Mutual Monitoring in the Cloud

Final Presentation

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PUBP-6727 OCY

The Problem

- Cloud computing infrastructure is essentially ubiquitous.
- Cloud service providers must cater to customers, especially regulated ones.
- A major barrier is ongoing evaluation of the provider’s cybersecurity posture.
- The results are often centralized bureaucracies.

The Problem

- Are cloud security bureaucracies the right way?
- Are they the only way?
- Who watches the watchers?

FedRAMP™

The Solution

- Analyze FedRAMP ConMon's strengths and weaknesses.
- Design an alternative model, for FedRAMP *and* similar programs.
  - Stakeholders mutually monitor each other with transparency services.
  - Forgo control-driven assessment, focus measurable security properties.
  - Use a simple quantitative framework for measuring properties.
- Do not certify, do not authorize, but **measure** *each other*.

Background

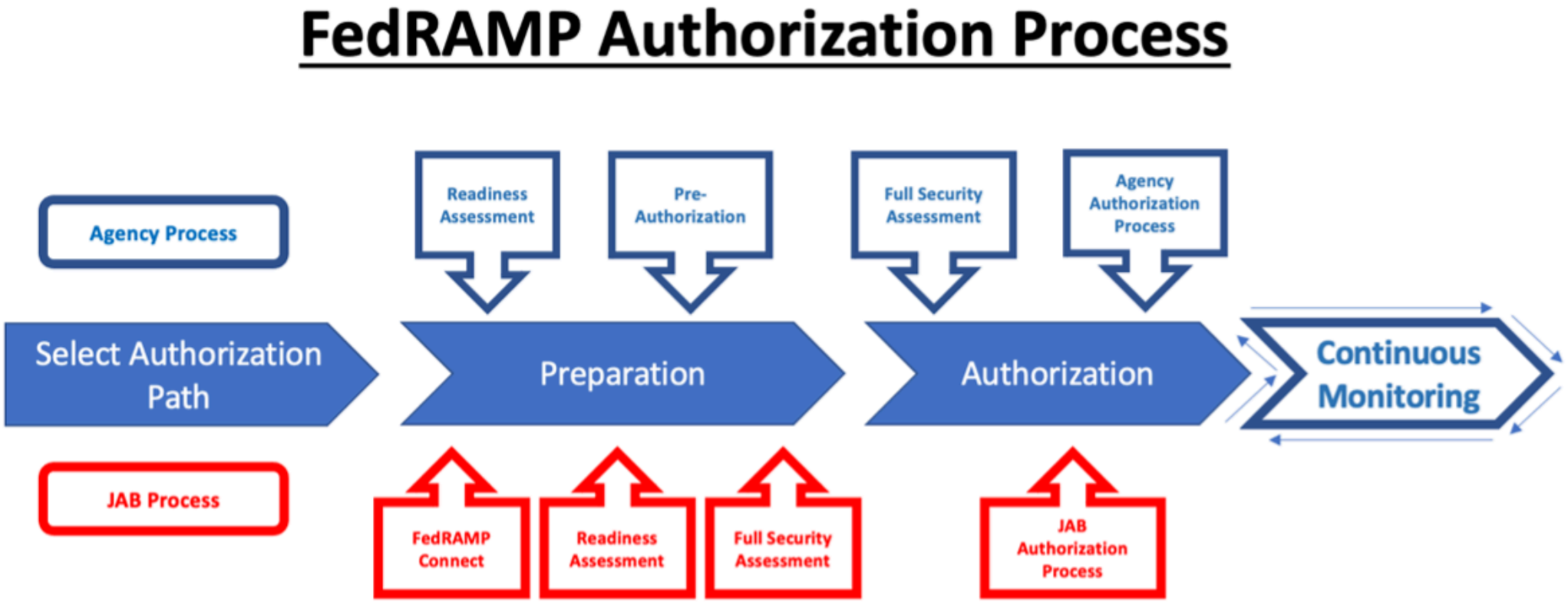
- What is FedRAMP?
- What is FedRAMP ConMon?
- What works?
- What doesn't?

What is FedRAMP?

In mid-2009, an interagency effort, created under the Federal Cloud Computing Initiative, was established to focus on solving a single problem statement—How do we best perform security authorization and *continuous monitoring for out-sourced and multiagency systems*?

> Metheny, M. (2017). Introduction to the federal cloud computing strategy. In Federal Cloud Computing (pp. 239). Elsevier. https://doi.org/10.1016/b978-0-12-809710-6.00001-9

What Were the FedRAMP Processes? (+ JAB)



Note: Readiness Assessment is required for the JAB Process and is optional but highly recommended for the Agency Process

What Are the FedRAMP Processes? (— JAB)

01 Preparation

Readiness Assessment

(Optional, but highly recommended)

- RAR Development
- FedRAMP PMO Review of RAR
- Remediation (if needed)
- FedRAMP Marketplace Designation – Ready

Pre-Authorization

- Partnership Establishment
- Authorization Planning
- Kickoff Meeting
- FedRAMP Marketplace Designation – In Process

02 Authorization

Full Security Assessment

- Security Authorization Package (SSP, SAP, SAR, POA&M)*

Agency Authorization Process

- Agency Review of Security Authorization Package
- SAR Debrief
- Remediation
- Agency Final Review
- Agency Issues ATO
- FedRAMP PMO Review
- Remediation (if needed)
- FedRAMP Marketplace Designation - Authorized

03 Continuous Monitoring

Post Authorization

- Ongoing Continuous Monitoring Deliverables
- Annual Assessment

** The full security assessment may be prepared in advance of the authorization phase, or completed during the authorization phase. This is dependent on the agency's review approach.*

What is FedRAMP ConMon?

