Ensuring Digital Transformation Value

The Digital Maturity Model and Survey

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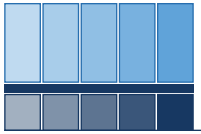


Ensuring Digital Transformation Value

The Digital Maturity Survey

For businesses where science is critical to success, Enthought has developed a model for digital maturity that serves multiple purposes in ensuring digital transformation initiatives deliver value. This survey asks a question for each of the elements of the model.

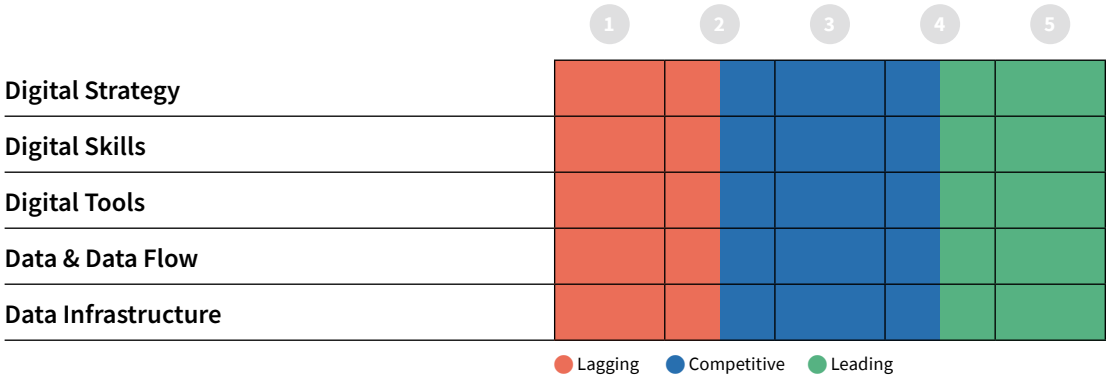
This is a soft copy version of the Digital Maturity Survey, significantly expanding the response options, and including their implications for businesses. It is designed to assist those involved in digital transformation initiatives to evaluate their strategy, current state, plans, and identify critical gaps that may limit or prevent delivering business value. Its 5 elements organized in this sequence also assist in seeing the bigger picture in what is required for digital transformation initiatives to succeed. Their success is not found in incremental improvements (although these are part of it), but in the possibilities for the business the new generation of digital technologies and skills can provide.

This digital maturity model can be a structure for developing strategy, prioritizing investment, developing integrated plans, auditing performance, and guiding management and governance. It can also be used to survey employees to understand their perceptions of how the organization is progressing in bringing value from digital transformation initiatives.

Digital Maturity Response Summary

Thank you for participating in our digital maturity survey. Below is a table designed to provide a general sense of where your organization stands in its ability to successfully deliver business value through digital transformation initiatives. Consider how you evaluated your organization in each of the 5 digital maturity elements. Subsequent pages expand on each.

Scoring Your Organization



	Lagging	Competitive	Leading
Digital Strategy	Lacking a clear strategic vision limits any organization's digital transformation, but does not prevent project-by-project success.	Having a digital strategy, however limited, enables a company to both make progress as an organization to improve business performance, and improve project-by-project impact.	A clear digital strategy, management-led with investment, not only ensures delivery across the organization, it motivates all employees to be part of it.
Digital Skills	Failure to develop digital skills inhibits the organization's ability to leverage new technologies, limiting innovation, with only incremental improvements through improved features in technology in use.	Improving digital skills indicates a potential for innovation through taking advantage of new technology, but more advanced methods of prototyping and application of AI and ML techniques may not be possible.	Scientists with leading edge skills can code prototypes, innovate quickly, apply AI/ML techniques, automate processes, and create new possibilities in their work.
Digital Tools	A business that is not proactive in adopting new digital tools will be severely limited in what it can achieve through its ever larger data sets, analysis, automation, and application of computational power.	Selective adoption of digital tools both on projects and across the organization can add significant value, but will be limited in scale and impact unless part of a larger business-driven plan.	Wide adoption of business-driven digital tools enables efficient data generation and collection, availability and deep analysis to provide greater scientific insights leading to faster, better decisions.
Data & Data Flow	Limited data with poor flow is perhaps the largest waste of expert time, largely limiting progress to optimizing existing workflows, and does not provide the necessary volume of high-quality data necessary to leverage AI/ML techniques.	Tackling 'the data problem' based on a business-driven requirement is always beneficial. However, results will be limited to incremental improvements unless the organization as a whole addresses quality, consistency, and availability, including automated processes to generate additional data to apply AI/ML techniques.	The ability to capture, store, and access data (including that automatically generated) to apply AI/ML techniques, gives the organization the potential to realise orders of magnitude business improvements.
Data Infrastructure	Not addressing data infrastructure as part of an integrated plan places limitations on all aspects of any digital transformation initiative, from availability to experts to data collection to analysis capabilities.	Even a limited investment in data infrastructure will improve availability to experts and enable them to apply digital tools, experiment with computational power, visualize and share results, and explore new workflows.	An advanced data infrastructure will enable access and sharing of all data, automated generation of new, and expert collaboration, leveraging the complete range of today's computational power.

