State of Cyber Security in SCADA/Control Systems

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Agenda

Purpose: Highlight the electric utility perspective on cyber security for SCADA/Control Systems

- Background
- Evolution of SCADA systems
- Problem Statements
- Proposal for further works

Acknowledgement: Hans Hol, Marc Tritschler

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Göran Ericsson

- **Swedish National Grid 1997-**
  - **Manager IT Security** (As of 2007-01-01)
  - Former Data- and Telecommunications: various positions
- **1996** PhD: *”On Communication in Power System Control”*
- **CIGRÉ** = Conseil International des Grands Réseaux Electriques, International Council on Large Electric Systems
  - Chairman WG D2.22 on Information Security (**2006 –**)
  - Swedish Delegate of SC D2 (Information Systems and Telecommunication) (**2000 –**)
- **IEEE**
  - Senior Member Power Engineering Society **2006**
  - Power System Communications Committee
- Has published >30 papers in international forums, both within and outside IEEE. Mostly utility perspective:
  - **Information Security for Power Control Systems**
  - **Power System Communications** (the ”life nerve”)

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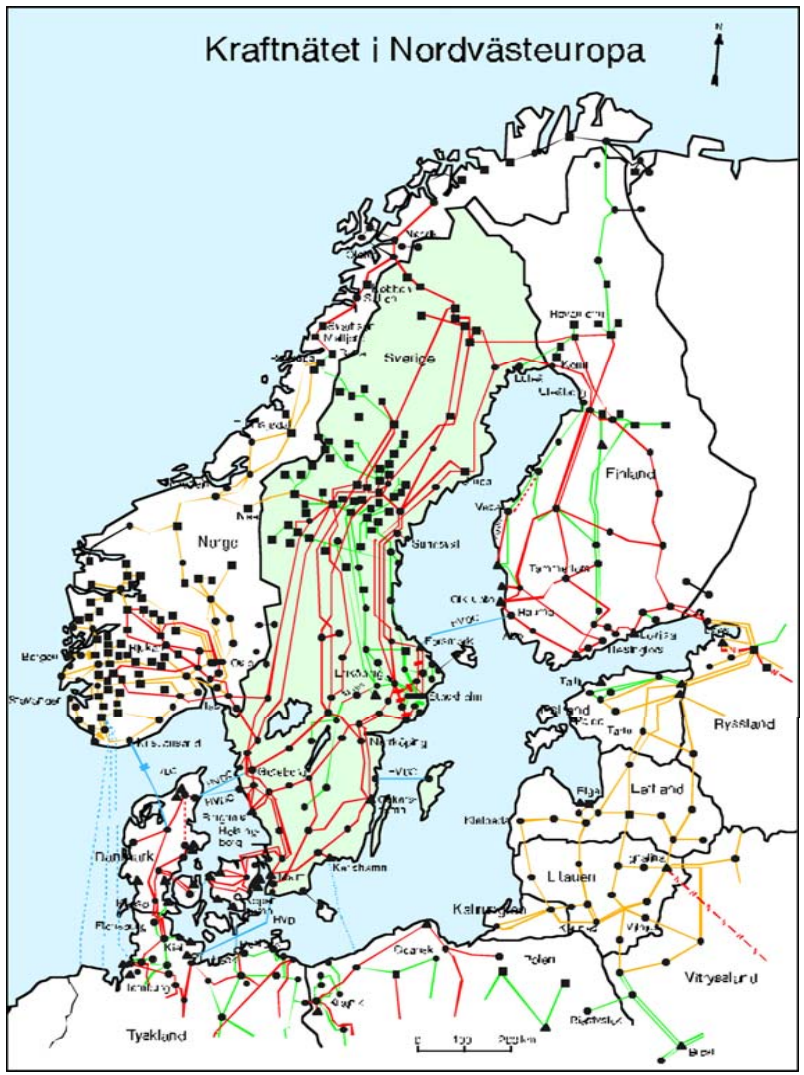
Swedish National Grid (Svenska Kraftnät)



