

Enabling Multilingual Collaboration through Machine Translation

Real-time multilingual capability for chat and community forums will transform how Intel delivers global content at an enterprise level.

Executive Overview

To better serve Intel's global customer base in their native languages and reduce support costs, Intel IT conducted two proof-of-concepts (PoCs) and designed prototypes that integrate machine translation (MT) into existing collaboration environments to deliver real-time multilingual chat and community forums—enterprise capabilities that had not been previously commercially available. We concluded that multilingual chat and forums could be used successfully by our customer support teams, and these tools had significant promise to deliver many benefits across the enterprise.

Intel is constantly seeking compelling ways to communicate with and support its customers globally. Our vision is to enable people who speak different languages to communicate and collaborate with each other—improving overall customer experience and increasing support efficiency. Our objective for the PoCs was to research the quality, usability, and performance of using MT to deliver multilingual interaction capability in chat and community forums.

Our results showed that multilingual collaboration tools have the potential to not only enable customers to collaborate in their own language, but to also significantly improve customer experience. We anticipate a future MT solution will deliver the following benefits:

- Improve the way we connect and empower our employees and customers online

- Reduce or avoid additional support costs
- Increase Intel's reach to existing and new customers no matter where they live by eliminating language barriers
- Make the online support environment more collaborative and easier to use
- Add value across our entire corporation in areas where multilingual collaboration is required to drive innovative solutions, business partnerships, and revenue

We plan to continue our research, and we are currently working on a beta production version of a solution that integrates MT into Intel Community forums. We are also looking into opportunities to scale these efforts into customer support, sales, marketing, research and development, product development, factory support, and other departments that need multilingual tools to better collaborate.

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BUSINESS CHALLENGE

One of our core roles as an IT organization is to deliver timely solutions that facilitate business growth, increase efficiency, and forge closer links with customers. Intel's business strategy is based on growth, especially in key market segments such as consumer electronics and embedded devices, and in global emerging markets.

We need low-cost ways to attract and support a variety of new customers in an environment of shifting expectations. The Web is now the first information source for many customers and a growing channel for collaboration with peers, partners, and suppliers.

Recently, Pew's Internet & American Life Project found that people are showing a strong preference toward going online first to find what they need before resorting to other mediums. "Search and email remain the two online activities that are nearly universal among adult internet users, as 92% of online adults use search engines to find information on the Web, and a similar number (92%) use email. These two behaviors have consistently ranked as the most popular, even as new platforms, broadband and mobile devices continue to reshape the way Americans use the internet and web."¹ Furthermore, according to a white paper published by Outsell's Gilbane Group,² the fastest growing areas of the Internet are social media sites where people find and contribute content, such as customer knowledge bases, discussion forums, blogs, online communities, and online chat. The current surge in social

media is being driven by enterprises such as Intel using these sites to better engage with their customers. Because Intel has a diverse global customer base, and human translators cannot scale to meet the needs of fast, inexpensive, and accurate translations, the only viable alternative is real-time machine translation (MT).

Collaboration is particularly useful in helping Intel grow its business in emerging markets. These emerging markets offer great potential for growth, but often have limited resources and lack expertise. Over 80 percent of Intel's revenue comes from outside the North American region. Research by the Common Sense Advisory³—a firm specializing in research on globalization and localization—indicates that people in our top two markets, China and Brazil, are more likely to purchase products if product information and troubleshooting are localized, and by inference this may include chat and community forums.

The lack of commercially available enterprise tools that overcome the language barrier has created several problems, including:

- **Less effective use of our online content.** Many global customers cannot rapidly resolve product issues themselves or resolve these issues through peer collaboration online. For example, some visitors to our community forums have been copying content from the community forums and pasting that content into free web-based MT systems. This creates an uneven user experience for our global online audience (see Figure 1) and could also potentially expose confidential content.

