



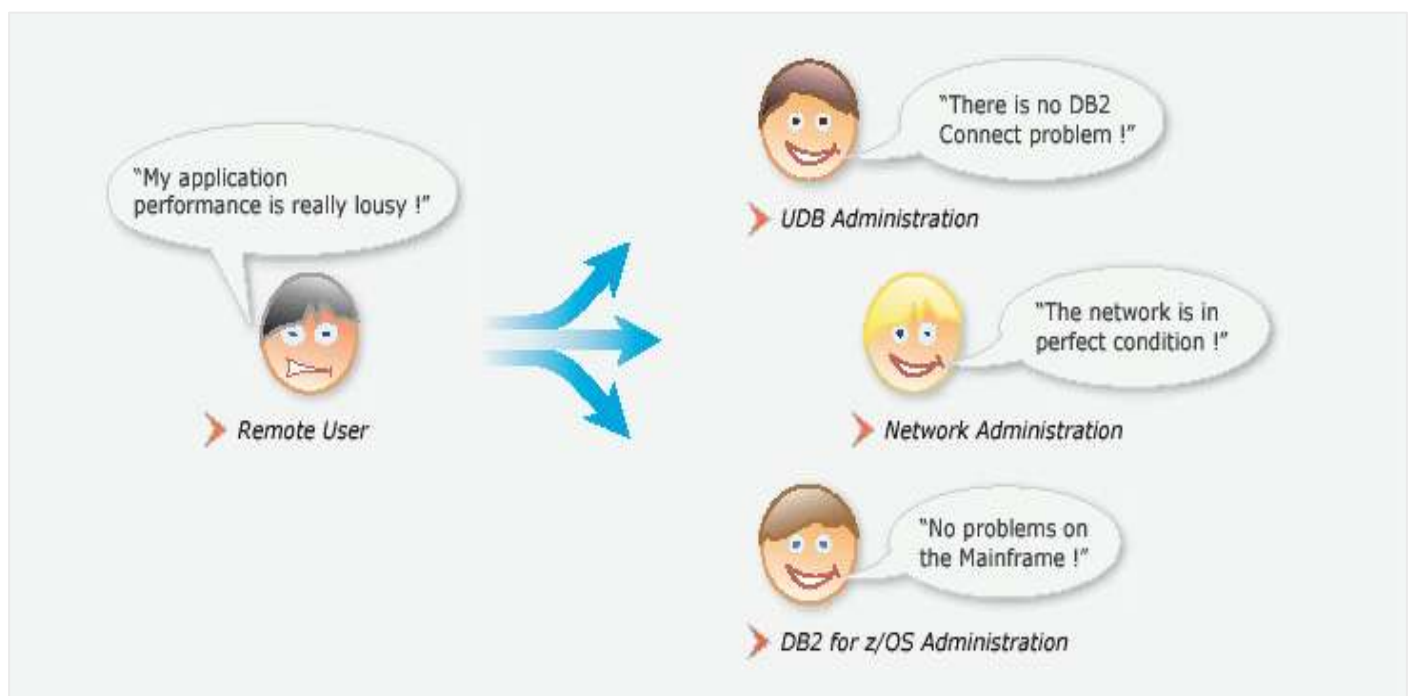
## Speedgain Gateway Monitor (itgain's DB2 Gateway Monitor)

### *'Unraveling the Mystery of Performance Issues in a DB2 Connect Environment'*

by Per Stricker and Thomas Kalb, itgain

No longer will the DBA and the IT organization be held captive to wasteful downtime due to the difficulty of identifying performance problems in the DB2 Gateway. itgain has a new breakthrough product called the DB2 Gateway Monitor. This software will immediately pinpoint a problem that is occurring within your gateway connections, identify the component responsible, and provide an automated path for tuning. It will go even further with its threshold reporting that triggers an alarm when a critical situation is detected. To identify DB2 Connect connection problems, you need connection with which to do your problem determination. Well, with the DB2 Gateway Monitor from itgain, critical information is placed at your fingertips via the user interface and Gateway Monitor performance database. With itgain's unique DB2 Gateway Monitor you will always stay ahead in the performance game.

Every DBA dealing with DB2 Connect has experienced the following situations as shown in the following figure:



**Figure 1.** Where's the Problem?

As shown in Figure 1, no one has identified the problem nor the solution while the end user still experiences poor performance! In addition, the process to explore and identify the problem is often very time consuming and complicated. Many different departments are involved, a great variety of traces are available for analysis and then finding the correct one may be difficult.. Some traces are very hard to read, so even the right trace data may present a challenge to an experienced IT professional. To make life easier and remove the burden on the IT organization, itgain has developed the Speedgain Gateway Monitor software product.

## Architecture

Unlike other DB2 monitoring products the Speedgain Gateway Monitor does much more than just report on monitoring elements..The itgain DB2 Gateway Monitor is designed for 24 by 7 monitoring of the DB2 Connect Gateways. It provides real-time and exception



based monitoring as well as point-based monitoring with excellent drilldown capabilities to easily pinpoint the cause of production problems. The Speedgain Gateway Monitor keeps historic data that enables DBAs to analyze problems that occurred hours, days or even weeks before. To support all these features the successful architecture of Speedgain for LUW was adopted and extended to the Speedgain Gateway Monitor.

It consists of 3 major components as shown in Figure 2.

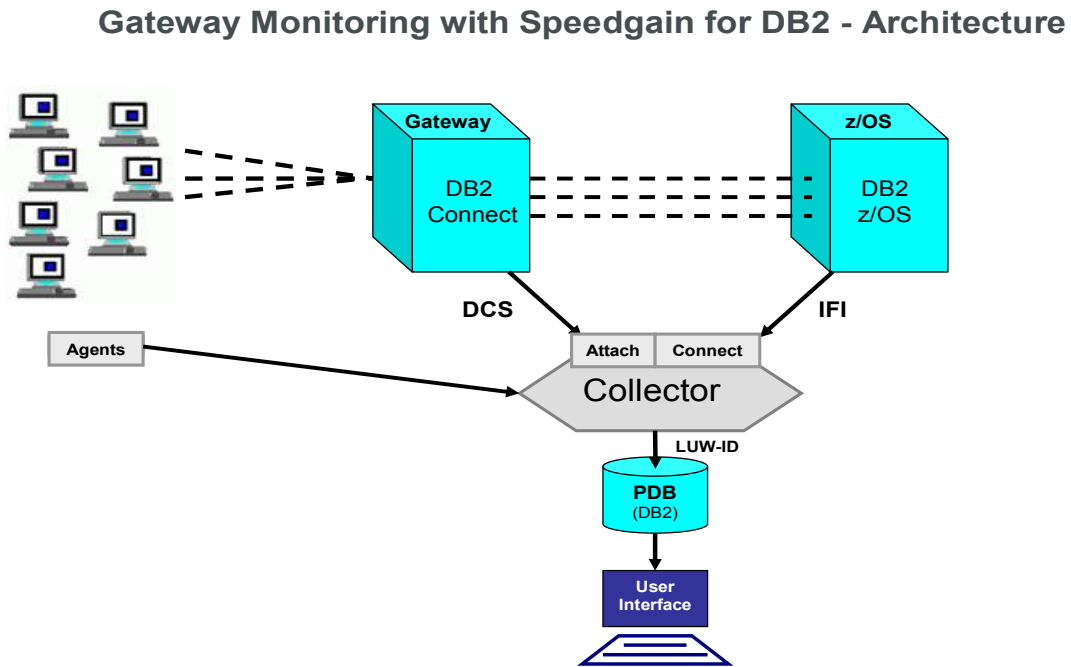


Figure 2. Gateway Monitor Architecture



We will now take a closer look at each of these 3 components.

### **The Collector**

The collector is a central component within the Speedgain Gateway Monitor architecture. It collects performance data remotely from the DB2 Connect Servers and the DB2 for z/OS Subsystems which are to be monitored. It is available for LINUX, AIX, Solaris and Windows. It usually runs on a separate server and not on any of the gateway servers.

#### ***Performance data***

The collector attaches to the DB2 Connect Gateway servers and collects the following performance data:

- **DCS Snapshot data**
- **Regular Snapshot data**

From the z/OS and the DB2 for z/OS Subsystems it gets:

- **IFI Records (z/OS)**
  - 0001 System Statistics
  - 0002 Accounting
  - 0148 Data Base Access Threads (DBAT)
  - 0318 Dynamic Statement Cache
- **DSNZPARMS**
- **TCP/IP (netstat)**
- **USS (Thread information, BPXPARMS)**
- **MVS (CPU, SIO)**
- **MVS Enclaves (WLM-API, SMF type 30 und 72)**
- **And more ....**

All of this data is stored in the performance database (PDB) and is available for immediate use in diagnosing and solving performance problems.

#### ***Configuration***

All performance data is collected within a predefined interval and stored in the performance database (PDB). To control the amount of data collected, monitoring can be separately turned on and off for each DB2 Subsystem and Gateway.

