VRDA

Vulnerability Response Decision Assistance

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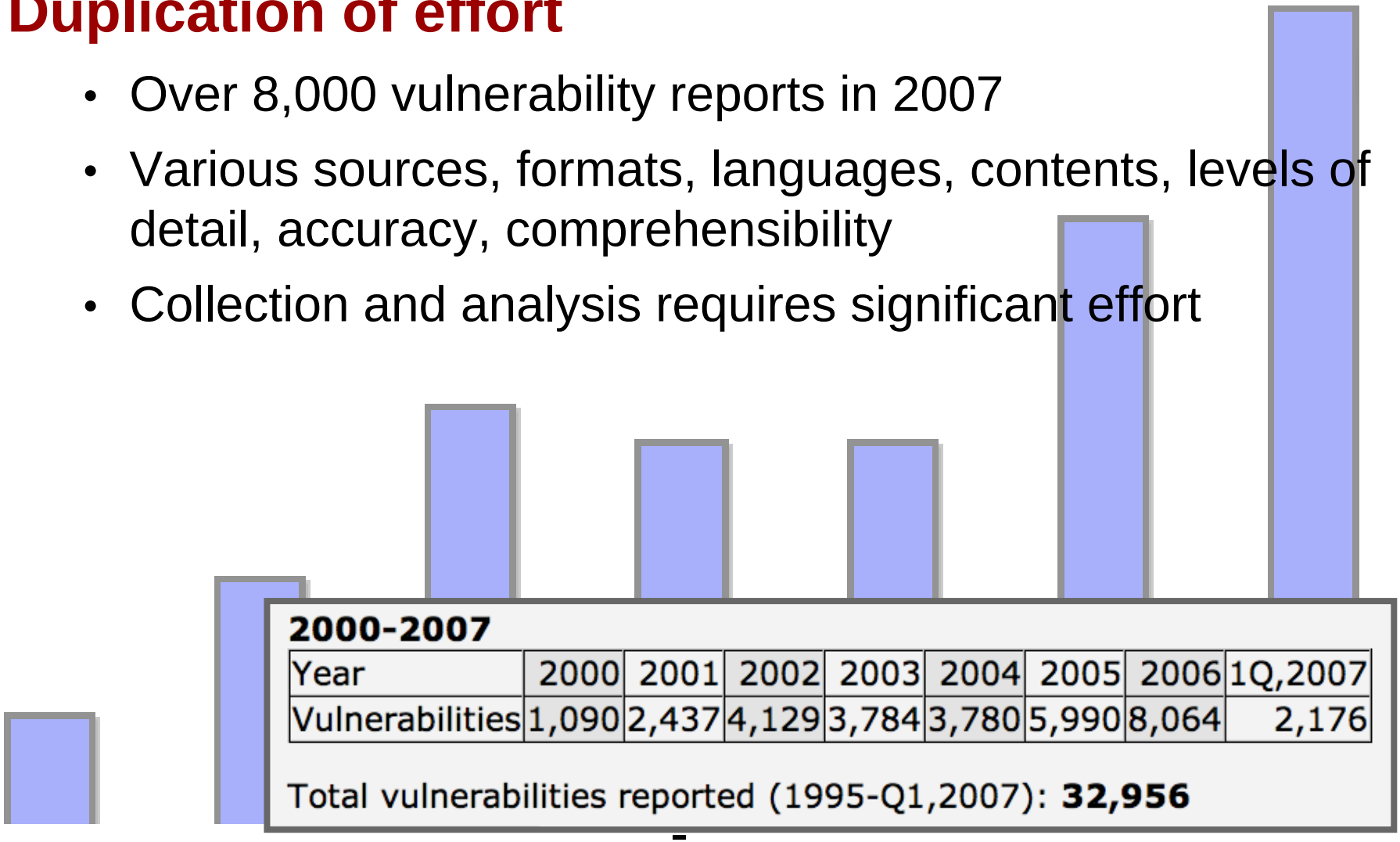
FIRST 2007

VRDA Rationale and Design

Problems

Duplication of effort

- Over 8,000 vulnerability reports in 2007
- Various sources, formats, languages, contents, levels of detail, accuracy, comprehensibility
- Collection and analysis requires significant effort



2000-2007

Year	2000	2001	2002	2003	2004	2005	2006	1Q,2007
Vulnerabilities	1,090	2,437	4,129	3,784	3,780	5,990	8,064	2,176

Total vulnerabilities reported (1995-Q1,2007): **32,956**

Problems (2)

Inconsistent response decisions

- Analysts may disagree
- Analysts apply personal prejudices
- Decisions may not represent organizational values

Problems (3)

Existing metrics insufficient

- Most metrics output global severity values
  - "One size does not fit all."
- Common Vulnerability Scoring System (CVSS)
  - Contains environmental metrics
  - Focus on base score
- Values vary by organization
  - May respond differently to the same vulnerability
  - Use different software
  - Use the same software in different ways
  - Value information assets differently

Solution

VRDA proposes to answer the question:

How do I best respond to a given vulnerability report?

