CLAIMS

What is claimed is:

1. A system for controlling clock frequency of processors, said system comprising:

a utilization measurement module to measure utilization of said processors;

a correlation module to estimate a balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors; and

a clock frequency adjustment module to calculate a clock frequency adjustment based on said estimated balance and said measured utilization and to update said clock frequency of said processors based on said calculated adjustment.

2. The system of claim 1, wherein said correlation module is further to:

change said clock frequency for a period of time associated with said balance estimation;

measure utilization change during said period of time; and

estimate said balance based on a ratio of said utilization change to said clock frequency change.

3. The system of claim 2, wherein said correlation module is further to compare said ratio to a threshold ratio and associate said balance with said P/C workload if said ratio is less than said threshold ratio.

4. The system of any of claims 1-3, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

5. The system of claim 4, wherein said utilization measurement module is further to re-measure utilization of said processors after an elapsed time interval; and said clock frequency adjustment module is further to decrease said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

6. The system of any of claims 1-5, wherein said updating of said clock frequency further comprises adjusting a voltage-frequency pairing of a control state of said processors.

7. The system of any of claims 1-6, wherein said processors are processor cores

and/or graphics processing units (GPUs).

8. The system of of any of claims 1-7, wherein said system is incorporated in a smart phone, smart tablet, notebook or laptop computer.

9. A method for controlling clock frequency of processors, said method comprising:

measuring utilization of said processors;

estimating balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors;

calculating a clock frequency adjustment based on said estimated balance and said measured utilization; and

updating said clock frequency of said processors based on said calculated adjustment.

10. The method of claim 9, wherein said balance estimation further comprises:

changing said clock frequency for a period of time associated with said balance estimation;

measuring utilization change during said period of time; and

estimating said balance based on a ratio of said utilization change to said clock frequency change.

11. The method of claim 10, further comprising comparing said ratio to a threshold ratio and associating said balance with said P/C workload if said ratio is less than said threshold ratio.

12. The method of any of claims 9-11, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

13. The method of claim 12, further comprising:

re-measuring utilization of said processors after an elapsed time interval; and

decreasing said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

14. The method of any of claims 9-13, wherein said updating of said clock frequency further comprises adjusting a voltage-frequency pairing of a control state of said processors.

15. The method of any of claims 9-14, wherein said processors are processor cores and/or graphics processing units (GPUs).

16. At least one computer-readable storage medium having instructions stored thereon which when executed by a processor result in the following operations for controlling clock frequency of processors, said operations comprising:

measuring utilization of said processors;

estimating balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors;

calculating a clock frequency adjustment based on said estimated balance and said measured utilization; and

updating said clock frequency of said processors based on said calculated adjustment.

17. The computer-readable storage medium of claim 16, wherein said balance estimation further comprises the operations of:

changing said clock frequency for a period of time associated with said balance estimation;

measuring utilization change during said period of time; and

estimating said balance based on a ratio of said utilization change to said clock frequency change.

18. The computer-readable storage medium of claim 17, further comprising the operations of comparing said ratio to a threshold ratio and associating said balance with said P/C workload if said ratio is less than said threshold ratio.

19. The computer-readable storage medium of any of claims 16-18, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

20. The computer-readable storage medium of claim 19, further comprising the operations of:

re-measuring utilization of said processors after an elapsed time interval; and

decreasing said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

21. The computer-readable storage medium of any of claims 16-20, wherein said updating of said clock frequency further comprises the operation of adjusting a voltage-frequency pairing of a control state of said processors.

22. The computer-readable storage medium of any of claims 16-21, wherein said processors are processor cores and/or graphics processing units (GPUs).

23. A system for controlling clock frequency of processors, said system comprising:

means for measuring utilization of said processors;

means for estimating balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors;

means for calculating a clock frequency adjustment based on said estimated balance and said measured utilization; and

means for updating said clock frequency of said processors based on said calculated adjustment.

24. The system of claim 23, wherein said balance estimation further comprises:

means for changing said clock frequency for a period of time associated with said balance estimation;

means for measuring utilization change during said period of time; and

means for estimating said balance based on a ratio of said utilization change to said clock frequency change.

25. The system of claim 24, further comprising means for comparing said ratio to a threshold ratio and means for associating said balance with said P/C workload if said ratio is less than said threshold ratio.

