

Documentation with Doxygen and DocBook

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January 30, 2014

Topics

- Documentation is Essential
- Doxygen
- DocBook
- Questions

Documentation is Essential

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Essential for Your Own Sanity

- People are burdened with multiple tasks and projects, often meaning you will be an expert in none of them.
- Will you remember what you did, why you did it and how it works? For how long will you remember it?
- Are you going to distribute your work? Good documentation can lower your support load.

Essential for Others

- So your coworkers don't curse your name when they have to support your stuff when:
 - you are on vacation or you have to tend to an urgent situation
 - you get hit by the proverbial bus...
 - they need to modify it
- So end users have a chance to use your magnum opus without cursing (too much)...

Essential for Tasks

- Installation
- Configuration
- Monitoring
- Use
- Problem identification and correction
- Maintenance and modification

Code Comprehension

- Writing code usually consumes only a smaller portion of your time. Supporting that code is often a longer term, but sporadic, task.
- The next three slides help illustrate the effect different types of documentation, or the lack thereof, can have on code comprehension.

The Really, Really Ugly

```
I n t,e,l[80186],*E,m,u,L,a,T,o,r[1<<21],X,*Y,b,Q=0,R=0;I
Z*i,M,p,q=3;I*localtime(),f,S,kb=0,h,W,U,c,g,d,V,A;N,O,P=983040,j[5];SDL_Surface*k=0;i(K,P+(L?2*o:2*o+o/4&7))i(D,r[a(I)E[259+4*o
+0])i(w,i[o]+~(-2*47[E])*~L)i(v,(z((f^=S^N)&16),G(N-S&&1&(40[E]^f>>C-1)))J(){V=61442;$;0--;)V+=40[E+0]<<D(25);}i(H,
(46[u=76,J(),T(V),T(9[i]),T(M),M(P+18,=,4*o+2),R(M,=, r[4*o]),E]=0))s(o){$;0--;)40[E+0]=1&&1<<D(25)&o;}i(BP,
(*i+=262*o*z(F((E&15)>9[42[E])),*E&=15))i(SP,(w(7),R&&-1[i]&&o?R++ ,Q&&Q++ ,M--:0))DX(){$,0*=27840;0--;)0[(I*)k->pixels]=--!(1<<7-0
%8&r[0/2880*90+0%720/8+(88+952[l]/128*4+0/720%4<<13)];SDL_Flip(k);}main(BX,nE)n**nE;{9[i=E+r+P]=P>>4;$;q;}j[--q]=++nE?
open(*nE,32898):0;read(2[a(I)*i=*j?lseek(*j,0,2)>>9:0,j],E+(M=256),P);$;Y=r+16*9[i]
+M,Y-r;Q|R|kb&46[E]&&KB)--64[T=1[0=32[L=(X=*Y&7)&1,o=X/2&1,l]=0,t=(c=y)&7,a=c/8&7,Y]>>6,g=~T?y:(n)y,d=BX=y,l,!T*t-6&T-2?T-1?d=g:0:
(d=y),Q&&Q-- ,R&&R--x(0=*Y,0=u=D(51),e=D(8),m=D(14)_0=*Y/2&7,M+=(n)c*(L^(D(m)[E]|D(22)[E]|D(23)[E]^D(24)[E]))_L=*Y&8,R(K(X)[r],=,c)_