Digital Maturity Model

Digital Maturity is defined as the state of progress in the application of the latest in scientific software tools and infrastructure technologies, by a suitably skilled workforce, leveraging all available data to deliver significantly improved business results.

Digital transformation initiatives are multi-year investments that cross the organization and introduce significant change on multiple levels. For science-driven businesses, Enthought has developed a definition of digital transformation as ***'…a process of facilitating and accelerating an organization's journey towards greater digital maturity'.***

Transitioning from that definition to crafting strategy and structuring plans is a challenge. For that reason, Enthought defines 'digital maturity' in five categories to enable organizations beginning these multi-year journeys to structure their approach.

It is worth noting that the technology elements of this definition are advancing rapidly, challenging the other components of digital transformation initiatives to keep pace. The case can be made that much of the technology advance follows Moore's Law, doubling in capability every two years (Moore's Law states the number of transistors in a dense integrated circuit doubles about every two years.)

The survey includes one question for each element of digital maturity. This expanded version of it, and implications, follows the same structure. The elements of the digital maturity model are:

- **Digital Strategy**
- **Digital Skills**
- **Digital Tools**
- **Data & Data Flow**
- **Data Infrastructure**

This 5-point model for Digital Maturity was developed by Enthought from working on digital transformation initiatives with companies from multiple industries, among them materials science, chemistry, semiconductors, life sciences, and energy. The starting point was their laboratories, where skills and data were key. A critical part of plans was to deliver business value early and continuously. This ensured motivated scientists and supportive management. From the lab, digital transformation initiatives move into other parts of the organization.

Digital Maturity Importance

Organizations with high Digital Maturity implement a repeatable, management-led approach to all projects. The organization is focused on maintaining leadership in its market segments and knows this will come through digitally transforming how it runs its business. Integration is seamless, and rapid adoption of new technologies and tools is encouraged at all levels of the organization.

The Five Elements of Digital Maturity

Digital Strategy	Digital Skills	Digital Tools	Data and Data Flow	Data Infrastructure
• Vision • Strategy • Business Objectives Driven • Management and Leadership • Governance • Organization Change / Change Management	• Mindset • "Problem Finding" • Applying Digital Tools to Solve Scientific Problems • Combining Domain Knowledge • Data Science • Scientific Software Development Skills	• Prioritized and Designed Based on Business Value • Supports Routine and Ad Hoc Analysis • Prioritization → Specification → Development → Deployment → Adoption → Support	• Quantity • Quality • Rate • Completeness • Central Accessibility • Discoverable • Discipline • Culture	• Scientific Data Management Focus • Automated Data Collection and Ingestion • Usable by Expert Networked Devices • Scalable Compute and Storage • Supports R&D Workflows
↓	↓	**IF NOT ADDRESSED**	↓	↓
Project by Project Impact	**Limited Innovation**	**Compute Not Leveraged**	**Workflow Optimization Only**	**Widespread Frustration**

Typically, digitally mature organizations have centrally funded teams focused on digital transformation with a clear charter and support from management. They are leaders in – and through – innovation, and their business results prove it.

Organizations with limited Digital Maturity often struggle with structuring and delivering value from their digital initiatives. They lack an overarching vision and strategy for digital transformation and typically are asking the question 'where to start'. 'Where to start' is a question not just for the scientists in the lab, but for IT, HR (recruiting), R&D managers, and especially executive leadership.

