# Context and Development of the DRAMBORA Toolkit

Joint DCC and DPE Tutorial

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NANETH, 3 May 2007



## What do digital repositories do?

- Handle a wide variety of media types
- Guarantee authenticity of the object it holds
- Protect integrity from intended and accidental harm
- Enable verification
- Ensure accessibility
- Be self-contained



## Trust in repositories

- Trustworthiness is an important characteristic that the repository will have to demonstrate
- How to demonstrate trust in a repository?
- Digital curation is all about taking organisational, procedural, technological and other uncertainties and transforming them into manageable risks



## Critical Services Require Trust

- Task Force on Archiving of Digital Information asserted in 1996:
  - "a critical component of digital archiving infrastructure is the existence of a sufficient number of trusted organizations capable of storing, migrating, and providing access to digital collections."
- RLG/OCLC "Trusted Digital Repositories – Attributes and Responsibilities" (2002)
  - depositors trust information holders
  - information holders trust third party service providers
  - users trust digital assets provided by repositories

## Trust Explained

- Expectations of depositors
- Aspirations of service providers
- Management concerns
- Security
- Authenticity and integrity
- Accessibility
- Documentation, metadata and assets self-contained and accommodated in-house



## Attributes and Responsibilities

- Compliance with OAIS
- Administrative Responsibility
- Organisational Viability
- Financial Sustainability
- Technological and Procedural Suitability
- System Security
- Procedural Accountability



## Establishing Trust in a Repository

- How is it established?
- How is it maintained?
- How is it secured?
- What happens when it is lost?
- How can it be verified?
- Can repositories *do* what the say and *show* that they do what they say?
- Have they thought about what they are doing?



## Audit and Certification

- Formal means of establishing trust
  - people
  - data
  - processes
  - managing of organisation

## How does an audit proceed?

- Peer review?
- Payment? How much?
- Incentives?
- How is independence assured?
- Who is the ideal auditor?



## Defining Activities and Context

- UK's Digital Curation Centre (DCC) and Europe's Digital Preservation Europe (DPE)
- Collaboration with:
  - Trustworthy Repository Audit and Certification (TRAC) Criteria and Checklist Working Group
  - Center for Research Libraries' (CRL) Certification of Digital Archives project
  - Network of Expertise in Long-term Storage of Digital Resources (*nestor*)
  - International Repository Audit and Certification Birds of a Feather Group



## TRAC Criteria and Checklist

- Outlines best practice criteria for trusted repositories in three distinct areas
- Currently available at: http://www.crl.edu/PDF/trac.pdf
- Takes OAIS as its intellectual foundation, and the benchmark for measuring success
- Aspiration is standardisation; comparable with what ISO 17799 offers for Information Security Audit
- More about certification than audit



## *nestor* Criteria Catalogue

- 14 criteria, enriched by detailed explanations and concrete examples
  http://edoc.huberlin.de/series/nestormaterialien/8/PDF/8.pdf
- Groupings entitled:
  - Organisation Framework
  - Object Management
  - Infrastructure and Security
- Relates specifically to a German context

## DRAMBORA

- DCC and DPE conceived the *Digital Repository Audit Method Based on Risk Assessment* in early 2007
- Based on a number of test-audits conducted by the DCC and an analysis of existing audit criteria
- First version available from http://www.repositoryaudit.eu



## Yet another checklist?

- Existing methods are:
  - too static – 'one size fits all' approach
  - too much fixed on the OAIS reference model
  - too little emphasis on evidence in the auditing process
- Audit results should help to manage the repository better continuously, not just give a one-time evaluation



## What are we seeking to audit?

- Institutional means to manage context to ensure preservation:
  - people
  - data
  - processes
  - management
  - technological means
  - resource



## Fundamental Question is of Risk

Are repositories capable of:

- identifying and prioritising the risks that impede their activities?
- managing the risks to mitigate the likelihood of their occurrence?
- establishing effective contingencies to alleviate the effects of the risks that occur?
- If so, then they are likely to engender a trustworthy status – if they can demonstrate these capabilities

# DCC/DPE Audit Principles

- It should be a self-audit that repositories do themselves, based on the provided tools
- Self-audit could be a preparatory step for taking an external audit
- It should be flexible and be valid for repositories of all shapes and sizes and of different contexts
- It should be assessing how well the repository is managing the risks it is facing when it does what it does
- It should offer advice on how to overcome the risk situations and what other repositories have done in similar situations

