



Unity Adaptive Performance 2023

Content and Quality Scaling done at the right time



Unity Adaptive Performance

Unity Adaptive Performance (UADP) package allows game developers to get feedback about the engine bottleneck, the thermal and power state of a mobile device and react appropriately.

Benefits:

- **FPS:** By stabilizing the frame rate and the game performance, the players enjoy a more pleasant experience.
- **Power and heat:** Helps to save the devices battery (power), which means play longer.

Problem - Limitations on Mobile

Temperature

No active cooling

Performance Throttling

Power

Limitation of Battery

Use more power than needed

Developer can't control temperature, throttling and frequency

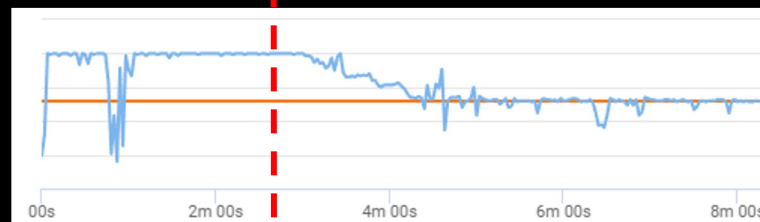
Temperature **After Throttling**



Core Freq

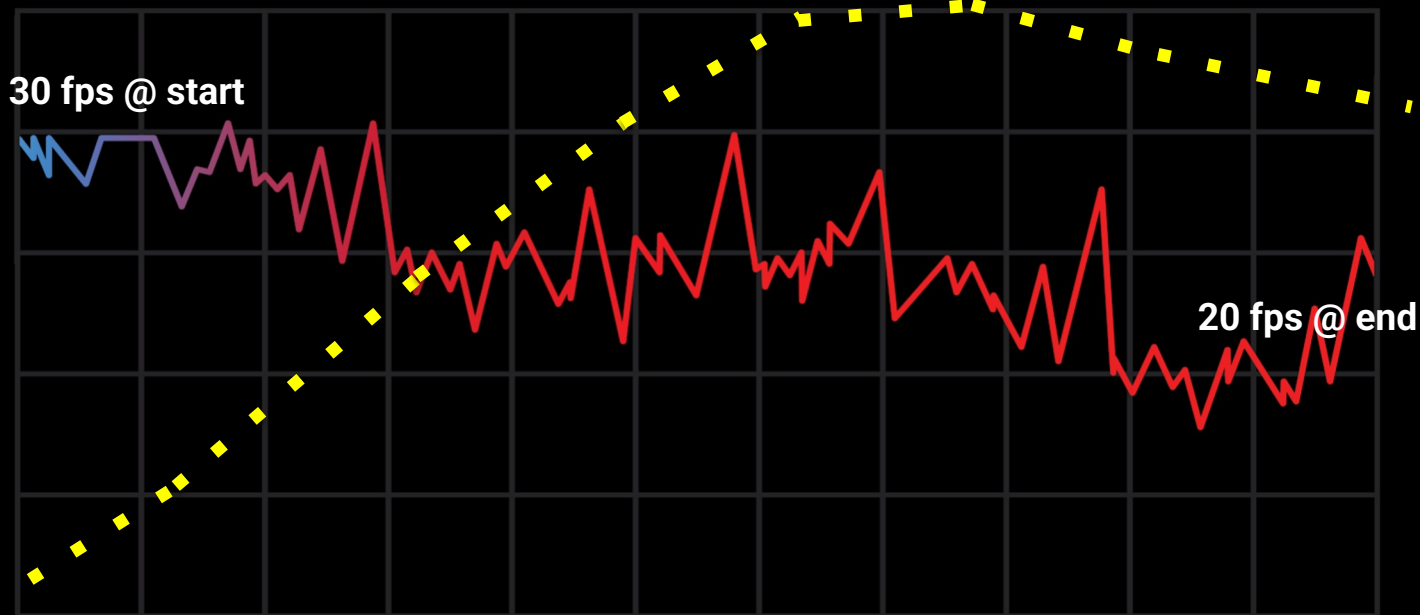


FPS



Adaptive Performance - Thermal Throttling

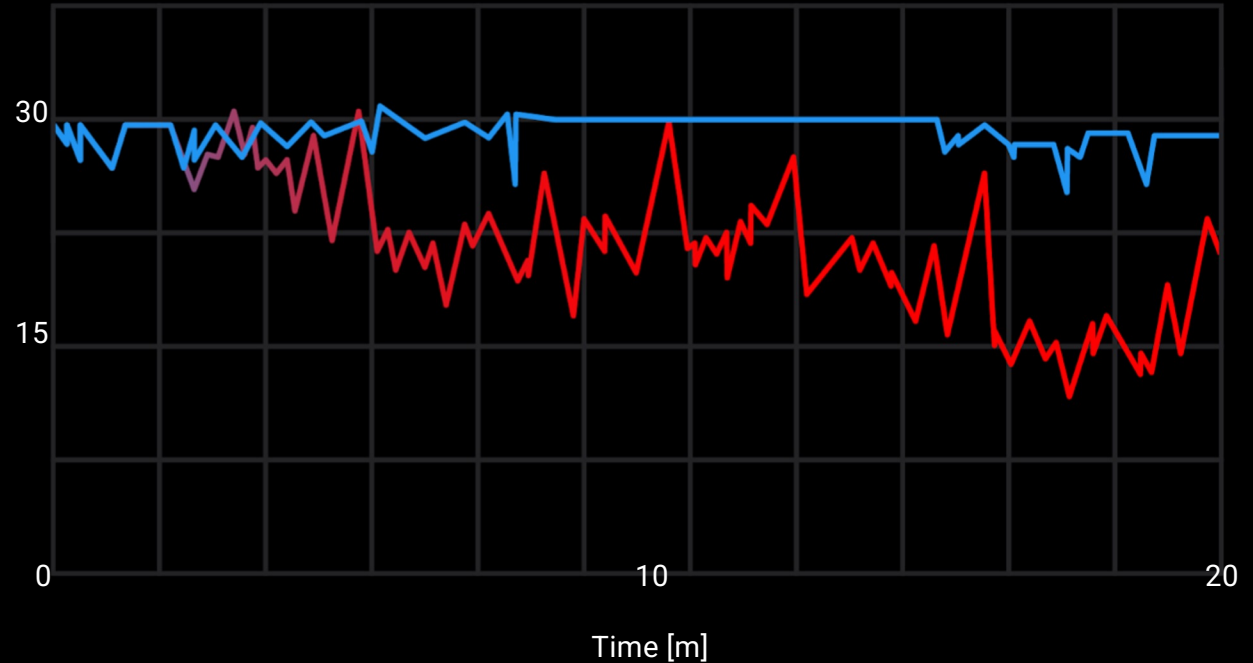
Performance drops and fluctuation **Throttling ?**



