

Leveraging New Enterprise Content/Collaboration Opportunities with Office 365

Introduction

There are now unprecedented opportunities in enterprise content and collaboration, after several decades of mixed results stemming from a series of disruptive market shifts and product updates. This document provides an overview of the key opportunities, explaining how tools and services pioneered for consumer Internet services – including Google and Bing search, Facebook, Twitter, Pinterest, and others – are now swiftly and constructively altering the enterprise content/collaboration landscape.

As a preview, sections in this document address:

- [New enterprise content and collaboration opportunities](#): six trends collectively creating a content/collaboration crescendo
- [The enterprise content/collaboration twilight zone](#): how the stark differences between traditional enterprise tools and leading consumer Internet services such as Facebook, Twitter, and Pinterest are causing content/collaboration complications
- [Enterprise content chaos causes and consequences](#): how today's common content management problems evolved over time, along with an explanation of what's required to leverage new content management opportunities
- [Enterprise collaboration chaos causes and consequences](#): a similar survey for collaboration tools and services
- [Enterprise application chaos causes and consequences](#): how collaborative applications have been used (and misused), along with requirements for leveraging new opportunities
- [Leveraging the new opportunities with CASAHL DART](#): how CASAHL's solution is uniquely powerful for helping enterprises fully leverage their Office 365 investments

New Enterprise Content and Collaboration Opportunities

Before diving into the opportunities, let's start with some basic definitions. Terms including "content" and "collaboration" have been used inconsistently in the software industry during the past thirty years, and have also been occasionally over-hyped. For the purposes of this document:

- **Content** refers to digital information of any type – including:
 - Documents, optimized for human comprehension, and organized in terms of narrative, hierarchy, and sequence. The most common document types include:
 - Files: word processing, spreadsheet, presentation, PDF, image, video, and other file types
 - Web pages: Internet and intranet pages, usually defined in HTML and JavaScript; Web pages have been hypertext since the World Wide Web was invented, and modern Web pages routinely leverage advanced hypertext capabilities, such as embedded interactive documents, making it possible to read and take action on a variety of document types (e.g., embedded live spreadsheets) without leaving the Web page context
 - Databases: while documents are organized in terms of narrative, hierarchy, and sequence, databases are collections of descriptions of various entities, e.g., customers, products, and enterprise assets; databases are ideally defined in a way that makes them useful across a variety of document, Web page, and application scenarios (rather than being exclusively associated with a single usage context)
- **Collaboration** refers to joint purposeful activity, and is often facilitated through workspaces and workflows involving a variety of content types; examples include:
 - Team spaces, which make it easy for communities of people (typically with shared roles or interests) to collectively create documents, such as customer proposals and product plans
 - Conversation channels in which people share information items and related responses, e.g., for customer and competitor news tracking
 - Workflow applications involving role-based activities, e.g., managers approving employee equipment requests or vacation proposals

Content and collaboration obviously predated related software tools and services, but they're rapidly evolving in interesting and productive ways through the combination of several market dynamics. The rest of this section reviews six of the most significant trends, highlighting influences from consumer Internet dynamics, and concludes with a recap of their combined impact on enterprise content and collaboration.

Mobile: The Most Personal Computing and Communication Devices

Smartphones and tablets have dramatically altered computing and communication patterns. One significant new content/collaboration opportunity is the ability to have first-class support for related tools and services on mobile devices. This means it's possible, for example, to be notified of important updates and to be able to participate in collaborative spaces, conversations, and applications from your preferred mobile device. The user experience and tools are consistent with their PC client-based counterparts; the primary differences are the screen size (perhaps not so different, with large-screen

smartphone “phablets” and tablets) and more emphasis on touch and voice input, rather than traditional keyboard and mouse input.

Modern mobile devices are not just satellites to PCs, and they are in some ways more productive for content and collaboration than PCs have traditionally been. Leading mobile device platforms include consistent and consolidated notification services, for example, and support personal app-level notification preferences (e.g., I can opt to have my work-supplied email messages always pop-up on my home screen, but not allow distracting Facebook notifications). Similar consolidated and customizable notification options are now appearing in the latest PC operating systems (Mac OS and Windows 10), making it much simpler to track and customize notifications.

Some of the biggest content/collaboration advantages for mobile devices stem from their mobility and related services – people take their smartphones and tablets with them more often than they lug around their PCs, and since smartphones, in particular, have a variety of communication- and location-related services, they can leverage context in ways PCs generally don’t (e.g., to capture photos and videos along with location details). Mobile devices can also facilitate collaboration among co-located people, e.g., identifying colleagues with a specific skill who are currently in your vicinity.

Cloud: The New Enterprise Infrastructure Default

There has been a lot of cloud-related hype and uncertainty over the last several years, and enterprises still need to carefully scrutinize candidate cloud service providers, but it’s now clear that cloud – especially public cloud – infrastructure is the new default deployment option for many enterprises. A [recent IDC report](#), for example, noted that cloud infrastructure spending reached nearly 30% of overall IT infrastructure spending in the first quarter of 2015, and is growing much more rapidly than on-premises infrastructure investments.

The shift to cloud infrastructure offers a wide range of advantages relative to on-premises alternatives, including financial benefits, significantly reduced administration and overhead, a more frequent and less disruptive update cycle, and radically expanded capacity and scalability. Hybrid (mixed on-premises and cloud) infrastructure will be the dominant enterprise infrastructure pattern for the immediate future, but content and collaboration investments are rapidly shifting to cloud service providers, with leading examples such as Office 365 and Google Apps building significant enterprise momentum.

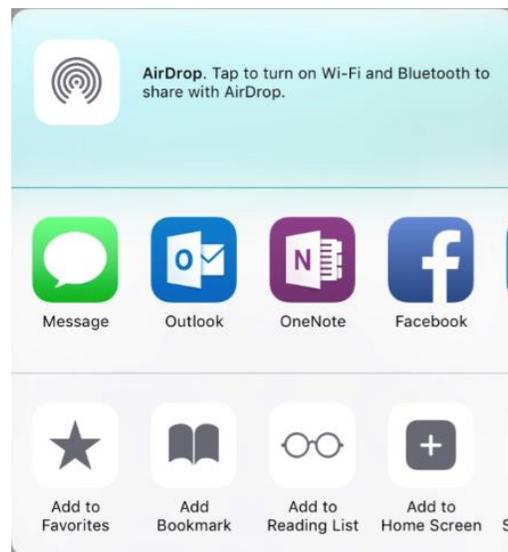
Cloud-aware devices also make it possible to seamlessly manage your documents, data, and other resources in the cloud, rather than exclusively on a single device. This approach in turn makes it much simpler to securely share information items with others, as there’s a single master copy of each item, hosted in a cloud service that supports sharing and activity logging. It also makes it much easier for enterprises to deal with lost or stolen devices; the devices can be remotely wiped without losing any of the content used on the device (because the master copies are cloud-based). From a user experience point of view, however, all of the cloud sync and share services are seamlessly integrated; when properly configured, users can act as if all of the content items they’re working with are local to their devices, and need not be burdened with any of the background sync and share service details. Many people using smartphones and tablets are already familiar with this approach, based on experience with consumer Internet services that make it possible for personal music, photo, and other document collections to automatically appear on all of their mobile and PC devices. Cloud experiences are also increasingly likely to include social tools and services.

Social: Going far Beyond “Facebook for the Enterprise”

“Enterprise social” was a broadly promoted theme for several years, but the first wave of vendors associated with the theme have struggled to establish sustainable business models, and many have either been acquired (becoming features of broader platforms rather than stand-alone offerings) or shifted their focus to other domains (e.g., project management rather than general-purpose enterprise social). Instead of attempting to simply provide the in-house equivalent of Facebook or Twitter for the enterprise, successful enterprise social tools and services include the abilities to:

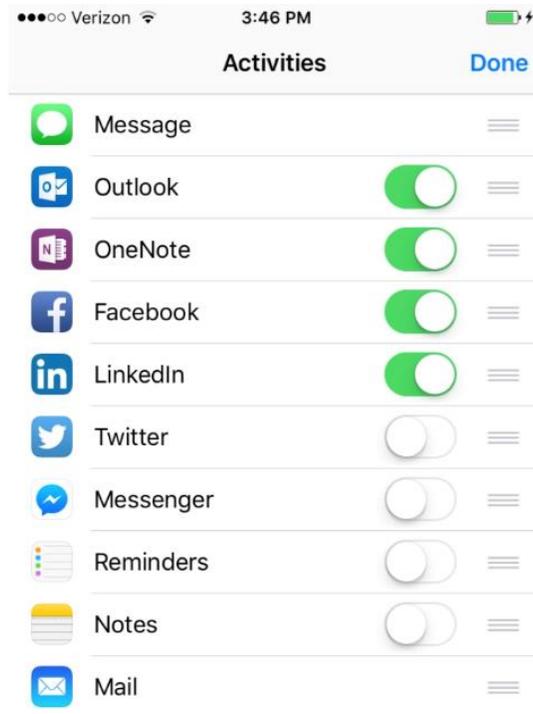
- Connect people with common interests or objectives based on their activities
- Share selected content items with other people or groups of people
- Express personal interest, e.g., subscribe to a team space for updates, follow a conversation topic, *like* a specific content item, and review others’ interests and recommendations
- Comment on a content item, and read others’ comments in existing conversations

These and other social actions are ideally available in most usage contexts, not just in specific tools or services. Here again, consumer-oriented Internet services and device platforms serve as useful leading indicators. The Apple iOS 9.0 Safari “share box” () , for example, offers several options:



The options include both sharing via specific communication channels (text message, Outlook email message, OneNote, Facebook, etc.) and taking related actions on the selected item(s).

