

An Open Geospatial Consortium- based Arctic Climatology Sensor Network Prototype

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Study Area: Barrow, Alaska



- “Top of the world”, Point Barrow Alaska, is the nations northern most point
- One mile away lies the city of Barrow, the northern most settlement on the continent
- Less than 4,000 people live in the area
- March 2010, The Smithsonian Magazine published an article titled, “Barrow, Alaska: Ground Zero for Climate Change”

Project Objectives

- Create Data Information System
- Use Open Geospatial Consortium (OGC) Standards
- End to End Geographic Information Network



Motivation

- Interoperability
- Scalability
- Extensibility

Ultimately,

internet based stationary and mobile location
and time aware sensor networks



Direction

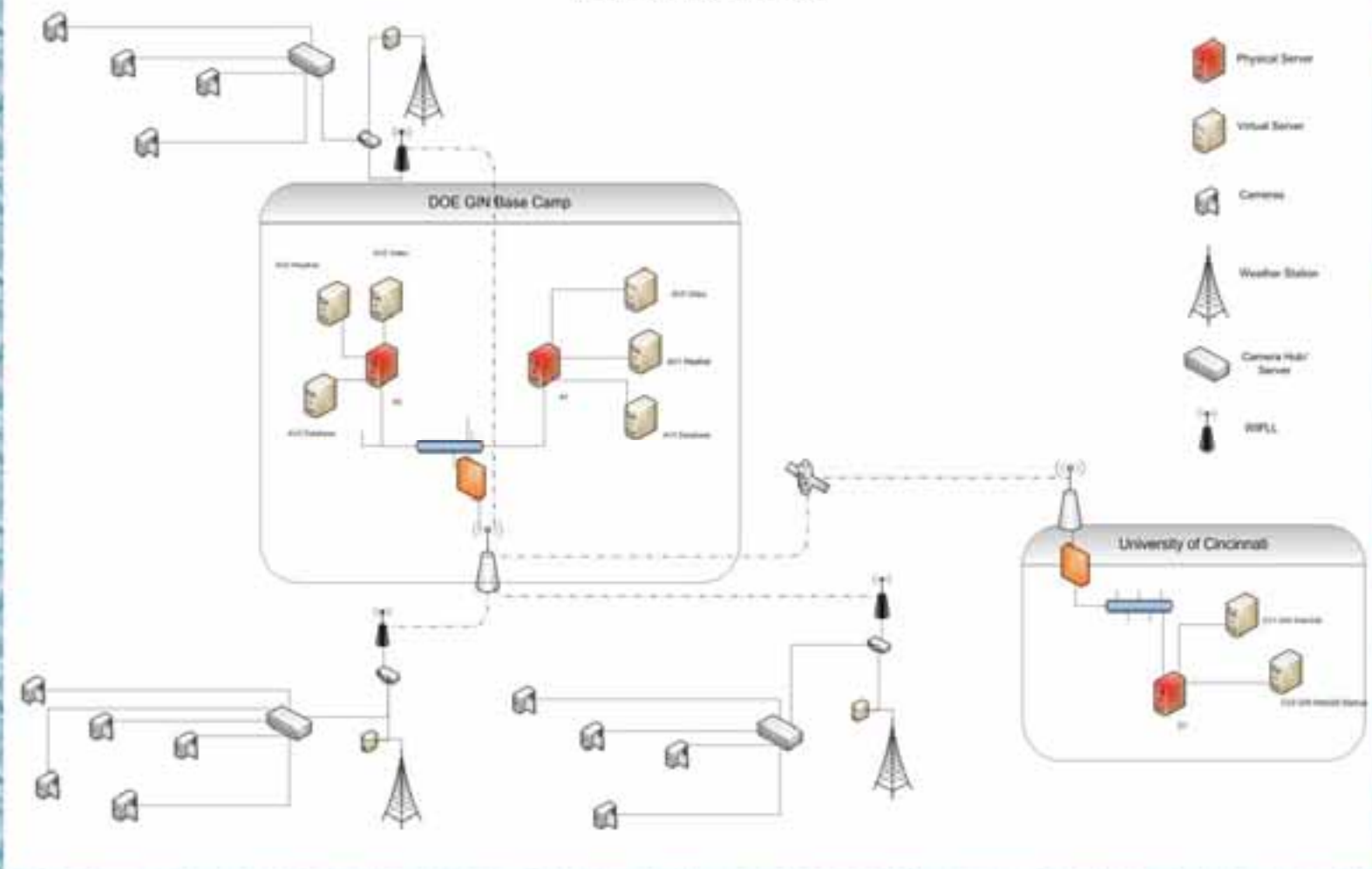
- TCP/IP
- Microsoft Windows
- File Transfer Protocol
- ESRI, ArcGIS Server
- SQL Server

