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# Gartner's Top Predictions for IT Organizations and Users, 2007 and Beyond

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We highlight 10 predictions that herald changes in approach for IT organizations and the people they serve.

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## 1.0 What You Need to Know

Gartner's top predictions showcase the trends and events that will change the nature of business and IT in 2007 and beyond. Selected from across our research areas as the most compelling and critical predictions, the trends and topics they address this year indicate that priorities, markets, cultures and technologies are all rapidly changing. These changes will require that IT and business change their approach to delivering and quantifying value. In addition, a stronger focus on consumers and customers in general is key to the markets these predictions will affect.

Some key insights include views that are contrary to popular belief in the IT industry. Among the counterviews are a coming slowdown in sourcing due in part to oversupply, a potential bump in the road for Asian service providers due to under-representation and a relatively early peak in the growth of blogging due to maturing use of the technology. Other notable insights, such as the growth and use of mobile devices to track employees and an increased focus by corporations on social responsibility, indicate that organizations will care more about tracking the proper use and purpose of their resources moving forward.

The Windows operating system will get more frequent yet smaller updates in the future, reinforcing the trend toward modular architectures. Data center and IT infrastructure budgets will increasingly target more-innovative technologies to combat financially motivated security threats and to mitigate the growing environmental concerns. In fact, power generation for cooling systems will gain more attention, while reduction in spending on items like bandwidth and the cost of maintaining PCs will help produce the monies needed to innovate.

In short, our predictions cover a wide spectrum of trends, some proceeding as expected, while others are showing signs of "growing pains."

#### **Selecting Predictions**

The selection process included evaluating several criteria that define a top prediction. We examined issues such as audience appeal and impact. The average reader of the Wall Street Journal should be able to follow each prediction and its effect on areas of interest. In addition, the predictions are intended to compel readers to action and position them to take advantage of the coming changes, not be damaged by them. Newsworthiness and conciseness of the predictions also played a large role in their selection.

These top predictions are for general technology areas, rather than being specific to industries (see "Gartner's Top Predictions for Industry Leaders, 2007 and Beyond") or roles within an organization (see "Gartner's Top Predictions for IT Leaders, 2007 and Beyond").

A new aspect of this year's predictions is that we have mixed strategic planning assumptions (SPAs) with our basic predictions. SPAs are accompanied by a probability measure from 0.1 to 0.9, indicating confidence in the prediction. Our basic predictions do not have this probability. Where the prediction is written as an SPA, we feel that more insight is provided through the probability qualification.

In reading these predictions, it will become apparent that our top predictions are pulled directly from research that is topical and ongoing. Our predictions include implications and recommendations for organizations seeking change opportunities. IT professionals must examine these predictions for opportunities to increase their support of consumer-driven requirements and their ability to help the business deliver stronger services to those customers.

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## 2.0 Outsourcing

Outsourcers beware: As market share declines, some key outsourcing vendors will cease to exist in their current named form. The reduced number of large contracts, increased amount of competition, and reduction in contract sizes have placed great pressure on outsourcers, which will have to "sink or swim" based on support for selective outsourcing and disciplined multisourcing competencies.

## 2.1 Prediction

Through 2009, market share for the top 10 IT outsourcers will decline to 40.0%, equaling a revenue shift of \$5.4 billion.

Analysis by Kurt Potter and Richard T. Matlus

## 2.2 Key Findings

A variety of market conditions, drivers and inhibitors will reach a critical mass and force a decline in the market share for the top 10 worldwide outsourcers, resulting in a market share change from 43.5% now to 40.0% in 2009. This represents a potential gross revenue shift of \$5.4 billion.

- There are fewer available large outsourcing contracts above \$250 million in total contract value, effecting significant continuing revenue to the top service providers. However, with fewer large contracts than in the past and great competition for selection in the largest opportunities, pricing pressure has allowed the typical revenue and high gross profit margins to decrease for the equal amount of work.
- In response to new market conditions and increased competition, providers have made improvements in cost structures through continued standardization, automation, global delivery, virtualization and grid computing. Staff is being hired offshore while being reduced onshore.
- Selective outsourcing has allowed second-tier providers a better place at the bidding table than in the past. It is used as a strategic tool to increase competitive pressure on providers. Selective outsourcing is replacing traditional takeover outsourcing, with many very large internal organizations discovering that their size often allows them better price performance than with the largest IT outsourcers. Selective "re-insourcing" and the division of remaining services among two or more IT outsourcers puts pressure on provider profit margins. Many are also opting to fix their problems and optimize first, then take bids for these refined environments.
- Fifteen percent to 25% gross profit margins for data center, desktop and storage services has put pressure on providers to evaluate divestiture and expanded use of third parties for certain service lines, regions and vertical industries.
- In mature world regions (North America, Western Europe and Japan), provider revenue growth is slowing. Revenue growth for the 10 largest IT services providers in 2005 was a mature 4.0%, with a rate of 0.5% for the top three providers. When looking only at IT management services (the core value component of IT outsourcing), the top 10 providers' growth rate in mature regions was marginally higher at 5.0%, with a rate of 1.7% for the top three providers.
- Average contract values and contract terms have been decreasing or otherwise troubled over the past six years. In 2000, average outsourcing contract value was \$619 million, compared with \$200 million in 2005. Even with a probable increase for the first time in



three years expected for 2006, the long-term trend remains. Shorter contract terms combined with less revenue allows organizations more opportunity for evaluation of other providers, further forcing more value for less cost.

- With the top 10 global service providers facing the risk of fewer large outsourcing contracts, some have undertaken strategic initiatives to create services targeted at the small and midsize business (SMB) segment. Some providers are slow to react, preferring to economize until a possible turnaround appears, while others are offering token initiatives to satisfy nervous investors in hopes of organic uptake.
- Nontraditional service providers, specializing and focused on business outcomes, such as software as a service, utility computing, focused managed services, specialized hosters and others, are eroding the traditional concept of takeover outsourcers. Incremental at first, they are making gains with SMBs and smaller large enterprises, and confusing and delaying purchase decisions by large organizations that must evaluate these services as part of their overall due diligence within their sourcing strategies.
- Contract renegotiations are occurring at a quickening pace. Because business and IT requirements are changing faster than in the past, it is not unusual to see two major renegotiations within the term of a five-year contract. One- or two-year extensions are also commonplace. At each of these renegotiation events, price for performance is compared against the market and often forces concessions on service providers, further driving down per-unit prices.

#### 2.3 Market Implications

- Through 2009, at least three of the top 10 IT outsourcers (see "Preliminary Market Share for Top 10 IT Outsourcers, 2005") will cease to exist in name, with their services and product portfolios divided into spin-off companies, divestitures, longtime partners and faceless third-party aggregators. Providers of all sizes will rationalize portfolios based on desired regions, service lines and vertical industries.
- Most of the SMB market will remain resistant to standardization by providers with a culture of large contract priorities. Conversely, the financial imperatives of large outsourcers dictate they maintain higher operating margins related to large, takeover outsourcing engagements. Many large outsourcers will unapologetically refuse to focus on the SMB. The largest IT outsourcers will "willingly" narrow their focus on the largest organizations, providing services to support the global delivery requirements necessary for their largest clients and selected areas of comfortable profitability. Small and midsize providers can offer solution-specific, industry-specific and regional offerings to capitalize on SMBs and will have little choice in doing so. Second-tier providers will see incremental growth from SMB outsourcing business, but big increases will not be seen for the top-tier providers. Each provider will have to evaluate its place in the services ecosystem.

