Web-Based Development and Functional Size Measurement

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Web-Based Development and Functional Size Measurement

- Introduction
- Web-based applications
- Web-interfaces to existing applications
  - Dynamic web-sites
  - Static web-sites
- Web-points

(A step towards a Capers Jones content metric? Maybe.)

- Conclusion
Introduction
Web-Based Development

• Web-based development ranges over
  – web-based applications
    • provide the full user functionality of a software application via a web-browser
    • include web-based versions of existing applications and new types of application that did not previously exist
    • utilise HTML based forms, embedded scripts and dynamically generated HTML pages along with back-end servers to provide an application’s user functionality
Web-Based Development

- web-interfaces to existing applications
  - provide remote and broad access to an existing application via a web-browser
  - utilise HTML based forms, embedded scripts and dynamically generated HTML pages to provide similar functionality as is provided by existing application interfaces
Web-Based Development

– dynamic web-sites
  • provide regularly changing and/or customisable information to users about an organisation, person, topic or issue
  • utilise dynamically generated HTML pages and maintain data for display in a database
Web-Based Development

- **static web-sites**
  - provide predominantly static information about an organisation, person, topic or issue
  - utilise static hard-coded HTML pages connected with hyperlinks
  - may include a number of HTML pages supporting simple interactive user functionality
Web-Based Development

• All types of web-based development typically utilise elements that are not so commonly found in traditional applications
  – non-textual (*multi-media*) elements
    • graphics
    • video
    • audio
  – externally sourced elements
    • papers and reports made available on the web
  – hypertext links to other related web-sites
Functional Size Measurement

- Functional size measurement (FSM)
  - indicates the functional size of the software delivered to the end-user
  - typically expressed in function points
  - serves as a key driver for calculating the effort required to deliver the software
  - facilitates negotiation on the feasibility to deliver the specified software functionality within a specified schedule and cost
Applying Functional Size Measurement to Web-Based Development

• The ability to effectively and usefully apply FSM to web-based development depends upon
  – the type of web-based development to be performed
  – the use to which the FSM results are to be applied

• In some cases where FSM can be applied to the web-based development
  – functional size is not the major delivery effort driver
  – the functional size determined does not usefully express the size of the web-site to be developed or enhanced

• More useful information can therefore be obtained from alternative web metrics
Web-Based Applications
Web-Based Applications Description

• As the Internet matures, the web is increasingly used to provide remote and broad access to fully featured applications via a web-browser

• Web-based applications are implemented by
  i) HTML based forms, embedded scripts and dynamically generated HTML pages for entry and display of data and servers for performing the applications’ processing
  ii) using the web as a standard interface in which to wrap an independent application (*Java applet approach*)
Web-Based Applications
Applying Functional Size Measurement

• In general, FSM can be applied throughout the development and delivery of web-based applications in a similar manner as for traditional applications
  i) identify the web-based application’s transactions and data
    • it is important to carefully consider any administrative functionality required to maintain the application
    • administrative functionality may be accessed by a system-level web-interface, or it may be accessed off-line through a conventional application interface
Web-Based Applications
Applying Functional Size Measurement

ii) assess the identified functionality via FSM to determine the functional size

- functional size is typically expressed in function points

iii) utilise productivity data relevant to web-based development to assess the effort required to deliver the web-based application

- as with all web-based development, the additional effort required to construct and/or obtain any required non-textual and externally sourced elements must be carefully assessed when determining delivery effort
Web-Based Applications
http://www.hotmail.com

Hotmail provides standard email application functionality via a web-based application. FSM can be applied to Hotmail in a similar manner as it would be applied to a traditional email application such as Eudora.

The administrative functionality for maintaining Hotmail is inaccessible to end-users but must be carefully considered when sizing the delivered application.
Web-Based Applications
http://www.irb.cs.uni-magdeburg.de/sw-eng/us/java.fp

A simple Java applet for function point calculation that runs within a web wrapper.