Partnerships

- INTRUST Group Inc.
- Linoma Software



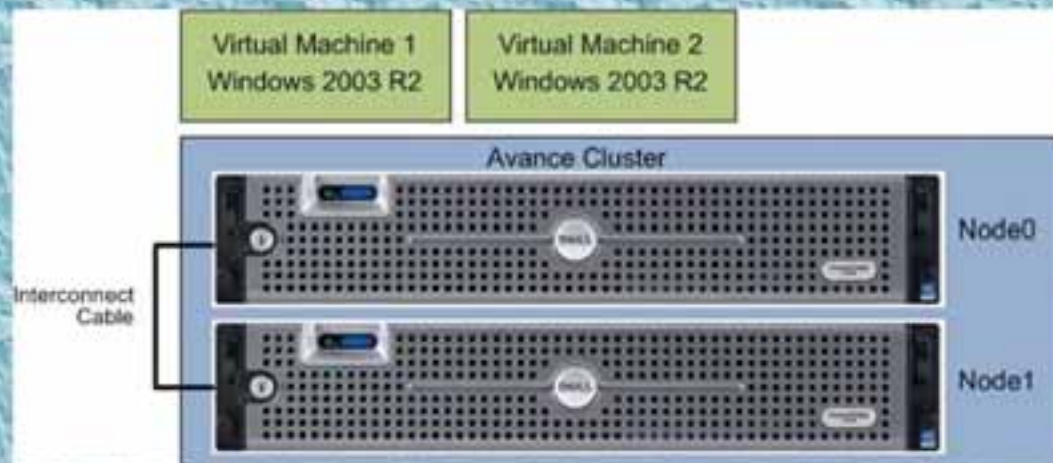
Prototype GIN Network



Remote Server Virtualization

Avance

High Availability software created by Stratus
Has Xen Server Virtualization software
embedded within Avance





