BGPmon: the Next Generation

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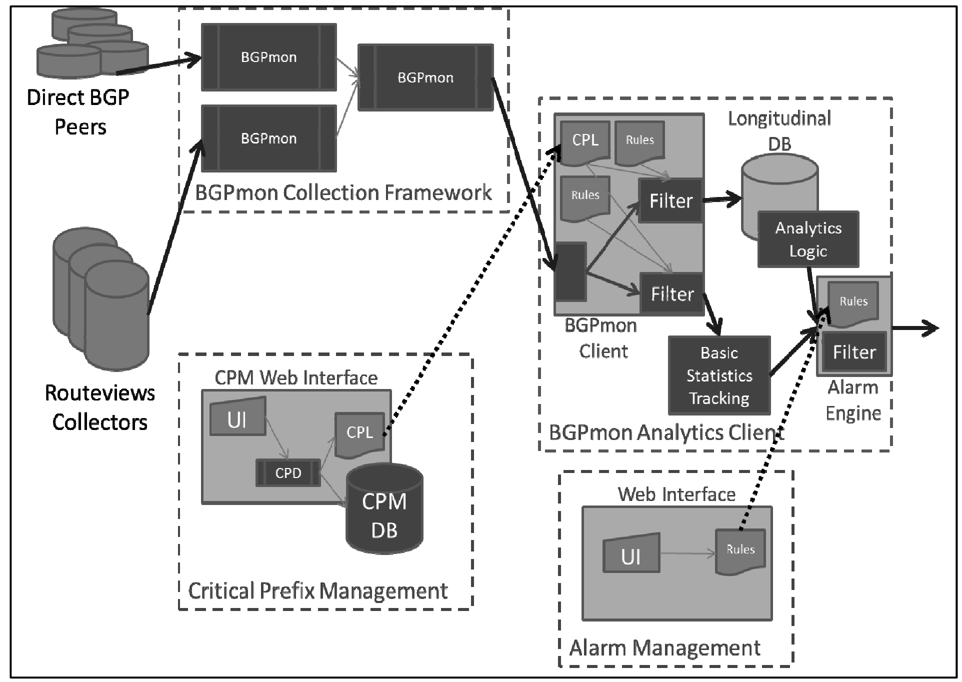
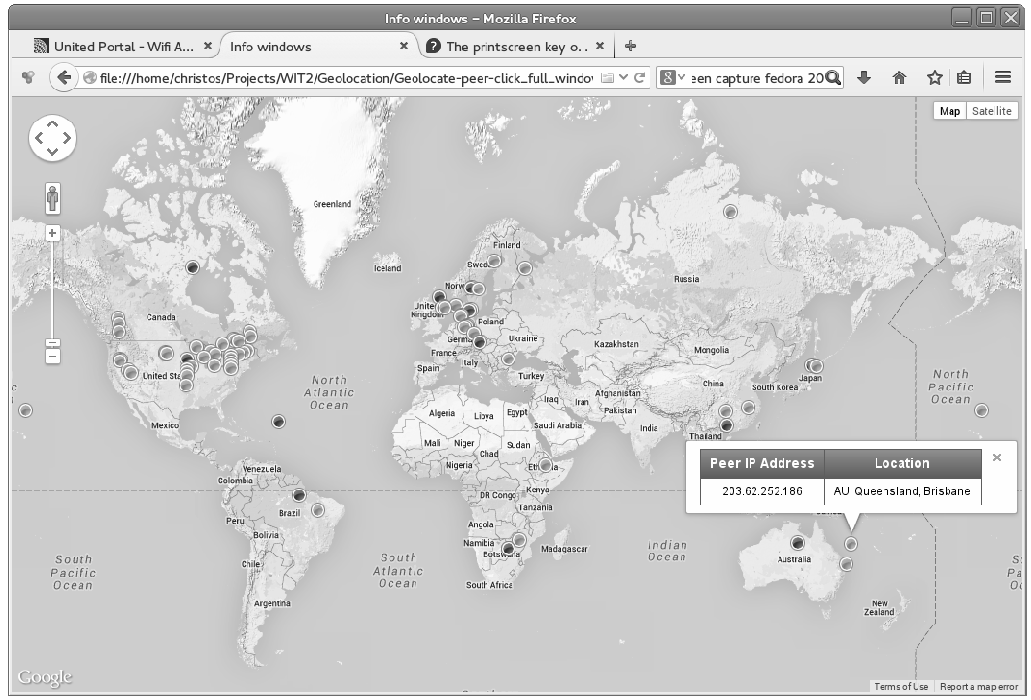
BGPmon: the Past

