Moving Follow the Wind/Follow the Sun to Production

Survival IT

- Obama's National Science Advisor John Holdren "Mitigation alone won't work, because the climate is already changing, we're already experiencing impacts….A mitigation only strategy would be insanity,"

- Equal emphasis given to adaptation – avoiding the unmanageable, and adaptation – managing the unavoidable."

- Obama's Climate Adaptation Executive Order
  - http://www.stumbleupon.com/su/1tU8go/www.good.is/post/obama-s-secret-climate-adaptation-plan/

Climate Change Impact on Internet and NRENs

- UK Government study Climate Change could ruin the Internet
  - http://www.grist.org/list/2011-05-09-climate-change-could-ruin-the-internet

- Severe Flooding and Droughts will affect energy distribution system

- Last year Nuclear power plants in France were forced to shut down because cooling water was too warm

- Germany is committed to shutting down all of its nuclear plants

- Droughts will restrict production of hydro-electric power

# The need to move to clouds powered by wind and sun

- Campus computing 20-40% electrical energy consumption on most campuses
  - Studies in UK and The Netherlands

- CANARIE study -Closet clusters represent up to 15% of electrical consumption – UBC study

- CANARIE study Campus data center represents 8-20% of electrical consumption
  - IISD study of Dalhousie, UoAlberta and Ottawa U

- IISD study demonstrated that moving Canadian research to cloud would pay for itself in energy savings and CO_2 reduction

- Clouds could save universities millions of dollars in energy and support costs
  - http://green-broadband.blogspot.com/2010/12/how-r-networks-can-help-universities.html

Building Networks to Survive Climate Change

- Wind and solar power are most likely candidates because of opportunity cost/benefit analysis especially time to deploy
  - Nuclear has high opportunity cost because of time to deploy
  - http://climateprogress.org/2008/12/14/stanford-study-part-1-wind-solar-baseload-easily-beat-nuclear-and-they-all-best-clean-coal/

- But renewable energy sites are usually located far from cities and electrical distribution systems are not designed to carry load
  - http://www.americanprogress.org/issues/2008/12/pdf/renewable_transmission.pdf
  - Local wind/solar will be an important component

- Design Principles for Building Networks to Survive Global Warming
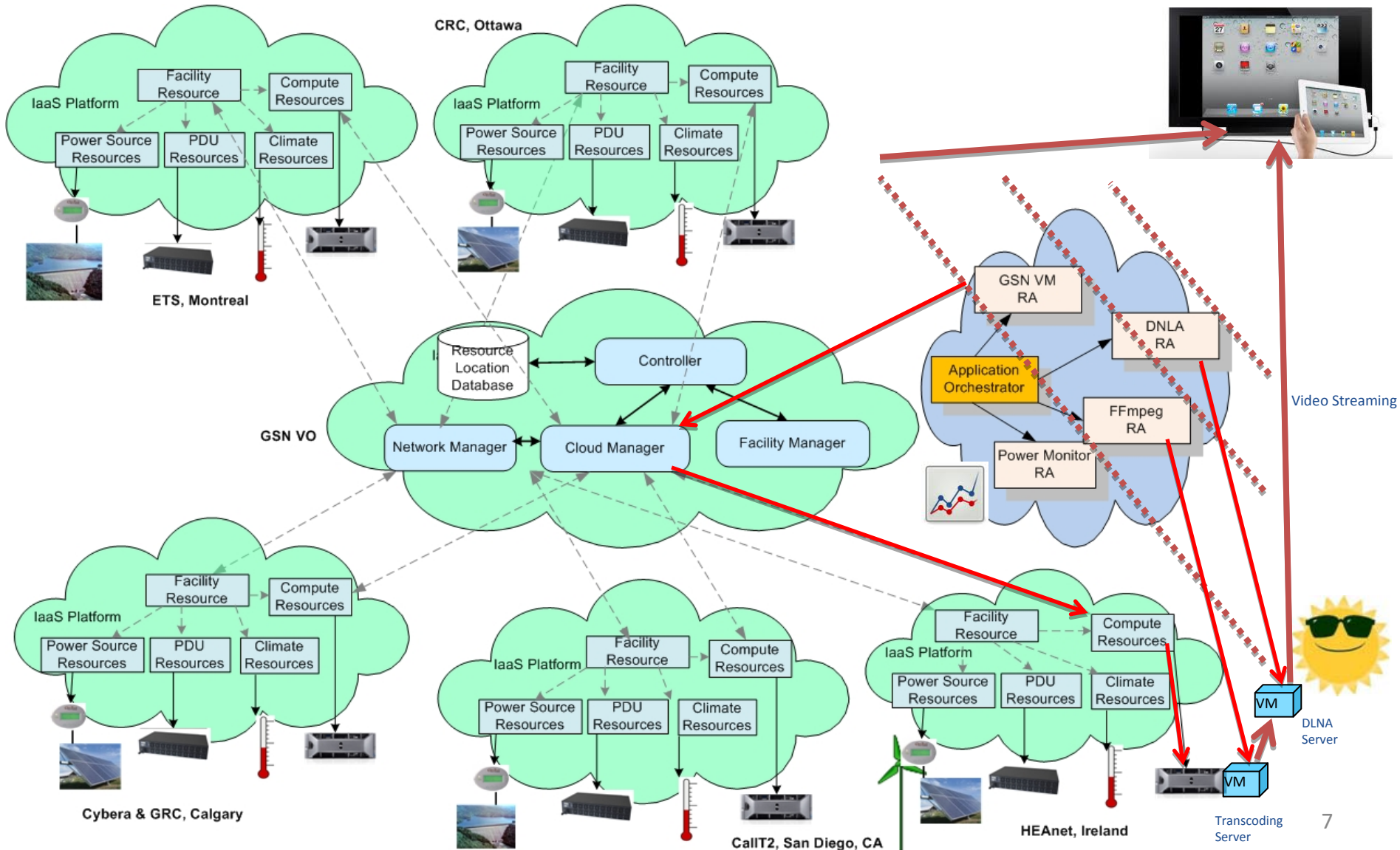 - http://green-broadband.blogspot.com/2011/02/design-principles-for-building-networks.html

