

Event Builder Tasks

Task Summary

- Global
 - Choose/design event fragment transport protocol (TCP/IP, AAL5, ?).
 - Design fast control/routing system.
 - Choose virtual connection topology.
- SEB's
 - Hardware, OS choice.
 - DCM interface implementation.
 - ATM interface testing, transmission protocol **software**.
 - Event fragment routing/control **software**.
 - ONCS control interface **software**.
 - Performance Testing.
- Switch
 - Hardware testing, monitoring.
 - Switch configuration/control **software**.
 - Switch performance measurement, monitoring **software**.
- ATP's
 - Transmission protocol **software**.
 - Event assembly **software**.
 - Trigger decision control **software**.
 - ONCS control interface **software**.

Event Builder - Manpower

Nevis Manpower

⇒ Currently at Nevis (Event-builder)

- B. Cole (1/2)
- W. Zajc (moral support)
- Jamie Nagle (1/?)

⇒ Additional manpower plans at Nevis (sharing of students with DCM likely)

- “Network engineer” (Interviewing candidate next week).
- Event-builder software coordinator (programmer or Ph.D ?)
- Post-doc (EvB) (Interviewing candidate in 2 weeks)
- Two undergraduate students for summer +.
- One graduate student likely (summer + ?)
- Will start search for 3rd post-doc soon.

Manpower Outside Nevis

- RD-31 -- Already have contributed (see below).
- Georgia State -- Interested in trigger software.
- BNL -- John Haggerty working closely with us on SEB
- Sub-system physicists (trigger algorithms).

RD-31 - PHENIX

⇒ RD-31 Situation

- RD-31 has ceased to exist as official CERN project.
- Large component of RD-31 in Atlas demonstrator-C project.
- J.P. Dufey and others on LHC-B.
- RD-31 trying to retain integrity independent of Atlas.
- Much enthusiasm from RD-31 people to “participate” in PHENIX event-builder project as “prototype” for ATLAS (?)
- Demonstrator-C project nearly identical to PHENIX conceptual design.

⇒ How to collaborate with RD-31?

- Still not clear – RD-31 trying to resurrect itself as another entity.
- MOU should be signed with Saclay ?, Dufey ?
- Will provide resources instead of asking for resources.
- I (+Bill ?) Will meet with RD-31 again in April.

Event Builder Progress, Milestones

Progress since Jan 97 - Technical

- Complete specification for SEB (few loose details)
- Conceptual plan for routing/front-back communication.
- Education re: ATM, PCI, Windows-NT, ...
- Better understanding of traffic shaping problems from RD-31

Progress since Jan 97 - Administrative

- Job searches underway for additional manpower @ Nevis
- “Loose” collaboration established with RD-31 Group (J.P. Dufey, P. LeDu et al.)
- Detailed cost estimate for ATM solution with explicit provisions for staging/scaling.
- Market search performed for all vendors or Network interfaces and switches.
- Vendor contacts made with Cisco, Bay Networks, Fore, 3Com

Milestones - Past

- Jan 31 - DCM Protocol decision – Close but not yet.
- Feb 11 - Choose SEB prototype hardware - Done but vendor not chosen
(Hopefully next week).
- Feb 11 - Choose SEB operating system - Done.

Milestones - Future (still in flux)

- Jun 1 - Final decision on switch technology.
- Jun 1 - Choose vendor for prototype hardware.
- Aug 31 - Test SEB + NIC.
- Aug 31 - Produce 1st version of event assembly, trigger coordination code
(use in sector test !)
- Sep 31 - Test SEB throughput.
- Dec 31- Complete prototype SEB + Switch + ATP system.

Current Specifications for the Phenix SEB

- Functional specs
 - SEB receives data from DCM's, buffers fragments, sends fragments to destination ATP over switch.
 - Partitioning requirements → only one granule in one SEB.
 - Design allows one **physical** SEB to function as multiple **logical** SEB's.
 - Conversion to switch protocol occurs at SEB output.
 - SEB's may receive routing information from external source.
- Hardware
 - Will use a standard PCI motherboard (ATX ?) with 5 V signalling, 33 MHz clock.
 - Will use a single Intel compatible processor.
 - Will use an Intel chipset.
 - Will contain one or more DCM → SEB PCI interface card(s).
 - Will contain a single PCI network interface card for data flow.
 - Will contain standard ethernet NIC for ONCS control.
 - > 32 Mbyte host and/or PCI memory.
- Operating System - Windows NT.
 - CORBA implementation available.
 - Network interface drivers universally available.
 - Use multi-threaded processes ?
 - Need for monitor ? – No good for long term.
 - Remote booting ? – Not necessary but convenient.
- Responsibilities
 - DCM interface + driver - John.
 - Memory pool software - Chris.
 - Event fragment routing - Nevis.
 - ATM interface - Nevis.
 - ONCS control interface - Nevis.