Automated Data Movement

Linoma Software

Go Anywhere Director

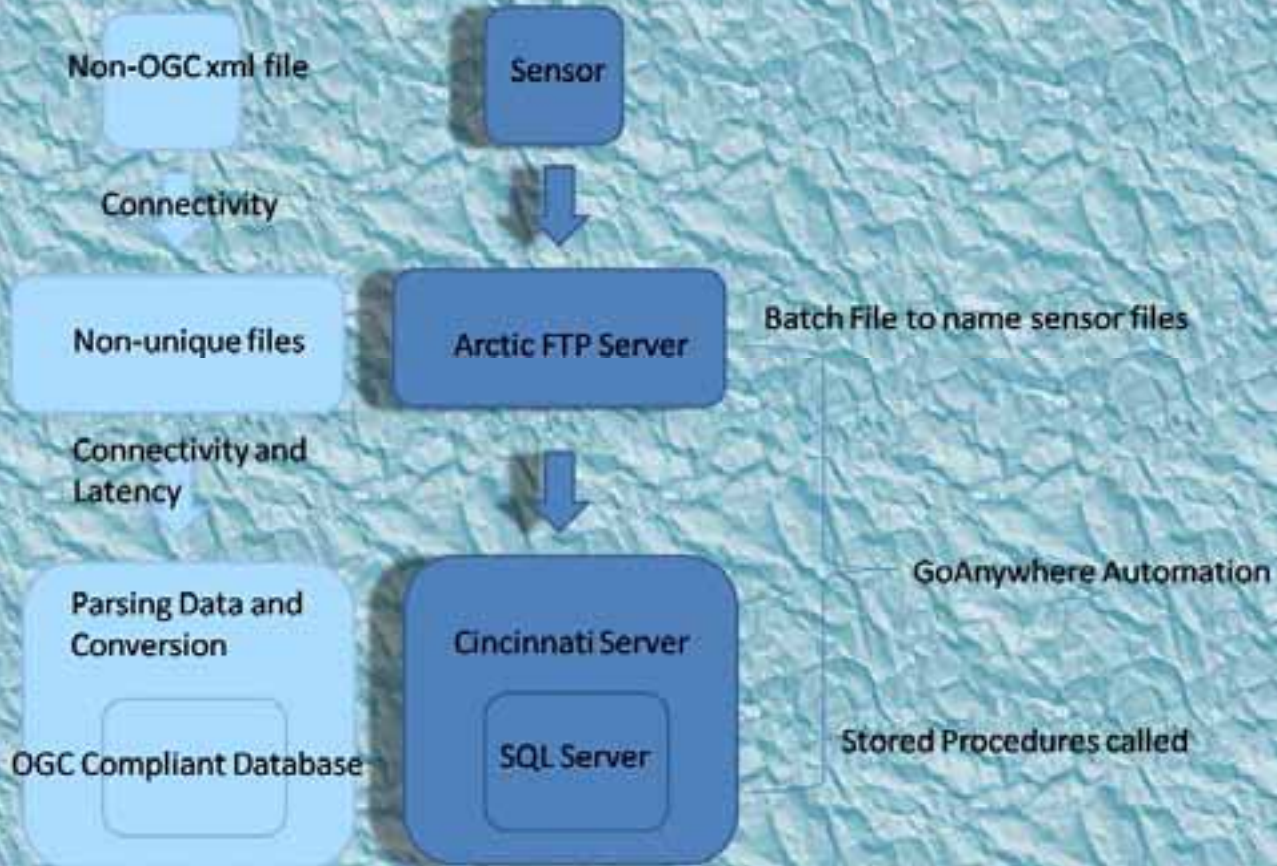
streamlines and manages data movement through an innovative centralized approach. It allows your organization to connect to almost any system (internal or external) and securely exchange data using a wide variety of standard protocols.



Data Flow

Challenges

Solutions



Original XML File

```
- <data timeframe="actual">
  <item sensor="date0" cat="date" unit="utc">20090810234001</item>
  <item sensor="date0" cat="date2" unit="utc">10.08.2009 23:40:01</item>
  <item sensor="date0" cat="puredate" unit="utc">10.08.2009</item>
  <item sensor="date0" cat="time" unit="utc">23:40:01</item>
  <item sensor="date0" cat="year" unit="utc">2009</item>
  <item sensor="date0" cat="month" unit="utc">08</item>
  <item sensor="date0" cat="day" unit="utc">10</item>
  <item sensor="date0" cat="dayofweek" unit="utc">1</item>
  <item sensor="date0" cat="hour" unit="utc">23</item>
  <item sensor="date0" cat="min" unit="utc">40</item>
  <item sensor="date0" cat="sec" unit="utc">01</item>
  <item sensor="date0" cat="date" unit="local">20090810234001</item>
  <item sensor="date0" cat="date2" unit="local">10.08.2009 23:40:01</item>
  <item sensor="date0" cat="puredate" unit="local">10.08.2009</item>
  <item sensor="date0" cat="time" unit="local">23:40:01</item>
  <item sensor="date0" cat="year" unit="local">2009</item>
  <item sensor="date0" cat="month" unit="local">08</item>
  <item sensor="date0" cat="day" unit="local">10</item>
  <item sensor="date0" cat="dayofweek" unit="local">1</item>
  <item sensor="date0" cat="hour" unit="local">23</item>
  <item sensor="date0" cat="min" unit="local">40</item>
  <item sensor="date0" cat="sec" unit="local">01</item>
  <item sensor="lunar" cat="phase" unit="percentage">78.2</item>
  <item sensor="lunar" cat="phase" unit="segment">5</item>
```


