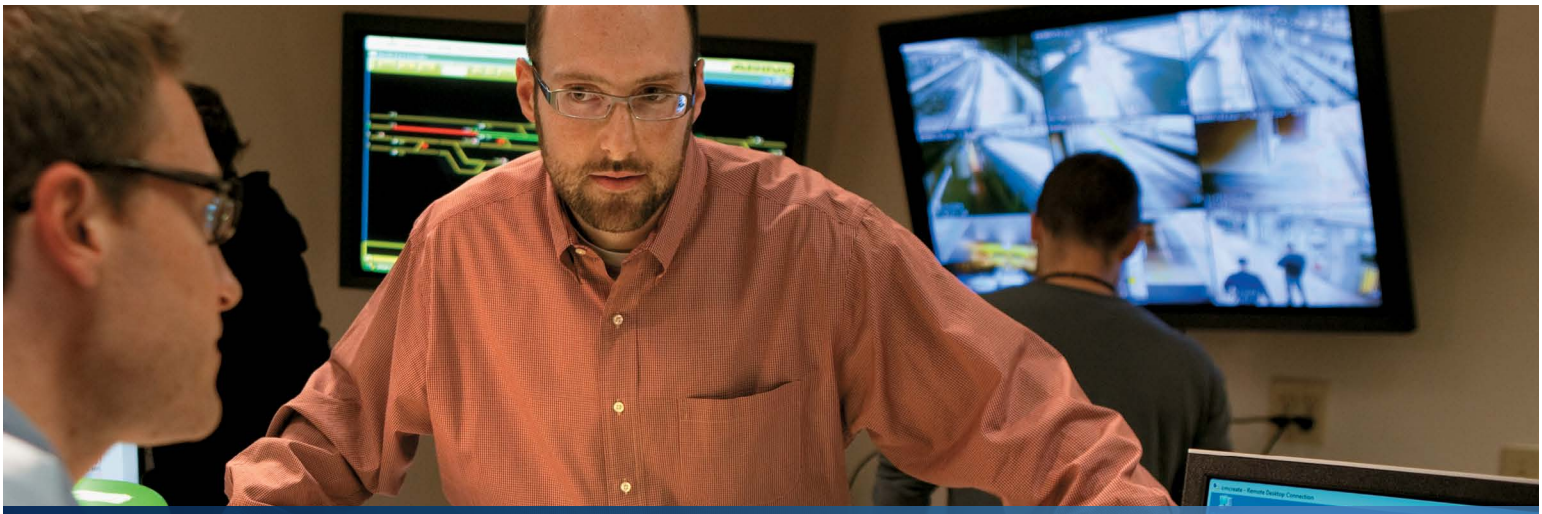
Microsoft



Operational Excellence

EXECUTIVE STRATEGY BRIEF

Managing a World-Class Global Network

Global Foundation Services (GFS) is responsible for the strategy and delivery of the foundational platform for Microsoft® cloud services such as search, advertising, HealthVault™ , MSN®, Office 365, Windows Azure™, and XBOX Live®, etc. with a driving focus on operational excellence in everything we do.

In this strategy brief, learn how Microsoft ensures reliability and availability around the clock, and maintains a robust process for incident management, service support, and change management with speed, efficiency, and trust.

A DAY IN THE MICROSOFT CLOUD

THE SUSTAINABILITY IMPERATIVE

At Microsoft, we are committed to driving software and technology innovations that help people and organizations improve the environment. Our goal is to reduce the impact of our operations and products, and to be a leader in environmental responsibility. The environmental sustainability commitment for our cloud infrastructure is extensive.

- We standardize on energy-efficient servers and place a great deal of focus on configurations that use natural air flow or water economization for cooling.
- We deploy sensors throughout our facilities so we can quickly respond to changes in temperature and humidity, and we're constantly on the lookout for ways to reduce wastes and improve efficiency.
- We measure and analyze everything we do. The metric we use to track energy efficiency is Power Usage Effectiveness (PUE), a ratio of the power and cooling overhead required to support our server load, and we strive to reduce this ratio to 1.125 by 2012.
- We believe that the datacenter industry as a whole needs to share best practices around energy efficiency. That's why we helped found and actively participate in The Green Grid and Climate Savers Computing industry consortiums.
- We also work closely with U.S. Environment Protection Agency, and are a proud participant and endorser of the European Union (EU) Code of Conduct for Datacenters, a voluntary program that encourages datacenter organizations to use electricity efficiently. In addition we share our best practices around environmental sustainability in published papers and blogs available at http://www.globalfoundationservices.com.