L=e+3,o=0,a=X x a=m _T(X[i])_A(X[i])_a<2?M(U,+=1-2*a+,P+24),v(f=1),G(S+1-a==1<<C-1),u=u&4?19:57:a-6?
CX+2,a-3|T(9[i]),a&2&T(M),a&1&M(P+18,=,U+2),R(M,=,U[r]),u=67:T(h[r])_ (W=U B u=m,M--L,R(W[r],&d)B 0 B L(==)B
L(=),S=0,u=22,F(N>S)B L?c(I Z,i):c(I/**/n,E)B L?c(Z,i):c(n,E)B L?V(I Z,I,i):V(I n,I Z,E)B L?V(Z,int,i):V(n,Z,E))_+
+e,h=P,d=c,T=3,a=m,M--++e,13[W=h,i]=(o)!=L)?(n)d:d,U=P+26,M--!o,u=17+(m=a)_ (a=m B L(=))_F(N<S)B L(|=)B e(+)B e(-)B L(&=)B
L(=),F(N>S)B L(^=)B L(-),F(N>S)B L(=))_!L?L=a+8 x L(=):!o?Q=1,R(r[p=m x V],=,h):A(h[r])_T=a=0,t=6,g=c x M(U,=,W)_ (A=h(h[r]),V=m?+
+M,(n)g:o?31&2[E]:1)&&(a<4?V%=a/2+C,R(A,=,h[r]):0,a&1?R(h[r],>=,V):R(h[r],<=,V),a>3?u=19:0,a<5?0:F(S>>V-1&1)B R(h[r],
+ ,A>>C-V),G(h(N)^F(N&1)B A&=(1<<V)-1,R(h[r],+ ,A<<C-V),G(h(N*2)^F(h(N)))B R(h[r],+ ,(40[E]<<V-1)+ ,A>>1+C-V),G(h(N)^F(A&1<<C-V))B
R(h[r],+ ,(40[E]<<C-V)+ ,A<<1+C-V),F(A&1<<V-1),G(h(N)^h(N*2))B G(h(N)^F(h(S<<V-1)))B G(h(S))B 0 B V<C|F(A),G(0),R(h[r],
+ ,A*~((1<<C)-1>>V))_ (V=!-1[a=X,i]B V&=!m[E]B V&=m[E]B 0 B V=!+1[i]),M+=V*(n)c _M+=3-o,L?0:o?9[M=0,i]=BX:T(M),M+=o*L?(n)c:c _
M(U,&W)_L=e+8,W=P,U=K(X)_!R|1[i]?M(m<2?u(8,7,):P,=,m&1?P:u(Q?p:11,6,)),m&1|w(6),m&2|SP(1):0_!R|1[i]?M(m?P:u(Q?
p:11,6,)- ,u(8,7,)),43[u=92,E]=!N,F(N>S),m|w(6),SP(!N==b):0 _o=L,A(M),m&A(9[i]),m&2?s(A(V)):o|(4[i]+c)_R(U[r],=,d)_
986[l]^9,R(*E,=,l[m?2[i]:(n)c])_R(l[m?2[i]:(n)c],=*E)_R=2,b=L,Q&&Q++_W-U?L(^=),M(U,^=,W),L(^=):0 _T(m[i])_A(m[i])_
Q=2,p=m,R&&R++_L=0,O=*E,F(D(m+=3*42[E]+6*40[E]),z(D(1+m)),N=*E=D(m-1)_N=BP(m-1)_1[E]=~h(*E)_2[i]=~h(*i)_
9[T(9[i]),T(M+5),i]=BX,M=c _J(),T(V)_s(A(V))_J(),s((V&~m)+1[E])_J(),1[E]=V _L=o=1 x L(=),M(P+m,=,h+2)_+M,H(3)_M+=2,H(c&m)_+
+M,m[E]&&H(4)_ (c&=m)?1[E]=*E/c,N=*E%=c:H(0)_*i=N+m&E[L=0]+c*1[E]_*E=-m[E]_*E=r[u(Q?p:m,3,*E+)]_m[E]^=1 _E[m/2]=m&1 _R(*E,&c)_ (a=c
B write(1,E,1)B time(j+3),memcpy(r+u(8,3,),localtime(j+3),m)),a<2?*E=~lseek(0=4[E][j],a(I)5[i]<<9,0)?(a?write:read)
(0,r+u(8,3,))*i:0:0),0=u,D(16)?v(0):D(17)&&G(F(0)),CX*D(20)+D(18)-D(19)*~!!L,D(15)?0=m=N,41[43[44[E]=h(N),E]=!N,E]=D(50):0,!+q?
kb=1,*l?SDL_PumpEvents(),k=k?k:SDL_SetVideoMode(720,348,32,0),DX():k?SDL_Quit(),k=0:0:0;}i(F,40[E]=!o)i(z,42[E]=!o)i(G,48[E]=o)
```

Excerpt from cable3.c, author Adrian Cable (Creative Commons Attribution-ShareAlike 3.0 Unported License).