The applet can be sized using FSM in a similar manner as it would be if it were a traditional application.
Web-Interfaces to Existing Applications
Web-Interfaces to Existing Applications

Description

• Many existing applications are being extended through the addition of a web-interface
  – provide the same or similar user functionality as offered by existing traditional interfaces to an application
  plus
  – allow the existing applications to be easily accessed remotely and by a broad user base

• Web-interfaces are typically implemented using HTML based forms, embedded scripts and dynamically generated HTML pages that communicate with the existing applications
Web-Interfaces to Existing Applications
Applying Functional Size Measurement

- FSM can be applied to web-interfaces
  i) identify the transactions and data accessed by each HTML page comprising the web-interface
    a) a web-interface may include additional functionality to
       - satisfy the need to work offline from the main application
       - simplify the work flow and provide additional help to address the needs of a broader range of end-users
  ii) assess the identified functionality via FSM to determine the functional size
  iii) utilise productivity data to assess the effort required to deliver the web-interface
MAXI provides a web-interface to a variety of applications providing Victorian State and Local government services including bill paying, registration and bookings.

The size of the functionality provided by MAXI can be assessed using FSM.

The MAXI web-interface is significantly simpler than the original application interfaces.
Dynamic Web-Sites
Dynamic Web-Sites

Description

- Dynamic web-sites predominantly provide regularly changing and/or customisable information to users about an organisation, person, topic or issue, although other interactive user functionality may also be available
  - data for display is maintained in a database
  - data in the database is accessed and dynamic HTML pages are generated by a server for display on a user’s web-browser
Dynamic Web-Sites
Applying Functional Size Measurement

• FSM can be applied to dynamic web-sites
  i) identify the transactions and data accessed on each
dynamically generated HTML page
  • the transactions will typically consist predominantly of
  inquiries and outputs (*IFPUG FSM*)
  ii) assess the identified functionality via FSM to determine
  the functional size
  iii) utilise productivity data to assess the effort required to
deliver the web-interface
The results of inquiries that display such items as summaries of the day’s main news items and up-to-the-moment breaking news are dynamically constructed into HTML pages and displayed on the end-user’s browser.

Additional functionality for maintaining the database of news items for display is inaccessible by end-users but must be considered when sizing the delivered application.
Static Web-Sites
Static Web-Sites
Description

• Static web-sites provide predominantly static information about an organisation, person, topic or issue
• Implemented as collections of hard-coded HTML pages
• Include both textual and non-textual elements
• Organised as hyperdocuments and include hyperlinks connecting pages within the site and pointing to other related web-sites
• Constructed using simple tools e.g. Microsoft FrontPage or manually using a text editor
Static Web-Sites

Functional Size Metrics Applicability

• In many cases, FSM *does not* adequately address the actual size of a static web-site or the effort to deliver it
  – the size and effort to deliver a static web-site is more closely related to the number, size and complexity of the HTML pages that comprise it, *not* the functionality it provides to users
Static Web-Sites
Applying Functional Size Metrics

• **Example**
  – an organisation has a static web-site that includes HTML pages that describe the services the organisation offers
  – the marketing department wishes to add detailed descriptions of a large number of new services along with sparkling new graphics!

• although this request may *only marginally* increase the functional size of the web-site, if at all

• it will *significantly* increase the web-site’s size and complexity in terms of number, size and complexity of its HTML pages and will involve a significant effort to complete
Static Web-Sites
Alternative Web Sizing Metrics

- Alternative sizing metrics for static web-sites include
  - number and complexity of HTML pages, where page complexity addresses
    - page size (word count, bytes)
    - number and type of non-textual elements and externally sourced elements within a page
    - number and type of hyperlinks into and out of a page
  - total number and type of unique non-textual and externally sourced elements used within a web-site
Static Web-Sites
http://www.isbsg.org.au

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HTML page from a static web-site containing simple text and graphics and hyperlinks to related pages

Static web-sites such as this are best assessed using metrics such as number and complexity of HTML pages within the web-site
Static Web-Sites
Additional Effort Assessment

- Effort assessment must also carefully consider the effort and cost to
  - write and/or obtain the textual content
  - construct and/or obtain non-textual and externally sourced elements
  - construct and/or obtain any required infra-structure components that would be automatically provided as part of the development environment in more mature technologies

- (This is in fact true for all web-based development!)
Static Web-Sites
http://www.mmv.vic.gov.au

Static HTML page containing several complex graph elements that impact upon the page’s complexity.

