HPC in Ontario

Chris Loken, CTO

HPC User Forum

Tucson 2018

Who/what Are We?

- Coordinator and advocate for provincial Advanced Research Computing (ARC) agenda and Big Data strategy in Ontario
- New not-for profit funded by province; 5.5 FTEs
- Partners include the key university-based Ontario ARC providers (consortia): CAC, SHARCNET, SciNet, HPC4Health, SOSCIP
- Represent provincial consortia within Compute Canada

Quick Facts

- US ~10x Canada in terms of population and GDP
- Ontario represents ~40% of Canada by population and GDP
- Toronto region ~44% of Ontario population
  - 6.4M people
  - 18.5% of Canadian GDP
  - Second largest financial centre in North America
  - Third largest tech sector in NA
  - Fourth largest city in NA

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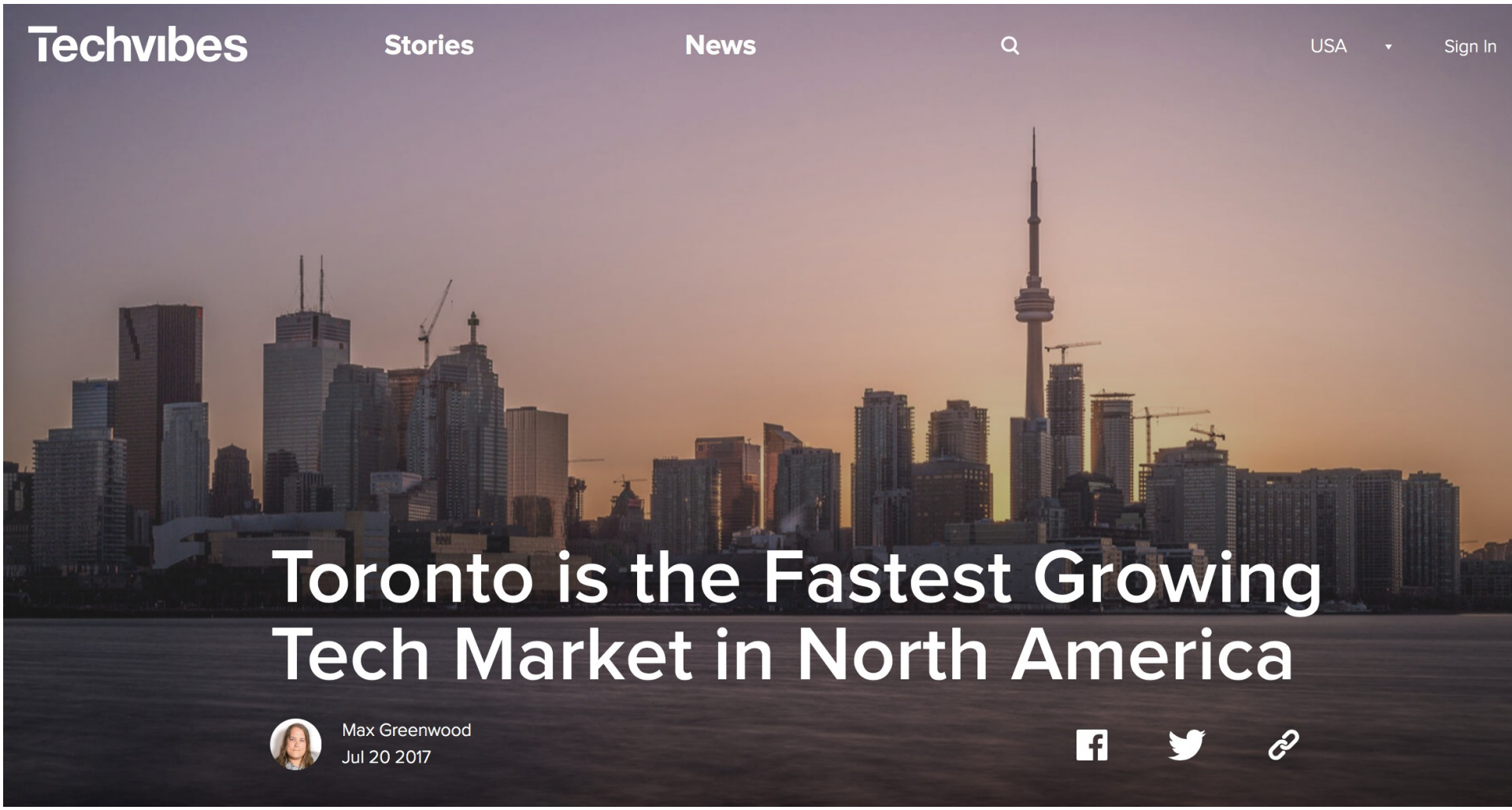


