Collaboration in Design Builds

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“May you live in interesting times”
“Interesting”  Good

• Many products to choose from
• Rich set of features and functions
• Multiplatform solutions beginning to appear
• Movement to Web and Cloud
• Changing TCO
“Interesting”

Not So Good

• High cost on many; pricing per component
• Most not standards-based
• Unique, non-intuitive interfaces
• Significant training required
• Limited features and functionality at this time
How the World Has Changed

• Most businesses are global *at launch*
• Businesses are increasingly real time
• Convergence has become a way of life
• Science, product development, and product cycles are compressing
• The source of value has shifted for manufacturing
• Competencies, future capabilities, and “ultra tech” are the prime driver
• The traditional value chain is forever dead
Technology—Webster’s

- The science of the practical or industrial arts
- Applied science
- A method of achieving a practical purpose
- The totality of the means employed to provide objects necessary for human sustenance and comfort
What is Technology?

“Application of knowledge to objectives”

—J. P. McTague, “Wielding a Three-Edged Sword,”

*Federal Lab Technology*
Information and Communication Trends

• Seamless Interoperability Between Heterogeneous Networks
• Mobility for All
• User Centered Content-Based Information Access
• Agents Take Over Routine Work
• “E”- Processes for Business and Private Life
• Human Computer Interaction is Turning Into Human Computer Cooperation
People have been dealing with Collaboration Issues For a Long Time
The Tower of Babel

About 4000 BCE
The Consequences?

An end to easy Collaboration
Still Having Difficulties At That Location
Collaboration to sustain a competitive advantage
Collaboration consistently delivers business value
Collaboration Technologies

Companies today are facing several critical business challenges brought on by the increasingly virtual nature of their workplaces. More and more, employees are scattered across regions, nations, and continents and yet they must be able to collaborate with one another, and with partners and customers, at any time and from anywhere. At the same time, organizations are concerned about the security and confidentiality of their collaborations.
We are born to work and play together in teams. But we have to give enough of ourselves to let the filaments connect.

— Paul F. Levy, CEO
Beth Israel Deaconess Medical Center
A Very Brief History of Organizations

Small Group + Hierarchy + Bureaucracy + Network + Collaborative

Nomads
- 3 Million BCE – 10,000 BCE

Agriculture
- 10,000 BCE – 17th Century

Industry
- 17th Century – 20th Century

Information
- 1945…1998 – 21st Century

Self Forming Groups
- 1999–2015…

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Why does technology-aided collaboration remain a difficult problem?

• Involves communication among PEOPLE; since when has working with people been easy?

• Each field has its own methods, vocabulary, etc., as do instruction, business meetings, and collaborations. SIMILAR, but NOT THE SAME.

• Sometimes it takes a long time to understand how to make best use of a technology
Definition

• Collaboration is a process defined by the recursive interaction of knowledge and mutual learning between two or more people who are working together in an intellectual endeavor toward a common goal.

• Collaboration does not necessarily require leadership and can even bring better results through decentralization and egalitarianism.

• Collaborative methods are processes, behaviors, and conversations that relate to collaboration between individuals. These methods specifically aim to increase the success of teams as they engage in collaborative problem solving.
The Three Cs of Collaboration Tools and Technology

Communication (IDEAS)  Collaboration (DATA)  Coordination (WORK)

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Collaborative Ecosystem

Infrastructure Security

<table>
<thead>
<tr>
<th>Management/Administration Tools</th>
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</thead>
<tbody>
<tr>
<td>Training/Classrooms</td>
</tr>
<tr>
<td>CRM/Contact Center Applications</td>
</tr>
<tr>
<td>Collaborative Intelligence</td>
</tr>
<tr>
<td>Collaboration Portlets</td>
</tr>
</tbody>
</table>

| Instant Messaging (IM)/Presence Wikis/Blogging/Streaming |

| Conferencing (Audio, Web, Video) |

| Speech Applications (ACD, IVR, Speech Recognition, Self-Service, etc.) |

| Shared Workplaces, Enterprise Suite |

| Calendar & Scheduling |

<table>
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<tr>
<th>UM</th>
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<tbody>
<tr>
<td>Fax</td>
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<tr>
<td>Email</td>
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<td>Voicemail</td>
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</tbody>
</table>

| IP PBX | Service Provider | Carrier |

Transport Networks: LAN, Mobile
Why Should Collaborative Tools Be Treated as a Priority Now?

