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Power Saving for Virtualised Workloads

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When to use power management technology?
**Use case:** User space governor, implements P-state control on behalf of applications

**Challenges**

1. **Nature of the application** preventing the OS governors to act
   - Polling threads, e.g. Telco use cases => limits
   - impact of kernel power infra. & governors.
   - All cores appear 100% busy.

2. **Root access** for application

3. **Application implementation** of power monitor/measure/act
   - User space governor manages power for
   - workload/application overcomes root & implementation of power control

4. **Metrics visibility**
   - Power control decision relies on Key Performance Indicators (KPIs) specific to the application => not OS visible

5. **Diversity** between virtualised and host approach, write once run anywhere not possible

6. **Availability of Power controls** in the guest

Overall benefit is to achieve residency in Low Power Modes, in this example via slow down / P-state controls
Components in a Solution (Simplified)

- **User space governor** manages power for workload/application
- Access to Power control relies on Key Performance Indicators (KPIs) specific to the application
- **Virtualised Power Controls** requires a “custom” API, interface and backend to get access
  - Build components
    - Custom P-state API for requests from Guest to Host
    - Virtio-serial for transport guest => host
    - Backend daemon / agent
    - Backend module to interface to cpufreq / intel_pstate
    - Latency range is single digit milli-seconds
- **Opportunity**
  - Guest visible proxy sysfs/…/..frequency requests, a future evolution for virtualised use cases?
  - Backed by a simple precedence policy in the host kernel
Summary & Discussion

- Why? Direct control path allows wider adoption and usage of power technology

- Opportunity to move away from "custom" build to standard approach (APIs and driver for Guest OS)
  - Guest OS driver for P-states?

- Increase adoption of lower power modes and reduce carbon footprint via lower electricity consumption

- Thank you!