Goals

- Record vulnerability data in structured format
- Support individualized response decision
- Transition organizational knowledge from human analysts to VRDA
- Improve response accuracy and consistency
- Reduce duplication of effort

Audience

System administrators

- Operational responsibility for fixing systems

CSIRTs

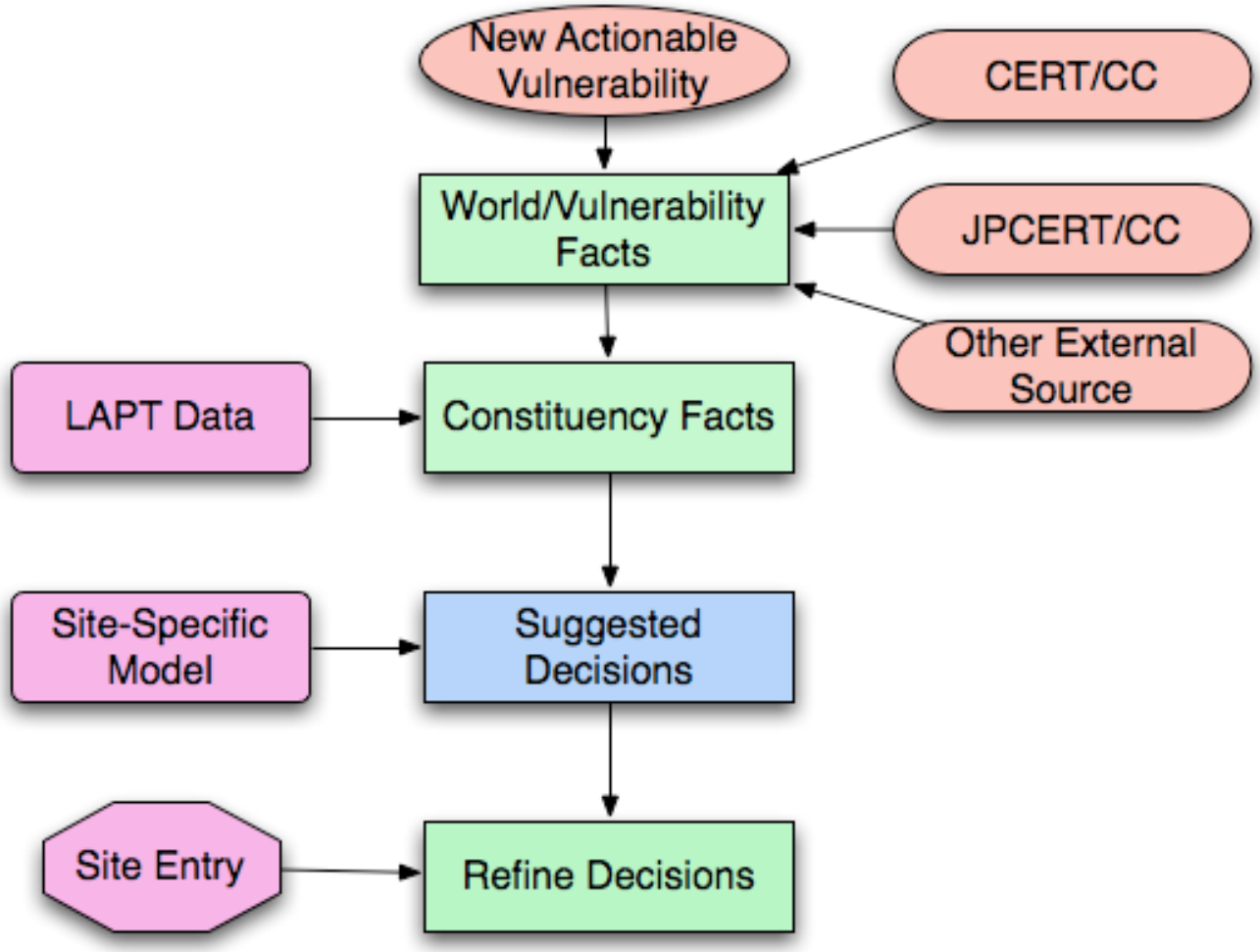
- Provided advice to system administrators, users