Adaptive Performance - Example

Frame Rate

- Adaptive Performance
- Without Adaptive Performance





Adaptive Performance - Lifecycle

Problem Detection

Source Identification

Correction

Overheating:

- CPU
- GPU
- Modem
- Skin Temperature
- Memory
- IO

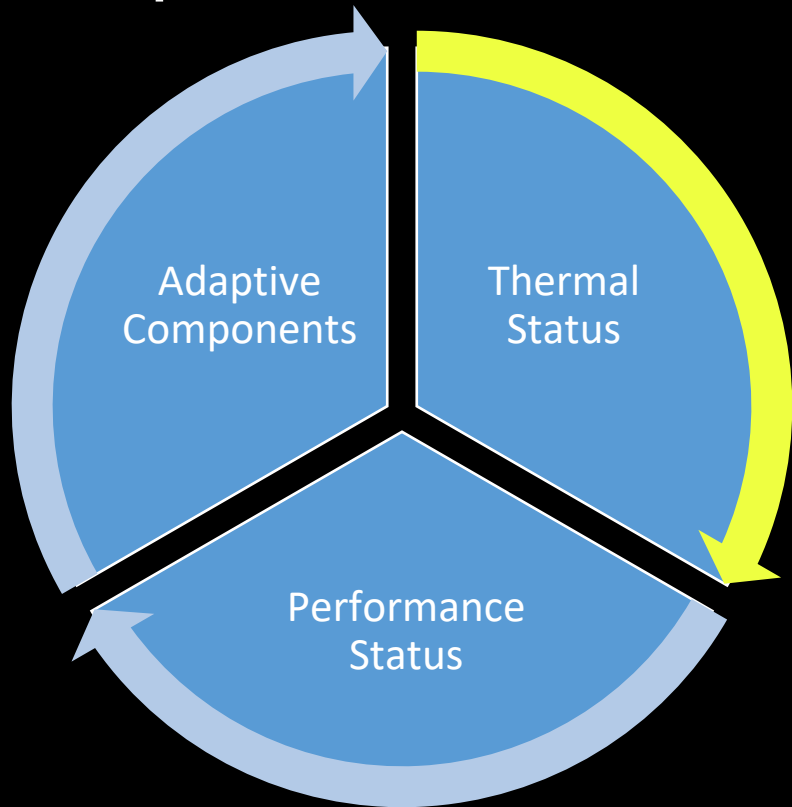
Precise Timing:

- Frametime
 - CPU Frametime
 - GPU Frametime
- CPU/GPU Level
- Scene Quantities
 - Mesh size (LODs)
 - Textures
 - Animations (LODs)
 - Sounds

Workload Adaptation:

- CPU Load (Simulation)
- GPU Load (Post Process)
- Network Traffic (Streaming Quality)
- Memory Bandwidth (Texture Mipmap)

Adaptive Performance - Thermal Status



Temp Trend  → -1.0 ... 1.0

Temp Warning  → NoWarning
→ Imminent
→ Throttling

Temp Level  → 0.0 ... 1.0

GPU JT  → 0.0 ... 1.0

CPU JT  → 0.0 ... 1.0

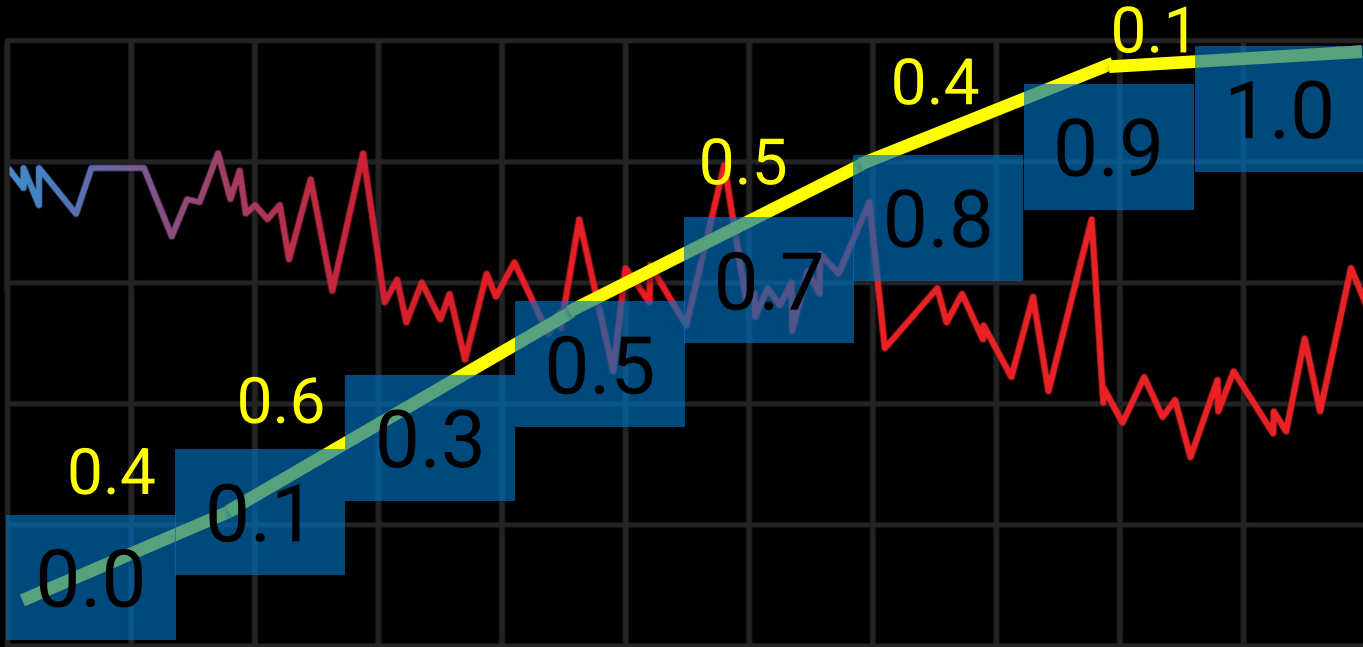
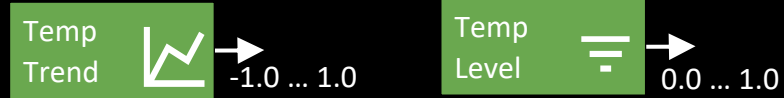
Thermal Metric