¹ Purcell, Kristen, "Search and email still top the list of most popular online activities." Pew Internet & American Life Project. Pew Research Center (August 2011). www.pewinternet.org/Reports/2011/Search-and-email.aspx

² Emery, Vince, "Translating Social Media and Dynamic Content in Real Time for Customers: New Options for the Enterprise." Outsell's Gilbane Group (November 2011). www.gilbane.com/beacons.html

³ DePalma, D. A., N. Kustanovitz, B. B. Sargent, and N. Kelly, "Localization Matters: Why Adapting Products and Websites to Local Market Needs Means Good Business." Common Sense Advisory (November 2008). www.commonenseadvisory.com/Portals/_default/Knowledgebase/Articleimages/081122_R_Localization_matters_Preview.pdf

- **Longer and more costly customer support calls or e-mail exchanges**, and a lack of flexibility to operate out of the most cost-effective support and sales locations. In a follow-the-sun model of support, where online sales and support is available around-the-clock, chat must always be accessible in the customer's native language. However, it is costly to staff support centers with agents skilled in both language and technology.

With no available enterprise solution for multilingual collaboration on the market, Intel IT's translation and localization teams initiated two proof-of-concept (PoC) projects to research the quality, usability, and performance of using MT to deliver multilingual interaction capability in chat and community forums.

SOLUTION

Intel is constantly seeking compelling ways to communicate and support its customers globally. Our vision is to enable people who speak different languages to communicate and collaborate with each other—improving overall customer experience and satisfaction, increasing support efficiency, and helping our sales teams extend their reach.

Intel CEO Paul Otellini addressed this global vision during his presentation at the CEO Summit in 2010⁴: "Intel has arguably an audacious vision: This decade we will create and extend computing technology to connect and enrich the lives of every person on earth."

People around the world expect to be able to do business in their native language. Intel IT has had a long commitment to and deep experience in providing solutions that help our business groups cost-effectively communicate with customers—and potential customers—in the many languages they speak.

⁴ CEO Summit 2010. "Leading Innovation for the Next 5 Billion." Paul S. Otellini, president and CEO. November 16, 2010.

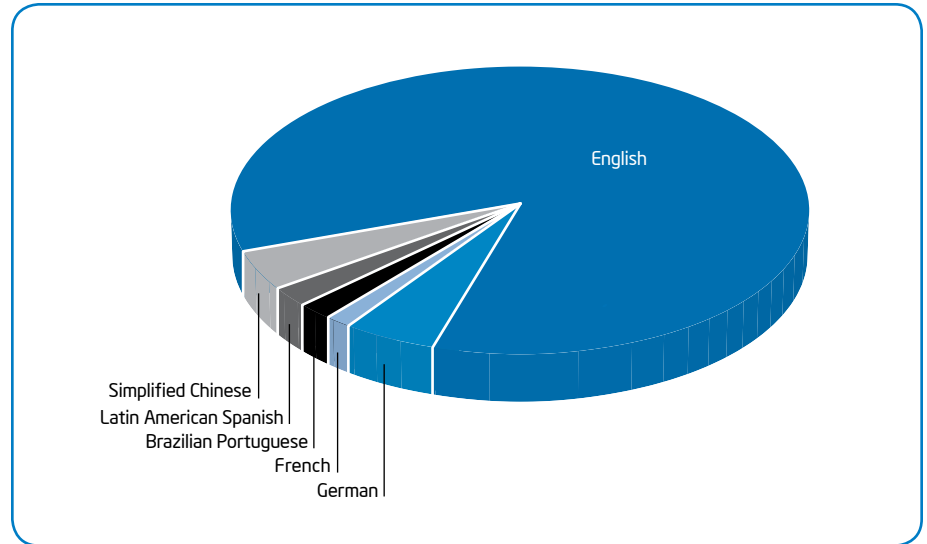


Figure 1. Top six languages used by our global online audience, sampled during one month. Intel internal data, December 2011.

What is Machine Translation?

Machine translation (MT) is a software-based tool that translates text or speech from one natural language to another—for example, English to French and French to English. The bi-directional translation capability and speed is key for both parties who rely on near-real time contextual conversation to create mutual understanding.

