

# Analyzing Software Licenses in Open Architecture Software Systems



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June 5, 2009

# More and more systems...



- ... are composed of components from many sources
- ... under a variety of licenses (some of which may conflict)
- ... and evolving by component replacement not development

# Unity Software

- Integrates multiple third party libraries
  - The Mono Class Library, Copyright © 2005 - 2008 Novell, Inc.
  - The Mono Runtime Libraries, Copyright © 2005 - 2008 Novell, Inc.
  - Boo, Copyright © 2003 - 2008 Rodrigo B. Oliveira
  - UnityScript, Copyright © 2005 - 2008 Rodrigo B. Oliveira
  - OpenAL cross platform audio library, Copyright © 1999 - 2006 by authors.
  - PhysX physics library. Copyright © 2003-2008 by Ageia Technologies, Inc.
  - libvorbis. Copyright (c) 2002-2007 Xiph.org Foundation
  - libtheora. Copyright (c) 2002-2007 Xiph.org Foundation
  - zlib general purpose compression library. Copyright (c) 1995-2005 Jean-loup Gailly and Mark Adler
  - libpng PNG reference library
  - jpeglib JPEG library. Copyright (C) 1991-1998, Thomas G. Lane.
  - Twilight Prophecy SDK, a multi-platform development system for virtual reality and multimedia. Copyright © 1997 - 2003 Twilight 3D Finland Oy Ltd
  - dynamic\_bitset, Copyright © Chuck Allison and Jeremy Siek 2001 - 2002.
  - The Mono C# Compiler and Tools, Copyright © 2005 - 2008 Novell, Inc.
  - libcurl. Copyright (c) 1996 - 2008, Daniel Stenberg <daniel@haxx.se>.
  - PostgreSQL Database Management System (formerly known as Postgres, then as Postgres95)
  - FreeType. Copyright (c) 2007 The FreeType Project (www.freetype.org).
  - NVIDIA Cg. Copyright (c) 2002-2008 NVIDIA Corp.

# Challenges to license analysis



- Licenses
  - Numerous license types, variants, versions
  - Incomplete
  - Hard to understand
  - Legally binding
- License analysis
  - May be intractable for developers, lawyers, etc.
  - May be constrained by time and resources

Applications Places System

GCTL - Package - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://proxy.arts.uci.edu/gamelab/

Logged in as: walt.scacchi - Slacker: 150 points

## GAME CULTURE & TECHNOLOGY LAB

Mission Events Projects Tools Players Package Docs

English Language

Search Advanced Search

prev - next ...

### Package

**Coming Soon!** An updated version of the GCTL portal software. This open source distribution package is our little gift to those of you who may want to set up a collaboration infrastructure of your own. That's right... believe it or not it's FREE!!!

Here's what the generic version will look like once installed.

**Getting Face-Lifted: 09/15/2008 VCP 1.0**

- MySQL/PHP-based Portal CMS (see the "Docs")
- Wiki (using MediaWiki)
- Weblog (using B2evolution)
- News Feeder (using Gregarius)
- Document Version Control System (using DCM v2.0)
- Teleconference Suite (using Red5 Flash Server and Blab! Lite)
- Search Engine and Crawlbot (using Sphider)

Calendars - Evolution

File Edit View Actions Search Help

New Send / Receive Print Delete Previous Today Next Go To Day

Calendars Monday 12 Jan 2009 Show: Any Category Search: Summary Contains

Google

- Walt Scacchi

On This Computer

- Personal

Contacts

- Birthdays & Annivers...

Monday 12 January

9 am

10 am

11 am

12 pm

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

8 pm

Tasks

Summary

Click to add a task

Memos

Summary

Click to add a memo

January 2009

Mon	Tue	Wed	Thu	Fri	Sat	Sun
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

