

Consulting

Our consulting revenue fluctuates depending upon the mix of new implementation projects we perform as compared to those performed by our enabled clients or led by our partners. See "Our consulting revenue is significantly dependent upon our consulting personnel implementing new license and cloud arrangements" in Item 1A of this Annual Report for additional information.

The decrease in consulting revenue in 2019 was primarily due to a decrease in billable hours.

Gross profit

(Dollars in thousands)

(Dollars in thousands)	2019		2018		Change	
Software license	\$	275,792 99%	\$	282,950 98%	\$	(7,158) (3)%
Maintenance		254,924 91%		239,310 91%		15,614 7 %
Cloud		67,918 51%		45,218 55%		22,700 50 %
Consulting		2,727 1%		22,338 9%		(19,611) (88)%
	\$	601,361 66%	\$	589,816 66%	\$	11,545 2 %

The recent shift in our revenue mix toward cloud arrangements has resulted in slower total gross profit growth as our cloud business continues to grow and scale. Revenue from cloud arrangements is generally recognized over the service period, while revenue from term and perpetual license arrangements is generally recognized upfront when the license rights become effective.

Gross profit

The increase in total gross profit in 2019 was primarily due to increases in cloud and maintenance revenue.

Gross profit percent

The decrease in cloud gross profit percent in 2019 was driven by an increase in costs as we accelerated our investments in cloud infrastructure and service delivery to support future growth. The decrease in consulting gross profit percent in 2019 was driven by a decrease in billable hours as consulting resources were transitioning to new projects after completing a large project and an increase in consulting resource availability as we continue growing and leveraging our partner network.

Operating expenses

Selling and marketing

(Dollars in thousands)

	2019		2018		Change		
Selling and marketing ⁽¹⁾	\$	474,459	\$	373,495	\$	100,964	27%
As a percent of total revenue ⁽²⁾		52%		42%			
Selling and marketing headcount, end of period		1,631		1,224		407	33%

⁽¹⁾ Includes compensation, benefits, and other headcount-related expenses associated with selling and marketing activities, as well as advertising, promotions, trade shows, seminars, and the amortization of client-related intangibles. ⁽²⁾ Selling and marketing as a percent of total revenue has been impacted by a shift in revenue in favor of our subscription offerings, particularly cloud arrangements, which has resulted in slower total revenue growth in the near term. Revenue from cloud arrangements is generally recognized over the service period, while revenue from term and perpetual license arrangements is generally recognized upfront when the license rights become effective.

The increase in 2019 was primarily due to \$81.2 million in compensation and benefits, attributable to an increase in headcount and \$11.9 million in deferred contract cost amortization. The increase in headcount reflects our efforts to increase our sales capacity to deepen relationships with existing clients and target new accounts.

Research and development

(Dollars in thousands)

	2019		2018		Change		
Research and development ⁽¹⁾	\$	205,210	\$	181,710	\$	23,500	13%
As a percent of total revenue		23%		20%			
Research and development headcount, end of period		1,657		1,621		36	2%

⁽¹⁾ Includes compensation, benefits, contracted services, and other headcount-related expenses associated with the development of our products, as well as enhancements and design changes to existing products and the integration of acquired technologies.

The increase in 2019 was primarily due to \$14.7 million in compensation and benefits, attributable to an increase in headcount and equity compensation, and \$5.1 million in cloud hosting expenses as we expand our cloud-focused research and development activities.