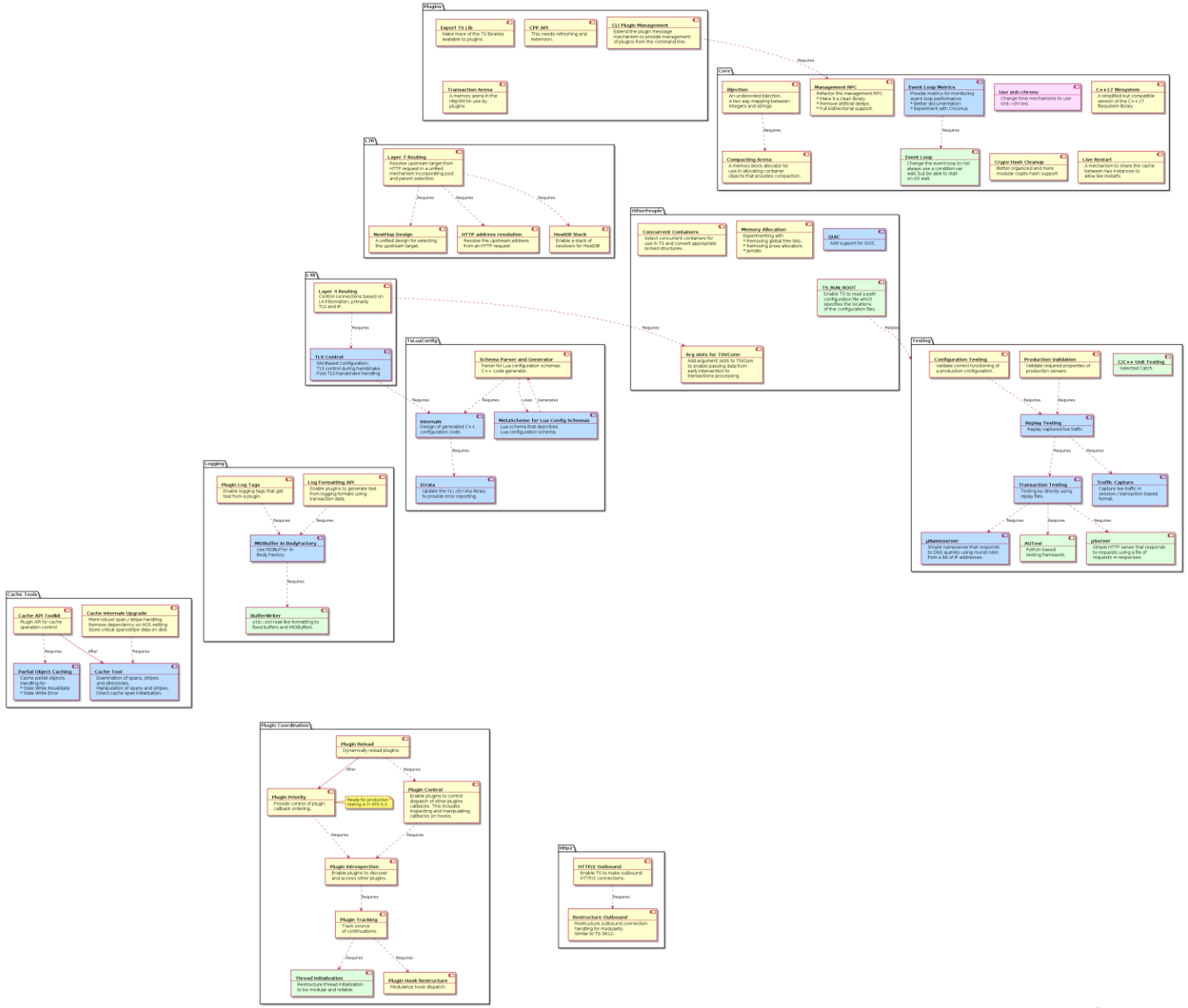
AMC's Tech Corner

Long Range Planning

- Add functionality to address shortcomings.
- Frequently missing features that are just not quite there.
  - Need to find these and build them out to usability.
- Need to stay competitive.


