



How fast are your files?TM

***DXTI:
Data Transferred/Time Index Metric***

***The I/O Speedometer and Odometer for Your
Files, Devices, and Applications!TM***

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Background

- New metric introduced (October 2011) in version 7.0.199 of the hIOmon file and disk I/O monitoring software
- Index value that relates the total **amount of *data transferred*** to the total **amount of *response time*** taken by I/O operations to transfer this data
- Resembles “fuel economy” index (i.e., miles-per-gallon or “MPG”) as an overall measure of “performance efficiency”



DXTI Metric

- Data Transferred/Time Index (DXTI) metric provides a “high-level” means for relative comparison of I/O performance:
 - ✓ Higher the Index value, better the performance
 - ✓ “Better performance” in terms of more data transferred and/or less required response time (application wait)
 - ✓ Akin to more miles driven (more data transferred) for fuel used (response time taken to transfer this data), or similarly, same miles (data transferred) but less fuel (less response time)
- Basic concept behind metric is simple:
 - ✓ “Better” storage I/O operation performance is fundamentally about transferring (more) **data** faster (i.e., in less **time**)
 - ✓ So the “amount of **data transferred**” and respective “response **time taken**” are the two components of the DXTI metric



DXTI Metric Calculation

- Calculation is straightforward and simple:
 - ✓ DT = observed overall total amount of **data transferred** by the I/O operations (converted to megabytes for scaling)
 - ✓ RT = corresponding combined sum of the observed time durations (i.e., **response times**) of the I/O operations that were performed to transfer this data
 - ✓ $DXTI = DT / RT$
- Individual response times include both the queue time and the service time for the respective I/O operation
- From the application/user perspective, the response time is seen as the actual amount of time (wait) required to perform the particular data transfer I/O operation request



MPG and DXTI Commonalities

- Both deal with **key** components related to **performance**:
 - ✓ Amount of distance traveled (*amount of data transferred*)
 - ✓ Amount of fuel used to travel that distance (*aggregated response time taken to transfer this data*)
- And in both cases the **focus** is upon:
 - ✓ What the auto/storage is primarily used for (i.e., to travel some distance or *to move some data*)
 - ✓ The expenditure required to do (i.e., the amount of fuel used or *the amount of response time taken*)
- Both use concrete, measured values to calculate the index:
 - The **actual** miles driven (**actual** *amount of data transferred*)
 - The **actual** amount of fuel used (*the actual combined sum of the response time taken*)



MPG and DXTI Commonalities (continued)

- Both have a direct impact upon the end-user:
 - ✓ Pocketbook/cost in the case of MPG (*application wait in the case of DXTI, which also can be a pocketbook/cost issue*)
- Both are subject to variability (“your mileage may vary”), which can be due to a number of factors:
 - ✓ MPG: speed; various traffic, weather, and vehicle conditions; loads/occupants; changes in terrain; etc.
 - ✓ DXTI: data transfer sizes; queue depths; read/write ratios; random/sequential access ratios; etc.



MPG and DXTI Commonalities (continued)

- For both, the variability can be further compounded by “**user-dependency**”
 - ✓ Same auto, but different drivers (same system, but different users)
 - ✓ My *typical* MPG/DXTI can be different than your *typical* MPG/DXTI
- For both, merit in establishing **baseline** index values; e.g.:
 - ✓ When evaluating the actual impact of introducing changes; e.g., an engine tune-up, proper tire inflation (*faster interface, new SSD*)
 - ✓ In actually quantifying the impact/benefit of such changes
 - ✓ And where apparent anomalies arise (e.g., a lower than expected MPG-DXTI value), the investigation can accordingly shift to other commonplace metrics, e.g., average/max Miles-Per-Hour (*average/high queue depth*) that might be the underlying, aggravating factors.

