Future Network Monitoring for IXPs

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Outline of talk

1. Problem space and requirements
   - John Souter
2. Networks Research Group at UCL
3. The RMF Architecture
4. Demo
5. Opportunities for collaboration
6. Current status and Next steps
7. Questions and Discussion

Problem Space and Requirements

Outline problem space [1]

- Many IXPs have similar monitoring requirements
- All have semantically similar tools
- The tools often differ in the presentation of information, e.g.:
  - different hardware logs for data source
  - “home brew” scripts for processing logs
  - different visualisation front ends

Outline problem space [2]

- This makes it tricky to:
  - share information directly
  - use common information for troubleshooting
  - make comparisons of multi-site data
  - perform analysis using multi-site data
- IXPs recognise this is a growing problem

Outline requirements

- Based on discussion + email:
  - John Souter and Saleem Bhatti
- Allow IXPs to share data easily
- Devise a system for:
  - representing similar data in a common format
  - allowing easy, **secure**, remote access to data
  - common APIs
  - still make use of the "normal" data/log files
  - still make use of the existing tool base if possible

Networks Research Group at UCL

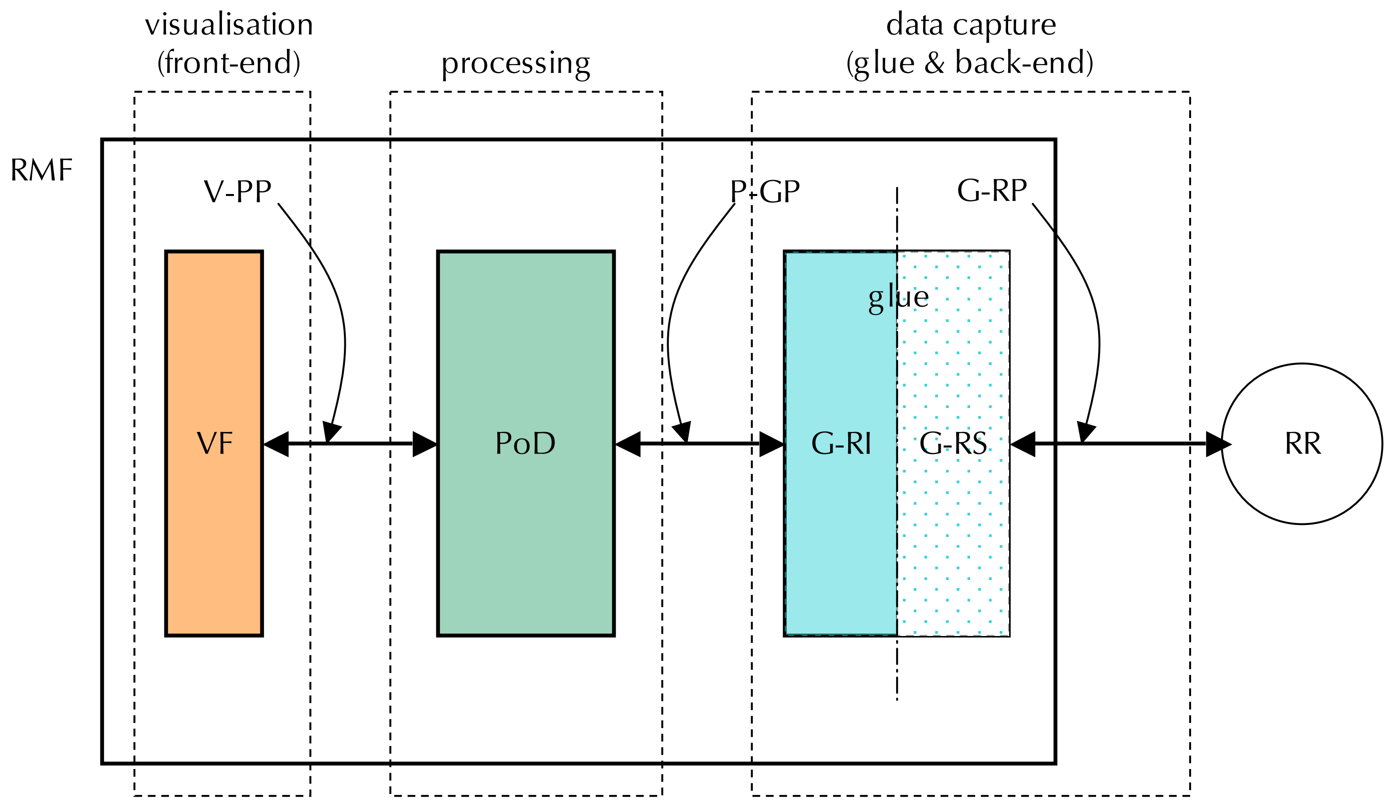
Research Agenda

- Internet Architecture and Evolution:
  - networking in the large
  - routing
  - protocols
  - QoS
  - congestion control
  - high-speed networking
  - control and management
- Internet Applications:
  - multimedia
- Mobile and Wireless Networked Systems
- Practical, experimental, **collaborative** research

