

This is the tutorial for IBM's Application Performance Analyzer for z/OS[®], one of the IBM zSeries[®] problem determination tools.



- Introduction
- The application tuning process
- Entering observation requests
 - Navigation and options
 - Entering requests
 - Examples
- Viewing analysis reports
- An analysis walkthrough
- Printing analysis reports
- Working with program source

You can use this course to learn how Application performance analyzer can help you improve the performance of your applications, by showing which programs and statements are using the most time and system resources. The objective is that you will find this training format informative and convenient, since you can take the course at your own pace.

By taking this tutorial, you will understand the various features of APA, and how you can use it to develop a better understanding of the performance characteristics of your applications. APA provides new application-specific functions beyond the standard z/OS system utilities and monitors, and is designed to address the needs of application developers working with complex applications.

Take a look at the sections in this tutorial. If you have not already used APA, you should take each section in order. But if you have already used it and want to learn more about a particular topic, you might want to go directly to that section.

You are in the introduction now, and in this section there is an overview of how APA is used and how to get the manuals from the IBM website.

In the next section: "The application tuning process", you will learn about the steps that you might perform to identify performance bottlenecks in your applications. You will learn how to identify CPU-intensive and wait-intensive applications, and how APA can be used to assist you during the process.

Take the "Entering observation requests" section to learn about navigation and options using the APA interface. Also, take the section to learn how to start an APA observation session to gather performance information about your application while it runs and to see examples of various scenarios in which an observation request can be entered.

In the "Viewing analysis reports" section, you will learn to navigate the performance reports to understand the information that APA makes available after it has gathered information about an application. The analysis reports provide data you can use to help isolate performance bottlenecks.

The next section: "An analysis walkthrough" shows a step by step example of using APA performance reports to determine where an application is spending the bulk of its time.

The "Printing analysis reports" section will show you how to generate printable reports, send them to SYSOUT and generate a PDF or XML file.

And finally, take the "Working with program source" section to learn how to map program source information so that you can pinpoint individual program statements that might be causing performance problems. In this section, you will also learn how to compile your program so that source information is available for APA in the right format.

What is Application Performance Analyzer?



- APA is a tool that helps you perform application performance tuning for applications running on z/OS systems
- What is application performance tuning?
 - The process of minimizing the amount of time and system resources (CPU, IO, and so on) that an application uses

3

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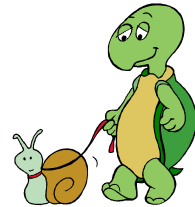
APA is a tool that helps you perform application performance tuning for applications running on z/OS systems.

Application performance tuning is the process of minimizing the amount of time and system resources that your application uses when it run. By system resources, it is typically referring to CPU time, and IO operations (such as reading and writing to files or databases).

When should you do application performance tuning?



- Typically, application tuning is done when a performance problem is noticed
- A transaction's response time is slow
 - A batch job did not complete in the required time window



4

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When should you perform application performance tuning?

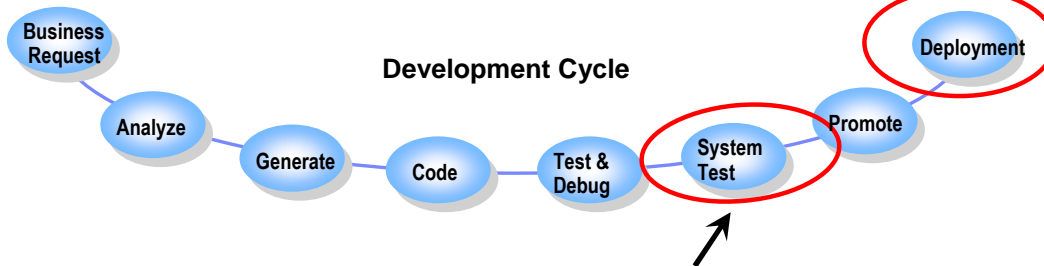
Most often, you will do application tuning when you have noticed a problem. For example, online transactions are running too long, and users are complaining about long response times. Or maybe a batch job that runs every day starts to run longer than usual, and does not complete in its scheduled time window.

Why should you do application performance tuning?