- Svenska Kraftnät is a public utility
- Our core business is power transmission on the national level 220kV, 400kV
- 16,000 km power lines
- Interconnections w/ Norway, Finland, Denmark, Poland, and Germany
- Svenska Kraftnät has provided telecom network services to external customers since 1994
- Optical fiber network 8,000 km WRAP, OPGW

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Background

- Electricity is of paramount importance for our society
- Digital threats are increasing
- SCADA systems and substations are being increasingly interconnected with other systems
- In earlier projects, IT-security was not considered to a great extent

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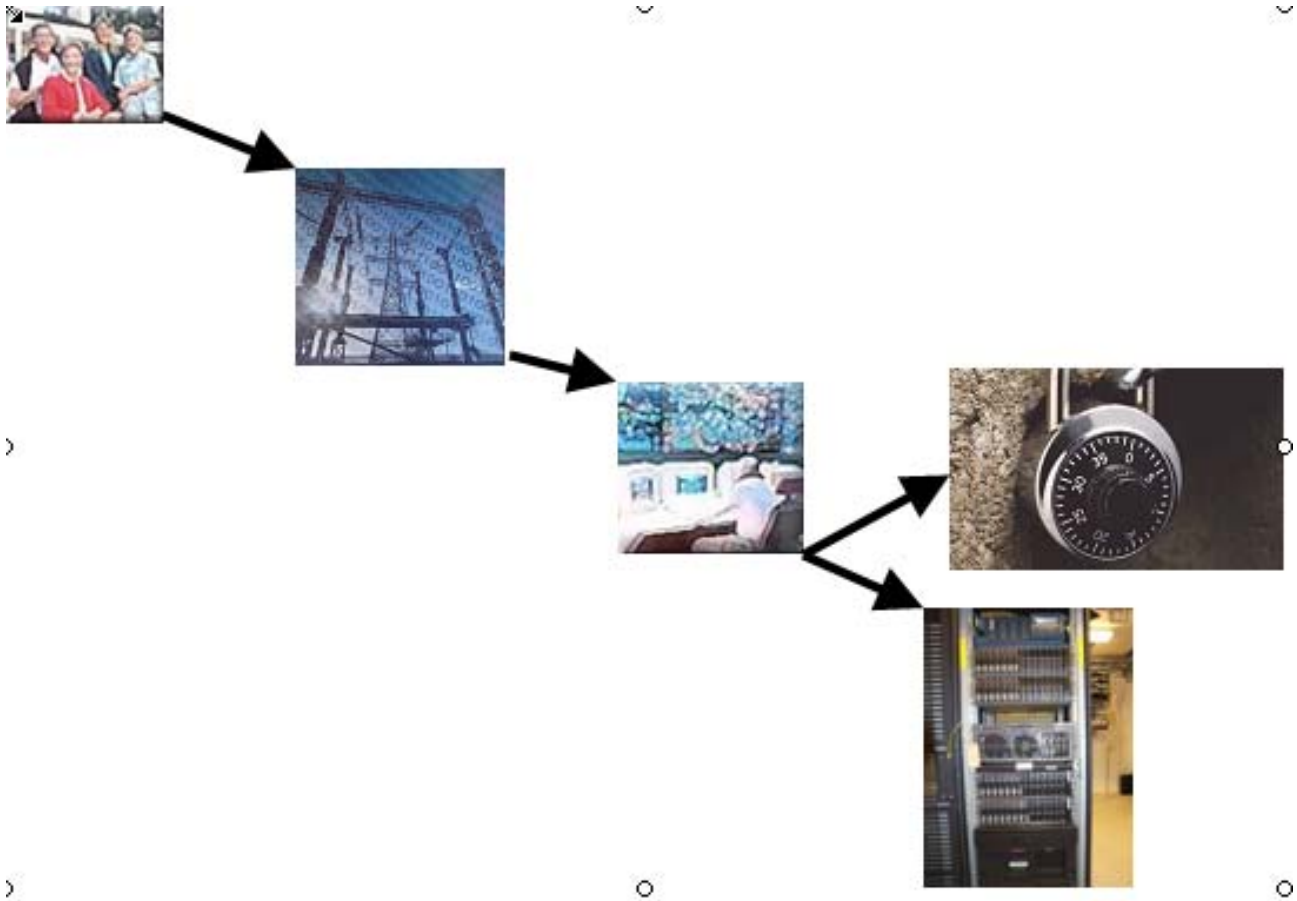
Chain of dependencies



