Science Gateway Security Recommendations

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• Our abstract:  http://go.illinois.edu/gwsecabstract

• These slides:  http://go.illinois.edu/gwsecslides
Science Gateway Security Concerns

• **Confidentiality** of pre-publication research data
• **Integrity** of research results
• **Availability** of services

• Provide **trustworthy** service to researchers
• Maintain **trust** of resource providers
• Use resources in **compliance** with policies

• Each science gateway is **unique**
  • Assess risks to determine appropriate mitigations
  • Risk = Likelihood x Impact
Science Gateway Risk Factors

- small, closely-knit user community
- public data (sky survey data)
- internal resources
- focused functionality

- large, distributed, open user community
- sensitive data (personal health info)
- external resources
- wide range of user capabilities

less risk  more risk
Science Gateways and Resource Providers

Deployment models include:

- **Dedicated**: Resources managed by science gateway
  - Science Gateway sets its own policies
  - Example: Rosetta Online Server That Includes Everyone (ROSIE)

- **Transparent**: Providing a new interface to existing resources
  - Users have accounts on existing resources
  - Example: TeraGrid Visualization Gateway

- **Tiered**: Science Gateway manages resource allocation
  - Science Gateway manages its own users
    - Using community account / robot certificate at resource provider
    - May send per-user attributes to resource providers
  - Examples: CIPRES, GENIUS
TeraGrid Science Gateway AAAA Model (2005)

http://dx.doi.org/10.1145/1838574.1838576
Existing Security Recommendations

- Virtual Organization Portal Policy (EGI-InSPIRE SPG, 2010)

- Securing Science Gateways (Hazlewood and Woitaszek, 2011)
### VO Portal Policy (EGI-InSPIRE SPG, 2010)

<table>
<thead>
<tr>
<th>Portal Class</th>
<th>Executable</th>
<th>Parameters</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple one-click</strong></td>
<td>provided by portal</td>
<td>provided by portal</td>
<td>provided by portal</td>
</tr>
<tr>
<td><strong>Parameter</strong></td>
<td>provided by portal</td>
<td>chosen from enumerable and limited set</td>
<td>chosen from repository vetted by the portal</td>
</tr>
<tr>
<td><strong>Data processing</strong></td>
<td>provided by portal</td>
<td>chosen from enumerable and limited set</td>
<td>provided by user</td>
</tr>
<tr>
<td><strong>Job management</strong></td>
<td>provided by user</td>
<td>provided by user</td>
<td>provided by user</td>
</tr>
</tbody>
</table>

**General Conditions**

- Limit job submission rate
- Audit logging
- Assist in security incident investigations
- Securely store passwords, private keys, and user data

TeraGrid: Securing Science Gateways (Hazlewood and Woitaszek, 2011)

- Recommendations:
  - Per-user accounting
  - Limiting access at resource providers (restricted shell, grid interfaces)
  - Separating per-user data from shared software and data
  - Individual accounts for science gateway developers
  - Short-lived certificates for remote access

Table 1: TeraGrid Science Gateway Summary

<table>
<thead>
<tr>
<th>Gateway Name</th>
<th>Gateway Infrastructure</th>
<th>AuthN Credential Community</th>
<th>AuthN Credential User</th>
<th>Execution</th>
<th>Data Movement</th>
</tr>
</thead>
</table>

Table 2: TeraGrid Resource Provider Science Gateway Security Policy Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indiana</td>
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http://doi.acm.org/10.1145/2016741.2016781
Science Gateway User Authentication

• Why authenticate users?
  • Access to external resources
  • Personalization
  • Maintaining state across sessions
  • Accounting / tracking usage

• How to authenticate users?
  • Outsourced: federated identities, identity as a service
  • Internal: password DB managed by science gateway
Federated User Authentication

- Avoid managing user passwords!
- SAML: campus identities
- OpenID/OAuth: public identities
- Enables two-factor authentication
If your science gateway needs to handle user passwords:

• Protect passwords from online attack
  • Use HTTPS
  • Block brute-force attacks (e.g., Fail2Ban)

• Protect passwords from offline attack
  • Store password hashes
  • Use a strong hashing algorithm, with per-password salt
  • Use existing password hashing implementation
    • e.g., PHP password_hash()
  • http://security.blogoverflow.com/2013/09/about-secure-password-hashing/
Science Gateway Operational Security

- **Prevent** (eliminate) threats (when possible)
- **Detect** security incidents
- **Respond** effectively to security issues

**Goal**: manage risks

**First Step**: Early communication with local security staff
- Provide security services (monitoring, scanning, logging, etc.)
- Identify security policies and best practice recommendations tailored to your local environment
- Establish relationships now in case of security incident later
Basic Operational Security Checklist

Prevent
- Software patching
- Control admin access
- Vulnerability scanning
- Firewalls
- Physical security

Detect
- File integrity checking
- Intrusion detection
- Log monitoring

Respond/Recover
- Centralized logging
- Secure backups

sciencegatewaysecurity.org | trustedci.org
Continuous Software Assurance

The Software Assurance Market Place (SWAMP) is a DHS S&T sponsored open facility to become operational in January 2014. It is driven by the goal to expand the adoption of software assurance (SwA) by software developers.

The SWAMP will enable you to:

- **Identify** new (possible) defects in your software every time you commit a change
- **Identify** new (possible) defects in a software/library/module you are using every time a new version is released
- **Track** the SwA practices of your project

While protecting your privacy and the confidentiality of your data.

http://continuousassurance.org
Science Gateway Security: Community Resources

http://trustedci.org/help
http://sciencegatewaysecurity.org/discussion
http://xsede.org/gateways