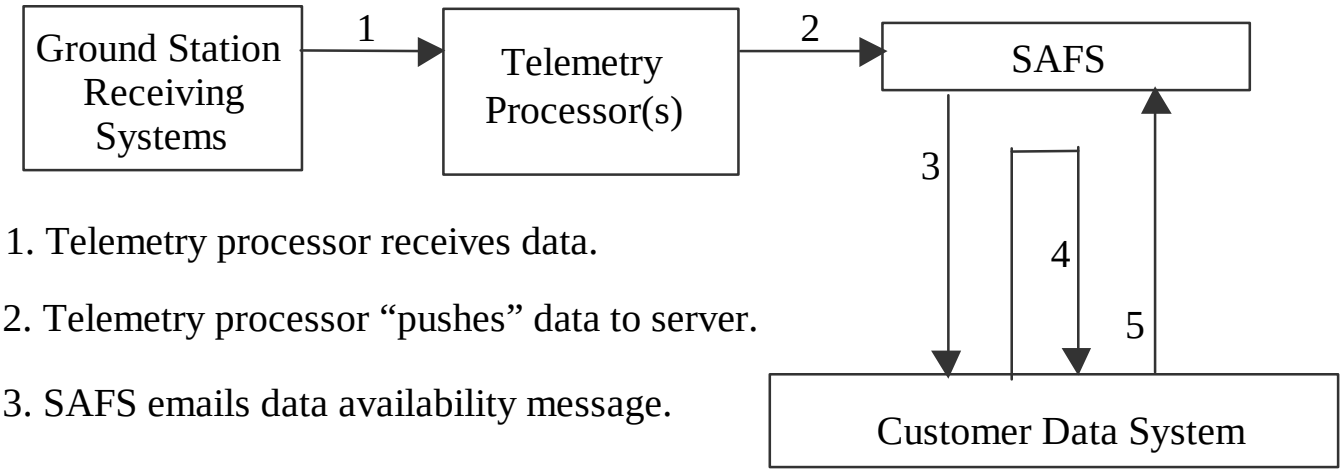


S/C Data
Messages

SAFS: Customer "Pull" Model

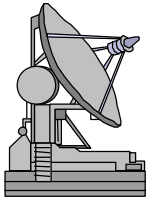


Standard Autonomous File Server (SAFS)

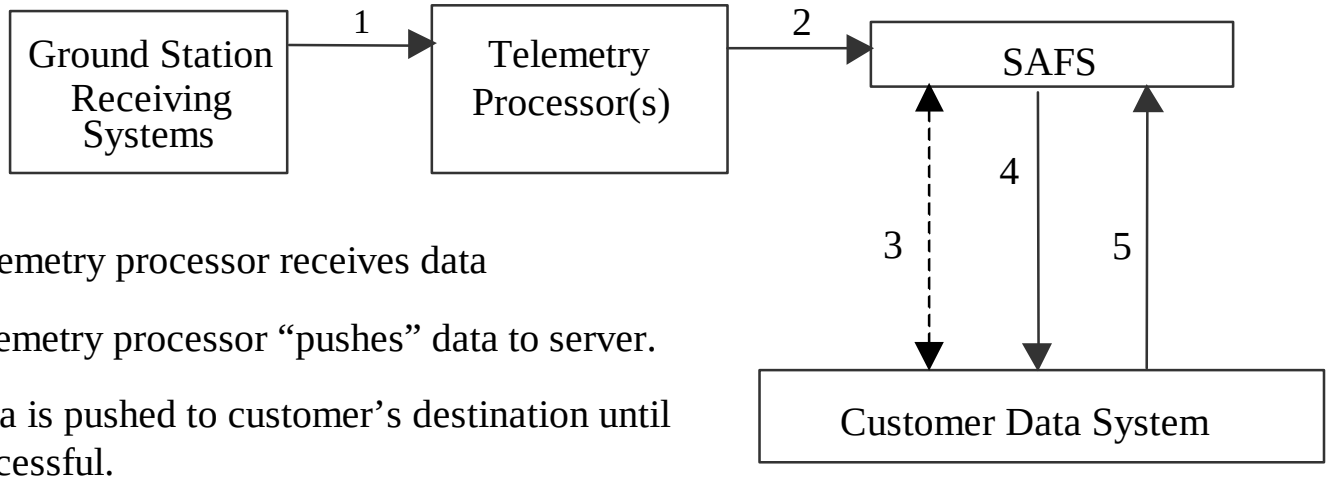


1. Telemetry processor receives data.
2. Telemetry processor "pushes" data to server.
3. SAFS emails data availability message.
4. Customer "pulls" data file if needed.
5. Customer emails success, failure or file not needed confirmation to SAFS.
6. SAFS updates database(s) , and does file management as needed.

