Proposal Details

The Foundation is prohibited from conducting or funding any lobbying or political campaign activities, as these terms are specifically defined under U.S. tax law. Unlike many of our grantees/vendors who may engage in limited lobbying, the Foundation cannot lobby or fund any lobbying activities carried out by its grantees/vendors. We request that you please review the information at the following link, Foundation Funds and Advocacy, to assess whether any of your proposed activities may constitute lobbying as defined by the IRS. If so, you should revise your proposal accordingly prior to submission.

1. Executive Summary

Provide a brief summary of the investment.

The University of Washington proposes to found the Digital Financial Services Research Group (DFS RG) to investigate technologies that will improve the ability of banks and mobile operators to deploy digital financial service products that reach the poor.   The goal is to develop and deploy technological solutions to specific challenges that impede the introductions and wide scale deployment of these financial products. The group will work in close collaboration FSP's Emerging Technology Team (ETT) and other Gates' partners to:

- Survey the technological landscape to identify promising ones for DFS.
- Evaluate candidate technologies found by UW, FSP, and Gates partners for suitability and potential impact.
- Prototype and field test ideas.
- Build out the most promising ideas as toolkits that be tested broadly.
- Establish a technology demonstration lab that allows hands on exploration of financial technology products.

The expected outcome is a set of candidate technologies which have been vetted and field tested, which show the potential for commercialization and large scale impact. In addition the UW DFS Research Group will provide a new environment for the FSP team to brainstorm and innovate in collaboration with a team of computer science and information technology experts at the UW.

Describe the charitable purpose of this work. (1-2 sentences)

Note: This will inform the description of the investment, if approved, in any agreement and if posted on gatesfoundation.org.

Access to digital financial services will improve the economic wellbeing and financial security of a vast number of people. This work will address a technological gap in to the widespread deployment of these services.

2. Problem Statement

Describe the problem, why it is a problem, and who is impacted by the problem. What specific elements of the problem is this investment trying to address?

Low profitability, lack of client demand, and the outright failure of many DFS launches can be traced back to difficult barriers and frictions that hinder the business model and scalability of DFS systems. Many of these barriers and frictions could be addressed by high potential emerging technologies but often the requisite translation of these technologies from the lab or from other sectors into usable tools for the DFS space is not happening with the necessary urgency.

With this initiative we would like to accelerate the creation or translation of high potential emerging technologies that have the potential for dramatic improvements in efficiency, speed, scalability, cost, security, and client value.

The "DFS RG" will bring together a group of top scientists and technology developers from a wide variety of fields to collaborate and build technology that will improve merchant payments, client onboarding, agent management, and other pain points in DFS systems. High potential ideas will be developed into prototypes and tested in the field with mobile operator partners and banks.

FSP has identified the following set of DFS problems as the highest priority for technology innovation:

1. **Fraud and cyberattacks –** *Going forward there will be increasing risks to both consumers and providers from counterfeiting, petty fraud, and unauthorized third party transactions.*
2. **Proximity payments user experience** - *Current solutions are slow (1min+) and taxing on consumers requiring many steps and entering numbers, thus limiting the potential to digitize the economy through this important channel.*
3. **Identity and on-boarding –***Know Your Customer (KYC) requirements and lack of digital ID verification technology delay customer sign-up for DFS as does the difficulty of communicating value and convincing clients. Inputting customer data, verifying ID/biometric, and teaching customers about the product and its value to them are all major commercial challenges which often result in failure to enroll or low levels of active usage. Governments and bulk payers lack low-cost identification, authorization, and targeting mechanisms for social welfare disbursements.*
4. **Analytics for product development and risk scoring –** *Lenders, insurers, and other DFS providers have limited client data and poor analytics capability. This limits product design efforts and defeats credit and insurance risk profiling.*
5. **CICO agent recruitment, training, and management** - *With large, distributed agent networks, it is difficult for agent network managers to train agents to reach a consistent quality of service. Agents also have difficulty maintaining sufficient cash balances and when banks are far and have limited hours. Agent network management is the highest cost center for mobile money deployments.*
6. **Financial management and budgeting by end users –** *poor clients find it hard to plan, budget, optimize, shield money from temptation, or avoid having it appropriated by others. This results in failures to achieve savings goals, over-indebtedness, underinsured, missed opportunities, high stress, and low asset accumulation.*

