Computing needs for running experiments

- Look at 2 experiments:

	BaBar	CDF
Start of data taking	1999	2002
Run until	2010	2010
Italian physicists	~80	~60

- CDF is an evolution of previous experiment (1985)
- BaBar is brand new

- How much data/CPU ?
- What is done in US, what in Italy ?
- What are the needs in the INFN sites ?
  - Skip national farms (Caspur, CNAF)
- **Their data, my opinions**

Centralita' dei servizi di calcolo: oltre il "computing"

- 90% dell'attivita' di un ricercatore e' davanti ad un computer
  - Posta elettronica
  - Lettura documenti/articoli (biblioteca → web)
  - Sviluppo software
  - Analisi
  - Scrittura documenti, presentazioni, articoli
  - CAD (elettronico, meccanico)
  - Test di elettronica/rivelatori
  - Controllo esperimento (anche remoto)

- Tutto questo dipende dai servizi di calcolo della sezione
  - GRAZIE

29/6/99 Commissione Calcolo a Napoli: Bisogni di CDF nel Run II (2000 - 2003 - ...)

- Cominciamo dalla fine, i bisogni:
  - **RETE! RETE!! RETE !!!**
    - intercontinentale
    - italiana
    - locale

    OK! OK!! OK!!!
    Ma: niente relax
  - system management: **linux** ~ci siamo, ancora ~nascosto
  - licenze: compilatore C++: KAI Niente licenza, gcc in arrivo
  - supporto software: Root, C++, Java, SMQL Ancora li' + Python
  - collaborazione a distanza: videoconf + application sharing
  - ancora rete: Qualita' di Servizio

    Ancora un bisogno, minori speranze: bastano reti sovradimensionate !?

CDF vs BaBar (in numbers)

- Data (Root I/O)
  - 10^9 events/year
  - 250KB/event
  - 500TB/year data (not yet)
- HW at FNAL
  - 200 duals now (1K coming)
  - 128-CPU SMP leaving
  - 30TB disk (200 coming)
- User's analysis
  - ~100 data sets ~1TB each
  - TOO MUCH TO COPY
    - CENTRAL MODEL
    - All at FNAL

- Data (Objectivity + Root I/O)
  - 5*10^9 events/year
  - 30KB/event
  - 550TB total data now
- HW at SLAC
  - O(1500) machines now
  - 40TB disk
- User's analysis
  - "micro" now ~10TB total
  - CAN COPY
    - HIERARCHICAL
    - Tier A-B-C

CDF vs BaBar (in words)

- Similar disk/CPU requirements
  - Central analysis farm: O(1000) machines
  - Central data repository: O(100)TB on disk, O(1PB) on tape
    - CDF has more (more complex) data
    - BaBar has Objectivity
- CDF started with one big + many very small computing centers
  - can't move data
  - political/practical reasons (manpower e.g.)
- BaBar started with one big + few medium + many small
  - can move data
  - Objectivity encourage this (but makes it very hard)
  - political/practical reasons (cost share)

Computing Model Dictionary

- Try to use common definitions (from BaBar)
  - **Tier A ~1000 CPU**
    - stores raw data (the PetaBytes)
    - run reconstruction
    - allow analysis of "ALL" reconstructed data
    - produces MC
    - accessed from everybody, anytime (7x24)
    - provides several GRID-like services
  - **Tier B ~ 100 CPU**
    - allow analyisis of "SOME" reconstructed data
    - produces MC
  - **Tier C ~ 10 CPU**
    - allow analysis of "LITTLE" reconstructed data

CDF/BaBar Italy Computing Models

- **Past** (plan)
  - **Tier A/B** at FNAL
  - **Tier C** in Italy (3~4)
- **Present**
  - Building our **Tier B** at FNAL (easy, just buy)
  - No **Tier C**
- **Next**
  - **Tier B+** at CNAF
  - GRID (EDG, DataTAG)
- **Future**
  - Interactive at CNAF ?

- **Past**
  - **Tier A** at SLAC
  - national INFN **Tier B** at Caspur
    - ☞ much, much work
- **Present**
  - **Tier A** at Padova-SLAC-IN2P3-PPARC
  - **MC** at Roma1
- **Next**
  - GRID (EDG)
- **Future**
  - **Tier A,MC**: Pd,Rm → CNAF ?

