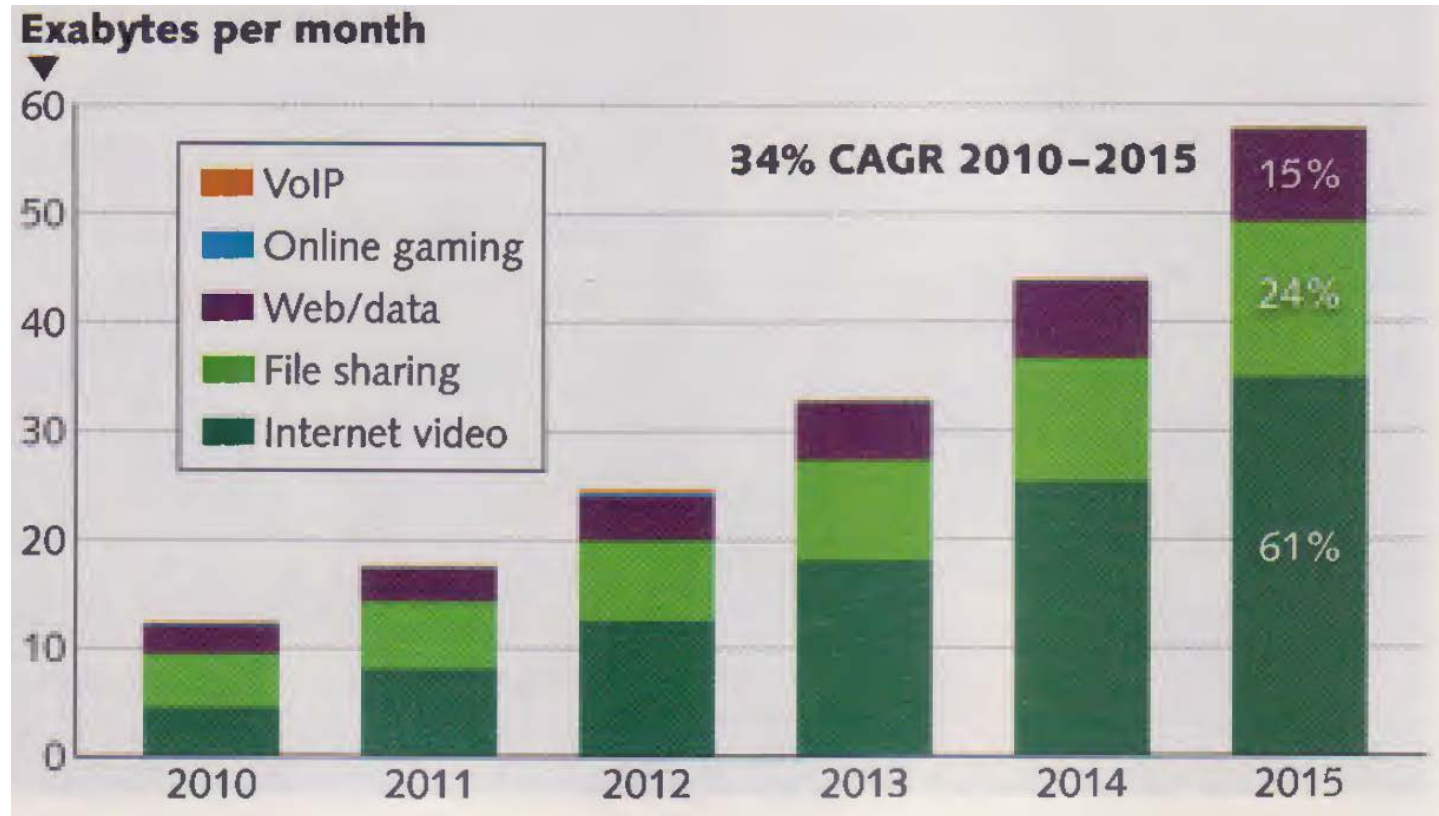


# Global Internet Demand (Cisco 2011 Projections)



From "Multilevel Modulation Formats Push Capacities Beyond 100 Gbits/sec," Shubhashish, Data, and Crawford, In Laser Focus World, February, 2012, pp. 58-63.