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Physical and Logical Security

- Physical security – easy to grasp
- Logical, digital security – how about that?
- Is it possible to hack a substation over Internet? – YES!
- Set up technical solutions
- Impose new rules + Follow up

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General trends

- From proprietary to COTS (Commercial Off The Shelf)
- Increasing use of standard products (PC, operating system, networking equipment, …)
  - Well-known knowledge, not only on one/two persons
  - No ”security-by-obscurity” anymore
- Use of broadband connections – new possibilities open up
- BUT: Is everyone aware of both POSSIBILTIES and RISKS?
- Does everyone make an active decision?

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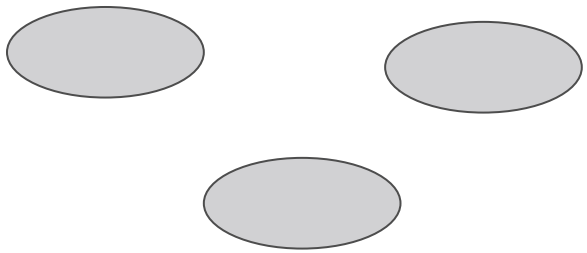
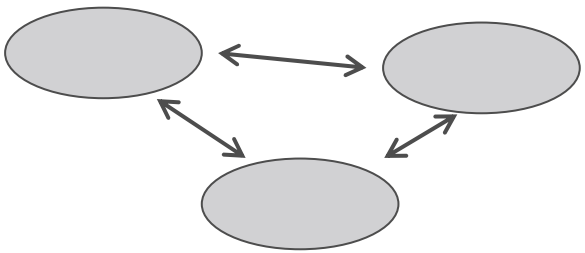
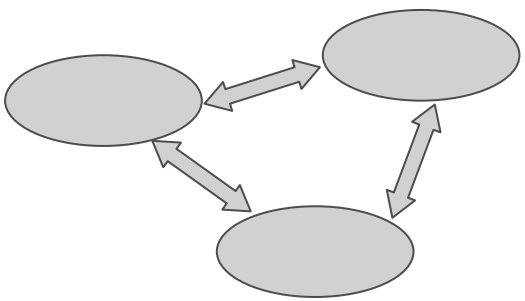
Development of Industrial Control Systems 1(2)



1. Islands of operation



2. Interconnected



3. Partially Integrated

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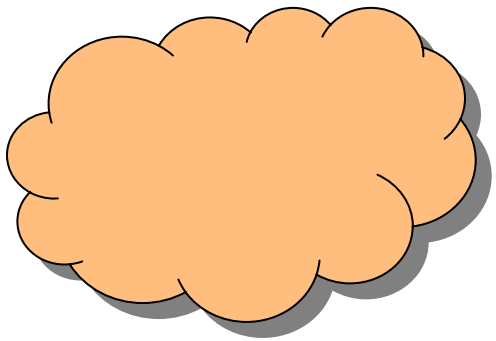
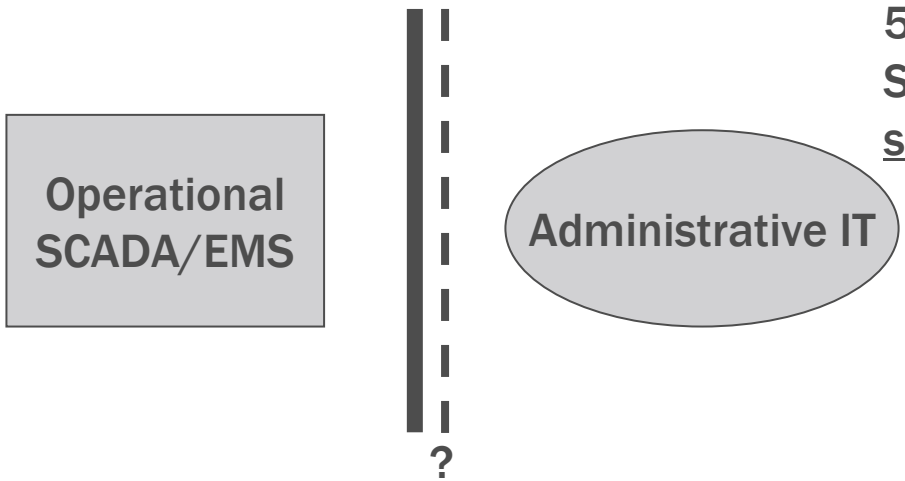
Development of Industrial Control Systems 2(2)