The GreenStar Network Map

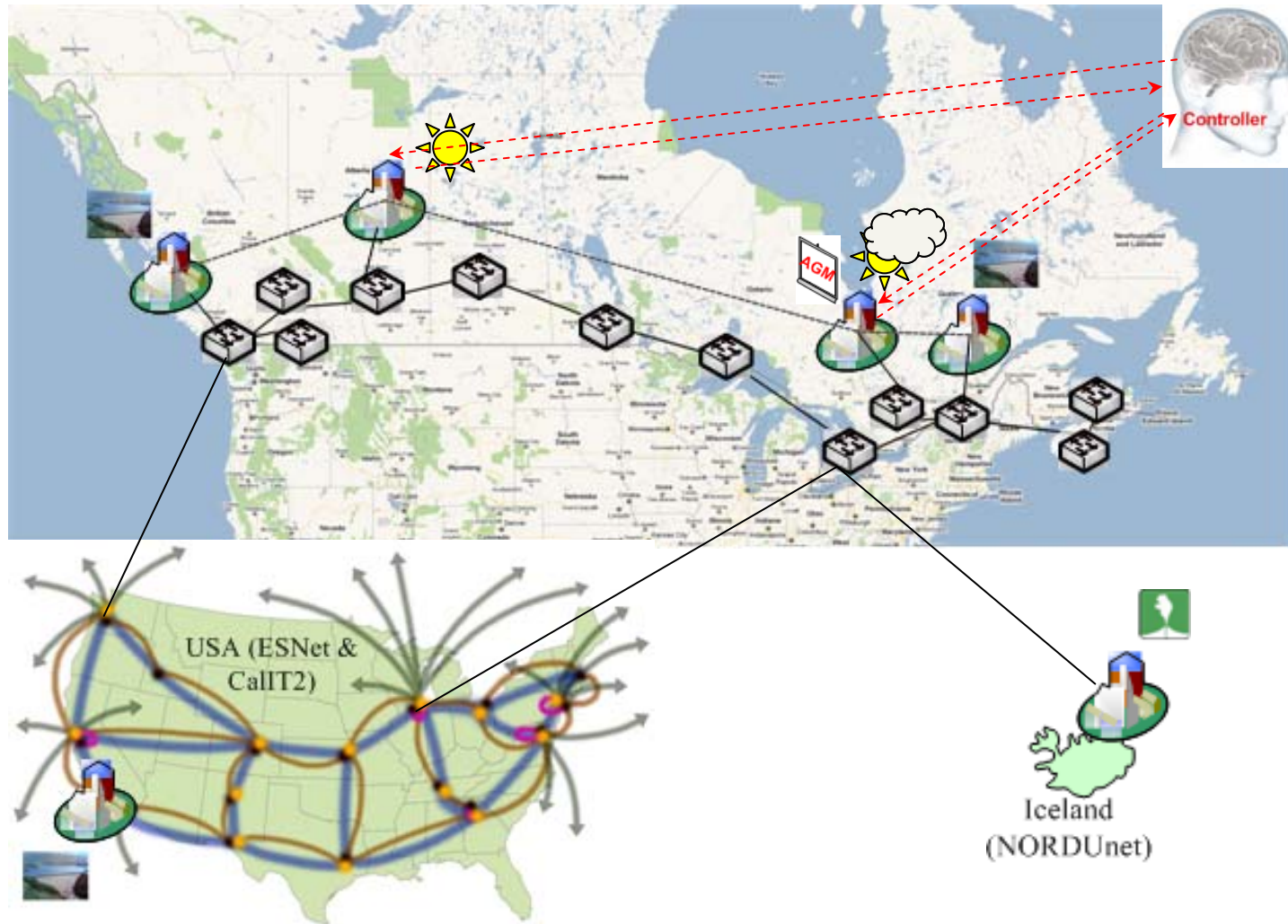GreenStar Network – World's