An IT Architecture for Emory

Presentation to Full CIRT

October 11, 2001

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Agenda

- Why we need an IT architecture
- What has been done so far
- Next step

2

Challenge to change

- **Changes in Information Technology (IT) provide new opportunities**
  - **Deliver education**
  - **Do research**
  - **Be more efficient**
- **This requires changes to processes and the IT systems that support them**

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• Deliver education: submission of assignments by e-mail, ask questions of lecturer and other students via e-mail or electronic conference, web-accessible lecture notes and slides, distance learning via the web, audio and video of a lecture via web, team teach with an instructor in another country.

•Do research: Faster computations, network access to remote facilities, remote control of a telescope

• More efficient: automate processes like changes to salaries and titles, purchasing

• Changes to processes: Add functionality - might require new version. Using technology can change from centralized scheduling of orientation to scheduling by whoever is talking to a new hire and reduce the orientation delay. Requires a scheduling system to support it.

Why is changing the systems a challenge?

Isn't it just a system-specific issue?

Add new systems and upgrade existing ones

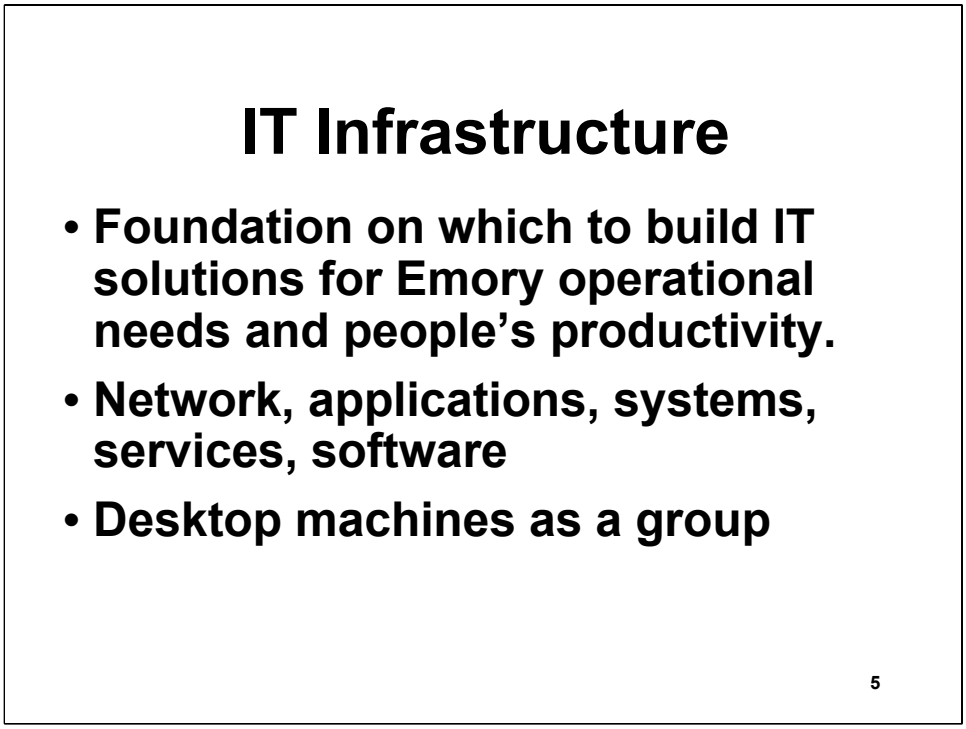
Easily exchange information between systems and allow new systems to get to information they need

Much information is in existing systems - Want to be able to find it and get to it when authorized

Want to be able to change as quickly as needed

Seems to require more people than ever so support costs are going up

People making local decisions want to know overall technical direction so can be compatible, take advantage of future changes, and have a sense of whether their needs will be met



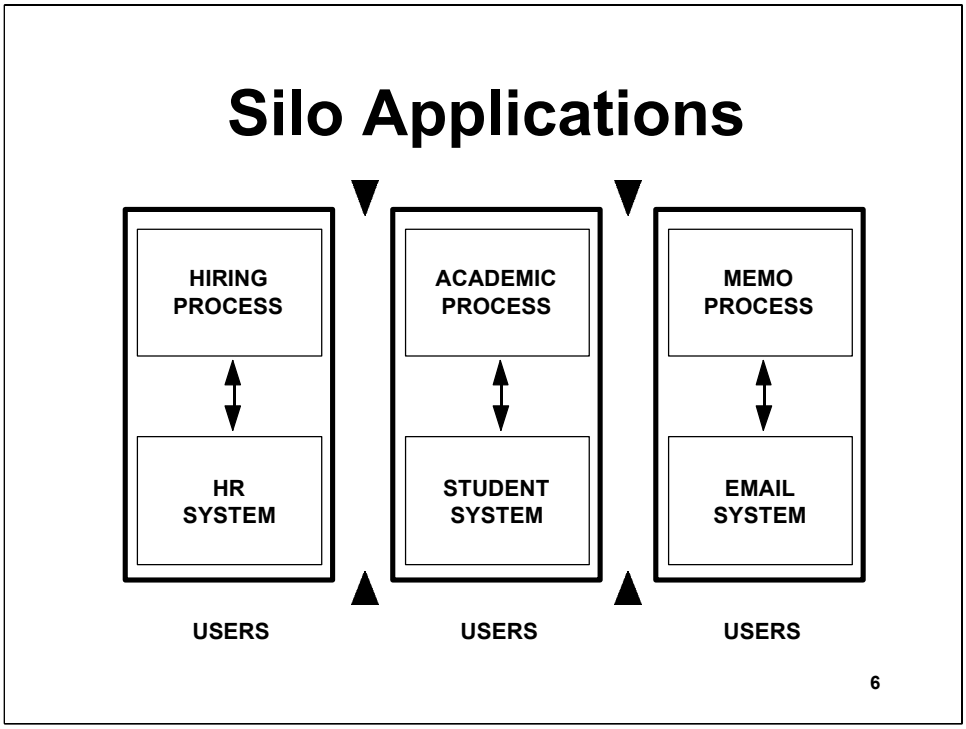
Although we want the goals in general, the subject today is mostly about Emory's IT Infrastructure, especially Emory-wide IT resources.

•Administrative information systems (financial, personnel, student records)

•Academic systems: Blackboard, LearnLink, A/V streaming

•Campus networks

•Email, web, Meeting Maker, library online catalog



But there are problems with the infrastructure

Over time many application systems were created to support specific needs.

•Hiring Process: Employees come and go, keep up with information about them

•Academic Process: Students are recruited, enrolled, take courses, get grades, drop out, graduate.