#### ***Minimize Data Volume***

To reduce the amount of data to be inserted in the PDB the Collector compares data from one snapshot to the other and inserts only data that has actually been changed into the PDB. This reduces the number of inserts for an average environment by 90% and therefore reduces the workload significantly and allows the performance data to be stored for a much longer period of time.



### ***Alerting***

For each performance value default thresholds are provided. Thresholds can be customized and set to your environment. The collector checks for threshold violations and triggers a user exit if such a violation occurs. Some user exits are provided with the product such as the Tivoli exit to integrate with the TEC Console, and an Email exit to send emails. In addition it is simple to write your own exit to handle threshold violations in any way you may desire.

### **The Performance Database (PDB)**

The PDB is a DB2 Database that typically resides on a DB2 LUW Server (although it could reside on z/OS as well). A common setup is to install the PDB together with the collector on one server.

### ***Historical Data***

The PDB stores all performance data collected by Speedgain with history. This is an extremely powerful feature as it enables DBAs to travel back in time and analyze problems that occurred one hour, one day or even one week ago. In addition it gives you great reporting capability as well as the means to easily identify trends.

### ***SQL Tuning***

As the collector stores all data from the dynamic statement cache, the PDB provides valuable information for SQL tuning and to improve your index design e.g. by feeding the dynamic SQL information to the Index designer((not available on z/OS yet))? May need to rewrite.

### ***System Tuning***

To find the optimum setup for your gateway configuration you need to be able to measure the impact of your changes to the system performance. Therefore it is vital to compare system performance before and after the changes were applied. The PDB has all the data you need including performance metrics as well as configuration information such as DSNzParms and DBM/DB configuration from the Gateway.

### ***Settings***

Last but not least the PDB also stores settings for the Speedgain Collector such as threshold configuration and monitoring switches. This allows you to automatically change the monitoring based on the workload and time of day. For example you could change the configuration and switch settings from OLTP mode to a different configuration for nightly, weekly, or monthly batch jobs and batch reporting.

## The Speedgain Client

### High Level Monitoring And Drilldown

As previously mentioned the main focus of the product is to efficiently determine the cause of performance problems when they occur. Therefore the top level of the Speedgain Client shows all Gateway “links” that are monitored as a pipe. Each pipe is divided into 3 segments

- one for the gateway server,
- one for the network
- one for the z/OS System.

The length of each segment represents the time being spent for each component. For further investigation of problems it is possible to drill down to each component to obtain detailed information.

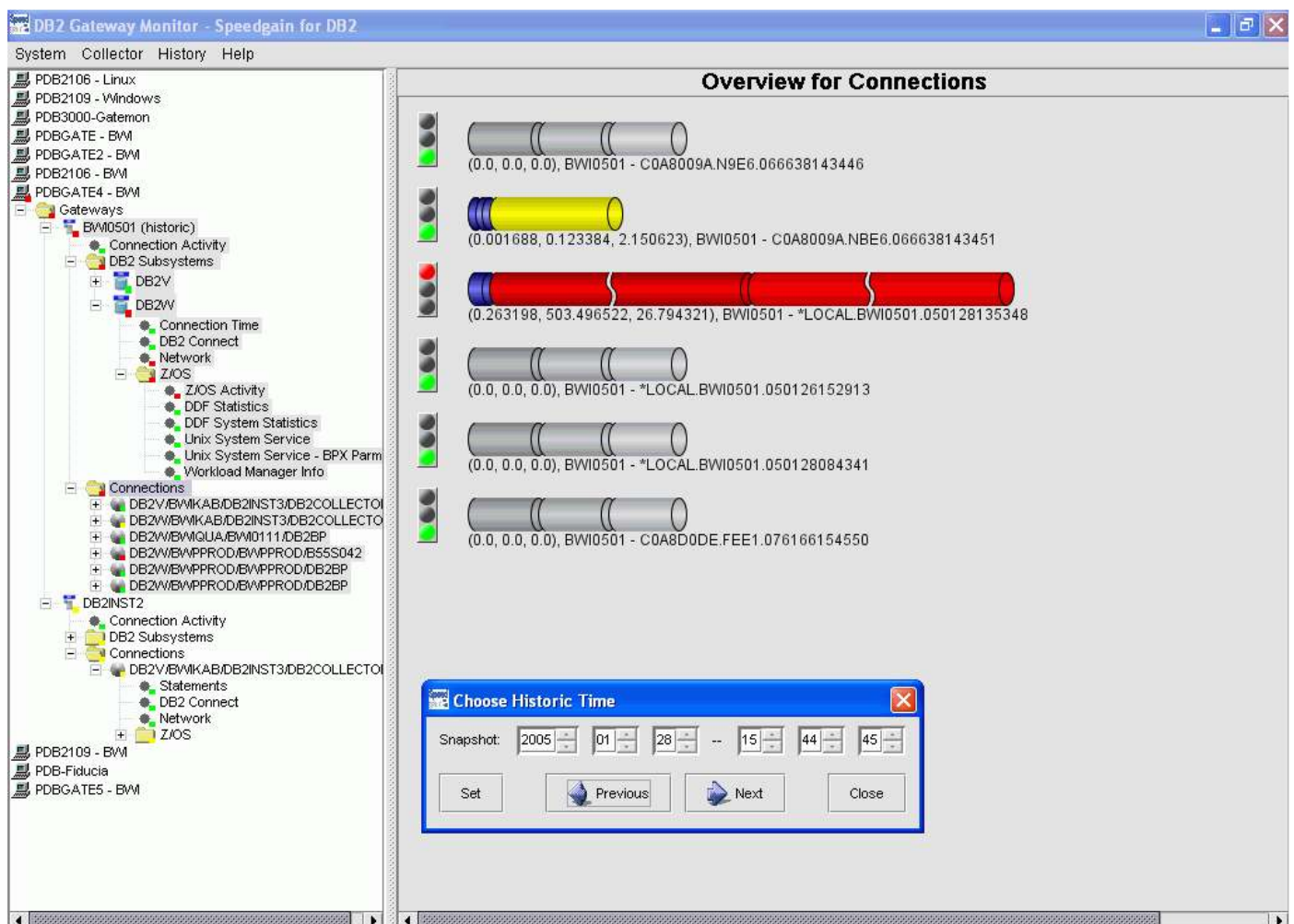


Figure 3. Connection Overview – Historic Time

### Time Travel

Some problems occur during instances when no one is looking at a real time monitor and DBAs or other staff may be unavailable when a problem occurs. Such situations can occur repeatedly and can prove to be costly. With the Speedgain Gateway Monitor architecture and PDB, DBAs and support staff can answer such questions as, What happened last weekend? What was the cause of the performance slow down last night or 2 hours ago? The Speedgain Gateway Monitor allows one to travel back right to the point in time where the problem occurred and provides all the information needed to analyze and solve the problem. This capability is truly unique to the industry and has been sorely needed by DB2 DBAs, network administrators and operations staff, for some time.



### **Configuration of the Speedgain DB2 Gateway monitoring system**

The Speedgain Client is an easy to use Graphical User Interface and is used to configure the Speedgain Gateway Monitor and to display all performance data and recommendations. The configuration includes the setting of monitoring switches, snapshot frequency, definition of thresholds, collector configuration, health monitoring, notification information and much more.

### **Analysing performance with the Speedgain Client**

The source of all performance data within the Speedgain Gateway Monitor is the PDB Speedgain Client. The Speedgain Client provides an intuitive access to the Data in the PDB. It is capable of dealing with more than one Performance Database (although one is sufficient in most environments).

To work with the Seedgain Client you first need to connect and logon to a PDB.