The sharing channel list can also be personalized. An iPhone example:



From a social perspective, in this example, I can easily share items from my iPhone via Outlook, OneNote, Facebook, Twitter, and LinkedIn. Android and Windows Phone offer similar personalization options, and both Mac OS and Windows 10 tools and services support similar personalization options.

Pinterest is another useful leading indicator. Its [overall mission](#) – enabling people to “discover and save creative ideas” – supports the use of *boards*, within which users can “pin” and share references to content items. Pinterest is also adding more options for users to take actions in context, e.g., to explore purchase options for products referenced in a pinned content item. Microsoft, with Delve, has adopted a similar board-centric approach for Office 365 information item discovery and sharing; we’ll revisit Delve later in this document.

Big Data Analytics and Machine Learning: For Analytics and Recommendations

Another significant -- although sometimes subtle -- consumer Internet trend involves the use of big data analytics and machine learning techniques. The general ideas include:

- Unobtrusively (indeed, sometimes stealthily) capturing *everything* about user interests, activities, and relationships, and building a graph data model that connects the collected data items
- Analyzing the graphs to identify useful patterns; machine learning techniques can be used to identify unanticipated patterns
- Applying the observed and inferred patterns in order to offer recommendations based on predictive analytics

In the consumer Internet domain, this approach is routinely used in ecommerce tools and services (e.g., Amazon recommendations) as well social media. It’s also a controversial practice, with several related security and privacy considerations resulting in requests for more transparency and regulation, in terms

of making it easy for people to determine what types of data are being collected about their interests, activities, and relationships, and about how that data may be used and shared.

Several “knowledge management” products were introduced to the enterprise market over the last couple decades but generally struggled to gain momentum in part due to security and privacy concerns. The storage and processing needs of large-scale big data analytics and machine learning were also enterprise deployment constraints in the past – it’s not easy or inexpensive to capture and analyze *everything*, using traditional on-premises infrastructure, especially when the on-premises norms include premium storage area networks in perennially-constrained corporate data centers.

User expectations shaped by experience with consumer Internet tools and services are rapidly changing enterprise requirements in this context, as people seek to leverage the types of insights and recommendations they routinely experience in consumer Internet services for their work activities. Indeed, user preferences in this context have often led people to rely on consumer Internet tools and services for work-related activities, often outside of enterprise IT control, creating significant security and compliance risks. Fortunately, the latest enterprise-oriented content/collaboration tools and services make it possible to have the best of both worlds: the familiarity and flexibility of consumer Internet tools/services, along with the requisite enterprise controls. The shift to cloud-based services also addresses the capacity and cost constraints associated with historical on-premises knowledge management initiatives.

Modern User Experiences: A Focus on Informing and Taking Action in Context

Enterprise content has historically been a fragmented and complicated concern, with specialized tools and services for document management, enterprise content management, file management, image management, records management, and Web content management. A lot of computing history is represented in the various domains. For example, enterprise computing started with basic file management, and was then further specialized by vendors focused on document management (e.g., for word processing files), enterprise content management (e.g., with more stringent requirements for document workflow and auditing), and Web content management (for intranet and Internet pages rather than working exclusively with traditional document types). As a result of this cumulative content management complexity, content/collaboration activities are often cumbersome, with related information captured in a variety of incompatible systems, and users frustrated by the need to learn inconsistent tools and waste a lot of time requesting access to needed information.

Successful consumer Internet services offer dramatically different user experiences. Instead of subjecting users to a variety of arcane content distinctions based on long-obsolete computing constraints, consumer services such as Google, Bing, Facebook, and Pinterest present content models that are:

- Contextualized: unobtrusively taking into account your identity, access privileges, and preferences, and, when useful (and when permitted), your current location, the time of day, and perhaps information in your calendar
- Hypertext: presenting content in a seamless blend of document and database elements, so that users can focus on the information context rather than wasting time shifting between disparate tools

- User experience-focused: with a focus on informing and making it possible to take action in context, rather than leaving it as an exercise for the user to copy/paste and switch between multiple tools in order to accomplish tasks

Consider, for example, searching for “movies near me” in Google or Bing. Here’s a Google result snapshot:

Web News Videos Images Shopping More Search tools

Movies playing near Andover, MA 01810

Steve Jobs Movie - Now Playing in Select Theaters
www.fandango.com/Steve_Jobs
 Out Everywhere 10/23. Find Tickets!
[Get Tickets](#) [Watch The Trailer](#)
[See The Reviews](#) [Become A Fan](#)

Showtimes for Steve Jobs

	Thu, Oct 15	Fri, Oct 16	Sat, Oct 17	Sun, Oct 18
All times	Morning Afternoon Evening Night			
Kendall Square Cinema - Map	Standard 8:00pm 9:15			
AMC Loews Boston Common 19 - Map	Standard 8:00pm			

In the news

Aaron Sorkin's 'Steve Jobs' Con
 New York Times - 10 hours ago
 And although "Steve Jobs," the movie, which opened in a handful of theaters on Friday, ...

Woz talks to Bloomberg about Steve Jobs movie, turning down a return to Apple and electric cars
 9 to 5 Mac - 5 hours ago

"Steve Jobs" movie rings up big box office returns
 CNET - 4 days ago

Steve Jobs
 2015 - Drama film/Biography - 2h 2m

6.8/10 IMDb 87% Rotten Tomatoes 82% Metacritic

With public anticipation running high, Apple Inc. co-founders Steve Jobs (Michael Fassbender) and Steve "Woz" Wozniak get ready to unveil the first Macintosh in 1984. Jobs must also deal with personal issues related to ex-girlfriend Chrisann Brennan and their young daughter Lisa. Eventually fired, J... More

Release date: October 9, 2015 (USA)
 Director: Danny Boyle
 Screenplay by: Aaron Sorkin
 Music composed by: Daniel Pemberton
 Distributor: Universal Studios

Critic reviews View 2+ more

The best thing about "Steve Jobs," the thing that makes it work as both tribute and critique, is how messy it is.

This example is:

- Contextualized: I allowed Google to use my current location, and the time of day was used to only present future movie show times (e.g., I executed the search mid-day, so morning and early afternoon show times were excluded; if I had selected the following day, however, all show times would have been displayed). I could also easily view a map showing theater locations and directions from my current location.
- Hypertext: content and data seamlessly blended in the search result, for the movie I selected (*Steve Jobs*), include document summaries and links (e.g., to movie reviews), multimedia (e.g., images and links to movie trailers), and a lot of structured data (e.g., movie theater locations and show times).

- User experience-focused: the search result page presents a number of opportunities to take action in context, rather than just reading content; I could watch a trailer, rent or purchase the movie and immediately start watching it (if it were available for streaming or purchase), select a local theater and purchase tickets for a specific show time, and more, all without disruptive context shifts.

As a second example, consider the following Bing snapshot of a search for “procter & gamble:”

The screenshot shows a Bing search result for "procter & gamble". At the top, it displays "2,980,000 RESULTS" and location filters for "Near Andover, MA". The main result is "PG.com Home: sustainability, company ... - Procter & Gamble" with a link to "www.pg.com/en_US/index.shtml". Below this are sections for "PG.com Brands", "All Brands", "Careers", "Contact Us", and "Company".

On the right side, there is a "Map of procter & gamble" showing a location in Boston, MA. Below the map is a detailed "Procter & Gamble" entry including the P&G logo, a description of the company as an American multinational consumer goods company headquartered in Cincinnati, Ohio, and founded in 1837. It lists the CEO as Alan G. Lafley and founders as William Procter and James Gamble. The stock price is shown as 80.70, up 0.65 (+0.81%) as of July 07, 12:31 PM EDT. Social media links for Wikipedia, Twitter, and Facebook are provided.

Below the company details is a "Local results for procter & gamble" section listing three locations in Boston, MA, with addresses and phone numbers. At the bottom, there are links to the "Procter & Gamble - Wikipedia" page and the "Procter & Gamble - Homepage - US".

Again we see an intuitive, informative, and action-oriented result that is:

- Contextualized: the result displays, for example, the P&G stock price at the moment I entered the query, along with a map showing P&G facilities near my current location.
- Hypertext: Bing blends a mix of content, including related news article summaries and links along with images and interactive maps; it also includes structured data such as the current PG stock price and company details (date founded, current CEO, company founders, etc.).

- User experience-focused: depending on my goals in researching P&G, I might opt to learn more about P&G as an investment opportunity, get directions to a local office, or explore some P&G competitors (by following the “People also search for” links).