#### 2.4 Recommendations

 With the side effect of expanding options, those organizations with sophisticated sourcing strategies will naturally drift toward selective outsourcing and disciplined multisourcing competencies. On average, organizations now manage four outsourcers, and this level will increase for many. The journey to this level of sourcing competency will be marked with periodic public notice of failed contracts that are, in fact, reactions to competitive pressure that creates new expectations of service and quality. The level of choice afforded organizations by disciplined multisourcing means providers will come

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and go naturally from their provider portfolio by design. Organizations should evaluate expansion of sourcing project management offices or creation of a "sourcing office" to better manage multiple providers and to nurture strategy, contract, evaluation and management expertise. If your organization has a sole provider that decides to divest part of the service line, you may be forced into managing multiple providers over time based on the original provider's actions.

- As major renegotiation points occur more often, during these events organizations need to revisit their contracts and ensure terms and conditions are favorable in the current and future environment marked by high vendor churn. Cancellation for convenience and assignment clauses must be appropriate to reduce the management and business risk with anticipated provider changes. Hence, providers and buyers alike must concentrate on these issues at contracting time. As contract renewals and extensions are happening at a quickening pace, contract stakeholders should take these opportunities to address unforeseen provider changes. Organizations must set internal expectations for change to forestall anxiety and overreaction by stakeholders.
- Organizations should exploit the major business changes (mergers, acquisitions and divestitures) of their service providers to gain price concessions and better service optimization. During major business changes, service providers face more pressure to renew contracts with existing clients to create an air of normalcy.
- For many mature IT outsourcing areas, organizations should prepare to accept industry standards to gain further price concessions. Organizations should prudently evaluate traditional service levels that may be too high, considering new and sometimes permanent changes in service quality. Each organization must decide which services are no longer relevant or where quality is good enough. Some of these decisions will be made by the marketplace through more standardized services. Other decisions will be based on individual enterprise requirements.
- With business stakeholders affecting more IT outsourcing decisions and price differences being negligible, the level of service differentiations will be marginal for providers, and brand awareness and preference will have a higher impact on contract decisions. Providers should increase their focus on the brand and shore up consistent service delivery that enhances and reinforces the brand message, along with access to board-level directors.

#### 2.5 Related Research

- "Preliminary Market Share for Top 10 IT Outsourcers, 2005"
- "The Future of Outsourcing: What the Numbers Tell Us"
- "Market Trends: Outsourcing Contracts, Worldwide, 2005"
- "Outsourcing Contract Trends, 2005: Prepare for More Smaller Deals and More Providers"
- "User Survey Analysis: Strategies for IT Outsourcing, North America, 2005"

## 3.0 IT Service Providers

The number of global players in consulting that come from Asia is relatively small. This will limit the ability of the Asian juggernaut to grow revenue streams rapidly and become global leaders.

While it is easy to predict the emergence of Asian service providers, this prediction goes in the opposite direction and provides key insight.

## 3.1 Prediction

Only one Asia/Pacific-based service provider will make the global top 20 through 2010\*.

#### Analysis by Jacqueline Heng and Rolf Jester

\*The rankings are based on IT services revenue only. A global service provider is defined as a company that derives at least 30% of its revenue from customers outside its home country. That revenue should come from all three major global regions — Americas, Europe, and Asia/Pacific and Japan. NEC, Hitachi and Samsung Data Systems do not fit this description.

## 3.2 Key Findings

Many people believe the next multinational service provider will come from Asia/Pacific, but this is not going to happen. Today, Fujitsu is the only Asia/Pacific vendor in the global top 20 based on revenue.

Tata Consulting Services (TCS) is the only Asia/Pacific-based external service provider (ESP) in the global top 50. Infosys is close behind, and at its current growth rate it will likely be in the top 50 in the next two years. Indian service providers generally have been growing 30% to 40% annually and are gaining market share. However, this growth is difficult to sustain and would still not be enough to put TCS or Infosys in the global top 20 without a major acquisition.

There has been considerable discussion about Chinese service providers. However, the largest Chinese ESP, Digital China, is ranked No. 238 globally and is focused totally on the domestic Chinese market. The offshore providers based in China are small. The other Japanese and South Korean providers focus almost entirely on the local market.

Despite the above global analysis of the total IT services market, the picture changes when one examines only commercial (nongovernment) business. Looking purely at that segment, two Indiabased providers will be among the top 10 providers by 2010. That separate prediction is discussed in "Predicts 2007: Offshore Outsourcing Moves Beyond Labor Arbitrage" by Fran Karamouzis and Ian Marriott.

Asia/Pacific-based ESPs are providing focused competition to the current leading multinational ESPs. These Asia/Pacific-based ESPs have strong branding and presence in their home countries, and many of them want to build international operations on that strength. After observing the success of Indian vendors, many Asia/Pacific-based ESPs have similar aspirations. However, success in the local market does not guarantee success in the global market where competition is fierce, where Asia/Pacific vendors have little or no knowledge of the market or customers, and where their brands are effectively unknown. Some Asia/Pacific-based ESPs have made acquisitions to strengthen their operations globally; however, these have been in niche areas with smaller companies and have not resulted in the necessary global reach. There have also been attempts at spinoffs or the creation of new entities for International business; however, focus slowly dilutes, and the ESPs have lacked the resources to stretch beyond the region.

#### 3.3 Market Implications

The shape of the competitive landscape in Asia/Pacific is not expected to change significantly as a result of the actions of Asia/Pacific-based service providers. However, Gartner Dataquest expects acquisitions among current global service providers and that Asia/Pacific-based service providers, such as Fujitsu, Wipro, TCS, Infosys and Satyam, will expand their geographical reach.



For global ESPs, the implications are as follows:

- Whether you consider them as competitors or as potential partners, Asia/Pacific-based ESPs are, with few exceptions, serious players only in their home countries.
- Few even have a significant amount of business in other Asia/Pacific countries, with the exception of Fujitsu and Singapore-based NCS.

Global user companies must be aware that local ESPs can serve their local needs in Asia/Pacific, but almost all of them operate entirely within one country.

#### 3.4 Recommendations

Gartner makes the following recommendations for global ESPs:

- Your competitive strategy should (with the exceptions discussed) consider Asia/Pacific ESPs as local, not global, competitors.
- You can consider partnering with them or acquiring them to meet your local needs in individual Asia/Pacific countries.

Gartner makes the following recommendations for users:

- If you need a service provider to serve your needs in multiple countries regionally or globally, then your choice will be among the established global multinationals. These would include, depending on the type of services needed, Fujitsu and the major Indian companies.
- The evaluation criteria for offshore services are unchanged.

