Power Management Design and Verification

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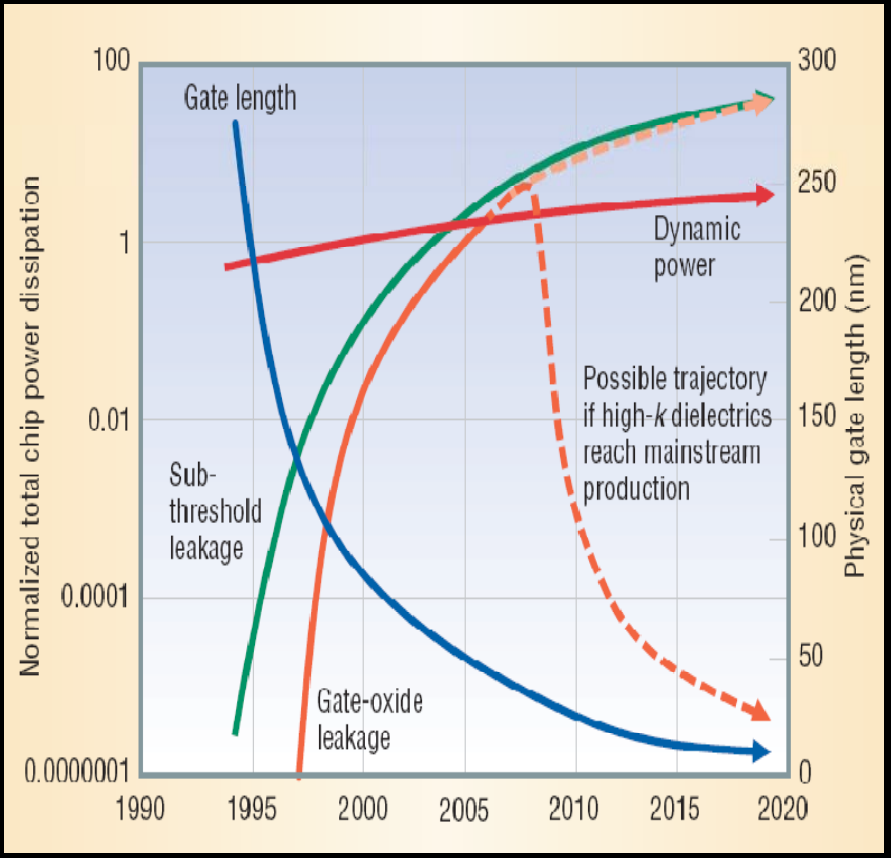
Power Trends

- Power: Dynamic , Leakage
- Dynamic: Activity, Frequency, Capacitance, Supply Voltage (V)
- Dynamic Power α V^2
- Leakage : Sub-threshold , Gate-Tunneling
- Leakage Power α V, e^{-Vt}
- Manage: Dynamic, Active Leakage, Standby Leakage