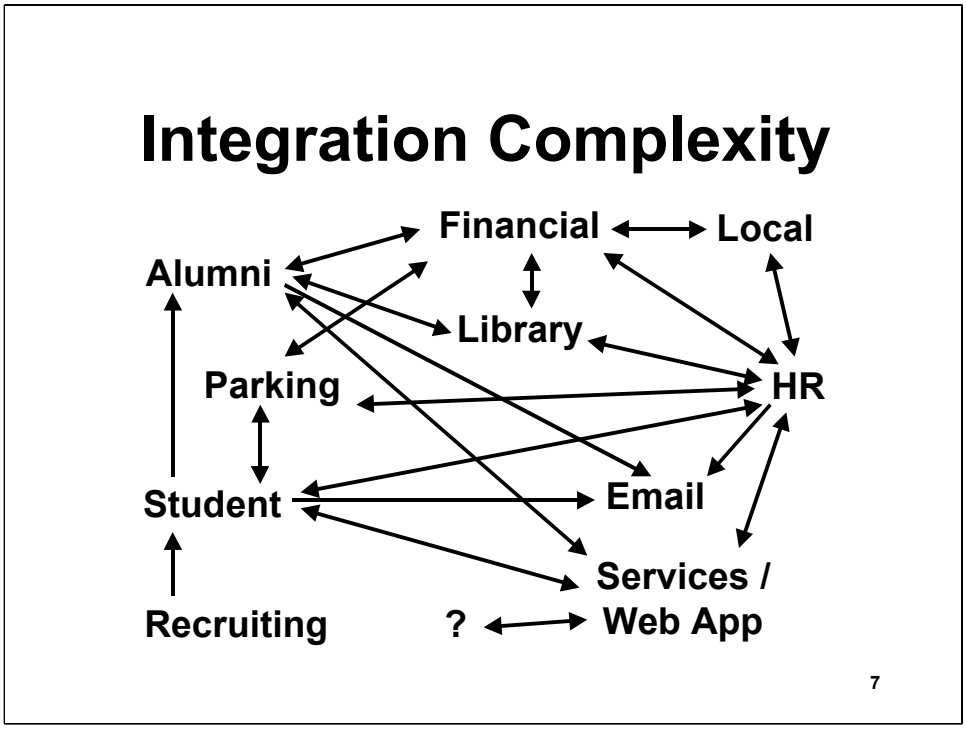
•Memo Process: People communicate via memos and notes

•Another could be Finance process

Initially they were stand-alone systems.

Information is spread over multiple systems.

However, systems began to need to communicate with each other.



Initially feeds were set up on a system by system basis as the need arose.

Eventually this leads to considerable complexity.

Each feed between a pair of systems was typically done in its own unique way.

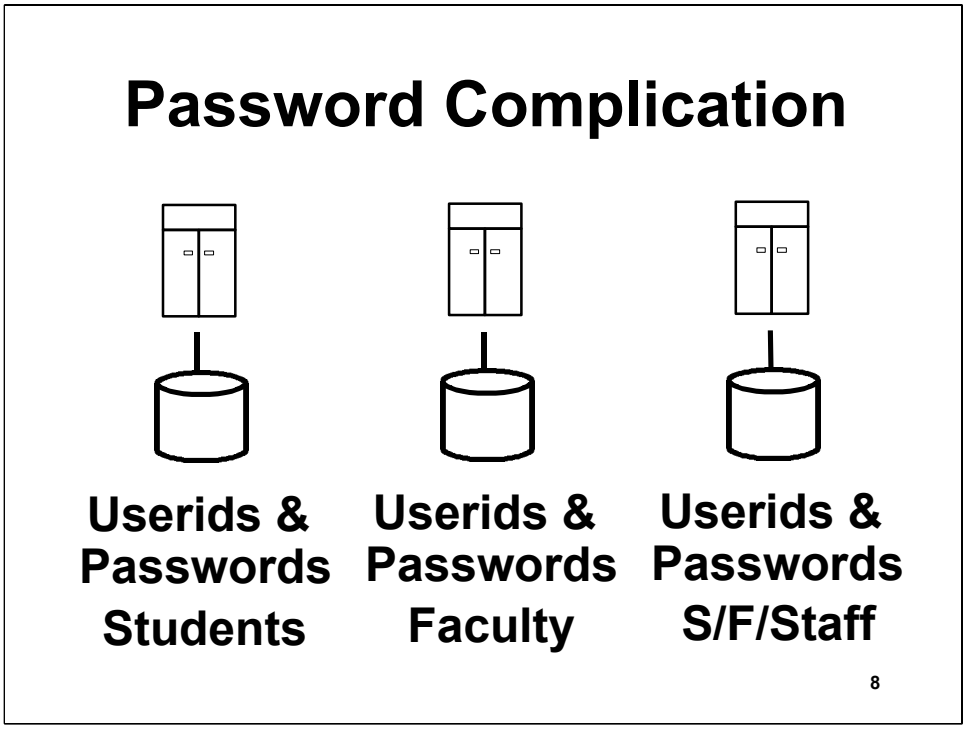
Often one wrote a file and the other read it.

Complexity makes it difficult to make changes. It is hard to predict what the result will be and hard to diagnose problems.

Hard to add another system or another feed.

If must process feed in batch, then lengthens the downtime for that processing.

Complicated to speed up processing. What if one wants to read its feeds more often. Then all the others must make them available more often.



Separate systems had separate password files

Problems:

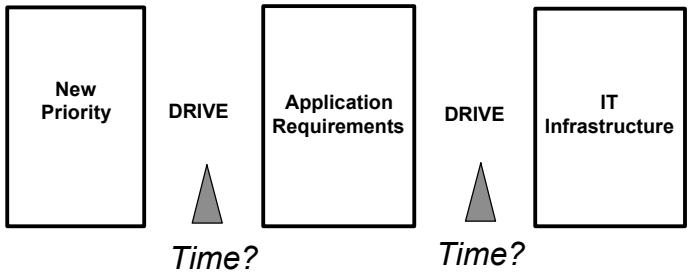
•Each system has to separately set up userids and passwords

