



# CrucialPoint

## Megatrends in Enterprise IT

Bob Gourley

October 2010

# Purpose of this brief

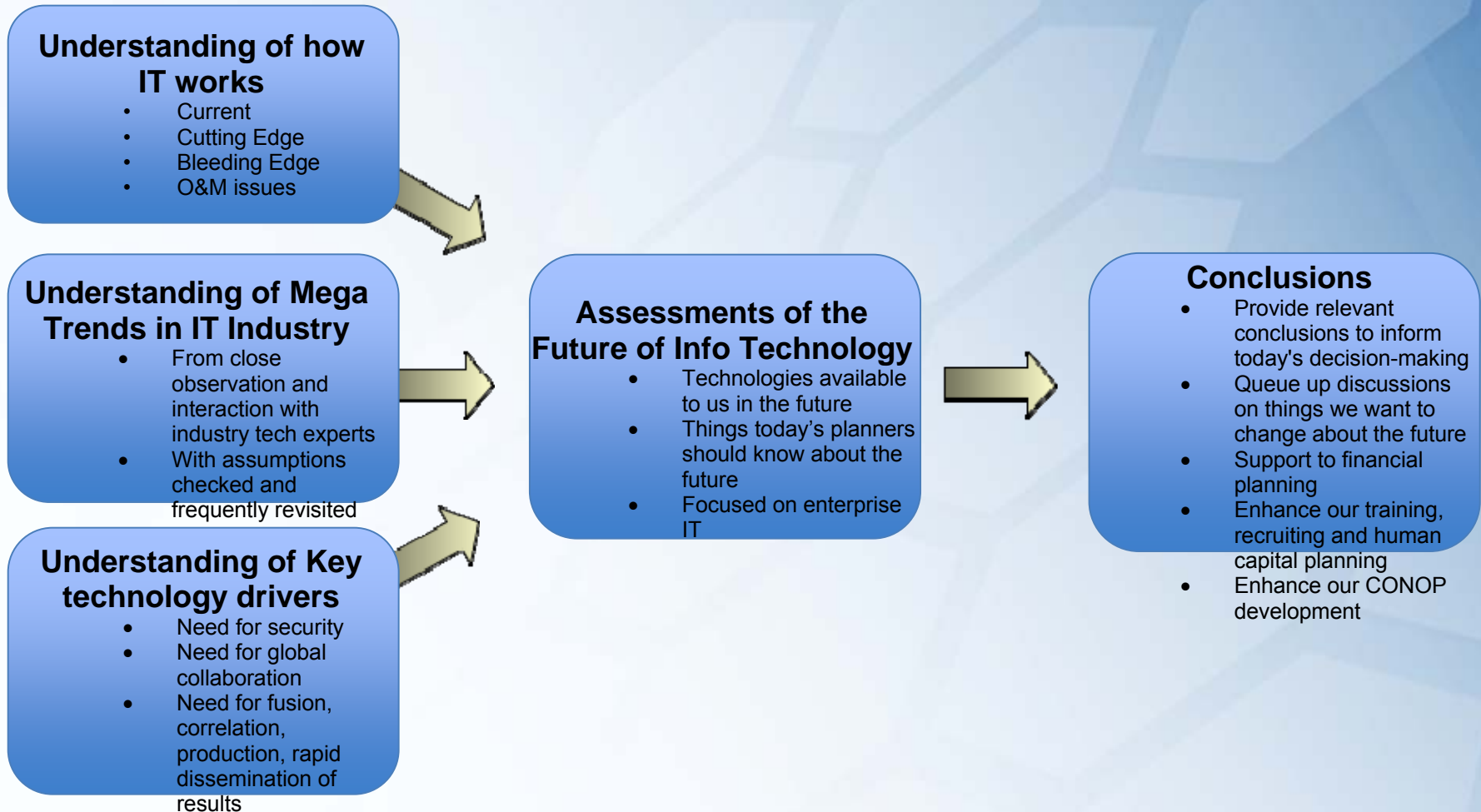
- This presentation is meant to provide insights of use to today's planners.
- It is not meant to be about all technology. It focuses on technology thought to be most relevant for enterprise IT.
- This presentation is not about the future of requirements, the future of policy or the future of CONOPs. But the future of IT is coupled to these subjects and some assumptions about those areas are made.
- This presentation is in perpetual draft. It is being used to help dialog with other experts. If you are reading it your input is requested.
  - Disclaimer: Although this has been reviewed by dozens of world class experts, it is full of personal opinions, and it covers a subject that is rapidly changing. I will ask all who read it to give me feedback on whatever they think is wrong.
  - Takeaways: You will have a better feel for coming technologies which will give perspectives of use to today's decisions

