This paper explores a thought process that can guide an enterprise in adopting Web 2.0 technologies. We investigate the challenges internal and external to the organization, involved in enterprise adoption of Web 2.0. It also recommends an iterative adoption model for handling those challenges with detail discussion of different steps of the same.
Introduction

In the software industry today, one of the trickiest questions to answer is – “How can enterprise leverage the next paradigm of web computing, popularly known as Web 2.0?” Enterprise adoption of Web 2.0 (also known as Enterprise 2.0) is all about leveraging the emerging Web 2.0 technologies within an organization for employees, partners and customers. The objective is to allow all stakeholders, of the enterprise (internal and external), to use the Web 2.0 way of computing to communicate, collaborate, contribute and participate. However, the formative state of Web 2.0 presents a big challenge. Also, at present, some Web 2.0 principles are too elusive in nature for tangible enterprise benefits.

Given these, it is presently very difficult for most enterprises to plan for a controlled transition to the Web 2.0 model of computing. At the same time, standing still will effectively mean going backward. Industry gurus identify this as the key challenge in enterprise realization of Web 2.0. Currently, there are not many thought processes/opinions to tackle this problem.

This whitepaper aims to provide a thought process that can guide an enterprise in tackling this problem. It will investigate the key challenges involved in enterprise adoption of Web 2.0. It will also recommend an iterative adoption model for handling the challenges, with detailed discussion of the different steps in the model.

Key challenges in enterprise Web 2.0 adoption

Web 2.0 adoption challenges can be classified into two broad categories –

- Challenges due to the Formative State of Web 2.0 and
- Challenges due to the Social Computing Aspect of Web 2.0.
Challenges due to Formative State of Web 2.0

These challenges are, by nature, external to an enterprise. They cover the perception-based and dynamic nature of the current state of Web 2.0. Recognizing them is a must to define a good, holistic strategy for Web 2.0 adoption.

Lack of clarity in Web 2.0 concepts – The first step to reap the benefit from any new idea is to understand its key characteristics and principles. Currently, there is no single viewpoint available on Web 2.0 characteristics, which can help one to understand the Web 2.0 principles in their entirety. Web 2.0 viewpoints range from a very simplistic view, as adopted by Forrester Research in identifying six core technology aspects of Web 2.0\(^{iv}\), to the detailed analysis done for Web 2.0 around 25 characteristics classified in 5 different groups. This poses the first challenge in differentiating between reality and myth/hype.

Continuously changing Web 2.0 landscape – Even as we talk, some parts of the existing Web 2.0 technologies (or their usage) are getting reshaped. Due to the sheer scope for innovation in the Web 2.0 world, this pace cannot be controlled or predicted. Consolidation is bound to happen in the near future, but at the same time, deviations and divergences will also continue. So, the challenge for an enterprise is to identify the optimal way to keep pace with this change.

Lack of generic and proven usage patterns – There is no generic combination of Web 2.0 characteristics that have evolved so far\(^{v}\). It differs from one industry vertical to another, with some common sets\(^{v}\). Even within a given industry vertical, there is substantial variation from organization to organization. For instance, for a generic retailer like Wal-Mart, promoting a user group may not make sense at all. However, for a speciality hi-fi audio retailer, the same can make sense as its target audience by and large take buying decisions based on expert opinion.

Maturity of platforms/products/standards – Most enterprise software vendors are trying to include support for development of Web 2.0 features. However, given the dynamics of Web 2.0, it is difficult to find one that can support all Web 2.0-related needs. There are also isolated Web 2.0 specific products/tools available in the market. But, integrating them with the enterprise stack can be an issue. Most enterprises, today, prefer to get all the Web 2.0 features bundled in their preferred technology platform. However, the products/platforms are yet to mature to fulfil that need.

In this context, the security aspect of Web 2.0 needs special mention. Wide use of standards - like RSS/ATOM, JSON, REST, etc. - in Web 2.0 development keeps existing security challenges, related to use of XML (as payload over the wire), intact. In addition, there are some emerging security challenges. Sometimes, these challenges are because of the immaturity of these standards (e.g. lack of standard in mime-type of RSS and ATOM, which need to be tackled through proper programmatic inspection of header content). Sometimes, they are a result of architectural flaws (supporting direct consumption of feed at client side). Further, they could also be due to the aggregation of content from various sources (the pattern that is the backbone of Web 2.0 collaboration), which makes the use of a single security model nearly impossible.