- **Resolve production performance problems**

- Improve response time in online applications
- Reduce batch run time
- Fix application bottlenecks



- **Prevent problems in new / modified applications**

- Ensure performance goals are still being met
- Verify that changes will not hurt performance

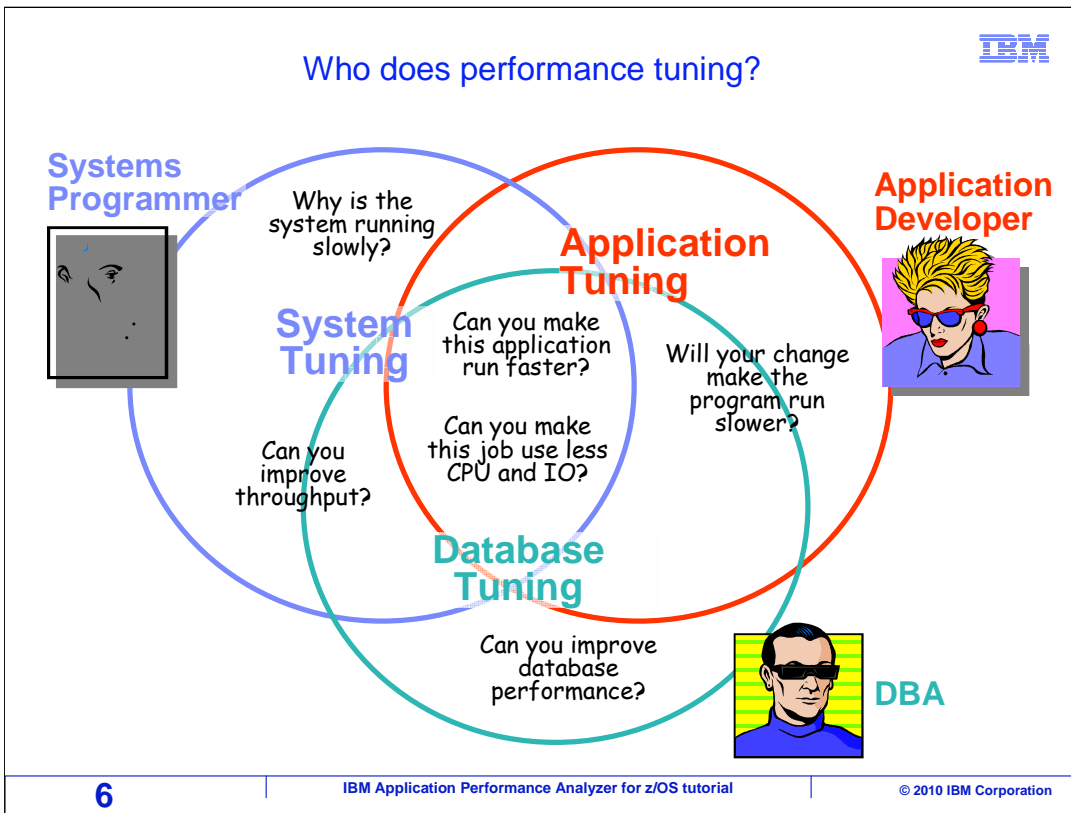
5

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It is probably most typical to do application performance tuning when you notice that production applications have problems, that is slow response times or batch jobs running too long. And the focus of the tuning effort should be to fix performance bottlenecks.

But it can also be advantageous to do performance tuning earlier in the application life cycle, during system testing. At this stage, you might be able to identify potential problems before they get to production. You can ensure that new applications meet your performance goals, and that changes that you have made will not have an adverse performance impact.



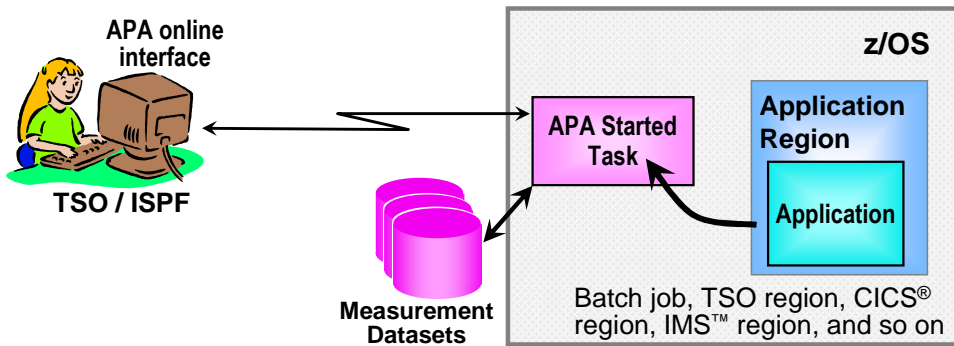
So who does performance tuning? There might be a lot of people who have roles in the application tuning process. And each can have a different perspective on the problem. An application developer might be more focused on the performance of a single application, or a set of applications. He or she might be interested in questions like, “Will a change make the program run slower?”. A Database Administrator might approach the issue from the perspective of how the database management system performs, and might be more interested in questions like “Can the database performance be improved?”. And a systems programmer might approach it from the perspective of the entire system, rather than individual applications, and might have interest in questions such as “Why is the entire system running slowly?”. As this chart implies, all of these people have overlapping interests. Questions like “Can the application be changed to run faster?” and “Can the job be changed to use less CPU and I/O” can be of interest to all. This is often best resolved through a collaborative effort.