First Zero Carbon Network & Cloud
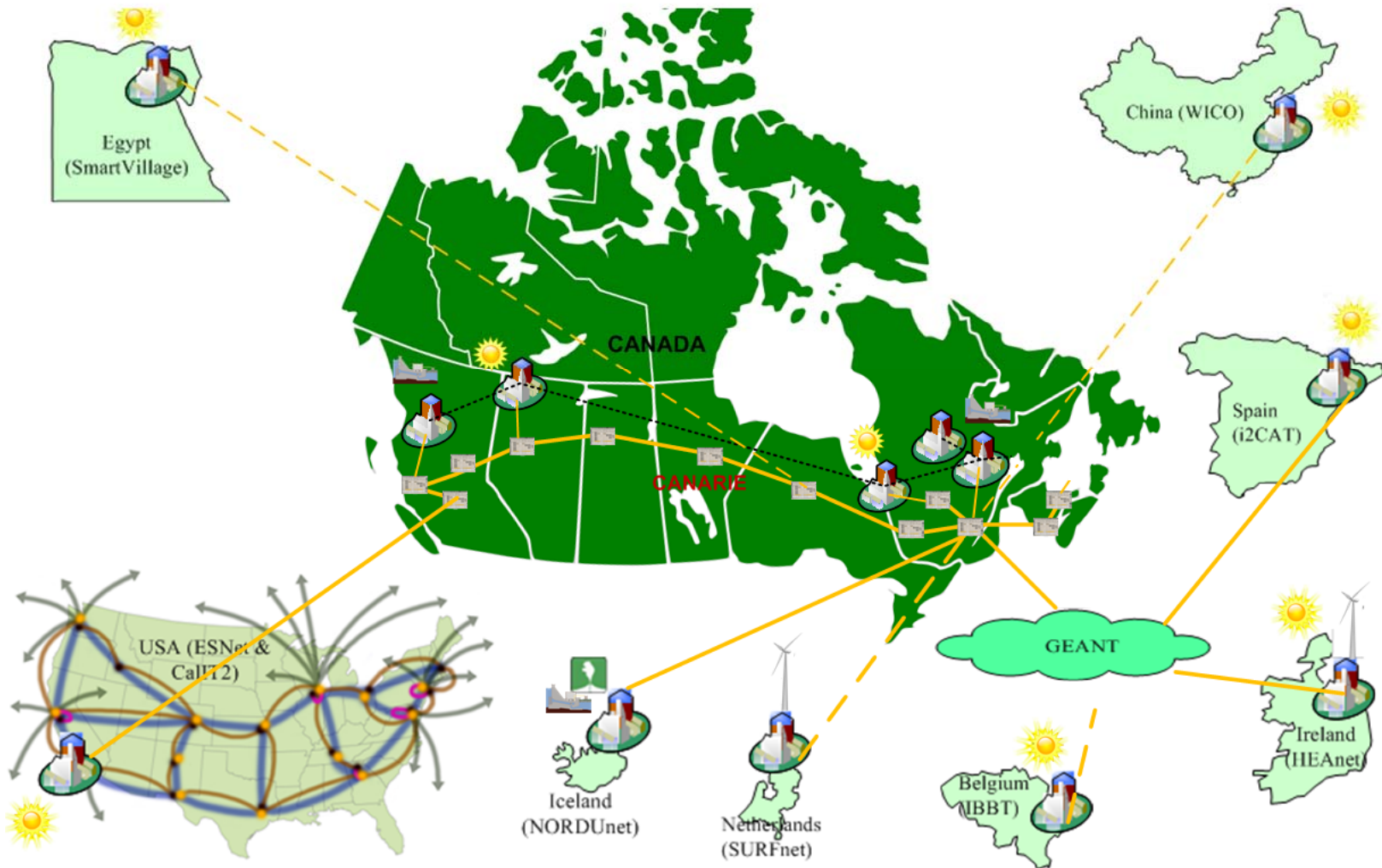
The GreenStar Network