SAFS: Customer "Push" Model



Standard Autonomous File Server (SAFS)



1. Telemetry processor receives data
2. Telemetry processor "pushes" data to server.
3. Data is pushed to customer's destination until successful.
4. SAFS emails file delivery notification confirming transfer success or failure.
5. Customer emails success or failure confirmation to SAFS.
6. SAFS updates database(s), and does file management as needed.

SAFS: Project Setup Parameters

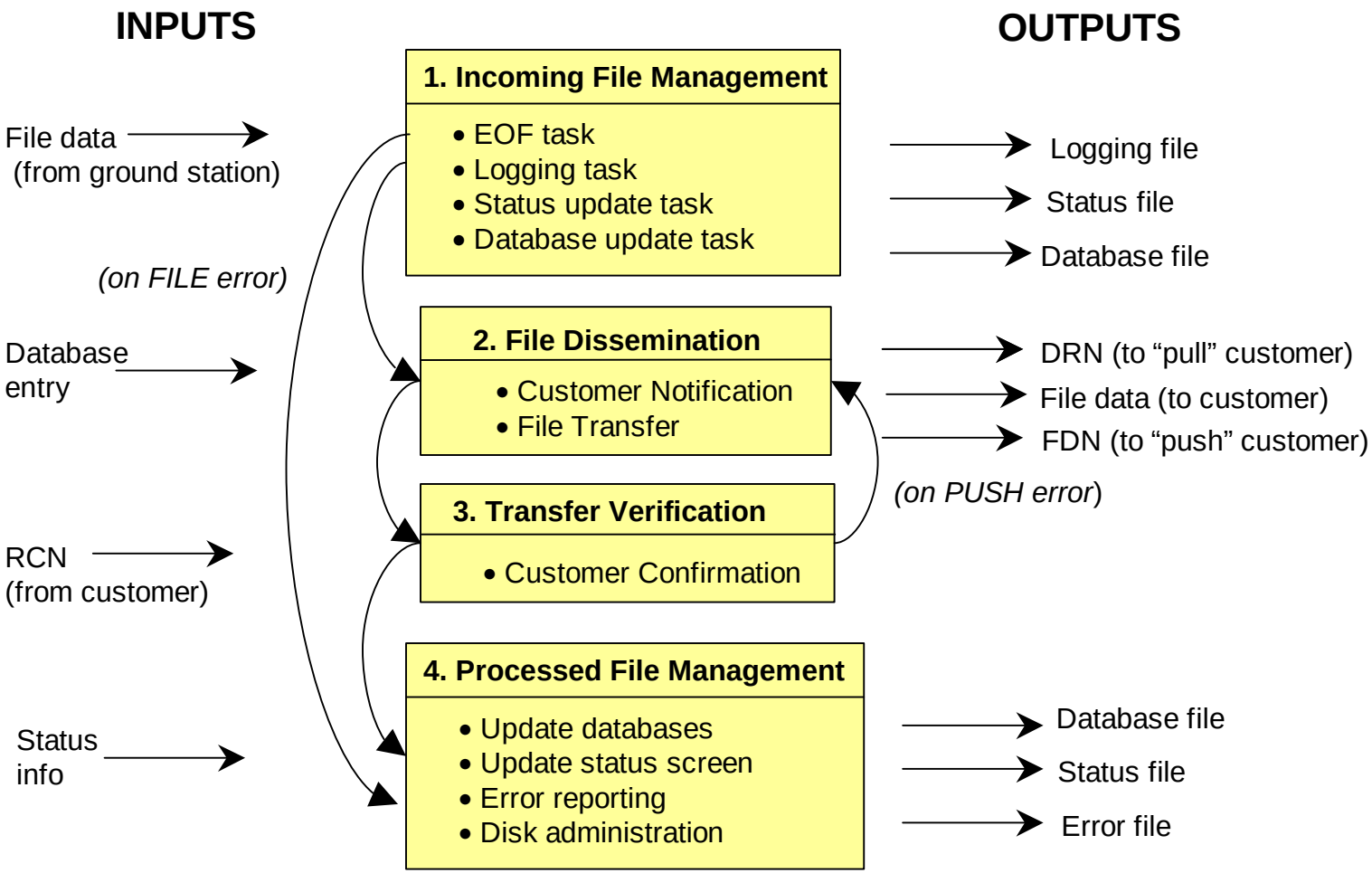
Customer Information:

