Increasing the Adoption of Disruptive Technologies to Improve E&C Business Performance

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4:00 – 5:30 p.m.
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The application system landscape

Technologies used for E&C
Topics

The Evolving Application System Landscape

Cloud Computing

Effective Application Selection

Summary
The evolving application system landscape

• Today’s application system landscape is being influenced by some key factors:
  • Diversity of application architecture (IoT, anywhere apps, composite apps, etc.) brings challenges
  • Cybersecurity is a major concern
  • Growing acceptance of cloud-based applications
  • Bloated application portfolios increase cost and complexity that are not always in line with the business value they support
  • Some 48 percent of 1,116 CIOs and senior IT executives said their companies have more applications than required to run the business*
  • Only 37 percent said a majority of the applications their business is running are mission critical, while 70 percent reported that at least 20 percent of their applications are redundant*
  • While respondents in developed countries have more mature application portfolios, this comes at the cost of poorer alignment between IT and business departments*
  • Still, CIOs around the world are planning to increase their investments in new applications. Some 59 percent overall said they would spend either "more" or "significantly" more on applications, while some 85 percent of respondents in emerging markets said the same*

* Capgemini study
Application architecture diversity is stressing business-IT relationship

• Days of IT driving application development to inexperienced business users is over
• End-user computing has evolved into bring-your-own-device (BYOD) and citizen application development
• Social media and networking, mobile and the internet have created new ways (and expectations) about what business applications should provide
• Emphasis is on the front-end applications that have the same capabilities as native applications
• End-users expect mobile apps will access enterprise capability
• Application development requires the adoption of a “Right-Speed IT” application development approach
• Current application framework may need to be overhauled to create a foundation to be more responsive to business needs – this requires IT and business to work closely to achieve
• Shadow IT contributes to the misalignment of IT resources to critical business need and hidden technology budget growth
Cybersecurity is a major concern

- Hackers are using inexpensive, store-bought equipment to shut down enterprise systems
- According to Gartner, 75% of mobile apps fall below basic security expectations
- Recent HP cyber risk report found:
  - 86% of web applications tested had serious issues with authentication, access control, and confidentiality
  - Mobile applications have unique security concerns
    - 80% of mobile applications unintentionally revealed information of potential benefit to malicious attackers
    - 71% stored data in an unsecure manner
    - 66% didn’t protect data via encrypted communication or other means
    - 31% had the potential to reveal geo-location information (how many of these really need your physical location?)
- Developers are unaware of the potential security holes their programming techniques introduce
- Effective cybersecurity measures include:
  - Identification and management of critical infrastructure that is vulnerable to cyber compromises and focusing security resources accordingly
  - Recognition that it is an ongoing/continuous management process, not a one-time fix
  - Understanding that it is not achieved through technology alone
  - Planning for resiliency in the event of a cybersecurity incident
Reducing your application portfolio can generated direct and indirect savings

Rationalization projects require close coordination with other cost reduction efforts to amplify savings without compromising service quality.

Rationalization, when done properly, should enable savings from other projects, such as:

- Server rationalization
- Project rationalization
- Data storage optimization
- Improve hardware utilization

Application rationalization also enables new savings opportunities such as:

- New, more efficient shared services
- Easier migration to, or extension of, a standard application architecture
- A standardized, more successful, software development lifecycle
- Optimized training for field adoption
What is cloud computing?

Cloud Computing is changing the way how businesses purchase and deploy IT services

- Cloud Computing (‘Cloud’) has emerged as one of the most significant information technology (IT) developments over the past decade
- Cloud is a disruptive set of concepts and technologies which is enabling breakthrough transformation in IT and business models
- Cloud offers organizations new and flexible ways to manage IT costs, scale IT operations and streamline related human resources and processes
- Cloud differs from traditional outsourcing and hosting in that provides the following:
  - Abstract hardware and software resources
  - Consumed as a variable expense (pay per use)
  - Increased elastic capacity and capability
  - Resources provisioned without human intervention
  - Rapid deployment and initialization of services
  - Access to cutting edge technology
  - Reduced total cost of ownership
  - Ability to redeploy your IT staff to other key areas
What cloud is and what cloud is not

