A Little Knowledge is a Dangerous Thing

Technology Transfer Workshops
Training the community in new networking technologies

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New Technology Transfer

• “New” is the operative word here
  • As new technologies and capabilities emerge from the R&D pipeline, we cannot expect the community to automatically understand them

• The subject matter experts (SMEs) must transfer the technology to the broader community...

• Key questions:
  • Who are the SMEs?
  • Who are the “broader community”? 
  • What process should we use to transfer the technology to the broader community?
First: Who is the target community?

- We need to have a specific audience in mind:
  - Network engineering and operations personnel
  - Administrative management
  - Applications software developers
  - POUs (plane old users)

- The information needed by each of these groups is different.
How do we transfer information?

• Documentation
  • Always necessary, not always sufficient
  • This is often adequate for really bright industrious personnel
  • But it requires substantial effort for new personnel to cull through the documentation to understand what they need to know, and then to find that information
  • Even so, good documentation presents the information in a fashion that starts with basic functional description and progressively exposes greater technical detail
How do we transfer information?

- Tech Transfer must begin with advertising!
  - It is often the case that the target community does not even know that new technology is available!

- Presentations, demos, papers
  - Introductory presentations at relevant conferences
    - *User* conferences – i.e bio-informatics, HEP, RA, etc.
  - Introduce these new network capabilities to the community and explain how they will benefit them!
  - Demos are useful – to a point.
  - Experimental deployments present the new technology as a viable service
How to transfer technical expertise?

- Classical teacher-student training:
  - In the professional environment, long, in-depth courses are not practical as part of general technical training.
  - Short, focused, intensive courses are an effective method for moving professionals quickly into the technology
    - Seminars ~a few hours
    - Workshops ~a day or two
    - Short Courses ~a few days, a week max
  - Short – but more frequent – workshops allow more people to attend
Workshops

- Workshops or seminars are often an efficient means to move the students from zero or minimal knowledge to a basic useable competence very quickly
  - Must appreciate the zero/minimal knowledge starting point
  - The material must be limited in scope, very focused
  - Retention requires experience – must include exercises that utilize the material
  - The process must allow the students to organize the information in their head – i.e. gain a top-down perspective
The workshop must have a clear and specific objective: what are you trying to accomplish?

- Ex: The attendees will be able to design, deploy, and utilize GMPLS based provisioning services using the DRAGON/OSCARS software.

A statement of this sort is useful in developing the content as well as communicating the purpose to attendees.

The objective and the target audience should be considered together:

- The engineering teams focus more on design and deployment of the network services.
- The software developer would need more applications notes and tools (libraries, GUIs, debugging procedures, etc.).
- Introductory workshops may provide a broader overview with less depth/detail. (Good for management.)
Who is the “Target Audience”?

- Most of the R&E networking technology transfer concerns the engineering and operations personnel
  - The engineering personnel design our networks, so they are the first point of engagement as we deploy new capabilities
- But...
  - Success of a new technology requires the users (application developers) to adopt it
Applications Outreach is a Black Art

- Paradox: *How do you find users of the technology before the technology is available to use?*

- “Applications” comprise a very general open ended set of users:
  - (This is an issue beyond just workshops or short courses.)
  - How do we recognize applications environments that could *potentially* leverage these technologies?
  - How do we present new service paradigms to these users in a way that entices them to become “early adopters”?
  - How do we attract potential user to attend a workshop?
  - Given the scope of effort implementing new paradigms… how quickly can we expect to see new applications actually using the technologies we are presenting? How much collateral development is required to incorporate the new paradigm?
Applications Outreach is a Black Art

- “Engineering” targets are easy to find:
  - These are our regular R&E networks community
  - Campus networking is less active in the national and international core R&E activities – so we know less of them

- Even within the engineering community there are important differences in perspective:
  - Campus: security, scaling access issues, end system management
  - Core: scaling of core service capacity globally
  - Manager vs Architect vs Design: different questions being asked regarding the new technology
  - Engineering vs Operations
Reaching the Audience

• Most organizations have “appropriate” email lists to announce a workshop
  • Don’t spam inappropriate lists
• Post announcements on Websites (rather than emailings)
  • Most sponsor organizations have some page called “Upcoming Events” or Activities, Training, etc.
  • These are good places to post details and use a URL pointer
• Verbal reference is often highly effective in related meetings and conferences
• Maintain a public registration list so attendees can see who will (or did) attend.
Engineering Workshops

- **Focus: Service deployment**
  - How does the technology map into network services and capabilities? i.e. How does it work?
  - What are the design rules and options? What are the design tradeoffs?
    - Understanding how it works does not mean the engineering team will need to write code...but the insight allows the technology to be tailored to the needs of each network
  - What infrastructure is required to deploy the technology?
    - Is specific hardware required? Servers, transport equipment, specialized hardware or software?
  - How do you verify operation? How to detect and resolve problems?
Applications Workshops

• Focus: Software and User interfaces
  • How can the technology enable new application service models? i.e Does it improve existing capabilities? or does it offer a new paradigm?
    • A new paradigm needs more Big Picture indoctrination
    • Ex: ubiquitous dynamic virtual circuits enable new approaches to distributed IT applications – unconventional thinking is required. TCP tuning improves existing services.
  • User Interfaces – how will the user take advantage of the new technology?
    • How does the user take advantage of the new capabilities?
    • Sometimes the user doesn’t know – only the app developer needs to understand the interface
  • How do you verify operation? How to detect and resolve problems?
Who should present?