Examples of interesting research problems

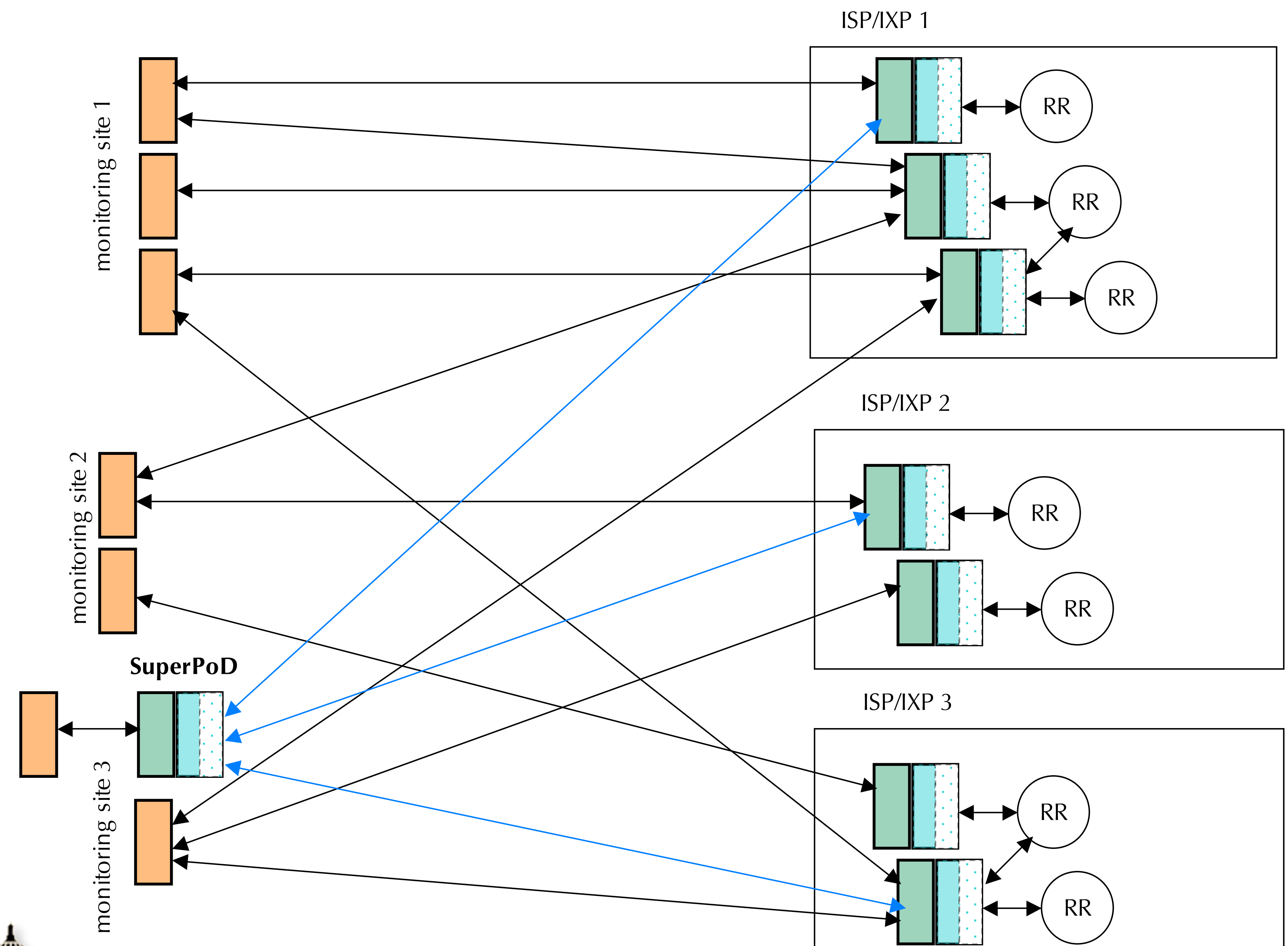
- Interaction between BGP convergence process and route flap damping
- Large-scale effects of interaction between inter-domain and intra-domain routing
- Congestion control in the large:
  - synchronisation effects, stability, macro effects, etc.
- Denial of service:
  - what is happening? how do we spot it? effects on network?
- Traffic modelling and performance analysis:
  - topology vs. routing

The RMF Architecture for network monitoring of IXPs



G-RI	glue - resource independent part	RMF	resource monitoring function
G-RS	glue - resource specific part	RR	real resource
G-RP	glue/resource protocol	PoD	processing of data
P-GP	PoD/glue protocol	VF	visualisation function
		V-PP	visualisation/PoD protocol

All the solid-shaded parts are "standardised".
All protocols (except G-RP) are "standardised".


ISP/IXP 1
RR
RR
RR
monitoring site 1
ISP/IXP 2
RR
RR
monitoring site 2
SuperPoD
ISP/IXP 3
RR
RR
monitoring site 3

Demo

The story so far - Architecture

- Multi-site, configurable, **secure**, remote monitoring
- Modular system
- IXP and hardware-independent architecture
- Extensible:
  - uses existing back-end tools and scripts
- Scaleable through encapsulation:
  - a PoD can use other PoDs as back-ends - a **SuperPoD**
- **Secure**:
  - uses SSL, using X.509 certificates
  - mutual authentication between front-end and PoD

The story so far - Implementation

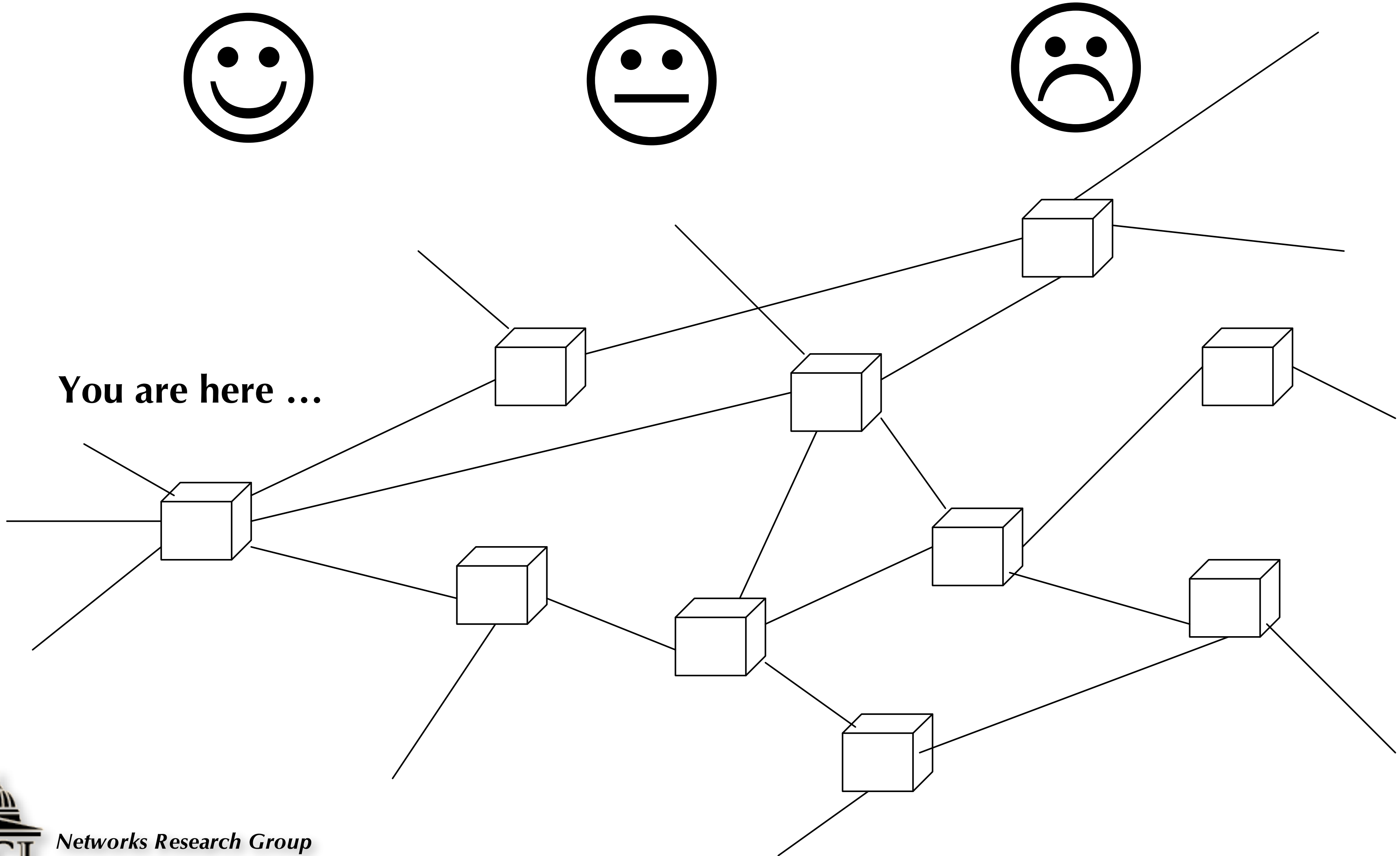
- Modular and platform independent
- Language independence - currently Java:
  - but could be python/Tk, perl/Tk, C++/Qt, …
  - front-ends can be text-based, of course ☺
- Client / PoD independence
- PoD yields actual data, not just a graph
- Some new visualisation of data
- ‘Real deployment’ at LINX

