

TimeTable Publisher

Frank Purcell

TriMet

Presented @ GOSCON

October 12, 2006

TRI  MET

Presentation Overview

Brief History of the Project

Introduction to the TimeTable Publisher

Project Status & Learnings

Next Steps?

History

Transit Forum Workshop – October 2005

Origins: Dynamic Timetable Generator

- DTG Chosen as a trial open source project last October
- Polly Okunieff deserves credit for this earlier work

Replaces Legacy System @ TriMet

- Started March 2006. First release September 2006

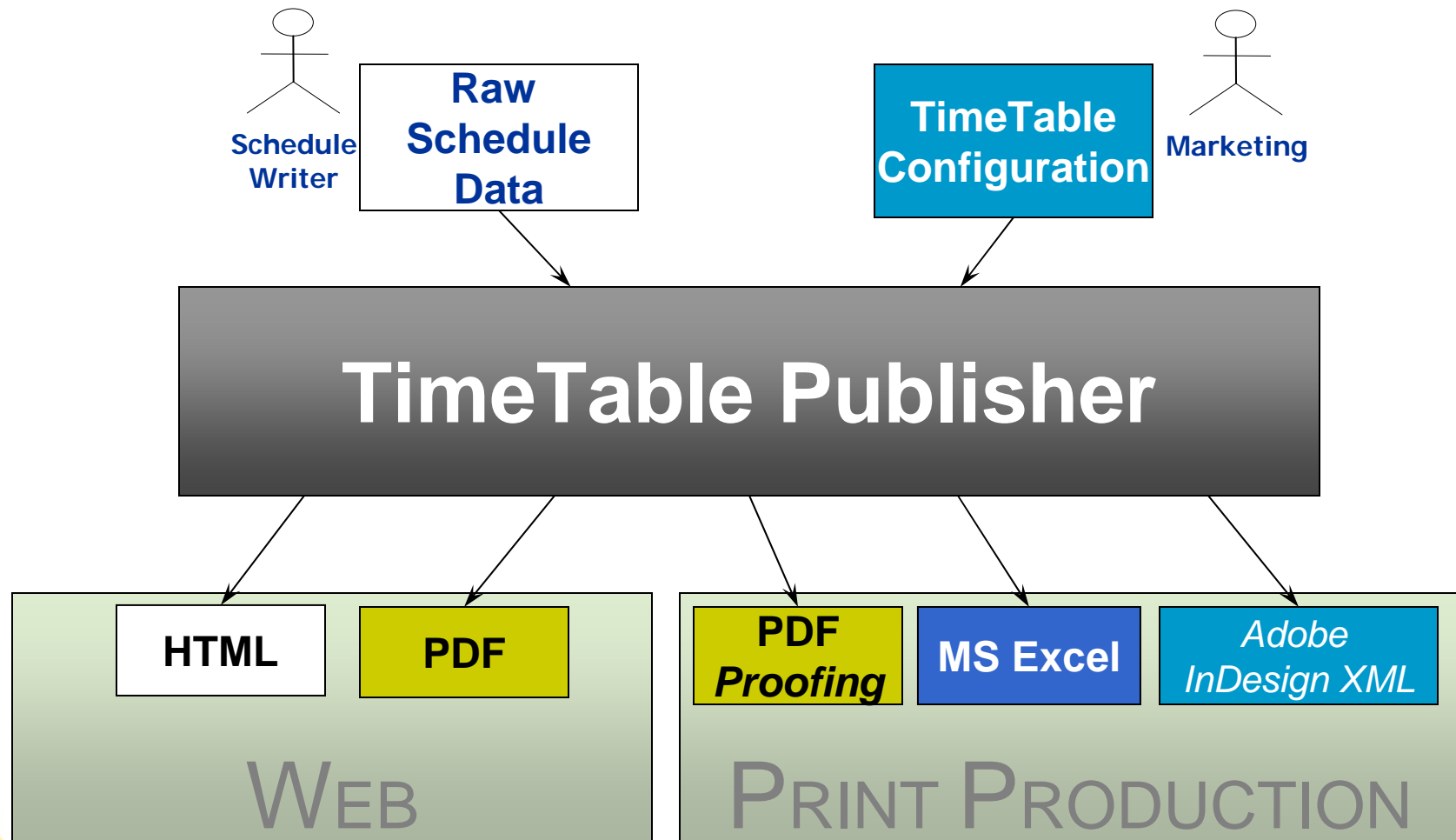
What

System that produces Timetables in various formats.

Raw scheduling data requires preparation for public use that is normally a very tedious and time-consuming manual process for most transit agencies.

The TimeTable Publisher is a single system that takes *raw scheduling* data as input from various sources, and outputs *timetables* into various formats for *public* use.