Transcoding and Video Streaming service provision based on Follow the Sun and the Wind
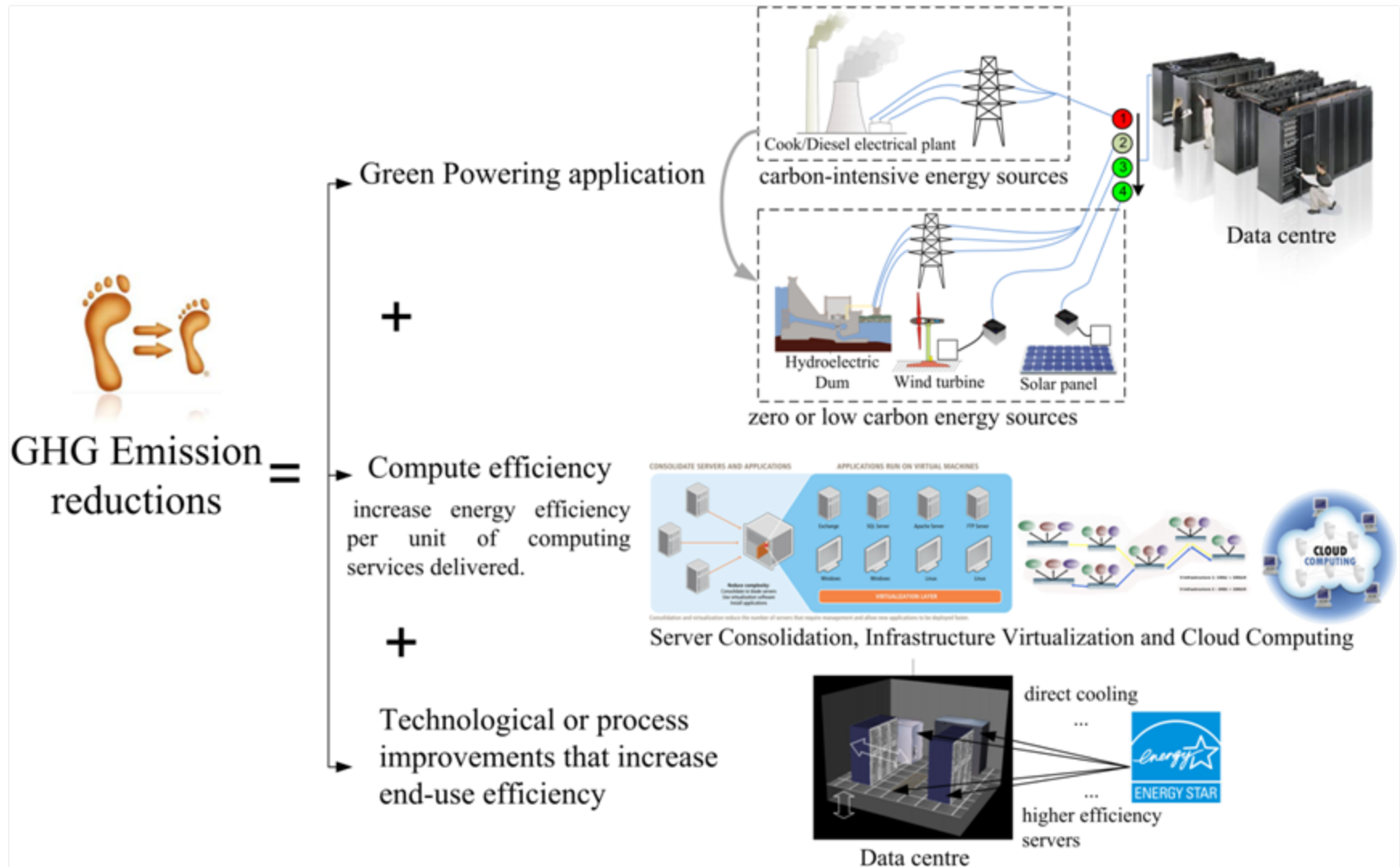
GV- CANARIE AGM
Live demonstration

✵ Simulation on global scale Simulation.mp4

Carbon Protocol
How Real Reductions will be Achieved

GHG Emission reductions =

Green Powering application

+

Compute efficiency
increase energy efficiency per unit of computing services delivered.