We now routinely take this sort of search result for granted, but the results represent an astonishing amount of investment and coordination by the search and content providers. That’s as it should be; we’re able to focus on our interests and the tasks at hand, and are not required to know anything about how the results were created and delivered.

Expanding on the contextualized hypertext user experience theme for a moment, next consider the sharing options referenced earlier in this document: using “share box”-accessible options on my phone, tablet, or PC, I could next select one or more of the content items in one of the search result pages and, without shifting context, annotate and share the items via a variety of channels.

Now imagine how similar approaches could streamline common work-related activities. While consumer Internet service providers may know your identity, the type of music you prefer, and where you live, work-related details that can be usefully leveraged by content/collaboration tools and services include your role and skills, the people and teams you routinely communicate and collaborate with, the projects you’re involved with, products and customers with which you have experience, and a great deal of detail about your work calendar. Effectively leveraging these types of information can dramatically improve content/collaboration endeavors.

Revitalized Productivity Tools and Services: A New World of Documents

The productivity application categories that were central to the personal computing wave – word processors, spreadsheets, and presentation graphics – didn’t significantly change for most of the first twenty years of the PC era. Building on many of the market dynamics previously discussed in this document, however, the latest generation of productivity tools and services ushered in some significant changes that greatly simplify content/collaboration activities. Many of the recent developments started with consumer-oriented services and are now also included with the latest enterprise-oriented offerings.

Productivity apps used to follow a basic programs-have-files model, with one person working on a file at a time, collaboration generally facilitated by creating and commenting in new versions of a file, and sharing handled via email message file attachments or files stored in a document workspace or on a file server. The file formats were initially binary and proprietary, further complicating file-based collaboration (e.g., if you didn’t have a recent version of the productivity app used to create the file, you might not be able to open and work with it).

Recent productivity tools and services such as Google Apps, Microsoft Office 365, and Quip, however, offer new capabilities including:

- Direct support for cloud storage services such as Apple iCloud, Box, Dropbox, Google Drive, and Microsoft OneDrive, making it possible to collaborate on a single version of a document, rather than juggling multiple versions; cloud infrastructure services for identity, authorization, and access control are used to address related security requirements
- Concurrent authoring, so multiple people can update a single document at the same time, along with presence awareness, enabling authors to see who else is working in the same document,

and to optionally start conversations with them; this is a radical simplification compared to the earlier approach of sending/sharing versions of files

- The ability to work in browser and native client apps, so people collaborating via the documents don't need to have the latest versions of the productivity tools installed on their devices; there are also powerful native client apps for popular mobile device platforms such as Android and iOS
- Support for industry standards such as Open XML for document definitions, replacing earlier binary and proprietary file formats
- Expanding support for compound documents with embedded productivity tool components, e.g., Web pages with embedded and interactive spreadsheets; this model is conceptually similar to the Microsoft OLE model (for object linking and embedding) from the 1990s, but builds on modern Web infrastructure rather than vendor-specific frameworks and services, and works on all leading client platforms

There are also relatively new (compared to the early PC era productivity tool types) tool categories, such as note-taking and sharing (e.g., Evernote and Microsoft OneNote) and Web-centric presentations that can include embedded productivity tool documents (e.g., Microsoft Sway). OneNote is a bit of a chameleon; it can appear as a traditional stand-alone productivity application, but can also be used with shared notebooks to address many scenarios that might have otherwise been handled with a wiki or other type of workspace. Evernote, OneNote, and Sway, in another significant departure from productivity app business-as-usual, are also free (or "freemium," with optional fee-based services, for Evernote).

[Microsoft GigJam](#) is an example of another emerging tool type. GigJam (in limited testing as of fall 2015) starts with a collaborative canvas, on which collaborators can create mini-applications composed of application and content resources from a variety of applications, all without being burdened with underlying system/service details. GigJam looks a lot like an elaborate screen-sharing service, but all of the canvas components are live, enabling collaborators to dynamically work in a shared context, rather than just reviewing content.

From an enterprise content/collaboration perspective, revitalized productivity tools and services make it possible to greatly simplify activities that used to require a lot of configuration and administration, making it much more straightforward for people to collaborate by working on shared documents. The new approach also makes it possible to unobtrusively enforce enterprise policies, e.g., for information rights management.

A Content/Collaboration Crescendo

To briefly recap, several consumer Internet-pioneered tool and service trends are now coming together to create compelling enterprise content and collaboration opportunities.

- Mobile: enterprise employees need to be able to be notified of pertinent updates and to take related actions from their preferred devices, and smartphones and tablets are now generally preferred to PCs, for mobile professionals, so content/collaboration tools and services must treat mobile devices as full and first-class citizens

- Cloud: traditional on-premises deployments are generally more expensive, complex, and constrained than cloud alternatives, and they also preclude fully leveraging big data analytics and machine learning techniques
- Social: enterprise employees need to be able to share and collaboratively engage colleagues from *all* tool/service contexts, but with appropriate enterprise-class defaults for privacy, security, and compliance concerns
- Big data analytics and machine learning: to facilitate full leverage of content/collaboration tools and services, big data analytics and machine learning techniques must be unobtrusively and purposefully applied, while making sure that enterprise security, privacy, and compliance concerns are consistently and comprehensively accounted for
- Modern user experiences: for peak productivity and responsiveness, enterprises need to deliver the same contextualized, hypertext, and user experience-focused tools and services that have made consumer Internet offerings so popular and useful
- Revitalized productivity tools and services: the latest productivity tools and services make it possible to work with word processing, spreadsheet, presentation, and other document types in a Web-centric model that supports all popular device types and leverages cloud infrastructure services for sharing and security

Compared to legacy content/collaboration tools and services, the future ahead looks very bright. Paradoxically, however, the current enterprise content/collaboration realities often look more like 20th than 21st century experiences.

The Enterprise Content/Collaboration Twilight Zone

For many enterprises, the new content/collaboration opportunities described in the previous section remain tantalizingly out of reach, due to the cumulative and counterproductive consequences of many years of content/collaboration chaos. This section provides additional context-setting by reviewing the current content/collaboration chaos from the perspective of a millennial enterprise new-hire, and previews later sections of the document which will elaborate on the causes and consequences of content/collaboration chaos.

To dive into the details, imagine you're a recent college graduate, just getting started in your first full-time job with a large enterprise. You've been working with Internet-centric tools and services for as long as you can remember, including:

- Instant messaging (IM, a.k.a. texting) for person-to-person communication; IM is likely to be your primary tool for staying in sync with others
- Skype, Google Hangouts, and similar tools for video conversations and other media sharing
- Google, Bing, Wikipedia, and other search tools for information discovery and exploration
- Services such as Facebook, Twitter, Pinterest, and Tumblr for sharing posts and links with groups of people, discovering new things, and tracking popular and trending topics
- Coauthoring-capable Web tools (such as Google Docs, Microsoft Office Online, and Quip), for group projects, along with wikis and blogs
- Multi-player games, which may not seem directly applicable to enterprise work environments, but can facilitate what you may consider to be your most productive collaboration domain (e.g., coordinating joint purposeful activity in ridding the world of hostile invaders)
- Email, probably your least-favorite tool, but one you need to periodically check anyway, since some asynchronous communication contexts (e.g., coordinating activities with parents) often can't yet be completely handled via IM

You've almost certainly had a smartphone since your early teens, and can't easily imagine what it was like to *not* always have immediate access to Internet services for searching, maps, and other information needs. Your smartphone also provides you with an at-a-glance view of recent activity, e.g., new activity counts for IM messages, Facebook messages, Twitter direct messages, and more. Somewhat paradoxically, however, you probably don't use your smartphone for telephone calls very often, except when timing is tight, or perhaps for occasional calls with your parents (and you are more likely to use Skype or a similar tool, for long audio/video conversations).

It's also likely you're comfortable with single sign-on services, such as using your Facebook, Google, and/or Microsoft account identities to access a variety of services, and having those services immediately accessible via your many devices. Once you authenticate on the device with a password, PIN, your thumbprint, or some other means, you aren't subsequently prompted for your credentials for Facebook and other identity service providers, since you opted to have the credentials stored on your device when you initially authenticated.

When you started your new enterprise job, however, you found yourself in a very different world for content and collaboration. If your employer is a typical large enterprise, you are likely expected (or explicitly required) to:

- Comply with rules limiting at-work use of familiar consumer-oriented Internet tools and services, especially for instant messaging, since those have likely been deemed inadequate for enterprise security and privacy concerns, and are presumed to be used primarily for personal rather than work activities
- Use email as a primary means of asynchronously communicating with others, spending several hours a day (at work and at home) in Microsoft Outlook, to keep up with email, manage your schedule, and coordinate activities with colleagues
- Learn a variety of new tools in order to participate in collaborative applications, including an intranet portal for basic human resources activities, custom workflow applications for some routine business processes (e.g., equipment requisitions, or updating your retirement savings plan choices), and perhaps custom email forms for other activities
- Focus on Microsoft Word, Excel, and PowerPoint as primary document creation tools, perhaps along with a range of Microsoft Access applications for data-driven domains that are too complex for Excel but not elaborate enough to warrant enterprise IT support for a more formal database application (e.g., using a database management system such as Microsoft SQL Server or Oracle Database)
- Rely on email message file attachments as a primary means of sharing documents that are likely stored on your PC, in shared document repositories (e.g., in SharePoint or Notes), and in a variety of cloud-based file sharing services (e.g., Box, Dropbox, Google Drive, and Microsoft OneDrive)
- Master the art of foraging for the information resources you need in order to engage in work activities involving the enterprise and its products, customers, partners, and competitors; as a further complication, few of the content resources you can find are freshness- or salience-rated, so you can't be confident you're not working with stale or otherwise unhelpful content

You may opt to routinely carry two smartphones, for personal and work contexts, in order to keep context boundaries clear. If your employer has a BYOD (bring your own device) policy, you may have been required to install an app on your personal smartphone which gives your employer permission to remotely delete at least work-related parts of your device, if it's lost or stolen.

