
Unified Measurements

GENI Requirements and Specifications

for

Embedded Real-Time Measurements

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Motivation

Today's optical WDM transport networks

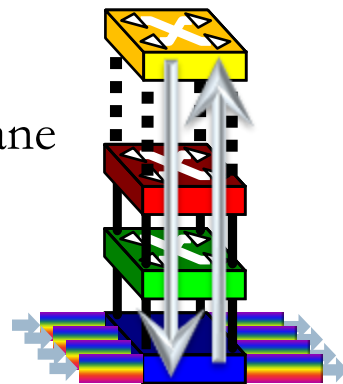
- allocate sufficient power margins for high physical-layer reliability,
- are “error-free” (bit error ratios $< 10^{-15}$), and
- provide small link outage probabilities (10^{-4} to 10^{-8}).

So why should we care?

Increase in network flexibility calls for relaxed physical layer performance constraints

Major GENI Challenges

- Architectural experimentations across diverse heterogeneous technologies by supporting **embedded real-time measurements** and enabling **cross-layer communications/optimization** for dynamic, impairment aware traffic management.
- Development of GENI requirements for real-time measurements capabilities
- Evaluate performance impact under several scenarios of bidirectional cross layer information exchange
- Integration of measurement resources into substrate and control plane framework(s) within the GENI prototyping efforts
- Monitoring of underlying framework conditions during experiment



Content

- Measurements as a GENI Resource
- Requirements and Specifications
- Unified Measurement Framework
- Conclusion

Measurements as a GENI Resource

(Examples, there is much more)

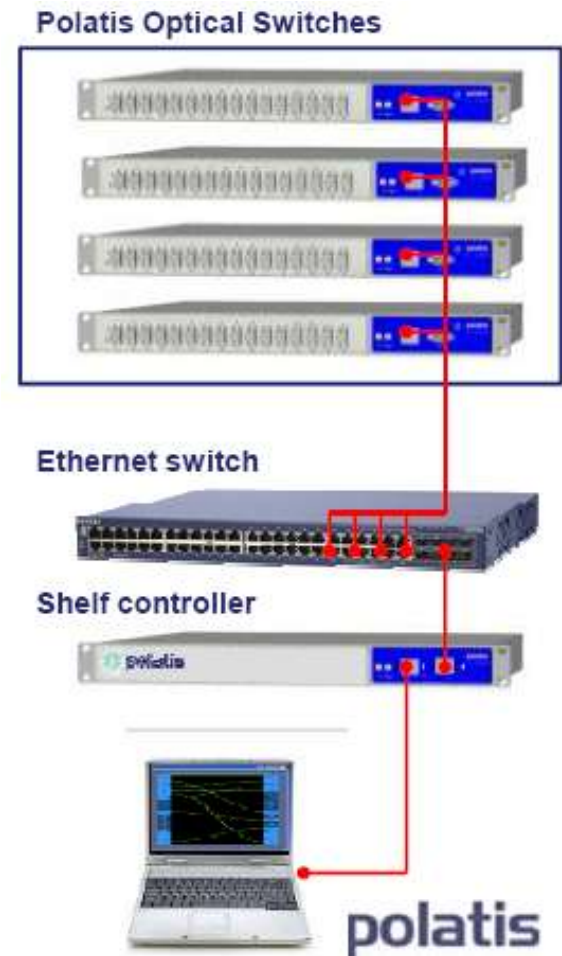
<i>Infinera DTN</i>	<i>Adva Optical Networking</i>	<i>Ekinops</i>	<i>Polatis fiber switch</i>	<i>NetFPGA</i>
Bit error counter (FEC)	Bit error counter (FEC) optical power monitor	Bit error counter (FEC)	Optical power monitor Optical power control	Freely programmable FPGA
Proto-GENI BEN	MAX GpENI	GpENI	BEN	SSP Overlay Proto-GENI

Milestone 1, [http://groups.geni.net/geni/wiki/Embedded Real-Time Measurements](http://groups.geni.net/geni/wiki/Embedded%20Real-Time%20Measurements)