- Name
- E-mail address
- System internet address (for “push” only)
- Directory path for “pushed” files
- Login and password on customer’s system (for “push” only)
- Communication link and data rate
- Communication type: FTP or COTS (push or remotely activated pull)
- Type of access: pull/push
- Number of files expected

File information:

- Type of file
- File latency
- Retention period
- Size of file
- Expected frequency

SAFS: Functional Specifications



SAFS: Administration

- Distribute “heart beat” status indicator (“a SAFS Light”).
- Provide for customer/project updates, additions and deletions.
- Perform disk management.
- Provide reporting functions:
  error, logs, home page status updates, ….
- Oversee system configuration updates:
  server OS, increase drive capacity, ….

SAFS: Reporting Information

- Transfer logs
- Actual latency from data acquisition to data delivery
- File information:
  - Date/time received, transferred, deleted
  - No. of successful transfers
- Communication:
  - Throughput rate
- Error logs
- Disk usage
- System “heart beat” reported to the ground station

SAFS REPORTS

1. Report Options

- period: daily/weekly/monthly summary
- filter: project/file type/function/site/customer
- latency: detailed/summary
- network: throughput rate/delivery rate

2. Interactive Query

3. Site Monitor

LATENCY Report

File name:_____ **Customer:_____**

Method(Push/Pull):____ **Transfer Result(S/F):____**

Ground Station:_____ **TM Processor:_____**

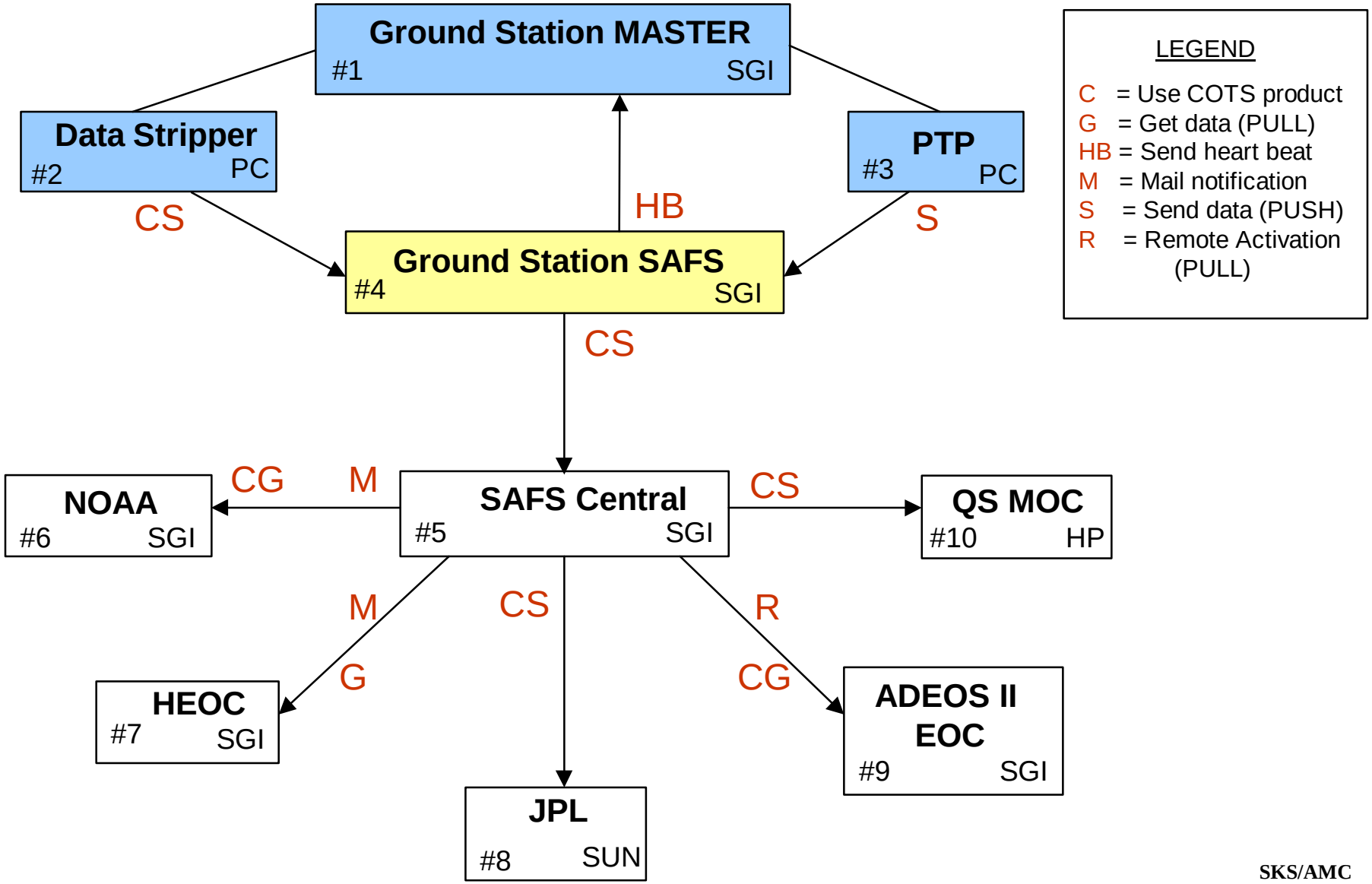
	Delta Time	Accum. Time
Start time of pass:_____		
Time to GS SAFS:_____	_____	_____
Time to Central SAFS:_____	_____	_____
(Notification Time:_____)	_____	_____
Time Transfer Completed:_____	_____	_____