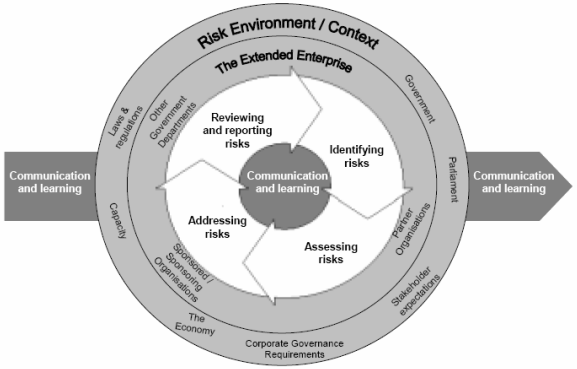


# Assessing risk

- Most risk assessment exercises are based on a benchmark that is established first
- By defining what success means first it is easy to assess how far from this measure you currently are
- Enterprise risk management is emerging
- Australian Risk Management Standard AS/NZS 4360, latest version is from 2004



# Risk Management Model






# DRAMBORA Core Aspects

- Authentic and understandable digital object
- Risk based
- Bottom-up approach to assessment (contrast with TRAC and *nestor* methodologies)
- Not about benchmarking, but could be used alongside benchmarking standards or criteria

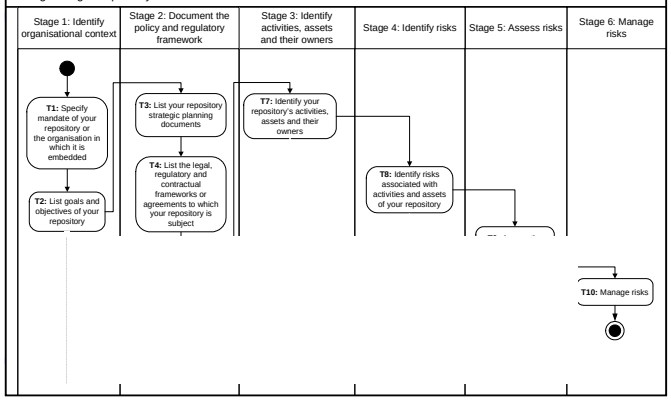
# DRAMBORA Stages

DRAMBORA requires auditors to undertake the following 6 stages:

- Identification of objectives
- Identification of policy and regulatory framework
- Identification of activities and assets
- Identifying risks related to activities and assets
- Assessing risks
- Managing risks



# DRAMBORA Workflow




# Ten Tasks

- What is the mandate of your repository
- What are the goals and objectives of your repository
- What policies does your repository have in place to support and regulate how these goals and objectives are to be achieved
- What legal, contractual and other regulatory requirements / confines does your repository operate in
- What standards and codes of practice does your repository follow
- Any other things that influence how your repository does the what it is supposed to be doing



# Ten Tasks

- What are the activities that your repository does to achieve its goals and objectives within the context and confines set by the regulatory environment, and what assets do you use and produce in the course of these activities, including staff, skills, knowledge, technology
- What are the risks associated with all of the above
- How would you assess these risks
- How do you manage these risks

## Interpreting Results

- The self-audit produces a composite risk score for each of the eight functional classes.
- This numeric result can be compared with risk scores of other functional classes and allows the identification of the areas of repository work that are most vulnerable to threats.



## Anticipated applications

- Validatory: Internal self assessment to confirm suitability of existing policies, procedures and infrastructures
- Preparatory: A precursor to extended, possibly external audit (based on e.g., TRAC)
- Anticipatory: A process preceding the development of the repository or one or more of its aspects



## DRAMBORA Future

- Test audits and feedback on the methodology – Spring-Summer 2007
- Version 2.0 to be released in September, as an interactive on-line tool
- Produce a formal audit report at the end of the self-audit
- Version 3.0 in Spring 2008
- Certification of self-auditors in 2008 (?)



## Your role

We would like you to:

- Learn today how to use the audit toolkit
- Use it in a test-audit on any digital repository
- Tell us:
  - what results did you get?
  - where do you think the methodology should be improved and how?
  - what functionality should the on-line tool have?

## Feedback

Please send all your comments, thoughts, suggestions, criticisms, opinions to:

**feedback@repositoryaudit.eu**

Thank you!



## DRAMBORA in Practice: Using the Self Audit Toolkit

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## DRAMBORA Outcomes

- Documented organisational self-awareness;
- Catalogued risks;
- Understanding of infrastructural successes and shortcomings;
- Preparation for full scale external audit.