Power Trends

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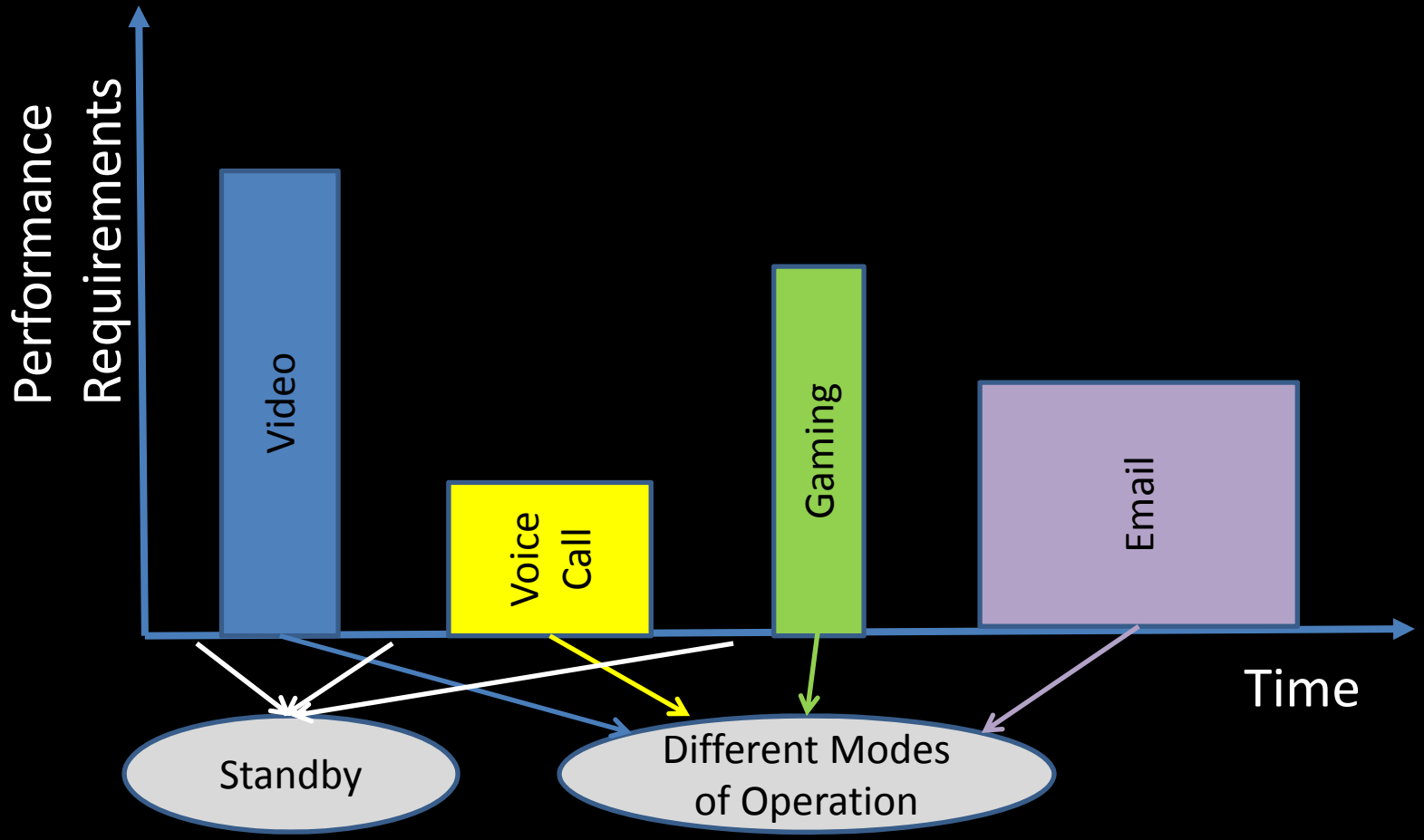
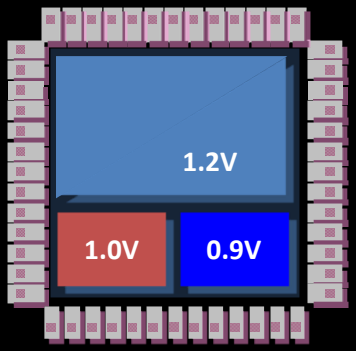
Power Consumption in a Mobile Phone

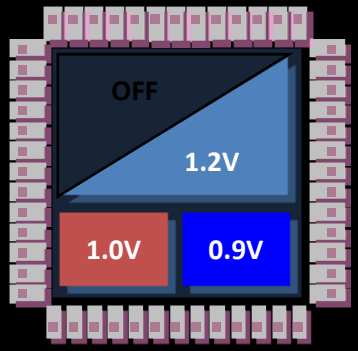


Voltage is the key variable to manage power in all modes

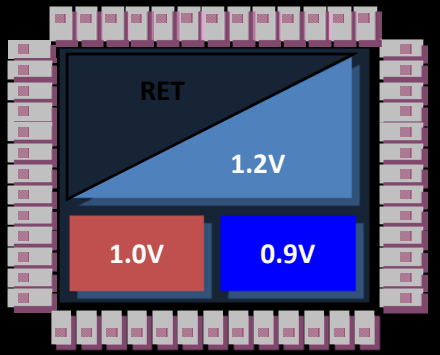
Power Management Techniques



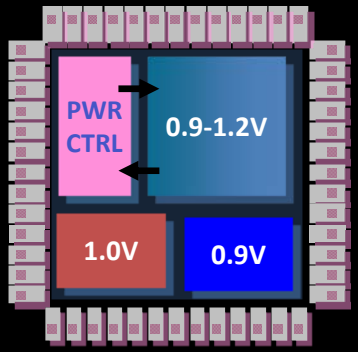
Multiple Supply Voltage (MSV)



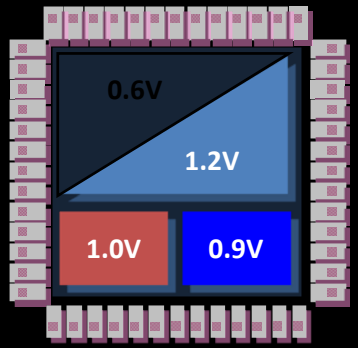
MTCMOS & Power Gating (PG)



