

Emerging Technologies and the European Financial Services Industry



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TowerGroup Take-Aways

- Biometrics show promise for identity verification and security, with new retinal scanning devices demonstrating exceptional accuracy rates.
- Assisted self-service techniques and devices will eventually augment the branch network with customer access from anywhere.
- New processing technologies such as those afforded by molecular/DNA transistors show promise for dealing with the needs of risk management and algorithmic processing.
- Trading rooms are looking to emerging technologies to address an increasing demand for power and speed.
- Location-aware devices and wireless networking advances such as WiMax and WiMedia allow for global tracking.
- Networking technologies such as grid networks provide a platform for data consolidation and high-speed assessments throughout an organization.

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Report Coverage

Managing emerging technology has always been an area of uncertainty for financial services institutions (FSIs). FSIs often waste valuable resources on technologies that don't live up to expectations, or they find themselves struggling to remain competitive as other FSIs adopt technologies that customers crave. Selecting technologies to invest in is difficult because the benefits that emerging technologies may provide to financial operations are not always obvious. Today, the technology mix is more important than ever because effective emerging solutions sometimes combine several technologies with a resulting profound effect on business operations. This TowerGroup Research Note highlights some of emerging technologies that are likely to provide value to the financial services industry.

Background

Technologies rarely evolve independently. A perfect example is the telephone. Rather than a single technology, it is a compilation of networking technology, switching technology, and transmitting technology that constitutes an evolutionary advance. Financial services providers must consider many technologies and not concentrate resources on a single point. Today, the technology mix is more important than ever because emerging solutions combine sometimes hundreds of technologies with profound effect.

The financial services industry is considering evolutionary technology in many areas: Processing technology is beginning to show promise with such advancements as molecular/protein DNA transistors, and networking advancements include high-speed wireless technologies such as WiMax and WiMedia. Verification technologies are increasingly secure, with biometric technologies



such as retinal scanning devices exhibiting nearly perfect accuracy. "Location-aware" technologies that determine and transmit location through triangulation by means of the Global System for Mobile Communication (GSM) or the Global Positioning System (GPS) are being miniaturized and embedded in an array of devices, and the tracking capabilities continue to progress to accuracies of less than a meter. Applications are evolving that will permit real-time or nearly instant transmission of location to interested parties. Trading rooms are also evolving with the needs of complex algorithms and risk management tools that require the processing power of grid networks. Consumers' interactions with their banks at branches are evolving into assisted self-service as banks exploit the advances in handheld devices to lower operational costs and improve the customer experience.

Financial services institutions must keep abreast of all these and other emerging technologies. Waiting for competitors to adopt a new technology and taking too long to decide whether to adopt lead to loss of market share.

TowerGroup Ratings for the Emerging Technologies in Europe

To provide some guidance, TowerGroup rates a selection of emerging technologies based on the following criteria (see Exhibit 1):

- Maturity
- Number of years for technology to reach an established stage (YTE)
- Effect on operations or customer (Effect)
- Expected movement in next five years (Movement)
- Costs associated with research, development, and implementation (Cost)
- Effect on business (Business)
- Areas of financial services that will be most affected by technology (Department)



TowerGroup Rating Scale for Emerging Technologies in Europe (2005)

Maturity	YTE	Effect	Movement	Cost	Business	Department
1. Concept	1	1. Limited to operations	1. From operations to customer, costly to valuable	1. Low (<1% of overall operations cost)	1. Minor: Will not change business models or operational methodologies	1. Retail banking operations
2. Modeling	2	2. Customer and operations, but mostly operations	2. From customer to operations, costly to valuable	2. Moderate (1% to <5% of overall operations cost)	2. Moderate: Will change business models or operations methodologies but outcomes remain similar	2. Investment and securities, including asset management
3. Prototyping	3	3. Customer and operations, but mostly customer	3. From operations to customer, valuable to costly	3. High (>5% of overall operations cost)	3. Extensive: Will change business models or operations methodologies and create new customer offering or distribution channel	3. Corporate and wholesale banking
4. Testing	4	4. Limited to customer	4. From customer to operations, valuable to costly			4. Insurance
5. Limited production	5					5. Back office or operations in unallocated departments
6. Full-scale production	6					6. All areas
7. Established	7					

YTE = Number of years for technology to reach established stage. Effect = Effect on operations or customer.
 Movement = Expected movement in next 5 years. Cost = Costs associated with R&D and implementation.
 Business = Effect on business. Department = Areas of financial services most affected by technology.

Exhibit #: 44:13E-E1
 Source: TowerGroup

Exhibit 1

TowerGroup Rating Scale for Emerging Technologies in Europe (2005)

Source: TowerGroup

The Emerging Technologies

The technologies that TowerGroup predicts will have a major effect on the European financial services industry in the next five years and beyond are shown in Exhibit 2 and discussed in the following sections.