#### 3.5 Related Research

- "Ten Reasons Local External Service Providers Should Seek Opportunities in Asia/Pacific and Japan"
- "Market Focus: Critical Success Factors for Aspiring Pan-Asian IT Services Providers"
- "Major Inhibitors to the Emergence of Pan Regional External Service Providers in Asia/Pacific Diluted"
- "Expansion Across Asia/Pacific Is Difficult for Local IT Service Providers"
- "Pan-Regional Service Markets Offer Opportunities, Risks for ESPs"
- "Rating Tool Helps ESPs Evaluate Expansion in Asia/Pacific IT Services Market"
- "India's ICT Industry: Increasing in Global Visibility and Relevance"
- "China's ICT Industry: Current State and Future Direction"
- "What Chinese IT Services Providers Must Do to Succeed in the Global Market"

## 4.0 Community Marketing and Blogs

Blogging as a phenomenon has entered the public consciousness in a big way. However, there are limits to the growth of even a Web 2.0 phenomenon like blogging, as the initial excitement about it has begun to be replaced with a more rational view of how blogging technologies should



be used. This leads us to ponder whether there is a peak point in blogging growth, after which the phenomenon will become the norm.

#### 4.1 Prediction

Blogging and community contributors will peak in the first half of 2007.

Analysis by Ed Thompson, Adam Sarner and Esteban Kolsky

#### 4.2 Key Findings

The number of bloggers and Internet community participants will peak in early 2007. This is a good sign, showing that a frenzy of transitory involvement is ebbing, and these channels will have more-meaningful value for marketing.

- There were more than 56 million active weblogs ("blogs") in October 2006, according to Technorati, but the average life span is three months and declining.
- Given the trend in the average life span of a blogger and the current growth rate of blogs, there are already more than 200 million ex-bloggers. Consequently, the peak number of bloggers will be around 100 million at some point in the first half of 2007.
- Both MySpace and Facebook lost visitors in September 2006, according to Nielson/NetRatings, a Web-tracking service. The number of unique U.S. visitors at MySpace fell 4% to 47.2 million from 49.2 million in August, and the number of visitors to Facebook fell 12% to 7.8 million from 8.9 million.
- Community involvement varies, with fewer than 2% of all Internet users acting as frequent contributors, between 10% and 15% contributing occasionally and more than 50% lurking, reading or watching what the communities are discussing.
- Today's overexuberance will give way to a steady state of at least 30 million active bloggers and 30 million frequent community contributors worldwide. The steady state will grow again, but much more slowly, as the global Internet population rises.
- After the recent blogging and community froth, the information divulged by the remaining frequent contributors will be a skilled marketer's gold mine.

#### 4.3 Market Implications

- Companies will make a tenfold increase in investment in online marketing technology during the next five years.
- Marketers will need to work harder to identify which of the smaller, fragmented communities are having a high impact in niches that they care about.
- They will have to find new ways to mine this information to improve product development, brand management, customer segmentation, campaign targeting and word-of-mouth marketing.
- Marketers will need to consider taking action, as did Adidas, Starwood Hotels and Reuters, which opened a news bureau in the simulation game "Second Life" in October 2006.
- A series of new applications and technologies will hit the market with Web analytics, blog and community text-mining tools at the forefront from vendors such as Omniture, Lithium and Umbria.



- Marketers will need many new skills in areas such as sociology, psychology and anthropology and use techniques such as game theory to connect, contribute and gain customer insight from these communities.
- By 2008, the first effective system will appear that collects customer-contributed information from multiple social networks to improve campaign management.
- By 2010, marketers who successfully use customer-created content as part of their marketing efforts will increase conversion rates with prospects and established customers by an average of 25%.

#### 4.4 Recommendations

- Marketing departments in all industries should allocate at least one employee to be an online customer community specialist with the job of searching and monitoring what is being said about the organization and its offerings.
- Marketers should consider outsourcing some services to social networking service providers that help companies organize and/or track communities for customer insight.
- The IT organization should seek out data-mining, Web analytics, e-marketing and campaign management products, because community-aware technology offerings are being developed in these areas.

#### 4.5 Related Research

- "Predicts 2007: A Return to Growth Fuels Marketing Technology Spending"
- "Hype Cycle for CRM Marketing Applications, 2006"
- "Five Best Practices for Establishing an Online Community for Marketing Benefits"
- "Campaign Management: Extending Relationships Through the Gaming Console"

## 5.0 Compliance

Corporate social responsibility is a topic that has gained much media attention of late, as major corporate scandals have been revealed to the public. As a result, regulation has become a key issue for government and the corporate world, with the aim of ensuring more-responsible behavior. However, the need for companies to be socially responsible to their employees, customers and shareholders is growing as well. The future will see corporate boards and executives make this social dynamic a more critical priority.

## 5.1 Prediction

By 2009, corporate social responsibility (CSR) will be a higher board- and executive-level priority than regulatory compliance.

Analysis by French Caldwell and John Bace

## 5.2 Key Findings

Nearly all organizations have successfully mastered the fundamental compliance requirements of the recent laws and regulations dealing with corporate governance, transparency and financial controls. Many of these same companies also adhere to regulations that deal with social and environmental concerns: the rights of employees, clean air and water regulations, and so forth. In



many cases, companies achieve standards beyond what is required by law, either in response to special interest groups and investors, or just because it is possible and needed. For instance, a company dependent on clean water — for example, a beverage company — may rely on local water supplies for production. That company benefits from working with local officials and nongovernmental organizations to improve local water. This effort could likely be reported as a cost in the company's annual financial report and at the same time as a CSR initiative in its report on sustainable development.

Most large companies and many midsize and smaller ones take advantage of the opportunities that globalization has provided, principally lower labor costs offshore and finding new markets for existing goods and services. Working with governments and communities in developing countries, company leaders become more aware of the needs and challenges of developing world economies and communities. However, few organizations include meeting these needs and challenges in their operations and strategy. Instead, they are driven mostly by near-term financial objectives. This strategic myopia is dangerous in a world with 24/7 worldwide media coverage containing facts and fallacies: The onset of risk and its consequences happen at a much-quicker pace today. Take, for example, recent items from the news:

- Corporate executives are found spying on journalists: Indictments are handed down in weeks.
- News of tainted spinach as the cause of a single death creates more than a \$1 billion loss for the prepackaged salad industry in less than a month.
- Oil leaks in Prudhoe Bay pipelines in Alaska and a Texas refinery explosion undermine a multinational oil company's CSR branding campaign, and lead regulators to publish a damaging report on the company's safety programs.

Many CSR initiatives are ending up on the CIO's desk: Disposal of electronic equipment, data center power consumption and the job's impacts of sourcing are three that almost every CIO faces.

#### 5.3 Market Implications

A growing number of companies are including CSR in their strategic and operational planning, some going so far as to take the leap to "carbon neutrality." While many companies cannot take large leaps, CSR, at a minimum, suggests that management makes decisions based not just on financial factors, but also on the social, local economic and environmental consequences of the organization's operations. Diverse management philosophies — such as W. Edwards Deming ("the father of total quality management [TQM]") and Robert S. Kaplan and David P. Norton ("The Balanced Scorecard") — have embraced the concept. And at least one study — "Corporate Social and Financial Performance: A Meta Analysis," 24(3) 403-443, by Marc Orlitzky, Frank L. Schmidt and Sara L. Rynes, Sage Publications (2003) — has found a positive correlation between social and environmental performance and profitability, although a recent article in The Economist shows CSR expense most often exceeds tangible returns.