## Anticipated applications

- Validatory: Internal self assessment to confirm suitability of existing policies, procedures and infrastructures
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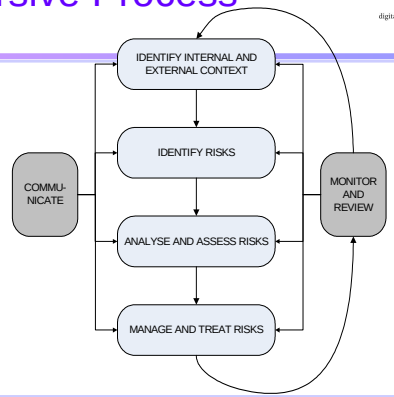
# A Recursive Process



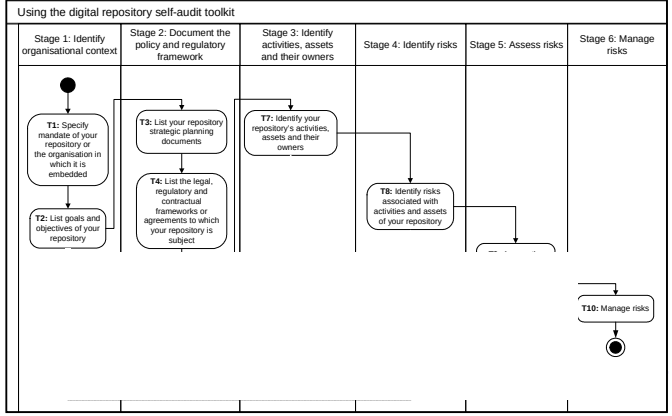



# DRAMBORA Stages

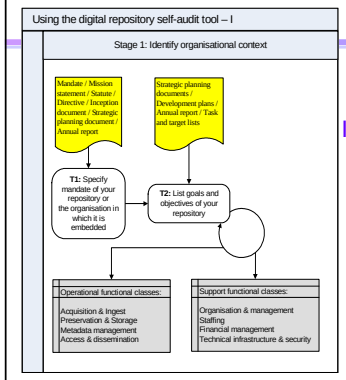
- Establish organisational profile
- Develop contextual understanding
- Identify and classify repository activities and assets
- Derive registry of pertinent risks
- Undertake assessment of risks (and existing management means)
- Commit to management strategies



# DRAMBORA Workflow




| *Risk Relationship* | *Definition of Risk Relationship* |
|---|---|
| **Explosive** | where the simultaneous execution of *n* risks has an impact in excess of the sum of each risk occurring in isolation |
| **Contagious** | where a single risk's execution will increase the likelihood of another's |
| **Complementry** | where avoidance or treatment mechanisms associated with one risk also benefit the management of another |
| **Domino** | where avoidance or treatment associated with a single risk renders the avoidance or treatment of another less effective |
| **Atomic** | where risks exist in isolation, with no relationships with other risks |




Identify organisational context



# Organisational Context

- The first stage in developing an organisational profile
- Building a platform to facilitate risk awareness
- Success reflects organisational characteristics and aspirations



# Stage 1: Tasks

- Identify organisational mandate
  - derived from mission statement or enacting instrument
- Identify organisational goals
  - why does organisation exist?
- Well established means for subsequent risk definition and assessment
- Success demands access to personnel and documentation



# Organisational Mandate

- Example Mandate:
  - The role of *[repository_name]* is to assist researchers to locate, access and interpret *[type_of_data]* produced by *[named_data_creator_group]* and to ensure its long term integrity.

# Organisational Goals

- Associated with one of 8 functional classes
  - Acquisition & Ingest
  - Preservation & Storage
  - Metadata Management
  - Access & Dissemination

  } operation classes

  - Organisation & Management
  - Staffing
  - Financial Management
  - Technical Infrastructure & Security

  } supporting classes



# An example objective...

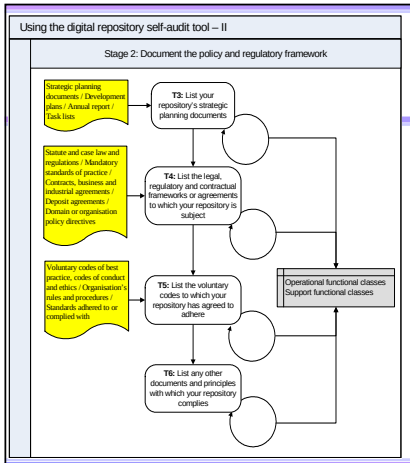
- Restrict authorisation to deposit materials, withdraw materials, disseminate materials, and request reports to the individuals specified in the agreement with the associate.