Temperature Warning

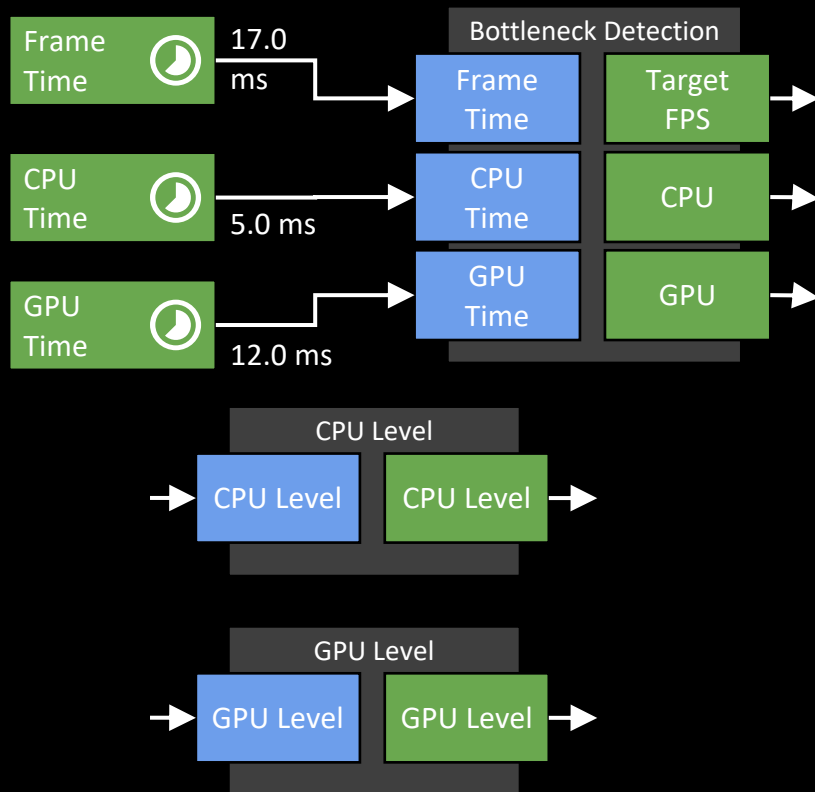
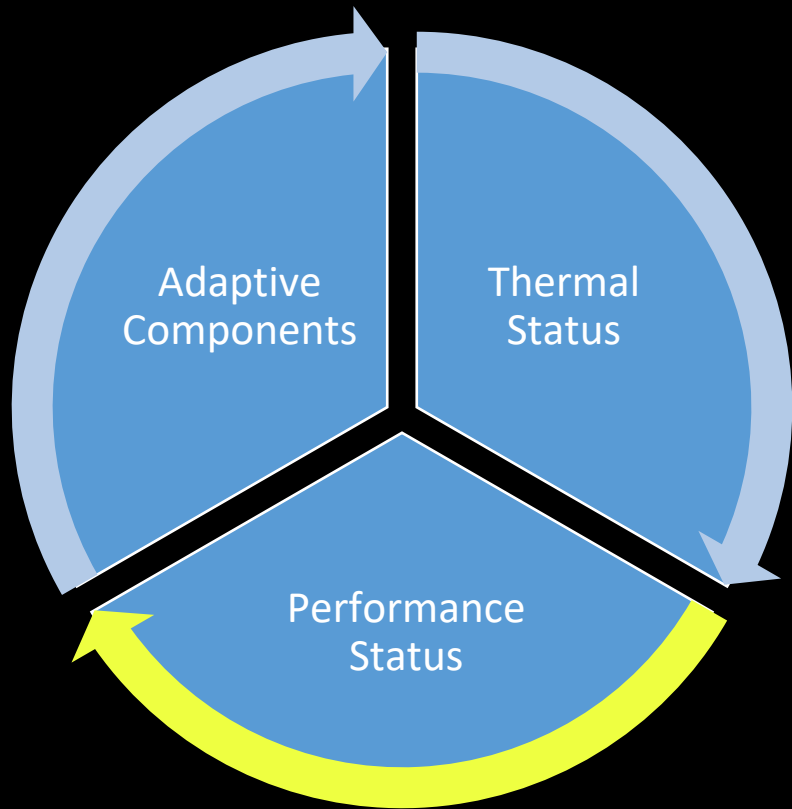


Thermal Metric

Temperature Level

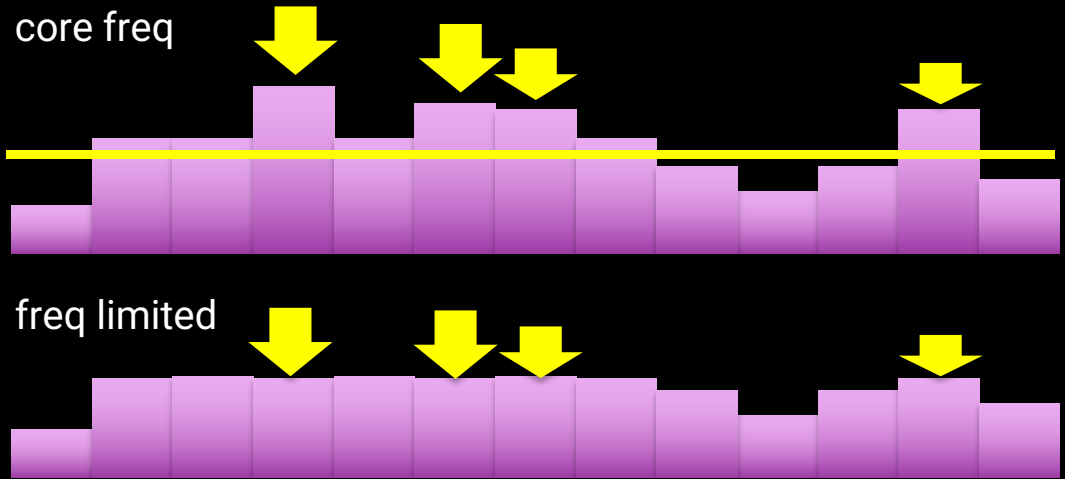
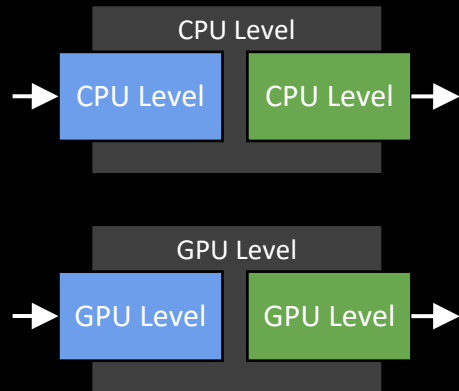