Organizations that embrace CSR do so for many reasons. These can include:

- Risk management Building a culture in which the organization is perceived consistently as decent and honest can protect the reputation, and it can often keep regulators and lawmakers from questioning activities.
- License to operate An organization that takes a proactive stance on social and environmental issues and that embraces CSR can often avoid the unwanted attention of governmental agencies, regulators and activists.



- Brand differentiation In today's marketplace, a unique product or service lasts an extremely short time before it becomes a commodity. The overall reputation of the organization can provide the difference in a "me too" marketplace.
- Personnel and recruitment In a world in which talent and resources are tight, current and potential employees are looking to join and stay with organizations that have a positive image.
- Guilty conscience By embracing positive social and environmental issues, companies may divert attention from less-wholesome organizational activities.

For whatever reason an organization embraces CSR, the organization becomes more of a partner with the community and its stakeholders and expands its operational horizon beyond a quarterly focus on profitability.

A substantial body of knowledge and resources is available today for organizations seeking to develop a CSR philosophy. Some of this material is categorized under the principles of "sustainable development" and "environmental management standards." The International Organization for Standardization has published ISO 14000, which provides a guideline for organizations to minimize environmental (air, water and land) impacts from operations (refer to www.iso.org/iso/en/prods-services/otherpubs/iso14000/index.html ).

The Global Reporting Initiative published in October 2006 its "Sustainability Reporting Guidelines v3.0" (see <u>www.globalreporting.org</u>). The guidelines provide suggestions on how to report on economic, environmental and social performance.

#### 5.4 Recommendations

At a minimum, ensure that operational processes include controls that are effective in meeting publicly acceptable norms for compliance with governance, social and environmental regulations.

Meeting regulatory compliance is the basic cost of admission. Above and beyond that, CSR looks to improve the quality of life, enhance health and safety, and improve environmental conditions by lower power consumption or reducing toxic waste, and so on.

Prioritize those initiatives that promise real benefits, such as improved quality and safety, or lower power consumption. Then look to initiatives that tangibly improve the company's license to operate — that is, that build goodwill with communities in which the company operates, plans to expand operations, or wishes to open new markets.

Take care in approaching CSR as a branding exercise. Negative events, such as environmental incidents, safety failures and ethics violations, are "a negative force multiplier" when a company brands itself as "socially responsible."

#### 5.5 Related Research

- "Corporate Social Responsibility Demands Will Affect Bank IT"
- "Best Practices on How to Organize for Sustainable Compliance"
- "Understanding the Components of Compliance"
- "Why 'Going Green' Will Become Essential for Data Centers"
- "How CEO Concerns in Mid-2006 Are Shaping IT Agendas"



## 6.0 Security

Security continues to be a concern for corporations and is growing as a concern for users. An increase in financially motivated but undetected security violations provides a mandate for enterprises to focus more attention on detecting intrusions.

## 6.1 Prediction

By the end of 2007, 75% of enterprises will be infected with undetected, financially motivated, targeted malware that evaded their traditional perimeter and host defenses.

Analysis by Neil MacDonald

## 6.2 Key Findings

The threat environment is changing — financially motivated, targeted attacks are increasing, and automated malware-generation kits allow simple creation of thousands of variants quickly — but our security processes and technologies haven't kept up. Targeted attacks against a small number of organizations or attacks that morph quickly don't create the visibility for the creation of a signature, breaking the model of legacy antivirus and other signature-based prevention mechanisms.

Security products can't stop what they don't recognize as a threat, and this will affect all organizations, large and small. By the end of 2007, we believe that three out of four organizations will be infected with financially motivated, targeted malware that has evaded their traditional perimeter and host defenses and remains installed and undetected on their endpoints. Yet, these organizations will remain "blissfully ignorant," taking false comfort in antivirus and network scans that continue to show zero infections.

Although fewer than 10% of the attacks on the Internet are targeted against a single company, the financial impact to an individual business of a single successful targeted attack will be 50 to 100 times greater than the impact of a successful worm or virus event. We have projected that through 2009, the financial damage experienced by businesses because of targeted attacks will increase at least five times faster than damage caused by mass events (0.8 probability).

#### 6.3 Market Implications

Advanced malicious-code detection and prevention capabilities are needed. Traditional signaturebased antivirus and firewalls are insufficient for comprehensive malicious-code detection and prevention. Legacy antivirus mechanisms must be supplemented with more-advanced styles of intrusion prevention in network- and host-based security. Addressing targeted threats should not require that organizations purchase dozens of new security point solutions. Rather, security platforms should evolve to deliver more types of security protection for little or no additional cost. The convergence onto security platforms is seen in the desktop, next-generation network firewalls and e-mail security servers, making their more-limited predecessors obsolete.

#### 6.4 Recommendations

Protecting against targeted attacks requires strengthening all of an enterprise's information security processes and technologies:

• Investments in vulnerability management processes — Malicious code would have no impact if there were no underlying vulnerability to exploit. Consequently, ongoing improvements in patching capabilities are needed, but most successful attacks will occur at the application level. Organizations should proactively scan applications and

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application source code for security vulnerabilities, ideally in development and quality assurance before applications are placed into production.

- Investments in intrusion prevention systems (IPSs), network- and host-based Because we can't patch as quickly as new exploits appear, organizations should proactively shield endpoints against attacks targeted on known vulnerabilities. On desktops and servers, behavioral IPSs are maturing that prevent unknown and targeted attacks by monitoring how applications interact with the operating system (OS). Leadingedge vendors offer malicious-code simulation in advance of execution in e-mail gateways and host-based intrusion prevention system (HIPS) products, with some providing virtual machine-based execution of code to observe behavior and contain damage. A simple way to strengthen protection capabilities is to activate hardwarebased protections mechanisms with an OS that supports them (for example, Windows XP Service Pack 2 with no execute/execute disable [NX/XD] activated).
- Investments in network access control Keeping unmanaged and potentially infected devices off the network will reduce attacks. Even machines that appear healthy may be or become infected. Thus, once a machine is connected, network behavior analysis should be used for monitoring suspicious patterns of network behavior indicating a potentially compromised machine.
- Investments in identity and access management (activity monitoring, such as user activity monitoring, database activity monitoring and transaction monitoring for suspicious activity) — Use content monitoring and filtering, starting with network egress points and, longer term, ideally combined with device control, to prevent inappropriate disclosure of intellectual property. Perform separation-of-duties analysis for administrative control across all systems with check-in/check-out of administrative credentials with full logging of activities while the ID is in use.
- Investments in security information and event management (SIEM) Use SIEM for the correlation of disparate sources of security information to determine illicit activity.

#### 6.5 Related Research

- "Integrate Security Best Practices and Tools Into Software Development Life Cycle"
- "Understanding Strengths and Weaknesses of Host-Based Intrusion Prevention Styles"
- "Prevent Targeted Attacks"
- "Hype Cycle for Information Security, 2006"
- "Identifying and Solving Vulnerability Management Weak Spots"
- "Best Practices for Implementing Host-Based Intrusion Prevention Systems"

## 7.0 Operating Systems

The next generation of operating environments will be more modular and will be updated incrementally. The era of monolithic deployments of software releases is nearing an end. Microsoft will be a visible player in this movement, and the result will be more flexible updates to Windows and a new focus on quality overall.

## 7.1 Prediction

Vista will be the last major release of Microsoft Windows.