Operating at Huge Scale

Microsoft's cloud is one of the largest worldwide. Global Foundation Services powers over 200 services for our consumers and businesses 24x7x365 via globally distributed datacenters, networking, and security, infrastructure applications and tools, and operational management teams.

Since 1994, Microsoft has been managing online service delivery challenges with the launch of our first cloud offering—MSN. Today our cloud infrastructure supports more than 1 billion customers and 20 million businesses a year. We are continuing to increase our capacity, putting more than $9.5 billion per year in R&D, while continually improving the operational processes to maximize reliability, performance, and efficiency.

Across the company, 70 percent of our engineers are focused on the cloud. In one year that will increase to 90 percent.

Since we opened our first datacenter in September 1989, Microsoft has invested over $2.3b in its cloud infrastructure to support the growing needs of our customers, while continually improving the operational processes to maximize service reliability, performance, and efficiency.

At the foundation, effective cloud infrastructure management comes down to two key things—keeping the site up and costs down.

"Our first line of support is the Microsoft Operations Center—globally distributed with failover capabilities, and staffed 24/7/365 with engineers able to triage, mitigate, and escalate issues as they occur in real time."

DAYNE SAMPSON
GENERAL MANAGER,
GLOBAL FOUNDATION SERVICES

Microsoft Datacenter in Quincy, Washington

Microsoft's Cloud Infrastructure Strategy

Microsoft's cloud infrastructure operations center on building out our global capacity through innovative datacenter design, delivering high availability through effective operational management, and maintaining a secure and trusted cloud infrastructure while reducing our impact on the environment.

Our strategy is focused on smart growth, measurable efficiency, and global trust.

Smart Growth—We judiciously add capacity within our datacenters and markets to respond to customer demands when and where they need it. Microsoft's latest datacenter designs use a modular approach that allows us to scale rapidly to new capacity demands, while reducing the cost of initial build and ongoing operations.

Measurable Efficiency—We measure constantly, making power and performance trade-offs while focusing on uptime, availability, performance and power usage. Microsoft leverages technology innovations in server consolidation to generate the maximum compute capacity across the fewest servers while maintaining workload isolation.

"Microsoft has a number of important security certifications and attestations today, including PCI, SAS70, ISO27001, and most recently FISMA NIST SP800-53 revision 3 standard."

PETE BODEN
GENERAL MANAGER,
ONLINE SERVICES SECURITY & COMPLIANCE

Global Trust—We maintain robust policies and procedures to keep our customers data and our sites secure from attack, while protecting the privacy of personally identifiable information. Microsoft understands the difference between consumer and enterprise information, and quarantines private company information from commercial use.

We are also committed to driving software and technology innovations that help people and organizations improve the environment. Our goal is to reduce the impact of our operations and products, and to be a leader in environmental responsibility. The environmental sustainability commitment for our datacenters is extensive. Our approach includes the following:

Environmental Sustainability—We are committed to environmental sustainability across the company; datacenters are a key area where Microsoft establishes and maintains environmentally sustainable policies in the design, operations and ultimate decommissioning of datacenter resources.

Industry leadership and Best Practice Sharing—We not only strive to be a responsible citizen in the IT industry, we recognize that advancing the collective knowledge and encouraging industry sharing will result in innovative technological advances beneficial to all.

Modular Datacenters

Microsoft is committed to offering flexibility for our customers to support future growth while giving speed to market advantages, as well as cost certainty (e.g., avoiding the costs of monolithic or customized datacenter builds in the future).

- We believe that the next generation of datacenters, like our modular, pre-fabricated, industrialized datacenters, will consist of ultimately off-the-shelf components and parts rather than completely customized builds every time. Today, we are streamlining our traditional build process with a more refined, scalable, phased approach to support an on-demand, 'just in time' datacenter.
- The main benefits of this approach are speed to market, efficiency, operational savings in the long run, and scalability. These benefits are all obviously direct parallels with the advantages that datacenter modularization advances will also give.
- There will obviously be caveats to this time schedule (such as the implementation of new IT innovations for efficiency and customization levels), but we think our roadmap for delivery of computing capacity, scalability, uptime, and security will be very attractive, while allowing our cloud services' businesses to remain competitive as the market evolves.