Current MT software enables customization by domain or profession (such as news or semiconductor technical content, in the case of Intel), which often improves results by limiting the scope of possible out-of-context interpretations. This technique is particularly effective in domains where formal or formulaic language is used.

There are a number of different approaches to MT. Three of the most common are:

- **Rules-based MT.** Rules-based MT uses linguistic information and bilingual dictionaries for each language pair to analyze the content in its source language and generate text in the target language. Translation quality can lack fluency, and these types of translation solutions tend to be expensive to develop.
- **Statistical MT.** Statistical MT employs statistical translation models whose parameters stem from the analysis of monolingual and bilingual corpora, an existing body of material, to generate text in the target language. Statistical MT provides good quality when a large corpora is used to train the system. Compared to rules-based MT, the translation is generally more fluent and reads well. However, the translation is not always predictable or consistent. Statistical MT is also much less expensive to develop than rules-based MT systems. One of the most-widely used free web search platforms takes advantage of this model, given its access to a large body of content for analysis.
- **Hybrid MT.** A hybrid system combines the strengths of statistical and rules-based translation methodologies and offsets some of the weaknesses of the individual model.

Most MT systems in use today tend to be based either on the statistical or hybrid methodologies. Intel currently uses statistical-based MT systems.

Machine Translation

Since 2007, we have been using MT to increase the volume and reduce the cost of translation on the Intel Customer Support web site on www.intel.com/support. The top languages used by our customers include Brazilian Portuguese, French, German, Latin American Spanish, and Simplified Chinese (see Figure 1).

Given the amount of content in our customer support knowledge base, our limited budget could cover translation of up to only 20 percent of the content into any given language using human translation. For customers with limited or no command of English, the language barrier significantly hindered access to information and did not offer a good customer experience.

In 2007, we conducted a pilot using statistical MT to translate from English to Latin American Spanish. We learned that we can use MT to deliver fully automatic useful translation. The translation quality had to be good enough to help customers solve their problems, and this could be achieved even if some translations were not grammatically perfect. As long as the translation helped to solve the issue or answer a customer's question, the translation was considered successful. Our pilot demonstrated to us that MT is able to deliver translation that is both understandable and actionable.

After years of successfully using MT to deliver and publish raw, automated translation for five languages on the Intel Customer Support web site with no or little human involvement, we wanted to explore whether we could have similar success in interactive environments such as chat or community forums where creation and translation had to be in real time. Our translation and localization teams initiated two PoC projects to research the quality, usability, and performance of

using MT to deliver multilingual interaction capability in these real-time environments.

The goal of both PoCs was to drive efficiencies in the support center to reduce costs and to help increase customer satisfaction and loyalty.

Proof of Concept 1: Multilingual Chat Using Machine Translation

Chat poses several challenges for successful multilingual implementation. It's an unconstrained environment, where people use short cuts and abbreviations, such as F2F for face-to-face and K for okay. Typos and misspellings are common, and communication is fast paced. In addition, support agents are handling multiple chats, which can be in multiple languages, creating an increasingly difficult and distracting environment. The successful multilingual chat solution needed to provide acceptable translation quality despite these challenges and also needed to meet the usability requirements of support agents so they can serve a wider customer base.

For the first PoC, we integrated three different MT systems with the same chat application, and we used Intel call center agents to simulate agent-to-customer chats.

SUCCESS CRITERIA

To be considered a success, MT in chat needed to:

- Be accessible—anytime and anywhere—in the customer's native language
- Improve the online customer experience
- Improve support team efficiency while engaging with non-English speaking customers
- Meet Intel's translation quality and usability standards

- Integrate into the existing online support structure that customers used
- Provide a solution that could scale across the business

The solution needed to foster real-time communication between support agents or subject matter experts, and global customers in the languages that represented the regions responsible for a majority of Intel's revenue.

METHODOLOGY

Based on our requirements, we worked through a four-step process that consisted of researching, prototyping, testing, and analyzing the results and feedback from our usability tests on MT in chat.