Receipt Confirmation(Y/N):____

Allowable Time:_____

Latency met(Y/N):___

SAFS: Lab Prototype Configuration



SKS/AMC
11/10/98

SAFS: COTS Advantages

- Guaranteed file delivery
- Recovery from point of failure
- Stop/resume transmission control
- Programmable network bandwidth (adjustable transmission rates)
- On-the-fly compression
- File transfer security
- Multi-Platform support provides standardization
- On-line network monitoring
- Shorter development time - application programming interface
- Multicasting option (not available on all COTS)

SAFS: COTS Products Comparison

StarBurst Cyber Caster	StarBurst MFTP	FASTCopy	Checkpoint FTP	Features
•	•	•		Guaranteed file delivery (self-correcting transmissions)
•	•	•	•	Recovery from point of failure
•	•	•		Stop/Resume transmission control
•	•	•		Programmable network bandwidth
• •		• •	•	On-the-fly compression Automatic un-compression
•	•	• •	•	File security: Authentication Data transfer firewall
•	•	•		Multi-platform/cross-platform support
• • • •	•	• • • • •		Application Programming Interface Automated tasks Pre-transfer processing Post-transfer processing Scheduled transfers
•				High speed transmission for multiple destinations
•				Multiple files packaged for single-file transmission
$$$$$$	$$$$	$$		Cost

SAFS: COTS File Transfer Comparison

Protocol	Data Type	Bandwidth	Compress	Time (secs) *
FTP	R/T Mission	10.0 Mbps (Ethernet)	N	37
FASTCopy	R/T Mission 30.5 MB binary data	10.0 Mbps (Ethernet)	N	37
		10.0 Mbps (Ethernet)	Y	20
		1.5 Mbps (T1)	N	159
		1.5 Mbps (T1)	Y	24
	JPL tif 30 MB image data	10.0 Mbps (Ethernet)	N	37
		10.0 Mbps (Ethernet)	Y	97
		1.5 Mbps (T1)	N	145
		1.5 Mbps (T1)	Y	156
	Pathfinder 10 MB image data	10.0 Mbps (Ethernet)	N	13
		10.0 Mbps (Ethernet)	Y	19
		1.5 Mbps (T1)	N	54
		1.5 Mbps (T1)	Y	33
StarBurst				TBD
Checkpoint FTP				TBD

*Note: Times are approximate due to circuit utilization and scheduling contingencies at the time of transfer.