Opportunities for collaboration

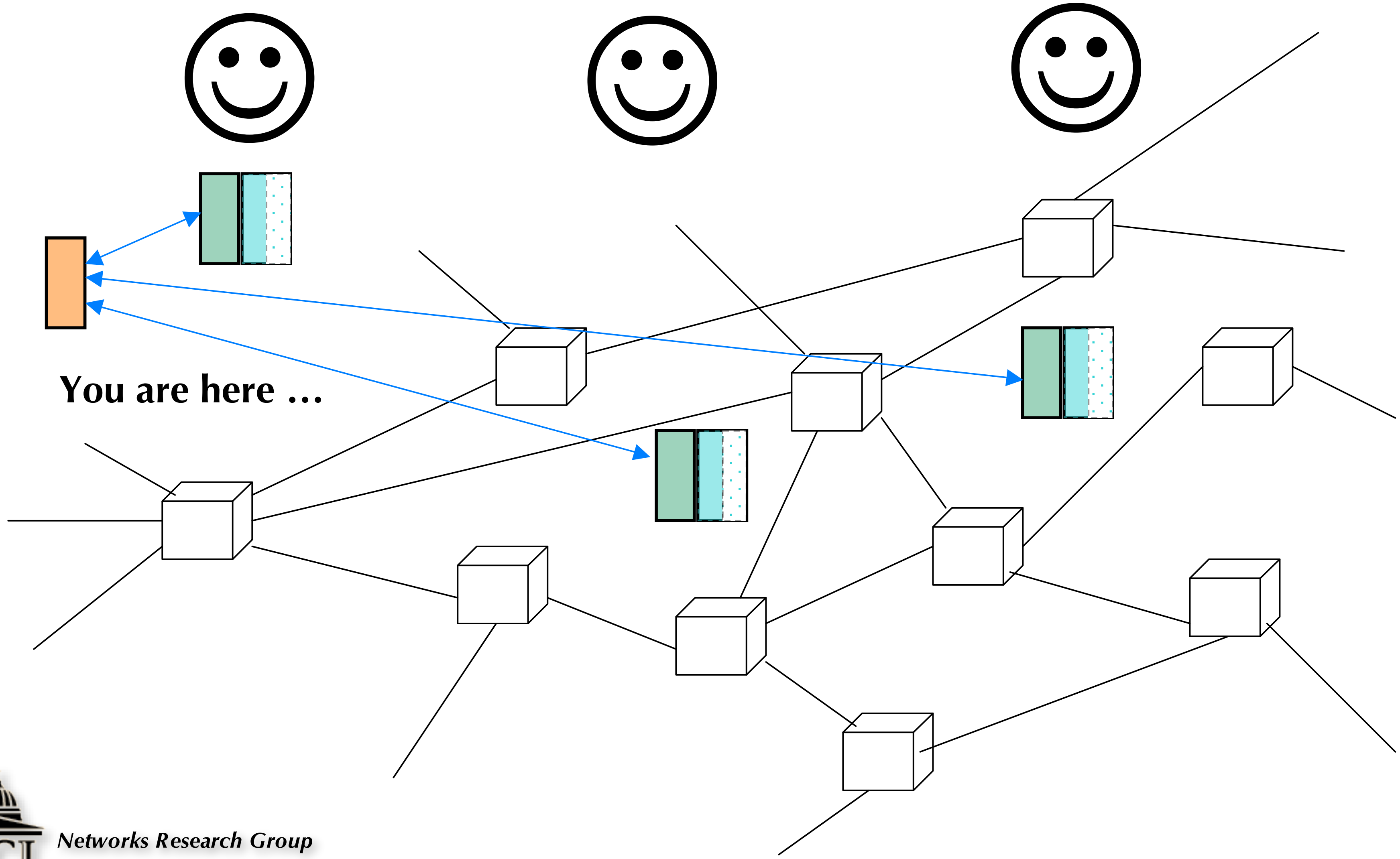
IXPs looking after the network

- Care of the network
- Different timescales:
  - different tools
  - different information
  - different actions
- A more unified, valuable view of the network:
  - not just individual points in the network
- Allow IXPs to help each other more