26. The system of any of claims 23-25, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

27. The system of claim 26, further comprising:

means for re-measuring utilization of said processors after an elapsed time interval; and

means for decreasing said clock frequency if said re-measured utilization is greater than

said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

28. The system of any of claims 23-27, wherein said updating of said clock frequency further comprises means for adjusting a voltage-frequency pairing of a control state of said processors.

29. The system of any of claims 23-28, wherein said processors are processor cores and/or graphics processing units (GPUs).

CLAIMS

What is claimed is:

1. A system for controlling clock frequency of processors, said system comprising:

a utilization measurement module to measure utilization of said processors;

a correlation module to estimate a balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors; and

a clock frequency adjustment module to calculate a clock frequency adjustment based on said estimated balance and said measured utilization and to update said clock frequency of said processors based on said calculated adjustment.

2. The system of claim 1, wherein said correlation module is further to:

change said clock frequency for a period of time associated with said balance estimation;

measure utilization change during said period of time; and

estimate said balance based on a ratio of said utilization change to said clock frequency change.

3. The system of claim 2, wherein said correlation module is further to compare said ratio to a threshold ratio and associate said balance with said P/C workload if said ratio is less than said threshold ratio.

4. The system of claim 1, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

5. The system of claim 4, wherein said utilization measurement module is further to re-measure utilization of said processors after an elapsed time interval; and said clock frequency adjustment module is further to decrease said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

6. The system of claim 1, wherein said updating of said clock frequency further comprises adjusting a voltage-frequency pairing of a control state of said processors.

7. The system of claim 1, wherein said processors are processor cores and/or graphics processing units (GPUs).

8. The system of claim 1, wherein said system is incorporated in a smart phone, smart tablet, notebook or laptop computer.

9. A method for controlling clock frequency of processors, said method comprising:

measuring utilization of said processors;

estimating balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors;

calculating a clock frequency adjustment based on said estimated balance and said measured utilization; and

updating said clock frequency of said processors based on said calculated adjustment.

10. The method of claim 9, wherein said balance estimation further comprises:

changing said clock frequency for a period of time associated with said balance estimation;

measuring utilization change during said period of time; and

estimating said balance based on a ratio of said utilization change to said clock frequency change.

11. The method of claim 10, further comprising comparing said ratio to a threshold ratio and associating said balance with said P/C workload if said ratio is less than said threshold ratio.

12. The method of claim 9, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

13. The method of claim 12, further comprising:

re-measuring utilization of said processors after an elapsed time interval; and

decreasing said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

14. The method of claim 9, wherein said updating of said clock frequency further comprises adjusting a voltage-frequency pairing of a control state of said processors.

15. The method of claim 9, wherein said processors are processor cores and/or graphics processing units (GPUs).

16. At least one computer-readable storage medium having instructions stored thereon which when executed by a processor result in the following operations for controlling clock frequency of processors, said operations comprising:

measuring utilization of said processors;

estimating balance between producer/consumer (P/C) workload and non-P/C workload executing on said processors;

calculating a clock frequency adjustment based on said estimated balance and said measured utilization; and

updating said clock frequency of said processors based on said calculated adjustment.

17. The computer-readable storage medium of claim 16, wherein said balance estimation further comprises the operations of:

changing said clock frequency for a period of time associated with said balance estimation;

measuring utilization change during said period of time; and

estimating said balance based on a ratio of said utilization change to said clock frequency change.

18. The computer-readable storage medium of claim 17, further comprising the operations of comparing said ratio to a threshold ratio and associating said balance with said P/C workload if said ratio is less than said threshold ratio.

19. The computer-readable storage medium of claim 16, wherein said clock frequency adjustment is a clock frequency increase if said estimated balance is associated with a P/C workload and if said measured utilization is less than a utilization threshold.

20. The computer-readable storage medium of claim 19, further comprising the operations of:

re-measuring utilization of said processors after an elapsed time interval; and

decreasing said clock frequency if said re-measured utilization is greater than said utilization threshold and if said clock frequency adjustment was a clock frequency increase.

21. The computer-readable storage medium of claim 16, wherein said updating of said clock frequency further comprises the operation of adjusting a voltage-frequency pairing of a control state of said processors.

22. The computer-readable storage medium of claim 16, wherein said processors are processor cores and/or graphics processing units (GPUs).