- Never before have so many projects had their project team members at such great distances
- Never before have we attempted to carry out such a huge project with so many projects
- Never before have the teams we must interact with been so geographically dispersed
- Never before have we had to deal with such a complex engagement in a remote environment with as many connections as we do today
# Brief Look at the Evolution of Collaboration Technology

<table>
<thead>
<tr>
<th>Category</th>
<th>Years</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CUSeeMe</strong></td>
<td>Cornell (1992)</td>
<td>Reflectors</td>
</tr>
<tr>
<td><strong>T.120</strong></td>
<td>NetMeeting (1995/6)</td>
<td>VCON Meeting Point, RadVision DCS, SGIMeeting, Lotus Sametime, SunForum, MeetingOne, PictureTel LiveLan</td>
</tr>
<tr>
<td><strong>Whiteboard/Chat/IM</strong></td>
<td>Netscape Conference (1997)</td>
<td>Voxphone, MERCI (Teledraw) e/pop</td>
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<tr>
<td><strong>Virtual Room</strong></td>
<td>Videoconferencing System (VRVS) (1996)</td>
<td></td>
</tr>
<tr>
<td><strong>Remote Control</strong></td>
<td>VNC (1998)</td>
<td>Timbuktu, RealVNC</td>
</tr>
<tr>
<td><strong>Custom/Hybrid</strong></td>
<td>Tango (1998)</td>
<td>Habañero, AG Dist. PowerPoint, Ezenia Placeware, ThinAnywhere, AC/SPARC</td>
</tr>
<tr>
<td><strong>Wiki</strong></td>
<td>Wiki Wiki (1998)</td>
<td>Twiki</td>
</tr>
<tr>
<td><strong>AG</strong></td>
<td>Virtual Venue (1998)</td>
<td></td>
</tr>
<tr>
<td><strong>JAVA/Javascript</strong></td>
<td>Habañero</td>
<td>JCE, mDesk, Brainshark, iMeet, JAMM, MeetingPlace</td>
</tr>
<tr>
<td><strong>Peer to Peer (P2P)</strong></td>
<td>Jxta (2001)</td>
<td>Groove, BitTorrent, Gnutella, Napster, UseNet, Peercasting</td>
</tr>
</tbody>
</table>
Current Collaboration Technology

- RTC: Web/Audio/Video Conferencing and Virtual Classroom
- Collaborative CRM
- Messaging platform
- Distributed Project Management Virtual Workplace and Process
- Tacit KM and Intellectual Capital
- Portals and Online Communities
- Collaborative Content Management LMS, LCMS
- Collaborative Infrastructure: email, Data Routing, Security, cross platform support
- Distributed Project Management Virtual Workplace and Process
Real-Time Collaboration Timeline

- **1979**: RTC Technology Conceived
- **1980**: Networked Audio and Video Gain Momentum
- **1990**: H.234 Ratified
- **1995**: H.323 Ratified
- **1996**: Data/Web Conferencing Emerges
- **1997**: T.120 Ratified and the Internet Emerges
- **1998**: MS Net-Meeting 2.0 Released
- **2000**: 2000-2007 Broadband Infrastructure Rollout
- **2001**: 2001-2006 RTC Convergence
- **2002**: 2002-2005 Telecoms Integrate with RTC
- **2003**: SIP.SIMPLE and XMPP
- **2004**: Movement Towards Mobile Collaboration
- **2005**:
Collaborative Networks