A 1980s era PC emulator in 4043 bytes — One of the IOCCC 2013 winners!

Not Documented

```
void
globus_i_gfs_data_brain_ready(
    void *          user_arg)
{
    void *          arg;
    globus_list_t * list;

    globus_mutex_lock(&gfs_i_data_brain_mutex);
    {
        gfs_i_data_brain_ready = GLOBUS_TRUE;
        list = gfs_i_data_brain_ready_list;
        gfs_i_data_brain_ready_list = NULL;
    }
    globus_mutex_unlock(&gfs_i_data_brain_mutex);

    while(!globus_list_empty(list))
    {
        arg = globus_list_remove(&list, list);

        globus_i_gfs_data_brain_ready_delay_cb(arg);
    }
}
```

Excerpt from `globus_i_gfs_data.c`, part of the Globus Toolkit GridFTP server, © 1999-2006 University of Chicago (Apache License 2.0).

Doxygenated

```
/*!
 * @brief Implement initialization is acquisition for read locks.
 *
 * Provides exception safe lock acquisition and release for RWLocked objects.
 * Ensures the lock is released when the enclosing scope exits, regardless
 * if this happens by exception or a return/break.
 */
class ReadSentry
{
private:
    RWLocked&    lock;

public:
    //!@name Constructors
    //!@{
    ReadSentry() = delete;
    ReadSentry(const ReadSentry&) = delete;
    ReadSentry(ReadSentry&&) = delete;

    /*!
     * @brief Constructor.
     *
     * Acquires the lock.
     *
     * @param[in] l The Locked object.
     */
};
```

Excerpt from locking.h, part of the HSS libutils C++ library, © 2013 UCAR

Doxygen

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Doxygen

- www.doxygen.org
- Written by Dimitri van Heesch and additional contributors.
- Current version (Dec 2013) is 1.8.6
- Runs on Linux, OS X, Unix and Windows
- Supports C, C++, C#, Fortran, Java, Objective-C, PHP, Python, Tcl, VHDL, some IDL flavors and, to some extent, D.

Doxygen Advantages

- The documentation is embedded in the source code, making it harder to lose, and immediately accessible to persons reading that code.
- Doxygen parses the source code and can warn you when documentation is missing for code constructs or when they are out of sync.
- Doxygen takes care of most of the grunt work to produce attractive and usable documentation.
- Integrates easily with make, etc.

