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Persistence and Prevalence in the Mobility of Dartmouth Wireless Network Users

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T. chnical R. p7rt TR2003-455
Advis7r: David K7tz
May 2003

Abstract

Wi%less local-a%a netwo%ks (WLAj s) a%e inc%asing in 6o6ula%it89 As mo%e 6eo6le use WLAj s it is im6o%tant to unde%stand how these use%s behave9 We anal8zed data collected ove%th%ee months of 2I I2 to measu%e the 6e%sistence and 6%evalence of use%s of the Da%tmouth wi%less netwo%k9

We found that most of the use%s of Da%tmouth's netwo%k have sho%t association times and a high %ate of mobilit89 This obse%vation fits with the 6%edominantl8 student 6o6ulation of Da%tmouth CollegeObecause students do not have a fixed wo%k6lace and a%e moving to and f%om classes all da89

1 Intr7ducti7n

Since 2I I 1Owe have collected extensive data to stud8 the use of a wi%less netwo%kOs6ecificall8 the wi%less netwo%k at Da%tmouth College9 Anal8zing the usage 6atte%ns will hel6 develo6e%s to build and maintain wi%less netwo%ks that a%e bette% suited to the use%s needs9

This 6a6e%ex6lo%es the mobilit8 and association time of use%s of the Da%tmouth wi%less netwo%kObased on data fo%ove%two thousand use%s9 With an unde%standing the behavio%of a wi%less netwo%k use%Odevelo6e%s can design mo%e effective a66lications that simultaneousl8 take advantage of the wi%less netwo%k and the behavio%of the wi%less use%sOnetwo%k o6e%ato%s can mo%e effectivel8 de6lo8 and manage netwo%ksOand enginee%s can design mo%e effective netwo%k 6%otocols and 6%oducts9

2 Backgr7und

Da%tmouth College de6lo8ed its wi%less netwo%k in S6%ng 2I I 19 B8 S6%ng 2I I 2Ot he%e we%e about 5I I Cisco S8stems Ai%net model 35I[1] access 6oints 6%oviding 11 Mb6s cove%age :4E9 Because Da%tmouth College has a %elativel8 small cam6usOthe wi%less netwo%k cove%s all the buildings on cam6us and most of the outdoo%s6aces as well9 The wi%less netwo%k cove%s do%mito%iesOclass%oomsOofficesOand 6ublic s6acesO including the G%eenOa la%ge g%ass8 a%ea in the cente%of cam6us :4E9 The%e a%e usuall8 seve%al access 6oints 6e%buildingOso the%e a%e often %egions whe%e multi6le access 6oints can be hea%d9

StudentsOstaffOand 6%ofesso%s use this netwo%k9 All unde%g%aduates at Da%tmouth a%e %e7ui%ed to own a com6ute%9 At the time we collected the data fo%this 6a6e%Oabout

[1] S6ecifications at www9cisco9com9

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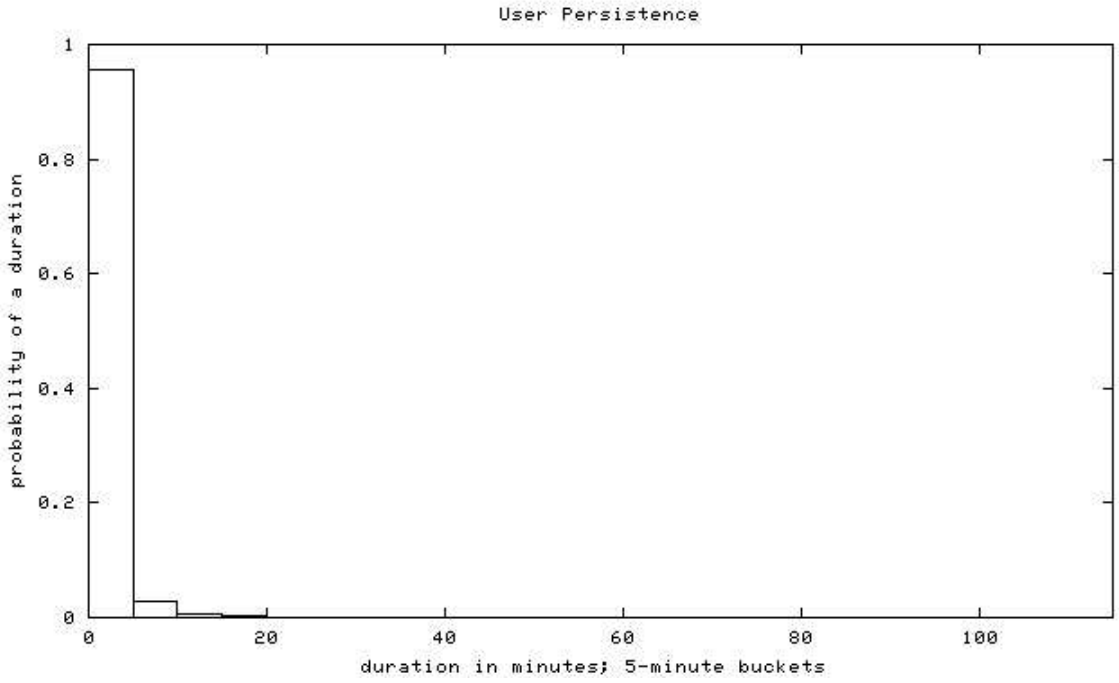

