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SURVEY

Image Builder/Data Handling System Design

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Basic Structure

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Image Builder/Data Handling System will consist of five nodes and a supervisor:

- DHS supervisor layer
  - Maintain the current status information of DHS nodes
  - Coordinate the connections between monsoon PANs and DHS node
- DHS
  - Collect pixel data from science/focus PANs
  - Combine pixel data with metadata
  - Form multi-extension FITS file and deliver to downstream

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Basic Idea

1. DHS will consist of a set of Linux boxes
2. One DHS node assembles data from Five science/focus PANs at any time
3. Current active DHS node is determined by DHS supervisor
4. Connection between PANs and DHS are through TCP/IP sockets
5. DHS machine is server; PANs are clients
6. Clients push the pixel data and metadata into DHS
7. DHS stuffs the data into the shared memory

Architecture

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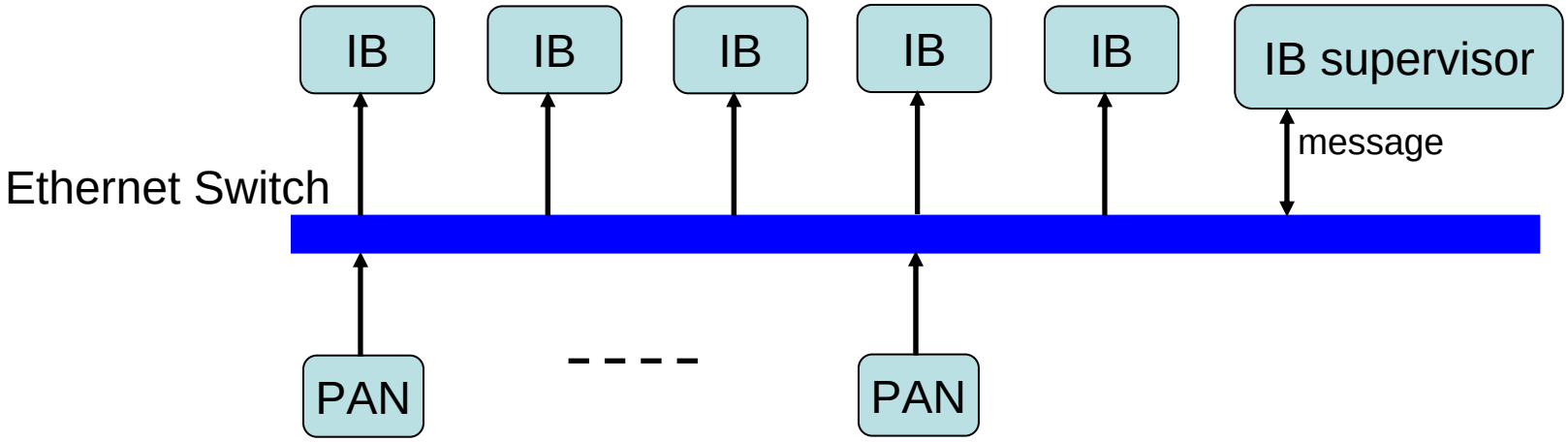
- Image Builder Supervisor directs pixel data to one IB machine at any time



Data Flow

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Primary Processes in DHS

1. collector:
   - Listen to connection from clients (PANs)
   - Stuff the pixel data into the shared memory cache
   - Listen for commands from supervisor layer, reporting the current status
2. sharedMemoryManager:
   - Organize the shared memory cache
   - Reorient the memory page to account for CCD readout direction
   - Provide access pointer for other processes
3. pixelFeed
   - Gather global metadata from database
   - Assemble image from the shared memory into FITS format
   - Send file to DTS through sockets

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Data Flow Testing (1)

- A toy model has been developed
- Client on (storm.des.hep.uiuc.edu) Pentium 4 Linux machine
- Server on (cyclone.des.hep.uiuc.edu) Pentium 4 Linux machine

Transferring data from half full PAN 18/2:

numCcd = 9;

nx = 2248; rows pixel

ny = 4146; columns pixel

4 bytes/pixel

Total data = 2248 * 4146 *4 *9

= 335, 527, 488 bytes

The data is equivalent to 9 CCD pixel data with 4 bytes per pixel.

Data Flow Testing (2)

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Ethernet switch 10Mb/100Mbps, Ethernet Adaptors (?)
Received data : 335, 527, 488 bytes

Packet size (bytes)	Action	Trial 1 (sec)	Trial 2 (sec)	Trial 3 (sec)	Average (sec)	Average Rate (1/sec)
1024	Recv	29	28	29	29	11.57 Mbytes 92.56 Mbits
	&Save	81	81	81		
4096	Recv	28.52	28.15	27.84	28.17	11.91 MBytes 95.28 Mbits
	&Save	100	100	100		
8192	Recv	30.40	29.41	28.91	29.57	11.34 MBytes 90.7 Mbits
	&Save	100.13	104.88	102.89	102.63	

Estimation: Total time = (~30*2)/PAN x 5 PANs = 300 seconds with current switch.
Need a faster Ethernet switch to repeat the test!!!

Data Flow Testing (3)

- Two clients (tempest and storm sending data)
- One server (cyclone receiving data through two different ports)
- Tempest started the transferring 1 seconds earlier and finished in 31 seconds, with rate ~90Mbps
- Storm started the process late and the connection was set, but the transmission was almost halted, and continued after tempest was done
- Total time was doubled w.r.t. one client one server case.

	Tempest	Storm
Time for 9 CCD data	31 seconds	61 seconds

Estimation of DHS node

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- Assumptions
  - 1 gigabit/second switch, actual 30% efficiency (conservative)
    - R = 300 bits/sec
  - Pixel size per CCD (p = 2248*4146 = 9,320,208 pixels)
  - 4 bytes per pixel (n = 4)
  - 18 full size CCDs per PAN (C = 18)
  - Total Bytes to transfer per PAN (B=p*n*C= 671,054,976 bytes)
  - Total 5 PANs (N=5)
  - Transfer time t1=B*N/R=90 seconds (<100 sec Exposure) (OK!)
  - Time for data operation (e.g. focus) in DHS t2 = 200 (s)
  - Time for data output to DTS t3= 90 (s)

Node = (90 + 200 + 90)/100 = 4

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Next Step

- Write Interface Control document
- Test the client code and implant it into MONSOON
  - Link the correct dhsUtil.lib in MONSOON which will send data to DHS (modify the monsoon library)
- Develop the server
  - Develop based on DHS software from NEWFIRM
- Design DHS supervisor layer

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Reference

- DES image builder design follows data handling system and data capture agency software in NEWFIRM project at NOAO
- In NEWFIRM, one DHS matches one PAN
- The data are delivered to one data capture agent machine to form multi extension FITS file