The research will focus on these main areas as its initial technology roadmap and will work with FSP to evolve this list as time goes on. The group will also focus on solutions to these issues that involve fundamentally pushing technological boundaries (whereas simple process improvements, which may also address some of these issues, will not be pursued here but elsewhere in the FSP portfolio.)

3. Scope and Approach

Describe the scope and approach of the proposed work. This should be a narrative description of the principal results the investment would achieve and how those results relate to the problem described above (rather than a list of outcomes and outputs.) Note: You will provide a list of outcomes and outputs in the Results Framework

a. Description

The UW proposes to found the Digital Financial Services Research Group (DFS RG) to create technologies that will improve the ability of banks and mobile operators to deploy digital financial service products. The group, guided by FSP's Emerging Technology Team (ETT) and other Gates' partners, will address a range of recognized challenges for DFS systems. The expected outcome is a set of candidate technologies to support digital financial services that have been vetted, field tested, and show potential for commercialization and large scale impact. To achieve this a pipeline of projects will be established that begins with landscaping and initial assessments. Building on this, the technologies will be taken through rapid prototyping and assessment. The most promising technologies will be further developed and refined, and then deployed as toolkits to be evaluated as potential technologies for broader use for financial services. We propose a project with initial funding for two years. This time period is necessary, so that in the first year the group can be established, and start with assessment and prototype projects. This will lay the ground work, so that in year two, technology initiative projects can be launched.
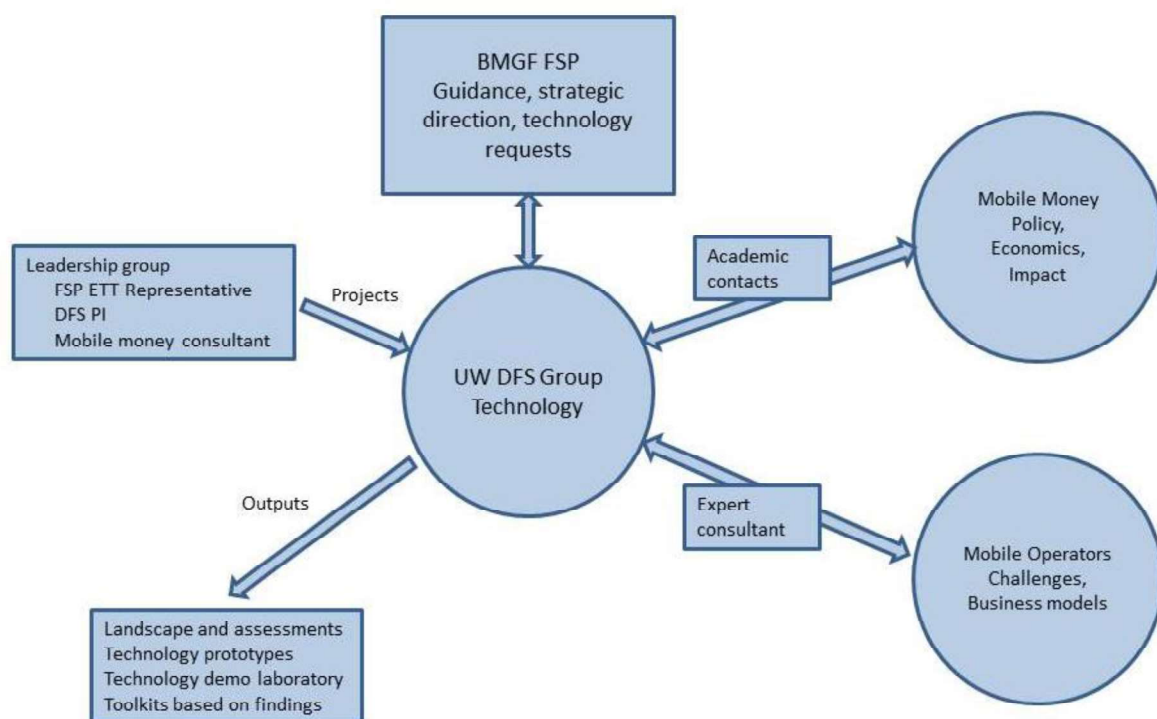