Publication Date: 1 December 2006/ID Number: G00144544



Analysis by Brian Gammage, Michael A. Silver and Leslie Fiering

#### 7.2 Key Findings

Vista will be the last major release of Windows in its current form. The current, integrated architecture of Microsoft Windows is unsustainable — for enterprises and for Microsoft. Look for future versions to move toward a more modular architecture.

Historically, the new features and functionality of each major Windows release came at the cost of added scale and complexity. For Microsoft, the complexity has meant integrating an increasingly unwieldy code base and quality assurance testing across the millions of potential user configurations. For business users who must also deal with maintaining legacy applications, each new Windows release has meant greater deployment costs and complexity. So, Microsoft and its customers have a vested interest in reversing the trend.

Businesses want new versions of Windows to be easier to deploy and manage. Microsoft wants to accelerate the rate at which it releases updates for Windows to show more value to Software Assurance (SA) customers, but it must also make those updates easier to test, deploy and absorb.

Both sets of requirements would be satisfied by a shift toward a more modular operating system (OS) architecture, in which horizontal functions, such as management and security, are separated from user applications. Organizations could rationalize the "management footprint" of their PCs and deliver higher levels of service at lower cost. Microsoft could decouple its development projects and deliver smaller, focused upgrades on a regular basis.

#### 7.3 Market Implications

Making Windows more modular will appeal strongly to Microsoft, encouraging enterprise users to move from buying Windows to subscribing to a Windows service through SA. Historically, users have been hesitant. They expect a subscription to mean regular updates, and many who cover their Windows OS with SA have received no significant upgrade during the term of their contract. Delays in the release of Vista have further undermined confidence in the value of SA on Windows. Making Windows more modular would make it easier for Microsoft to deliver regular updates and boost the perceived value of SA on Windows. Microsoft could make exclusive access to a more regular stream of Windows updates a strong selling point for SA. The predictable income stream would also enhance Microsoft's appeal to the investment community.

The enabling technology for making Windows more modular is virtualization, which will be added to Windows Vista by 2009 at the latest. Virtualization technology enables software components to be securely confined within allocated resources. Any attempt to break confinement is trapped in hardware and reported to the OS for remediation. Such confinement allows components to be added without compromising system security or stability.

We expect Microsoft's virtualization strategy for PCs to be similar to that already outlined for x86 servers, with a Windows hypervisor and a "service partition" that controls how horizontal system functions, such as management and security, are used. The service partition will act as the arbiter of how other partitions (instance or appliance) access system resources. The combination of the service partition and the ability to deliver horizontal functions in software appliances provides the key for unbundling the Windows OS.

Once the Windows hypervisor is added to Vista, we expect Microsoft to move toward a more modular development approach and, by 2010, deliver a major release of Windows based on a modular architecture (0.6 probability). Gartner believes the next major Windows release after Vista could come in at least two partitions: a service partition dedicated to system

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management/security functions (most likely invisible to the user) and at least one other for user applications.

To accompany this change, Windows packaging would also evolve. The basic version of Windows will consist of a framework that comprises the hypervisor, service partition and a basic application partition. Updates to these and access to additional partitions (whether parent or child) will require a subscription relationship with Microsoft. For enterprises, SA will become an essential part of the Windows offering, because, without it, there will be no access to key system management, security and user features.

These changes would help make the Windows OS easier to manage and would enable Microsoft to address two immediate challenges — the need to accelerate Windows development and its desire to drive sales of SA on Windows. However, the real long-term value to Microsoft would be in creating a platform that could evolve quickly to respond to competitive market threats, such as the emergence of Web-based software delivery models from Google and others.

#### 7.4 Recommendations

Enterprises should expect a significant update to be made available for the Windows Vista OS in the second half of 2008 (Windows hypervisor) or 2009 (Windows hypervisor plus service partition). This will be the first milestone that demonstrates the move toward a more modular OS. At the same time, enterprises should consider the value and timing of any SA agreements on Windows. Once its hypervisor is released, Microsoft will likely begin delivering more-frequent, valuable updates. From 2010, SA will effectively be mandatory for any PC deployed with the more modular Windows OS.

#### 7.5 Related Research

- "Vista Will Be the Last Major Windows Release as We Know It"
- "Redefining the PC: The Slow Path to a Hypervisor"

## 8.0 Client Computing

The world is getting better at managing PC resources, and the tools available to support such efforts have grown in ability. For this reason, the amount spent on managing PCs will decrease, enabling that money to be shifted to automation and virtualization. This, in turn, will reduce the cost of maintenance even further over time.

The growing importance and focus on manageability, automation and reliability will provide a welcome means of differentiating PCs in a market that is increasingly commoditized. Many of the manageability and support tools will be broadly available across multiple vendors. However, vendors that can leverage these tools further and can graduate from claims of "goodness" to concrete examples of cost savings will have a market advantage.

## 8.1 Prediction

By 2010, the average total cost of ownership (TCO) of new PCs will fall by 50%.

Analysis by Brian Gammage, Leslie Fiering and Michael A. Silver

## 8.2 Key Findings

Between 2006 and 2010, a variety of factors will combine to drive a 50% fall in the cost of ownership of new PCs deployed by businesses and other organizations. The reduced cost of running PCs will come from:

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- More automated manageability and support tools. These tools are improving and/or automating processes for security, asset management, software patching, virus remediation, diagnostics and so on. They reduce labor on the part of the IT group and the end user. In many cases, they can help prevent problems (for example, security) and reduce the need for remediation. In others, the IT support job can be simplified by having better visibility on the history of a user's device and software load as well as having better remote diagnostic tools. Simply turning Windows automatic updates on can have a profound effect in reducing malware exploits, for example, in the unmanaged populations and among notebook users who may not be able to get regular updates from a central corporate server.
- Improved ability to manage a greater portion of the user population more tightly, even to the point of locking them down. Well-managed systems will be able to achieve significant cost savings from asset tracking, software deployment, backup/recovery, wireless connection management and so on — without lockdown. Of course, lockdown can bring even further benefits in some environments.
- Increases in user sophistication and growing user familiarity with PC-based tools. Many PC operations that currently generate support calls and detract from user productivity in end-user operations time will become routine to a generation of workers that has literally grown up with PCs (switching wireless connections, synchronizing or moving data across platforms, adapting to new applications or changing interfaces, and performing first-level diagnostics and problem isolation on hardware and software problems — in large part, with the aid of automated tools listed above).
- Shift toward Web 2.0-based and OS-agnostic applications.
- Continuously declining capital costs (expected to drop 20% to 30% by 2010). The lower capital costs are also coupled with higher reliability. Hardware failure rates have been declining significantly during the past two years as PC OEMs have recognized that it is less costly to design reliability into the systems at the front end than to pay for warranty costs at the back end.

With the expected delivery of a Microsoft hypervisor in 2009 and committed support from key market players, coexistence of security software appliances and other virtual machines will become possible. At the same time, familiarity, the arrival of new VT/Pacifica-aware configuration tools and new software delivery techniques (such as streaming) will enable companies to manage mass deployments of virtual machines onto systems. This will minimize the need to perform detailed image management and create a managed and secure way of working with noncorporate assets.