+

Technological or process improvements that increase end-use efficiency

Cook/Diesel electrical plant
carbon-intensive energy sources

Data centre

Hydroelectric Dum   Wind turbine   Solar panel
zero or low carbon energy sources

Server Consolidation, Infrastructure Virtualization and Cloud Computing

direct cooling
...
ENERGY STAR
...
higher efficiency servers
Data centre

Mantychore & GSN Strategy

European GSN star with Mantychore provisioned connections
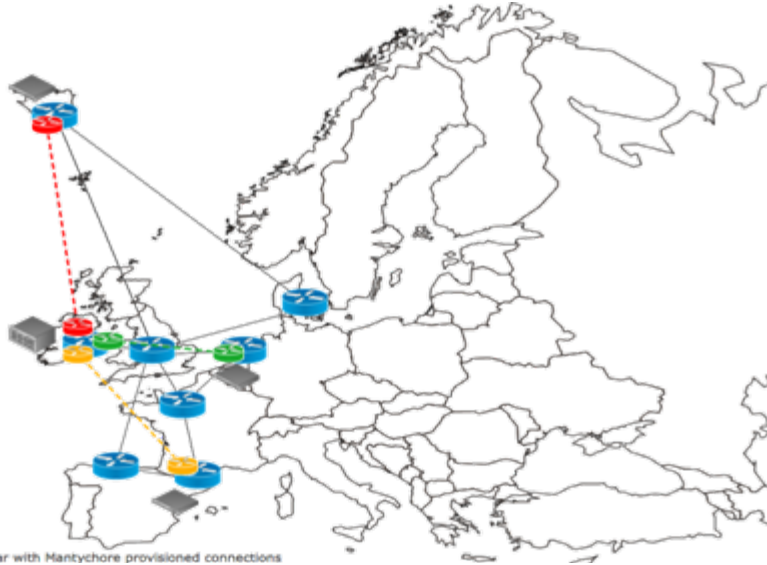
Summer 2011 - second stage of GSN and Mantychore Integration:

- Connect European GSN nodes together to an Euro GSN Hub

- Develop Integrated Mantychore – GSN Solutions Q3 and Q4 2011

2012 –Third stage of GSN and Mantychore Integration :

- Connect Euro GSN Hub to Canada Hub
- Test Hub to Hub Interaction and switching IaaS to nodes at either Hub

NYSERDA EverGreen Project and Goals

- Demonstrate the feasibility of deploying a network of Performance Optimized Datacenters (PODs), geographically distributed to exploit the availability of renewable energy for its operation.

- Use the wind power that is currently stranded, i.e. not-delivered to the grid due to the T&D constraints.

- Major Industry Partners – HP and AMD

  - Optimizing the utilization of the available renewable power for computing by intelligently redistributing computational load;
  - Minimizing losses associated with power transmission by placing the PODs near the power source;
  - Providing energy and design efficiency through the use of additional passive cooling for the PODs

- Provides data center operators means to avoid expensive utility upgrades, keeping the infrastructure and Transmission & Distribution costs low

- Use the wind power that is currently stranded, i.e. not-delivered to the grid due to the T&D constraints.

The NYSERDA EverGreen Team

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Economic benefits of follow the wind/sun architectures

- Cost- and Energy-Aware Load Distribution Across Data Centers
    - http://www.cs.rutgers.edu/~ricardob/papers/hotpower09.pdf
    - Green data centers can decrease brown energy consumption by 35% by leveraging the green data centers at only a 3% cost increase

- Cutting the Electric Bill for Internet-Scale Systems
    - Companies can shift computing power to a data center in a location where it's an off-peak time of the day and energy prices are low
    - Cassatt a product that dynamically shifts loads to find the cheapest energy prices
    - 45% maximum savings in energy costs
    - http://ccr.sigcomm.org/online/files/p123.pdf
    - http://earth2tech.com/2009/08/19/how-data-centers-can-follow-energy-prices-to-save-millions/

- Computing for the future of the planet
    - http://www.cl.cam.ac.uk/research/dtg/~ah12/
    - http://earth2tech.com/2008/07/25/data-centers-will-follow-the-sun-and-chase-the-wind

Some potential commercial projects

- ezCloud – cloud computing using methane on farms

- GreenQCloud in Iceland working with SURFnet

- Several solar and wind powered data centers in the US

You tube video

- http://www.youtube.com/watch?v=OFPvBjURlHA
-

New CTO of FCC

- D H will be new CTO of FCC
- Knowledgeable of GLIF & Greenstar
- Intends to make "green" a major direction for FCC and telecom in the US