APA’s focus is on the application tuning process. There are other monitors, Omegamon for example, that are designed to provide information across multiple applications or for an entire system. APA is designed to help you understand the detailed performance characteristics of a single application.

How does APA help you tune your application?



- APA collects detailed performance information about an application while it runs
- It processes the collected info, and presents it in formatted displays and reports



7

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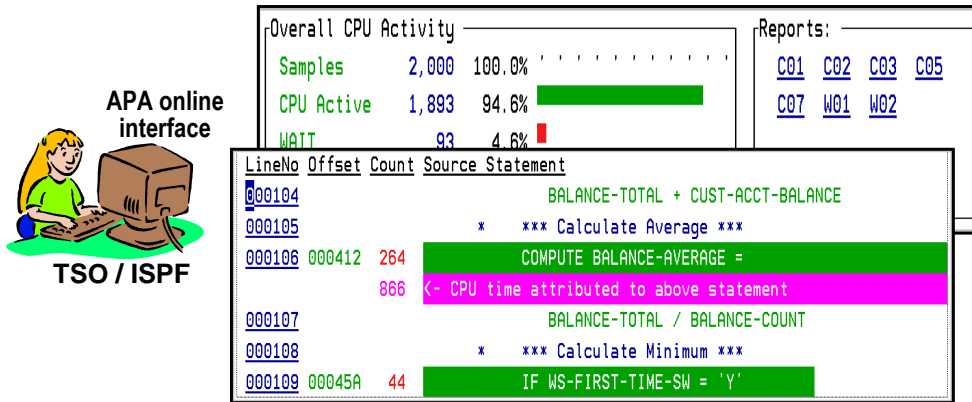
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APA can collect detailed performance information about an application while it runs. After it has observed an application running, it processes the collected information, and presents it in formatted displays and reports. Most people use APA by accessing it through its online interface from TSO.

What are you trying to determine using APA?



- Use APA to answer the question:
"Where is the application spending its time?"
- Based on the answer, "Can a change be made to make it run faster?"



8

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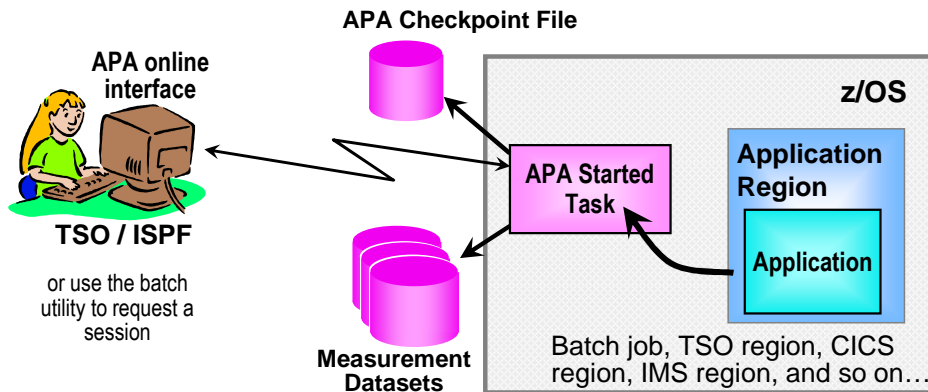
How does APA help you tune your application? The most important thing that APA does is to help you answer the question: "Where is the application spending its time?". For example, is it spending most of its time, using CPU cycles, reading or writing to files, or waiting on other resources. And specifically, which programs or modules are causing the CPU or wait time. Based on the answer, you are better equipped to answer the question: "Can a change be made to the application or the system to make it run faster?"

