PARAMETERIZED SWITCH - STRUCTURE

Model of the switch assumes modular architecture of the switch. Switch is assembled out of the modules with an arbitrary number of ports per module (this is one of the configuration parameters). Frames can be transferred either between ports on the same module (intra-module communication) or between ports on different modules (cross-module communication).

Model of the parameterized switch assumes that there is a model of low level communication layer. Model of the low level communication layer handles traffic on the communication medium according to the Ethernet protocol and delivers frames to the parameterized model. Frames delivered to the parameterized model should allow access to the Ethernet control information: source address, destination address. The model handles frame delivered to the parameterized model for a time necessary to model transfer through internals of the switch. At the end of that time the frame is put into output queue. It is expected that the low level communication layer will access frames from the output queue and send them to communication medium according to the Ethernet protocol.

Basic principle of the operation of the parameterized model assumes that any limitations in resources available in the switch can be modeled as input queuing. When frame arrives to the switch a check is made whether there are enough resources in the switch to transfer the frame to the output queue of the destination port. In case the check is positive the frame is inserted into transfer queue. In the transfer queue the frame waits for a time corresponding to the time it would take a frame to traverse internals of the switch without any congestion. In case the check is negative the frame is put into wait queue where it stays till resources become available (usually when another frame leaves the switch). If resources become available the frame is pulled out from the wait queue and inserted into transfer queue When the transfer time elapses frame is pulled out from the transfer queue and inserted at the end of output queue of the destination port. In such scenario, the backplane (drawn in the picture 7 as crossbar) is fully nonblocking medium to transfer frames between modules. Frames may experience limitations in getting to the backplane, but once they get access there is nothing what may affect their transfer to the destination output queue.

Decision whether frame can be inserted into traffic queue or into wait queue is based on the switch resources calculations. The resources are characterized by parameters.

Max Loads (comes from measurements) are maximum loads (in MB/s) the switch can handle without dropping frames

Transfer Bandwidth is based on measurement of the time it takes for the frame to be transferred through the switch (Ping-Pong).

Each frame inserted into transfer queue reserves portion of the Max Load proportional to the Transfer Bandwidth. When Max Load is fully reserved, arriving frame has to go into wait queue.

On most switches the MaxLoad is a monolitically decreasing function of frame size. On the other hand, the bandwidth assigned to frame transfer is quantized. To perform calculations on these two parameters the concept of Bandwidth Filler Frames was invented and adopted. Decrease in max Load due to shorter frames is modeled by inserting artificial frames, existing only internally in the switch. Artificial frames reserve switch's bandwidth, making switch tougher to get through for the real, arriving frames. This results in drop of the MaxLoad for shorter frames (what is actually measured).

PARAMETERIZED SWITCH – STATUS

- Model recently transferred into OPNET 6.0 on WNT (significant improvement in modeling speed)
- Model ready to be adapted to different modeling environments (PTOLEMY, SIMDAQ (?))
- Model is a base component for Large Ethernet Network studies – current interest in "big_central_switch" architecture.