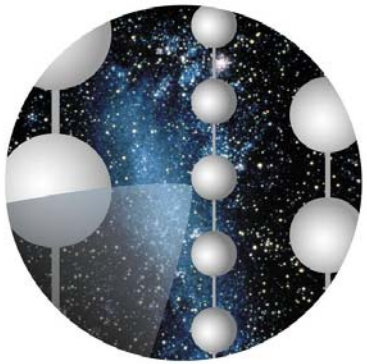


IceCube Teleport System

Many-to-Many Communications Through Iridium's SBD

David Bogen
IceCube Project - University of Wisconsin-Madison

Outline

- Overview of IceCube
- Communication Challenges
- Design of IceCube Teleport System (ITS)
- Implementation
- Results

10,000’ Overview of IceCube

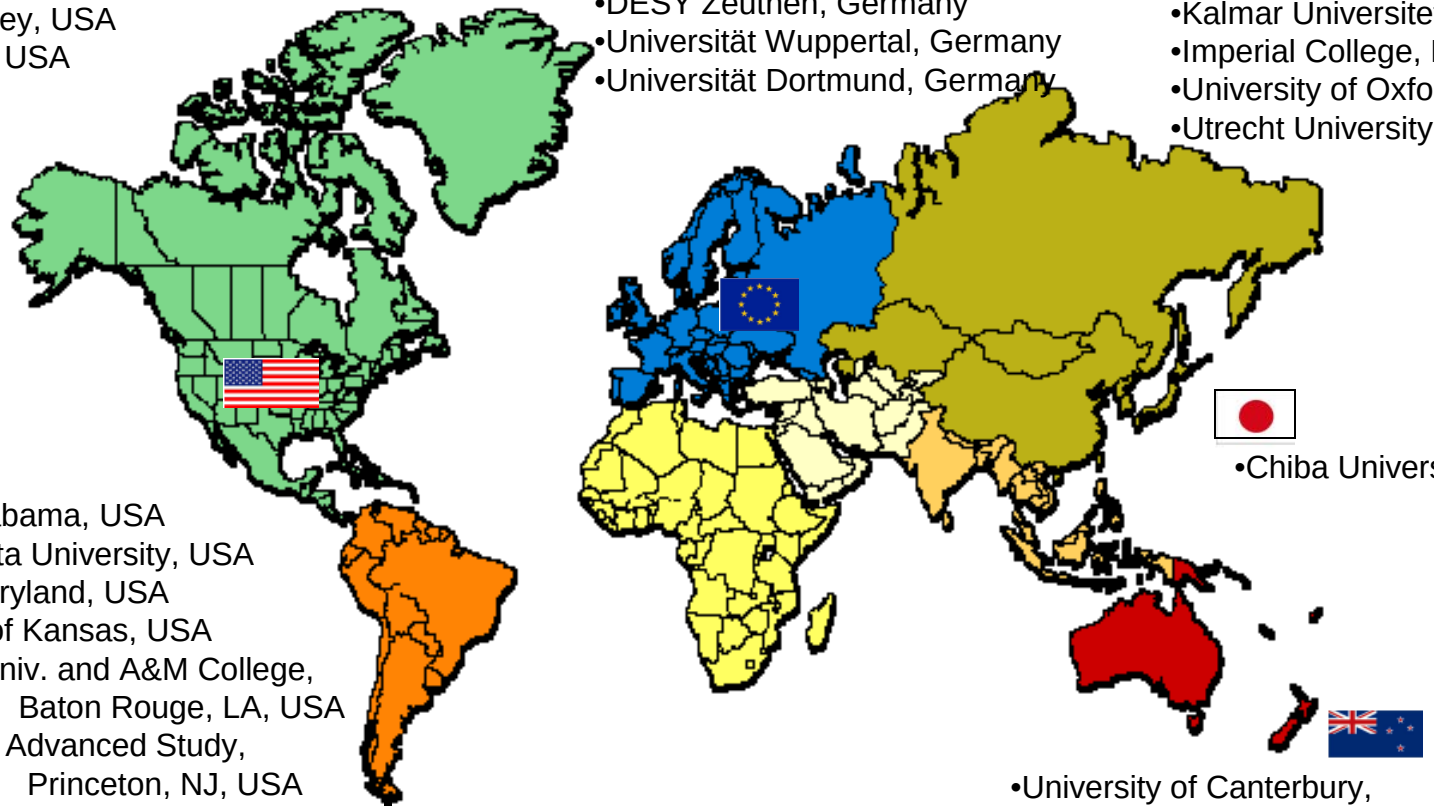
IceCube Collaboration

IceCube

•Bartol Research Inst, Univ of Delaware, USA
•Pennsylvania State University, USA
•University of Wisconsin-Madison, USA
•University of Wisconsin-River Falls, USA
•LBNL, Berkeley, USA
•UC Berkeley, USA
•UC Irvine, USA

•Université Libre de Bruxelles, Belgium
•Vrije Universiteit Brussel, Belgium
•Université de Mons-Hainaut, Belgium
•Universiteit Gent, Belgium
•Universität Mainz, Germany
•DESY Zeuthen, Germany
•Universität Wuppertal, Germany
•Universität Dortmund, Germany

•Humboldt Universität, Germany
•MPI, Heidelberg
•Uppsala Universitet, Sweden
•Stockholm Universitet, Sweden
•Kalmar Universitet, Sweden
•Imperial College, London, UK
•University of Oxford, UK