Vendors

- Product security response teams

Anybody regularly responding to vulnerability reports

Operational Concept



Components

Decisions to make: Tasks

Vulnerability representation: Facts

Product usage: LAPTs

Encoding decision-making: Decision Model

Tasks

Decisions an organization must make

Specific to each VRDA user

Example tasks

- Publish an advisory
- Initiate patch process
- Implement workaround
- Ignore (don’t expend effort on low priority vulnerabilities)

Facts

Properties of vulnerabilities and their environment

Assertions based on available information

- Vulnerability Facts–inherent technical attributes
- World Facts–about environment
- Constituency Facts–specific to VRDA user organization

Balance accuracy, completeness, granularity, cost

LAPTs

Lightweight Affected Product Tags

Problem: Constituency facts cannot be given to you

LAPTs identify products affected by vulnerability

Facilitates lookup of constituency facts

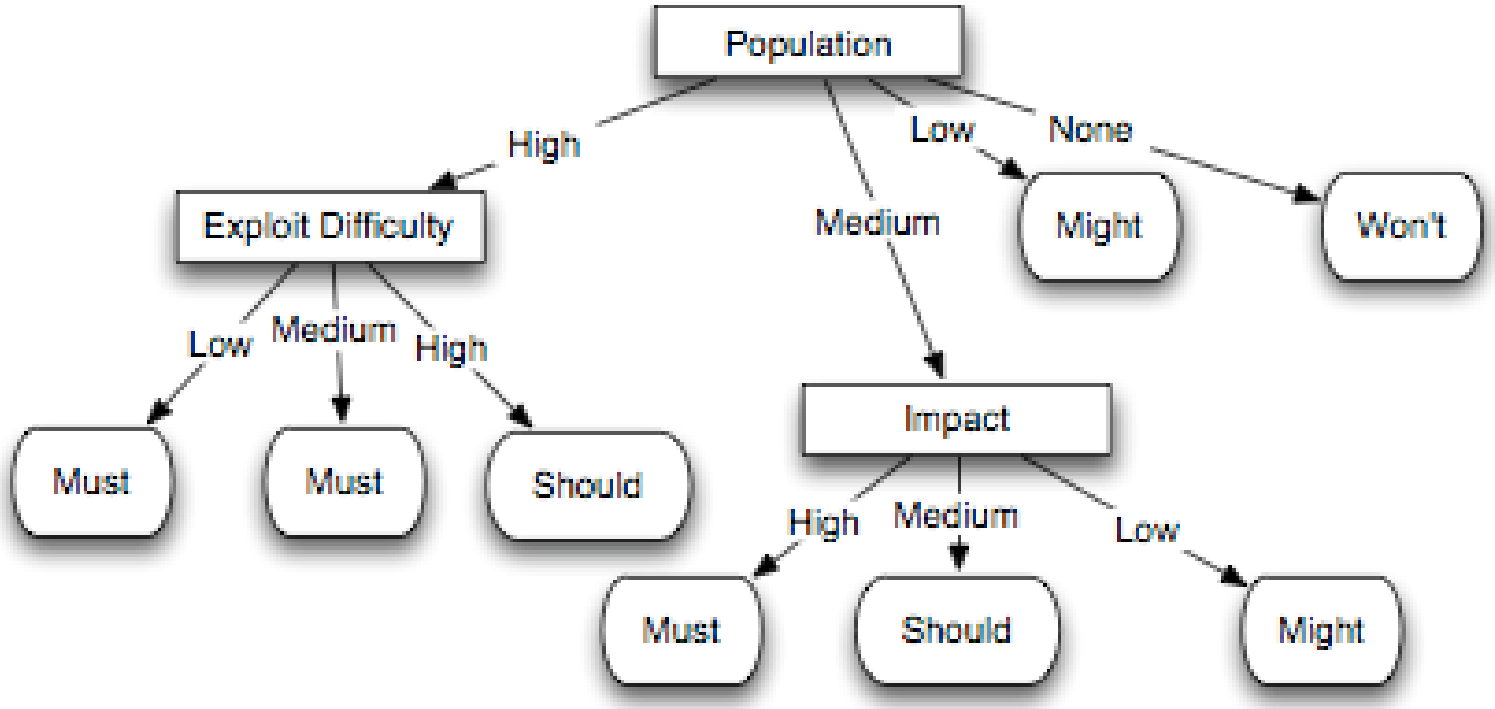
- External feed provides LAPTs for each vulnerability
- Cross-reference with your database

Decision Model

Represents individualized decision-making behavior

Expert system encoding organizational values

Decision trees



Decision Model (2)

Why decision trees?

