



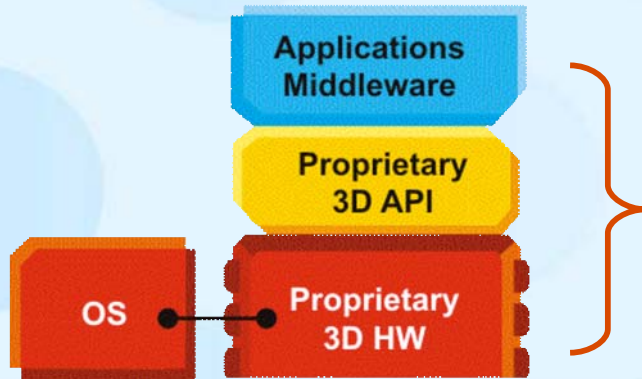
The integrator's dilemma

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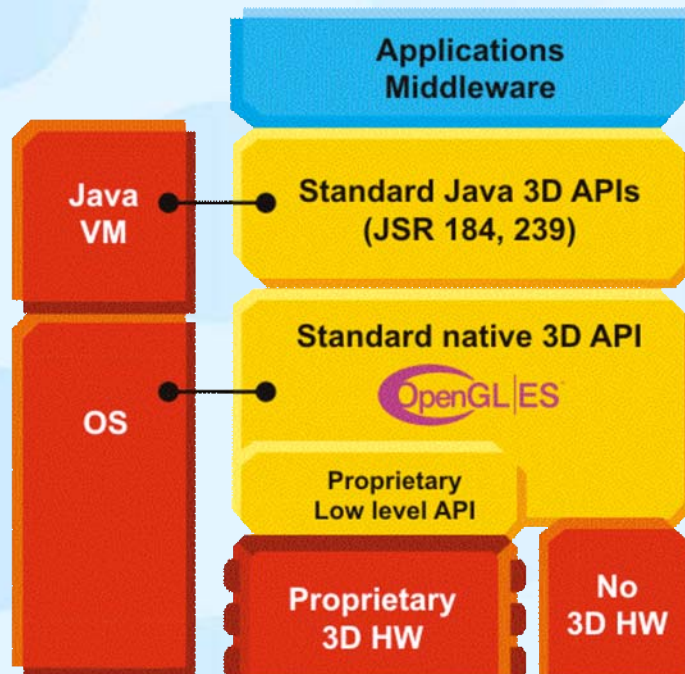


How things *used to be* (the console model)

- Platform totally controlled by the owner (Nintendo, Sony, MS, ...)
- New features introduced every 4 years
- HW driven – developers can access very low-level graphics tech
- Completely stable and simple operating environment (OS, HW, ...)
- There is no complexity problem



Embedded 3D graphics *today*



- Standards-driven
- New features every year
- A dozen OSs, a dozen JVMs, a couple of CPU families, half a dozen architectures, ...