The Principal Emerging Technologies That Will Affect the European Financial Services Industry (2005)

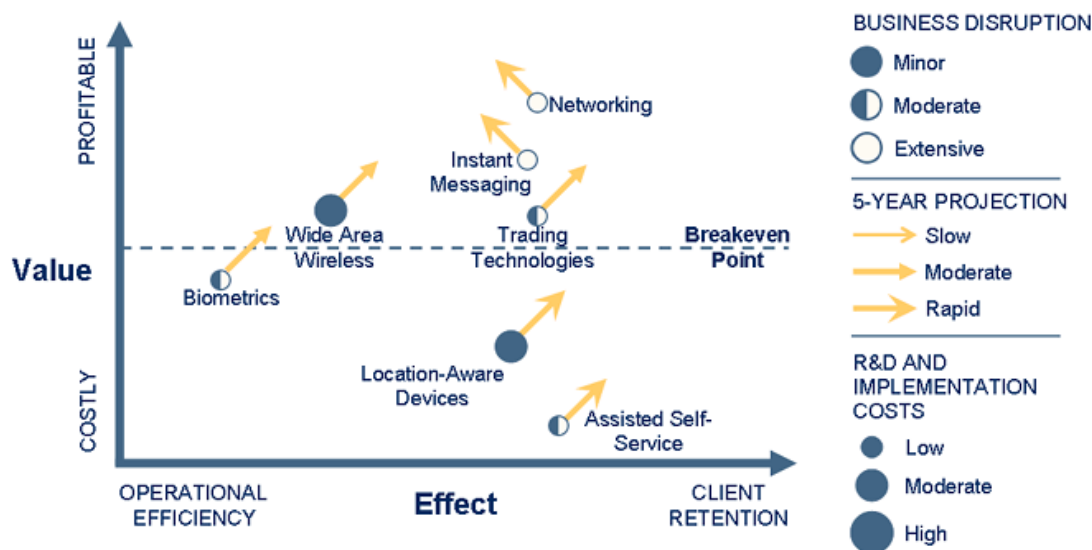


Exhibit # 44:13E-E2
Source: TowerGroup

Exhibit 2

The Principal Emerging Technologies That Will Affect the European Financial Services Industry (2005)

Source: TowerGroup

Biometrics

Ratings: Maturity, 4; YTE, 3; Effect, 2; Movement, 1; Costs, 1; Business, 2; Department, 1,4,5

Biometrics, which uses technology to identify individuals through unique personal traits, covers a number of technologies, including those using voice, finger, hand, iris, or face for purposes of identification. Each of the most promising identification methods identified in Exhibit 3 is at different stage of development, as illustrated by the current "false match" rates, the most important metric for the technology. Currently, the false match rates are 3% for voice, less than 0.01% for finger, 1.5% for hand, and well below 0.001% for iris. Of course, all these match rates are expected to improve within the next several years.



Biometrics and Location-Aware Devices Affecting the European Financial Services Industry (2005)

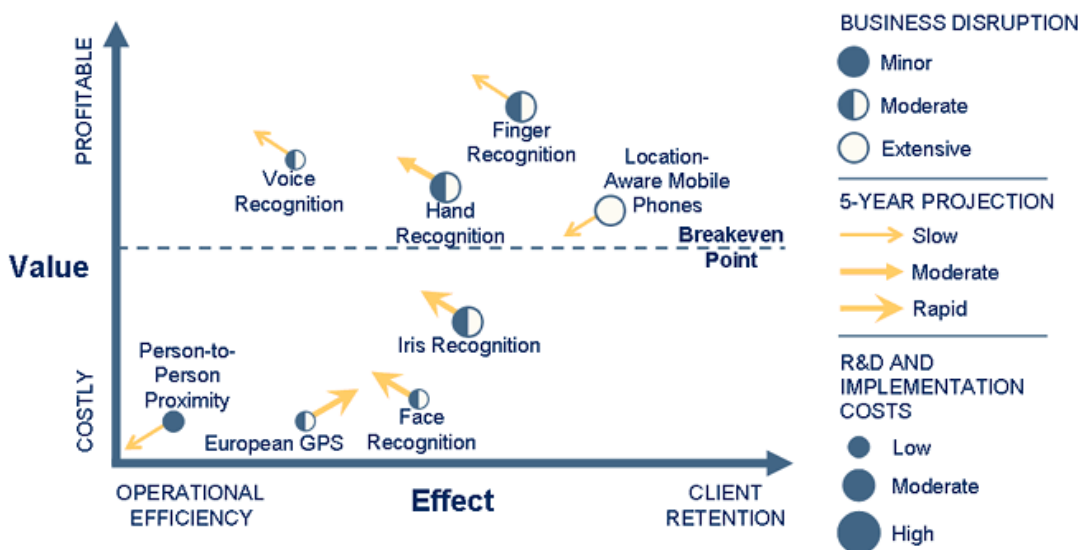


Exhibit # 44:13E-E3
Source: TowerGroup

Exhibit 3

Biometrics and Location-Aware Devices Affecting the European Financial Services Industry (2005)