Computing Model evolution

- In CDF some "small" (Italy, UK...) growing to medium+
  - O(100) nodes, access to all collab (no Tier spec)
  - now can move lots of data
  - want share hw across countries (too many data)
- In BaBar top big one is splitting, therefore Italian medium one is growing (30→110 nodes)
  - BaBar keeps very distributed MC production
    - little impact on Italy
- CDF+BaBar converging toward one large computing facility (at CNAF) embedded in a world-wide GRID strucuture
- Both will do without local mini-farms
  - Taking data and analysing them is a lot of work
  - A large working farm is a lot of work
    - BaBar Padova: 12 people to build reprocessing farm

The BaBar reprocessing farm:

largest INFN computing facility
largest italian IBM Linux cluster

BaBar Reprocessing farm fully cabled

CDF needs

- Access to Fermilab
  - Kerberos. Soon add GRID (non-EDG)
- Access to Regional Center(s) (also outside Italy)
  - GRID

- Interactive work =
  - Histogram (paw/root): 2GHz + 1GB + 200GB
  - Code develop/debug: add CDF sw (AFS, 2GB cache)
  - Job submission: GRID/Kerberos
- Interactive work locally means one of the two:
  - Heavy Desktop (2CPU, 4 disks, frequent upgrade)
  - Light Desktop (~X-term , more flexible)
    - ☞ mini-farm with non-batch access

BaBar needs

- Continued support for (growing) farms in Padova and Roma
  - Mostly ran by experiment personnel (both physicists and computing)
  - BaBar people take care remotely of farm needs
    - decentralized manpower (make everybody usefull)
    - centralized hardware (make workload minimal)
    - single facility (make any work serve everybody)
- No other farms planned
- Support for interactive work everywhere
  - My guess is that this is similar to CDF
- GRID soon

Esperimento in Running: l'esperienza di CDF

- Stabilita'
  - Ambiente definito, costante, funzionante
    - ☞ possibile pianificare lavoro in base a cosa c'e'/ci sara'
    - ☞ niente promesse a vuoto please
- Continuita'
  - Non si possono perdere giorni od ore di lavoro (sul rivelatore e' sempre un emergenza) perche' si e' rotta una macchina/disco o perche' si cerca di fare meglio quando bene era sufficiente
- Minimo garantito
  - Servizi essenziali innanzi tutto
  - Nuove soluzioni: con cautela
  - Sicurezza: non gabbia

Il "minimo garantito ovunque per tutti"

- Net (also wireless)
  - Security, but also access to and from outside
    - ☞ data copy, GRID
- E-mail 24x7 from anywhere
  - IMAP, IMHO, backup
- Windows+Linux, ps+pdf
  - Calcolo : Linux
  - Talks+Ammin: PPT+Excel
  - Docs: Latex + Word
- Desktops
- Home directories
- Scratch areas
- Web server
- Mail list server
- Local clusters must be robust
  - Dual hosts, RAID, Backup, UPS
- Printers
- Laptop

- Eterno problema: il manpower
- Copiare ? Centralizzare/clonare (e-mail, print, web, MS-Office) ?
  - Eg: my web page = directory AFS, PPT = Citrix @ FNAL

CDF wishes: software

- Large, neverending need for software development
  - C++ - Java – Html – Perl – Python – Root – SMQL – cvs – gdb – (x)emacs – Netscape – Memory checker – code optimisation…
- Aiuto = Consulenza
  - esperti dal servizio calcolo ?
- Aiuto = Sviluppo
  - possibile passare al servizio calcolo lo sviluppo di tools, GUI's, pezzetti di package ?
  - non tanto un bisogno quanto un'opportunita'
  - il calcolo come la meccanica e l'elettronica: fornire parti critiche e qualificanti di un esperimento
  - Succede in realta', ma in modo un po' personale, scoordinato e con grandi differenze di qualita'

Conclusioni

- "The computer is the network"
- Architettura:
  - **Most computing work done in a few dedicated places**
    - Alcuni servizi di calcolo (Padova e.g.) hanno le competenze per rendere possibili farms "di produzione", ma..
    - Farm = heavy work ➔ minimize, optimize
  - **Sezione = portale ai servizi**
    - Mail – web – GRID
    - Unix + Windows
- Software:
  - Gli esperimenti si arrangiano grazie ai laboratori (esteri)
    - molta frammentazione, nessuna soluzione diventa di tutti
  - C'e' spazio nell'INFN per un "servizio di consulenza e sviluppo sw di alto livello"