Power Gating & State Retention



Dynamic or Adaptive Voltage Frequency Scaling (DVS, DVFS, AVS, AVFS)



Low-VDD Standby

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Power Types Targeted

Technique			Power Being Managed		
			Standby Leakage	Active Leakage	Dynamic
Power Gating	PG		■		
Retention with PG	RPG		■		
Multiple Supply Voltages	MSV			■	■
Dynamic Voltage Scaling	DVS			■	■
Adaptive Voltage Scaling	AVS			■	■
Multi-Threshold CMOS	MTCMOS			■	
Adaptive Body-Biasing	ABB		■	■	

■ Primary ■ Secondary ■ Verification Impact

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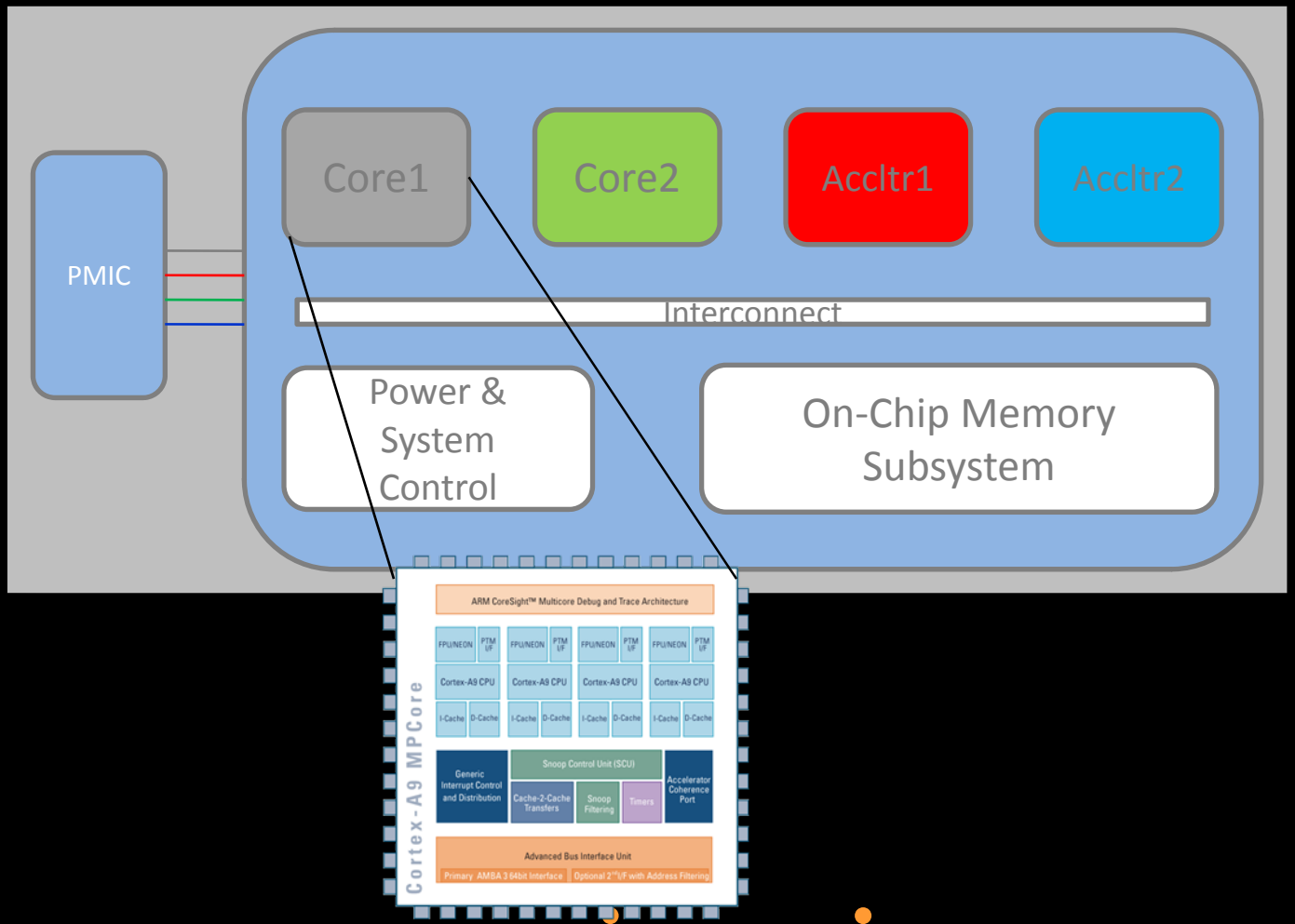
Typical Power Managed SoCs