•Utrecht University, Netherlands



•Chiba University, Japan

•Univ. of Alabama, USA
•Clark-Atlanta University, USA
•Univ. of Maryland, USA
•University of Kansas, USA
•Southern Univ. and A&M College,
• Baton Rouge, LA, USA
•Institute for Advanced Study,
• Princeton, NJ, USA
•University of Alaska, Anchorage

•University of Canterbury,
Christchurch, New Zealand

Neutrino Telescope

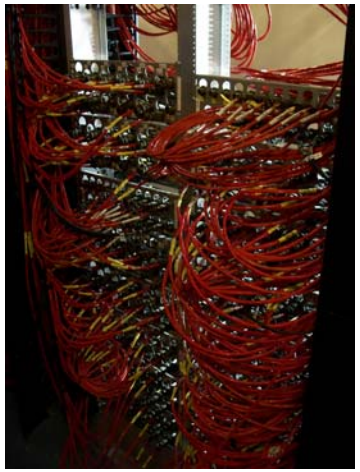
Detector Overview

- 2.5km deep
- 1 cubic km area
- 80 strings
- 60 modules/string
- 160 surface modules (80 stations)
- Data center
- Completion in 2011

QuickTime™ and a
decompressor
are needed to see this picture.

IceCube Lab (ICL) Data Center

- Over 90 servers
- Gigabit Ethernet
- Climate monitoring
- Power conditioning
- Over 50TBs of storage
- Redundant firewalls



Communication Challenges

- Time sensitive information
- Limited satellite coverage
  - When satellites below horizon, must rely on Iridium-based e-mail system
- Iridium-based e-mail system
  - Completely unpredictable delivery times
  - Affected by external forces