•Harder to secure multiple password files

•Ids and passwords must be managed by users in multiple places

•Changes in status must be managed in multiple places

Traditional Approaches Fail



- **When time is the key constraint**
- **When time is the key driver**

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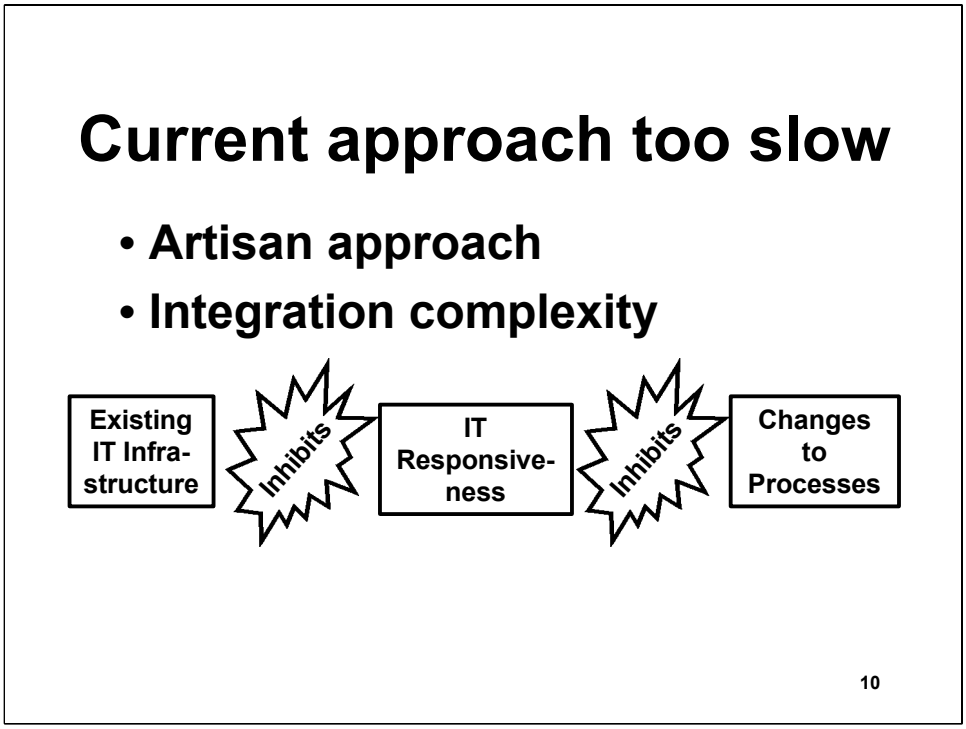
Traditional approach to add a system or make a change was to lock down the requirements and write the application or select one and then make any needed changes to the infrastructure to support it.

If writing code, what if the requirements change before you can do that?

You need a bigger server to upgrade to get a new feature. Might take a long time to look at existing choices, have a fight over Sun versus IBM unix or mainframe, size it, get it in, etc.

Might need more disk space, but seem never to be able to get an accurate prediction of the next year's needs. Then not in budget.

May need information from many systems, but the number of feeds is already exceeding the capacity of some system to support. Or you must discover where to find the information. And figure out what the data you are getting really means.



• Things have become a mess.

•Artisan approach: Start anew deciding on the servers and other technology and make decisions based on the people who are involved and their technical preferences.

•Build system and configure it anew. Each is a work of art.

• Get large variation in systems and software, making it more and more difficult to integrate it -- make it work together.

•Without a standard way to exchange data between systems, the approach must be developed anew for each new system. As the number of them grow, it gets harder and takes more time.

Change process: automate some aspect of operation, add some capability (like Blackboard)

Systemic responses

Users take greater control, increasing variation and complexity

- **Duplicate systems**
- **Shadow databases: fragmented & duplicate information, uncertain meaning**
- **Complex access management**
- **Increased support costs, slowed Emory-wide solutions**

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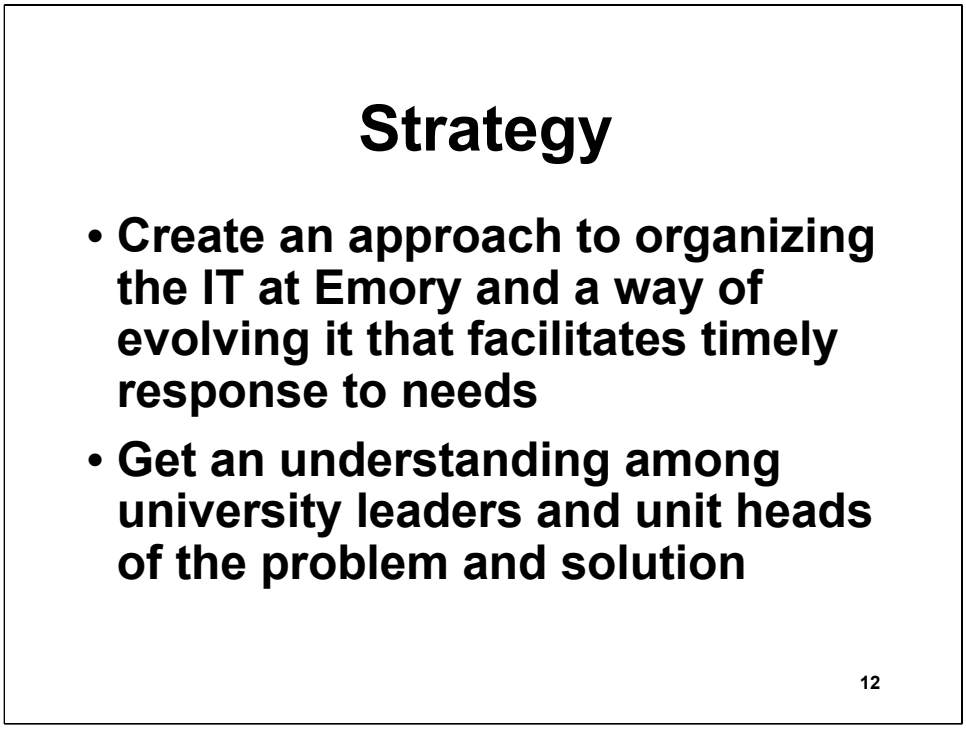
• Can get multiple systems to keep up with applicants, because of difficulty changing existing system to accommodate needs of other units. Duplicates effort, and systems may vary in quality. Spreads information more. Makes access to all the data for a university-wide look more difficult.

• Shadow systems to keep up with expenses, because existing system is too hard to change. Generates duplicate work. Making a change to the main system can have unforeseen repercussions, so that may make change more difficult.

• Complex access management: Each system has its own way of handling logins and passwords. When bring in a new system, so far is difficult to integrate it into common login scheme. Each different scheme makes the whole business more complex. This slows down the response to adding a new system.

• Every server is configured differently, so more centralized management is difficult. When all the workstations in a department are configured differently, extra time is needed to assess the setup before help can be provided. Off site help is less effective.