<table>
<thead>
<tr>
<th>Cloud is…</th>
<th>Cloud is NOT….</th>
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<tbody>
<tr>
<td>Managed set of Shared Services</td>
<td>Solution for all infrastructure issues</td>
</tr>
<tr>
<td>Scalable and elastic based on demand</td>
<td>Like-for-like swap for existing IT</td>
</tr>
<tr>
<td>Software-defined and rapidly configurable</td>
<td>Infinite in scale or performance</td>
</tr>
<tr>
<td>Paid for based on consumption</td>
<td>Necessarily cheaper than current IT</td>
</tr>
<tr>
<td>Enabler for agile IT delivery</td>
<td>Without some compromises</td>
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**Executives are wanting to make sense of it**

- Main benefit is to convert capex into opex
- Cannot move data outside certain geographies
- We can bypass IT
- Increase speed to market
- What is our Cloud strategy?
Cloud service models

Figure 1. SaaS dominates the cloud market

Total Public Cloud Markets (US$ billions)

By 2020 SaaS will account for $133 billion of the $160 billion industry, while IaaS will make up $5 billion, PaaS $12 billion, and BPaaS $10 billion.

Source: “Sizing the Cloud.” Rick, Stefan and Kisker, Holger. Forrester Research, April 21, 2011
Cloud trends

• Adoption of cloud across organizations and enterprises is a growing reality, but much of the usage for large enterprises is in addition to existing capability, not in addition to it

• Executing a strategy in which processes are truly understood and technology are then architected to support them, will create competitive advantage, whereas often the reverse is the case

• CIOs are increasingly required to connect cloud to core as well as cloud to cloud systems. This is creating a need for CIOs to have a co-ordinated, orchestrated strategy – and this will drive a new class of cloud offerings that are focused on business outcomes

• Sharing and reuse of cloud resources, both public and private, for repeatable business processes generates efficiencies through better balancing how they are delivered at the time when they are needed rather than being held as dedicated capabilities
Preparing for cloud

• Create a cloud-ready organization
• Redefine the roles of IT and business
• Strengthen IT governance
• Design a cloud-ready IT architecture
• Define criteria for which activities to migrate to cloud
• Develop a cloud strategy and roadmap
• Establish an integration plan
Cloud can be better, faster (and sometimes cheaper)

• According to a recent Forrester survey of more than 1,000 firms across North America and Europe, cloud buyers anticipate the following benefits:
  − Lower cost both upfront and long-term (48 percent of respondents anticipated long-term cost savings from moving to SaaS)
  − Faster delivery of application features as well as greater business agility
  − Better support and satisfaction

• Although the **upfront costs** of SaaS are **generally lower**, a recent Gartner study found that **over the long run**, defined as five years or more, **infrastructure and license costs of on premise solutions are often less expensive**
Why application-centric projects fail

The top 3 reasons large projects fail according to CIOs are directly related to employee adoption, sponsorship and expectations.

- Lack of Employee Adoption: 82%
- Inadequate Sponsorship: 72%
- Unrealistic Expectations: 65%
- Poor Project Management: 54%
- Business Case not Compelling: 46%
- Scope Expansion / Uncertainty: 44%
- No Organizational Change Plan: 43%
- Silos/No Horizontal Process View: 41%
- IT Perspective not Integrated: 36%

Source: Deloitte CIO Survey
Application lifecycle

Application selection is first step in the process of bringing new application capability into an organization. Fully appreciating the lifecycle helps a company make a more informed application acquisition decision.