# An Important Note

During this presentation each slide will be up for a few seconds. Don't try to read them as they flash by. I'll e-mail you a copy to read slowly later.

During the brief I'll just hit the key points.

# Methodologies



Sources of the assessments in this presentation include numerous Gartner reports/briefings, analysts with industry CTOs and other tech leaders, review of key online technical journals and interviews with technologists

# Part One

# Epoch Change

# The IT We Know Today Is Almost Over

## Most Enterprise IT Today:

- Customized, complex applications many designed locally
- Limitless user interfaces, each designed for customized, complex applications
- Proprietary datastores with business logic coded into the datastore
- Servers bought and owned by local IT departments
- Desktops bought and owned by local IT departments
- Desktops loaded and configured individually or by local IT folks
- Inefficient Datacenters
- Large Power Bills for Large Data Centers
- Local IT departments increasingly inefficient
- Fruitless attempts to satisfy needs of mobile users
- Knowledge workers who need automation but get poor IT service
- No understanding of the future of IT so no ability to plan
- Poor ability to search, poor ability to discover
- Comms bought with not enough attention to SLA/Latency/Quality/Security

# How can we know what tomorrow's IT will look like?

- Track mega trends
- Track disruptive innovations
- Track what community leaders are doing
  - DISA, NSA, Army Intel, SOCOM, CIA, NGA, Dept of Transportation
  - Microsoft, Google, Amazon, Adobe, Oracle/Sun, Cisco, Global Crossing, Cloudshield
  - New disrupters (like CollabNet, Endeca, Triumphant, Invincea)
  - Technologies available today and trends moving them forward provide some interesting conclusions relevant to all.

# Key Mega Trends for IT

- **Convergence and trend towards unified communications and user empowerment**
- **Increasing open development of software and hardware**
- **Cloud Computing and massive ingest/parsing of data**
- **Green IT and support to total mission effectiveness**
- **Increasing pace of technology development and probability of disruption**

**Please read the full brief for details on these trends and many specific technologies available today.**

# Part Two

## More on the Mega Trends

# Convergence and trend towards unified user empowerment

- Consumerization is the most important component of this mega trend. All IT around the globe is being impacted by this trend. IT development will focus increasingly on consumers vice government or enterprises
- Mass collaboration on problems. Social networking and IT tools to support that.
- Expect huge consumer-demand for location aware technologies, which will accelerate these technologies.
- Will see continuing demands for more consumer bandwidth (especially for video/image related uses)
- Huge increases in wireless/cellular bandwidth (1Gig wireless to desktop proven in labs, will be available to consumers one day)

## Demographic Trends

- US stockholders own most enterprise IT companies but most engineering is overseas (expect more enterprise IT solutions from overseas).
- Demographic shifts will begin to decrease intellectual capital advantage of the US unless changes are made to immigration law.
- Graying workforce in the US and other key Western nations (this trend impacts every ally)
- Global competition for talent
- This trend underscores the critical importance of coalition action and coordination/communication/collaboration

## Increasing open development of software and hardware

- Embraced by all major IT companies and large numbers of programmers
- This trend is fueling a growing need for in-house programming talent
- Smart use of open source can enhance security posture
- Proprietary software comes with open API's and plugs into existing architectures in open ways

# Cloud Computing

- Cloud based continuous services that connect to us all and appliance-like connected devices enabling us to interact with these services.
- Including Private Clouds, Public Clouds, Edge Clouds and a spectrum in between.
- Driven by functionality improvements, but also cost, agility and security benefits.
- Security benefits will only come with planning and work. Without planning and work, security becomes a nightmare.
- Security Issues:
  - Multi-Tenancy: requires secure access and separation of user allocated cloud resources
  - Availability: If you are using a cloud it better be there
  - Confidentiality: Will you be putting all your eggs in one discoverable basket?