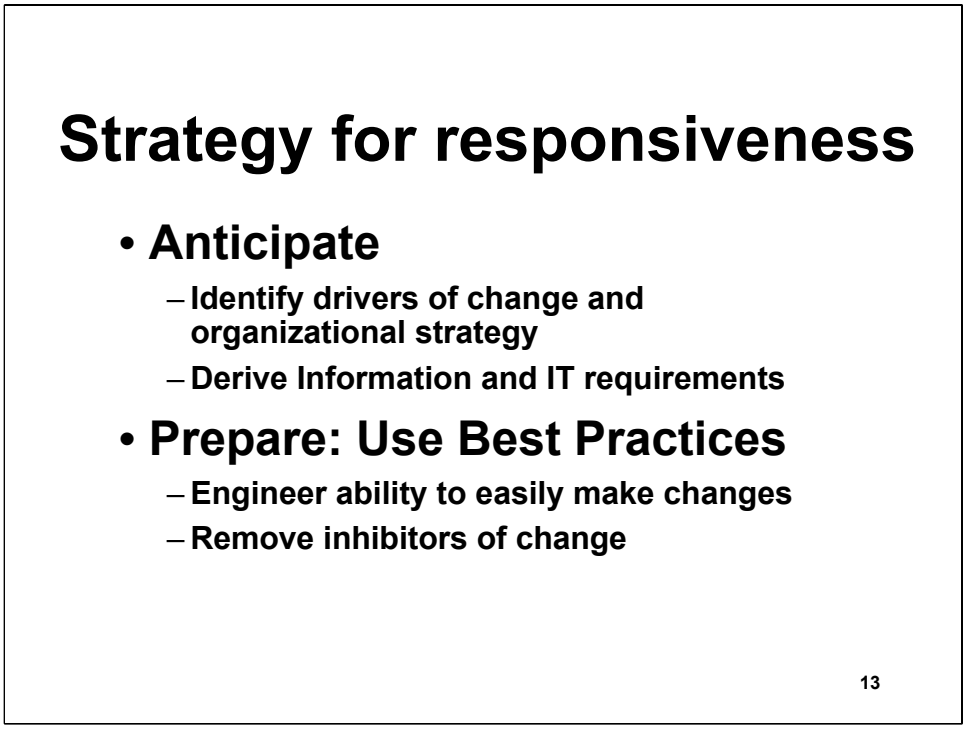


• The strategy to address these problems now and in the future is to have an approach to the way technology is acquired and organized so that it makes change easy.

•This means we can respond to a need without knowing all the details in advance: Can add more disk space, more processing power, an additional feed, get to needed information, add a server, install a system

• Optimizing for the common good across Emory may be suboptimal for someone or some department, so people who make decisions need to understand how the information technology supports the work of Emory. They need to have a common understanding of what the overall goals are, sources of the need to change, and what that implies for the way we acquire and organize information technology.

• People need to be in agreement at a high level on what we are trying to accomplish and the strategy for doing it.



The basic strategy is then to organize and operate in a way that enables information technology to respond as fast as the university needs.

The strategy to enable this is to create an adaptive architecture.

Anticipate: Look at Emory's goals and at the environmental challenges and trends to which it must respond. Then can look for technologies to track so can be ready. For example, might see that we will need to automate more process, so workflow technologies need to be tracked and piloted. Similarly for document management, wireless, video conferencing

Prepare: At same time, create the systems so that even if we don't know the exact changes that will be required in the future, we can make them faster. Example: Can expect that people will move, rooms will be made into offices, people will want network access anywhere, so put cable into every room of a building when build it. Put in wiring suitable for today as well as tomorrow. Then can meet future needs more quickly.

Complexity is an inhibitor to change, so keep the designs and infrastructure simple. Thus don't run network wiring between buildings, but rather to a central location. Troubleshooting and understanding the consequences of a change is then easier.

Always need more capacity, so make that easy to add quickly.

Common Mistakes

- **Thinking that just having product standards or interoperability is enough**
- **Not showing how the strategy supports Emory's long term priorities**
- **Not having a common vision with senior management of the problem and solution**
- **Not taking a systemic approach**
- **Treating this as a one-time event**

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• Product standards are important, but they will change over time. The question is how the standards will be set and will change. Product standards do not address the other issues of adaptability.

• It must be clear to everyone, and especially decision-makers, how the architecture supports enterprise goals and requirements.

• The senior administrators and management must all be on the same page as to how IT will be used to support the organization.

• The enterprise architecture must enable systems that cut across the various units of the organization. The issue is how to make these work together, how to make the whole system work better.

• Once the principles are in place, they must be continually applied, refined, further developed to take into account changes in trends and technologies. Governance is an ongoing process.

4 Keys to Success

1. Collaboration and cross-functional involvement
2. Enhancing unit heads' understanding of IT
3. Communicating in understandable terms
4. Enforcing architecture discipline

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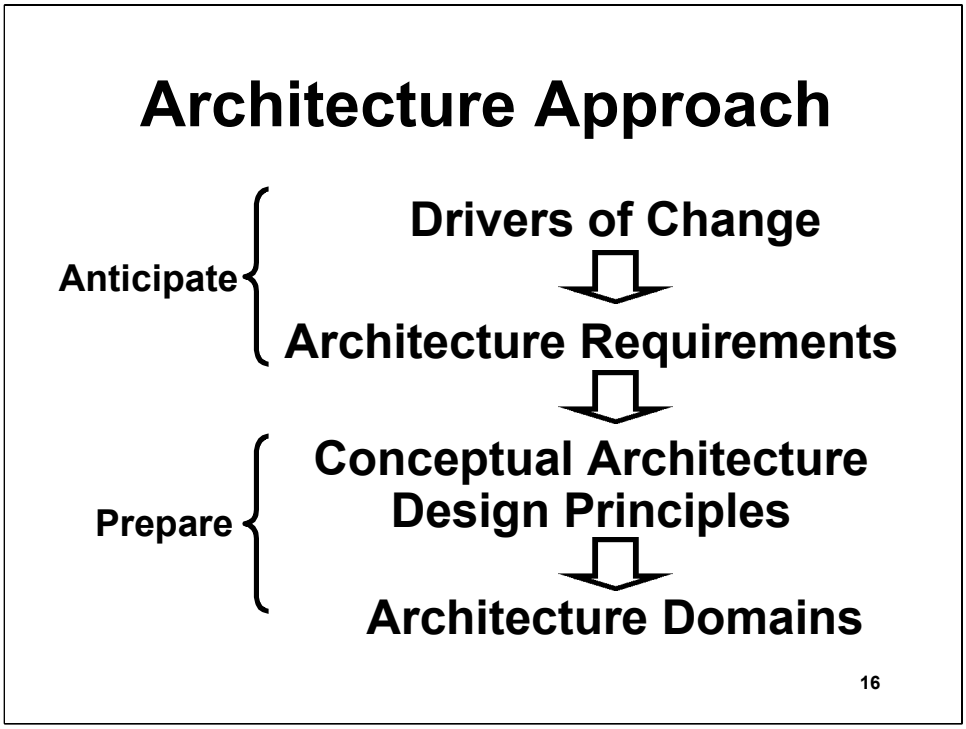