Digital Strategy

Assessing Digital Strategy: The effectiveness of Digital Strategy exists on a spectrum, ranging from 1 (none centralized, some localized) to 5 (a well defined, centrally supported and executed strategy focused on digitally transforming the organization).

How would you describe your organization's strategy and management engagement for digital transformation?

1. There is no strategy related to digital transformation. Various parts of the business are progressing ad hoc initiatives and projects, but without senior management oversight or any interdependence. Project successes are most often linked to an individual with the influence and initiative to drive change within their area of responsibility.

2. There is some strategic guidance for digital transformation, but lacking integration. Management has provided some resources to facilitate and accelerate selected 'digital projects' across the organization. There are some successful projects, but they are most often an incremental improvement to an existing workflow. Innovation is very limited.

3. There is a clear strategy at a high level, which has case-by-case adoption in the organization. Business units are able to translate this into actionable projects. However, these do not roll up to show organizational progress on a company-wide digital transformation. Innovation is limited and business impact is incremental.

4. There is a well defined strategy for digital understood by the organization. The strategy sets priorities, guides and supports investment, with management oversight and visibility of individual business results. There is a centrally funded team providing support for digital transformation projects. There is continuous business value delivered by projects.

5. There is a well defined strategy for digital that is understood by the organization, and is being implemented. Senior management provides guidance and investment, maintaining oversight and measuring business impact, both in specific projects and the wider organization. There is a centrally funded team providing support for digital transformation projects as well as delivering certain specific projects.

Where is your company?

1. Any digital initiatives in the organization will likely have a limited, project-by-project impact, and often be individually driven.

2. 3. Organizations in this range need to find champions in senior management who appreciate the importance of strategy, and focus on moving from 'project-by-project' success to organizational digital transformation.

4. 5. The organization is strategically positioned with committed management for market leadership through successful digital transformation initiatives across the company.

Digital Skills

Assessing Digital Skills: Digital Skills dictate an organization's ability to execute on strategy and leverage new technology. The range of digital skills is vast, from data related to coding prototypes, to modeling and simulation, to mastery of AI, machine learning and deep learning techniques.

What is the skill level across the organization for progressing digitally led initiatives – including scientific software development – by core business domain experts, data scientists and central teams?

1. The skill levels of individuals in the organization related to digital advances have not substantially changed in the last 1-2 years. There have not been new positions created nor targeted for hiring in the areas of data science or domain experts with coding skills.
2. There have been ad hoc training initiatives in scientific software by different parts of the organization, but these have been as much familiarization as skills. There has been some hiring where digital skills were a consideration. There is steady, if slow progress in the level of digital skills in the organization.
3. The different areas of the organization have recognized the importance of increasing competence in scientific software development and digital technologies. Business units are investing in training and there is ad hoc hiring for specific digital skills and areas of business. The overall competence in the organization is advancing.
4. There is management support for increasing the skills of the organization in scientific software development and digital technologies. There are numerous members of the scientific community taking part in courses and successfully applying those skills in their projects. There are specific hiring and career development plans to increase digital capabilities. There is evidence of the impact of new digital skills on various digital projects, including through AI/machine learning techniques.
5. There is management support and central investment for increasing the capabilities of the organization in scientific software development and digital technologies. This includes multiple training courses across much of the scientific community, who then are successfully applying this to their work. There are specific hiring and career development plans to increase digital capabilities. Domain experts are delivering digital transformation projects with clear business impact visible to management and aligned to the organization's strategy.

Where is your company?

1. There is limited innovation or change in existing workflows, other than what comes through incremental advances in the technology currently in use.
2.
3. Managers and scientists in organizations in this range need to assess the personnel resources available to support and deliver digital transformation projects. This may be existing domain experts training in scientific software techniques, data scientists or resources in a central team supporting digital transformation initiatives. HR may be engaged for recruiting new skills profiles. Focus on developing skills to enable reinventing existing workflows, building a culture for the value of data.
4.
5. The organization has the necessary skills to take full advantage of the advances in digital technologies, including scientists able to code prototypes (most often in Python), automation of processes, and implementing AI/machine learning techniques.