# Green IT and support to total mission effectiveness

- Power cost is a key driver
- Also driven by regulation
- But this trend is causing a re-look at the ability of IT to better support collaboration from a distance, which will have big impacts on total mission effectiveness.
- Will also, in many cases, drive enhanced ability to leverage workforce from where ever they are.

## Increasing pace of tech fielding and probability of disruption

- InfoTech, NanoTech and BioTech are building synergies off of each other
- Must assimilate new technologies fast
- Ugly fact: Our systems are in many ways subject to degradation, either due to malicious activity or due to interdependencies of complex systems.
- Cyber Security includes all steps required to ensure mission effectiveness- Information confidentiality, integrity, availability. These are all made harder in environments that are complex and rapidly changing.

**“Complexity Kills: Complexity sucks the life out of users, developers and IT. Complexity makes products difficult to plan, build, test and use. Complexity introduces security challenges. Complexity causes administrator frustration.” – Ray Ozzie at ozzie.net**

# Part Three

## Some more specific trends

# Future of Information Technology



Virtualization



Virtual Reality



Applications



Sensor Feeds



Visualization



Search



Robotics



Storage



Collaboration



Communications



Enterprise and  
Grid Management



Security



Operating Systems



Devices



Location-Aware  
Tech



Servers

# Location Aware Technology



**Location-Aware Technology:** Applications and devices that know where they are and can leverage that knowledge.

- Potentially the biggest impact on how enterprises serve their mission over the next 3 to 5 years.
- Big enabler: knowledge of where your cell phone is located.
- US law requires your cell phone transmit accurate location data for emergency purposes
- Where you have been and where you are is the ultimate biometric
- Understanding, discovering, predicting location and knowing who is where is key growth area
- Your every movement, transaction, communication can be tracked and recorded.
- Powerful apps will leverage this data.

# Virtualization



**Virtualization**: a technology aided technique for hiding the physical characteristics of computing resources, including making a single resource (like a server, operating system, application or storage device) act like multiple resources. It can also make multiple resources look like one.

- Wireless laptops with totally virtualized, stateless power available today.
- Virtualization has proven effective as a means for increasing efficiencies, and as a potential solution for disaster recovery.
- Virtualization technologies will change the way agencies support all users, but most users will not know that.
- Virtualization is a flattener for hardware producers, which might change the hardware end of the PC and Server business. It will also likely impact our SOA with virtualized SOA environments.
- Over the planning period, VMware will continue to be strongest player in both the server and workstation Virtualization markets. Exchange runs faster on VMware than in native mode. What do you think about that!
- You can also virtualize Storage (like Datadomain), IO (xsgo), and just about anything else you can think of in the IT department.



**Big enterprises needs to leverage virtualization to better enable the secure insertion of COTS**

# Security Technologies



**Security Technologies:** Technologies that contribute to the confidentiality, integrity and availability of information. Security technologies generally operate under the configuration control and guidance of the Chief Information Assurance Officer. These technologies include: firewalls, intrusion detection devices, PKI, auditing, security testing, policy servers, and access control mechanisms.

- We are tracking the ability of government provided encryption to scale to future comms requirements.
- All IT providers are getting more serious about security, however, no one controls the entire stack, leaving lots of room for fault lines that can be exploited in standard commercial security.
- Identity and authentication of users will long remain a critical component of our security technology.
  - We do not expect any “Single Sign On” solution to provide comprehensive access to dispersed data. It will provide access to more and more data, but current data management/ownership constructs will prevent ubiquity.
- Cross domain solutions will all be governed at the enterprise-level. Individual programs will not develop their own cross-domain solutions.
- Encryption at rest enterprise buy for DoD will help change the marketplace in a very positive way.
- Solutions that maintain device configuration (Triumphant) are critical to enterprise health in the face of changing threats (zero-day). Solutions that protect browser from exploitation of unknown threats (Invincea) also badly needed.
- DPI is a critical component in any security implementation.
- Data Loss Prevention also key. The best DLP solutions are those with global awareness capabilities
- Can you monitor for IPv6?