SAFS: File Naming Convention

Set by scheduling

P## - PTP sequence number
D## - Data Stripper sequence number

QuikSCAT: sci/hk1/hk2

dat
mta

ProjectID YYYYMMDDHHMMSS TMprocessorID Type . Ext

Pass Recording Start Time

YYYY	Year
MM	Month
DD	Day of Month
HH	Hour (24 hour clock)
MM	Minutes
SS	Seconds

SAFS: Sample File Name

qst = QuikSCAT

p01 = PTP #1

sci = science

dat = data file

qst19981125132245p01sci.dat

Pass Recording Start Time (**YYYYMMDDHHMMSS**)

Year	1998
Month	11
Day of Month	25
Hour (24 hour clock)	13
Minutes	22
Seconds	45

SAFS: Mail SUBJECT Format

SUBJECT:

Fixed Value

NR - normal mail

I - Data Ready Notification (DRN)
R - Receipt Confirmation Notification (RCN)
D - File Delivery Notification (FDN)

Station/customer ID - GSFC,WGS, AGS, SGS, ASF, QNRT, QPAC, MOC

***nn* - Spacecraft**

***mm* - Data Type**

F - BB - C - DDDD_DDDD - EEEE_EEEE

Sending ID **Receiving ID**

SAFS: Mail MESSAGE Format - DRN/RCN

Message Content:

< BOM>

Fixed Value

File Name to retrieve with absolute path

File Size (in bytes)

Station/customer ID - GSFC,WPS, AGS, SGS, ASF, QNRT, QPAC, MOC

nn - Spacecraft

mm - Data Type

CON> B> C> DDDD_DDDD > E>

Receiving ID

Status of data retrieval - only used for RCN
- 0 - Successful Retrieval
- 1 - Duplicate file
- 2 - Error

< EOM>

SAFS: Mail Format Examples - DRN/RCN

SAMPLE MESSAGES

- **Dummy DATA file ready to retrieve from Central SAFS by JPL**

```
Subject: F-NR-I-GSFC_1001-JPL_1001

<BOM>
CON>/safs/qscat/data/qst19981125132245p01sci.dat>27346>JPL_1001>>
<EOM>
```

- **Dummy DATA file retrieved properly by JPL from Central SAFS**

```
Subject: F-NR-R-JPL_1001-GSFC_1001

<BOM>
CON >/safs/qscat/data /qst19981125132245p01sci.dat>27346>JPL_1001>0>
<EOM>
```

SAFS: Mail MESSAGE Format - FDN

Message Content:

< BOM>

Fixed Value

File Name to retrieve with absolute path

File Size (in bytes)

Station/customer ID - GSFC,WPS, AGS, SGS, ASF, QNRT, QPAC, MOC

***nn* - Spacecraft**

***mm* - Data Type**

CON> B> C> DDDD_DDDD > E>

Sending ID

N/A in file source location line in FDN

SAFS: Mail MESSAGE Format - FDN cont'd

Message Content:

Fixed Value

File Name of destination of delivered file with absolute path

File Size (in bytes)

Station/customer ID - GSFC,WPS, AGS, SGS, ASF, QNRT, QPAC, MOC

nn - Spacecraft

mm - Data Type

CON> B> C> DDDD_DDDD > E>

Receiving ID

Status of data delivery
- 0 - Successful Delivery to primary destination
- 1 - Successful Delivery to secondary destination
- 2 - Transfer Error

< EOM>

SAFS: Mail Format Examples - FDN

SAMPLE MESSAGES

- **Dummy DATA file successfully delivered from Central SAFS to NOAA**

Subject: F-NR-D-GSFC_1001-NOAA_1001

<BOM>
CON>/safs/qscat/data/qst19981125132245p01sci.dat>27346>GFSC_1001>>
CON>/*xxxxxx*/*yyyyy*/*zzzzz*/qst19981125132245p01sci.dat>27346>NOAA_1001>0>
<EOM>

Note:
The content of the first CON> line indicates the source location of the data file.
The second CON> line contains the destination location of the delivered data file.