You've probably also memorized a half-dozen or so identity/password pairs, because some of the legacy enterprise resources and software as a service (SaaS) tools you're working with don't support the device-level authentication shortcuts you've been taking for granted during the last few years.

In other words, you started your new enterprise career in mid-2015, but the content/collaboration tools, services, and modus operandi used by your employer would be familiar to someone starting a similar job ten years earlier. Indeed, many the tools and services might even be familiar to someone starting a similar job forty or fifty years earlier, with the primary differences being the use of digital rather than paper documents and email messages rather than paper inter-office envelopes.

Perhaps you also had some college friends who went to work for a start-up or small business, and you were perplexed to learn that *they* get to work with much more familiar tools and services (ones introduced during this century).

If you happen to actually be a millennial in this type of enterprise content/collaboration twilight zone: before you think about bailing from the enterprise world and heading back to school for a graduate

degree, or perhaps trying to land an interview with a start-up, it will probably be helpful to understand how large enterprises ended up with chaotic collections of content/collaboration resources. Perhaps counterintuitively, it's also helpful to consider the possibility that your new employer may actually be poised to leapfrog into a much more modern and productive world, if it can figure out how to effectively optimize and migrate its legacy content/collaboration tools and resources.

Finally, if you're not a millennial new-hire, but still want to get a sense of what may be preventing effective use of the latest content/collaboration tools and services within your enterprise, you may still find the following sections useful (and perhaps even cathartic), even if you haven't been using state-of-the-art content/collaboration tools since elementary school.

We'll start with a review of the causes and consequences of enterprise content, and follow with sections on collaboration and applications. In addition to explaining causes and consequences, each of the sections will also provide an overview of enterprise requirements for transitioning from chaos to order.

Enterprise Content Chaos Causes and Consequences

This section focuses on the causes and consequences of enterprise content management chaos. To preview what follows:

- Constrained, complex, and costly content systems: an overview of the market dynamics that led to common enterprise content chaos patterns
- Common consequences of content chaos: the enterprise impact of chaotic content systems
- Emerging enterprise content opportunities: some reasons why it's mission-critical to move beyond the content chaos, along with some requirements for making order out of content chaos

Constrained, Complex, and Costly Content Systems

One of the first things to consider, when trying to fathom how enterprises end up with content/collaboration chaos, is the fact that enterprise hardware, software, and networking technologies have advanced *very* rapidly over the last few decades. The first several decades of enterprise content systems were largely defined by constrained, complex, and costly storage, processing, and networking technologies. Early content systems initially replaced (or augmented) paper-based business processes, with many content systems essentially providing streamlined and digital versions of earlier paper form-based business systems. The constrained capabilities and high costs of early content systems led to specialization by content type and workflow patterns; over several decades, this resulted in a wide variety of software product categories, including (in alphabetical rather than introduction timeframe chronological sequence):

- Content management: serving as a generic term for systems for managing digital information stored a variety of content types
- Database management: focusing on more structured and less document-oriented content, and optimized for applications rather than human readers
- Digital asset management (DAM): supporting multimedia content types (e.g., image, music, and video files) and related access and authorization privileges
- Document management: essentially representing file management extended with related services for document workflow needs, such as check-in/out and versioning, along with serial and parallel document workflow processes
- Enterprise content management (ECM): extending document management for advanced enterprise requirements such as end-to-end usage tracking for audit and content control policy compliance
- File management: providing basic storage services, and serving as the foundation for other content services and commonly used for storing and organizing Microsoft Office documents (Word documents, Excel spreadsheets, and PowerPoint presentations), PDF, and other file types
- Image management: specializing DAM with a focus on image management and processing tools and services
- Knowledge management (KM): including systems that attempt to go beyond basic content management capabilities by adding more “semantics” and advanced usage pattern analytics
- Records management: specializing document management with highly structured documents, supporting digital signatures or other mechanisms to ensure documents/records aren't tampered with

- Search services: focusing on indexing a variety of content types, in order to make content more readily findable
- Taxonomy and other metadata management tools: serving to facilitate the organization and application of structured vocabularies and categorization mechanisms
- Video content management: specializing DAM with a focus on video preparation and management
- Web content management (WCM): addressing intranet- and Internet-focused systems for creating and managing structured collections of Web pages
- Wikis: providing a more informal and flexible type of WCM, facilitating collaborative authoring of collections of related pages
- XML content management: working with XML (Extensible Markup Language) documents, which are often highly structured and complex; XML content management systems include support for a variety of related standards such as XML Schema, XPath, and XQuery, and replaced many earlier ECM systems based on SGML

That's an exhausting but far from exhaustive list, as there are many more specialized categories (e.g., email systems used as long-term content repositories, ECM transactional services, and several categories of database management systems). You probably get the idea that there is a paradox of abundance in enterprise content system software product categories, each with associated enterprise IT career paths, leading product/service vendors, industry analyst domain experts, industry events, standards committees, and domain-specific vocabularies.

Amid all of this convoluted content system evolution, enterprise content system acquisition and deployment trends, over the last several decades, often included:

- Starting with files and databases: files for basic content management, and more structured applications and databases for business domains including accounting, human resources, and manufacturing. Microsoft Office has long been the de facto standard for productivity application documents. Database management systems (DBMSs) such as Microsoft SQL Server, Oracle Database, Oracle MySQL, and Postgres now dominate the enterprise database market, but most enterprises also still have large collections of legacy and/or specialty database products (e.g., mainframe DBMSs, workgroup databases managed in Microsoft Access, and recent "Web-scale" apps based on recent NoSQL systems).
- Acquiring one or more ECM systems for complex document management needs, often led by individual business groups (e.g., human resources might have started with Documentum, while engineering preferred FileNet, in part based on which ECM systems were supported by related packaged application suites).
- Deploying one or more content/collaboration platforms, most likely starting in the early 1990s with Lotus Notes, and later shifting to Microsoft SharePoint.
- Adding DAM systems to work with specialized content types, such as engineering diagrams; remember these systems were probably deployed a long time before people routinely carried the always-connected Internet supercomputers we call smartphones, when the costs of storage and media-handling tools were still exorbitant.
- Investing in one or more WCM systems to catch the commercial Internet wave, starting in the mid-1990s, often with products offered by traditional ECM vendors, or with intranet portal

products originally offered by startups that were eventually acquired and merged into ECM product suites.

- Exploring KM system options in attempts to better leverage disparate content systems, often in the late 1990s or early in this century, and likely at significant expense and with disappointing results.
- Picking up one or more XML-centric systems along the way (or perhaps simply using advanced XML document management capabilities available in leading DBMSs), either for general-purpose needs or bundled into domain-specific applications.
- Adopting one or more open source systems in domains including ECM and WCM, as low- or no-cost open source alternatives to traditional enterprise software products gained market acceptance.
- Deploying a mix of enterprise social-related content systems, such as blogs and wikis, in hopes of addressing enterprise requirements not fully (or cost-effectively) met by collaboration and intranet platform vendors.
- Signing up for one or more cloud-based content storage/sync/sharing services, e.g., Box, Dropbox, Google Drive, or Microsoft OneDrive, generally to replace traditional file servers, and to reduce the risk of losing content that might otherwise be stored exclusively on a single device (e.g., on the hard drive of an employee's laptop).

Unsurprisingly, these acquisition and deployment trends have resulted in widespread content chaos.

Common Consequences of Content Chaos

The enterprise content system patterns over the years all probably made sense at the time they were embraced, as enterprises sought to expand their content management endeavors to address new opportunities based on changing constraints, complexity, and cost variables over many years. The cumulative consequences, however, now commonly include:

- Content held captive in a variety of specialized, isolated, and expensive systems, often with significant redundancy (i.e., duplicated content) and highly variable content integrity and quality. This challenge is sometimes partially addressed with the acquisition and deployment of search engines supporting multiple types of content systems, making the content more accessible, but generally these do not improve content integrity and quality, or facilitate the retirement of legacy systems.
- Inadvertent retention of content that is no longer required for business purposes, and that may create unnecessary risks (e.g., in the event of an e-discovery challenge).
- Inconsistent access control policy enforcement, in part because some content systems were deployed with the expectation that they would remain accessible to only a small group of users.
- Sporadic (at best) compliance with enterprise content policies, especially for content systems/services acquired outside the purview of enterprise IT (e.g., marketing groups signing up for Box or Dropbox accounts because they want to move faster than their IT colleagues are ready to do).
- Dependencies on struggling legacy content system vendors that may be unstable and unable to make significant investments in their products/services, making it unlikely, for example, that full, first-class client support for mobile devices will be a near-term option.