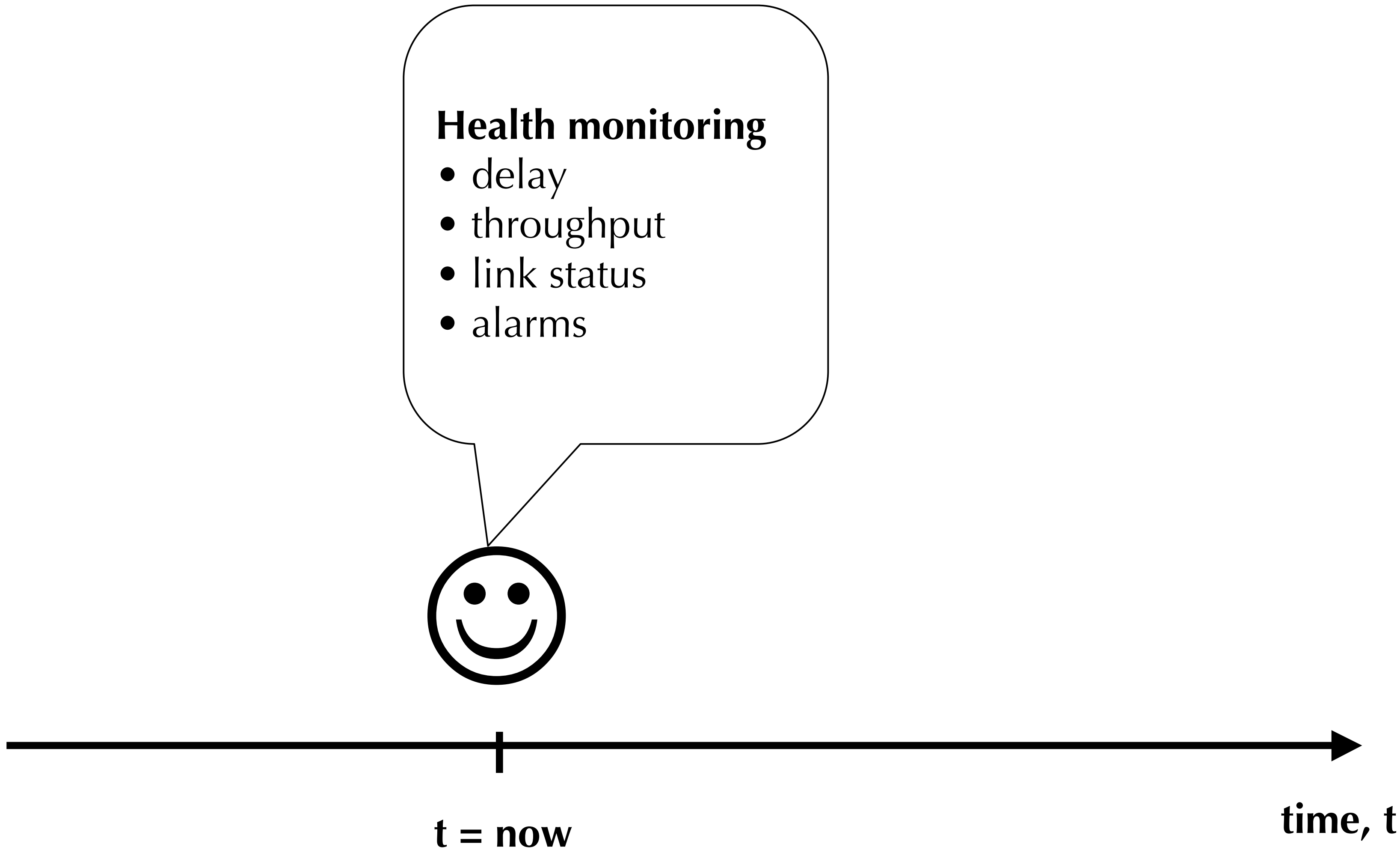
Spatial monitoring advantage [1]



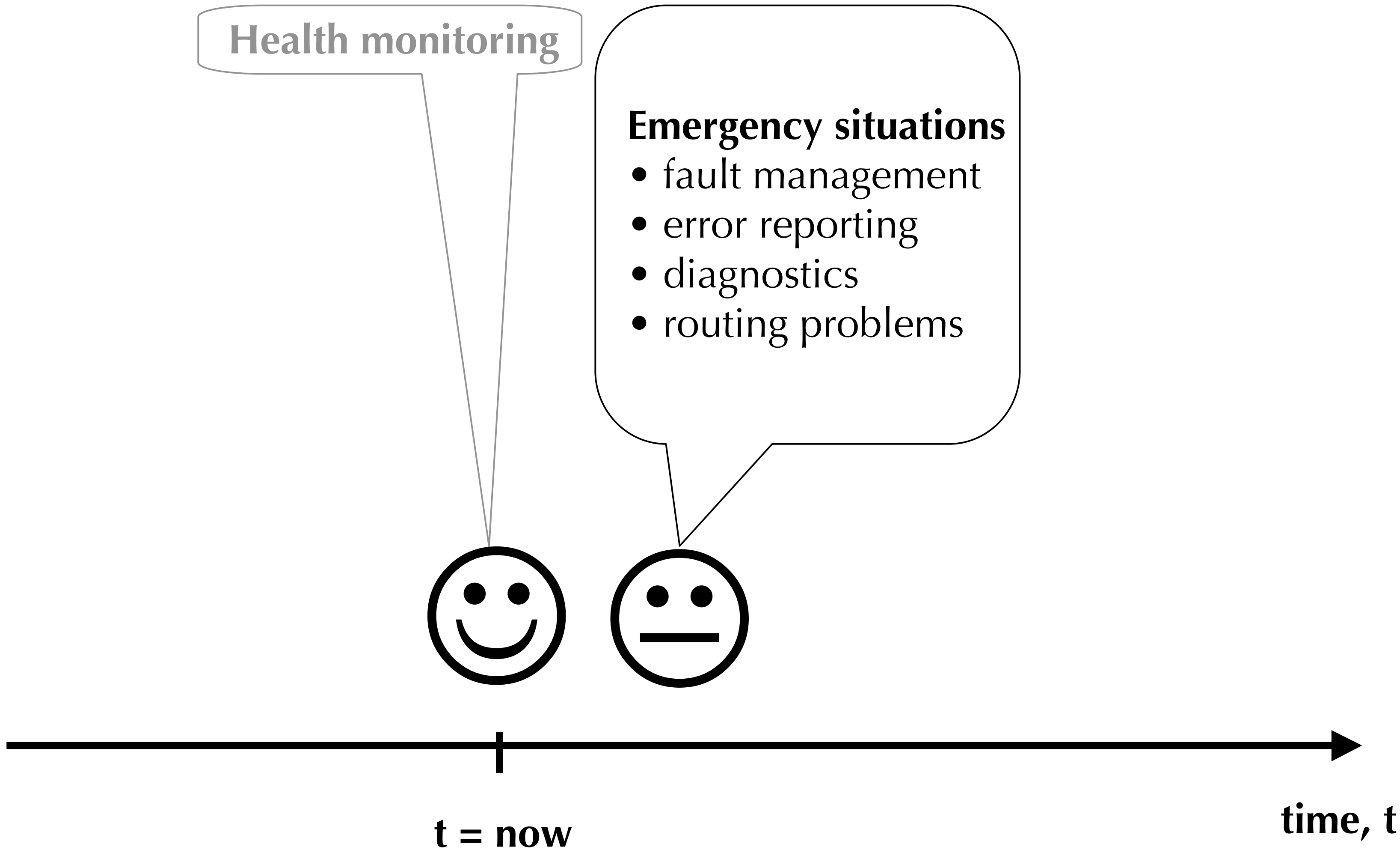
Spatial monitoring advantage [2]