Digital Tools

Assessing Digital Tools: Digital Tools are those advanced scientific softwares which can be developed internally, or are commercially available, as well as open source. Accessing the complete range is fundamental to any science business digital transformation. These are increasingly in the Python programming language.

How would you rank your organizations' use of digital tools and technologies?

1. The organization is using much the same softwares and digital tools as for the previous 1-2 years. There are no centralized efforts to advance the digital tools used by our scientists, and there is limited initiative in the various parts of the organization.

2. Certain business units are adopting new digital tools on a project-by-project basis, mainly from software providers, both new and existing. There is organizational recognition of the importance of advancing our digital tools, however, with limited central investment and coordination.

3. There is proactive adoption of new digital tools in various parts of the organization – mainly from software companies, both existing and new – with some teams experimenting writing code, targeting specific business problems. There is experimentation with cloud based capabilities (data, compute). There is management support and investment available for these initiatives.

4. There is proactive adoption of new digital tools widely in the organization, including those developed by software suppliers, consultants, and the teams themselves, applied to specific business problems. There are ongoing initiatives with cloud based capabilities (data, compute) delivering value to specific projects. There is a centralized team able to develop digital tools, with investment and coordination for many of these initiatives. IT is engaged and providing support.

5. There is proactive adoption of new digital tools across the organization, including those developed by software suppliers, consultants, and the teams themselves, with strong knowledge of what is available open source. These are applied across the organization. As part of a company strategy, there are ongoing initiatives with cloud based capabilities (data, compute) delivering value on multiple projects. There is a centralized team providing support, investment and coordination of digital tools, including development, and sharing experience across the organization. IT is working seamlessly with the organization.

Where is your company?

1. Any improvements in existing workflows will be limited to advances in digital tools brought in through software providers and any ad hoc consulting resources. Progress made with data availability and structure will not yield business value, and the power of cloud/compute will not be leveraged.

2.

3. Managers and scientists in organizations in this range need to think beyond incremental improvements in existing workflows and look for possibilities where new digital technologies can enable innovation with significant business impact. Focus on identifying digital technologies that can reinvent existing workflows, creating new data sets, and accessing the power of cloud/compute with AI/machine learning.

4.

5. The organization is identifying and applying new digital technologies from a variety of sources to deliver significant business value as part of a company-wide strategy. Existing workflows are being reinvented, new data created, accessing the power of cloud/compute with AI/machine learning.

Data & Data Flow

Assessing Data & Data Flow: Achieving Digital Maturity and delivering business value is highly dependent on the organizations' culture and ability to harness its data in a highly organized way. Generating the significant volumes of data through automation and applying AI/machine learning techniques are necessary to create a new generation of science workflows.

How would you describe data quality, quantity, accessibility, and discipline in its collection, management and use?

1. The organization's approach to data and its management has not fundamentally changed in the last 1-2 years. Historical data continues to be a significant challenge to find, access, clean up and combine with new, for robust analysis.
2. There have been ad hoc initiatives to improve data accessibility. However, it is very difficult to access historical data and understand quality, before analysis can begin. There is likely significant, relevant data undiscovered.
3. There are ongoing investments to improve historical and new data accessibility, where there is now reasonable efficiency. Clean up and combining with new data in workflows for analysis is delivering value.
4. Data initiatives are uniformly benefiting the organization through efficient access to the majority of relevant data. Clean up and integration into new workflows is efficient. Advanced search (e.g. model based for analogues) is being explored.
5. Data initiatives have been highly successful in providing access to all relevant historical data. Clean up and integration into workflows is seamless. Data organization and advanced search techniques are mitigating the issue of individual knowledge.

Where is your company?

1. The availability of existing and limited new data will constrain any improvements in workflows through new skills and digital technologies. The power of automation and AI/machine learning to deliver value are not available.
2.
3. Managers and scientists in organizations in this range need to look closely at where data exists, its quality, how it can be accessed, shared, and used in new workflows. Explore generating new data sets to introduce possibilities in business value and expert efficiency through automation, and AI/machine learning techniques.
4.
5. The organization appreciates the value of data, and is working to ensure that all data is available, of high quality and understood. New data being generated targets improved business performance. Advanced search techniques using different models can offer new possibilities in reinventing workflows.