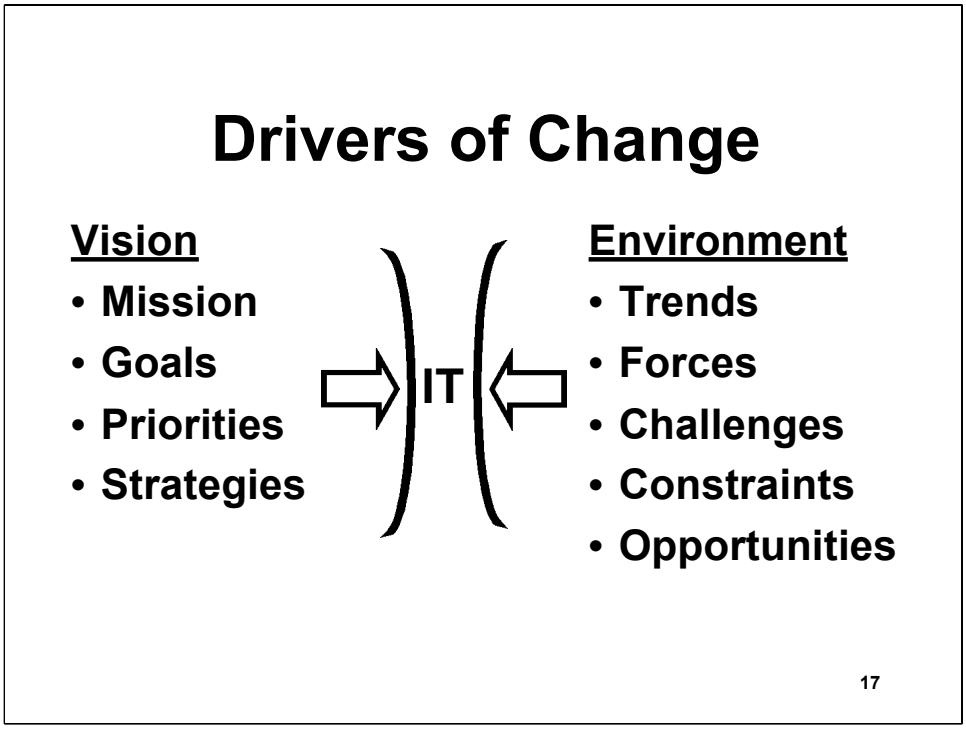
Look at what is driving change at Emory and determine what IT Emory will need to be able to respond.

Internationalization, collaboration implies networks & adherence to higher-education and industry standards.

Will need to be able to quickly increase capacity, so might buy a server that is not full so have room to grow.

Or have room to add more disks.

Or be able to add more servers and balance the load.



Need common understanding, so quickly review.

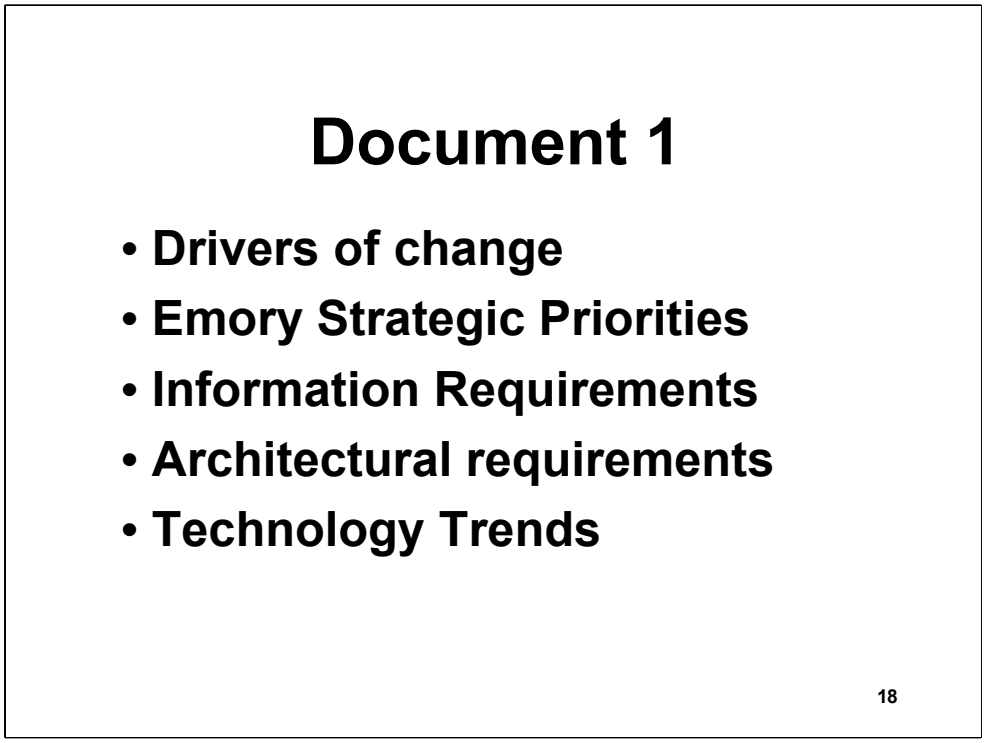
Trends like new technologies

Forces like federal requirements

Challenges like Napster

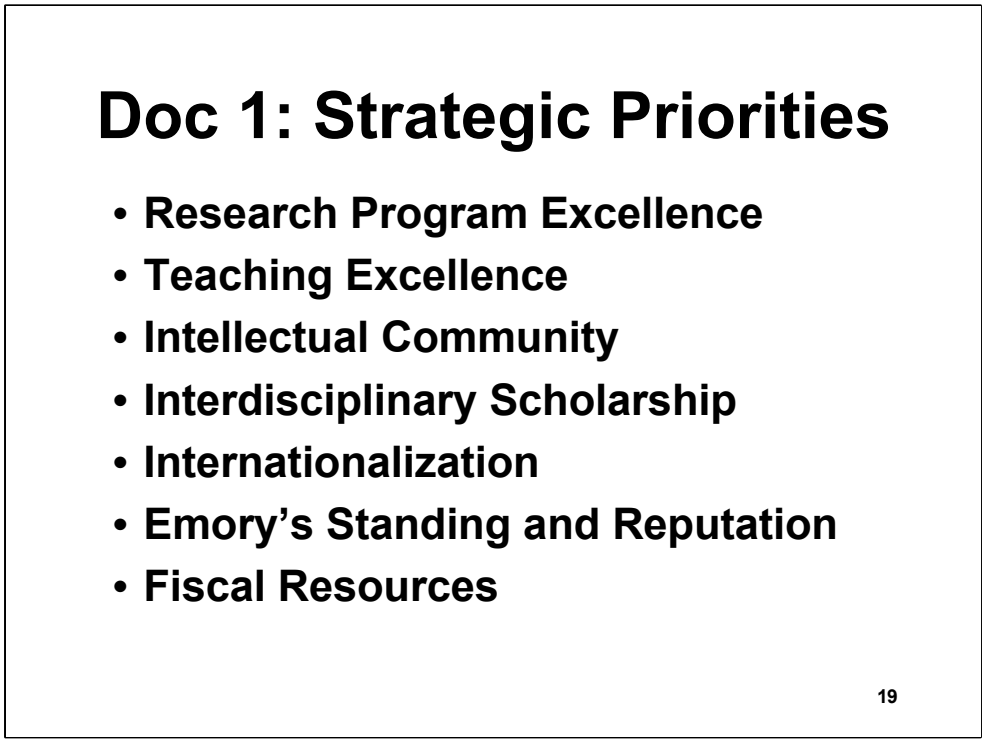
Constraints like the economy, value of endowment, willingness to pay more tuition

Opportunities: New technology can use, like wireless and streaming and course management, PeopleSoft upgrade feature



Doc 1 already accepted by CIRT.