Adaptive Performance - Performance Status



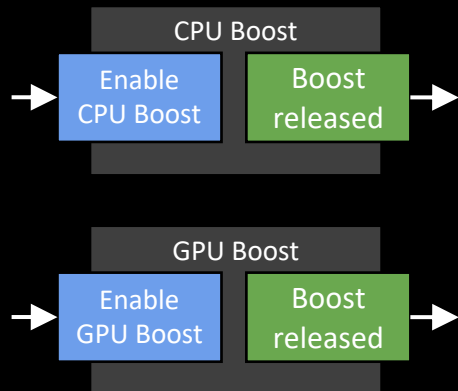
Performance Status

Performance Level

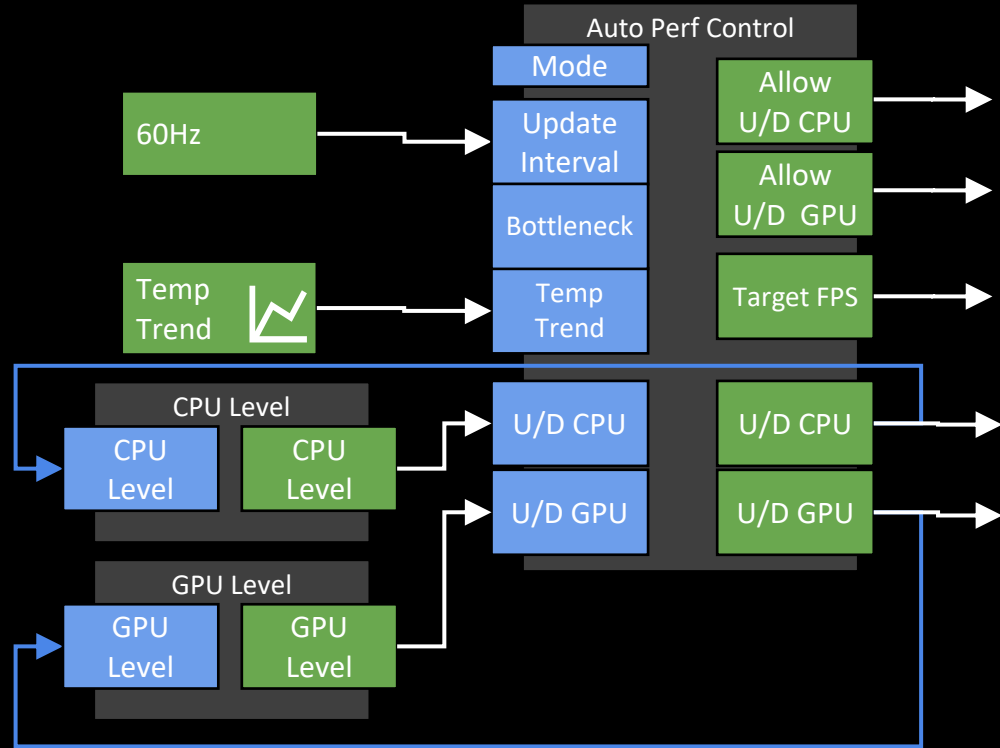
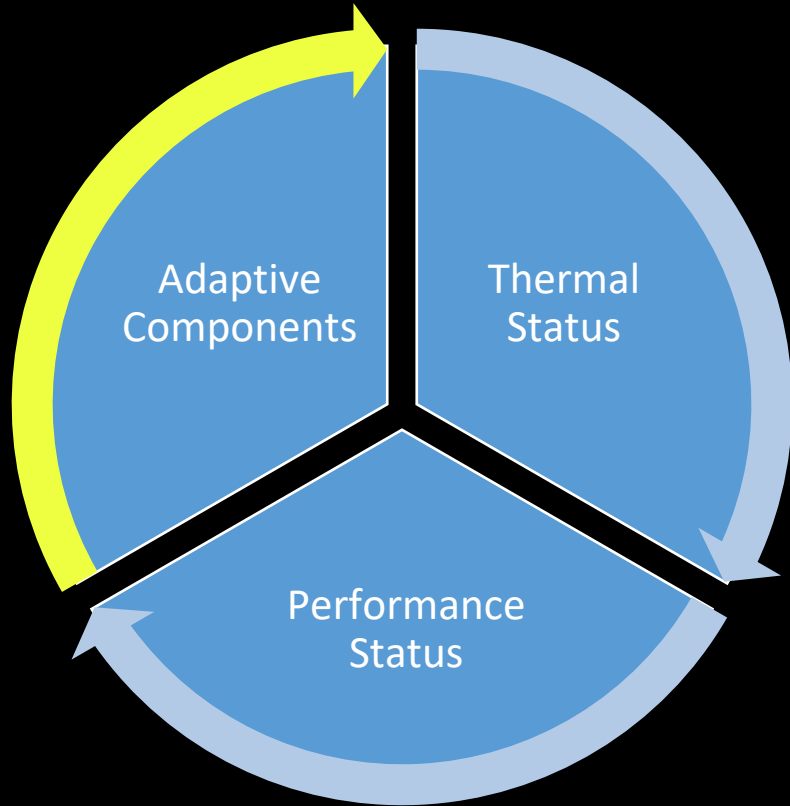