- New Technology SMEs are generally the scientists or developers that brought the technology to maturity
  - But these folks are often *not* good instructors
  - SMEs and your instructors should sit down and jointly develop *and test* the curriculum
- The instructors should be experienced in those aspects of the technology that they will be teaching
  - A network engineering w/s should have expertise in designing and deploying the technology
  - An application W/S should have software engineer expertise leading
- Make sure you have enough instructors!
  - Rule of thumb: 1:~5 students
  - (standing and talking and being enthusiastic all day – maybe for two days – is tough!)
Who should present?

• SMEs may (should?) participate in workshops to answer questions and to assist with finer details
  - SME involvement also exposes the SME to the student’s perspective which can feed back into the technology development process.
• The workshop leader (instructor) instills as much confidence in the technology as the technology itself
  - Keeping concepts clear and as simple as possible
  - Not over promising the benefits
  - Acknowledging limitations
  - Getting questions answered quickly and clearly
• A green instructor just reading the slides is no better than just reading the documentation...
Workshop content

• Keep it Simple!
  • “Hello World” theory.
  • Present a simple but complete example of the technology, early in the workshop, in order to orient the student and provide a baseline understanding

• Incrementally construct more complex & sophisticated scenarios.

• Be practical!
  • A workshop will not create experts - don’t try to.
  • Decide what basic concepts the students need to walk away with – and focus on those!
Basic Pod Data Plane
Pod Network Elements

Network Aware Resource Broker - “NARB”

Virtual Label Switching Router - “VLSR”

End System
Management Addressing

“Red” pod: ASN=1
“Blue” pod: ASN=2
“Yellow” pod: ASN=3
“Green” pod: ASN=4

Workshop Gateway Router

Management VLAN 192.168.<asn>.n/16

Dynamic Data plane port group = g3-g24
Dynamic VLAN range = 100...200

GRE<x> = 10.<asn>.<x>.n / 30
GRE7 = 10.1.7.0 / 30
TEaddr = 11.<asn>.<x>.n / 30
Inter-Domain Logical Topology

ASN 1

ASN 2

ASN 3

ASN 4

Intra-domain ctrl plane
Inter-domain ctrl plane
Data plane
Workshop content

- Use this fact: *Incorporate “hands on” exercises*
  - People still learn from physical experience
  - Forces the student to organize and access the concepts mentally to address a representative problem.
  - Ex: In the GMPLS w/s, cabling the test network helped students become familiar with specific important details of the infrastructure that would be required to complete the exercises.
  - And the physical activity kept them awake
Workshop content

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• Printed materials
  •
  •
  •
  •

• Exercises should be clear, concise, and specific!

• Always include the answers !!
  • (but someplace separate so they have to make a real effort to cheat)
Workshop Logistics

- Insure an adequate venue
  - How many students?
  - How many instructors?
  - [BIG] Name tags for all!
- How much space is required?
  - Air conditioning! (for computers *and* people)
  - Power strips
- Supporting technology
  - Projectors and white boards, projectors *on* whiteboards, …
  - Networks (wired and wireless)
  - Student logins to local net and to lab machines
  - HD videoconferencing (for students and presenters)
New technology transfer takes time (months and years), expect a sustained effort:

- Always plan a series of workshops
  - Timed to give the instructors rest and time to edit the content
  - The DCN workshops were two months apart
- The early workshops act to tune and tighten the material
  - How much can you truly accomplish? *Simplify and condense*
  - What material is not getting across? Needs re-thinking the approach, exercises, etc.
- Announce 2-4 months in advance
• Do not overload the students!
  • Complex technical material is hard on the brain - don’t force feed them too much!
  • Better to offer an “advanced” class at a later date
  • Or include additional material/exercises for self study
• Plan for ~five hours of structured material per day
  • 830am to 10am – Lecture 1
  • Break
  • 1045am to 12noon – Exercise 1
  • 12noon to 1pm lunch - Discussion
  • 1pm to 230pm – Lecture 2
  • Break
  • 245pm to 4pm – Exercise 2
  • 4pm to 5pm Q&A/clean up and prep for day2
Workshop Sponsorship

• Get a Host institution to sponsor individual workshops… or the whole series
  • The Host gets visibility
  • The host helps with local logistics

• Cost recovery
  • The sponsor can defray some of the costs
    • Provides the meeting room/lab space
    • Provides technical support where testbed systems are required
  • May still require a registration fee

• Costs include:
  • Instructor(s) time and travel expenses (including preparation!)
  • Materials
  • Shipping (particularly of computer systems for labs)
DCN HandsOn Workshop Agenda

• Day 1
  - 8am   Overview of GMPLS
  - 9am   Exercise #1: Designing the Intra-Domain GMPLS Control Plane with VLSR and NARB
  - 12noon Lunch
  - 1pm   Exercise #2: Configuring OSCARS for Intra-domain Provisioning
  - 3pm   Debugging the Control Plane
  - 4pm   Adjourn
  - 7pm   Dinner(?) Mai Tais (?)

• Day 2
  - 9am   Exercise #3: Configuring OSCARS for Interdomain Provisioning
  - 12noon Lunch
  - 1pm   Exercise #4: XML Interface and the “Web Page”
  - 3:30pm Wrap up
  - 4pm   Adjourn
Summary

- Tell ‘em what you are going to tell ‘em
- Then you tell ‘em
- Then you tell ‘em what you just told ‘em

- Target your audience
- Keep it simple
- Hands-on exercises
- Offer the training as often as practical

- Workshops can be extremely useful and engender a supportive adopter community

Thanks!