Source: TowerGroup

The financial services industry will greatly benefit from these types of technologies as identity theft and consumers' mistrust of merchants' use of online transmission of personal payment data continue to grow. In fact, after government systems such as identity cards and passports, the financial services industry will be the leader in adopting these technologies. They should emerge for payment verification as a replacement for personal identification number (PIN) or signature at the point of sale (POS), at automated teller machines (ATMs) as a replacement for PIN and possibly for the card itself, and at branches for identification instead of a plastic card. The two principal selling points are inability to replicate and speed of identification. The challenges include the high cost of the detection devices, the lack of portability, system speed trade-offs, the lack of standards, and the skepticism of clients.

Location-Aware Devices

Ratings: Maturity, 3; YTE, 5; Effect, 3; Movement, 1; Costs, 2; Business, 3; Department, 1,2,3,4

Location-aware devices include mobile phones and office access cards that have the ability to precisely determine and store or transmit their location. Mobile phone operators have been aggressively pursuing location-aware technology for implementation into their handsets. Exhibit 3 illustrates the progress that has already been realized. Companies like Nokia and Ericsson are aggressively implementing chipsets in mobile phones that can harness satellite-based global positioning (GPS) location capability. In concert with GPS capability, wireless operators have been working with infrastructure suppliers on powerful new algorithms to refine location position calculations using existing attributes of Global System for Mobile Communication (GSM) as well as harness new powers of Universal Mobile Telecommunications System (UMTS) networks. Nokia



THR880i, targeted to a professional market, and Nokia 5140i, targeted to consumers, are examples of mobile devices available today that provide location-aware technology in small and fashionable units with an accuracy of 25 meters.

The impact of location-based technologies will be at once disruptive and transforming to the business process of financial services institutions. For example, TowerGroup expects location-based capability to be an integral component of nonintrusive authentication for payments and purchases using mobile phones. Contextual Short Message Service (SMS) can finally be realized that targets individuals where and when they are most likely interested in a mobile commerce transaction. New customer conveniences can be enabled that may include options like banks bidding on loan terms while the prospect is at the car dealership, or confirming a car loan acceptance and loan term as the customer approaches the dealership; car dealerships may be able to exploit location technology to determine if a prospect customer has visited a competitor.

In the wake of corporate scandals such as that of Enron, tracking customers is not the only concern; corporations of all kinds must also track employees to ensure compliance with increasingly complex and global regulations. Much work has been done in managing electronic and traditional mail communications, blocking them where appropriate and alerting management to inappropriate contact. The one area that has been difficult to manage has been person-to-person communication. It is nearly impossible today to make sure a trader does not talk to an analyst in the lunch room. Location-aware devices have the potential to solve these problems.

A UK company called Star-Map has been demonstrating the use of building access cards as a tracking tool, illustrating how an alarm goes off in a room when a trader and an analyst covering the same industry are in proximity for more than 20 seconds. Although today the cards are limited to a building populated by workers equipped with Star-Map technology, the company is working on methods of tracking people throughout the day, regardless of their location.

The challenge for location-aware devices is to get users to carry them. Consumers generally consider the technology intrusive, and employees feel that "Big Brother" is watching. Technology can help allay these fears. Star-Map has developed an alerting function to make sure the building access card does not remain motionless for more than a few minutes, thus forcing users to carry their cards, which increases the cards' effectiveness. Consumers will be provided incentives to carry the devices, which will be high-design units integrated into necessary tools such as the mobile phone. Ultimately, the challenges connected with location-based devices and the opportunities they enable are not technology related. FSIs must be careful to achieve the delicate balance between the business opportunities enabled by location-aware technology and customer privacy preferences and concerns.

Instant Messaging

Ratings: Maturity, 7; YTE, 5; Effect, 3; Movement, 2; Costs, 1; Business, 1; Department, 6

Instant messaging is a technology-based, real-time or near-real-time, one-to-one communication method. In Europe, the predominant form of instant messaging is Short Message Service, or SMS. The British alone sent over 30 billion SMS messages in 2004, and in Europe, the number of SMS messages is expected to reach 200 billion in 2005.

By contrast, PC-based instant messaging with applications such as Microsoft Instant Messaging accounts for less than 30% of the messaging traffic throughout Europe, and only 3% of that messaging is considered business-relevant data.

The vast majority of the SMS messages in the European Union are not business related, with an average of only 45% of financial services employees in Europe using a mobile technology for work. In France and the United Kingdom, the percentages reach almost 60%.