SAFS: Customer File Requirements

QuikSCAT				
CUSTOMER		FILE TYPE	FILE SIZE	DATA LATENCY
Space craft (MOC)		PBK HK1	3.1 MB	2.5 hours
JPL (SEAPAC)		PBK HK2	3.1 MB	2.5 hours
		PBK SCI	30.0 MB	2.5 hours
NOAA		PBK HK2	3.1 MB	2.5 hours
		PBK SCI	30.0 MB	2.5 hours

ADEOS-II				
CUSTOMER	MODE	FILE TYPE	FILE SIZE	DATA LATENCY
NOAA	1	DCS real L0	0.9 MB	2.5 hours
	1	GLI 1KM	540.0 MB	11.0 hours
	2	DCS real L0	0.9 MB	2.5 hours
	2	GLI 1 KM	540.0 MB	11 hours
	2	SeaWinds	26.8 MB	2.5 hours
EOC	1	DCS real L0	0.9 MB	2.5 hours
	2	DCS real L0	0.9 MB	2.5 hours
	2	AMSR	84.15 MB	1.0 hour
	2	ILAS	81.65 MB	1.0 hour
	2	HK	3.1 MB	?

SAFS: QuikSCAT Data Volumes

QuikSCAT				
Type	**Vol/Orbit**	**Pass/Day ***		**Maximum Total Daily Volume**
HK1	3.1MB	14 WPS 14 SGS 14 AGS		43.4MB WPS 43.4MB SGS 43.4MB AGS
HK2	3.1MB			43.4MB WPS 43.4MB SGS 43.4MB AGS
SCI	30.0MB			420.0MB WPS 420.0MB SGS 420.0MB AGS
QuikSCAT TOTAL		**14**		**506.8MB**

* Since the number of passes/site have not yet been determined, we have assumed the worst case per site in order to estimate the daily volume; however the mission total is based on 14 passes/day.

SAFS: ADEOS-II Data Volumes

ADEOS-II					
Type	**Vol/Orbit**	**Pass/Day**	**Mode 1 Daily Volume**	**Mode 2 Daily Volume**	**Maximum Total Daily Volume**
AMSR-L0	84.15MB	2-4 WPS 8-14 ASF		336.6 MB WPS 1178.1 MB ASF	336.6 MB WPS 1178.1 MB ASF
ILAS-II – L0	81.65MB			326.6 MB WPS 1143.1 MB ASF	326.6 MB WPS 1143.1 MB ASF
GLI-1km L1	540.0MB		2160.0 MB WPS 7560.0 MB ASF	2160.0 MB WPS 7560.0 MB ASF	2160.0 MB WPS 7560.0 MB ASF
SeaWinds	26.8MB			107.2 MB WPS 375.2 MB ASF	107.2 MB WPS 375.2 MB ASF
HK	3.1MB			12.4 MB WPS 43.4 MB ASF	12.4 MB WPS 43.4 MB ASF
DCS/real L0	0.9MB		3.6 MB WPS 12.6 MB ASF	3.6 MB WPS 12.6 MB ASF	3.6 MB WPS 12.6 MB ASF
ADEOS-II TOTAL		**14**	**2163.6 MB WPS 7572.6 MB ASF**	**2946.4 MB WPS 10312.4 MB ASF**	**2946.4 MB WPS 10312.4 MB ASF**