# Optical Encoding

Differential Polarization  
Keying (DPK)

Wavelength Division  
Multiplexing

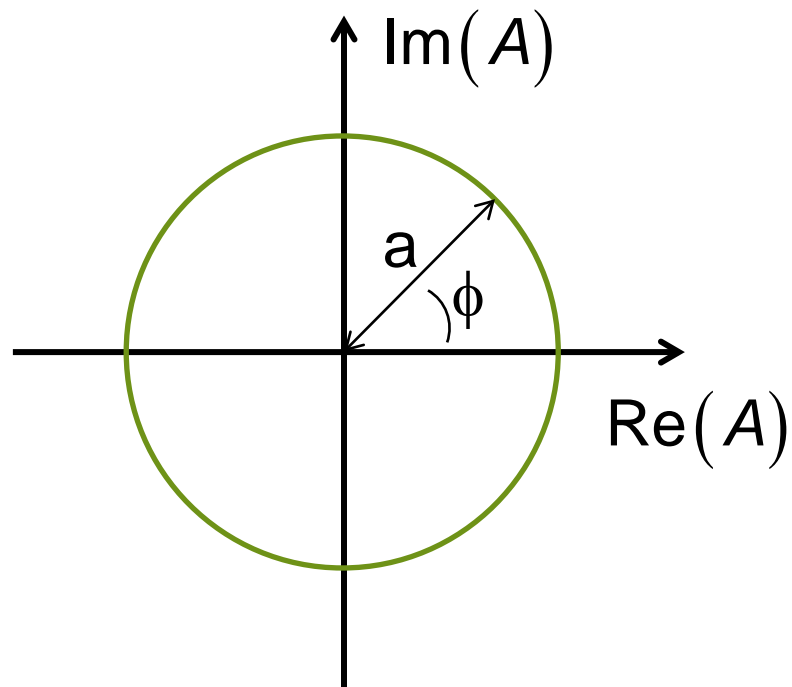
$$\vec{E}(\vec{r}) = \hat{e} \operatorname{Re} \left[ a \exp(i\phi - i\omega_0 t) \right]$$

Amplitude Modulation (AM)  
On-Off keying (OOK)