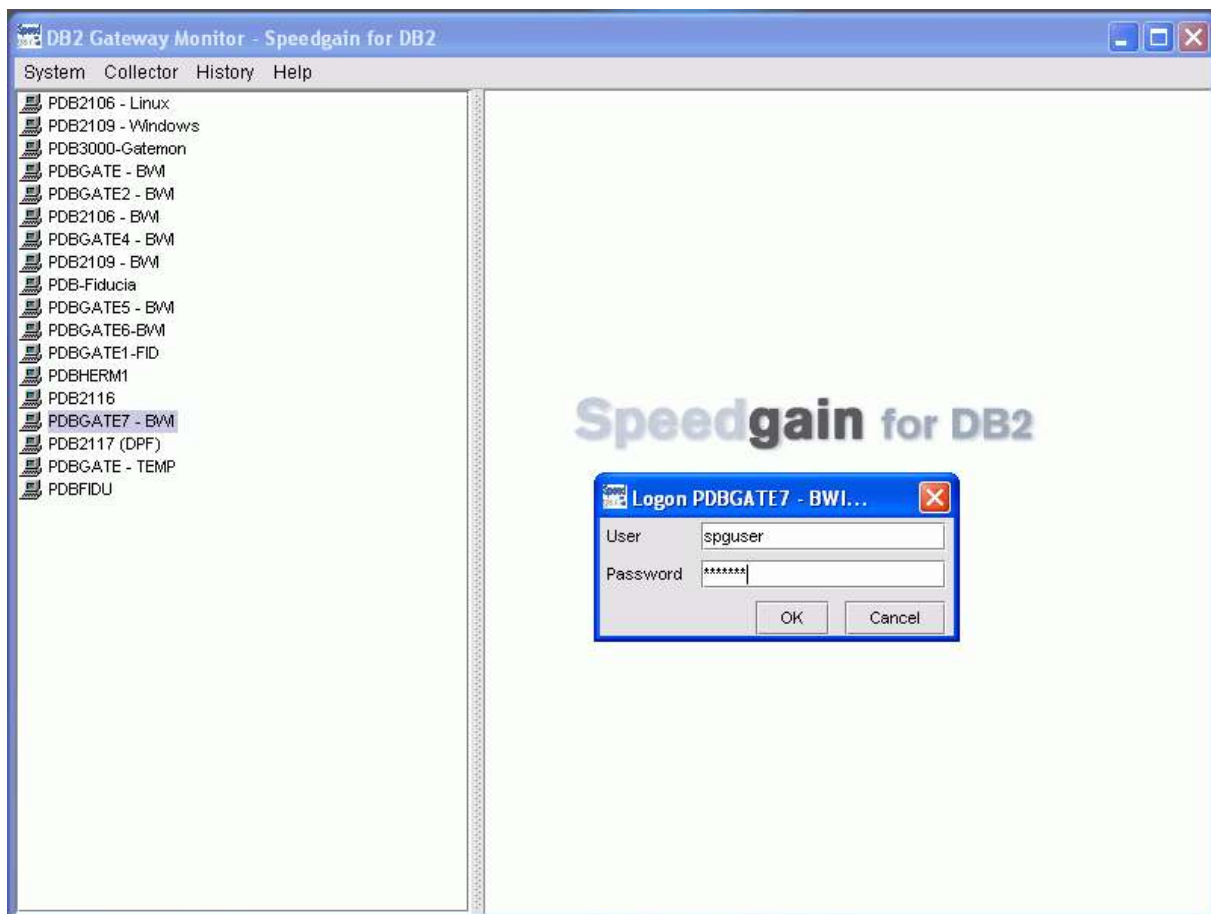


Figure 4. Speedgain Gateway Client

### **High level monitoring**

After a successful logon to a PDB the monitored gateways (those gateways for which the collector collects performance data) are displayed in the tree on the left. On the right each path from one of the gateways to a monitored DB2 Subsystem is displayed as a pipe.

The pipe representing a path is divided in 3 sections. The first Section represents the gateway, the second the network and the 3<sup>rd</sup> the z/OS. The length of each pipe represents the time being spent in this component for all currently active connections between two snapshots. This provides an intuitive overview for connections for all monitored DB2 subsystems.

In the following sample we have 3 gateways (BW0501, BW0701 and DB2INST2) and 3 DB2 Subsystems on the z/OS (DB2B, DB2V and DB2W).

The following paths are configured:

- BW0501 to DB2B (currently no activity)
- BW0501 to DB2V (Overall time and z/OS time is critical)
- BW0501 to DB2W (everything is fine)
- BW0701 to DB2V (currently no activity)
- DB2INST2 to DB2V (overall time gives a warning and z/OS time is critical)

Conclusion: DB2V is the critical resource!

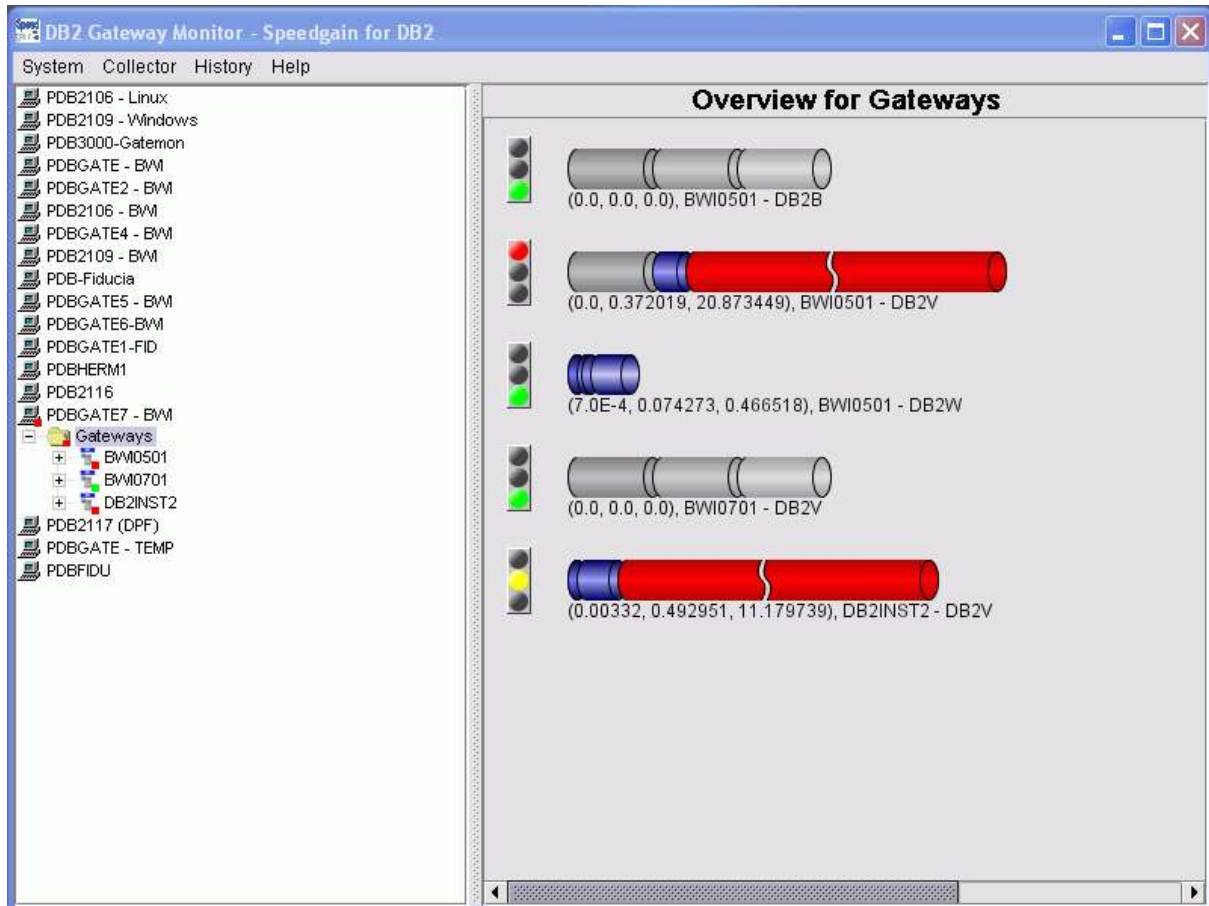


Figure 5. Realtime monitoring overview (this figure should come before historic and same with paragraph don't you think?)

Thresholds can be defined for the time being spent within each component as well as for the overall connection time.

In the preceding sample the snapshot interval is set to 60 seconds. This means that the collector collects DCS snapshot data and performance data from the mainframe every 30 seconds.

Default monitoring thresholds are set as follows

	Warning (yellow light)	Critical (red light)
Gateway	2 sec	5 sec
Network	2 sec	5 sec
z/OS	5 sec	10 sec
Overall	10 sec	20 sec

Table 1-1. Default Monitoring Thresholds

The status of a single component is indicated by the color of the corresponding segment of the pipe. The overall status is indicated by the traffic light left from the pipe. For the path DB2INST2 – DB2V this results in a yellow light for the overall connection (11.57 sec is more than 10.00 sec but less than 20.00 sec) and a red light for the z/OS component (11.18 sec. > 10.00 sec.)

**One-click-to-the-problem**

By double clicking the critical resource ...finish....