Data Infrastructure

Assessing Data Infrastructure: Data Infrastructure is the foundation of Digital Transformation. It is the management of scientific data and the organizations' computing focus. Data infrastructure supports an R&D workflow, enabling scientists' use through various networked devices. Critical components of the necessary infrastructure to drive the organization toward greater digital maturity include automated data collection, an integrated platform, cloud storage and computing.

Which of the following best describes your organization's data infrastructure, approach, and investment in service of leveraging recent digital advances to deliver business impact?

1. Data infrastructure remains largely IT function driven, with few changes in the last 1-2 years. Accessing historical data and combining it with new in workflows is largely unchanged.
2. There have been ad hoc initiatives (e.g. data lakes, cloud storage) to improve historical data access, enabling incremental improvements to workflows. There have not been changes in platforms to enable advanced scientific computing.
3. There are centrally supported plans and projects (e.g. cloud storage/computing) that have significantly improved access to historical data, and its combination with new data. There are pilot projects advancing infrastructure, for example cloud based computing, sharing of CNN models.
4. Data infrastructure (e.g. cloud storage/computing) provides efficient search and access to historical data, and its combination with new data. Infrastructure enabling advanced scientific computing is in place, with a number of business units using this infrastructure.
5. Data infrastructure is highly functional for search and access of historical data. Where appropriate, data collection and ingestion is automated. Infrastructure enabling advanced scientific computing is in place and widely used.

Where is your company?

1. The lack of investment in data infrastructure will highly limit any potential from new scientific computing capabilities and scientist skills. There will be widespread frustration in the scientific community as this constraint becomes increasingly visible.
2.
3. Managers and scientists in organizations in this range need to look closely at their data infrastructure and its interdependence with all data sources and computational technologies. Infrastructure must enable advanced search techniques, automated data creation, ingestion, and AI/machine learning techniques. As the organization advances in software technology and skills, data infrastructure limitations will become a source of frustration for scientists.
4.
5. The organization appreciates the importance of data infrastructure and is investing to ensure it keeps pace with a new generation of data, accesses legacy data, and works seamlessly with new software technology and skills in the business. Data infrastructure never constrains new workflows and the creativity of scientists, including applying AI/machine learning techniques.