**Strategy Selection and Planning**
- Clear business imperative and accompanying business case
- Functional evaluation with significant business, operational and IT involvement
- Senior level involvement and sponsorship
- Holistic fit of package(s) to the business (strategy, process, technology, people)
- Comprehensive and objective information about vendor capabilities
- Consensus throughout organization on project objectives and vendor selection
- Clear roadmap and plan for implementation

**Implementation**
- Well defined and approved requirements
- Clear IT integration roadmap and plan
- Senior level involvement and sponsorship
- Business driven decisions with IT support and management
- Effective project management
- Package implementation expertise
- Comprehensive change management program to promote new capabilities
- Sufficient preparation of organization for change
- Timely and effective communications
- Proven implementation success

**Operation**
- Effectively transition project roles to ‘way of life’
- Achieve stable environment as soon as possible
- Continue to promote commonality across the organization
- Build and leverage process expertise into further improvements
- Look for opportunities to build on platform once in place and stable
- Clear ownership for achieving benefits
- TCO and benefits realization tracking
- Effective operation and maintenance partnership(s)
Comprehensive selection methodology

People, process and technology are at the core of a successful application acquisition

**Data Collection**
- Understand Business Imperatives
- Understand Current Business & IT Limitations

**Discovery**
- Define Desired Business Drivers, Requirements, and Imperatives

**Evaluation**
- Evaluate Vendor Solutions

**Recommendation**
- Develop Business Case
- Define Next Steps

### Potential Deliverables

- Core capabilities supporting business strategy
- Required IT application functionality
- Scope statement
- Identification of sponsors and SMEs
- Workshop / interview materials
- Desired business, technical, & non-functional requirements
- Preliminary report & “down-select” recommendation on Financial Management application options
- RFP / Vendor questionnaire
- Vendor score card
- Demonstration scripts & evaluation templates
- Comparative analysis of application options against prioritized criteria
- Solution recommendation and fit/gap
- Validated business case and recommendation
- Final recommendation and cost estimate presentation

### Accelerators/Tools

- Selection Methodology
- Industry Process Mapping
- Vendor Evaluation Matrix
- Process Categorization Framework
- Enterprise Value Map

### Major Activities

- Collect existing financial, system and process documentation
- Interview key business stakeholders
- Summarize business drivers & requirements
- Review current IT system application and infrastructure implications
- Identify relevant leading business and IT practices
- Research the list of vendor solutions
- Interview/RFP vendors on relevant system capabilities
- Prepare and finalize demo scripts
- Create scorecard from acquired functional, technical, & non-functional capabilities
- Evaluate solutions against scorecard
- Develop and validate initial business case
- Validate recommendation
- Develop functional roadmap and implementation estimate (including timing, resources and cost)
- Develop high-level technical approach
- Present final recommendations and quote
A balanced scorecard for selection can confirm the important evaluation criteria and be accountable for the final recommendation:

- **Responsiveness of account teams**
- **Contract terms and conditions**
- **Account management approach**

### Standard functionality requirements covering desired application footprint
- Leverage application acquisition knowledgebase and accelerators

### Differentiating Functionality Requirements
- Leverage SMAs
- Evaluate extensibility or interoperability with existing business capability

### Other
- Responsiveness of account teams
  - Contract terms and conditions
  - Account management approach

### Targeted Product Demonstrations
- Company tailored scenarios focused on differentiating functionality
- Extended Company SMA teams

### Technical Requirements
- Migration impact
- BI/Reporting
- Database
- Integration
- Data Models

### Customer References / Executive Visits
- Similar customers
- Top to top executive meetings
- Case studies and references

### Vendor Pricing
- Cost estimation templates

### Vendor Profile & Fit
- Scalability
- Product strategy and roadmap
- Cultural fit
Identification of signature processes leads to a more cost effective selection effort over a shorter period of time.

“Signature” Processes are Key

Uses a process categorization framework to focus the application software selection on a company’s “signature” processes.

