

ISAC Electronic Work Permit System

the crib notes

Hello, I assume that since you are reading these notes that you were interested in the subject of my talk given at WAO07, Trieste. I have written these notes to accompany the presentation slide show which is also available for downloading off of the WAO07 home page.

These notes were written as a replacement for me. The slides are very brief points of the ideas discussed and so are not much use by themselves. My hope is that these notes will explain what I was trying to get across with each slide and allow the reader to better understand the subject and allow them to ask questions if so desired.

The notes are separated into sections for each slide, except the first one :-P. The best thing would be for the reader to go through the slide show first and then decide which slides they would like to know more about and then simply go to the appropriate sections of the notes.

So here we go...

Slide #2

History

When the ISAC facility first began operating, a paper work permit system was used. This system was based, in form and function, on the permit system that has been in use in the TRIUMF Main Control Room for the 500MeV Cyclotron. During the summer of 2001 a summer student, Wendy Wiggins, was hired and given the task to develop an electronic system to control the work permits for the ISAC facility. In December 2001 the initial version of the ISAC Electronic Work Permit System(WPS) was finished and brought into use. Since then, the WPS has been exclusively to schedule and catalogue all work done on commissioned systems at the ISAC facility.

Slide #3

Motivation

A very significant motivation for switching to an electronic form for the WPS was to allow it to be used as a tool more easily. Work permits contain a very large amount of data concerning the maintenance history of everything from a whole building down to specific devices on the beam line. A WPS that makes this data more readily available to be used as a tool was seen as a very desirable thing.

The graph on this slide shows the number of work permits issued for the ISAC facility before and after the electronic WPS was brought into use. The rise in the number of permits from 1998 to the present shows how the number of permits issued grown as more devices were installed as the ISAC facility was brought on-line and as the facility has been expanded to this day. From the graph one can see that the ISAC facility has been averaging about 700 permits per year since 2001. The time required to perform a search in an electronic WPS is much less than what would be needed to perform a similar search on a paper system

Slide #4

Motivation(2)

A web-based interface to the WPS was also desired. This allows users access to the system from any computer on site. This remote access the the WPS for filling out of permits and editing of existing permits increases the convenience for most users and has the added benefit of reducing the traffic through the Control Room. In general it has been found that anything that can increase the ease of use and simplicity of use of the system has increased the motivation of users to accept the new system.

A common concern of remote access is the loss of face to face interaction between the person taking out the permit and the people that are signing off on it. This issue is discussed further on Slide #10. It should be noted that this concern has not been found to be a significant problem at the ISAC facility.

Slide #5

Structure of the ISAC WPS

The WPS consists of three main parts:

1. The database which contains all the work permit information as well as information about each user of the WPS. Our database is written in MySQL but is currently being moved to PostgreSQL, see Slide #14.
2. The web-based interface to the database. This is used to take out new permits, edit existing permits, search the permit archive, as well as several functions not directly associated with a particular permit. The interface is accessible from most computers on site. The web interface was written in PHP but is in the process of being translated to Perl, see Slide #14.
3. Several support applications run behind the scenes and are used to perform regular scheduled tasks that do not require any user interaction. These include tasks such as backup of the WPS database, updates of the user/password lists and weekly email notifications sent to users and WPS administrators. Support applications are discussed further on Slide #13.

Slide #6

Structure of the ISAC WPS(2): Interface

This slide gives the main points of the web-based interface, mentioned above, and includes a sample of the interface front page that the user is presented with when they open the WPS web page.

The interface has three sections:

1. The title/login area – This portion simply contains the title, a link to the revision history, the access status and the login button. A user is not required to log into the WPS in order to use it. Any functions of the WPS that do not affect the contents of the database, e.g. searching, are available to any user and do not require the user to be logged in. Functions that can affect the contents of the database require the user to log in before those functions become available. One can see in the top left corner that I(Rob Shanks) was logged in when the screen shot was taken.
2. The function buttons section – This is where the buttons for the functions available to a user are located. This list of buttons is dynamic and changes depending on if the user is logged in or not and what the privilege level of the user is, see Slide #11.
3. The main frame section – Any window opened by the function buttons are displayed here. By default, when the WPS is first accessed a list of the permit from the past 14 days that have a status code of Pending or Active, see Slide #10, are displayed.

Slide #7

Structure of the ISAC WPS(3): Interface(2)

This slide is used to go over some basic points that were significant considerations for the design of the user interface to the WPS. On the left of the slide are some of the points mentioned and on the right is a screen grab of the permit form used to fill out a new permit in the WPS*.