- A lack of coordination and collaboration among related IT groups. It's not unusual to find that people focused on file and document management systems don't interact much with their coworkers focused on database systems, for example, again creating an environment that's conducive to redundant and low-quality content (e.g., making it very difficult to establish consistent 360-degree content views of business entities such as customers and products). These communication breakdowns can also lead to poor form-follows-function technology choices such as using a document-oriented system for data-centric needs, or a database management system for needs that would be better addressed by a document management system (a topic we'll revisit in a later section focused on application chaos).
- Myriad end user experience challenges, including the need to manage multiple sets of credentials and to be diligent when working with content of highly variable integrity and quality. These challenges in turn create strong incentives for end users to attempt to take more personal control of their own content, e.g., by signing up with a file sharing and synchronization service that may not be on the enterprise IT-approved vendor list.
- The end user experience challenges are also conducive to users resorting to least-common-denominator approaches, such as sharing files via email message file attachments or IM services, even when doing so is a violation of corporate policy (e.g., using consumer-oriented email or IM services to share files with external parties). Sharing content by sending copies of files also creates more content redundancy, and makes it much more difficult to ensure all interested parties are working with the latest file versions. Having content spread across a large number of isolated systems also makes it exceptionally difficult for end users to determine which content is likely to be most useful, based on popularity and reader ratings.

As one clear indication of widespread dissatisfaction with enterprise content resources, LinkedIn, in [a blog post introducing its LinkedIn Lookup](#) service, highlighted research indicating that only "38 percent of professionals said their companies' intranets are effective at helping them learn about their coworkers," and "46 percent say they look up coworkers on LinkedIn." Many enterprise employees are also likely default to Google or Bing searches when looking for information about their own employer's offerings, rather than trying to navigate labyrinth intranet content systems.

Emerging Enterprise Content Opportunities

An unusual thing happened while enterprises were busy collecting, deploying, and managing dozens of content systems: the underlying storage, processing, and networking technologies that were for many years constrained, complex, and costly went through several decades of extension and refinement, and are now abundant, accessible, and affordable. In parallel, broad adoption of real or de facto industry standards, many of them accelerated by major advances in consumer Internet services, along with the shift to public cloud platforms for many IT infrastructure needs, have combined to dramatically reduce the need for historically specialized content systems types.

Revisiting the key trends introduced earlier in this document, some important new opportunities presented by the latest content systems include:

- Mobile: smartphones and tablets are first-class citizens, so content creators don't need to develop platform-specific versions of content resources, and end users have full and secure access to content on their preferred devices.

- Cloud: leveraging the infrastructure services available in leading public clouds such as Microsoft Azure and Office 365 can dramatically simplify enterprise infrastructure complexity and administration.
- Social: in services including Office 365, social capabilities such as liking, following, and commenting on content are available throughout the platform, rather than being limited to a single tool/service domain.
- Big data analytics and machine learning: content discovery is no longer limited to searching, as predictive analytics and machine learning techniques are applied to automatically identify potentially relevant content resources.
- Modern user experiences: with tools organized around content models that are contextualized, hypertext, and user experience focused, users are able to take action in context without being distracted by content repository and application context boundaries.

In fewer words, the overall opportunity is for enterprises to productively combine the most effective techniques and tools refined in leading consumer Internet services with enterprise requirements for access control, audit, and other concerns. [Microsoft Delve](#), for example, leverages the key market trends with a user experience that combines the best features from services such as Facebook and Pinterest with seamless enterprise-oriented infrastructure services, so that employees can easily discover and work with the full scope of content resources to which they have access privileges. Content items from a variety of sources – OneDrive, Groups, SharePoint, Yammer conversations, and more – are all combined in a simple user experience that helps employees focus on their business tasks at hand rather than being inconvenienced by the underlying content system details.

Another benefit of leveraging solutions such as Microsoft Delve is the fact that most employees are likely eager to work with the tools, because they are already familiar with the general concepts based on their experience with leading consumer Internet services. This is a big departure from earlier content system generations, which often required extensive (and expensive) training, and were routinely rejected by end users.

By transitioning from content chaos to fully leveraging the emerging opportunities, enterprises can significantly simplify their content deployments and greatly improve employee productivity while gaining more effective control of their content resources and compliance requirements. It's not simply a question of signing up for the latest content cloud platform services, however, as enterprises must assess and optimize their existing content resources for the new content services, a process that requires a multi-source, multi-target content/collaboration transition solution such as [CASAHL DART](#), which we'll revisit in the final section of this document.

Enterprise Collaboration Chaos Causes and Consequences

This section focuses on the causes and consequences of enterprise collaboration chaos. As a preview, what follows in this section:

- Changing enterprise collaboration trends and priorities: an overview of the market dynamics that led to common enterprise collaboration chaos patterns
- Common consequences of collaboration chaos: the enterprise impact of chaotic collaboration systems
- Emerging enterprise collaboration opportunities: some reasons why it's mission-critical to move beyond the collaboration chaos, along with some requirements for making order out of collaboration chaos

Changing Enterprise Collaboration Trends and Priorities

One big problem with the collaboration tools/platforms business over the last quarter-century is the fact that there is no industry consensus on what “collaboration” means. For the purposes of this discussion, collaboration simply refers to *joint purposeful activity* – people working together to address common goals.

Communication, in contrast, is about transmitting content between two points, so collaboration is directly facilitated through communication and content in some type of shared context, such as a project team workspace.

A brief recap of key collaboration market dynamics over the last few decades:

- In the 1970s, computerized collaboration was largely limited to large host computers, with email and file sharing systems such as [IBM PROFS](#) (for Professional Office System) and Digital Equipment Corp.'s [VAX Notes](#). The latter was partly inspired by [PLATO](#), a computer assisted instruction system developed at the University of Illinois during the 1960s and 1970s.
- The first wave of PC-based collaboration generally included a lot of manual steps, such as copying a productivity application file to a floppy disk and hand-delivering it (or sending it via inter-office mail), to colleagues. Although rudimentary when compared to today's norms, this “[sneakernet](#)” approach represented a big advance relative to typing (or printing) and distributing paper-based documents. Several minicomputer-based systems from vendors such as Data General, Prime, and Wang were also popular during this period, and supported networked rather than floppy disk-based document sharing, but their cost and complexity limited their deployment potential.
- [Lotus Notes](#), introduced in 1989 and directly inspired in part by PLATO, was a pioneering “groupware” system for client/server PC systems. It combined flexible document management, discussions, and email in a platform supported on multiple client and server operating systems. Because the underlying operating systems during those years were relatively primitive in comparison to today's platforms, Notes bundled a broad foundation of infrastructure services for identity, authentication, authorization, message routing, and much more. Notes also included an elaborate replication subsystem to address networking limitations (and costs) in an era long before Wi-Fi and consumer broadband were the norm. Over several releases, Notes also expanded to include extensive document-centric application development tools and templates, making it a successful platform for forms- and workflow-oriented application

domains. Several enterprise content management (ECM) platforms were also introduced around this time, including FileNet and Documentum, but they were more specialized and expensive than Notes, and lacked email.

- Email systems were also used for a range of collaboration and content sharing needs during this period, with Microsoft Exchange public folders, for example, introduced in 1996. Email-based collaboration has always been problematic, however, and Exchange public folders met with limited market success, with the feature eventually being displaced by Microsoft SharePoint (and later OneDrive for Business). Some enterprise groups -- likely technology-oriented ones, such as IT and engineering -- also, in parallel, during this period, leveraged Internet-native communication-centric collaboration and content-sharing tools, such as [Internet Relay Chat \(IRC\)](#), and Internet newsgroups such as [Usenet](#).
- The advent of commercial Internet computing in the mid-1990s led to a wave of vendors focused on intranet portals (essentially intra-enterprise Web sites) and Web content management (WCM), including document workflow tools suitable for a range of forms-based collaboration. [SharePoint](#) was introduced in 2001, and represented the consolidation and rebranding of several earlier Microsoft products (e.g., FrontPage, a pioneering Web content creation tool, and document management services built on the Web app server included with Windows Server). As was the case with Notes, the SharePoint product team had to bundle a broad assortment of infrastructure services and document-centric application development tools, due to limitations in the underlying operating systems and complexity in the then state-of-the-art tools for professional developers. SharePoint also had deep dependencies on other Microsoft technologies, including, Windows Server, SQL Server, and (in SharePoint's first few releases) Internet Explorer.
- At the beginning of this century, the product development teams for both Notes and SharePoint tried, generally with mixed results, to accommodate market trends that went beyond the products' foundation-level document-centric capabilities, but enterprises often looked elsewhere to leverage blogs, wikis, group conversations, and other "enterprise social" trends. This period also brought increased industry focus on open source and Internet-centric standards, and led to a shift away from proprietary and binary file formats to open standards such as Open XML.
- The popularity of communication/collaboration-conducive consumer Internet services resulted in market demand for "Facebook for the enterprise" solutions, with simplified user experiences and pervasive support for social actions such as following people and topics, liking and tagging content, and recommendations based on collaborative and predictive analytics. Atlassian Confluence, IBM Connections, Jive, and Yammer (acquired by Microsoft in 2012) are leading examples of products in this domain. [Slack](#) is a more communication channel-oriented (IRC-like) tool/service that has also been popular recently. Leading application vendors, especially cloud-based, software-as-a-service (SaaS) vendors such as Salesforce.com, also offer related communication/collaboration tools (both their own and via integration with other tools and services).