Performance Status

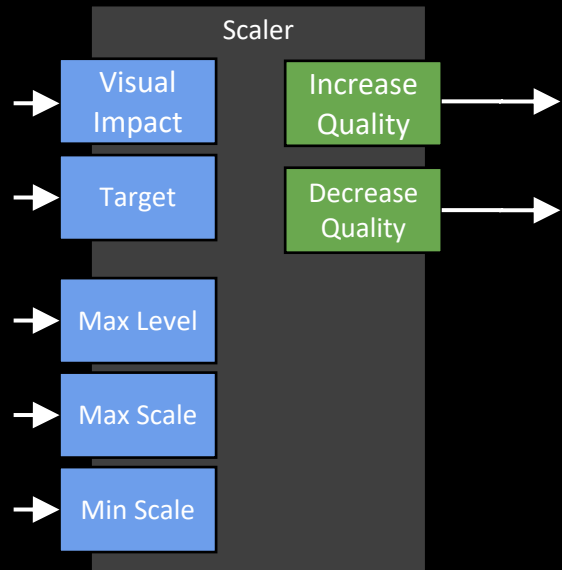
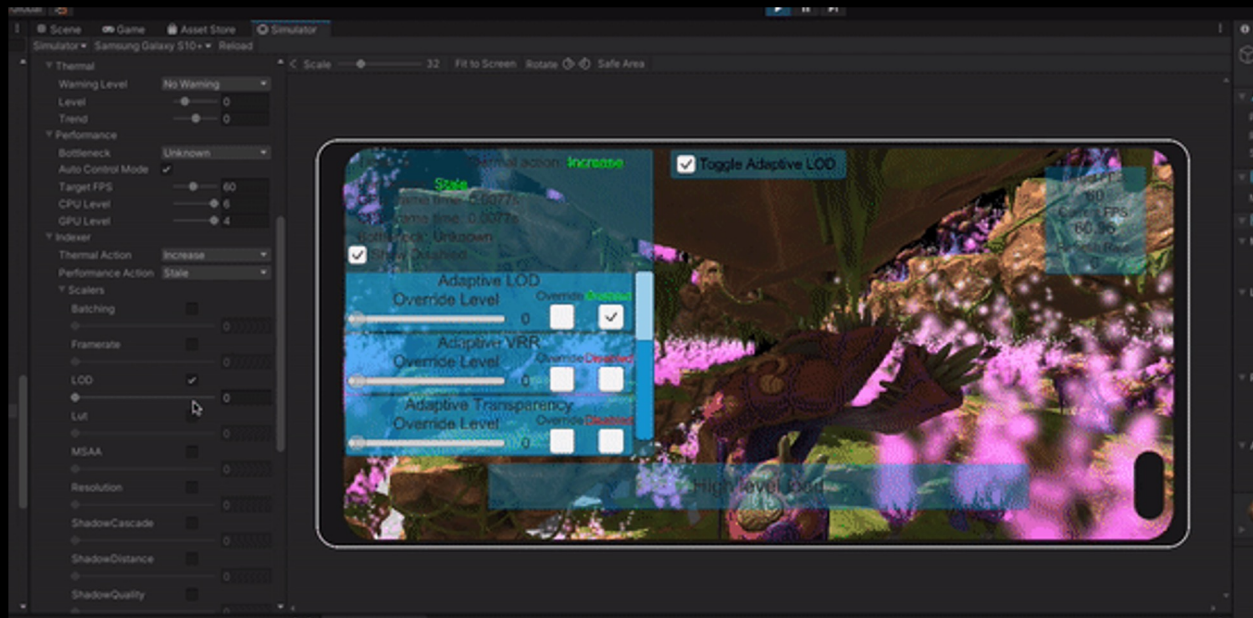
Boost Mode



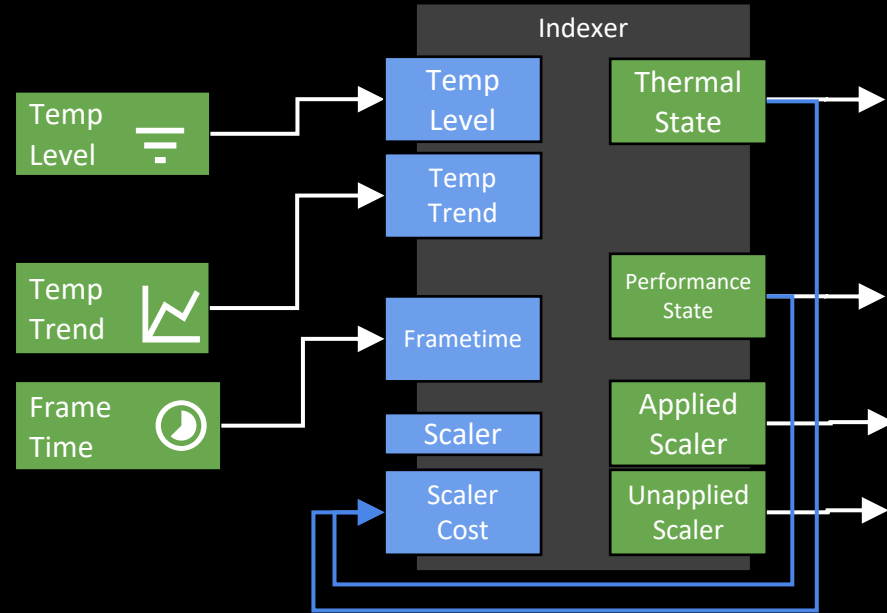
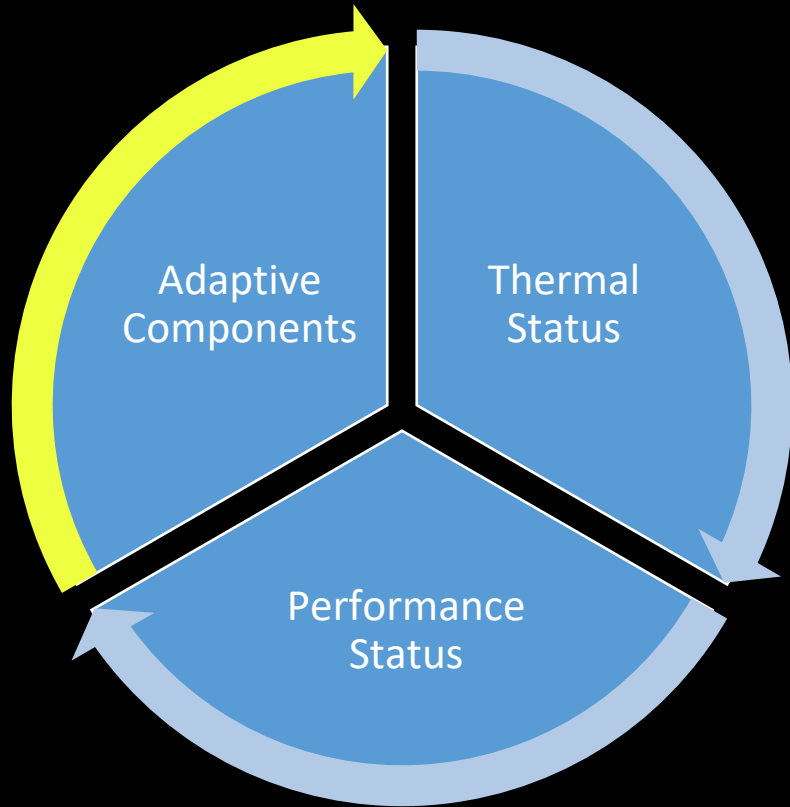
Adaptive Performance - Game Components