Doxygen Work Flow

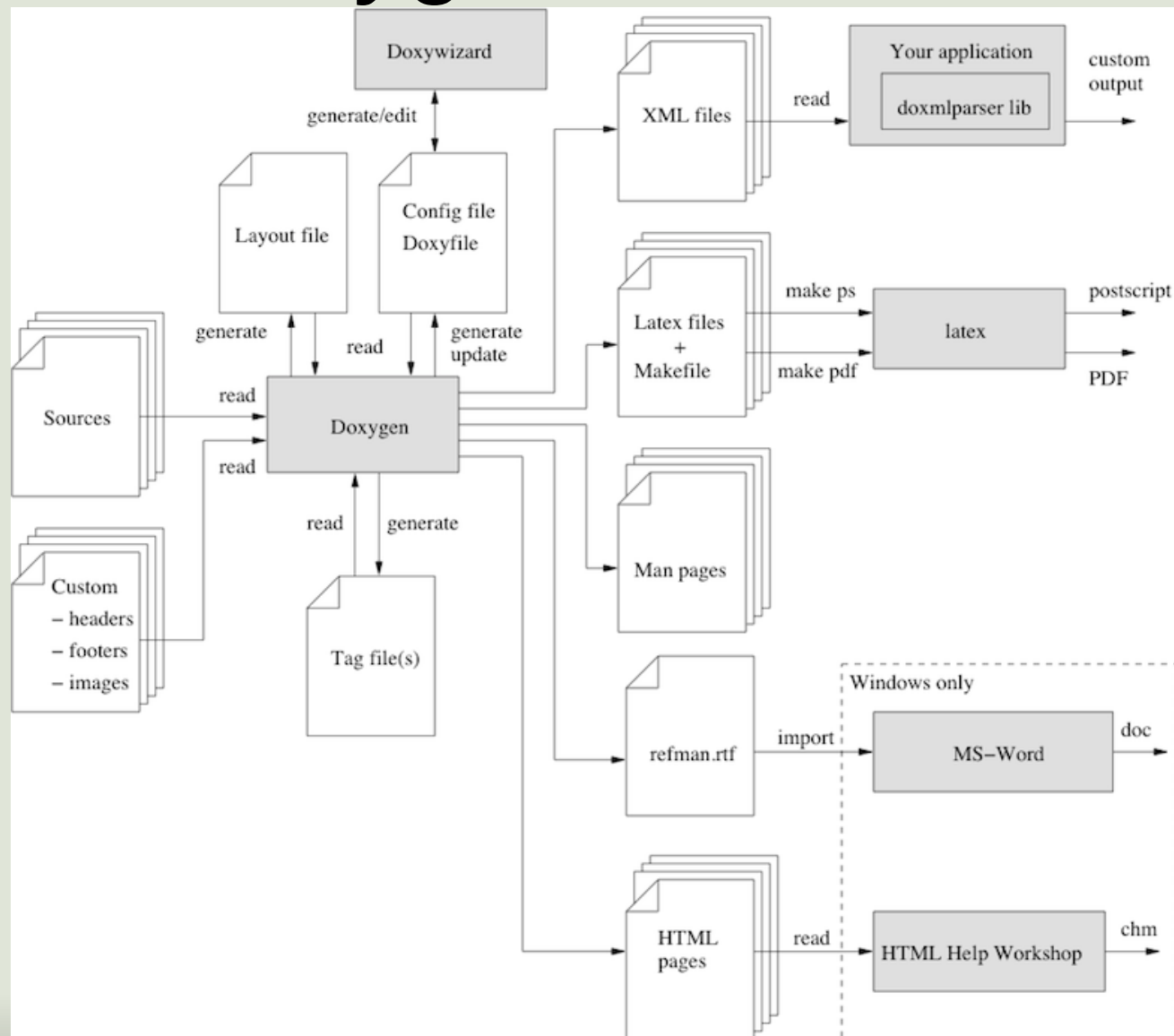


Figure 3.1 from the Doxygen User Manual © 1997-2013 Dimitri van Heesch (GPL)

Doxygen Inputs

- Text configuration file(s):
 - Option settings
 - Output format enables
 - Local customizations
- Source code embedded comments (including optional HTML tags and entities)
- External text files and images
- Doxygen tag files referencing another component's Doxygen documentation.

Doxygen Output Formats

- HTML, LaTeX, man pages, RTF, XML, DocBook
- Indirect support for:
 - Compiled HTML Help (aka Windows 98 Help)
 - Qt Compressed Help
 - Eclipse Help
 - XCode DocSets
 - PostScript
 - PDF

Doxygen HTML Output

- The most popular output format according to the Doxygen web site.
- The look is easily customizable using CSS.
- Automatically generated hyperlinks makes navigation easy.
- Examples (external to this slide set)