Figure 1. Positioning of UW DFS group with other areas: Success of the DFS group depends on leveraging complementary expertise. We have academic contacts in policy and economics, both at UW and elsewhere who we can work with. For working with Mobile Operators, and to help identify the key technical challenges, we will work with an expert consultant through FSP. The DFS group will have a collaborative relationship with FSP, and receive guidance and strategic direction from them. The leadership group for the project will have representatives from FSP and UW, and will have a formal role in establishing the activities conducted.

Governance, management, and team structure

The DFS Research Group, led by Professor Richard Anderson, will draw on expertise of faculty from the Department of Computer Science and Engineering and the Information School. Faculty members who will initially be in the research group are Joshua Blumenstock, Yoshi Kohno, Franzi Roesner, and Kurtis Heimerl. The group will study and develop core technologies to support deployment of financial services for the poor. To complement the group's expertise in technology, ties will be developed with other academic departments, including the EPAR group in the Evan's School. The group will work with an external consultant expert on mobile money and mobile operators.

The research group will consist of faculty, students, and staff. Some students will formally belong to the group by being advised by faculty and supported by research assistantships, and other students will participate in a less formal basis, through projects, courses and meetings. There will be a staff programmer to support work on the projects and help manage some of the engineering issues. A program manager will help manage the projects, and support interactions with FSP and external partners. The research group will work closely with FSP and external partners, as we discuss below.

Work in the project will take place in three main streams: short term projects, technology initiatives, and a technology demonstration lab.

- Short term projects: The projects will come in multiple types: Literature/Landscape, Assessments (either formative or technology evaluation), and Technology prototyping. Some the projects may involve travel of in country assessments of prototypes. In some cases, a single topic could be carried through multiple project stages. Successful projects would be presented back to ETT and lead to conference publications.

The time frame for literature or landscape projects, or projects to "figure out a technology" would be about a month. Technology prototype projects should take about three months, and will be designed with a series of milestones.

- Technology Initiatives: Technology initiatives will be longer term projects developing, field testing, and deploying an innovative technology. These projects will not begin until the second year of funding, as there will be substantial background work to identify promising candidates. A review by multiple members of FSP will be required before these projects are launched. These projects will involve multiple graduate students, and could be topics for PhD theses, and should result in multiple publications. The projects would also be developed so that they can be handed over to partners at their completion. We anticipate that we will develop the technology in a "tool kit" form, so that it can be deployed in multiple configurations in the field. This adaptability is necessary so that technologies can fit the mobile operator's contexts. The technology initiative projects will require foreign travel to allow for collecting requirements and technology evaluation.
- Technology Lab: We will establish a technology lab that maintains working versions of various financial technologies and other ICTD tools. These will generally be technologies created outside of UW. This will allow us to have running and evaluated versions of the technologies, and also give students expertise with different technologies. The technologies will be available in different formats for demos, including on-line demos, or set up for booth demos, or provided as hands on demos for various stakeholders. The technology lab will have an important role as an entry-point for students in the DFS project, and to support educational outreach activities.