Normalization

GA	
<input type="checkbox"/>	timeframe
<input type="checkbox"/>	sensor
<input type="checkbox"/>	cat
<input type="checkbox"/>	unit
<input type="checkbox"/>	item



Weather *	
<input type="checkbox"/>	date
<input type="checkbox"/>	time
<input type="checkbox"/>	longitude
<input type="checkbox"/>	latitude
<input type="checkbox"/>	elevation
<input checked="" type="checkbox"/>	location
<input type="checkbox"/>	serialnumber
<input type="checkbox"/>	MACaddress
<input type="checkbox"/>	sunrise
<input type="checkbox"/>	sunset
<input type="checkbox"/>	temp
<input type="checkbox"/>	humrel
<input type="checkbox"/>	dew
<input type="checkbox"/>	heatindex



Weather_History *	
<input type="checkbox"/>	date
<input type="checkbox"/>	time
<input type="checkbox"/>	longitude
<input type="checkbox"/>	latitude
<input type="checkbox"/>	elevation
<input checked="" type="checkbox"/>	location
<input type="checkbox"/>	serialnumber
<input type="checkbox"/>	MACaddress
<input type="checkbox"/>	sunrise
<input type="checkbox"/>	sunset
<input type="checkbox"/>	temp
<input type="checkbox"/>	humrel
<input type="checkbox"/>	dew
<input type="checkbox"/>	heatindex

Spatial Data Relationship

Sensors *	
<input type="checkbox"/>	sensorname
<input type="checkbox"/>	sensortype
<input type="checkbox"/>	latitude
<input type="checkbox"/>	longitude
<input type="checkbox"/>	elevation
<input type="checkbox"/>	direction
<input checked="" type="checkbox"/>	location
<input type="checkbox"/>	geometry_column

Weather *	
<input type="checkbox"/>	date
<input type="checkbox"/>	time
<input type="checkbox"/>	longitude
<input type="checkbox"/>	latitude
<input type="checkbox"/>	elevation
<input checked="" type="checkbox"/>	location
<input type="checkbox"/>	serialnumber
<input type="checkbox"/>	MACaddress
<input type="checkbox"/>	sunrise
<input type="checkbox"/>	sunset
<input type="checkbox"/>	temp
<input type="checkbox"/>	humrel
<input type="checkbox"/>	dew
<input type="checkbox"/>	heatindex



ESRI OGC Participation

Principle Member

Actively Participates

- Technical Committee
- Planning Committee
- Board of Directors
- All three OGC programs
 - Interoperability, Standards, Community
- Architecture Board
- Others.....

OGC[®]
Open Geospatial Consortium, Inc.