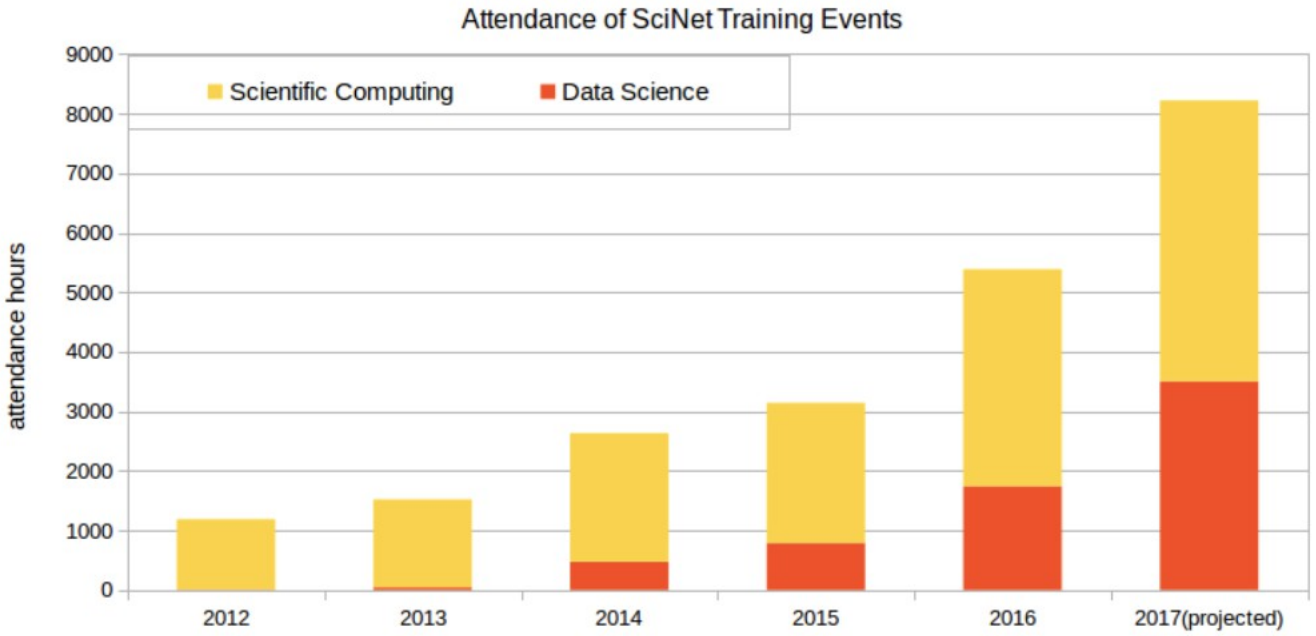
Differences in Canada

- Funding largely driven by single entity – Canada Foundation for Innovation (CFI)
- Essentially no mid-tiers of computing; need more than a desktop? Use one of large, shared national systems
- Every university-based PI can access the national systems (but annual peer-review process for large users)
- Refer to Advanced Research Computing (ARC) rather than HPC

