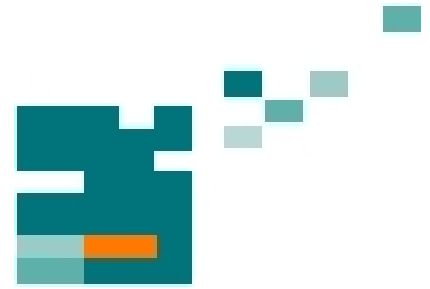


54. IWK
Internationales Wissenschaftliches Kolloquium
International Scientific Colloquium



**Information Technology and Electrical
Engineering - Devices and Systems, Materials
and Technologies for the Future**



Faculty of Electrical Engineering and
Information Technology

Startseite / Index:

<http://www.db-thueringen.de/servlets/DocumentServlet?id=14089>

Impressum

Herausgeber: Der Rektor der Technischen Universität Ilmenau
Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c.
Peter Scharff

Redaktion: Referat Marketing
Andrea Schneider

Fakultät für Elektrotechnik und Informationstechnik
Univ.-Prof. Dr.-Ing. Frank Berger

Redaktionsschluss: 17. August 2009

Technische Realisierung (USB-Flash-Ausgabe):
Institut für Medientechnik an der TU Ilmenau
Dipl.-Ing. Christian Weigel
Dipl.-Ing. Helge Drumm

Technische Realisierung (Online-Ausgabe):
Universitätsbibliothek Ilmenau
[ilmedia](#)
Postfach 10 05 65
98684 Ilmenau

Verlag:



Verlag ISLE, Betriebsstätte des ISLE e.V.
Werner-von-Siemens-Str. 16
98693 Ilmenau

© Technische Universität Ilmenau (Thür.) 2009

Diese Publikationen und alle in ihr enthaltenen Beiträge und Abbildungen sind urheberrechtlich geschützt.

ISBN (USB-Flash-Ausgabe): 978-3-938843-45-1
ISBN (Druckausgabe der Kurzfassungen): 978-3-938843-44-4

Startseite / Index:

<http://www.db-thueringen.de/servlets/DocumentServlet?id=14089>

OPERATOR TRAINING EXPERIENCE

*Danny Günther, Michael Kratz, Pedro Moreno,
Jürgen Schellenberg, Dirk Westermann, Carsten Zimmermann*

ABSTRACT

The need for training of power system operators for distribution networks has grown in the last years due to more and more complexity of modern SCADA systems or/and evolution of the distribution power grid from a passive one to smart grid with a increasing amount of dispersed and regenerative generation. Additionally the working specialists going retired and need to be substituted by fresh staff. The knowledge about operating the primary process is lost if there is no place for experience exchange. In contrast the younger generation has deep understanding of computer technology and handling with modern SCADA systems but not the same deep knowledge about the primary process the older one have. A platform for training primary and secondary technique failures is needed to train understanding of the primary process as well as the understanding of the secondary equipment as an important tool for power system operation. The great interest of distribution network operators in training their operator staff shows, the topic has a huge relevance for their further education and experience exchange as a basis for future power system operation with today's quality.

In 2007 an operator-training platform was created at the Power System Department of the Ilmenau University of Technology in cooperation with industrial partners. It's a prosecution of a 40 years tradition of training power system operators. The training was launched 1960 utilizing the hardware power system model with primary equipment failures scenarios. Today's training focus is a holistically approach of understanding the primary and secondary process, their force among each other and soft skills like stress handling, communication terminology in operation tasks and experience exchange between operators of different companies, but also a generation exchange between the older specialists and the younger operators.

This paper describes the today's operator training holistic approach and the platform set up. The modules of the training, the experiences made in the trainings since 2007 and a development roadmap are presented.

Index Terms – Operator Training, SCADA Systems, Power System Simulation

1. INTRODUCTION

Within liberalization and the development from a passive to an active distribution network the operation of power systems becomes more complex which is a great challenge for the operation staff. The distribution network system (DNS) operator becomes economically responsible if failures in his domain occur. Not delivered power from dispersed generation means a disadvantage for the provider also for the DNS.