Security is the primary inhibitor to business class instant messaging; almost 70% of banks indicate they don't believe that instant messaging in any form is secure enough to handle client or transaction data. The evolution of instant messaging to wireless systems and new devices such as



Blackberry and smart phones will complicate security initiatives for the financial services industry. Meanwhile, both institutional and retail customers are looking to technology with the capabilities for convenient on-demand connection and alerting at any time wherever the customers may be. It is critical that solutions include machine-to-machine (M2M), person-to-person (P2P), and person-to-machine (P2M) connectivity. For the industry, this means increased transparency, quick turnaround response mechanisms, and 24-hour operations. The challenges include identifying the type of information for which the systems must be "message enabled" and managing the end-to-end security and the verification methods that this medium will inevitably confront. Exhibit 4 illustrates that the financial services industry has been slow in accepting instant messaging; however, TowerGroup expects a moderate take-up of the technology in the next five years.

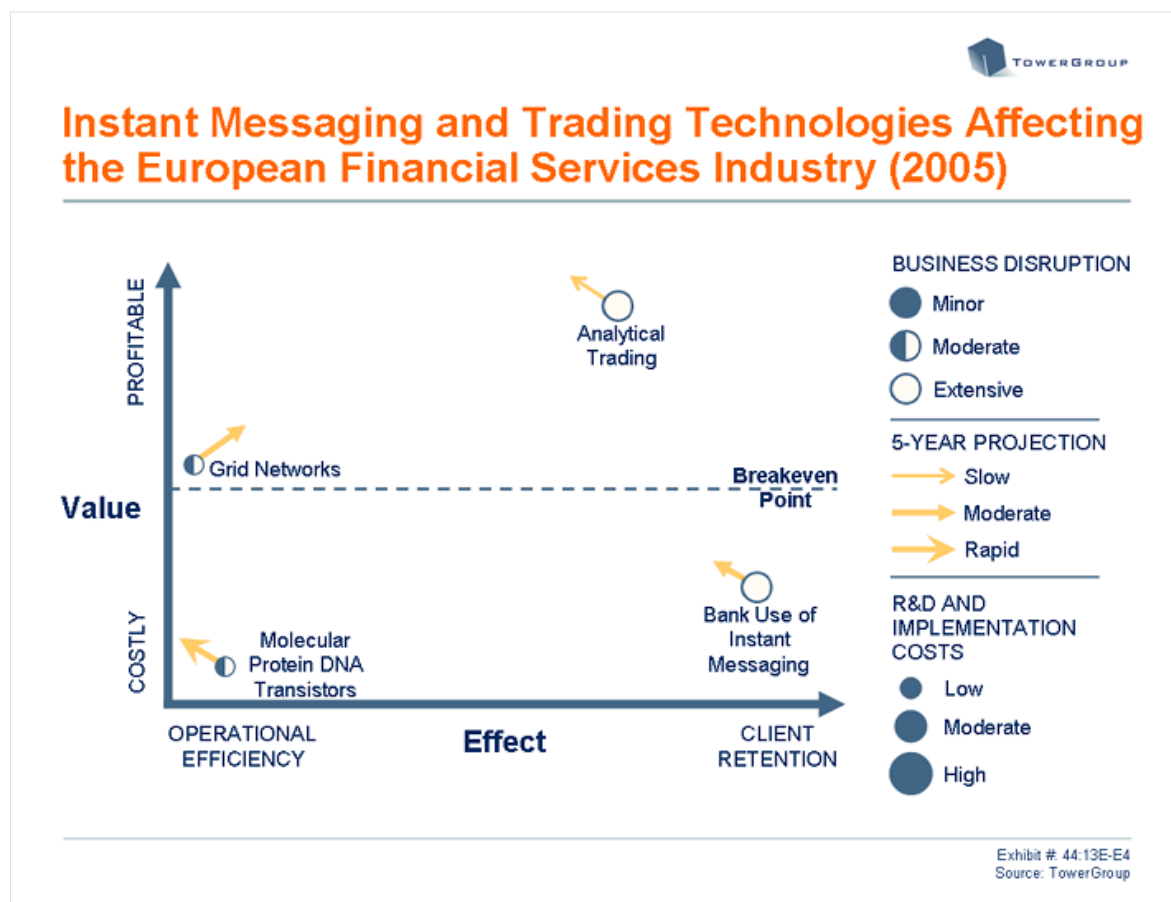


Exhibit 4

Instant Messaging and Trading Technologies Affecting the European Financial Services Industry (2005)

Source: TowerGroup

Trading Technologies

Ratings: Maturity, 3; YTE, 3; Effect, 2; Movement, 1; Costs, 2; Business, 3; Department, 2,5

Dealing room trading activities are hampered by three major technology shortcomings. They are insufficient processing power, lack of seamless integration with other parts of the organization, and slow processing speed. Trading technology is used in the dealing room of a financial services provider that allows for trading positions. In an increasingly competitive environment with shrinking margins, a few seconds can make the difference between success and failure of a trade. This reality is creating stagnation in the industry and will encourage the rapid adoption of emerging technologies.