*One-click-to-the-problem (critical resource DB2V)*

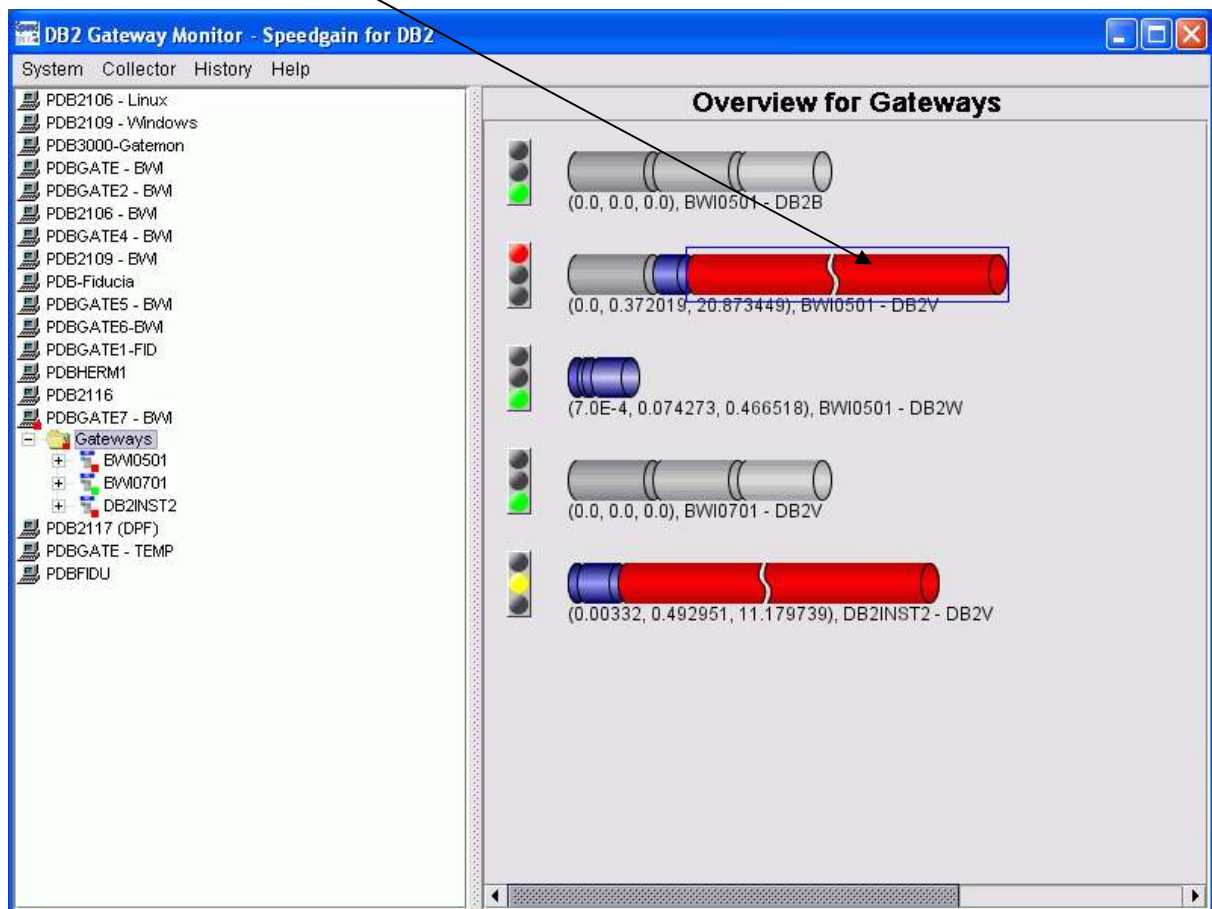


Figure 6. One click

...the tree expands and the cause of the problem will be pinpointed. In this case the relative elapsed execution time (which is the execution time for all connections from DB2INST2 on the z/OS between 2 snapshots).

(critical resource DB2V)

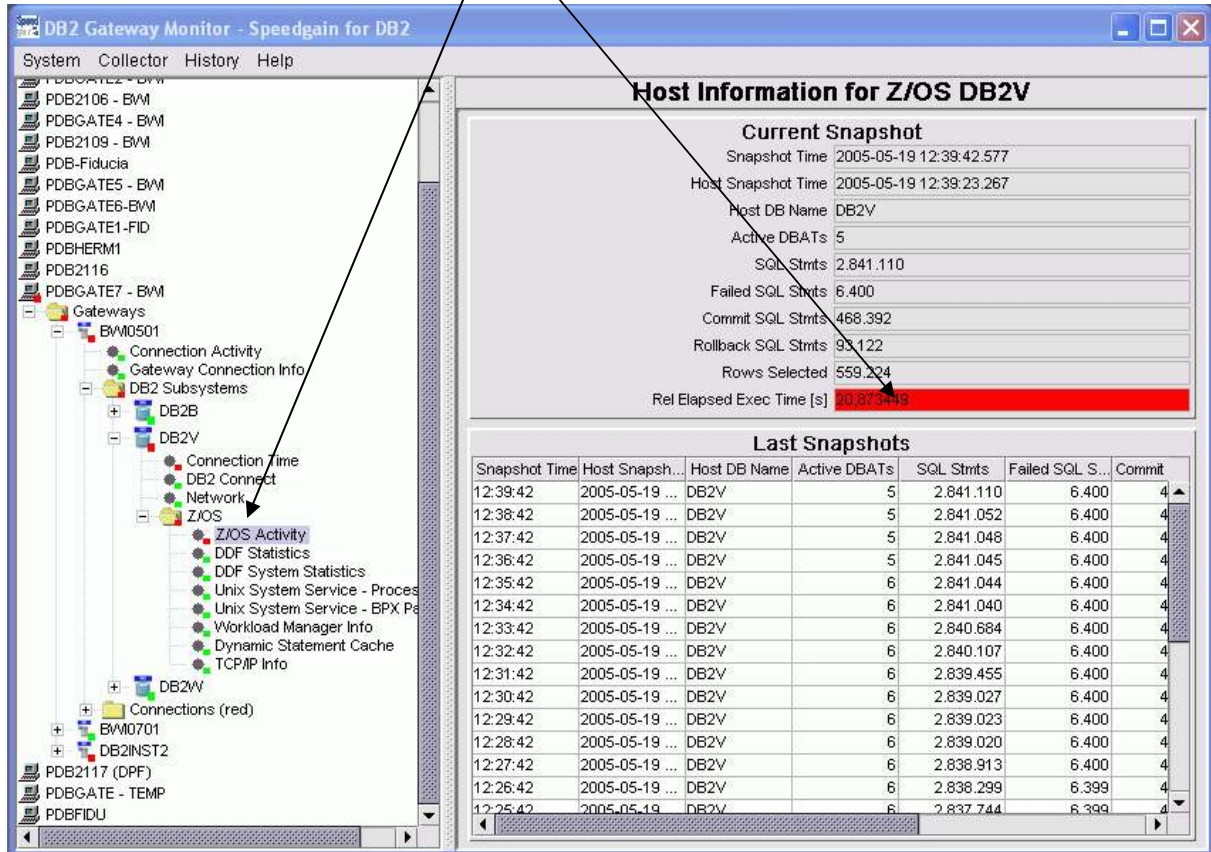


Figure 7 Detailed information z/OS activity

Or get detail about the critical path with just one click on the traffic light.

One click to the problem (critical path BWI0501 <-> DB2V)

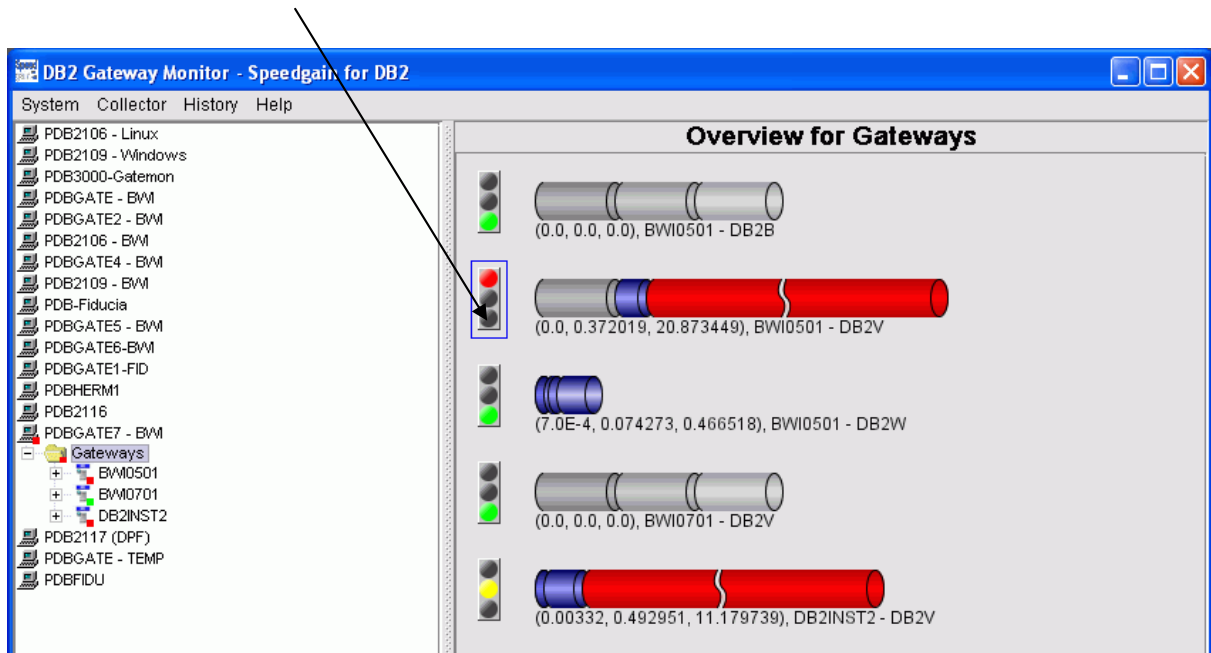


Figure 8. One click again

(Path BWI0501 <-> DB2V)