# Collaboration Technologies



**Collaboration Technology:** a technology which assists humans in working together. In the this context, this is normally humans (probably geographically dispersed) working together to create intelligence.

- The age of stand alone collaborative tools is nearly over. Expect all future tools to be “collaborative” tools.
- Trends toward convergence indicate future collaborative capabilities will be centered on our existing full service directories and will also integrate standard enterprise scheduling software and DVTC and VOIP.
- Analysts need means to collaborate via multiple paths at all levels. Pervasive tele-collaboration is a key requirement.
- Other key drivers will be the rapidly shifting consumer focused capabilities found in an increasing number of social software and other Web2.0 sites.
- This is not only about collaboration with intelligence but with customers. And it is most definitely about collaboration with allies.
- Look for tools that bridge workflow across and outside the enterprise. From private clouds to public clouds to external partners. One to watch: Jive



DCO has over 240,000 registered users and does 20 million meeting minutes a month. User empowerment is coming and will mow down old processes like a Mack truck.

# Collaboration (continued)

## The rise of Web2.0



**Web2.0:** Originally coined to mean the next generation net, its popular usage now has the term meaning “whatever is hottest/newest/available now on the net.” The mindmap to the right is a now common concept for web2.0 constructed by Markus Angermeier.

Web 2.0 websites typically include some of the following features/techniques:

- [Rich Internet application](#) techniques (AJAX soon dead)
- Flex open source framework for web apps
- Flash for interactivity
- semantically valid [XHTML](#) and [HTML markup](#)
- [Microformats](#) extending pages with additional [semantics](#)
- [Folksonomies](#) (in the form of [tags](#) or [tagclouds](#), for example)
- [Cascading Style Sheets](#) to aid in the separation of presentation and content
- [REST](#) and/or [XML](#)- and/or [JSON](#)-based [APIs](#)
- Syndication, aggregation and notification of data in [RSS](#) or [Atom](#) feeds
- [Mashups](#), merging content from different sources, client- and server-side. One to watch: JackBe (leader in enterprise mashup)
- [Weblog](#)-publishing tools
- [Wiki](#) or [forum](#) software, etc., to support [user-generated content](#)



All the big IT firms are moving into the Web2.0 world, including:

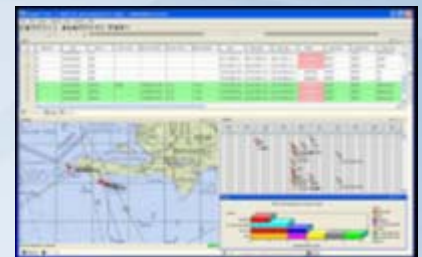
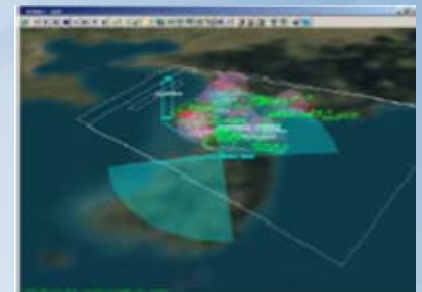
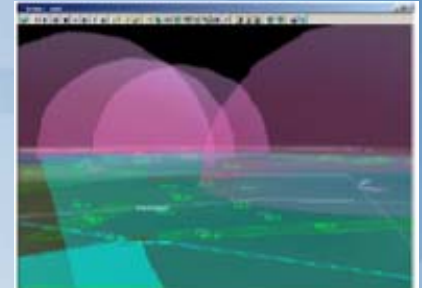
**Microsoft**  
**IBM**  
**Cisco**  
**Oracle**  
**HP**  
**EMC**  
**Adobe**

# ISR Tools



**ISR Tools:** In this context, these are capabilities that assist users in planning, visualizing, managing and directing collection over a battlefield.

- Too many of today's ISR tools are not fully integrated into the enterprise, resulting in sub-optimized performance for end users. Future tools are being written to take advantage of SOA concepts
- Expect more movement towards force-structure-aware networks
- Expect a greater ability to focus on long mission threads. And real time mission intelligence.
- Our newest, hardest missions require systems which can automate the population of knowledge bases, provide next-best observation, support uncertainty management, and provide integrated planning tools. Systems must enable real-time, dynamic re-tasking.
- SOA constructs will be the greatest single driver of future ISR tools, but in the context of ISR tools like DGCS, Web Services will NOT be the technology of choice for SOA. Too much data is being moved and too many users will need access to the tools and services for a web service approach to be used in SOA.
- GeoPDF, 3D PDF, Flash/Flex embedded in PDF, with content control/DRM. Dashboards that auto synch for command situational awareness.