Plugins
Export TS Lib
Make more of the TS libraries available to plugins.
CPP API
This needs refreshing and extension.
CLI Plugin Management
Extend the plugin message mechanism to provide management of plugins from the command line.
Transaction Arena
A memory arena in the HttpSM for use by plugins
Requires
Core
Bjection
An underoraded bijection. A two way mapping between integers and strings
Management RPC
Refactor the management RPC. * Make it a clean library. * Remove artificial delays. * Full bidirectional support.
Event Loop Metrics
Provide metrics for monitoring event loop performance. * Better documentation * Experiment with Circonus
Use std::chrono
Change time mechanisms to use std::chrono.
C++17 filesystem
A simplified but compatible version of the C++17 filesystem library
Compacting Arena
A memory block allocator for use in allocating container objects that provides compaction.
Event Loop
Change the event loop to not always use a condition var wait, but be able to stall on I/O wait.
Crypto Hash Cleanup
Better organized and more modular crypto hash support
Live Restart
A mechanism to share the cache between two instances to allow live restarts
L7R
Layer 7 Routing
Resolve upstream target from HTTP request in a unified mechanism incorporating pod and parent selection.
Requires
Nexthop Design
A unified design for selecting the upstream target.
HTTP address resolution
Resolve the upstream address from an HTTP request.
HostDB Stack
Enable a stack of resolvers for HostDB
OtherPeople
Concurrent Containers
Select concurrent containers for use in TS and convert appropriate locked structures.
Memory Allocation
Experimenting with * Removing global free lists. * Removing proxy allocators. * Jemalio
QUIC
Add support for QUIC.
TS_RUN_ROOT
Enable TS to read a path configuration file which specifies the locations of the configuration files.
Related
L4R
Layer 4 Routing
Control connections based on L4 information, primarily TLS and IP.
TLS Control
SNI Based Configuration. TLS control during handshake. Post TLS-handshake handling.
Arg slots for TSVConn
Add argument slots to TSVConn to enable passing data from early intervention to transactions processing.
TsLuaConfig
Schema Parser and Generator
Parser for Lua configuration schemas. C++ code generator.
Uses
Generates
Internals
Design of generated C++ configuration code.
MetaScheme for Lua Config Schemas
Lua schema that describes Lua configuration schema.
Errata
Update the ts::Errata library to provide error reporting.
Testing
Configuration Testing
Validate correct functioning of a production configuration.
Production Validation
Validate required properties of production servers.
C/C++ Unit Testing
Selected Catch.
Replay Testing
Replay captured live traffic.
Transaction Testing
Testing by directly using replay files.
Traffic Capture
Capture live traffic in session / transaction based format.
jsNameserver
Simple nameserver that responds to DNS queries using round robin from a list of IP addresses.
AUTest
Python based testing framework.
jsServer
Simple HTTP server that responds to requests using a file of requests ⇔ responses.
Logging
Plugin Log Tags
Enable logging tags that get text from a plugin.
Log Formatting API
Enable plugins to generate text from logging formats using transaction data.
MIOBuffer in BodyFactory
Use MIOBuffer in BodyFactory.
BufferWriter
std::ostream like formatting to fixed buffers and MIOBuffers.
Cache Tools
Cache API Toolkit
Plugin API for cache operation control.
Cache Internals Upgrade
More robust span / stripe handling. Remove dependency on AOS setting. Store critical span/stripe data on disk.
Alter
Partial Object Caching
Cache partial objects. Handling for * Stale While Revalidate * Stale While Error
Cache Tool
Examination of spans, stripes and directories. Manipulation of spans and stripes. Direct cache span initialization.
Plugin Coordination
Plugin Reload
Dynamically reload plugins.
Plugin Priority
Provide control of plugin callback ordering.
Ready for production testing in 7.1 ATS 5.3
Plugin Control
Enable plugins to control dispatch of other plugins callbacks. This includes inspecting and manipulating callbacks on hooks.
Plugin Introspection
Enable plugins to discover and access other plugins.
Plugin Tracking
Track source of continuations.
Thread Initialization
Restructure thread initialization to be modular and reliable.
Plugin Hook Restructure
Modularize hook dispatch.
Http2
HTTP/2 Outbound
Enable TS to make outbound HTTP/2 connections.
Restructure Outbound
Restructure outbound connection handling for modularity. Similar to TS-3612.