Information Flow



Screen Shots – Configure & PDF

[Home](#) | [Configure](#) | [Compare](#) | [Print](#) | [View](#) | [Vertical View](#) | [Data](#) | [Stop Level Data](#) | [Mock Data](#) | [WS-](#)

reload configuration revert timepoints bypass configuration (timepoints) update page

MAX Red Line

Service Date (on / after): 1-14-2007 select

Outbound Inbound
 Weekdays Saturday Sunday

Stops heading toward: MAX to Portland International

Merlo & 158th (9828)	Beaverton TC (9821)	Sunset TC (9969)	Washington Park (10120)	Goose Hollow / SW Jefferson (10118)
----------------------	---------------------	------------------	-------------------------	-------------------------------------

MAX Red Line html preview / pdf preview

Weekday MAX to Portland International Airport

Elmonica / SW 170th Ave Stop ID 9830	Merlo & 158th Stop ID 9828	Beaverton TC Stop ID 9821	Sunset TC Stop ID 9969	Washington Park Stop ID 10120	Goose Hollow / SW Jefferson Stop ID 10118	Pioneer Square Stop ID 8334	Old Town / Chinatown Stop ID 8339	Rose Quarter T Stop ID 8340	Hawthorne TC Stop ID 8344	Gateway TC / NE 99th Ave Stop ID 8347	Parkrose / Summer TC Stop ID 10572	Portland International Airport Stop ID 10579
3:27	3:29	3:37	3:43	3:50	4:06	4:11	4:23	4:27	4:34	4:41	4:46	4:54
4:04	4:05	4:13	4:18	4:23	4:38	4:34	4:44	4:51	4:58	5:03	5:11	5:16
4:43	4:43	4:51	4:56	5:01	5:16	5:17	5:27	5:33	5:40	5:45	5:53	5:59
5:16	5:24	5:29	5:34	5:41	5:56	5:52	6:02	6:08	6:15	6:22	6:30	6:36
5:31	5:39	5:44	5:49	5:56	6:11	6:07	6:17	6:23	6:30	6:37	6:45	6:51
5:46	5:54	5:59	6:04	6:11	6:26	6:22	6:32	6:38	6:45	6:52	7:00	7:06
6:07	6:12	6:17	6:22	6:29	6:44	6:40	6:50	6:56	7:03	7:10	7:18	7:24
6:22	6:27	6:32	6:37	6:44	6:59	6:55	7:05	7:11	7:18	7:25	7:33	7:39
6:38	6:43	6:48	6:52	7:00	7:15	7:11	7:21	7:27	7:34	7:41	7:49	7:55
6:52	6:57	7:02	7:06	7:14	7:29	7:25	7:35	7:41	7:48	7:55	8:03	8:09
7:06	7:11	7:17	7:21	7:29	7:44	7:40	7:50	7:56	8:03	8:10	8:18	8:24
7:22	7:27	7:33	7:37	7:45	7:60	7:56	8:06	8:12	8:19	8:26	8:34	8:40
7:41	7:46	7:52	7:56	8:04	8:19	8:15	8:25	8:31	8:38	8:45	8:53	9:00
8:07	8:12	8:18	8:22	8:30	8:45	8:41	8:51	8:57	9:04	9:11	9:19	9:25
8:26	8:31	8:37	8:41	8:49	9:04	9:00	9:10	9:16	9:23	9:30	9:38	9:44
8:45	8:50	8:56	9:00	9:08	9:23	9:19	9:29	9:35	9:42	9:49	9:57	10:03
9:04	9:09	9:15	9:19	9:27	9:42	9:38	9:48	9:54	10:01	10:08	10:16	10:22
9:23	9:28	9:34	9:38	9:46	10:01	9:57	10:07	10:13	10:20	10:27	10:35	10:41
9:42	9:47	9:53	9:57	10:05	10:20	10:16	10:26	10:32	10:39	10:46	10:54	11:00
10:01	10:06	10:12	10:16	10:24	10:39	10:35	10:45	10:51	10:58	11:05	11:13	11:19
10:20	10:25	10:31	10:35	10:43	10:58	10:54	11:04	11:10	11:17	11:24	11:32	11:38
10:39	10:44	10:50	10:54	11:02	11:17	11:13	11:23	11:29	11:36	11:43	11:51	11:57
10:58	11:03	11:09	11:13	11:21	11:36	11:32	11:42	11:48	11:55	12:02	12:10	12:16
11:17	11:22	11:28	11:32	11:40	11:55	11:51	12:01	12:07	12:14	12:21	12:29	12:35
11:36	11:41	11:47	11:51	11:59	12:14	12:10	12:20	12:26	12:33	12:40	12:48	12:54
11:55	12:00	12:06	12:10	12:18	12:33	12:29	12:39	12:45	12:52	13:00	13:07	13:13
12:14	12:19	12:25	12:29	12:37	12:52	12:48	12:58	13:04	13:11	13:18	13:26	13:32
12:33	12:38	12:44	12:48	12:56	13:11	13:07	13:17	13:23	13:30	13:37	13:45	13:51
12:52	12:57	13:03	13:07	13:15	13:30	13:26	13:36	13:42	13:49	13:56	14:04	14:10
13:11	13:16	13:22	13:26	13:34	13:49	13:45	13:55	14:01	14:08	14:15	14:23	14:29
13:30	13:35	13:41	13:45	13:53	14:08	14:04	14:14	14:20	14:27	14:34	14:42	14:48
13:49	13:54	14:00	14:04	14:12	14:27	14:23	14:33	14:39	14:46	14:53	15:01	15:07
14:08	14:13	14:19	14:23	14:31	14:46	14:42	14:52	14:58	15:05	15:12	15:20	15:26