SDE

OGC

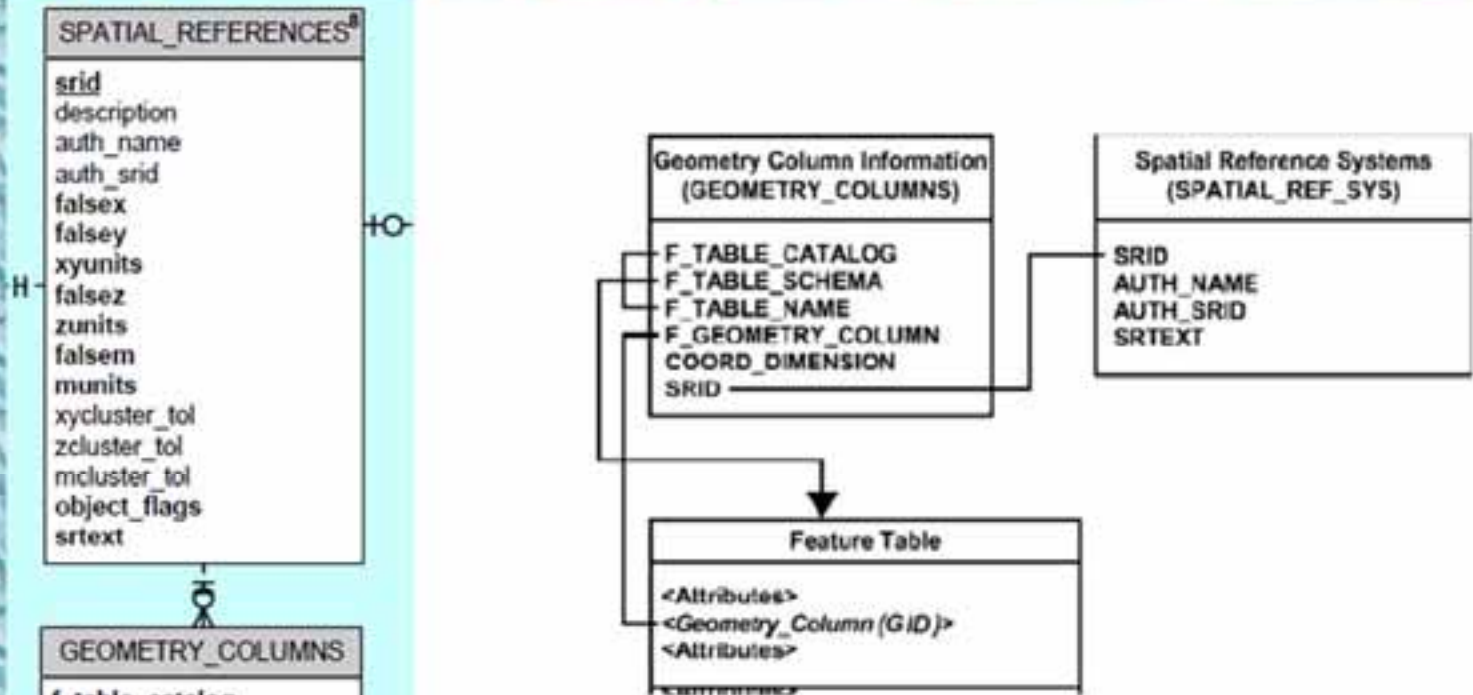


Figure 3: Schema for feature tables using SQL with Geometry Types

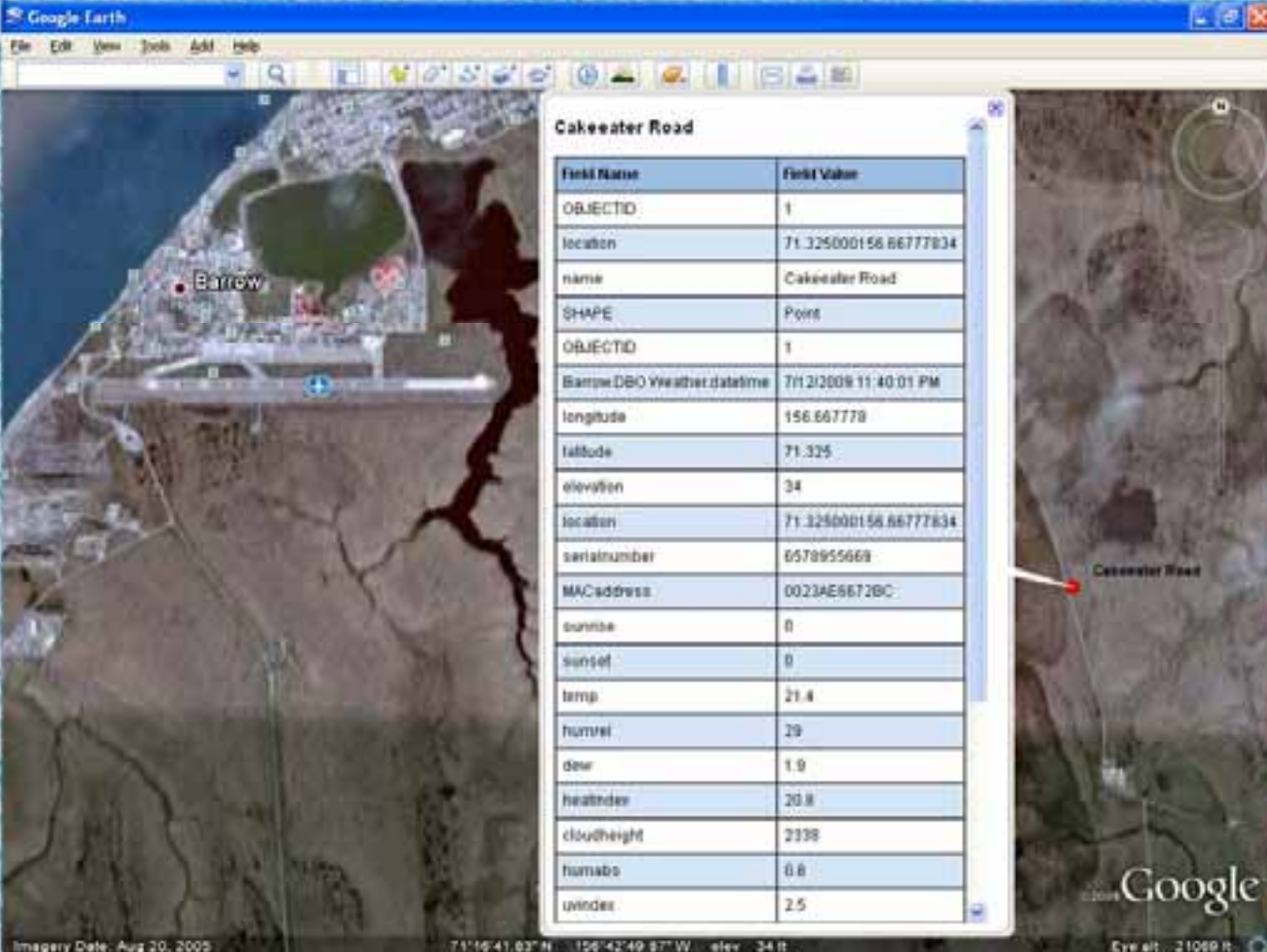


Visualization



Keyhole Markup Language (KML)

Supported by ArcGIS Server as an output format



The screenshot shows the Google Earth interface with a KML overlay. The main map displays an aerial view of Barrow, Alaska, with a red pin and a white arrow pointing to a specific location. A data table is overlaid on the map, titled "Cakeeater Road". The table contains the following data:

Field Name	Field Value
OBJECTID	1
location	71.325000156 86777834
name	Cakeeater Road
SHAPE	Point
OBJECTID	1
Barrow.DBO.Weather.datetime	7/12/2009 11:40:01 PM
longitude	156.867778
latitude	71.325
elevation	34
location	71.325000156 86777834
serialnumber	6578955669
MACaddress	0023AE6672BC
sunrise	0
sunset	0
temp	21.4
humidity	29
dew	1.9
heatindex	20.8
cloudheight	2338
humidity	0.8
windindex	2.5