4. Today. Full integration, due to open system requirements



5. De-coupling between Operational SCADA/EMS and Admin IT, to secure operational

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Development of communication capabilities

From

- Small, narrowband paths in the wood

To

- Broad, 7-lane highways

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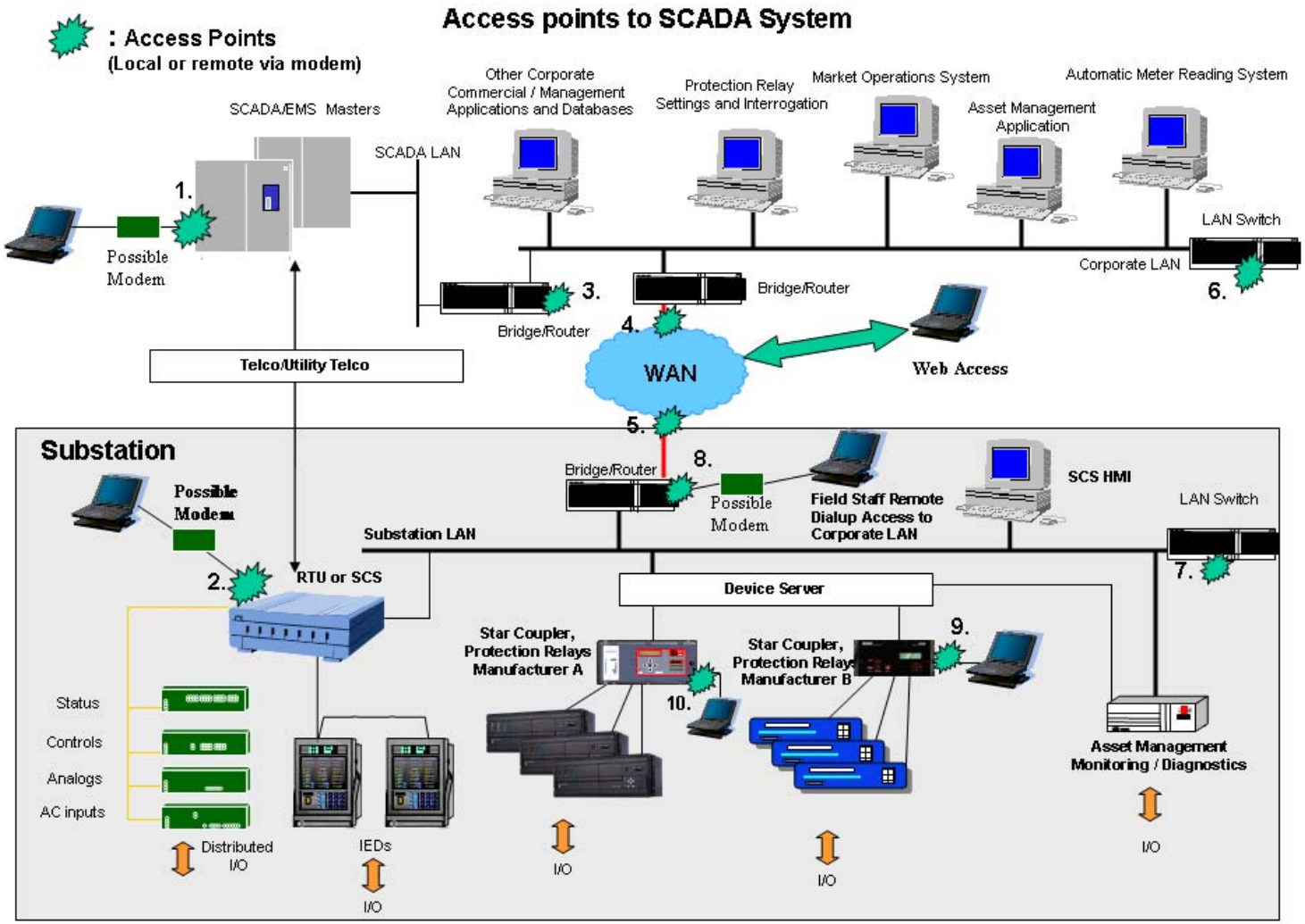
Access points to SCADA system



