Project Name:	Defining software technology	**Start Date:**	2017-01-02
Project Number:	1710	**Completion Date:**	2018-03-21

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Reliability (%)	65	99	Yes
Scalability (%)	100	8500	Yes
Availability (%)	96	99.9	Yes

Canada Revenue Agency (CRA) Eligibility of work in SR&ED projects containing software development - Transcript Mach 22, 2017

Slide 10:

As mentioned in an earlier slide, Experimental Development is undertaken for the purpose of achieving technological advancement.

So, what is technology?

Technology is not a physical entity.

Technology is the practical application of scientific knowledge and principles.

It is the knowledge of how scientifically determined facts and principles are embodied in the material, device, product, or process.

As technology evolves, the practical applications of scientific knowledge and principles as well as the technological knowledge associated with the products, processes, or devices become the scientifically determined facts and principles for further development.

Let’s look at some examples to illustrate this.

Field of Science/Technology:

Software engineering and technology (2.02.09)

Project Details:

Intended Results:	Develop new processes, Improve existing processes
Work locations:	Lab
Key Employees:	
Evidence types:	Progress reports, minutes of project meetings; Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Design, system architecture and source code; Project records, laboratory notebooks; Project planning documents; Photographs and videos; Design of experiments; Records of trial runs; Contracts

Scientific or Technological Advancement:

Uncertainty #1: O/S design issues

Slide 11: Example 1:

A microcontroller or microprocessor can run machine code without an operating system and any user developed software can run directly on it.

In contrast, in an Operating System, user developed software runs within a managed environment.

The kernel has process management, memory management, and input/output (I/O) management to govern the environment.

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Within process management, a scheduler manages tasks and processes using complex data structures working in conjunction with other embodiments. As we can see, within a modern Operating System, kernel and other embodiments not mentioned in the slide make up the scientifically determined facts and principles.

Similarly for the kernel, it is the process management, memory management, I/O management and others. As we go down further, the scheduler has Lists, Queues, etc.

The most significant underlying key variables are:

kernel - process, memory & I/O mgmt, process mgmt - scheduler lists & queues

Technology or Knowledge Base Level:

Activity #1-1: Big data examples (Fiscal Year 2017)

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	250 alternatives
Trials:	17 runs / samples

Slide 13:

We looked at the definition of technology through software examples.

New products/services are being built using or combining various technologies for creating complex applications. This is driving relentless progress.

The trend in software development has shifted in the direction of shared services such as Software as a Service, Platform as a Service and Infrastructure as a Service.

We see this manifest as Cloud computing which is made possible by tremendous advancements in hardware and software technologies.

From software perspective, Cloud services became possible through advancement in networking and distributed infrastructure and computing.

All these developments make use of various advancements in software technology stack.

This is an illustration of how various advancements provide a platform for modern big data applications.

Results:

- Reliability: 88 % (67% of goal)
- Scalability: 4400 % (51% of goal)
- Availability: 99.3 % (84% of goal)

Conclusion:

As you all know, different companies compete in different areas of technology. For example, a company working on scalable distributed computing and processing deals with different technologies than a company working on databases or content delivery network. These companies have the potential of advancing technology in their respective areas.

Significant variables addressed: kernel - process, memory & I/O mgmt, process mgmt - scheduler lists & queues

Uncertainty #2: Micro processors

Slide 12:

Even when we use a microcontroller without an Operating System, the tools used to generate the machine code can come from a tool-set.

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For example, a well known open source electronic platform provides a tool which uses the principles of programming language to enable writing in a higher level language, uses the principles of compiler that turns the code into object files (machine readable instructions), and a linker to combine the object files with libraries.

Principles of programming languages, compiler, linker, and Graphical User Interface are some of the scientifically determined facts and principles within the tool-set.

Similar evolution can be seen in technologies associated with Web systems, Information systems, micro-controller based systems, relational databases, No-Structured Query Language (SQL) databases, distributed storage and retrieval etc.

The most significant underlying key variables are:

programming languages, compilers, linkers, Interface

Technology or Knowledge Base Level:

Activity #2-1: Technology vs. features (Fiscal Year 2017)

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	147 alternatives
Trials:	13 runs / samples
Physical prototypes:	7 samples
Lines of code:	14800 Lines of prototype code

Slide 14:

Companies produce various products and services using technology. SR&ED looks at the advancement in technology necessary to deliver the new or improved products and services. Therefore it is important to distinguish between technology and product.

Often the name of the product, process, or device is also used to identify the technology.

The distinction is:

Product, process, or device conveys feature, functionality, capability, etc.

Technology is about the knowledge of how the constituents embodied within the product, process or device, function to deliver the feature, functionality, capability, etc.

For example: Web information system publishing tools that also serve as document management and storage systems come with features, interfaces, application program interfaces (APIs) and tool-sets to build information systems.

Results:

Conclusion:

Slide 15:

Understanding the capabilities and limitations of such systems for building an information system, use of their API/interfaces to develop an information system, or information about their features and functionality are about a product.

On the other hand, knowledge of the internal workings of such systems and how inter-relationships produce, influence, and impact the features, interfaces, APIs, tool-sets etc., are related to the technology.

Significant variables addressed: compilers, Interface, linkers, programming languages

Documentation:

- Offline Documents: Supporting documentation

Uncertainty #3: Other areas

Slide 48:

Technological advancements in software development projects can involve:

New or improved techniques and methods in computing to store, search, process, and manage vast collection of data (big data). Typically undertaken in Universities and large research labs.

Advancements necessary in support of software technology stack or tools.

Advancements necessary for new or improved infrastructures like internet driven Cloud and distributed computing.

Advancements necessary to support scaling, reliability and availability of software based systems.

Advancements in other technology areas like vision and medical imaging, video transmission, telecommunication (voice), automation, controls, etc.

The most significant underlying key variables are:

improved infrastructure options (unresolved), scaling, reliability & availability options (unresolved), vision design options (unresolved), technology stack or tool designs (unresolved), big data methods (store, process, manage) (unresolved)

Technology or Knowledge Base Level:

Activity #3-1: Ineligible activities (Fiscal Year 2017)

Methods of experimentation:

Slide 27:

We will now look at a few examples to illustrate common misconceptions about technological uncertainty. The first example is to emphasize that absence of a capability does not equate to a technological uncertainty.

A company wants to build a new version of their client server mobile application. The older version of the application worked in conjunction with a well known Enterprise Server that offered server side Push. The new version of the application was required to work in setups where the Enterprise server could not be used.

In client server applications, the server responds to client requests. With a server side Push service, client applications can receive information from their servers even if they did not initiate a request.

Results:

Conclusion:

The company cannot claim the lack of availability of the Push capability from the Enterprise server as a technological uncertainty for its work to build some form of a Push service.

The company has to identify a limitation of technology that is preventing the development of its own Push service.

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