# Visualization

**Visualization:** In this context, this refers to the ability to link the two greatest processors in our grid, the computational power of our enterprise and the human brain.

- The tie to commercial technology so far has not provided a good way to enable our analysts with wrap-around desktop screens. We meet needs by lining up more monitors next to each other. This clunky setup is pretty much the state of the art.
- But enhanced 2D/3D workstations with agile wideband interfaces to the brain are the need.
- Utility of capabilities like Touch Table or Jeff Han's Perceptive Pixel to visualize and interact with data shows promise. If live data is brought in these will be disruptive technologies.
- CAVE might provide another disruptive capability. Its use in multiple academic centers of excellence and its use in a couple of government locations is a positive note.
- SuperHDTV, HR Motion Imagery, 40Kx40K hyperspectral are driving key visualization requirements.



# Storage



**Storage:** In this context, the ability of the enterprise to securely hold information. Our enterprise approach to storage is moving us away from storage tightly coupled to individual programs/projects towards storage that is managed as an enterprise mission/function.

- Enterprise storage options remain DAS, NAS, SAN with SCSI and iSCSI options. iSCSI will grow in the enterprise (different value propositions guarantee the continued coexistence of these options). All will drop in price and increase in capability.
- Rapid increase in sensor feeds will outpace our ability to store.
- Disparate, heterogeneous storage will be the norm well into the future. Distributed data synch and the software to manage data as an enterprise is the key requirement. Simultaneous shared access to large file storage systems. Data encryption at rest. More meta than data.
- Growth to multi-petabyte online distributed, federated archives. High performance grid storage. Massive Arrays of Idle Disks (MAID)
- Deduplication is important. Not just deduplication of backups. One to watch: Data Domain.

## **Terabyte (1024 Gigabyte)**

1 Terabyte: 50,000 trees made into paper and printed  
2 Terabytes: An academic research library  
10 Terabytes: Printed collection of US Library of Congress  
100 Terabytes: The entire internet

## **Petabyte (1024 Terabyte)**

1 Petabyte: 3 years of EOS data  
10 Petabytes: All US academic research libraries  
100 Petabytes: All printed material

## **Exabyte (1024 Petabyte)**

1 Exabytes: All words ever spoken by human beings

## **Zettabyte (1024 Exabyte)**

## **Yottabyte (1024 Zettabyte)**

1 Yottabyte: Everything that there is

# Communications



**Communications:** Most of which are IP based or IP friendly.

- Comms between fixed facilities will be enhanced by a factor of 100 over the next 5 years.
  - We will need this enhanced capacity to enable true all source intelligence fusion and video collaboration
  - Enhanced comms is required for full support of virtualization and enterprise storage strategies.
- Comms to most mobile users will always be unique.
  - Technologies like WiMax or other advanced 4G coming fast
  - But the tactical environment cannot depend on the use of infrastructures required for commercial-like communications
  - The critically important demands of the tactical environment will always present challenges to dissemination of national intelligence to battlefield users.
- IPv6 in use at about 1/2 of 1% of US circuits. IPv6 leader in US is Global Crossing
- Comms must support real-time tele-presence and tele-collaboration and enhanced video
- Capability of interest: Ethernet, at a global scale



# Robotics



**Robots:** Electro-mechanical devices that can perform autonomous or pre-programmed tasks. Robots can operate under the control of humans, like the Predator UAV.

- Expect incredible increase in sensor feeds from UAV, UGV, USV and other robots.
- Robotic sensors will place very high demand on our communications and computing infrastructures
- Storage of data and ability to search across it will also be impacted by the rise of robots.
- Collection management applications will need continual enhancement.



# Devices

**Devices**: User hardware. The things applications and solutions run on. Workstation, Keyboard, Monitor, Mouse, Phone, etc.