DocBook

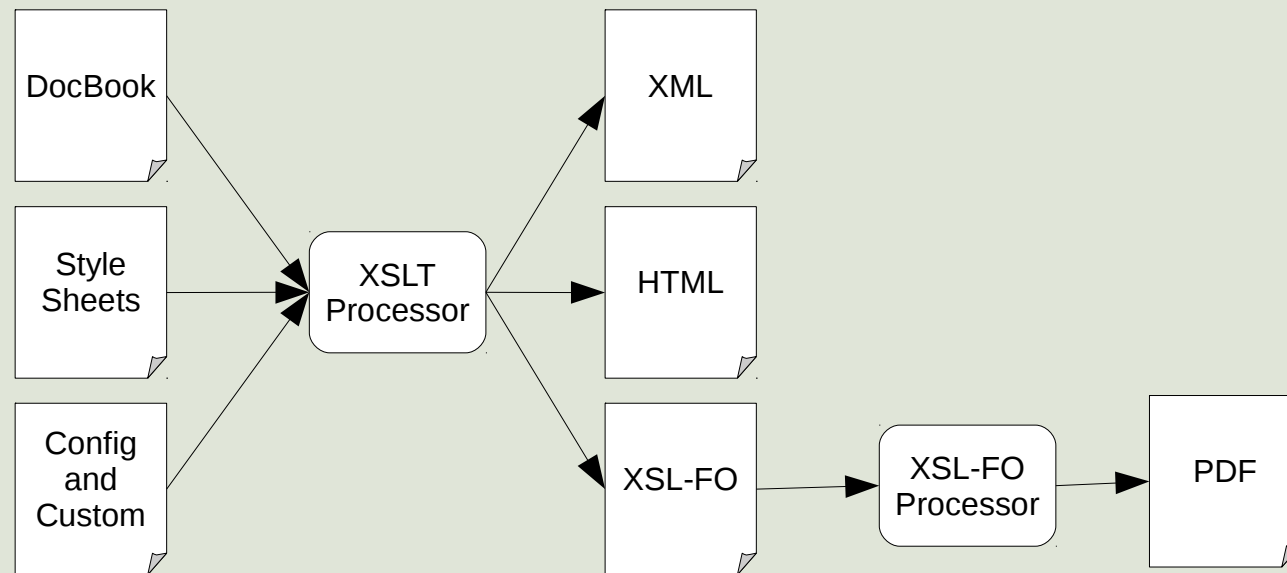
DocBook

- DocBook is an XML based semantic markup language for technical documentation.
- Current version is 5.0.
- Specification is maintained by the Organization for the Advancement of Structured Information Standards (OASIS).

DocBook vs WYSIWYG

- DocBook has a higher learning curve.
- DocBook source files focus on **content and semantic meaning**, not presentation.
- DocBook is not a single application – it requires a tool set to produce output. i.e.:
 - Repeat: (edit / make / review output)
- WYSIWYG tools often get in your way and obscure semantic meaning.

DocBook Workflow



Getting Started with DocBook

- You really should acquire these books:
 - DocBook 5: The Definitive Guide
 - How to create DocBook source files
 - DocBook XSL: The Complete Guide
 - How to convert DocBook files to other formats
- Install a tool set:
 - Available packages for your favorite distribution
 - Do it your self (my “how to” notes at SEA web site)
 - Use the XML mode of \$EDITOR

Sample DocBook Toolset

- Your favorite \$EDITOR
- Saxon 6.5.5 XSLT processor
- DocBook XSL 1.78.1 style sheets
- Apache FOP 1.1 XSL-FO processor
- Jing 20091111 schema validator
- make

DocBook Inputs

- XML/XSL text files:
 - Configuration and customizations
 - Document content
 - Custom DocBook schema extensions
 - Custom output format style sheets
- External files and images

DocBook Output Formats

- Produce multiple output formats from a single source by using different XSL style sheets or other post processors:
 - XML
 - HTML
 - XSL-FO (postprocess this to PDF)
 - man pages
 - texinfo
 - custom

DocBook Hints

- Use XML entities (macros) for:
 - reducing the amount of typing you have to do
 - hide the verbosity of XML tagging
 - document wide changes can be made in one location
 - keep one copy of content that is repeated in multiple places
- Conditional text allows one source to produce variant content output (i.e. for different OS targets).
- Split larger documents into parts by making use of XML Inclusions.
- Use a schema validator to verify document consistency

DocBook Useful Links

- Schema: <http://docs.oasis-open.org/docbook/specs/docbook-5.0-spec.html>
- DocBook 5: The Definitive Guide: <http://docbook.org/tdg5/index.html>
- The DocBook Project: <http://docbook.sourceforge.net/>
- DocBook XSL: The Complete Guide: <http://www.sagehill.net/docbookxsl/index.html>
- Apache FOP: <http://xmlgraphics.apache.org/fop/>
- Saxon XSLT Processor: <http://saxon.sourceforge.net/>
- XML spec: <http://www.w3.org/TR/2008/REC-xml-20081126/>
- XSL spec: <http://www.w3.org/TR/2001/REC-xsl-20011015/Overview.html#contents>
- XSLT spec: <http://www.w3.org/TR/xslt>
- docbook2x (docbook2man): <http://docbook2x.sourceforge.net/>
- HOWTO DocBook tool chain on Linux:
<http://sea.ucar.edu/event/documentation-doxygen-and-docbook>