14:27	14:32	14:38	14:42	14:50	15:05	15:01	15:11	15:17	15:24	15:31	15:39	15:45
14:46	14:51	14:57	15:01	15:09	15:24	15:20	15:30	15:36	15:43	15:50	15:58	16:04
15:05	15:10	15:16	15:20	15:28	15:43	15:39	15:49	15:55	16:02	16:09	16:17	16:23
15:24	15:29	15:35	15:39	15:47	16:02	15:58	16:08	16:14	16:21	16:28	16:36	16:42
15:43	15:48	15:54	15:58	16:06	16:21	16:17	16:27	16:33	16:40	16:47	16:55	17:01
16:02	16:07	16:13	16:17	16:25	16:40	16:36	16:46	16:52	17:00	17:06	17:14	17:20
16:21	16:26	16:32	16:36	16:44	16:59	16:55	17:05	17:11	17:18	17:25	17:33	17:39
16:40	16:45	16:51	16:55	17:03	17:18	17:14	17:24	17:30	17:37	17:44	17:52	17:58
17:00	17:05	17:11	17:15	17:23	17:38	17:34	17:44	17:50	17:57	18:04	18:12	18:18
17:19	17:24	17:30	17:34	17:42	17:57	17:53	18:03	18:09	18:16	18:23	18:31	18:37
17:38	17:43	17:49	17:53	18:01	18:16	18:12	18:22	18:28	18:35	18:42	18:50	18:56
17:57	18:02	18:08	18:12	18:20	18:35	18:31	18:41	18:47	18:54	19:01	19:09	19:15
18:16	18:21	18:27	18:31	18:39	18:54	18:50	19:00	19:06	19:13	19:20	19:28	19:34
18:35	18:40	18:46	18:50	18:58	19:13	19:09	19:19	19:25	19:32	19:39	19:47	19:53
18:54	18:59	19:05	19:09	19:17	19:32	19:28	19:38	19:44	19:51	19:58	20:06	20:12
19:13	19:18	19:24	19:28	19:36	19:51	19:47	19:57	20:03	20:10	20:17	20:25	20:31
19:32	19:37	19:43	19:47	19:55	20:10	20:06	20:16	20:22	20:29	20:36	20:44	20:50
19:51	19:56	20:02	20:06	20:14	20:29	20:25	20:35	20:41	20:48	20:55	21:03	21:09
20:10	20:15	20:21	20:25	20:33	20:48	20:44	20:54	21:00	21:07	21:14	21:22	21:28
20:29	20:34	20:40	20:44	20:52	21:07	21:03	21:13	21:19	21:26	21:33	21:41	21:47
20:48	20:53	21:00	21:04	21:12	21:27	21:23	21:33	21:39	21:46	21:53	22:01	22:07
21:07	21:12	21:18	21:22	21:30	21:45	21:41	21:51	21:57	22:04	22:11	22:19	22:25
21:26	21:31	21:37	21:41	21:49	22:04	22:00	22:10	22:16	22:23	22:30	22:38	22:44
21:45	21:50	21:56	22:00	22:08	22:23	22:19	22:29	22:35	22:42	22:49	22:57	23:03
22:04	22:09	22:15	22:19	22:27	22:42	22:38	22:48	22:54	23:01	23:08	23:16	23:22
22:23	22:28	22:34	22:38	22:46	23:01	22:57	23:07	23:13	23:20	23:27	23:35	23:41
22:42	22:47	22:53	22:57	23:05	23:20	23:16	23:26	23:32	23:39	23:46	23:54	24:00
23:01	23:06	23:12	23:16	23:24	23:39	23:35	23:45	23:51	23:58	24:05	24:13	24:19
23:20	23:25	23:31	23:35	23:43	23:58	23:54	24:04	24:10	24:17	24:24	24:32	24:38
23:39	23:44	23:50	23:54	24:02	24:17	24:13	24:23	24:29	24:36	24:43	24:51	24:57
23:58	24:03	24:09	24:13	24:21	24:36	24:32	24:42	24:48	24:55	25:02	25:10	25:16
24:17	24:22	24:28	24:32	24:40	24:55	24:51	25:01	25:07	25:14	25:21	25:29	25:35
24:36	24:41	24:47	24:51	24:59	25:14	25:10	25:20	25:26	25:33	25:40	25:48	25:54
24:55	25:00	25:06	25:10	25:18	25:33	25:29	25:39	25:45	25:52	26:00	26:07	26:13
25:14	25:19	25:25	25:29	25:37	25:52	25:48	25:58	26:04	26:11	26:18	26:26	26:32
25:33	25:38	25:44	25:48	25:56	26:11	26:07	26:17	26:23	26:30	26:37	26:45	26:51
25:52	25:57	26:03	26:07	26:15	26:30	26:26	26:36	26:42	26:49	26:56	27:04	27:10
26:11	26:16	26:22	26:26	26:34	26:49	26:45	26:55	27:01	27:08	27:15	27:23	27:29
26:30	26:35	26:41	26:45	26:53	27:08	27:04	27:14	27:20	27:27	27:34	27:42	27:48
26:49	26:54	27:00	27:04	27:12	27:27	27:23	27:33	27:39	27:46	27:53	28:01	28:07
27:08	27:13	27:19	27:23	27:31	27:46	27:42	27:52	27:58	28:05	28:12	28:20	28:26
27:27	27:32	27:38	27:42	27:50	28:05	28:01	28:11	28:17	28:24	28:31	28:39	28:45
27:46	27:51	27:57	28:01	28:09	28:24	28:20	28:30	28:36	28:43	28:50	28:58	29:04
28:05	28:10	28:16	28:20	28:28	28:43	28:39	28:49	28:55	29:02	29:09	29:17	29:23
28:24	28:29	28:35	28:39	28:47	29:02	28:98	29:08	29:14	29:21	29:28	29:36	29:42
28:43	28:48	28:54	28:58	29:06	29:21	29:17	29:27	29:33	29:40	29:47	29:55	30:01
29:02	29:											