## 8.3 Market Implications

New PCs will present a significantly less complex "footprint" to manage and secure than at present, with enhancements in platform-level technology enabling higher levels of automation for many operational tasks. Exceptions to standard IT policies and processes will become easier to contain, while improvements in the understanding and technical know-how of users will make common support issues much faster and less costly to resolve. A significant percentage of the savings will be in end-user operations — that is, faster problem resolution and the ability to absorb software migrations and new applications faster with less downtime and peer support. There will also be a reduction in administration and operations costs, especially on the support side. Some of the operations cost savings will be offset by the need to integrate and maintain manageability tools.

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Because PCs represent a major percentage of IT budgets, reduced PC TCO will impact the bottom line. Ideally, it will allow IT shops to reallocate budget from tactical, low-return-on-investment projects to more-strategic business transformation projects. In many cases, however, it will simply be a welcome means to withstand omnipresent budget cuts.

For PC OEMs, the reduced PC TCO costs will lead to greater capital spending — more PCs at higher average selling prices (ASPs). The more likely scenario is that users will continue to demand lower ASPs. However, the reduction in support requirements will also impact PC OEMs and reduce their operating expenses as well.

The growing importance and focus on manageability, automation and reliability will provide a welcome means of differentiating PCs in a market that is increasingly commoditized. Many of the manageability and support tools will be broadly available across multiple vendors. However, vendors that can leverage these tools further and can graduate from claims of "goodness" to concrete examples of cost savings will have a market advantage.

#### 8.4 Recommendations

Now, more than ever, businesses of all sizes need to understand and begin to implement best practices for managing and securing their PCs. Even smaller accounts without the critical mass to afford major centralized systems can benefit from simple tools such as Windows automatic updates. While it is still early to implement virtualized appliances for support and security, IT organizations should begin to familiarize themselves with the enabling technologies.

PC OEMs need to focus on building security, manageability, diagnostics and remediation into their systems as well as backing their TCO savings claims with case studies and concrete examples.

#### 8.5 Related Research

• "Use Processes and Tools to Reduce TCO for PCs, 2005-2006 Update"

## 9.0 Mobile and Wireless

The mobile world is creating what might be called the "follow-me Internet." Local regulations have arisen to protect users' privacy, but growing demands for national safety and civil protection are relaxing some of the initial privacy limitations. Marketing incentives will also push users to forgo privacy concerns, and many other scenarios will enable outsiders to track their users.

## 9.1 Prediction

By 2010, 60% of the worldwide cellular population will be trackable via an emerging "follow-me Internet."

Analysis by Monica Basso, Ken Dulaney and David Mitchell Smith

## 9.2 Key Findings

As cellular telephony became mainstream, an early prediction was for the rapid emergence of mobile location services (MLSs). MLS adoption has been limited to date, with regional differences due to specific market or regulatory conditions. Governments have pushed degrees of adoption. In the U.S., government mandated MLS to support E911 services. In Europe, only levels of accuracy have been specified to support E112 services. Asia/Pacific has seen broad adoption, with some 10 million subscribers.



Although there have been many system implementation difficulties, these systems are about to broaden, mostly enabled by satellite positioning technology. An indicator of this trend is given by a recent announcement by Nokia, market leader in the mobile handset market, of many new Global Positioning System (GPS)-enabled devices to arrive in 2007. In addition, location services will be complemented by sensors that provide applications with other user presence attributes.

As location capabilities mature in mobile networks and devices, thanks to satellite-positioningrelated technology, another key trend is developing in the Internet market. Local search services — enabling users to find maps, directions, navigation paths and relevant places around a geographic location — are now available (for PC and mobile device clients) and increasingly popular on any Internet megaportal, including Google, Yahoo and MSN. The automatic detection of a mobile user's precise location might transform today's Internet local searches into exceptional mobile buddies for people on the move.

As a result, the mobile world is creating what might be called the "follow-me Internet." Local regulations have arisen to protect users' privacy, but, at the same time, a growing demand for national safety and civil protection is relaxing some of initial privacy limitations. Marketing incentives will also push users to forgo privacy concerns. And there will be many other scenarios that will enable outsiders to track their users.

#### Mobile location services are finally emerging; other types of sensors are being integrated.

After years of promise, mobile location services are becoming available as operator value adds to cell phone technologies, but also via other devices connected to satellite services, such as GPS and the upcoming European Galileo system. Vendors have greatly reduced the cost of the chips for location services as well as enabled them to be packaged in many formats. Furthermore, other important sensor technologies are coming to cellular phones, such as electronic compasses that sense direction and accelerometers that can detect motion. Many other sensors, including cameras and body sensors, may also be incorporated into a variety of devices, providing a more comprehensive view of the user.

## Mobile location-based services will leverage community concepts and mobile technology to be the next big "Web 2.0" driver by 2010.

Web 2.0 takes advantage of communities of users. Community on the Web and in the physical world come together when actual physical location is factored in. Location-based "mashups" utilizing mapping information are already becoming a mainstay of Web 2.0. Consumers are starting to use these services from mobile devices, but integration of location remains somewhat cumbersome. We expect to see competition and partnerships emerge among GPS providers and current providers of Web 2.0 mapping sites (for example, Google Maps, Windows Live Local and Yahoo Maps) as well as mobile communications providers. Adjacent markets, such as music players and services, will also take advantage of these concepts. Tim O'Reilly, originator of the Web 2.0 conference and concept, has added a new conference called "Where 2.0" as a way to try to drive this trend. The more broad availability of mobile phones with location capabilities will be a driver. The relative slowness of the maturing of mobile Web technologies will be an inhibitor. The most successful services will, at least initially, use specialized client applications.

#### Children will be tracked; some worker categories will also be tracked.

Violence on children is a horrific, still-growing reality in our society, according to a recent report from the United Nations. In 2002, more than 53,000 children died worldwide as result of homicide; 150 million girls and 73 million boys under age 18 experienced forced sexual intercourse and other forms of violence. Amazingly, one of the settings in which violence against children occurs is schools and other educational places. The U.N. and other humanitarian organizations have



elaborated recommendations to worldwide states, to protect their children and prohibit any form of violence against them.

On an individual basis, particularly in modern countries, parents have many growing fears about the welfare of their children. Losing them, abductions and sexual violence are among the many threats. New child-friendly toys with wearable embedded location technologies will shortly be available at low cost, and families will adopt them to monitor their children's movements at home or outside. Kindergartens, schools and other public institutions will adopt location-aware products to grant children safety when under their responsibility. Parents will increasingly force teenagers to use location-aware products — either mobile phones or wearable items. Cars can be instrumented with technology that can also be report logs of driving habits. First examples of such products are already available in the market, for example i-Kids, Firefly and LG VX-1000 are children's phones with GPS capability; Sprint family locator, Disney family finder and Verizon VZ Navigator are all location services for families to track their kids. As threats to children increase, knowledge of their continual whereabouts will occupy a piece of any parent's budget in providing for his or her family.

We anticipate that 20% of users will, to some degree, be forced into trackability, through coercion or incentives. Vehicles used in transportation and logistics industries are now routinely being tracked, and, increasingly, workers will accept monitoring as a condition of employment. In the office, many countries have upheld a company's right to read employee e-mail. Companies are also beginning to track their employees for safety and productivity, as well as to spot illegal activity. But, once tracked, what is acceptable or not acceptable behavior may move into gray areas between the right to track and privacy.