Event-builder - Technical issues

Technical decisions remaining

Decision/Problem	Affects	Date
DCM - SEB Interface protocol	SEB Hardware, Software	ASAP
Online data format	SEB, ATP Software ATP Performance studies	April 15, 1997
ATM vs Fast Ethernet	SEB, ATP Hardware Switch Data xfer protocol stack	June 1, 1997
NT Implementation of SEB	SEB software	July 1, 1997
SEB - ATP Routing/Handshaking	SEB, ATP software	October 1, 1997
Protocol layering	SEB, ATP software	October 1, 1997

ATM vs Fast Ethernet

⇒ ATM

- Switches **currently** can provide 500 Mbyte/s required by UCDR.
- **Provides extensive traffic shaping tools for congestion avoidance.**
- Provides **(desired)** connection-oriented service.
- Provides multi-casting (not broadcasting) capability “in hardware”.
- Provides CRC checking of **data** in hardware.
- Intrinsically switched (not shared-medium or hub) standard.
- Provides cell-loss priority scheme to prevent “meltdown”.
- TCP/IP services over ATM now standard if desired.
- Commercially viable.
- Proof-of-principle exists.

⇒ Why choose anything else ?

- Cost -- **becoming less of an issue** (not dominant cost in EvB).
- Complexity -- Comes with desired features, rely on others (RD-31).
- Lack of commercial viability -- **no !**.
- “Familiarity” with alternative -- **red herring**.

⇒ Fast ethernet

- Large frames (or poor performance) + poor/non-existent traffic shaping.
- Does not provide several \highlight(crucial) desired features.
- Commercial market not necessarily relevant to event-building problem.

Event Builder Costs, Staging

UCDR Event Builder Design Goal

- Target bandwidth - 500 Mbyte/s.
- Ultimate bandwidth - 2 Gbyte/s.
- At that time UCDR = 2.5 x “blue book”
- Now more like ½ “design” luminosity (bunch doubling, event size+)
- Previous rate estimates based on average fill luminosity not peak.
- At roll-up UCDR version costs 1.27 Million, consistent with baseline.

Staging of event builder

- Event-builder is inherently scalable from front to back.
- Try to estimate Day-1 rate requirements:
 - ⇒ item 10% blue-book = 20 Mbyte/s using UCDR rules.
 - ⇒ Factor of 2 in event size “guaranteed”.
 - ⇒ Add safety factor of 2 (enough ??).
 - ⇒ Handle peak luminosity (currently design by average) - factor of 2.
 - ⇒ Get “minimal” requirement of 160~Mbyte/s.
- Scale front/back evenly to preserve triggering (above 20 Mbyte/s).
- Manpower and switch crate, power, etc. do not scale.
- Maintain minimum number of SEBs (8) for reasonable configuration.
- **Scaled version saves \$400K.**

	Prototype	Scaled	Full (UCDR)
Hardw Subtotal	98297	335886	779280
Labor subtotal	98323	294970	294970
Total	196620	827476	1270870

Event Builder Procurements/Expenses FY97

Items

- Prototype SEB's
- Small (prototype) switch
- Network interface cards
- DCM interfaces
- PCI, ATM network analyzers
- Engineering, software support
- Travel for engineer (CERN - 1 month during summer 97)

EVB Component	Item	Quantity	Expected Item Cost	Actual Item Cost	Expected Cost	Actual Cost
SEB	PC CPU	4	\$3,500.00		\$14,000.00	
	NIC	4	\$1,000.00		\$4,000.00	
	DCM Interface	4	\$2,000.00		\$8,000.00	
	Fiber or UTP5	10	\$100.00		\$1,000.00	
Switch	Prototype	1	\$20,000.00		\$20,000.00	
Test Equipment	PCI Analyzer	1	\$12,000.00		\$12,000.00	
	Network Analyzer	1	\$20,000.00		\$20,000.00	
Miscellaneous	Books	5	\$500.00		\$2,500.00	
	MODSIM	1	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00
	Travel	1	\$2,500.00		\$2,500.00	
Labor	Network Eng.	5	\$8,193.00		\$40,965.00	
	Software coord.	4	\$8,193.00		\$32,772.00	
Total			\$80,986.00		\$160,737.00	