• Networks are nodes linked with a common purpose.
• Nodes are people, positions, teams, organizations, knowledge.
• Networks can be as small as a virtual team of two or as large as a cross-enterprise, cross-industry, global alliance.
• Organizations are networks.
• The common elements of the alliances define the collaborative security.
Challenge and Opportunity

- Rapid establishment of distributed teams in ever changing, complex world
- Growing transnational threats and opportunities require virtual, global, multidisciplinary teams
- Future teams need to be:
  - secure
  - fast and agile – re-task able, coordinated, precise
  - decisive in a dynamic, complex, uncertain world
  - knowledge superior
- Distributed, Collaborative (synchronous/asynchronous) analysis/decision support
COLLABORATION
Sandbox Dilemma

Because it is easier than working with others...

• I’ll download my own data
• I can keep it “current enough”
• I want/need to be different...
  - Field formats
  - Field names
  - Update cycle
• What do you mean Version Control
An Ideal Team for the Era of Collaborative Innovation

• A Russian to generate ideas
• An American to see and chase the money
• A Japanese to develop the strategy
• A German to organize the process
• A Chinese to manufacture the product
• A Kuwaiti to buy the outcome
• A New Zealander to manage cross-cultural differences
Case Example

It's not System
– It’s the business process and culture
Case Example
Competing in a Global Environment

Taylor’s Law (1910 – 1950s)
Scientific Management

Sarnoff’s Law (1960 - 1980)
“Human Side” Management

Metcalfe’s Law (1980 - 2000)
Quality Management Era

Reed’s Law (2000 - Future)
E-Manufacturing

Value Chain
- Firm Infrastructure
- Human Resources Management
- Technology Development
- Procurement
- Inbound Logistics
- Operations
- Outbound Logistics
- Marketing & Sales
- After Sales-Service

Value Shop
- Firm Infrastructure
- Human Resources Management
- Technology Development
- Procurement
- Infrastructure Support
- Problem Finding & Acquisition
- Problem Solving
- Simon’s Problem Solving Model
- Control/Evaluation
- Execution
- Choice

Value Created in the Assembly Line (Operations)
Value Created by Transforming Inputs Into Products
Value Created by Providing Solutions, Not Services
Value Created By Self Forming Groups

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Sarnoff’s Law – 1960s to mid 1980s

For one-way broadcast communication, the value of the network itself rises proportionally to N, the potential number of listeners.

Value Chain

Value created by transforming inputs into products
Internet Direction
**Metcalfe’s Law** — Mid 1980s to 2000s

The value of a network increases exponentially with the number of nodes – $N^2$. A network becomes more useful as more users are connected.

**Value Shop**

- Firm Infrastructure
- Human Resources Management
- Technology Development
- Procurement

**Value created by providing solutions, not services**

**Simon’s Problem Solving Model**

- Problem Finding & Acquisition
- Problem Solving
- Choice
- Execution
- Control/ Evaluation

**Value**

- Metcalfe
- Sarnoff

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Internet Direction

Servers
Reed’s Law — 2001 and into the future

Any system that lets users create and maintain groups creates a set of group-forming options that increase exponentially with the number of potential members. And as a function, \(2N\) dominates \(N^2\) - which means that even if each individual group-forming option is worth much less than an individual connection, eventually the total set of group-forming options will have far more option value.

**Value Network**
- Mediating technology facilitates exchange relationships

<table>
<thead>
<tr>
<th>Firm Infrastructure</th>
<th>Human Resources Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Development</td>
<td>Procurement</td>
</tr>
<tr>
<td>Network Promotion and Contract Management</td>
<td>Service Provisioning</td>
</tr>
<tr>
<td><em>Invite and select customers to join network</em></td>
<td><em>Establish, maintain and terminate links</em></td>
</tr>
<tr>
<td><em>Initialize, manage, and terminate contracts</em></td>
<td><em>Billing for value received</em></td>
</tr>
<tr>
<td>Infrastructure Operation</td>
<td>Maintain and run physical and information network</td>
</tr>
</tbody>
</table>

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Internet Direction
Competing in a Global Business Environment