Governance

An advisory board will be established for the project. This board will include two members from FSP and five staff members from UW including members of the project as well as external faculty. Additional board members may be included from outside UW and FSP. The board will be responsible for reviewing major decisions on topics and products, and will receive regular reports on selected projects and status. The choice of the Technology Intiatives will require the concurrence of the advisory board.

Identifying projects

Each quarter, two thematic areas will be identified, in consultation with FSP, for project focus. These areas will be drawn from the list of challenges to DFS systems. The thematic areas will be selected to encourage depth in exploration of ideas with the goal of identifying the areas for high impact future investments. However, we will not exclude high priority projects if they fall outside the current thematic areas.

As a research group, there will be brainstorming and informal exploration of ideas. A list of candiate projects will be maintained and prioritized. A formal mechanism for specifying the official projects conducted by the research group will be established. Each project will have a faculty advisor to oversee the work. Projects will have requirements and expected outputs and project with expected duration of more than six weeks will have intermediate milestones. The DFS project manager will track all of the projects.

The DFS research group will have a leadership team consisting of the project PI, a representative of ETT, and an outside consultant. This group will be responsible for determining the official projects, and identifying appropriate resources for the work. Project ideas will be initiated by FSP, UW or externally, and will be vetted and supported by all three partners. The formal process will use a template that includes a problem statement, outputs, milestones, and IP plan. Approval will take place at the weekly leadership meeting. Projects ideas could be initiated by UW, FSP, or the external consultant. These decisions will be reported to the advisory board.

There are a number of areas where UW has existing expertise that could support initial project work. At a high level, these areas match with specific challenges from the "pain points", but further refinement is necessary.

- Open Data Kit. There are many data collection problems (such as agent registration) which could involve smart phone applications.
- USSD Communication. This is planned work coming out of our mobile messaging work that could be applied in the financial domain.
- Paper to Digital. The ODK Scan project is using mobile phones for scanning paper records – currently focusing on the health domain.
- Projecting Health (Community Led Video Education, building on ideas from Digital Green). Potential applications to consumer financial education.
- Security of mobile applications. It has been documented that many mobile money smartphone apps have serious security holes. There is work to be done both in developing robust applications, and in understanding the processes that led to these security issues.
- Local cellular communication. Kurtis Heimerl, who has been working on low cost cellular base stations, will be joining the CSE department in 2016. This approach to "local cellular" could have direct tie ins with digital financial services.

Staffing Model

The UW DFS group will consist of UW faculty, students, and staff, along with some external participants. There will be a group of core faculty who would directly contribute to the project and supervise student projects. The initial list of faculty is Anderson, Blumenstock, Kohno, and Roesner, with Heimerl joining in 2016. The core faculty will be contribute to the technical leadership of the project, and will supervise students on individual projects. The core faculty will participate in the quarterly meetings with FSP. Other faculty will be involved in the group as affiliate faculty. Affiliate faculty may supervise individual projects.

Students are a major part of the project, as much of the technical work will be done by students. The students in Computer Science and Engineering are very strong, but they also have many opportunities. One of the keys to the success of the DFS research group is to engage students in ways that are meaningful. Three different groups of students will be involved in the research group, PhD students, Masters' students, and undergraduate students.

- PhD students will lead some of the longer term projects, and will provide mentorship for other students. Several of the students currently in the ICTD lab will start with this role.
- Masters' students. Some masters' students will be recruited for technical work in assessments and prototyping. This could include students outside of Computer Science.
- Undergraduate students. Undergraduate students will also be involved in the project and have the potential for multi-year engagement with the work.

The budget for the proposal has support for five graduate research assistants and three undergraduate research assistants. Part of the initial strategy for student recruitment will be to offer a series of seminars.

The project will have two additional staff members. One is a program manager, who will manage the administrative side of the work, and will also track and support the individual projects. The second position will be a staff programmer, who will work across the technology prototype projects, as well as support the technology demonstration lab. Additional administrative support will come from CSE support staff. A postdoc will be hired in the second year of the project, as we do not believe we will have time to recruit a qualified candidate for the first year.