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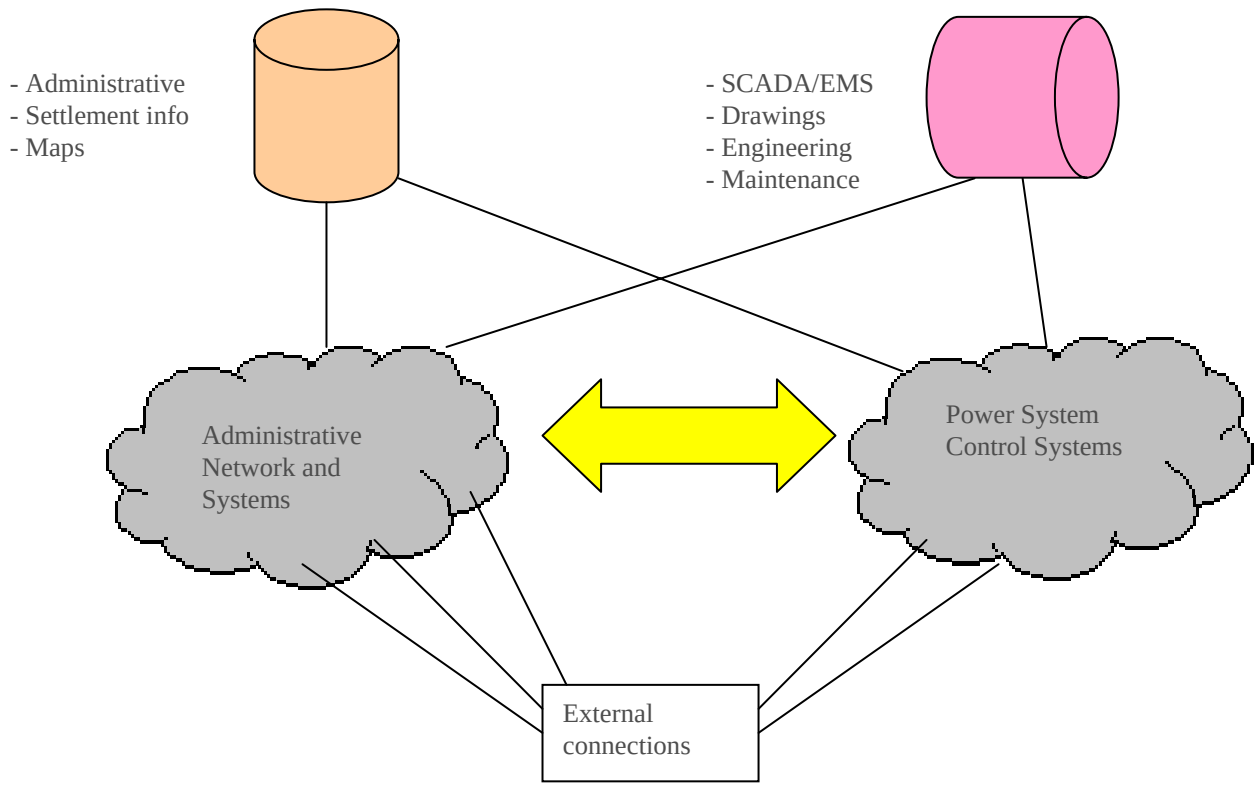
Interconnected systems