- Monthly assessments
  - Updated inventory; vulnerability scans; remediation plan
- Significant change requests
- Annual assessments
  - Updated inventory; vulnerability scans; remediation plan
  - Subset of full initial assessment

What is FedRAMP ConMon?

- Out-of-band coordination between provider and agency customers
- Manual upload of all data to max.gov or high repository
- Review by agency and FedRAMP PMO staff (sometimes separately)
- Synchronous meetings to review and adjust POA&Ms

What works?

- Consistent process (when followed)
- Rigor in third-party analysis and checking
- Standardized reporting
  - Detecting gaps in coverage at points in time
  - Analyzing trends in cloud security posture

What doesn't?

- Manual review and analysis mechanisms
- Too many different processes based on provider details
- No automation to retrieve continuous monitoring data
- No automation to combine data with "CSPs of the CSP"
- Centralized reviews and approvals slow change

What doesn't?

- No means to continuously check auditor, agency, or FedRAMP repository
- Lack of verifiable trust mechanisms for alternatives
  - Decentralized systems
  - Federated systems

Solution

- Prototyping software
- Architecture specification

Prototyping

- Started Transparency Service API after first rough draft of spec
  - Python 3 and Flask REST API framework
  - Open-source cryptograph, cwt and requests libraries
- Finished initial shared utils works
- Encountered trouble interpreting multiple IETF specs with more time allotted

Architecture Specification

- Use Cases
- Architecture
- Components
- Flows

Evaluation

	Yes	No
Did you request access to max.gov FedRAMP package?	2	6
Did you receive max.gov's FedRAMP package?	3	5

Evaluation

	-2	-1	0	1	2	📈
MAX.gov effective?	2	1	2	3	-	🤷
Leveraged system data effective today?	1	1	5	-	1	🤷
Leveraged system data important in future?	-	-	-	1	7	👍👍👍
Submitting raw data effective today?	-	4	2	2	-	👎
Submitting raw data important in future?	-	-	1	3	4	👍👍
Summarizing and linking to it important?	-	-	-	3	5	👍👍👍

📈 key: 👎 negative 🤷 neutral 👍 positive

Evaluation

	-2	-1	0	1	2	📈
OSCAL important today?	1	2	2	-	4	👍 👍
OSCAL important in future?	1	-	1	2	4	👍 👍
Digital signatures effective today?	3	2	3	-	-	👎 👎
Use digital signatures often today?	4	1	1	-	2	👎 👎
Digital signatures important in future?	-	-	1	2	5	👍 👍 👍

📈 key: 👎 negative 🤦 neutral 👍 positive

Evaluation

	-2	-1	0	1	2	📈
Common scanning support effective today?	1	2	-	3	2	🤷
Common scanning support important in future?	1	-	-	1	6	👍👍👍
Significant change tracking effective today?	3	2	2	1	-	👎👎
Significant change tracking important in future?	-	1	-	1	6	👍👍👍

📈 key: 👎 negative 🤷 neutral 👍 positive

Evaluation

	-2	-1	0	1	2	📈
Vulnerability management effective today?	1	2	2	1	2	🤷
Vulnerability management important in future?	-	-	1	-	7	👍👍👍
Securing confidential data effective today?	1	-	1	4	2	👍👍👍
Securing confidential data important in future?	-	-	1	-	7	👍👍👍

📈 key: 👎 negative 🤷 neutral 👍 positive

Evaluation

	-2	-1	0	1	2	📈
3PAO measurement effective today?	2	3	2	1	-	👎 👎
3PAO measurement important in future?	-	-	2	3	3	👍 👍 👍
Economic incentives effective today?	3	3	-	2	-	👎 👎
Economic incentives important in future?	-	1	-	-	7	👍 👍 👍
Centralization effective today?	-	2	3	2	1	👍
Decentralization important in future?	3	-	2	1	3	👍 👍

📈 key: 👎 negative 🤷 neutral 👍 positive

Solution Limitations

- Incomplete transparency service implementation
- Additional use cases for quantitative measurement framework
- Interaction patterns for ecosystem of different transparency services

Solution Limitations

- Encrypted data storage for adjacent service confidentiality
- Custom role-based access control for adjacent service confidentiality
- Concrete privacy-enhancing techniques for transparency service confidentiality

Next Steps and Future Work

- Complete a prototype implementation 🤞
- Vet new use cases for economic incentives of mutual monitoring
- Design applications of quantitative framework for new use cases
- Design privacy-enhancing techniques for transparency service confidentiality

Feedback

- You can provide feedback in multiple ways.
- Post in the class discussion board in Canvas.
- Open issues in my GitHub repo at github.com/aj-stein/practicum/issues.

Conclusion

Et fin.

(Find me on the Internet if you want to learn more.)