Insufficient processing power and speed is an issue in modern trading environments because of two factors: analytical/black box trading (program trading) trading and risk management. Analytical trading evolved immensely from 2002 to 2005, such that many firms today are deploying analytical models with hundreds and sometimes thousands of variables. The increased complexity and the larger number of data feeds under evaluation put a strain on the ability of a model to execute buy/sell orders in a timely fashion. Additional processing power will be necessary to improve timeliness, especially because the average trader may have hundreds of analytical trading formulas to choose from.

Risk management is also pushing the limits of processing power as more elements are being brought to a single processing point, causing a bottleneck. It is not uncommon to have risk formulas that require calculating the real-time average of an entire portfolio. For a universal bank, that could mean 75 terabytes of data need to be processed in real time. On the trading floor, even a 30-second delay in attaining results could erase profit opportunities.

In the near future, FSIs, especially universal banks with operations in different time zones, will invest heavily in grid computing and massively parallel processing (MPP) grid computing that will provide access to enormous amounts of computing power. JPMorgan Chase has already demonstrated this capability with the successful implementation of a grid architecture that has 3,000 central processing units (CPUs) processing complex risk calculations.

A couple of the larger European FSIs will likely move some of their trading applications to mainframes to take advantage of the massive processing power. This process will be facilitated by the additional capabilities of mainframe operating systems to operate desktop or networking software.

Exhibit 4 illustrates that most of the technologies in this sector, especially analytical trading, are already profitable. In the longer term, trading rooms will see the introduction of CPUs that have the promise of exponentially faster processing speeds. Molecular/protein DNA transistors show promise as silicone chips begin to reach their limits.

Assisted Self-Service

Ratings: Maturity, 2; YTE, 5; Effect, 3; Movement, 1; Costs, 2; Business, 3; Department, 6

Human interaction and self-directed technologies combine to form a seamless channel with assisted self-service. Although the technology is still a long way from becoming a reality, when it does, it will revolutionize the financial services industry. The reason assisted self-service will take some time to mature is that it is not a single technology but a series of emerging technologies, as illustrated in Exhibit 5, all of which must mature before they can work together to provide the value customers will crave.



Assisted Self-Service Technologies Affecting the European Financial Services Industry (2005)

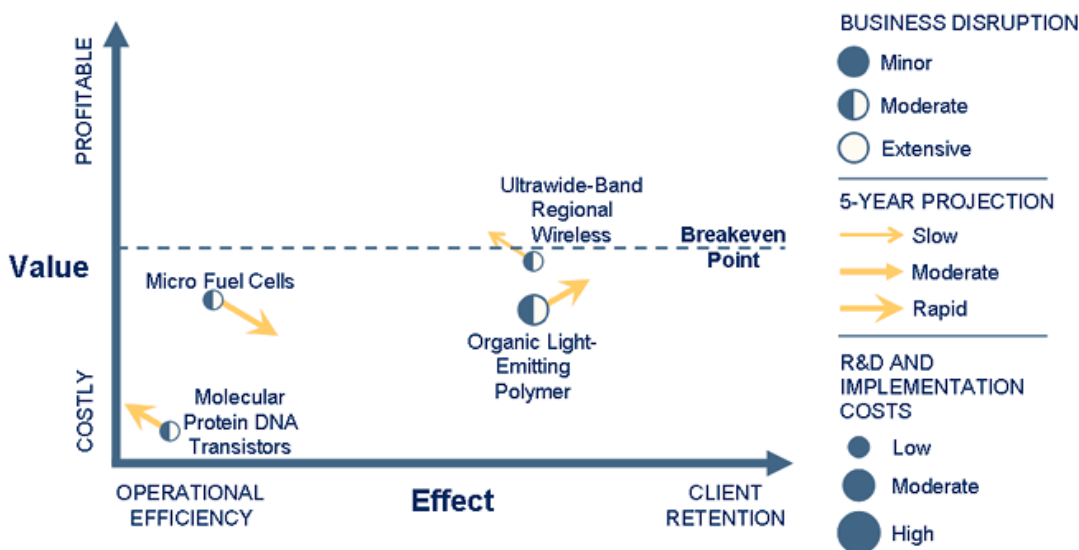


Exhibit # 44:13E-E5
Source: TowerGroup

Exhibit 5

Assisted Self-Service Technologies Affecting the European Financial Services Industry (2005)

Source: TowerGroup

Let's create a vision of the future. You have just walked into a car dealership. In your hand, you have a card or other device that can display an image and from which you can "call up" or be called by an advisor. The advisor can discuss your financial position with you, make recommendations on payment options, and even discuss a purchase or negotiate with the dealer on your behalf, all in real time.