Gives the vision of the common requirements.



1. Research Program Excellence: Improve Emory's prominence as a research university by increasing the number of excellent, preeminent and distinctive research programs.

2. Teaching Excellence: Demonstrate commitment to high quality teaching by increasing the support and status of teaching at Emory.

3. Intellectual Community: Enhance the climate in which students, faculty, and staff can work and develop as individuals and help set direction and priorities by increasing the sense of intellectual community.

4. Interdisciplinary Scholarship: Meet the changing demands of today's research environment by increasing the amount of interdisciplinary scholarship.

5. Internationalization: Achieve preeminence as an international research university by increasing the commitment to international research, teaching, study and service.

6. Emory's Standing and Reputation: Facilitate the way the world understands Emory and Emory's capacity to increase its prominence.

7. Fiscal Resources: Increase available resources for new initiatives through increased funding, cost control and efficiencies.

Doc 1: IT Trends

- Hardware will get faster, cheaper, denser and more diverse.
- Demand for capacity will continue to increase.
- Demand for access to “anything” from “anywhere” will continue to grow.
- Security will be a primary concern with increased dependence on network applications.
- IT expertise will continue to be scarce and its cost will continue to rise.

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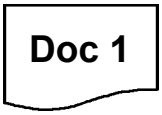
Diverse: Additional technologies that we must utilize

Capacity: email disk space is growing at more than 6 GB per month. Upgrades for new features need faster processors.

Some Arch Requirements

- Automate work flow
- Integrate systems
- Add new devices
- Find and access information
- Secure resources as needed
- Support multiple types of data
- Access external networks
- Manage increasing amounts of information
- Support broad-based standards
- Network access to systems
- Excellent campus network



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Document 2

- **Gives Conceptual Architecture Principles**
- **Describes how the principles support Emory's priorities and IT architecture requirements**
- **Defines Technical Architecture Domains**

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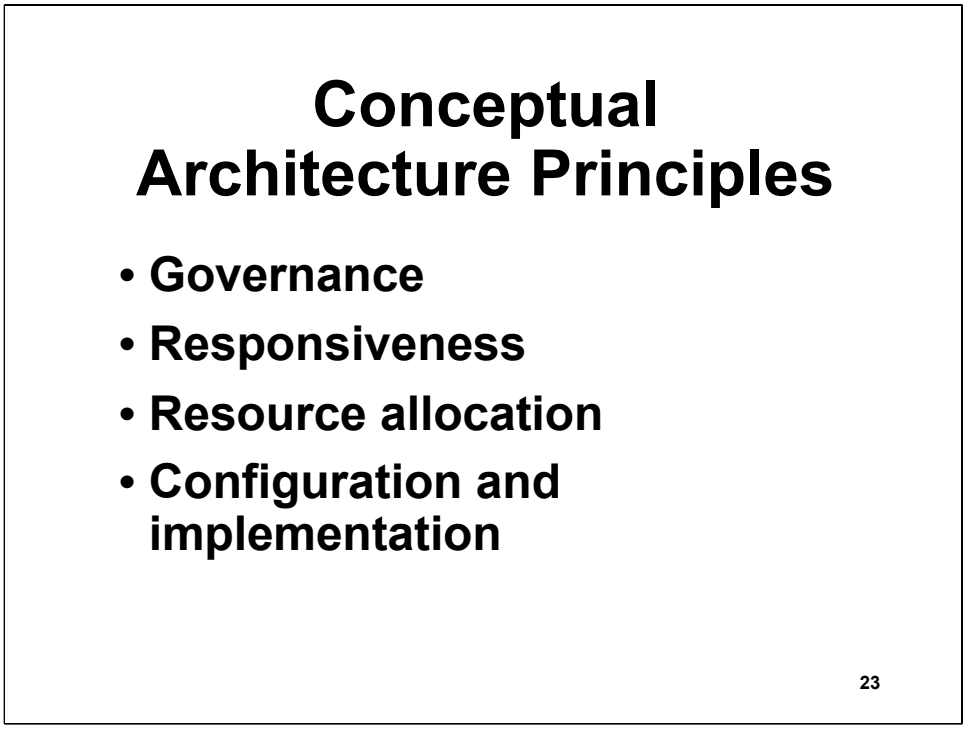
Principles for how organize and evolve the infrastructure

Best practices

Need to break up all the IT stuff into manageable pieces so can talk about how to deal with each one



These are very general so that they apply widely - to networks, systems, applications, etc.

Each one needs to be more specific in how it would support the general principles

Costing and pricing promote desirable behavior

Responsiveness Strategy

- **Anticipate Needs**
- **Investigate solutions**
- **Reduce complexity; use standards**
- **Provide headroom for growth**
- **Organize as reusable components; building blocks with standard interfaces**

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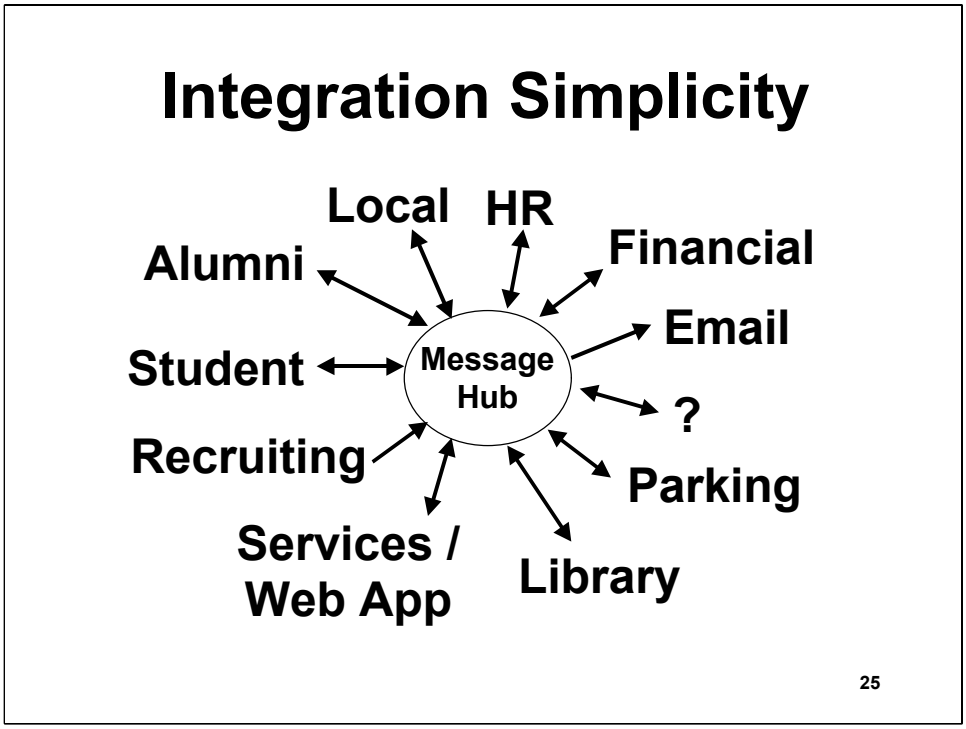
May not know how much more disk space you will need, but you will need it, so be prepared.