The TimeTable Publisher Addresses the Following Problems

- **Common Data Standard: Google Transit Feed Spec** (with minor enhancement), if it's widely adopted by agencies, will provide the ideal common input format.
- **Raw scheduling data is not intended for human consumption, and would appear incomplete without further processing** (eg: *Configure* concept).
- **Publishing Needs – the engine produces:**
 - HTML & PDF for the Web
 - Adobe *InDesign* XML for Print
 - Potentially Others (easily any text file format)

Project Status

Internal Release at TriMet

- TM Marketing dept. are Configuring for Print Production & Web
- Future project phase will address *Operations Group* needs.

King County Metro and WA-DOT

- Google Transit Feed Spec as a Common File Format
- Keeping it simple for now – not using any Configuration.
- Tim Moore & Mike Berman (KING Co.) and Marcy Jaffe (WA-DOT)

Looking to Release to Open Source

- Which Open Source License?
- Where to Host as an Open Source Project?
- Resource Requirements?

Learnings Pros & Cons

PROS

- Google File Format is a key enabler to wider adoption.
- Timetable issues and needs are the similar between agencies.
- No showstoppers yet encountered.
- Working together with Tim, Marcy and Mike has been great.

CONS

- Configuration is Complex
- Requires some amount of technical skill to install & run.
- Java application, so the more experience with Java and Java Web Application Servers, the smoother the implementation.

Next Steps

Open Source

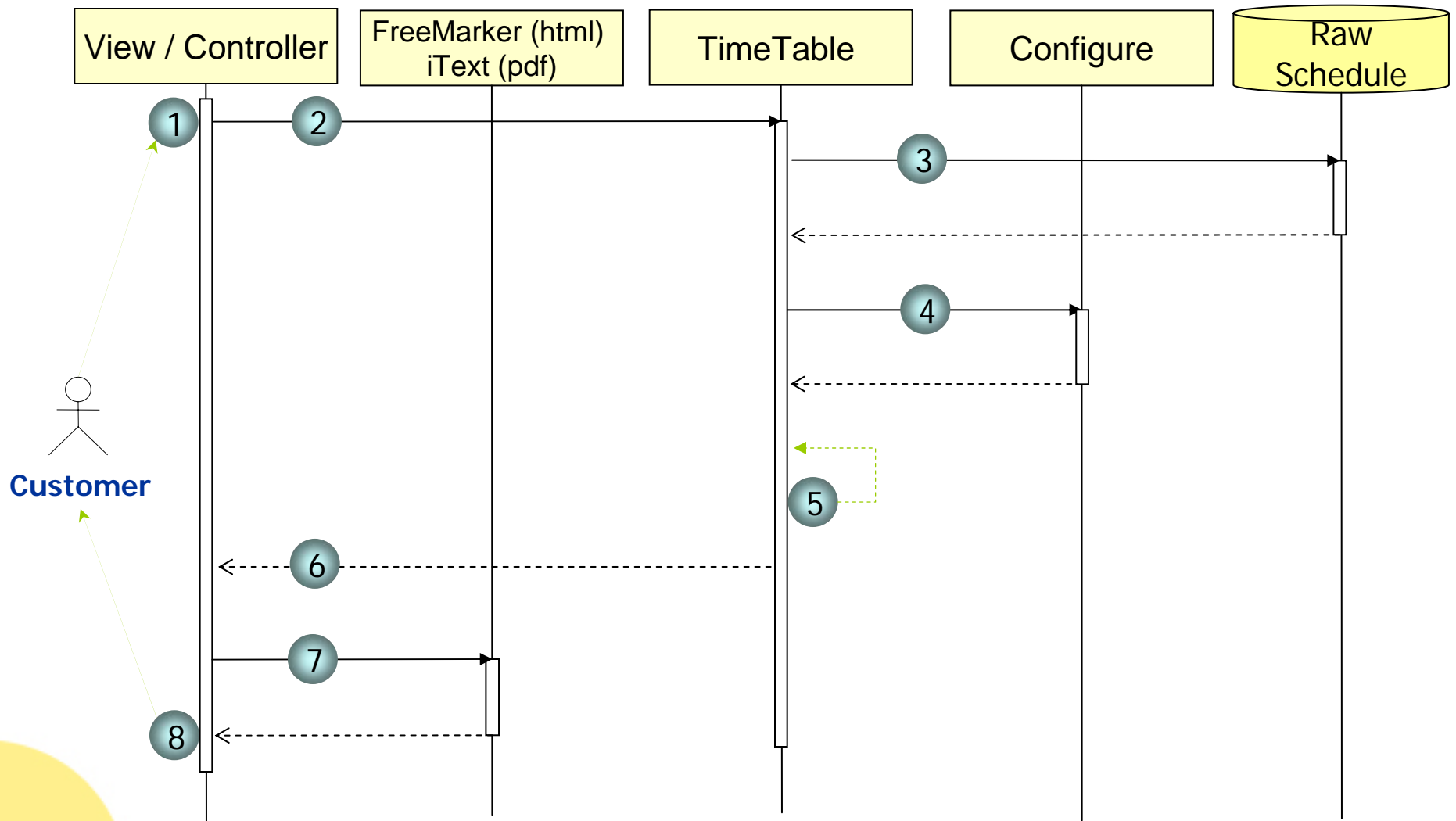
- What Open Source License?
- Where to Host the Project?
- What roles and responsibilities are needed to move forward? WHO?
- What is the role of vendors?