Performance Monitoring Example

Polatis Fiber Switch

- Remote monitoring options
 - GUI
 - Embedded web browser
 - Remote network control center
- Switch management
 - SNMPv3, TL1, SCPI protocols
- Interfaces
 - Ethernet
 - Serial (RS232)
 - GPIB



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Requirements

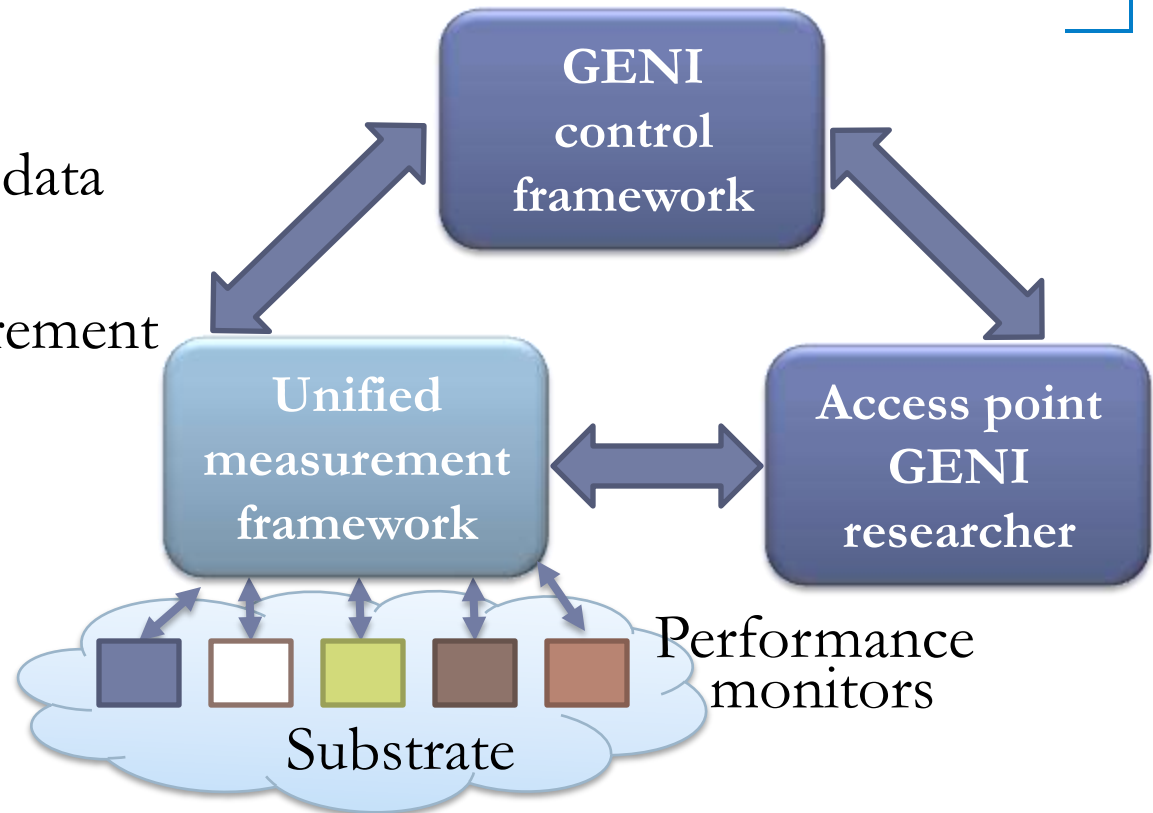
- Large number of interfaces
(depending on number of PMONs)
- Abstraction of interfaces
- Preparation of measurement data
- Extensibility
- Manageability

