Four Levels of Metal Example
Advanced Metallization

Dual damascene IC process

- Oxide deposition
- Stud lithography and reactive ion etch
- Wire lithography and reactive ion etch
- Stud and wire metal deposition
- Metal chemical-mechanical polish

Source: IBM Corp.

Source: Digital Integrated Circuits, 2nd ©
Microprocessor Interconnect

- Microprocessor interconnect
- 8 levels of metal
- Steadily increasing pitch and thickness with higher levels for higher performance

Source: IBM

Source: ITRS Interconnect, 2005

Figure 70  Cross-section of Hierarchical Scaling—MPU Device
Source: ITRS Interconnect, 2005
ASIC Interconnect

- Application Specific IC (ASIC) interconnect
- 8 levels of metal
- More regular structure
  - Semi-global is 2x Intermediate pitch
  - Global is 4x Intermediate pitch

Figure 71  Cross-section of Hierarchical Scaling—ASIC Device
Source: ITRS Interconnect, 2005
IBM
90 nm

- 64-bit microprocessor
- (1) Al(Cu) [top]
- (2) 6x Cu
- (3) 2x Cu
- (5) 1x Cu
- (1) W local [bottom]
  - 0.12 µm width & spacing

Source: IBM
Intel 14 nm

- Broadwell Core M
- 13 metal layers
- Super thick top level metal
- MIM-capacitor layer under the top level metal
Intel 14 nm

- Broadwell Core M
- Detail of metal layers 1–12