There is much evidence that people are willing to accept some trackability in exchange for convenience (being able to locate friends or receiving electronic promotions based on location), lower-cost services (free online e-mail services) and safety (traffic cameras and video surveillance). Although we anticipate much public debate on the privacy issues, the tendency will be toward more trackability, not less.

#### Even in protected societies, marketing incentives will force tracking.

Much like caller ID, where users don't think about where such information is distributed, many won't keep track of just what information is being transmitted to whom. Even where safeguards exist, marketing incentives will force users to permit tracking. A growing availability of location data will consequently see organized collection, storage and handling of personal data by third parties, not only for marketing, but also for safety and control by government institutions. A potential correlation of location data with other individual data will enable police and other law enforcement bodies to strengthen controls and the ability to prevent crime. However, this may also generate a potentially dangerous situation in terms of individual rights, freedom limitations and, eventually, a threat to democracy conditions. In European countries, we expect to see growing concerns by individuals.

#### Dictatorial governments will use location and sensors to track their societies.

Many societies exist where governments will not provide for the privacy of their users. Although carriers may provide location-blocking services, such governments may force operators to provide location data, implement unauthorized access to individual data repositories, or independently track their citizens through cell phone and other technologies. These technologies will help these governments exert control over their populations.



#### 9.3 Market Implications

Not only have location services brought forth many conveniences, such as finding nearby services or optimal navigation paths with minimal travel in an age of high energy costs and big traffic congestion on roads; they have also enabled user tracking. The manifestation of tracking capabilities is poised to take many directions. Governments must work especially hard to deal with the many implications of location tracking. On the positive side, lives can be saved. On the negative side, user privacy can be seriously jeopardized.

#### 9.4 Recommendations

IT must recognize that location and sensor technology will have much broader use in its applications. From safety and navigation, to knowing where employees are and routing them efficiently to the customer side, to monitoring and control of their work habits — mobile location services have enormous potential.

#### 9.5 Related Research

- "Hype Cycle for Wireless Hardware, Software and Services, 2006"
- "Hype Cycle for Consumer Mobile Applications, 2006"
- "Tracking People, Products and Assets in Real Time"

## **10.0 Networking**

Corporations continuing to invest in traditional networking approaches, such as ever-increasing private bandwidth, are finding that their investments are being wasted. Successful companies will focus on adding value to business processes, spending on bandwidth only where necessary, and supporting public services with optimization technologies.

#### **10.1 Prediction**

Through 2011, enterprises will waste \$100 billion buying the wrong networking technologies and services.

Analysis by Bob Hafner and Mark Fabbi

#### **10.2 Key Findings**

Enterprises are missing out on opportunities to build a network that would put them at a competitive advantage. Instead, they follow outdated design practices and collectively will waste at least \$100 billion in the next five years.

Disruptive technologies have emerged that should dramatically change how enterprises architect their networks. Approaching network design in a new way will have a significant impact on the capabilities of the network, as well as radically changing the underlying cost model. However, these opportunities are being missed by the vast majority of companies as they continue to follow well-established, but now outdated, design methodologies. Much of the \$100 billion is simply being wasted on technologies that are not necessary, fixing problems that don't exist, while investments in areas that could transform the business are missed.

In the network equipment market, companies are buying Gigabit Ethernet to the desktop for users who are using much less than one-tenth of what is installed today. The installation of Gigabit Ethernet often provides 100 times (that is, two orders of magnitude) more bandwidth then they need or can use. Putting IP screen phones next to the larger-screen PC on the desktop doesn't

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make sense. IP screen phones are expensive — the applications that run on them are all customdeveloped under proprietary software and, in many cases, already exist on the PC (or could be developed more cost-effectively on the PC). Most importantly, for the same cost (or less), the enterprise could purchase unified communications applications that logically link the PC and an inexpensive phone, giving the PC and phone far greater functionality. Finally, companies are blindly following "vendor recommended" network architectures, buying "just in case" features and functionality that will never be used during the life of the equipment. The total waste in network equipment purchases will very conservatively amount to \$45 billion during the next five years.

In services, companies continue to throw bandwidth at problems — expensive and private bandwidth — when public services and optimization technologies are more appropriate. Using new WAN technologies can enable enterprises to use the WAN more efficiently and defer WAN bandwidth upgrades by more than three years. We estimate that more than \$55 billion will be wasted on these services and, in most cases, buying bandwidth will not actually fix the problems it was trying to solve.

Beyond the \$100 billion in wasted investments for the overall market, we also believe that the U.S. government will waste \$20 billion in IPv6 investments during the next five years — again missing out on other technology investments as it follows unwarranted technology upgrades.

A portion of the money that could be saved should be still spent, but on technologies and services that improve the business. Most companies will eventually spend this money on more-useful technology, but not before wasting money on unneeded technologies and services. Collaboration and mobility will be key to driving productivity, but, ironically, because these are soft benefits or reside outside the IT department, most companies have been unwilling or unable to justify these expenses.

#### **10.3 Market Implications**

By following outdated design principals, 70% of organizations will be at a competitive business disadvantage by missing out on initiatives that drive new business processes, but not having budget room due to the overexpenditures in other areas. Of network organizations, 20% will face outsourcing because they are not meeting business requirements, while also showing poor cost and vendor management practices. Ten percent of organizations will emerge as new thought leaders — driving new modes of architecting their networks and delivering business value, all while reaping significant cost advantages.

#### **10.4 Recommendations**

The top two business priorities for CIOs during 2006 were to "improve business processes" and "reduce enterprise costs." Enterprises must start their network design process by thinking about applications and business processes. By being part of the application project teams, network architects will be better-able to anticipate and drive investments into areas that will make a difference to the business, rather than spending money on traditional "enhancements." Review current network spending plans focusing on near-term (one- to three-year) needs, and do not invest without an identified business need that will provide a significant productivity boost for most/all users within the enterprise. Don't fix problems for areas that are not broken, and don't prepare for functionality that will never be used. Do not follow traditional network design best practices; these are now outdated. Do not simply grow bigger and faster in any portion of the network. Look for the disruptive technologies, such as WAN optimization, public services and better communication applications, as a better way to build the network.

Analyze expected shifts in the worker population, especially toward mobile and remote workers. Focus investments on application performance, network-based security, wireless and mobility, IP WANs, and converged voice applications.

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#### 10.5 Related Research

- "Don't Purchase IP Screen Phones If You Have a PC on Your Desk"
- "Gigabit Power-Over-Ethernet Switches Are Largely Unnecessary"

## 11.0 Data Centers

Power and cooling are perennial issues in the data center. With higher densities of processors proliferating, problems in this area continue to grow. Although the power and cooling challenge of high-density computer equipment will persist in the short term, a convergence of innovative technologies will begin to mitigate the problem by 2010.

#### 11.1 Prediction

By 2008, nearly 50% of data centers worldwide will lack the necessary power and cooling capacity to support high-density equipment.

Analysis by Michael A. Bell

#### 11.2 Key Findings

With the advent of high-density computer equipment such as blade servers, and 1U rackable systems, electrical power demand can approach 25 KW to 30 KW per rack. This compares to only 2 KW to 3 KW per rack only three to five years ago. Increased power translates into significant increase in heat gain, where the electrical cost to cool the data center can equal or exceed the power to energize the computer equipment.