- This approach will be developed through a series of facilitated, cross-functional “signature” process confirmation workshops and will:
  - Support development of evaluation criteria (outlined on the next slide) focused on a company’s unique requirements (quadrants 2 and 4)
  - Facilitate greater differentiation between the potential application solutions
  - Promote acceleration of the selection process

### Process Categorization Quadrant

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>Category</th>
<th>Requirements</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Out of Scope</td>
<td>- Solution: Bolt-On common application&lt;br&gt;- Input: Company &amp; application SMAs&lt;br&gt;- Review: Business</td>
</tr>
<tr>
<td>2</td>
<td>Differentiating Application Requirements</td>
<td>- Solution: Customization or extension&lt;br&gt;- Input: Company &amp; application SMAs</td>
</tr>
<tr>
<td>3</td>
<td>Standard Functional Requirements</td>
<td>- Solution: Sweet spot for application&lt;br&gt;- Input: application SMAs</td>
</tr>
<tr>
<td>4</td>
<td>Differentiating Process Requirements</td>
<td>- Solution: Customization or extension&lt;br&gt;- Input: Company &amp; application SMAs</td>
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<tr>
<th>Client Customized Processes</th>
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<tr>
<th>Industry Common Processes</th>
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**Application Core Functionality**
Governance: critical for success

A well-defined IT Governance structure and governance processes will be critical for the execution of successful application management.

**IT Governance Model**

- **IT Executive Steering Committee**
- **IT Governance Council**
- **IT Governing Bodies**
  - Arch.
  - IT Strat & Plng
  - Quality Assur
  - Development

**Governance Membership**

- CEO, COO, CFO, CIO
- CIO, CTO, Business Group Presidents, Divisional Program Sponsors, and IT Senior Management
- CTO, Architecture Director, Development Director, IT Strategy & Planning Director and Quality Assurance Director

**Program Management Office (PMO)**
- IT Program and Portfolio Director
- IT Strategy & Planning Director
- IT Program Managers
- IT Project Managers
Emerging technologies for E&C
A background on IoT and Industry 4.0
IoT is not just a technology, it is a Technology Architecture

IoT stitches together a number of existing technologies

But why now?

- **Mobility**
  - ~15 years ago the emergence of 3G cellular launches a proliferation of wireless protocols such as Bluetooth and ZigBee

- **Edge Computing**
  - ~10 years ago growing computing power and shrinking size allows computing to be put in the field

- **Analytics**
  - ~5 years ago massive data handling and analytics tools go open source, allowing a proliferation of ways to connect all IoT technologies

Source: Deloitte Tech Trends 2016
Information flows..., we therefore need to consider how value is created and captured in flows.

The Information Value Loops helps us think about important strategic questions with clients such as “Where to Play?” and “How to Win?”
Emerging technologies at the digital/physical interface are impacting businesses, across industries, in profound ways

### Advanced materials
Materials innovation has evolved from natural materials to synthetics and then custom materials. Now, materials are designed as end-to-end functional solutions.

### Additive manufacturing
Additive Manufacturing could be used to achieve supply chain transformation, product performance enhancements, or both.

### Robotics
Industrial robots are becoming more user-friendly and can now be programmed to easily switch between tasks and interact in close proximity to / with humans and in extended digital landscapes.

### Distributed generation
Alternative energy is making performance gains, but is limited by storage solutions. Advances in storage and micro grid management technologies enable improvements.

### Modular operations
Products, processes, and operations are being designed in pieces that are flexible and can easily be repurposed to match customer demand, meet product design requirements, etc.

### Advanced sensors
Advanced sensors are smarter and more proactive and predictive in monitoring, as a result of advances in technology and companies are integrating sensors in product design and operations.

### Remote-controlled operations
Centralized hubs allow for manufacturing and operations centers to be supervised by fewer people with the assistance of analytics.

### Facebook of assets
Combined with advances in sensors, the Facebook of assets could improve asset management capabilities by providing a database of assets with real-time statuses.

### Smart machines
Machines – equipped with sensors integrated with software – assess the environment and the machine’s performance in order to predict issues.

### Advanced analytics & visualization
Companies are using new analytic techniques and technologies to extract value out of existing data. The application of data science is finding patterns to predict future outcomes and trends.

### Advanced computing
Increases in power and Artificial Intelligence, such as cognitive analytics, machine learning, and natural language processing have enhanced capabilities to analyze data more effectively.

