

We Claim:

1. A monitoring system for virtual application environments comprising:

at least one physical machine executing a first operating system;

at least one virtual machine operating on at least one of the at least one physical machines, each such virtual machine operating a second operating system; and

an agent program operating on each of the at least one physical machines,

where, each agent program is operable to obtain a first set of metrics from the first operating system, such first set of metrics including metrics in respect of each virtual machine as viewed by the first operating system, and operable to connect to the second operating system of each virtual machine hosted on the physical machine the agent program operates on and obtain a second set of metrics in respect of the virtual machine from the second operating system, the agent program further operable to communicate the first and second sets of metrics to a manager program.

2. A monitoring system for virtual application environments comprising:

at least one physical machine executing a first operating system;

at least one virtual machine operating on at least one of the at least one physical machines, each such virtual machine operating a second operating system; and

an agent program operating on each of the at least one physical machines and at least one vm agent program operating on a virtual machine hosted by the physical machine,

where, the agent program is operable to obtain a first set of metrics from the first operating system, such first set of metrics including metrics in respect of each virtual machine as viewed by the first operating system and operable to connect to the second operating system of each virtual machine hosted on the physical machine, excepting the virtual machines having a vm agent program operating thereon, the agent program operates on and obtain a second set of metrics in respect of the virtual machine from the second operating system, each vm agent program operable to obtain a second set of metrics in respect of the virtual machine from the second

operating system of the virtual machine on which it operates, the agent program further operable to communicate the first and second sets of metrics to a manager program and the vm agent program further operable to communicate the second set of metrics to the manager program.

5 3. A monitoring system for virtual application environments comprising:

at least one physical machine executing a first operating system;

at least one virtual machine operating on at least one of the at least one physical machines, each such virtual machine operating a second operating system; and

an agent program,

10 where, the agent program is operable to connect to each physical machine in turn to obtain a first set of metrics from the first operating system, such first set of metrics including metrics in respect of each virtual machine as viewed by the first operating system and operable to connect to the second operating system of each virtual machine hosted on the physical machine and obtain a second set of metrics in
15 respect of the virtual machine from the second operating system, the agent program further operable to communicate the first and second sets of metrics to a manager program.

4. A monitoring system for virtual application environments according to any one of claims 1 to 3, including an application agent program, the application agent program
20 operable to obtain a third set of metrics in respect of a pre-determined application running on the virtual machine.

5. A monitoring system for virtual application environments according to claim 4, where the agent program includes the application agent program.

6. A monitoring system for virtual application environments according to claim 2 or
25 claim 4, as dependent on claim 2, where, in situations where a virtual machine is acting as a virtual server for at least one virtual desktop, the vm agent program operating on such virtual machine is operable to connect to each virtual desktop and obtain a fourth set of metrics in respect of the virtual desktop and communicate the fourth set of metrics to the manager program.

7. A monitoring system for virtual application environment according to claim 1 or claim 3, where, in situations where at least one virtual machine is acting as a virtual server for a plurality of virtual desktops, the agent program is further operable to connect to each virtual desktop and obtain a fourth set of metrics in respect of the virtual desktop and communicate the fourth set of metrics to the manager program.
8. A monitoring system for virtual application environments according to any preceding claim, where the manager program executes on a physical computer system and also operates as the agent program in respect of that physical machine.
9. A monitoring system for virtual application environments according to any one of claims 1 to 7, where the manager program executes on a stand-alone device in communication with the physical computer systems.
10. A monitoring system for virtual application environments according to any one of claims 3 to 7, as dependent on claim 3, where the agent program executes on a stand-alone device in communication with the physical computer systems.
11. A monitoring system for virtual application environments according to any preceding claim, where any one of the agent program, vm agent program, and/or application agent program as appropriate, operates to assess each metric in the respective set of metrics such agent program obtains and communicate the assessment of such sets of metrics to the manager program in place of the actual sets of metric values.
12. A monitoring system for virtual application environments according to any one of claims 1 to 10, where any one of the agent program, vm agent program and/or application agent program, as appropriate, operates to assess each metric in the respective set of metrics such agent program obtains and communicate the assessment of such sets of metrics to the manager program in addition to the actual sets of metric values.
13. A monitoring system for virtual application environments according to claim 11 or claim 12, where the agent program, vm program or application program, as appropriate, is operable to transmit only those metrics, if any, of the respective set or sets of metrics obtained by such agent program that have been assessed as abnormal.