Take another example. A couple is discussing their financial future over dinner. A question arises, and they want to get some information about a product or service. With assisted self-service, they can just bring out the device in their kitchen, have a conversation with the relationship manager, and make a purchase decision on the spot. Considering that 80% of retail investment decisions are made after 6:00 p.m. in people's primary residence, this can be a very useful function.

The technologies that need to mature, however, are very complex. First, molecular/protein DNA transistors must evolve. They will allow for small processing chips that will be wafer thin and can be mounted on a device no larger than an ordinary credit card. Second, microfuel cells still have to evolve. These biological alternatives to batteries offer 10 times the power in a fraction of the space. Wireless technology, video, and sound are power intensive, and current battery technology would render the portable device unusable. Next, changes must be made to the light emitting polymer or organic light emitting diode (LEPs/OLED) to allow for placement of light-emitting material onto almost any surface without the need for backlighting. This improvement will be necessary to provide a display that can illustrate data and video on a portable device. Finally, ultrawide-band regional wireless technology must emerge from the test phase. The key to assisted self-service is the mobility of the system; customers need it in the kitchen as well as in the mall or wherever a



financial decision is being considered.

Networking Technologies

Ratings: Maturity, 5; YTE, 2; Effect, 1; Movement, 1; Costs, 2; Business, 1; Department, 6

Although networks have had a long time to evolve, they are still inhibitors to many new technologies. A variety of technologies are emerging in this space, all of which are targeting increased speed and power. The first and probably the most surprising driver is the advancements in mainframe and supercomputing. Today, the fastest computer is Blue Gene/L built by IBM at Lawrence Livermore National Laboratory in the United States; it can process 136.8 trillion calculations per second. Recently, Japanese computer scientists began to build a 10 quadrillion calculation machine, which is 73 times faster than Blue Gene. This development is important because the complexity in risk calculations and trading algorithms has reached the limits of practicality with the current slow processing times.

Persistent debate about the future of mainframes and the need for such power in the financial services industry is undoubtedly based on FSIs' inability to take full advantage of the massive amounts of power because of the limitations in networking technology. Today, the average European universal bank must process about 75 terabytes of data, and the amount to be processed is expected to increase exponentially. The more data and the more sophisticated the analytics, the greater the need for high bandwidth and massive processing capabilities.

In addition to organic growth in data processing, the increase in consolidation of FSIs in Europe will increase the need for processing power at individual firms. TowerGroup believes that the mainframe will be an important part of all the big banks and that networking technologies will facilitate this evolution.

Of the many networking technologies illustrated in Exhibit 6, grid computing is one that has experienced some success. Grid and MPP grid computing is the use of networks to move processing needs to idle processors regardless of where they are on the network. Another emerging technology is semantic web, which allows data to be shared by applications throughout the enterprise or communities. This technology appears promising, and if it matures, it will increase the processing capability exponentially.



Networking and Wide Area Wireless Devices Affecting the European Financial Services Industry (2005)

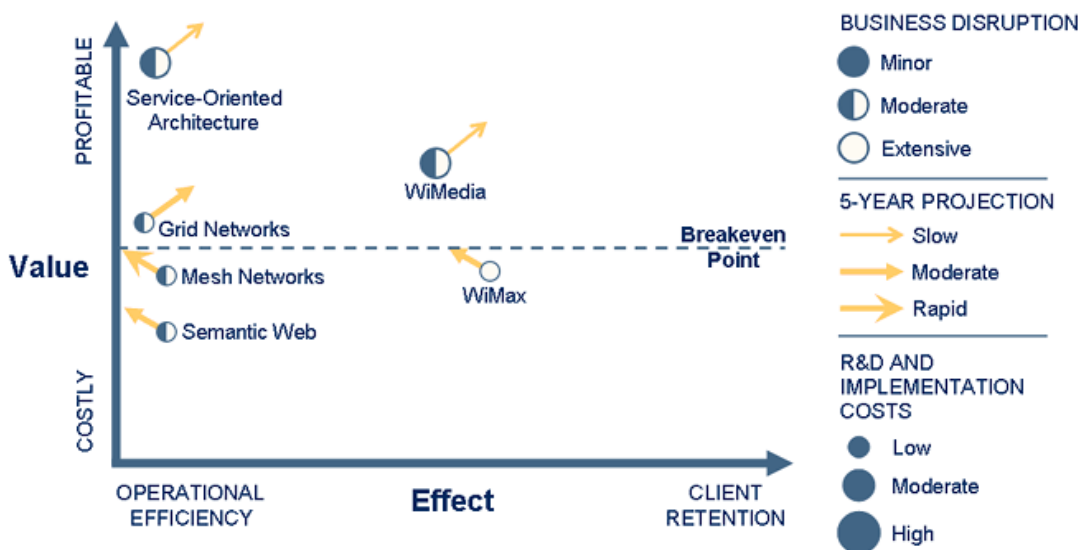


Exhibit # 44:13E-E6
Source: TowerGroup

Exhibit 6

Networking and Wide Area Wireless Devices Affecting the European Financial Services Industry (2005)

Source: TowerGroup

One of the limiting factors for the evolution of networks is the complexity involved in their talking to each other, so mesh networks have been developed to deal with this issue. In a mesh network, all networks, regardless of protocol or devices, can talk to each other.