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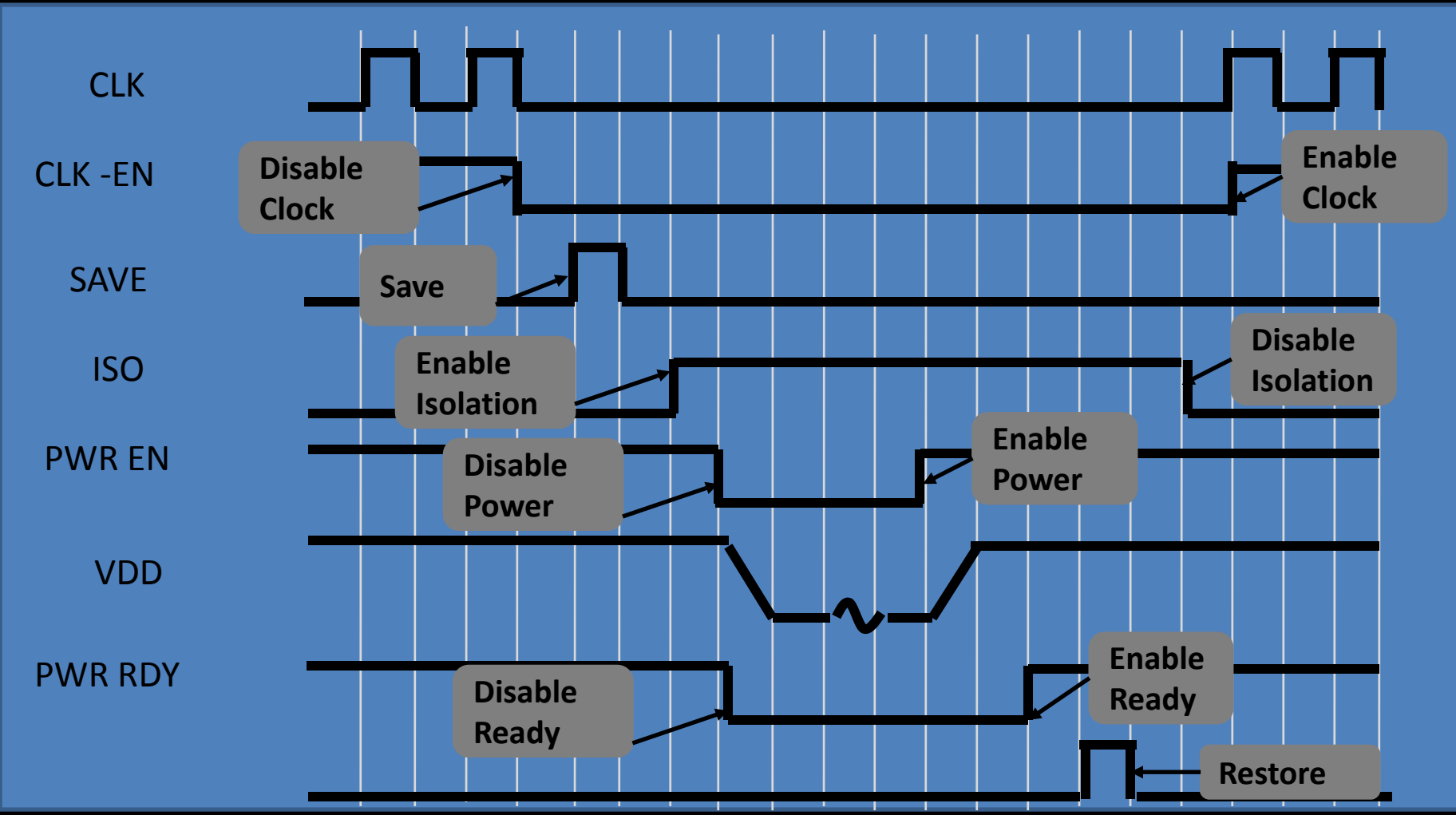
In Domain Power Sequencing



Power Management Tutorial

- Power management techniques
- Implementing power management techniques
- Verification issues arising due to power management techniques
- Working with verification issues examples in real design situations

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