Mail

Contacts

Calendars

Tasks

Memos

\*OSS-OA-Notes-Jan09.abw

File Edit View Insert Format Tools Table Collaborate Documents Help

Normal Times New Roman 12

### Notes on Open Source Software and Open Architectures

Thomas Alspaugh, Hazel Asuncion, and Walt Scacchi  
January 2009

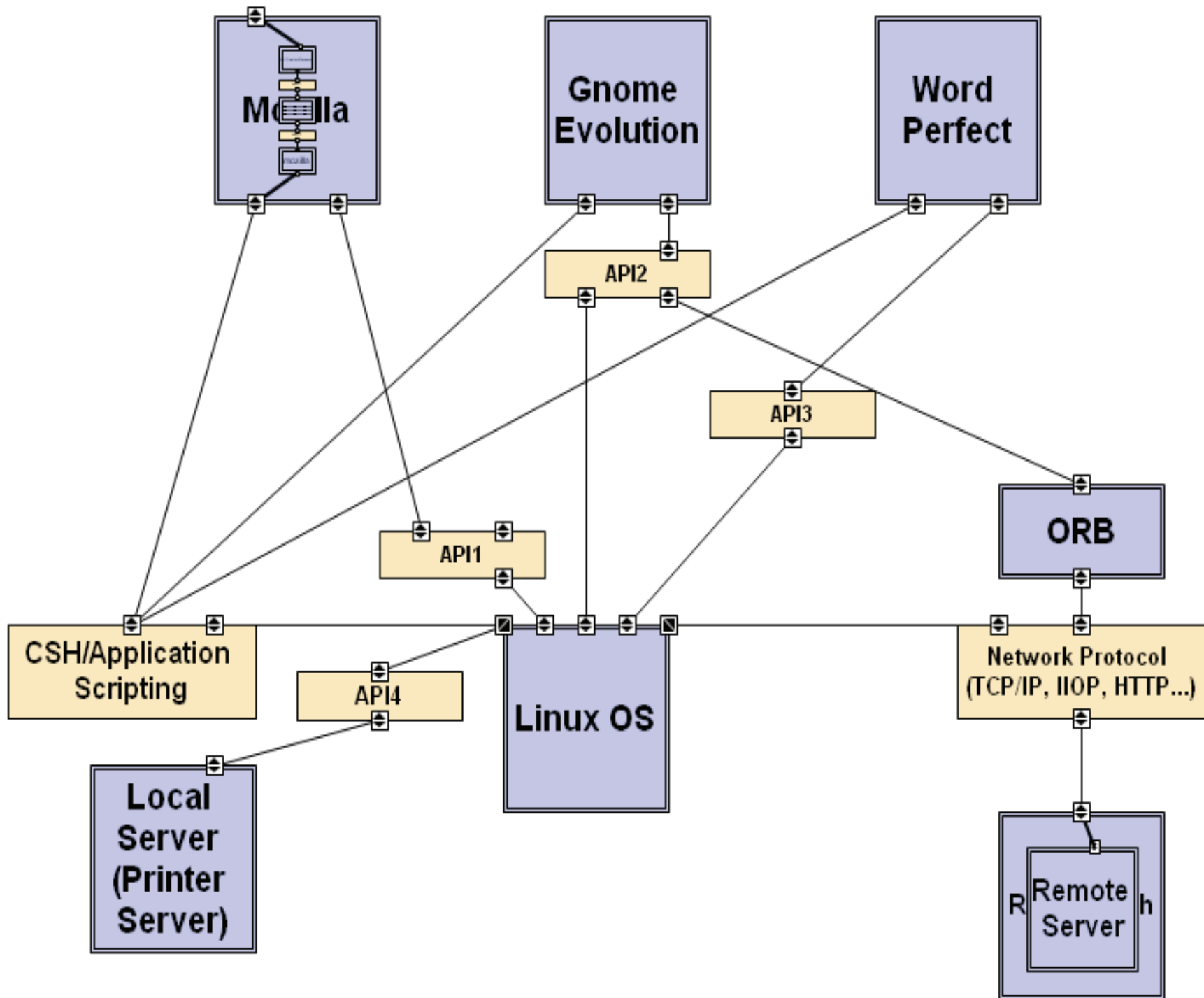
liveuser@localhost:~

File Edit View Terminal Tabs Help

```

ip6tables-multi      pcmcia-socket-startup  vgremove
ip6tables-restore   pidof                  vgrename
ip6tables-save       pivot_root             vgs
ipmaddr              plipconfig             vgscan
iptables             plymouthd              vgsplit
iptables-multi       portrelease            weak-modules
iptables-restore     portreserve            ybind
[liveuser@localhost ~]$ ls
bin  dev  home  lost+found  mnt  proc  sbin  srv  tmp  var
boot  etc  lib  media      opt  root  selinux  sys  usr
[liveuser@localhost ~]$ ls /selinux
access          compat_net      initial_contexts  policyvers
avc             context        load              reject_unknown
booleans       create         member            relabel
checkreqprot   deny_unknown   mls               user
class          disable        null
commit_pending_bools  enforce       policy_capabilities
[liveuser@localhost ~]$

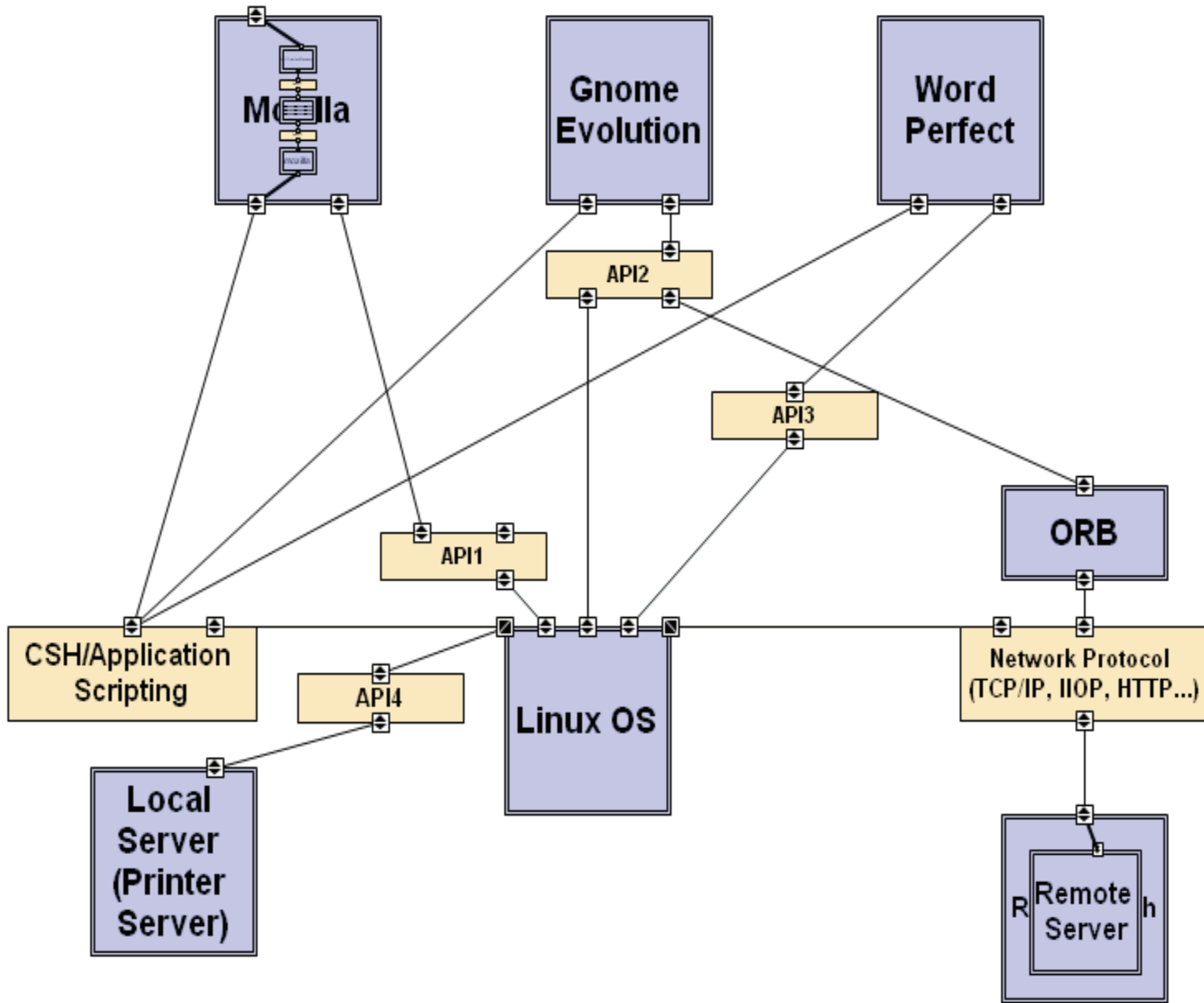
```