Technical

- What are other agencies requirements?
- Visit Us:
 - <http://timetablepublisher.org>
 - <http://groups.yahoo.com/group/TransitForumNet>

END

Sequence – Rendering a TimeTable



Components of the Application

Schedule Data Import

- The TimeTable Publisher can source data from both a database or from a set of files (eg: CSV or XML).
- The system has built-in functionality to read the Google Transit Data Feed CSV format (the data format being used for Google Transit).
- Custom data adapters can also be built. These adapters extend and reuse existing system interfaces in an effort to reduce the work necessary to get a custom data format into the system.

Configure Tools

- More esoteric configuration parameters are controlled via structured data files in the CSV (comma separated value) format.
- The entire configuration can be viewed and edited with common desktop applications (eg: Microsoft Excel).
- A user interface is provided to allow the user to build timetables out of raw scheduling data.
- A web tool allows the user to edit which timepoints appear on a table. This web tool also provides a view into the complete configuration.

Components of the Application

Output Tools (includes batch and real-time generation of data). Timetables are published in the following data formats: XML, XML (for direct import into Adobe InDesign), HTML, PDF, Text

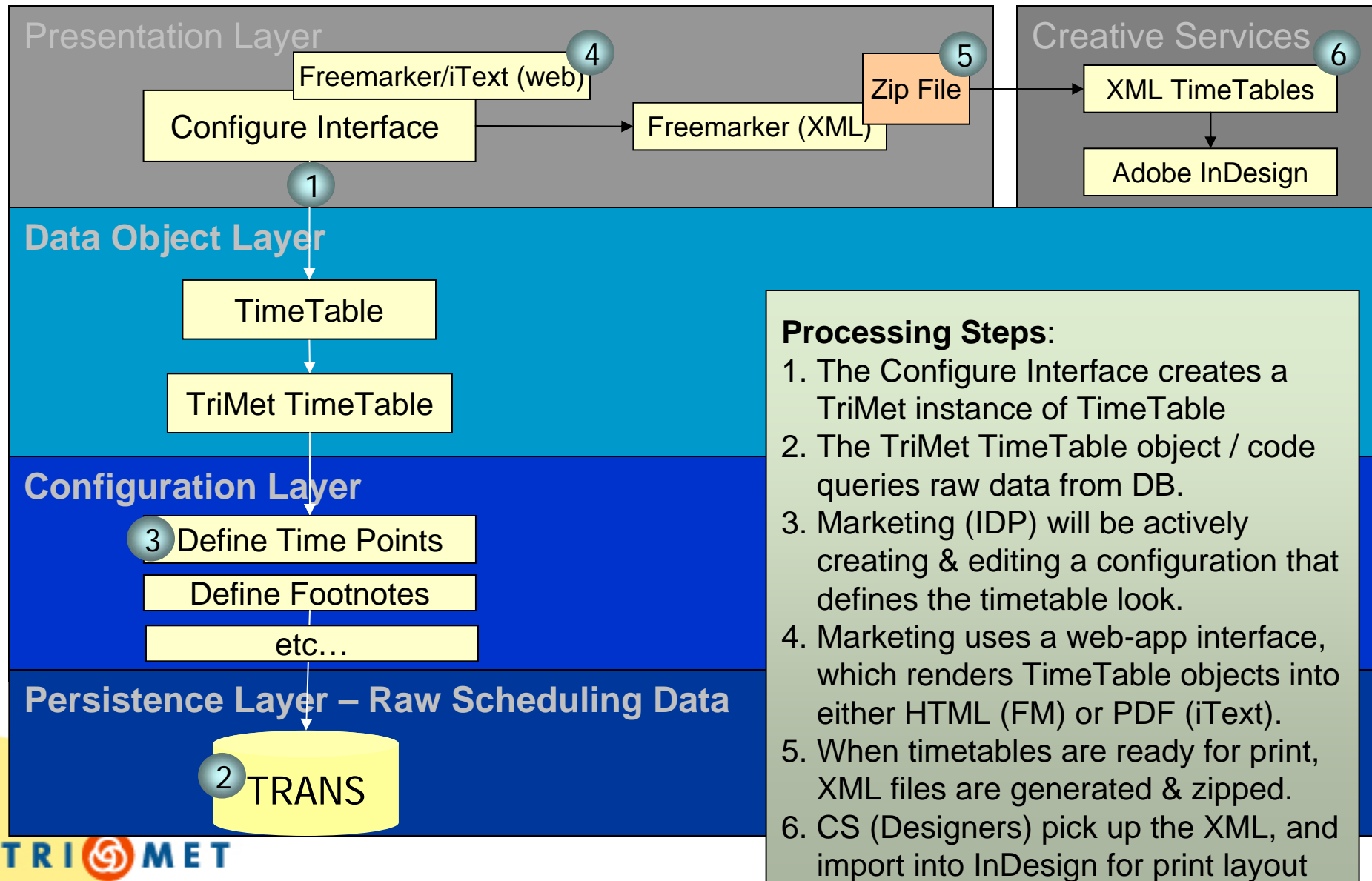
- The TimeTable Publisher can act as either a web application in real time, and/or run as an offline batch file processor, where a ZIP file of timetables is published in one or more of the file formats above.
- A command line tool is provided to create a ZIP file of timetables in their specified format. A web based batch generator (tool to generate ZIP files via a web interface) is similar to the command line batch file generator.
- Web based interface for a real-time view of the data
- Output in PDF or HTML (could be a customer facing web application)