14. A monitoring system for virtual application environments according to any preceding claim, where the first set of metrics includes metrics that fall within at least one of the following categorisations: outside processor metrics; outside memory metrics; outside disk metrics; outside network metrics; outside transmission control protocol metrics; outside process-related metrics; and outside log information.
15. A monitoring system for virtual application environments according to any preceding claim, where the second set of metrics includes metrics that fall within at least one of the following categorisations: inside processor metrics; inside memory metrics; inside disk metrics; and inside network metrics.
16. A monitoring system for virtual application environments according to any preceding claim, where the manager program is operable to perform root-cause error identification techniques on receipt of the various sets of metrics from the agent program, vm agent program and application agent program, as appropriate.
17. A monitoring system for virtual application environments according to any preceding claim, where the manager program provides for the administrator to select those metrics to form the various sets of metrics monitored by the agent program, vm agent program and application agent program, as appropriate.
18. A monitoring system for virtual application environments according to claim 17, where the manager program provides for the administrator to select the amount of time which is to elapse for each selected metric before that metric is re-assessed by the agent program, vm agent program and/or application agent program, as appropriate.
19. A monitoring system for virtual application environments according to claim 17 or claim 18, where the manager program provides for the administrator to enter connection details in respect of each virtual machine, the manager program operable to communicate such connection details to the appropriate agent program to allow them to connect to such virtual machines.
20. A monitoring system for virtual application environments according to any preceding claim, where after communicating the appropriate set of metrics or assessment thereof to the manager program, the manager program and each agent program, vm agent program or application agent program, as appropriate, execute a validation

process to determine whether the configuration the manager program operates under is the same as the configuration the agent program, vm agent program or application agent program, as appropriate, operates under.

21. A monitoring system for virtual application environments according to claim 20,
5 where the validation process includes compares the timestamp of the configuration the manager program operates under with the timestamp of the configuration the agent program, vm agent program or application agent program, as appropriate, operates under.

22. A monitoring system for virtual application environment according to any preceding
10 claim where the first set of metrics also includes metrics relating to the performance of the physical machine on which the agent program which records the first set of metrics operates.

23. A method of monitoring a virtual application environment comprising the steps of:

15 obtaining a first set of metrics including metrics in respect of each virtual machine from an operating system of a physical machine hosting such virtual machines;

connecting, in turn, to a second operating system of each virtual machine hosted on the physical machine; AND

20 obtaining a second set of metrics in respect of the virtual machine from the second operating system.

24. A method of monitoring a virtual application environment according to claim 23, further including the step of connecting, in turn, to each physical machine.

25. A method of monitoring a virtual application environment according to claim 23 or claim 24, including the step of obtaining a third set of metrics in respect of a pre-determined application running on one or more of the virtual machines.

26. A method of monitoring a virtual application environment according to any one of claims 23 to 25, where, in situations where a virtual machine is acting as a virtual server for at least one virtual desktop, the method includes the additional steps of:

connecting to each virtual desktop hosted by the virtual machine; and

obtaining a fourth set of metrics in respect of the virtual desktop.

27. A method of monitoring a virtual application environment according to any one of claims 23 to 26, where the method further includes the step of assessing each metric in the respective sets of metrics.

5 28. A method of monitoring a virtual application environment according to any one of claims 23 to 27, where the method further includes the step of performing root-cause error identification techniques in respect of the various sets of metrics obtained.

10 29. A method for monitoring a virtual application environment according to any one of claims 23 to 28, where the method further includes the step of allowing an administrator to select those metrics to form the various sets of metrics to be monitored.

15 30. A method for monitoring a virtual application environment according to any one of claim 29, where the method further includes the step of allowing the administrator to select the amount of time which is to elapse for each selected metric before a value for that metric is again obtained.

20 31. A method for monitoring a virtual application environment according to any one of claims 23 to 30, where the method further includes the step of allowing an administrator to enter connection details in respect of each virtual machine to be connected to.

25 32. A method for monitoring a virtual application environment according to any one of claims 23 to 31, where the method further includes the step of executing a validation process to determine whether the various sets of metrics to be obtained has changed and, if so, to ensure that further repetitions of the method obtain the various sets of metrics as newly defined.

30 33. An agent program for monitoring a virtual application environment, where the agent program is operable to obtain a first set of metrics from a first operating system executing on a physical machine, such first set of metrics including metrics in respect of each virtual machine as viewed by the first operating system, and operable to connect to a second operating system executing on a virtual machine, the agent program thereafter operable to obtain a second set of metrics in respect of

the virtual machine from the second operating system and communicate the first and second sets of metrics to a manager program.

34. An agent program for monitoring a virtual application environment, where the agent program is operable to connect to each physical machine in the virtual application environment in turn to obtain a first set of metrics from a first operating system executing thereon, such first set of metrics including metrics in respect of each virtual machine hosted by the physical machine as viewed by the first operating system and operable to connect to a second operating system executing on each virtual machine hosted by the physical machine and obtain a second set of metrics in respect of the virtual machine from the second operating system, the agent program further operable to communicate the first and second sets of metrics to a manager program.

35. A computer program product for monitoring a virtual application environment, the computer program product including executable code which when implemented by a suitable processing system causes the suitable processing system to obtain a first set of metrics including metrics in respect of each virtual machine from an operating system of a physical machine hosting such virtual machines; connect, in turn, to a second operating system of each virtual machine hosted on the physical machine and obtain a second set of metrics in respect of the virtual machine from the second operating system.

36. A computer program product for monitoring a virtual application environment according to claim 35, where the computer program product is for performing the method of any one of claims 23 to 32.