### Virtual industrialization
Before opening a new facility or repurposing a shop floor, manufacturers can run detailed simulations, determining the most efficient and cost effective setups limiting trial and error.

### Digital infrastructure
Advances from fiber optics to storage capabilities are handling more data, faster, and with more energy efficiency.

### Cloud computing
In combination with other digital advances, cloud storage will provide the storage enabling intensive data capture and analysis that integral part to Industry 4.0.

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Manufacturing has undergone eras of transformational change from the first industrial revolution (mechanical production) to the second (electricity and mass production) and the third (information technology).

These technologies will continue to evolve over time. We need a way to organize and understand them for our clients!
Industry 4.0: connecting atoms-to-bits

**Physical**
- Advanced Materials
  - Biomimetic Nanocomposite
- Advanced Robotics
- 3D Printing
- Intelligent Machining
- Warehouse Automation

**Digital**
- Supercomputing
- Crowd Sourcing & Social
- Digital Twinning
- Multi-physics Simulations
- The Cloud
- Advanced Analytics

A convergence of technologies will enable new solutions

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**Transportation** | **Medicine** | **Industrial Systems** | **Personal Well Being** | **Food and Water** | **Energy**

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Technologies evolve and converge to create new business opportunities.
Industry 4.0 is about completing the digital-to-physical-to-digital loop

Smart industry or “INDUSTRIE 4.0” refers to the technological evolution from embedded systems to cyber-physical production systems. *

1 Establish a Digital Record

Capture information from physical world to create a digital record of the physical operation and supply network

2 Analyze and Visualize

Machines talk to each other to share information, allowing for advanced analytics and visualizations of with real-time data from multiple sources

3 Generate Movement

Apply algorithms and automation to translate decisions and actions from the digital world into movements in the physical world

* Source: Germany Trade & Invest: “Smart Manufacturing for the Future”
The term Industry 4.0 promises a new industrial revolution.

### Timeline

<table>
<thead>
<tr>
<th>Late 18th century</th>
<th>Beginning of 20th century</th>
<th>1970s–2000s</th>
<th>2010 onward</th>
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</table>

### First industrial revolution: Power generation
- Introduction of the power loom in 1784
- Mechanization of production facilities with water and steam power

### Second industrial revolution: Industrialization
- Introduction of the assembly line in slaughterhouses in 1870
- Electrification drives mass production in a variety of industries

### Third industrial revolution: Electronic automation
- Development of the first programmable logic controller (PLC) in 1969
- Growing application of electronics and IT to automate production processes

### Fourth industrial revolution: Smart automation
- Increasing use of cyber-physical systems (CPS)
- In January 2011, Industry 4.0 was initiated as a “Future Project” by the German federal government
- With the introduction of IPv6 in 2012, virtually unlimited addressing space becomes available
- Governments, private companies, and industry associations have been focusing on Industry 4.0 and making investments since the 2010s

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**Capital Replaces Labor**

**Information Replaces Capital**
I4.0 remains about completing the physical-digital-physical loop in pursuit of business value.
The growth of IoT in building design and management is growing fast

Figure 2. Potential growth in worldwide IoT sensor deployments for CRE (2015–20), millions

Source: Chart created and analysis performed by the Deloitte Center for Financial Services based on Gartner research: “Forecast: Internet of Things, endpoints and associated services, Worldwide, 2015,” Gartner Inc., October 29, 2015. For more information on categories and sensor types included in the graph, please refer to appendix 1.