Step 1: Conduct market research to find viable solution partners.

Our translation and localization teams at Intel researched several MT solution providers on the market with the capability to integrate with the third-party chat platform that Intel uses. We collaborated with three MT solution providers.

Step 2: Develop prototypes of MT solutions in a single chat application.

Three prototypes were developed to deliver multilingual chat; each prototype integrated MT into our existing chat application. Our Intel localization engineering team developed one prototype while two of the solution providers developed the other two prototypes.

Our prototype, shown in Figure 2, includes the source and translation display at the top. At the bottom, it shows a preview of the translation, as well as a reverse translation. We included a button that enabled customers to request another translation if they didn't understand the first translation.

Step 3: Test the efficacy of each solution using appropriate Intel resources.

We used our translation quality assurance team and in-country support call agents to test and evaluate the prototypes and translation quality. They engaged in eight different multilingual chat scenarios in two language pairs.

- English and Latin American Spanish, bi-directional
- English and Simplified Chinese, bi-directional

Step 4: Evaluate translation quality and determine which solution could best meet our quality and cost requirements.

We asked the participants to evaluate translations on a five-point Likert scale, with five being the highest score: “understandable and actionable, most text translated accurately” (see Figure 3). We performed a standard Intel translation quality assurance (QA) evaluation and used it as a baseline for comparison. We surveyed the participants for information on performance after each testing session, and we also evaluated translations of random

chats that were not part of the formal testing process.

RESULTS

Our analysis of QA ratings and surveys from our tests indicated that the translation quality for all three prototypes was good; a high proportion of the translations were understandable and actionable (see Figure 3). We concluded that multilingual chat could be successfully used in a post-sales customer support environment. In addition, multilingual chat looked promising as a successful collaboration tool in other environments such as pre-sales and sales.

The results showed variations in translation quality depending on the language pair. Spanish translations scored higher than Chinese, which suggests that additional training of the MT system could improve the Chinese chat. Successful translation was generally achieved when the agent or customer asked for clarification or rewording.

In the feedback from post-test surveys, the participants suggested that spelling and terminology assistance could help improve the quality of the translation, and a good integrated dictionary of general technical and

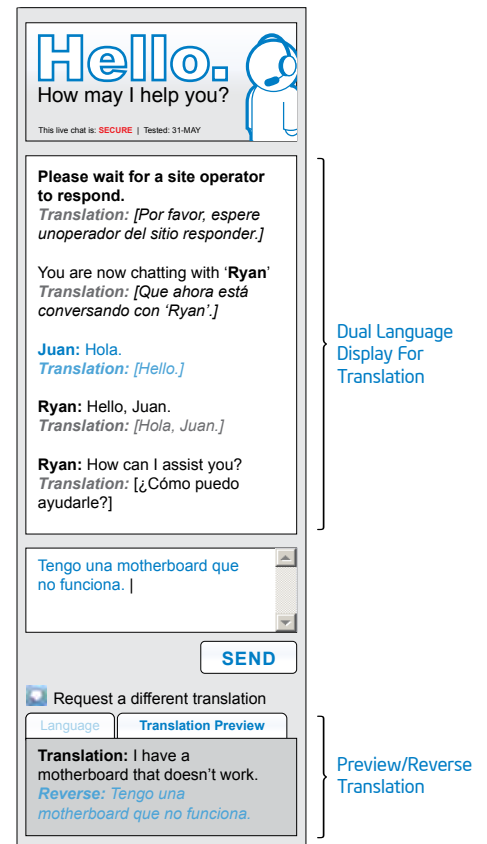


Figure 2. Our multilingual chat prototypes were designed for ease of use in a fast-paced support environment.