Intellectual property

The intellectual property policies for this project will be designed within University and Departmental guidelines. The Computer Science and Engineering department has an Intellectual Property Oversight committee that will provide guidance, and the University has an organization currently named Comotion that manages intellectual property. IP issues will be reviewed with the department oversight committee on a quarterly basis. If background IP is identified that it is likely to be used in future projects it will be declared. (Open Data Kit is that the type of background IP that we will declare – although it is Open Source, so easy to handle.)

Our experience is that the most successful model for making or technologies available in developing countries is to rely on a "commercially friendly" open source model, which is supported by licenses such as BSD and Apache. Open source is important to allow low cost products to be distributed

and supported. However, it is important that entities can adapt the software and develop it into products that they can commercialize.   In most cases, the software projects under the DFS RG will release the code under an open source licenses.   This is particularly important for the technology initiatives, where we want to have the software adopted broadly and potentially adopted by commercial partners. The technology prototype projects will usually be Open Source, but this is not as strict a requirement, since a prototype may be just a short term project to test an idea.

When a project is initiated through the leadership group, an IP assessment will be done, and any new background IP will be declared. The projects will need to identify their software licensing model in advance. For the technology initiatives, we will conduct a review with UW Comotion.

The work done by the UW DFS Group will be open academic work. Students will publish papers in conferences and journals based upon their project work. All work published from this project will be shared with FSP, and will cite the funder in an agreed upon form. The landscape studies and assessments will be public documents. We plan to post the studies on the UW DFS website as a series of UW DFS briefs.

We will put data use agreements in place in the case where we receive proprietary data sets.

As needed, describe why you believe the approach would lead to the desired results. Reference related work, existing evidence from evaluations or systematic reviews, and/or relevant experience, etc.

This proposed project is to create technologies that will improve the ability of banks and mobile operators to deploy digital financial service products. In order to be successful, the work will align with the mission of University of Washington to draw on the strengths of a university engaged in both research and education:

- Have impact based on disciplinary expertise.   The work draws on our expertise in Information and Communication Technology for Development (ICTD), Computer Science and Engineering, and Information Science. The work will have direct real world impact, continuing the success we have had with projects such as Open Data Kit and Projecting Health. The University has been very supportive of successes metrics beyond academic publication.
- Demonstrate success in research. This project will result in published research results in refereed conferences and journals to bring extra rigor and disseminate the findings and engage the broader field to the challenges.
- Promote the development of students. High potential students will be involved in this project as they advance to their degrees. Many students are attracted by opportunities that combine technical challenges with social impact.
- Contribute to the educational curriculum.   We will develop and offer graduate courses and seminars based on the work.   Digital financial services will provide project topics for our senior capstone project course.

Addressing the technology challenges for digital financial services requires drawing across computer science for expertise.   Areas of expertise that we can draw on include from the UW Department of Computer Science and Engineering include:

- Information and Computing for Development (ICTD) . ICTD focuses on adapting and understanding the use of technology in low resource settings. This includes environments' with poor networking infrastructure, an emphasis on mobile communication, and considering how technology is used by populations with low literacy.   UW has established itself as one of the leading universities for ICTD research.
- Security. Computer security looks at developing systems that are more robust to a variety of threat models. Security considers the process of building secure applications, as well as the process of identifying risks. Security is obviously a central concern for financial applications.
- Big Data (Data base, Visualization). One of the major new areas in computing is "big data" which combines traditional areas (such database) with the vast amount of data that is now being collected. Visualization techniques are central to getting value out of this data.
- Networking. Infrastructure is a necessary component for financial transactions.
- Cellular Technology. The technology used by mobile operators is a central part of DFS. An understanding of the technology is necessary both for the development of services, and for establishing security guarantees. Another opportunity is the use of low cost cellular base stations to expand the reach of the cellular (and financial) networks.
- Machine learning. Machine learning has been very successful in constructing predictive algorithms based on large amounts of data. For financial services, one important application is in fraud prediction.
- Software Engineering. The focus of software engineering is developing techniques to implement large and correct software systems. One of the interesting opportunities is to apply formal methods for the evaluation of software systems to evaluate the correctness of financial protocols.
- Human Computer Interaction. There are many applications of HCI to financial technologies. This includes usability and cross cultural issues. Many problems related to computer security are actually HCI problems – since peoples understanding of computer systems are often exploited in attacks, so security/HCI is very important for strengthening systems.