As with the enterprise content system deployment pattern history summarized in the previous section, enterprise collaboration system acquisition and deployment pattern often resulted in very complex and often ineffective collections of disparate systems. A typical enterprise collaboration history for a North American organization, for example, includes:

- The use of ECM and DAM systems for high-value collaborative application domains such as engineering drawings and pharmaceutical drug trial documentation
- Large-scale deployments of Lotus Notes and/or Microsoft Exchange for messaging-based document workflow
- A shift, over the last twenty years, to intranet systems, especially Microsoft SharePoint
- Experimentation with a variety of “enterprise social” tools and services

Overall, these patterns have caused a great deal of collaboration chaos.

Common Consequences of Collaboration Chaos

The chaos stemming from cumulative collections of collaboration systems has created significant enterprise challenges, including:

- Islands of collaborative tools and applications, creating extensive redundancy and inconsistency in related content, and requiring error-prone end user actions (e.g., cutting and pasting content between collaborative applications), when business domains span system boundaries
- Often undocumented and poorly architected collaborative applications, due to the tendency to have the apps developed by “informal” (nonprofessional) application developers who haven’t been trained in application and database development concepts
- Collaboration platforms and tools used for applications for which they’re not a great form-follows-function fit, generally application domains that are more data- than document-centric and can be more effectively addressed using traditional database management systems (DBMSs)
- Dependencies on legacy products, often from vendors that are now focused on other opportunities; for example, IBM attempted to completely replace Lotus Notes with its ill-fated [IBM Workplace](#) product family more than a decade ago, and more recently with [IBM Connections](#) and [IBM Verse](#), leaving the Notes/Domino product family mostly in “maintenance mode” (with IBM continuing to offer Notes support but not investing much in new product features)

These enterprise patterns are collectively very expensive, as products/services tend to not be retired after they have been used for collaborative applications. They also tend to inhibit enterprise agility, as new collaborative applications spanning multiple systems require coordination among several teams of people working with increasingly obsolete technologies.

Despite having access to extensive collections of enterprise collaboration systems, it’s also still common for employees to facilitate content-based workflow processes by using modern “sneakernet” replacements, such as using email messages with file attachments or sending files via IM services. This approach is generally a worst-case scenario for collaborative applications, as it’s conducive to out-of-control content dissemination and duplication, versioning nightmares, and workflow processes that are manually intensive, inconsistent, and error-prone.

Emerging Enterprise Collaboration Opportunities

More than a quarter-century after the first release of Lotus Notes, the traditional enterprise collaboration market is being modernized through the combination of productivity-oriented cloud platform tools/services and Web-centric application development techniques that seamlessly integrate

collaboration capabilities into modern user experiences, rather than relying on separate and specialized systems. Traditional on-premises collaboration platforms such as SharePoint will also continue, but will be increasingly relegated to on-premises content repositories searchable through Office 365.

Here’s a brief summary of how many enterprises will transition their collaboration-related resources using new capabilities of Office 365:

Resource Type	Traditional Approach	Cloud Collaboration
Document libraries	Notes and SharePoint document libraries	OneDrive folders, often associated with Groups
Discussion databases	Notes discussion databases and SharePoint discussions	Group conversations and contextual Yammer conversations
Team spaces	Notes and SharePoint team workspaces	Delve organizational profiles and project-specific Groups and microsites
Lists/tables	Notes and SharePoint lists	Site lists, Excel Online workbooks, and Azure databases (relational and document-oriented)
Collaborative applications	Custom Notes and SharePoint applications	Office 365 apps

Office 365 also provides new tools and services that have no prior on-premises platform counterparts. Office Graph, for example, is a new Office 365 content and activity repository that represents a flexible graph database of Office 365 content and related user activities. Delve is a powerful new platform, built on Office Graph, that includes a content-focused discovery dashboard as well as new organizational analytics tools; it will also play a prominent role in Microsoft’s next-generation enterprise portal platform, code-named “Infopedia.”

In another broad collaboration-conducive development, many of the notification services (e.g., for new or updated activity in a collaboration context) formerly presented via system-specific activity streams are now being consolidated into platform-level notification services, making it much easier for people to keep up with collaborative activities across all of their devices.

Leveraging the emerging enterprise collaboration opportunities is not a mere proposition of signing up for Office 365, however. To rapidly build employee momentum with Office 365 and to get full value from existing collaborative applications, enterprises need to assess their current deployments, determine which Office 365 capabilities are the best fit for application-specific needs, and automate the migration process. Highly complex collaborative applications, typically built in Notes or SharePoint, are often disaggregated and recomposed using new Office 365 capabilities. These are all requirements that can be fully addressed with [CASAHL’s DART product suite](#), which we’ll explore in the final section of this document.

Enterprise Application Chaos Causes and Consequences

This section focuses on the causes and consequences of enterprise application chaos. As a preview, what follows in this section:

- Legacy platforms and other causes of collaborative application chaos: an overview of the market dynamics that led to common enterprise collaborative application chaos patterns
- Common consequences of application chaos: the enterprise impact of chaotic applications
- Emerging enterprise application opportunities: some reasons why it's mission-critical to move beyond the content chaos, along with a preview of collaboration capabilities in Microsoft GigJam
- Leveraging the new opportunities: a summary of requirements for taking advantage of emerging collaborative application opportunities

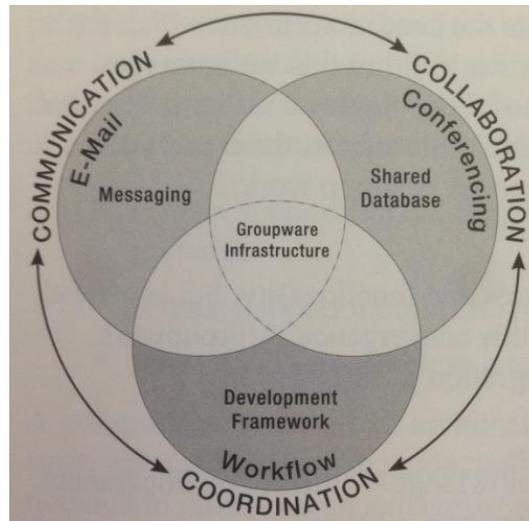
Legacy Platforms and Other Causes of Collaborative Application Chaos

Many enterprises have struggled with collaborative application chaos since Lotus Notes was introduced in 1989. Microsoft SharePoint, introduced a dozen years later, has occasionally also proven to be conducive to collaborative application chaos. To understand related dynamics, it's useful to start by revisiting the early Notes application model.

The development team at Iris Associates, the company that created Notes (and acquired by Lotus Development Corp. in 1994), had to address many platform challenges. When Notes was introduced:

- PC-based enterprise messaging (email and calendaring/scheduling) was a recent development (larger host-based systems such as IBM PROFS had been around for many years, however).
- Productivity applications typically included Lotus 1-2-3, WordPerfect, and Harvard Graphics. The first version Windows of Microsoft Office wouldn't appear until late 1990 (although earlier versions were available for Mac OS and OS/2).
- Application development was generally split between professional programming tools (e.g., using C or C++) and specialized systems such as dBASE, which was a higher-level tool for database-oriented applications. Visual Basic wouldn't appear until 1991, and the first release of Microsoft Access followed in late 1992.
- PC operating systems were relatively primitive, compared to today's norms. Server operating systems had very limited services for identity, authentication, and authorization (access control), for example. Internet-centric standards such as TCP/IP wouldn't become the enterprise norm for several more years.

When Notes 1.0 was developed between 1984 and 1989, it was by necessity (due to limited underlying operating system capabilities) a largely self-contained platform, as suggested by the image below.



Source: *Groupware: Communication, Collaboration, and Coordination*, Lotus Development Corp., 1995

Notes defined a new “groupware” category, combining infrastructure services, enterprise messaging, document databases, and a document-oriented application development framework. It complemented then-popular productivity applications, providing document databases in which people could collaborate on word processing documents, for example, and also provided a general-purpose discussion database model for collaborative conversations. Although Notes wasn’t considered directly competitive with then-popular enterprise content management (ECM) products, it proved to be very popular for relatively simple document-centric application needs.

There was also considerable client and server operating system diversity, so Notes was eventually released for several client and server platforms (Windows, OS/2, Mac OS, and several UNIX client platforms, for example). This variability made it advantageous for the Notes platform to bundle infrastructure services that didn’t depend on underlying platform-specific capabilities.