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Evolution of SCADA systems

- Being available over Internet
- Now based on the same technique as common administrative office IT systems: COTS
- Being integrated with administrative IT-system
- => *Same vulnerabilities for SCADA systems as for administrative IT systems!*
- *What to do?*
- Disturbances can affect essential infrastructures:
  - *Electric power, water, heat, gas, transportation*
  - Inter sectorialTvärsektoriellt
  - How many authorities have responsibility in a country?
- CIP = Critical Infrastructure Protection
- CIIP = Critical **Information** Infrastructure Protection

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Evolution of SCADA systems

- Cost – bespoke platforms were becoming too expensive to develop and maintain
- Time-to-market
- Increased hierarchical architecture requirements – data transfer, monitoring and management
- Broadband communication capabilities
- Vendors increasingly use COTS products

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Problem Statement – Utility perspective

- Awareness already there?
- Substation security is weak
  - What kind of equipment is being installed?
    Is IT cyber security included?
  - Overload of firewalls, switches ?
  - How can a utility rely on that the vendor's knowledge of security is sufficient?
- Resources
  - Staffing
  - Money
- SCADA systems not designed *from the beginning* to be secure
- ”Security-by-obscurity” is not enough

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Problem Statement – Utility perspective

- Previously: Systems deployed by ”fit and forget”
- Now:
  - Systems must actively managed and maintained
    - Evergreen approach?
  - Systems have a great deal of complexity
  - Do we always know what we end up buying?
    - Systems based on vendor developed + third-party software
    - Difficult to have detailed knowledge of all aspect of a system
  - Do vendors have detailed knowledge?

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Problem Statement – Utility perspective

- Security vulnarabilities are a moving target
  - Many, Varied, Complex, …
- Security aspects must be treated from the very beginning in projects – even *before* procurement
- Who takes resposibility for security when deploying a new system:
  - Utility?
  - Vendor?
  - Both?
  - None?

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Problem Statement – Utility perspective

- Deploy technical secure solution +
- Make people aware and committed +
- Introduce routines for security

- How do we introduce and enforce standards among power utilities?

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Proposal

- Security is a new, always on-going issue that needs to be taken care of
- Awareness
- Fully support from top management
- Active decisions, based on risk assessment
- Resources (both at utilities and vendors)
  - Staffing
  - Money

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Proposal

- Users must address security within a structured framework
  - Technical
  - Policies, procedures, compliance checks, …
- Users must push vendors
- Both control systems and IT skills needed to understand technical vulnerabilities, risks and possible solutions

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Proposal – System design and support

- Centralized logging
  - Tools
  - Automated alarms on incidents
- Forensic possibilities
  - Save information for later analysis
- ”Evergreen” approach
- Patch service
  - Applications: Allocations, Operating System, 3rd party SW, share ware, …
  - Tested patches: Time consideration
- Support 24-7

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Proposal

- Use country / EU electric power organizations to stress cyber security
- Security part of procurement
- Risk assessment at major changes and regular intervals
- Use a standard framework/similar in the area of control systems
  - ISO 27000 (17799), NERC CIP, NIST SP800, …
- Routines and processes in place
- Part of daily operation
- ”Personal responsibility”?

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Awareness

- Entire Swedish National Grid
  - Web-based education
  - Part of incentive program
- Management
  - Need for funding
  - Need for staffing!
- Critical system governance
  - Importance of following the work processes
  - Importance of good order
- Cooperation with other companies

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Sweden: Governmental coordination on SCADA Security

Based on existing organizations, develop existing expertise, coordinate relevant resources, utilize international experience and knowledge.

- Extended cooperation on SCADA security within the government
- Further develop on-going cooperation on SCADA Security between Swedish and foreign authorities
- Raise the awareness on Cyber Security among users and vendors of SCADA systems
- Develop technical and administrative recommendations and guidelines, and participate in international standardization works.

