

# IOScheduler.java

```
import java.util.LinkedList;

public class IOScheduler
{
    /**
     * VARIABLES*****
     */
    LinkedList<Integer> defaultQueue;    // I/O for non-blocked jobs
    LinkedList<Integer> blockedInQueue; // I/O for blocked, in-memory jobs
    LinkedList<Integer> blockedOutQueue; // I/O for blocked, not in-memory jobs
    LinkedList<Integer> terminatedQueue; // I/O for terminated jobs
    LinkedList<Integer> reportedToSwap;
    int inIO;                          // current process in I/O

    /**
     * CONSTRUCTOR*****
     */
    IOScheduler ()
    {
        defaultQueue = new LinkedList<Integer>();
        blockedInQueue = new LinkedList<Integer>();
        blockedOutQueue = new LinkedList<Integer>();
        terminatedQueue = new LinkedList<Integer>();
        reportedToSwap = new LinkedList<Integer>();
        inIO = -1;
    }

    /**
     * PRIVATE METHODS*****
     */
    /**
     * Gets next available I/O task
     */
    void ioCheck ()
    {
        // System.out.println("-I/O Queues:");
        // System.out.println("--BlockedIn Queue has " + blockedInQueue.size());
        // System.out.println("--Terminated Queue has " + terminatedQueue.size());
        // System.out.println("--Default Queue has " + defaultQueue.size());
        if (inIO == -1)
        {
            // Checks terminated first
            if (!terminatedQueue.isEmpty()) {
                inIO = terminatedQueue.remove();
            }
            // Then in-memory-blocked
            else if (!blockedInQueue.isEmpty()) {
                inIO = blockedInQueue.remove();
            }
            // Then regular jobs
            else if (!defaultQueue.isEmpty()) {
                inIO = defaultQueue.remove();
            }
            // If an I/O task was found, run it
            if (inIO != -1) {
                // System.out.println("--Job is sent to do I/O");
                JobTable.setDoingIO(inIO);
            }
        }
    }
}
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        sos.siodisk(inIO);
    }
}

/**
 * PUBLIC METHODS*****
 */

/**
 * Accepts new job for I/O
 * Adds new job to default I/O queue
 * @param jobID of the job to add
 */
public void add (int jobID)
{
    // System.out.println("-IOScheduler accepts new job");
    JobTable.incrementIO(jobID);
    defaultQueue.add(jobID);
    ioCheck();
}

/**
 * Checks to see if given job is doing I/O
 * @param jobID job to query
 * @return boolean true if job in I/O, false otherwise
 */
public boolean doingIO (int jobID)
{
    if (jobID == inIO) {
        // System.out.println("--Job " + jobID + " is doing I/O");
        return true;
    }
    else {
        // System.out.println("--Job " + jobID + " is not doing I/O");
        return false;
    }
}

/**
 * When I/O has finished, removes current job from inIO
 * Tries to start next job if available
 * Updates inIO
 * @return jobID of process that just finished I/O and jobID of
 * process that needs to be brought into memory
 */
public int ioDone ()
{
    // If job which finished I/O is valid
    int jobID = inIO;
    inIO = -1;
    if (jobID != -1) {
        // Decrement & get it's I/O pending
        JobTable.decrementIO(jobID);
        JobTable.unsetDoingIO(jobID);
        // If the job is ready to be unblocked
        if (JobTable.getIO(jobID) == 0 && JobTable.isBlocked(jobID)) {

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        JobTable.unsetBlocked(jobID);
    }
}

ioCheck();
return jobID;
}

/**
 * Prints status of I/O
 */
public void print () {
    // System.out.println("-I/O Report:");
    // System.out.println("--In I/O: " + inIO);
    // System.out.println("--Next In Queue: ");
    // System.out.print("---Terminated: ");
    // for (int i = 0; i < terminatedQueue.size(); i++)
    // {
    //     System.out.print(terminatedQueue.get(i) + ", ");
    // }
    // System.out.print("---blockedInQueue: ");
    // for (int i = 0; i < blockedInQueue.size(); i++)
    // {
    //     System.out.print(blockedInQueue.get(i) + ", ");
    // }
    // System.out.print("---blockedOutQueue: ");
    // for (int i = 0; i < blockedOutQueue.size(); i++)
    // {
    //     System.out.print(blockedOutQueue.get(i) + ", ");
    // }
    // System.out.print("---DefaultQueue: ");
    // for (int i = 0; i < defaultQueue.size(); i++)
    // {
    //     System.out.print(defaultQueue.get(i) + ", ");
    // }
}

/**
 * Checks blocked in-memory for jobs to swap out
 * @return jobID of job to swap out
 */
public int readyToLeave ()
{
    // Job that is ready to leave, initialized to invalid
    int swapOutBlockedJob = -1;

    // If blocked jobs are in memory
    if (!blockedInQueue.isEmpty()) {
        // Checks if last element in queue is already swapping,
        // if not, then set to swap in
        if (blockedInQueue.getLast() != inIO) {
            swapOutBlockedJob = blockedInQueue.getLast();
        }
        // Checks if a blocked job has exceeded its in memory time,
        // if it has, then set to swap out
        else if (JobTable.getPriorityTime(blockedInQueue.getFirst())
            > 1000) {

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        swapOutBlockedJob = blockedInQueue.getFirst();
    }
    // Checks to if job selected hasn't already requested to
    // be swapped. If it has, then invalidate job to swap out.