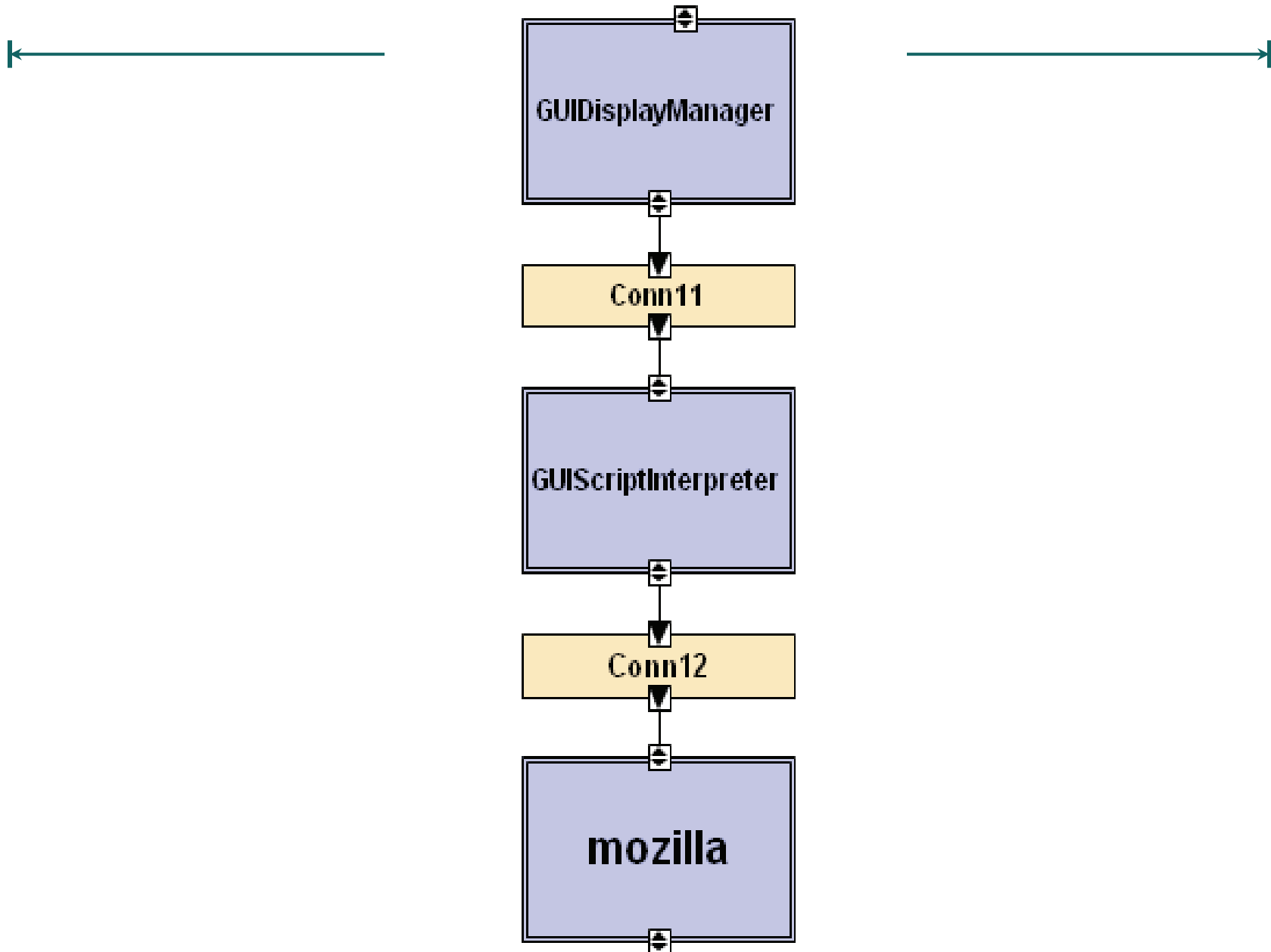












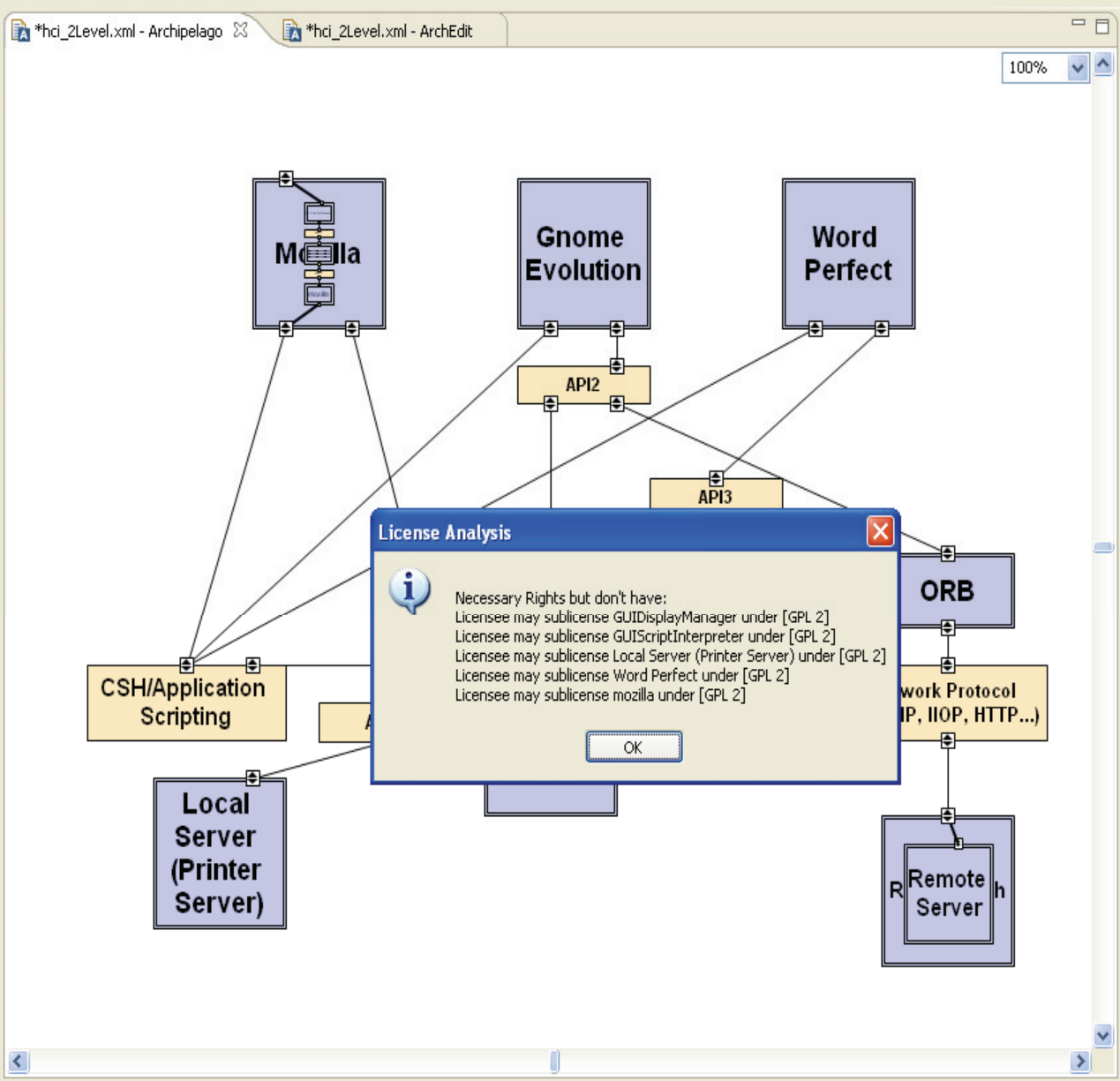






Outline

- /z\_license/hci\_2Level.xr
  - Activity Diagrams
  - Statecharts
  - Structures
    - main
      - MoZilla SubArch
      - RS\_Subarch
  - Types
    - Component Typ
      - MoZillaComp
      - RemoteServ
    - Connector Type
    - Interface Types



**License Analysis**

Necessary Rights but don't have:  
Licensee may sublicense GUIDisplayManager under [GPL 2]  
Licensee may sublicense GUIScriptInterpreter under [GPL 2]  
Licensee may sublicense Local Server (Printer Server) under [GPL 2]  