Adaptive Performance - Scaler



Adaptive Performance - Indexer

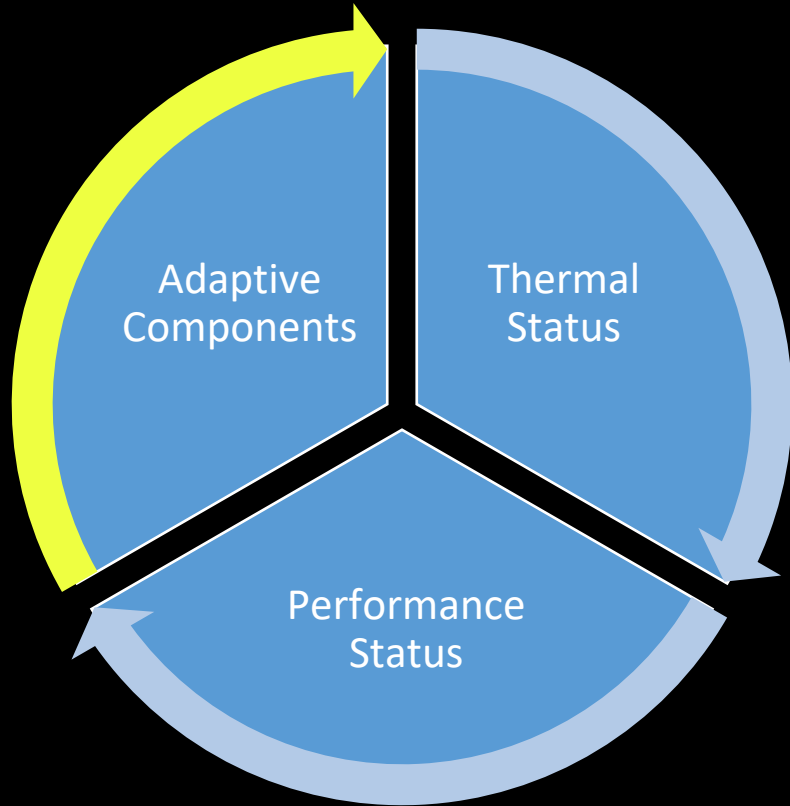


Adaptive Performance - Providers

Potential providers for Adaptive Performance:

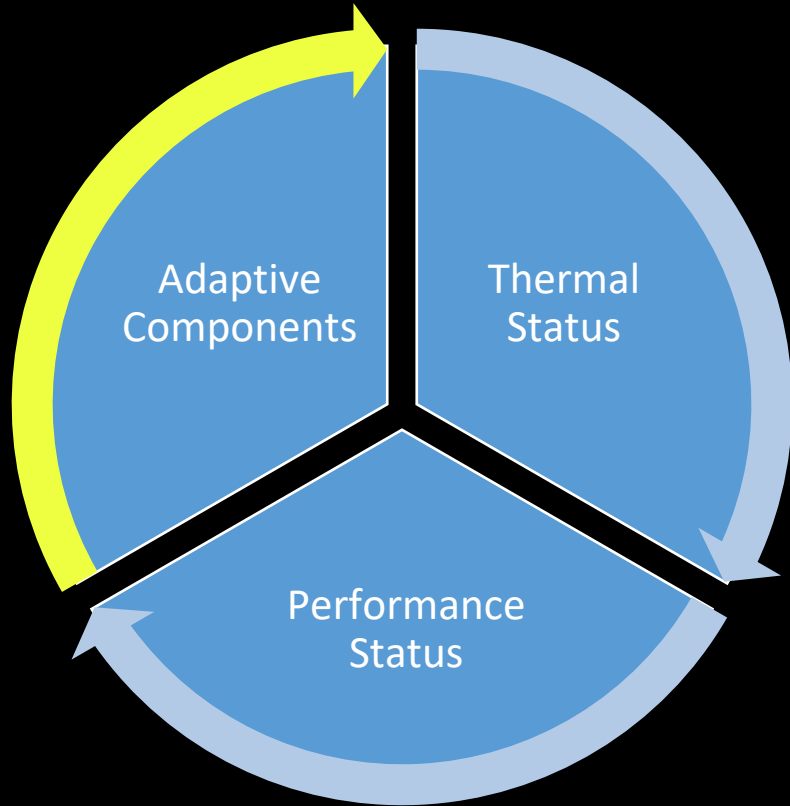
- Android Provider (Android 11 & 12)
- ARM Provider
- Chrome OS Provider (update to Android 12)
- Imagination Provider
- Qualcomm Provider
- Oculus Provider
- Apple Provider
- Desktop Provider
- Console Provider (Switch, PS4)

Adaptive Performance - Game Components



- Adaptive Framerate
- Adaptive VRR
- Adaptive Resolution
- Adaptive Sorting
- Adaptive Batching
- Adaptive Shadowmap Resolution
- Adaptive Shadow Distance
- Adaptive Shadow Quality
- Adaptive Shadow Cascades
- Adaptive LOD
- Adaptive MSAA
- Adaptive View Distance