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CIGRÉ experiences

- CIGRÉ = Conseil International des Grands Réseaux Electriques, International Council on Large Electric Systems www.cigre.org
- Convenor of WG D2.22 on Information Security
  - Frameworks. Security Domains (Logical)
  - Risk Assessment
  - Security Technology considerations
  - Output: Technical Brochure (TB) 2009
    - Recommendations

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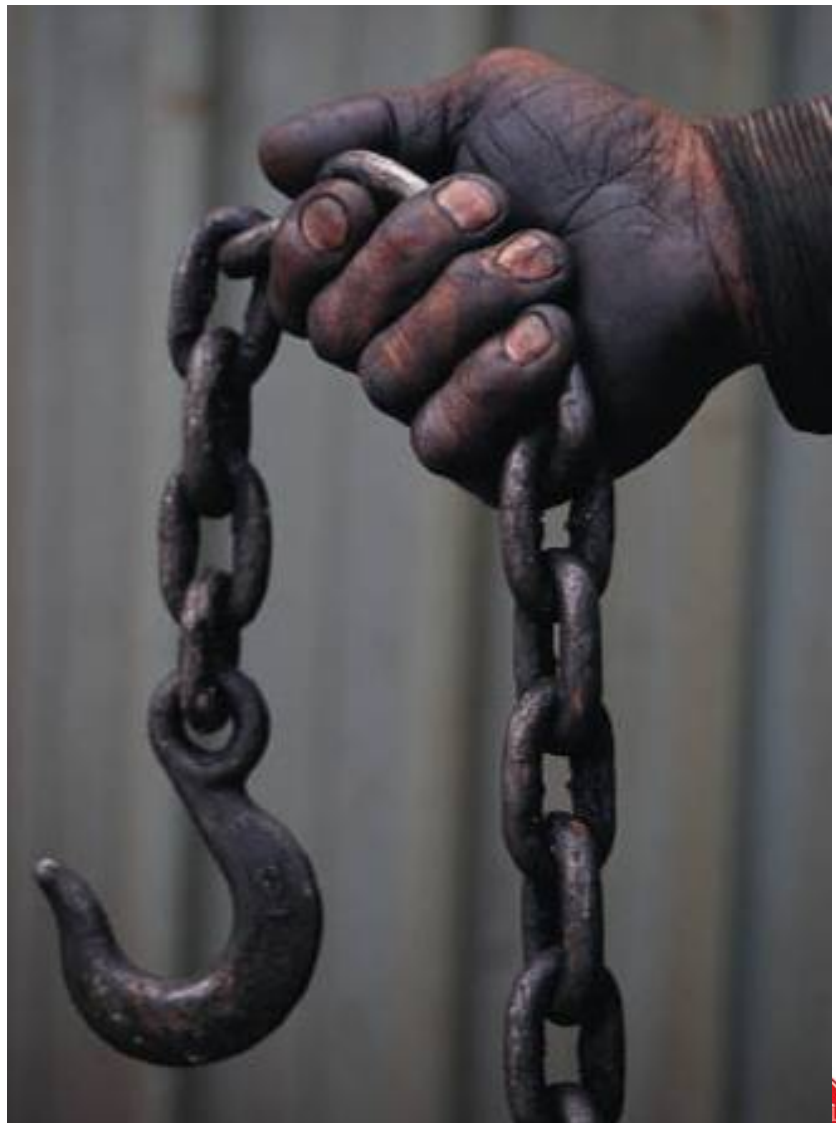
Securing your operation is hard and continuously on-going work

- Include in daily operation
- Learn from other people's mistake
- You don't have time nor money to do them yourselves



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Final recommendations

- Speak the language that gets and retains corporate attention
  - ”Risk management", ”Governance" etc.,
  - not ”Firewalls", ”Encryption" etc.

  Therefore has a better chance of getting budget
- Make on-going management of security part of the new "business as usual" for control systems
- Build a structured framework for the management of control systems security within an overall control systems governance framework, from the control centre to the end devices in the field
- Embed security requirements into projects and security related roles into project teams right from the start
- Make sure that control systems support teams have the right skills, which include large amounts of IT and network engineering skills

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Questions?

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