Effort assessments must address the effort to construct or obtain the graphic elements.
Menu system requires more than 650 lines of custom JavaScript code. Was the menu system provided cheaply by a tool, or did it have to be constructed from scratch?
Web-Points
Web-Points

Description

• Web-points are a metric for assessing the delivered size and delivery effort of static web-sites
  – (web-points can also be applied to other types of web-based development, if desired)
  – web-points size a web-site by addressing the number and complexity of HTML pages within the site
• complexity is classified as Low, Average or High and a number of web-points are assigned to each page based upon
  – the size of each page in words
  – the combined number of hyperlinks into and out of a page
  plus the number of non-textual elements on a page
Web-Points
Description

• Web-points can be utilised along with productivity data to determine the effort to develop or enhance a static web-site
  – the effort figure includes requirements analysis, design, construction, testing and implementation of the HTML pages
  – it *does not* include developing or obtaining the page contents or the non-textual elements used within the pages; this must be determined independently
Web-Points
Sizing a Web-Site

1. Determine the number, size and complexity of the HTML pages within a web-site
   - size and complexity is classified as Low, Average or High based upon the size of each page in words and the combined number of hyperlinks into and out of a page plus the number of non-textual elements on a page

<table>
<thead>
<tr>
<th>Link Count; In, Out &amp; Non-Textual*</th>
<th>Word Count*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>0 - 300</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Low</td>
<td>Avg</td>
</tr>
<tr>
<td>Avg</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>&gt; 15</td>
<td>&gt; 500</td>
</tr>
</tbody>
</table>

- the HTML pages within the CHARISMATEK web-site are classified
  - 13 Low
  - 5 Average
  - 11 High

* The ranges used for assessing link count and word count have been calibrated for CHARISMATEK’s data. Other organisations may find different ranges better reflect their data.
Web-Points
Sizing a Web-Site

2. Determine the total size of the web-site in web-points

- the total size of the CHARISMATEK web-site in web-points is
  - \((13 \times 4) + (5 \times 6) + (11 \times 7) = 159\) web-points

<table>
<thead>
<tr>
<th>HTML Page Size</th>
<th>Web-Points*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4</td>
</tr>
<tr>
<td>Avg</td>
<td>6</td>
</tr>
<tr>
<td>High</td>
<td>7</td>
</tr>
</tbody>
</table>

* The values used for allocating web-points to complexities have been calibrated for CHARISMATEK’s data. Other organisations may find different values better reflect their data.
Web-Points
Determining the Effort to Develop a Web-Site

3 Utilise the project delivery rate \((PDR)\) to determine the effort to develop the web-points

- effort includes the requirements analysis, design, construction, testing and implementation of the HTML pages
- it does not include developing or obtaining the page contents or the non-textual elements used within the pages

\[
\text{Effort} = PDR \times \text{size}
\]

\[
PDR^* = 0.5 \text{ web-points / hour}
\]

- the effort required to develop the CHARISMATEK web-site is
  - \(0.5 \times 159 = 79.5 \text{ hours}\)

* The PDR used to determine effort has been calculated for CHARISMATEK’s environment. Other organisations may find a different PDR better reflects their environment.
Web-Points

Determining the Effort to Develop a Web-Site

4 Determine the additional effort required to develop and/or obtain
   – the page content
   – the unique non-textual elements
   – the externally sourced elements
   – the customised infrastructure components
   – the CHARISMATEK website includes
     • 29 graphics files
     • 5 PDF files
     • 12 auto generated HTML files
     • 5 ZIP files
   – the effort to construct and/or obtain these elements must be individually assessed
Static Web-Sites
Simple User Interaction

- Static web-sites that consist predominantly of hard-coded HTML pages will often contain a small number of pages that implement simple interactive user functionality
  - search on-line collections
  - maintain simple bulletin boards
  - gather basic information
Simple User Interaction

http://www.ifpug.org/home/docs/cfpssearch.html

IFPUG has recognized a need to provide the names of current Certified Function Point Specialists without disclosing their confidential membership information.