- Many completely stateless devices, but also traditional PC.
- Expect continuing heterogeneity.
- Integrated/converged VOIP/PC/Web service platforms.
- Very high resolution geo-temporal displays.
- Advanced video tele-collaboration.
- New means of interacting with data (gesture).
- Require advanced high res vis, wideband, agile human interfaces. Need good HMI on the front-end of everything (good use of both sight and sound).
- Must load the human perceptive systems optimally.
- Need low power, long life devices. Some wireless power.



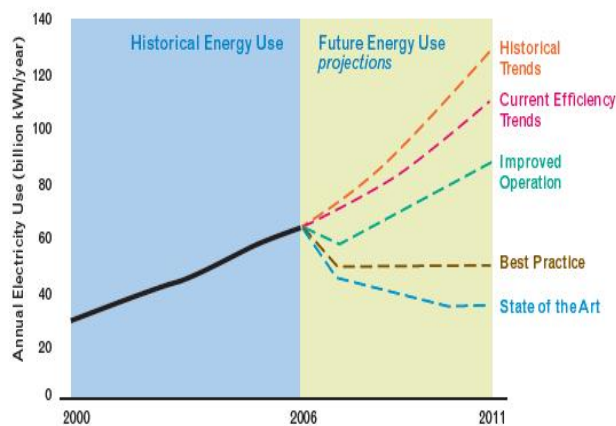
**Note: There are 2B PCs in the world today. There are 4.5B cell subscriber accounts. Guess which device is winning the race?**

# Servers

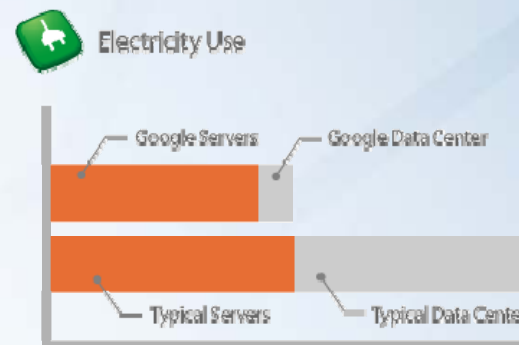


**Servers:** Computers which host applications (and operating systems) for remote users.

- Data centers are increasingly made up of disaggregated devices. But looks for Data center powerhouse companies to change that.
- ATCA standards from telecom world will benefit all data centers. Everything hot swappable. But with fewer moving parts that is actually less of a big deal.
- Trend is for more comms direct to server core. We can buy off the shelf systems today with 20GigE direct to multiple core servers. Infiniband scales higher direct to core and across the enterprise fabric.
- Moore's Law is not the best measure of computing performance. Core's law is alive. The number of cores per chip will double every 24 months.
- Best measure of computing power is becoming compute power per watt



Source: Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431, US EPA, August 2, 2007



# Operating Systems



**Operating Systems**: Software which ensures all computing devices can manage hardware and software. Orchestrate CPU, keyboard, monitor, mouse and other devices.

- Linux and Windows have significant growth ahead, but a heated fight will probably present opportunities for Solaris
- The long term future of Unix is not easy to predict at this stage. Today, it is the most powerful, secure OS in existence, and over the planning period it will remain so.
- Will there be an OS for the cloud?

# Application Development



**Applications:** Software that does stuff

- Of most importance is the mission focused software of the enterprise. The primary point of user interaction.
- We will not have a single IDE or a single favored development tool/method/language.
- Expect .NET and J2EE Also expect more LAMP and (LINUX with Apache/MySQL/PERL/PHP/PYTHON)
- Expect stronger enterprise management of application development and more code reuse and service reuse. Also expect more efficient ways of transitioning code to operations.
- Services allowing users more power over their own app creation including composite apps (giving the ability to create applications to the people closest to the problem). Situational Software.
- Need apps and solutions that can empower users to get data/info their way and rapidly collaborate/create/share. Too few of today's apps do this well.
- Apps must access/leverage the Data Layer and fit in to the Service Oriented Architecture.
- A strong player has disrupted the application development world: Flex.



# Virtual Reality



**Virtual Reality:** In this context, this is technology that allows a user to interact with a computer-based simulated environment. The term encompasses modeling and simulation.