Graphic: Deloitte University Press | DUPress.com
Using IoT to design, build, manage and maintain

**Increased cost savings due to operational efficiency; minimal revenue benefits**

- Individual BMS with limited interconnectivity
- Reduced manual intervention, though companies need to manage disparate systems
- Slower decision making with minimal to no analytics
- Requires dedicated infrastructure per BMS solution
- Individual sustainability initiatives
- Negligible focus on tenant and end-client experience

**Higher order cost and revenue benefits due to full integration and deep customer focus**

- Greater interconnectivity due to more integration at the front-end interface through specialist software solutions
- Relatively lower manual intervention in managing operations
- Faster decision making due to an integrated view
- Enhanced sustainability initiatives driven by minimal analytics
- Enhanced integration into enterprise resource planning (ERP), asset management, and basic business intelligence solutions
- Increased focus on tenant and end-client experience through individual initiatives (open Wi-Fi access, rewards programs, etc.)
- Minimal revenue generating services to tenants beyond rental income

**Fully integrated, IoT-enabled BMS**

- More open communication at device level, integrated storage and analysis of diverse information on common platforms, including cloud
- Minimal to no manual involvement
- Intelligent decision making as IP-enabled devices result in automated point decisions and enhanced strategic insights
- Leveraging one infrastructure to operate all BMS solutions
- Full integration into ERP, asset management, and predictive analytical solutions
- Full sustainability program with supportive analytics
- Deeper focus on tenant and end-client experience (footpath technologies)
- Enhanced revenue generating services to tenants (infrastructure, analytics, direct marketing, etc.)

**Partially integrated BMS**

Source: “Building automation prepares for the Building Internet of Things (BIoT),” Memoori, May 1, 2014; Deloitte Center for Financial Services analysis.

Graphic: Deloitte University Press | DUPress.com
Applying disruptive technologies to C&E
Using Industry 4.0 technologies to construct and manage buildings: IoT

Contour crafting full-sized structures

Consider: Low cost, rapid delivery, unique structural approaches, landscape and other decorative approaches.

Creating physical 3D model of building design


Additive Manufacturing Impact on Products and Supply Chains

<table>
<thead>
<tr>
<th>Product evolution</th>
<th>Business model evolution</th>
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<tbody>
<tr>
<td>1 Stasis</td>
<td>2 Supply Chain evolution</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
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Collaborative Design/Production

Consider: Customer collaboration & experimentation. Differentiation/brand-enhancement through unique design. Tailoring to accommodate space constraints.

Routine Maintenance and Support

Consider: Scan and replace low value, wear items. Reverse engineer hard to find/acquire items. Accelerate repair/replace cycle time.
Additional C&E use cases for Industry 4.0 and IoT

- **Condition-based Maintenance**
  Maintenance based on active monitoring of equipment’s present/predictive condition reducing un-warranted spend and shut-downs

- **Tool Lifecycle Management**
  Track and optimize production asset effectiveness through introduction, maintenance, and retirement

- **Equipment Tracking**
  Identify location and description of fixed/moving assets/people within premises. Enable internal mapping and routing of assets

- **Remote Monitoring**
  Delivering dealers, distributors, and end users real-time information and analytics related to fleet position, performance, and efficiency

- **Leak Detection**
  Use sensors that see, feel, smell, and hear both inside and outside a pipe to determine breaches

- **Personnel Safety**
  Use sensors to detect leaks, high temperature, radiation. Use Smart glasses/tablets to walk through appropriate safety checks
Takeaways

- **IoT and Industry 4.0 on their way.**
  - IoT is a critical element of Industry 4.0 -- Trillions of dollars investment, billions of devices are already in play
  - It’s not just about smart phones and fitness trackers

- **Deliberate on the strategic questions of “Where to Play?” and “How to Win?”**
  - Identify your position in the information value chain and identify the bottlenecks that highlight opportunities for value creation and capture.
  - Identify the transformation opportunities available to your business. Plenty of metaphors already exist.

- **Bits and Atoms both matter**
  - Sure, IT is important, but failing to remember that manufacturing and distribution are physical acts is naïve.
  - Integration of both IT and OT are important. We need to manage the physical-to-digital-to-physical transition in an Industry 4.0 world.
  - True Industry 4.0 capability is going to require leaders to think about integrated, not isolated, technologies.

- **It’s not a technology, it’s an architecture**
  - Industry 4.0 will alter business models.
  - We are not talking about a single technology to implement and walk away. We are talking about an integrated set process and tools that need to be managed.