- Observable, understandable
- Can be created and refined by hand

Model creation

- Design initial model from experience
- Create empirical model based on recorded data

VRDA Usage with KENGINE

KENGINE

VRDA implementation developed by JPCERT/CC

- Intend to open-source

KENGINE provides consistent analysis and reasoning action

Other KENGINE functions

- Task management
- LAPT management
- Decision tree management
- Reporting

KENGINE

Minimum resources to handle the maximum number of vulnerabilities

Deployment

Interview user organization

- Determine all possible tasks
  - Identify task dependencies
  - Mandatory/conditional actions do not involve choice, not tasks
- Determine facts
  - Select only facts necessary to make decisions about tasks

Develop decision model

- Teach/train the system using sample VRDA data and choosing appropriate tasks
- Create or modify decision trees manually

KENGINE Customization

Interview session with analysts and system administrators to elicit tasks and facts

What's the **population** of this product?

What kind of **service** does this system provide? **Importance** of the system?

Security products?

any **incident activity?**

Develop Decision Model

Identify dependencies between tasks and facts

KENGINE can generate decision tree automatically

Parameter: What's the **Population** of this products in my organization?

Value: population **high.** Also this is an **authentication system** for critical service…

Remediation/action:
- Publish alert
- Validate patch immediately

Usage