# Exercise 1: 15 minutes

- Document the mandate of the example repository
- Document the core objectives of the example repository
- Document some of the regulatory influences upon the repository






Document Policy and Regulatory Framework

## Document policy and regulatory framework

- Aimed at ensuring the repository:
  - operates correctly with respect to regulatory frameworks
  - has an efficient and effective policy framework
  - is aware of societal, ethical, juridical and governance frameworks
  - is aware of legal, contractual and regulatory requirements to which it's subject



## Strategic Planning Documents

- Identified within:
  - procedural or operational manuals
  - intranet or shared network storage
  - wikis
- Includes
  - Policies
  - Procedures



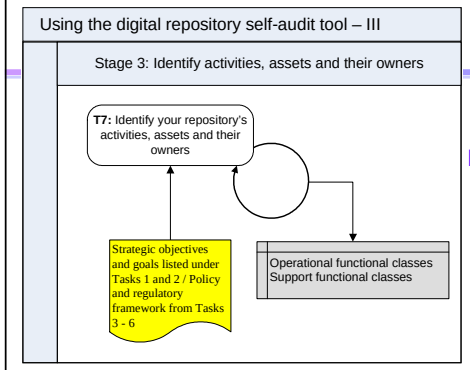
## Legal, regulatory, contractual frameworks

- Including:
  - Statute, case law and regulations
  - Mandatory standards of practice
  - Domain specific regulations
  - Contractual obligations and service level agreements
- Inferred by determining:
  - nature of repository; its domain area; relevant legislation (e.g. enacting legislation); third party contracts



## Voluntary codes & other documents

- Voluntary codes:
  - Standards imposed upon or adopted by repository
  - Standards forming the basis for other audits
  - Formal compliance programmes
  - Existing risk management programmes
- Other documents
  - e.g., Internal memorandums




Identify Activities, Assets and their Owners



# Activities, Assets and Owners

- Building conceptual model of what the repository does
  - split broad level mission and goals into more specific activities or work processes
  - assign to individual responsible actors
  - link to one or more key assets
  - **clues within**: business process re-engineering; imaging & work flow automation; activity-based costing or management; business classification development; quality accreditation; systems implementation



# Instructions for this stage

- Hierarchical analysis
  - breaking up organisation's activities into logical parts and sub-parts
    - charter
    - what makes organisation unique?
    - functions and operations
- Process Analysis
  - look in more detail at how repository conducts its business and what is involved



# Organisational Assets

- Includes:
  - information (databases, data files, contracts, agreements, documentation, policies and procedures)
  - software assets
  - physical assets
  - services and utilities
  - processes
  - people
  - intangibles, such as reputation

# Example response

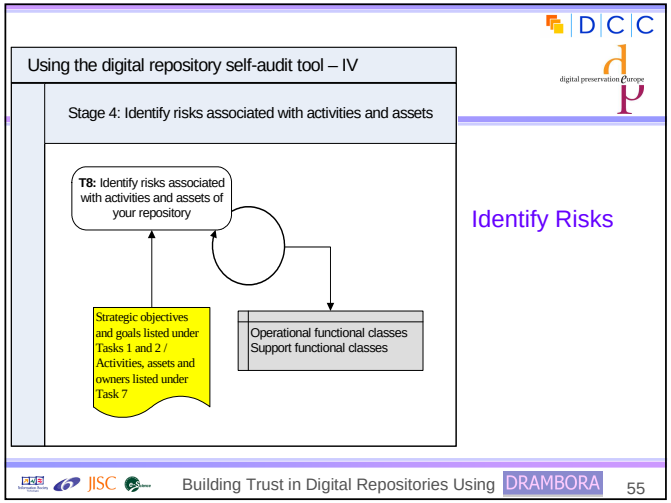
- Based on earlier objective:
  - **Activity: Implement authentication and authorisation subsystems to reflect agreed access rights and restrictions**
  - **Assets: Authentication and authorisation systems; contracts; technical infrastructure**
  - **Owner: Dissemination**



# Exercise 2: 45 minutes

- Derive specific organisational activities and assets associated with organisational issues already identified
- Classify these according to the owner (e.g., management, technical administrator, ingest, documentation etc)
- Consider useful practical means of activity derivation/identification








# Identifying Risks

- Assets & Activities associated with vulnerabilities – characterised as risks
- Auditors must build structured list of risks, according to associated activities and assets
- No single methodology – brainstorming structured according to activities/assets is effective