Might not know what the load on a student scheduling system will be, but can anticipate a heavy load during drop/add, and need to be ready to add capacity.

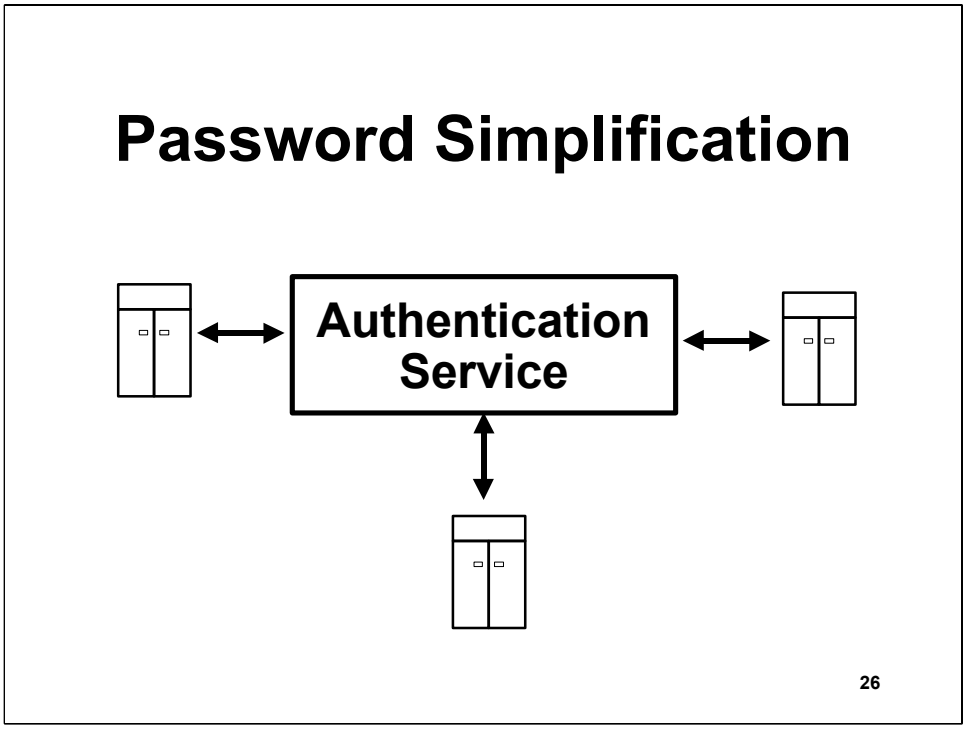
Instead of creating online web surveys anew, have a system that people can reuse to create them.



Message hub is reusable

makes integration easier

has a standard interface



Simpler approach:

Use a readily available standard interface to the service

Better protect the userids and passwords

Change status in one place for all interested systems

Domains

- Security
- Directory
- Network
- Application
- Platform
- Integration
- Intranet
- OnLine Learning
- Collaboration
- Data, Info. Mgt.
- Distributed Environment Mgt.

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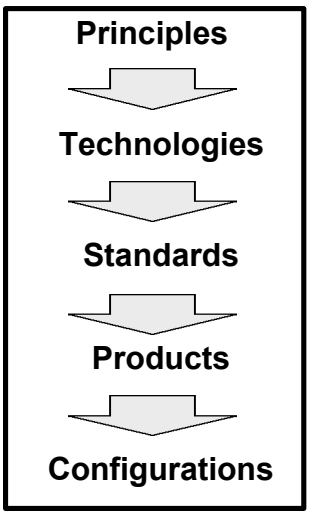
Some of these are used by others

They are interdependent

So need the overall set of principles to avoid conflicts

Domain Arch. Docs



- **Design principles of each domain architecture are subordinate to the conceptual architecture**
- **"Configuration standards" are critical to reducing integration complexity and total cost of ownership "TCO"**

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Responsiveness at the high level

Products & configurations to reduce long term cost (esp. management cost)

Directory Service

- Look up official information
- Emory related people, places and things
- Emory-wide applicability
- Available to authorized people and systems anywhere, anytime on Internet

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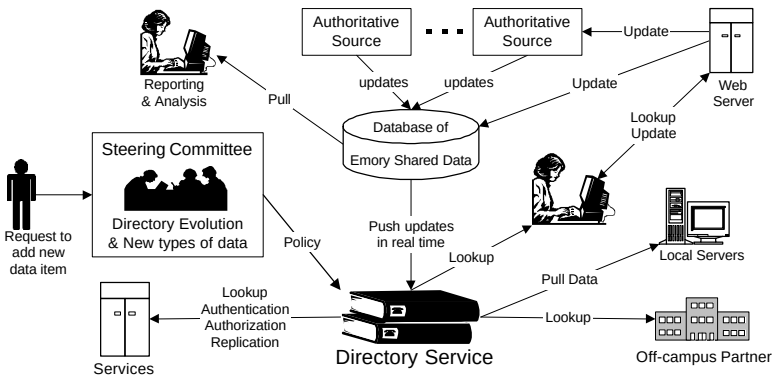
Directory Service



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Security Domain

- **Assets - Resources to protect**
- **Risks - Possible harm or loss.**
- **Classification - Protection needed.**
- **Countermeasures - Reduce probability of harm or loss to an acceptable level**
  - **Policy**
  - **Technology to implement policy**

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•Assets - Resources that need protection.

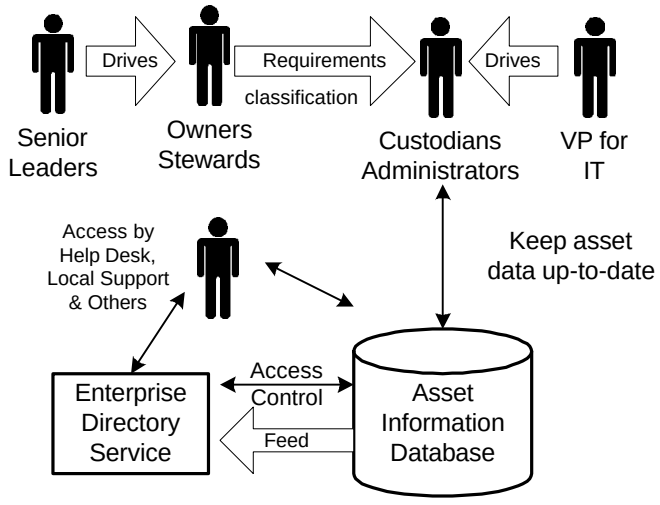
•Risks - Possibilities of harm or loss.