Get or create VRDA data

Score organization-specific facts

Process vulnerability reports

- Use the decision model
- Record actual decisions

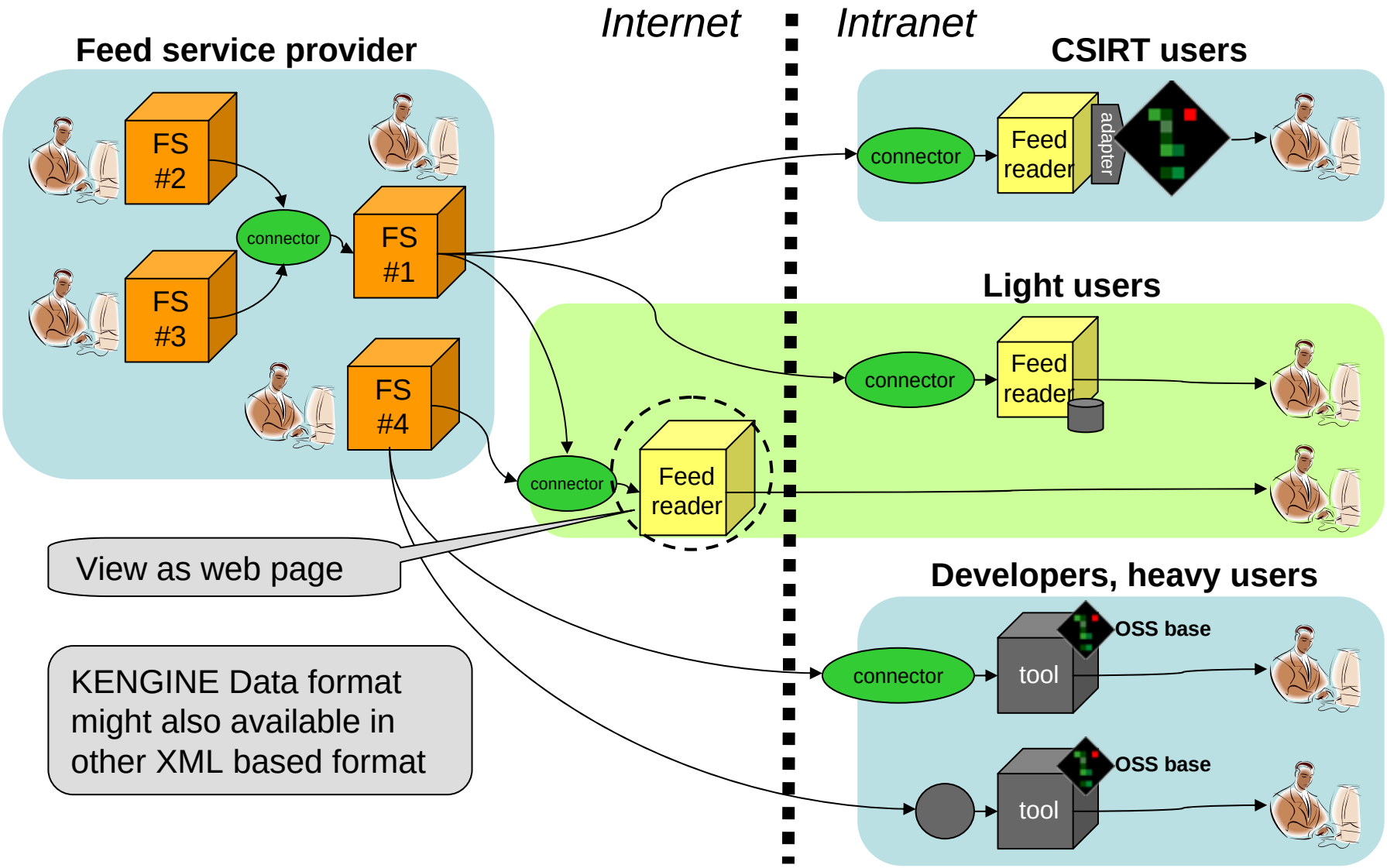
Feedback

Compare recommendations with actual decisions

Refine decision making process

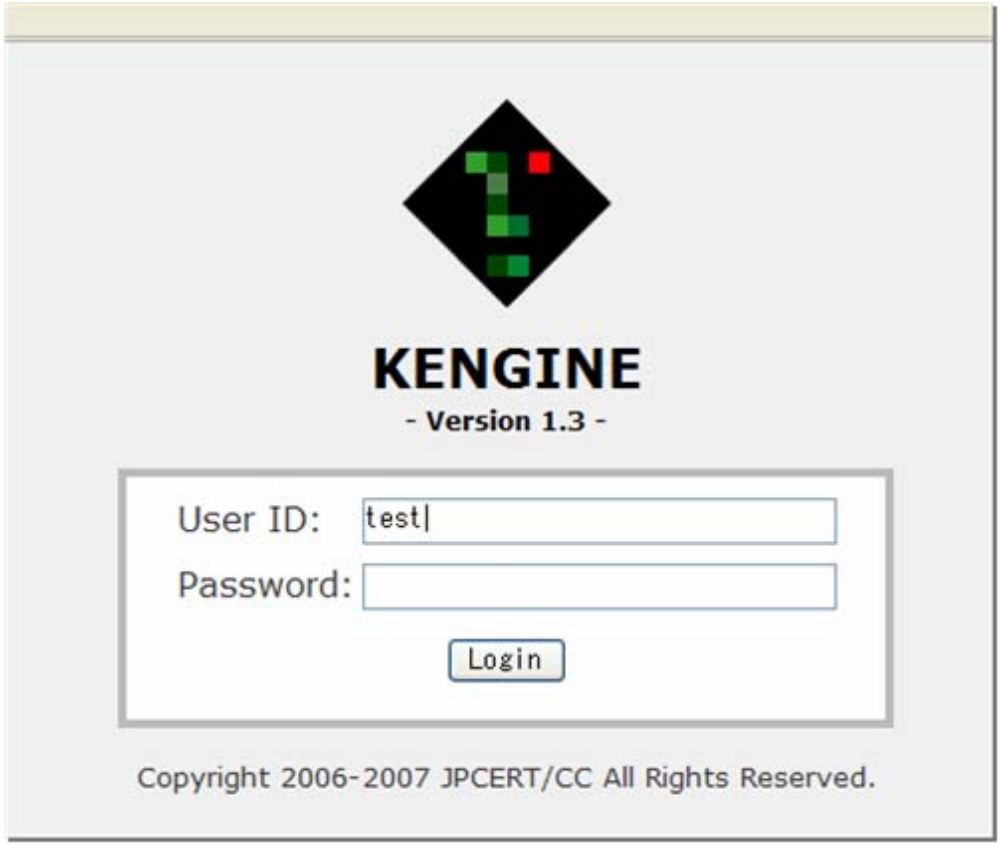
- Update decision model
- Facts may be missing or inaccurate
- Tasks may be missing

KENGINE Usage Patterns



KENGINE Data format might also available in other XML based format

KENGINE


KENGINE
- Version 1.3 -
User ID:
test
Password:
Login
Copyright 2006-2007 JPCERT/CC All Rights Reserved.

Vulnerability Reports

Report ID	Title	Priority [8]	Status	Assign	Task			Created Updated
					Analyze	Security_Alert	Sharing	
JVN#00000023	MS Updates for Multiple Vuls	1	Pending Close (D2)	admin admin	Yes Final	Notify Final	Yes Final	'07/08/14 '07/08/14
JVN#00000029	MS Updates for Multiple Vuls	1	Proposal Req'd (Detailed)	admin admin	Yes Computed	Notify Computed	No Computed	'07/08/14 '07/08/14
JVN#00000013	Sourcefire Snort DCE/RPC Preproce...	1	Pending Close (D2)	admin admin	Yes Final	Refer Final	No Final	'07/06/14 '07/08/14
JVN#00000028	MS SQL Vulnerability	1	Proposal Req'd (Surface)	admin None	Yes Computed	Alert Computed	No Data Computed	'07/08/14 '07/08/14
JVN#00000021	Abobe Acrobat reader	1	Decision Req'd (Surface)	None None	Yes Computed	Refer Proposed	No Data Computed	'07/07/14 '07/08/14
JVN#00000025	GnuPG Vulnerability	1	Detailed Analysis Req'd	admin admin	Yes Computed	Notify Computed	No Data Computed	'07/08/14 '07/08/14