Adaptive Performance - Future Components



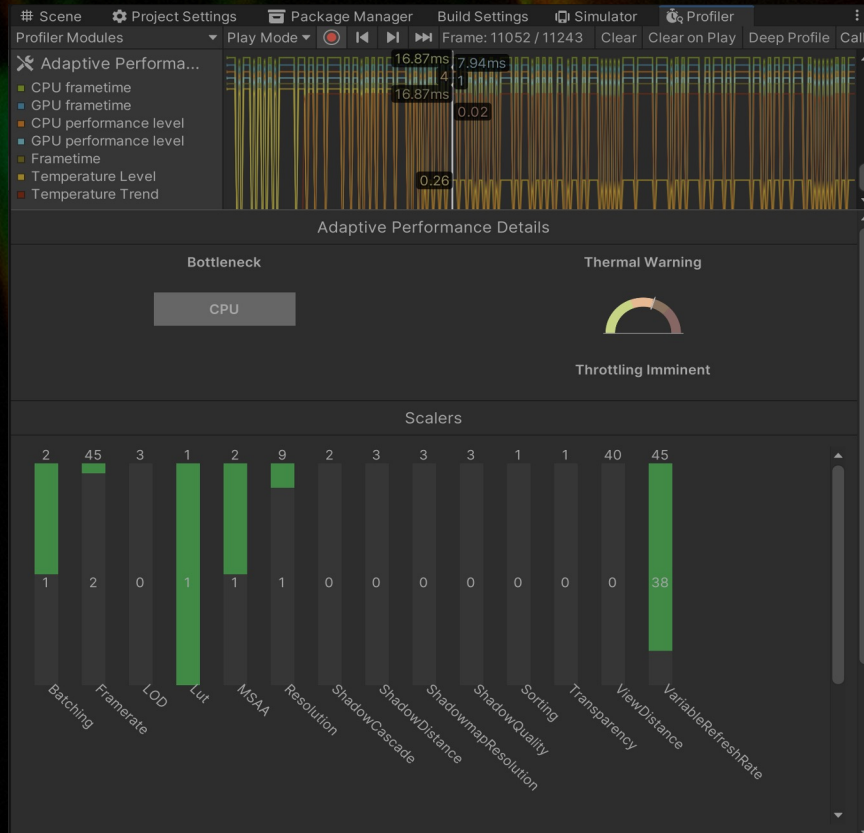
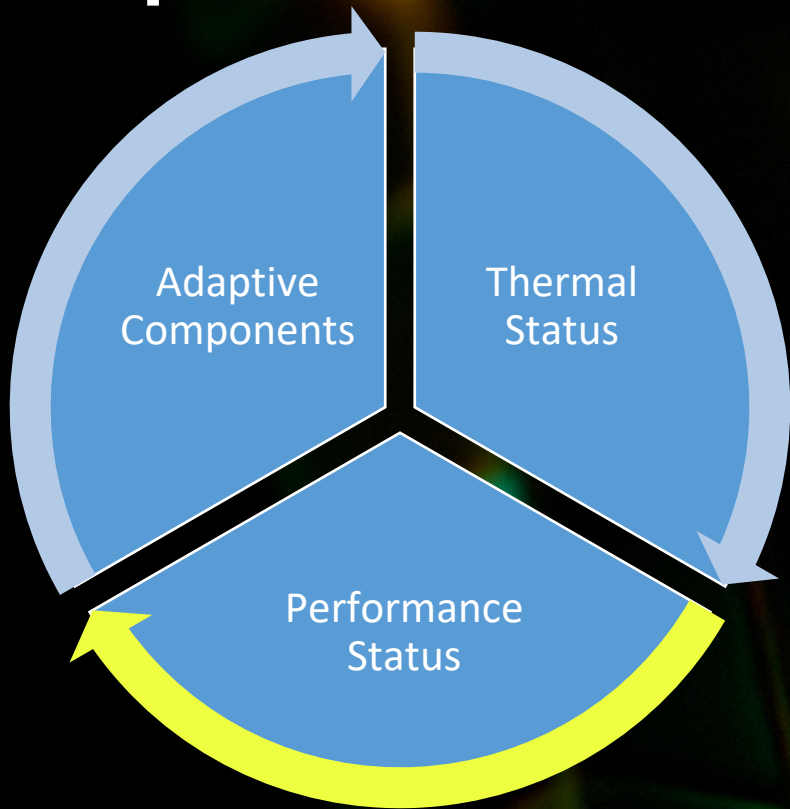
- Adaptive VRS
- Adaptive Physics
- Adaptive Memory
- Adaptive Network
- Adaptive Animation (LODs)
- Adaptive Object Culling
- Adaptive World Distance
- Adaptive Fog
- Adaptive Lense Flare
- Adaptive VFX

Adaptive Performance - Scaler Profiles

The screenshot shows the Unity Project Settings window for a Samsung (Android) build. The left sidebar lists various settings categories, with 'Adaptive Performance' expanded to show 'Samsung (Android)'. The main panel is titled 'Samsung (Android)' and contains the following settings:

- Performance Action Delay: 4
- Scaler Settings
 - Scaler Profiles
 - Default Scaler Profile
 - BossLevel
 - Framerate:
 - Resolution:
 - Batching:
 - LOD:
 - Min Scale: 0.4
 - Max Scale: 1
 - Max Level: 3
 - Visual Impact: High
 - Target: GPU
 - LUT:
 - MSAA:
 - Shadow Cascade:
 - Shadow Distance:
 - Shadowmap Resolution:
 - Shadow Quality:
 - Sorting:
 - Transparency:
 - View Distance:
 - MainMenu
 - FTUI

Adaptive Performance - Profiler





The Adaptive Performance Profiler Module

CPU & GPU frametime

Temperature Level & Trend

Bottleneck & Thermal Warning



Adaptive Performance - Device Simulator

The screenshot displays the Unity Device Simulator interface for a Samsung Galaxy S10+ device. The left sidebar contains various settings panels:

- Device Specifications:** OS: Android OS 9 / API-28 (PPR1.180610.011/G975), CPU: ARMv8 FP-ASIMD AES, GPU: Mali-G76, Resolution: 1440 x 3040.
- Screen Settings:** Resolution: 3040 x 1440, Full Screen: checked, Auto-Rotation: checked, Orientation: Landscape Left.
- Application Settings:** System Language: English, Internet Reachability: Not Reachable, On Low Memory: On.
- Adaptive Performance:** Thermal, Performance, Bottleneck: Unknown, Auto-Control Mode: On, Target FPS: 60, CPU Level: 6, GPU Level: 4.

The main simulator window shows a 3D scene with a blue sky and a ground plane. Performance metrics are overlaid on the scene:

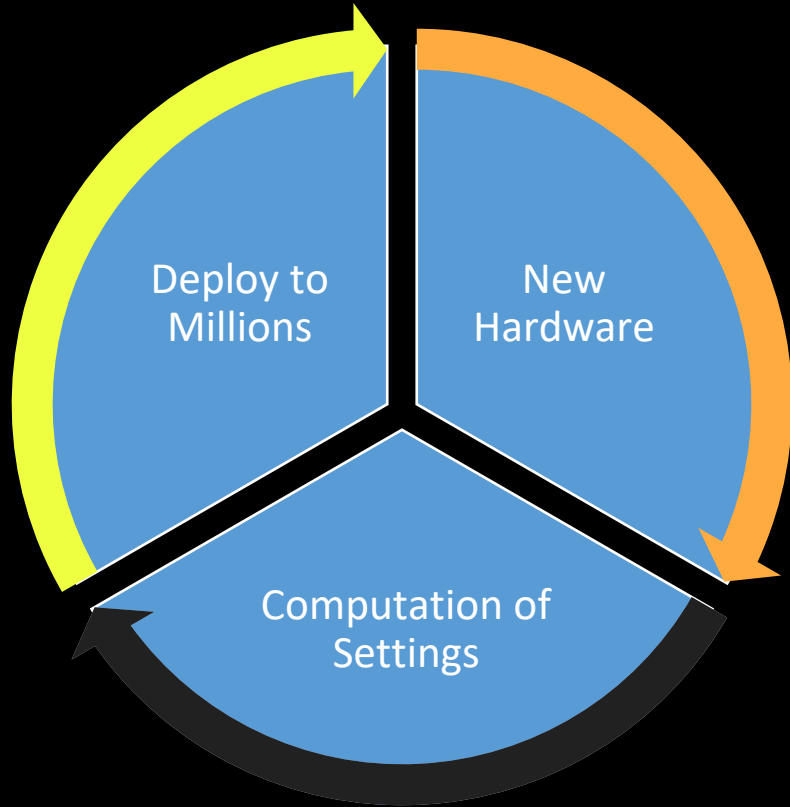
- Average Frame Time: 17.30 ms
- Average CPU Time: 8.16 ms
- Average GPU Time: 8.16 ms
- Object Count: 97
- Current Bottleneck: CPU
- Target Bottleneck: CPU
- Warning: Ramping up CPU load Timeout in 59.03s



Adaptive Performance - What's Next?

