The FBI Virtual Case File Project:

The Virtual Case File was a software applications developed by the FBI (in 2000).
- Abandoned 5 years after starting, while still in development, and cost the federal government $170 million.
- Iconic example of tax money waste in a failed attempt to fix a dangerously obsolete government system.
- This system was started as a reluctantly forced response to 911, and aimed to improve the critically inefficient information architecture of the FBI.
- The following is seen to contribute to the overall failure of the system;
    - Bureau largess (Liberality in bestowing gifts, especially in a lofty or condescending manner) - the FBI were too easy with spending the money on building the system.
    - Bureaucracy (excessive multiplication of, and concentration of power in,administrative bureaus or administrators) - the FBI had the power and didn't need to ask permission to build the system.
    - Counter-productive competition

In September 2000, the FBI announced the "Trilogy" program;
- Intended to modernize the bureau's outdated IT infrastructure.
- 3 parts
    - Purchase of modern desktop computers for all FBI offices.
    - Development of secure high-performance WAN & LAN networks.
    - Modernizing the FBI's suite of investigative software applications.
- First two successful, despite cost overruns.
- Replacing the FBI's Automated Case Support (ACS) system proved difficult;
    - ACS was developed in house by the FBI
    - Used to manage all documents relating to cases being investigated by the FBI.
    - The project was originally scheduled to take 3 years and cost US$380 million.
    - By 2000, ACS was considered a legacy system, made up of many separate applications that were difficult to use.
    - ACS was built on top of many obsolete 1970s-era software tools including a very old programming language Natural, ADABAS db management and IBM green screen terminals.
    - Some IT analysts believed that ACS was already obsolete when it was first deployed in 1995.

Problems and abandonment of the project
- New director of FBI elected one week before September 11 (2001) attacks.
- The attacks highlighted the FBI's information sharing problems, and increased pressure on the FBI to modernize IT wise.
- In December 2001, the VCF's goal was changed to being a complete replacement of all previous applications and migration of the existing data into and Oracle database.
- As a result, the project deadline was pushed to December 2003.
- In December 2002, the FBI asked the US congress for increased funding, seeing it was behind schedule. Congress approved an additional $123 million for the Trilogy project.

- In March 2004, FBI director testified that the system would be operational by the summer, although this seemed unlikely to happen.
- SAIC (Scientific Applications International Corporation) - who were in charge of developing the software, claimed this would require over $50 million, which the FBI refused to pay.
- In May 2004, the FBI agreed to pay SAIC $16 million in an attempt to salvage the system.
- Meanwhile, the FBI had already began talks for a replacement system beginning as early as January 2005.
- Development continued throughout 2004, until the project was officially scrapped in January 2005.

Reasons for failure - the project demonstrated a systematic failure of software engineering practices;
- Lack of a strong blueprint from the outset led to poor architectural decisions.
- Repeated changes in specification.
- Repeated turnover of management, which contributed to the specification problem.
- Micromanagement (management or control with excessive attention to minor details) of software developers.
- The inclusion of many FBI Personnel who had little or no formal training in computer science as managers and even engineers on the project.
- Scope creep (uncontrolled changes or continuous growth in a project's scope) as requirements were continually added to the system even as it was falling behind schedule.
- Code bloat (production of code that is perceived as unnecessarily long, slow, or otherwise wasteful of resources) due to changing specifications and scope creep. At one point it was estimated the software had over 700,000 lines of code.
- Planned use of a flash cutover deployment (an immediate change in a complex system, with no phase-in period), which made it difficult to adopt the system until it was perfected.

Implications
The bureau faced a great deal of criticism following the failure of the VCF program. The program lost $104 million in taxpayer money. In addition, the bureau continues to use the antiquated ACS system, which many analysts feel is hampering the bureau's new counter-terrorism mission. In March 2005, the bureau announced it is beginning a new, more ambitious software project code-named Sentinel to replace ACS.

Link John suggested;
http://spectrum.ieee.org/computing/software/who-killed-the-virtual-case-file

The UK e-University Project

The UK e-University was first proposed by the UK Secretary of State for Education in February 2000, as a vehicle to deliver online the best of UK higher education across the world.

Reasons for failure:
- Spent £50 million, but only attracted 900 students against a target of 5,600. UKeU vastly overestimated the demand for the e Learning system.

- The UKeU took a supply-driven rather than demand driven approach.

- Insufficient market research in a new and emerging market. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.

- Very ambitious venture in an emerging market which added pressure when ambitious business decisions were taken.

- The project failed to form effective partnerships with, or gain significant investment from, the private sector. The failure to find private sector partners or investors should have caused the holding company, HEFCE and the DfES to have concerns sooner rather than later about the viability of the project.

- The awarding of bonuses to senior executives of UKeU. The bonus scheme and potential share packages are examples of the anomalies that were caused by the fact that the structure and systems were set up under the assumption that private investment would be part of the project.