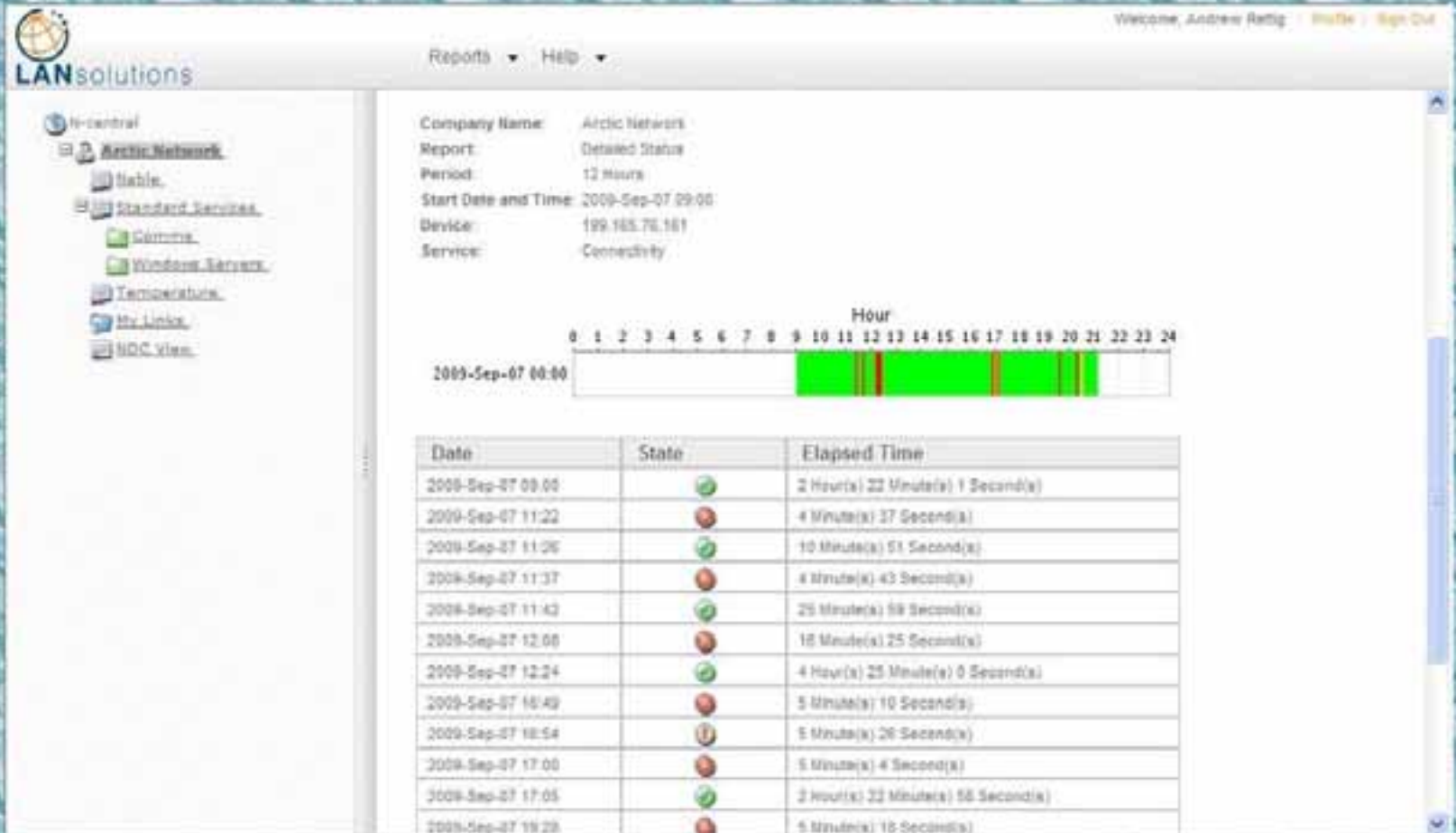
The interface includes a menu bar (File, Edit, View, Tools, Add, Help), a toolbar with various navigation and tool icons, and a status bar at the bottom showing coordinates (71°16'41.93" N, 156°42'49.87" W) and elevation (34 ft). The Google logo is visible in the bottom right corner of the map area.

Adding Imagery Geoinformatics

FebCam 31, Wed Aug 27 09:03:11 2003
Exposure: 400



Network Monitoring



Questions?