Unified measurement framework

PMON ... performance monitor

Unified Measurement Framework Requirements

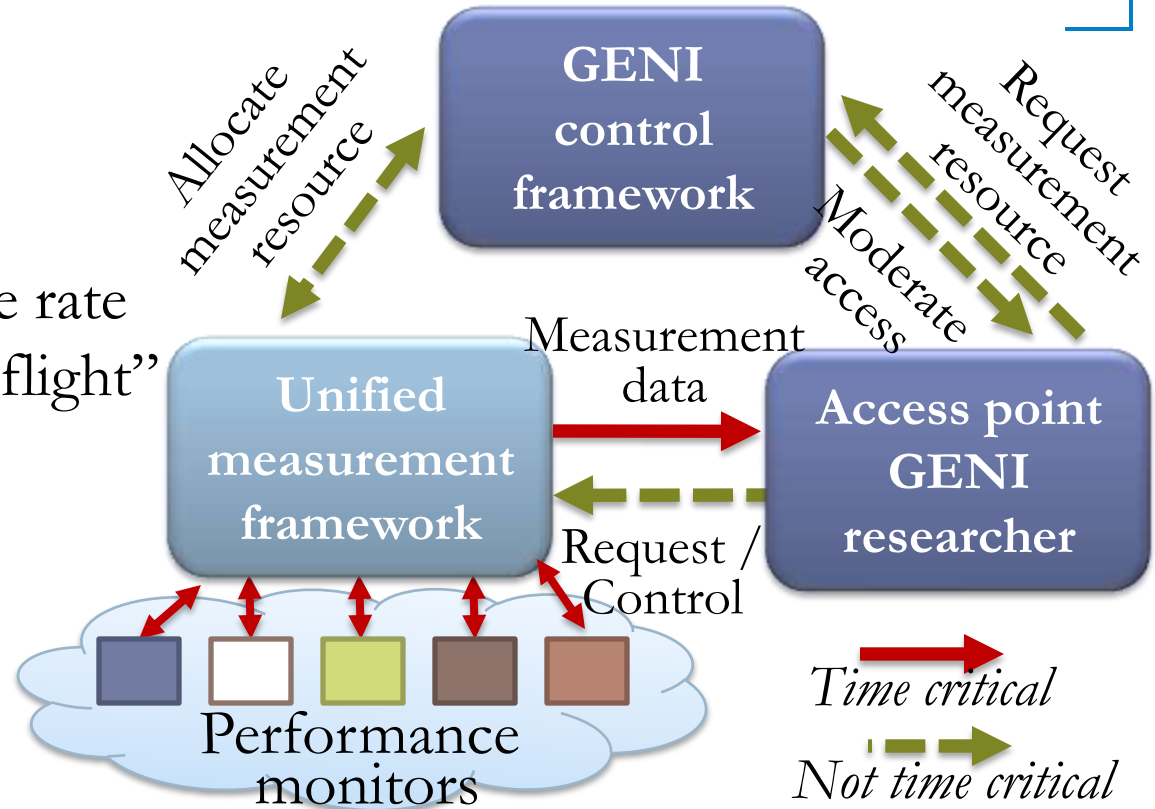
- Access control
- Acquire measurement data
- Basic processing
- Abstraction of measurement capabilities
- Single point of access
- Storage capacity
- Unified interfaces to researcher and control framework



Present a uniform view of measurement capabilities within the substrate and make them sliceable/accessible.

Unified Measurement Framework Specifications

- Interfaces
- Timing constraints
 - Measurement update rate
 - Maximum “time-of-flight”
- Storage capability
 - Measurement data
 - Access data
 - Drivers



Milestone 2, [http://groups.geni.net/geni/wiki/Embedded Real-Time Measurements](http://groups.geni.net/geni/wiki/Embedded%20Real-Time%20Measurements)

Unified Measurement Framework Implementation (Examples)

- On substrate equipment
- External hardware unit
 - Computer (Server) with storage capability
 - NetFPGA (10G-NetFPGA)
 - Interfaces: Ethernet, GPIB, Serial, ...
 - Support protocols: TL1, SMNP, ...



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Summary

- Control and acquire measurement data in a unified way
- Abstract measurement capabilities and equipment
- Provide a single point of access
(for the GENI researcher and the control framework)
- Enable basic processing of the measurement data
- Provide some storage capacity
- Allow for easy reconfiguration
- Reduce software, hardware, and design overhead



Announcement

Network simulator NS-2 modules ready for download

Milestone 3

[http://groups.geni.net/geni/wiki/Embedded Real-Time Measurements](http://groups.geni.net/geni/wiki/Embedded%20Real-Time%20Measurements)