SAFS: Drive Size Requirements

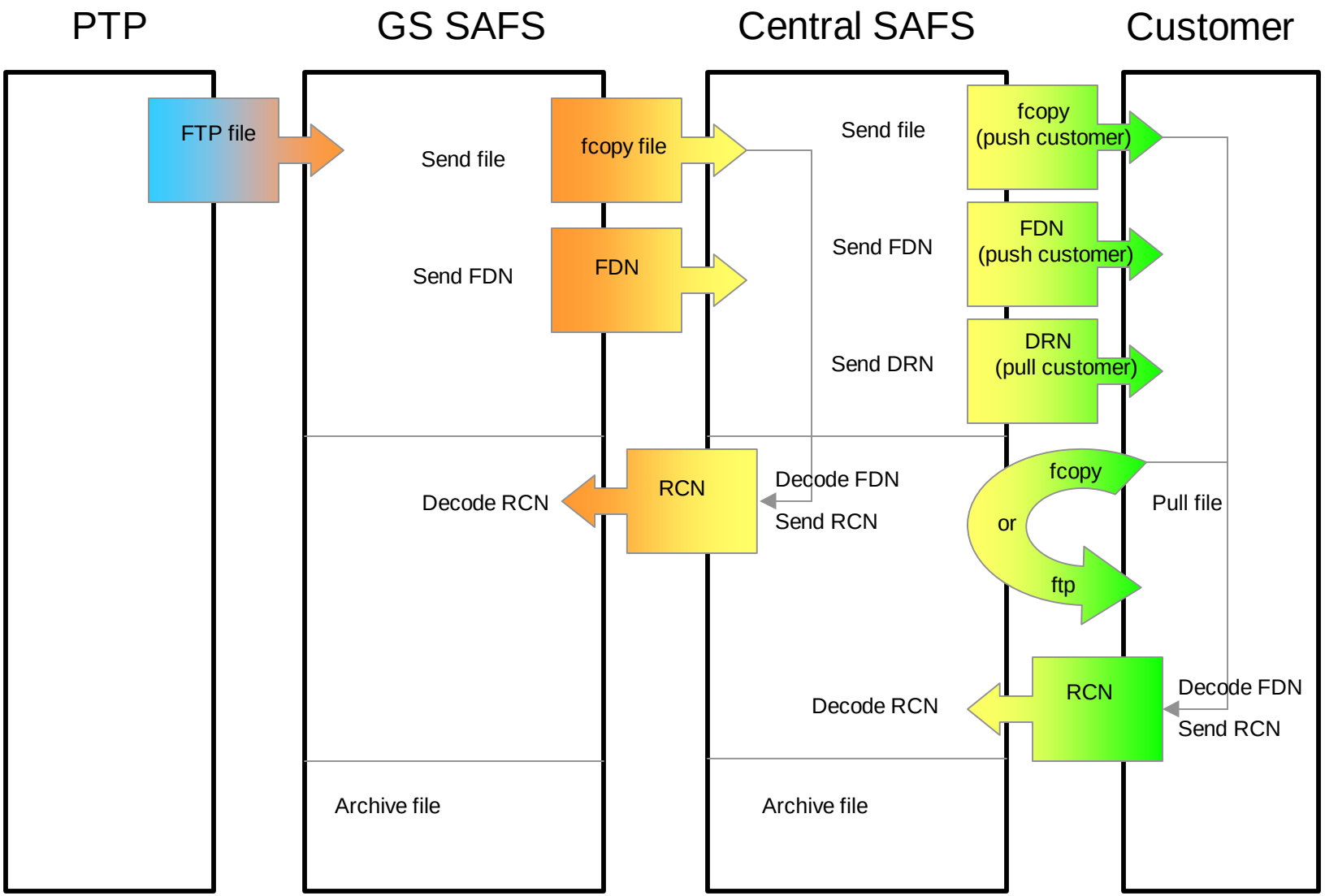
SAFS	QuikSCAT	ADEOS-II	Daily Total	96 Hour Total
WPS	506.8 MB	2946.4 MB	3,453.2 MB	13,812.8 MB
AGS	506.8 MB		506.8 MB	2,027.2 MB
SGS	506.8 MB		506.8 MB	2,027.2 MB
ASF		10,312.4 MB	10,312.4 MB	41,249.6 MB
Central	506.8 MB	13,258.8 MB	14,779.2 MB	59,116.8 MB

Based on this data volume, we are recommending the following drive storage sizes:

WPS	**27 GB**	* (3+1+2)	6x9 GB =	**54 GB**	
AGS	**9 GB**	* (3+1+2)	6x9 GB =	**54 GB**	(45 GB minimum recommended)
SGS	**9 GB**	* (3+1+2)	6x9 GB =	**54 GB**	(45 GB minimum recommended)
ASF	**90 GB**	* (10+1+4)	15x9 GB =	**135 GB**	
Central	**126 GB**	* (14+1+5)	20x9 GB =	**180 GB**	