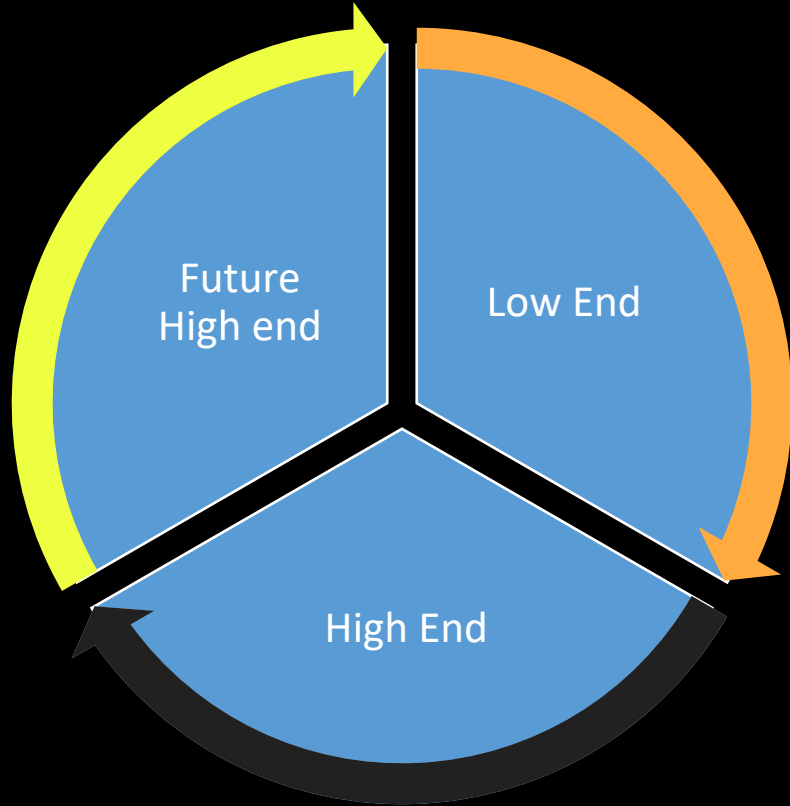
- Adaptive Performance Now
 - More Scalers, More Providers
 - Visual Scripting Integration
 - Recorder & Simulator
 - Game Driven Interface
- Adaptive Performance Next
 - Memory Adaptive
 - Variable-Rate Shading
 - Super Resolution
 - SpaceWarp Frame Interpolation

Adaptive Performance - Adaptive Settings AI

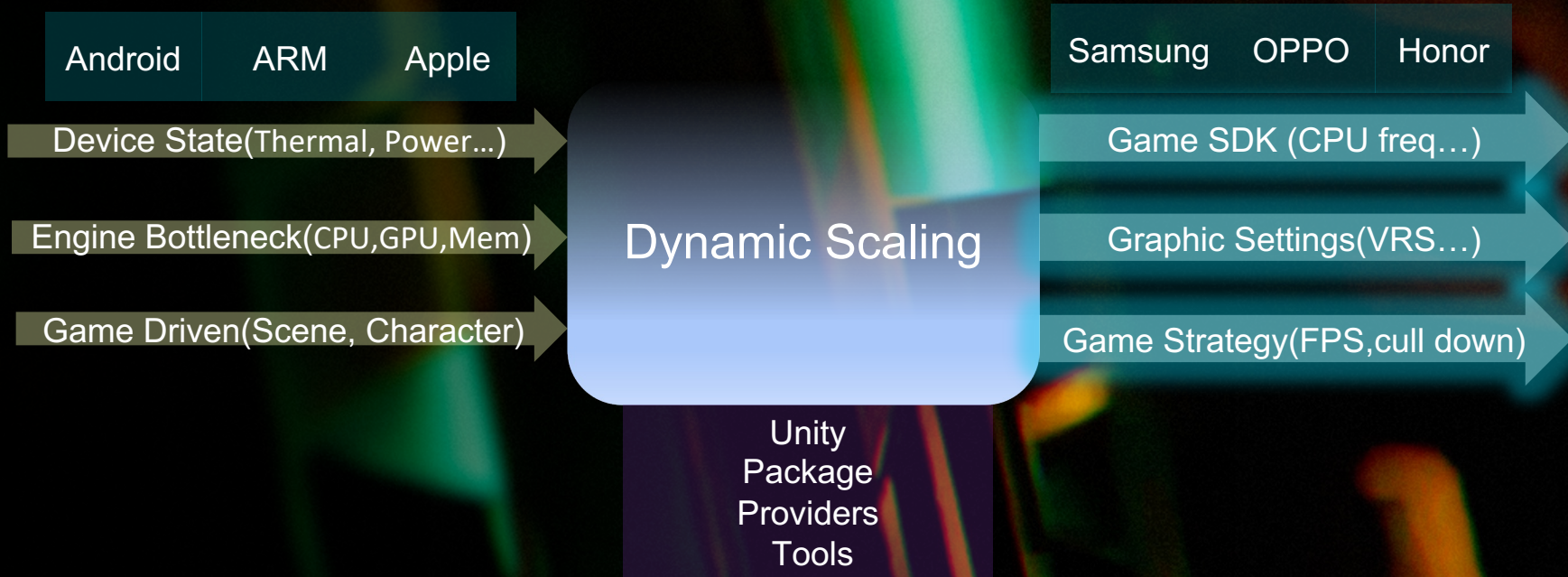


- Settings should be automated and a manual override could be offered to reduce work for devs.
- Hardware statistic + performance + thermal data (if needed) sent to backend
- Best scenario profilers are generated
- Profiles are downloaded during start and cached on device after FTUE.

Adaptive Performance - Scalability



- Build once - improve anywhere/anytime!
- Content can be scaled based on device status and not hardware components.
- Content looks better on next new hardware.
- Cross-Device Performance Optimization Pattern.





Adaptive Performance - Resources

- <https://docs.unity3d.com/Packages/com.unity.adaptiveperformance@5.0/manual/index.html>
- <https://create.unity3d.com/optimize-mobile-game-eBook>
- <https://forum.unity.com/threads/adaptive-performance-package.652306/>
- <https://blog.unity.com/games/build-stunning-mobile-games-that-run-smoothly-with-adaptive-performance>



Thank you!

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