Here is how APA works



- **First, request an observation session**

- Use the online interface to request a session
- Monitor an active application, or schedule a future session



9

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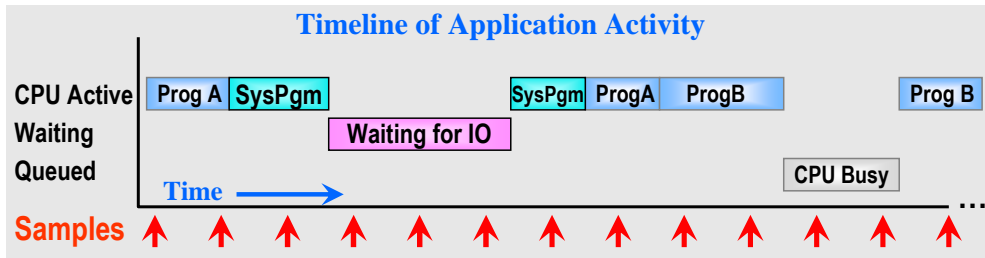
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Here is how it works. First, you request an observation session. The easiest way to do it is to use the online interface to tell APA to monitor your application while it runs. You can either monitor an application that is running right now, or schedule an observation session or sessions at some time in the future. During an observation session, APA collects performance information while the application runs, and stores the data in one or more measurement data sets. The observation request itself is stored in a file called the checkpoint file.

APA collects samples



- APA uses "Sampling"
 - APA collects information at fixed intervals
 - During each "sample", APA determines what the application is doing and why



- Collected data are stored in a measurement data set
- Samples are aggregated later, when you view APA reports

10

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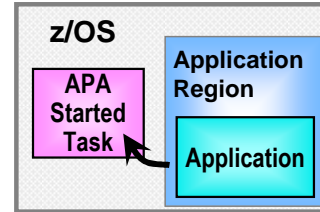
APA collects performance information using a sampling technique. When APA's observation session begins, it takes one sample. That means that APA takes something like a snapshot of what the application is doing at one moment in time. It determines whether the application is actively using the processor or waiting for system resources, and it gets detailed information about the program, and even the instruction that is either using CPU time or waiting. APA retains the detailed information for that sample, and then waits for a fixed interval of time. Then it takes another sample, to find out what the application is doing at that moment, and collects information. For example, in this chart during the first two samples, the application was executing instructions in program A. During the third sample, it was executing instructions in a system module. During the next three samples, it was waiting for an I/O operation to complete. At any point in time, an application can only be in one of three states. It can be executing instructions in a program, which means it is using CPU time. It can be waiting for a system resource, such as for a file I/O operation to complete. Or, it can be waiting because the system CPU is busy servicing other processes.

Over time, APA will collect a statistically significant set of samples. And when aggregated, it gives you detailed information about where the application spends most of its time.

What overhead does APA have?



- **APA runs in its own address space**
 - Most of APA's processing does not increase resource usage (CPU, IO, and so on) of the application being monitored



- APA reports the CPU time that it uses

Excerpt of the "Measurement Profile" report

CPU time TCB	56.20 sec
CPU time SRB	0.02 sec
Service Units	2,512,623
Measurement SRB	0.09 sec

- System overhead from a single APA session is typically insignificant and does not skew measurement statistics
 - You can control the sampling rate if overhead is a concern

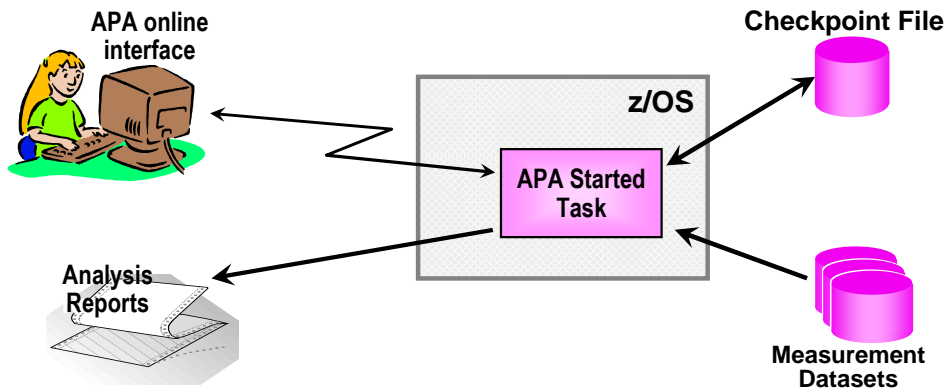
When you are using a monitor to collect performance information about an application, there is sometimes a concern about how much overhead the monitor has. First, be aware that APA runs in its own address space, so most of APA's processing does not increase the resource usage of the application being monitored. Of course, APA does use some CPU cycles to do its work, although most typically it will have no measurable impact on the application. However, APA reports exactly how much CPU time it uses. System overhead from a single APA session is typically insignificant and does not skew measurement statistics. But if it is still a concern, you can control APA's sampling rate.

