

Regional Opt-In

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and

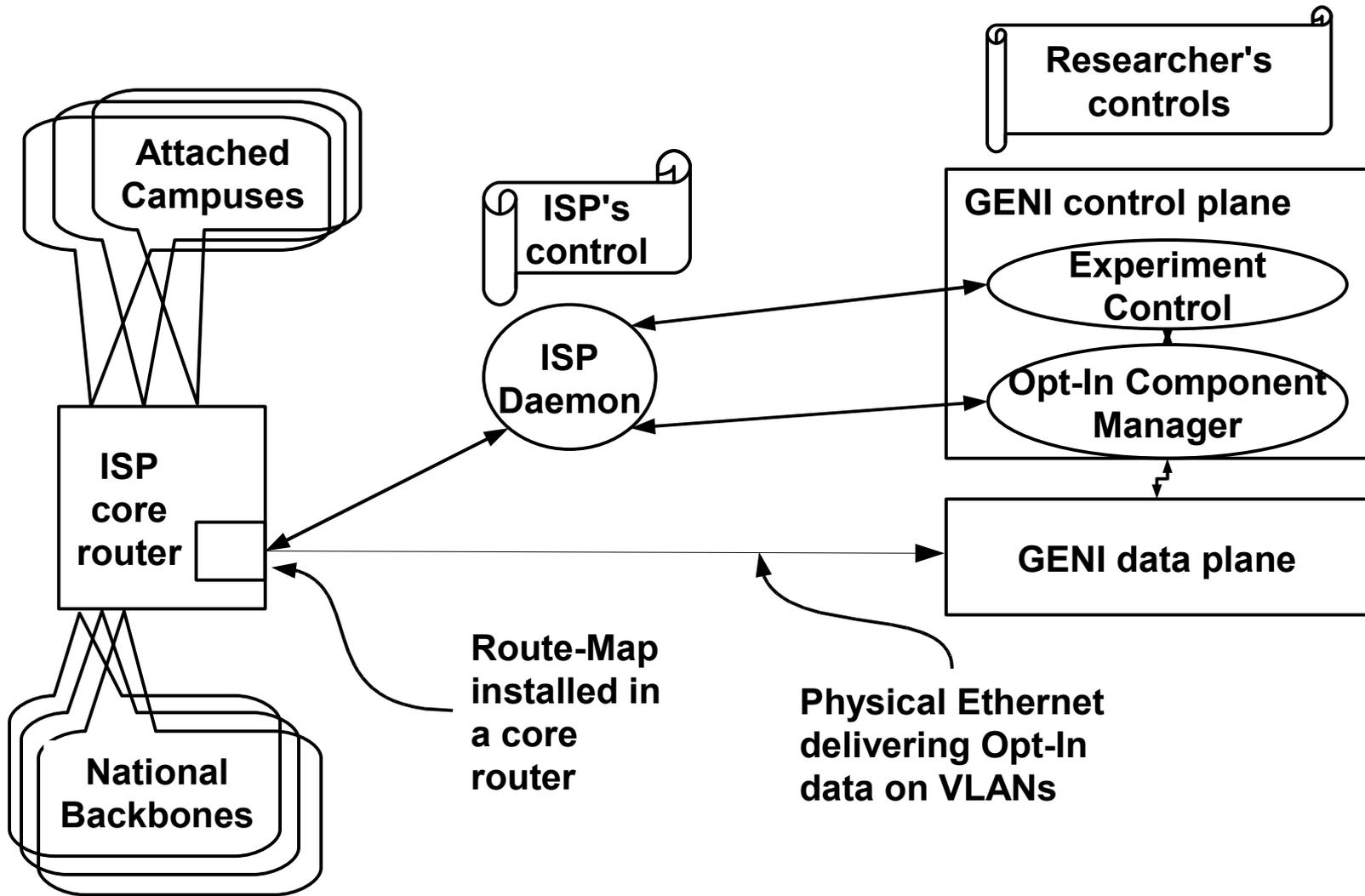
Three Rivers Optical Exchange (3ROX)

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Regional Opt-In

- Interpose GENI at regional interconnects
- Intercept “innocent user” traffic
 - AKA wholesale Opt-in
 - Completely authentic traffic
 - Intrinsically Layer 3
- Want a strong position:
 - (Eventually) Ask NSF to encourage participation
 - Progressive: Specific programs, then CNS, CISE, all NSF
 - Complete control of impact to users
 - Minimize unexpected consequences
 - Avoid outages
 - Avoid leaking PII (Personally Identifiable Information)