Layer 7 Routing

- Route based on layer 7 data – the HTTP request.
- Fundamentally: generate stream of IP addresses based on HTTP request and configuration.
- Make HostDB/DNS modular and pluggable.
  - Make NextHop logic a module in the HostDB stack.
  - Enable load feedback / load balancing.

Layer 4 Routing

- This is a thing now apparently.
- Already moving in this direction with Persia's work on SNI remap / configuration.
- Need to be able to control
  - Inbound SSL negotiations (ALPN, cyphers, certificate verification)
  - Tunneling, upstream target.
  - Access.
- Potentially foreign protocol observers.
- Tunneled transactions still get TXN_START and TXN_CLOSE
- Need TSVConn arguments to make this work well.

Outbound Restructuring

- Restructure outbound classes and operations to parallel the inbound structures.
  - E.g. TS-3612.
  - ServerSession, ServerTransaction
- HTTP/2 outbound
  - Requires outbound restructuring.
  - HTTP/2 outbound streams become ServerTransaction instances.
  - Need configuration to control
    - Low water / minimum outbound HTTP/2 to an upstream.
    - Load balancing / maximum streams per outbound HTTP/2.

Plugin Coordination

- A generalization of earlier plugin priority work.
- Goal: control of callback dispatch, ordering and enabling.
- Phases:
  1. Thread initialization via generic continuations. [DONE]
  2. Hook dispatch modularization.
  3. Plugin continuation tracking.
  4. Plugin introspection.
  5. Hook introspection and control – priorities and/or partial ordering.
  6. Configuration (static ordering control).

Plugin Coordination

- Plugin tracking should make plugin debugging much easier.
  - Core error messages can specify which plugin.
  - E.g. “continuation used after deleted”
- Long term – plugin reload.
  - Old plugin can be marked ‘dead’ and events for continuations from that plugin discarded by the event loop.

Cache : Partial Object Caching

- Chunked caching.
- Hopefully better performance due to less lock contention, no flying Dutchman retries.
- Stale while revalidate.
  - This required changes in the basic live cache object structures.
  - Now there are “slices”, time based versions of alternates.
  - Only latest slice is written to disk, others are discarded when the object becomes inactive.
  - Also needed for handling server based updates to partially cached objects.
- Thundering herd mitigation.
  - May have some performance impact, need to investigate.

Cache Tool

- Command line access to cache information.
  - Replaces internal ‘stripe inspector’.
  - Spans, stripes, directory data.
  - Detect unused spans.
- Manipulation of storage setup.
  - Clear spans, stripes.
  - Allocate stripes from spans.
- Updates to cache storage structure required for stripe management.
  - Want to change stripe size, directory with minimal cache data loss.

Cache Storage Updates

- Store stripe metadata sizing information.
  - Currently recomputed from scratch every process start based on configuration.
  - Fragile and unchangeable.
- Exploring ways to make it forward & backward compatible.
  - Initially store extra data as extra.
  - Cleared stripes will new updated stripe header with data directly built in.

Technical Advances

Baby steps forward

Forwarded Header (Walt Karas)

- RFC-7239 compliant implementation of Forwarded header in core.
- Replaces X-Forwarded-For.
- Very configurable.
  - Each value can be enabled/disabled independently.
  - Extension to track protocol or protocol stack on inbound connection.
  - Host can be configured as with Via.