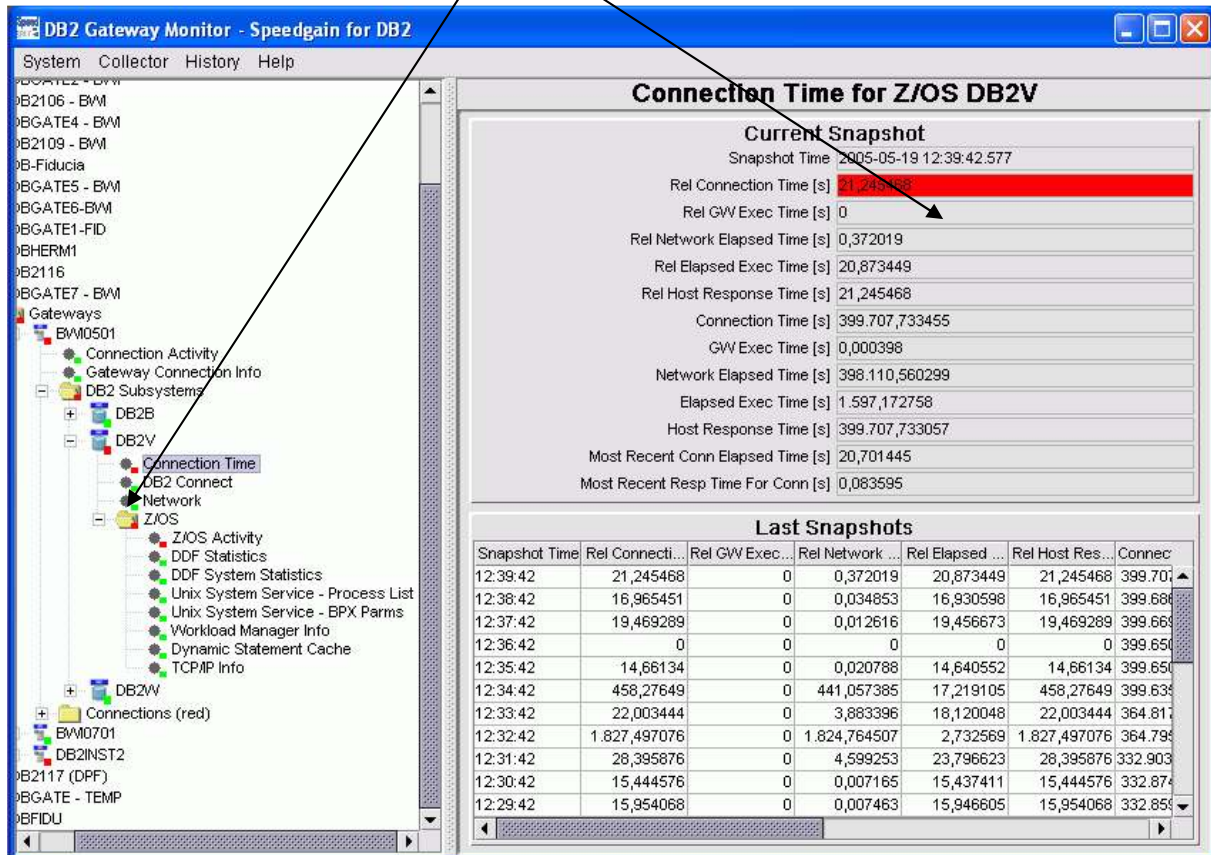


Figure 9. Detailed information z/OS connection time

The Relative Connection Time is the overall time for gateway, network and z/OS resources consumed by all active connections during the snapshot interval for the path BWI0501 -> DB2V.

**Dynamic Statement Cache**

In many cases performance problems on the mainframe are caused by poorly constructed SQL. To enable administrators to pinpoint these kind of problems easily Speedgain displays the relevant information from the Dynamic Statement Cache.

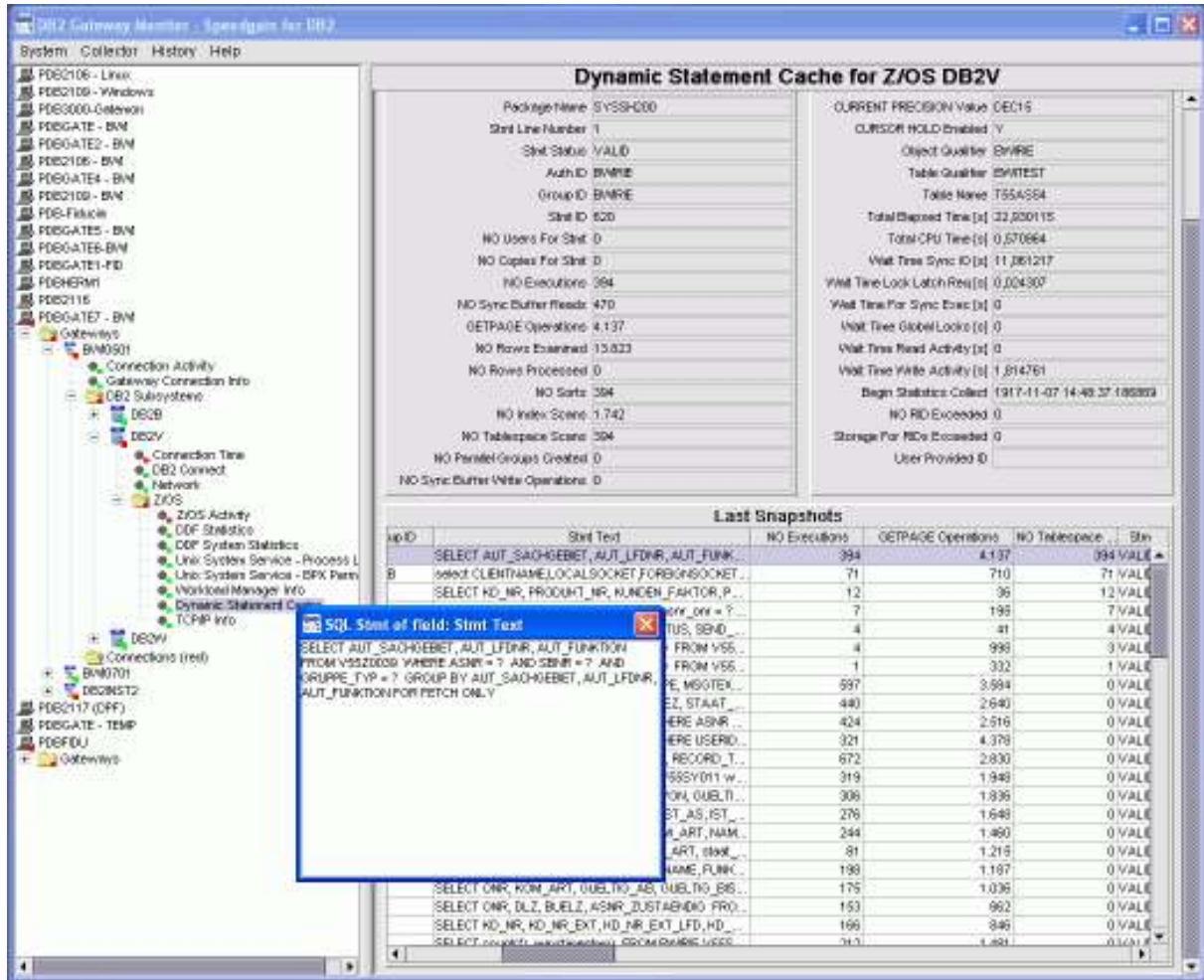


Figure 10. Capturing SQL from the Dynamic Cache

**Drilldown Analysis**

But there are many possible reasons for poor performance besides unacceptable SQL statements. Many different components are involved when a remote application connects to DB2 for z/OS. Starting with the COMM DRIVER and ending up in the DB2MSTR address space. The following picture gives an overview about the information the DB2 Gateway Connect monitor supplies for each component. The ability to capture and synthesize information from such disparate processes is a breakthrough capability only provided by the Speedgain Gateway Monitor!