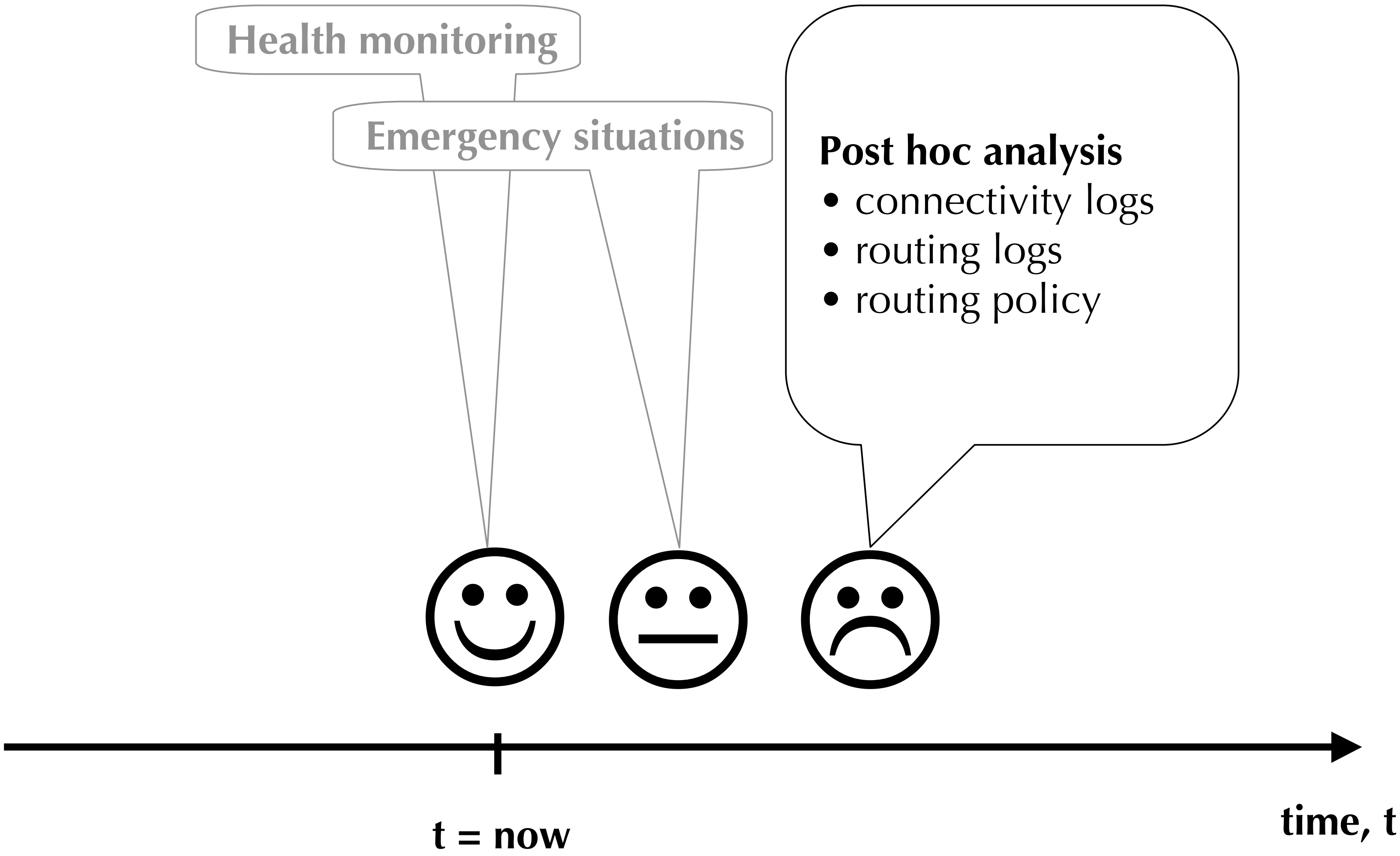
Temporal monitoring advantage [1]



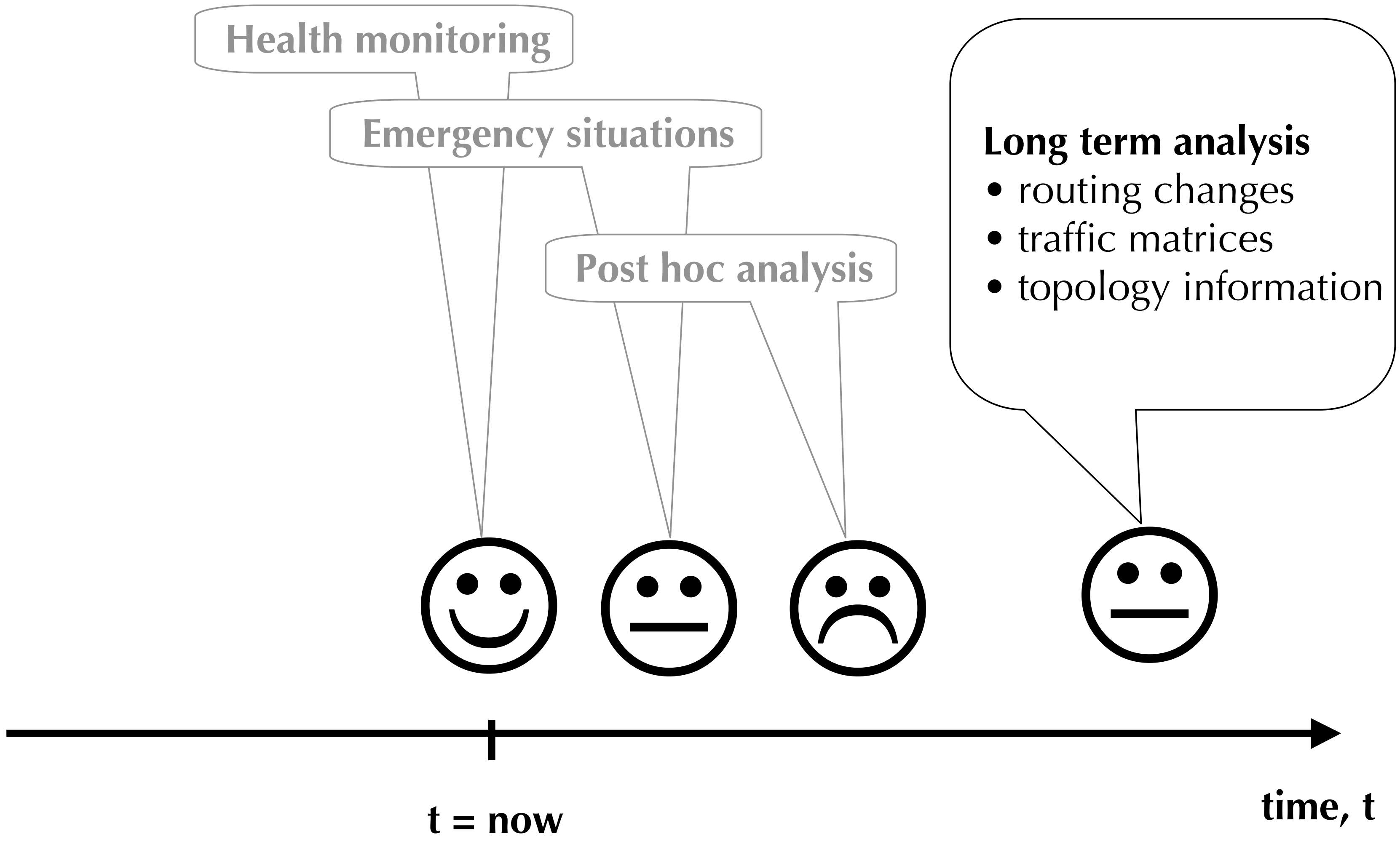
Temporal monitoring advantage [2]



