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Cyberinfrastructure and the Research Process in Canada

**Findings from Toronto Workshop
December 17, 18, 2009**



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The Workshop

- CANARIE, CUCCIO and Compute Canada invited subject matter experts and stakeholders in the research process to a workshop
 - 14 participants – Domain Researchers from various disciplines; Computer Science Researchers; HPC community; national and regional networks (CANARIE & ORANs) and CIOs
- Objective - to identify and document current state of, and process by which researchers obtain cyberinfrastructure resources needed to support their activities



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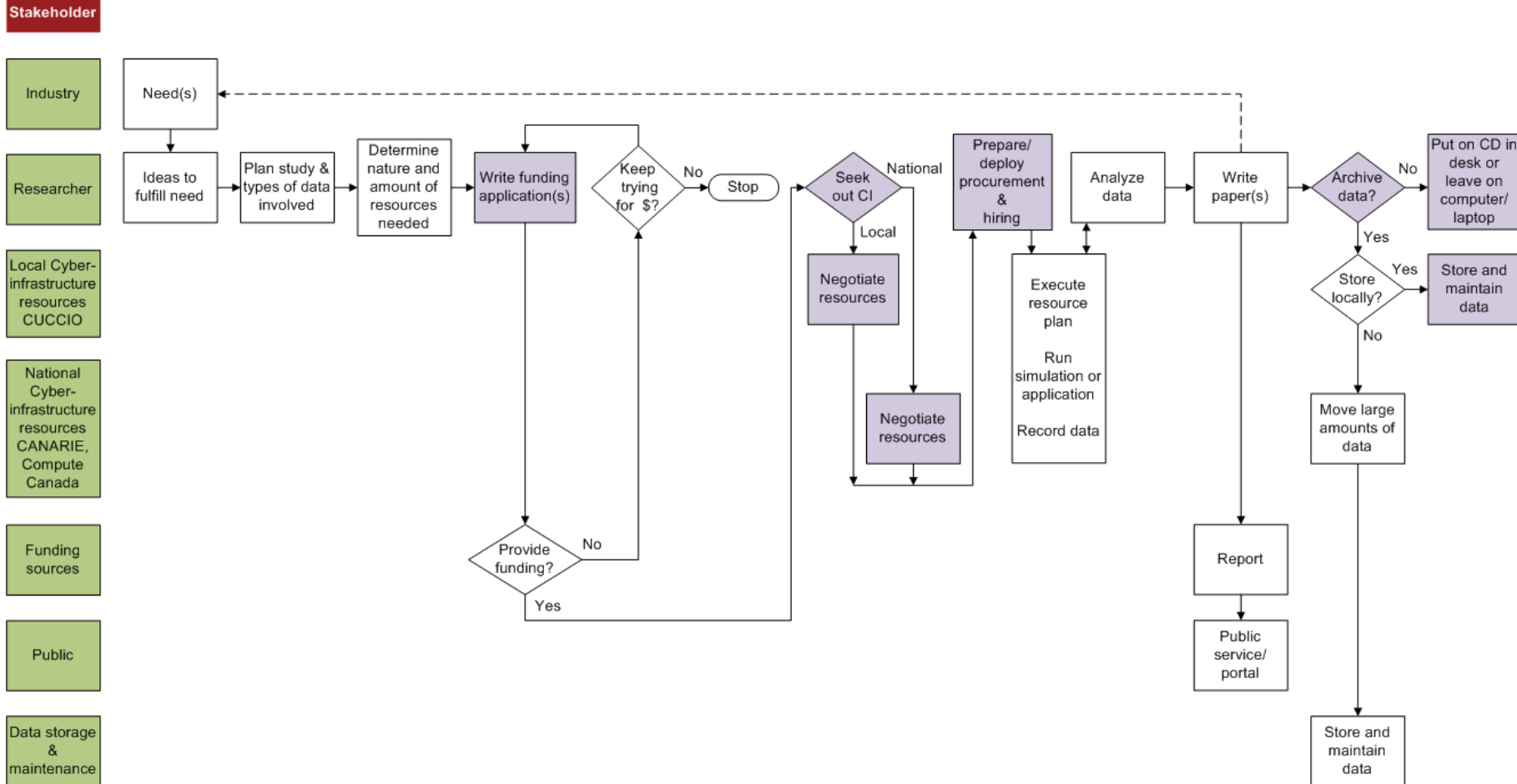
Workshop Results

1. Defined common definitions for
 - Cyberinfrastructure
 - High Performance Computing (HPC)
 - Grid Computing
 - Cloud Computing
2. Created a map of the research process identifying cyberinfrastructure needs
3. Suggested solutions to some issues
4. Defined a vision of cyberinfrastructure for 2015

The Research Process in Canada



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Major Issues Identified - Funding



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Fragmented Funding Process

- No one-stop shop exists
- Researchers learn as they go how to access needed resources
- Researchers often don't know what's needed
 - Cyberinfrastructure not their domain of expertise
- Short-term funding commitments for IT a major issue



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Major Issues Identified - Cyberinfrastructure

- **Advanced Networks - Connectivity Challenge**
 - End-to-end connectivity can be a challenge
 - There are policy issues around CANARIE network connection to commodity network
 - Access to research network from outside the institution can be challenging for Researchers
- **Middleware - Canada Lags Rest of World**
 - No capacity to support development of a national middleware “platform”
 - Each researcher typically develops their own which is inefficient and potentially ineffective
 - No group in Canada is studying Middleware; not easy to obtain funding (slightly funded by CANARIE)