HOLISTIC DATACENTER OPTIMIZATION

The Microsoft datacenter operations team continually seeks ways to drive more efficient use of power and cooling in datacenters. Our measurements of server performance under load and workload analysis has enabled us to right-size our server platforms. We have eliminated unnecessary components, use higher efficiency power supplies and voltage converters, and bounded the expandability of server platforms to achieve significant power savings.

We look at specific measures such as processor performance per-dollar per-watt to determine the optimum tradeoffs in processor selection. We have found that by using lower performance, lower watt processors we can deliver greater overall efficiency for both power utilization and deployment cost. We have also learned that we can widen the operating range of our servers and use free air cooling and water economization to improve efficiencies.

This continual measurement and analysis allows us to push the boundaries of datacenter efficiency, helping reduce operating costs while improving environmental sustainability.

Keeping Sites Up

The Microsoft Operations Center (MOC) delivers a centralized management that provides competitive advantages of speed, efficiency, trust, service reliability, and quality to Microsoft's cloud services.

The MOC is highly integrated to the core network and datacenter infrastructure to deliver comprehensive incident management and service support. It manages one of the largest Microsoft System Center implementations in the world, as well as non-Windows environments.

As a federated operations center, it maintains a robust business continuity process— with failover capabilities in Redmond, India and California—retaining instant availability of geo-replicated service continuity in the event of a natural disaster or other calamity.

Driving Costs Down

To respond with the right resource allocations, while optimizing operating costs, Microsoft has moved away from the standard industry practice of allocating costs by use of space to a more relevant measure of allocating against key cost drivers. These drivers include energy consumption, bandwidth consumption, incident response, and server capacity to provide transparent and accurate billing across our resource pool.

This comprehensive billing approach helps businesses make the right decisions and trade-offs necessary for their online services, and allows the datacenter operation's teams to optimize the placement of compute and bandwidth capacity with appropriate scale.

Microsoft has developed a proprietary tool called SCRY that tracks power usage, server utilization, and carbon output, along with environmental conditions inside and outside the datacenter. This tool is the backbone of our ability to monitor workload consumption in real time and to allocate costs and resources in a fully rationalized manner.

"Microsoft is committed to not only improving our own designs and operational practices, but also sharing those with others in the datacenter community."

KEVIN TIMMONS
GENERAL MANAGER,
DATACENTER SERVICES

Global Network Reliability

To ensure fast and reliable connectivity to online services and data, Microsoft combines globally-distributed datacenters, edge computing nodes with one of the world's largest fiber backbones to provide over 2.5 terabits per second of capacity to over 1200 networks with 99.95 percent availability. This network provides multiple paths to many providers, allowing instantaneous re-routes around internet failures to maintain high reliability. Additionally, our Content Distribution Network service scales automatically without user intervention.

The company is continuously investing heavily in dark fiber, and currently maintains over 17,000 miles of fiber with equipment at 400+ sites with point-click capacity augmentation. This expanding capacity enables expansion in a matter of minutes, rather than taking several months.

Security, Privacy and Compliance

Microsoft recognizes that privacy protections are essential to building the customer trust needed for cloud computing and the internet to reach their full potential. Customers also expect their data and applications stored in the cloud to remain private and secure.

While the challenges of providing security and privacy are evolving along with the cloud, the underlying principles haven't changed—and Microsoft remains committed to those principles. We work to build secure systems and the cloud infrastructure that will help us protect an individual's privacy, and we adhere to clear, responsible privacy policies in our business practices—from software development through service delivery, operation, and support.