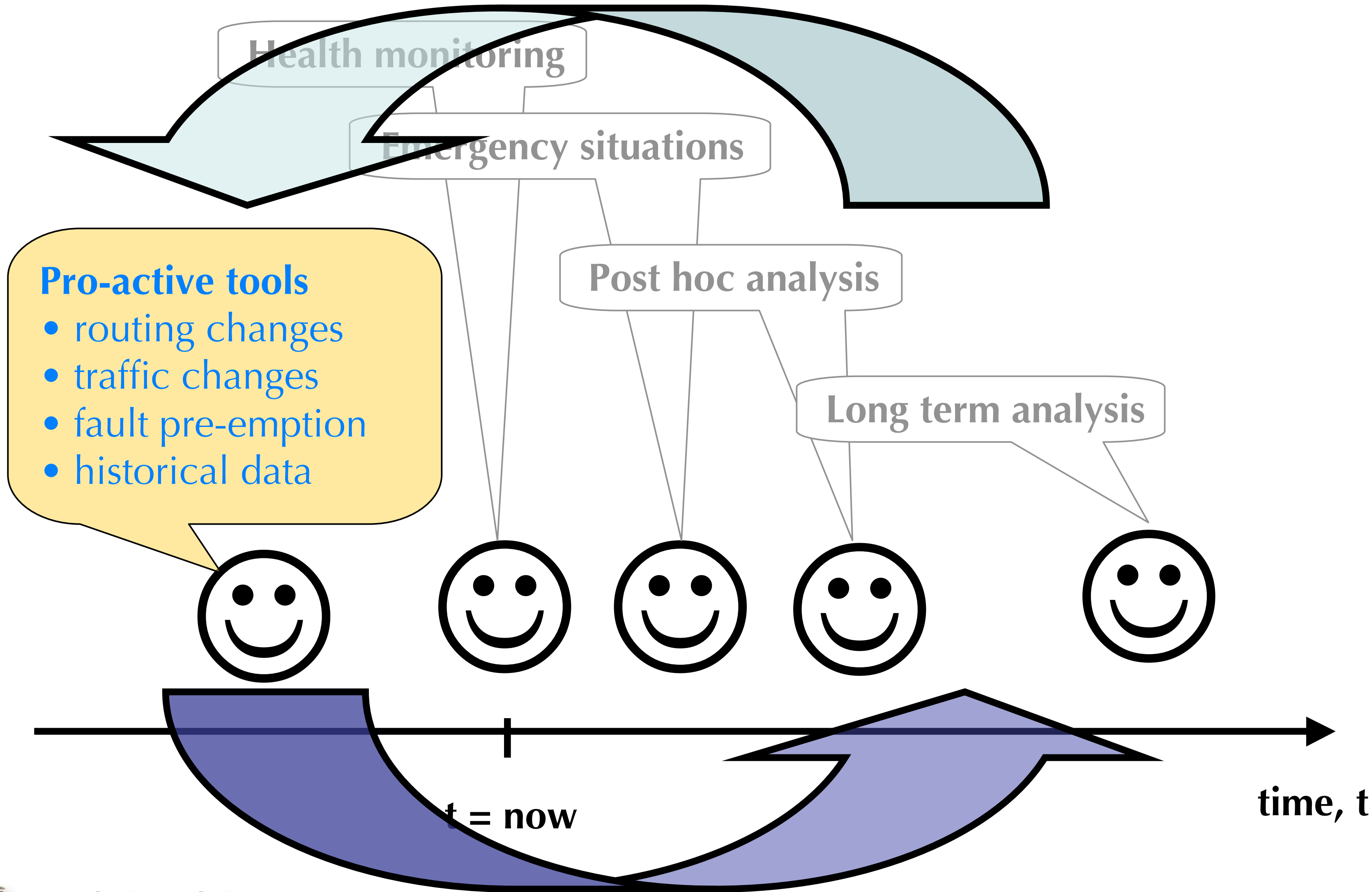
Temporal monitoring advantage [3]



Temporal monitoring advantage [4]



Temporal monitoring advantage [5]



Current status and Next Steps

Current status

- Working prototype: architectural proof-of-concept
- Reasonably stable:
  - running at LINX since 27 August 2004
- Software engineering:
  - needs some tidying up
  - needs packaging (release end Jan 2005)
- Software will be released as **open source**:
  - can provide remote help with installation
- Need to build more functionality
- Architectural refinement

Next steps

- **Look at the routing information:**
  - 'in-the-wild' behaviour of routing
  - this will give us huge insights
- Engage with IXP community:
  - examine the problem space in more detail
- Deploy the monitoring more widely:
  - information from more of the Euro-IX network
- Further development

How can we make progress? [1]

Get involved!