    // If it hasn't then add to reported to swap list
    if (reportedToSwap.contains(swapOutBlockedJob)) {
        swapOutBlockedJob = -1;
    }
    else {
        reportedToSwap.add(swapOutBlockedJob);
    }
}
return swapOutBlockedJob;
}

/**
 * Checks blocked not in-memory for jobs to swap in if there is no
 * blocked job in memory
 * @return jobID of job to swap in
 */
public int readyToReturn ()
{
    int swapInBlockedJob = -1;
    if (blockedInQueue.isEmpty() && !blockedOutQueue.isEmpty()) {
        swapInBlockedJob = blockedOutQueue.getFirst();
        if (reportedToSwap.contains(swapInBlockedJob)) {
            swapInBlockedJob = -1;
        }
        else {
            reportedToSwap.add(swapInBlockedJob);
        }
    }
    return swapInBlockedJob;
}

/**
 * Moves a jobs I/O to correct queue when status changes
 * @param jobID the job to move
 */
public void moveIO (int jobID)
{
    if (jobID != -1) {
        int ioCount = JobTable.getIO(jobID);
        if (ioCount > 0) {
            if (reportedToSwap.contains(jobID)) {
                reportedToSwap.remove((Integer)jobID);
            }
            // System.out.println("-IO");
            // Query the jobTable to determine which list I/O should move to
            // Move to terminated
            if (JobTable.isTerminated(jobID)) {
                // Remove from default, blockedIn
                // System.out.println("--Moving to terminatedQueue");
                while (defaultQueue.contains((Integer)jobID)) {
                    defaultQueue.remove((Integer)jobID);
                }
            }
        }
    }
}

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        terminatedQueue.add(jobID);
    }
    while (blockedInQueue.contains((Integer)jobID)) {
        blockedInQueue.remove((Integer)jobID);
        terminatedQueue.add(jobID);
    }
}
// Move to blockedOut
else if (JobTable.isBlocked(jobID)) {
    // Move to blockedOut
    if (JobTable.getAddress(jobID) == -1 ||
        (JobTable.getAddress(jobID) != -1 &&
         JobTable.isSwapping(jobID))) {
        // System.out.println("--Moving to blockedOutQueue");
        // Remove from blockedIn
        while (blockedInQueue.contains((Integer)jobID)) {
            blockedInQueue.remove((Integer)jobID);
            blockedOutQueue.add(jobID);
        }
        while (defaultQueue.contains((Integer)jobID)) {
            defaultQueue.remove((Integer)jobID);
            blockedOutQueue.add(jobID);
        }
    }
    // Move to blockedIn
    else if (JobTable.getAddress(jobID) != -1 ||
             (JobTable.getAddress(jobID) == -1
              && JobTable.isSwapping(jobID))) {
        // System.out.println("--Moving to blockedInQueue");
        // Remove from default
        while (defaultQueue.contains((Integer)jobID)) {
            defaultQueue.remove((Integer)jobID);
            blockedInQueue.add(jobID);
        }
        while (blockedOutQueue.contains((Integer)jobID)) {
            blockedOutQueue.remove((Integer)jobID);
            blockedInQueue.add(jobID);
        }
    }
}
}
}
}
}
}
}

```