sophisticated PLCs, with as many as 8,000 I/O points and 128,000 words of memory. These family members, using common I/O systems and programming peripherals, can interface to a local communication network. The family concept is an important cost-saving development for users.

Figure 1-4. Allen-Bradley's programmable controller family concept with several PLCs.

Like hardware advances, software advances such as the ones listed below, have led to more powerful PLCs:

- PLCs have incorporated object-oriented programming tools and multiple languages based on the IEC 1131-3 standard.
- Small PLCs have been provided with powerful instructions, which extend the area of application for these small controllers.
- High-level languages, such as BASIC and C, have been implemented in some controllers' modules to provide greater programming flexibility when communicating with peripheral devices and manipulating data.
- Advanced functional block instructions have been implemented for ladder diagram instruction sets to provide enhanced software capability using simple programming commands.
- Diagnostics and fault detection have been expanded from simple system diagnostics, which diagnose controller malfunctions, to include machine diagnostics, which diagnose failures or malfunctions of the controlled machine or process.
- Floating-point math has made it possible to perform complex calculations in control applications that require gauging, balancing, and statistical computation.