Ontario Landscape

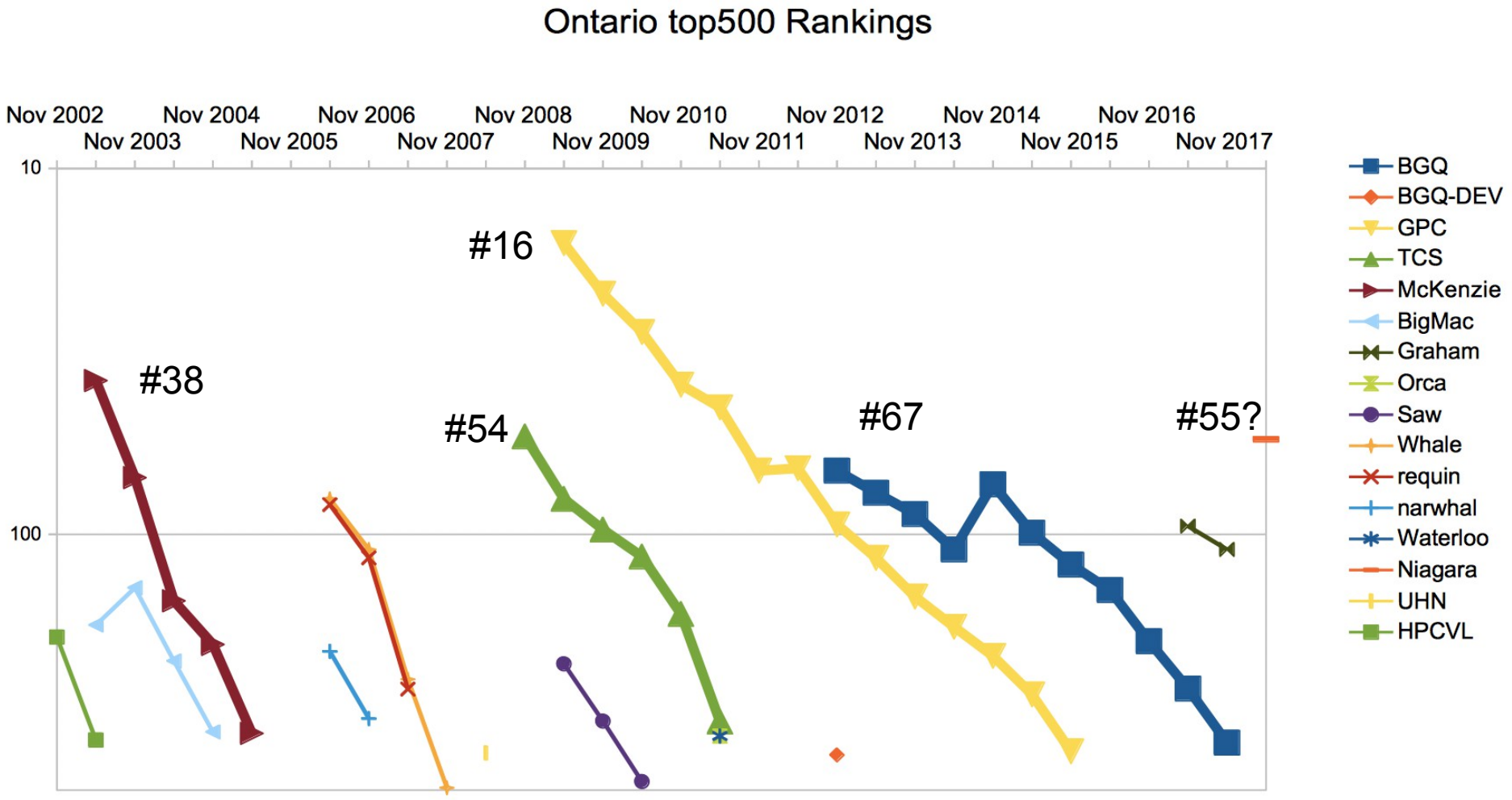
- 800 PIs and 3,000 users based in Ontario
- Used ~100K core-yrs (880M core-hrs) last year
- Usual suspects: climate, astro, high-energy physics, aerospace, molecular modeling, genomics etc
- ~70 expert ARC staff (HQP) across 4 sites; operate systems, support users, facilitators
- Significant training efforts: summer schools, workshops, mini-courses and for-credit courses

Ontario Landscape



One site's training events – 8x increase in person-hrs taught;
Large growth in data science classes (parallel R, python, ML)

Ontario Landscape



McKenzie, #38, 512 cores, 2D-mesh GigE; $900K
GPC, #16, 32K cores, $14M
Niagara ~55, 60K cores, $17M

New Systems - finally!

Graham (U Waterloo):

- 1.23 PF Rmax (#95)
- 35K Broadwell cores, 320xP100, EDR
- Huawei

Niagara (U Toronto):

- 3.0PF Rmax (#50-55?)
- 60K Skylake cores, EDR Dragonfly+, Excelero burst buffer
- Lenovo

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- SciNet
  - Off-campus, purpose-built HPC center
  - 4MW power feed, PUE=1.18 (measured)
  - Four #1 Canadian systems since 2008
- HPC4Health
  - Two hospitals sharing infrastructure! More entities joinining
  - Multi-tenancy elastic secure cloud
- SOSCIP
  - Unique R&D consortium using advanced computing to drive industrial innovation through academic-industry partnerships soscip.org

Science

CHIME – Canadian Hydrogen Intensity Mapping Experiment

- Probe expansion of universe, study pulsars, FRBs etc
- On-site DSP, correlator etc – 7 PetaOps of GPUs, FPGAs and X86 in a Faraday cage

Challenges

Funding Model:

- Feds provide 50% of capital; province must match
- Feds provide 40% of operating; province 40%; host institution 20%
- Guess who sets the rules? What do institutions get for their 20%?
- Capital and operating are separate grants; not even on on same schedule!

Challenges

Unpredictable funding

- 8+ years between last two funding rounds!