# Kinds of risk

- Assets or activities fail to achieve or adequately contribute to relevant goals or objectives
- Internal threats pose obstacles to success of one or more activities
- External threats pose obstacles to success of one or more activities
- Threats to organisational assets



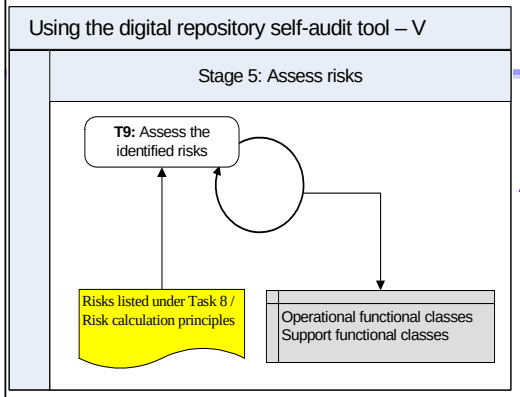
# Anatomy of a Risk

| | |
|---|---|
| **Risk Identifier:** | *A text string provided by the repository to uniquely identify this risk and facilitate references to it within risk relationship expressions* |
| **Risk Name:** | *A short text string describing the risk* |
| **Risk Description:** | *A longer text string offering a fuller description of this risk* |
| **Example Risk Manifestation(s):** | *Example circumstances within which risk will or may execute* |
| **Date of Risk Identification:** | *Date that risk was first identified* |
| **Nature of Risk:** | *Physical environment* |
| | *Personnel, management and administration procedures* |
| | *Operations and service delivery* |
| | *Hardware, software or communications equipment and facilities* |
| **Owner:** | *Name of risk owner - usually the same as owner of corresponding activity* |
| **Escalation Owner:** | *The name of the individual who assumes ultimate responsibility for the risk in the event of the stated risk owner relinquishing control* |

| | |
|---|---|
| **Stakeholders:** | *Parties with an investment or assets threatened by the risk's execution, or with responsibility for its management* |
| **Risk Relationships:** | *A description of each of the risks with which this risk has relationships* |
| **Risk Probability:** | *This indicates the perceived likelihood of the execution of this particular risk* |
| **Risk Potential Impact:** | *This indicates the perceived impact of the execution of this risk in terms of loss of digital objects' understandability and authenticity* |
| **Risk Severity:** | *A derived value, representing the product of probability and potential impact scores* |
| **Risk Management Strategy(ies):** | *Description of policies and procedures to be pursued in order to manage (avoid and/or treat) risk* |
| **Risk Management Activity(ies):** | *Practical activities deriving from defined policies and procedures* |
| **Risk Management Activity Owner:** | *Individual(s) responsible for performance of risk management activities* |
| **Risk Management Activity Target:** | *A targetted risk-severity rating plus risk reassessment date* |



Using the digital repository self-audit tool – V




Assess Risks



# Assess Risks

- Fundamental issues are:
  - probability of risks
  - potential impact of risks
  - Relationships between / groupings of risks
- A risk assessment must be undertaken for each identified risk

# Risk Assessment

- For each risk auditors must record:
  - example manifestations of risk
  - probability of its execution
  - potential impact of its execution
  - relationships with other risks
  - risk escalation owner
  - severity or risk (quantification of seriousness, derived as product of probability and impact)



| Risk Impact Score | Interpretation |
|---|---|
| 0 | *Zero* impact, results in **zero loss** of digital object authenticity and understandability[1] |
| 1 | *Negligible* impact, results in **isolated but fully recoverable loss** of digital object authenticity and understandability |
| 2 | *Superficial* impact, results in **widespread but fully recoverable loss** of digital object authenticity and understandability |
| 3 | *Medium* impact, results in **total but fully recoverable** loss of digital object authenticity and understandability |
| 4 | *High* impact, results in **isolated loss, including unrecoverable loss** of digital object authenticity and understandability |
| 5 | *Considerable* impact, results in **widespread loss, including unrecoverable loss or loss that is recoverable only by third party** of digital object authenticity and understandability |
| 6 | *Cataclysmic* impact, results in **total and unrecoverable loss** of digital object authenticity and understandability |

[1] Note that we use understandability in its broadest sense to encapsulate technical, contextual, syntactical and semantic understandability.