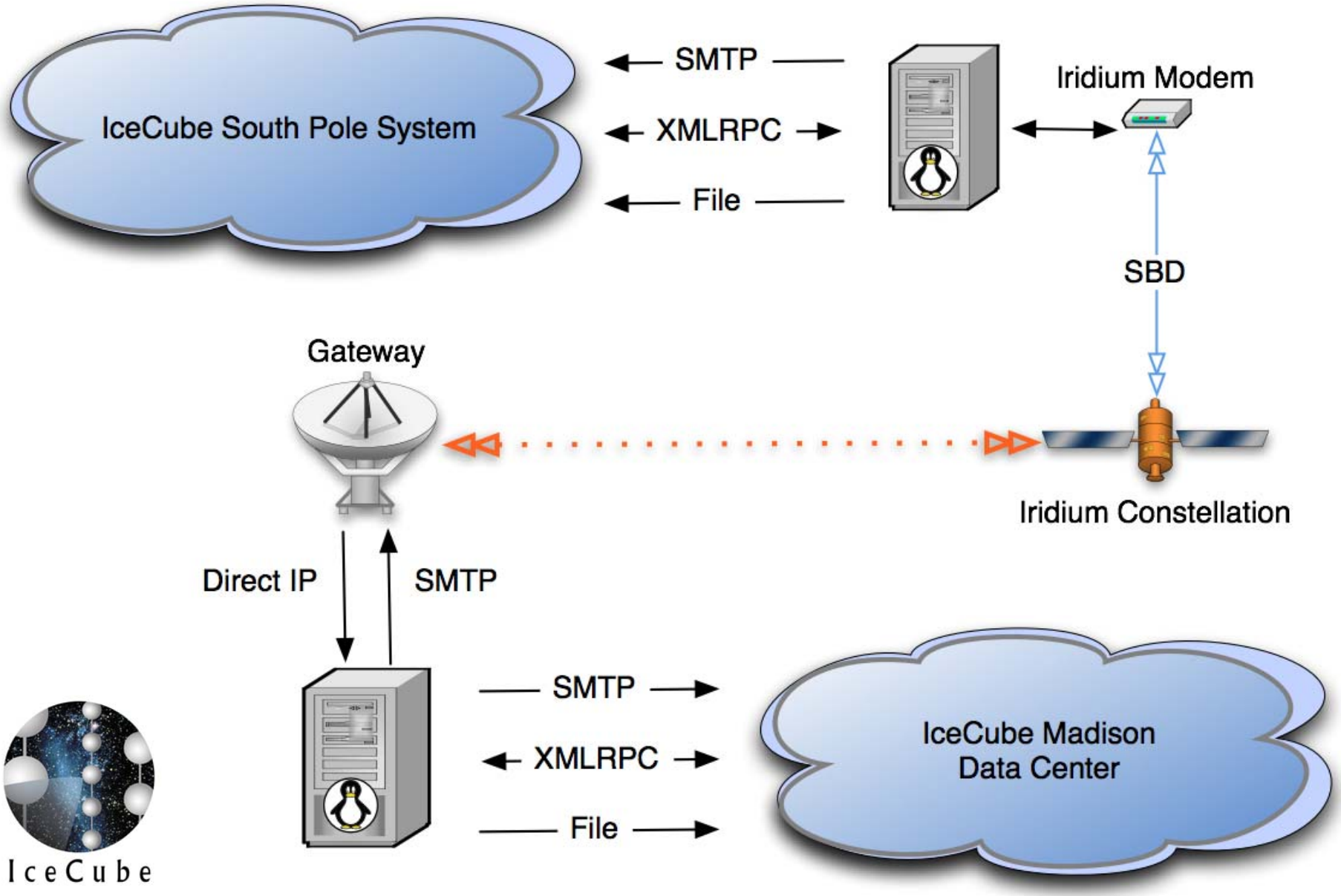
Design of ITS

- Accommodate multiple uses
- Language neutral
- Network accessible
- Exclusive to IceCube
- Enforce some level of access-control
- First-in, first-out queuing

Implementation

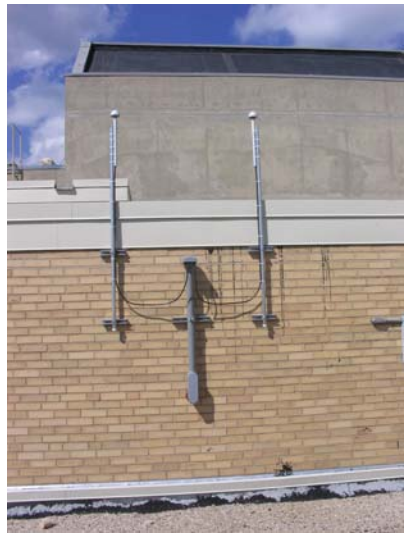
- XML-RPC
- Linux (RedHat Enterprise Linux)
- Multiple daemons to isolate failures
- Reserved payload for future growth or additional overhead
- No delivery acknowledgement
- One-shot delivery

ITS Message Flow



Current Implementations

- South Pole Test System
  - Located in Madison, WI
  - Provides test bed for application development and application integration



- South Pole System
  - Located in ICL
  - Live system used in production

Results

- Currently used by four distinct groups in collaboration; more anticipated
- Deliver a message one-way in roughly twenty seconds
- Leverage investment in SBD across multiple efforts

Possible Future Improvements

- Sender/receiver authentication via crypto
- Limited delivery queuing and retries
- Improved performance monitoring
- Improved logging