Licensee may sublicense Word Perfect under [GPL 2]  
Licensee may sublicense mozilla under [GPL 2]

OK

Traceability Variability

**New Tracelink**

Start Recording Recover Manual

**Tracelink Details**

Import Links Export Links

**Tracelink Options**

Trace Analysis License Analysis

Navigator

- HelloWorld2a
- license
  - .project

ArchStudio 4

Point mouse cursor at tool for more detail.



## License Analysis



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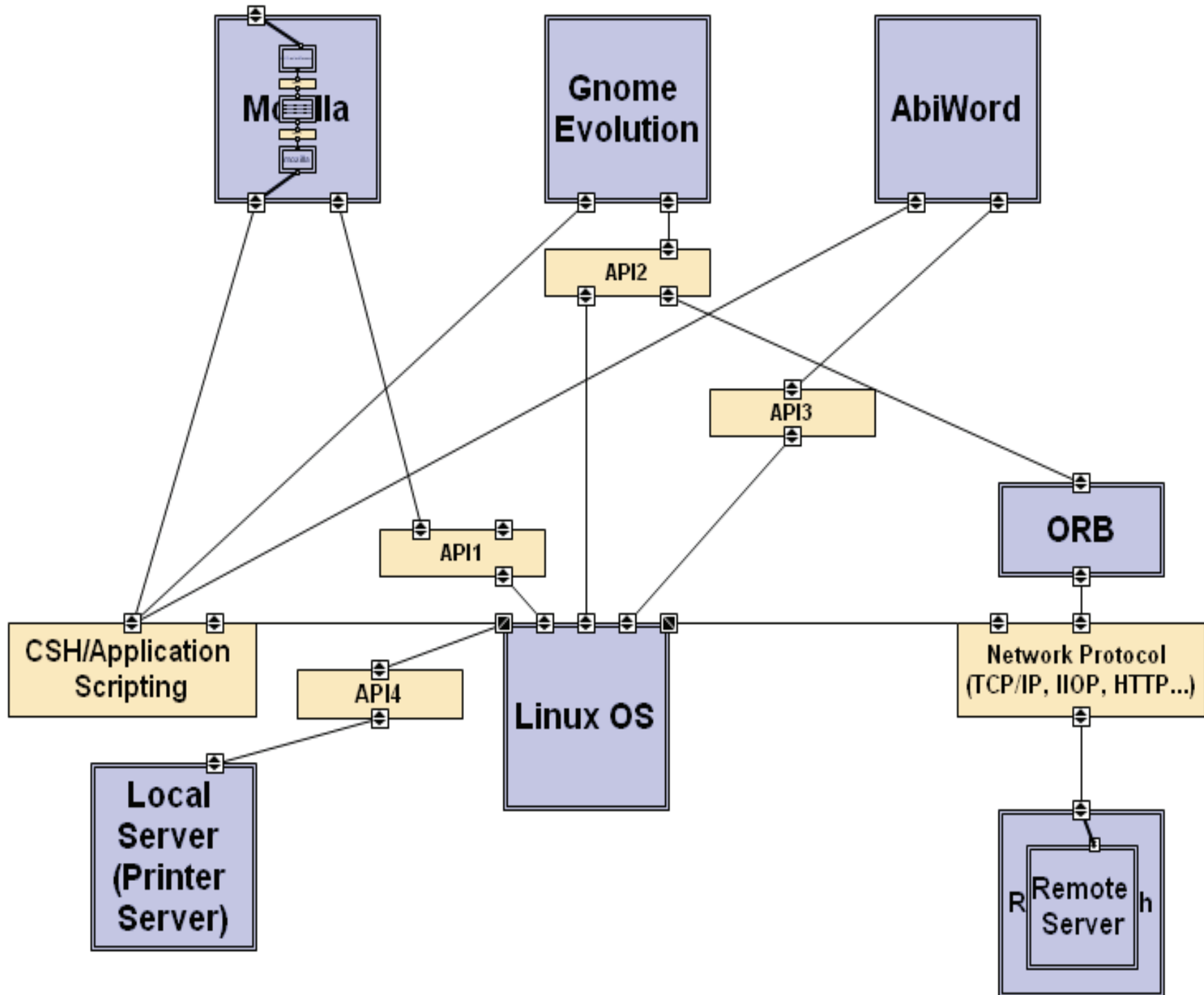
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Licensee may sublicense Word Perfect under [GPL 2]