Event Loop Changes (w/Fei Deng)

- Finally committed (thanks OKNet!)
- Changes event loop so that it can stall on I/O instead of a condition variable.
- By default maintains previous behavior.
  - Changed for ET_NET threads to wait on sockets.
- Run in production at Yahoo! for over two years.
- Major reduction in latency for rapid, tiny transaction processing.
  - 99% latency under 20ms, average under 6ms.
- Metrics added to track event loop performance.
  - Watch for outliers.

BufferWriter (Walt Karas)

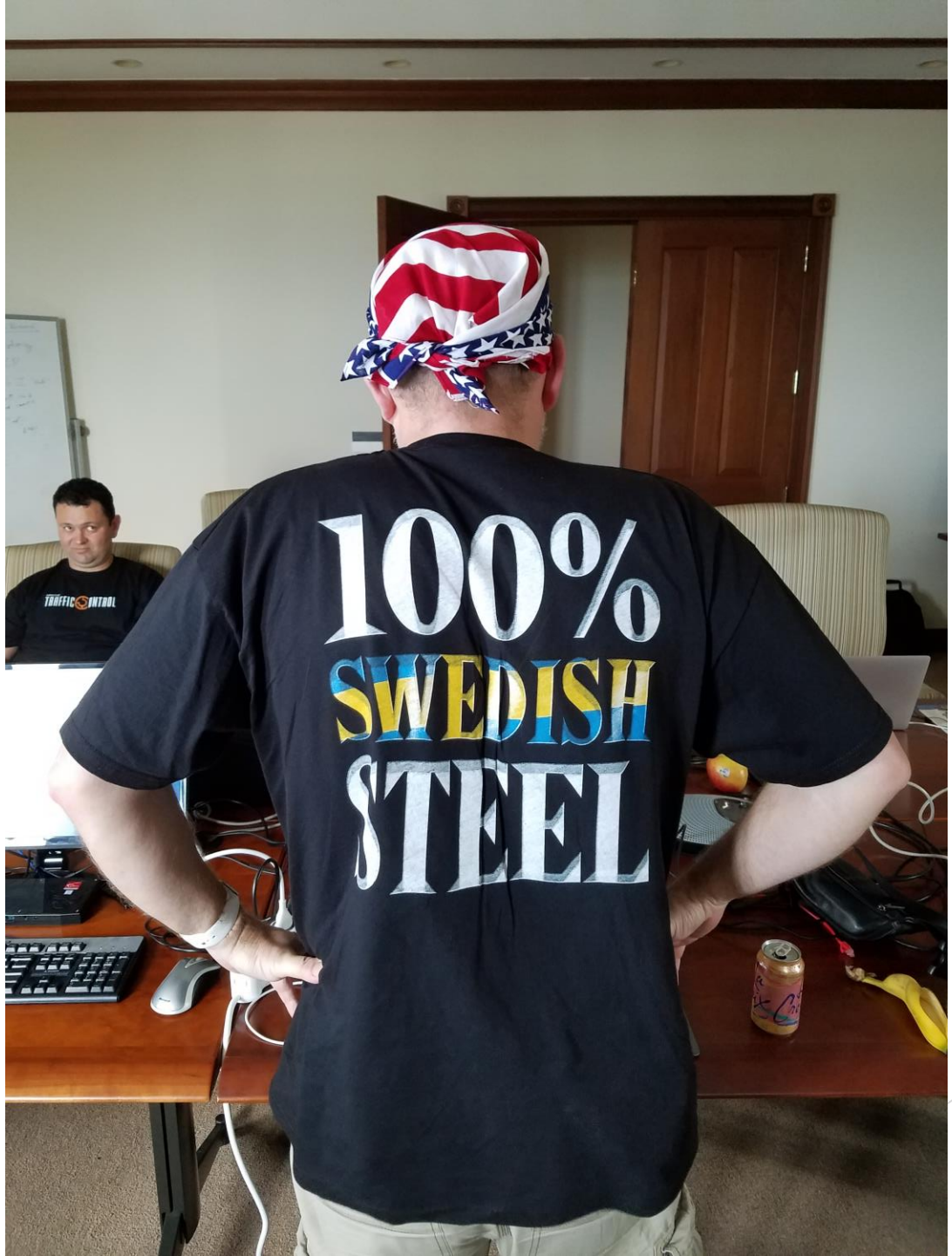
- Type safe C++ stream style writing to fixed buffers.
- No more
```
memcpy(str, field, strlen(field));
str += strlen(field);
```
- Buffer size checks on every write.
- Easily add formatting for classes.
- Code is cleaner and more robust without loss of performance.
- Time to talk about replacing Debug() with something better.

