Outline

• Ryzen product family
• Zen CPUs
• Ryzen architecture
  - Chiplets
• Ryzen APUs
Ryzen Products

• Ryzen Desktop products
  - CPUs and APUs
  - Threadripper

• Ryzen Mobile
  - For laptops – usually are all APUs

• Ryzen Embedded
CPU Product Nomenclature

- **Zen core - 14nm**
  - Ryzen 3/5/7 1xxx (Summit Ridge)
  - Threadripper 19xx

- **Zen+ core - 12nm**
  - Ryzen 3/5/7 2xxx (Pinnacle Ridge)
  - Threadripper 29xxx

- **Zen2 core – 7nm CCD**
  - Ryzen 3/5/7/9 3xxx (Matisse)
  - Threadripper 39xx
APU Product Nomenclature

- **Zen core, Vega GFX (“Raven Ridge”)**
  - Desktop: Ryzen (Pro) 3/5 2xxxG
  - Mobile: Ryzen (Pro) 3/5/7 2xxxU/H

- **Zen+ core, Vega GFX (“Picasso”)**
  - Desktop: Ryzen (Pro) 3/5 3xxxG
  - Mobile: Ryzen (Pro) 3/5/7 3xxxU/H

- **Zen2 core, Vega GFX (“Renoir”)**
  - Desktop: Not yet released
  - Mobile: Ryzen (Pro) 3/5/7 4xxxU/H
Cool Fact

- All Zen/Zen+/Zen2 based desktop products are socket AM4 compatible
  - Applies to both CPUs and APUs
  - Also to monolithic APU dies as well as new chiplet architecture in Matisse
Zen Cores
Zen Design Target

At = Energy Per Cycle

"Steamroller" + 40% work per cycle

Total Efficiency Gain

"Bulldozer" "Piledriver" "Steamroller" "Excavator"

Instructions-Per-Clock

Energy Per Cycle
Zen Roadmap

14nm / 12nm Shipping

14nm / 12nm Shipping

7nm Shipping

7nm+ Design Complete

“ZEN 3”

“ZEN 4”

2017 - 2022
“ZEN 2”

MICROARCHITECTURAL HIGHLIGHTS

- New TAGE branch predictor
- 2x op cache capacity
- Reoptimized L1I cache
- 3rd address generation unit
- 2x FP data path width
- 3x L1 load+store bandwidth
- 2x L3 capacity
- Improved prefetch throttling
- 2 threads per core (SMT) carried forward

15% IPC IMPROVEMENT FROM “ZEN” TO “ZEN 2”
- Each core has individual L1-I, L1-D and L2 caches.
- There can be up to 4 cores and 16MB of shared L3 cache in a core complex (CCX) - 2 CCX’es are combined into a single CPU chiplet (CCD).
Chiplet Design

- 3.8 Billion FETs, 74 mm²
  - CCD
- 7nm

12nm

**Server IO Die**
- 8.34 Billion FETs
- 416 mm²

12nm

**Client IO Die**
- 2.09 Billion FETs
- 125 mm²

- “Rome”
- “Matisse”
- X570 Chipset

**Optimized I/O Die Enables Common Latency to All Cores/Caches**

**Infinity Fabric™ Enables Modularity (MCM), Scaling (CCD Count)**

**Each IP in its Optimal Technology**
Chiplet Flexibility

Matisse
Single CCD

Matisse
Dual CCDs

Rome
8 CCDs
Larger IOD
Matisse CPU
Ryzen 3xxx CPU (“Matisse”)

- A Desktop SoC and a Chipset
  - IOD combined with CCD(s) form the CPU
  - Standalone IOD re-purposed as Chipset

- Leading I/O
  - 48GB/s native PCIe™ BW
  - 4 USB 3.1 10Gb/s ports

- Memory BW
  - 51.2 GB/s Memory BW
  - Dual Channel DDR4 3200 MT/s

- Overclocking
  - Improved Memory overclocking (Phy, Package)
  - De-coupled various IO-die clocks for flexibility

- AM4 Platform Longevity
  - Compatible with AM4 platform
Desktop Performance Improvement

Application Performance In Power Efficient TDP

- Compute heavy workloads benefit from power efficient design
- Content Creation, Rendering benchmarks see large gains
- Additional cores in 3900X deliver substantial compute power
Benefits from PCIe Gen4

IO Performance
- Up to 2x PCIe BW vs prior Ryzen generation

Storage Performance
- Large Block Sequential accesses are severely limited by link speeds

3DMark® PCIe Feature Test
- Vertex animation (game VFX) is sensitive to bus bandwidth, allowing significant upside

DaVinci Resolve
- Bus bandwidth is a significant limiting factor for non-linear editing (NLE) performance
Renoir APU
Ryzen 4xxx APU ("Renoir")
CPU performance

**SINGLE-THREAD PERFORMANCE**
- Cinebench R20 1T

**MULTI-THREAD PERFORMANCE**
- Cinebench R20 nT
  - ~90%

**GRAPHICS PERFORMANCE**
- 3DMark® Time Spy
  - ~28%

- Core i7-1065G7
- Ryzen 7 4800U

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- Ryzen 7 4800U
Laptop iGPU Gaming Performance

![Chart showing FPS for 1080p Low Settings]

- DOTA 2: ~55
- Fortnite: ~56
- League of Legends: ~87
- Rocket League: ~85
- Overwatch: ~80
- GTA V: ~36
- CS:GO: ~29
- ~130

Core i7-1065G7
Ryzen 7 4800U
More questions?
Backup
Old “Integrated Graphics” Architecture

790GX Architecture

AM2+ Socket

- DDR2 1066Mhz
- DVI, HDMI, DisplayPort
- VGA
- DRR2 / DDR3 Performance Cache
- 12 x USB 2.0
- PCI Interface
- HD Audio
- 1x16 16GB/s
- 1x4 PCIe
- HT3 5.2 GT/s
- Advanced Clock Calibration Link

- 40 Unified Shaders
- 700 Mhz 3D Engine
- 64/128 bit memory interface
- Direct X 10 - RV610 core
- AVIVO HD
- UVD

PCI Express 2.0
6x SATA 3.0 Gb/s
Parallel ATA
6x1 PCI Express® 2.0 GPP