The starting point and still the most important aspect of networking innovation is service-oriented architecture, which has struggled to gain a foothold in Europe. The ability to share components throughout a universal bank will significantly reduce product development costs and increase the speed at which new products can be deployed.

In the future, networks and processing power will become more important with the improvement of behavioral data availability, the ever-increasing size of the European universal bank, and the extended reach of financial services. The industry will experience exponential growth in networking needs and processing power, and the new and emerging technologies will provide sufficient bandwidth and speed to remain ahead of the client base.

Wide Area Wireless

Ratings: Maturity, 3; YTE, 3; Effect, 2; Movement, 2; Costs, 1; Business, 2; Department, 6

Wide area wireless technology provides 802.16g (WiMax)/UWB (ultra wide band) 803.15.3a (WiMedia) for wireless and high-speed access to a network or another computer. Continued evolution of the ubiquitous 802.11a/b/g (Wi-Fi) standard has provided the financial services industry with two emerging technologies illustrated in Exhibit 6 that stand to address the two limitations of standard Wi-Fi platform: namely, a 100-meter transmitting radius and the limitations in speed.



Of significance is a suite of mobile broadband wireless access (MBWA) technologies that have garnered significant attention by telecom operators. The technical developments are contained in IEEE standards activities known as IEEE 802.16 revisions A through G. The specifications are evolving to target a broader market opportunity for fixed, nomadic, and mobile high-speed wireless broadband applications that may not be realized by third-generation technologies like UMTS. The important aspect of WiMax is its inherent capability to support a uniform Internet Protocol (IP)-based wireless environment for both asynchronous (transaction data) and isochronous services (VoIP, Video) with specific parameters for quality of service (QoS). As one might expect, WiMax network deployments must bear the burden of adapting to different network architectures of telecom operators while still supporting standardized components and interfaces to achieve multiple-vendor interoperability.

WiMax is especially interesting when it is touted as a "3G killer" because the cost of deploying a city-size network is a fraction of the cost of deploying third-generation (3G) technology. In addition, licenses for the 3.5-GHz spectrum, which WiMax operates, have cost significantly less than the 3G licenses auctioned a few years ago. For example, in the United Kingdom, the government brought in £22 billion for 3G but only £90 million for WiMax.

Financial services institutions should expect the business impact of WiMax to evolve through distinct stages:

Stage 1. Point-to-Point and Point-to-Many Points Access. FSI should expect WiMax to be used at a network augment (backhaul) to local public and metropolitan deployment of Wi-Fi and wireline distribution of digital subscriber line (DSL) and data over cable television (cable TV). Telecom operators will leverage WiMax to expand the reach of its broadband services where the physical or economic restraints would otherwise make broadband reach unattainable. FSIs will be able to exploit WiMax services to branch offices at lower cost, increase incremental capacity, or enable new network resiliency to guard against unexpected network outages.

Stage 2. Nomadic Access. WiMax capability will include significant coverage that is not line-of-site as well as WiMax chipsets integrated into computing devices. This will allow for static access by a growing population of device-carrying individuals as well as access from kiosk service depots. An example deployment might include the ability to more cheaply deploy network connected automated teller machines (ATMs) opportunistically.

Stage 3. Full Mobility Access. Public Hot Spot Wi-Fi grows cold. TowerGroup expects implementation of key developments particularly in the area of roaming in Stage 3 as well as accelerated embedding of semiconductors in devices. The fast speeds (50-plus Mbs), higher resistance to interference, multimodal access, and QoS capability will usurp the value of Wi-Fi as a meaningful technology set for anything beyond local indoor use (for which it was originally designed). By this stage, we believe WiMax becomes an important complement to the characteristics of existing 3G networks and services and not the 3G killer as some press and uninformed sources of hyperbole about it may suggest. Picochip is a key European supplier, as is US-based Intel as well as Qualcomm, which recently announced the acquisition of Flarion, a company that holds significant intellectual property that is relevant to WiMax roaming.

The second key technology to be aware of is WiMedia, which is based on the IEEE standard 801.15.1a. The best way to think of WiMedia is as the next generation of Bluetooth. WiMedia is different from Bluetooth (and to some extent its parent, Wi-Fi) in that it uses modulated pulses of energy rather than a radio frequency carrier. The benefit is 10 GHz of bandwidth at a fraction of the energy and cost of alternatives. Although WiMedia is not itself a wide area technology, it is likely to become a significant entry point to wide area networking technologies. Unfortunately, the range of 803.15.3a is limited, but it is still useful for security in a corporate or branch environment and for localized device connectivity. This is especially true in Europe, where available radio frequencies are in short supply.