- New ways of modeling and simulation and collaboration will be created for our analysts and for our enterprise operators.
- Our workforce and our users, like other American IT workforces and users, is graying. Skills shortages will fuel an increasing automation of IT processes and user processes. This graying of the workforce will also drive simulation, modeling and prediction technologies– making this a major technology shift.
- Other uses of virtual reality will be found by our analysts and collectors.



# Information Access



**Search:** In this context, we mean the computer based but human focused/driven examination designed to find that which is concealed. Search helps you find what you know exists and what you know you need.

**Discovery:** Helps users find what they need, even if they don't know what to look for. This is a much more open ended problem. Gartner tracks both search and discovery in the category “information access.”

- Federated, semantic based search capabilities will continue to improve. But it is a flawed approach to think that an analyst must think of every possible question and search every database for every possible question. That does not scale.
- Expect continuing advances in new, more powerful search capabilities including in-stream media management using new multi-threaded capabilities. However, these powerful search capabilities are not keeping up with the drive to interconnect and access increasingly large data sets (which is required for horizontal interoperability). We will continue to face search-scaling problems.
- We expect richer, higher bandwidth interfaces into more human senses, including the use of more interactive interfaces. This is a movement away from entering terms into a web-based search box. First- the search box gets on every app, but later the search box goes away and is replaced with a statement of desire and then guided navigation/iteration of results.
- Federating and integrating results a long term challenge. Ensuring attacks on relevance also a challenge.
- Capabilities provided by leaders in “guided navigation” like Endeca provide disruptive capabilities we will want to accelerate into the environment.
- Architect so data finds data, the right info (and relevance) finds users, and users continually access relevance.

# What these trends tell us

- .Brace yourself. The relentless march of computational power will continue.
- .Step back and rethink the basics of your workflow and policies
- .Think of a flexible iPhone-type device with 1Gig per second connectivity. Think of that device connected to billions of sensors, not just over battlefield, but in buildings, streets, vehicles, clothing, consumer goods.
- .Think of this being viewed in easy to understand/comprehend ways (with guided navigation to all information)?
- .Cloud computing (use of computations services from “the grid”) will Accelerate
- .Government IT powerhouses (like NSA, NGA, DISA) will deliver more and more capability to users via the grid
- .Wireless comms to your personal phone and desktop will double every two years



**What can you do on your own, with no approval, with no extra money?  
Probably A great deal!**

# How Can We Accelerate The Future?

- Investigate new ways of encrypting data and identity management to enable better use of grid computing and to enable better use of commercial off the shelf devices.
- Speed the conversion of legacy applications and tightly coupled data to SOA-type model where data is separated from application.
- Investigate new ways to get devices, including desktops, that does not involve the acquisition executive needing to approve every purchase (if you can figure out how to do this let us all know).
- All IT departments move now to a terminal services model of desktop presentation. "Hybrid" clients.
- Establish new means to automate to reduce errors and costly downtime
- Ensure compliance with policy, especially security policy
- All IT professionals everywhere should learn and master ITIL. All those who develop SAAS should master CMMI. But remember, education and experience trump IT certifications-- every time!
- All leaders in government who do not know how to use IT should step aside and let others who are more qualified lead.
- Keep seeking out disruptive IT
- Keep moving to IPv6- consider its security implications
- Seek out advanced global communications capabilities
- Maintain focus on user and the mission

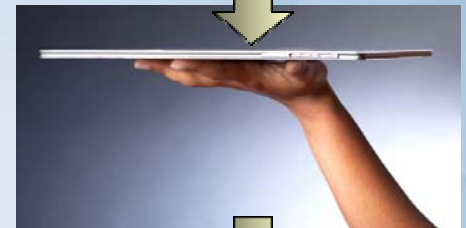
# Please help with your thoughts/input/questions

E-mail: [bob@crucialpointllc.com](mailto:bob@crucialpointllc.com)

Blog: <http://ctovision.com>

Twitter: <http://www.twitter.com/bobgourley>

Facebook, Plaxo, LinkedIn, etc: See the blog.