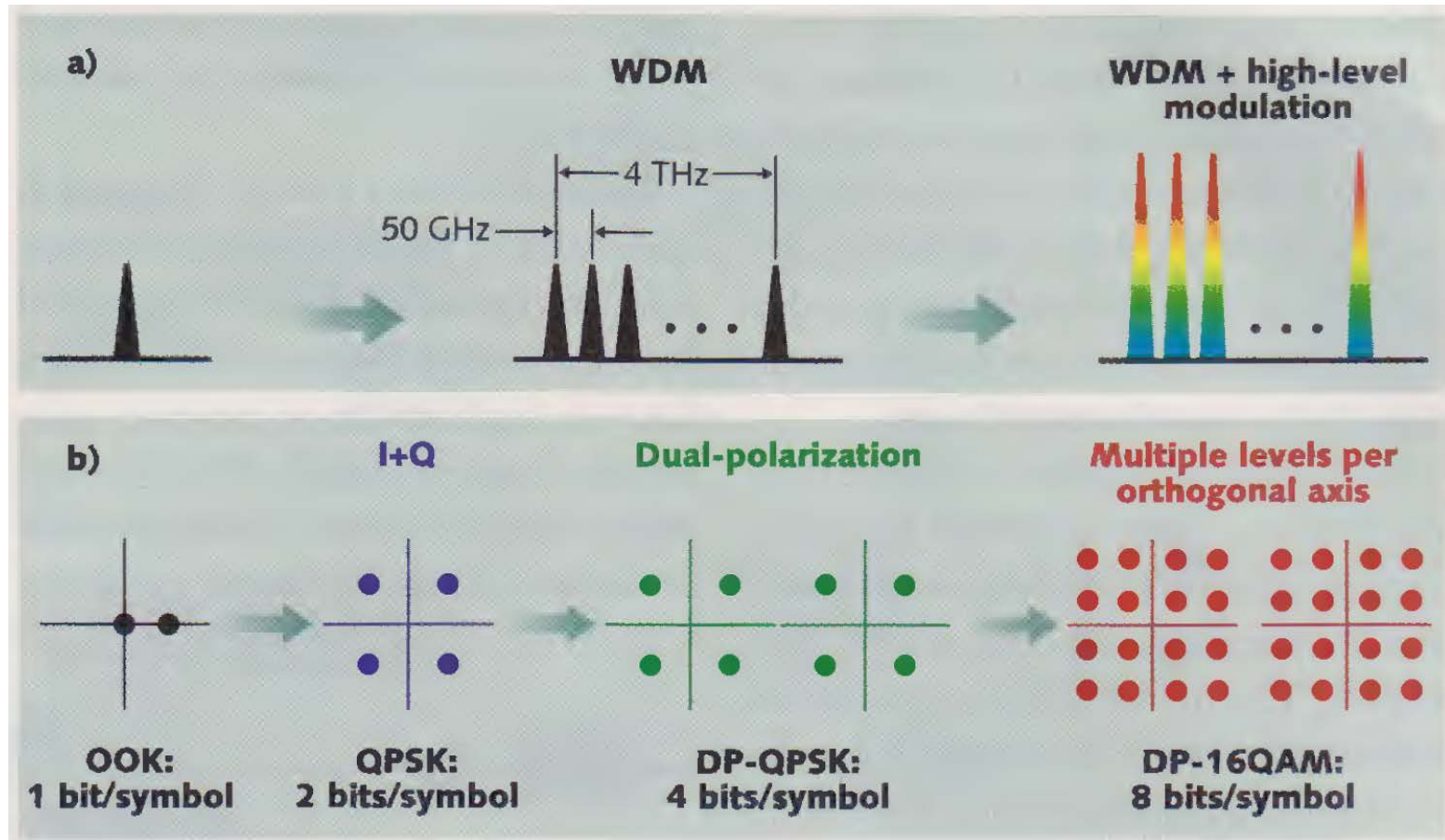
Phase Modulation (PM)  
Phase-Shift Keying  
(PSK)

# Complex Amplitude

$$A = a \exp(i\phi)$$



# Horizontal and Vertical Stacking of Information



From "Multilevel Modulation Formats Push Capacities Beyond 100 Gbits/sec," Shubhashish, Data, and Crawford, In Laser Focus World, February, 2012, pp. 58-63.

# Optical Networking History and Forecast

**Exhibit 1: Progression of Optical Networking**

Stage	Timeframe	Main Technologies	Applications
<b>Initial optical networks</b>	1980–1995	SDH/SONET	Telephony, voice traffic, dial-up modem traffic
<b>WDM/10G</b>	1995–2005	Growing WDM, 10GbE	Internet traffic ramps
<b>WDM/ROADM/40G</b>	2005–2012	Widespread 10G and introduction of 40G/OTN; SDH/SONET recedes; ROADMs	FTTx broadband, video, ICPs, super data centers; Netflix, Facebook, YouTube, iTunes
<b>Optical reboot</b>	2013–2020	100GE, 100G, coherent optics, ROADM/OTN mesh networks, packet transport	Cloud computing; widespread video, mobile broadband, yet-to-be invented apps

From “The Fast Approaching 100G Era,” by Andrew Schmitt, Directing Analyst, Optical Infonetics Research Inc., (© Infonetics Research 2011)