To address the limited networking capabilities of the period, Notes incorporated a replication model that made it possible to efficiently distribute applications and content across occasionally-connected networks. The replication model also facilitated working offline, e.g., participating in a document or discussion database when working on an airplane or otherwise network-disconnected, and replicating (synchronizing) when next network-connected.

Notes application developers often started by customizing one of the bundled templates, usually beginning with discussion, document, or team workspace templates and then modifying forms (document templates) and views for their needs. An asset tracking application, for example, could be based on a document database template with some custom form and view fields added in order to capture asset identifiers and categories, with email used to facilitate related workflow processes (e.g., routing equipment requisition requests).

The application development features in Notes were expanded over several releases, starting with a formula language-based development model (inspired by the Lotus 1-2-3 formula language, with document-related extensions) and eventually supporting a Visual Basic-like programming framework

(LotusScript) and application program interfaces (APIs) that could be used from C, C++, Java, and other programming languages.

The power, accessibility, and flexibility of Notes, combined with then-higher costs and complexity of general-purpose application development tools, resulted in Notes being used as an application platform for both document-centric applications and a wide range of applications for which Notes was not an ideal form-follows-function fit, such as more data- than document-centric content management, and more operational/transactional than document workflow-oriented business processes. In many cases, the application development and database management alternatives were considerably more expensive, and required much deeper technical skills, so the Notes platform became a path of least resistance for many application developers. Notes also had the advantage of already being on most employees' desktops, since the Notes client included enterprise messaging as well as document database capabilities, simplifying application distribution and modifications (key considerations, before the advent of Internet browser-based applications).

When SharePoint was introduced in 2001, it provided a document-oriented platform companion to the enterprise messages tools and services provided by Microsoft Exchange (first released five years earlier). SharePoint was built on a Web server (the IIS Web server bundled with Windows Server) and DBMS (SQL Server) foundation. Unlike Notes, SharePoint was only available on a single server operating system (Windows Server), and initially required Windows clients running the Internet Explorer browser. The SharePoint team, starting with a more Internet-oriented approach, also opted to not include capabilities equivalent to the Notes replication model (although some replication-related features were added after Microsoft acquired Groove Networks in 2005).

The combination of Exchange, SharePoint, and Microsoft Office followed a trajectory that was in several respects similar to the earlier Notes experience. SharePoint was used to complement Office applications, for example, with document sharing and workflow capabilities. It also offered some discussion/conversation capabilities, although they were far less elaborate than the corresponding capabilities in Notes. Most significantly, in terms of this collaborative application survey, SharePoint also offered a range of application development tools and services that become popular for both document-centric and general-purpose applications, and it became a path-of-least-resistance option for many application developers, just as Notes had done several years earlier.

Both Notes and SharePoint also evolved, as platforms, to address several subsequent market trends, ranging from integrated real-time communications (tying into Lotus Sametime and Microsoft Lync, for example) to blogs, wikis, and other enterprise social software tools and services. The enterprise social forays were not broadly successful, leading IBM and Microsoft to develop or acquire other enterprise social-focused products (e.g., IBM Connections and Microsoft Yammer).

Several other content/collaboration products and services have been introduced during the last twenty years, but Notes and SharePoint have been by far the most widely-deployed enterprise content/collaboration application platforms.

Common Consequences of Enterprise Application Chaos

While Notes and SharePoint enabled the creation of a wide range of collaborative applications, they were also conducive to chaotic application development and management practices, with consequences commonly including:

- Uncontrolled proliferation of collaborative applications: it's easy to create a new collaborative application in Notes or SharePoint, starting with templates, but that capability can be something of a mixed blessing, as many applications have been created, infrequently used, and abandoned. This pattern can create significant enterprise risks, such as inadvertently keeping copies of documents that could prove problematic in an e-discovery action.
- Extensive and uncoordinated duplication of effort: the often-informal nature of Notes and SharePoint application development led to a lot of isolated projects, often created by nonprofessional developers who didn't make efforts to determine if their application needs overlapped with other applications or enterprise systems.
- Large collections of fragile and un- or poorly-documented applications, often with significant complexity due to years of incremental modifications as business needs change: this pattern created significant problems, as the applications are often problematic (with bugs or general inconsistencies) and difficult to modify in order to address changing business requirements. It's also increasingly difficult to find skilled Notes developers, and a similar pattern will likely follow for SharePoint, since Microsoft has retired earlier SharePoint development tools including InfoPath and SharePoint Designer, and is likely to introduce a new form-centric application development tools to be used in conjunction with Office 365 and Azure, perhaps as extension of its new [PowerApps](#) tool for mobile application development.
- Applications with poor form-follows-function fits with Notes and SharePoint, e.g., using document collections to capture and manage data that would be more effectively managed in a database management system (DBMS) or cloud database service: the often less-than-ideal mappings have led to often elaborate workarounds, creating even more complex and difficult-to-maintain custom code and dubious deployment decisions (e.g., breaking an application into multiple instances because of performance or capacity constraints, when using a document database for high-volume and data-centric needs). The platform vendors have made several attempts to address related challenges. For example, Lotus offered the NotesSQL driver, developed by CASAHL under contract for Lotus in the early 1990s, in an attempt to make it easier to use Notes-managed lists with popular query and reporting tools. IBM also briefly offered an option to store Notes databases on DB2, after IBM's 1995 acquisition of Lotus Development Corp., but there are still fundamental limitations in using a document-optimized storage system to address data-centric requirements.
- Inadequate support for mobile devices such as smartphones and tablets: Notes and SharePoint were both designed before modern mobile devices became popular, and their application development frameworks have constrained the extent to which people using mobile devices could participate in collaborative applications.

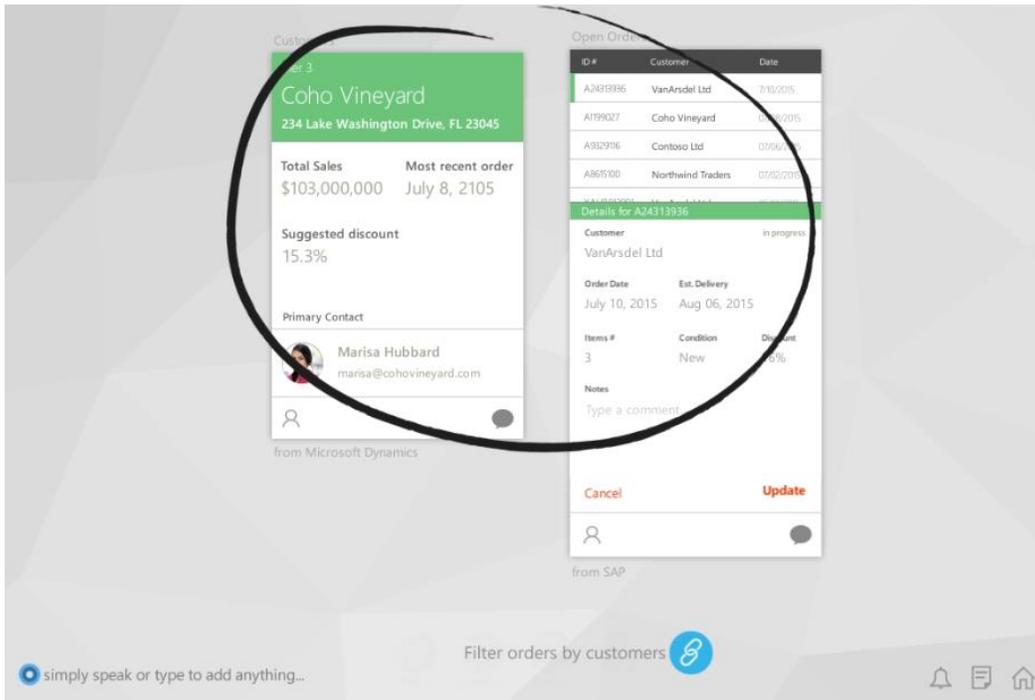
Overall, the most problematic consequences enterprises face today, with chaotic collections of legacy collaborative applications, include being unable to address changing business requirements in a timely manner and being stuck with increasingly obsolete technologies which, in terms of total cost of ownership, are likely to be significantly more expensive than modern alternatives such as Office 365.