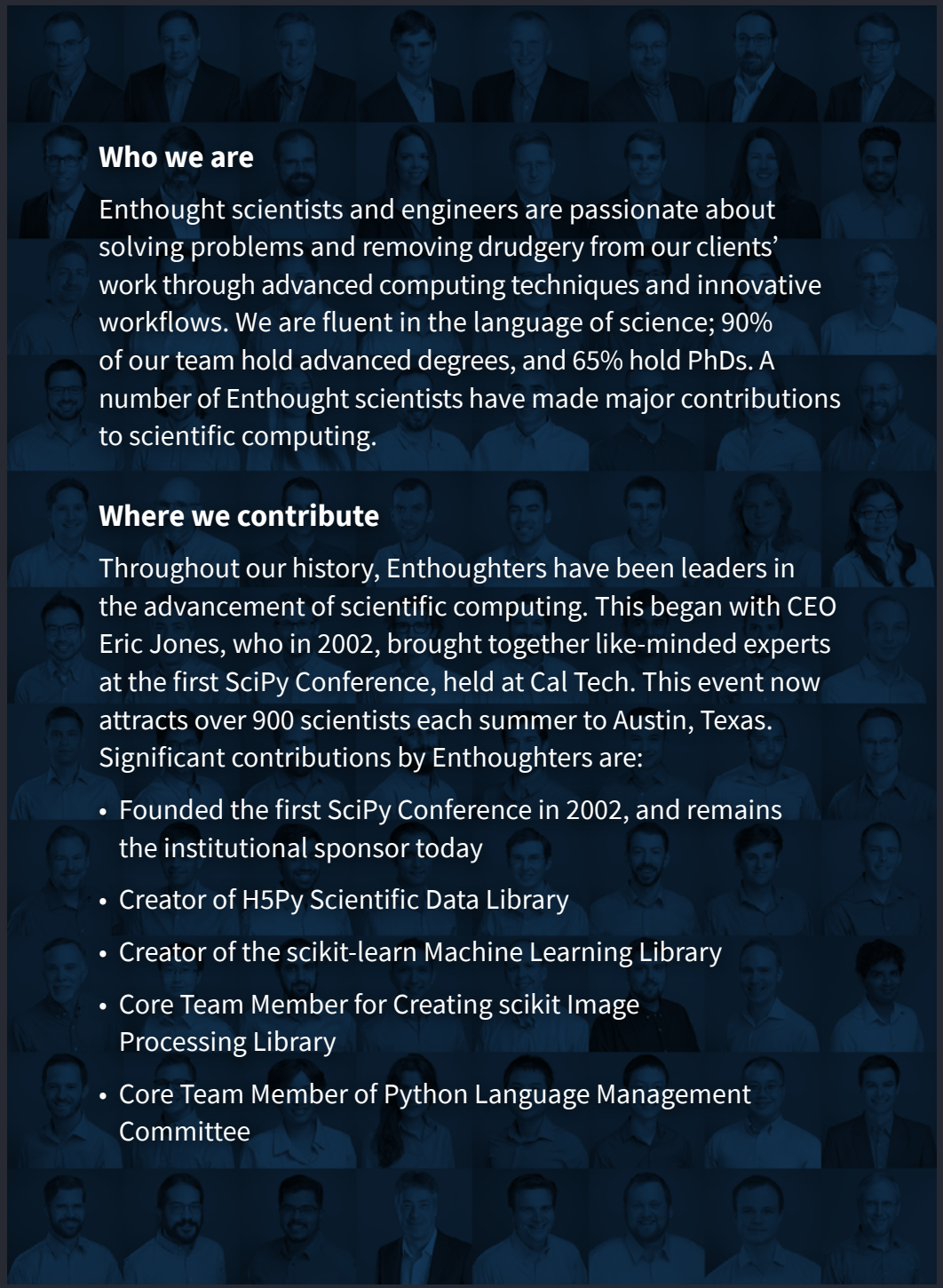
About Enthought

For companies where science is critical to business success, Enthought combines software development skills, client domain understanding, and change management expertise to collaboratively deliver transformative results.

90%
Scientists & Engineers

65%
PhDs

Since 2001
+5
Locations



Who we are

Enthought scientists and engineers are passionate about solving problems and removing drudgery from our clients' work through advanced computing techniques and innovative workflows. We are fluent in the language of science; 90% of our team hold advanced degrees, and 65% hold PhDs. A number of Enthought scientists have made major contributions to scientific computing.

Where we contribute

Throughout our history, Enthoughters have been leaders in the advancement of scientific computing. This began with CEO Eric Jones, who in 2002, brought together like-minded experts at the first SciPy Conference, held at Cal Tech. This event now attracts over 900 scientists each summer to Austin, Texas. Significant contributions by Enthoughters are:

- Founded the first SciPy Conference in 2002, and remains the institutional sponsor today
- Creator of H5Py Scientific Data Library
- Creator of the scikit-learn Machine Learning Library
- Core Team Member for Creating scikit Image Processing Library
- Core Team Member of Python Language Management Committee

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HOUSTON, TX, USA
Energy Solutions
Est. 2018

CAMBRIDGE, UK
Est. 2007

ZÜRICH, SWITZERLAND
Est. 2019

TOKYO, JAPAN
Est. 2019

OUR ORIGIN

Enthought was founded in 2001 when CEO Eric Jones was conducting postdoctoral research in electrical engineering at Duke University using the Python scientific software stack. He recognized its potential to solve tough science problems and remove drudgery from the work of technical people. Eric began developing Scientific Python and networking to enlist like-minded experts to join him.

OUR WORK

We collaborate with clients to define opportunities, explore possibilities, craft scientific software, design enabling infrastructure, and train their experts in apprenticeship-style programs to develop new techniques and workflows, fundamentally changing how their business performs. Research laboratories stand out as examples of how this approach can have a transformative impact on the business.

OUR FUTURE

We see unlimited potential for business impact through advanced scientific computing techniques, compute infrastructure and automation. A new generation of digital scientists will craft innovative workflows, automatically generating the orders of magnitude more data necessary to apply AI/machine learning techniques. This will fundamentally change businesses and the value they deliver

Learn more at enthought.com

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