Modern power network operation SCADA systems are full of information and communication technology. Older specialists have well knowledge about their power network but mostly a distance to computer driven operation. They are grown up with point-to-point connections and their workflow was oriented to non-SCADA controlled operation and/or state observation. If these specialists are going retired the very deep fundamental knowledge about the primary process is lost. Their substitute is problematic, due to missing fundamental experiences of power system control and need to decrease of fix cost in operation tasks. On the other hand the following generation is well familiar with modern SCADA systems.

Soft skills like susceptibility for stress, prudence are not only important indicators for long term healthiness of the operator staff. They have also an impact to the operation tasks. The philosophy doing the right to the right time and prevent blackouts following small failures are not naturally a quality all operators have. Especially modern SCADA systems with a huge amount of monitored outstations can overload the operators with information he has to divide in necessary ones and unnecessary. If also the systems graphical user interface and/or additionally signals for warning occur it is very important for any operator to analyze the situation as fast as possible and do the right at the right time. If the operator is overstressed this could result in a system blackout. Such situations can be trained for habituation getting familiar with.

If the today's quality of effective operation should be equal with active distribution networks or, in the future, smart grids, there is a need for training and experience exchange between DNS companies. Due to the great interest of distribution network operators in training their operator staff they show, the topic has a huge relevance for their further education and experience exchange as a basis for future power system operation with today's quality.

In 2007 an operator-training platform was created at Power System Department of the Imenau University of Technology in cooperation with industrial partners. It's a prosecution of a 40 years tradition of training power system operators. The training was launched 1960 utilizing the hardware power system model with primary equipment failures scenarios. Today's training focus is a holistically approach of understanding the primary and secondary process, their force among each other and soft skills like stress handling, communication terminology in operation tasks and experience exchange between operators of different companies, but also a generation exchange between the older specialists and the younger operators.

2. TRAINING PLATFORM

All To maximize the training effect the training platform is equipped with a real redundant SCADA system, equipped with two workstations. To have a realistic environment is not only a nice to have feature, it is essential to create the right atmosphere for training purposes. The fundamental concept of the platform illustrates figure 1.

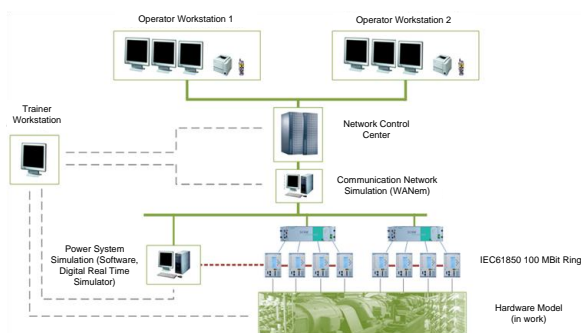


Figure 1: Operator Training Platform Setup

The SCADA system itself is used as human machine interface (HMI) for operation tasks and simulation of failures of the secondary

equipment. The process simulation is based on a multi-level architecture; each one specialized for different simulation/training purposes. Transients are simulated with a real time digital simulator. The simulation models are limited in size due to computing capacity. The system is used if simulations of failures or transients are necessary; especially to train earth faults are synchronization. Load flow oriented simulations are necessary if large networks are needed, especially for switching operation or handling of symmetric faults. Both simulations (primary and secondary equipment) can be used simultaneously to create scenarios both interact.

3. PAGE OPERATOR TRAINING A HOLISTIC APPROACH

Surveys showed that an operator training needs a holistically approach. For operators it is important to train from a global point of view. They need excellent knowledge about operation power networks, controlling network regulators, strategies for failures detection and adjustment. They need also knowledge about their operation tools, the SCADA system itself to get familiar with different classes of information technology errors and which impact they could have to the operation tasks.

Figure 2 illustrates the different training objectives. They are mapped to different training modules. They are designed to be freely combinable depending on the trainee's request but with no mitigation of casual relations between training entities.