- UKeU allowed the development of the technology platform to drive its strategy and the development of programmes. It had a skewed focus on the platform, based on an assumption that once this was right, the original projections of very high student numbers would be easy to realise. Unfortunately this assumption was not based on research evidence, but on an over confident presumption about the scale of the demand for wholly internet based e-learning.

- The e-learning platform lacked functionality.
- The UKeU focused too much on providing an integrated (combining or coordinating separate elements so as to provide a harmonious, interrelated whole) e-learning platform.

What should have been done:
We do not want the Government to become increasingly risk-averse (takes the project direction with less risk involved) as a result of what happened with UKeU experience. Instead it should learn from this experience and, in the future, take a more experimental approach to such high risk ventures.

This would involve
- Focussing more on testing various models and prototypes;

- Taking an evidence-based approach;
- Involving the private sector as partners in a more organic process;
- Undertaking effective risk-assessment procedures;
- Setting open and transparent success criteria for such projects.

Link John suggested;
http://www.publications.parliament.uk/pa/cm200405/cmselect/cmeduski/205/205.pdf

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Questions: Answer all questions.

a) Discuss the two most important underlying causes for each of the project failures – may or may not be related to the fact that these are software projects.

FBI Virtual Case File
- Lack of a proper plan:
    - The project started without a proper plan on how to complete the system.
    - A plan that would at each stage of the systems development, detail the stages tasks, timeframe and budget should have been put in place (basic plan).
    - A software development model should have been used. For example, an agile approach would have been helpful considering the systems rapidly changing nature. Each and every task to be completed at each stage should have been mapped out in advance (better plan).

- Repeated changes in specification:
    - New features were continuously being added to the project specification, even when the project was already behind schedule, over budget and the other features were still full of bugs.
    - These constant changes were accompanied by constant changes in code, making the code very cumbersome and unusable / needed to be migrated with previous system features.
    - Constant turnover of management also contributed to this specification problem as developers and managers left projects unfinished, slowing down production as new staff assigned to the unfinished project took time to understand code, get up to speed with feature etc.

UK e-University
- Spent £50 million, but only attracted 900 students against a target of 5,600.

- ○ This vast overestimation in demand for the system was due to insufficient market research in a new and emerging market. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.

- The project failed to form effective partnerships with, or gain significant investment from, the private sector.
    - ○ The failure to find private sector partners or investors should have caused the holding company, HEFCE to have concerns sooner rather than later about the viability of the project. However, the project still proceeded even with lack of future funding & investment.

b) Discuss how much the quality of the Software Engineering Process contributed to each failure.

A software development process may be described as a set of activities required to develop a software system. Currently there are many software development processes but all involve:

- Specification -> defining what the system should do.
- Design & Implementation -> defining the organization of the system and implementing the system.
- Validation -> checking that the system does what the user wants.
- Evolution -> changing the system in response to changing customer needs.

The four elements above are essential for a software development project.

FBI Virtual Case File
- Specification
    - ○ The system was continually going through changes in its specification, with new features being added, meaning teams were always having a hard time delegating work to be carried out on new features and also existing features.
    - ○ Constant turnover of management also contributed to this specification problem as developers and managers left projects unfinished, slowing down production as new staff assigned to the unfinished project took time to understand code, get up to speed with feature etc.

- Design & Implementation
    - ○ Because of new features being added so often, the organization of the system would have changed often and should have been redesigned as a result, to be implemented in a different manner. However this would have been difficult (happening so often) and was clearly not done to a sufficient standard.

- Validation
    - ○ It was practically impossible to assess if the system did what the user wants as it was never actually finished and new features were added to its specification regularly, changing what its users wanted the system to do.

- - ○ Managers & engineers with no CS background were involved in this process, who were unable to complete this task correctly from a software development view.

  - ● Evolution
    - ○ The system never evolved, as the system was never finished. New features were added too often, which held back the completion of existing features. Because features were not completed & tested to a sufficient standard, they never had the chance to evolve.

UK e-University
- ● Specification
  - ○ The system did not have a solid specification. There was insufficient market research to define what the system needed to do. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.

- ● Design & Implementation
  - ○ UKeU allowed the development of the technology platform to drive its strategy and the development of programmes. It had a skewed focus on the platform, based on an assumption that once this was right, the original projections of very high student numbers would be easy to realise. Unfortunately this assumption was not based on research evidence, but on an over confident presumption about the scale of the demand for wholly internet based e-learning.

- ● Validation
  - ○ The system only attracted 900 students against a target of 5,600. In this case, 900 students would not give an appropriate representation of whether or not the system did what the user wants. There was also a lack of market research meaning in the early stages of the project, it was not correctly established what the system would do for the user, which in turn made it difficult to validate the system when required.

- ● Evolution
  - ○ The failure to find private sector partners or investors should have caused the holding company, HEFCE to have concerns sooner rather than later about the viability of the project. However, the project still proceeded even with lack of future funding & investment. Overall the project did not have sufficient funds to continue working on or evolving the project over time.

c) Discuss two important technical/software engineering aspects of each of these project failures which are distinctive and differ from the other project failure.