Other Technologies to Watch

As illustrated in Exhibit 7, many other technologies will have an effect on the financial services industry, including:

- **Advanced ATMs.** These have more functions than the ubiquitous traditional ATM.
- **Augmented realities.** A client's perception is augmented by relevant information.
- **Check and document image exchange.** This technology allows for the capture and manipulation of images of checks and other documents.
- **Dynamic relationship pricing.** This technology is used for determining the price of products based on a customer's overall relationship with a financial institution and the customer's ability to pay.
- **Electronic ink digital paper.** Plastics pick up input from a stylus.
- **Front-office fraud detection.** This technology helps identify fraudulent activity at the initial interaction by the client.
- **Information extraction.** Relevant data is extracted from unstructured repositories.
- **Person-to-person payments.** Devices allow a person to give money to others or receive money from others electronically if the two parties have similar devices.
- **Push technologies.** These prompt users to specific events based on users' desires and needs.
- **Real-time analytics.** Analysis of all data points facilitates alerting capabilities.
- **Really simple syndication.** This is the technology Web logs use to inform new users of changes to sites.
- **Smart dust.** Miniature sensing devices detect environmental conditions and proximity through tiny lasers.
- **Speech recognition.** This technology interprets human voices as commands.
- **Text mining.** This method of searching and retrieving data works regardless of location or protocols used.
- **Thought recognition and brain interface.** These devices can recognize brain patterns through an input device.
- **Trusted computing group.** These hardware and operation system controls have strong exclusion capabilities.
- **Truth verification.** Analysis of voice variations or physical characteristics determines the truth.
- **Visualization technologies.** These applications allow for enormous amounts of data in graphical presentations.



Important Technologies to Watch That Will Affect the European Financial Services Industry (2005)

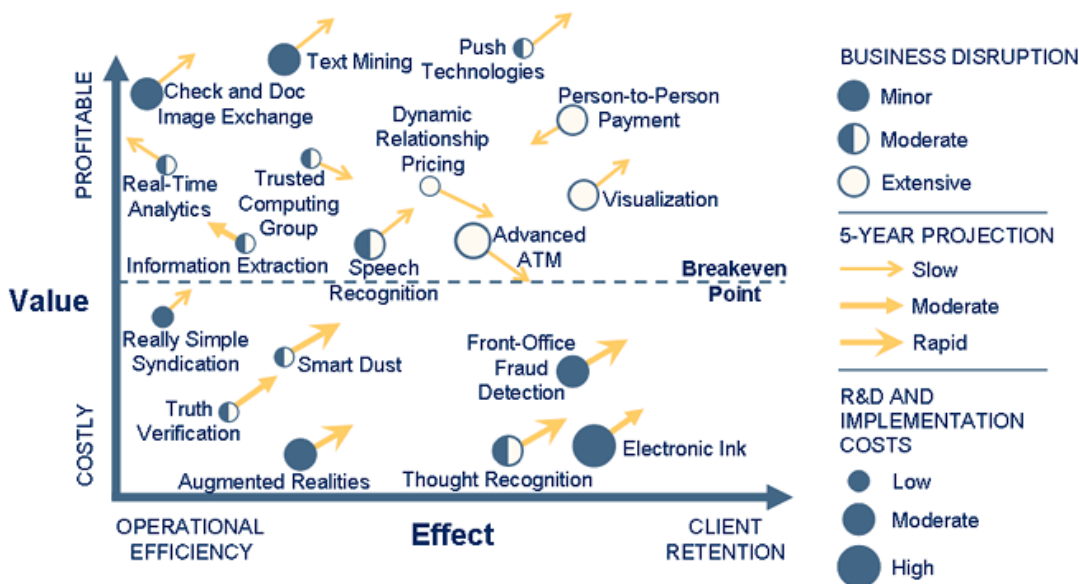


Exhibit # 44:13E-E7
Source: TowerGroup

Exhibit 7

Important Technologies to Watch That Will Affect the European Financial Services Industry (2005)

Source: TowerGroup

Summary

Technology had been a pivotal factor in the financial services industry through several decades. The institutions in the industry have consistently been the early adopters of emerging technologies and often guide the development of technologies to suit their demanding needs. The struggle for European financial services institutions has been to identify useful technologies in the early development stages so that they can influence their development as well as prepare themselves for deployment as early as possible. The struggle is becoming more difficult because the number of emerging technologies that show promise is increasing. These technologies cannot be ignored. Evolving technologies will allow banks to concentrate on core competencies to provide better services to their customers.