- We expect that nearly 50% of data centers worldwide will lack the necessary power and cooling capacity to support high-density equipment by 2008.
- However, a flurry of innovation is under way that will converge during the next three years to substantially mitigate the power/cooling issue.
- Processor manufacturers such as Intel and AMD are competing aggressively to market more-energy-efficient chipsets with reported energy efficiencies of 30% to 35% for equal or greater computing power.
- In-chassis cooling technology (such as SprayCool) applies a nonconductive agent under pressure directly onto the processors, using inkjet nozzle technology. The evaporative effect of the spray absorbs heat, and condenses and returns the heated liquid to a heat exchanger that interfaces with a chilled-water loop in the bottom of the rack. Another inchassis technology, Cooligy, employs a different concept. The heart of the system is what the vendor describes as a "microchannel" heat exchanger. This is a unique heat sink that is attached directly to the processors. A water-based, low-viscosity fluid is pumped through the microchannels whereby heat is absorbed by the fluid and then passed through an air-based radiator (fan driven), thus eliminating the need for a water loop.
- In-rack cooling solutions are being offered by a number of vendors, including IBM (reardoor exchanger); HP's water cooled rack, Knurr (an Emerson unit); and Sanmina's Ecobay water-cooled rack. These solutions can eliminate between 15 KW (IBM) and 35 KW (Knurr). Each of the systems requires a water loop or liquid refrigerant.
- In-row cooling offers a number of product solutions, including Liebert's XD series, which mounts sensible cooling units on the rack, ceiling mounted, or the new in-row unit the



XDH unit. Another product is APC's InfraStruXure, which offers in-row cooling units. These solutions can support rack densities in the 15-KW to 25-KW range.

- Many of the vendors offer power management software solutions that monitor server workloads, adjust power and shift demand as required. The aim of these tools is to enable preset system parameters to be used to regulate key server characteristics. For example, HP's Insight Control enables users to dynamically adjust power and cooling to better manage energy consumption, and its Power Regulator enables users to manage server power consumption and system performance based on business needs. IBM has introduced the Power Executive module, which is aimed at managing the power distribution across the whole rack. In this way, users can monitor the power usage and the heat emissions and can regulate the metrics per server. We expect that these systems will interoperate with other third-party systems during the next three years to offer an integrated workload and energy management and monitoring system.
- One vendor, Sun, has announced a "data center in a box," which provides a fully equipped mini data center with power and cooling that supports eight racks of servers, with a power rating up to 25 KW per rack in a space of a standard shipping container (160 square feet).
- Many of the server vendors offer facilities advisory services aimed at assessing data center capacities, and offer products and services to mitigate heat and power constraints.
- In the U.S., a number of private and public initiatives promote energy efficiency in the data center. The Green Grid is a consortium of processor and server manufacturers chartered to evolve energy conservation standards. The U.S. Environmental Protection Agency (EPA) has just released a draft protocol that provides a uniform methodology for measuring server energy efficiency under various workload thresholds. And the U.S. Congress is close to passing legislation that will fund an EPA study to evaluate data center power efficiency and to put forth recommendations for encouraging greater energy conservation in the data center.

#### **11.3 Market Implications**

- The convergence of these innovations and initiatives is expected to yield substantial solutions to the power and cooling problem by 2010. Already, the issue is prompting aggressive competitive offerings from the processor and server manufacturers.
- For many clients, selective retrofits of their data center facilities environments will suffice to provide the needed head room for higher-density equipment. In other cases, clients will require a relocation to a new, fully enhanced data center facility to achieve the necessary capacity for near-term and longer-term requirements. The market outlook suggests substantial increases in data center construction, renovation and expansion during the next three years.
- These innovations will also prompt significant upgrades to third-party colocation facilities; however, these improvements will result in higher rates, particularly for increased capital amortization and energy costs. We also expect growth in third-party, specially built data center facilities such as those offered by Digital Realty Trust and 365 Main. Other real estate development companies will enter the data center market with competitive offerings as demand increases for enhanced data center facilities.
- The server vendors will continue to introduce new products, services and software solutions to address the issue.

- These trends will not be confined to the North American markets but will impact global markets, particularly in rapidly developing countries, such as India and China.
- We also expect an increase in governmental activities, focused principally on various • incentives to encourage data center energy conservation, but certain governmental actions may also include possible sanctions and penalties for excessive power usage.
- We expect increased political pressure, particularly in Europe, where the "green • movement" is promoting increased energy efficiencies. These pressures will certainly focus on the energy-intensive data center market.

#### **11.4 Recommendations**

- Take a holistic approach in planning, designing and laying out the data center to • optimize power and cooling capacity.
- If you're planning an upgrade to your current data center; you should plan for capacity • upgrades for the short term (through 2010), with spot cooling solutions. If you're planning a new data center, you should anticipate the introduction of these innovations over the life of the new facility and provide core infrastructure, such as "wet aisles," and plumbed zones in the new facility to support in-rack and in-row water cooling for highdensity rack configurations.
- Monitor power demand by rack. As the average kilowatts per rack exceed 6 KW. • consider alternative cooling solutions, such as in-rack or in-row solutions. Where the minimum kilowatts in a row are above 15 KW, consider in-rack liquid cooling solutions.
- Conduct an energy audit of the data center; determine actual energy costs and how • these costs are allocated between machine power and all other power. Institute energy efficiency measures as necessary.
- Identify high-density zones within the raised floor area that should be considered for • water-cooled or other liquid-cooled solutions.
- Determine the average workload you expect for your server portfolio (use a range such as 15% to 20%). Then, request that prospective vendors report their products' energy efficiency at that level over a specified time period.
- Closely monitor the technical road map of each of the vendors, and target system upgrades in conjunction with a data center relocation project.
- If you use a service provider to host your data center operations, scrutinize the current contract relative to energy cost allocation, scalability and capacity to support highdensity equipment. Strive to renegotiate energy cost allocations if you are a low power user.

#### 11.5 Related Research

- "Findings for Why Chilled Water Is Coming to Large Data Centers" •
- "How to Manage Heat and Power Problems in the Data Center"
- "A Message From Data Center Managers to CIOs: Wake Up to Our Energy Crisis" •
- "High-Density Servers: Cool Technology, Hot Issues for Data Centers" •
- "Why Is Cool Now 'Hot' for IT Planners"



#### Note 1 Strategic Planning Assumptions and Predictions

Gartner's Predicts reports use two types of statements to formulate our actionable advice about the future:

- Strategic planning assumptions (SPAs) are accompanied by a probability (0.1 to 0.9) that indicates our degree of confidence that the statement is correct in terms of substance and timing. This probability will help you match your level of risk tolerance to decisions about technology.
- **Predictions** are unequivocal statements about the future and therefore never have a probability. A prediction indicates that we believe the statement to be true exactly as expressed in terms of its substance and timing. Predictions are actionable advice.

We occasionally may pair a prediction (no probability) and SPA (with a probability) to provide more in-depth guidance about different aspects of a future event.

This research is part of a set of related research pieces. See "Gartner Predicts 2007 and Beyond" for an overview.

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