APA uses analysis reports



▪ View and print analysis reports

- View sample file data from the APA online interface
- Or print performance reports to SYSOUT or to a PDF file
- Sample file data can also be written in XML format



12

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After an APA observation session has completed, the information is presented to you using analysis reports. You can view and print these reports. Most people view the reports directly using the APA online interface in TSO. Or you can print reports to SYSOUT, or even generate PDF files that you can download to your workstation and print from there.. APA generates its reports by aggregating data from the measurement data sets. Sample file data can also be written to a file in XML format and viewed in an XML reader

What information does Application Performance Analyzer provide?



- APA reports detailed information about:

<u>Category:</u>	<u>Sub-categories (partial list) :</u>
CPU usage	by Module, by Statement, by Timeline, ...
WAIT time	by Module, Statement Attribution, ...
DB2®	various Metrics by SQL stmt, Plan, Thread, ...
CICS	various Metrics by Txn and by Task, ...
IMS calls	by CPU Time, Call Service Time
DASD usage	by Device, by File, by Timeline, ...
HFS usage	by Device, by File, by Timeline, ...
MQ	by Queue, by Request, by Transaction ...
Storage	by Device, by Task, by Timeline, ...
And more	

13

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You can view a wide range of performance reports. Here are just a few. There are reports that describe CPU usage, and these reports are broken down by program or module, and you can even drill right down to the program statements that use the most CPU time. There are similar reports for wait time. Using these reports, you can identify which programs or modules caused the most wait time, and drill right down to the program statements. For DB2 applications, there are reports containing various metrics, broken down by SQL statement, by the plan, by the thread, and so on. For CICS applications, the information is broken down by transaction, by task, by program, and much more. For IMS applications, there are reports broken down by CPU time and by call service time. And there are reports that provide information about disk usage and storage.

What languages are supported?



- APA will monitor applications written in any language, and can also provide source level information for:
 - **COBOL**
 - Enterprise COBOL
 - COBOL for OS/390/VM
 - COBOL for MVS/VM
 - VS COBOL II
 - OS/VS COBOL
 - **PL/I**
 - Enterprise PL/I
 - OS PL/I
 - **C / C++**
 - **Java™**
 - **Assembler**

For source-level analysis, source info must be saved when the program is compiled

Depending on the compiler, this can be:

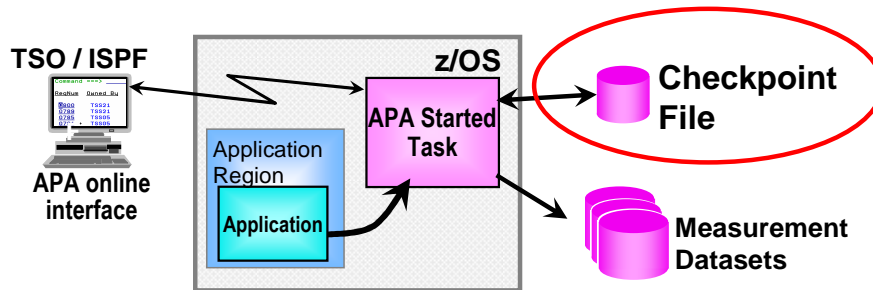
- a compiler listing
- a SYSDEBUG file
- a LANGX file
- an ADATA file

One of the best features of APA is that you can drill down to the program statement level, to identify exactly which statements caused the most CPU time and wait time. APA can perform this source mapping for the programs using the IBM compilers that is indicated on the slide. They include COBOL, PLI, C, C++, Java, and Assembler. To enable source mapping in APA, source information must be saved when your programs are compiled. Depending on the compiler, source information can be saved in the form of compiler listings, SYSDEBUG files, LANGX files, or assembler ADATA files.