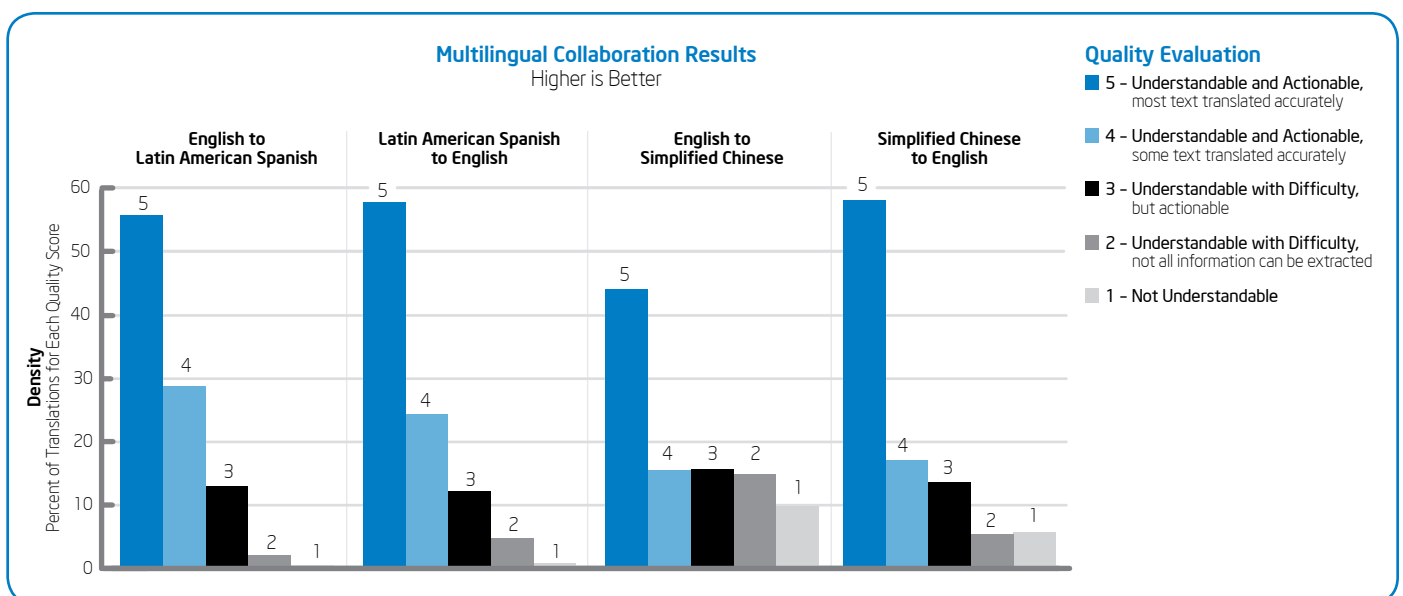


Figure 3. The results—the cumulative scores for all machine translation chat systems—showed that multilingual collaboration in real-time chat provides reasonable translation quality.

computer terms could also be helpful. Most participants reported that it was useful to see a preview and reverse translation of their text before sending the message. They also preferred seeing the source and translation in the chat window, particularly if they had some understanding of both languages.

Overall, our PoC results showed that multilingual collaboration in real-time chat provides reasonable translation quality and allows customers to collaborate in their own language.

Proof of Concept 2: Machine Translation in Community Forums

In this PoC, we designed and implemented a prototype that integrates MT into the Intel Community platform. We wanted to research the quality, performance, and usability of using MT to deliver multilingual collaboration capability for both Support and other Intel communities.

This PoC had goals similar to that of the multilingual chat PoC: to increase customer satisfaction and to drive efficiencies in the support center. By enabling this self-help environment for a larger, global audience, we can reduce support costs because fewer customer care interactions are needed on the phone and through e-mail.

Our vision for MT in the Intel Community forums had the potential to transform the way our communities work (see Table 1). Our primary goal was to remove the language barrier, enabling people to read all community posts regardless of the source language, to make comments in their native language, and to collaborate with community members from different parts of the world.

We knew there was a demand for this type of solution because some visitors to the forums were copying content out of the forums and pasting it into free web-based MT systems. Incorporating MT into the forum would create a more consistent and seamless experience for our global users, and would

help them more rapidly find answers to their product questions.