UW Faculty

Richard Anderson (PhD Stanford University) is a professor of Computer Science and Engineering at the University of Washington. He leads the ICTD group at University of Washington and oversees the development of Open Data Kit, a suite of mobile data collection tools. The work in ICTD spans multiple technologies and domains including mobile applications, text messaging, data integration and visualization, and IVR.   He is also a founder of Projecting Health, a community-led video education initiative in India. He has worked closely with PATH since 2009 as a member of the Digital Health Solutions Group focusing on projects involving mobile technology, data reporting, behavior change communication, and managing the vaccine cold chain.

Joshua Blumenstock (PhD UC Berkeley) is an Assistant Professor at the Information School, an Adjunct Assistant Professor of Computer Science, and a co-director of the Data Science and Analytics Lab at the University of Washington. His research focuses on understanding the social and economic impact of new technologies through the use of large-scale, behavioral data from developing countries.   He is a recipient of the Intel Faculty Early Career Honor and a former fellow of the Thomas J. Watson Foundation and the Harvard Institutes of Medicine. Dr. Blumenstock has been involved in several projects supported by the Financial Services for the Poor team at the Bill and Melinda Gates Foundation. Currently, he is a co-PI on BMGF-funded "Mobile data for socio-economic indicators," a project that develops new methods for measuring poverty and related socio-economic indicators from mobile phone Call Detail Records.

Tadayoshi Kohno (PhD UCSD) is the Short-Dooley Professor of Computer Science & Engineering at the University of Washington and an Adjunct Associate Professor in the UW Information School. His research focuses on helping protect the security, privacy, and safety of users of current and future generation technologies. Kohno is the recipient of an Alfred P. Sloan Research Fellowship, a U.S. National Science Foundation CAREER Award, and a Technology Review TR-35 Young Innovator Award. Kohno has authored more than a dozen award papers, has presented his research to the U.S. House of Representatives, was profiled in the NOVA ScienceNOW "Can Science Stop Crime?" documentary, and is a past chair of the USENIX Security Symposium. Kohno is also a member of the U.S. Government's Defense Science Study Group, the National Academies Forum on Cyber Resilience, the IEEE Center for Secure Design, and the USENIX Security Steering Committee.

Franzi Roesner (Phd University of Washington) is an assistant professor in Computer Science and Engineering at the University of Washington. Her research focuses on improving computer security and privacy for end users of existing and emerging technologies, including the web, smartphones,

and emerging augmented reality platforms. Her work on application permissions in modern operating systems (including smartphones) received the Best Practical Paper Award at the 2012 IEEE Symposium on Security and Privacy, her work on security and privacy for augmented reality was featured on the cover of the Communications of the ACM magazine, and her defense for tracking by social media widgets on the web was incorporated into the Electronic Frontier Foundation's Privacy Badger tool.

Kurtis Heimerl (PhD UC Berkeley) will join the Computer Science and Engineering department as an Assistant Professor in 2016. Kurtis' research interests span information and communication technologies and development (ICTD), human-computer interaction, and networks and systems. He was recognized by MIT Technology Review with a TR35 Award in 2014 for his work on The Village Base Station (VBTS), a low-cost, low-power system for providing small-scale, locally-owned cellular networks in rural communities that lack existing cellular coverage. After building the one of the first community cellular networks in a small village in Papua, Indonesia in 2013, Kurtis co-founded a startup company, Endaga, to commercialize the technology and bring VBTS to more communities around the world.