- Service model:
  - XML streaming - updates and RIBS
  - Perl toolkit to manipulate XML
- Scaling based on chaining
- Version 7.4 (Jan 2015) was the last release based on the old mode to include new features
- Version 7.5 will include bug fixes only
- v8 will be a complete rewrite

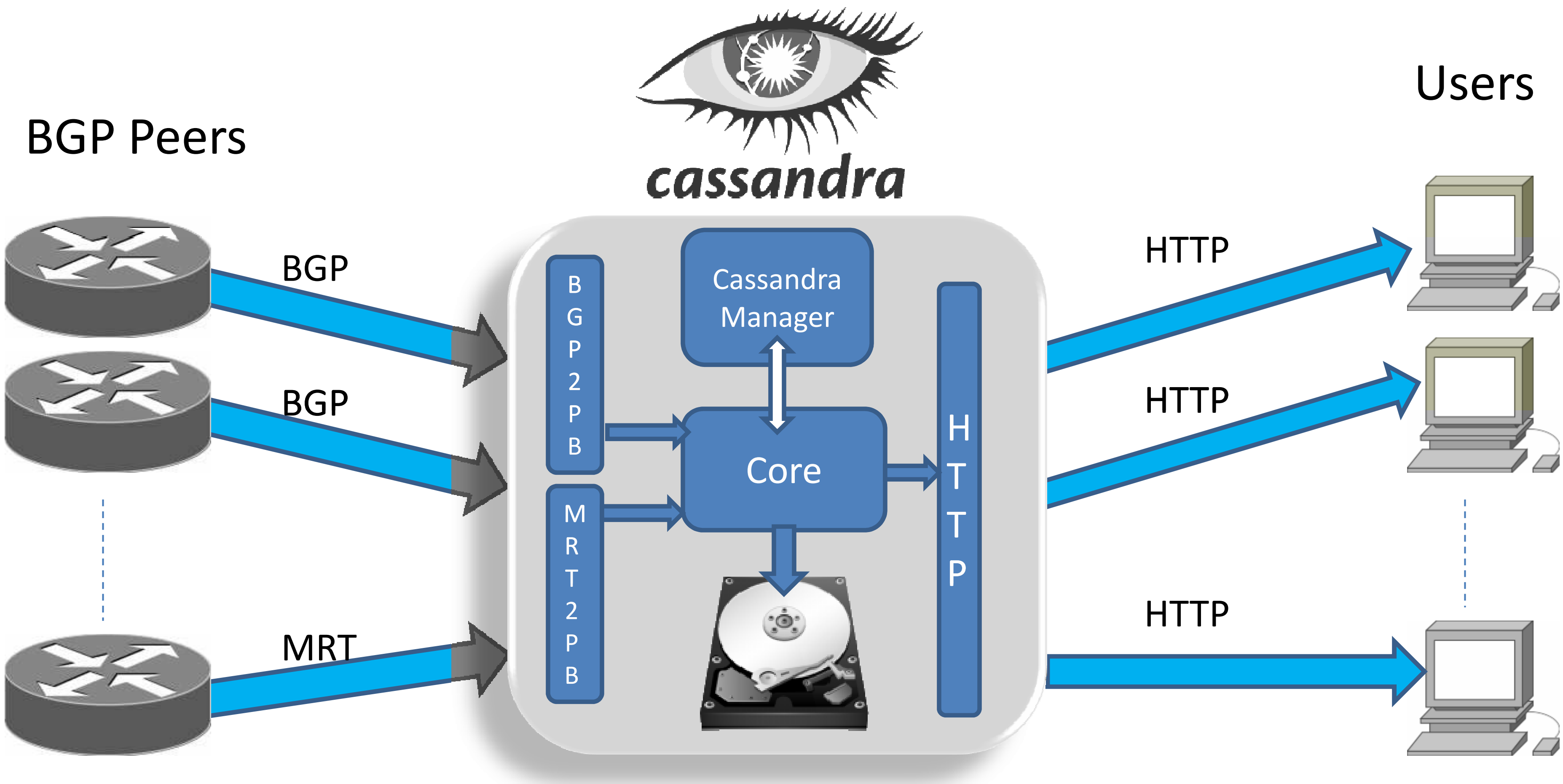


New in v7.4

- Bug fixes (many more left)
- Geolocation of peers and collectors, down to city level
  - 330 peers, IPv4 and IPv6
  - configuration file, read on startup
  - local operators can add more peers as needed
- Offline MRT2XML translator
- Improved logging
- OpenBSD support



The New BGPmon Node Architecture



Cassandra Cluster

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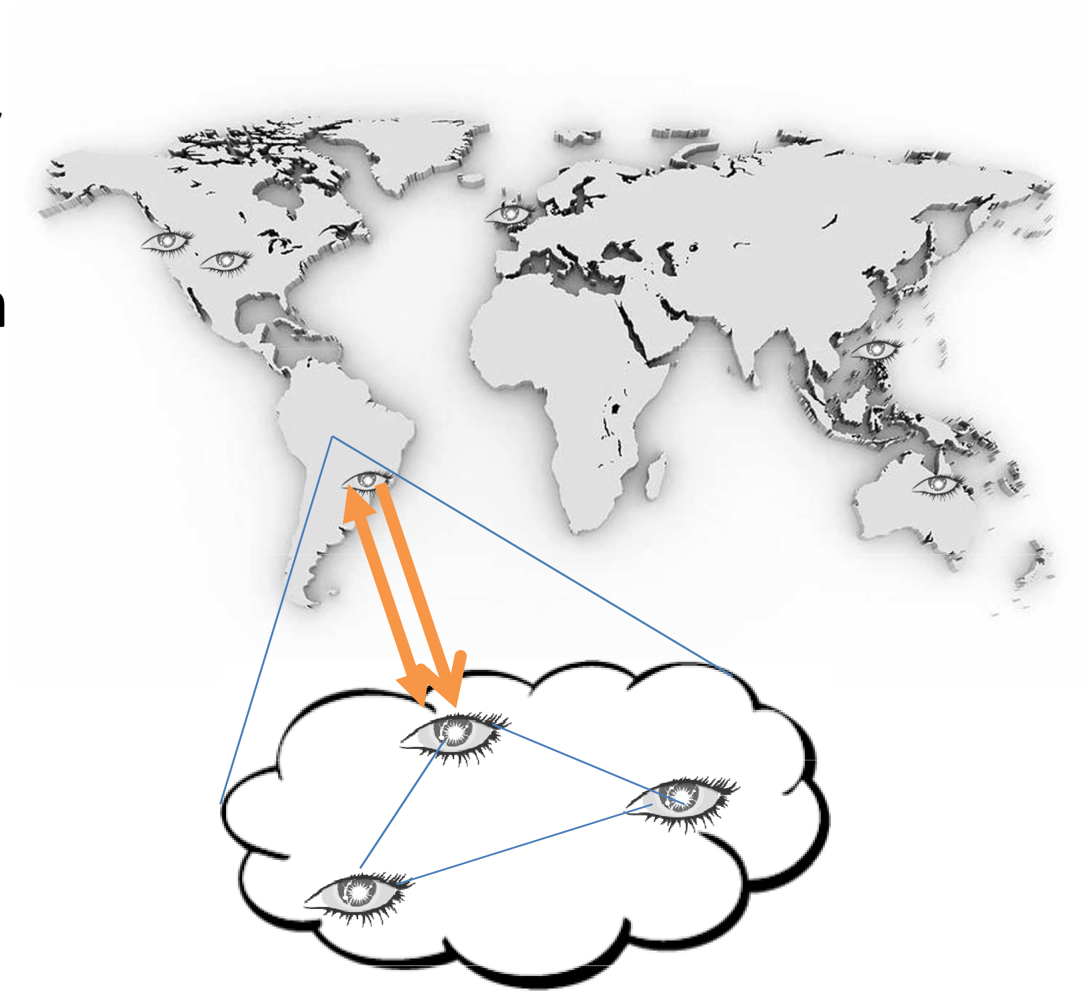
Private BGPmon Deployment

- Networks can deploy independent instances of BGPmon
- Interconnection options:
  - None
  - Import only
  - Import/Export



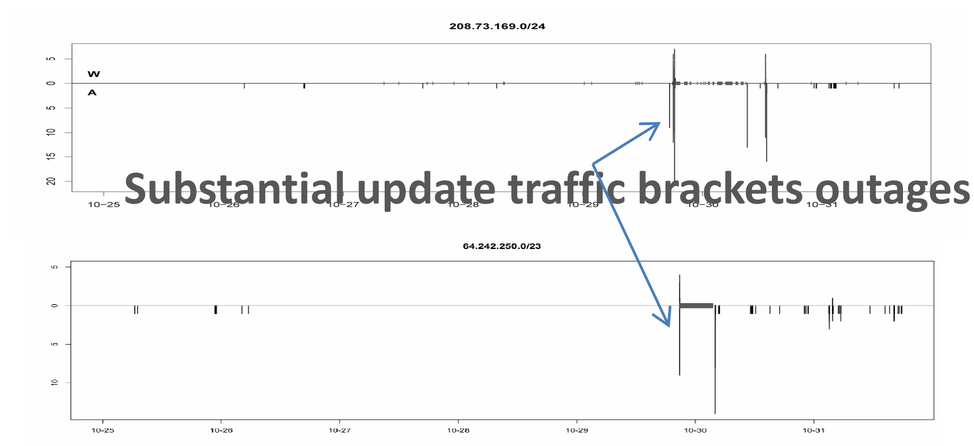
Tracking Outages (in progress)

- Outage data provided by the LACREND project at ISI (PI: John Heidemann)
- 2^{nd} order information, derived from ISI's ping sweeps
- Two community services (in progress):
  – Public outage DB
  – Outage visualization with annotation capabilities

OutageDB

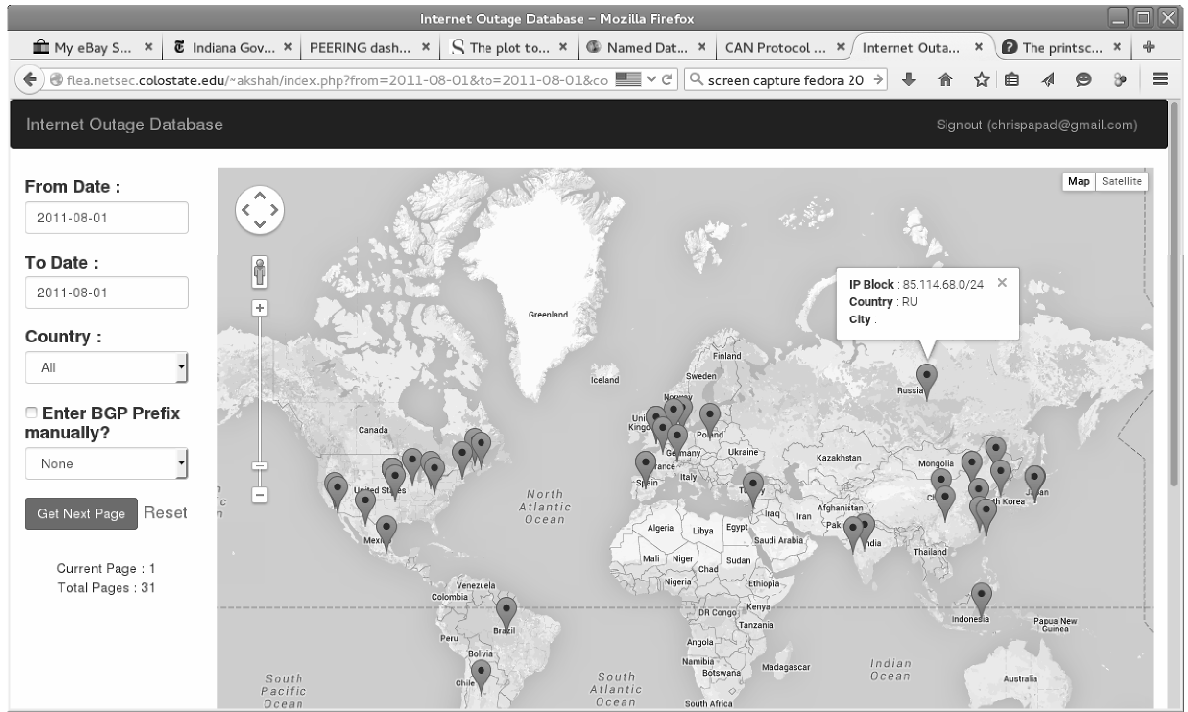
- OutageDB contains:
  - Outage information
  - BGP messages before and after the outage
- Research question: Can we model outages at the control plane and predict an outage is about to happen?

Outage ID	IPBlock	BGP_LPM	BlockAggr	Outage Start	Outage End
54	128.125.92.0/24	128.125.0.0/16	128.125.0.0/17	2012-10-27 06:20:21	2012-11-08 18:16:03



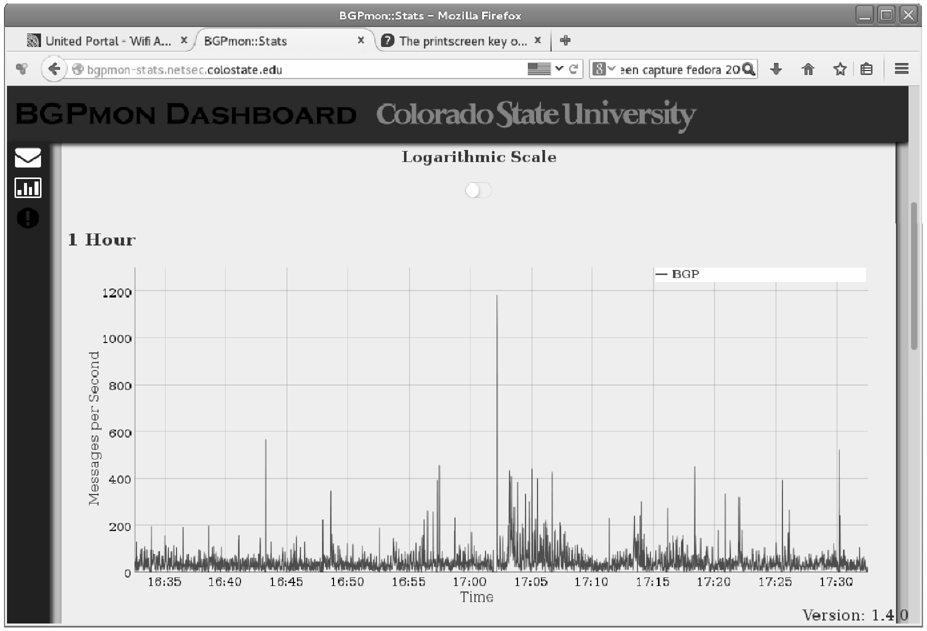
Outage Visualization and Annotation

- OutageDB client
- Filters:
  - Time range
  - Country
  - Prefix
- Google login for annotations (TBD)



BGP Stats (in progress)

- Real time statistics from the BGPmon archive
- Client of the BGPmon archive
- Filters:
  - All BGP
  - NLRI
  - MP Reach
  - MP Unreach
  - Withdraw
  - Per peer and location (TBD)



BGPmon in a Nutshell

- collect BGP messages
- store them
- serve the user queries:
  - return sets of stored messages
  - reduce sets of stored messages to results
  - transform messages to other formats

General Requirements

- Lightweight core
  - hundreds of BGP peers. thousands of client queries
- Extensible
  - support different input/output formats
- Scalable
  - utilize all available cores
  - Easy node addition
- Language-agnostic Ecosystem
- Leverage available technologies, industry proven best practices

Requirements - Core

- Minimal BGP talker
  - everything in / keepalive out
- HTTP as client interface
  - directly modeling the request/response paradigm
  - easily cacheable
- The core is a request/response router

Requirements - Scalability and Data Interchange

- Concurrent message passing
- Lock-less due to CSP-style synchronization
- Robust Storage
- Flexible wire format

Technologies

- Language: Golang
  - mature (7 years old)
  - compiled and static typed
  - concurrency primitives (typed channels/goroutines)
  - rich standard library (net/, bufio/, encoding/{json, xml})
  - multiplatform (Linux,{Free, Open, Net}BSD, OSX, Windows for x86/arm/amd64)
- Storage: Cassandra
  - elastic scalability
  - transaction support
    - atomicity
    - tunable consistency
  - automatic cluster synchronization
- Internal Format: protocol buffers
  - compilers for most languages
  - heavily optimized for efficient transfer over the wire
  - automatic JSON decoration for debugging

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BGPmon Robustness

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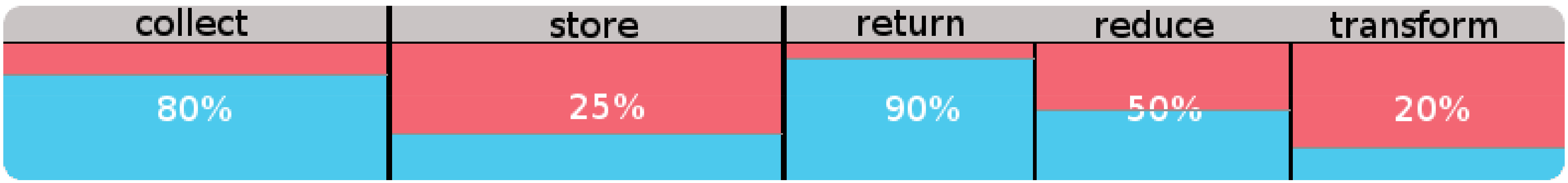
Example: Replication Factor 2

One Link Loss – System is Robust

Two Link Loss – AU Data Saved Locally

Connectivity Restored – Data Added to Cassandra Cluster

So where are we now?



- Fully fledged concurrent bgpd implementation
  - Mainly developed by OSRG, NTT, Japan
  - JSON configuration and control over HTTP
- Our additions to it include:
  - gomrt
    - pure golang library to read and write MRT data
    - builds on the bufio interfaces
  - RPC control plane

Current Archive

- HTTP interface to expose the data in a unified format that abstracts away file structure
- Prototype for the RESTful BGPmon interface
  - specify date range and the format
  - gomrt to parse deeper in MRT
  - Return result over an HTTP 1.1 chunked encoding channel
- Allows caching of most popular data
- Handles thousands of concurrent requests on pretty much commodity hardware

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The New User Interface

- Simple HTTP-based **pull model**
  - NOT the same as pulling files from the RouteViews archive
- Request parameters:
  - Time range (s) - *YYYYMMDDHHMMSS*
  - Data type (updates or RIBs)
  - Data format (currently MRT - TBD: XML, JSON)
  - Statistics (TBD)
  - Connectivity maps (TBD)
- Example request (try it!):
  - $> *curl -o outputfile* *http://bgpmon.io/archive/mrt/updates?start=20150301000000\&end=20150301010000*
  - $> *curl -o outputfile* *http://bgpmon.io/archive/mrt/ribs?start=20150301000000\&end=20150301010000*

Cassandra - RV Integration

- Currently experimenting with appropriate schemas to store our BGP data
- Cassandra allows building a schema with the indexing variables living next to the whole protobuf blob
- Over 10years of RouteViews data (11TB as of 2015)
  - We are an official mirror
- Archive will be imported into the Cassandra and made available through the new BGPmon

stats

- The stats server is client to the archive
- Same request format, returns statistics in JSON:
  - withdrawals
  - NLRI
  - mpreach/mpunreach
- We provide client-side javascript to render graphs on the browser

testing/deployment

- Everything is dockerized
- We provide docker images that bundle Cassandra, golang, protobuf compilers and our gobgp code
- We plan to distribute BGPmon as a docker image

Future Work

- Add more information to the underlying DB
  - Outages
  - Data plane (ISI's pinger project)
  - Hijacks
  - More?
- Cloud hosting?

BGPmon networks

- Data sharing between nodes in a monitoring network
  - Just configuring their Cassandras to be in the same cluster
    - automatic replication
  - CSU will maintain such an infrastructure with public data
    - users can choose between running their own BGPmons and having their Cassandras join an existing cluster
    - or just peer with a BGPmon and access their data over the RESTful interface
    - pushing data to the dbs has to be done by an approved user of our public cluster
    - if an organization so desires, they can run their own private cluster/instance
    - they will be still be able to pull all the public data we provide