*Volume + RAID Level + Hot Backup = Total number of drives

SAFS: File Transfer Logic



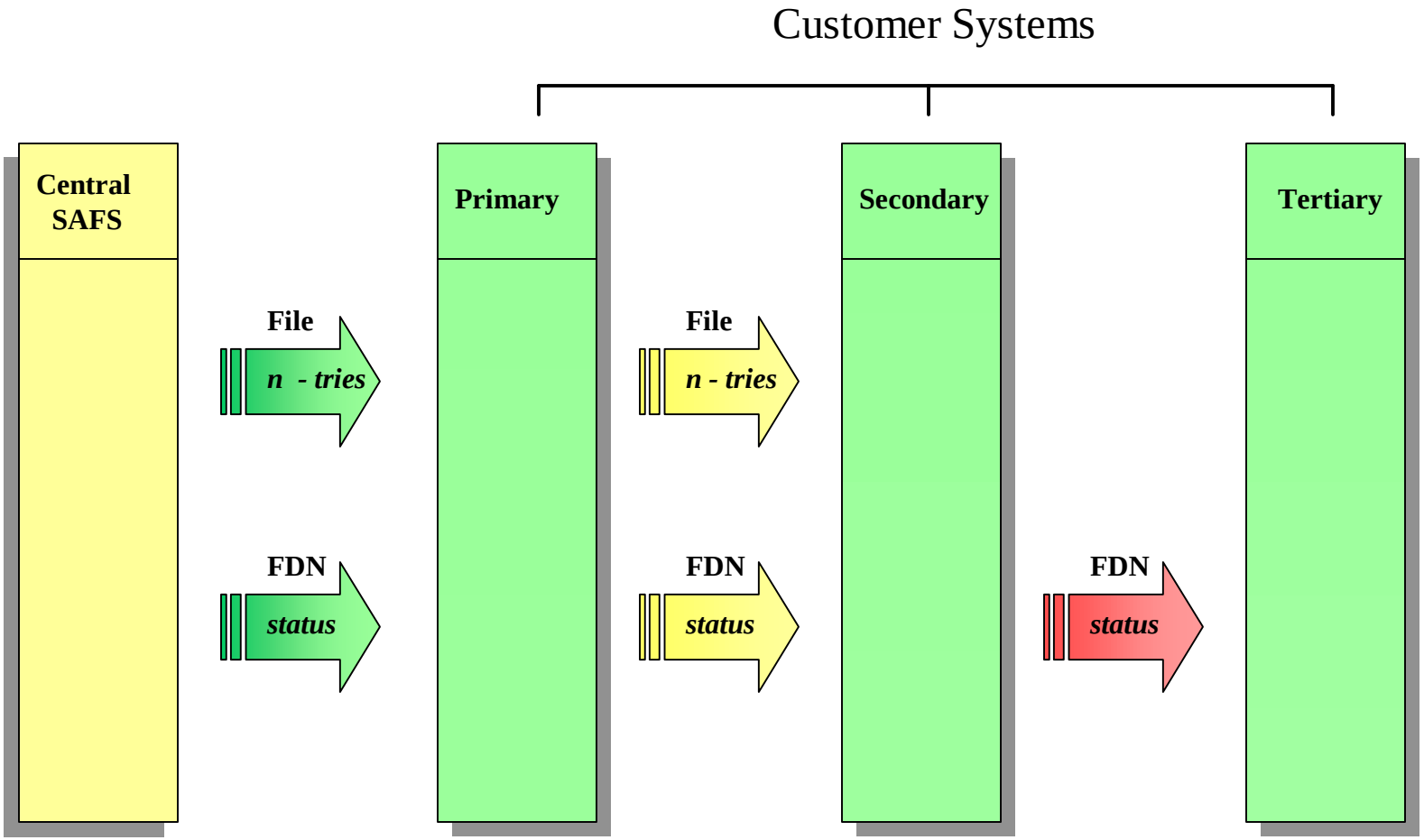
SKS/AMC
11/10/98

SAFS: Possible Fail-over Options

1. Network degradation/problems:
   - SAFS/customer monitoring
   - WPS Link Controller (LC) notification
   - Network personnel notification

2. SAFS "push" failure
   - Retry ***n*** times
   - Use secondary destination
   - E-mail FDN with failure status
   - Customer "pulls" files

3. Ground Station (GS) SAFS system down
   - GS Master monitors SAFS heartbeat
   - Remote debugging
   - Contract maintenance support
   - Redundancy
   - Files re-routed to Central SAFS

4. Central SAFS system down
   - GS SAFS/customer monitoring
   - WPS LC notification
   - Network Operations Center (NOC) personnel "hands and feet"
   - Mission critical support activation
   - Redundancy

SAFS: Push Transfer Failover Options