Secondly, protecting the usage of content (audio/video) has to be considered. This is done by using Digital Rights Management solutions. The content - pertaining to training, meetings, sales campaign, etc. – that is delivered over audio/video needs to be protected so that it doesn't appear on YouTube someday. Also, the content may get maliciously tampered.

Scarcity of skill and experience – Getting skilled people for Web 2.0 development is not only costly, but also, difficult as these people cannot address the end-to-end requirement of enterprise Web 2.0 adoption. A big part of Web 2.0 development is about integrating it with the existing enterprise architecture stack. People with Web 2.0 experience, though good in Web 2.0 specific technologies, lack experience/understanding of the usage of the same in an enterprise context.

This is especially so when integrating Web 2.0 technologies with server-side architecture of an enterprise\(^{vii}\).

Challenges due to Social Computing aspect of Web 2.0

Web 2.0 is essentially social in nature, in terms of collaboration and participation. So, even though one can create a Web 2.0 strategy, adoption of the same cannot be predicted and controlled entirely. This gives rise to the following challenges, typically internal to an enterprise.

Readiness – Most Web 2.0 technologies have some underlying assumptions about the readiness of organizations. These assumptions are related to cultural readiness as well as architectural readiness.
For instance, blogs may be completely unused if an organization does not foster an open culture, encouraging employees to express their opinions publicly. Enterprise-level use of mashups can never happen if all Lines of Business are not ready to expose their services. For product customization by end users, business architecture needs to be ready to accept and process end-user inputs. Similarly, the information architecture needs to support huge volume of unstructured data, which will be produced and consumed by Web 2.0 applications. Additionally, the, infrastructure architecture needs to handle the sudden surge of usage due to Web 2.0 adoption. It is, often, found that service orientation in an enterprise is the necessary foundation block before the enterprise can seriously embark into the Web 2.0 adoption journey.

Control and governance – Effective use of Web 2.0 technologies to support collaboration equates to lesser control and governance. However, this is essentially a two way sword. Less of it can affect the productivity, information security, reliability of information; more of it can stop usage and participation, defeating the purpose. For example, in case of product customization by end-users, there should be some control of the extent to which a user can customize. However, that control may irritate the end-user, limiting their participation. So, striking the right balance is the key to success and there is no uniform solution for it.

Another important aspect is that an enterprise cannot be truly web2.0 enabled, if it doesn’t connect people to the outside world. There have to be clear policies defining how internal web2.0 systems of enterprise will interact with external web2.0 systems, which are very popular.

In this context, control of digital content, like audio/video, needs special attention. A lot of content pertaining to training, meetings, sales campaign etc. is delivered in an enterprise over audio/video. They need to be protected so that they don’t appear on YouTube someday. Also, the content may get tampered with. There are some standard solutions available in market, which help in creating an audio/video content that can determine who can use it and for how long. Any modification of content can be identified through encryption, which essentially stops it from playing.

Justifying the investment – The benefits of Web 2.0 are typically intangible and incremental in nature. It will always be difficult to get enough funds for lack of hard justification for such investment. In many cases, it is found that only after deploying a critical mass of Web 2.0 technology, the pay off starts coming in. Not only that, there can always be other pressing concerns which need more investment/ focus than investment in Web 2.0 experiments.

Ensuring adoption – Although a Web 2.0 feature is implemented with the right intention and following practices in similar industries, the same may not be accepted and used widely in the given enterprise context. For example, Wiki may be a good way to share and build a knowledge base in a collaborative way. However, in an organization, an employee may be more comfortable with in-person knowledge sharing through focussed sessions. Essentially, this depends on the organizational culture and practices.

Recommendation – An iterative adoption model

Keeping in mind the challenges of Web 2.0 adoption, enterprises should go in for an iterative adoption model with short implementation phases. This iterative model suggests forming boundaries for each iteration, focusing on next level of implementation of a set of carefully selected Web 2.0 features.

