Top Ten Emerging Technologies to Drive Mission Performance

Dr. David F. McQueeney
CTO, IBM Federal

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“Swivel Chair Integration”
2003: Air Operations Center
So what’s changed?
Enterprise-Class IT:
“…as Simple as Possible but no Simpler*”

- Complex problems tend to require complex solutions…
- Tradeoff between depth of function and simplicity of use
- What’s the scope of “enterprise” anyway?

* A. Einstein
Top Ten Emerging Technologies … Four Groups

- Base Technology
- Software, Infrastructure and SOA
- Information Management
- Web 2.0 … The Internet as a Platform
Base Technology: What does $1000 buy?

![Graph showing the increase in computational power over time]

Year: 1900 to 2020

- Mechanical
- Vacuum tube
- Electro-mechanical
- Discrete transistor
- Integrated circuit

Computations/sec: 1E-12 to 1E+12

After Kurzweil, 1999 & Moravec, 1998
32-bit Processor Trends

Multi-core processors will emerge to offset slow down in frequency growth

- Frequency growth rate historically ~35% (CAGR)
  - Prescott (90 nm): only 10-15% CAGR growth

Sources: Competitive Analysis Technical Team (CATT), Intel
Delivering System Performance: Post-Scaling Parallelism

1998 – 2003: Scaling Driven

- Applications, Middleware, OS
- Compiler, Bus & Memory Interfaces
- Semiconductors, Processor Core, Cache, Package, I/O, Cooling, Interconnect

2004: Integration Driven

- Applications, Middleware, OS, Hypervisor, Cluster Management
- Semiconductors, Multiple Cores, Embedded Memory, Accelerators, Power/Adaptability Hooks, Interconnects, Switch Fabric, Cache, High-Speed I/O, Compiler

- Semiconductors, Processor Core, Cache, Package, I/O, Cooling

System Level
- 80% CAGR
- Applications, Middleware, OS

Chip Level
- 60% CAGR
- Compiler, Bus & Memory Interfaces
- Semiconductors, Processor Core, Cache, Package, I/O, Cooling, Interconnect

Uni-processor
- 50% CAGR

90% CAGR System-level integration levers
65% CAGR
Chip-level integration levers
20% CAGR
Top Ten Emerging Technologies
The Software, Infrastructure and SOA Group

- Application Optimized Systems
- Event-Driven Architecture
Modularity At All Levels is Enabling a New Era of Application-Optimized Systems

System Level

Processor blades/drawers/racks

Subsystem Level

Memory, I/O subsystem, Specialty blades

Chip Level

Multi-threads, Multi-cores, Specialty cores, Accelerators, Busses, I/O

SoC design, Compilers, Libraries

System level design, Protocols

Operating systems, Middleware, Management tools

Business Level

Business processes

Web Services, SOA
Enterprise Service Bus
The Power of Modularity – “#1”
The Event-Driven World

- Billing
- Security
- Fraud alerts
- Retrospective processing

- Intelligent Oil Field
- Surveillance
- RFID-enabled Checkout
- RFID-enabled Scanning

- Location Based Service (Traffic)

IPv6 Map
VoIP, VoD, IMS, etc.
SOA Programming Model for Event Orientation

Routed Events
Intelligent Routing

- Combines with brokered event mechanisms
- Content-based routing
- Transformation
- Standards-based, e.g., XML and Web Services

Orchestration Service
Sophisticated Process Flow

- Combines basic ESB services with long running stateful processes (event choreography)
- Supports looping constructs, state management, conditional constructs, forks, threads, joins, etc.
- Publish event, wait for event, etc.

Event Stream Processing
Aggregating and Correlating Events

- Event filtering rules
- Aggregation of events
- Event detection patterns
- Not all events pass through
- Event generation, event history

IF (IBM Price) < (IBM VWAP) THEN (Buy IBM)
Top Ten Emerging Technologies
The Information Management Group

- Master Data Management
- Text Analytics
What is Master Data Management?

- Decouples master information from individual applications
- Becomes a central, application independent resource
- Simplifies ongoing integration tasks and new app development
- Ensure consistent master information across transactional and analytical systems
- Addresses key issues such as data quality and consistency proactively rather than “after the fact” in the data warehouse
Text Analytics: Reaching back into the information pipeline

Between 80 and 90 percent of information on the Internet and corporate networks is unstructured.