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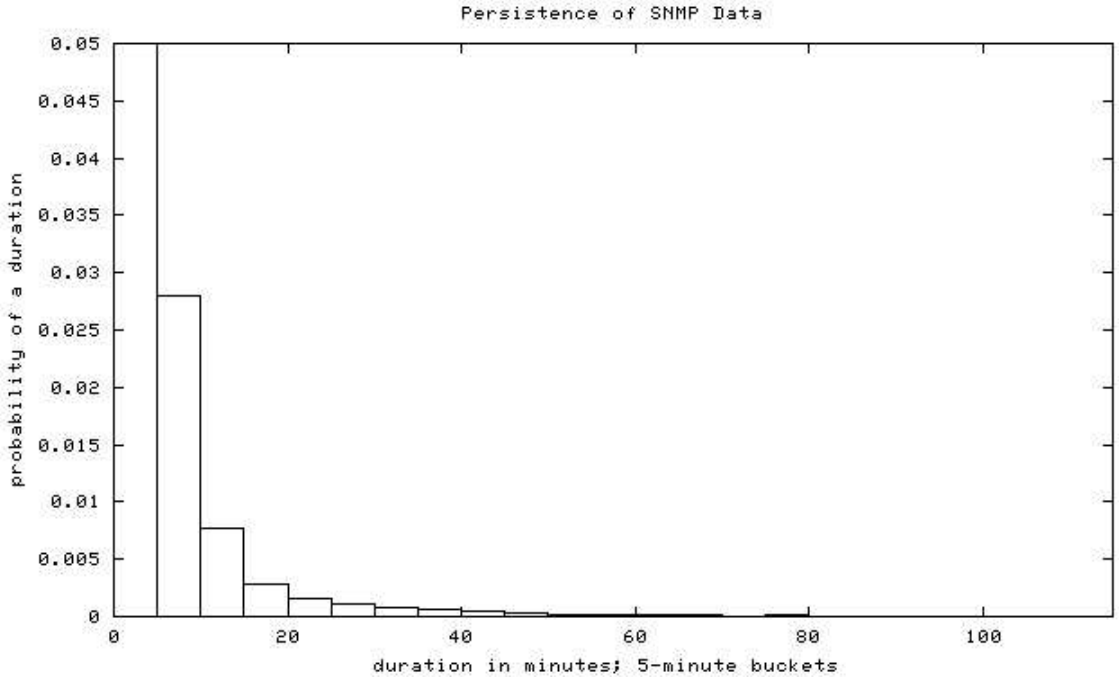

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□ouod ot henotlVc%k%ell□o ullot hlRot f ot l42Gldcul%ds%lnlhosol6eca l(i%eilosls % x 7 □ llz□7 O□ □ □A2ldct 6%e%l d%jll8 %wl6c(t hli cesloiicdnosnct lh(eosnct i□ll1Ag lc6louu oiicdnosnct il- %e%ul%ils ot ls%la rt(s%luct fjll8 %wlouicl6c(t hlinf t n6ndot sla cvnunswlrt s %el(i%elLcL(uosnct ll%9%l- ns lct uwl6c(elodd%ilLcrt sijllx vc(sl□Xg lc6ls %el(i%eil9rins%la a ce%ls ot lct %lodd%ilLcrt slL%elhowjll8 nilis(hwlct uwldc9%e%lnlct %lecca l- ns l6c(elodd%i Lcrt sill c- %9%ellicls %la cvnunswloiL%dsilc6ls %lhosoloe%t cslLoesnd(uoeuwla %ot rt f6(uj

xd wc k7l asc

□ %l%nna rt %ls %lL%eiris%l d%lot hlLe%9oul%d%lc6loul- ne%u%ilt %s- cekl(i%eilrt %u9%l- %%kilosl' oesa c(s l7 cul%f%lh(ert flI Lert flKAAKl- %lK)AAl□x 7 lohhe%li%l

Wi %Wds loc%la- n t lwWWkl(WdL Aj oc)glj 6suj soAj gl %8 Ae9lmAd%Wh%lW wlbWh%l8 se%b%gg i Ai j bWsA lL W9%locsglwWWi Wosmj bWbvls o%e%gos hk

z g%eglAfloc%l(WdL Aj ocl8 se%b%gg1 %8 Ae9lgcA8 lWbWh%lWL Aj dAflL A6sbsovk 2 bL AgdI D' lAflj g%eglc Wd%lWL %wsWli e%dWb% m%lj w%dTC' kllOc%e%fAe%xlL AgdAfloc%lj g%eg We%lcshcbvlL A6sb%x%d% lsfloc%vlgi % wlWgsh sfsmWdWL Aj dAfloc%selosL %ls lA %li bWm%k OcsglL A6sbsovlfsogls l8 socloc%lL Aw%bAflggj w% ogloW9s hloc%selbWoAi glWAj wlmWL i j gloA mbWgglW wloAlggj wvl8 soclfes% wgls lAj dAfloc%l8 WlbAmWsA gk

S %lfAj wlocWdL AgdAfloc%lWmosdsovl8 WgloW9s hli bWm%ls lb%ggloc Wlfsd%lL s j o%gk Bj oj e%la- n t li Abbs hlAfl8 se%b%gg1 %8 Ae9glgcAj bwli AbblL Ae%lfe%uj % dbvloc Wl%d%evlfsd% L s j o%gloAlA6oWs lL Ae%lw%6WSb%wlL A6sbsovlwWbWk

6. r si t nc adval at hM

5l8 Aj bwlbs9%loAloc W9lg%d%eWdi %Ai b%lfAelc%bi s hlL %loceAj hcloc sgloc%gsg3t eAf%ggAe (WdswlMAo lfAelc sgli Wd% m%lW wlgvL i Wcvloc eAj hcAj doc%lmAj eg%lAfloc sgli W%e4loc%lgoWfflAf 2 mW%L smlE AL i j os hxl%gi %msWbvlGsm9l7 WoA lWwla j gWla mc8 We:xlfAeloc%selc%bi l8 soc a t a alWwln WbW64loc%lw%d%bAi %eglAflE AeWG%6xlomi wj L i xlh j i bAoxlWwlhW8 94lW wlWdL v fes% wglfAeloc%selgj i i Aeck

7. b ayafat saM

[K1] 2 Wwl7 WbWmc WweWxl; %Affe%vln klZ A%b9%exlt WeWL dsel7 Wcbxl W wlt klZ % 9Wb GWhWkllEc WeWmo%es:s hlj g%el6%WdsAelWwl %8 Ae9li %efAeL Wm%ls lWi j 6bsm 8 se%b%gg1 2 - kl5 l*useraadai gn ef lha 2002 ACM SIGMETRICS Cei fasai ra ei Ma n samai l i d Meda ai g ef Cemp las Synlamn*xli Wi%gl KVCRTDCxln Ws W(%b G%vxl j %lTDDTkl2 En lt e%ggk

[T1] n WiwWb% W7 WbWs g9 WlW wlt WbE WgoeAk EcWeWmo%es:s hln A6sbsovlWwl- %8 Ae9lz gWi%ls lWE Aei AeWb%lS se%b%gg1 AmWR2 e%W - %8 Ae9kl5 l*useraadai gn ef lha TDD Ii lasi laei Cei fasai ra ei Mebca Synlamn, App or laei n, i d Sas cran (MebcSyn)*li Wi%gl D R K .llz a - 5X 2 ggAmsWsA xln WlTDDk

[1] GA l j omcs glW wl b%lS kl %aj eWk n %Wgj e%L % cglfeAL lWmWL i j gl8 se%b%gg1 %8 Ae9kl5 l*useraadai gn ef lha IEEE Ii lasi laei Cei fasai ra ei Cemm i or laei n (ICC)*xldAbj L %lCxli Wi%gl K KR K 1x - %8 lYAe9xl2 i esblTDDTkl5 lEAL i j o%dla Ams%evlt e%ggk

[1] (WdswlMAo lW wlMA66vl ggs% k 2 Wbgsgl AflWmWL i j gR8 sw%l8 se%b%gg1 %8 Ae9kl5 l*useraadai gn ef lha Ecghlh Ai i Ii lasi laei Cei fasai ra ei Mebca Cemp lai g i d Nalweskai g (MebcCem)*li Wi%gl KD1 RKKI.ll2 En lt e%ggxla %lo%L 6%dlTDDTk