Each iteration, in turn, should comprise four basic steps - namely Identify, Analyse, Plan and Implement. Also, each iteration has to be supported with a continuous assessment of Web 2.0 innovation and changes happening in the industry (direction and trends, maturity, best practices and experiences) and the current state of Web 2.0 adoption (need, preparedness and benefits realized). The feedback from assessment will essentially decide whether it makes sense for the enterprise to go in for the next level of implementation of a given Web 2.0 feature or to discard the same. Also, it will provide enough insight on whether to take up another set of Web 2.0 features for implementation in the next iteration.
The key aspects of the model are depicted in the diagram below.

**Identify** – The first and most vital part is identifying and listing the Web 2.0 features, which are suitable for implementation in a given enterprise context. Doing this right will ease out all the three types of challenges described above.
To gain an understanding of the popular Web 2.0 features, we recommend a detailed classification of characteristics of Web 2.0 in 5 broad aspects of Content, Collaboration, Commerce, Computing as a service, and Technology. However, while the first four are more on the application side of Web 2.0 principles, technology is the enabler for them.

This list can be filtered using common features that have, so far, been successfully adopted by other organizations, belonging to same domain. However, the final list should be created looking at the following key aspects –

- **Which Web 2.0 features are already present in the organization officially or unofficially?** Examples may be instant messaging and blogging as an accepted collaboration tool in your organization. This will not only give a good understanding of what Web 2.0 features are appealing to people in the organization, but also will provide a good assessment of the ones that will take the least time to implement.

- **Are there some Web 2.0 features that can solve some of the current problems easily?** Often, enterprises struggle to communicate or disseminate some high level guiding principles (like Enterprise Architecture strategy, etc.). A collaboration platform can solve this very easily. These are the cases that can help in getting initial investments and also demonstrate the capabilities to the business.

- **Are there any strategic initiatives planned where Web 2.0 principles can be effectively used?** There always will be some strategic initiatives that may benefit by following Web 2.0 principles. This can lead to selection of some Web 2.0 features in the list.

**Analyse** – After listing the target Web 2.0 features, it is essential to assess the organization’s current state and availability of technology for implementation. This step is important to handle the internal challenges and the challenges related to the formative state of the technology.

Reviewing the internal challenges for implementing the shortlisted features will filter the list and result in a roadmap with prioritized features. The key guideline here is that the required changes should be achievable in an incremental fashion. Any Web 2.0 features that needs significant revamp of any of the enterprise architecture viewpoint may not be the right candidate.
On the other hand, assessing the maturity of the industry to implement these features requires a careful selection of the Web 2.0 products/tools available in the market. This is one of the biggest challenges, given the immature state of the industry. To ensure that the tools selected have the right ingredients, the key aspects of Web 2.0 should be kept in mind. Many points of view are available today in the industry, the popular one being using SLATES\textsuperscript{xviii} characteristics of Web 2.0. The other framework that can be used for this purpose is FLATNESSES\textsuperscript{ix}. Most of the time, CIOs prefer to get all the required Web 2.0 features from the same product/platform. However, this exercise may reject some items from the initial implementation phases, due to the unavailability of the right tool in the market.

This step will typically produce the following inputs for subsequent phases –

- Identifying the candidate applications for Web 2.0 enhancements. Obviously, complex applications are not the right candidates for the same. Similarly, applications supporting complex processes are not good candidates either. Another key output is a roadmap indicating the timelines for Web 2.0 enhancement of all candidate applications.
- Mapping target applications to the short listed Web 2.0 features.
- Identifying the modules of logical architecture that need refinement with new/modified services and interfaces. Mapping them to the short listed Web 2.0 features.
- Identifying the existing data entities that will be affected. Defining the ways to enhance/modify them and mapping them to the Web 2.0 features.
- Impact on hardware, due to specific usage patterns of the Web 2.0 features
- List of industry tools/products to be used for different Web 2.0 features.

Plan – At this stage, based on data gathered from the prior analysis, a plan should be created, that can be easily tuned based on the feedback and benefits from the initial phases of implementation. The key guidelines for creating this plan are –

- Should be iterative and each iteration:
  - Should not have too many Web 2.0 feature planned for implementation in a given phase
  - Should be aligned with the roadmap created in the previous step for applications to be enhanced
  - Dependency between the iterations should be minimum, so that even if an iteration is abandoned, the next one can go on
  - Implementation of a given Web 2.0 feature may happen across multiple phases. For example, an enterprise not ready with enough service orientation using standard protocols, can still go in for mashups using tools like Yahoo Pipe. This can be part of the first phase. Later on, when the enterprise is ready with the required services and access control, full-fledged mashup implementation may happen
  - At the beginning, the focus should be in implementing/formalizing the features that are already in use
  - Should ensure that the plan does not affect other initiatives. Instead. It should be integrated with them by resolving the dependencies.
  - Should leverage existing best practices and experiences in industry.