Regional Opt-In



Implementation at 3ROX

- Non-profit GigaPoP run by PSC
 - CMU, PITT, PSU, WVU, most k-12 in western PA
 - Libraries, museums, etc
 - Some commercial sites
 - Roughly 200k users
- Connections to multiple backbones
 - NLR, I2, (ETF), NLR transit rail
 - Sprint, Global Crossing
- Redundant core routers
 - Approximately \$250k each

Opt-In Intercept

- Use route-map (Cisco) or firewall-filter (Juniper)
 - ACL style packet header match
 - Implemented in Ternary Content Addressable Memory (TCAM)
 - Applies some action, such as override regular routing
- Can match many combinations of fields
 - From: CMU to: Stanford
 - Port 53 (DNS)
 - Student housing subnets
 - DSCP byte (Differentiated Service Code Points)
 - Include or exclude individual IP addresses

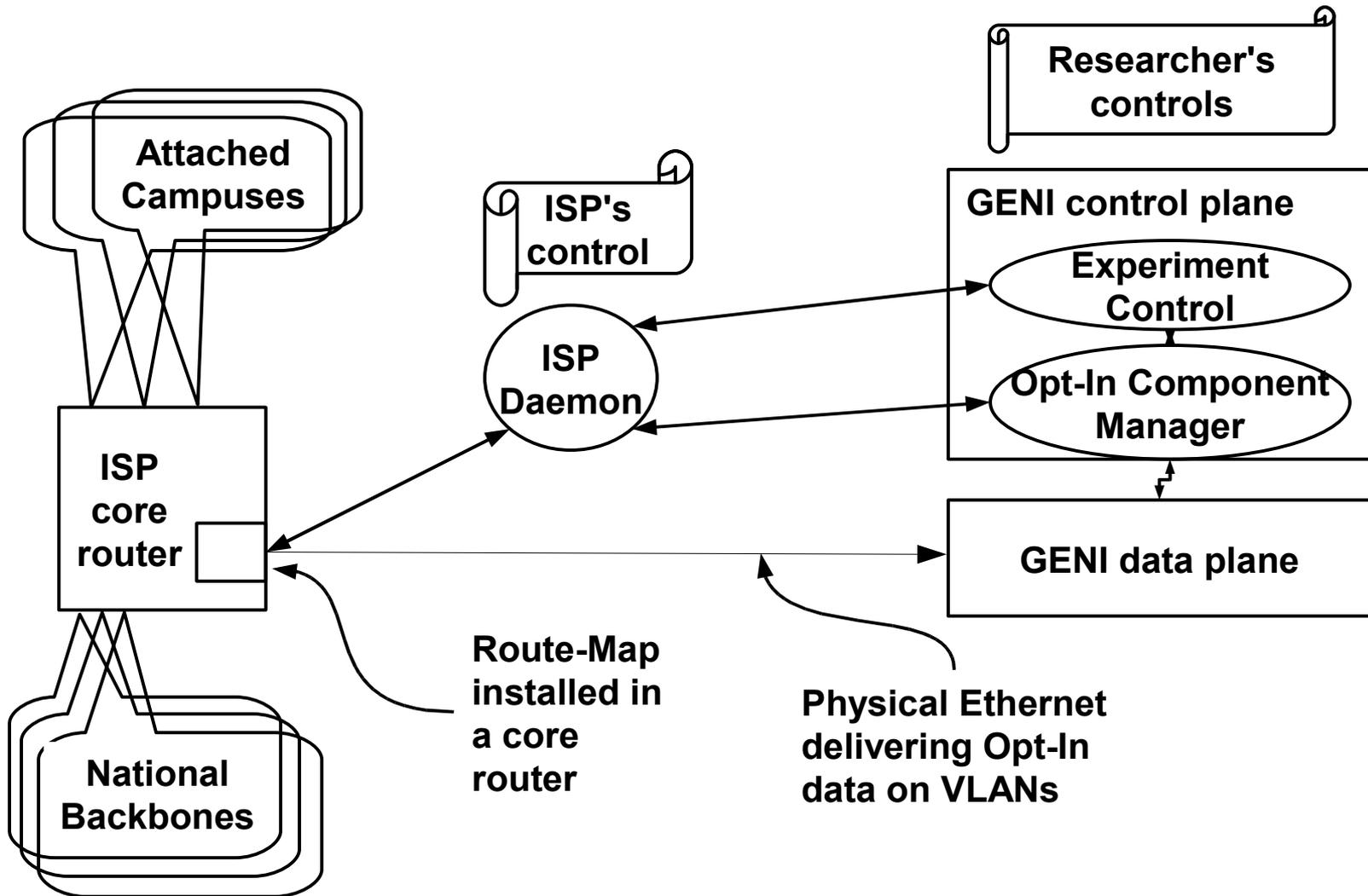
Robustness is key

- Opt-In failures hurt everyone
 - Not just the experimental subjects
 - Especially the ISP staff
- Opt-In mechanism itself must be ISP grade
 - Not “GENI grade”
 - Down time direct cost is several dollars per second
 - Indirect cost is probably orders of magnitude higher
- Need to strongly manage interaction with GENI