Licensee may sublicense mozilla under [GPL 2]

OK

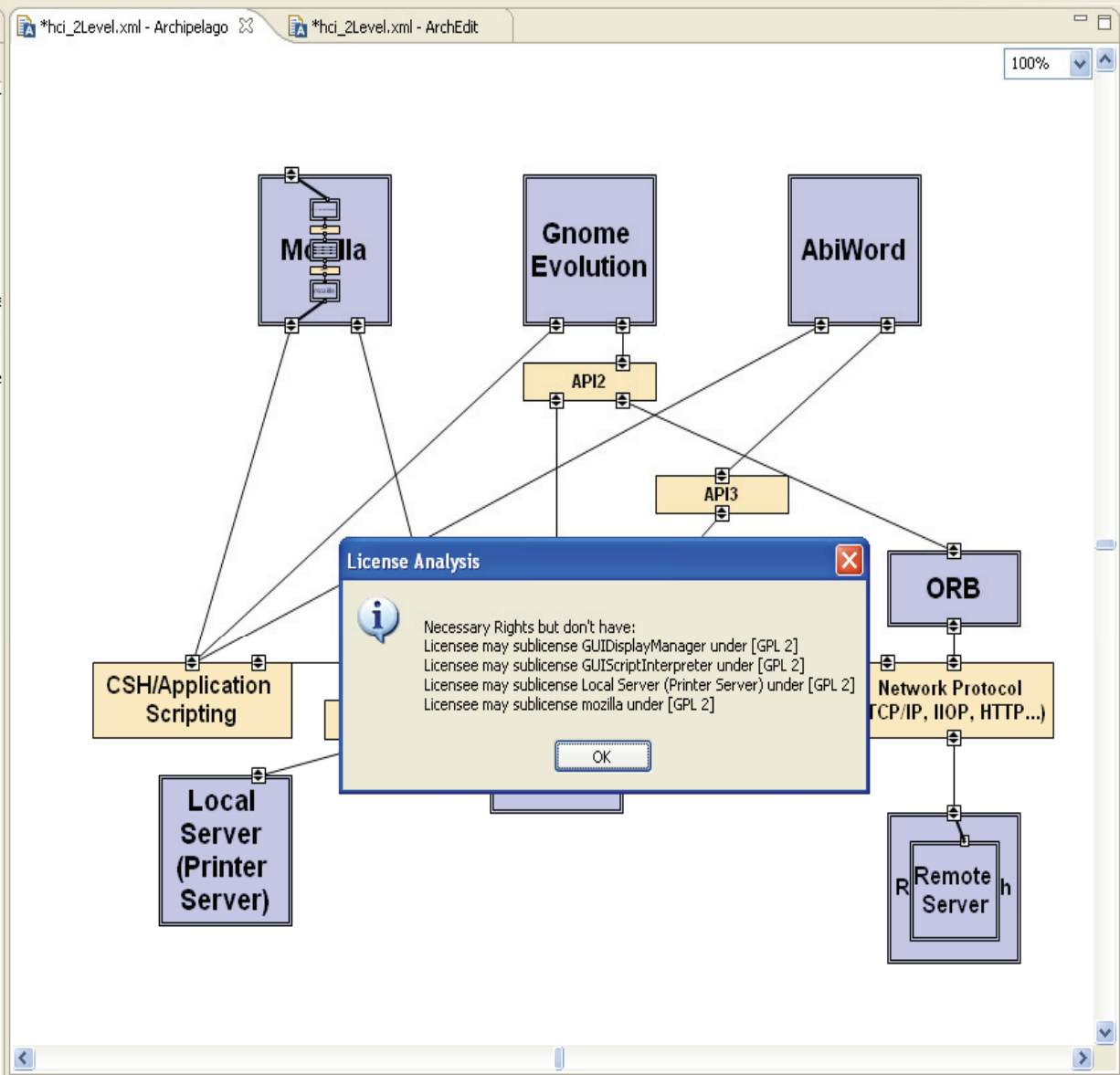






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Trace Analysis License Analysis

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- HelloWorld2a
- license
  - .project
  - hci\_2Level.xml

# ArchStudio 4

Point mouse cursor at tool for more detail.