The checkpoint file stores the observation's status



- When you request an observation session, APA records the status of your request in a Checkpoint File
- The checkpoint entry is updated with info about the session as it starts / runs / completes
- In a SYSPLEX environment, it is on shared DASD
- Information is retained across IPLs



15

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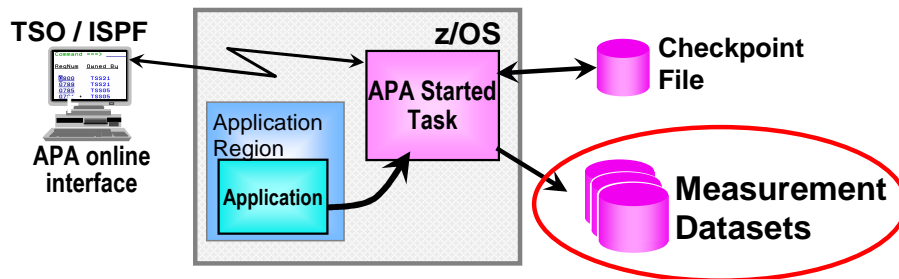
When you request an observation session, the entry is stored in the checkpoint file. The checkpoint entry contains information about the session, and is updated as the session starts, and completes.

In a SYSPLEX environment, the checkpoint file can be on shared DASD. That way, you can request an observation session from one LPAR for an application that is running on another LPAR. Also, information in the checkpoint file is retained across IPLs. So you can request an observation session to run at some future time, and the request is retained even if the system is IPLed.

The measurement datasets store the sampling data



- Sampling data from an observation session is stored in Measurement Datasets
 - They are allocated automatically by APA
 - The names are controlled by the Systems Administrator, and typically start with:
`' user-id . owner-id . request-# . JOBNAME '`
 - If you delete an observation session, the Measurement Datasets are also deleted



16

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Sampling data from observation sessions are stored in measurement data sets. Measurement data sets are allocated automatically by APA when an observation session starts. The names of the files are controlled by the person who installs APA. If you delete an observation session, the measurement data sets are also deleted automatically.

IBM PD Tools (including APA) information is on the web



<http://www.ibm.com/software/awdtools/deployment/>

The screenshot shows the IBM website for z/OS Problem Determination Tools. The page includes a navigation menu, a search bar, and a main content area with sections for 'Retooling System z for SOA Workloads Growth', 'Webcast', 'Why IBM', 'What we offer', and 'Products'. A red arrow points to the 'Products' section, and a callout box says 'Select APA from the list'. The footer contains the number '17', the text 'IBM Application Performance Analyzer for z/OS tutorial', and the copyright notice '© 2010 IBM Corporation'.

You can get the APA manuals, and more information about APA from the IBM website. From your Internet browser, go to www.ibm.com/software/awdtools/deployment/. Then select Application Performance Analyzer from the Products section.

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Highlights

- Brochure: IBM Problem Determination Tools Reference Guide (295KB)

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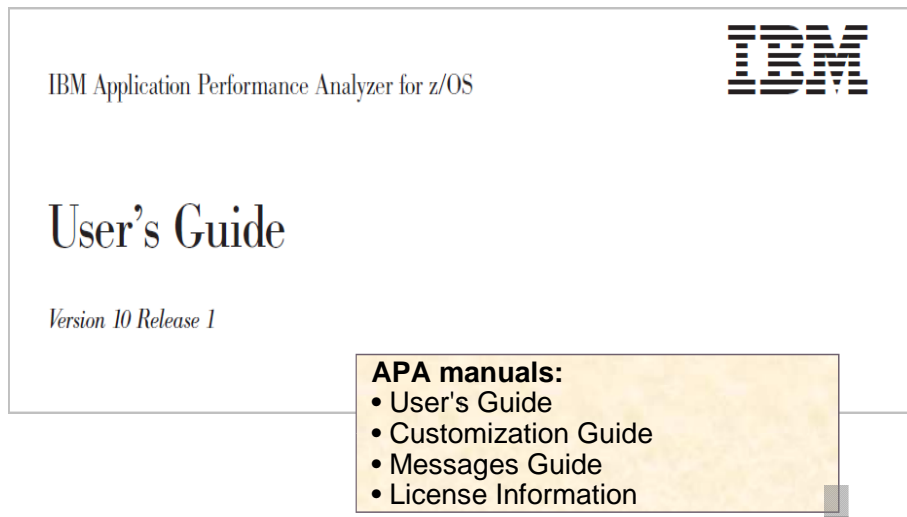
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From the APA library, you can view the manuals online or download them in PDF format. One advantage to downloading the manuals to your workstation is that you can perform text searches for keywords of interest.



Most people should download the Users Guide, and if you are the person responsible for installing APA, you will also want to download the Customization Guide.

That is the end of this section, an introduction to application performance analyzer.

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