Since most facilities that begin using an electronic WPS are transitioning from an existing paper system, a significant portion of the user base will most often need to be convinced that the switch is a good idea. It is assumed that the designers and division/group heads have already been convinced. To do this, the WPS must not only be at least as useful as the previous system but must also be easier to use. A good example of this is the ability to program your VCR to record a show at a certain time. I think this is a standard feature on all VCRs by now but I can't think of many people that I know who use this useful feature. Why? Because it's quite difficult to figure out.

The first rule should be that the input required from the user be as simple as possible. Computers are very good at helping with this due to their speed. Filling out fields and simple calculations should be automated whenever possible. If the desired information already exists in the database then it can be retrieved and the fields filled in by the WPS. Once a user is logged in then they should not have to supply any of their personal data. The WPS already knows which user is logged in and can do a query to get information such as a user's group or local. Computers are really good at math too so should be used for this whenever possible. The user should not have to figure out when their permit will expire based on the start time and duration they enter.

Fields that require a choice to be made from specified options can be given a default value to save time. A good example of this is giving any date selection field the default value of the current day. A note of caution should be given here though. Default selections can be dangerous. If a user forgets or is simply too lazy to bother making the correct selections then the default selection could be incorrect and lead to problems. Care should be taken when what, if any, default selections should be given. A good trick is to give any important fields a default selection that is invalid. This way a user can be required to fill out the important fields before the form can be submitted.

If one is moving to an electronic WPS from an existing paper one then do not hesitate to copy things from the existing system, see Slide #8.

* Note how the user logged in on this slide has different buttons available. This is due to a different privilege level.

Slide #8

Structure of the ISAC WPS(4)

This slide contains pictures of a completed permit from the ISAC WPS(left) and a permit from the paper WPS that the electronic one was based on. One can see many similarities in the layout of both permits. This was done intentionally to make the transition from one system to the other easier for users. This also allowed the electronic WPS to take advantage of the good design of the existing paper system.

All forms in the ISAC WPS that the user would be required to fill out were patterned after the corresponding forms in the existing paper system wherever it was possible.

Slide #9

Permit Numbering

Permits in the ISAC WPS are organized using a date and number system. When a permit is first submitted, it receives a unique number consisting of the current date and an integer. The integer is incremented by one for each permit that day and starts at one again on the next day.

Permits that have not been approved to begin work are given a negative number to distinguish them from permits that have received approval and been made active, see Slide #10.

This simple numbering system allows a lot of information to be displayed through it. One can see when a permit was taken out. one can see how many permits, both active and pending, were taken out on a certain day. One can also see the order in which the permits were submitted.

In the picture on the right we see a list of permits from Sept 19th. We can see that there were 11 permits that were submitted, 9 of which have been activated and 2 still awaiting approval.

Slide #10

Permit Status & Permissions

A permit passes through several important steps between being first submitted and when it is closed. A set of status codes was established to indicate what state a permit was in.

1. **Pending:** This is the status that a permit is given when it is first submitted. A Pending permit still requires a series of approvals to be given before work can proceed.
2. **Active:** Once a permit has been given the required approvals and the work is ready to begin, it is given the status of Active. This indicates that the work is under way and must be considered for other work in the area(s)/system(s) affected by this permit.
3. **Completed:** Once the work has been finished then the worker responsible for the permit must fill in an end of job note and declare the system to be operational or not.
4. **Closed:** Once the work has been confirmed as completed and no follow up is required then a permit is given the status of Closed. This status indicates that all input regarding this job should be in.

In order to move a permit from one status to another there are certain requirements. Before a permit is accepted as Pending, several fields used to describe the proposed job must be filled out. Before a permit can be accepted as Completed an end of job note must be filled out and the system must be declared operational or not. The movement of a permit to the Active status is more controlled other statuses. In the ISAC WPS it was decided that only Operations should be able to grant a permit an Active status. Before a permit can be accepted as Active, it must receive 3 approvals. The person responsible for the area(s)/system(s) affected by the permit must be informed of the job and give their approval, a member of the safety group must also be consulted and indicate what hazards, if any, are present and what precautions must be taken to ensure worker safety. The final approval is that of the Operations group. Ensuring that only qualified people are able to give approvals and do other important tasks in the WPS, a set of user types was created, each with different permission levels. These user types are discussed further on Slide #11.