- Join the monitoring deployment:
  - use the tools
  - we are happy to help with configuration of tools
- Provide feedback on use of tools
- Provide the “really interesting” data:
  - iBGP/IGP, BGP, other routing info such as policies
  - filtered packet traces
- Understanding of problems and requirements
- Contribute to the system

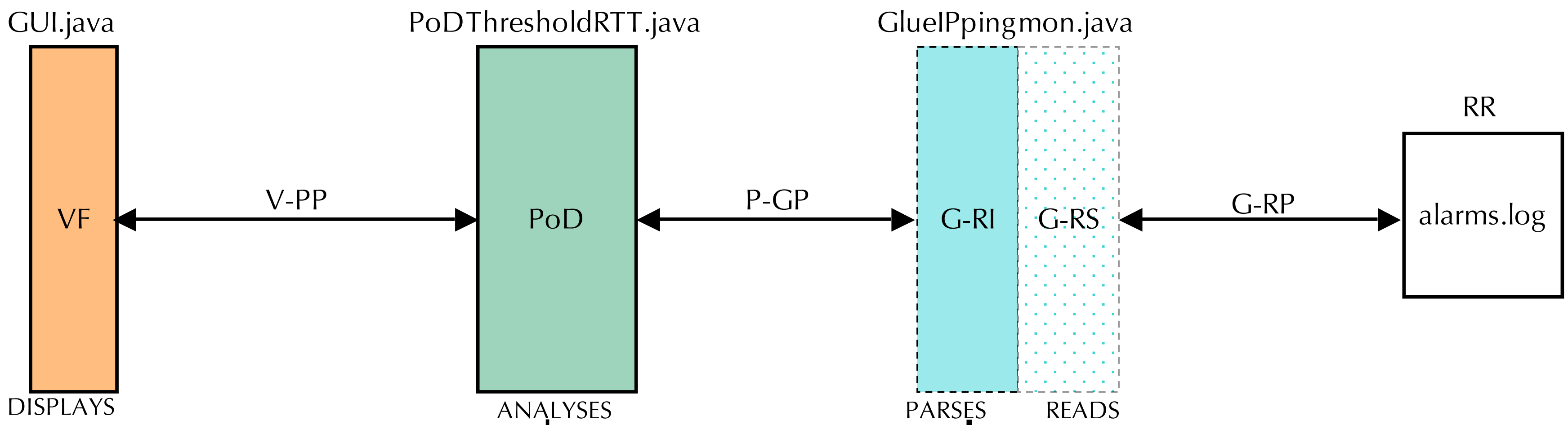
How can we make progress? [2]

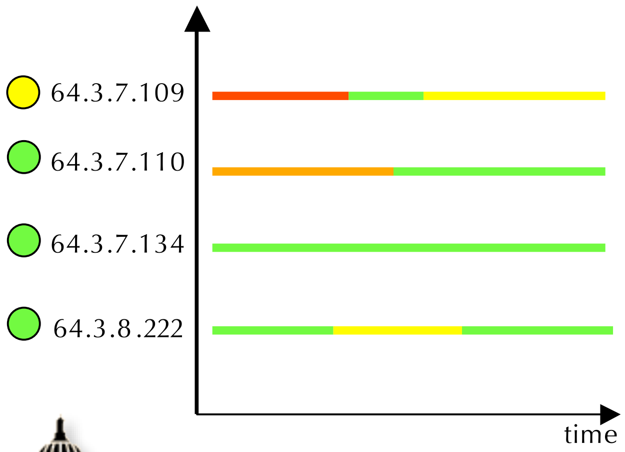
- Get in touch with us:
  - S.Bhatti@cs.ucl.ac.uk F.Huici@cs.ucl.ac.uk
- Current software available end Jan 2005:
  - set-up distributed monitoring across Euro-IX
- Set-up data feeds for routing information
- What do you need at your site to take part?
  - a modest linux box with Java, gcc/g++, fping
  - future: someway of accessing routing-packet exchanges (e.g. a log written to the linux box)

Questions and discussion

Additional Slides

Example: RTT Threshold RMF





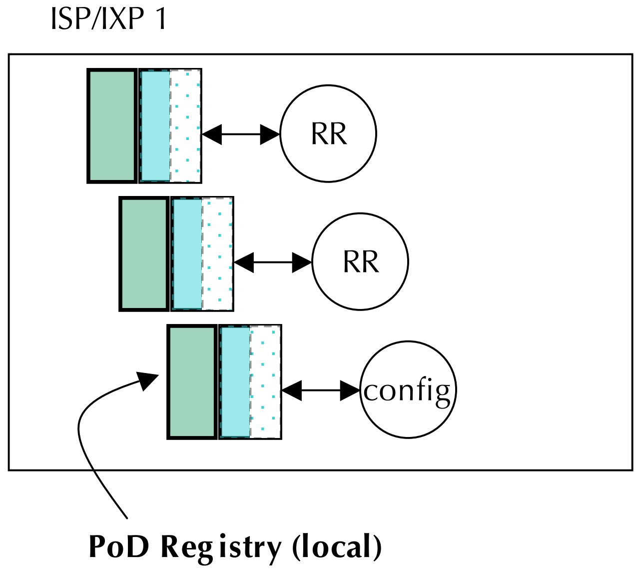
Vector	line1	line2	line3	…
[0]	DATE	DATE	DATE	
[1]	TIME	TIME	TIME	
[2]	ADDR	ADDR	ADDR	
[3]	COLOR	COLOR	COLOR	

Vector	line1	line2	line3	…
[0]	DATE	DATE	DATE	
[1]	TIME	TIME	TIME	
[2]	ADDR	ADDR	ADDR	
[3]	RTT	RTT	RTT	

PoD Registry and PoD Init [1]