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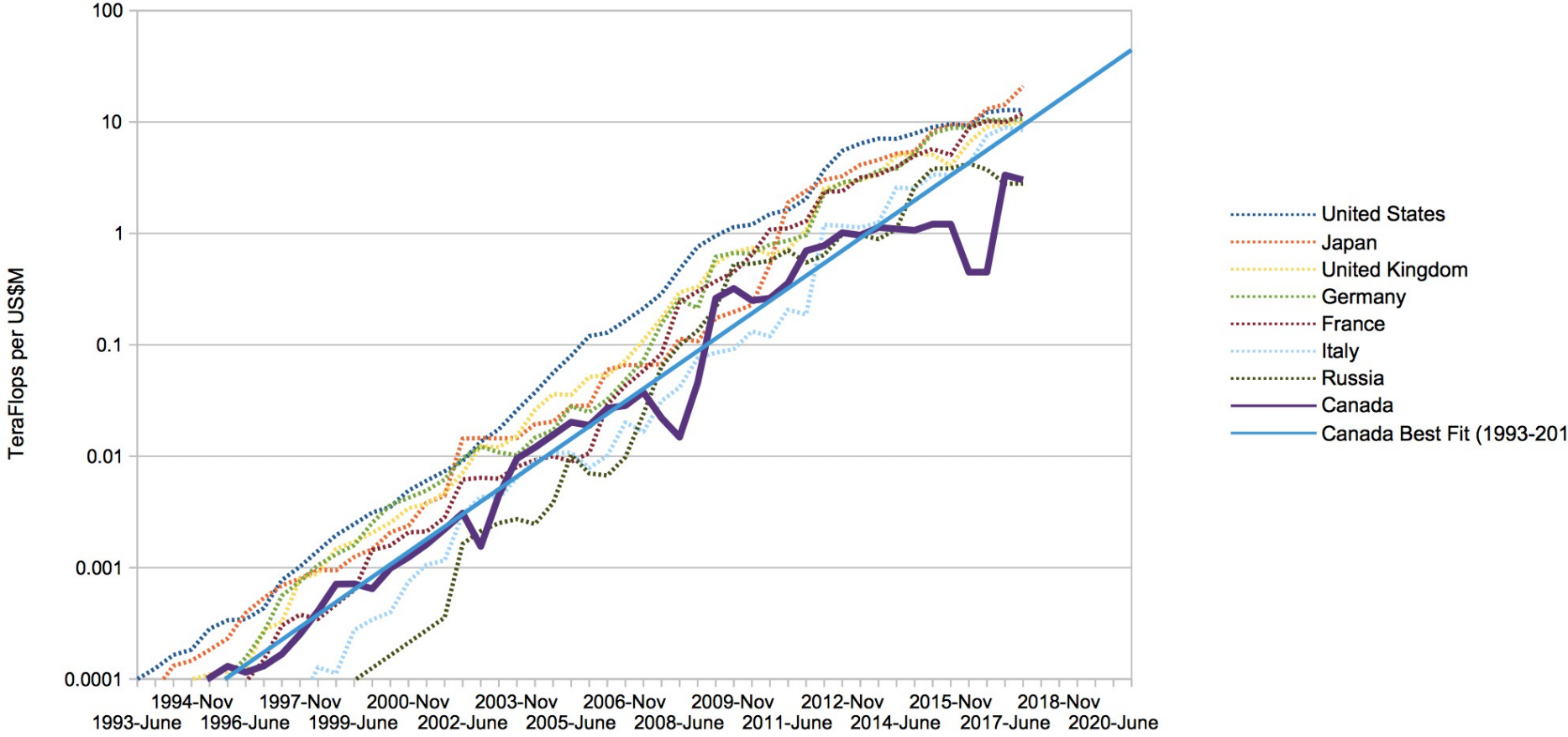
Top500 Aggregate Compute Power per GDP: G8 Countries



Challenges

- **Power costs:**
- Among highest in Canada (but first North American govt to eliminate coal; 14% of power from renewables)
- Good incentive for low PUE! (SciNet data center had PUE=1.16 in 2009)
- Recent rule changes have made >1MW datacenters eligible for significant reductions
  - Major portion (~60%) of annual bill is proportional to your fraction of usage during the 5 peak-hrs in previous year
  - So far, one of our sites has seen ~25% reduction in rates
  - Plus energy-efficiency rebates!

Opportunities

- HQP strategy - consider qualifications, training, retention, skills gaps, industry needs
- Technology Investment Strategy – identify researcher needs, future trends, set target investment levels for province
- AI efforts - Vector Institute, Uber etc
- Health-AI project with Compute Ontario, HPC4Health, Vector, ORION (provincial R&E network)

Conclusions

- Large system refresh ($100M across country for 5 systems – just one RFP to go!)
- Pivotal time for future of ARC funding - new federal govt announcement ($572M for digital research infrastructure)
- Compute Ontario playing significant provincial role