**Value Chain**
- Firm Infrastructure
- Human Resources Management
- Technology Development
- Procurement
- Inbound Logistics
- Operations
- Outbound Logistics
- Marketing & Sales
- After-Sales Service

**Value Shop**
- Problem Finding & Acquisition
- Problem Solving
- Simon’s Problem Solving Model
- Choice
- Control/Evaluation
- Execution

**Value Created in the Assembly Line (Operations)**
- Standardization Parts and Processes
- Economies of Scale
- Producer-Centric Design, Mfg., and Delivery
- Vertical Orientation
- Required inventory buffers
- Locally Oriented

**Value Created by Transforming Inputs Into Products**
- Stable Relationships
- Price Conscious
- Producer Led Design
- Global Companies
- Regionalism
- Productivity
- Subsidiaries
- Plant Replication by Region

**Value Created by Providing Solutions, Not Services**
- Lean Manufacturing
- Shift to Horizontal Structure
- Focus on Core Competency
- Reliability and Durability
- Producer Led Design
- Multinational Trade
- Market Centric Design & Delivery

**Value Created By Self Forming Groups**
- Consumer Centric Design and Delivery
- Flat Corporate Structures
- Collaborative Virtual Networks
- Mass Customization
- Transparency
- Speed and Agility
- Global Orientation

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Taylor’s Law
(1910 – 1950s)
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Reed’s Law
(2000 - Future)
E-Manufacturing

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Elements of Successful Collaborations

- Common goal
- Process and workflow
- Trust
- Rules of engagement
- Mutual benefit
- Management support
- Team rewards
- Training
- Critical mass

Culture of Sharing
Four Levels Of Collaboration

• **Information level** (or transactional collaboration): sharing of data and information, e.g., prices, inventory data, logistics data, business performance data, design data, etc.

• **Systems level**: sharing of applications, source code, software, middleware, databases and repositories, hardware, etc.

• **Process level**: sharing parts of a procurement process, inventory management process, supply chain processes, product design processes, etc.

• **Relationship level**: sharing contextual competencies, e.g., tire manufacturing with automobile design, outsourcing context. The highest level of maturity at this level will be to exhibit dynamic collaboration capabilities wherein enterprises are able to identify partners and work with them electronically.
Case Example

Any system is only as good as the data inputed.
What is Collaboration?

Features & Functions:

- Whiteboard
- Chat or Instant Messenger
- Shared Documents (Still Image)
- File Transfer
- Shared Applications
- Remote Control
- Pointers
- Surveys, Polling, Quizzing
- Recording
- Telephone and/or VC Bridges
- Video Streaming
- Animation Support

- Chair Control
- Scheduling and Timers
- Agendas for Meetings, Classes
- Announcement Boards
- Participant List, Status panels
- Management Console
- Directories
- Logging, Tracking
- Security
  - Authentication
  - Encryption
- Shared Repository, Meeting/Class Archives
Perhaps Easier to Understand From Social Interaction Model

- Show and Tell (one to many)
- Person to Person (a “team”)
- Group to Group (a set of teams)
- A Meeting?
- Sitting around at the job site working?
- Doing an review together?
- How does your collaboration system do its work?
Collaboration Technologies

Collaboration technologies have undergone many changes over the last 20 years. They started out as a niche product with the application, transport, and security all included in the product. This began to change with the introduction of intranets, secure VPNs, and enterprise-wide networking. This change began to move elements of the transport and security down to the network level. During this time, applications began to be integrated within other products. Prime examples of this are the collaborative tools integrated into Microsoft office and IBM Lotus notes.
Collaboration Platform Decision

The collaboration platform decision is increasingly becoming a *stack decision* — taking into account not just messaging, real-time collaboration, and team collaboration platforms, but also the organization’s internal standards for office productivity, portal software, enterprise content management, enterprise directories, application servers, databases, and operating systems. As a result, the market for point collaboration products (e.g., team collaboration, enterprise instant messaging) is shrinking as *collaboration features get absorbed into the software infrastructure*. In the future, organizations will continue to swap out collaboration point products for enterprise collaboration platforms, and the market will continue to consolidate.
…[T]he design of the system is the design of the enterprise; and if the system can’t change, the enterprise can’t change!

