

Autonomous Drone Engineer

B2 – Hardware Architecture

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Autonomous Drone Solutions Architect



RealTime and Smart

Flight Controller = Real Time

A quadcopter needs to balance the 4 motors:

- very quickly
- constantly
- without interruption

That's why this task is managed by a simple **microcontroller**. *Ex: STM32*

The microcontroller has limited processing power, but it is a deterministic behavior. You can be sure it will run your software in time. It is real-time.

Compute Board = Smart

If you need your drone to follow a simple GPS path, a microcontroller is enough. But if you want your drone to be autonomous, you'll need to avoid collision avoidance, perform computer vision tasks, communicate over IP networks. You'll need a **compute board**, typically running Linux.

This board will be connected to sensors like Intel RealSense, run complex software stacks and interact with the network. This type of heavy computation is usually **not done in real time**.

Summary

There's a clear separation of tasks:

- Simple real time computation by the **flight controller**
- Complex computations by the **compute board**

It is a **typical architecture** for autonomous drones.

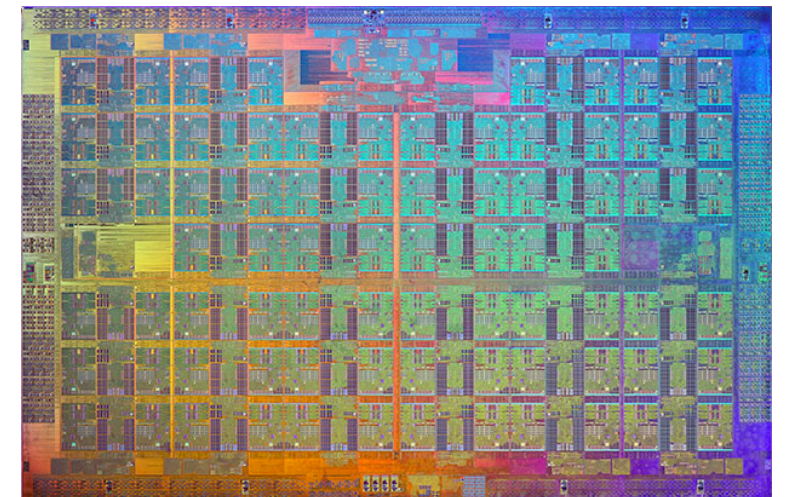
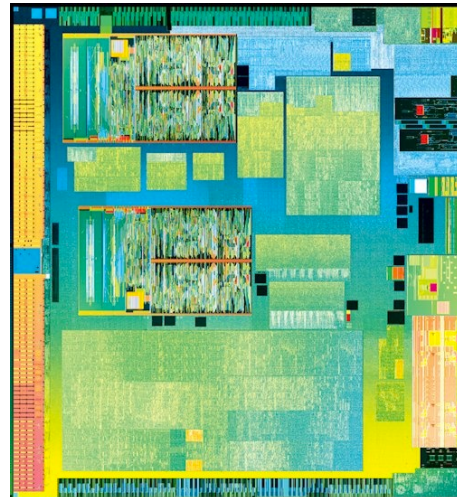
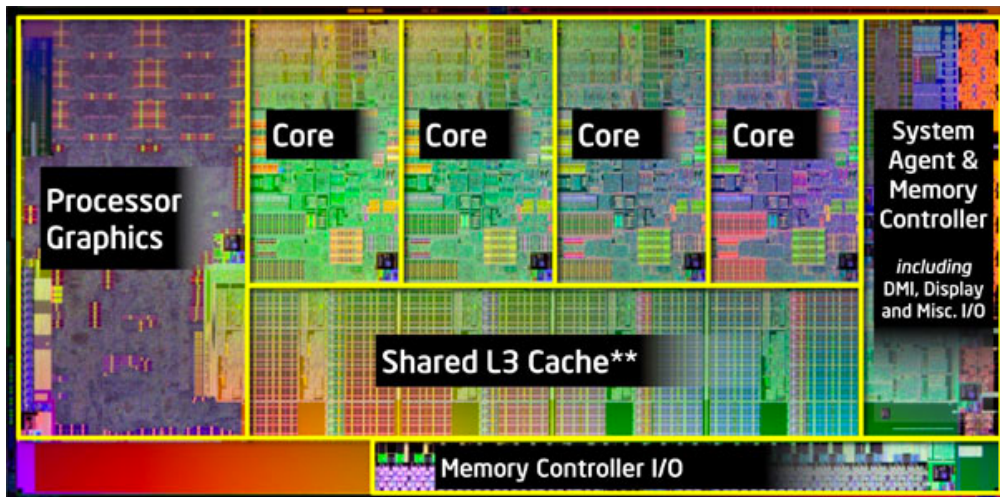
By working with Intel Aero,
you develop **durable and interoperable skills**.

Compute Architecture

(De)Centralized? Generic/Specific?

Trends in computer history:

- PCs and servers: Centralized generic computing (IA CPUs, + GPU)
- Mobile world: Dedicated decentralized computing (modems, IPU, ...)
- HPC trend: Centralized parallel and specific computing (CPU OR GPU)



(De)Centralized? Generic/Specific?

Proposed architecture for drones:

- Central generic computing for logic and custom code (Aero board)
- Decentralized specific computing for
 - 3D sensing (RealSense)
 - CV (Movidius)
 - Radio (LTE modem)
 - FPGA

Communications

Communications

Two systems:

- Peer2Peer:
 - Wifi P2P (consumer IP based RC Drones)
Usually highly optimized long range wifi, can support HD Video
 - Radio P2P (hobbyist RC drones)
Great for low latency
- Centralized:
 - Wifi (uncommon, problem with wifi strength)
 - Mobile networks like LTE (obvious choice for long range autonomous drones)

Drones flying in the same space do not require P2P radio comms
Only centralized mobile based communications are scalable

Intel Aero board has wifi included and supports M.2 professional LTE modems

Conclusion

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Intel Aero platform is:

- built from Best Known Methods
- proposing a compute architecture that's both flexible and powerful
- a good platform to develop skills, as it based on standards

Thanks

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<https://intel-aero.github.io>

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