Diff Tool: used to perform various comparisons between two service dates to determine the changes made and differences between the two schedules.

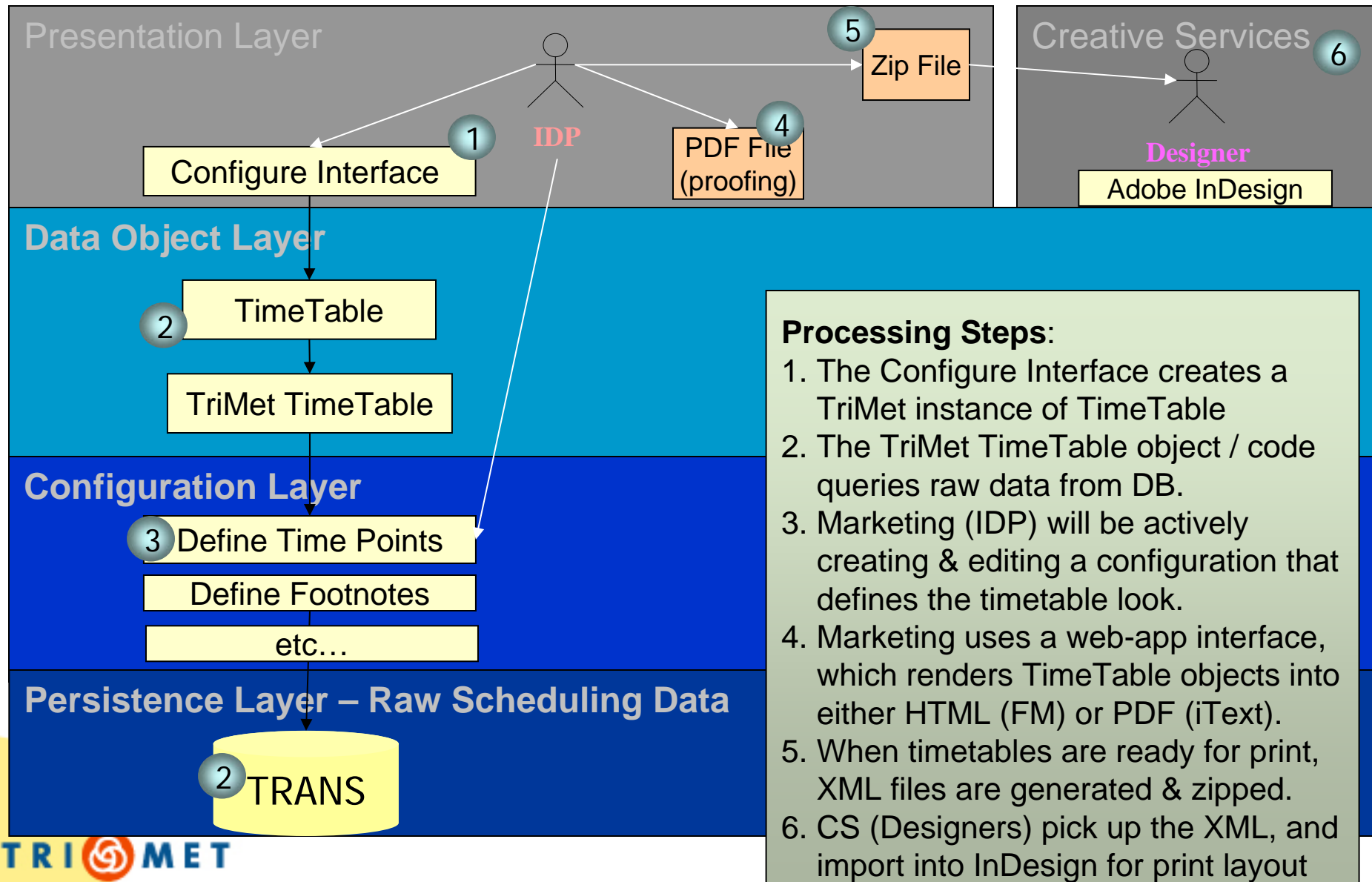
Multi Agency Tool: Design goal is for multiple transit agency use. This tool is not tied to TriMet's data model -- there is a generic model of a timetable that TriMet's data (and potentially other agencies' data) is translated into. Minimal effort (e.g., little to no coding) to get another agency's scheduling data flowing through this system and generating timetables.