ISP Daemon

- Proxy between GENI and core router
 - Owned and managed by the ISP
 - Can be audited/instrumented per the ISP's interests
 - Participates in the ISP's private authentication
 - Participates in the GENI control plane
- ISP must have ultimate control over Opt-In
 - E.g. may veto Opt-In during unrelated failures
 - Otherwise any ISP will refuse to participate
- Enforce IRB “Human Subjects” policies
 - IRB permissions required for all experiments

Regional Opt-In



Needs two levels of control plane

- Opt-In Component Manager
 - Looks like a slightly specialized sliver
 - Has to match experimenters credentials to IRB policies
- Experiment Control
 - Don't enable Opt-In unless the entire slice is ready
 - Out-of-band and In-band liveness checks and monitoring
 - Automatic shutdown on failures
 - Inhibit sliver/slice deallocation/preemption
 - Potentially unbound complexity
 - Do a place holder now
 - Foresee an evolving solution

The Big Picture

- Regional Opt-In must support all stakeholders
 - The ISP and the ISP's staff
 - The innocent users
 - Researchers
 - The IRB
- Aim for the highest standards
 - Accept and document necessary compromises
- Spiral 1 is a first cut at the technical problem
 - Use existing or ad-hoc policies and procedures

Spiral 1 Regional Opt-In deliverables

- Spiral 1 Opt-In requirements
- Reference design
- Local Opt-In prototype
 - Solicit real experiments from local campuses
- Spiral 1 end-to-end demonstration
 - ***** Seeking collaborators *****
- The usual reports, etc

Beyond Spiral 1

- IRB issues (unfunded small proposal)
- Opt-in experiment scenarios

IRB issues

- Institutional Review Board
- Supervises all experiments on Human Subjects
- See CFR Title 45, Part 46
 - “Protection of Human Subjects”
- Two standard review protocols
 - Social Sciences & Biomedical
- The main rules:
 - Subject has to give informed consent
 - Must protect Personal Identifiable Information (PII)
 - Must balance/justify the risks

Network research, Opt-In and the IRB

- Informed Consent isn't generally feasible
 - Akin to field testing new highway detour signs
 - Exception are permitted but need extra considerations
 - E.g. Public notices, Opt-out instructions
- Primary risks are technical issues
 - Interactions with obscure or experimental services
 - Most users frequently “Opt-In” to new services
 - Unintended PII leaks
 - Inferences about trace data, etc
- These all require accurate risk assessment
 - Technology issues may be more subtle the ethics

The IRB and telecom law

- (I am not a lawyer)
- Strong, IRB supervised, PII protection may be sufficient to placate telecom lawyers

- There are existing procedures to protect IRB supervised studies from subpoena
 - E.g surveys about drug use

Managing the user base

- Core tension between users and researchers
 - Researchers need “innocent users”
 - Users want stable (advanced) services
 - Researchers want to change things
- Consider some regional Opt-In scenarios
 - Simple Opt-In
 - Version agility for sustained Opt-In
 - Weaning users from an experimental service

Simple Opt-in Scenarios

- Short running or small scale experiments
- IP address based
 - Individual (enumerated) Opt-In
 - IP prefix block (subnet)
 - IP prefix block (subnet) except individual Opt-out
- No dynamic updates at this point
 - Robustness deliverables deleted for spiral 1

Version agility for sustained Opt-In

- Allocate two long lifetime slices
 - Alpha slice with Individual Opt-In for developers, etc
 - Frequent changes and restarts
 - Beta slice with Wholesale Opt-In
 - One stable version
- Upgrade services by exchanging Opt-In filters
 - Alpha slice becomes new beta w/ Wholesale Opt-In
 - Beta slice disassembled and rebuilt for new alpha
- Claim: Researchers can have full version agility as long as they consider their own internal version compatibility issues.
- Regional Opt-In facilitates gracefully upgrading an experimental services.

Weaning users from an experimental service

- Assume you have a success disaster:
 - Experimental service with limited resources
 - Too many addicted and demanding “innocent” users
 - They continue to invite their friends to Opt-In by word of mouth
- Convert from wholesale to individual Opt-in
 - Automate the (re)Opt-In process
 - Disallow new users
 - Require periodic renewals
 - But make them progressively harder

- Long term goal: fully manage Opt-In for all users