- AIM Launcher
- ArchEdit
- Archipelago
- Archlight
- Selector
- Type Wrangler



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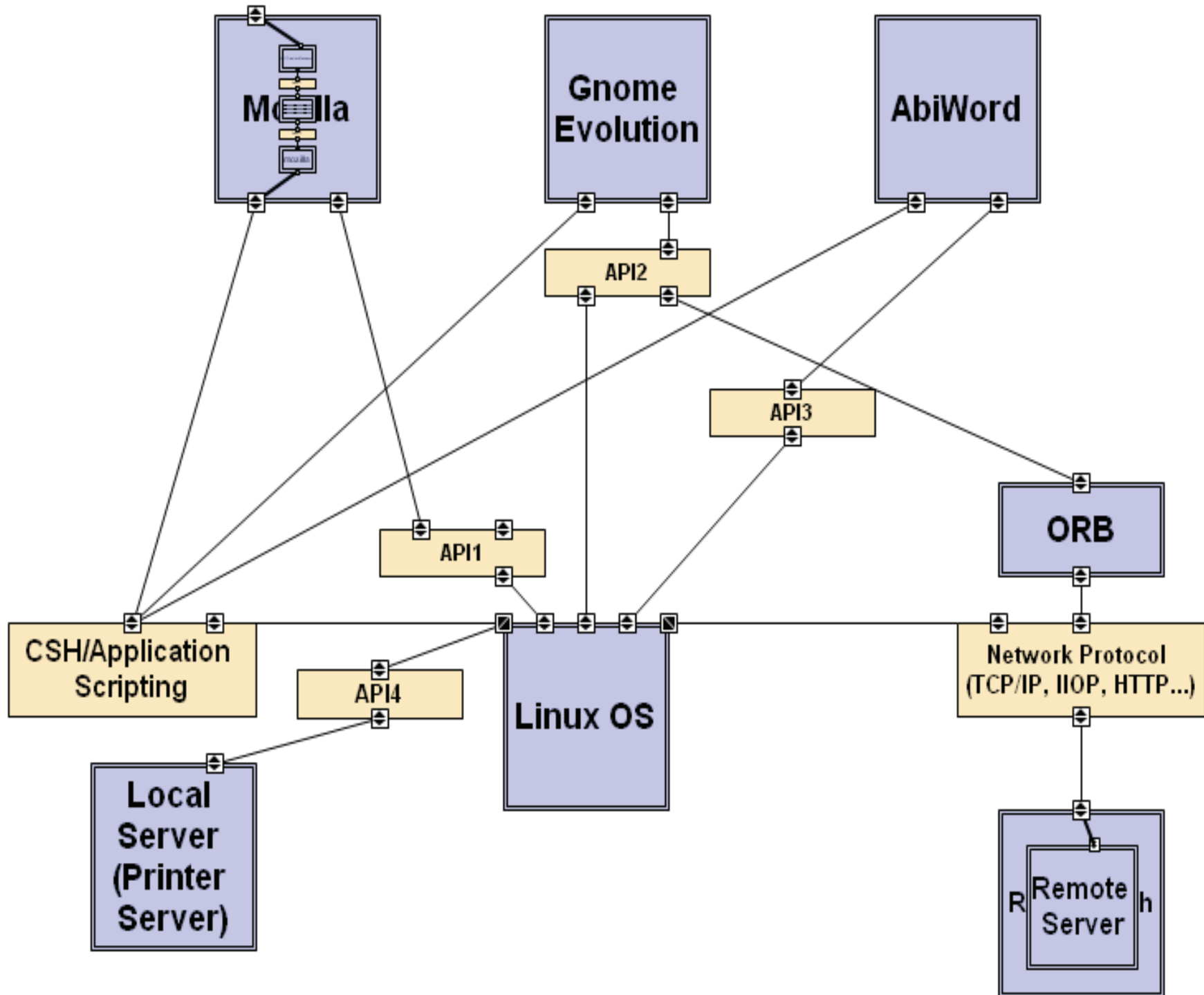
Licensee may sublicense mozilla under [GPL 2]

OK

# License Firewall



- Blocks the propagation of reciprocal licenses
- Layer of connectors that surrounds a substructure
  - Dynamic links
  - Client server connections
  - License shims



File Edit Navigate Search Project Run Window Help



Outline

- [-] XArch
  - [-] ArchAnalysis
  - [-] ArchStructure [main]
  - [-] ArchStructure [Mozilla SubArch]
  - [-] ArchStructure [RS\_Subarch]
    - [-] Component [Remote Server]
      - [-] Description
      - [-] Interface [[New Interface]]
      - [-] License
        - [-] **Licname**
      - [-] Description
  - [-] ArchTypes
    - [-] ComponentType [MozillaComp]
    - [-] ComponentType [RemoteServerComp]
  - [-] LicenseLookup
  - [-] RenderingHints3

hci\_2Level.xml - ArchEdit

ArchEdit *Syntax-Directed Architecture Editor*

## Licname: Description

Name	Value
value	BSD



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OK

# Open Architecture (OA) System



- Open Architecture
  - OSS or proprietary with open API
  - Overall system rights minimally allows use and redistribution
- Topology of components and connectors
- Configured subsystem or system