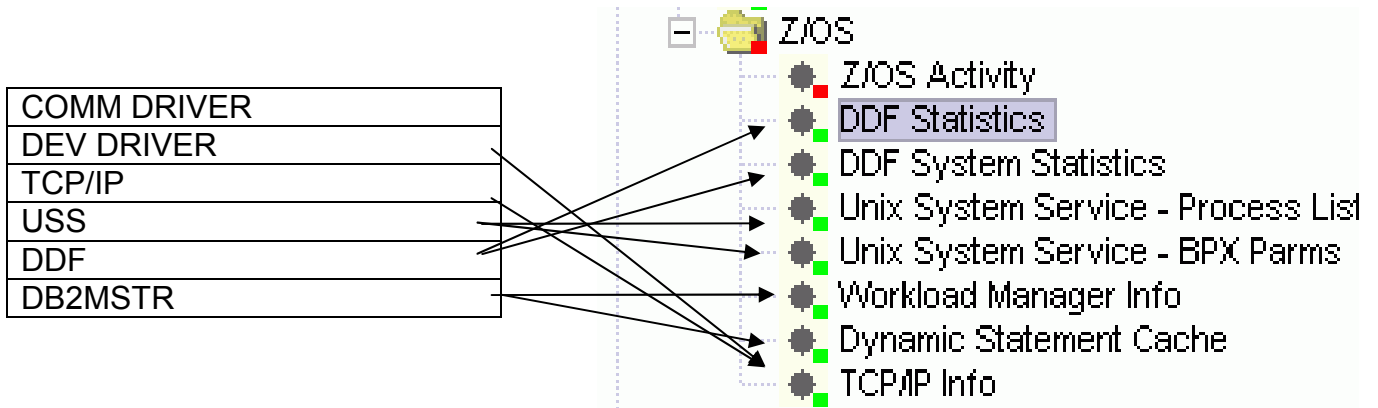


Figure 11. Information sources for Gateway Monitor

This is where one can drilldown and start a detailed investigation of the problem by analyzing the workload and the configuration for each component to find bottlenecks and more... finish....

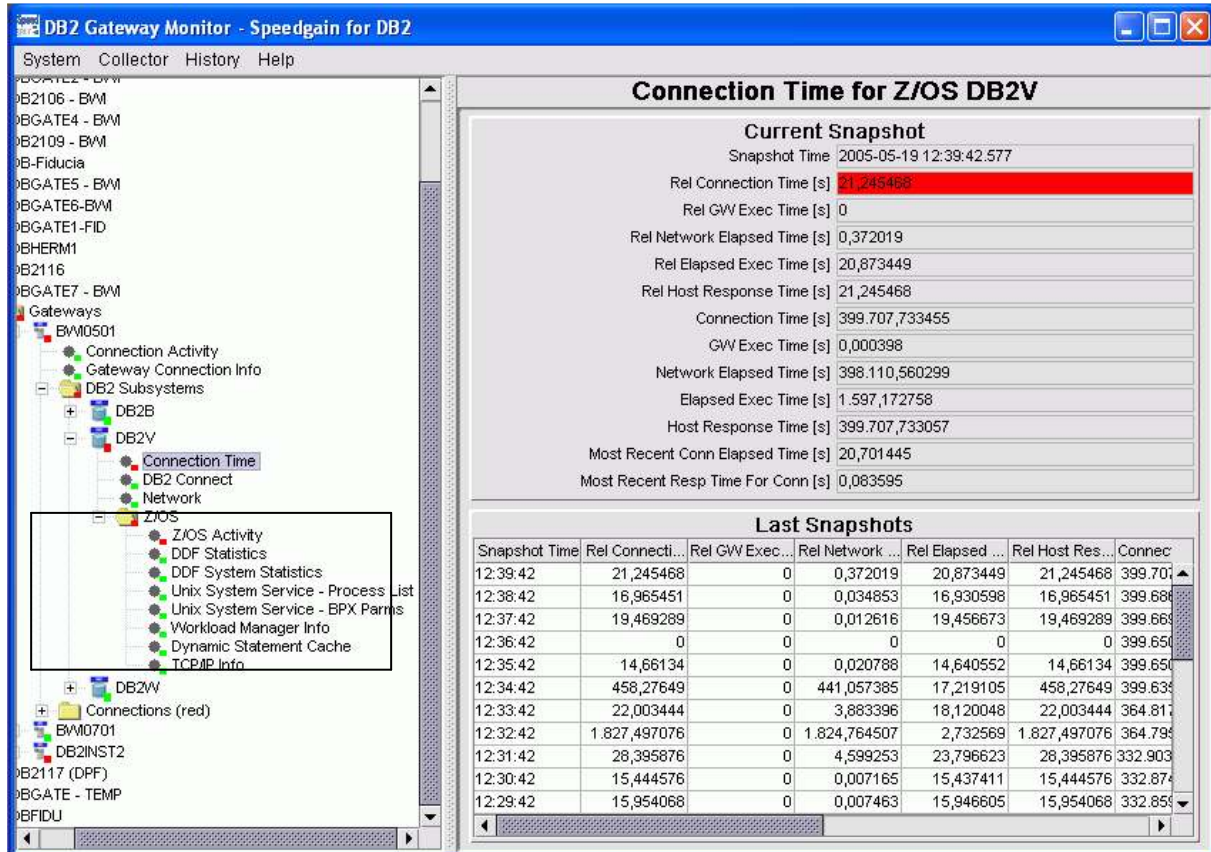


Figure 12. Drill down

Under z/OS Activity you find summarized SQL activity figures as shown below.

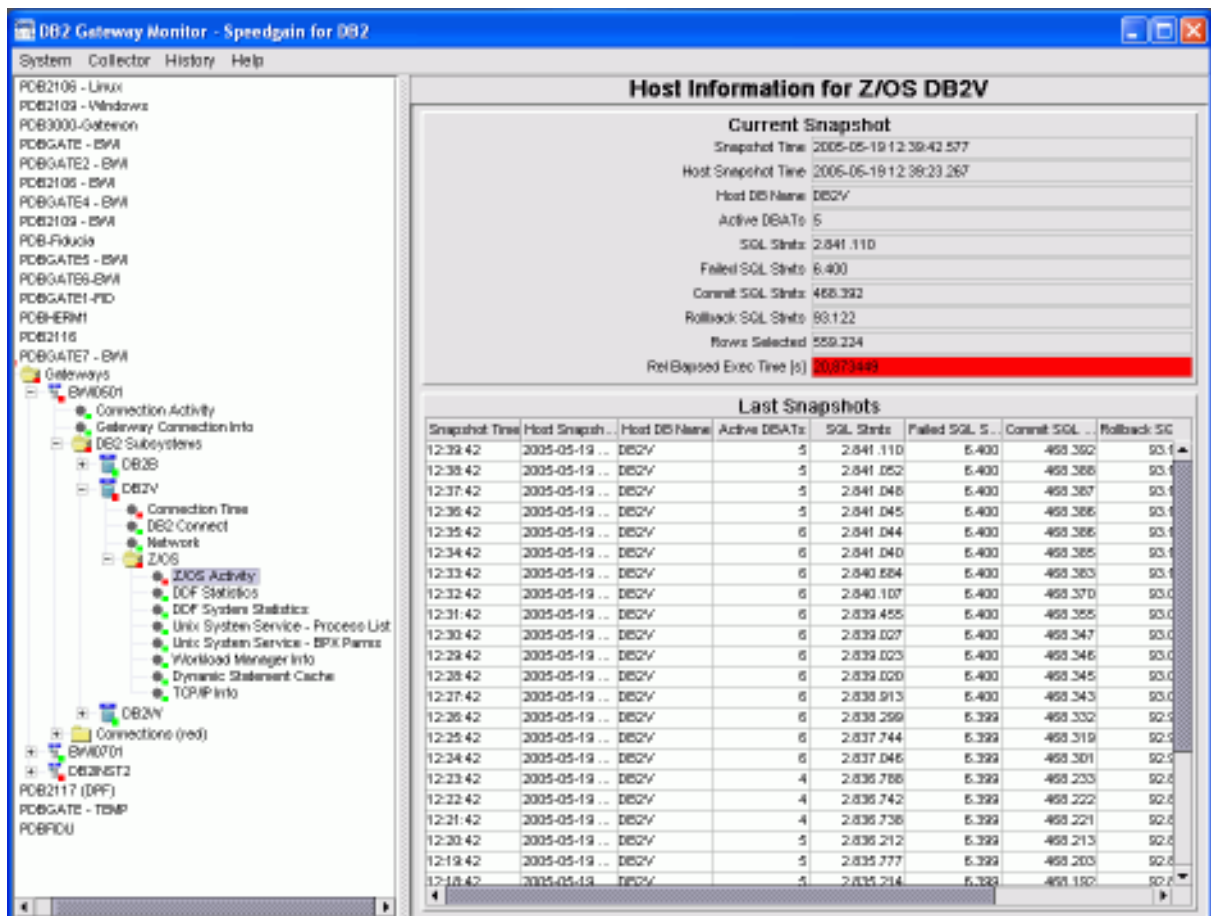


Figure 13. z/OS information

From DDF, the following information is available

- SQL-Workloads
  - o SQL STMT SENT

- SQL STMT RECEIVED
- PREPARES SENT
- PREPARES RECEIVED
- Block-Fetching-Workload
  - BLOCK FETCH SENDS
  - BLOCK FETCH RECEIVED
  - BLOCK FETCH ROWS
  - FETCHES PER BLOCK
  - BLOCK FETCH RATIO
- UOW-Workloads
  - COMMIT SENT
  - COMMIT RECEIVED
  - ROLLBACK COUNT
  - COMMIT COUNT
- Connection-Workloads
  - CONVERSATIONS INITIATED TO
  - CONVERSATIONS INITIATED FROM
  - CREATED DBAT REQ SENT
  - CREATED DBAT REQ RECEIVED
  - MESSAGE SENT
  - MESSAGE RECEIVED
  - BYTES SENT
  - BYTES RECEIVED
  - CONVERSATION REQ QUEUED
- TWO-PHASE-COMMIT Workload
  - BACKOUT COORD SENT
  - BACKOUT COORD RECEIVED
  - LAST AGENTS SENT
  - LAST AGENTS RECEIVED
  - FORGETS COORD SENT
  - FORGETS PART RECEIVED
  - INDOUBT COUNT

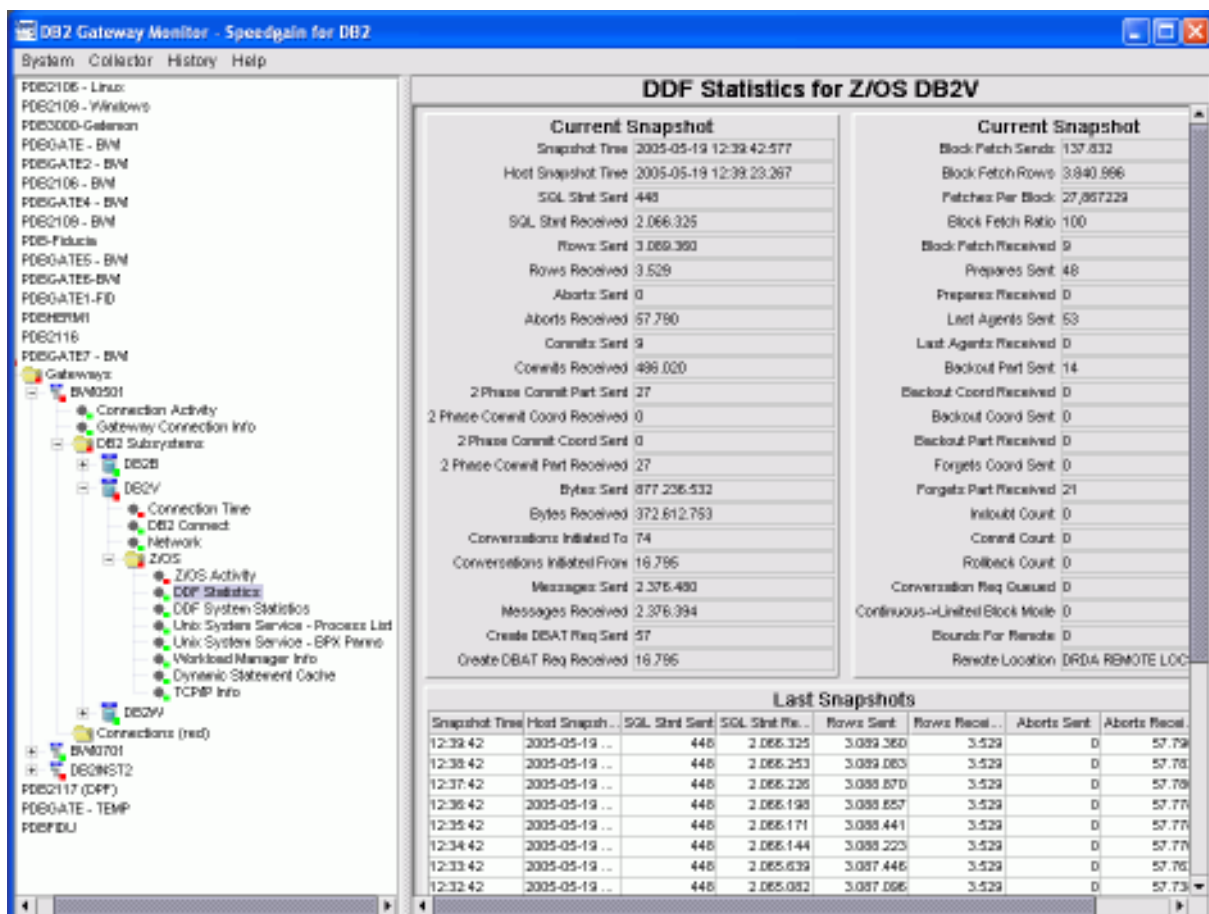


Figure 14. DDF Statistics

### Thread Pooling

How well does my thread pooling really work? This is an excellent question asked by many, but normally not easy to answer. The Speedgain Gateway Monitor provides the answer right away. Just have a look in the DDF – SYSTEM WORKLOAD information to get detailed pooling information for both

- TYPE 1 (PRIVATE PROTOCOL)
- TYPE 2 (DRDA PROTOCOL)

connections.

Optimization of pool configuration is easy using the historic features of the Speedgain Gateway Monitor to see the impact of configuration changes. (change inactive.. to inactive and ...active ....to active.

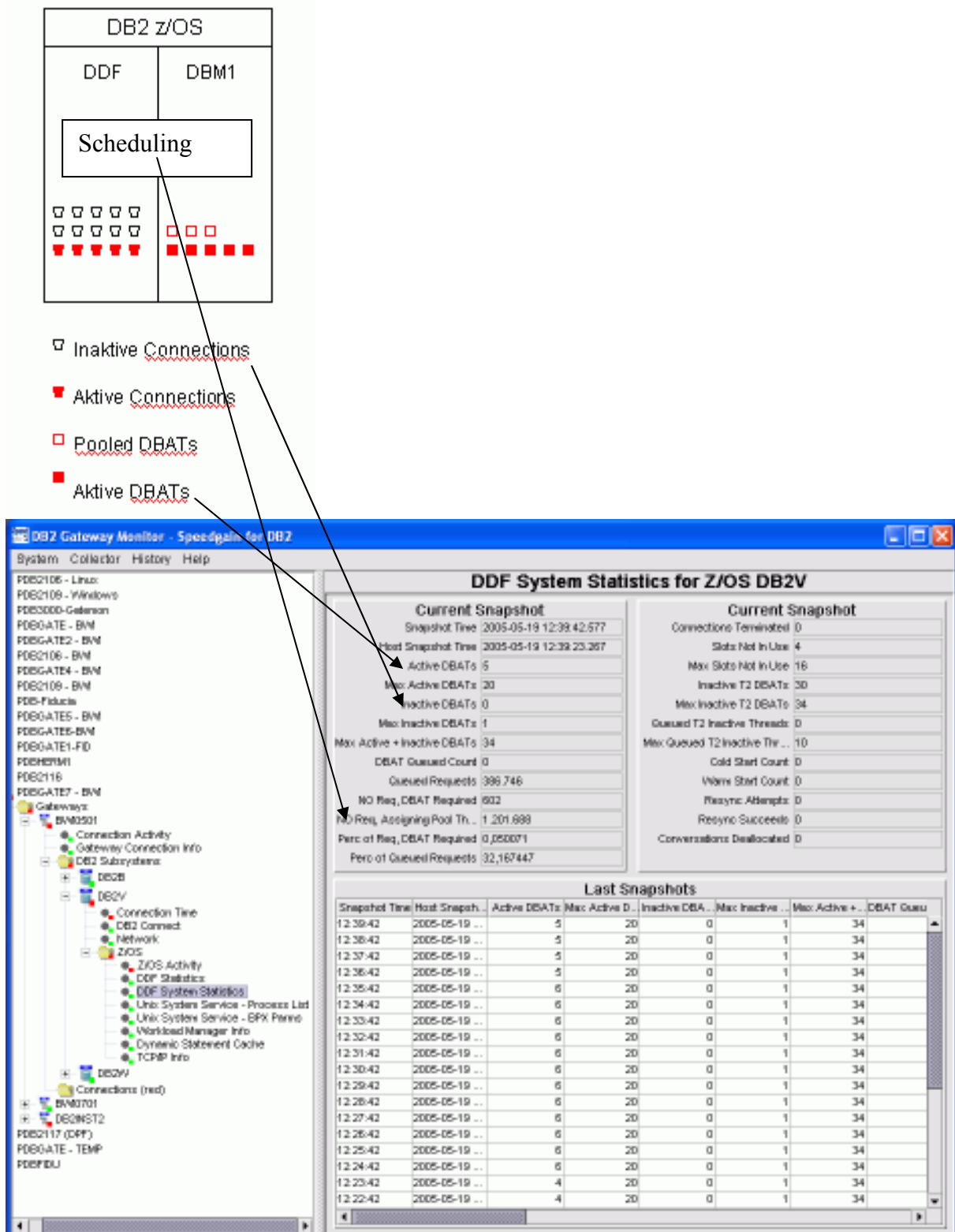


Figure 15. DDF Thread pooling information

### USS (Unix System Services) THREAD WORKLOAD AND CONFIGURATION

The USS Workload implied by remote DB2 connections is basically determined by the number of number of threads in the DB2 DDF (Distributed Data Facility) Address Space and the number of system calls executed by these threads. The number of USS threads needed for DDF is calculated as follows:

- 1 for the DDF-Listener
- 1 for the DDF-Coordinator
- 1 for each connected thread

All this information is available within the Speedgain Gateway Monitor

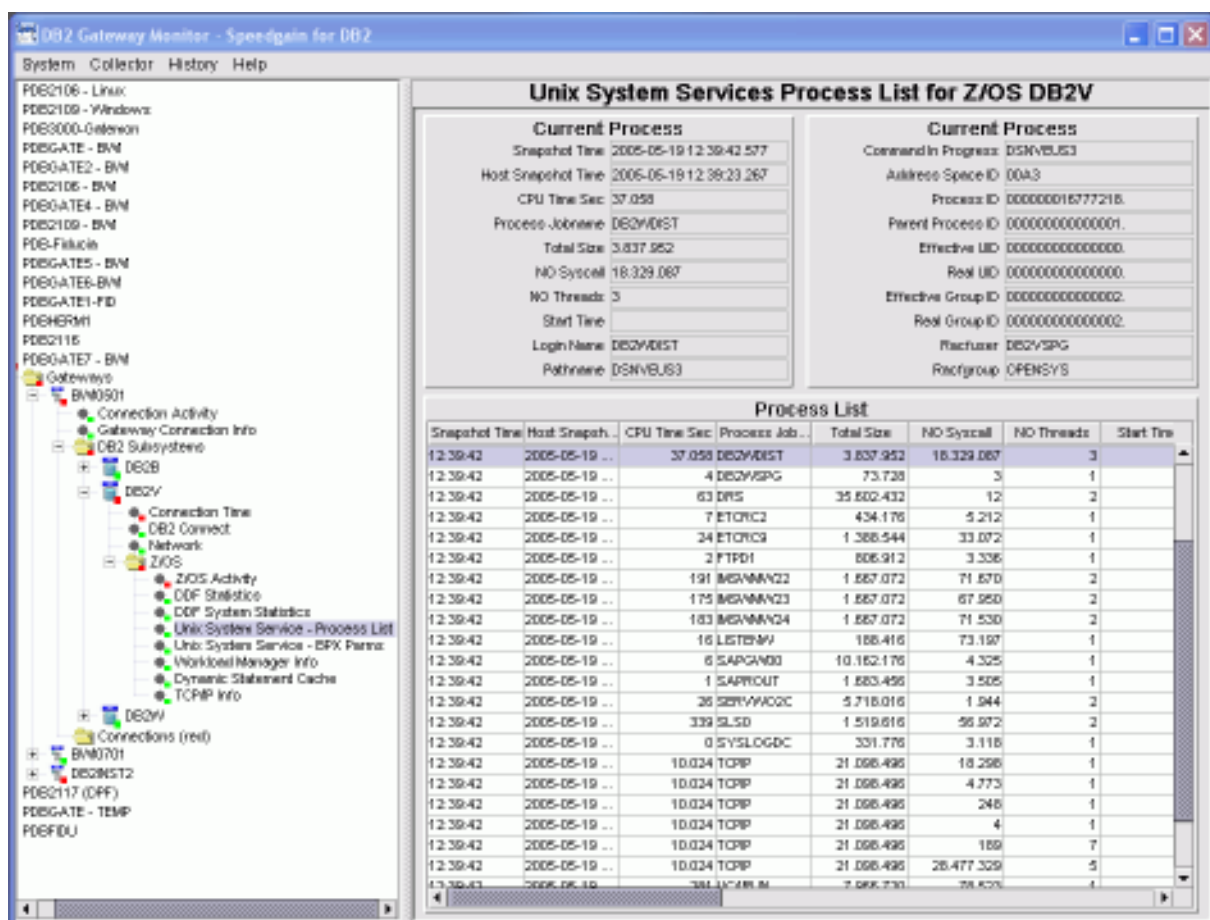


Figure 16. Unix System Service information

USS Workload information combined with data from the USS configuration helps to find bottlenecks. E.g. in the USS Configuration you can specify the maximum number of active threads handled at one time. What happens if this number is reached? The answer is: new requests for thread creation will be queued, which might have a heavy impact on DB2 performance for remote connections.

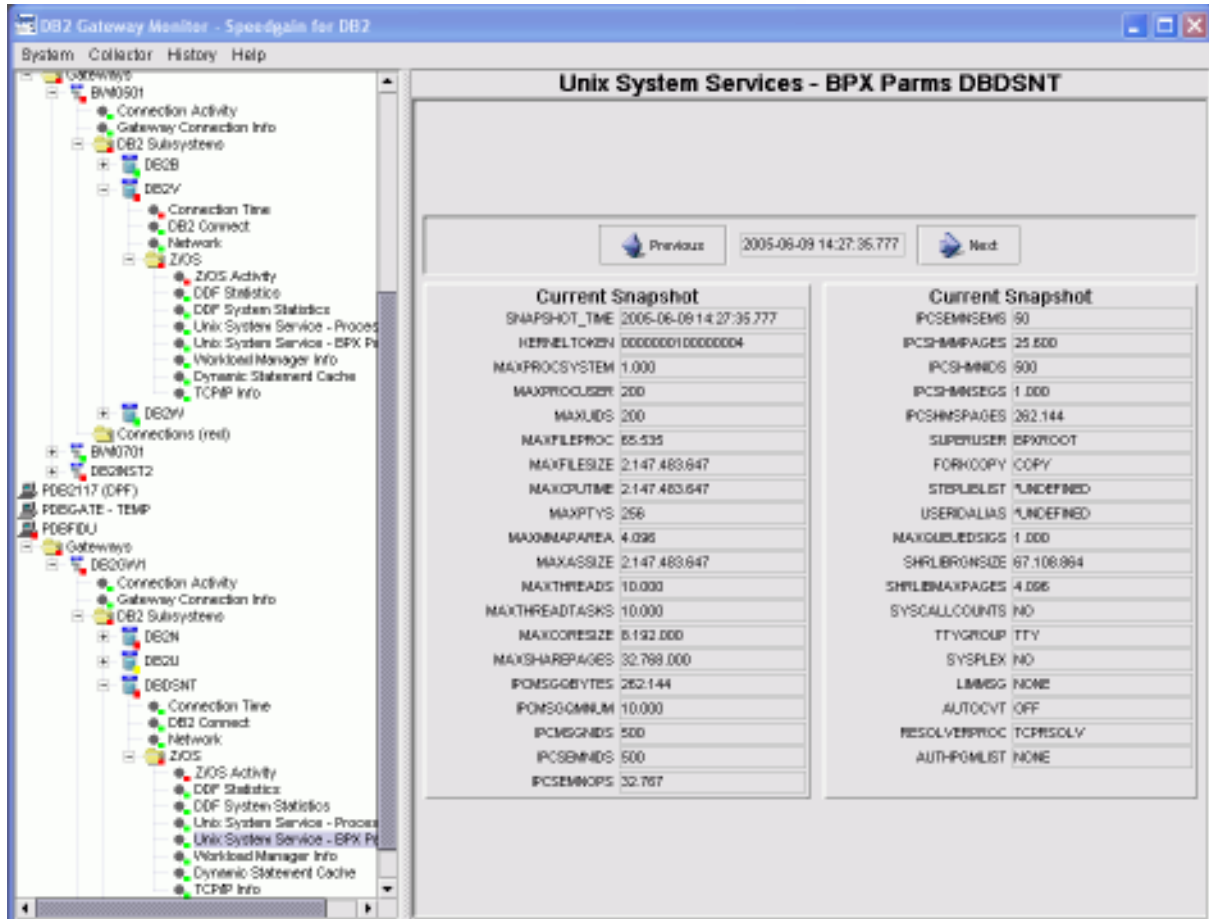


Figure 18. USS Configuration

**Summary**

The Speedgain Gateway Monitor is revolutionary since it is the only product in the industry that is totally focused on remote DB2 connections. It allows you to conduct end-to-end enterprise wide monitoring of remote DB2 connections, with just one tool. The Speedgain Gateway Monitor is a very powerful and flexible monitoring solution for DB2 Connect. It contains real-time monitoring capability and 24x7 unattended monitoring via a provided user exit through which DBAs, operations staff, or network administrators can be sent a page or an email if a threshold is breached. With the performance database, historical analysis and trending can be easily conducted. Answers to questions regarding past DB2 Connect performance problems can now be easily found and answered. This is especially useful in organizations with hundreds or thousands of connections where it is impossible for a DBA to pinpoint problems when relegated to looking at an online monitor. The product can also be used by operations personnel to monitor DB2 on a 24x7 basis.

Key configuration parameters and workload metrics are monitored and predefined default thresholds are used to alert DBAs to problems via YELLOW and RED lights for the affected resource. The software is architected to take you right to the cause of the problem and answers the Question "Where is the performance bottleneck in my DB2 Connect environment?" within a matter of seconds. Suboptimal SQL is easily identified and planned enhancements are offered including an SQL graphical explain. The Speedgain Gateway Monitor breaks down the previous barriers to DB2 Connect monitoring and provides first-time DB2 Connect monitoring capabilities that organizations cannot be without.