header_rewrite INBOUND

- The header_rewrite plugin now has a set of “INBOUND” conditions and substitutions.
- Data about the inbound connection.
- Much more reliable for detecting SSL vs. plain text connections.
- Detection of HTTP/2 vs. HTTP/1.
- Some day will do “OUTBOUND” too.

TextView

- Replaces `StringView` – named changed to avoid confusion.
- Subclass of `string_view` and therefore has those methods.
- Same footprint as `string_view` and just as fast to construct / copy.
- Interchangeable – conversion to and assignment from `string_view`.
- Used when contents of the view need to be examined / parsed.
- Easy replacement for `strtok` and Tokenizer.
  - No modification of source string.
  - No memory allocation.


100%
SWEDISH
STEEL

Briefings.

C++ Eleventy

C++ Eleventy
Guide for Contributors

- I talked about C++ techniques at two previous summits, read the slides.
- Containers
  - Current only std::vector is approved for general use.
  - The concern is excessive and uncontrolled memory allocation. I have seen Traffic Server deployments brought low by exactly from plugins.
  - The issue cannot be entirely solved via better allocators. Fixed sized buffers or pre-allocated memory will always be faster than allocated memory.
  - There is ongoing work in this area, but it proceeds slowly.

Parsimony

There is a general concern about code bloat and much effort has been made in the past to decrease the over all code size. For what Traffic Server can do it has a remarkably small code base. This is not an accident.

For this reason think twice, then reconsider again, if you really need to add a support class. Avoid this if you can, especially if the class is used only once or in limited circumstances. Also avoid putting classes in separate files if the class isn't used in other file scopes. See if there are existing classes or other techniques which, with a bit of work, could be made to suffice.

If the support class is really needed, see if it can be made a bit more general to cover other uses.

Separability

Pull requests should be as small as possible. This yields the important result that isolatingchanges that cause problems and recovering from them is much easier. This means that if new classes / technology / support is required for a pull request, it is almost always better to contribute it in a separate, prior pull request. Pull requests that have a lot of new classes and other things have a very difficult time, both because the additional support obscures the realpoint of the pull request and that discussions can get bogged down on details in the support that aren't critical for the overall work.

Consistency

Traffic Server is an old project with people who have been working on it for over a decade. They are comfortable with where things are and how things are done. This doesn't mean it's perfect but unless there is a clear, strong reason to change, you should peruse the code and try to do things in a similar way.

One example would be initialization. There are various ways to do this in C++, mostof which result in the same machine code. Therefore it's a reasonable expectation that you will do this in the same way as the existing code. As a newcomer to the community, try to show a bit of respect for existing customs and habits, *especially* when such things have no real impact on code quality.

* Although we now recommend using braces for initialization as much as possible. But there is a strong reason for that.

Documentation

Documentation is critical to a successful project. Even the best technology will be abandoned if users, administrators, and contributors cannot understand it.

For this reason a pull request may be blocked if it adds new features without documentation for those features. For instance, a new configuration variable must always be accompanied by documentation for that variable.

Cache Write Lock

- No more missed cache write lock.
- Essential reason is cache writes must now create the alternate slice at the start of the write, not at write completion.