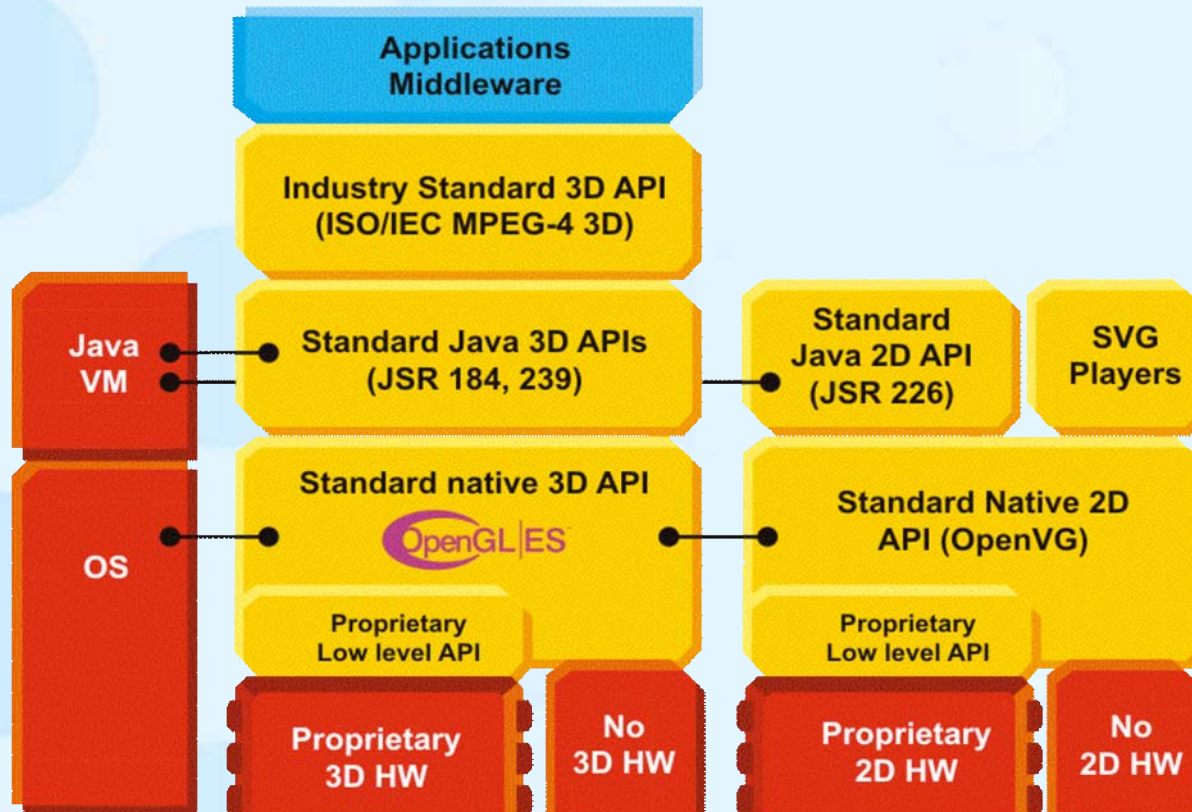


How things are now

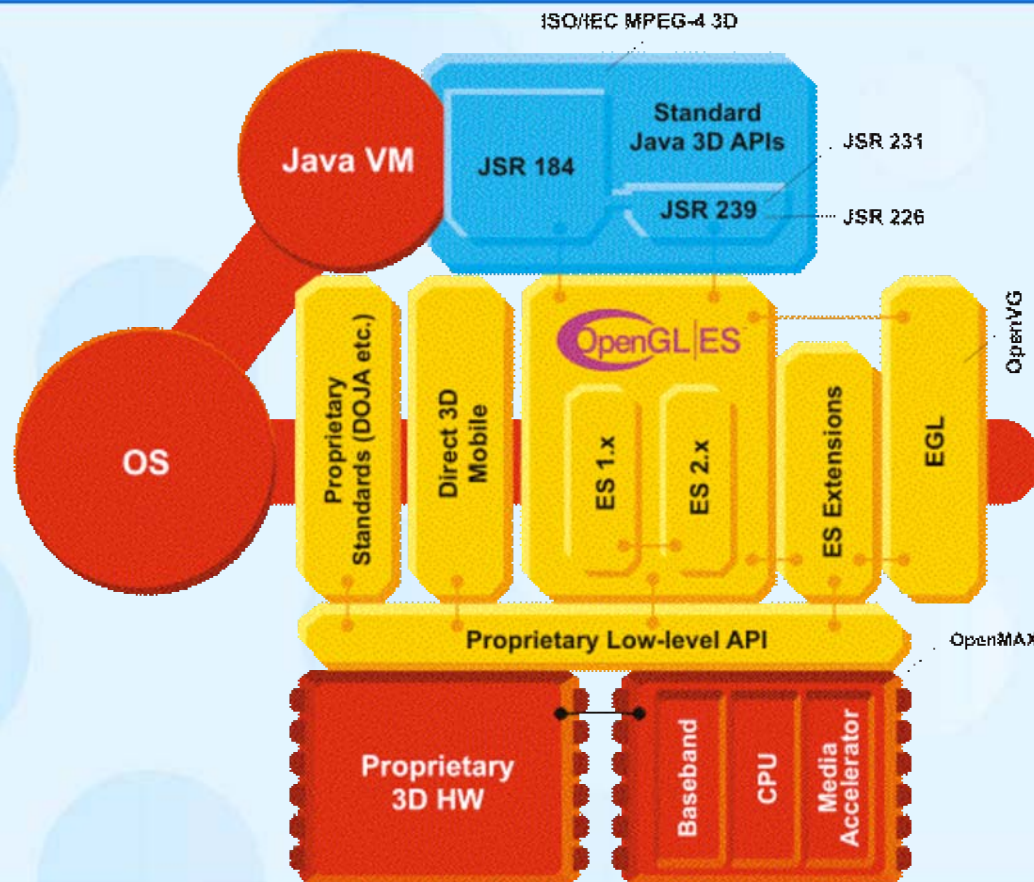
- Significant number of players in the ecosystem
 - OS, Java VM, CPU, GPU, audio, video/TV, multimedia accelerator, JSR/2D/3D/SVG/benchmark/middleware vendors
 - 5–15 vendors for each component
- Most areas well-defined and driven by open standards
 - This is possible only because the tech is already standardized :)
 - “Open” = control in a decentralized fashion
 - “Standard” = buyers know what to ask for and what they get
 - JCP, Khronos Group, MPEG
- Most companies focus on their own area of expertise



How things *will be* in 2005 – 2006



The 3D part in 2005 – 2006



What will it cost?

- Cost of technology implementations is moderate
 - Open standards prevent monopolies
 - Competitive market keeps prices reasonable
- "Taxes" need to be paid to the big boys
 - IP licensing
 - TCK fees, conformance testing
- The real cost is in putting it all together
 - Integration and testing costs time as well as money
 - Grave risk due to uncertainty
 - This facet will eventually dominate the whole equation



What will happen?

- Structure of the ecosystem becomes clearer
- Cross-component standardization begins
 - Already happening at Khronos/JCP
- Operators will mandate the standards
 - This development leads to the complexity problem
- Pre-integration will become critical
 - Reduces complexity, risks, and overall cost
 - Distribution arrangements and industry consolidation
 - The OS and VM vendors to be the major players
 - Dark horses: DoCoMo, Chinese government, MPEG?
 - The balance of control in the industry will change



Thank you!