Google Transit: With the advent of Google Transit -- and more importantly, multiple agencies generating data for Google Transit in a common format -- this tool will leverage the Google Transit Feed Specification file format (which Google intends to make an open standard) as a primary data input for raw scheduling data.

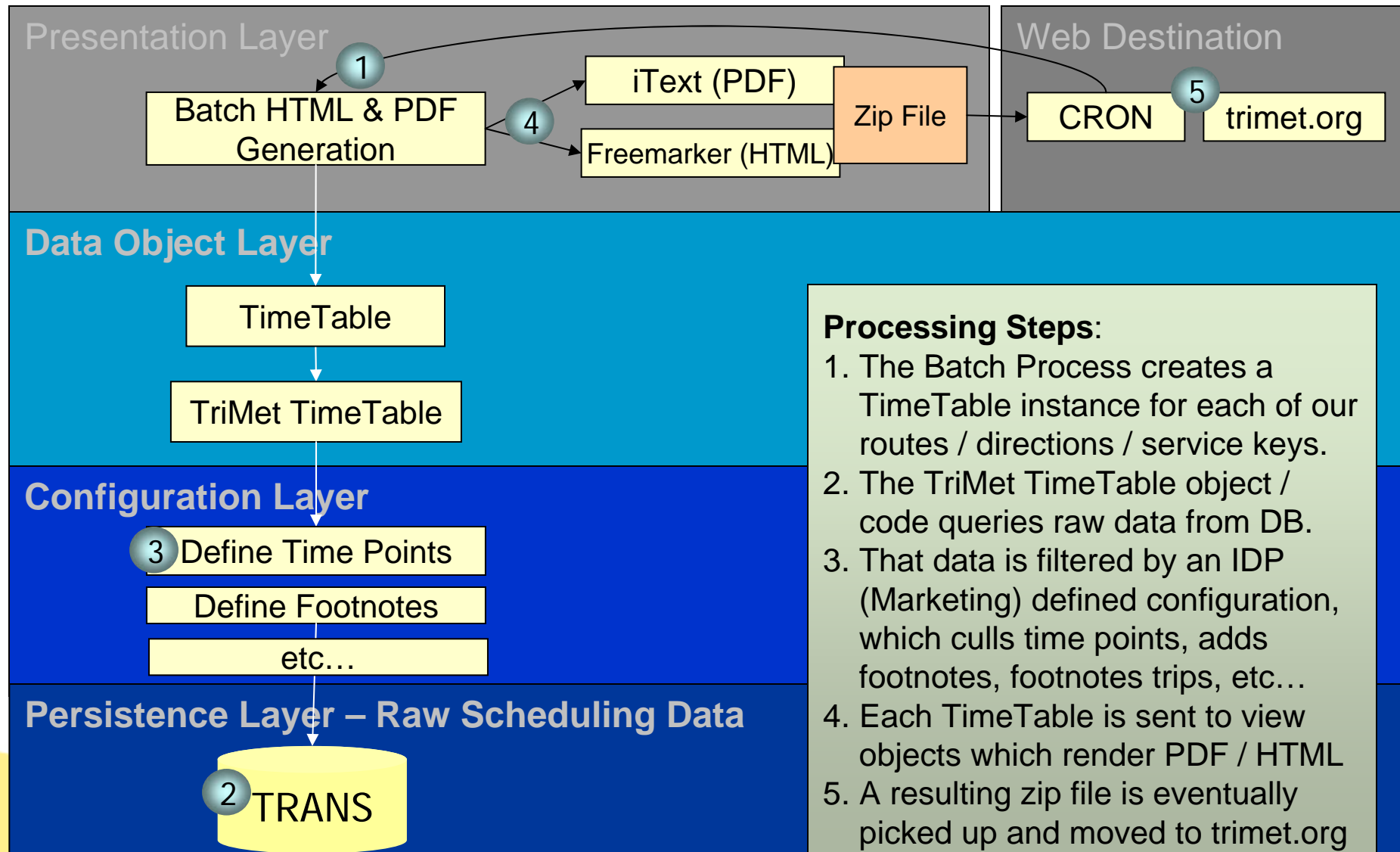
Swimlane – TriMet Print Prep



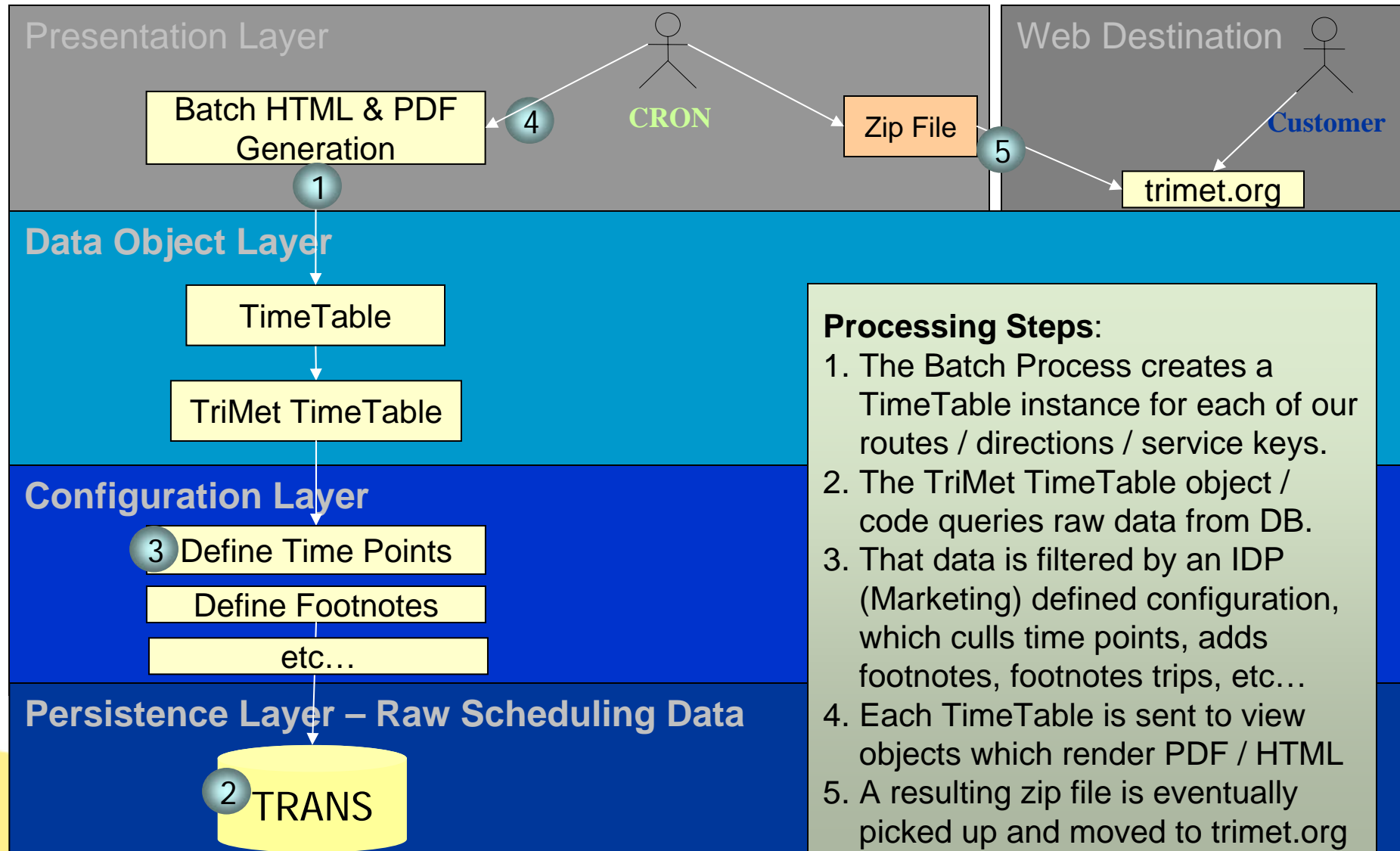
Swimlane – TriMet Print Prep



Swimlane – TriMet Website



Swimlane – TriMet Website



Java Libraries Used

Where	Technology	Comment
HTML & XML	FreeMarker	<p><u>Essential</u> tool: templating language for Java. You put Java beans (or collections of beans) on the FreeMarker stack, and dispatch control to your FreeMarker template. Within the template, you mix static text & markup with content from your beans (in this case TimeTable interface objects), to build a page.</p> <p>FreeMarker is run both as POJO to batch generate content, as well as within TimeTable Pub's online configure & view tools</p>
	FreeMarker Servlet	Part of FreeMarker – allows templates to be used as dynamic web pages, where control hits servlet first & template second, ala the MVC Model 2 pattern.
	Java Script	A fair amount of Java Script was used in the Configure Tool.
PDF	iText	Java library for generating PDF files. Like FreeMarker templates, iText code understands how to traverse the objects that make up our abstract TimeTable data interface.
Data Tier	OpenCSV	Great little library for reading & writing CSV files.
	Hibernate	Object to relational binding, used in this project to read data from the database. Main advantages are 1) queries return data into java objects, as opposed to clunky result-sets, 2) built-in object caching and connection pooling, 3) automated code-generation of bindings.

Construction Technologies Used

When	Technology	Comment
Development	Eclipse	Really need an editor with auto-completion and refactoring tools, especially using hibernate. Plus, Eclipse has is a database viewer, hibernate binder (big time saver), revision control, and a J2EE debugger etc... Just a vital tool.
	emacs	Quick & dirty editor that complements Eclipse.
Build Time	Apache Ant	The entire build, from code-gen to compile to .war deployment is handled by Ant...making the build process easily repeatable.
	Hibernate Tools	<i>Hibernate Tools</i> is used to reverse engineer relational tables into objects and their O/R bindings, freeing up a lot of time that would otherwise be spent on building & maintaining plumbing code.
Run Time	Hibernate	Converse with a database <i>entirely</i> via JavaBeans.
	Java 5.0	Heavy use of Generics (eg: Parametized Types / Templates), to add type clarity to Container objects. 5.0 Enums are also a used quite a bit. An Annotation used sparingly (but these are very cool in certain circumstances).