# Backup Slides

# If I Were In Your Shoes

- Of course keep your focus on your users and the mission
- Find ways to enable user-focused mashups (this should be very low-cost)
- Find better ways to use what you have already bought (if you have bought licenses) and better ways to bring in more open source for functions you don't have money for
- Find better ways to leverage other development efforts elsewhere in the community
- Levy your own requirements on others:
  - Community collaboration on software development
  - Code sharing
  - CONOP exchanges

# So What?!

- Real work and focused investment on the IT enterprise is positioning us to take advantage of new technologies— but we need to keep building on success and take steps for more agility in the enterprise.
- It is time to get in synch with if not ahead of the mega trends discussed in this presentation.
- IT planners are thinking and acting differently now.
- IT planners are being more proactive in defining what challenges are best resolved with tech solutions and which ones can be best addressed with policy or other changes or CONOPs.

# What the future tells us

- Plan now to enhance our agility. The most important agility is in our ability to analyze whether or not a proposed capability or new technology will actually result in a net gain in productivity and mission capability.
- Also of importance, but of a secondary importance to the above, we must enhance our ability to adopt new technologies. We must also speed our ability to configure existing technology. Some ways to focus on agility:
  - Find and eliminate applications/solutions that are not delivering required functionality or that can be terminated for other reasons.
  - Ensure our framework and integrators guide focus on agility
  - Find and eliminate unneeded work being asked of government or contract positions and refocus those positions on things that contribute to agility
  - Find more IC and DoD partners who we can team with to our customer's advantage (and find the right areas to divide IT challenges with).
- Enhance our liaison and interactions with others, to enhance agility, to enhance support to customers on starved nets, and to avoid tech disruption. Interdependence will be an enduring requirement. We are in this together with our partners in and out of government.
  - Must enhance our tech liaison (and speed of tech exchanges) with allies.
  - For the government team, linkages to DISA are critical because of the challenges of disseminating intelligence to users in comms starved environments.
  - Nothing gleaned from a study of technology indicates any future challenges in partnerships with IC or other federal agencies or with Services or COCOMs.
  - The potential for disruptive technology from industry or academia (including DNA computing or quantum computing) is high during the planning period so liaison is critically important.
  - Fiscal realities will keep us pushing towards more common/economical solutions and better teaming agreements.

# What the future tells us

- Keep appropriate focus and sense of urgency on cross domain. Collaboration with customers for analysis, production and dissemination will require well thought out cross-domain solutions that bridge different worlds.
- Refocus job skills to emphasize communications and enterprise storage management. Retain expertise in all enterprise IT technologies, but the mix of our technologists should shift to include more advanced network engineers and more enterprise storage technologists. These disciplines will become as important to us in the future as enterprise systems engineers are to us today.
- Build five year roadmap for our enterprise management toolkit and related enterprise visualization systems. All technology disciplines must have views into the state of the enterprise to ensure mission focus and agility.
- The increase in virtualization and the increase in automation will make IT failure an even more costly proposition. This will drive the need for more complex enterprise modeling and simulation technologies.
  - Plan now for increased engagement in the open source technology community. If we are using open source, widely known, multiple author software we should be involved in ensuring its quality.
  - With growing concerns and government focus on environmental issues, expect increased adoption of “Green Technologies”

# What the future tells us

- Plan now for redesign of JWICS to use new networking standards to ensure we are operating the grid at the highest possible capacity.
- Engineer for enhanced wide area wireless capability. Which solution do we scale up? WiMAX?
- More IT workers will be user-facing. Pure IT know-how will no longer be enough. IT workers will require strong leadership ability, knowledge of their non-IT partner mission needs, and knowledge of the processes of their customers.
- Security will be a continuing concern. New techniques and tools are required to mitigate new threats, especially new threats regarding open source in our enterprise. Multi-level security and cross domain are enduring requirements.
- Automate with brutal efficiency

# Pace of Technology Development

<b>“Moore’s Law”</b>	Computing doubles every 18 months
<b>“Fiber Law”</b>	Communication capacity doubles every 9 months
<b>“Storage Law”</b>	Storage doubles every 12 months
<b>“Greg’s Law”</b>	Number of cores on a chip doubles every 24 months
<b>“Swatch’s Law”</b>	Build it quick and get it out there and see if they like it
<b>“Gourley’s Law”</b>	No one can name a law after himself, except this one

# Questions/Comments?