—John Zachman, Founder, Zachman Institute for Framework Advancement
Worldwide Broadband Access

Source: Technology Futures, Inc.

Historical Data Source: ITU

World Broadband Access 2006

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The first looking at millions of broadband subscribers, and the second looking at the penetration.
Wireless Mobile Broadband

Data Source: FCC

Source: Technology Futures, Inc.

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Forecast of 2.5G and Above Subscribers by Region — Millions

- Asia-Pacific
- South America
- North America
- Europe
- ME-Africa
- Japan
Convergence of Devices…
The Most Visible…

• Mobile phones turn into mobile multifunctional devices:
  – Integrated FM radio
  – Camera
  – DVB-H on mobile phones
  – Integrated Wi-Fi

• Personal communications devices
  – TV cards
  – MP3 Devices

• Interactive TV sets
  – display a TV signal & computer data simultaneously, watching TV and surfing Internet at the same time

• Final stage-service/network neutral devices
  – Emphasis on programming equipment
Today’s Mobile Reality is Changing

• 2 billion mobile phone users worldwide
  – Historically communication devices

• Mobile phones are no longer “phones”
  – Multimedia devices
  – Capture and consume
  – Entertainment, information services

• Digitalization, miniaturization, mobility, connectivity, communities

• By 2010, there will be 3 billion users of “mobile devices” and 2 billion TV viewing multimedia devices

• People are spending more time with new media
Mobile Broadband vs. Wireline Broadband

Data Source: FCC

Source: Technology Futures, Inc.

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Unwired Internet

IPv6 Backbone

Wireless MAN
IEEE 802.16e, 802.20

Wireless LAN
IEEE 802.11a, b, g

Celluler
W-CDMA, CDMA 2000

MANET

Broadcasting

Wired Broadband
Network: FTTH, ADSL

Mobile Adhoc Network (MANET)
Personal Area Network, Vehicle-to-Vehicle
Wireless Broadband Changes Everything….

• Habits and behaviors sometimes change quickly:
  – Once you had a great (and affordable) experience with new technology, you usually
don’t want to miss it anymore.
    See: Blackberry, iPod, Skype, in-flight Wi-Fi, HD radio…

• Wireless enables two-way, personalized media
  (as opposed to mass media)

• Mobile content access will dwarf desktop-based access 10:1

• In wireless broadband, interaction takes on a whole new meaning:
  – “Sharing” will become a default standard
  – Multimedia communications will abound (messages, video, photo, sound)
  – Games become all-pervasive (posing other problems)
  – Shared content creation is now “on the fly” (contributing, remixing, mashing, etc.)
  – Location-based CONTENT services will explode

• Receivers become senders too
The Nature of Communications Has Been Changing...

People to People → People to Things → Things to Things
The Global Grid

From Client/Server... to every computer's a server

Client systems are dedicated to needs of a user

Single application running in client or server

A data object resides on a single server

Clients systems do work and store data for other users

Application "chunks" run concurrently in multiple systems

Data object is segmented and stored redundantly

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To Every Sensor is a Server

Processor
Data Storage
Communications
Rich variety of sensors

Phone - PDA
Smart Dust
Microstorage
(Areal density 100x’s CD)
Microphone
Embedded Biofluidics Chip
Robot

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Growth at the Edge of the Network

- Mobile
- Device to Device
- Sensors
- Entertainment
- Smart Home
- Distributed Industrial
- Autos/Trucks
- Smart Toys

Converged Content

Traditional Computation
“Mobile phones are more than a billion smart computers we can’t ignore that may create a software spiral like that of PC over the next 10 years.”

—Paul Otellini, CEO, Intel

“We really believe we are on the cusp of a whole new era of mobile computing.”