Vulnerability Report Detail

** General Information ** Edit

Report ID	: JVN#00000023		
Title	: MS Updates for Multiple Vuls		
Memo	:		
Status	: Pending Close (D2)		
Created	: 2007/08/14 23:11	**Last Updated**	: 2007/08/14 23:28
Created By	: admin		
Tri Handler	: admin	**Vul Handler**	: admin
Surface Completed	: 2007/08/14 23:12		
Detailed Completed	: 2007/08/14 23:28		
Decision Finalized	: 2007/08/14 23:28		
Report Closed	:		

Hide ** Analysis Information **

- LAPT - Edit

Selected LAPTs

[Microsoft-Excel][Microsoft-InternetExplorer][Microsoft-Windows-Vista][Microsoft-Windows-XP][Microsoft-Word]

- FACT - Edit

Impact)

The impct of the vulnerability is:

None Low ✔ Medium High Unknown

Access_Required)

The type of network and/or physical access required to exploit this vulnerability is:

Routed ✔ Non-routed Local Physical Unknown

Authentication_Required)

What level of authentication does exploiting this vulnerability require?

None Limited ✔ Standard Privileged Unknown

LAPT Management

Search | Reset

Items per page: 50

Name	Related Reports	FACT		Last Checked	Action	
		Organization_Used	Importance			
Adobe-Acrobat	0	Yes	Low	61days	Edit	Delete
Adobe-Acrobat-Reader	1	Yes	Medium	61days	Edit	Delete
Apache	1	Yes	High	61days	Edit	Delete
Apple-MacOS-X	2	Yes	Low	61days	Edit	Delete
Apple-QuickTime	2	No	None	61days	Edit	Delete
Apple-Safari	1	Yes	Low	61days	Edit	Delete
Bind	1	Yes	High	61days	Edit	Delete
Cisco-IOS-10	1	Yes	High	61days	Edit	Delete
Debian	1	No	None	61days	Edit	Delete

Task Workflow

Report ID	Task	Decision	Priority [8]	Task Status: Not Started | In Progress | Completed	Update	Memo	Details	Last Updated Report Closed	Action
JVN#00000005	Analyze	Yes Final	1	○ ◉ ○					Details Memo
JVN#00000003	Analyze	Yes Final	1	○ ○ ◉					Details Memo
JVN#00000010	Analyze	Yes Final	1	○ ○ ◉					Details Memo
JVN#00000023	Analyze	Yes Final	1	○ ◉ ○					Details Memo
JVN#00000020	Analyze	Yes Computed	1	◉ ○ ○					Details Memo
JVN#00000002	Analyze	Yes Final	1	○ ◉ ○					Details Memo
JVN#00000012	Analyze	Yes Final	1	○ ○ ◉					Details Memo

Decision Tree

Name:

Security_Alert

Back

Master :

Tree Tag Name : MASTER-Generated

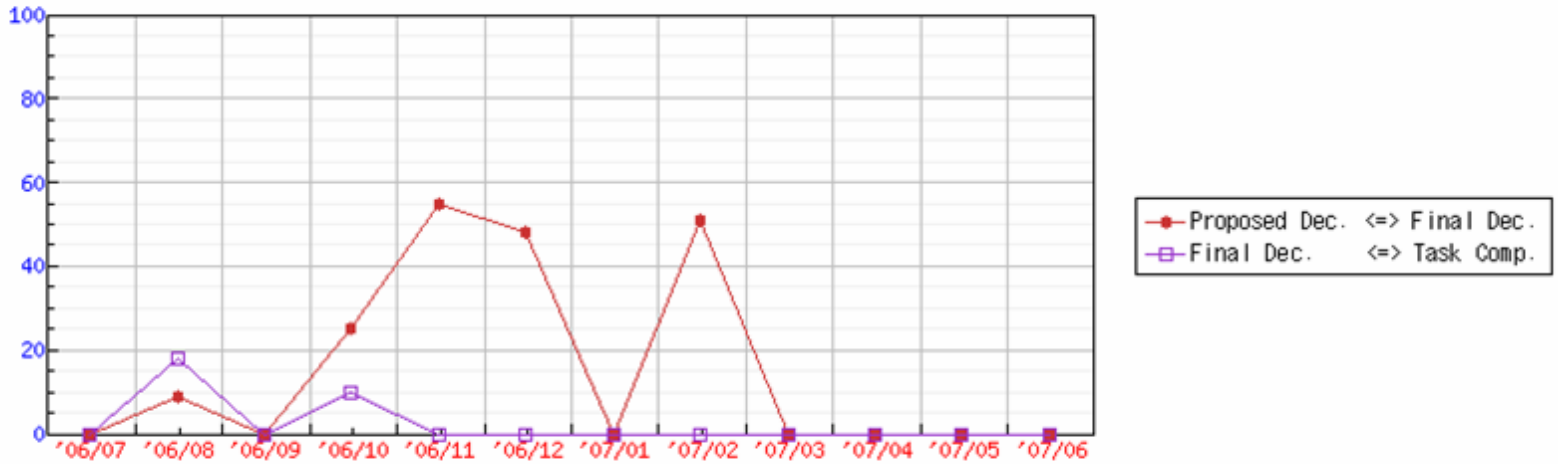
Comment :