4. Risk Mitigation

As needed, describe any significant risks to the success of this project and how you plan to address them.

Two risks are identified in setting up the DFS research group. The first risk is that there will be difficulties in bridging the needs of FSP and the structure of a university research group. This project is based on a different model than the typical academic research grant than would come through funders such as the National Science Foundation. The second risk is of a slow start up in the first year, which may limit the number of projects completed.

To ensure that we successfully bridge between FSP and the university we plan will have regular interactions between the groups including hosting at FSP consultant at UW. The governance model will allow all parties to have input into the selection of projects, with an additional mechanism for high priority projects of FSP to be acted on quickly. At the start of the grant, we will document the processes for managing the research group. In the budget, we have included resources for a programmer, and a technical writer which will complement student skills and make it easier to deliver on the projects.

Faculty involved in the project have substantial experience with BMGF and NGOs. The PI, Richard Anderson, has been working with Digital Health Solutions group at PATH for the last five years, with an extended sabbatical 2009-2011, and a continued consulting relationship since then. Joshua Blumenstock has worked on multiple projects funded through FSP.

A risk faced in the first year of the project is getting it started quickly so that results can be achieved in the timeframe. The key is getting students interested and involved early. Two seminars will be offered in the fall to attract students, a graduate seminar that will read papers on financial technologies, and an undergraduate seminar on ICTD. These seminars will take place prior to funding. In order to initiate prototyping projects quickly, we can utilize some of the groups existing assets, such as ODK 2.0 for project work, or take on a project related to USSD which is currently under investigation. Our current work on security of mobile devices will tie in directly with the planned group, so we will propose cyber security as one of the initial themes. We will plan to work on technology lab projects in the first quarter of funding, as this will be a way to get early visible results, gain experience with financial technologies, and build infrastructure to support the group.

5. How We'll Work Together

This question is intended to begin the dialogue on how foundation staff would work with you to achieve the intended outcomes. Topics could include minimal staff support, any specific issues that would likely need on-going discussion, regular communications, or other information to help establish mutual expectations and assist with implementing the proposed work.

This project will require close interaction between ETT and the UW DFS group. ETT will designate a primary contact who will work with UW. This person will be a member of the leadership team, which will also include the project PI, and an external consultant with expertise in mobile money and mobile operators. The leadership team will have weekly meeting held at UW. The ETT representative will have a regular presence at UW, and will optionally be involved in seminars and working with students.

UW will hold quarterly meetings with a larger group from FSP and the UW faculty in the DFS group. These meetings will be for review and guidance on the project, a report out of UW DFS group activities, and to determine the thematic areas for the next quarters work.

FSP will participate in bi-annual digital financial services workshops held at UW. These will be half day meetings with an invited talk, a series of short presentations on UW project results, a brainstorming session, and a social event.

Success of the UW DFS group depends on complementary expertise in financial services and mobile operators. UW will host an external consultant hired by FSP who will provide this expertise. The consultant will have office space co-located with the DFS group so that he or she can work closely with us. The consultant will be a member of the leadership team for the project, and will you his or her expertise to guide the selection of project topics. There are multiple options for how the consultant could work with the DFS Group, including helping to supervise students and leading seminars.

Meeting	Frequency	FSP Attendees	
Leadership meeting	Weekly	1	The leadership group will meet every week (in person or by phone) to review progress and administrative matters.
Project review meeting	Quarterly	3	Results from the previous quarter will be reviewed, and thematic areas identified.
DFS Workshop	Semi-annual	8	Technical meeting that will bring together stakeholders.
FinTech research seminar	Weekly	Optional	A graduate research seminar will meet weekly to read research papers.
Project meetings	Periodic	Optional	Individual projects have regular meetings where FSP attendance would be welcome.

Table 1. Proposed interactions between FSP and UW DFS.