Goldman Sachs, March 2001
Top Ten Emerging Technologies
The Web 2.0 Group

- Tools: RSS, AJAX, PHP
- Standards: REST, XHTML
- Techniques: Wikis, Blogging, Mash-ups, Tagging
The Web 2.0 Landscape.. A different way of thinking

The Web
as
“The Platform”

Tools: RSS, AJAX, PHP, Ruby

Standards: REST, XHTML

Techniques: Mash-up, wiki, tagging, blogging

Light-weight programming models

Services, not packaged software

Architectural participation

Harnessing collective intelligence

Rich user experiences

Small pieces loosely joined, or “re-mixed”

Software that gets better as more people use it

Light-weight programming models

Rich user experiences
Art of the Possible: Situational Applications

- Situational application development involves aggregating, customizing, or extending an existing collection of simple web services
  - Built to solve an immediate, specific business problem
  - Typically performed by non-traditional programmers (e.g., business professionals, analysts, other IT staff, etc.)
  - Makes use of pre-existing software components or services such as spreadsheets, report generators or vertical business applications already in use
  - Manipulates static and increasingly dynamic content – information-centric
  - Accelerated by a community-based development approach

Integration is pushed to the edges, just “good enough” for the task at hand…
Rapid Growth of Domain-Specific Services

Examples of companies offering services on the web today, and growing ...

- Amazon Web Services
- UPS
- DHL Web Services
- Salesforce
- USPS Web Tools
- FedEx Tracking
- Yahoo!
- Microsoft
- Terraforma
- eBay
- PayPal
- NDFD XML
- Google Maps API

Repository for boutique services
Mash-up

One Mash-up definition from Wikipedia

...a musical genre which, in its purest form, consists of the combination (usually by digital means) of the music from one song with the a cappella from another. Typically, the music and vocals belong to completely different genres. At their best, bastard pop songs strive for musical epiphanies that add up to considerably more than the sum of their parts.

List of stores

Google Map web service

SAP order fulfillment

RSS feed of top-selling items

Wiki commands to compose application
Summary: Top Ten Emerging Technologies

10) Low power operation
9) Micro-scale parallelization
8) Application-Optimized Systems
7) Event-Driven Architecture
6) Master Data Management
5) Text Analytics
4) Web 2.0 Tools: RSS, AJAX, PHP
3) Web 2.0 Standards: REST, XHTML
2) Web 2.0 Techniques: Wikis, Blogging, Mash-ups, Tagging

#1: Putting it all Together … Modeling
Evolution Toward Business/Mission Modeling

- Mission Strategy/CONOPS Modeling
- Mission Performance Modeling
- Mission Process Modeling
- Object Oriented Analysis and Design
- Structured Analysis & Design
- Flowcharts
- Mission/Business Semantics
Examples

- E-CollabCenter.com
- GCSS-AF
- National Weather Service
IBM’s E-CollabCenter.com
Secure Real Time Awareness and Information Sharing for the Warfighter

World-wide Instant Messaging with DoD Personnel

Real Time Shared Situational Awareness

Shared Information through Web Conferences (with or without Audio/Video)

Shared Information through Persistent Chat Rooms
U.S. Air Force: Free developers to spend more time creating value-added business solutions that can scale across entire organization

Challenge: Point-to-point interfaces between Air Force combat support systems was staggering & costly to maintain

**Business Driven Decision:**
- Needed a well-designed open architecture to prevent its technology from becoming obsolete thus creating unstable, and fragmented systems
- System modernizations were hampered by the need to support or use proprietary mechanisms to exchange data

**Delivering Business Value:**
- Has gained huge scale efficiencies
- Has avoided significant software redevelopment costs
- Able to deliver new capabilities more quickly and cost-effectively than before

**Through greater IT flexibility:**
- Able to have single-sign-on access to more than 200 operational services and capabilities
National Weather Service: Successfully maintain the system on an ongoing basis as changes are required.

Challenge: Maintain full capabilities in the event of extreme system failure or attack.

Business Driven Decision:
- Needed to modernize the current legacy systems, to allow expansion of capabilities to handle significant increases in both the volume & size of messages & transactions.
- A significant contributing factor to the increased size of messages is the advancement of graphics depicting radar and weather images.

Delivering Business Value:
- Throughput has more than doubled, providing over 40 percent more efficiency with the new messaging backbone based on open standards.

Through greater IT Flexibility:
- Allows more than half a million messages worldwide on a daily basis.
What Have We Learned: Levels of Integration

1. Swivel Chair/Clip Board Integration
   - 1960’s – present
   - One system, one screen, one “service”
   - Caused by “silos” and generally strongly protected and entrenched

2. Integration at the “glass”
   - 199X – present
   - From Browser based aggregation
   - To a sophisticated role based portal

3. EAI – Enterprise Application Integration
   - 1990’s to present
   - Workflow or BPM, current core standard is BPEL

4. Application Integration
   - Eco-systems around an “application” (e.g. ERP)
   - ETL (Extract, Transform, Load)
   - Information Streaming (e.g. Ground Stations)

5. Information Federation
   - Reach out for Information, aggregate “query”
   - Search (structured and unstructured)

So why is this important?
Swivel Chair Integration: The End Result?