Implement – Critical success factors include the speed and cost of implementation of the target features. Hence, quick implementation is the key and it largely depends on the availability of the right interfaces and services, use of appropriate tools/frameworks and availability of skilled resources. However, it may be difficult to find skilled Web 2.0 professionals, given the state of the technology. So, what one should really look for are the designers/developers with a sound background in the core technology on which the Web 2.0 features will be built. For example, if you are planning to give your core Java-based applications a new layer of Web 2.0 functionality, a good Java designer/developer is a good bet. Also, industry-wide available Web 2.0 specific mailing lists and discussion forums can serve as good sources for resolving Web 2.0 implementation issues. Typically, the most challenging part is the optimal utilization of the existing core architecture and functionality. Through this, the existing professionals with Web 2.0 training can also prove to be effective enough.

Continuous assessment – All the core steps of the model will rely on continuous assessment of Web 2.0 innovation and changes in the industry and the enterprise Web 2.0 adoption state. This is the key aspect of the model. Unless assessed continuously and decisions are taken from time to time, based on the assessment, the entire Web 2.0 adoption program can get into the wrong track, with the implementation of useless Web 2.0 features and/or use of wrong tools, standards.
A Web 2.0 continuous assessment group may be formed to implement this. This group –

- Should be formed with people who have a good understanding of Enterprise Architecture (EA) and the culture, of the enterprise.
- Needs to be up-to-date with awareness of and insight into Web 2.0 happenings in industry, typically ahead of the rest of the organization in Web 2.0.
- Need not focus full time on this job, but should have a mandate to continue for a longer duration. This is in contrast to the requirement for the team, which will get involved in the core steps (Identify, Analyse, Plan, and Implement) – which can get formed and dismantled on a need basis.
- May be formed by the part time involvement of people from existing EA group as the knowledge of enterprise architecture and culture is the key to success.
- Should continuously monitor and -
  - Keep a tab on evolution of different Web 2.0 features and their relevance to the enterprise context
  - Assess the Web 2.0 features provided by a product/platform, which is part of the enterprise standard operating environment. Also, assess their roadmap toward Web 2.0 evolution.
  - Look out for the right Web 2.0 skills/experiences inside and outside the enterprise. As discussed before, supplementing skills of selected internal resources (with right knowledge and experience related to enterprise’s architecture and culture) with training/exposure to Web 2.0 technologies can be the most effective solution.
  - Develop and maintain liaison and a relation with different Web 2.0 forums and groups to be up-to-date on best practices and proven ideas.
  - Track the internal needs for Web 2.0 features. This includes being aware of existing adoptions (may be unofficial), identifying the right use of Web 2.0 features in any strategic initiative, and also the quick ones with obvious benefits.
  - Be aware of the status of different viewpoints of enterprise architecture. Also, helping them to be ready for leveraging Web 2.0 principals and being aware of and monitoring the enterprise culture and viewpoint on different Web 2.0 features across the hierarchy.
  - Monitor the benefits realized from Web 2.0 implementations. Every Web 2.0 features implemented should be monitored closely to see the usage trend and benefits. This can provide an early indication of success. So, deciding on a right monitoring framework - what to monitor, how to monitor (instrumentation, etc.), when to monitor, and how to analyse is very important.
  - Be aware of the high level findings and issues faced during the execution of core steps of the model. This also will help in early identification of Web 2.0 features that are going to be successful and the ones that are going to fail.

**Conclusion**

To conclude, there are three important aspects of enterprise adoption of Web 2.0. It may not be necessary for an enterprise to adopt every aspect/feature of Web 2.0. However, it is important to find the ones that are right in the enterprise context. Next, it is important to understand that not all of the implemented Web 2.0 features will provide the anticipated business benefits. That way, an incremental approach will always be more helpful. Finally, continuous assessment and monitoring of the state of the industry (with respect to Web 2.0) as well as Web 2.0 adoption in the enterprise (need, preparedness and benefits realized) is a must to achieve overall success.
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