- Consider field "Importance"
  - Unknown -> Consider field "Impact"
    - Unknown -> Consider field "Required_Actions"
      - Unknown -> Consider field "Authentication_Required"
        - Unknown -> "No_Act"
        - Privileged -> "No_Act"
        - Standard -> "No_Act"
        - Limited -> "Refer"
        - None -> "Notify"
      - Complex -> "No_Act"
      - Simple -> "Notify"
    - High -> "Alert"
    - Medium -> "Notify"
    - Low -> "Refer"
    - None -> "No_Act"
  - High -> Consider field "Impact"
    - Unknown -> Consider field "Activity"
      - Uknown -> "No_Act"
      - Our incident -> "Alert"

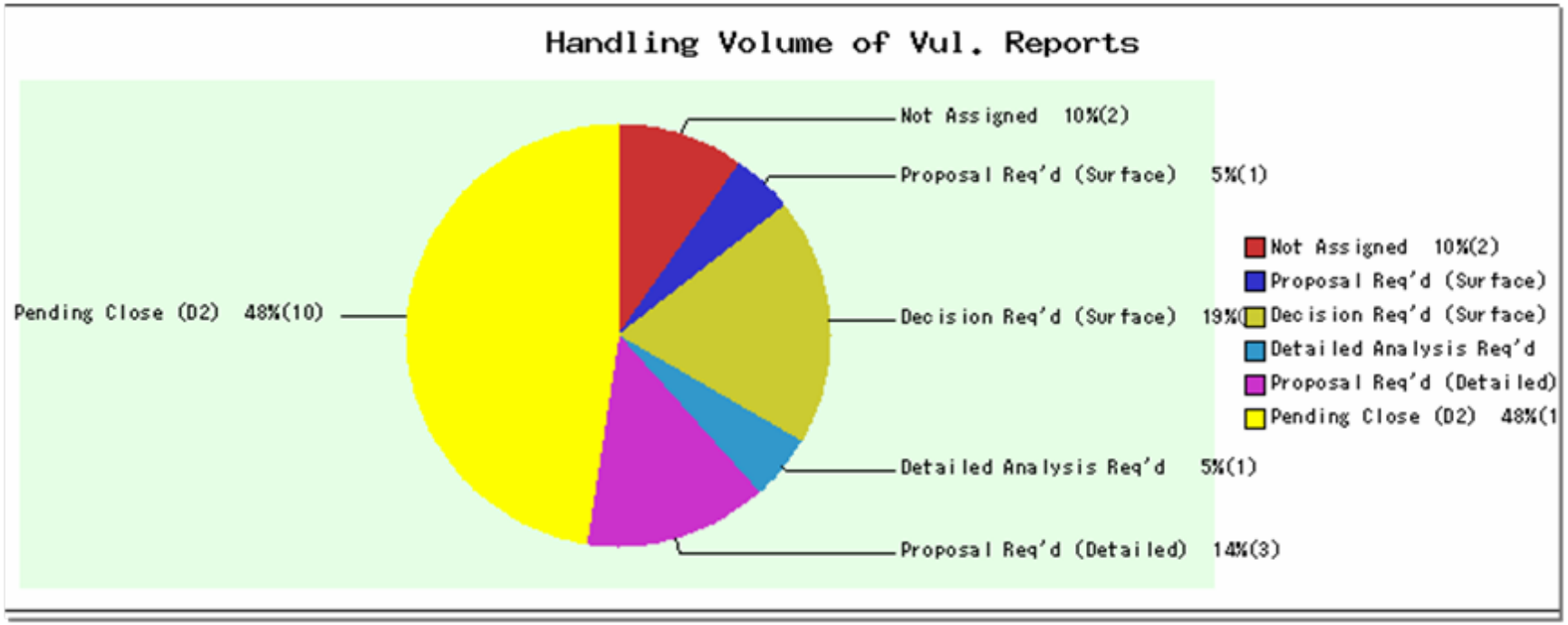
Task Deviation Report