# Risk Impact

- Impact can be considered in terms of:
  - impact on repository staff or public well-being
  - impact of damage to or loss of assets
  - impact of statutory or regulatory breach
  - damage to reputation
  - damage to financial viability
  - deterioration of product or service quality
  - environmental damage
  - *loss of digital object authenticity and understandability is ultimate expression of impact*

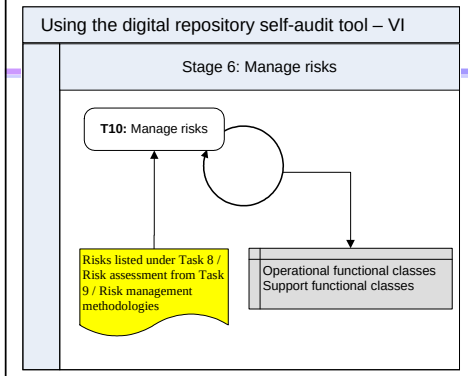


| Risk Probability Score | Interpretation |
|---|---|
| 1 | Minimal probability, occurs once every **100 years or more** |
| 2 | Very low probability, occurs once every **10 years** |
| 3 | Low probability, occurs once every **5 years** |
| 4 | Medium probability, occurs once **every year** |
| 5 | High probability, occurs once **every month** |
| 6 | Very high probability, occurs **more than once every month** |

## Determining impact and likelihood

- Consider:
  - Historical experiences
  - Mitigation/avoidance measures already in place
  - Experiences beyond repository itself
    - Relevant research
    - Expert opinion (e.g. legal, technical, environmental)
    - Experiences of comparable organisations






Manage Risks



## Manage Risks

- Combination of avoidance, tolerance and transfer
  - avoid circumstances in which risk arises
  - limit likelihood of risk
  - reduce potential impact of risk
  - share the risk
  - retain the risk



## Risk Management & DRAMBORA

- The toolkit refrains from prescribing specific management policies
- Instead, auditors should:
  - choose and describe risk management strategy
  - assign responsibility for adopted measure
  - define performance and timescale targets
  - reassess success recursively

## Management Risk: Steps

- Auditors should:
  - identify suitable risk responses
  - identify practical responses to each risk
  - identify owners for risk management activities
  - investigate threats arising from risk management
  - prioritise risks
  - update risk register and circulate information
  - secure approval for planning and allocations



## Example Risk Derivation

- **Risk Name: Authentication subsystem fails**
- **Risk Description: Systems for limiting accessibility of information are insufficeint, resulting in inappropriate accesses or failure to access**
- **Nature of Risk: Operations & service delivery; hardware, software or communications equipment & facilities**



## Example Risk Derivation (2)

- **Example Risk Manifestations: Individuals who are not entitled to have access to content can access it. Repository system relies upon IP-based authentication, but since all users within University *x access the web via a proxy the application perceives any access from that campus as coming from a single IP and every resident user gains access***



## Example Risk Derivation (3)

- **Avoidance**
  - Define policies describing requirements to correspond to contractual agreements and other regulatory, legislative or contextual provisions
  - Implement and formally test appropriate systems
  - Establish robust technical infrastructure to satisfy system demands

## Example Risk Derivation (4)

- **Treatment**
  - Determine shortcoming that led to failure and subsequently remedy it
  - Implement policy to describe appropriate system reaction if system is self-aware of failure (e.g, upon failure refuse all access attempts)



## Exercise 3: 1 hour

- Derive risks associated with each activity, asset or individual
- Discuss the potential impact and likelihood associated with these risks based on your own experiences
- Discuss and document appropriate risk management strategies



## Interpreting the Audit Result

- Composite risk score enables quantification of risks' severity
  - illustrates vulnerabilities
  - facilitates resource investment
- Online tool will feature rich reporting mechanisms
  - what should this consist of?



## After the audit

- Improvement requires ongoing activity
  - are risk management strategies working?
  - are risks within a satisfactory tolerance level?
  - risk exposure must be reassessed on an ongoing basis
  - risk management strategies must be re-evaluated
  - management must be informed of developments

## Improving DRAMBORA

- Toolkit usability concerns remain
- Can a single individual coordinate an audit?
- Can risks be effectively derived where activities meet or transactions occur?
- We're very interested to hear your thoughts (now, or after you use DRAMBORA)



## What we'd like to know

- What features would you like to see within the toolkit's online version?
- What have you learned about your repository following DRAMBORA assessment?
- Have you combined DRAMBORA effectively with other tools/check-lists?



## Closing Questions?

- If you have any further questions please email us at feedback@repositoryaudit.eu
- We'd be delighted to hear of your own experiences using the DRAMBORA toolkit