SUCCESS CRITERIA

To be considered a success, MT in the Intel Community forums needed to:

- Integrate with the current community look and feel, which is familiar to community members, and be easy to use and intuitive
- Encourage communication between community managers and participants in the languages that represent the regions responsible for a majority of Intel’s revenue
- Display the translation side-by-side with the original text to enhance usability and instill user confidence
- Improve the online customer experience
- Meet Intel’s translation quality and usability standards
- Provide a solution that could scale across the business

Table 1. Vision to Transform Intel Community Forums to Multilingual Communities

Today	Future
Community members can interact in only one language; global customers can’t participate in forum discussion using their native language	Increase interaction by enabling multilingual discussions, where anyone coming to the community can participate using their native language
Content is separated by different communities	Enable greater collaboration and sharing with all content in one community
Intel Support Community is available only in English and Simplified Chinese (two separate communities)	Build a single global community where more languages can conveniently be added over time
Community support bounded and limited by time zones	Community support can be extended across time zones
Difficult to support Intel customers equally on a global scale	Increase ability to support global customers with the same standards

METHODOLOGY

Our methodology involved designing and implementing the prototype, usability testing, and the analysis of results and feedback.

Step 1: Design a prototype.

In this PoC, we designed and implemented a prototype that integrates MT into the Intel Community platform (see Figure 4). The prototype seamlessly integrates into the existing user interface for the forum with the addition of a Translate button next to the Response button. To translate a post, the user clicks the Translate button and chooses a language from a drop-down menu. The MT system then translates the post.

Step 2: Test and evaluate the MT solution using dialogue from a pre-selected community environment.

We selected 10 samples of forum interactions in English from the Support Community forum, with each sample ranging from five to 17 individual exchanges. Bi-directional language pair evaluations using the MT tool with English as the source language were assembled and reviewed for four target languages: French, German, Latin American Spanish, and Simplified Chinese.

We repeated this process, using French, German, and Brazilian Portuguese as source languages and used MT to translate them into English.

In-country customer support agents and our translation and localization team

members participated in the evaluations. We performed a regular Intel translation quality assurance evaluation and used it as a baseline for comparison.

The evaluation criteria included:

- A human evaluation of the support community engagement
- Translation quality, usability, and performance assessments

Step 3: Analyze the results and feedback.

Participants reported that the translation quality was acceptable in most cases; the MT system performed better in some languages. They also found that the MT system performed without a noticeable delay, and it was easy to use and intuitive.

RESULTS

In this PoC, we achieved our objective of successfully integrating MT into Intel's existing Community platform and delivering a multilingual collaboration capability with acceptable performance and translation quality. This capability has the potential to improve customer experience in our communities, expand access to information that would otherwise not be available to them due to a language barrier, increase global collaboration and information sharing, and reduce calls to support. For our next step, we are developing a beta production system that we plan to test and evaluate over a six-month period.



Figure 4. Our proof-of-concept that used machine translation for community forums demonstrates our ability to integrate multilingual collaboration into Intel's existing customer support community architecture. In the example shown, the language is being translated to French.

CONCLUSION

In both PoCs, we observed a reasonable degree of quality in the bi-directional translations of all selected languages using a moderately priced MT solution.

We anticipate these results and this technology will lead to a better experience for our global customers by reducing language barriers. We also anticipate significant cost avoidance for support because customers can get information more autonomously through self-service.

As a result of our efforts and research, we anticipate a future MT solution will deliver the following benefits:

- Make information easier to access
- Increase our reach to existing and new customers no matter where they live by eliminating language barriers

- Improve the way we connect and empower our employees and customers online
- Make the online support environment more collaborative and easier to use
- Reduce support costs or avoid them
- Add value across our entire corporation in areas where multilingual collaboration is required to drive solution innovations, business partnerships, and revenue

We plan to continue our research, and we are currently working on a beta production version of a solution that integrates MT into Intel Community forums.

ACRONYMS

MT	machine translation
PoC	proof of concept
QA	quality assurance

For more information on Intel IT best practices, visit www.intel.com/it.


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