Emerging Enterprise Application Opportunities

There have been dramatic improvements in the enterprise content/collaboration market over the last several years. An earlier section provided an overview of the key market dynamics. Some of the developments that are most important for collaborative application developers include:

- The advent of cloud platforms such as Azure and Office 365, with powerful and standards-based infrastructure services (e.g., for identity, authentication, authorization, versioning, content indexing and searching, and much more), eliminating the need for many of the services previously bundled in platforms such as Notes and SharePoint.
- Platform-wide collaboration-enabling services, such as Office 365 Groups, that are much simpler and more streamlined than traditional collaborative application approaches for common project collaboration needs. Providing group membership (i.e., access control) and resources including a shared document repository, conversations, and a project team calendar, the Office 365 Groups services can also be more readily integrated with line-of-business applications (e.g., customer relationship management, human resources, and other business domains).
- Far more powerful productivity applications, offering coauthoring, versioning, seamlessly integrated comment/conversation and notification services, along with document workflow capabilities. The latest versions of Microsoft Office also work in both traditional client application and browser-based usage modes, and support the leading mobile device platforms. These capabilities have greatly reduced need to create document database-oriented sites/applications simply to foster document-level collaboration and workflow.
- Contextual conversation capabilities, so that instead of setting up a dedicated site/application to foster collaborative conversations, it's now possible to use platform-wide conversation tools such as those provided in Office 365 Groups and Yammer conversations.
- Powerful and standards-based options for embedding dynamic and interactive content in documents and Web pages, making it straightforward, for example, to embed interactive Word, Excel, and PowerPoint content, along with interactive data reports built in tools such as Microsoft Power BI. These advanced hypertext capabilities, combined with contextual collaboration and communication capabilities, are very powerful for ad hoc collaborative endeavors.
- Industry standard-based document management and application tools, especially HTML5, JavaScript, and JSON, along with forms-rendering technologies that automatically format content for different device sizes and capabilities.
- Dramatic improvements in content indexing, search, and discovery services, including proactive recommendation services based on advanced data analytics. The Office Graph and Delve technologies included in Office 365, for example, go far beyond the search capabilities available for on-premises releases of Notes and SharePoint, and the Office Graph is also the foundation for emerging tools such as Delve Organizational Analytics.
- Much simpler and more cost-effective database-related tools and services, including a new generation of document database engines; collectively, these developments make it much easier to use tools that are strong form-follows-function fits for specific application needs, and to more readily and seamlessly integrate related resources in modern user experiences.
- All of the advances listed above are also amplified, in terms of business value, when integrated with modern software as a service (SaaS) applications such as Microsoft Dynamics CRM, Salesforce.com, and Workday. The SaaS applications can be integrated with collaboration tools and can also feed business content and activities into the Office Graph, making the line-of-business resources accessible to discovery dashboards such as Delve.

For a compelling example of near-term future collaborative application opportunities, consider Microsoft’s [Project GigJam](#), introduced at the 2015 Microsoft Worldwide Partner Conference. GigJam provides a collaborative canvas on which multiple participants can share and take action on application components. GigJam includes some simple and intuitive yet very powerful capabilities, such as the ability to dynamically link content from disparate systems, and to assign tasks to participants working asynchronously (e.g., who may be working in different parts of the world, or working offline).



Source: GigJam demo video in the [Project GigJam: Unleashing the human process](#) blog post

In the GigJam screen shot above, for example:

- The collaboration initiator used voice commands to Cortana in Windows 10 (e.g., “Hey Cortana, show me my open orders”) to open interactive views of customer and open order information (which could come from different SaaS applications)
- By circling the content views, the initiator instructed GigJam to link and synchronize the content views; moving to a different customer, for example, would also show the open orders for that customer
- Additional participants can be easily added, and assigned different access rights (e.g., view-only or edit)
- All authorized participants can take action in context, as they’re working with full versions of the “micro-application,” not just participating in a traditional screen-sharing Web conference
- When work is assigned to participants not working in-real time, the assigning participant is informed of updates and is able to replay and review assignee actions, and to approve or reject the results
- All participants can also use additional communication and collaboration tools, such as Skype, to establish additional shared context

More GigJam details are expected to be unveiled over the next few months, and it's likely to become a "killer app" for Microsoft's new [Surface Hub](#) interactive display.

To recap, emerging enterprise application opportunities make it possible to:

- Have far fewer isolated collaborative applications, as many of the collaboration capabilities are now available as platform-wide services and as features of the latest productivity applications
- Reduce content redundancy and improve content quality, by using a better form-follows-function fit approach with document- and data-oriented tools/services
- Facilitate contextual and dynamic collaboration by working with emerging tools such as Microsoft GigJam

Collectively, these opportunities make it possible to increase productivity, remain more responsive to changing business needs, and significantly reduce expenses by retiring legacy technologies.

Leveraging the New Opportunities with CASAHL DART

Migrating content and collaborative resources to Office 365 can be a daunting task, especially for enterprises with thousands (or tens of thousands) of document workspaces and applications deployed on more than one legacy platform. In order to fully leverage the new opportunities, enterprises need to be able to:

- Conduct a comprehensive, efficient, and secure inventory of deployed content and collaborative applications: CASAHL's [Pre-Migration Assessment](#) service addresses this need, supporting multiple source platform types (SharePoint, Notes/Domino, file systems, Exchange public folders, file-sharing services including Box and Google Drive, and CMIS-compliant ECM systems) and using automated tools to produce complete inventories of deployed applications along with application-level complexity and traffic ratings and target technology recommendations. The Assessment service also identifies and consolidates applications based on common templates, often significantly reducing the overall migration project scope.
- Build stakeholder consensus: different collaborative applications are often maintained by people who rarely (if ever) directly work together, so it's critically important to get all stakeholders on the same page and to factor in qualitative assessment input before finalizing migration plan priorities. [CASAHL's DART Dashboard](#) is a collaborative solution, populated by the results of a Pre-Migration Assessment exercise, that efficiently fosters stakeholder collaboration.
- Support multiple target tools/services: migrating traditional content/collaboration content and collaborative applications requires full support for new Office 365 capabilities such as Groups and Delve; simply migrating legacy applications as-is only serves to perpetuate historical limitations. The [CASAHL DART product suite](#) supports targets including the new Office 365 tools as well as a wide range of database technologies, all with a highly automated approach that scales to support the largest enterprise migration projects.
- Disaggregate and recompose legacy collaborative apps: many of the tools and services bundled into legacy platforms are now redundant with Office 365 and Azure infrastructure services, and Office 365 offers a compelling set of new tools for collaborative application developers. CASAHL's [Application Recomposition](#) service combines CASAHL's tool suite with domain expert consultants to provide a turn-key solution for complex collaborative application migration. End-to-end automation is key to Application Recomposition, as more manual alternatives result in far more expensive and unpredictable migration projects.
- Seamlessly support integration requirements: most enterprises use multi-phase migration projects, sequenced by stakeholder priorities and business needs. Having seamless integration between legacy and new collaborative applications minimizes disruption during the transition period. It's also advantageous to be able to more flexibly integrate collaborative applications with other enterprise resources, including SaaS applications and database management systems and services. Application recomposition, for example, can result in having a collaborative application disaggregated, with large tables migrated to database services such as Azure SQL Database rather than a new collaborative application, and with integration services used to automate synchronization between the enterprise resources and collaborative applications. This approach makes it possible to fully optimize the use of enterprise content resources while also maximizing simplicity for collaborative application developers. CASAHL's [ecKnowledge platform](#), part of the DART product suite, addresses both types of integration with a unified solution.

CASAHL has also developed a suite of helper tools to automate common enterprise migration patterns, further simplifying and streamlining migration projects by addressing source- and target-specific capabilities and generating, executing, and monitoring eCKnowledge tasks. By applying insights gained during thousands of successful migration projects worldwide and incorporated into this highly-automated approach, CASAHL is able to leverage its DART platform and helper tools to dramatically reduce migration costs and project durations, compared to more manual migration alternatives.

In terms of engagement model options, CASAHL typically handles the full migration lifecycle, optionally partnering with systems integrators when customers have a preferred SI vendor. CASAHL also offers [a Fixed-Fee Migration service option](#), for enterprises seeking to quickly migrate a subset of high-priority sites and applications with a low-cost and low-risk solution. FFM is often the initial step in a multi-phase migration project.

Enterprise customers also have the option of licensing and deploying the DART product suite on their own, for complex migration projects that entail protracted integration capabilities, or to facilitate comprehensive and continuous monitoring of content/collaboration deployments. CASAHL offers training and support resources for enterprise customers preferring self-managed deployments.

The most common pattern, however, even for Office 365 migration projects involving huge collections of content and application resources spread across multiple systems (often a mix of Notes/Domino, traditional SharePoint, and Google Apps), is for CASAHL's team of domain experts to directly handle the end-to-end migration project, optionally working with customers' preferred systems integrators.

To recap, Office 365 represents an unprecedented opportunity for enterprises to dramatically improve their content and collaboration. CASAHL is a migration specialist that has been exclusively focused on addressing related requirements for more than twenty years, and the CASAHL DART solution makes it possible to cost-effectively and quickly leverage the full power of Office 365 by optimizing and migrating previously-deployed content and collaborative applications from a wide variety of traditional platforms as well as services such as Box and Google Drive. Please visit <http://www.casahl.com/> for more details on how CASAHL's solutions can help you fully leverage your Office 365 investment.

About CASAHL

Since its inception in 1993, CASAHL has maintained an exclusive focus on providing enterprise-class solutions that optimize and modernize collaboration and content environments such as SharePoint, IBM Notes/Domino, Google Docs, Office 365, Enterprise Content Management, DBMS, and ERP systems. CASAHL has worked with more than 2,000 enterprise customers worldwide.

CASAHL won Microsoft Partner of the Year in 2009 and 2010 for Migration solutions. Platform vendors including IBM, Microsoft, and Sybase have OEMed products from CASAHL to optimize and modernize customer deployments for their respective platforms.

CASAHL's unique solution provides automatic discovery and analysis of existing systems, along with automated generation of transition, coexistence, and integration tasks among previously deployed environments and modern alternatives such as SharePoint and Office 365.



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