CS510 Languages and Low Level Programming: Portfolio submission, Topic 12

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Topic 12. Explain how the requirements of low-level systems programming motivate the desire for (and benefit from) language based support.

Low-Level system programming is difficult and error prone, developing software in this environment is tedious. Languages used for LLP, like Assembly and C (especially Assembly) are very powerful but do very little when it comes to error checking. A special domain specific language/compiler would greatly simplify system programming. Typical programming errors like buffer overflow, division by zero, null pointer dereference etc. are laborious to detect without proper operating system support. LLP specific language should be able to detect them during compilation, rather than runtime.

LLP has many repetitive, though hardware specific tasks like setting Page Directory, and Interrupt Vector Table, etc which are purely mechanical by nature and need lots of bits manipulations. For historical reasons bit patterns in various parts of the system are very different and unpredictable due to backward compatibility requirement. Many of these operations would be a lot easier, faster and reliable if supported by the language.
Another challenge in Low Level Programming is re usability of code - it is hard to achieve since every application is restricted to specific hardware, there is no Kernel API that general programmers are used to. However many of the problems can be abstracted by the Language or Standard Library.
Understanding how different parts of the LLP application are tied together can be problematic, since vital parts of code spread out among multiple domain specific languages and physical locations, also functionality interactions can happen at unexpected places or be hidden, for example by interrupts, or system calls.

Would be interesting to talk to someone from big hardware manufacturing company to see if there is any proprietary tools exists for this purpose.