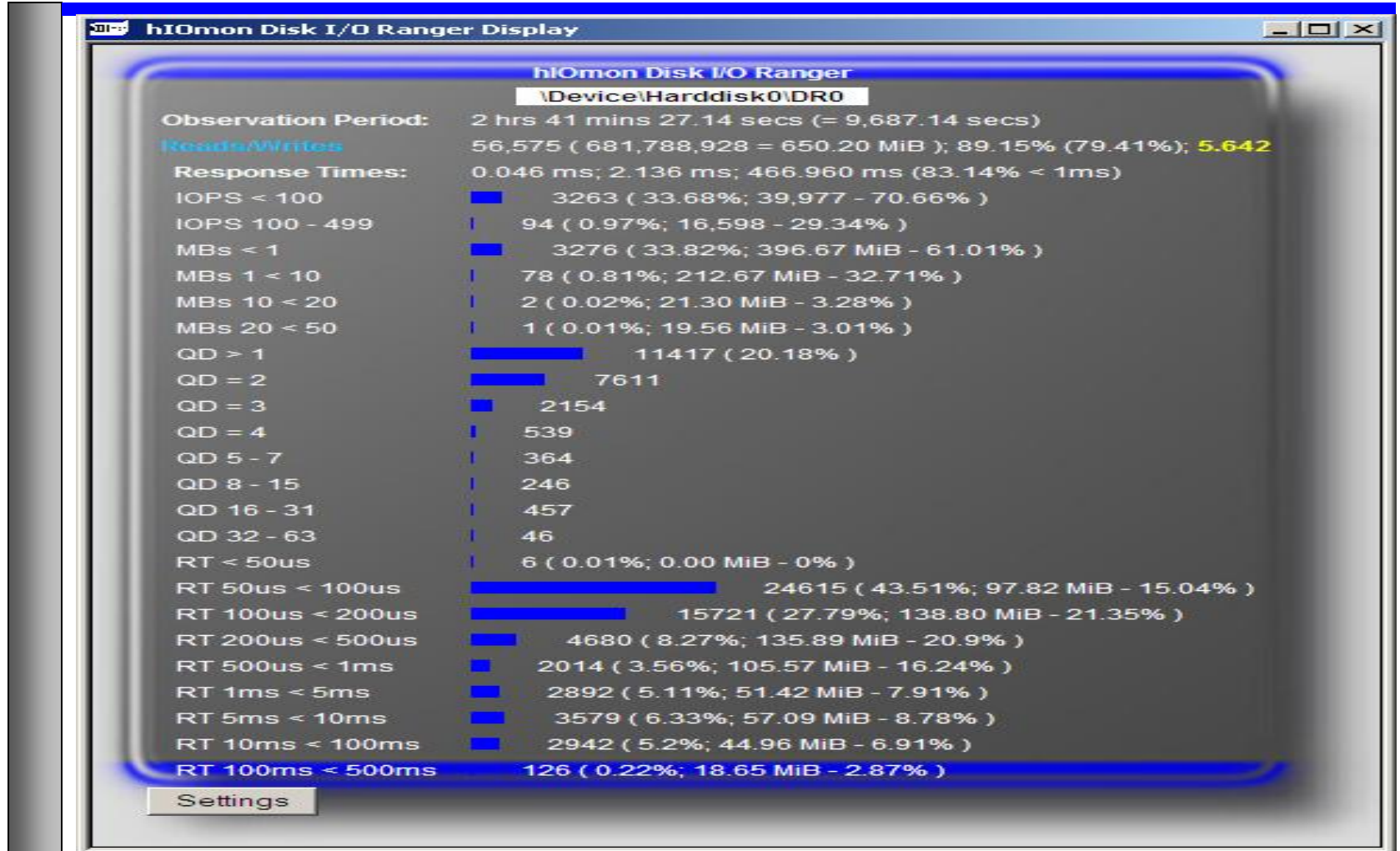


DXTI Display Screen Shots

- Screen shots of the hIOmon “Disk I/O Ranger Display” app showing the DXTI metric values highlighted in yellow:
 - ✓ App provides real-time displays of observed metrics collected by the hIOmon I/O Monitor
 - ✓ These metrics are summary metrics automatically aggregated by the hIOmon I/O Monitor without requiring the collection and post-processing of I/O operation trace information
 - ✓ DXTI metric values can be provided:
 - Upon an individual file, device, and process/application basis
 - That empirically reflect actual everyday, normal usage of the computer system (i.e., beyond benchmarking test scenarios)