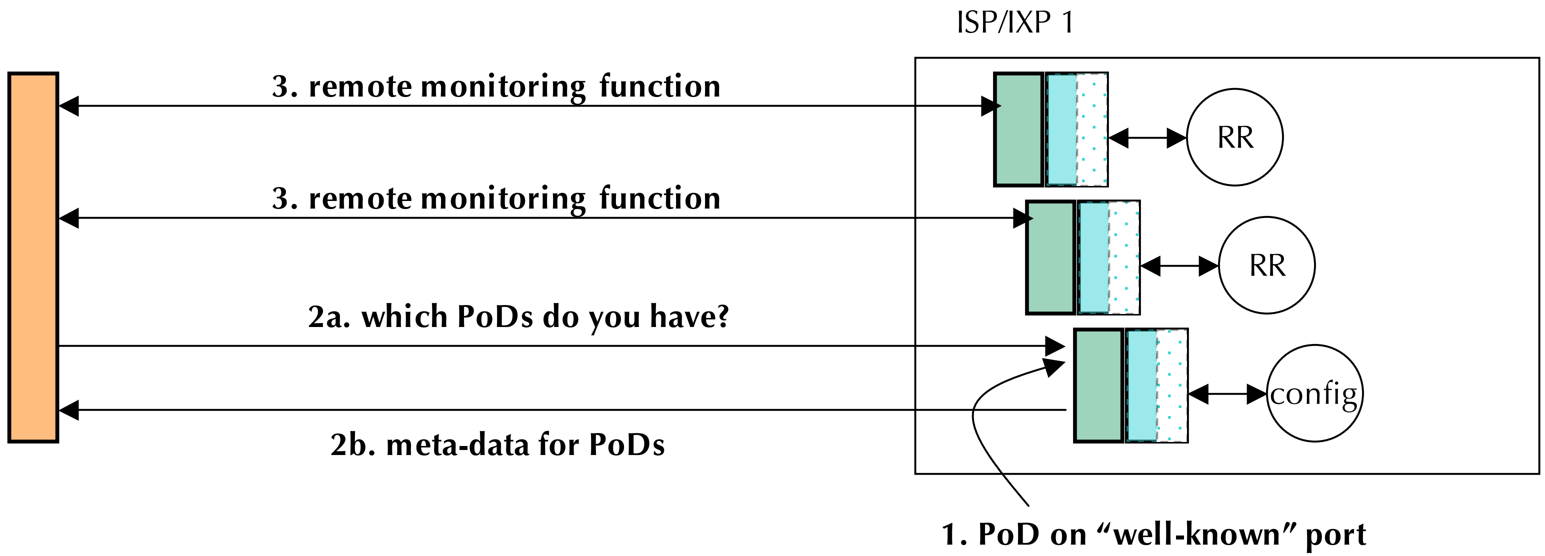
1. Client/VF needs to know what PoDs exist at a site:
   - need configuration info for client/VF
   - (PoD meta-data)
2. Need to start PoDs at site:
   - site-specific start-up configuration for PoDs

PoD Registry and PoD Init [2]

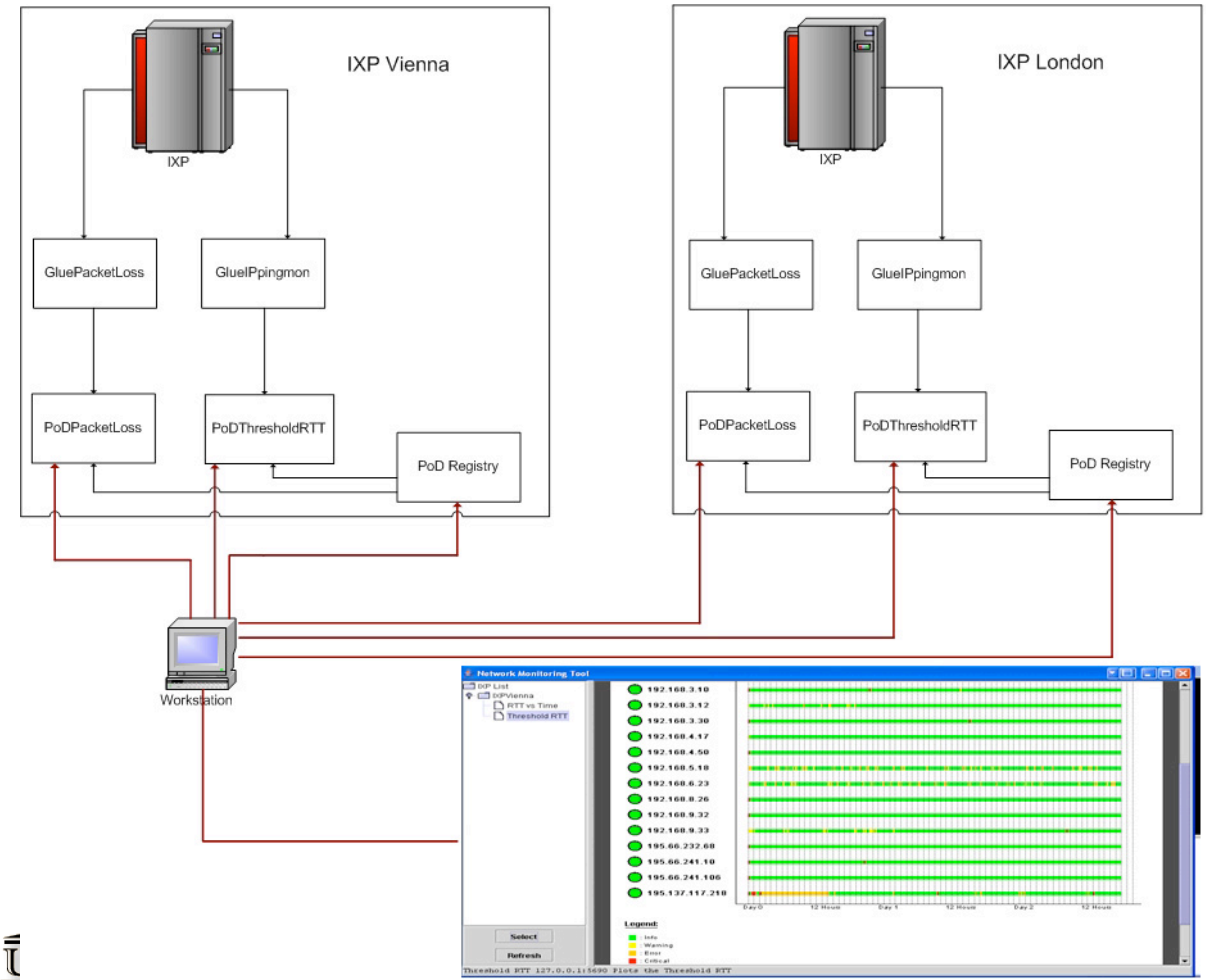


1. PoD registry reads local config
2. Local PoDs are instantiated
3. PoD Registry is updated with PoD info:
   - PoD type
   - PoD addr/port/proto

PoD Registry and PoD Init [3]



1. PoD Registry listens on "well-known" port
2. Client/VF contacts PoD:
   a. requests PoD meta-data
   b. PoD responds with info on all instantiated PoDs
3. Client/VF can then contact PoDs to complete RMF


IXP Vienna
IXP
GluePacketLoss
GlueIPpingmon
PoDPacketLoss
PoDThresholdRTT
PoD Registry
IXP London
IXP
GluePacketLoss
GlueIPpingmon
PoDPacketLoss
PoDThresholdRTT
PoD Registry
Workstation
Network Monitoring Tool
IXP List
IXPVienna
RTT vs Time
Threshold RTT
192.168.3.10
192.168.3.12
192.168.3.30
192.168.4.17
192.168.4.50
192.168.5.18
192.168.6.23
192.168.8.26
192.168.9.32
192.168.9.33
195.66.232.68
195.66.241.10
195.66.241.106
195.137.117.218
Select
Refresh
Legend: