

Minutes: ATSC Applications Subcommittee

21 September 2004, 10:00 a.m. 4:00 p.m. EDT
NAB, 1771 N Street, N.W., Washington, D.C.

1. WELCOME AND ROLL-CALL

Chairman Sterling Davis (Cox Broadcasting) called the meeting to order at 10:00 a.m. at the headquarters of the National Association of Broadcasters in Washington, D.C. He thanked NAB for hosting today's meeting and asked the participants to identify themselves. The attendance list is given in **Attachment 1**.

2. APPROVAL OF DRAFT AGENDA

Chairman Davis asked for consideration of the draft agenda, which was posted to the AS reflector on September 14 (**Attachment 2**). He noted one correction with regard to agenda item #13: where Craig Todd is listed it should be Craig Tanner. No further changes were requested and the draft agenda was accepted as submitted.

3. APPROVAL OF DRAFT MINUTES OF 8 JUNE 2004

Chairman Davis asked for consideration of the draft Minutes of the June 8 meeting, posted to the AS reflector on June 30 (AS-063r1, **Attachment 3**). Jerry Whitaker (ATSC) reported that an updated version of the draft Minutes (AS-063r2, **Attachment 4**) was posted on July 2 that included: 1) the addition of an action item noted by Graham Jones (NAB) in a posting to the AS reflector on June 30; 2) a correction to Section 3 that Mike Dolan was representing TBT (not Nielsen as originally stated); and 3) corrected wording in Section 12 provided by Mark Eyer (Sony) in his posting to the AS reflector on June 30. In addition, Garry Paxinos (USD TV) called attention to a spelling error in the summary of action items. Art Allison (NAB) requested that the document number be included within the text of the document. Jeff Krause (NCTA) added that under Section 8, the ACAP White Paper AHG list should be modified to include Craig Tanner rather than Craig Todd. No further changes were requested and the document was accepted as modified.

4. REVIEW OF ACTION ITEMS FROM THE LAST MEETING

The following action items were developed at the June 8 meeting of the Application Subcommittee. Bracketed dates indicate items carried forward from a previous meeting [date].

- 1) Kelly Williams to contact Skip Pizzi of the TV Anytime Forum to explore liaison with regard to PVR digital program insertion work currently underway in AS. Mr. Williams to invite Mr. Pizzi to prepare a presentation to AS on the work of TV Anytime. [12-09-2003]

Carried forward. Chairman Davis said some progress has been made on this action item, which will be discussed later in the agenda.

- 2) Steve Smith to inquire whether WRAL might be interested in participating in the AHG formed to develop a draft White Paper on ACAP. [02-18-2004]

Completed. Chairman Davis reported that Mr. Smith has made the appropriate contacts and determined that WRAL personnel are interested in participating in such a project.

- 3) Chairman Davis to contact NAB and MSTV with the goal of having the "Roadmap to Products and Services" seminar placed on the agendas for upcoming NAB and MSTV Boards of Directors meetings.

On agenda. Chairman Davis reported that MSTV has been contacted and is interested in adding this topic as a Board agenda item; NAB has yet to be contacted.

- 4) Chairman Davis to follow-up with advertising agency trade organizations to gauge their interest in participating in the "Roadmap to Products and Services" seminar.

On agenda.

- 5) Chris Lennon to draft a requirements statement for proposed work relating to data exchange applications and to post said document to the AS reflector. Upon resolution of any comments, Chairman Davis to forward the document to the ATSC Board for formal consideration.

On agenda.

- 6) Graham Jones and Chris Lennon to communicate to SMPTE Engineering VP Peter Symes the proposal for development of a standard for Traffic Data Exchange and to identify whether SMPTE would prefer to take on this work.

Completed. Chairman Davis said more details on this project will be discussed under agenda item #7.

- 7) Mike Dolan to lead an AHG on Streaming Text Data and to bring back a draft requirements document for consideration at the next meeting. AHG members include Ed Williams, Mark Eyer, Art Allison, and Robert Blanchard.

Completed. The document was posted to the AS reflector on September 7 (**Attachment 5**).

- 8) Ed Williams to review the low bit rate audio/video requirements document (AS-055) keeping in mind the discussion today and to produce a revised requirements document for final approval at the next AS meeting.

Completed. The document was posted to the AS reflector on September 15 (**Attachment 6**).

- 9) Chairman Davis to place the following item on the agenda for the next AS meeting: "ACAP White Paper Project."

Completed.

- 10) Garry Paxinos to lead an AHG to develop a requirements document regarding possible use of advanced codecs in the main mode for consideration by AS at the next meeting. The AHG is to include: Brian Smith, Mark Eyer, Wayne Bretl, Steve Smith, Art Allison, C.B. Patel, Garry Paxinos, James Fang, and a representative to be named from Tribune.

Completed. A report from the AHG is scheduled for today's agenda.

- 11) Jerry Whitaker to set up an email reflector for the advanced codec AHG.

Completed.

5. OPENING REMARKS OF THE CHAIRMAN

Chairman Davis recognized that the committee has a full agenda today. He called attention to the scheduled presentations relating to new DTV system functionality, and welcomed the opportunity to discuss these issues in more detail.

6. TV ANYTIME LIAISON REPORT (KELLY WILLIAMS)

Chairman Davis reported that Kelly Williams (NAB) is working to line up a presentation at a future AS meeting.

7. TRAFFIC-AUTOMATION-CONTENT DELIVERY (CHRIS LENNON)

Chairman Davis reviewed the background of this topic, specifically the potential need for standardization work in the area of data exchange among traffic, automation, and content delivery systems. He asked Chris Lennon (Encoda Systems) to update the committee on the project status.

Mr. Lennon reported that, per direction from AS at the last meeting, he briefed SMPTE Engineering Vice President Peter Symes on the need for work in this area, leading to a discussion with SMPTE S-22, "Television Systems Technology." Mr. Lennon reported that the proposal was received with enthusiasm and a new S-22 AHG was formed, with Mr. Lennon serving as the chair. He said the work is moving forward quickly, with extensive liaison with other groups and organizations. Graham Jones (NAB) will serve as a liaison between the S-22 AHG and ATSC T3/S1. Mr. Lennon added that Mr. Jones has proposed that PMCP serve as the foundation for further work on this project.

Chairman Davis asked Mr. Lennon to keep AS updated on the progress of the work within SMPTE S-22.

8. MANAGING TECHNOLOGY AND INNOVATION—A DTV ROADMAP, MEETING PLANNING (MARK RICHER)

Mr. Richer reminded the committee that an AHG consisting of Craig Tanner (Sharp), John Henderson (Hitachi), Ed Caleca (PBS), and Lynn Claudy (NAB) was formed to follow-up on a planned meeting of non-technical industry leaders to address the future use of ATSC standards in the marketplace. AS agreed that the meeting should be open to all related industries, and that we should strongly encourage the participation of broadcasters and consumer receiver manufacturers' representatives involved in planning new services and products. Mr. Richer identified the following key goals:

- Educate the attendees about the potential use of existing ATSC standards and those under development.
- Solicit input about the likely market roll-out of related products and services.
- Recruit new non-technical participants in the ongoing work of the Applications Subcommittee.

Mr. Richer updated the committee on the progress of this effort. He reminded the committee that a draft program had been developed and a target date had been selected. However, he reported that feedback from the AHG has not been terribly positive on moving forward as planned. Instead, he recommended pursuing the project at a later date—perhaps early next year.

Chairman Davis opened the floor for discussion. Various views were offered on how this project could move forward with the greatest benefit to ATSC. Wayne Luplow (Zenith) urged AS to continue to develop the project; he said technology will continue to move forward and as such a "DTV Roadmap" meeting is important to future success. Robert Blanchard (Sony) suggested that the Roadmap meeting could be held in conjunction with the ATSC Annual meeting. Chairman Davis offered that it was important for AS to take some type of positive action on this proposal, such as schedule a date for the Roadmap meeting early next year.

Mr. Richer acknowledged the viewpoints expressed and stated his agreement with many of them. He added, however, for such a meeting to reach its full potential certain issues need to shake out, which will require some time. He suggested that in his report to the Board of Directors next week, Chairman Davis bring the topic up and entertain a discussion at the Board level. Chairman Davis took an action item to do so.

9. STREAMING TEXT DATA REQUIREMENTS

Chairman Davis called attention to the draft requirements document prepared by the streaming text AHG regarding streaming text applications (**Attachment 5**). Chairman Davis asked for feedback from the committee on the document and the preferred route forward. Comments included the following:

- Mark Eyer (Sony) said he saw value in the proposal, but suggested that it should include a general discussion of service announcement. Mr. Allison countered that the document is already specific enough in this area. A technical discussion followed between Mr. Eyer and Mr. Allison, with revised wording agreed to.
- Mr. Krauss suggested the addition of a new requirement stating “These data services should be identified as being either associated with related video and audio or not associated.” This change was accepted by the committee.
- Mr. Eyer suggested that the first requirement be that any streaming text service should be built upon existing standards if at all possible. This suggestion was accepted by the group.
- Mr. Krauss suggested the addition of a new requirement stating “The capability should exist for broadcasters to signal that the display should defaulted on.” This suggestion was accepted by the committee.
- Craig Tanner (Sharp) noted that storage and archive of streaming text data for services discussed here would be an important issue going forward. He went on to point out that, once a specialist group begins working on such a service, it might find there is really no need or support for it. If that happens, Mr. Tanner expressed the hope that ATSC would abandon the project and not just keep moving forward with a standard that nobody really wants.
- Mr. Eyer commented there is a need for an organization or group to push this type of service; as yet, he observed, it does not have one. Mr. Tanner echoed that sentiment. He said someone in this space needs to lead and direct the effort.

Additional modifications to specific text were suggested and discussed by the committee. Chairman Davis asked Mr. Allison to prepare a revised document based on the discussion and to bring it back to the committee after the lunch break in hopes of finishing this item today.

The meeting broke for lunch at 12:15 p.m.

The meeting resumed at 1:15 p.m.

Chairman Davis called attention to the revision of AS-065 as prepared by Mr. Allison during the lunch break. Chairman Davis said it was his goal to gain the consensus of AS to accept the document as revised and to forward it to the Board for further consideration. The committee reviewed the document and agreed to several additional changes; the final version is given in **Attachment 5a**.

Mr. Richer acknowledged the progress that AS has made on this project. However, he said there remains the question of how the services outlined in the requirements document would integrate with ACAP. He said the relationship of these services needs to be resolved—either in AS or in T3. He added that when AS-065 goes to the Board, there should be some mention of this issue.

Discussion followed on Mr. Richer’s points of concern, with a variety of views expressed. Seeking to determine the sense of the committee, Chairman Davis conducted a straw poll and observed that while there was support for the document, it was not sufficient to move forward at this time.

Chairman Davis drew the discussion to a close. The committee agreed to the following action items:

- Consumer electronics manufactures to provide feedback on the concept of streaming text data services in time for the next AS meeting.
- Chairman Davis to solicit feedback from broadcasters on the concept of streaming text data services in time for the next AS meeting.
- Chairman Davis to contact Craig Smithpeters, chair of T3/S2, and invite his comments and participation in moving the streaming text data services document forward.

10. ADVANCED EPG PROPOSAL PRESENTATION (JIM THEBERGE)

Chairman Davis noted that the T3/S8 AHG on Advanced EPG development (S8-3) has been reactivated under the leadership of Jim Theberge (EAT TV). He invited Mr. Theberge to brief AS members on current work of the group.

Mr. Theberge's presentation focused on the need for a standard to allow broadcasters to leverage DVRs for sponsor-supported programming (**Attachment 7**). Such a standard, he explained, would allow the future of TV advertising to unfold in a more dynamic way. Mr. Theberge suggested that such a standard would define a protocol for the carriage of metadata in an ATSC DTV broadcast stream to enable linkage to non-real-time-delivered video in support of advanced advertising applications, which could include:

- Extended advertising.
- Telescoping long-form ads from traditional 30 sec spots or from product placement segments within programs.
- Sponsored extended viewing material for programs (e.g., blooper reel, behind the scenes footage, actor interviews, and so on).
- Targeted advertising.
- Personalized ad replacement based on viewer preferences or media consumption habits.
- EPG advertising presentations.

He went on to outline the proposed steps forward:

- Recommendation from AS to move forward on the project.
- Develop a requirements document.
- Develop an associated project schedule.
- Recruit stakeholder support for the working group.

Chairman Davis opened the floor for discussion on Mr. Theberge's proposal. Mr. Eyer, chair of T3/S8, clarified the scope situation with regard to S8-3. Mr. Allison suggested that the committee defer any decision on this subject until hearing the next presentation, which also operates in the same general space. Chairman Davis and the committee agreed to this course of action.

11. SEGMENT-BASED VIDEO BROWSING PRESENTATION (SANGHOON SULL, KOREA UNIVERSITY)

Chairman Davis introduced Professor Sanghoon Sull from the Department of Electronics and Computer Engineering at Korea University. Mr. Sull and his research group are working to develop new video technologies for both consumers and broadcasters.

Mr. Sull said his group has recently focused its efforts on improvements to PSIP, and in the process developed a segment descriptor scheme that facilitates frame-accurate access to broadcast and recorded streams in DVRs. Mr. Sull said he believes the segment descriptor method can also be used to make DVR users voluntarily watch ads that match their particular

interests. Last September, he explained, his organization did a successful field trial of the system using terrestrial ATSC PSIP in Korea. Mr. Sull went on to give a detailed presentation on the applications and architecture of the system (**Attachment 8**).

Primary applications as outlined by Mr. Sull included:

- Allowing viewers to access specific segments of recorded programs (i.e., table of contents-based browsing).
- Allowing viewers to easily see only those commercial messages (including infomercials) that match their particular interests.

Mr. Sull explained that the advantages of this approach include:

- For the service provider/broadcaster: only minor modification to current digital broadcasting system software would be required for new, innovative, and attractive services.
- For the user/consumer: new features that include “speed viewing” by intelligent fast-forward or rewind, segment play/replay, and easy access to announcements, programs, and commercial messages of interest.

Chairman Davis opened the floor to discussion. Points raised by committee members included requirements for frame-accuracy and scrambling of segment information, if desired.

Because of the similarity of the proposals from Mr. Theberge and Mr. Sull, Chairman Davis asked for ideas from the committee on how these might be coordinated and/or moved forward. Discussion focused on how the proposals could evolve from a business standpoint. Mr. Allison commented that the proposals are interesting and he urged AS to find a way help them move forward.

Mr. Richer echoed Mr. Allison’s comments. He said that in the world of DTV and PVRs, broadcasters need to find some way to leverage available technologies to improve service to consumers. He added that while DVRs are currently a real threat to broadcasters, they also represent an opportunity.

Mr. Allison suggested that a long analysis period for these proposals would not be a good approach. He expressed some skepticism regarding the specific applications offered, but pointed out that the same mechanisms could be used for educational and home shopping applications. Bob Rast (LINX) acknowledged the need to be creative but cautioned that we need to think this through first. He said there must be some positive business interest here.

Mr. Luplow asked Mr. Sull about the interest, if any, on the part of Korean commercial broadcasters in this technology. Mr. Sull said there was interest on the part of content providers in games and shopping applications, but not in commercials. He noted that the means already exists for skipping commercials, and as such the Korea University proposal does not represent a threat to the current commercial broadcast paradigm.

Mr. Theberge agreed that commercial broadcasters have not been active in this area, however, he did acknowledge interest on the cable television side with regard to VOD-related services.

Mr. Luplow suggested that a small group of broadcasters come back with a background paper as a method of determining the potential interest in moving these concepts forward. While acknowledging the value of the proposals, he said the first step should be to develop a talking paper that can serve as a center point for the effort.

Ed Williams (PBS) noted with interest the proposals; he said PBS has been considering concepts that are not all that dissimilar, albeit for noncommercial applications. He endorsed the idea of a succinct talking paper (or “pre-requirements paper”) as a way of moving forward.

Mr. Therberge and Mr. Sull took an action item to work up a summary paper detailing the concept of advanced advertising/segment-based video browsing, the business case(s) for these proposals, and why it is important to broadcasters—both commercial and non-commercial—and to distribute it to the AS reflector prior to the next meeting.

In response to a question, Chairman Davis stated that AS is currently giving no guidance to S8-3—either to move forward or not—on the proposal outlined previously.

12. APPROVAL OF VERY LOW BITRATE VIDEO REQUIREMENTS DOCUMENT (ED WILLIAMS)

Chairman Davis reminded the committee that this issue was discussed at the last AS meeting, the outcome of which was an action item for Mr. Williams to update AS-055, “Requirements for Low Bit-Rate Video and Audio Program Streams.” Mr. Williams called attention to the revised document, given in **Attachment 6**. He reviewed changes made to AS-055 since it was last reviewed by AS and the reasons for the changes.

Mr. Williams said the requirements document describes a functionality that will permit optimization of the DTV channel for multicast operation. He suggested that the functions of related equipment used for processing and displaying digital television programming likely can be described in more technical detail through the creation of a task force or specialist group once the initial concepts and requirements are defined and established.

Mr. Williams urged that AS determine if a standard should be developed for the generation, test and monitoring, and reception of low bit rate video and audio streams. At some point, he offered, a Recommended Practice for low bit-rate barker channels should be developed and coordinated so that broadcasters, cable system operators, and receiver manufacturers fully understand the expectations of all participants in the ATSC terrestrial broadcast standard.

Mr. Goldberg asked for clarification of certain issues within the document, and Mr. Williams responded. Mr. Eyer said he felt that the document misses the point on several technical issues; he said a requirements document needs to be more succinct. Mr. Goldberg echoed that sentiment, adding that a T3 specialist group would need more specificity.

Mr. Luplow suggested that some transport specialists should assist in refining the document, after which AS could reconsider it. Chairman Davis agreed.

Chairman Davis asked Mr. Williams to work with Mr. Eyer and Mr. Goldberg to refine AS-055 based on today’s discussion, and to bring the document back to AS for consideration at the next meeting.

13. ACAP WHITE PAPER AHG DISCUSSION AND PLAN

Chairman Davis reminded the committee that this issue was suggested at a previous AS meeting, but has not been acted upon due to resource limitations. He said it would be carried over to the next meeting.

14. REPORT FROM AHG ON ADVANCED CODECS IN THE MAIN STREAM (GARRY PAXINOS)

Chairman Davis reminded the committee that at the last AS meeting an AHG was formed to develop a requirements document relating to the use of advanced codecs in the main stream. The AHG, led by Garry Paxinos, included Brian Smith, Mark Eyer, Wayne Bretl, Steve Smith, Art Allison, C.B. Patel, James Fang, and a representative from Tribune.

Mr. Paxinos briefed the committee on where this effort now stands (**Attachment 9**). He reviewed the assumptions of the AHG and the concerns that members have on this issue. Open

questions were detailed and discussed. Mr. Paxinos went on to outline the options for moving forward; specifically:

- Option 1 formation of a proponents group to create a draft requirements document for consideration by AS.
- Option 2 continue discussions on the reflector in an effort to reach a consensus on requirements.
- Option 3 hold a face-to-face meeting to continue discussions.

Chairman Davis opened the floor for discussion. Mr. Goldberg questioned one of the assumptions of the AHG, namely “It is desirable to support an advanced codec in the main stream.” Discussion followed on whether this point accurately portrays the feelings of the AHG. Mr. Paxinos pointed out that these assumptions were taken from the Minutes of June 8 AS meeting.

Mr. Krauss suggested that the AHG should proceed as it sees fit and report back when it is done. Mr. Allison acknowledged the market concerns of the various stakeholders in this debate. He said the only question is whether we want to have new codecs in the main stream via a standardized process, or a non-standardized process. Mr. Eyer commented that the ATSC standardization process is intended for television, and that niche closed systems do not need standards.

Mr. Richer observed that the multiple codec issue will need to be decided sooner or later. He said it could happen in AS, or be sent to the Board for consideration. He expressed hope that this could be done in a positive, constructive manner.

Chairman Davis asked Mr. Paxinos what, if anything, the AHG needs from AS to move forward. Mr. Paxinos invited suggestions from the committee. Mr. Rast offered that a teleconference would be a good place to start.

Chairman Davis asked Mr. Paxinos to continue the work that the AHG has begun and to report back at the next AS meeting.

15. OTHER BUSINESS

Chairman Davis acknowledged that AS has not had a brainstorming session in some months. He said the only reason is that we have had meetings with little available time on the agenda. Chairman Davis emphasized that he is not dropping the concept, but holding it out there for a meeting with more time-flexibility.

15.1 White Paper Priority List

Chairman Davis called attention to the White Paper priorities list, given below:

- Antenna technology and steering
- DCC
- CA
- Data broadcasting
- “Gold Rack”
- Opportunistic data
- B to B: narrowcasting, electronic billboards, broadcast advertising
- ATSC Standards
- ACAP

Chairman Davis reminded committee members to keep these “communications of applications” projects in mind as it considers future work.

16. NEXT MEETING OF THE APPLICATIONS SUBCOMMITTEE

The next meeting of the Applications Subcommittee is scheduled for 18 November 2004.

17. ADJOURNMENT

There being no further business before the Applications Subcommittee, the meeting was adjourned at 4:00 p.m. EDT.

Action Items Developed at this Meeting

The following action items were developed at the September 21 meeting of the Application Subcommittee. Bracketed dates indicate items carried forward from a previous meeting [date].

- 1) Kelly Williams to contact Skip Pizzi of the TV Anytime Forum to explore liaison with regard to PVR digital program insertion work currently underway in AS. Mr. Williams to invite Mr. Pizzi to prepare a presentation to AS on the work of TV Anytime. [12-09-2003]
- 2) Chairman Davis to contact NAB with the goal of having the “Roadmap to Products and Services” seminar placed on the agenda for an upcoming NAB Board of Directors meeting [06-08-2004].
- 3) Chris Lennon to keep AS updated on the progress of work within SMPTE S-22 relating to traffic/automation content delivery.
- 4) Chairman Davis to raise to the “DTV Roadmap” project at the next ATSC Board of Directors meeting as a topic for discussion.
- 5) Consumer electronics manufactures to provide feedback on the concept of streaming text data services in time for the next AS meeting.
- 6) Chairman Davis to solicit feedback from broadcasters on the concept of streaming text data services in time for the next AS meeting.
- 7) Chairman Davis to contact Craig Smithpeters, chair of T3/S2, and invite his comments and participation in moving the streaming text data services document forward.
- 8) Jim Therberge and Sangoon Sull to work up a summary paper detailing the concept of advanced advertising/segment-based video browsing, the business case(s) for these proposals, and why it is important to broadcasters—both commercial and non-commercial.
- 9) Ed Williams to work with Mark Eyer and Adam Goldberg refine AS-055 based on today’s discussion for consideration by AS at the next meeting.

Attachments

Attachment 1: Attendance List

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/9-21-04_AS_Attendance.doc

Attachment 2: AS-066, Draft Agenda

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-066_draft_agenda_21_09_2004.doc

Attachment 3: AS-063r1, Draft Minutes from 8 June 2004 Meeting

http://www.atscmembers.org/sg/AS/2004_06_08_Meeting/AS-063r1.doc

Attachment 4: AS-063r2, Revised Draft Minutes from 8 June 2004

http://www.atscmembers.org/sg/AS/2004_06_08_Meeting/AS-063r2.doc

A redline of AS-063r2 relative to the posting of AS-063r1 on June 30 is given in:

http://www.atscmembers.org/sg/AS/2004_06_08_Meeting/AS-063r2_redline.doc

Attachment 5: AS-065r4, Streaming Text Requirements

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-065R4_streaming_text.doc

Attachment 5a: AS-065r5, Revised Streaming Text Requirements

[http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-065R5_streaming_text\(changes_accepted\).doc](http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-065R5_streaming_text(changes_accepted).doc)

Attachment 6: AS-055, Low Bit Rate Video

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-055%20Low%20Bit%20Rate%20Video-Audio%20rev%201.doc

Attachment 7: AS-069, Advanced Advertising Proposal

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-069_Advanced_Advertising_Proposal.ppt

Attachment 8: AS-068, Sanghoon Sull Presentation

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-068_psip2AS_v7_sull.pdf

Attachment 9: Advanced Codec AHG Report

http://www.atscmembers.org/sg/AS/2004_09_21_Meeting/AS-070_Advanced%20CODEC%20in%20the%20Main%20Stream.ppt