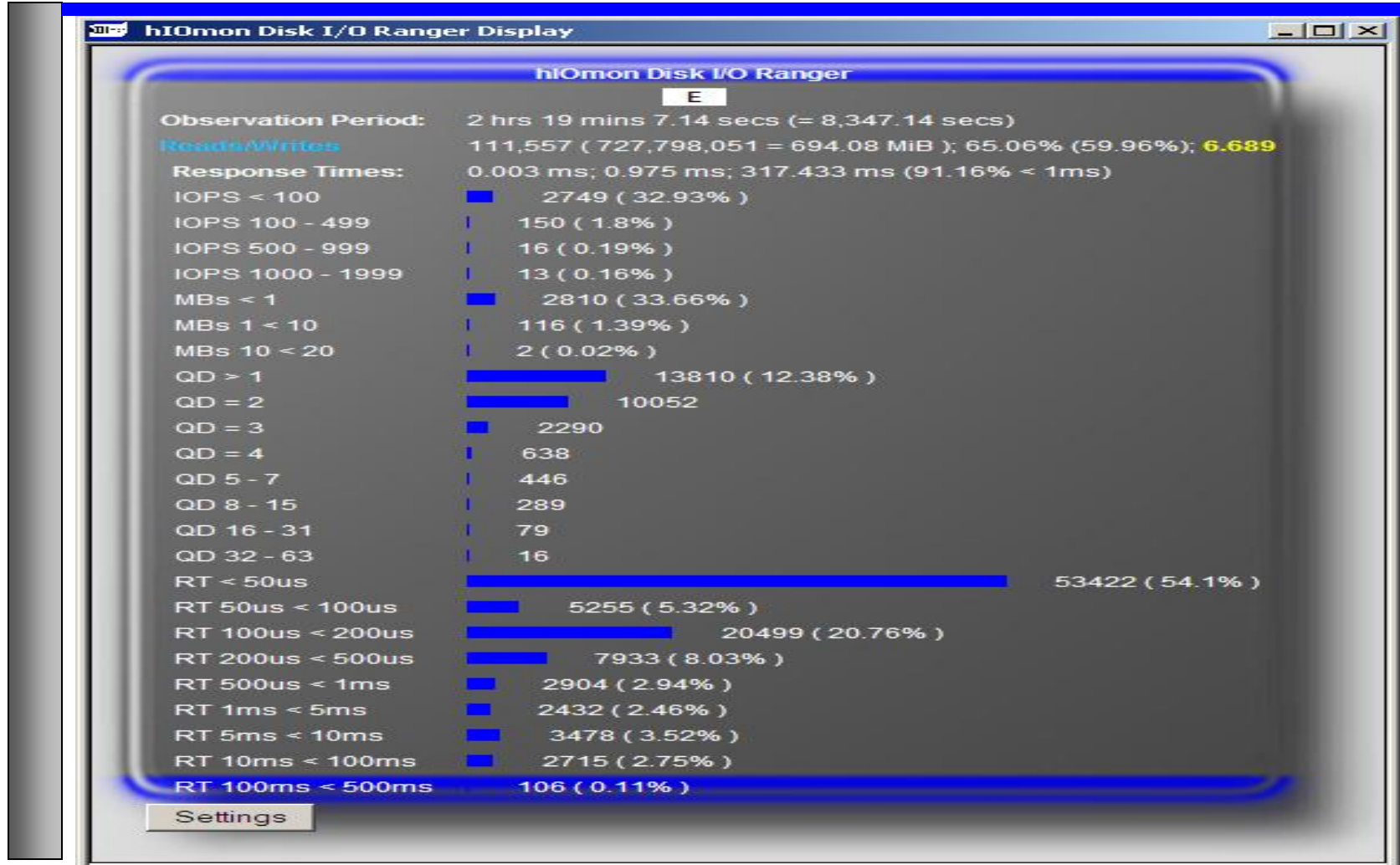


OS Physical Device



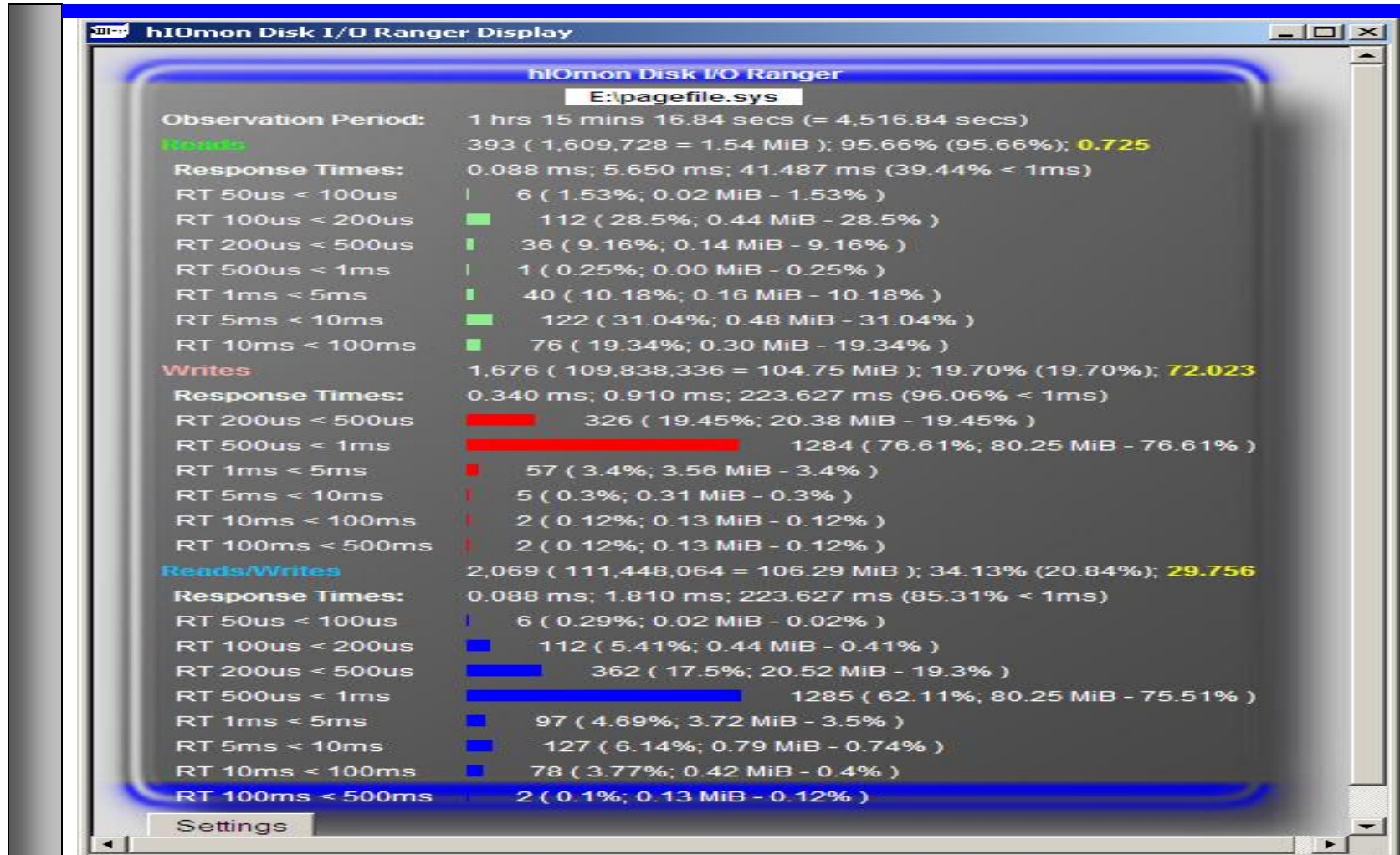


Logical Device



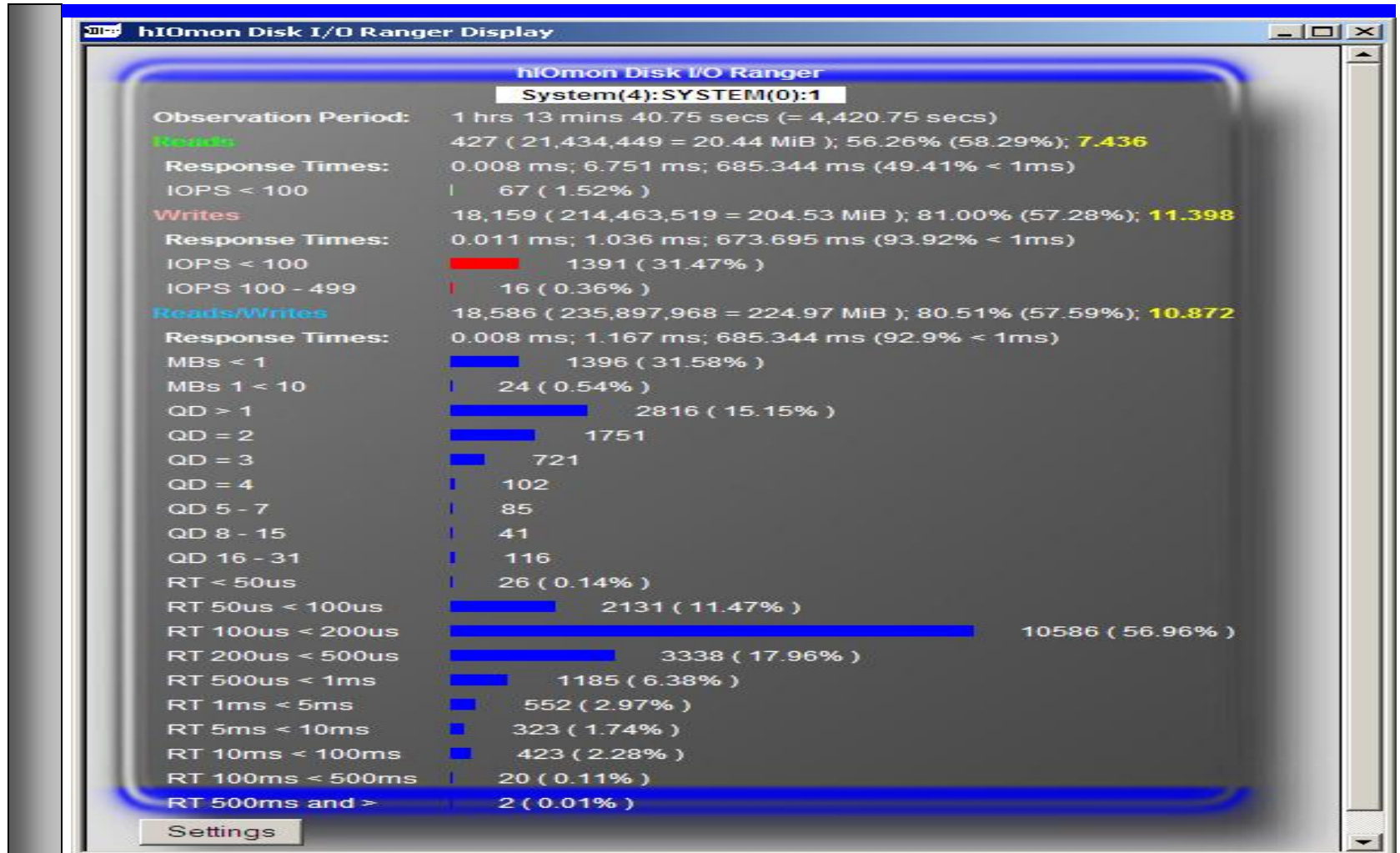


System Page File





System Process





hIOMon Support

- The Data Transferred/Time Index (DXTI) metric can be displayed by the:
 - ✓ hIOMon Presentation Client (Java-based client)
 - ✓ hIOMon WMI Browser (HTML application)
 - ✓ hIOMon CLI
- Can also be displayed/exported in real-time by the hIOMon “Disk I/O Ranger Display” client app
- The DXTI metric also easily calculated from the unique “summary” I/O operation metrics that can be collected/exported by hIOMon



Additional Information ...

Available at the hyperI/O web site:

<http://www.hyperIO.com/hlOmon/hlOmonDataTransferredTimeIndexMetric.htm>

<http://www.hyperIO.com/hlOmon/ScreenShots/hlOmonDiskIORangerDisplay.htm>