Task:Analyze Review Decision

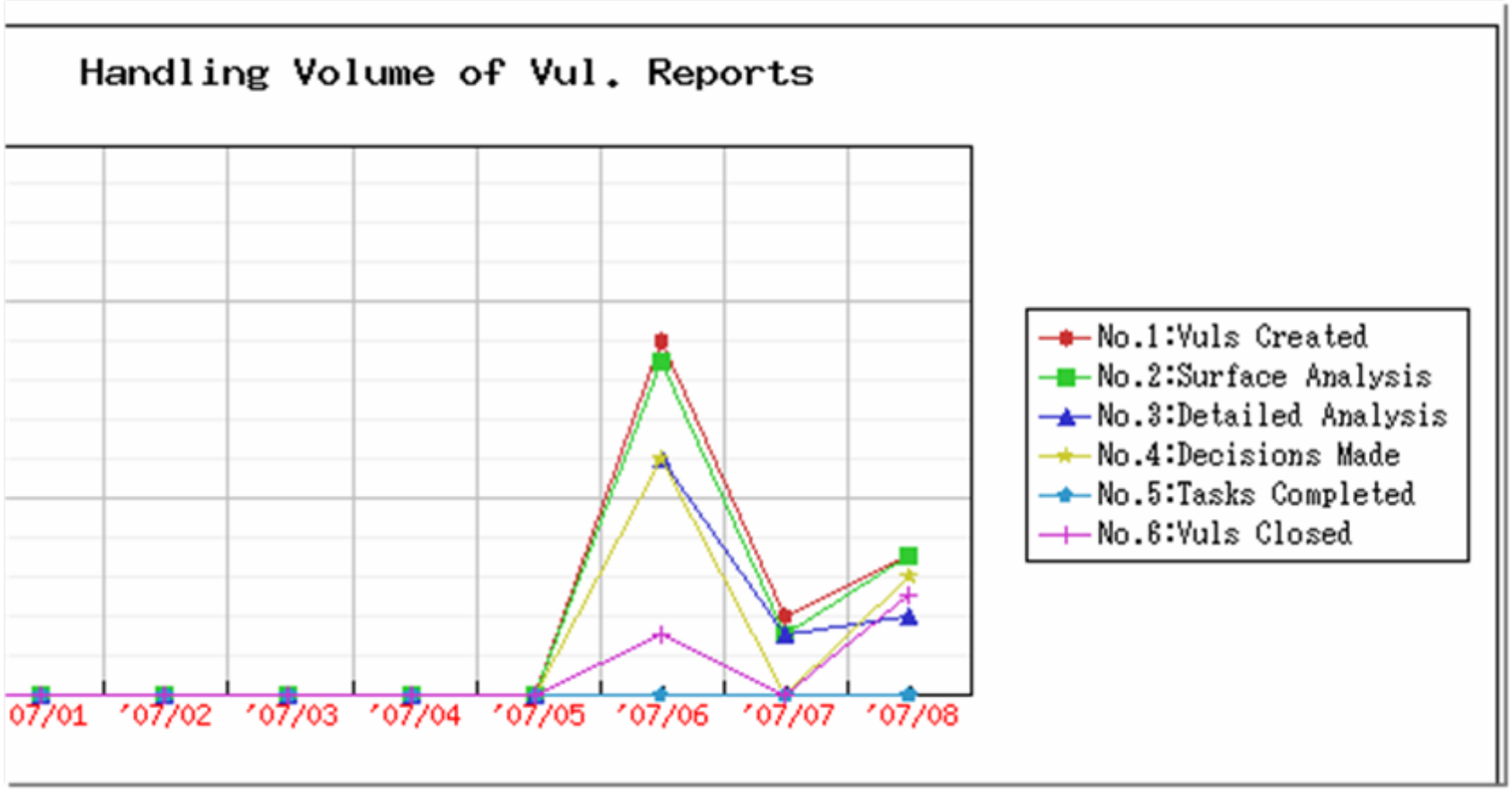
	'06/07	'06/08	'06/09	'06/10	'06/11	'06/12	'07/01	'07/02	'07/03	'07/04	'07/05	'07/06	Average
Proposed Dec. <=> Final Dec.	0%	9%	0%	25%	55%	48%	0%	51%	0%	0%	0%	0%	44%
Final Dec. <=> Task Comp.	0%	18%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	2%



Progress Report



Handling Volume Report



Future

KENGINE availability

- JPCERT/CC intends to provide open-source
- Documented in Japanese and English

JPCERT/CC

- VRDA data feeds with vulnerability and world facts
- Pilot program in progress
- Deployment consulting

CERT/CC

- Developing pilot program

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