# Components

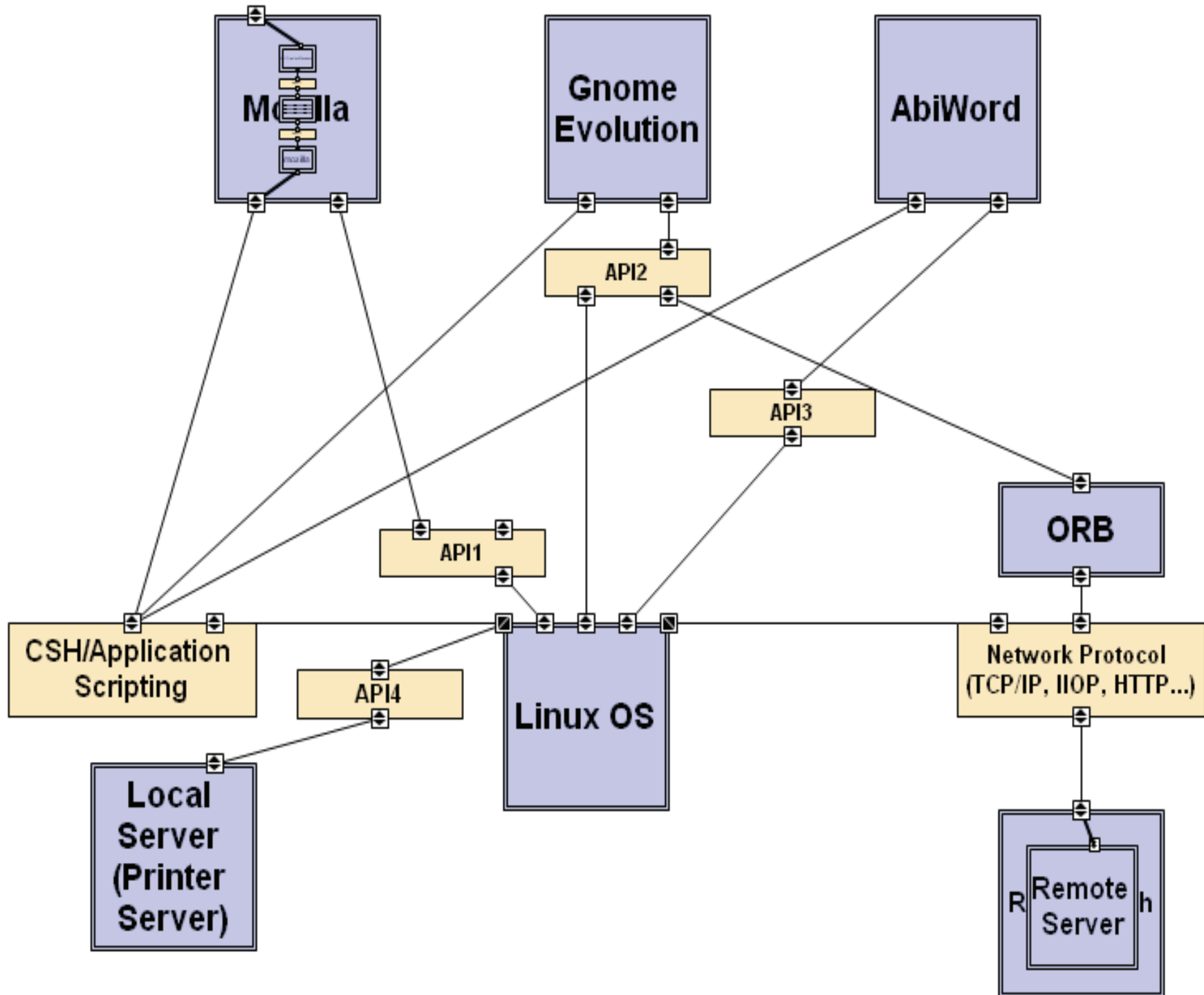


- Software source code components
  - Standalone programs
  - Libraries, frameworks, or middleware
  - Inter-application script code (e.g., for building subsystems)
  - Intra-application script code (e.g., for Rich Internet Apps.)
- Executable software components (binaries)
- Software services

# Connectors



- Communication
  - Application program interfaces (APIs)
  - Network protocols
  - Etc.
  
- License
  - Propagate license
  - Act as a license firewall together with a substructure