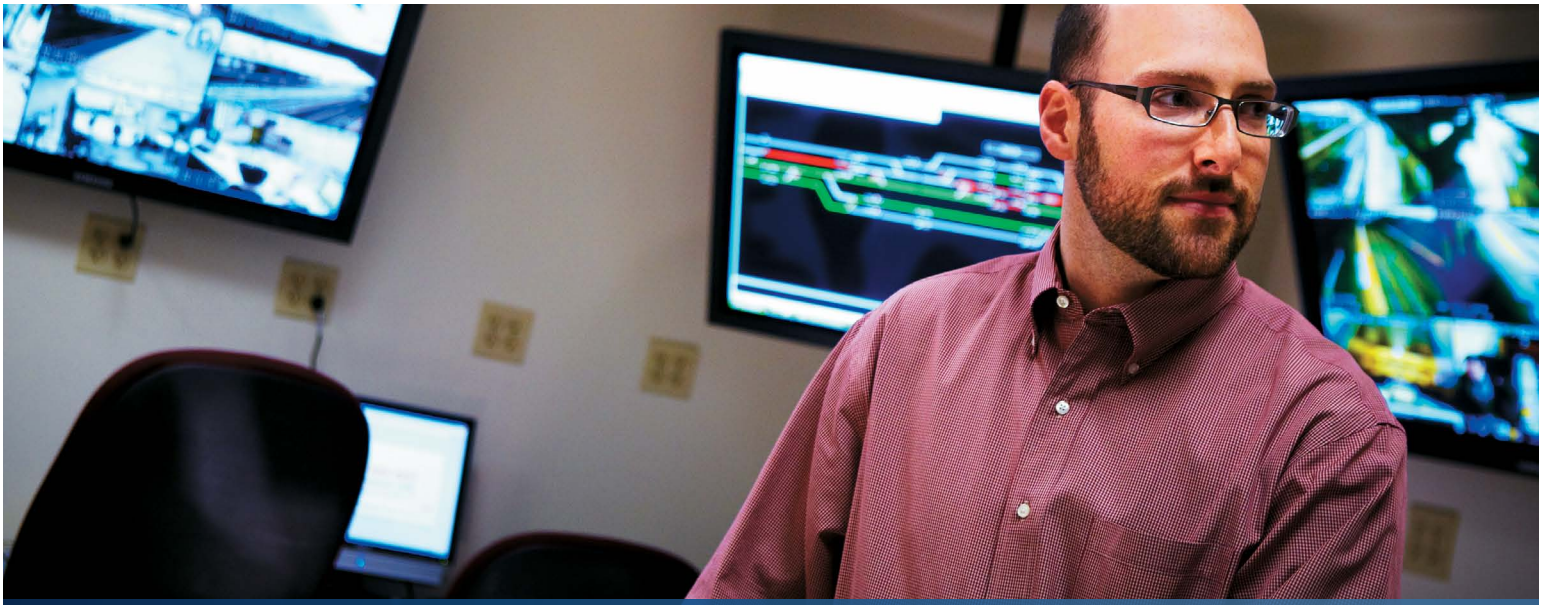
Microsoft's Online Services Security and Compliance team operates a comprehensive security program and control framework that is evaluated regularly by external parties.

The ISO standard is the foundation of our program. While the ISO/IEC 27001:2005 certification standard includes about 150 security controls for our scope, we adhere to more than 300 security controls. We choose to exceed the standard to manage risks that are unique to the cloud infrastructure. In addition, the security program and capabilities are subject to a SAS 70 Type I and II review. The FISMA Certification and Accreditation, ISO certification, and SAS 70 attestations demonstrate Microsoft's commitment to delivering a trustworthy cloud computing infrastructure.

Some of the audits and assessments that the Microsoft cloud infrastructure environment undergoes on a regular basis include: the Payment Card Industry Data Security Standard, Sarbanes-Oxley, Health Insurance Portability and Accountability Act (HIPAA), and Media Ratings Council for the integrity of advertising system data generation and processing.

MICROSOFT DATACENTER CERTIFICATIONS AND ATTESTATIONS, DECEMBER 2010

ISO 27001	✓
SAS 70 Type II	✓
HIPAA/HITECH	✓
Various State, Federal, and International Privacy Laws (95/46/EC—aka EU Data Protection Directive; California SB1386; etc.)	✓
PCI Data Security Standard	✓
FISMA Certification & Accreditation	✓



Microsoft has extensive experience operating cloud services' infrastructures, with a history of innovation, operational excellence and industry leadership. As Microsoft's cloud services portfolio and infrastructure continues to grow with new services and applications launching on a rapid basis, the Global Foundation Services team is making thoughtful investments to answer our customer's needs for greater availability, lower latency, increased security, and lower costs.

Please visit www.globalfoundationservices.com for more information.

A DAY IN THE MICROSOFT CLOUD