Please visit the Members Only Search for complete contact information.

On-line search of the IFPUG certified function point specialist database displays any entries matching the user's search item.

Updated: November 1, 1999
On-line guestbook allows the user’s details and a message to be recorded and allows previous messages to be viewed.
Static Web-Sites
Simple User Interaction

• FSM can be used to determine the delivered size and delivery effort of the interactive user functionality.

• If the interactive functionality corresponds to only a small proportion of a web-site, however, it may still be preferable to use the alternative web sizing metrics, such as web-points, to assess the delivered size and delivery effort.
Static Web-Sites
Information System Structured Web-Sites

- Although implemented as a set of hard-coded HTML pages, a static web-site’s structure may reflect aspects of a typical information system application (or a dynamic web-site)
  - menus for navigation
  - inquiries showing lists of items of particular types
  - inquiries showing details of a particular type of item
  - simple interactive functionality
Static Web-Sites
Information System Structured Web-Sites

- Why are information system structured web-sites implemented using static HTML pages and not as dynamic web-sites?
  - small quantity of data
  - non-volatile data
  - developers lack familiarity with more sophisticated web technologies
  - web-sites are developed by non-IT professionals, without experience and skill using traditional IT techniques
Information System Structured Web-Sites

http://www.ifpug.org/home/docs/ac99presentations.html

1999 Annual Conference Presentations

This is a downloadable PowerPoint 97 file (size: 1.85 MB) as presented at the 1999 IFPUG Annual Conference.

"What's New, An Update on IFPUG and Function Points" by Carol Dekkers and Dr. Patricia McPhee

This is a downloadable PowerPoint 97 file (size: 217 K) as presented at the 1999 IFPUG Annual Conference.

"Beyond CPM 4.1
CPC 1999-2000 Projects"

The HTML page structure reflects an inquiry displaying all the conference presentation items.

The static HTML page adequately displays the small number of non-volatile items.

Updated: November 16, 1999
Static Web-Sites
Information System Structured Web-Sites

• FSM can be applied to information system structured web-sites and a delivered size determined
  – identify transactions and data as if the HTML pages were generated dynamically and not hard-coded

• Utilising FSM to determine a functional size can be particularly useful when an expected increase in data volume or volatility makes conversion to a dynamic web-site necessary and/or economical
The HTML page structure reflects an inquiry displaying CHARISMATEK’s papers available online.

The likelihood of a larger quantity and increased volatility of the displayed data in the future, may make the conversion to a dynamic web-site both necessary and economical, and therefore sizing by FSM useful.
Example

- the CHARISMATEK website can be assessed using function point analysis to identify its logical transactions and logical files and determine its functional size

- determining development and enhancement effort must consider environmental issues particular to web-based development
Conclusion
Conclusion

• FSM can be effectively and usefully applied to
  – web-based applications
  – web-interfaces to existing applications
  – dynamic web-sites

• In all these cases, the web serves as a new type of user interface through which to deliver the types of functionality that are typically delivered by various traditional types of application
Conclusion

• FSM can be effectively and usefully applied to static web-sites in cases where
  – changes to a web-site predominantly correspond to changes in the functionality offered by the web-site e.g. *inquiring on a new type of product* or *adding a user’s email details to a mailing list*
  – an increase in the volume of data or the requirement for dynamic data makes it necessary and/or economical to move from a static to a dynamic web-site

• These situations are most likely to occur when a static web-site’s structure closely matches that of an information system
Conclusion

• Alternative web sizing metrics, such as web-points, addressing the number and complexity of the HTML pages that comprise the web-site, are more useful for sizing static web-sites where
  – a web-site’s structure does not closely match that of an information system
  – changes to a web-site predominantly correspond to changes to the pages’ contents e.g. updating the contents of an on-line article or adding a series of graphics to improve the aesthetics of a homepage

• (Web-points can, in fact, be effectively applied to assess the size and effort required to deliver any static web-site!)
Conclusion

Important

• When assessing the effort to deliver any web-based development, it is always necessary to consider the effort to construct and/or obtain any non-textual or externally sourced elements used within the web-site!