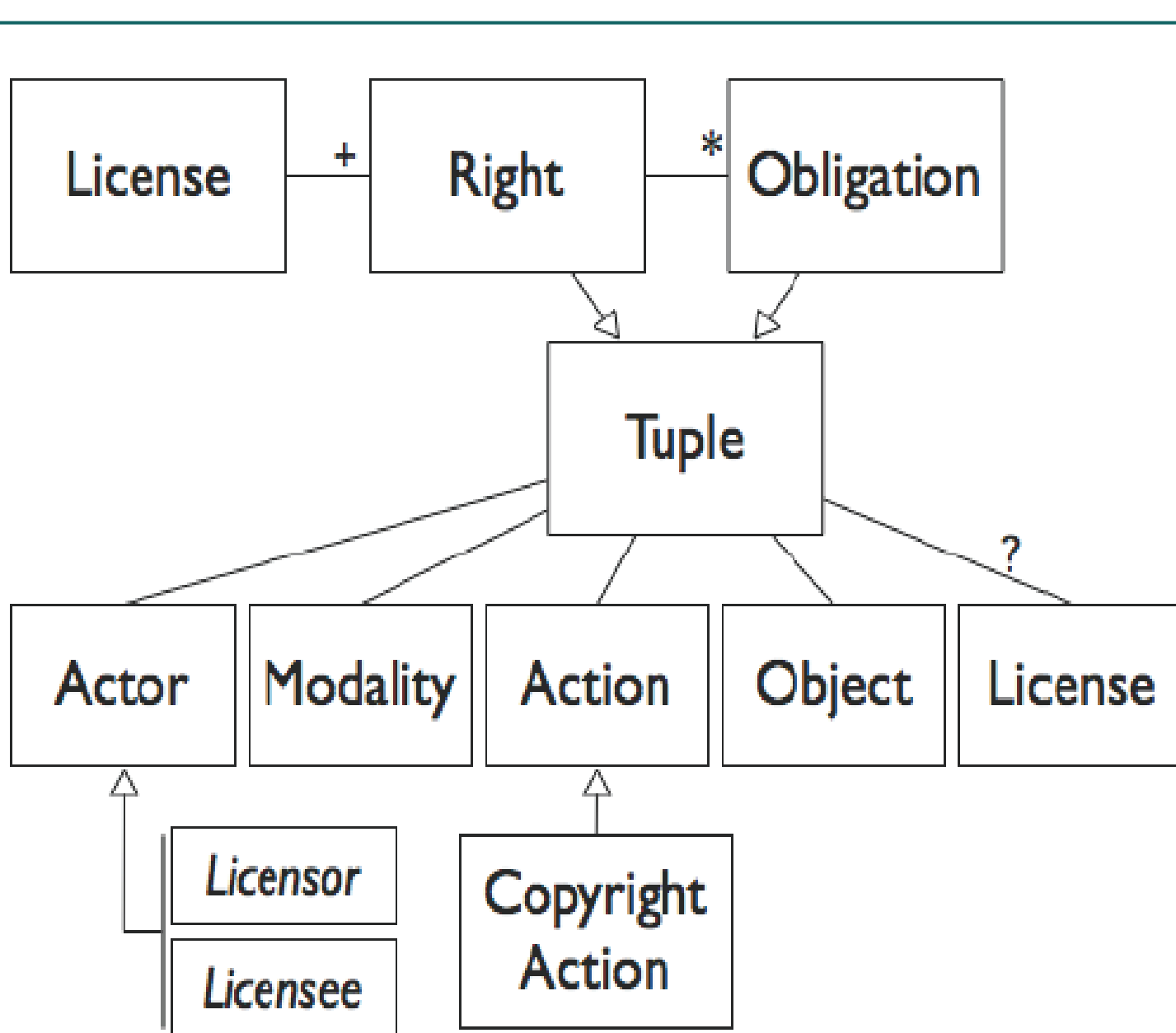


# Different Licenses



- Rights and obligations regarding usage
- GPL (Gnu Public License)
  - Right to access, study, modify, and *reciprocal* obligation to redistribute modified source code
- Mozilla
  - Tri-license for its software like Firefox Web Browser:
- And many others!

# License metamodel



# Rights



- Copyright

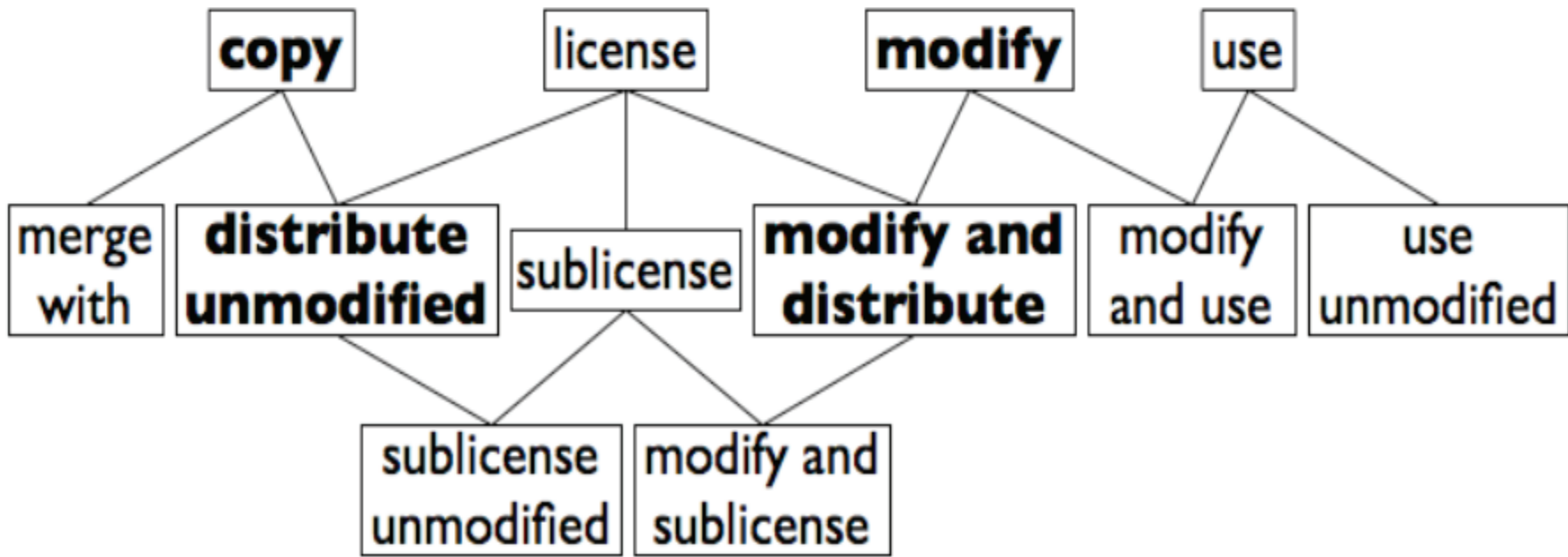
- Author has certain rights: use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies
- Rights may be licensed individually to others
- Obligations

# Obligations



- Pay a fee
- Preserve the copyright and license notices (academic licenses)
- Publish your modified source at no cost (MPL)
- Publish all source code linked with (reciprocal license – GPL)
- Derivative works sublicensed under the same license (GPL, MPL, ...)
- Collective works sublicensed under GPL regardless

# Partial order of copyright actions





# Modality and Object




- Modality
  - Right
    - May or Need Not
  - Obligation
    - Must or Must Not
- Object
  - May be source, component, or other items within scope

# Example license (BSD)



- Right
  - Licensee \* may \* distribute <Any Source> under <This License>
- Obligation
  - Licensee \* must \* retain the [BSD] copyright notice in [file.c]

# Types of License Conflicts

- 
- Unfulfilled correlative rights (or unfulfilled obligations)
    - For each right
      - Go through each obligation
        - Generate correlative right:
          - » Must → may
          - » Must not → need not
        - Check if correlative right exists
  - Right-obligation conflict
  - Obligation-obligation conflict



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OK

# OA Design & License Analysis Environment



- Operational prototype OA design and license environment
- An extension to the *ArchStudio* Architecture Design Environment from UC Irvine
  - <http://www.isr.uci.edu/projects/archstudio/>

# It is possible...



- To automate license analysis
  - Formal specification of licenses
  - Formal description of OA as xADL
- To analyze license interaction at different levels of granularity
  - Substructure level
  - System level
- To analyze license interaction across the different architecture levels
  - System to substructure levels

# Acknowledgements



- Research supported by:
  - Acquisition Research Program at the Naval Postgraduate School
  - Grants #0534771 and #0808783 from the National Science Foundation (NSF)
- No endorsement implied.

# Thank you!



## Questions?