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Major Issues Identified - Cyberinfrastructure

- **Computing** - Canada must be competitive in order to attract Researchers
 - Reduced research teams mean reduced research capacity, thereby diminishing the value of the research, potentially leading to Tier 2 Science
 - Many Researchers would prefer to contribute to sustaining a facility rather than procure, install and maintain their own infrastructure
- **Storage – Data Storage and Archiving Gap**
 - Lack of good mechanisms to store, maintain and share research data; findings often poorly archived thereby depleting research investment



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Major Issues Identified - Cyberinfrastructure

- **People and Expertise Gap**
 - Projects often lack the funding for cyberinfrastructure expertise; most funding agencies only fund capital
 - Capital Rich, People Poor
 - Lack of highly qualified people
 - Researchers often must do the IT or use Grad students
 - The NSF invests \$1 in people for every \$1 spent on hardware
- **Remote Sensors**
- **Visualization**



Issues and Possible Solutions

ISSUE, OWNER, PRIORITY	POSSIBLE SOLUTION
<p>“Last Mile” problem</p> <ul style="list-style-type: none">• high bandwidth pipes to campus edge but bottlenecks restrict Researchers’ ability to move and share data <p>Owner: CUCCIO Priority: High</p>	<ul style="list-style-type: none">• Provide CIOs with requirements list and reference architecture• Get campus more engaged with ORANs• Have universities better support off-site centres• Increase process awareness to Researchers know what’s available
<p>Middleware</p> <ul style="list-style-type: none">• No large scale integrated development platforms <p>Owner: CANARIE, Compute Canada Priority: Medium to High</p>	<ul style="list-style-type: none">• CANARIE to fund non-domain specific NEP to evolve middleware• Provide access to resources and facilities to test innovations developed in NEP projects• Need development fund for production environment and includes mechanism to evolve integrated development platform



Issues and Possible Solutions

ISSUE, OWNER, PRIORITY	POSSIBLE SOLUTION
<p>Fragmented Funding process</p> <ul style="list-style-type: none">• Inefficient, detracting from research activities <p>Owner: Funding Agencies Priority: High</p>	<ul style="list-style-type: none">• Have ONE funding application form; get agencies together to review and fund• Provide help to get appropriate information for proposals• Establish peer reviews for interdisciplinary projects• Take less time on contracts• Reduce overhead admin and accounting
<p>Data Storage and Management Gap</p> <ul style="list-style-type: none">• Data not being shared; some is lost <p>Owner: All Priority: High</p>	<ul style="list-style-type: none">• Establish data repository with standards and an architecture• Include data management plan• Partner with National Library and/or Archives Canada• Educate Researchers on importance



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Issues and Possible Solutions

ISSUE, OWNER, PRIORITY	POSSIBLE SOLUTION
<p>Large organizations are inflexible and unable to deal with special requirements</p> <p>Owner: Compute Canada Priority: Medium to High</p>	<ul style="list-style-type: none">• Earmark people with capital to conform to regulatory or special security requests• Set up batch jobs for compliance• Not every system/computer is HIPPA compliant



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Issues and Possible Solutions

ISSUE, OWNER, PRIORITY

Low awareness among Researchers of cyberinfrastructure resources - continued

Owner: Universities, CUCCIO

Priority: High

POSSIBLE SOLUTION

- Educate Research community on what's available and most appropriate
- Educate CIOs to they can help provide services to guide Researchers
- Educate CIOs; need Reference Architecture
- Provide booklet for Grad students; resource listing in first page of anti-virus program ensuring it gets read
- Use website, Facebook-type page or portal to list resources
- Get CANARIE, CUCCIO and Compute Canada launch a Comms. company for one-stop shopping
- Create one entity to review all projects and associated cyberinfrastructure components to ensure secure, streamlined efficiency with storage and maintenance of project output
- Give ½ day presentation to Researchers; attend their conferences; educate government granting councils, institutions, Researcher and Grad students



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Vision 2015

- **“Research Canada”/“Cyberinfrastructure Canada”**
 - Consolidation of organizations and creation of “Research Canada”, enabling a one-stop shop for Researchers’ CI needs such as:
 - Funding, Support, Resources, Integrated tools and technology
 - Singular application process that includes all cyberinfrastructure needs including expertise
 - Research Canada provides both cyberinfrastructure research and services
 - “Centres of Excellence” for cyberinfrastructure research on computing, technology, middleware and data archiving

Consolidation - A One Stop Shop



Definitions

- **Cyberinfrastructure:** An integrated environment for research supporting end-to-end needs of researchers. Integrates information processing and management resources, including:
 - Advanced Networks
 - Middleware
 - High Performance Computing
 - Data Storage, Curation, etc.
 - Sensor networks
 - Visualization
 - People and Expertise



Definitions

- **High Performance Computing (HPC):** Whatever compute technology that provides very large scale computing power. Computing at a scale beyond what's possible on the desktop
- **GRID Computing:** Coordinated access to distributed resources across administrative domains
- **Cloud Computing:** Virtualized, on-demand, community computing detached from the local environment where everything is a service