•Classification - Protection needed.

•Countermeasures - Ways to reduce the probability of harm or loss to an acceptable level.

- •Policy
- •Technology to implement policy.

Security: Assets



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Security: Risks

- **Security analyst & admin.**
- **“Clearinghouse” (database) of risks & countermeasures**
- **Assess threats and reports of attacks & compromises**
- **Send alerts**
- **Security recommendations**
- **Scan for vulnerabilities**

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Analyst

•Research, validate risks & security info.

•Direct tracking of incidents & intrusions

•Decide when warnings & notifications

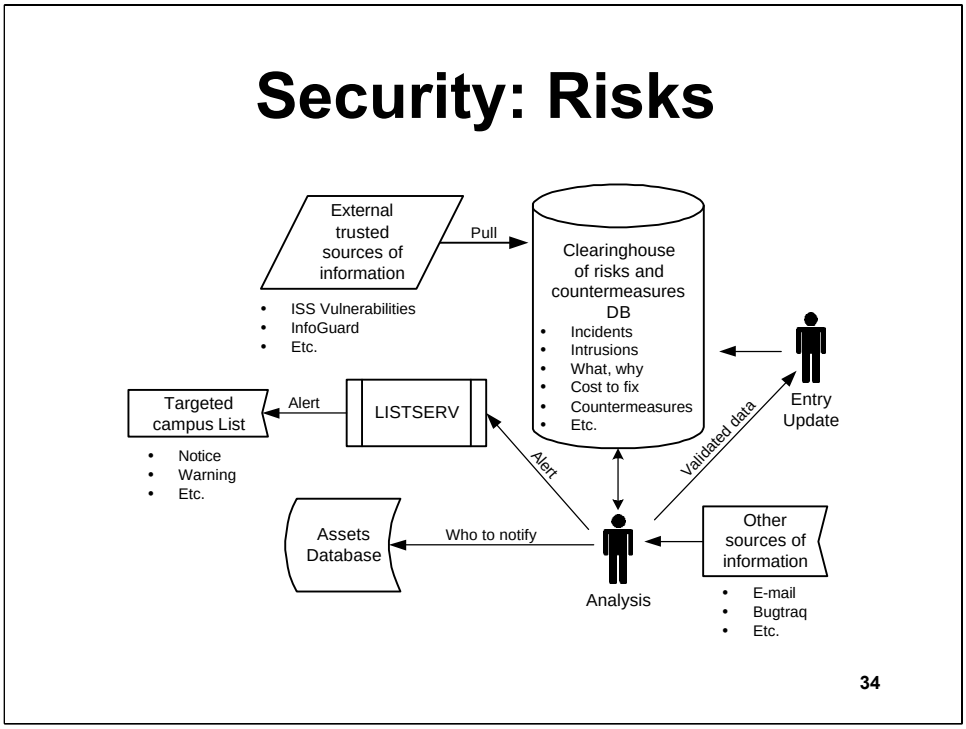
•Recommend plans, policies, stds, procedures, technology

Admin

•Perform activities to secure resources

•Assist with application security needs

•Scan for vulnerabilities



Security analyst

- Maintain clearinghouse of risks and countermeasures (due care)
- Keep up with threats
- Take reports of attacks and compromises
- Assess reports
- Issue alerts

Countermeasure: Zone of Trust

- **Certified at same security level**
- **Firewall "guards the door"**
- **Network intrusion detection**
- **System vulnerability scanner (optional)**
- **Other checks (optional)**

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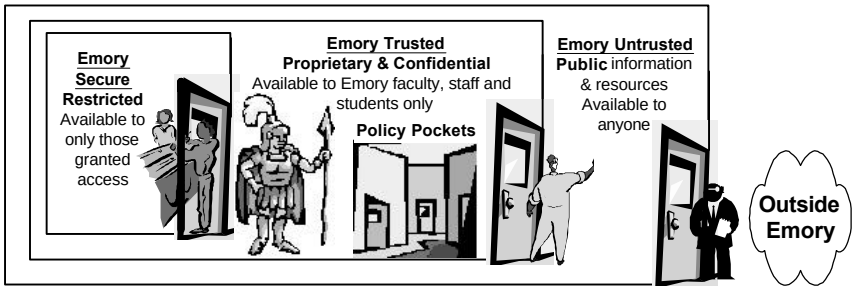
Other check might be to scan email for viruses

System intrusion detection, virus detection, regular scans and audits of logs and administrative procedures may be necessary to be certified at a level of trust.

Security: Countermeasures

Zones of Trust

Restricted | **Trusted** | **Protected but Untrusted**



Most Sensitive | **Internal & Confidential** | **Public**

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IT Architecture

- Mission driven
- Policies, procedures, standards, principles, products, configurations
- Guide technology choices
- Guide development of infrastructure

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Organizational Scope

- Emory students, faculty and staff
- No matter where they are located
- “Emory” alone includes all its sites.
- Interoperability with Emory Healthcare insofar as University Health Sciences are concerned.

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Level of applicability

- Emory enterprise-wide infrastructure.
- All changes to the IT infrastructure and to all parts of the enterprise-wide solution life cycle.
- Not Unit IT decisions that are of local benefit and do not adversely affect university resources.
- Consider effect of local decision on the overall system.

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Usage

- **Default: adhere to the architecture.**
- **Do not follow it blindly**
- **IT experts recommend the approach to take in case of tradeoffs.**
- **Decision-makers must justify an exception if they wish to disregard it.**

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Implies governance body to approve exception (or not)

Time Line

- 1999: Provost chartered ITA under CIRT
- Spring 2000: Document 1 (Requirements) approved by CIRT
- Spring 2001: Document 2 (Design Principles) done
- Summer 2001: Security & Directory done

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Representation & Review

- University depts. & units
- Healthcare Info. Systems
- Network Communications
- IT directors, Local Support
- CIRT Exec. & Full CIRT last year
- Digital Futures Seminar
- ITA constituents
- IT-ARCH@listserv.emory.edu

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Approval

- Not a decision to spend money
- Set technical direction
- Framework for making decisions
- Position Emory so it can more quickly act and exploit opportunities to advance its priorities

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Conclusion

- **Please read the documents at least through Section 3**
- **Please give feedback when you can**
- **http://www.emory.edu/EITA**
- **IT-ARCH@listserv.emory.edu**
- **Questions of clarity: ospwd@emory.edu**

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