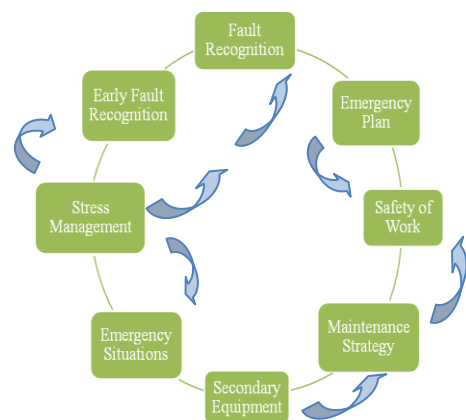


Figure 2: Holistic Consideration of the Operator Training; Topic coherencies

For example, training primary process errors is used for analyzing operators' activities in the module stress training. Furthermore, based on detailed knowledge of the secondary equipment, economically and technological reasonable service and maintenance strategies are explained. Figure 3 illustrates the basic course with its training modules.

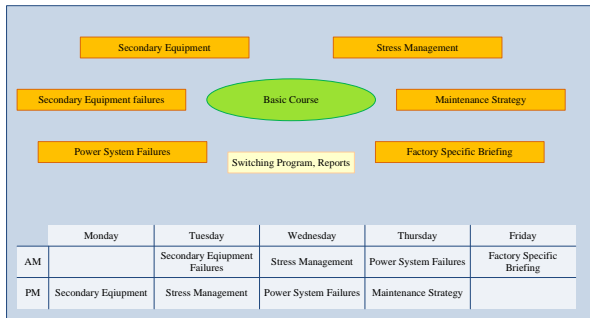


Figure 3: Schedule of the Basic Course

With this holistic approach an operator training is available includes training modules of primary and secondary equipment, their interactions and special operator soft skills. The stress management module is an integrated part of the training and well accepted by the trainees.

4. DEVELOPMENT ROADMAP

After graduating the basis course it makes sense to complete additionally specialized courses for stabilization primary process operation skills and prophylactic failure handling. The basis course is designed independent from specialized failures or power systems architecture. Future developments will be courses for typical failures (e.g. earth fault location) and company specific requirements. Figure 4 illustrates the next steps in development training courses.

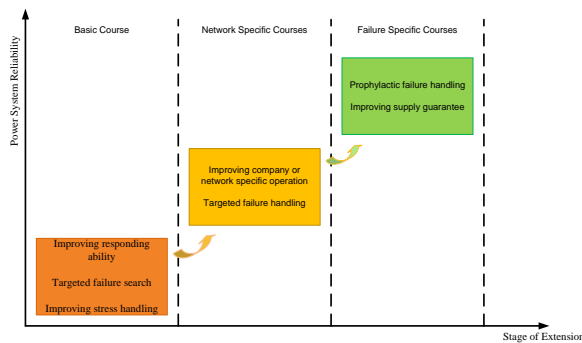


Figure 4: Course Roadmap

5. CONCLUSION

In the year 2007 an operator-training platform was created at the Power System Department of the Ilmenau University of Technology in cooperation with industrial partners. Operators from industry and public services have successfully completed the basic course in the last years. The results approve the correctness of the holistically operator training approach. The extension of the training modules is planned in the next years. Prospective it will be possible to train company specific and failure dedicated.

6. REFERENCES

- [1] Meyer P., Kümmerling S., Kratz, M., Westermann, D.: „Architektur eines Simulators für Energie-, Informations- und Kommunikationstechnologien“, 2007
- [2] Stubbe, M.; Promel, F.: „Training Operators To Acute System Contingencies“, CIGRE, 2006
- [3] Westermann, Schellenberg, Jung, Paul; Energiewirtschaft, Heft 21, Seite 56-60
- [4] Anderson, Max D.: „Power System Operator Training Problems“, IEEE Transactions on Power Systems, Vol.1, 1986
- [5] IEE Colloquium on ‘Operator Training Simulators’, 1992