—Steve Ballmer, CEO, Microsoft
Does the Tool Feel like Progress or Not?
The most critical factor to successful collaboration is not the technical barriers but rather the people barrier.

—Andrew White, Logility, Inc.
Case Example

Collaboration REQUIRES Time and Specialized people
The Challenge of Collaboration Technology Adoption

- Technology adoption is a slow, phased process
- Physical distance is an obstacle to adoption
  - People learn from neighbors
  - Organizational mandates have limited range
- Collaboration technologies require universal adoption but have inherent limiting properties
  - Tragedy of the Commons
  - Critical mass
  - Difficulty of learning infrequent features
  - Visibility of performance
Main Objectives, In Any Collaborative Effort:

1. *Integration of people, process, and technology:* Any collaborative effort would aim at bringing integration between people and processes, people and technology, and technology and processes.
Main Objectives,
In Any Collaborative Effort:

2. **Superior communication and synchronization**: The other outcome of collaboration is more accurate, frequent, and two-way or multiple-way communication across all company locations, better information exchange with partners, enhanced knowledge management, and improved external communications to the customer base and the market at large. This results in better synchronization of all activities in the organization.
Case Example
Drivers

• Shift from Ownership to Partnership
• Trust Built between Partners
• Information Technology
• Convergence of Integration, Interactivity, and Infrastructure Technologies
• Networked Businesses
• Emergence of XML as the De Facto Data Transport
• B2B and B2C Collaboration
• Knowledge Management and Collaboration Technologies
Constraints

• Externalizing Automation
• Evolution of a Digital Equivalent of Trust
• Balancing Privacy and Security Concerns
• Consortium Development between Communities
• Internal Challenges
Collaboration Technologies

Source: David Smith

Source: Technology Futures, Inc.
Evolving—Self Forming

- A.I. Deep Search
- Intelligent Agents
- Knowledge Networks
- Massive Multiplayer Games
- Life Logs
- Market Places
- Emergent Groups

- Ontologies
- Taxonomics
- XML
- Knowledge Bases
- Life Casting
- Knowledge Management
- Group Minds

- Search Engines
- Enterprise Portals
- Mobile Technologies
- Wikis
- WeBlogs

- Databases
- Content Portals
- Websites
- Auctions
- Social Networks

- File Servers
- Conference Calls
- Emails
- Groupware
- Social Media

- Phone Calls
- P2P File Sharing
- Computer Conferencing
- Community Portals

Source: David Smith

Speed of Connectivity — Informational

Speed of Connectivity — Social
Collaborative

Level 1
Info-Enabled
Enterprise

- Defined Cross-functional Processes
- Information Level Collaboration
- Functional View of Value Chain
- Fuzzy View of Core & Context
- Lagging Metrics
- Key Differentiator: Information

Level 2
Interfaced
Enterprise

- Managed Measurable Enterprise-wide Processes
- System Level Collaboration
- Aligned Value Chains
- Bias Toward Core
- Lagging Metrics
- Key Differentiator: Transactions
- Selective Partnering

Level 3
Integrated
Enterprise

- Optimized Cross-enterprise Processes
- Process Level Collaboration
- Synchronization of Value Chains
- Increased Differentiation Between Core & Context
- Real-time Metrics
- Key Differentiator: Optimized Processes
- End-to-end Process Automation

Level 4
Adaptive
Enterprise

- Optimized Processes Adept to Change
- Dynamic Collaboration
- Real-time Value Chain Configuration
- Increased Strategic Differentiation Between Core & Context
- Leading Metrics
- Key Differentiator: Adaptability
- Alliances, Co-opetition
- Approach to Innovation: Manage Discontinuity

Computers Link Distributed Tasks and Share Information

Computers Link Distributed Tasks and Share Information

Computers Automate, Track and Measure Processes

Computers Automate, Relationships With Partners/customers

Process Maturity

Internal to the Enterprise

External to the Enterprise

Collaborative Capability
develop great solutions
innovate!
collaborate
Thank You.

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