FBI Virtual Case File
- ● Repeated turnover of management
  - ○ Constant turnover of management made it difficult to make progress on the system as developers and managers left projects unfinished, slowing down production as new staff

assigned to the unfinished project took time to understand code, get up to speed with feature etc. As a result the project as a whole was never completed.

- In the case of the UKeU project, the project was completed and after completion, was in use by its intended audience. It was expected that there would be approx 5,600 users of the system once it was released, however this number was greatly exaggerated and after release there were only 900 users of the system.

- Repeated changes in specification:
    - New features were continuously being added to the project specification, even when the project was already behind schedule, over budget and the other features were still full of bugs.
    - These constant changes were accompanied by constant changes in code, making the code very cumbersome and either unusable or needed to be migrated with previous system features.
- On the other hand, the UKeU system did not have as many features defined in the project specification, in fact once completed, the system itself lacked functionality. The UKeU focused too much on providing an integrated (combining or coordinating separate elements so as to provide a harmonious, interrelated whole) e-learning platform, and thus neglected other features that could have been added.

UK e-University

- Did not know what the users wanted. Spent £50 million, but only attracted 900 students against a target of 5,600.
    - This vast overestimation in demand for the system was due to insufficient market research in a new and emerging market. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.
- Knew what the users wanted (too much). The FBI Virtual Case File project on the other hand, cost over $170 million. The FBI also asked the US congress for increased funding, seeing it was behind schedule. Congress approved an additional $123 million.

- The UKeU took a supply-driven rather than demand driven approach.
    - This was the biggest mistake made when developing the system. The project began with insufficient market research in a new and emerging market. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.
- For the FBI Virtual Case File project, an opposite approach was taken. The FBIs project was completely demand driven. A new easy-to-use system for managing FBI cases and sharing data efficiently was greatly needed.

d) Even if a good software engineering process was followed, state (in order of importance) what you think would have been the four most critical technical/software implementation issues that might have contributed to each project software not working as expected. Discuss why you think the top technical issue for each project is the most critical.

FBI Virtual Case File
- Planned use of a flash cutover deployment (an immediate change in a complex system, with no phase-in period), which made it difficult to adopt the system until it was perfected.

- Code bloat due to changing specifications and scope creep. At one point it was estimated the software had over 700,000 lines of code.
  - This was the biggest software issue with the system. There was far too much unnecessary code. This made is very difficult to redesign code, add new elements to the code without breaking another part, finding bugs or even finding the part of the code that implements a particular feature.

- (Richard's Answer on most critical issue) The FBI had the ACS which was a legacy system was the main issue, SAIC had to create an electronic interface to this which could have posed many issues, even with the best software engineering process for VCF when the ACS was developed parts of the system could have been left undocumented meaning SAIC wouldn't be able to easily estimate a time frame for this and it's would be a black area in the project.

  Though the reports on this are kind of conflicting, one site says they planned to replace it, but the FBI report said they were going to interface it and continue using it, so it depends where you read from!

- Repeated turnover of management
  - Constant turnover of management also contributed to this specification problem as developers and managers left projects unfinished, slowing down production as new staff assigned to the unfinished project took time to understand code, get up to speed with feature etc.

- Micromanagement (management or control with excessive attention to minor details) of software developers.
  - The developers were spending too much time trying to make each feature perfect, meaning other features were being neglected. Those features that developers spent so much time on may also have needed to be recoded to work with new features on a regular basis.

- The inclusion of many FBI Personnel who had little or no formal training in computer science as managers and even engineers on the project.
  - These personnel did not know how to properly ensure that the software was doing what it should.

UK e-University
- The UKeU took a supply-driven rather than demand driven approach.
  - This was the biggest mistake made when developing the system. The project began with insufficient market research in a new and emerging market. There was no formal market research undertaken to assess either the level of demand or the nature of the demand and the type of e-learning required.
  - After spending £50 million, the system only attracted 900 students against a target of 5,600. UKeU vastly overestimated the demand for the e Learning system.

- The project failed to form effective partnerships with, or gain significant investment from, the private sector.
  - The failure to find private sector partners or investors should have caused the holding company, HEFCE to have concerns sooner rather than later about the viability of the project. However, the project still proceeded even with lack of future funding & investment. Overall the project did not have sufficient funds to continue working on or evolving the project.

- UKeU allowed the development of the technology platform to drive its strategy and the development of programmes.
  - It had a skewed focus on the platform, based on an assumption that once this was right, the original projections of very high student numbers would be easy to realise. Unfortunately this assumption was not based on research evidence, but on an over confident presumption about the scale of the demand for wholly internet based e-learning.

- The awarding of bonuses to senior executives of UKeU.
  - The bonus scheme and potential share packages are examples of the anomalies that were caused by the fact that the structure and systems were set up under the assumption that private investment would be part of the project.

e) Another Question