On right most column of the picture on this slide we can see which approvals have been given to each permit. Note how all Active permits have all three approvals but not all permits that have been given approval are Active.

Slide #11

Security: Managing DB Integrity

In order to maintain the security of the application and the integrity of its contents, it was decided that a log in system would be used. Any functions that affect the contents of the database, such as filling out or editing a permit, require the user to login. This way if a user does something wrong then the administrators will know who did it.

Users are issued privileges in order to give them access to certain functions that they are required to do in the WPS.

There are 5 different user types used in the ISAC WPS:

1. **Regular user:** This is the default permission level. Access to basic functions are granted. Since all users have this permission level by default, most of these functions do not require the user to log in be accessible.
2. **Surveyor:** Users with this privilege have the permissions of a regular user as well as the ability to grant approval from the safety group for a pending permit.
3. **Area Supervisor:** Users with this privilege have the permissions of a regular user as well as the ability to grant area supervisor approval to a pending permit.
4. **Operator:** If a user is given the Operator permission level then they have the privileges of a regular users as well as the ability to grant the Operations approval for a pending permit. An Operator is able to grant a permit Active status. An Operator is also able to fill out a permit for someone else and fill out approvals sections in consultation with the appropriate person.
5. **Kahuna:** This is the administrator permission level. Access to all WPS functions is given to these users. Only Kahunas are able to add users to the WPS and change existing users permissions.

No matter how much you trust your users they will still make mistakes. So in order to ensure that the data that is entered into the WPS is in fact good data, several constraints are placed on the input fields. This is a good way of preventing the submission, weather accidental or intentional, of bad data into the WPS.

In the picture on this slide we can see some different user types. User Aoki, Jonathan is one of our operators and so has that permission level. All of our operations staff are qualified surveyors so Jon has that permission as well. The left most column shows several users that are area supervisors and the areas that they are supervisors for. Ignore the duplicate entry at the top. That is a known bug. :-P

Slide #12

Security: Managing DB Integrity(2)

Management of the users of the system is just one of the things to worry about. The other is the computer code that makes up the database and user interface. The benefits of extensive testing and bug-checking ensure that the system will be stable, reliable and run trouble free. Well, almost.....

Most of the testing of the ISAC WPS is done on a test platform that contains a copy of the actual WPS database. This allows testing and development to be done without the fear of damaging the real database.

Having an established schedule for software upgrades and bug fixes can prevent many problems. Applying fixes haphazardly can lead to more bugs and problems than it fixes. Careful thought and testing must be done in order to prevent this. For the ISAC WPS a software update is done roughly every 6 months. If a bug is determined to affect the operation of the WPS in a way that conflicts with the specifications then a bug fix may be developed and tested rapidly. If a fix cannot be produced with sufficient speed and confidence then there is always the option of rolling back the software to a previous version. Bugs that are deemed to be insignificant as well as features developed by programmers and requested by users are best left until the next scheduled update to allow for testing and refinement.

Slide #13

Support Applications

There are several applications associated with the WPS that run behind the scenes and are unseen by users. These include such things as database backup, updates of the user email and password lists and weekly email notices to administrator and users.

At the ISAC facility we use several electronic applications such as an electronic log-book and an electronic fault report system. Currently these applications do not interact with the WPS so I hesitate to call them support applications. An integration of these applications is planned, see Slide #14, and once these applications are able to interact with each other I will feel more comfortable calling them support applications.

Slide #14

What does the Future Hold

We are currently in the process of a major software change for the ISAC WPS. We are in the process of changing the database over from MySQL to PostgreSQL. The user interface is being translated from PHP into Perl. These changes are motivated by the desire to get the WPS to be able to interact with several other electronic applications at the ISAC facility. The majority of the other applications were written in these languages so the WPS was the odd man out. The integration of the electronic applications will allow for the automation of more tasks and the inclusion of data from one application in another.

The method of defining the area in which a job is to take place is not perfect. Some jobs cross several areas, in the WPS only a single work area can be specified. Also differentiation of areas and systems in the same area requires some improvement.

There has been an interest from management to see the WPS take on a stronger safety related function. This will require a more extensive system of user qualifications and permissions. This work is still in development.

Once the safety related features of the WPS are accepted then it is expected that the WPS will be deployed across the TRIUMF site, not restricted to just the ISAC facility.

Well, that's the end of it. Hopefully these notes helped you understand the slides better. If you have any other questions about any of the slides and/or these notes or if you have a completely new question then feel free to contact me, Rob Shanks robertsATtriumfDOTca.